M E M O R A N D U M

TO: Ananias Calvin, P.E.
Project Management Coordinator
Division of Highway Design

FROM: William Broyles, P.E.
Geotechnical Branch Manager
Division of Materials

BY: Danny Molen
Geotechnical Branch

DATE: December 3, 2004

SUBJECT: **Oldham County**
FD52 093 0393 002-006 D
KY 393 from I-71 to KY 146
Station 330+85 to 401+00
Item # 5-234.00
Mars # 5941402D
Geotechnical Engineering Roadway Report

An abbreviated geotechnical engineering report is completed for the subject project. The Geotechnical Branch performed the drilling, sampling and testing. The purpose of the investigation was to define the soil and subsurface conditions. Reduced size geotechnical notes sheet, soil profile sheets, cut and embankment stability sheets are attached. The CADD input for these sheets is being e-mailed to the design consultant (Skees Engineering), as DGN files, for incorporation into the roadway plans.

The Select Rock Quantity Sheet was submitted by the design consultant. Based on these estimates, a sufficient quantity of limestone and/or durable shale will be available from roadway excavation on this project to perform all the following applicable notes requiring this material.

Stability analyses were performed at several locations, which indicated no problems to be expected with slopes constructed at 2:1 or flatter. The drawings are attached showing the results of these analyses.

Geotechnical recommendations are as follows:

1). In accordance with Section 206 of the current Standard Specifications, the moisture content of embankment material shall not vary from the optimum moisture content as determined by KM 64-511 by more than +2 percent or less than -2 percent. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment construction. Refer to the Family of Curves for moisture/density correlation.

2). All soils, whether from roadway or borrow, may require manipulation to obtain proper moisture content prior to compaction. Direct payment shall not be permitted for rehandling, hauling, stockpiling, and/or manipulating soils.

3). Excavation of surface ditches and channel changes adjacent to embankment areas shall be performed prior to the placement of the adjacent embankments. The material excavated for the channel changes and surface ditches is suitable for embankment construction if dried to proper moisture content in accordance with Section 206 of the current Standard Specifications. Direct payment shall not be permitted for rehandling, hauling, stockpiling, and/or manipulating soils.

4). The contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical section. These operations shall be incidental to the roadway price.

5). The contractor shall conduct grading operations in such a manner that limestone from roadway excavation be stockpiled separately or otherwise manipulated so that ample quantities are available for those areas requiring said material. No direct payment will be allowed for such necessary manipulating as stockpiling, hauling and/or double handling the material.

6). The contractor shall conduct grading operations in such a manner that durable shale from roadway excavation be stockpiled separately or otherwise manipulated so that ample quantities are available for those areas requiring said material. No direct payment will be allowed for such necessary manipulating as stockpiling, hauling and/or double handling the material.

7). To provide a working platform for embankment construction, a sufficient thickness (estimated to be 3 ft) of limestone and/or durable shale from roadway excavation shall be placed over all soft and/or saturated foundation areas that may be detected during construction and/or to fill and stabilize the existing drains located within the limits of the roadway embankment construction, as directed by the Engineer. The placement of this material is incidental to the unit bid price for roadway excavation or embankment-in-place. The rock material shall be underlain with Geotextile Fabric, Type III, in accordance with Sections 214 & 843 of the current Standard Specifications. For estimation purposes only, the following areas are anticipated to require the above referenced treatment. Actual thickness and locations of the working platform will be determined by the Engineer during construction. The cost of placing the working platform shall be incidental to the unit price bid for roadway excavation (or embankment-in-place) and geotextile fabric. Wet areas were noted during the subsurface investigations at the following approximate locations:

<u>Mainline</u>
Station 391+25 to 391+75
<u>Frontage Road</u>
Station 144+60 to 145+10

8). The contractor shall construct foundation embankment benches and transverse benches as indicated on the plans and/or as directed by the Engineer, prior to placement of embankments in areas requiring such benches.

9). Transverse benching and/or perforated pipe underdrains shall be installed at the following approximate locations and any others designated by the Engineer. Contrary to Standard Drawing RDP-006, transverse benches and perforated pipe underdrains shall be placed on both the upgrade and downgrade cut to fill transitions.

Station 340+00
Station 350+50
Station 372+25
Station 382+40

10). Foundation embankment benches shall be placed in accordance with Standard Drawing RGX-010 at the locations listed below and/or as directed by the Engineer.

Ramp C-1
Station 9+00 to 10+25
Frontage Road
Station 143+75 to 144+75
CSXT Runaround
Station 2424+25 to 2428+75

11). The pond at the following location and any others designated by the Engineer shall be drained and any soft or saturated material shall be removed (approximately 2 feet). Use of this excavated material shall be limited to final dressing of roadway slopes, as directed by the Engineer. Approximately 2 feet of limestone and/or durable shale from roadway excavation may be required to stabilize the area. However, the actual thickness shall be determined by the Engineer. The placement of this material is incidental to the unit bid price for roadway excavation or embankment-in-place.

Station 346+50

12). Shale (above or below the RDZ, durable or nondurable) cannot be used in the subgrade.

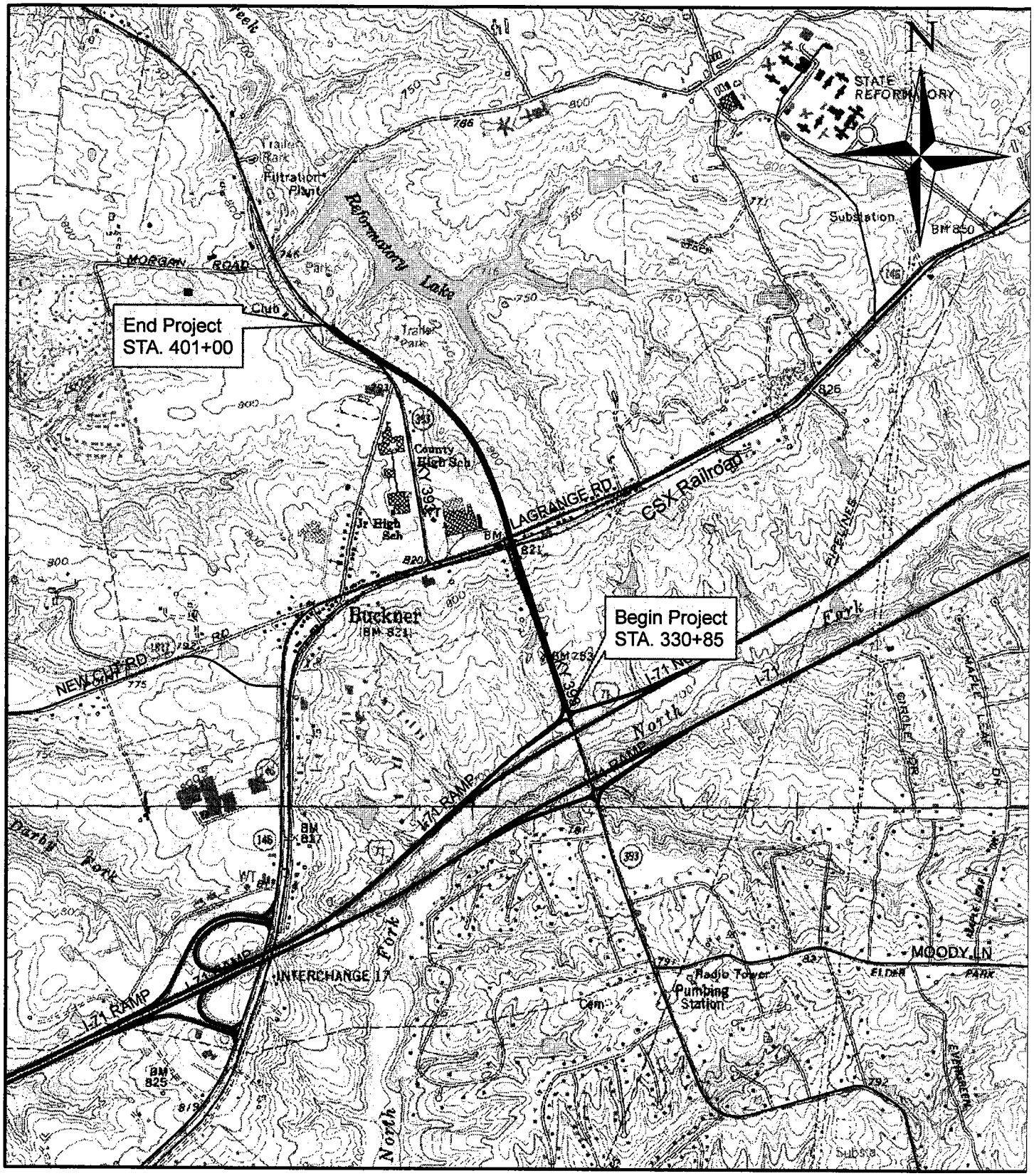
DESIGN RECOMMENDATIONS . . .

1). The project should be designed for a 2 foot rock roadbed. A CBR design value of 11.0 is recommended for the rock, and a CBR design value of 2.0 is recommended for the soil beneath the rock. The rock shall consist of limestone from roadway excavation. The placement of this material is incidental to the unit bid price for roadway excavation or embankment-in-place.

cc: Kentucky Transportation Center
Division of Design (Plan Processing Section)
TEBM for Pavement Design
Division of Construction
TEBM for Construction (District) 2 copies
TEBM for Preconstruction (District)
Skees Engineering

Attachments

OLDHAM COUNTY - KY 393



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OLDHAM COUNTY
KY 393
FROM I-71 TO NORTH OF KY 146
ITEM # 5-340.00
MARS # 5941402D

GEOTECHNICAL SYMBOL SHEET

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

AASHTO Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35% or less passing 0.075 mm)							Silt-Clay Materials (More than 35% passing 0.075 mm)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, Percent Passing											
2.00 mm (No. 10)	50 max	---	---	---	---	---	---	---	---	---	---
0.425 mm (No. 40)	30 max	50 max	51 min	---	---	---	---	---	---	---	---
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of Fraction Passing 0.425 mm (No. 40)											
Liquid Limit	---		---	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min

Unified Soil Classifications

MAJOR DIVISIONS		SYMBOL	NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well graded sands or gravelly sands, little or no fines.
		SP	Poorly graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS LL IS LESS THAN 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays.
	SILTS AND CLAYS LL IS GREATER THAN 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
UNCLASSIFIED MATERIAL		NONE	Non-classified material(i.e. overburden, pavement, slag, etc.) Include visual description.

AI	Activity Index
LI	Liquidity Index
S+C	Silt + Clay (% finer than No.200 Sieve)
○	Rockline Soundings
◕	Disturbed Sample Boring
◎	Undisturbed Sample Boring
⊙	Undisturbed Sample Boring & Rock Core
●	Rock Core
⌖	Slope Inclinometer Installation typical applications: ⌖ ◕ ⊙ ⌖ ●
OW	Observation Well
➡	Approximate Footing Elevation
▼ (Date)	Water Elevation
VS (psf)	Field Vane Shear Strength
▮	Thin-walled Tube Sample
<	Standard Penetration Test Sample
N	Penetration Resistance
Qu (psf)	Unconfined Compressive Strength
UU (psf)	Unconsolidated Undrained Triaxial Strength
w%	Moisture Content
KY RQD	Rock Quality Designation (Kentucky Method)
STD RQD	Rock Quality Designation (Standard Method)
SDI(JS)	Slake Durability Index (Jar Slake Test)
REC	Core Recovery
∅	Angle of Internal Friction (Total Stress)
$\overline{\emptyset}$	Angle of Internal Friction (Effective Stress)
c (psf)	Cohesion (Total Stress)
$\overline{c}$ (psf)	Cohesion (Effective Stress)
δ (pcf)	Total Unit Weight
RDZ	Rock Disintegration Zone
OB	Overburden Bench
IB	Intermediate Bench
R	Refusal
NR	Refusal Not Encountered

LIMESTONE

SANDSTONE

DURABLE SHALE (SDI ≥ 95)

NONDURABLE SHALE (SDI < 95)

COAL

TALUS, MINE WASTE, FILL MATERIAL, BOULDERS, & ETC.

GRANULAR EMBANKMENT

STRUCTURE GRANULAR BACKFILL

SLOPE PROTECTION

DATE
DATE
CHECKED BY
APPROVED BY
DD-MMM-YYYY HH:MM

GEOTECHNICAL SYMBOL SHEET

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

GEOTECHNICAL NOTES

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Station 144+60 to 145+10

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Station 350+50
Station 372+25
Station 382+40

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Station 2424+25 to 2428+75

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Station 346+50

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DATE
DATE
CHECKED BY
APPROVED BY

KENTUCKY
DEPARTMENT OF HIGHWAYS
COUNTY OF
OLDHAM

PROJECT
NUMBERS

GEOTECHNICAL NOTES

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

Field Drilling and Sampling were performed in the period of MAY, 20 04 to, JUNE 20 04 .

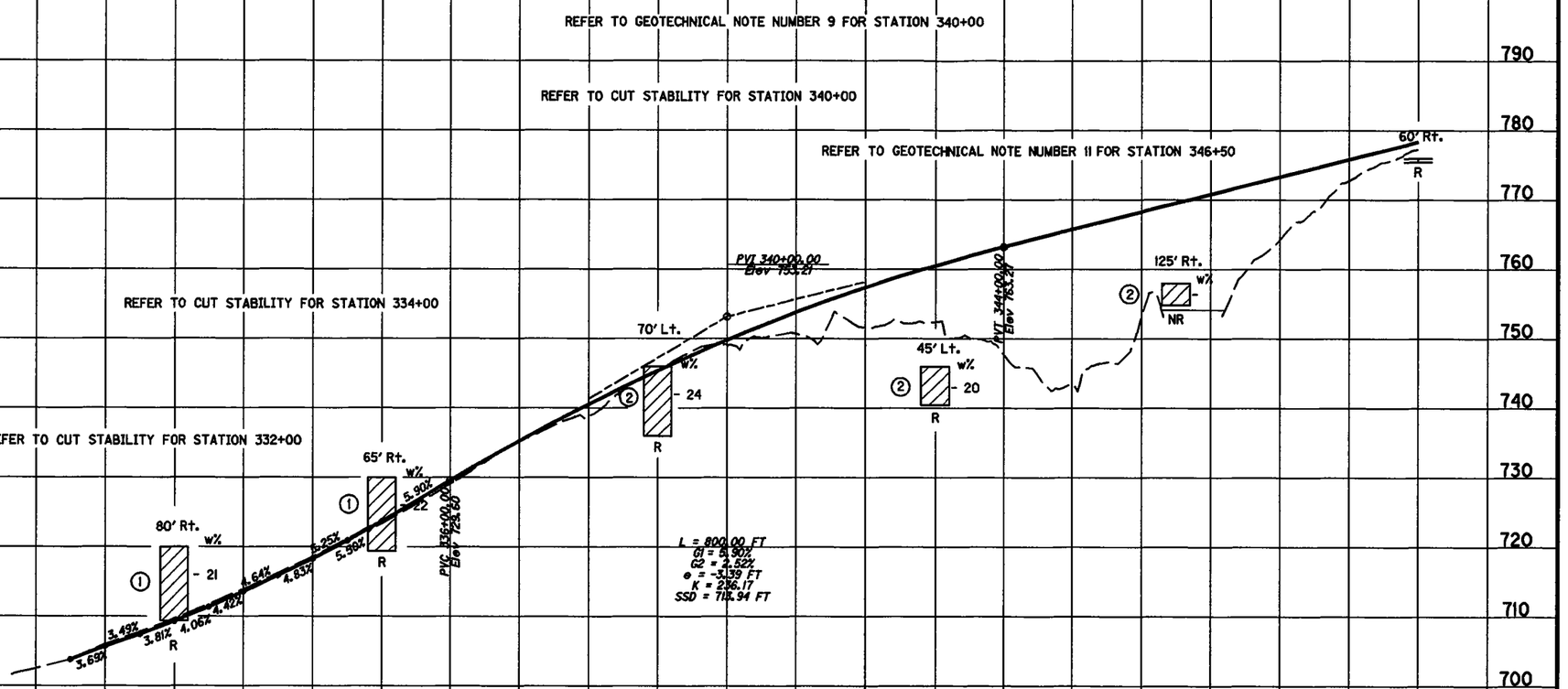
Detailed data and interpretation of subsurface conditions encountered in individual borings are shown on the soil profile. Soil and rock strata discriptions and indicated boundaries are based on engineering interpretation of available subsurface information obtained at selected locations, and may not neccessarily reflect the actual variation in subsurface conditions between borings and samples.

The observed water levels and/or subsurface conditions indicated on the soil profile are as recorded at the time of exploration. These water levels and/or subsurface conditions may vary considerable with time, according to the prevailing climate, rainfall or other factors and are otherwise dependent on the duration of and methods used in the exploration program.

Selected rock cores and all applicable drill logs, are stored at the Division of Materials in Frankfort and are available for inspection on request. Contact the Division of Materials, Geotechnical Branch for availability information and to schedule an inspection.

NOTICE - Without regard to the materials encountered, all roadway and drainage excavation shall be unclassified and shall be designated as Roadway Excavation. It shall be distinctly understood that any reference to rock, earth or any other materials on the plans or cross sections whether in numbers, words, letters, or lines, is solely for the Department's information and is not to be taken as an indication of classified excavation or the quantity of either rock, earth or any other material involved.

The bidder must draw his own conclusions as to the conditions to be encountered. The Department does not give any guarantee as to the accuracy of the data and no claim will be considered for additional compensation when the materials encountered are not in accord with the classification shown



SAMPLE NO.		1	2
STATION		332+00	339+00
OFFSET		80' Rt.	70' lt.
DEPTH		0.0-10.5	0.0-10.0
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	0
	SAND (- NO 10 + NO. 200)	11	9
	SILT (- 0.075 mm + 0.002 mm)	51	48
	CLAY (- 0.002 mm)	38	43
LIQUID LIMIT		32	38
PLASTIC LIMIT		21	21
PLASTICITY INDEX		11	17
ACTIVITY INDEX		.29	.39
SPECIFIC GRAVITY		2.74	2.77
AASHTO CLASSIFICATION		A-7-6(9)	A-6(16)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		3.2	1.6
MAXIMUM DRY DENSITY (pcf)		110	104
OPTIMUM MOISTURE CO		18	20
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-

KENTUCKY
DEPARTMENT OF HIGHWAYS
COUNTY OF
OLDHAM

PROJECT NUMBERS

SOIL PROFILE, KY 393
STA. 330+00 TO 350+00

DATE
DATE
CHECKED BY
APPROVED BY

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DD-MMM-YYYY HH:MM

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

REFER TO CUT STABILITY FOR STATION 356+50

REFER TO CUT STABILITY FOR STATION 353+50

REFER TO CUT STABILITY FOR STATION 361+00

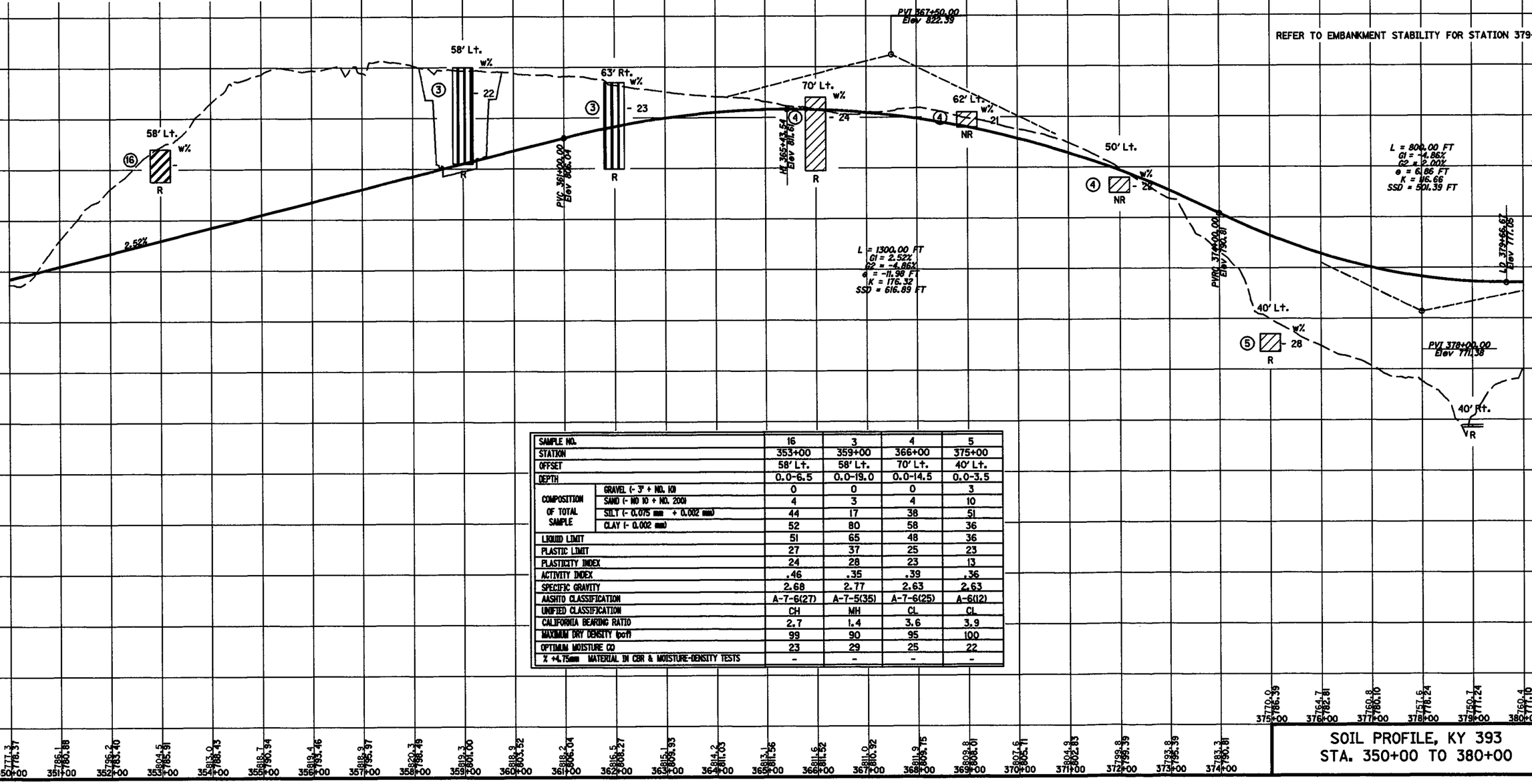
REFER TO CUT STABILITY FOR STATION 357+00

REFER TO CUT STABILITY FOR STATION 367+50

REFER TO GEOTECHNICAL NOTE NUMBER 9 FOR STATION 350+50

REFER TO GEOTECHNICAL NOTE NUMBER 9 FOR STATION 372+25

REFER TO EMBANKMENT STABILITY FOR STATION 379+50



SAMPLE NO.		16	3	4	5
STATION		353+00	359+00	366+00	375+00
OFFSET		58' Lt.	58' Lt.	70' Lt.	40' Lt.
DEPTH		0.0-6.5	0.0-19.0	0.0-14.5	0.0-3.5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	0	0	3
	SAND (- NO 10 + NO. 200)	4	3	4	10
	SILT (- 0.075 mm + 0.002 mm)	44	17	38	51
	CLAY (- 0.002 mm)	52	80	58	36
LIQUID LIMIT		51	65	48	36
PLASTIC LIMIT		27	37	25	23
PLASTICITY INDEX		24	28	23	13
ACTIVITY INDEX		.46	.35	.39	.36
SPECIFIC GRAVITY		2.68	2.77	2.63	2.63
AASHTO CLASSIFICATION		A-7-6(27)	A-7-5(35)	A-7-6(25)	A-6(12)
UNIFIED CLASSIFICATION		CH	MH	CL	CL
CALIFORNIA BEARING RATIO		2.7	1.4	3.6	3.9
MAXIMUM DRY DENSITY (pcf)		99	90	95	100
OPTIMUM MOISTURE (%)		23	29	25	22
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-	-	-

SOIL PROFILE, KY 393
STA. 350+00 TO 380+00

PREPARED BY ____ DATE ____
CHECKED BY ____ DATE ____
APPROVED BY ____ DATE ____

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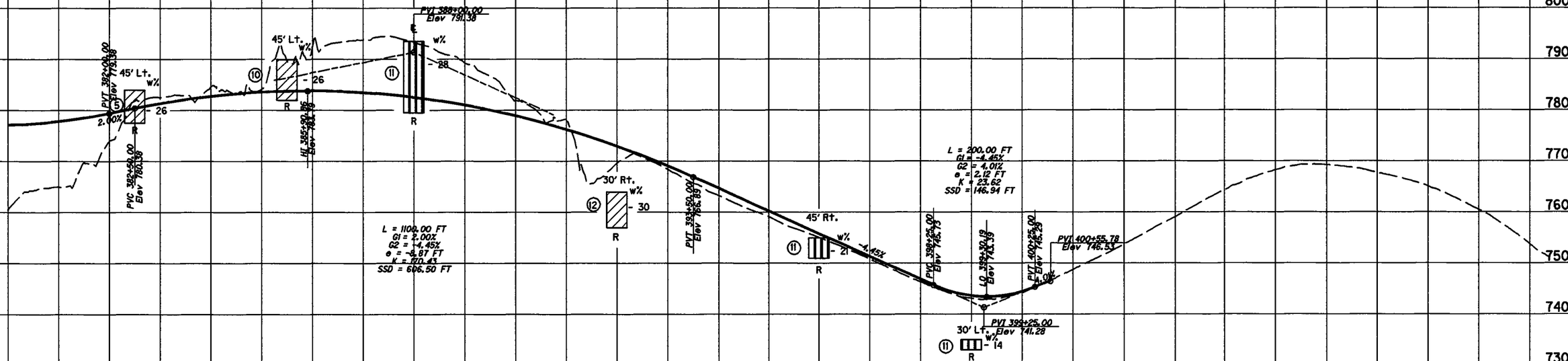
DD-MMM-YYYY HH:MM

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

REFER TO GEOTECHNICAL NOTE NUMBER 9 FOR STATION 382+40

REFER TO GEOTECHNICAL NOTE NUMBER 7 FOR STATION 391+25 to 391+75

REFER TO CUT STABILITY FOR STATION 387+50



SAMPLE NO.		5	10	11	12
STATION		375+00	385+50	388+80	392+00
OFFSET		40' Lt.	45' Lt.	℄	30' Rt.
DEPTH		0.0-3.5	0.0-8.0	0.0-14.0	0.0-7.0
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	3	10	1	3
	SAND (- NO 10 + NO. 200)	10	18	7	6
	SILT (- 0.075 mm + 0.002 mm)	51	39	25	50
	CLAY (- 0.002 mm)	36	33	66	41
LIQUID LIMIT		36	32	56	36
PLASTIC LIMIT		23	20	30	21
PLASTICITY INDEX		13	12	26	15
ACTIVITY INDEX		.36	.36	.39	.36
SPECIFIC GRAVITY		2.63	2.68	2.78	2.75
AASHTO CLASSIFICATION		A-6(12)	A-6(7)	A-7-5(28)	A-6(14)
UNIFIED CLASSIFICATION		CL	CL	MH	CL
CALIFORNIA BEARING RATIO		3.9	4.1	2.6	5.8
MAXIMUM DRY DENSITY (pcf)		100	107	94	113
OPTIMUM MOISTURE CO		22	17	26	13
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-	-	6

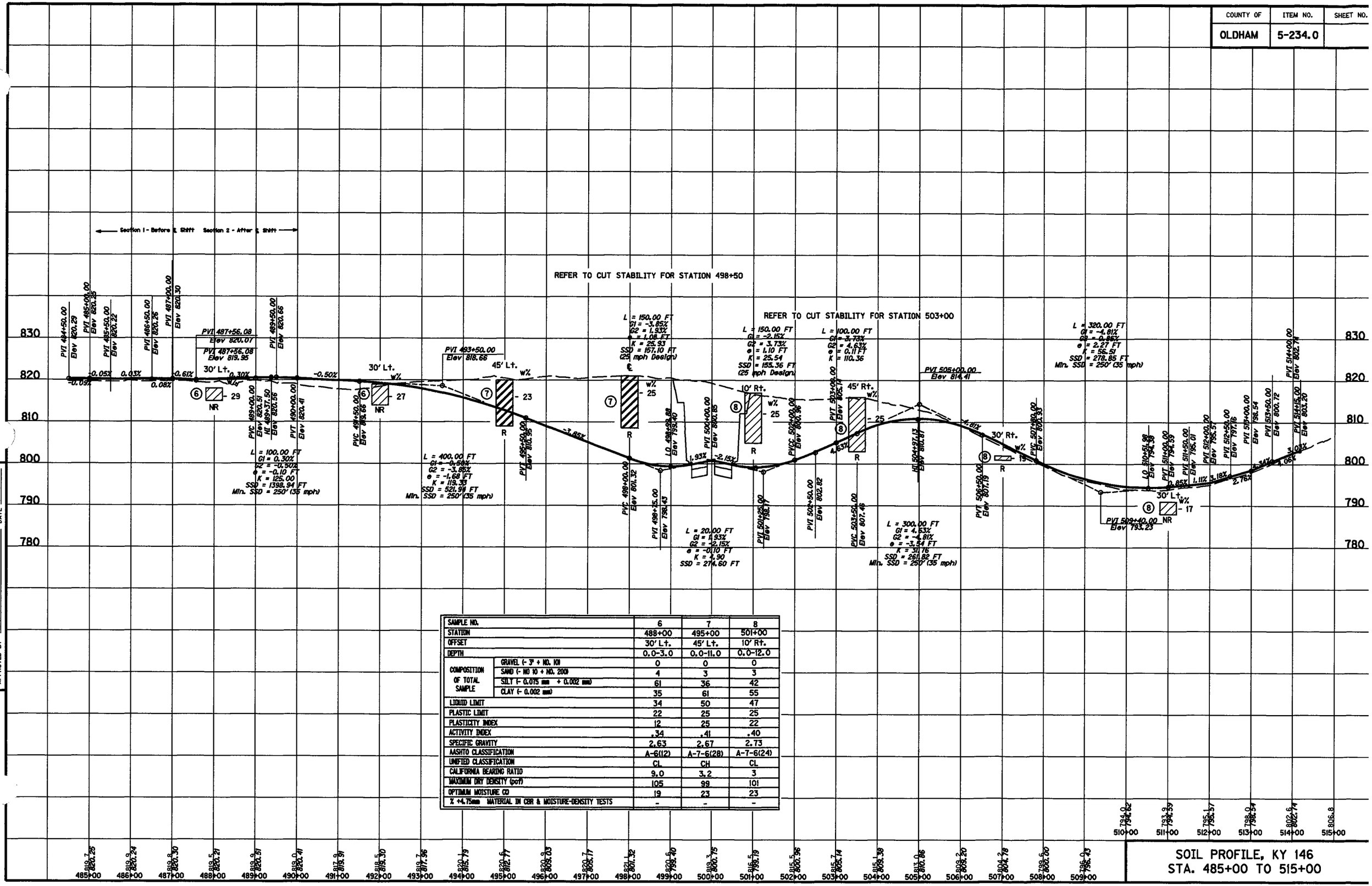
380+00	381+00	382+00	383+00	384+00	385+00	386+00	387+00	388+00	389+00	390+00	391+00	392+00	393+00	394+00	395+00	396+00	397+00	398+00	399+00	400+00	401+00	402+00	403+00	404+00	405+00	406+00	407+00	408+00	409+00	410+00
769.4	765.0	773.9	782.5	784.6	784.1	782.2	783.8	789.3	781.9	778.1	769.6	768.4	763.2	759.1	755.1	750.8	746.3	743.1	744.2	748.7	753.7	759.0	764.3		768.2	769.2	761.7	765.1	760.5	753.8
777.10	777.81	778.38	781.31	782.72	783.55	783.79	783.44	782.51	780.99	778.88	776.19	772.91	768.04	764.66	761.21	755.75	751.30	746.84	743.58	744.42										

SOIL PROFILE, KY 393
STA. 380+00 TO 410+00

DATE

APPROVED BY

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	



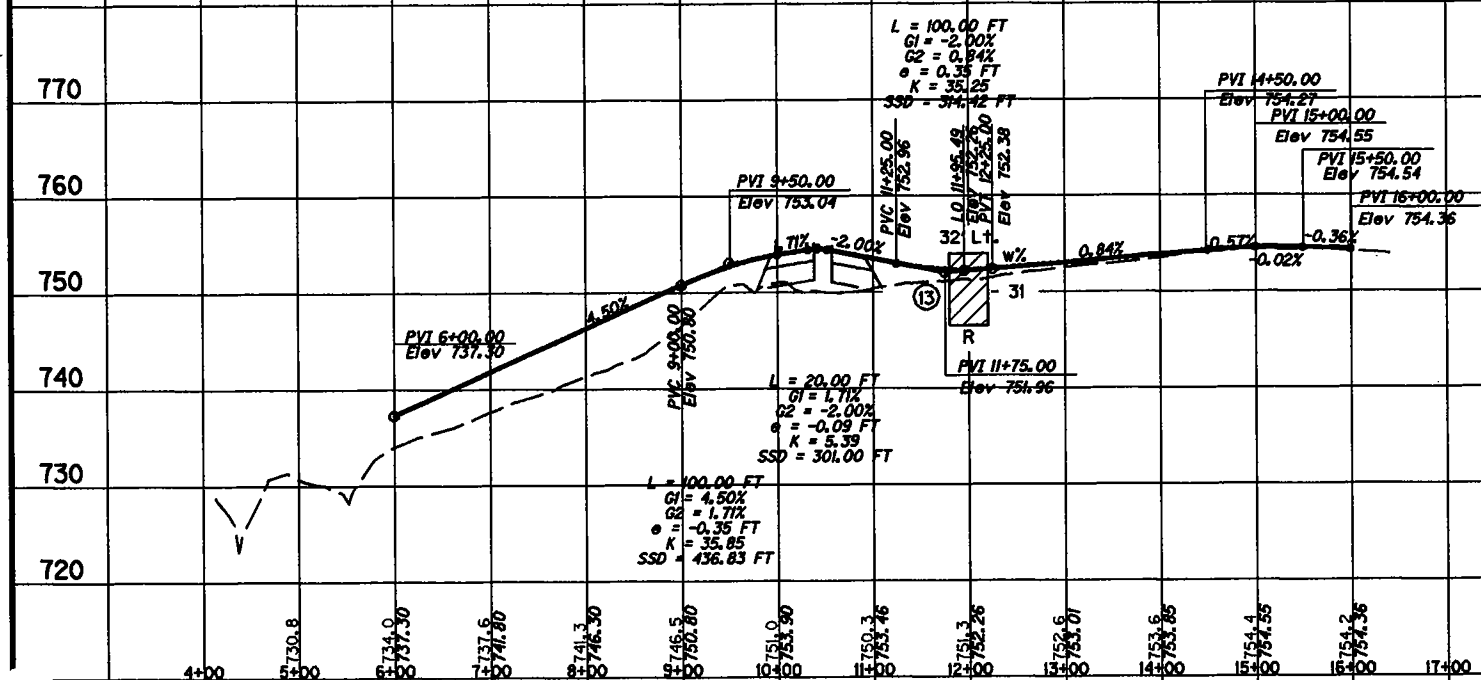
SAMPLE NO.		6	7	8
STATION		488+00	495+00	501+00
OFFSET		30' Lt.	45' Lt.	10' Rt.
DEPTH		0.0-3.0	0.0-11.0	0.0-12.0
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	0	0
	SAND (- NO 10 + NO. 200)	4	3	3
	SILT (- 0.075 mm + 0.002 mm)	61	36	42
	CLAY (- 0.002 mm)	35	61	55
LIQUID LIMIT		34	50	47
PLASTIC LIMIT		22	25	25
PLASTICITY INDEX		12	25	22
ACTIVITY INDEX		.34	.41	.40
SPECIFIC GRAVITY		2.63	2.67	2.73
AASHTO CLASSIFICATION		A-6(12)	A-7-6(28)	A-7-6(24)
UNIFIED CLASSIFICATION		CL	CH	CL
CALIFORNIA BEARING RATIO		9.0	3.2	3
MAXIMUM DRY DENSITY (pcf)		105	99	101
OPTIMUM MOISTURE CO		19	23	23
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-	-

SOIL PROFILE, KY 146
STA. 485+00 TO 515+00

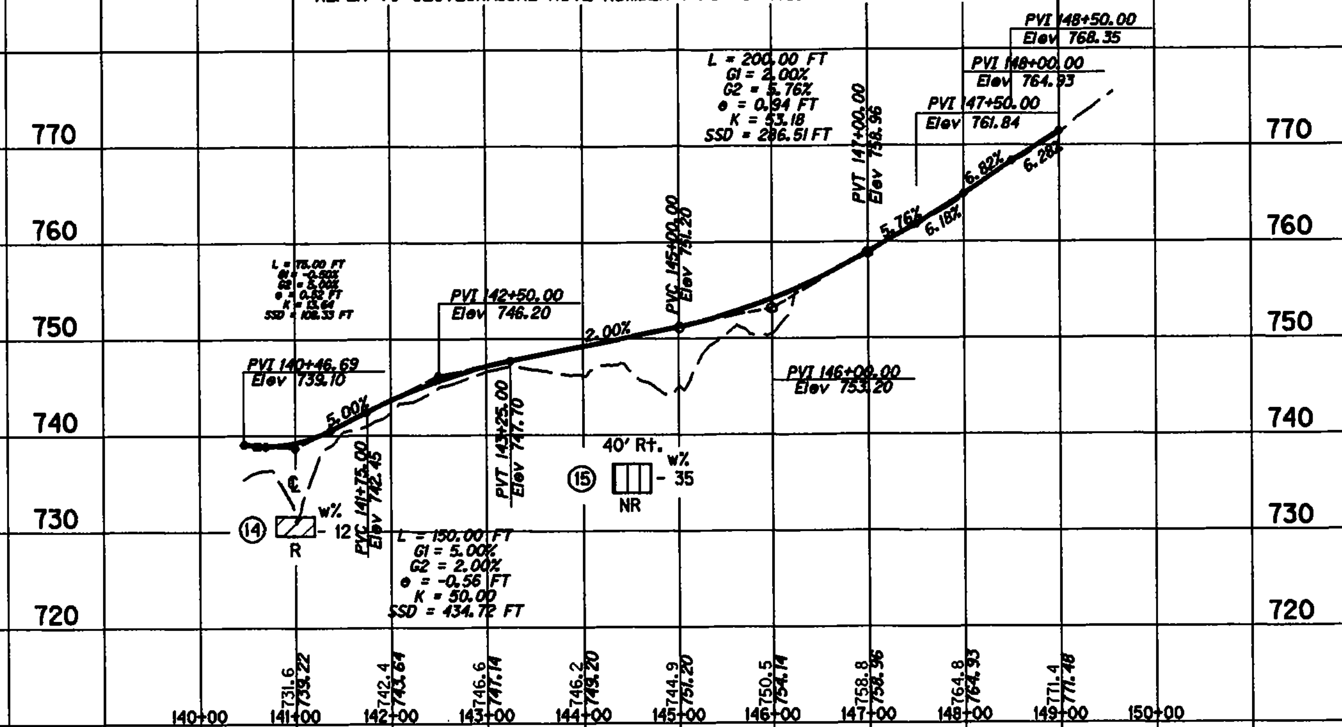
COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

REFER TO GEOTECHNICAL NOTE NUMBER 10 FOR STATION 143+75 to 144+75

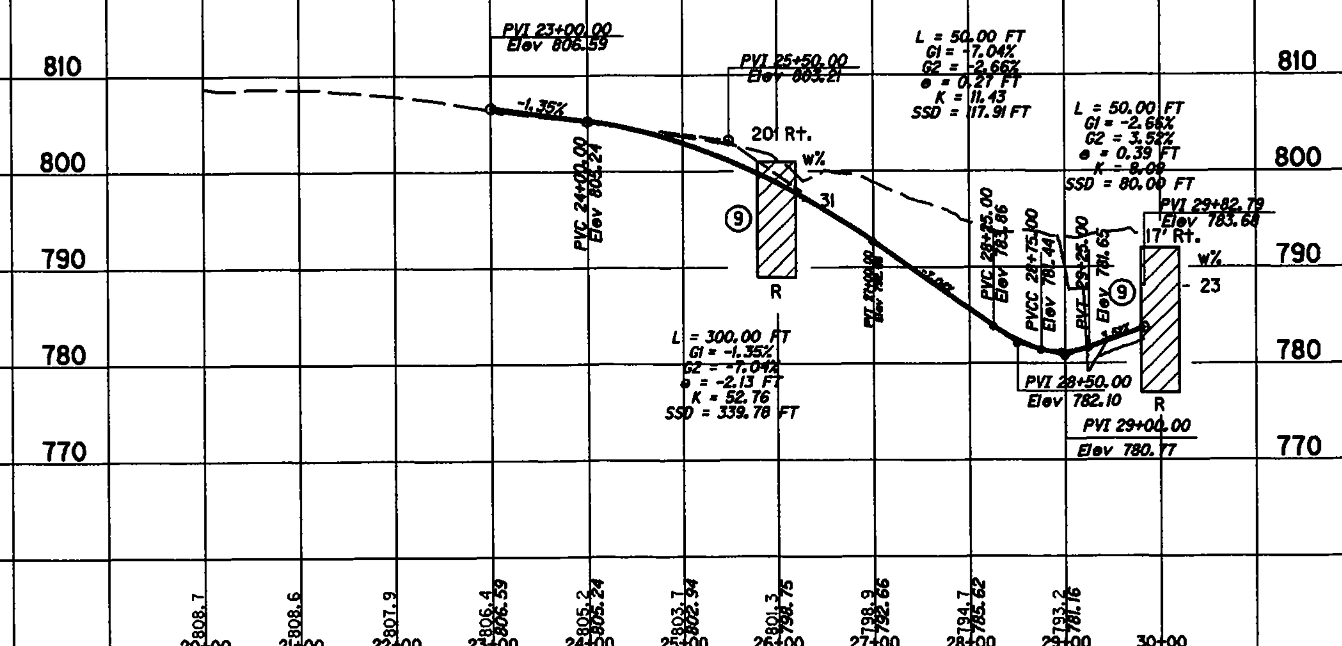
REFER TO GEOTECHNICAL NOTE NUMBER 7 FOR STATION 144+60 to 145+10



SOIL PROFILE, COMMERCE PKWY.
STA. 4+00 TO 17+00



SOIL PROFILE, FRONTAGE RD.
STA. 140+00 TO 150+00



SOIL PROFILE, KY 393 CONN.
STA. 20+00 TO 30+00

SAMPLE NO.		13	14	15	9
STATION		12+00	141+00	144+50	26+00
OFFSET		32' Lt.	℄	40' Rt.	20' Rt.
DEPTH		0.0-7.5	0.0-2.0	0.0-3.0	0.0-12.0
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	4	5	2
	SAND (- NO 10 + NO. 200)	7	18	11	6
	SILT (- 0.075 mm + 0.002 mm)	51	47	54	42
	CLAY (- 0.002 mm)	42	31	30	50
LIQUID LIMIT		36	29	40	44
PLASTIC LIMIT		21	18	26	22
PLASTICITY INDEX		15	11	14	22
ACTIVITY INDEX		.35	.36	.47	.44
SPECIFIC GRAVITY		2.64	2.74	2.70	2.73
AASHTO CLASSIFICATION		A-6(14)	A-6(7)	A-6(12)	A-7-6(22)
UNIFIED CLASSIFICATION		CL	CL	ML	CL
CALIFORNIA BEARING RATIO		3.7	3.6	4.9	2.5
MAXIMUM DRY DENSITY (pcf)		106	118	96	101
OPTIMUM MOISTURE (%)		20	15	21	22
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-	-	-

CHECKED BY ____ DATE ____
APPROVED BY ____ DATE ____

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SOIL PROFILES, COMMERCE PKWY.
FRONTAGE RD. & KY 393 CONNECTOR

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

FACTORS OF SAFETY		
INTERMEDIATE TERM	A	2.0
LONG TERM	B	1.4

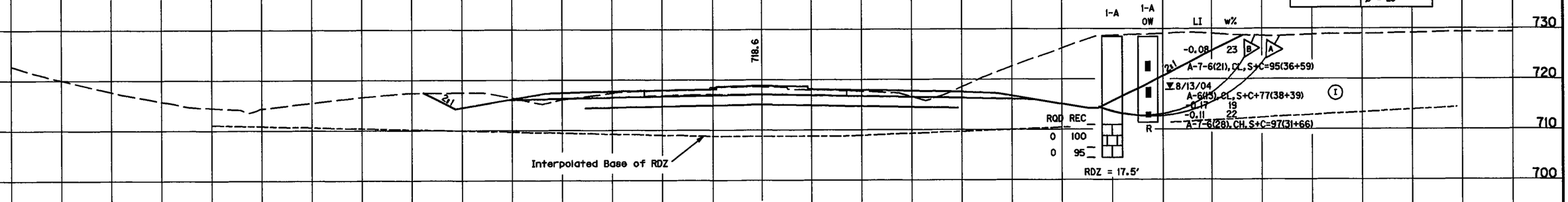
ASSUMED SOIL STRENGTH PARAMETERS	
SOIL	I
INTERMEDIATE TERM	γ = 125 pcf c = 200 psf ϕ = 28°
LONG TERM	γ = 125 pcf $\bar{c}$ = 40 psf $\bar{\phi}$ = 28°

SUMMARY OF TRIAXIAL TEST DATA	
STATION	334+00
OFFSET	77' Rt.
DEPTH	10.0-12.0 15.0-16.0
$\bar{c}$	195 psf
$\bar{\phi}$	28°

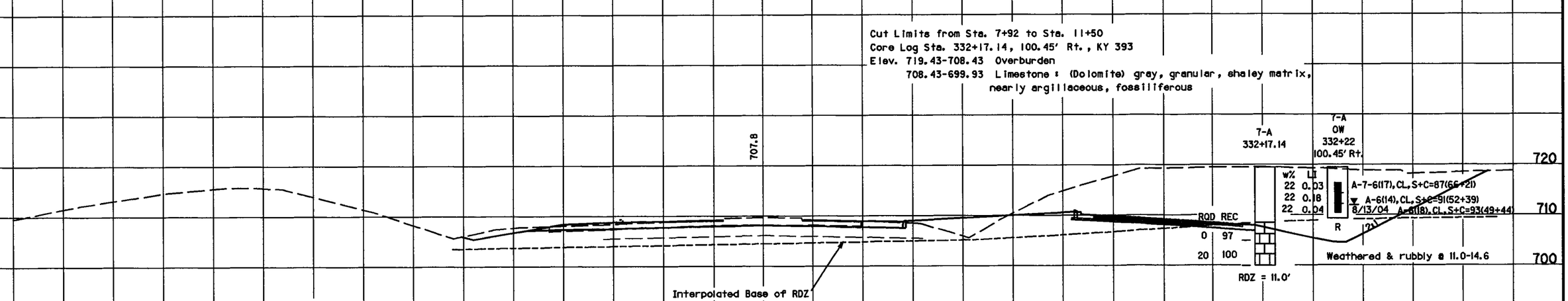
Additional Rockline Soundings

Station	Offset	Depth to Refusal
333+00	75' Rt.	12.0'
335+00	65' Rt.	10.5'
336+00	70' Rt.	8.0'

Cut Limits from Sta. 331+50 to Sta. 336+50
Core Log Sta. 334+00, 70' Rt.
Elev. 728.43-710.93 Overburden
710.93-704.43 Limestone : (Dolomite) gray, crystalline-granular, shaley matrix w/occasionally argillaceous partings & zones, fossiliferous



Cut Limits from Sta. 7+92 to Sta. 11+50
Core Log Sta. 332+17.14, 100.45' Rt., KY 393
Elev. 719.43-708.43 Overburden
708.43-699.93 Limestone : (Dolomite) gray, granular, shaley matrix, nearly argillaceous, fossiliferous



Ramp C-1
Additional Rockline Soundings

Station	Offset	Depth to Refusal
8+00	50' Rt.	7.0'
9+00	25' Rt.	8.0'
11+00	30' Rt.	12.0'

Ramp C-1
Sta. 10+00, 20' Rt.

DATE

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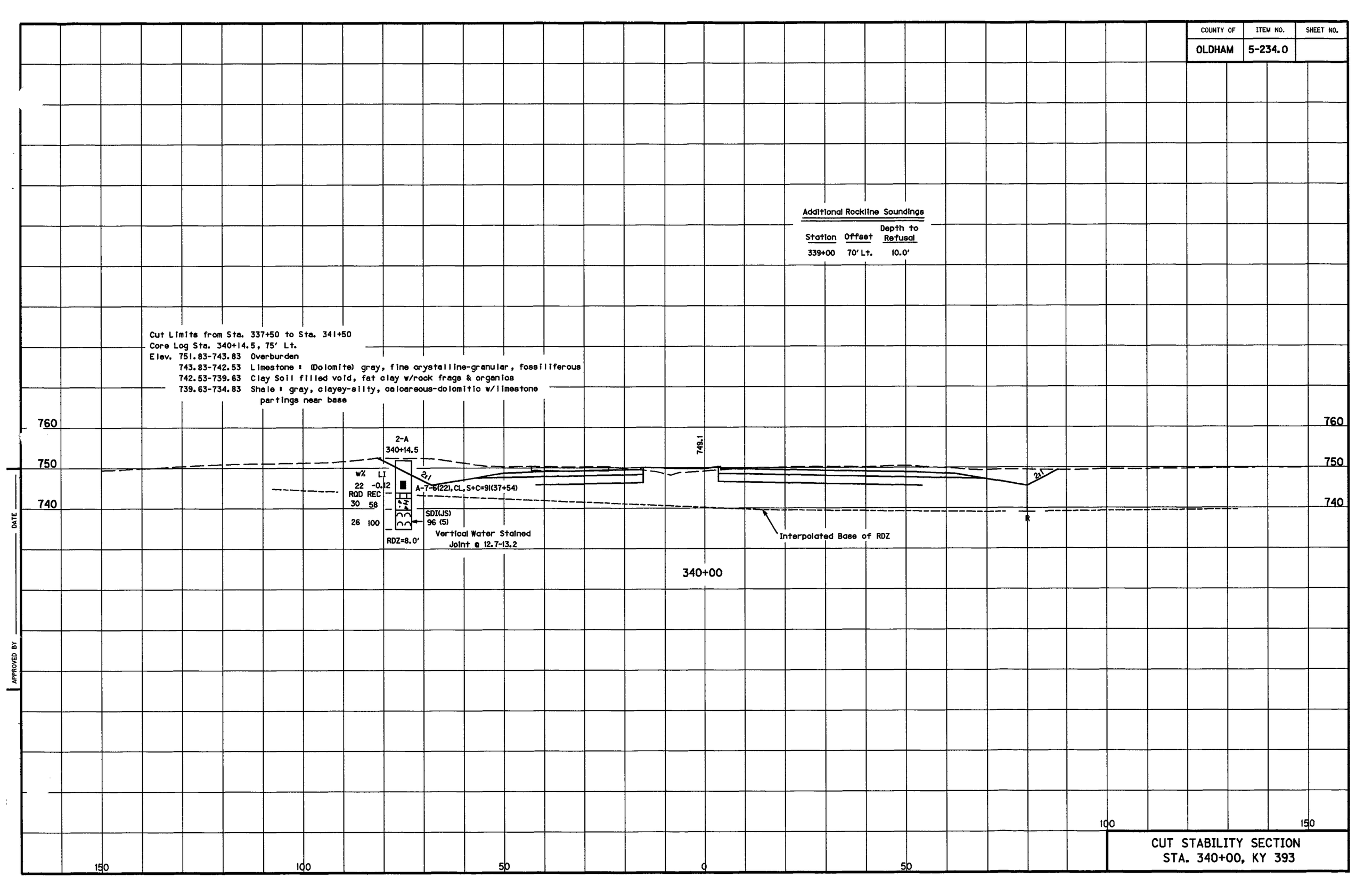
CUT STABILITY SECTION
STA. 332+00 & 334+00, KY 393

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

Cut Limits from Sta. 337+50 to Sta. 341+50
Core Log Sta. 340+14.5, 75' Lt.
Elev. 751.83-743.83 Overburden
743.83-742.53 Limestone : (Dolomite) gray, fine crystalline-granular, fossiliferous
742.53-739.63 Clay Soil filled void, fat clay w/rock frags & organics
739.63-734.83 Shale : gray, clayey-silty, calcareous-dolomitic w/limestone partings near base

Additional Rockline Soundings

Station	Offset	Depth to Refusal
339+00	70' Lt.	10.0'



CUT STABILITY SECTION
STA. 340+00, KY 393

DATE
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FACTORS OF SAFETY		
INTERMEDIATE TERM	A	2.0
LONG TERM	B	1.4

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

ASSUMED SOIL STRENGTH PARAMETERS	
SOIL	I
INTERMEDIATE TERM	γ = 125 pcf c = 200 psf ϕ = 28°
LONG TERM	$\bar{\gamma}$ = 125 pcf $\bar{c}$ = 40 psf $\bar{\phi}$ = 28°

Hole 4
Core Log Sta. 356+45, 14.5' Lt.
Elev. 819.1-806.1 Overburden
806.1-798.0 Limestone : (Dolomite) buff, white-tan, granular, very weathered & solutioned, porous, vuggy
798.0-795.7 Limestone (Dolomite) gray, fine crystalline-granular
795.7-792.6 Shale : gray, clayey, fissile
792.6-790.2 Limestone : (Dolomitic) gray, fine-coarse crystalline, bioclastic w/shale partings @ 28.1-28.9
790.2-786.5 Limestone : (Dolomite) orange-buff white, granular, porous, vuggy
786.5-780.1 Shale : (Dolomite) gray, micritic mudstone, crypto-fine crystalline

Hole 3
Core Log Sta. 356+61.85, 60' Rt.
Elev. 816.79-805.29 Overburden
805.29-798.89 Limestone : (Dolomite) buff, white-tan, granular, very weathered & solutioned, porous
798.89-796.59 Limestone (Dolomite) gray, fine crystalline-granular
796.59-795.79 Shale : gray, clayey w/calcareous, siltstone lenses & crossbedding

Cut Limits from Sta. 351+00 to Sta. 365+00
Core Log Sta. 353+50, 65' Rt.
Elev. 806.27-800.27 Overburden
800.27-799.27 Limestone : (Dolomite) brown, granular, weathered
799.27-796.37 Shale : brown-gray, clayey, fissile
796.37-788.27 Limestone : (Dolomitic) gray, fine crystalline-granular w/limited shale partings
788.27-773.07 Shale : gray, clayey-silty, occasionally fissile, w/calcareous mudstone siltstone partings & zones
773.07-770.27 Limestone : (Dolomite) light gray, fine-coarse crystalline, fossiliferous, w/limited shale partings

Additional Rockline Soundings

Station	Offset	Depth to Refusal
352+00	65' Rt.	5.5'
353+00	58' Lt.	6.5'
353+00	62' Rt.	5.5'
354+00	58' Lt.	9.5'
359+00	58' Lt.	10.0'
359+00	63' Rt.	13.5'
360+00	58' Lt.	12.0'
360+00	63' Rt.	13.5'
362+00	58' Lt.	16.5'
362+00	63' Rt.	17.0'
363+00	58' Lt.	14.0'
363+00	63' Rt.	14.0'
364+00	58' Lt.	15.5'

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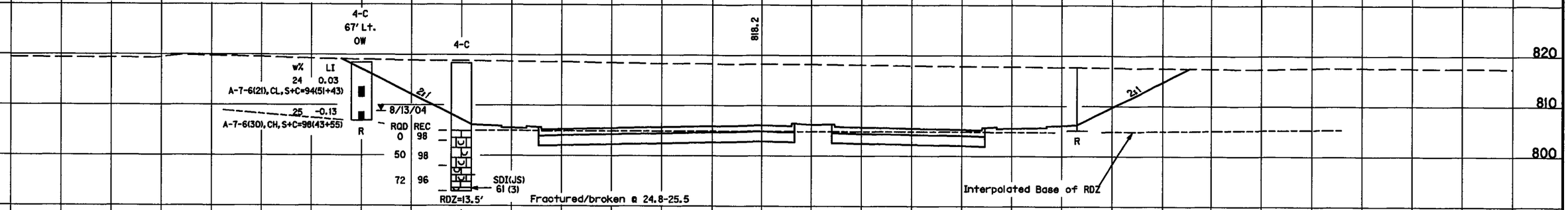
CUT STABILITY SECTION
STA. 353+50 & 356+50, KY 393

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

Hole 4 C
Core Log Sta. 361+00, 60' Lt.
Elev. 818.4-804.9 Overburden
804.9-796.1 Limestone : (Dolomite) tan-brown, granular, weathered, & solutione, porous, vuggy
796.1-793.6 Limestone : (Dolomitic) gray, in shaley matrix
793.6-792.9 Shale : gray, silty

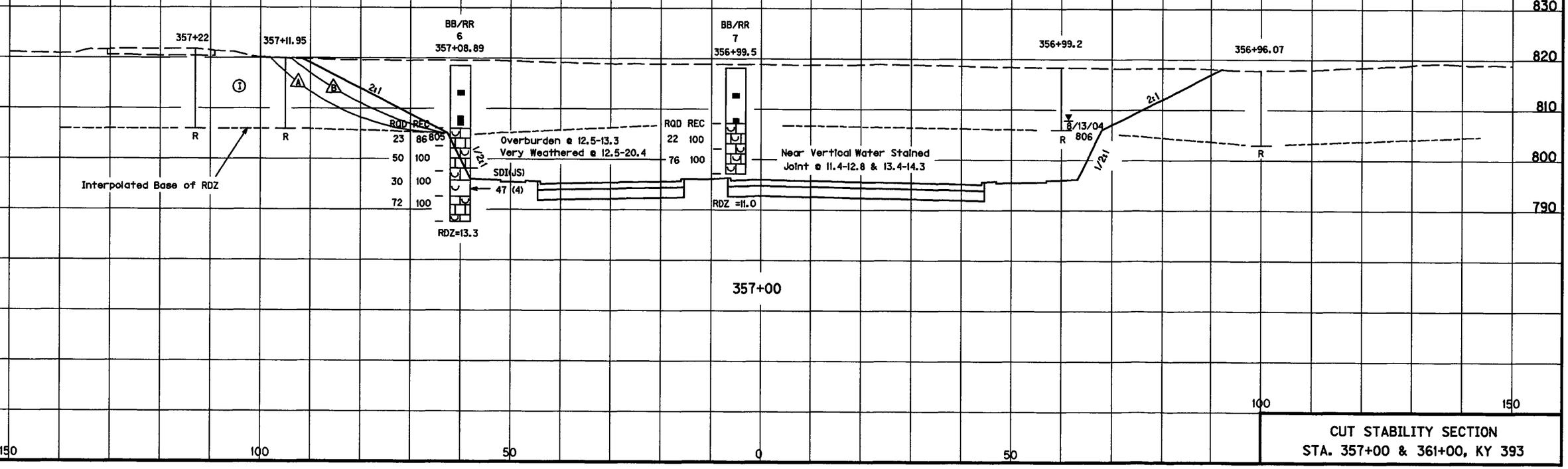


FACTORS OF SAFETY		
INTERMEDIATE TERM	A	2.2
LONG TERM	B	1.4

ASSUMED SOIL STRENGTH PARAMETERS	
SOIL	I
INTERMEDIATE TERM	γ = 125 pcf c = 200 psf ϕ = 28°
LONG TERM	γ = 125 pcf c = 40 psf ϕ = 28°

Hole 6
Core Log Sta. 357+08.89, 60' Lt.
Elev. 818.58-806.08 Overburden
806.08-798.18 Limestone : (Dolomite) buff-white-tan, granular, weathered, porous & solutioned
798.18-795.78 Limestone : (Dolomitic) gray, fine, crystalline-granular
795.78-792.58 Shale : gray, clayey, fissile
792.58-787.58 Limestone : (Dolomitic) gray, fine-coarse crystalline w/limited shale partings

Hole 7
Core Log Sta. 356+99.5, 5' Lt.
Elev. 818.25-807.25 Overburden
807.25-797.25 Limestone : (Dolomite) tan-brown, granular, highly weathered, solutioned, porous w/near vertical fracture set



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CUT STABILITY SECTION
STA. 357+00 & 361+00, KY 393

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

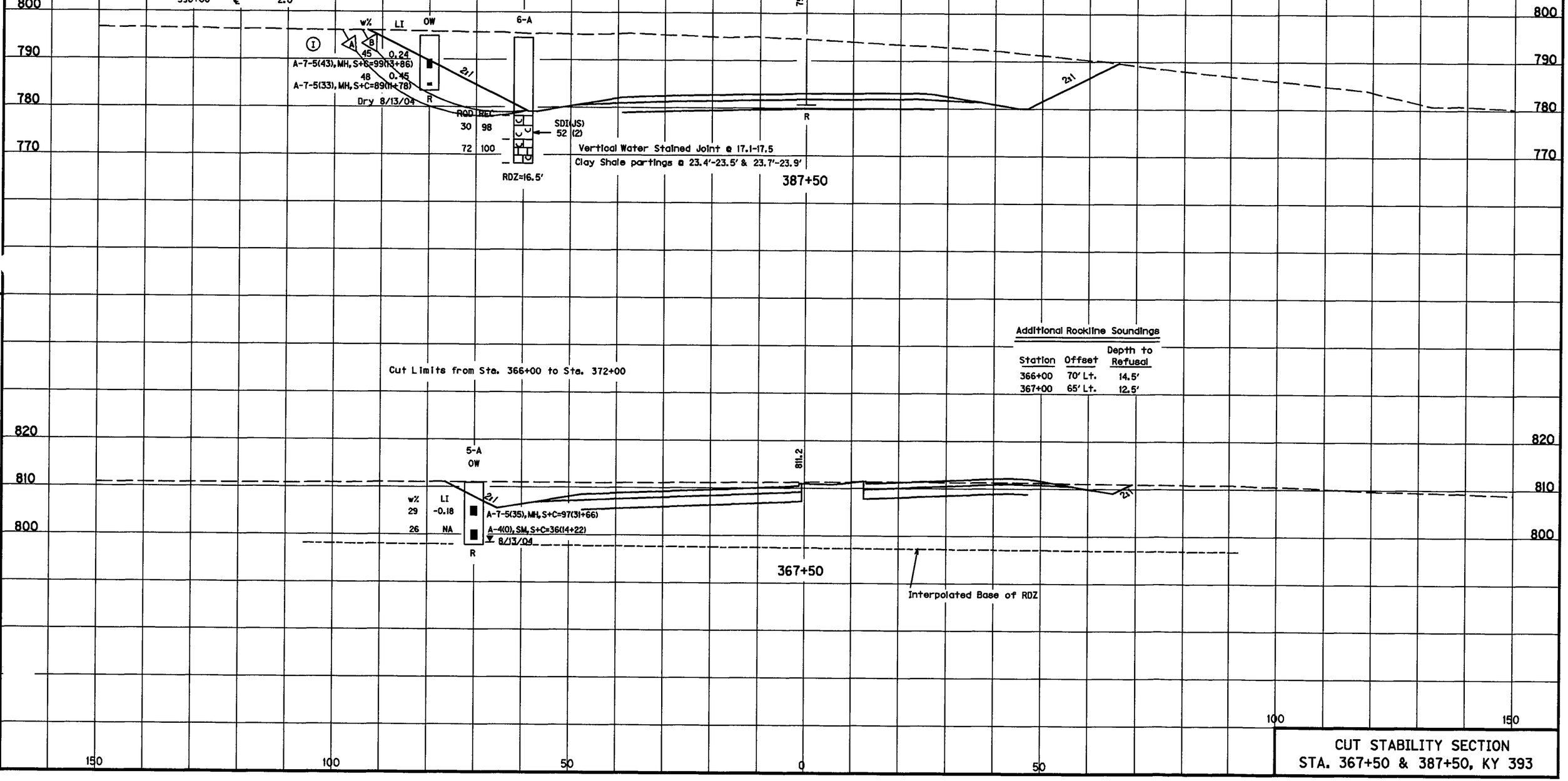
Additional Rockline Soundings

Station	Offset	Depth to Refusal
382+50	45' Lt.	6.5'
383+00	45' Lt.	3.5'
385+50	45' Lt.	8.0'
386+00	40' Lt.	10.0'
387+50	℄	14.0'
388+00	58' Lt.	10.0'
388+00	℄	14.0'
389+00	58' Lt.	12.5'
389+00	47' Rt.	10.0'
390+00	℄	2.0'

FACTORS OF SAFETY		
INTERMEDIATE TERM	A	2.1
LONG TERM	B	1.4

ASSUMED SOIL STRENGTH PARAMETERS	
SOIL	I
INTERMEDIATE TERM	γ = 125 pcf c = 200 psf ϕ = 28°
LONG TERM	γ = 125 pcf $\bar{c}$ = 40 psf $\bar{\phi}$ = 28°

Hole 6 A
Cut Limits from Sta. 381+50 to Sta. 391+00
Core Log Sta. 387+50, 60' Lt.
Elev. 794.5-778.15 Overburden
778.15-776.15 Limestone : (Dolomite) reddish brown-gray, granular, w/intermittent water staining
776.15-773.15 Shale : clayey-silty, gray, calcareous
773.15-768.15 Limestone : (Dolomite) gray, granular w/limited shale partings



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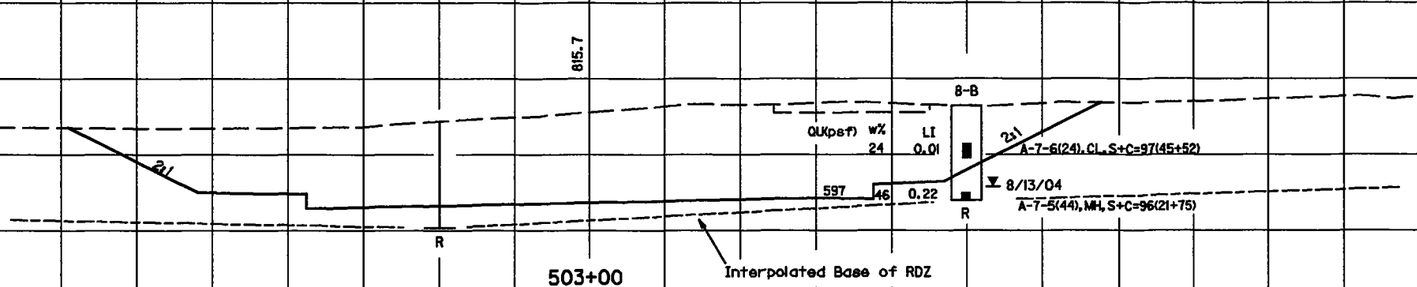
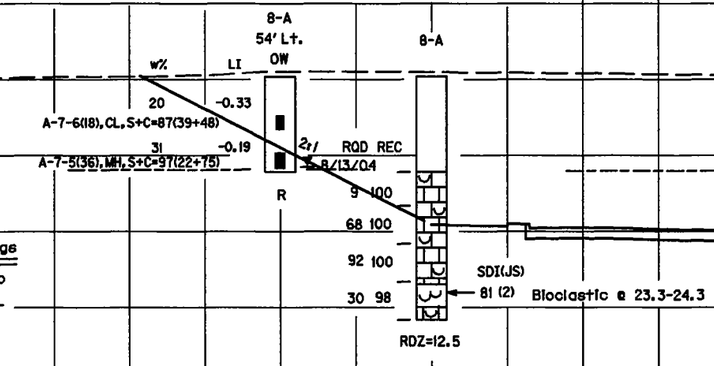
CUT STABILITY SECTION
STA. 367+50 & 387+50, KY 393

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	



Cut Limits from Sta. 493+00 to Sta. 506+00
Core Log Sta. 498+50, 50' Lt.
Elev. 820.4-807.9 Overburden
807.9-793.1 Limestone : (Dolomite) buff, white-tan, granular, very weathered solutioned, porous, vuggy, gray & unweathered w/shaley matrix below 24.3'
793.1-790.1 Shale : gray, clayey-silty, calcareous, fissile
790.1-788.4 Limestone : (Dolomite) brown-gray, water stained, shaley matrix



Additional Rockline Soundings

Station	Offset	Depth to Refusal
494+00	45' Lt	11.0' NR
494+00	℄	11.0'
495+00	45' Lt.	11.0'
496+00	50' Lt.	11.0'
496+00	25' Rt.	14.0'
497+00	52' Lt.	18.5'
497+00	30' Rt.	14.5'
498+00	52' Lt.	16.0'
498+00	℄	12.5'
500+00	52' Lt.	11.5'
500+00	20' Rt.	17.0'
501+00	52' Lt.	9.5'
501+00	10' Rt.	12.0'
502+00	50' Lt.	14.5'

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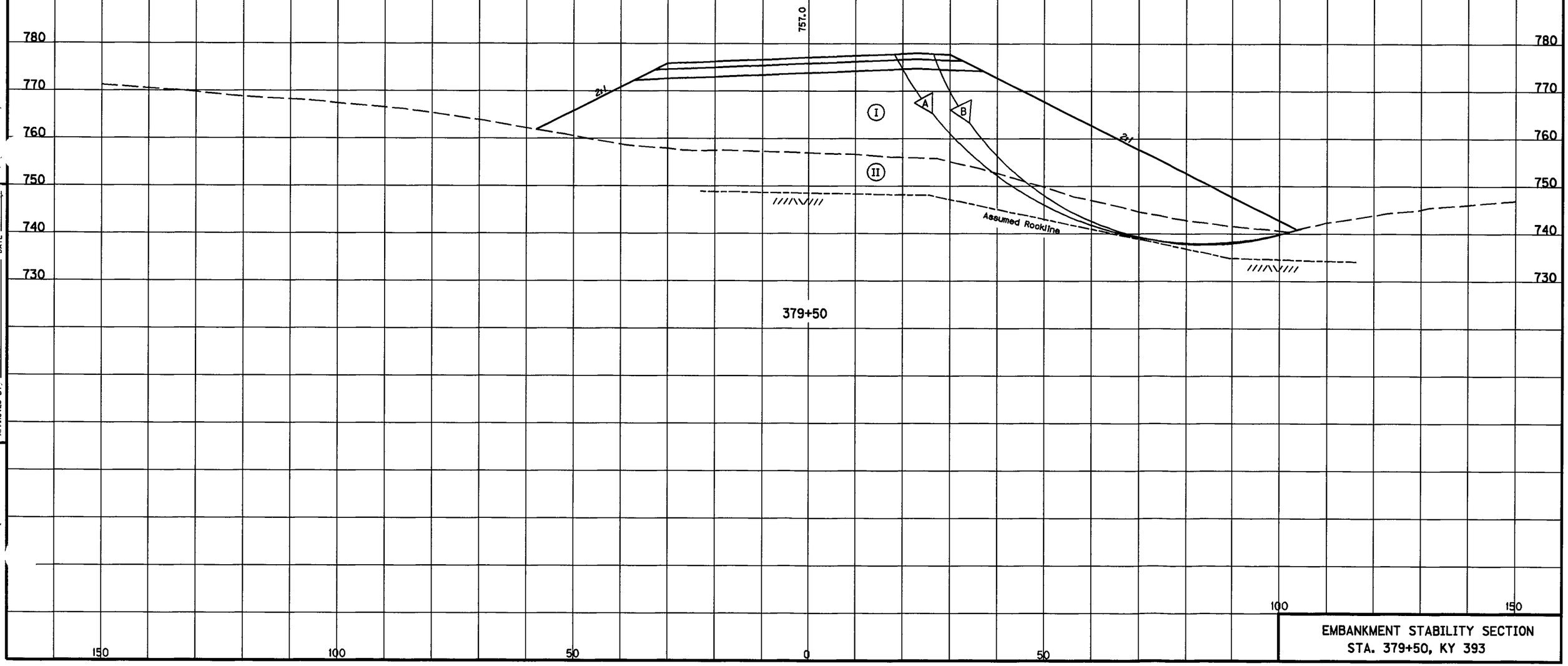
CUT STABILITY SECTION
STA. 498+50, 503+00, KY 146

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-234.0	

FACTORS OF SAFETY		
SHORT TERM	A	2.1
LONG TERM	B	1.4

ASSUMED SOIL STRENGTH PARAMETERS		
SOIL	I	II
SHORT TERM	γ = 125 pcf c = 1500 psf ϕ = 0°	γ = 125 pcf c = 1250 psf ϕ = 0°
LONG TERM	γ = 125 pcf $\bar{c}$ = 250 psf $\bar{\phi}$ = 25°	γ = 125 pcf $\bar{c}$ = 200 psf $\bar{\phi}$ = 20°



EMBANKMENT STABILITY SECTION
STA. 379+50, KY 393

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