COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
FRANKFORT, KY 40622

MANUAL TITLE: ***Construction Guidance Manual*** **REVISION NO.:** **8**

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REQUESTED BY: **Brad Webb** **NEW:**

NEW & REVISED POLICIES

CHAPTER/ SECTION	EXPLANATION	OLD PAGES TO BE DELETED	NEW PAGES TO BE ADDED
	The purpose of this printing is to include the following new and revised policies in the *Construction Guidance Manual*. This revision also includes two index updates.		
CST-00	Table of Contents	CST-01	CST-01
CST-300	Contractor's Payroll: General Certified Payroll Review Consultant Inspections	CST-306-1 CST-306-2 CST-316	CST-306-1 CST-306-2 CST-316
Produced & Distributed by Organizational Management Branch			

COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
FRANKFORT, KY 40622

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NEW PROCEDURE

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	The purpose of this printing is to include the following revised procedures in the *Construction Guidance Manual*. This revision also includes two index and four exhibit updates.		
CST-00	Table of Contents Table of Exhibits	CST-01 CST-03	CST-01 CST-03
CST-100	Federal Highway Administration - Field Relationship	CST-108-2	CST-108-2
CST-800	Nuclear Density – Moisture Meters - Introduction Responsibilities Nuclear Gauges Thermoluminescent Dosimeter (TLD)	CST-801 CST-802 CST-803 CST-804	CST-801 CST-802 CST-803 CST-804
CST-9000	Nuclear Gauge Emergency Procedures Nuclear Gauge Location Report Securing a Nuclear Gauge Leak Test Instruction Form	CST-9065	CST-9065 CST-9114 CST-9115 CST-9116
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COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
FRANKFORT, KY 40622

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CST-00	Table of Contents Alphabetical Index	CST-01 CST-02	CST-01 CST-02
CST-300	Contractor's Payroll: General Certified Payroll Review Consultant Inspections	CST-306-1 CST-306-2	CST-306-1 CST-306-2 CST-316
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COMMONWEALTH OF KENTUCKY
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FRANKFORT, KY 40622

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CST-00	Table of Contents Table of Exhibits	CST-01 CST-03	CST-01 CST-03
CST-300	Submission of DBE Subcontracts	CST-304-3	CST-304-3
CST-400	Formal Acceptance Contractor Performance Evaluations	CST-403	CST-403-1 CST-403-2
CST-500	Division of Construction Forms	CST-502	CST-502
CST-9000	DBE Detailed Plan/Subcontract Request Form, TC 63-35DBE DBE Detailed Plan/Subcontract Request Form, TC 14-35 Final Pay Estimate Letter, TC 63-24 Final Pay Estimate Letter	CST-9011 CST-9032	 CST-9011 CST-9032
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CHAPTER/ SECTION	EXPLANATION	OLD PAGES TO BE DELETED	NEW PAGES TO BE ADDED
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CST-00	Table of Contents Table of Exhibits	CST-01 CST-03	CST-01 CST-03
CST-300	Contractor's Payroll: General Checking the Payroll Certified Payroll Review Wage Compliance Checks	CST-306-1 CST-306-2 CST-307	CST-306-1 CST-306-2 CST-307
CST-9000	Certified Transcript of Weekly Labor Payroll & Weekly Statement of Compliance, TC 14-308	CST-9012	
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	The purpose of this printing is to include the following revised procedure in the *Construction Guidance Manual*. This revision also includes one index update.		
CST-00	Table of Contents	CST-01	CST-01
CST-300	Equal Employment Opportunity: EEO Aide	CST-308-1	CST-308-1
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CONSTRUCTION GUIDANCE MANUAL

ISSUED BY

COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET

MAY 2009

Produced by Organizational Management Branch
Office of Human Resource Management

TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.transportation.ky.gov/

Steven L. Beshear
Governor

Joseph W. Prather
Secretary

OFFICE OF THE SECRETARY
OFFICIAL ORDER 105419

SUBJECT: *Construction Guidance Manual*

This manual has been prepared to provide information and guidance to personnel of the Kentucky Transportation Cabinet. Its purpose is to establish uniformity in the interpretation and administration of laws, regulations, policies, and procedures applicable to the operations of the Division of Construction and its relationship with other units of the Cabinet.

The policies and procedures set forth herein are hereby approved and declared effective unless officially changed.

All previous instructions, written and oral, relative to or in conflict with this manual are hereby superseded.

Signed and approved this 23rd day of June, 2009.

Joseph Prather
Secretary

Approved as to Legal Form

Office of Legal Services

Kentucky UNBRIDLED SPIRIT

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PREFACE

The Division of Construction's *Construction Guidance Manual* is written as a guide to construction personnel in the Kentucky Transportation Cabinet's Department of Highways. The techniques outlined in this manual should be followed as closely as practicable; however, situations arise where individual engineering judgment must be utilized. It is intended that the procedures set forth herein will establish reasonable, uniform policies and procedures while maintaining sufficient flexibility to permit the application of sound engineering judgment to the solution of special problems.

This manual mentions several specific products used by construction personnel to complete daily tasks and are included solely for guidance purposes. This manual assumes no liability on the part of the Kentucky Transportation Cabinet for the products included, nor is it intended to promote any product, supplier, or manufacturer over another. Furthermore, inclusion in this manual does not imply continued or future use of a product.

	Chapter INDEXES
	Subject Table of Contents

00 INDEXES

01 Table of Contents 04/16
02 Alphabetical Index 05/15
03 List of Exhibits 01/13

100 GENERAL INFORMATION

101 Design of This Guidance Manual 05/09
102 Introduction 05/09
103 Department Organization 05/09
104 Division of Construction 05/09
105 Section Engineer
- 105-1 Crew Organization 05/09
- 105-2 Responsibilities 05/09
- 105-3 Care of Office, Field, & Vehicular Equipment 05/09

106 Inspector 05/09
107 Personnel Conduct 05/09
108 Federal Highway Administration (FHWA)
- 108-1 Overview 05/09
- 108-2 Field Relationship 07/15

109 Archaeological Coordination 05/09
110 Construction Surveying 05/09
111 Safety
- 111-1 Overview 05/09
- 111-2 In-House Safety 05/09
- 111-3 Injury & Accident Reporting 05/09
- 111-4 Construction Safety 05/09

112 Traffic Control Through Highway & Street Work Zones
- 112-1 Introduction 05/09
- 112-2 Policy 05/09
- 112-3 Preconstruction Procedures 05/09
- 112-4 Construction Procedures 05/09
- 112-5 Process & Review Evaluation 05/09

113 Highway Closure & Accident Reports
- 113-1 Incident Reporting 05/09
- 113-2 Notification Methods & Reporting Responsibilities 05/09

114 Hazardous Wastes & Substances 05/09

200 PRECONSTRUCTION REQUIREMENTS
201 Project Plans 05/09
202 Plan Review 05/09
203 Field Check of Structures 05/09
204 Field Books & Staking 05/09
205 Determining Personnel, Vehicle, & Signing Requirements 05/09
206 Right-of-Way Concerns
206-1 Encroachments on the State's Right-of-Way 05/09
206-2 Work on the Railroad Right-of-Way 05/09
207 SiteManager Diary 05/09
208 Traffic Control 05/09
209 Preconstruction Conference 05/09

300 CONTRACT ADMINISTRATION
301 Construction Revisions 05/09
302 Contractor Pay Estimate 05/09
303 Change Order & Supplemental Agreements
303-1 General 05/09
303-2 Writing a Change Order 05/09
303-3 Nonparticipating Items 05/09
303-4 Supporting Documentation 05/09
303-5 Time Extensions 05/09
303-6 Change Order in Draft Status 05/09
303-7 Change Order in Pending Status 05/09
304 Subcontractor
304-1 General 05/09
304-2 Submission of Non-DBE Subcontract Requests 05/09
304-3 Submission of DBE Subcontracts 01/13
305 Equipment Lease / Rental Agreements 05/09
306 Contractor's Payroll
306-1 General 04/16
306-2 Certified Payroll Review 04/16
307 Wage Compliance Checks 06/12
308 Equal Employment Opportunity
308-1 EEO Aide 03/12
308-2 EEO Discussion at Preconstruction Conference 05/09
309 Time
309-1 Contract Time 05/09
309-2 Time Extension Request 05/09
309-3 Working Days 05/09
309-4 Working Day Statement 05/09
309-5 Additional Time 05/09
309-6 Contract Overtime & Liquidated Damage Review 05/09
310 Extra Work 05/09

300 CONTRACT ADMINISTRATION (cont.)
311 Claims
311-1 Introduction 05/09
311-2 Initiating the Claim 05/09
311-3 Acknowledgement of Receipt of Claim 05/09
311-4 Prosecution of the Work & Records 05/09
311-5 Current Pay Estimate 05/09
311-6 Completion of Work 05/09
311-7 District-Level Review 05/09
311-8 Review by Central Office 05/09
311-9 Paying a Claim 05/09
311-10 Possible Mediation 05/09
311-11 Administrative Hearing 05/09
311-12 Summary of Claims Process 05/09
312 Value Engineering 05/09
313 Construction Noise 05/09
314 Historic Preservation Laws 05/09
315 Essential Manuals & Publications 05/09
316 Consultant Inspections 04/16

400 POST-CONSTRUCTION REQUIREMENTS
401 Final Inspection 05/09
402 Completion of a Project 05/09
403 Formal Acceptance & Contractor Performance Evaluations
403-1 Formal Acceptance 01/13
403-2 Contractor Performance Evaluations 01/13
404 Contract Overtime 05/09
405 Final Estimate
405-1 General 05/09
405-2 Verifying Quantities at Section Engineer Office Levels 05/09
405-3 Verifying Quantities at District Office Levels 05/09
405-4 Central Office Final Estimate Section 05/09
405-5 Final Estimate Package 05/09
405-6 Contractor Review 05/09
405-7 Final Estimate Payment 05/09
405-8 Closing the Contract in SiteManager 05/09

500 FORMS USED BY CONSTRUCTION FORCES
501 General 05/09
502 Division of Construction Forms 01/13
503 Forms from Other Divisions & Agencies 05/09

600 CONSTRUCTION SURVEYING
601 Introduction 05/09
602 Field Books 05/09
603 Plan Review 05/09
604 Project Control & Stakeout 05/09
605 National Geodetic Survey & U.S. Geological Survey Markers 05/09
606 Borrow Site Cross-Sections 05/09
607 Locating & Staking Pipe Culverts 05/09
608 Checking Original Cross-Sections 05/09

600 CONSTRUCTION SURVEYING (cont.)
609 Land Slides 05/09
610 Slope Stakes 05/09
611 Grade Stakes (Bluetops) 05/09
612 Pay Estimate 05/09
613 Staking Structures
613-1 Overview 05/09
613-2 Reinforced Concrete Box Culverts 05/09
613-3 Bridges (General) 05/09
614 Roadway Geometry 05/09
615 Surveying Equipment
615-1 Introduction & Care 05/09
615-2 Levels 05/09
615-3 Leveling Rods 05/09
615-4 Total Station Theodolites 05/09
615-5 Prism & Prism Poles 05/09
615-6 SDR33 Electronic Field Books 05/09
615-7 Instrument Tripods 05/09
615-8 Instrument Boxes 05/09
615-9 GPS Surveying Equipment 05/09

700 ENVIRONMENTAL PROTECTION & LANDSCAPING
701 Environmental Protection Introduction 05/09
702 Contractor Responsibilities 05/09
703 Section Engineer Responsibilities 05/09
704 Seventeen-Acre Limit 05/09
705 Temporary Erosion Controls 05/09
706 Permanent Erosion Controls 05/09
707 Construction Activities Affecting Streams 05/09
708 Sinkholes 05/09
709 Contractor Noncompliance 05/09
710 Liquidated Damages 05/09
711 Final Inspection & Acceptance 05/09
712 Landscaping 05/09

800 NUCLEAR DENSITY – MOISTURE METERS
801 Introduction 07/15
802 Responsibilities 07/15
803 Nuclear Gauges 07/15
804 Thermoluminescent Dosimeter (TLD) 07/15
805 Nuclear Density Tests 05/09

900 GRADE & DRAIN CONSTRUCTION
901 Clearing & Grubbing 05/09
902 Roadway & Drainage Excavation
902-1 Introduction 05/09
902-2 Preliminary Excavation Operations 05/09
902-3 Rock Excavation 05/09
902-4 Borrow Excavation 05/09
902-5 Waste 05/09
902-6 Waste & Borrow Site Approval 05/09

900 GRADE & DRAIN CONSTRUCTION (cont.)
903 Embankment Construction
903-1 Determining Material Types Used in Embankments 05/09
903-2 Earth Embankment 05/09
903-3 Rock Embankment 05/09
903-4 Subgrade 05/09
903-5 Embankment-in-Place 05/09
904 Haul Roads 05/09
905 Design Quantities 05/09
906 Precast Small Drainage Structures 05/09

1000 SUBGRADE & BASE CONSTRUCTION
1001 Subgrade Construction 05/09
1002 Dense Graded Aggregate Base (DGA) & Crushed Stone Base (CSB) 05/09
1003 Drainage Blankets 05/09
1004 Weighing Subgrade & Base Materials
1004-1 Introduction 05/09
1004-2 Automatic Printing Scales, Truck Tare Weights, & Weigh Tickets 05/09
1004-3 Preparation & Handling of Weigh Tickets 05/09
1004-4 Daily Summary 05/09
1004-5 Resolution of Quantities & Payment 05/09
1005 Subgrade Stabilization by Chemicals 05/09

1100 BITUMINOUS CONCRETE PAVEMENT
1101 Introduction 05/09
1102 Section Engineer Responsibilities 05/09
1103 District Materials Engineer Responsibilities 05/09
1104 Initial Project Preparation 05/09
1105 Wedging or Leveling Courses 05/09
1106 Tack Coat 05/09
1107 Curing Seal 05/09
1108 Weighing & Verification 05/09
1109 Preparation for Placing Bituminous Mixtures 05/09
1110 Placing Bituminous Mixtures 05/09
1111 Joints 05/09
1112 Bituminous Indented Rumble Strips 05/09
1113 Asphalt Mixing Plants 05/09
1114 Bituminous Pavers 05/09

1200 JOINTED PLAIN CONCRETE PAVEMENT
1201 Introduction 05/09
1202 Material Requirements
1202-1 General 05/09
1202-2 Aggregates 05/09
1202-3 Cement 05/09
1202-4 Fly Ash 05/09
1202-5 Admixtures 05/09
1202-6 Miscellaneous Paving Items 05/09
1202-7 Curing Concrete 05/09
1203 Concrete Plant 05/09

1200 JOINTED PLAIN CONCRETE PAVEMENT (cont.)
1204 Prepaving
1204-1 General 05/09
1204-2 Plan Review 05/09
1204-3 Contractor Meeting 05/09
1204-4 Employees Required for Inspection 05/09
1204-5 Documentation 05/09
1204-6 Testing 05/09
1205 Paving Operation
1205-1 General 05/09
1205-2 Subgrade Preparation 05/09
1205-3 Placement of Load Transfer Assemblies, Tie Bars, & Forms 05/09
1205-4 Drainage Blanket 05/09
1205-5 Weather Limitations 05/09
1205-6 Slip Form Paving 05/09
1205-7 Formed Pavement 05/09
1205-8 Hand Placing 05/09
1205-9 Station Numbering 05/09
1205-10 Curing 05/09
1205-11 Testing 05/09
1205-12 Documentation 05/09
1206 Post Paving Procedures 05/09
1207 Opening to Traffic 05/09

1300 STRUCTURES
1301 General 05/09
1302 Safety & Health 05/09
1303 Structure Excavation
1303-1 General 05/09
1303-2 Bridges 05/09
1303-3 Culverts 05/09
1303-4 Retaining Walls & Crib Walls 05/09
1303-5 Removal of Existing Structures 05/09
1304 Cofferdams
1304-1 General 05/09
1304-2 Design 05/09
1304-3 Installation 05/09
1305 Bearing Piles
1305-1 General 05/09
1305-2 Preparation for Pile Driving 05/09
1305-3 Material 05/09
1305-4 Inspection 05/09
1305-5 Equipment 05/09
1305-6 Test Piles 05/09
1305-7 Pile Driving 05/09
1305-8 Concrete Piles 05/09
1305-9 Cast-in-Place Piling 05/09
1306 Falsework & Forms
1306-1 Falsework 05/09
1306-2 Forms 05/09

1300 STRUCTURES (cont.)

1307 Concrete
1307-1 Introduction 05/09
1307-2 Inspection 05/09
1307-3 Placing Concrete 05/09
1307-4 Temperature Limitations & Protection 05/09
1307-5 Curing Concrete 05/09
1307-6 Surface Finish 05/09
1307-7 Construction Date, Load Design, & Drawing Number Identification 05/09
1307-8 Investigating Low-Strength Concrete 05/09
1308 Reinforcing Steel 05/09
1309 Structural Steel
1309-1 General 05/09
1309-2 Bridge Seats 05/09
1309-3 Fabrication 05/09
1309-4 Project Site Inspection 05/09
1309-5 Storage 05/09
1309-6 Erecting Structural Steel 05/09
1309-7 Steel Nuts & Bolts 05/09
1309-8 Bolting Members 05/09
1309-9 Bolt Tightening Procedures 05/09
1309-10 Field Welding 05/09
1309-11 Anchor Bolts 05/09
1309-12 Bearings 05/09
1310 Welding
1310-1 General 05/09
1310-2 Qualifying Welding Operators 05/09
1310-3 Welding Position 05/09
1310-4 Welding Electrodes 05/09
1310-5 Field Welding 05/09
1311 Prestressed Concrete
1311-1 General 05/09
1311-2 Preconstruction Conference 05/09
1311-3 Field Inspection 05/09
1311-4 Erection 05/09
1311-5 Concrete Deck Placement 05/09
1312 Reinforced Concrete Bridge Slabs
1312-1 General 05/09
1312-2 Initial Project Review 05/09
1312-3 Inspection upon Delivery 05/09
1312-4 Storage & Handling 05/09
1312-5 Sampling & Testing 05/09
1312-6 Steel Placement 05/09
1312-7 Concrete Placement 05/09
1312-8 Surface Finish 05/09
1312-9 Curing 05/09

1300 STRUCTURES (cont.)

1313 Bridge Deck Overlay
1313-1 General 05/09
1313-2 Initial Project Review 05/09
1313-3 Preconstruction Conference 05/09
1313-4 Overruns 05/09
1313-5 Deck Preparation Prior to Placing Overlay 05/09
1313-6 Preliminary Preparation 05/09
1313-7 General Procedure for Placing Overlay 05/09
1313-8 Low Slump Concrete Overlay 05/09
1313-9 Latex Concrete Overlay 05/09
1314 Bridge Painting
1314-1 Introduction 05/09
1314-2 Surface Preparation 05/09
1314-3 Paint (Coating) 05/09
1314-4 Inspection 05/09
1314-5 New Structural Steel 05/09
1314-6 Maintenance Cleaning & Painting Steel Bridges 05/09
1315 Permanent Signing 05/09
1316 Lighting 05/09
1317 Signalization 05/09
1318 Precast or Prefabricated Culverts
1318-1 Precast Three-Sided Culverts 05/09
1318-2 Metal Arch Culverts 05/09

	Chapter INDEXES
	Subject Alphabetical Index

A

Agencies- Site Approval 902-6
Archeology 109
As-Built Plans 201
Asphalt Adjustments 303-2

B

Bearing Piles ..... 1305-1—9
Bearing Piles- Inspection 1305-4
Bearing Piles- Materials 1305-3
Bearing Piles- Pile Driving 1305-2,7
Benchmarks 604
Bituminous Concrete Pavement
- Curing Seal 1107
- Introduction 1101
- Joints 1111
- Mixing Plants 1113
- Placement 1110
- Placement Preparation 1109
- Rumble Strips 1112
- Site Preparation 1104
- Tack Coat 1106
- Wedging/Leveling Courses 1105

Bituminous Pavers 1114
Borrow Site-Establishment 606, 902-4,6
Bridge Seat Specifications 1309-2
Bridge Deck
- Curing 1307-5
- Examination 1313-2
- Overlay ..... 1313-1—9
- Overlay Preparations 1313-5,6

Bridge Painting ..... 1314-1—6
Bridge Slabs ..... 1312-1—9

C

Calibrated Wrenches 1309-9
Chain of Command 103
Change Orders
- Policy & Procedures ..... 303-1—7
- Supporting Documentation 303-4

Claims ..... 311-1—12
Clearing 901
Closing the Contract 405-8
Cofferdams 1304-1,2,3
Completion Date Establishment 402
Concrete
- Bituminous Pavement 1100
- JPC 1200
- Structural 1307
  - Construction & Investigations 1307-7,8
  - Curing 1307-5
  - Identifications 1307-7, 1311-1
  - Inspection 1307-2
  - Investigations 1307-8
  - Placement 1307-3
  - Surface Finishes 1307-6
  - Temperature Limitations 1307-4

Construction Signing Requirements 205
Construction Revisions 301
Consultant Inspections 316
Contested Work Orders 105-2
Contract Overtime 309-6, 404
Crew Member Expectations 105-1
Cross-Section Checks 608
Cut Stability Sections 902-2

D

DBE Subcontracts 304-2,3
Deficiencies, Steel 1309-4
Diary, Site Manager 207
District Materials Engineer (DME) 1103
Drain Construction 901
Drainage Blankets 1003, 1205-4
Drainage Structures, Precast 906

E

Embankment
- Earth 903-2
- -in-Place 903-5
- Materials 903-1
- Rock 903-3
- Subgrade 903-4

E (cont.)

Encroachment 604
Encroachment Removal 206-1
Environmental Protection
  Final Inspection 711
  Intro & Responsibilities 701, 702, 703, 709
Equal Employment Opportunity 308-1,2
Equipment
  Care 105-3
  Lease/Rentals 305
Erosion Control
  Permanent 706
  Temporary 705
Excavation
  Borrow 902-4,6
  Design Quantities 905
  Preliminary Operations 902-2
  Roadway & Drainage 902-1
  Rock 902-3
  Structures ..... 1301-1—5
Extra Work 310

F

Fabrication 1309-3
False Work & Forms 1306-1,2
Federal Highway Association (FHWA)
  Field Relationship 108-2
  Overview 108-1
Field Books 204, 602, 613-1,2,3, 615-6
Field Check 203
Field Engineers 104
Field Welding 1309-10
Final Estimate 405
Final Inspection 401
Formal Acceptance 403
Forms
  Construction Forces 501, 502, 503
  List 502, 503
Foundation Preparation & Backfill 613-2
Fuel Adjustments 303-2

G

GPS Surveying Equipment 615-9
Grade Staking 611
Grubbing 901
Guidance Manual Design 101

H

Haul Roads 904
Hazardous Waste 114
Historic Preservation 314, 109
Horizontal Curves 614

I

Inspections
  Consultant 316
  Final 401
Inspector Duties 106

J

Jointed Plain Concrete Pavement (JPC)
  Concrete Plants/ Testing 1203, 1205-11
  Curing 1202-7
  Daily Work Reports 1204-5, 1205-11
  Hand Placing 1205-8
  Introduction 1201
  Material Requirements 1202
  Opening to Traffic 1207
  Pavement Operations- Curing 1205-10
  Paving Operation 1205-1
  Post Paving 1206
  Prepaving Contractor Meeting 1204-3
  Prepaving Documentation 1204-5
  Prepaving Plan 1204-1,2
  Prepaving Testing 1204-6
  Subgrade Preparation 1205-2

K

L

Land Slides 609
Landscaping 712
Lighting 1316
Liquidated Damage Report 309-6, 710
Load Transfer Assemblies 1205-3

M

Mail Box Turnouts 1104
Materials 315
Materials- Measured by Weight ..... 1004-1—5
Metal Arch Culverts 1318-2
Mill Test 1309-1
Moisture Meters 801, 802

N

National Geodetic Survey & US Geological Survey Markers 605
Noise Control 313
Nuclear Density
  Introduction 801
  Nuclear Gauges 803
  Responsibilities 802
  Tests 805
  Thermoluminescent Dosimeter (TLD) 804
Nuclear Gauges 803

O

Original Plans 201
Overruns 1313-4

P

Pay Estimates 302, 612
Payroll, Contractor 306-1,2
Personnel Conduct 107
Personnel Requirements 205
Pipe Culverts, Locating 607
Preconstruction Meeting
- Bridge Deck Overlay 1313-3
- EEO Discussion 308-2
- Policy & Procedure 209
- Prestressed Concrete 1311-2

Preservation 802
Prestressed Concrete
- Deck Placement 1311-5
- Erection 1311-4
- Field Inspection 1311-3
- General 1311-1
- Preconstruction Conference 1311-2

Q

R

Railroad Right-of-Way Concerns 206-2
Record Plans 201
Reinforcing Steel 1308
Reporting Accidents
& Incidents 111-3, 113-1, 113-2
Reviewing Plans 202

S

Safety
- Overview 111-1
- In-House Safety 111-2
- Injury & Accident Reporting 111-3
- Construction 111-4
- Structure Construction 1302

Section Engineer Duties &
Responsibilities 105-1, 105-2, 105-3, 1102
Seventeen-Acre Limit 704, 706
Signalization 1317
Signing, Permanent 1315
Sinkholes 708
Site Approval 902-6
Slip Form Paving 1205-6
Slope Stakes 610
Spiral Curves 614
Staking
- Bituminous Concrete Pavement 1104
- Bridges 613-2,3 602
- Clearing & Grubbing 901
- Contract 601
- Pipe Culverts 607
- Project Plans 201
- Reinforced Concrete Box Culverts 613-2
- Structures (General) 613-1

Station Numbering 1205-9
Steel Bolts & Nuts 1309-7,8,9,11
Steel-Site Inspections 1309-4
Streams 707
Structural Steel 1309
Structural Steel Erection 1309-6
Structural Steel Storage 1309-5
Structures Overview 1301
Subcontract Requests 304-2
Subcontractor- General Requirements 304-1
Subgrade
- Construction Preparation 1001
- Crushed Stone Base (CSB) 1002
- Dense Graded Aggregate Base 1002
- Stabilization by Chemicals 1005

Supplemental Agreements 303-1
Surveying 601
Surveying
- Control Points 604
- Equipment
  - GPS 615-9
  - Instrument Boxes 615-8
  - Levels 615-2,3
  - Prism 615-5
  - Total Station 615-4
  - Tripods 615-7
  - Care 615-1
  - Electronic Field Book 615-6
- Policy ..... 110, 601—615
- Roadway Geometry 614
- Section Engineer Responsibilities 613-1
- Slopes & Grades 610, 611
- Staking Bridges 613-3
- Structures 613-1

T

Temporary Traffic Control Plan 112-3, 112-4
Three Sided Culverts 1318-1
Tie Bars 1205-3
Time
- Change Order 309-5
- Contract 309-1
- Extensions 303-5, 309-2

Traffic Control ..... 112-1—5, 208

U

V

Value Engineering.....312
Vehicle Requirements.....205
Vertical Curves.....614

W

Wage Checks.....307
Waste Site.....902-5,6
Weather Limitations 1205-5, 1307-4
Welding .....1310-1—4
Welding- Field 1310-5
Wet Curing 1307-5
Working Day- Statement.....309-4
Working Day- Defined.....309-3

X Y Z

	Chapter GENERAL INFORMATION
	Subject Design of This Guidance Manual

ORGANIZATION & NUMBERING

Chapters—The subject matter in the manual is divided into chapters. The chapter title appears in the upper right-hand corner of the first page of a subject and in the upper left-hand corner of any subsequent page.

Sections—Some chapters are divided into sections. Each section title, instead of chapter title, appears in the upper right-hand corner of the first page of a subject and in the upper left-hand corner of any subsequent page.

Subjects—Chapters and sections are arranged by subjects.

Subject Number—Each subject is assigned a number, which appears in the upper right-hand corner of each page of the subject. For example, Chapter 400 includes subject 404, followed by subject 405, which is divided into section subjects 405-1 through 405-8.

"CST" Prefix—Preceding each subject number, this prefix stands for the manual title *Construction*.

Subject Title—The title of a subject appears in the upper right-hand corner of the first page of a subject and in the upper left-hand corner of any subsequent page.

Date—The latest issuance date of a subject appears at the bottom of each page of the subject. This date agrees with the latest issuance date shown for the subject in the Table of Contents **(CST-01)**.

Page Numbering—Each subject has its own page numbering, which appears at the bottom of each page.

LOCATING INFORMATION

Indexes—Two indexes appear at the front of the manual, and one index appears at the back:

- **Table of Contents (CST-01)**—This index at the front lists the titles of the manual's chapters and sections and their subjects, as well as other information, in numerical order. It includes the latest issuance dates of all the subjects. As the manual matures, these dates change.

LOCATING INFORMATION (CONT.)

- **Alphabetical Index (CST-02)**—This index at the front alphabetically lists key information in the manual. Generally, it directs the user to subject titles and to margin, paragraph, and subparagraph headings within subjects.

- **List of Exhibits (CST-03)**—This index at the back lists the manual's exhibits and includes the latest issuance date of each exhibit. As the exhibits mature, the issuance dates change.

QUESTIONS

Whom to Contact—For answers to questions about the contents of the manual, please contact the Division of Construction at (502) 564-4780.

For copies of the manual, please contact:

Organizational Management Branch
Transportation Cabinet Office Building
6th Floor West
200 Mero Street
Frankfort, KY 40622

	Chapter GENERAL INFORMATION
	Subject Introduction

PURPOSE

This manual primarily serves as a guide for the section engineer and construction inspection personnel within the Kentucky Transportation Cabinet (KYTC) to allow for the uniform application of construction specifications and inspection practices.

This manual establishes uniform procedures and guidance in the administration of:

- Construction Projects
- Field Inspection
- Construction Surveying
- Preparation of Project Records

All engineering personnel engaged in construction supervision and inspection shall follow the recommended practices contained in this manual to the extent applicable under their encountered conditions.

	Chapter GENERAL INFORMATION
	Subject Department Organization

PURPOSE

Within the KYTC, the Department of Highways is organized for the purpose of research, designing, constructing, and maintaining an adequate system of safe highways capable of providing a safe economical means of transportation for the citizens of the Commonwealth.

The organization chart in Figure 1 below illustrates the current chain of command within the KYTC as it pertains to construction within the Department of Highways:

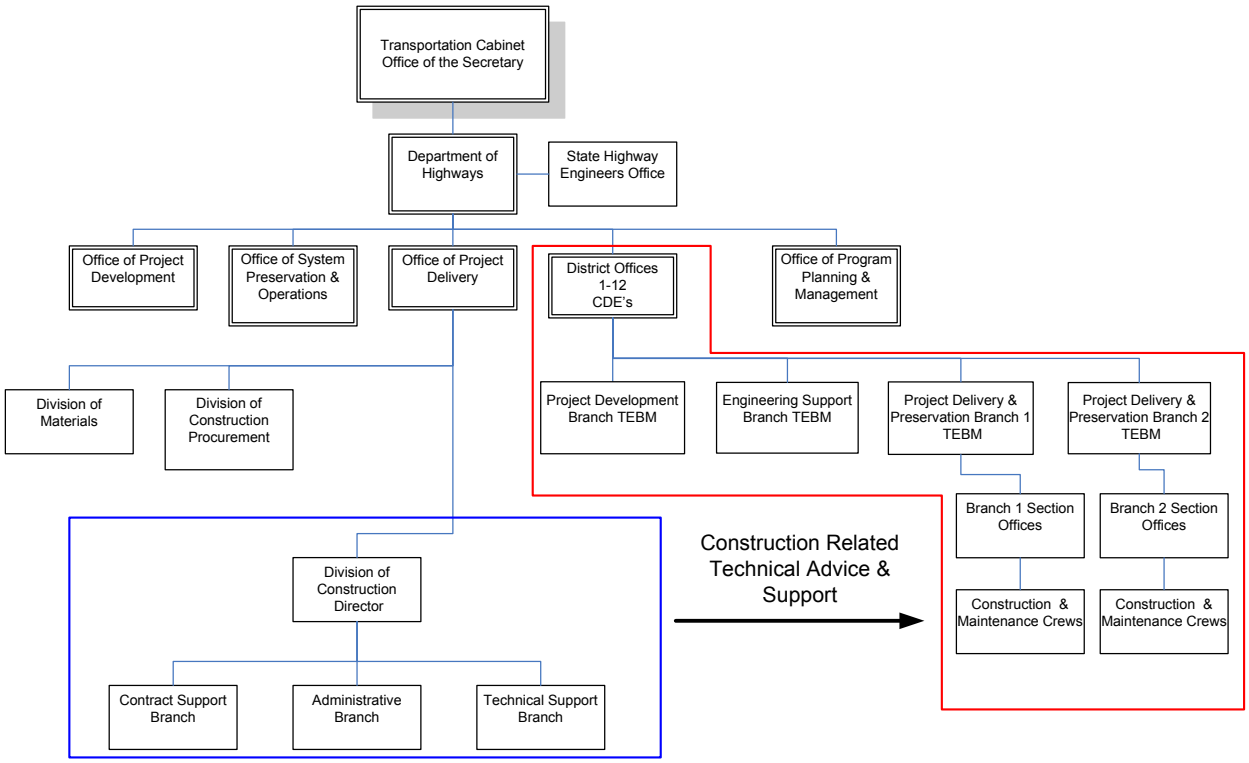

Figure 1

ORGANIZATION

The State Highway Engineer is the technical advisor to the Secretary of Transportation and, under the direction of the Secretary, manages the engineering function of the Department of Highways. Assistant and Deputy State Highway Engineers assist the State Highway Engineer in engineering responsibilities.

The Director of the Division of Construction is directly responsible to the Deputy State Highway Engineer for Project Delivery on all matters relating to contract administration and project construction.

Each district's Transportation Engineer Branch Managers (TEBM) for Project Delivery and Preservation are directly responsible through the chief district engineer to the Department of Highways.

The district TEBM's for Project Delivery and Preservation may be assisted in his responsibilities by:

- District materials engineer having charge of all matters relating to the materials utilized on construction projects
- Section engineers having direct charge of the highway construction

The Chief District Engineer (CDE) is the administrative head of the district, unclassified, and accountable through the Department of Highways to the Secretary of Transportation.

The section engineer (SE) operates under the general supervision of the district TEBM's for Project Delivery and Preservation and is the Department's representative on the project. The Department assigns personnel to the SE for assistance with the staking and inspection of projects.

	Chapter GENERAL INFORMATION
	Subject Division of Construction

RESPONSIBILITIES

The Division of Construction is charged with the responsibility of administering highway construction by contract from award until the project's completion and the contractor is paid in full, including the checking and verification of final estimates. Other divisions furnish assistance with problems in their special areas of responsibility.

The Division of Construction provides:

- *Construction Guidance Manual* that gives detailed instructions for field inspection and contract administration
- Leadership for formal training programs to improve the skills of project personnel
- Technical advice and support to chief district engineers and their district construction staff as pertains to highway construction projects by contract

ORGANIZATION

The Director of Construction heads the Division of Construction. The following staff members assist the director:

- Three Transportation Engineering Branch Managers (TEBM)
- Field engineers (acting as liaisons to the districts)
- Specialty Inspectors
- Safety Staff
- Specifications Staff
- Administrative Staff

The director and staff are directly responsible for the uniform and continual monitoring of the construction engineering inspection activities for all twelve districts.

FIELD ENGINEERS

The field engineers are the operational representatives of the Director of Construction and are assigned responsibility for a specific area (normally three districts, but may be more or less). In addition, they may be assigned special functions and responsibilities as the need arises.

FIELD ENGINEERS (CONT.)

The field engineers are responsible for general administration, including making formal acceptance of completed projects and participating on the Value Engineering and Claims review committees as requested by the director. The general duties for field engineers include:

- Field inspections on active construction projects to ensure uniform compliance with policies, procedures, contract documents, specifications, and federal regulations when applicable
- Final inspection of completed projects
- Reviewing and making recommendations of proposed change orders, construction revisions, and other project related documents
- Advising the districts regarding solutions to technical problems, plan changes, and errors related to construction projects
- Advising and coordinating the Division of Construction's activities with other divisions
- Advising and consulting with the Federal Highway Administration on federal-aid projects
- Special assignments, as required

	Section SECTION ENGINEER
	Subject Crew Organization

AUTHORITY

Each construction contract is under the responsible charge of a section engineer (SE). The district assigns the SE to the project prior to the award of the contract.

As the Department's representative, the SE will have frequent personal contacts with the contractors, property owners, municipal officials, utility representatives, and the traveling public. Working relationships with these individuals often determines the effectiveness of the SE and the SE's crew.

SECTION ENGINEER DUTIES

The SE is responsible for:

- Construction of the project in accordance with the plans
- Enforcement of governing specifications and special provisions
- Control of inspection and proper documentation
- Delegating authority and properly assigning duties to crewmembers based on their respective experience, training, and position

EXPECTATIONS FOR CREW MEMBERS

Each crew member should:

- Clearly understand the SE's expectations of him or her
- Have sufficient training in other than assigned duties, so the temporary loss of the services of a key person does not impair the crew's efficiency

	Section SECTION ENGINEER
	Subject Responsibilities

PURPOSE

The Division of Construction's primary goal is to complete projects that attain the greatest public benefit with the most efficient use of public resources in accordance with applicable laws and regulations. The section engineer's (SE's) mission is to ensure that projects are built in accordance with the awarded contract's plans and specifications.

SECTION ENGINEER RESPONSIBILITIES

The SE in charge of a construction contract is responsible for ensuring the successful completion of the project. More specifically, the SE's duties include:

- Thoroughly reviewing a contract's plans, proposal, and specifications (upon receiving assignment of a contract)
- Being fully informed of the contractor's schedule of operations and methods to achieve the schedule
- Accounting and monitoring all work items
- Ensuring successful administration of the project
- Maintaining daily records of all project activities
- Maintaining the Project Diary in SiteManager, which includes, but is not limited to, the following information:

  - Day-by-day documentation of the orders, explanations, and events that occur on the job
  - Notes on serious discussions pertaining to the project (recorded using language readily understood by someone not involved with the project)

  Note: The Project Diary may be used as evidence in court actions; therefore, the SE needs to approve the diary in SiteManager daily.

- Ensuring that crew members are properly trained for the work that they may be inspecting
- Ensuring:

  - Proper documentation and computation of pay quantities resulting from field measurements
  - Verification of computations
  - Maintenance of applicable records in a professional manner

SECTION ENGINEER RESPONSIBILITIES (CONT.)

Note: The individual preparing the computations and the individual verifying them shall sign and date this documentation. All supporting data, such as weigh tickets and invoices, shall be preserved in chronological order and the whereabouts of these items shall be referenced in the documentation.

- Documenting that all materials used on the project meet applicable specifications
- Assisting the Division of Materials in scheduling progress and final record tests
- Verifying dimensions and elevations—a traditional safeguard against errors
- Conducting relationships with contractors, their representatives, and material suppliers in a professional manner
- Establishing a regular schedule of job conferences with applicable parties for discussion of problems and schedules
- Holding a preconstruction conference as detailed in the Specifications and **CST-209**
- Scheduling additional meetings during the project, as necessary

WORK NOT COVERED IN THE CONTRACT

A contractor enters a contract to complete work in accordance with plans and specifications. The Cabinet shall not order extra work unless the method of payment to the contractor is indicated in the contract or by change order. In addition, the SE shall never knowingly permit a contractor to expend time, money, or labor in an unacceptable construction operation or to achieve an unacceptable end product under the applicable contract.

CONTESTED WORK ORDERS

If a contractor or project superintendent refuses a legitimate order, the SE shall know the steps (detailed in contract documents) that will legally impose the proper restraints. The SE shall present seriously contested orders to the contractor in writing and maintain copies in the Project File and District Construction Office. The SE shall also present these contested orders to the Federal Highway Administration (FHWA) on federal full-oversight projects.

The SE shall fully detail all such incidents in the Project Diary, including any witnesses.

The SE shall avoid dealing directly with laborers and equipment operators. Upon noticing a problem, the SE shall consult the contractor's project representative (superintendent or foreman). The SE's job is to see that the desired results are achieved; the methods of achieving them are up to the contractor. Where a specific method or methods are designated, the SE shall not waive or change the specification without a change order.

APPROVAL FOR CONTRACT CHANGES

Approval for changes that may materially affect the project shall be reviewed by:

- District Staff
- Central Office Staff
- FHWA, when involved on federal full-oversight projects

Note: All changes from the plans and specifications shall be documented and supported in the project files. Most changes will necessitate a change order. If a change does not require a change order, the SE may document this in the Project Diary or by a memo written to the project file.

PUBLIC RELATIONS

Representatives of the public's interest on highway construction contracts oversee the spending of large sums of tax dollars. The progress of the project will often generate interest from locally elected officials and news media. Public representatives shall respectfully refer questions regarding contracts and work progress to the district public information officers or the district office representative responsible for releasing that information.

The SE shall keep the job in good traveling condition, making every effort to minimize inconvenience to the tourist, the commuter, and the people living and working within the construction limits. The SE and construction crew shall be polite and considerate when approached by the public.

CORRESPONDENCE

The SE occasionally receives correspondence from citizens interested in the project. The SE shall answer all letters (addressed to him or her) within two weeks of receipt.

In any event, the SE shall discuss the receipt of every letter with the district construction engineer.

	Section SECTION ENGINEER
	Subject Care of Office, Field, & Vehicular Equipment

OVERVIEW

The ready availability of good equipment is vital to the successful completion of all projects. Poorly maintained or faulty equipment could involve the loss of time and money on construction projects.

The section engineer (SE) shall:

- Assign the equipment for use by the crew
- Ensure that crew members receive proper training in the care and use of the equipment, including an understanding of its capabilities and limitations and sufficient knowledge to perform minor upkeep such as cleaning and minor adjustments

Note: The SE must realize that the attitude they show towards maintenance and care of equipment is reflected largely in the actions of the crew.

OFFICE EQUIPMENT

Office machines such as computers, copiers, adding machines, weigh ticket machines, or calculators may be maintained by company representatives that visit field offices or by submission of the faulty equipment to the district office. In any case, the SE shall ascertain as accurately as possible the source of any trouble and contact the district engineer for further instructions.

Proper use of dust covers (normally furnished with this type of equipment) and routine maintenance (as prescribed by company representatives or manuals) will extend the life of the machines and minimize any problems associated with their use.

All computers shall be equipped with dust covers and a surge protection device. Efforts should be made to protect computers from liquids, food, and smoke. Data disks should be protected from magnetic sources (such as the telephone) and kept in as safe a place as possible.

LABORATORY & FIELD EQUIPMENT

Engineering instruments and laboratory equipment are delicate and precise pieces of equipment. The layout and control of all highway construction work is dependent on the accuracy of this equipment. The SE shall have this equipment readily at hand and in good condition throughout the construction season.

LABORATORY & FIELD EQUIPMENT (CONT.)

Trucks carrying these instruments or the instruments themselves shall be properly equipped with boxes and retaining devices designed to properly cushion and protect the instruments during transport. Engineering instruments and laboratory equipment shall be properly cleaned, adjusted, and lubricated with regularity.

VEHICULAR EQUIPMENT

Operators of Department-owned vehicles shall:

- Observe all traffic laws
- Practice courtesy in driving
- Maintain all safety devices in operating condition
- Keep vehicles properly serviced and cleaned as provided by Department policy

EQUIPMENT INVENTORY

The SE shall make a periodic inventory of all equipment, paying particular notice to the condition and repair needs of the equipment. The Division of Construction recommends that the SE perform an annual inventory during the winter months.

REPAIRS

Crew members shall perform minor repairs and maintenance as soon as possible. Equipment shall not be stored without first being cleaned, oiled, and properly adjusted.

Major repair needs of field instruments shall be itemized and reported to the district office. See **CST-615-1** for additional details on this procedure.

	Chapter GENERAL INFORMATION
	Subject Inspector

OVERVIEW

Proper inspection requires good judgment, common sense, and a thorough knowledge of the work and contract requirements. Having authority, the inspector on construction projects shall enforce the specifications.

CONFLICT RESOLUTION

The inspector shall attempt to reason with the contractor realizing that some conflicts will require mediated resolution. The section engineer SE (or superior of the SE if necessary) shall resolve differences in interpretation that arise with the contractor.

The inspector's authority comes from the right to enforce the contract, not from superior knowledge or ability. The inspector must always bear in mind that the management of the work is the contractor's business; however, if the contractor employs methods that the inspector has reason to believe will impair the quality of the finished product, the inspector shall advise the contractor's representative accordingly and notify the SE immediately.

No inspector, regardless of position, is authorized to revoke, alter, enlarge, or release any requirements of the contract. The inspector is authorized and obligated to reject out-of-specification materials and work.

MAINTAINING DATA & REPORTS

The inspector is responsible for:

- Accurately completing daily records of all work performed and the materials used
- Preparing and entering in SiteManager the necessary daily reports covering all work assignments
- Being on the job during designated working hours

	Chapter GENERAL INFORMATION
	Subject Personnel Conduct

POLITICAL ACTIVITY

State and local employees principally employed with any activity financed in whole or in part with federal funds are subject to provisions of the Hatch Act—a federal law concerning political activity. Cabinet employees meeting the above criteria shall not:

- Run for public office in a partisan election
- Use official authority or influence to interfere with or affect the results of an election or nomination
- Directly or indirectly coerce contributions from subordinates in support of a political party or candidate

For more information concerning the Hatch Act and updated advisories, refer to http://www.osc.gov/ha_state.htm.

Political activity for Cabinet employees is also limited by KRS 18A.140 and 101 KAR 2:130. For more information concerning the Cabinet's policy on political activity, refer to the *Human Resources Management Guidance Manual*.

ETHICS

All Commonwealth employees shall conduct themselves ethically in all transactions concerning organizations that do business with the Commonwealth both during and outside of working hours. Employees should contact the Executive Branch Ethics Commission for any questions of ethical concern at http://ethics.ky.gov.

FALSIFICATION & FALSE STATEMENTS

23 CFR 635.119 – False Statements requires that the following notice be posted on all highway projects receiving federal funding "where it is readily available to and viewable by all personnel concerned with the project:"

Notice to All Personnel Engaged on Federal-Aid Highway Projects

United States Code, title 18, section 1020, reads as follows:

FALSIFICATION & FALSE STATEMENTS (CONT.)

Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the costs thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction of any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever, knowingly makes any false statement, false representation, false report, or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever, knowingly makes any false statement or false representation as to a material fact in any statement, certificate, or report submitted pursuant to the provisions of the Federal-aid Road Act approved July 11, 1916 (39 Stat. 355), as amended and supplemented,

Shall be fined not more than $10,000 or imprisoned not more than five years, or both.

	Section FEDERAL HIGHWAY ADMINISTRATION (FHWA)
	Subject Overview

JURISDICTION

The United States Department of Transportation's Federal Highway Administration (FHWA) is the principal highway agency of the federal government and administers the Federal-Aid Highway Program. This program has been redefined to include those roads in the National Highway System (NHS).

In Kentucky, the roads in the National Highway System are, generally, the interstate system and all freeways and principal arterials. In addition to the interstate system, this includes all parkways, toll roads, and portions of various federal routes and major Kentucky routes.

FEDERAL FUNDING SOURCES

Proceeds of motor fuel and other highway user excise taxes deposited in the Highway Trust Fund finance the federal share of highway costs. Moneys for highway improvements are apportioned to the states in accordance with formulas established by law.

ORGANIZATION

The Federal-Aid Highway Program in Kentucky is administered through a division office headed by a division administrator. The division administrator is delegated wide authority for administration of the program in accordance with policy established by the FHWA headquarters.

The division administrator in the Kentucky division reports to a director of field services in Atlanta, Georgia; who in turn reports to the Administrator of the Federal Highway Administration in Washington, D.C. Staff specialists (in the resource center and the Washington, D.C. office) act as consultants and advisors to the division administrator.

The FHWA transportation engineer frequently visits construction projects and acts as the FHWA division administrator's representative on all field matters. Each transportation engineer in the Kentucky division reports directly to the FHWA project delivery team leader. Other staff specialists in the division office, the resource center, and occasionally the Washington office may accompany the transportation engineer on inspections or visits to the field. They provide special assistance and may take an active part in inspections.

ANNUAL INSPECTION PROGRAM

The division office establishes an annual inspection program based on the Department of Highways' active projects. Four types of inspections make up this annual program:

- Process Review/Product Evaluation (PR/PEs) (Statewide or Area-wide)
- Inspection-In-Depth (IID) (Statewide, Area-wide, Project Specific)
- Project Inspection
- Final Inspection

PROCESS REVIEW / PRODUCT EVALUATION

PR/PEs are comprehensive reviews having three primary objectives:

- Assure that state processes, procedures, and controls are in substantial conformance with federal requirements
- Assure that projects are constructed in substantial conformance with state processes, procedures, and controls
- Identify opportunities and implementation plans to advance existing processes, procedures, controls, and technology to the state of the practice or state of the art

PR/PE's determine if the state transportation agency's method of doing business (with enough product verification) is working satisfactorily. Process reviews are generally undertaken on a statewide or area-wide basis and should include a review of the process at key decision points. As appropriate, state oversight projects should be included in the sample of projects inspected as part of the PR/PE.

INSPECTIONS-IN-DEPTH

IIDs may be made on individual projects or may be part of a statewide review effort. IIDs are product-oriented but involve the tracking of processes necessary to correct deficiencies or to identify and promote processes that produce high quality products on either a project or statewide basis. These detailed inspections involve the review of specifications, procedural manuals, and specific contract requirements.

PROJECT INSPECTION

Project inspection is an on-site review to evaluate project activities and the quality and progress of the work and, if appropriate, to follow up on findings from previous inspections. These reviews are generally more limited in scope than a PR/PE, IID, or inspections at the completion of particular phases of a project (e.g. a structure inspection prior to completion of grade work around that structure).

FINAL INSPECTION

A final inspection is a review to determine the extent that the project has been completed in reasonably close conformance with the plans, specifications, and authorized changes.

	Section FEDERAL HIGHWAY ADMINISTRATION (FHWA)
	Subject Field Relationship

WORKING WITH FHWA REPRESENTATIVES

All Department employees shall cooperate with the FHWA during all phases of the contract. Construction personnel, in particular, shall be courteous to FHWA representatives during their inspections. FHWA personnel are delegated to ask questions relating to progress, quality, contractor's payrolls, etc. They may also take field measurements, review test procedures and results, or investigate requested contract changes.

The section engineer (SE), or designated representative, shall be present at the “Inspection-In-Depth” and the "Project Inspection". The SE shall be present at the FHWA "Final Inspection". The branch manager for Project Delivery & Preservation, or designee, shall attend both the "Inspection-in-Depth" and the "Project Inspection."

FHWA personnel have no authority over the contractor; nor do they have any direct authority over the SE. They may discuss changes in procedures and make recommendations while visiting the project; however, the SE shall not implement any substantial changes as a result of recommendations by FHWA personnel unless authorized by the district construction office.

FHWA PERSONNEL DUTIES

FHWA personnel are obligated to verify that the KYTC expends all federal funds in compliance with federal laws, regulations, and policy. More specifically, FHWA representatives:

- Conduct field inspections of federal-aid projects by:
  - Advising on problems and deficiencies
  - Coordinating corrective actions
  - Reviewing and evaluating safety practices
  - Sharing innovative practices, procedures, and technologies
- Monitor projects to provide for cost containment and schedule adherence
- Evaluate projects in terms of:
  - Structural and geometric design standards and applications

FHWA PERSONNEL DUTIES (CONT.)

- Economic and environmental factors
- Maintenance and construction costs
- Traffic analysis and service
- Aesthetics
- Appropriateness for the proposed highway system

➢ Evaluate and approve:

- Project authorizations
- Concurrence in award of contracts
- Change orders and work orders for extra work
- Contract claims and reimbursement to the state
- Projects upon correction of deficiencies and completion of work

➢ Review the adequacy and coordinate corrective actions of:

- Proposed rights-of-way
- Construction plans and agreements for utility and railroad work
- Consultant agreements
- Plans for work zone traffic control and detours
- Temporary structures
- Traffic safety during construction
- Procedures to eliminate or reduce adverse impact

➢ Review plans, specifications, and estimates (PS&E) for:

- Appropriate application of design standards and criteria
- Conformance with policy and regulations
- Eligibility for federal participation
- Traffic safety features
- Reasonableness of estimated unit prices
- Fulfillment of environmental commitments
- Proper standard and special specifications and contract provisions

➢ Review and evaluate information studies, engineering reports, and other documents; and recommend alternatives and modifications

➢ Meet with the KYTC, consultants, and local officials to coordinate, advise, and explain federal laws, regulations, policies, and requirements pertaining to the Federal-Aid Highway Program and monitor compliance, as applicable

STEWARDSHIP & OVERSIGHT

The "Stewardship and Oversight Agreement" between the FHWA and KYTC details the responsibilities of each agency given a particular project type. **Table 1** summarizes the agency with the primary oversight responsibility for a given project.

STEWARDSHIP & OVERSIGHT (CONT.)

TABLE 1

Type of Project	Primary Oversight Responsibility
Interstate	FHWA
Non-Interstate NHS	KYTC
Non-NHS – All Projects	KYTC
Appalachian Developmental Highway System Projects	FHWA

Other projects may be selected for FHWA oversight through a mutual agreement by FHWA and KYTC. This selection may be based on project complexity, emergencies, or other characteristics.

Tables 2 and 3 are excerpts from the "Stewardship and Oversight Agreement" and indicate the responsible agencies for a given action and project type.

TABLE 2

Construction & Contract Administration Project Activity Approval Charts					
Project Activities		**Agency Responsible**			
Approval Action	Reference Document	FHWA Oversight: Interstate & ADHS Projects	KYTC Oversight: Non-Interstate NHS Projects	KYTC Oversight: All Non-NHS Projects	Other Projects Subject to FHWA Oversight by Mutual Agreement
Approve exceptions to competitive bidding	23 CFR 635.104 & 204	FHWA	FHWA	FHWA	FHWA
Approve advertising period of <3 weeks	23 CFR 635.112	FHWA	FHWA	FHWA	FHWA
Concur in award of contracts	23 CFR 635.114	FHWA	KYTC	KYTC	FHWA
Concur in rejection of bids	23 CFR 635.114	FHWA	FHWA	FHWA	FHWA
Approve change and extra work orders	23 CFR 635.120	FHWA	KYTC	KYTC	FHWA
Approve time extensions	23 CFR 635.121	FHWA	KYTC	KYTC	FHWA
Accept material certifications	23 CFR 637.207	KYTC	KYTC	KYTC	KYTC
Concur in settlement of claims	23 CFR 635.124	FHWA	KYTC	KYTC	FHWA
Concur in termination of contracts	23 CFR 635.125	FHWA	KYTC	KYTC	FHWA
Final Acceptance/Inspection	23 USC 114a & 121	FHWA	KYTC	KYTC	FHWA
Construction Inspections	FAPG G 6042.8	FHWA/KYTC	KYTC	KYTC	KYTC
Determination of cost effective methods	23 CFR 635.204 & 104	FHWA	FHWA	FHWA	FHWA
Emergency relief	23 CFR 668	FHWA	FHWA	FHWA	FHWA

STEWARDSHIP & OVERSIGHT (CONT.)

TABLE 3

Construction & Contract Administration Project Activity Approval Charts		
Program	**Reference**	**Agency Responsible**
Buy America	23 CFR 635.410	FHWA
Local Public Agency Projects	23 CFR 635.105	KYTC
Project/Construction Authorization	23 CFR 635.106 (a)	FHWA
Quality Assurance (Program) Reviews	23 CFR 637	FHWA
Labor Compliance	2 CFR Parts 1, 3, 5, 6, & 7	FHWA (Forwarded to HQ)

FHWA & CONTRACTOR CORRESPONDENCE

On FHWA full-oversight projects, the FHWA transportation engineer shall be copied on all **formal** correspondence with the contractor.

	Chapter GENERAL INFORMATION
	Subject Archaeological Coordination

REGULATIONS

The Commonwealth of Kentucky Antiquities Act, KRS 164.705-735, and the federal provisions found at 36 CFR 800.6, require that materials of an archeological nature discovered during the course of construction work or otherwise shall be reported.

PROCEDURE

On a construction project when it appears that materials of an archaeological nature such as Indian ruins, sites, buildings, artifacts, fossils, or other objects of antiquity have been encountered, the section engineer (SE) shall immediately halt all work in the vicinity of the objects and notify the district Project Delivery & Preservation office, the Central Office Division of Construction field engineer, and the Division of Environmental Analysis as soon as possible.

The district office will, in turn, contact the Division of Construction and steps shall be taken to advise the appropriate authorities of the artifacts and permit them to inspect the site to determine a future course of action. Until such inspection occurs and construction is authorized to proceed, the SE shall take preventative measures to protect the site and assure that archaeological materials are not removed or disturbed by construction or other personnel.

Following the consultation with the Division of Environmental Analysis; the State Highway Engineer, transportation planning engineer, or designee shall decide further action on a case-by-case basis.

Additional guidance can be found in "*Removal of Artifacts from State Property (State Highway Engineer Memorandum 3/18/2002)*," (**Exhibit 9005**).

	Chapter GENERAL INFORMATION
	Subject Construction Surveying

POLICY

The Department requires "contract staking" on most major projects and on many other projects. Under the contract requirements, the Department will generally furnish the initial horizontal and vertical control points and right-of-way stakes as well as take the initial cross sections. The contractor must generally furnish all other layout and grade stakes to complete the project.

The Department's survey party shall take:

- All initial cross sections
- All final cross sections
- Other measurements used to determine the final quantities

For surveying information, Department employees and contractors should see **CST-600**, “Construction Surveying.”

	Section SAFETY
	Subject Overview

OVERVIEW

The importance of safety in Department construction operations cannot be overemphasized. In the United States, millions of man-hours of work are lost each year due to accidents. National Safety Council statistics indicate that injuries in the construction industry are three times as great as the average of all industries.

The prevention of accidents and injuries and the conservation of material and equipment are vital concerns of management. The section engineer (SE) shall monitor the safety of Cabinet personnel under his or her direct supervision. Contractors shall provide a safe workplace for their employees by ensuring compliance with all federal, state, and local safety regulations. Contractors shall provide a written *Contractor's Construction Safety Program* and any additional documentation necessary to verify that the contractors comply with **all** applicable safety and health regulations to the Division of Construction's safety liaisons in the Central Office.

The documentation of data relating to safety is as important as the necessity for maintaining accurate records of the work performed by the contractor. This data may be a vital factor in determining circumstances if the SE or those under his or her supervision are involved in claims resulting from accidents to persons, equipment, or property.

The SE or designee should routinely make an effort to review the functioning of contractors' safety measures for the public to ensure that adequate protection is provided for the public from existing or potential hazards in the vicinity of work areas. Since most accidents result from a combination of unsafe conditions and unsafe acts of people, motivating employees to safety alertness is an essential part of safety activities.

	Section SAFETY
	Subject In-House Safety

POLICY

The Transportation Cabinet shall comply with the Kentucky Occupational Safety and Health Act as well as all other applicable federal, state, or local safety regulations to ensure the safety of all Cabinet employees. Management, supervisors, and safety personnel shall establish, implement, and enforce safety and health standards for Cabinet personnel.

The section engineer (SE) shall ensure that employees under his or her supervision:

- Have a copy of the Cabinet's *Employee Safety and Health Manual* and related supplements
- Understand the provisions of the manual
- Receive detailed instructions on safety procedures when assigned a new job task with which he or she is unfamiliar

DEFECTIVE EQUIPMENT

The SE shall immediately report defective equipment to the District Construction Safety Coordinator. Equipment shall not be used when it constitutes a hazard to any employee or to the public, or when continued use may cause further damage to the equipment.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

The SE shall determine and enforce the use of proper PPE necessary for the employee to safely perform assigned tasks. PPE is available at district equipment garages or may be requisitioned from the Division of Equipment in Frankfort. Requests for special safety equipment not carried in stock shall be directed to the Employee Safety and Health Branch at (502) 564-6963.

The SE ensures that proper safety items are available and are utilized in accordance with **Chapter 8**, "Personal Protective Equipment (PPE)" of the *Employee Safety and Health Manual*.

PERSONAL PROTECTIVE EQUIPMENT (PPE) (CONT.)

Each employee shall:

- Accept the recommended safety procedure and have regard at all times for the safety of fellow employees and the public
- Report unsafe equipment and working conditions to an immediate supervisor
- Wear required personal protective equipment for the task being performed
- Not engage in horseplay or any behavior that may result in injury during hours of employment
- Not be under the influence of or use drugs or intoxicants when on duty
- Learn and follow the regulations set forth in the *Employee Safety and Health Manual*

Employees are expected to contribute ideas and suggestions for safety improvement practices.

EMPLOYEE SAFETY VIOLATIONS

Willful or continued violations of established safety and health regulations are grounds for disciplinary action (see **GAP-901**, "Employee Discipline" in the *General Administration & Personnel Manual*).

	Section SAFETY
	Subject Injury & Accident Reporting

INJURY REPORTING

Every work-related personal injury shall be reported to the immediate supervisor as soon as possible. The supervisor shall provide the IA-1 form, *Workers Compensation-First Report of Injury or Illness* (**Exhibit 9044**), to the employee to complete. The employee shall complete the form in detail and then return it to the supervisor. For further information refer to **Chapter 6**, "Injury Reporting" in the *Employee Safety and Health Manual*.

ACCIDENT REPORTING

All accidents involving the Transportation Cabinet vehicles or equipment shall be reported on KSP-232 form, *Kentucky Civilian Traffic Collision Report* (**Exhibit 9006**). The KSP-232 form shall contain correctly outlined details of the accident in a statement by the person involved. If the person involved in the accident cannot give a written statement, office personnel or the supervisor shall complete the form in the involved person's own wording.

The completed form shall be mailed to the district office and then copies shall be forwarded to the district construction safety coordinator and the Office of Legal Services in Frankfort. The district construction safety coordinator will use this copy to investigate the accident and shall report findings to the section engineer. A copy of the police report, if applicable, shall accompany this report.

The district's loss control committee shall review the accident and decide what action to pursue in cases involving carelessness, negligence, or intentional abuse.

Cabinet equipment that has been accidentally damaged shall not be repaired unless a copy of the KSP-232 form has been filed with the district or central office repair garage foreman at the time the equipment is presented for repair. A copy of KSP-232 form shall be attached to the garage repair.

	Section SAFETY
	Subject Construction Safety

CONTRACTOR'S COMPETENT PERSON

The contractor's competent person shall ensure that the contractor fulfills obligations concerning the contractual safety requirements. Cabinet personnel are neither trained nor assigned to inspect, implement, or enforce safety standards. If, however, the section engineer (SE) or a member of the crew observes construction practices with recognized hazards, the practice in question shall be reported immediately to the contractor's competent person on the project.

CABINET EMPLOYEES

The Kentucky Transportation Cabinet (KYTC) is responsible for the safety of all Cabinet employees. The Cabinet will not permit any employee to work in or around unsanitary or unsafe conditions.

All KYTC employees on the project should monitor contractor and subcontractor activities for obvious or suspected noncompliance with the Plan and safety, health and sanitation laws, rules, regulations, and guidelines. The contractor's competent person or safety officer is responsible for seeing that each contractor fulfills his or her obligations concerning the contractual safety requirements. Any concerns regarding safe construction practices should be raised immediately with the contractor's competent person, the project superintendent, or the contractor's safety officer for the operation in question.

Due to training and liability constraints, the Cabinet does not have the authority to accept a specific condition as being in compliance with OSHA requirements. Furthermore, it is not the intent of the specifications for KYTC employees to function as OSHA enforcement or OSHA inspectors. However, if a recognized danger is considered to be imminent, the appropriate phase or phases of the work shall be immediately suspended by the SE until the condition is corrected. Imminent danger is any situation or condition occurring on a construction project that, in the opinion of the SE, may result in serious injury or death to construction personnel or the public. The contractor is responsible for compliance with their Plan.

CABINET EMPLOYEES (CONT.)

In the instance where a contractor or contractor's safety officer fails to respond appropriately to the safety concerns of the SE, the SE may contact OSHA for further assistance in resolving the matter at:

EPPC – Department of Labor
OSH Division of Compliance
1047 U.S. 127 South, Suite 4
Frankfort, KY 40601-4381
(502)564-3070

CONSTRUCTION SAFETY COORDINATOR

Each district Project Delivery & Preservation office shall have an employee assigned the responsibility of coordinating safety activities in the district related to construction projects. The construction safety coordinator shall:

- Coordinate safety related construction activities between the Central Office, the district office, and the SE's office
- Correlate and disseminate safety-related information to the SE
- Aid the SE in acquiring safety equipment for personnel
- Attend preconstruction conferences
- Periodically review safety practices of Cabinet personnel on active construction projects
- Cooperate with the district safety office

AUTHORITY

The construction safety coordinator cannot supersede the SE's authority or relieve the SE of the responsibility of enforcement of safety rules and regulations for Cabinet personnel on a project.

	Section TRAFFIC CONTROL THROUGH HIGHWAY & STREET WORK ZONES
	Subject Introduction

PURPOSE

This section provides guidance and establishes procedures to assure that adequate consideration is given to motorists, pedestrians, and construction workers on all construction projects, as detailed in the Department's *Policy and Procedures for the Safety and Mobility of Traffic through Work Zones* located on the Division of Construction's website at:

http://transportation.ky.gov/construction/Policy_Procedures/workzonepolicy.pdf

BACKGROUND

During recent years, traffic safety in highway and street work zones has been greatly emphasized. Much has been accomplished in the past, but recent field reviews conducted by public interest groups, the General Accounting Office, and the FHWA demonstrate a need for further improvement in traffic safety in highway and street work zones.

The procedures shown in this section attempt to reduce or eliminate the following deficiencies noted in the national field reviews to improve traffic safety and mobility in highway and street work zones:

- Inadequate planning and coordination during plan, specification, and estimate preparation resulting in insufficient attention to traffic control
- Inadequate enforcement of safety features included in the contract
- Insufficient collection and analysis of available accident data on a project or statewide basis
- Inadequate delineation of intended travel paths, especially at night
- Inadequate protection of motorists from hazardous work areas
- Failure to adequately remove obsolete pavement markings and signs
- Storage of construction equipment and materials too close to the traveled way
- Inadequate taper distances for lane changes
- No person assigned responsibility for traffic control at the project level
- Unprotected temporary guardrail and concrete barrier ends
- Improper flagging practices
- Unprotected or improperly delineated pavement edge drop-offs

	Section TRAFFIC CONTROL THROUGH HIGHWAY & STREET WORK ZONES
	Subject Policy

POLICY

The Cabinet, by Administrative Regulation 603, KAR 5:050, adopted the 2004 revision of the *Manual on Uniform Traffic Control Devices* (MUTCD) for use on all roads and streets in Kentucky. Part VI of the MUTCD sets forth basic principles and prescribes standards for the design, application, installation, and maintenance of the various types of traffic control devices for highway and street construction, maintenance operation, and utility work. The MUTCD does not intend to address in depth all the situations that may occur in traffic control in work zones.

The procedures in this section provide guidelines to help ensure that the MUTCD is properly implemented on all of the Cabinet's activities requiring work zones on highways and streets. The MUTCD sets minimal standards for the Cabinet to follow. The Cabinet may only make these more stringent through requirements in standard drawings, specifications, plans, or other contract documents.

	Section TRAFFIC CONTROL THROUGH HIGHWAY & STREET WORK ZONES
	Subject Preconstruction Procedures

TRAFFIC MANAGEMENT PLAN (TMP)

Projects let by the Cabinet shall be referred to as either "Significant" or "Other".

Significant Projects shall be:

- Any Interstate System project that is anticipated to occupy a location for more than 3 days
- Any project on any multilane roadway that is anticipated to occupy a location for more than 3 days where the existing directional DHV is over 1000 vehicles per hour, per lane, that would close a lane during the peak hours
- Any project on a 2 lane roadway that is anticipated to occupy a location for more than 3 days where the existing DHV (both directions) is over 1000 vehicles per hour that would close a lane during the peak hours
- Any project on the Interstate or National Highway System that would involve a detour

All projects not meeting the aforementioned requirements shall be referred to as **Other Projects**.

For Significant Projects, a Transportation Management Plan (TMP) shall be developed that details a strategy to manage the work zone impacts. The TMP will include a Temporary Traffic Control Plan (TTCP) and a Public Information Plan (PIP). TMPs for significant projects shall also be developed consistent with the Traffic Impact Guidelines listed later in this section. For all other projects the TMP will only consist of a TTCP, unless the project team determines that a Public Information Plan is necessary.

The approval of the TMP will be the responsibility of the project development team (PDT). The project manager and the district branch managers for Construction and Traffic shall approve and sign the TMP. The FHWA shall approve and sign the TMP for federally-funded interstate or other full oversight projects. The TMP must be approved by the time final plans are sent to the Plan Processing Section. A copy of the approved TMP will be retained in the project files by the district, with a copy transmitted to the location engineer in Central Office Design.

TRAFFIC MANAGEMENT PLAN (TMP) (CONT.)

For other projects (not identified as "Significant", such as routine surfacing, overlays, pavement marker installations, etc.) for which the proposal is the only bidding document developed for the specific project, a TTCP shall be developed and approved by the division in charge of managing the project.

TEMPORARY TRAFFIC CONTROL PLAN (TTCP)

The Temporary Traffic Control Plan may range in scope from being very detailed (designed solely for a specific project) to referencing any number of specified documents. The degree of detail in a TTCP will depend on the project complexity and the relationship of traffic with the construction activities. When necessary, the TTCP shall include the specific phasing required for the particular project, such as multiple lane paving operations, bridge rehabilitation projects, etc. Drawings and notes shall be developed and placed on traffic control sheets within the plans.

To assure consideration is given to traffic control from the inception of design activities, the proposed concept for traffic control shall be discussed at the preliminary line and grade inspection with appropriate notation included in the inspection report. The designer responsible for plan preparation shall expand on the concept recommended at the preliminary line and grade inspection, with the compilation of a detailed suggested sequence of construction. This is to be reviewed at the time of the final joint inspection by the section engineer and design staff.

The scope of the TTCP shall be determined at the time of the final joint inspection once the sequence of construction is considered firm. The TTCP will be developed using the Standard Specifications and Standard Drawings as a basis. Only those requirements not provided in the Standard Specifications required for maintaining and controlling traffic are to be written into the TTCP. The TTCP will clearly indicate all required phasing, methods of traffic control, and any time or construction limitations that will be placed on the contractor.

Attention shall be given to developing strategies that will limit impact to the traveling public. As much as possible, the existing number of lanes shall be maintained throughout a construction project, particularly on the interstates and other major routes. Where it is determined that lane restrictions are necessary, assuring limited closures must be a primary consideration. Considerations for these decisions will include restricting work during peak periods of traffic flow on the route and demanding the use of nighttime construction. The TTCP shall also take into account other adjacent roadway sections that may be under construction and avoid conflict between competing phases of adjacent projects.

DEVELOPING A TTCP FOR INTERSTATE PROJECTS

The following traffic impact guidelines shall be utilized to develop a TTCP for interstate projects:

- Expected queue length due to lane closures shall be analyzed and should not exceed 3 miles more than what would normally be expected without the construction project.
- Total closures of an interstate segment should not be considered unless there is an interstate detour available that can safely accommodate the expected increased traffic.
- User costs shall be analyzed and the use of incentives/disincentives to encourage timely completion of the total project or critical phases should be considered.

DEVELOPING A TTCP FOR NON-INTERSTATE PROJECTS

The following traffic impact guidelines shall be utilized to develop a TTCP for non-interstate projects:

- Expected queue length due to lane closures shall be analyzed and should not exceed 3 miles more than what would normally be expected without the construction project.
- Total closures of a segment should not be considered unless there is a detour available that can handle the expected increased traffic.

  Note: Alternate travel routing should not exceed 10 miles.

GENERAL TTCP GUIDELINES

In developing and implementing the TTCP, pre-existing roadside safety hardware shall be maintained at an equivalent or better level than existed prior to project implementation.

The construction plans or contract proposal shall specify that the furnishing, installing, moving, replacing, maintaining, and cleaning of traffic control devices required by the TTCP are either unit bid, a lump sum bid, or incidental to the contract. The complexity of the project will determine the pay method selected. For proposal-only projects, such as resurfacing projects, traffic control should normally be incidental to the contract. This method of payment normally should not be used for projects with detailed, complex TTCPs.

For projects such as routine surfacing, bridge deck overlays, pavement marker installations, etc., that do not require the usual reconstruction activities (plan development, joint inspection, etc.) and for which the proposal is the only bidding document developed for the specific project, the TTCP may consist of standard drawings with reference to standard specifications, standard drawings, and the MUTCD.

PUBLIC INFORMATION PLAN

On significant projects, the project team shall formulate a Public Information Plan that identifies communication strategies that will be used to inform the affected road users, the general public, area residences, businesses, and appropriate public entities concerning the work zone traffic control measures of the project. The district's public information officer shall be included on the project teams for significant projects.

Public information should be provided through methods best suited for the project, and may include information on the project characteristics, expected impacts, closure details, and commuter alternatives. Some of the methods to be considered include public meetings, media stories or ads, web sites, highway advisory radio, changeable message signs, 511 messages, printed material at selected sites, rest area kiosks, etc. The Public Information Plan shall be implemented by Cabinet personnel, by hiring a public relations consultant, or by making it a part of the construction contract.

	Section TRAFFIC CONTROL THROUGH HIGHWAY & STREET WORK ZONES
	Subject Construction Procedures

IDENTIFYING PROJECT & SAFETY COORDINATORS

Each administrative district shall identify an individual as the district work zone safety coordinator (DWZSC). This individual shall coordinate the monitoring and reporting of all activities related to the safety and mobility of traffic through work zones in the district.

As outlined in **CST-209**, the section engineer, and other interested parties, shall review, discuss, and plan for traffic control at the preconstruction conference. Required traffic inspections shall be documented daily on the daily work report.

For each project, the Cabinet and the contractor shall each designate a project traffic coordinator who has the primary responsibility and sufficient authority for implementing the TMP and other safety and mobility aspects of the project. Both positions shall be established at the preconstruction meeting. Both the Cabinet's and the contractor's designated project traffic coordinator shall be certified as a work zone supervisor. Work zone supervisor certification and flagger certification programs will be made a part of the standard specifications.

TEMPORARY TRAFFIC CONTROL PLAN ALTERATIONS

After a project is placed under contract, the contractor may be permitted to develop his or her own Temporary Traffic Control Plan (TTCP) to be used in lieu of the TTCP provided in the construction plans. The contractor's plans will be approved for use only if the Cabinet and FHWA, if applicable, find that the plan is as good as, or better than, the plan provided in the construction plans. The contractor may also be permitted to offer a revision, for approval, to any portion of the existing TTCP.

To receive approval for major changes to the TTCP, the contractor must submit his detailed alternate plan or revision to the section engineer. Depending on the complexity of the requested revision, the major change may be processed as a construction revision, change order, or other document satisfying the condition of written approval. Any major change or alternate TTCP must submit to the same level of traffic impact analysis as was required for the initial Traffic Management Plan (TMP).

TEMPORARY TRAFFIC CONTROL PLAN ALTERATIONS (CONT.)

The contractor will not be permitted to implement any part of an alternate plan or revision until he or she has received written approval from the Cabinet. All major revisions to a project's TTCP shall be reviewed by the initial signers to the subject plan before any revision is implemented. Minor changes may be approved and appropriately documented by the section engineer for immediate implementation as he or she deems necessary.

The initiation of any change order that affects the flow of traffic through the project shall require a review and possible modification of the current TTCP.

CRASH & SAFETY MONITORING

The section engineer, or designee, shall monitor the crash history for work zones on construction projects. The section engineer shall review the existing traffic control if he or she becomes aware of a crash within a work zone on any project, including any collisions that may occur upstream of the work zone that are likely caused by features of the downstream work zone. When requested by the section engineer, the district branch manager for Traffic shall assist in this review. A written report of this analysis and any recommendations shall be sent to the district branch manager for Construction and the district's work zone safety coordinator.

On all construction projects, the district's work zone safety coordinator (DWZSC) shall:

- Maintain a list of all reported crashes
- Locate and retain copies of crash reports for all work zone collisions
- Provide copies of the reports to the section engineer when necessary

On Significant Projects, the work zone safety coordinator shall search for crash records of unreported collisions. These records can normally be found by routinely reviewing crash data for roadways under construction. These collisions shall be included on the overall list of project collisions, and crash records shall be retained.

Inspections required by this manual shall be documented in either the diary or daily inspection report.

CONTRACTOR LIABILITY

It is not the intent of this policy to relieve the contractor of his or her responsibility to continually inspect and maintain the traffic control items and to safely enable the movement of traffic through the work area. The contractor is responsible for traffic safety on the project. The state's responsibilities shall be limited to identifying acceptable control levels and taking measures to effectively enforce contract provisions. However, the contractor's responsibilities shall not be diminished by the state's failure to completely enforce such provisions.

ACCIDENT REPORTING

The section engineer shall report all known traffic accidents that occur on a project as soon as possible to the chief district engineer. The section engineer shall, to the best of his or her ability, analyze the circumstances involved in the accident and advise the chief district engineer (through the branch manager for Construction) of recommended changes, if any, in the TMP.

The district branch manager for Engineering Support, when requested, will assist in the investigation and analysis. An effort will be made by the section engineer to obtain accident reports prepared by law enforcement officers having jurisdiction in the project area. This data will be utilized in evaluating the TMP.

	Section TRAFFIC CONTROL THROUGH HIGHWAY & STREET WORK ZONES
	Subject Process & Review Evaluation

DISTRICT REVIEW

The branch manager for Traffic shall routinely review all traffic control devices on all significant construction projects and report findings to the chief district engineer. Major deficiencies shall be brought to the immediate attention of the section engineer and branch manager for Construction.

STATEWIDE REVIEW TEAM

A review team consisting of representatives of the Divisions of Construction, Traffic, Maintenance, and Design shall annually review randomly selected projects throughout the state to assess the effectiveness of the procedures included in this document. The representative of the Division of Construction shall serve as chairperson of the review team and be responsible for organizing the team, scheduling the reviews, and reporting the results.

This review team shall recommend revisions to this document when they deem it appropriate. All revisions shall receive the concurrence of the Department of Highways and the FHWA for approval by the Secretary of Transportation.

REPORT DISTRIBUTION

The results of each annual review shall be compiled in a written report and a copy of this report forwarded by the Director of the Division of Construction to the FHWA. The Director of Construction shall also forward copies to those offices within the Cabinet that have an interest in the contents of the report.

	Section HIGHWAY CLOSURE & ACCIDENT REPORTS
	Subject Incident Reporting

INCIDENTS TO REPORT TO FHWA

Incidents meeting the following criteria shall be reported promptly to the FHWA (nights, holidays, weekends, as well as normal working hours):

- Accidents and incidents involving multiple fatalities, numerous injuries, or significant property damage involving fire, explosion, or release of hazardous materials necessitating the evacuation of the immediate area, thus closing roads, streets, or highways
- Any accident involving a school bus resulting in fatalities or disabling injuries
- Any incident causing a major highway to be closed for more than 24 hours, except for closures (maintenance, construction, etc.) where the public has been notified in advance via newspaper, radio, or television announcements
- Any incident that causes major damage to highway facilities
- All bridge failures or closures (Please advise if the closure was the result of a bridge inspection)

INCIDENTS TO REPORT TO FHWA TRANSPORTATION ENGINEER

Accidents on federal aid construction projects causing deaths or disabling injuries to workers on the job or to the general public shall be reported during normal work hours to the appropriate FHWA transportation engineer or project delivery team leader.

	Section HIGHWAY CLOSURE & ACCIDENT REPORTS
	Subject Notification Methods & Reporting Responsibilities

METHOD OF NOTIFICATION

Reporting of any of the listed incidents shall be made to the Central Office, Division of Maintenance as soon as possible. Reports during normal work hours (or at any time when access to the state government telephone system is available) shall be made by calling (502) 564-4556. The Division of Maintenance is manned on a 24-hour basis, seven days a week. If not feasible to call on the state government telephone system, notification may be made by calling (800) 372-7175.

REPORTING RESPONSIBILITIES FOR DISTRICT PERSONNEL

It will be the responsibility of the following individuals to report the particular incident to Central Office in the order indicated:

1. Branch Manager for Project Delivery & Preservation

2. Chief District Engineer

During off-duty hours, the person on emergency assignment in the district office will precede the above list and supply the needed information to the appropriate person in the Central Office.

REPORTING RESPONSIBILITIES FOR SECTION ENGINEER

The section engineer's office shall notify the chief district engineer of any accident on a federal aid construction project causing death or disabling injuries to workers or the general public. The chief district engineer shall transmit the report to the Central Office, Division of Maintenance as soon as possible.

REPORTING FOR NON-FEDERAL AID PROJECTS

The section engineer shall also report accidents on non-federal aid projects to the chief district engineer. These reports shall clearly state that they concern a non-federal aid project. It is not necessary to report accidents on non-federal aid projects to the FHWA.

REPORTING RESPONSIBILITIES FOR CENTRAL OFFICE

Upon receipt of any report pertaining to incidents detailed in **CST-113-1**, Central Office personnel shall direct the report to the following Federal Highway Administration official in the order indicated:

NAME	OFFICE PHONE	CELL PHONE
Colin McCarthy	502-223-6727	518-210-2289
Evan Wisniewski	502-223-6740	502-330-4731
Jose Sepulveda	502-223-6721	502-330-5800
Tony Young	502-223-6751	502-330-7494
John Ballantyne	502-227-6747	502-330-4733
Dennis Luhrs	502-223-6723	502-330-4730

Any major incident occurring during nighttime, weekends, or holidays shall be reported to the FHWA as soon as possible. Road closures due to snow or flooding shall be reported the following morning immediately after receiving the district office report.

	Chapter GENERAL INFORMATION
	Subject Hazardous Wastes & Substances

PURPOSE

This chapter provides guidance and establishes procedures to help assure that adequate consideration is given to construction sites with potentials for hazardous wastes.

SECTION ENGINEER RESPONSIBILITIES

When finding a previously undiscovered or suspected hazardous waste site, the section engineer:

1. Reports the site to the district office, the Division of Construction liaison, and the Division of Environmental Analysis
2. Halts work in the vicinity of the site
3. Requests an investigation of the site to assess the presence of contamination and to determine the need for any cleanup
4. Oversees any mitigation or cleanup required as a part of the construction contract because of the involvement with a hazardous site

REQUESTS FOR INVESTIGATION

The Division of Construction shall make all requests for investigation of a potential hazardous waste site using the *Hazardous Substance/Waste Site Investigation Request* (**Exhibit 9002**). The Division of Construction shall transmit the completed form and all necessary information to the Division of Environmental Analysis so that they may perform an investigation.

UNDERGROUND STORAGE TANKS

Exhibits 9003 and **9004** provide guidance concerning the discovery and removal of underground storage tanks.

	Chapter PRECONSTRUCTION REQUIREMENTS
	Subject Project Plans

PLAN DISTRIBUTION

The district project delivery and preservation office will be furnished with the following sets of plans to be distributed as follows:

- District office—One set of record plans
- Section engineer (SE)—five sets of roadway and cross-sections, three sets of roadway plans, and eight sets of structure plans

Note: On all other projects, such as signing, major surfacing, safety, etc., one complete set of record plans will be furnished to the district project delivery and preservation office with seven complete sets to the SE.

In all cases, the SE will retain one complete set of plans as office plans and as many additional sets or partial sets deemed necessary for the project. The SE distributes the remaining plans to the contractor in whatever manner satisfies both parties.

For larger projects, reduced plans may be obtained from the Division of Highway Design, Plan Reproduction Center on the first floor of the Transportation Office Building in Frankfort approximately at the time of the letting.

ORIGINAL ROADWAY PLAN

The SE will receive the original plans early in the life of the project. Eventually, this set of plans will become the "As-Built" plans. In addition, the SE will utilize these plans to run copies of the plan sheets for construction revisions, permits, etc. This is an important set of plans and care must be taken to preserve them from damage or loss.

The SE may request additional copies of the original plans by either contacting the Division of Construction field liaison or the Division of Highway Design, Plan Reproduction Center at (502) 564-3598.

If contractors desire additional plan sets beyond those furnished by the SE, they may contact the Plan Reproduction Center. Contractors will be billed at the current printing rate for additional copies.

ORIGINAL STRUCTURE PLANS

The Division of Structural Design retains original structure plans and files them by their drawing number. They are not distributed to the SE. Any reference to specific structure plans, whether written or verbal, should include the project number, type of structure, station number, and drawing number.

RECORD PLANS

Two sets of record plans, referred to as official plans, are prepared for each project. One set is retained on file in the Division of Construction and the other set is filed at the district project delivery and preservation office. A copy of every construction revision shall be inserted in the record plans in each office. The record plans shall be kept on file in each office until all payments are received for the applicable project. At this time, the record plans will be removed from the active plan files, identified for future reference, and destroyed.

"AS-BUILT" PLANS

The SE prepares "As-Built" plans for submission with the final estimate. Eventually, they are received in the Division of Construction with the final estimate. After the Division of Construction reviews the final estimate, the original "As-Built" plans are transferred to the Division of Highway Design Microfilm Section to be reviewed and transferred to the Department of Library and Archives for microfilming. The Department of Library and Archives will store the original "As-Built" plans according to their record and retention schedule.

	Chapter PRECONSTRUCTION REQUIREMENTS
	Subject Plan Review

PLAN FAMILIARIZATION

Prior to the beginning of actual construction, the section engineer (SE) should thoroughly check the plans and become familiar with the project in general. This includes, but is not limited to:

- Comparing the typical roadway section as shown on the plans with the roadway section as shown on the cross-section sheets in order to find potential variations, other than noted differences

  Note: Variations may indicate an error in excavation or surfacing quantities that could lead to an error in the location, size, and length of a structure.

- Checking plan dimensions and quantities of all structural plans, including all critical elevations, flow lines, lengths, clearances, etc.

- Thoroughly reviewing plan quantities of surfacing materials

  Note: Road intersections, curve widening, mailbox turn-outs, and private entrances, if applicable, must be included in the area to be surfaced.

The SE shall inform the district project delivery and preservation office of any plan discrepancies, apparent plan errors, or insufficient plan quantities for reconciliation.

	Chapter PRECONSTRUCTION REQUIREMENTS
	Subject Field Check of Structures

PRELIMINARY FIELD CHECK

The section engineer shall make a field check of all bridges and culverts prior to the contractor beginning any work on the structure aside from staking. These checks should be done as early as possible with any recommended changes or discrepancies brought to the attention of the district construction office.

	Chapter PRECONSTRUCTION REQUIREMENTS
	Subject Field Books & Staking

PREPARING PROJECT FIELD BOOKS

After being assigned to the project, the section engineer (SE), or surveying party chief responsible for the field work, should begin preparation of project field books as soon as possible. This is to occur before any staking is done.

Refer to **CST-600**, "Construction Surveying," for further information.

STAKING

The SE should begin staking the project at the earliest possible date after the field books have been prepared. If the project has contract staking, the SE should have his or her staking substantially complete by the time of the preconstruction conference and be ready to turn the project over to the contractor.

Section 201 of the Standard Specifications details the SE's staking responsibilities.

	Chapter PRECONSTRUCTION REQUIREMENTS
	Subject Determining Personnel, Vehicle, & Signing Requirements

PERSONNEL

The section engineer (SE) should review available manpower and make plans for any foreseeable problems. Job training should be instituted as needed for issues related to shortages in necessary experience or knowledge. The SE shall alert the district project delivery and preservation office of any anticipated personnel shortages at the earliest possible date.

VEHICLES

The SE should anticipate crew vehicle requirements and inform the district project delivery and preservation office of this situation. Additional requests for vehicles should be submitted to the district project delivery and preservation office. The Division of Fleet Management in Frankfort distributes vehicles.

CONSTRUCTION SIGNING

The SE should inspect the project soon after receipt of the plans to determine the project signing requirements. Any recommendations concerning construction signs are to be presented at the preconstruction conference or to the contractor as requested. For further information, refer to **CST-112**, "Traffic Control through Highway & Street Work Zones."

	Section RIGHT-OF-WAY CONCERNS
	Subject Encroachments on the State's Right-of-Way

REMOVAL OF ENCROACHMENTS

All right-of-way as shown on the plans is to be free of encroachments unless stipulated in the deed. If encroachments, such as fences, buildings, signs, etc., are found on the right-of-way, the section engineer (SE) must:

- Advise the property owner of the encroachments

  Note: The SE shall always be accompanied by a crewmember when informing a property owner of an encroachment.

- Stake the area of the encroachment sufficiently to present a clear picture to the property owner

- Record their actions, any witnesses, and the results in the daily work report and project diary

- Fully inform the district project delivery and preservation office of progress

- On FHWA full-oversight projects, contact the FHWA regarding the encroachment issue

If the encroachment is not immediately removed, the SE should notify the District Executive Director who will immediately consult the district legal staff. The legal staff will contact the property owner and advise them of the necessity of removing the encroachment. At this time, the District Executive Director will also present a written legal notice requesting removal of the encroachment (**Exhibit 9024**).

Upon expiration of the time specified in the legal notice, the SE field checks the encroachment area for compliance. If the encroachment is not removed, the District Executive Director will undertake the necessary action to have the encroachment removed.

	Section RIGHT-OF-WAY CONCERNS
	Subject Work on the Railroad Right-of-Way

REGULATIONS

Section 107.18 (E) of the Standard Specifications requires the contractor to obtain protective public liability insurance with regard to working on railroad right-of-way.

INSURANCE

This liability insurance is required for any work within railroad right-of-way regardless of whether this requirement is noted in the proposal or inadvertently omitted from the proposal. The insurance policy shall be received by the Department prior to issuance of the work order.

The section engineer (SE) should review each proposal involving work on railroad right-of-way and insure that the railroad protective insurance is a contract requirement.

If the project involves work on railroad right-of-way, or if there is any doubt, and if there is no requirement for this insurance in the proposal, the SE shall notify the district project delivery and preservation office who shall immediately notify the Division of Construction.

RAILROAD FLAGGING

Projects requiring the contractor to work over adjoining railroads must require that the railroad provide flagging while the work could endanger trains. Sometimes the contractor is required to reimburse the railroad for this cost (an incidental cost in the contract), and other times the state pays the railroad for the flagging costs. The project proposal will specify which requirement applies to the contract.

The SE shall check the project bid proposal for all projects involving work over or immediately adjacent to railroads and verify that railroad flagging is required.

If flagging is not a requirement in the proposal and the contractor is required to work over or adjacent to a railroad, the SE shall advise the district project delivery and preservation office who shall immediately notify the Division of Construction.

	Chapter PRECONSTRUCTION REQUIREMENTS
	Subject SiteManager Diary

PURPOSE

The section engineer's (SE's) SiteManager diary entry is a very important document. The accuracy and completeness of the diary will ultimately affect the settlement of:

- Claims
- Liquidated damages
- Liability claims and suits
- Disputed quantities

The dairy shall be kept absolutely factual, current, and complete.

Refer to Section 12 of the *SiteManager Construction Training Manual* for all details relating to the diary.

CREATING A DIARY

The SE will create a Diary for each day an item of work is recorded on an inspectors daily work report for all contract types. A Diary will also be created daily (including weekends and holidays) to charge/not charge a day of work on Working Day Contracts.

DIARY ENTRIES

The SE shall review each inspector's daily work report and record pertinent information related to any disputed items of work, delays, discrepancies found in the plans, differences of opinion between Department personnel and the contractor. It is very desirable that emphasis be placed on recording any information that might have bearing on claims and disputes, either existing or anticipated.

	Chapter PRECONSTRUCTION REQUIREMENTS
	Subject Traffic Control

OVERVIEW

The provisions and requirements for protection of the public by the contractor through furnishing, installing, and maintaining barricades, signs, pavement markers, and other traffic control devices are set out in some detail in Section 112 of the Standard Specifications. The section engineer (SE) should see that the contractor provides for the safe movement of traffic per their maintenance of traffic plan, but he or she should avoid issuing instructions that differ from the contractor's maintenance of traffic plan which will shift the burden of responsibility to the Cabinet. The SE shall call the contractor's attention to any questionable situation that exists, and instruct him or her to take the necessary action to properly provide protection and warning to the traveling public. The SE shall keep a careful record of all traffic control inspections made, their results, and any instructions to the contractor.

Section 112 also provides that all traffic control devices shall conform to the *Manual on Uniform Traffic Control Devices for Streets and Highways*, current edition.

Reflective materials for construction signs, barricades, and delineation shall conform to Section 830 of the Standard Specifications.

EVALUATING THE TRAFFIC CONTROL PLAN

Prior to the preconstruction conference, the SE should review the project plans and proposal carefully with emphasis on any special notes and/or drawings pertaining to the traffic control plan. The SE should also inspect the project in the field and make notes of any unusual or unanticipated traffic related problems that exist. The SE should bring the list of issues to the preconstruction conference for discussion.

ADDRESSING THE TRAFFIC CONTROL PLAN AT THE PRECONSTRUCTION CONFERENCE

At the preconstruction conference the contractor will outline his or her order of work and review his or her proposed method for handling traffic. The contractor will also be expected to designate supervisory personnel that will be responsible for traffic control and available to the SE twenty-four hours a day, seven days a week, throughout the life of the project whether work is active or not.

ADDRESSING THE TRAFFIC CONTROL PLAN AT THE PRECONSTRUCTION CONFERENCE (CONT.)

The preconstruction conference will provide an opportunity to discuss project traffic control and possibly improve traffic service over that originally proposed. Any changes requested by the contractor solely for the benefit of his or her operations would have to provide equal traffic service in order to receive consideration. Any changes in the traffic control plan must also meet the requirements of the Traffic Management Plan, discussed in **CST-112**. This will require a review by the original signatories and FHWA, if applicable.

The district traffic engineer must be invited to attend the preconstruction conference. This will assist in determining the Department's traffic control responsibilities since the contractor's responsibility ends and the Department's begins 1500 feet outside the project limits. These limits may be adjusted through special provisions. The procedure for handling existing signage belonging to the Department but that may be in conflict with the construction work, should be discussed and agreed on with the district traffic engineer.

ERECTING SIGN & TRAFFIC CONTROL DEVICES

Just prior to beginning construction, the contractor shall erect the necessary signs and traffic control devices to protect the traveling public. The SE must inspect and agree to these signs and devices before work is permitted to start.

Traffic control can be a phased operation and only the devices necessary for immediate operations need to be installed. The SE must see that the public has adequate warning of construction work at each work site but must not permit the premature erection of signs that would mislead or confuse travelers.

The contractor shall cover erected signs until they become applicable to the situation. This sign covering must be done in a manner that is nonhazardous and nondamaging and shall cover the sign completely.

Changing signing requirements, as the construction progresses, may cause conflicts with existing Department signs when the road is being built under traffic. When this occurs, the SE should advise the district traffic engineer so that the signs may be adjusted to meet current conditions.

During the period of active construction on the project, the contractor must keep signs and other traffic control devices current with the existing traffic conditions, clean, and in good state of repair. The SE should ensure traffic control devices are inspected every day and frequently at night. Since familiarity with the job often dulls one's realization of problem areas, the SE should seek the opinion of others relative to the effectiveness of the traffic control.

ERECTING SIGN & TRAFFIC CONTROL DEVICES (CONT.)

In accordance with Section 112 of the Standard Specifications, the contractor's responsibility for the maintenance of barricades, signs, and lights will not cease until the project has been accepted.

	Chapter PRECONSTRUCTION REQUIREMENTS
	Subject Preconstruction Conference

GENERAL

As soon as possible, after a project has been awarded and the work order has been issued, the district project delivery and preservation office should arrange a conference with the contractor and other interested parties to review construction details, proposed schedules, etc.

Before the meeting, the section engineer (SE) should study the plans and any special provisions or notes and make a field inspection of the project to get well acquainted with requirements and existing conditions.

To arrange the meeting at a time most convenient to everybody, it is suggested that the district project delivery and preservation office contact the principal parties as to their availability and preference by telephone after which, formal notification will be made by letter.

LETTER OF NOTIFICATION

The letter of notification shall be written to the prime contractor with copies distributed to all concerned parties, as shown below. In this letter, the contractor shall be notified of items on the agenda and any specific problems or contract requirements that require documentation or submittals at the meeting. The prime contractor shall also be requested to bring any subcontractors of the project to the meeting.

Copies of the letter of notification will be sent to the following:

- FHWA (if applicable)
- All utility companies involved
- Municipal and/or county engineers (if applicable)
- Railroad (if applicable)
- Other specialized or interested parties as deemed necessary

Email notification of the letter will be sent to the following:

- District Executive Director
- Director, Division of Construction
- Division of Construction Procurement
    - EEO (if applicable)
    - Wage Compliance
    - Training (if applicable)

LETTER OF NOTIFICATION (CONT.)

- Division of Maintenance
- Division of Materials
- District Personnel
    - Utility Agent (if utilities are involved)
    - District Materials Engineer
    - District Traffic Engineer

RECORD OF MEETING

Minutes shall always be taken of the preconstruction conference and a record made of those in attendance and who they represent. **The proceedings shall be digitally recorded with supplemental notes taken by the district project delivery and preservation office.** The recording becomes a permanent verbal record of the meeting and shall be retained by the district project delivery and preservation office until the project files are closed out. A written record of the meeting shall be prepared in letter form to the Director, Division of Construction, with copies sent to all participants, the District Executive Director's Office, the FHWA, if applicable, and the project file.

UTILITIES

Notices shall be sent to all utility companies having utility adjustments to be made and those that have already relocated their facilities (particularly if these facilities remain within project limits). Every effort should be made to afford the contractor as much information as possible relative to the location of and timetable for relocating any utilities or, if the utilities have already been moved, the location of the new facilities as well as the old, provided they were abandoned and not removed.

In the event that high-pressure gas lines, telephone trunk lines, railroads, or other utilities of a critical nature are located within project limits, the representatives of these companies shall be asked at the meeting to give the name, address, telephone number, and other pertinent information of their nearest responsible representative.

The district utility agent can assist in making arrangements for the utility companies to attend the meeting, introducing the representatives at the meeting, and, in general, providing background information necessary to understand the overall situation relative to utilities within project limits.

Those items affecting utilities should be discussed immediately following the presentation of the contractor's plan of operation and progress schedule. The utility companies may then be excused if they do not wish to remain for the detailed discussion of the contract work.

If the contractor's schedule conflicts with the removal or relocation of any utilities on the project, an effort should be made to revise the schedules of the utility company, the contractor, or both in a manner satisfactory to all and most advantageous to the work involved.

BEFORE YOU DIG

The contractor shall be advised at every preconstruction conference that it is the contractor's responsibility to ensure that all utilities are marked and not disturbed by operations including lines owned or managed by the Department. The contractor should be made aware of the B.U.D (before you dig) service at 1-800-752-6007. They should be informed that not all companies are part of this system and that the County Clerk's office can assist in contacting other utility companies.

SUBJECTS TO BE DISCUSSED

The preconstruction conference shall be conducted according to the *Pre-Construction Conference Checklist* (**Exhibit 9001**). The following topics shall be addressed in preparing an agenda for the preconstruction meeting:

- Prime contractor and principal personnel
- Project contract time
  - Completion date
  - Procedure for assessment of time
  - Proposed plan of operations
  - Progress schedule for the entire project
- Construction revisions
- Employee and public safety
- Erosion and pollution control requirements
  - BMP
  - Notice of Intent
  - Spill Prevention Plan (if applicable)
  - Other environmental issues
- Project staking
- Construction signing and traffic control
- Labor compliance provisions
  - Submission of payrolls
  - Necessary posters
  - EEO
  - Trainees
  - Minimum wages requirements
- Materials
  - Notification of material sources
  - Material sampling procedures
  - List of suppliers
- Excess material or borrow sites
  - Permits requirements
  - Archeological survey
  - Property owner agreement

SUBJECTS TO BE DISCUSSED (CONT.)

- Subcontracts
- Equipment rental and lease agreements
- Contractor evaluation form
- Claims procedures
  - TC 63-32 form, *Notice of Changed Condition/Disagreement* (**Exhibit 9021**)
  - Discussion of process (Section 105.13 of the Standard Specifications)
- Work on or over railroad right-of-way
- Utility issues
- Project specific issues and plan issues

This list is not all inclusive of the topics that should be covered for a particular project. Section 108.02 of the Standard Specifications contains a detailed description on submittals that are required at the preconstruction conference.

	Chapter CONTRACT ADMINISTRATION
	Subject Construction Revisions

CAUSES FOR A REVISION

A construction revision will be submitted when:

- A right-of-way change is recommended
- A change in a typical section is recommended
- A change in any other major design feature is recommended

PREPARING CONSTRUCTION REVISIONS

The following outlines the procedure for construction revisions to be submitted and processed in a uniform manner:

1. The district shall utilize reproducible sensitized film (Mylar) to copy the original plan sheet that is on file in the section engineer's office. Care must be taken to obtain a legible copy capable of reproducing legible copies.

2. Prepare a construction revision as follows:

   a. Insert the county, item number, and revision number together with the sheet number (relative to the specific revision) and total number of sheets in the revision, in the upper right hand corner of each sheet in the revision.

   b. Original data being revised shall be canceled out but not obliterated or removed from the sheet.

   c. When right-of-way is acquired or altered in any manner, the acreage indicated on the summary sheet must be corrected as a part of the revision and a revised right-of-way strip map must be included.

   d. Revised data shall be done in black India ink and marked as such. Also the area of revision shall be boldly indicated by circling or indicating it in some such practical method to draw attention to its limits.

PREPARING CONSTRUCTION REVISIONS (CONT.)

3. Each Construction Revision shall include a Mylar cover sheet consisting of the "Construction Revision Index Sheet." (See **Exhibit 9007**.) There are spaces for 10 revisions on each cover sheet and they must be used in numerical sequence. The cover sheet is numbered "1A" so as not to interfere with the normal numbering of revision sheets that start with the number one. If more than 10 revisions are encountered on a project, designate the next cover sheet as "1B" and change the revision number to 11, etc. Do not count the cover sheet when counting the number of sheets in the revision. This cover sheet may be obtained from the district project development office. Each revision block on the cover sheet shall be prepared as follows:

   a. Assign the revision to the correct sequential revision number on the sheet.

   b. Check whether right-of-way "is" or "is not" involved.

   c. When a federal participated project (part of the National Highway System) is involved, insert "Verbal Approval by _____ (name of Federal Highway Administration representative giving verbal approval) on _____ (date of such approval)."

   d. List each original page number included in the revision excluding the cover page. Original page numbers relate the revision to the original plans and are not to be confused with the sequential sheet numbers assigned to the revision sheets for purposes of tracking the revision.

   e. Obtain necessary signatures. Signature stamps are not acceptable however a superior may appoint a representative who may fill in the superior's name followed by the representative's signature.

   f. Insert a clear concise statement as to the necessity of the revision in the space provided.

   Note: This procedure makes it a little unhandy to immediately follow one revision with another revision without a delay since the "Construction Revision Index Sheet" must be returned before the next revision may be submitted. To offset this delay, two consecutive revisions can be submitted simultaneously using the same cover sheet for both revisions. Send a note of explanation with the revisions when this situation is encountered.

FHWA APPROVAL

Proposed revisions involving National Highway System roads must indicate verbal approval by the representative of the Federal Highway Administration assigned the particular district responsibilities. See step 3(c) above for inclusion of "Verbal Approval" in revision.

FORMAL APPROVAL & DISTRIBUTION

The Director of Construction will review the revision upon submittal to Central Office. If in agreement with the revision, the Director will sign and submit it to the Executive Director of the Office of Project Delivery and Preservation for consideration and approval.

On FHWA full-oversight projects, formal approval will be submitted through the FHWA.

After formal approval, the approved construction revision will be delivered to the Plan Reproduction Section, Division of Highway Design. At that time, copies of the revised plans will be distributed to the appropriate district, the Division of Highway Design, and the Division of Construction. In addition, copies will be sent to the FHWA on all projects with full federal oversight. The original copy of the construction revision is to be returned by the Plan Reproduction Section to the originating office to be used in the development of the as-built plans. The original copy of the "Construction Revision Index Sheet" will be reused with the next revision and will be included with the as-built plans.

When a construction revision requires a change order, the change order shall be processed concurrently with the revision.

	Chapter CONTRACT ADMINISTRATION
	Subject Contractor Pay Estimate

ESTIMATE PAY PERIODS

Contractor pay estimates are submitted every other week. Overall, this is a total of 26 possible pay estimate periods a year.

DISTRICTS

Estimate pay periods for all twelve designated districts occur on Tuesdays. The Division of Construction will distribute preprinted yearly calendars, reflecting these submittal dates.

The normal cutoff dates for the Tuesday estimates will be no later than the preceding Sunday. Project cutoff (end) dates must be consistent for all progress estimates within a district.

END DATE

The end date is the critical date in creating an estimate. When an open pay estimate is created for the first time or regenerated by the software, a search is made backward, from the end date to the beginning of the project. Any daily work reports (DWR's) that are authorized by an approved Diary earlier than or equal to the end date will be considered for payment.

If a DWR qualifies by date comparison, SiteManager looks to see if the record is available for payment by virtue of not having been included in a previous estimate. The estimate shall include every qualifying record. An estimate can be regenerated as many times as necessary, with each regeneration searching the pay records for qualifying records as described above. DWR's included on an estimate will no longer be available for edit.

PROCEDURE FOR COMPILING PAY ESTIMATE

Frequent problems encountered when compiling an estimate are addressed below. Contact the district project delivery and preservation office or the Division of Construction if assistance is needed.

- **Payment**—For payments:
  - Estimates shall not be submitted with a negative payment except for the final estimate.
  - No estimate, except the final estimate, shall be submitted with a payment due the contractor of less than $500.00.

PROCEDURE FOR COMPILING PAY ESTIMATE (CONT.)

- **Demobilization**—This item shall be paid in accordance with Section 110.04 of the Standard Specifications on all contracts, regardless of the original contract amount.

- **Estimate Periods**—The following dates are used to establish estimate periods:

  - The beginning date is either:

    - The date work was started on the project for the first estimate
    - The next date following the previous estimate through date

  - The through date will be either:

    - The last date of the period (cutoff date)
    - The last date work was performed, if the estimate is for work done after the project completion date

    Note: If the final estimate is being processed and checked by any of the appropriate offices, the through date may be established as applicable.

- **Work Day Reports**—Work day reports will be closed out on the appropriate estimate cutoff dates. If no estimate is submitted, the applicable work day report will still be necessary. The paper reports, including distribution, for work days will continue in the normal manner.

- **Change Orders**—Change orders involving a special note, a time extension, or a specification variance, for example, may not include funding modifications, but must be entered promptly.

- **Change Order/Funding Modification**—Procedures in the Central Office are set in motion by the submittal and approval of a change order involving a "Funding Modification." These procedures result in the contract moneys being increased (or decreased) in the state accounting system by the amount of the change order. See **CST-303** for additional information pertaining to the change order/funding modification.

- **The Division of Construction**—Once the Division of Construction receives the final estimate, the Administrative Branch shall generate any further contractor pay estimates.

WITHHOLDING OR RELEASING PAY ESTIMATES

It is considered preferable to withhold pay on a particular item deemed unsatisfactory rather than an entire estimate. Circumstances do arise, however, when it is necessary or preferable to withhold an entire estimate. The following information addresses this situation.

WITHHOLDING OR RELEASING PAY ESTIMATES (CONT.)

The district project delivery and preservation office should notify the contractor at least one pay period ahead in writing before payment may be withheld on a contractor's work estimate **unless time constraints determine otherwise**. Notification may be done by formal letter or by fax followed by a letter. Notification of release may be done by fax.

No request for withholding or releasing contractor's payment is to be directed to any person or division other than the Division of Construction.

The primary location for withholding payment is the section engineer's office. Simply do not process the estimate for payment. The contractor shall be advised of this action and the reason thereof in writing. Adequate documentation must be maintained. The district project delivery and preservation office and the Central Office, Division of Construction must be kept advised.

The district project delivery and preservation office may choose to withhold a pay estimate after the estimate is transmitted for payment from the section engineer. Again, just simply do not send the estimate for payment. This procedure shall only be implemented as a last resort when other means of resolving the situation have been exhausted. Adequate documentation must be maintained and the Division of Construction shall be kept advised.

	Section CHANGE ORDER & SUPPLEMENTAL AGREEMENTS
	Subject General

DEFINITIONS

Section 101 of the Standard Specifications defines a change order as, "A written order issued by the engineer to the contractor, detailing significant changes to the specified work quantities or that increase or modify the scope of the original contract."

Section 101 of the Standard Specifications defines a supplemental agreement as, "A written agreement executed by the contractor and the Commissioner, with the consent of the surety when required, covering significant changes and revised or new unit prices and items, that supplements the original contract."

Note: A supplemental agreement is included in a change order and, for the purpose of discussion in this section, all procedures outlined for change orders apply equally to supplemental agreements unless otherwise noted.

IMPORTANCE OF ACCURATE PREPARATION

A change order constitutes a legal supplement to the contract and is binding on both the Department of Highways and the contractor, therefore the section engineer (SE) shall carefully and accurately prepare all change orders. Care must be taken to make the explanation as clear and concise as possible. The SE must remember that the reader may not be familiar with the project and must clarify the explanation accordingly. Proper English is essential in preparing a change order.

CHANGE ORDER APPROVAL OVERVIEW

The SE shall promptly submit change orders when the need arises. Change order concepts are normally submitted and approved through email to the Executive Director of the Office of Project Delivery and Preservation prior to entry into SiteManager for approval. The SE will normally send an email outlining the problem, the proposed solution, and estimated cost associated with it. This email would be sent to the district project delivery and preservation office and Central Office field liaison. After the Central Office field liaison receives concurrence from the district project delivery and preservation office concerning the change, they will then obtain approval from the Director of Construction and the Executive Director of the Office of Project Delivery and Preservation.

CHANGE ORDER APPROVAL OVERVIEW (CONT.)

If the change order involves a federal full-oversight project, the concept email must be sent to the FHWA for "verbal" approval. This "verbal" approval does not relieve the need to get the change order written in SiteManager and formally approved.

The Central Office field liaison will verify funds if the change orders involve funding from either the Division of Maintenance or Department of Rural and Municipal Aid. Programs administered by these work units usually have a limited amount of funds available for approved projects. Overruns and change orders on projects could result in insufficient funds to let other projects that may have a high priority in the approved program. All change orders and anticipated overruns must be checked closely to be assured of obtaining the best possible utilization of available funds.

CST-303-1—CST-303-7 outline the procedure for writing change orders in SiteManager and the approval path that a change order goes through once entered into the system.

	Section CHANGE ORDER & SUPPLEMENTAL AGREEMENTS
	Subject Writing a Change Order

REFERENCE

Section 14 of the section engineer's *SiteManager Training Manual* (**Exhibit 9008**) illustrates step by step how to prepare a change order.

DETAILED ITEM DESCRIPTION

The explanation describing the purpose and need for the items is probably the most critical part of the change order. The section engineer (SE) shall include a description for every item on the change order and include precise locations of each item such as station numbers when applicable. Descriptions shall never include proper names. Explanations shall refer to specific offices and not specific individuals. Poor or inadequate explanations will usually result in delaying the approval of a change order.

The SE must carefully write explanations for change orders, particularly when supplemental items are involved, since both the contractor and the Department of Highways are being committed to a legal and binding agreement. The explanation must be clear, concise, and to the point and include sufficient explanation to enable persons unfamiliar with the project to gain a clear understanding of the change.

BASIS OF COST FOR ITEMS

Items of supplemental agreement need to have basis of cost, for example costs in line with average unit bid prices for similar items of work, cost-plus analysis by the department personnel, or documented costs by the contractor.

FUEL & ASPHALT ADJUSTMENTS

Descriptions for fuel and asphalt adjustment change orders shall always include the month that the project was let and the months that the adjustment covers. Price adjustments for liquid asphalt and fuel are required for specific bid items over certain threshold quantities, per the formulas outlined in Section 109.07 of the Standard Specifications. Adjustments are to be based on the index provided in the proposal.

If a bid item that qualifies for the adjustments are added by change order, the beginning index shall be the posted index when the supplemental price was submitted and not the index in the proposal. No contract time shall be given as part of this adjustment.

	Section CHANGE ORDER & SUPPLEMENTAL AGREEMENTS
	Subject Nonparticipating Items

POLICY

The section engineer shall email the Central Office change order manager when a nonparticipating item needs to be added to a federal-aid project. A new nonparticipating funding category may need to be established.

The section engineer shall copy the email to the Central Office field engineer and include a cost estimate for the item.

Once the category is established in SiteManager, the Central Office change order manager will notify the section engineer.

	Section CHANGE ORDER & SUPPLEMENTAL AGREEMENTS
	Subject Supporting Documentation

DOCUMENTATION AS REFERENCE

The section engineer does not need to include lengthy calculation or contractor price justifications as part of the change order submittal in most cases; however, the change order shall include a note stating where such documentation is to be found (usually on file in the section engineer's office).

REQUIRED DOCUMENTATION

On all federal-aid projects the change order shall include documentation substantiating the cost. In many cases, this may take the form of comparisons to average unit bid prices, but more detailed analysis may be required.

	Section CHANGE ORDER & SUPPLEMENTAL AGREEMENTS
	Subject Time Extensions

TIME EXTENSIONS

If a time adjustment is justified due to an increase in work, delays, etc., it must be done by change order.

Section 14 of the section engineer's *SiteManager Training Manual* (**Exhibit 9008**) gives examples of general statements that could be included in a change order explanation for a time extension. However, the adjustment must have a specific detailed description included describing the reason that an adjustment in time was granted.

	Section CHANGE ORDER & SUPPLEMENTAL AGREEMENTS
	Subject Change Order in Draft Status

CHANGE ORDER IN DRAFT STATUS

After preparing a change order in SiteManager, the section engineer (SE) shall email the change order (in either a .pdf or .html copy) to the following for review in draft status:

- District Project Delivery and Preservation Branch Manager
- Central Office Construction Field Liaison
- Director, Division of Construction
- Division of Construction Change Order Manager
- Executive Director, Office of Project Delivery and Preservation
- FHWA Liaison, if applicable

The SE shall also send the change order for approval within SiteManager. This procedure is detailed in Section 15 of the SE's *SiteManager Training Manual*.

The SE shall also email a copy of the change order to the Chief District Engineer (Executive Director) and project development manager from the work unit (Department of Rural and Municipal Aid, Division of Maintenance, or Division of Highway Design) where the project originated. This email is for informational purposes only.

The Central Office change order manager will forward the change order to the Division of Program Management once it is received. This will ensure that funds are set aside to cover this change.

Additionally, the SE shall send a copy of the "draft" change order to the contractor without the signature sheet. The SE should advise the contractor:

- To check the change order for any errors
- Of the time sensitive nature of this process
- To respond to the SE as soon as possible concerning any errors
- To **not** consider this "draft" change order as any indication of whether or not the change order will be approved

	Section CHANGE ORDER & SUPPLEMENTAL AGREEMENTS
	Subject Change Order in Pending Status

SWITCHING THE CHANGE ORDER TO PENDING STATUS

The section engineer (SE) may switch the change order to pending status once it has been approved by the Office of Project Delivery and Preservation's Deputy Executive Director, the Change Order Review Committee, if applicable, or the FHWA, if applicable. At this point, the SE shall sign the change order and then send this signed copy to the contractor for signatures. The change order shall include a cover letter instructing the contractor to mail the signed change order directly to the Office for Project Delivery and Preservation's Executive Director.

APPROVAL PROCESS

Once the status is switched to pending within SiteManager, the change order must be forwarded again for approval. The following individuals shall be included in the approval process:

- Section engineer on the date mailed to the contractor
- Administrative assistant for the Office for Project Delivery and Preservation's Executive Director on the date the contractor returned the signed copy
- State Highway Engineer on the date the State Highway Engineer signs the original copy
- Central Office change order manager on the date that the Division of Accounts releases the funds for the change order and the items are available for payment

After signing the change order, the State Highway Engineer sends it to the Division of Accounts for funding. Once funding is available, the change order is transferred to the Division of Construction Procurement for inclusion with the original contract documents, who will forward a copy of the signed change order to the Division of Construction change order manager. The change order manager will:

- Send a copy to:
  - District Construction Office
  - Contractor
  - FHWA, if applicable
- Attach a pdf copy to the contract in SiteManager

CHANGE ORDER WORK

The contractor shall not start work that is part of the change order until the change order is included in the original contract documents. When unusual circumstances or emergencies justify starting the change order work, tentative advance approval may be sought from the Central Office Division of Construction field engineer who will correspond with the Director of the Division of Construction and the FHWA, if applicable. **This advance approval must be ratified through formal approval as soon as practical.**

	Section SUBCONTRACTOR
	Subject General

GENERAL REQUIREMENTS

A subcontractor is an approved agent of the contractor and shall not work on a project until:

- The subcontract request form is approved by the Director of the Division of Construction
- Subcontracted items are entered into SiteManager

Section 108.01 of the Standard Specifications allows the contractor to subcontract a portion of the work, but the contractor must perform 30% of the total contract cost with his or her own organization. The Department will not allow any subcontractor to exceed the percentage of work to be performed by the prime contractor and will require the prime contractor to maintain a supervisory role over the entire project.

A subcontractor (referred to as first-tier subcontractor) may, with written approval of both the Department and the prime contractor, further subcontract a portion of his or her work as long as the work to be subcontracted does not exceed 50% of the work originally subcontracted to him or her by the prime contractor.

The recipient of this work (referred to as the second-tier subcontractor) may not further subcontract any portion of the work.

SUBCONTRACTS FOR PARTIAL CONTRACT ITEMS

If the proposed subcontract (either first- or second-tier) covers only a portion of a contract item, such requests shall contain the subcontractor's responsibility in relation to the item or items involved. For instance, if the request includes manipulation or placing of a contract item, the contractor responsible for purchasing the materials must be designated in the request along with a statement that substantiating data is on file and open to inspection at all times by Department personnel or when the quantity to be subcontracted is not the entire amount, limitations by stations must be shown as well as any another defining restrictions.

SUBCONTRACTS FOR PARTIAL CONTRACT ITEMS (CONT.)

When a partial item such as "Laying Only" or "Erection Only" is subcontracted, the subcontractor shall not furnish the materials to the prime contractor. For example, a contractor subcontracts for the "Paving Only" of bituminous asphalt, the same contractor would not be allowed to furnish the bituminous material to the prime contractor since, in effect, there would be more contract work involved than indicated by the partial item.

	Section SUBCONTRACTOR
	Subject Submission of Non-DBE Subcontract Requests

SUBCONTRACT REQUESTS

The prime contractor shall send all subcontract requests, with the exception of DBE subcontracts, directly to the Director of the Division of Construction for approval. This submission does not require a copy of the subcontractor's certificate of insurance. It is the prime contractor's responsibility to ensure the subcontractor is prequalified by the Department to perform the work subcontracted and has current liability insurance in force before the subcontractor begins work.

The TC 63-35 form, *Subcontract Request* (**Exhibit 9009**), indicates that the prime contractor will maintain copies of the subcontract and the certificate of insurance and have them available for review by the Department. The form also indicates that the prime contractor shall send a copy of the subcontract request to the district project delivery and preservation branch manager when it is sent to the Central Office Division of Construction for approval.

SECOND-TIER SUBCONTRACT REQUESTS

The first-tier subcontractor submits second-tier subcontract requests to the prime contractor with a letter of request. If the prime contractor finds the second-tier subcontract acceptable, the prime contractor will forward a copy of the letter of request along with the completed TC 63-35 including the appropriate items of work to the Director of the Division of Construction for approval. The TC 63-35 must be signed by the prime contractor as confirmation of acceptance of the second-tier subcontractor.

SUBCONTRACTS FOR CHANGE ORDER ITEMS

Subcontracts for change order items will need to be submitted on a modified version of the subcontract request form. The prime contractor shall use the TC-63-35CO (**Exhibit 9010**) for these subcontracts.

SPECIALTY ITEM WORK

Specialty item work that may be accomplished by contractors that are certified for that item, but not necessarily prequalified by the Department, will not require a submission of a subcontract. For example, if a project had a rest area as part of the project, the drywall contractor would be considered a specialty contractor. The Department doesn't prequalify for that, but the contractor would be certified to do the work.

SPECIALTY ITEM WORK (CONT.)

For specialty items, the prime contractor will be indicated as performing the work items in SiteManager. Payment for specialty items of work will require a closure report submitted through the prime contractor to the section engineer.

DBE SUBCONTRACTS

The prime contractor shall send DBE subcontracts directly to the Division of Construction Procurement prior to the award of a contract.

	Section SUBCONTRACTOR
	Subject Submission of DBE Subcontracts

DBE SUBCONTRACTS

Once a project is awarded, the prime contractor shall submit a detailed DBE plan, TC 14-35 form (**Exhibit 9011**) to the Division of Construction Procurement. This plan will be approved prior to the work order. The Division of Construction Procurement will send a copy of the DBE subcontract plan to the appropriate district Project Delivery and Preservation Branch Manager.

	Chapter CONTRACT ADMINISTRATION
	Subject Equipment Lease / Rental Agreements

GENERAL

Lease-rental agreements must be approved by the Department before the equipment is used on the project except in an emergency situation.

The section engineer (SE) may give verbal approval to use leased or rented equipment when an emergency or unexpected situation arises. Once the emergency or unexpected situation ends, the contractor shall perform one of the following:

- Immediately remove the equipment from the project
- Submit an acceptable copy of the lease or rental agreement prior to that time

In all cases where rented equipment is involved, the operators and other project personnel associated with the rental equipment must appear on the contractor's payroll.

APPROVAL

The SE shall request an agreement that is signed by both the lessor and lessee, with signatures that are verified by a notary public. The SE shall review the request and make a recommendation to the district project delivery and preservation branch manager. The branch manager will give formal approval (or denial) of the agreement and send copies of the approved agreement to:

- Prime Contractor
- Subcontractor (if applicable)
- Lessor
- Section Engineer
- FHWA (if applicable)
- Division of Construction

The process for equipment/rental agreements should be discussed at the preconstruction conference. The contractor should be made aware that the approval process could take some time for approval and that it is important for early submittal. No consideration will be given toward a time extension in the event that an agreement isn't processed due to untimely submittal by the contractor.

	Section CONTRACTOR'S PAYROLL
	Subject General

POLICY

The contractor shall submit either an electronic copy or 2 paper copies of their certified payrolls to the section engineer (SE) for all federal-aid projects. Certified payrolls are required upon request on state-funded projects.

PRECONSTRUCTION CONFERENCE

During the preconstruction conference, the contractor should be thoroughly briefed on all the payroll information contained herein. The last day of the contractor's pay week and weekly pay day shall be established so the SE will know when to expect the payrolls. The prime contractor is responsible for prompt and accurate submission of any subcontractor's payrolls and it is suggested that the subcontractor's payrolls be required to meet the submission dates established by the prime contractor.

PAYROLL SUBMITTALS

The contractor shall adhere to the following guidelines when required to submit payrolls:

- The contractor shall submit the payrolls, accompanied by statements of compliance, to the SE within 7 days after the ending of the applicable pay period.
- The required weekly payroll information may be submitted in any form desired. Payrolls may be submitted on a U.S. Department of Labor WH-347 form, *Payroll* (**Exhibit 9013**). The prime contractor shall properly certify each payroll.
- Minority employees and trainees shall be designated by some method on each applicable payroll by the contractor or subcontractor. No method is specified or preferred as long as the contractor or subcontractor briefs Department personnel on the method used.
- The payrolls shall not include full social security numbers or home addresses.

Payrolls with full SSN's or addresses shall be deleted or destroyed.

When complete and accurate contractor payrolls have not been received by the SE for the periods covered by the previous estimate, the SE shall initiate action to withhold payment of the contractor's current estimate.

	Section CONTRACTOR'S PAYROLL
	Subject Certified Payroll Review

PAYROLL REVIEW

The contractor shall submit either an electronic or paper copy of the certified payrolls to the section engineer (SE) for all federal-aid contracts. The SE shall review the payroll to ensure the contractors listed for the pay period submitted were the actual contractors working during that period. The payrolls shall be stored electronically using data management software.

The SE shall notify the contractor if they are not receiving payrolls or if the payrolls which they receive do not coincide with the contractor that was working during the pay period shown.

The Division of Construction Procurement shall be responsible for ensuring wage reviews are performed in accordance with federal guidelines.

	Chapter CONTRACT ADMINISTRATION
	Subject Wage Compliance Checks

OVERVIEW

The Division of Construction Procurement will perform all wage rate reviews.

PERFORMING WAGE CHECKS

The Division of Construction Procurement will utilize the TC 14-312 form, *Engineer's Wage & Hour Report* (**Exhibit 9014**), in the preparation of the Wage Compliance Report required by the Federal Highway Administration on all federal-aid projects.

VIOLATIONS

All wage violations will be handled by the Division of Construction Procurement. The Division of Construction Procurement will review the controversy and arrange any formal hearings necessary to enforce wage requirements of the contractor.

ASSISTANCE

Wage representatives of the Division of Construction Procurement are available to assist the SE with:

- Wage complaints and alleged violations requiring investigation on the project
- Complaints received or detected after a project is completed
- Obtaining additional wage rates on a project

Any request for the assistance by the Division of Construction Procurement in this matter shall be addressed to the Director, Division of Construction Procurement.

	Section EQUAL EMPLOYMENT OPPORTUNITY
	Subject EEO Aide

ASSIGNMENT & RESPONSIBILITIES

Each district project delivery and preservation office will assign a particular individual the responsibilities of an equal employment opportunity aide who shall:

- Present and explain EEO requirements to the contractor at the preconstruction conference
- Receive the FHWA-1391 form, *Federal-Aid Highway Construction Contractors Annual EEO Report* (**Exhibit 9015**), from the section engineer (SE), in July only
- Review, initial and submit the FHWA-1391 form to the Division of Construction Procurement
- Attend compliance reviews conducted by Department and FHWA personnel
- Conduct training reviews

Note: Trainee interviews may be delegated to the SE.

	Section EQUAL EMPLOYMENT OPPORTUNITY
	Subject EEO Discussion at Preconstruction Conference

EEO PROJECT REQUIREMENTS

All federal-aid construction projects larger than $10,000 contain Equal Employment Opportunity (EEO) requirements. The contractor is to be advised at the time of the preconstruction conference of the responsibilities concerning the EEO requirements. The EEO requirements will be found in Part III of the project proposal.

The prime contractor and any subcontractor present shall name their company and project EEO officers at the meeting and document these assignments by a letter to the section engineer.

EEO requirements are part of the contract documents; therefore, the contractor is required to fulfill the requirements contained therein. This requires record keeping and documentation of the contractor's efforts to comply with EEO provisions. These guidelines shall be reviewed in detail at the preconstruction conference. A copy is then signed by the reviewer and also by the contractor (or a representative) and copies of this signed document are placed in the district project delivery and preservation office files and the section engineer's files.

	Section TIME
	Subject Contract Time

CONTRACT TIME SPECIFICATION

The contract proposal will specify the contract time for a project one of the following ways:

- In working days
- In calendar days
- As a specified completion date
- In some cases, a combination of the above

	Section TIME
	Subject Time Extension Request

REQUEST FOR TIME EXTENSION

As stipulated in Section 108.07 of the Standard Specifications when the contractor believes that additional compensation or contract time is due because of a suspension or delay, the contractor shall submit to the section engineer (SE), in writing, a request for an adjustment within 7 calendar days after work is resumed. This request shall include any reasons for the delay and any supporting documentation.

PROCESSING A TIME EXTENSION REQUEST

When receiving a request for a time extension, the SE shall:

- Sign and date (on the date received) the request to indicate acknowledgment of the request
- Send a copy of the request immediately to the district project delivery and preservation office for review and consideration
- Immediately start reviewing all project information [such as project diaries, working day reports (if applicable), correspondence, etc.] and make copies of all pertinent information to compile a file available upon request by the district office or Central Office
- Be prepared to present a recommendation concerning the validity of the request

The contractor shall provide adequate reasons with supporting documentation in the request to justify consideration of a time extension. Failure to submit such reasons under the applicable contract provisions and specifications will be considered just cause for rejection of the request. If, however, the request merits consideration, the district project delivery and preservation branch manager will forward the request, the branch manager's recommendation, and any available supporting documentation through the Chief District Engineer's office to the Division of Construction for consideration. If the recommendation is to grant either the time requested or a portion of it, the time period recommended shall be clarified. This action shall be carried out and submitted to the Division of Construction in a timely manner.

PROCESSING A TIME EXTENSION REQUEST (CONT.)

On full-oversight projects the Division of Construction shall notify the FHWA of requests for time extensions.

The Division of Construction will review the request and will advise the district project delivery and preservation branch manager of the decision to either concur or disagree with the recommendation. The district project delivery and preservation branch manager will then transmit this decision to the contractor.

NOTIFICATION OF DECISION

If the Department agrees to the request, the SE shall immediately process a change order to this effect.

If the district office or Central Office rejects the request, the SE shall notify the contractor of this decision in writing.

	Section TIME
	Subject Working Days

WORKING DAYS

Section 101 of the Standard Specifications defines a working day as "A calendar day, exclusive of Saturday, Sunday, holidays, or days when the weather, seasonal, or temperature limitations of the specifications, or other conditions beyond the control of the contractor, prevent, as judged by the engineer, construction operations from proceeding for at least 5 hours by the normal working force engaged in performing the controlling item or items of work."

When the contract time is specified in working days, the section engineer (SE) shall determine when the contractor should or should not be charged a working day. This designation must be noted on the daily work report in SiteManager.

The Standard Specifications specifically provide that working days are not to be charged on the following days even though the contractor performed work:

- Saturdays, Sundays, and designated holidays

  Note: Check with the Division of Construction if in doubt as to whether a day is a designated holiday.

- Days during December, January, February, and March

- Days during which work on the controlling items are prohibited by and days during which work progressed for less than five hours by the normal working force due to:

  - Seasonal or temperature limitations as defined by the Standard Specifications
  - Weather Conditions

- Days during which work on the controlling items is suspended by the SE, unless the suspension is due to the fault or neglect of the contractor

Except as outlined above, the SE will begin charging working days beginning with the 31st calendar day following the date of *Notice to Begin Work*.

DEFINITION OF CONTROLLING OPERATIONS

The SE must determine the controlling operation to administer a working day contract.

A *controlling operation* is that item or items or work that the contractor must do on that day to:

- Move the job one day closer to completion
- Ensure the orderly completion of the contract within the specified time
- Permit continuation of the progress

As a general guide, the controlling operation should be a broad phase of the work. It is not necessary nor is it considered desirable to be too restrictive in the determination. In most instances, the controlling operation will include a number of bid items; however, near the beginning or end of a project, it is possible that the controlling operation could be limited to a single bid item such as "Clearing and Grubbing" or "Final Dressing."

	Section TIME
	Subject Working Day Statement

WORKING DAY STATEMENT

The section engineer (SE) will furnish the contractor biweekly statements showing:

- Number of days charged for the period
- Total number of days charged to the contract through that date
- Number of days remaining for completion of the contract

The SE shall provide the working day report to the contractor every month (except for the months of December, January, February, and March) throughout the entire life of the contract regardless of whether the contract time is on working days or liquidated damages. This report can be generated in SiteManager.

The time period covered by the working day statement will be the same as that covered by the current estimate.

WRITTEN PROTEST

The working day statement will be deemed to have been accepted by the contractor as correct unless a written protest containing supporting evidence for a change within 14 calendar days after the submitted date of the biweekly working day statement being protested.

If a protest of this nature occurs, the Department will undertake immediate action to resolve the dispute. The protest should be resolved at the district level if at all possible. If this does not prove feasible, the district office will contact the Division of Construction to settle the dispute. If a change needs to be made, the SE can modify the time charges for the relevant dates within the Diary in SiteManager.

GENERATING THE WORKING DAY REPORT IN SITEMANAGER

Section 13 of the *Section Engineer's SiteManager Training Manual* illustrates how to generate a working day report. The SE shall also generate a *Summary to Contractor Report* in SiteManager to send with the working day report to the contractor.

DELIVERY TO CONTRACTOR

If at all possible, the working day statement should be delivered to the contractor's designated representative at the project site. This procedure shall be discussed and agreed upon at the preconstruction conference. If it is necessary to mail the statement, it shall be done by certified mail with a return receipt requested. The statement shall indicate:

- Delivery procedure used
- Delivery or mailing date
- Name and position of recipient, if possible

COVER LETTERS

The SE shall use the TC 63-41 form, *Working Day Memo No. 1* (**Exhibit 9016**), as a cover letter with working day statements submitted on a project prior to the expiration of time.

After time has expired for a project and liquidated damages are applicable, the SE shall use the TC 63-42 form, *Working Day Memo No. 2* (**Exhibit 9017**), as the cover letter for working day statements.

	Section TIME
	Subject Additional Time

ADDITIONAL TIME FOR CHANGE ORDERS

In all cases where a change order is prepared to cover an overrun in plan quantities or when a supplemental agreement is to be executed for additional work, a determination shall be made concerning any additional time warranted because of the work. If additional time is found to be justified, it shall be included as a part of the supplemental agreement or change order.

Every change order shall address time, either as a statement detailing a specific time extension or a statement to the effect that *Contract Time is Unaffected by this Change*.

In all instances, an increase in contract time shall be processed at the earliest practical date and not deferred until the project is complete or until contract time has expired.

APPROVAL

Methods of granting additional time vary by circumstance and the type of contract. Each case has to be considered on an individual basis.

As a general rule, the additional time required to do the work shall be established by change order prior to beginning the work. If this is not considered feasible because the work is too far in the future or for whatever reason, the change order should stipulate that additional time will be granted to cover the work with the exact number of days to be determined at a later date and included in a change order.

	Section TIME
	Subject Contract Overtime & Liquidated Damage Review

REVIEW SUBMITTAL

When a project is completed after the original specified contract time has expired, the section engineer (SE) shall prepare and submit the TC 63-26 form, *Contract Overtime and Liquidated Damage Review* (**Exhibit 9018**), to the district project delivery and preservation office.

The district project delivery and preservation office shall:

- Check the TC 63-26 form for accuracy
- Include any information they may deem applicable
- Forward the form to the Division of Construction as soon as possible and not later than 90 days after a project is called complete

Since all overruns of any consequence have been accounted for by applicable time extensions, it is not necessary to delay submission of this form pending final determination of contract moneys.

LIQUIDATED DAMAGE REPORT

The district project delivery and preservation office shall submit a TC 63-26 form to the Division of Construction when liquidated damages apply. This report shall:

- Be forwarded to the Director of the Division of Construction
- Contain sufficient information to adequately explain the reason for the liquidated damage charges
- Discuss any unresolved contentions on the part of the contractor on a point-by-point basis with the findings and recommendations of the Chief District Engineer included
- Include a statement in the “Remarks” section to the effect that either all of the contractor's contentions are addressed or that none exist
- Be copied and sent to the FHWA on full-oversight projects

Supporting documentation to be submitted with the TC 63-26 form shall include, but not be limited to, copies of the following:

- All change orders involving time extensions
- Pertinent correspondence from the contractor
- Pertinent correspondence from the Department
- Pertinent Working Day Reports, if applicable

LIQUIDATED DAMAGE REPORT (CONT.)

The organization of this report shall be with the TC 63-26 form first, followed by the findings and recommendations of the district office, and then the supporting documentation arranged in chronological order.

Providing that either the contractor's contentions have been satisfactorily resolved or there are no contentions, the Director of the Division of Construction shall review this report and the final will be routinely processed for payment. If outstanding contentions remain, the Director of the Division of Construction will review the report further further.

CENTRAL OFFICE REVIEW

When the Division of Construction receives a Liquidated Damage (L.D.) Report that has unresolved contentions on the part of the contractor, it will be submitted for review to the Director of the Division of Construction. After further review, the Division of Construction will prepare a response to the Liquidated Damage Report that will direct the necessary course of action considered appropriate to settle the issue in accordance with applicable specifications.

The Director of the Division of Construction will discuss the decision with the Executive Director of the Office of Project Delivery and Preservation~~,~~ and advise the district project delivery and preservation branch manager of the results in writing. The district branch manager will make a formal notification to the contractor of the action taken that may consist of either the charging of applicable liquidated damages or the fact that no liquidated damages will be charged.

If liquidated damages are charged, the contractor shall also be advised of a right to appeal directly to the Highway Commissioner.

If no liquidated damages are charged, the contractor will be notified and advised that the final estimate will be processed.

On full-oversight projects, the FHWA needs to be involved in this process.

	Chapter CONTRACT ADMINISTRATION
	Subject Extra Work

GENERAL

Section 101.03 of the Standard Specifications defines extra work as, "An item of work not provided for in the Contract as awarded but found essential by the Engineer for the satisfactory completion of the Contract."

A supplemental agreement shall be written and executed prior to beginning work on all extra work for which there is agreed upon unit or lump sum prices. An extension of contract time will be considered on all projects involving extra work and shall be included in the supplemental agreement, if applicable. Section 109.04 of the Standard Specifications contains additional information and direction for extra work.

PREPARING FOR FORCE ACCOUNT WORK

When no agreement is reached for extra work to be done at lump sum or unit prices, such work may be authorized by the Department to be done on a force account basis only when all items are agreed upon in writing before beginning the work. A supplemental agreement shall be written and executed prior to beginning cost-plus work to provide funds and authority for the work.

Equipment rental rates shall be itemized in the supplemental agreement along with the source for the rates. Rates of contractor-owned equipment shall be limited to the monthly rates set forth in the *Blue Book for Construction Equipment* and adjusted for year, model, and region. Hourly rates shall be determined by dividing the adjusted monthly rate by 176 and adding the *Blue Book* estimated operational costs. Approved equipment rented from a recognized rental agency specifically for the cost-plus work is eligible for reimbursement at a documented reasonable invoice cost. The Department will pay rental rates for equipment required to be on standby at half the normal rate (excluding operational cost) and pay for standby time for a maximum of 8 hours per day and 40 hours per week.

Work shall not start until the supplemental agreement has been submitted and approved. Supporting documentation should be submitted with, but not as part of, the supplemental agreement. The supplemental agreements shall also include any additional time justified by virtue of the extra work.

FORCE ACCOUNT WORK

The following topics detail the requirements for determining the costs of force account (cost-plus) work:

- **Labor**—The people employed on the work must be listed daily; therefore, the contractor shall furnish the required wage information on every employee expected to be used on the work. The wage shall include the cost of workers' compensation insurance, public liability insurance, and any other taxes or insurance added to labor costs. The Department will add 25 percent to the cost to compensate for office overhead and general superintendence.
- **Materials**—The section engineer (SE) shall include all materials actually used in the work on the current pay estimate, providing proper documentation has been furnished. Before final payment can be made on materials, the contractor shall furnish the SE invoices, affidavits, or other proof of payment for materials established as acceptable to the Highway Department. Final payment of materials will be based on the actual cost to the contractor (including transportation charges and sales tax) to which the Department will add a sum equal to 15 percent.
- **Equipment & Tools**—Rental equipment will be measured in hours of actual working time and necessary traveling time of the equipment within the limits of the project unless special equipment has been ordered in connection with the cost-plus work. For special equipment, the Department will pay the rental rate for the equipment that is required on the work and will add an amount equal to 15 percent of the rental sum as full compensation for fuel, lubricants, and filters. Rental rates shall be established on the same basis as other rental equipment, such as the *Blue Book*, etc. Paid invoices will be necessary on all equipment rented from rental agencies. Standby rates are paid at half (1/2) the agreed rental rate.

  The contractor shall furnish the SE with the exact description of each unit of equipment that will or might be used in the work, including all applicable portions of the following:

  - Manufacturer's name, model designation, serial number, and year manufactured
  - Rated capacity, such as engine horsepower, lifting capacity, drawbar horsepower, etc.
  - Gasoline- or diesel-powered
  - Crawler or rubber-tired
  - Size of bucket and type of boom, such as ¾-cubic yard dragline, one cubic yard, clamshell, etc.
  - Power graders rated by net weight without attachments
  - Trucks classified by type, such as tandem, pickup, etc., and rated according to gross vehicle weight, wheel configuration, cab configuration, and 4X4 or 4X2
  - Lowboy or carryalls rated by tare weight and distance traveled
  - All attachments for crawler tractors such as bulldozer, angle dozer, control unit type, ripper, and type of power drive

DAILY FIELD RECORD The SE or a designated representative shall prepare a daily record of all work performed as ordered on a cost-plus basis by completing a TC 63-11 form, *Force Account Daily Field Record* (**Exhibit 9019**). The SE shall maintain the original and send a copy to the contractor.

If any disagreement exists that involves these forms or their contents, all work shall be halted immediately until such time as the differences are resolved.

The SE or a representative shall complete the TC 63-11 form daily as follows:

1. Fill the top portion completely every day.
2. Fill in the following lower sections as work requires:
   A. For labor:
      - Include the foreman in charge
      - Include the job classification of each employee
      - Keep regular hours and overtime hours separately
      - Describe work done by each employee

        Note: If job classification and description of duties do not correspond, give a detailed explanation under "Remarks."

   B. For materials:
      - Enter all materials used in the day's work
      - Collect and attach all weight tickets, invoices, bills of lading, bar lists, etc., for the materials delivered during the day
      - Show the delivered materials and quantities under "Remarks"

   C. For equipment:
      - Describe the equipment and attachments completely. For example, "A.C. Crawler Tractor, Model HD 16 DP, Serial Number L10349aB, torque converter, power shift diesel engine and bulldozer blade attachment"
      - Show the number of hours each piece of equipment worked
      - Indicate any idle time during working hours and explain fully if idle time was related to action on the part of the Department
      - Supplement above data with explanations, if necessary
      - Describe any problems

   D. Sign the form and obtain the signature of:
      - Contractor's designated representative
      - Chief Inspector

        Note: A stamped or otherwise reproduced signature is not acceptable.

The TC 63-11 form must be filled out and agreed to on a daily basis. It does not replace the inspector's daily work report. If sufficient space is not provided for the necessary information, another sheet shall be used. **Every sheet used shall be signed and dated.**

PREPARATION OF CONTRACTOR'S PAY ESTIMATE

The SE uses the TC 63-10A form, *Labor Payroll for Extra Work*, TC 63-10B form, *Equipment Rental for Extra Work*, and TC 63-10C form, *Material Incorporated in Extra Work* (**Exhibit 9020**), to compile the contractor's current pay estimate for cost-plus work. The TC 63-10C form also provides for a summation of costs from all 3 forms. These forms can be found on the Division of Construction webpage.

The work periods should match the contractor's weekly pay period except when ending or beginning a pay estimate period.

To process the TC 63-10A:

- The SE's office personnel enter the data and calculate the wages.
- When the contractor's payrolls are received, all data should be checked.
  - The contractor shall submit a separate payroll for the cost-plus work unless otherwise directed by the SE.
  - Wage rates that are not in accordance with the contract or previous agreement shall not be entered.

To process the TC 63-10B:

- The SE's office personnel enter all equipment data.
- Only rates previously agreed upon may be entered.
- The description of equipment must be sufficient to fully identify the equipment.

To process the TC 63-10C:

- The SE's office personnel enter all materials used during the applicable week.
- Unit prices shall comply with the previous agreement.

CHANGE ORDERS

If, during the life of the cost-plus work, the funds provided for in the original supplemental agreement do not prove sufficient, a second change order must be submitted to obtain additional funds.

In the final analysis, after all documentation is checked and agreed to by the Department of Highways personnel, a last change order must be submitted establishing the total costs of the completed work.

	Section CLAIMS
	Subject Introduction

GENERAL

Issues may arise during the project lifecycle where the section engineer (SE) and contractor disagree on the work and compensation arrangement of the contract. **If possible, the contractor and SE should work together to resolve any issue that arises on a project before the situation deteriorates into a claim.** Claims are time consuming and costly to the Department. They tie up key field personnel that could best be utilized on other work and require significant administrative work.

A claim is to be considered a last resort, not a first line of defense. When the SE believes it is necessary or beneficial, he or she shall contact district and Central Office personnel to assist in resolving issues prior to a claim being initiated.

If issues on a project remain unresolved, the claims process may be the course of action pursued by the contractor.

The claims process is administered through Section 105.13 of the Standard Specifications, Kentucky Administrative Regulations (KAR 603 2:015 Sections 9 & 10), and Kentucky Revised Statute (KRS 13B.140). This process is very structured and the contractor should be informed about this process at the preconstruction conference (note this in the preconstruction conference minutes) and when the SE believes a claim will occur.

CLAIMS INVOLVING FEDERAL FULL-OVERSIGHT PROJECTS

If the claim involves a project with federal full-oversight, the Division of Construction shall contact the FHWA immediately and include them throughout the entire process.

	Section CLAIMS
	Subject Initiating the Claim

PROCEDURE

The claims process begins when the contractor notifies the section engineer (SE) of the intent to file a claim by submitting TC 63-32 form, *Notice of Changed Condition/Disagreement* (**Exhibit 9021**), to the SE. The contractor shall submit this form within 10 days of the date that the contractor knew of or should have known of the events causing the claim. If the claim is for extra work as defined in the standard specifications applicable to the project, the contractor must submit the TC 63-32 prior to beginning the disputed work.

The TC 63-32 form is located on the Cabinet website at:

http://transportation.ky.gov/Organizational-Resources/Pages/Forms-Library-(TC-63).aspx

The SE shall advise the contractor where to find this form when advising them of the claims process.

LATE SUBMITTALS FOR CLAIMS

If the TC 63-32 is not received as required or received after the 10-day deadline, the Cabinet will not consider a claim.

The timely filing of notice by the contractor is not to be construed as establishing the validity of the claim.

	Section CLAIMS
	Subject Acknowledgement of Receipt of Claim

ACKNOWLEDGMENT

The section engineer (SE) will respond to the contractor notifying them of the receipt of notice of the claim by submitting the TC 63-33 form, *Acknowledgement of Notice of Changed Condition/Disagreement* (**Exhibit 9022**) to the contractor. The SE shall send this form within 7 days of receiving the TC 63-32 form, *Notice of Changed Condition/Disagreement* (**Exhibit 9021**). The SE shall send copies of the TC 63-32 and TC 63-33 forms to the district project delivery and preservation office and the Director of the Division of Construction.

After consulting with and receiving the advice of the district project delivery and preservation office, the SE shall address the following points in the acknowledgment (TC 63-33):

- The reasons that the claim is not considered justified (for example, Why did the issue become a claim?)

- Any areas of the TC 63-32 needing clarification

  Note: This could involve points that were unclear or that needed additional information beyond what was stated in the TC 63-32. Quite often, the submission of TC 63-32 is general in nature and lacks sufficient specific information to gain a clear understanding of the proposed claim.

If any portion of the proposed claim is justified, the SE shall indicate this and include an analysis of the disagreement. A negotiation meeting shall be scheduled immediately with the contractor to attempt to reach an agreement on any portion of the work that can be removed from the claim.

	Section CLAIMS
	Subject Prosecution of the Work & Records

GENERAL

Once the proper forms are submitted for the particular work involved in the claim, the contractor shall complete the work as directed in the construction documents and by the section engineer (SE). Both parties shall carefully track this work with costs tracked according to Section 109.04 of the Standard Specifications.

The contractor's compliance with this provision and the SE's accounting of the costs does not validate the claim.

PROPER FACILITIES

In order for the contractor to comply fully with the specifications, the SE shall be provided with the same information as required for extra work to be done on a cost-plus basis. This consists of rates for workmen, rental rates for equipment utilized, and invoices for materials used. If the contractor does not furnish this information in a satisfactory manner, the SE shall immediately advise the contractor, in writing, that the **potential claim for additional compensation has been compromised** because proper facilities are not being provided to keep account of actual costs.

DAILY RECORDS

The SE shall use the TC 63-11 form, *Force Account Daily Field Record* (**Exhibit 9019**), to maintain a daily record of labor, equipment, and materials for the disputed work. This work is to be maintained in exactly the same manner as specified for cost-plus work that has been agreed upon. See **CST-310**, "Extra Work" for more information.

PAYROLLS

The contractor shall submit payrolls to cover the work under contention separately from all normal work unless directed otherwise by the SE.

COMPILATION OF COST

The SE shall compile the cost of the disputed work weekly on the TC 63-10A, TC 63-10B, and TC 63-10C forms (**Exhibit 9020**). This compilation is the same as that specified for cost-plus work except estimate periods do not have to be broken out.

	Section CLAIMS
	Subject Current Pay Estimate

POLICY

Items of contract work completed in a satisfactory manner and otherwise eligible for payment shall be entered in the current estimate in a normal manner even though it is involved in the claim.

See **CST-302**, “Contractor Pay Estimate” for more information.

	Section CLAIMS
	Subject Completion of Work

COMPILING COSTS

After completion of the work in dispute and upon receipt of all paid invoices, etc., for materials, the section engineer (SE) shall calculate the total costs of the work. This shall be done carefully and thoroughly as this compilation could become the basis for the maximum liability of the Department if the contractor ultimately prevails in pursuit of the claim. The SE shall compile this data as soon as possible while the information is fresh and the personnel involved in the work are available.

Pending further action by the contractor, the SE shall retain all cost records in project files. These cost records are for the sole use of the Department to evaluate the information submitted in a formal claim by the contractor. The contractor has to develop any costs from company records. **An "Intent to Claim" along with the necessary record keeping does not constitute a claim nor should it be construed as such.**

PROCEDURE

If the contractor decides to pursue the claim, he or she shall submit a formal claim in writing that contains:

- Sufficient details to establish the nature of the claim
- Monetary amount specified for the claim
- Itemized accounting of the items involved
- Rational basis for the amount of payment requested

Note: The monetary amount shall consist of a clear, concise statement reflecting the total amount of the claim.

The SE shall summarily reject and return, to the contractor, any claim presented that does not contain sufficient information to make a determination as to the validity and amount of the claim.

The SE should inform the contractor that it is in his or her best interest to complete the following as soon as possible for a timely resolution. Submission of the claim will proceed in one of the following methods:

- If the claim involves extra work, the contractor shall submit a report detailing the dollar amount of the claim, the basis of the claim, and any supporting documentation to the SE no later than 30 days after the receipt of a *Formal Acceptance Report of Completed Construction* (**Exhibit 9023**).

PROCEDURE (CONT.)

- If the claim involves final quantities and payments, the contractor shall submit a report detailing the dollar amount of the claim, the basis of the claim, and any supporting documentation to the SE no later than 60 days after receipt of the TC 63-34 form, *Final Release* (**Exhibit 9034**), as sent to the contractor by the Cabinet.

- If the claim involves a delay, the contractor shall create a report detailing:

  - Dollar and time amount of the claim
  - Basis of the claim
  - An as-built schedule compared with the as-bid schedule indicating the delay or delays
  - Description detailing the responsible party and actions causing the delay
  - Any supporting documentation

  The contractor shall submit this report to the SE no later than 30 days after the receipt of the *Formal Acceptance Report of Completed Construction*. If the contractor did not submit a project schedule at the preconstruction meeting, the Cabinet will not consider the claim for delay.

	Section CLAIMS
	Subject District-Level Review

PROCEDURE

Upon the submission of the claim materials by the contractor, the section engineer (SE) and district project delivery and preservation branch manager will have 60 days to attempt to settle the claim with the contractor.

The SE shall:

- Review the formal claim as presented by the contractor
- Check the breakdown of items and moneys against office records
- Indicate if the records match those submitted by the contractor
- Specify any differences found in the review
- Include any other pertinent information concerning the claim
- Submit the claim to the district project delivery and preservation branch manager along with a recommendation concerning the validity of the claim

The district project delivery and preservation branch manager will review the contractor's claim and, if desired, may request a meeting with the contractor to be conducted in the district office. The contractor will be advised of the meeting date, the necessity of developing all pertinent information (including substantiating records), and the need of potential witnesses.

This meeting is at the option of the contractor and, if deemed unnecessary by the contractor, it is not required that it be held. This meeting is not a hearing and should not be handled in such a manner; however, if the meeting does occur, detailed stenographic notes or a tape recording shall be kept. The district project delivery and preservation branch manager shall note if the contractor rejected the offer of a meeting.

The district project delivery and preservation branch manager shall develop all points pertinent to this claim to the extent possible. Any differences between the claim and the SE's records should be reconciled, if possible.

PROCEDURE (CONT.) The district shall make a determination to settle or dispute the claim within 60 days. This determination shall be relayed to the contractor and Central Office in the appropriate time limit. Along with the determination, the district project delivery and preservation branch manager shall forward to the Division of Construction a report complete with:

- Minutes of the meeting (if such a meeting occurs)
- Original contractor's claim
- Copies of all documents submitted by the contractor in support of the claim
- Any comments and recommendations

	Section CLAIMS
	Subject Review by Central Office

POLICY

If the claim is not settled at the district level, the district shall submit the claim and all accompanying information to the Director of the Division of Construction who will have 90 days to make a final determination.

Prior to making the final determination, the director will hold an informal conference with the contractor to reach a resolution to the claim or identify issues needing resolution. If the conference is unsuccessful, the director will notify the contractor of the Cabinet's decision (the final determination) and the contractor's right to a hearing according to KAR 603 2.015 Section 10.

If the district or Central Office fails to meet stipulated deadlines, their inaction indicates a denial of the claim. If the director fails to submit a final decision within the deadline stipulated previously, the Cabinet will bear the costs associated with the hearing officer (if a hearing occurs).

	Section CLAIMS
	Subject Paying a Claim

CLAIMS PROCESSED AS EXTRA WORK

For a claim found to be just, the Department of Highways will pay for it as "Extra Work" as provided in Section 104.03 of the Standard Specifications. This provision does not establish a claim contrary to the terms of Section 104.02.

PREPARING A SUPPLEMENTAL AGREEMENT

To pay a claim, the section engineer will prepare a supplemental agreement to be executed by all parties to the contract. The supplemental agreement will be written to authorize payment of the cost of the work, as agreed to by the Department of Highways and the contractor with the exception that contract items previously paid on a current estimate that were involved in the claim are to be deducted from the final amount. The body of the document shall include an explanation for the deductions.

CLAIMS PAID WITH FEDERAL FUNDS

FHWA approval is required to pay claims with federal funds.

CONTRACT TIME EXTENSIONS DUE TO A CLAIM

The supplemental agreement shall include any extension of applicable contract time.

	Section CLAIMS
	Subject Possible Mediation

USING A MEDIATOR

Upon a written agreement of both parties, the claim could be mediated through a formal nonbinding mediation with a mutually agreed upon mediator. The parties will equally share the costs associated with this action.

TERMINATING MEDIATION

If either party terminates the mediation, the contractor may still request a hearing according to KRS Chapter 13B and has 30 days from the notice of termination of the mediation to make such a request.

	Section CLAIMS
	Subject Administrative Hearing

ADMINISTRATIVE HEARING

If the contractor wishes to request an administrative hearing, he or she must do so within 30 days of the notification of the Cabinet's final decision and be in accordance with KRS Chapter 13B. The previous administrative claims process (discussed in **CST-311-6**, **CST-311-7**, and **CST-311-8**) must be exhausted prior to the contractor requesting an administrative hearing.

FILING A LAWSUIT

As an alternative course of action, the contractor may chose to forego the KRS Chapter 13B administrative hearing and file a lawsuit with the district court in Frankfort, KY.

	Section CLAIMS
	Subject Summary of Claims Process

SUMMARY The following table summarizes the claims process for several different events that may occur:

Claims Process Summarization Table

Event	Contractor Action	Department Action	Time Limit from Event
1. Dispute/Issue on the jobsite	Contractor and section engineer (SE) should work together to resolve disputes as they arise.		
2. Contractor knows or should of known of events causing claim	Contractor initiates the claims process by notifying the SE of the intent to file a claim by submitting TC 63-32, *Notice of Changed Condition/ Disagreement*.		10 Days; Prior to beginning any disputed extra work (as defined in the Standard Specifications)
3. SE receives form TC 63-32		The SE must respond by submitting TC 63-33 *Acknowledgement of Notice of Changed Condition/Disagreement* to the contractor.	7 Days
4. TC 63-32 and TC 63-33 submitted	The contractor must complete the work as directed by the construction documents and the SE. Both parties shall carefully track and document the work with costs tracked according to specification 109.04.		Immediately
5. Work involved in the claim is complete		The SE determines if the claim is justified. If so, it is paid for as “Extra Work” under specification 104.03.	

Claims Process Summarization Table (cont.)

6. The SE determines the claim is not justified	1. If the claim involves extra work, the contractor must submit a report detailing the dollar amount of the claim, the basis of the claim, and any supporting documentation to the SE. 2. If the claim involves final quantities and payments, the contractor must submit a report detailing the dollar amount of the claim, the basis of the claim, and any supporting documentation to the SE.		30 Days from receipt of the formal acceptance 60 days from receipt of the final release as sent to the contractor by the Cabinet
7. Submission of the claim materials to the SE by the contractor		The SE shall notify the Central Office field engineer & Contract Administration Branch of the claim. The SE and the district PDP BM will attempt to settle the claim with the contractor.	60 Days
8. The claim is not settled in 60 days		Division of Construction's Director will hold an informal conference with the contractor to try to reach a settlement or identify issues needing resolution. If the conference does not successfully settle the claim, the director will make a final determination.	90 Days
9. Conference unsuccessful and the director makes a final determination regarding the claim		Director will notify the contractor in writing of the Cabinet's decision and of the contractor's right to an administrative hearing according to KAR 603 2:015 Section 10.	
10. Contractor receives written notice of the Cabinet decision & wishes to have an administrative hearing	Contractor requests a hearing pursuant to KAR 603 2:015 Section 10.		30 Days

**The parties of the claim may mutually agree to have the claim mediated by a mutually agreed upon mediator with costs shared equally. If mediation is terminated, the contractor still has the right to a hearing pursuant to KAR 603 2:015 Section 10.
**This process is governed by KAR 603 2:015 Section 9 and KRS 13B.140.

	Chapter CONTRACT ADMINISTRATION
	Subject Value Engineering

INTRODUCTION

The Department encourages the development of new and improved construction processes, particularly those that provide the same or better product at a reduced price. Section 111 of the Standard Specifications describes value engineering and details the restrictions to value engineering proposals. Under the provisions of this specification, the contractor is provided an incentive to submit contract cost reduction proposals to the section engineer (SE). In general, the proposal must provide an equivalent product and not impair the essential functions or characteristics of the project while reducing the cost of the project.

The SE is not required to consider any proposal submitted. Frivolous proposals should be discouraged and promptly rejected.

VALUE ENGINEERING PROPOSALS ALREADY BEING CONSIDERED BY THE CABINET

Occasionally, value engineering proposals may suggest changes or modifications in design standards that may be under consideration by the Department but not yet adopted. In general, these submittals will go through the typical review procedure; however, such submittals are not considered to meet the intent of the value engineering concept and are subject to denial.

Note: Denial as a value engineering proposal does not preclude implementing the change as a supplemental agreement or in a change order outside the terms of value engineering.

PROCESSING A VALUE ENGINEERING PROPOSAL

The contractor should address a value engineering proposal to the SE. The SE should review the proposal and transmit it along with any comments and any necessary supporting documentation to the district project delivery and preservation branch manager (PDPBM) as soon as possible. The district PDPBM should review the submittal and forward the request along with pertinent comments and supporting documentation to the Director of the Division of Construction.

The Value Engineering Review Committee within the Division of Construction will review the proposal, as submitted by the district office.

PROCESSING A VALUE ENGINEERING PROPOSAL

Following a determination by the committee, the Director of the Division of Construction will advise the district PDPBM of the decision to accept or reject the proposal. The district PDPBM will advise the SE of the decision, so that the contractor may be advised.

All such transmittals shall be done in writing.

PROPOSAL DENIAL

In accordance with Section 111.03 of the Standard Specifications, this decision is final and not subject to the provisions of Section 105.13, "Claims for Adjustments and Disputes." The letter of denial should, therefore, terminate consideration of the proposal as a value engineering concept.

PROPOSAL ACCEPTANCE

If the proposal is accepted, the SE will issue a letter of acceptance and follow it with a supplemental agreement that will address the necessary contract modifications and time adjustments in accordance with Sections 111.04 and 111.05 of the Standard Specifications.

On federal full-oversight projects, if the value engineering proposal is accepted, the Director of the Division of Construction or designated field engineer will provide the details of the value engineering proposal to the FHWA and discuss the proposal for concurrence prior to returning it to the district.

	Chapter CONTRACT ADMINISTRATION
	Subject Construction Noise

PROJECT PLAN / CONTRACT NOISE CONTROLS

The project plans or contract may contain notes pertaining to regulating construction noise by the contractor. The contractor may be required to provide sound deadening devices, shields, or physical barriers and take such noise abatement measures necessary to restrict the transmission of noise in the immediate vicinity of:

- Schools
- Hospitals
- Rest homes
- Churches
- Libraries
- Museums
- Parks
- Other noise sensitive sites specified in the contract

These measures may consist of limited working hours (for example, to minimize noises during school hours) or may specify certain times for blasting. Unless otherwise specified in the contract or plans, no payment will be made for any noise abatement requirements or limitations.

The section engineer shall review the plans and proposal carefully and noise abatement requirements shall be discussed in detail at the preconstruction conference. Notes pertaining to this discussion shall be included in the report submitted to the Division of Construction.

The section engineer has the same authority regarding specified noise abatement procedures as other contractual documents and specifications and will be governed accordingly. In case of a violation, and depending on the seriousness and nature of the situation, the section engineer may take whatever action that is necessary, including temporary suspension of work or withholding of pay estimates.

ALTERING PROJECT PLAN / CONTRACT NOISE ABATEMENT PROCEDURES

Depending on work schedule and method of operation, the contractor may propose a noise abatement procedure different from that specified.

ALTERING PROJECT PLAN / CONTRACT NOISE ABATEMENT PROCEDURES (CONT.)

If this proposal is deemed acceptable by the section engineer and district project delivery and preservation personnel, a change order will be prepared voiding the prescribed procedures and setting forth the new procedure.

No changes will be made until this revised procedure is approved by the Central Office, Division of Construction.

	Chapter CONTRACT ADMINISTRATION
	Subject Historic Preservation Laws

POLICY

Section 106 of the Historical Preservation Act of 1966 is defined as being applicable to borrow sites on federal-aid contracts. Section 205.03.01 of the Standard Specifications details the implementation of this act, as it refers to borrow sites.

The contractor shall abide by all requirements of the specifications when obtaining borrow sites for both federally- and state-funded projects.

The Department will abide by all rules under this specification when borrow sites are designated by the Department.

	Chapter CONTRACT ADMINISTRATION
	Subject Essential Manuals & Publications

NECESSARY MATERIALS FOR CONTRACT ADMINISTRATION

The section engineer needs to keep (or have access to) the following manuals and publications in his or her office to properly manage a project:

- *Standard Specifications for Road and Bridge Construction* (current and applicable editions)
- *Construction Guidance Manual*
- *Standard Drawings* (current and applicable versions including *Headwall Supplement RDH Series*)
- Manual on Uniform Traffic Control Devices
- *Employee Safety and Health Manual*
- Pictorial Surface Preparation Standards for Painting Steel Surfaces (SSPC-Vis-1)
- Basic Engineering Handbook
- Labor Compliance Manual
- Inspector's Job Guide for Construction (pocket manual)
- Section Engineer's SiteManager Training Manual
- Kentucky Occupational Safety and Health Standards for the Construction Industry

Division of Materials manuals:

- *Materials Field Sampling and Testing Guidance Manual*
- *Materials Guidance Manual*
- Materials SiteManager Training Manual
- *Kentucky Methods* (for testing and acceptance procedures for materials)
- *List of Approved Materials* (available only online at: http://transportation.ky.gov/materials/ListofApprovedMaterials.htm)
- *Aggregate Source Book* (available only online at: http://transportation.ky.gov/materials/aggregate.htm) (listing of aggregate sources, approved and unapproved, with addresses, locations, and telephone numbers)

	Chapter CONTRACT ADMINISTRATION
	Subject Consultant Inspections

OBTAINING SERVICES

As workload and staff levels dictate, the division may request the Division of Professional Services let a professional services contract. This contract will provide technical field assistance with monitoring and inspection of contracted highway work to ensure compliance with all contract provisions.

SCOPING MEETING

Once a consultant has been selected for a professional services contract, the project manager (PM) in the Division of Construction for the contract, (likely the Transportation Engineering Branch Manager (TEBM) for the Contract Support Branch) will conduct a scoping meeting with the consultant. The meeting will cover issues pertinent to the contract such as:

- Contract time frames
- Consultant responsibilities
- Consultant requirements (such as the number of inspectors, qualifications of inspectors, equipment, notification requirements, etc.)
- Chain of command
- Reporting of work time
- Other pertinent issues

After the meeting, the PM will contact the TEBMs in the districts covered by the contract. The PM will provide the consultant's contact information and levels of inspection available on the contract.

The district TEBMs or their representatives will make the determination when consultant inspection is needed and select the appropriate level from the consultant's levels provided in the contract. Once the consultant provides the names of the inspectors, the section engineer shall verify that the inspectors have the required qualifications.

REPORTING FOR WORK

The consultant inspector should report daily to the location designated by the district TEBM or his or her representative. It is recommended to use the section office, but in some instances the project site may be more appropriate.

TIMESHEETS

The section engineer (SE) shall provide a timesheet for the consultant. The consultant will complete the timesheet daily. The SE will then review and sign each timesheet. The consultant will keep the original timesheet and the SE will keep a copy for the project files in ProjectWise.

PAYMENT

The consultant will submit biweekly or monthly invoices (TC 40-408 form, *Engineering and Engineering-Related Services Pay Estimate*) with a summary listing of each inspector and all timesheets to the district office. The district TEBM or his or her representative will review the consultant's submittals including, but not limited to, the following items:

- Hours requested for payment matches the hours on the timesheets for the applicable pay period.
- The requested rate of payment matches the level of inspection requested. For example, if a Tech I was requested, the rate of payment should be for a Tech I and not for a Tech III.
- The project number on the invoice matches the project number charged on the timesheet.

If the submitted invoice and other documentation are acceptable, the TEBM shall sign the TC 40-408 form and forward the signed invoice, timesheets, and summary listings to the Division of Professional Services for payment. A copy shall be sent to the PM.

	Chapter POST-CONSTRUCTION REQUIREMENTS
	Subject Final Inspection

SECTION ENGINEER

When work on the contract is coming to an end, the section engineer (SE) will initiate the finalization of the contract. The SE will enter the "Open to Traffic" date as a SiteManager "Key Date" and notify the district.

DISTRICT OFFICE

The district project delivery and preservation branch manager will notify the Central Office liaison and request a final inspection.

CENTRAL OFFICE

After the contractor completes all essential work on the contract, the Central Office liaison shall:

- Enter the "Substantial Work Complete" date in SiteManager
- Inspect the contract to determine if corrective work is needed
- Invite the applicable FHWA transportation engineer (on FHWA full-oversight projects)

STRUCTURES

Final inspection of all structures shall be made as soon as the structure work is complete, regardless of the completion status of the contract as a whole.

BITUMINOUS PROJECTS

The SE shall ensure that the contractor has met all contract requirements and performed all required clean-up. The final inspection shall be done in the presence of the contractor to review and discuss any additional or corrective work.

	Chapter POST-CONSTRUCTION REQUIREMENTS
	Subject Completion of a Project

ESTABLISHING A COMPLETION DATE

After the contractor completes all essential work on the contract, the section engineer will enter the "Work Complete Key Date" in SiteManager.

	Section FORMAL ACCEPTANCE & CONTRACTOR PERFORMANCE EVALUATIONS
	Subject Formal Acceptance

GENERAL

The contractor shall perform all additional or corrective work resulting from the final inspection under the direct supervision of the section engineer (SE).

PROCEDURE

After the contractor has completed the corrective work, the SE will enter the "Corrective Work Complete Key Date" in SiteManager.

When the Central Office liaison receives notification that corrective work is completed, the liaison will generate the "Formal Acceptance" report and enter the acceptance date in the SiteManager "Critical Date."

DATE OF FORMAL ACCEPTANCE

If no additional or corrective work is needed during the final inspection, the project completion date will be the formal acceptance date.

If additional or corrective work is specified at final inspection, the date the corrective work is completed will be the formal acceptance date.

	Section FORMAL ACCEPTANCE & CONTRACTOR PERFORMANCE EVALUATIONS
	Subject Contractor Performance Evaluations

GENERAL

The section engineer (SE) shall perform contractor performance evaluations in accordance with the *Construction Procurement Manual* (**CP-203**, "Construction Prequalification Committee").

PROCEDURE

The SE shall complete the TC 14-19 form, *Contractor Performance Evaluation* and mail a signed copy of the form to the contractor and the Central Office Division of Construction Procurement's Prequalification and Compliance Branch.

The SE shall place a copy of the completed *Contractor Performance Evaluation* in the Project Wise contract folder.

	Chapter POST-CONSTRUCTION REQUIREMENTS
	Subject Contract Overtime

SUBMITTAL REQUIREMENTS

When a project is completed after the original specified time has expired, the section engineer (SE) shall submit a TC63-26 form, *Contract Overtime and Liquidated Damage Review* (**Exhibit 9018**) as directed in **CST-309-6**. The SE shall submit this form to the Central Office within 60 days after project completion.

SECTION ENGINEER

Any time extension requests or other contentions that the contractor registers to the SE shall be forwarded to the district project delivery and preservation office as soon as possible.

DISTRICT OFFICE

The district project delivery and preservation office shall complete the TC 63-26 and any unresolved extension requests. Then, the district office will forward this to the Central Office as soon as possible, within 60 days of contract completion.

MONEY OVERRUN

A change order that gives a time extension involves a specific amount of money and a specified amount of time. The total "Net Increase" of all change orders specifying additional time shall be subtracted from the "Final Contract Amount." The total amount remaining will be compared to the "Original Contract Amount" (Line 7, Form TC 63-26). If this amount is greater, the difference will be considered for additional time based on money overrun.

The determination and extension of contract time shall comply with Section 108.07 of the Standard Specifications.

CENTRAL OFFICE

The Central Office shall process Liquidated Damage reports as outlined in **CST-309-6**.

	Section FINAL ESTIMATE
	Subject General

OVERVIEW

Each final estimate shall be compiled, checked, and submitted to the Central Office Final Estimate Section within the established time frame of the date of formal acceptance. This time frame is:

- 90 days on proposal projects
- 120 days on grade and drain projects

The section engineer shall keep the district project delivery and preservation office fully aware of progress in compiling the final estimate. Any significant underruns or overruns shall be brought to their attention immediately.

The district project delivery and preservation office shall keep the Central Office Final Estimate Section aware of any significant overruns or underruns and of any claims made by the contractor.

After the formal acceptance report is received, the inspector over the contract will begin verifying the final pay quantities.

	Section FINAL ESTIMATE
	Subject Verifying Quantities at Section Engineer Office Levels

INSPECTOR PROCEDURES

To verify final estimate pay quantities the inspector shall:

- Run the "Installed Work" report in SiteManager to verify that all DWR's have been approved for payment
- Research any DWR's that have not been approved (as determined by running the "Installed Work" report)
- Run the DWRALL report and use Excel to create a pay book that shows what items were recorded on DWRs for each date worked
- For all weighed materials:
  - Total the last load tickets for each pay item and compare to the total paid
  - Determine the reasons for any differences between total ticket quantities and amounts paid for the items and make appropriate corrections in SiteManager

    Note: There must be last load tickets for the quantity paid. In some cases, the inspector may need to get a copy of a missing weigh ticket from the quarry or from the contractor.
- Evaluate the quantities concerning roadway excavation

  Note: Roadway excavation is paid as plan quantity, plus or minus authorized adjustments. If anything other than plan quantity is paid, calculations must be shown for the authorized adjustments. The inspector shall check these calculations during final check.
- For all pay items, verify the quantity paid and have the verifying documents available for use by the district office during final check

  Note: This documentation may be saved electronically on CD, or by maintaining a paper file as may be the case with weighed material.

SECTION ENGINEER PROCEDURES

After the inspector has determined that all quantities are verified, the section engineer (SE) finishes checking the final:

- Entering the "Ready For Materials Check-RE Key Date" in SiteManager
- Generating the "Dispute/Claim Summary" report to verify that no unresolved disputes or claims exist
- Verifing that all change orders are approved or denied by generating the "Unapproved Change Order Aging" report
- Verifing all stockpile balances are zero

  Note: If a balance remains, the SE shall close out the stockpile.

- Calculating any fuel or asphalt adjustments to verify they are correctly recorded in SiteManager

After all checks are made in the SE's office, the SE will create a DWR with any corrected quantity and enough demobilization paid to equal 75% of the plan quantity. This will be paid as the last progress estimate. After this estimate is paid, the SE will create and approve a DWR with the remaining 25% demobilization and submit the estimate to the contractor. The contractor has up to 15 days to review the proposal final quantities. This submittal may be done through email or html.

After the review period, the SE shall enter the "Resident Final Check Key Date" in SiteManager and send the district office manager:

- A notification email that includes the "Fuel and Asphalt" spreadsheets as an attachment
- Any documentation needed to verify quantities paid
- The As-Built plans

The SE shall generate **but not approve** an estimate that the district can use to verify quantities.

	Section FINAL ESTIMATE
	Subject Verifying Quantities at District Office Levels

DISTRICT OFFICE MANAGER PROCEDURES

The district office manager shall enter the files received from the resident engineer in "District Office Key Date" in SiteManager. To verify the quantities paid the district office manager shall:

1. Run the "Installed Work" report in SiteManager to verify that all DWR's have been approved in SiteManager
2. Run the DWRALL report in SiteManager to have an electronic pay book to verify quantities
3. Verify all last load tickets making sure that there are corresponding weigh tickets for quantity paid
4. Closely check the "Fuel and Asphalt" adjustment spreadsheet, making sure the adjustments have been properly applied
5. Continue checking all quantities to assure the accuracy of the final estimate
6. After all quantities are verified, check Doc_Viewer or eMARS to verify that enough funds exist in the contract to process the payment
7. After funding verification is made, enter the "District Final Check Key Date" in SiteManager
8. Send to the Central Office Final Estimate Section:
   - As Built plans
   - Email notification that states the final is ready to be processed and that includes
     - Contract ID
     - Amount of Final Estimate
     - Fuel and Asphalt Spreadsheets (as attachment)
     - LD Report (as attachment)

	Section FINAL ESTIMATE
	Subject Central Office Final Estimate Section

CENTRAL OFFICE FINAL ESTIMATE PROCEDURES

Upon receipt of the final estimate notification email from the district office manager, the Final Estimate Section shall:

- Verify that all required "Key Dates" are entered in SiteManager
- Check the "Checklist Event Dates" in SiteManager to verify that material certification has been done
- Enter the "Files Received in Central Office Key Date" in SiteManager
- Generate the final estimate for use to verify quantities
- Verify that all change orders have been approved or denied
- Verify that all stockpiles have been closed
- Verify that there are no outstanding DWR's
- Use the "Fuel and Asphalt Adjustment" spreadsheets to verify the accuracy of the adjustment
- Print any "Liquidated Damage" reports and attach them to the final estimate package

	Section FINAL ESTIMATE
	Subject Final Estimate Package

CENTRAL OFFICE FINAL ESTIMATE SECTION PROCEDURES

After completing the last final check, the Central Office Final Estimate Section creates a final estimate package to be sent to the Division of Accounts. The Final Estimate Section enters the SiteManager Key Dates:

- "Central Office Final Check"
- "Date Final Release Sent"
- Projected date for "Date Final Release Received"

The Final Estimate Section shall

- Print one copy of the "Final Estimate Data Sheet" and two copies of the "Final Release" from SiteManager

  Note: These are put together to create the final package.

- Send a copy of the "Final Estimate" and one copy of the "Final Release" to the contractor for approval

	Section FINAL ESTIMATE
	Subject Contractor Review

CONTRACTOR REVIEW

After receipt of the "Final Release" and a copy of the "Final Estimate," the contractor has 60 days to review the contract. If the contractor agrees with the final pay amount, the contractor signs the "Final Release" letter and returns it to the Director of the Division of Construction. If no "Final Release" is returned after 60 days, the contract may be paid by official order.

If the contractor disagrees with the final pay amounts, he or she may file a claim to the Division of Construction.

	Section FINAL ESTIMATE
	Subject Final Estimate Payment

FINAL ESTIMATE PAYMENT

After receiving the signed "Final Release" from the contractor, the Central Office Final Estimate Section applies approval to the final estimate in SiteManager and enters the "Final Release Critical Date" and "Date Release Return Key Date" in SiteManager. This initiates closing out the contract in eMARS.

When a contract is final paid by official order, the above procedure shall be followed with the exception that a note is entered in SiteManager that states that the final was paid by official order.

	Section FINAL ESTIMATE
	Subject Closing the Contract in SiteManager

CLOSING THE CONTRACT

After payment of the final estimate in eMARS, the contract balances are closed or taken to zero dollars. The Central Office Final Estimate Section then applies the final approval level to the estimate in SiteManager and enters the "Physical Work Complete Date" in the "Critical Dates."

Note: Once the "Physical Work Complete Date" is entered in SiteManager, **there can be no more changes to the contract**.

	Chapter FORMS USED BY CONSTRUCTION FORCES
	Subject General

DISCUSSION OF FORMS

This chapter includes a complete listing of the forms generated and maintained by the Division of Construction and other forms that are relevant and often used by construction forces, regardless of their origin (other Cabinet divisions, other state agencies, FHWA, etc.). **CST-502** lists the forms and includes a discussion of their purpose. This manual also includes these forms as exhibits.

This chapter is meant to assist personnel in finding and using necessary forms but it is by no means an exhaustive list of forms that construction personnel may need.

MODIFICATION OF FORMS

Many of the forms included in this chapter can be found electronically or easily typed into a personal computer. Even though this makes it easy for the forms to be modified and changed to meet specific project needs, **unauthorized personnel shall not alter a Cabinet form**. The creation and modification of forms have a legal approval process that shall be complete before they are used in the field. Personnel seeking modifications to a particular form shall contact the Central Office, Division of Construction to have those modifications made.

EXPLANATION OF FORM DESIGNATION

Cabinet forms are titled and numbered for identification purposes. The typical designation is "TC *##-##, The Form Title*," for example TC 63-12 form, *Daily Report of Weighed Materials*. The form number is TC 63-12. The "TC" stands for Transportation Cabinet, the "63" is the Division of Construction's designated prefix number, and "12" represents the specific form number within the Division of Construction.

LAST REVISION DATE

Each Cabinet form indicates the revision date (near the form number) for that form. For example, the TC 63-12 form shows its revision date as "Rev. 5/87." Personnel shall make every effort to use the most up-to-date form. The *Forms Registry* lists the most recent revision date of all the Cabinet's forms and is found online at:

http://transportation.ky.gov/kytciforms/formslibrary/Forms%20Registry.pdf

REQUIRED INFORMATION ON EVERY FORM

The contract id (CID) shall be included on every form. Any form that is completed shall have enough reference information to identify:

- Date completed
- Who completed the form
- Project for which the form was completed

Chapter

FORMS USED BY CONSTRUCTION FORCES

Subject

Division of Construction Forms

CURRENT FORMS The following table lists the current applicable forms used by the Division of Construction:

Division of Construction Forms Table

Form #	Form & Form Letter Name	Date of Revision
TC 63-8	Record of Piles Furnished & Driven	5/02
TC 63-8M	Record of Piles Furnished & Driven—Metric	5/02
TC 63-9	Concrete Trip Ticket	7/92
TC 63-10A	Labor Payroll for Extra Work	6/01
TC 63-10B	Equipment Rental for Extra Work	6/01
TC 63-10C	Materials Incorporated in the Work	6/01
TC 63-11	Cost-Plus Work Daily Field Record	1/86
TC 63-12	Daily Report of Weighed Materials	5/87
TC 63-14	Daily Inspectors Report for Bridge Painting	3/00
TC 63-22	Record of Test Pile No.	5/02
TC 63-22M	Record of Test Pile No.—Metric	5/02
N/A	Final Pay Estimate	N/A
TC 63-26	Contract Overtime & Liquidated Damage Review	3/00
TC 63-31	Weighman's Tare Check Report	5/87
TC 63-32	Notice of Changed Condition/Disagreement	10/01
TC 63-33	Acknowledgment of Notice of Changed Condition/Disagreement	6/00
TC 63-34	Final Release	7/93
TC 63-35	Subcontract Request	3/00
TC 63-41	Working Day Memo No. 1	3/01
TC 63-42	Working Day Memo No. 2	3/00
TC 63-43*	Request for Rideability Test	9/00
TC 63-46	Nuclear Meter Daily Log Sheet	6/01
TC 63-47	Moisture-Density Test Report—Soils	11/98
TC 63-49	In-Place Density Using Control Strip	11/98
TC 63-55	Concrete Mixer Performance & Condition Approval	4/87
TC 63-61	Erosion Control Inspection Report	6/01
TC 63-62	Pre-Construction Safety & Health Checklist	10/01
TC 63-63	Notification of Imminent Danger	7/06

DIVISION OF CONSTRUCTION FORMS

The Division of Construction supports the following forms:

- **TC 63-8 form, *Record of Piles Furnished & Driven* (Exhibit 9025)**—This form (discussed in **CST-1305-4**) is used by the section engineer (SE) and is part of the record keeping associated with driving piles. It is also included as part of the final estimate records.

- **TC 63-8M form, *Record of Piles Furnished & Driven-Metric* (Exhibit 9026)**—This form is the same as above but for metric units.

- **TC 63-9, *Concrete Trip Ticket* (Exhibit 9027)**—This trip ticket (discussed in **CST-1203**) is designed to accommodate any type of concrete, whether central mixed or non-agitated. There is, therefore, space for data that may or may not be appropriate for the particular type of concrete being placed. This form is to be used for each load of concrete delivered to the project regardless of type. This form is furnished in duplicate on NCR paper. The original goes in the project files and the inspector retains the copy for his or her files.

- **TC 63-10 form, *Force Account Workbook***—This is actually a series of forms discussed in **CST-310**. They are used by the SE to compile field cost data from force account work. These forms are also used to compile the cost of work involved in claims as discussed in **CST-310**. In both circumstances, the daily field cost records are kept on a TC 63-11 form and transferred to these forms on a periodic basis. The following forms are available as computer generated forms:

  - **TC 63-10A form, *Labor Payroll for Extra Work* (Exhibit 9020)**
  - **TC 63-10B form, *Equipment Rental for Extra Work* (Exhibit 9020)**
  - **TC 63-10C form, *Materials Incorporated in the Work* (Exhibit 9020)**

- **TC 63-11 form, *Force Account Daily Record* (Exhibit 9019)**—This form (discussed in **CST-310**) is used to keep the daily cost records that will be compiled on the TC 63-10 form as discussed above. This form is furnished in duplicate on NCR paper. The SE or inspector keeps the original (white) copy and the contractor gets the yellow copy. Each form shall be signed by the contractor's representative, the inspector, and the SE.

- **TC 63-12 form, *Daily Report of Weighed Materials* (Exhibit 9028)**—This form (discussed in **CST-1004-1**) is used to provide a daily summary of weighed materials. This form is furnished in quadruplicate on NCR paper in colors of white, canary, pink, and goldenrod. The contractor can use this form in different ways (depending on the weighing method being used), so the procedures in **CST-1000** should be reviewed.

DIVISION OF CONSTRUCTION FORMS (CONT.)

- **TC 63-14 form, *Daily Inspectors Report for Bridge Painting* (Exhibit 9029)**—This form is used by the inspector on a bridge painting project and shall be filled out with care to details. It is used as a supplement to the Daily Work Report in SiteManager and shall not be used on a stand-alone basis.

- **TC 63-22 form, *Record of Test Pile No.* (Exhibit 9030)**—This form (discussed in **CST-1305-6**) is the form of record for each test pile driven on a project.

- **TC 63-22M form, *Record of Test Pile No.-Metric* (Exhibit 9031)**—This form is the same as above but for metric units.

- **Form letter, *Final Pay Estimate* (Exhibit 9032)**—The SE uses this form letter to put the contractor on notice that the final estimate for the project is ready for review. It shall be sent as soon as the final estimate is completed (approximately the same time the final is submitted to the district for checking). This form is available as a computer-generated form letter.

- **TC 63-26 form, *Contract Overtime & Liquidated Damage Review* (Exhibit 9018)**—This form (discussed in **CST-309-6**) shall be submitted by the SE on every project not completed on time, regardless of whether it has adequate time extensions or not, within 30 days after the actual completion date.

- **TC 63-31 form, *Weighman's Tare Check Report* (Exhibit 9033)**—This form is discussed in **CST-1004-1**. It may be necessary to use this form if problems are encountered with the computerized scale operation.

- **TC 63-32 form, *Notice of Changed Condition/Disagreement* (Exhibit 9021)**—This form (discussed in **CST-311-2**) is given to the contractor at the preconstruction conference.

- **TC 63-33 form, *Acknowledgment of Notice of Changed Condition/ Disagreement* (Exhibit 9022)**—The SE uses this form (discussed in **CST-311-3**) to respond to the *Notice of Changed Condition/Disagreement* form submitted by the contractor. This response must be made within seven days of receiving the *Notice of Changed Condition/Disagreement* form. **This time frame shall be followed.** This form is available as a computer generated form.

- **TC 63-34 form, *Final Release* (Exhibit 9034)**—The Division of Construction submits this form to the contractor along with the final estimate for a completed project. This form provides a method for the contractor to indicate written acceptance of the final estimate. See Section 109.06 of the Standard Specifications.

DIVISION OF CONSTRUCTION FORMS (CONT.)

- **TC 63-35 form, *Subcontract Request* (Exhibit 9009)**—This form (discussed in **CST-304-1** & **CST-304-2**) may be used for both first-tier and second-tier subcontractors. This form shall be handed out and discussed at the preconstruction conference. See Section 108.01 of the Standard Specifications. This form is available as a computer generated form.

- **TC 63-41 form, *Working Day Memo No. 1* (Exhibit 9016)**—This form is initiated by the SE, as discussed in **CST-309-3** & **CST-309-4**. This form is used while work days are ongoing and is available as a computer generated form.

- **TC 63-42 form, *Working Day Memo No. 2* (Exhibit 9017)**—This form is initiated by the SE, as discussed in **CST-309-3** & **CST-309-4** and is used on a working day project after time has expired. This form is available as a computer generated form.

- **TC 63-43 form, *Request for Rideability Test* (Exhibit 9035)**—The SE uses this form to request a rideability test of the bituminous pavement of a specific project and to record the data of the rideability test. This form is available as a computer generated form.

- **TC 63-46 form, *Nuclear Meter Daily Log Sheet* (Exhibit 9040)**—This form is for recording the day-to-day disposition of the nuclear meters. See **CST-800** for additional information.

- **TC 63-47 form, *Moisture-Density Test Report-Soils* (Exhibit 9041)**—This form is intended for use with soils, DGA, and CSB (crushed-stone base) and should be used to meet the requirements of **KM 64-512**. See **CST-800** for additional information.

- **TC 63-49 form, *In-Place Density Using Control Strip* (Exhibit 9036)**—This form is to meet the needs of in-place density testing using control strip and the establishment of a target density. See **CST-800** for additional information.

- **TC 63-55 form, *Concrete Mixer Performance & Condition Approval* (Exhibit 9037)**—This form (discussed in **CST-1204**) is a sticker to be placed in a concrete truck. It is usually handled by the concrete supplier, but on a rare occasion it may need to be placed by either the SE or inspector.

- **TC 63-61 form, *Erosion Control Inspection Report* (Exhibit 9042)**—This form is used to make the inspections required by Sections 213.03.01 and 213.03.03 of the Standard Specifications and satisfies the inspection requirements of the KPDES permit. It also serves as the written notice to the contractor in case of penalties according to Section 213.03.02 of the Standard Specifications.

DIVISION OF CONSTRUCTION FORMS (CONT.)

- **TC 63-62 form, *Preconstruction Safety & Health Checklist* (Exhibit 9038)**—This form is submitted by the contractor at the preconstruction conference with the written "Construction Safety Program" as discussed in **CST-111-1** & **CST-111-4**.

- **TC 63-63 form, *Notification of Imminent Danger* (Exhibit 9039)**—The SE or safety coordinator submits this form to the contractor, notifying him or her of a stop work situation in which danger to workers exist on a particular project.

Chapter

FORMS USED BY CONSTRUCTION FORCES

Subject

Forms from Other Divisions & Agencies

TABLE OF FORMS

The following table lists the applicable forms not maintained by the Division of Construction that are used by construction forces:

Forms Used by Construction Forces Table
(Not Maintained by Division of Construction)

Form #	Name	Form Ownership
TC 71-14	Consent and Release	Maintenance
TC 14-312E	Engineer's Wage and Hour Report	Construction Procurement
IA-1	Workers Compensation-First Report of Injury or Illness	Personnel Services
KSP-232	Civilian Traffic Collision Report	Kentucky State Police
FHWA-47	Statement of Materials and Labor Used by Contractors on Highway Construction Involving Federal Funds	Federal Highway Administration
FHWA-1391	Federal-Aid Highway Construction Contractors Annual EEO Report	Federal Highway Administration

DISCUSSIONS OF FORMS

Construction forces use the following forms:

- **TC 71-14 form, *Consent & Release* (Exhibit 9045)**—The section engineer (SE) uses this form whenever it becomes necessary to perform any activity or work off the right-of-way on private property. This includes, but is not limited to, surveying, ditching, unanticipated waste or borrow sites that must be provided by the Department, slides, etc. This form is also useful in those circumstances when the property in question is being acquired by the Department but access is desirable before acquisition is final. Due care shall be used to ensure the property owner signing the form has the legal right to make the agreement.

- **TC 14-312E form, *Engineer's Wage and Hour Report* (Exhibit 9014)**—This form (discussed in CST-307) is used when making periodic checks of the wages being paid by the contractor.

DISCUSSIONS OF FORMS (CONT.)

- **IA-1 form, *Workers Compensation-First Report of Injury or Illness* (Exhibit 9044)**—Every personal injury must be reported on this form within seven working days following the injury. The IA-1 form will be mailed to the district office and then forwarded to the Office of Legal Services. For further information, see **CST-111-3**.

- **KSP-232 form, *Civilian Traffic Collision Report* (Exhibit 9006)**—All accidents involving Cabinet vehicles and equipment must be reported using this form. The KSP-232 form will be mailed to the district office and then forwarded to the Office of Legal Services in Frankfort. For further information, see **CST-111-3**.

- **FHWA-47 form, *Statement of Materials and Labor Used by Contractors on Highway Construction Involving Federal Funds* (Exhibit 9043)**—This form is submitted by contractors on federal-aid projects. This form, properly filled out, must be submitted with the final estimate.

- **FHWA-1391 form, *Federal-Aid Highway Construction Contractors Annual EEO Report* (Exhibit 9015)**—This form is completed by the contractor and submitted to the section engineer once a year (in July only). For further information, see **CST-308-1**.

	Chapter CONSTRUCTION SURVEYING
	Subject Introduction

INTRODUCTION

Most roadway contractors now utilize earth moving equipment, dozers, graders, etc. outfitted with GPS allowing their operators to build a road by watching a monitor instead of being guided by a forest of stakes in the ground. Department personnel shall ensure the validity of GPS measurements using GPS when available or spot checking using traditional methods.

RESPONSIBILITIES

The Standard Specifications Section 201—Staking specifies the Department and contractor responsibilities in regard to staking on construction projects. This chapter discusses proven techniques and procedures for various types of construction staking and measurements.

CONTRACT STAKING

When contract staking is listed as a bid item, the contractor shall furnish all necessary personnel and equipment to provide a construction staking party as provided in Section 201.01-05 of the Standard Specifications.

In accordance with the Standard Specifications, the contractor's staking party shall be under the general supervision of a licensed professional engineer or licensed land surveyor. The section engineer should sufficiently check the contractor's staking to determine that the methods and procedures used will produce desired results.

At completion of the project, the contractor shall submit all field books to the section engineer for review and to include in the section engineer's file. The Standard Specifications specify the Department's responsibilities with respect to project staking when contract staking is a bid item.

	Chapter CONSTRUCTION SURVEYING
	Subject Field Books

FIELD BOOKS

Field books are permanent source documents and may serve as a legal reference. The section engineer shall record all field notes in standard bound field notebooks. The notes shall be organized and as neat as possible with figures and measurements sufficiently clear to provide for easy reading and checking of computations and quantities. All pages should be numbered and the weather, dates, and personnel shown at the beginning of each day's notes.

The field book cover shall include:

- Contract Id
- County
- Route No. Road Name

The section engineer's name, address, and phone number should be on the back of the front cover in case of loss.

Exhibit 9046 provides an example of a completed field book cover and index.

	Chapter CONSTRUCTION SURVEYING
	Subject Plan Review

CHECKING PLANS

Plans should be checked and field books and electronic data prepared prior to beginning construction staking. **Plans should never be taken for granted.** The section engineer shall:

- Recalculate centerline geometries and record the necessary data
- Check plan grades
- Compare bridge grades with road grades to ensure proper vertical alignment

  Note: Bridge plans should particularly be studied for orientation. Vertical clearances should be checked as well as the dimensions of footings, piers, rockers, beams, and deck so that they are in agreement with footing and deck elevations.

- Perform a field check for omissions or topographical changes that may have occurred after the location survey so that recommendations can be prepared and the contract status revised prior to the commencement of work

Any errors or omissions shall be corrected and entered in the section engineer's office plans and field books and, ultimately, in the "As-Built" plans. Any appreciable error should be immediately reviewed with the district project delivery and preservation office since Design and Right of Way may be affected.

ELECTRONIC DATA

Electronic data controllers (for example Sokkia SDR33 and Trimble TSCII) can be used in conjunction with or as an alternative to establishing field books. Electronic coordinate files can be created and uploaded to the data controllers. When using an electronic data controller, the information shall be printed and bound to serve as field books and as a reference in the field.

Various stake road programs (**Exhibit 9060**) found in the data controller can be used to stake fieldwork by entering horizontal, vertical, and roadway template information directly from the plans. The data controller can then generate and stake out information based on proposed station, offsets, and elevations.

ELECTRONIC DATA (CONT.)

Uploading proposed roadway alignments to the data controller should be performed before field work commences.

The section engineer shall perform manual checks to verify data collector output for proposed alignment coordinates, elevations, and templates.

	Chapter CONSTRUCTION SURVEYING
	Subject Project Control & Stakeout

CONTROL POINTS

Control points appear in the roadway plans, usually on the "Reference Sheet", and are monuments, either disks set in concrete or iron pins with caps, that have both horizontal (coordinate) and vertical (elevation) values assigned to them. The Department and the contractor use these points for all surveying duties required to complete the project.

These points are derived from high accuracy reference networks such as the National Geodetic Survey, the U.S. Geological Survey, and the Kentucky High Accuracy Reference Network (KYHARN).

The section engineer (SE) must verify control points for accuracy prior to construction either by the traverse method or from GPS observations.

BENCHMARKS

Benchmarks are also shown on the plans and normally only have vertical (elevation) values assigned to them. They are usually nails or spikes in trees or power poles and are normally referred to as "Permanent Benchmarks" (B.M.'s), as opposed to new benchmarks established by the SE that are referred to as "Temporary Benchmarks" (T.B.M.'s). Permanent benchmarks are numbered in sequence with the project stationing, for example, B.M. No. 19, B.M. No. 20, etc. Temporary benchmarks are assigned the same number as the permanent benchmark from which it was established with an alphabetical suffix as identification, for example, T.B.M. No. 19A, T.B.M. No. 20A, and T.B.M. No. 20B.

All benchmarks should be established where they will give the easiest access to future engineering work and be as safe as possible from the construction work. The SE shall accurately note the description, location, and elevation of each benchmark and include them in the permanent record plans. Copies shall be placed in all field books for convenience of field personnel.

CHECK LEVEL

Check levels should be run to establish the accuracy of the benchmarks as noted on the plans. This work needs to be done as soon as possible and may be performed in conjunction with the verification of the project control points if sufficient personnel are available. In addition to checking the plan benchmarks, new or temporary benchmarks are established throughout the project in strategic locations. All future accuracy of highway grades on the project depend on accurate benchmarks, so these check levels must be done with care.

CHECK LEVEL (CONT.)

The SE shall create a "Level" field book that will ultimately contain all permanent and temporary benchmarks and their elevations, locations, and descriptions. All check levels and any subsequent checking should also be included if possible. Refer to **Exhibits 9047** and **9048**.

STRUCTURES

Either one or more benchmarks shall be established conveniently close to each culvert and bridge on the project and shall be located so that they can be read with one setup of the level (if the terrain permits). Structures spanning wide streams may have to have several benchmarks, but they should be checked closely.

It is good construction practice to use the same benchmark through the entire construction period of the structure.

PIPE

Each pipe and particularly the larger pipes should have a benchmark close enough to be read with one setup if possible.

RIGHT-OF-WAY & TEMPORARY EASEMENTS

The contractor shall stakeout right-of-way and temporary easements making certain that the SE and inspectors have the ability to check these points throughout the project as required. Sufficient stakes shall be set at any location with a property or encroachment problem to enable all parties to get a clear understanding of the right-of-way location. Stakes should be marked as “right-of-way” or “temporary easement” and noted with the station number and offset width.

ENCROACHMENT

At this stage in the stakeout work, the SE shall carefully note all encroachments and take the necessary action to obtain their early removal. Property owners should be advised to remove fences and buildings from within the limits of the right-of-way in advance of the contractor's clearing and grubbing operations.

The SE should advise inspectors and field forces to be alert at all times for new encroachments that infringe on the established right-of-way. Any indication of such activity must be checked immediately and if found to be an encroachment, necessary steps must be taken to cause its removal.

With few exceptions, adjacent property owners will cooperate in keeping the right-of-way clear of encroachments if they are properly advised of the necessity and if the right-of-way is properly marked. The inspector on the project shall so advise applicable property owners as well as determine the right-of-way limits.

Note: No field employee can authorize a new encroachment or permit an old encroachment to remain within the limits of the right-of-way.

	Chapter CONSTRUCTION SURVEYING
	Subject National Geodetic Survey & U.S. Geological Survey Markers

INTRODUCTION

During the past century and a half, the National Geodetic Survey (formerly U.S. Coast and Geodetic Survey) and the U.S. Geological Survey, both Federal entities, has been determining with great accuracy the latitude and longitude, state plane coordinates and/or elevation of thousands of locations throughout the United States. At most points, a bronze disk is embedded in concrete or bedrock while some later marks consist of a steel rod driven to solid resistance encased in a pipe with a protective cap. These marks are used by engineers and surveyors for various public and private projects.

Other survey marks include U.S. Army Corps of Engineers disks, found mostly around lakes and streams predominately in eastern Kentucky and TVA (Tennessee Valley Authority) disks, found in western Kentucky.

DISK PRESERVATION

Preservations of the survey disks are vitally important. At one time, there were upwards of 20,000 such marks in Kentucky but, through the years, this number has dwindled considerably. The section engineer should ensure that all crew members are familiar with these markers (**Exhibit 9050**) and the following instructions:

- Never remove or disturb a survey marker.
- Upon encountering a survey marker that appears in danger of destruction or damage by erosion, construction, or other causes, take appropriate steps to preserve it.
- If it becomes necessary in the course of construction to relocate a survey mark (belonging to NGS/USGS or not), place an immediate call to the Division of Construction for assistance.

	Chapter CONSTRUCTION SURVEYING
	Subject Borrow Site Cross-Sections

ESTABLISHING THE BORROW SITE

The area from which borrow is to be removed must be determined and plainly staked by the contractor before cross sectioning can start. The volume of material moved will be measured in the original position by the cross-section, average end-area method.

If the borrow site lies adjacent to construction, the regular road cross-section can be extended to include the area involved. However, care must be taken to differentiate between roadway excavation and borrow excavation if they coincide.

If the borrow site is located away from the construction area, two or more control points must be established to provide a basis for cross-sections. The control points should fall well outside any possible operation of the contractor.

BORROW SITE SKETCH

A sketch of the layout of the borrow site will appear on the first page of the notes and shall include:

- Control points
- Stationing
- Borrow limits
- Description of the location of the site usually referenced to the roadway station numbers
- All other pertinent information to enable any person, unfamiliar with the project, to re-establish and carry on with the work

If a field book sketch is too crowded, an alternate method is to provide this information on cross-section paper with adequate referral notes in the field book.

Exhibit 9049 provides an example of typical cross section notes.

	Chapter CONSTRUCTION SURVEYING
	Subject Locating & Staking Pipe Culverts

RESPONSIBILITIES

The contractor shall stake pipe culverts. **It is good practice of Cabinet personnel to verify the accuracy of the contractor's work.** A permanent record of the entire procedure and data should appear in the project pipe book.

STAKING PROCESS

When staking pipe culverts, the contractor shall:

1. Check the plan lengths and flow line elevation of the pipe in the field and, if necessary, adjust to fit field conditions

   Note: Flow line elevations of a pipe culvert will normally be based on the elevations of the natural flow line of the channel.

2. Set a working hub and tack on the centerline of the pipe at an offset distance from each end of the pipe sufficiently removed from the work zone but also close enough to be readily accessible to the pipe laying crew

3. Set a reference hub and tack further out from each end of pipe in as safe a location as possible to simplify potential restoration of the working hub

4. Take elevation measurements on the top of the hubs

5. Mark a guard stake with the centerline station number, measured offset distance, size of pipe, and the cut or fill from hub to flow line at the referenced end of pipe

6. Flag additional long guard stakes (with the designated color for pipe) to protect the hubs and information stakes

USING DATA CONTROLLERS

Data Controllers can assist the field operation of setting out centerline of pipe and box culverts by using the "Set out line" program found in the surveying menu. This program allows the field party to:

- Stake the centerline of pipe from a point with known coordinates and along a specified bearing
- Stake at any distance along any desired centerline
- Set an offset and grade if needed

USING DATA CONTROLLERS (CONT.)

This program is also useful for laying out bridge abutments and piers. Box culvert footers can be entered as a horizontal and vertical alignment along with a template representing the width of the culvert footer. This provides the ability to collect elevations (original ground, top of rock, plan grade, etc.) at any point along the footer alignment and the data controller calculates cut or fill to finished grade.

Refer to the manual that comes with the respective data controller for specific information for the use of these programs.

Chapter

CONSTRUCTION SURVEYING

Subject

Checking Original Cross-Sections

EVALUATING ORIGINAL CROSS-SECTIONS

To adequately establish original ground elevations, the section engineer (SE) should determine by observation of the conditions in the field (and by check sections if necessary) the need for any of the following:

- Retaking the original cross-sections
- Extending the original cross-sections
- Making necessary additions to the original cross-sections

CROSS-SECTIONS DEVELOPED FROM AERIAL PHOTOGRAPHS

The SE should be extremely careful when encountering original cross-sections developed from aerial photography, particularly with those involving steep side hill cuts. Original cross-sections developed from aerial photographs are normally of sufficient accuracy for construction; however, this project type requires the SE to take sufficient check sections to ensure the accuracy of the originals.

	Chapter CONSTRUCTION SURVEYING
	Subject Land Slides

INTRODUCTION

When slides occur that involve failures in original ground behind the cut slope stakes or in the cut slope, the section engineer (SE) shall take immediate action. Slides invariably mean an increase in construction cost and, depending on their nature and extent, can involve redesign, construction revisions, acquiring additional right-of-way, and considerable additional roadway excavation. All these operations require time and result in delays in completing the project. The SE shall make every effort to expedite his or her work and cooperate with all involved parties to get the project on schedule.

PROCEDURE

If it appears that the slide or repair of the slide will disturb original ground beyond the limits of the original cross-sections, the survey party shall immediately extend the cross-sections. These sections shall be taken and plotted as soon as possible since all subsequent actions and decisions depend on their availability. The limits of these sections shall include at least 100 feet on each side of the slide area (or more if necessary) and extend to stable ground, if possible. If the sections need to extend off the right-of-way, the SE shall get the property owner's permission in writing. The extended sections should be plotted right after they are taken on the same scale as the originals. The SE shall also notify the district project delivery and preservation office of the slide as soon as possible detailing:

- Slide location (sta. nos.)
- Extent of the slide
- Estimates of how the slide will effect the contractor's operation
- Any action that he or she has initiated

The SE shall also afford the Division of Structural Design-Geotechnical Branch any staking or aid they may require if they are consulted on the problem.

SLIDE MATERIAL USED FOR ROADWAY FILL

At the discretion of the SE, material removed can be used as borrow excavation for a roadway fill.

	Chapter CONSTRUCTION SURVEYING
	Subject Slope Stakes

INTRODUCTION

Set by the contractor, slope stakes are the control points to the right and left of roadway centerline at points where the finished side slopes will intersect the surface of the original ground. These stakes guide the contractor in constructing cuts and fills.

As a general rule, slope stakes are referenced to:

- Shoulder grade for fills
- Either shoulder grade or ditch grade in cuts

REQUIRED SLOPE STAKE MARKINGS

The front of the stake (toward centerline) shall indicate:

- Either cut or fill
- Amount of cut or fill based on the vertical measurement from the shoulder or ditch grade to the slope stake
- Horizontal measurement from the slope stake to the ditch line or shoulder point
- Slope

The back of the stake will show the station number. If it becomes necessary to offset the stake from its correct location, the offset distance shall also be shown on the front. See **Exhibit 9051**.

SETTING SLOPE STAKES

Slope stakes should not be set until all the clearing and grubbing is finished in their vicinity. They should be adequately guarded with laths flagged with the appropriate color for slope stakes.

The procedure for setting slope stakes may be found in any good surveying textbook.

SLOPE STAKE FIELD BOOK

If contract staking is specified, the contractor shall maintain a slope stake field book and submit it to the section engineer to include with the final estimate.

	Chapter CONSTRUCTION SURVEYING
	Subject Grade Stakes (Bluetops)

INTRODUCTION

Fine grade control is necessary to aid the contractor in establishing typical subgrade section. This fine grade control is established by setting hubs (referred to as bluetops) every 50 feet to the typical subgrade section. These bluetops are set to the hundredth in elevation and are located left and right of pavement centerline, usually at the edge of pavement.

The section engineer (SE) should review the operation for setting bluetops thoroughly with the contractor and be sure everybody understands the procedure. If contract staking is involved, the SE needs to approve the procedure utilized and perform routine checks as the job progresses.

If contract staking is specified, the contractor shall maintain grade field books and submit them to the SE to include with the final estimate.

SETTING GRADE STAKES

All grades for bluetops shall be computed to the nearest 0.01-foot of the required grade. Bluetops are normally set for the top of subgrade and the top of the aggregate base material. A lath should be driven at each bluetop to serve as a guard stake and should show the station number designation.

Bluetops are generally located at the opposing edges of pavement and at centerline of the lane; however, these locations may be modified to fit each particular contractor's operation.

It may be necessary in the case of passing lanes or wide curb and gutter sections to set additional bluetops to aid in controlling the fine grade.

USING DATA CONTROLLERS TO SET GRADE STAKES

The use of autograde machines on larger projects requires a completely different system for setting grade stakes. The stake road program available in most data controllers may be used to check bluetops. The proposed horizontal & vertical alignments along with the roadway template must be loaded into the data controller. This process creates a 3D wireframe model of the proposed roadway allowing the field crew to check cut or fill at any location along the proposed alignment.

USING DATA CONTROLLERS TO SET GRADE STAKES (CONT.)

All data controller calculations shall be verified manually before using this technique.

	Chapter CONSTRUCTION SURVEYING
	Subject Pay Estimate

ROADWAY EXCAVATION

Roadway excavation must be calculated biweekly for purpose of pay estimates. To estimate roadway excavation quantities for biweekly estimates, the section engineer (SE) shall:

- Estimate a quantity of material based on information printed for the type and size of equipment being used and swell factors for material being moved to determine a close approximation of material moved by each unit
- Keep an accurate load count of trips made with the equipment used each day and verify it matches the count turned into the foreman or superintendent

Periodically, field measurements must be made to verify that the estimated roadway excavation quantities accurately depict the quantity of material that has been removed. To accomplish this, the SE shall:

1. Take abbreviated cross-sections and/or run a profile of sufficient magnitude to establish within reasonable accuracy the elevation(s) of undistributed materials in all significant roadway cuts and record this information using the following guidelines:
   - Keep all data in a bound field book used expressly for this purpose or in the Electronic Field Book. Electronic Field Book data shall be printed and kept in a bound notebook or file.
   - Note the date that the field measurements are made to compare the quantity of roadway excavation estimated by load counts up to that date.
2. Plot the data thus obtained on the office cross-section sheets and calculate the quantity of material excavated over the applicable pay period
3. Reference the cross-sections by date and keep a record of the calculations

   Note: This may be done on the cross-sections sheets, space permitting.
4. Reconcile the calculated quantities with previously estimated quantities and enter the corrected quantity in the Item Quantity Record

EMBANKMENT-IN-PLACE

When embankment-in-place is a bid item, the SE shall use methods similar to those detailed under roadway excavation for the purpose of biweekly pay estimates and also field measurements to verify estimated quantities. The field measurement should be made on the roadway embankment instead of roadway excavation.

BORROW MATERIAL

Borrow excavation should be calculated periodically or at the end of borrowing operations for the purpose of verifying accuracy of roadway embankment estimates or field measurements of roadway embankments. To accomplish this, the SE shall:

1. Plot the original borrow pit cross-sections on reproducible paper using the following guidelines:

   - It is preferable to use copies of the original sections for monthly estimate purposes and retain the originals for the final cross-sections.
   - It is recommended the baseline be referenced in some manner to the centerline of mainline or approaches.

2. If the borrow pit proves to be so irregular as to make it difficult to obtain accurate quantities, take the cross-sections or profiles on the embankment(s) and utilize the office blueprint plans much the same as detailed under roadway excavation

   Note: The shrinkage or swell factor must be considered with this method.

SPECIAL EXCAVATION

Special excavation, when included as a bid item, will be considered independent of the embankment-in-place.

	Section STAKING STRUCTURES
	Subject Overview

GENERAL

The contractor shall stake all structures. The section engineer (SE) and other Cabinet personnel must have the ability to check their work.

FIELD BOOKS / NOTEBOOKS

The field books/notebooks for structures should be prepared in advance and include all necessary data so they will be available when staking begins. All information placed in a field book pertaining to a particular structure should be together. The Cabinet prefers that the survey party chief be assigned this responsibility since he or she will gain an insight into the peculiarities of the particular structure being staked.

All sketches in field books shall:

- Be neat and drawn with a straightedge
- Include a certain amount of basic information pertaining to the structure or portion of the structure under consideration including, but not limited to:
  - Outer dimensions of the structure
  - Flow line elevation or other pertinent grades
  - Structure excavation limits and skew, if applicable
  - Any grade changes or other design revisions, such as the raising or lowering of a culvert flow line, that involve changes from the original plans

Prior to staking any structure, the plan dimensions and layout shall be checked for errors.

SECTION ENGINEER RESPONSIBILITIES

Every structure, regardless of size or complexity is simply a component part of the highway and must fit into the overall project. **The SE shall ensure that no culvert or bridge be staked without being absolutely sure that it fits the survey centerline and approach grade controls.**

The SE should ensure that the contractor's supervisory personnel are thoroughly briefed on the staking procedure. The SE should review a bridge layout in the field with the foreman or man in charge of building the bridge. Layout procedures vary in different parts of the country and a wrong assumption can be disastrous.

STRUCTURE INSPECTOR RESPONSIBILITIES

The structure inspector should also be thoroughly familiar with the layout. If possible, the inspector should be involved in the actual layout work, particularly for complex structures.

	Section STAKING STRUCTURES
	Subject Reinforced Concrete Box Culverts

FIELD BOOK / NOTEBOOK

Each culvert should occupy separate pages or sections of the field book/notebook. Sufficient pages must be allowed for a clear layout of the culvert and the necessary structure excavation shots, both original and final, and any necessary computations. If structure excavation, concrete, steel, or any other quantity is calculated from cross-section sheets, the data in the field book must be cross-referenced.

STAKING

In the staking of reinforced concrete box culverts, the contractor shall:

- Establish lines representing centerline of the culvert, front or outside face of the parapets, and the front face of each wing

  Note: This work must be done with a total station or a similar instrument of comparable accuracy. Establishing or re-establishing the wing lines with a carpenter's square is not permitted. See **Exhibit 9055**.

- Reference each line with a minimum of at least three hubs with tack and applicable informational guard stakes

- Utilize laths decorated with the appropriately colored ribbon for culvert stakes to protect the hubs from heavy equipment

- Place each reference hub outside the construction limits

USING DATA CONTROLLERS

Box culvert footers can be entered as a horizontal and vertical alignment along with a template representing the width of the culvert footer. This provides the ability to collect elevations (original ground, top of rock, plan grade, etc.) at any point along the footer alignment and the data controller calculates cut or fill to finished grade. Refer to the manual that comes with the respective data controller for specific information for the use of these programs.

ESTABLISHING BENCHMARKS

A benchmark shall be established near the culvert location, but out of the construction zone, to use in establishing elevations and setting grades. It is very important that the level person always checks back in on this benchmark.

CULVERT FLOW LINES

The inlet and outlet flow line elevations designated on the plans represent the flow line elevations on the centerline of the culvert at each end of the culvert. When the culvert is skewed to the roadway, flow line grades must be calculated for points where barrel walls and wing walls intersect. The contractor shall set up on one end of the culvert centerline and align the entire length of the structure.

FIELD CHECK

The section engineer (SE) shall report any discrepancies in either alignment or grade to the district project delivery and preservation office as soon as possible and certainly before the contractor orders the reinforcing steel or begins work.

EXCAVATION QUANTITIES

The SE shall make preparations to take the necessary structure excavation shots either at the same time the culvert is laid out or shortly thereafter. The SE shall review the culvert plans closely to determine if any special requirements or necessary drawings exist that will affect the procedure. For example, some culvert plans may stipulate roadway excavation for the culvert barrel or may change the outside limits for structure excavation from normal Standard Specification requirements (18" outside of "neat lines"). Requirements of this nature, if included in the structure plans, will materially affect the excavation quantities and shall be accounted for before beginning this operation.

Refer to **Exhibit 9052 (Sheets 1 & 2)** for examples of procedures utilized in taking structure excavation shots and roadway excavation shots, if necessary.

Refer to **Exhibit 9053** for an example of structure excavation shots in a field book. Refer to **Exhibit 9056** for staking culvert wings.

CONTRACT STAKING

When the contract includes "Contract Staking," the contractor bears full responsibility for culvert staking. The SE still has to make alignment and grade checks as discussed previously under "Field Checks" and is also responsible for the structure excavation quantities. The SE shall:

- Check the centerline point, the skew angle, and the length as staked
- Note all discrepancies in the diary
- Report all discrepancies to the contractor

Note: Cabinet personnel shall not correct contractor's stakes. If the discrepancy is serious, follow-up checks shall be made. Concrete shall not be placed until the discrepancy is resolved.

FOUNDATION PREPARATION & BACKFILL

Section 603 of the Standard Specifications details foundation preparation and backfill requirements. When staking a culvert on a project, the SE or inspector should review project plans and documentation to determine the extent of staking necessary.

FOUNDATION PREPARATION & BACKFILL (CONT.)

The pay item of "Foundation Preparation" is a lump sum item that includes a number of construction operations. Staking is not necessary for common excavation if the "Foundation Preparation" bid item is listed.

The following remain as pay items and shall be measured for payment:

- Solid rock excavation
- Any undercutting below plan footing elevation due to poor soil or rock

	Section STAKING STRUCTURES
	Subject Bridges (General)

INTRODUCTION

Bridges range greatly in size, shape, and complexity, therefore prescribing staking procedures to fit all possible situations is difficult, if not impossible. The information presented herein primarily concerns basic bridge layout and checking. The section engineer (SE) must use acceptable surveying procedures as established in recognized surveying text books to properly perform staking for bridges.

FIELD BOOK

Field books should be prepared essentially using the same methods explained in **CST-602**, "General Information" and **CST-613-2**, "Culverts." For bridges, the field book shall contain all calculations and pertinent data including, but not limited to:

- Layout work
- Structure excavation
- "X" dimensions
- Deck elevations
- Handrail data

All information pertaining to a particular structure needs to appear together in a field book, so it may be necessary to leave considerable space. Depending on the size of the bridge, an entire field book may be utilized on a single structure.

STATION NUMBER

The station number shown on the bridge plans is normally the station at the center of the bridge.

DETERMINING CENTERLINE

Two points on centerline of survey at each end of the bridge should be established as a control for the centerline of the bridge. These points should be well past the end of the bridge, preferably on high ground that will not be disturbed by construction operations. These points should be properly referenced so they can be reestablished if necessary.

In staking a bridge on a tangent, it is important to align the centerline by looking direct with the transit through all points. If it is not possible to do this, double centering should be performed.

CONTROL POINT FOR PIER, BENT, & ABUTMENT LOCATION

The station of one of the points shall be determined and used as a control point for locating piers and abutments.

ESTABLISHING WORKING LINES FOR PIERS, BENTS, & ABUTMENTS

The working line is generally the back face of the abutment or end bent and the designated station number is usually on this line. Sometimes the working line established by the plans for the abutment or end bent is the centerline of bearing. **Care shall always be taken to ensure that the working line used in the staking of the structure is correctly identified.** In the case of a bridge skewed to the roadway, lateral distances from the point line of the pier, end bent, etc., may not be equal and should be noted. This must be taken into consideration when staking the location of piles in the end bent. In the case of cantilever wall abutments, it might be preferable to reference the vertical face of the wall. In all instances guard stakes should clearly identify the working line.

The working line of the abutment or end bent (the centerline of bearing or some other designated line) and the working line of each pier (generally the centerline) should be carefully established. The working lines should then be referenced with a minimum of three tacked hubs on either side of each pier, bent, or abutment. These points should be well clear of construction operations and identified with stakes that include the following information (written with a water-proof marking pen or keel):

- Centerline station number
- Offset distance (accurately measured) of the particular hub from centerline
- Component part of the bridge (such as Pier No. 2, End Bent No. 1, etc.)

The hubs and stakes should be well guarded by laths flagged with the appropriate bridge color.

The hubs shall be placed in readily accessible locations for future checking of the structure as work progresses. This allows for checking of the bridge layout exceptionally well, particularly if the first two lines of offset hubs can be located parallel to the bridge centerline. The span lengths and skew can then be readily checked. An example of a bridge layout similar to this is included in **Exhibit 9054**.

SETTING WORKING LINES WITH DATA CONTROLLERS

The data controller can assist the field operation of setting out the working line of abutments and piers by using the “Set out line” program found in the surveying menu and offers the following capabilities:

SETTING WORKING LINES WITH DATA CONTROLLERS (CONT.)

- Staking the working line from a point with known coordinates and along a specified bearing
- Flexibility of staking at any distance along the working line
- Setting an offset and grade if needed

Refer to the manual that comes with the respective data controller for specific information for the use of this program.

ESTABLISHING BENCHMARKS

The Cabinet prefers benchmarks to be established at each end of the bridge at locations as convenient to the bridge as possible and in as safe a location as possible from the construction work area. **These benchmarks must be accurate.** For convenience, these benchmarks may be transferred to solid locations on the structure at a later date.

STAKING CURVED STRUCTURES

Caution shall be utilized when staking a structure in a curve. The SE and chief inspector should be thoroughly familiar with the geometric layout before staking begins. It may be necessary to prepare a separate sketch by referring to more than one plan sheet to assimilate all the information essential for the correct stakeout. The SE shall clearly understand if dimensions are given along the curve or given along the tangent line. Any offsets shown between the centerline or roadway and centerline of bridge should be carefully noted. When calculating dimensions from curve data or transferring from the curve to the tangents, it is imperative that a second party checks all calculations.

CHECKING FIELD LAYOUT

The field layout of every bridge should be thoroughly checked. This check shall be made by a different survey party from that making the original layout. If possible, a different procedure should be used.

CONTRACT STAKING

When "Contract Staking" is included in the contract, the contractor bears full responsibility for bridge staking and has the option of having applicable layout work checked by some other private engineering firm.

The SE shall check the contractor's bridge layout regardless of what the contractor does in the way of checking. **Cabinet personnel shall not change the contractor's stakes.** If a discrepancy exists, it shall be resolved before work is allowed to progress.

The contractor may elect to use the SE's check instead of utilizing another private engineering firm. While the Cabinet does not object to this, it should not be encouraged. The SE assumes no responsibility for the bridge layout whether correct or incorrect.

EXCAVATION QUANTITIES

Structures excavation quantities are arrived at similarly to that explained in **CST-613-2**. Refer to **Exhibit 9053** for a field book example.

FOUNDATION PREPARATION & BACKFILL

Section 603 of the Standard Specifications details foundation preparation and backfill requirements. When staking a bridge on a project, the SE or inspector should review project plans and documentation to determine the extent of staking necessary.

The pay item of "Foundation Preparation" is a lump sum item that includes a number of construction operations. Staking is not necessary for common excavation if the "Foundation Preparation" bid item is listed.

The following remain as pay items and shall be measured for payment:

- Solid rock excavation
- Any undercutting below plan footing elevation due to poor soil or rock

For staking, measurement, and calculations of solid rock excavation, as well as undercutting, refer to **CST-613-2** and **CST-1300**.

	Chapter CONSTRUCTION SURVEYING
	Subject Roadway Geometry

VERTICAL CURVES

All roadway straight-line grades are connected by vertical curves. Vertical curves:

- Insure smooth riding on the pavement
- Improve appearance
- Provide safe sight distance for the motorist

All distances along vertical curves are measured horizontally and all offsets from the tangents to the curve are measured vertically. The length of a vertical curve depends on the total change in grade between two straight-line grades and the safe rate of change of grade for the design speed and required sight distance.

A vertical curve is classified symmetrical or nonsymmetrical, depending on whether or not it is the same length on both sides of the V.P.I. See **Exhibit 9057** for an example of a symmetrical vertical curve.

HORIZONTAL CURVES

All roadway alignments consist of:

- Tangents, or straight sections of roadway
- Curves that connect tangents

Perhaps the most basic of all horizontal curves is the simple circular curve. It is also the basis from which all other horizontal curves are developed so a thorough understanding of the simple curve is necessary before one can understand other types of curves. Other types of circular curves encountered in highway construction are the compound and reversed curves. The spiral is a special adaptation to a simple curve.

SIMPLE CURVE

A simple curve is an arc of a circle connecting two tangents differing in direction. Refer to **Exhibit 9058** for more simple circular curve information.

COMPOUND CURVE

A compound curve is a combination of two or more simple curves in the same direction with a common tangent at the point of junction.

REVERSED CURVE A reversed curve is a combination of two simple curves of opposite curvature with a common tangent at the point of junction.

SPIRAL CURVE The spiral curve is used as an easement or transition between the tangent and the curve at the P.C. and the curve to the tangent at the P.T. to counter the abrupt change in a simple curve between the tangents and the curve. See **Exhibit 9059** for an example of a spiral curve.

	Section SURVEYING EQUIPMENT
	Subject Introduction & Care

INTRODUCTION

Surveying instruments are sensitive precision instruments, and as such, need attentive care to retain their accuracy. They are also very expensive and difficult to obtain. The equipment is subjected to the worst kind of abuse from dust and moisture that will result in excessive wear unless cleaned frequently. A little time spent cleaning them will minimize down time and repair bills. Special care in transporting the instrument in a vehicle will avoid knocking the equipment out of adjustment.

All surveying instruments should be checked at frequent intervals to ensure required accuracy. A permanent location for convenient pegging of levels should be established.

All personnel using surveying instruments shall make every effort to prevent damage to these necessary tools. Surveying equipment must never be left unattended. Every means shall be exercised to ensure the safety of both instruments and personnel while working under conditions of traffic or construction operations.

CARRYING INSTRUMENTS

During fieldwork, levels may be carried on their tripods on the shoulder. The tripod should be held in such a position that the instrument is nearly balanced, but with a slight tendency to fall forward when the tripod is held with one hand. When the instrument with tripod is carried in this position, the instrument can be quickly brought to a vertical position in an emergency, with the tripod on the ground.

When carrying an instrument through thick woods or in passing through doorways, personnel should put the tripod under the arm, with the instrument in front for protection.

For transportation in vehicles or whenever the instrument would be in danger if carried on its tripod, the level should either be carried in its box or in the arms with one hand under the leveling base. There is always less danger of disturbing the adjustments if the instrument is in its box and properly secured. The Total Stations must always be carried in the case regardless of the distance.

EQUIPMENT CARE & ADJUSTMENT

Applicable personnel shall know the proper methods of care and adjustment of survey instruments in the field. These instructions, however, are not given with the intent that personnel should attempt to make repairs or adjustments with which they are not thoroughly acquainted. When in doubt as to the nature of the trouble, personnel shall turn the instrument in for repairs or adjustments with a written, detailed explanation of the trouble in question.

Under no circumstances shall adjustments be attempted on Total Station Theodolites and Electronic Field Books. If in doubt as to the instrument's integrity, it shall be turned in for adjustment and repair.

TURNING AN INSTRUMENT IN FOR REPAIRS

To turn an instrument in for repairs, the section engineer (SE) shall attach the following information to the instrument:

- An explanation of the malfunction or damage
- Section engineer's name
- Crew number

The SE shall then contact the applicable district project delivery and preservation office and request instructions on turning in the instrument.

The SE must not forget about the instrument once it is sent in for repairs. A periodic check on its availability could aid in its prompt return.

	Section SURVEYING EQUIPMENT
	Subject Levels

SELF-LEVELING LEVELS

The self-leveling level employs an optical system to establish a precise level line of sight. This system replaces the sensitive spirit level bubble used for that purpose in the conventional Wye and Dumpy Levels. In general, the line of sight is reflected through three prisms within the telescope. The two end prisms are fixed while the middle one is free to swing as a pendulum acts under the force of gravity. So long as the pendulum prisms hang freely, a level line of sight is maintained regardless of whether or not the telescope tube is truly level.

HAND LEVELS

The hand level (or Locke Level) is only used for approximate elevations. It is a metal tube with a plain glass cover at each end with a spirit level fastened to the top of the tube and seen in the left side of the field of view. Some hand levels have telescopic ability, however most do not. The cross hair is adjusted by two opposing screws.

The hand level is a versatile piece of equipment and has many uses. The survey party may use a hand level to extend cross-sections in rough terrain. The grade inspector needs one to check on the thickness of the embankment lift. The section engineer will find many uses for the hand level, such as checking the fall of a drainage ditch or a pipe or making a rough check in any situation involving grades or elevations.

The hand level is a great time-saver when used correctly, however it is not considered a precise instrument and shall not be used when accuracy is necessary.

	Section SURVEYING EQUIPMENT
	Subject Leveling Rods

LEVELING RODS

Cabinet construction personnel customarily use the 25-foot fiberglass, telescoping rod. Whether in English (feet/tenths) or metric (meters/centimeters) these rods are extremely useful for all types of level work. Sometimes personnel use the Philadelphia rod that is made of wood and extends to 13 feet.

Personnel shall keep level rods as clean as possible by wiping them dry after working in the rain and oiling any screws or sliding parts.

	Section SURVEYING EQUIPMENT
	Subject Total Station Theodolites

TOTAL STATION THEODOLITES

These instruments incorporate precise angular measurement (horizontal and vertical) and electronic distance measurement in the same unit. Early models had verniers for angular measurement while later models have digital readouts. These instruments all have optical plumbing.

The Department primarily uses the Sokkia SET 5F brand of Total Stations. Refer to the manual that accompanies the device for the specifics of its many capabilities as built-in features. It works in conjunction with the SDR33 Data Collector (**CST-615-6**) to assist the field crews in completing their work in a more timely and efficient manner.

	Section SURVEYING EQUIPMENT
	Subject Prism & Prism Poles

PRISM & PRISM POLE

Prisms are made of glass and configured in a way to reflect a signal from the total stations for accurately measured distances. They sit on top of a telescoping rod that has a level bubble (to assure being plumb) and swivel both horizontally and vertically to provide the best signal reflection.

Most prisms purchased by the Cabinet have a –30mm offset called a "Prism Constant." The total station **must** be set to account for this offset or it will read an incorrect distance that is 30mm too long.

	Section SURVEYING EQUIPMENT
	Subject SDR33 Electronic Field Books

INTRODUCTION

The SDR33, also known as a Data Collector, can store and calculate survey data of virtually all types. The SDR33 Electronic Field Book can calculate positions based on centerline station and offset throughout the project limits by use of the Roading Program as well as coordinate positions by use of the Topography and COGO programs. It also has the capabilities of aiding bridge and culvert stakeouts. Applicable personnel should become familiar with the SDR33 Data Collector operations manual and the basic operations before attempting to establish points in the field.

ROADING PROGRAM

The horizontal and vertical alignments can be entered directly into the SDR33 Roading Program from information found in the roadway plans. The Roading Program will calculate any position within the project limits without the need of coordinates calculated by other methods. The SDR33 simply needs the station and offset (elevation if needed) that is desired to set out; or after taking a reading on the rod, it can calculate the station and offset (elevation if needed).

The information collected or set out can be downloaded to a personal computer to be printed and placed in a bound reference, as described later in this section. This gives the field crew the flexibility to perform surveying operations in a more timely, efficient, and precise manner when collecting borrow site/waste area cross-sections, original ground or as-built cross-sections, setting out/relocating centerline, right-of-way/temporary easements, etc. The Roading Program can also generate coordinates for any centerline station and offset needed throughout the project limits, as long as the centerline is consistent with the coordinate system established for the project.

TOPOGRAPHY

This program is used to collect positions on the jobsite and store the coordinates in the SDR33 Data Collector. It is primarily used for collecting traverse loop information, cross sections, and other necessary topographical information. Refer to the device's operation manual for the details of how this program operates.

COGO—SET OUT COORDS

This program is used to set out positions on the jobsite. These positions are points (such as centerline, right of way, etc.) that have known coordinates (coords) calculated either by hand or from the designer. Refer to the device's operation manual for the details of how this program operates.

COGO—SET OUT LINE

This program is used to set out bearings along a culvert centerline or bridge work lines (abutments and piers). The bearings must start at a point with known coords and can be set out at specified intervals, grade, or offset. Refer to the device's operation manual for the details of how this program operates.

WORKING WITH COLLECTED DATA

The SDR33 Electronic Field Book has enough memory to store sufficient data from multiple surveys—without having to be downloaded into a computer—so they can handle a normal days work. Although, it is recommended that information collected throughout a day of fieldwork is downloaded to the personal computer as soon as possible to create a permanent record. All data should be printed and placed in a bound field book. The data can be plotted conventionally by hand or in the electronic file using the CADD program MicroStation.

Coordinate information for the "Job" (the SDR33 considers a "Job" to be a coordinate file for the project) to be entered into the SDR33 Data Collector may be found in the plans. This information may be manually inputted by using the "Keyboard input" program or electronically inputted by using an electronic file from the designer (if available). Personnel shall not assume that the information in an electronic file from the designer is correct. Personnel shall check the coordinate geometry for accuracy and verify that the traverse loop in the field has not been disturbed.

	Section SURVEYING EQUIPMENT
	Subject Instrument Tripods

INSTRUMENT TRIPODS

Field personnel should use the following guidelines concerning tripods:

- The tripod legs should not be allowed to become loose. The bolts at the head of the tripod should be well tightened against the wood; for example, the proper tension is such that, if one of the tripod legs is raised and allowed to fall of its own weight, it should sink slowly to the ground.
- The shoes should be examined to see if they are loose. The screws should be set tightly.
- The points of the shoes should be sharpened whenever necessary.
- The tripod should be wiped off whenever it gets wet.
- The tripod cap should be in place whenever the tripod is not in use.

	Section SURVEYING EQUIPMENT
	Subject Instrument Boxes

INSTRUMENT BOXES

The safety of the instrument often depends upon the way it is packed in the box. The rubber cushions underneath the box, the leather straps, buckles, hinges, and fasteners should be examined frequently and kept in good condition.

Total Stations should be placed in their cases with care. They only fit in the packing one way. If the box does not close easily, the instrument is probably out of position. Total Stations must always be carried in their cases regardless of the distance.

	Section SURVEYING EQUIPMENT
	Subject GPS Surveying Equipment

GPS SURVEYING EQUIPMENT

This equipment, consisting of a base receiver and a rover receiver, radios, antennas and data collector, utilizes a constellation of satellites orbiting the earth to accurately determine positions on the ground. This type of equipment does not require “line of sight” and can greatly speed up surveying operations. Electronic files, similar to those used in the SDR33, are created and downloaded to the data collector to survey the project.

At the request of the section engineer, this equipment can be used on their projects statewide by calling Central Office Division of Construction.

Chapter

ENVIRONMENTAL PROTECTION & LANDSCAPING

Subject

Environmental Protection Introduction

GENERAL

Highway construction can cause water pollution, air pollution, erosion, and other damage to the environment. Damage may not always be restricted to the right-of-way, occasionally causing the silting of streams outside project limits. Visual pollution (eye sores) can result from poor selection of waste and borrow sites and the final condition of these sites. Haul roads may also cause erosion, pollution, and unsightliness if not intelligently located and constructed.

REGULATIONS

The Standard Specifications, the plans, and the proposal contain the requirements and procedures to control erosion and minimize air pollution during construction. The section engineer will also have to become acquainted with state and local laws and ordinances concerning environmental issues (for example, burning laws and state water pollution control laws).

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Contractor Responsibilities

POLICY

Section 213.03.01 of the Standard Specifications requires the contractor to sign the Best Management Practices (BMP) plan from the proposal addressing temporary and permanent erosion control work for the project. This plan shall be supplemented by a TC 63-61 form, *Erosion Control Inspection Report* (**Exhibit 9042**) that lists the first areas to be disturbed and BMP's to be used. Once constructed according to good engineering practices, the section engineer shall approve these BMP's before work can begin. The BMP plan should be signed at the preconstruction conference and no disturbance shall be made before it is signed. This plan covers the entire project including methods of erosion control on waste areas, borrow pits, and haul roads.

All laws and ordinances to protect the environment shall be followed. (Refer to Sections 107.01, 107.01.03, 107.01.04, and 213.03 of the Standard Specifications.) All erosion control work, both temporary and permanent, is to be coordinated throughout the life of the contract to provide effective and continuous erosion control.

The contractor shall be responsible for all areas of disturbance caused by the project outside of right-of-way and adhere to a SPCC Plan as described in Construction Memo No. 03-07 (**Exhibit 9061**).

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Section Engineer Responsibilities

REQUIREMENTS

The section engineer shall enforce the requirements of Section 212 "Erosion Control" and Section 213 “Water Pollution Control" in the same manner as the rest of the Specifications. Particular attention should be given to the following topics and accompanying requirements:

- **Clearing and Grubbing**—Clear no more than necessary to construct the road and provide safety. Be particularly careful to preserve vegetation along streams. If there is no clearing line on the plans, establish clearing limits. Refer to **CST-901** for additional information.

- **Burning**—Burn in accordance with state and local laws. Do not burn near live timber since heat from fires may kill or damage standing timber.

- **Stream Crossings**—Construct as specified in Section 213.03 and 213.03.04 of the Standard Specifications. Ensure necessary permits are obtained. These permit requirements are found in the project proposal and the contractor must post the necessary permits on the project bulletin board. Refer to **CST-707**.

- **Erosion Control**—Sign the BMP Plan and cooperate with the contractor as described in Section 213.03.01 of the Standard Specifications and Construction Memo No.02-06 (see **Exhibit 9062**). Rigorously perform and enforce inspections (see TC 63-61 **Exhibit 9042**) and maintenance of the BMP’s as described in Section 213.03.03. Provide the contractor a copy of all inspections requiring remedial action. Keep a BMP Plan notebook containing information as outlined in **Exhibit 9063**.

- **Pollutants**—Make periodic inspections of fuel storage areas and other possible pollutants to check for leaks. Never allow pollutants to be stored near a waterway without some means of preventing material from entering the stream in case of accidental spills. Reference the project KPDES BMP Plan, groundwater protection plan, and Oil Pollution SPCC plans for specific requirements.

- **Rock Drills**—Check periodically to ensure that water sprays and dust collectors are operating.

REQUIREMENTS (CONT.)

- **Dust Control**—Require watering of grade during dry periods to prevent air pollution and to provide safety. See Standard Specification 107.01.04 for further guidance.

- **Permanent Seeding**—Require the contractor to prepare a seeding plan as per Section 212.03.03 of the Standard Specifications. Require progressive seeding during favorable weather and designate areas (not quantities) to be seeded.

- **Waste Areas, Borrow Pits, & Haul Roads**—Consider erosion potential and unsightliness in making decisions as to approval or non-approval. Refer to Construction Memo No. 03-07 (**Exhibit 9061**) paragraph 2 before giving approval. Refer also to **CST-902-4** "Borrow Excavation," **CST-902-5** "Waste," and **CST-904** "Haul Roads."

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Seventeen-Acre Limit

SEVENTEEN-ACRE LIMIT

In accordance with Section 213.03.02 of the Standard Specifications, no more than 750,000 square feet (17.22 acres) of erodible material may be exposed on a project without a written request by the contractor and approval by the section engineer (SE). Permission shall only be given if the SE is satisfied with the contractor's effectiveness in controlling erosion on areas previously exposed.

The 17-acre limit places the SE in a position to control the amount of disturbed area on a project. This requirement plus the use of temporary erosion controls and progressive seeding reduces the erosion and resulting water pollution potential.

Many contractors clear a project without grubbing it immediately. This procedure does not normally expose erodible earth until the stumps and brush are grubbed. Grubbing can be done in a progressive manner just ahead of the grading operations. This procedure is acceptable to the Cabinet.

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Temporary Erosion Controls

CONTROL MEASURES

Temporary erosion control measures shall be used to control erosion until the establishment of a permanent stand of vegetation exists. The following different types of installations are to be used as needed on areas disturbed on the project (including haul roads, borrow pits, and waste areas):

- Brush Barriers
- Silt Traps
- Silt Fence
- Temporary Mulch
- Sedimentation Basin
- Temporary Seeding and Protection
- Temporary Ditches

Devices shown as site specific on the original plans must be included in the BMP plan or a detailed analysis must be performed to demonstrate a better result may be achieved. The presence of a site specific plan does not mean that additional BMP's will not be needed.

Section 213.03.05 of the Standard Specifications details construction procedures and requirements concerning the use of temporary erosion controls. The locations of the temporary controls may be shown on the plans as site specific but are usually proposed by the contractor and approved by the section engineer. These locations are also designated as part of the regular inspections. Any temporary erosion control work that is necessary due to negligence (failure to install permanent seeding during favorable conditions or other permanent controls as directed by the section engineer) shall be performed at the expense of the contractor.

KPDES SEDIMENT & EROSION CONTROL REQUIREMENTS

See **Exhibit 9061** for a KPDES permit and requirements (particularly Part 4, Section B of this permit).

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Permanent Erosion Controls

SEEDING & PROTECTION

The contractor shall perform permanent seeding as grade work progresses. Exposed areas are to be brought to final configurations as soon as practical and seeding performed. If permanent seeding and protection is not practical within 14 days, the area must be stabilized by some other method. The section engineer (SE) may limit any new excavation based on the contractor's ability to seed and protect existing exposed areas.

The 17-acre limit (**CST-704**) on exposed erodible areas applies to grade work as well as clearing and grubbing. This limit is the maximum with the actual amount of allowable exposed erodible earth to be based on existing conditions in the field (such as, capability of contractor to "keep seeding caught up," erodibility of soils, and time of year).

Section 212 of the Standard Specifications discusses seed mixtures, rates, materials, and procedures required in seeding operations.

Whenever a paved ditch is added in an area previously seeded and protected, any reseeding or sodding required as a result of this operation is to be paid, provided the disturbed area is reasonable. The same criteria also apply to any reseeding required on disturbed areas previously seeded or sodded at the SE's direction due to a required plan change.

SODDING

Sections 212.03.04 and 827.11 of the Standard Specifications discuss sodding requirements. All sod is inspected at the source and is subject to inspection on the project. Any sod that has browned out or contains weeds is to be rejected or culled on the project. Sod is guaranteed in accordance with Section 212.03.04 of the Standard Specifications. Normally, the time frame for the check of the sod guarantee will coincide with the "Acceptance of Seeding" inspection and will be performed at that time by the Division of Construction specialty liaison.

EROSION CONTROL BLANKET

Section 212.03.03 (E) of the Standard Specifications discusses erosion control blanket procedures and requirements.

PERMANENT TURF REINFORCEMENT MATTING

The special note located on the Division of Construction webpage discusses permanent turf reinforcement matting requirements.

PAVED DITCHES & CHANNEL LININGS

Section 709 of the Standard Specifications discusses requirements for paved ditches and Section 703 details requirements for channel linings.

Contractors shall install paved ditches and channel lining as early as possible. **On occasion, the project plans require the installation of paved and/or rock lined ditches as one of the first operations. This requirement must be followed closely.** The use of channel lining in highly developed urban areas is questionable due to the unsightliness as woody vegetation develops, creating maintenance problems. Research has shown that turf reinforcement matting and grass can be used in place of channel lining. The SE shall monitor erosion as it develops and decide if permanent controls other than seeding are needed.

TOP DRESSING

Top dressing is an additional application of fertilizer (possibly agricultural limestone) applied, at a predetermined strength and rate, to specified seeded and sodded areas on the project that have an existing satisfactory stand of vegetation. The top dressing gives the vegetation on the project a final application of fertilizer for strength. Contractors shall never apply top dressing until the grass has matured beyond the seedling stage. Section 212.03.03 (D) of the Standard Specification discusses requirements of top dressing.

Top dressing is a separate item of work and is a pay item. Depending on the situation, it will not normally be applied to a project until after it is called complete. No liquidated damages will be assessed in this event, provided the work is completed as specified in Section 108.09 of the Standard Specifications.

The desirable time to make the decision concerning the top dressing application is at the "Acceptance of Seeding" inspection (**CST-711**). The Division of Construction specialty liaison will advise the SE on the advisability of utilizing top dressing at that time.

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Construction Activities Affecting Streams

REGULATIONS

The USACE Nationwide Permit #14 limits such activities to the minimum necessary to construct the project (See **Exhibit 9064**). Section 213.03 and 213.03.04 of the Standard Specifications summarize the requirements of this permit.

CHANNEL CHANGE CONSTRUCTION GUIDELINES

Contractors shall construct channel changes in such a manner as to minimize water pollution. An undisturbed "plug" of soil or rock should remain in place on the upstream end of the channel change until the remainder of the channel change has been completed, including rip-rapping and fish habitat improvement structures when required. Construction of channel changes shall not begin so late in the construction season that they will remain incomplete during winter shutdown unless they are entirely in rock excavation.

Always check the plans and proposal for any reference to the "Department of Fish and Wildlife." Sometimes they are to be contacted regarding the diversion of water from the natural stream into the channel change and also to give advice on the location of fish habitat improvement structures. All dams used for diversion of water from the natural stream into the channel change are to be constructed of rock.

Note: Contractors should also give particular attention to the type and size of stone to be used for rip-rap.

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Sinkholes

SINKHOLES

Section 215 of the Standard Specifications details the required treatment of sinkholes within project limits. Due to EPA restrictions it is very important that contractors adhere to the requirements of these treatments.

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Contractor Noncompliance

WITHHOLDING WORK ESTIMATES

Whenever the section engineer determines that a contractor is not complying with contract requirements to control erosion and to prevent water pollution, pay estimates may be withheld and grading operations may be suspended (Section 213.03.02 of the Standard Specifications). This includes failure to satisfactorily install temporary or permanent erosion controls.

Payment is to be withheld until the project is brought into compliance. See **CST-302** for procedures concerning withholding pay estimates.

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Liquidated Damages

LIQUIDATED DAMAGES

Sections 105.12, 108.09, and 213.03.02 discuss liquidated damage assessment. A TC 63-61 form, *Erosion Control Inspection Report* (**Exhibit 9042**) stating required remedial action and delivered to the contractor serves as the written notification.

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Final Inspection & Acceptance

SECTION ENGINEER

The section engineer (SE) shall include erosion control work and related items in the project final inspection, including a written record of all corrective and additional work considered necessary to bring the project into compliance with the applicable plans, specifications, and other contract documents.

DISTRICT PROJECT DELIVERY & PRESERVATION OFFICE

The district project delivery and preservation office shall review all erosion control and related items as part of its final inspection and note any corrective work necessary to bring the project into compliance with the applicable plans, specifications, and other contract requirements.

COMBINATION FINAL

It is preferable for the SE and the district project delivery and preservation office to combine their final inspections. In this event, the SE shall include appropriate notes in his or her inspection report including the names of the inspection party.

SCOPE OF FINAL

Final inspections are the Cabinet's last effort at controlling erosion under the applicable contract, so the inspections must be thorough with regards to all phases of erosion control and seeding. Contractors shall repair (or dress and line if necessary) ditches that have eroded. The final inspection shall include checks (and any necessary corrective measures) for the following:

- Pipe inlets/outlets for erosion and protection as necessary
- Sod for life and correct installation
- Erosion control blankets and turf reinforcement matting for proper installation
- Seeding

Note: Seeding should be checked closely with any repairs specified even though it will get another inspection later. See "Acceptance of Seeding" below.

CENTRAL OFFICE

A representative of the Director, Division of Construction shall make a final inspection of all erosion control and related items on the project at or near the time the project is called complete.

CORRECTIVE WORK

All corrective and additional work required as a result of project final inspections shall be completed and paid in accordance with the requirements of Section 212.04.06 of the Standard Specifications. This work shall be completed at the earliest practical date to avoid conflict with the requirements involved in the "Acceptance of Seeding" as discussed next.

ACCEPTANCE OF SEEDING

The contractor shall care for and maintain all erosion control work in a satisfactory condition throughout the life of the contract. After a project has been called complete, the Division of Construction liaison will determine the acceptability of the seeding within a three-month to six-month time frame as prescribed in Section 212.03.03 (G) of the Standard Specifications. At that time, it will be determined what corrective work, if any, is required to place the project seeding in a satisfactory condition. The “Acceptance of Seeding” inspection may be performed at the time of the final inspection if the following requirements are met:

- The project has a relatively small seeding area.
- No sod has been used.
- The existing stand of grass is the specified type.
- The existing stand of grass appears satisfactory.

Payment and procedures for any corrective work will be in accordance with Section 212.04.06 of the Standard Specifications. **The section engineer shall not allow any corrective work that was directed prior to project completion or as a result of final inspection(s) to carry over to the time of the final inspection for “Acceptance of Seeding.”**

Any corrective work found necessary on the erosion control inspection for “Acceptance of Seeding” will be performed as soon as conditions become favorable for this work. The time frame for completion of this corrective work shall be in accordance with Section 108.09 of the Standard Specifications. Accordingly, the contractor may be given a specified date to complete corrective work on the inspection report. The assessment of liquidated damages shall be noted at a reduced rate when corrective work to fulfill seeding acceptance requirements is not completed as applicable.

The need for top dressing will normally be determined at the same time as the "Acceptance of Seeding" inspection as will the sod guarantee inspection.

	Chapter ENVIRONMENTAL PROTECTION & LANDSCAPING
	Subject Landscaping

GENERAL

Aesthetic significance is created when plant life (destroyed during the construction phase) is replaced with high quality nursery-grown plant material onto the reshaped terrain. This cosmetic approach aids in softening the scars left behind by highway construction. Systematic rearrangement of trees and shrubs is utilized quite extensively on major thoroughfares and is considered essential to the general acceptance of a project by the public.

The importance of a landscaping (beautification) project cannot be overemphasized. Individuals assigned to supervise a project of this nature should be made aware of the significance that such a project has on the overall highway system.

The landscaping contractor shall furnish high-quality plant material and shall maintain the quality of plant material and professional workmanship throughout all phases of the operation.

THE AMERICAN STANDARD FOR NURSERY STOCK

Section 724.02 of the Standard Specifications stipulates that "All plants shall conform to *The American Standard for Nursery Stock*, current edition, as published by the American Association of Nurserymen, Landscape Architects, Landscape Contractors, and others trading in or specifying nursery plants."

At the onset of a landscaping project the section engineer (SE) shall receive a copy of *The American Standard for Nursery Stock* and specialized equipment (such as calipers and other measuring devices) to enable personnel to perform plant inspections. The standards and measuring devices are available by contacting the assigned liaison in the Division of Construction, Central Office.

A SE assigned to former landscaping projects may have copies of *The American Standard for Nursery Stock*. However, SE's are cautioned to check on the current status of information with the assigned Central Office liaison since these standards are revised frequently.

RESPONSIBILITIES

As stated in Section 724.03 of the Standard Specifications, the contractor has seasonal and other various restrictions concerning planting and landscaping operations. This section describes restrictions on planting seasons, weather conditions, and other conditional requirements. Landscape contractors shall follow these requirements closely to have a high percentage of plant survival.

Often while staking the project, the tree or bed location may require relocation due to unforeseen circumstances. If problems such as these arise and the SE needs advice, he or she shall obtain advice and assistance from the Central Office liaison. The SE shall work closely with the Central Office liaison assigned to that area on all landscaping matters. As in all cases, however, the SE shall submit his or her requirements to the district project delivery and preservation office and not directly to the Central Office.

TRANSPORTATION

Landscape contractors shall transport all plant material from the nursery source to the project site by covered vehicle. This can be accomplished by covering the entire load of plants, or individually. This protects plant material from windburn and dehydration. Plant transportation may take place in some instances by covered van. At any rate, all plants shall be protected from sun and wind while in shipment from nursery to project site, per specification 724.03.02.

TEMPORARY STORAGE

In accordance with Section 724.05 of the Standard Specifications, the contractor shall immediately make provisions for temporary storage of plant material. This section should be dealt within a matter of hours after plants are received on the project site. The SE and Central Office liaison shall closely supervise storage procedures.

PLANTING HOLES

As stated in Section 724.07 of the Standard Specifications, and as also stated on the summary sheet of plans, contractors shall strictly follow plant hole dimension requirements. This needs to be emphasized throughout the initial plant phase.

PRUNING

Due to the transplanting process, it is understood that a large portion of plant root systems are lost. Taking this into consideration and using expert advice from successful nurserymen and *The American Standard for Nursery Stock*, it is necessary to compensate for this root loss by removing a prescribed outer portion of the branching or twigs from deciduous shrubs and trees. Approximately, one-third to one-half of the growth of the previous season should be removed. The Central Office liaison shall be consulted before pruning operations commence.

INITIAL PLANTING PROCEDURE

Section 724.12 of Standard Specifications provides dimensions and step-by-step instructions concerning the planting of balled and burlapped (B & B) container-grown, bare-root, and seedling plants. This section shall be adhered to closely.

PLANT MATERIALS

Whenever possible, the Central Office liaison should inspect all plant materials in the nursery prior to being dug. In any event, all plant materials shall be inspected and accepted by the SE in conjunction with the Central Office liaison (preferably immediately after being received).

The American Standard for Nursery Stock is the guide used for plant material requirements.

CERTIFICATE OF INSPECTION

Plant Material Certificate of Inspection must accompany all plant shipments. This certifies that the State Entomologist has inspected the nursery and found it to be free of harmful disease and insect pests. Do not confuse the Certificate of Inspection with plant invoice. The Certificate of Inspection and plant invoice are two separate documents. The plant invoice must state correct variety and size shipped.

Both previously discussed documents must be presented to the SE (or representative) prior to the plant material being unloaded onto the project.

As plants are being unloaded, the SE (or representative) shall inspect the plants for proper size and quality. If balled and burlapped plants are received, the ball dimensions must be checked for conformance with requirements specified on the plans or proposal.

All shade trees shall be closely checked at the time of off-loading for quality, mechanical injury, insect damage, and disease damage, and shall be callipered for correct trunk size. The height relationship to caliper size shall be analyzed at this time also.

REJECTION OF PLANTS

Plant material shall be rejected in the following situations:

- Plants do not meet plan requirements in ball size, trunk diameter, height, diameter-height ratio, degree of heavy grade, branching, spread, etc.
- Plants are delivered onto the project in what appears to be an unhealthy condition.
- Plants are not shipped in a covered vehicle or are not covered in an acceptable manner.
- Plants are brought onto the project with broken balls, or incur other forms of mechanical injury during or after shipment.
- Plants show signs of insect or disease damage.
- Plants exhibiting any qualities preventing them from conforming to *The American Standard for Nursery Stock*.

CONTAINER PLANTS On occasion, container plants are permitted as specified by plan notes or as allowed by specifications in lieu of B & B plants. *The American Standard for Nursery Stock* shall be the guide for these plants; however the Central Office liaison shall be called in to assist with this matter.

MAINTENANCE Section 724.17 of the Standard Specifications describes maintenance requirements during the period of establishment. If specific problems arise, the Central Office liaison shall be consulted.

REPLACEMENT PLANTING Replacement planting shall be made during the time specified in the proposal or plan notes. All replacement plant material and workmanship shall be of the same high quality as was utilized during initial planting. The Central Office liaison shall inspect replacement plants before planting.

	Chapter NUCLEAR DENSITY - MOISTURE METERS
	Subject Introduction

GENERAL

The Nuclear Density-Moisture Gauge is a critical piece of equipment in the areas of field testing and job control. The nuclear density gauge is the standard by which the Kentucky Transportation Cabinet will accept the density of soil, certain aggregate applications, and certain bituminous applications. All gauges are utilized for density checks with the depth of use not to exceed 12 inches. The nuclear density gauge utilizes radioactive sources and is potentially dangerous if used improperly. The rules and regulations described herein are based on federal guidelines.

Kentucky Administrative Radiation Regulations 902 KAR 100 applies to the possession or use of radioactive material and is administered by the Cabinet for Public Health, Radiation Control Branch under the authority of KRS 211.842 to 211.848.

This chapter conforms to the applicable provisions of 902 KAR 100. All personnel using, transporting, or handling a nuclear density gauge, or those authorizing the use, transportation, or handling of a nuclear density gauge shall be thoroughly familiar with these requirements.

All Cabinet personnel involved in construction operations shall be knowledgeable of and able to fulfill their responsibilities with respect to the care and handling of nuclear density gauges. The safety and welfare of the operator and the general public are paramount and take precedence over all other considerations. Operators shall take all training seriously and know not only their responsibilities, but also those of their supervisor insofar as their impact on the nuclear density gauge and its use. **CST-802** lists the nuclear gauge responsibilities of each level in the Division of Construction.

A Thermoluminescent Dosimeter (TLD) badge (**CST-804**) will be issued to the gauge operator. Each badge is personalized with the gauge operator's name and shall be worn on the torso outside the outer-most layer of clothing. The TLD badge monitors the radiation and neutron exposure the TLD badge receives.

	Chapter NUCLEAR DENSITY - MOISTURE METERS
	Subject Responsibilities

CENTRAL OFFICE, DIVISION OF CONSTRUCTION

The Central Office, Division of Construction, is licensed under the provisions of 902 KAR 100 to possess and use nuclear density gauges. The oversight responsibilities, by license, fall under the designated radiation safety officer (RSO) named by the Director of the Division of Construction. All gauges are assigned and issued by the Division of Construction under the authority of this license. The RSO duties and responsibilities include ensuring:

- Radioactive materials possessed under the license conform to the materials listed on the license
- Use of devices, particularly in the field, is only by individuals authorized by the license
- Proper safety and Haz-Mat training is given and recorded to all potential operators prior to issuance of their TLD badges and training records are available 5 years after the employees' last use of a gauge
- Thermoluminescent Dosimeters (TLD) badges are issued to the various districts for use by the gauge operators; the operators' use the gauges; and the return of the badges to the manufacturer's electronic laboratories for analysis
- Maintenance of a current list of operators certified for operation of gauges
- Results of all TLD users are reviewed and monitored
- Employees are trained on how to understand the TLD analysis reports every three years or when a change in reporting method occurs
- Gauges are properly secured against unauthorized removal at all times when they are not in use
- Proper authorities are notified promptly in case of accident or damages to gauges (due to fire, theft, etc.)

CENTRAL OFFICE, DIVISION OF CONSTRUCTION (CONT.)

- Audits are performed at least annually by the RSO or his or her designee to ensure the following:

  - The licensee is abiding by Cabinet and DOT regulations and the terms and conditions of the license (such as periodic leak tests, inventories, use limited to trained, approved users).

  - The licensee's radiation protection program content and implementation achieve occupational doses and doses to members of public that are As Low As Reasonably Achievable (ALARA) (see 902 KAR 100:019, Section 2).

  - The licensee maintains required records of personnel exposure; receipt, transfer, and disposal of radioactive material; and gauge-user training (sufficient to comply with Cabinet requirements).

- Results of audits, identification of deficiencies, and recommendations for change are documented (and maintained for 3 years minimum), provided to management for review, and prompt action is taken to correct deficiencies

- Audit results and corrective actions are communicated to all personnel who use radioactive material (regardless of their location)

- All incidents, accidents, and personnel exposure to radiation in excess of ALARA or 902 KAR 100:019 limits are investigated and reported to the Cabinet and other authorities, as appropriate, within required time limits

- All gauges are inventoried twice a year at approximate 6-month intervals

  Note: Central Office RSO or designee will conduct one, and the district RSO will conduct the other. Records will be maintained for 3 years and inventory recorded on the KYTC Nuclear Gauge Location Report (**Exhibit 9114**).

- Receipt of all nuclear density-moisture gauges from the factory, checking calibration of each gauge prior to assignment to district personnel, and returning gauges to the factory for maintenance, updating, and leak testing

- Assignment and issuance of gauges to the various districts according to workload

  Note: These gauges may be recalled at any time and reassigned at the discretion of the Division of Construction.

- Radioactive material is transported in accordance with all applicable DOT requirements

CENTRAL OFFICE, DIVISION OF CONSTRUCTION (CONT.)

- Radioactive material is disposed of properly
- Up-to-date copies of regulations 902 KAR are provided, new or amended regulations are reviewed, and license procedures are revised as needed to comply with Cabinet regulations
- License is amended whenever there are changes in licensed activities, responsible individuals, or information or commitments provided to the Cabinet in the licensing process
- Required “leak tests” are performed on the entire inventory of gauges

DISTRICT OFFICE, PROJECT DELIVERY & PRESERVATION

The district radiation safety officer is responsible for:

- Assigning gauges to section engineers and crews
- Performing a quarterly collection of exposed TLDs from the section engineers’ offices and dispensing replacements
- Returning the collected TLDs to the Central Office, Division of Construction within 10 days after the receipt of the replacements
- Conducting one inventory per year of all the gauges within his her district
- Making training accessible to or providing training to the section engineers and gauge operators
- Conducting “Leak Tests” on an as-needed basis for the Central Office RSO
- Distributing safety-related information to involved personnel and follow-up reviews to ensure the information is utilized
- Supervising the use and handling of the gauges and ensuring that safety procedures are followed
- Performing periodic field checks of the section engineers’ offices and the gauge operators to ensure that proper records are being maintained and correct safety procedure are followed
- Ensuring that each section engineer has enough trained operators, sufficient nuclear gauges, and adequate transportation and storage capabilities available to meet inspection responsibilities

SECTION ENGINEER

The section engineer is responsible for:

- Receiving training in emergency procedures and recommended procedures for use
- Having a thorough knowledge of the use, care, storage, and transportation of the nuclear gauge and a reasonable knowledge and understanding of the operator's manual
- Ensuring that he or she has an adequate number of trained operators available to meet the responsibilities of his or her office

  Note: Temporary employees shall not be used in this job.
- Impressing upon the operators that the cost of the gauges (nearly $5,000) makes the gauge one of the most expensive pieces of equipment assigned to the office and that its function makes it one of the most critical
- Assigning responsible, certified personnel (trained in gauge maintenance and care) to operate the gauges

  Note: Careless handling shall not be tolerated.
- Ensuring that proper warning labels are in place on shipping containers used for transporting gauges and also in the place of storage
- Obtaining or receiving replacement TLDs from the district office, retrieving exposed TLDs from the operators, and returning them to the district office

  Note: This must be done in time for the district office to return the monitors to the Division of Construction within 10 days.
- Ensuring that no individual operates the nuclear gauge without properly using his or her own TLD badge

OPERATOR

The operator shall:

- Be qualified for gauge operation and have knowledge of maintenance, storage, transporting, and operation of the gauge
- Receive training in biological effects and radiological health requirements prior to usage

  Note: The initial safety training received will be, at a minimum, a radiation safety training class presented by one of the density gauge manufacturers (Troxler Electronic Laboratories, Humboldt Scientific, Inc., or InstroTek, Inc.).

OPERATOR (CONT.)

Note: KYTC will not conduct the initial safety training but can provide HazMat training.

- Receive training in emergency procedures and recommended procedures for use
- Receive HazMat training (as required by Subpart H of 49 CFR) that shall be current within 3 years if qualifying for vehicular transport of the gauges
- Read, understand, and be willing to comply with the appropriate operator's manual
- Stay informed on density testing requirements and procedures by studying job specifications, sampling and testing manuals, and seeking advice from knowledgeable individuals
- Be at least 19 years old

	Chapter NUCLEAR DENSITY - MOISTURE METERS
	Subject Nuclear Gauges

GAUGE CARE

The operator shall keep the gauge clean and perform preventive maintenance frequently. After use in a dusty area, the gauge should be wiped with a clean, dry cloth. If the gauge is used on DGA or plastic concrete, the operator retracts the source to shielded position so the bottom may be wiped clean with a damp cloth after each test to prevent build-up of material on the bottom of the gauge.

When in use on bituminous concrete, care shall be taken to remove all sticky material from the gauge base. Various solvents may be used to soften and remove asphalt. The manufacturer recommends using mineral spirits and WD 40. The operator should use solvents sparingly and avoid getting the solvents on the top shell of the gauge. Stubborn deposits may require the use of a putty knife, but care shall be taken to not mar the base.

The operator shall handle the gauge carefully, making certain not to drop or jar the gauge. The gauge is sturdy, but unnecessary roughness may compromise performance. These gauges are moisture resistant; however, the operator shall try to keep them as dry as possible.

GAUGE STORAGE & SECURITY

Gauges shall only be stored in a pre-approved location that is designated by the Central Office radiation safety officer (RSO) as an approved storage facility. If any changes are made to this approved facility that would place a worker's permanent work station within 15 feet of the gauge, the employee or employee's supervisor shall notify the district RSO immediately.

Gauges shall be stored in these approved locations with a minimum of at least 2 independent physical controls to secure each gauge.

Storage examples are:

- The portable gauge is stored inside a locked storage shed within a secured outdoor area (such as a fenced parking area with a locked gate or where the gate is kept shut and locked all times except for entry or exit).
- The portable gauge is stored inside a locked, non-portable cabinet inside a room with a locked door.
- The portable gauge is stored in a separate locked area inside a locked mini-warehouse or storage facility.

GAUGE STORAGE & SECURITY (CONT.)

Keys to the nuclear gauges shall be kept by the users of the gauges or within a managed lock box at the storage location accessible by the qualified users. The key storage access shall be managed by the section engineer at the approved location.

When not in use, the gauge shall be stored in an unused room or location at least 15 feet away from a permanent work station and kept under redundant lock and key at all times. The storage area for the gauge must be dry, ventilated, and secure. The section engineer shall ensure the proper posting of appropriate warning signs in gauge storage areas. This includes preparing and prominently posting the following note to firemen: "**All radioactive materials are sealed and in tungsten steel containers. Premises may be entered under emergency conditions.**" This note should be in **bold** letters and as many used as deemed necessary.

All storage areas shall be pre-approved by the RSO or designee. Drawings showing dimensions to the nearest work stations, if applicable, shall be kept on file. These drawings shall also include the physical address of the storage area.

TRANSPORTATION & SECURITY OF NUCLEAR GAUGE

Personnel shall exercise extreme care and precautions in the transportation of nuclear gauges, especially from the storage site to place of operations. These precautions include, but are not limited to, the following:

- Gauges shall only be transported in DOT-approved Type A containers containing all legible required markings.
- Radiation yellow II warning signs shall be permanently affixed to transport cases.
- When transporting a gauge in a SUV, van, car, or pickup truck, the Type A container shall have a minimum of:
  - A lock on the outside of the case
  - A steel chain or cable with 2 independent locks secured to the vehicle and passed through the handles and over the top of the case ensuring that the top cannot be opened without the removal of such.

Note: Instructions for securing the gauge are as follows:

1. Ensure that the Type A container is locked utilizing the front clasp of the container (**Exhibit 9115**, Lock A).

TRANSPORTATION & SECURITY OF NUCLEAR GAUGE (CONT.)

2. Utilize a single length of chain approximately 12 feet long with two additional locks (**Exhibit 9115**, Locks B and C) to be used in securing the container to the vehicle.

3. Take one end of the chain and wrap it around the Type A container's side carrying handle and back to the vehicle's driver-side attachment point.

4. Padlock (**Exhibit 9115**, Lock B) the chain back to standing end of the chain to secure one side forming a loop.

5. Take the remainder of the chain and place it over the top of the container through the top handle, if available, making a turn through the handle pulling it taught over the top of the container.

6. Take the remainder of the chain and loop it around the right- side carrying handle and lock through the vehicle's passenger-side attachment point.

7. Remove all remaining slack and attach the remainder of the padlock (**Exhibit 9115**, Lock C) to the standing end of the chain forming a loop.

- Gauges shall either be secured as noted above or under constant surveillance.

- Gauges in transit shall always be accompanied with transport papers for the appropriate brand of gauge. The current copies can be obtained from the district RSO. These documents are as follows:

  - Emergency Procedures (**Exhibit 9065**)
  - Bill of Lading (**Exhibit 9066**)
  - Current Radiation Safety License, TC 95-2 (**Exhibit 9067**)

  These documents are included with every gauge and should be stored with the case. During gauge transportation, they are to be openly carried in the cab of the truck within arms-reach of the driver, preferably in the passenger seat next to the operator or in a sleeve on the driver-side door. They shall not be placed in the glove box or center console. These documents should be updated annually or whenever there are changes in personnel.

GAUGE OPERATION & TROUBLESHOOTING

Gauge operation is covered in the operator's manual (user's guide) and also in hands-on training classes provided by the Cabinet. Each gauge should have an operator's manual or user's guide. If a gauge is lacking a manual, personnel shall notify the district RSO with the gauge make and model to get a replacement copy. In case of gauge malfunction or failure, personnel shall follow the recommended troubleshooting procedures outlined in the operator's manual provided with the gauge. For issues that cannot be resolved or diagnosed at the operator level, the district RSO shall be contacted.

LEAK TESTS

Leak tests will be performed on 12-month intervals by either the RSO or his or her designees using the manufacturer's kit. Kits will be analyzed by the manufacturer with results mailed back to the RSO. The RSO shall review this information and notify the Cabinet for Health & Family Services (CHFS) of any abnormal leakage. Leak tests on the gauges shall be performed in accordance with the recommendations of the manufacturer. Current manufacturer's instructions for leak tests are listed on the Leak Test Instruction Form (**Exhibit 9116**).

	Chapter NUCLEAR DENSITY - MOISTURE METERS
	Subject Thermoluminescent Dosimeter (TLD)

TLD GUIDELINES

TLDs are used to measure exposure to occupational radiation. All TLDs are assigned with the operator's name imprinted on the badge. TLDs are not transferable and must only be used by the assigned operator. Operators assigned a TLD shall:

- **Never store TLD monitors in close proximity to nuclear gauges, microwave radiation, x-rays, or direct sunlight**
- Store the TLD in a neutral area while not wearing the TLD
- Avoid badge contact with washing machines, TV's, medical x-rays, computers, or heat
- Leave the TLD at the office
- Not take the TLD home

TLD DATA PERSONAL REPORTS

Personal reports are available to each user through the Nuclear Gauge Inventory (NGI) database. These reports show each quarter's totals and cumulative totals. Each operator shall be trained to understand the TLD results and receive training every three years thereafter. This training is conducted in conjunction with Haz-Mat training.

TLD DATA PRINTOUTS

Printouts containing data showing TLD distribution along with replacement TLDs are sent to each district office quarterly. Each district will keep a copy of the printout for their records. The Radiation Exposure Report (**Exhibit 9068**) shows an example of the printout. The manufacturer provides the Division of Construction a record by district of all individuals listed in the printout. This record covers a calendar year (updated quarterly) and provides the following information:

- Radiation exposure readout from the used TLDs for the most current expired quarter
- Cumulative total of radiation exposure for the current calendar year as well as permanent exposure for each individual

This record should be displayed in the workplace and be available at any time upon request. If this record shows that an operator received an unusual dose of radiation during the year, he or she shall be immediately notified.

RETURNING TLDS When returning the TLDs, a note of explanation shall be included on the printout for any TLD lost or destroyed in the field and shall indicate all changes in requests (including appropriate names). Additional or replacement TLDs may be obtained at any time. Requests may be made over the telephone with confirmation in writing.

	Chapter NUCLEAR DENSITY - MOISTURE METERS
	Subject Nuclear Density Tests

SECTION ENGINEER RESPONSIBILITIES

The section engineer shall keep daily logs detailing the use and maintenance of nuclear density gauges. The varied uses of the nuclear gauge also mandate that different forms be utilized to take full advantage of the gauge's versatility.

REQUIRED FORMS

The section engineer and the operator should be thoroughly familiar with the following forms and their functions:

- **TC 63-46 form, Nuclear Meter Daily Log Sheet (Exhibit 9040)**—This log shall be kept with each nuclear gauge. The disposition of the gauge must be shown for each day whether the gauge is used or not. The section engineer shall submit this log to the district construction office the first and fifteenth of each month. The district construction office shall submit the log to the Division of Construction as soon as all logs are received from assigned gauges.

- **TC 63-47 form, Moisture Density Test Report (Exhibit 9041)**—This particular form is used with Soils, DGA, and CSB (Crushed Stone Base) and meets the requirements of **KM 64-512**. The user shall input the information electronically and upload it into SM Materials.

	Chapter GRADE & DRAIN CONSTRUCTION
	Subject Clearing & Grubbing

RIGHT-OF-WAY STAKES

Prior to the start of clearing and grubbing operations, the section engineer (SE) shall see that clearing and grubbing right-of-way stakes (along with other stakes such as centerline references, etc.) are well guarded and properly flagged. **CST-600** details proper staking techniques.

CLEARING LIMITS

Contractors shall not perform clearing or grubbing operations beyond clearing lines indicated on the roadway plans unless authorized by property owner consent release or otherwise directed by the SE. When clearing lines are not indicated on the plans, the SE shall establish the limits of clearing and grubbing necessary based on the cross sections and slope stakes. The clearing lines indicated on the plans or established by the SE should allow sufficient work space beyond the slope stake lines to properly construct and final dress the slopes, ditches, etc. Areas between the clearing line and the right-of-way lines should be left in an undisturbed condition, if possible. The SE shall mark all trees, shrubs, structures, or other items not to be disturbed by the clearing operations.

The SE shall confirm the adequacy of the clearing lines, and as near as possible, verify its accuracy and compatibility with the cross sections.

The SE shall limit the exposed erodible soil resulting from the clearing and grubbing operations to that area allowed by the Specifications. The SE and the contractor will meet to locate predisturbance BMP's. These BMP measures are to be installed prior to clearing and grubbing operations in all locations practical. (See **CST-700** for further information.)

The following items shall all be discussed and clarified at the preconstruction conference:

- Confinement of clearing and grubbing within the clearing lines
- Need for and extent of clearing selected areas beyond the clearing lines
- Scheduling of clearing limits for environmental control

GRASS FIELDS

On occasion, the clearing and grubbing limits extend across cleared fields covered by an existing stand of grass. The SE should limit disturbing these areas to the minimum necessary to construct the road. If in doubt as to the suitability of the grass for right-of-way purposes, the SE should check with the district project development and preservation branch manager who may consult the Division of Construction landscape architect.

PAY ITEM

Normally clearing and grubbing is paid as a "Lump Sum" with a unit of one. The number of acres involved in this lump sum will be found in the "General Summary" in the front of the plans. This pay item is not affected by the clearing limits unless noted in the plans or unless the SE makes authorized adjustments.

PROGRESS PAY ESTIMATE

After an area has been cleared and grubbed to the satisfaction of the SE, the SE shall measure the satisfactory area and pay the "Lump Sum" item as a percentage of the clearing limit area found in the "General Summary." The total "Lump Sum" item paid shall not exceed 1.0 unless the SE has made authorized adjustments for overrun.

INCREASE QUANTITIES

If the clearing and grubbing acreage requires an increase due to a slide or other authorized change, the SE shall (in accordance with Section 202.05 of the Standard Specifications) compute changes in payment at a unit price based on the "Lump Sum" bid divided by the total estimated area of "Clearing and Grubbing" shown on the original plans. The change order shall include:

- The basic calculations for this procedure as part of the explanation and a reference to Section 202.05 of the Standard Specifications
- The original lump sum and bid price of clearing and grubbing (as a decrease)
- The new lump sum and the revised price (which includes the total of the original bid price plus the computed cost for the additional acreage) as a "Supplemental Item Increase"

The net effect is to increase the original lump sum price of the "Clearing and Grubbing Item" by the amount of the increased acreage multiplied by the amount bid per acre. The SE may follow this procedure for subsequent adjustments; however, the adjusted total acreage and price from the previous change order must be used to make the calculations in lieu of the original price and acreage.

	Section ROADWAY & DRAINAGE EXCAVATION
	Subject Introduction

GENERAL

Roadway and drainage excavation consists of the removal and satisfactory disposal of all materials taken from within the limits of the work contracted (the area between the original ground line and the excavation limits established or approved by the section engineer as shown on the final cross sections).

Prior to beginning excavation operations, proper disposal of all clearing and grubbing debris must be completed, particularly if the excavation is for the purpose of embankment construction.

PROGRESS PAY ESTIMATES

To derive excavation progress pay estimates, the section engineer should follow the procedures for the compilation of quantities for progress pay estimates detailed in **CST-612**.

	Section ROADWAY & DRAINAGE EXCAVATION
	Subject Preliminary Excavation Operations

SLOPE STAKES

Prior to starting excavation, slope stakes should be set at fifty foot intervals to conform to the required typical section as provided for on the plans. It may become necessary to vary the slopes depending upon the nature of the materials encountered or to accommodate for slides that may occur. When contract staking is involved, the contractor shall not make slope changes without the section engineer's approval. See **CST-610** for additional information on slope stakes.

SOIL PROFILE

If the plans provide a soil profile, the section engineer (SE) should review the recommendations carefully and ensure they are followed. The SE shall notify the district project delivery and preservation branch manager immediately upon encountering soil conditions that vary greatly from the information shown on the soil profile.

Most plans designate the types of soil that are suitable for use as top fills or refill material. They also identify soft or unstable areas and provide for the distribution of any available rock to these sites. Every effort should be made to conserve the rock material for this purpose. The SE should review the soil profile with the contractor's representative and address any special requirements. The SE shall also monitor the day-to-day excavation and embankment operation closely to ensure proper compliance with all applicable plan notes.

CUT STABILITY SECTIONS

Most grade and drain plans that have a significant amount of excavation will have cut stability sections that immediately follow the soil profile. These sections portray the cut slopes and relate the various rock elevations (as determined by coring, visual inspection, or other methods) to the prescribed benching. Generally, each cut will have several such sections shown for guidance. The SE should review the sections closely and check with the contractor's representative to ensure that the contractor is knowledgeable of these sections and that he or she is performing the excavation accordingly. The contractor's staking party shall use these sections to determine their presplitting stakes.

	Section ROADWAY & DRAINAGE EXCAVATION
	Subject Rock Excavation

GENERAL

Concerning rock excavation operations, the contractor shall:

- Prevent overshooting and excessive breakage
- Shape final slopes to the established template with no deviation readily discernible from the roadway
- Remove all loose or fractured rock from the rock slope

ROADBED EXCAVATION

The contractor shall remove all rock encountered in roadbed excavation from the sub-grade to the required depth below the finished grade. The final surface of the rock excavation shall be left in such condition that allows complete drainage of the sub-grade and have no holes or pockets. The section engineer shall:

- Inspect the rock surface prior to refilling to determine if sub-surface water will be discharged into the sub-grade
- Ensure that the contractor performs any necessary corrective action prior to placing refill materials
- Take sufficient elevation checks throughout the cut to assure the rock removal meets the required depth

PRESPLITTING

When presplitting, it is desirable to obtain smooth rock faces in the rock or shale formations. The SE should spot check the contractor's blasting operation to ensure that the contractor follows applicable local, state, federal, and project-specific guidelines for blasting. The SE is not expected to be an expert on blasting. Any questions concerning presplitting and production blasting should be directed to the district project delivery and preservation (PDP) branch manager. The district PDP branch manager may contact the Central Office construction liaison for further guidance.

Generally, limestone and sandstone presplitting holes should be spaced from 24 inches to 36 inches and shale from 24 inches to 30 inches. Overshooting and undershooting conditions are undesirable and should be held to a minimum.

ROCK ADJACENT TO STRUCTURES

When the project requires shooting in areas where rock excavation is adjacent to structures, the contractor shall take precautions in shooting operations. If possible, the contractor should complete the shooting prior to placing concrete in the structure. In many instances, structures have been damaged as a result of shooting in adjacent areas. Damages, which are not readily discernible, often occur as a result of shooting near these structures.

	Section ROADWAY & DRAINAGE EXCAVATION
	Subject Borrow Excavation

GENERAL REQUIREMENTS

Unless otherwise provided on the plans, the contractor shall obtain sites for borrow pits outside of the right-of-way limits at his or her own expense. All borrow shall be obtained from sites approved by the section engineer (SE). Refer to Section 205.03 in the Standard Specifications.

When borrow material is required, the SE should check the plans and proposal for hydraulic analysis requirements. The SE should contact the district project delivery and preservation branch manager for assistance if needed.

These requirements apply equally regardless of whether borrow material is a bid item or utilized as embankment-in-place.

PROPOSED BORROW SITE

If the contractor is required to provide borrow sites, the contractor shall submit plans of the proposed borrow site accompanied with a request for review and approval by the SE. The plans and written request shall contain, not limited to, the following information:

- Plan, profile, and cross-sections, including:
  - Original and final elevations
  - Proposed erosion and pollution controls of the pit during operations and after operations (final condition)
  - Existing topography and drainage

  Note: Plans, profile, and cross sections shall be scaled drawings submitted on standard-size reproducible plan sheets and contain enough detail to show the configuration of the area upon completion of the borrow operations.

- Written agreement with the property owner that includes any preference the property owner may have concerning the seed mixture used on the site

  Note: No permission will be granted for the property owner to do his or her own seeding.

PROPOSED BORROW SITE (CONT.)

- Approval of the Division of Water Resources of the Department of Natural Resources and Environmental Protection if streams or floodways are affected
- Approval of all applicable regulatory agencies (such as the US Forest Service, US Army Corps of Engineers, US Coast Guard, and local planning and zoning commissions)
- Approval of utility owners when overhead, on-ground, or underground utilities are involved
- Archaeological clearance of the proposed site unless the site has been recently disturbed

REVIEW OF BORROW SITE PROPOSAL

After receiving a borrow site proposal the SE shall make an on-site inspection and consider the following:

- Effects of drainage to public and private property
- Before and after aesthetics of the borrow site area
- Compliance of the proposal with the Specifications, plans, and good construction practices
- Borrow pit slopes will be left flat enough to minimize erosion
- An undisturbed buffer zone will be left in areas where the borrow pit borders on a property line

APPROVAL OF SOILS

The SE shall take sufficient soil samples to accurately determine the quality of the material in the borrow pit. It is suggested that a minimum of one test hole per acre be excavated to a depth equal to, if not deeper than, the final grade proposed by the contractor.

The SE shall take soil samples from each soil horizon and record the sample depth, soil layer thickness, and location in a field book. This sampling technique determines the quality of the soils in the site and provides information for future density tests.

The contractor shall provide access to the borrow site and the necessary excavation to enable the SE to obtain sufficient samples.

	Section ROADWAY & DRAINAGE EXCAVATION
	Subject Waste

GENERAL REQUIREMENTS

No excavated material shall be wasted without written permission. The section engineer (SE) should:

- Consider how to best utilize excess material to benefit the roadway on projects with roadway excavation in excess of that required for normal embankment construction
- Review the plans closely with emphasis on embankment slopes and available right-of-way
- Whenever possible, flatten slopes and fill depressions, gullies, etc.

  Note: In doing so, the SE may find it necessary to lengthen or raise drainage pipes, change flow lines, or install drainage boxes.
- Review the proposed changes with the district project delivery and preservation branch manager, particularly if changes in contract pay items are involved.

Refer to Sections 204.03.08 and 204.04.09 of the Standard Specifications for more information concerning waste materials.

The advantages of utilizing excess material in the above manner include:

- Improving roadway safety by flattening slopes
- Decreasing or eliminating the need for guardrail
- Decreasing problems from erosion
- Fills can be made more stable
- Future maintenance requirements can be minimized

Any location (inside or outside the limits of the right-of-way) should be avoided as a waste site if the additional loading of the proposed waste could result in a slide. The SE should check the plans and proposal for hydraulic analysis requirements and contact the district project delivery and preservation branch manager for any concerns.

PROPOSED WASTE SITE

If the plans or proposal requires the contractor to provide waste areas, the contractor shall submit plans of the proposed waste site accompanied with a request for review and approval by the SE. The plans and written request shall contain, not limited to, the following information:

- Plan, profile, and cross-sections or contours including:

  - Original and final elevations
  - Sub-surface type and rock line, when applicable
  - Any preparatory work such as, but not limited to, benching and sub-drainage
  - Any necessary data to assure foundation and slope stability
  - Existing topography and drainage
  - Proposed erosion and pollution controls

  Note: Plan, profile, and cross-sections should be scaled drawings, submitted on standard-size reproducible plan sheets and should contain enough detail to show the configuration of the original ground and the anticipated configuration of the area upon completion of the waste operations.

- Written agreement with the property owner including any preference the property owner may have concerning the seed mixture used on the site (designated in writing)

  Note: No permission will be granted for the property owner to do his or her own seeding.

- Approval of the Division of Water Resources of the Department of Natural Resources and Environmental Protection if streams or floodways are affected

- Approval of all applicable regulatory agencies (such as the US Forest Service, US Army Corps of Engineers, US Coast Guard, and local planning and zoning commissions)

- Approval of utility owners when overhead, on-ground, or underground utilities are involved

- Geotechnical investigation report, when required

  Note: The geotechnical investigation report is the contractor's responsibility and expense. The contractor shall engage a prequalified engineering consultant, approved by the Cabinet, when required to submit this report. Names of prequalified geotechnical consultants may be obtained from the Division of Structural Design's Geotechnical Branch through the Division of Construction

WASTE SITE PROPOSAL REVIEW

After receiving a waste site proposal the SE should make an on-site inspection and consider the following:

- Effect of drainage to public and private property
- Before and after aesthetics of the waste area site
- Consequences of potential foundation failures or slides that would affect public or private property

Other requirements for waste sites are:

- Waste sites adjacent to roadway embankments shall be constructed at an elevation below the embankment shoulder.
- Any waste placed within the right-of-way and incorporated in the construction should be placed and compacted in the same manner as the embankment.
- The placement of waste shall not overload sewers, pipelines, and other structures.
- Waste shall not be placed around utility poles or over gas lines without the contractor obtaining an agreement from the utility company (releasing the Cabinet from responsibility).

	Section ROADWAY & DRAINAGE EXCAVATION
	Subject Waste & Borrow Site Approval

WASTE & BORROW SITE APPROVAL

Compiling this information is a time consuming process and, unless promptly acted on by the contractor, could result in a delay in access to the waste or borrow material. Soil samples should be taken as early as practical after the contract is awarded for borrow sites. The possibility always exists that the soils will not meet the requirements and another borrow site will have to be selected. The section engineer (SE) shall review the requirements of the waste or borrow section with the contractor at the preconstruction conference.

When the SE is satisfied with the contractor's proposal, the SE shall transmit the proposal and any recommendations to the district project delivery and preservation (PDP) branch manager for review.

The district PDP branch manager, or delegated representative, shall then review the proposal and, if necessary, inspect the proposed site. When the district representative is satisfied with the contractor's proposal, the district representative shall make written approval of the request outlining the conditions of approval. The district will submit the waste or borrow proposal along with recommendations and comments to the Division of Construction Central Office for further review or approval if any of the following conditions exist concerning proposed waste or borrow sites:

- Massive amounts of material are involved (100,000 cubic yards or more).

  Note: This requirement also applies to sites starting out at less than 100,000 cubic yards and later modified to include more than 100,000 cubic yards.

- Foundation or slope stability problems may exist.

- Health, welfare, and life may be adversely affected.

- Public or private property may be adversely affected.

- Large environmental impacts are imminent.

ADDRESSES OF INVOLVED AGENCIES

The following address list includes various agencies that may be involved in the acquisition of waste or borrow sites depending on location.

Department of Natural Resources and Environmental Protection
Ash Building
14 Reilly Road
Frankfort, Kentucky 40601
Phone: (502) 564-3410

US Army Engineer District, Huntington
502 8th Street
Huntington, WV 25701-2070
Phone: (304) 399-5395

US Army Corps of Engineers, Louisville
P.O. Box 59
Louisville, KY 40201-0059
Phone: (502) 315-6102

US Army Corps of Engineers, Nashville
P.O. Box 1070
Nashville, Tennessee 37202-1070
Phone: (615) 736-5626

US Army Corps of Engineers, St. Louis
1222 Spruce Street
St. Louis, MO 63103-2833
Phone: (314) 331-8010

United States Coast Guard
Commander (aon)
Eighth Coast Guard District
Hale Boggs Federal Building
500 Poydras Street
New Orleans, LA 70130
Phone: (504) 671-2268

	Section EMBANKMENT CONSTRUCTION
	Subject Determining Material Types Used in Embankments

EMBANKMENT SPECIFICATIONS

Refer to Section 206, *Embankment* of the Standard Specifications.

ROCK

Rock, as used in embankment construction, is defined as unweathered limestone, durable shale (SDI ≥ 95 by **KM 64-513**), or durable sandstone. Any reference to “rock” refers to these type materials. SDI is the acronym for "Slake Durability Index."

EARTH / SOILS

Earth or soils, as used in roadway embankments, includes earth, nondurable shale (SDI < 95 by **KM 64-513**), friable sandstone, weathered rock, waste crushed aggregate, bank gravel, creek gravel or similar materials. Unless otherwise specified in the project plans, compaction shall be as specified in Section 206.03 of the Standard Specifications.

SHALE

Shale is considered to be soil or soil-like in all circumstances unless tested and found to have an SDI ≥ 95.

Shale formations may change properties as the location in the formation changes. Shale shown in the soil-profile sheets as being durable with an SDI ≥ 95 may be used as rock initially but shall be sampled and tested frequently for confirmation. If the shale tests at an SDI < 95, it shall be treated as soil.

	Section EMBANKMENT CONSTRUCTION
	Subject Earth Embankment

PRECONSTRUCTION INSPECTION

Prior to an embankment's construction, the section engineer (SE) shall carefully inspect the area serving as its foundation. All areas of questionable supporting capacity and poor drainage should be given special attention.

The presence of soft or very wet conditions may suggest the need for:

- Removal of unstable material
- Installation of sub-surface drainage facilities to remove spring or seepage water
- Aeration to dry the material

The SE shall always be on the alert to detect conditions of this type.

Certain cases require mechanical or chemical stabilization of the area. The Geotechnical Branch shall evaluate these areas and make necessary recommendations.

UNSTABLE AREAS

Embankments to be placed over swampy or other unstable areas that will not support the weight of the hauling equipment may (when indicated on the plans or directed by the SE) be constructed by end-dumping or otherwise depositing successive loads behind the leading edge of the lift and blading the material into place.

This process (called "bridging") is used to develop a working platform for fill construction. Rock or granular material should always be used for this operation, when available. Under no conditions shall a material be utilized for bridging that is above optimum moisture. This initial lift should have sufficient thickness capable of supporting the hauling equipment without pumping or heaving, but shall not exceed three feet unless indicated on the plans or directed by the SE.

The original ground will retain a certain amount of inherent stability when not disturbed by heavy equipment or when allowed to stabilize over a lengthy period after having been subjected to heavy equipment. The SE shall require the contractor to minimize equipment usage in areas of questionable stability until the embankment is well established. If the stability is critical, the SE may eliminate the removal of sod over the area to preserve the natural ground stability.

WATER TABLE

When constructing an embankment across flat or level land, special ditches should be excavated on both sides of the fill area before embankment construction begins.

If conditions require it, perforated pipe or filter fabric may be used in the original ground under the embankment location in conjunction with the ditches. This installation type lowers the water table and increases the stability of the natural ground.

STEEP SLOPES

In constructing embankments on slopes with grades of 15 percent or steeper, the contractor shall obtain a good interlock between the sloping foundation and the new embankment by cutting steps with horizontal and vertical faces in the original slope as the embankment is brought up in layers. This process is called benching. Projects with areas of steep embankment will often require benching as a pay item. Refer to applicable plan sheets, Standard Specifications, and Standard Drawings for more information.

Original ground on a slope of less than 15 percent shall be loosened to a depth of six inches and compacted in accordance with the requirements for compaction as prescribed for the project.

GENERAL

The inspector must not permit the contractor to incorporate any undesirable material (logs, roots, stumps, etc.) in the embankment. In addition, the inspector must be fully aware of any formations designated by the plans to be wasted (such as coal, coal bloom, etc.).

Construction hauling over fills should not be confined to the same path or track but should be spread out over the entire width of the embankment to avoid ruts and areas of non-uniform compaction. During earth embankment construction, if any part of the roadway loses density or becomes unstable under the action of the contractor's equipment, that section must be recompacted. As applicable, the addition of moisture or aeration to remove moisture may be required to obtain density. It may be necessary to remove the material entirely and replace it with material that can be compacted to the required density.

Note: Heavy vibrations may wick water to the surface, causing an unstable area. In many cases, when the vibrations have ceased for a period of time, the water will return to the natural water level and the embankment material will regain its structural integrity.

At the end of each day's work, the surface of the embankment should be compacted, graded, and crowned to allow runoff of rain water. If rain occurs before work resumes, the amount of water soaked or trapped in the fill would be minimized and the stability of the fill would be maintained as much as possible.

SPECIAL SHALE EMBANKMENT

The project plans may include specific instructions (usually in the Geotechnical Notes or Soil Profile Sheets) requiring special construction procedures for soil-like shales that are more restrictive than normal compaction procedures. The notes may require:

- Soil-like shales to be constructed in lifts less than twelve inches
- Addition of considerable water
- Special handling and compaction procedures
- Use of specific equipment

When included in the plans, the contractor shall follow these requirements closely.

Note: Sufficient water has been found to be critical in this procedure and the closer to optimum (or even above) the better for slaking and quicker compaction to meet the requirements.

	Section EMBANKMENT CONSTRUCTION
	Subject Rock Embankment

CONSTRUCTION SPECIFICATIONS

A rock embankment is constructed principally of unweathered limestone, durable shale (SDI ≥ 95 by **KM 64-513**), or durable sandstone. A rock embankment shall be constructed in layers with the thickness of each layer or lift not to exceed three feet. The thickness of the lift is controlled by the dimensions of the dominant rock size. Each lift shall be constructed by rock dumped on the preceding lift that is then pushed or dozed over the face of the lift in such a manner as to ensure that the action of dozing should fill all voids and eliminate bridging the broken rock in the lift. A rock fill constructed in this manner does not normally require rolling.

When a rock and shale or a rock and soil mixture is utilized to construct a fill, each lift shall be limited to twelve inches unless the mixture is composed primarily of rock larger than twelve inches. In this case, the thickness of the lift may be increased to that of the rock size up to a maximum of three feet. Compaction is required in this operation, but the amount of rock in the mixture (rock > 60%) may eliminate the density test requirement.

When rock is available on a project, every effort should be made to schedule the excavation procedures so that the rock will be available to stabilize the original ground when starting the fill, particularly in soft or wet areas.

	Section EMBANKMENT CONSTRUCTION
	Subject Subgrade

SUBGRADE

The section engineer (SE) shall ensure that the materials incorporated into subgrade construction meet the plans and specification requirements for select CBR (California Bearing Ratio) material or rock subgrade. In addition, the SE shall see that the subgrade is checked for compliance with specification tolerances and density requirements and that all areas of soft and yielding subgrade are corrected.

	Section EMBANKMENT CONSTRUCTION
	Subject Embankment-in-Place

EMBANKMENT-IN-PLACE

When "Embankment-in-Place" is specified on the plans or in the proposal, all construction requirements of the Standard Specifications shall apply. The final pay quantity of "Embankment-in-Place" will be the design quantity as stipulated in Section 206.04.01 of the Specifications.

Unless otherwise stipulated in the plans or proposal notes, the Specification requirements regarding either waste or borrow sites apply fully to Embankment-in-Place construction with the exception that cross-sections for the purpose of computing quantities are not necessary for borrow pits.

	Chapter GRADE & DRAIN CONSTRUCTION
	Subject Haul Roads

PURPOSE

The contractor normally constructs haul roads to provide access to the work site for equipment.

HAUL ROADS BUILT WITHIN PLANNED ROADWAY LIMITS

When haul roads are built within the planned roadway limits, all construction shall adhere to the Standard Specifications for Embankment Construction, Section 206. If the grade of the haul roads will be near that of the design grade, construction of the roadway to a partial width for haul road purposes should not be permitted.

HAUL ROADS EXTENDING OFF THE RIGHT-OF-WAY

When a haul road extends off the right-of-way, the section engineer (SE) should pay close attention to the drainage. If borrow or waste sites are involved, the contractor's plans shall show all haul roads and drainage.

HAUL ROADS INVOLVING THE TRAVELING PUBLIC

If the haul road involves the traveling public, the SE shall pay special attention to the construction of warning signs and require the use of flag persons if necessary. Sight distances of the approaching motorists should also be a point of consideration.

UNUSED HAUL ROADS

Unless otherwise required or permitted, when haul roads are no longer being used they shall be site graded and reseeded at the contractor's expense to the satisfaction of the SE.

	Chapter GRADE & DRAIN CONSTRUCTION
	Subject Design Quantities

PAYMENT OF EARTHWORK BASED ON DESIGN QUANTITIES

Section 204.04.01 of the Standard Specifications provides for payment of earthwork to be based on design quantities.

When assigned a project with payment of earthwork based on design quantities, the section engineer (SE) does not have to cross-section and compute the entire roadway excavation.

CHECK SECTIONS

Final check sections shall be taken in cuts to substantiate that the slopes have been constructed within the tolerances specified by Section 204.03.10 of the Specifications. The frequency should average one section per 500 feet of cut along the centerline of survey with a minimum of one section per cut.

When Embankment-in-Place is specified, this requirement also applies to fills. These sections are to be plotted on the as-built plans to be submitted with the final estimate and are to become part of the project record. Elevations are to be taken in rock cuts to substantiate excavation to the template refill line.

AUTHORIZED EXCAVATION FIELD MEASUREMENTS

Field measurements must be taken on embankment benching, undercutting, and/or slides to calculate yardage for payment of authorized adjustments. In addition, field measurements must be paid on authorized excavation not included on the plans (such as ditches and private entrances).

Benching quantities are not part of the “Design Quantities” and are considered “Authorized Adjustments to Design Quantities of Roadway Excavation or Embankment-In-Place” and must be calculated from field measurements (see Section 204.04.02 of the Standard Specifications).

Benching quantities shall not be paid as plan or design quantity.

AUTHORIZED EXCAVATION CUT SLOPES

Authorized changes in cut slopes shall be paid to the revised plan template.

When slope changes are made, the revised slopes shall be drawn on the design cross-section sheets to become the new design slope. The SE shall use the new design slope to compute additional (or subtractive) quantities and classify them as "Authorized Adjustments." The SE shall utilize only the new areas in the computations and not involve the original design quantities. Whenever authorized adjustments of any type are made, the SE should get them plotted and calculate the yardage as soon as possible.

CHANGE ORDERS FOR AUTHORIZED EXCAVATION

Whenever a change order is necessary to authorize an increase in roadway excavation on a design quantity project, the SE shall include a concise description of the change in work and the quantity changed.

UNAUTHORIZED EXCAVATION

Payment shall not be made for unauthorized excavation.

	Chapter GRADE & DRAIN CONSTRUCTION
	Subject Precast Small Drainage Structures

SPECIFICATIONS

See Section 710.03.01 of the Standard Specifications for additional information pertaining to installation and materials.

Shop drawings are not required and will not be accepted for consideration for statewide approval for those structures (such as manholes) that standard drawings customarily permit the use of precast components. Similarly, some standard drawings contain specific requirements pertaining to cast-in-place structures and these notes will govern in all cases unless a specific variance is approved.

CRITERIA FOR PAYMENT

The section engineer (SE) shall use the same criteria for payment of precast drainage units as used for cast-in-place units. Again, these criteria are in Section 710.03.01 of the Standard Specifications.

An "order" is not required to be placed for precast units or for cast-in-place units. Unanticipated job conditions that affect precast units are considered the contractor's responsibility even if the unit is on the jobsite. The SE has full latitude to make any changes on the project; these changes include revising flow lines or eliminating items.

There is no obligation for payment of these changes unless the precast unit has been installed. The consideration for payment of a precast unit after installation is similar to that for cast-in-place units, as is the procedure for removal and replacement if necessary.

STOCKPILE PAYMENT

Precast small drainage structures are not eligible for payment as "Stockpile Items." Precast units, either included in the contract as specific bid items or specified historically by the Department's Standard Drawings, do qualify for consideration for stockpile payment as permitted by the Standard Specifications.

APPROVED DRAWING

An approved drawing must be on file for any unit to qualify for payment.

ACCEPTANCE OF UNIT

A representative from the district material engineer's (DME's) office of the district where the fabrication plant is located will normally perform the necessary fabrication inspections at the plant. The DME's office must be informed of the fabrication two weeks prior to the fabrication.

ACCEPTANCE OF UNIT (CONT.)

If this fabrication plant inspection is satisfactory, the materials inspector will affix an approval stamp to each unit prior to shipment to the jobsite. This stamp must be in place before the SE will accept the unit for installation on the project. However, the existence of this stamp does not mean the SE will automatically accept the unit. The unit must be in satisfactory physical condition, of a proper size and configuration for the specified location and, in general, be installed in a satisfactory manner before it is acceptable at the job site.

APPROVED DRAWINGS

Precast small drainage structures shall be in substantial conformance with approved drawings. The latitude to adapt Standard Drawings to various conditions in the field utilizing cast-in-place methods does not exist for pre-cast units. If a manufacturer needs to construct a precast unit to accept skewed pipe, multiple pipe openings or other variations, an approved drawing reflecting the modifications must be on record.

Two procedures exist for submission of drawings for approval. The primary procedure is statewide approval and the secondary procedure is project-specific approval. **Exhibit 9069** details both procedures. The SE shall have an approved drawing on file consisting of either a statewide drawing or a project-specific drawing for every precast small drainage structure used in lieu of a cast-in-place unit. An approved drawing must be stamped, signed, and dated by an engineer in the Division of Construction.

STATEWIDE APPROVAL

In this procedure the manufacturer obtains approval, as indicated by a stamp affixed to the drawing, from the Division of Construction. The Division of Materials distributes copies of the approved drawing to all SEs, DMEs, and others on a statewide basis.

PROJECT-SPECIFIC APPROVAL

This procedure was devised to meet a specific design need on a particular project. The contractor submits the drawing for this type of approval to the SE who forwards it to the district Project Delivery & Preservation Branch for review, and then on to the Division of Construction, Central Office. If approved, the Central Office Division of Construction will affix an approval stamp to the drawing. Approval of a particular drawing for a specific project does not imply its approval for use on other projects. This procedure must be followed on each project.

EXHIBIT 9069

This exhibit includes guidance to the designer, manufacturer, and the SE and details the subject of small precast drainage structures more comprehensively than this article. This exhibit is included to facilitate the copying and distribution of the information to inspectors, fabricators, and other interested parties. **Exhibit 9070** details the fabrication limits for these structures.

	Chapter SUBGRADE & BASE CONSTRUCTION
	Subject Subgrade Construction

PREPARATION OF SUBGRADE

The roadway subgrade supports the base and surface courses. A good subgrade allows good ridability and durability and often a longer life. The section engineer (SE) or inspector shall be satisfied with the subgrade's condition before the base or surfacing operations are allowed to proceed. The contractor shall construct subgrade in accordance with Section 207 of the Standard Specifications and any applicable special notes included in the project documents.

The contractor shall compact the subgrade to a uniform density throughout, according to the density and moisture control requirements of Section 206.03.03. At any time the subgrade loses its density for any reason, the contractor shall recompact the subgrade to the required density. Subgrade material below optimum moisture may require scarifying, added water, and manipulation to the required depth before compaction. Subgrade above optimum moisture may require drying and/or scarifying before compaction.

CHECKING SUBGRADE

The SE shall:

- Check the subgrade with a template or string line to within tolerances of Section 204.03.10 of the Standard Specifications
- Direct the contractor to correct areas of yielding or unstable material and backfill with approved materials
- Test the subgrade in accordance with the *Materials Field Sampling and Testing Manual*, applicable plan notes, and specifications
- Not allow the contractor's equipment to rut or break the density of the subgrade before applying the base course

Note: The SE should be cautious in permitting continuous hauling over sandy soils or wet subgrade constructed of silt or clay soils, as this could result in breaking density.

SUBGRADE MATERIALS

The SE shall ensure that the materials incorporated into the subgrade construction meet the plan's and specification's requirements for select CBR material or rock subgrade as specified. Plans that require the use of select material in the subgrade should be reviewed in detail early in the life of the contract.

SUBGRADE MATERIALS (CONT.)

The contractor, in consultation with the SE, may deem it necessary to stockpile rock or CBR material to meet these requirements. A clear understanding should be reached with the contractor as to how these materials will be handled and saved for specified use before they are wasted or otherwise utilized and become unavailable. It is undesirable to have a situation where the contractor must go to a waste site to recover wasted rock or even obtain borrow to meet select material requirements.

SUBGRADE INSPECTOR'S CHECKLIST

The subgrade inspector shall:

- Check the foundation on which the subgrade material is to be placed for desired width and elevation as determined by the plan cross-sections with unstable and yielding areas corrected prior to subgrade construction
- Review the contract plans and proposal to determine the subgrade requirements
- Ensure that subgrade material is sampled and tested and meets all requirements prior to being incorporated into the construction

  Note: At the same time, proctor densities shall be obtained for later compaction testing.

  Note: When subgrade chemical stabilization is required, it may also be necessary to sample the subgrade for testing to determine application rate and depth. This should be done as soon as feasible before the addition of any chemicals to the subgrade material.

- Ensure that the subgrade is constructed to desired line and grade in accordance with the plan cross-sections and all undesirable materials (such as roots, large rocks, etc.) are removed
- Perform required density testing to ensure proper compaction
- Check for yielding and unstable areas and ensure the contractor makes all necessary corrections

  Note: Areas of failing density shall be reworked until desired compaction is obtained.

- Check the subgrade for proper drainage to ensure that no water will be trapped on the subgrade surface
- Ensure that the subgrade is protected from unnecessary vehicular traffic

  Note: Damaged subgrade shall be corrected as soon as possible to obtain the desired grade and density.

- Check the final grading of subgrade to specified tolerances by string lining

	Chapter SUBGRADE & BASE CONSTRUCTION
	Subject Dense Graded Aggregate Base (DGA) & Crushed Stone Base (CSB)

GENERAL

Dense graded aggregate base (DGA) or crushed stone base (CSB) shall be applied in one or more courses on an approved subgrade and shaped to the required typical section and alignment. The base shall be plant-mixed as required by the Specifications, Section 302.03.01.

MIXING & TRANSPORTING

The aggregate and water shall be thoroughly mixed in an approved type mixer at the plant. The mixed material is then transported to the project in such a manner that the material, when placed, will be of uniform gradation and moisture content. Methods of transportation shall not cause undue segregation. Canvas covers will be required on trucks during transportation whenever the time between loading and spreading exceeds thirty minutes to minimize early drying of the mixture.

The mixture shall be placed with an approved mechanical spreader and brought to a typical cross-section and grade without segregation. The inspector should frequently check on the mix and make any necessary adjustments in order to maintain optimum moisture in the mix. The contractor shall wet the subgrade or previous base layer before placing base material.

BASE WITH SHOULDER CONSTRUCTION

When the shoulder material is of earth, a portion of the adjacent shoulder shall be compacted concurrently with each course of granular base as specified in Section 209.03.02 of the Standard Specifications. Prior to compaction of each course of the aggregate base, shoulder material shall be built firmly against the aggregate base. Shoulder material should be constructed to a width of not less than 18 inches and to a height after compaction that is equivalent to the base course. Compaction of the base material shall be in accordance with Section 302.03.04 of the Standard Specifications.

PLACEMENT

The inspector shall:

- Observe the mix carefully during the compaction
- Correct any locations of segregation
- Check the as-built section with a template (or ensure maintenance of the proper cross-section)

PLACEMENT (CONT.) The contractor shall reshape any variation from line, grade, or typical section with a grader and add additional materials where necessary.

COMPACTION The contractor shall:

- Compact the base with a 16-ton pneumatic roller or 8-ton steel wheel vibratory roller
- Regardless of thickness, establish a 500-foot control strip of full width at the beginning of the base course construction for each lift
- Use the same equipment and procedures intended for the remainder of the base course

The control strip is used to determine the level of compaction needed to achieve optimum density in the field. After two passes of compaction equipment, Cabinet personnel will use three random locations in the control strip and take density measurements in accordance with **KM 64-002** and Section 302.03.04 of the Standard Specifications. The control strip shall be compacted until no further increase in density is obtained.

CONTROL STRIP The base material will be visually inspected by the inspector after each pass to determine if the aggregate is being crushed, cracked, shoved, or shows signs of other distress. If a problem occurs, the contractor will need to use other equipment or methods to achieve satisfactory results.

After a satisfactory control strip has been established, ten random field densities & moisture readings in the control strip will be taken by the inspector. The average of the ten tests will be used to obtain the target density for the base. The moisture readings are used if problems obtaining proper density occur. The actual moisture should be 2 percent (+/-) of the moisture content obtained during target density.

DENSITY TEST BY LOTS The remaining area of base material will be divided into 2500 square-yard lots. Each lot will further be divided into five sublots. A density measurement will be taken at one random location within each sublot. The average density of the five sublots is required to measure 98 percent of the target density. No individual sublot density shall be less than 95 percent of the target density. If the average density or an individual density does not meet the requirements, the laydown operation shall be stopped and the area recompacted or reworked until the prementioned density requirement is met.

Each lift of aggregate base shall be maintained to uniform grade and cross section. If a final lift is to be trimmed with an automatic grading machine, it should be constructed ½"—1" higher before trimming. After the final cut, the contractor shall wet and roll the base with a static roller, after which density test(s) will be retaken.

DENSITY TEST BY LOTS (CONT.)

If, for any reason, the base material loses density, the contractor shall remove or rework the material to again obtain the required density. If there is any indication that the integrity of any course has deteriorated, additional tests shall be made prior to placing the next course and the required density shall be reestablished.

Note: The use of contractor's hauling equipment can be restricted if previously placed aggregate base course can be used.

Traffic, space, and time may require some hauling across the base course but the contractor shall ensure that the base is shaped and rolled and meets density requirements before placing the next course.

No direct payment will be made for any materials, labor, or equipment required to maintain or repair any course of aggregate base prior to placing the next course.

SHOULDER DRAINS

Shoulder drains, as required by the plans or specifications, shall be constructed in accordance with Section 209.03.02 of the Standard Specifications. Permanent lateral drains shall not be constructed until the completion of the entire earthwork portion of the shoulder construction. Temporary drains shall be utilized as directed by Section 209.03 of the Specifications.

MOISTURE CONTENT

At the pugmill, water shall be added in only such amounts as is absolutely necessary to obtain density.

AGGREGATE BASE INSPECTOR'S CHECKLIST

The aggregate base inspector shall:

- Be thoroughly familiar with Division 300, *Aggregate Base Courses* in the Standard Specifications, applicable plan requirements, and required testing and verification procedures

- Verify with the district materials engineer that the aggregate base material has been approved at the source and that the pugmill has been approved for operation

- Inspect for proper transport of materials and discuss weighing procedures with the contractor or supplier

- Inspect the contractor’s equipment that will be used for placement and compaction

  Note: The contractor shall place the material with an approved mechanical spreader to avoid unnecessary segregation.

- Inspect frequently to ensure that aggregate base is arriving on the project at the proper moisture content

AGGREGATE BASE INSPECTOR'S CHECKLIST (CONT.)

- Take frequent depth checks to determine that the aggregate base is being spread at the depth desired to the proper line and grade to ensure the correct thickness after compaction

  Note: Prior to compaction of each course of aggregate base, shoulder material shall be built firmly against the DGA. The shoulder material shall be constructed to a width of not less than 18 inches and to a height equivalent to the base course once compaction is complete.

- Check for temporary or permanent shoulder drain construction as required

- Check that the contractor takes adequate precaution to ensure that the material trimmed during the final grading operation does not become contaminated and can be incorporated in subsequent aggregate base construction

  Note: Waste of the trim material shall not be permitted.

- Check the final grading of the aggregate base to the specified tolerance in accordance with the plan typical section by stringline

- Ensure that density testing is performed on each course of material and that the compaction is approved prior to placing subsequent courses or surface construction

- Request the contractor to protect the aggregate base from unnecessary vehicular traffic

  Note: If the aggregate base surface deteriorates or becomes damaged, the contractor shall add, wet, and compact additional material to a satisfactory surface and density.

	Chapter SUBGRADE & BASE CONSTRUCTION
	Subject Drainage Blankets

GENERAL

Pavement drainage blankets remove water from pavement structure and transfer water to pipe or edge of shoulders. A drainage blanket may, depending on plan requirements, be one of the following:

- Untreated Aggregates
- Asphalt Treated Aggregates
- Portland Cement Treated Aggregates

Of the three types, asphalt treated is probably the most used with untreated a close second. Generally, the construction requirements for drainage blankets can be found in Section 303 of the Standard Specifications.

A pavement drainage blanket provides an excellent method of collecting and draining water from the pavement structure. It is particularly effective when used in combination with an internal perforated pipe system. A blanket is generally placed on some type of water proof layer that aids in the collection of surface water penetrating the pavement structure without permitting the passage of water into the subgrade. This layer may be a chemically-treated subgrade or an intermediate layer of stabilized aggregate base or dense graded aggregate base (DGA).

Note: A project with a pavement drainage blanket should also have a waterproof layer required by the plans and set up in the contract. If this is not the case or there are questions, the section engineer (SE) should contact the district Project Delivery & Preservation Branch for guidance.

PERFORATED PIPE DRAINAGE SYSTEM

The perforated pipe system normally installed with drainage blankets is particularly susceptible to damage when used with the untreated blanket. The SE must ensure that the contractor follows the plans and proposal and uses due care when working in the vicinity of the pipe. Even then, the perforated pipe should be checked for damage and replaced if necessary. Proper function of the perforated pipe is critical to the entire drainage installation and every effort shall be made to see that the pipe system is intact before it is covered with the pavement structure. The pipe drainage system is required to be monitored in accordance with Section 704.03.02 before placement of final surface course to ensure integrity of system.

UNTREATED DRAINAGE BLANKET (UDB)

Size No. 57 aggregate is normally used for this drainage blanket. This material must, in general, be laid with an asphalt paver or spread with an autograde machine. The UDB should be placed in accordance with Section 303.03.02(A) of the Standard Specifications.

A spreader box, such as used with DGA, will not work well. Reasonably accurate grade control is necessary since the aggregates must be compacted to grade immediately following the laying operation. Manipulating this loose rock to any great extent with a grader is not very practical or efficient; however, a small grader may be required in combination with a roller to help keep the rock level and tight until it is covered with the following pavement course.

ASPHALT TREATED BLANKET (ATDB)

The gradation of the aggregates in this drainage blanket is specified in Section 805. The blanket must be laid with an asphalt paver meeting the requirement of Section 403.02.07 of the Standard Specifications and it must meet the surface tolerances specified in Section 403.03.11 for base courses. The ATDB should be placed in accordance with Section 303.03.02(A) of the Standard Specifications. **CST 1101—1114** provides additional guidelines relative to asphalt pavements. Normal compaction requirements and thickness checks by coring apply to asphalt concrete pavements constructed on ATDBs.

RIDEABILITY

The ATDB can significantly enhance the rideability of a pavement project when constructed properly. The asphalt paver must be operated with full electronic grade controls; however, superior results have been obtained when it is operated on a graded reference line. (See **CST-1110** for additional information.)

CEMENT TREATED DRAINAGE BLANKET (CTDB)

Mixing and hauling shall be in accordance with Section 501 (PCC Pavement) of the Standard Specifications. Spreading, consolidation, and finishing equipment shall be used in conformance to Section 501. The CTDB shall be placed in accordance with Section 303.03.02(B). The SE may approve alternate methods upon demonstration of a 3,000 square-yard test strip.

The material will be compacted with a 10-ton steel wheeled roller, unless the SE determines consolidation is acceptable without rolling. If the contractor uses a standard vibratory slipform paver, rolling should not be needed. The CTDB shall be covered with a 4-millimeter thick plastic or curing membrane for 3 days. The CTDB shall be placed only if the ambient temperature is 45° F and rising.

	Section WEIGHING SUBGRADE & BASE MATERIALS
	Subject Introduction

SPECIFICATIONS

In accordance with Section 109.01.02 of the Standard Specifications, the contractor or material supplier shall furnish all personnel necessary to perform weighing (including tare weighing) and prepare required records. In this respect, all references to *weigher,* refer to either the contractor's or the material supplier's representative.

The procedures described in **CST-1004-1—1004-5** apply to all materials measured by weight for payment.

	Section WEIGHING SUBGRADE & BASE MATERIALS
	Subject Automatic Printing Scales, Truck Tare Weights, & Weigh Tickets

AUTOMATIC PRINTING SCALES

All aggregate sources and hot-mix asphalt plants shall be equipped with automatic printing scales with some minor exceptions as noted in Section 109.01.03 of the Standard Specifications.

TRUCK TARE WEIGHTS

When it is necessary to use a tare sheet to record truck tare weights, the section engineer (SE) shall use the TC 63-31 form, *Weighman's Tare Check Report* (**Exhibit 9033**).

If the automatic printing scales are designed and utilized so as not to require tare weights to compute net weight, the SE shall obtain the tare weight of every truck to be used in hauling prior to hauling on the project. This tare weight will be used in meeting the requirements of Section 105.10 of the Standard Specifications. Unless required by the SE, it will not be necessary to tare the trucks again when the tare is not used in the pay quantity calculations. Refer to Section 109.01.03(A)(2) of the Standard Specifications.

The contractor (or material supplier) shall prepare the daily tare sheet (when used) and it shall be signed by the plant manager, certifying that the tare data is correct.

The tare weight of each truck involved in hauling material must be checked in accordance with Section 109.01.03 of the Standard Specifications.

The SE should monitor this procedure closely.

WEIGH TICKETS

The automatic printer shall produce a weigh ticket for each load which contains all information in digital form that is on the Department's conventional weigh ticket.

These tickets shall include the following required information:

Note: This is the minimum required data and does not limit the information that may be printed at the contractor's option.

- **Supplier Name**—If a company has more than one plant or quarry, the specific source shall also be identified.

WEIGHT TICKETS (CONT.)

- **Customer**—KY Transportation Cabinet
- **County, Project Number, Contract Id (CID)**
- **Type of Product**—Bit. Base, D.G.A., C.S.B., etc.
- **Date and Time**
- **Load Number**—Tickets for each project shall have a sequential load number for each load. These numbers may be entered manually, but indelible ink (ball point, etc.) must be used. **Sequential load numbers are critical to the necessary checking of tickets in the SE's office. It would be impossible to account for missing loads and/or tickets without sequential numbers.**
- **Truck Number**
- **Weight**—May be shown in tons in lieu of pounds provided the weight is shown to at least .01 ton. If the gross and tare weights are used in the computation of net weight, they must be shown on the ticket. It is preferable that gross and tare always be shown on all tickets; however, they may be waived when they do not enter into the computation and the printing equipment does not have the capability. Metric weights shall be used, when required, with similar limits as prescribed for English weights.
- **Certification**—A certification statement similar to that presently in use on Department tickets must be provided for the signature of the field ticket taker. To make the ticket more versatile, the word "Owner" may be used in the certification in lieu of the name "Department of Highways."
- **Signatures**—Lines for the signature of the plant weigher and the signature and receiving time of the field ticket checker must be provided.

It is preferable that automatic printer tickets be prepared in 4-part NCR with colors similar to that customarily used by the Highway Department as follows:

- Original Ticket..... White
- Duplicate Ticket ..... Green
- Triplicate Ticket..... Yellow
- Quadruplicate Ticket..... Pink

Depending on the capabilities of the equipment, multiple layered tickets may be impractical, as may be the colors. The Department is flexible on this; however, **CST-1004-3** and **CST-1004-4** discuss requirements concerning weigh tickets that must be followed.

	Section WEIGHING SUBGRADE & BASE MATERIALS
	Subject Preparation & Handling of Weigh Tickets

PROCEDURE

The following standard procedures concerning weigh tickets must be followed:

1. The weigh person shall:

   - Weigh materials
   - Prepare and sign weigh tickets in at least triplicate
   - Include on the ticket the time of day that the material was weighed

   The contractor shall provide the original to the Cabinet's inspector.

2. The weigh person shall deliver the original and duplicate tickets to the truck driver at the time the material is weighed. A delivery of additional copies of the ticket to the driver is discretionary, but the original and one copy is required.

3. The Cabinet inspector will claim the original ticket upon delivery of the material to the job site and sign (**Not initial**) for the delivery in the certification space, noting the time of delivery in the space provided. The inspector shall obtain all original tickets weighed out for the project. The original ticket, for those loads not qualifying for payment, should be claimed, declared "Void," and noted as to the appropriate reason.

4. The truck driver shall retain a copy of the ticket for the use of the contractor performing the work. The use of this ticket is discretionary with the contractor or vendor.

Another copy of the ticket may be retained by the vendor or contractor at the end of each day's weighing operation for their records. This ticket is discretionary and may take the form of some other record.

	Section WEIGHING SUBGRADE & BASE MATERIALS
	Subject Daily Summary

OVERVIEW

When a small quantity of material (such as millings) are to be weighed at a location that does not have facilities for the printing of tickets, the weigher or plant manager shall prepare the Daily Summary [TC 63-12 form, *Daily Report of Weighed Materials* (**Exhibit 9028**)] for each working day. Preparation shall be in accordance with Section 109, "Measurement and Payment" of the Standard Specifications.

The plant manager shall fill in the "Total Weighed" quantity located at the bottom of the TC 63-12 form. This is the amount certified by the plant manager in accordance with Section 109.01.03 (C) of the Standard Specifications.

The section engineer's office shall fill in the "Total Net Pay Quantity (Tons)" quantity (located at the bottom of the TC 63-12 form) when the pay quantities are resolved for the day's hauling. This amount is entered in the "Item Quantity Record" as the pay quantity.

ITEMS INCLUDED ON THE DAILY SUMMARY

The Daily Summary shall include:

- A list of all loads shipped that day
- Truck number and load (or ticket) number for each load

  Note: The load or ticket number must be sequential for consecutive loads of a particular material to a specific project.

- Net weight of each load
- Total net weight shipped that day (supported by an adding machine tape when necessary)

  Note: It is not necessary, with electronic scales and automatic printers, to run an adding machine tape on the gross or tare weights or on the net weights if a cumulative total is printed on each ticket or if a computer printout at the end of the day will provide the data. An adding machine tape for net tonnage will be necessary if the equipment can not carry such a cumulative total or furnish a computer printout. An adding machine tape will also be necessary in the event of equipment failure. This adding machine tape is part of the Daily Summary and is the responsibility of the plant manager as specified in Section 109.01.03 (C) of the Standard Specifications.

ITEMS INCLUDED ON THE DAILY SUMMARY (CONT.)

Note: A printout from a computer spreadsheet (not part of the weighing system) is acceptable in lieu of the adding machine tape. The Daily Summary complete with a Certification Statement could be prepared on a computer spreadsheet for each day's run.

	Section WEIGHING SUBGRADE & BASE MATERIALS
	Subject Resolution of Quantities & Payment

OVERVIEW

In every case, the determination of pay quantities will be based on the original tickets taken up on the job site. Material rejected for payment (as discussed in **CST-1004-3**) must be taken into account in this resolution.

THREE DAY SUBMITTAL TIME

In accordance with Section 109.01.02 of the Standard Specifications, the contractor has three working days to get the completed and signed daily summary and daily tare sheet to the section engineer (SE). No tonnage will qualify for payment until these documents have been received and checked by the SE's office. There will not be any temporary payments with intent to resolve pay tonnage at a later date. Failure of the plant or supplier to get this information to the SE on a timely basis will result in delaying payment for the materials in question. **This point should be discussed at the preconstruction conference.**

RESOLVING QUANTITIES

Any differences between "Total Weighed" and "Total Net Pay Quantity" must be resolved for each day's run. At the option of the SE, this would be done using one of the following techniques:

- The Daily Summary (TC 63-12) (**Exhibit 9028**) is used to show the resolution. "No Pay" would be deducted from the "Total Weighed" to determine the "Total Net Pay Quantity." The tare sheet would be checked against the tare weights used, when applicable. A short reason shall be included for no pay quantities. An adding machine tape or spreadsheet printout would be necessary to support computations.

- A computer printout (spreadsheet) is prepared to reflect each Daily Summary showing one of the following:

  - The "Total Weighed" as certified by the plant manager is correct
  - The "Total Weighed" followed by a list of tonnage to be deducted and a net total that will be the "Total Net Pay Quantity" for the day

  The tare sheet would be checked against the tare weights used, when applicable. A short reason shall be included for no pay quantities.

RESOLVING QUANTITIES (CONT.)

- The last ticket showing the total for the day is used. Any rejected loads on this ticket shall be indicated and include a corresponding, explanatory reason. The rejected amount is then subtracted from the daily total shown on the last ticket to give a total net pay quantity.

The "Total Net Pay Quantity" as determined by the first two above options would be the tonnage entered into SiteManager for payment. It shall not be adjusted for penalties of any nature including thickness tolerances. Penalties distort the daily weighed quantities and lead to confusion and difficulties in checking the resolution of weighed quantities. Penalties will be addressed as line item adjustments elsewhere in the estimate.

PREPARATION OF FINAL PAY ESTIMATE

CST-405-2 details the preparation of the final estimate when items paid by the ton are involved.

	Chapter SUBGRADE & BASE CONSTRUCTION
	Subject Subgrade Stabilization by Chemicals

GENERAL

The contract will specify if chemical stabilization is to be used. Normally, this work involves roadbed stabilization by either mixing Portland cement or hydrated lime with the roadbed material. Subgrade prepared for chemical stabilization shall be free of rocks of a size specified by the plans or Section 208 of the Standard Specifications.

PREPARATION OF EXISTING ROADWAY

The roadway shall be shaped to the plan grade, line, and cross-section. The roadway subgrade shall be free of organic material (such as roots) and any rocks larger than 4 inches to a depth below the stabilization limits. The equipment used to mix the soil and stabilizer (lime or cement) does not operate effectively with rock fragments.

The chemical stabilization quantities established in the contract are estimates. Actual field samples of the subgrade material shall be submitted to the Division of Structural Design's Geotechnical Branch to determine the optimum amount of stabilizer (cement or lime). Since this process may take a week, samples of the subgrade should be taken and submitted as soon as the contractor has placed the material.

STAKING FOR CHEMICAL STABILIZATION

Staking of the subgrade to prepare for chemical stabilization requires more than a routine approach on the part of the contractor. Generally, offset grade stakes work reasonably well when set no further than 50 feet apart. It may also be necessary to set additional stakes out in the roadbed at transverse break points (as in super elevations) or when the roadbed is so wide as to make the transfer of grades from the shoulder offset stakes impractical or inaccurate.

The problem arises with the stakes set out in these locations because the traveling rotary pulverizing mixers, used to mix the chemicals with the roadbed material, destroy all stakes set in the roadbed. These grade stakes must then be reset to enable the grade to be brought into specification tolerances. Timing is critical in resetting these stakes, since the staking must follow closely behind the compaction operation and the entire stabilization process must be completed within specified time constraints.

STAKING FOR CHEMICAL STABILIZATION (CONT.)

It is suggested that the section engineer discuss staking procedures with the contractor in some detail. The section engineer should provide for grade checking to establish the accuracy of the contractor's work.

GRADE

A certain amount of swell in the subgrade is to be expected after the addition of lime or cement. Provisions are made to allow grade adjustments for stabilizer. To receive stabilization the subgrade will be placed 0.1 foot below finished subgrade elevation, in accordance with Section 204.03.10 (5).

Swell refers to an increase in volume and is caused by the introduction of additional material into a compacted subgrade. For instance, if 10 percent cement is added to a compacted subgrade 12 inches deep, it is not reasonable to expect this mixture to be compacted and restored to the same grades as before the cement was added. Another reason for swell is the chemical reaction between the subgrade material and the chemical additive. It is difficult to predict the amount of swell since it is influenced by many factors, such as the amount and type of chemicals being added, the depth of treatment, the type of subgrade material, etc. The Division of Structural Design's Geotechnical Branch can best advise on the amount of swell to expect after running required tests on the subgrade material. In the natural course of events, this information may not be available until after the subgrade is initially cut to grade, so grade adjustments may have to be made without this data.

On surfacing projects when the subgrade has been prepared under another contract, the subgrade should have been prepared using the target elevation discussed above if it is known that chemical stabilization is to be incorporated. If the grade is not prepared in this manner and chemical stabilization is to be used, consideration should be given to adjustments in the plan grades.

When a project includes grade, drain, and surfacing and the subgrade is to be chemically stabilized, subgrade elevations should be established on the low side of the plan grade (the **target** elevation discussed above) to allow for the possibility of swell.

Regardless of any adjustments, the subgrade must always be constructed to the cross section tolerances specified in Section 204.03.10 (6) of the Standard Specifications.

One procedure that shall never be used is to go back on a chemically stabilized grade after it has been finished and start trimming an otherwise acceptable subgrade in an effort to restore plan grade. If the discrepancy is so bad as to raise this consideration; consult with the district Project Delivery & Preservation Branch and the Division of Construction on corrective measures. Higher grade would eliminate wasting good subgrade.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Introduction

INTRODUCTION

This chapter furnishes instructions and procedures necessary in the construction of bituminous pavement of the plant-mix type regardless of gradation of aggregates, kind and quantity of bituminous material, or pavement use.

This guidance information details the methods employed, equipment used, and inspection required to perform construction using bituminous mixtures on a prepared foundation. This information also meets the specific requirements of the contract and reasonably conforms with the lines, grades, thicknesses, and typical sections shown on the plans (or within the tolerances specified or established).

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Section Engineer Responsibilities

ASSIGNING PERSONNEL TO PAVING OPERATIONS

The section engineer (SE) should assign as a minimum the following personnel to each paving operation:

- One Paving Inspector
- One Ticket Taker (when available)

The contractor's operations may require two or more paving inspectors. One inspector should stay with each paving operation and additional inspectors may be necessary to aid in overseeing the operation. It may also be necessary to add additional ticket takers on projects where significant tonnage is laid each day.

Prior to starting each project, the SE needs to meet with the contractor's personnel and the inspectors to discuss all of the project's specifications and expectations so there will be no questions concerning the required final results.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject District Materials Engineer Responsibilities

DISTRICT MATERIALS ENGINEER (DME) RESPONSIBILITIES

The DME is generally responsible for materials testing, mix design, and plant approval and set-up. Refer to the *Materials Guidance Manual* for details of the DME's responsibilities.

The DME and the section engineer (SE) have overlapping responsibilities to a certain extent and should work closely together to achieve the best possible job. The single most critical factor of this cooperation is communication. The DME and the SE must keep each other up-to-date with the contractor's plans and the project's current situation to get the job done.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Initial Project Preparation

RESURFACING PROJECT

After receiving the plans (and/or proposal) and contract for a bituminous resurfacing project, the section engineer (SE) and assigned paving inspectors should read the specific requirements for the proposed construction. A prepavement meeting with the contractor should be scheduled for the proposed project covering the following topics:

- Careful examination of the condition of the existing surface should be made to determine where and how much leveling and wedging is needed to correct the typical section, grade, and areas where the pavement has deteriorated to the point that normal resurfacing does not correct (see **CST-1105**, "Wedging or Leveling Courses").

- The type of equipment should be discussed. If the roadway is 18 feet wide, the contractor should not expect to perform the work with a 10-foot paver without modifications. If a pavement wedge is required and the material is being placed monolithically, then the contractor should have a paver with a modified screed.

- The width needed to receive and accommodate the proposed overlay should be determined. Whenever possible, a constant width pavement should be maintained. It is also imperative that obstructions be dealt with appropriately. Obstructions can be delineated by signing, striping, or corrected by maintenance. Sudden changes to width should be avoided.

- Care should be taken to not increase drop off conditions. When the project contains the special note for pavement wedge, the material should be placed separately or with a paver that has a modified screed.

- The length of the project shall be checked against the project description in the contract.

- Any corrective work needed prior to construction that is not within the scope of the contract shall immediately be referred to the district project delivery and preservation office so any necessary repairs or corrections may be made before construction begins.

STAKING

The SE should send a staking party to the project to measure the proposed length and record the beginning and ending stations. Station stakes shall be:

- Set laterally outside the limits of construction at longitudinal intervals not to exceed 500 feet
- Used in proportioning and distributing quantities during the construction process
- Set in a conspicuous location, readily visible to the paving inspector

APPROACHES, ENTRANCES, & MAIL BOX TURNOUTS

These installations shall be constructed in accordance with the applicable version of Standard Drawing RPM 110. Deviations from the requirements in this Standard Drawing are not permitted without the concurrence of the Central Office, Division of Construction.

CHECKING QUANTITIES

From the field measurements, the SE or the paving inspector shall compute the gross square yards. Using the prescribed rate of application per square yard of bituminous base, binder, or surface as indicated in the plans or proposal, the total tons for the project shall be computed. Any significant differences between these calculated quantities and those set up in the contract shall be reported to the district Project Delivery and Preservation Branch as soon as possible so that quantities can be adjusted to achieve the desired design thickness.

Neither the SE nor the paving inspector have the authority to overrun the quantities on any bituminous concrete paving project without proper authorization, nor should the thickness of the mat be either decreased or increased from the specified depth without authorization. In addition, the width of the roadway shall not be changed without authorization.

PATCHING PROJECTS

In general, patching projects are similar to resurfacing projects and shall be treated similarly. The above procedures shall apply with suitable modifications for the peculiarities of a patching project. **Unless specified otherwise in the proposal, patching shall be full width. Patches in the center of the road, on one side, or of any partial width are not to be constructed.** Staking will be similar to resurfacing contracts.

Tack shall be applied at the rate prescribed in the proposal. The SE or a designated assistant shall ride the roads under contract, measure and stake the specific patch locations (beginning and ending), and calculate necessary quantities. Tack may be incidental to the bid price of the bituminous material; however, quantities shall be calculated for testing and accountability.

If additional pay quantities are needed, the SE shall consult with the district Project Delivery and Preservation Branch.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Wedging or Leveling Courses

SPECIFICATIONS

Leveling and wedging shall be done in accordance with Section 403 of the Standard Specifications.

RESURFACING

The contractor shall review existing pavements (specified to receive a wedging or leveling course) prior to an overlay. The contractor shall check the existing surface for:

- Bumps
- Sags
- Changes in Crown
- Rate of Superelevation

The contractor shall correct all detected irregularities, so far as possible and practical, by this wedging or leveling course in advance of the final surface course. The contractor shall be careful to not adversely affect the superelevation in the leveling process. It may be necessary to carry the course full width to maintain the proper superelevation.

Checking of the existing surface for irregularities can be done in a variety of ways. One way is to drive the roadway to be surfaced at various speeds noting places where corrective work is needed. These areas can then be stringlined or straightedged and marked with paint to indicate the extreme edges of the areas that require wedging.

ADJUSTING MANHOLES

When resurfacing municipal projects, it is difficult to anticipate final elevation of the riding surface until all leveling, wedging, and base courses have been completed. Because of this difficulty the division suggests not to attempt to preset manhole frames or other castings until this preliminary work has been substantially completed. Accordingly, they should be referenced, paved over, then dug out and adjusted just prior to placing the final surface course. This process eliminates any unsightly appearance of patching around the fixture in the finished surface course and minimizes rough spots.

PAYMENT FOR ADJUSTING MANHOLES

Payment for adjusting manholes shall be in accordance with Section 403.05.01 of the Standard Specifications. This specification prescribes the payment due for adjusting manholes if this work is not originally set up as a pay item. This work may or may not be originally set up as a pay item.

Prior to beginning work, the SE or project inspector needs to review the project paving limits on site and compare those findings to the project documents to determine the required use of this specification. If the project does not have an adjustment pay item set up on the project and the on-site project review shows that adjustments are necessary, the SE shall create a supplemental pay item.

The creation of a supplemental pay item requires a “Funding Line” added to the job for “Utility Reimbursable Costs,” followed by a “Change Order” using the new “Funding Line” to pay for “Adjust Manhole Masonry” and/or “Adjust Manhole Ring” depending on site requirements.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Tack Coat

GENERAL

The application of tack coats shall be in accordance with Section 406 of the Standard Specifications.

The tack coat increases the bond between the old and new surface and normally consists of an emulsified asphalt material to be applied at a specified rate per square yard on an existing surface. If the tack coat is too heavy, the tack may act as a lubricant between the two surfaces causing the mat to slip when rolled. If the tack coat is not adequate, the mat will not bond to the underlying course properly and may slip under the roller causing waving or map cracking of the mat being placed. In either case, subsequent raveling will occur and deterioration of the surface will eventually develop.

TRAFFIC

On projects where traffic must be maintained during the resurfacing operation, traffic should be stopped while applying tack to prevent spray from getting on vehicles. Traffic should be kept off a freshly tacked surface until the tack breaks, if at all possible, since tack is initially slick and may constitute a danger to a moving vehicle. Tack breaks quicker in the summer when the pavement is hot than it does in the spring or fall when it is cooler.

APPLYING TACK

The rate of tack needed to provide an adequate uniform coat depends on the condition of the existing surface to be tacked and the application rates specified in Section 406.03 of the Specifications and the contract. The contractor shall apply the tack coat well in advance of the paving operation to allow all water to evaporate before placement of the bituminous mat.

This chemical process is termed “Breaking” or “Setting.” The color of the tack will change to a dark brown color when it breaks. This breaking will occur a short time after application with the exact length of time depending on the ambient air and pavement temperatures.

Work should be planned so that no more tack coat than is necessary for the day's operation is placed on the surface. Tack may be washed off the pavement by a heavy rain and have to be replaced when the pavement is dry. Existing traffic and weather conditions may curtail the distance tack can be placed ahead of the paving operation.

APPLYING TACK (CONT.)

The contractor can use sand to protect traffic and structures within the project limits from the effects of the tack. This also assists in preventing excess tack from leaving the project.

ACCEPTANCE & PAYMENT

The paving inspector shall calculate and record the quantity of tack material used each day to determine if the required application rate is being met per the Standard Specification 406.03.03. Tack destroyed by rain or other unanticipated incidents is normally considered the contractor's responsibility.

The *Materials Field Sampling and Testing Manual* details procedures for accepting tack material. Refer to **CST-1107** under the side-heading "Prime Coats" for additional information.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Curing Seal

GENERAL

The application of curing seal shall be in accordance with Section 406 of the Standard Specifications. In general, bituminous curing seals are applied only to granular type bases that will receive an overlay of bituminous concrete surface or some type of seal coat. Bituminous curing seals:

- Penetrate and fill the voids of the granular base
- Key and cement the base aggregates together
- Form a moisture barrier
- Aid in preventing capillary attraction of water into the uppermost layer or layers of the surface structure

SURFACE PREPARATION

New projects that will receive an application of bituminous curing seal shall have a roadbed surface that is dense, free from loose extraneous material, and sufficient in moisture content to prevent penetration of the asphalt material. The roadway shall be shaped at least 6 inches beyond the edges of the proposed bituminous overlay.

CURING SEAL APPLICATION

Curing seal shall not be applied until the grade has been inspected and approved by the section engineer (SE) or the paving inspector.

The SE or the paving inspector should compute the surface area to be sealed. In this computation, the curing seal shall be at least 6 inches wider than the normal surface width to ensure that all the areas underneath the pavement have an application of seal coat. The gross area to be sealed also includes the areas involved in curve widenings, road approaches, and entranceways. The total gallons necessary to seal coat the project shall be computed using the specified rate of application per square yard indicated in the Standard Specification 406.03.03 (C).

Before the curing seal's application, the length of the spray bar shall be adjusted to conform to the width of application being made without overlapping. It is good practice during the sealing operation to seal the normal roadway width first, then go back and seal curve widenings, road approaches, and entranceways. At the time of application, the temperature of seal material shall be within the range indicated in Section 406.03.03 of the Standard Specifications.

CURING SEAL APPLICATION (CONT.)

Under extreme dry and dusty conditions and prior to the seal treatment, a light application of water may be applied uniformly to the area to be sealed. This prevents the seal material from collecting in balls and, as the water percolates into the voids of the granular base, causes the seal to be molecularly attracted, resulting in better penetration.

The curing seal shall be allowed to cure before being covered by the bituminous course unless otherwise approved by the SE. The contractor shall protect and maintain the curing seal against damage. All damaged areas must be repaired before being covered by the next bituminous course. The contractor shall provide all necessary barricades, warning signs, and flagmen to ensure the safety of the traveling public, and shall further provide for the public convenience and safety as specified in Section 107 of the Standard Specifications. All traffic control, for the traveling public and public convenience shall be included in the projects pay item “Maintain and Control Traffic.”

PRIME COATS

Prime coats are applied the same manner as curing seal, only the rates change. Prime coats should be applied in accordance with section 406 of the Standard Specifications.

The prime coat shall be allowed to cure before covering with bituminous asphalt unless otherwise approved by the SE. This can cause traffic problems since most of the routes that this process affects are narrow gravel roadways.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Weighing & Verification

POLICY

Every shipment of liquid asphalt material to the project shall be accompanied by the Certified Weight Ticket ("Green Sheet") from the supplier in accordance with procedures prescribed in the *Materials Field Sampling and Testing Manual*. The paving inspector must collect these documents to be included with project sampling and the section engineer's file for each operation.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Preparation for Placing Bituminous Mixtures

EQUIPMENT CHECK

Before beginning bituminous paving operations, the section engineer (SE) or paving inspector should visually check the paver, distributor, and rollers. Any apparent violations of the specifications shall be brought into compliance before work starts. Once work is underway, any piece of equipment failing to perform satisfactorily, in the judgment of the SE or the paving inspector, shall be replaced or parked until the situation is corrected.

It is not the responsibility of the SE or inspector to determine what is wrong with a piece of equipment, why it won't perform satisfactorily, or what it will take to repair it. This information should, however, be available from the contractor and should be documented in the inspector's daily work report and project diary.

FINAL BASE CHECK

On aggregate bases carrying traffic, chuck holes and raveled areas frequently develop in the sub-base between the time it is shaped and primed and the bituminous mat is placed. If the damage to the prime is extensive, the contractor may have to reshape and reprime. In most cases, however, the contractor can satisfactorily restore the base by filling holes and raveled areas with the mixture and compacting with the roller in advance of the paving operation.

The maintenance of the prime coat is the responsibility of the contractor and any material used to fill holes and raveled areas in lieu of repriming shall be deducted from the final pay quantity.

On resurfacing projects, the inspector should make a visual check of the tack coat application. The contractor shall remove excess material or cover it with a blotter course of dry sand to prevent excessive tack from bleeding through the asphalt mat.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Placing Bituminous Mixtures

PAVING OPERATION The Cabinet recommends the following guidelines when placing bituminous mixtures.

- When the paving machine is positioned on the roadway to be paved, the screed should be lowered onto blocks of the same thickness as the loose mat to be placed and the thickness screws nulled (adjusted).
- If starting from a previously laid mat, blocks of the same thickness as the difference between the loose and compacted mats should be used.
- The screed heater should be turned on and the screed heated to near the temperature of the mixture being placed.
- A guide such as a stringline should be set in a location to be easily visible from the operator's position on the paver.

  Note: This guide will normally be set well out in front of the paver operation and it should be checked and approved by the paving inspector early on so as to not interfere with the paving operation.
- As soon as the screed has been heated to the desired temperature, or to a temperature that will lay the mixture without undue tearing of the surface, operations may begin.
- If operations begin at a transverse joint of a previously placed mat, the paver should be allowed to travel only a short distance and stopped until the joint has been made, rolled, and straightedged by the use of a 10-foot (or 3-meter) straightedge furnished by the contractor.

  Note: As soon as the joint has been made and straightedged, paving operations should be resumed.
- If segregation, tearing of the mat surface, or an uneven mat thickness is evident, the paver should be stopped immediately and should not resume until the cause is determined and corrected.

  Note: It may be necessary to continue to run while adjustments are made but this should not continue indefinitely.

PAVING OPERATION (CONT.)

- Handwork behind the paver should be held to the absolute minimum. Prior to placement, all necessary adjustments should be made to the paver and the mixture that would prevent excessive handwork.

  Note: The workers handling the rakes or lutes should watch for a crooked edge of the mat and make corrections by cutting away and discarding material, or filling indents with material from the hopper.

  Note: If trucks are properly manipulated and the operator follows the preset guideline edge, corrections of the mat should not be necessary.

RIDE QUALITY

The section engineer (SE) and the contractor shall thoroughly discuss the topics raised in Section 410, "Asphalt Pavement Ride Quality" of the Standard Specifications at the preconstruction conference including:

- Electronic Controls
- Paver Speeds
- Roller Patterns
- Longitudinal and Transverse Joints
- Material Delivery

When the project is ready for testing, the SE or the district Project Delivery and Preservation Branch will submit TC 63-43 form, *Request for Rideability Test* (**Exhibit 9035**) to the Director, Division of Construction to request a rideability test. The Director of the Division of Construction will endorse this request to the Pavement Branch of the Division of Maintenance and the project will be scheduled for testing. Normally, this request is made when the contractor and the SE jointly agree the project is ready for testing. For all practical purposes, a project is considered ready for testing when the pavement to be tested is complete.

Note: This does not imply that the entire project has to be complete (or even the shoulders since they are not involved in the testing).

The contractor shall keep the lanes to be tested free from interference as far as the testing vehicle is concerned. It is also suggested that the contractor sweep the lanes and clear them of debris before these test runs are made. Such work normally enhances the test results.

It is very desirable (on the part of the Cabinet) that the contractor strives to achieve the best possible ride.

The following may help to achieve the best possible ride:

- Generally when a paver must use a ski, it should use at least a 50-foot ski (or an electronic equivalent) for sensor control. The longer the ski, the smoother the pavement since it bridges small irregularities.

RIDE QUALITY (CONT.)

- On new construction, the subgrade may be cut to grade with an autograde machine (such as a CMI™) sensing off a graded reference line or using GPS surveying. In this situation, a bituminous paver, in good working order, would need only the ski discussed above and good slope control to achieve high quality work.

  The contractor can obtain better results by cutting the subgrade wide enough to accommodate a ski arrangement on both sides of the bituminous paving machine. In the two-ski arrangement, the automatic slope control would be unnecessary as the skis would provide the proper slope on tangent and superelevated sections.

- When the subgrade is prepared by graders, the best chance of consistently achieving high quality rideability on new construction is obtained by running the paver on a graded reference line. At a minimum, the first two courses should be laid using the reference line and the remaining courses laid using the 50-foot ski arrangement.

CONTINUITY OF OPERATIONS

An essential of good paving operations is the uniform continuity of operation. Good riding qualities are easier to obtain in a continuous operation than in a stop-start operation. Quality and rideability suffers when the paver must stop frequently.

If there is an appreciable delay in paver operations, it is good practice to run all the material out of the hopper and stop the paver just as the feed screws begin to run out of material. Before starting the paver again, sufficient hot material should be augured back to the screed, and the paver should be allowed to stand until the material already laid in front of the screed has warmed. If the duration of the delay is such that the mix will completely cool out, a transverse joint should be made.

The paver should be adjusted to the speed providing the best results for the type of mixture used and that coordinates satisfactorily with the rate of material delivery to the paver to provide a uniform rate of placement (without intermittent operation of the paver). This also applies when using a material transfer vehicle (MTV) to supply asphalt mix to the paver.

Transporting vehicles should be held against the paver to prevent bumping and spillage of material in front of the tracks or tires. Any spillage should be cleaned, especially in front of tracks or tires, to prevent the formation of a bump in the mat. Trucks should not be used to pull the paver. For successful operations, manipulation of thickness controls should be held to the very minimum. Quick and repetitive movement of the toe points to control thickness should be avoided. Moving parts of the machine should be operated at the recommended speeds.

RECORD KEEPING

During the day's operation, the inspector or a helper should:

- Take the temperature of the mix as it is delivered and record it in the Daily Work Report
- Take frequent depth measurements to ensure that the design thickness is being maintained
- Check the amount of material placed against a theoretical tonnage for the same area

  Note: Required tonnage should be determined by actual roadway measurements and not by proposal quantity.

- Notify the SE if proposal quantity is insufficient
- If a load of material is rejected, write the word "VOID" and the reason for the rejection on front of the white ticket and deduct the amount from the accepted pay quantity
- Document voided load information and the reason for deduction in the Daily Work Report for easier reference
- Perform a constant check of the yield to reduce the possibility of a significant overrun or underrun and to serve as an indicator of other problems (such as poor or inaccurate slope control, out of typical, or paver malfunction)

  Note: The yield check is considered a critical part of the inspector's job and it must be maintained in an accurate and current manner.

- Record the day's total on the Daily Work Report maintained in Trnsport – SiteManager.

COMPACTION

Rollers shall meet the requirements of Section 403.02.08 of the Standard Specifications. Procedures for rolling shall be as stipulated in Section 403.03.10.

DENSITY

The object of rolling a bituminous pavement is to:

- Produce a good smooth riding surface
- Obtain a high degree of density and a very tightly knit surface—an essential to the durability of the bituminous mat

The density of the pavement is tested according to Section 402 of the Standard Specifications. When cores are taken, they must be marked after compaction is complete at random locations. The coring operation shall be done in the presence of Cabinet personnel. The Cabinet personnel must maintain custody of the cores until the density testing is performed. Every precaution should be taken to handle the cores according to the applicable Kentucky Methods mentioned in Section 402 of the Specifications. The cores shall be protected from extreme temperatures and moisture. Further guidance concerning Asphalt Density Cores can be found in Construction Memo number 04-07 (**Exhibit 9071**).

INSPECTION

The SE shall impress upon the inspector the necessity of a close and continual observance of the rolling operation. The inspector should have a thorough knowledge of the applicable specifications and be well briefed on the different types of rollers and their uses and limitations.

TIMING

The timing of breakdown rolling, intermediate rolling, and final rolling primarily depends on the temperature of the mat which, in turn, varies with the:

- Gradation of the aggregate
- Inherent stability of the mix
- Type and condition of foundation
- Atmospheric conditions at the time of placing

Past experience, both on the part of the paving inspector and the contractor's personnel may be combined with a limited amount of experimentation to determine the best procedure to obtain the desired results. In all cases, the breakdown roller should be kept as close behind the paver as possible without inflicting damage to the mat.

FAILURE TO PERFORM

Failure of a roller to perform satisfactorily is grounds for removing the roller from operation until it is repaired. Depending on the severity and timing of the malfunction, the contractor may be allowed to finish the day's run with the roller.

If the riding quality is being adversely affected or other ill effects are noticeable, the roller should be removed from the operation even if it means suspending the operation for lack of a replacement.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Joints

GENERAL

Joints shall be constructed as directed by Section 403.03.07 of the Standard Specifications. The subject of joints includes:

- Longitudinal joints
- Transverse joints
- Joints between an asphalt surface and a Portland cement concrete slab
- Joints between a concrete curb and gutter

STAGGERED JOINTS

One of the most critical aspects in the construction of a joint as related to a long life and good service of the bituminous pavement is the staggering or offsetting of joints (transverse and longitudinal).

Longitudinal joints shall be placed according to Section 403.03.07 of the Standard Specifications. On all projects the contractor shall take care to offset the joint from true centerline so that pavement markers and striping are not placed on the joint. Striping crews shall not stripe the centerline in an offset position. Offsetting the joint allows for joint sealing and helps to keep raised pavement markers in place.

On new construction and resurfacing projects, transverse joints shall be offset with relation to a joint established in a preceding layer at a minimum of 10 feet (or 3 meters). Transverse joints resulting from adjacent courses of bituminous material shall be located a minimum of 100 feet (or 30 meters) apart.

LONGITUDINAL JOINTS

On longitudinal joints, a high degree of density shall be obtained in the pavement or against a curb and gutter. If insufficient material is placed above the level of a previously compacted lane to allow for compaction of the mat being placed, the roller will be supported by the previously placed mat and the material, for a short distance from the joint, will not be adequately compacted.

Ideally, the surface on either side of the joint should match perfectly after rolling, but it would be much better to have slight surplus of material and a slightly higher elevation of the lane being placed, thereby ensuring the desired density, than to obtain an absolutely smooth transition from lane to lane with subsequent raveling.

LONGITUDINAL JOINTS (CONT.)

By observation, it can be determined how much the mat will be compressed when rolled. The mat being placed should be of such a thickness that it will be flush with the elevation of the previously compacted lane after compaction.

To properly construct a longitudinal joint, the paver screed should overlap the previous compacted lane by 1 to 2 inches and should leave the material higher than the previous compacted pass by the amount of consolidation being obtained under final rolling.

TRANSVERSE JOINTS

Transverse joints should be held to the minimum in any pavement structure. When it becomes necessary to make a transverse joint, the division recommends the following procedure:

1. The paving machine should be stopped when all material is emptied from the hopper and a roll of approximately 500 pounds of material is left in front of the screed.

   Note: The paver should be stopped at this time because the mat thickness will decrease due to the weight of the screed as the material tends to run out.

2. The screed should be lifted and the paver moved off the roadway.

3. Workmen using smooth blade shovels should then cut a straight line transversely for the full depth of the mat and to a width of 18 inches or more in the area the screed stopped.

   Note: For best results, the vertical face should be at right angles to the lane or roadway.

4. A piece of oil paper, canvas, or other suitable material should be laid to cover the full length of the joint. This provides an unbonded joint over the vertical face.

5. Using a portion of the excess bituminous material, a temporary ramp is then constructed for the full width of the mat to provide a smooth transition from the mat to the original surface.

   Note: Any unused excess material is then discarded.

6. The roller should roll the joint as soon as possible using the same pattern of rolling as used in the mat.

7. When proceeding from the joint, the paver should be positioned so that the leading edge of the screed is slightly behind the joint and supported on the cold mat by wooden or metal blocks.

   Note: The wood or metal blocking should have a thickness equal to the amount of consolidation expected after compaction.

8. The screed should be heated, and the distributing screw box filled with hot material (to the normal operating level) before starting to pave away from the joint.

TRANSVERSE JOINTS (CONT.)

In all instances, transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth riding surface. A rough joint in the base may affect the riding qualities of the surface. The joint should be straightedged for smoothness while it is hot and material added or removed as necessary to provide an unnoticeable joint in the finished surface.

When adding or removing material after the joint is rolled, the high or low area should be loosened with a rake to a depth of approximately one-half inch and the necessary material added or removed and rerolled.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Bituminous Indented Rumble Strips

OVERVIEW

Bituminous indented rumble strips are a significant safety enhancement and the section engineer and the contractor shall ensure that they are constructed properly. The procedure outlined below is developed around the equipment most frequently used for this purpose; however, it is not the only equipment used and variances of this procedure may prove just as effective. The requirements of roller timing, roller weight, proper alignment, correct depth and spacing, and minimal distortion are all important factors and should be monitored closely regardless of the equipment.

EQUIPMENT

A steel wheel tandem roller should be used for this purpose. Metal strips of the required configuration should be welded to the drive wheel of the roller. The strips should be attached symmetrically about the center of the drive wheel and spaced to produce the required intervals of the indentions.

This construction task can be accomplished through other equipment configurations. If the contractor chooses to utilize an alternate equipment configuration, the section engineer shall first observe and approve the effectiveness of the apparatus before its operation can continue.

The roller should be equipped with a guide to uniformly maintain the required distance of rumble strips from the edge of the travel way. The roller must be in good mechanical condition and equipped with a good watering system to ensure wheels are kept wet—particularly the wheel with the indention strips.

CONSTRUCTION PROCEDURE

As in any bituminous paving operation, the breakdown roller should follow as close behind the paving machine as practical to pinch and seal the joint adjacent to the previous mat. The breakdown roller should make one complete pass over the mat before the rumble strip operation begins.

The rumble strip operation should commence when the mix temperature is between 155° F and 165° F (68° C and 74° C). If the mix is too hot, the material will adhere to the indention strips and, if it is too cold, the area around the indention strips will be torn and the depth of the rumble could be too shallow.

CONSTRUCTION PROCEDURE (CONT.)

The roller should be operated at about the same speed as the paving machine—about 80 to 100 feet (24 to 30 meters) a minute. The roller has time to press the contact strip firmly into the mat at this speed. If the roller is operated too fast, it will maintain a jumping, clawing rhythm and leave distorted indentions.

The roller should always be operated with the idle, or guide wheel forward. The operator should set the guide so as to uniformly maintain the required distance from the edge of the travel way.

The finish roller should not roll onto or over the indention strips except to correct distorted indentions.

Note: A three-wheel roller is not good for this operation. The guide wheel runs on the break between the pavement and the shoulder and it is hard to steer and maintain a uniform distance from travel way. The indention strips also have to be put on the pulling wheel leading to deeper indentions on the high side and lesser indentions on the outside because of the weight.

If an oversight occurs and required rumble strips are not rolled in, the rumble strips shall be installed by sawing as specified in Section 403.03.08 in the Standard Specifications. **There will be no consideration for elimination of the rumble strips.**

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Asphalt Mixing Plants

OVERVIEW

ASTM D995 provides some general descriptions of various types of asphalt mixing plants. Generally, two types of plant operations are used in Kentucky:

- **Batch plant**—Aggregates are proportioned by weight in a hopper and the asphalt material is proportioned by weight or volume.
- **Dryer drum plant**—Aggregates are proportioned by weight over calibrated belt scales and the asphalt liquid is added by weight by calibration of the asphalt pump.

Each plant type shall conform to Section 401 of the Standard Specifications.

QUALITY CONTROL PLAN (QCP)

Prior to beginning the construction season, the contractor shall submit a TC 64-418 form, *Contractor's Quality Control Plan/Checklist* to the appropriate district materials engineer (DME) for approval for each plant in accordance with **KM 64-426**, *Requirements for Process-Control Testing and Inspection of Asphalt Mixtures by the Contractor*. This document outlines the sampling, process-control, inspection, and the anticipated frequencies of each.

AGGREGATE STOCKPILES

Aggregate stockpiles shall be provided and maintained in accordance with Section 401.02.01 of the Standard Specifications. The contractor shall maintain and check aggregate stockpiles as part of the process control responsibilities outlined in KM 64-426.

ASPHALT PLANT INSPECTION

Asphalt mixing plant inspection must comply with Section 401 of the Standard Specifications. Plant setup and quality control inspection shall comply with Section 402 of the Standard Specifications. The DME normally oversees these activities. The following personnel are involved in bituminous plant setup and quality control inspection. The duties and responsibilities of these individuals are explained in Section 402 of the Standard Specifications, KM 64-426, **MAT-303**, "Asphalt Mixtures Testing Section" of the *Materials Guidance Manual*, and in **MFS-300** chapter, "Asphalt Mixtures" in the *Materials Field Sampling Manual*.

SUPERPAVE PLANT TECHNOLOGIST (SPT)

The contractor shall provide a qualified SPT to be present during production and to perform the daily inspection, process control, and acceptance testing at the plant site. The DME or section engineer (SE) will provide a qualified SPT who shall:

- Verify the contractor's acceptance test (one sublot per lot)
- Perform acceptance testing of density cores for compaction Option A mixtures (four mainline cores for each type of mixture and two joint cores for surface mixtures per sublot)

SUPERPAVE MIX DESIGN TECHNOLOGIST (SMDT)

The contractor shall provide a SMDT to be responsible for the submission of all mix designs and making adjustments to the mixture during production.

The Cabinet shall use a qualified SMDT for approval of all mix designs.

FIELD LABORATORY

The contractor shall furnish and maintain a field laboratory according to Section 106.03.02 of the Standard Specifications. The laboratory must be inspected and qualified according to the Department's Quality Assurance Program for Materials Testing and Acceptance and meet the minimum requirements as outlined in Section 401.02.01 of the Standard Specifications. The laboratory shall be equipped with all the required equipment necessary for the plant inspector to accurately perform the testing required by the Standard Specifications. The contractor's SPT shall be equipped with:

- Copy of the job-mix formula
- Project proposal
- Standard Specifications
- Computer to record and submit test data on the Asphalt Mixtures Acceptance Workbook (AMAW)

NECESSARY TESTS

The contractor shall:

- Notify the SE of the intent to start a minimum of 24 hours before beginning production
- Furnish the facilities, equipment, personnel, and other resources needed to comply with **KM 64-426** and **KM 64-435**
- Provide a Quality Control Plan (QCP) to the SE
- Complete the setup duties of **KM 64-421**
- Prepare and submit two hand-mixed gravities to the SE before the start of the second day of production

NECESSARY TESTS (CONT.)

After the setup period, the contractor's SPT shall perform the process control operations of KM 64-426 and enter the test data into the AMAW. The SE or the DME shall provide a qualified SPT or SMDT to verify the contractor's acceptance test (one sublot per lot) according to KM 64-435 and enter the verification data into the AMAW.

ADDITIONAL RESPONSIBILITIES

The Department's qualified SPT or SMDT shall witness the contractor obtain a PG binder sample at the required frequency as outlined in the *Materials Field Sampling Manual* or in SiteManager Materials. The SE shall submit the samples to the Central Office Division of Materials along with the bill of lading and certification.

The DME or the SE shall obtain the Excel spreadsheet from the contractor within five working days of the completion of each lot of material and assign a SiteManager ID and upload the spreadsheet into SiteManager.

SECTION ENGINEER RESPONSIBILITIES

The SE has direct authority over the preparation and operation of an asphalt plant within the limits imposed by the Standard Specifications with respect to materials being produced or about to be produced for an assigned project. This definition of authority is not meant to preclude or intrude upon the responsibilities of the DME. The DME is charged with certain authority and responsibilities regarding an asphalt plant producing material for state use—the execution of which are vital to the welfare of the project.

The SE and DME should be aware that when the DME is operating under the authority of a project number, he or she is operating under the authority of the SE who has been assigned the project responsibility. In the final analysis, the SE must stand responsible for the end results.

Good communication and cooperation between the SE and DME is extremely important to the proper operation of bituminous plants and to the entire project. Each office shall see that the other is properly notified of project-related activity in a prompt and timely manner.

The DME must be fully aware of the documentation and testing procedures required to establish the plant as an approved source of material and to operate on a daily basis. The DME must check to see that such tests are run and that adequate documentation is received by his or her office.

WEIGHING & VERIFICATION

The asphalt mixture shall be weighed at the mixing plant. The scales at the asphalt mixing plant must comply with Section 401.02 of the Standard Specifications. The scales for weighing the mixture shall be checked and given a certificate of accuracy prior to the start of the construction season and shall be rechecked periodically as specified in Section 109.01.02 of the Standard Specifications. The method for the weighing of materials shall be as specified in Section 109.01 of the Standard Specifications.

HAULING EQUIPMENT The SE or DME shall inspect and approve all hauling equipment. Trucks failing to meet the requirements of Section 403.02.06 of the Standard Specifications shall not be used on the project.

	Chapter BITUMINOUS CONCRETE PAVEMENT
	Subject Bituminous Pavers

OVERVIEW

Many types of pavers are used in placing bituminous concrete pavements. Some of the new modern pavers are extremely sophisticated; however, all known pavers meeting the requirements of Section 403.02.07 of the Standard Specifications which are in good operating condition can produce satisfactory results.

Note: This specification requires that the augur and vibrator operate the full width of the screed.

Before placing bituminous mixture with the paver, the inspector should become familiar with accepted practices of the operation of the particular paving machine to be used and with the principles of its nomenclature. Handbooks of the various details and operating instructions are usually obtainable from the contractor or the manufacturer.

Cooperation between the paving inspector and the contractor's foreman or superintendent usually results in a better understanding of the equipment functions and a better finished product.

It is not the responsibility of either the section engineer (SE) or the paving inspector to make actual adjustments of a bituminous paver. Paver adjustments are the responsibility of the contractor and shall be so requested, when necessary. It is, however, the responsibility of the SE and the paving inspector to be thoroughly familiar with the paver being used, its adjustments, and the reaction to these adjustments. This knowledge will contribute substantially toward obtaining the best possible bituminous surface.

PAVER CHARACTERISTICS

Three brands of pavers are used most frequently in Kentucky:

- Barber Green
- Cedar Rapids
- Blaw Knox

Some characteristics and principles are common to several of the machines and will be discussed, followed by an outline of the differences and adjustments peculiar to each individual machine.

PAVER CHARACTERISTICS (CONT.)

All machines consist of two basic units:

- Tractor unit (which includes the receiving hopper, distributing screws, power plant, and controls)
- Screed unit (which strikes off the mixture, provides the initial compaction, and includes screed heaters, thickness controls, and crown controls)

MOBILITY

Pneumatic-tired rollers or crawlers provide the mobility for all machines. The crawler-mounted unit should be checked prior to paving operations to see if the crawlers are snug but not tight. If they are too loose, the sprockets (on which the crawlers are mounted) can climb the crawlers with a rhythmic, bumping movement. This movement is reflected to the screed, which in turn causes a ripple effect in the surface of the pavement. In the pneumatic-tired equipment, tire pressure should be checked and inflated to the pressure specified by the manufacturer.

SCREED UNIT

The screed unit of all machines is towed by long arms attached to pivot points located forward on the tractor unit. This permits the screed to operate on a floating principle that tends to compensate for irregularities in the base that affect the tractor unit.

The method of adjusting the mat thickness and the distance in which the change takes place differs somewhat between the various machines.

- On the Cedar Rapids and the Barber Green machines, the screed seeks a level such that the bottom of the screed is parallel to the direction to pull, and adjustments in the thickness of the course being placed are made by tilting the screed up or down around the pivot pin just above the screed.
- On the Blaw Knox machine, the connection between the screed and the arm attached to the tractor unit is rigid. The tilt of the screed is changed by raising or lowering the pivot point of the arm at the tractor unit.

Although the method of effecting the change in thickness is different, it is conceivable that the principle is the same. The screed is supported by the mat being placed. Since it is free to float, it is therefore possible to make an immediate change in thickness while the machine is either idle or moving.

When the thickness controls are adjusted, the screed seeks a new level (up or down) when the machine moves forward, yet the total effect of the change may not be realized until the machine has moved several feet (or meters). Therefore, the machine should be allowed to move at least 15 feet (5 meters) before subsequent changes are made.

SCREED UNIT (CONT.) The sensitivity of the controls differs widely between machines and the maximum amount of adjustment that should be made at any time varies with each machine. The amount of change in thickness that will be produced by any given adjustment in the controls depends on the mixture being placed, so it's impossible to say that a particular adjustment will change the mat thickness a definite amount. General guidelines for each machine include:

- In the Barber Green paver, approximately 2 1/2 turns of the thickness control will change the mat thickness approximately 1 inch (25 mm). Accordingly, the maximum adjustment at any one time should be limited to approximately 1/4 inch (6 mm).

- In the Blaw Knox paver, approximately eight turns of the thickness control handle will produce a change of 1 inch (25 mm) in mat thickness, so approximately one turn could be permitted at any one time.

- The thickness control on the Cedar Rapids machine is much more sensitive, and control adjustments should be limited to only one notch of the control handle at any one time.

FLOW CONTROL GATES

All paving machines have adjustable flow control gates that regulate the amount of mixture carried from the receiving hopper to the distributing augers. They should be set to keep the augers at least two-thirds covered with material when the slat feeders are operated 80 to 90 percent while the paver is in motion. In all cases the feed should be set to accommodate the mat thickness and should never be set to the extent that the material in front of the screed will intermittently rise and fall. Flooding and starving the screed produces a rough, segregated texture and imperfections in the finished surface.

Most modern pavers are equipped with automatic devices that control the flow of material to the screed. The adjustment of the sensing device and the flow gates should be so coordinated that the feeders operate most of the time.

All machines have provisions for adjustment of crown in the screed. It is usually desirable to provide a slight amount of crown in the screed to avoid the appearance of the mat being low in the center of the lane being paved. Usually the crown allowed on rural type pavements is 1/8 inch (3 mm); however, urban cross-slopes may require special adjustments as directed by the SE. The crown at the front edge of the screed should be 1/16 inch (1.6 mm) higher than the back. This differential may vary with the type of material being placed, but is usually helpful in improving surface texture across the paved width.

INITIAL COMPACTION & STRIKE-OFF

With the Barber Green machine, initial compaction is obtained by a tamping bar that also strikes off the material for the screed. The tamping bar moves up and down 1,200 to 1,500 times per minute, the vertical travel being 1/8 inch (3 mm) for each stroke. The limits of vertical travel of the tamper bar is a very important paver adjustment and greatly influences the appearance of the finished surface. The horizontal face of the tamper bar should extend 1/64 inch (.4 mm) below the bottom of the screed plate at the bottom of the vertical stroke. If the tamper bar comes down too far, or not far enough, the resulting effect may be a scuffed or open-textured surface. The tamper bar is beveled on the front face reducing the width of the bottom edge to 1/4 inch (6.4 mm). The bottom edge strikes off the material so the screed can ride over it. The beveled front face of the tamper primarily compacts the mixture as the paver moves forward.

The tamper gradually wears with use and will eventually develop a knife edge. When this occurs, the same type of surface imperfections will appear as described above. When the bottom edge of the tamper bar wears to approximately one-half of its original thickness, it should be replaced. Screed plates should be checked frequently. The plate usually wears out first at approximately 4 to 6 inches (100 to 150 mm) from the trailing edge. The first indication will be either a concave undulation or actual ripples in the surface of the plate. When the screed has been extended they should be checked for proper bolting and that they form a true extension of the tamper bar and the screed plate.

Some Barber Green pavers are mounted on rubber (rather than tracks) and some are equipped with a vibratory screed (rather than tamper bars/leveling screed combination).

Much of the foregoing discussion of the adjustments and features of the Barber Green paver also applies to the Blaw Knox machine. Initial compaction is accomplished by a tamping bar, but it is in two sections. The vertical travel is 3/8 inch (9.5 mm) per stroke, and the lower limits of travel should be 1/64 inch (.4 mm) below the screed plate. Clearance between the tamper and the screed should be five to ten thousands of an inch. The tamper is provided with a two-speed transmission. The slower speed is recommended for paving speeds of up to 28 feet (8.5 meters) per minute; higher paving speeds require the higher tamping speed. On the Blaw Knox machine, the height of the distributing augers is also adjustable. The height can be varied to produce the best results with the material being placed, but generally 5 inches above the existing surface will produce satisfactory results.

It is important that the tires on the Blaw Knox paver be maintained at a uniform pressure for all tires. The manufacturer recommends a minimum of 35 psi (241 kPa) when hydro-inflated and 90 psi (621 kPa) when only air is used.

INITIAL COMPACTION & STRIKE-OFF (CONT.)

The Cedar Rapids machine differs from those previously mentioned in that the screed itself strikes off the material and provides the initial compaction by means of four electronic vibrators. The intensity of vibration for each of the vibrators may be controlled by adjustment of individual rheostats. Normally, the rheostats are set at about one-fourth open to start and adjusted for best appearance of the mat.

AUTOMATIC SCREED CONTROL

Section 403.02.07 of the Standard Specifications requires that all bituminous concrete pavers be equipped with automatic screed controls with sensors, and defines the limits whereby implementation of these electronic controls are optional or mandatory.

ADJUSTING GRADE & CROSS-SLOPE

Automatic screed control devices are designed to maintain desired grade and cross-slope automatically by raising or lowering the pivot point of the screed arms to control the screed angle of attack. The elevation is indexed from a reference independent of the tractor unit of the paver, which may be stringline, a traveling ski, or a matching shoe on the previously compacted surface, or uncompacted surface when pavers are operated in tandem.

PRIMARY COMPONENTS

The five main components of an automatic screed control are the sensor, pendulum, control box, command panel, and electric motors to activate cylinders to change the screed tilt, automatically compensating for irregularities in the roadway surface. Automatic screed controls were designed to:

- Improve smoothness of horizontal alignments
- Prevent sway in the typical cross-section

The sensor gets its information from a sensing device riding on a grade reference which may be a ski-like arrangement or a shoe riding on the grade itself. The type of external reference to be used depends upon the existing surface and the desired end results. If the existing surface does not provide the desired riding quality or if it is desired to pave to a predetermined profile grade, an effective stringline or ski-like arrangement is required.

The ski-like arrangement for some pavers is of the hinge type with a spring-loaded equalizing line, while others are of the equalizing pressure type. A 20 to 30-foot ski is usually desirable where sharp vertical curves exist in the roadway profile, while a 4-foot ski would be most preferable on flat profiles.

Note: The paver will only lay to the accuracy of the reference and will not correct any errors in the reference.

PRIMARY COMPONENTS (CONT.) The matching shoe is designed to match a previously laid compacted or uncompacted mat, and can also be used effectively in conjunction with a ski to match a gutter grade (when slope control is not specified) providing the gutter grade is satisfactory.

ADJUSTMENTS An automatic screed control system may be operated in manual, semi-automatic, or fully automatic position.

In the manual position, the mat thickness is controlled with the thickness control screws, as with any conventional machine.

In the semi-automatic position, one side of the screed is controlled by the system.

In the fully automatic position, both sides of the screed are controlled by the system and the thickness screws are not used to change mat thickness.

Once the operation begins, adjustment in mat thickness, if necessary, should be made with the sensor control screws. Adjustments can be made with the grade control knob on the command panel, but this is not as easy and convenient as using the sensor control screws. The manual screed controls should not be used for adjustments in mat thickness when the screed is set in the full automatic position.

	Chapter JOINTED PLAIN CONCRETE PAVEMENT
	Subject Introduction

INTRODUCTION

Jointed Plain Concrete Pavement (JPC) has the advantages of having high strength and durability. However, without close supervision by qualified inspectors, these advantages can be greatly compromised. The section engineer (SE) should assign sufficient, reliable, and knowledgeable inspectors to this operation and arrange his or her schedule to spend as much time as possible at the job site.

In order to plan for the inspection needed and to avoid future problems after the project begins, the SE needs to become familiar with the plans, proposal, standard drawings, and specifications for this operation. Section 501 of the Standard Specifications addresses this type of construction in detail.

	Section MATERIAL REQUIREMENTS
	Subject General

GENERAL

The section engineer (SE) is responsible for submitting all samples used in JPC construction to the district materials laboratory for testing and approval unless otherwise specifically directed. Therefore, the SE needs to be familiar with the requirements of this manual, the current *Standard Specifications for Road and Bridge Construction*, the *Materials Field Sampling and Testing Manual*, the *Precast/Prestressed Concrete Manual*, and the requirements of the plans and proposal.

The SE shall accurately maintain his or her files and records so representatives of the Cabinet or the FHWA can easily review them for any information potentially needed in connection with the contract. The SE needs to make certain that his or her files contain approved copies of test reports covering all materials used.

Sampling at the jobsite or concrete plant includes, but is not limited to:

- Load transfer assemblies
- Longitudinal joint tie bars
- Transverse construction joint tie bars
- Sawed expansion and contraction joint materials
- Curing compound
- Air entraining agents
- Bond breakers
- Admixtures
- Cement samples
- Mineral admixtures

	Section MATERIAL REQUIREMENTS
	Subject Aggregates

OVERVIEW

Fine and coarse aggregates shall be furnished, stockpiled, and handled on the job or at the concrete plant so that uniformity of grading and free moisture content at the time of batching will be maintained. Watering or sprinkling of the stockpiles may be necessary for consistency and to keep the aggregate from pulling moisture needed for hydration away from the cement, particularly in hot weather and when new materials are added to the stockpile. The site on which stockpiles are to be placed shall be firm, clean, and reasonably level, preferably consisting of DGA or like material. Materials stockpiled at areas remote from the plant site shall be used only when authorized by the section engineer (SE).

ESTABLISHING SAMPLING & TESTING RESPONSIBILITIES

At or about the time of the preconstruction conference, the SE shall determine the contractor's suppliers of fine and coarse aggregates and notify the district materials engineer (DME). The SE should coordinate with the DME the responsibility of sampling and performing the gradation tests. The sampling procedure from various sources such as conveyor belts, flowing aggregates, stockpiles, trucks, barges, and railroad cars shall be done in accordance with the *Materials Field Sampling and Testing Manual* (**MFS-207**). See **CST-209** for information concerning the preconstruction conference.

AGGREGATE USAGE GUIDELINES

The following points apply to the handling of all aggregates:

- Fine and coarse aggregates must meet the requirements of the specifications.
- Fine and coarse aggregates shall be placed in separate stockpiles or bins to prevent materials at the edge of the stockpiles from intermixing.
- Stockpiles shall be built in layers not to exceed three feet in height and each layer shall be completed before beginning the next layer.
- Aggregates shall not be removed from the stockpiles within one foot of the ground until final clean up of the work.

AGGREGATE USAGE GUIDELINES (CONT.)

- Materials that have become mixed with foreign matter or fine and coarse aggregates that have become intermixed shall be rejected.

- Aggregates shall be handled in such a manner that the moisture content will be reasonably uniform for each concrete placement. Continually sprinkling or watering the stockpile may be necessary to accomplish this.

- Batching directly from a washing plant shall not be permitted.

- All aggregates, where handled by hydraulic methods or where washing is involved, shall be stockpiled or binned and allowed to drain at least twelve hours before being used.

- The SE, through project inspectors, should monitor the contractor's handling of the aggregates to ensure that the aggregate does not include foreign matter such as dirt, wood, coal, chert, etc.

- The contractor may provide fresh mined coarse aggregates to the project. This aggregate may be absolutely dry as opposed to saturated, surface dry (the normal condition of most coarse aggregate). In this event, the SE should consult with the district Project Delivery and Preservation office and the DME since the mix design must be modified (or other actions taken) to account for the super-dry condition of the aggregate.

	Section MATERIAL REQUIREMENTS
	Subject Cement

SPECIAL CEMENT GUIDELINES

The section engineer (SE) should observe the following special precautions concerning cement:

- When stored, cement shall be protected at all times from moisture.
- Cement shall be handled in a manner to prevent loss, wetting, or contamination.
- When using bulk cement, every precaution shall be exercised to maintain a clean, clear cement feed to the cement batching bin so that the correct batch weight will be maintained at all times.
- Daily records of the cement shipments to the job batching plant shall be furnished to the SE.
- The temperature of the cement at the time of its incorporation into the mixture shall not exceed 170º F.
- Different brands of cement should not be mixed unless the area where the concrete is to be placed can be identified.

	Section MATERIAL REQUIREMENTS
	Subject Fly Ash

INTRODUCTION

Fly ash, considered a cementitious material, is used in place of cement as a cost reducer and can be used to increase workability, reduce permeability, and mitigate alkali silica reaction.

LIMITATIONS

Fly ash can reduce early strength development and shall not be used when high early strength is desired. The section engineer (SE) needs to be aware that the specifications impose limitations on the amount of fly ash that can be substituted for cement and that quantities should be monitored very closely as detailed in Section 601.03.03(C)2 of the Standard Specifications. Also, Section 601.03.09(D) limits the time of year that fly ash may be used.

APPROVED SOURCES

The Division of Materials maintains a list of approved fly ash sources by power plant and distributor.

	Section MATERIAL REQUIREMENTS
	Subject Admixtures

POLICY

Admixtures may include air entraining agents, water reducers, and superplasticizers. The contractor shall obtain approval on all chemicals prior to use in the concrete.

	Section MATERIAL REQUIREMENTS
	Subject Miscellaneous Paving Items

POLICY

JPC pavement may include reinforcing tie bars, load transfer assemblies, joint seal materials, expansion paper, etc. These items need to be sent to the Division of Materials for approval as soon as they are received on the project. The items should be stored so that they are protected from mud and have limited exposure to damaging weather.

UNCOATED STEEL PRODUCTS

Any uncoated steel product will rust if left exposed. A light coat of rust should not affect the performance of the material. However, if the rust flakes off, then proper cleaning of the steel needs to be made before it is used in the pavement.

	Section MATERIAL REQUIREMENTS
	Subject Curing Concrete

INTRODUCTION

The attention directed at mixing and placing concrete to achieve the best possible pavement is wasted unless the concrete is cured properly. Curing concrete properly is critical for the concrete to achieve its strength and durability. Curing the concrete deserves the full attention of the section engineer and responsible inspectors and shall never be taken lightly or assigned a minor role in the concrete inspection process. The primary methods of curing include white membrane curing (curing compound), wet burlap, and curing blankets and are detailed in Section 501.03.15 of the Standard Specifications.

All of the following curing methods shall be maintained and monitored for the entire duration of the curing requirement.

CURING COMPOUND

Curing compound is probably the method of choice for most contractors. When delivered to the project, the contractor shall store the curing compound in an accessible area and monitor it to assure that the material is not damaged, contaminated, or adversely affected by the weather. Curing compound shall not be used if it has frozen and shall be retested if exposed to freezing weather.

Note: Curing compound has a limited shelf life and any expired material shall be removed from the jobsite.

WET BURLAP

Wet burlap is generally used where curing compound is forbidden such as construction joints, exposed reinforcing steel, etc. If the contractor desires, he or she can cure the entire pavement with wet burlap. In any event, care must be exercised to ensure the burlap is kept wet for the entire curing period.

CURING BLANKETS

Curing blankets are used less than either curing compound or wet burlap. They may be used in conjunction with wet burlap to help retain the moisture on the concrete. Curing blankets may have a layer of burlap bonded to the underside to assist in retaining the moisture. Curing blankets are frequently used with some sort of insulation for curing during cold weather.

	Chapter JOINTED PLAIN CONCRETE PAVEMENT
	Subject Concrete Plant

GENERAL

The contractor typically has the option of installing a concrete plant on the jobsite or obtaining concrete from a commercial producer.

The section engineer (SE) should ensure that concrete is batched properly and delivered to the jobsite conforming to all the project requirements and specifications regardless of the plant location. This includes ensuring that proper inspection is made of the plant, the mix design being approved, and that all the samples of the concrete's ingredients are made according to the *Materials Field Sampling and Testing Manual*.

When applicable, QC/QA Special Note 10E of the Standard Specifications places the quality control responsibilities (for example, establishing the mix design according to the *Precast/Prestressed Concrete Manual*, the control of the ingredients, the trip tickets, and records and test results at the plant) in the hands of the contractor. These responsibilities may be performed by the Cabinet at the contractor's option when the quantity of concrete delivered to the jobsite is 250 cubic yards or less.

INITIAL PLANT INSPECTION

Before any concrete is batched to the project, the SE should check the plant for conformance to the requirements of the Division of Materials. This includes observing plant operations to ensure that all conveyors, bins, scales, vents, gates, etc. are functioning properly.

Note: Scales shall have up-to-date testing and certification and return to zero after the bins are emptied.

MIX DESIGN

Section 601.03.02 of the Standard Specifications requires the contractor to submit, for approval, the mix designs needed on the project when the quantity exceeds 250 cubic yards.

BATCH RECORDS

The SE shall ensure that the contractor keeps a *Concrete Trip Ticket* (TC 63-9 form, **Exhibit 9027**) daily that records the following:

- Date of Pour
- Number of batches produced for the project
- Batch weights

BATCH RECORDS (CONT.)

- Moisture test results
- Size of a batch
- Cubic yards of concrete produced for the project
- Actual footage placed
- Theoretical footage that concrete produced for the project should have placed
- Difference between the actual footage placed and the theoretical footage that concrete produced for the project should have placed (expressed as a percent)
- Cement used
- Cement received
- Fly ash received
- Sand or aggregate received
- Theoretical cement on hand
- Actual cement on hand
- Difference between theoretical cement on hand and actual cement on hand (expressed as a percent)
- Sand used
- Total sand used to date
- Stone used
- Total stone used to date
- Time plant started
- Time plant stopped
- Hours of plant operation

TESTING

To assure a consistent mix (especially at the start of the project) the contractor needs to perform slump and air tests on a regular basis. The SE shall ensure that the contractor runs moisture tests **at least** twice a day (beginning first thing in the morning and when freshly delivered stockpile material is to be used) to control the mix according to the moisture in the fine and coarse aggregates. These tests shall be performed as outlined in the *Kentucky Methods* manual.

If the producer performs these tests, the SE shall verify that proper testing methods are being employed.

	Section PREPAVING
	Subject General

OVERVIEW

Prior to beginning the paving on the project, the section engineer (SE) and assigned inspectors should familiarize themselves with all aspects of the project. This includes, but is not limited to:

- Maintenance of traffic
- Joint details
- Pavement design
- Contractor's equipment and manpower
- Grades
- Cross sections
- Other aspects listed in Section 501 of the Standard Specifications

PREPAVEMENT MEETING

To help avoid problems that could cause delays in the project after the work begins, the Cabinet and contractor personnel shall hold a prepavement meeting to discuss:

- Contract requirements
- Proposed paving schedule
- Haul routes
- Batch plant and stockpile site locations
- Delivery access
- Target air content and slump
- Sampling procedures and locations
- Curing schedule
- Joint sawing methods
- Equipment and timing
- Joint layout
- Joint sealing
- Construction joint method
- Method of vibration
- Pouring sequence

	Section PREPAVING
	Subject Plan Review

POLICY

The section engineer (SE) shall review the plans with emphasis on the items discussed in this policy below.

JOINT DETAILS

The SE shall pay particular attention to joint details on large urban area projects with many ramps and intersections. Offset or small angled joints (for example, sharp triangles or points) can cause undue cracking, affect the performance of the pavement, and shall be avoided.

Doglegs or perpendicular joints are recommended to avoid cracking and care should be taken to ensure that the joints do not lock up at these locations. The SE should anticipate where the joints on the subsequent pour will be to avoid a point in a later phase. Sometimes a dogleg will need to be formed into the next lane or formed into the lane being poured to avoid a point.

Joints should always follow the lane lines (unless not allowed by partial width construction) because traffic may perceive longitudinal joints in the pavement as lane lines as the striping fades.

Note: Unless required by the plans, all lanes shall be dropped from the right with the joints following this plan.

MAINTENANCE OF TRAFFIC

Unless the project is a completely new road or involving a road closed to traffic, maintenance of traffic will likely be a requirement. More than likely, the construction will be done in accordance with the direction of traffic flow. This will greatly affect the paving operation and partial width construction may be required.

The SE should review the Traffic Control Plan and study the problems created by the traffic to determine the best way to construct the project.

HAND PLACEMENTS

Unless otherwise provided, the pavement is to be placed mechanically as outlined in the specifications. However, as field conditions merit, it may be necessary to hand place the JPC pavement in certain areas. These areas shall be held to a minimum and generally determined before work begins.

HAND PLACEMENTS (CONT.)

In some circumstances partial width construction may involve hand placement, so the SE should be prepared to discuss its use and the inherent problems with the contractor.

DRAINAGE

The SE shall review the pavement plans for proper drainage, especially at intersections and areas where two separate roadways or ramps intersect.

	Section PREPAVING
	Subject Contractor Meeting

PREPAVEMENT MEETING

The Cabinet and the contractor shall conduct a prepavement meeting to help eliminate problems before they become critical after the work begins and cause delays on the project. The following should be discussed at this meeting:

- The contractor's equipment and how it conforms to Section 501 of the Standard Specifications

- The equipment used to deliver the concrete to the jobsite

  Note: The time of discharge of concrete differs between truck mixers (agitating trucks, and dump trucks or paddle agitating "dump crete" type trucks). See Section 601.03.07 of the Standard Specifications for these times.

- The haul route from the concrete plant to the jobsite

  Note: It is especially important to discuss how the contractor plans to protect the newly placed concrete when necessary to haul over it.

- The number of employees the contractor plans to use

- The contractor's responsibility for protecting the pavement due to weather conditions

- Confirmation that the contractor's plan for hand placement of the pavement conforms to the plans and specifications

- The contractor's method of protecting unsealed joints (including a plan to keep the pavement free of debris that could cause damage to the pavement surface)

- An established line of communication between the section engineer (SE) and the contractor so that the project is not delayed because of misinformation or delays in acquiring approvals

- Paving sequence

PREPAVEMENT MEETING (CONT.)

- Target air and slump
- Sampling procedures and locations
- Curing schedule
- Joint sawing
  - Conventional vs. early entry (soft cut)
  - Timing
  - Number of saws
  - Accurate marking
  - Depth
- Joint sealing
  - Type
  - Application
  - Sampling
- Construction joints (header construction method)
- Vibration equipment
  - Monitors
  - Handheld vibrating
- Tie-bars
  - Installation method
  - Size
  - Epoxy
- Dowel bars
- Adding moisture to the concrete surface for finishing

	Section PREPAVING
	Subject Employees Required for Inspection

DETERMINING PERSONNEL REQUIREMENTS

The section engineer (SE) should determine the number of employees necessary to properly inspect the paving operation.

ESTABLISHING INSPECTOR RESPONSIBILITIES

The SE shall discuss and review each inspector's responsibilities as they pertain to work assignments. The SE should also establish a line of communication with the inspectors so any problem can be resolved quickly.

	Section PREPAVING
	Subject Documentation

ESTABLISHING DOCUMENTATION PROCEDURES

The section engineer (SE) shall establish a procedure for proper documentation of the paving by using Daily Work Reports (DWR's), field books, and diaries and assure that each employee assigned to the paving project knows the proper method of documentation. This should minimize possible errors that could cause a delay in payment to the contractor.

Note: When describing the pavement that has been placed during the day, the station numbers should be as accurate as possible.

Note: When paving multilane roadways, the pavement lanes will be numbered from the median lanes out.

PREPARING THE FINAL ESTIMATE & DWR FOR ENTRIES

The SE shall lay the groundwork for preparation of the Final Estimate as well as proper procedures for entering pay quantity data in the DWR's. See **CST-405-2**.

DIARIES

All drawings and sketches should be made on the DWR (or on cross-section paper and referenced by the DWR) and shall document, at a minimum:

- Beginning and ending stations
- Pavement width
- Pavement offset

	Section PREPAVING
	Subject Testing

POLICY

The section engineer (SE) shall ensure that all the necessary tests and approvals are obtained on materials before paving begins. This includes, but is not limited to:

- Aggregate Gradation
- Reinforcing Steel
- Dowel Bars
- Load Transfer Assemblies
- Cement
- Joint Seal
- Curing Compound

	Section PAVING OPERATION
	Subject General

OVERVIEW

There are several critical items during this phase of the project operation that need close supervision. Ensuring conformance to the plans and Standard Specifications at this time should assure a high quality and durable pavement.

The section engineer shall consult with the district Project Delivery and Preservation office and, if necessary, the Central Office, Division of Construction for assistance and direction concerning any problems.

	Section PAVING OPERATION
	Subject Subgrade Preparation

REQUIREMENTS

The contractor shall prepare the subgrade as outlined in the plans and specifications and compacted to meet Standard Specification requirements. The aggregate subgrade shall be fine graded by an approved mechanical means to the grade required by the plans.

The grade can be checked by use of a level or a string line stretched between the grade stakes or “blue top” hubs.

Note: The subgrade shall be consistent and within the required tolerances, as this will affect the final smoothness or rideability of the pavement and could shorten the expected life of the pavement.

When using forms, the contractor shall use a planer that will ride on the forms grading the base within the forms to provide a proper grade.

See **CST-1000** for additional information and procedures pertaining to subgrade and base construction.

	Section PAVING OPERATION
	Subject Placement of Load Transfer Assemblies, Tie Bars, & Forms

GENERAL

Load transfer assemblies, tie bars, and forms must be placed securely and in their proper plan location for the pavement to function as designed.

LOAD TRANSFER ASSEMBLIES

Load transfer assemblies need to be well staked and placed properly. Normally the dowels are parallel to the longitudinal grade line of the pavement. It is necessary to place reference stakes, nails, or other reference methods along the axis of the assembly on the outside of the proposed pavement to provide the proper line for the joint.

TIE BARS

Tie bars can be tied in place by the use of approved stakes or placed in the pavement using mechanical or hand-operated devices during the concrete placement operation. The section engineer (SE) should confirm that the contractor's method places the steel tie bars at the proper height and location.

All tie bars shall be clean. If the pavement is adjacent to previously placed concrete and the tie bars have concrete on them, the contractor must use an approved method to clean them. A small amount of curing compound on the reinforcing steel is permissible per Section 501.03.15.A of the Standard Specifications.

FORMS

If forms are used, the contractor shall place and anchor them as outlined in Section 501 of the Standard Specifications.

Two-sided forms of the proper thickness dimension with a wide base are required. Straight (one-sided) forms supported by pins or any forms of the wrong height supported by extra gravel to gain height are not acceptable.

Damaged, bent, warped forms shall be marked as such and removed from the project.

Flexible forms should be used in sharp radii to provide a smooth curve.

Note: It is very important that the grade of the base be properly compacted and graded to assure a consistent form grade. This should greatly improve the rideability and longevity of the pavement.

FORMS (CONT.) The contractor shall first compact the grade and then install the forms on the grade.

Note: Material shall not be filled and compacted within the forms after they are set, except for minor final grade check adjustments.

	Section PAVING OPERATION
	Subject Drainage Blanket

POLICY

Superior pavement performance can be usually achieved by providing the ability to drain water from underneath the slab. If the contractor uses a drainage blanket to accomplish this, the section engineer (SE) should check the grade and thickness of this layer. The SE should also ensure that the contractor constructs perforated pipe drains to plan grade and elevation to assure free draining of the layer.

See **CST-1003** for additional information concerning drainage blankets.

	Section PAVING OPERATION
	Subject Weather Limitations

DETERMINING WEATHER LIMITATIONS

Before paving begins, the section engineer (SE) shall determine if the temperature and weather will be appropriate for paving. If weather conditions will adversely affect paving, the contractor shall delay operations until the weather becomes acceptable.

PLASTIC SHEETING

The contractor shall always have readily-available, sufficient plastic sheeting to cover and protect unhardened concrete pavement in case of rain.

DAMAGED PAVEMENT DUE TO WEATHER

If rain does damage pavement, the contractor must submit, for approval, a proposed method of correcting the problem. In this situation, concrete pavement is not normally considered eligible for payment until the contractor implements satisfactory corrective measures.

	Section PAVING OPERATION
	Subject Slip Form Paving

OVERVIEW

The contractor shall use accurate control measures to ensure that concrete is placed to the proper grade and alignment. With this type of paving, a string line or other accurate control measures need to be securely fastened to allow the paver's electronic sensors to function properly. To achieve good pavement rideability, the paths supporting the paver's tracks shall be properly compacted, free of all debris, and stable.

PAVING GUIDELINES

The following special points need to be considered during this operation:

- The section engineer (SE) should review and document the contractor's paving equipment and ensure that the proper equipment is furnished and complies with Section 501 of the Standard Specifications.

- The concrete should normally be placed by means of a conveyor, chute, spreader, or other approved device in front of the paver. Augers or other nonsegregating devices may be used to distribute the concrete evenly along the width of the paver; however, the concrete should never be moved by vibration.

  Note: Concrete improperly spread in front of the paver may cause the paver to "ride" upon the pile of concrete thereby causing an uneven pavement.

- To get an even, consistent slab, a paver needs to be continuously moving. The SE should work with the contractor to see that the delivery of the concrete is timed to assure this.

- The contractor shall take special care to see that the paver forms the applicable edges and curbs smoothly, consistently, and without any excessive edge slump as specified by Section 501.03.19 of the Standard Specifications. A 10-foot straightedge is required in making this determination. If unsatisfactory results are being obtained, the SE shall immediately inform the contractor so he or she can make the necessary adjustments to the paver or concrete mix to correct this problem.

PAVING GUIDELINES (CONT.)

- The contractor shall place reinforcing bars (either drilled and epoxied tie bars or tie bar baskets) at the proper locations shown in the standard drawings or plans.

  Note: The longitudinal tie bars shall not cross the pavement transverse contraction or expansion joints. They must be kept a safe distance from the joint to avoid breaking the corners. If the bar spacing causes this to happen, the contractor shall use an approved means to see that the pavement is properly "tied" at these locations.

- The SE shall randomly perform depth checks to ensure the slab is being constructed at the proper thickness.

- Behind the paver, a 10-foot straightedge should be used to help eliminate any uneven areas. This straight edge shall not be used as a finishing float. If the pavement slab requires an extreme amount of handwork behind the paver, the contractor shall immediately adjust the paver or concrete mix.

- The burlap drag shall be kept damp but not so wet that it causes an undue amount of water on the concrete slab.

- Water shall not be sprayed directly on the uncured slab. If moisture needs adding to the surface under extremely dry or windy conditions, an approved fogging device shall be used. The SE shall not allow pump sprayer nozzles to be removed for more water. The addition of water is to replace the water from the mix lost to evaporation.

- The SE shall monitor the random transverse grooving. Unless otherwise approved by the SE, the contractor shall perform pavement texturing with a mechanical device at random spacing. If this becomes impractical, hand grooving may be acceptable if satisfactory results are obtained. The SE shall ensure grooving conforms to Section 501.03.13(H) of the Standard Specifications and that the grooving (tining) machine provides proper depth grooving and does not break or damage the pavement edges.

- The SE shall check the vibrator monitor to verify that the vibrators are working properly and that the frequency is within an acceptable range (8000—11,000 rpm).

- The SE shall visually check the mat for proper consolidation, line, grade, slope, etc. continuously through the pour and determine if the operation should continue if immediate problems cannot be resolved.

	Section PAVING OPERATION
	Subject Formed Pavement

POLICY

Formed JPC paving is similar to slip form paving except that the paver or mechanical screeds or rollers ride on fixed forms.

The forms shall be clean, properly treated with a bond breaker, and pinned so they are stable. The tops of the forms must be clean and smooth.

Rocking or shifting of the forms shall not be permitted.

	Section PAVING OPERATION
	Subject Hand Placing

OVERVIEW

It is the intent of the specifications that a paving "train" performs all JPC paving using approved pavers, etc. However, there are many cases where it is impractical or impossible to use the equipment outlined in Section 501 of the Standard Specifications. Examples of this are small block out sections needed to maintain the existing traffic or isolated areas that have variable pavement widths. Hand placing of the concrete may be the only practical way to construct the pavement in these circumstances.

PAVING GUIDELINES

When hand placing the concrete pavement, the following should be noted:

- All control of mixes, delivery, etc. shall be applicable.
- Forms shall conform to all the requirements of Section 501 of the Standard Specifications.
- The section engineer (SE) shall ensure that the subgrade, aggregate bases, and drainage blankets (if applicable) are graded to the required elevation and tolerances in the small and irregular areas.
- The contractor shall place the concrete in the forms by chute or other approved means so that a minimum amount of manipulation is needed. **The concrete shall not be moved by vibration**.
- Sufficient vibrators need to be available to assure consistent consolidation of the concrete.
- Walking in the concrete should be discouraged, however if necessary, it should be kept at a minimum and any "footprints" shall be repaired by the finishers by properly removing the void left by the footprint.
- The contractor shall use a screed device that may be a mechanical roller (Clary type), vibrating straight edge, or a rigid straight edge. The screed shall be at least 2 feet longer than the width of the formed area. Screed shall be straight and true. Warped rollers or bent screeds shall not be used.

PAVING GUIDELINES (CONT.)

- The contractor shall have a 10-foot straightedge available to assure a consistent grade.
- The contractor shall not spray water on the concrete surface except by an approved fogging device.
- Burlap drag and transverse grooving shall closely follow the Standard Specifications.

	Section PAVING OPERATION
	Subject Station Numbering

POLICY

The contractor shall cast station numbers into the pavement as per Standard Drawing RPX-001 and Section 501.03.13(I) of the Standard Specifications.

	Section PAVING OPERATION
	Subject Curing

GENERAL

The section engineer (SE) should calculate the total amount of curing compound needed for newly placed pavement. The SE should randomly check the quantity being used to assure that the contractor is applying the proper amount of compound. If forms are used, the contractor shall apply curing compound to the sides as soon as the forms are removed. The application shall be applied within the required specified time period.

COLD WEATHER

An important aspect of curing is maintaining the concrete at the proper temperature as required by the specifications, particularly when cold weather is anticipated. Before paving begins, the contractor shall propose the method he or she plans to use if the air temperature becomes low enough to adversely affect the new pavement. This method shall be approved and adhered to whenever the predicted temperature falls in this range.

Materials and supplies necessary to implement these procedures shall be readily available and at the work site before proceeding to place concrete when cold weather is a possibility.

CURBS

If curbs require casting separate from the JPC pavement, the contractor shall keep the curing compound clear of the location of the construction joint and reinforcing steel. This area is normally cured with wet burlap. Any curing compound sprayed in these areas must be removed completely before construction of curbs.

	Section PAVING OPERATION
	Subject Testing

POLICY

The section engineer (SE) shall perform slump and air tests at the specified times as listed in the *Materials Field Sampling and Testing Manual*. A passing slump and air test must be obtained from the first concrete delivered to the project before the contractor can place any concrete. After this, the concrete placing operation should not be stopped unless a failing test occurs. In the event of a failing test, the SE shall delay the placement operation until obtaining a passing test.

CYLINDER TEST SPECIMENS

The SE shall make cylinder test specimens of the concrete at the proper intervals. If the pavement needs to be opened to traffic as soon as possible, sufficient additional sample cylinders should be made to provide information relative to the concrete's early strength.

Note: In critical situations, it may be desirable to request a high early strength concrete mix.

The cylinders shall be cured as required by the Standard Specifications.

	Section PAVING OPERATION
	Subject Documentation

GENERAL

The following documentation is important for JPC pavement operations:

- Trip tickets should be filled out accurately. As slump and air tests are made, the test results should be written on the applicable ticket.

- Slump and air test reports shall show all tests made during the placement. If a failing test occurs, the test reports shall show the results of an approved test that allows the concrete placement to continue.

- The Daily Work Report (DWR) shall contain all information concerning the paving operation, including:

  - All equipment the contractor has and is required to have
  - Clear documentation of the accurate location of the pavement placed and an accurate measurement for payment of this
  - All calculations for pay quantities
  - Record of the weather, temperature, and any other environmental item that may affect the pavement
  - Amount of concrete delivered to the jobsite
  - Any delays that occur regardless of cause

  See **CST-1204-5** for additional information on DWRs.

- The section engineer Diary shall record any events that may affect the paving.

- It is helpful to establish a paving field book to keep a reference of when each area of the pavement has been placed. This is especially helpful when there is a discrepancy between the pay record and the contractor's records.

	Chapter JOINTED PLAIN CONCRETE PAVEMENT
	Subject Post Paving Procedures

STRAIGHT EDGING

If the plans do not specify a ride quality requirement, the section engineer (SE) shall straight edge the pavement as required in Section 501.03.19(B) of the Standard Specifications as soon as practical. The contractor shall make the necessary corrections as required by diamond grinding or removal and replacement of the slab.

JOINTS

The contractor shall saw joints as soon as possible to control the pavement cracking as required by Section 501.03.17 of the Standard Specifications and the "Roadway Pavement" section of the Standard Drawings (RPN & RPS series). The contractor shall install an approved temporary seal to protect the sawed joint from debris.

Note: The contractor is responsible for the care of the sawed joints and if the method chosen is not satisfactory, the SE should enforce this requirement and ensure that the contractor takes the necessary corrective action.

PAVEMENT SMOOTHNESS TESTING (RIDE QUALITY)

The necessary pavement smoothness testing with either a profilograph or profiler is to be performed according to the plans and Section 501.03.19 of the Standard Specifications as soon as practical. The SE should request this testing, through the district Project Delivery and Preservation office, to the Central Office, Division of Construction. Arrangements shall be made several days ahead of time to allow for scheduling of the test and coordination with the contractor.

PAVEMENT MAINTENANCE

Pavement maintenance is very important during construction. Construction traffic shall not be allowed on the pavement unless necessary. The contractor shall take the necessary measures to ensure that the pavement is kept clean, especially when construction equipment will have to use the newly constructed slab. This includes continually sweeping the pavement and any protective overlay to protect the slab from off-road equipment that must "ride" on the new slab and any necessary temporary joint seals.

Note: Legal load limits apply to any construction equipment running on the new pavement.

SAWED JOINTS The contractor shall

- Resaw joints to the proper width and depth according to the required method of sealing
- Thoroughly clean all resaw joints
- Apply the required method of sealing
- Repair any damages in the area of the sawed joint by an approved method before making any final joint seals

SEALING JOINTS When the contractor uses neoprene seals, the transverse joint seals shall be continuous across the entire pavement unless otherwise approved by the SE.

Cutting may be permitted only when maintenance of traffic dictates partial width construction, but this shall be reviewed closely by the SE. Such cutting shall be kept at an absolute minimum. Any locations where the neoprene seal must be cut, including longitudinal joints, will require an adhesive lubricant-hot seal. Refer to Section 501.03.18 of the Standard Specifications for sealing requirements.

CORRECTING DAMAGE OF CRACKING If damage is done to the pavement or uncontrolled cracking occurs on the slab, the contractor shall submit, for approval, a method for correcting this problem before opening the pavement to traffic. If this is impractical, the contractor shall perform the correction measures as soon as possible with proper control of traffic.

	Chapter JOINTED PLAIN CONCRETE PAVEMENT
	Subject Opening to Traffic

SPECIFICATIONS

Section 501.03.20 of the Standard Specifications outlines the requirements for opening the pavement to traffic and involves the safety and welfare of the public.

Before opening the pavement to traffic the section engineer shall ensure that the contractor has:

- Thoroughly cleaned and sealed the pavement
- Installed all required signing and striping according to the plans, specifications, and the MUTCD (including possible detour signing)
- Installed all guard rail, barrier walls, crash cushions, and other safety devices as per the plans including either temporary or permanent striping and pavement markers

  Note: Exceptions can be made as dictated by the Maintenance of Traffic Plan.
- Installed all signals and made certain that they are functioning properly
- Removed any equipment, stockpiles, additional paving devices, etc. to a clear distance from the roadway

	Chapter STRUCTURES
	Subject General

OVERVIEW

This chapter provides guidance for administering adequate and uniform structure inspections during construction. Primary emphasis is placed on the construction procedures and operations required to build bridges and culverts. Little or no discussion is specifically directed at the construction of headwalls, drainage boxes, etc.; however, the Division of Construction finds that the information contained herein on concrete, reinforcing steel, safety, and other related subjects can be equally applied to these areas of construction.

This chapter provides information concerning best construction practices, but in no way addresses the time and personnel constraints that various construction crews work under. It is understood that the section engineer must prioritize project inspection, yet experience has shown that taking care of the details and trying to be proactive saves time and money in the long run.

As always, all contractual obligations including the plans and specifications shall be adhered to.

STAKING STRUCTURES

CST-600, "Construction Surveying" covers the staking of structures and related subjects and should be used in conjunction with this chapter.

PAY QUANTITIES

CST-600, "Construction Surveying", and **CST-400**, "Post-Construction Requirements" contain information related to structures pay quantities.

SUBMITTALS

The following list includes submittals pertaining to structural work that shall be requested from the contractor and forwarded to the Central Office Division of Construction. This is not an all inclusive list, but does generally cover general bridge and culvert construction.

The contractor shall submit these at the earliest opportunity to allow appropriate time for review. The contractor should not begin work on these items until obtaining proper approval.

Note: If the contractor elects to begin work without approvals, he or she does so at his or her own risk. The contractor shall be required to perform any changes at his or her cost.

SUBMITTALS (CONT.) Other sections of this chapter discuss the following information about particular submittals:

- Pile reports (**CST-1305**)
- Precast box or 3-sided culvert shop drawings and designs (**CST-1318-1**)
- Metal arch or other metal culvert shop drawings and designs (**CST-1318-2**)
- Deck falsework overhang designs and drawings (**CST-1306-1**)
- Pachometer testing (if completed by district) (**CST-1312-7**)
- Revised pouring sequence (**CST-1312-1**)
- Cofferdam or shoring designs and drawings (**CST-1304**)
- Falsework designs and drawings (**CST-1306-1**)
- Any structural steel drawings (**CST-1309**)

Note: Each approved shop drawing and design shall be stamped by the Central Office liaison engineer who reviewed it.

	Chapter STRUCTURES
	Subject Safety & Health

OVERVIEW

Safety and health are subjects of vital importance to all areas of construction and shall be treated as such by the contractor and all Department of Highways employees. The problems encountered in the construction of structures differ from those encountered on grade work and merit special consideration. The conditions encountered in the building of structures range from working in trenches and cofferdams to working high above ground or water. The nature of the work often places a group of workers at the same location for extended periods. As a result, both safety and health protection shall be implemented at each work site in a manner to best fit the existing conditions and with consideration of the quasi-permanent nature of the work site.

KENTUCKY SAFETY & HEALTH STANDARDS

The contractor shall abide by the "Kentucky Occupational Safety and Health Standards for the Construction Industry" as promulgated by the Kentucky Department of Labor (803 KAR 2). The section engineer shall utilize these standards in enforcement of the safety rules and regulations pertaining to the project. Sections particularly applicable to structures include but are not limited to:

- Excavations, Trenching, and Shoring 803 KAR 2:415
- Concrete, Concrete Forms, and Shoring 803 KAR 2:416
- Tunnels and Shafts, Caissons, Cofferdams, and Compressed Air 803 KAR 2:418

For additional information concerning the enforcement of these requirements, refer to the appropriate section in **CST-100**.

Section 107 of the Standard Specifications contains requirements pertaining to safety, health, sanitation, and air pollution.

	Section STRUCTURE EXCAVATION
	Subject General

OVERVIEW

Section 603 of the Standard Specifications defines how structure excavation shall be performed, measured, and paid. The section engineer and the project inspectors should read and consult the specifications for specific details.

CLASSIFICATIONS

Section 603.03.01 of the Standard Specifications state that structure excavation shall be classified as "Structure Excavation Common" or "Structure Excavation Solid Rock" for all bridge foundations and reinforced concrete box culverts. Structure excavation necessary in the construction of crib walls and retaining walls shall be "Structure Excavation Unclassified," unless otherwise specified on the plans. Section 603.03.01 contains exact definitions of each particular classification of structure excavation.

FOUNDATION PREPARATION

Foundation preparation is a pay item that is also used for structures and as a "Lump Sum" can include several different phases of the excavation. This item is primarily used for culvert excavation and backfill although it has been used for bridge excavation. Refer to Section 603.04.03 of the Standard Specifications for further details.

STRUCTURES

This chapter provides separate discussions pertaining to excavation for the following types of structures:

- Bridges (**CST-1303-2**)
- Culverts (**CST-1303-3**)
- Retaining and crib walls (**CST-1303-4**)
- Removal of existing bridges, culverts, and other incidental items of wet stone and dry stone masonry (**CST-1303-5**)
- Pipe culverts, storm drains, sewers, headwalls, anchors, boxes (**Exhibit 9075**)

	Section STRUCTURE EXCAVATION
	Subject Bridges

PLAN REVIEW

The section engineer (SE) and the project inspectors shall closely examine the plans for special notes and specific details concerning the structural requirements for the footing being excavated. Notes, arrows, or other symbols are frequently added to pier footings indicating the footing is to be placed against rock. For example, if notes indicate the footing is to be placed against solid rock and the contractor excavates the rock outside the limits of the neat line, the contractor must place additional concrete against solid rock at his or her expense.

The SE shall check existing site conditions, stream alignment, and existing roadway grades, **especially once the new structure is staked**, against the plans to determine if the new structure is in general alignment with on-site conditions. Several factors (such as the age of the design plans, improper staking, new roadway repairs, stream scour, etc.) can change the conditions anticipated by the designers. The Cabinet must address these issues before work begins.

LOCATING EXISTING UTILITIES

Before excavating, the contractor and the SE shall survey the excavation site and examine the plans to locate any indicated existing utilities. The contractor shall contact the utility companies who will provide elevations and precise locations regarding their installations. The SE or inspector should ensure that the contractor is aware of the "Before-You-Dig" (BUD) service and its advantages in locating underground utilities. Each utility company should be requested to furnish the contractor elevation, location, and any other pertinent information they may have on utilities near the work.

CHECKING GRADES & QUANTITIES FOR ERRORS

The SE should have the project inspector check plan grades and structure excavation quantities for arithmetic errors. The SE should take original ground elevations, top of rock elevations, and bottom of rock elevations using methods outlined in **CST-600**.

Exhibit 9072 depicts procedures to be used in computing various pay items and pay quantities involving bridge excavation.

SAFETY PROCEDURES

The SE and the project inspector shall be safety conscious and impress upon the contractor the importance of using good safety procedures. The contractor shall devise methods to keep the excavated area as dry as possible. This can be done by pumping, drainage ditches, etc., keeping in mind good erosion control practices. Also the excavated area shall be OSHA compliant meaning it is shored or sloped back.

Note: The SE and project inspectors are not OSHA inspectors. The contractor is responsible for OSHA compliancy.

The footings for river crossings subject to scouring shall extend into solid rock unless the plans specify otherwise. The bottom of the footings should be as level as possible. The contractor may cut a sump into the rock outside the footing area to provide a low spot to collect water for pumping. Foundation seals may also be used.

SUITABLE FOUNDATION

After reaching the plan footing elevation, the contractor shall clean and dewater the footing so the inspector can visually inspect the surfaces for suitable foundation material. The surfaces should have relatively few fractures or splits (no soil or mud present) and the surfaces should have a generally sound appearance.

If the visual inspection shows suitable surface conditions, the contractor shall then drill at least one test hole a minimum of five feet below the surface. The inspector shall observe the drilling operation and inspect the drillings as they are bored from the hole. If there is no evidence of a mud seam or voids, then no further drilling is required and construction of the footing can proceed.

If evidence of a mud seam, voids, or other unsuitable material exists, further investigation is required and the district branch manager and the Central Office Division of Construction shall be consulted. The contractor shall drill more holes for inspection. The inspector shall prepare a log of the drillings to determine the location of the voids or unsuitable material. Lowering of the footings may be required, but preferably the unsuitable material would be removed and mass concrete used to bring the footing base back to the plan elevation.

Note: The foundation should support the structure for decades to come. If any question whatsoever exists about the soundness of the supporting material, the SE and the inspector shall consult the district branch manager and Central Office Division of Construction.

RAISING THE FOOTING BASE

In some cases suitable material may be encountered at a higher elevation than shown in the plans. Before raising the elevation of the footing base, the SE shall consult the district branch manager and Central Office Division of Construction. If the plans indicate the footing shall not be raised, the contractor shall continue the excavation to the depth as shown regardless of the suitability of material encountered at higher elevations.

PROJECT IMPACTS FROM RAISING OR LOWERING THE FOOTING BASE

If the footing is raised or lowered, the contractor shall maintain the plan footing thickness. The height of the wall or column constructed above the footing will be adjusted to compensate for the footing elevation change.

Lowering the footing and increasing the length of the wall or column may require adjustment in the reinforcement. The plan lengths of the vertical wall or column reinforcement may allow for a small adjustment in length otherwise the lengths must be adjusted or additional reinforcement of the same size must be ordered to provide an additional splice. It is critical to maintain the length of splice as shown in the plans. Additional horizontal reinforcement may be required; maintain the same size and spacing of the horizontal reinforcement found in the plans.

FOOTINGS

The contractor shall properly clean the footing and pump out as much water as possible prior to placing concrete. After the concrete has been placed, cured, forms removed, and patched, the contractor shall clean the excavated area of all mud, debris, etc. and properly backfill the area to original ground elevation.

Note: Since standing water can cause foundation material to soften and deteriorate in a short period of time, the contractor shall backfill the area as soon as possible.

BACKFILL

The contractor shall use good material for backfill. In wet conditions, the SE may permit the contractor to begin backfill with a lift of stone at the contractor's expense. The remainder of the backfill shall be done in a manner to comply with specifications. Excavated material may be acceptable as backfill providing it meets requirements.

The contractor shall bring backfill material up in equal lifts all around the footing or stem so the structure will not be displaced. The contractor shall complete backfill to a level that allows water to drain away from the structure.

Density of backfill is critical in all cases and especially under roadways. The contractor shall obtain adequate compaction to prevent excessive settlement or drainage problems.

	Section STRUCTURE EXCAVATION
	Subject Culverts

PLAN REVIEW

The section engineer (SE) shall closely examine structure plans for footing details such as special notes requiring the footing to be placed in rock, against rock, or excavating rock to provide for an earth cushion.

The SE shall check existing site conditions, stream alignment, and existing roadway grades, **especially once the new structure is staked**, against the plans to determine if the new structure is in general alignment with on-site conditions. Several factors (such as the age of the design plans, improper staking, new roadway repairs, stream scour, etc.) can change the conditions anticipated by the designers. The Cabinet must address these issues before work begins.

LOCATING EXISTING UTILITIES

Before excavating, the contractor and SE shall survey the excavation site and examine the plans to locate existing utilities. The contractor shall contact the utility companies who will provide elevations and precise locations regarding their installations. The SE or inspector should ensure that the contractor is aware of the "Before-You-Dig" (BUD) service and its advantages in the location of underground utilities.

COMPUTING CULVERT EXCAVATION

The SE's survey party, or the inspector working with the contractor's crew, shall take original ground elevations, top of rock elevations, bottom of footing elevations, and any other information necessary to compute final pay quantities using methods outlined in **CST-600**.

Exhibit 9073 covers various situations and procedures for computing culvert excavation.

EXCAVATION

The contractor shall excavate in accordance with sound safety practices and abide by all permits and laws governing stream pollution.

The contractor should use care in blasting if the footing is to be cut into rock and concrete placed against the rock. The Cabinet will not pay additional money for excavation outside the neat lines of the footing due to the contractor's over-blasting.

EXCAVATION (CONT.)

The contractor shall drill test holes at least 5 feet deep at least every 50 linear feet of footing as a test for suitable solid rock. For culverts with parallel footings under the walls or with an extra-wide footing, the contractor may need to drill more than one line of holes. In this case, the contractor shall stagger the holes between footings on 25-foot centers.

Note: More holes may be drilled depending on footing conditions.

If the footing is designed for an earth foundation, the contractor shall make soundings to ensure that the minimum earth cushion (2 feet) exists between the bottom of footing and top of solid rock. For solid rock foundation, the contractor may need to backfill the area under the paved flow line using dry compactable materials or a fine shot rock. The rock should be shot fine enough so that no individual rock creates a point bearing.

If the apron wall at the inlet or outlet end of a culvert with earth foundation hits rock, the contractor shall excavate the rock a minimum of one foot so that the wall toes into rock. This does not apply to culverts with rock foundation designs since the apron wall toes into and rests on rock.

If the contractor has completed the excavation for the bottom slab and footings of a culvert and the conditions of the foundation material becomes unsatisfactory because of rain or ground water, the contractor shall place sufficient coarse aggregate or filter fabric to prevent the infiltration of mud into the concrete. Alternatively, the mud can be entirely removed and replaced with suitable stable material. These operations are performed at the expense of the contractor.

A wet condition resulting from the contractor's operation is not to be confused with an unstable foundation (which requires stabilizing and/or undercutting and is generally considered a pay item). The SE shall discuss this situation with the district branch manager before proceeding.

BACKFILLING

Backfill operations should begin on as dry a foundation as possible. The contractor shall place lifts as level as possible and keep the elevations of the backfill material on the two sides of the culvert equal to prevent displacement of the structure. The SE should perform density tests on the backfill material, if practical and desired.

The contractor shall install geotextile-wrapped backfill drains above weep holes just prior to backfill since this product is subject to deterioration due to sunlight and other construction activities. The SE shall ensure that the contractor places the proper face against the concrete and takes special precautions to seal the drain top to provide positive drainage into the weep hole. Consult geotextile-wrapped backfill drain product literature for guidance relative to attachment to concrete walls and other special features.

BACKFILLING (CONT.) If the height of fill above weep holes exceeds 30 feet, the contractor must use #57 stone drains. The contractor shall keep the column of stone for the weep hole drains from being contaminated and ensure it extends to the elevation of the top of the culvert. If the contractor stacks bags for the #57 stone column, the bags utilized must be freely draining and not silt up. Large open meshed bags or chicken wire are considered acceptable containers.

Note: Burlap and solid polyethylene bags are not acceptable.

The contractor shall backfill all culverts as soon as possible to original ground elevations and grade the area to allow water to drain away from the structure.

Backfill material shall extend a minimum of 2 feet above the top slab of a culvert before any rock fill or heavy equipment are placed on it.

	Section STRUCTURE EXCAVATION
	Subject Retaining Walls & Crib Walls

PLAN REVIEW

The contractor shall excavate retaining walls and crib walls as shown on the plans.

The section engineer (SE) shall check existing site conditions, stream alignment, and existing roadway grades, **especially once the new structure is staked**, against the plans to determine if the new structure is in general alignment with on-site conditions. Several factors (such as the age of the design plans, improper staking, new roadway repairs, stream scour, etc.) can change the conditions anticipated by the designers. The Cabinet must address these issues before work begins.

The SE shall take original ground elevations in accordance with **CST-600** and bottom of excavation elevations so that excavation can be computed in accordance with the Standard Specifications. See **Exhibit 9074** for details of pay limits.

PREDETERMINING DRAINAGE ADEQUACY

The SE shall ensure that the elevations of the weep holes are six inches above the backfill elevation on the exposed face of the retaining wall (or six inches above flow line for retaining walls without fill on the exposed face). The SE shall consult with the district branch manager concerning any questions of the adequacy of the drainage.

If the SE determines that the retaining wall height or length is inadequate to meet field conditions, the SE shall contact the district branch manager who, in turn, may contact the Central Office Division of Construction.

Water cannot be allowed to stand in the excavated area near the footing since saturation of the bearing material may cause the loaded retaining wall to fail.

BACKFILL

The contractor shall backfill the excavated area as soon as the concrete has gained sufficient strength. The SE shall perform density tests on the backfill material, if possible, to determine if compaction requirements are being fulfilled. The contractor shall drain backfill by geotextile-wrapped backfill drains. Refer to **CST-1303-3** for additional information concerning geotextile-wrapped backfill drains.

BACKFILL (CONT.) The SE should not permit the contractor to use heavy equipment in the area being backfilled unless it is kept a sufficient distance away to preclude damage.

	Section STRUCTURE EXCAVATION
	Subject Removal of Existing Structures

PLAN REVIEW

The section engineer (SE) should be familiar with existing bridges, culverts, and wet stone and dry stone masonry to be removed and shall consult the plan notes, proposal notes, and specifications for the method of payment.

Note: It is very important that the SE recognize the method of payment as it may be necessary to measure the volume of the removal item if it is to be paid by the cubic yard.

Special care should be taken to ensure the removal item does not get paid more than once. For example, if a culvert falls within the limits of the structure excavation for a new culvert and is to be paid as a lump sum item, it would be necessary to cross section it and deduct the volume from the quantity of structure excavation for the new culvert. The exhibits prepared for this section include examples of removing structures.

RECORDING PROJECT INFORMATION TO DETERMINE PAY QUANTITIES

The SE should make detail sketches showing calculations, dimensions, and elevations for record purposes and inform the contractor when this is being done (as they may want to have someone from their organization assist in taking the measurements). This can prevent controversy about the exact pay quantity. Section 203 of the Standard Specifications should be consulted for this type of removal.

	Section COFFERDAMS
	Subject General

INTRODUCTION

The contractor shall erect (and subsequently remove) cofferdams in accordance with Section 603.03.06 of the Standard Specifications.

Generally, any temporary structure driven or installed to a desired depth for keeping water and earth out of structure excavation by resistance of lateral pressures may be termed a cofferdam. Cofferdams shall be water tight as to permit dewatering by pumping and provide a reasonably dry work area for concrete masonry operations.

A cofferdam is usually constructed of sheeting, wales, and struts. These are generally structural steel members.

	Section COFFERDAMS
	Subject Design

RESPONSIBILITIES

The contractor bears the entire responsibility for design, construction, maintenance, and removal of a cofferdam. The Department of Highways, however, reserves the right to review all cofferdam designs before construction is started. Due to time and personnel constraints, the Department's focus is primarily on shoring that restrains roadway and bridge fills or fall under constraints of another agency like the railroad.

PROCEDURE

The contractor shall submit a minimum of four copies of cofferdam design to the section engineer (SE) at least four weeks before the contractor plans to begin construction of the cofferdam. The SE shall check the plans with respect to the following points:

- Completeness of design—Does the design provide sufficient data to build the cofferdam?
- Completeness of design—Are connection types (whether bolted or welded) and details designed and shown in the drawings?
- Sufficient clearance—Is the clearance between the neat lines of the foundation and the sheeting or wales sufficient to accommodate construction of forms and inspection?
- High water—The lowest point on the top of the sheet piling should be sufficiently high above normal pool to provide adequate safety against flooding when a sudden rise occurs.
- Vented or flooded elevation—Do the project plans require a vented or flooded elevation? If so, is this vent shown in the design? This is a standard requirement when a foundation seal is necessary.
- Tip elevation—Does the sheeting extend well below the bottom of the footing or is it keyed into rock satisfactorily?
- Navigation requirements—Is sufficient channel clearance provided?
- Railroad requirements—Has adequate track clearance been provided? Have railroad surcharge loads been considered?
- Any obvious errors or omissions.

PROCEDURE (CONT.) If the cofferdam design appears substantially complete, the SE shall forward it, with recommendations, for review by the Central Office, Division of Construction. The SE shall, however, return the design to the contractor for revision or clarification if it lacks essential details or contains obvious errors.

DESIGN REVIEW The Central Office, Division of Construction, will review the design and any accompanying recommendation and will return the design to the contractor through the district branch manager and the SE along with appropriate comments and recommendations. The time to review, whether four weeks or longer, must be planned for by the contractor and will not be considered a delay to the project.

OUTSIDE AGENCIES Cofferdams adjacent to railroads must be approved by the railroad. Cofferdams in navigable streams must be reviewed and approved by the U. S. Coast Guard for navigation lighting and channel clearance. There may also be other agencies that need to review and approve shoring or cofferdams.

The cofferdam plan will be forwarded to these agencies by the Central Office, Division of Construction who will liaison with them to obtain approvals.

	Section COFFERDAMS
	Subject Installation

INTRODUCTION

Cofferdam construction usually begins by making a frame that acts as a template to hold the sheets to plan dimension during driving. The section engineer (SE) shall require the contractor to make the initial alignment of the frame as accurate and stable as possible to minimize movement of the sheets during driving and to maintain clearances.

DRIVING SHEETING

The contractor needs to drive the sheets well below the bottom of excavation. Usually, the same type of driving equipment used for driving piling may be used for driving sheeting with the driving head modified to accommodate the type of sheeting being used. Other acceptable types of driving equipment include the drop (gravity) hammer or the vibratory hammer. When using the drop hammer, it is usually necessary to seat sheeting in rock with a power hammer. The vibratory hammer drives sheeting fast, at a uniform rate, and with minimum damage. It is also used in extracting sheeting.

Note: Cofferdam sheeting **shall not** be used to establish permanent line or grade references because of its tendencies to slip, lean, and warp under pressure.

EVALUATING THE COFFERDAM

The SE shall:

- Become very familiar with the cofferdam construction
- Discuss all procedures with the contractor or project superintendent
- Stay current with the cofferdam construction
- Always keep cofferdam design plans and the structure plans available at the work site
- Ensure the contractor closely follows the design, as reviewed

Project conditions occasionally change and it may become necessary to strengthen the design. It is considered acceptable procedure to upgrade the design strength of a cofferdam to meet changed conditions, but a redesign beyond minimal material changes should be resubmitted for review per **CST-1304-2**.

Note: The size of a member shall never be decreased or eliminated without resubmission for a review of the revised design.

INSPECTION

Exhibit 9076 provides guidelines for cofferdam inspections during construction.

SAFETY

Safety during all phases of construction and use of the cofferdam shall be of critical concern to the SE and a responsibility of the contractor. The SE shall thoroughly discuss safety issues with the contractor. Existing rules and regulations, such as those found in the "Kentucky Occupational Safety and Health Standards for the Construction Industry," shall be adhered to closely.

REMOVAL

Although cofferdam removal is not as exact as its installation, the SE shall observe the operation closely to ensure that the contractor exercises caution when working around in-place structural components.

Note: Partial or complete backfill will be required before cofferdam removal.

	Section BEARING PILES
	Subject General

PURPOSE

Bearing piles are used to support structures where dependable foundation materials are deep below the ground surface making spread footings impractical or uneconomical. They transfer loads from the structure footing or foundations to the bearing material through friction, point bearing, or a combination of both.

STANDARD SPECIFICATIONS

Piles generally will be steel or concrete as indicated in the plans. Concrete piles may be precast or cast-in-place. Timber piles are generally used for temporary bridges or falsework. Construction procedures for all pile types shall comply with Section 604 of the Standard Specifications (or, as in the case of drilled shafts, comply with the Special Notes in the proposal). The material requirements for precast and prestressed piles are in Section 605 of the Standard Specifications. The material requirements for steel piles are in Section 812.01.01(A) of the Standard Specifications.

STANDARD DRAWINGS

The Standard Drawings include pertinent dimensions, reinforcement requirements, splice details, types of concrete, etc. for all acceptable types of piling under the general heading of "Bridge Piling."

OTHER PERTINENT INFORMATION

Although this manual provides sufficient information to handle most piling jobs, there will be pile hammers used occasionally that are not included in this text. The contractor shall provide any necessary data not included in this manual.

NOTE: This data will be provided if available in the Central Office.

	Section BEARING PILES
	Subject Preparation for Pile Driving

PILE LAYOUT

The contractor shall use the plans to locate each pile's position. Each pile will be vertical or battered as specified. Flanges of steel H-piles shall be oriented as shown on the plans.

The contractor is responsible for the pile layout; however, the piling inspector shall thoroughly check the layout before pile driving begins. Typical layout procedures shall consist of physical templates that can be fixed to the surface where the pile is being driven. This ensures proper control of the location and orientation of the pile during the driving operation.

PILE ALIGNMENT INSPECTION

The piling inspector shall check the alignment of each pile before driving starts. Vertical piles may be checked in the leads by a carpenter's level at least four feet long to achieve the desired accuracy. Battered piles may be checked in the leads using a triangular template (that has been cut to the desired batter) in conjunction with a carpenter's level.

PREDRILLING

The contractor may need to predrill through the existing overburden on projects prior to placing bearing piles. This creates a pile socket to a depth that ensures the minimal pile tip elevation is met per the project documents. After completing predrilling, the contractor shall install the pile into the socket to full depth and backfill with sand, pea gravel, or other material approved by the section engineer.

TEMPORARY CASING

The contractor may need to place a temporary casing to prevent collapse of the predrilled socket. The casing must be removed once the piling is in place and the socket is backfilled, prior to driving.

DRIVING A PREDRILLED PILE

The contractor shall exercise care during the driving of a predrilled pile. The initial strikes generally take place with the pile tip against rock. The driving process is to seat the pile tip and achieve refusal on the pile.

	Section BEARING PILES
	Subject Material

HEAT NUMBERS

The heat numbers on all steel H-piles, splice plates, and shell piles must be checked against signed mill test reports. For approval, the contractor must provide the section engineer (SE) a copy of the mill test report signed by a representative of the producer. The SE will review these test reports and notify the contractor in writing of the approved heat numbers and forward a copy of the approval letter to the Division of Construction. Any material delivered to the job site that does not have the required markings for heat numbers or signed mill test reports shall be automatically rejected.

CONCRETE PILES

The SE shall ensure that the Division of Materials has approved precast or prestressed concrete piles not cast at the job site by checking for the presence of the Kentucky Oval Stamp. Review **CST-1311** for further information concerning prestressed concrete.

PILE SPLICES

The contractor shall:

- Make all pile splices precisely in accordance with the plan details and applicable standard drawings
- Have all welding performed by qualified and certified welders for the type of joint and position of weld being performed (see **CST-1310**).
- Ensure all splice plates have mill test reports
- Avoid the splicing of concrete piles when possible

  Note: If unavoidable, concrete piles shall be spliced in accordance with the appropriate standard drawing or plan details.
- Bevel groove weld joints according to the required details

Note: Cut-off elevations be in accordance with **Exhibit 9078**.

The SE shall visually inspect all welds for size and quality.

PILE POINTS

Pile points shall conform to the requirements of the current standard specification. The contractor shall attach all pile points precisely in accordance with the plan details and applicable standard drawings.

PILE POINTS (CONT.) All welding must be performed by qualified and certified welders for the type of joint and position of weld being performed (see **CST-1310**). Unless otherwise approved by the Department, the contractor shall follow Section 604.02.06 of the Standard Specifications by reviewing the List of Approved Materials (LAM) for approved pile point types and their suppliers.

Note: Contractors may propose to use other suppliers and other points by submitting sufficient information for Department review and approval. Substitution of points shall be at no additional cost to the Department. The contractor shall not be allowed any extension in contract time for Department review of proposed substitutions.

STOCKPILING The Department may make partial payments for materials on hand for bearing piles as stipulated in Section 109.05.01 of the Standard Specifications. The maximum quantity paid will be the design (plan) quantity increased or decreased by approved changes. The SE shall take care to record and preserve the heat numbers on each pile and pile point (if not factory-attached) during stockpiling. This ensures the ability to check the heat numbers to the signed mill reports just prior to placement.

	Section BEARING PILES
	Subject Inspection

INTRODUCTION

Administration and inspection of pile driving work requires sound judgment and complete familiarity with the plans and specifications. Discrepancies between plan requirements and observed results are not unusual. Decisions must be made promptly to avoid delays to the contractor. When in doubt, the section engineer (SE) shall seek help from the district branch managers for Project Delivery & Preservation in making required decisions, and the district branch managers for Project Delivery & Preservation shall discuss any unusual situations or problems with the Central Office, Division of Construction.

PERFORMING INSPECTIONS

The inspector shall:

- Be present at all times when pile driving is being performed
- Be sufficiently familiar with contractual requirements as to be able to accept or reject each pile as it is driven
- Determine and document pile pay lengths and record data to establish that the piles conform to contract requirements for penetration and bearing
- Keep neat, accurate, and complete signed records in the project file (**Exhibit 9025**)
- Inspect all piles of any type for damage prior to, during, and after driving
- Accurately measure the length of all piles and build-up prior to driving

PILING REPORTS

The inspector shall complete a TC 63-22 form, *Record of Test Pile No.* (**Exhibit 9030**) at time of driving test pile and submit it to Central Office, Division of Construction and Geotechnical Branch, Division of Structural Design.

After the contractor drives all the piling in a bent or pier, the inspector shall complete a TC 63-8 form, *Record of Piles Furnished and Driven* (**Exhibit 9025**) and submit it to the SE. After review, the SE shall submit the form to the district office for checking. This form is then submitted to the Central Office along with the final estimate.

PILING REPORTS (CONT.)

Note: When filling out the TC 63-8 form, the length of cut-off shown on battered piles is the actual length of material cut-off, not the vertical difference between the original top (prior to cutting) of pile and cut-off elevation.

The SE shall submit a completed copy of the Pile Record plan sheet to the Division of Construction who will forward it to the Division of Structural Design for entry onto the original plans.

	Section BEARING PILES
	Subject Equipment

LEADS

Pile driving leads must be rigidly held in position by guys, stiff braces, templates, or other satisfactory means to ensure support to the pile during driving. The axis of the leads must coincide with the axis of the piles. The leads shall be of adequate length to reach the ground prior to beginning driving.

The contractor should provide a batter template and carpenter's level for determining plumbness and correct batter. Leads with heavy points that penetrate solid ground and hold the leads firmly in the correct position during driving generally are adequate and will not require templates. When templates are necessary it is suggested that the contractor use a minimum of ten-inch by ten-inch timbers, securely anchored. See Section 604.02.07(B) of the Standard Specifications for additional information.

PILE HAMMERS

The section engineer (SE) shall check the hammers during driving to ensure they provide the length of stroke and number of blows per minute that the hammer manufacturer indicates. Driving resistance values computed when these requirements are not met will be considered invalid. Bearing values shall only be accepted when the equipment is working properly.

The SE shall check the size and weight of the hammer to see that it conforms to Section 604.02.07(A) of the Standard Specifications relative to the type of pile being used. The hammer must also satisfy any plan note requirements relative to its size and cushion material.

Pile hammers shall always have renewable shock cushions between the helmet and ram. The contractor shall place a timber cap or cushion (generally consisting of layers of plywood) on the top of concrete piles to prevent damage to the pile.

The contractor shall equip diesel or air hammers that have an enclosed ram with a gauge and charts that will evaluate the equivalent energy produced. The contractor must be able to prove the gauge's reliability and accuracy before use. Recalibration may be required. If the contractor uses vibratory hammers, other types of hammers must seat the piles so the bearing may be determined.

PILE HAMMERS (CONT.)

Exhibits 9081, **9082**, **9083**, **9084**, and **9085** provide pile driving and extracting equipment data for bearing capacity calculations and inspection information.

Exhibits 9086, **9087**, **9088**, and **9089** reflect the data required to determine bearing capacity for specific hammers. The contractor shall provide sufficient data on the hammer to determine its capacity.

	Section BEARING PILES
	Subject Test Piles

GENERAL

Before driving test piles for a structure, the district branch manager for Project Delivery & Preservation shall be notified so that a representative may be present to assist the section engineer (SE) in determining when adequate bearing is obtained. The subsurface data sheet of the plans shall always be reviewed to verify the specified length of the test pile. When an obvious error is detected, the SE shall consult the Central Office, Division of Construction for advice.

The contractor shall mark the test pile in one-foot increments starting from the bottom of the pile. The SE shall record the number of blows required for each foot of penetration on the TC 63-22 form, *Record of Test Pile* (**Exhibit 9030**). The SE shall provide a means of determining top of pile and cut-off elevations after piling are driven. This data is used for record purposes in determining the length of cut-off and shall also be recorded on the TC 63-8 form (**Exhibit 9025**).

The SE may require additional test piles when difficulty is encountered in obtaining the plan bearing capacity or when pile lengths vary significantly. It is the contractor's responsibility to determine the pile length to order.

A test pile is normally driven deeper than a pile to provide the necessary information concerning bearing capacities of subsurface strata. The SE uses test piles to determine capability of the contractor's equipment and adequacy of design. The contractor shall be responsible for determining pile lengths that may be necessary to obtain the required bearing values.

The contractor shall use the same model and size of pile hammer used to drive the remaining piles in the structure as the one used to drive the test pile. The contractor shall use the same type of piles in the remainder of the group as the type tested for the group. See Section 604.03.06 of the Standard Specifications for addition information.

CONTRACTOR'S ORDER LENGTH

The contractor shall determine the order length of production piles that may be necessary to obtain the required bearing values. The contractor may use subsurface data and the test pile results to determine the order lengths. The contractor does so at their own risk with no obligation by the Department of Highways' representatives. **Exhibit 9080** provides a table for estimating lengths for battered piles.

CONTRACTOR'S ORDER LENGTH (CONT.)

Note: The contractor shall hold the use of pile splices to a minimum.

Note: The contractor shall not routinely splice several short segments of piles.

LOAD TESTS

When the contract requires load tests, the SE shall obtain from the contractor an outline of the method of performing the tests. The outline shall include:

- Sketches
- Description of the method of test loading
- Description of the method of instrumentation for measuring test loads
- Description of the method of measuring the test pile settlement under load

  Note: The contractor shall complete all load tests before driving production piles.

The Department shall provide sufficient time for redesign of piling, if bearing is less than indicated on the plans. **Exhibit 9030** shows suggested forms to record load tests.

	Section BEARING PILES
	Subject Pile Driving

BEARING CAPACITY

The bearing capacity of the pile is determined by using the applicable formula for the pile hammer being used. The contractor must obtain the bearing capacity, either as required by plan notes or that which is determined to be required by the load test. A pile splice will be required when necessary to obtain bearing. The plan terminology "Required Driving Resistance" is synonymous with the traditional required bearing capacity.

REFUSAL

When the plans specify that piles are to be driven to REFUSAL, the contractor must realize that the pile will generally never completely stop. Care should be exercised to **not** overdrive piles. The inspector shall never simply require "1/8-inch in 10 blows" or some arbitrary requirement, but shall always base the acceptance on an adequate bearing for the hammer being used. The following table shows the adequate bearing capacities for different steel piles:

Steel Pile Bearing Capacities

Bearing Capacity (tons)	Steel Pile Flange Width (inches)
150	12
180	14
200	16

Note: See **CST-1305-2** for additional steps when predrilling is required.

FRICTION PILE

The minimum penetration of any pile is ten feet or more in firm material and twenty feet or more in soft material. A penetration of ten feet or more into original ground and ten feet or more below stream bed is also required.

When driving is hard and damage to the pile is expected, or where it is impossible to obtain minimum penetration, the contractor should use jetting or auguring. When jets are used, the volume and pressure at the jet nozzles shall be sufficient to freely erode the material adjacent to the pile. If an outside jet is used, it shall be used alternately around the perimeter of the pile to ensure that accurate vertical alignment of the pile is maintained.

FRICTION PILE (CONT.)

In certain sections of the state, friction piling does not always attain “Required Driving Resistance” upon completion of driving. This condition appears to be a result of the "puddling" (liquefaction) of free water against the pile during driving. This tends to lubricate the pile and create a quick condition. If the pile is allowed to set for a short period of time (6—24 hours), it will tend to "set" or "freeze." The “Required Driving Resistance” will then increase significantly.

When this situation arises, the contractor shall stop driving one or two feet above cut-off elevation. The pile shall be restruck after a short period of time (6—24 hours) and driven to the “Required Driving Resistance” as called for in the project documents. The driving mentioned above ensures that the pile will retain the “Required Driving Resistance.”

Note: This condition will only be accepted when free water is present and a review of the boring log indicates similar material for a considerable depth.

If the pile breaks loose during restriking, the contractor shall splice the pile and continue driving until “Required Driving Resistance” is obtained.

	Section BEARING PILES
	Subject Concrete Piles

GENERAL

The contractor shall give particular attention to methods of handling concrete piles. The Standard Drawings show details for handling and applicable pick-up for both reinforced concrete piles and prestressed concrete piles.

TWO-FOOT STRIP-DOWN

Consideration must be given to a minimum two-foot strip-down, where required to provide the exposed one foot and ten inches of reinforcing steel or strands in concrete pile.

When this two-foot strip-down is required to expose the reinforcement steel, that length is added to the length below cut-off elevation for purposes of payment.

When the pile has been driven too low to provide the one foot and ten inches of exposed reinforcement and it is necessary to weld on the reinforcement bars, payment will be as though the one foot and ten inches of length of pile had been provided. That will constitute full payment for exposing adequate length for splicing (making the splice and providing the material).

Exhibit 9077 shows one method of acceptable welded reinforcement lap splice.

	Section BEARING PILES
	Subject Cast-In-Place Piling

SHELL PILING

The lengths of seamless steel or welded pipe shell and fluted steel pile shell that the contractor may drive with various hammers are not restricted as long as the hammer meets minimum energy requirements of the Standard Specifications.

The contractor must carefully drive steel shells to avoid crushing or buckling of the shells. Collapse of the shells can be suspected when the top of the pile suddenly gets out of line, or a noticeable difference in bearing capacity occurs. If bearing has been gradually increasing during driving, and suddenly starts to decrease, driving shall be stopped and the pile inspected.

The contractor is responsible for selecting the pile shell wall thickness to withstand the driving forces required to obtain the minimum bearing and penetration required. In the event of pile collapse, the section engineer shall notify the Central Office Division of Construction to determine if a piling redesign will be required.

After driving and before placing concrete, all shell piles shall be thoroughly inspected by the section engineer with a light to determine if the pile in place is in good condition and free of water, debris, bends, buckles, etc. Mirrors can provide reflected sunlight on sunny days. Artificial light will be required otherwise.

DRILLED SHAFTS

A drilled shaft is a foundation that is constructed by placing fresh concrete in a drilled hole. Reinforcing steel can be installed in the excavation, if desired or specified. Concern for scour of pile foundations or spread footings on rock has made drilled shafts more popular. Drilled shafts can allow deep foundations to be constructed without cofferdams, therefore, saving project costs.

A drilled shaft is similar to a cast-in-place or shell pile except it has a large diameter (usually three to six feet) and is generally not driven. Drilled shafts are reinforced similar to a circular column. They may bear on solid rock or entirely on soil. Steel casings may be either permanent or temporary. Drilling slurry may be used at the contractor's option or required by the contract depending on subsurface conditions.

DRILLED SHAFTS (CONT.)

The plans include drilled shaft reinforcement and dimensional details. **CST-1307-3** discusses procedures for concrete placement. Additionally, there may be a special note concerning drilled shafts as part of the contract proposal that will contain requirements for:

- Preconstruction Submittal
- Material
- Construction Methods
- Equipment
- Subsurface Exploration
- Construction Tolerances
- Method of Measurement
- Basis of Payment

The contractor shall carefully follow plan details, Special Note requirements, and other applicable project documents and should address any concerns or questions concerning drilled shafts to the Division of Construction Central Office.

	Section FALSEWORK & FORMS
	Subject Falsework

INTRODUCTION

The Cabinet stresses the use of good falsework in construction. Inadequate falsework is not only hazardous to the safety of workers, but may increase the ultimate cost of construction or result in damage to adjacent private or public property.

Falsework is composed of structural units such as beams, joists, bents, columns, studs, trusses, arches, bracings, and forms designed under standard engineering procedures. Each individual unit may act independently or in combination with other units to shore or support anticipated loads.

FALSEWORK DESIGN

The contractor is responsible for the design and stability of falsework. The section engineer (SE) or an authorized project inspector shall review the contractor's falsework drawings to ensure that the falsework is constructed in accordance with the approved drawings.

The SE shall closely examine the design of joints and connections. The design shall explicitly show the design calculations and the detail of the drawings.

Exhibits 9090 and **9092** shows information for bridge deck falsework. The contractor shall submit detailed drawings to the SE in triplicate for all units of the falsework needed to support the structure. The drawings shall include design calculations for all features that do not utilize the Department's tables. **Exhibit 9091** contains sufficient information for the SE to spot-check falsework submittals. Falsework designs must be prepared and stamped by a Kentucky Registered Professional Engineer in accordance with Section 601.03.11 of the Standard Specifications, and must adhere to all current OSHA regulations.

The loading condition to be used in the design shall comply with the Standard Specifications, or if actual dead load, live load, and impact loading conditions prove to be greater, then the loading from such analysis shall be used.

Any design procedure for falsework that the contractor chooses shall comply with the current accepted practice for timber, steel, and concrete bridge design.

DESIGN REVIEW

A review of the falsework shall start with the SE. The SE shall ensure that the drawings include all dimensions and sizes of the major members and essential connections. The SE shall check the drawings and calculations for obvious errors and forward the drawings to the district branch manager for Project Delivery & Preservation for review. The district shall endorse and transmit the plans and calculations, with noted comments, to the Central Office, Division of Construction for final review. The SE shall inform the contractor of any falsework inadequacies discovered in the review process and advise the contractor of the portions of the falsework plan that require revision and resubmittal.

Note: The contractor shall not be allowed to begin construction of the falsework until the review is complete.

Note: The SE shall closely check the spacing and size of load carrying members and the load carrying capacity of all material used.

The SE shall carefully study Section 601.03.11 of the Standard Specifications and have a fully reviewed copy of the contractor's falsework plan at the erection site for reference during construction.

The SE shall direct any comments noted by the Division of Construction on the reviewed copy of the falsework plan to the attention of the contractor, engineer, and the superintendent in charge of erection. It is very important that this information not be laid aside in the SE's office.

MATERIALS INSPECTION

The SE shall examine all material to be used as a part of the falsework. Timber shall be free of an excessive number of knots, checks, cracks, and holes; be straight and true; and have the dimensions called for in the falsework plan. Steel members must be of the proper shape and size noted in the plans and be free of bent flanges, holes, splices, and lost cross section due to excessive rust. Steel falsework members must not be welded or tacked to the flange or web of any steel member of the bridge.

FALSEWORK ERECTION

The SE shall direct the location of any splices in steel tension members to the attention of the district office personnel for their approval. If the district office has any doubt about the location of any splice and its effect on the integrity of the falsework, they shall consult the Division of Construction personnel who reviewed the falsework plan.

The SE shall check the site to ensure the conditions at the site have not changed and to ensure that the falsework plan will be workable with the existing contours, elevations, etc. The contractor shall complete any necessary excavation or fill work before erecting the falsework.

The SE shall be sure the material supporting the footings is as good as that represented by the contractor's falsework plan. When the supporting material has low bearing capacity, the contractor shall compact or replace it as directed by the SE.

FALSEWORK ERECTION (CONT.)

As the falsework is being erected, the SE shall check the dimensions to verify compliance with the falsework plan. Even though the falsework design is reviewed, the SE shall examine the overall soundness of the falsework for any obvious omission or weakness. The SE shall use the following general guidelines when examining falsework erection:

- Any sills used as footing shall have true and even bearing on the supporting material and be firmly anchored. Material supporting sills must be protected from settlement or lateral displacement.
- Any "deadmen" used in the falsework plan shall be firmly anchored and protected from any sort of displacement.
- All vertical members of the falsework shall be straight and plumb and cut-offs shall be accurately made to ensure uniform bearing at both the top and bottom. When a corbel is provided, attachment to the vertical member shall be rigid and the member shall be designed. Short stubs or blocks will not be permitted in these members when members are cut too short.
- Caps shall be placed so that they secure an even and uniform bearing over the tops of supporting posts.
- Beams spanning from cap to cap shall extend fully over the cap as detailed on the falsework plan and shall have the required bearing area.
- Plywood shall not be used to block-up or provide vertical support for any load carrying member.
- A sufficient number of nails and bolts shall be used to guarantee the stability of the structure.
- The load rating and spacing of the overhang brackets that the contractor is using shall be checked to ensure they agree with those specified on the plans.

Good housekeeping during the falsework erection phase and while it is being maintained is essential to the safety of the workers. The falsework shall be examined from a “safety to worker’s” viewpoint and the contractor shall cut off any hazardous projecting members.

The SE shall not permit any changes in the reviewed falsework plans without being submitted and reviewed in the same manner as the original falsework plan.

The SE shall check the falsework to ensure all clearances pertaining to roads, streams, railroad, etc. are properly observed and, where required, shall ensure clearances are posted. The contractor shall timely install any illumination or other markings required by the plans, permits, ordinances, laws, or that may be deemed necessary by the SE to identify height or width restrictions.

FALSEWORK MAINTENANCE

The SE and the contractor shall not forget about the maintenance of the falsework after it is installed.

The SE shall:

- Periodically check and closely examine the falsework prior to placing any extraneous loading on it
- Check wedges and jacks to ensure they are properly positioned and tight
- Closely observe the location of heaters during the curing operation and their proximity to falsework and ensure that the contractor properly maintains and guards these devices to prevent fires and subsequent damage to the falsework and the structure

FALSEWORK REMOVAL

The contractor shall not remove or loosen any falsework that centers or supports any concrete work (including wedges) without the permission of the SE. Section 601.03.14 of the Standard Specifications details the removal of falsework and forms.

After removing the falsework, the contractor shall:

- Neatly stack the falsework
- Remove the falsework from the project site
- Clean up all waste material and leave the work site in a good housekeeping condition

	Section FALSEWORK & FORMS
	Subject Forms

MATERIAL

Form panels for exposed surfaces made of plywood shall conform to the requirements of the current U.S. Product Standard PS-1, for Exterior B-B, Class I or Class II concrete form, or any material suited for forming that will produce similar or better results. The plywood must have a stamped mark "Exterior B-B Concrete Form" or "Exterior Concrete Plyform." All other panel grade designations shall be subject to approval of the Central Office, Division of Construction.

The plywood shall have a minimum of five plies and shall not be less than 3/4 inches thick.

CONSTRUCTION

The contractor shall build forms sufficiently tight to prevent leakage of mortar from the concrete. In addition to the requirements in Section 601 of the Standard Specifications, all formwork must be adequately braced, supported, and tied together to maintain the position and shape, true to the dimensions, lines, and grades of the structure. Form wedges shall be adequately secured and shall be rechecked during concrete placement to prevent distortion or failure of the formwork.

The section engineer (SE) should not allow gaps exceeding 1/16 inch width between edges of form panels. Where gaps cannot be avoided, the contractor shall cover them with tin sheet strips, or other means approved by the SE, prior to the concrete placement. The SE shall never allow the use of aluminum as a method of gap correction or hole patch on forms. Aluminum reacts negatively with cement causing cracking and blisters.

The contractor shall space the studs or joists supporting the forms so that the deflection of the form between adjacent supporting joints or studs shall not exceed 1/360 of the clear span.

The contractor shall always maintain good housekeeping around and within the form system. The form system shall be cleaned of waste lumber, wire, nails, and other materials not intended to stay within the form. A quality finish on concrete revolves around the use of good formwork.

The SE shall examine all used forms brought to the project site; reject those that are split, badly worn, and deteriorated; and not permit the contractor to place rejected forms in the form system.

CONSTRUCTION (CONT.)

Note: An occasional hole may be patched with form patches or tin, but badly deteriorated forms are not to be used.

Forms to be used in the form system shall be cleaned of all dirt, mortar, and foreign material. Removable forms shall always be coated with form oil prior to use. This form oil will be a commercial quality form oil or other equivalent coating that will permit ready release of the forms without chipping or damage to the concrete and will not discolor the concrete.

FORM DESIGN

Form design is not usually checked as rigorously as falsework design. There are occasions, however, when the plans require it or circumstances deem it necessary. When this happens, the following guidelines are applicable.

The following loading conditions in the Standard Specifications must be adhered to:

- 50 pounds per square foot for live load
- Not less than 160 pounds per cubic foot for weight of concrete, steel, and forms

See Section 601.03.11 of the Standard Specifications for additional information.

Form design shall have an adequate safety factor to accommodate additional form pressure resulting from vibrations of the form or concrete and from impact during concrete placement from concrete buckets or any type of placing equipment.

Primarily, forms shall be checked for flexure, shear, and deflection. The computed deflection shall not exceed 1/360 of the clear span. Flexure and shear stresses shall not exceed the allowable stresses recommended by the American Institute for Timber Construction (AITC) for plyforms and by the American Institute for Steel Construction (AICS) for metal forms. Section properties of concrete plyforms shall refer to the *Timber Construction Manual*, prepared by the American Institute for Timber Construction, or the *Plywood Design Specification*, published by the American Plywood Association.

The SE should not delay the endorsement of the design to the district office for further review.

STAY-IN-PLACE METAL BRIDGE DECK FORMS

The computed deflection for stay-in-place bridge deck forms is based on 1/180 of the form span rather than 1/360 as discussed above. The designs of these forms are not required to be reviewed or checked by the Department. The contractor shall submit the design and drawing to the SE, who will use it to verify construction of formwork.

FORM LINERS

Form liners can be used to enhance the aesthetics of many concrete structures that will be visible to the public after construction is completed. The use of such forms requires detailed attention on both the Department and contractor's level. Special concrete mix designs, concrete placement, concrete consolidation, and temperature requirements are a few of the details that must be addressed to ensure that a quality product is achieved.

In all instances, the form liner manufacturer's product data sheets will provide the necessary guidance as to the proper installation of their product. The contractor must provide the Department these data sheets prior to the use of the form liners, and they must be adhered to by the Department and the contractor throughout the life of the form liners on the project.

	Section CONCRETE
	Subject Introduction

GENERAL

Structural concrete shall conform to Section 601 of the Standard Specifications.

The section engineer and his or her personnel shall ensure that the contractor properly proportions, mixes, transports, deposits, cures, and finishes all structural concrete. **CST-1202—CST-1204** and the *Precast/ Prestressed Concrete Manual* should be consulted for concrete plant inspector guidelines. Since these other references include concrete requirements at the batching plant, the remainder of this section will deal with job-site concrete requirements.

One very important job-site requirement of the contractor is to provide job-site—plant communications. This is critical during the early stages of a placement when mix design adjustments can be made by the plant inspector at the job-site inspector's request. This communication can make the difference in acceptable and unacceptable concrete, especially when long hauls are involved.

Exhibit 9095 provides guidance on the effects of changes to the concrete mix design or weather conditions.

	Section CONCRETE
	Subject Inspection

ADDING WATER & ADMIXTURES TO THE MIX

Section 601.03.05 of the Standard Specifications contains pertinent information concerning the contractor's responsibility for adding admixtures and water to the mix.

If it becomes necessary to add water to the concrete mix at the job-site, the inspector shall consult the water underrun on the trip ticket to determine the maximum water that can be added. After water is added, the amount shall be noted on the trip ticket along with the subsequent slump test. It is important that this slump be recorded. The contractor shall make an additional thirty mixing revolutions each time water is added. Since trip tickets become a permanent part of the project files and may be audited at a later date, they shall be thoroughly and legibly completed.

For mass concrete pour projects, it is advised to have state personnel at both the concrete plant and the job-site. The plant inspector will convey required information to the job-site inspector via trip tickets (**Exhibit 9027**). Both the plant and job-site inspector should refer to this exhibit for instruction pertaining to filling out the ticket.

TIME OF DISCHARGE

After cement is added to water or to the aggregate, whichever occurs first, the time intervals allowed in Section 601.03.07 of the Standard Specifications for placement of the concrete in its final position shall be followed.

Concrete delivery must satisfy these time requirements and meet the required slump, air content, and visual inspection at the jobsite to be acceptable.

Truck mixers have metallic plates mounted in a visible location detailing the manufacturer's recommendations regarding loading capacities, mixing and agitating speeds, etc. Each truck must have such a plate, and it must be legible for the truck to qualify to deliver concrete to the project. Both the plant inspector and the project inspector shall check the plate and be sure that the truck operates within the required limits. Excessive mixing speed prevents adequate mixing due to centrifugal forces.

CONCRETE MIXER PERFORMANCE TEST

The section engineer (SE) shall run performance tests on all concrete mixers making delivery to the project in accordance with Kentucky Method **(KM) 64-311** as stipulated in Section 601.02.16(C) of the Standard Specifications.

Anytime the SE deems it necessary, additional performance tests may be run on a truck. If the truck does not pass the performance test, the sticker shall be removed and use of the truck disallowed.

A satisfactory performance test shall be indicated by placing a sticker (**Exhibit 9037**) in a protected and easily visible place in the applicable truck. The inspector running the test shall sign the sticker using the SE's name. The district branch for Project Delivery & Preservation shall maintain a supply of the stickers for distribution. The SE shall keep the records of the performance tests in his or her office.

	Section CONCRETE
	Subject Placing Concrete

UNLOADING

Concrete is normally delivered from the transit mix truck or on-site plant by concrete bucket, conveyor, pump, or Georgia buggy. For all methods, the contractor shall prevent segregation and excessive drying of the mix.

Note: Aluminum pipes or chutes are prohibited because of an adverse chemical reaction between cement and aluminum.

CONCRETE PUMP

If a concrete pump is used, the mix design may be modified to provide for more fine aggregate. The Division of Materials shall be contacted for instructions concerning this modification. Usually a pump line is primed and lubricated with a grout mixture. This grout shall not be used in the structure and shall be disposed of properly. Use of a pump requires uniform concrete consistence, therefore, the section engineer (SE) shall inform the plant inspector and job-site personnel of the importance of a consistent concrete slump. Concrete that is either too wet or too dry can clog pump lines. Excessive slump shall not be allowed.

Since slump and entrained air content often changes during pumping operations, the SE shall monitor these properties at its location of final placement to ensure specification compliance. It is also important that an adequate supply of concrete be provided to ensure continual movement of the concrete within the pump lines. On deck pours, some type of protection may be required under pump line joints to prevent spillage on the deck forms and reinforcing steel when pump lines are broken and epoxy-coated steel must be protected from damage that may be caused by pump line joints. The slump and air content target values should always be mid-range of the specifications to allow for variation and yet remain within the specifications.

Concrete pumps can place concrete very fast when the pumps are working properly. For concrete pumps to work without the lines "freezing up," there must be a constant supply of concrete. The concrete supply should be managed to avoid delays between trucks even if it requires one truck holding back its discharge until another truck is in sight. Generally two trucks can be at the hopper of a pump, but only one discharging at a time. The second truck can take over when the first empties out and keep the hopper filled while the first truck is switched out. The one-truck-at-a-time scenario forces the contractor to stage trucks, allows sampling of one truck only, and keeps the pump fed. Air loss is a concern when a pump has to stop. Large mass concrete placements may require a different approach.

CONCRETE PUMP (CONT.)

The SE, contractor, and all pertinent persons involved shall discuss in a prepour meeting all necessary steps and standby equipment required to ensure a continuous pour in case of breakdown.

DECK PREPARATION

The contractor should moisten the forms and reinforcing steel with a water spray immediately before concrete placement to prevent excessive dehydration of the concrete adjacent to the forms and steel and to cool the steel. Spraying should be done in a manner which will not allow excess water to stand where it will mix with the concrete.

DROPPING CONCRETE

The contractor:

- Shall plan placement methods so that concrete is not segregated and neither steel nor forms displaced
- Shall never allow concrete to free fall more than five feet as this tends to segregate the mixture
- Should use a pipe chute or tremie when the concrete fall exceeds five feet
- Should direct the flow of the concrete to prevent striking the reinforcing steel and causing segregation

Hoppers with flexible hoses may be adapted to most situations. Longer pipes and tremies usually come in sections that can be removed as the elevation of the concrete placement increases.

COMPACTING CONCRETE BY VIBRATION

The contractor:

- Should deposit concrete as near to its final position as possible
- Shall compact concrete by vibration in accordance with Section 601.03.09(A) of the Standard Specifications

  Note: Over-vibration may cause entrapped air against forms and segregation and is almost as harmful as under-vibration which causes honeycombing.
- Shall closely observe vibrating methods and avoid undesirable procedures such as moving concrete with the vibrator instead of shovels
- Shall adapt forms for vibrator access, when necessary, for tall or thin concrete placements
- Shall never start a concrete operation unless he or she has at least one spud vibrator

COMPACTING CONCRETE BY VIBRATION (CONT.)

- Shall place and vibrate concrete in horizontal lifts not exceeding twelve inches in depth
- Shall unite fresh lifts into the previous layer by working the vibrator into the previous lift to prevent a cold joint

  Note: Unless provisions are made to retard the concrete mixture, a layer shall not be allowed to set more than 20 minutes before fresh concrete is placed against it.
- Should discourage workers from walking in concrete after it has been vibrated, otherwise the concrete shall be revibrated

BRIDGE SEATS

Bridge seats that will support steel spans shall be finished in accordance with Section 601.03.09 of the Standard Specifications. See **CST-1309-2** for more information on bridge seats.

PLACING UNDERWATER

Concrete may only be placed under water for foundation seals or drilled shafts. Usually this is required when a cofferdam cannot be dewatered by conventional methods. If this condition exists, the excavation or piling will be prepared for the concrete seal and the water level in the excavation or cofferdam will be allowed to stabilize. Moving water within an underwater placement is to be avoided.

Concrete seals are shown on plans when their need is anticipated. If an unanticipated condition arises that requires a seal, the SE must discuss this condition with the Central Office, Division of Construction.

Foundations where cofferdams cannot be dewatered shall be inspected by divers to ensure that all silt is removed prior to commencing the foundation seal pour.

Concrete placed under water shall be of a Class A modified mixture, **unless otherwise approved by Central Office Division of Materials** and placed through a tremie in accordance with Section 601.03.09(B) of the Standard Specifications. Unless otherwise approved or directed by the SE, the contractor shall adhere to the following guidelines when placing concrete under water:

- The tremie should extend approximately three feet into the plastic concrete.
- Tremie sections must be removed from the top, not the bottom, as the concrete is placed to ensure that the bottom remains in the fresh concrete.
- The contractor must devise some method of monitoring the elevation of the top of the fresh concrete to ensure that tremie sections will be raised as necessary to prevent them from being trapped in hardened concrete.

PLACING UNDERWATER (CONT.)

- The tremie should have a sealed bottom flap-gate to prevent entrance of water.

  Note: If open-ended, a ball (usually a basketball) is placed in the pipe and is displaced by concrete.

- If the tremie is raised above the surface of the concrete during the pour, the contractor must repeat the initial start-up procedures.

- Several tremies will be required for projects having large underwater concrete placements.

- The concrete shall be placed continuously without delay and an approximately horizontal surface should be maintained.

- Contrary to above water concrete placement requirements, underwater concrete is not vibrated nor disturbed in any manner after placement.

- Concrete seals are not normally reinforced with steel prior to concrete placement but dowel bars may be required to be drilled and grouted into the hardened foundation seal.

- The contractor shall never drop concrete into standing water more than a few inches deep.

- The contractor shall not vibrate the concrete along the edge adjacent to the water until the water is forced onward by the concrete mass to a drain or out the forms.

- The cofferdam or excavation can be dewatered when the concrete has attained sufficient strength to withstand the upward hydrostatic pressure.

- Extra concrete test cylinders should be molded in order to determine the concrete's in-place strength at three days, or more if necessary.

  Note: The concrete must age at least three days before dewatering.

- After the water is removed, the contractor shall clean all undesirable material from the top of the seal by a means that will not damage the green concrete.

  Note: The undesirable material will look like the wash-out from a concrete truck.

- Normally cores will be taken through the foundation seal into rock to ensure the integrity of the seal and to verify that all silt was removed before the seal began. If the contract did not require this, it should be determined whether the Department or the contractor should do this by supplemental agreement.

  Note: This generally is not required if the footer is supported on drilled shafts or piles.

PLACING UNDERWATER (CONT.)

- The top of the seal should be removed down to good sound concrete as determined by the SE.

Concrete seal thickness is generally 0.43 (62.4 PCF/144 PCF) times the hydrostatic head exerting pressure at the bottom of the seal. The seal corners may be as much as six inches lower than the center of the seal to permit drainage.

Note: Seals are not to be used at the contractor's discretion when a cofferdam fails to function properly. They will only be installed where shown on plans or at locations designated by the Central Office, Division of Construction.

Occasionally, the plans specify foundation seals in anticipation of wet conditions that do not develop and the contractor dewaters the cofferdam. In those cases, the foundation seal should be eliminated and the columns extended to save the Department these costs. This requires review of the pier design for the increased column height.

CONSTRUCTION JOINTS

When the placement of additional concrete against existing concrete has been delayed until existing concrete has attained its initial set, the contact surface between the two placements is known as a construction joint. Construction joints other than those shown on the plans are to be avoided if possible. The contractor shall not place construction joints in tension zones, because the joints tend to open and leak even though the reinforcement handles the stress. See Section 601.03.10 of the Standard Specifications for more construction joint information.

Before concrete placement begins at a construction joint, the SE shall ensure that forms are drawn tight against the previous pour and that an approved bonding agent has been applied to the construction joint. This should prevent offsets in alignment and is very important at surfaces such as bridge curb construction.

Many times chamfer strips are required at a construction joint in order to provide a rustication groove. This groove tends to make the construction joint less noticeable. If the plans do not provide for such a groove, the exposed surface of the concrete should be smoothly finished. Feather edges at the intersection of sloped top surface and vertical construction joints (such as in wingwalls) can be avoided by blocking out the forms to create an inset into the pour at the top of the joint. Unless specified on the plans, horizontal construction joints will not be allowed within eighteen inches of the top of any face.

	Section CONCRETE
	Subject Temperature Limitations & Protection

GENERAL

When concrete is placed in extreme hot or cold weather, special conditions shall apply to the concrete mixture and its curing procedures. During placement, fresh concrete shall be between 50º F and 90º F.

The job-site inspector shall have a thermometer so that concrete temperatures can be monitored. Section 601.03.09(D) of the Standard Specifications requires a maximum-minimum, or recording thermometer to monitor curing temperatures adjacent to the concrete and beneath the insulation.

The use and placement of the thermometer will be at the section engineer's discretion with emphasis on areas most affected by temperature change.

COLD WEATHER CONCRETE

When concrete is placed in cold weather the minimum curing temperature of Section 601.03.09(D) of the Standard Specifications will apply. When required, the contractor shall submit, **prior to cold weather concrete placement**, a written request to the section engineer (SE) that details the proposed methods of maintaining the minimum curing temperature and methods for keeping the concrete moist. Heaters may also be necessary.

Note: The required temperatures referred to as "minimum curing temperatures" (45º F for three days and 40º F for four additional days) **are the temperature of the concrete itself and not the surrounding air**.

The SE should never demand a particular heating method in enforcing cold weather concrete specifications, but should maintain a position of approving or disapproving the contractor's proposed methods.

The inspector shall check temperatures of the concrete at least twice a day and record these times and temperatures on daily work reports. The contractor shall be immediately advised of any deficient temperature readings and shall take the proper actions to bring curing temperature within specifications requirements. The inspector shall take note of the actions performed by the contractor to remedy the deficient temperature.

COLD WEATHER CONCRETE (CONT.)

It is very important to avoid the possibility of a flash set when it becomes necessary to heat mix ingredients at the concrete plant. In order to do this, when water or aggregate is heated above 100º F, the water and aggregate shall be mixed prior to the addition of cement and the mixture of water and aggregate shall not exceed a temperature of 90º F when the cement is added.

The contractor shall take precautions to prevent water from freezing in all drilled and formed holes that will remain in concrete through the winter months. Several methods may be used to accomplish this and the SE shall check their effectiveness periodically throughout the winter.

The requirements of cold weather concrete work are currently being updated. The contractor is required to submit a plan for doing work in these conditions and further guidance is in development by the Division of Materials to be formulated into a KY Method. If you have any questions or concerns about the contractor's plan contact the Division of Materials.

HOT WEATHER CONCRETE

In hot weather, the contractor must make efforts to maintain the temperature of the mixture below 90º F. This can be accomplished by many methods and the SE should not direct the contractor to use a specific method. A position of approving or disapproving the contractor's methods shall be maintained.

The contractor should spray water on reinforcing steel and metal forms to keep them relatively cool.

The 90º F specification only applies to the placement of concrete and not to the curing process.

The SE shall reject fresh concrete above 90º F at the truck as out-of-specification material.

	Section CONCRETE
	Subject Curing Concrete

INTRODUCTION

All concrete (other than that in pipe culvert headwalls) requires curing which can be accomplished by wet curing or the application of membrane curing compound.

Curing requirements are easily overlooked and the section engineer (SE) must exert an extra effort to ensure the Standard Specification requirements are enforced. Curing procedures and requirements shall be thoroughly discussed with the contractor well in advance of concrete placement to ensure a mutual understanding of specification requirements. The SE may exert authority to suspend future concrete operations on a project until the contractor can adequately perform curing operations.

SURFACES REQUIRING WET CURING

Because the membrane curing compound does not always allow a good bond, the contractor shall wet cure all surfaces that will receive any of the following:

- Masonry Coating
- Concrete Stain
- Stone Veneer
- Thin-Film Coating
- Additional Concrete

Concrete that cannot be cured by curing compound must be wet cured for not less than seven days. A wet cure consists of covering the concrete with a double thickness of burlap or an acceptable substitute. This covering is kept continually wet for the duration of the seven-day curing period. When using artificial heat, the contractor must maintain moisture on the concrete and in the surrounding air.

MEMBRANE CURING COMPOUND

All surfaces not mentioned above may be cured by application of a membrane curing compound, commonly called "curing compound."

Unless otherwise approved or directed by the SE, the contractor shall adhere to the following guidelines:

- White-pigmented curing compound is only allowed on bridge decks and top or bottom slabs of box culverts.

MEMBRANE CURING COMPOUND (CONT.)

- Other properly patched and approved structure surfaces may be sprayed with clear curing compound.
- Curing compounds must be agitated before use. The curing compound drums usually contain an agitator to which a crank can be attached.
- Dilution of curing compound is not permitted, but warming in a water bath to approximately 100º F to increase fluidity, is permitted.
- Curing compound may be applied in one application. If uniform coverage is not obtained with one application, the contractor shall be required to make two applications. The first application should be applied as soon as practical after the concrete has been textured and is sufficiently stable to prevent the spray from damaging the surface or as soon as forms are removed and voids are patched.
- When required, the second application should immediately follow the first and be applied approximately ninety degrees in direction to the first application. During the second application spray extra compound on the light areas of the first application.
- The application rate should be continually monitored by the inspector to ensure thorough coverage.
- The curing compound must be applied by an approved pressure sprayer described in Section 601.02.24 of the Standard Specifications.
- Curing compound must be maintained for seven days.
- Any areas of the compound receiving damage during the seven-day curing period must be resprayed, and areas expected to receive heavy use should be protected.
- The contractor shall thoroughly clean areas that are to receive a masonry coating or additional concrete anytime curing compound overspray falls on them.
- Curing compound should never be applied to construction joints or to bridge decks that are to receive an overlay or onto reinforcement bars. If done, the contractor must completely remove the curing compound by whatever means necessary.

BRIDGE DECK CURING

Section 609.03.12 of the Standard Specifications details the requirements for bridge deck curing.

	Section CONCRETE
	Subject Surface Finish

GENERAL

The three types of concrete surface finish are:

- Ordinary
- Masonry-Coated
- Floated-Surface

All concrete surfaces require an ordinary surface finish. Some surfaces also require either a masonry-coated or floated-surface finish.

The contractor's finishing methods should result in a smooth, even-textured concrete surface. As soon as the concrete has attained sufficient strength, the contractor shall remove all form ties, anchorages, and tie wires. All cavities and depressions must be cleaned, pointed, filled with mortar, cured, and finished in accordance with Section 601.03.18(A) of the Standard Specifications. The contractor shall remove irregular projections, fins, and form bulges from all surfaces that will be exposed in the finished structure.

ORDINARY SURFACE FINISH

The ordinary surface finish will provide a surface uniform in color, texture, and smoothness. The section engineer (SE) shall inspect and accept each face of a structure individually. If the contractor exerts care in form construction and vibrates and spades the concrete sufficiently during placement, it will save much finishing effort after form removal.

The Department restricts the contractor from any delay of ordinary surface finish operations, because patches bond to "green" concrete much better than to hardened concrete. The specifications require the ordinary surface finish immediately after form removal. To make patches on an uncontaminated surface and to get the proper cure on these patches, the contractor shall not delay providing the ordinary surface finish. The enforcement of these timely requirements will require a special effort by the SE and his or her personnel.

The SE will have to use discretion in determining when an ordinary surface finish should be provided during cold weather. The contractor must protect the ordinary surface finish from freezing.

MASONRY-COATED SURFACE FINISH

After concrete surfaces have received an approved ordinary surface finish, some will also require a masonry coating surface finish. Surfaces to receive a masonry coating surface finish are depicted on the project plans or are specified in Section 601.03.18(B) of the Standard Specifications. The contractor shall not cure these surfaces with curing compound. This surface finish consists of the application of a masonry coating by brush, roller, or sprayer in accordance with the manufacturer's recommended practice. Only coatings on the *List of Approved Materials (LAM)* from the Division of Materials shall be used.

Since the bond between the concrete and coating is critical, a clean surface is imperative. The contractor shall ensure that the surface to receive the coating is clean and free from dust and oil. Bridges carrying traffic before coating application could require extensive cleaning.

A masonry coating will not cover deficiencies in the ordinary surface finish. Many times the coating will accentuate irregularities; therefore, a good ordinary surface finish is still absolutely important. Before applying the masonry coating, the contractor shall fill air holes in the concrete with the coating or an approved mortar. Mortar must be thoroughly cured before the application of most masonry coatings.

The contractor shall apply masonry coating in strict conformance with the manufacturer's recommendations. These recommendations are found in the coating manufacturer's brochures the contractor must provide to the SE. Water-based coatings require wetting the concrete surface prior to their application. This presents a special problem concerning protection of the applied coating during early spring and late fall when overnight temperatures may unexpectedly fall below freezing. An overnight freeze may cause the coating to spall off the concrete. Solvent-based masonry coating requires a dry surface for application but is less affected by cold temperatures.

Before beams are erected, the SE shall ensure that the contractor coats any abutment backwalls that will be made inaccessible by the erection of beams. The contractor shall apply the masonry coating to a depth of six inches below adjacent backfill. Therefore, the coating shall be applied before final grading and dressing operations.

Note: Excessive thicknesses of coating will not cure properly.

FLOATED-SURFACE FINISH

The floated-surface finish shall be constructed in accordance with Section 601.03.18(C) of the Standard Specifications. Surfaces such as tops of pier caps, bridge seats, tops of formed walls, culvert slabs, etc. will receive the floated-surface finish.

To provide this finish, the contractor must place a slight excess amount of concrete in the forms; therefore, special care should be taken to ensure that the concrete is finished to proper grade.

SURFACE TEXTURES Surfaces that receive wear from vehicles or pedestrians are given textures for skid resistance. The two most common textures are broomed and tined. New bridge decks are tined and most deck overlays and sidewalks are broomed. The project specifications will detail which type is required.

	Section CONCRETE
	Subject Construction Date, Load Design, & Drawing Number Identification

REQUIRED IDENTIFICATIONS

All bridges and box culverts require a stenciled construction date and drawing number. This date will be the year the contract was executed, not the year the structure was completed. The plan drawing number is different for each structure. Bridges with a clear span of twenty feet or more also require the bridge design load capacity be stenciled on them. All bridges require the stenciled name of the contractor and subcontractor, if applicable.

LOCATIONS FOR IDENTIFICATIONS

All of these identifications shall be located and constructed in accordance with the plan referenced standard drawing and Section 601.03.19 of the Standard Specifications. The section engineer and the contractor shall discuss the location of these identifications at an early date to ensure their correct placement.

The stencils will always be on the inlet ends of box culverts unless the construction consists only of an extension on the outlet end, in which case the stencil should be on the outlet end.

IDENTIFICATIONS ON PRESTRESSED CONCRETE STRUCTURES

CST-1311-1 discusses locations on prefabricated deck sections that have no suitable location on the abutments for the stencil.

	Section CONCRETE
	Subject Investigating Low-Strength Concrete

INVESTIGATION

If cylinder strengths indicate that low-strength concrete may be present in a structure, the section engineer (SE) shall investigate the concrete in accordance with **KM 64-314**.

The district materials engineer (DME) shall automatically investigate any in-place concrete that is represented by a low-strength cylinder report. The SE shall, however, pursue the problem and provide the DME necessary assistance.

INVESTIGATION RESULTS

The DME will furnish the results of the investigation to the:

- Section Engineer
- Branch Manager for Project Delivery & Preservation
- Central Office, Division of Construction District Liaison

These individuals shall interpret the investigation results, decide on any action necessary, and issue instructions to the contractor accordingly.

Note: This policy does not relieve the SE from executing the other procedures outlined in KM 64-314.

	Chapter STRUCTURES
	Subject Reinforcing Steel

GENERAL

Reinforcing steel is placed in concrete to resist stresses due to flexure, shear, tension, compression, and temperature changes. In general, the furnishing and placement of steel reinforcement shall comply with Section 602 of the Standard Specifications. Section 811 of the Standard Specifications details material requirements for reinforcing steel.

Reinforcing steel is specified by the bar number that indicates its diameter in eighths of an inch. For example, a No. 4 bar has a diameter of one half-inch, a No. 11 bar will have a diameter of 1 3/8 inches, etc. The bar size is rolled in the bar at intervals along its length. Section 602.04.01 of the Standard Specifications shows the weight per foot and nominal dimensions according to bar size.

Exhibit 9096 contains information pertaining to the grades and identification marks of reinforcing steel.

CHECKING PLANS FOR ERRORS

As soon as possible after receiving bridge plans, **it is very important that** the section engineer (SE) ensure that an experienced inspector checks the plan quantity and dimensions of bridge and culvert reinforcement. The inspector shall note any bars omitted from the bill of reinforcement and shall verify epoxy-coated steel designations.

If errors are noted, the SE shall notify the district branch manager for Project Delivery & Preservation and contractor immediately. This notification should prevent the contractor from ordering unnecessary reinforcing steel. Reinforcing steel errors caught after delivery to the job-site may be costly to the Department. After notification of an error, Central Office will verify the error through the Division of Structural Design, and a plan revision will be issued. Some minor errors may not require revised plans.

QUANTITY ADJUSTMENTS

It is extremely desirable to discover any major errors in reinforcing steel before the steel is delivered to the project. When plan errors are not discovered prior to fabrication, the Department must purchase any steel that cannot be utilized in the structure by supplemental agreement. The unused steel will be given to district maintenance forces.

QUANTITY ADJUSTMENTS (CONT.)

Reinforcing steel of this nature will be paid by supplemental agreement. The price will be established by the contractor's invoice cost plus delivery and handling cost, if applicable. If the plan error involves a change in reinforcing steel quantity, the change order shall also reflect this change.

SALVAGE VALUE

On federal aid projects, federal participation may be withheld on the salvage value of the reinforcing steel that the state maintenance receives. If the nature of the reinforcing steel is such that maintenance forces want it, then the price previously mentioned (as being established by invoice, etc.) should be entered in the supplemental agreement as a nonparticipating item.

Maintenance forces may be able to use straight bars but may not want bent bars. In this instance, an estimate of the steel poundage going to maintenance forces would be made and entered in the supplemental agreement as a nonparticipating item. The remaining steel would not have a salvage value and should be entered as a participating item with the contractor requested to dispose of it. This procedure should not be implemented unless a substantial quantity of reinforcing steel is involved.

JOB-SITE STORAGE

Reinforcing steel shall be protected at all times from damage. The contractor shall straighten any bent bars before placing them on the work. The SE shall reject bars that have sharp kinks. Heat shall not be utilized in straightening steel.

The contractor shall store reinforcing steel in a neat, workmanlike manner on the project. It should not be stored on the ground but should be supported off the ground in a manner satisfactory to the SE, usually on lumber. Dumping of steel from a truck or placing in haphazard piles will not be tolerated. If possible, the steel should be stored near the structure in which it is to be used. The contractor shall clean epoxy-coated bars by wire brush when necessary and touch up any nicks, scrapes, or cuts before placing in deck.

EPOXY-COATED STEEL

The contractor must take special precautions when handling epoxy-coated reinforcing steel to prevent damage to the epoxy coating, including:

- Bands that secure bar bundles should be lined.
- Nylon slings or protected cables should be used to lift epoxy steel.
- Care shall be taken to prevent adjacent bar bundles from shifting so that epoxy coating is not scratched.
- Extended outdoor storage at the job-site should be avoided.
- If bars are stored outside, storage should be limited to two months or less.
- If the outdoor storage is expected to exceed two months, the bars should be kept off the ground and covered for protection against moisture and sunlight.

SAMPLING & TESTING

Reinforcing steel shall be sampled and tested in accordance with Section 811.02.02 of the Standard Specifications and the procedures set forth in the *Materials Field Sampling and Testing Guidance Manual*.

It is acceptable practice to either saw or burn a bar to obtain a sample. If burning is used, an extra inch of length should be added to each burned end.

Note: Do not burn epoxy-coated steel. The epoxy coating is flammable and the fumes are toxic.

PLACING & FASTENING

All placing and fastening of reinforcing steel shall comply with Section 602.03.04 of the Standard Specifications.

Reinforcing steel must be secured in the correct position before concrete placement is begun. The SE or the project inspector shall check the steel for correct positioning before concrete placement is started and again during the concrete operation to be assured no shifting has occurred. The spacing and concrete cover on reinforcing steel are design features. Positions shown in the plans are necessary to obtain the required strength in the structure.

The contractor shall place the reinforcing steel and allow a sufficient time thereafter to permit inspection and approval by the SE or the inspector prior to beginning concrete placing operations. Any concrete placed contrary to this requirement is subject to rejection in accordance with Section 105.12 of the Standard Specifications.

The SE shall give special attention to the location of steel that will be in the vicinity of drilled anchor bolt holes. Even though mislocated steel may require that it be severed or the anchor bolt relocated; neither of these is desirable.

All steel reinforcement (other than that for bridge slabs) shall be placed and tied to the requirements and tolerances of Section 602.03.04 of the Standard Specifications. Section 609 applies to bridge slabs. **Exhibit 9097** provides guidance for inspection and acceptance of epoxy-coated reinforcing steel as well as recommended construction practices.

CLEANING

When secured inside structure forms, steel reinforcement shall be free from dirt, loose rust, paint, oil, grease, and curing compound. The contractor shall remove any substance that could prevent a good bond between the steel and concrete. Most foreign substances such as dirt and rust can be removed by wire brushing. Sometimes a contractor may prefer to sandblast the reinforcing steel when a large area is dirty or utilize a solvent or detergent to remove oily substances. **Do not sandblast epoxy-coated steel.** The SE or inspector shall thoroughly inspect reinforcing steel as it is placed.

SPLICING

Reinforcing steel shall be furnished according to plan lengths, with splices of the proper lap and at locations shown on the plans. The SE or inspector shall ensure that the minimum specified lap is provided. Extra length may be provided for the possibility of lowering footings and extending column lengths. Spliced bars shall be tightly wired together and be in contact along the entire length of the lap.

The contractor shall make all splices (whether straight bar, spiral, or metal mesh) in accordance with Section 602.03.06 and 602.03.07 of the Standard Specifications.

If mechanical or welded splices are allowed by structure plans, the contractor shall perform them in strict compliance with the plans, Standard Specifications, and manufacturer's recommendations. When using field-added splices, the contractor shall take special care to ensure that enough clearance is left between adjacent bars to provide for complete concrete encasement of all steel.

Generally, all mechanical splices are sampled and tested to ensure that the splice develops more strength than the bar. It generally is required to exceed 125 percent of the tensile strength of the bar. If lap splices are used, the SE or inspector shall ensure that the splice does not interfere with the proposed cover.

BRIDGE DECKS

The placement of reinforcing steel for bridge decks shall meet the tolerance stipulated in Section 609.03.03 of the Standard Specifications. See **CST-1312-6** for information pertaining to steel placement in bridge decks.

	Section STRUCTURAL STEEL
	Subject General

INTRODUCTION

The section engineer (SE) shall be thoroughly familiar with the details of all phases of bridges and be sure the project inspector is properly instructed in all phases of steel bridge construction prior to the beginning of work. Section 607 of the Standard Specifications governs the construction of steel bridges.

MILL TEST REPORTS

All major structural steel, including bolts, is required to have mill test reports with actual physical and chemical test results. The Division of Construction must check these test reports to verify compliance with the applicable specification. When structural steel is inspected by an outside testing agency, then that agency checks the test reports and the test reports will be distributed to the SE by the Division of Construction. Appearance of the inspection company's seal stamp on steel members signifies that test reports are approved.

Minor structural steel (such as armored edges and build-up plates on expansion dams to accommodate overlays) is only required to be commercial-grade steel and neither mill test reports nor certifications are required.

The SE reviews and approves test reports for H piles. This is the only steel, requiring test reports, that is accepted solely by field personnel because of the complexity of other specifications. See **Exhibit 9079** for additional information.

	Section STRUCTURAL STEEL
	Subject Bridge Seats

SPECIFICATIONS

Section 601.03.09(A) of the Standard Specifications require that bridge seats on pier or abutment risers that directly support steel bearings be constructed monolithically with the cap and 1/8 inch higher in elevation.

After the concrete has thoroughly hardened, the contractor shall grind it to the plan elevation using a Carborundum stone grinder until the finished surface, checked with a spirit level, shows no variation in excess of 1/32 inch above or below a true level plane. This ensures a level uniform surface that will provide uniform bearing.

Precise location of the bearing lines and substructures is critical for steel construction due to design and fabrication concerns. The contractor shall construct bridge seat elevations as detailed on the plans so that holes for connection of the component sections of the steel superstructure will be properly aligned. The centerline of bearings of piers and abutments must be precisely located.

	Section STRUCTURAL STEEL
	Subject Fabrication

PREFABRICATION MEETING

The Central Office Division of Construction will hold a meeting at the fabrication shop before any structural steel work is started. This meeting shall be attended by the fabricator, Division of Construction personnel, and the Cabinet's consultant inspection service. The contractor, district personnel, or designer are not required but can attend the meeting. The consultant shall document the meeting and provide all with a report. Division of Construction personnel will generally run the meeting.

Attendees of this meeting shall discuss, not limited to, the following:

- Fabrication and delivery schedules
- Weld procedures
- Shop inspection by the Cabinet's consultant
- Testing types and frequencies
- Requests for Information (RFI's)
- Shop drawings

This meeting shall be followed up by a general walk through of the shop that usually results in more communication of the shop processes.

SHOP INSPECTIONS

The Division of Construction shall conduct periodic shop inspections. These inspections are not necessarily scheduled or conducted as a meeting and may coincide with the Division of Construction field engineer visit to deal with fabrication problems. The Division of Construction conducts a shop walk-through to ensure the quality of the fabrication and to provide a check of the Cabinet's consultant. **Exhibit 9093** details the shop inspection. The Division of Construction field engineer shall write a report of the visit.

FABRICATION DOCUMENTATION

The Central Office field engineer in charge of the shop fabrication shall keep the district and other entities informed of all reports, drawings, and other information; although it will generally be for records only.

SHOP DRAWINGS

During the fabrication phase of steel bridges, the fabricator will prepare shop drawings and submit them to the Division of Structural Design for review. This review shall occur before fabrication begins. The Division of Structural Design will stamp each approved reviewed drawing.

MATCH-MARKING

The steel will be assembled, checked by the Department's inspectors, and match-marked as detailed on the shop drawings. Future erection in the field will be accomplished using the shop drawings that detail where each match-marked piece fits in the structure.

FINAL FABRICATION INSPECTION

Prior to the structural steel being shipped from the fabrication shop, the inspector will determine its acceptability. If it meets approval, based on all of the contract requirements, the inspector will place the “Inspection Agency” seal signifying approval in a visible location on each member.

	Section STRUCTURAL STEEL
	Subject Project Site Inspection

OVERVIEW

When the structural steel is received on the project, the section engineer (SE) or the project inspector shall make a close visual inspection as soon as possible. It should be inspected for shipping damage and any noticeable fabrication oversights.

The SE must recognize that even though the structural steel must be stamped with the "Inspection Agency" seal (**CST-1309-3**), the presence of this seal does not mean that he or she should automatically accept the steel as delivered to the project. The field inspection is critical and must be thorough, as it will be the last opportunity for anyone to closely inspect the steel.

Note: The project contractor bears full responsibility for the condition of the steel.

COMMON DEFICIENCIES

The following list shows the most commonly noted deficiencies:

- Open spaces exist between ends of bearing stiffeners and flange

  Note: Bearing stiffeners shall be milled or ground to secure an even bearing against the flanges.

- Intermediate stiffeners do not fit sufficiently tight to exclude water after being painted

- Flanges not at right angles to webs

- Bows or kinks in web plates, flanges, and stiffeners

  Note: This can especially occur when the steel components were tied down.

- Unacceptable welds (such as weld overlaps that have not been properly faired, excessive porosity in welds, and cracked or broken welds)

  Note: Incomplete welds are sometimes found in the flange to web welds at end of girders when run-off tabs were not used.

COMMON DEFICIENCIES (CONT.)

- Weld efflorescence as evidenced by a gray-white deposit around welds and caused by lack of neutralization or incomplete cleaning of welds

- Fill plate or splice plates tack-welded to girders

  Note: Tack welds shall be removed and ground smooth prior to bolting.

The SE or inspector shall report any found deficiencies to the Central Office Division of Construction for an opinion on correction or rejection of the steel.

	Section STRUCTURAL STEEL
	Subject Storage

STORING STRUCTURAL STEEL

The section engineer (SE) shall ensure that the contractor is properly storing the steel by checking to see that it is adequately supported and blocked above the ground. It should be stored in a properly drained area and adequately braced to prevent it from being blown over by high winds. An acceptable method of bracing girders should include braces from ground and connections between girders.

The contractor must satisfactorily store the steel before any partial payment is made.

The SE shall:

- Ensure that the contractor has flagged or marked the area properly to protect against other construction activity
- Regularly check the stored steel for settlement or damage

	Section STRUCTURAL STEEL
	Subject Erecting Structural Steel

ERECTING STRUCTURAL STEEL

The section engineer or the project inspector shall:

- Discuss the contractor's erection scheme in detail with the project superintendent prior to erection
- Check and approve any necessary falsework bents for load carrying ability and structural integrity
- Review the contractor's proposed method of lifting the girders

  Note: Lifting points must be located in such a manner as to prevent buckling of the members.

  Note: Lifting lugs that damage the flanges by causing indentations in the steel will not be permitted.
- Accurately measure the distance between the centerlines of bearing prior to erection of any structural steel
- Satisfactorily resolve any discrepancies before erection is begun

  Note: The use of "Come Along" is sometimes necessary in steel erection but should not be permitted to fit or pull together members where excessive sweep or distortion occurs because it will leave excessive residual stresses in the steel.

The contractor shall erect structural steel in accordance with approved erection drawings. The SE or project inspector shall inspect the steel to ensure the erection sequence will allow the required positioning for all members to be properly fitted. Sometimes the contractor must erect girders from one particular side to be able to fit the diaphragms. The contractor shall also take care to position the diaphragms on the correct side of the stiffener.

	Section STRUCTURAL STEEL
	Subject Steel Nuts & Bolts

HIGH-STRENGTH BOLTS

The section engineer (SE) shall visually inspect high-strength bolts to ensure they are A325. An A325 bolt must have and can be identified by:

- Three radial lines on the top of the head (unless weathering steel is specified)
- The legend "A325" stamped on the head
- The manufacturer's mark

Heavy semi-finished hexagonal nuts (manufactured in accordance with ASTM A325) are identified on at least one face by the correct letter or mark symbol for that grade of nut. Bolts shall also be clean and free of rust.

Sampling and testing of bolts, nuts, and washers shall be in accordance with the *Materials Field Sampling and Testing Guidance Manual*. The Division of Materials also has the ability to tension test bolts to assure strength characteristics, when requested.

ROTATIONAL CAPACITY (LUBRICANT) TEST FOR STRUCTURAL STEEL BOLTS

The Rotational Capacity Test (R. C. Test) is required for all plain, galvanized, and weathering structural steel bolts, nuts, and washers. This test determines if the components of the structural fastener can be used together to obtain the required tension without damage to any parts of the assembly and without excessive torque.

Section 813.09.02(D) of the Standard Specifications discusses the R. C. Test. **Exhibit 9098** provides a detailed description of performing the R. C. Test and includes a worksheet for performing the R. C. Test and a Certification Sheet for recording the results.

Note: The contractor shall perform the R. C. Test and witnessed by Department personnel.

ROTATIONAL CAPACITY (LUBRICANT) TEST FOR STRUCTURAL STEEL BOLTS (CONT.)

The most common cause of rejection, as determined by the R. C. Test, is due to excessive torque. This is usually caused by lack of lubrication or weathered or rusted bolts or nuts. Fasteners failing the R. C. Test for these reasons may be cleaned, relubricated, and used in installation, provided they pass a subsequent R. C. Test.

The required tension and the turn test tension shown in the Standard Specifications and the exhibits are for ASTM A325 bolts only. If the plans call for ASTM A490 high-strength bolts, the SE shall contact the Division of Construction to obtain the tensions required.

STORAGE

The contractor shall store bolts in a clean, dry area protected from the elements as approved by the SE.

Only the bolts necessary for use during a work shift shall be removed from the storage area during that shift. Any unused bolt assemblies from a shift, especially from opened containers, shall be considered a separate lot for testing during the next work shift.

	Section STRUCTURAL STEEL
	Subject Bolting Members

INTRODUCTION

The project inspector shall observe the installation of bolts and determine that proper procedures are being followed. **Never allow the bolt tightening to proceed under method of "ironworkers calibrated ear."**

CONTACT SURFACES

All joint contact surfaces shall be free of scale, burrs, dirt, paint and other foreign material (except tight mill scale on weathering steel) that would prevent solid seating of the parts. Splice plates should be checked and removed for cleaning, if necessary, prior to erection.

BOLT TIGHTENING TECHNIQUES

Before final tightening of the bolts in a joint, the plates or members to be bolted should be brought into good, firm contact. If the contractor needs to over-tighten bolts to pull members together, all bolts that exceed 110 percent of required tension shall be removed and replaced. (When using calibrated wrenches, an override is used to exceed the allowable or required cut-off.)

Bolts shall be tightened in a connection by progressing systemically from the most rigid part of the joint to the free edges. After all bolts have been installed in a joint with the calibrated wrench, the wrench shall be returned to "touch up" those bolts previously tightened that may have loosened by the tightening of subsequent bolts, until all bolts are torqued to the required amount.

INSPECTION

The project inspector shall check a minimum two bolts in each connection and 10 percent of the bolts in large connections with the manual torque wrench, previously calibrated as specified.

If one or more of the bolts in the connection are below the minimum tension, all the bolts in the connection must be checked. Bolts may be torqued to the correct tension, loosened, and retorqued one time. Bolts tightened more times than this must be discarded and not reused.

REAMING & BURNING HOLES

In making a connection, sometimes the contractor needs slightly ream an occasional hole. However, excessive reaming shall not be permitted. Burning of holes to increase their size will not be permitted nor is burn cutting of any new steel to be permitted without prior approval by the Division of Construction.

REAMING & BURNING HOLES (CONT.)

The inspector shall check that the contractor used and properly oriented the correct plates at the correct location before allowing any reaming of holes.

	Section STRUCTURAL STEEL
	Subject Bolt Tightening Procedures

CALIBRATED WRENCHES

When using this procedure to tighten bolts, the impact wrenches shall be calibrated wrenches that are properly adjusted to secure a bolt tension slightly in excess of the minimum required bolt tension given in Section 607.03.05 of the Standard Specifications. The contractor must calibrate the wrenches twice daily.

These wrenches shall be calibrated by tightening bolts in a device capable of indicating actual bolt tension (such as the "Skidmore-Wilhelm Tensile Testing Device").

Note: Any similar device is satisfactory.

Note: The tensile testing device must also be used to check the manual torque wrench used by the inspector for either method of tightening bolts.

Not less than three typical bolts from the lot size being installed shall be utilized in the calibration and the results averaged. Power wrenches must be of such design that they can be adjusted to stall or cut-out at the selected tension in approximately ten seconds. Sometimes "in-line" air regulators are not capable of performing this function satisfactorily, in which case, they should not be used.

When tightening bolts in the tensioning device for the purpose of calibration, a different bolt, nut, and washer will be used each time. Additional use of the same bolt, nut, and washer will result in widely varying tension-torque indications. The manual torque wrench may be calibrated at the same time the impact wrenches are calibrated using these tightened bolts.

Nuts shall be in tightening motion when torque is measured.

The average torque measured in the tests of three bolts shall be taken as the job inspection torque.

TURN-OF-NUT TIGHTENING

A representative sample of not less than three bolts and nuts of each diameter, length, and grade to be used in the work shall be checked at the start of work in a device capable of indicating bolt tension.

TURN-OF-NUT TIGHTENING (CONT.)

The test shall demonstrate that the method of estimating the snug-tight condition and controlling turns from snug tight to be used by the bolting crews develops a tension not less than 5 percent greater than the tension required by Section 607.03.05 of the Standard Specifications.

Bolts shall be installed in all holes of the connection and brought to a snug-tight condition. Snug tight is defined as the tightness that exists when the plies of the joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a person using an ordinary spud wrench.

Snug tightening shall progress systematically from the most rigid part of the connection to the free edges, and then the bolts of the connection shall be retightened in a similar systematic manner as necessary until all bolts are simultaneously snug tight and the connection is fully compacted. Following this initial operation, all bolts in the connection shall be tightened further by the applicable amount of rotation specified in Table 5 of the *AISC Specifications for Structural Joints*.

Note: During the tightening operation, there shall be no rotation of the part not turned by the wrench.

DIRECT TENSION INDICATORS

Most projects will require checking the bolt tension by using direct tension indicators. There are many different types of tension indicators. The most commonly used direct tension indicators (DTI) in steel structures are essentially washers with raised dimples that compress when the proper tension is applied to the bolt. The bolt tension is checked by inserting a feeler gage between the dimples of the DTI to see that it was properly compressed. The section engineer (SE) and inspector shall become familiar with the manufacturer's specific instructions for installation.

Normally the contractor will install the DTI under the bolt head or the non-turned element of the bolt assembly. In some cases the bolt assembly may have to be oriented so that the bolt head and DTI are inaccessible to check for proper compression. In these rare cases the DTI may be installed under the nut or the turned element. Installation in this manner requires additional hard washers and bolt length. The manufacturer’s instructions shall be consulted for additional installation requirements. Once the dimples of this DTI have been compressed to any extent, they may not be reused.

Before installing any DTI bolt assemblies on a project, the SE shall test at least three different bolt assemblies including the DTI in a device that will indicate the bolt tension. This will show that the DTI compresses properly at the correct tension. The SE shall check at least 10 percent (not less than two) of the bolt assemblies in each field connection with a feeler gage at the DTI according to the manufacturer’s directions.

DIRECT TENSION INDICATORS (CONT.)

Generally, this means that the gage will not enter the gap of the DTI in at least half of the insertion points. The SE shall visually inspect the bolts not checked with the feeler gage to ensure the DTI is compressed. If the bridge will receive a field coat of paint, the SE shall check that the gaps behind the indicators are sealed by the paint.

	Section STRUCTURAL STEEL
	Subject Field Welding

POLICY

Field welding shall not be permitted on any portion of a steel structure unless specifically required by the plans or permitted in writing by a Division of Construction field engineer, upon checking with the Division of Structural Design, and then only in the manner and at the locations designated in the written authorization.

Note: Welding shall not be used to attach falsework support brackets, clips, gussets, filler plates, etc. to load carrying members.

	Section STRUCTURAL STEEL
	Subject Anchor Bolts

INTRODUCTION

The contractor shall not drill anchor bolt holes and shall not set anchor bolts until all structural steel is erected and all bolts properly torqued throughout the structure. Exceptions may be made on large river crossings; however, these exceptions require the approval of the Central Office, Division of Construction.

ANCHOR BOLT HOLES

The contractor shall carefully locate anchor bolt holes to avoid the steel reinforcement. Anchor bolt holes shall be covered or otherwise plugged to prevent water from standing. This will prevent the formation of ice and ensure that the holes will be dry when hot molten lead is poured around the bolts. The anchor bolt should be heated so that it will not cool the molten lead before it reaches the bottom of the hole. The hole must be completely filled to the top of the masonry plate.

GROUTING

When the plans allow grouting of the anchor bolts, the grout must be an approved type and fluid, so that the hole can be partially filled and the anchor bolt inserted to cause the grout to flow out the top of the hole.

	Section STRUCTURAL STEEL
	Subject Bearings

CALCULATING STRUCTURAL CHANGES

The contractor shall give careful consideration to the setting of bearings and shall consult the plans for any notes pertaining to the bearings. To obtain the proper inclination of each bearing for the temperature at the time of setting, the contractor may need to calculate the amount of expansion or contraction of the girders due to the temperature changes of the steel.

Sometimes the contractor needs to calculate the anticipated elongation or angular change of the bottom flanges of simple span girders due to the dead load of the concrete slab. This amount of elongation should be considered in setting the bearings so that they will be vertical at the temperature designated on the plans—usually 60 F.

STEEL ROCKER BEARINGS

Steel rocker bearings are now used primarily in railroad bridges. **Exhibit 9099** includes detailed instructions and an example of the necessary calculations in the setting of bridge rockers.

ELASTOMERIC BEARING PADS

Elastomeric bearing pads may scoot under extreme temperature changes before a deck is placed if the beam weight proves inadequate to hold the pads in place. If slippage occurs or if the beams are set during extreme temperatures, the contractor may need to jack up the beams for adjustment of elastomeric pads at "normal" temperatures.

	Section WELDING
	Subject General

POLICY

Except as shown on the plans, welding of any nature **shall not** be performed on the load carrying members of a bridge without the written consent of the Central Office, Division of Construction, or an authorized representative, and then only in the manner and at the location designated in the authorization. This includes installation of stay-in-place forms and falsework.

Most structural steel welding in Kentucky bridges is performed in steel fabrication shops under the inspection of a qualified testing agency by consultant agreement. However, occasionally field welding is required and Department section engineers (SEs) and inspectors must have a working knowledge of the necessary requirements and good welding practices to properly inspect the work.

SAFETY ISSUES

Inspectors shall note the following safety issues:

- Welding arcs are brighter than the sun and can cause eye injury.
- Sparks and spatters can cause fires or burns.
- Sparks can spray up to 30 feet away.

Inspectors shall wear appropriate clothing and handle themselves accordingly when near welding operations. See chapter 11 of the *Employee Safety and Health Manual* for proper clothing details.

REGULATIONS

The contractor shall perform all field welding as specified in the Standard Specifications for Road and Bridge Construction, special provisions, plan notes, and the applicable American Welding Society (A.W.S.) Specifications for Highway and Railway Bridges. The ANSI/AASHTO/AW5 D1.5-2002 (or current edition) Bridge Welding code applies to welding main members. In order to avoid any confusion, the SE shall discuss welders, procedures, applicable regulations, and other details with the contractor prior to welding.

WELDING CATEGORIZATION

All welding generally falls into one of two categories, either fillet or groove welds. Fillet welds are considered to be partial penetration welds and groove welds are either partial penetration or full penetration welds.

TACK WELDS & ARC STRIKES

Tack welds and ARC strikes on high tension members are known causes of cracks. **These shall be prohibited.** Even when these welds and strikes are ground off, micro cracks may exist.

	Section WELDING
	Subject Qualifying Welding Operators

WELDER QUALIFICATION & CERTIFICATION

A welder must be qualified by possessing a valid certification before performing any field welding. The section engineer (SE) must check the welder's certification to determine that the welder is qualified for making the specified type and position of weld. The certification must show that the welder has been qualified within the last 24 months and must have been tested and certified by a recognized state or private testing agency. The Division of Materials maintains a listing of approved vocational schools for testing welders and a listing of welders certified by that office, and may be contacted concerning a welder's qualification.

The SE must retain a copy of the qualification papers or welder qualification number in the project files on each welder performing on the job. Other welding on the project such as cofferdams, shoring, jack supports, etc. also need to be completed by a qualified welder due to large amount of stresses these welded joints are expected to handle.

Note: Allowable stresses for construction purposes generally are much greater than that expected of permanent work.

One exception to welder qualification is welding of stay-in-place formwork. An inexperienced welder can easily burn through this thin-gauge galvanized metal; thus, a **competent** welder in this type of formwork is preferred. Refer to **Exhibit 9101** for examples of welds.

WELDING TEST

If the welder lacks or has invalid certification papers, the welder must pass a welder's qualification test before performing any welding on the project. This test may be conducted by an approved vocational school testing agency or the Division of Materials. The Division of Materials maintains a list of approved testing agencies. Testing procedures shall comply with **KM 64-110** and the results shall be submitted to the Division of Materials with the TC 64-753 form, *Shielded Metal Arc Welders or Mig Welders*.

Note: KM 64-110 is applicable for splicing piles and minor structural steel repair. Major structural steel repair shall require welder qualifications per AWS D1.5-2002 Bridge Welding Code (or current edition).

	Section WELDING
	Subject Welding Position

WELDING POSITION QUALIFICATIONS

Before a welder is permitted to perform any welding, the welder must be qualified to make the specified weld according to the position in which the weld will be made.

WELDS

In accordance with the welding position definitions described in **Exhibit 9100**, all welds encountered in actual construction shall be classified as one of the following:

- Flat
- Horizontal
- Vertical
- Overhead

Each qualification weld shall be made in the position in which the welding will be performed in the work, except that test welds made in the 1F or 1G positions qualify for flat and horizontal fillet welding. **Exhibit 9101** shows examples of acceptable and unacceptable welds.

GROOVE WELD POSITIONS

Plates shall be welded in the following groove weld positions:

1. Position 1G (flat)—The plates shall be placed in an approximately horizontal plane and the weld metal shall be deposited from the upper side. See **Exhibit 9100**.
2. Position 2G (horizontal)—The plates shall be placed in an approximately vertical plane with the groove approximately horizontal. See **Exhibit 9100**.
3. Position 3G (vertical)—The plates shall be placed in an approximately vertical plane with the groove approximately vertical. See **Exhibit 9100**.
4. Position 4G (overhead)—The plates shall be placed in an approximately horizontal plane and the weld metal deposited from the underside. See **Exhibit 9100**.

FILLET WELD POSITIONS

Plates shall be welded in the following fillet weld positions:

1. Position 1F (flat)—The plates shall be placed so that each fillet weld is deposited from the upper side with its axis approximately horizontal and its throat approximately vertical. See **Exhibit 9100**.

2. Position 2F (horizontal)—The plates shall be placed so that each fillet weld is deposited on the upper side of the horizontal surface and against the vertical surface. See **Exhibit 9100**.

3. Position 3F (vertical)—The plates shall be placed in approximately vertical planes and each fillet weld shall be deposited on the vertical surfaces. See **Exhibit 9100**.

4. Position 4F (overhead)—The plates shall be placed so that each fillet weld is deposited on the underside of the horizontal surface and against the vertical surface. See **Exhibit 9100**.

	Section WELDING
	Subject Welding Electrodes

ELECTRODE CLASSIFICATION

A welding electrode is classified by the letter "E" and a four-digit number (such as E 6010, E 7018, etc.). The letter "E" denotes a welding "electrode." The first two digits of the four-digit number indicate the minimum tensile strength of the deposited weld metal in Kips per square inch (KSI). The third digit indicates the position or positions in which the electrode is capable of making satisfactory welds; for example, "1" is an all-position electrode, "2" signifies flat and horizontal positions only, and "3" is the flat position only. The fourth digit relates to the composition of the flux and type of current to be used ("5," "6," and "8" are low hydrogen).

Only electrodes meeting the requirements of Part A and Part B of Chapter 4 of AWS D1.5-2002 Bridge Welding Code (or current edition) may be used. If there is any question regarding an electrode, the Central Office Division of Construction shall be contacted prior to its use.

ELECTRODE COATING & CARE

During the welding process, the electrode coating forms a gas shield to prevent absorption of impurities from the atmosphere and flux in the coating purifies the molten metal. Two characteristics of this method of welding are:

- Solidified slag on the weld face
- Weld splatter that sticks to the surrounding metal

Note: Both of these deposits are removed by chipping or scraping.

Low hydrogen electrodes are susceptible to absorbing moisture and producing unacceptable welds; therefore, the electrodes shall be kept dry. The electrodes must be in tightly sealed metal containers when received and must be used within the specified time period (usually four hours) after opening or must be dried in an oven, as required.

	Section WELDING
	Subject Field Welding

OVERVIEW

Generally, necessary field welding (other than that used for splicing piling) will be stipulated in the structure plans or the shop drawings. The shop drawings will normally outline the complete approved welding procedure. The section engineer (SE) shall ensure that the contractor exactly follows the procedure. Changes in procedures may be made **only** with prior approval of Central Office, Division of Construction. **Exhibit 9100** offers guidance in interpreting welding symbols on project structure plans and shop drawings.

Manual shielded metal arc welding (SWAW) is the most common form of welding in the field and is sometimes referred to as manual, hand, or stick welding.

The sizes and lengths of welds shall not be less than those specified in detail drawings, nor shall they be substantially in excess of those requirements without approval. The location of welds shall not be changed without the approval of the Central Office, Division of Construction.

The base metal shall be prepared such that surfaces and edges to be welded shall be smooth, clean and free of rust, uniform, and free from fins, tears, or cracks and shall meet all other requirements conforming to AWS specifications. The limits of acceptability and the repair of visually observed edge defects in plates shall be determined by discussion with the Central Office, Division of Construction. Members to be welded shall be brought into correct alignment and held in position by bolts, clamps, wedges, struts, or tack welds (when permitted) until welding has been completed.

Note: Tack welds that are welded over and melted into the final weld are permitted if properly performed.

WELD INSPECTION

The SE or inspector must closely inspect the quality of the finished weld to determine if the completed weld is acceptable. The weld must have all slag removed so that the weld can be inspected. The weld profile and size must be correct. The welds must be free of cracks and excessive porosity. There shall not be overlap along edges of weld passes and no undercut into the base metal along the edge of weld.

WELD INSPECTION (CONT.)

The Central Office, Division of Construction can make inspection tools available to aid in weld inspection, including weld size gages and temperature sticks. **Exhibit 9102** shows examples of welds and a discourse on nondestructive testing.

CORRECTING DEFECTIVE WELDS

The SE shall contact the Central Office, Division of Construction for approval of methods for correcting defective or unsound welds. The minimum preheat and interpass temperatures shall be in accordance with the approved welding procedure. Questions concerning any deviations from these specified temperatures shall be directed to the Central Office, Division of Construction.

Note: Welds shall be cleaned and neutralized according to the current specifications prior to painting.

PILING

The SE generally encounters the use of welding in splicing piling. The welders doing this type of welding have to be qualified for the types of welds being used.

When steel bearing piling (H-pile) have to be spliced, the welder must be qualified for:

- The overhead fillet position and the horizontal groove position for the diamond plate splice
- The horizontal groove and vertical fillet welds for "pile splicers"

When cast-in-place (shell) piles need splicing, minimum requirements for a welder require qualification in the horizontal groove position.

	Section PRESTRESSED CONCRETE
	Subject General

INTRODUCTION

Prestressed concrete members used for structures generally includes:

- Piles
- I-beams
- Deck Panels
- Box Beam Deck Units
- Box Beam Spread Girders

I-beams and box beam spread girders are used to support conventional deck construction. Box beam deck units are positioned side by side to form a deck and may or may not be overlaid with a wearing surface, depending on the plans.

Section 605 of the Standard Specifications and the *Precast Prestressed Concrete Guidance Manual* provide complete and comprehensive requirements for prestressed and precast concrete members and shall be read closely by the section engineer (SE) and any inspectors assigned to this type of work.

MATERIALS

Prestressed concrete members are normally inspected at the casting plant by a representative of the Division of Materials. This inspector will stamp each member approved for shipment with the "Kentucky Oval" stamp. Members should not be unloaded from the delivery truck and certainly not erected if they do not bear this stamp, without first checking with the Division of Materials for an explanation.

Existence of the stamp does not indicate automatic acceptance of the prestressed member nor does it relieve the contractor of his or her responsibilities regarding the member.

TEST REPORTS & CERTIFICATIONS

Certifications for elastomeric bearing pads are transmitted to the SE during shipment of the members for a particular structure. The test reports for the beams are placed on the Division of Material's computer. The SE shall verify the acceptability of the test reports with the district materials engineer.

ENGRAVED (NAME) PLATES

Difficulty is occasionally encountered in locating the design drawing number, construction date, design load, and contractor's name on these types of structures. The contractor shall not omit the installation of any required engraved plates. If no poured-in-place concrete is available that is satisfactory for these plates, they should be placed on the exterior fascia of the exterior girder at the fabricating plant. The following typical plate locations are generally found satisfactory:

- Beam Supplier—Exterior face of exterior beam at abutment
- Contractor Name—Outside face of barrier wall near abutment
- Date-Loading—Outside face of barrier wall near abutment
- Bridge Drawing No.—Outside face of barrier wall near abutment

Note: Placement of any of the above inscriptions in an exterior beam is acceptable.

Standard Drawing BGX-006 details the sizing for stencils. The SE shall direct any questions to the Division of Construction, if there is a problem with these locations.

SHOP DRAWINGS

Shop drawings are required on prestressed I-beams and deck units, but not for piles. The contractor's designated fabricator shall submit shop drawings to the Director, Division of Structural Design, for review in accordance with Section 605.03.05(B) of the Standard Specifications. The fabricator shall not begin work until review of the drawings is completed. The Division of Structural Design will send a reviewed copy to the SE and the district branch manager for Project Delivery & Preservation for their files and use. The contractor's shop drawings are also sent to the district office for distribution in most cases.

MATCHING GRADES

Reconstruction of an existing structure involves matching the new and old grades. To avoid serious problems, profiles of the existing bridge shall be taken and plotted. The new profile shall then be plotted for comparison to ensure correct slab depths, cross slopes, and profiles at centerline and gutterlines.

The use of precast pier caps and abutments to repair substructures requires careful consideration of the new seat elevations. The existing profile shall be established and each element of the superstructure (slab, haunch, beam, and bearing) can then be subtracted to obtain the correct cap seat elevation. Slight corrections can be made in the beam haunch to properly match the profile grade.

	Section PRESTRESSED CONCRETE
	Subject Preconstruction Conference

GENERAL

Normally on superstructure replacement projects, the plans require that the contractor to check the plan grade, span lengths, girder skews, etc. against existing project conditions. Any problems or discrepancies the contractor may have encountered as a result of this check shall be discussed during the preconstruction conference.

The section engineer (SE) shall carefully review all plan notes, proposal notes, etc. along with any special information from the designer, since each structure is a special case and may contain certain items to be done on an experimental basis. The SE shall discuss inspection procedures for field checking the prestressed members with the contractor (as mentioned in **CST-1311-3**) and as deemed applicable to the particular situation by the district branch manager for Project Delivery & Preservation and the SE.

A common problem on projects with only proposal notes and without plans involves distances designated as clear spans that are mistaken for distance out-to-out or centerline of bearing to centerline of bearing. The SE shall check the beam and span lengths on these projects closely.

	Section PRESTRESSED CONCRETE
	Subject Field Inspection

PRELIMINARY INSPECTION

The section engineer (SE) or the inspector shall visually inspect prestressed concrete members after they are received at the job site and before they are unloaded. This inspection primarily checks for shipping damage but any other obvious defects shall be noted. If any member is damaged or otherwise judged to be unacceptable, the contractor shall be informed immediately of its condition and advised that it is unacceptable before it is unloaded. This affords the contractor a chance to return unacceptable members to the fabrication plant with the least inconvenience and expense.

Some defects may be field corrected while others are uncorrectable. Any proposal to attempt to correct the defects in the field must be made by the contractor and will have some bearing upon the decision to unload the member or return it to the fabricator. If electing to make repairs in the field, the contractor must outline the proposed repair procedure in a letter to the SE. Final review and approval of this procedure must be made in the Central Office, Division of Construction.

Note: On FHWA full-oversight projects, the FHWA shall be advised of the review and approval of any repair procedures.

The SE shall not render payment for any member that is unacceptable until it has been replaced with an acceptable member or is satisfactorily repaired. The contractor **shall not** set and anchor a member into place or have the lifting strands cut while its acceptance is in question.

ERECTION INSPECTION

Most contractors elect to set the members into place onto the structure from the trucks. This inspection will then, out of necessity, be after the members are in place. The SE or the inspector shall give the beams a thorough inspection that includes a check to see that the fabricator finished the members as required by the specification. The contractor shall satisfactorily correct or complete any unfinished work on the part of the fabricator.

This inspection also includes a close check of dimension tolerances. Section 605.03.08 of the Standard Specifications shows the tolerances for various prestressed members.

ERECTION

INSPECTION (CONT.)

The SE or inspector shall closely check for cracks, condition of the bearing area of the member, concrete patches on holes at draped strand hold-down devices, vertical camber in the member, length, etc.

The contractor **shall not** incorporate any member judged to be out of the specification requirements into the structure on a permanent basis until investigated by the district branch manager of Project Delivery and Preservation and the Central Office, Division of Construction and corrected in accordance with their recommendations.

The contractor must temporarily brace the beams as they are set until permanent bracing can be established. The beams must be tied off to the caps and not just to the adjacent beams.

FINISHING

The SE shall inspect the prestressed units for the surface finish requirements of Section 605.03.07 of the Standard Specifications. The plant inspector will have checked the surface finish at the plant, but a field inspection shall be made to ensure no damage to the finish occurred during shipping. Careful consideration should be given to surfaces directly outside the location of the prestressed strands.

The masonry coating requirements of Section 601.03.18 of the Standard Specifications shall be followed after the girders are in place. Generally, only the exterior face and bottom of the exterior girder gets masonry coated.

	Section PRESTRESSED CONCRETE
	Subject Erection

SEATING & BEARING The section engineer (SE) or the inspector shall ensure the prestressed members are properly seated and bearing correctly. For box beam deck units this needs to be done prior to tensioning the transverse tension rods.

FALSEWORK The SE shall check the contractor's falsework prior to placing the concrete deck on prestressed I-beams to be sure sufficient precautions have been taken to prevent exterior I-beams from overturning as the slab is placed. This is sometimes done by physically tying the tops of the exterior girders together using reinforcing steel in the slab.

It is the contractor's responsibility to satisfy the condition and no additional pay is allowed for this work.

Note: Temporary supports will not be permitted under prestressed members when placing the concrete deck slab.

	Section PRESTRESSED CONCRETE
	Subject Concrete Deck Placement

GENERAL

The steel stirrups protruding from the tops of prestressed I-beams or box beams shall penetrate the reinforced concrete slab a minimum of two inches. If this is not possible, the section engineer (SE) shall contact the district branch manager for Project Delivery & Preservation who may contact the Division of Construction for guidance.

If the plans stipulate a pouring sequence, the contractor may not change the sequence unless approved by the Central Office, Division of Construction and the designer.

If the plans require the contractor to place the concrete deck in its entirety before allowing any concrete to set, attention shall be placed on the amount of retarder used. The SE shall be satisfied that this requirement can be met before allowing the contractor to start placing the slab.

	Section REINFORCED CONCRETE BRIDGE SLABS
	Subject General

INTRODUCTION

Much effort is required of a section engineer (SE) and assigned inspectors to ensure that bridge deck concrete is properly proportioned, mixed, transported, deposited, finished, and cured in such a manner as to provide a completed project in accordance with the applicable plans and specifications.

INSPECTION EQUIPMENT

The district must furnish sufficient equipment, in good working order, to the inspection personnel. The SE must impress the importance of such equipment and its proper care upon the inspectors. Backup equipment should be available for **all equipment** in each crew office.

INSPECTING STEEL STIRRUPS

The steel stirrups protruding from the tops of prestressed I-beams or box beams shall penetrate the reinforced concrete slab a minimum of two inches. If this is not possible, the SE shall contact the district branch manager for Project Delivery & Preservation who may contact the Division of Construction for guidance.

ALTERING POURING SEQUENCE

If the plans stipulate a pouring sequence, the contractor may not change the sequence unless approved by the Central Office, Division of Construction and the designer. The contractor shall submit a request with the following information

- Retarder schedule that can keep the concrete plastic between phases
- Concrete delivery/placement in CY/hr
- Manpower and equipment
- Past history of placements of this size

The emphasis is to provide the Cabinet with assurances that the placement can take place without negatively affecting the bridge.

CONCRETE DECK PLACEMENT

If the plans require the contractor to place the concrete deck in its entirety before allowing any concrete to set, attention shall be placed on the amount of retarder used. The SE shall be satisfied that this requirement can be met before allowing the contractor to start placing the slab.

REFERENCE

In general, information pertaining to concrete, reinforcing steel, and concrete bridges is contained in other sections of this guidance manual. These sections should be referred to even though the information may be very similar to the contents of this section.

	Section REINFORCED CONCRETE BRIDGE SLABS
	Subject Initial Project Review

OVERVIEW

A thorough preliminary review of the project is an important aspect in obtaining a good bridge deck. This review includes, not limited to, a traffic survey and checking the plan quantities.

TRAFFIC SURVEY

Although the majority of the bridge slabs constructed will be on a new structure, some projects require that a new slab be constructed on an existing bridge while traffic is maintained. As soon as such a project is assigned, the section engineer (SE) shall make an extensive review of the traffic at the bridge site and discuss any anticipated problems with the district branch manager for Project Delivery & Preservation and the district traffic engineering & planning section. The SE shall discuss recommendations or questions resulting from this review with the contractor at the preconstruction conference.

CHECKING PLAN QUANTITIES

CST-1308 emphasizes the importance of verifying the plan quantities at any early date. This is especially true since epoxy-coated reinforcing steel is used in most bridge slabs and the time to reorder may be longer than for uncoated steel.

	Section REINFORCED CONCRETE BRIDGE SLABS
	Subject Inspection Upon Delivery

PROCEDURE

When reinforcing steel is delivered to the jobsite, the section engineer shall:

- Spot check the reinforcing steel
- Note any damaged bars
- Have the contractor repair or replace damaged bars
- Reject Bars with variations in excess of the allowable tolerances shown in the *C.R.S.I. Manual of Standard Practice* referred to in Section 602.03.03 of the Standard Specifications
- Contact the district materials engineer or Central Office, Division of Materials if the quality of any reinforcing steel is in question

	Section REINFORCED CONCRETE BRIDGE SLABS
	Subject Storage & Handling

STORAGE & HANDLING

The contractor shall store and handle reinforcing steel in the manner described in **CST-1308** to minimize damage to the steel.

REPAIRING EPOXY-COATED BARS

The contractor shall repair epoxy-coated bars that require repair because of nicks or abrasions using the epoxy repair material supplied by the manufacturer.

	Section REINFORCED CONCRETE BRIDGE SLABS
	Subject Sampling & Testing

REQUIREMENTS

Reinforcing steel shall be sampled and tested as described in **CST-1308** and in accordance with Section 811.02.02 of the Standard Specifications and the *Materials Field Sampling and Testing Guidance Manual*.

	Section REINFORCED CONCRETE BRIDGE SLABS
	Subject Steel Placement

REQUIREMENTS

The general conditions that apply to placing and fastening reinforcing steel are described **CST-1308** and are to be followed where applicable. Reinforcing steel for bridge slabs shall be accurately located and firmly held in position to the tolerances specified in Section 609.03.03 of the Standard Specifications.

METAL SUPPORTS

Generally an approved metal chair, as described in Section 811 of the Standard Specifications, is used to support the top and bottom mats of reinforcing steel. The section engineer shall perform a close inspection to ensure that the contractor has placed sufficient chairs to prevent sagging of reinforcing steel under construction traffic.

TYING DOWN STEEL

The contractor shall securely tie top and bottom mats of steel at intervals no greater than eight feet in the longitudinal and transverse directions to prevent movement of the steel during concrete placement. Wires used to tie the mats in place shall be No. 9 gauge (0.148 inch in diameter) and coated as per Section 602.03.05 of the Standard Specifications. Ties should be as vertical as possible, since those ties that are at an angle with the deck are often not snug and may tend to permit shifting of the steel.

SPLICES

Early attention must be given to longitudinal splices in bridge decks since short splices found after the steel is in place will result in the contractor having to rehandle all of the longitudinal steel. **CST-1308** offers additional guidance on splice lengths and the use of mechanical or welded splices.

	Section REINFORCED CONCRETE BRIDGE SLABS
	Subject Concrete Placement

CONCRETE PLACEMENT

Except for a few specific points, the guidelines that pertain to structural concrete, as discussed in **CST-1307**, apply to Class "AA" concrete for bridge slabs.

TEMPERATURE LIMITATIONS

In addition to the requirements for temperature limitations and protection of concrete discussed in **CST-1307-4**, Class "AA" concrete for bridge slabs shall not be placed during the months of January and February. Cold weather occurs, however, during months other than January and February and the section engineer (SE) is encouraged to make use of a seven-day weather forecast.

When cold weather may occur during deck placement or curing time, the SE shall require a written request from the contractor detailing the proposed methods of maintaining minimum curing temperature, moist curing, and fire protection. Section 601.03.09(D) of the Standard Specifications details weather limitations and protection.

NIGHTTIME PLACEMENT

If a nighttime placement is required, the SE shall ensure the number, location, and intensity of the lights will satisfactorily illuminate all phases of the work.

Note: Adequate lighting shall exist behind the finishing machine where it is necessary to inspect the straight edging and curing operations. A flashlight held by the inspector is not considered adequate.

Note: If traffic is maintained on an adjacent roadway, caution shall be exercised to prevent blinding a passing motorist.

To ensure the availability of adequate inspection personnel, the SE shall review the inspection requirements well before the scheduled nighttime operation and convey the personnel needs, if any, to the district branch manager for Project Delivery & Preservation.

Nighttime deck placements pose a special problem in inspection supervision of the operation. District branch manager for Project Delivery & Preservation should visit each operation at night and make every effort to furnish the SE with necessary guidance and direction.

NIGHTTIME PLACEMENT (CONT.)

Safety is an important aspect of all deck placements and may become even more critical after dark. Adequate preparation must be made during the daylight hours to provide safe access to all parts of the operation for the necessary inspection.

CONSTRUCTION JOINTS

Except in cases of emergency, the contractor shall provide construction joints only as shown on the pouring sequence of the design plans. However, the plans usually permit the pouring sequence to be changed with the written approval of the SE. Although the pouring sequence may be changed, the construction joint locations are usually not altered.

In cases of emergency, such as a mechanical breakdown or falsework failure, a construction joint may be provided in locations shown in **Exhibit 9103**. If the emergency occurs where a joint cannot be permitted, the contractor may have to "wash out" the concrete back to a point where a joint is permissible. The construction joint as provided shall be subject to the requirements of Section 601.03.10 of the Standard Specifications and as discussed in **CST-1307-3**.

EXPANSION JOINTS & ARMORED EDGES

The expansion joint dimension shown on the plans is usually the width of the joint for a specific temperature, such as 60º F. For temperatures higher or lower than the specified temperature, the joint opening must be adjusted accordingly at the time of installation. Consideration for making this adjustment is similar to that for expansion rockers. If any welding is needed for the armored edge construction, the SE shall consult with the Central Office, Division of Construction for direction.

The plans often give the contractor an option to provide one of several types of neoprene expansion dams. The manufacturer's recommendations shall be followed closely in making these installations. The bearing seat for these systems shall be constructed properly with consideration being given to the grade and alignment of the structure. The plans generally require the manufacturer's representative be present when this type dam is set. The SE shall never waive this requirement. If the structure is on a steep grade, the top surface of the expansion dam or armored edge shall be parallel to the roadway grade. This may require the vertical leg of the angle to be slightly inclined.

PREPOUR CHECK LIST

The following list is not intended to show all the preparation necessary for a concrete placement but is to alert the inspector to items that may be critical to obtaining a bridge slab consistent with the specification requirements.

- Have all the necessary parties attended a prepour meeting?
- Has the falsework been approved?

PREPOUR
CHECK LIST (CONT.)

- Has the reinforcement been tested and approved?
- Has the contractor made preparation for temperature limitation and protection?
- Are curing preparations adequate?
- Are expansion dams, armored edges, and drains set to proper grade?
- Are forms clean and mortar tight and adjusted to correct line and grade?
- Check to see that transverse screed guides are parallel to the plan cross-section of the slab.
- Check the finishing machine rails and rail supports, making sure that they do not deflect when the finishing machine runs over them.
- Is construction joint material, keyway forms, and emergency bulkhead material available?
- Check overhang brackets to make sure that they do not deflect when loaded.
- Is the reinforcement correctly located, supported, and tied? Are extra chairs available if needed?
- Has the "dry run" been made with the necessary adjustments to obtain proper clearance to steel?
- Does a visual inspection of the reinforcing steel and rails reveal good alignment and uniformity of installation?
- If SIP forms are used, have they been approved and are they in accordance with the shop drawings and Special Provisions?
- Are air vent tubes, if required, installed correctly?
- Are the cable clamps connecting the PCI beams over the piers in place?
- Have the tops of the PCI beams been properly tied together to prevent rotation of the exterior beams?
- Have proper provisions been made if a concrete pump hose is to be utilized? (For example, extra chairs, plywood over steel, etc.)
- Check the weather forecast. Make provisions for inclement weather, if anticipated.

FINISHING MACHINE "DRY RUN" & DEPTH CHECKS

All reinforced concrete slabs shall be finished with a mechanical finishing machine meeting the requirements of Section 609.02.09 of the Standard Specifications. Before any concrete is placed, the contractor will have the rails installed and the finishing machine set for the specific grade and template. The setting of the machine will be checked by the SE and a "dry run" shall be made with the finishing machine fully operational and carrying a load similar to that imposed during the placing operation. The contractor or contractor's superintendent shall witness this dry run.

Unless another suitable method is proposed by the contractor and approved by the SE, the following procedure for making a "dry run" shall be utilized. It has been found to be an effective and complete check of the slab thickness and concrete cover over the reinforcing steel.

Note: This procedure should be used when an oscillating screed or cylindrical type finishing machine is to be used. It should be performed after all steel reinforcement has been placed and properly tied in the slab and after the finishing machine has been set for the required line and grade.

1. A template block equal in depth to the plan dimension of the concrete cover over the top mat of reinforcing steel must be attached to the bottom side of the screed. Since this attachment is temporary it can be made by clamps or similar devices.

2. The template block must be attached to the bottom finishing surface of the screed that will be the closest to the steel when the screed passes over it. Normally, this will be the trailing end of the screed.

3. After the template block is installed a "dry run" of the entire bridge slab shall be made.

4. At each location where the block cannot clear the reinforcement, the forms or the finishing machine rails should be adjusted to ensure the required cover and depth. No adjustment should be necessary in the reinforcing steel if the proper height chairs are used.

During the concrete placement, the inspector will make depth checks of the slab depth and concrete cover at numerous locations by use of a probe in the fresh concrete directly behind the finishing screed. Special care should be taken when SIP metal forms are used to ensure the probe is not being pushed down into the styrofoam in the corrugations resulting in erroneous depth readings.

Final adjustments shall be made to the machine and rails during the "dry run." It is very important that the SE and the contractor satisfy themselves that the machine and rails are properly set to obtain the correct grades, cover, and thickness at this time and that no further adjustments will be necessary during the placement operation except as may be required to transition from one cross section to another. Any necessary adjustments shall be made by the contractor.

FINISHING MACHINE "DRY RUN" & DEPTH CHECKS (CONT.)

When the bridge deck cross-section is not constant from one end of the bridge to other (such as going from a normal crown to a full super-elevated section) it is necessary to adjust the finishing machine manually to make the transition. During the "dry run" as the machine is moved through the transition zone, **the contractor shall make adjustments to the machine at longitudinal intervals corresponding to the grid lines**. The amount the machine is adjusted at each breakpoint of the machine frame and the corresponding grid point locations shall be marked on the forms in a location visible to the operator. Only these amounts of adjustment shall be made during the actual concrete placement.

The SE or the project inspector shall observe the adjustments closely during the transition. As a final check just prior to concrete placement, the SE or inspector shall check the screed against an expansion dam or concrete header.

The depth of cover over the top mat of steel will be measured by pachometer at a later date in accordance with Section 602 of the Standard Specifications and penalties assessed, if necessary, in accordance with Section 609.05. If any reason to suspect a deficiency in slab thickness exists, the SE shall notify the Division of Construction to make arrangements for core drilling the slab.

	Section REINFORCED CONCRETE BRIDGE SLABS
	Subject Surface Finish

GENERAL

The section engineer (SE) shall check the plans and proposal to determine if texturing, waterproofing membrane, or a wearing surface is required for the concrete deck. Regardless of the type of finish required, the entire surface shall be checked with an approved ten-foot floating straightedge or finishing tool. Any variations or ridges greater than 1/8 inch shall be eliminated by using a long handled bull-float and rechecked with the ten-foot straightedge.

If the plans specify that a waterproofing membrane or special surface course is to be applied, texturing will not be required and the application of a liquid curing compound will not be permitted, as per Section 609.03.11 of the Standard Specifications.

When texturing is not required, a burlap drag shall follow the straight edging operation with the direction of the drag being the same as the placing operation. The burlap drag shall be kept damp and free of hardening concrete.

If a waterproofing membrane or special surface course is not required, the surface shall then be textured or grooved as described in Section 609.03.10 of the Standard Specifications unless otherwise provided in the contract.

	Section REINFORCED CONCRETE BRIDGE SLABS
	Subject Curing

INTRODUCTION

Curing of structural concrete in general is discussed more fully in **CST-1307-5**. However, certain specific points that pertain to bridge slabs are reemphasized below.

REQUIREMENTS

Immediately after finishing, and while slightly damp, the contractor shall coat the surface with a white pigmented membrane-forming curing compound conforming to the requirements of Section 823.02 of the Standard Specifications. The curing compound shall be applied at the rate described in Section 609.03.12 of the Standard Specifications and with spray meeting the requirements of **CST-1307-5**.

APPLYING CURING COMPOUND

The contractor shall take care to prevent the compound from being applied to surfaces that are to bond to other concrete or from getting on the reinforcing steel. Special care should be exercised around epoxy-coated steel. Sandblasting is required to remove curing compound from these areas (with the exception that epoxy-coated steel shall not be sandblasted).

As soon as **practical** after application of the compound, the contractor shall cover the entire area of the slab between the curb lines with two layers of wet burlap (or one layer of wet burlap and one layer of burlene). The contractor shall keep these wetted continuously for seven calendar days after the concrete has been placed. If no burlene is available, the section engineer (SE) should encourage the use of a layer of plastic. The SE will need to exercise some judgment in determining the correct time to apply the burlap so as not to damage the green concrete surface. When concrete is placed in cold weather, the SE shall make sure that the contractor places all insulating material on top of the curing material.

	Section BRIDGE DECK OVERLAY
	Subject General

SPECIFICATIONS Section 606 of the Standard Specifications addresses bridge deck overlays.

OVERVIEW The section engineer must be thoroughly familiar with the project plans, proposal, and applicable special provisions. The nature of overlays requires that much of the critical work be done at night. This magnifies the problems and responsibilities of the section engineer. Thorough planning and initial preparation are critical if adequate supervision and inspection are to be furnished for these nighttime operations.

GUIDANCE The following exhibits provide data and worksheets for controlling bridge deck overlay projects:

- **Exhibit 9107**: Computing Theoretical Absolute Volume
- **Exhibit 9108**: Chart No. 1—Target Density
- **Exhibit 9109**: Thin Lift Overlay Nomograph
- **Exhibit 9110**: Water Cement Ratio for Cement Concrete
- **Exhibit 9111**: Water Cement Ratio for Latex Concrete
- **Exhibit 9112**: Design Data Form for Concrete Mobile

	Section BRIDGE DECK OVERLAY
	Subject Initial Project Review

GENERAL

A thorough preliminary review by the section engineer (SE) and crew is critical in obtaining a good bridge deck overlay placed in accordance with applicable plans and specifications. This review shall include, not necessarily limited to, the following subjects.

TRAFFIC SURVEY

As soon as assigned a bridge deck overlay project, the SE shall:

- Make an extensive traffic review of the bridge site that includes a study of possible traffic problems such as sight distance, driving lane widths, signing requirements, and any other traffic-related peculiarities that might influence the safe and expedient handling of traffic
- Review the plans and proposal requirements
- Discuss any anticipated problems with the district branch manager for Project Delivery & Preservation and possibly the district traffic engineer
- Study the need for traffic signals and their applicability to the situation
- Discuss any recommendations resulting from this review with the contractor at the preconstruction conference

CHECKING PLAN QUANTITIES

All quantities for use in constructing the bridge deck overlay shall be checked. The SE shall have the survey party profile the existing deck by running a profile in the vicinity of each gutter line and on the centerline. This profile is referred to as a "3 Point Profile"; however, additional profile lines may be necessary if the bridge includes more than two lanes. Each profile should include shots no further apart than 10 feet and be plotted on an exaggerated scale of one inch to 10 feet horizontal and one inch to 0.2 foot vertical. Utilizing this information, the SE shall make a determination concerning the following:

- **Drainage**—Existing drainage capabilities of the deck can be studied and a determination made concerning any improvements that may be necessary to provide adequate drainage.

CHECKING PLAN QUANTITIES (CONT.)

- **Riding Surface**—The quality and configuration of the riding surface shall be studied. The existing roadway crown, cross-slopes, super-elevation if any, and any sags or bumps will be evident and subject to consideration for correction in the overlay placement. The SE must determine whether placing the overlay parallel to the existing surface will yield a good riding surface or if it will be necessary to design new grades.

  Note: It may not be practical or economical in some cases to restore the deck of an old bridge to a new configuration without encountering an undue overrun of overlay material.

- **Overlay Quantities**—The SE shall estimate the quantity of overlay material necessary to do the work and compare this with plan quantities. If additional quantities are required, the SE shall contact the district branch manager for Project Delivery & Preservation who may contact the Central Office, Division of Construction for direction concerning this additional quantity. Funds should be made available for any additional quantities before the work is performed or the decision should be made to parallel existing grade and minimize overruns.

STRUCTURAL STEEL INSPECTION

The SE shall field check the quantity of structural steel (usually related to adjustments in armored edges and expansion dams) for length, width, and thickness. If any discrepancies in plan dimensions are discovered, the contractor shall be notified immediately and proper action taken to correct the error.

EXAMINING THE DECK

The SE shall take surface measurements of the deck and perform computations to check the amount of deck area specified by the plans to be scarified. Similarly, the area of the curb and gutter to be sealed with epoxy, if required, shall be calculated and checked against plan quantity.

A close check should be made of the deck condition with respect to the possible need for full-depth patching. It is not practical to arrive at exact quantities of full-depth patching before work starts. It is possible, however, to get an approximation of quantities. Possible areas that may require full-depth patching will show under the deck by spalling of the concrete or by cracks that will be delineated in white (caused by calcium leaching through the cracks). Special attention should be given to any joints and drains for this problem.

CHANGE ORDERS

The SE shall execute a change order as soon as possible to obtain approval of any increase in quantities that are recommended as a result of this preliminary investigation. The change order shall include additional time, if applicable.

	Section BRIDGE DECK OVERLAY
	Subject Preconstruction Conference

GENERAL

A preconstruction conference shall be held on every project. It is not possible to touch on every aspect of this type work herein because of different problems encountered. Several subjects for discussion will be mentioned, however, in addition to those required in **CST-200**.

PRELIMINARY INSPECTION RESULTS

The results of the section engineer's preliminary inspection shall be discussed thoroughly with emphasis on any problems or changes encountered. The contractor's plans for handling traffic shall be discussed in detail.

PLAN REQUIREMENTS

All plan and proposal requirements shall be discussed with the contractor in detail. The applicable special provisions shall be reviewed carefully, particularly since they are subject to change from one project to the next.

MATERIAL STOCKPILING

The remoteness of some overlay projects makes this a subject of special consideration. The contractor should be cautioned that material will have to be available for sampling and testing early enough so these procedures won't delay the operation. The stockpile should also have sufficient lighting to permit proper inspection of the materials being loaded. Truck lights alone are often not adequate. Also tarps or some other means to prevent the contamination of the stockpiles shall be used.

TRUCKS

The truck mixers to be used shall be discussed in detail. Their condition is very important. Limitations involving loading and unloading shall be reviewed to determine that sufficient trucks will be available to ensure continuous operations.

SUPERVISORY PERSONNEL

A supervisor must be available, particularly during actual overlay placements, to carry out instructions of the section engineer (SE) or the inspector. It is not satisfactory for any supervisor to operate any equipment or perform any other function that renders him or her unavailable to the SE. Failure to meet this requirement may be justification for postponing or suspending operations under authority of Section 105.06 and 108.06 of the Standard Specifications.

	Section BRIDGE DECK OVERLAY
	Subject Overruns

GENERAL

The section engineer (SE) must monitor quantities closely and make every effort to minimize overruns. It is recognized, however, that the condition of an old bridge may be worse than anticipated, so it is often difficult to avoid overruns.

The nature of full-depth patching makes it difficult to determine the quantity of concrete needed until the removal of unsound concrete is fairly well advanced. Because of this, the SE must monitor this operation closely, both to ensure that only unsound concrete is removed and to keep up with the quantities involved. It is suggested that a suitable basis on which to estimate the total amount of full-depth patching needed for a bridge is to base the needs of the last half of the bridge on the quantity used in the first half. Past experience has indicated this approach to be reasonably accurate, subject to obvious differences observed.

CHANGE ORDERS

Additional funds must be approved for any predictable overruns or construction changes before the work is initiated. As mentioned previously, some unanticipated overruns will occur, however these additional quantities shall be included in a change order at the earliest practical date. The change order shall include additional time, if applicable.

EXCESSIVE OVERRUN FORMULA

It may be desirable to submit change orders for additional quantities of major items and in particular of overlay materials when it is not quite clear if the overrun formula will be ultimately applicable. When this situation occurs and the formula is not utilized, the following statement shall be included in the change order:

> "*It is understood by all concerned that the additional quantities described herein may be subject to unit price adjustments as directed in Subsection 104.02.02 of the Standard Specifications.*"

	Section BRIDGE DECK OVERLAY
	Subject Deck Preparation Prior to Placing Overlay

GENERAL

The methods used, attention to details, and effort exerted on this phase of the operation is crucial to the performance and durability of the completed project.

MONITORING THE SCARIFICATION PROCESS

The contractor shall provide a uniformly scarified deck. The section engineer (SE) shall closely examine scarifier teeth before starting work to be sure all teeth are in place and reasonably uniform in length. The SE shall utilize positive methods to monitor the depth of material removed from the deck during the scarification process.

One way to accomplish this is to have the contractor make alternate passes with the scarification equipment, leaving strips of the old deck for purpose of comparison. The strips of old deck can then be removed to the level of the previous passes thus giving positive control of the depth removed.

Another method is to use a string line from predetermined points with elevations recorded along the string line at these points. By comparison of elevations, the inspector can determine how much material has been removed. This method has worked well in cutting the transition in bridge decks when approach slabs are rigid pavement.

SOUNDING THE DECK

The SE shall be very thorough in sounding the old deck and careful to mark the limits of unsound concrete to be removed. The SE shall closely check all areas to ensure the contractor has removed all weak or loose concrete. This is a critical aspect of the deck preparation and warrants close inspection since any unsound or loose concrete not removed is likely to cause the overlay to lose bond. If the condition of the deck is worse than anticipated, the SE shall estimate the quantities and funds needed and contact the district branch manager for Project Delivery & Preservation.

The SE shall thoroughly sound the deck with a hammer or reinforcement bar or by dragging a chain across the entire area of the deck and marking any loose or unsound concrete with paint for later removal during the jack hammering phase of deck preparation.

SOUNDING THE DECK (CONT.)

Debonded loose concrete gives a thud or dull rattling sound instead of a ringing sound. Bouncing sand particles while sounding with a hammer is a sure way of determining lack of bond.

The SE shall closely inspect the jackhammer operation with special attention given to the weight of the hammers used. Section 606.02.10(B) of the Standard Specifications requires that the hammers provided weigh 40 pounds or less. While it is desirable to remove any unsound concrete, care should be exercised to minimize the removal of sound concrete.

Special precaution should be utilized when using jackhammers around reinforcing steel and copper strips (water stops) to avoid any damage. Any reinforcing steel or copper strips damaged shall be replaced or repaired and securely tied down before the overlay is placed.

Partial or full depth removal of concrete may be accomplished using hydrodemolition. Refer to Section 606.03.03 of the Standard Specifications for hydrodemolition.

The SE shall sound the deck one additional time after the overlay is placed before opening the deck.

BLAST CLEANING

The contractor shall not start the blast cleaning operation until all the above work has been satisfactorily completed. Blast clean the entire area of the deck surface according to Section 606.03.04 of the Standard Specifications.

As a general rule, a contractor will schedule the blast cleaning operation to barely precede the overlay placement. This is understandable in view of the plan requirement for the entire deck including all exposed reinforcing steel, copper strips, etc. to be absolutely clean when the overlay is placed. In general, the contractor shall perform the following concerning blast cleaning operations:

- Remove all rust from expansion dams, reinforcing steel, and drains
- Remove all laitance from the concrete including any new full-depth concrete in place
- Give special attention to the vertical sides of curbs and adjacent overlays since a good bond there is critical
- Blow off the deck with air that is clean and oil free just prior to overlay placement
- If traffic is maintained on the bridge, perform blast cleaning operations within 12 hours immediately preceding overlay placement

	Section BRIDGE DECK OVERLAY
	Subject Preliminary Preparation

GENERAL

The contractor and the section engineer (SE) shall meet to schedule the overlay placement for a realistic and definite time and to adequately address the following:

- Are all materials stockpiled, properly maintained, and certified or tested?
- Is all necessary equipment on the job and in working condition?
- Does the contractor have sufficient personnel available to perform the work?
- Is satisfactory lighting at the job site?

CALIBRATING THE TRUCK MIXER

The contractor shall:

- Calibrate the truck mixer in accordance with **KM 64-312**
- Charge the truck with material and cover it to control the moisture content
- Protect stockpiles to maintain uniform moisture content
- Take care in removing material from the stockpile to be sure the operator does not get too low in the stockpile and charge the truck with contaminated material
- Provide additional lighting (as necessary) beyond that available from the truck to facilitate adequate inspection of the truck loading operation

KM 64-312 stipulates in detail the equipment needed and procedures to be used in the calibration of continuous-type mixers (concrete mobiles) used in the production of latex concrete and Portland cement (low slump) concrete. The SE and the inspector shall be thoroughly familiar with these procedures. For additional information see **Exhibit 9104**.

The contractor shall furnish the equipment needed to calibrate the concrete mobile in accordance with the Standard Specifications. The equipment must be clean and in good working order. The SE shall review equipment requirements with the contractor at the preconstruction conference. KM 64-312 details the necessary equipment for calibration. **Exhibit 9105** shows a concrete mobile mixer check list.

CALIBRATING THE TRUCK MIXER (CONT.) The SE shall ensure that the continuous mixer calibration is verified by a yield check early during each overlay placement. The contractor must provide a ¼-cubic-yard box and the yield is checked in accordance with Section 10 of KM 64-312.

FINISHING MACHINE RAILS The SE shall:

- Supervise finishing machine rail erection and adjustments to grade
- Inspect the rails to ensure they are not damaged or bent
- Check individual chairs to be sure they are in contact with the rail when the machine passes over them
- Examine the system used to support the rails off the end of the bridge for its lateral stability as well as its ability to support the load without settling

  Note: A string line may be used to set intermediate rail chairs between extreme chairs at expansion dams or span ends. This method should prevent irregularities in the existing sidewalk or deck becoming incorporated in the overlay.

FINISHING MACHINE The SE shall check the finishing machine to see that:

- The screeds are straight and clean
- There are no hydraulic leaks, particularly when it is revved up to operational RPMs
- It moves smoothly in forward and reverse on the rails
- It has sufficient vibratory capacity in good working order
- The screed and strike-off mechanisms operate smoothly
- The machine is in generally good operating condition

The finishing machine must be set for the specified grade and template by the contractor and checked by the SE.

The contractor shall make a dry run with the finishing machine fully operational and carrying a load similar to that imposed during placing operations. That is, the finishing machine should be carrying the operator, the light plant, if applicable, and any other equipment it will have to carry during an actual placing operation. The grade of the finishing machine must be adjusted to the existing expansion dams. Final adjustments shall be made to the machine and the rails during this dry run to ensure that the overlay will have the proper grades and minimum thickness. It is very important that the SE and contractor satisfy themselves that the machine and rails are properly set at this time so that no further adjustments will be necessary during placing operations.

After the dry run is satisfactorily completed, the contractor shall positively “lock off” handles that adjust the grade of finishing machine legs in order to prevent their accidental movement. This "lock off" must be monitored by the inspector during overlay placement.

NIGHTTIME OPERATION

If nighttime operations are required, the SE shall check the number and intensity of lights and determine if their location is satisfactory to furnish adequate lighting to properly illuminate the work.

Note: Caution should be exercised to be sure that lights do not blind passing motorists.

WORK BRIDGES

The SE shall check the number and condition of work bridges. A minimum of two bridges should be furnished by the contractor. The SE may request additional bridges if the nature of the operation or inspection procedures make it necessary. Section 105.01.03 of the Standard Specifications requires the contractor to provide assistance as required to make a complete and detailed inspection.

MISCELLANEOUS EQUIPMENT

The SE shall check the quantity and condition of burlap, wheel barrows, plastic sheeting, hoses, brooms, and water for curing. Sufficient materials and equipment of this type must be readily available and in usable condition before starting the overlay placement.

OIL LEAKS

The mixer truck and any other piece of equipment the contractor will have on the deck during placement operations shall be checked for hydraulic or oil leaks. Preventive measures will be utilized to keep the equipment from leaking or tracking foreign material on the deck. The contractor should also be advised that it is a good practice to keep tarps available in the event a leak is discovered.

ACCESS TO WORK

In some cases (particularly when the overlay is placed full-width) problems arise related to the SE having ready access for inspection of the work. More specifically, with the finishing machine operating from curb to curb, there is no ready access from the rear of the operation to the front and vice versa. According to Section 105.01.03, when such a situation exists, access for inspection must be furnished and the primary requirements are accessibility, safety, and non-interference with the contractor's operation.

	Section BRIDGE DECK OVERLAY
	Subject General Procedure for Placing Overlay

GENERAL

Many of the requirements for placing latex and low slump concrete overlays are similar in nature and will be discussed jointly as follows.

JOB CONTROL SAMPLING & TESTING

The section engineer (SE) shall make preliminary preparations for job control sampling and testing. If the bridge is subject to vibration from traffic, all material testing shall be done on solid ground off the bridge deck.

All testing shall be done with as little interference in the contractor's operation as possible. Samples of latex shall be taken at random times during each placement to ensure that the latex is not accidentally becoming diluted.

APPLYING GROUT

The contractor shall apply grout as stipulated in the Standard Specifications. It is very important that grout is applied properly (scrubbed in) to all vertical surfaces such as curbs, drains, or a previously placed overlay since the resulting joints are extremely susceptible to water penetration. Grout should not be allowed to puddle or dry out and fresh grout shall always be available. The contractor shall neatly brush and properly cure the final grout coating of all longitudinal and transverse joint top surfaces.

Note: Grout shall not be applied when using hydrodemolition.

FINISHING MACHINE

The SE shall closely observe the finishing machine to ensure it is properly consolidating the overlay and leaving a good finish. The SE shall perform and record random depth checks of the finished overlay thickness. Excessive variations from the predetermined depth (determined during the dry run) are sufficient reason for suspending operations until the contractor can correct the problem.

FINISHED SURFACE

The SE shall inspect the finishing behind the finishing machine to ensure proper grades are being obtained around drains, expansion dams, and gutter lines. The grooving or texturing operation shall be observed closely to be sure the required width and depth are being obtained and that the termination points are correct.

FINISHED SURFACE (CONT.)

Special attention should be directed to the timing of the texturing or grooving as related to the passage of the finish machine. Waiting too long to perform either of these operations may result in tearing of the surface or displacement of the aggregate. Texturing too early may result in the overlay flowing back together, thus eliminating the grooves or texturing. Some trial and error may be necessary to establish the proper timing but it should be established as early as possible and maintained throughout the operation.

The overlay shall be straight-edged the following day in accordance with Section 609.03.08 of the Standard Specifications and appropriate action taken as specified in this section. Tolerances for the straight-edging shall be obtained from the Standard Specifications.

The SE shall sound the overlay one last time to determine if there are any unbonded areas. If any are found, the contractor shall:

1. Cut the unbonded areas out
2. Square up the hole
3. Apply a bond coat
4. Patch with overlay material

	Section BRIDGE DECK OVERLAY
	Subject Low Slump Concrete Overlay

DECK DRYNESS

The dryness of the original deck is critical in this operation. The section engineer (SE) shall direct special attention to this requirement and enforce it rigidly.

GROUT

The SE shall closely observe the mixing of grout. A determination shall be made early in the operation for the amount of water required to be added to the sand and cement to achieve a grout of acceptable consistency.

Note: Haphazard mixing of unknown quantities of materials is not to be permitted.

The grout should be agitated continuously and kept thoroughly mixed.

DENSITY TESTS

The contractor shall furnish a work bridge from which density tests may be run that is separate from those used to finish the overlay. The SE shall perform density tests at the predetermined locations and make calculations expeditiously to determine if density has been obtained. The linear distances between tests shall not exceed the limits set forth in the *Materials Field Sampling and Testing Guidance Manual*. Procedures for density tests shall be in accordance with **Exhibit 9106**. When a failing density test is obtained, the following procedure shall be followed unless otherwise directed:

1. Immediately stop all forward motion of the overlay operation. Record the location of this action.

2. Make additional passes with finishing machine to consolidate overlay to specified density. The passes must run back to the vicinity of overlay compacted to satisfactory density as evidenced by the last passing test.

3. If satisfactory density is obtained, the operation may resume. It should be recognized that the recompacted section may be too hard to achieve satisfactory grooving or texturing. Appropriate action will have to be taken depending on plan requirements and the condition of the overlay. When the operation resumes normal progress, slow the finishing machine down and density test results should improve.

DENSITY TESTS (CONT.)

4. If recompaction of the overlay fails to achieve passing density, the failing material must be removed and replaced with acceptable concrete at the contractor's expense as required in the Standard Specifications. The area of suspect material is defined to extend from the point of ceasing operation (as defined in Step 1 above) to the immediate vicinity of the nearest passing test. In this event, it is considered acceptable procedure to take additional density tests at ten-foot increments both forward and backward from the point of failure to determine the limits of failing material. If this procedure is used, the base density test to be used in the computations should be the one nearest the test being run. An alternate procedure would be to remove all material back to the previously passing test without taking any intermediate tests. The choice of procedure is at the discretion of the SE.

5. If it is necessary to implement Step 4 above, this action should be undertaken immediately if at all possible. Under no circumstances should work be allowed to proceed to another lane or section of the deck without finishing the section or lane in question including replacement of all unacceptable concrete. Nuclear density tests for low slump concrete can be reported on sample form as shown by **Exhibit 9104, page 9**. **CST-800** details the use of nuclear gauges.

CURING

Applying burlap when concrete is too plastic can cause damage to the surface. Care should be exercised in determining the correct time to apply burlap and start the fogging operation. The burlap applied to the concrete should be thoroughly wet but allowed to drain before using.

Curing shall be done in accordance with Section 606.03.18(A)(4) of the Standard Specifications.

	Section BRIDGE DECK OVERLAY
	Subject Latex Concrete Overlay

PREWETTING THE DECK

The contractor shall prewet the original deck as required in the Standard Specifications. It is a further requirement that the deck be kept constantly wet preceding the overlay operation.

The problem encountered in keeping the deck wet is the disposal of accumulated water. This problem is particularly acute if the overlay operation is moving upgrade or is on a superelevated section or if partial depth patches exist. The inspector shall watch this operation closely and not permit any accumulation of water.

LATEX GROUT

The operation of scrubbing the latex grout from the latex concrete mixture into the deck results in a sizeable quantity of coarse aggregate left over. The contractor shall collect this aggregate and dispose of it outside the overlay operation. The latex grout should remain fluid until covered by the overlay material.

The finishing and texturing operations shall closely follow the finishing machine so they can be completed prior to the latex concrete "setting" at its surface.

CURING

The burlap shall be thoroughly wet, but allowed to drain before being applied to the deck. Be sure water is not draining from the burlap since latex will be washed from the surface leaving coarse aggregate exposed.

This curing shall be done in accordance with Section 606.03.17(A)(4) of the Standard Specifications.

	Section BRIDGE PAINTING
	Subject Introduction

GENERAL

A paint coating serves the dual functions of metal preservation and improvement of appearance. Paint forms a protective coating that separates the corrodible metal surface from the corrosive action of oxygen and moisture thereby reducing or preventing structural component section loss. The service life of a paint coating is governed by many factors such as:

- Severity of exposure
- Degree of surface preparation
- Composition and thickness of paint layer
- Method of application
- Quality of application

The cleaning and painting of structural steel requires knowledgeable and **close** supervision by the section engineer (SE) and the project inspectors. Every SE should have at least one inspector on the crew with in-depth experience and education in bridge paint project inspection and administration, or consider use of consultant project administration management or inspection.

PROTECTION OF THE PUBLIC

Regardless of the size of the bridge or its location, painting contractors will invariably find themselves involved with the traveling public. In accordance with the Standard Specifications, the contractor is solely responsible for any damage resulting from the operations. The contractor is required to protect the following against damage or disfigurement by paint or paint materials:

- Their Staff
- Cabinet Personnel
- The Public
- Public and Private Property
- The Environment

Despite all possible precautions on the part of the contractor, accidents do happen. The contractor shall make preparations to handle the complaints or emergency situations before starting the cleaning or painting operation.

PROTECTION OF THE PUBLIC (CONT.)

At the preconstruction conference, the contractor shall furnish the name of the responsible persons that will be available at all times to handle any inquiries, problems, or emergencies and shall also clarify how problems will be handled when they occur.

Note: If no conference is held, the SE shall obtain this information for the project diary prior to the contractor starting work.

The SE and the painting inspector may find that they are approached by irate citizens regarding paint damage or other claims. In this event, they shall listen politely but refrain from judging on the validity of the claim. They shall, however, give the name of the contractor's employee responsible for handling paint damage or other claims or the contractor's liability insurance company's name if the contractor is no longer on the project.

	Section BRIDGE PAINTING
	Subject Surface Preparation

CLEAN SURFACES

The nature of painting work makes skillful and continuous inspection mandatory during the surface preparation operation. The best coating of paint possible will be rendered ineffective if applied over poorly prepared steel.

To get a good paint job, it is essential that the surface be clean and dry and has acceptable surface preparation. This provides a suitable foundation for coating adherence. This is not only critical to the first coat, but to additional coats as well. Grease or oil, dirt, rust, loose scale, old paint coating and dampness are the principal causes for the breaking of bond between the metal and the paint, or between the various films of paint.

SURFACE INSPECTION

Properly working inspection equipment is essential for project inspection. Each project shall have available for the inspectors:

- At least one sling psychrometer
- One copy of the U.S. Weather Bureau Psychrometric Tables
- One surface temperature thermometer for determining when ambient weather conditions and temperatures meet the requirements listed in the Standard Specifications or Manufacture's Product Data Sheets (PDS)
- Dry Film Thickness Gauges (both electronic magnetic nondestructive and a Tooke type destructive)
- A micrometer and sufficient replica tape to measure anchor pattern, (surface profile) ASTM D 4417 Method C, as required in the Standard Specifications
- A dull 2 inch scraper or putty knife
- Mirrors
- Clear glass or plastic bottles
- Additional equipment as required

CLEANING METHODS Cleaning methods shall conform to the Standard Specifications, plans, and proposal. It is essential that each section engineer have available inspection staff with knowledge of accepted industry standards (for example SSPC and NACE) to provide quality assurance inspection of the surface preparation. Copies of these standards are available through Central Office, Division of Construction and Division of Maintenance.

	Section BRIDGE PAINTING
	Subject Paint (Coating)

REQUIREMENTS

All paint shall conform to the applicable section of the Standard Specifications or as otherwise designated in the contract. Contractors shall also follow these general guidelines:

- All coatings will be inventoried and inspected for container and contents integrity when delivered to the contractor's storage site.
- Any paint that is rejected shall be removed from the job before any painting is started.
- All coatings will be sampled for approval by Central Office Division of Materials.
- Coatings that fail will be removed from the storage site and not permitted on the project site. Some coatings may be approved but with a deduction (Section 821 of the Standard Specifications).

ACCEPTING PAINT THAT HAS BEEN TRANSFERRED

Occasionally a section engineer (SE) may be requested to accept paint that has been job-tested on the basis of a transfer of materials. In this event, a SE must proceed with caution. Generally, the transfer of paint by this procedure between SEs in the same district or even between SEs in neighboring districts may be accomplished with less effort than resampling.

When paint is transferred over distances greater than this, however, problems may arise (such as relating paint received to that transferred, mix-ups in quantities, or other confusing factors).

Unless the SE is absolutely sure of a satisfactory relationship between the transfer of materials and the paint received, the paint should be sampled before used on the project.

THINNER

If the contractor desires to use paint (coating) thinner or reducer, he or she must submit a written request through the SE to the Central Office Division of Materials. Thinner or reducer may only be used with written approval from the Central Office Division of Materials.

THINNER (CONT.) If approved, paint thinner may be used as specified in the manufacturer's written application instructions. The thinner used must be the type recommended in the written instructions and must not exceed the maximum amount specified or approved. If the contractor has not supplied the application instructions, thinner shall not be added.

When mixing and applying coatings, inspectors will ensure that the contractor adheres to the coating manufacturer's procedures, recommendations, and methods.

	Section BRIDGE PAINTING
	Subject Inspection

OVERVIEW

The section engineer shall see that the inspectors assigned to bridge painting jobs have a thorough understanding of the job and their responsibilities. Experience is a very important asset to a bridge painting inspector since decisions must be made concerning the quality of a contractor's work based on visual interpretations and comparisons.

REPORTING

The inspector shall complete the TC 63-28 form, *Daily Work Report* and TC 63-14 form, *Daily Inspector's Report for Bridge Painting* (**Exhibit 9029**) daily. The total number of gallons and inventory identifier of each type of coating used shall be recorded on a daily basis with running totals kept from day to day. The inspector shall also indicate the areas accepted and any problems encountered along with other required information.

FINAL INSPECTION

On site, inspectors shall coordinate with Central Office personnel to schedule partial final and final inspections. Large projects with many structures or numerous portions of a large structure may require multiple moves by the contractor facilitating the need to perform multiple partial final inspections.

Central Office personnel will perform multiple inspections as well as regular in-progress project reviews.

The project will not be considered complete until the following have been completed:

- Final review of partial finals
- Complete project walk-through
- Final inspection

	Section BRIDGE PAINTING
	Subject New Structural Steel

REQUIREMENTS

The cleaning and painting of new structural steel shall comply with Section 607.03.23 of the Standard Specifications and applicable plan and proposal notes.

The section engineer (SE) or a designated representative shall inspect all steel when delivered to the job site for compliance with Section 607.03.23(C) of the Standard Specifications. Field cleaning and painting shall be done in accordance with Parts “D” and “E" of this specification.

STEEL INSPECTION

Generally, the presence of the shop inspector's stamp indicates that the paint meets the specifications. However, occasionally, steel will get shipped that differs significantly from the specification requirements. In this case, the presence of a shop inspector's stamp on the steel does not automatically mean that the SE has to accept the steel as delivered to the project. The field inspection, prior to erection, shall be critical and thorough since it will be the last opportunity for anyone to closely examine the steel.

The project contractor bears full responsibility for all work, including the first coat of paint done in the shop.

PAINTING OPERATIONS

All cleaning and painting of a new bridge must proceed in an orderly fashion with each operation (whether it be cleaning or individual paint coats) being completed by bays, sections, or other readily identifiable sections of the structure before commencing with the next operation.

	Section BRIDGE PAINTING
	Subject Maintenance Cleaning & Painting Steel Bridges

REQUIREMENTS

The cleaning and painting of existing steel bridges shall comply with Section 614 of the Standard Specifications and applicable plan and proposal notes.

	Chapter STRUCTURES
	Subject Permanent Signing

SIGN APPROVAL

Signing contracts shall comply with Section 715 of the Standard Specifications, the MUTCD, Standard Drawings, and the plans. The section engineer (SE) shall:

- Thoroughly inspect all sign trusses, posts, panels, sheets, reflective material, and messages prior to erection
- Verify all members for size, thickness, size of weld, proper galvanizing, etc.
- Approve mill test reports
- Submit shop drawings to the Division of Traffic for sign message and post details

The Division of Bridges reviews sign truss shop drawings.

INSPECTING SIGN INSTALLATION

The SE shall check the location of all signs when they are staked to ensure that the sign is clearly visible and that clear zone requirements are met. Standard beam supports that are set into concrete bases must be behind guardrail or beyond the clear zone from edge of pavement.

Break-away beam supports are required for all signs that are unprotected by guardrail or barrier wall and within the clear zone. **All break-away components shall be installed exactly according to the plans so that the sign will yield when impacted by a vehicle but will not yield from wind loads below the design wind speed.** Correct bolt torque is critical to the break-away connection functioning correctly.

COVERED SIGNS

Signs that must be covered to prevent conveying the incorrect message must follow the manufacturer's recommendation for covering material. If signs must be covered a long time, then they should not be installed until near the time that the road is ready to be opened to traffic because many materials used to cover a sign will damage its reflectivity. Covered signs must be covered completely.

	Chapter STRUCTURES
	Subject Lighting

REQUIREMENTS

Roadway lighting must be constructed in accordance to the plans and Section 716 of the Standard Specifications. Lighting projects require close coordination between the Division of Traffic, the district traffic engineer, the section engineer (SE), and the contractor. **Any questions about pole placement, splicing, etc. shall be answered with coordination from the Division of Traffic.**

Section 834 of the Standard Specifications details lighting material requirements. The SE shall closely check the catalog and model numbers, power ratings, etc. for compliance. Generally, anchor bolts and connecting bolts are the only materials that require mill test reports for acceptance on lighting work.

ROADWAY LIGHTING APPROVAL PROCESS

The light standards or poles, break-away transformer bases, luminaries, control cabinet, conduit, fuse connections, photoelectric switches, junction boxes, etc. are approved through brochures, shop drawings, or catalog cuts.

The SE shall submit five sets of drawings for the materials that the contractor proposes to use to Central Office Division of Construction.

The Division of Construction will submit as necessary to the Division of Traffic or Planning for approval.

INSPECTION

The SE shall ensure that the materials installed are the same as approved. **The inspector shall pay particular attention to the construction of concrete bases and ensure that the anchor bolt patterns match the transformer base bolt pattern.**

The following is a minimum inspector's check list:

- **Concrete pole bases**—Correct size, rebar cage, anchor bolt size and pattern, anchor bolt nuts all tight, projection above ground, anchor bolt test reports, leveling nuts (if required), grouting between transformer base and concrete base (if required), shims (if required) galvanized. **It is critical that ground rods be installed according to the plan.**

INSPECTION (CONT.)

- **Light Pole Standards**—Plumb, clean and unmarred finish, pole caps, correct pole height and length of arm, correct wattage luminaire, pole arm and luminaire are the same model as approved, correct size fuse in fused connector in base, transformer base grounded, spare conduits are installed as indicated in the plans and notes, **pole hardware is installed according to manufacturer's recommendations (for example, clevis hook is placed the appropriate distance from the winch in high mast poles)**.

- **Service Pole and Control Cabinet**—Ensure correct pole and cabinet size, ground rod, lighting arrester, photoelectric switch, cabinet is aluminum or galvanized finish as required and good finish, no rusting of hardware, correct switches and controls in cabinet, circuits are numbered correctly, **all wires are identified with appropriate labeling**, project inspected by power company and state inspector of State Fire Marshal's Office.

- **Conduit, Wires, Trenching, and Junction Boxes**—The conduit, wires, and junction boxes must be the size and type specified and approved. **All wire shall be identified by labels at all locations where the wire is visible, such as junction boxes, poles, and cabinets. Splicing shall only be allowed at locations specified on the plans.** The trenches shall be properly backfilled (pay particular attention to the size and type of backfill) to original ground elevation, graded, and seeding restored.

	Chapter STRUCTURES
	Subject Signalization

REQUIREMENTS

Traffic signalization projects require close coordination between the Division of Traffic, the district traffic section engineer, the section engineer (SE), and the contractor. **Any questions about pole placement, splicing, etc. shall be answered with coordination from the Division of Traffic. Splicing shall only be allowed at locations specified on the plans.** The contract will provide details for the number and location of signals, support poles, and traffic loop sensors and controllers. Section 835 of the Standard Specifications details traffic control devices material requirements.

SIGNALIZATION APPROVAL PROCESS

The contractor shall submit five sets of catalog cuts and drawings for the proposed materials to the SE for submission to Central Office Division of Construction who will pass along to the appropriate division for approval. The contractor must indicate which model of a particular product is proposed, because there are numerous models listed on submitted literature.

INSPECTION

The SE shall verify that all materials provided are the ones that were approved for use.

The SE shall ensure the vertical clearances to all signals meet the contract requirements and that all strain poles, control cabinets, hardware, etc. are rust-proof, the type required, and unmarred. All wires shall have drip loops as specified. Signal heads must be properly located and oriented to match approaching traffic alignment. Whenever possible, poles should be placed behind guardrail or beyond the clear zone from edge of pavement.

The inspector's minimum checklist for lighting inspection (**CST-1316**) also applies to signalization inspections.

PROJECT COMPLETION

The project must be inspected and approved by Central Office and the district Traffic Section for conformance to the specifications, drawings, and plans. The project shall be properly dressed and restored before calling the job complete.

	Section PRECAST OR PREFABRICATED CULVERTS
	Subject Precast Three-Sided Culverts

REFERENCE

Exhibit 9113 details precast three-sided culverts.

INTRODUCTION

Precast three-sided culverts have gained in popularity due to the ease and speed of construction. This is especially evident in road closure situations. These culverts are cast generally in eight-foot sections and placed on strip concrete footings.

These culverts are considered to be *soil interactive* meaning that the shape of the culvert, which tends toward an arch, allows the soil forces to place the walls in compression similarly to a dried laid stone arch.

The Division of Material maintains a list of approved producers and facilities. Approved culvert systems include:

- Con Span
- Bebo
- Hyspan
- Omega

The Cabinet does not consider these types of structures as an equal alternate to cast-in-place culverts. Precasting lends itself to higher quality of the product, but the assembled culvert has joints, lift holes, a potential for differential settlement, and possibly different stream flow characteristics.

If the contractor wishes to change out a cast-in-place culvert for a precast, he or she must negotiate with the section engineer (SE) the details (to include a reduction in price) for the change. Central Office, Division of Construction will have final approval.

Since the proposal or plans may have come from different divisions of the Cabinet, pertinent information (such as geotechnical or water flow) may not be included. It is the contractor's responsibility to provide assurance to the Cabinet that the system will meet site conditions. In particular, the Division of Highway Design will develop plans with a generic structure, giving the contractor the freedom to choose among several alternates, but the selected structure must meet site requirements.

SITE EVALUATION

Prior to the contractor submitting shop drawings, the SE shall check existing site conditions, stream alignment, and existing roadway grades, **especially once the new structure is staked**, against the plans or proposal to determine if the new structure will be in general alignment with on-site conditions. Several factors (such as the age of the design plans or proposal, improper staking, new roadway repairs, stream scour, etc.) can change the conditions anticipated by the designers and must be addressed by the Cabinet before work begins.

Of primary importance are the stream or rock elevations and the roadway elevations. These culverts have a very definitive amount of fill height that must be met and the criteria for that height will vary on the type of culvert. One of the more prevalent problems found is installing the culvert then finding that additional fill or cover is needed, leading to costly grade adjustments.

LOCATING UTILITIES

Before excavating, the contractor and SE shall survey the excavation site and examine the plans to locate existing utilities. Utility companies shall be contacted to provide the contractor with elevations and precise locations regarding their installations.

The SE or inspector shall ensure the contractor is aware of the "Before-You-Dig" (BUD) service and its advantages in location of underground utilities. Each utility company should be requested to furnish the contractor elevation, location, and any other pertinent information they may have on utilities near the work.

SITE PREPARATION

Generally the contractor will begin work on the excavation (generally the LS of Foundation Prep) and place the concrete strip footings while the producer works toward precasting and delivering the units. This makes it imperative that consideration is given to the timely delivery of submittals that shall include:

- Design
- Shop drawings
- Placement
- Backfill requirements
- Letter confirming existing site conditions meet system requirements

These submittals will be reviewed and given approval by the Central Office Division of Construction who will distribute the approvals to the appropriate agencies.

MATERIALS INSPECTION

The Division of Materials will conduct plant inspections during fabrication and provide feedback to the Division of Construction of fabricating problems and delivery times.

The project inspector shall look for the appropriate KY Oval on all units delivered (signifying acceptance material-wise).

CULVERT ERECTION

The contractor can generally erect the units in just a few hours. Thus it would be beneficial for all to work out the details of the placement to include:

- Access for trucks
- Crane location
- Manipulation of units to an upright position
- Placement grade and alignment
- Shimming of units

Project inspectors shall inspect the units on the truck as they are delivered for:

- Cracks
- Spalls
- Chipped Corners
- KY Oval

Units having any problems shall not be unloaded onto the site.

SEALING JOINTS

Once the culvert has been erected, the contractor shall:

- Seal the culvert's joints per the manufacturer's specifications
- Grout the keyway where the unit rests with a nonshrink grout
- Fill all holes (from erection or shipping) with grout

FIELD MODIFICATIONS

Field modification of these culverts **shall not be allowed** to include cutting or drilling to accommodate misfits, utilities, or pipe drainage. These modifications should have been planned for and detailed in the shop drawings.

BACKFILL

The contractor shall backfill the culvert per the requirements established in the approved drawings. Since this is a soil interaction structure, backfilling is very critical and generally proceeds with a well-graded material in equal lifts on either side of the structure. The contractor generally will use stone instead of soil, in that fill requirements are easier to achieve. The Cabinet may stipulate stone or even flowable fill as an assurance against future settlement over the structure.

Equipment shall not cross the culvert until the fill over the culvert has been placed. The culvert is not designed to resist loading without adequate backfill.

MISCELLANEOUS WORK

Miscellaneous work (such as weep holes, erosion control, etc.) shall be completed per specifications and other criteria of this manual.

	Section PRECAST OR PREFABRICATED CULVERTS
	Subject Metal Arch Culverts

REFERENCE

Exhibit 9094 details metal arch culverts.

INTRODUCTION

Metal arch culverts have gained in popularity due to the ease and speed of construction similar to the three-sided precast culverts. These culverts are furnished as either aluminum or steel-plate and may include a concrete flow line or an asphalt coating. These culverts are considered to be *soil interactive* meaning that the shape of the culvert, which tends toward an arch, allows the soil forces to place the walls in compression similarly to a corrugated pipe.

Metal arch culvert usage shall comply with *Special Note 9V – for Aluminum and Steel Structural Plate Box Culvert* of the Standard Specifications.

The Division of Materials maintains a list of approved producers and facilities. Approved systems include:

- Contech Construction Products
- Lane Metal Company

Since the proposal or plans may have come from different divisions of the Cabinet, pertinent information (such as geotechnical or water flow) may not be included. It is the contractor's responsibility to provide assurance to the Cabinet that the system will meet site conditions.

SITE EVALUATION

Prior to the contractor submitting shop drawings, the section engineer (SE) shall check existing site conditions, stream alignment, and existing roadway grades, **especially once the new structure is staked**, against the plans or proposal to determine if the new structure will be in general alignment with on-site conditions. Several factors (such as the age of the design plans or proposal, improper staking, new roadway repairs, stream scour, etc.) can change the conditions anticipated by the designers and must be addressed by the Cabinet before work begins.

Of primary importance are the stream or rock elevations and the roadway elevations. These culverts have a very definitive amount of fill height that must be met and the criteria for that height will vary on the type of culvert. One of the more prevalent problems found is installing the culvert then finding that additional fill or cover is needed, leading to costly grade adjustments.

LOCATING UTILITIES Before excavating, the contractor and the SE shall survey the excavation site and examine the plans to locate existing utilities. Utility companies shall be contacted to provide the contractor with elevations and precise locations regarding their installations. The SE or inspector shall ensure the contractor is aware of the "Before-You-Dig" (BUD) service and its advantages in location of underground utilities. Each utility company should be requested to furnish the contractor elevation, location, and any other pertinent information they may have on utilities near the work.

SITE PREPARATION Generally the contractor will begin work on the excavation (generally the LS of Foundation Prep) and place bedding while the producer works toward fabricating and delivering the materials. This makes it imperative that consideration is given to the timely delivery of submittals that shall include:

- Design
- Shop drawings
- Placement
- Backfill requirements
- Letter confirming existing site conditions meet system requirements

These submittals will be reviewed and given approval by the Central Office Division of Construction who will distribute the approvals to the appropriate agencies.

CULVERT ERECTION The contractor can generally assemble and erect the sections in just a few hours. Thus it would be beneficial for all to work out the details of the placement to include:

- Lifting supports
- Crane location
- Placement grade and alignment

FIELD MODIFICATIONS Field modification of these culverts **shall not be allowed** to include cutting or drilling to accommodate misfits, utilities, or pipe drainage. These modifications should have been planned for and detailed in the shop drawings.

BACKFILL The contractor shall backfill the culvert per the requirements established in the approved drawings. Since this is a soil interaction structure, backfilling is very critical and generally proceeds with a well-graded material in equal lifts on either side of the structure. The contractor generally will use stone instead of soil, in that fill requirements are easier to achieve. The Cabinet may stipulate stone or even flowable fill as an assurance against future settlement over the structure.

Equipment shall not cross the culvert until the fill over the culvert has been placed. The culvert is not designed to resist loading without adequate backfill.

MISCELLANEOUS WORK

Miscellaneous work (such as stone for outlets, erosion control, etc.) shall be completed per specifications and other criteria of this manual.

	Chapter INDEXES
	Subject Table of Exhibits

EXHIBIT NUMBER	FORM TITLE	CHAPTER REFERENCE
9022	Acknowledgement of Notice of Changed Condition/ Disagreement, TC 63-33	311-3, 502
9071	Asphalt Density Cores (Construction Memorandum 04-07)	1110
9047	Bench or Check Level Notes (Typical)	604
9066	Bill of Lading (Example)	803
9062	BMP Inspection & Maintenance (Construction Memorandum 02-06)	703
9063	BMP Notebook Guidance	703
9104	Bridge Deck Overlays: Cement Concrete Overlay Sequence of Events	1313-6, 1313-8
9108	Bridge Deck Overlays: Chart No. 1 – Target Density	1313-1
9107	Bridge Deck Overlays: Computing Theoretical Absolute Volume	1313-1
9105	Bridge Deck Overlays: Concrete Mobile Check List	1313-6
9112	Bridge Deck Overlays: Design Data Form for Concrete Mobile	1313-1
9106	Bridge Deck Overlays: Instructions for Taking Densities	1313-8
9109	Bridge Deck Overlays: Thin Lift Overlay Nomograph	1313-1
9110	Bridge Deck Overlays: Water Cement Ratio for Cement Concrete	1313-1
9111	Bridge Deck Overlays: Water Cement Ratio for Latex Concrete	1313-1
9076	Cofferdam Inspection During Construction	1304-3
9060	CoGo Example	603

9095	Concrete Mix “Rules of Thumb”	1307-1
9037	Concrete Mixer Performance & Condition Approval, TC 63-55	502, 1307-2
9027	Concrete Trip Ticket, TC 63-9	502, 1203, 1307-2
9045	Consent & Release, TC 71-14E	503
9007	Construction Revision Index	301
9018	Contract Overtime & Liquidated Damage Review, TC 63-26	309-6, 404, 502
9052	Culvert Cross Sections	613-2
9067	Current Radiation Safety License	803
9029	Daily Inspectors Report for Bridge Painting, TC 63-14	502, 1314-4
9028	Daily Report of Weighed Materials, TC 63-12	502, 1004-4, 1004-5
9011	DBE Detailed Plan/Subcontract Request Form, TC 14-35	304-3
9103	Emergency Construction Joints	1312-7
9014	Engineer’s Wage & Hour Report, TC 14-312E	307, 503
9097	Epoxy Coated Reinforcing Steel Inspection Guidelines	1308
9042	Erosion Control Inspection Report, TC 63-61	502, 702, 703, 710
9093	Fabrication Construction Memorandum	1309-3
9092	Falsework: Dayton Superior Data	1306-1
9090	Falsework: Stay-In-Place Metal Forms	1306-1
9091	Falsework: Typical Overhang Installation & Calculations	1306-1
9015	Federal-Aid Highway Construction Contractors Annual EEO Report, FHWA-1391	308-1, 503
9046	Field Book Cover & Index (Typical)	602
9053	Field Notes—Culvert Outlet (Typical)	613-2
9032	Final Pay Estimate Letter	502
9034	Final Release, TC 63-34	311-6, 502
9044	First Report of Injury or Illness, IA-1	111-3, 503
9019	Force Account Daily Field Record, TC 63-11	310, 311-4, 502

9020	Force Account Workbook-Labor Payroll, Equipment Rental, & Materials, TC 63-10	310, 311-4, 502
9023	Formal Acceptance Report of Completed Construction	311-6
9050	Geodetic Survey Mark Preservation	605
9002	Hazardous Substance/Waste Site Investigation Request	114
9036	In-Place Density Using Control Strip, TC 63-49	502
9006	Kentucky Civilian Traffic Collision Report, KSP-232	111-3, 503
9061	KPDES Permit & SPCCP (Construction Memorandum 03-07)	702, 703, 705
9114	KYTC Nuclear Gauge Location Report	803
9116	Leak Test Form	804
9024	Legal Notice–Unauthorized Encroachment on State-Owned Right-of-Way, TC 99-14E	206-1
9055	Level Adjustment—Two Peg Method	613-2
9048	Level Notes (Typical)	604
9051	Marking of Slope Stakes	610
9094	Metal Arch Culvert	1318-2
9041	Moisture Density Test Report, TC 63-47	502, 805
9021	Notice of Changed Condition/Disagreement, TC 63-32	209, 311-2, 311-3, 502
9039	Notification of Imminent Danger, TC 63-63E	502
9065	Nuclear Gauge Emergency Procedures	803
9040	Nuclear Meter Daily Log Sheet, TC 63-46	502, 805
9079	Pile Acceptance: Mill Test Reports (Construction Memorandum No. 3-91)	1309-1
9081	Pile Driver & Extractor Data: Air or Steam Hammers	1305-5
9082	Pile Driver & Extractor Data: Diesel Hammers	1305-5
9083	Pile Driver & Extractor Data: Impact & Vibrator Pile Drivers & Extractors	1305-5
9085	Pile Driver & Extractor Data: Typical Auger Drilling Operation	1305-5
9084	Pile Driver & Extractor Data: Updated Pile Driver Types	1305-5
9080	Piling: Estimate Table for Battered Pile Lengths	1305-6

9088	Piling: Manufacturer's Data for Ice Pile Driving Equipment	1305-5
9086	Piling: Manufacturer's Data for Kobe Diesel Pile Hammer	1305-5
9087	Piling: Manufacturer's Data for MKT Pile Driving Equipment	1305-5
9089	Piling: Manufacturer's Data for Vulcan Pile Driving Equipment	1305-5
9078	Piling: Steel Piling Driven Below Cutoff	1305-3
9077	Piling: Welded Reinforcement Pile Splice	1305-8
9113	Precast 3-Sided Culvert	1318-1
9070	Precast Small Drainage Structure: Fabrication Limits	906
9069	Precast Small Drainage Structures: Guidelines for Preparation of Shop Drawings & Inspection of Units	906
9001	Preconstruction Conference Checklist	209
9038	Pre-Construction Safety & Health Checklist, TC 63-62	502
9049	Profile & Cross Section Notes (Typical)	606
9068	Radiation Exposure (TLD) Report	804
9025	Record of Piles Furnished & Driven, TC 63-8E (Blank Form & Completed Example)	502, 1305-4, 1305-6
9026	Record of Piles Furnished & Driven (Metric), TC 63-8M	502
9030	Record of Test Pile, TC 63-22E (Blank Form & Completed Example)	502, 1305-4 1305-6
9031	Record of Test Pile (Metric), TC 63-22M	502
9096	Reinforcing Steel Identification Marks	1308
9005	Removal of Artifacts from State Property (State Highway Engineer Memorandum 3/18/2002)	109
9035	Request for Rideability Test, TC 63-43	502, 1110
9098	Rotational Capacity Testing	1309-7
9115	Securing a Nuclear Gauge	803
9058	Simple Circular Curve	614
9008	SiteManager Manual Section 14: Change Order Basics	303-2, 303-5
9059	Spiral Curve	614
9056	Staking Culvert Wings	613-2

9043	Statement of Materials & Labor Used by Contractors on Highway Construction Involving Federal Funds, FHWA-47	503
9072	Structure Excavation: Bridges	1303-2
9073	Structure Excavation: Culverts	1303-3
9075	Structure Excavation: Pipe Culverts, Storm Drains, Sewers, Headwalls, Anchors, Boxes, Etc.	1303-1
9074	Structure Excavation: Retaining Walls & Crib Walls	1303-4
9054	Structure Layout (Typical)	613-3
9010	Subcontract Request Form-Change Order Items, TC 63-35CO	304-2
9009	Subcontract Request Form, TC 63-35	304-2, 502
9099	Temperature Adjustments for Bridge Rockers	1309-12
9003	Underground Storage Tanks—Construction Contract Removal	114
9004	Underground Storage Tanks—Discovered During Construction	114
9064	U.S. Army Corps of Engineers Nationwide Permit #14	707
9013	U.S. Department of Labor Payroll Form, WH-347	306-1
9057	Vertical Curves	614
9033	Weighman's Tare Check Report, TC 63-31	502, 1004-2
9101	Welding: Examples & Criteria	1310-2
9102	Welding: Nondestructive Testing	1310-5
9100	Welding: Welding Positions, Symbols, & Definitions	1310-3, 1310-5
9016	Working Day Memo No. 1, TC 63-41	309-4, 502
9017	Working Day Memo No. 2, TC 63-42	309-4, 502

TC 63-64
06/2009

PRECONSTRUCTION CONFERENCE CHECKLIST

PROJECT INFORMATION: ***The Contractor should complete this page prior to the pre-construction conference.

Project Number and Description: _____

Contract Id: _____ Letting Date: _____ Award Date: _____

Work Order Date: _____ Contract Amount: $_____

RESIDENT ENGINEER INFORMATION:

Resident Engineer in Charge of Project: _____

Office Phone Number: (___)_____ Cell Phone Number: (___)_____

Fax Number: (___)_____

Mailing Address: _____

_____

**THE CONTRACTOR SHALL SEND ALL CORRESPONDENCE THROUGH THE RESIDENT ENGINEER.

CONTRACTOR INFORMATION

Prime Contractor: _____

Email Address: _____

Mailing Address: _____

_____

Office Telephone Number: (___)_____

Project Superintendent: _____ Cell phone Number: (___)_____

Project EEO Officer: _____ Company EEO Officer: _____

Project Traffic Coordinator: _____ Telephone Number: (___)_____

Work Zone Traffic Control Supervisor: _____

Work Zone Traffic Control Technician: _____

Engineer or Land Surveyor in Charge of Staking: _____

Certified Asphalt Field Technician: _____

KEPSC Qualified Erosion Control Inspector: _____ Telephone Number: (___)_____

Competent Project Safety Designee: _____ Telephone Number: (___)_____

CONTRACT TIME INFORMATION:

☐ Specified Completion Date ☐ Working Day Contract ☐ Calendar Day Contract

Completion Date: _____ Number of Working Days: _____

Number of Calendar Days: _____

Expected Begin Date: _____ Expected End Date: _____

Milestone Completion Dates: _____

_____

_____

☐ Discussion of working day statements being sent to the Contractor as required by Specification 108.07.02.

☐ Discuss how time will be charged on the project with the Contractor.

☐ Review with the Contractor how liquidated damages will be charged to the job given the project time and traffic control limitations.

Time Associated Liquidated Damages: $ _____/Day

***There may be other liquidated damages, incentives and disincentives, and lane rental charges that will need to be discussed on a project specific basis.

Notes: _____

_____

_____

_____

PROGRESS SCHEDULE:

☐ Written narrative (received 2-working days prior to today's date)

***If box is not checked, postpone conference to satisfy specification 108.02.

Is an activity bar chart required? ☐ Yes ☐ No

***If a bar chart is required, the Contractor will have 30-days to submit the scheduling documents satisfying specification 108.02.

***Note that a bar chart may be required at any point in the project by the Engineer.

Did the Contractor make a verbal presentation of their progress schedule detailing their plan of action as detailed in specification 108.02? ☐ Yes ☐ No

☐ Discuss the schedule update process and how this process varies according to the scheduling documents required.

***If any of the provisions of specification 108.02 are not met, the Cabinet will withhold progress payments and may apply a penalty equal to ½ the liquidated damages rate as detailed in specification 108.02.

Notes: _____

_____

_____

SUBCONTRACTS/LEASE AND EQUIPMENT RENTAL AGREEMENTS/DBE:

☐ Submit subcontracts directly to the Division of Construction for approval.
***All subcontractors are to be paid within 14 days after the Prime Contractor is paid on projects with any Federal funding.

☐ Submit DBE subcontracts directly to the Division of Construction Procurement.

☐ Contractors should submit a letter from each DBE subcontractor designating the superintendent and stating that this individual is not affiliated with the Prime Contractor.

☐ For Federal Aid contracts requiring DBE goals:
- The Prime Contractor must make payments to DBE's within 7 days after the Prime Contractor is paid.
- The Prime Contractor must submit photocopied payments and a completed DBE Payment form within 7 days of receipt of payment from KYTC to the following:

  Office of Civil Rights and Small Business Development
  Attn: DBE Payments
  6th Floor West
  200 Mero Street
  Frankfort, Kentucky 40622

☐ Equipment rental and lease agreements must by approved by the Engineer. It is the Contractor's responsibility to ensure timely submittals of these.
- All equipment must be clearly identified.
- Operators must be on the contractor's payroll and be paid correct scaled wages as applicable.
- Both parties, lessee and lessor, must sign (notarized) request.

Notes: _____

_____

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_____

RIGHT OF WAY ISSUES:

☐ Open discussion of specific parcels that may not have right of entry or where demolition of specific structures will be required.

Notes: _____

_____

_____

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UTILITY ISSUES:

☐ Discussion of each utility that is affected by the project and an update on relocation status of each entity.

Notes: _____

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_____

RAILROAD ISSUES:

☐ Open discussion of any railroad issues that may affect the project. Time allowance for the railroad representative to discuss issues they may have.

*Who is responsible for payment and tracking the time of any required railroad flagmen?

☐ Kentucky Transportation Cabinet ☐ Contractor

Notes: _____

_____

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_____

ENVIRONMENTAL ISSUES:

☐ Signed BMP plan

☐ Agreement by Contractor and Cabinet for a date to complete a Pre-disturbance Inspection Report

☐ Seeding Plan

☐ Spill Prevention Plan (if applicable) – Required by 40 CFR Part 112 when storing in excess of 1320 gallons of petroleum products (cumulative, including equipment w/ 55+ gallon tanks) on project site. Plan must be prepared in accordance with the Oil Pollution Prevention & Control Act and the Clean Water Act. The plan must be job specific and certified by a Professional Engineer.

☐ Notice of Intent – Must be filed 48 hours before work begins

☐ Burning (if applicable) – Perform all burning in accordance to Regulation 401 KAR 63:005.

☐ Applicable Permits (Corps of Engineers, Division of Water, Etc.)- Copies of these documents are to be posted on project bulletin board and also attached to BMP.

☐ Storage/Removal of Hazardous Materials

☐ Bridge/Other Demolition ***Notify Local Air Quality Officials to determine necessity of a permit.

☐ Archeology Requirements

Notes: _____

_____

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BLASTING PLAN: (If applicable)

☐ The blasting plan must be submitted for acceptance by the Department at least 30 days prior to drilling. The submitted plan should be in compliance with Section 107.11 of the specifications and Special Note 11D when applicable.

☐ Discuss any disincentives associated with blasting.

Notes: _____

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_____

WASTE OR BORROW SITES:

☐ Contractor is required to obtain all applicable permits for waste or borrow sites outside of right-of-way. The Contractor was advised as this meeting that waste site or borrow site approval would require the following procedures to be satisfied:

Notes: _____

_____

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WASTE SITES:

☐ Waste areas must be approved by the Department prior to use. Submittals should be submitted timely and shall include all information and provisions required by Section 204.03.08 of the Standard Specifications.

Proposed Waste Sites- The plans and written request shall contain, but not necessarily be limited to, the following information:

1. Plan, profile, and cross-sections or contours.
   A. Original and anticipated elevations.
   B. Sub-surface type and rock line, when applicable.

C. Any preparatory work such as, but not limited to, benching and sub-drainage.
D. Any necessary data to assure foundation and slope stability.
E. Existing topography and drainage.
F. Proposed erosion controls.

**Plan, profile and cross-sections should be scale drawings, submitted on standard-size reproducible plan sheets and should contain enough detail to show the configuration of the original ground and the anticipated configuration of the area upon completion of the waste operations.

2. Written agreement with the property owner.
   A. If the property owner has any preference in seed mixture for the site, it should be designated in writing.
   B. No permission will be granted for the property owner to do his own seeding.
3. Approval of the Division of Water Resources of the Department of Natural Resources and Environmental Protection if streams or floodways are affected. ***KPDES permit required if disturbed area > 1 acre.***
4. Approval of other regulatory agencies when applicable, such as, but not limited to, US Forest Service, US Corps of Engineers, US Coast Guard, and Local Planning and Zoning Commissions. If US COE permit is not required, provide written notice from COE stating they have no jurisdiction or permit is not required.
5. Approval of utility owners when utilities are involved.
6. Archeology clearance of the proposed site.
7. A geotechnical investigation may be requested and paid for according to specification 204.03.08.

Notes: _____

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BORROW SITES:

☐ Borrow sites must be submitted for review and approval by the Resident Engineer. The submittal must contain all information requested by Section 205 of the Standard Specifications. The submittal must contain the following information, but not necessarily limited to the following information:

1. Plan, Profile and Cross-Sections
   a. Original and anticipated elevations.
   b. Proposed erosions & pollution controls.
      1. While pit is operational.
      2. Final condition.
   c. Existing topography and drainage.

***Plans profile, and cross sections should be scale drawings submitted on standard size reproducible plan sheets and should contain enough detail to show the anticipated configuration of the area upon completion of the borrow operations.

2. Written agreement with property owner.
   a. If the property owner has any preference in seed mixture for the site, it should be designated in writing.
   b. No permission will be granted for the property owner to do his own seeding.
3. Approval of the Division of Water Resources of the Department of Natural Resources and Environmental Protection if streams or flood ways are affected. ***KPDES permit required if disturbed area > 1 acre.***
4. Approval of other regulator agencies when applicable such as, but not limited to, US Forest Service, Corps of Engineers, US Cost Guard, and Local Planning and Zoning Commissions.
   If US COE permit is not required, provide written notice from COE stating they have no jurisdiction or permit not required.
5. Approval of utility owners when utilities are involved.
6. Certification to the Department that the site has been reviewed by a professional archaeologist.
7. Certification that the state historic preservation officer has reviewed the report of the archaeologist and agrees with the findings.

Notes: _____

_____

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HAULING TO OR FROM THE PROJECT:

☐ The Contractor is responsible for obeying all load limit regulations concerning hauling of materials to the jobsite. ***See Construction Memo date August 12, 2005.

***Hauling over new or existing structures must be within legal limits. These may vary based on State or Federal controlling limits. Federal Highways will not pay for anything over legal hauling limitations.

Notes: _____

_____

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_____

MATERIALS: ***The Resident should ensure this list is forwarded to the District Materials Engineer.

☐ List of material suppliers: _____

_____

_____

_____

What types of pipe will be used on this project?: _____

Will the drainage structures be CIP or precast?: _____

Does the project involve greater than 250 cubic yards of concrete? ☐ Yes ☐ No
***If yes, the specifications require that the producer must be in compliance with Kentucky Method 64-323 and on the List of Approved Materials.

☐ Mix Designs (asphalt and concrete) must be approved prior to starting work that pertains to that item.

Notes: _____

_____

_____

_____

NOTICE OF CHANGED CONDITION/DISAGREEMENT:

☐ Distribute a paper copy to the Contractor and provide website for the online form. (http://transportation.ky.gov/construction/forms/)

☐ Discuss the newly outlined procedure in the Standard Specifications. Claims resolution process outlined specifically in Section 105.13.

***The contractor must file notification of in a timely manner as outlined in specification 105.13.

Notes: _____

_____

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CONTRACTOR/DEPARTMENT PERFORMANCE EVALUATIONS:

☐ Discuss when the Contractor performance evaluations will be completed. Provide the Contractor a copy of the form.

☐ Discuss the Department performance evaluation form and the time which they should be completed. Provide the Contractor with the website for the online form. (http://transportation.ky.gov/construction/forms/)

Notes: _____

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SAFETY:

- ☐ Ensure compliance with sections 107.01.01 and 107.08 of the Standard Specifications.
- ☐ All parties must read, sign, and date the Pre-construction Safety and Health Checklist.
- ☐ Provide two copies of the Contractor's Construction Safety Program. Provide one copy to Kim Ellis in the Central Office Division of Construction for review.

Notes: _____

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PUBLIC INFORMATION OFFICER: (IF APPLICABLE)

- ☐ Discussion of when notification for lane closures or road closures should be provided. The Department should have 2 week notice at a minimum.

Notes: _____

_____

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TRAFFIC CONTROL PLANS:

- ☐ Signing diagrams submitted at the pre-construction meeting.
- ☐ Minor traffic changes can be approved by the Engineer.
- ☐ Major changes will be approved by the Project Team. Timely submittal is important because this will take some time.
- ☐ Significant ☐ Unclassified Project. Work Zone Traffic Control Supervisor and Work Zone Traffic Control Technician requirements in accordance with Standard Specification 112.03.12.

Do double fine work zones apply to this project? ☐ Yes ☐ No
***All flagmen must be certified and carrying proof of the certification.

Notes: _____

_____

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_____

CHANGE ORDERS:

- ☐ Change Orders must be approved prior to work starting, however, if an emergency situation arises, the Resident Engineer can obtain approval for the work either by fax or email.
- ☐ Important to submit information requested by the Resident Engineer in a timely manner. All supplemental items need to have a detailed price breakdown and justification.

Notes: _____

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_____

PROJECT PLANS AND PROPOSAL:

- ☐ General Project Specific Notes
- ☐ Special Notes applicable to the project
- ☐ CAP notes
- ☐ Questions concerning plans
- ☐ Discussion of future project meetings (Pre-Pave, Pre-pour, Pre-blast, Pre-electrical and any other Meetings that the Resident may require)

***Following this checklist, attach an outline of project specific topics to be discussed at this meeting including those in the project plans and proposal.

Notes: _____

_____

_____

_____

ELECTRICAL PROJECT COMPONENTS:

***If this project involves significant electrical components, consult the district Traffic Engineer to determine if Central Office Traffic Operations should attend this conference. In any case, the Contractor is urged to invite the electrical subcontractor to attend.

Is a pre-electrical meeting needed onsite? ☐ Yes ☐ No
***If this meeting is needed, Central Office Traffic Operations should be invited.

☐ Shop drawings should be sent directly to Central Office Traffic Operations.
***Responses to the contractor regarding these drawings should be copied to the project engineer.

☐ Field questions should be directed through the project engineer.
***In no case shall the electrical subcontractor make field adjustments without requesting permission from the project engineer; who will in turn notify Central Office Traffic Operations of any changes.

☐ Request the electrical final inspection from Traffic Operations
***When the electrical final inspection is needed, the contractor shall request this inspection by contacting Central Office Traffic Operations and copying correspondence to the project engineer and Central Office Construction District Liaison.

Notes: _____

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WAGE REQUIREMENTS:

☐ Send Certified Personnel Payrolls to:

Kentucky Transportation Cabinet
Division of Construction Procurement
200 Mero Street
Frankfort, KY 40622
ATTN: Certified Payrolls Enclosed

☐ Submit a copy of the Certified Personnel Payrolls to the Resident Engineer
***Send and submit these payrolls weekly.

EEO WAGE REQUIREMENTS:

☐ Required Contract Provisions for Federal-Aid Construction Contracts are included in the Project Proposal. It is the contractors' responsibility to develop and maintain acceptable Affirmative Action plans designed to eliminate discrimination based on race, color, religion, sex, or national origin. Documentation shall be kept in contractors' office.

Checklist:

1. Projects covered by federal regulations: ☐ Yes ☐ No
2. Minority goals established: _____% for this project.
3. Female goals established: _____% statewide and should be applied the same on this project by the contractor.
4. Form PR 1391 submission: Form PR 1391 is an annual report for work performed in July of each year. This report must be submitted for your last work period worked in July.
5. OFCCP subcontractor notification: The contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within ten (10) working days of award of any construction subcontract in excess of $10,000.00 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is performed. The notification shall be mailed to:

   Regional Director
   Office of Federal Contract Compliance Programs
   61 Forsyth Street, SW, Suite 7B75

Atlanta, Georgia 30303-8609
(404) 562-2424

The covered area for this project is _____County.

6. Number of Trainees Assigned: _____

**Form TC14-309 is to be submitted and approved by the Division of Construction Procurement prior to beginning work, and Form TC 14-310 listing the trainee should be submitted prior to Trainee beginning work.

7. Trainee Classifications: _____

_____

_____

8. Weekly Training Reports: ☐ Yes ☐ No

***Form 14-311 submitted to Resident Engineer showing hours worked. Payment will only be made to contractor for hours worked in the trainee classification.

9. Ethnic Group of Trainees: ☐ Yes ☐ No, ☐ Minority or ☐ Female
10. Trainee Starting Dates: As soon as work starts in classification or when work is available. _____

_____

_____

11. EEO Review Scheduling: An EEO Review may be scheduled for this project. The contractor will be notified by certified mail of the date of the review.
12. Referral Sources: Referral sources for minority and female employee hiring should be contacted by the contractor and establish two-way communication with them.
13. Project EEO Officer: The contractor will designate someone on the project as the EEO Officer and notify the Resident Engineer by letter of his selection. This notice shall be placed on the bulletin board. This will apply to the subcontractors on the project also.
14. Company EEO Officer: The contractor will designate someone in the company as the company EEO Officer and notify the Resident Engineer by letter of his selection. This notice shall be placed on the bulletin board. This will apply to subcontractors on the project also.
15. Designation of minority and females on payroll: Designation of minority and females on payrolls must be done by the contractor and subcontractors.
16. Payroll submission federal projects only: Payrolls must be submitted to the Resident Engineer weekly, not later than seven days after the ending of the payroll period. Submit two (2) copies. The Resident Engineer will flag estimates for nonpayment if payrolls are more than two weeks delinquent at the time estimates are processed. Subcontractors may certify their own payrolls if the prime contractor concurs. Payrolls should have correct project #'s, Contract ID #'s, and all necessary information. Note how fringes are to be paid; if to a fund, please furnish a copy of breakdown.
17. Classifications: Employee classifications shown on the payrolls must be

classifications actually being performed by each employee.

18. Overtime: Overtime is to be paid after an employee works eight (8) hours a day or forty (40) hours a week, whichever gives the employee the greater wages. At least time and one-half the base rate is required for all overtime. An employee and an employer may enter into a written agreement or a collective bargaining agreement to work more than eight (8) hours a calendar day, but not more than ten (10) hours a calendar day for the straight time hourly rate. Wage violations or questions should be directed to the designated Engineer.
19. Wage and Hour Reviews: Wage and Hour Reviews will be conducted at least every six (6) months by the Resident Engineer. Compliance Section employees may also conduct Wage and Hour Reviews.
20. Bulletin Board, Wage and EEO Packet: You are furnished a set of wage rates and EEO posters for the bulletin boards.
21. Bulletin Boards: Bulletin boards must be placed where they are readily accessible to all employees and applicants for employment. Bulletin boards must be maintained during the construction period to assure that all posters are legible.
22. DBE Subcontracting: The percentage to be subcontracted to DBE firms is _____% as specified in the proposal. These subcontracting goals must be met or satisfactory documentation submitted showing contractors were unable to locate DBE firms, before the contract is awarded. Should additional subcontractors be requested subsequent to award, the contractor must affirmatively seek DBE firms and document such efforts. The DBE subcontractor must send the Resident Engineer a letter, prior to starting work on the project, naming the Project Superintendent, the Project EEO & Safety Officer, and the Company EEO Officer. The subcontractor must place a copy of this letter on the bulletin board.

    On June 17, 1983, a policy was established by the Executive Director of the Office of Contract Procurement to furnish a **letter of notification** to the contractor at the Pre-Construction Conference. The letter will be read at this time and the contractor is requested to sign it and retain a copy. A copy will be furnished for each subcontractor.

Notes: _____

_____

_____

TC 63-64
06/2009

Signature Sheet & Statement of Understanding:

District: _____ Preconstruction Conference Date: _____

***The undersigned agree to be honest and forthcoming during this conference with the intent of communicating and cooperating with one another in a partnering effort to achieve the best possible product for the Commonwealth of Kentucky.

Name (Printed)	Signature	Company	Email Address **Check if you would like a copy of the minutes.	Phone
			☐	
			☐	
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			☐	
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			☐	
			☐	
			☐	
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			☐	

***The District recorder and Transportation Engineering Branch Manager shall attach the written minutes and a CD of the digital recording of the Preconstruction Conference to this checklist document and send the whole document to the Central Office to be placed in the project file.

TC 63-64
06/2009

Signature Sheet & Statement of Understanding:

District: _____ Preconstruction Conference Date: _____

***The undersigned agree to be honest and forthcoming during this conference with the intent of communicating and cooperating

Name (Printed)	Signature	Company	Email Address **Check if you would like a copy of the minutes.	Phone
			☐	
			☐	
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with one another in a partnering effort to achieve the best possible product for the Commonwealth of Kentucky.
***The District recorder and Transportation Engineering Branch Manager shall attach the written minutes and a CD of the digital recording of the Preconstruction Conference to this checklist document and send the whole document to the Central Office to be placed in the project file.

TC 63-64
06/2009

Signature Sheet & Statement of Understanding:

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Name (Printed)	Signature	Company	Email Address **Check if you would like a copy of the minutes.	Phone
			☐	
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			☐	

***The District recorder and Transportation Engineering Branch Manager shall attach the written minutes and a CD of the digital recording of the Preconstruction Conference to this checklist document and send the whole document to the Central Office to be placed in the project file.

COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
FRANKFORT, KENTUCKY 40622

DON C. KELLY, P.E.
SECRETARY
AND
COMMISSIONER OF HIGHWAYS

BRERETON C. JONES
GOVERNOR

MEMORANDUM

TO: D.W. Lambert, Director
Division of Environmental Analysis

FROM:

DATE:

SUBJECT: **Hazardous Substance/Waste Site Investigation Request**
County: **Project No.:**

The subject project may involve the acquisition of property which includes a potential hazardous substance/waste site. The following information is submitted for an evaluation of any potential contamination of the proposed right–of–way. Plans with cover sheet or aerials and a project location map are attached which show the location of the sites to be investigated and existing and proposed right–of–way.

Business Name:
Business Address:
Business Phone No.:
Nature of Business:
_____ Currently in operation
_____ No longer in operation

Presence of Hazardous Substance/Waste: _____Yes _____Undetermined

Owner's Name:
Owner's Address
Owner's Phone No.:

Parcel No.:
Project's Proposed Let Date:
Information Needed By:

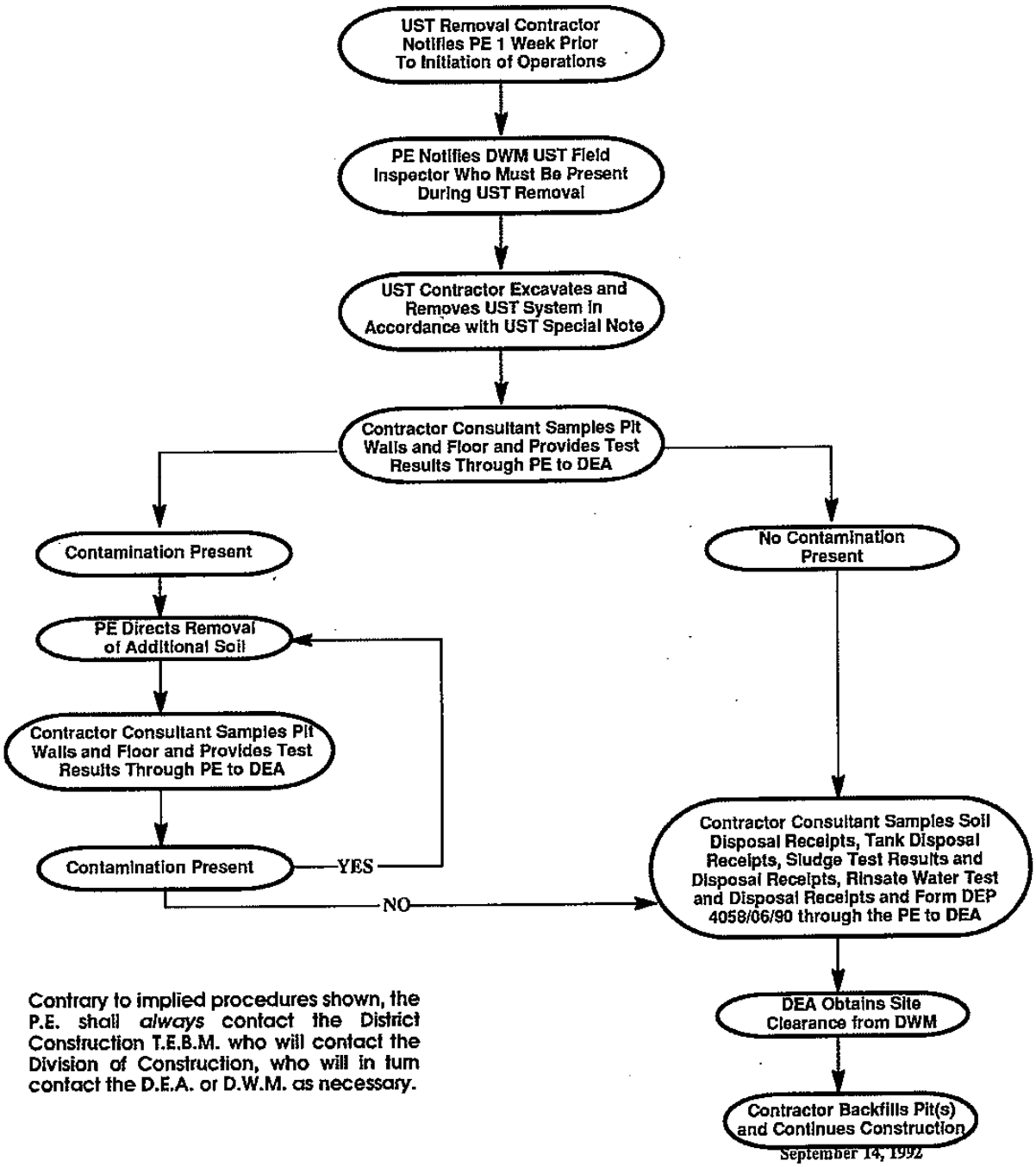
For Further Information, Contact: _____ Phone: _____

"AN EQUAL OPPORTUNITY EMPLOYER M/F/H"

September 14, 1992

UNDERGROUND STORAGE TANKS

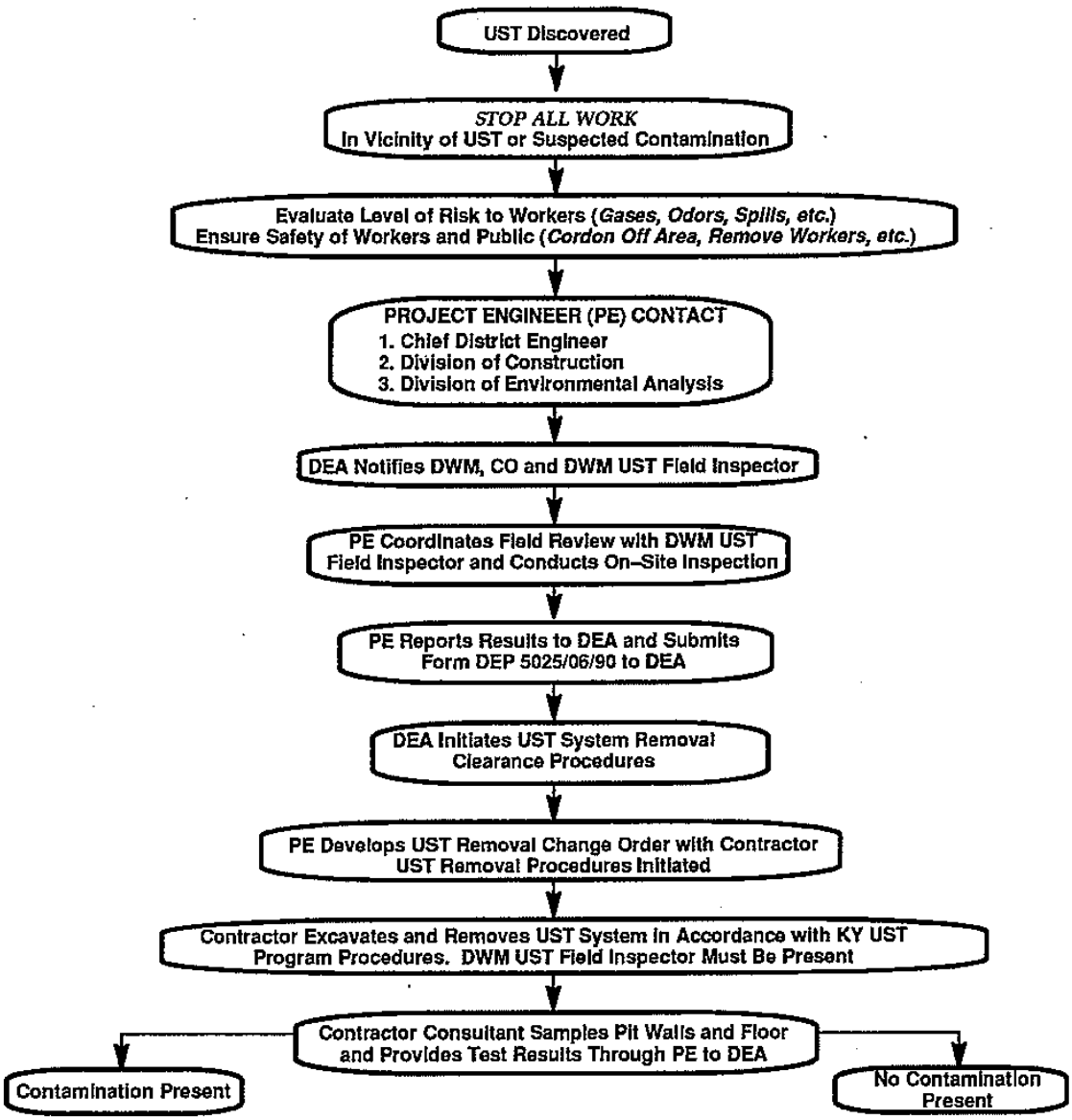
CONSTRUCTION CONTRACT REMOVAL



Contrary to implied procedures shown, the P.E. shall *always* contact the District Construction T.E.B.M. who will contact the Division of Construction, who will in turn contact the D.E.A. or D.W.M. as necessary.

UNDERGROUND STORAGE TANKS

DISCOVERED DURING CONSTRUCTION



Follow same procedure as outlined under "Construction Contract Removal" in CST-9003 at this point.

Contrary to implied procedures shown, the P.E. shall *always* contact the District Construction T.E.B.M. who will contact the Division of Construction, who will in turn contact the D.E.A. or D.W.M. as necessary.

DIVISION OF ENVIRONMENTAL ANALYSIS
D. W. LAMBERT, P.E., DIRECTOR
(502) 564–7250

DEFINITIONS

UST = Underground Storage Tanks
DEA = Division of Environmental Analysis
DWM = Division of Waste Management
PE = Project Engineer

September 14, 1992

Commonwealth of Kentucky
Transportation Cabinet
Frankfort, Kentucky 40622

James C. Codell, III
Secretary of Transportation

Paul E. Patton
Governor

Clifford C. Linkes, P.E.
Deputy Secretary

MEMO TO: Deputy State Highway Engineers
Assistant State Highway Engineers
Department of Highways Directors
Chief District Engineers

FROM: J. M. Yowell, P.E.
State Highway Engineer

DATE: March 18, 2002

SUBJECT: Removal of Artifacts from State Property
Advisory for All Department of Highways Employees

During a recent construction project, a previously unidentified archaeological site was uncovered. After the discovery of the site by local collectors, it was looted and destroyed. This archaeological site represented the remains of a prehistoric hunting camp over 8,000 years old, and its destruction represents an irreplaceable loss to the Commonwealth. Most individuals are not aware that the removal of artifacts from state property is a Class D felony, punishable by 1 to 5 years in prison, fines of between $1,000 to $10,000, and the forfeiture of any equipment used in the commission of the offense. (KRS 164.990, KRS 534.030) Artifacts are defined as any object manufactured or fashioned by people that is 50 years of age or older.

The laws applicable to the above situation include Kentucky Revised Statutes 164.715 and Subsection 1 of 164.720. KRS 164.715 states that "No person shall willfully injure, destroy, or deface any archaeological site or object of antiquity situated on lands owned or leased by the Commonwealth or any state agency or any political subdivision or municipal corporation of the Commonwealth." Subsection 1 of KRS 164.720 states that "No person shall explore, excavate, appropriate or remove from land owned or leased by the Commonwealth or any state agency or any political subdivision or municipal corporation of the Commonwealth, any archaeological site or object of antiquity without first obtaining a permit from the Department of Anthropology (at the University of Kentucky) upon the recommendation of the agency owning or having control of the land upon which the same is situated."

EDUCATION PAYS

KENTUCKY TRANSPORTATION CABINET
"PROVIDE A SAFE, EFFICIENT, ENVIRONMENTALLY SOUND, AND FISCALLY RESPONSIBLE TRANSPORTATION SYSTEM WHICH PROMOTES ECONOMIC GROWTH AND ENHANCES THE QUALITY OF LIFE IN KENTUCKY."
"AN EQUAL OPPORTUNITY EMPLOYER M/F/D"

March 18, 2002
Page 2

For a Class D felony, the punishment is 1 to 5 years imprisonment, fines of $1,000 to $10,000, or double the gain from the commission of the offense and up to $20,000 for corporations. In addition, Subsection 1 of KRS 164.990 (Penalties) states that "Any person who violates the provisions of KRS 164.715 or subsection (1) of KRS 164.720 is guilty of a Class D felony, and in addition, thereto shall forfeit to the state all equipment used in committing the offense for which such person is convicted."

The intent of this memorandum is to advise and make Cabinet personnel aware of laws, which apply, to our Right of Way and the activities, which occur upon them. If Cabinet personnel observe people metal-detecting or digging on state property, they should ask to see the permit issued for such activity. If the person or persons cannot produce a permit duly noted and signed by the proper authorities and issued from the Department of Anthropology at the University of Kentucky, they are in violation of Kentucky Revised Statutes and must immediately return any artifacts in their possession and leave the property. If they persist in attempts to remove artifacts from state property, the state police should be notified. Allowing illegal activities such as the removal of artifacts from state property may result in lengthy project delays and may jeopardize the release of federal funding and permits.

In all cases where it is suspected that artifacts are being removed from state property, the Kentucky Transportation Cabinet's Division of Environmental Analysis must be contacted. The Division's archaeologists will be able to answer questions regarding the removal of artifacts from state property. Please note that the laws governing the removal of artifacts pertain to STATE PROPERTY ONLY and do not affect the collection of artifacts on private property. Once Right-of-Way is acquired by the state, the property is to be considered protected by all applicable laws and regulations.

Please note that the intent of this advisory is to increase Cabinet awareness of the ramifications of the laws noted above on activities, which occur intentionally and unintentionally on our right of way. Also note that the laws apply to private citizens, contractors and employees of the Cabinet. Please distribute this advisory to all personnel within your office. If you or any of your employees have any concerns or require addition clarification, please contact David Waldner, the Director of the Division of Environmental Analysis at the following phone number (502) 564-7250.

JMY/JLM/ln

c: John Mettiller
Geri Grigsby

COMMONWEALTH OF KENTUCKY
CIVILIAN TRAFFIC COLLISION REPORT

MAIL TO: Kentucky State Police, Criminal ID\Records Br., 1250 Louisville Road, Frankfort, KY 40601

Please print legibly or type all information. Use black or dark blue ink. Make copies before mailing.
Do not complete this report if the traffic collision was investigated by a police officer.

Date of Collision _____ Time _____ ☐ AM ☐ PM County _____

This Collision Occurred In Limits of (City or Town) _____

or _____ Miles ☐ N ☐ S ☐ E ☐ W Of (City or Town) _____

On Roadway Number or Roadway Name Intersection Roadway Name / # Or Between Streets (Roadway Name / #)

YOUR INFORMATION (Vehicle 1)	OTHER VEHICLE / PEDESTRIAN (Vehicle 2)
Driver _____	Driver _____
First Middle Last	First Middle Last
Address _____	Address _____
Driver's License (Number & State) _____	Driver's License (Number & State) _____
Date of Birth (Month/Day/Year) _____	Date of Birth (Month/Day/Year) _____
Phone _____	Phone _____
Owner of Vehicle _____	Owner of Vehicle _____
First Middle Last	First Middle Last
Address _____	Address _____
Vehicle Make & Year _____ Model _____	Vehicle Make & Year _____ Model _____
Registration Plate Number & State _____	Registration Plate Number & State _____
Insurance Company _____	Insurance Company _____
Address _____	Address _____
Damage to Vehicle	Damage to Vehicle
Estimated Cost of Repairs	Estimated Cost of Repairs

Damage to Property Other than Vehicle _____

Owner's Name _____ Estimated Cost of Repairs _____

Owner's Address

DIAGRAM WHAT HAPPENED IN THIS COLLISION (Number Vehicles, Your Vehicle is Vehicle 1)	DESCRIBE WHAT HAPPENED
Indicate North by Arrow **N**	

Name of Person Completing Report _____

Sign Here (Owner or Driver) Making Report Date of Report

KRS 189.635(4) provides that:

Any person operating a vehicle on the highways of this state who is involved in an accident resulting in any property damage exceeding five hundred dollars ($500) in which an investigation is not conducted by a law enforcement officer shall file a written report of the accident with the Department of Kentucky State Police within ten (10) days of occurrence of the accident upon forms provided by the department.

DO NOT COMPLETE THIS REPORT IF THE TRAFFIC COLLISION WAS INVESTIGATED BY A POLICE OFFICER

Instructions

(1) If you were involved in a collision with a pedestrian, enter the pedestrian information in the OTHER VEHICLE/PEDESTRIAN space provided for OTHER VEHICLE/PEDESTRIAN and print the word "PEDESTRIAN" in the OWNER block.
(2) If you were involved in a collision with a vehicle other than a motor vehicle, (for example, snowmobile, minibike, bicycle, all-terrain vehicle, trail bike, or other non-motor vehicle) enter the driver, owner, and vehicle information as you normally would for OTHER VEHICLE/PEDESTRIAN.
(3) If a vehicle is unoccupied at the time of the collision, enter all available information pertaining to that vehicle. Be sure to correctly enter the vehicle's license number and vehicle's description in the appropriate VEHICLE block.
(4) Driver information must be entered exactly as it appears on each driver's license.
(5) Owner information must be entered exactly as it appears on the registration receipt of each vehicle involved in the collision.
(6) If you were involved in a collision in which there were more than two vehicles, additional report forms must be filled out. On the form, place the information for the third vehicle in then space marked "YOUR INFORMATION" and identify it as Vehicle 3. Use the space marked "OTHER VEHICLE/PEDESTRIAN" for the fourth vehicle and identify it as Vehicle 4, and so on.

Please complete the following information by marking the appropriate values (X).

PRE-COLLISION DIRECTION OF TRAVEL

Vehicle 1	*Vehicle 2*	
☐	☐	North
☐	☐	South
☐	☐	East
☐	☐	West

Pre-Collision Vehicle Action

Vehicle 1	*Vehicle 2*	
☐	☐	Avoiding Object in Roadway
☐	☐	Backing
☐	☐	Changing Lanes
☐	☐	Entering Parked Position
☐	☐	Going Straight Ahead
☐	☐	Leaving Traffic Lane
☐	☐	Making Left Turn
☐	☐	Making U Turn
☐	☐	Merging
☐	☐	Overtaking
☐	☐	Parked
☐	☐	Slowing or Stopped
☐	☐	Starting from Parking
☐	☐	Starting in Traffic
☐	☐	Stopped in Traffic
☐	☐	Wrong Way
☐	☐	Other
☐	☐	Unknown

1ST EVENT COLLISION WITH
Non-Fixed Object

- ☐ Animal
- ☐ Bicycle
- ☐ Deer
- ☐ Motor Vehicle in Transport, Other Roadway
- ☐ Other Motor Vehicle
- ☐ Pedestrian
- ☐ Railroad Train
- ☐ Other Object/Not Fixed

1ST EVENT COLLISION WITH (continuation)
Fixed Object

- ☐ Bridge Parapet End
- ☐ Bridge, Pier, Abutment
- ☐ Bridge Rail
- ☐ Building/Wall
- ☐ Crash Cushion/Impact Attenuator
- ☐ Culvert/Head Wall
- ☐ Curbing
- ☐ Earth Embankment/Rock Cut/Ditch
- ☐ Fence
- ☐ Fire Hydrant
- ☐ Guardrail End
- ☐ Guardrail Face
- ☐ Light/Luminaire Support
- ☐ Mailbox
- ☐ Median Barrier
- ☐ Other Post, Pole or Support
- ☐ Overhead Sign Support
- ☐ Sign Post
- ☐ Snow Embankment
- ☐ Toll Booth
- ☐ Traffic Signal Support
- ☐ Tree
- ☐ Utility Pole
- ☐ Other Fixed Object

Non-Collision

- ☐ Fell from Vehicle
- ☐ Fire/Explosion
- ☐ Jackknife
- ☐ Overturned
- ☐ Ran off Roadway (Only)
- ☐ Submersion
- ☐ Other Non-Collision

WEATHER

- ☐ Blowing Sand, Soil, Dirt, Snow
- ☐ Clear
- ☐ Cloudy
- ☐ Fog/Smog/Smoke
- ☐ Fog with Rain
- ☐ Raining
- ☐ Severe Crosswinds
- ☐ Sleet/Hail
- ☐ Snowing
- ☐ Other

ROADWAY CONDITION

- ☐ Dry
- ☐ Ice
- ☐ Sand, Mud, Dirt, Oil, Gravel
- ☐ Snow/Slush
- ☐ Wet
- ☐ Other

ROADWAY SURFACE

- ☐ Asphalt
- ☐ Concrete
- ☐ Gravel
- ☐ Other

ROADWAY CHARACTER

- ☐ Curve & Grade
- ☐ Curve & Hillcrest
- ☐ Curve & Level
- ☐ Straight & Grade
- ☐ Straight & Hillcrest
- ☐ Straight & Level

ROADWAY TYPE

- ☐ County Road
- ☐ Federal
- ☐ Frontage Road
- ☐ Interstate
- ☐ Local Street
- ☐ Parkway
- ☐ State
- ☐ None of the Above

TRAFFIC CONTROL

- ☐ Advisory Speed Sign
- ☐ Center Line
- ☐ Flashing Light
- ☐ Median
- ☐ No Passing Zone
- ☐ Officer or Flagman
- ☐ RR Gates
- ☐ RR Signs or Signals
- ☐ School Zone Signs
- ☐ Stop & Go Signal
- ☐ Stop Sign
- ☐ Warning Signs
- ☐ Yield Signal
- ☐ Other
- ☐ None

KSP 232
Revision Date 04-01-2009

CONSTRUCTION REVISION INDEX

COUNTY OF	ITEM NO.	SHEET NO.

COUNTY: _____ PROJECT NO. _____

ROAD NAME : _____ CONTRACT ID : _____

PREPARED BY _____ DATE
CHECKED BY _____ DATE
APPROVED BY _____ DATE

CONSTRUCTION REVISION NO.1

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ DISTRICT EXECUTIVE DIRECTOR DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ EXECUTIVE DIRECTOR FOR PROJECT DELIVERY DATE

EXPLANATION OF REVISION NO. 6

CONSTRUCTION REVISION NO.2

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION/SEE CHANGE ORDER NO. ____
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ CHIEF DISTRICT ENGINEER DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ ASST. STATE HWY. ENGINEER CONST. DATE

EXPLANATION OF REVISION NO. 6

CONSTRUCTION REVISION NO.3

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION/SEE CHANGE ORDER NO. ____
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ CHIEF DISTRICT ENGINEER DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ ASST. STATE HWY. ENGINEER CONST. DATE

EXPLANATION OF REVISION NO. 6

CONSTRUCTION REVISION NO.4

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION/SEE CHANGE ORDER NO. ____
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ CHIEF DISTRICT ENGINEER DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ ASST. STATE HWY. ENGINEER CONST. DATE

EXPLANATION OF REVISION NO. 6

CONSTRUCTION REVISION NO.5

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION/SEE CHANGE ORDER NO. ____
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ CHIEF DISTRICT ENGINEER DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ ASST. STATE HWY. ENGINEER CONST. DATE

EXPLANATION OF REVISION NO. 6

CONSTRUCTION REVISION NO.6

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION/SEE CHANGE ORDER NO. ____
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ CHIEF DISTRICT ENGINEER DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ ASST. STATE HWY. ENGINEER CONST. DATE

EXPLANATION OF REVISION NO. 6

CONSTRUCTION REVISION NO.7

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION/SEE CHANGE ORDER NO. ____
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ CHIEF DISTRICT ENGINEER DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ ASST. STATE HWY. ENGINEER CONST. DATE

EXPLANATION OF REVISION NO. 6

CONSTRUCTION REVISION NO.8

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION/SEE CHANGE ORDER NO. ____
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ CHIEF DISTRICT ENGINEER DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ ASST. STATE HWY. ENGINEER CONST. DATE

EXPLANATION OF REVISION NO. 6

CONSTRUCTION REVISION NO.9

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION/SEE CHANGE ORDER NO. ____
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ CHIEF DISTRICT ENGINEER DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ ASST. STATE HWY. ENGINEER CONST. DATE

EXPLANATION OF REVISION NO. 6

CONSTRUCTION REVISION NO.10

RIGHT OF WAY IS ☐ IS NOT ☐ INVOLVED
____ SHEETS IN REVISION/SEE CHANGE ORDER NO. ____
DATE APPROVED BY FHWA: _____
PAGE NOS. IN REVISION: _____

SUBMITTED BY: _____ PROJECT ENGINEER DATE
RECOMMENDED BY: _____ CHIEF DISTRICT ENGINEER DATE
RECOMMENDED BY: _____ DIRECTOR OF CONSTRUCTION DATE
APPROVED BY: _____ ASST. STATE HWY. ENGINEER CONST. DATE

EXPLANATION OF REVISION NO. 6

USER: $$$$USER$$$$
DATE: $$$$DATE$$$$
FILE NAME: $$$$c:\design\fhwa\specification$$$$
S-SHEET NAME: _____

Learning Module

Section 14 Change Order Basics

By the end of this module, you will be able to:

- Understand the rules and life cycle of Change Orders
- Create a Change Order Header
- Navigate to Change Order functions from the Change Order Header
- Apply a Time Adjustment to a Change Order
- Modify existing Contract Items on a Change Order
- Add New Contract Items to a Change Order
- Calculate a Change Order
- Apply Standard and non-standard Explanations to a Change Order

October 2007

Change Orders General Concepts

The change order process allows legal changes to be made to a Contract by creating, approving, and tracking changes.

Contract Change Orders may include:

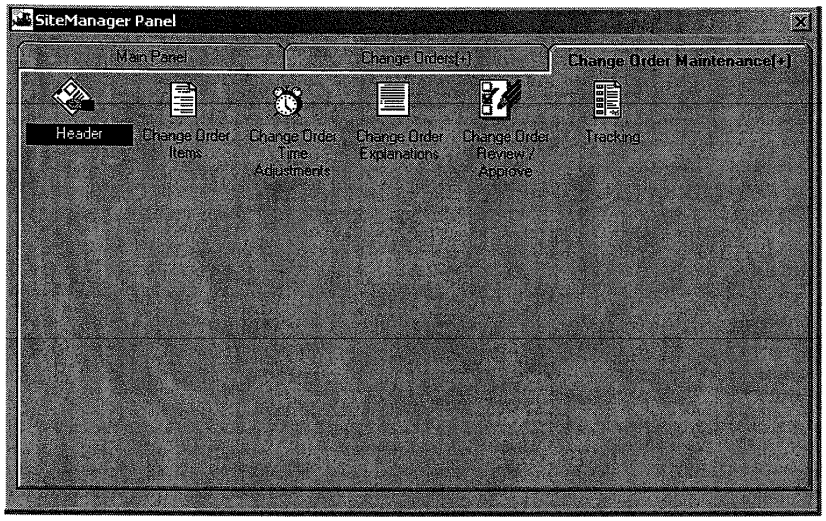
- Quantity adjustments for existing items
- Adding new items of work to the contract
- Time Extensions on milestones or revisions to Contract time or Contract completion date
- Additions to the Contract not affecting time or item quantities

Users can combine the functions in one CO EXCEPT for a Final Quantity change order.

Except for zero dollar, Users can specify more than one function to make up a change order. Before a change order is saved, edits are performed to ensure that its components are reconciled with its selected functions. Messages advise the User if information has not been entered for a selected function.

Each CO must be associated with one Contract.

Before the User can select a specific window in the Change Order (CO) function, a specific Contract must be selected from a pick list containing valid Contracts, and associated, existing COs. A specific Contract must be selected from the pick list to create a new change order.



The Change Order Maintenance Panel

Figure 14-1

Exercise 14-1

In the following exercise, you will navigate to the Change Order Maintenance Panel. Participants will log on using the jpowell ID in the ROS group.

1. Double-click the **SiteManager Training (Non-Inspector)** program icon on the desktop.
2. In the **User ID** field, type **jpowell**.
3. In the **Password** field, type **kentucky**.
4. Click the **Logon** button.
5. On the **Main Panel**, double-click the **Change Orders** icon.
6. On the **Change Orders** panel, double-click the **Change Order Maintenance** icon.

Change Order Life Cycle

The life cycle of contract change orders is reflected in the change order functions in SiteManager.

1. **Creation of a New Change Order**

A CO can only be created by a User with specific authority to create new change orders. A change order must be associated with an existing active Contract. Specific information about the change order must be recorded using the Change Order Header window, the Change Order Items window, the Time Adjustments window, and/or the Change Order Explanations window.

2. **Maintaining Change Orders**

Once a CO has been created, updates to the CO information may be required. Change Order header information, items, time frames, and explanations may be modified in update mode on the appropriate windows.

A CO can be:

- **Kept in Draft and sent for review only**

3. **Review and Approval of Change Orders**

After it is created, a draft CO can be forwarded via In-box notification for parallel review. Parallel review is concurrent review by more than one reviewer at a time.

Users involved in reviewing a draft CO or approving a pending CO can record their decisions about proposed changes to the Contract on-line, using the Review/Approve window. Reviewers/Approvers receive an In-Box message from the author requesting an action, review or approval for the CO. The In-Box message specifies the Contract and change order number.

All change orders on a contract must be either Approved or Denied in order for the Physical Work Complete Date to be entered in Contract Administration, as part of the Contract completion process. (Change Orders may not be in a Draft or Pending status for the Contract completion process.)

All COs must be approved or denied before Contract Completion can occur.

4. Tracking the Change Order

At any time, the writer of the CO may view the status of a change order in the review or approval cycle by opening the Tracking window. The Tracking window for a CO is a view-only window and displays:

- The date a request for recommendation was sent to a reviewer or approver
- The reviewer or approver's name
- The action requested - review or approve
- The date the reviewer or approver makes a recommendation
- The recommendation - Approved or Denied
- Any Remarks the reviewer or approver has made

Authorized users may also display details about current and historic Contract items on-line using the Item Summary window.

5. Reports

Once approved, change order data may be analyzed to help manage the change order process. The Change Order Reports function allows users to produce reports that gather information about trends in Contract changes.

Change Order Conditions

There are three conditions that affect how the Change Order process in SiteManager works. These are the:

- Type of Contract
- Function(s) associated with the change order
- Status of the change order

CHANGE ORDER FUNCTIONS

There are six types of change orders:

- Overrun/Underrun
- Extra Work
- Time Adjustment
- Force Account – The Kentucky Transportation Cabinet will not use this function
- Zero Dollar
- Final Quantity – The Kentucky Transportation Cabinet will not use this function

A change order may be a combination of types except for a Final Quantity CO, a singular change order required for contract completion, or a Zero Dollar.

Users define the purpose of the change order by selecting among the different functions. Except for Final Quantity and Zero Dollar, users can specify more than one function to make up a change order. The functions available on a change order are:

Overruns or Underruns: Used when the quantities associated with the Contract items are either exceeded or not needed to complete the Contract or work item.

Extra Work: Used when additional work items are required to complete the Contract.

Time Adjustments: Used when the timeframes need to be adjusted to reflect the completion period for a milestone or Contract.

Force Account: The Kentucky Transportation Cabinet will not use this function.

Zero Dollar: Used only for contract adjustments that will not affect the dollar amount of the Contract (example: changing the location of a project).

Final Quantity: The Kentucky Transportation Cabinet will not use this function.

CHANGE ORDER STATUS

The CO Status field is a user-entered and controlled field (except for the Approved status). The allowable change order Status types are:

Draft: When the change order is being created or edited, and forwarded on for review.

Pending: When the change order is put into approval process, forwarded on for approval and cannot be modified.

Draft and Pending are the only allowed statuses until the change order is denied or approved.

Denied: When the change order is disapproved and not revised. The user must change the status to denied manually after the change order is disapproved.

A Denied change order may have its status changed to back to Draft, be edited (revised), have its status changed to Pending and be resent through the approval process.

Approved: Approved status is set when the last approver completes the approval process. When the change order has been approved by its final approval level, it cannot be altered. Adjustments can only be made by creating a new change order.

When the CO is approved it becomes read-only and the items become available on DWRs.

When the CO is created and saved to the database, field edits are performed and the status is checked. The status options, Approved and Denied, are not available for selection by the User until the approval/denial process is complete. All change orders must be in the Approved or Denied status for the contract completion process.

The Kentucky Transportation Cabinet Change Order Process Plan

In KYTC, all change orders will typically be created and maintained by the Resident Engineer. In some cases, the Resident Office Manager, Central Office Construction Personnel, or other Users designated by the Director of Construction may also create and maintain change orders. There are four phases in the KYTC CO Process Plan. They are as follows:

Creation of a Change Order

- Prepare any applicable paperwork (i.e., cost estimate for funding modifications)
- Create the change order on the Change Order Header window in SiteManager

Maintaining a Change Order

- Track the change order
- Revise the change order as necessary
- Generate applicable change order reports

Change Order Review/Approval Process

- Forward the change order for parallel review
- Change status to Pending
- Forward the change order for approval
- Change the status to Approved or Denied

Change Order Reports

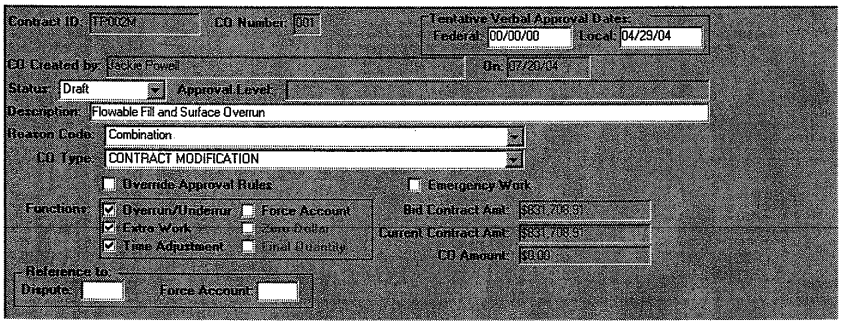
Contractor Change Order Report - This report shall be generated to serve the purpose of a legal modification of the contract. This document will be sent to the contractor for review and signatures. The report will contain Contract and project data detailing the directed changes. A person in the Resident Engineer's Office will be required to send this document to parties who do not have access to SiteManager for review.

The Unapproved Change Order Aging Report, Change Order/Reason Code Breakdown Report, and the Time Extension Granted Reports can be used to track trends in the Contract changes during the lifetime of the Contract.

Creating a Change Order Header

The Change Order Header window allows an authorized User to:

- Create a new change order by entering a new descriptive information for a change order, or
- Maintain the current descriptive information about an existing change order as the status of the change order progresses from Draft through Pending to Approved or Disapproved.



The Change Order Header Window

Figure 14-2

In the Kentucky Transportation Cabinet, the Resident Engineer will use the Header window to view existing change order information and for entering data when creating a new change order. Data would include the status, description, type, reason, and functions of the change order.

The Change Order Description should contain information that summarizes the major items of work included in the Change Order.

The CO Reason field will have Kentucky Transportation Cabinet-defined reasons for Change Orders.

The CO Type field will have a choice of Funding Modification and Contract Modification. Funding Modification will be chosen when signatures from the contractor are not required (e.g., overrun and underrun of Contract Items or renewal of Contract.) Contract Modification will be chosen when signatures are required by the contractor (e.g., specification change, time extensions, addition of supplemental items, or a combination Change Order with funding and Contract modifications.)

The Federal tentative verbal approval date will be used when the FHWA gives its verbal approval or written approval of the Change Order. This is required for all Contracts with Federal Oversight. The Local tentative approval will be used to indicate the date the commissioner's office approved the concept of the Change Order. The approval email should be attached to the Change Order Header window. This is required for all Contracts with funding modifications or when supplemental agreements require additional funds be added to the Contract.

When the need arises for a funding modification, the Resident Engineer should prepare the cost estimate or have the contractor submit the cost estimate. This cost estimate will be submitted to present the cost to the Fund Manager as an inquiry to see if the funds are available for the proposed Contract funding modification.

Justification of cost, time extensions, project records and comments can be included using the Attachments button on the toolbar at top of screen.

Exercise 14-2

In the following exercise, you will create Change Order 001 for Contract TP002M. Participants should be logged on using the jpowell ID in the ROS group.

1. On the **Change Order Maintenance** panel, double-click the **Header** icon.
2. Click the **Services** menu and click **Choose Keys**.
3. In the **Contract ID** list box, scroll to and double-click Contract **TP002M**.
4. In the **Description** field, type **Flowable fill and Surface Overrun**.
5. In the **Reason Code** drop-down list, click the expand arrow to the right of the current selection and click **Combination**.
6. In the **CO Type** drop-down list, click the expand arrow to the right of the current selection and click **Contract Modification**.
7. Click the **Overrun/Underrun** check box (ON).
8. Click the **Extra Work** check box (ON).
9. Click the **Time Adjustment** check box (ON).
10. In the **Tentative Verbal Approval Date Local** field, type **042904**.
11. Click the **Save** button.
12. Click the **Attachments** button.
13. Click the **New OLE** button.
14. Click the **Create From File** folder tab.
15. Click the **Browse** button.
16. In the **Browse** window, double-click the file **CO Email M 001.pdf**.
17. On the **Create From File** folder tab, click **Ok**.
18. In the **Name** field, type **20040429COEM**.
19. In the **Description** field, type **Email from Commissioner's Office stating initial approval to create the Change Order**.
20. Click the **Add All** button to add security groups to the attachments.
21. Click the **Add** button at the bottom of the screen to add the attachment to the DWR.
22. Click the **Attachments** button to close the attachment.
23. Click the **Save** button.

Click the Save button here to enable the Attachments button.

Standard SiteManager Functionality

The following standard SiteManager functionality is accessible in this window:

- External Documents
- Generic Fields
- Linkage of records between SiteManager functions
  - Disputes/Claims

Creating Change Order Time Adjustments

The Time Adjustments window allows authorized Users to enter one or more time adjustments for a change order. At least one adjustment must be recorded using this window if the Time Adjustment function is selected on the change order.

RESTRICTIONS ON TIME ADJUSTMENT ENTRIES

Time adjustments may be related to:

- The Contract completion date
- Milestone(s) on the Contract, or
- Both the Contract completion date and milestone(s) associated with the Contract

The Charge Type for the Contract determines which timing components of the Contract and its associated milestones may be entered and modified. There are three charge types for contracts. The changeable fields and required fields on the Time Adjustment Window are determined by the Contract's charge type as follows:

Available Days (AD) Charge Type: Computes time periods based on the working days charged to the Contract and/or to each milestone. Only the number of days adjusted may be entered in the Time Adjustment Window. No completion date applies to this charge type.

Fixed Date (DT) Charge Type: Has a specific fixed end date for the Contract or for milestones within the Contract. Only the completion date field may be entered. The system computes the number of days adjusted.

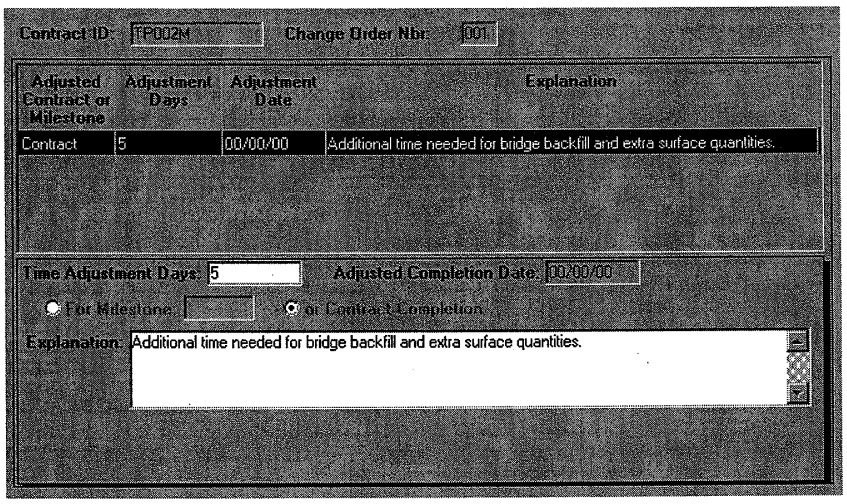
Calendar Days (CD) Charge Type: Computes the end date for the Contract and for milestones based on the number of calendar days allocated for the work. The number of days adjusted may be entered. The system then computes the completion date.

Additional limitations apply to entries on the Time Adjustments window as follows:

- Only one adjustment to the Contract completion date may be entered per change order.
- Multiple contract milestone adjustments may be entered for a single change order.

- Each milestone may only be included in one change order, but that change order time adjustment may be maintained (updated or deleted) subsequently.
- Text explaining reasons for the time adjustment may be entered.
- The status of the associated change order determines whether the fields on this window are display only or may be modified by the user
- Time adjustments may only be entered while a change order is in Draft status.
- Change orders in a Draft status allow the following fields to be entered or updated: time adjustment days, adjusted completion date, milestone/contract completion status (radio button), and milestone.
- Changes orders in a Pending, Approved, or Disapproved status do not allow updates to these fields.

Tip: Only one adjustment may be modified at a time. The User must save the changes to one adjustment before making other modifications to the change order time adjustments.



The Change Order Time Adjustments Window

Figure 14-3

In the Kentucky Transportation Cabinet, the CO Time Adjustment window is similar to KYTC's current Time Extension/Explanation box on the Change Order form. <u>The same explanations will apply:</u>

1 Contract Time is Unaffected.

<u>Working Days Contract</u>

2 Extend Working Days from _____ as Specified in the contract to ____. "A Net Increase of _____ Working Days."

3 Extend Working Days from _____ as Specified in Change Order ___ to ____. "A Net Increase of _____ Working Days."

<u>Calendar Day Contract</u>

4 Extend Calendar Days from _____ as Specified in the contract to ____. "A Net Increase of _____ Calendar Days."

5 Extend Calendar Days from _____ as Specified in Change Order ____ to ____. "A Net Increase of _____ Calendar Days."

<u>Specified Completion Date Contract</u>

6 Change the Specified Date of Completion from ____ as Specified in the contract to ____. "A Net Increase of _____ Days."

7 Change the Specified Date of Completion from ____ as Specified in Change Order ___ to ____. "A Net Increase of _____ Days."

If there is a need to go into more detail about the time adjustment, the Explanation text box will accommodate that as well. The User must give a reasonable explanation to justify the time adjustment.

This does not need to be typed exactly, this is an example.

Exercise 14-3

In the following exercise, you will navigate to the CO Time Adjustment window from the Header window and create a time adjustment on Change Order 001 on Contract TP002M. Participants should be logged on using the jpowell ID in the ROS group.

1. On the **Header** window, click the **Services** menu and click **CO Time Adjustments**.
2. Click the **Time Adjustment Days** field and type **5**.
3. Click the **Or Contract Completion** radio button.
4. In the **Explanation** field, type **Extend working days from 100 as specified in the contract to 105. A net increase of 5 working days. Additional time needed for bridge backfill and extra surface quantities.**
5. Click the **Save** button. **Returns back to the Header window.**
6. Click the **Close** button.

Standard SiteManager Functionality

The following standard SiteManager functionality is accessible in this window:

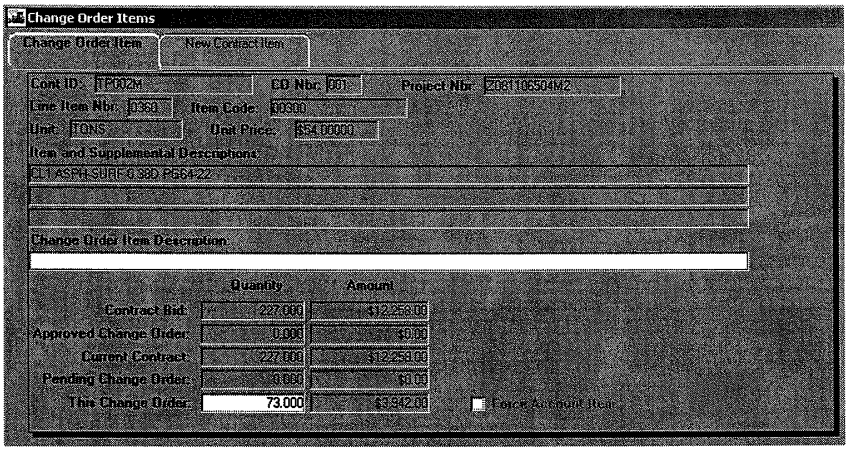
- Remarks (Open Optional Remarks - Explanation)

Modify Existing Contract Items

The Change Order Items window allows the User to:

- Select an existing item on the Contract for inclusion in the change order
- Add a new item to the Contract by including it in the change order
- Select and modify an existing item in the Contract already associated with the change order
- Delete an item from a change order

Whenever the change order function is an overrun/underrun and/or extra work, the Change Order Items window must be used to make the corresponding entries and/or modifications to the change order items. Extra work requires adding completely new Contract items. Overrun/underrun requires modifying existing contract pay items.



The Change Order Item Folder Tab

Figure 14-4

In the Kentucky Transportation Cabinet, the creator of the change order Header will complete the information in the Change Order Items folder tab. The Change Order Item Description field and the Force Account field will not be used at KYTC.

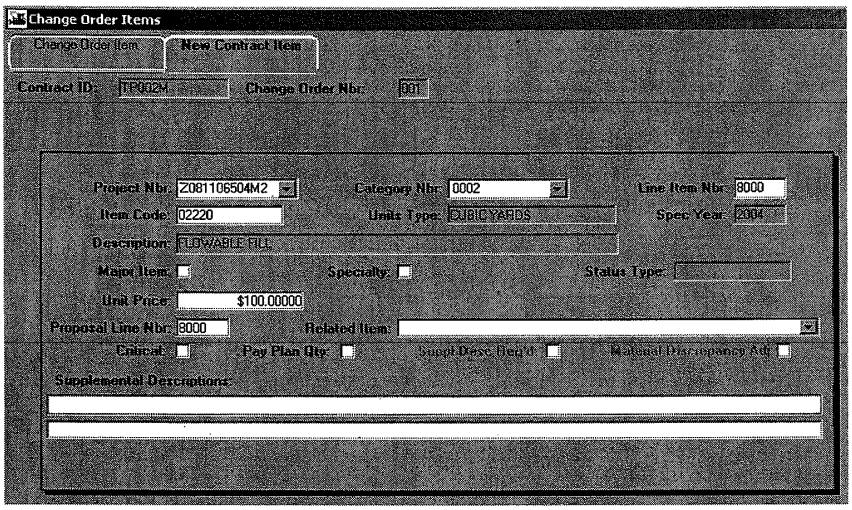
Exercise 14-4

In the following exercise, you will modify the quantity of an existing contract item on Contract TP002M. Participants should be logged on using the jpowell ID in the ROS group.

1. On the **Header** window, click the **Services** menu and click **CO Items**.
2. Click the **Services** menu and click **New CO Item**.
3. In the **Contract Items** list box, scroll to and double-click the Line Item Number **0360 CL1 ASPH SURF**.
4. In the **This Change Order Quantity** field, type **73**.
5. Click the **Save** button.

Adding New Contract Items in a Change Order

New items may only be added to an active Contract through the change order process. When a new item is added to a Contract, the user must enter a Line Item Nbr, unit price, the quantity of the item, and a description of the item on the New Item tab of the Change Order Item window.



The New Contract Item Folder Tab

Figure 14-5

In the Kentucky Transportation Cabinet, the creator of the change order Header will complete the information on the New Contract Item folder tab. Line item numbers for new contract items (supplemental items) will begin with 8000 and be numbered consecutively throughout the life of the project. Line item numbers for Stockpiled material items added to a Contract will begin with 9000 and be numbered consecutively throughout the life of the project.

The Division of Design, PS&E Section will maintain the Item Code list. The change order creator will have the Division of Design, PS&E Section generate a number if an existing Item Code cannot be used. New Item Codes are to be used only as approved by the Division of Design, PS&E Section.

Tip: When a new item is added to the contract through this process, the information about a new line item is not saved to the database until it is completed and saved on the Change Order Item tab. The New Contract Item tab performs all edits and passes all new item data to the Change Order Item tab where both the new item and change order information are saved. The contract item list *is not* updated with the new item until the change order is approved.

A New Item is not added to the contract Item list until the CO is approved.

Exercise 14-5

In the following exercise, you will add a New Item to the existing Draft Change Order 001 on Contract TP002M. Participants should be logged on using the jpowell ID in the ROS group.

1. On the **Change Order Item** folder tab, click the **New** button.
2. Click the **New Contract Item** folder tab.
3. In the **Project Nbr** drop-down list, click the expand arrow to the right of the current selection and click **Z081106504M2**.
4. In the **Category Nbr** drop-down list, click the expand arrow to the right of the current selection and click **0002**.
5. In the **Line Item Nbr** field, type **8000**.
6. Using the right mouse button, click the **Item Code** field.
7. In the object menu, click **Search**.
8. In the **Item Code** list box, scroll to and click Item Code **02220 2004 FLOWABLE FILL**.
9. Click **Ok**.
10. In the **Unit Price** field, type **100.00**.
11. In the **Proposal Line Nbr** field, type **8000**.
12. Click the **Change Order Item** folder tab.
13. In the **This Change Order** quantity field, type **30**.
14. Click the **Save** button.
15. Click the **Close** button.

The Line Item Nbr must be unique.

Returns back to the Header window.

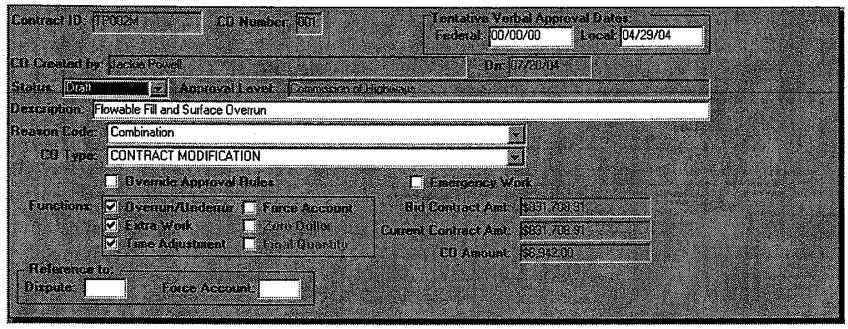
Standard SiteManager Functionality

The following standard SiteManager functionality is accessible in this window:

- Generic Fields
- Remarks

Calculating a Change Order

After the full change order creation or maintenance activities are complete, including entries or updates to the change order items, time adjustments and explanations windows as desired, the user may re-calculate the display only values on the Change Order Header window.



The Change Order Header Window

Figure 14-6

Exercise 14-6

In the following exercise, you will calculate Change Order 001 on Contract TP002M. Participants should be logged on using the jpowell ID in the ROS group.

1. On the **Header** window, click the **Save** button.
2. Click the **Services** men and click **Calculate Change Order**.
3. Click the **Save** button.
4. Click the **Close** button.

SiteManager calculates the total amount of the CO and displays the amount in the CO Amount field.

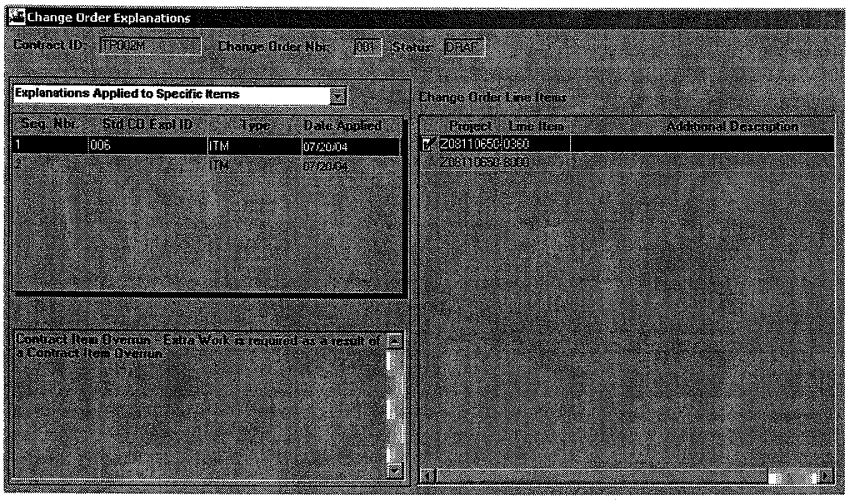
Applying Change Order Explanations

The Change Order Explanation window is used to document the reasons for Contract changes. This window allows the author of the change order to record the reason for changes in the Contract included in the change order. It also allows reviewers and approvers to view the change order reasons. There are two types of explanations that may be associated with a Contract change order:

- One or more specific explanations pertaining to *items* on a Change Order, and
- One or more explanations pertaining to the Change Order as a whole.

When the change order is in Draft Status and the window is in new mode, the user may use the lower data window to

- Display and search the list of standard explanations for this contract type, or
- Type a non-standard explanation description in the multi-line edit text field.



The Change Order Explanations Window

Figure 14-7

The Kentucky Transportation Cabinet Change Order Standard Explanations:

Explanation ID	KYTC Defined Standard Text	Attach for Change Order Type
001	Lot Pay Adjustment for Asphalt Mixtures	LOT PAY ADJUSTMENT
002	Ride Quality Adjustment	RIDE QUALITY ADJUSTMENTS
003	Fuel and Asphalt Adjustments	FUEL AND ASPHALT ADJUSTMENTS
004	Contract Omission – Extra Work is required as a result of a Contract Omission.	CONTRACT OMISSIONS
005	Utility – Extra Work is required as a result of a Utility Issue.	UTILITY ISSUES
006	Item Overrun – Extra Work is required as a result of a Contract Item Overrun.	CONTRACT ITEM OVERRUN
007	Geotechnical Issue – Extra Work is required as a result of Geotechnical Issues.	GEOTECHNICAL
008	Enhancement – Extra Work is required to improve or enhance the project including Traffic Control, Construction Revisions, etc.	CONTRACT ENHANCEMENTS
009	Environmental – Extra Work is required to comply with environmental laws and Specifications.	ENVIRONMENTAL
010	The Project Proposal requires the Contractor to be compensated by the Department for the agreed upon prescribed Incentive.	INCENTIVE/DISINCENTIVE PROJECTS
011	Project renewal for the subsequent calendar year.	CONTRACT RENEWALS
012	Accounting Adjustment	ACCOUNTING ADJUSTMENTS
013	Value Engineering Proposal	VALUE ENGINEERING
014	Cost is less than or equal to 110% of the average unit bid price.	COST JUSTIFICATION
015	Itemized cost breakdown supplied by the contractor including equipment, labor materials, and time needed to perform proposed work.	COST JUSTIFICATION
016	Cost comparison to the competitive bid contracts in an area or district for items similar to scope of work.	COST JUSTIFICATION
017	Item special in nature justified by the Contractor. (Only applicable for owner or other delays, extension agreements or other contract modifications.)	COST JUSTIFICATION
018	Cost Plus Worksheets (Documentation for cost plus worksheet attached to the change order as supplemental data.)	COST JUSTIFICATION

The Kentucky Transportation Cabinet Standard Explanations Table

Table 14-1

The General CO Explanations function will not be used.

Explanations applied to Specific Items will be used only if the Change Order Type (Header Window) is a combination change order. Both a standard explanation for the item(s) and cost justification, and a statement directing the Contractor to do the proposed work (entered with "free-flow" text) is required. The following are examples of "free-flow" text directing the Contractor to do the work:

Rt. Sta. 115+00 to Rt. Sta. 118+00 remove 630 sq. yards of existing pavement.

Sta. 133+18 construct 20'x 6.5'x 66' RCBC at 300 Skew RT.

Explanations for All Line Items will be used when all line items can be characterized by the Change Order Type (Header Window). A statement directing the Contractor to do the proposed work (entered with "free-flow" text) and a standard explanation for cost justification are both required.

Exercise 14-7

In the following exercise, you will apply explanations to Change Order 001 on Contract TP002M. Participants should be logged on using the jpowell ID in the ROS group.

1. On the **Change Order Maintenance** panel, double-click the **Change Order Explanations** icon.
2. In the drop-down list, click the expand arrow to the right of the current selection and click **Explanation Applied to Specific Items**.
3. Click the **New** button.
4. Using the right mouse button, click the **Pick Std Exp ID** field.
5. In the object menu, click **Search**.
6. In the **Explanation ID** list box, scroll to and click **006 – Contract Item Overrun**.
7. Click **Ok**.
8. In the **Change Order Line Items** area, double-click Item Number **0360**.
9. Click the **Save** button.
10. Click the **New** button.
11. Click the lower text field and type **Additional quantities needed to tie into existing pavement**.
12. In the **Change Order Line Items** area, double-click Item Number **0360**.
13. Click the **Save** button.
14. Click the **New** button.
15. Using the right mouse button, click the **Pick Std Exp ID** field.
16. In the object menu, click **Search**.
17. In the **Explanation ID** list box, scroll to and click **008 – Owner Induced Enhancement**.
18. Click **Ok**.
19. In the **Change Order Line Items** area, double-click Item Number **8000**.
20. Click the **Save** button.
21. Click the **New** button.
22. Click the lower text field and type **To change from select granular embankment to flowable fill to reduce settlement**.
23. In the **Change Order Line Items** area, double-click Item Number **8000**.
24. Click the **Save** button.
25. Click the **Close** button.

Review for Section 14

Contract Change Orders may include:

- Quantity adjustments for existing items
- Adding new items of work to the contract
- Extra Work
- Time Extension on milestones or revisions to a contract completion date
- Final Quantity

To access the Change Order Header window:

1. On the **Main** panel, double-click the **Change Order** icon.
2. On the **Change Order** panel, double-click the **Change Order Maintenance** icon.
3. On the **Change Order Maintenance** panel, double-click the **Header** icon.
4. In the **Contract** list box, scroll to and double-click the desired contract.
5. In the **Change Order** list box, scroll to and click the desired change order.
6. Click **Ok**.

To modify a change order header:

1. On the **Main** panel, double-click the **Change Order** icon.
2. On the **Change Order** panel, double-click the **Change Order Maintenance** icon.
3. On the **Change Order Maintenance** panel, double-click the **Header** icon.
4. In the **Contract** list box, scroll to and double-click the desired contract.
5. In the **Change Order** list box, scroll to and click the desired change order.
6. Click **Ok**.
7. Modify the desired fields as needed.
8. Click the **Save** button.

To navigate to other CO functions from the Header Window:

1. Create a New Change Order Header or open an existing Change Order Header.
2. Click the **Services** menu and click the **CO Items, CO Time Adjustments,** or **Change Order Tracking** choice.

To modify an existing time adjustment to a contract or milestone:

1. On the Change Order Maintenance panel, double-click the CO Time Adjustment icon.

Or

1. In the **Header** window with the correct Change Order open, click the **Services** menu and click the **CO Time Adjustment** choice.
2. In the top data window, highlight the desired **Contract** or **Milestone** adjustment choice.
3. If enabled, in the **Time Adjustment Days** field, type the modified number of days the contract or a milestone is adjusted.
4. Press the **Tab** key.
5. If enabled, in the **Adjusted Completion Date** field, type the modified completion date of the contract or a milestone.
6. Press the **Tab** key.
7. Click either the **for Milestone** or the **or Contract Completion** radio button (ON) to indicate whether this is a modification of a previous milestone or a contract adjustment
8. Press the **Tab** key.
9. Modify the **Explanation** for the new time adjustment if desired.
10. Click the **Save** button.

To modify an existing contract item:

1. On the **Change Order Maintenance** panel, double-click the **CO Time Adjustment** icon.

Or

1. In the **Header** window with the correct Change Order open, click the **Services** menu and click the **CO Time Adjustment** choice.
2. On the **Change Order Item** folder tab, click the **Services** menu and click the **New CO Item** choice.
3. In the **Contract Items** list box, scroll to and click the desired Contract Item.
4. Click **Ok**.
5. In the **Change Order Description** field, type the description for the item change.
6. Press the **Tab** key.
7. In the **Quantity** field, type change order quantity.
8. Click the **Save** button.

To add a new contract line item from the Item Master List:

1. On the **Main** panel, double-click the **Change Order** icon.
2. On the **Change Order** panel, double-click the **Change Order Maintenance** icon.
3. On the **Change Order** Maintenance panel, double-click the **Change Order Item** icon.
4. Click the **New Contract Item** folder tab.
5. In **Line Item Number** field, type new number.
6. In the **Project Number** drop-down list, click desired project.
7. In the **Category Nbr** drop list, click desired category.
8. Using the *right* mouse button, click the **Item Code** field.
9. From the object menu, click the **Search** choice.
10. In the list box, scroll to and click the new Item code.
11. Click the **Unit Price** choice and type **220**.
12. In the **Related Item** drop-down list, click the expand arrow to the right of the current selection and click the desired choice.
13. If applicable, click the **Critical** check box (ON).
14. If applicable, click the **Pay Plan Quantity** check box (ON).
15. If applicable, click the **Material Discrepancy Adjustment** checkbox (ON).
16. Click the **Supplemental Descriptions** field and type the desired description for the first line.
17. Press the **Tab** key.
18. Type the second line of the supplemental descriptions.
19. Click the **Change Order Item** folder tab.
20. Click the **Change Order Item Description** field and type description.
21. Click the **This Change Order Quantity** field and type desired quantity.
22. If applicable, click the **Force Account** check box (ON).
23. Click the **Save** button.

To apply a standard explanation to a change order:

1. On the **Main** panel, double-click the **Change Order** icon.
2. On the **Change Order** panel, double-click the **Change Order Maintenance** icon.
3. On the **Change Order Maintenance** panel, double-click the **Change Order Explanation** icon.
4. Click the **Open** button.
5. In the **Contract** list box, scroll to and double-click the desired contract.
6. In the **Change Order** list box, scroll to and click the desired change order.
7. Click **Ok**.
8. Using the *right* mouse button, click the **Pick Std Exp ID** field.
9. From the object menu, click the **Search** choice.
10. In the **Explanation** list box, scroll to and click the desired choice.
11. Click **Ok**.
12. Click the **Save** button.

To add a non-standard explanation:

1. On the **Main** panel, double-click the **Change Order** icon.
2. On the **Change Order** panel, double-click the **Change Order Maintenance** icon.
3. On the **Change Order Maintenance** panel, double-click the **Change Order Explanation** icon.
4. Click the **Open** button.
5. In the **Contract** list box, scroll to and double-click the desired contract.
6. In the **Change Order** list box, scroll to and click the desired change order.
7. Click **Ok**.
8. Click the lower text field and type the explanation.
9. Click the **Save** button.

Summary Exercise for Section 14

In the following exercise, you will update Change Order 002 on Contract TP002M. Participants should be logged on using the jpowell ID in the ROS group.

1. Navigate to the **Header** window.
2. Create an **Extra Work** Change Order **002** for Contract **TP002M**.
    - The description is **Beam Quantity Not in Structure Plans**.
    - The Reason Code is **Contract Omission**.
    - The type of change order is a **Contract Modification**.
    - The date the Commissioner's Office approved the concept of the Change Order is **05/18/04**.
    - Attach the email stating the approval to create the change order to the Header window as an OLE attachment. The file is called **CO Email M 002** and is located in smtrains\smfiles.
        - The name of OLE Attachment is **2004051804**.
        - The Description of the OLE Attachment is **Email from Commissioner's Office stating initial approval to create the Change Order**.
        - Attach all security groups to the OLE Attachment.
3. Navigate to the **CO Items window** and add a new item that does not currently exist on the contract using the following information:
    - Line Item Number **8001**
    - Project Number **Z081106504M2**
    - Category Number **0002**
    - Item Code **08631**
    - Spec Year **2004**
    - Unit Price **$50.00**
    - Proposal Line Number **8001**
    - Change Order quantity **120**
4. Calculate the Change Order.
5. Apply standard explanation numbers **004** and **014** to all items on the change order.

6. Apply the non-standard explanation **Quantity of beams not included in original contract** to all line items on the change order.
7. Navigate to the **Change Order Maintenance** panel.

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION
SUBCONTRACT REQUEST

TC 63-35
Rev.2/15/07

CONT_ID _____

SUBCONTRACT NO: _____ Tier Y/N _____

TO: Greta Smith, P.E.
Director, Division of Construction

FROM: _____
Prime Contractor KYTC Vendor Number

SUBJECT: _____ _____
County Fed/State Project Number

I hereby request to subcontract a portion of the subject project to:

_____
KYTC Vendor Number

The amount to be subcontracted by this request is $ _____ or _____ % of the
(Original contract amount or subcontract amount if Tier request)
I have previously subcontracted as follows:

NAME OF SUBCONTRACTOR	AMOUNT	PERCENT

The total amount to be subcontracted including this request is $ _____ or _____ % of the (original contract) or (subcontract) amount.

This subcontractor has been furnished a copy of Appendix B of 49 CFR Part 29 and advised to include the Certification in all lower tier covered transactions and in all solicitations for lower tier transactions (Federal Aid Contracts only).

The proposed subcontractor is on the Department's list of qualified contractors to perform work requested and a copy of current insurance coverage will be available at the prime contractor's office before the subcontractor begins work on project.

_____ _____
Prime Contractor Date

CC District TEBM for Construction

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION
SUBCONTRACT REQUEST

TC63-35
Rev 2-15-07

Page _____

CONT_ID

Additional form

(*) When description is limited by such as "Laying Only", "Erection Only", "Manipulation Only", etc. it should be so indicated and explained.

(**) When the quantity is not the entire amount of Contract or Sub-Contract estimate, limitations by stations must be shown or definitely designated in some suitable, positive manner.

Unit prices used on this request should list the prices as reflected in the contract and are for Departmental use only and are not to be considered the exact prices agreed to by the contractors.

The Items to be subcontracted are as follows:

Proposal Line Number	Bid Item Code	Description	Unit	Quantity	Unit Price	Money	flag
						$ -	

TOTAL _____

TC 63-35CO
Rev.2/15/07

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION
SUBCONTRACT REQUEST

Supplemental Change Order Items

CONT_ID _____

SUBCONTRACT NO: _____ Tier Y/N _____

TO: Greta Smith, P.E.
Director, Division of Construction

FROM: _____
Prime Contractor KYTC Vendor Number

SUBJECT: _____ _____
County Fed/State Project Number

I hereby request to subcontract a portion of the subject project to:

_____
KYTC Vendor Number

The amount to be subcontracted by this request is $ _____

I have previously subcontracted as follows:

NAME OF SUBCONTRACTOR	AMOUNT

The total amount to be subcontracted including this request is $ _____

This subcontractor has been furnished a copy of Appendix B of 49 CFR Part 29 and advised to include the Certification in all lower tier covered transactions and in all solicitations for lower tier transactions (Federal Aid Contracts only).

The proposed subcontractor is on the Department's list of qualified contractors to perform work requested and a copy of current insurance coverage will be available at the prime contractor's office before the subcontractor begins work on project.

_____ _____
Prime Contractor Date

CC District TEBM for Construction

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION
SUBCONTRACT REQUEST
Supplemental Change Order Items

TC63-35CO
Rev 2-15-07

Page _____

CONT_ID

Additional form

(*) When description is limited by such as "Laying Only", "Erection Only", "Manipulation Only", etc. it should be so indicated and explained.

(**) When the quantity is not the entire amount of Contract or Sub-Contract estimate, limitations by stations must be shown or definitely designated in some suitable, positive manner.

Unit prices used on this request should list the prices as reflected in the contract and are for Departmental use only and are not to be considered the exact prices agreed to by the contractors.

The Items to be subcontracted are as follows:

SiteManager Project Number	Project Line Number	Change Order Number	Bid Item Code	Description	Unit	Quantity	Unit Price	Money	flag
								$ -	

TOTAL _____

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION PROCUREMENT
DBE Plan/SUBCONTRACT REQUEST

TC 14-35
Rev. 09/01/11

CONTRACT ID (CONTID) _____
Subcontract # : _____
TO : Ryan Griffith
Director: Division of Construction Procurement

FROM : _____ 1st Tier Subcontractor: _____
Prime Contractor (if applicable)

SUBJECT : _____ County _____ Project Number

I hereby request to utilize for DBE participation a portion of the subject project to:
_____ of _____

DBE Employer Identification Numbers: Federal _____ KY _____
The amount to be subcontracted by this request is DBE _____ or _____ Contract Worth _____ or _____ of the
(original contract) or a subcontract amount of

I have previously requested approval for subcontracts or agreements with other DBE as follows:

Name of DBE firm	DBE Amount	DBE %	Contract "Worth" Amount	Contract %
Totals based on original contract Amounts				

This section applicable if DBE firm is also a Subcontractor of work on Project:
This subcontractor has been furnished a copy of Appendix B of 49 CFR Part 29 and advised to include the Certification in all lower tier covered transactions and in all solicitations for lower tier transactions (Federal Aid Contracts only).

_____ Prime Contractor's Signature _____ Date

_____ 1st Tier Subcontractor's Signature(if applicable) _____ Date

_____ DBE Participant Signature _____ Date

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION PROCUREMENT
DBE Plan/SUBCONTRACT REQUEST

TC 14-35
Rev. 6/23/11

Contract ID (ContID) _____ Prime _____ DBE Firm _____

(*) When description is limited by such as "Laying Only" "Erection Only" "Manipulation Only" etc. it should be so indicated and explained.

(**) When the quantity is not the entire amount of (Contract) or (Sub-Contract) estimate, limitations by stations must be shown or definitely designated in some suitable, positive manner.

Unit prices using Contract Unit Price should be for Bid Unit Price for work to be performed by Sub Contractor. DBE Unit price should be for the agreed upon price for item or portion of item of contract work.

DBE Participation Non-Pay Estimates Work Items

Description	Total Contract Quantity	Unit	DBE Unit Price	Dollar Amount based on DBE Price	Comments

Page Total

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION PROCUREMENT
DBE Plan/SUBCONTRACT REQUEST

TC 14-35
Rev. 6/23/11

Contract ID (ContID) _____ DBE Firm _____

(*) When description is limited by such as "Laying Only" "Erection Only" "Manipulation Only" etc. it should be so indicated and explained.

(***) When the quantity is not the entire amount of (Contract) or (Sub-Contract) estimate, limitations by stations must be shown or definitely designated in some suitable, positive manner.

Unit prices using Contract "worth" Unit Price should be for Bid Unit Price for work to be performed by Sub Contractor. If partial work item ie "laying only" then use agreed to price for Contract "worth" Unit Price. DBE Unit price should be for the agreed upon price for item or portion of item of contract work.

The Items to be subcontracted are as follows:

Supplier 60% Y/N	Project Control (PCN) Number	Category Number	Project Line Number	Description	Unit	Contract Quantity	Contract "Worth" Unit Price	Dollar Amount based on Contract Price	DBE Quantity	DBE Unit Price	Dollar Amount based on DBE Price
									-		
									-		
									-		
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Comments:

U.S. Department of Labor
Employment Standards Administration
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions, Form WH-347 Inst.)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

Rev. April 2006

OMB No.: 1215-0149
Expires: 04/30/2009

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐ ADDRESS

PAYROLL NO. FOR WEEK ENDING PROJECT AND LOCATION PROJECT OR CONTRACT NO.

(1) NAME, ADDRESS, AND SOCIAL SECURITY NUMBER OF EMPLOYEE	(2) NO. OF WITHHOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT. OR ST.	(4) DAY AND DATE / HOURS WORKED EACH DAY							(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	(9) NET WAGES PAID FOR WEEK
			O																	
			S																	
			O																	
			S																	
			O																	
			S																	
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The Copeland Act (40 U.S.C. 3145) requires contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) Regulations 29 CFR Part 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. Compliance with these requirements is mandatory. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

We estimate that it will take an average of 56 minutes to complete this collection of information, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection of information, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, ESA, U. S. Department of Labor, Room S3502, 200 Constitution Avenue, N. W., Washington, D. C. 20210.

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 CFR Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Start. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. 276c), and described below:

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination Incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, of if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in Section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in Section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.

* U.S. G.P.O.:1997 519.861

Contract ID No.: _____

KENTUCKY TRANSPORTATION CABINET
Division of Construction Procurement
Compliance Section

TC 14-312E
Rev. 06/2007
Page 1

ENGINEER'S WAGE AND HOUR REPORT

Date: _____ County: _____

Project: _____

Name: _____

☐ Contractor ☐ Subcontractor

Foreman: _____

Address: _____

City/State: _____

Telephone: _____

FORMS POSTED:

* Wage Schedule	☐ YES	☐ NO
* Contractor Notice (TC 14-314)	☐ YES	☐ NO
* Non-Discrimination in Employment (TC 14-313)	☐ YES	☐ NO
Notice (Form FHWA 1022)	☐ YES	☐ NO
* Safety and Health Protection on the Job	☐ YES	☐ NO
* Kentucky Law Requires	☐ YES	☐ NO
Wage Rate Information (Form FHWA 1495)	☐ YES	☐ NO
Equal Employment Opportunity	☐ YES	☐ NO
ALL REQUIRED POSTERS	☐ YES	☐ NO

*** Posters Required on State Project Job Sites**

	NAME	ADDRESS		
1	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
2	NAME	ADDRESS		
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
3	NAME	ADDRESS		
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
4	NAME	ADDRESS		
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
5	NAME	ADDRESS		
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
6	NAME	ADDRESS		
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
7	NAME	ADDRESS		
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
8	NAME	ADDRESS		
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
9	NAME	ADDRESS		
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
10	NAME	ADDRESS		
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID

TC 14-312E Rev. 06/2007 Page 2

Date:_____ County:_____ Name:_____

Project:_____ Contract ID No.: _____ ☐ Contractor ☐ Subcontractor

A. Do you know where wage rates are posted?
B. Have you been informed about your fringe benefits?
C. Have you been charged for tools used in performing your duties except for reasonable avoidable loss or damage thereto?
D. Have you ever been charged for any transportation furnished by contractor or his agents?
E. Has your employer made arrangements for the cashing of your paychecks?
F. When you work in a higher classification, are you paid the proper wage rate for that classification?

1._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

2._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

3._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

4._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

5._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

6._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

7._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

8._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

9._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

10._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

Resident Engineer_____ Signature_____
Print/Type Name Here

Compliance Officer_____ Signature_____
Print/Type Name Here

Contract ID No.: _____

KENTUCKY TRANSPORTATION CABINET
Division of Construction Procurement
Compliance Section

TC 14-312AE
Rev. 06/2007
Page 1

ENGINEER'S WAGE AND HOUR REPORT
CONTINUATION PAGE

Date:_____ County:_____ Foreman:_____

Project:_____ Address:_____

Name:_____ City/State:_____

☐ Contractor ☐ Subcontractor

Telephone:_____

11	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
12	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
13	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
14	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
15	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
16	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
17	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
18	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
19	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID
20	NAME		ADDRESS	
	OBSERVED WORKING AS	CLASSIFICATION	WAGE ☐ UNKNOWN	OVERTIME ☐ WORKED ☐ PAID

TC 14-312AE Rev. 06/2007 Page 2

Date:_____ County:_____ Name:_____

Project:_____ Contract ID No.: _____

☐ Contractor
☐ Subcontractor

A. Do you know where wage rates are posted?
B. Have you been informed about your fringe benefits?
C. Have you been charged for tools used in performing your duties except for reasonable avoidable loss or damage thereto?
D. Have you ever been charged for any transportation furnished by contractor or his agents?
E. Has your employer made arrangements for the cashing of your paychecks?
F. When you work in a higher classification, are you paid the proper wage rate for that classification?

11._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

12._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

13._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

14._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

15._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

16._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

17._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

18._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

19._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

20._____
A. ☐ YES ☐ NO
B. ☐ YES ☐ NO
C. ☐ YES ☐ NO
D. ☐ YES ☐ NO
E. ☐ YES ☐ NO
F. ☐ YES ☐ NO

Resident Engineer_____ Signature_____
Print/Type Name Here

Compliance Officer_____ Signature_____
Print/Type Name Here

FEDERAL-AID HIGHWAY CONSTRUCTION CONTRACTORS
ANNUAL EEO REPORT

OMB NO. 2125-0019
Report For
July _____

1. CHECK APPROPRIATE BLOCK ☐ Contractor ☐ Subcontractor	2. NAME AND ADDRESS OF FIRM	3. FEDERAL-AID PROJECT NUMBER	4. TYPE OF CONSTRUCTION

5. COUNTY AND STATE	6. PERCENT COMPLETE	7. BEGINNING CONSTR. DATE	8. DOLLAR AMOUNT OF CONTRACT	9. ESTIMATED PEAK EMPLOYMENT	
				Month and Year (a)	Number of Employees (b)

10. EMPLOYMENT DATA

JOB CATEGORIES	Table A: TOTAL EMPLOYEES		TOTAL MINORITIES		BLACK *Not of Hispanic Origin*		HISPANIC		AMERICN INDIAN OR ALASKAN NATIVE		ASIAN OR PACIFIC ISLANDER		WHITE *Not of Hispanic Origin*		Table B: APPRENTICES		ON THE JOB TRAINEES	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
OFFICIALS *(Managers)*																		
SUPERVISORS																		
FOREMEN/WOMEN																		
CLERICAL																		
EQUIPMENT OPERATORS																		
MECHANICS																		
TRUCK DRIVERS																		
IRONWORKERS																		
CARPENTERS																		
CEMENT MASONS																		
ELECTRICIANS																		
PIPEFITTERS																		
PAINTERS																		
LABORERS, SEMI-SKILLED																		
LABORERS, UNSKILLED																		
TOTAL																		
Table C																		
APPRENTICES																		
ON THE JOB TRAINEES																		

11. PREPARED BY: *(Signature and Title)*	DATE	REVIEWED BY: *(Signature and Title of State Highway Official)*	DATE

This report is required by law and regulation (23 U.S.C. 140a and 23 CFR Part 230). Failure to report will result in noncompliance with this regulation.

FORM FHWA-1391 (Rev. 3-92)

PREVIOUS EDITIONS ARE OBSOLETE

Agency Display of Estimated Burden for Federal-Aid Highway Construction Contractors Annual EEO Report

The average completion time for this form is 1 Hour. If you wish to comment on the accuracy of the estimate or make suggestions for reducing the burden, please direct your comments to OMB and FHWA at the following addresses:

Office of Management and Budget
Paperwork Reduction Project 2125-0019
Washington, D.C. 20503

Federal Highway Administration
Office of Civil Rights, HCR-10
400 7th Street, SW.
Washington, D.C. 20590")

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

TC 63-41
Rev. 7/93 Mod. 03/00

WORKING DAY MEMO NO. 1

MEMO TO: _____
Contractor

ATTENTION: _____

FROM: _____

DATE: _____

CONTRACT ID: _____

PROJECT NO: _____ COUNTY: _____

WORKING DAY STATEMENT: _____

Attached is a copy of a statement of working days charged to this project
from _____ thru _____
As stipulated in the Standard Specifications, Section 108.07.02, this statement will be deemed to be acceptable as correct by your company unless you submit a written protest containing supporting evidence for a change within fourteen (14) days of the above date.

_____
PROJECT ENGINEER

c: File
District Executive Director
Division of Construction

Delivered to:

Date:
Mail, Email or Hand Delivery:

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION
WORKING DAY MEMO NO. 2

TC 63-42
Rev. 7/93 Mod. 03/00

MEMO TO: _____
Contractor

ATTENTION: _____

FROM: _____

DATE: _____

CONTRACT ID: _____

PROJECT NO: _____ COUNTY: _____

WORKING DAY STATEMENT: _____

Attached is a copy of a statement of working days charged to this project
from _____ thru _____
As stipulated in the Standard Specifications, Section 108.07.02, this statement will be deemed to be acceptable as correct by your company unless you submit a written protest containing supporting evidence for a change within fourteen (14) days of the above date.

_____
PROJECT ENGINEER

NOTE: This project was not completed on time and daily charges as agreed liquidated damages are applicable to the project. These charges will be deducted on a calendar day basis as per Section 108.09 of the Standard Specifications.

This working day statement has no effect on these charges and is being submitted solely as a matter of record, however, it should be reviewed closely since it may be utilized in the event a time extension is applicable.

c: File
District Executive Director
Division of Construction

Delivered to:

Date:
Mail, Email or Hand Delivery:

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

TC 63-26
Mod. 11/07

CONTRACT OVERTIME AND LIQUIDATED DAMAGE REVIEW

Date _____ Contract Id _____ District _____
County _____ Project No. _____
Road _____ Contractor _____
Type Contract: O Working Day O Specified Completion Date O Calendar Day O Combination

Type Contract:

(1) Date of Letting _____
(2) Date Contract Awarded _____
(3) Date Contract Executed _____
(4) Effective Date to Begin Work _____
(5) Date Work Started _____
(6) Actual Completion Date _____
(7) Original Contract Amount _____
(8) Final Contract Amount _____
(9) Total Money O Underrun O Overrun _____

WORKING DAY CONTRACTS

(10) Total Working Days Original Contract _____
(11) Additional Working Days Allowed (Chg. Order No.) _____
(12) Amount To Be Performed Per Day on Original Contract _____
(13) Date Original Working Days Expire _____
(14) Date Extended Working Days Expire _____

SPECIFIED COMPLETION DATE OR CALENDAR DAY CONTRACTS

(10) Specified Completion Date _____
(11) Calendar Day Contract (Original Exp. Date) _____
(12) Amount To Be Performed Per Day on Original Contract _____
(13) Additional Calendar Days Allowed (Chg. Order No.) _____
(14) Date Extended Calendar Days Expire _____

SUMMATION OF LIQUIDATED DAMAGES

(15) Total Overtime (Compare Items No. 6 & 14) _____
(16) Credits -- Winter Period * _____
(17) Credits -- Seasonal Limitations * _____
(18) Credits -- Other * _____
(19) Total Calendar Day Credits (Sum of No. 16, 17, & 18) _____
(20) Total Days Liquidated Damages (Item No. 15 Minus Item No. 19) _____
(21) Liquidated Damage Charge Per Day _____
(22) _____ Calendar Days @ 1/2 rate of $ - Equals $ -
(23) _____ Calendar Days @ Full Rate of $ - Equals $ -
(24) _____ Equals _____
(25) Total Liquidated Damage Charges $ -

REMARKS:

* List Dates in Remarks and Explain

_____
District Executive Director

TRANSPORTATION CABINET
Department of Highways
Division of Construction

TC 63-11
Nov-07

FORCE ACCOUNT DAILY FIELD RECORD

Contract Id: _____

Work Performed By: _____
Prime Contractor Sub-Contractor

County: _____ Project No: _____ Route: _____

Day: _____ Date: _____

EMPLOYEE NAME	CLASS OF WORK	REG. HRS.	O.T. HRS.	DESCRIPTION OF DUTIES

EQUIPMENT	RATED CAP.	TIME USED	REMARKS

MATERIALS USED	QUANTITY	REMARKS

Description of Activities & Remarks: _____

The labor, materials, and equipment used this date on the specified work operations are correct.

Contractor: _____ Date: _____

Inspector: _____ Date: _____

Project Engineer: Date:

TC 63-10A
Mod 11/07

TRANSPORTATION CABINET
Department of Highways
Division of Construction

Contract Id:
County :
Contractor :
Dates :

Description of work :
Week of and
Location :
Work authorized by:

Name of Employee	Classification		Date & Hours per day	Total (hrs.)	Hourly Rate ($/hr.)	Fringes Rate ($/hr.)	Fringe Benefits ($)	Total Salary
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00			$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00
		O.T.		0.00	$0.00	0.00	$0.00	$0.00
		S.T.		0.00		0.00	$0.00	$0.00

TOTAL WAGES $ -

Workman's Compensation =
Social Security & Unemployment =
Public Liability =

TOTAL OVERHEAD 0.00%

TOTAL FRINGES $ -

0.00% * $0.00 = $ -
SUBTOTAL $ -
+ 25.00% $ -
Labor Grand Total $ -

TRANSPORTATION CABINET
Department of Highways
Division of Construction

TC 63-10B
Mod 11/07

EQUIPMENT RENTAL FOR EXTRA WORK

Contract Id:
County :
Contractor :
Dates :

Description of work :
Location :
Work authorized by

Description of Equipment Make Type H.P. Misc.	Year	Rate $ per Month/Week Day or Invoice		Blue Book Pg. #	Time Date & Hours per day	Total (hrs.)	Rate ($/hr.)	Total Money
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00
	0	$ -		0		0.0	$0.00	$0.00

	SUBTOTAL	0.00
FUEL & LUBRICANTS	15%	0.00
EQUIPMENT GRAND TOTAL		0.00

TRANSPORTATION CABINET
Department of Highways
Division of Construction

TC 63-10C
Mod 11/07

MATERIAL INCORPORATED IN EXTRA WORK

Contract Id :
County :
Contractor :
Date :
Description of work :
Location :
Work authorized by :

Type of Material	Quantity	Unit	Unit Price	% Tax	$ Tax	Total Amount
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
					$0.00	$ -
TOTAL MATERIALS						$0.00

15% $ -

MATERIALS GRAND TOTAL $ -

MATERIALS		$ -
EQUIPMENT		$ -
LABOR		$ -
SUBTOTAL TOTAL		$ -
Bond +		$ -
GRAND TOTAL		$ -

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS

TC 63-32
Mod. 11/07

Notice of Changed Condition/Disagreement

DATE: _____

TO: _____
Project Engineer

SUBJECT: *603 KAR 2:015 Sections 9 & 10*

PROJECT NO: _____ CONTRACT ID: _____

COUNTY:

Please accept this letter as Notice of a Change of Condition/Disagreement on the subject project.

BID ITEMS: _____

REASON: _____

LOCATION: _____

CONTRACTOR: _____
BY: _____
TITLE: _____

NOTE: The Project Engineer should Acknowledge receipt of this notice Within 7 days by transmitting Form TC 63-33 to Contractor.

RECEIVED BY: _____
TITLE: _____
DATE RECEIVED: _____

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

TC 63-33
Mod.11/07

Acknowledgement of Notice of Changed Condition/Disagreement

RACT ID: _____

PROJECT NUMBER: _____ COUNTY: _____

ROAD NAME: _____

CONTRACTOR: _____

SUB-CONTRACTOR (if involved): _____

* Date Notice of Changed Condition/Disagreement: _____

TO THE ATTENTION OF: _____

TITLE: _____

Please be advised that this office is in receipt of a Notice of Changed Condition/Disagreement, dated _____, on the subject project. Please be advised that this dispute shall be governed by the procedures and provisions set forth in 603 KAR 2:015 sections 9 & 10.

Please be advised that pursuant to Section 105.13 of the applicable edition of Standard Specifications for Road and Bridge Construction, it is the Contractor's responsibility to keep a strict account of all costs related to the substance of the changed condition/disagreement. The project engineer will acknowledge his or her approval/disapproval with the records each day.

Neither the Notice of Changed Condition/Disagreement nor the fact that the Engineer has acknowledged the cost shall be construed as proving or substantiating the validity of the potential claim.

COMMENTS:

*This form should be transmitted within 7 days of receipt by Project Engineer of Contractor's Notice of Changed Condition/Disagreement

BY: _____
PROJECT ENGINEER

COPY TO: District Office
Director, Division of Construction
Project File

DATE: _____

COMMONWEALTH OF KENTUCKY

TRANSPORTATION CABINET

DEPARTMENT OF HIGHWAYS

DIVISION OF CONSTRUCTION

Formal Acceptance Report of Completed Construction

Contract ID: **073413** Date of Report: **11/08/2007**

District: **07** County: **MERCER** Project No.: **084GR07R010**
Type of Construction: **ASPHALT RESURFACING**
Prime Contractor: **MAGO CONSTRUCTION COMPANY LLC**
Address: **PO BOX 669 BARDSTOWN, KY 40004 Phone: 5023483953**
Date of Completion: 09/24/2007 NO Corrective work required
Inspection Dates: Surfacing 10/04/2007 Striping 11/02/2007

PROJECT DESCRIPTION

0708419200704 Road Name : BATTLEFIELD ROAD FROM THE WASHINGTON COUNTY LINE MP(0.000) EXTENDING EASTERLY TO THE BOYLE COUNTY LINE MP(2.957) Distance : 2.96 ASPHALT RESURFACING

0708416230702 Road Name : MANN'S ROAD FROM KY 1989 MP(0.000) EXTENDING NORTHERLY TO KY 390 MP(2.740) Distance : 2.74 ASPHALT RESURFACING

Comments The District reported that no corrective work was required on this project.

THE EXECUTIVE DIRECTOR (CHIEF DISTRICT ENGINEER) REPORTED THAT WORK HAS BEEN COMPLETED IN A MANNER SATISFACTORY TO THE PROJECT ENGINEER. THIS PROJECT IS NOW CONSIDERED COMPLETE IN ITS ENTIRETY. THEREFORE, FORMAL ACCEPTANCE IS EFFECTIVE: 09/24/2007

Copies to:	Executive Director	Rummage, Jim P.E.	
	Project Eng.	Faeth, Charlotte B., P.E.	**Greta Smith, P.E.**
	Contractor	MAGO CONSTRUCTION COMPANY LLC	**Director**
	Div. of Planning	Greg Witt, P.E.	**Division Of Construction**
	Div. of Accounts	Federal Billing	**BY: Rachel Mills, P.E.**

KENTUCKY TRANSPORTATION CABINET
Department of Highways
Permit Branch

TC 99-14E
Rev. 05/03

LEGAL NOTICE

_____Kentucky

_____
(Month/Day/Year)

TO:_____
Name

_____
Address

_____
City State Zip Code

Unauthorized Encroachment on State-Owned Right-of-Way_____County,

Project No._____ _____Road.

The _____
Type of Encroachment

located_____miles from_____

which you have placed, or caused to be placed_____feet within and on state-owned right-of-way constitutes an encroachment in violation of KRS 177.103 through KRS 177.106.

In accordance with KRS 177.106 you are hereby notified to immediately remove the above-mentioned encroachment. Failure to comply with this notice within_____time will make it necessary for the Transportation Cabinet to cause said encroachment to be removed and then to collect the cost thereof from you or to take other appropriate legal action.

_____
Chief District Engineer

BY:_____

I hereby certify that the foregoing notice was served

by_____

a copy of same to_____

at the above address on this_____

day of_____, 20_____.

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION
RECORD OF PILES FURNISHED AND DRIVEN

TC 63-8E
Rev. 05/02

Drawing No. _____ Page 1 _____
Project Number _____ PCN _____ County _____ Location of Structure _____
Road Name _____ Bridge Over _____ Station _____
Hammer(Size,Make) _____ Actual Stroke Lgth. _____ Weight of Ram _____ lbs. Fall _____
Type of Pile _____ Batter _____ Gauge Pressure _____ Energy/Blow _____

Pile No.	Pile Orien.	Date Driven	Original Length of Pile (Feet)	Build Up (Feet)	Cut-Off Elev. (Feet)	Cut-Off Length (Feet)	Final Elev. Tip of Pile (Feet)	Pay Length Test (Feet)	Pay Length Production (Feet)	Heat (Steel Pile)	Pene. Last 10 Blows (Inches)	Avg. Fall Last 10 Blows (Feet)	Bearing Capacity (Tons)
Total This Page					----		----			----	----	---	---
Total Continuation Page(s)			0.00	0.00	----	0.00		0.00	0.00	----	----	----	---
Grand Total					----					----	----	----	---

cc: District TEBM for Construction
Division of Construction

Submitted By: _____ Project Engineer _____ Date

Checked By: _____ District TEBM for Construction _____ Date

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

RECORD OF PILES FURNISHED AND DRIVEN

TC 63-8E
Rev. 05/02

Drawing No. 25855
Project Number BRO 5137 (33) PCN 07~1003 County Jefferson Location of Structure Endbent 2
Road Name U.S. 60 Bridge Over Floyd's Fork Station 120 + 49
Hammer(Size,Make) Berminghammer B-300 Actual Stroke Lgth. 10.8 Weight of Ram 3750 lbs. Fall
Type of Pile H 12 X 53 Batter 3 to 1 Gauge Pressure 200.00 Energy/Blow 40,300

Pile No.	Pile Orien.	Date Driven	Original Length of Pile (Feet)	Build Up (Feet)	Cut-Off Elev. (Feet)	Cut-Off Length (Feet)	Final Elev. Tip of Pile (Feet)	**Pay Length Test (Feet)	**Pay Length Production (Feet)	Heat (Steel Pile)	Penc. Last 10 Blows (Inches)	Avg. Fall Last 10 Blows (Feet)	Bearing Capacity (Tons)
26	VT	07/30/07	30.00		597.95	2.25	570.20	27.75		274139	0.38	10.00	272.73
25	V	07/30/07	30.00		597.95	2.06	570.01		27.94	289294	0.50	10.00	250.00
24	V	07/30/07	30.00		597.53		567.53		30.00	289294	0.25	10.00	300.00
23	V	07/30/07	30.00		597.95	1.25	569.20		28.75	289294	0.38	10.00	272.73
22	B	07/30/07	35.00		597.95	1.18	565.87		33.82	296826	0.75	10.00	214.29
21	B	07/30/07	35.00		597.95	5.69	570.14		29.31	296826	0.50	10.00	250.00
20	B	07/30/07	35.00		597.95	1.71	566.37		33.29	289258	0.38	10.00	272.73
19	B	07/30/07	35.00		597.95	5.70	570.15		29.30	289258	0.50	10.00	250.00
18	B	07/30/07	35.00		597.95	5.71	570.16		29.29	289258	0.88	10.00	200.00
17	B	07/30/07	35.00		597.95	5.19	569.67		29.81	289258	1.00	10.00	187.50
16	B	07/30/07	35.00		597.95	5.73	570.18		29.27	296826	0.63	10.00	230.77
15	B	07/30/07	35.00		597.95	0.92	565.62		34.08	289295	0.50	10.00	250.00
Total This Page			400.00)		----	37.39	----	27.75	334.86	----	----	---	---
Total Continuation Page(s)			0.00	0.00	----	0.00	Plan Qty	0.00	0.00	----	----	----	
Grand Total			400.00)		----	37.39	(30.00)	30.00	334.86	----	----	----	

**(Test Pile was used in the footing, therefore the length to be paid is 30 ft due to section 604.04.03. and the request by the contractor to use 30 ft instead of the 35 ft originally directed in the plans.)

cc: District TEBM for Construction
Division of Construction

Submitted By: Dav Kessinger — Project Engineer — 7/31/2007 Date

Checked By: _____ District TEBM for Construction — Date

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

TC 63-8M
Rev. 05/02

RECORD OF PILES FURNISHED AND DRIVEN (METRIC)

Drawing Number _____ Page 1 _____
Project Number _____ PCN _____ County _____ Location of Structure _____
Road Name _____ Bridge Over _____ Station _____
Hammer(Size,Make) _____ Actual Stroke Lgth. _____ Weight of Ram _____ kg Fall _____
Type of Pile _____ Batter _____ Gauge Pressure _____ Energy/Blow _____

Pile No.	Pile Orien.	Date Driven	Original Length of Pile (meters)	Build Up (meters)	Cut-Off Elev. (meters)	Cut-Off Length (meters)	Final Elev. Tip of Pile (meters)	Pay Length Test (meters)	Pay Length Production (meters)	Heat (Steel Pile)	Pene. Last 10 Blows (mm)	Avg. Fall Last 10 Blows (meters)	Bearing Capacity (kN)
Total This Page					----		----			----	----	----	----
Total Continuation Page(s)					----					----	----	----	----
Grand Total					----					----	----	----	----

cc: District TEBM for Construction
Division of Construction

Submitted By: _____ _____
Project Engineer Date

Checked By: _____ _____
District TEBM for Construction Date

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

TC 63–9
Rev. 7/92

CONCRETE TRIP TICKET PCN: _____

CH NO. _____

DATE _____ TRUCK NO. _____ LOAD NO. _____

PROJECT NO. _____ COUNTY _____

QUANTITY _____ CY CLASS CONC _____

BEGIN MIXING TIME _____ am ____ pm ____ REV _____

END MIXING TIME _____ REV _____

TIME LOADED _____ *(Non–agitated concrete only)*

MIX DESIGN MAXIMUM FREE WATER _____ Gal/Bag

WATER UNDERRUN _____ Gal/CY _____ Total Gallons

SET RETARDER USED Yes _____ Type _____ No _____

WATER REDUCER USED Yes _____ Type _____ No _____

REMARKS _____

Concrete batch weights were provided in accordance with approved mix design:

Signed: _____
Plant Inspector

STATION NO. _____ STRUCTURE ID _____

MIX REVOLUTIONS Begin _____ End _____

TOTAL MIX REVOLUTIONS JOBSITE _____ CONCRETE TEMP _____ ° F

WATER ADDED JOBSITE _____ Gal AIR _____

SLUMP #1 _____ In. SLUMP #2 (*water added*) _____ In.

ENDING TIME _____ ELAPSED TIME _____ Min.

REMARKS _____

Signed: _____
Jobsite Inspector

TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

TC 63-12
Rev. 5/87

PCN: _____

DAILY REPORT OF WEIGHED MATERIALS

PROJECT NO. _____ COUNTY _____

TYPE OF MATERIAL _____ DATE _____ 19____

SCALES LOCATED AT _____

MAINT. TCT NO. _____ ELECTRONIC SCALES (YES) (NO) SHEET _____ OF _____

TRUCK NO.	GROSS POUNDS	TARE POUNDS	NET POUNDS	TICKET NO.	REMARKS
TOTALS					

*TOTAL WEIGHED _____ TONS | _____ | TOTAL NET PAY QUANTITY (TONS)

*I _____ (Plant Manager) (KYTC Employee) DO HEREBY CERTIFY THAT THE ABOVE QUANTITY OF MATERIAL WAS FOR THE SOLE USE AND BENEFIT OF THE COMMONWEALTH OF KENTUCKY.

PAY QUAN. COMPILED BY: _____ CHECKED BY: _____

APPROVED: _____
PROJECT ENGINEER

White - From Weighman to Project Engineer
Canary - From Weighman to Contractor
Pink - Retained by Weighman
Goldenrod - From Weighman to Vendor

NOTE: Each kind of material must be listed on separate sheets.

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

TC 63-14
Rev. 5/98 Mod. 03/00

DAILY INSPECTORS REPORT FOR BRIDGE PAINTING

County: _____ Date: _____ District No. _____

Project No. _____ PCN: _____ Hours Worked: _____

Contractor: _____ No. of Workers: _____

Painting Contractor: _____

Time				
Dry Bulb (°F)				
Wet Bulb (°F)				
Steel Temp. (°F)				
Relative Humidity (%)				
Dew Point (°F)				
Weather Comments:				

Compressor Type	
Compressor Capacity	
No. of Blasters	
Pressure @ Compressor	
Blotter Tests Performed	
Comments:	

Anchor Pattern (Mils)				ATTACH TAPES HERE
Location				
Visual Standard				
Wet Film Thk Ck (Mils)				

Results of Dry Film Measurements (MILS):

Coating Manufacturer	Type of Coating	Lot No.	Batch No.	No. Gal. Used

Comments: (Include areas reblasted, special instructions to contractor, problems, etc.)

Inspected By: _____ Resident Engineer: _____

NOTE: This form is to be used as supplement to Daily Inspectors Report TC No 63-28

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION
RECORD OF TEST PILE

TC 63-22E
Rev. 3/83 Mod. 05/02

Test Pile No _____
Location of Structure _____

Page 1

Project Number _____
Project Code Number _____
County _____
Road Name _____
Bridge Over _____
Station _____
Hammer (Size, Make) _____
Formula _____
Actual Stroke Length _____
Weight of Ram (lbs.) _____
Fall (ft) _____
Type of Pile _____
Orientation _____
Gauge Pressure (psi) _____
Energy/Blow (ft./lbs.) _____
Blows Per Minute _____
Plan Bearing (tons) _____
Concrete Mix Used _____
Orig. Length of Pile (ft.) _____
Build Up (ft.) _____
Cut-Off Elevation _____
Cut-Off Length _____
Final Elev. Tip of Pile _____
Pay Length (ft.) _____
Plan Qty. Length (ft.) _____
Drawing Number _____
Date Driven _____

Penetration (Feet)	No. of Blows per foot	Average Height of	Theoretical Bearing (Tons)	Penetration (Feet)	No. of Blows per foot	Average Height of	Theoretical Bearing Tons
					BUTT		
35							
34				65			
33				64			
32				63			
31				62			
30				61			
29				60			
28				59			
27				58			
26				57			
25				56			
24				55			
23				54			
22				53			
21				52			
20				51			
19				50			
18				49			
17				48			
16				47			
15				46			
14				45			
13				44			
12				43			
11				42			
10				41			
9				40			
8				39			
7				38			
6				37			
5				36			
	TIP						

_____ Date Submitted
_____ Project Engineer

cc: District TEBM for Construction
Division of Construction

***Insert gauge pressure for hammers with enclosed rams.

Total Penetration - Last 10 blows _____in.@_____ ft. Theo. Bearing _____ Tons

KENTUCKY TRANSPORTATION CABIN
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

TC 63-22E
Rev. 3/83 Mod. 05/02

RECORD OF TEST PILE

Test Pile No: 26 (Revised Dwg)
Location of Structure: Endbent 2

Page 1 of 2

Project Number	BRO 5137 (33)
Project Code Number	07~1003
County	Jefferson
Road Name	U.S. 60
Bridge Over	Floyd's Fork
Station	120 + 49
Hammer (Size, Make)	Berminghammer B-300
Formula	P=2WH/S+0.1
Actual Stroke Length	10.8
Weight of Ram (lbs.)	3750
Fall (ft)	
Type of Pile	H 12 X 53
Orientation	Vertical
Gauge Pressure (psi)	200.00
Energy/Blow (ft./lbs.)	40300.00
Blows Per Minute	38 to 60
Plan Bearing (tons)	150.00
Concrete Mix Used	
Orig. Length of Pile (ft.)	30.00
Build Up (ft.)	
Cut-Off Elevation	597.95
Cut-Off Length	2.25
Final Elev. Tip of Pile	570.20
**Pay Length (ft.)	27.75
Plan Qty. Length (ft.)	30.00
Drawing Number	25855
Date Driven	7/30/2007

**(Test Pile was used in the footing, therefore the length to be paid is 30 ft due to section 604.04.03. and the request by the contractor to use 30 ft instead of the 35 ft originally directed in the plans.)

Penetration (Feet)	No. of Blows per foot	Average Height of Fall**	Theoretical Bearing (Tons)	Penetration (Feet)	No. of Blows per foot	Average Height of Fall**	Theoretical Bearing Tons
					BUTT		
35							
34				65			
33				64			
32				63			
31				62			
30				61			
29				60			
28				59			
27				58			
26	52			57			
25	20			56			
24	11			55			
23	8			54			
22	8			53			
21	10			52			
20	9			51			
19	8			50			
18	8			49			
17	7			48			
16	7			47			
15	7			46			
14	6			45			
13	6			44			
12	5			43			
11	6			42			
10	6			41			
9	5			40			
8	6			39			
7	5			38			
6	3			37			
5	7			36			
TIP							

Date Submitted

Dav Kessinger
Project Engineer

cc: District TEBM for Construction
Division of Construction

**Insert gauge pressure for hammers with enclosed rams.

Total Penetration - Last 10 blows 0.38 in.@ 10.00 ft. Theo. Bearing 272.73 Tons

FORMULAS:

$P = \frac{2WH}{S+1.0}$ for gravity hammers.

$P = \frac{2WH}{S+0.1}$ for single-acting steam hammers.

$P = \frac{2WH}{S+0.1}$ for single-acting air hammers.

$P = \frac{2E}{S+0.1}$ for double-acting steam hammers.

$P = \frac{2WH}{S+0.1}$ diesel hammers (having unrestricted rebound of ram).

$P = \frac{2E}{S+0.1}$ diesel hammers (having enclosed ram).

Where P=Safe bearing power in pounds.
W=Weight, in pounds, of striking parts of hammer.
H=Height of fall in feet.
S=Penetration in inches per blow for the last 5 to 10 blows for gravity hammers and the last 10 to 20 blows for steam, air or diesel hammers.

E=90% of the average equivalent energy in foot pounds as determined by gauge attached to pile hammer and recorded during the period when the penetration per blow is being observed but not to exceed 13,500 foot-pounds for the enclosed ram type diesel hammers having a manufacturers rating of 18,000 foot-pounds and 23,600 foot-pounds for the enclosed ram type diesel hammers having a manufacturers rating of 30,000 foot-pounds.

The above formulas are applicable only when:

(a) The hammer has a free fall.
(b) The head of the pile is not broomed or crushed.
(c) The penetration is reasonably quick and uniform.
(d) There is no sensible bounce after the blow.

NOTE: For structural steel bearing piles, the contractor shall furnish the Department with three (3) copies each of mill orders, mill shipping statements and mill test reports.

The test reports shall be certified before a Notary Public.

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION

TC 63-22M
Rev. 3/83 Mod. 05/02

RECORD OF TEST PILE (METRIC)

Test Pile No _____
Location of Structure _____

Page 1

Project Number _____
Project Code Number _____
County _____
Road Name _____
Bridge Over _____
Station _____
Hammer (Size, Make) _____
Formula _____
Actual Stroke Length (m) _____
Weight of Ram (kg) _____
Fall (m) _____
Type of Pile _____
Orientation _____
Gauge Pressure (MPa) _____
Energy/Blow (N/m) _____
Blows Per Minute _____
Plan Bearing (kN) _____
Concrete Mix Used _____
Orig. Length of Pile (m) _____
Build Up (m) _____
Cut-Off Elevation (m) _____
Cut-Off Length (m) _____
Final Elev.Tip of Pile (m) _____
Pay Length (m) _____
Plan Qty. Length (m) _____
Drawing Number _____
Date Driven _____

Penetration (meters)	No. of Blows per .25 meter	Average Height of Fall**	Theoretical Bearing (kN)	Penetration (meters)	No. of Blows per meter	Average Height of Fall**	Theoretical Bearing (kN)
					BUTT		
9.5							
9.25				17			
9				16.75			
8.75				16.5			
8.5				16.25			
8.25				16			
8				15.75			
7.75				15.5			
7.5				15.25			
7.25				15			
7				14.75			
6.75				14.5			
6.5				14.25			
6.25				14			
6				13.75			
5.75				13.5			
5.5				13.25			
5.25				13			
5				12.75			
4.75				12.5			
4.5				12.25			
4.25				12			
4				11.75			
3.75				11.5			
3.5				11.25			
3.25				11			
3				10.75			
2.75				10.5			
2.5				10.25			
2.25				10			
2				9.75			
	TIP						

Date Submitted _____ Project Engineer _____

cc: District TEBM for Construction
Division of Construction

**Insert gauge pressure for hammers with enclosed rams.

Total Penetration - Last 10 blows _____mm@_____ Theo. Bearing _____kN

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION
FINAL PAY ESTIMATE LETTER

Rev. 12/99 Mod. 01/13

TO: _____
Contractor

_____
Address

ATTENTION: _____

SUBJECT: Final Pay Estimate Sent to District Office

DATE: _____ Contract Id: _____

Attached is a copy of Final Pay Estimate No. _____ for _____ County, Contract Id: _____, as indicated by the Estimate, liquidated damages ____ARE NOT____ applicable to the Project.

Please compare the quantities shown with your records and advise if there are any discrepancies.

The Final Pay Estimate is being submitted to the District Office for checking where it will be available for your review until _____. Should you wish to make such a review, please contact _____, Transportation Engineer Branch Manager.

These quantities have yet to be checked by the District Office, as mentioned above, nor have they been checked by the Central Office, Division of Construction. Consequently, they are not to be considered absolute therefore, should any major changes become apparent, you will be notified.

If liquidated damages are applicable to the project, you will be notified of the final charges subsequent to the review by the Central Office, Division of Construction.

Sincerely,

_____
Project Engineer

c: Transportation Engineer Branch Manager
Director of Construction
Central Office Final Estimate Section

TRANSPORTATION CABINET
Department of Highways
Division of Construction

TC 63-31
Rev. 5/87

Weighman's Tare Check Report

PROJECT NO. _____ PCN: _____ County _____

Type of Material _____ Date _____ 19____

Scales Located at _____

TRUCK NO.	PREVIOUS TARE	TIME	NEW TARE	TIME	NEW TARE	REMARKS

NOTE: The tare weight of each truck has been determined to the nearest twenty (20) pounds and the minimum requirement of checking tare at least once each day and other times, as shown, was made on an unscheduled basis.

SIGNED BY _____
WEIGHMAN

TC 63-34
Mod 7/93

FINAL RELEASE

TO: TRANSPORTATION CABINET
FRANKFORT, KENTUCKY

This is to certify that Contractor of

having completed the contract with the Transportation Cabinet

covering the construction Road, officially known as

County Project No. will accept as full and final statement

payment in the amount of $ which is based on Final Estimate No.

which has been approved by the Transportation Cabinet, and hereby releases the Transportation Cabinet and the Commonwealth of Kentucky from any further liability thereon.

And further, I certify that the provisions and requirements of all federal and state labor laws and wage requirements as set forth in the special provisions for this contract have been complied with.

Nothing embraced therein shall be construed to release the contractor from violations of wage requirements, federal and state labor laws as set forth in this contract, or from liability for payment of any claims incurred or labor, materials, or supplies used or furnished for use in the performance of the aforesaid contract, or from liability for damages, if any, resulting from wrongful or negligent acts of the contractor in the performance of the aforesaid ~~contract, and~~ the contractor agrees to hold the Cabinet harmless therefrom.

CH NO.
PCN

NAME OF CONTRACTOR

State of Kentucky

County of _____ Sct.

_____
(By) Authorized Agent

Subscribed and sworn to before me by _____

_____ this _____ day of

_____ ,19 _____

_____
Notary Public

My Commission expires
_____ , 19 _____ .

COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS

TC63-43
Rev. 02/96 Mod. 09/00

PROPOSAL CODE NO: _____ DISTRICT NO. _____
LETTING DATE: _____ **RIDEABILITY TEST REPORT** MARS JOB NUMBER _____
CONTRACTOR: _____
PROJECT NO. : _____ ROUTE: _____ COUNTY: _____
LOCATION FROM: _____ MI. PT. _____
TO: _____ MI. PT. _____

COMMENTS: _____ LENGTH: _____

REQUESTED BY: PROJECT ENGINEER ☐ DISTRICT OFFICE ☐ DIV. OF CONST. ☐ CONTRACTOR ☐

NAME: _____

COMMENTS: _____

DATE: _____ DATE RI NEEDED _____ REQUIRED RI _____

OLD PAVEMENT AC ☐ PCC ☐ COMPOSITE ☐ OTHER ☐

THICKNESS DGA _____ PCC _____ AC. SURF _____ BASE _____ BINDER _____ OGFC _____

SURF. PREP: MILLING _____ SCRATCH COURSE _____ LEVEL & WEDGE _____

OTHER EDGE DRAIN (TYPE) _____

NEW PAVEMENT NEW CONST. ☐ OVERLAY ☐ MILL & AC INLAY ☐ BK. & ST w/ OVERLAY ☐

SUBGRADE: SOIL _____ ROCK _____ LIME MOD _____ CEMENT MOD _____ MECH MOD _____
THICKNESS OF: DGA _____ CSB _____ TR DR BLK _____ UNT DR BLK _____ PCC _____

AC SURF: (CLASS) _____ SURF _____ BINDER _____ BASE _____ DESIGN EAL _____

EDGE DRAIN (TYPE) _____ CBR _____ ADT _____ SAMI ○ Yes ○ No

Was MTD (Material Transfer Device) used: ○ Yes ○ No If 'YES' indicate Pavement Type: ○ Surface ○ Base

TEST DATE: _____ DEGREES F: _____ WEATHER _____

TESTED BY: _____ PVMT TYPE _____

STRIP CHARTS TO: _____ DATE: _____

PURPOSE OF TEST CHECK ☐ ACCEPTANCE ☐ AFTER CORR. ☐ OTHER ☐

COMMENTS: _____

	DIRECTION	MILEPOINTS	RIDEABILITY INDEX LANE 1	LANE 2	LANE 3	PERCENT PAY LANE 1	LANE 2	LANE 3
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								

RESULTS VALIDATED BY: _____ DATE: _____

KENTUCKY TRANSPORTATION CABINET
Department of Highways
Division of Construction

TC 63-49
Rev 11/98

In-Place Density Using Control Strip

DIST NO: _____ DATE: _____
METER NO: _____ MODEL NO: _____
PROJECT NO: _____ COUNTY: _____ TYPE MAT'L: _____
CONTRACTOR: _____ ROAD NAME: _____ ROUTE NO: _____

ROLLERS

	Brand & Description	Weight
ROLLER 1:		
ROLLER 2:		
ROLLER 3:		

REMARKS: _____

CONTROL STRIP

BEGINNING STA: _____ LENGTH: _____ FT/METER WIDTH: _____ FT/METER
REMARKS: _____ LANE:

3 CHECK DENSITY MEASUREMENTS

SITE 1 @ STA: _____ REMARKS: _____
SITE 2 @ STA: _____ REMARKS: _____
SITE 3 @ STA: _____ REMARKS: _____

DENSITIES:	TEST 1	TEST 2	TEST 3	TEST 4
SITE 1:	lb/cf	lb/cf	lb/cf	lb/cf
SITE 2:	lb/cf	lb/cf	lb/cf	lb/cf
SITE 3:	lb/cf	lb/cf	lb/cf	lb/cf
AVERAGE:	0	0	0	0

TARGET DENSITY

10 random locations

	STATION	Density Count	Density		Moisture Count	Percent Moisture	Comments
TEST # 01				lb/cf			
TEST # 02				lb/cf			
TEST # 03				lb/cf			
TEST # 04				lb/cf			
TEST # 05				lb/cf			
TEST # 06				lb/cf			
TEST # 07				lb/cf			
TEST # 08				lb/cf			
TEST # 09				lb/cf			
TEST # 10				lb/cf			
AVERAGE DENSITY			**0**			**0**	

REMARKS: _____

Procedure in accordance with Section 207. Of Specifications Inspector _____

KENTUCKY TRANSPORTATION CABINET
Department of Highways
DIVISION OF CONSTRUCTION

TC 63-55
Rev. 4/87

CONCRETE MIXER

PERFORMANCE AND CONDITION APPROVAL

SLUMP DEVIATION SATISFACTORY ____ YES ____ NO

METAL PLATE FOR DRUM SPEEDS ____ YES ____ NO

AUTOMATIC REV. COUNTER ____ YES ____ NO

WATER MEASURING DEVICE ____ YES ____ NO

MIXER DRUM FREE OF CONCRETE ____ YES ____ NO

DATE APPROVED _____ BY _____

THIS APPROVAL EXPIRES 1 YEAR FROM THIS DATE

TRUCK NUMBER _____

CONCRETE PRODUCER NAME _____

MIXER DRUM INSPECTED FOR HARDENED CONCRETE

	DATE	INITIAL		DATE	INITIAL
JAN			JULY		
FEB			AUG		
MAR			SEPT		
APR			OCT		
MAY			NOV		
JUNE			DEC		

KENTUCKY TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION
PRE-CONSTRUCTION SAFETY AND HEALTH CHECKLIST

I. CONTROL OF SAFETY AND HEALTH ISSUES

The contractor is reminded that public and employee safety is his responsibility. Any violations of the Kentucky Occupational Safety and Health (KOSH) Standards or situations involving danger to the public or employees will be brought to his attention immediately. If the severity of the situation warrants, the Cabinet will intervene in his operation to help protect employees or the public.

The Cabinet is especially proactive on work site hazards, which expose Cabinet inspectors to potential injury or death. We expect you will provide, as required, any specific information and training to our Cabinet inspectors on hazardous chemicals or other special hazards present on your work site project.

Discussion and exchange of information on hazards, chemical hazards (MSDS's) and safety and health responsibilities are paramount in KOSHA standards.

II. GENERAL APPLICABLE KOSH STANDARDS FOR CONSTRUCTION (not all inclusive)

The following standards and excerpts of standards are in part and others may apply to your operations.

_X_ indicates applicable _N/A_ indicates non-applicable

____ ***1926.23 & .50 Medical Services and First Aid;*** Provisions shall be made prior to commencement of the project for prompt medical attention in case of serious injury. In the absence of an infirmary, clinic, hospital, or physician, that is reasonably accessible in terms of time and distance to the work site, which is available for the treatment of injured employees, a person who has documented evidence of a valid certificate in first aid training, shall be available at the work site to render first aid. A first aid kit with appropriate supplies shall be easily accessible when required.

____ ***1926.25 Housekeeping;*** During the course of construction, form and scrap lumber with protruding nails, and other debris and materials shall be kept clear from work areas, passageways, and structures.

____ ***1926.28 Personal Protective Equipment;*** The employer is responsible for requiring the wearing of appropriate personal protective equipment (PPE) in all operations where there is an exposure to hazardous conditions. The Contractor is responsible for assuring proper PPE is worn.

____ ***1926.51 Sanitation; A.*** an adequate supply of portable drinking water shall be provided in all places of employment. Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from the container. Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose. The common drinking cup is prohibited.

____ ***C.*** Toilets shall be provided for the employees, a minimum of one per twenty (20) employees or less. This will not apply to mobile crews having transportation readily available to nearby toilet facilities.

____ ***1926.59(e)(2) Hazard Communication/Multi-employer workplaces;*** Employers who produce, use, or store hazardous chemicals at the workplace in such a way that the employees of another employer may be exposed shall provide information and training to the other exposed employer's employees.

____ ***1926.150 Fire Protection; (c)(1)(vi)*** A fire extinguisher of appropriate rating is required whenever flammables are stored and whenever equipment is refueled.

III. SPECIFIC SAFETY ISSUES INHERENT TO THIS PROJECT (not all inclusive)

____ ***1926.50 Medical Services and First Aid;*** Where the eyes or body of any persons may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use. (Minimum 15 minute flush)

____ ***1926.62 LEAD STANDARD;*** The employer shall assure that no employee is exposed to lead at concentrations greater than fifty micrograms per cubic meter of air (50 ug/m squared) averaged over an 8-hour period. We will provide air monitoring to determine exposures for Cabinet inspectors. The KYTC will require the contractor to provide and share use of hand/face washing facilities and appropriate lead waste containers at any level of lead exposure. Additionally abrasive blast work or

anytime the PEL is exceeded mechanical ventilation, lavatories, change rooms, showers, lunch room, will be provided and shared with Cabinet personnel.

Name of your competent person _____ Phone number ( ) _____

____ ***1926.106 Working Over or Near Water; A.*** Employees working over or near water where danger of drowning exists, shall be provided with U.S. Coast Guard approved life jacket or buoyant work vest.

____ ***C.*** Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations.

____ ***D.*** At least one life saving skiff shall be immediately available at locations where employees are working over or adjacent to water.

____ ***1926.146 Confined Spaces;*** No employees shall enter drilled shafts or other confined spaces. Host employer and Contractor shall communicate possible hazards and intentions of entry.

____ ***1926.201 Signaling;*** Flagger signals shall conform to the "Manual on Uniform Traffic Control Devices for Streets and Highways". Flaggers shall be trained, wear appropriate red or orange vest, and use appropriate hand signaling devices to direct traffic.

____ ***1926.500, 501, 502, 503 & APPENDIX A, B, C, D, E, Fall Protection;*** 501(b)(1) Unprotected sides and edges. Each employee exposed to a fall of six (6) feet or more to a lower level shall be protected from falling by use of guardrail systems, safety net systems, or personal fall arrest systems.
NOTE: Horizontal Lifelines: Must meet Cabinets horizontal lifeline evaluation guidelines.

Name of your qualified person _____ Phone number ( ) _____

____ ***1926.650, 651, 652, & APPENDIX A, B,C, D,E, F; EXCAVATIONS;*** The walls and faces of all excavations in which employees are exposed to danger from moving ground shall be guarded by shoring system, sloping of the ground or some other means. All slopes shall be excavated to at least the angle of repose except for areas where solid rock allows for line drilling or pre-splitting.

____ ***TRENCHING;*** Each employee in an excavation shall be protected from cave-ins by an adequate protective system properly designed. Trenches 5 feet or more in depth shall be shored, laid back to a stable slope, or some other equivalent means. When trench slopes are laid back in Type B (or average) soils, a slope of 1:1 is recommended. Consult these standards Table B-1 and Figure B-1 in Appendix B for proper determination.

Name of your competent person _____ Phone number ( ) _____

____ ***1926.900 BLASTING AND USE OF EXPLOSIVES;*** The employer shall permit only authorized and qualified persons to handle and use explosives. The prominent display of adequate warning signs warning against the use of mobile radio transmitters shall be placed on road.

____ ***1926.1101 ASBESTOS;*** Employer shall ensure no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an 8 hour time-weighted average.

Name of your competent person _____ Phone number ( ) _____

___ ***OTHERS;***

IV. KYTC'S COMMITMENT TO SAFETY AND HEALTH COMPLIANCE

___ Who in your company is responsible for coordinating your safety and health program?

Name & Title _____ Phone number ( ) _____

___ Is safety and health a full time position? YES ___ NO ___ On this project? YES ___ NO ___

___ Does your company perform safety audits? YES ___ NO ___ How often? _____

If yes, are safety audits documented? YES ___ NO ___

___ Does your company have a written safety and health program? YES ___ NO ___

Written hazard communication program? YES ___ NO ___

Written environmental compliance assurance program? YES ___ NO ___

___ Are all of these documents available for review? YES ___ NO ___

If no, EXPLAIN? _____

Review of your policies and procedures does not constitute approval or an endorsement.

ALL CHECKLIST SPACES AND BLANKS MUST BE MARKED.

_____ **DATE** _____

CONSTRUCTION SAFETY COORDINATOR

_____ **DATE** _____

PRIME CONTRACTOR'S SIGNATURE

TC 63-63E
Rev. 07/06

TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.kentucky.gov

Ernie Fletcher
Governor

Bill Nighbert
Secretary

RE: Imminent Danger Project No.:_____
County:_____ PCN:_____

The Cabinet has been made aware, and has contacted you, regarding the work on the above-mentioned project which may not be complying with the provisions of Kentucky Occupational Safety and Health Standards for the Construction Industry (29 CFR Part 1926, as adopted by 803 KAR 2:400 through 2:425). Specifically, those concerning:

Subpart E, Personal Protective and Life Saving Equipment
Subpart L, Scaffolds
Subpart M, Fall Protection
Subpart P, Excavations
Subpart X, Stairways and Ladders
Other:_____

Therefore, because of the concern of imminent danger to employees, work will stop on this project until full compliance has been met.

Please be advised, the Cabinet has always expected project contractors to fully comply with the provisions of 29 CFR Part 1926, and expects compliance of this standard be maintained through the life of the project.

CC: Secretary of Transportation
Director, Division of Construction
TEBM, District Office
Safety Administrator, Division of Construction

KentuckyUnbridledSpirit.com

Kentucky UNBRIDLED SPIRIT

An Equal Opportunity Employer M/F/D

SOURCE SPECIFICATIONS:
TROXLER GAMMA SOURCE: 8+/-mCi CESIUM 137
TROXLER NEUTRON SOURCE: 40+/- mCi AMERICIUM-241: BE
HUMBOLT GAMMA SOURCE: 10 mCi (NOM) CESIUM 137
HUMBOLT NEUTRON SOURCE: 40 mCi (NOM) AMERICIUM-241: BE

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
DIVISION OF CONSTRUCTION
NUCLEAR METER DAILY LOG SHEET

TC 63-46
Rev. 4/92 Mod. 06/01

DATE: _____

PROJECT ENGINEER: _____ CREW NO: _____ DISTRICT NO: _____

PLACE OF STORAGE: _____ METER MANUFACT: _____ GAUGE SERIAL NO: _____

DATE	TIME OUT	TIME IN	OPERATOR	UNIFORM PROJECT NUMBER	COUNTY	MAINTENANCE			NO. OF TESTS
						GREASED	CLEANED	CHARGED	
						☐	☐	☐	
						☐	☐	☐	
						☐	☐	☐	
						☐	☐	☐	
						☐	☐	☐	
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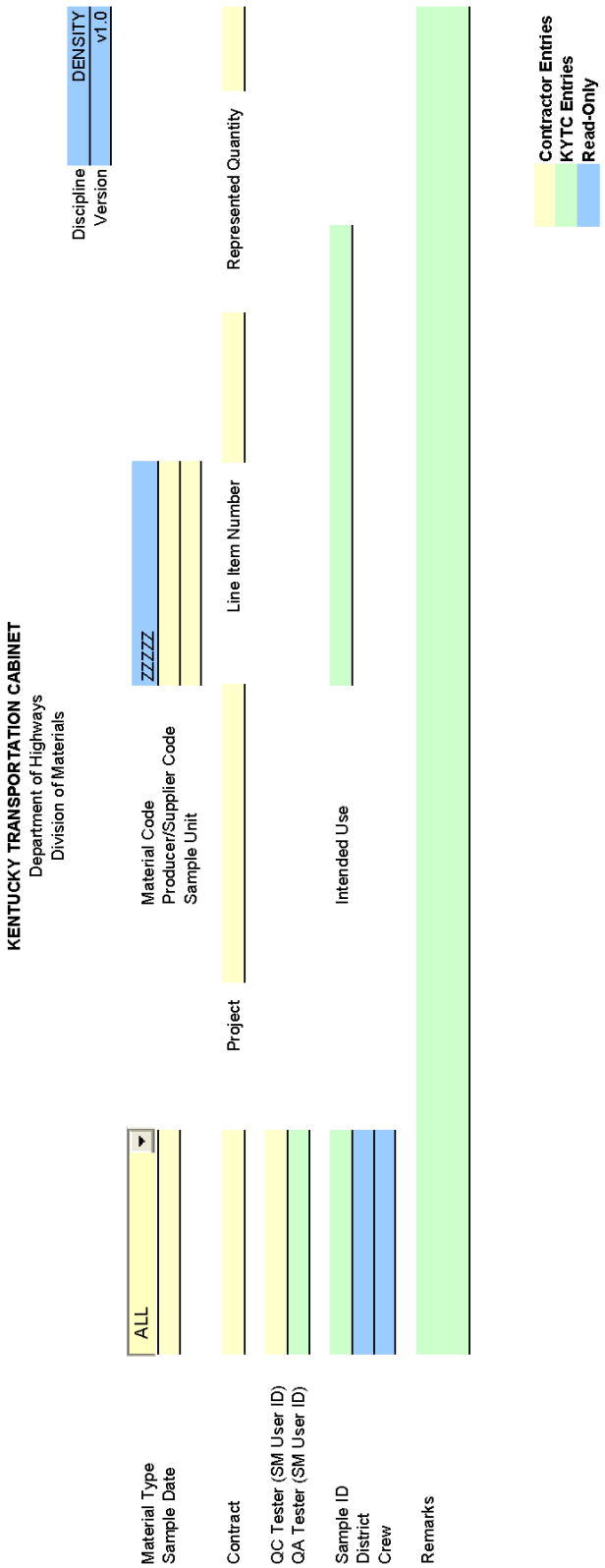
						☐	☐	☐	
						☐	☐	☐	
						☐	☐	☐	
						☐	☐	☐	
								TOTAL TEST THIS PERIOD	

Submit on 1st & 15th of the month-- show dispostion each day.


KENTUCKY TRANSPORTATION CABINET
Department of Highways
Division of Materials
Discipline
Version
DENSITY
v1.0
Material Type
Sample Date
ALL
Material Code
Producer/Supplier Code
Sample Unit
ZZZZZ
Contract
Project
Line Item Number
Represented Quantity
QC Tester (SM User ID)
QA Tester (SM User ID)
Sample ID
District
Crew
Intended Use
Remarks
Contractor Entries
KYTC Entries
Read-Only

Moisture-Density Test Report

METER #	
MODEL #	

ROAD NAME	
ROUTE #	
COUNTY	

Note: For DGA & CSB, test section 2500 SY (2100 SM) 5 equal sections of 500 SY (420 SM) @ random locations

SiteManager Sample ID							
Roll/Sublot #	1	2	3	4	5		
Station #							
CL Offset Distance							
Latitude							
Longitude							
Elevation							
DGA or CSB or SOIL	ALL	ALL	ALL	ALL	ALL		ALL
Standard Density Count							
Standard Moisture Count							
QC or QA	QC	QC	QC	QC	QC		QA
Test Depth							
Density Count							
Wet Density (lb/cf)							
Moisture Count							
Moisture (lb)							
Dry Density (lb/cf)							
% Moisture							
Target Density (lb/cf)*							
Optimum Moisture (%)						Avg. 5 test	
% Compaction**							
Required % Compaction	95	95	95	95	95	98	95
Moisture Correction (%)							
Pass or Fail							
QA validation of QC tests (P or F)***							

Plus 4 Material correction from KM 64-512							
Proctor Value from Plans							
Corrected Proctor Density from KM 64-512							
QC Tests Witnessed by KYTC							

**Proctor from Project Plans or Corrected Proctor*
*** 95% minimum individual test, average of 5 test 98%*
**** The QA test results must be within +- 5 lb/cu ft of the Wet Density and +- 1% of the Moisture Content for all four (4) QC tests associated with it.*

Contractor Entries
KYTC Entries
Read-Only

Kentucky Transportation Cabinet

Department of Highways
Division of Construction

TC 63-61
Mod. 06/07

Erosion Control Inspection Report

Scope of Inspection

Project #: _____

C.I.D. #: _____

Road Name: _____

Prime Contractor: _____

Type of Inspection: _____

Rainfall Since Last Inspection: _____

Date: _____

Contractor Representative: _____

Inspector: _____

Inspector Qualifications: _____

Resident Engineer: _____

Actions Required from Last Inspection have been performed: _____

Inspection Results

Areas To Be Disturbed

Stations	Imminent Construction Activity	Location of BMP's to be Placed	Remarks

Disturbed Areas

Stations	Construction Activity	Date of Last Activity	Location of Existing BMP's to be Corrected	Location of Additional BMP's Necessary	Location of Areas Where Stabilization is Required

Stabilized Areas

Stations	Type of Stabilization	Location of Existing BMP's to be Corrected	Location of Additional BMP's Necessary	Remarks

House - Keeping	Locations	Remarks
Vehicle Exit Points		
Concrete Wash-Out		
Chemical Containment		

Additional Comments

Inspection Summary

*Note: This report only details actions that must be taken at this time. Records of all previous actions and devices utilized are compiled in the Daily Work Reports related to this project.

Action by the contractor is required according to this report **Yes / No**

KYTC Representative: Date: KYTC Resident Engineer: Date:

NOTE: In accordance with the requirements of the KYTC Standard Specifications for Road and Bridge Construction 2004, Subsection 213.03.02, a penalty equal to the contractual provision for liquidated damages will be imposed on the Contractor if the deficiencies identified in this Erosion Control Inspection Report are not corrected in a manner acceptable to the Department of Hightways within 5 days of receipt of this report. Failure to correct may result in the suspension of all operations and the withholding of all amounts due on current pay estimates until all aspects of the subject work are completed and approved

Contractor Representative: Date:

OMB NO. 2125-0033

U.S. Department of Transportation
Federal Highway Administration

STATEMENT OF MATERIALS AND LABOR USED BY CONTRACTORS ON HIGHWAY CONSTRUCTION INVOLVING FEDERAL FUNDS

PART A *To be completed by FHWA or State Highway Personnel (See instructions on reverse)*

STATE*	COUNTY	FEDERAL PROJECT NO.*	URBAN ( ) RURAL ( )*

ITEM	DESCRIPTION		ROADWAY	BRIDGE *(Over 20 ft)*	DATE STARTED*
CONSTRUCTION TYPE CODES					
1	LENGTH OF PROJECT	MILES			DATE COMPLETED*
2	FINAL* CONSTRUCTION COST	DOL			TOTAL NO. BRIDGES

PART B *To be completed by; contractor - see instructions on reverse (REMARKS Attach a plain sheet of paper)*

3	**LABOR*** TOTAL PROJECT	TOTAL LABOR-HOURS	GROSS EARNINGS

ITEM	DESCRIPTION	UNIT	PROJECT QUANTITY
4	TOTAL COST OF ALL MATERIALS AND SUPPLIES*	DOL.	
5	PETROLEUM PRODUCTS*	GAL.	
6	CEMENT	BBL.	
7		LB.	
8		TON.	
9	AGGREGATES PURCHASED	TON.	
10		CU. YD.	
11	BITUMINOUS MATERIAL	GAL.	
12	LUMBER	THSD . BD. FT.	
13	REINFORCING STEEL	LB.	
14	STRUCTURAL STEEL	LB.	
15	READY-MIXED CONCRETE	CU. YD.	
16	PREMIXED BITUMINOUS PAVING MATERIALS	TON.	
17	AGGREGATES PRODUCED	TON	
18		CU. YD.	
19	MISCELLANEOUS STEEL	LB.	
20	NOISE BARRIERS	LIN. FT.	
21	GUARDRAIL	LIN. FT.	
22	BRIDGE RAIL	LIN. FT.	
23	FINAL CONTRACT AMOUNT FOR SIGNS	DOL.	
24	FINAL CONTRACT AMT. FOR LIGHTING	DOL.	
25	FINAL CONTRACT AMT. FOR TRAFFIC SIGNALS	DOL.	

CULVERT ITEMS

SIZE *(In.)*	LGTH *(Lin ft)*
26 CORR. STEEL CULVERT	
27 CONCRETE PIPE	

28 CLAY PIPE	
SIZE *(In.)*	LGTH *(Lin ft)*
29 CORR. ALUMINUM CULVERT	
30 PLASTIC PIPE	

REVIEWED BY DATE

*MUST BE REPORTED ON ALL REPORTS

FORM FHWA-47 (Rev. 7-98) PREVIOUS EDITIONS ARE OBSOLETE

DISCARD BEFORE SUBMISSION

DEPARTMENT OF TRANSPORTATION
Federal Highway Administration

SUPPLEMENTAL INFORMATION

STATEMENT OF MATERIALS AND LABOR USED BY CONTRACTORS ON HIGHWAY CONSTRUCTION INVOLVING FEDERAL FUNDS

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this form is 2125-0033. The average completion time for this form is 5 hours. If you wish to make suggestions, please fax them to 202-366-3988; or mail to:

Federal Highway Admi nistration
Construction Cost An alysis Group, HNG-13
400 7th Street, SW
Washington, D.C. 20590

INSTRUCTIONS FOR PREPARING AND TRANSMITTING FORM FHWA-47

GENERAL REQUIREMENTS

Form FHWA-47 should be transmitted for each Federal-aid project involving construction performed under contract awarded by competitive bidding that is located on the National Highway System (NHS), except projects for which the total final construction cost of the roadway and bridge is less than $1,000,000 or projects consisting primarily of (1) the installation of protective devices at railroad grade crossings, or (2) highway beautification.

Form FHWA-47 should be transmitted with or, if data is already available, in advance of the Final Report required by Federal-aid Policy Guide Chapter 6 G 6011.11

A separate form should be transmitted for each contract except that data for two or more contracts on the same project may be combined when such contracts are completed at approximately the same time. In case of a combination, the earliest starting date and the latest completion date should be reported. Where a single contract covers more than one project, one form may be prepared for each project or for the entire contract, provided none of the data are duplicated. A Form FHWA-47 should not be prepared for a contract covering only the purchase of material but the quantity of material should be reported when subsequently included in a construction project. In all cases, only the original of Form FHWA-47, typed or clearly lettered, and no carbon or photocopies, should be transmitted to the Washington Office.

If nonparticipating work is included in the contract, all data should be combined with the Federal-aid data in preparing the form. Data for any subcontract must be combined by the State or the division office with the prime contract if not so combined by the prime contractor. It will be the State's responsibility to see that all prime contract and subcontract costs, material, and labor-hours have been reported for each contract, and no duplication of data are involved. Quantities of State-furnished materials should be included with contract quantities, and costs of STATE-furnished materials should be added to Item 2 "Final Construction Cost" and also to Item 4 "Total Cost of All Materials and Supplies." All quantities should be reported to the nearest whole unit and only in the units specified. All costs should be reported to the nearest dollar.

Check urban or rural to indicate whether the major cost is for work within an urban area or in a rural location.

All figures should be verified for reasonableness by State highway department and Federal Highway Administration division office engineers. The total material cost and the total labor-hours and gross earnings should bear reasonable relationships to the final construction cost. Also the quantity of each material reported should be reasonable with respect to the quantities of other materials. For example, if a large quantity of reinforcing steel is reported with no cement or ready-mixed concrete, an error of omission in reporting would be indicated.

Generally, the total cost of materials, supplies, and labor should be substantially less than the final construction cost, as the latter also includes costs of equipment ownership, overhead, and profit which are not required to be reported. If the final construction cost is less or only a few percent more than the total cost of materials, supplies and labor, the indication is that the contractor suffered a loss on the project or that there is an error in reporting. In such case, if it is determined that the figures reported are correct, a statement should be made on a plain sheet of paper marked "Remarks" to the effect that the contractor actually did suffer a loss, (verify with contractor).

Part A- INFORMATION TO BE SUPPLIED BY FEDERAL HIGHWAY ADMINISTRATION OR STATE HIGHWAY PERSONNEL (FEDERAL-AID POLICY GUIDE CH. 6 G 6011.11)

Item 1- "Length of Project." - Report official roadway mileage and official bridge mileage.

Item 2 - "Final Construction Cost" - Show best estimate of Federal and State costs incurred to date for contract items, extra work performed by contractor, and State-furnished materials.

PART B - INFORMATION TO BE SUPPLIED BY CONTRACTOR IMMEDIATELY UPON COMPLETION OF CONTRACT OR PROJECT

Specific Instructions for the Following Numbered Items:
Item 3 - Report total labor-hours worked and earnings of all contractor's employees on the project, including those on operation and maintenance of equipment.
Item 4 - This should be the total cost, at the jobsite of all construction materials and supplies purchased for and used on the project, including the cost of materials for signing and lighting and the cost of any materials and supplies not specifically listed hereon. Costs of equipment or equipment rental and the cost of operating the equipment, except the costs of fuel and lubricants, should not be included in this item. Small items of equipment such as jackhammers, handtools, repair parts, tires, etc., are not considered to be supplies. Costs of such items and also overhead costs should not be included. The amount included here for aggregates produced should be only the cost paid by the contractor for the aggregates and should not include the costs of excavating, processing, loading and hauling. Wages and labor-hours for aggregates produced should, of course, be included with Item 3.
Item 5 - Report total number of gallons of all gasoline, diesel oil, lubricating oil, and grease for equipment and trucks. For conversion purposes use factor of 8 pounds of grease per gallon.
Items 6, 7, and 8 - Report quantity of cement used on project. Do not report here the cement included in Item 15.
Items 9 and 10 - Report quantity of aggregates purchased from commercial producers, such as sand, gravel, crushed stone, etc. Do not report here aggregates included in Items 15 and 16. Aggregates produced by the contractor shall be reported as Items 17 and 18.
Item 11 - Report number of gallons of bitumens such as asphalt and tar. Do not report here bituminous materials included in Item 16.
Item 12 - Report all lumber products purchased for and use on the project, including plywood and pressed wood, but excluding timber piling, lumber in fencing, guardrail, and signs, and lumber purchased for or used on previous projects and previously reported. The quantity of lumber should be reported as the number of thousand board feet and not as the number of board feet.
Item 13 - Report total number of pounds of reinforcement (plain or coated) for both structures and pavement. Include estimated quantities of reinforcing and prestressing steel in purchased precast units, except concrete pipe reinforcement.
Item 14 - Report total number of pounds of structural steel, steel H-piling, and sheet piling.
Item 15 - Report total number of cubic yards of ready-mixed concrete plus estimated quantity of concrete in purchased precast units, excluding Item 26.
Item 16 - Report total number of tons of bituminous paving mixtures that are purchased in a prepared condition ready for placement as they reach the job.
Items 17 and 18 - Report total quantity of aggregates such as sand, gravel, crushed stone, etc., produced by the contractor.
Item 19 - Report estimated total weight of steel products not appropriate for Items 13, 14 and 26, such as joint devices, tubular piling, etc.
Items 20, 21, and 22 - Report total lengths, in linear feet, of all types of noise barriers, guardrail and bridge rail.*
Item 23 - Report final contract amount for all types of signs including foundations, posts, structural supports, etc. Do not include traffic signals.*
Item 24 - Report final contract amount for highway and bridge lighting including foundations, conduits, standards, wiring, switches, luminaires, etc. Do not include traffic signals.*
Item 25 - Report final contract amount for traffic signals.*

Item 26 - Report, by size, regardless of class, type, gauge or coating, total number of linear feet of corrugated steel pipe, structural plate pipe, pipe-arches and arches.
Item 27 - Report, by size, regardless of class, type, gauge or coating, total number of linear feet of plain and reinforced concrete drain and culvert pipe.
Item 28 - Report, by size, total number of linear feet of clay pipe.
Item 29 - Report, by size, total number of linear feet of corrugated aluminum culvert.
Item 30 - Report, by size, total number of linear feet of plastic pipe.

*Quantities of steel, concrete and lumber used in connection with Items 20, 21, 22, 23, 24, and 25 should not be reported unless difficulties are encountered in segregating such quantities from total quantities.

FORM FHWA-47 (Rev. 7-98)

IA-1 WORKERS COMPENSATION – FIRST REPORT OF INJURY OR ILLNESS

General

Employer (Name & Address incl. zip)		Carrier/Administrator Claim Number	Report Purpose Code
		Jurisdiction	Jurisdiction Claim Number
		Insured Report Number	
		Employer's Location Address (if different)	Location No.
Sic Code	Employer FEIN		Phone No.

Carrier/Claims Admin

Carrier (Name, Address & Phone Number)		Policy Period	Claims Admin (Name, Address & Phone Number)
		To	
		☐ Check if self insured	
Carrier FEIN	Policy Number or Self-Insured Number		Administrator FEIN
Agent Name & Code Number			

Employee/Wage

Legal Name (Last, First, Middle)	Date of Birth	Social Security Number		Date Hired	State of Hire
Address (Incl. Zip)	Sex: ☐ Male ☐ Female ☐ Unknown	Marital Status: ☐ Unmarried/ Single/Div. ☐ Married ☐ Separated		Occupation/Job Title	
				Employment Status	
Phone	No. of Dependents	☐ Unknown		NCCI Class Code	
Wage Rate $ ☐ Day ☐ Week	☐ Month ☐ Other	# Days Worked/WK # Hrs Worked per Day		Full Pay for Date of Injury? ☐ Yes ☐ No	
				Did Salary Continue? ☐ Yes ☐ No	

Occurrence

Time Employee Began Work ☐ AM ☐ PM	Date of Injury or Illness	Time Occurred ☐ AM ☐ PM	Last Work Date	Date Employer Notified	Date Disability Began
Employer Contact Name/Phone Number		Type of Illness/Injury	Part of Body Affected		
Did Injury/Illness Exposure Occur on Employer's Premises? Yes ☐ No ☐		Type of Illness/Injury Code	Part of Body Affected Code		
Department or location where accident or illness exposure occurred		All Equipment, Materials, or Chemicals Employee was using when accident or illness exposure occurred.			
Specific Activity the Employee was engaged in when the accident or illness exposure occurred.		Work Process the Employee Was Engaged in when accident or illness exposure occurred.			
How injury or illness/abnormal health condition occurred. Describe the sequence of events and include any objects or substances that directly injured the employee or made the employee ill.				Cause of Injury Code	
Date Returned to Work	If Fatal, Date of Death	Were Safeguards or Safety Equipment Provided? ☐ Yes ☐ No			
		Were they used? ☐ Yes ☐ No			

Treatment

Physician/Health Care Provider (Name & Address)	Hospital (Name & Address)	Initial Treatment
		0 ☐ No Medical Treatment
		1 ☐ Minor: By Employer
		2 ☐ Minor Clinic/Hosp
		3 ☐ Emergency Care
		4 ☐ Hospitalized > 24 hr.
		5 ☐ Future Major Medical/Lost Time Anticipated

Other

Witness to Accident (Name & Phone Number)			
Date Administrator Notified	Date Prepared	Preparer's Name & Title	Preparer's Phone Number

IA-1 (2/95) **SEE NEXT PAGE FOR IMPORTANT STATE INFORMATION/SIGNATURE**

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Applicable in Alaska

A person who willfully makes a false or misleading statement or representation for the purpose of obtaining or denying a benefit or payment is guilty of theft by deception.

Applicable in Arkansas

Any person or entity who willfully and knowingly makes any material false statement or representation for the purpose of obtaining any benefit or payment, or for the purpose of defeating or wrongfully decreasing any claim for benefit or payment or obtaining or avoiding worker's compensation coverage or avoiding payment of the proper insurance premium (or who aids and abets for either said purpose), under this chapter shall be guilty of a Class D. felony.

Applicable in California

Any person who makes or causes to be made any knowingly false or fraudulent material statement or material representation for the purpose of obtaining or denying workers' compensation benefits or payments is guilty of a felony.

Applicable in Connecticut

This form must be completed in its entirety. Any person who intentionally misrepresents or intentionally fails to disclose any material fact related to a claimed injury may be guilty of a felony.

Applicable in Delaware and Oklahoma

Any person who, knowingly and with intent to injure, defraud, or deceive any Insurer, files a statement of claim containing any false, incomplete or misleading information is guilty of a felony. The lack of such a statement shall not constitute a defense against prosecution under this section. *Delaware Statutes Regulation: Del #C Section 913(B)

Applicable in Florida

Any person who, knowingly and with intent to injure, defraud or deceive any employer or employee, insurance company or self-insured program, files any statement of claim containing any false or misleading information is guilty of a felony of the third degree.

Applicable in Idaho

Any person who Knowingly and with the intent to injure, Defraud, or Deceive any Insurance Company, Files a Statement of Claim Containing any False, Incomplete or Misleading information is Guilty of a Felony.

Applicable in Indiana

A person who knowingly and with intent to defraud an insurer files a statement of claim containing any false, incomplete, or misleading information commits a felony.

Applicable in Kentucky and New York

Any person who knowingly and with intent to defraud any insurance company or other person files a statement of claim containing any materially false information, or conceals for the purpose of misleading, information concerning any fact material thereto, commits a fraudulent insurance act, which is a crime. In New York, such person shall also be subject to a civil penalty not to exceed five thousand dollars and the stated value of the claim for each such violation.

Applicable in Michigan

Any person who knowingly and with intent to injure or defraud any insurer submits a claim containing any false, incomplete, or misleading information shall, upon conviction, be subject to imprisonment for up to one year for a misdemeanor conviction or up to ten years for a felony conviction and payment of a fine of up to $5,000.00.

Applicable in Minnesota

A person who files a claim with intent to defraud or helps commit a fraud against an insurer is guilty of a crime.

Applicable in Nevada

Pursuant to NRS 686A.291, any person who knowingly and willfully files a statement of claim that contains any false, incomplete or misleading information concerning a material fact is guilty of a felony.

Applicable in New Hampshire

Any person who, with purpose to injure, defraud or deceive any insurance company, files a statement of claim containing any false, incomplete or misleading information is subject to prosecution and punishment for insurance fraud, as provided in RSA 638:20.

Applicable in New Jersey

Any person who knowingly files a statement of claim containing any false or misleading information is subject to criminal and civil penalties.

Applicable in Ohio

Any person who, with intent to defraud or knowing that he is facilitating a fraud against an insurer, submits an application or files a claim containing a false or deceptive statement is guilty of insurance fraud.

Applicable in Pennsylvania

Any person who knowingly and with intent to injure or defraud any insurer files a claim containing any false, incomplete or misleading information shall, upon conviction, be subject to imprisonment for up to seven years or payment of a fine of up to $50,000.

Applicable in Utah

Any person who knowingly presents false or fraudulent underwriting information, files or causes to be filed a false or fraudulent claim for disability compensation or medical benefits, or submits a false or fraudulent report or billing for health care fees or other professional services is guilty of a crime and may be subject to fines and confinement in state prison.

EMPLOYEE SIGNATURE:
IA-1 (2-95)

KENTUCKY TRANSPORTATION CABINET
Division of Maintenance

TC 71-14E
Rev. 03/2009

CONSENT AND RELEASE

County _____ Road _____

Route No. _____ Address _____

Mile Point _____ _____

WHEREAS, the Transportation Cabinet, Commonwealth of Kentucky, in order to protect Highway No. _____ finds it necessary to do the following work:

The work will be done on the land of:

NOW, THEREFORE, in consideration of the above and the incidental benefits accruing to the property, I hereby consent and agree that the Transportation Cabinet may come upon the above property and do the work as set out above, and do further agree that I will assert no claim for damages against the Transportation Cabinet by reason of said work, but by these presents shall be forever barred.

Date _____
Day/Month/Year

_____
Property Owner

_____
Property Owner

Witness _____
County Superintendent/Designated Representative

Approved _____
Chief District Engineer

TYPICAL FIELD BOOK

BOOK 1 OF 10

PCN 07-1224

~~PROJ. NO. I 64-3(57)95~~

JULY 27, 2007

~~JUNE 17, 1992~~

PULASKI

~~CARTER~~ COUNTY

US 27

~~LEX.-CATLETTSBURG RD.~~

C & G BOOK 1 of 1

TYPICAL INDEX

~~TRANSIT BOOK 1 OF 1~~	~~PAGE~~
~~Align & Topo. Sta. 0 to 412~~	~~1-70~~
~~Align. Rev. "A" Sta. 46 to 56~~	~~71-80~~
LEVEL BOOK 1 OF 1	
Profile Levels, B.M.'s Sta.1 to 280	1-75
Drainage Data	76-80
CROSS SECTION BOOK 1 OF 2	
X-Sec. & Soundings Sta. 0 to 280	1-70
Data on O'head Crossing, Sta. 182+	75-77
Levels, X-sect. & Drainage Rev. "A"	80-93
COMPLETE NOTES BOOK 1 OF 1	
(where all notes are included in one book.	
Align. & Topo. Sta. 0 to 52	1-15
Profile Levels, B.M.'s Sta. 0 to 52	17-28
X-Sect. & Drainage, Sta. 0 to 52.	30-51

NOTE: A complete index of each book should be shown on the flyleaf of said book in a manner similar to the above example.

When the project includes more the one book, a general index of the various books should be show on the flyleaf of Transit Book. NO. 1

Each book no. on the index sheet should show the total no. of books included as: Transit Book 1 of 2(Transit Books) Level Book 2 of 3 (Level Books), etc.

TYPICAL BENCH OR CHECK LEVEL NOTES

STA.	+	H. I.	-	ELEV.		
BM #1	3.08	352.52		349.44	349.44	(USGS BM) "X" on NE corner of S. abutment of C & O RR Bridge 200' left of Sta. 1+30
TP	11.80	364.11	0.21	352.31		
TP	12.42	375.82	0.71	363.40		
BM #2			4.27	371.55	371.55	Spike in root of 24" Oak, 40' rt. Sta. 8+40
TP	9.22	378.73	6.31	369.51		
BM #3			8.96	369.77	369.77	Spike in root 3" Sycamore,110' lt. Sta. 14+20
TP	0.70	369.27	10.16	368.57		
TP	0.24	357.01	12.50	356.77		
TP	0.98	348.58	9.41	347.60		
BM #4			7.36	341.22	341.22	"X" on NW corner bottom conc. step front porch of 1 s. brick res. of R.A. White, 70' rt. Sta. 38+65

CHECK
349.44
+ 38.44
-46.66
341.22 ✓

38.44 ✓ 46.66 ✓

Date: Page No. Party:
Weather:

Note: Show party personnel, date & weather at the beginning of each days work.

NEVER ERASE

TYPICAL LEVEL NOTES

STA.	+ ROD	H. I.	- ROD	INTER. ROD	ELEV.
BM #1	3.08	352.52			349.44
0+00				4.8	347.7
1				5.6	346.9
+ 70				4.8	347.7
+ 70				12.8	339.7
				13.2	339.3
+ 89				12.8	339.7
+ 89				4.8	347.7
				8.4	344.1
2				5.1	347.4
+ 60				4.4	348.1
3				3.2	349.3
4				5.7	346.8
BM #2			0.89		351.63
5				4.3	348.2
TP	11.8	364.11	0.21		352.31
6				11.2	352.9
7				9.4	354.7
+ 34				8.7	355.4
+ 37				11.3	352.8
+ 40				8.3	355.8
8				7.6	356.5
9				6.9	357.2
	14.88		0.21		

Date: Page No. Party:

Weather:

USGS B. M. near corner of Court House
27' Rt. Sta. 0 + 40

Note: Show party personnel, date & weather at the beginning of each days work.

℄ East Abut.
Edge Water, E. Side Rd'g on solid rock
℄ Creek Channel, Rd'g on solid rock
Edge Water, W. Side, Rd'g on solid rock
℄ West Abut.
High Water - 1935(Headwater)

Top of Ridge

Nail in root 10" Maple, 60' Lt. Sta. 4+63

Bank
℄ Ditch
Bank

CHECK
349.44
+14.88
-0.21
364.11

NEVER ERASE

TYPICAL PROFILE & CROSS SECTION NOTES

ORIGINAL GROUND

STA.	+	HI	-	ELEV	CLASS
BM #1	5.26	354.70		349.44	
0 +0			7 .0	347.7	Earth & Old Asp' Avg. 5' deep to sta. 2+00
1 +0			7.8	346.9	
+ 70			7 .0	347.7	
+ 89			7 .0	347.7	
2+0			7.2	347.5	
TP	10.84	361.90	3.64	351.06	10% S.R. sta. 2+00 to sta. 10+0

NOTE:
M=Edge of Metal
F=Fence
E.W.=Edge of Water
S.R.=Solid Rock

Check
349.44
+ 16.10
- 3.64
16.10 361.90 3.64

Date: Page No. Party:
Weather:

Left ℄ Right

USGS BM 27' Lt. Sta. 0+40

46.4 47.0 46.5 47.4 | 47.4 46.6 47.7 48.1 48.7
8.3 7.7 8.2 7.3 | 7.3 8.1 7.00 6.6 6
30 19.5 12 6 | 7 13.5 15 20 30
S.R. 46.8 F 47.0 46.0 M 46.1 | M 46.7 46.9 46.5 F 47.0
7.9 7.7 8.7 8.00 | 8.00 7.8 8.2 7.7
30.5 18 11 5 | 7.5 12 20 30
F 46.8 47.3 M 47.3 | M 47.1 47.3 F 45.3 42.1
E. Abut 7.9 7.4 7.4 | 7 7.4 9.4 12.6
Bridge 30 10 7 | 7.5 10 15 30.5
42.1 F 47.4 M 47.1 | M 47.7 47.4 F 46.5 E.W. 46.1
W. Abut 12.6 7.3 7.00 | 7 7.3 8.3 8.6
Bridge 26 10 7 | 7 10 11 31
45.0 E.W. 46.7 46.4 M 47.4 | M 47.3 46.3 F
9.7 8 8.3 7.3 | 7.4 8.4
30 13.5 10 4 | 10 17
S.R. M | M

NOTE: Show party, personnel, date & weather at the beginning of each day's work.

NEVER ERASE

GEODETIC SURVEY MARK PRESERVATION

During the past century and a half, the U.S. Department of Commerce's National Ocean Survey (formerly the Coast and Geodetic Survey) has been determining with great accuracy the latitude and longitude and/or elevation of thousands of locations throughout the United States. At each point a bronze marker is imbedded in cement or bedrock. More than half a million of these markers have been placed in the U.S. and its possessions.

The bronze disks, measuring about three and one-half inches in diameter, mark survey points for latitude and longitude, elevation, gravity, and azimuth or direction. They are used by engineers, surveyors, and mapping agencies as the basis or framework for maps, charts, local control and boundary surveys, and for various public and private engineering projects.

The cost of surveying and placing a single mark ranges from around $100 to several thousand, depending on the type of survey, accuracy, and proximity to other survey monuments.

Resurveying operations throughout the United States have revealed the destruction of an alarming number of permanent survey marks. To remedy this situation as much as possible, NOAA, the National Oceanic and Atmospheric Administration, asks the public's cooperation in preserving these marks.

Many of the marks have been covered with dirt or debris and destroyed because construction crews were not aware of their location. To prevent this, the practice of marking the location of the survey disks with wooden posts set nearby was begun in the 1940's. As these wooden posts deteriorated, metal signs bolted to metal fence posts were later substituted. These white signs, called Witness Posts, are set near survey marks to aid in their recovery and protection.

Here's how the public can help preserve these marks:

Never remove or disturb a survey marker unless authorization is obtained from NOAA. The National Geodetic Survey has a team of Mark Maintenance Engineers who will normally perform the necessary maintenance. If a mark is removed or displaced, its value as a survey point is lost and expensive re-surveying is usually required.

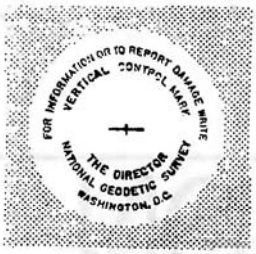
If you see a survey mark which appears in danger of destruction or damage by erosion, construction, or other causes, please take appropriate steps to preserve it. If danger is by construction, call it to the attention of the foreman or flag the mark by stakes.

You will be performing a commendable public service in helping to preserve these valuable survey markers.

In all cases, submit a report of your actions or finding to Director, National Geodetic Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland, 20852.

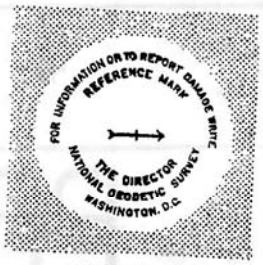
U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Survey

KNOW THESE MARKS



VERTICAL
(NEW)

HORIZONTAL
(NEW)



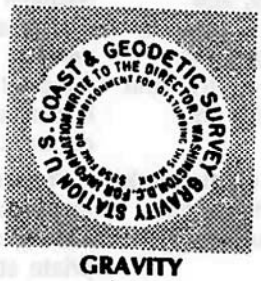
REFERENCE
(NEW)

TRAVERSE
(OLD)

TRIANGULATION
(OLD)

TOPOGRAPHIC
(OLD)

REFERENCE
(OLD)



GRAVITY
(OLD)

AZIMUTH
(OLD)

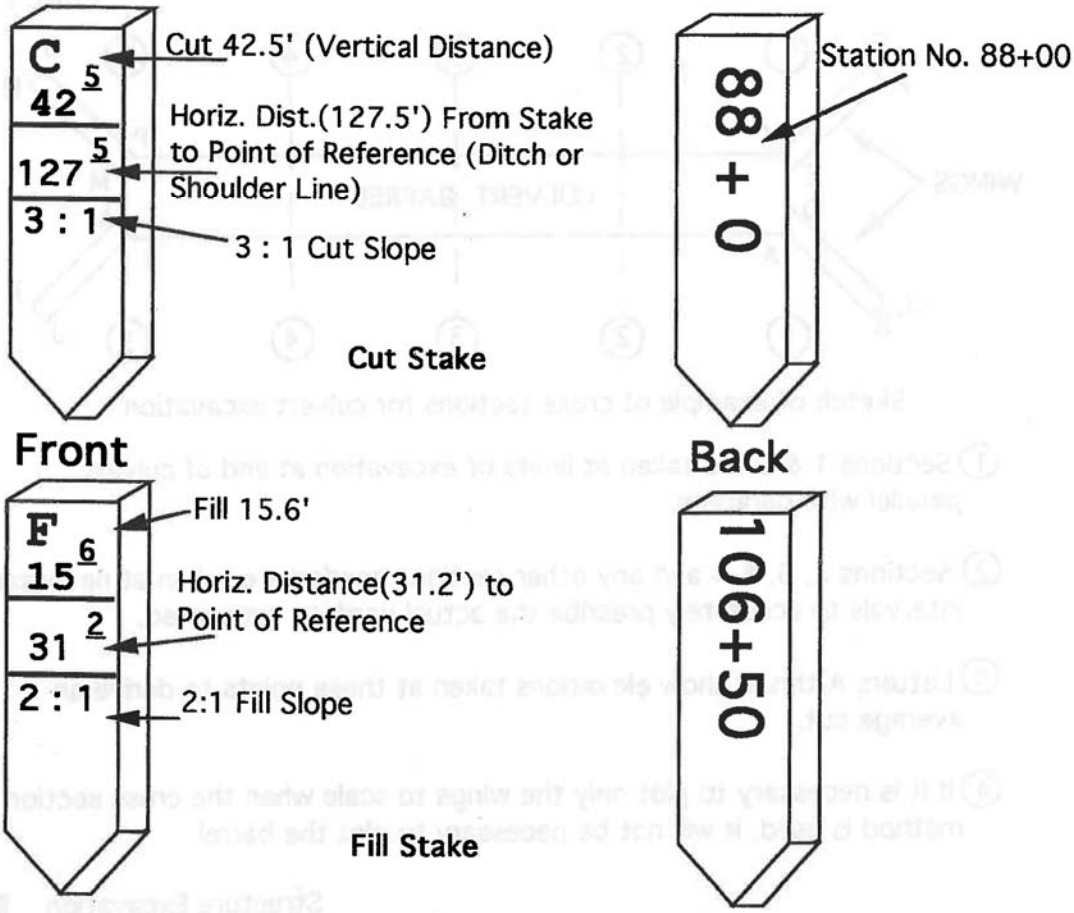
VERTICAL
(OLD)

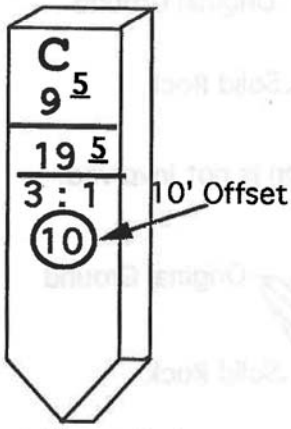
FACE LEGENDS

Standard bronze station marks of the National Geodetic Survey (formerly marks of the Coast and Geodetic Survey) are set in concrete or bedrock to serve as a permanent mark for the particular station it represents. Additional information concerning these marks may be obtained by writing to:
Director, National Geodetic Survey, NOAA, Rockville, Md., 20852.

NOAA/PA 73022 (Rev.) 1974

MARKING OF SLOPE STAKES





Offset Slope Stake

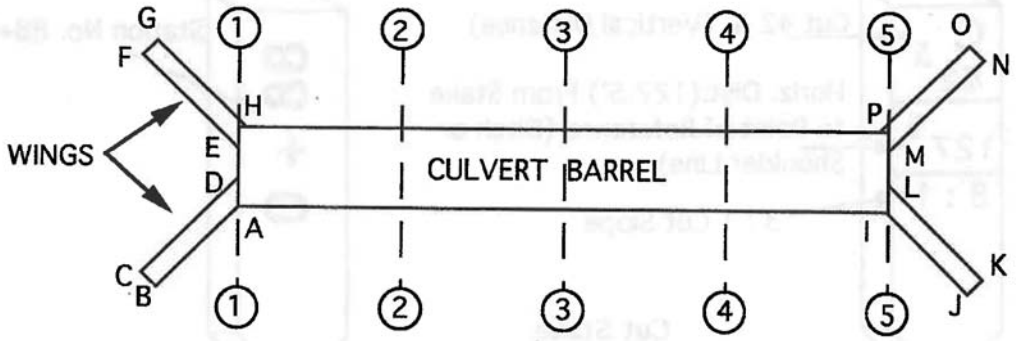
General Instructions:

In setting slope stakes, the rod is read to the nearest tenth of a foot and horizontal distances measured, usually with a mettalic tape, at right angles to the survey centerline and recorded also to the nearest tenth of a foot.

Slope stakes shall be driven so that the top of the stake leans away from the centerline for fill stakes and toward the centerline for cut stakes. A standard 1" x 2" x 18" is preferred for use in setting slope stakes.

Use either blue keel or black waterproof marking pen for marking stakes. Data must resist fading or washing off.

CULVERT CROSS SECTIONS



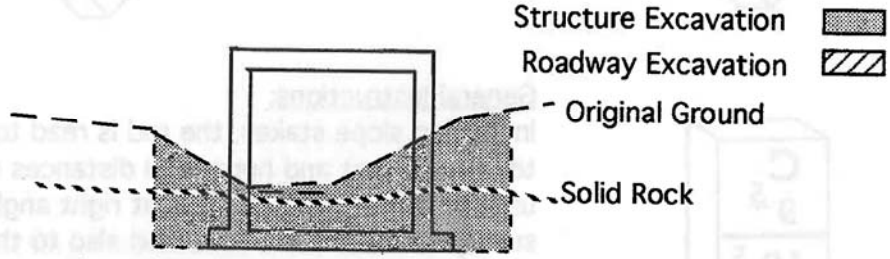
Sketch of example of cross sections for culvert excavation

1. Sections 1 & 5 are taken at limits of excavation at end of culvert parallel with parapets.

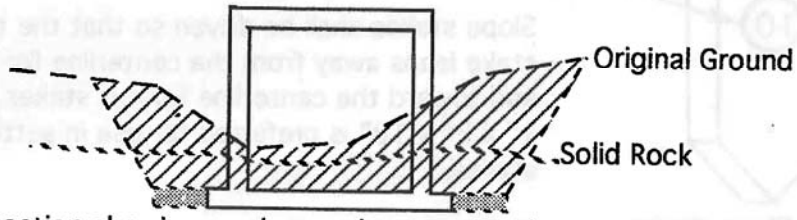
2. Sections 2, 3, & 4 and any other sections needed are taken at necessary intervals to accurately presribe the actual yardage excavated.

3. Letters A thru P show elevations taken at these points to derive an average cut.

4. If it is necessary to plot only the wings to scale when the cross section method is used, it will not be necessary to plot the barrel.

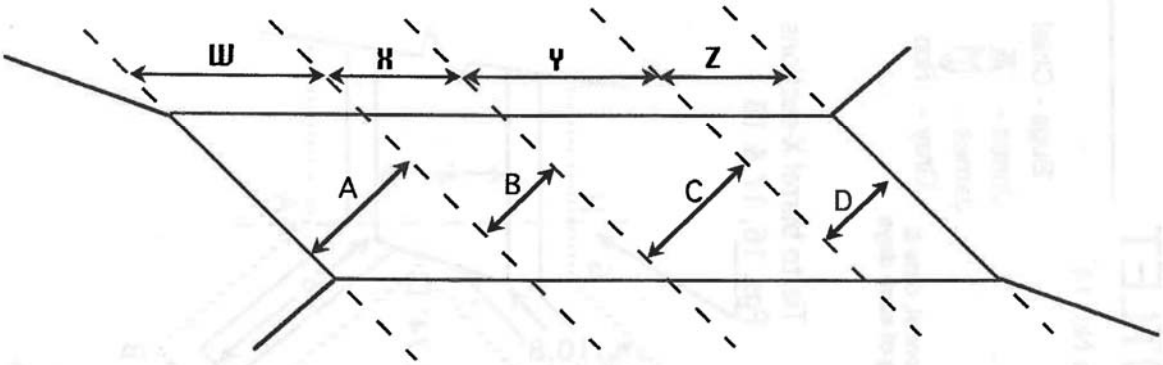


Typical Cross-section where roadway culvert excavation is not involved.



Typical cross-section showing roadway culvert excavation. Whether footer is formed or poured to neat line may be shown in this section.
See Chapter 8 for detailed information on Structure Excavation

CULVERT CROSS SECTIONS

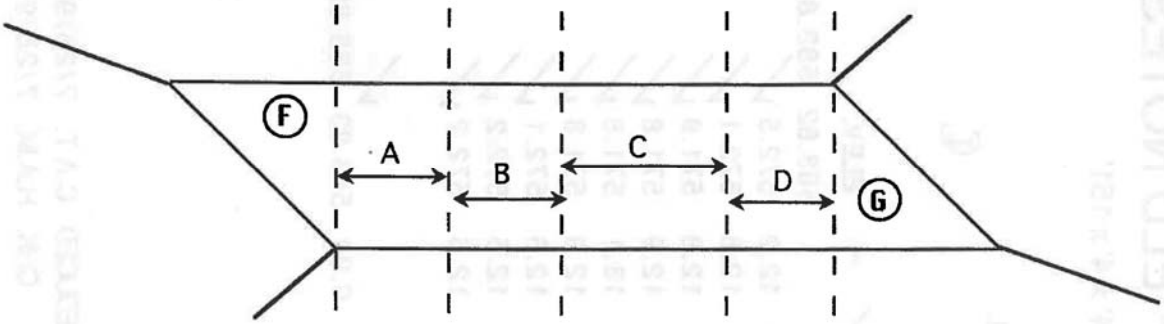


Cross-section method of excavation for skewed culverts

1. Sections taken on same skew as culvert

2. Distances A, B, C, & D are computed by multiplying skewed distance (designated by **W, X, Y & Z** on this sketch) times sine of the angle.

3. Example of this would be a distance of 25 ft. (**W, X, Y or Z**) measured along barrel of culvert on a 30° skew. The actual distance used for computing yardage would be 25 X .86603 (Sine of 30°) or 21.65 ft. (A, B, C or D)



Alternate method of computing yardage on culverts by cross section method.

1. Sections taken at right angles to barrel.

2. Areas F & G computed by average elevation method. These areas areas to be drawn to scale along with wings.

3. The distances between sections (A, B, C, & D) by this method will be measured along the centerline or a line parellel with the centerline of the culvert and the sections will be taken perpendicular to this line.

FIELD NOTES - CULVERT OUTLET

Sta. 495+77.05 - Const. 4' x 4' x 151'
R. C. Cul. @ 30° Sk. Rt.

Orig. Grd. Elev. Outlet Lt.

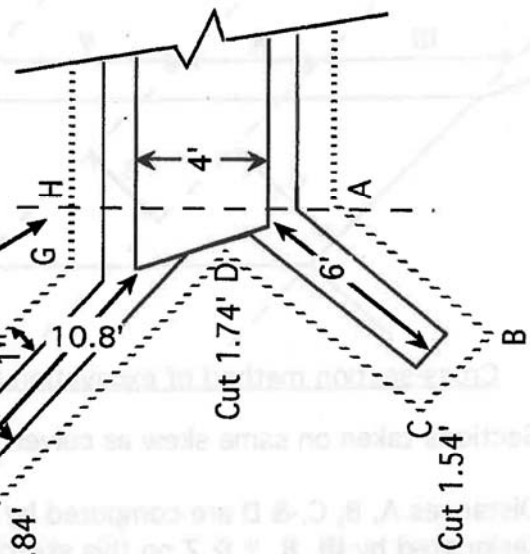
7/23/92 Page No. 14
Fair: 68° - 73°

Drawing No. 18813

Note: Show party personnel, date & weather at the beginning of each days work.

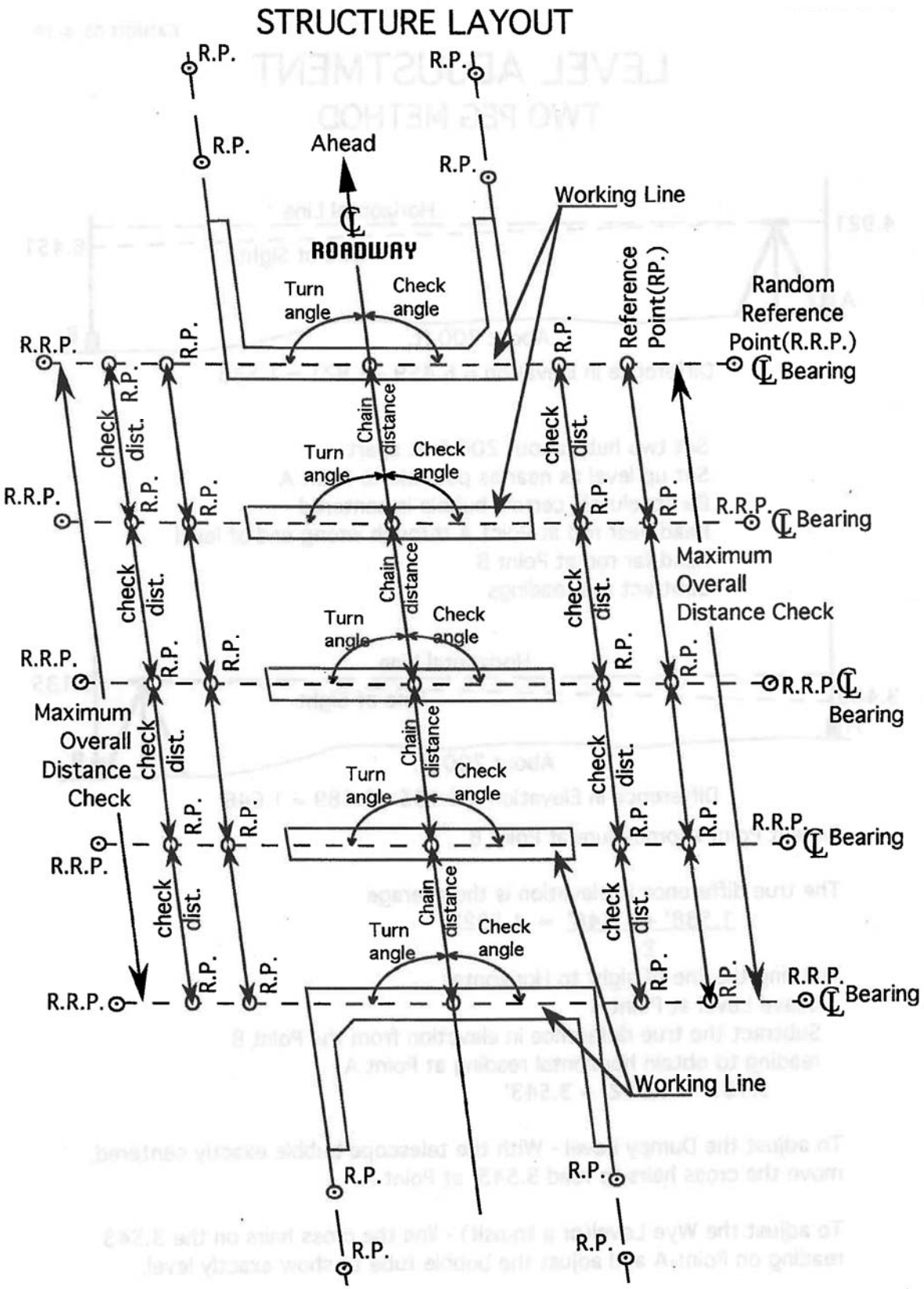
Bugs - Chief
Jones - ⇐
James - ⇒
Gray - Rod

STA.	+	H. I.	-	ELEV.
BM #57	0.91	584.73		583.82
A			12.2	572.5
B			12.6	572.1
C			12.8	571.9
D			12.9	571.8
E			13.1	571.6
F			12.9	571.8
G			12.6	572.1
H			12.5	572.2
I			12.6	572.2
BM #57		584.73	0.90	583.83 583.82

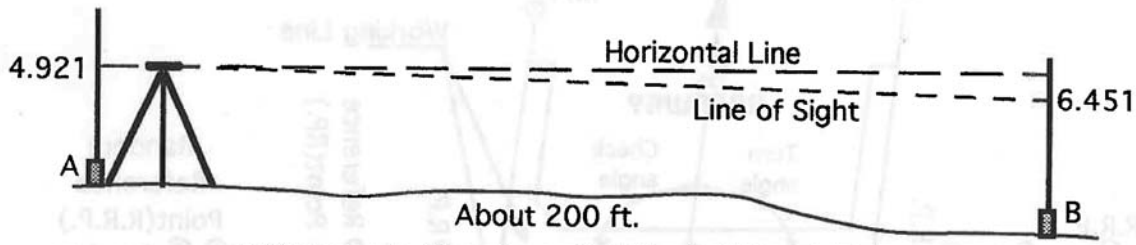


REDUCED C.A.T. 7/25/92
CHK. H.A.M. 7/26/92

NEVER ERASE

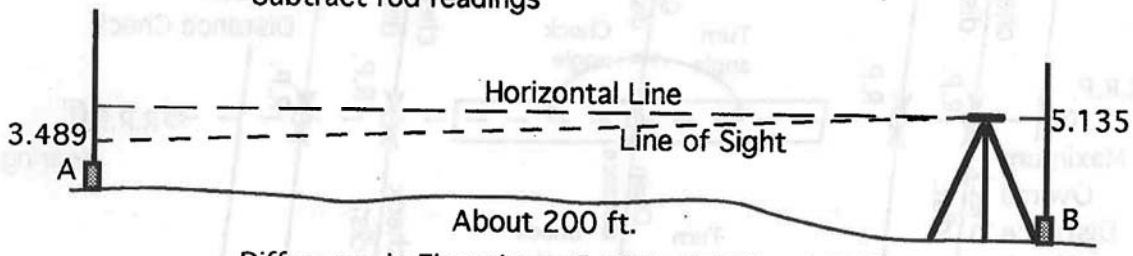

STRUCTURE LAYOUT
R.P.
Ahead
Working Line
ROADWAY
Turn angle
Check angle
Reference Point(RP.)
Random Reference Point(R.R.P.)
R.R.P.
Bearing
check dist.
Chain distance
Maximum Overall Distance Check

LEVEL ADJUSTMENT
TWO PEG METHOD



Difference in Elevation = 6.459 - 4.921 = 1.538

Set two hubs about 200 feet apart
Set up level as near as possible to Point A
Be absolutely certain bubble is centered
Read near rod at Point A through wrong end of level
Read far rod at Point B
Subtract rod readings



Difference in Elevation = 5.135 - 3.489 = 1.646

Repeat Point A procedure at Point B

The true difference in elevation is the average

$$\frac{1.538' + 1.646'}{2} = 1.592'$$

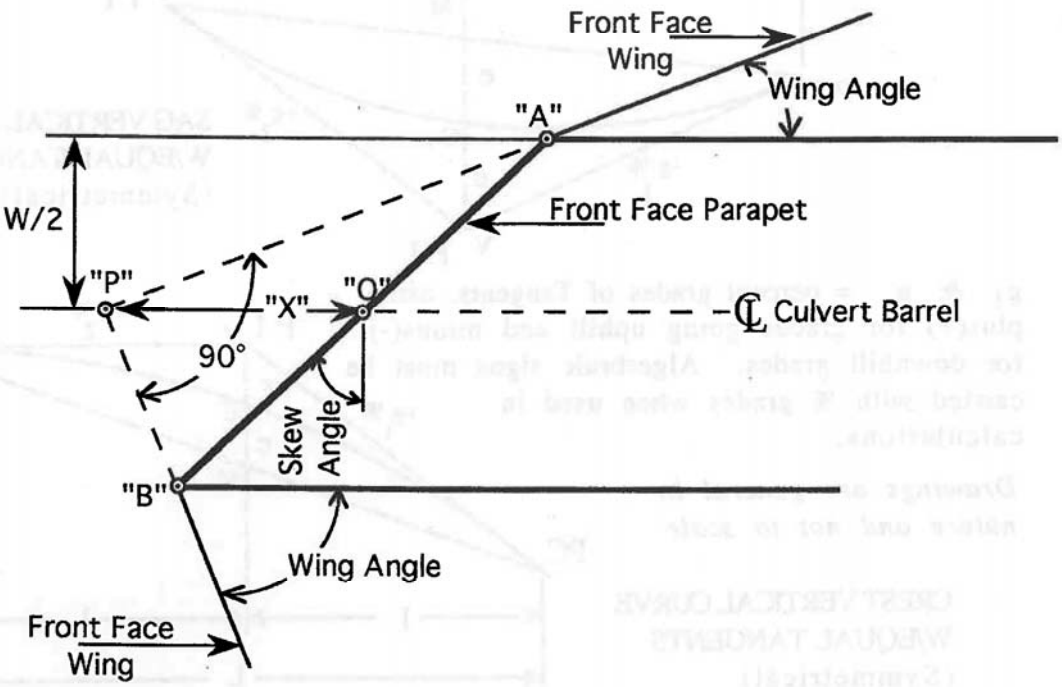
To bring the line of sight to Horizontal:
Leave Level at Point B
Subtract the true difference in elevation from the Point B reading to obtain horizontal reading at Point A
5.135 - 1.592 = 3.543'

To adjust the Dumpy Level - With the telescope bubble exactly centered, move the cross hairs to read 3.543' at Point A.

To adjust the Wye Level(or a transit) - line the cross hairs on the 3.543 reading on Point A and adjust the bubble tube to show exactly level,

STAKING CULVERT WINGS

NOTE: THIS IS A PROCEDURE FOR STAKING CULVERT WINGS WHEN THE WING ANGLES ADD UP TO 90° ONLY.

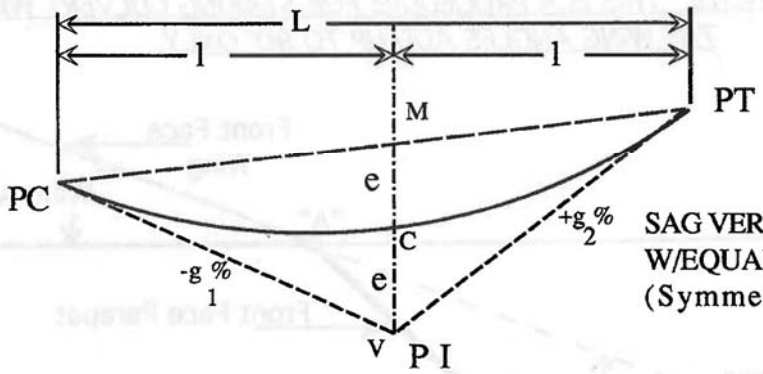


"X" = the distance from the point of intersection of the front face of the parapet and the culvert centerline (point "O") to the projected intersection (point "P") of the wing lines

"X" = (W/2) divided by (Cosine of the Skew Angle)
where "W" = inside width of culvert

Procedure:
(1) Layout points "A", "O", "B", & "P" when staking culvert
(2) Turn wing angles from point "P" and stake wings.
(3) Check - Wing lines must cross points "A" & "B".

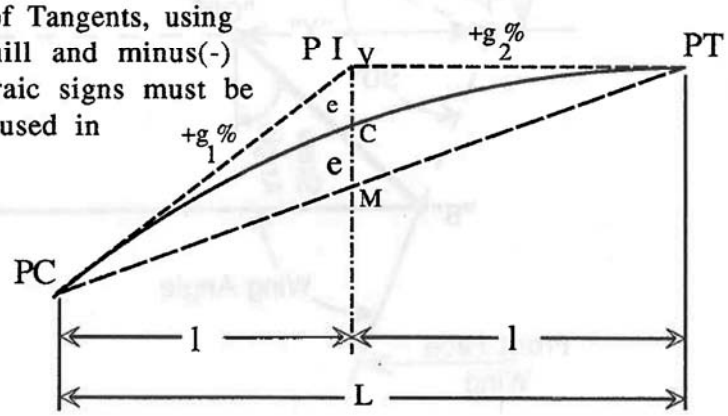
VERTICAL CURVES



SAG VERTICAL CURVE
W/EQUAL TANGENTS
(Symmetrical)

g_1 & g_2 = percent grades of Tangents, using plus(+) for grades going uphill and minus(-) for downhill grades. Algerbraic signs must be carried with % grades when used in calculations.

Drawings are general in nature and not to scale.



CREST VERTICAL CURVE
W/EQUAL TANGENTS
(Symmetrical)

PROPERTIES OF A SYMMETRICAL VERTICAL CURVE

L = Total length of curve in stations: for example, if L = 400', this curve would be shown on plans as "400 V. C."

l = Length of tangent, both tangents are equal for a symmetrical curve.

e = Vertical offset(ft.) from the Vertex(V), called the P I, to the middle of the curve; e = 1/2 the distance from M to V

P.C. & P.T. = Beginning and ending points of a vertical curve, may be called "V.C." on roadway plans with the elevation shown in feet.

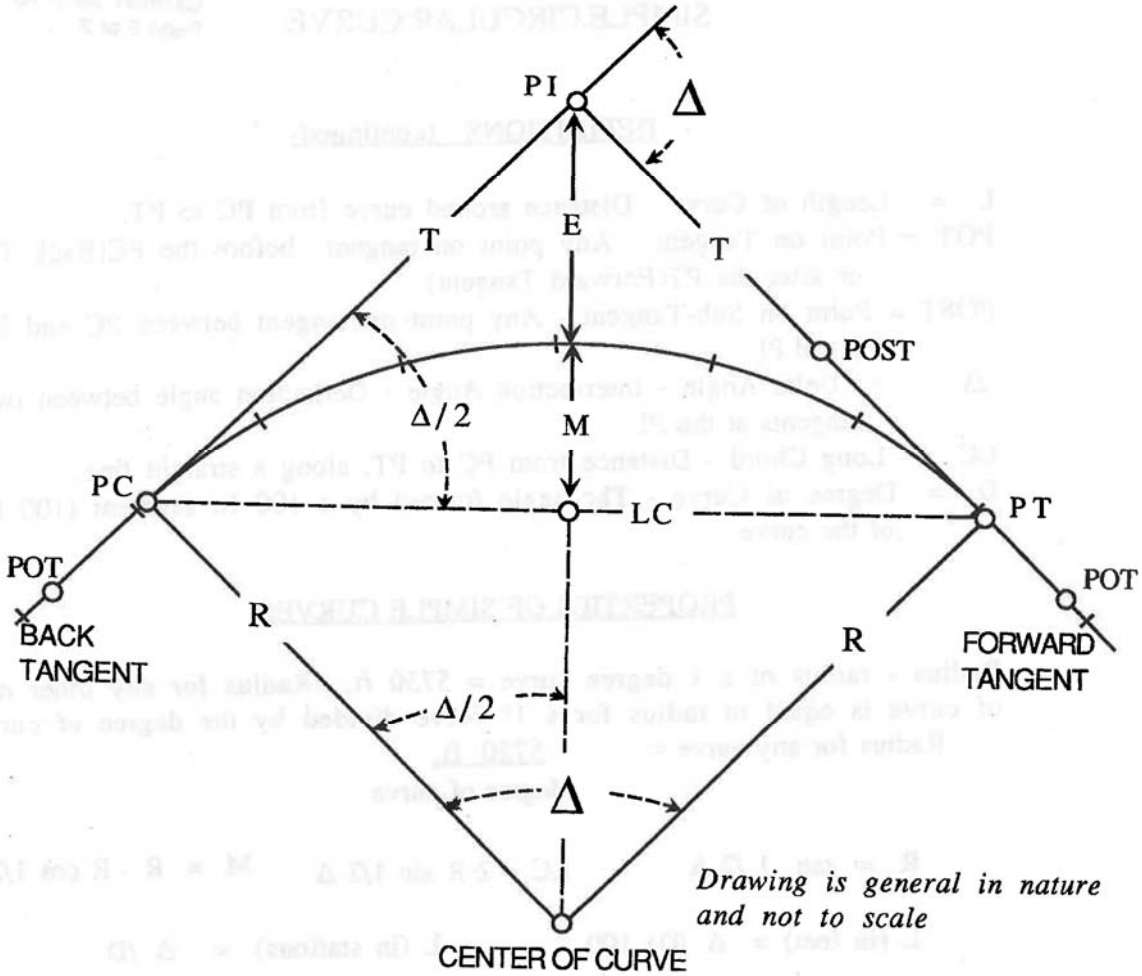
P.I. = Point of intersection of the two straight grades, g_1 & g_2, usually shown on plans as (P.I.) along with a station no. and elevation

e = Difference in elevation between midpoint(C) of the vertical curve and the P.I. = the distance from (C) to (M), the midpoint of a chord from PC to PT

Sight Distance = Visibility on vertical curves is usually designated on plans as "NPSD" for Non-Pasing Sight Distance or as "HLSD" for Headlight Sight Distance, with the distance shown in feet in both cases.

Unsymmetrical Vertical Curve = This is a vertical curve with unequal tangents. It is rarely encountered and is not discussed herein.

SIMPLE CIRCULAR CURVE



DEFINITIONS

Simple Circular Curve - An arc of a circle connecting two tangents differing in direction.

P. I. = Point of Intersection - The point where the Back Tangent and the Forward Tangent intersect.

P. C. = Point of Curvature - Point(station) where Back Tangent ends and curve begins.

P. T. = Point of Tangency - Point(station) where curve ends and Forward Tangent starts.

R = Radius - Radius of the curve

T = Tangent - Distance from PC or PT to P I, in a straight line.

E = External - Distance from Middle of Curve to P I

M = Middle Ordinate - Distance to curve from mid point on L C @ 90°

SIMPLE CIRCULAR CURVE

DEFINITIONS (continued)

L = Length of Curve - Distance around curve from PC to PT.
POT = Point on Tangent - Any point on tangent before the PC(Back Tangent) or after the PT(Forward Tangent)
POST = Point on Sub-Tangent - Any point on tangent between PC and PI or PT and PI
Δ = Delta Angle - Intersection Angle - Deflection angle between two tangents at the PI
LC = Long Chord - Distance from PC to PT, along a straight line.
D = Degree of Curve - The angle formed by a 100 ft. segment (100 ft. arc) of the curve

PROPERTIES OF SIMPLE CURVES

Radius - radius of a 1 degree curve = 5730 ft. Radius for any other degree of curve is equal to radius for a 1° curve divided by the degree of curve.

$$\text{Radius for any curve} = \frac{5730 \text{ ft.}}{\text{degree of curve}}$$

$R = \tan 1/2\,\Delta$ $\quad LC = 2\,R \sin 1/2\,\Delta$ $\quad M = R - R \cos 1/2\,\Delta$

$L \text{ (in feet)} = \Delta / D)\ 100$ $\quad L \text{ (in stations)} = \Delta / D$

$D = 100\,\Delta / L$ $\quad D = 5730/R$ $\quad E = (R/\cos 1/2\,\Delta) - R$

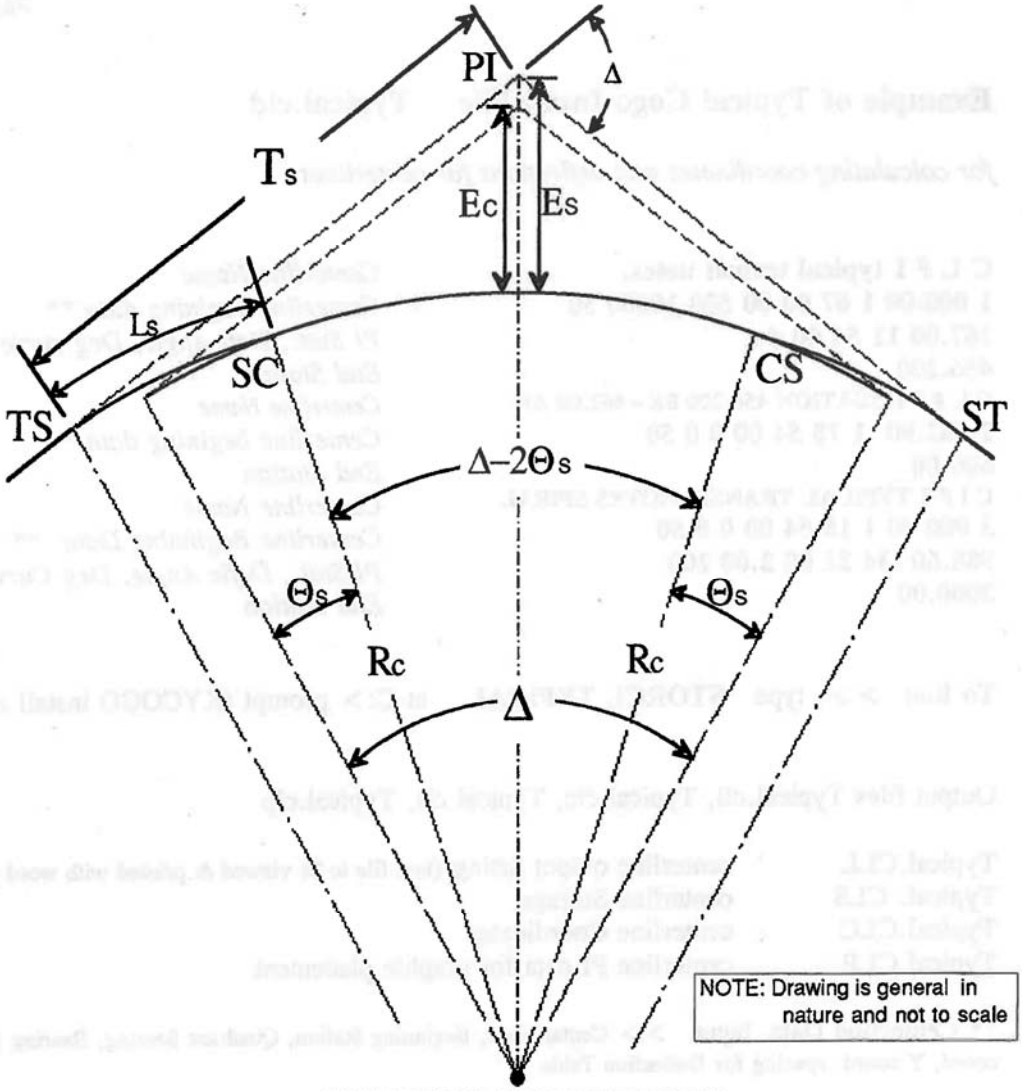
PT Station = PC Station + L $\quad$ PI Station = PC Station + T

Deflection Angle = 1/2 D (for each station of 100 feet)
For a distance of less than 100 ft. on the curve (call it C), calculate the deflection (call it d) as follows:

$$d \text{ (in degrees)} = D/2 \times C/100$$

$$d \text{ (in minutes)} = 0.3\ C\ D$$

SPIRAL CURVE



NOTATIONS AND DEFINITIONS

P. I. ---- Point of intersection of the main tangents
T.S ---- Point of change from tangent to spiral
S.C. ---- Point of change from spiral to circle
C.S. ---- Point of change from circle to spiral
S.T. ---- Point of change from spiral to tangent
R c ---- Radius of the circular curve
L s ---- Length of the spiral curve between T.S. and the S.C.
T s ---- Tangent distance, P.I. to T.S. or S.T.
E s ---- External Distance, P.I. to center of circular curve
Δ —— Intersection angle between main tangents
Θ_S —— Central angle of spiral arc Ls, called spiral angle
D c ---- Degree of circular curve

Example of Typical Cogo Input File Typical.cld

for calculating coordinates and deflections for centerlines

C L # 1 typical transit notes.	*Centerline Name*
1 000.00 1 67 00 00 500 10000 50	*Centerline begining data ***
167.00 11 54 00 4	*PI Stat., Defl Angle, Deg curve or radius*
456.200	*End Station*
C L # 2 EQUATION 456.200 BK=462.90 AH	*Centerline Name*
2 462.90 1 78 54 00 0 0 50	*Centerline begining data ***
600.00	*End Station*
C l # 3 TYPICAL TRANSIT NOTES SPIRAL	*Centerline Name*
3 000.00 1 18 54 00 0 0 50	*Centerline Beginning Data ***
988.60 -34 22 00 2.00 200	*PI Stat., Defle Angle, Deg Curve or radius*
3000.00	*End Station*

To Run >> type **STORCL TYPICAL** at C:> prompt (KYCOGO install and in path)

Output files Typical.cll, Typical.clc, Typical.cls, Typical.clp

Typical.CLL	centerline output listing (text file to be viewed & printed with word processor)
Typical. CLS	centerline Storage
Typical.CLC	centerline Coordinates
Typical.CLP	centerline PI data for graphic placement

** Centerline Data Input >> Centerline #, Beginning Station, Quadrant Bearing, Bearing D M S, X coord, Y coord, spacing for Deflection Table

See Section 17 of the KYCOGO manual for more detailed information on input forms and variables used for input.

Output file Typical.cll (after running STORCL TYPICAL)
vview file Typical.cll with any word processor (DWA, E88 etc)

```
======== STORCL Version Jan-17-1991
=========================================
========  Jul-23-1992   11:59 am

  C L # 1 typical transit notes.
  Centerline No. 1  --  P.I.s defined by Station
-----------------------------------------------------------------------------

  P.O.T.     0+00.0000    N 67^00'00.00" E      500.0000   10000.0000   1

-----------------------------------------------------------------------------

  P.I.       1+67.0000                          653.7243   10065.2521   2

  P.C.       0+17.7130    N 67^00'00.00" E      516.3049   10006.9210   3
  P.T.       3+15.2130    N 78^54'00.00" E      800.2186   10093.9931   4

  M.O.C.     1+66.4630                          655.9991   10057.8346   5
  Rad Pt                                       1075.9860   8688.3949   6

                P.I.  =    1+67.0000
                Delta =  11^54'00.00" Right
                C     =  4^00'00.00"
                T     =    149.2870
                L     =    297.5000
                R     =   1432.3945
                E     =      7.7585

            ------------ Deflection Table ------------

  Instrument at P.C. -- Sta. 0+17.7130
        0+50.0000    0^38'44.67"          32.286     32.286
        1+00.0000    1^38'44.67"          49.997     82.276
        1+50.0000    2^38'44.67"          49.997    132.240
        2+00.0000    3^38'44.67"          49.997    182.164
        2+50.0000    4^38'44.67"          49.997    232.033
        3+00.0000    5^38'44.67"          49.997    281.830
        3+15.2130    5^57'00.00"          15.213    296.966

-----------------------------------------------------------------------------
  P.O.T.     4+56.2000    N 78^54'00.00" E      938.5681   10121.1362   7
```

Note: take coordinates from Station 4+56.200 above and insert as beginning cooridates of Centerline 2 and Rerun STORCL TYPICAL *(this will make the coordinates for centerlines 1 & 2 relative to each other)*

```
======== STORCL Version Jan-17-1991
==========================================
========  Jul-23-1992  11:59 am

C L # 2 EQUATION 456.200 BK = 462.90 AH
Centerline No. 2  --  P.I.s defined by Station

-----------------------------------------------------------------

P.O.T.    4+62.9000   N 78^54'00.00" E      .0000     .0000   8

-----------------------------------------------------------------

P.O.T.    6+00.0000   N 78^54'00.00" E    134.5352   26.3948   9
```

```
==========================================
======== STORCL Version Jan-17-1991
==========================================
========  Jul-23-1992  11:59 am

C l # 3 TYPICAL TRANSIT NOTES SPIRAL
Centerline No. 3  --  P.I.s defined by Station

-----------------------------------------------------------------------

P.O.T.    0+00.0000   N 18^54'00.00" E      .0000      .0000   10

-----------------------------------------------------------------------

P.I.      9+88.6000                   320.2248    935.3000   11

T.S.      0+02.5369   N 18^54'00.00" E      .8218      2.4002   12
S.C.      2+02.5369   N 16^54'00.00" E    63.3959    192.3479   13
C.S.     17+20.8703   N 13^28'00.00" W   108.3501   1692.2993   14
S.T.     19+20.8703   N 15^28'00.00" W    57.2637   1885.6535   15

M.O.C.    9+61.7036                   185.8301    939.3279   16
Rad Pt                            -2677.6731   1025.1483   17

Spiral PI In                          44.0135    128.5529   18
Spiral PI Out                         92.8230   1757.1406   19

          P.I.  =   9+88.6000
          Delta =  34^22'00.00" Left
          C     =   2^00'00.00"
          Ts    =    986.0631
          Ls    =    200.0000
          Lc    =   1518.3333
          Theta =   2^00'00.00"
          L.T.  =    133.3418
          S.T.  =     66.6744
          R     =   2864.7890
          Es    =    134.4550

          x     =    199.9756
          y     =      2.3269
          k     =     99.9959
          p     =       .5818
```

---------- Deflection Table ----------

Instrument at T.S. -- Sta. 0+02.5369

0+50.0000	-0^02'15.16"	359^57'44.84"	47.463	47.463
1+00.0000	-0^09'29.94"	359^50'30.06"	50.000	97.463
1+50.0000	-0^21'44.72"	359^38'15.28"	50.000	147.461
2+00.0000	-0^38'59.48"	359^21'00.52"	50.000	197.453
2+02.5369	-0^39'59.98"	359^20'00.02"	2.537	199.989

Instrument at S.C. -- Sta. 2+02.5369

2+50.0000	-0^28'28.67"	359^31'31.33"	47.463	47.463
3+00.0000	-0^58'28.67"	359^01'31.33"	49.999	97.458
3+50.0000	-1^28'28.67"	358^31'31.33"	49.999	147.447
4+00.0000	-1^58'28.67"	358^01'31.33"	49.999	197.424
4+50.0000	-2^28'28.67"	357^31'31.33"	49.999	247.386
5+00.0000	-2^58'28.67"	357^01'31.33"	49.999	297.329
5+50.0000	-3^28'28.67"	356^31'31.33"	49.999	347.250
6+00.0000	-3^58'28.67"	356^01'31.33"	49.999	397.144
6+50.0000	-4^28'28.67"	355^31'31.33"	49.999	447.008
7+00.0000	-4^58'28.67"	355^01'31.33"	49.999	496.838
7+50.0000	-5^28'28.67"	354^31'31.33"	49.999	546.630
8+00.0000	-5^58'28.67"	354^01'31.33"	49.999	596.381
8+50.0000	-6^28'28.67"	353^31'31.33"	49.999	646.086
9+00.0000	-6^58'28.67"	353^01'31.33"	49.999	695.742
9+50.0000	-7^28'28.67"	352^31'31.33"	49.999	745.345
10+00.0000	-7^58'28.67"	352^01'31.33"	49.999	794.891
10+50.0000	-8^28'28.67"	351^31'31.33"	49.999	844.376
11+00.0000	-8^58'28.67"	351^01'31.33"	49.999	893.798
11+50.0000	-9^28'28.67"	350^31'31.33"	49.999	943.151
12+00.0000	-9^58'28.67"	350^01'31.33"	49.999	992.432
12+50.0000	-10^28'28.67"	349^31'31.33"	49.999	1041.638
13+00.0000	-10^58'28.67"	349^01'31.33"	49.999	1090.765
13+50.0000	-11^28'28.67"	348^31'31.33"	49.999	1139.808
14+00.0000	-11^58'28.67"	348^01'31.33"	49.999	1188.765
14+50.0000	-12^28'28.67"	347^31'31.33"	49.999	1237.631
15+00.0000	-12^58'28.67"	347^01'31.33"	49.999	1286.403
15+50.0000	-13^28'28.67"	346^31'31.33"	49.999	1335.076
16+00.0000	-13^58'28.67"	346^01'31.33"	49.999	1383.649
16+50.0000	-14^28'28.67"	345^31'31.33"	49.999	1432.115
17+00.0000	-14^58'28.67"	345^01'31.33"	49.999	1480.473
17+20.8703	-15^11'00.00"	344^49'00.00"	20.870	1500.625

Instrument at S.T. -- Sta. 19+20.8703

17+20.8703	0^39'59.98"	.000	199.989
17+50.0000	0^29'11.79"	29.130	170.865
18+00.0000	0^14'36.58"	50.000	120.869
18+50.0000	0^05'01.36"	50.000	70.870
19+00.0000	0^00'26.13"	50.000	20.870

P.O.T.	30+00.0000	N 15^28'00.00" W	-230.5161	2925.7034	20

TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.kentucky.gov

Ernie Fletcher
Governor

Bill Nighbert
Secretary

Marc Williams
Commissioner of Highways

Construction Memo No. 03-07

MEMO TO: District Executive Directors
TEBMs for Construction
District Construction Engineer
Resident Engineers

FROM: Greta Smith, P. E.
Director
Division of Construction

DATE: April 24, 2007

SUBJECT: Kentucky Pollution Discharge Elimination System Permit Coverage and Spill Protection Control and Countermeasure Plans

Due to recent communication from FHWA, the KY Division of Water, and US Environmental Protection Agency, the following is provided as a clarification for Spill Protection Control and Countermeasure (SPCC) plans and the Kentucky Pollution Discharge Elimination System (KPDES) KYR 10 permit coverage for all areas disturbed as a result of work that is accomplished for the Kentucky Transportation Cabinet (KYTC).

1) KYTC Division of Construction will continue the policy of obtaining the KPDES Permit for all areas within project right-of-way. Any exception to this policy will be noted in project specific special notes. The Best Management Practices (BMP) bid items are for use on the project within the right-of-way limits.

2) The prime contractor continues to be responsible for obtaining coverage under the KYR 10 KPDES Permit for all areas of disturbance (obtained by the contractor) outside right-of-way limits. Excess material sites obtained by the Cabinet are considered within right-of way limits. This policy applies to all off site areas regardless of size. The contractor shall provide copies of the Notice of Intent (NOI) and letter of coverage from the Kentucky Division of Water as proof of the permitted areas off of right-of-way. Copies of inspection reports (required for compliance with the KPDES permit) will be provided to the Cabinet upon request.

3) The prime contractor for each project is advised that when petroleum products (fuel, oil, etc.) in quantities that exceed 1,320 gallons are managed in conjunction with the project site, a SPCC plan must be prepared in accordance with the Oil Pollution Prevention and Control Act and the Clean Water Act. The threshold volume is determined by adding the capacity of all containers that hold petroleum products with a capacity of 55 gallons or more. This requirement applies to all contracts, not just those with a KPDES permit. The contractor is required to supply a copy of the plan for the project or an affidavit stating the SPCC plan is not applicable pursuant to the requirements of 40CFR 112.

4) The contractor is fully responsible for compliance with the SPCC and KPDES permit requirements. In accordance with the Standard Specifications, Section 107.14, 'the Contractor shall save harmless the Commonwealth, the Department and all of its officers, agents, and employees from all suits, actions or claims that may result from the contractors failure to comply with these requirements.'

5) Final closure of the project will not occur until all disturbed areas that are caused by project activities are stabilized and a notice of termination (NOT) has been filed with the Division of Water. The Contractor is responsible for filing the NOT for all permitted areas off of right-of-way. A copy of the NOT will be provided to the KYTC prior to issuance of final acceptance.

The requirements detailed in this memorandum are not a change to policy or standard specifications pertaining to existing projects. The KYTC has been advised to obtain evidence that contractors are complying with existing federal law, specifically, the Clean Water Act and the Oil Pollution Prevention Act.

If you have any questions regarding these procedures please contact this office.

c.	Marcelyn Mathews	Jim Rummage	Steve Waddle
	Wesley Glass	Chuck Knowles	Nancy Albright
	Ray Polly	David Kratt	Duane Thomas
	C. O. Engineers	FHWA	KAHC

TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.kentucky.gov

Ernie Fletcher
Governor

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Acting Secretary

Marc Williams
Commissioner of Highways

Construction Memo: 02-06

Memo To: Chief District Engineers
TEBM's for Construction
District Construction Engineers
Resident Engineers
Highway Contractors

From: Dexter Newman, P.E., Director

Date: February 06, 2006

Subject: Standard Specification Section 213.03.03
KPDES BMP Inspection and Maintenance

Currently, this section requires inspection of the erosion control devices weekly and after each 0.1 inch rainfall event. This specification has been modified to require inspection of erosion control devices weekly and after each 0.5 inch rainfall event. The remainder of this provision remains unchanged.

With this change is a reminder to use Form TC 63-61 Erosion Control Inspection Report/Update to document all inspections performed for the project. Also, form TC 63-60 is to be used for certification by the contractor and resident engineer concerning the storm water best management practices plan. This form and the initial storm water BMP plan that reflects the erosion controls to be used at the beginning of the project are to be completed prior to the initiation of construction. Erosion controls called for by the BMP plan for the initial phase of construction are to be in place before earth disturbing work commences. An electronic version of these forms is available on the web at:

http://transportation.ky.gov/construction/forms/

We have been doing much better on establishing erosion control on the project in recent years. However, we are not documenting our efforts. Please scan the above forms when completed and e-mail them to Stephen Bowling and Shelby Jett, who need them for documentation purposes. Also, please do the same for the weekly erosion inspections. From the regulatory agency's viewpoint, if the erosion control efforts are not documented, they never happened.

In the fall of 2006, there will be an effectiveness review of our erosion control processes in regards to storm water management. The documentation requested by this memo will be a part of that review.

DN/mgf

KPDES KYR10 Permit

This notebook contains the documentation used by KYTC inspectors for compliance relating to the KPDES KYR10 general permit for construction. The sections in this notebook are:

- Permit - KPDES Permit
- NOI - Notice of Intent
- BMP Plan - Best Management Practices Plan
- 401/404 - Clean Water Act Section 401/404 certification/permit
- EPSC - Erosion Prevention and Sediment Control Plan Sheets
- Contract - Contract information relating to the KPDES permit
- DWRs - Daily Work Reports
- Inspections - Project inspections for KPDES Permit BMP Plan compliance.
- SPCC – A copy of the contractors Spill Prevention Control and Countermeasure plan if there is one.
- Correspondence

The KPDES KYR10 permit is used by KYTC for compliance with the Federal Clean Water Act as it pertains to permitted discharge of storm water from highway construction activities.

Records retention – The documents that relate to the KPDES permit and its compliance are to be retained for a period of three years or a period of one year after the Notice of Termination has been submitted to the Division of Water.

KPDES

STORM WATER GENERAL PERMIT

PERMIT NO.: KYR10

GENERAL KPDES PERMIT FOR STORM WATER POINT SOURCE DISCHARGES

CONSTRUCTION ACTIVITIES

In compliance with the provisions of the Kentucky Revised Statutes Chapter 224 and pursuant to 401 KAR 5:055, Section 5, the following discharges are authorized:

All new and existing storm water discharges associated with construction activity that are required to have a permit pursuant to 401 KAR 5:055, Section 1 and KRS 224.16-050.

Specifically excluded from authorization under this permit are operations that:

1. Are subject to an existing individual KPDES permit or application,
2. Are subject to a promulgated storm water effluent guideline or standard,
3. The Director has determined to be or may reasonably be expected to be contributing to a violation of a water quality standard or to the impairment of a 303(d) listed water, or
4. Are into a surface water that has been classified as an Exceptional or Outstanding or National Resource Water.

The receiving water for any discharge authorized by this permit is located within the political boundaries of the Commonwealth of Kentucky. Such authorization is in accordance with the effluent limitations and other conditions set forth in PARTS I, II, III, and IV hereof. This permit consists of this cover sheet, PART I 1 page, PART II 1 page, PART III 1 page, and PART IV 4 pages.

This permit shall become effective on October 1, 2002.

This permit and the authorization to discharge shall expire at midnight, September 30, 2007.

9/13/02
Date Signed

Jeffrey W. Pratt, Director
Division of Water

Robert W. Logan
Commissioner

DEPARTMENT FOR ENVIRONMENTAL PROTECTION
Division of Water, Frankfort Office Park, 14 Reilly Road
Frankfort, Kentucky 40601
Printed on Recycled Paper

A. Effluent Limitations and Monitoring Requirements

No monitoring is required.

B. Schedule of Compliance

The permittee shall achieve compliance with all requirements upon notification of coverage under this general permit.

STANDARD CONDITIONS FOR KPDES PERMIT

The permittee is also advised that all KPDES permit conditions in KPDES Regulation 401 KAR 5:065, Section 1 will apply to all discharges authorized by this permit.

This permit has been issued under the provisions of KRS Chapter 224 and regulations promulgated pursuant thereto. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any other permits or licenses required by this Cabinet and other state, federal, and local agencies.

PART III

OTHER REQUIREMENTS

A. Retention of Records:

The permittee shall keep the Best Management Practices (BMP) plan developed in accordance with PART IV of this permit one (1) year after coverage under this permit ends. This period may be extended by request of the Director at any time.

B. Reopener Clause:

This permit shall be modified, or alternatively revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under 401 KAR 5:050 through 5:080 and KRS 224 if the effluent standard or limitation so issued or approved:

1. Contains different conditions or is otherwise more stringent than any effluent limitation in this permit; or

2. Controls any pollutant not limited in this permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements of KRS Chapter 224 when applicable.

C. Other Discharges:

All discharges covered by this permit shall be composed entirely of storm water except for discharges from fire fighting activities, fire hydrant flushing, potable water sources, waterline flushing, irrigation or lawn watering, detergent free building or pavement washing where spills or leaks of toxic materials have not occurred or have been completely removed, air conditioning condensation, natural springs, and uncontaminated ground water sources.

This permit can only authorize storm water discharges from construction activity that are mixed with storm water discharges from other industrial activity, including dedicated asphalt and concrete plants, if the other industrial activity discharge is in compliance with a different KPDES permit.

D. Releases in Excess of Reportable Quantities:

The presence of hazardous substances or oil in the storm water discharge shall be minimized in accordance with the BMP plan. Coverage under this permit does not relieve the permittee of the reporting requirements of 40 CFR Part 117 and 40 CFR Part 302.

PART IV

BEST MANAGEMENT PRACTICES

A storm water Best Management Practices (BMP) plan shall be developed in accordance with good engineering practices for each site covered by this permit. The BMP plan shall identify potential sources of pollution that may reasonably be expected to affect the quality of storm water discharges from the site. The BMP plan shall describe and ensure the implementation of practices that are to be used to reduce the pollutants in storm water discharges and to assure compliance with the terms and conditions of this permit. Facilities must implement the BMP plan required by this PART as a condition of this permit.

The BMP plan shall:

1. Be completed before submittal of the NOI for coverage under this permit.

2. Be implemented beginning with the initiation of construction activities.

Signature and Plan Review:

The BMP plan shall be signed in accordance with PART II and shall be kept onsite.

The permittee shall make the BMP plan available upon request to the Director, to a state or local agency approving sediment, erosion, grading or storm water management plans, or in the case of a storm water discharge to a MS4 with a KPDES permit, to the operator of the system.

After a review, the permittee may be notified that the BMP plan does not meet the minimum requirements of this PART. In that case, the permittee shall modify the BMP plan within seven (7) days of notification and shall submit a written certification that the requested changes have been made.

BMP plans required by this permit are considered reports that shall be made available to the public, upon written request by the public, in accordance with Section 308(b) of the Clean Water Act (CWA). However, the permittee may claim any portion of the BMP plan as confidential, in accordance with 40 CFR Part 2.

Plan Modification:

The permittee shall modify the BMP plan when there is a change in design, construction, operation, or maintenance of the site which has a significant effect on the potential for the discharge of pollutants to waters of the Commonwealth and shall implement the changes within seven (7) days.

Modification for Ineffectiveness:

The permittee shall amend the BMP plan if it proves to be ineffective in controlling the discharge of pollutants to waters of the Commonwealth and shall implement the changes within seven (7) days.

Minimum Requirements:

The BMP plan shall include, as a minimum, Items A through H.

A. Site Description:

The BMP plan shall include a clear description of the nature of the construction activity, the order of major soil disturbing activities, estimates of the total project area and the total disturbed area, the post construction runoff coefficient, any existing data describing soil condition or discharge quality, receiving water name, and a site map. The site map shall indicate drainage patterns and show approximate slopes after grading, areas of disturbance, the location of control measures, surface waters or wetlands, and storm water discharge locations.

B. Sediment and Erosion Control Measures:

The BMP plan shall include a clear description of what sediment and erosion control measures will be used and when they will be implemented. (For example, perimeter controls for one (1) portion of the site will be installed after the necessary clearing and grubbing, but before clearing and grubbing the remaining portions of the site. Perimeter controls will be actively maintained until upward portions of the site are stabilized). The following control measures shall be used as a minimum.

1. Soil Stabilization Practices - Existing vegetation shall be preserved where possible. All disturbed areas of the site shall be stabilized. Stabilization shall begin within 14 days on areas of the site where construction activities have permanently or temporarily (for 21 days or more) ceased. When snow cover causes delays, stabilization shall begin as soon as possible.

   Stabilization practices include seeding, mulching, placing sod, planting trees or shrubs, and using geotextile fabrics and other appropriate measures.

2. Perimeter Structural Practices - Silt fences or other equivalent structural practices shall be used on all side and down slope borders of the site. Alternatively, a sediment basin shall be used that provides 3,600 cubic feet of storage capacity per disturbed acre drained. For common drainage locations that serve more than ten (10) disturbed acres at one time, a sediment basin must be used if possible.

   Structural practices include protecting drain inlets and outlets and using silt fences, earthen dikes, drainage swales, sediment traps, check dams, subsurface drains, pipe slope drains, reinforced soil retaining systems, gabions, sediment basins and other appropriate measures. The installation of these devices may be subject to Section 404 of the CWA.

3. Storm Water Management Devices - Management devices shall be installed during construction to control the pollutants in storm water discharges that will occur after construction has been completed. Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel as necessary to provide a non-erosive flow so that the original physical and biological characteristics and functions of the receiving waters, such as the hydroperiod and hydrodynamics, are maintained and protected. When considering storm water management devices, the goal should be 80% removal of Total Suspended Solids that exceed predevelopment levels. If this goal is not met, the permittee shall provide justification for refusing each device based on site conditions.

Management devices include velocity dissipation devices, storm water retention and detention basins, wet ponds, vegetated swales and natural depressions used for flow reduction, runoff infiltration devices, sequential systems that combine several devices and other appropriate measures. The installation of these devices may be subject to Section 404 of the CWA.

The permittee is not responsible for the maintenance of these devices once discharges associated with construction activity have been eliminated.

C. Other Control Measures:

No solid materials, including building materials, shall be discharged to waters of the Commonwealth, except as authorized by a Section 404 permit.

Off-site vehicle sediment tracking and dust generation shall be minimized.

Waste disposal methods and sanitary sewer or septic systems shall comply with applicable state or local regulations.

D. Other State or Local Plans:

The BMP plan shall include any requirements specified in sediment and erosion control plans, storm water management plans or permits that have been approved by other state or local officials. Upon submittal of the NOI, other requirements for surface water protection are incorporated by reference into and are enforceable under this permit (even if they are not specifically included in the BMP plan required by this permit). This provision does not apply to master or comprehensive plans, non-enforceable guidelines or technical guidance documents that are not identified in a specific plan or permit issued for the construction site by state or local officials.

E. Maintenance:

The BMP plan shall include a clear description of the maintenance procedures necessary to keep the control measures in good and effective operating condition.

F. Inspections:

Qualified personnel shall inspect all storm water control measures, discharge locations, vehicle exits, disturbed areas of the construction site and material storage areas at least once every seven (7) days (and within 24 hours of the end of a storm that is 0.5 inches or greater) and areas that have been temporarily or finally stabilized at least once a month. Revisions to the BMP plan based on the results of the inspection shall be implemented within seven (7) days.

Control measures shall be inspected to ensure correct operation. Accessible discharge locations shall be inspected to ensure that velocity dissipation devices are effective in preventing significant impacts to receiving waters. Vehicle exits shall be inspected for evidence of, or the potential for, off-site sediment tracking. Disturbed areas and material storage areas that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system.

A report summarizing the scope of the inspection, names and qualifications of personnel making the inspection, the date of the inspection, major observations relating to the implementation of the BMP plan, and any corrective actions taken shall be made and kept as part of the BMP plan for at least three (3) years after the date of inspection, or until one (1) year after coverage under this permit ends. The report shall be signed in accordance with Part II of this permit.

G. Non-Storm Water Discharges:

The BMP plan shall identify and ensure the implementation of appropriate pollution prevention measures for any non-storm water component of a discharge as listed in PART III C, except for flows from fire fighting activities.

H. Contractors and Subcontractors:

The BMP plan shall clearly state the contractor or subcontractors that will implement each control measure identified in the BMP plan. All contractors and subcontractors identified in the BMP plan must sign a copy of the certification statement below in accordance with PART II of this permit before conducting any professional service at the site:

> "I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification."

The certification must include the name and title of the person providing the signature, the name, address, and telephone number of the contracted firm, the address, or other identifying description of the site and the date the certification is made. All certification statements must be included in the BMP plan.

JAMES E. BICKFORD
SECRETARY

PAUL E. PATTON
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
FRANKFORT OFFICE PARK
14 REILLY RD
FRANKFORT KY 40601

FACT SHEET

GENERAL KPDES PERMIT FOR STORM WATER POINT SOURCE DISCHARGES

CONSTRUCTION ACTIVITIES

KPDES No.: KYR10
Date: July 22, 2002

1. COVERAGE UNDER THIS GENERAL PERMIT

Area of Coverage:

This permit covers all areas of the Commonwealth of Kentucky.

Discharges Eligible for Coverage:

This permit covers all new and existing storm water discharges associated with construction activity. Only construction activities that disturb five (5) acres or more are required to have coverage under this permit. Beginning in March 2003, construction activities that disturb one (1) acre or more are also required to have coverage under this permit.

Limitations on Coverage:

This permit does not authorize discharges that:

1. Are subject to an existing individual KPDES permit or application,
2. Are subject to a promulgated storm water effluent guideline or standard,
3. The Director has determined to be or may reasonably be expected to be contributing to a violation of a water quality standard or to the impairment of a 303(d) listed water, or
4. Are into a surface water that has been classified as an Exceptional or Outstanding or National Resource Water.

2. REQUIREMENTS FOR GENERAL PERMIT COVERAGE

Notice of Intent:

A signed copy of a Notice of Intent (NOI) form must be submitted to the following address 48 hours before construction activity begins:

Kentucky Division of Water
KPDES Branch
Inventory and Data Management Section
14 Reilly Road
Frankfort, Kentucky 40601

vb

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Unless notified by the Director to the contrary, owners or operators who submit the above notification are authorized to discharge storm water associated with construction activity under the terms and conditions of this permit. Discharge may begin 48 hours after the NOI is postmarked, even if the permittee has not yet received a copy of the general permit from the Division of Water.

Notice of Termination:

When all storm water discharges associated with construction activity are eliminated and the site has been finally stabilized, the owner or operator must submit a signed copy of a Notice of Termination (NOT) form in order to end coverage under this general permit and nullify its requirements. NOTs are to be sent to the above address.

Change of Ownership:

When the owner or operator of a site covered by this permit changes, the new owner or operator must submit a notice 48 hours before the change in order to transfer coverage under this general permit. Change of ownership notices are to be sent to the above address.

3. ADDITIONAL INFORMATION

Municipal Notification:

Sites which discharge storm water associated with construction activity to a municipal separate storm sewer system (MS4) shall submit a signed copy of the NOI to the operator of the MS4 48 hours before construction activity begins.

Other Storm Water Discharges:

Storm water discharges authorized by this permit may be combined with other sources of storm water that are not associated with construction activity if the resulting discharge is in compliance with this permit.

4. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

No monitoring is required.

5. JUSTIFICATION OF PERMIT CONDITIONS

The following regulations are pursuant to KRS 224.10-100, 224.70-100, and 224.70-110.

Best Management Practices:

This requirement is consistent with 401 KAR 5:065, Section 2(10).

Antidegradation:

The conditions of 401 KAR 5:029, Section 1(1) will be satisfied by coverage under this permit. A review under Section 1(2), (3), and (4) will not be applicable.

6. COMPLIANCE SCHEDULE

The permittee shall achieve compliance with all requirements upon notification of coverage under this general permit.

7. PERMIT DURATION

This permit is valid for five (5) years. Upon issuance of a new general permit, the permittee will have coverage automatically renewed. A new NOI or other notification is not necessary.

8. PERMIT INFORMATION

The application, draft permit, fact sheet, public notice, comments received, and additional information is available from the Division of Water at 14 Reilly Road, Frankfort Office Park, Frankfort, Kentucky 40601.

9. REFERENCES AND CITED DOCUMENTS

All material and documents referenced or cited in this fact sheet are part of the permit information as described above and are readily available at the Division of Water Central Office. Information regarding these materials may be obtained from the person listed below.

10. CONTACT

Additional information concerning this permit may be obtained from Ronnie Thompson at the address noted in Item 8 or at (502) 564-2225, extension 423.

11. PUBLIC NOTICE INFORMATION

Please refer to the attached Final Permit Decision Cover Letter or Public Notice for details regarding the procedures for a final permit decision, deadline for comments, and other information required by 401 KAR 5:075, Sections 12 and 4(2)(e).

Notice of Intent and Notice of Termination (NOI / NOT)

These document are required by the KPDES KYR10 permit.

The permit becomes effective 48 hours from the time the NOI is submitted to the Division of Water. The Division of Water interprets this to mean the date it is received by them. Inspections are to be performed continuously (on a weekly, monthly and after ½ inch rain events) from the time of submission of the NOI until the NOT is filed.

This section will contain:

- Notice of Intent (NOI) as signed and transmitted to the Division of Water
  - The Notice of Intent (NOI) any time after letting. Following the transmittal of the NOI, an inspection should be performed documenting the status of the project. This inspection should occur within one week of transmittal of the NOI (See the Inspection tab for further guidance).
- The letter of transmittal for the Notice of Intent to the Division of Water:
  - This transmittal letter is to be signed by the Chief District Engineer.
  - This letter of transmittal is to include a statement that delegates responsibility for signing reports to the resident engineer in charge of the project. Include how to contact the resident engineer in this statement.
  - Use a method for delivering this letter that confirms the date the Division of Water receives the NOI.
  - Send a copy of the transmittal letter and NOI to the Division of Construction and the Division of Environmental Analysis.
  - The notice of intent is to be copied to the local MS4 agency when the project is inside of the MS4 jurisdiction (city limit and/or county). The letter of transmittal to the Division of Water should indicate sending a copy to the local MS4 agency. Check with the District MS4 coordinator if you have questions.
- A copy of the receipt showing the date the Division of Water received the NOI is to be placed in this section of the folder.
  - Enter the date that the NOI received by the Division of Water in Site Manager
- The letter of Coverage from the Division of Water.
  - Enter the date of this letter and permit number in site manager.
- A notice of termination is to be prepared at the time the project is stabilized and formaled. The NOT is to be signed by the Chief District Engineer and sent to the Division of Water.
  - Use a method delivering this letter that confirms the date the Division of Water receives the NOT.
  - Enter the date NOT is submitted into site manager.

Section I – General Information

Contact List:

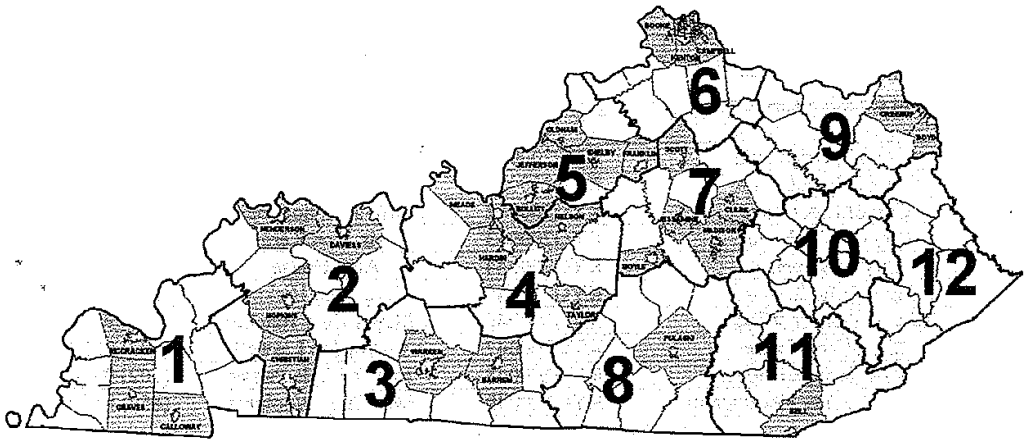
Kentucky Transportation Cabinet
Office of Project Development
Division of Environmental Analysis
200 Mero Street, W5-22
Frankfort, Kentucky 40622

Director – David Waldner .....(502) 562-7250
KYTC Statewide sMS4 Coordinator – Shelby Jett.....(502) 562-7250

District Phase II Coordinators
District 1 – Paducah: Allen Thomas .....(270) 898-2431
District 2 – Madisonville: Charlotte Cotten.....(270) 824-7080
District 3 – Bowling Green: Renée Slaughter.....(270) 746-7898
District 4 –Elizabethtown: Kevin Young.....(270) 766-5066
District 5 –Louisville: Jeff Schaeffer.....(502) 367-6411
District 6 – Covington: Mike Bezold.....(859) 341-2700
District 7 – Lexington: Phil Logsdon .....(859) 246-2355
District 8 – Somerset: Tom Clouse.....(606) 677-4017
District 9 – Flemingsburg: Deanna Harris.....(606) 845-2551
District 10 - Jackson: Jeff Allen .....(606) 666-8841
District 11 – Manchester: Dean Croft.....(606) 598-2145
District 12 - Pikeville: Frank Castle .....(606) 433-7791

Kentucky Division of Water
KPDES Branch
14 Reilly Road
Frankfort Ky 40601

(502) 564-3410



Partner Entity Table:

Community / Entity	Permit No.	Official Contact	Telephone
City of Radcliff	KYG2000001	Mr. Harold Brown	(270) 351-8150
City of Ashland	KYG2000002	Mr. Marion Russell	(606) 327-2007
Hardin County Fiscal Court	KYG2000003	Vicki Brackett	(270) 765-2350
City of West Point	KYG2000004	Mr. Jon Baldridge	(502) 922-4260
Oldham County Fiscal Court	KYG2000005	Ms. Beth Stuber	(502) 222-1476
City of Richmond	KYG2000006	Mr. Mike Roberts	(859) 623-1000
Sanitation District No.1-No. KY	KYG2000007	Mr. Sean Blake Ms. Sara Zeph Mr. Jim Gibson Ms. Jamie Eggemeyer	(859) 578-7468 (859) 578-6744 (859) 578-6882 (859) 578-6764
City of Hillview	KYG200008	Mr. James Eadens	(502) 957-5280
City of Hopkinsville	KYG200009	Mr. J. D. Longenfelder	(270) 887-4285
City of Mt.Washington	KYG200010	Mr. Joseph Fick	(502) 538-4216
City of Murray	KYG200011	Mr. James Oakley	(270) 762-0330
City of Glasgow	KYG200012	Mr. Jack Chadwell	(270) 651-5977
City of Florence	KYG200013	Mr. Eric Hall	(859) 647-5416
City of Danville	KYG200014	Mr. John Bowling	(859) 238-1200
City of Campbellsville	KYG200015	Ms. Suzie Bradley	(270) 469-3966
City of Mayfield	KYG200016	Mr. Brad Rogers	(270) 247-1981
Christian County Fiscal Court	KYG200017	Mr. Chris Sutton Mr. Craig Morris	(270) 886-9484 (270) 886-9484
City of Owensboro	KYG200018	Mr. Joseph Schepers	(270) 687-8641
City of Henderson	KYG200019 #	Mr. John Baker	(270) 826-2824
City of Bowling Green	KYG200020	Mr. Tim Slattery	(270) 393-3099
City of Paducah	KYG200021	Mr. Rick Murphy	(270) 444-8511
City of Madisonville	KYG200022	Ms. Julie Perry Mr. William Jackson	(270) 824-2120 (270) 824-2120
City of Shelbyville	KYG200023	Mr. W. H. Brown	(502) 633-4754
City of Hebron Estates	KYG200024	Mayor Jerry Clark	(502) 957-3106
Greenup County Fiscal Court	KYG200025	Judge Robert Carpenter	(606) 473-6440
City of Greenup	KYG200026	Mayor Donna Hewlett	(606) 473-7331
City of Muldraugh	KYG200033	Mr. Anthony Lee	(502) 942-2824
City of Frankfort	KYG200034	Mr. Eric Brooker	(502) 352-2087
City of Elizabethtown	KYG200035	Mr. Robert Bush	(270) 765-6121
City of Shepherdsville	KYG200036	Mayor Joseph Sohm	(502) 955-7803
City of Bardstown	KYG200037	Mr. George Greenwell	(502) 348-5947
City of Vine Grove	KYG200038	Mayor Gary Minter	(270) 877-2422
Bullitt County Fiscal Court	KYG200039	Deputy Judge Executive Robert Flaherty	(502) 543-2262
City of Georgetown	KYG200040	Mr. Ray Caywood	(502) 867-2000
City of Nicholasville	KYG200041	Mr. Gary Goldey	(859) 885-1321
City of Oak Grove	KYG200042	Mr. Josh Sommer	(270) 439 5979
City of Winchester	KYG200043	Mr. Ken Kerns	(859) 744-2821
City of Somerset	KYG200044	Alex Godsey	(606) 679-6366
City of Middlesboro	KYG200045	Mayor Ben Hickman	(606) 248-5670
City of Pioneer Village	KYG200046	Mayor Gary Hatcher	(502) 957-3800
City of Fox Chase	KYG200047	Mayor Joe Laswell	(502) 955-9593
City of Hunters Hollow	KYG200048	Mayor Linda Parker	(502) 957-4205
Jessamine County Fiscal Court	KYG200049	Ms. Kelly Woolums	(859) 885-4500

(# Has not co-permitted with KYTC)

The KPDES BMP Plan for the project

- The BMP Plan as signed by all parties:
  - Resident Engineer
  - Contractor
  - Sub Contractors that have any responsibility for implementing the BMP Plan.

401/404 Permit

US Army corps of Engineers Section 404 permit.

- Include a copy of the US Army Corps of engineers permit for this project, if any.
- Include a copy of the Division of Water 401 water quality certification letter, if any.

EPSC Plan Sheets

- These plan sheets will show areas within the right of way that are covered by the subject permit. Information on these plans includes:
  - Potential areas of the project that may be disturbed. These areas will be annotated as Disturbed Drainage Areas (DDAs)
  - The point discharge locations.
  - The area draining to each point discharge.
  - Areas where storm water run off leaves the project by sheet flow.
  - Site specific solutions proposed by the design engineer.

Contract

This section will contain information extracted from the contract documents that are specific to this project:

- Contract bid items for Best Management Practices (BMPs)
- Special Notes/supplemental specifications relating to erosion prevention and sediment control or the KPDES permit.
- The CAP
- Pre-construction meeting notes relating to the KPDES permit.

Daily Work Reports (DWRs)

The DWRs will be maintained in Site Manager. This tabbed section is for use by the resident to provide a place to put the DWRs that relate to requests for information about the KPDES permit or compliance issues.

Kentucky Transportation Cabinet
Highway Construction
KPDES Stormwater Discharge Inspection Guide

1. General
BMPs are installed and maintained per BMP Plan.
Construction entrances are installed at all points of site access.
Sensitive features are identified and protected.

2. Inspection Sequence
When approaching site, give an overall assessment of the site. Do the BMPs generally appear to be functional?
When entering site, assess whether sediment is in the street.
Start at the outlet of each drainage area.
Has any sediment left the site at the outlet?
If yes, how much was there and how far did it travel. If the outlet protection is the cause, then note that corrections are needed. If not, then move up the drainage area to determine the cause.
If no sediment left the site, travel up the drainage area to the next BMP to check its integrity.
Keep moving up the drainage area checking the integrity of each BMP.
Check for stabilization of previously disturbed areas.
Check for land disturbance and BMPs in newly disturbed areas.

3. Construction Entrances
Stone is adequately clean to effectively remove mud from vehicle tires.
Installed 2" or larger stone, 6-inch minimum depth laid on a geotextile fabric.
Minimum length is 50 feet; minimum width is 14 feet (one way traffic) or 24 feet (two-way traffic).

4. Temporary Diversions
Berm is stabilized.
Side slopes are no more than 2H:1V.

5. Topsoil Stockpiling/Excess Material Management on Right of Way
Do not place on roadway or pavement or in floodplains or channels.
Need sediment barrier.
Need stabilization if stockpile is idle for more than 14 days.
Areas off Right of Way are covered by a contractor obtained KPDES permit.

6. Vegetated Buffers
Areas that need to remain vegetated for buffer zones have been identified.
Buffers are not to be mowed or sprayed.

7. Stabilized Areas
Areas where finish grade has been complete for 14 days or where operations have ceased for 21 days are to be stabilized by:
Temporary mulch is to be applied with a thickness of two inches of coverage and tacked.
Seed and protect per seeding plan, sodding, erosion blanket , chemical stabilization or other methods.

8. Erosion Control Blankets
Final slopes of erodable materials 2H:1V or steeper should be protected with ECB.
Ground under ECB should be smooth so that ECB makes good contact with ground.
Installation begins with trench at top of hill and then rolled down hill.
Adjacent strips are overlapped per manufacturer's recommendation.
ECB is anchored per manufacturer's recommendation.

9. Outlet Protection
Apron dimension and material size matches BMP Plan.
Rip-rap thickness is 1.5 times the maximum stone diameter.
Geotextile fabric is under rip-rap.

Kentucky Transportation Cabinet
Highway Construction
KPDES Stormwater Discharge Inspection Guide

10. Energy dissipation
Geotextile fabric is under any rip-rap.
Top of rip-rap or concrete at downstream end is level with the receiving area.

11. Silt Fence
Not being used in concentrated flow.
Drainage area is no more than ¼ acre per 100 linear foot of silt fence.
Installed on the contour or with J-Hooks.
Fence is trenched in with stakes on downstream side.
Support posts must be steel or 2 x 4 wood or approved by the resident engineer.
Sediment behind fence is not greater than 1/3 the height of the fence or 18 inches max.

12. Drainage Structure Inlet Protection
All sides of the inlet are protected.
Inlet does not cause water to pond and cause traffic hazards or damage to other property.
Overflow point is provided.
Sediment behind inlet protection is not greater than ½ the height of the barrier.

13. Temporary Sediment Trap
Traps are sized to receive 3600 cubic feet of sediment (cumulative) per disturbed acre in the upstream drainage area.
Drainage area to trap does not exceed 10 acres.
Trap is not located in waters of the US.
Trap flow length is at least twice its flow width.
Trap embankment slopes are no more than 2H:1V.
Silt traps A, B and C are constructed in accordance with standard drawings.
Center of Silt Trap B is lower than the outer ends.
Silt Traps are not being by-passed.
Sediment in trap is less than half of the trap volume.

14. Sediment Basin
Basin flow length is at least twice the flow width.
Basin side slopes, berms, inlets, and outlet channels are stabilized.
Trap is sized to receive 3600 cubic feet of sediment per disturbed acre in the upstream drainage area.
Drainage area to basin is a minimum of 10 acres and maximum of 120 acres.
Dam height is not greater than 20 feet.
Inside and outside dam slopes are no more than 3H:1V.
Minimum top width of dam is 10 feet.
Overflow spillway is armored.
Inflow is diverted to back of basin.
Emergency spillway energy dissipator is at least four feet beyond the toe of the dam.
Sediment in basin is less than half of the trap volume.
15. Good housekeeping
Specific areas for concrete wash are provided in accordance with the BMP Plan.
There is adequate containment of fuel, chemicals, waste, etc. Contaminants are not being introduced to storm water.

16. Inspection follow-up
Inspection form is completed and signed.
Inspection findings have been communicated to the Contractor and others, as determined at the Precon Mtg.
BMP deficiencies have been communicated to the Resident Engineer.
BMP Plan is put back in its place.

Inspections

An initial inspection will be performed either before or within one week of after filing of the Notice of intent (NOI) with the division of water. No work may be performed until this inspection is performed. This inspection will cover the entire project to identify areas that need to have BMPs to prevent pollution from leaving the project. The initial area to be worked will have BMPs identified that are needed to manage areas that will be disturbed. BMPs for areas to be disturbed must be installed before work begins.

- Inspections will be performed:
  - Initially, before any work involving disturbance activities occurs.
  - Weekly for areas that have been disturbed.
  - Following a ½ inch or greater rain event.
  - Monthly for areas that are stabilized.
- Inspections will address all work that is to be performed in the week following the inspection.
- Inspections will continue until the Notice of Termination (NOT) is filed.

Inspection reports are to cover the major observations about the condition and performance of BMPs. BMPS that need to be cleaned, added, removed, etc. are to be noted here in general terms. The status of construction by stations is to be tracked. The specific actions to be taken by station and BMP are to be detailed in the Daily Work Reports.

At least three months records of the inspection reports required by the KPDES permit are to be kept in this section of the folder.

Spill Prevention Control and Countermeasure (SPCC) plan

Contractors that manage over 1,320 gallons of petroleum products (fuel and oil) are required by 40 CFR 112 to have a SPCC plan. This tab is the place to put a copy of this plan.

Correspondence

This tab will contain all correspondence not filed in another tabbed section that is related to compliance with the KPDES permit. It will include:

- Five day letters – copies of five day letters are to be sent to the Division of Environmental Analysis and the Division of Construction.
- Any other correspondence to and from the contractor that relates to implementation of the BMP plan that is not covered by inspection reports.
- Memos that relate to the implementation of the BMP Plan for this project.

ENVIRONMENTAL AND PUBLIC PROTECTION CABINET

Ernie Fletcher
Governor

Capital Plaza Tower
500 Mero Street, 5th Floor
Frankfort, Kentucky 40601
Phone: (502) 564-5525
Fax: (502) 564-3354
www.eppc.ky.gov

Teresa J. Hill
Secretary

General Certification--Nationwide Permit # 14
Linear Transportation Projects

This General Certification is effective March 19, 2007, in conformity with the requirements of Section 401 of the Clean Water Act of 1977, as amended (33 U.S.C. §1341), as well as Kentucky Statute KRS 224.16-050.

Agricultural operations, as defined by KRS 224.71-100(1) conducting activities pursuant to KRS 224.71-100 (3), (4), (5), (6), or (10) are deemed to have certification if they are implementing an Agriculture Water Quality Plan pursuant to KRS 224.71-145.

For all other operations, the Commonwealth of Kentucky hereby certifies under Section 401 of the Clean Water Act (CWA) that it has reasonable assurances that applicable water quality standards under Kentucky Administrative Regulations Title 401, Chapter 5, established pursuant to Sections 301, 302, 304, 306 and 307 of the CWA, will not be violated for the activity covered under NATIONWIDE PERMIT 14, namely Linear Transportation Projects, provided that the following conditions are met:

1. This general certification shall not apply to nationwide permits issued for individual crossings that are part of a larger road segment project where the cumulative, unmitigated wetland impacts within a 14-HUC total one (1) acre or more.

2. The individual stream crossing will impact less than 300 linear feet of intermittent or perennial streams, unless excluded by condition # 3. Impacts to ephemeral streams are not limited under this general certification.

3. This general certification shall not apply to nationwide permits issued for individual crossings which meet condition # 2 but that are part of a larger road segment project where the cumulative, unmitigated intermittent and perennial stream impacts within a 14-HUC exceed 500 linear feet.

4. The activity will not occur within waters of the Commonwealth identified by the Kentucky Division of Water as Outstanding State or National Resource Waters, Cold Water Aquatic Habitat, or Exceptional Waters.

General Certification--Nationwide Permit #14
Linear Transportation Crossings
Page Two

5. Stream impacts covered under this nationwide permit and undertaken by those persons defined as an agricultural operation under the Agricultural Water Quality Act must be completed in compliance with the Kentucky Agricultural Water Quality Plan.

6. Projects that do not meet the conditions of this general certification require an individual Section 401 water quality certification.

7. Activities qualifying for coverage under this general water quality certification are subject to the following conditions:

   - Stream crossings shall be constructed in such a manner that does not impede the movement of aquatic organisms.

   - Measures shall be taken to prevent or control spills of fuels, lubricants, or other toxic materials used in construction from entering the watercourse.

   - In areas not riprapped or otherwise stabilized, revegetation of stream banks and riparian zones shall occur concurrently with project progression. At a minimum, revegetation will approximate pre-disturbance conditions.

   - To the maximum extent practicable, all in stream work under this certification shall be performed during low flow.

   - Heavy equipment, e.g. bulldozers, backhoes, draglines, etc., if required for this project, should not be used or operated within the stream channel. In those instances where such in stream work is unavoidable, then it shall be performed in such a manner and duration as to minimize turbidity and disturbance to substrates and bank or riparian vegetation.

   - Any fill shall be of such composition that it will not adversely affect the biological, chemical, or physical properties of the receiving waters and/or cause violations of water quality standards. If riprap is utilized, it is to be of such weight and size that bank stress or slump conditions will not be created because of its placement.

   - If there are water supply intakes located downstream that may be affected by increased turbidity and suspended solids, the permittee shall notify the operator when work will be done.

General Certification--Nationwide Permit #14
Linear Transportation Crossings
Page Three

- Removal of existing riparian vegetation should be restricted to the minimum necessary for project construction.

- Should evidence of stream pollution or jurisdictional wetland impairment and/or violations of water quality standards occur as a result of this activity (either from a spill or other forms of water pollution), the Kentucky Division of Water shall be notified immediately by calling 800/928-2380.

Non-compliance with the conditions of this general certification or violation of Kentucky state water quality standards may result in civil penalties.

This general certification will expire on March 19, 2012, or sooner if the USACE makes significant changes to this nationwide permit.

NUCLEAR GAUGE EMERGENCY PROCEDURES

Shipping Name-Radioactive material, Type A package, Special Form, UN3332
Kentucky Transportation Cabinet (KYTC) Lic# 201-086-51

EMERGENCY PROCEDURES

- **Cordon off a 20' radius around area of incident**
- **Detain any equipment or vehicle involved in incident**
- **Unless there is an immediate health threat, DO NOT MOVE the gauge or its contents.**
- **Call Rob Hecker, Radiation Safety Officer (RSO) (502) 564-6963 office (502) 330-5947 cell**
- **Call Cabinet for Health and Family Services, Radiation Branch (502) 564-3700 after hours (800) 255-2587**

DO NOT TOUCH OR MOVE DAMAGED METERS

IMMEDIATELY NOTIFY THE ABOVE

Additional Phone Number(s)
Gauge Manufacturers:

Troxler Electronic Laboratories, (919) 549-9539
Humboldt Scientific, (800) 535-5053
Instrotek, (800) 424-9300
Seaman Nuclear Corporation, (414) 762-5100

Over>>>>>>>>

NUCLEAR GAUGE EMERGENCY PROCEDURES

Radioactive material, Type A package, Special Form, UN3332
Kentucky Transportation Cabinet (KYTC) Lic# 201-086-51

1. **PROPER SHIPPING NAME**
   - Radioactive material, Type A package, Special Form, UN3332

POTENTIAL HAZARDS

2. **HEALTH HAZARDS**
   - Radiation presents minimal risk to lives of persons during transportation accidents.
   - Undamaged packages are safe; damaged packages or materials released from packages can cause external radiation hazards. Contamination is not suspected.
   - Packages (cartons, boxes, drums, articles, etc.) identified as "Type A" by marking on packages or by shipping papers contain non-life endangering amounts. Radioactive sources may be released if packages are damaged in moderately severe accidents.
   - Commonly available instruments can detect most of these materials.
   - Water from cargo fire control is not expected to cause pollution.

3. **FIRE OR EXPLOSION**
   - Packaging can be consumed without content loss from sealed source capsule.

EMERGENCY ACTION

4. **IMMEDIATE PRECAUTIONS Note..cordon off area**
   - Priority response actions may be performed before taking radiation measurements.
   - Priorities are life saving, control of fire and other hazards, and first aid.
   - Isolate hazard area and deny entry. Notify RSO and Radiation Branch of accident conditions.
   - Delay final cleanup until instruction or advice of the RSO and Radiation Branch.
   - Positive pressure self-contained breathing apparatus (SCBA) and structural firefighter's protective clothing will provide adequate protection against internal radiation exposure, but not external radiation exposure.

5. **FIRE**
   - Do not move damaged packages; move undamaged packages out of fire zone.
   - **Small Fires:** Dry chemical, CO2 water spray or regular foam.
   - **Large Fires:** Water spray, fog (flooding amounts)

6. **SPILL OR LEAK**
   - **Do not touch damaged packages or spilled material.**
   - Slightly damaged or damp outer surfaces seldom indicate failure of inner container.
   - If source is identified as being out of package, stay away and await advice from Radiation Branch.

7. **FIRST AID**
   - Use first aid treatment according to the nature of the injury.
   - Persons exposed to special form sources are not likely to be contaminated with radioactive material.

TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.kentucky.gov

BILL OF LADING

Shipper: Kentucky Transportation Cabinet
Division of Construction
200 Mero Street, West Wing-3rd Floor
Frankfort, KY 40622

USA DOT 7A TYPE A
RADIOACTIVE MATERIAL – TYPE A PACKAGE
SPECIAL FORM, NONFISSILE OR FISSLE-EXCEPTED,
UN 3332, RQ

Cs-137 0.37 GBq (10mCi)
Am-241:Be 1.48 GBq (40 mCi)

RADIOACTIVE YELLOW LABEL II, TI = 0.2

******EMERGENCY CONTACT******
KYTC EMERGENCY 502-564-2080
DIVISION OF EMERGENCY MANAGEMENT 800-255-2587
HUMBOLDT 800-255-3924 or 919-832-6509
RADIATION HEALTH 502-564-3700
JEREMIAH LITTLETON 502-564-4780 or 502-229-8626

This is to certify that the above named materials are properly classified, described, packaged marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper: Kentucky Transportation Cabinet
Division of Construction

Example

CABINET FOR HEALTH SERVICES
COMMONWEALTH OF KENTUCKY
RADIOACTIVE MATERIAL LICENSE

PAGE 1

1. LICENSEE AND 2. ADDRESS

KY TRANSPORTATION CABINET
200 MERO STREET 3RD FL W. WING
STATE OFFICE BLDG
FRANKFORT, KY 40622

ATTENTION: JEREMIAH LITTLETON, PE
TELEPHONE: 502-564-4780

PURSUANT TO KRS 211.842 ET SEQ., THE KENTUCKY CABINET FOR HUMAN RESOURCES REGULATIONS, 902 KAR 100, AND IN RELIANCE ON STATEMENTS AND REPRESENTATIONS HERETOFORE MADE BY THE LICENSEE, A LICENSE IS HEREBY ISSUED TO RECEIVE, ACQUIRE, OWN, POSSESS AND TRANSFER RADIOACTIVE MATERIAL LISTED BELOW; AND TO USE SUCH RADIOACTIVE MATERIAL FOR THE PURPOSE(S) AND AT THE PLACE(S) DESIGNATED BELOW. THIS LICENSE IS SUBJECT TO ALL APPLICABLE RULES, REGULATIONS, AND ORDERS OF THE CABINET FOR HEALTH SERVICES, NOW OR HEREINAFTER IN EFFECT AND TO ANY CONDITIONS SPECIFIED BELOW.

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3. LICENSE NUMBER: 201-086-51
AMENDMENT NO. 63

4. EXPIRATION DATE: JUNE 30, 2008

5. REVIEWER: 46

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6. LICENSED MATERIAL	7. FORM	8. POSSESSION LIMIT
A. CESIUM 137	A. SEALED SOURCE (TROXLER DWG. A-102112)	A. NO SINGLE SOURCE TO EXCEED 9 MILLI-CURIES
B. AMERICIUM 241	B. SEALED SOURCE (TROXLER DWG. A-102451)	B. NO SINGLE SOURCE TO EXCEED 44 MILLI-CURIES

CABINET FOR HEALTH SERVICES
COMMONWEALTH OF KENTUCKY
RADIOACTIVE MATERIAL LICENSE

LICENSE NUMBER: 201-086-51 AMENDMENT 63 PAGE 2

C. AMERICIUM 241	C. SEALED SOURCE (TROXLER DWG. A-100608)	C. NO SINGLE SOURCE TO EXCEED 100 MILLI-CURIES
D. CESIUM 137	D. SEALED SOURCE (HUMBOLT MODEL 2200064)	D. NO SINGLE SOURCE TO EXCEED 11 MILLI-CURIES
E. AMERICIUM 241	E. SEALED SOURCE (HUMBOLT MODEL 2200067)	E. NO SINGLE SOURCE TO EXCEED 44 MILLI-CURIES

9. AUTHORIZED USE

A TO BE USED IN TROXLER MODEL 3400 SERIES OR 4640 SERIES MOISTURE/DENSITY GAUGE TO MEASURE PROPERTIES OF CONSTRUCTION MATERIALS.

B. TO BE USED IN TROXLER MODEL 3400 SERIES MOISTURE/DENSITY GAUGE TO MEASURE PROPERTIES OF CONSTRUCTION MATERIALS.

C. TO BE USED IN TROXLER MODEL 3241 SERIES ASPHALT CONTENT GAUGE TO MEASURE BITUMINOUS MIXTURES.

D. AND E. TO BE USED IN HUMBOLT SCIENTIFIC MODEL 5001 COMPACTION CONTROL GAUGES TO MEASURE PROPERTIES OF CONSTRUCTION MATERIALS.

CONDITIONS:

10. THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE KENTUCKY CABINET FOR HEALTH SERVICES ADMINISTRATIVE RADIATION REGULATIONS, 902 KAR 100.

11. RADIOACTIVE MATERIAL MAY BE STORED AT:
A. THE LICENSEE'S ADDRESS STATED IN ITEM 2.

B. THE LICENSEE'S DISTRICT OFFICES AS APPROVED BY THE RADIATION PROTECTION OFFICER.

C. 1227 WILKINSON BOULEVARD, FRANKFORT, KENTUCKY 40601

CABINET FOR HEALTH SERVICES
COMMONWEALTH OF KENTUCKY
RADIOACTIVE MATERIAL LICENSE

RADIOACTIVE MATERIAL MAY BE USED AT TEMPORARY JOB SITES, IN AREAS NOT UNDER EXCLUSIVE FEDERAL JURISDICTION, ANYWHERE IN THE COMMONWEALTH OF KENTUCKY WHERE THE CABINET MAINTAINS JURISDICTION FOR REGULATING THE USE OF RADIOACTIVE MATERIAL. (THIS CONDITION DOES NOT PROHIBIT USE IN OTHER STATES UNDER RECIPROCITY PRIVILEGES WHICH MAY BE GRANTED BY THE REGULATORY AGENCY HAVING JURISDICTION.)

12. RADIOACTIVE MATERIAL SHALL BE USED BY, OR UNDER THE SUPERVISION AND IN THE PHYSICAL PRESENCE OF JEREMIAH LITTLETON, P.E. ALTERNATIVELY, RADIOACTIVE MATERIAL MAY BE USED BY INDIVIDUALS WHO HAVE BEEN TRAINED AS SPECIFIED IN APPLICATION FILED MAY 18, 2004, AND HAVE BEEN APPROVED IN WRITING BY THE RADIATION SAFETY OFFICER. THE LICENSEE SHALL MAINTAIN RECORDS OF THE TRAINING RECEIVED BY INDIVIDUALS DESIGNATED AS USERS FOR INSPECTION BY THE CABINET FOR FIVE YEARS FOLLOWING THE LAST USE OF RADIOACTIVE MATERIAL BY THE INDIVIDUAL. THIS TRAINING PROGRAM IS APPLICABLE ONLY TO INDIVIDUALS WHO SHALL USE LICENSED MATERIAL UNDER THE AUTHORITY OF THIS LICENSE.

13. THE RADIATION SAFETY OFFICER FOR THE ACTIVITIES AUTHORIZED BY THIS LICENSE IS JEREMIAH LITTLETON, P.E. .

    NOTWITHSTANDING THE PERIODIC LEAK TEST REQUIRED BY 902 KAR 100:060, SUCH REQUIREMENT DOES NOT APPLY TO SOURCES THAT ARE STORED AND NOT BEING USED. THE SOURCES EXCEPTED FROM THIS TEST SHALL BE TESTED FOR LEAKAGE PRIOR TO ANY USE OR TRANSFER TO ANOTHER PERSON UNLESS THEY HAVE BEEN TESTED WITHIN SIX MONTHS.

14. SEALED SOURCES CONTAINING RADIOACTIVE MATERIAL SHALL NOT BE OPENED OR REMOVED FROM THEIR RESPECTIVE SOURCE HOLDERS BY THE LICENSEE.

15. ANY CLEANING, MAINTENANCE OR REPAIR OF THE GAUGE(S) INVOLVING REMOVAL OF THE SOURCE ROD FROM THE DEVICES OR REMOVAL OR DISMANTLING OF SHIELDING SHALL BE PERFORMED ONLY BY THE MANUFACTURER OR BY OTHER PERSONS SPECIFICALLY AUTHORIZED BY THE CABINET, THE U.S. NUCLEAR REGULATORY COMMISSION OR AN AGREEMENT STATE TO PERFORM SUCH SERVICES.

16. EACH PORTABLE GAUGE SHALL HAVE A LOCK OR OUTER LOCKED CONTAINER DESIGNED TO PREVENT UNAUTHORIZED OR ACCIDENTAL REMOVAL OF THE SEALED SOURCE FROM ITS SHIELDED POSITION. THE GAUGE OR ITS CONTAINER MUST BE LOCKED WHEN IN TRANSPORT, STORAGE OR WHEN NOT UNDER THE DIRECT SURVEILLANCE OF AN AUTHORIZED USER.

CABINET FOR HEALTH SERVICES
COMMONWEALTH OF KENTUCKY
RADIOACTIVE MATERIAL LICENSE

LICENSE NUMBER: 201-086-51 AMENDMENT 63 PAGE 4

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17. THE LICENSEE SHALL CONDUCT A PHYSICAL INVENTORY EVERY SIX (6) MONTHS TO ACCOUNT FOR ALL SEALED SOURCES RECEIVED AND POSSESSED UNDER THE LICENSE. THE RECORDS OF THE INVENTORIES SHALL BE MAINTAINED FOR FIVE (5) YEARS FROM THE DATE OF THE INVENTORY FOR INSPECTION BY THE CABINET, AND SHALL INCLUDE THE RADIONUCLIDES, QUANTITIES, MANUFACTURER'S NAME AND MODEL NUMBERS, LOCATION OF SEALED SOURCES, AND THE DATE OF THE INVENTORY.

18. THE LICENSEE MAY TRANSPORT RADIOACTIVE MATERIAL, OR DELIVER RADIOACTIVE MATERIAL TO A CARRIER FOR TRANSPORT, IN ACCORDANCE WITH THE PROVISIONS OF 902 KAR 100:070, AND OTHER DEPARTMENTS OF THE COMMONWEALTH OF KENTUCKY HAVING JURISDICTION.

19. IN ADDITION TO THE POSSESSION LIMITS IN ITEM 8, THE LICENSEE SHALL FURTHER RESTRICT THE POSSESSION OF RADIOACTIVE MATERIAL TO QUANTITIES BELOW THE MINIMUM LIMIT SPECIFIED IN 902 KAR 100:042, SECTION 11, FOR ESTABLISHING DECOMMISSIONING FINANCIAL ASSURANCE.

20. EXCEPT AS SPECIFICALLY PROVIDED OTHERWISE IN THIS LICENSE, THE LICENSEE SHALL CONDUCT ITS PROGRAM IN ACCORDANCE WITH THE STATEMENTS, REPRESENTATIONS, AND PROCEDURES CONTAINED IN THE DOCUMENTS, INCLUDING ANY ENCLOSURES, LISTED BELOW. THE CABINET FOR HEALTH SERVICES REGULATIONS, 902 KAR 100, SHALL GOVERN UNLESS STATEMENTS, REPRESENTATIONS, AND PROCEDURES IN THE LICENSEE'S APPLICATION AND CORRESPONDENCE ARE MORE RESTRICTIVE THAN THE REGULATION.

    A. APPLICATION DATED MAY 18, 2004, SIGNED BY DEXTER NEWMAN, DIRECTOR OF CONSTRUCTION.

    B. LETTERS DATED:

        1. JULY 8, 2004, SIGNED BY JANICE EVANS FLYGSTAD, RSO.
        2. SEPTEMBER 21, 2005, SIGNED BY JANICE FLYGSTAD, RSO.
        3. JUNE 23, 2006, SIGNED BY JANICE M. FLYGSTAD, RSO.
        4. SEPTEMBER 11, 2006, SIGNED BY JEREMIAH LITTLETON, P.E.

MANAGER
RADIATION HEALTH BRANCH

MARK D. BIRDWHISTELL
SECRETARY
CABINET FOR HEALTH AND FAMILY SERVICES

DATE ISSUED MAY 30, 2007

FACILITY ID: 21600

REPORT DATE: 06/14/07

FACILITY: KY. DOT-CENTRAL OFFICE
ATTENTION: JANICE EVANS
200 Mero St - West Wing
3rd Fl. Construction
FRANKFORT, KY 40622

TROXLER
TROXLER RADIATION MONITORING SERVICES
A Division of Troxler Electronic Laboratories, Inc.
3008 Cornwallis Road • Box 12057 • RTP, NC 27709
Tel: 877-876-9537 ext 2226 • Fax: 919-485-2250

Accredited by the National Institute of Standards and Technology through NVLAP for whole body dosimetry.

NVLAP lab code: 100559-0

Technical Director: S. A. Browne

RADIATION EXPOSURE REPORT

NAME	DOSIMETER ID	BADGE TYPE	WEAR TERM	EXP TYPE	EXPOSURE TO BADGE (MILLIREM)			CUMULATIVE TOTALS (MILLIREM)						NOTES	SSN	BIRTHDATE
								CALENDAR YEAR			LIFETIME					
					SHALLOW	DEEP	EYE	SHALLOW	DEEP	EYE	SHALLOW	DEEP	EYE			
Period Beginning:	01/01/07															
Control Badge	424004	C	Q													
BOOKER, TREVOR	[redacted]	W	Q		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		XXX-XX-[redacted]	[redacted]
CRISWELL, STEVE	[redacted]	W	Q		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		XXX-XX-[redacted]	[redacted]
LITTLETON, JEREMI	[redacted]	W	Q		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		XXX-XX-[redacted]	[redacted]
PAUL, M.	[redacted]	W	Q		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	359	343	276		XXX-XX-[redacted]	[redacted]
QUARLES, D.	[redacted]	W	Q		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	251	212	210		XXX-XX-[redacted]	[redacted]
RADCLIFF, CHUCK	[redacted]	W	Q		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		XXX-XX-[redacted]	[redacted]
WOOLDRIDGE, G.	[redacted]	W	Q		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	369	350	223		XXX-XX-[redacted]	[redacted]
YOUNG, D.	[redacted]	W	Q		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	313	282	271		XXX-XX-[redacted]	[redacted]

TERMS AND EXPLANATIONS

Badge Type
A = Area badge
C = Control badge
E = Extremity badge
W = Whole body badge

Exp Type
G = Gamma
B = Beta
X = X-ray
N = Neutron

Dose Definitions
<MDL = Dose is less than minimum detectable level
Shallow = Dose equivalent at 7 mg/cm^2 tissue depth
Eye = Dose equivalent at 300 mg/cm^2 tissue depth
Deep = Dose equivalent at 1000 mg/cm^2 tissue depth

Notes
MC = Missing control badge. Default background used.
HC = High control badge reading.
LB = Badge returned > 6 months after period end.
DB = Damaged badge
AR = Low reading

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

PRECAST SMALL DRAINAGE STRUCTURES
GUIDELINES FOR PREPARATION OF SHOP DRAWINGS ANDINSPECTION OF UNITS

General Information Shop drawings should be prepared with care and attention to details since they must contain directions not only for fabrication of the structure in the shop, but also for installation in the field when appropriate. It is anticipated that they will be used by both the contractor and the state inspectors in the field installation process as well as by the manufacturer and the plant inspector in the fabrication process. These drawings will be used as supplements to the applicable Standard Drawings and not on a stand–alone basis. As such, any components of the Standard Drawings which remain unchanged need not be addressed. This includes such items as grills, grates, etc.

Shop drawings are not required nor will they be accepted for consideration for those structures, such as manholes, which the Standard Drawings customarily permit the use of precast components. Similarly, some standard drawings contain specific requirements pertaining to cast–in–place requirements and these notes will govern in all cases.

The manufacturer has full responsibility for the integrity, content and quality of his shop drawings. These drawings must be checked and approved by the Division of Construction before they may be used to fabricate units for project installation. This check is directed at dimensions, as compared to Standard Drawings, the location of reinforcing steel, applicable notes and the overall practicality of the drawings. This check and approval process does not relieve the manufacturer of his responsibilities regarding the drawings or the units subsequently fabricated from the drawings. The Division of Construction will apply an approval stamp to all approved drawings. All drawings used in the fabrication and inspection of the structures, either in the plant or at the job site, must have this stamp.

A representative from the District Material Engineer's office, in whose area the fabrication plant is located, will normally perform the necessary fabrication inspections at the plant. The procedures for this inspection are outlined elsewhere and will not be discussed herein. If this plant fabrication inspection is satisfactory, the Materials Inspector will affix an approval stamp to each individual unit prior to shipment to the job site. This stamp must be in place before the Project Engineer will accept the unit for installation on the project. On the other hand, the existence of this stamp does not mean automatic acceptance by the Project Engineer. The unit must be in satisfactory physical condition, of a proper size and configuration for the specified location and, in general, installed in a satisfactory manner before it is acceptable at the job site.

The Project Engineer shall use the same criteria for payment of a precast drainage unit as would be used for a cast–in–place unit. There is no requirement that an "order" be placed for precast units any more so than there is for cast–in–place units. Unanticipated job conditions that affect a precast unit are considered to be the contractor's responsibility even if the unit is on the job. The Project Engineer has full latitude to make any changes on the project, including revising flow lines or eliminating items, up until the precast unit is installed without being obligated for payment. The consideration for payment of a precast unit, after installation, is similar to that for cast–in–place units as is the procedure for removal and replacement, if necessary. Precast units are not eligible for payment as "Stockpile Items" any more so than cast–in–place units.

Precast small drainage structures shall be in substantial conformance with approved drawings. The latitude to adapt Standard Drawings to various conditions in the field utilizing cast–in–place methods does not exist for precast units. If a manufacturer needs to construct a precast unit to accept skewed pipe, multiple pipe openings or other variations, an approved drawing reflecting the modifications must be on record.

The Department accepts no responsibility for notification to the manufacturer of changes in Standard Drawings that might affect existing approved shop drawings. The Standard Drawings listed by the plans as applying to the project and/or current standards in use at the time the project is let to construction shall govern over approved shop drawings.

1. Drawing Numbers

The drawings shall have a uniform numbering system for convenient identification. The following procedure issuggested:

a. Create a prefix consisting of not more than two letters taken from the manufacturer's name followed by the applicable standard drawing prefix (*i.e., CRDP–010 or KPRDP–010 where the "C" stands for Cloud or the "KP" stands for Kentucky Precast.*)

b. The number should be the same as the applicable Standard Drawing. If the shop drawing includes more than one Standard Drawing (*i.e., more than one number*) assign one standard drawing number as the shop drawing number and explain in the drawing notes.

2. Drawing Notes

The following notes generally fit all applications and should, when applicable, be included on the drawings:

a. This drawing to be used with applicable version of DOH Std. Drawing No. ??. (*With this note, it is not necessary for the version no. such as 02 or 03 to be shown since it is subject to change.*)

b. 2 inch Minimum Concrete Cover on all reinforcing steel.

c. Section 710.03.02 of the *Standard Specifications for Road and Bridge Construction* applies to this structure. (*This specification covers the type of concrete and various aspects of precast structures so there is no need for repetition of these notes on the shop drawings.*)

d. 3/4 inch chamfer on all exposed edges. (*To be included on those structure drawings with exposed concrete [i.e., headwalls, etc.]*)

e. Approved non–shrinking grout shall be used to fill all voids and around pipe ends.

f. Reinforcing steel bars to be tack welded at all intersections in accordance with Section 605.04 of the *Standard Specifications for Road and Bridge Construction.*

3. Drawing Size & Distribution

Standard plan size drawing film (*i.e., 22" by 36"*) should be used for preparation of the shop drawings; however, if the manufacturer elects, 12" by 17 3/4" may be used providing the drawing can be depicted clearly. The standard size film, when used, will be reduced by the Department to 12" by 17 3/4" for distribution to the field offices. No other sizes will be permitted . This is the same size as reduced plans and is considered the optimum size to retain good readability and yet be handled easily. It is preferred that these drawings and any lettering be done in ink so as to reproduce clearly.

a. The manufacturer is responsible for sending good, readable drawings on reproducible film (*normally milar or sepia*) in the required size to the Division of Construction for approval.

b. The Division of Construction will have 140 copies of each approved drawing made for initial distribution. Copying cost is $0.20 per sheet. This calculates to a charge of $28.00 per set for 140 copies of each drawing. Additional copies will be made at the manufacturer's request for his use. The Department will make the copies and bill the manufacturer for the cost. These prices and quantities are subject to change without notice.

c. The Division of Materials will make distribution of the drawings and will also maintain and distribute the List of Approved Drawings. Distribution will be made to the Divisions of Construction and Materials, all Project Engineers' offices, all District Construction and Materials offices and all active Construction Consultants' offices.

d. The Division of Construction will retain all approved drawings used for making distribution copies in its files. It is anticipated that the manufacturer will retain the unapproved originals in his files to be used for future modifications.

4. Additional Requirements

a. Pickup Points – Pickup points generally take the form of cast–in–place handler holes, inserts or wire embedded in the concrete. In the case of the handler holes or inserts, the holes shall be filled with non–shrinking grout as discussed in 2e above. When wire is used, it shall be a non–rusting type even when cut. Wire used for this purpose shall be cut off after placement of the unit except wire used in box tops may be left provided it does not interfere with construction of the structure or need to be removed for other reasons. Appropriate instructions for the applicable procedure shall be included in the drawing notes.

b. Reinforcing Steel – Bar size may be increased and spacing may be decreased in the interest of providing additional strength for handling and shipping. Bars may not be rearranged simply for convenience of the fabricator.

It is acceptable to tack weld reinforcing steel in precast small drainage units. All drawings submitted by precastors for approval shall include the following note or one similar in nature "Reinforced steel bars to be tack welded at all intersections in accordance with Section 605.04 of the Standard Specifications."

c. Preformed Pipe Openings – Varying wall thicknesses of drainage pipe have made it necessary that some design consideration be given to the preformed pipe opening so as to accommodate the particular pipe to be used by the contractor. In short, conflicts have been encountered with preformed pipe openings when the larger sized concrete pipe with thicker walls have been used. The outer diameter of the pipe, when included with the additional 3" diameter, results in the preformed opening intruding into the structure walls and/or insufficient concrete cover over the pipe. This sitiuation is in conflict with the Department's standards and is not to be permitted. Shop drawings must either address this problem or the unit will be unacceptable when manufactured with these deficiencies. The following points must be kept in mind when preparing drawings for each structure. The last page of this exhibit portrays these limits in a drawing.

- The hole opening for the pipe will not be allowed to infringe on the wall thickness.
- At least 4" of concrete with adequate reinforcing steel must be provided above the top of the hole opening for the pipe.

d. Chamfer Edge – It is acceptable for the edges of precast units to be struck with a rounded edging tool as opposed to the standard 3/4" chamfer. The rounded edge should have a minimum of 1/2" radius and be neat and workmanlike.

It is generally required that all exposed edges be chamferred; however, not all edges of precast units remain exposed. Curb box inlet tops, for instance, do not remain exposed when abutted by sidewalks. The installation of chamfer strips in portions of a structure to be abutted by concrete is not acceptable and units, thus, fabricated are not acceptable and must be replaced.

5. Project Specific Shop Drawings

The foregoing discussion has been directed primarily to statewide approval for small drainage structure shop drawings. This is the preferred method of handling shop drawings; however, there also exists a need for having a procedure whereby dedicated drawings may be submitted for approval to meet a specific project's needs. The following procedure is setforth:

a. Shop Drawings – Each drawing shall be identified by the county and project number. A minimum of six copies of each drawing should be submitted by the contractor to the Project Engineer along with a request for approval for use on the project. The drawing(s) may be any size (*minimum 81/2" by 11"*) depending on the nature of the drawing. They must also be clear, legible and capable of being reproduced. The Project Engineer will review the drawings and, when he is satisfied, forward five to the District Construction Office for review and submission to the Division of Construction for consideration of approval. If the Project Engineer or the District Office does not recommend approval of the drawing, it should so stated, including appropriate reasons, in the submittal.

b. Distribution – Providing the drawing is approved, the Division of Construction will retain one copy of the approved drawing in the project files and return three copies to the District Construction Office where one copy will be retained and two copies returned to the Project Engineer. The Project Engineer will return one approved drawing to the contractor who will have the responsibility of making sufficient additional copies for distribution to the fabricator and the District Materials Engineer. The Project Engineer shall have an approved drawing in his project files for each small drainage structure not covered by the statewide drawings and the unit must have the D.M.E's approval stamp before the structure shall be permitted to be installed on the project.

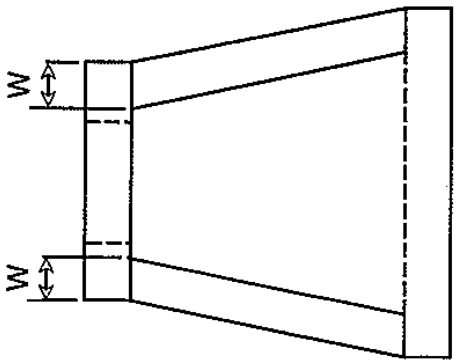
c. Limitations – Approval of a particular drawing for a specific project does not imply approval to use on other projects. This procedure must be followed on each project.

d. Except for the differences noted in a, b and c above, all other requirements discussed in statewide approval shall apply to Project Specific Drawings.

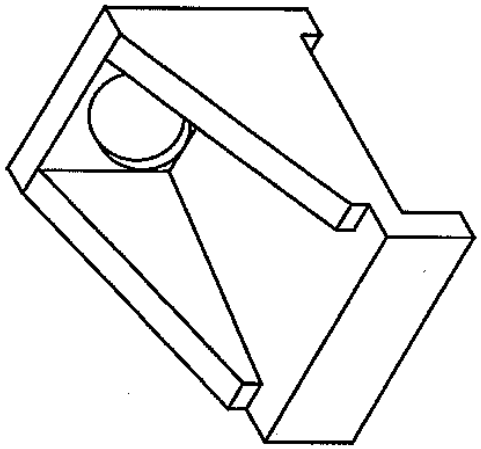
Prepared By The Division of Construction

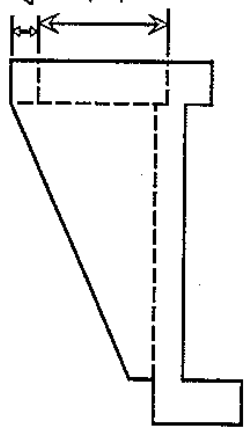
PRECAST SMALL DRAINAGE STRUCTURE

FABRICATION LIMITS

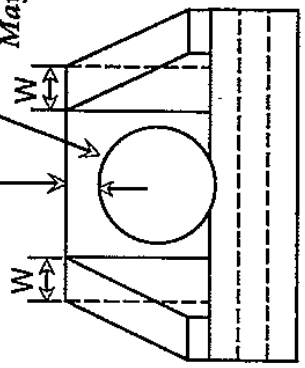


TOP VIEW





SIDE VIEW



FRONT VIEW

TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.kentucky.gov

Ernie Fletcher
Governor

Bill Nighbert
Secretary

Marc Williams
Commissioner of Highways

Construction Memo No. 04-07

MEMO TO: District Executive Directors
TEBMs for Construction
District Construction Engineers
District Materials Engineers
Resident Engineers

FROM: Greta Smith, P.E.
Director
Division of Construction

DATE: April 25, 2007

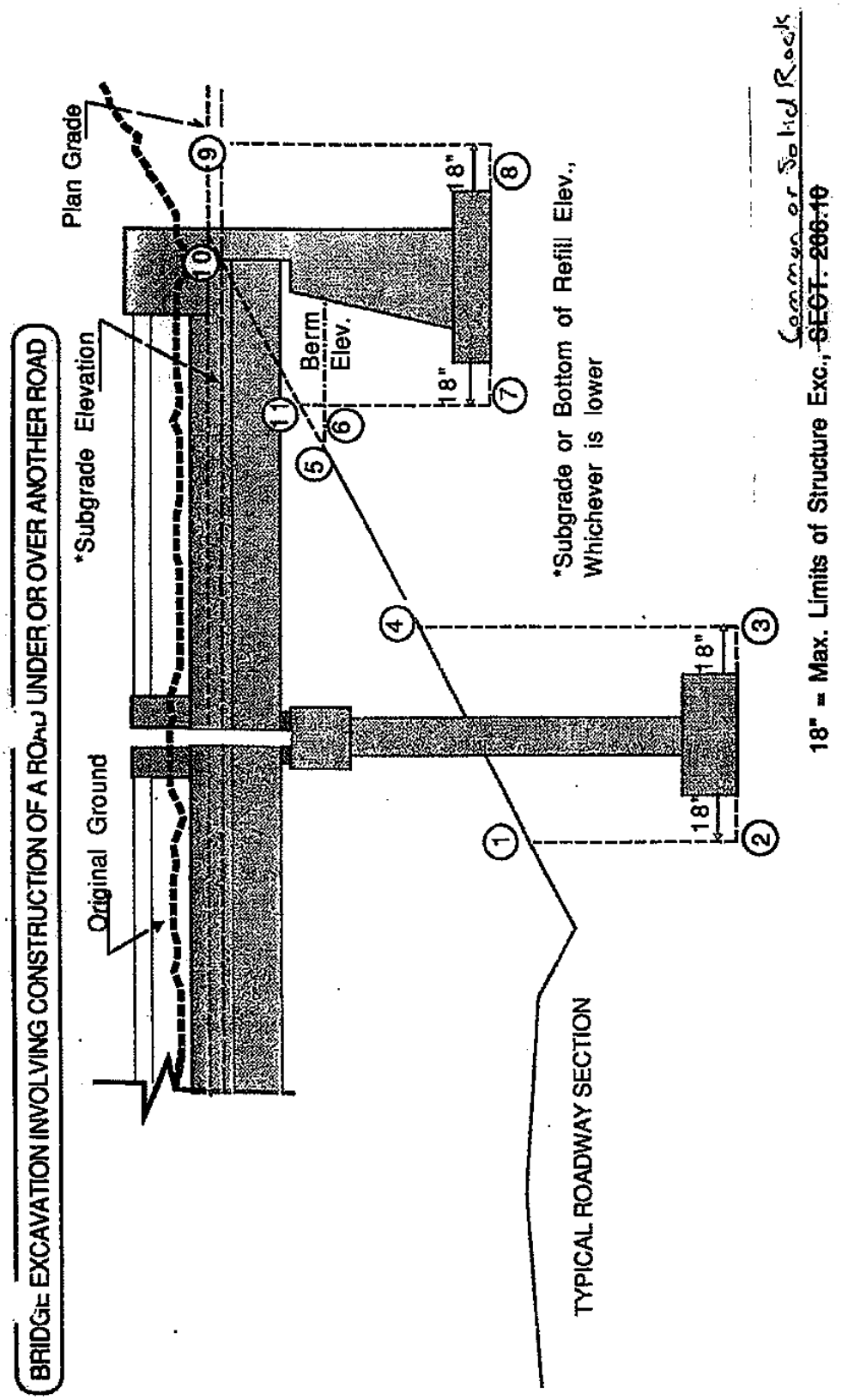
SUBJECT: Asphalt Density Cores

In accordance with Subsection 402.03.02 part D), we mark the pavement at the randomly determined locations after compaction is complete and the Contractor furnishes the cores to the nearest laboratory facility (Contractor or Department lab) for density determination by the Engineer.

Due to apparent inconsistencies in cores, we need to ensure all cores are taken in the presence of Department personnel, transported by us, and remain in our custody until density testing is performed. We realize this will require scheduling and may be difficult with current staffing, but at this time it is necessary in order to maintain the integrity of our test results.

If you have any questions regarding these procedures please contact this office.

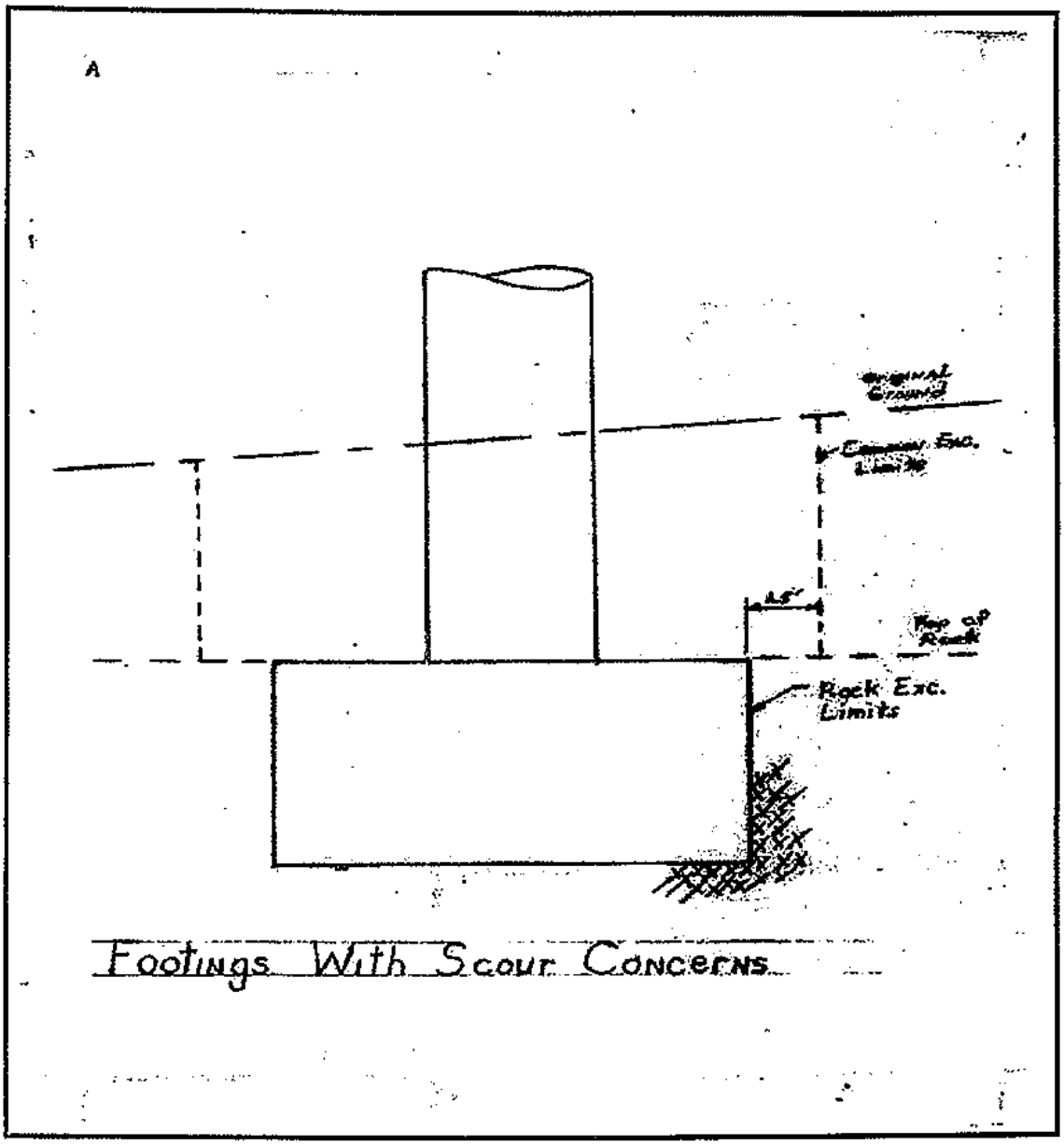
c: Marcelyn Mathews
Jim Rummage
Wesley Glass
C.O. Engineers
KAHC
PAIKY
FHWA



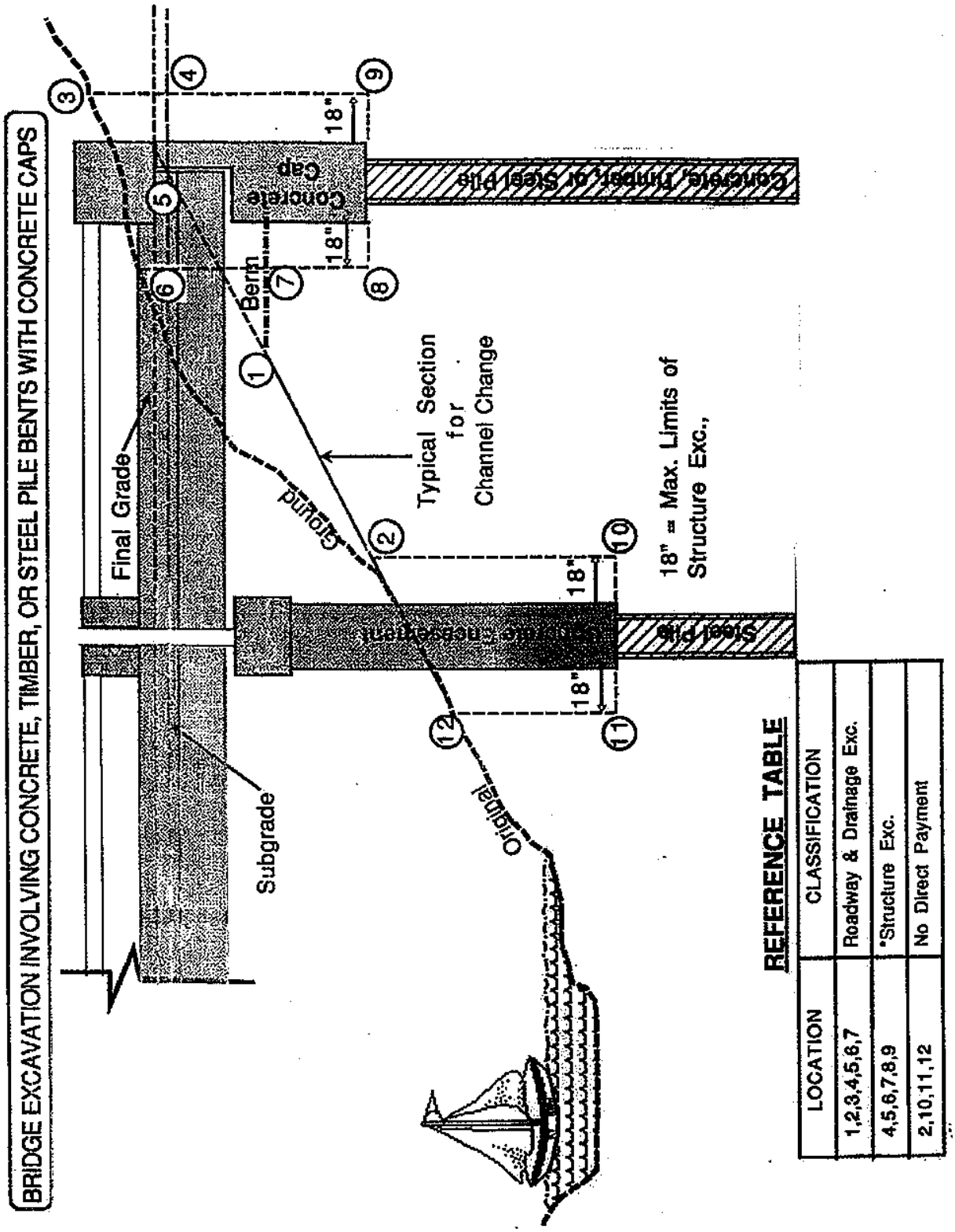
REFERENCE TABLE

LOCATION	CLASSIFICATION
1,4,5,6,11,10,9	Roadway & Drainage Exc.
6,7,8,9,10,11	**Structure Exc.
1,2,3,4	**Structure Exc.

BRIDGE EXCAVATION INVOLVING SCOUR CONCERNS

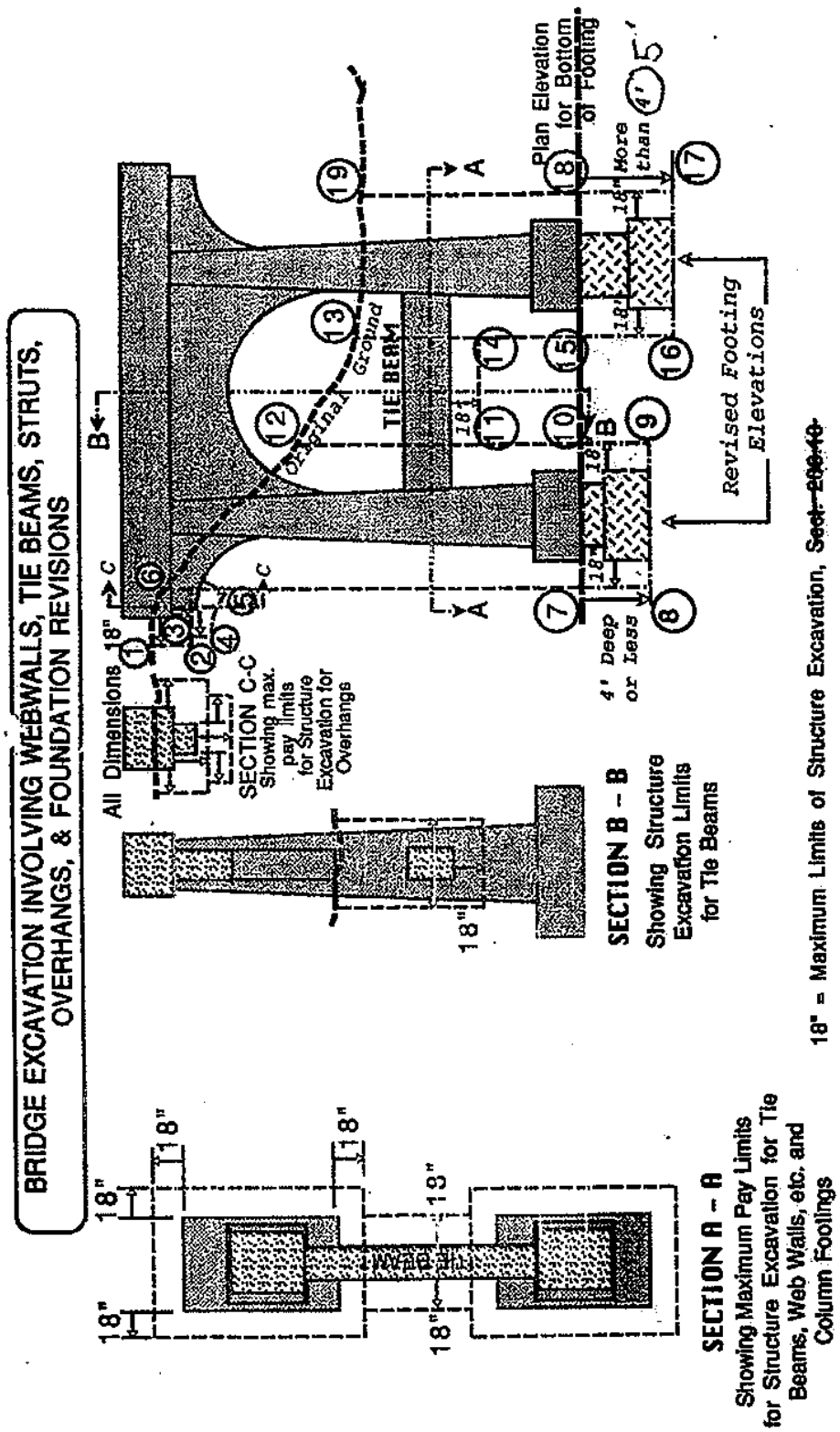


When the plans require, excavate footing to the full limits of the plan dimensions. Then the concrete should be placed against the rock face. This seals the concrete/rock interface reducing scour. When this is required, the payment of structural excavation – solid rock is to the neat limits of the plan footing.



REFERENCE TABLE

LOCATION	CLASSIFICATION
1,2,3,4,5,6,7	Roadway & Drainage Exc.
4,5,6,7,8,9	*Structure Exc.
2,10,11,12	No Direct Payment

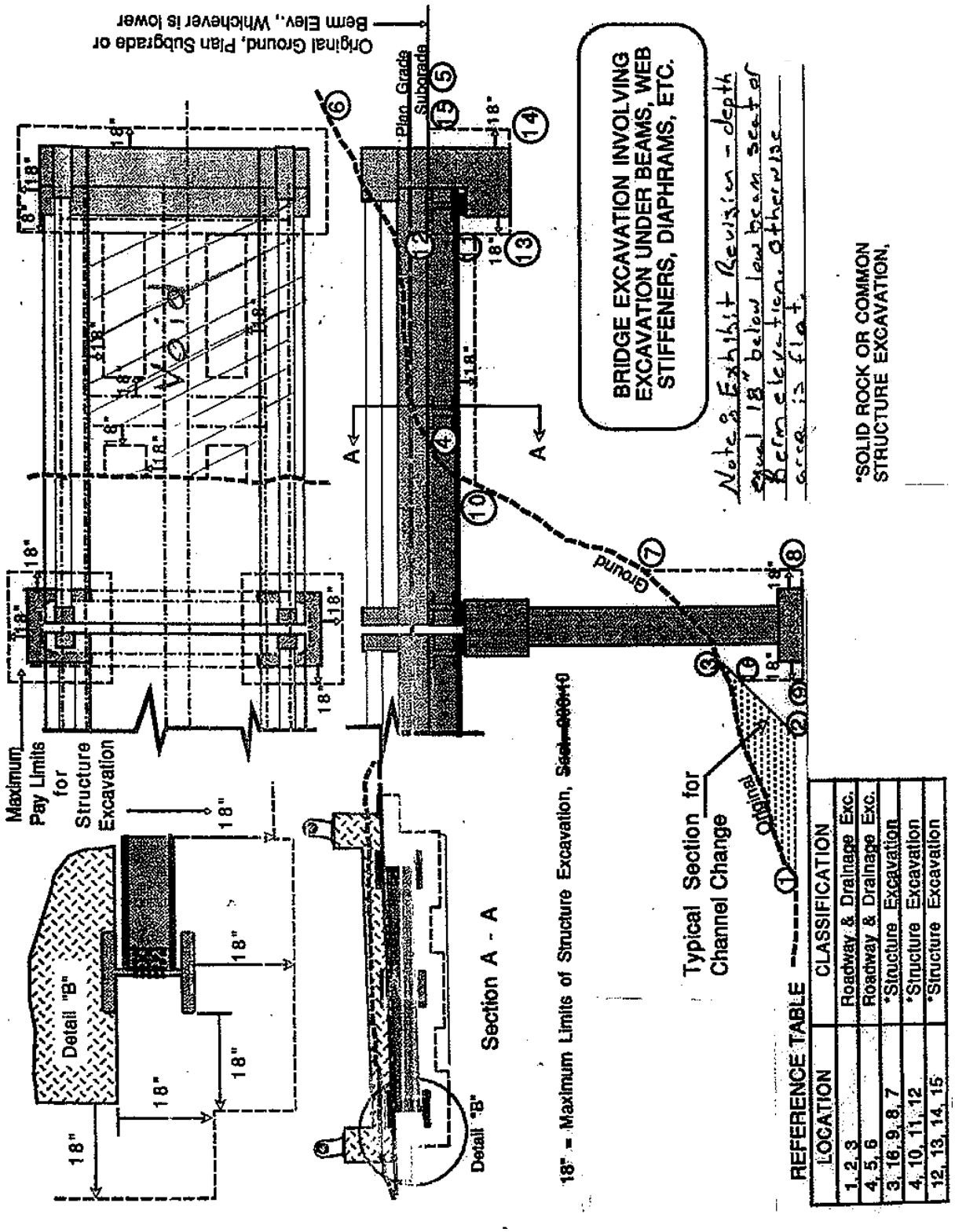


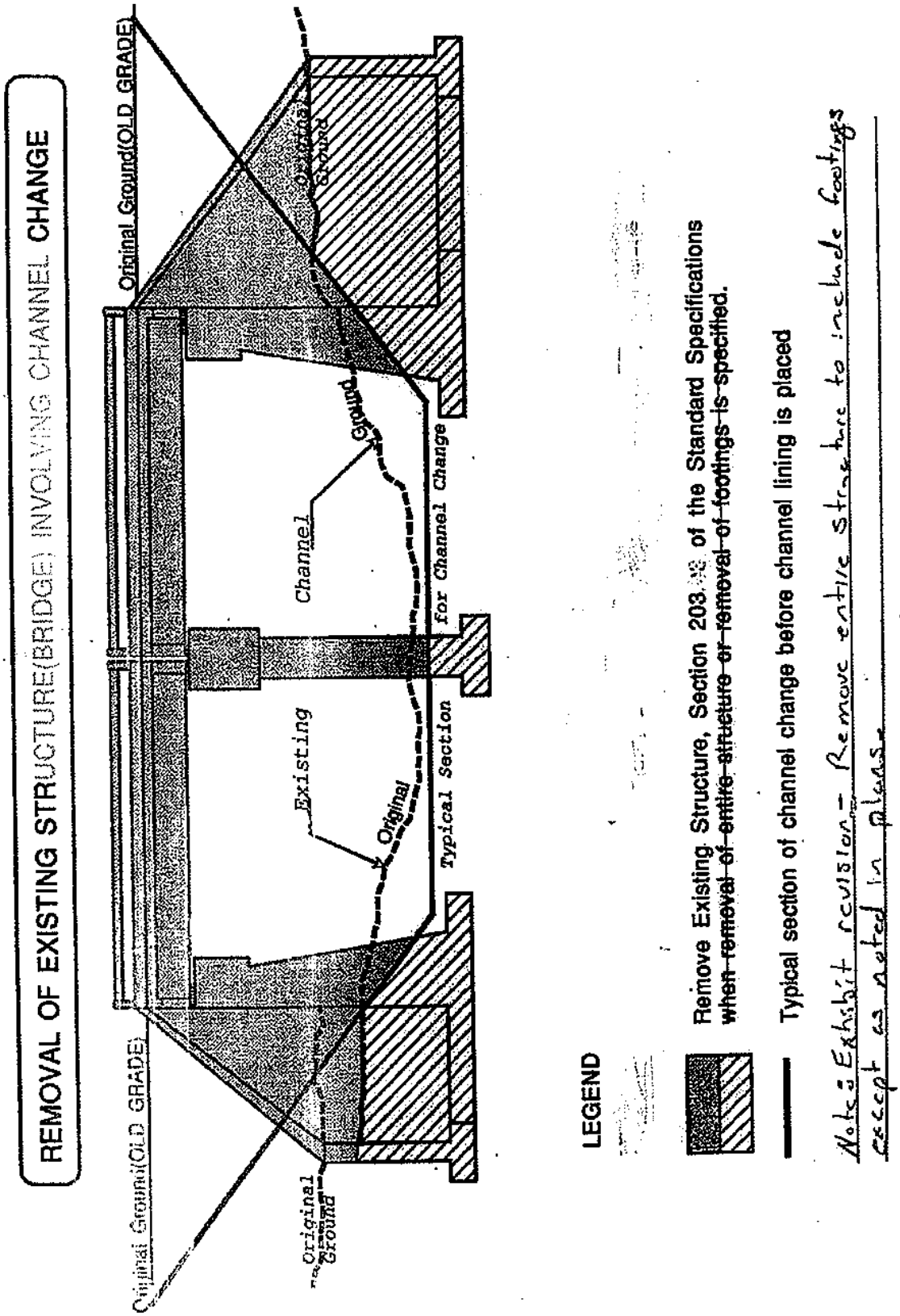
18" = Maximum Limits of Structure Excavation, ~~Sect. 200.10~~

REFERENCE TABLE

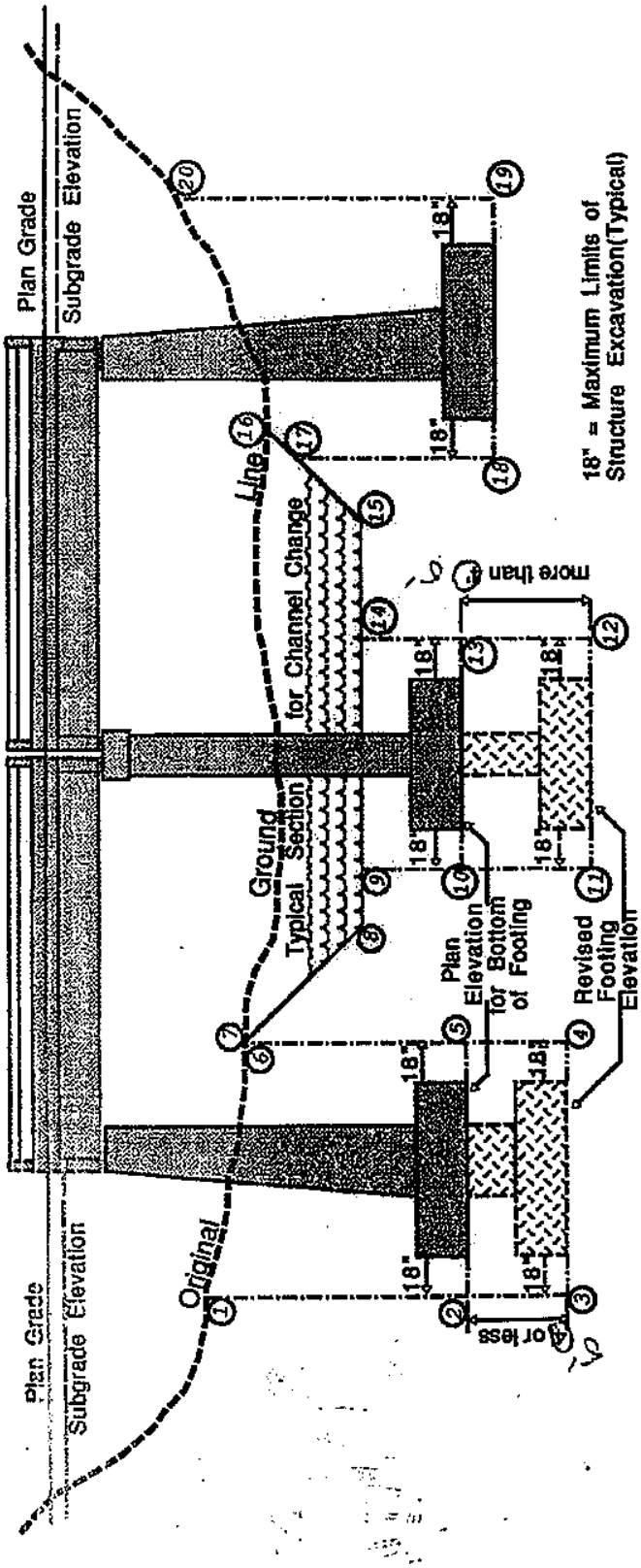
LOCATION	CLASSIFICATION
1,2,3,4,5,6	*Structure Excavation
6,7,8 9,10,11,12	*Structure Excavation
11,12,13,14	*Structure Excavation
13,14,15,18,19	*Structure Excavation
15,16,17,18	Supplemental Agreement

*SOLID ROCK OR COMMON STRUCTURE EXCAVATION, ~~Sect. 200.08~~


Original Ground, Plan Subgrade or Berm Elev., Whichever is lower
Plan Grade
Subgrade
Ground
Maximum Pay Limits for Structure Excavation
Detail "B"
Section A - A
Typical Section for Channel Change
Original
18" = Maximum Limits of Structure Excavation, Slope 0.00:1.0
BRIDGE EXCAVATION INVOLVING EXCAVATION UNDER BEAMS, WEB STIFFENERS, DIAPHRAMS, ETC.
Note: Exhibit Revision - depth equal 18" below low beam seat or Berm elevation, otherwise area is flat.
*SOLID ROCK OR COMMON STRUCTURE EXCAVATION.
REFERENCE TABLE
LOCATION | CLASSIFICATION
1, 2, 3 | Roadway & Drainage Exc.
4, 5, 6 | Roadway & Drainage Exc.
3, 16, 9, 8, 7 | *Structure Excavation
4, 10, 11, 12 | *Structure Excavation
12, 13, 14, 15 | *Structure Excavation

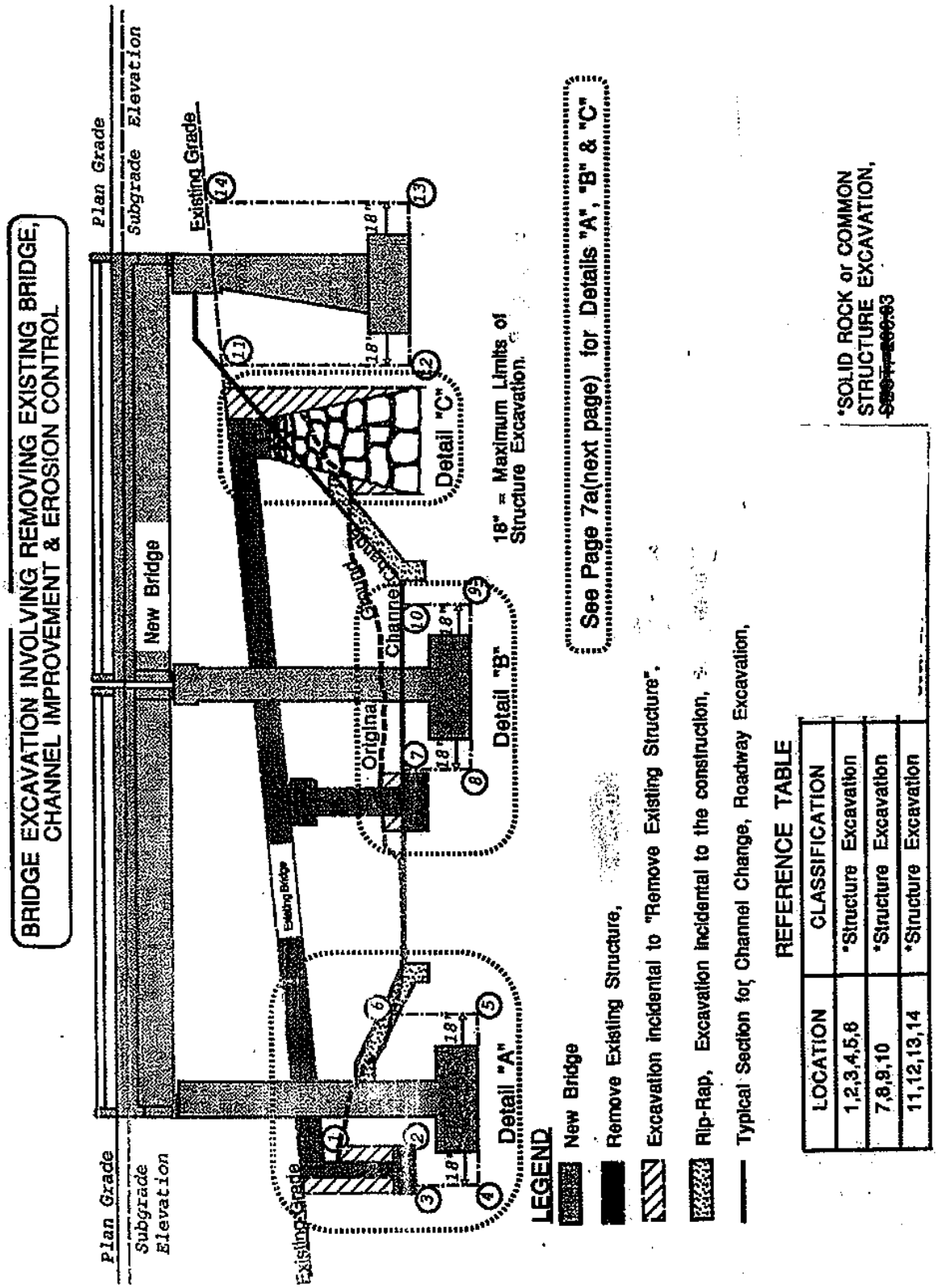

REMOVAL OF EXISTING STRUCTURE(BRIDGE) INVOLVING CHANNEL CHANGE
Original Ground(OLD GRADE)
Original Ground(OLD GRADE)
Original Ground
Original Ground
Channel
Existing
Original
Typical Section for Channel Change
LEGEND
Remove Existing Structure, Section 203.[illegible] of the Standard Specifications ~~when removal of entire structure or removal of footings is specified.~~
Typical section of channel change before channel lining is placed
Note: Exhibit revision - Remove entire structure to include footings except as noted in plans

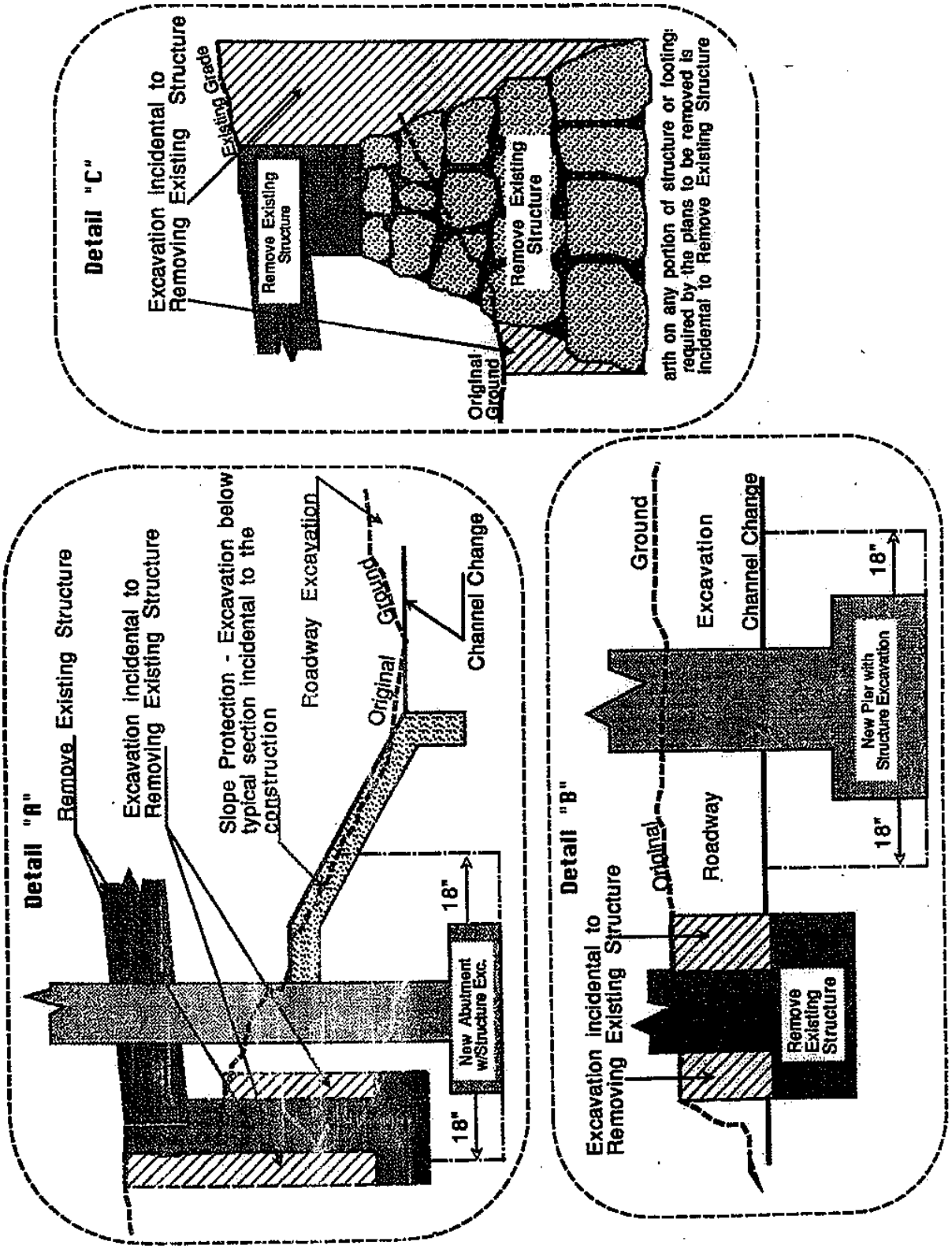
BRIDGE EXCAVATION INVOLVING CHANNEL CHANGE AND FOUNDATION REVISIONS



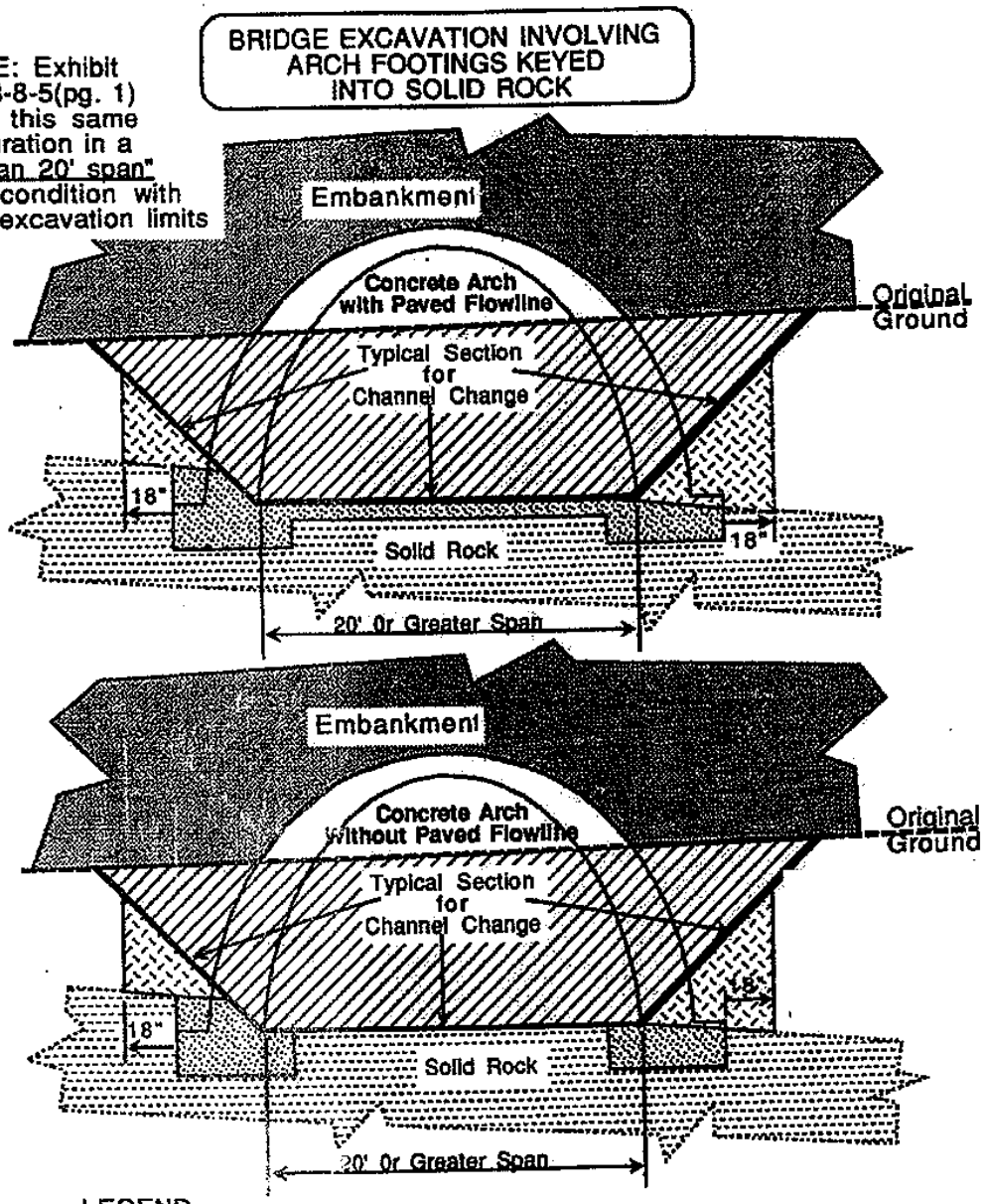
REFERENCE TABLE

LOCATION	CLASSIFICATION
1,2,5,6	*Structure Excavation
9,10,13,14	*Structure Excavation
16,17,18,19,20	*Structure Excavation
2,3, 4, 5	*Structure Excavation
10,11,12,13	Supplemental Agreement
7,8,15,16	Roadway Excavation


BRIDGE EXCAVATION INVOLVING REMOVING EXISTING BRIDGE, CHANNEL IMPROVEMENT & EROSION CONTROL
Plan Grade
Subgrade Elevation
Existing Grade
New Bridge
Existing Bridge
Original Channel
Detail "A"
Detail "B"
Detail "C"
18" = Maximum Limits of Structure Excavation.
See Page 7a(next page) for Details "A", "B" & "C"
LEGEND
New Bridge
Remove Existing Structure,
Excavation incidental to "Remove Existing Structure",
Rip-Rap, Excavation incidental to the construction,
Typical Section for Channel Change, Roadway Excavation,
REFERENCE TABLE
LOCATION | CLASSIFICATION
1,2,3,4,5,6 | *Structure Excavation
7,8,9,10 | *Structure Excavation
11,12,13,14 | *Structure Excavation
*SOLID ROCK or COMMON STRUCTURE EXCAVATION,


Detail "A"
Remove Existing Structure
Excavation incidental to Removing Existing Structure
Slope Protection - Excavation below typical section incidental to the construction
Roadway Excavation
Original Ground
Channel Change
18"
New Abutment w/Structure Exc.
18"
Detail "B"
Excavation incidental to Removing Existing Structure
Original
Roadway
Ground
Excavation
Channel Change
Remove Existing Structure
New Pier with Structure Excavation
18"
18"
Detail "C"
Excavation incidental to Removing Existing Structure
Existing Grade
Remove Existing Structure
Original Ground
Remove Existing Structure
arth on any portion of structure or footing required by the plans to be removed is incidental to Remove Existing Structure

NOTE: Exhibit No. 63-8-5(pg. 1) shows this same configuration in a "less than 20' span" (Culvert) condition with applicable excavation limits



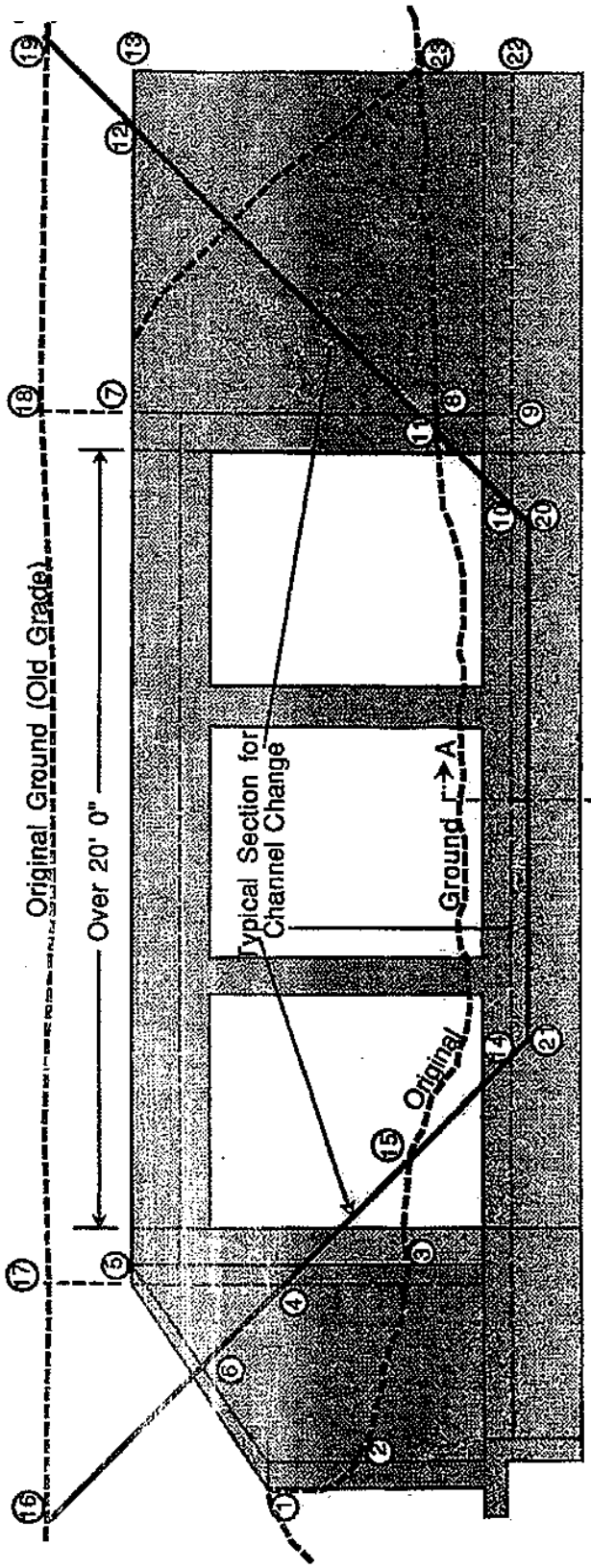
LEGEND

- Embankment
- Solid Rock
- Roadway Excavation.
- Structure Excavation, Common.
- Structure Excavation, Solid Rock.

18" = Maximum Limits of Structure Excavation.

NOTE: (1) Excavation of solid rock outside of neatline of footing of arch shall be avoided
(2) If no channel change, i.e. Roadway Exc., is involved, the area shown as Roadway Exc. shall be paid as the appropriate Structure Excavation. See Exhibit 63-8-5, pg. 1 for an example of this method.
(3) Excavation may also be paid as Foundation Prep

REMOVAL OF EXISTING STRUCTURE (ARCH OR LARGE CULVERT) CLASSIFIED AS A BRIDGE

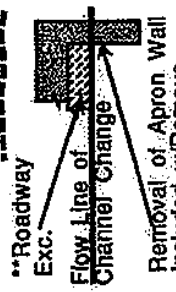


Section for wings or attached retaining walls

**Section is included in Removal of Existing Structure through apron wall, Channel Exc. included in Roadway Excavation elsewhere

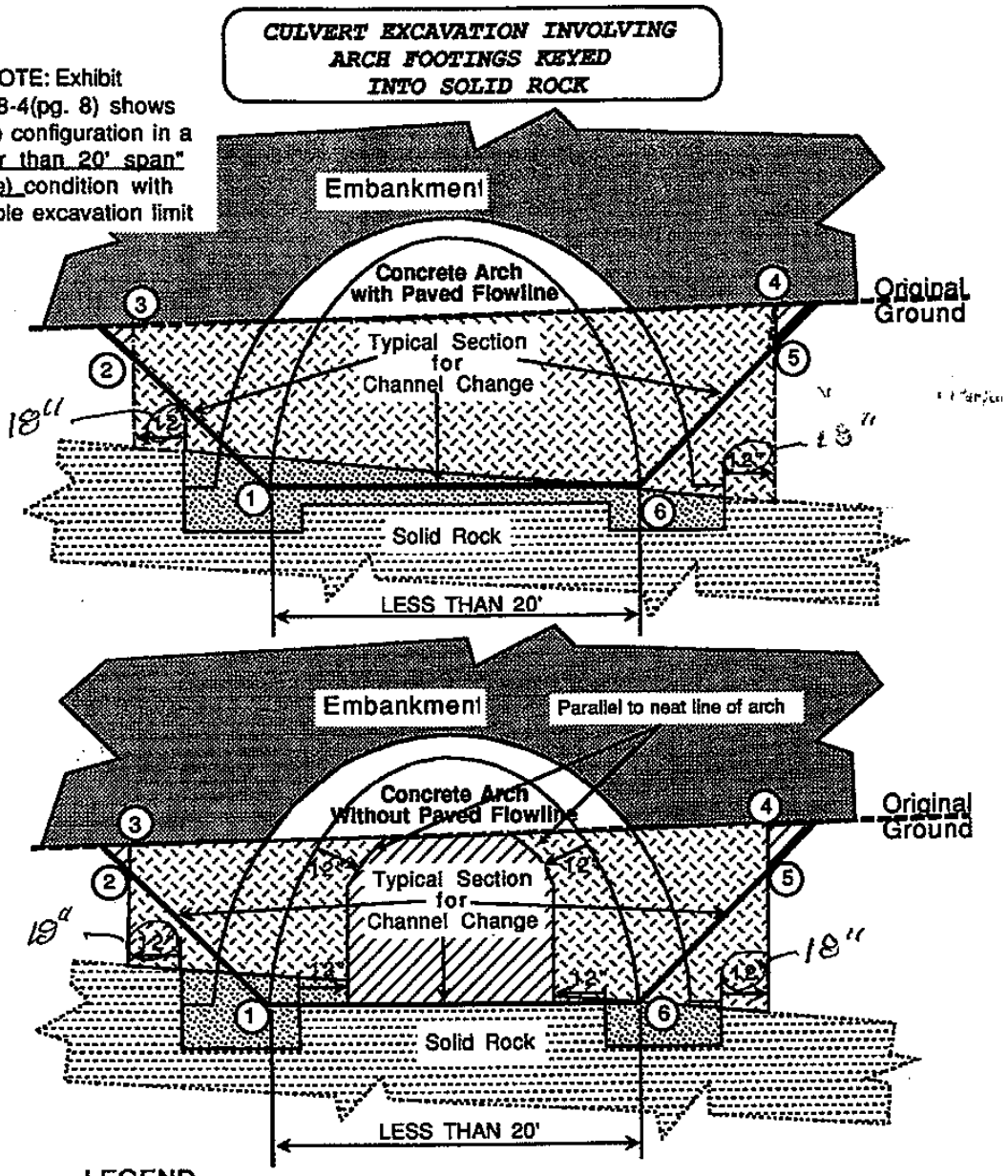
REFERENCE TABLE

LOCATION	CLASSIFICATION
1,2,3 ,5 *	Remove Existing Structure
7,8,23,13 *	Remove Existing Structure
4,17,18,9,14	Remove Existing Structure
10,14,21,20 **	Remove Existing Structure
4,16,17	Roadway Excavation
9,10,19,18	Roadway Excavation
10,14,21,20 **	Roadway Excavation



May also be paid as Funded Item Prep

NOTE: Exhibit No. 63-8-4(pg. 8) shows this same configuration in a "greater than 20' span" (Bridge) condition with applicable excavation limit

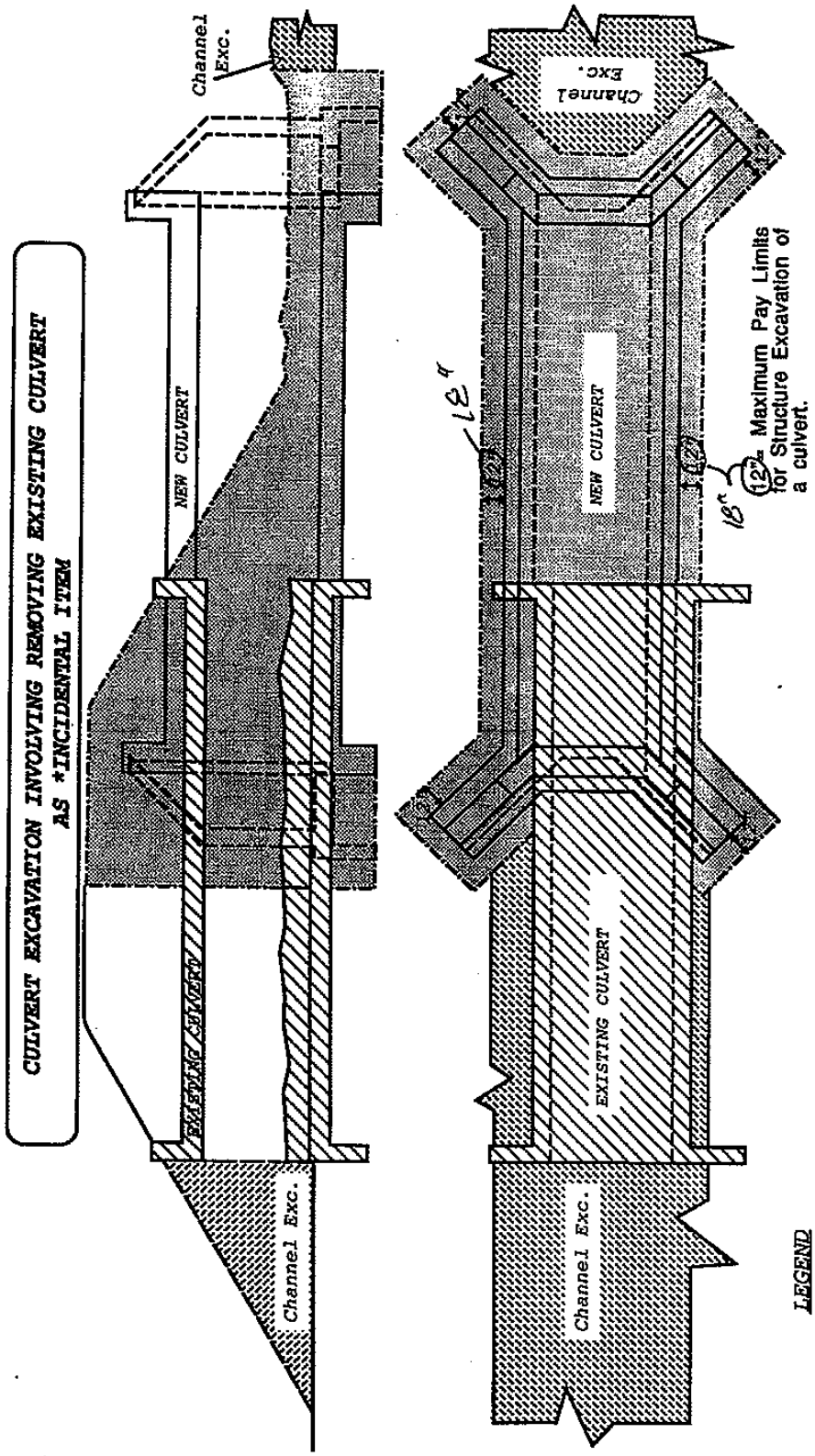


LEGEND

- Embankment
- Roadway Excavation,
- Structure Excavation, Common,
- Structure Excavation, Solid Rock,
- Solid Rock

NOTE: The area bounded by the points 1, 2, 3, 4, 5, & 6 will be calculated as "Roadway Excavation" when the finished cross section governs per Spec. 206.10.01. In the event plans designate that "Structure Excavation" takes precedence over Roadway Excavation, the areas designated by the "LEGEND" will govern.

Note: Payment may also be as Foundation Prep - LS



LEGEND

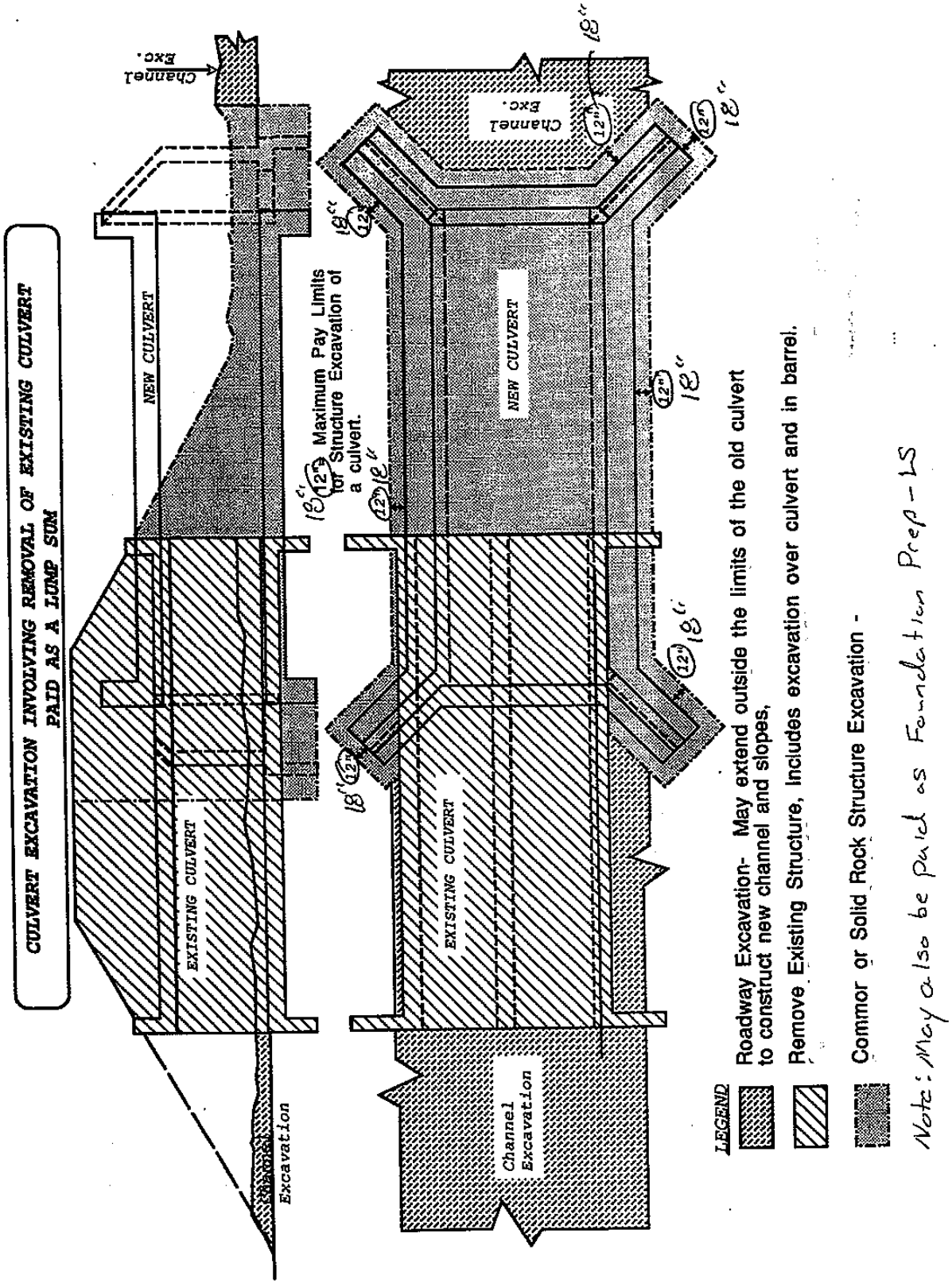
Roadway Excavation- May extend outside the limits of the old culvert to construct new channel and slopes.,

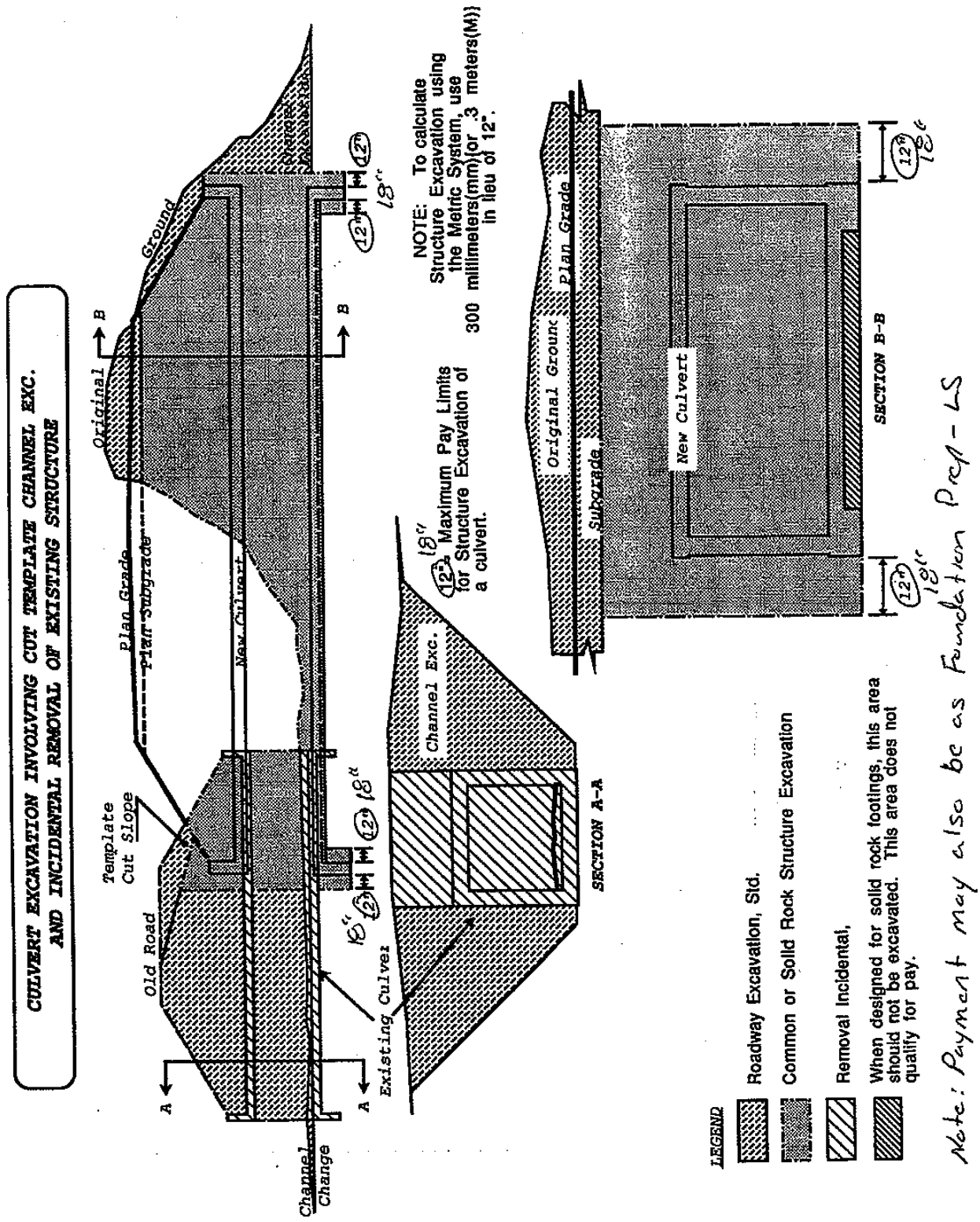
No Pay Item, Incidental to the contract unless included as a bid item in the proposal - Includes excavation over culvert and in barrel.

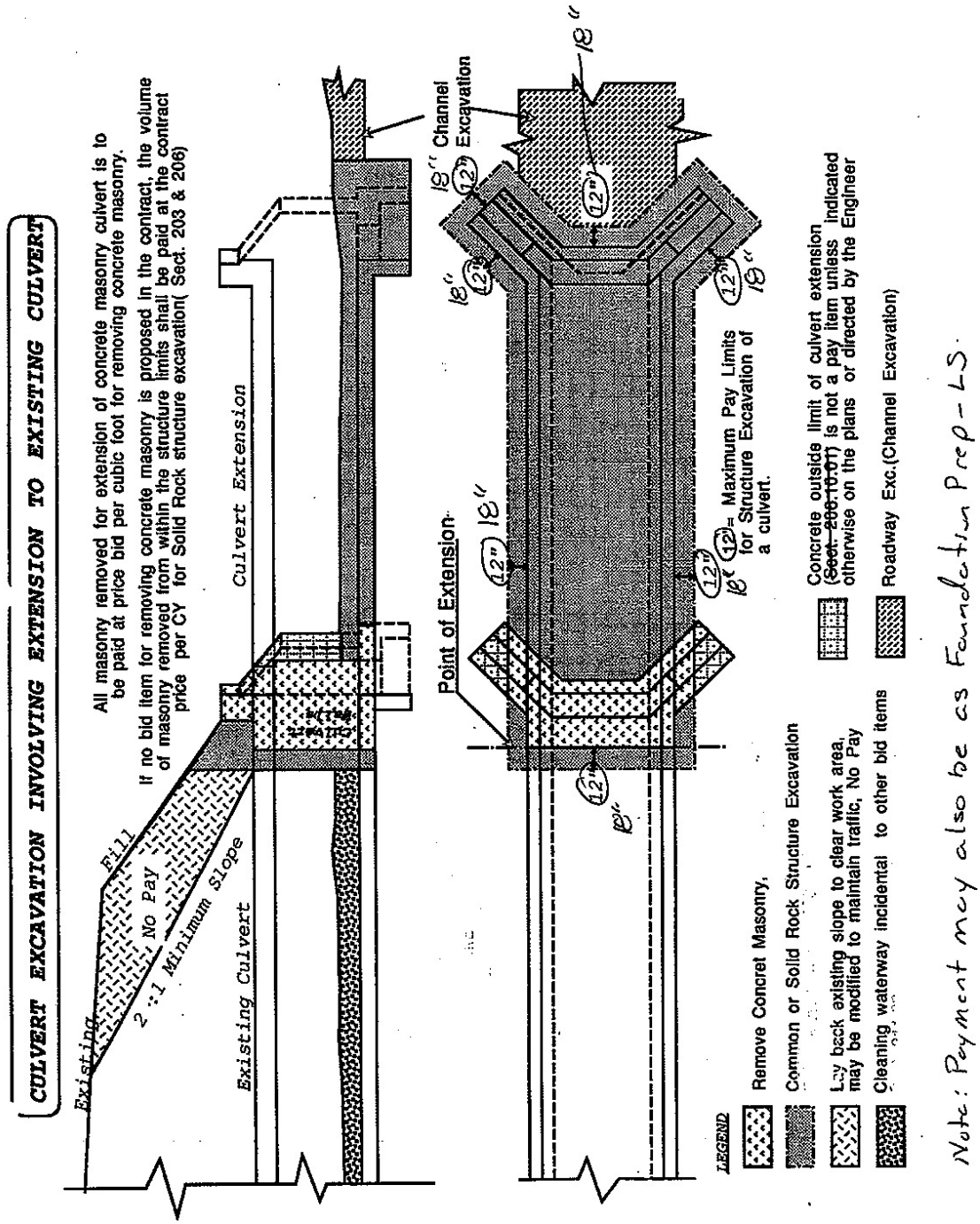
Common or Solid Rock Structure Excavation -

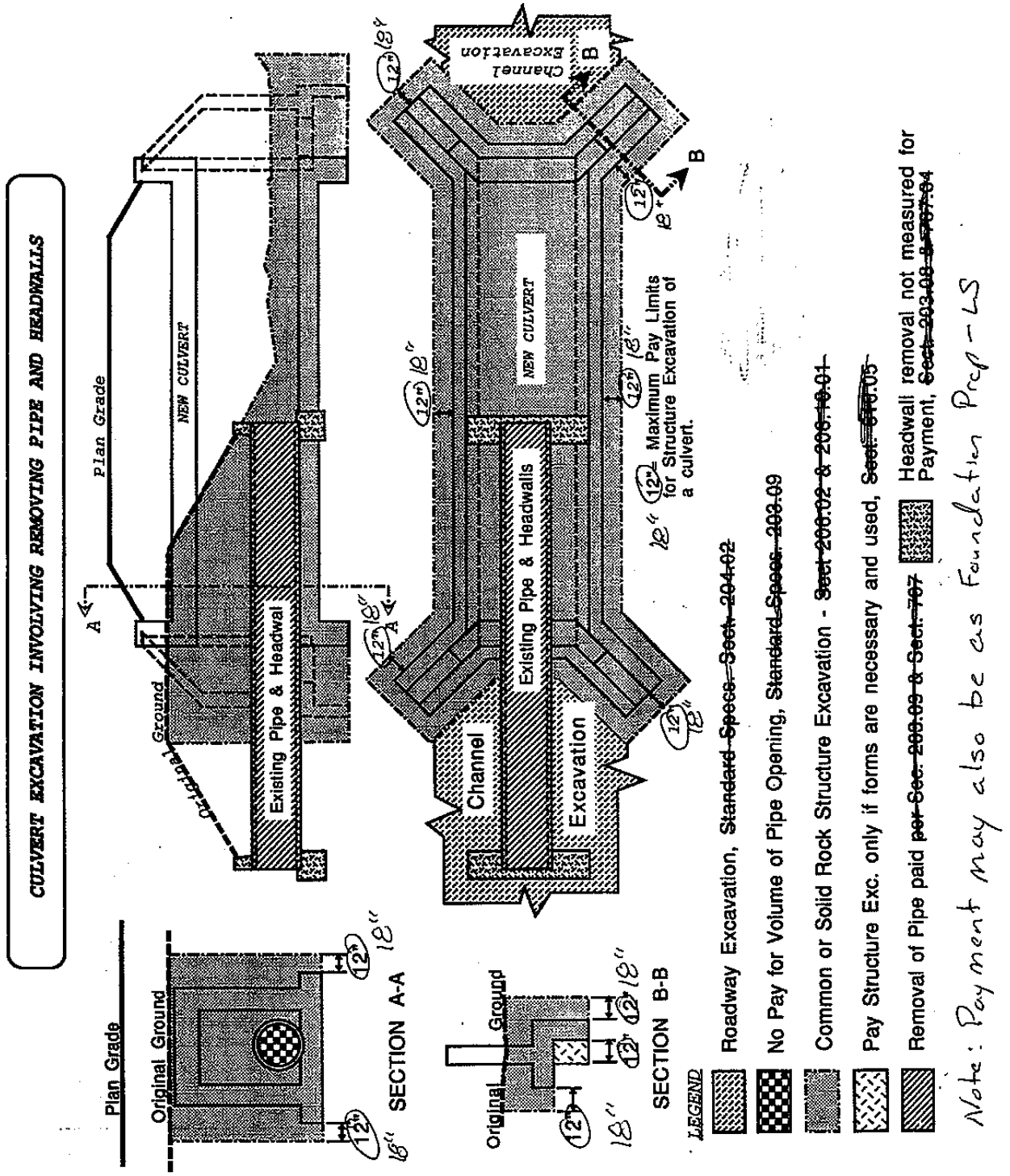
*Incidental is defined as being specified as such in the contract or as not being shown as a pay item,

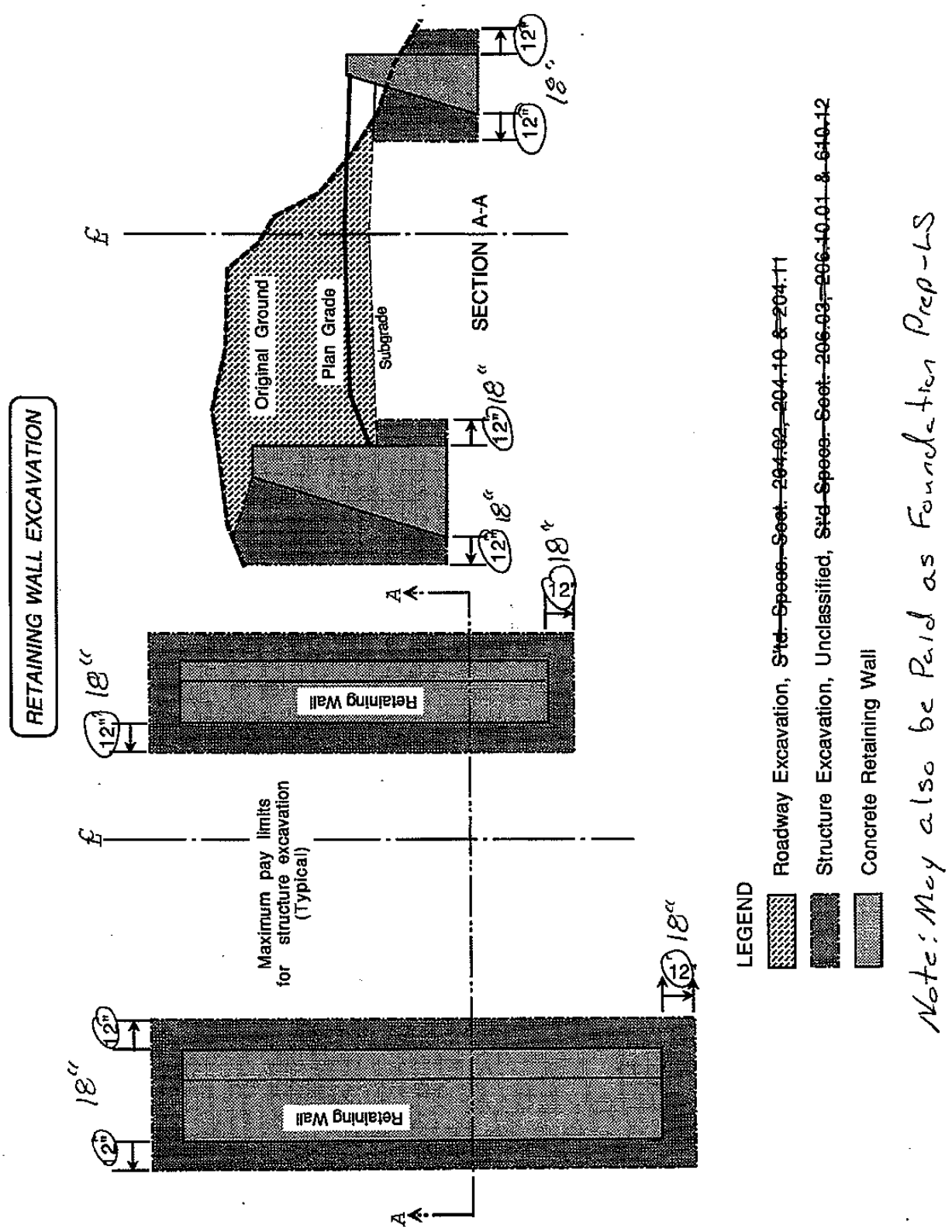
Note: Payment may also be as Foundation Prep - LS

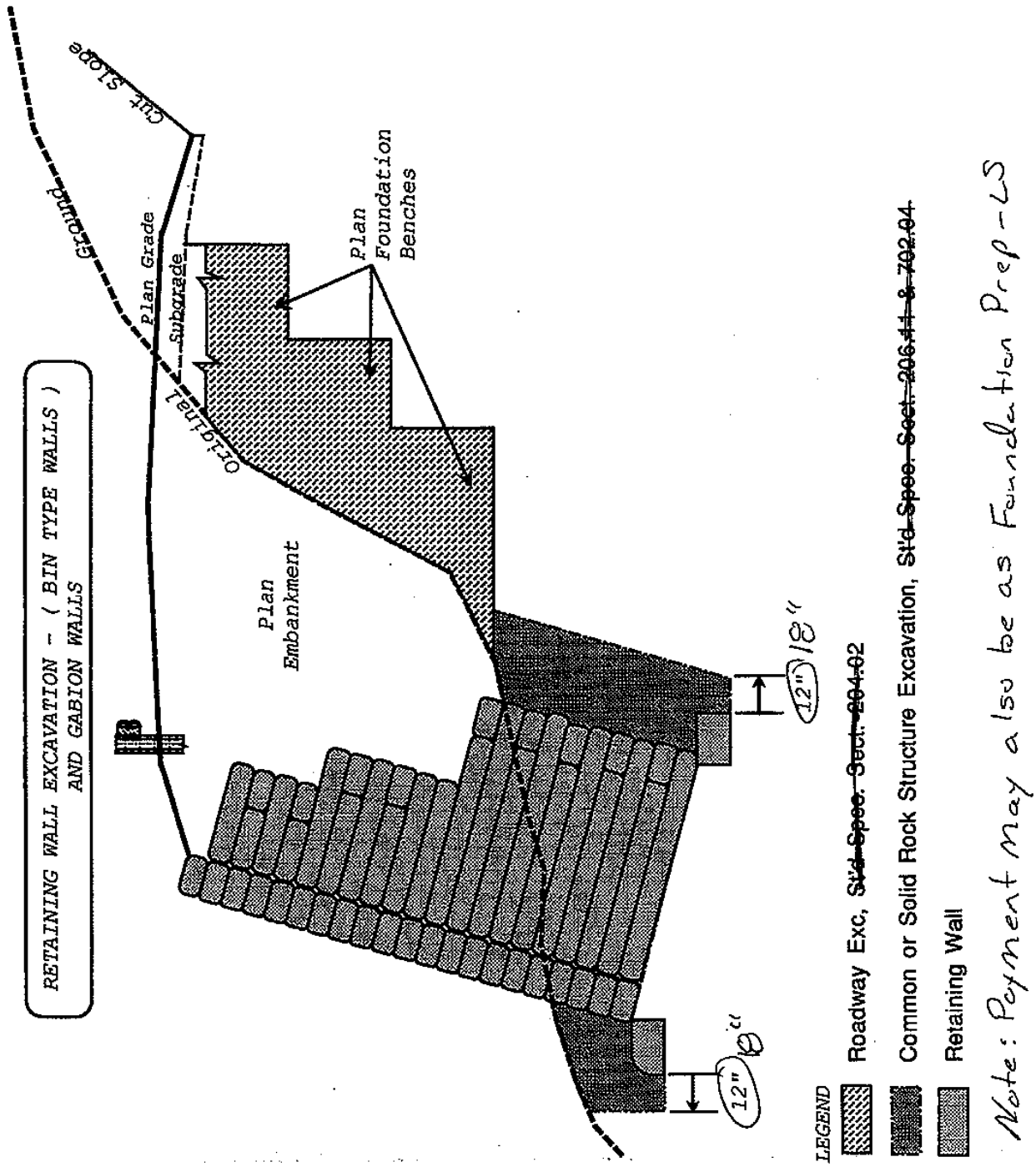

CULVERT EXCAVATION INVOLVING REMOVAL OF EXISTING CULVERT
PAID AS A LUMP SUM
NEW CULVERT
EXISTING CULVERT
Channel Exc.
Channel Excavation
Maximum Pay Limits for Structure Excavation of a culvert.
12"
18"
LEGEND
Roadway Excavation- May extend outside the limits of the old culvert to construct new channel and slopes,
Remove Existing Structure, Includes excavation over culvert and in barrel.
Commor or Solid Rock Structure Excavation -
Note: May also be paid as Foundation Prep - LS

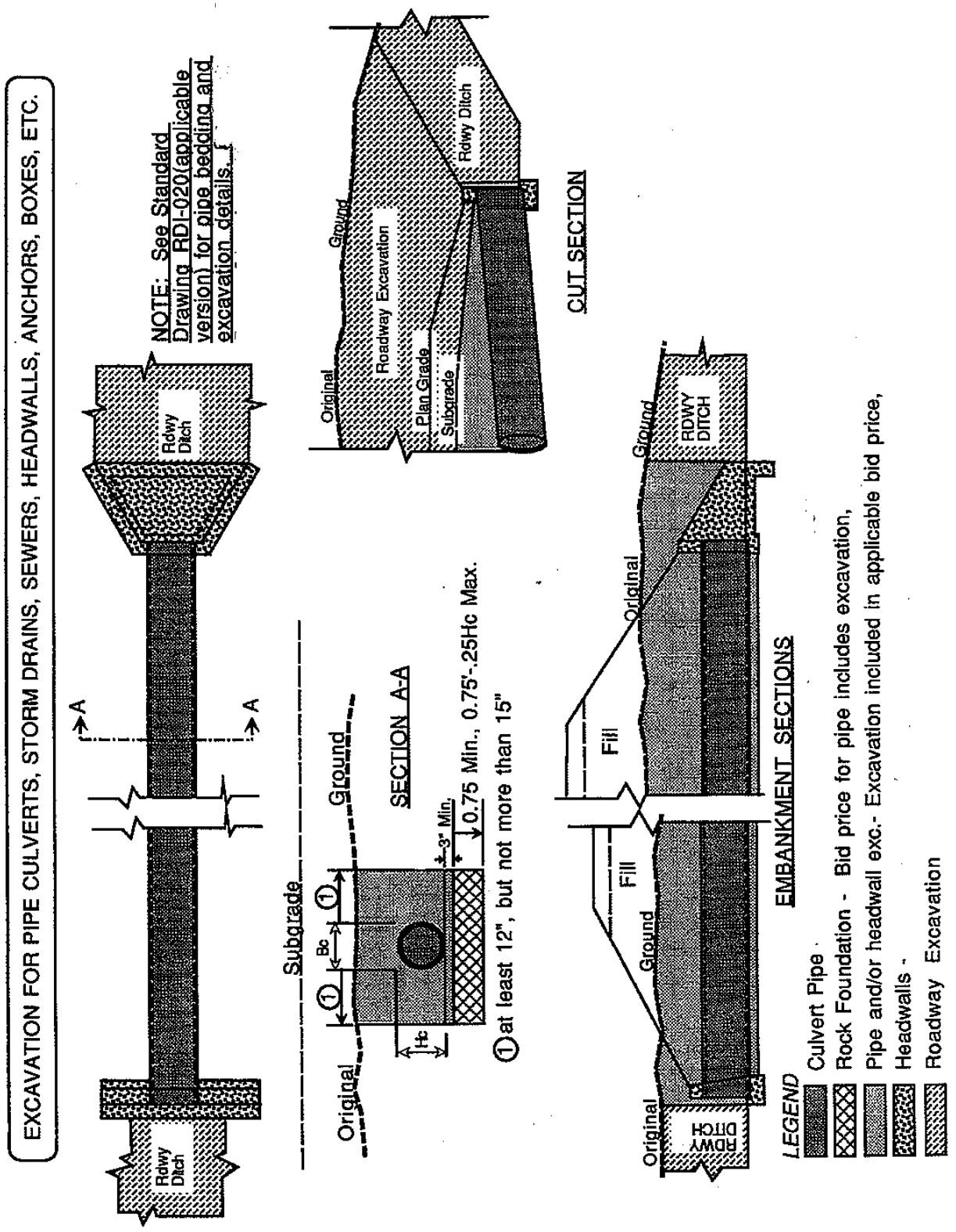

CULVERT EXCAVATION INVOLVING CUT TEMPLATE CHANNEL EXC.
AND INCIDENTAL REMOVAL OF EXISTING STRUCTURE
Original Ground
Plan Grade
Plan Subgrade
New Culvert
Template Cut Slope
Old Road
Channel Change
Existing Culvert
Channel Exc.
SECTION A-A
Original Ground
Plan Grade
Subgrade
New Culvert
SECTION B-B
NOTE: To calculate Structure Excavation using the Metric System, use 300 millimeters(mm) for .3 meters(M) in lieu of 12".
18" Maximum Pay Limits for Structure Excavation of a culvert.
LEGEND
Roadway Excavation, Std.
Common or Solid Rock Structure Excavation
Removal Incidental,
When designed for solid rock footings, this area should not be excavated. This area does not qualify for pay.
Note: Payment may also be as Foundation Prep - LS

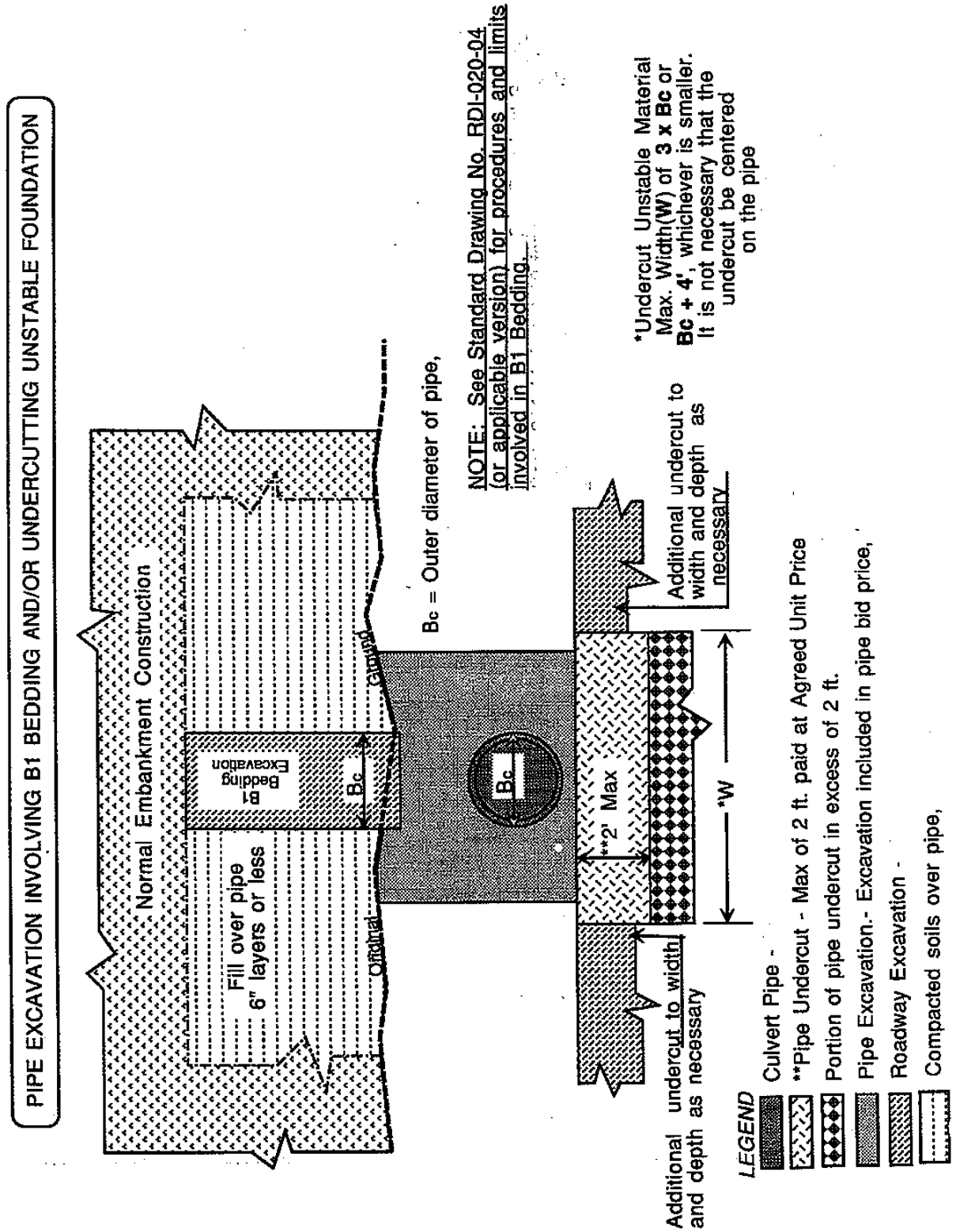

CULVERT EXCAVATION INVOLVING EXTENSION TO EXISTING CULVERT
All masonry removed for extension of concrete masonry culvert is to be paid at price bid per cubic foot for removing concrete masonry.
If no bid item for removing concrete masonry is proposed in the contract, the volume of masonry removed from within the structure limits shall be paid at the contract price per CY for Solid Rock structure excavation(Sect. 203 & 206)
Existing
Fill
No Pay
2 :1 Minimum Slope
Existing Culvert
Culvert Extension
Channel Excavation
Point of Extension
18"
12"
= Maximum Pay Limits for Structure Excavation of a culvert.
LEGEND
Remove Concret Masonry.
Common or Solid Rock Structure Excavation
Lay back existing slope to clear work area, may be modified to maintain traffic, No Pay
Cleaning waterway incidental to other bid items
Concrete outside limit of culvert extension (Sect. 206.10.01) is not a pay item unless indicated otherwise on the plans or directed by the Engineer
Roadway Exc.(Channel Excavation)
Note: Payment may also be as Foundation Prep - LS.


CULVERT EXCAVATION INVOLVING REMOVING PIPE AND HEADWALLS
Plan Grade
NEW CULVERT
Original Ground
Existing Pipe & Headwal
A
Channel Excavation
B
NEW CULVERT
Existing Pipe & Headwalls
Channel
Excavation
12"
18"
Maximum Pay Limits for Structure Excavation of a culvert.
Plan Grade
Original Ground
SECTION A-A
Original Ground
SECTION B-B
LEGEND
Roadway Excavation, ~~Standard Specs. Sect. 204.02~~
No Pay for Volume of Pipe Opening, ~~Standard Specs. 203.09~~
Common or Solid Rock Structure Excavation - ~~Sect. 206.02 & 206.10.01~~
Pay Structure Exc. only if forms are necessary and used, ~~Sect. 206.05~~
Removal of Pipe paid ~~per Sec. 203.09 & Sect. 707~~
Headwall removal not measured for Payment, ~~Sect. 203.08 & 707.04~~
Note: Payment may also be as Foundation Prep - LS

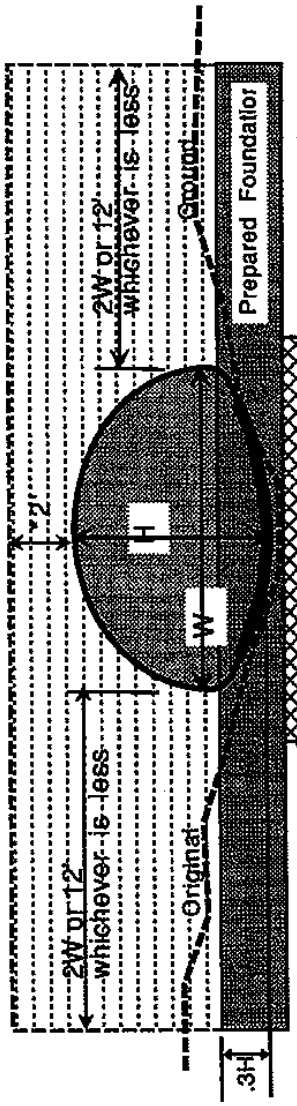

RETAINING WALL EXCAVATION
Original Ground
Plan Grade
Subgrade
SECTION A-A
Retaining Wall
Retaining Wall
Maximum pay limits for structure excavation (Typical)
12"
18"
LEGEND
Roadway Excavation, ~~Std. Specs. Sect. 204.02, 204.10 & 204.11~~
Structure Excavation, Unclassified, ~~Std Specs. Sect. 206.03, 206.10.01 & 610.12~~
Concrete Retaining Wall
Note: May also be Paid as Foundation Prep-LS


RETAINING WALL EXCAVATION - (BIN TYPE WALLS)
AND GABION WALLS
Cut Slope
Ground
Plan Grade
Subgrade
Original
Plan Foundation Benches
Plan Embankment
12"
18"
12"
18"
LEGEND
Roadway Exc, ~~Std. Spec. Sect. 204.02~~
Common or Solid Rock Structure Excavation, ~~Std. Spec. Sect. 206.41 & 702.04~~
Retaining Wall
Note: Payment may also be as Foundation Prep-LS


EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, SEWERS, HEADWALLS, ANCHORS, BOXES, ETC.
NOTE: See Standard Drawing RDI-020(applicable version) for pipe bedding and excavation details.
Rdwy Ditch
Rdwy Ditch
A
A
Subgrade
Original
Ground
Bc
1
1
Hc
SECTION A-A
3" Min.
0.75 Min., 0.75'-.25Hc Max.
1 at least 12", but not more than 15"
Original
Ground
Roadway Excavation
Plan Grade
Subgrade
Rdwy Ditch
CUT SECTION
Original
Ground
RDWY DITCH
Fill
Fill
Ground
Original
RDWY DITCH
EMBANKMENT SECTIONS
LEGEND
Culvert Pipe
Rock Foundation - Bid price for pipe includes excavation,
Pipe and/or headwall exc.- Excavation included in applicable bid price,
Headwalls -
Roadway Excavation

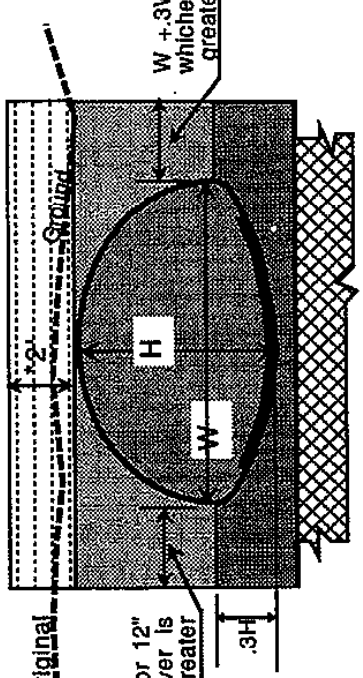

PIPE EXCAVATION INVOLVING B1 BEDDING AND/OR UNDERCUTTING UNSTABLE FOUNDATION
Normal Embankment Construction
Fill over pipe
6" layers or less
B1
Bedding
Excavation
Bc
Original
Ground
Bc = Outer diameter of pipe,
NOTE: See Standard Drawing No. RDI-020-04
(or applicable version) for procedures and limits
involved in B1 Bedding.
*Undercut Unstable Material
Max. Width(W) of 3 x Bc or
Bc + 4', whichever is smaller.
It is not necessary that the
undercut be centered
on the pipe
Additional undercut to
width and depth as
necessary
**2' Max
*W
Additional undercut to width
and depth as necessary
LEGEND
Culvert Pipe -
**Pipe Undercut - Max of 2 ft. paid at Agreed Unit Price
Portion of pipe undercut in excess of 2 ft.
Pipe Excavation.- Excavation included in pipe bid price,
Roadway Excavation -
Compacted soils over pipe,

EXCAVATION AND BACKFILLING FOR STRUCTURAL PLATE PIPES, PIPE ARCHES, AND ARCHES



* 2 ft. backfill over the top of the pipe is required except where the road grade dictates otherwise. See Spec. 612.05 or 612.06

STANDARD BEDDING, POSITIVE PROJECTION



A Negative Projection situation may be created for a Positive Projection pipe by construction of embankment

STANDARD BEDDING, NEGATIVE PROJECTION

LEGEND

- Pipe
- Pipe Exc.- Excavation included in applicable bid price,
- Rock Foundation - Bid price for pipe includes excavation,
- Foundation Preparation -Excavation and backfilling incl. in bid price,
- Compacted soils over pipe,
- Paved Invert

Inspection of Sheet Pile Cofferdams During Construction

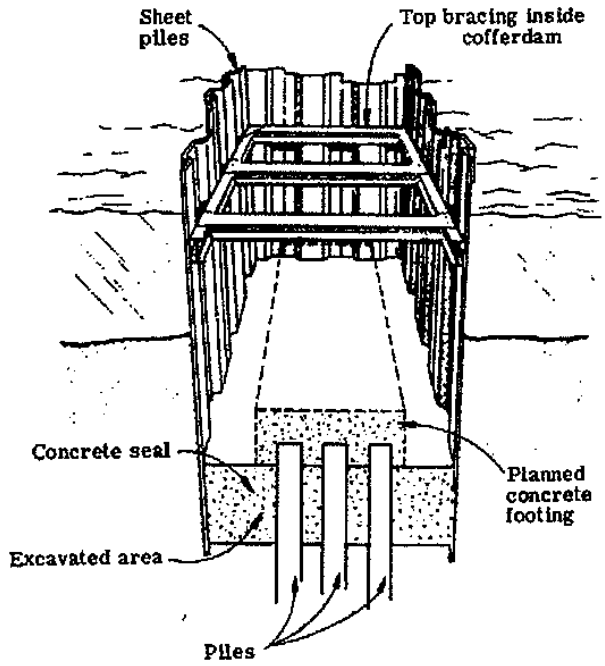
Roy Jorgenson
Roy Jorgenson and Associates
©2003 Pile Buck, Inc.

Basic Information

Cofferdams are temporary structures constructed to keep water and soil out of excavations in which bridge piers or other substructures are to be built. Usually, cofferdams are dewatered so that the substructures can be built under dry conditions. After the substructures have been completed, the cofferdams are removed.

As an inspector, your task is to inspect the work done by the contractor during construction, dewatering and removal of cofferdams. One important point needs to be made at the start: a cofferdam is a tool of the contractor. He or she is responsible for its design and construction.

The diagram below shows some of the important parts of a cofferdam. We will discuss the construction and use of these parts and your inspection duties. The design of cofferdams will vary from project to project, but the basic functions shown here will be a a part of every design.



The design of a cofferdam is left to the contractor; however, this design can be subject to approval by the engineer. If the engineer requests a design review, the contractor must submit the working drawings for approval.

The working drawings will show the type of cofferdam planned and the amount of clearance inside the cofferdam. This clearance is important; there must be enough room for the substructure to be built, including room for equipment and personnel. Additionally, the cofferdam must be deep enough to allow footing placement at the proper elevation. If you have questions about the working drawings or the size and depth of the cofferdam, ask your project engineer.

Locating the Cofferdam

It is the contractor's responsibility to initially establish horizontal and vertical control. This is done by setting up reference points and benchmarks, either on land or adjacent structures. The contractor is responsible for transferring these controls to the cofferdam. This may be easy or hard depending upon how far away the cofferdam is from the reference points.

Once the foundation and sheet piles are driven, the contractor will establish permanent points on the sheet piling or bracing. These points may be either painted or scratched on the material, but any points should be marked so that you can easily read them. These reference points are important; they give you the information needs to check:

- Alignment of the template (sometimes spelt templet) for the piles and footing;
- Dimensions of the excavation and the footing; and

- Elevations of the piles, the seal and the footing.

Once the footing is in place, the reference points can be transferred to a point on the footing, from which the remaining structure elevations and dimensions can be checked.

General Sequence

Before describing the inspection of specific steps of cofferdam work, we will deal with the basic sequence of the work. These steps may vary from project to project, but for our purposes they will serve as a typical example. These steps are as follows:

1. Temporary piles are driven to hold the template for the cofferdam.

2. The template is set on the temporary pile. This template can be remain in the cofferdam as bracing.

3. Sheet piles are set in place and driven. The sheet piles will be placed around the template or bracing that will hold them in position.

4. The foundation pit is excavated inside the cofferdam. If needed, excavation will go beyond plan grade if unsuitable material is encountered. Suitable materials will be used as backfill.

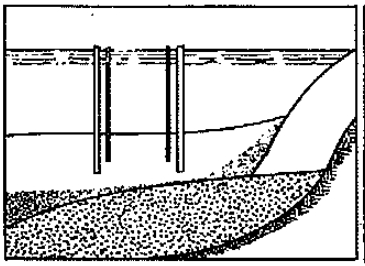
5. Foundation piles are driven, using the top ring of bracing as a template for spacing and positioning. After pile driving, more excavation may be needed. If a foundation pile tip's elevation is higher than the cofferdam sheet pile tips, notify the geotechnical engineer.

6. The concrete seal is placed on the bottom of the foundation pit. The concrete is placed underwater to form a seal, which keeps the water from seeping through the foundation.

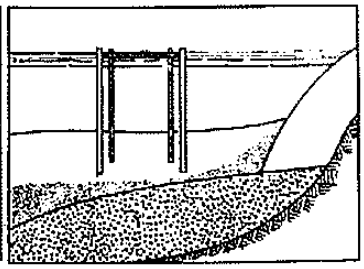
7. The cofferdam is dewatered (pumped dry) so that work can begin on the substructure.

8. When the substructure is completed, the cofferdam is flooded and sheet piling is extracted.

They are illustrated in the following drawings.

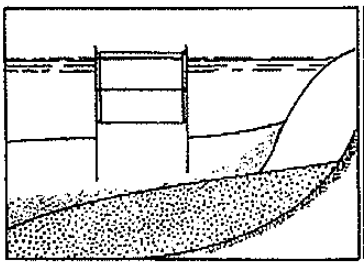


Step 1. Temporary piles are driven.

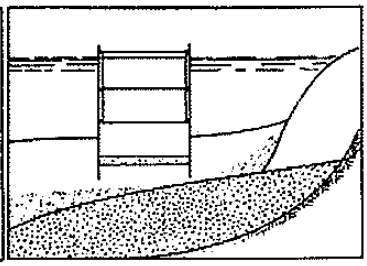


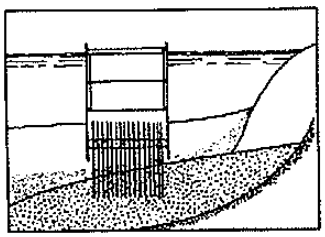
Step 2. Template set on temporary piles.

Step 3. Set and drive sheet piles.

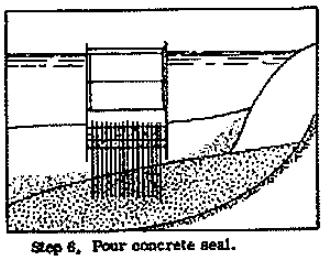


Step 4. Excavate and backfill, if needed.

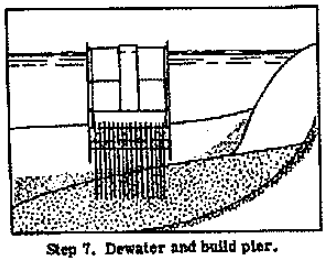




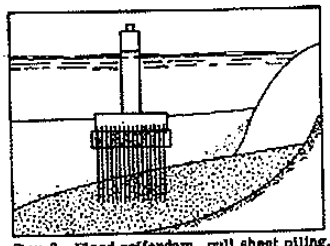
Step 5. Drive foundation piles.



Step 6. Pour concrete seal.



Step 7. Dewater and build pier.



Step 8. Flood cofferdam, pull sheet piling. Remove bracing frame, complete pier.

Placing Steel Sheet Piles

Materials

Most cofferdams are constructed of steel sheet piles. Steel offers the most strength and durability—and it can be removed and used again. The type of steel sheet piles used is up to the contractor, but you should be familiar with the characteristics of the piling. Most sheet piles are the deep-arch types that interlock as shown below:

You will have to make a few checks on the piles both before and during installation:

- Check the sizes of the steel sheet piles. They must be long enough and have the dimensions shown on the working drawings.
- Check for crimped flanges or damaged interlocks. On regular steel H-piles, minor damage will not affect the driving or strength of the piles, but on steel sheet piles, even small crimps or bends can make driving and interlocking difficult and dangerous.
- Check the handling holes and other openings in the sheets. All holes that will be below the water level must be plugged or welded so that the cofferdam will remain dry after it is dewatered.

It is a good idea to check the steel sheet piles before installation, since damage can occur during storage and handling.

Setting and Driving

The most important step in setting and driving sheet piles is the construction of a well-built guide structure. In many cases, the guide structure may be a top level of bracing that is constructed between struts—extended foundation piles.

First, a few struts are driven around the perimeter of the planned cofferdam. These piles will extend above the water level. After this, a bracing framework is set up between these struts. This guide structure should be checked for proper location.

There may be a need for more than one guide structure. When the top bracing is placed after the sheet piles are driven, a temporary inside guide frame may be used. Alternatively, if the sheet piles extend much higher than the water level, a guide frame may be place on top of the bracing.

As mentioned earlier, the actual construction of the cofferdam—including setting and driving the sheet piles—is the responsibility of the contractor. Still, you should be familiar with the work. Some of the important steps are listed below:

- The entire cofferdam should be set in place before the bulk of the driving is done.
- Setting should begin at one corner and continue around the cofferdam. Some of the sheet piles may need to be driven more, so that the structure will hold in place. Be sure the corners are vertical and placed in the right locations. This will ensure the proper positioning of the remaining sheet piling.

- All of the sheet piles must be set vertically. The corners are more rigid and the walls will adjust to fit them. This is why it is especially important to keep the corners vertical. If any piles begin to lean, they should be reset.

- The actual driving of the sheet piles should be done a few feet at a time, working around the cofferdam and driving the sheet piles at approximately the same time.

Cofferdam construction procedures will vary from one contractor to another.

Length and Penetration

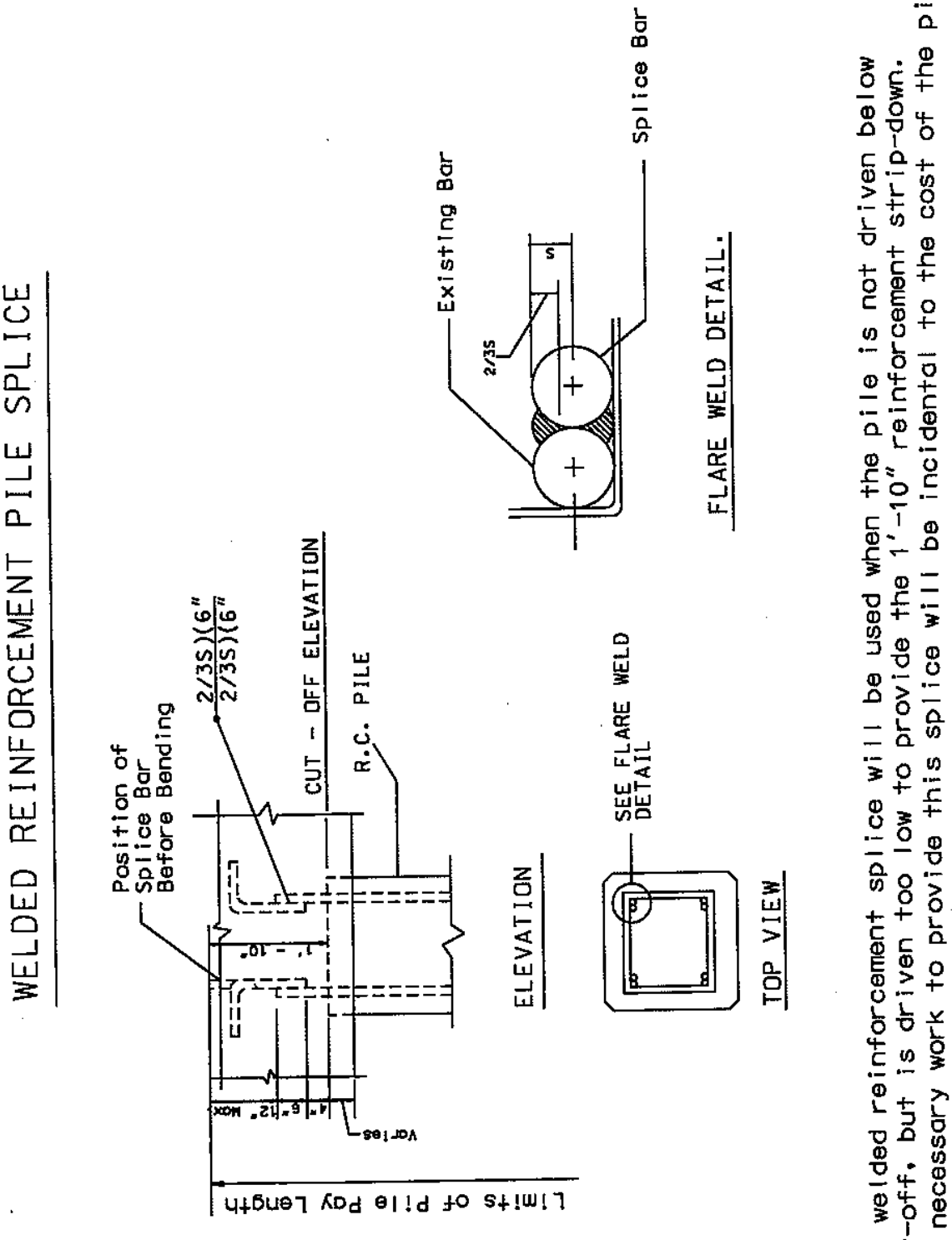
The proper length and penetration of the steel sheet piles in the cofferdam will be shown on the working drawings. You will not need to compute bearing or check blow counts, but you should inspect the final driven sheet piles for some general conditions:

- If the cofferdam is to be dewatered, the sheet piles must be driven to sufficient depth to insure a dry seal. Additionally, it must have adequate bracing to keep it from collapsing under water pressure.

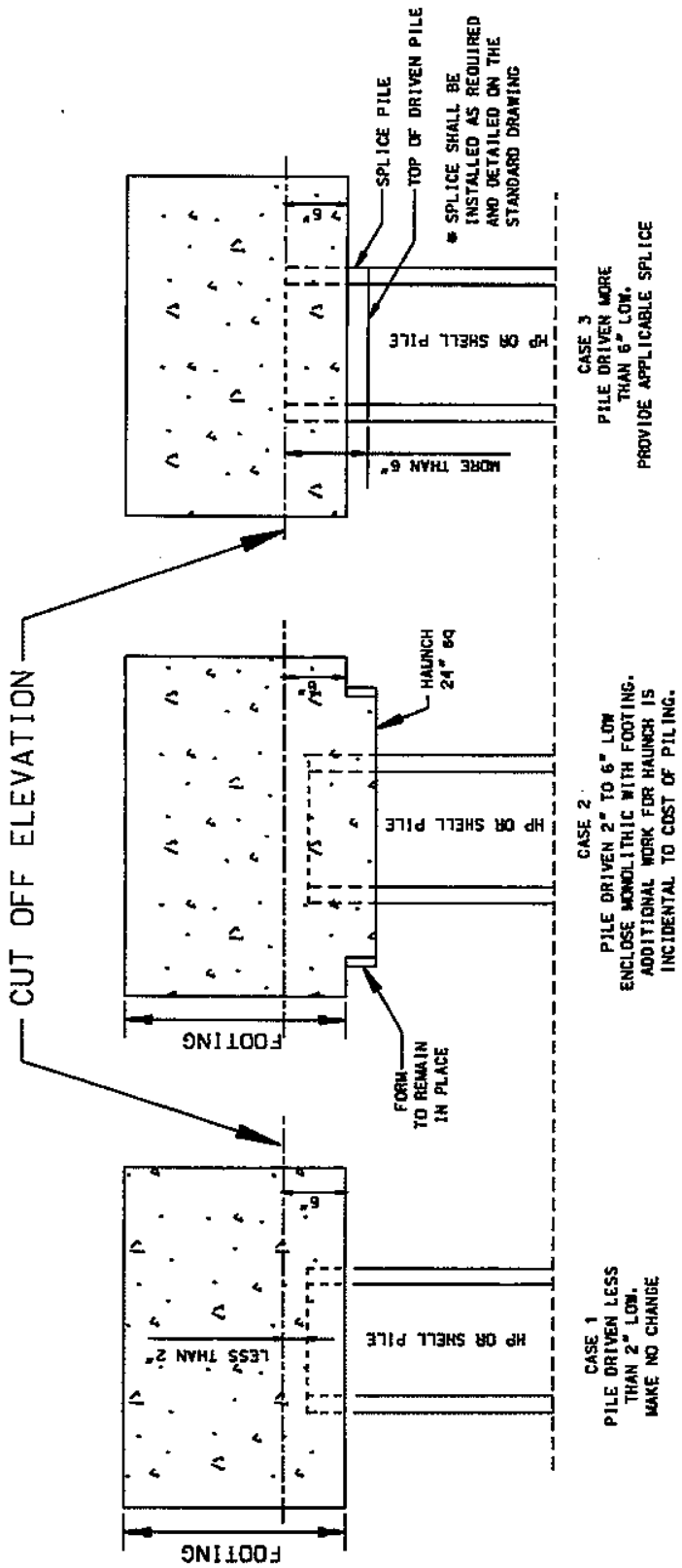
- No matter how deep a sheet pile is to be driven, it must have enough bearing capacity to support the weight of the pile, the top brace or other guide frames, and other construction equipment.

- Cofferdams must not tilt or move laterally during driving. If they do, they must be righted or enlarged to provide the necessary clearance.

- Welding at interlocks should be avoided where possible. If welding is done, however, no welding material should be placed inside the interlock. Otherwise, free movement will be blocked.



The welded reinforcement splice will be used when the pile is not driven below cut-off, but is driven too low to provide the 1'-10" reinforcement strip-down. All necessary work to provide this splice will be incidental to the cost of the pile.



1) FOR 14" HP PILING CASE 2 MAY APPLY FOR 2" TO 7" RANGE
2) FOR END BENTS OR ABUTMENTS, BUILD UP PILES TO CUT-OFF LENGTH UNLESS THE REQUIRED LENGTH OF THE BUILD UP IS INSUFFICIENT TO ALLOW INSTALLATION OF THE STANDARD DRAWING INDICATED SPLICE. IN THIS CASE MAKE NO CHANGE IN AS-DRIVEN PILE.
3) FOR PILE BENTS, BUILD UP ALL PILES TO CUT-OFF. IF THE LENGTH OF BUILD UP IS INSUFFICIENT TO ALLOW INSTALLATION OF THE STANDARD DRAWING INDICATED SPLICE, REMOVE ENOUGH OF THE DRIVEN PILE TO AFFORD INSTALLATION OF THE SPLICE. NO PAYMENT WILL BE ALLOWED FOR THE REMOVED LENGTH.

STEEL PILING DRIVEN BELOW CUT-OFF

COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
FRANKFORT, KENTUCKY 40622

MILO D. BRYANT
SECRETARY
AND
COMMISSIONER OF HIGHWAYS

WALLACE G. WILKINSON
GOVERNOR

Construction Memo No. 3-91

MEMO TO: Chief District Engineers
District Branch Managers for Construction
Resident Engineers
Consultant Engineers for Construction

FROM: Paul Gravely, P. E. P.D. Gravely
Director,
Division of Construction

DATE: March 6, 1991

SUBJECT: Mill Test Reports
Steel "H" Piles

Effective immediately, mill test reports for steel "H" piles shall be checked for compliance with the specifications by the resident engineer's office instead of sending to the Division of Construction. The standard drawings require "H" piles to conform to the requirements of ASTM-A36.

The test report should be checked for the following:

(1) Made in America
(2) Size of Shape: HP 12x53, HP 14x73, etc.
(3) Tensile Requirements: Yield Strength, Tensile Strength, Elongation
(4) Chemical Requirements: Carbon (C), Phosphorus (P), Sulphur (S) (Copper is only required when Standard Drawings BSP 005-04 and BSP 006-04 are required by the plans and Manganese (MN), Silicon (Si) are not required for steel shapes)
(5) Test Report is signed by responsible representative of Company.

Upon verification of compliance with the ASTM A36 requirements, advise the contractor in writing of the approval and list the heat numbers that are approved. A copy of this approval letter should be sent to Division of Construction and Division of Materials. All test reports must be reviewed and approved before the piles represented by the test report are driven.

[redacted], an example mill test report, and an example letter of approval are attached for reference.

cc: Roy Back
Division of Materials
Federal Highway Administration

D12

"AN EQUAL OPPORTUNITY EMPLOYER M/F/H"

Note: Contact the Division of Construction for questions concerning ASTM A36-89.

United States Steel Corporation

MAR 16

Metallurgical Test Report

01.000.0772 (REV. 7-78)

Homestead Borough, Allegh... My Commission Expires Ap... 83 Member, Pennsylvania Association of Notaries

JOB, CONTRACT NO.

P. O. DATE | PURCHASE ORDER NO. 100 02/05/81

SHIPPERS NO. 5319 3/10/81 | MILL ORDER NO. FC39375 | INVOICE NO. 163-27325

VEHICLE IDENTITY OBL 1269

VENDOR: HOMESTEAD WORKS
HOMESTEAD, PA. 15120

SOLD TO: [redacted] JOINT VENTURE
P O BOX 85
LEBANON JUNCTION KY 40150

SHIP TO: [redacted] JOINT VENTURE
C/O JOBSITE APPROX MILE
POST 102 ON I-65
COLESBURG KY

BEING DULY SWORN ACCORDING TO LAW, DEPOSES AND SAYS THAT THE CHEMICAL ANALYSES AND/OR TEST RESULTS SHOWN IN THIS REPORT ARE CORRECT AS CONTAINED IN THE RECORDS OF THE COMPANY.

A.J. JOSEPH, CH. MET.

DATE 03/10/81

SPEC. & SP. ASTM A36-77A

SHAPES
01 MILL SWORN T/R - ANALYSIS - REPORT TEST RESULTS PER PRODUCT SPECN CAPTION

STATE OF PENNSYLVANIA
COUNTY OF ALLEGHENY
SUBSCRIBED AND SWORN TO BEFORE ME THIS 11 DAY OF March 1981

Eugene E Boyle

ITEM NO.	MATERIAL DESCRIPTION: THICKNESS OR SECTION	WIDTH, DIA. OR FT. WT.	LENGTH	QUANTITY	WEIGHT	HEAT NO.	TEST OR PIECE IDENTITY	YIELD PT. PSI	TENSILE STR. PSI	ELONGATION % IN 8"	ELONGATION % IN 2"	% RED. OF AREA	BEND
01	HP12X53		60-00.00	12	38160	74B055	HP12X53	43800	63900	28.0			
							HP12X53	42200	64800	29.0			
01	HP12X53		60-00.00	5	15900	75B130	HP12X53	43800	64000	30.5			
							HP12X53	42000	63300	29.5			
01	HP12X53		60-00.00	8	25440	75B130	HP12X53	42000	63300	29.5			
							HP12X53	43800	64000	30.5			
02	HP12X53		40-00.00	13	27560	65B144	HP12X53	41700	61900	32.5			
							HP12X53	44400	63800	26.5			

HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CB	CO
74B055	HEAT	23	68	004	019	052												
75B130	HEAT	22	72	006	019	047												
65B144	HEAT	20	71	005	017	026												

015096 DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN VERTICAL DOTTED LINE OR DECIMAL POINT

Attach to Construction Memo 3-91

S A M P L E

January 2, 1992

Inahurry Construction Company
P. O. Box XXX
Bardstown, KY

SUBJECT: Hardin County
BRZ 999(000)
Bridge @ Station 50+00
Test Report - Steel Piling

Gentlemen:

The attached mill test report for the HP 12x53 steel piling has been reviewed. The test report indicates that this material conforms to ASTM A36 as required by Standard Drawing BPS-003-04 and is satisfactory to use.

The following heat numbers are approved:

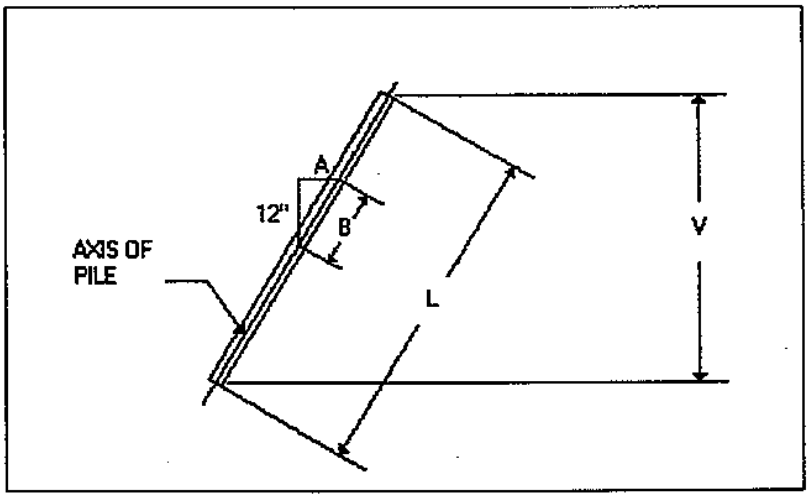
74B055
75B130
65B144

Sincerely,

Jim Dandy
Resident Engineer

cc: District Office Construction
Division of Materials
Division of Construction

TABLE FOR ESTIMATING LENGTHS OF BATTERED PILES



BATTER	DIMENSIONS			DIMENSION OF PILE	
		A	B	V (ft)	L (ft)
4" in 12"		4"	1.05409' or 12.6492"	10	10.54
				20	21.08
				30	31.62
				40	42.16
				50	52.70
3" in 12"		3"	1.03078' or 12.3693"	10	10.31
				20	20.61
				30	30.92
				40	41.23
				50	51.54
2-1/2" in 12"		2-1/2"	1.02147' or 12.2577"	10	10.22
				20	20.43
				30	30.65
				40	40.86
				50	51.08
2" in 12"		2"	1.01379" or 12.1655"	10	10.14
				20	20.28
				30	30.42
				40	40.56
				50	50.69
1-1/2" in 12"		1-1/2"	1.00778" or 12.0934"	10	10.08
				20	20.16
				30	30.23
				40	40.31
				50	50.39
1" in 12"		1"	1.00347' or 12.0416"	10	10.03
				20	20.07
				30	30.10
				40	40.14
				50	50.17

AIR OR STEAM HAMMERS

MFGR.	MODEL	RATED ENERGY (FT.-LBS.)	TYPE	BLOWS PER MINUTE	WEIGHT OF RAM (LBS.)	MAX. STROKE (FT.-IN.)	AIR[1] REQ'D (CFM)	REC.[2] COMP. (CFM)	BOILER HP ASME	AIR OR STEAM (PSI)	HOSE SIZE (IN.)	WEIGHT[3] (LBS.)	LENGTH[3] (FT.-IN.)	WIDTH AT LEAD RAILS (INCHES)
CONMACO	300	80,000	SGL.ACT.	55	30,000	36	1,905		247	150	3	55,390	16-5	56
	200	60,000	SGL.ACT.	60	20,000	36	1,634		217	120	3	44,560	15-0	56
	160	48,750	SGL.ACT.	60	16,250	36	1,275	1,800	198	120	3	37,200	15-0	42
	140	42,000	SGL.ACT.	60	14,000	36	1,164	1,500	178	110	3	34,750	13-10	42
	160D	41,280	DIFFER.	103	16,000	15 1/2	1,550	2,000	237	160	3	35,400	13-7 1/2	42
	125	40,425	SGL.ACT.	50	13,500	39	940	1,500	120	125	2 1/2	21,840	14-10	32
	115	37,375	SGL.ACT.	50	11,500	39	910	1,200	99	120	2 1/2	20,780	15-0	32
	140D	34,000	DIFFER.	103	14,000	15 1/2	1,425	1,800	211	140	3	31,280	12-5	42
	100	33,500	SGL.ACT.	50	10,000	39	820	1,050	85	100	2 1/2	19,280	14-2	32
	80	26,000	SGL.ACT.	50	8,000	39	730	1,050	75	85	2 1/2	17,280	14-2	32
	65	19,500	SGL.ACT.	60	6,500	36	650	750	67	100	2	12,100	13-0	26
	50	15,000	SGL.ACT.	60	5,000	36	565	600	54	80	2	10,600	13-0	26
MKT	B20	60,000	SGL.ACT.	60	20,000	36			190	150	3	38,650	15-6	36
	B14	37,500	SGL.ACT.	60	14,000	32			155	100	3	31,700	13-7	36
	B10	32,500	SGL.ACT.	55	10,000	39	1,000	1,500	130	80	2 1/2	22,380	14-1	30
	11B-3	19,150	DBL.ACT.	95	5,000	19	900	1,200	128	100	2 1/2	14,000	11-1 1/2	26
	10B-3	13,100	DBL.ACT.	105	3,000	19	750	1,200	104	100	2 1/2	10,850	9-2	24
	9B-3	8,750	DBL.ACT.	145	1,600	17	600	900	85	100	2	7,600	8-3 3/4	20
	7	4,150	DBL.ACT.	235	800	9 1/2	450	750	65	100	1 1/2	5,000	6-0 1/2	21
	6	2,500	DBL.ACT.	275	400	8 3/4	400	600	45	100	1 1/4	3,900	5-3 1/8	15
	5	1,000	DBL.ACT.	300	200	7	250	450	35	100	1 1/4	1,500	4-9	11
VULCAN	530	150,000	SGL.ACT.	42	30,000	60	2,076	2,400	340	150	5	55,160	21-5	37
	520	100,000	SGL.ACT.	42	20,000	60	1,657	2,000	250	102	5	45,160	21-6	37
	400C	113,484	SGL.ACT.	100	40,000	16 1/2	4,657		700	150	5	91,200	16-3 1/2	80
	050	90,000	SGL.ACT.	55	30,000	36	1,833	2,000	247	150	3	55,410	16-4	54
	512	60,000	SGL.ACT.	41	12,000	60	1,094	1,200	200	100	2 1/2	23,480	18-5	26
	020	60,000	SGL.ACT.	60	20,000	36	1,634	2,000	217	120	3	43,785	15-0	54
	300C	80,200	DBL.ACT.	98	20,000	15 1/2	1,746	2,000	260	142		59,000	13-2	37
	510	60,000	SGL.ACT.	41	10,000	60	952	1,050	160	85	2 1/2	21,480	18-5	26
	016	48,750	SGL.ACT.	60	16,250	36	1,282	1,500	210	120	3	33,300	14-6	32
	014	42,000	SGL.ACT.	60	14,000	36	1,200	1,500	206	110	3	27,500	14-6	32
	508	40,000	SGL.ACT.	41	8,000	60	818	900	150	65	2 1/2	19,480	18-5	26
	140C	36,000	DBL.ACT.	103	14,000	15 1/2	1,425	1,750	211	140	3	27,954	12-3	32
	506	32,500	SGL.ACT.	46	6,500	60	744	900	112	100	2	12,025	17-5	20
	010	32,500	SGL.ACT.	50	10,000	39	1,002	1,200	157	105	2 1/2	18,750	15-0	26
	OR	30,225	SGL.ACT.	38	9,300	39	1,020	1,200	148	2 1/2	100	18,050	15-0	26
	08	26,000	SGL.ACT.	50	8,000	39	880	900	127	85	2 1/2	16,750	14-10	26
	505	25,000	SGL.ACT.	46	5,000	60	563	600	92	77	2	11,800	17-5	20
	80C	24,450	DBL.ACT.	111	8,000	16 1/2	1,245	1,500	183	120	2 1/2	17,885	12-1 5/8	26
	0	24,375	SGL.ACT.	50	7,500	39	841	900	128	80	2 1/2	16,250	15-0	26
	06 (106)	19,500	SGL.ACT.	60	6,500	36	625	900	94	100	2	1,200	13-0	20
	65C	19,200	DBL.ACT.	117	6,500	15 1/2	991	1,200	142	150	2	14,886	12-1	20
	50C	15,100	DBL.ACT.	120	5,000	15 1/2	889	900	125	120	2	11,782	20-0	20
	1 (106)	15,000	SGL.ACT.	60	5,000	36	565	600	81	80	2	9,700	12-9	20
	30C	7,260	DBL.ACT.	135	3,000	19 1/2	488	600	40	120	1 1/2	7,036	8-11	19
	2	7,260	SGL.ACT.	79	3,000	29	336	450	49	80	1 1/2	6,780	11-6	19
	DGH-900	5,750	DBL.ACT.	360	900	10	877	900	115	78	1 1/2	5,000	6-9	18
	18C	3,600	DBL.ACT.	150	1,800	10 1/2	568	450	45	120	1 1/4	4,139	8-3 1/8	6 1/4
	DGH-100D	643	DBL.ACT.	595	100	6	120	125		100	1	786	4-2	3 3/4

NOTES:

1 Air required at the hammer or extractor. See Note 2.

2 Compressor output must exceed air required at hammer due to line and efficiency losses. Vulcan states " It is advisable that the adiabatic consumption figure be increased by approximately 30 per cent in the determination of the required compressor size." MKT states "Generally, to assure satisfactory hammer operation, your compresssor should be able to deliver 150 per cent of this actual compressed volume.

3 MKT hammers are listed with flat anvils. Vulcan and Conmaco hammers are listed with standard base, no drive cap. Menck hammers are listed without drive cap.

DIESEL HAMMERS

MFGR.	MODEL	RATED ENERGY [1] (FT.-LBS.)	TYPE	BLOWS [1] PER MINUTE	WEIGHT OF RAM (LBS.)	MAX [1,2] STROKE (INCHES	EIGHT (LBS.)	ENGTH (FT.-IN.)	WIDTH AT [4] LEAD GUIDES (INCHES)
DELMAG	D46-02	48,400 to 105,000	SGL.ACT.	37-53	10120	128	19900	17-3	32
	D44	43,500 to 87,000		37-56	9500	137	22300	15-10	37
	D36-02	38,000 to 83,100		37-53	7900	128	17700	17-3	32
	D30-02	31,800 to 62,900		38-54	6600	127	13150	17-2	26
	D30	23,800 to 54250		39-60	6600	126	12350	14-2	26
	D22-02	24,600 to 48,400		38-54	4850	127	11400	17-2	26
	D22	39700		40-60	4850	127	11200	14-2	26
	D15	27100		40-60	3300	132	6600	13-11	20
	D12	22500		40-60	2750	130	6050	13-11	20
	D5	9100		42-60	1100	116	2750	12-6	15 3/8
KOBE	K45	91100		39-60	9920	110	25600	18-6	36
	K42	79000		40-60	9260	102	24000	18-6	36
	K35	70800		39-60	7720	110	18700	17-8	36
	K32	60100		40-60	7050	102	17750	17-8	30
	K25	50700		39-60	5510	110	13100	17-6	26
	K22	41300		40-60	4850	102	12350	17-6	26
	K13	25200		40-60	2870	106	8000	16-8	26
I.C.E. / LINK BELT	1070	70000	DBL.ACT.	64-68	10000	7-0	21500	17-10	30
	660	50000		84-88	7564	6-7	24480	17-0 4/3	30
	640	40000		74-77	6000	6-8	15600	16-2	26
	520	30000		80-84	5070	5-11	14200	14-4	26
	422	22500		76-82	4000	5-8	9750	13-11	22
	440	18100		88-92	4000	4-8	9839	13-6	20
	312	18000		100-105	3857	4-7	10375	10-9	26
	180	8100		90-95	1725	4-9	4645	11-3	20
MITSUBISHI	MB70	141000	SGL.ACT.	38-60	15840	107	46000	19-6	42
	MH45	84300		42-60	9920	102	24500	15-8	37
	M43	84000		40-60	9460	107	22660	16-3	37
	MH35	65600		42-60	7720	102	18500	15-1	32
	M33	64000		40-60	7260	106	16940	15-8	32
	MH25	46900		42-60	5510	102	13200	14-6	28
	M23	45000		42-60	5060	107	11220	14-0	26
	MH15	28100		42-60	3310	102	8400	13-11	26
	M145	26000		42-60	2970	105	7260	13-6	26
MKT	DE70B/50B[5]	59500		40-50	7000	8-6	14700	16-11	26
	DE70B/50B[5]	42500		40-50	5000	8-6	12700	16-11	26
	DA55C[6]	42500	DBL.ACT.	40-50	5000	8-6	17000	17-4	26
	DA55C[6]	38200		78-82	5000		17000	17-4	26
	DE33/30B/20B[5]	28050		40-50	3300	8-6	7750	15-11	20
	DE33/30B/20B[5]	23800		40-50	2800	8-6	7250	15-11	20
	DA35C[6]	23800		40-50	2800	8-6	10800	17-0	20
	DA35C[6]	21000	DBL.ACT.	78-82	2800		10800	17-0	20
	DE33/30B/20B[5]	17000	SGL.ACT.	40-50	2000	8-6	6450	15-11	20

NOTES:

1 Rated energy, blows per minute and stroke vary with soil resistance and fuel setting.

2 Equivalent stroke for double-acting hammers.

3 Without drive caps.

4 For box leads, Delmag hammers require adapters to fit box leads.

5 Different rams useable with same hammer.

6 Convertible from single-acting to double-acting.

VIBRATORY DRIVER/EXTRACTORS

MFGR	MODEL	ECCENTRIC MOMENT IN-LBS	TYPE	FREQUENCY	AMPLITUDE INCHES	HP	MAX LINE PULL FOR EXTRACTION	PILE CLAMPING FORCE TONS	SUSPENDED WEIGHT LBS.	SHIPPING WEIGHT	LENGTH FT. - IN.	WIDTH FT. - IN.
I.C.E.	1412	8000	HYDRAULIC	400-1200	1-1 1/2	780	80	250	31700	52300	13 - 08	8 - 0
	812	4000	HYDRAULIC	400-1600	1/2-1	570	40	100	15600	30500	9 09	8 - 0
	612	4000	HYDRAULIC	400-1200	1/4-1	250	40	100	15600	24500	8 - 0	2 - 0
	416	2000	HYDRAULIC	400-1600	1/4-1	325	40	100	13100	22000	8 - 09	8 - 0
	216	1000	HYDRAULIC	400-1600	1/4 - 3/4	185	30	50	4825	12450	6 - 06	3 - 11
	116	600	HYDRAULIC	400-1600	1/4 - 5/8	105	20	50	4200	10100	5 - 09	3 - 09
VULCAN	1150	1150	HYDRAULIC	1600	3/4	131	33	50	6500	13500	9 - 09	3 - 09
	2300	2300	HYDRAULIC	1600	1	258	33	87	8200	18700	10 - 10	3 - 09
	4600	4600	HYDRAULIC	1600	1 1/4	515	66	176	16000	32500	11 - 02	6 - 03
H & M	H-75A		HYDRAULIC	18-2300	3/8 - 1/2	175	20	62	400/7500	12500	5 - 07	3 - 01
	H-2750	3400	HYDRAULIC	900-1000	3/4 - 1	250	30	100	11000	17500		
MKT	V-36	5000	HYDRAULIC	1600	0.75	580	80	100	18800	36300	12 - 03	9 - 11
	V-20	2600	HYDRAULIC	1700	0.63	310	60	70	12500	23900	10 - 11	8 - 00
	V-5	1000	HYDRAULIC	1640	0.50	79	25	62	6800	10800	8 - 03	6 - 07

NOTES:

1 Includes vibrator, typical hydraulic clamp, and power cables or horses.

2 Includes vibrator, clamp, generator or hydraulic power pack, power cables or hoses.

3 For standard sheet piling clamp.

4 Distributed in United States by L.B. Foster Co.

Updated January 2007

				English Units			SI Units		
ID	Hammer Manufacturer	Hammer Model	Hammer Type	Energy/Power (klp-ft)/(kW)	Ram Weight (klps)	Stroke (ft)	Energy/Power (kJ)/(kW)	Ram Weight (kN)	Stroke (m)
777	APE	100	VIB	194	0.318	30	194	1.415	30
778	APE	100E	VIB	194	0.144	30	194	0.642	30
779	APE	100HF	VIB	260	0.144	43	260	0.642	43
595	APE	Oct-60	ECH	80	20	4	108.48	89	1.22
772	APE	15	VIB	59.67	0.108	30	59.67	0.481	30
780	APE	150	VIB	260	0.144	30	260	0.642	30
782	APE	150HF	VIB	466	0.32	43	466	1.424	43
781	APE	150T	VIB	260	0.17	30	260	0.759	30
594	APE	15-60	ECH	150	30	5	203.4	133.5	1.52
773	APE	20	VIB	59.67	0.15	38.3	59.67	0.668	38.3
783	APE	200	VIB	466	0.289	30	466	1.284	30
784	APE	200T	VIB	466	0.341	30.83	466	1.517	30.83
785	APE	200T HF	VIB	738	0.341	43	738	1.517	43
774	APE	20E	VIB	59.67	0.15	38.3	59.67	0.668	38.3
770	APE	3	VIB	10.58	0.004	38.3	10.58	0.019	38.3
786	APE	300	VIB	738	0.342	25	738	1.522	25
787	APE	400B	VIB	738	0.78	23.33	738	3.471	23.33
591	APE	5.4mT	ECH	26	12	2.17	35.26	53.4	0.66
775	APE	50	VIB	194	0.233	30	194	1.037	30
776	APE	50E	VIB	194	0.233	30	194	1.037	30
771	APE	6	VIB	10.58	0.009	38.3	10.58	0.038	38.3
788	APE	600	VIB	800	1.052	23.3	800	4.681	23.3
592	APE	7.2mT	ECH	51.3	16.2	3.17	69.56	72.09	0.97
570	APE	D 1	OED	1.95	0.308	6.67	2.65	1.371	2.03
577	APE	D 100-13	OED	246.3	22.03	11.18	333.98	98.034	3.41
584	APE	D 12-42	OED	34	2.83	12.36	46.11	12.593	3.77
582	APE	D 125-32	OED	307.29	27.56	11.15	416.69	122.642	3.4
579	APE	D 16-32	OED	39.36	3.53	11.25	53.37	15.708	3.43
571	APE	D 19-32	OED	42.82	4.19	10.25	58.07	18.646	3.12
580	APE	D 19-42	OED	42.82	4.19	10.6	58.07	18.646	3.23
581	APE	D 25-32	OED	57.88	5.512	10.5	78.48	24.528	3.2
572	APE	D 30-32	OED	70.07	6.61	10.6	95.01	29.414	3.23
573	APE	D 36-32	OED	84.06	7.93	10.6	113.98	35.288	3.23
574	APE	D 46-32	OED	107.48	10.14	10.6	145.75	45.123	3.23
583	APE	D 50-32	OED	115.76	11.025	13.1	156.97	49.061	3.99
575	APE	D 62-22	OED	161.46	13.66	11.82	218.94	60.787	3.6
576	APE	D 80-23	OED	196.99	17.62	11.18	267.12	78.409	3.41
569	APE	D 8-22	OED	17.94	1.764	12.5	24.32	7.848	3.81
578	APE	D 8-32	OED	18	1.76	10.25	24.41	7.832	3.12
596	APE	HI 400U	ECH	400	80	5	542.4	356	1.52
789	APE	Tan 400	VIB	1476	1.368	23.33	1476	6.088	23.33
790	APE	Tan 600	VIB	1800	2.105	23.3	1800	9.367	23.3
541	BANUT	3 Tonnes	ECH	17.34	6.61	2.62	23.52	29.414	0.8
542	BANUT	4 Tonnes	ECH	23.14	8.82	2.62	31.38	39.249	0.8
543	BANUT	5 Tonnes	ECH	28.92	11.02	2.62	39.21	49.039	0.8
544	BANUT	6 Tonnes	ECH	34.72	13.23	2.62	47.07	58.873	0.8
545	BANUT	7 Tonnes	ECH	40.49	15.43	2.62	54.9	68.663	0.8

540	BANUT	S10000	ECH	86.81	22.05	3.94	117.72	98.122	1.2
535	BANUT	S3000	ECH	26.04	6.615	3.94	35.31	29.437	1.2
536	BANUT	S4000	ECH	34.72	8.82	3.94	47.09	39.249	1.2
537	BANUT	S5000	ECH	43.41	11.025	3.94	58.86	49.061	1.2
538	BANUT	S6000	ECH	52.09	13.23	3.94	70.63	58.873	1.2
539	BANUT	S8000	ECH	69.45	17.64	3.94	94.17	78.498	1.2
402	BERMINGH	B200	OED	18	2	9	24.41	8.9	2.74
422	BERMINGH	B200 5	OED	21	2	10.5	28.48	8.9	3.2
423	BERMINGH	B2005	OED	24.12	2.68	9	32.71	11.926	2.74
406	BERMINGH	B21	OED	53.25	4.63	11.5	72.2	20.604	3.51
403	BERMINGH	B225	OED	29.25	3	9.75	39.66	13.35	2.97
401	BERMINGH	B23	CED	22.99	2.8	8.21	31.17	12.46	2.5
414	BERMINGH	B23 5	CED	22.99	2.8	8.21	31.17	12.46	2.5
415	BERMINGH	B250 5	OED	26.25	2.5	10.5	35.59	11.125	3.2
424	BERMINGH	B2505	OED	35.4	3	11.8	48	13.35	3.6
404	BERMINGH	B300	OED	40.31	3.75	10.75	54.66	16.688	3.28
410	BERMINGH	B300 M	OED	40.31	3.75	10.75	54.66	16.688	3.28
425	BERMINGH	B3005	OED	35.4	3	11.8	48	13.35	3.6
416	BERMINGH	B3505	OED	47.2	4	11.8	64	17.8	3.6
405	BERMINGH	B400	OED	53.75	5	10.75	72.88	22.25	3.28
412	BERMINGH	B400 4.8	OED	43.2	4.8	9	58.58	21.36	2.74
413	BERMINGH	B400 5.0	OED	45	5	9	61.02	22.25	2.74
411	BERMINGH	B400 M	OED	53.75	5	10.75	72.88	22.25	3.28
417	BERMINGH	B4005	OED	59	5	11.8	80	22.25	3.6
418	BERMINGH	B4505	OED	77.88	6.6	11.8	105.61	29.37	3.6
419	BERMINGH	B5005	OED	92.04	7.8	11.8	124.81	34.71	3.6
421	BERMINGH	B550 C	OED	88	11	8	119.33	48.95	2.44
420	BERMINGH	B5505	OED	108.56	9.2	11.8	147.21	40.94	3.6
431	BERMINGH	B6005	OED	160.95	13.64	11.8	218.25	60.698	3.6
433	BERMINGH	B6505	OED	207.68	17.6	11.8	281.61	78.32	3.6
432	BERMINGH	B6505 C	OED	253	22	11.5	343.07	97.9	3.51
530	BRUCE	SGH-0312	ECH	26.04	6.61	3.94	35.31	29.414	1.2
531	BRUCE	SGH-0512	ECH	43.42	11.02	3.94	58.88	49.039	1.2
532	BRUCE	SGH-0712	ECH	60.8	15.432	3.94	82.45	68.672	1.2
533	BRUCE	SGH-1012	ECH	86.86	22.046	3.94	117.78	98.105	1.2
625	BRUCE	SGH-1212	ECH	104.25	26.46	3.94	141.37	117.747	1.2
626	BRUCE	SGH-1312	ECH	112.92	28.66	3.94	153.12	127.537	1.2
627	BRUCE	SGH-1315	ECH	141.01	28.66	4.92	191.21	127.537	1.5
628	BRUCE	SGH-1412	ECH	121.63	30.87	3.94	164.93	137.371	1.2
629	BRUCE	SGH-1415	ECH	151.88	30.87	4.92	205.95	137.371	1.5
630	BRUCE	SGH-1612	ECH	138.96	35.27	3.94	188.43	156.951	1.2
631	BRUCE	SGH-1615	ECH	173.53	35.27	4.92	235.3	156.951	1.5
632	BRUCE	SGH-1618	ECH	208.09	35.27	5.9	282.17	156.951	1.8
633	BRUCE	SGH-1619	ECH	219.73	35.27	6.23	297.96	156.951	1.9
634	BRUCE	SGH-1812	ECH	156.34	39.68	3.94	212	176.576	1.2
635	BRUCE	SGH-1815	ECH	195.23	39.68	4.92	264.73	176.576	1.5
636	BRUCE	SGH-2012	ECH	173.71	44.09	3.94	235.56	196.2	1.2
637	BRUCE	SGH-2015	ECH	216.92	44.09	4.92	294.15	196.2	1.5
638	BRUCE	SGH-2312	ECH	199.8	50.71	3.94	270.93	225.659	1.2
639	BRUCE	SGH-2315	ECH	249.49	50.71	4.92	338.31	225.659	1.5
640	BRUCE	SGH-3012	ECH	260.59	66.14	3.94	353.36	294.323	1.2
641	BRUCE	SGH-3013	ECH	282.42	66.14	4.27	382.96	294.323	1.3

642	BRUCE	SGH-3015	ECH	325.41	66.14	4.92	441.25	294.323	1.5
643	BRUCE	SGH-4012	ECH	347.47	88.19	3.94	471.17	392.445	1.2
644	BRUCE	SGH-4212	ECH	364.84	92.6	3.94	494.73	412.07	1.2
645	BRUCE	SGH-5012	ECH	434.31	110.23	3.94	588.92	490.523	1.2
396	BSP	CG180	ECH	131.92	26.454	4.99	178.89	117.72	1.52
397	BSP	CG210	ECH	153.91	30.863	4.99	208.7	137.34	1.52
398	BSP	CG240	ECH	175.9	35.272	4.99	238.52	156.96	1.52
399	BSP	CG270	ECH	197.88	39.681	4.99	268.33	176.58	1.52
400	BSP	CG300	ECH	219.87	44.09	4.99	298.14	196.2	1.52
379	BSP	CX110	ECH	78.11	19.84	3.94	105.92	88.29	1.2
600	BSP	CX165	ECH	120.93	24.249	4.99	163.98	107.91	1.52
601	BSP	CX180	ECH	131.92	26.454	4.99	178.89	117.72	1.52
602	BSP	CX210	ECH	153.91	30.863	4.99	208.7	137.34	1.52
603	BSP	CX240	ECH	175.9	35.272	4.99	238.52	156.96	1.52
604	BSP	CX270	ECH	197.88	39.681	4.99	268.33	176.58	1.52
605	BSP	CX300	ECH	219.87	44.09	4.99	298.14	196.2	1.52
374	BSP	CX40	ECH	28.21	6.613	4.27	38.25	29.43	1.3
375	BSP	CX50	ECH	37.61	8.818	4.27	51	39.24	1.3
376	BSP	CX60	ECH	47.01	11.022	4.27	63.75	49.05	1.3
377	BSP	CX75	ECH	52.07	13.227	3.94	70.61	58.86	1.2
378	BSP	CX85	ECH	60.75	15.431	3.94	82.38	68.67	1.2
391	BSP	HA30	ECH	260.37	66.135	3.94	353.07	294.3	1.2
392	BSP	HA40	ECH	347.16	88.18	3.94	470.76	392.4	1.2
380	BSP	HH1.5	ECH	16.25	3.303	4.92	22.04	14.698	1.5
386	BSP	HH11-1.2	ECH	95.54	24.25	3.94	129.56	107.912	1.2
393	BSP	HH11-1.5	ECH	119.31	24.25	4.92	161.78	107.912	1.5
387	BSP	HH14-1.2	ECH	121.59	30.86	3.94	164.87	137.327	1.2
394	BSP	HH14-1.5	ECH	151.83	30.86	4.92	205.88	137.327	1.5
388	BSP	HH16-1.2	ECH	138.87	35.272	3.94	188.3	156.96	1.2
395	BSP	HH16-1.5	ECH	173.54	35.272	4.92	235.32	156.96	1.5
389	BSP	HH20	ECH	173.58	44.09	3.94	235.38	196.2	1.2
390	BSP	HH20S	ECH	173.58	44.09	3.94	235.38	196.2	1.2
381	BSP	HH3	ECH	26.02	6.611	3.94	35.29	29.42	1.2
382	BSP	HH5	ECH	43.37	11.02	3.94	58.82	49.039	1.2
383	BSP	HH7	ECH	60.78	15.427	3.94	82.42	68.65	1.2
384	BSP	HH8	ECH	69.5	17.64	3.94	94.24	78.498	1.2
385	BSP	HH9	ECH	78.17	19.84	3.94	106	88.288	1.2
369	BSP	SL20	ECH	14.11	3.308	4.27	19.13	14.72	1.3
370	BSP	SL30	ECH	21.69	5.51	3.94	29.42	24.52	1.2
176	CONMACO	C 100	ECH	32.5	10	3.25	44.07	44.5	0.99
179	CONMACO	C 100E5	ECH	50	10	5	67.8	44.5	1.52
177	CONMACO	C 115	ECH	37.38	11.5	3.25	50.68	51.175	0.99
180	CONMACO	C 115E5	ECH	57.5	11.5	5	77.97	51.175	1.52
181	CONMACO	C 125E5	ECH	62.5	12.5	5	84.75	55.625	1.52
182	CONMACO	C 140	ECH	42	14	3	56.95	62.3	0.91
183	CONMACO	C 160	ECH	48.75	16.25	3	66.1	72.312	0.91
191	CONMACO	C 160 **	ECH	51.78	17.26	3	70.21	76.807	0.91
184	CONMACO	C 200	ECH	60	20	3	81.36	89	0.91
194	CONMACO	C 200E5	ECH	100	20	5	135.6	89	1.52
185	CONMACO	C 300	ECH	90	30	3	122.04	133.5	0.91
195	CONMACO	C 300E5	ECH	150	30	5	203.4	133.5	1.52
171	CONMACO	C 50	ECH	15	5	3	20.34	22.25	0.91

192	CONMACO	C 50E5	ECH	25	5	5	33.9	22.25	1.52
186	CONMACO	C 5200	ECH	100	20	5	135.6	89	1.52
187	CONMACO	C 5300	ECH	150	30	5	203.4	133.5	1.52
188	CONMACO	C 5450	ECH	225	45	5	305.1	200.25	1.52
173	CONMACO	C 550	ECH	25	5	5	33.9	22.25	1.52
174	CONMACO	C 565	ECH	32.5	6.5	5	44.07	28.925	1.52
189	CONMACO	C 5700	ECH	350	70	5	474.6	311.5	1.52
172	CONMACO	C 65	ECH	19.5	6.5	3	26.44	28.925	0.91
193	CONMACO	C 65E5	ECH	32.5	6.5	5	44.07	28.925	1.52
190	CONMACO	C 6850	ECH	510	85	6	691.56	378.25	1.83
175	CONMACO	C 80	ECH	26	8	3.25	35.26	35.6	0.99
178	CONMACO	C 80E5	ECH	40	8	5	54.24	35.6	1.52
521	DAWSON	HPH1200	ECH	8.72	2.3	3.79	11.82	10.235	1.16
522	DAWSON	HPH1800	ECH	13.72	3.3	4.16	18.61	14.685	1.27
523	DAWSON	HPH2400	ECH	17.32	4.189	4.13	23.48	18.64	1.26
525	DAWSON	HPH4500	ECH	32.56	7.716	4.22	44.15	34.336	1.29
524	DAWSON	HPH6500	ECH	46.98	10.25	4.58	63.7	45.612	1.4
526	DAWSON	HPH9000	ECH	66.3	10.471	6.33	89.91	46.596	1.93
3	DELMAG	D 12	OED	22.61	2.75	10.8	30.65	12.237	3.29
37	DELMAG	D 12-32	OED	31.33	2.82	11.81	42.48	12.549	3.6
38	DELMAG	D 12-42	OED	33.3	2.82	11.81	45.16	12.549	3.6
39	DELMAG	D 14-42	OED	34.5	3.086	11.81	46.78	13.733	3.6
4	DELMAG	D 15	OED	27.09	3.3	10.8	36.74	14.685	3.29
5	DELMAG	D 16-32	OED	40.2	3.52	11.76	54.51	15.664	3.58
40	DELMAG	D 19-32	OED	42.44	4	11.76	57.55	17.8	3.58
41	DELMAG	D 19-42	OED	43.24	4	11.86	58.63	17.8	3.61
35	DELMAG	D 19-52	OED	43.24	4	11.86	58.63	17.8	3.61
46	DELMAG	D 21-42	OED	55.75	4.63	14	75.59	20.604	4.27
6	DELMAG	D 22	OED	40.61	4.91	9.5	55.06	21.849	2.9
7	DELMAG	D 22-02	OED	48.5	4.85	13.44	65.77	21.582	4.1
8	DELMAG	D 22-13	OED	48.5	4.85	13.44	65.77	21.582	4.1
9	DELMAG	D 22-23	OED	51.22	4.85	13.44	69.45	21.582	4.1
10	DELMAG	D 25-32	OED	66.34	5.51	13.76	89.96	24.52	4.19
11	DELMAG	D 30	OED	59.73	6.6	9.5	80.99	29.37	2.9
12	DELMAG	D 30-02	OED	66.2	6.6	13.44	89.76	29.37	4.1
13	DELMAG	D 30-13	OED	66.2	6.6	13.44	89.76	29.37	4.1
14	DELMAG	D 30-23	OED	73.79	6.6	13.44	100.06	29.37	4.1
15	DELMAG	D 30-32	OED	75.44	6.6	13.73	102.29	29.37	4.18
16	DELMAG	D 36	OED	83.82	7.93	10.57	113.66	35.288	3.22
17	DELMAG	D 36-02	OED	83.82	7.93	12.98	113.66	35.288	3.96
18	DELMAG	D 36-13	OED	83.82	7.93	19.98	113.66	35.288	6.09
19	DELMAG	D 36-23	OED	88.5	7.93	12.98	120	35.288	3.96
20	DELMAG	D 36-32	OED	90.56	7.93	13.14	122.8	35.288	4.01
21	DELMAG	D 44	OED	90.15	9.5	9.52	122.25	42.275	2.9
22	DELMAG	D 46	OED	107.08	10.14	10.57	145.2	45.123	3.22
23	DELMAG	D 46-02	OED	107.08	10.14	12.94	145.2	45.123	3.94
24	DELMAG	D 46-13	OED	96.53	10.14	12.94	130.9	45.123	3.94
25	DELMAG	D 46-23	OED	107.08	10.14	12.94	145.2	45.123	3.94
26	DELMAG	D 46-32	OED	122.19	10.14	13.1	165.69	45.123	3.99
1	DELMAG	D 5	OED	10.51	1.1	9.62	14.24	4.895	2.93
47	DELMAG	D 5-42	OED	10.56	1.1	9.6	14.32	4.895	2.93
27	DELMAG	D 55	OED	125	11.86	11.15	169.51	52.777	3.4

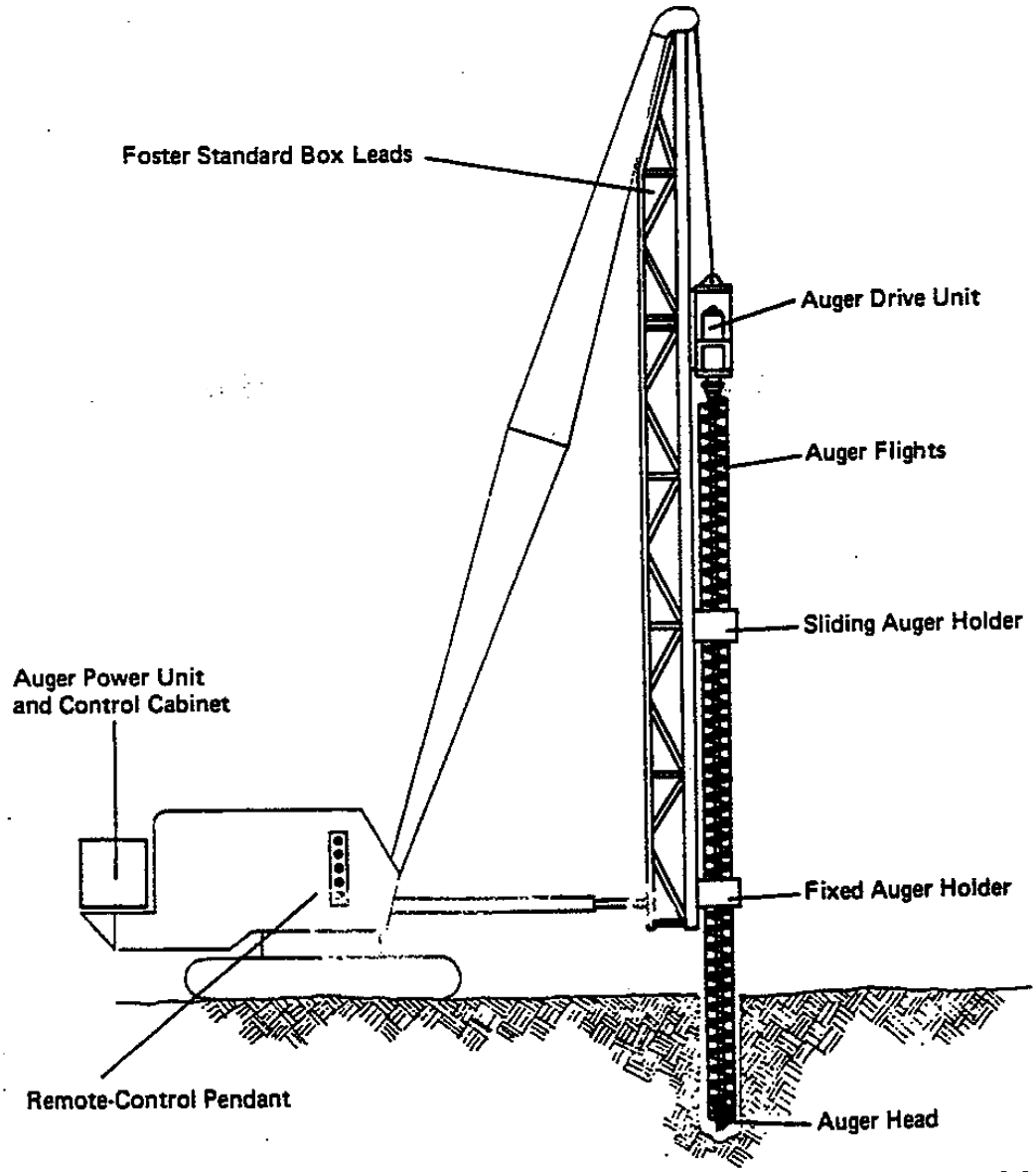
28	DELMAG	D 62-02	OED	152.45	13.66	12.71	206.72	60.787	3.87
29	DELMAG	D 62-12	OED	152.45	13.66	12.71	206.72	60.787	3.87
30	DELMAG	D 62-22	OED	164.6	13.66	13.26	223.2	60.787	4.04
36	DELMAG	D 6-32	OED	13.52	1.322	10.23	18.34	5.883	3.12
31	DELMAG	D 80-12	OED	186.24	17.62	12.87	252.55	78.409	3.92
32	DELMAG	D 80-23	OED	212.5	17.62	13.05	288.15	78.409	3.98
2	DELMAG	D 8-22	OED	20.1	1.76	12.05	27.25	7.832	3.67
33	DELMAG	D100-13	OED	265.67	22.066	13.5	360.25	98.194	4.11
43	DELMAG	D120-42	OED	301.79	26.45	11.81	409.23	117.702	3.6
45	DELMAG	D125-42	OED	313.63	27.56	13.6	425.29	122.642	4.15
44	DELMAG	D150-42	OED	377.33	33.07	11.81	511.66	147.161	3.6
42	DELMAG	D200-42	OED	492.04	44.09	16.83	667.21	196.2	5.13
804	DKH	PH-10	ECH	86.79	22.045	3.94	117.69	98.1	1.2
805	DKH	PH-13	ECH	112.83	28.658	3.94	153	127.53	1.2
806	DKH	PH-20	ECH	216.98	44.09	4.92	294.22	196.2	1.5
807	DKH	PH-30	ECH	325.47	66.135	4.92	441.33	294.3	1.5
808	DKH	PH-40	ECH	433.96	88.18	4.92	588.44	392.4	1.5
801	DKH	PH-5	ECH	43.4	11.023	3.94	58.84	49.05	1.2
802	DKH	PH-7	ECH	60.75	15.432	3.94	82.38	68.67	1.2
803	DKH	PH-7S	ECH	60.75	15.432	3.94	82.38	68.67	1.2
372	FAIRCHLD	F-32	ECH	32.55	10.85	3	44.14	48.283	0.91
371	FAIRCHLD	F-45	ECH	45	15	3	61.02	68.75	0.91
56	FEC	D-18	OED	39.7	3.97	11.76	53.83	17.667	3.58
50	FEC	FEC 1200	OED	22.5	2.75	8.18	30.5	12.237	2.49
51	FEC	FEC 1500	OED	27.09	3.3	8.21	36.74	14.685	2.5
52	FEC	FEC 2500	OED	50	5.5	9.09	67.79	24.475	2.77
53	FEC	FEC 2800	OED	55.99	6.16	9.09	75.93	27.412	2.77
54	FEC	FEC 3000	OED	63.03	6.6	9.55	85.47	29.37	2.91
55	FEC	FEC 3400	OED	73	7.48	9.76	98.99	33.286	2.97
350	HERA	1250	OED	25.34	2.809	9.02	34.36	12.5	2.75
351	HERA	1500	OED	30.4	3.371	9.02	41.23	15	2.75
349	HERA	1900	OED	44.41	4.19	10.6	60.23	18.646	3.23
352	HERA	2500	OED	50.67	5.618	9.02	68.71	25	2.75
353	HERA	2800	OED	56.76	6.292	9.02	76.96	28	2.75
354	HERA	3500	OED	70.94	7.865	9.02	96.2	35	2.75
355	HERA	5000	OED	101.35	11.236	9.02	137.43	50	2.75
356	HERA	5700	OED	115.54	12.809	9.02	156.67	57	2.75
357	HERA	6200	OED	125.67	13.933	9.02	170.41	62	2.75
358	HERA	7500	OED	152.02	16.854	9.02	206.14	75	2.75
359	HERA	8800	OED	178.37	19.775	9.02	241.87	88	2.75
92	HITACHI	HNC100	ECH	86.79	22.045	3.94	117.69	98.1	1.2
93	HITACHI	HNC125	ECH	108.49	27.557	3.94	147.12	122.63	1.2
90	HITACHI	HNC65	ECH	56.42	14.33	3.94	76.5	63.77	1.2
91	HITACHI	HNC80	ECH	69.43	17.636	3.94	94.15	78.48	1.2
734	HMC	115+800	VIB	597	1.347	20.4	597	5.994	20.4
564	HMC	119	ECH	88	22	4	119.33	97.9	1.22
722	HMC	13+200	VIB	149	0.353	26.7	149	1.569	26.7
724	HMC	13H+200	VIB	164	0.353	29.8	164	1.569	29.8
723	HMC	13S+200	VIB	149	0.353	26.7	149	1.569	26.7
565	HMC	149	ECH	110	27.5	4	149.16	122.375	1.22
566	HMC	187	ECH	138	34.5	4	187.13	153.525	1.22
567	HMC	19D	ECH	14	3.5	4	18.98	15.575	1.22

735	HMC	230+1600	VIB	1193	2.694	20.4	1193	11.988	20.4
725	HMC	25+220	VIB	164	0.605	20.9	164	2.694	20.9
726	HMC	26+335	VIB	242	0.705	25.6	242	3.139	25.6
727	HMC	26S+335	VIB	242	0.705	25.6	242	3.139	25.6
560	HMC	28A	ECH	28	7	4	37.97	31.15	1.22
561	HMC	28B	ECH	21	7	3	28.48	31.15	0.91
720	HMC	3+28	VIB	21	0.108	26.8	21	0.483	26.8
721	HMC	3+75	VIB	56	0.108	36.1	56	0.483	36.1
568	HMC	38D	ECH	28	7	4	37.97	31.15	1.22
728	HMC	51+335	VIB	242	1.211	19.5	242	5.389	19.5
729	HMC	51+535	VIB	377	1.211	26.4	377	5.389	26.4
731	HMC	51+740	VIB	485	1.211	27.5	485	5.389	27.5
730	HMC	51S+535	VIB	377	1.211	26.4	377	5.389	26.4
562	HMC	62	ECH	46	11.5	4	62.38	51.175	1.22
732	HMC	76+740	VIB	485	1.816	21.7	485	8.083	21.7
733	HMC	76+800	VIB	597	1.816	26.1	597	8.083	26.1
563	HMC	86	ECH	64	16	4	86.78	71.2	1.22
507	HPSI	1000	ECH	50	10	5	67.8	44.5	1.52
501	HPSI	110	ECH	44	11	4	59.66	48.95	1.22
502	HPSI	150	ECH	60	15	4	81.36	66.75	1.22
503	HPSI	154	ECH	61.6	15.4	4	83.53	68.53	1.22
508	HPSI	1605	ECH	83	16.6	5	112.55	73.87	1.52
504	HPSI	200	ECH	80	20	4	108.48	89	1.22
512	HPSI	2000	ECH	80	20	4	108.48	89	1.22
509	HPSI	2005	ECH	95.1	19.02	5	128.96	84.639	1.52
505	HPSI	225	ECH	90	22.5	4	122.04	100.125	1.22
510	HPSI	3005	ECH	154.32	30.865	5	209.26	137.349	1.52
511	HPSI	3505	ECH	176.32	35.265	5	239.1	156.929	1.52
506	HPSI	650	ECH	32.5	6.5	5	44.07	28.925	1.52
998	HYPOTHET	EX 4	OED	23.38	2.75	8.5	31.7	12.237	2.59
134	ICE	100-S	OED	100	10	12	135.6	44.5	3.66
126	ICE	1070	OED	72.6	10	7.26	98.45	44.5	2.21
552	ICE	110-SH	ECH	37.72	11.5	3.28	51.15	51.175	1
703	ICE	23-Nov	VIB	164	0.46	31.7	164	2.047	31.7
554	ICE	115	ECH	46	11.5	4	62.38	51.175	1.22
553	ICE	115-SH	ECH	37.95	11.5	3.3	51.46	51.175	1.01
135	ICE	120-S	OED	120	12	12.42	162.72	53.4	3.79
140	ICE	120S-15	OED	132.45	15	12.25	179.6	66.75	3.73
715	ICE	125	VIB	984	1.042	25.8	984	4.637	25.8
713	ICE	1412B	VIB	597	2.036	21	597	9.06	21
881	ICE	1412BT	VIB	1193	1.667	21.7	1193	7.418	21.7
714	ICE	1412C	VIB	470	2.022	23	470	9	23
717	ICE	14-23	VIB	164	1.165	35	164	5.184	35
716	ICE	14RF	VIB	242	1.013	38.3	242	4.508	38.3
556	ICE	160	ECH	64	16	4	86.78	71.2	1.22
555	ICE	160-SH	ECH	64	16	4	86.78	71.2	1.22
120	ICE	180	OED	8.13	1.73	4.7	11.03	7.698	1.43
136	ICE	200-S	OED	100	20	6	135.6	89	1.83
137	ICE	205-S	OED	170	20	10.5	230.52	89	3.2
701	ICE	216	VIB	130	0.46	26.7	130	2.047	26.7
702	ICE	216E	VIB	130	0.46	26.7	130	2.047	26.7
557	ICE	220	ECH	88	22	4	119.33	97.9	1.22

TYPICAL AUGER OPERATING CONFIGURATION

A typical auger set-up in standard pile driving leads is shown below. The Auger Drive Unit is equipped with guide channels for 26" box leads. The Auger Flights are supported during drilling by a Fixed Auger Holder attached to the bottom of the leads and a Sliding Auger Holder which moves downward during drilling. The Auger Head cuts through the soil and feeds it onto the Auger Flights. The Auger Power Unit is normally mounted on the back of the crane for maximum mobility. The augering operation is controlled by the Remote-Control Pendant which can be located in the crane cab.

For predrilling for piling, the auger is often mounted on the side of standard box leads as pictured in the photograph at the left. This permits the pile hammer to operate in its normal position. On larger jobs, separate cranes may be used for augering and for pile driving.



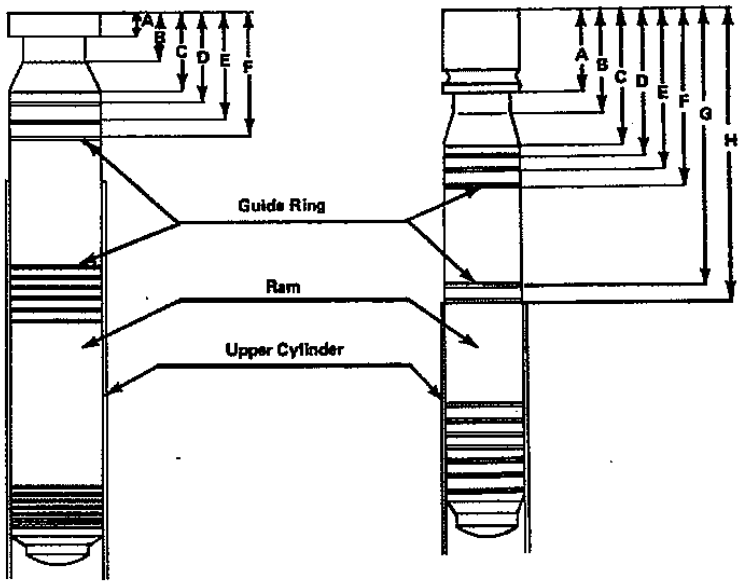
May 16, 1979

FOSTER CONSTRUCTION PRODUCTS

KOBE DIESEL PILE HAMMER

KOBE - TECHNICAL
KT - 0012

MEASUREMENT OF RAM STROKE — FOSTER PRODUCT DATA SHEET



K60 K13, K25, K35, K45

The ram of the Kobe hammer has several easily identifiable features which serve as useful guides in observing the stroke of the hammer during operation. The figures and table below give the actual stroke at several of these observable guide points.

Distance Ram Extends Above Top Of Upper Cylinder	RAM STROKE (FEET)				
	K13*	K25	K35	K45	K60
At Top	3.62	3.21	3.17	3.61	6.15
A	5.35	5.39	5.30	5.55	6.64
B	5.59	5.78	5.79	6.12	7.30
C	6.12	6.21	6.29	6.69	7.96
D	6.32	6.55	6.45	6.92	8.28
E	6.63	6.88	6.78	7.25	8.61
F	--	7.21	7.11	7.58	8.94
G	8.51	9.83	9.40	9.42	10.75
H	8.81	10.16	9.73	9.74	--

** Serial numbers above 10-1638*

FOSTER
L.B. FOSTER COMPANY

Measurement of Ram Stroke

Kobe diesel pile hammers are rated at an energy per blow equal to the weight of the ram multiplied by the length of the stroke. Counting the blows for a one-minute period or observing the height of the ram stroke will give an accurate rated energy and can be translated into bearing capacity by use of the Kobe Bearing Charts* which employ the commonly used Engineering News formula or by computation using any other of the many dynamic formulae.

BLOWS PER MINUTE	STROKE (FEET)	RATED ENERGY (FT-LBS)				
		K13	K25	K35	K45	K60
52	4.92'	14,120	27,109	37,982	48,806	64,944
51	5.12'	14,694	28,211	39,526	50,790	67,584
50	5.35'	15,355	29,479	41,302	53,072	70,620
49	5.55'	15,929	30,581	42,846	55,056	73,260
48	5.78'	16,589	31,848	44,622	57,338	76,296
47	6.04'	17,335	33,280	46,624	59,917	79,728
46	6.30'	18,081	34,713	48,636	62,496	83,160
45	6.60'	18,942	36,366	50,952	65,472	87,120
44	6.89'	19,774	37,964	53,191	68,349	90,948
43	7.22'	20,721	39,782	55,738	71,622	95,304
42	7.55'	21,669	41,601	58,286	74,896	99,660
41	7.94'	22,788	43,749	61,297	78,765	104,808
40	8.33'	23,907	45,898	64,308	82,634	109,956
39	8.76'	25,141	48,268	67,627	86,899	115,632
38	9.25'	26,548	50,968	71,410	91,760	112,100
37	9.75'	27,983	53,723	75,270	96,720	128,700

** Kobe Product Data Sheet KD-0021*

NOTE: Maximum Ram Stroke which Kobe will honor under warranty is as follows:

MODEL NUMBER	WEIGHT OF RAM	STROKE OF RAM	ENERGY
K-13	2,870 lbs.	8.86 ft.	25,428 ft-lbs.
K-25	5,510 lbs.	9.35 ft.	51,519 ft-lbs.
K-35	7,720 lbs.	9.35 ft.	72,182 ft.lbs.
K-45	9,920 lbs.	9.35 ft.	92,752 ft-lbs.
K-60	13,200 lbs.	9.35 ft.	123,420 ft-lbs.

Note: The information set forth herein has been obtained from source (s) which are believed to be reliable. L. B. Foster Company assumes no responsibility whatsoever for the accuracy or reliability of the information.

FOSTER
L.B. FOSTER COMPANY
415 Holiday Drive, Pittsburgh, PA 15220
Phone 1-800-255-4500, or call your local Foster Sales Office
W-511 10/90 2.5M

BEARING CAPACITY CHARTS

USING THE ENGINEERING NEWS FORMULA

Assume the piles are to be driven with a Kobe K13 hammer. The ram weight (W) will then be 2860 lbs. Further assume that a bearing capacity (R) of 76 tons is required for each pile.

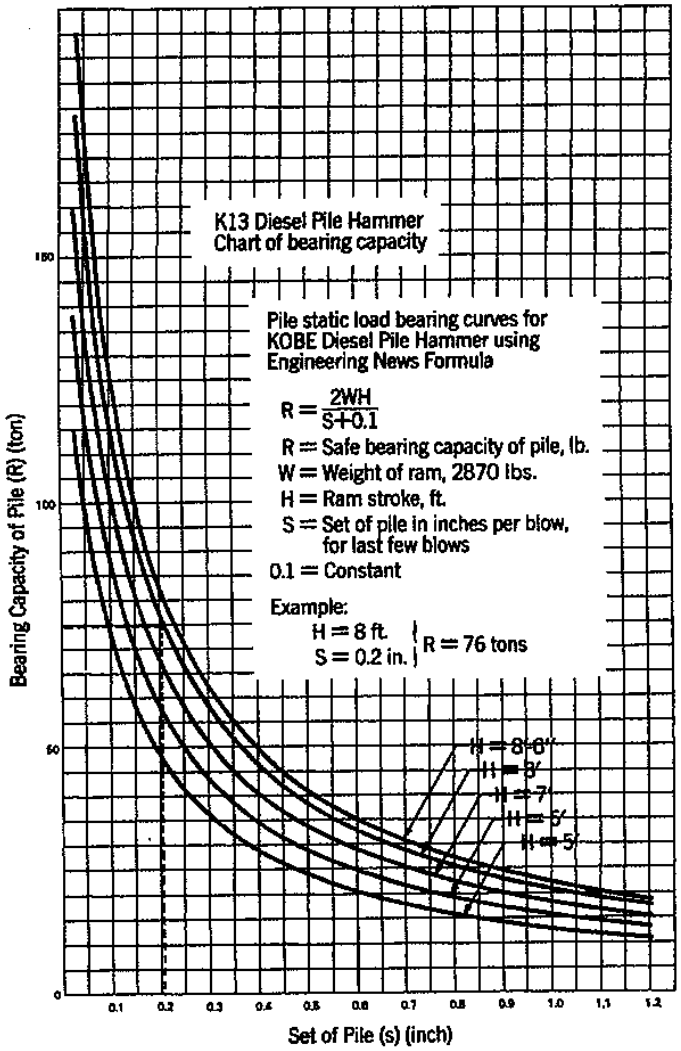
If the K13 is observed to be driving with an 8 foot stroke, the graph shows that to obtain a 76 ton bearing, a set of 0.2 inches per blow (or 5 blows to the inch) is required. Therefore, if the penetration is at or below 0.2 inches per blow (or at or above 5 blows per inch), the pile will support the required 76 tons.

At an 8 foot stroke and a set of 0.3 inch per blow (or about 3 blows per inch), the pile will only support 57 tons and driving should continue.

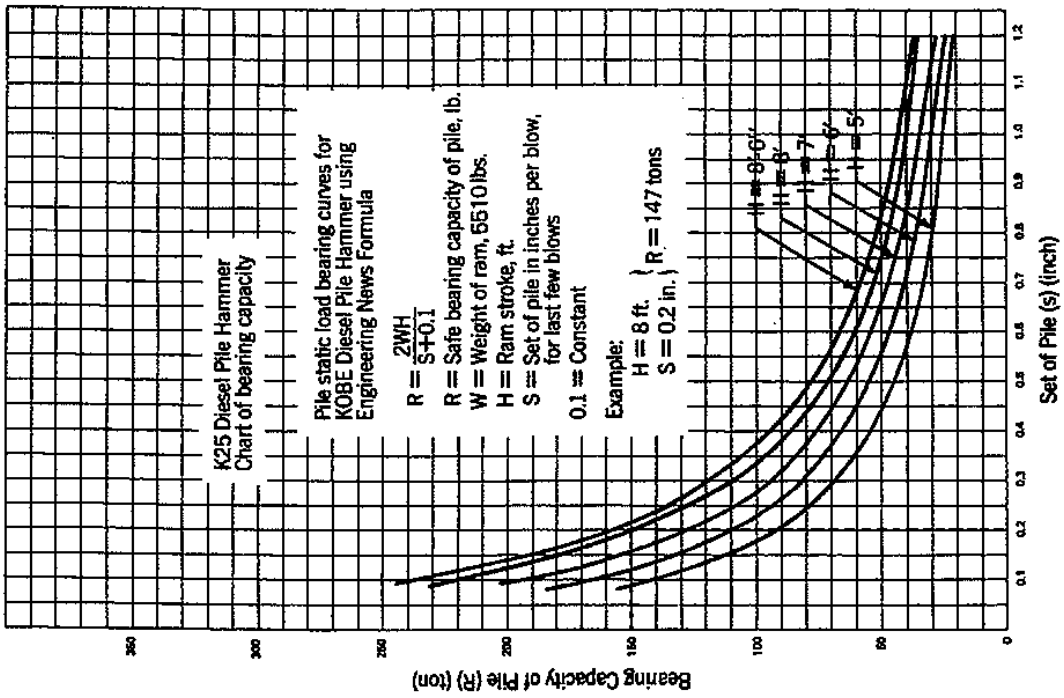
At a 6 foot stroke and a set of 0.1 inch per blow (or 10 blows per inch), the pile will support 86 tons, well above the required bearing.

Note: A set of 0.1 inch per blow or 10 blows to the inch is normally considered refusal for any pile hammer. Driving beyond this point is not considered "normal and proper use" as covered by the Kobe warranty.

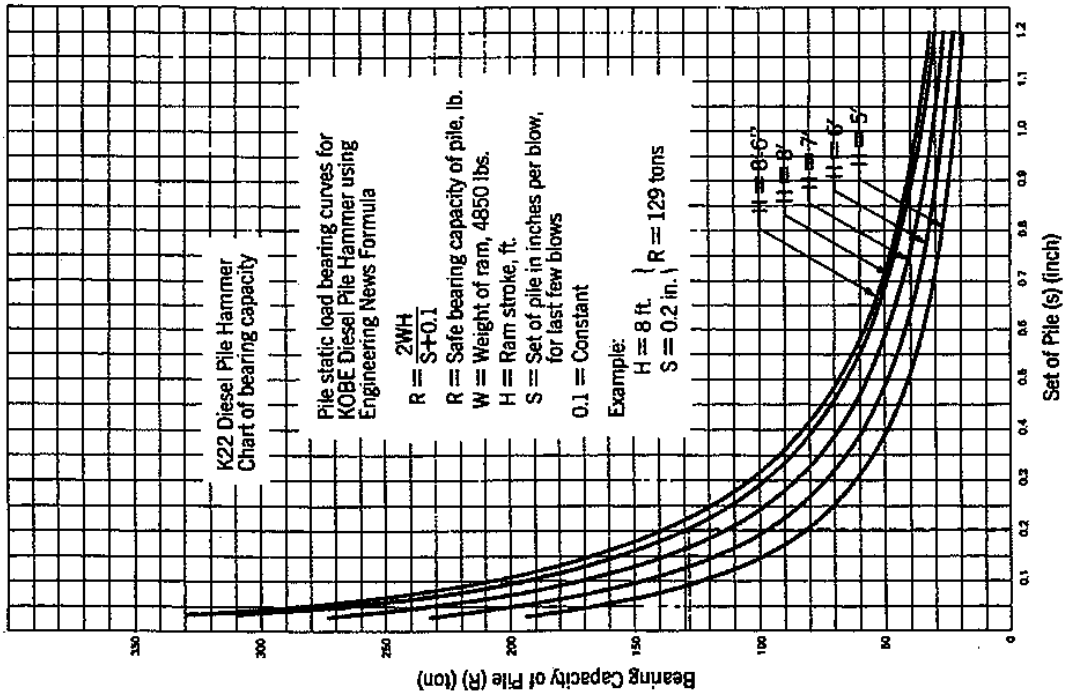
KOBE K13



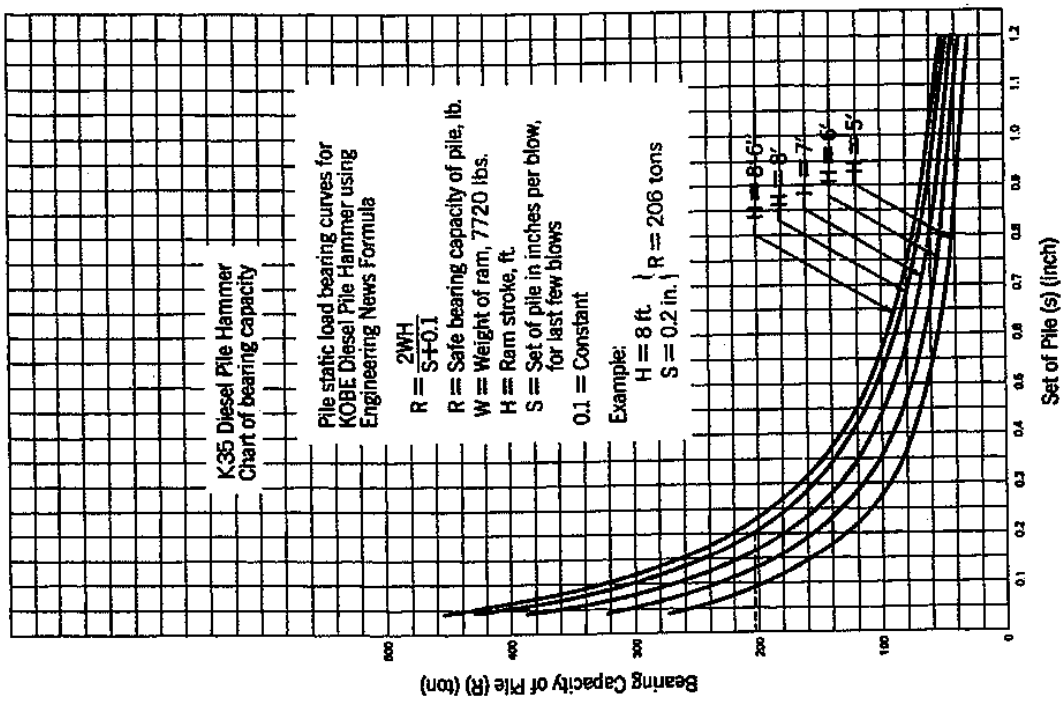
KOBE K25



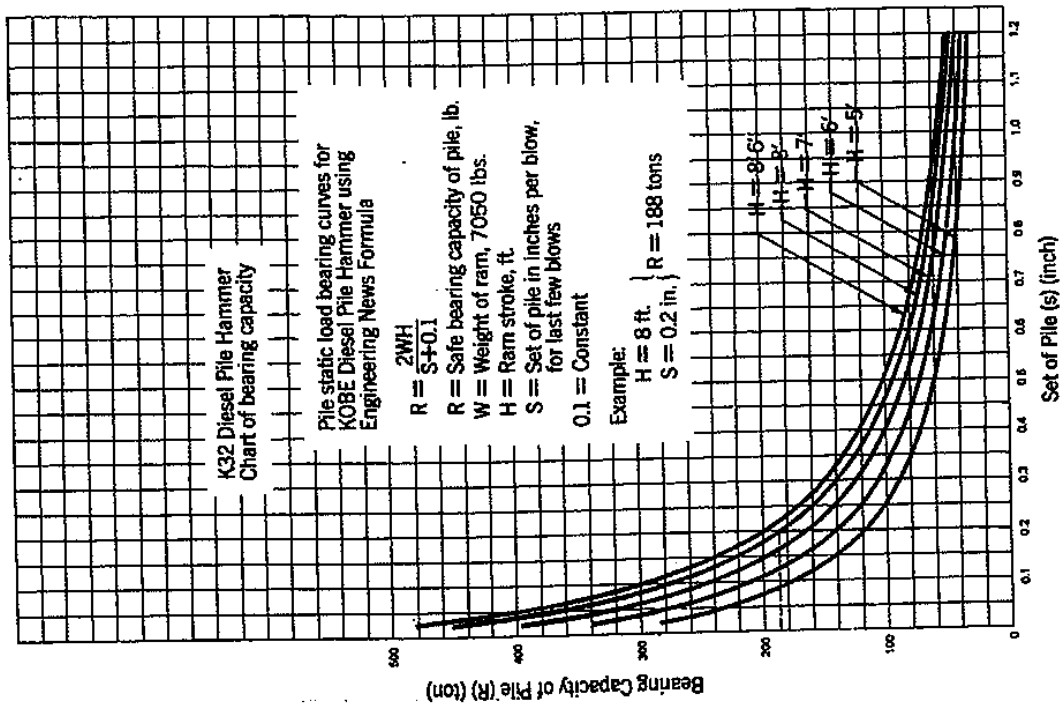
KOBE K22



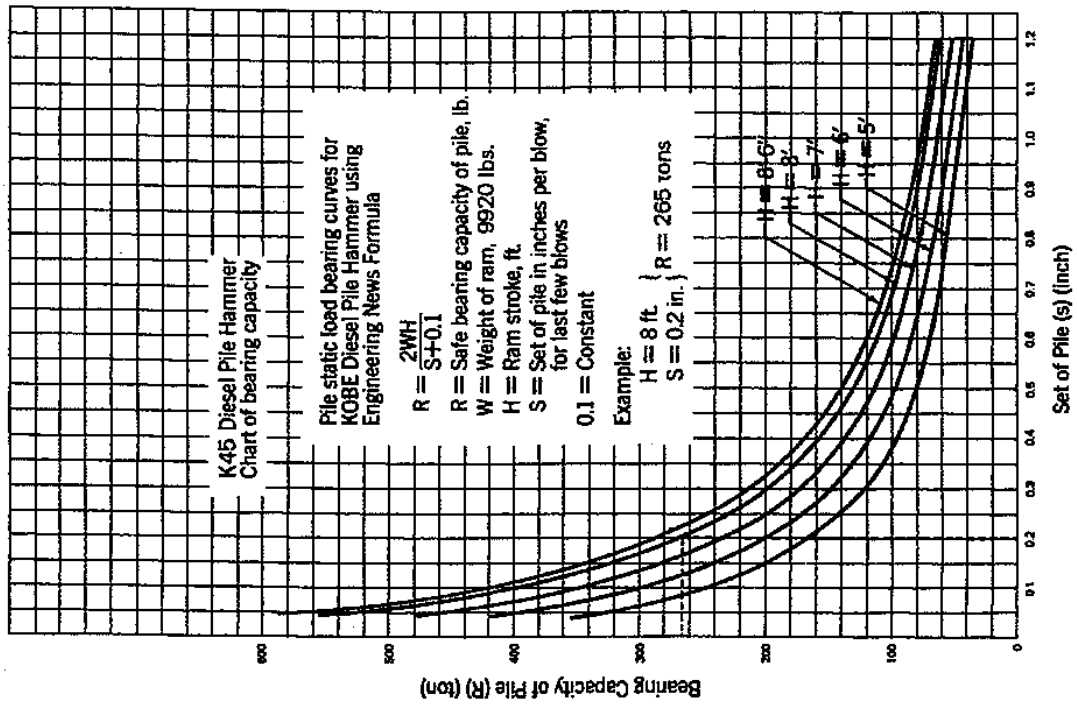
KOBE K35



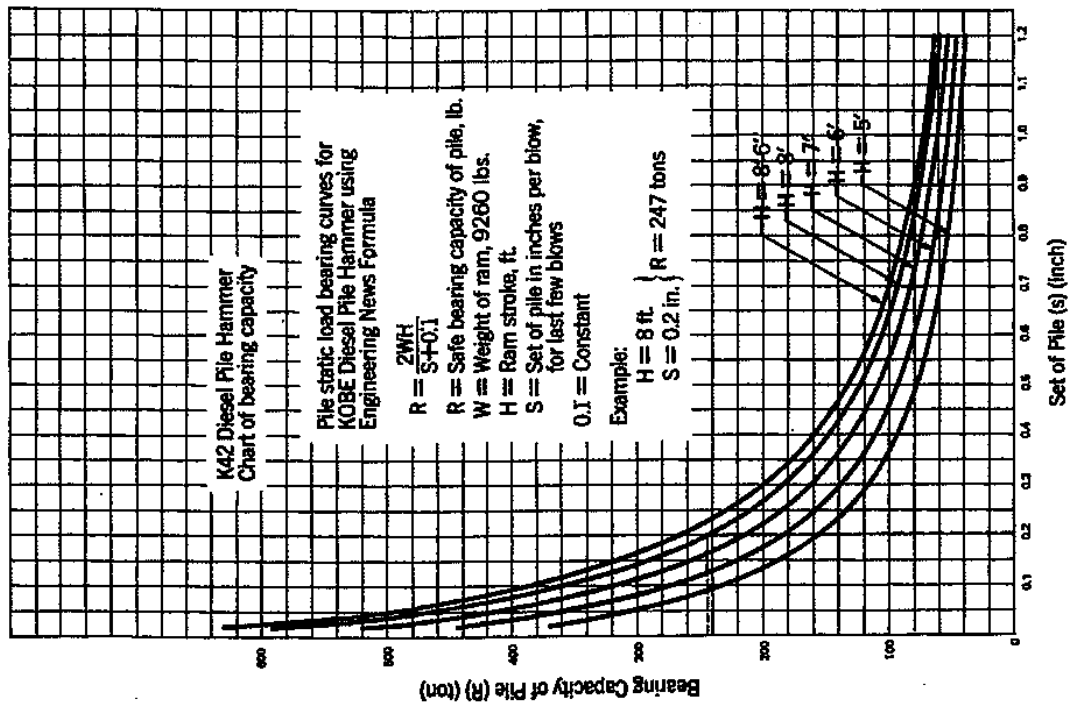
KOBE K32



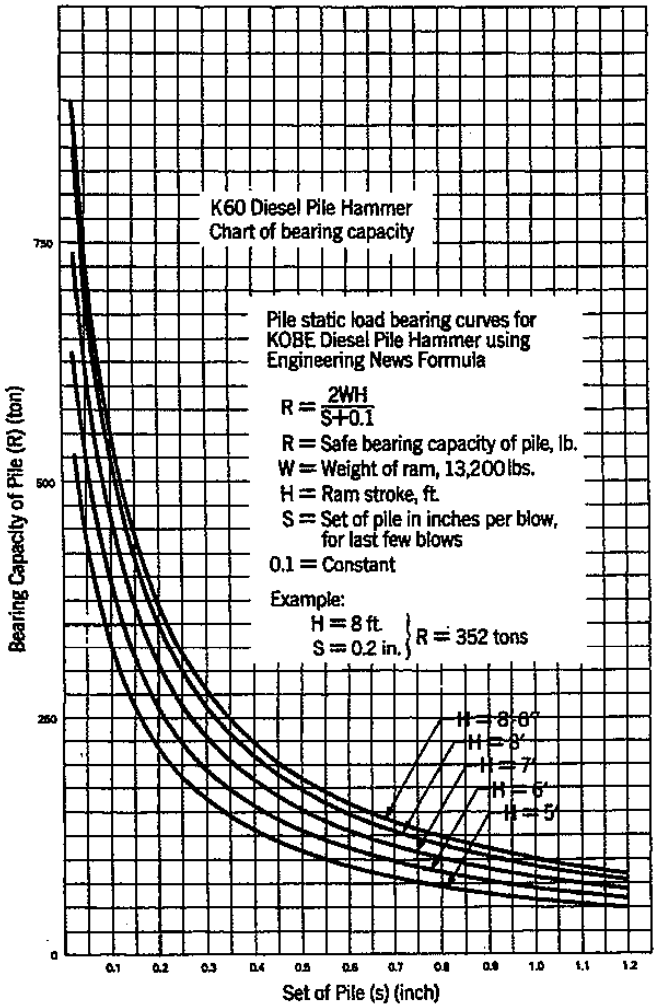
KOBE K45



KOBE K42



KOBE K60



L. B. Foster Construction Products include:

Piling Products
- Steel Sheet Piling
- H-Bearing Piles
- Pipe Piling
- Piling Accessories

Pile Driving Equipment
- IHC Hydrohammer
- Vibro® Drivers/Extractors
- Kobelco Diesel Hammers
- Pile Threaders
- Pile Driving Parts and Accessories

Fabricated Products
- Steel Grid Bridge Decking
- Bridge Railing
- Bridge Components

Note: The information set forth herein has been obtained from source (s) which are believed to be reliable. L. B. Foster Company assumes no responsibility whatsoever for the accuracy or reliability of the information.

FOSTER
L.B. FOSTER COMPANY
415 Holiday Drive, Pittsburgh, PA 15220
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W-4188 10/90 2.5M

Kobelco Operation

Kobelco diesel's powerful striking force has three phases — compression, impact and combustion. Here's how it works.

Fuel Injection and Compression

When the ram is lifted by the tripping device to a predetermined height, it is automatically released. The ram falls under its own weight and actuates the cam of the fuel pump which injects a measured amount of fuel into a specially designed receptacle in the anvil. Continuing its downward fall, the ram closes the intake-exhaust ports and compresses the air in the cylinder ahead of the ram. The compression of the trapped air tightens the anvil and drive cap against the top of the pile in preparation for the impact blow. Compression also assists in starting the pile downward.

Impact Blow

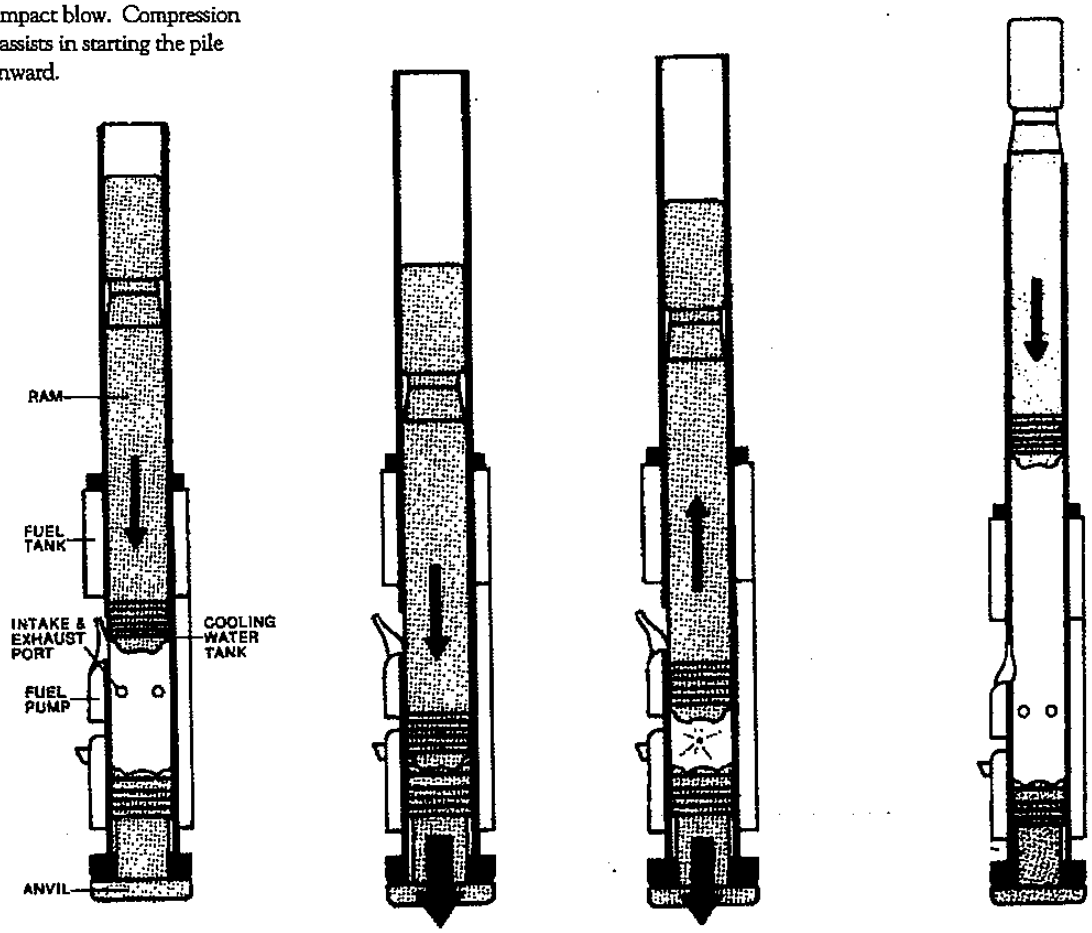
The falling ram strikes the anvil and delivers its impact energy to the pile, driving the pile rapidly downward.

Combustion and Power Stroke

As the ram impacts with the anvil, the fuel atomizes into the annular combustion chamber around the ram and anvil. The hot compressed air ignites the air-fuel mixture. The resulting explosive force pushes the pile further downward and propels the ram upward. The expanding gas in the cylinder is discharged when the rising ram opens the intake-exhaust ports.

Fresh Air Intake

As the ram rises above the intake-exhaust ports, fresh air is drawn into the cylinder. The fuel pump cam returns to its original position in preparation for injection on the next stroke. The ram continues freely upward until arrested by gravity and then again begins its downward stroke.



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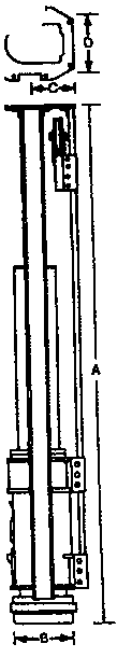
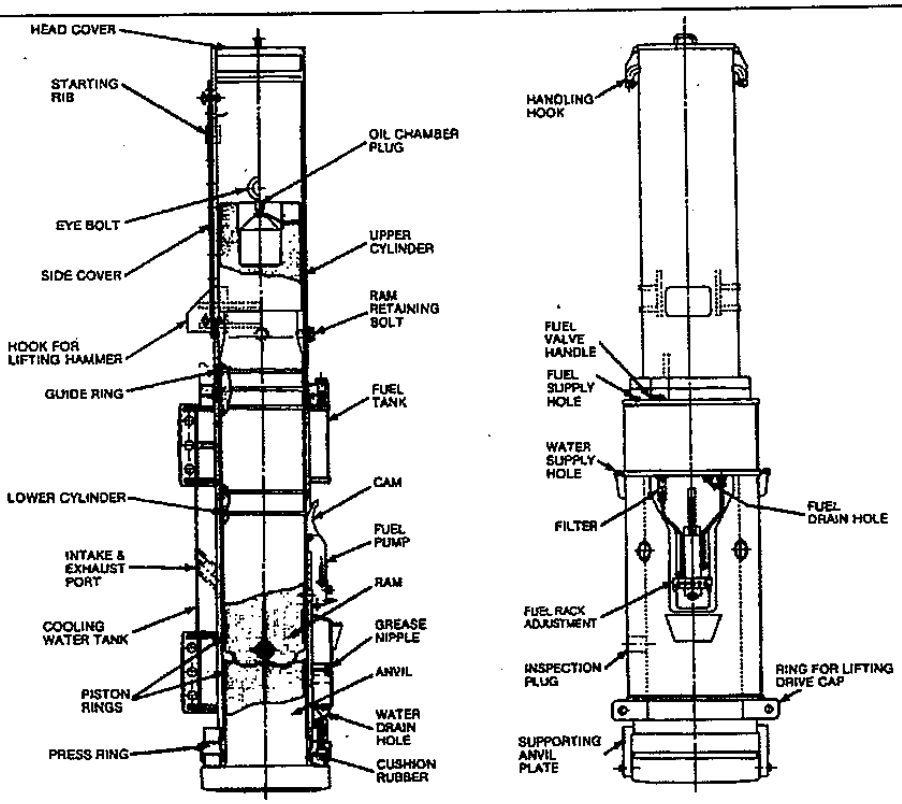
obelco Specifications



		K13	K25	K35	K45
Total length, A	Ft. - in.	16 - 8	17 - 6	17 - 8	18 - 7
Diameter of anvil, B	In.	19.25	23.25	27.50	31.50
Depth, center to back, C	In.	17.00	19.25	21.75	25.25
Width between guide rails, D	In.	26	26	36	36
Total weight	Lb.	7,800	13,200	19,100	25,300
Weight of ram	Lb.	2,870	5,510	7,720	9,920
Energy per blow (min-max)	Ft. - Lb.	13,200 - 25,390	23,500 - 51,540	31,700 - 72,150	39,000 92,760
Ram Stroke (min-max)	Ft.	4.60 - 8.85	4.26 - 9.35	4.11 - 9.35	3.93- 9.35
Number of blows	Blows/min.	40 - 60	39 - 60	39 - 60	39 - 60
Explosive force	Lb.	149,900	238,100	330,800	421,200
Fuel tank capacity	Gal.	10.6	10.6	12.5	17.00
Lube oil tank capacity, ram	Gal.	1.3	1.85	2.50	3.56
Water tank capacity	Gal.	18.5	21.1	37.0	45.0
Fuel consumption	Gal./hr.	.8 - 2.1	2.4 - 3.2	3.2 - 4.3	4.5 - 5.5
Lube oil consumption, ram	Gal./hr.	.25	.4	.5	.66

Model KB60 and KB80 - Special order by request

L. B. Foster Company reserves the right to make revisions to the specifications without notification.



KOBE K-13 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 2870
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	3	5	6	6	7	8	3.000
8	6	9	11	13	14	15	1.500
12	9	13	16	18	21	22	1.000
16	12	17	20	24	27	29	0.750
20	14	21	25	29	33	35	0.600
24	17	24	29	33	38	41	0.500
28	19	27	33	38	43	46	0.429
32	21	30	36	42	48	51	0.375
36	23	33	40	46	53	56	0.333
40	25	36	43	50	57	61	0.300
44	27	39	46	54	62	65	0.273
48	29	41	49	57	66	70	0.250
52	30	43	52	61	69	74	0.231
56	32	46	55	64	73	78	0.214
60	33	48	57	67	77	81	0.200
64	35	50	60	70	80	85	0.188
68	36	52	62	73	83	88	0.176
72	38	54	65	75	86	91	0.167
76	39	56	67	78	89	95	0.158
80	40	57	68	80	92	98	0.150
84	41	59	71	83	95	100	0.143
88	42	61	73	85	97	103	0.136
92	44	62	75	87	100	106	0.130
96	45	64	77	89	102	108	0.125
100	46	65	78	91	104	111	0.120
104	47	67	80	93	107	113	0.115
108	48	68	82	95	109	116	0.111
110	48	69	82	96	110	117	0.109
120	50	72	86	100	115	122	0.100
130	52	75	90	104	119	127	0.092
140	54	77	93	108	124	131	0.086
150	56	80	96	112	128	136	0.080
160	57	82	98	115	131	139	0.075
170	59	84	101	118	135	143	0.071
180	60	86	103	121	138	146	0.067
190	62	88	106	123	141	150	0.063
200	63	90	108	126	144	152	0.060
225	66	94	112	131	150	159	0.053
250	68	97	116	136	155	165	0.048
275	70	100	120	140	160	170	0.044
300	72	103	123	144	164	174	0.040
325	73	105	126	147	168	178	0.037
350	75	107	128	150	171	182	0.034
375	76	109	130	152	174	185	0.032
400	77	110	132	155	177	188	0.030
425	78	112	134	157	179	190	0.028
450	79	113	136	159	181	193	0.027
475	80	115	137	160	183	195	0.025
500	81	116	139	162	185	197	0.024
525	82	117	140	164	187	199	0.023

KOBE K-25 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 5510
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	6	9	11	12	14	15	3.000
8	12	17	21	24	28	29	1.500
12	18	25	30	35	40	43	1.000
16	23	32	39	46	52	55	0.750
20	28	39	47	55	63	67	0.600
24	32	46	55	64	73	78	0.500
28	36	52	63	73	83	89	0.429
32	41	58	70	81	93	99	0.375
36	45	64	76	89	102	108	0.333
40	48	69	83	96	110	117	0.300
44	52	74	89	103	118	126	0.273
48	55	79	94	110	126	134	0.250
52	58	83	100	117	133	142	0.231
56	61	88	105	123	140	149	0.214
60	64	92	110	129	147	156	0.200
64	67	96	115	134	153	163	0.188
68	70	100	120	140	159	169	0.176
72	72	103	124	145	165	176	0.167
76	75	107	128	150	171	182	0.158
80	77	110	132	154	176	187	0.150
84	79	113	136	159	182	193	0.143
88	82	117	140	163	186	198	0.136
92	84	120	143	167	191	203	0.130
96	86	122	147	171	196	208	0.125
100	88	125	150	175	200	213	0.120
104	90	128	153	179	205	217	0.116
108	91	131	157	183	209	222	0.111
110	92	132	158	184	211	224	0.109
120	96	138	165	193	220	234	0.100
130	100	143	172	201	229	244	0.092
140	104	148	178	208	237	252	0.086
150	107	153	184	214	245	260	0.080
160	110	157	189	220	252	268	0.075
170	113	162	194	226	258	276	0.071
180	116	165	198	231	264	281	0.067
190	118	169	203	236	270	287	0.063
200	121	172	207	241	276	293	0.060
225	126	180	216	252	287	305	0.053
250	130	186	223	261	298	316	0.048
275	134	192	230	269	307	326	0.044
300	138	197	236	276	315	335	0.040
325	141	201	241	282	322	342	0.037
350	144	205	246	287	328	349	0.034
375	146	209	250	292	334	355	0.032
400	148	212	254	297	339	360	0.030
425	150	215	258	301	344	365	0.028
450	152	218	261	305	348	370	0.027
475	154	220	264	308	352	374	0.026
500	156	222	267	311	355	378	0.024
525	157	224	269	314	359	381	0.023

KOBE K-35 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 7720
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	9	12	15	17	20	21	3.000
8	17	24	29	34	39	41	1.500
12	25	35	42	49	56	60	1.000
16	32	45	54	64	73	77	0.750
20	39	55	66	77	88	94	0.600
24	45	64	77	90	103	109	0.500
28	51	73	88	102	117	124	0.429
32	57	81	98	114	130	138	0.375
36	62	89	107	125	143	151	0.333
40	68	97	116	135	154	164	0.300
44	72	104	124	145	166	176	0.273
48	77	110	132	154	176	187	0.250
52	82	117	140	163	187	198	0.231
56	86	123	147	172	197	209	0.214
60	90	129	154	180	206	219	0.200
64	94	134	161	188	215	228	0.188
68	98	140	168	195	223	237	0.176
72	101	145	174	203	232	246	0.167
76	105	150	180	210	239	254	0.158
80	108	154	185	216	247	262	0.150
84	111	159	191	223	254	270	0.143
88	114	163	196	229	261	278	0.136
92	117	168	201	235	268	285	0.130
96	120	172	206	240	274	292	0.125
100	123	175	211	246	281	298	0.120
104	125	179	215	251	287	305	0.115
108	128	183	219	256	293	311	0.111
110	129	185	222	258	295	314	0.109
120	135	193	232	270	309	328	0.100
130	141	201	241	281	321	341	0.092
140	145	208	249	291	333	353	0.086
150	150	214	257	300	343	365	0.080
160	154	221	265	309	353	375	0.075
170	158	226	272	317	362	385	0.071
180	162	232	278	324	371	394	0.067
190	166	237	284	331	379	402	0.063
200	169	241	290	338	386	410	0.060
225	176	252	302	352	403	428	0.053
250	183	261	313	365	417	443	0.048
275	188	269	322	376	430	457	0.044
300	193	276	331	386	441	469	0.040
325	197	282	339	395	451	479	0.037
350	201	287	345	402	460	489	0.034
375	205	292	351	409	468	497	0.032
400	208	297	356	416	475	505	0.030
425	211	301	361	421	482	512	0.028
450	213	305	366	427	488	518	0.027
475	216	308	370	431	493	524	0.025
500	218	311	374	436	498	529	0.024
525	220	314	377	440	503	534	0.023

KOBE K-45 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 9920
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	11	16	19	22	26	27	3.000
8	22	31	37	43	50	53	1.500
12	32	45	54	63	72	77	1.000
16	41	58	70	82	93	99	0.750
20	50	71	85	99	113	120	0.600
24	58	83	99	116	132	141	0.500
28	66	94	113	131	150	160	0.429
32	73	104	125	148	167	178	0.375
36	80	114	137	160	183	195	0.333
40	87	124	149	174	198	211	0.300
44	93	133	160	186	213	226	0.273
48	99	142	170	198	227	241	0.250
52	105	150	180	210	240	255	0.231
56	110	158	189	221	253	268	0.214
60	116	165	198	231	265	281	0.200
64	121	173	207	242	276	293	0.188
68	126	179	215	251	287	305	0.176
72	130	186	223	260	298	316	0.167
76	135	192	231	269	308	327	0.158
80	139	198	238	278	317	337	0.150
84	143	204	245	286	327	347	0.143
88	147	210	252	294	336	357	0.136
92	151	215	258	301	344	366	0.130
96	154	220	265	309	353	375	0.125
100	158	225	271	316	361	383	0.120
104	161	230	276	322	368	391	0.115
108	164	235	282	329	376	399	0.111
110	166	237	285	332	380	403	0.109
120	174	248	298	347	397	422	0.100
130	181	258	310	361	413	438	0.092
140	187	267	320	374	427	454	0.086
150	193	276	331	386	441	468	0.080
160	198	283	340	397	453	482	0.075
170	204	291	349	407	465	494	0.071
180	208	298	357	417	476	506	0.067
190	213	304	365	426	486	517	0.063
200	217	310	372	434	496	527	0.060
225	226	323	388	453	518	550	0.053
250	235	335	402	469	536	570	0.048
275	242	345	414	483	553	587	0.044
300	248	354	425	496	567	602	0.040
325	254	362	435	507	580	616	0.037
350	259	369	443	517	591	628	0.034
375	263	376	451	526	601	639	0.032
400	267	382	458	534	610	649	0.030
425	271	387	464	542	619	658	0.028
450	274	392	470	548	627	666	0.027
475	277	396	475	554	634	673	0.026
500	280	400	480	560	640	680	0.024
525	283	404	484	565	646	686	0.023

KOBE K-60 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 13200
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	15	21	26	30	34	36	3.000
8	29	41	50	58	66	70	1.500
12	42	60	72	84	96	102	1.000
16	54	76	93	109	124	132	0.750
20	66	94	113	132	151	160	0.600
24	77	110	132	154	176	187	0.500
28	87	125	150	175	200	212	0.429
32	97	139	167	195	222	236	0.375
36	107	152	183	213	244	259	0.333
40	116	165	198	231	264	281	0.300
44	124	177	212	248	283	301	0.273
48	132	189	226	264	302	321	0.250
52	140	200	239	279	319	339	0.231
56	147	210	252	294	336	357	0.214
60	154	220	264	308	352	374	0.200
64	161	230	276	321	367	390	0.188
68	167	239	286	334	382	406	0.176
72	173	248	297	347	396	421	0.167
76	179	256	307	358	409	435	0.158
80	185	264	317	370	422	449	0.150
84	190	272	326	380	435	462	0.143
88	195	279	335	391	447	475	0.136
92	200	286	344	401	458	487	0.130
96	205	293	352	411	469	499	0.125
100	210	300	360	420	480	510	0.120
104	215	306	368	429	490	521	0.116
108	219	313	375	438	500	531	0.111
110	221	316	379	442	505	537	0.109
120	231	330	396	462	528	561	0.100
130	240	343	412	480	549	583	0.092
140	249	355	426	498	569	604	0.086
150	257	367	440	513	587	623	0.080
160	264	377	453	528	603	641	0.075
170	271	387	464	542	619	658	0.071
180	277	396	475	554	634	673	0.067
190	283	405	485	566	647	688	0.063
200	289	413	495	578	660	701	0.060
225	301	430	517	603	689	732	0.053
250	312	446	535	624	714	758	0.048
275	322	459	551	643	735	781	0.044
300	330	471	566	660	754	801	0.040
325	337	482	578	675	771	819	0.037
350	344	491	590	688	786	836	0.034
375	350	500	600	700	800	850	0.032
400	355	508	609	711	812	863	0.030
425	360	515	618	721	823	875	0.028
450	365	521	625	729	834	886	0.027
475	369	527	632	738	843	896	0.025
500	373	532	639	745	852	905	0.024
525	376	537	645	752	860	913	0.023

KOBE K-13 DIESEL HAMMER

P = 2 W H / S + 0.1 — WEIGHT OF RAM = 2870 — REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	29	41	49	57	66	70
2 7/16	4 7/8	29	42	50	58	67	71
2 3/8	4 3/4	30	43	51	60	68	72
2 5/16	4 5/8	30	43	52	61	69	74
2 1/4	4 1/2	31	44	53	62	71	75
2 3/16	4 3/8	32	45	54	63	72	77
2 1/8	4 1/4	32	46	55	64	73	78
2 1/16	4 1/8	33	47	56	66	75	80
2	4	33	48	57	67	77	81
1 15/16	3 7/8	34	49	59	68	78	83
1 7/8	3 3/4	35	50	60	70	80	85
1 13/16	3 5/8	36	51	61	71	82	87
1 3/4	3 1/2	37	52	63	73	83	89
1 11/16	3 3/8	37	53	64	75	85	91
1 5/8	3 1/4	38	55	66	77	87	93
1 9/16	3 1/8	39	56	67	78	90	95
1 1/2	3	40	57	69	80	92	98
1 7/16	2 7/8	41	59	71	82	94	100
1 3/8	2 3/4	42	60	73	85	97	103
1 5/16	2 5/8	43	62	74	87	99	105
1 1/4	2 1/2	45	64	77	89	102	108
1 3/16	2 3/8	46	66	79	92	105	112
1 1/8	2 1/4	47	68	81	95	108	115
1 1/16	2 1/8	49	70	83	97	111	118
1	2	50	72	86	100	115	122
15/16	1 7/8	52	74	89	104	119	126
7/8	1 3/4	54	77	92	107	122	130
13/16	1 5/8	55	79	95	111	127	135
3/4	1 1/2	57	82	98	115	131	139
11/16	1 3/8	60	85	102	119	136	145
5/8	1 1/4	62	88	106	124	141	150
9/16	1 1/8	64	92	110	129	147	156
1/2	1	67	96	115	134	153	163
7/16	7/8	70	100	120	140	160	170
3/8	3/4	73	104	125	146	167	177
5/16	5/8	77	109	131	153	175	186
1/4	1/2	80	115	138	161	184	195
3/16	3/8	85	121	145	169	193	205
1/8	1/4	89	128	153	179	204	217
1/16	1/8	95	135	162	189	216	230
0	0	100	144	172	201	230	244

KOBE K-25 DIESEL HAMMER							
	P = 2 W H / S + 0.1	WEIGHT OF RAM = 5510 REFUSAL SHALL BE BETWEEN 150 - 180 TONS					
PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	55	79	94	110	126	134
2 7/16	4 7/8	56	80	96	112	128	136
2 3/8	4 3/4	57	82	98	114	131	139
2 5/16	4 5/8	58	83	100	116	133	141
2 1/4	4 1/2	59	85	102	119	136	144
2 3/16	4 3/8	61	86	104	121	138	147
2 1/8	4 1/4	62	88	106	123	141	150
2 1/16	4 1/8	63	90	108	126	144	153
2	4	64	92	110	129	147	156
1 15/16	3 7/8	66	94	113	131	150	159
1 7/8	3 3/4	67	96	115	134	153	163
1 13/16	3 5/8	69	98	118	137	157	167
1 3/4	3 1/2	70	100	120	140	160	170
1 11/16	3 3/8	72	103	123	144	164	174
1 5/8	3 1/4	73	105	126	147	168	178
1 9/16	3 1/8	75	108	129	151	172	183
1 1/2	3	77	110	132	154	176	187
1 7/16	2 7/8	79	113	136	158	181	192
1 3/8	2 3/4	81	116	139	162	186	197
1 5/16	2 5/8	83	119	143	167	191	203
1 1/4	2 1/2	86	122	147	171	196	208
1 3/16	2 3/8	88	126	151	176	202	214
1 1/8	2 1/4	91	130	156	182	207	220
1 1/16	2 1/8	94	134	160	187	214	227
1	2	96	138	165	193	220	234
15/16	1 7/8	100	142	171	199	228	242
7/8	1 3/4	103	147	176	206	235	250
13/16	1 5/8	106	152	182	213	243	258
3/4	1 1/2	110	157	189	220	252	268
11/16	1 3/8	114	163	196	229	261	278
5/8	1 1/4	119	170	203	237	271	288
9/16	1 1/8	123	176	212	247	282	300
1/2	1	129	184	220	257	294	312
7/16	7/8	134	192	230	268	307	326
3/8	3/4	140	200	240	281	321	341
5/16	5/8	147	210	252	294	336	357
1/4	1/2	154	220	264	309	353	375
3/16	3/8	162	232	278	325	371	394
1/8	1/4	171	245	294	343	392	416
1/16	1/8	182	259	311	363	415	441
0	0	193	276	331	386	441	468

KOBE K-35 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 7720
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	77	110	132	154	176	187
2 7/16	4 7/8	79	112	135	157	180	191
2 3/8	4 3/4	80	114	137	160	183	194
2 5/16	4 5/8	82	117	140	163	186	198
2 1/4	4 1/2	83	119	143	166	190	202
2 3/16	4 3/8	85	121	145	170	194	206
2 1/8	4 1/4	86	124	148	173	198	210
2 1/16	4 1/8	88	126	151	176	202	214
2	4	90	129	154	180	206	219
1 15/16	3 7/8	92	131	158	184	210	223
1 7/8	3 3/4	94	134	161	188	215	228
1 13/16	3 5/8	96	137	165	192	220	233
1 3/4	3 1/2	98	140	168	197	225	239
1 11/16	3 3/8	101	144	172	201	230	244
1 5/8	3 1/4	103	147	176	206	235	250
1 9/16	3 1/8	105	151	181	211	241	256
1 1/2	3	108	154	185	216	247	262
1 7/16	2 7/8	111	158	190	222	253	269
1 3/8	2 3/4	114	163	195	228	260	276
1 5/16	2 5/8	117	167	200	234	267	284
1 1/4	2 1/2	120	172	206	240	274	292
1 3/16	2 3/8	124	178	212	247	282	300
1 1/8	2 1/4	127	182	218	254	291	309
1 1/16	2 1/8	131	187	225	262	299	318
1	2	135	193	232	270	309	328
15/16	1 7/8	139	199	239	279	319	339
7/8	1 3/4	144	206	247	288	329	350
13/16	1 5/8	149	213	256	298	341	362
3/4	1 1/2	154	221	265	309	353	375
11/16	1 3/8	160	229	274	320	366	389
5/8	1 1/4	166	238	285	333	380	404
9/16	1 1/8	173	247	296	346	395	420
1/2	1	180	257	309	360	412	437
7/16	7/8	188	269	322	376	430	456
3/8	3/4	197	281	337	393	449	477
5/16	5/8	206	294	353	412	471	500
1/4	1/2	216	309	371	432	494	525
3/16	3/8	228	325	390	455	520	553
1/8	1/4	240	343	412	480	549	583
1/16	1/8	254	363	436	509	581	618
0	0	270	386	463	540	618	656

KOBE K-45 DIESEL HAMMER							
	P = 2 W H / S + 0.1	WEIGHT OF RAM = 9920 REFUSAL SHALL BE BETWEEN 150 - 180 TONS					
PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	99	142	170	198	227	241
2 7/16	4 7/8	101	144	173	202	231	245
2 3/8	4 3/4	103	147	176	206	235	250
2 5/16	4 5/8	105	150	180	210	240	255
2 1/4	4 1/2	107	153	183	214	244	259
2 3/16	4 3/8	109	156	187	218	249	265
2 1/8	4 1/4	111	159	190	222	254	270
2 1/16	4 1/8	113	162	194	227	259	275
2	4	116	165	198	231	265	281
1 15/16	3 7/8	118	169	203	236	270	287
1 7/8	3 3/4	121	173	207	242	276	293
1 13/16	3 5/8	123	176	212	247	282	300
1 3/4	3 1/2	126	180	216	253	289	307
1 11/16	3 3/8	129	185	221	258	295	314
1 5/8	3 1/4	132	189	227	265	302	321
1 9/16	3 1/8	135	194	232	271	310	329
1 1/2	3	139	198	238	278	317	337
1 7/16	2 7/8	142	203	244	285	326	346
1 3/8	2 3/4	146	209	251	292	334	355
1 5/16	2 5/8	150	214	257	300	343	365
1 1/4	2 1/2	154	220	265	309	353	375
1 3/16	2 3/8	159	227	272	317	363	385
1 1/8	2 1/4	163	233	280	327	373	397
1 1/16	2 1/8	168	240	289	337	385	409
1	2	174	248	298	347	397	422
15/16	1 7/8	179	256	307	358	410	435
7/8	1 3/4	185	265	317	370	423	450
13/16	1 5/8	192	274	328	383	438	465
3/4	1 1/2	198	283	340	397	453	482
11/16	1 3/8	206	294	353	411	470	500
5/8	1 1/4	214	305	366	427	488	519
9/16	1 1/8	222	317	381	444	508	540
1/2	1	231	331	397	463	529	562
7/16	7/8	242	345	414	483	552	587
3/8	3/4	253	361	433	505	577	613
5/16	5/8	265	378	453	529	605	642
1/4	1/2	278	397	476	556	635	675
3/16	3/8	292	418	501	585	668	710
1/8	1/4	309	441	529	617	705	750
1/16	1/8	327	467	560	654	747	794
0	0	347	498	595	694	794	843

KOBE K-60 DIESEL HAMMER

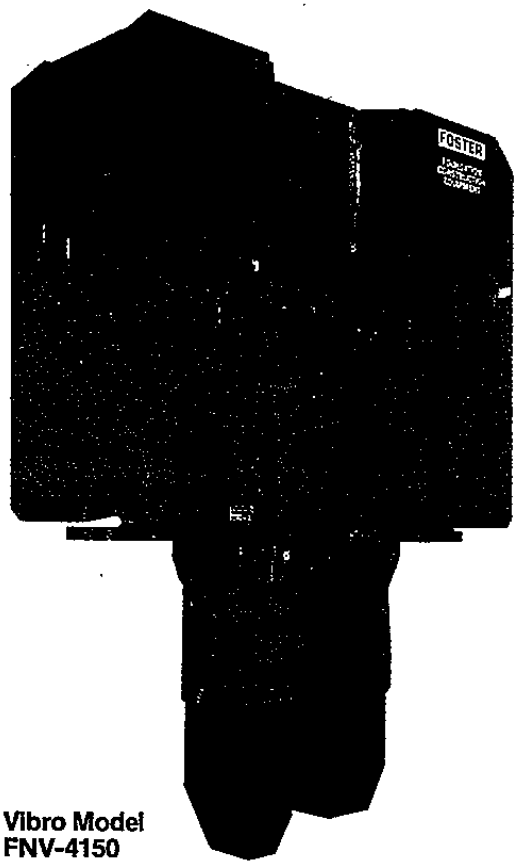
P = 2 W H / S + 0.1 WEIGHT OF RAM = 13200
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	132	189	226	264	302	321
2 7/16	4 7/8	134	192	230	269	307	326
2 3/8	4 3/4	137	196	235	274	313	332
2 5/16	4 5/8	139	199	239	279	319	339
2 1/4	4 1/2	142	203	244	284	325	345
2 3/16	4 3/8	145	207	248	290	331	352
2 1/8	4 1/4	148	211	253	296	338	359
2 1/16	4 1/8	151	216	259	302	345	366
2	4	154	220	264	308	352	374
1 15/16	3 7/8	157	225	270	315	359	382
1 7/8	3 3/4	161	230	275	321	367	390
1 13/16	3 5/8	164	235	282	329	375	399
1 3/4	3 1/2	168	240	288	336	384	408
1 11/16	3 3/8	172	246	295	344	393	417
1 5/8	3 1/4	176	251	302	352	402	427
1 9/16	3 1/8	180	258	309	361	412	438
1 1/2	3	185	264	317	370	422	449
1 7/16	2 7/8	190	271	325	379	433	460
1 3/8	2 3/4	195	278	333	389	445	472
1 5/16	2 5/8	200	285	342	400	457	485
1 1/4	2 1/2	205	293	352	411	469	499
1 3/16	2 3/8	211	302	362	422	483	513
1 1/8	2 1/4	217	311	373	435	497	528
1 1/16	2 1/8	224	320	384	448	512	544
1	2	231	330	398	462	528	561
15/16	1 7/8	238	341	409	477	545	579
7/8	1 3/4	246	352	422	493	563	598
13/16	1 5/8	255	364	437	510	583	619
3/4	1 1/2	264	377	453	528	603	641
11/16	1 3/8	274	391	469	548	626	665
5/8	1 1/4	284	406	487	569	650	690
9/16	1 1/8	296	422	507	591	676	718
1/2	1	308	440	528	616	704	748
7/16	7/8	321	459	551	643	735	781
3/8	3/4	336	480	576	672	768	816
5/16	5/8	352	503	603	704	805	855
1/4	1/2	370	528	634	739	845	898
3/16	3/8	389	556	667	778	889	945
1/8	1/4	411	587	704	821	939	997
1/16	1/8	435	621	745	870	994	1056
0	0	462	660	792	924	1056	1122

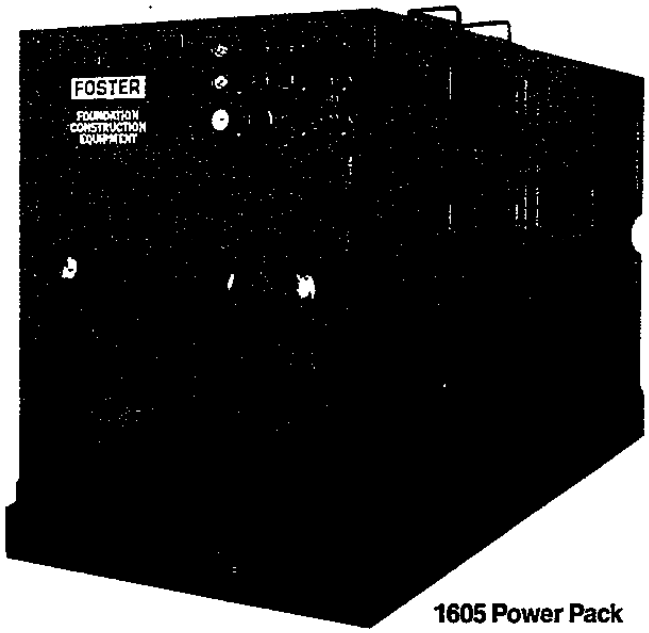
FOSTER L.B.FOSTER COMPANY

PILE DRIVING EQUIPMENT

VIBRO DRIVER®/ EXTRACTOR



Vibro Model FNV-4150



1605 Power Pack

The state of the art in hydraulic vibratory technology.

Foster's new **full power hydraulic control system** utilizes a constant horsepower control to deliver full available power in over 95 percent of all driving conditions. Other vibros deliver full available horsepower to the work of vibration only a very small percentage of the time. So Foster gives you the best performance on sheeting, H-beams, caissons and other driving/extracting jobs.

The new full power design provides an **increased maximum torque to eccentric moment ratio.** This ratio gives you a good idea of the machine's ability to maintain its rated speed.

Remote control of engine speed lets the operator select the optimum driving frequency and permits throttling back to low idle in order to save fuel and reduce noise during pile handling intervals.

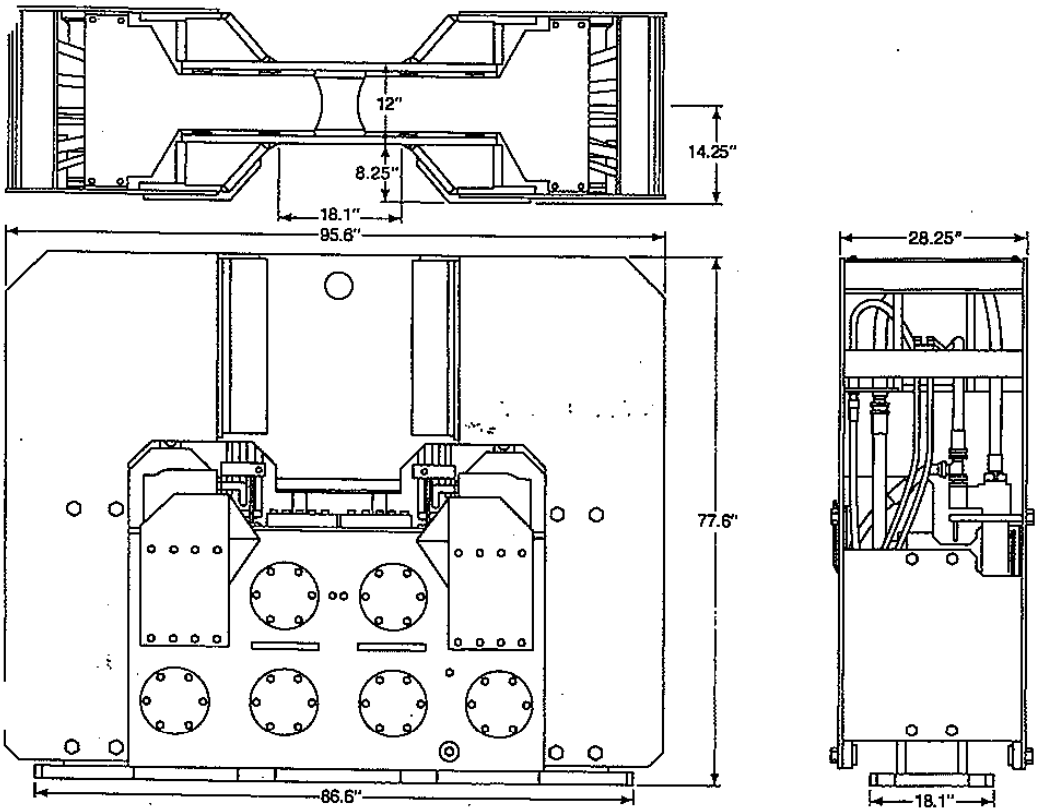
There have been major advances in **transmission design,** including specially strengthened gears cut in a manner to reduce noise and increase gear life. Moreover, the new transmission design eliminates key and keyway failure.

The new full power hydraulic control system offers **built-in protection.** A safety shut-down system protects hydraulic components from contamination, loss of oil, overspeed and overheating. Indicator lights make short work of trouble shooting and repair.

A duplex pendant station allows full control from the remote pendant or the control panel itself, thus eliminating downtime from pendant malfunctions.

Finally, a duplex main return filter allows continued work on a second clean element to minimize downtime.

Dimensions and Specifications



SPECIFICATIONS FOR MODEL FNV-4150 VIBRO DRIVER/EXTRACTOR:

Type—Hydraulic
Eccentric Moment—4166/3125 in./lbs.
Frequency—900-1500 Vpm
Amplitude—5/8 in.-1¼ in.
Driving Force—134 tons
Maximum Operating Pressure—5000 psi
Maximum Flow—160 gpm
Working Line Pull for Extraction—55 tons

Type of Suspension—Elastomeric
Pile Clamping Force—145/200 tons
Suspended Weight (A)—16495 lbs.
Shipping Weight (B)—31995 lbs.
Length—95.6 in.
Width—27.25 in.
Throat Width—12 in.
Hammer Height—77.6 in.

A. Suspended weight includes Driver/Extractor, Typical Driving/Extracting Head, and 1½ in. Hydraulic Hoses.

B. Shipping weight includes Driver/Extractor, Power Pack, Driving/Extracting Head, and Hydraulic Hoses.

SPECIFICATIONS FOR MODEL 1605 HYDRAULIC POWER PACK

ENGINE SPECIFICATIONS:
Type—Caterpillar, Model 3408 DITA
Engine Horsepower—570 hp
Maximum rpm—2100 rpm

HYDRAULIC PUMP SPECIFICATIONS:
Type—Rexroth Tandem A7V225
Maximum Output Pressure—5000 psi
Maximum Output Flow—160 gpm
Clamp Pressure—5000 psi

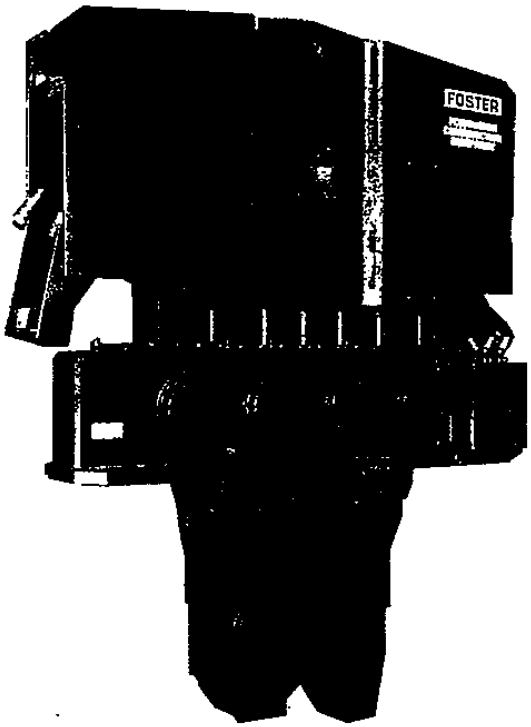
GENERAL SPECIFICATIONS:
Hydraulic Oil Tank Capacity—300 gal.
Fuel Tank Capacity—125 gal.
Approximate Fuel Consumption at Maximum Output—17.6 gal./hr.
Overall Length—12'
Overall Width—5'4"
Overall Height—6'10"
Weight (Wet)—16660 lbs.
Weight (Dry)—13880 lbs.
Skid Type Fuel Tank
Totally enclosed with locking doors
Engine Precleaner
Hydraulic Hose Quick Disconnects.
Duplex Control Circuit.
Automatic Shutdown on contamination, loss of oil, overspeed and overheating.
Hand Held Control Pendant.

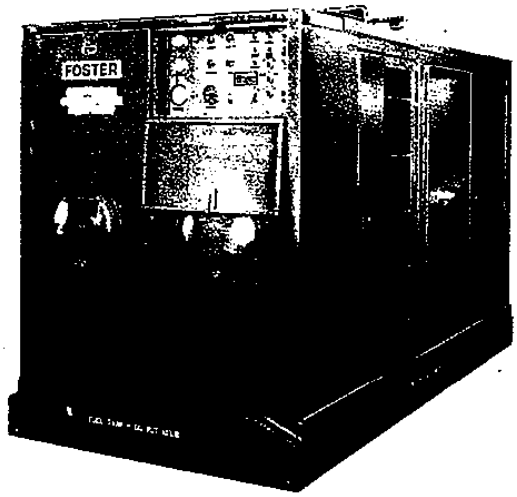
For further information write:
L. B. FOSTER COMPANY
415 Holiday Drive
Pittsburgh, PA 15220
Phone 412/928-3400, or call your local Foster Sales Office.

FOSTER L.B.FOSTER COMPANY

W-2460 9/88 2.5M

FOSTER CONSTRUCTION PRODUCTS
PILE DRIVING EQUIPMENT
VIBRO DRIVER®/EXTRACTOR





Vibro Model FMV-1800 **805 Power Pack**

The state of the art in hydraulic vibratory technology!

Foster's new **full power hydraulic control system** utilizes a constant horsepower control to deliver full available power in over 95 percent of all driving conditions. Unlike other vibros, the Foster Vibro Model FMV-1800 delivers full available horsepower to the pile. You get the best performance possible on sheeting, H-beams, caissons and other driving/extracting jobs.

Foster's full power design provides an **increased maximum torque to eccentric moment ratio.** This ratio illustrates the machine's excellent ability to maintain its rated speed.

Through **remote control of the engine speed,** the operator selects the optimum driving frequency and can throttle back to low idle, saving fuel and reducing noise during pile handling intervals.

Major advances in transmission design include specially strengthened gears cut to reduce noise and increase gear life. Moreover, the transmission design eliminates key and keyway failure.

Foster's full power hydraulic control system offers **built-in protection.** A safety shut-down system protects hydraulic components from contamination, loss of oil, and overheating. Indicator lights provide at-a-glance trouble shooting and repair.

Finally, a duplex pendant station allows full control from the remote pendant of the control panel itself, thus eliminating downtime from pendant malfunctions.

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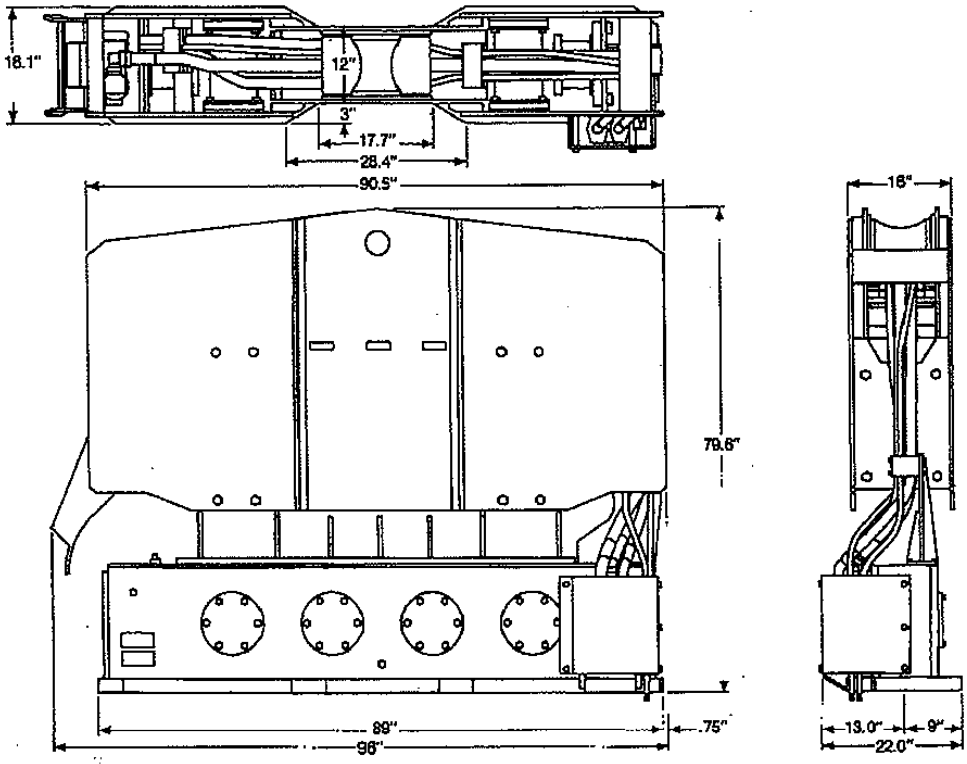
Dimensions and Specifications



SPECIFICATIONS FOR MODEL FMV-1800 VIBRO DRIVER/EXTRACTOR

Type - Hydraulic
Eccentric Moment - 1800 in./lbs.
Frequency - 1000 - 1600 Vpm
Amplitude - 5/16 in. - 3/4 in.
Driving Force - 65 tons
Maximum Operating Pressure - 5000 psi
Maximum Flow - 80 gpm
Working Line Pull for Extraction - 30 tons

Type of Suspension - Elastomeric
Pile Clamping Force - 90/120 tons
Suspended Weight (A) - 11000 lbs.
Shipping Weight (B) - 24375 lbs.
Length - 96 in.
Width - 21.1 in.
Throat Width - 12 in.
Hammer Height - 79.6 in.

A. Suspended weight includes Driver/Extractor, Typical Driving/Extracting Head, and 1-1/4 in. Hydraulic Hoses.

B. Shipping weight includes Driver/Extractor, Power Pack, Driving/Extracting Head, and Hydraulic Hoses.

SPECIFICATIONS FOR MODEL 805 HYDRAULIC POWER PACK

ENGINE SPECIFICATIONS
Type - Caterpillar 3208
Engine Horsepower - 220 hp
Maximum rpm - 2800 rpm

HYDRAULIC PUMP SPECIFICATIONS
Type - Rexroth A7V225
Maximum Output Pressure - 5000 psi
Maximum Output Flow - 80 gpm
Clamp Pressure - 5000 psi

GENERAL SPECIFICATIONS
Hydraulic Oil Tank Capacity - 170 gal.
Fuel Tank Capacity - 110 gal.
Appoximate Fuel Consumption at Maximum Output - 12 gal./hr.
Overall Length - 10'6"
Overall Width - 5'4"
Overall Height - 5'10"
Weight (Wet) - 13000 lbs.
Weight (Dry) - 11000 lbs.
Skid Type Fuel Tank
Totally enclosed with locking doors

Hydraulic Hose Quick Disconnects.
Automatic Shutdown on contamination, loss of oil, and overheating.
Hand Held Control Pendant.
Duplex Control Unit.

L. B. Foster is a manufacturer, fabricator and distributor of construction and highway products, tubular products and rail products.

FOSTER
L.B. FOSTER COMPANY

CORPORATE OFFICES
415 Holiday Drive
Pittsburgh, PA 15220
Phone: 1-800-255-4500

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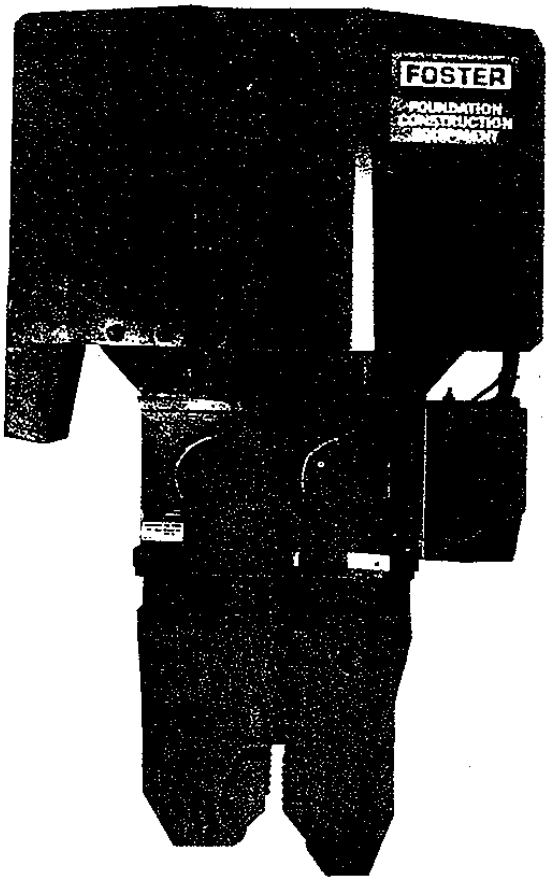
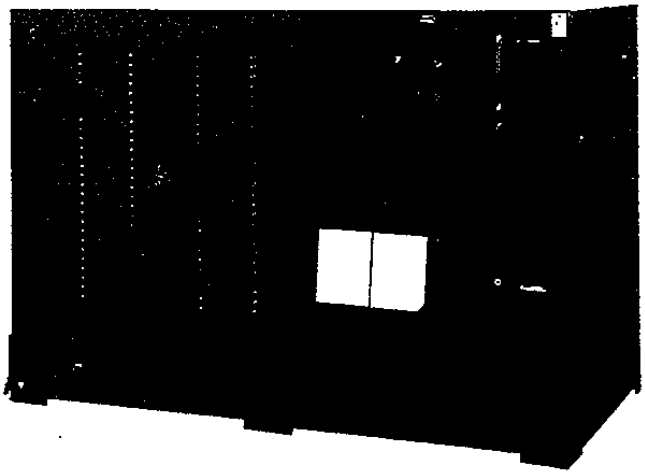
FOSTER L.B.FOSTER COMPANY

PILE DRIVING EQUIPMENT

VIBRO DRIVER®/ EXTRACTOR



VIBRO MODEL FNV-1000



753 HYDRAULIC POWER PACK

The **Foster Vibro Driver® /Extractor** is designed to drive or extract sheet piling, pipe, timber, concrete pile, caisson pile, H, I and wide-flange beams.

The slim Foster Vibro can drive a single sheet pile between piles already in place. Concentration of the vibro's full power on a single sheet pays off in greater **efficiency** when it is impossible to drive or extract pairs.

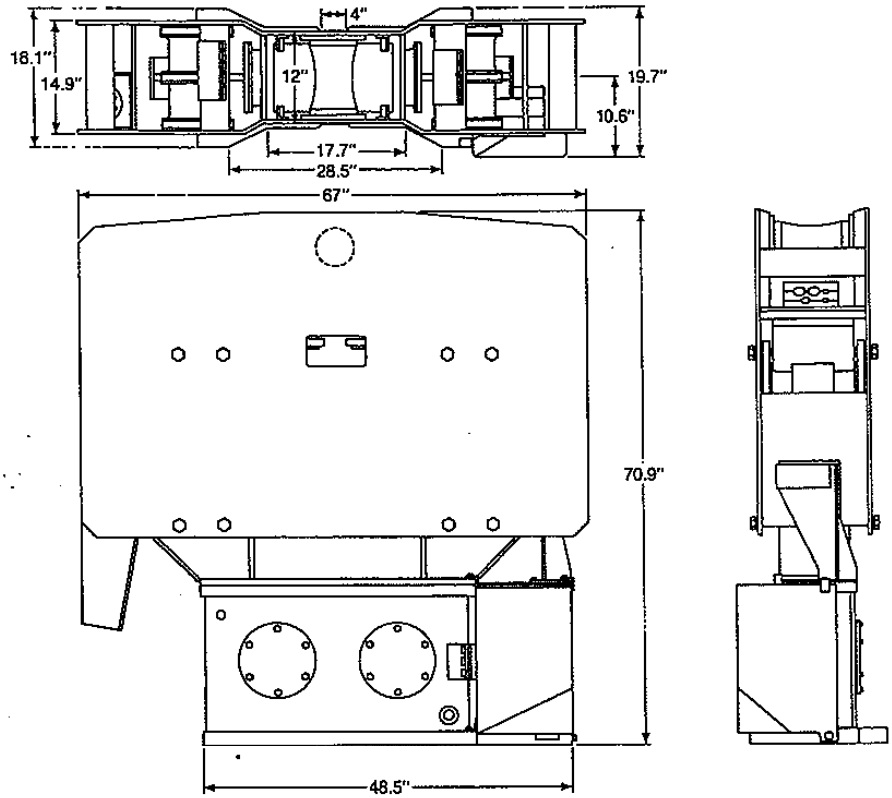
The positive hydraulic gripping action of the clamping head practically **eliminates top-end battering, brooming or distortion** of piling. Foster Vibros are available on request with proper mountings to operate on box type leaders.

There have been major advances in **transmission design,** including specially strengthened gears cut in a manner to reduce noise and increase gear life. Moreover, the new transmission design eliminates key and keyway failure and allows field bearing replacement without transmission disassembly.

The new full power hydraulic control system offers **built-in protection.** A safety shut-down system protects components from overspeed and overheating.

A duplex pendant station allows full control from the remote pendant or the control panel itself, thus eliminating downtime from pendant malfunctions.

Dimensions and Specifications



SPECIFICATIONS FOR MODEL FNV-1000 VIBRO DRIVER/EXTRACTOR:

Type—Hydraulic
Eccentric Moment—1000 in./lbs.
Frequency—1000-1600 Vpm
Amplitude—¼ in. - ¾ in.
Driving Force—37 tons
Maximum Operating Pressure—3000 psi
Maximum Flow—70 gpm
Working Line Pull for Extraction— 20 tons

Type of Suspension—Elastomeric
Pile Clamping Force—90 tons
Suspended Weight (A)—6094 lbs.
Vibratory Weight W/Head—3400 lbs.
Shipping Weight (B)—10500 lbs.
Length—67 in.
Width—19.7 in.
Throat Width—12 in.
Hammer Height—70.9 in.

A. Suspended weight includes Driver/ Extractor, Typical Driving/Extracting Head, and 1 in. Hydraulic Hoses.

B. Shipping weight includes Driver/ Extractor, Power Pack, Driving/ Extracting Head, and Hydraulic Hoses.

SPECIFICATIONS FOR MODEL 753 HYDRAULIC POWER PACK

ENGINE SPECIFICATIONS:
Type—Caterpillar 3208
Horsepower—185 hp
Maximum rpm—2800 rpm

HYDRAULIC PUMP SPECIFICATIONS:
Type—Uchida-Rexroth GXP
Maximum Output Pressure—3000 psi (@ 2400 rpm)
Maximum Output Flow—75 gpm
Clamp Pressure—3000 psi

GENERAL SPECIFICATIONS:
Hydraulic Oil Tank Capacity—100 gal.
Fuel Tank Capacity—55 gal.
Approximate Fuel Consumption at Maximum Output—9.0 gal./hr.
Overall Length—96"
Overall Width—47"
Overall Height—65"
Weight (Wet)—6800 lbs.
Weight (Dry)—5700 lbs.
Skid Type Fuel Tank
Hydraulic Hose Quick Disconnects

Automatic shutdown on overspeed and overheating
Hand held Control Pendant
Duplex Control Circuit

For further information write:
L.B. FOSTER COMPANY
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Pittsburgh, PA 15220
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FOSTER **L.B.FOSTER COMPANY**

W-2458 4/90 5M

PILE DRIVING EQUIPMENT

DIESEL PILE HAMMERS

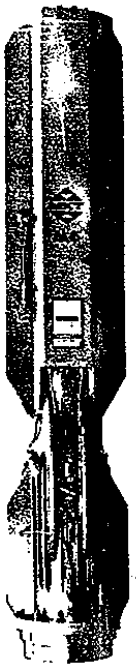
SINGLE-ACTING WITH INTERCHANGEABLE RAM SIZES

One cylinder . . . multiple ram sizes and energy ranges. Another MKT first to meet the contractor's requirement for hammer size flexibility. Reduced equipment investment costs.

Uses include driving H-beam, concrete, pipe, wood or sheet pile for highway bridges, building foundation: retaining walls, sewer line excavations and cofferdams.

MODEL	DE-33/30/20C				DE-70/50C		DE-150/110	
	DE-20	DE-30	DE-33		DE-50	DE-70	DE-110	DE-150
ENERGY RATING (ft.lbs.) (kg-m)	12,000-20,000 1,660-2,766	16,800-28,000 2,323-3,872	19,800-33,000 2,738-4,561	24,000-40,000 3,317-5,529	30,000-50,000 4,149-6,915	42,000-70,000 5,809-9,682	66,600-93,500 9,125-12,930	90,000-127,5 12,450-17,56
RAM WEIGHT (lbs.) (kg)	2,000 907	2,800 1,270	3,300 1,495	4,000 1,814	5,000 2,268	7,000 3,175	11,000 5,000	15,000 6,804
STROKES/MINUTE	40-50	40-50	40-50	40-50	40-50	40-50	40-50	40-50
WIDTH OVERALL (in.) (mm)	20 508	20 508	20 508	20 508	26 660	26 660	32 813	32 813
LENGTH OVERALL (ft.) (mm)	15-11 4,850	15-11* 4,850	15-11 4,850	15-11 4,850	17-11 5,460	17-11 5,460	17-10½ 5,448	19-10½ 6,058
SHIPPING WEIGHT W/DRIVE CAP (lbs.) (kg)	7,400 3,356	8,200 3,719	8,700 3,946	9,400 4,263	14,285 6,479	16,285 7,386	27,150 12,315	32,150 14,583

ENERGY RATING CLARIFICATION: MKT ratings of impact atomization, single-acting diesel hammers, a based upon the observed ram stroke on the MKT factory test stand. Published energy is equal to ram weig x stroke. Actual energies per blow of diesel hammers are a function of the quality and quantity of fuel explod in their combustion chambers and the physical condition of the combustion chambers. Since these varia are normally unmeasurable in the field, the ram stroke obtainable when operating an open-end diesel hamm at nominal refusal (on a test stand, driven pile or mat providing refusal) multiplied times its weight is considere a reasonable, conservative indicator of the minimum energy per blow delivered by an open-end diesel hamme



DOUBLE-ACTING . . . CONVERTIBLE TO SINGLE-ACTING

An exclusive MKT first . . . Select the driving mode best suited to soil conditions. Increase return on investme by lowering equipment investment costs.

Uses include driving H-beam, concrete, pipe, wood or sheet pile for highway bridges, building foundation retaining walls, sewer line excavations and cofferdams. Conversion time is approximately two hours. The hammers also have fully automatic lubrication systems.

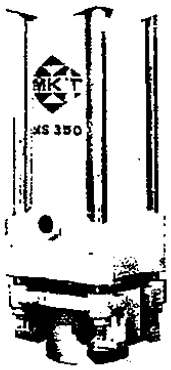
MODEL	DA-15C		DA-35C		DA-45		DA-55C	
	DOUBLE ACTING	SINGLE ACTING	DOUBLE ACTING	SINGLE ACTING	DOUBLE ACTING	SINGLE ACTING	DOUBLE ACTING	SINGLE ACTING
ENERGY RATING (ft. lbs.) (kg-m)	6,600-8,200 913-1,134	6,600-9,350 913-1,293	15,600-21,000 2,157-2,904	16,800-23,800 2,323-3,291	18,500-30,700 2,558-4,245	24,000-34,000 3,319-4,701	31,200-38,200 4,314-5,282	30,000-42,5 4,148-5,87
RAM WEIGHT (lbs.) (kg)	1,100 500		2,800 1,270		4,000 1,815		5,000 2,268	
STROKES/MINUTE	86-92	40-50	78-82	40-50	78-82	40-50	78-82	40-50
WIDTH OVERALL (in.) (mm)	20 508		20 508		26 660		26 660	
LENGTH OVERALL (ft.) (mm)	13-11 4,242		17 5,182		15-1 4,597		17-4 5,283	
SHIPPING WEIGHT W/DRIVE CAP (lbs.) (kg)	6,000 2,722		12,100 5,489		15,900 7,214		18,800 8,528	

STEAM/AIR PILE DRIVERS

MS 350 and 500 VARIABLE STROKE

Unique design, single acting hammers. Differential valving reduces steam/air consumption . . . lowers operating cost. One-piece ram/cylinder offers 40% weight reduction vs. competitive models . . . permits use of smaller crane. Extra large ram impact area provides greater production . . . less pile and hammer damage. Remote air-controlled variable stroke (12 to 48 inches) allows exact energy selection matching hammer blows to soil conditions.

MODEL	ENERGY RATING	RAM WEIGHT	STROKES/ MINUTE	COMPRESSOR SIZE	WIDTH OVERALL	LENGTH OVERALL	NET WEIGHT
MS-350	7,716-30,800 (ft. lbs.) 1,067-4,200 (kg-m)	7,716 (lbs.) 3,500 (kg)	40-50	900 (CFM) 25.5 (CMM)	26 (in.) (mm)	180⅝ (in.) (mm)	10,500 (lbs.) 4,763 (kg)
MS-500	22,000-44,000 (ft. lbs.) 3,043-6,085 (kg-m)	11,000 (lbs.) 5,000 (kg)	40-50	1,200 (CFM) 34 (CMM)	26 (in.) (mm)	181 (in.) (mm)	15,500 (lbs.) 7,030 (kg)



DOUBLE-ACTING SHEET PILE HAMMERS

Applications include driving wood or steel sheeting for shallow-cut water line, gas line or sewer construction. Will drive light or short sections of H-beam, pipe and timber piling for piers, docks or quays, retaining walls and the underpinning of buildings where there is limited head room. Used by well drillers as casing drivers; by the mining industry to break up material too large for the crushers; by the steel industry as skull breakers and core strippers; by state highway departments for soil samplers and post drivers, and below water. The hammers can also be inverted for use as a pile extractor.

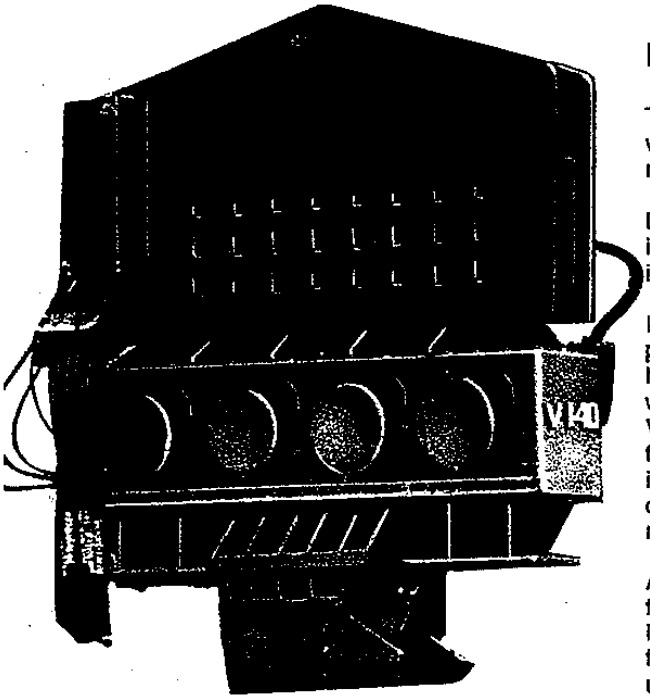
MODEL	ENERGY RATING	RAM WEIGHT	STROKES/ MINUTE	AIR COMSUMPTION	COMPRESSOR SIZE	NET WEIGHT	SHIPPING WEIGHT W/FITTINGS
#5	1,000 (ft. lbs.) 138 (kg-m)	200 (lbs.) 91 (kg)	300	250 (CFM) 7.08 (CMM)	365 (CFM) 10.34 (CMM)	1,500 (lbs.) 680 (kg)	1,560 (lbs.) 708 (kg)
#6	2,500 (ft. lbs.) 346 (kg-m)	400 (lbs.) 181 (kg)	275	400 (CFM) 11.33 (CMM)	600 (CFM) 16.99 (CMM)	2,900 (lbs.) 1,315 (kg)	2,970 (lbs.) 1,347 (kg)
#7	4,150 (ft. lbs.) 574 (kg-m)	800 (lbs.) 363 (kg)	225	450 (CFM) 12.74 (CMM)	750 (CFM) 21.24 (CMM)	5,000 (lbs.) 2,268 (kg)	5,075 (lbs.) 2,302 (kg)

DOUBLE-ACTING PILE HAMMERS

Another first! The double-acting pile hammer was introduced to the contractor by McKiernan-Terry in 1897. Used to drive steel sheet pile for deep cut water main or trunk sewer line construction, cofferdams, retaining walls. High productivity through rapid impact blows. Also commonly used to drive H-beams, timber and steel pipe. All models have underwater driving capability. Equipped with moil or chisel points, underwater rock demolition is another special application. Fully enclosed for protection of working parts and personnel safety.

MODEL	ENERGY RATING	RAM WEIGHT	STROKES/ MINUTE	AIR CONSUMPTION	COMPRESSOR SIZE	NET WEIGHT	SHIPPING WEIGHT W/FITTINGS
9B3	8,750 (ft. lbs.) 1,210 (kg-m)	1,600 (lbs.) 726 (kg)	145	600 (CFM) 16.99 (CMM)	900 (CFM) 25.49 (CMM)	7,000 (lbs.) 3,175 (kg)	7,100 (lbs.) 3,221 (kg)
[illegible]B3	13,100 (ft. lbs.) 1,812 (kg-m)	3,000 (lbs.) 1,361 (kg)	105	750 (CFM) 21.24 (CMM)	1,200 (CFM) 33.98 (CMM)	10,850 (lbs.) 4,922 (kg)	11,000 (lbs.) 4,990 (kg)
11B3	19,150 (ft. lbs.) 2,648 (kg-m)	5,000 (lbs.) 2,268 (kg)	95	900 (CFM) 25.49 (CMM)	1,200 (CFM) 33.98 (CMM)	14,000 (lbs.) 6,350 (kg)	14,200 (lbs.) 6,441 (kg)

VIBRATORY PILE DRIVER/EXTRACTOR



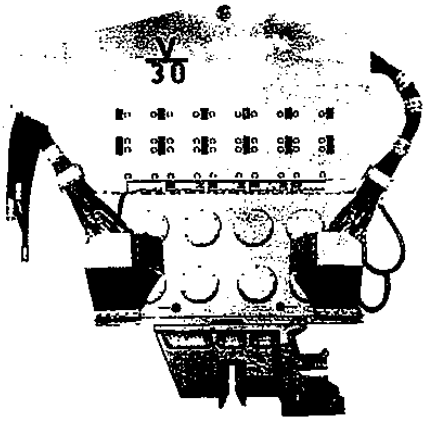
HYDRAULIC POWERED

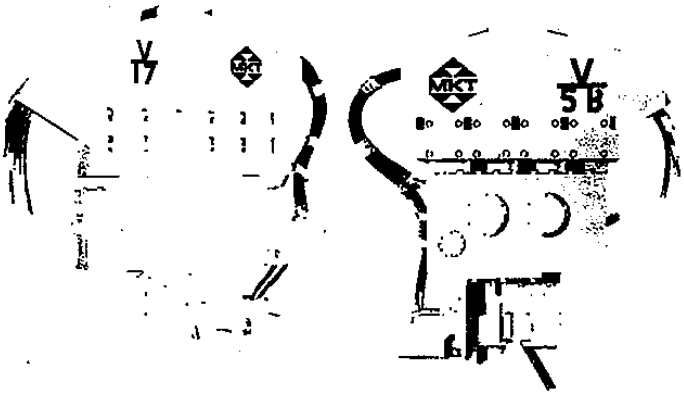
The application of hydraulic power to the principle of vibratory pile installation was conceived, engineered, manufactured and first offered to the contractor by MKT.

Drive by slacking holding line. Extract by pulling in holding line. Fast acting clamp, quiet operation, crane boom isolation from vibration.

In application the Model V-2A is ideal for lightweight sheet piling, guard rail posts, timber sheeting and low headroom projects. The Model V-5B is typically used where the sheet pile length varies from 20 to 40 feet. The V-17 is used on projects where the sheeting will range from 40 to 60 feet. The V-30 is best for the tougher jobs in soils with blow counts exceeding 60 per foot. V-140 is designed extra **tough** for the toughest jobs. (Note: V-2A not shown.)

All models are used for driving and/or extracting of pile for: foundations, cellular cofferdams, sewer and water lines, retaining walls, and driving and extracting caissons for building and transmission tower foundations. Also used to drive end-bearing: H-beams, wood or pipe pile. Can be operated to drive or extract piles under water after proper sealing.



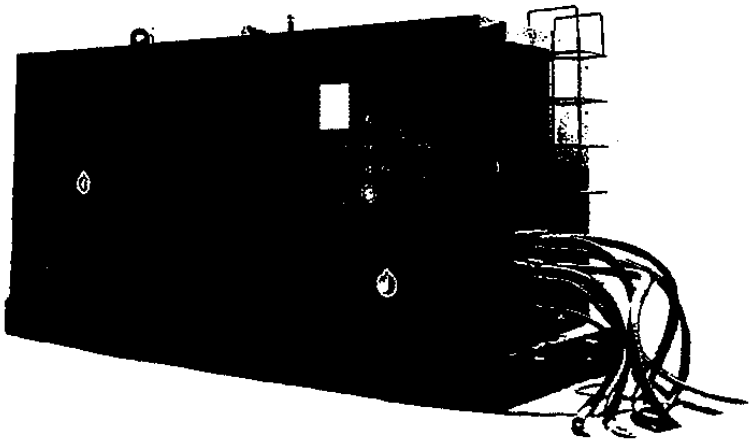


MODEL		V-2A	V-5B	V-17	V-30	V-140
DRIVING FORCE	(tons) (tonnes)	18 16.3	50 45.4	80 72.6	160 145.3	390 353.9
MAX. HYDRAULIC HP	(hp)	44	135	275	550	1,400
FREQUENCY	(cpm)	1,800	1,800	1,600	1,600	1,400
AMPLITUDE	(in.) (mm)	.75 19	.75 19	.75 19	1.0 25.4	1.0 25.4
MAXIMUM LINE PULL	(tons) (tonnes)	8 7.26	30 27.2	60 54.5	80 72.6	150 136.1
WEIGHT	(lbs.) (kg)	2,400 1,088	7,200 3,265	12,000 5,443	15,000 6,805	42,000 19,050

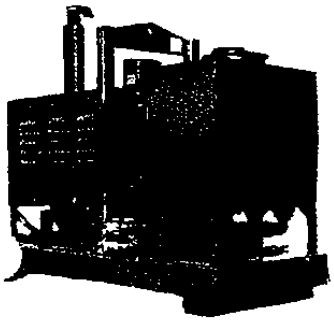
HYDRAULIC POWER UNITS

. ›m, hydraulic power units are offered by MKT for: hydraulic augers, hydraulic vibratory driver/extractors, and hydraulic-›owered bottom braces. Although designed for MKT products, MKT hydraulic power units can be used as the prime-movers or other hydraulic equipment designed to operate within their pressure and flow specifications.

HYDRAULIC POWER UNIT	USED WITH EQUIPMENT MODEL	DIESEL ENGINE	RPM	OPERATING PRESSURE PSI	OPERATING FLOW GPM	WEIGHT (lbs.)
HP-50	V-2	DEERE 3179D	2,200	2,500	30	2,500
HP-175	V-58	DEERE 6068T or 6359A	2,200	3,000	75	4,000
HP-175	H-1200B	DEERE 6068T or 6359A	2,200	3,000	75	4,000
HP-240	HA-18	DEERE 6076A	2,200	2,500	130	7,500
HP-280A	HVA-36	GM 6-71T	2,100	5,000	80	9,000
HP-325	V-17	GM 6V-92T	2,100	5,000	94	14,500
HP-550	V-30	GM 12V-71TA	2,100	5,000	178	17,500
HP-600	V-30	GM 12V-71TA	2,100	5,000	188	17,000
HP-650	V-30	GM 12V-92T/CAT 3412	2,000	5,000	200	17,500
[illegible]-1800	V-140	GM 16V149T1	1,900	5,000	400	43,000

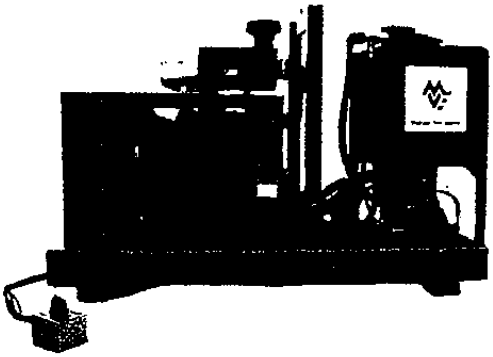


HP-600



HP-175

HYDRAULIC AUGER SYSTEMS



MKT offers three models of hydraulic augers, all with proportionate torque to speed combinations.

Contractors are discovering many uses for our augers such as pre-drilling for the ease of placement of steel or concrete piles. Other frequent uses have been the drilling out of driven pipe, angular operation for the installation of tiebacks, and through the use of our hollow output shaft, auger cast piles may be installed.

As in all MKT equipment our augering systems are dependable, highly productive and versatile (i.e. MKT augers operate within leads, on a spud beam or on the side of leads. MKT auger systems include a skid mounted, diesel driven hydraulic power unit. These units feature simple and dependable design utilizing hydraulic - over - hydraulic remote controls.

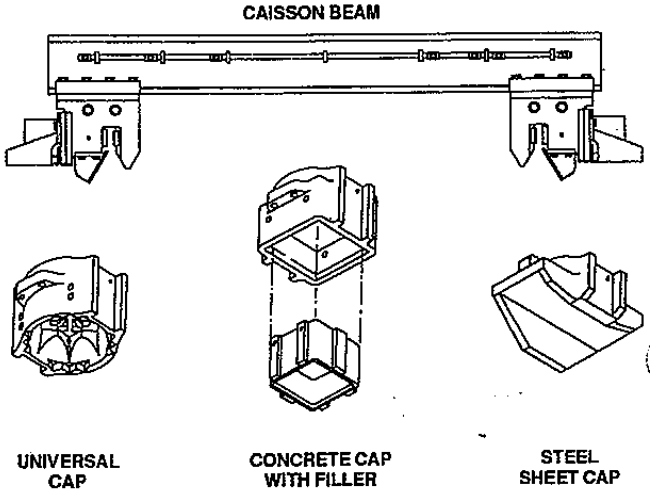
	OUTPUT TORQUE			OPERATING PRESSURE		
MODEL	(ft. lbs.)	(kg/m)	AUGER RPM	PSI	BARS	WEIGHT
H-1200B	12,000	1,660	40	3,000	207	1,900 lbs.
HA-18	18,000	2,560	60	2,500	172	2,250
HVA-36	16,000/36,000	2,200/4,980	80/35	5,000	345	3,250

ACCESSORIES

DRIVE CAPS AND CLAMP ASSEMBLIES

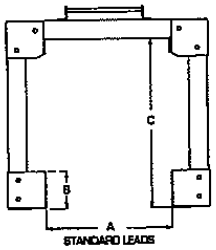
A variety of Drive Caps, Clamp Assemblies and other Accessories is available for each size Hammer. Most fit more than one pile size or type.

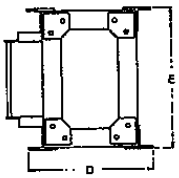
A Drive Cap is an accessory to Diesel and Double-Acting Pile Hammers. Drive Caps are slung under an Anvil by cable that is fastened to the Hammer.



QUALITY LEADS FEATURE

Sections are manufactured from rigid ASTM A-500 square and rectangular tubing, A-36 angle and plate for maximum strength and minimum weight. Sections are assembled and drilled in jigs for interchangeability. Lead sections are available from 5 to 30 feet in five-foot increments, with full-length ladders designed to provide safe toe-room. In addition to standard sections, MKT offers custom designed leads for many special pile driving applications.





SIZE	A	B	C	D	E	WEIGHT/FOOT
8 x 20	21"	8"	32"	—	—	115
8 x 26	27"	8"	36"	—	—	150
8 x 32	33"	8"	44"	—	—	180
11 x 32	33"	11"	44"	—	—	205
11 x 37	37"	11"	53"	—	—	260
EL-100	—	—	—	26"	30"	100

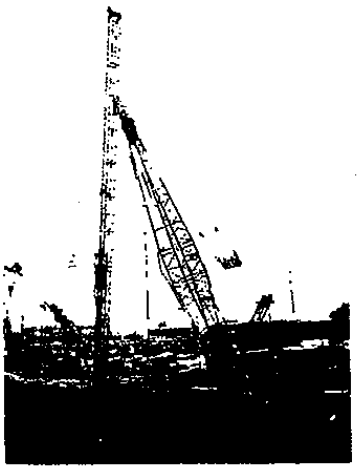
SWINGING LEAD SYSTEMS

Swinging Leads are suspended from a crane line and either hang freely, stab into the ground, or are held by a bottom brace. MKT Swinging Leads are lightweight and can lay down easily to free the crane for other uses. Maximum flexibility allows driving in a hole or over the edge of your excavation.

While precise pile positioning is slow and difficult, swinging leads are the most inexpensive and simple lead system available. MKT recommends the use of a 3 drum crane, using lines for hammer, pile, and leads respectively for optimum productivity. MKT Swinging Leads assemble from three basic sections - a 30-foot top section, a 5-foot stab section, and standard mid sections. The 30-foot top section is tapered to provide adequate crane boom clearance. A ball attachment to accept standard shackles is standard with the top section. A 5-foot stab section is located at the bottom of the system to help stabilize the leads. Mid sections are available in 5 to 30-foot lengths in 5-foot increments.

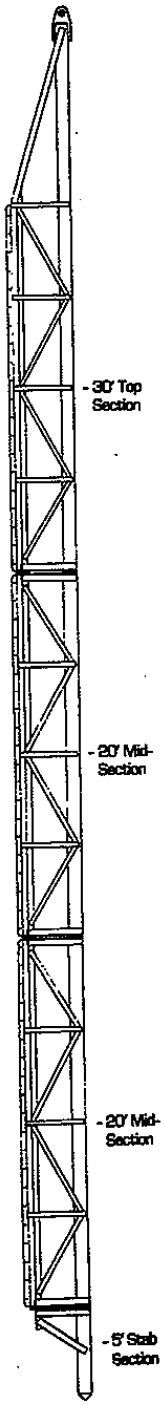
FIXED LEAD SYSTEMS

MKT Fixed Lead Systems provide maximum production where job conditions call for long pile lengths, extremely heavy piles, or accurate batters. Fixed leads are attached to the crane boom and supported by a bottom brace at the base of the leads. Three other special components are required for the fixed leads: (1) a head sheave assembly, (2) boom adapter, and (3) base plate. Many optional features can be added to a fixed lead system to meet the specific needs for any pile driving application. Examples of some options are: Hydraulic Pile Gates (for locating and holding the pile in place within the leads.) Side-Mounted Auger Tracks (for pre-drilling and pile driving from the same crane), and Lead Slides (for allowing the leads to be raised or lowered to work at varying grades). MKT's engineering department can assist with other options designed to minimize job time and increase productivity utilizing the latest in CAD technology.



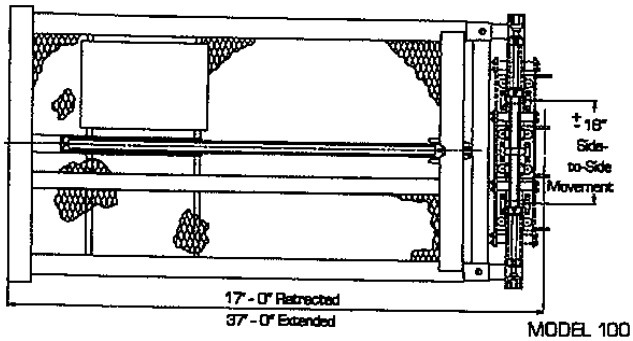
RAILROAD LEAD SYSTEMS

MKT Railroad Lead Systems were designed with the precise needs of a railroad pile driving application in mind. Our Railroad Leads feature lightweight components with the capability of rapid set-up and fold-down. The MKT Railroad Systems need only a three drum crane while most other systems require a four drum crane. MKT Railroad Systems use 1 line for the hammer, 1 line for the pile and 1 line for lead slide capability. In addition MKT Railroad Systems feature remote controls for direction of the entire pile driving operation from within the crane cab.



SWINGING LEAD SYSTEM

HYDRAULIC BOTTOM BRACES



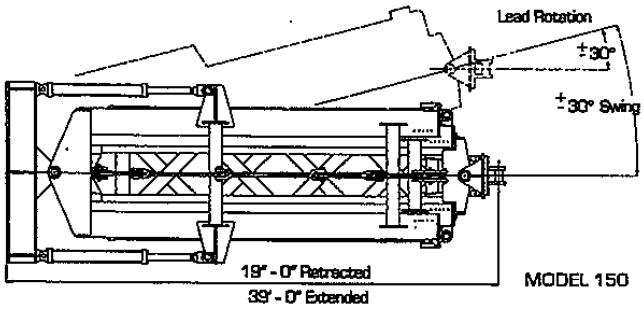
MODEL 100

MKT Hydraulic Bottom Braces provide quick and accura lead adjustment for most batter conditions. Each Botto Brace is remote controlled allowing the crane operator direct the entire pile driving operation. MKT offers fo standard Bottom Brace models to meet the needs of a wic range of fixed lead applications. Each Bottom Brace available with its own self-contained hydraulic power ur or several external sources may be modified for use. (i. crane engine, auger power unit.) Model 125 not shown

CAUTION: All bottom braces and fixed lead componen are intended to be used as a complete system. Whe separating components from a system, a comple engineering review must be done.

MKT MODEL 100 HYDRAULIC BOTTOM BRACE

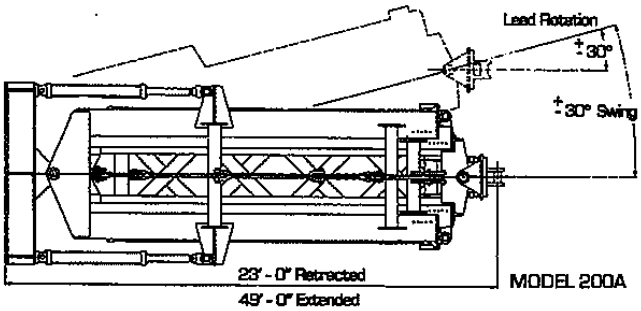
The Model 100 Bottom Brace provides 20 feet of extensi (10 feet hydraulic and 10 feet manual) and plus or min $1^1/_2$ feet hydraulic side-to-side movement. The Model 1 is most productive on small to medium pile drivi applications where only fore, plumb, and aft batter pil will be driven.



MODEL 150

MKT MODEL 150 HYDRAULIC BOTTOM BRACE

The Model 150 Bottom Brace provides a fully hydrau extension of 20 feet, plus or minus 30 degree swing, ar plus or minus 30 degree lead rotation. The Model 15 is most productive on medium to large pile drivir applications where a full range of batter piles will be drive



MODEL 200A

MKT MODEL 200A HYDRAULIC BOTTOM BRACE

The Model 200A Bottom Brace provides a fully hydrau extension of 26 feet, plus or minus 30 degree swing, ar plus or minus 30 degree lead rotation. The Model 200A most productive on large pile driving applications where full range of batter piles will be driven.

DISTRIBUTED BY:

MANUFACTURING INC.
1188 Pershall Road
St. Louis, Missouri 63137

We reserved the right to amend these specifications at any time without notice. The only warranty applicable is our standard written warranty. We make no other warranty - expressed or implied.

MKT DE-20 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 2000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	2	3	4	5	5	5	3.000
8	4	6	8	9	10	11	1.500
12	6	9	11	13	15	16	1.000
16	8	12	14	16	19	20	0.750
20	10	14	17	20	23	24	0.600
24	12	17	20	23	27	28	0.500
28	13	19	23	26	30	32	0.429
32	15	21	25	29	34	36	0.375
36	16	23	28	32	37	39	0.333
40	18	25	30	35	40	43	0.300
44	19	27	32	38	43	46	0.273
48	20	29	34	40	46	49	0.250
52	21	30	36	42	48	51	0.231
56	22	32	38	45	51	54	0.214
60	23	33	40	47	53	57	0.200
64	24	35	42	49	56	59	0.188
68	25	36	43	51	58	61	0.178
72	26	38	45	53	60	64	0.167
76	27	39	47	54	62	66	0.158
80	28	40	48	56	64	68	0.150
84	29	41	49	58	66	70	0.143
88	30	42	51	59	68	72	0.136
92	30	43	52	61	69	74	0.130
96	31	44	53	62	71	76	0.125
100	32	45	55	64	73	77	0.120
104	33	46	56	65	74	79	0.115
108	33	47	57	66	76	81	0.111
110	33	48	57	67	77	81	0.109
120	35	50	60	70	80	85	0.100
130	36	52	62	73	83	88	0.092
140	38	54	65	75	86	92	0.086
150	39	56	67	78	89	94	0.080
160	40	57	69	80	91	97	0.075
170	41	59	70	82	94	100	0.071
180	42	60	72	84	96	102	0.067
190	43	61	74	86	98	104	0.063
200	44	63	75	88	100	106	0.060
225	46	65	78	91	104	111	0.053
250	47	68	81	95	108	115	0.048
275	49	70	84	97	111	118	0.044
300	50	71	88	100	114	121	0.040
325	51	73	88	102	117	124	0.037
350	52	74	89	104	119	127	0.034
375	53	76	91	106	121	129	0.032
400	54	77	92	108	123	131	0.030
425	55	78	94	109	125	133	0.028
450	55	79	95	111	126	134	0.027
475	56	80	96	112	128	136	0.026
500	56	81	97	113	129	137	0.024
525	57	81	98	114	130	138	0.023

MKT DE-30 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 2800
REFUSAL SHALL BE BETWEEN 160 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	3	5	5	6	7	8	3.000
8	6	9	11	12	14	15	1.500
12	9	13	15	18	20	22	1.000
16	12	16	20	23	26	28	0.750
20	14	20	24	28	32	34	0.600
24	16	23	28	33	37	40	0.500
28	19	26	32	37	42	45	0.429
32	21	29	35	41	47	50	0.375
36	23	32	39	45	52	55	0.333
40	25	35	42	49	56	60	0.300
44	26	38	45	53	60	64	0.273
48	28	40	48	56	64	68	0.250
52	30	42	51	59	68	72	0.231
56	31	45	53	62	71	76	0.214
60	33	47	56	65	75	79	0.200
64	34	49	58	68	78	83	0.188
68	35	51	61	71	81	86	0.176
72	37	53	63	74	84	89	0.167
76	38	54	65	76	87	92	0.158
80	39	56	67	78	90	95	0.150
84	40	58	69	81	92	98	0.143
88	41	59	71	83	95	101	0.136
92	43	61	73	85	97	103	0.130
96	44	62	75	87	100	106	0.125
100	45	64	76	89	102	108	0.120
104	46	65	78	91	104	111	0.115
108	46	66	80	93	106	113	0.111
110	47	67	80	94	107	114	0.109
120	49	70	84	98	112	119	0.100
130	51	73	87	102	116	124	0.092
140	53	75	90	106	121	128	0.086
150	54	78	93	109	124	132	0.080
160	56	80	96	112	128	136	0.075
170	57	82	98	115	131	140	0.071
180	59	84	101	118	134	143	0.067
190	60	86	103	120	137	146	0.063
200	61	88	105	123	140	149	0.060
225	64	91	110	128	146	155	0.053
250	66	95	114	132	151	161	0.048
275	68	97	117	136	156	166	0.044
300	70	100	120	140	160	170	0.040
325	72	102	123	143	164	174	0.037
350	73	104	125	146	167	177	0.034
375	74	106	127	148	170	180	0.032
400	75	108	129	151	172	183	0.030
425	76	109	131	153	175	186	0.028
450	77	111	133	155	177	188	0.027
475	78	112	134	156	179	190	0.025
500	79	113	135	158	181	192	0.024
525	80	114	137	160	182	194	0.023

MKT DE-33 DIESEL HAMMER							
	$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 3300 REFUSAL SHALL BE BETWEEN 150 - 180 TONS						
AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	4	5	6	7	9	9	3.000
8	7	10	12	14	17	18	1.500
12	11	16	18	21	24	26	1.000
16	14	19	23	27	31	33	0.750
20	17	24	28	33	38	40	0.600
24	19	28	33	39	44	47	0.500
28	22	31	37	44	50	53	0.429
32	24	35	42	49	56	59	0.375
36	27	38	46	53	61	65	0.333
40	29	41	50	58	66	70	0.300
44	31	44	53	62	71	75	0.273
48	33	47	57	66	75	80	0.250
52	35	50	60	70	80	85	0.231
56	37	53	63	74	84	89	0.214
60	39	55	66	77	88	94	0.200
64	40	57	69	80	92	98	0.188
68	42	60	72	84	95	101	0.176
72	43	62	74	87	99	105	0.167
76	45	64	77	90	102	109	0.158
80	46	66	79	92	106	112	0.150
84	48	68	82	95	109	116	0.143
88	49	70	84	98	112	119	0.136
92	50	72	86	100	115	122	0.130
96	51	73	88	103	117	125	0.125
100	53	75	90	105	120	128	0.120
104	54	77	92	107	123	130	0.115
108	55	78	94	109	125	133	0.111
110	55	79	95	110	126	134	0.109
120	58	83	99	116	132	140	0.100
130	60	86	103	120	137	146	0.092
140	62	89	107	124	142	151	0.086
150	64	92	110	128	147	156	0.080
160	66	94	113	132	151	160	0.075
170	68	97	116	135	155	164	0.071
180	69	99	119	139	158	168	0.067
190	71	101	121	142	162	172	0.063
200	72	103	124	144	165	175	0.060
225	75	108	129	151	172	183	0.053
250	78	111	134	156	178	190	0.048
275	80	115	138	161	184	195	0.044
300	83	118	141	165	189	200	0.040
325	84	121	145	169	193	205	0.037
350	86	123	147	172	197	209	0.034
375	88	125	150	175	200	213	0.032
400	89	127	152	178	203	216	0.030
425	90	129	154	180	206	219	0.028
450	91	130	156	182	208	221	0.027
475	92	132	158	184	211	224	0.025
500	93	133	160	186	213	226	0.024
525	94	134	161	188	215	228	0.023

MKT DE-33 DIESEL HAMMER (4000 # RAM)							
	$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 4000 REFUSAL SHALL BE BETWEEN 150 - 180 TONS						
AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	5	6	8	9	10	11	3.000
8	9	13	16	18	20	21	1.500
12	13	18	22	25	29	31	1.000
16	16	24	28	33	38	40	0.750
20	20	29	34	40	46	49	0.600
24	23	33	40	47	53	57	0.500
28	26	38	45	53	61	64	0.429
32	29	42	51	59	67	72	0.375
36	32	46	55	65	74	78	0.333
40	35	50	60	70	80	85	0.300
44	38	54	64	75	86	91	0.273
48	40	57	69	80	91	97	0.250
52	42	60	73	85	97	103	0.231
56	45	64	76	89	102	108	0.214
60	47	67	80	93	107	113	0.200
64	49	70	83	97	111	118	0.188
68	51	72	87	101	116	123	0.176
72	53	75	90	105	120	128	0.167
76	54	78	93	109	124	132	0.158
80	56	80	96	112	128	136	0.150
84	58	82	99	115	132	140	0.143
88	59	85	102	118	135	144	0.136
92	61	87	104	122	139	148	0.130
96	62	89	107	124	142	151	0.125
100	64	91	109	127	145	155	0.120
104	65	93	111	130	149	158	0.115
108	66	95	114	133	152	161	0.111
110	67	96	115	134	153	163	0.109
120	70	100	120	140	160	170	0.100
130	73	104	125	146	166	177	0.092
140	75	108	129	151	172	183	0.086
150	78	111	133	156	178	189	0.080
160	80	114	137	160	183	194	0.075
170	82	117	141	164	188	199	0.071
180	84	120	144	168	192	204	0.067
190	86	123	147	172	196	208	0.063
200	88	125	150	175	200	213	0.060
225	91	130	157	183	209	222	0.053
250	95	135	162	189	216	230	0.048
275	97	139	167	195	223	237	0.044
300	100	143	171	200	229	243	0.040
325	102	146	175	204	234	248	0.037
350	104	149	179	209	238	253	0.034
375	106	152	182	212	242	258	0.032
400	108	154	185	215	246	262	0.030
425	109	156	187	218	250	265	0.028
450	111	158	189	221	253	268	0.027
475	112	160	192	224	255	271	0.025
500	113	161	194	226	258	274	0.024
525	114	163	195	228	260	277	0.023

MKT DE-50 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 5000
REFUSAL SHALL BE BETWEEN 160 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	6	8	10	11	13	14	3.000
8	11	16	19	22	26	27	1.500
12	16	23	27	32	36	39	1.000
16	21	29	35	41	47	50	0.750
20	25	36	43	50	57	61	0.600
24	29	42	50	58	67	71	0.500
28	33	47	57	66	76	80	0.429
32	37	53	63	74	84	89	0.375
36	40	58	69	81	92	98	0.333
40	44	63	75	88	100	106	0.300
44	47	67	80	94	107	114	0.273
48	50	71	86	100	114	121	0.250
52	53	76	91	106	121	128	0.231
56	56	80	95	111	127	135	0.214
60	58	83	100	117	133	142	0.200
64	61	87	104	122	139	148	0.188
68	63	90	109	127	145	154	0.176
72	66	94	113	131	150	159	0.167
76	68	97	116	136	155	165	0.158
80	70	100	120	140	160	170	0.150
84	72	103	124	144	165	175	0.143
88	74	106	127	148	169	180	0.136
92	76	108	130	152	174	184	0.130
96	78	111	133	156	178	189	0.125
100	80	114	136	159	182	193	0.120
104	81	116	139	163	186	197	0.115
108	83	118	142	166	189	201	0.111
110	84	120	143	167	191	203	0.109
120	88	125	150	175	200	213	0.100
130	91	130	156	182	208	221	0.092
140	94	135	162	188	215	229	0.086
150	97	139	167	194	222	236	0.080
160	100	143	171	200	229	243	0.075
170	103	147	176	205	234	249	0.071
180	105	150	180	210	240	255	0.067
190	107	153	184	215	245	260	0.063
200	109	156	188	219	250	266	0.060
225	114	163	196	228	261	277	0.053
250	118	169	203	236	270	287	0.048
275	122	174	209	244	278	296	0.044
300	125	179	214	250	286	304	0.040
325	128	183	219	256	292	310	0.037
350	130	186	223	261	298	316	0.034
375	133	189	227	265	303	322	0.032
400	135	192	231	269	308	327	0.030
425	136	195	234	273	312	331	0.028
450	138	197	237	276	316	336	0.027
475	140	200	239	279	319	339	0.025
500	141	202	242	282	323	343	0.024
525	142	203	244	285	326	346	0.023

MKT DE-20 DIESEL HAMMER

P = 2 W H / S + 0.1 — WEIGHT OF RAM = 2000 — REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	20	29	34	40	46	49
2 7/16	4 7/8	20	29	35	41	47	49
2 3/8	4 3/4	21	30	36	41	47	50
2 5/16	4 5/8	21	30	36	42	48	51
2 1/4	4 1/2	22	31	37	43	49	52
2 3/16	4 3/8	22	31	38	44	50	53
2 1/8	4 1/4	22	32	38	45	51	54
2 1/16	4 1/8	23	33	39	46	52	56
2	4	23	33	40	47	53	57
1 15/16	3 7/8	24	34	41	48	54	58
1 7/8	3 3/4	24	35	42	49	56	59
1 13/16	3 5/8	25	36	43	50	57	60
1 3/4	3 1/2	25	36	44	51	58	62
1 11/16	3 3/8	26	37	45	52	60	63
1 5/8	3 1/4	27	38	46	53	61	65
1 9/16	3 1/8	27	39	47	55	62	66
1 1/2	3	28	40	48	56	64	68
1 7/16	2 7/8	29	41	49	57	66	70
1 3/8	2 3/4	29	42	51	59	67	72
1 5/16	2 5/8	30	43	52	61	69	74
1 1/4	2 1/2	31	44	53	62	71	76
1 3/16	2 3/8	32	46	55	64	73	78
1 1/8	2 1/4	33	47	56	66	75	80
1 1/16	2 1/8	34	48	58	68	78	82
1	2	35	50	60	70	80	85
15/16	1 7/8	36	52	62	72	83	88
7/8	1 3/4	37	53	64	75	85	91
13/16	1 5/8	39	55	66	77	88	94
3/4	1 1/2	40	57	69	80	91	97
11/16	1 3/8	41	59	71	83	95	101
5/8	1 1/4	43	62	74	86	98	105
9/16	1 1/8	45	64	77	90	102	109
1/2	1	47	67	80	93	107	113
7/16	7/8	49	70	83	97	111	118
3/8	3/4	51	73	87	102	116	124
5/16	5/8	53	76	91	107	122	130
1/4	1/2	56	80	96	112	128	136
3/16	3/8	59	84	101	118	135	143
1/8	1/4	62	89	107	124	142	151
1/16	1/8	66	94	113	132	151	160
0	0	70	100	120	140	160	170

MKT DE-30 DIESEL HAMMER

P = 2 W H / S + 0.1 WEIGHT OF RAM = 2800
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	28	40	48	56	64	68
2 7/16	4 7/8	29	41	49	57	65	69
2 3/8	4 3/4	29	41	50	58	66	71
2 5/16	4 5/8	30	42	51	59	68	72
2 1/4	4 1/2	30	43	52	60	69	73
2 3/16	4 3/8	31	44	53	61	70	75
2 1/8	4 1/4	31	45	54	63	72	76
2 1/16	4 1/8	32	46	55	64	73	78
2	4	33	47	56	65	75	79
1 15/16	3 7/8	33	48	57	67	76	81
1 7/8	3 3/4	34	49	58	68	78	83
1 13/16	3 5/8	35	50	60	70	80	85
1 3/4	3 1/2	36	51	61	71	81	87
1 11/16	3 3/8	36	52	63	73	83	89
1 5/8	3 1/4	37	53	64	75	85	91
1 9/16	3 1/8	38	55	66	76	87	93
1 1/2	3	39	56	67	78	90	95
1 7/16	2 7/8	40	57	69	80	92	98
1 3/8	2 3/4	41	59	71	83	94	100
1 5/16	2 5/8	42	61	73	85	97	103
1 1/4	2 1/2	44	62	75	87	100	106
1 3/16	2 3/8	45	64	77	90	102	109
1 1/8	2 1/4	46	66	79	92	105	112
1 1/16	2 1/8	48	68	81	95	109	115
1	2	49	70	84	98	112	119
15/16	1 7/8	51	72	87	101	116	123
7/8	1 3/4	52	75	90	105	119	127
13/16	1 5/8	54	77	93	108	124	131
3/4	1 1/2	56	80	96	112	128	136
11/16	1 3/8	58	83	100	116	133	141
5/8	1 1/4	60	86	103	121	138	146
9/16	1 1/8	63	90	108	125	143	152
1/2	1	65	93	112	131	149	159
7/16	7/8	68	97	117	136	156	166
3/8	3/4	71	102	122	143	163	173
5/16	5/8	75	107	128	149	171	181
1/4	1/2	78	112	134	157	179	190
3/16	3/8	83	118	141	165	189	200
1/8	1/4	87	124	149	174	199	212
1/16	1/8	92	132	158	184	211	224
0	0	98	140	168	196	224	238

MKT DE-33 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 3300
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	33	47	57	66	75	80
2 7/16	4 7/8	34	48	58	67	77	82
2 3/8	4 3/4	34	49	59	68	78	83
2 5/16	4 5/8	35	50	60	70	80	85
2 1/4	4 1/2	36	51	61	71	81	86
2 3/16	4 3/8	36	52	62	72	83	88
2 1/8	4 1/4	37	53	63	74	84	90
2 1/16	4 1/8	38	54	65	75	86	92
2	4	39	55	66	77	88	94
1 15/16	3 7/8	39	56	67	79	90	95
1 7/8	3 3/4	40	57	69	80	92	98
1 13/16	3 5/8	41	59	70	82	94	100
1 3/4	3 1/2	42	60	72	84	96	102
1 11/16	3 3/8	43	61	74	86	98	104
1 5/8	3 1/4	44	63	75	88	101	107
1 9/16	3 1/8	45	64	77	90	103	109
1 1/2	3	46	66	79	92	106	112
1 7/16	2 7/8	47	68	81	95	108	115
1 3/8	2 3/4	49	69	83	97	111	118
1 5/16	2 5/8	50	71	86	100	114	121
1 1/4	2 1/2	51	73	88	103	117	125
1 3/16	2 3/8	53	75	91	106	121	128
1 1/8	2 1/4	54	78	93	109	124	132
1 1/16	2 1/8	56	80	96	112	128	136
1	2	58	83	99	116	132	140
15/16	1 7/8	60	85	102	119	136	145
7/8	1 3/4	62	88	106	123	141	150
13/16	1 5/8	64	91	109	127	146	155
3/4	1 1/2	66	94	113	132	151	160
11/16	1 3/8	68	98	117	137	156	166
5/8	1 1/4	71	102	122	142	162	173
9/16	1 1/8	74	106	127	148	169	180
1/2	1	77	110	132	154	176	187
7/16	7/8	80	115	138	161	184	195
3/8	3/4	84	120	144	168	192	204
5/16	5/8	88	126	151	176	201	214
1/4	1/2	92	132	158	185	211	224
3/16	3/8	97	139	167	195	222	238
1/8	1/4	103	147	176	205	235	249
1/16	1/8	109	155	186	217	248	264
0	0	116	165	198	231	264	281

MKT DE-33 DIESEL HAMMER (4000# RAM)

P = 2 W H / S + 0.1 WEIGHT OF RAM = 4000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

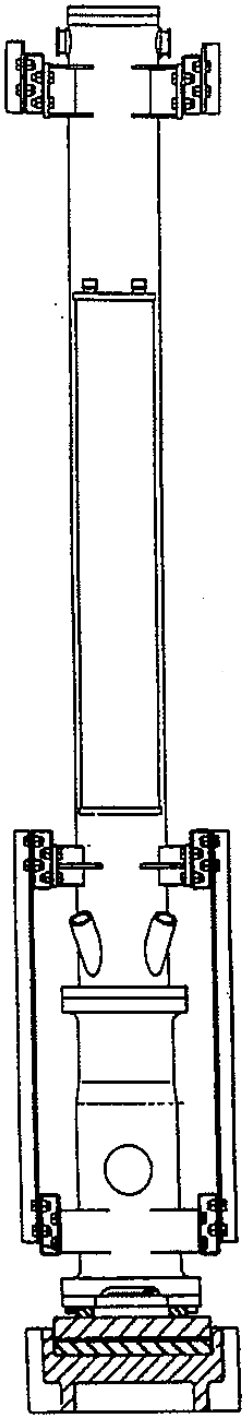
PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	40	57	69	80	91	97
2 7/16	4 7/8	41	58	70	81	93	99
2 3/8	4 3/4	41	59	71	83	95	101
2 5/16	4 5/8	42	60	72	85	97	103
2 1/4	4 1/2	43	62	74	86	98	105
2 3/16	4 3/8	44	63	75	88	100	107
2 1/8	4 1/4	45	64	77	90	102	109
2 1/16	4 1/8	46	65	78	91	104	111
2	4	47	67	80	93	107	113
1 15/16	3 7/8	48	68	82	95	109	116
1 7/8	3 3/4	49	70	83	97	111	118
1 13/16	3 5/8	50	71	85	100	114	121
1 3/4	3 1/2	51	73	87	102	116	124
1 11/16	3 3/8	52	74	89	104	119	127
1 5/8	3 1/4	53	76	91	107	122	130
1 9/16	3 1/8	55	78	94	109	125	133
1 1/2	3	56	80	96	112	128	136
1 7/16	2 7/8	57	82	98	115	131	139
1 3/8	2 3/4	59	84	101	118	135	143
1 5/16	2 5/8	61	86	104	121	138	147
1 1/4	2 1/2	62	89	107	124	142	151
1 3/16	2 3/8	64	91	110	128	146	155
1 1/8	2 1/4	66	94	113	132	151	160
1 1/16	2 1/8	68	97	116	136	155	165
1	2	70	100	120	140	160	170
15/16	1 7/8	72	103	124	145	165	175
7/8	1 3/4	75	107	128	149	171	181
13/16	1 5/8	77	110	132	154	177	188
3/4	1 1/2	80	114	137	160	183	194
11/16	1 3/8	83	119	142	166	190	201
5/8	1 1/4	86	123	148	172	197	209
9/16	1 1/8	90	128	154	179	205	218
1/2	1	93	133	160	187	213	227
7/16	7/8	97	139	167	195	223	237
3/8	3/4	102	145	175	204	233	247
5/16	5/8	107	152	183	213	244	259
1/4	1/2	112	160	192	224	256	272
3/16	3/8	118	168	202	236	269	286
1/8	1/4	124	178	213	249	284	302
1/16	1/8	132	188	226	264	301	320
0	0	140	200	240	280	320	340

MKT DE-50 DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 5000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	50	71	86	100	114	121
2 7/16	4 7/8	51	73	87	102	116	124
2 3/8	4 3/4	52	74	89	104	119	126
2 5/16	4 6/8	53	75	91	106	121	128
2 1/4	4 1/2	54	77	92	108	123	131
2 3/16	4 3/8	55	78	94	110	125	133
2 1/8	4 1/4	56	80	96	112	128	136
2 1/16	4 1/8	57	82	98	114	131	139
2	4	58	83	100	117	133	142
1 15/16	3 7/8	60	85	102	119	136	145
1 7/8	3 3/4	61	87	104	122	139	148
1 13/16	3 5/8	62	89	107	124	142	151
1 3/4	3 1/2	64	91	109	127	145	155
1 11/16	3 3/8	65	93	112	130	149	158
1 5/8	3 1/4	67	95	114	133	152	162
1 9/16	3 1/8	68	98	117	137	156	166
1 1/2	3	70	100	120	140	160	170
1 7/16	2 7/8	72	103	123	144	164	174
1 3/8	2 3/4	74	105	126	147	168	179
1 5/16	2 5/8	76	108	130	151	173	184
1 1/4	2 1/2	78	111	133	156	178	189
1 3/16	2 3/8	80	114	137	160	183	194
1 1/8	2 1/4	82	118	141	165	188	200
1 1/16	2 1/8	85	121	145	170	194	206
1	2	88	125	150	175	200	213
15/16	1 7/8	90	129	155	181	206	219
7/8	1 3/4	93	133	160	187	213	227
13/16	1 5/8	97	138	166	193	221	234
3/4	1 1/2	100	143	171	200	229	243
11/16	1 3/8	104	148	178	207	237	252
5/8	1 1/4	108	154	185	215	246	262
9/16	1 1/8	112	160	192	224	256	272
1/2	1	117	167	200	233	267	283
7/16	7/8	122	174	209	243	278	296
3/8	3/4	127	182	218	255	291	309
5/16	5/8	133	190	229	267	305	324
1/4	1/2	140	200	240	280	320	340
3/16	3/8	147	211	253	295	337	358
1/8	1/4	156	222	267	311	356	378
1/16	1/8	165	235	282	329	376	400
0	0	175	250	300	350	400	425

ICE MODEL 40S DIESEL PILE HAMMER



WORKING SPECIFICATIONS

Rated energy	40,000 ft-lbs (5,530 kg-m)
Minumum energy	16,000 ft-lbs (2,212 kg-m)
Stroke at rated energy	10'(3.04 m)
Maximum obtainable stroke	10'2"(3.1 m)
Speed (blows per minute)	38-55
Bearing based on EN formula	200 tons (181 tons)

WEIGHTS

Bare hammer	7,500 lbs (3,402 kg)
Ram	4,000 lbs (1,814 kg)
Anvil	545 lbs (247 kg)
Typical operating weight with cap	8,600 lbs (3,900 kg)

CAPACITIES (adequate for normal day)

Diesel fuel tank	11 gal (42 l)
Lube oil tank	5 gal (19 l)

DIMENSIONS OF HAMMER

Width (side to side)	20"(508 mm)
Depth	29"(737 mm)
Centerline to front	13 3/4"(349 mm)
Centerline to rear	15 1/4"(387 mm)
Length (hammer only)	15'9"(4.80 m)
Operating length (top of ram at max. stroke to pile)	27'2"(8.28 m)

DIMENSIONS OF LEADS

Face width of guide rails	4-8"(100-200 mm)
Distance between guide rails	20 1/2-26 1/2"(520-670 mm)

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40SSPEC.CHP-0690

ICE 40S DIESEL PILE HAMMER BEARING CHART

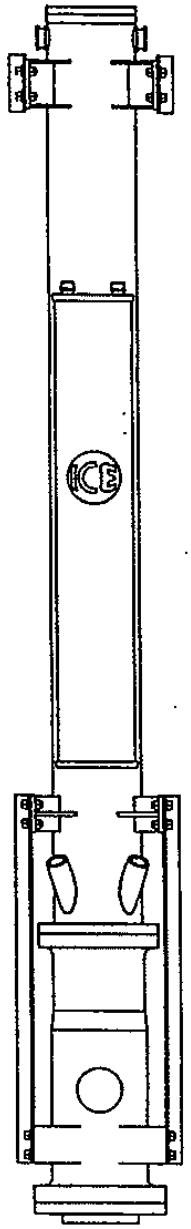
This chart is based on the Engineering News formula for pile bearing and is provided as a convenience only for those applications where this formula is specified. ICE has no preference for this particular formula over any other.

Pile bearing (tons) = 2E/(S+0.1)/2000, where E = Hammer energy (ft-lbs) and S = Pile set (inches per blow)

Blows per minute	Stroke (feet)	Energy (ft-lbs)	Pile set (Blows per inch) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
38	10.00	40,000	66	92	114	133	150	164	177	189	200	209	218	226	233	240	246	251	257	262	266
39	9.90	39,600	66	91	113	132	148	163	176	187	198	207	216	223	231	237	243	249	254	259	264
40	9.36	37,440	62	86	106	124	140	154	166	177	187	196	204	211	218	224	230	235	240	245	249
41	8.83	35,320	58	81	100	117	132	145	156	167	176	185	192	199	206	211	217	222	227	231	235
42	8.39	33,560	55	77	95	111	125	138	149	158	167	175	183	189	195	201	206	211	215	219	223
43	7.97	31,880	53	73	91	106	119	131	141	151	159	166	173	180	185	191	196	200	204	208	212
44	7.57	30,280	50	69	86	100	113	124	134	143	151	158	165	171	176	181	186	190	194	198	201
45	7.20	28,800	48	66	82	96	108	118	128	136	144	150	157	162	168	172	177	181	185	188	192
46	6.84	27,360	45	63	78	91	102	112	121	129	136	143	149	154	159	164	168	172	175	179	182
47	6.54	26,160	43	60	74	87	98	107	116	123	130	137	142	147	152	156	160	164	168	171	174
48	6.23	24,920	41	57	71	83	93	102	110	118	124	130	135	140	145	149	153	156	160	163	166
49	5.91	23,640	39	54	67	78	88	97	105	111	118	123	128	133	137	141	145	148	151	154	157
50	5.63	22,520	37	51	64	75	84	92	100	106	112	117	122	127	131	135	138	141	144	147	150
51	5.33	21,320	35	49	60	71	79	87	94	100	106	111	116	120	124	127	131	134	137	139	142
52	5.07	20,280	33	46	57	67	76	83	90	96	101	106	110	114	118	121	124	127	130	132	135
53	4.80	19,200	32	44	54	64	72	79	85	90	96	100	104	108	112	115	118	120	123	125	128
54	4.52	18,080	30	41	51	60	67	74	80	85	90	94	98	102	105	108	111	113	116	118	120
55	4.24	16,960	28	39	48	56	63	69	75	80	84	88	92	95	98	101	104	106	109	111	113
56	3.93	15,720	26	36	44	52	58	64	69	74	78	82	85	88	91	94	96	98	101	102	104

CAUTION: Driving at ten blows per inch (set of 0.1 inch per blow) is considered practical refusal. Driving in excess of ten blows per inch for more than six inches of driving or driving in excess of 20 blows per inch at all is considered improper use and will void the hammer warranty.

ICE MODEL 42S DIESEL PILE HAMMER



WORKING SPECIFICATIONS

Rated energy	42,000 ft-lbs (5807 kg-m)
Minumum energy	16,000 ft-lbs (2212 kg-m)
Stroke at rated energy	10'-3" (312 cm)
Maximum obtainable stroke	10'-5" (318 cm)
Speed (blows per minute)	37-55
Bearing based on EN formula	210 tons (190 tons)

WEIGHTS

Bare hammer	7,610 lbs (3452 kg)
Ram	4,088 lbs (1854 kg)
Anvil	545 lbs (247 kg)
Typical operating weight with cap	8,710 lbs (3950 kg)

CAPACITIES (adequate for normal day)

Diesel fuel tank	11 gal (42 l)
Lube oil tank	5 gal (19 l)

DIMENSIONS OF HAMMER

Width (side to side)	20" (508 mm)
Depth	29" (737 mm)
Centerline to front	13 3/4" (349 mm)
Centerline to rear	15 1/4" (387 mm)
Length (hammer only)	16'-1" (490 cm)
Operating length (top of ram to top of pile)	27'-9" (846 cm)

DIMENSIONS OF LEADS

Face width of guide rails	4-8"(100-200 mm)
Distance between guide rails	20 1/2-26 1/2"(520-670 mm)

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(219) 424-0405

sd42S-0392

ICE 42S DIESEL PILE HAMMER BEARING CHART

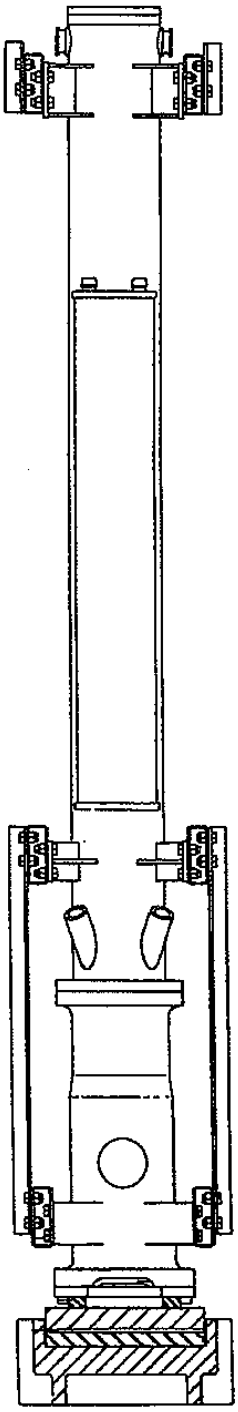
This chart is based on the Engineering News formula for pile bearing and is provided as a convenience only for those applications where this formula is specified. ICE has no preference for this particular formula over any other.

Pile bearing (tons) = 2E/(S+0.1)/2000 where E=Hammer energy (ft-lbs) and S=Pile set (inches per blow)

Blows Per Minute	Ram Stroke (Feet)	Hammer Energy (ft-lbs)	Pile Set (Blows per Inch)																		
			2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
37	10.28	42,000	70	97	120	140	158	173	187	199	210	220	229	237	245	252	258	264	270	275	280
38	10.00	40,880	68	94	117	136	153	168	182	194	204	214	223	231	238	245	252	257	263	268	273
39	9.90	39,600	66	91	113	132	149	163	176	188	198	207	216	224	231	238	244	249	255	259	264
40	9.36	37,440	62	86	107	125	140	154	166	177	187	196	204	212	218	225	230	236	241	245	250
41	8.83	35,320	59	82	101	118	132	145	157	167	177	185	193	200	206	212	217	222	227	231	235
42	8.39	33,560	56	77	96	112	126	138	149	159	168	176	183	190	196	201	207	211	216	220	224
43	7.97	31,880	53	74	91	106	120	131	142	151	159	167	174	180	186	191	196	201	205	209	213
44	7.57	30,280	50	70	87	101	114	125	135	143	151	159	165	171	177	182	186	191	195	198	202
45	7.20	28,800	48	66	82	96	108	119	128	136	144	151	157	163	168	173	177	181	185	189	192
46	6.84	27,360	46	63	78	91	103	113	122	130	137	143	149	155	160	164	168	172	176	179	182
47	6.54	26,160	44	60	75	87	98	108	116	124	131	137	143	148	153	157	161	165	168	171	174
48	6.23	24,920	42	58	71	83	93	103	111	118	125	131	136	141	145	150	153	157	160	163	166
49	5.91	23,640	39	55	68	79	89	97	105	112	118	124	129	134	138	142	145	149	152	155	158
50	5.63	22,520	38	52	64	75	84	93	100	107	113	118	123	127	131	135	139	142	145	148	150
51	5.33	21,320	36	49	61	71	80	88	95	101	107	112	116	121	124	128	131	134	137	140	142
52	5.07	20,280	34	47	58	68	76	84	90	96	101	106	111	115	118	122	125	128	130	133	135
53	4.80	19,200	32	44	55	64	72	79	85	91	96	101	105	109	112	115	118	121	123	126	128
54	4.52	18,080	30	42	52	60	68	74	80	86	90	95	99	102	105	108	111	114	116	118	121
55	4.24	16,960	28	39	48	57	64	70	75	80	85	89	93	96	99	102	104	107	109	111	113
56	3.93	15,720	26	36	45	52	59	65	70	74	79	82	86	89	92	94	97	99	101	103	105

CAUTION: Driving at ten blows per inch (set of 0.1 inch per blow) is considered practical refusal. Driving in excess of ten blows per inch for more than six inches of driving or driving in excess of 20 blows per inch at all is considered improper use and will void the hammer warranty.

ICE MODEL 70S DIESEL PILE HAMMER



WORKING SPECIFICATIONS

Rated energy	70,000 ft-lbs (9,677 kg-m)
Minumum energy	28,000 ft-lbs (3,872 kg-m)
Stroke at rated energy	10'(3.04 m)
Maximum obtainable stroke	10'2"(3.1 m)
Speed (blows per minute)	38-55
Bearing based on EN formula	350 tons (318 tons)

WEIGHTS

Bare hammer	14,100 lbs (6,396 kg)
Ram	7,000 lbs (3,175 kg)
Anvil	1,220 lbs (553 kg)
Typical operating weight with cap	16,000 lbs (7,258 kg)

CAPACITIES (adequate for normal day)

Diesel fuel tank	18 gal (68 l)
Lube oil tank	8 gal (30 l)

DIMENSIONS OF HAMMER

Width (side to side)	26"(660 mm)
Depth	37 1/2"(953 mm)
Centerline to front	17"(432 mm)
Centerline to rear	20 1/2"(521 mm)
Length (hammer only)	16'8"(5.08 m)
Operating length (top of ram at max. stroke to pile)	27'2"(8.28 m)

DIMENSIONS OF LEADS

Face width of guide rails	8"(200 mm)
Distance between guide rails	26 1/2"(670 mm)

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70SSPEC.CHP-0690

ICE 70S DIESEL PILE HAMMER BEARING CHART

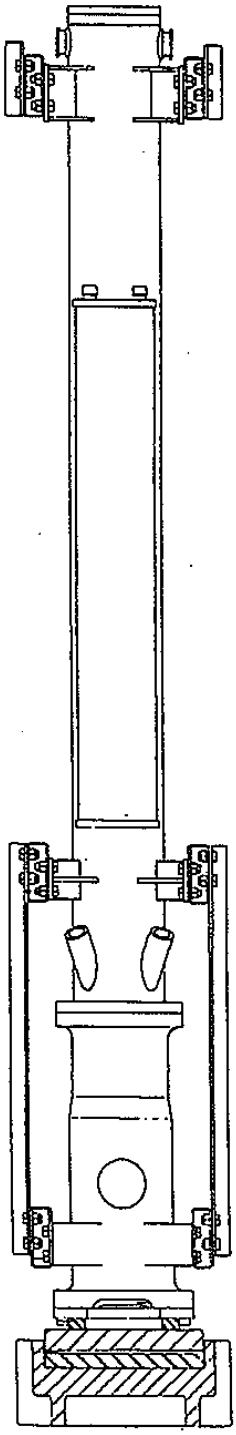
This chart is based on the Engineering News formula for pile bearing and is provided as a convenience only for those applications where this formula is specified. ICE has no preference for this particular formula over any other.

Pile bearing (tons) = 2E/(S+0.1)/2000, where E = Hammer energy (ft-lbs) and S = Pile set (inches per blow)

Blows per minute	Stroke (feet)	Energy (ft-lbs)	Pile set (Blows per inch) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
38	10.00	70,000	116	161	200	233	262	288	311	331	350	366	381	395	408	420	430	440	450	458	466
39	9.90	69,300	115	159	198	231	259	285	308	328	346	363	378	391	404	415	426	436	445	454	462
40	9.36	65,520	109	151	187	218	245	269	291	310	327	343	357	370	382	393	403	412	421	429	436
41	8.83	61,810	103	142	176	206	231	254	274	292	309	323	337	349	360	370	380	389	397	404	412
42	8.39	58,730	97	135	167	195	220	241	261	278	293	307	320	331	342	352	361	369	377	384	391
43	7.97	55,790	92	128	159	185	209	229	247	264	278	292	304	315	325	334	343	351	358	365	371
44	7.57	52,990	88	122	151	176	198	218	235	251	264	277	289	299	309	317	326	333	340	347	353
45	7.20	50,400	84	116	144	168	189	207	224	238	252	264	274	284	294	302	310	317	324	330	336
46	6.84	47,880	79	110	136	159	179	197	212	226	239	250	261	270	279	287	294	301	307	313	319
47	6.54	45,780	76	105	130	152	171	188	203	216	228	239	249	258	267	274	281	288	294	299	305
48	6.23	43,610	72	100	124	145	163	179	193	206	218	228	237	246	254	261	268	274	280	285	290
49	5.91	41,370	68	95	118	137	155	170	183	195	206	216	225	233	241	248	254	260	265	271	275
50	5.63	39,410	65	90	112	131	147	162	175	186	197	206	214	222	229	236	242	248	253	258	262
51	5.33	37,310	62	86	106	124	139	153	165	176	186	195	203	210	217	223	229	234	239	244	248
52	5.07	35,490	59	81	101	118	133	146	157	168	177	185	193	200	207	212	218	223	228	232	236
53	4.80	33,600	56	77	96	112	126	138	149	159	168	176	183	189	196	201	206	211	216	220	224
54	4.52	31,640	52	73	90	105	118	130	140	149	158	165	172	178	184	189	194	199	203	207	210
55	4.24	29,680	49	68	84	98	111	122	131	140	148	155	161	167	173	178	182	186	190	194	197
56	3.93	27,510	45	63	78	91	103	113	122	130	137	144	150	155	160	165	169	173	176	180	183

CAUTION: Driving at ten blows per inch (set of 0.1 inch per blow) is considered practical refusal. Driving in excess of ten blows per inch for more than six inches of driving or driving in excess of 20 blows per inch at all is considered improper use and will void the hammer warranty.

ICE MODEL 90S DIESEL PILE HAMMER



WORKING SPECIFICATIONS

Rated energy	90,000 ft-lbs (12,472 kg-m)
Minumum energy	36,000 ft-lbs (4,989 kg-m)
Stroke at rated energy	10'(3.04 m)
Maximum obtainable stroke	10'2"(3.1 m)
Speed (blows per minute)	38-55
Bearing based on EN formula	450 tons (409 tons)

WEIGHTS

Bare hammer	16,800 lbs (7,636 kg)
Ram	9,000 lbs (4,091 kg)
Anvil	1,790 lbs (813 kg)
Typical operating weight with cap	20,000 lbs (9,091 kg)

CAPACITIES (adequate for normal day)

Diesel fuel tank	22 gal (83 l)
Lube oil tank	9 gal (34 l)

DIMENSIONS OF HAMMER

Width (side to side)	29"(737 mm)
Depth	39"(991 mm)
Centerline to front	19 1/2"(495 mm)
Centerline to rear	19 1/2"(495 mm)
Length (hammer only)	17'3"(5.26 m)
Operating length (top of ram at max. stroke to pile)	28'9"(8.76 m)

DIMENSIONS OF LEADS

Face width of guide rails	8"(203 mm)
Distance between guide rails	32 1/2"(825 mm)

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(219) 424-0405

90SSPEC.CHP-0390

ICE 90S DIESEL PILE HAMMER BEARING CHART

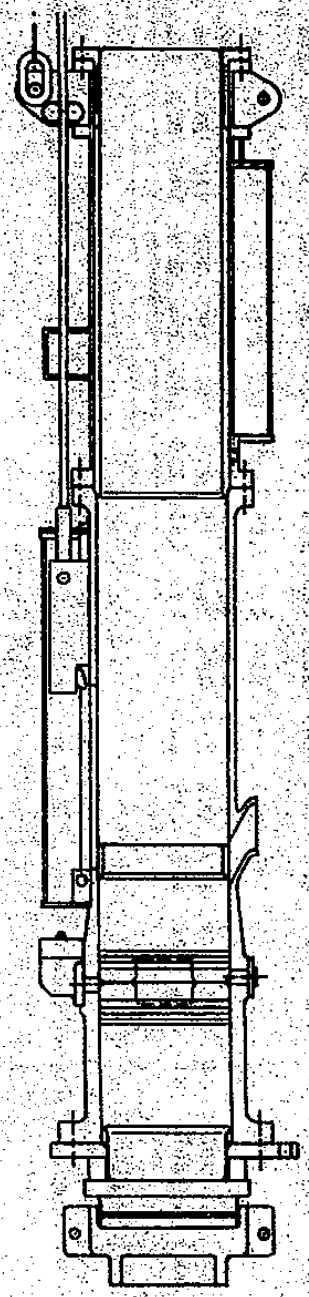
This chart is based on the Engineering News formula for pile bearing and is provided as a convenience only for those applications where this formula is specified. ICE has no preference for this particular formula over any other.

Pile bearing (tons) = 2E/(S+0.1)/2000, where E = Hammer energy (ft-lbs) and S = Pile set (inches per blow)

Blows per minute	Stroke (feet)	Energy (ft-lbs)	Pile set (Blows per inch) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
38	10.00	90,000	150	207	257	300	337	370	400	426	450	471	490	508	525	540	553	566	578	589	600
39	9.90	89,100	148	205	254	297	334	366	396	422	445	466	486	503	519	534	548	561	572	583	594
40	9.36	84,240	140	194	240	280	315	346	374	399	421	441	459	476	491	505	518	530	541	551	561
41	8.83	79,470	132	183	227	264	298	327	353	376	397	416	433	449	463	476	489	500	510	520	529
42	8.39	75,510	125	174	215	251	283	310	335	357	377	395	411	426	440	453	464	475	485	494	503
43	7.97	71,730	119	165	204	239	268	295	318	339	358	375	391	405	418	430	441	451	461	469	478
44	7.57	68,130	113	157	194	227	255	280	302	322	340	356	371	385	397	408	419	428	437	446	454
45	7.20	64,800	108	149	185	216	243	266	288	306	324	339	353	366	378	388	398	408	416	424	432
46	6.84	61,560	102	142	175	205	230	253	273	291	307	322	335	347	359	369	378	387	395	403	410
47	6.54	58,860	98	135	168	196	220	242	261	278	294	308	321	332	343	353	362	370	378	385	392
48	6.23	56,070	93	129	160	186	210	230	249	265	280	293	305	316	327	336	345	353	360	367	373
49	5.91	53,190	88	122	151	177	199	219	236	251	265	278	290	300	310	319	327	334	341	348	354
50	5.63	50,670	84	116	144	168	190	208	225	240	253	265	276	286	295	304	311	319	325	331	337
51	5.33	47,970	79	110	137	159	179	197	213	227	239	251	261	271	279	287	295	302	308	314	319
52	5.07	45,630	76	105	130	152	171	187	202	216	228	239	248	257	266	273	280	287	293	298	304
53	4.80	43,200	72	99	123	144	162	177	192	204	216	226	235	244	252	259	265	272	277	283	288
54	4.52	40,680	67	93	116	135	152	167	180	192	203	213	221	229	237	244	250	256	261	266	271
55	4.24	38,160	63	88	109	127	143	157	169	180	190	199	208	215	222	228	234	240	245	250	254
56	3.93	35,370	58	81	101	117	132	145	157	167	176	185	192	199	206	212	217	222	227	231	235

CAUTION: Driving at ten blows per inch (set of 0.1 inch per blow) is considered practical refusal. Driving in excess of ten blows per inch for more than six inches of driving or driving in excess of 20 blows per inch at all is considered improper use and will void the hammer warranty.

ICE MODEL 200S DIESEL PILE HAMMER



WORKING SPECIFICATIONS

Rated energy	100,000 ft-lbs (13,830 kg-m)
Minimum energy	40,000 ft-lbs (5,520 kg-m)
Stroke at rated energy	5' (1.52 m)
Maximum obtainable stroke	5'6" (1.67 m)
Speed (blows per minute)	53-70
Bearing based on EN formula	500 tons (454 tonnes)

WEIGHTS

Bare hammer	33,600 lbs (15,240 kg)
Ram	20,000 lbs (9,073 kg)
Anvil	3,900 lbs (1,770 kg)
Typical operating weight	39,000 lbs (17,690 kg)

CAPACITIES (adequate for normal day)

Diesel fuel tank	26 gal (98 l)
Lube oil tank	9 gal (34 l)

DIMENSIONS OF HAMMER

Width (side to side)	32" (813 mm)
Depth	49" (1,245 mm)
Centerline to front	24" (610 mm)
Centerline to rear	25" (635 mm)
Length (hammer only)	17' (5.1 m)
Operating length (top of ram at maximum stroke to pile)	27'2" (8.2 m)

DIMENSIONS OF LEADS (see Note)

Face width of guide rails	8" (200 mm)
Distance between guide rails	32 1/2" (670 mm)

Note: Pads for wider leads and guide angles for other width leads available.

HERCULES MACHINERY CORPORATION
P.O. Box 5198 • 3101 New Haven Avenue
Fort Wayne, Indiana 46895
(219) 424-0405

200S-0690

ICE 200S DIESEL PILE HAMMER BEARING CHART

This chart is based on the Engineering News formula for pile bearing and is provided as a convenience only for those applications where this formula is specified. ICE has no preference for this particular formula over any other.

Pile bearing (tons) = 2E/(S+0.1)/2000, where E = Hammer energy (ft-lbs) and S = Pile set (inches per blow)

Blows per minute	Stroke (feet)	Energy (ft-lbs)	Pile set (Blows per inch) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
52	5.22	104,400	174	240	298	348	391	429	464	494	522	546	569	590	609	626	642	657	671	684	696
53	5.01	100,200	167	231	286	334	375	412	445	474	501	524	546	566	584	601	616	630	644	656	668
54	4.81	96,200	160	221	274	320	360	396	427	455	480	503	524	543	561	577	592	605	618	630	641
55	4.62	92,400	154	213	264	308	346	380	410	437	462	484	504	522	539	554	568	581	594	605	616
56	4.45	89,000	148	205	254	296	333	366	395	421	445	466	485	503	519	534	547	560	572	583	593
57	4.28	85,600	142	197	244	285	321	352	380	405	428	448	466	483	499	513	526	538	550	560	570
58	4.11	82,200	137	189	234	274	308	338	365	389	411	430	448	464	479	493	505	517	528	538	548
59	3.96	79,200	132	182	226	264	297	326	352	375	396	414	432	447	462	475	487	498	509	518	528
60	3.79	75,800	126	174	216	252	284	312	336	359	379	397	413	428	442	454	466	477	487	496	505
61	3.66	73,200	122	168	209	244	274	301	325	346	366	383	399	413	427	439	450	460	470	479	488
62	3.52	70,400	117	162	201	234	264	289	312	333	352	368	384	397	410	422	433	443	452	461	469
63	3.38	67,600	112	156	193	225	253	278	300	320	338	354	368	382	394	405	416	425	434	442	450
64	3.25	65,000	108	150	185	216	243	267	288	307	325	340	354	367	379	390	400	409	417	425	433
65	3.11	62,200	103	143	177	207	233	256	276	294	311	325	339	351	362	373	382	391	399	407	414
66	2.99	59,800	99	138	170	199	224	246	265	283	299	313	326	338	348	358	368	376	384	391	398
67	2.85	57,000	95	131	162	190	213	234	253	270	285	298	310	322	332	342	350	358	366	373	380
68	2.72	54,400	90	125	155	181	204	224	241	257	272	284	296	307	317	326	334	342	349	356	362
69	2.59	51,800	86	119	148	172	194	213	230	245	259	271	282	292	302	310	318	326	333	339	345
70	2.45	49,000	81	113	140	163	183	201	217	232	245	256	267	276	285	294	301	308	315	321	326

CAUTION: Driving at ten blows per inch (set of 0.1 inch per blow) is considered practical refusal. Driving in excess of ten blows per inch for more than six inches of driving or driving in excess of 20 blows per inch at all is considered improper use and will void the hammer warranty.

ICE MODEL 40S DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 4000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	5	6	8	9	10	11	3.000
8	9	13	15	18	20	21	1.500
12	13	18	22	25	29	31	1.000
16	16	24	28	33	38	40	0.750
20	20	29	34	40	46	49	0.600
24	23	33	40	47	53	57	0.500
28	26	38	45	53	61	64	0.429
32	29	42	51	59	67	72	0.375
36	32	46	55	65	74	78	0.333
40	35	50	60	70	80	85	0.300
44	38	54	64	75	86	91	0.273
48	40	57	69	80	91	97	0.250
52	42	60	73	85	97	103	0.231
56	45	64	76	89	102	108	0.214
60	47	67	80	93	107	113	0.200
64	49	70	83	97	111	118	0.188
68	51	72	87	101	116	123	0.176
72	53	75	90	105	120	128	0.167
76	54	78	93	109	124	132	0.158
80	56	80	96	112	128	136	0.150
84	58	82	99	115	132	140	0.143
88	59	85	102	118	135	144	0.136
92	61	87	104	122	139	148	0.130
96	62	89	107	124	142	151	0.125
100	64	91	109	127	145	155	0.120
104	65	93	111	130	149	158	0.115
108	66	95	114	133	152	161	0.111
110	67	96	115	134	153	163	0.109
120	70	100	120	140	160	170	0.100
130	73	104	125	146	166	177	0.092
140	75	108	129	151	172	183	0.086
150	78	111	133	156	178	189	0.080
160	80	114	137	160	183	194	0.075
170	82	117	141	164	188	199	0.071
180	84	120	144	168	192	204	0.067
190	86	123	147	172	196	208	0.063
200	88	125	150	175	200	213	0.060
225	91	130	157	183	209	222	0.053
250	95	135	162	189	216	230	0.048
275	97	139	167	195	223	237	0.044
300	100	143	171	200	229	243	0.040
325	102	146	175	204	234	249	0.037
350	104	149	179	209	238	253	0.034
375	106	152	182	212	242	258	0.032
400	108	154	185	215	246	262	0.030
425	109	156	187	218	250	265	0.028
450	111	158	189	221	253	268	0.027
475	112	160	192	224	256	271	0.025
500	113	161	194	226	258	274	0.024
525	114	163	195	228	260	277	0.023

ICE MODEL 42S DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 4088
REFUSAL SHALL BE BETWEEN 160 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	5	7	8	9	11	11	3.000
8	9	13	15	18	20	22	1.500
12	13	19	22	26	30	32	1.000
16	17	24	29	34	38	41	0.750
20	20	29	35	41	47	50	0.600
24	24	34	41	48	55	58	0.500
28	27	39	46	54	62	66	0.429
32	30	43	52	60	69	73	0.375
36	33	47	57	66	75	80	0.333
40	36	51	61	72	82	87	0.300
44	38	55	66	77	88	93	0.273
48	41	58	70	82	93	99	0.250
52	43	62	74	87	99	105	0.231
56	46	65	78	91	104	111	0.214
60	48	68	82	95	109	116	0.200
64	50	71	85	100	114	121	0.188
68	52	74	89	104	118	126	0.176
72	54	77	92	107	123	130	0.167
76	55	79	95	111	127	135	0.158
80	57	82	98	114	131	139	0.150
84	59	84	101	118	135	143	0.143
88	61	86	104	121	138	147	0.136
92	62	89	106	124	142	151	0.130
96	64	91	109	127	145	154	0.125
100	65	93	111	130	149	158	0.120
104	66	95	114	133	152	161	0.115
108	68	97	116	136	155	165	0.111
110	68	98	117	137	156	166	0.109
120	72	102	123	143	164	174	0.100
130	74	106	128	149	170	181	0.092
140	77	110	132	154	176	187	0.086
150	79	114	136	159	182	193	0.080
160	82	117	140	164	187	199	0.075
170	84	120	144	168	192	204	0.071
180	86	123	147	172	196	208	0.067
190	88	125	150	175	200	213	0.063
200	89	128	153	179	204	217	0.060
225	93	133	160	187	213	227	0.053
250	97	138	166	193	221	235	0.048
275	100	142	171	199	228	242	0.044
300	102	146	176	204	234	248	0.040
325	104	149	179	209	239	254	0.037
350	107	152	183	213	244	259	0.034
375	108	155	186	217	248	263	0.032
400	110	157	189	220	252	267	0.030
425	112	159	191	223	256	271	0.028
450	113	161	194	226	258	274	0.027
475	114	163	196	228	261	277	0.025
500	115	165	198	231	264	280	0.024
525	116	166	200	233	266	283	0.023

ICE MODEL 70S DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 7000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	8	11	14	16	18	19	3.000
8	15	22	26	31	35	37	1.500
12	22	32	38	45	51	54	1.000
16	29	41	49	58	66	70	0.750
20	35	50	60	70	80	85	0.600
24	41	58	70	82	93	99	0.500
28	48	66	79	93	106	113	0.429
32	52	74	88	103	118	125	0.375
36	57	81	97	113	129	137	0.333
40	61	88	105	123	140	149	0.300
44	66	94	113	131	150	160	0.273
48	70	100	120	140	160	170	0.250
52	74	106	127	148	169	180	0.231
56	78	111	134	156	178	189	0.214
60	82	117	140	163	187	198	0.200
64	85	122	146	170	195	207	0.188
68	89	127	152	177	203	215	0.176
72	92	131	158	184	210	223	0.167
76	95	136	163	190	217	231	0.158
80	98	140	168	196	224	238	0.150
84	101	144	173	202	231	245	0.143
88	104	148	178	207	237	252	0.136
92	106	152	182	213	243	258	0.130
96	109	156	187	218	249	264	0.125
100	111	159	191	223	255	270	0.120
104	114	163	195	228	260	276	0.115
108	116	166	199	232	265	282	0.111
110	117	167	201	234	268	285	0.109
120	123	175	210	245	280	298	0.100
130	127	182	218	255	291	309	0.092
140	132	188	226	264	302	320	0.086
150	136	194	233	272	311	331	0.080
160	140	200	240	280	320	340	0.075
170	144	205	246	287	328	349	0.071
180	147	210	252	294	336	357	0.067
190	150	215	257	300	343	365	0.063
200	153	219	263	306	350	372	0.060
225	160	228	274	320	365	388	0.053
250	166	236	284	331	378	402	0.048
275	171	244	292	341	390	414	0.044
300	175	250	300	350	400	425	0.040
325	179	256	307	358	409	435	0.037
350	182	261	313	365	417	443	0.034
375	186	265	318	371	424	451	0.032
400	188	269	323	377	431	458	0.030
425	191	273	328	382	437	464	0.028
450	193	276	332	387	442	470	0.027
475	196	279	335	391	447	475	0.026
500	198	282	339	395	452	480	0.024
525	199	285	342	399	456	484	0.023

ICE MODEL 90S DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 9000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	10	15	17	20	23	25	3.000
8	20	28	34	39	45	48	1.500
12	29	41	49	57	65	70	1.000
16	37	53	64	74	86	90	0.750
20	45	64	77	90	103	109	0.600
24	53	75	90	105	120	128	0.500
28	60	85	102	119	136	145	0.429
32	66	96	114	133	152	161	0.375
36	73	104	125	145	166	177	0.333
40	79	113	135	158	180	191	0.300
44	86	121	145	169	193	205	0.273
48	90	129	154	180	206	219	0.250
52	95	136	163	190	218	231	0.231
56	100	143	172	200	229	243	0.214
60	105	150	180	210	240	255	0.200
64	110	157	188	219	250	266	0.188
68	114	163	195	228	260	277	0.176
72	118	169	203	236	270	287	0.167
76	122	174	209	244	279	297	0.158
80	126	180	216	252	288	306	0.150
84	130	185	222	259	296	315	0.143
88	133	190	228	267	305	324	0.136
92	137	195	234	273	312	332	0.130
96	140	200	240	280	320	340	0.125
100	143	205	245	286	327	348	0.120
104	146	209	251	293	334	355	0.115
108	149	213	256	298	341	362	0.111
110	151	216	258	301	344	366	0.109
120	158	225	270	315	360	383	0.100
130	164	234	281	328	374	398	0.092
140	170	242	291	339	388	412	0.086
150	175	250	300	350	400	425	0.080
160	180	257	309	360	411	437	0.075
170	185	264	317	369	422	448	0.071
180	189	270	324	378	432	459	0.067
190	193	276	331	386	441	469	0.063
200	197	281	338	394	450	478	0.060
225	205	293	352	411	470	499	0.053
250	213	304	365	426	488	517	0.048
275	219	313	376	439	501	533	0.044
300	225	321	386	450	514	546	0.040
325	230	329	394	460	526	559	0.037
350	235	335	402	469	536	570	0.034
375	239	341	409	477	545	580	0.032
400	242	346	415	485	554	588	0.030
425	246	351	421	491	561	597	0.028
450	249	355	426	497	568	604	0.027
475	251	359	431	503	575	611	0.025
500	254	363	435	508	581	617	0.024
525	256	366	440	513	586	623	0.023

ICE MODEL 200S DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 20000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

AVG. HT. OF FALL	3.5	5	6	7	8	8.5	S
BLOWS PER FOOT	BEARING IN TONS						
4	23	32	39	45	52	55	3.000
8	44	63	75	88	100	106	1.500
12	64	91	109	127	145	155	1.000
16	82	118	141	165	188	200	0.750
20	100	143	171	200	229	243	0.600
24	117	167	200	233	267	283	0.500
28	132	189	227	265	303	322	0.429
32	147	211	253	295	337	358	0.375
36	162	231	277	323	369	392	0.333
40	175	250	300	350	400	425	0.300
44	188	268	322	376	428	456	0.273
48	200	286	343	400	457	486	0.250
52	212	302	363	423	484	514	0.231
56	223	318	382	445	509	541	0.214
60	233	333	400	467	533	567	0.200
64	243	348	417	487	557	591	0.188
68	253	362	434	506	579	615	0.176
72	263	375	450	525	600	638	0.167
76	271	388	465	543	620	659	0.158
80	280	400	480	560	640	680	0.150
84	288	412	494	576	659	700	0.143
88	296	423	508	592	677	719	0.136
92	304	434	521	608	694	738	0.130
96	311	444	533	622	711	756	0.125
100	318	455	545	636	727	773	0.120
104	325	464	557	650	743	789	0.115
108	332	474	568	663	758	805	0.111
110	335	478	574	670	765	813	0.109
120	350	500	600	700	800	850	0.100
130	364	520	624	728	832	884	0.092
140	377	538	646	754	862	915	0.086
150	389	556	667	778	889	944	0.080
160	400	571	686	800	914	971	0.075
170	410	586	703	821	938	997	0.071
180	420	600	720	840	960	1020	0.067
190	429	613	735	858	981	1042	0.063
200	438	625	750	875	1000	1063	0.060
225	457	652	783	913	1043	1109	0.053
250	473	676	811	946	1081	1149	0.048
275	487	696	835	975	1114	1184	0.044
300	500	714	857	1000	1143	1214	0.040
325	511	730	876	1022	1169	1242	0.037
350	521	745	894	1043	1191	1266	0.034
375	530	758	909	1061	1212	1288	0.032
400	538	769	923	1077	1231	1308	0.030
425	546	780	936	1092	1248	1326	0.028
450	553	789	947	1105	1263	1342	0.027
475	559	798	958	1118	1277	1357	0.025
500	565	806	968	1129	1290	1371	0.024
525	570	814	977	1140	1302	1384	0.023

ICE MODEL 40S DIESEL HAMMER

P = 2 W H / S + 0.1 — WEIGHT OF RAM = 4000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	40	57	69	80	91	97
2 7/16	4 7/8	41	58	70	81	93	99
2 3/8	4 3/4	41	59	71	83	95	101
2 5/16	4 5/8	42	60	72	85	97	103
2 1/4	4 1/2	43	62	74	86	98	105
2 3/16	4 3/8	44	63	75	88	100	107
2 1/8	4 1/4	45	64	77	90	102	109
2 1/16	4 1/8	46	65	78	91	104	111
2	4	47	67	80	93	107	113
1 15/16	3 7/8	48	68	82	95	109	116
1 7/8	3 3/4	49	70	83	97	111	118
1 13/16	3 5/8	50	71	85	100	114	121
1 3/4	3 1/2	51	73	87	102	116	124
1 11/16	3 3/8	52	74	89	104	119	127
1 5/8	3 1/4	53	76	91	107	122	130
1 9/16	3 1/8	55	78	94	109	125	133
1 1/2	3	56	80	96	112	128	136
1 7/16	2 7/8	57	82	98	115	131	139
1 3/8	2 3/4	59	84	101	118	135	143
1 5/16	2 5/8	61	86	104	121	138	147
1 1/4	2 1/2	62	89	107	124	142	151
1 3/16	2 3/8	64	91	110	128	146	155
1 1/8	2 1/4	66	94	113	132	151	160
1 1/16	2 1/8	68	97	116	136	155	165
1	2	70	100	120	140	160	170
15/16	1 7/8	72	103	124	145	165	175
7/8	1 3/4	75	107	128	149	171	181
13/16	1 5/8	77	110	132	154	177	188
3/4	1 1/2	80	114	137	160	183	194
11/16	1 3/8	83	119	142	166	190	201
5/8	1 1/4	86	123	148	172	197	209
9/16	1 1/8	90	128	154	179	205	218
1/2	1	93	133	160	187	213	227
7/16	7/8	97	139	167	195	223	237
3/8	3/4	102	145	175	204	233	247
5/16	5/8	107	152	183	213	244	259
1/4	1/2	112	160	192	224	256	272
3/16	3/8	118	168	202	236	269	286
1/8	1/4	124	178	213	249	284	302
1/16	1/8	132	188	226	264	301	320
0	0	140	200	240	280	320	340

ICE MODEL 42S DIESEL HAMMER

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = 4088
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	41	58	70	82	93	99
2 7/16	4 7/8	42	59	71	83	95	101
2 3/8	4 3/4	42	61	73	85	97	103
2 5/16	4 5/8	43	62	74	86	99	105
2 1/4	4 1/2	44	63	75	88	101	107
2 3/16	4 3/8	45	64	77	90	103	109
2 1/8	4 1/4	46	65	78	92	105	111
2 1/16	4 1/8	47	67	80	93	107	113
2	4	48	68	82	95	109	116
1 15/16	3 7/8	49	70	83	97	111	118
1 7/8	3 3/4	50	71	85	100	114	121
1 13/16	3 5/8	51	73	87	102	116	124
1 3/4	3 1/2	52	74	89	104	119	126
1 11/16	3 3/8	53	76	91	106	122	129
1 5/8	3 1/4	55	78	93	109	125	132
1 9/16	3 1/8	56	80	96	112	128	136
1 1/2	3	57	82	98	114	131	139
1 7/16	2 7/8	59	84	101	117	134	143
1 3/8	2 3/4	60	86	103	120	138	146
1 5/16	2 5/8	62	88	106	124	141	150
1 1/4	2 1/2	64	91	109	127	145	154
1 3/16	2 3/8	65	93	112	131	150	159
1 1/8	2 1/4	67	96	115	135	154	164
1 1/16	2 1/8	69	99	119	139	159	168
1	2	72	102	123	143	164	174
15/16	1 7/8	74	105	127	148	169	179
7/8	1 3/4	76	109	131	153	174	185
13/16	1 5/8	79	113	135	158	180	192
3/4	1 1/2	82	117	140	164	187	199
11/16	1 3/8	85	121	145	170	194	206
5/8	1 1/4	88	126	151	176	201	214
9/16	1 1/8	92	131	157	183	209	222
1/2	1	95	136	164	191	218	232
7/16	7/8	100	142	171	199	228	242
3/8	3/4	104	149	178	208	238	253
5/16	5/8	109	156	187	218	249	265
1/4	1/2	114	164	196	229	262	278
3/16	3/8	120	172	207	241	275	293
1/8	1/4	127	182	218	254	291	309
1/16	1/8	135	192	231	269	308	327
0	0	143	204	245	286	327	347

ICE MODEL 70S DIESEL HAMMER

P = 2 W H / S + 0.1 WEIGHT OF RAM = 7000
REFUSAL SHALL BE BETWEEN 160 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	70	100	120	140	160	170
2 7/16	4 7/8	71	102	122	143	163	173
2 3/8	4 3/4	73	104	124	145	166	176
2 5/16	4 5/8	74	106	127	148	169	180
2 1/4	4 1/2	75	108	129	151	172	183
2 3/16	4 3/8	77	110	132	154	176	187
2 1/8	4 1/4	78	112	134	157	179	190
2 1/16	4 1/8	80	114	137	160	183	194
2	4	82	117	140	163	187	198
1 15/16	3 7/8	83	119	143	167	191	203
1 7/8	3 3/4	85	122	146	170	195	207
1 13/16	3 5/8	87	124	149	174	199	212
1 3/4	3 1/2	89	127	153	178	204	216
1 11/16	3 3/8	91	130	156	182	208	221
1 5/8	3 1/4	93	133	160	187	213	227
1 9/16	3 1/8	96	137	164	191	219	232
1 1/2	3	98	140	168	196	224	238
1 7/16	2 7/8	101	144	172	201	230	244
1 3/8	2 3/4	103	147	177	206	236	251
1 5/16	2 5/8	106	151	182	212	242	257
1 1/4	2 1/2	109	156	187	218	249	264
1 3/16	2 3/8	112	160	192	224	256	272
1 1/8	2 1/4	115	165	198	231	264	280
1 1/16	2 1/8	119	170	204	238	272	288
1	2	123	175	210	245	280	298
15/16	1 7/8	126	181	217	253	289	307
7/8	1 3/4	131	187	224	261	299	317
13/16	1 5/8	135	193	232	270	309	328
3/4	1 1/2	140	200	240	280	320	340
11/16	1 3/8	145	207	249	290	332	353
5/8	1 1/4	151	215	258	302	345	366
9/16	1 1/8	157	224	269	314	358	381
1/2	1	163	233	280	327	373	397
7/16	7/8	170	243	292	341	390	414
3/8	3/4	178	255	305	356	407	433
5/16	5/8	187	267	320	373	427	453
1/4	1/2	196	280	336	392	448	476
3/16	3/8	206	295	354	413	472	501
1/8	1/4	218	311	373	436	498	529
1/16	1/8	231	329	395	461	527	560
0	0	245	350	420	490	560	595

ICE MODEL 90S DIESEL HAMMER

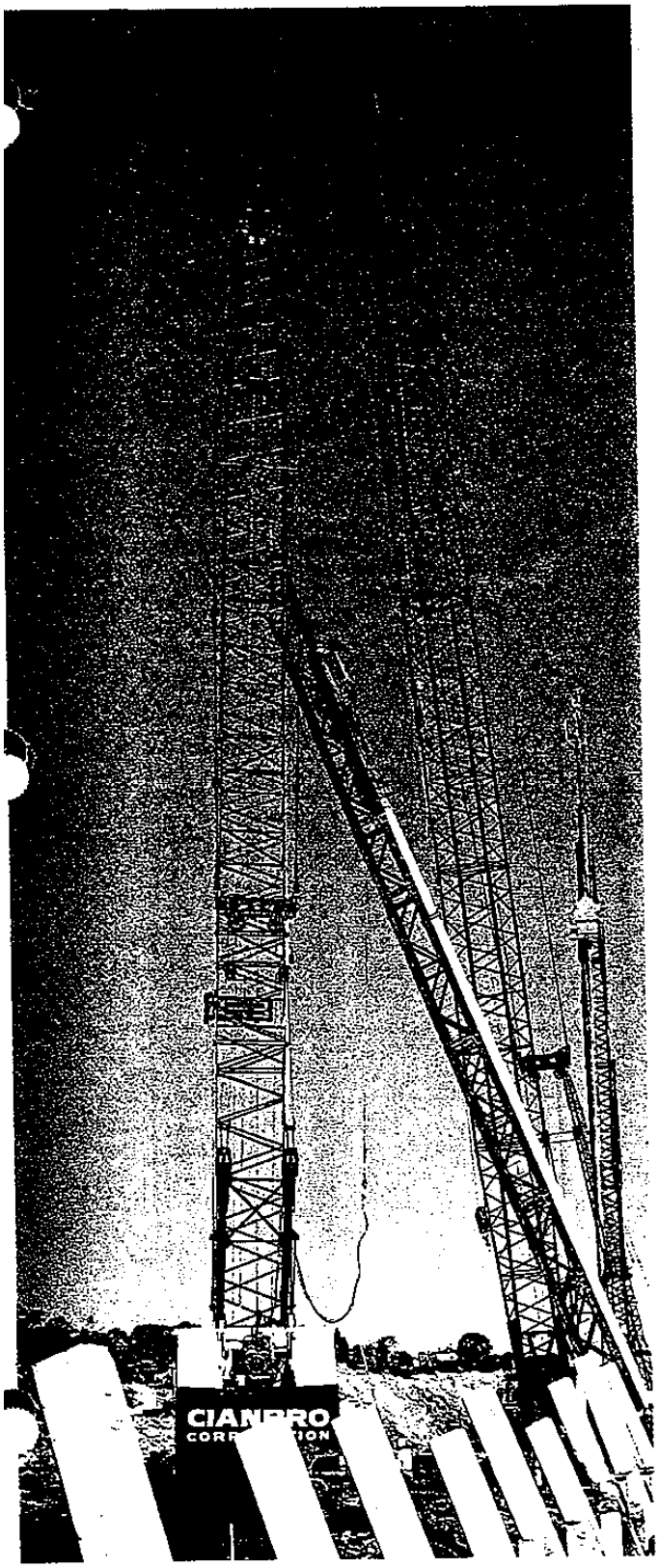
P = 2 W H / S + 0.1 WEIGHT OF RAM = 9000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	90	129	154	180	208	219
2 7/16	4 7/8	92	131	157	183	209	223
2 3/8	4 3/4	93	133	160	187	213	227
2 5/16	4 5/8	95	136	163	190	217	231
2 1/4	4 1/2	97	138	166	194	222	235
2 3/16	4 3/8	99	141	169	198	226	240
2 1/8	4 1/4	101	144	173	202	230	245
2 1/16	4 1/8	103	147	176	206	235	250
2	4	105	150	180	210	240	255
1 15/16	3 7/8	107	153	184	214	245	260
1 7/8	3 3/4	110	157	188	219	250	266
1 13/16	3 5/8	112	160	192	224	256	272
1 3/4	3 1/2	115	164	196	229	262	278
1 11/16	3 3/8	117	167	201	234	268	285
1 5/8	3 1/4	120	171	206	240	274	291
1 9/16	3 1/8	123	176	211	246	281	299
1 1/2	3	126	180	216	252	288	306
1 7/16	2 7/8	129	185	222	258	295	314
1 3/8	2 3/4	133	189	227	265	303	322
1 5/16	2 5/8	136	195	234	272	311	331
1 1/4	2 1/2	140	200	240	280	320	340
1 3/16	2 3/8	144	206	247	288	329	350
1 1/8	2 1/4	148	212	254	296	339	360
1 1/16	2 1/8	153	218	262	305	349	371
1	2	158	225	270	315	360	383
15/16	1 7/8	163	232	279	325	372	395
7/8	1 3/4	168	240	288	336	384	408
13/16	1 5/8	174	248	298	348	397	422
3/4	1 1/2	180	257	309	360	411	437
11/16	1 3/8	187	267	320	373	427	453
5/8	1 1/4	194	277	332	388	443	471
9/16	1 1/8	202	288	346	403	461	490
1/2	1	210	300	360	420	480	510
7/16	7/8	219	313	376	438	501	532
3/8	3/4	228	327	393	458	524	556
5/16	5/8	240	343	411	480	549	583
1/4	1/2	252	360	432	504	576	612
3/16	3/8	265	379	455	531	606	644
1/8	1/4	280	400	480	560	640	680
1/16	1/8	296	424	508	593	678	720
0	0	315	450	540	630	720	765

ICE MODEL 200S DIESEL HAMMER

P = 2 W H / S + 0.1 WEIGHT OF RAM = 20000
REFUSAL SHALL BE BETWEEN 150 - 180 TONS

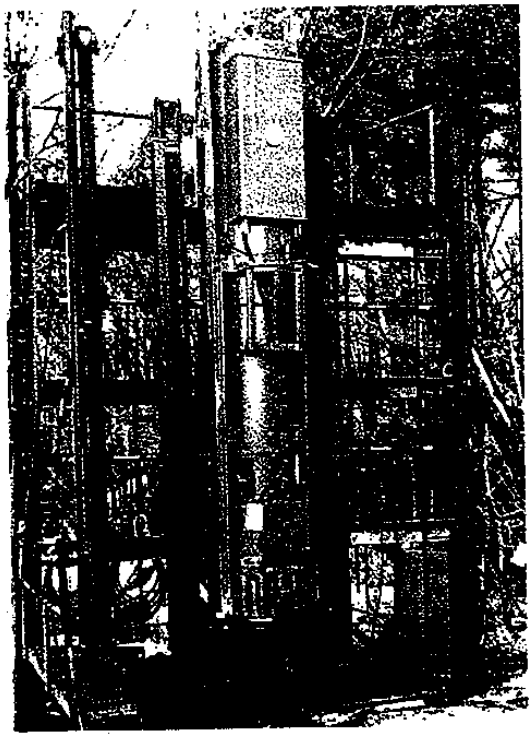
PENETRATION (INCHES)		AVERAGE HEIGHT OF FALL (FT.)					
10 BLOWS	20 BLOWS	3.5	5	6	7	8	8.5
		BEARING IN TONS					
2 1/2	5	200	286	343	400	457	486
2 7/16	4 7/8	204	291	349	407	465	495
2 3/8	4 3/4	207	296	356	415	474	504
2 5/16	4 5/8	211	302	362	423	483	513
2 1/4	4 1/2	215	308	369	431	492	523
2 3/16	4 3/8	220	314	376	439	502	533
2 1/8	4 1/4	224	320	384	448	512	544
2 1/16	4 1/8	229	327	392	457	522	555
2	4	233	333	400	467	533	567
1 15/16	3 7/8	238	340	409	477	545	579
1 7/8	3 3/4	243	348	417	487	557	591
1 13/16	3 5/8	249	356	427	498	569	604
1 3/4	3 1/2	255	364	436	509	582	618
1 11/16	3 3/8	260	372	447	521	595	633
1 5/8	3 1/4	267	381	457	533	610	648
1 9/16	3 1/8	273	390	468	546	624	663
1 1/2	3	280	400	480	560	640	680
1 7/16	2 7/8	287	410	492	574	656	697
1 3/8	2 3/4	295	421	505	589	674	716
1 5/16	2 5/8	303	432	519	605	692	735
1 1/4	2 1/2	311	444	533	622	711	756
1 3/16	2 3/8	320	457	549	640	731	777
1 1/8	2 1/4	329	471	565	659	753	800
1 1/16	2 1/8	339	485	582	679	776	824
1	2	350	500	600	700	800	850
15/16	1 7/8	361	516	619	723	826	877
7/8	1 3/4	373	533	640	747	853	907
13/16	1 5/8	386	552	662	772	883	938
3/4	1 1/2	400	571	686	800	914	971
11/16	1 3/8	415	593	711	830	948	1007
5/8	1 1/4	431	615	738	862	985	1046
9/16	1 1/8	448	640	768	896	1024	1088
1/2	1	467	667	800	933	1067	1133
7/16	7/8	487	696	835	974	1113	1183
3/8	3/4	509	727	873	1018	1164	1236
5/16	5/8	533	762	914	1067	1219	1295
1/4	1/2	560	800	960	1120	1280	1360
3/16	3/8	589	842	1011	1179	1347	1432
1/8	1/4	622	889	1067	1244	1422	1511
1/16	1/8	659	941	1129	1318	1506	1600
0	0	700	1000	1200	1400	1600	1700



DIESEL PILE HAMMERS

DOUBLE-ACTING FOR HIGH PRODUCTION

8,100-70,000 FT-LBS
1,120-9,700 KG-M



ICE'S COMPLETE RANGE OF DOUBLE-ACTING DIESEL PILE HAMMERS

• SEVEN MODELS

Seven models with a maximum energy range from 8,100 to 70,000 ft.-lbs. allow the proper hammer to be selected for every job.

Model 180 — 8,100 ft.-lbs. for timber piles and shorter sheet piling.

Model 440 — 18,100 ft.-lbs. for mid-length sheets, H-Beams, and pipe piles. Scavenging system permits efficient operation in very soft soils where other diesels will not start and run.

Model 422— 22,500 ft.-lbs. with low overall weight.

Model 520 — 30,000 ft.-lbs., long the standard on H-Beams is also unmatched on sheet piling and concrete piles.

Model 640 — 40,000 ft.-lbs., the big brother of the 520 for those jobs where extra energy is needed.

Model 660 — 50,000 ft.-lbs., high energy plus the scavenging system for outstanding soft-soil performance.

Model 1070— 70,000 ft.-lbs., hammer features a 10,000 pound ram for big concrete piles and other large hammer requirements. High speed—64/68 blows per minute—is almost twice that of single-acting diesels.

• HIGH-OUTPUT ENERGIES
• DOUBLE-ACTING DESIGN

The double-acting design provides high output energies at up to twice the number of blows per minute of other diesel hammers. Power cylinder scavenging and high-pressure fuel injection assures starting and continued running in soft soils. Energy is infinitely adjustable from half to full rated energy.

• HIGH PRESSURE FUEL INJECTION

Fuel under high pressure is injected into the hammer at the proper time to provide the best fuel-air mixture for efficient combustion. This results in a cleaner running hammer as well as easy starting and excellent soft soil performance. Pre-ignition is eliminated.

• OUTPUT ENERGY GAGE

The remote-reading output energy gage and charts give accurate and precise reading in foot-pounds of energy. It is not necessary to estimate energy by watching the ram stroke.

• RUGGED, LONG-LASTING DESIGN

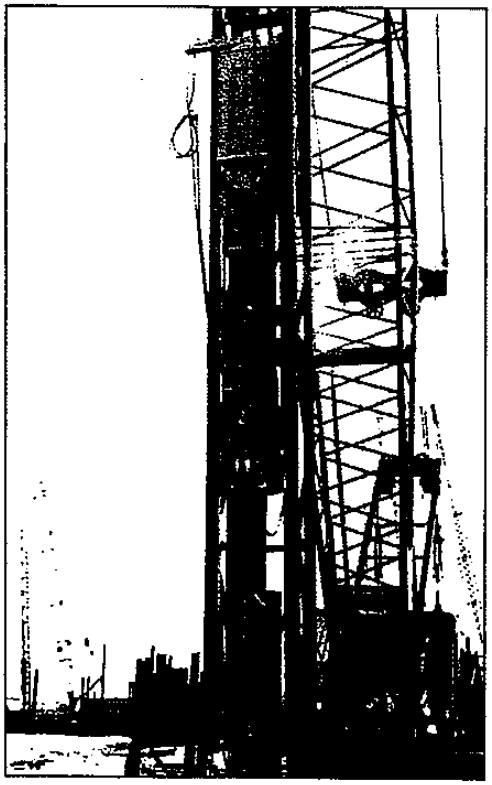
Enclosed cylinder top helps keep dirt and sand out of the hammer eliminating unneccessary wear of internal parts.
Protective wear rings at top and bottom of ram center the cylinder, eliminating ram-to-cylinder wall contact and greatly increasing the life of hammer.
Positive lubrication from a lube oil pump activated by the ram.
Shock reducing elastomer and cushion assembly. Elastomer protects the hammer from pile rebound. Plastic disc cushions and protects both piling and hammer.

• ONE-MAN OPERATION

With hammer throttle control mounted in operator's cab, crane operator controls the hammer operation.

• QUIETER OPERATION

Tests show that ICE double-acting diesels are over 50% quieter (4 dBA) than comparable single-acting diesel hammers.



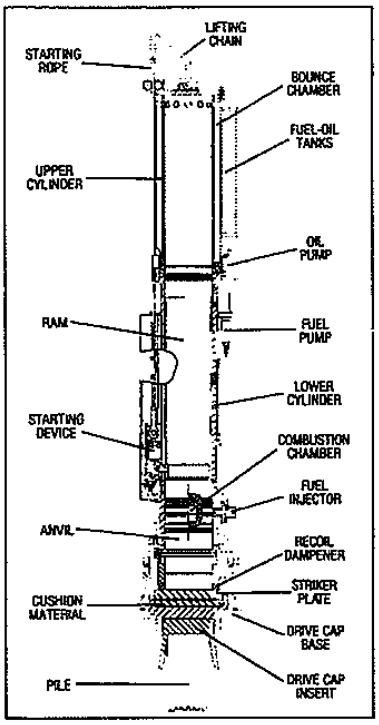
MODEL 1070 DRIVING 14" PIPE

OPERATION

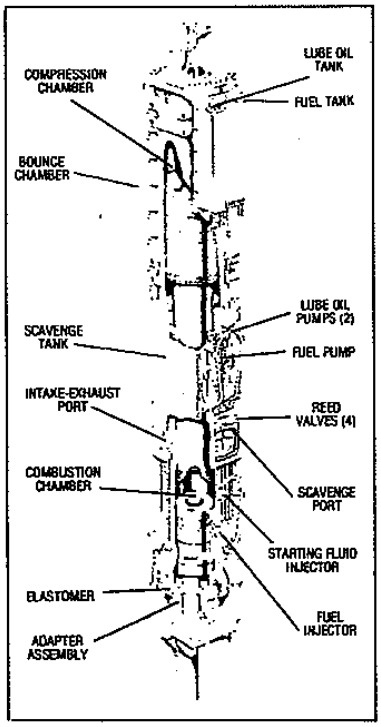
Whatever your driving requirement there's an ICE diesel pile hammer to match it. And all ICE diesel hammers are rated highest in horsepower in their class. The result: faster driving, lower operating costs, greater profits.

The ICE self-contained, free-piston diesel pile hammers operate on the two-cycle principle and are designed to deliver driving energy to the pile head in three forms . . . compression pre-load, impact, and explosive force.

To begin operation, the ram (free piston) is raised toward the top of the enclosed cylinder by a crane hoist line, compressing air above the ram in the cylinder and the connecting air tanks (bounce chamber) located on the outside of the cylinder. The ram is released and accelerated downward by the force of gravity plus the expansion of air from the bounce chambers above the ram into the upper cylinder. During the downward stroke, the ram closes off the intake-exhaust ports and compresses the trapped air in the power cylinder between the bottom of the ram and the anvil. Compressing the trapped air causes a heat rise in the combustion chamber and also creates a pre-loading force on the anvil and the pile.



Models 180, 422, 520, 640 and 1070



Models 440 and 660

As the ram nears the end of its downward stroke, it activates a fuel pump which injects atomized fuel under high pressure into the highly heated air in the combustion chamber(s) in the top of the anvil. The ram strikes the anvil, delivering impact energy to the pile. The combustible gases ignite and explode, sending the ram upward and the pile downward. This also transmits energy to the pile in addition to the output energy obtained from the ram's striking the anvil . . . keeps the pile in motion longer. The ram also actuates the lubricating oil pump to provide positive lubrication.

When the ram travels upward from combustion, the intake-exhaust ports are cleared. The burned gases blow out these ports. Simultaneously, air is compressed in the upper cylinder and bounce chamber tanks to complete the cycle.

The models 440 & 660 have a unique (patented) self-scavenging feature. As the ram rises, reed valves are closed by the partial vacuum in the scavenge chamber caused by the raising ram. When the scavenge ports are cleared; clean, fresh air is drawn into the lower cylinder, down across the combustion chamber and up through the scavenge chamber into the upper cylinder. When the ram begins its down stroke, the highly diluted air in the scavenge system rushes ahead of the ram, down across the combustion chamber and out through the intake-exhaust ports, further scavenging the cylinder and assuring a fresh supply of air.

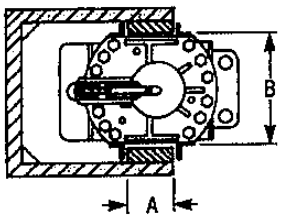
*Internal elastomer on Model 180.
Other models have external elastomer.

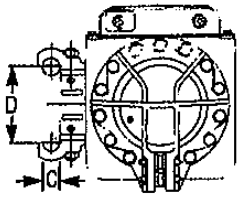
SPECIFICATIONS

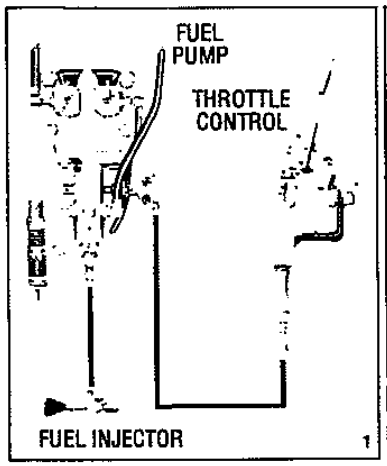
	UNITS		MODEL 180		440		422		520		640		660		1070	
Working Specifications																
Rated equivalent WH energy	ft.-lbs.	kg.-m.	8,100	1,120	18,100	2,517	22,500	3,112	30,000	4,149	40,000	5,533	50,000	6,916	70,000	9,700
Minimum operating energy	ft.-lbs.	kg.-m.	4,060	561	7,700	1,065	9,000	1,247	17,700	2,448	25,400	3,513	25,100	3,471	36,100	4,992
Rated equivalent ram stroke	ft.-in.	m.	4-9	1.45	4-8	1.42	5-8	1.71	5-11	1.80	6-8	2.03	6-7	2.02	7-0	2.13
Speed	blows per minute		90-95	90-95	88-92	88-92	76-82	76-82	80-84	80-84	74-77	74-77	84-88	84-88	64-68	64-68
Power rating	HP	KW	23.3	17.4	49.6	37.0	51.8	38.6	76.3	56.9	90	67	133.3	99.5	136	101
Bearing based on ENR formula	Tons	Tons	40.5	36.7	91.0	82.5	110	102	150.0	136.1	200	182	250.0	226.8	350	318
Weights																
Bare hammer	lbs.	kg.	4,645	2,062	9,840	4,463	9,750	4,431	13,400	6,078	14,460	6,560	24,480	11,104	21,500	9,700
Ram	lbs.	kg.	1,725	782	4,000	1,814	4,000	1,814	5,070	2,300	6,000	2,730	7,584	3,431	10,000	4,545
Anvil	lbs.	kg.	377	171	705	320	1,380	627	1,740	790	1,575	715	2,145	973	3,100	1,410
Typical operating weight with cap	lbs.	kg.	5,208	2,362	12,514	5,676	12,200	5,545	15,870	7,200	16,930	7,680	28,545	12,948	25,500	11,590
Capacities (adequate for normal day)																
Diesel fuel tank	gal.	lit.	5.5	20.8	13	49.2	13.8	52.2	11	41.6	11	41.6	26.0	98.4	35	133
Lube oil tank	gal.	lit.	1.9	7.2	1.8	6.8	4.5	17	2	7.6	2	7.6	4.2	16.1	10	38
Dimensions of Hammer																
Width (side to side)	in.	mm.	20	510	20	510	22	559	26	660	26	660	30	760	30	760
Depth	in.	mm.	24¼	620	34⅛	870	32¼	819	34⅜	870	34⅜	870	51	1,300	44	1,120
Centerline to front	in.	mm.	13⅛	330	17 1/16	430	16¼	413	17	430	17	430	25½	650	21½	545
Centerline to rear	in.	mm.	11⅛	280	17 1/16	430	16	406	17⅜	440	17⅜	440	25½	650	22½	575
Length (hammer only)	ft.-in.	m.	11-3	3.43	13-6	4.11	13-11	4.24	13-9	4.19	15-7	4.75	17-4	5.28	17-10	5.44
Operating length (top of Y-hitch lifting eye to pile driving surface of cap)	ft.-in.	m.	16-3	4.95	19-2	5.84	19-8	5.99	19-9	6.02	21-7	6.58	25-0	7.62	25-5	5.90
Dimensions of Leads (See Note 1)																
Face width of guide rails (A)	in.	mm.	4-8	100-200	4-8	100-200	4-8	100-200	8	200	8	200	8	200	8	200
Distance between guide rails (B)	in.	mm.	20½	520	20½/26½	520/670	22½/26½	570/670	26½	670	26½	670	30½/32½	775/825	30½/32½	775/825
Diameter of guide pipes (C)	in.	mm.	2¾	70	2¾	70	2¾	70	2¾	70	2¾	70	2¾	70	2¾	70
Center to center of guide pipes (D)	in.	mm.	13	330	13	330	13	330	13	330	13	330	13	330	13	330

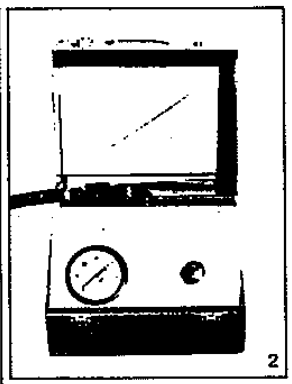
Note:
1: Pads for wider leads, guide angles for other width rails, and guide clips for spud type leads are available.

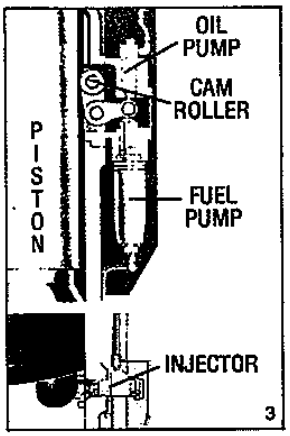
Constant improvement and engineering progress make it necessary that we reserve the right to make specification, equipment, and price changes without notice.

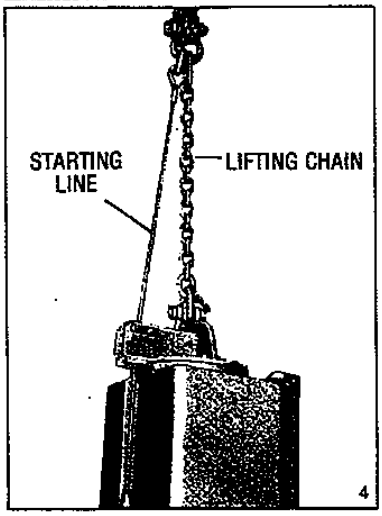


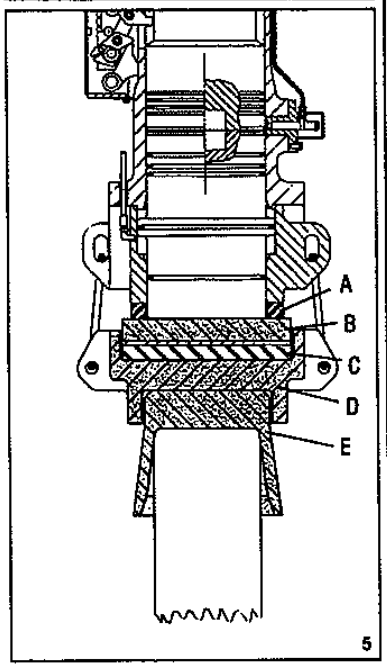


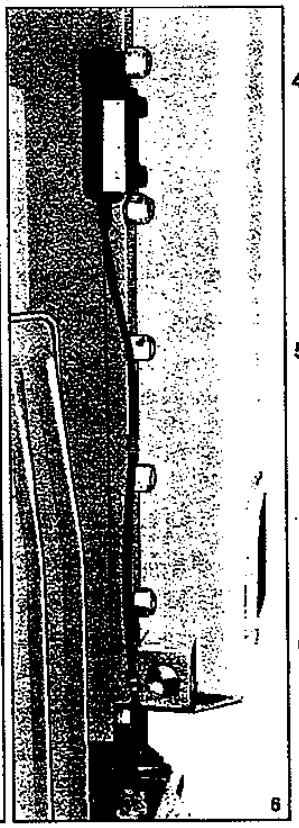












1. ICE diesel pile hammers are supplied with a hydraulic throttle control connected to a fuel injection pump located on the hammer. The pump supplies high pressure fuel to the fuel injector nozzle which sprays fuel into the combustion chamber. With the throttle control, it is possible to control the hammer energy output by varying the amount of atomized fuel injected, thus varying the ram stroke. The blow rate stays relatively constant. The operator can make throttle adjustments for different driving conditions.

2. The output energy gage provides a fast reading of hammer output energy during driving. A hose is connected from the compression tank to the gage. When the hammer energy output reading is desired, merely depress the gage button and a measurement of air pressure above the ram and in the compression tank is obtained. Referencing the energy graph, the equivalent WH energy (stored and potential) in ft.-lbs. is obtained from the dial reading.

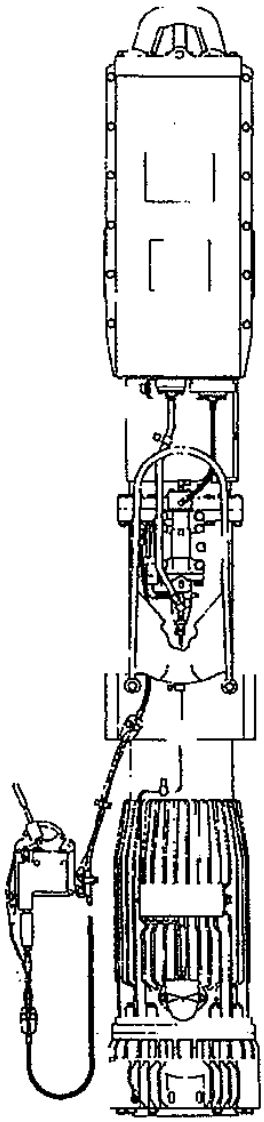
3. The fuel pump is cam or gas-pressure operated by the falling ram. Diesel fuel under high pressure is sent to the fuel injectors at the precise instant for optimum combustion. Special fuel-injection nozzles spray fuel into the combustion chamber in a pattern designed specifically for the ICE diesel hammer. At the same time, the oil pump is activated to lubricate the ram. The cam roller-bearing contacts the ram only between the compression rings, thereby eliminating the ring wear caused by the fuel pump cam of other diesel hammers.

4. The "Y" hitch is standard on all hammers. With the "Y" hitch, the lifting chain and starting line are connected to the single hoist line. This allows the single hoist line to serve the dual purpose of starting the hammer and centrally lifting the hammer when positioning in the leads. Auxiliary crane lines are free to handle piling or leads. An optional center-line lifting and starting line is available. Hydraulic starting devices are also available for most models.

5. The ICE drive cap system protects hammer and pile from damage, while providing an economical drive cap for most types of piling. The recoil dampener (A) protects the hammer from pile rebound. The strike plate (B) transmits hammer energy to the pile. The plastic cushion block (C) helps prevent damage to the pile and hammer. The drive cap base (D) contains the cushion material and accepts various types of drive cap inserts (E). Inserts are available for most types and sizes of piling.

6. For easier, quicker starting in cold weather, ICE diesel pile hammers are supplied with a patented starting fluid injection system. As the ram is raised, starting fluid is injected into the combustion chamber. The amount of fluid is controlled by a simple, vacuum actuated check valve connected to the fluid supply tank. For convenience, fluid tank can be filled with the hammer resting on the ground.

ICE MODEL 180 DIESEL PILE HAMMER



WORKING SPECIFICATIONS

Rated energy	8,100 ft-lbs (1,120 kg-m)
Minimum energy	4,060 ft-lbs (561 kg-m)
Rated equivalant ram stroke	4'9"(1.45 m)
Speed (blows per minute)	90-95
Power rating	23.3 HP (17.4 KW)
Bearing based on EN formula	40.5 tons (36.7 tons)

WEIGHTS

Bare hammer	4,645 lbs (2,062 kg)
Ram	1,725 lbs (782 kg)
Anvil	377 lbs (171 kg)
Typical operating weight	5,208 lbs (2,362 kg)

CAPACITIES (adequate for normal day)

Diesel fuel tank	5.5 gal (20.8 l)
Lube oil tank	1.9 gal (7.2 l)

DIMENSIONS OF HAMMER

Width (side to side)	20"(510 mm)
Depth	24 1/4"(620 mm)
Centerline to front	13 1/8"(330 mm)
Centerline to rear	11 1/8"(280 mm)
Length (hammer only)	11'3"(3.43 m)
Operating length (top of chain to drive cap)	16'3"(4.95m)

DIMENSIONS OF LEADS

Face width of guide rails	4-8"(102-203 mm)
Distance between guide rails	20 1/2-22 1/2"(520-570 mm)

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P.O. Box 5198 • 3101 New Haven Avenue
Fort Wayne, Indiana 46895
(219) 424-0405

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ICE 180 DIESEL PILE HAMMER BEARING CHART

This chart is based on the Engineering News formula for pile bearing and is provided as a convenience only for those applications where this formula is specified. ICE has no preference for this particular formula over any other.

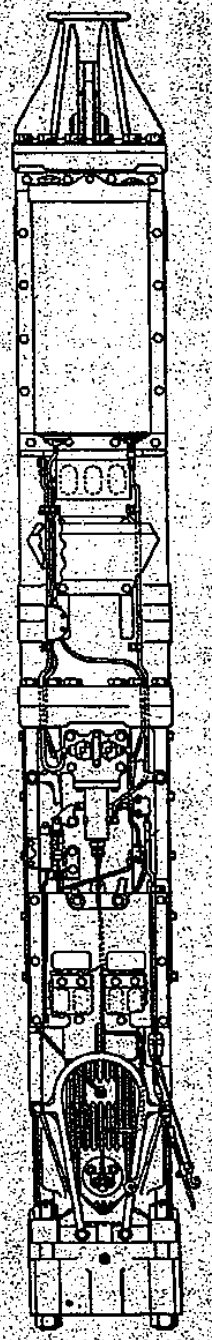
Pile bearing (tons) = 2E/(S+0.1)/2000, where E = Hammer energy (ft-lbs) and S = Pile set (inches per blow)

The gauge reading to energy correlation per the table below is based upon an energy gauge hose length of 50'. For other hose lengths, contact ICE.

Gauge reading (psig)	Energy (ft-lbs)	Pile set (Blows per inch) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
10	4,060	6	9	11	13	15	16	18	19	20	21	22	22	23	24	24	25	26	26	27
11	4,370	7	10	12	14	16	17	19	20	21	22	23	24	25	26	26	27	28	28	29
12	4,680	7	10	13	15	17	19	20	22	23	24	25	26	27	28	28	29	30	30	31
13	4,970	8	11	14	16	18	20	22	23	24	26	27	28	28	29	30	31	31	32	33
14	5,250	8	12	15	17	19	21	23	24	26	27	28	29	30	31	32	33	33	34	35
15	5,530	9	12	15	18	20	22	24	26	27	28	30	31	32	33	34	34	35	36	36
16	5,800	9	13	16	19	21	23	25	27	29	30	31	32	33	34	35	36	37	38	38
17	6,060	10	13	17	20	22	24	26	28	30	31	33	34	35	36	37	38	38	39	40
18	6,320	10	14	18	21	23	26	28	29	31	33	34	35	36	37	38	39	40	41	42
19	6,560	10	15	18	21	24	27	29	31	32	34	35	37	38	39	40	41	42	42	43
20	6,810	11	15	19	22	25	28	30	32	34	35	37	38	39	40	41	42	43	44	45
21	7,050	11	16	20	23	26	29	31	33	35	36	38	39	41	42	43	44	45	46	47
22	7,280	12	16	20	24	27	29	32	34	36	38	39	41	42	43	44	45	46	47	48
23	7,500	12	17	21	25	28	30	33	35	37	39	40	42	43	45	46	47	48	49	50
24	7,730	12	17	22	25	28	31	34	36	38	40	42	43	45	46	47	48	49	50	51
25	7,940	13	18	22	26	29	32	35	37	39	41	43	44	46	47	48	49	51	52	52
26	8,160	13	18	23	27	30	33	36	38	40	42	44	46	47	48	50	51	52	53	54

CAUTION: Driving at ten blows per inch (set of 0.1 inch per blow) is considered practical refusal. Driving in excess of ten blows per inch for more than six inches of driving or driving in excess of 20 blows per inch at all is considered improper use and will void the hammer warranty.

ICE MODEL 440 DIESEL PILE HAMMER



WORKING SPECIFICATIONS

Rated energy	18,100 ft-lbs (2,517 kg-m)
Minimum energy	7,700 ft-lbs (1,065 kg-m)
Rated equivalant ram stroke	4'8"(1.42 m)
Speed (blows per minute)	88-92
Power rating	49.6 HP (37 KW)
Bearing based on EN formula	91 tons (82.5 tons)

WEIGHTS

Bare hammer	9,840 lbs (4,463 kg)
Ram	4,000 lbs (1,814 kg)
Anvil	705 lbs (320 kg)
Typical operating weight	12,514 lbs (5,676 kg)

CAPACITIES (adequate for normal day)

Diesel fuel tank	13 gal (49.2 l)
Lube oil tank	1.8 gal (6.8 l)

DIMENSIONS OF HAMMER

Width (side to side)	20"(510 mm)
Depth	34 1/8"(870 mm)
Centerline to front	17 1/16"(430 mm)
Centerline to rear	17 1/16"(430 mm)
Length (hammer only)	13'6"(4.11 m)
Operating length (top of chain to drive cap)	19'2"(5.84m)

DIMENSIONS OF LEADS

Face width of guide rails	4-8"(100-200 mm)
Distance between guide rails	20 1/2-26 1/2"(520-670 mm)

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Fort Wayne, Indiana 46895
(219) 424-0405

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ICE 440 DIESEL PILE HA...ER BEARING CHART

This chart is based on the Engineering News formula for pile bearing and is provided as a convenience only for those applications where this formula is specified. ICE has no preference for this particular formula over any other.

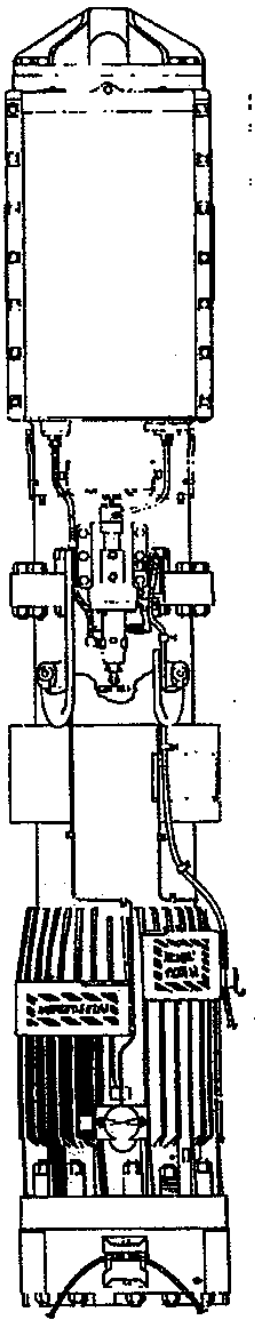
Pile bearing (tons) = 2E/(S+0.1)/2000, where E = Hammer energy (ft-lbs) and S = Pile set (inches per blow)

The gauge reading to energy correlation per the table below is based upon an energy gauge hose length of 50'. For other hose lengths, contact ICE.

Gauge reading (psig)	Energy (ft-lbs)	Pile set (Blows per inch) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
6	6,900	11	15	19	23	25	28	30	32	34	36	37	39	40	41	42	43	44	45	46
7	7,850	13	18	22	26	29	32	34	37	39	41	42	44	45	47	48	49	50	51	52
8	8,770	14	20	25	29	32	36	38	41	43	45	47	49	51	52	53	55	56	57	58
9	9,650	16	22	27	32	36	39	42	45	48	50	52	54	56	57	59	60	62	63	64
10	10,510	17	24	30	35	39	43	46	49	52	55	57	59	61	63	64	66	67	68	70
11	11,340	18	26	32	37	42	46	50	53	56	59	61	64	66	68	69	71	72	74	75
12	12,150	20	28	34	40	45	50	54	57	60	63	66	68	70	72	74	76	78	79	81
13	12,930	21	29	36	43	48	53	57	61	64	67	70	73	75	77	79	81	83	84	86
14	13,700	22	31	39	45	51	56	60	64	68	71	74	77	79	82	84	86	88	89	91
15	14,440	24	33	41	48	54	59	64	68	72	75	78	81	84	86	88	90	92	94	96
16	15,170	25	35	43	50	56	62	67	71	75	79	82	85	88	91	93	95	97	99	101
17	15,870	26	36	45	52	59	65	70	75	79	83	86	89	92	95	97	99	102	103	105
18	16,570	27	38	47	55	62	68	73	78	82	86	90	93	96	99	101	104	106	108	110
19	17,240	28	39	49	57	64	70	76	81	86	90	94	97	100	103	106	108	110	112	114
20	17,910	29	41	51	59	67	73	79	84	89	93	97	101	104	107	110	112	115	117	119
21	18,550	30	42	53	61	69	76	82	87	92	97	101	104	108	111	114	116	119	121	123

CAUTION: Driving at ten blows per inch (set of 0.1 inch per blow) is considered practical refusal. Driving in excess of ten blows per inch for more than six inches of driving or driving in excess of 20 blows per inch at all is considered improper use and will void the hammer warranty.

ICE MODEL 520 DIESEL PILE HAMMER



WORKING SPECIFICATIONS

Rated energy	30,000 ft-lbs (4,149 kg-m)
Minimum energy	17,700 ft-lbs (2,448 kg-m)
Rated equivalant ram stroke	5'11"(1.80 m)
Speed (blows per minute)	80-84
Power rating	76.3 HP (56.9 KW)
Bearing based on EN formula	150 tons (136 tons)

WEIGHTS

Bare hammer	13,400 lbs (6,078 kg)
Ram	5,070 lbs (2,300 kg)
Anvil	1,740 lbs (789 kg)
Typical operating weight	15,870 lbs (7,198 kg)

CAPACITIES (adequate for normal day)

Diesel fuel tank	11 gal (42 l)
Lube oil tank	2 gal (7.6 l)

DIMENSIONS OF HAMMER

Width (side to side)	26"(660 mm)
Depth	34 3/8"(870 mm)
Centerline to front	17"(430 mm)
Centerline to rear	17 3/8"(440 mm)
Length (hammer only)	13'7"(4.14 m)
Operating length (top of chain to drive cap)	19'9"(6.02 m)

DIMENSIONS OF LEADS

Face width of guide rails	8"(200 mm)
Distance between guide rails	26 1/2"(670 mm)

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P.O. Box 5198 • 3101 New Haven Avenue
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(219) 424-0405

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ICE 520 DIESEL PILE HAM...R BEARING CHART

This chart is based on the Engineering News formula for pile bearing and is provided as a convenience only for those applications where this formula is specified. ICE has no preference for this particular formula over any other.

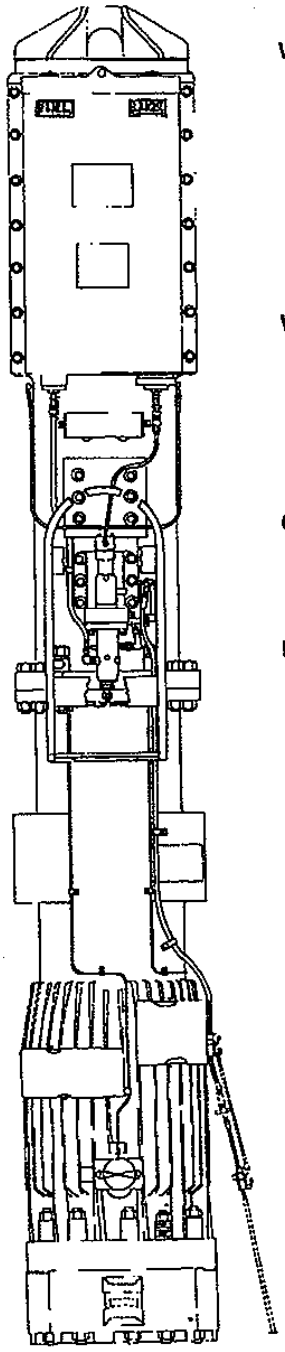
Pile bearing (tons) = 2E/(S+0.1)/2000, where E = Hammer energy (ft-lbs) and S = Pile set (inches per blow)

The gauge reading to energy correlation per the table below is based upon an energy gauge hose length of 50'. For other hose lengths, contact ICE.

Gauge reading (psig)	Energy (ft-lbs)	Pile set (Blows per inch) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
17	21,380	35	49	61	71	80	88	95	101	106	111	116	120	124	128	131	134	137	140	142
18	22,230	37	51	63	74	83	91	98	105	111	116	121	125	129	133	136	139	142	145	148
19	23,070	38	53	65	76	86	94	102	109	115	120	125	130	134	138	141	145	148	151	153
20	23,880	39	55	68	79	89	98	106	113	119	125	130	134	139	143	146	150	153	156	159
21	24,680	41	56	70	82	92	101	109	116	123	129	134	139	143	148	151	155	158	161	164
22	25,450	42	58	72	84	95	104	113	120	127	133	138	143	148	152	156	160	163	166	169
23	26,200	43	60	74	87	98	107	116	124	131	137	142	148	152	157	161	164	168	171	174
24	26,940	44	62	76	89	101	110	119	127	134	141	146	152	157	161	165	169	173	176	179
25	27,660	46	63	79	92	103	113	122	131	138	144	150	156	161	165	170	174	177	181	184
26	28,360	47	65	81	94	106	116	126	134	141	148	154	160	165	170	174	178	182	185	189
27	29,050	48	67	83	96	108	119	129	137	145	152	158	164	169	174	178	182	186	190	193
28	29,730	49	68	84	99	111	122	132	140	148	155	162	168	173	178	182	187	191	194	198
29	30,390	50	70	86	101	113	125	135	143	151	159	165	171	177	182	187	191	195	199	202

CAUTION:Driving at ten blows per inch (set of 0.1 inch per blow) is considered practical refusal. Driving in excess of ten blows per inch for more than six inches of driving or driving in excess of 20 blows per inch at all is considered improper use and will void the hammer warranty.

ICE MODEL 640 DIESEL PILE HAMMER



WORKING SPECIFICATIONS

Rated energy	40,000 ft-lbs (5,533 kg-m)
Minimum energy	25,400 ft-lbs (3,513 kg-m)
Rated equivalant ram stroke	6'8"(2.03 m)
Speed (blows per minute)	74-77
Power rating	90 HP (67 KW)
Bearing based on EN formula	200 tons (182 tons)

WEIGHTS

Bare hammer	14,460 lbs (6,560 kg)
Ram	6,000 lbs (2,730 kg)
Anvil	1,575 lbs (1,192 kg)
Typical operating weight	16,930 lbs (7,680 kg)

CAPACITIES (adequate for normal day)

Diesel fuel tank	11 gal (42 l)
Lube oil tank	2 gal (7.6 l)

DIMENSIONS OF HAMMER

Width (side to side)	26"(660 mm)
Depth	34 3/8"(870 mm)
Centerline to front	17"(430 mm)
Centerline to rear	17 3/8"(440 mm)
Length (hammer only)	15'7"(4.75 m)
Operating length (top of chain to drive cap)	21'7"(6.58m)

DIMENSIONS OF LEADS

Face width of guide rails	8"(200 mm)
Distance between guide rails	26 1/2"(670 mm)

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P.O. Box 5198 - 3101 New
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INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Corporate offices: 301 Warehouse Drive, Matthews, NC 28105, USA
800 438-9281 & 704 821-8200 FAX 704 821-6448
Telex 572385 ICE INTL

640-0690

ICE 640 DIESEL PILE HAMMER BEARING CHART

This chart is based on the Engineering News formula for pile bearing and is provided as a convenience only for those aplicaations where this formula is specified. ICE has no preference for this particular formula over any other.

Pile bearing (tons) = 2E/(S+0.1)/2000, where E = Hammer energy (ft-lbs) and S = Pile set (inches per blow)

The gauge reading to energy correlation per the table below is based upon an energy gauge hose length of 50'. For other hose lengths, contact ICE.

Gauge reading (psig)	Energy (ft-lbs)	Pile set (Blows per inch) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
14	25,390	42	58	72	84	95	104	112	120	126	132	138	143	148	152	156	159	163	166	169
15	26,400	44	60	75	88	99	108	117	125	132	138	144	149	154	158	162	166	169	172	176
16	27,370	45	63	78	91	102	112	121	129	136	143	149	154	159	164	168	172	175	179	182
17	28,310	47	65	80	94	106	116	125	134	141	148	154	160	165	169	174	178	181	185	188
18	29,230	48	67	83	97	109	120	129	138	146	153	159	165	170	175	179	184	187	191	194
19	30,120	50	69	86	100	112	124	133	142	150	157	164	170	175	180	185	189	193	197	200
20	30,980	51	71	88	103	116	127	137	146	154	162	168	175	180	185	190	195	199	202	206
21	31,820	53	73	90	106	119	131	141	150	159	166	173	179	185	190	195	200	204	208	212
22	32,650	54	75	93	108	122	134	145	154	163	171	178	184	190	195	200	205	209	213	217
23	33,450	55	77	95	111	125	137	148	158	167	175	182	189	195	200	205	210	215	219	223
24	34,230	57	78	97	114	128	140	152	162	171	179	186	193	199	205	210	215	220	224	228
25	35,000	58	80	100	116	131	144	155	165	175	183	190	197	204	210	215	220	225	229	233
26	35,740	59	82	102	119	134	147	158	169	178	187	194	202	208	214	219	225	229	234	238
27	36,470	60	84	104	121	136	150	162	172	182	191	198	206	212	218	224	229	234	238	243
28	37,190	61	85	106	123	139	153	165	176	185	194	202	210	216	223	228	234	239	243	247
29	37,890	63	87	108	126	142	156	168	179	189	198	206	214	221	227	233	238	243	248	252
30	38,580	64	89	110	128	144	158	171	182	192	202	210	218	225	231	237	242	248	252	257
31	39,250	65	90	112	130	147	161	174	185	196	205	214	221	228	235	241	247	252	257	261
32	39,910	66	92	114	133	149	164	177	189	199	209	217	225	232	239	245	251	256	261	266
33	40,560	67	93	115	135	152	167	180	192	202	212	221	229	236	243	249	255	260	265	270

CAUTION: Driving at ten blows per inch (set of 0.1 inch per blow) is considered practical refusal. Driving in excess of ten blows per inch for more than six inches of driving or driving in excess of 20 blows per inch at all is considered improper use and will void the hammer warranty.

PILE POINTS & SPLICERS

- **Reduce Pile Installation Cost**
- **Increase Pile Reliability**

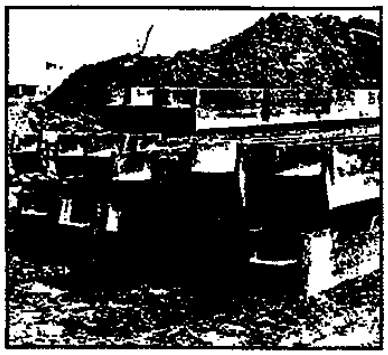
In these tight economic times with ever increasing labor, equipment and materials costs, all available products and techniques must be employed to reduce pile installation time and costs to insure the integrity of the piles being driven.

ICE offers a complete line of pile accessories including points, boots, couplers, splicers, cutting rings and edge protectors to help speed pile installation time and to help guarantee the load bearing capacity of driven piles. Often a small added investment in pile points or splicers will be returned several times over in reduced pile costs and/or reliability.

All ICE pile accessories are manufactured from high-strength materials and are made in sizes to fit all standard sizes and types of piles.

H-BEAM POINTS

The load bearing capacity of driven H-Beams can be greatly reduced if the pile is damaged during driving due to impact with rocks, boulders, rubble or other obstructions. ICE H-Beam points provide pile tip protection to minimize this type of damage. ICE points increase the bending strength of pile flanges and web from 2 to 6 times thereby helping insure that the pile reaches final bearing in position and in good condition.

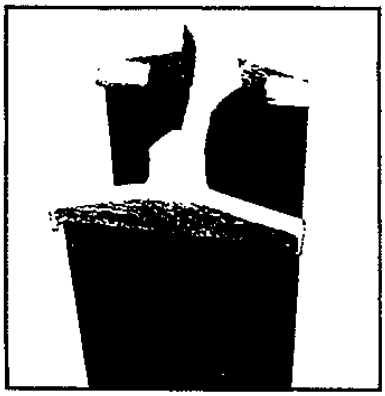


- Made of tough cast steel (ASTM A27 65/35).
- Maximum protection for critical outer corners of beam.
- Wide surface to support beam flanges.
- Quick and easy to attach.
- Assures undamaged piles.
- Sizes available for all H-Beam sections.

ROCK-BITE™ POINTS

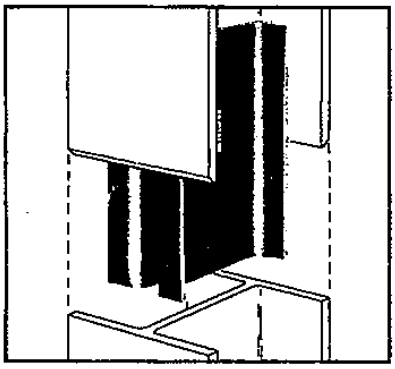
In response to market demand for H-Beam point protection beyond our standard points, ICE manufactures the ROCK-BITE cast steel point. The ROCK-BITE point provides added ability to punch through obstructions and to set the pile into harder bearing materials. ROCK-BITE teeth bite into sloping bearing strata with both vertical and batter piles. Available for all H-Beam sections.

- Thicker flanges and web for even greater protection than standard points.
- Heavy stabbing points for rock penetration on sloping surfaces.
- Increased flange tip depth for added strength.

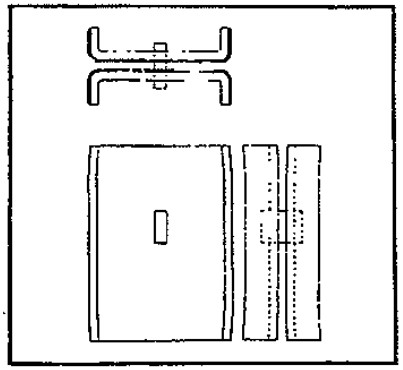


H-BEAM SPLICERS

On many pile jobs where splices are required in H-Beams, the time required to make the splice can equal or exceed pile driving time. ICE H-Beam splicers substantially reduce splicing time in two ways. First, pile alignment is quick and easy as the splicer also serves as the welding template. The splicer slips over the driven pile section and the new section easily slides into the top of the splicer providing quick and accurate alignment. Second, welding time is greatly reduced—often by up to 75% as only a fraction of the weld is required.



- Quick and easy to attach.
- Made of A-36 steel for easy welding.
- Tapered ends slide easily onto beam.
- Minimum delay time for pile driving crew.
- Splice stronger than unspliced beam.
- Sizes available for all H-Beam sections.



ROUND-TITE™ PILE COUPLINGS & BOOTS

ROUND-TITE fittings for pipe piles are designed to expand over the pipe and form a watertight fit; they do not deform the pipe as other available fittings do.

The ROUND-TITE boot and coupling also eliminate the necessity for any welding—in the shop or in the field. They attach easily and very quickly, thus saving considerable field time. This total time and labor cost reduction creates a tremendous savings for the contractor and the owner.

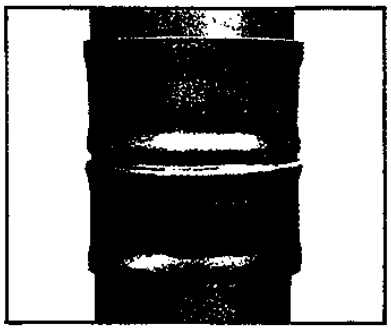
The ROUND-TITE boot is ideally suited for mandrel driving as well as the conventional driving method. The ROUND-TITE coupling virtually eliminates the problems connected with field welded pipe pile sections and those sections connected with other fittings. Because it expands over the pipe pile end, the ROUND-TITE coupling also seats easily and tightly over concrete-filled pipe sections.

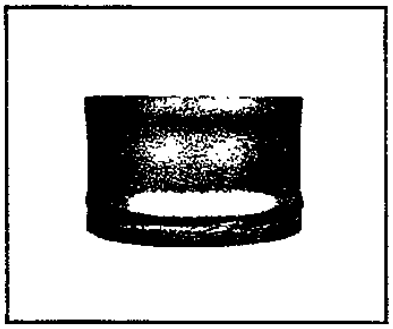
ROUND-TITE Coupling

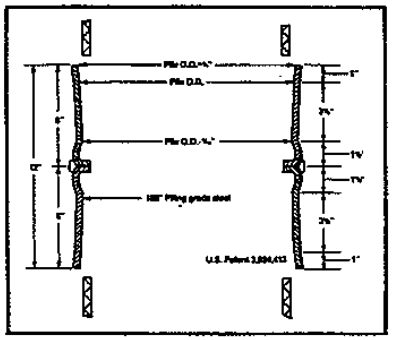
- Much longer than conventional couplers—has more bending resistance—piles drive straighter.
- Designed so that coupling, not the pile, is deformed slightly when two pile sections are driven together. Result: piles can be driven much harder without danger of telescoping.
- Creates a watertight joint. Tight fit results from slightly undersized sleeve being expanded as pile sections are driven together.

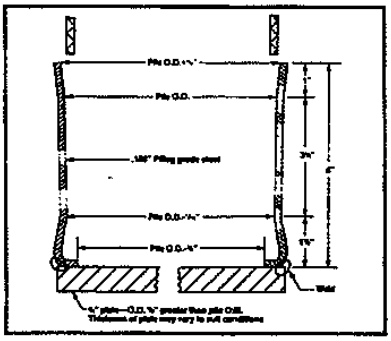
ROUND-TITE Boot

- Like the ROUND-TITE coupling, boot expands to create watertight fit on pile end.
- Eliminates shop and field welding; saves time in field, thus is more economical method of attaching bottom closure on pipe pile.
- Ideally suited for mandrel driving pipe piles as well as conventional method.





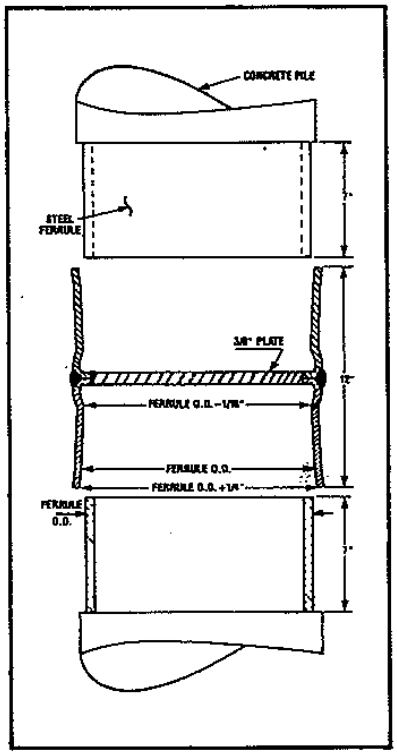




ROUND-TITE™ CONCRETE PILE COUPLINGS

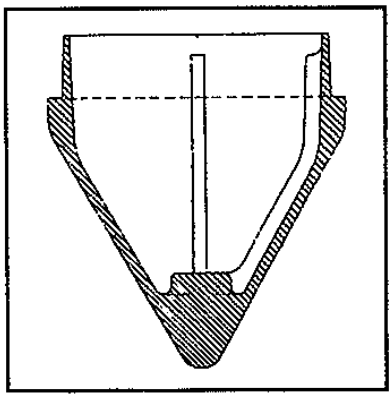
The ROUND-TITE coupling design is also available for use with concrete piles. During casting, the concrete pile is made with a steel ferrule on the end to be spliced. For multiple splices, ferrules are installed on both ends of the pile section. During driving, the coupling works exactly like the ROUND-TITE pipe coupling described on the previous page.

- No welding—in the shop or in the field.
- Attaches quickly and easily.
- Pile sections can be made in any length.
- Full strength coupling.
- Available in all regular pile sizes.

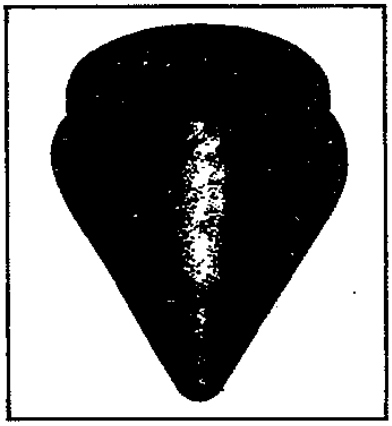


CONICAL POINTS FOR PIPE PILES

Where maximum pile bearing and minimum soil disturbance are required in addition to pile point protection, the ICE conical pipe pile point fills the bill.

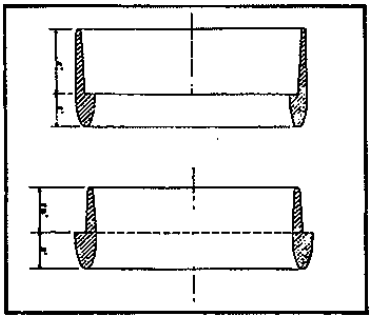


- Most dependable pile point protection. Distributes load over full circumference of pipe.
- Minimizes soil disturbance resulting in maximum friction bearing.
- Allows seating into rock without pile damage.
- Cast from tough alloy steel (ASTM A27 65/35).
- Driving force directed to flat ledge of shoe.
- Tapered lead allows quick, easy installation on pipe.
- Attach with friction fit or single, simple circumferential weld with a 5/16" fillet weld using a 70 series rod.



CUTTING SHOES FOR PIPE PILES

Cutting shoes are available for open-end piles, caissons and well pipes.

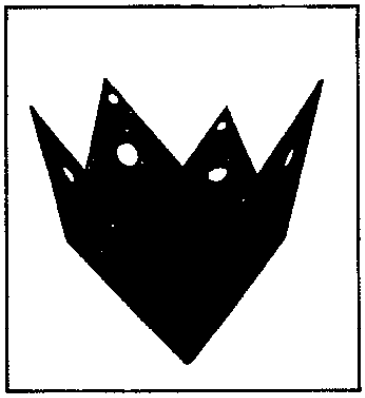


- Protects pile tip during driving.
- Allows seating into rock without pile damage.
- Cast from tough alloy steel (ASTM A148 90/60).
- Open end makes driving easier.
- Open end allows drilling below pile tip if required.
- Driving force directed to flat ledge of shoe.
- Tapered lead allows quick, easy installation on pipe.
- Attach with friction fit or single, simple circumferential weld with a 5/16" fillet weld using a 70 series rod.

TIMBER PILE POINTS

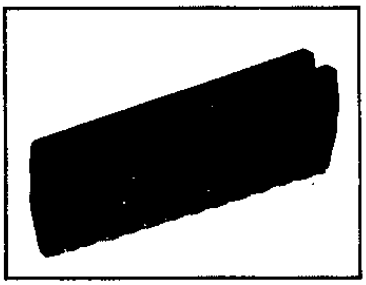
If soil data indicates possible pile damage due to obstructions or a stiff layer which must be penetrated, ICE timber pile points provide the required assurance that the pile will reach required bearing in good condition.

- Prevents pile splitting and brooming.
- Quick and easy to attach.
- Available for all timber pile sizes.
- Made of ASTM A-36 steel plate.



SHEET PILING PROTECTORS

ICE cast steel sheet pile edge protectors help insure pile penetration and at the same time provide significant protection for the leading edge of the pile.



- Edge fluting aids in keeping pile vertical while driving.
- Wedge shape opens slot to ease driving and reduces abrasion of pile coatings.
- Strong cast steel shoe protects pile edge from damage (ASTM A148 80/40).
- May be installed with tack-weld or drive fit.

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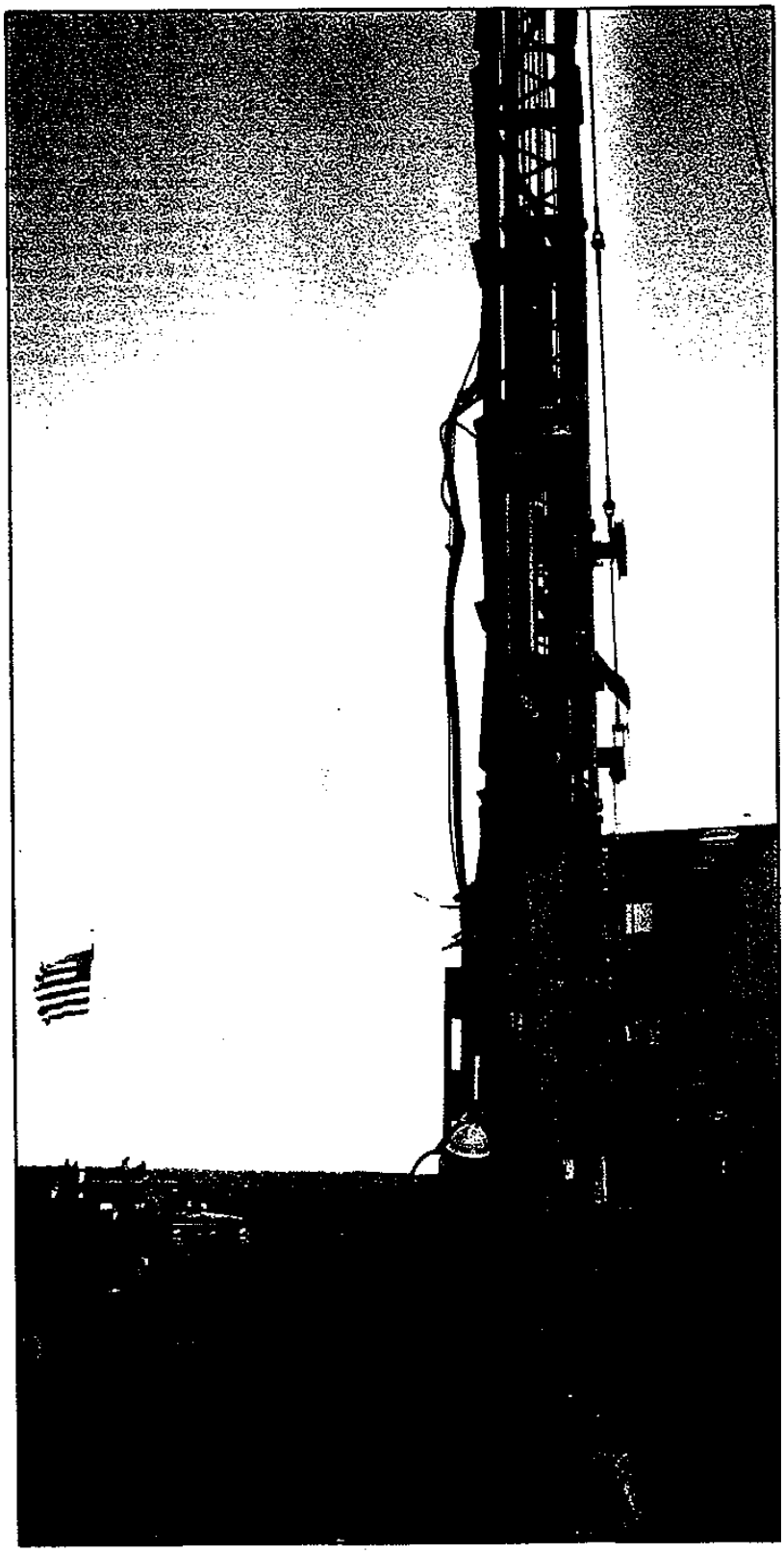
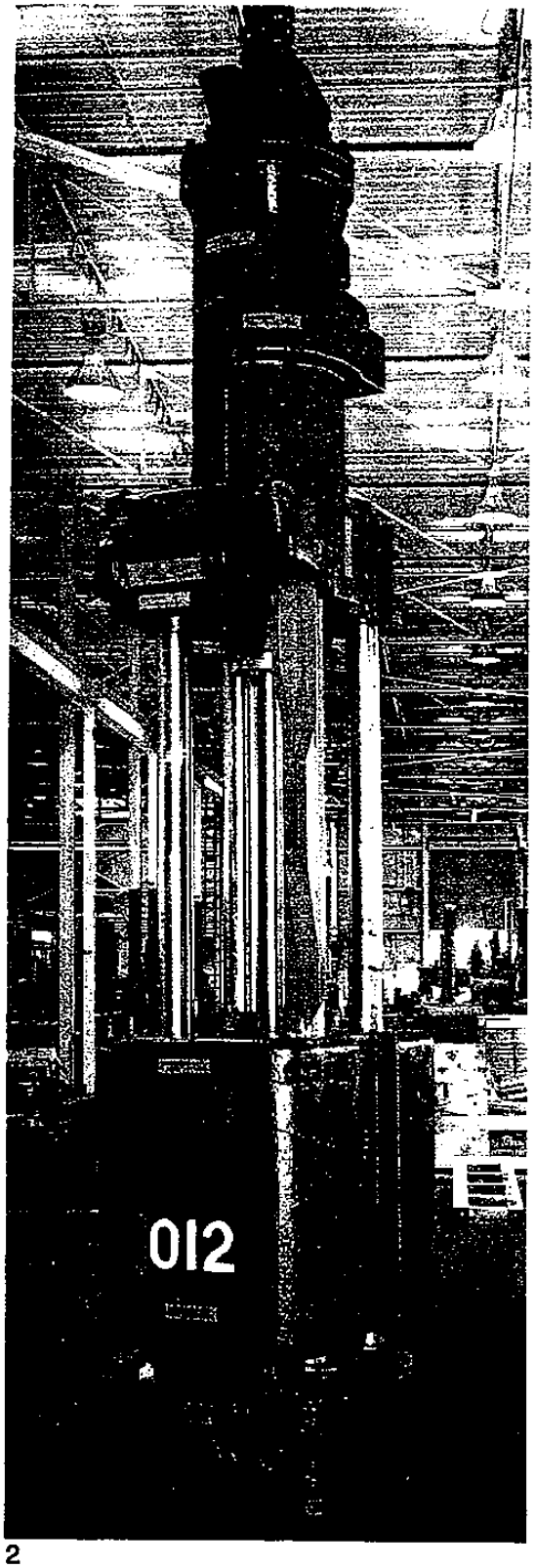


Specifications for Onshore Pile Hammers



2

INTRODUCTION

In 1887 Vulcan Iron Works manufactured and sold the first #1 hammer, the beginning of a long line of single-acting air/steam hammers. A half century later the first differential-acting hammer was produced, thus greatly adding to the versatility and range of the Vulcan open-style hammer line. Today the Vulcan air/steam driven pile hammers represent a century of development, refinement, and improvement while still adhering to the basic concept of a hammer that is simple to operate, service, and use, and that is basically free of persistent breakdown thus avoiding expensive and embarrassing delays. The result of all this is the long standing reputation of the Vulcan air/steam hammer for reliability and pile driving capability. In addition to the characteristics of the hammer itself, the owner is backed by a system of stocking and servicing dealerships to meet the needs of the contractor whenever and wherever needed.

There are basically two types of Vulcan air/steam hammers which are as follows:

1) Single Acting Hammers: These rely on gravity acting on the striking weight through a distance to achieve their striking energy. These are by far the more commonly used type of hammer. There are sixteen sizes available, from the original #1 with a rated striking energy of 15,000 ft-lbs (20.3kJ) to the 530 pile hammer which has a rated striking energy of 150,000 ft-lbs (203.4).

2) Differential Acting Hammers: These hammers use the steam or air pressure acting on the piston in addition to gravity to achieve their striking energy. Their striking energy is given by the formula:

$$E_r=(W_s + A_{sp}p_i)s$$

where E_r= rated striking energy, ft-lbs
W_s= weight of striking parts, lbs
A_{sp}= area of small piston, sq. in.
P_i= rated operating pressure at the hammer, psi
s= hammer stroke, ft.

These are available on special order; consult the factory for specifications.

Pile ranging up to 34" (864mm) diameter may be driven within the limits of the series of air/steam hammers. The specifications showing this and other data are given on pages 4 and 5. The operating principles of the hammers are shown on the opposite page. Special features of the hammers, including the new cable tie feature which allows the advantage of eliminating column keys without changing leaders, are shown on page 6. The complete set of driving accessories for the hammers, essential to any pile driving operation, are shown on page 7.

WARRANTY

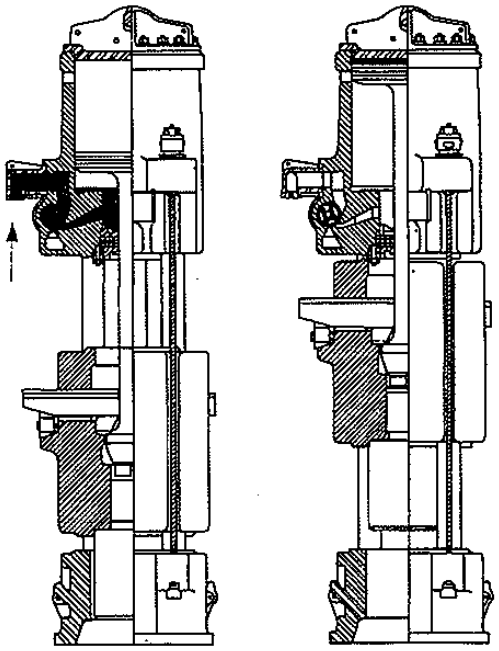
Vulcan Iron Works Inc. warrants these products to be in accordance with our published specifications or those specifications agreed to by Vulcan in writing at the time of the sale. Vulcan makes no other warranty, express or implied. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR ANY PARTICULAR PURPOSE ARE EXCLUDED FROM THIS WARRANTY. Our obligation and liability under this warranty is expressly limited to repairing or replacing, at Vulcan's option, any product which fails to meet these specifications within 180 days from date of initial use, but not to exceed one year from date of delivery. This remedy is exclusive and Vulcan's obligation does not include any transportation charges or costs of installation or any liability from direct, indirect or consequential damage or delay. If requested by Vulcan, products or parts for which a warranty claim is made are to be returned transportation prepaid to Vulcan. Any improper use, operation beyond rated capacity as stated in the written specifications, substitution of parts not approved by Vulcan in writing, or any alteration or repair by anyone other than a duly authorized representative of Vulcan shall void this warranty.

OPERATION

SINGLE ACTING HAMMERS

The cycle begins at impact. The valve is rotated in such a way as to admit steam or air into the cylinder below the piston. This raises the ram, the ram upwardly accelerating as shown in view 1. This continues until the exhaust wedge on the slide bar actuates the trip and rotates the valve to close off the steam or air inlet and open the area of the cylinder below the piston to the atmosphere where the compressed air or steam is exhausted. The ram continues a free rise upward, decelerating with gravity until the top of the piston passes the relief ports and closes in the dashpot at the top of the cylinder. This trapped air, shown in view 2, compresses and brings the rising ram to a halt. The ram then makes a free drop to impact. Shortly before impact the intake wedge rotates the valve to admit steam or air to the cylinder and the cycle starts once again.

For strokes less than full, the Vari-Cycle is used. This provides an additional exhaust wedge and trip shifting so that the distance the ram accelerates upward is shorter and thus the stroke as well. In most cases the use of a shorter stroke will eliminate the dashpot compression and the ram simply comes to rest in gravity.

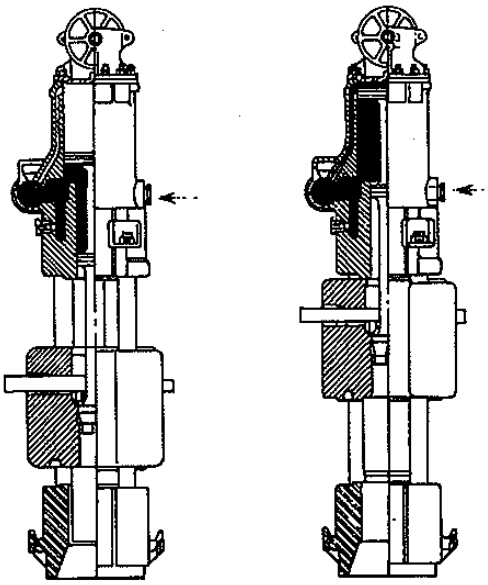


1 2

DIFFERENTIAL ACTING HAMMERS

The cycle begins at impact, the valve rotated so that the area above the large piston is open to the atmosphere and exhausting the compressed air or steam from the previous stroke, as shown in view 3. The area in the cylinder between the large and small pistons is always pressurized, and, as in the beginning of the cycle, when there is only atmospheric pressure on the top of the large piston, this creates an unbalanced force on the piston and the ram accelerates upward. As the ram moves upward the intake wedge actuates the trip, rotating the valve and admitting steam to the cylinder above the large piston as shown in view 4. This produces an unbalanced force downward on the ram, bringing the ram to a halt at the top of the stroke. The ram is then forced downward, gaining kinetic energy both from gravity and the downward acting steam or air force, to impact. Just before impact the exhaust wedge rotates the valve once again to exhaust the compressed air or steam above the large piston and the cycle starts once again.

For shorter strokes and lesser striking energies one need only reduce the pressure on the hammer. For the relation between lower operating pressure and reduced striking energy please consult your nearest Vulcan representative.



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3

SPECIFICATIONS

OPERATING DATA	1	06	505	08	506	010
Rated Striking Energy, ft.-lbs.	15,000	19,500	25,000	26,000	32,500	32,500
kJ	20.3	26.4	33.9	35.3	44.1	44.1
Blows per Minute-Normal Stroke, No Set	60	60	46	50	46	50
Nominal Stroke, in.	36	36	60	39	60	39
mm	914	914	1524	991	1524	991
Rated Operating Pressure at Hammer, psi	80	100	100	83	120	105
bar	5.52	6.89	6.89	5.72	8.27	7.24
Steam Consumption, lb/hr	2,794	3,230	3,176	4,158	3,843	5,022
Kg/hr	1,267	1,465	1,441	1,886	1,743	2,278
Required Boiler Horsepower	81	94	92	125	112	150
Air Consumption (Adiabatic), cfm	565	625	563	880	744	1,002
m^3/min	16.0	17.7	15.9	24.9	21.06	28.4
Required Air Compressor Size, cfm	600	750	600	900	900	1,050
m^3/min	17.0	21.2	17.0	25.5	25.5	28.4
DIMENSIONAL DATA						
Bore, in.	13.5	13.5	13.5	16.5	13.5	16.5
mm	343	343	343	419	343	419
Net Area of Piston, sq. in.	133.51	133.51	133.51	197.92	133.51	197.92
cm^2	861.4	861.4	861.4	1276.9	861.4	1276.9
Length of Hammer (overall), ft.-in.	12'-9"	12'-9"	17'-5"	14'-10"	17'-5"	15'-7"
m	3.88	3.88	5.31	4.52	5.31	4.75
Distance Across Female Jaws, in.	20	20	20	26	20	26
mm	508	508	508	660	508	660
Width of Female Jaws, in.	8¼	8¼	8¼	9¼	8¼	9¼
mm	210	210	210	235	210	235
Largest Outside Diameter of Pile, in. (Permitted by Standard Jaws)	18	18	18	24	18	24
mm	457	457	457	610	457	610
Size of Hose, in.	2	2	2	2½	2	2½
mm	51	51	51	64	51	64
WEIGHT DATA						
Weight of Striking Parts, lb.	5,000	6,500	5,000	8,000	6,500	10,000
Kg.	2,268	2,948	2,268	3,629	2,948	4,536
Net Weight of Hammer, lb.	9,700	11,200	11,800	16,750	13,025	18,750
Kg.	4,400	5,080	5,352	7,598	5,908	8,505
Shipping Weight of Hammer, lb.	10,100	12,100	12,700	17,500	14,000	19,500
Kg.	4,581	5,488	5,761	7,938	6,350	8,845

4

HAMMER SIZE

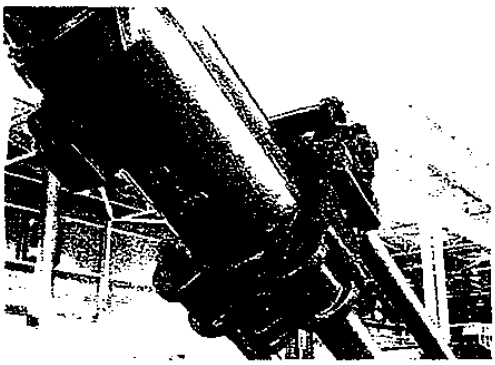
012	508	014	016	510	512	320	330	520	530
39,000 52.9	40,000 54.2	42,000 57.6	48,750 66.1	50,000 67.8	60,000 81.3	60,000 81.3	90,000 122.0	100,000 135.6	150,000 203.4
50	41	59	58	41	41	55	54	42	42
39 991	60 1524	36 914	36 914	60 1524	60 1524	36 914	36 914	60 1524	60 1524
125 8.62	65 4.48	110 7.58	120 8.27	83 5.72	100 6.89	102 7.04	150 10.34	102 7.04	150 10.34
5,835 2,647	4,542 2,060	6,111 2,772	6,814 3,091	5,480 2,486	5,940 2,694	6,200 2,812	8,280 3,756	7,160 3,248	8,680 4,391
175	150	200	210	160	200	200	250	250	300
1,075 30.4	818 23.2	1,161 32.9	1,275 36.1	932 26.4	1,094 31.0	1,432 35.3	1,795 50.8	1,652 46.8	2,076 58.8
1,200 34.0	900 25.5	1,300 36.8	1,300 36.8	1,050 29.7	1,200 34.0	1,600 45.3	2,000 56.6	2,000 56.6	2,400 68.0
16.5 419	16.5 419	19 483	19 483	16.5 419	16.5 419	21.75 552	21.75 552	21.75 552	21.75 552
197.92 1276.9	197.92 1276.9	255.26 1646.8	255.26 1646.8	197.92 1276.9	197.92 1276.9	335.75 2166.1	335.75 2166.1	335.75 2166.1	335.75 2166.1
15'-7" 4.75	18'-5" 5.61	13'-11" 4.24	13'-11" 4.24	18'-5" 5.61	18'-5" 5.61	17'-5½" 5.32	17'-5½" 5.32	21'-6" 6.55	21'-5½" 6.54
26 660	26 660	32 813	32 813	26 660	26 660	37 940	37 940	37 940	37 940
9¼ 235	9¼ 235	11¼ 286	11¼ 286	9¼ 235	9¼ 235	11¼ 286	11¼ 286	11¼ 286	11¼ 286
24 610	24 610	29 737	29 737	24 610	24 610	34 864	34 864	34 864	34 864
2½ 64	2½ 64	3 76	3 76	2½ 64	2½ 64	3 76.2	3 76.2	3 76.2	3 76.3
12,000 5,443	8,000 3,629	14,000 6,350	16,250 7,371	10,000 4,536	12,000 5,433	20,000 9,072	30,000 13,608	20,000 9,072	30,000 13,608
20,750 4,412	19,480 8,836	27,500 12,474	30,250 13,721	21,480 9,743	23,480 10,650	43,500 19,732	53,500 24,268	45,160 20,485	55,160 25,021
21,500 9,752	20,230 9,176	28,250 13,041	32,000 14,515	22,230 10,083	24,230 10,991	44,900 20,367	55,000 24,948	45,560 21,120	56,660 25,701

5

FEATURES

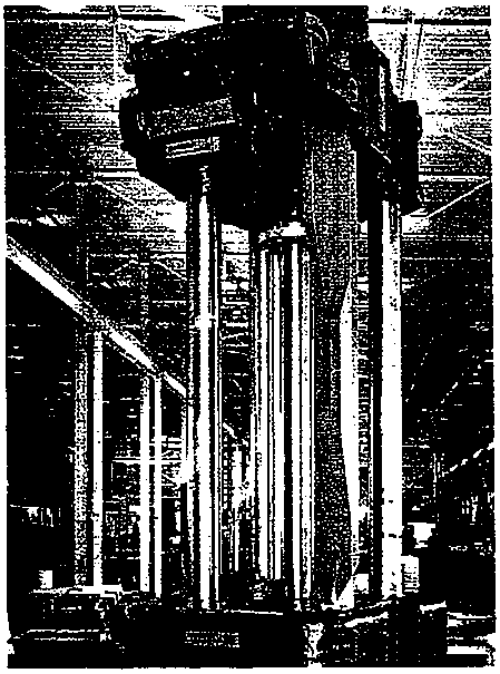
VARI-CYCLE (Single-Acting Hammers only)
As described previously (see "Operation") the Vari-Cycle provides an additional exhaust wedge and movable trip to give the user another available striking energy less than the full one. This trip is shifted from one wedge to another by means of a simple air cylinder attached to the main hammer cylinder. The availability of this lesser energy is almost essential when driving pile through soil where the resistance increases with the driven depth, which is generally the case. Any energy from one-third to full rated striking energy is available.

From all this the Vari-Cycle affords the contractor with a simple and reliable way of varying the energy of the hammer during driving.



CABLE TIES (All hammers)
All Vulcan onshore air/steam hammers are now furnished with cable ties to hold the cylinder, base, and columns together. These replace the column keys and as such they represent a major benefit to the contractor in terms of reduced maintenance. The cables are threaded through the columns and clamp the hammer together through the use of fittings, the cylinder end having a threaded fitting with a cable nut for simple tightening.

In the past adding cable ties has meant the necessity of widening the jaws on the hammer to accommodate them. With the Vulcan configuration this is eliminated and the hammer maintains its same clearance and leader configuration for both cable and keyed type hammers. The Vulcan design affords the best convenience and durability.



NYLON SLIDE BARS (All hammers)
An outgrowth from marine hammers, the nylon slide bar is now the standard slide bar for all Vulcan pile hammers. Made in one piece from a tough nylon, the slide bars are flexible to withstand whip, eliminate weld breakage, and afford the trip a more frictionless surface to slide on. In addition to being standard on new Vulcan hammers, the nylon slide bars may be used on used ones as well provided that the dovetail has been built up to its original configuration.

ACCESSORIES

Vulcan manufacturers a complete line of accessories to adapt its hammers to the driving of all normally used types of piling. The maximum size of pile that any given size of hammer is capable of driving is shown in the specifications of each hammer. Vulcan configures its accessories in such a way that all hammers with a common standard jaw size use the same accessory for a given pile. This adds to the versatility of Vulcan accessories and pile hammers alike.

Shown below are some of the type of accessories Vulcan manufactures for the different type pile:

(1) Pipe Caps: These are normally supplied with three steps, although more can be added or deleted upon request. They may be ordered without or with jaws, although in ordering any pipe cap it is necessary to specify the outside diameter and wall thickness of the pipe being driven.
(2) H-Beam Helmets: These are configured for all types of H-Beams supplied. In addition to the above with islands a flat face helmet is also supplied for greater versatility.
(3) Concrete Pile Driving Heads: These are sized for all sizes of standard concrete pile, whether square, round, or octagonal. The deep well in these accessories is to accommodate the pile cushion necessary to prevent spalling when driving concrete pile. If there is protruding reinforcing bar coming out of the top of the pile a pedestal driving head may be ordered, which makes from between the hammer and the pile for the re-bar.
(4) Wood Pile Driving Heads: These make the driving of wood pile as simple as that of concrete (without the pile cushion), eliminating McDermid bases and dished caps.
(5) Sheet Pile Helmets: These are available for all configurations of American and other sheet piling.

CUSHION MATERIAL
All Vulcan accessories are supplied with a well for cushion material. This is essential to avoid both hammer and pile damage, and moreover is now frequently used to improve the drivability of the pile by changing out cushion materials. There are two configurations of these wells which are as follows:

(A) Integral Ring and Pot: This is the preferred configuration, usable with the softer cushion materials.

(B) Capblock Follower w/Matching Accessory: This is used with harder cushion materials such as the Micarta & aluminum cushion combination.

> Vulcan does not market or recommend any specific cushion material. However most hammer breakages can be attributed to cushion material that is either too hard to begin with or has been allowed to compact excessively thus making it that way.

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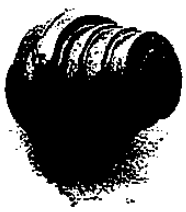

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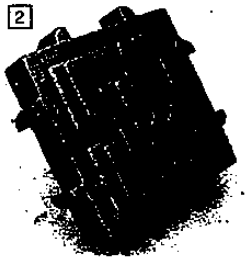

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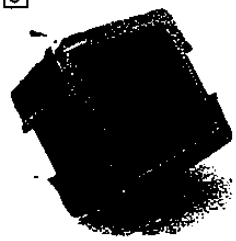

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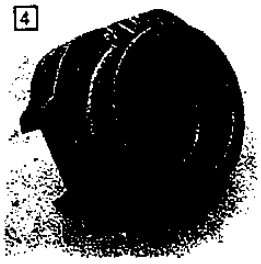

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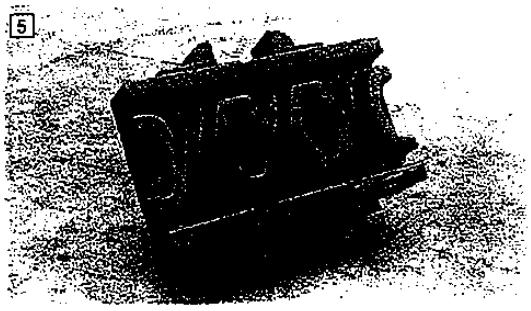

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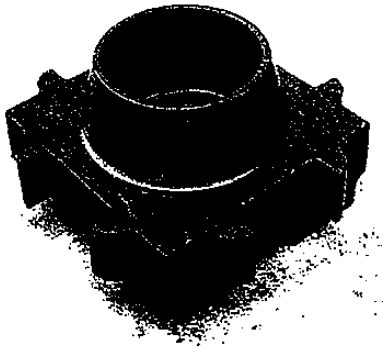

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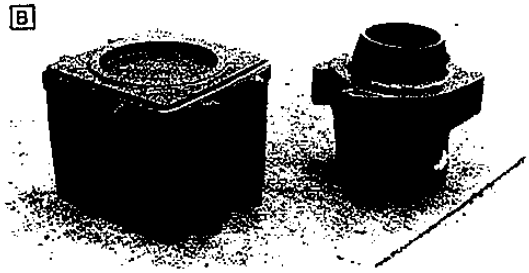

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VULCAN AIR/STEAM HAMMERS

$P = \frac{2WH}{S + 0.1}$ REFUSAL SHALL BE BETWEEN 150 - 180 TONS

MODEL #	1	06	505	08	508	010	012
Wt. of RAM	5000	6500	5000	8000	8500	10000	12000
AVG. HT. OF FALL	3	3	5	3.25	5	3.25	3.25
BLOWS PER FOOT	BEARING IN TONS						
4	5	6	8	8	10	10	13
8	9	12	16	16	20	20	24
12	14	18	23	24	30	30	35
16	18	23	29	31	38	38	46
20	21	28	36	37	46	46	56
24	25	33	42	43	54	54	65
28	28	37	47	49	61	61	74
32	32	41	53	55	68	68	82
36	35	45	58	60	75	75	90
40	38	49	63	65	81	81	98
44	40	52	67	70	87	87	105
48	43	56	71	74	93	93	111
52	45	59	76	79	98	98	118
56	48	62	80	83	103	103	124
60	50	65	83	87	108	108	130
64	52	68	87	90	113	113	136
68	54	71	90	94	118	118	141
72	56	73	94	98	122	122	146
76	58	76	97	101	126	126	151
80	60	78	100	104	130	130	156
84	62	80	103	107	134	134	161
88	63	83	106	110	138	138	165
92	65	85	108	113	141	141	169
96	67	87	111	116	144	144	173
100	68	89	114	118	148	148	177
104	70	91	116	121	151	151	181
108	71	92	118	123	154	154	185
110	72	93	120	124	155	155	187
120	75	98	125	130	163	163	195
130	78	101	130	135	169	169	203
140	81	105	135	140	175	175	210
150	83	108	139	144	181	181	217
160	86	111	143	149	186	186	223
170	88	114	147	152	191	191	229
180	90	117	150	156	195	195	234
190	92	120	153	159	199	199	239
200	94	122	156	163	203	203	244
225	98	127	163	170	212	212	254
250	101	132	169	176	220	220	264
275	104	136	174	181	226	226	272
300	107	139	179	186	232	232	279
325	110	142	183	190	237	237	285
350	112	145	186	194	242	242	290
375	114	148	189	197	246	246	295
400	115	150	192	200	250	250	300
425	117	152	195	203	253	253	304
450	118	154	197	205	257	257	308
475	120	156	200	208	259	259	311
500	121	157	202	210	262	262	315
525	122	159	203	212	265	265	317

VULCAN AIR/STEAM HAMMERS							
	$P = \frac{2WH}{S + 0.1}$ REFUSAL SHALL BE BETWEEN 150 - 180 TONS						
MODEL #	508	014	016	510	512	320	330
Wt. of RAM	8000	14000	16250	10000	12000	20000	30000
AVG. HT. OF FALL	5	3	3	5	5	3	3
BLOWS PER FOOT	BEARING IN TONS						
4	13	14	16	16	19	19	29
8	25	26	30	31	38	38	58
12	36	38	44	45	55	55	82
16	47	49	57	59	71	71	106
20	57	60	70	71	86	86	129
24	67	70	81	83	100	100	150
28	76	79	92	95	114	114	170
32	84	88	103	105	126	126	189
36	92	97	113	115	138	138	208
40	100	105	122	125	150	150	225
44	107	113	131	134	161	161	241
48	114	120	139	143	171	171	257
52	121	127	147	151	181	181	272
56	127	134	155	159	191	191	286
60	133	140	163	167	200	200	300
64	139	146	170	174	209	209	313
68	145	152	176	181	217	217	326
72	150	158	183	188	225	225	338
76	155	163	189	194	233	233	349
80	160	168	195	200	240	240	360
84	165	173	201	206	247	247	371
88	169	178	206	212	254	254	381
92	174	182	212	217	260	260	391
96	178	187	217	222	267	267	400
100	182	191	222	227	273	273	409
104	186	195	226	232	279	279	418
108	189	199	231	237	284	284	426
110	191	201	233	239	287	287	430
120	200	210	244	250	300	300	450
130	208	218	254	260	312	312	468
140	215	226	263	269	323	323	485
150	222	233	271	278	333	333	500
160	229	240	279	286	343	343	514
170	234	246	286	293	352	352	528
180	240	252	293	300	360	360	540
190	245	257	299	306	368	368	552
200	250	263	305	313	375	375	563
225	261	274	318	326	391	391	587
250	270	284	329	338	405	405	608
275	278	292	339	348	418	418	627
300	286	300	348	357	429	429	643
325	292	307	356	365	438	438	657
350	298	313	363	372	447	447	670
375	303	318	369	379	455	455	682
400	308	323	375	385	462	462	692
425	312	328	380	390	468	468	702
450	316	332	385	395	474	474	711
475	319	335	389	399	479	479	718
500	323	339	393	403	484	484	726
525	326	342	397	407	488	488	733

VULCAN AIR/STEAM HAMMERS

	P = 2WH / S + 0.1 REFUSAL SHALL BE BETWEEN 150 - 180 TONS						
MODEL #	1	08	505	08	508	010	012
Wt. of RAM	5000	6500	5000	8000	6500	10000	12000
	AVERAGE HEIGHT OF FALL (FT.)						
PENETRATION IN 10 BLOWS (INCHES)	3	3	5	3.25	5	3.25	3.25
	BEARING IN TONS						
2 1/2	43	56	71	74	93	93	111
2 7/16	44	57	73	76	95	95	113
2 3/8	44	58	74	77	96	96	116
2 5/16	45	59	75	78	98	98	118
2 1/4	46	60	77	80	100	100	120
2 3/16	47	61	78	82	102	102	122
2 1/8	48	62	80	83	104	104	125
2 1/16	49	64	82	85	106	106	127
2	50	65	83	87	108	108	130
1 15/16	51	66	85	89	111	111	133
1 7/8	52	68	87	90	113	113	136
1 13/16	53	69	89	92	116	116	139
1 3/4	55	71	91	95	118	118	142
1 11/16	56	73	93	97	121	121	145
1 5/8	57	74	95	99	124	124	149
1 9/16	59	76	98	101	127	127	152
1 1/2	60	78	100	104	130	130	156
1 7/16	62	80	103	107	133	133	160
1 3/8	63	82	105	109	137	137	164
1 5/16	65	84	108	112	141	141	169
1 1/4	67	87	111	116	144	144	173
1 3/16	69	89	114	119	149	149	178
1 1/8	71	92	118	122	153	153	184
1 1/16	73	95	121	126	158	158	189
1	75	98	125	130	163	163	195
15/16	77	101	129	134	168	168	201
7/8	80	104	133	139	173	173	208
13/16	83	108	138	143	179	179	215
3/4	86	111	143	149	186	186	223
11/16	89	116	148	154	193	193	231
5/8	92	120	154	160	200	200	240
9/16	96	125	160	166	208	208	250
1/2	100	130	167	173	217	217	260
7/16	104	136	174	181	226	226	271
3/8	109	142	182	189	236	236	284
5/16	114	149	190	198	248	248	297
1/4	120	156	200	208	260	260	312
3/16	126	164	211	219	274	274	328
1/8	133	173	222	231	289	289	347
1/16	141	184	235	245	306	306	367
0	150	195	250	260	325	325	390

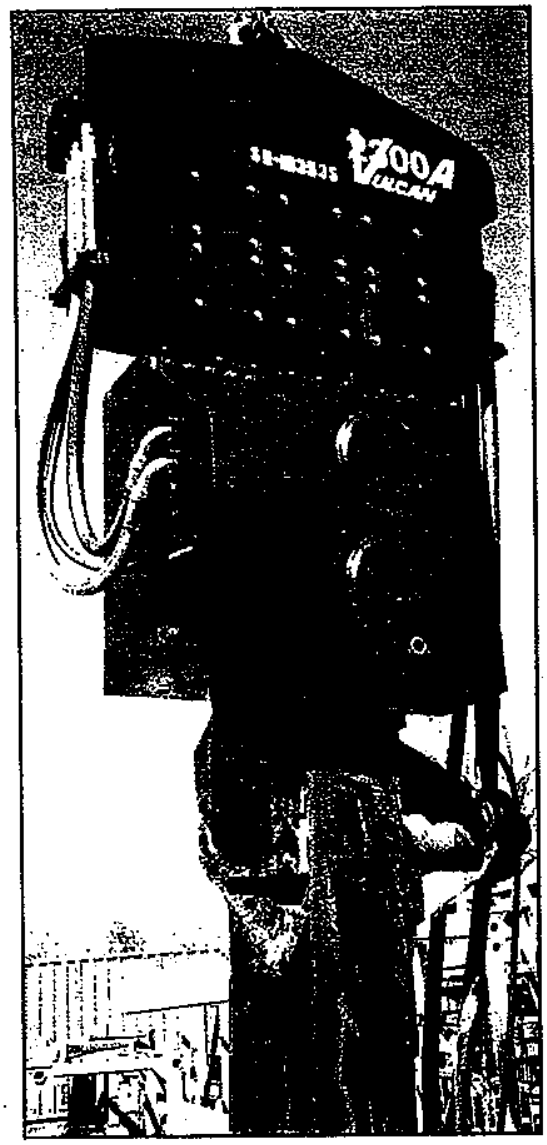
VULCAN AIR/STEAM DIESEL HAMMERS

$P = \frac{2WH}{S + 0.1}$ WEIGHT OF RAM = REFUSAL SHALL BE BETWEEN 150 - 180 TONS

MODEL #	508	014	016	510	512	320	330
Wt. of RAM	8000	14000	16250	10000	12000	20000	30000
	AVERAGE HEIGHT OF FALL (FT.)						
PENETRATION IN 10 BLOWS (INCHES)	5	3	3	5	5	3	5
	BEARING IN TONS						
2 1/2	114	120	139	143	171	171	429
2 7/16	116	122	142	145	175	175	436
2 3/8	119	124	144	148	178	178	444
2 5/16	121	127	147	151	181	181	453
2 1/4	123	129	150	154	185	185	462
2 3/16	125	132	153	157	188	188	471
2 1/8	128	134	156	160	192	192	480
2 1/16	131	137	159	163	196	196	490
2	133	140	163	167	200	200	500
1 15/16	136	143	166	170	204	204	511
1 7/8	139	146	170	174	209	209	522
1 13/16	142	149	173	178	213	213	533
1 3/4	145	153	177	182	218	218	545
1 11/16	149	156	181	186	223	223	558
1 5/8	152	160	186	190	229	229	571
1 9/16	156	164	190	195	234	234	585
1 1/2	160	168	195	200	240	240	600
1 7/16	164	172	200	205	246	246	615
1 3/8	168	177	205	211	253	253	632
1 5/16	173	182	211	216	259	259	649
1 1/4	178	187	217	222	267	267	667
1 3/16	183	192	223	229	274	274	686
1 1/8	188	198	229	235	282	282	706
1 1/16	194	204	236	242	291	291	727
1	200	210	244	250	300	300	750
15/16	206	217	252	258	310	310	774
7/8	213	224	260	267	320	320	800
13/16	221	232	269	276	331	331	828
3/4	229	240	279	286	343	343	857
11/16	237	249	289	296	356	356	889
5/8	246	258	300	308	369	369	923
9/16	256	269	312	320	384	384	960
1/2	267	280	325	333	400	400	1000
7/16	278	292	339	348	417	417	1043
3/8	291	305	355	364	436	436	1091
5/16	305	320	371	381	457	457	1143
1/4	320	336	390	400	480	480	1200
3/16	337	354	411	421	505	505	1263
1/8	356	373	433	444	533	533	1333
1/16	376	395	459	471	565	565	1412
0	400	420	488	500	600	600	1500

Since 1852

VULCAN IRON WORKS INC.



Specifications for Vibratory Pile Drivers/Extractors
Sizes 1150A, 2300A and 4600A

OVERVIEW OF FEATURES

Vulcan vibratory hammers continue a long tradition of simple but effective equipment to vibrate piling into the ground. (For an explanation of the operating principle, see back cover.) There are two main components of a Vulcan vibratory hammer system: the exciter, which produces the actual vibrating force, and the power pack, which provides the energy for the motor(s). on the hammer to turn the eccentrics. Both of these components are designed with a wide variety of features to make pile driving more productive for the customer; some of these are as follows:

Exciter

Simple gear and eccentric design includes teeth designed for quiet and reliable operation, additional lubrication of the bearings by the eccentrics, and easy replacement of individual components without having to replace entire assemblies of parts.

Suspension uses reliable and proven rubber springs for isolation of vibrations from the crane. Bias weight mounting is easy and unobtrusive. Crane connection through an anchor shackle which is both strong and replaceable if necessary.

Hoses are reduced to a minimum but are positioned for easy access if repair should be required.

Clamp is designed with integral cylinder for reliable operation and safety check valve in case of clamp hose cut (see back cover for other accessory information).

Power Pack

Hydraulic circuit design is simple and modern to reduce failure possibilities. Open loop hydraulics are simple to operate and service. Power packs are designed for maximum interchangeability and consistency of components.

Detroit Diesel engines are standard to provide for reliable operation and economical servicing. Pump and engine are matched so to eliminate gearbox pump drive and thus eliminate unnecessary power losses.

Controls are electric with remote control pendant connected to the power pack with a 30' (9140mm) long cord which is detachable at both ends for easy replacement. Power pack can be run from either the pendant or from the power pack itself. Like the hydraulics, the electric circuit design is simple for reliable operation and ready servicing.

ACCESSORIES AND SUPPORT

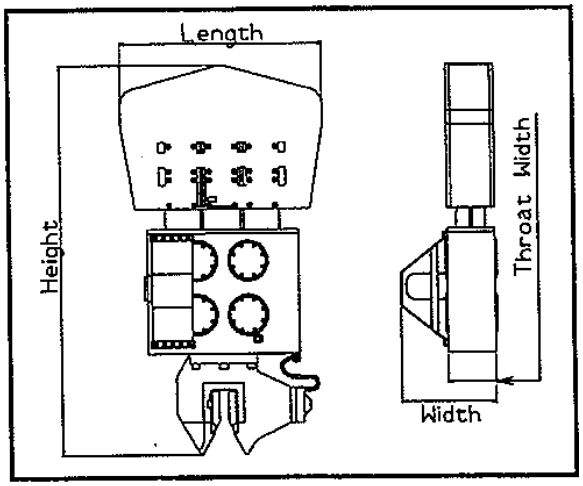
Vulcan produces a variety of accessories for its vibratory pile driving equipment. Some of these are as follows:

Sheeting Clamps: Vulcan produces two sizes of sheeting clamps; the 7" clamp, which is primarily for the 1150A and 2300A, and the 10" clamp, which is for the 4600A. The size refers to the bore of the clamp cylinder. Both of these clamps are simple and light weight for maximum performance. Sheeting clamps are also used with H-Beams as well as sheet piles, and a variety of jaws can be furnished for special applications.

Caisson Beams and Clamps: Vulcan manufactures caisson beams for the installation of caissons, along with a clamp that is both simple and reliable. The clamps can be moved and locked onto the beams and are infinitely adjustable for the various sizes of caissons. The beams are rugged and rigid to prevent breakage and excessive flexing.

Wood Clamps: We can furnish clamps for wood pile driving and extracting.

Field Service and Parts -- Vulcan maintains a qualified field service staff for worldwide service and support of Vulcan pile driving equipment. Vulcan also maintains a large inventory of spare parts for all vibratory hammers.



SPECIFICATIONS

		Hammer Size		
		1150A	2300A	4600A
Exciter				
Dynamic Force	U.S. Tons	41.8	83.6	167.2
	kN	*371.9*	*743.7*	*1487.5*
Frequency	RPM	1200-1600	1200-1600	1200-1600
	Hz	*20-26.7*	*20-26.7*	*20-26.7*
Sheeting Clamp Bore	in.	7	7	10
	mm	*178*	*178*	*254*
Maximum Clamp Pressure	psi	2500	5000	4500
	bar	*172*	*345*	*310*
Clamp Force	U.S. Tons	48	87	177
	kN	*427*	*774*	*1575*
Maximum Crane Pull	U.S. Tons	32	48	80
	kN	*285*	*427*	*712*
Dynamic Weight (w/o clamp)	lbs.	2950	4200	6400
	kg.	*1338*	*1905*	*2903*
Sheeting Clamp Weight	lbs.	1350	1350	3000
	kg.	*612*	*612*	*1361*
Static Weight	lbs.	2000	3000	5600
	kg.	*907*	*1361*	*2540*
Free Hanging Amplitude	in.	1/2"-3/4"	3/4"-1 1/8"	1"-1 3/8"
	mm	*13-19*	*19-29*	*25-35*
Total Suspended Weight	lbs.	6300	8550	16000
	kg.	*2858*	*3878*	*7257*
Length (see left)	in.	60	60	87
	mm	*1524*	*1524*	*2210*
Width (see left)	in.	24 1/2	28	28
	mm	*622*	*711*	*711*
Throat Width (see left)	in.	14	14	14
	mm	*356*	*356*	*356*
Height (see left)	in.	95	115½	134
	mm	*2413*	*2994*	*3404*
Power Pack				
Engine		Detroit Diesel 4-71N	Detroit Diesel 6V92-T	Detroit Diesel 12V-92TA
Maximum Engine Power	HP	155	305	625
	kW	*116*	*227*	*466*
Engine Speed @ Max. Power	RPM	2100	2100	2100
Maximum Drive Pressure	psi	2500	5000	5000
	bar	*172*	*345*	*345*
Weight	lbs.	7,500	11,000	16,500
	kg	*3402*	*4990*	*7484*
Length	in.	120	120	186
	mm	*3048*	*3048*	*4724*
Width	in.	72	72	72
	mm	*1829*	*1829*	*1829*
Height	in.	65	69	96
	mm	*1651*	*1753*	*2438*

OPERATING PRINCIPLE

Vulcan vibratory hammers move piling in soil by applying a rapidly alternating force to the pile by rotating eccentric weights about horizontal shafts. Each eccentric produces centrifugal, dynamic force acting in a single plane and directed toward the centerline of the shaft. The weights are mounted on timing gears, off center of the axis of rotation by the eccentric arm. The eccentrics are paired so the horizontal forces cancel each other, leaving us with only vertical force for the pile. For this purpose the Vulcan 1150A has one pair of eccentrics, the 2300A four and the 4600A eight, and all components are identical for maximum parts interchangeability.

Dynamic Force Equation

$$F_{dyn}=(RPM)^2K/70{,}423{,}000$$

where Fdyn = dynamic force of eccentics, U.S. Tons
RPM = eccentric rotation speed, RPM
K = eccentric moment, in-lbs

$$F_{dyn} = (\pi\theta)^2K/250$$

where F_{dyn} = *dynamic force of eccentrics, kN*
θ = *frequency of vibrations, Hz*
K = eccentric moment, kg-m

This force moves the pile up and down; the length of this movement is called the amplitude.

Amplitude Equation

$$A = 2K/W_v$$

where A = Peak-to-Peak Amplitude, in.
W_v=Vibrating Weight, lbs.

$$A = 2K/M_v$$

where *A = Peak-to-peak Amplitude, m*
M_v = *Vibrating Mass, kg*

Once the alternating force is made by the rotating eccentrics, the soil around the pile is weakened and the pile/hammer system pushes itself into the ground by its own weight. This pushing action can be augmented by static bias weights which are mounted on the suspension; these are available from Vulcan.

WARRANTY

Vulcan Iron Works Inc. warrants these products to be in accordance with our published specifications or those specifications agreed to by Vulcan in writing at the time of sale. Vulcan makes no other warranty, express or implied. **THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR ANY PARTICULAR PURPOSE ARE EXCLUDED FROM THIS WARRANTY.** Our obligation and liability under this warranty is expressly limited to repairing or replacing, at Vulcan's option, any product which fails to meet these specifications within ninety (90) days from date of delivery. This remedy is *exclusive* and Vulcan's obligation does not include any transportation charges or cost of installation or any liability from direct, indirect, or consequential damage or delay. If requested by Vulcan, products or parts for which a warranty claim is made are to be returned transportation prepaid to Vulcan. Any improper use, operation beyond rated capacity as stated in the written specifications, substitution of parts not approved by Vulcan in writing, or any alteration or repair by anyone other than a duly authorized representative of Vulcan shall void this warranty.

Since 1852

VULCAN IRON WORKS INC.
2909 Riverside Drive
P.O. Box 5402
Chattanooga, TN 37406 U.S.A.
Telephone (615) 698-1581
Toll Free (800) 742-6637
Facsimile (615) 698-1587

Bulletin 300B -- 9 April, 1992

Specifications subject to change without notice.

Authorized Representative

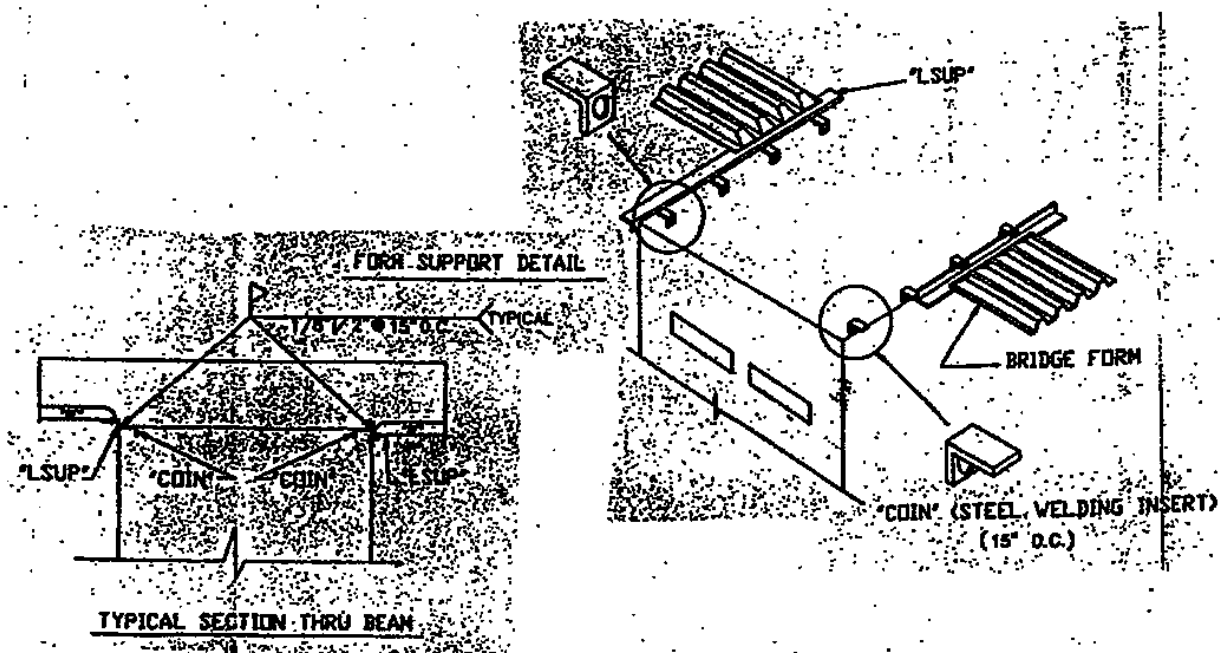
STAY-IN-PLACE METAL FORMS

Take "x-dimensions" as soon as possible. Stay-In-Place forms can not be adjusted. Must be right the first time.

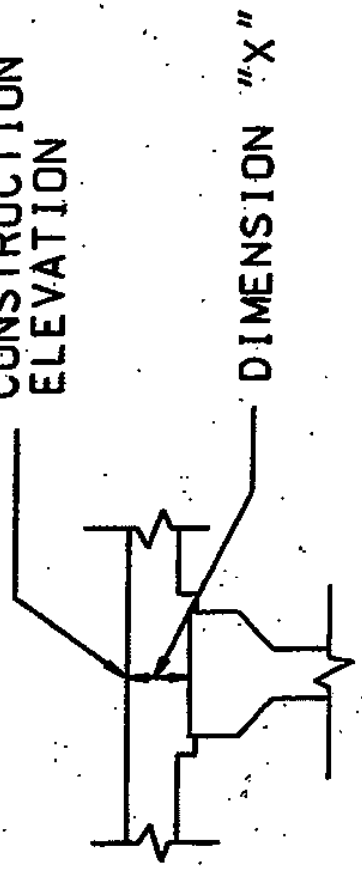
Shop Drawings for SIP Metal Forms no longer need to be approved by the Division of Bridge Design. Forward one copy to C.O. Construction.

Be careful about welds. Make sure the weld does not burn through the support angle.

The support angle can be turned either direction as shown in the drawing. Most shop drawings should show this.



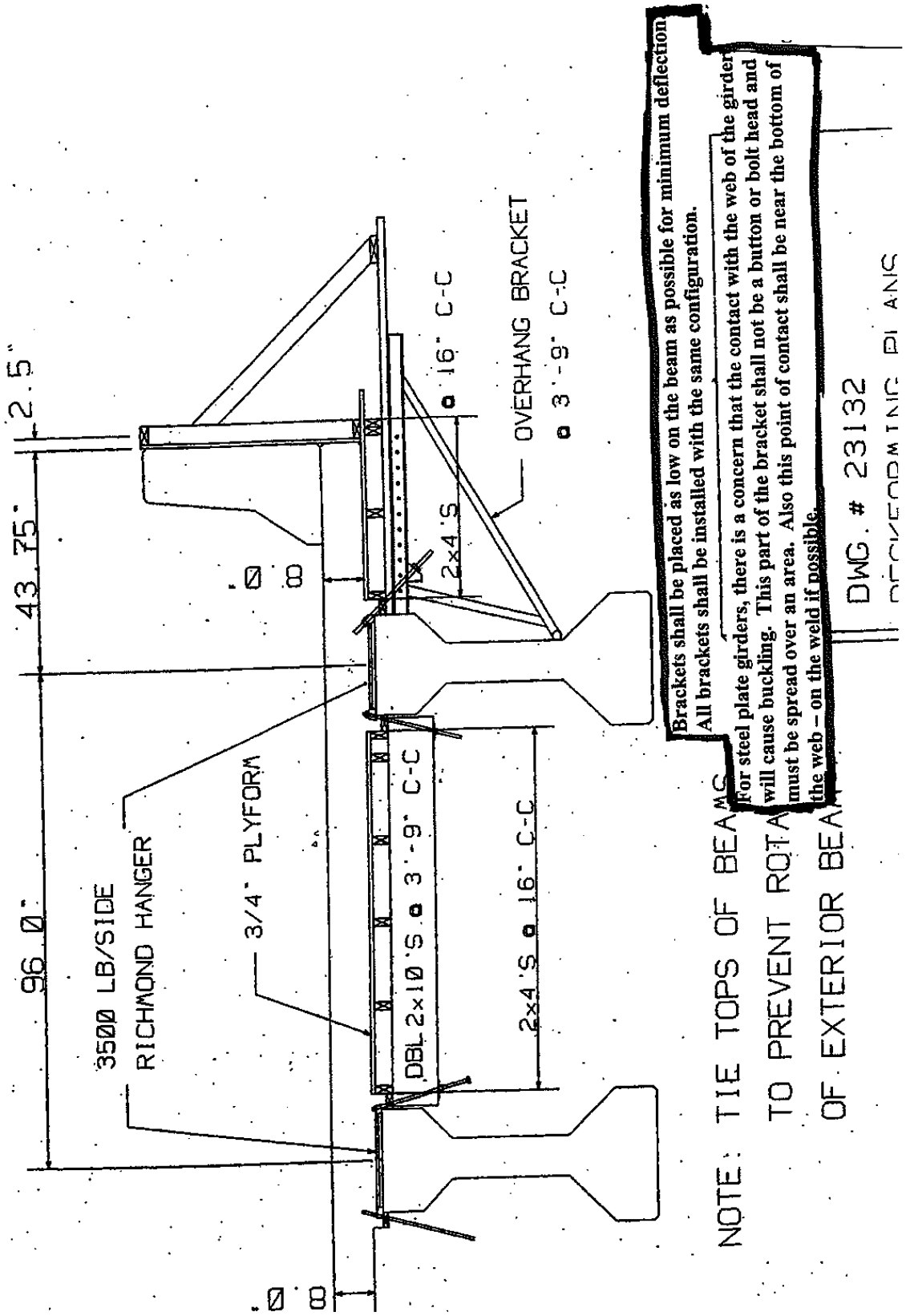
"X" DIMENSIONS



CONTRARY TO NOTES ON PLANS, TAKE "X" DIMENSIONS AS SOON AS POSSIBLE WHEN USING SIP METAL FORMS

LOOK FOR "X" DIMENSIONS BETWEEN 8" AND 10"

EXPECT "X" DIMENSIONS TO BE LESS AT MID-SPAN AND DEEPER CLOSE TO PIERS DUE TO BEAM CAMBER. IF "X" DIMENSION IS DEEPER AT MID-SPAN, NEED TO DOUBLE CHECK PLANS FOR VERTICAL CURVE, SUPER-ELEVATION, ETC.



Brackets shall be placed as low on the beam as possible for minimum deflection. All brackets shall be installed with the same configuration.

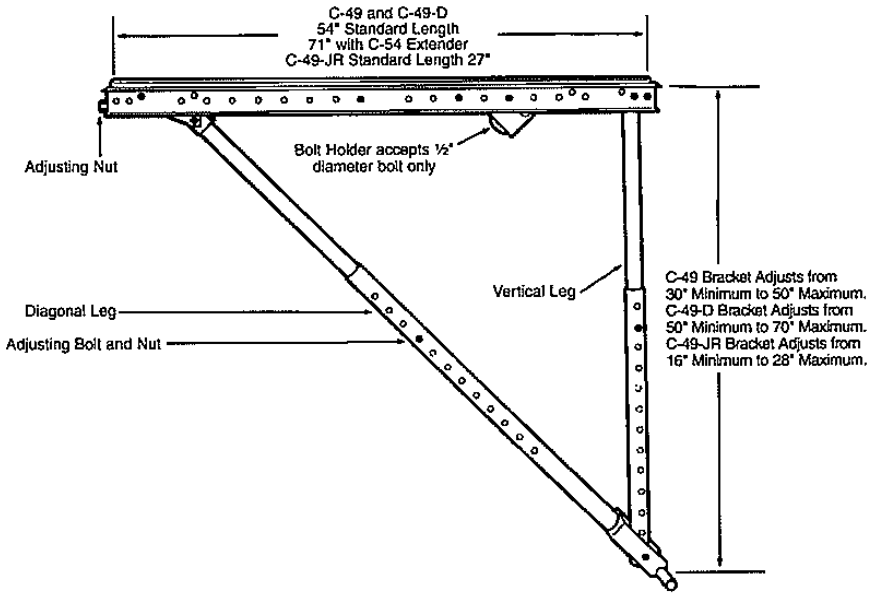
For steel plate girders, there is a concern that the contact with the web of the girder will cause buckling. This part of the bracket shall not be a button or bolt head and must be spread over an area. Also this point of contact shall be near the bottom of the web – on the weld if possible.

```
FD 04-118                                   P.E. 5403
DRAWING NUMBER 23132                        2/15/95
DECK FALSEWORK                              9/16/94 LETTING

BEAM SPACING------ 96 INCHES          CANTILEVER----------- 43.75 INCHES
FLANGE WIDTH------ 20 INCHES          CLEAR CANTILEVER----- 33.75 INCHES
CLEAR DISTANCE---- 76 INCHES          CANTILEVER THICKNESS-- 8 INCHES
SLAB THICKNESS---- 8 INCHES

-------------------------------LOADS---------------------------------

SLAB LOAD-------------- =( 8 /12)(160)= 106.6667 P.S.F.
CANTILEVER SLAB LOAD-- =( 8 /12)(160)= 106.6667 P.S.F.
LIVE LOAD------------- = 50 P.S.F.
SCREED LOAD----------- = 800 LBS.
TWO SPAN CONTINUOUS LOADING FACTOR = 1.25

---------------------CHECK OVERHANG BRACKETS-----------------------

SPACE BRACKETS AT 3.75 FT.
UNIFORM LOAD=(1.25)( 106.6667 + 50 )( 3.75 )( 33.75 /12)= 2065.43 LBS.
     ACTING AT 33.75 /2= 16.875 INCHES FROM EDGE OF FLANGE
SCREED LOAD = 800 LBS.
     ACTING AT 33.75 +2.5 = 36.25 INCHES FROM EDGE OF FLANGE
TOTAL BRACKET LOAD=  2065.43 + 800 = 2865.43 LBS.
     ACTING AT ( 2065.43 X 16.875 + 800 X 36.25 )/ 2865.43 = 22.28431
USE OVERHANG BRACKET WITH A RATED CAPACITY OF 2865.43 LBS. AT 22.28431
IN. FROM EDGE OF BEAM

-----------------------CHECK WALES-------------------------------

USE DBL. 2 X 10 'S AT 3.75 FT.
DESIGN SPAN LENGTH L= 76 IN.
W=(1.25)( 106.6667 + 50 )( 3.75 )/12= 61.19792 LBS./IN.
M=W X L X L /8=( 61.19792 )( 76 )( 76 )/8= 44184.9 IN-LBS
H=.75(W X (L-2D)/2bd => => =>
=> =>H=.75( 61.19792 )( 76 -(2 X 9.25 ))/2( 1.5 )( 9.25 )= 95.10488 PSI
FOR DBL. 2 X 10 'S       ALLOWABLE MOMENT= 68450  IN-LBS
                         ALLOWABLE HORIZ. SHEAR= 125 PSI

----------------------CHECK TIE RODS-----------------------------

IN OVERHANG BRACKETS R= 2865.43 /COS(45)= 4052.942 LBS.
IN WALES R=( 61.19792 )( 76 )/2= 2325.521 LBS.
USE .5 IN. DIAMETER  6000 LB. CAPACITY RODS IN OVERHANG
USE 1/2 IN. DIAMETER 6000 LB. CAPACITY RODS WITH WALES

---------------------CHECK 2 X 4'S-----------------------------

SPAN LENGTH = 41.5 INCHES
IN CANTILEVER USE  16  INCH SPACING
     W=( 16 /12)( 106.6667 + 50 )/12= 17.40741 LBS/IN
     M=( 17.40741 )( 41.5 )( 41.5 )/8= 3747.489 IN-LBS
     H=(.75)( 17.40741 )( 41.5 -(2 x 3.5))/(1.5)(3.5)= 85.79365 PSI
IN BETWEEN BEAMS USE  16 INCH SPACING
     W=( 16 /12)( 106.6667 + 50 )/12= 17.40741 LBS/IN
     M=( 17.40741 )( 41.5 )( 41.5 )/8= 3747.489 IN-LBS
     H=(.75)( 17.40741 )( 41.5 -(2 X 3.5))/(1.5)(3.5)= 85.79365 PSI
FOR 2 X 4 'S             ALLOWABLE MOMENT = 4900 IN-LBS.
                         ALLOWABLE HORIZ. SHEAR = 125 PSI
```

Bridge Overhang Brackets

DAYTON SUPERIOR

C-49, C-49-D and C-49-JR Bridge Overhang Brackets



Features:

Dayton Superior Bridge Overhang Brackets are designed with maximum adjustability to meet the varied overhang forming requirements on structural steel and precast/prestressed concrete beams. The C-49 and C-49-D Bridge Overhang Brackets accommodate an adjustment range of 30" to 70" and can be mounted to steel beams, precast concrete beams and concrete box beams with the appropriate hanger devices. Both of the bracket models can be easily and quickly preset on the ground and then set in place as needed.

The C-49-D Bridge Overhang Bracket has all of the features of the C-49 bracket but has longer vertical and diagonal legs. The longer legs, and resulting increase in adjustment, allow the bracket to be used on deep structural steel beams to position the construction load transfer near the beam's bottom flange.

Various accessories are available for the C-49 and C-49-D brackets. The Extender, Guardrail Receptacles and Wall Plate Assembly all add to the versatility of the Dayton Superior Bridge Overhang Brackets.

The C-49-JR Bridge Overhang Bracket is a small version of the C-49 bracket designed for use on smaller bridge beams. The C-49-JR has all the versatile design features of the bigger C-49 bracket and a vertical adjustment range of 16" to 28".

When requested, the C-49, C-49-D and C-49-JR brackets can both be shipped "knocked down" for ease in handling and shipping. Final assembly can be easily accomplished at the job site during the presetting operation.

Warning: Overhang brackets should be adjusted to proper grade during the normal "dry run" operation. DO NOT attempt an upward adjustment during the concrete pouring operation. Lowering the bracket adjustment is permissible during the concrete pour.

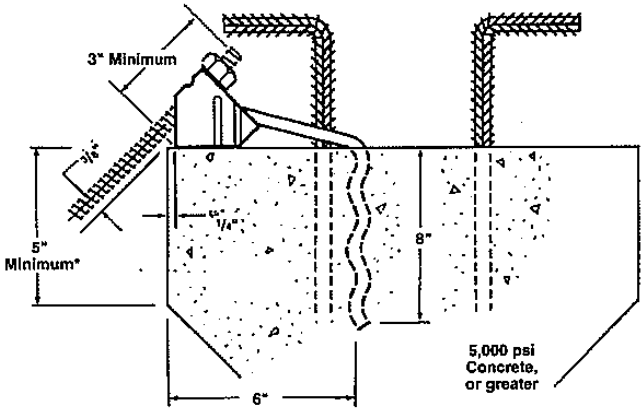
To Order:
Specify: (1) quantity, (2) name.

Example:
60 pcs. C-49 Bridge Overhang Brackets.

Exterior Hangers

DAYTON SUPERIOR

C-24 45° Pres-Steel Precast Half Hanger

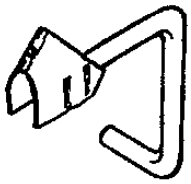


C-24 Type 4-AP

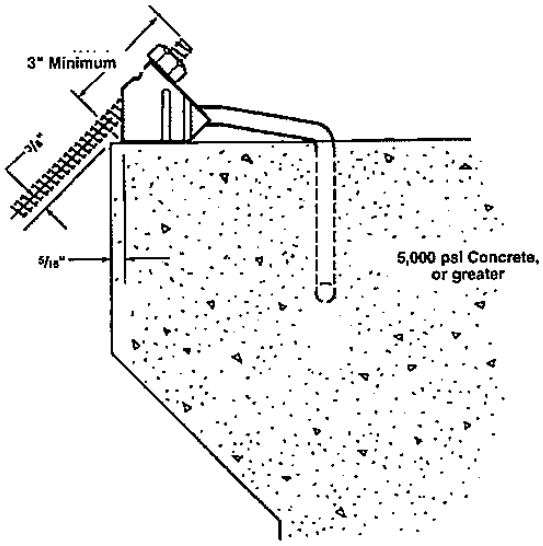
The C-24 45° Pres-Steel Precast Half Hangers are fabricated with a 45° 1/2" end section welded to a shaped strut. These units are designed to be cast into the top of a precast concrete beam and subsequently support the fascia overhang formwork. The C-24 45° precast half hanger is available in two styles.

C-24 45º Pres-Steel Precast Half Hanger		
Hanger Type	Safe Working Load	Bolt Diameter
4-AP	3,300 lbs.	1/2"
4-APR	6,000 lbs.*	1/2"
5-APR	6,000 lbs.*	3/4"

S.W.L. provides a factor of safety of approximately 2 to 1.



C-24 Type 4-APR
and
Type 5-APR



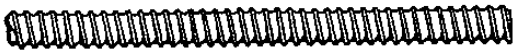
C-24 Type 4-APR
and
Type 5-APR

To Order:
Specify: (1) quantity, (2) name, (3) type.
Example:
400 C-24 45° Pres-Steel Precast Half Hanger, Type 4-APR.

Working Parts

DAYTON SUPERIOR

B-12 Continuous Coil Threaded Rod



The B-12 Continuous Coil Threaded Rod is manufactured from high strength steel and is available in precut lengths or in 10' or 12' lengths for field cutting. The B-12 rod can be used for form tying or hanging applications where various lengths of attachments are required.

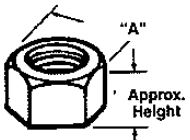
B-12 Continuous Coil Threaded Rod Selection Chart				
Coil Rod Diameter	Safe Working Load Tension (lbs.)	Minimum Area (sq. in.)	Minimum Coil Penetration	Stock Lengths
1/2"	9,000	.1385	2"	12'—0"
3/4"	18,000	.3079	2 1/4"	12'—0"

S.W.L. provides a factor of safety of approximately 2 to 1.

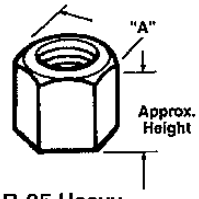
To Order:
Specify: (1) quantity, (2) strength designation, (3) diameter, (4) name, (5) length.

Example:
500 pcs. (6,000 ft.) 12M, 1/2" diameter B-12 Cont. Coil Threaded Rod x 12'-0" long.

B-13 Coil Nut and B-25 Heavy Coil Nut



B-13 Standard Coil Nut



B-25 Heavy Coil Nut

B-13 and B-25 Coil Nut Selection Chart					
Coil Nut Type	Dia.	Approx. Height	A Width Across Flats	Safe Working Load Tension (lbs.)	
				Using One B-13 Nut	Using Two B-13 Nuts or One B-25 Heavy Nut
B-13	1/2"	7/16"	3/4"	6,000	9,000
B-25	1/2"	13/16"	1 1/8"	—	9,000
B-13	3/4"	5/8"	1 1/8"	9,000	18,000
B-25	3/4"	13/16"	1 1/8"	—	18,000

S.W.L. provides a factor of safety of approximately 2 to 1.

The B-13 Coil Nut and B-25 Heavy Coil Nut are manufactured with coil thread and are used in conjunction with other coil threaded products to support bridge deck formwork.

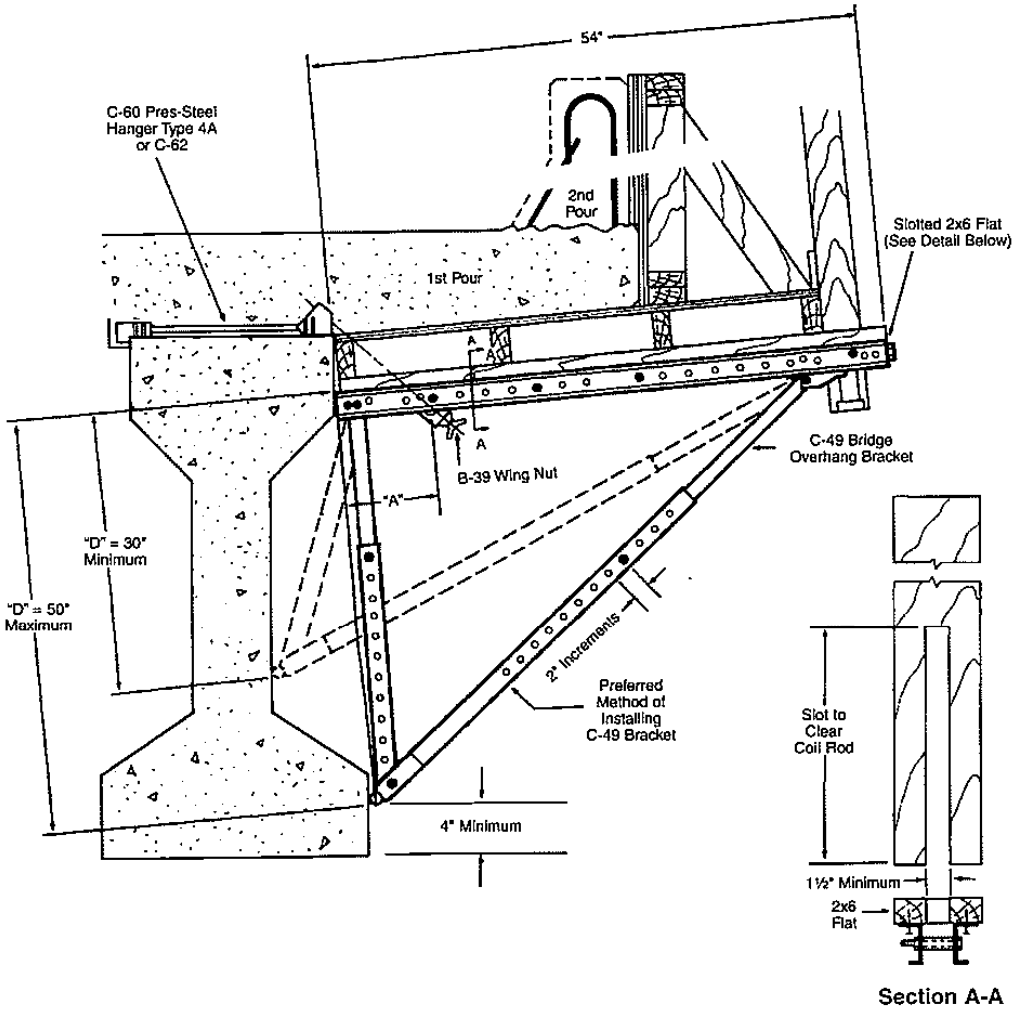
To Order:
Specify: (1) quantity, (2) name, (3) bolt diameter.

Example:
200 pcs. B-13 Coil Nut, 3/4".

Bridge Overhang Brackets

DAYTON SUPERIOR

C-49 Bridge Overhang Bracket Used on AASHTO Type III or Larger Precast Beams

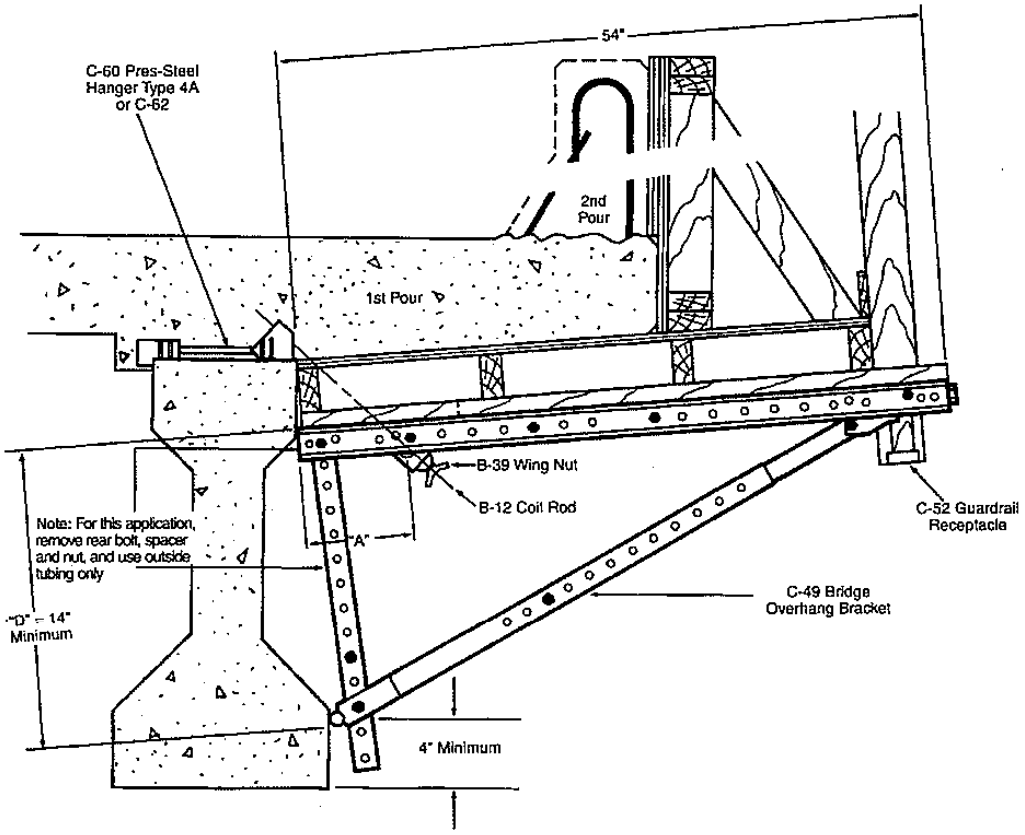


The C-49 bracket is very versatile and can be easily and quickly adjusted and configured to fit most types and sizes of precast/prestressed concrete bridge beams to support the required deck overhang formwork.

Bridge Overhang Brackets

DAYTON SUPERIOR

C-49 Bridge Overhang Bracket Used on AASHTO Type II Precast Beams

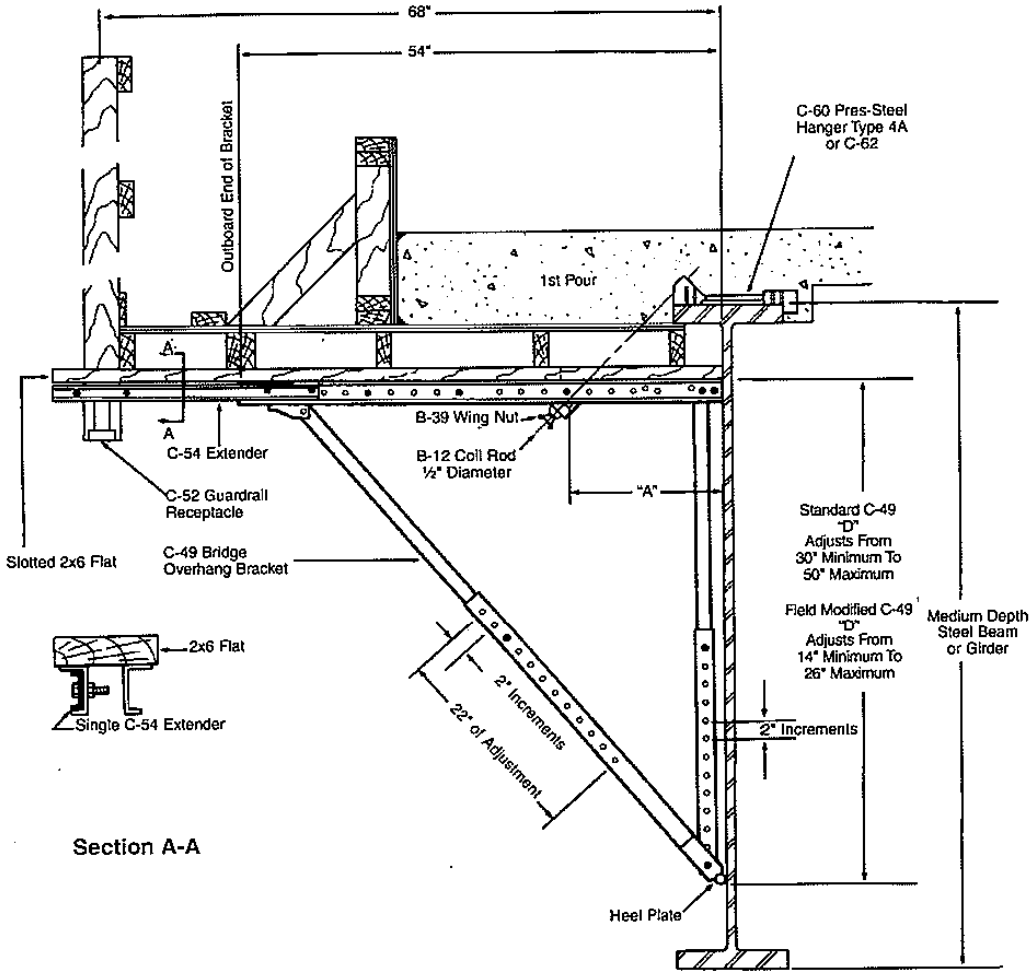


The C-49 bracket's versatility serves the smaller precast beams very well. By using only the outside tube of the vertical leg, the vertical height of the bracket can be reduced to a minimum of 14".

Bridge Overhang Brackets

DAYTON SUPERIOR

C-49 Bridge Overhang Bracket Used on Mid Depth Structural Steel



The vertical height of the C-49 bracket can be quickly and easily adjusted to transfer construction loads closer to the bottom flange. Moving the construction loads to the lower flange area reduces the twisting and bending tendency of the beam

General and Technical Information

DAYTON SUPERIOR

Safety Notes and Product Application

Dayton Superior strives to ensure that all products supplied from its manufacturing plants meet or exceed the safety requirements inherent in the proper use of its products. However, the performance of a product can be greatly affected by the manner in which the product is used. It is imperative that the user be instructed in the proper installation and use of the products displayed in this handbook prior to job application.

Product production runs are constantly sampled and tested to assure the user a high standard of quality. Samples are tested in Dayton Superior test facility or at independent testing laboratories. The safe working loads listed in this handbook were determined from the results of the testing programs and other sources.

The safety factor to be applied to a particular product is a variable dependent on the degree of hazard or risk involved in the application of the product. Job site conditions can often increase the degree of risk. Concentrated loads, such as construction materials stacked on the formwork, unsymmetrical placement of concrete, uplift, impact of machine delivered concrete, use of motorized carts, and formwork height, are examples that produce high risk factors. The user must adjust the safety factors accordingly to accommodate these risks.

Dayton Superior publishes the safe working loads and the associated minimum safety factors of its products and strongly advises that the minimum safety factors displayed in the table below not be compromised. When there are unusual job conditions, such as mentioned above, the minimum safety factors must be increased by the user. Refer to the provisions of the American National Standards Institute (ANSI A 10.9), the Occupational Safety and Health Administration (OSHA) Act, Part 1910 and 1926 and the American Concrete Institute (ACI) *Recommended Practice for Concrete Formwork* (ACI 347) when considering product safety factors.

Minimum Safety Factors of Formwork Accessories

Accessory	Safety Factor	Type of Construction
Form Tie	2.0 to 1	All applications.
Form Anchor	2.0 to 1	Formwork supporting form weight and concrete pressures only.
Form Anchor	3.0 to 1	Formwork supporting form weight, concrete, construction live loads and impact.
Form Hangers	2.0 to 1	All applications.
Anchoring Inserts (Used as Form Ties)	2.0 to 1	Precast concrete panels when used as formwork

Dayton Superior Technical Services

Dayton Superior maintains two strategically located technical service departments that are well staffed with trained personnel to service inquiries, take-offs and details for the users of Dayton Superior quality bridge deck accessories. See the back cover for addresses and phone numbers.

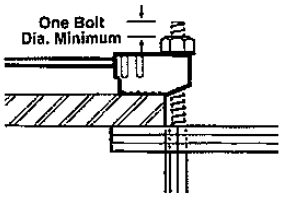
General and Technical Information

DAYTON SUPERIOR

Safe Working Load Considerations

All safe working loads shown in this handbook were established with the following factors considered:

1. All safe working loads shown in this handbook are based on the item being new or in "as new" condition. The safe working load is considered to be the greatest load that should be applied to a product.
2. All hangers shall have full bearing under the end section and shall be used only on the size beam for which they are manufactured.
3. Hangers must be correctly positioned on top of the beam so that the Coil Bolts or Coil Rods are the proper distance from the edge of the beam flange. This is normally ⅜" from the beam flange to the centerline of a ½" Coil Bolt or Coil Rod. Improper positioning of the hanger can seriously compromise the hanger's safe working load. Refer to the various product application sketches in this handbook.
4. Coil Nuts must have full bearing on hanger end sections. Use caution to ensure that the hangers and related hardware are not subjected to side loading.
5. All Coil Bolts, Coil Rods and related hardware shall be of proper length, diameter and capacity.
6. All Coil Bolts and Coil Rods must fully penetrate and extend through the Coil Nuts a minimum of one diameter (½" for a ½" diameter Coil Bolt or Coil Rod). Note sketch.
7. A qualified person must calculate all hanger and bracket live and dead loads. Refer to American Concrete Institute ACI 347.
8. When hangers and related items are electro-plated or hot-dip zinc galvanized, they must be properly baked to relieve hydrogen embrittlement. Failure to do so may result in a drastic reduction of the product's safe working load.



9. Extreme caution must be used when field welding. Welding may reduce material integrity and result in product failure. Dayton Superior recommends the use of a certified welder with a good working knowledge of materials, heat treatment and welding procedures. Since Dayton Superior is not able to control field conditions or workmanship, Dayton Superior DOES NOT guarantee any product altered after leaving the factory.
10. Impact wrenches are not to be used to tighten Coil Bolts or Coil Rods that are part of the bridge deck forming system.

The user of Dayton Superior products must evaluate the product application, determine the appropriate safety factor, calculate the applied loads and control all field conditions to prevent application of loads in excess of the products' safe working loads.

Hanger Considerations When Suspending Overhang Brackets

Dayton Superior recommends that interlock type hangers, i.e., a C-60 Type 4-A Pres-Steel Hanger, be used to suspend bridge overhang brackets when a finishing machine is supported on the overhang formwork. The user shall install the overhang brackets, hangers and form materials in such a manner that the Coil Bolts or Coil Rods make a 45° ± 5° angle with the top surface of the bridge beam.

Qualified personnel must accurately calculate the hanger and overhang bracket spacing so that the applied load passing through the Coil Bolt or Coil Rod is equal to, or less than the safe working load of the hanger.

Interior span loads must be calculated to determine the proper hanger spacing. When calculating interior span loads, always add a minimum of 50 pounds per square foot live load to the dead weight of the concrete.

General and Technical Information

DAYTON SUPERIOR

Safety Concerns

Incorrect use of hangers; insufficient bolt penetration through a coil nut; or altering a hanger in any way can result in premature failure and expose workers to unsafe conditions.

Reusable bridge deck forming accessories such as coil bolts, coil rods, etc., are subject to wear, misuse, overloading, corrosion, deformation, alteration and other factors that may affect safe working loads.

It is the responsibility of the user to continually inspect reusable accessories for wear and/or misuse and to discard them if wear or misuse is detected. Do not straighten bent forming accessories – discard them. Discard any reusable forming accessory that has been subjected to 70% or more of ultimate load of the product. Such items may have been stretched to a point where they have become brittle hard.

Dayton Superior recommends that all users of Dayton Superior deck forming products establish a quality control program to monitor and inspect their deck forming accessories. The frequency of inspections is best determined by the user and is dependent on the type of product use, frequency of use, duration of use and the environmental conditions during use.

The user of Dayton Superior products must evaluate the product application, determine appropriate safety factor, calculate the applied loads and control all field conditions to prevent application of loads in excess of the products' safe working loads.

Vertical Load for Design of Slab Forms

DESIGN LOAD — Based on 150 lbs. per Cubic Foot Concrete										
Slab Thickness, Inches	2	4	6	8	10	12	14	16	18	20
Pounds per Square Foot (See Note 1)	75	100	125	150	175	200	225	250	275	300
Pounds per Square Foot (See Note 2)	100	125	150	175	200	225	250	275	300	325

Note 1: Includes weight of concrete and reinforcing steel plus construction live load of 50 psf; weight of formwork not included.
Note 2: Includes weight of concrete and reinforcing steel plus construction live load of 75 psf; weight of formwork not included.

The American Concrete Institute publication, *Recommended Practice for Concrete Formwork*, (ACI 347) recommends that a minimum live load of 50 pounds per square foot (psf) be used in calculating formwork design loads. However, several states require higher live loads.

The American Concrete Institute publication, *Formwork for Concrete (ACI SP-4)* is a good reference for general formwork design, planning, materials, accessories, loading and pressure information, design tables and much more. Available from American Concrete Institute, P.O. Box 9094 Farmington Hills, MI 48333.

COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
FRANKFORT, KENTUCKY 40622

MILO D. BRYANT
SECRETARY
AND
COMMISSIONER OF HIGHWAYS

WALLACE G. WILKINSON
GOVERNOR

MEMORANDUM

TO: Bridge Construction Engineers

FROM: D. L. Gaines, P. E.
Trans. Engr. Br. Mgr.
Bridge Const. Branch

DATE: January 18, 1991

SUBJECT: Structural Steel
Fabrication Shop Inspections

Past fabrication problems have revealed a necessity for thoroughness in fabrication shop inspections.

We must get into the fine details for thoroughness of compliance with the plans, specifications and good fabrication practices. Routine inspections should be patterned after complete in-depth inspections but without documentation of all findings.

The following items are the minimum to be checked unless the trip is for sole purpose of addressing a specific problem.

1) Material Layout Area
   A. Check to see that inspector has received mill test reports and has checked them for compliance prior to use of material. Be sure that high strength bolts are included.
   B. Check several different flange and web plate heat numbers for traceability to the test report, piece mark, etc. This must be reliable for future reference. Be sure to check the charpy v-notch properties for compliance with plan requirements.
2) Check automatic submerged-arc welding (saw) against approved welding procedure. Check type of wire, and/or electrode, type of flux, speed of travel, joint preparation, voltage, preheating, post heating, etc.
3) Check to make sure all manual electrodes for SMAW and flux for submerged arc welds are being adequately dried in ovens per the specifications. The ovens must have thermometers!
4) Check fit-up of stiffeners, size of welds, surface finish of machined part, weld profiles, distortion of components, surface irregularities, bolt-hole patterns, etc. Ensure that there are no tack welds on any completed members. Check for indiscriminate arc strikes and be sure that blemishes and cracks from same are ground out. Check completed girders for sweep, and shear connector studs for weld quality. Ensure that camber and girder lay-down measurements are within tolerances.

- continued -

"AN EQUAL OPPORTUNITY EMPLOYER M/F/H"

BRIDGE CONSTRUCTION ENGINEERS
Janurary 18, 1991
Page Two

5) A. Check blast cleaning for steel painting for compliance with the pictorial standards. Observe the inspector take paint thickness checks with proper gauge. Note that the required thickness is 3.0 mils (tolerance = +2 and - .5) for normal surfaces and 1.5 mils ± 0.5 mils on splice plates. The reduced thickness for connections of cross frames, diaphragms and wind bracing to gussets and stiffeners may be waived provided that connection is not slip critical.
   B. Check to see if shop and/or inspector has sling psycrometer, charts and thermometer for measuring dew point and steel temperature.
   C. Check to see if surface profile is being measured and recorded and added to minimum paint thickness or paint thickness gauge may be zeroed on blasted steel before paint is applied.
   D. Check for mud cracking of paint and coverage in difficult locations. (Back of stiffener snipe cuts, bolt holes, etc.)
   E. Check paint storage areas. Must be in heated building.
   F. Check for cleaning (with detergent) of all oil from steel before steel is wheel-brated and check compressed air used for cleaning off dust by blotter test for moisture and oil.
6) Check the inspector's credentials for non-destructive testing.
   A. Check our computer file to see if all inspector's qualifications are up to date, and that he has been approved for use on KY work by letter by this section. Each inspector must be an AWS CWI welding inspector and ASNT Level II qualified and certified non-destructive testing for MT and RT or MT and UT.
   B. Insure that the correct non-destructive testing acceptance criteria is being used.
   C. Check to insure that the inspector is advising the fabricator of all deficiencies. The inspector should retain a record that the fabricator was so advised and how he was advised.
   D. Your visits to the fabrication shop should be unannounced, and you should be there early and late to observe the inspector's work hours.
   E. Note the number of days/week and hours/day worked by fabricator and these checked against the time sheets submitted by shop inspector. Inspectors should not regularly work more than 10 hours per day without approval of Division of Construction. If more than 12 hours per day is required then additional inspector must be required. Report any discrepancies immediately!
7) Check to see that the fabricator and shop inspector has available the following:

   A. Design Drawings and any Special proposal notes
   B. Approved Shop Drawings and Welding Procedures
   C. ANSI/AASHTO/AWS D 1.5-88 Specifications.
   D. Applicable Edition of Special Provision 4.

- continued -

BRIDGE CONSTRUCTION ENGINEERS
January 18, 1991
Page Three

E. The Pictorial Standards for Surface Preparation
F. The Kentucky Standard Specification for Road and Bridge Construction (Applicable Edition)
G. His own Non-destructive testing equipment, paint gauges, calibration plates, micrometer, inspection mirror, tapes, flashlight, weld gauge, etc.
H. The applicable ASTM or AASHTO Materials Specification for the structural steels being used.
I. The Appendix "D" of shop Inspection Agreement
J. AASHTO Fracture Critical Guide if applicable.

8) Observe the inspector perform actual non-destructive testing and become familiar with testing procedures. Discuss the quality of welds and the test frequency. Ensure that the welds comply with the contract requirements.
9) Check shop's quality control organization. The number of people, and their qualification who they report to, whether they monitor all work as it progresses, capabilities for non-destructive testing, etc. and whether the approved quality control organization is actually performing per AASHTO.

Upon completion of inspection, meet with the fabricator and shop inspector to discuss overall performance, existing problems, anticipated problems, progress, etc.

A follow-up written brief summary report should be made of your findings upon return from your trip. The report should be placed in project files and shop inspection file and sent to inspection agency.

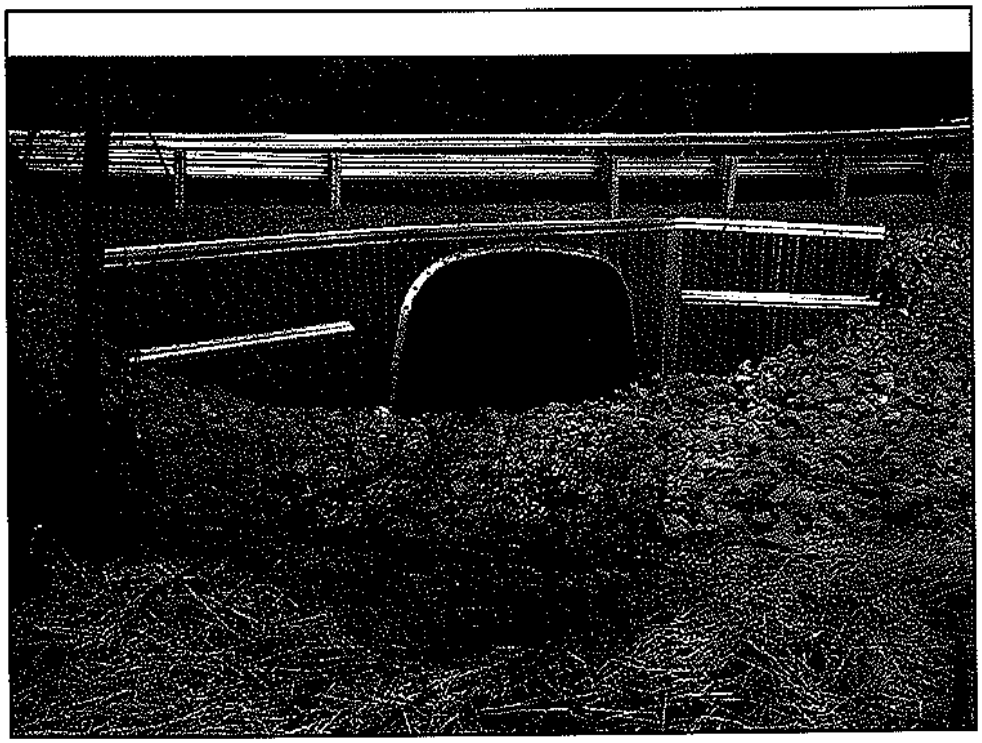
The above guidelines should be followed and normally one afternoon and the next morning in the shop will be adequate time for this type inspection. Each major project should have the fabrication shop visited at the Prefabrication Conference, again shortly after the fabrication gets in full production and on 4-6 week intervals thereafter.

cc: Paul Gravely
Roy Back, Jr.

SSFABINS

Metal Arch and other Misc. Structures

Nasby Stroop



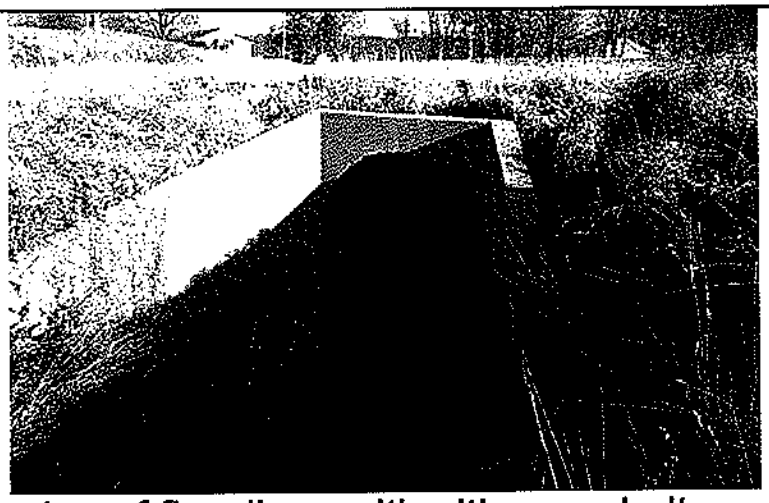
Section 612 of the Standard Specifications

- Structural Plate Soil Interaction Structures
  - Pipes
  - Pipe Arches
  - Arches

Materials Used

- Corrugated Aluminum Alloy
- Corrugated Steel

- Prefabricated sections that are assembled and erected on site.
- 612.03.03 – Shop drawing submittal and approval required.



- Paving of flow lines with either asphalt or concrete may be required. Total asphalt coating of the circumference of the pipe may also be required. See proposal/approved submittals.

Special Note 9V

- Provided with no field modifications
- Producers – Contech or Lane Metal Products
- Submittals required for C.O. approval

SPECIAL NOTE FOR ALUMINUM AND STEEL STRUCTURAL PLATE BOX CULVERTS

This Special Note will apply when indicated on the plans or in the proposal. Section references herein are to the Department's 2004 Standard Specifications for Road and Bridge Construction.

1.0 DESCRIPTION. Furnish and install either an aluminum or a steel structural plate box culvert as the Contract specifies.

2.0 MATERIALS.

2.1 Structure. These structures consist of prefabricated sections assembled and erected at the site. Prefabricated sections consist of corrugated aluminum or steel plates, as the Contract specifies, which have been factory shaped, punched, and coated when required. The Department will not permit field modifications except for tapping saddles or other devices to permit passage of other conduits or utilities through the structure. Furnish and install all ancillary items such as ribs, webs, stiffeners, footing pads, etc. that the design requires. Furnish and install endwalls and wingwalls when the plans require them. When endwalls are required, construct full height wing sections. Do not field bevel wing sections.

Before beginning erection, furnish to the Engineer applicable shop drawings, erection layouts, and manufacturer's brochures. The Department will accept plates and accessories by certificate of compliance from the manufacturer.

2.1.1 Aluminum Structure. Obtain the aluminum structural plate box culvert, and aluminum endwalls or wingwalls when required, from Contech Construction Products, Inc.

The Department will accept comparable aluminum structures produced by other companies when the Engineer approves. For such approval, submit sufficient data and design calculations to show that the proposed structures are equal in all respects to the Contech product and also include evidence of actual installations now in service that are performing satisfactorily.

Use aluminum accessories and plates, of the plan specified thickness, that conform to AASHTO M 219 or ASTM B 308 as applicable.

Where non-aluminum utilities are passed through, insulate with an electrolytic compound or approved equal, to prevent bi-metallic contact.

2.1.2 Steel Structure. Use either (1) Contech Construction Products' Multi-Plate Steel Box Culvert, or (2) Lane Metal Products Company's Low Profile Box Culvert.

The Department will accept comparable steel structures produced by other companies when the Engineer approves. For such approval, submit sufficient data and design calculations to show that the proposed structures are equal in all respects to those specified above and also include evidence of actual installations now in service that are performing satisfactorily.

Use steel accessories and plates, of the plan specified thickness, that conform to AASHTO M 167 for galvanized steel.

2.2 Asphalt Coating. On all steel drainage structures, except those installed as railroad tunnels, cattle underpasses, bicycle or pedestrian underpasses, or similar dry conditions, apply an asphalt coating conforming to Subsection 806.11.

2.3 Bedding Material. Use sand that conforms to Subsection 804.08.

Special Note 9V

- Backfill requirements are CRITICAL.
- Many proposals contradict 9V for backfill.
- Study Site Preparation Notes.

2.4 **Backfill Material.** Select any of the following alternates and obtain the Engineer's approval.

1) well graded or uniformly graded bank or creek gravel, crushed or uncrushed, up to 3 inches maximum size;
2) well graded or uniformly graded natural or crushed sand;
3) freely shot limestone or sandstone providing no individual fragment is larger than 3 inches and the material contains no more than 5 percent clay and/or shale, as determined by visual inspection by the Engineer;
4) crushed stone or crushed slag up to 3 inches maximum size (except DGA or Size No. 610);
5) other locally available materials meeting the approval of the Engineer (local soils conforming to soil classifications A-1 or A-3 from AASHTO M 145 will be acceptable). Do not use plastic soils, or materials containing significant amounts of unsuitable shale (SDI < 95 by KM 64-513); or
6) flowable fill conforming to Subsection 601.03.03, B). 5)

2.5 **Foundation Material.** Use material capable of supporting the imposed loads due to backfill weight and footing pressures of 2 tons per square foot.

3.0 CONSTRUCTION.

3.1 **Technical Representative.** Provide a technical representative from the structure producer to arrive at the start of the project. Ensure the technical representative is available thereafter to assist in the event problems or special circumstances arise. Technical assistance shall be provided at no additional cost to the Department.

3.2 **Site Preparation.** Perform structure excavation according to Section 206, except as modified herein.

On structures with footing pads, excavate trenches 3 inches below the elevation shown on the plans, and level the bottom of the trench with 3 inches of bedding material before placing the footing pads.

On structures with a full metal invert, excavate the entire area covered by the invert plates to a point 3 inches below grade and level with 3 inches of bedding material before placing the invert plates.

Take soundings for foundation design at the inlet and outlet of each culvert and at intervals no greater than 20 feet along the grade line of the bottom of the culvert, to a depth of one foot. Make soundings on the centerline and at each edge of the culvert. Where ledge rock, gravel, hardpan, or other unyielding material is encountered or known to exist within the limits stated, perform excavation in the area under the invert plates or footing pads. Extend the additional excavation to a depth of 0.042 H below the bottom of the metal plates, where H is the height of fill above the top of the culvert. However, regardless of the height of fill, the Department will require the additional depth to be a minimum of one foot and will not require it to be more than 0.75 Hc, where Hc is the total height of the culvert.

Backfill the additional excavation with an earth cushion of firmly compacted fine soils in layers of 6 inches or less, prior to placing the 3 inches sand bedding layer.

Excavate cross trenches as necessary to place metal headwalls when the plans require them.

Excavate a minimum width of the outside dimension of the box culvert including footing pads or invert plates plus 6 inches on each side.

Proper bedding preparation is critical for satisfactory performance of the box culvert. Place the bed for footing pads or invert plates to uniform lines and grade to avoid distortions

Special Note 9V

- Concentrate on Manufacture's Specifications and recommendations.

specifications.

3.3 **Installation.** Erect the culvert, and endwalls when required, in strict accordance with the manufacturer's recommendations. The Department will allow offsite assembly of the structure, provided prior approval is obtained, and assembly is in accordance with the manufacturer's instructions. Align plates circumferentially to avoid permanent distortion from the specified shape. Ensure the width and height of the completed structure is within 2 percent of the specified dimensions or 2 inches, whichever is greater.

Tighten bolts in the erected structure according to the manufacturer's recommendations, with good seam laps, while in proper shape, using nuts and bolts the manufacturer supplies. Construct concrete footings and headwalls in accordance with the plans.

Install the ribs, wales, and toewalls when required, according to the manufacturer's recommendations.

In side by-side installations, install the box culverts with footing pads or invert plates of each culvert no closer than 2 feet to the footing pads or invert plates of the adjacent culvert, unless the plans show otherwise. Excavate the entire volume between the culverts and place backfill.

3.4 **Backfill.** Proper placement and compaction of backfill are essential to obtain maximum strength and stability of the finished structure. Use equipment and construction procedures to prevent excessive structure distortion from occurring. The manufacturer of the structure will specify the magnitude of allowable shape changes during backfill. Monitor the shape of the structure to control distortion until all backfilling operations are completed.

On structures with concrete footing pads, backfill the trench for the pads to the flowline inside the culvert before outside backfilling begins.

Place granular backfill material in horizontal layers not exceeding 6 inches loose depth, and bring up uniformly on both sides of the structure. Compact each layer to the same level on all sides before proceeding to the next lift. Do not use compaction equipment or methods that produce earth pressures that cause distortion or damage. Place material on top of the structure at right angles to the centerline of the structure. Compact each layer of backfill to a density of at least 95 percent of the maximum density according to KM 64-511. The Department will determine the in-place density using nuclear gages. The Engineer may waive density testing when not feasible due to the nature of the material. When using flowable fill, place according to Subsection 601.03.09, C).

If the structure is not installed in a full depth trench, use backfill material for embankment adjacent to the structure for a distance equal to the span width on each side of the box culvert and to a height of 2 feet or subgrade elevation, whichever is lower, above the structure.

3.5 **Construction Loads.** Do not allow construction loads in excess of HS-20 vehicles to cross the completed box culvert unless it is internally braced. Design the support for such bracing so as not to impair the structural integrity or severely interfere with the hydraulics of the box culvert or its invert. Have the culvert manufacturer review the details of the bracing and submit them to the Engineer for approval.

3.6 **Headwalls.** Construct concrete headwalls, when required, according to the plans. Apply masonry coating to exposed surfaces of the headwalls when required by Subsection 601.03.18, B). When using an aluminum structure, coat aluminum surfaces that will be in contact with concrete with alumilastic compound or an approved equal prior to placing concrete.

Special Note 9V

- Measured per LF with lots of 'incidentals'.

4.0 MEASUREMENT.

4.1 **Structure Excavation.** The Department will measure Structure Excavation, as Structure Excavation, Common or Structure Excavation, Solid Rock according to Subsection 206.04.03, except on the sides of the structure the volume will be bounded by vertical planes 6 inches outside the footing pads or invert plates and parallel thereto.

The Department will measure material necessary for backfill in excess of the material excavated as Borrow Excavation, Roadway Excavation, or Embankment-in-Place, as applicable.

The Department will measure granular material used to replace excavated material that is unsuitable for backfill as Borrow Excavation, Roadway Excavation, or Embankment-in-Place. The Department will not measure earthwork for payment when the bid item is Embankment-in-Place unless the unsuitable material is wasted.

The Department will not measure flowable fill for payment and will consider it incidental to the structure.

The Department will not measure bedding for payment and will consider it incidental to the structure.

4.2 **Aluminum Structural Plate Box Culvert.** The Department will measure the quantity in linear feet at each location. The Department will consider the number of linear feet in each installation to be the plan length, increased or decreased by authorized adjustments. The Department will not measure ribs, webs, stiffeners, footing pads, toewalls, internal braces, or asphalt coating for payment and will consider them incidental to the structure.

4.3 **Steel Structural Plate Box Culvert.** See 4.2.

4.4 **Class A Concrete.** The Department will measure Class A Concrete in footings and headwalls according to Subsection 601.04.

4.5 **Reinforcement.** The Department will measure Steel Reinforcement in the footings and headwalls according to Subsection 602.04.

4.6 **Aluminum Box Culvert Endwalls.** When endwalls are required by the plans, the Department will measure the endwalls in individual units at each location.

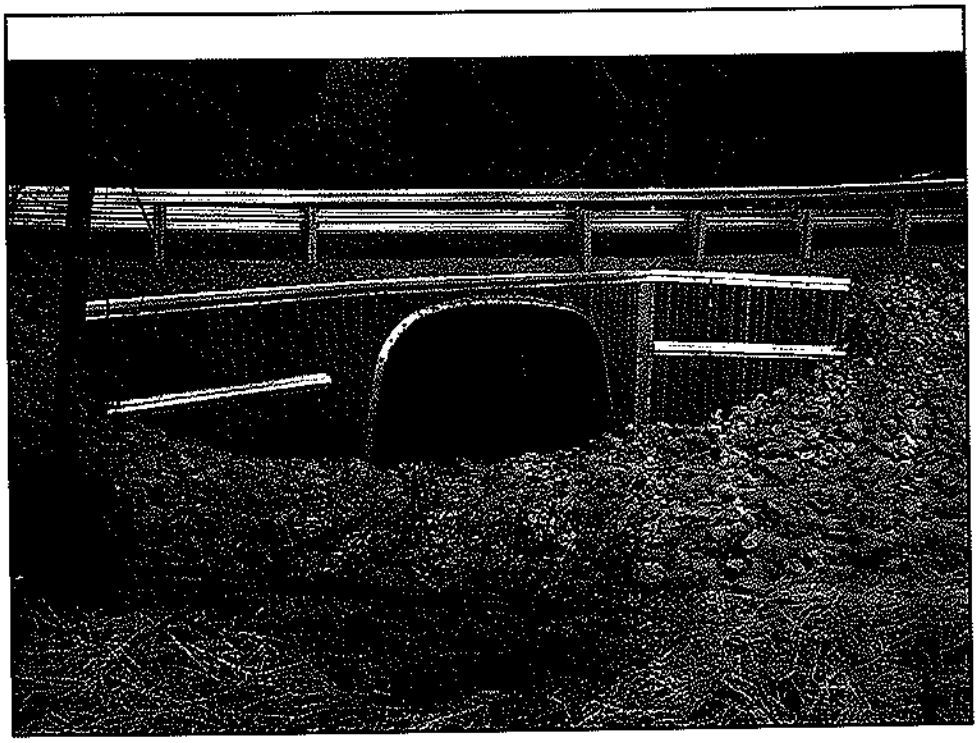
4.7 **Steel Box Culvert Endwalls.** See 4.6.

5.0 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
—	Aluminum Structural Plate Box Culvert	Linear Foot
—	Steel Structural Plate Box Culvert	Linear Foot
—	Structure Excavation, as classified	See Section 206.05
—	Concrete, Class	See Section 601.05
—	Steel Reinforcement	See Section 602.05
—	Aluminum Box Culvert Endwall	Each
—	Steel Box Culvert Endwall	Each

The Department will consider payment as full compensation for all work required in this note.

March 1, 2004



Concrete Mix – Rules of Thumb

Use these rules of thumb for quick evaluations of concrete mix changes. Don't forget that these general guidelines may not apply to all situations.

Adding 1 gallon of water to a cubic yard of concrete will...

- Increase slump about 1 inch
- Decrease compressive strength by 200 to 300 psi
- Increase shrinkage potential about 10%
- Waste as much as ¼ bag of cement

If fresh concrete temperature increases 10° F then...

- About 1 gallon of water per cubic yard maintains equal slump
- Air content decreases about 1%
- Compressive strength decreases 150 to 200 psi

If air content of fresh concrete...

- Increases 1% then compressive strength decreases about 5%
- Decreases 1% then yield decreases about ¼ cubic foot per cubic yard
- Decreases 1% then slump decreases about ½ inch
- Decreases 1% then durability increases about 10%

CHAPTER 1

REINFORCING BARS AND SPIRALS (Cont.)

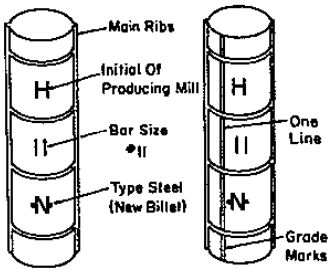
IDENTIFICATION MARKS — ASTM STANDARD BARS

The ASTM specifications for billet steel, rail steel, axle steel and low alloy steel reinforcing bars (A615, A616, A617 and A706) require identification marks to be rolled into the surface of one side of the bar to denote the producer's mill designation, bar size, type of steel and, for Grade 60, a grade mark indicating yield strength.* Grade 40 and Grade 50 bars show only three marks (no grade mark) in the following order:
1st — Producing Mill (usually an initial)
2nd — Bar Size Number (#3 through #18)
3rd — Type Steel: N for New Billet (S for Supplementary Requirements A615—#14 and #18 only)
A for Axle
I for Rail
W for Low Alloy

Grade 60 bars must also show a minimum yield designation grade mark of either the number 60 or one (1) grade mark line.

A grade mark line is smaller and between the two main ribs which are on opposite sides of all U. S. made bars. When a number grade mark is used, it is 4th in order.

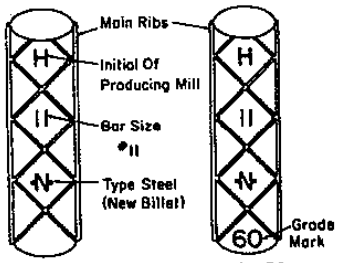
LINE SYSTEM — GRADE MARKS



Grade 40
Grade 50

Grade 60

NUMBER SYSTEM — GRADE MARKS



Grade 40
Grade 50

Grade 60

VARIATIONS: Bar identification marks may also be oriented to read horizontally (at 90° to those illustrated above).
Grade mark lines must be continued at least 5 deformation spaces.
Grade mark numbers may be placed within separate consecutive deformation spaces to read vertically or horizontally.

*See Appendix A for complete bar marks of concrete reinforcing bars produced by all U.S. manufacturers. The marks, listed alphabetically by producing mill, include the identification requirements of ASTM and the deformation pattern used by each mill.

INSPECTION

Epoxy-coated reinforcing bars should be inspected for damaged coating when the bars are received at the job site. The bars should also be inspected for damaged coating after they are placed in the structure, before concrete is poured.

Upon receipt of epoxy-coated bars at the job site, the Buyer should carefully check the quantities of bars against the bill of materials. The Buyer should also inspect the bars for damage to the coating.

Field inspection personnel should realize that the coated bars received at the job site have undergone considerable processing and testing. The material specifications require that certain acceptance tests be made at the Coating Applicator's Facility. The required acceptance tests are for thickness, continuity, and adhesion of coating.

Periodically during the coating application process, the coating thickness is measured to assure that it is within the specification limits. Continuity of coating involves monitoring of the coated bars for holidays. A holiday is defined as a pinhole in the coating that is not visible to the naked eye. Bend tests are made periodically on sample coated bars to check on the adhesion of the coating to the bar.

The specifications also require that damaged coating resulting from handling in the coating plant and fabrication operations be repaired if the damage exceeds specified limits.

At the job site, coated bars should not be subject to any of the above acceptance tests. In addition, there are no limits on the thickness of the patched areas where damaged coating is repaired.

Uncoated ends of bars. Occasionally touching up of sheared ends of epoxy-coated reinforcing bars may be missed during the fabrication process. The uncoated ends must then be touched up at the job site. They should be coated with the same patching material that is used for the repair of damaged coating.

Damaged coating. It should not be expected that epoxy-coated bars will be completely free of damaged coating. No doubt some damage will be incurred during shipment, and from handling and placing operations. In fact, most project specifications permit individual damaged spots up to a certain area or size without requiring repair of the damaged spots. Typically, the limit in project specifications on acceptable spots of damaged coating is in the order of 0.063 square inches (1/4 in. by 1/4 in.). Individual damaged spots larger than this limit would have to be repaired. In addition, project specifications usually limit the maximum amount of total coating damage to 2 percent of the total surface area per linear foot of the coated bar. In other words, the maximum amount of damaged coating, including repaired and unrepaired areas, should not exceed 2 percent of the surface area per foot of bar. Table 1 gives the maximum damaged areas based on 2 percent of the surface area in one-foot lengths for each bar size.

Based upon observations of practice and experience over many years, the amount of actual total damaged coating on bars at the job site is typically much less than the specification limit of 2 percent.

SHEARED ENDS OF COATED BARS — Bar Size #5

Properly coated end.

Minor damage, no touch-up is required.

Uncoated end, touch-up is required.

INSPECTION CONT'D

ACCEPTABLE COATED STRAIGHT BARS
Bar Size #5 Length = 6 in.

No damage

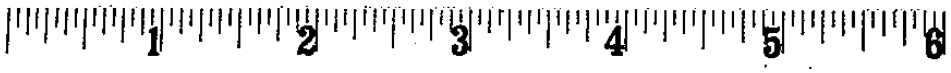
Minor damage; no touch-up is required

Total damage is approximately 1% of surface area of bar in 1-ft. length; no damaged spots are larger than 1/4 in. by 1/4 in.; no touch-up is required

Total damage is approximately 1% of surface area of bar in 1-ft. length; damaged spot is larger than 1/4 in. by 1/4 in.; touch-up of damaged spot is required

Total damage is nearly 2% of surface area of bar in 1-ft. length; no damaged spots are larger than 1/4 in. by 1/4 in.; no touch-up is required

Total damage is nearly 2% of surface area of bar in 1-ft. length; damaged spot is larger than 1/4 in. by 1/4 in.; touch-up of damaged spot is required



INSPECTION CONT'D

Bent bars. Examination of the physical condition of the coating on the outside radii of standard hooks and other bends might reveal cracks in the coating. The bars are acceptable if only hairline cracking is present and there is no discernible loss of bond (loss of adhesion) of the coating to the bar in the bent portion. When disbondment of the coating is evident, the disbonded coating should be removed from the bar. After removal of the coating, the affected areas should be cleaned and repaired with touch-up material.

Fading of color of coating. When epoxy-coated reinforcing bars are exposed to sunlight over a period of time, fading of the color of some epoxy coatings may occur. Since the discoloration does not harm the coating nor affect its corrosion-protection properties, such fading should not be cause for rejection of the coated bars.

ACCEPTABLE COATED BENT BARS
Bar Size #5 Standard Hooks

No damage

Minor damage, hairline cracking, no touch-up is required.

Total damage is approximately 1% of surface area of bar in 1-ft. length, no damaged spots are larger than 1/4 in. by 1/4 in., no touch-up is required.

Total damage is approximately 1% of surface area of bar in 1-ft. length, damaged spot is larger than 1/4 in. by 1/4 in., touch-up of damaged spot is required.

Total damage is nearly 2% of surface area of bar in 1-ft. length, no damaged spots are larger than 1/4 in. by 1/4 in., no touch-up is required.

Total damage is nearly 2% of surface area of bar in 1-ft. length, damaged spot is larger than 1/4 in. by 1/4 in., touch-up of damaged spot is required.

INSPECTION CONT'D

The preceding discussion of inspection is concerned essentially with evaluating the physical condition of the coating bars. On some projects, several other items directly related to epoxy-coated reinforcing bars might be included in the scope of field inspection. These other items involving inspection would depend upon the requirements for reinforcement, and the arrangements and details of the bars in the particular project.

For example, both uncoated and coated bars will be used on many projects. To avoid confusion, it is the responsibility of the Architect-Engineer to be precise on the design drawings in indentifying those bars which are to be coated. The placing drawings should show the locations of uncoated and coated bars. On the job site, the inspector should make sure that both types of bars, uncoated and coated, are placed where required by the placing drawings. Similarly, the inspector should check that the bar supports being used on the job conform to the requirements in the project specifications.

TABLE 1–MAXIMUM DAMAGED AREA

Bar Size	Diameter, in.	Perimeter, in.	Surface Area, sq. in./ft.	2% of Surface Area sq. in./ft.
#3	0.375	1.18	14.14	0.28
#4	0.500	1.57	18.85	0.38
#5	0.625	1.96	23.56	0.47
#6	0.750	2.36	28.27	0.57
#7	0.875	2.75	32.99	0.66
#8	1.000	3.14	37.70	0.75
#9	1.128	3.54	42.53	0.85
#10	1.270	3.99	47.88	0.96
#11	1.410	4.43	53.16	1.06
#14	1.693	5.32	63.84	1.28
#18	2.257	7.09	85.08	1.70

Recommended construction practices for coated bars are described in the following section. This section includes the repair of damaged coating on the bars and other touch-up work when coated bars are spliced with mechanical connections or by welding, if coated bars are field bent or straightened, and if coated bars are cut in the field. Such repair and touch-up work should be inspected to assure that it was done properly.

RECOMMENDED CONSTRUCTION PRACTICES

Handling and Storage

In unloading epoxy-coated reinforcing bars from a truck, care must be exercised to minimize scraping of the bundles or bar-to-bar abrasion from sags in the bundles. Do not skid the bundles of bars from the truck bed to the ground ("bar off"). Use power hoisting equipment for unloading and handling the bundles. Equipment for handling the bars should have protected contact areas. Nylon slings or padded wire rope slings should be used. Bundles of coated bars should be lifted at multiple pick-up points. Hoisting with a spreader beam or similar device is an effective method of preventing sags in bundles of coated bars.

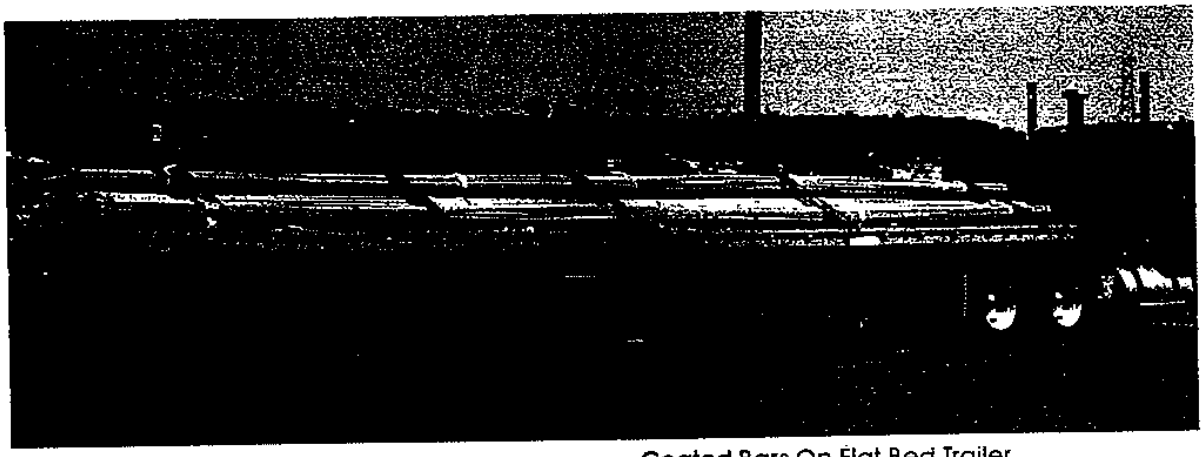
Epoxy-coated bars should be stored on timbers or other suitable protective cribbing. Reinforcing bars, and in particular coated bars, should be stored as close as possible to the area where they will be placed in the structure to keep handling operations to a minimum. Coated bars or bundles of coated bars should not be dropped or dragged.

Long-term storage of epoxy-coated reinforcing bars at the job site, such as from one construction season to the next, is not recommended. Deliveries of coated bars to the job site should be scheduled and coordinated with placing the bars in the structure to avoid any need for long-term storage. If circumstances or other conditions make it absolutely necessary to store coated bars outdoors for an extended period of time, the bars should be protected from direct rays of sunlight and sheltered from the weather. The following storage practices are suggested to prevent deterioration of the coating.

1. Store the bars above the ground on timbers or other suitable protective cribbing, space the dunnage close enough to prevent sags in the bundles.

2. If a relatively large quantity of bars has to be stored in a small area, bundles of straight bars should be stacked with adequate blocking placed between the layers of bundles.

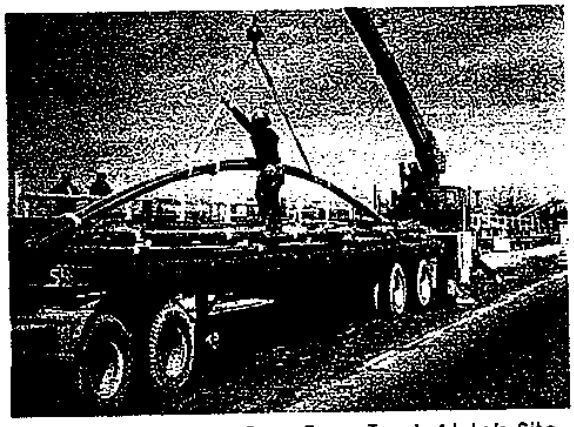
RECOMMENDED CONSTRUCTION PRACTICES CONT'D



Coated Bars On Flat Bed Trailer

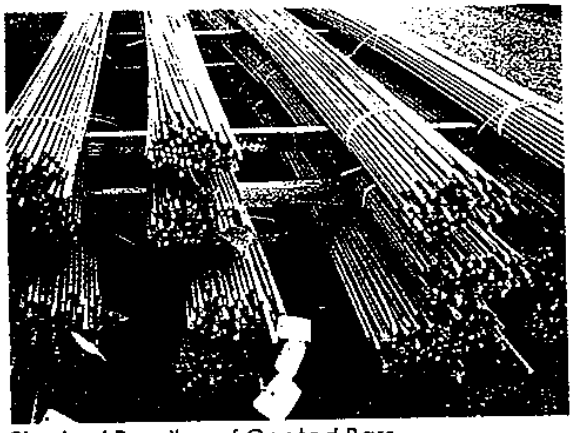
3. Cover the bars or bundles with opaque polyethylene sheeting or other suitable protective material. For stacked bundles, drape the protective covering over the sides of the bundles around the perimeter of the stack. Secure the covering adequately, and make provisions for adequate air circulation around the bars to prevent condensation under the polyethylene sheeting.

To maintain and assure identification of the stored bars, non-metallic tags on the bundles should be protected, or consideration should be given to attaching additional back-up galvanized metal tags on all bundles of bars. Since there are various possible shapes and dimensions of bent bars, some of the above suggested practices, such as stacking of bundles, may not be directly applicable nor practical for the storage of bent bars.



Unloading Coated Bars From Truck At Job Site

Coated Bars Stored At Job Site



Stacked Bundles of Coated Bars

RECOMMENDED CONSTRUCTION PRACTICES CONT'D

Placing

In general, placing of epoxy-coated reinforcing bars is done similarly as for uncoated bars. The key exception is that coated bars require more careful handling and placing. The same hoisting and handling methods and precautions as discussed above for unloading coated bars from a truck should be used and followed during all placing operations. Once bundles of coated bars have been broken, dragging one bar over another, or over any abrasive surface should be avoided. Using common-sense precautions should minimize coating damage during placing operations. Experience has shown that with such normal common-sense considerations, repair of damaged coating or field touch-up is seldom necessary.

Coated Bars Placed
In Bridge Deck.
Ready For Concrete Pour

Iron Workers Completing Placement of Coated Bars
In Large Bridge Deck

RECOMMENDED CONSTRUCTION PRACTICES CONT'D

Bar Supports and Tie Wire

Non-corrosive (compatible) bar supports and tie wire are usually used for epoxy-coated reinforcing bars. The requirements for these materials should be included in the project specifications. The purpose of the particular or compatible types of bar supports is to minimize damage to the coating on the bars during field placing of the coated bars, and not to introduce a potential source of corrosion at and in close proximity to the point of contact of the bar supports with the coated rebars. Usually wire bar supports or portions of them will be coated with epoxy or vinyl (plastic) material. It should not be expected that coated wire bar supports will be completely free of damaged coating. Bar supports on the job might be made of nonmetallic material. Reinforcing bars that are used as support bars should be epoxy-coated. CRSI recommendations for bar supports for supporting epoxy-coated reinforcing bars are:

A. Wire bar supports should be coated with dielectric material such as epoxy or plastic, compatible with concrete, for a distance of at least 2 inches from the point of contact with the epoxy-coated reinforcing bars, or,
B. Bar supports should be made of dielectric material, if precast concrete blocks with embedded tie wires or precast concrete doweled blocks are used, the wires or dowels should be epoxy-coated or plastic-coated, or,
C. Reinforcing bars that are used as support bars should be epoxy-coated. In walls reinforced with epoxy-coated bars, spreader bars where specified by the Architect-Engineer, should be epoxy-coated. Proprietary combination bar clips and spreaders that are used in walls with epoxy-coated reinforcing bars should be made of corrosion-resistant material or coated with dielectric material.

Coated tie wire is often required to minimize damage or cutting into the bar coating. Tie wire is typically black-annealed wire, 16-1/2 gauge or heavier. The coating material on the wire is usually plastic, epoxy, or nylon.

Splices

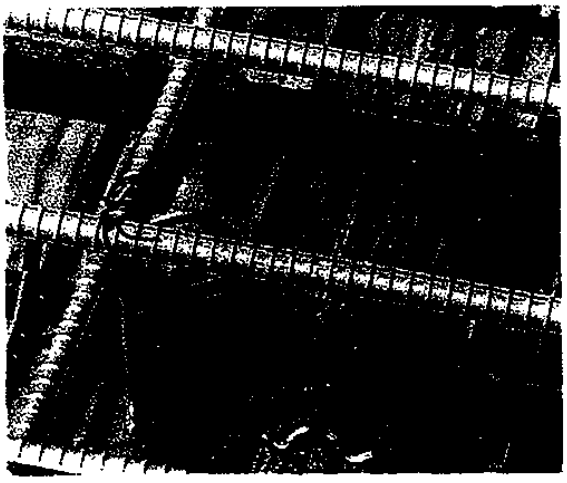
Splices of epoxy-coated bars are essentially the same as those for uncoated bars. The project specifications should contain any special requirements. For mechanically-coupled splices, the project specifications might require that after installing the couplers, all parts of the connections including steel splice sleeves, bolts and nuts must be coated with the same patching material which is used for the repair of damaged coating on the bars, and coating damage on the bars in the vicinity of the couplers must be repaired. For welded splices, the specifications might require that after completion of welding, all welds and all steel splice members when used to splice bars must be coated with the same patching material as that used for the repair of damaged coating on the bars, coating damage on the bars in the vicinity of the welded splices must be repaired, and suitable ventilation must be provided when welding coated bars.

Field Cutting

Field cutting of reinforcing bars, whether uncoated or coated, should be done only if permitted by the Architect-Engineer. The project specifications should cover field cutting, and in the case of epoxy-coated bars, the specifications should require coating of the cut ends with the same material that is used for the repair of damaged coating. Coating damage and field touch-up can be reduced by saw cutting rather than flame cutting.

Field Bending or Straightening ("Field Corrections")

The project specifications should also contain any special requirements for field bending or straightening of epoxy-coated bars which are partially embedded in hardened concrete. The specifications might require repair of damaged coating after the bending or straightening has been completed. If the Architect-Engineer approves the use of heat for the field bending or straightening, suitable ventilation should be provided.



Plastic-Coated Wire Bar Support
And Coated Tie Wire

RECOMMENDED CONSTRUCTION PRACTICES CONT'D

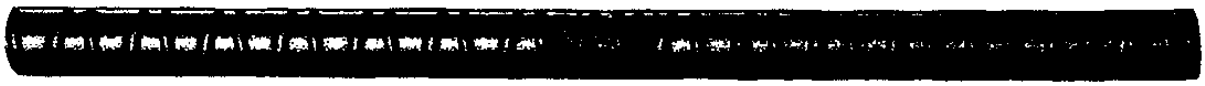
Other Precautions

After the epoxy-coated bars are placed, walking on the bars by workmen should be held to a minimum. Workmen should be careful not to drop large-hand tools or other heavy construction materials on the bars in place. Care should be exercised so that concrete conveying and placement equipment does not damage the coated bars. Runways for concrete buggies, hoses for pumping concrete, etc., should be set up, supported and moved carefully to minimize damage to the coating and not knock the bars out of their intended position.

Repair of Damaged Coating

When damaged coating must be repaired, the patching or touch-up material should be applied in strict accordance with the instructions furnished by the manufacturer of the patching material. Generally, surface preparation consists of thorough manual cleaning of damaged spots and complete removal of rust. Cleaning is usually done with a wire brush and emery paper. Care should be exercised during the surface preparation so that the bare areas are not made larger than necessary to accomplish the repair of the damaged spots. Repaired areas do not have as much corrosion resistance as the factory-applied epoxy coating.

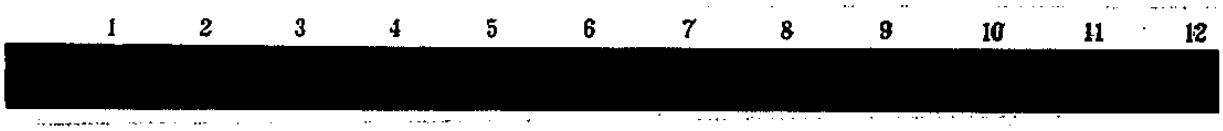
REPAIR OF DAMAGED COATING
Bar Size #5 Length = 12 in.



Damaged spots requiring touch-up

Damaged spots cleaned and ready for touch-up

Touch-up completed



`PROCEDURE FOR PERFORMING ROTATIONAL CAPACITY TEST BOLTS TO SHORT TO FIT TENSION CALIBRATOR

EQUIPMENT REQUIRED:

1. Calibrated torque wrench and an spud wrench or equivalent.
2. Spacers and/or washers with hole size no larger than 1/16 in. greater than bolt to be tested.
3. Steel section with normal size hole to install bolt. Any available splice hole can be used with a plate thickness that will provide the number of threads under the nut required in Step 1 below. Mark off a vertical line and lines 1/3 of a turn, 120 degrees; 1/2 of a turn, 180 degrees; and 2/3 of a turn, 240 degrees, from vertical in a clockwise direction on the plate.

PROCEDURE:

1. Install nut on bolt and measure stick out of bolt when 3 to 5 full threads of the bolt are located between the bearing face of the nut and the bolt head. Measure the bolt length, the distance from the end of the threaded shank to the underside of the bolt head.
2. Install the bolt into the hole and install the required number of shim plates and/or washer (one washer under the nut must always be used) to produce the thread stickout measured in Step 1.
3. Snug the bolt using a hand wrench. The snug condition should be the normal effort applied to a 12 inch long wrench. The applied torque should not exceed 20% of the torque determined in Step 5.
4. Match mark the nut to the vertical stripe on the plate.
5. Tighten the bolt by turning the nut using the torque wrench to the rotation listed below. A second wrench must be used to prevent rotation of the bolt head during tightening. Record the torque required to reach this rotation. Torque must be mesured with the nut in motion.

Bolt Length (measured in Step 1)	4 x bolt dia. or less	Greater than 4 but no more than 8 x bolt dia.	Greater than 8 x bolt dia.
Required Rotation	1/3	1/2	2/3

The measured torque should not exceed the values listed below. Assemblies which exceed the listed torques have failed the test.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2
Torque (ft-lbs)	150	290	500	820	1230	1500	2140	2810	3690

6. Tighten the bolt further to the rotation required below. The rotation is measured from the initial marking in Step 4. Assemblies which fail prior to this rotation either by stripping or fracture fail the test.

Bolt Length (measured in Step 1)	4 x bolt dia. or less	Greater than 4 but no more than 8 x bolt dia.	Greater than 8 x dia.
Required Rotation	2/3	1	1-1/3

7. Loosen and remove nut, and examine thread on the nut and bolt. No signs of thread shear failure, stripping or torsional failure of the bolt should be evident. Assemblies which have evidence of stripping have failed the test.

ROTATIONAL CAPACITY TEST WORKSHEET
SHORT BOLT

FOR 3/4 X 2 BOLT:

FROM STEP 5

MEASURED TORQUE -
(AT 1/3 TURN)

MAXIMUM TORQUE = 0.25 PD
WHERE: P = TURN TEST TENSION
FROM TABLE D4.1g (lbs.)
D = NOMINAL BOLT
DIAMETER (FEET)

MAX. TORQUE =
0.25 X 32,000 X (0.75/12)

MAX. TORQUE = 500 FT. LBS.

APPENDIX A1

PROCEDURE FOR PERFORMING ROTATIONAL CAPACITY TEST LONG BOLTS IN TENSION CALIBRATOR

'IPMENT REQUIRED:

1. Calibrated bolt tension measuring device of size required for bolts to be tested. Mark off a vertical line and lines 1/3 of a turn, 120 degrees; and 2/3 of a turn, 240 degrees, from vertical in a clockwise direction on the face plate of the calibrator.
2. Calibrated torque wrench.
3. Spacers and/or washers with hole size no larger than 1/16 in. greater than bolt to be tested.
4. Steel section to mount bolt calibrator. Flange of girder or cross frame accessible from the ground is satisfactory.

PROCEDURE:

1. Install nut on bolt and measure stick out of bolt when 3 to 5 full threads of the bolt are located between the bearing face of the nut and the bolt head. Measure the bolt length, the distance from the end of the threaded shank to the underside of the bolt head.
2. Install the bolt into the tension calibrator and install the required number of shim plates and/or washer (one washer under the nut must always be used) to produce the thread stickout measured in Step 1.
3. Tighten bolt using a hand wrench to the snug tensions listed below -0 kips, +2 kips.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2
Snug Tension (kips)	1	2	3	4	5	6	7	9	10

4. Match mark the nut to the vertical stripe on the face plate of the bolt calibrator.
5. ising the calibrated manual torque wrench, tighten the bolt to at least the tension listed below and record the torque required to reach the tension and the value of the bolt tension. Torque must be measured with the nut in motion.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2
Tension (kips)	12	19	28	39	51	56	71	85	103

. Further tighten the bolt to the rotation listed below. The rotation is measured from the initial marking in Step 4. Record the bolt tension. Assemblies which fail prior to this rotation either by stripping or fracture fail the test.

Bolt Length (measured in Step 1)	4 x bolt dia. or less	Greater than 4 but no more than 8 x bolt dia.	Greater than 8x bolt dia.
Required Rotation	2/3	1	1-1/3

. The bolt tension measured in Step 6 after the required rotation must equal or exceed the values in the table shown below. Assemblies which do not meet this tension have failed the test.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2
Tension (kips)	14	22	32	45	59	64	82	98	118

Loosen and remove nut, and examine the threads on the nut and bolt. No signs of thread shear failure, stripping, or torsional failure of the bolt should be evident. Assemblies which have evidence of stripping have failed the test.

culate and record the value of 0.25x the tension (pounds=kips x 1000) measured in Step 5 x the bolt diameter in feet. The torque measured and recorded in Step 5 must be equal to or less than this calculated value. Assemblies with torque values exceeding this calculated value failed the test.

ROTATIONAL CAPACITY TEST WORKSHEET
LONG BOLT

FOR 3/4 X 2 3/4 BOLT:

FROM STEP 5

MEASURED TENSION -
(28,000 - OR HIGHER)

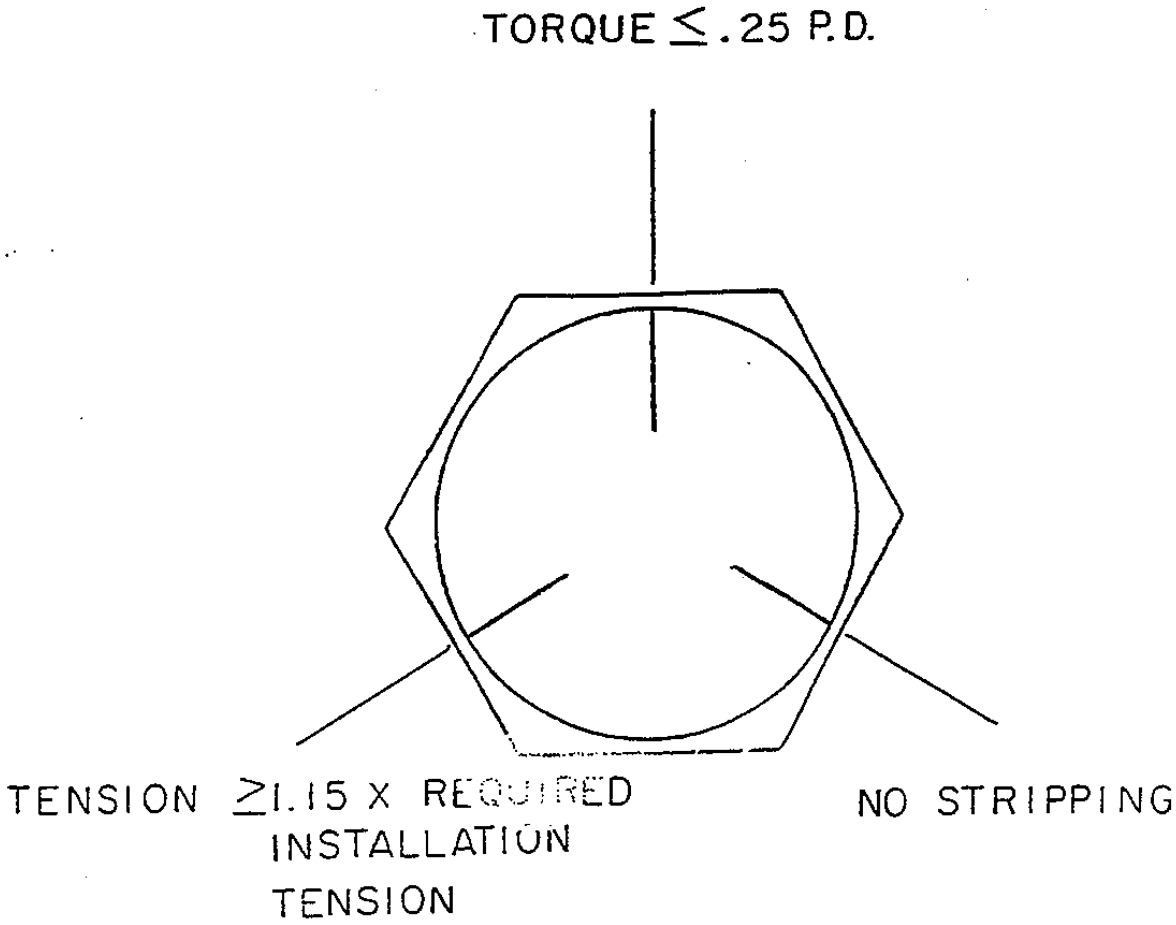
MEASURED TORQUE -

MEASURED TORQUE - 0.25 PD
WHERE: P = MEASURED BOLT TENSION (lbs.)
D = NOMINAL BOLT DIAMETER (ft.)

MAX. TORQUE
= 0.25X (TENSION) X (0.75) / 12
= 0.0156X (TENSION)

MAX. TORQUE =

ROTATIONAL CAPACITY TEST REQUIREMENTS



The following is the data that should be included in the rotational capacity test certification. The information may be presented in any form the certifier chooses.

ROTATIONAL CAPACITY TEST CERTIFICATION

DATE OF TEST_____ TESTING FIRM_____
LOCATION OF TEST_____ TESTER NAME_____

	BOLT	NUT	WASHER
MANUFACTURER	_____	_____	_____
LOCATION OF MANUF	_____	_____	_____
LOT NO.	_____	_____	_____
SPEC.(ASTM)	_____	_____	_____
GRADE(NUT)	_____	_____	_____

BOLT SIZE : DIA x LENGTH_____
TEST:(FHWA)_____ (ASTM)____ REQUIRED ROTATION_____

Test Notes:
1. Torque/Tension comparison between minimum tension (proof load) and full required rotation in test.
2. Tension at required turn>1.15 proof load.
3. Stripping (must turn with fingers after test) - no stripping passes.
4. Two samples are required to be tested.

SAMPLE I:
1. MEASURED TORQ____TENSION_____MAX.ALLOW.TORQUE @ T=.25PD____
2. MEASURED TENSION @ REQ. TURN_____ MIN. REQ. TENSION_____
3. STRIPPING YES____ NO____

SAMPLE II:
1. MEASURED TORQ____TENSION_____MAX.ALLOW.TORQUE @ T=.25PD____
2. MEASURED TENSION @ REQ. TURN_____ MIN. REQ. TENSION_____
3. STRIPPING YES____ NO____

R/C TEST LOT NO._____ TEST PASSED_____

SIGNATURE OF TESTER_____

NOTARY PUBLIC:
(Optional)

ROTATIONAL CAPACITY TEST / MAXIMUM TORQUE			
¾ INCH BOLT		⅞ INCH BOLT	
TENSION (KIPS)	TORQUE (FT-LBS)	TENSION (KIPS)	TORQUE (FT-LBS)
28	437	39	711
29	453	40	729
30	469	41	747
31	484	42	766
32	500	43	784
33	516	44	802
34	531	45	820
35	547	46	839
36	562	47	857
37	578	48	875
38	594	49	893
39	609	50	911
40	625	51	930
41	641	52	948
42	656	53	966
43	672	54	984
44	688	55	1003
45	703	56	1021

TEMPERATURE ADJUSTMENTS

BRIDGE ROCKERS

This exhibit consists of instructions pertaining to the installation and/or checking of bridge rockers for continuous span units. The proper setting of rockers is a critical factor in the long life of a bridge and should be given careful consideration and attention.

INSTRUCTIONS FOR SETTING ROCKERS

1. Strike centerline bearing on pier and abutment caps and set masonry bearing assemblies in place. (Do not drill anchor bolts yet)

2. Set structural steel and completely bolt up and position steel in its final location.

3. Jack up structural steel and reposition bottom masonry plate such that the rockers are inclined according to the temperature correction for the temperature of the steel (not the air). See example on Page 2 of this exhibit.

4. Drill anchor bolt holes.

5. Check setting of rockers and lead in the anchor bolts in accordance with the instructions in Section 63-08.0900 of this manual.

NOTE:

a. If the anchor bolts are leaded in and the rockers are incorrectly set, contact the District Construction Office for further instructions.

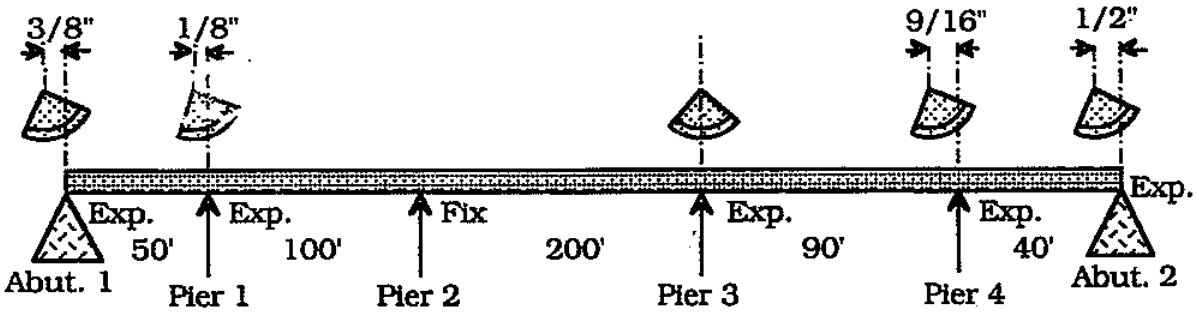
b. Total rocker corrections of simple spans are more involved than those described herein for continuous units. Bottom flange elongation and temperature correction should be considered. Normally, a correction chart will be included in the plans for this purpose. If no such chart is provided or if additional information is needed, the Project Engineer should contact the District Construction Office for instructions.

c. In rare cases, adequate clearance may not be available to drill the anchor bolt holes after the structural steel is set. In this event, the Project Engineer should contact the District Construction for guidance.

d. This example does not include steel elongation from dead load applications with the resulting camber reduction. Normally this situation is encountered on long river bridges and the plans will contain a chart for rocker settings. When this situation is encountered or when there is any question regarding elongation resulting from camber reduction, the Project Engineer should contact the District Construction Office.

TEMPERATURE ADJUSTMENTS

BRIDGE ROCKERS



Correction Factor in Feet(C) = .00000645 (T) (L)
T = Temperature Differential of the steel from 60°F
L = Distance from fixed point

NOTE: (1) The rocker will be in the expanded position with the rocker leaning away from the fixed point (Pier No. 2 in the example) when the temperature of the steel is greater than 60°F as in Abut. No. 1 and Pier No. 1. Conversely, the rocker will lean toward the fixed point when the temperature of the steel is less than 60°F as in Pier No. 4 and Abut. No. 1

Abut. No. 1:
Set at 90°F
T = 90°F - 60°F = 30°
L = 50' + 100' = 150'
C = .00000645 x 30 x 150 = .03 ' = 3/8"

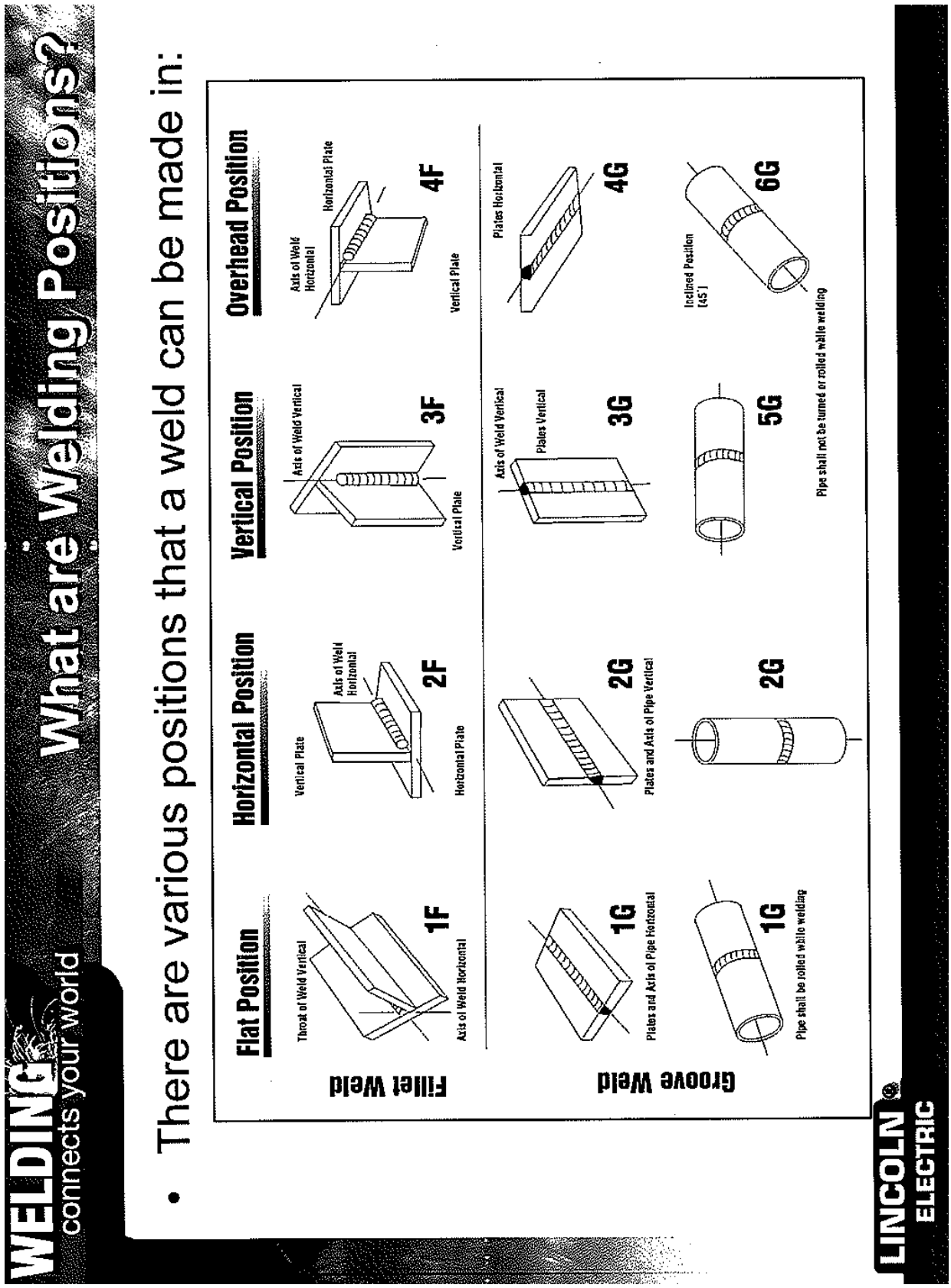
Pier No. 1:
Set at 80°F
T = 80°F - 60°F = 20°
L = 100'
C = .00000645 x 20 x 100 = .012' = 1/8"

Pier No. 3:
Set at 60°F
Set Rocker Vertical

Pier No. 4:
Set at 35°F
T = 60°F - 35°F = 25°
L = 200' + 90' = 290'
C = .00000645 x 25 x 290 = .047' = 9/16"

Abut. No. 2:
Set at 40°F
T = 60°F - 40°F = 20°
L = 200' + 90' + 40' = 330'
C = .00000645 x 20 x 330 = .043' = 1/2"

NOTE: Use steel temperature, not air temperature. Do not use temperature in Celsius with this formula.


WELDING
connects your world
What are Welding Positions?
• There are various positions that a weld can be made in:
Flat Position
Horizontal Position
Vertical Position
Overhead Position
Throat of Weld Vertical
Axis of Weld Horizontal
1F
Vertical Plate
Axis of Weld Horizontal
Horizontal Plate
2F
Axis of Weld Vertical
Vertical Plate
3F
Axis of Weld Horizontal
Horizontal Plate
Vertical Plate
4F
Fillet Weld
Plates and Axis of Pipe Horizontal
1G
Pipe shall be rolled while welding
1G
Plates and Axis of Pipe Vertical
2G
2G
Axis of Weld Vertical
Plates Vertical
3G
Plates Horizontal
4G
Inclined Position (45°)
5G
Pipe shall not be turned or rolled while welding
6G
Groove Weld
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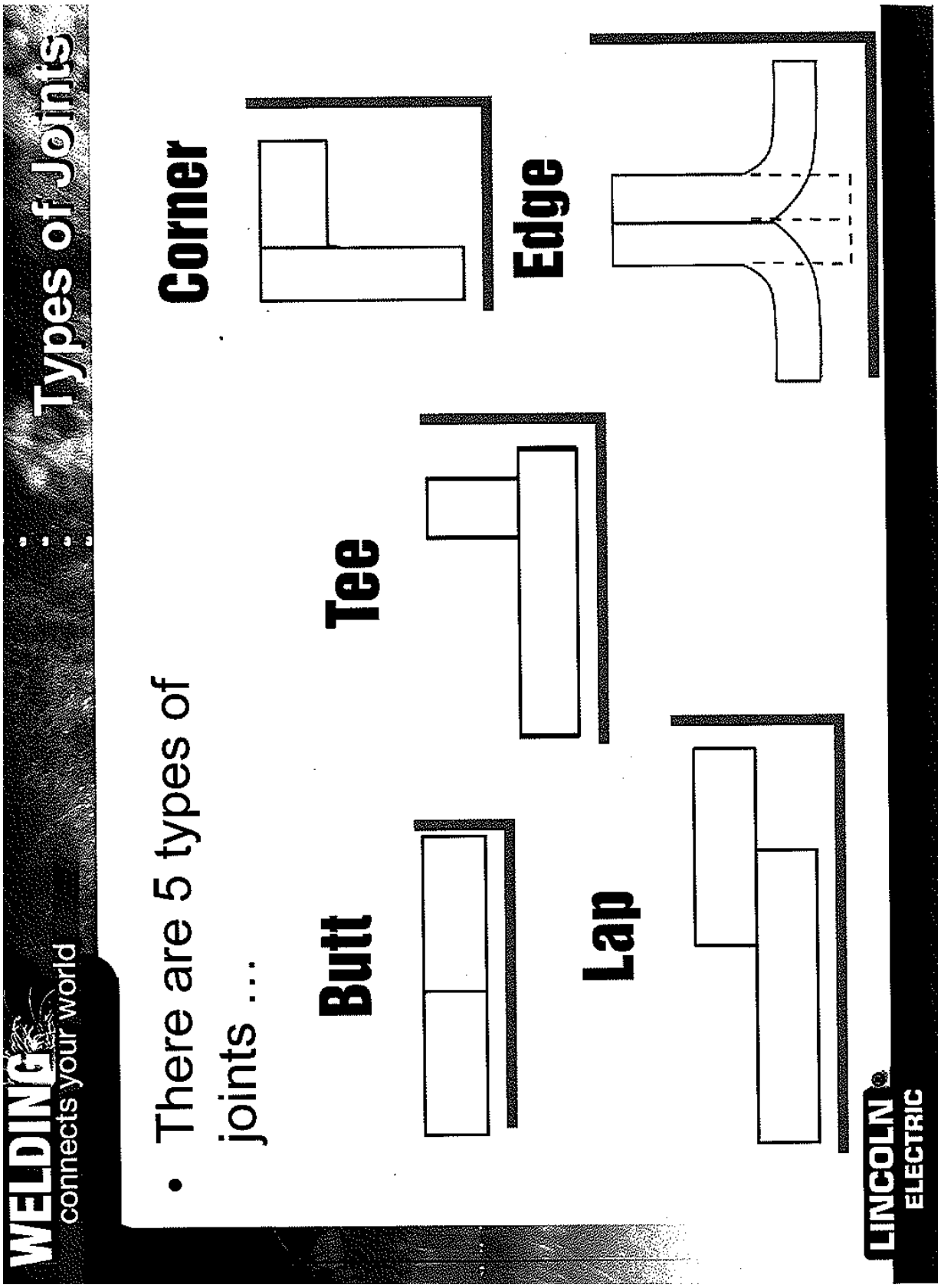
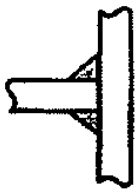
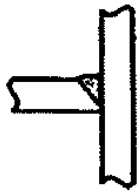

WELDING connects your world
Types of Joints
• There are 5 types of joints …
Corner
Edge
Tee
Butt
Lap
LINCOLN ELECTRIC

WELDING connects your world

Fillet and Groove Welds

- Groove and fillet welds can be made on many types of joints

	Fillet	Groove
Butt	N.A.	
Tee		
Corner		
Lap		N.A.

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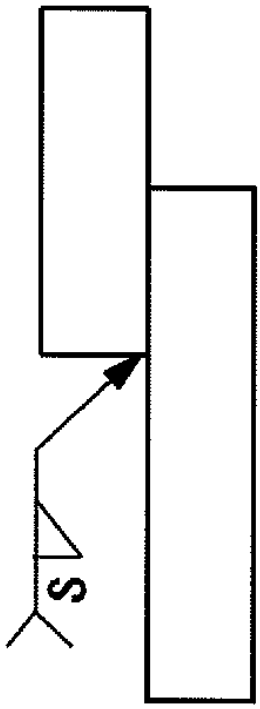
WELDING connects your world

Welding Symbols



- Welding symbols contain information about the weld to be made
  - *S – leg dimension of the weld*
  - *Triangle – the weld is to be made on the arrow side of this joint*
  - *Tail – any additional information required (i.e. position the weld is to be made)*
  - *Arrow - the joint the welding symbol applies to*

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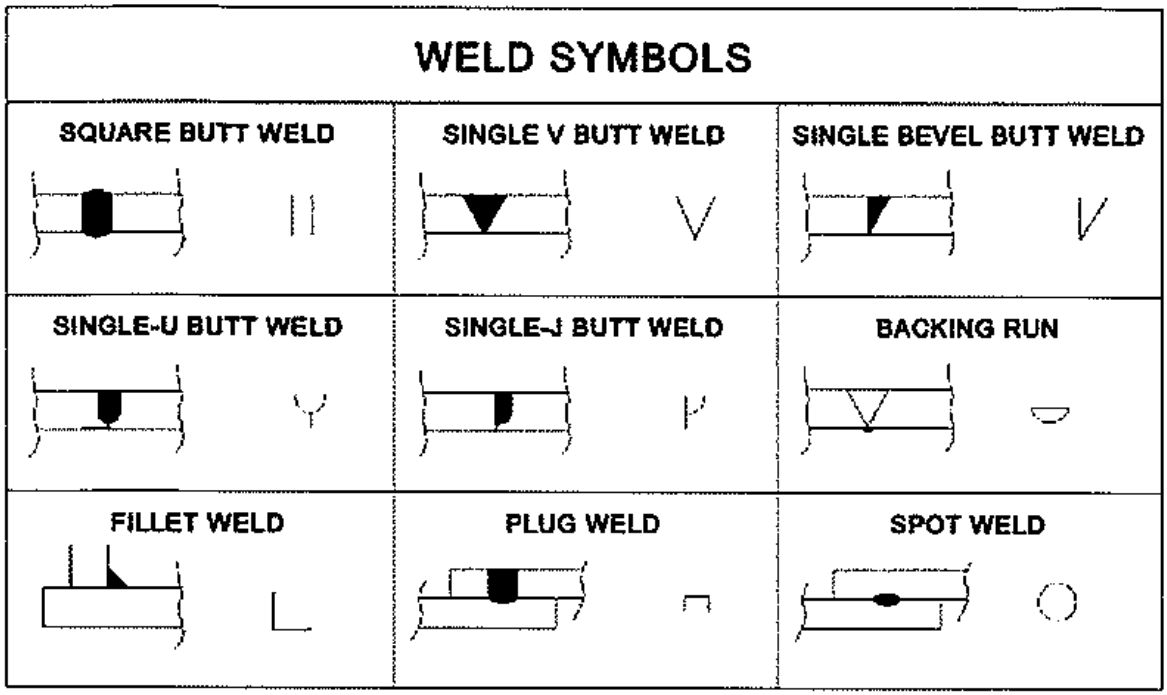
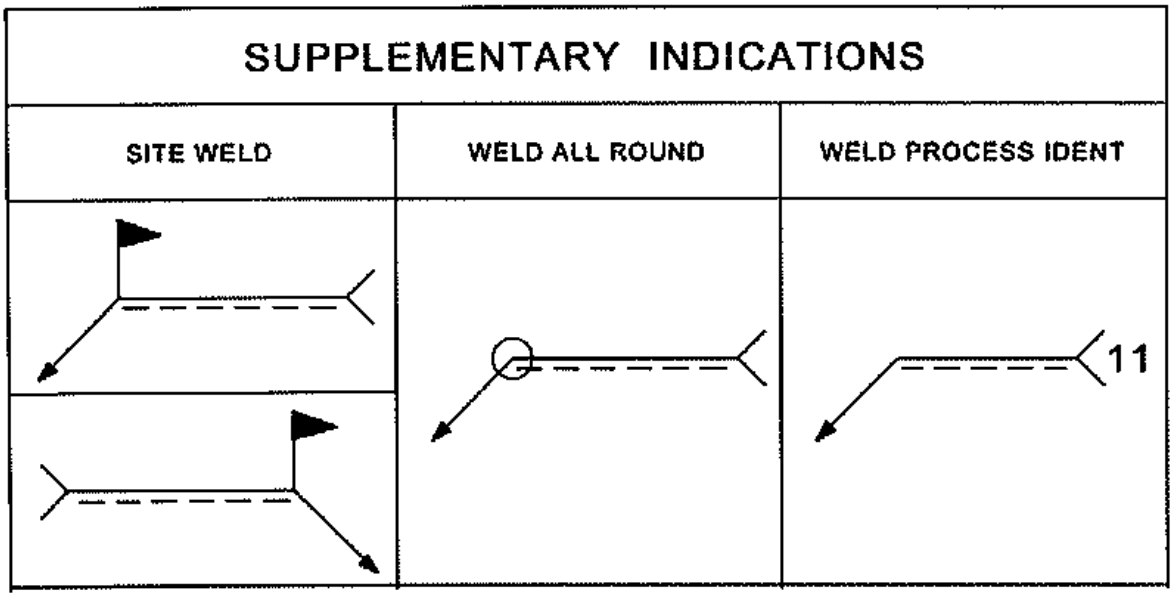
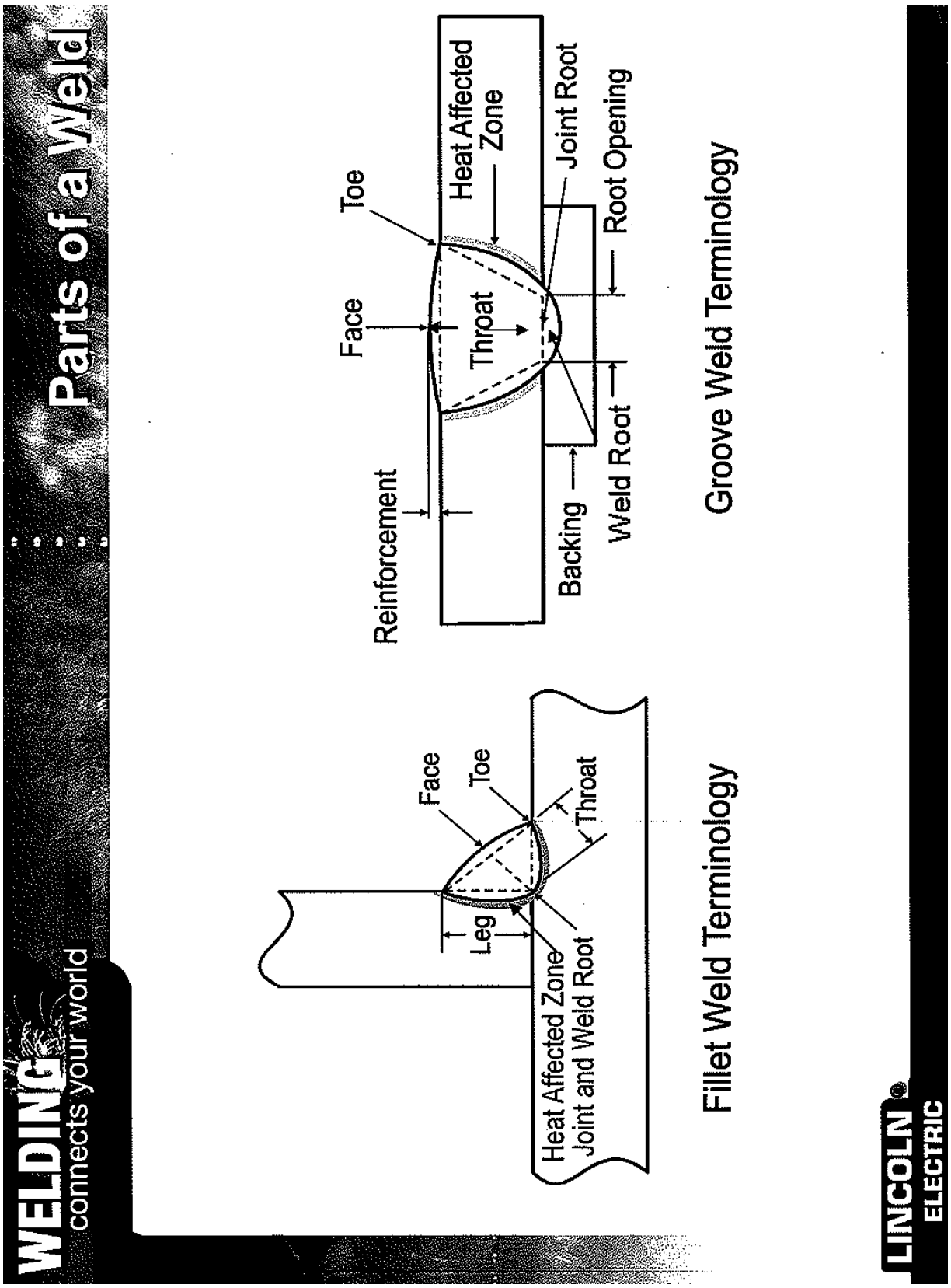
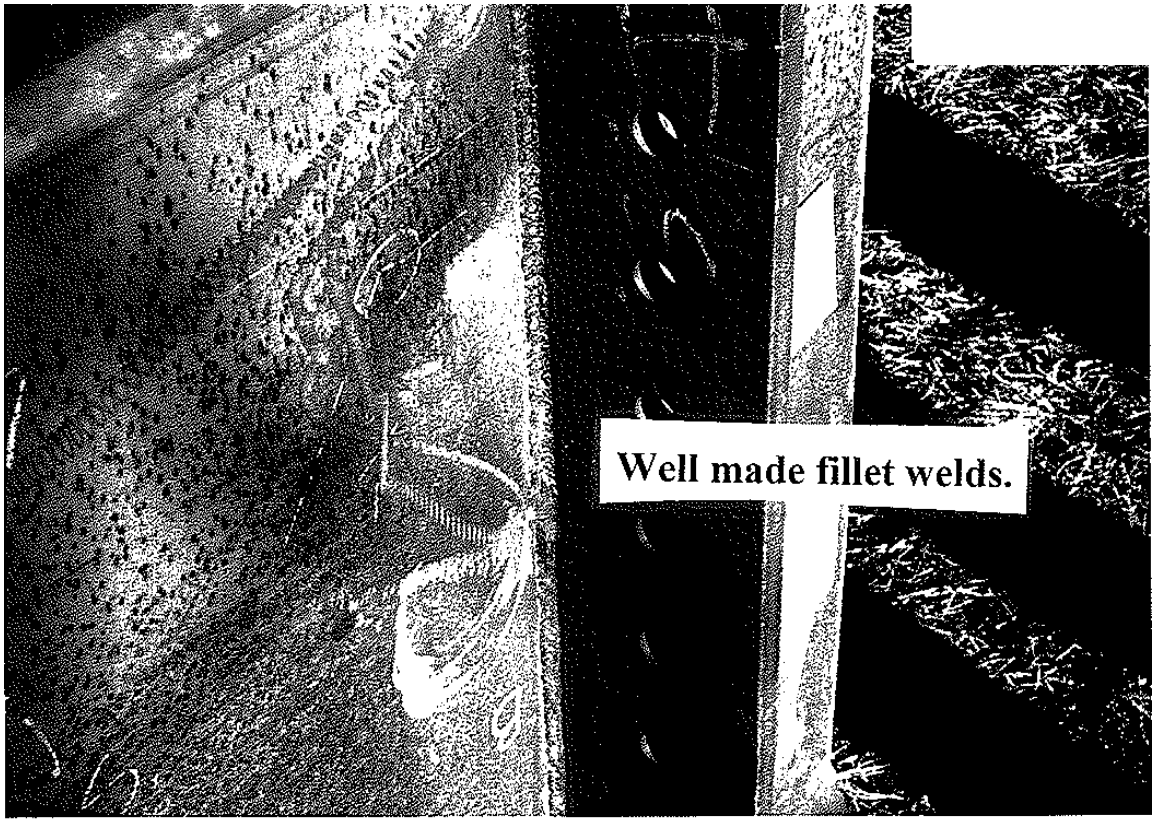
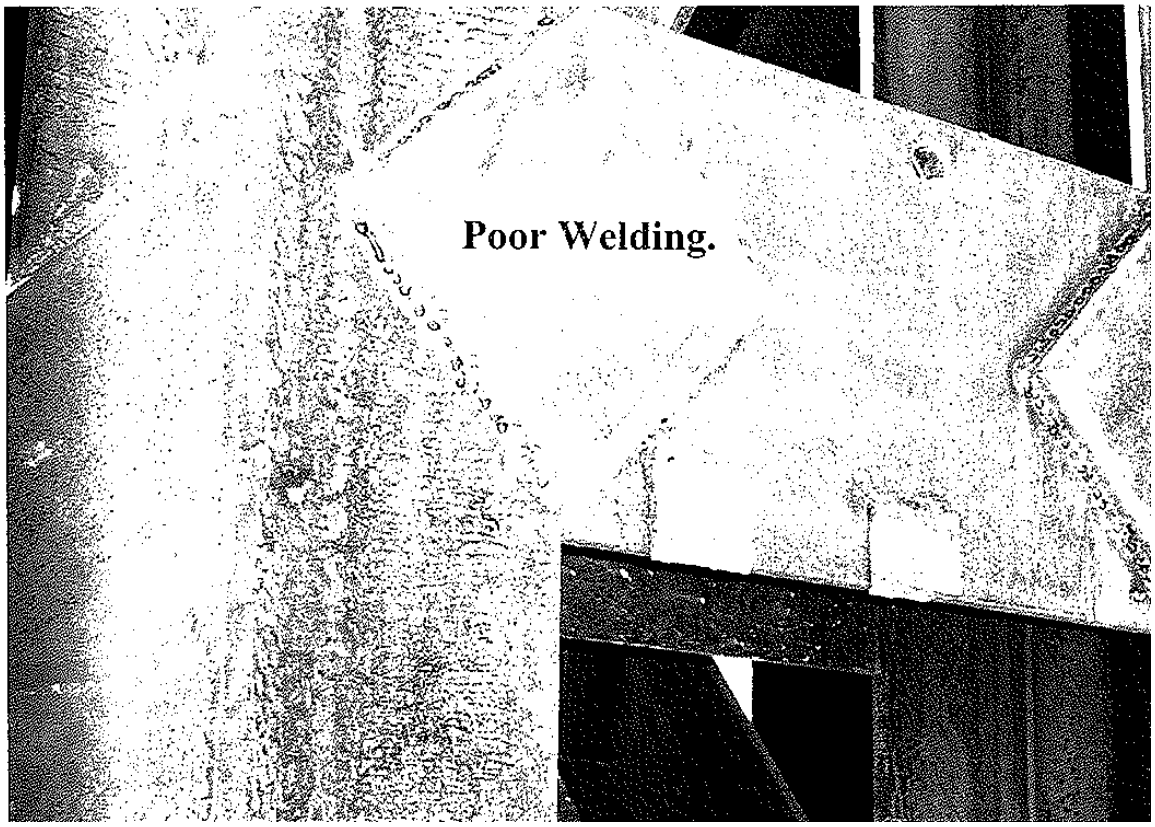

WELD SYMBOLS
SQUARE BUTT WELD
SINGLE V BUTT WELD
SINGLE BEVEL BUTT WELD
SINGLE-U BUTT WELD
SINGLE-J BUTT WELD
BACKING RUN
FILLET WELD
PLUG WELD
SPOT WELD


SUPPLEMENTARY INDICATIONS
SITE WELD
WELD ALL ROUND
WELD PROCESS IDENT
11


Parts of a Weld
WELDING connects your world
Toe
Face
Reinforcement
Heat Affected Zone
Throat
Joint Root
Root Opening
Weld Root
Backing
Groove Weld Terminology
Face
Toe
Throat
Leg
Heat Affected Zone
Joint and Weld Root
Fillet Weld Terminology
LINCOLN ELECTRIC

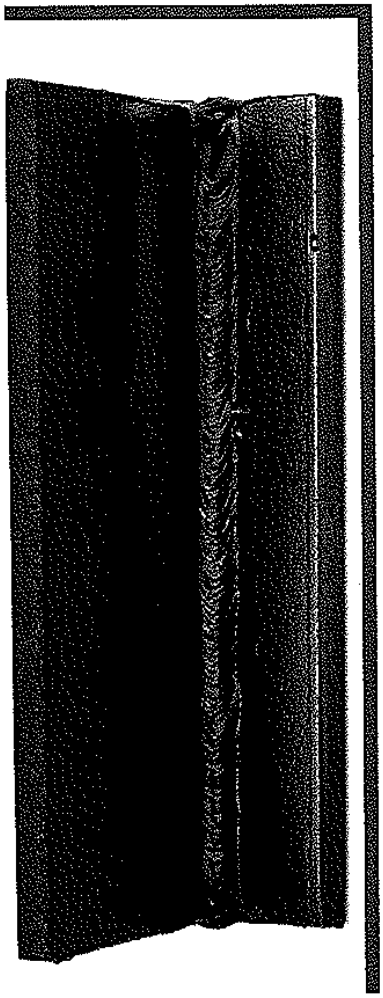

Well made fillet welds.


Poor Welding.

WELDING connects your world

Fillet Weld Inspection

- Fillet welds should:
  - *Have a flat to slightly convex face*
  - *Be uniform in appearance*
  - *Have equal leg size*
  - *Have good wash-in into base materials*
- This is an example of a good fillet weld:



LINCOLN ELECTRIC

The ABC's of Nondestructive Weld Examination

Reprinted courtesy of *Welding Journal* magazine.

An understanding of the benefits and drawbacks of each form of nondestructive examination can help you choose the best method for your application

By Charles Hayes

The philosophy that often guides the fabrication of welded assemblies and structures is "to assure weld quality." However, the term "weld quality" is relative. The application determines what is good or bad. Generally, any weld is of good quality if it meets appearance requirements and will continue indefinitely to do the job for which it is intended. The first step in assuring weld quality is to determine the degree required by the application. A standard should be established based on the service requirements.

Standards designed to impart weld quality may differ from job to job, but the use of appropriate weld techniques can provide assurance that the applicable standards are being met. Whatever the standard of quality, all welds should be inspected, even if the inspection involves nothing more than the welder looking after his own work after each weld pass. A good-looking weld surface appearance is many times considered indicative of high weld quality. However, surface appearance alone does not assure good workmanship or internal quality.

Nondestructive examination (NDE) methods of inspection make it possible to verify compliance to the standards on an ongoing basis by examining the surface and subsurface of the weld and surrounding base material. Five basic methods are commonly used to examine finished welds: visual, liquid penetrant, magnetic particle, ultrasonic and radiographic (X-ray). The growing use of computerization with some methods provides added image enhancement, and allows real-time or near real-time viewing, comparative inspections and archival capabilities. A review of each method will help in deciding which process or combination of processes to use for a specific job and in performing the examination most effectively.

Visual Inspection (VT)

Visual inspection is often the most cost-effective method, but it must take place prior to, during and after welding. Many standards require its use before other methods, because there is no point in submitting an obviously bad weld to sophisticated inspection techniques. The ANSI/AWS D1.1, Structural Welding Code - Steel, states, "Welds subject to nondestructive examination shall have been found acceptable by visual inspection." Visual inspection requires little equipment. Aside from good eyesight and sufficient light, all it takes is a pocket rule, a weld size gauge, a magnifying glass, and possibly a straight edge and square for checking straightness, alignment and perpendicularity.

Before the first welding arc is struck, materials should be examined to see if they meet specifications for quality, type, size, cleanliness and freedom from defects. Grease, paint, oil, oxide film or heavy scale should be removed. The pieces to be joined should be checked for flatness, straightness and dimensional accuracy. Likewise, alignment, fit-up and joint preparation should be examined. Finally, process and procedure variables should be verified, including electrode size and type, equipment settings and provisions for preheat or postheat. All of these precautions apply regardless of the inspection method being used.

During fabrication, visual examination of a weld bead and the end crater may reveal problems such as cracks, inadequate penetration, and gas or slag inclusions. Among the weld defects that can be recognized visually are cracking, surface slag inclusions, surface porosity and undercut.

The ABC's of Nondestructive Weld Examination | Lincoln Electric

On simple welds, inspecting at the beginning of each operation and periodically as work progresses may be adequate. Where more than one layer of metal filler is being deposited, however, it may be desirable to inspect each layer before depositing the next. The root pass of a multipass is most critical to weld soundness. It is especially susceptible to cracking, and because it solidifies quickly, it may trap gas and slag. On subsequent passes, conditions caused by the shape of the weld bead or changes in the joint configuration can cause further cracking, as well as undercut and slag trapping. Repair costs can be minimized if visual inspection detects these flaws before welding progresses.

Visual inspection at an early stage of production can also prevent underwelding and overwelding. Welds that are smaller than called for in the specifications cannot be tolerated. Beads that are too large increase costs unnecessarily and can cause distortion through added shrinkage stress.

After welding, visual inspection can detect a variety of surface flaws, including cracks, porosity and unfilled craters, regardless of subsequent inspection procedures. Dimensional variances, warpage and appearance flaws, as well as weld size characteristics, can be evaluated.

Before checking for surface flaws, welds must be cleaned of slag. Shotblasting should not be done before examination, because the peening action may seal fine cracks and make them invisible. The AWS D1.1 Structural Welding Code, for example, does not allow peening "on the root or surface layer of the weld or the base metal at the edges of the weld."

Visual inspection can only locate defects in the weld surface. Specifications or applicable codes may require that the internal portion of the weld and adjoining metal zones also be examined. Nondestructive examinations may be used to determine the presence of a flaw, but they cannot measure its influence on the serviceability of the product unless they are based on a correlation between the flaw and some characteristic that affects service. Otherwise, destructive tests are the only sure way to determine weld serviceability.

Radiographic Inspection

Radiography (X-ray) is one of the most important, versatile and widely accepted of all the nondestructive examination methods - Fig. 1. X-ray is used to determine internal soundness of the welds. The term "X-ray quality," widely used to indicate high quality in welds, arises from this inspection method.

Radiography is based on the ability of X-rays and gamma rays to pass through metal and other materials opaque to ordinary light, and produce photographic records of the transmitted radiant energy. All materials will absorb known amounts of this radiant energy and, therefore, X-rays and gamma rays can be used to show discontinuities and inclusions within the opaque material. The permanent film record of the internal conditions will show the basic information by which weld soundness and be determined.

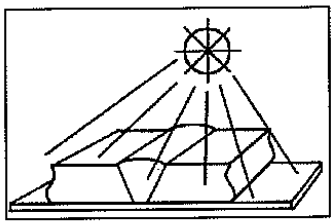


Fig. 1 - Radiography is one of the most important, versatile and widely accpeted examination methods.

X-rays are produced by high-voltage generators. As the high voltage applied to an X-ray tube is increased, the wavelength of the emitted X-ray becomes shorter , providing more penetrating power. Gamma rays are produced by the atomic disintegration of radioisotopes. The radioactive isotopes most widely used in industrial radiography are Cobalt 60 and Iridium 192. Gamma rays emitted from these isotopes are similar to X-rays, except their wavelengths are usually shorter. This allows them to penetrate to greater depths than X-rays of the same power, however, exposure times are considerably longer due to the longer intensity.

When X-rays or gamma rays are directed at a section of weldment , not all of the radiation passes are through the metal. Different materials, depending on their density, thickness and atomic number, will absorb different wavelengths of radiant energy.

The degree to which the different materials absorb these rays determines the intensity of the rays penetrating through the material. When variations of these rays are recorded, a means of seeing inside the material is available. The image on a developed photo-sensitized film is known as a radiograph. Thicker areas of the specimen or higher density material (tungsten inclusion), will absorb more radiation and their corresponding areas on the radiograph will be lighter - Fig 2.

The ABC's of Nondestructive Weld Examination | Lincoln Electric

Whether in the shop or in the field, the reliability and interpretive value of radiographic images are a function of their sharpness and contrast. The ability of an observer to detect a flaw depends on the sharpness of its image and its contrast with the background. To be sure that a radiographic exposure produces acceptable results, a gauge known as an Image Quality Indicator (IQI) is placed on the part so that its image will be produced on the radiograph.

IQI's used to determine radiographic quality are also called penetrameters. A standard hole-type penetrameter is a rectangular piece of metal with three drilled holes of set diameters. The thickness of the piece of metal is a percentage of the thickness of the specimen being radiographed. The diameter of each hole is different and is a given multiple of the penetrameter thickness. Wire-type penetrameters are also widely used, especially outside the United States. They consist of several pieces of wire, each of a different diameter. Sensitivity is determined by the smallest diameter of wire that can be clearly seen on the radiograph.

A penetrameter is not an indicator or gauge to measure the size of a discontinuity or the minimum detectable flaw size. It is an indicator of the quality of the radiographic technique.

Radiographic images are not always easy to interpret. Film handling marks and streaks, fog and spots caused by developing errors may make it difficult to identify defects. Such film artifacts may mask weld discontinuities.

Surface defects will show up on the film and must be recognized. Because the angle of exposure will also influence the radiograph, it is difficult or impossible to analyze fillet welds by this method. Because a radiograph compresses all the defects that occur throughout the thickness of the weld into one plane, it tends to give an exaggerated impression of scattered type defects such as porosity or inclusions.

An X-ray image of the interior of the weld may be viewed on a fluorescent screen, as well as on developed film. This makes it possible to inspect parts faster and at a lower cost, but the image definition is poorer. Computerization has made it possible to overcome many of the shortcomings of radiographic imaging by linking the fluorescent screen with a video camera. Instead of waiting for film to be developed, the images can be viewed in real time. This can improve quality and reduce costs on production applications such as pipe welding, where a problem can be identified and corrected quickly.

By digitizing the image and loading it into a computer, the image can be enhanced and analyzed to a degree never before possible. Multiple images can be superimposed. Pixel values can be adjusted to change shading and contrast, bringing out small flaws and discontinuities that would not show up on film. Colors can be assigned to the various shades of gray to further enhance the image and make flaws stand out better. The process of digitizing an image taken from the fluorescent screen - having that image computer enhanced and transferred to a viewing monitor - takes only a few seconds. However, because there is a time delay, we can no longer consider this "real time." It is called "radioscopy imagery."

Existing films can be digitized to achieve the same results and improve the analysis process. Another advantage is the ability to archive images on laser optical disks, which take up far less space than vaults of old films and are much easier to recall when needed.

Industrial radiography, then, is an inspection method using X-rays and gamma rays as a penetrating medium, and densitized film as a recording medium, to obtain a photographic record of internal quality. Generally, defects in welds consist either of a void in the weld metal itself or an inclusion that differs in density from the surrounding weld metal.

Radiographic equipment produces radiation that can be harmful to body tissue in excessive amounts, so all safety precautions should be followed closely. All instructions should be followed carefully to achieve satisfactory results. Only personnel who are trained in radiation safety and qualified as industrial radiographers should be permitted to do radiographic testing.

More | Article Index

The ABC's of Nondestructive Weld Examination

Reprinted courtesy of *Welding Journal* magazine.

Magnetic Particle Inspection (MT)

Magnetic particle inspection is a method of locating and defining discontinuities in magnetic materials. It is excellent for detecting surface defects in welds, including discontinuities that are too small to be seen with the naked eye, and those that are slightly subsurface.

This method may be used to inspect plate edges prior to welding, in process inspection of each weld pass or layer, postweld evaluation and to inspect repairs - Fig. 3.

It is a good method for detecting surface cracks of all sizes in both the weld and adjacent base metal, subsurface cracks, incomplete fusion, undercut and inadequate penetration in the weld, as well as defects on the repaired edges of the base metal. Although magnetic particle testing should not be a substitute for radiography or ultrasonics for subsurface evaluations, it may present an advantage over their methods in detecting tight cracks and surface discontinuities.

With this method, probes are usually placed on each side of the area to be inspected, and a high amperage is passed through the workplace between them. A magnetic flux is produced at right angles to the flow of current - Fig. 3. When these lines of force encounter a discontinuity, such as a longitudinal crack, they are diverted and leak through the surface, creating magnetic poles or points of attraction. A magnetic powder dusted onto the surface will cling to the leakage area more tenaciously than elsewhere, forming an indication of the discontinuity.

For this indication to develop, the discontinuity must be angled against the magnetic lines of force. Thus, when current is passed longitudinally through a workpiece, only longitudinal flaws will show. Putting the workpiece inside a solenoid coil will create longitudinal lines of force (Fig. 3) that cause transverse and angular cracks to become visible when the magnetic powder is applied.

Although much simpler to use than radiographic inspection, the magnetic particle method is limited to use with ferromagnetic materials and cannot be used with austenitic steels. A joint between a base metal and a weld of different magnetic characteristics will create magnetic discontinuities that may falsely be interpreted as unsound. On the other hand, a true defect can be obscured by the powder clinging over the harmless magnetic discontinuity. Sensitivity decreases with the size of the defect and is also less with round cracks such as gas pockets. It is best with elongated forms, such as cracks, and is limited to surface flaws and some subsurface flaws, mostly on thinner materials.

Because the field must be distorted sufficiently to create the external leakage required to identify flaws, the fine, elongated discontinuities, such as hairline cracks, seams or inclusions that are parallel to the magnetic field, will not show up. They can be developed by changing the direction of the field, and it is advisable to apply the field from two directions, preferably at right angles to each other.

Magnetic powders maybe applied dry or wet. The dry powder method is popular for inspecting heavy weldments, while the wet method is often used in inspecting aircraft components. Dry powder is dusted uniformly over the work with a spray gun, dusting bag or atomizer. The finely divided magnetic particles are coated to increase their mobility and are available in gray, black and red colors to improve visibility. In the wet method, very fine red or black particles are suspended in water or light petroleum distillate. This can be flowed or sprayed on, or the part may be dipped into the liquid. The wet method is more sensitive than the dry method, because it allows the use of finer particles that can detect exceedingly fine defects. Fluorescent powders may be used for further sensitivity

The ABC's of Nondestructive Weld Examination | Lincoln Electric

and are especially useful for locating discontinuities in corners, keyways, splines and deep holes.

Liquid Penetrant Inspection (PT)
Surface cracks and pinholes that are not visible to the naked eye can be located by the liquid penetrant inspection. It is widely used to locate leaks in welds and can be applied with austentic steels and nonferrous materials where magnetic particle inspection would be useless.

Liquid penetrant inspection is often referred to as an extension of the visual inspection method. Many standards, such as the AWS D.1. Code, say that "welds subject to liquid penetrant testing·shall be evaluated on the basis of the requirements for visual inspection."

Two types of penetrating liquids are used - fluorescent and visible dye. With fluorescent penetrant inspection, a highly fluorescent liquid with good penetrating qualities is applied to the surface of the part to be examined. Capillary action draws the liquid into the surface openings, and the excess is then removed. A "developer" is used to draw the penetrant to the surface, and the resulting indication is viewed by ultraviolet (black) light. The high contrast between the fluorescent material and the object makes it possible to detect minute traces of penetrant that indicate surface defects.

Dye penetrant inspection is similar, except that vividly colored dyes visible under ordinary light are used - Fig. 4. Normally, a white developer is used with the dye penetrants that creates a sharply contrasting background to the vivid dye color. This allows greater portability by eliminating the need for ultraviolet light.

The part to be inspected must be clean and dry, because any foreign matter could close the cracks or pinholes and exclude the penetrant. Penetrants can be applied by dipping, spraying or brushing, but sufficient time must be allowed for the liquid to be fully absorbed into the discontinuities. This may take an hour or more in very exacting work.

Liquid penetrant inspection is widely used for leak detection. A common procedure is to apply fluorescent material to one side of a joint, wait an adequate time for capillary action to take place, and then view the other side with ultraviolet light. In thin-walled vessels, this technique will identify leaks that ordinarily would not be located by the usual air test with pressures of 5-20 lb/in.2 When wall thickness exceeds ¹ in., however, sensitivity of the leak test decreases.

Ultrasonic Inspection (UT)
Ultrasonic inspection is a method of detecting discontinuities by directing a high-frequency sound beam through the base plate and weld on a predictable path. When the sound beam's plate path strikes an interruption in the material continuity, some of the sound is reflected back. The sound is collected by the instrument, amplified and displayed as a vertical trance on a video screen - Fig. 5.

Both surface and subsurface detects in metals can be detected, located and measured by ultrasonic inspection, including flaws too small to be detected by other methods.

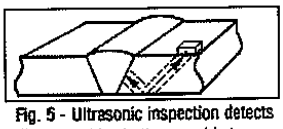


Fig. 5 - Ultrasonic inspection detects discontinuities both on and below the weld surface. Compact, portable equipment makes it easy to use in the field.

The ultrasonic unit contains a crystal of quartz or other piezoelectric material encapsulated in a transducer or probe. When a voltage is applied, the crystal vibrates rapidly. As an ultrasonic transducer is held against the metal to be inspected, it imparts mechanical vibrations of the same frequency as the crystal through a couplet material into the base metal and weld. These vibrational waves are propagated through the material until they reach a discontinuity or change in density. At these points, some of the vibrational energy is reflected back. As the current that causes the vibration is shut off and on at 60-1000 times per second, the quartz crystal intermittently acts as a receiver to pick up the reflected vibrations. These cause pressure on the crystal and generate an electrical current. Fed to a video screen, this current produces vertical deflections on the horizontal base line. The resulting pattern on the face of the tube represents the reflected signal and the discontinuity. Compact portable ultrasonic equipment is available for field inspection and is commonly used on bridge and structural work.

Ultrasonic testing is less suitable than other NDE methods for determining porosity in welds, because round gas pores respond to ultrasonic tests as a series of single point reflectors. This results in low-amplitude responses

that are easily confused with "base-line noise" inherent with testing parameters. However, it is the preferred test method for detecting plainer-type discontinuities and lamination.

Portable ultrasonic equipment is available with digital operation and microprocessor controls. These instruments may have built-in memory and can provide hard-copy printouts or video monitoring and recording. They can be interfaced with computers, which allows further analysis, documentation and archiving, much as with radiographic data. Ultrasonic examination requires expert interpretation from highly skilled and extensively trained personnel.

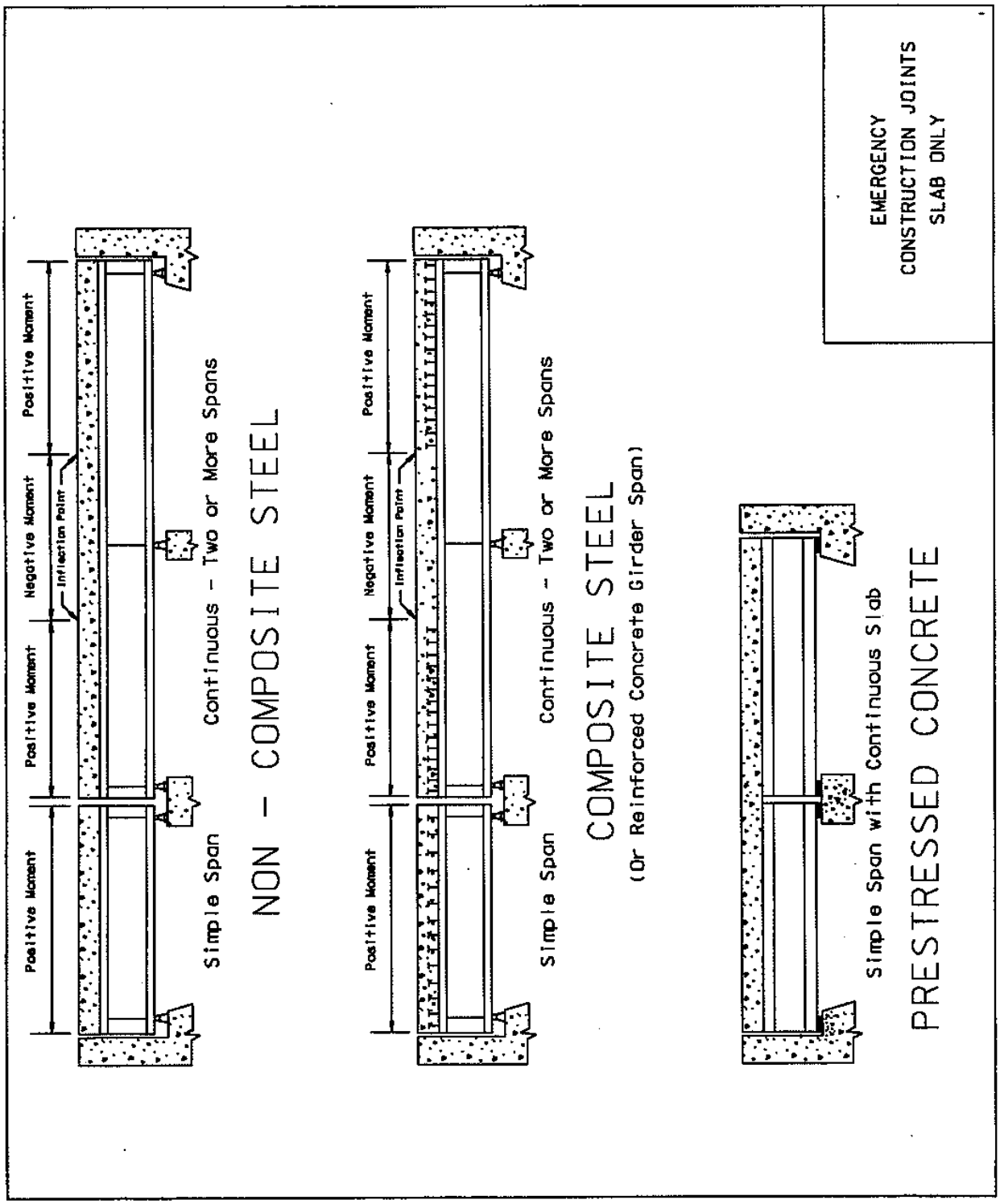
Choices Control Quality

A good NDE inspection program must recognize the inherent limitations of each process. For example, both radiography and ultrasound have distinct orientation factors that may guide the choice of which process to use for a particular job. Their strengths and weaknesses tend to compliment each other. While radiography is unable to reliably detect lamination-like defects, ultrasound is much better at it. On the other hand, ultrasound is poorly suited to detecting scattered porosity, while radiography is very good.

Whatever inspection techniques are used, paying attention to the "Five P's" of weld quality will help reduce subsequent inspection to a routine checking activity. Then, the proper use of NDE methods will serve as a check to keep variables in line and weld quality within standards.

The Five P's are:

1) Process Selection. The process must be right for the job.
2) Preparation. The joint configuration must be right and compatible with the welding process.
3) Procedures. The procedures must be spelled out in detail and followed religiously during welding.
4) Pretesting. Full-scale mockups or simulated specimens should be used to prove that the process and procedures give the desired standard of quality.
5) Personnel. Qualified people must be assigned to the job.


EMERGENCY
CONSTRUCTION JOINTS
SLAB ONLY
Positive Moment
Negative Moment
Positive Moment
Inflection Point
Simple Span
Continuous - Two or More Spans
NON - COMPOSITE STEEL
Positive Moment
Negative Moment
Positive Moment
Inflection Point
Simple Span
Continuous - Two or More Spans
COMPOSITE STEEL
(Or Reinforced Concrete Girder Span)
Simple Span with Continuous Slab
PRESTRESSED CONCRETE

EMERGENCY CONSTRUCTION JOINTS FOR BRIDGE SLABS

Definition of Terms

Inflection Point: An inflection point is the point where the bending moment changes from positive to negative and occurs at approximately 1/5th of the clear span distance from the face of the pier on multi-span, continuous units.

Negative Moment Area: The negative moment area is that section of a bridge slab located over a pier with the limits defined by inflection points, one of which is located on each side of the pier as explained above. The top of beams and the deck is in tension in the longitudinal direction an a negative moment area.

Composite Bridge Deck: A bridge in which the slab and beams are rigidly connected to cause the slab and beams to act together as a tee unit. This action is achieved on steel beam bridges with the use of shear connectors and on concrete beam bridges with reinforcing stirrup bars protruding form the top of the beams.

Non-Composite Bridge Deck: A non-composite bridge deck is a slab which is not tied to the beams. The design of the bridge is not based upon a tee unit.

Emergency Construction Joint Location

1. For the following types of structures an emergency construction joint may be made at any location in the slab except that no joint may be located within ten (10) feet of another construction joint:

   1) Simple Reinforced Concrete Deck Girder Spans
   2) Non-Composite Simple Steel Girder Spans
   3) Simple Prestressed Concrete Girder Spans.

2. For continuous girder spans it is desirable to locate an emergency construction joint prior to the negative moment area over the pier. This may require that some of the fresh concrete be "washed out" back to a desired joint location.

3. Composite Simple Steel Girder Spans: This type of structure will have shear connectors from end to end of span. No joints are allowed except as detailed on the plans. If a breakdown occurs, the contractor may elect to wash the concrete out if the quantity placed is small. If the quantity placed is a significant amount, the contractor may elect to install an emergency construction joint. In this event the project engineer should immediately contact the District Construction Office who in turn should contact the Central Office Division of Construction Bridge Engineer for direction. No more concrete shall be placed until the situation is resolved.

4. Composite Continuous Steel Girder Spans: This type of structure will have shear connectors located only in the positive moment areas. Usually there will be a pouring sequence on the plans or the plans may require that the concrete be kept in a plastic state by the addition of a set retarder until the entire deck is placed.

   An emergency construction joint may be made in the negative moment areas provided all the positive moment areas have been placed. If it is necessary to provide an emergency construction joint in a positive moment area, the Project Engineer should immediately contact the District Construction Office who in turn should contact the Central Office Division of Construction Bridge Engineer for guidance. No more concrete is to be placed until the situation is resolved.

General Note:

An approved epoxy grout should be used as an aid to bonding at all emergency construction joint locations.

CEMENT (Low Slump) CONCRETE OVERLAY

This exhibit has been prepared to explain as in-depth as possible the necessary computations involved in a Low Slump Concrete operation. The information presented here-in is from an actual project and is realistic. It is anticipated that the Inspector will make his own graphs to reflect his concrete truck calibration data, however, the forms used for the "Design Data For Concrete Mobiles" and for the "Water Cement Ratio" are available from the Central Office, Division of Construction. Blank copies of these forms have also been included as Exhibits 63-8-53, 54, & 55 and may be copied for use if the need arises.

It must be noted that this exhibit does not cover Latex Concrete, however, the procedures and computations for Latex Concrete are similar to those for Low Slump concrete and the transition should be made with little difficulty.

Accordingly, a sequence of events pertaining to a Low Slump Concrete operation has been prepared to aid in clarification of this exhibit. This information is presented as follows:

Sequence of Events

1. Inspect and calibrate Concrete Mobile Truck in accordance with KM 64-312. Use Form 64-317. See page 3 of this exhibit.

2. Determine the following data Form 64-105 (Concrete Mix Design) - Refer to Material's "Manual of Field Sampling and Testing Practices" for example.

   (A) Specific gravity of fine aggregate and coarse aggregate.

   (B) Percent absorption of coarse aggregate.

   (C) Weight per bag of each aggregate.

   (D) Ratio of aggregates.

3. Design the concrete mix using the "Concrete Mix Design" Form TD 64-305 (See Page 4 of this exhibit). Utilize information from the Special Provision applicable to the project and the Form TD 64-105 (Step 2 above) in making the calculations.

   (A) Calculate the free moisture of the fine and the coarse aggregate. Use whichever method prescribed in KM 64-306 that is applicable to the situation.

4. Obtain the Adjusted Aggregate weights due to moisture content from step 6 of Form 64-305. Plot this information on the form for "Design Data for Concrete Mobile", Page 10 of this exhibit.

5. Since this example concerns a low slump concrete overlay, compute the Design water/cement ratio on the form designed for this purpose (Page 11 of this exhibit). A similar form for latex overlay water/cement overlay has been included in this section as Exhibit No. 63-8-54.

6. Calculate the target density as follows; Compute the Average Combined Specific Gravity of the fine and coarse aggregates. Obtain the design added water in gal./C.Y. from the water/cement ratio form utilized in Step 5 above. Using this information, go to Chart No. 1 (Exhibit No. 63-8-51) to obtain the target density.

7. Upon completion of each truck load, the inspector will remove ticket from cement meter, verify reading and record the following data on the form titled "Design Data For Concrete Mobile" (See step 4 above)

   A. Meter Reading
   B. Water Meter Reading
   C. C.Y. produced (place in comments)

   When entire placement is completed, the inspector will summarize and record on the Water/Cement Ratio Form (Step 5 above) the following data:

   D. Total water used for entire placement
   E. Total C.Y. produced
   F. Compute water/cement ratio for entire placement

   A comparison may be made of the Design and Actual Water/Cement ratios and also of the Gal./C.Y. in each case.

8. Exhibit No. 63-8-54 is essentially the same Exhibit No. 68-8-53 which was used in Step 5 above, except it is for Latex Concrete. It should be noted that Form TD 64-305 (Mix Design Report) is not prepared for Latex. Weights of aggregates are obtained from the Special Provision applicable to the project.

TC 64-317
Rev. 1/78

KENTUCKY DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS
DIVISION OF MATERIALS
CONCRETE MOBILE CALIBRATION DATA SHEET

COUNTY	Caldwell	Project No.	MP 17-0175-B0012
CONTRACTOR	Golden Bridge	Date	5/2/79
TRUCK NO.	2	SERIAL NO. & CAPACITY	6CM5163 DH/24f 8cy-75.5-32
TRUCK R.P.M.	Hyd.	CALIBRATED BY	Roy J. White
CEMENT			

	Container Wt. 28.1 lb.		
	LBS.	COUNT	SECS.
1	103.4	80	32.2
2	99.6	80	32.2
3	97.2	80	32.4
4	98	80	32.2
5	97.8	80	32.3
TOTALS	496	400	161.3

Lbs./count = Total Lbs. / Total Counts = 496 / 400 = 1.2240

Lbs./sec. = Total Lbs. / Total Secs. = 496 / 161.3 = 3.0750

Sec. for 94 Lbs. = 94 / Lbs./County = 496 / 1.24 = 75.80 = 76

Sec. for 94 Lbs. = 94 / Lbs./Sec. = 94 / 3.075 = 30.57 = 31

SAND — Sec. for Calibration 31 Container Wt. 23.0# Moisture Content 3%

Dial Setting	2.5		3		3.5			
Lbs. of Sand	1340	132.1	166.4	166.3	197.5	195.9		
	130.4		165.6		194.2			

STONE — Sec. for Calibration 31 Container Wt. 23.0# Moisture Content 0%

Dial Setting	3.5		3.8		4		4.5		
Lbs. of Stone	150.6	151.2	166.5	167.1	182	181.9	203.8	202.2	
	151.8		167.7		181.8		200.6		

AIR — Sec. for Calibration 31 MB-YR Diluted 1 TO 5

Setting	0.4	0.6	0.8	1	1.2					
Fl. Ozs. or Lbs.	2.5	5	6.8	9	11.25					

PE "A" or TYPE "D" ADMIXTURE — Sec. for Calibration 31 Pozz 300-R Diluted 1 to 5

Setting	0.4	0.6	0.8	1						
Fl. Ozs.	6	9	12.5	16						

WATER — Sec. for Calibration 31 Container Wt. 3.75 lbs.

Setting	3	4	5	6						
Lbs.	21.31	27.2	32.61	39.14						

2.5	3.2	3.85	4.65		Counts Per C.Y. = 665
20.85	26.69	32.11	38.78		Counts Yield Test = 166
0.46#	0.51#	0.50#	0.36#		

TC 64-305
Rev. 3/92

KENTUCKY TRANSPORTATION CABINET
DIVISION OF MATERIALS

CONCRETE MIX DESIGN

County: Caldwell
Date: 5-2-79
Project No.: MP 17-0175-B0012
Concrete Class: Portland O. L.
Concrete Producer: Golden Bridge Company
Min. Cement Factor Bags/CY: 8.75
Plant Location: Concrete Mobile
Min. Cement Factor Lbs/CY: 823
Cement Brand: Marquetta
Max. Water Lbs/CY: 288
A or D Admix Brand: Master Builders Pozz 300-R 2/.88 oz./CY
Air Entraining Brand: Master Builders MB-VR 8 3/4 oz./CY
Fly Ash Source:
Class of Fly Ash:
Fly Ash % Reduction By Weight:
Replacement Ratio:
Fly Ash Sp. Gr.:

	FINE AGGREGATE DATA	COARSE AGGREGATE DATA
Source	Little River Sand Co.	Interstate Stone Co.
Bulk Sp. Gr. (S.S.D.)	2.63	2.68
Absorption, %	0.8	0.7
Free Moisture Content, %	3.0	0.0

MIX CALCULATIONS

1. Calculate Volume of Cement, Fly Ash and Total Water: Volume = V = $\frac{\text{Weight}}{\text{Sp. Gr.} \times 62.4}$

	MIX NO. 1	TIME		MIX NO. 2	TIME	
	Weight, Lbs	%	Volume, CF	Weight, Lbs	%	Volume, CF
Cement	823	—	4.187		—	
Fly Ash		—			—	
Water (*Total*)	262	—	4.199		—	
Air Content	0	5.5	1.485	0	5.5	1.485
2. Subtotals, Weight & Volume	1085	—	9.871		—	
3. 27 CF – Volume Total	—	—	17.129	—	—	

4. Calculate Fine and Coarse Aggregate Volumes: % Fine x Volume in Step 3 and % Coarse x Volume in Step 3. Calculate Fine and Coarse Aggregate Weight = Volume x Sp. Gr. x 62.4.

Fine Aggregate, SSD	1405	50	8.564			
Coarse Aggregate, SSD	1432	50	8.564			
5. Totals, Weight & Volume (Step 2 + Step 4)	3922	—	26.999		—	

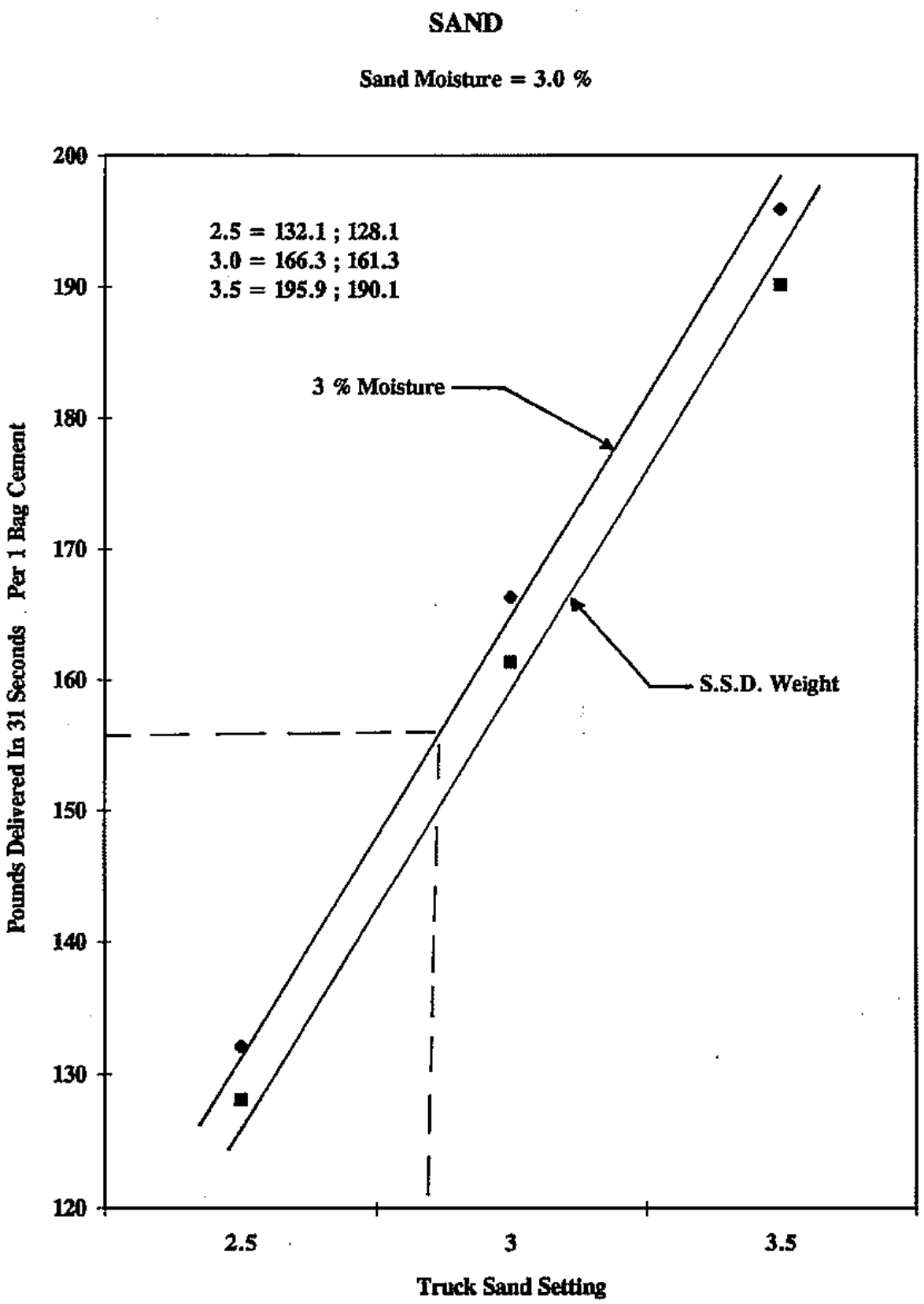
6. Calculate Adjusted Aggregate Weights Due to Moisture Content: SSD Aggregate Weights x 1.00 ± % Moisture in Decimal Form.

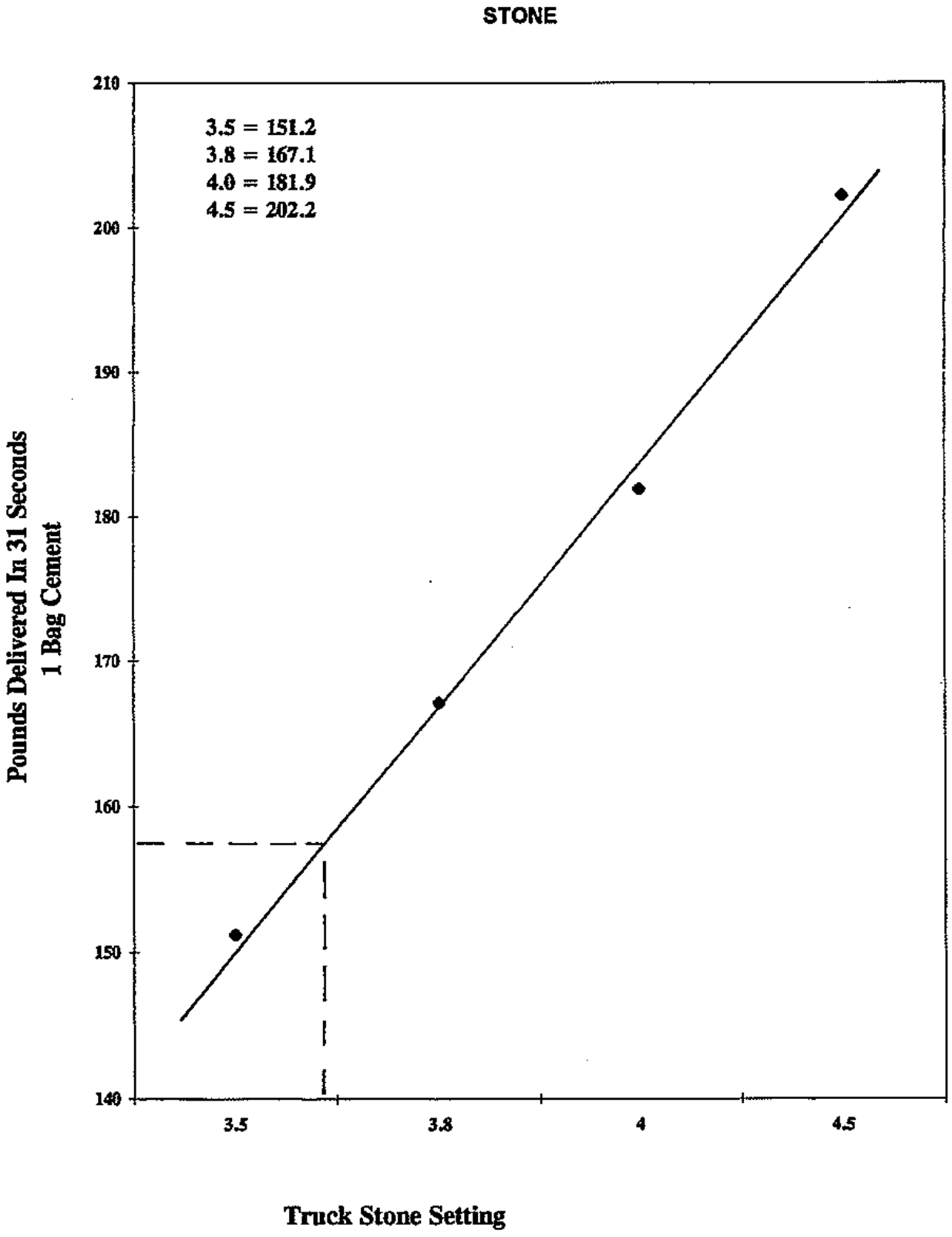
Adjusted Fine Agg. Wt.	1447	
Adjusted Coarse Agg. Wt.	1432	

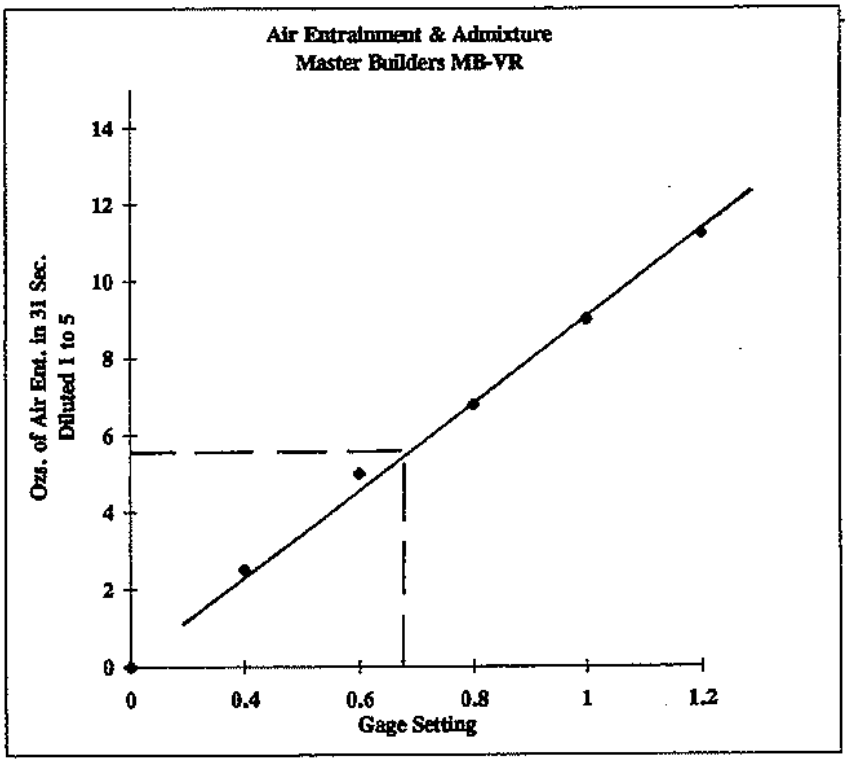
7. Calculate Water Added at Mixer: Subtract SSD Aggregate Weights from Adjusted Aggregate Weights, Total and Subtract from Total Water in Step 1.

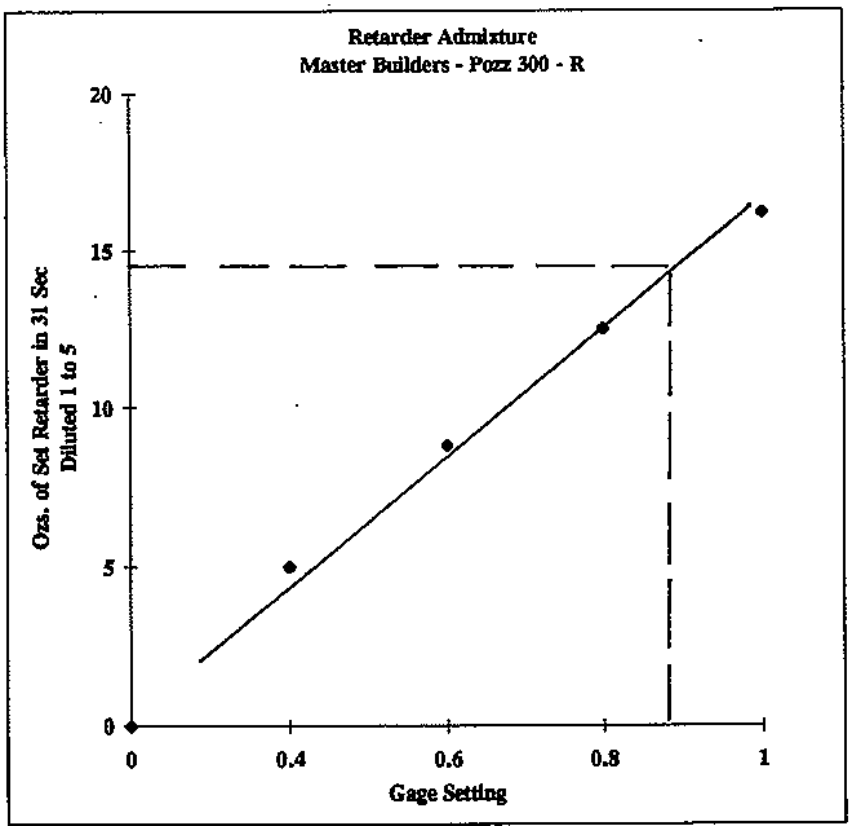
Water Added at Mixer (*Lbs., Gals.*)	220 : 26.38	:

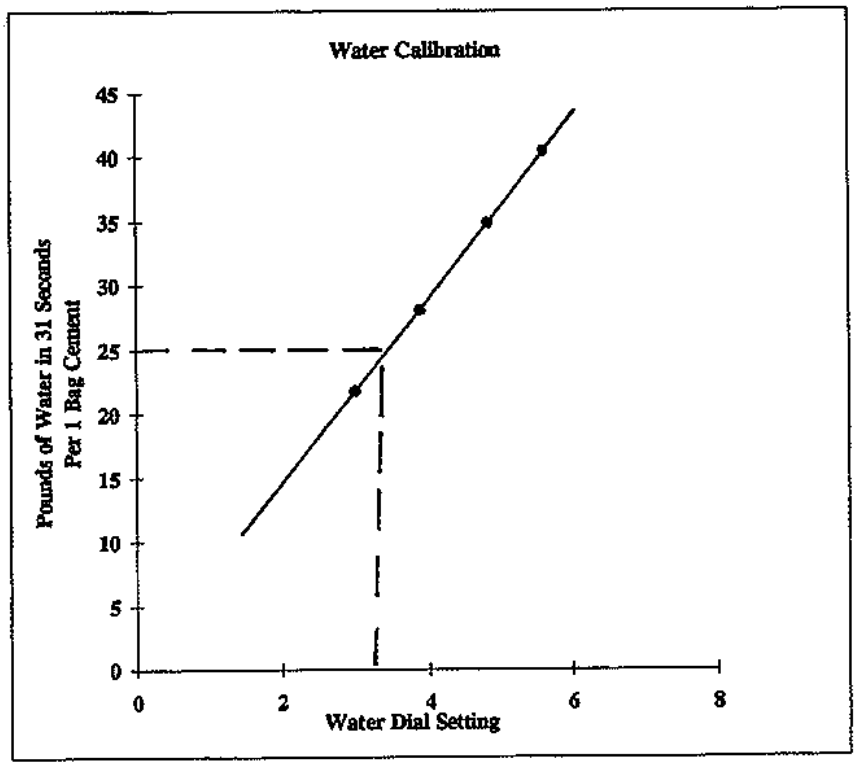
TEST RESULTS AT PLANT
Slump: 1/2 inch
Air Content: 5.6%
Concrete Temperature: 78 degrees
Water Underrun (Max – Step 1 Total): 26 lbs. : 3.12 Gal.
Plant Inspector:

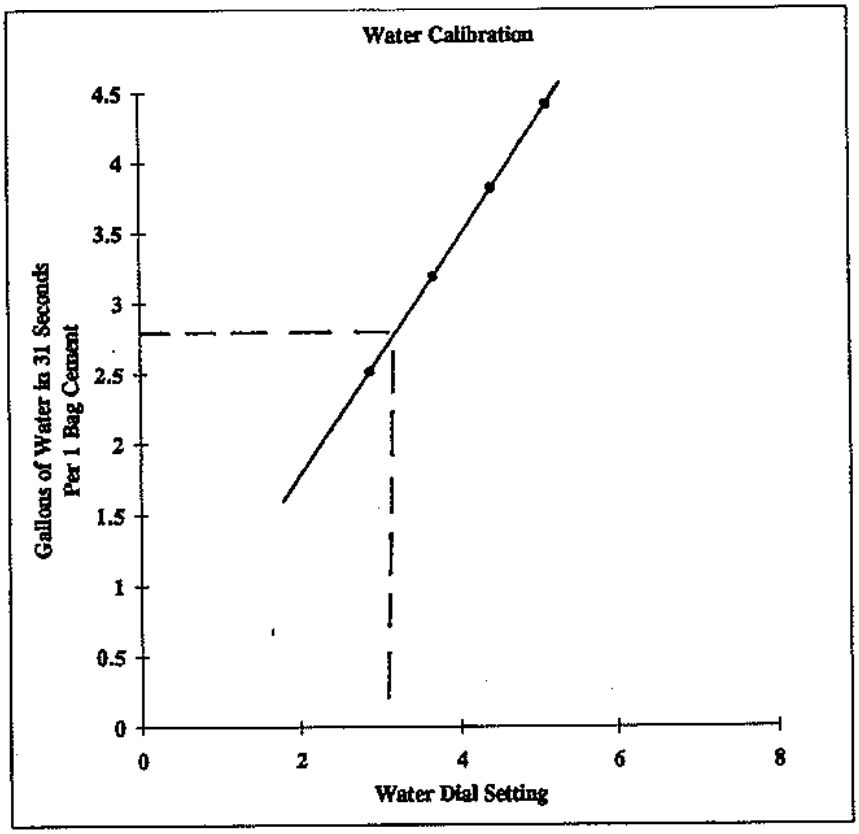

SAND
Sand Moisture = 3.0 %
2.5 = 132.1 ; 128.1
3.0 = 166.3 ; 161.3
3.5 = 195.9 ; 190.1
3 % Moisture
S.S.D. Weight
Pounds Delivered In 31 Seconds Per 1 Bag Cement
200
190
180
170
160
150
140
130
120
2.5
3
3.5
Truck Sand Setting


STONE
3.5 = 151.2
3.8 = 167.1
4.0 = 181.9
4.5 = 202.2
210
200
190
180
170
160
150
140
Pounds Delivered In 31 Seconds
1 Bag Cement
3.5
3.8
4
4.5
Truck Stone Setting


Air Entrainment & Admixture
Master Builders MB-VR
Ozs. of Air Ent. in 31 Sec.
Diluted 1 to 5
14
12
10
8
6
4
2
0
0
0.4
0.6
0.8
1
1.2
Gage Setting


Retarder Admixture
Master Builders - Pozz 300 - R
Ozs. of Set Retarder in 31 Sec
Diluted 1 to 5
20
15
10
5
0
0
0.4
0.6
0.8
1
Gage Setting


Water Calibration
Pounds of Water in 31 Seconds Per 1 Bag Cement
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
Water Dial Setting


Water Calibration
Gallons of Water in 31 Seconds Per 1 Bag Cement
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
2
4
6
8
Water Dial Setting

TROXLER

NUCLEAR COMPACTION TEST DATA

PROJECT MP 17-0175-B0012
JOB NUMBER
DATE May 2, 1979
TAKEN BY

TEST NUMBER	1	2	3	4	5	6	7	8	9	10
STATION	100+00									
OFFSET	15' Rt.									
ELEVATION										
MODE & DEPTH	B.S.									
DENS. CNT.	2760									
WET DENS.	147.7									
MSTRE. CNT.	609									
MOISTURE	–									
DRY DENS.	–									
% MOISTURE	–									
STD. DENS.	–									
OPT. MSTRE.	–									
% COMP.	–									
MSTRE. CORR.	–									

TEST NUMBER	11	12	13	14	15	16	17	18	19	20
STATION										
OFFSET										
ELEVATION										
MODE & DEPTH										
DENS. CNT.										
WET DENS.										
MSTRE. CNT.										
MOISTURE										
DRY DENS.										
% MOISTURE										
STD. DENS.										
OPT. MSTRE.										
% COMP.										
MSTRE. CORR										

DENSITY	MOISTURE

REMARKS:

DESIGN DATA FOR CONCRETE MOBILE

Un. Proj. No. MP 17-0175-B0012 Date May 2, 19 79

Truck Operator U. Kno Hu Contractor Golden Bridge Company

	Truck No. 1	Truck No. 2		Truck No. 1	Truck No. 2
Sand Dial Setting	2.97		Stone Dial Setting	3.7	
Pounds 165			Pounds 163		
Seconds 31			Seconds 31		
Moisture 3.0			Moisture 0.0		
Water Setting	3.5		Latex Steeling	N/A	
Pounds 25			Pounds		
Gallons 2.99			Gallons		
Seconds 31			Seconds		
Air Setting	0.7		Retarder Setting	0.95	
Oz. Pure 1			Oz. Pure 2.5		
Oz. Mix 6			Oz. Mix 15		
Seconds 31			Seconds 31		

	No. 1	No. 2
Counts Per Box Cement	76	
Counts Per Cu. Yd.	665	
Counts Per 1/4 C.Y. Yield Test	166	

	Load 1	Load 2	Load 3	Load 4
Total Water Meter R'dg.	267.2			
Total Latex Meter R'dg.	N/A			
Meter Register R'dg.	6783			
Comp. Test Cyl. No.	01-01-0A			
Truck No.	No. 1			

CALCULATIONS

COMMENTS: _____

_____ INSPECTOR

WATER CEMENT RATIO
CEMENT CONCRETE OVERLAY

'JN. PROJ. NO. MP 17-0175-B0012 CONTRACTOR Golden Bridge Company

DATE May 2, 1979 INSPECTOR

Design Cement (From Spec. Prov.) = (A) 8.75 Bags/C.Y.

Final Overlay Quantity = (B) 10.20 C.Y.

	DESIGN LBS./C.Y.	FINAL LBS.
WATER ADDED AT MIXER		
Meter Setting 3.5 Lbs./Bag x (A) 8.75 Bags/C.Y. =	(C) 218.75	
Final Water Meter Reading 267.2 Gal. X 8.34 Lb/Gal. =		(D)2228.
WATER ADDED IN AIR MIXER Type MB-VR		
Dilution 1 Oz. Admix. To 5 Oz. Water =)E) 6 Total Oz. Mixture		
Dispenser Setting 0.7 From Cal. Chart = (F) 6 Total Oz. Mix/Bag		
(F) 6 ÷ (E) 6 = (G) 1 Oz. Air Added		
(F) 6 - (G) 1 = (H) 5 Oz. Water Added		
(H) 5 x (A) 8.75 Bags/C.Y. ÷ 128 Oz./Gal. = (I) 0.34179 Gal./Water		
(I) .34179 Gal. Water x 8.34 lb./Gal. =	(J) 2.85	
Final Overlay Quan. (B) 10.20 C.Y. x (J) 2.85 =		(K)29.0
WATER ADDED IN WATER REDUCING ADMIX. (RETARDER)		
Dilution 1 Oz. Admix. To 5 Oz. Water = (L) 6 Total Oz. Mixture		
Dispenser Setting 0.95 From Cal. Chart = (M) 6 Total Oz. Mix/Bag		
(M) 15 ÷ (L) 6 = (N) 2.5 Oz. Of Reducer Added		
(M) 15 - (N) 2.5 = (O) 12.5 Oz. Water Added		
(O) 12.5 x (A) 8.75 Bags/C.Y. ÷ 128 Oz./Gal. = (P) 0.8545 Gal. Water		
(P) .8545 Gal. Water x 8.34 Lb./Gal. =	(Q) 7.13	
Final Overlay Quan. (B) 10.20 C.Y. x (Q) 7.13 =		(R) 72.7
WATER IN SAND		
Design Wgt./Bag = (S) 165 Lbs. Moisture = 3.0 % ÷ 100 = (T) 0.03		
(S) 165 Lbs. X (T) 0.03 x (A) 8.75 Bag/C.Y. =	(U) 43.31	
Final Overlay Quan. (B) 10.20 C.Y. x (U) 43.31 =		(V) 441.7
WATER IN STONE		
Design Wgt./Bag = (W) 163 Lbs. Moisture = 0.0 % ÷ 100 = (X) 0.0		
(W) 163 Lbs. X (X) 0.0 x (A) 8.75 Bags/C.Y. =	(Y) 0.0	
Final Overlay Quan. (B) 10.20 C.Y. x (Y) 0.0 =		(Z) 0.0
Total Design Water in Overlay = [Total of (C) + (J) + (Q) + (U) + (Y)] =	(AA) 272.04	

Design W/C Ratio = (AA) 272.04 Lbs/C.Y.
(A) 8.75 Bags/C.Y. x 94 Lbs./Bag = 0.3307

Total Water Used for Entire Pour = [Total of (D) + (K) + (R) + (V) + (Z)] = (BB) 2772.

Cement Used = (B) 10.20 C.Y. x (A) 8.75 Bags/C.Y. X 94 Lbs./Bag = (CC) 8389.5 Lbs.

Actual Water = (BB) 2772.00 Lbs. + 0.33045
(CC) 8389.50 Lbs.

Total Water = (BB) 2772.34 Lbs. = 0.33045 Gal./C.Y.
8.34 Lb./Gal x (B) 102.0 C.Y.

Design = (AA) 272.04 Lbs. = 32.62 Gal./C.Y.*
8.34 Lb./Gal

* Use this design Gal./C.Y. when calculating Theoretical Density. Note: Max. w/c Ration = 0.354

CONCRETE MOBILE - CHECK LIST

1. Incorporate check list specified by KY Method (KM) 64-312.

2. Sand and Stone should be placed in proper bins. Some trucks have vibrators only on sand bin.

3. Admixtures should be premixed at a predetermined ratio before pouring into truck tanks.

4. The gate openings should be checked to be sure they are within the proper operating range before beginning calibration of concrete mobile. The test gauge provided with the equipment (3" x 3" x 8") wooden block should be placed under the gate, and the gate lowered by means of hand wheel until it just touches the block. Increase the pressure on the hand wheel by one tenth on the dial. The pointer should indicate 6.4 ($\pm$.2) on both stone and sand dials. Use 1 11/16 inch thick block for magnum units in which sand dial should read 7.8 and stone dial reading should be 7.4.

NOTE: If necessary to adjust the pointers to bring dials within specifications the inspector should note pointer setting in reference to hand wheels and mark same with magic marker.

(It is possible to move the hand wheel and reset pointer to give a lower gate setting yet pointer be on correct calibration setting. Lower gate setting will cause less material per cu yard and should be caught when yield check is performed.)

5. Mix Conveyor

   A. Auger wear plates and blades on the mixing paddles and flighting plates must be within the specified limits of 1/4" above the mounting holes. This should be checked with wear gauge furnished by the truck operator. (Inspector can make one from right angle triangle).

   B. The angle of the mix conveyor should be no less than 15° will result in improper mixing. The inclinometer is located on the left side of the mix-conveyor but on many trucks has been removed or is no longer operative. The inspector should request the contractor to provide the means to determine the angle of incline in the case. This is most important for proper mixing.

INSTRUCTIONS FOR TAKING DENSITIES PRIOR AND DURING PLACEMENT OF CONCRETE OVERLAY

1. READ PROPOSAL AND SPECIAL NOTES APPLICABLE TO PROJECT.

2. Determine width of placement.

3. Make diagram, not to scale, of bridge deck showing lanes of concrete placement.

4. A base density test shall be taken every 50' in each lane of placement which has been machined prepared. These shall be numbered in such a way that the actual location of each test may be accurately determined.

5. The results of the base density tests should be recorded in a field book for future references along with such necessary data as location of test, direct reading, and actual wet density.

6. The densities taken on the existing bridge deck shall not be less than 140 PCF or more than 153 PCF. Move meter until the base densities are within the specified range.

7. Target Density shall be computed prior to beginning concrete placement. Use Charge No. 1 (Exhibit No. 63-8-51). A density, slump and air test is required every 50 ft. Per lane of concrete placement or one test per mobile mixed load, whichever will require the greater numbeer of testing.

Note: These instructions for taking densities is based on the Troxler 3400 - B Series Nuclear Density Gauges. If any other Troxler gauges or gauges from other manufacturers are used, concult the gauge's instruction manual for the proper method for taking densities on thin lift overlays.

8. When placement of concrete is begun, a density test shall be taken at the same location as those taken on the existing bridge deck by using Styrofoam in lieu of air gap stand.

9. Nuclear gauges, when used in the backscatter mode on overlays less than 3 inches, have certain limitations which must be overcome in order to obtain correct densities. The problem arises because the gauge "sees" through the thin overlay and the underlying material influences the gauge reading.

Recognizing this problem, a nomograph was developed which allows rapid determination of overlay density. To use the nomograph, it is necessary to know the density of the bottom layer and the thickness of the top layer. The simplest method of determining the bottom layer density is by taking nuclear density tests before the overlay is applied. Concrete is then placed and compacted. Backscatter density tests are on the top of the new pavement and the mat thickness determined. With this data, the density of the top layer may be determined from the nomograph. See Exhibit No. 63-8-49, page 3 of 3 for example. A blank copy of this nomograph is included as Exhibit No. 63-8-52.

(Material taken from the Troxler 3400-B Series Instruction Manual)

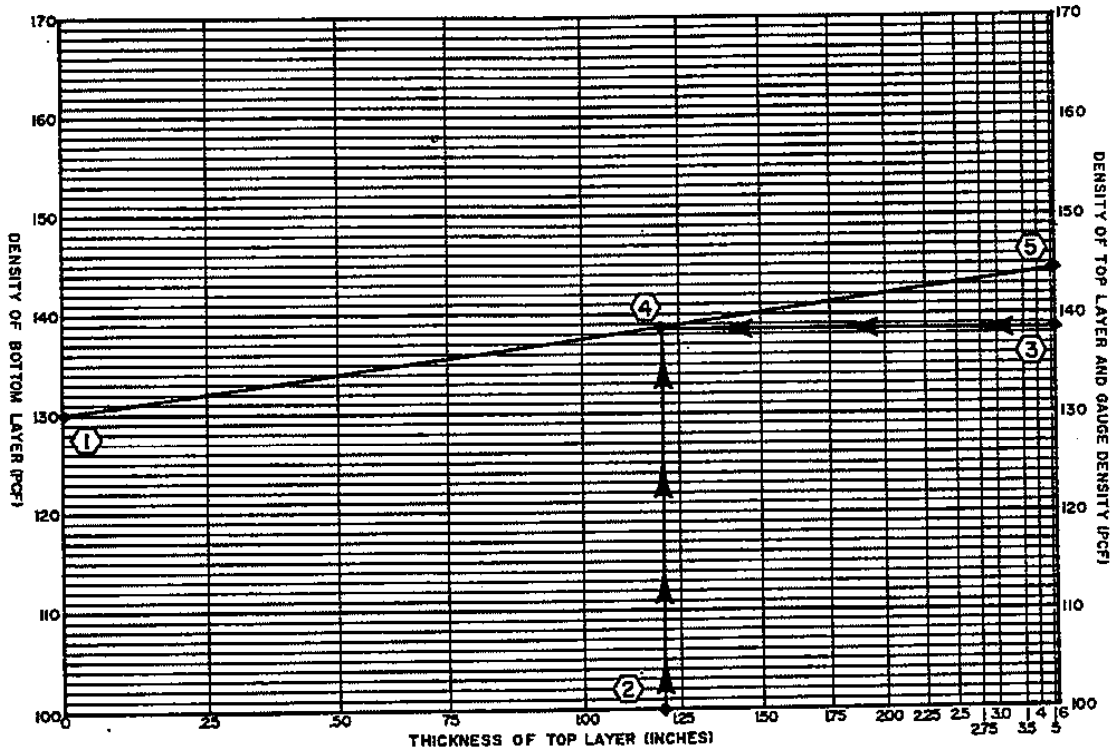
10. This in-place density will then be adjusted using the following formular as per Section 741.05 (D) of the Standard Specifications.

$$\text{Adjusted Density} = \frac{\text{in-place density} \times 0.945}{1.00 - \text{actual air content *}}$$

* Express actual air content as a decimal.

V-D-2. OVERLAY EXAMPLE - U.S. Customary Units

In this example the bottom layer density (left scale) is 130 PCF with a mat 1.2 inches thick overlaying it. A backscatter density test on the top of the mat (right scale) yielded a result of 138.5 PCF. A line is then drawn from 130 PCF on the left scale through the intersection of 1.2 inches (bottom) and 138.5 PCF (right) and extended to the right. The correct density for the top layer is then read from the nomograph as 144.5 on the right scale.



Nomograph for Thin Lift Overlays
U.S. Customary Units

Figure 5-2

METHOD OF COMPUTING THEORETICAL BASIC ABSOLUTE VOLUME

Portland Cement Low Slump Concrete (Overlay)

Cement Volume = $\frac{\text{Bags/CY}}{27} \times \frac{94 \text{ (wt. Of 1 bag)}}{3.15 \times 62.4}$

Liquid Volume = Design water (in pounds) per bag of cements plus all additives (in pounds) times bags per cubic yard divided by 27 equals liquid weights per cubic foot.

$\frac{\text{Liquid wt./C.F.}}{8.34}$ = volume of Liquid/C.F.

If design criteria is in gallons per cubic yard, compute as follows:

$\frac{\text{Gallons/CY}}{27} \times \frac{8.34}{62.4}$ = Volume/C.F.

Air = Use theoretical volume - no weight

Fine and coarse aggregate - Use total volume as one (1). Add cement volume, liquid volume and air volume together and subtract from one (1). This leaves the volume of fine and coarse aggregates. Since low slump concrete has 50% of fine aggregate and 50% of coarse aggregate, take the specific gravity of each and determine average combined specific gravities.

Compute weight of cement, liquids, and aggregates as shown in example below to determine target density.

EXAMPLE

Design Criteria -
Cement - 8.75 bags/CY
Total Liquid - 33.8 gals/CY
Air - 5.5%
Specific Gravity Fine Aggregate - 2.64
Specific Gravity Coarse Aggregate - 2.72

Cement Volume - $\frac{8.75}{27} \times \frac{94}{3.15 \times 62.4}$ = .15498 C.F.

Liquid Volume - $\frac{33.8}{27} \times \frac{8.34}{62.4}$ = .16731 C.F.

Air Volume - .05500 C.F.

.37729

Total Unit Volume -	1.00000
Total Volume Cement, Liquid and Air	0.37729
Total Volume Aggregates	0.62271
Specific Gravity of Fine Aggregate -	2.64
Specific Gravity of Coarse Aggregate -	2.72
Average combined Specific Gravities	5.36 ÷ 2 = 2.68

Theoretical Weight (Target Density)

Cement -	0.15498 x 3.15 x 62.4	=	30.46
Liquids -	0.16731 x 62.4	=	10.44
Air -	0.05500 x 00.0	=	0.00
Aggregates -	0.62271 x 2.68 x 62.4	=	104.14
	1.00000 Cubic Foot	=	145.04 Lbs.

Constants Used in Calculations

1 gal. water weighs 8.34 lb/gal.

1 cubic foot water weighs 62.4 lbs/C.F.

1 cubic yard = 27 cubic feet

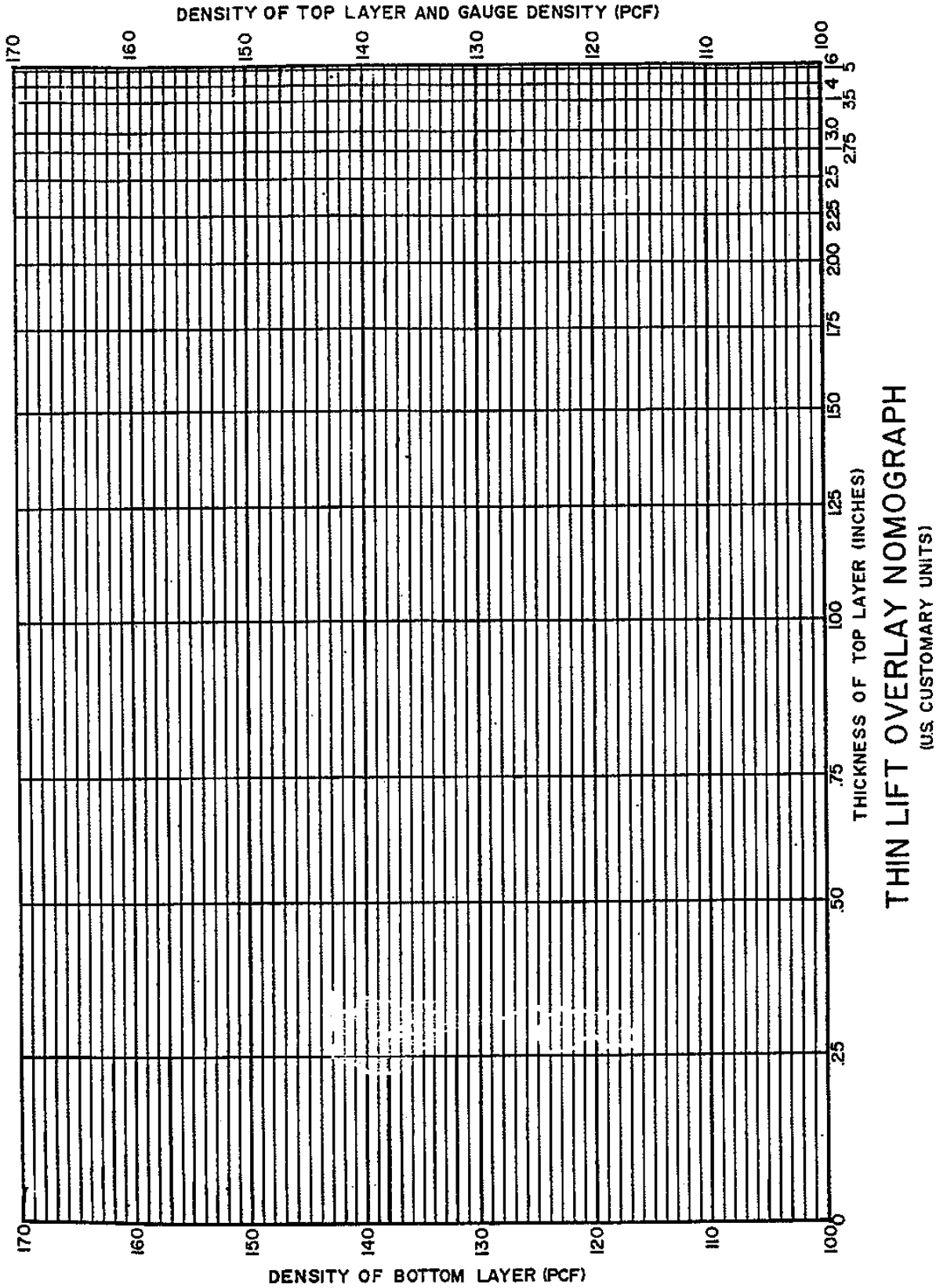
weight one (1) bag cement = 94 lbs/bag

CHART NO. 1

TARGET DENSITY BASED ON 5.5% AIR CONTENT WITH VARING SPECIFIC GRAVITIES AND VARYING AMOUNTS OF ADDED WATER, FREE WATER, SET RETARDER, WATER REDUCING AGENT, AND AIR ENTRAINED ADMIXTURE.

TOTAL WATER IN		AVERAGE COMBINED SPECIFIC GRAVITIES								
Gal./C.Y.	Lbs./C.Y.	2.61	2.62	2.63	2.64	2.65	2.66	2.67	2.68	2.69
30.4	253.54	144.01	144.41	144.81	145.21	145.61	146.01	146.4	146.8	147.2
30.6	255.2	143.91	144.31	144.71	145.11	145.5	145.9	146.3	146.7	147.1
30.8	256.87	143.81	144.21	144.61	145	145.4	145.8	146.2	146.6	146.99
31	258.54	143.71	144.11	144.51	144.9	145.3	145.7	146.1	146.49	146.89
31.2	260.21	143.61	144.01	144.41	144.8	145.2	145.6	145.99	146.39	146.79
31.4	261.88	143.51	143.91	144.3	144.7	145.1	145.49	145.89	146.28	146.68
31.6	263.55	143.41	143.81	144.2	144.6	144.99	145.39	145.79	146.18	146.58
31.8	265.22	143.31	143.71	144.1	144.5	144.89	145.29	145.68	146.08	146.47
32	266.89	143.21	143.61	144	144.4	144.79	145.19	145.58	145.97	146.37
32.2	268.55	143.12	143.51	143.9	144.3	144.69	145.08	145.48	145.87	146.26
32.4	270.22	143.02	143.41	143.8	144.19	144.59	144.98	145.37	145.77	146.16
32.6	271.88	142.92	143.31	143.7	144.09	144.49	144.88	145.27	145.66	146.05
32.8	273.55	142.82	143.21	143.6	143.99	144.38	144.77	145.17	145.56	145.95
33	275.22	142.72	143.11	143.5	143.89	144.28	144.67	145.06	145.45	145.85
33.2	276.89	142.62	143.01	143.4	143.79	144.18	144.57	144.96	145.35	145.74
33.4	278.56	142.52	142.91	143.3	143.69	144.08	144.47	144.86	145.25	145.64
33.6	280.22	142.42	142.81	143.2	143.59	143.98	144.36	144.75	145.14	145.53
33.8	281.89	142.32	142.71	143.1	143.49	143.87	144.26	144.65	145.04	145.43
34	283.56	144.22	142.61	143	143.38	143.77	144.16	144.55	144.94	145.32
34.2	285.23	142.12	142.51	142.9	143.28	143.67	144.06	144.44	144.83	145.22
34.4	286.9	142.02	142.41	143.79	143.18	143.57	143.95	144.34	144.73	145.11
34.6	288.56	141.92	142.31	142.69	143.08	143.47	143.85	144.24	144.62	145.01
34.8	290.23	141.82	142.21	142.59	142.98	143.36	143.75	144.13	144.52	144.91
35	291.9	141.72	142.11	142.49	142.88	143.26	143.65	144.03	144.42	144.8

NOTE: The Average Combined Specific Gravity is based on 50% Coarse and 50% Fine Aggregate
One Gal. Water Weighs 8.34 lb/gal.


DENSITY OF TOP LAYER AND GAUGE DENSITY (PCF)
170
160
150
140
130
120
110
100
DENSITY OF BOTTOM LAYER (PCF)
0
.25
.50
.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.75
3.0
3.5
4
5
6
THICKNESS OF TOP LAYER (INCHES)
THIN LIFT OVERLAY NOMOGRAPH
(U.S. CUSTOMARY UNITS)

WATER CEMENT RATIO
CEMENT CONCRETE OVERLAY

UN. PROJ. NO. _____ CONTRACTOR _____

DATE _____ INSPECTOR _____

Design Cement (From Spec. Prov.) = (A) _____ Bags/C.Y.

Final Overlay Quantity = (B) _____ C.Y.

	DESIGN LBS./C.Y.	FINAL LBS.
WATER ADDED AT MIXER Meter Setting ____ Lbs./Bag x (A) _____ Bags/C.Y. = Final Water Meter Reading _____ Gal. X 8.34 Lb/Gal. =	(C)_____	(D)_____
WATER ADDED IN AIR MIXER Type _____ Dilution _____Oz. Admix. To _____Oz. Water =)E) _____Total Oz. Mixture Dispenser Setting _____ From Cal. Chart = (F) _____ Total Oz. Mix/Bag (F) _____ ÷ (E) _____ = (G) _____Oz. Air Added (F) _____ - (G) _____ = (H) _____ Oz. Water Added (H) _____ x (A) _____ Bags/C.Y. ÷ 128 Oz./Gal. = (I) _____ Gal./Water (I) _____ Gal. Water x 8.34 lb./Gal. = Final Overlay Quan. (B) _____ C.Y. x (J) _____ =	(J) _____	(K) _____
WATER ADDED IN WATER REDUCING ADMIX. (RETARDER) Dilution _____Oz. Admix. To _____ Oz. Water = (L) _____Total Oz. Mixture Dispenser Setting _____ From Cal. Chart = (M) _____ Total Oz. Mix/Bag (M) _____ ÷ (L) _____ = (N) _____ Oz. Of Reducer Added (M) _____ - (N) _____ = (O) _____ Oz. Water Added (O) _____ x (A) _____ Bags/C.Y. ÷ 128 Oz./Gal. = (P) _____ Gal. Water (P) _____ Gal. Water x 8.34 Lb./Gal. = Final Overlay Quan. (B) _____ C.Y. x (Q) _____ =	(Q) _____	(R) _____
WATER IN SAND Design Wgt./Bag = (S) _____ Lbs. Moisture = _____ % ÷ 100 = (T) _____ (S) _____ Lbs. X (T) _____ x (A) _____ Bag/C.Y. = Final Overlay Quan. (B) _____ C.Y. x (U) _____ =	(U) _____	(V) _____
WATER IN STONE Design Wgt./Bag = (W) _____ Lbs. Moisture = _____ % ÷ 100 = (X) _____ (W) _____ Lbs. X (X) _____ x (A) _____ Bags/C.Y. = Final Overlay Quan. (B) _____ C.Y. x (Y) _____ =	(Y) _____	(Z) _____

Total Design Water in Overlay = [Total of (C) + (J) + (Q) + (U) + (Y)] = (AA) _____

Design W/C Ratio = (AA)_____ Lbs/C.Y.
(A) _____ Bags/C.Y. x 94 Lbs./Bag = _____

Total Water Used for Entire Pour = [Total of (D) + (K) + (R) + (V) + (Z)] = (BB) _____

Cement Used = (B) _____ C.Y. x (A) _____ Bags/C.Y. X 94 Lbs./Bag = (CC) _____ Lbs.

Actual Water = (BB) _____ Lbs. + _____
(CC) _____ Lbs.

Total Water = (BB) _____ Lbs. _____ = _____ Gal./C.Y.
8.34 Lb./Gal x (B) _____ C.Y.

Design = (AA) _____ Lbs. _____ = _____ Gal./C.Y.*
8.34 Lb./Gal

* Use this design Gal./C.Y. when calculating Theoretical Density. Note: Max. w/c Ration = 0.354

WATER CEMENT RATIO

LATEX CONCRETE OVERALY

UN. PROJECT NO. _____ CONTRACTOR_____

DATE _____ INSPECTOR _____

Design Cement (From Spec. Prov.) = (A) ___ Bags/C.Y. Final Overlay Quan. = (C) ____ C.Y.

Design Latex (From Spec. Prov.) = (B) ___ Gal./Bags Cement

Wgt. Latex = (D) ___ Lb./Gal.

	DESIGN LBS./C.Y.	FINAL LBS.
WATER ADDED AT MIXER		
Meter Setting _____ = _____ Lb./Bag x (A) ____ Bags/C.Y. =	(E) _____	
Final Meter R'dg. _____ Gals. x 8.34 Lbs./Gal. =		(F) _____
WATER ADDED IN LATEX		
% Water = 100% - Solids _____% = (G) _____ %		
(B) _____ Gal./Bag x (G) _____% x (D) _____ Lb./Gal. X 7 bags	(H) _____	
Final Latex Meter R'dg. _____ Gals. x (G) _____% x (D) _____ Lb./Gal. =		(I) _____
WATER IN SAND		
Design Wgt./Bag = (J) _____ Lbs. : Moisture = _____% ÷ 100 = (K) _____		
(J) _____ Lbs. x (K) _____ x (A) _____ Bags/C.Y. =	(L) _____	
Final Overaly Quan. (C) _____ C.Y. x (L) _____ =		(M)
WATER IN STONE		
Design Wgt./Bag = (N) _____ Lbs. : Moisture = _____ % ÷ 100 = (O)		
(N) _____ Lbs. x (O) _____ x (A) _____ Bags/C.Y. =	(P) _____	
Final Overaly Quan. (C) _____ C.Y. x (P) _____ =		(Q) _____
Total Design Water in Overaly [Total of (E) + (H) + (L) + (P)] =	(R) _____	
Total Water Used [Total of (F) + (I) + (M) + (Q)] =		(S) _____

Design W/C Ration = (R)_____ Lbs./C.Y._____
(A) _____ Bags/C.Y. x 94 Lb./Bag = _____
Cement Used = (C) _____ C.Y. x (A) _____ Bags/C.Y. x 94 Lbs./Bags = (T) _____ Lbs.

NOTE: Max. W/C Ratio = 0.400 Actual W/C Ratio = (S) _____ Lbs. ÷ (T) _____ Lbs. = _____

Truck Settings from Design Calibration

	Truck No. 1	Truck No. 2	
Water Meter Setting _____ Lbs.	_____	_____	
Latex Meter Setting _____ Gal.	_____	_____	Total Water _____ Gal.
Sand Gate Setting _____ Lbs.	_____	_____	Total Latex _____ Gal.
Stone Gate Setting _____Lbs.	_____	_____	Total C.Y. _____ Gal.
Seconds Per 94 Lbs. Cement	_____	_____	
Counts Per C.Y. Overlay	_____	_____	
Counts Per 1/4 C.Y. Overlay	_____	_____	
	Load No. 1	Load No. 2	
Final Water Meter Reading	_____	_____	
Final Latex Meter Reading	_____	_____	
Cement Meter Reading	_____	_____	
C.Y. Produced	_____	_____	

DESIGN DATA FOR CONCRETE MOBILE

Un. Proj. No. _____ Date _____, 19 ____

Truck Operator _____ Contractor _____

	Truck No. 1	Truck No. 2		Truck No. 1	Truck No. 2
Sand Dial Setting	_____	_____	Stone Dial Setting	_____	_____
Pounds _____			Pounds _____		
Seconds _____			Seconds _____		
Moisture _____			Moisture _____		
Water Setting	_____	_____	Latex Steeling	_____	_____
Pounds _____			Pounds _____		
Gallons _____			Gallons _____		
Seconds _____			Seconds _____		
Air Setting	_____	_____	Retarder Setting	_____	_____
Oz. Pure _____			Oz. Pure _____		
Oz. Mix _____			Oz. Mix _____		
Seconds _____			Seconds _____		

	No. 1	No. 2
Counts Per Box Cement	_____	_____
Counts Per Cu. Yd.	_____	_____
Counts Per 1/4 C.Y. Yield Test	_____	_____

	Load 1	Load 2	Load 3	Load 4
Total Water Meter R'dg.	_____	_____	_____	_____
Total Latex Meter R'dg.	_____	_____	_____	_____
Meter Register R'dg.	_____	_____	_____	_____
Comp. Test Cyl. No.	_____	_____	_____	_____
Truck No.	_____	_____	_____	_____

CALCULATIONS

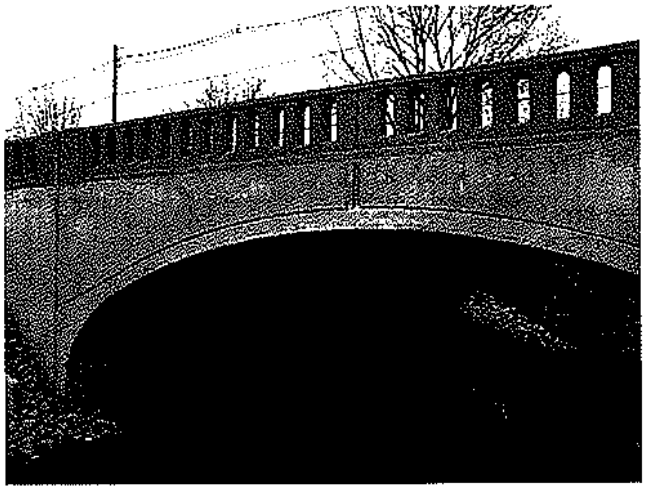
COMMENTS: _____

_____

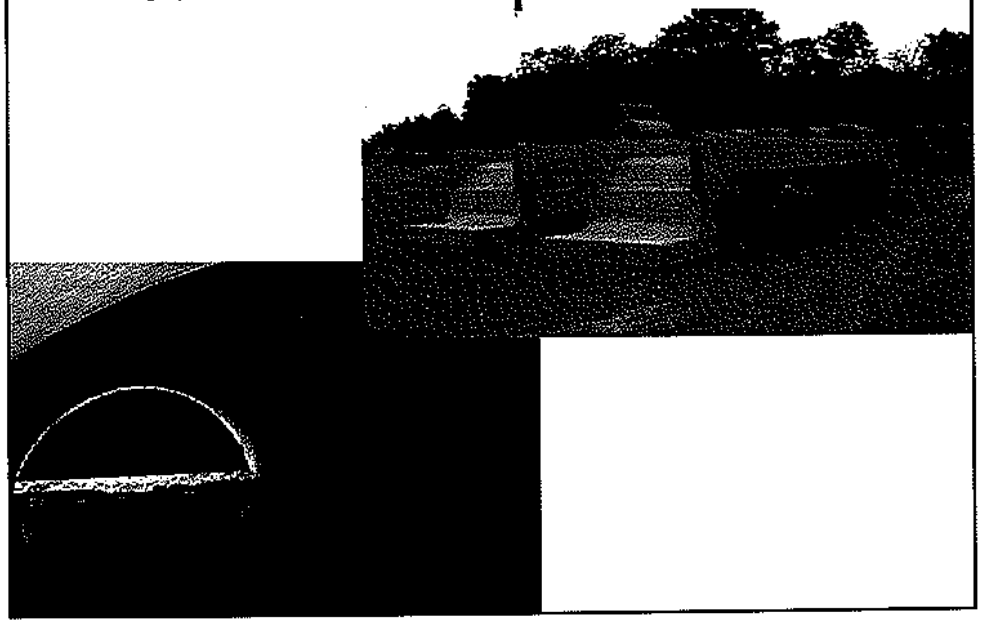
_____

_____
INSPECTOR

3-SIDED PRECAST STRUCTURES



Come in all shapes and sizes:



Types Include:

- *BEBO* Arch Systems
- CON/SPAN
- OMEGA Culverts
- HY-SPAN

PROS

- LOW MAINTENANCE
- ECONOMICAL
- AESTHETIC
- FAST TRACK INSTALLATION
- EASE OF CONSTRUCTION
- MINIMIZES CREEK BED DISTURBANCE

CONS

- NO STANDARD DESIGNS
- LITTLE OR NO PRE-CONSTRUCTION GEOTECNICAL STUDIES
- EROSION CONTROL DURING CONSTRUCTION
- SCOUR CONSIDERATIONS
- CRITICAL FILL INSTALLATION

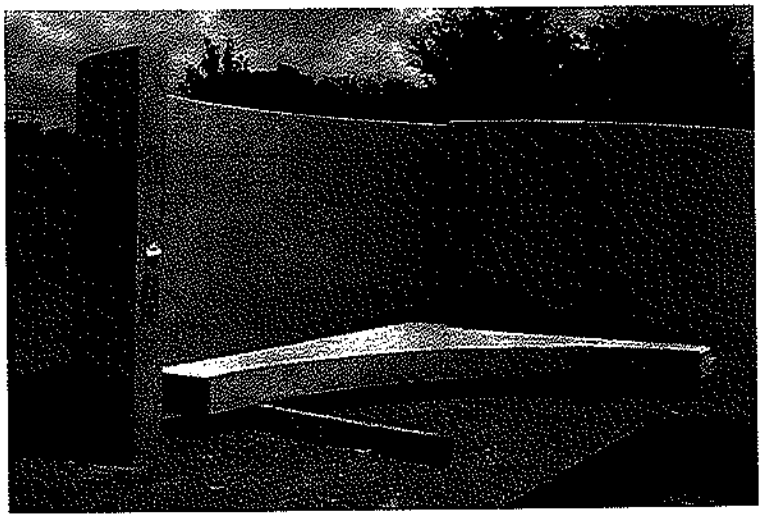
Special Construction Conditions:

1. Submission required by the contractor of: shop drawings, design, placement, backfill, and letter confirming existing site conditions. 5 sets.

Manufacturing Process

- Fabrication to be by an "Approved Precaster"
- Division of Materials to inspect and stamp with "KY Oval" prior to shipment

Typically Cast on Side



Possible Problems

- Not enough fill cover – lower footings or adjust the grade
- Improper casting- Check each unit for markings
- Wrong type (s) of fill material
- Fill not installed or compacted per plan
- Contractor drives equipment across early causing cracking or spalling – may need to replace, consult C.O. Construction.

KYTC Nuclear Gauge Location Report

Gauge Number: 13597 **Manufacturer:** Troxler Electronic Laboratories, Inc. **Model Number:** 3411B

District: 00 Central Office **Inventory Date:** 2/15/2013 **Name:**

Location Name: Crew 199 , 1227 Wilkinson Blvd. , Frankfort

Gauge Status Last Updated On	Description
2/15/2013	In Service

Transfer Date	Transferred from Location	Current Location
11/23/2011		Crew 199 , 1227 Wilkinson Blvd. , Frankfort

Gauge Number: 1556 **Manufacturer:** Troxler Electronic Laboratories, Inc. **Model Number:** 3241C

District: 00 Central Office **Inventory Date:** 2/15/2013 **Name:**

Location Name: Crew 199 , 1227 Wilkinson Blvd. , Frankfort

Gauge Status Last Updated On	Description
2/15/2013	In Service

Transfer Date	Transferred from Location	Current Location
6/7/1991		Crew 199 , 1227 Wilkinson Blvd. , Frankfort

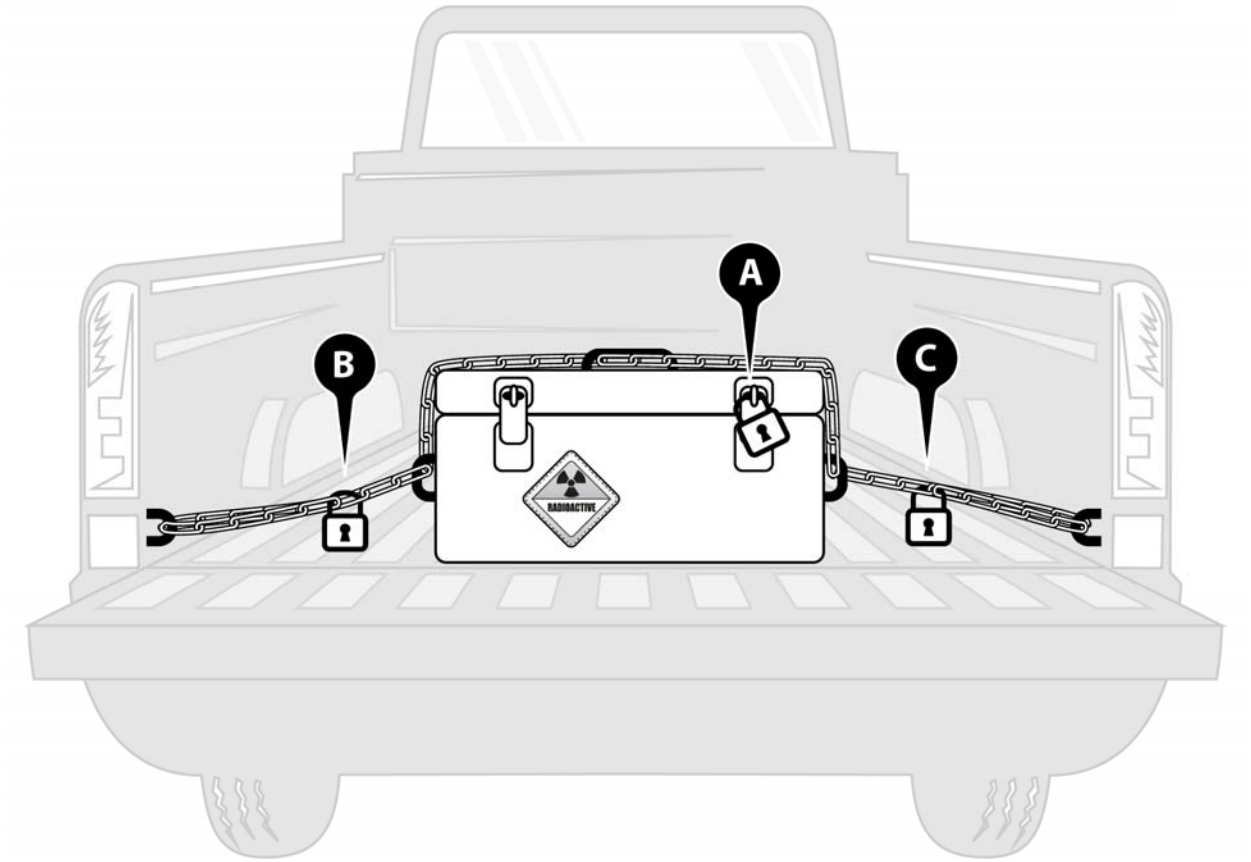
Gauge Number: 16151 **Manufacturer:** Troxler Electronic Laboratories, Inc. **Model Number:** 3411B

District: 00 Central Office **Inventory Date:** 2/15/2013 **Name:**

Location Name: Crew 199 , 1227 Wilkinson Blvd. , Frankfort

Gauge Status Last Updated On	Description
2/15/2013	In Service

Transfer Date	Transferred from Location	Current Location
		Crew 199 , 1227 Wilkinson Blvd. , Frankfort


A
B
C
RADIOACTIVE

FILL OUT THE INFO BELOW

Section 1	Section 2	Section 3
Company Name: KYTC-District	Fill this box, if this gauge has not previously been tested by InstroTek.	New customers only or if you are updating current information:
Gauge Model: (check one) ☐ InstroTek 3500 ☐ 3401 ☐ 3411 ☐ 3430 ☐ 3440 ☐ 3450 ☐ 4640 ☐ MC1DR ☐ MC3 ☐ 5001B ☐ 5001P ☐ 5001C ☐ 5001EZ ☐ Other: _____	Am-241:Be: _____ Cs-137: _____	Contact Name: _____ Mailing Address: _____ _____ Phone: _____ Fax: _____ Email: _____
Gauge Serial Number: _____ Test Date: _____ Signature: _____		

(Please sign the form and provide test date prior to mailing. A copy of this form may act as a receipt until the results are returned)

InstroTek, Inc.
Leak Test Form

1. a) Existing Customers: Only fill out section 1 if your gauge has been leak tested by InstroTek in the past.
   b) New Customers: Please fill out entire card for each gauge.
   Important: please make sure the form is signed and test date is included before mailing the form to InstroTek.
2. Complete Sections 1 and 2 only, if this particular gauge is being added to the ones previously tested by InstroTek.
3. Complete Sections 1, 2 and 3, if you are a new customer or if any of your contact information has changed.
4. Record gauge serial number on the provided plastic bag.
5. Lightly moisten swab with water. Remove excess water from the swab by using a clean paper towel.
6. Wipe each source location, with the swab, as per the gauge manufacturer's recommendations.
7. Place swab in the plastic bag and seal.
8. Use provided envelope and return the swab and this form to InstroTek, Inc.

Note: InstroTek provides email test results and notifications, along with an original hard copy as a service to our customers. Please indicate in section 3 above, if you are not interested in receiving email reports.

InstroTek, Inc.
5908 Triangle Drive, Raleigh, NC 27617
P. 919-875-8371 F. 919-875-8328
www.InstroTek.com