# COMMONWEALTH OF KENTUCKY
# TRANSPORTATION CABINET
# FRANKFORT, KY 40622

**MANUAL TITLE:** *Highway Design Guidance Manual*

**REVISION NO.:** 3

**DATE REQUESTED:** December 20, 2022

**REPRINT:**

**REQUESTED BY:** Kim Jasper

**NEW:**

# REVISED PROCEDURES

| CHAPTER/ SECTION | EXPLANATION | OLD PAGES TO BE DELETED | NEW PAGES TO BE ADDED |
|---|---|---|---|
| | The purpose of this printing is to include the following revised policies in the *Highway Design (HD) Guidance Manual*. This revision also includes a table of contents update. | | |
| **HD-200** | Preliminary Design | HD-203 | HD-203 |
| Produced & Distributed by Organizational Management Branch | | | |
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**COMMONWEALTH OF KENTUCKY**
**TRANSPORTATION CABINET**
**FRANKFORT, KY 40622**

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# REVISED PROCEDURES

| CHAPTER/ SECTION | EXPLANATION | OLD PAGES TO BE DELETED | NEW PAGES TO BE ADDED |
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| | The purpose of this printing is to include the following revised policies in the *Highway Design (HD) Guidance Manual*. This revision also includes a table of contents update. | | |
| **HD-200** | Preliminary Design | HD-203 | HD-203 |
| Produced & Distributed by Organizational Management Branch | | | |
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**COMMONWEALTH OF KENTUCKY**
**TRANSPORTATION CABINET**
**FRANKFORT, KY 40622**

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# REVISED PROCEDURES

| CHAPTER/ SECTION | EXPLANATION | OLD PAGES TO BE DELETED | NEW PAGES TO BE ADDED |
|---|---|---|---|
| | The purpose of this printing is to include the following revised policies in the *Highway Design (HD) Guidance Manual*. This revision also includes 2 index and 23 exhibit updates. | | |
| **HD-00** | Table of Contents | HD-01 | HD-01 |
| | Table of Exhibits | HD-02 | HD-02 |
| **HD-100** | Highway Design Philosophy | HD-103 | HD-103 |
| **HD-200** | Pre-Design Activities | HD-202 | HD-202 |
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| | Preparation of Contract Roadway Plans | HD-208 | HD-208 |
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| | Request for Funding Authorization, TC 90-122 | HD-200-03 | HD-200-02 |
| | Project Spend Down | HD-200-04 | HD-200-03 |
| | Design Funds Documentation Summary | HD-200-05 | HD-200-04 |
| | Project Authorization, TC 10-1 | HD-200-06 | HD-200-05 |
| | Preliminary Design Example Flowchart for Projects with a FONSI | HD-200-07 | HD-200-06 |
| | Water Related Impacts Summary | HD-200-08 | HD-200-07 |
| | Design Executive Summary | HD-200-09 | HD-200-08 |
| | Drainage Review Process | HD-200-10 | HD-200-09 |
| | Pre-Design Conference Minutes | HD-200-11 | HD-200-10 |
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| | Common Geometric Practices Rural Collector Roads | HD-700-02 | HD-700-02 |
| | Common Geometric Practices Rural Arterial Roads | HD-700-03 | HD-700-03 |
| | Common Geometric Practices Urban Roadways | HD-700-04 | HD-700-04 |
| | Typical Sections Rural Two-Lane | HD-700-05 | HD-700-05 |
| | Typical Sections Urban Two-Lane | HD-700-06 | HD-700-06 |
| | Typical Sections Rural Four-Lane | HD-700-07 | HD-700-07 |
| | Interstate Shoulder Widths | HD-700-08 | HD-700-08 |
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| | At-Grade Intersections | HD-902 | HD-902 |
| | Grade Separation Without Ramps | HD-903 | HD-903 |
| | Interchanges | HD-904 | HD-904 |
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COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.transportation.ky.gov/

**Matthew G. Bevin**
Governor

**Greg Thomas**
Secretary

## OFFICE OF THE SECRETARY
## OFFICIAL ORDER 110733

**SUBJECT:** *Highway Design 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 highway design by the Department of Highways.

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 27th day of March, 2017.

Greg Thomas
Secretary

Approved as to Legal Form

Office of Legal Services

# HIGHWAY DESIGN
# GUIDANCE MANUAL

**ISSUED BY**

COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET

**MARCH 2017**

Produced by Organizational Management Branch
Office of Human Resource Management

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**200 ADMINISTRATIVE PROCEDURES (cont.)**

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Design of This Guidance Manual

## HD-101.1 ORGANIZATION & NUMBERING

**"HD" Prefix**—Preceding each numbered division, this prefix stands for the manual title *Highway Design Guidance Manual*.

**Chapters**—The content of this manual is divided into chapters. Each chapter is assigned a consecutive number by hundreds (100, 200, 300, etc.). The chapter title appears at the top of each page.

**Subjects**—Chapters are divided into subjects. Each subject is assigned a consecutive number within its chapter range (HD-101, HD-102, HD-103, etc.) The subject number and title appear at the top of each page.

**Sections**—Subjects are divided into sections. Each section is assigned a consecutive number within its subject range (HD-101.1, HD-101.2, etc.) Section numbers appear down the left side of each page. A corresponding title is to the right of each section number.

**Subsections**—Some sections are divided into subsections. Each subsection is assigned a consecutive number within its section range (HD-101.1.1, HD-101.1.2, etc.) Subsection numbers appear down the left side of each page. A corresponding title is to the right of each subsection number.

**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."

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

## HD-101.2 LOCATING INFORMATION

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

## HD-101.2 LOCATING INFORMATION (cont.)

**Table of Contents (HD-01)**—This index at the front lists the numbers and titles of the manual's chapters, subjects, sections, and subsections, 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.

**Table of Exhibits (HD-02)**—This index at the front lists the manual's exhibits, including forms, worksheets, diagrams, etc., by number and title.

**Alphabetical Index (HD-03)**—This index at the back lists key information in alphabetical order and directs the user to subject numbers.

## HD-101.3 CROSS REFERENCES

A boldfaced subject number appearing within the text is a cross reference to additional information.

## HD-101.4 QUESTIONS

For additional copies of this manual, contact:

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

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***Chapter***

INTRODUCTION

***Subject***

## Purpose of This Guidance Manual

The purpose of the *Highway Design Guidance Manual* is to present detailed or descriptive design information for Kentucky road projects. This manual has been prepared to provide guidance to personnel of the Transportation Cabinet and primarily to the road designer. The guidance supplied in this manual is based upon Kentucky common practice and relies on guidance from other resources when appropriate.

This *Highway Design Guidance Manual* places an emphasis on flexibility. The goal is to be permissive by default and explicit where needed. Sufficient flexibility should encourage independent designs tailored to particular situations.  This manual should not supersede the application of sound engineering principles by experienced design professionals.

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*Chapter*

INTRODUCTION

*Subject*

Highway Design Philosophy

## HD-103.1 MISSION STATEMENT

The mission of the Division of Highway Design is “the timely delivery of engineering solutions and construction documents that maximize the use of highway funds and enhance the safety and operations of the highway system, the natural environment, and the human environment.”

## HD-103.2 PHILOSOPHY

The design philosophy presented in this manual is intended to promote flexibility in the design of highways. The design of highways should incorporate community values and safety and be efficient, effective mechanisms for the movement of people and goods. The Project Development Branch Manager’s (PDM’s) challenge is to balance preserving and protecting the environmental and cultural values in communities while also providing a highway facility that is safe and that provides the necessary mobility to ensure economic opportunities and an improved quality of life.

Design is a key ingredient in the project delivery process, and it is important to realize that the different functional components must work together to deliver projects. Environmental analysis, right-of-way acquisition, utility relocation, etc. are also key components of project delivery, and each component must be considered in the project decision. The National Environmental Policy Act of 1969 (NEPA) is the backdrop for the Cabinet’s transportation decision-making process. The NEPA process requires decision-makers to use a systematic and interdisciplinary approach. They should consider the environment, along with economic and technical considerations. In short, they should consider the three E’s—Engineering, Environment, and Economics—in all decisions. Highway designers should work with the different functional units to determine the best transportation decision.

There is discussion throughout this manual about the roles of project development teams (PDTs), PDMs, and the Central Office. The Central Office Division of Highway Design is in place to participate and provide support for the PDMs in the transportation decision-making process. The division will ensure that processes and procedures are followed appropriately.

## HD-103.2 PHILOSOPHY (cont.)

The Code of Federal Regulations (CFR) Title 23, “Highways,” Chapter 1, “Federal Highway Administration, Department of Transportation,” should be consulted for all federal-aid projects.

Designers should be flexible in decision-making concerning the design decisions made about each project. The context of the project and the identified performance issues need to be considered. The PDM has the responsibility of weighing all the particulars of a given project and making design decisions accordingly. Design decisions should consider safety, mobility, and preserving scenic, aesthetic, historic, environmental, and community values. Applicable performance measures should be applied. Design criteria shown in AASHTO’s “A Policy on Geometric Design of Highways and Streets” (Green Book) are intended as a guide allowing flexibility to encourage independent designs and engineering judgement. Noncompliance with geometric design criteria is not, by itself, a performance issue for a project on an existing road. If some aspects of the existing roadway geometry are out of the design criteria ranges shown in the Green Book and the road is performing satisfactorily, there is no need for a new project to modify those aspects of the existing roadway. KYTC’s limited fiscal resources should target known roadway performance deficiencies.

During the early project development or conceptual design process, key decision points are made that will help determine the outcome of a project. These key decision points are in line with the NEPA decision-making process. The product of the conceptual design phase is a transportation decision with an approved environmental document based on an alternate and not just the preliminary line and grade plans. There is only one product: the transportation decision documented in the environmental document and reflected in the engineering plans.

## HD-103.3 KEY DECISION POINTS

The following steps are key to the development of the project to ensure a shared transportation decision-making process:

- Purpose and Need
- Range of Alternatives
- Scope of Impacts
- Selected Alternative

**HD-203**, “Preliminary Design,” provides a detailed example of each step.

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HIGHWAY Design

*Chapter*

INTRODUCTION

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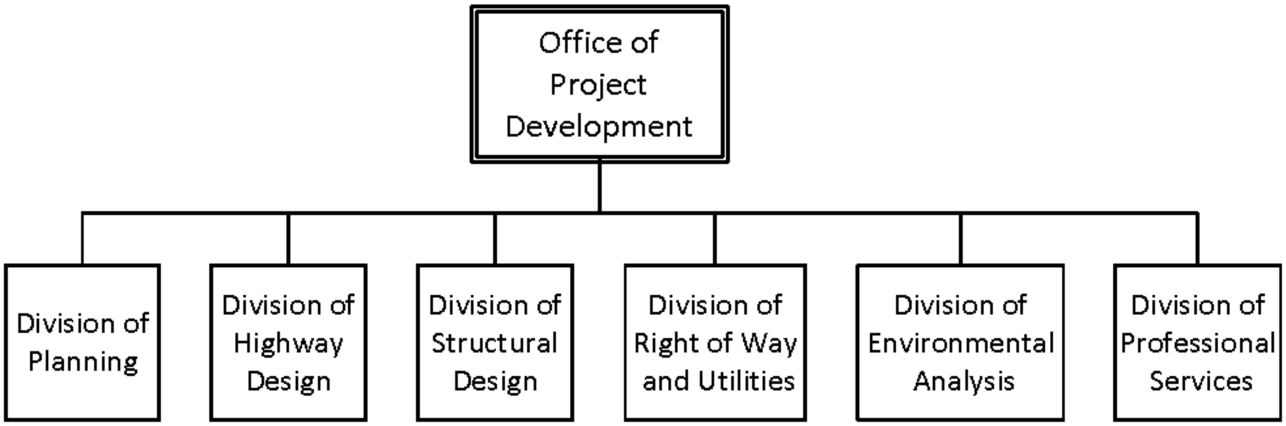
Organization

## HD-104.1 ORGANIZATIONAL CHARTS

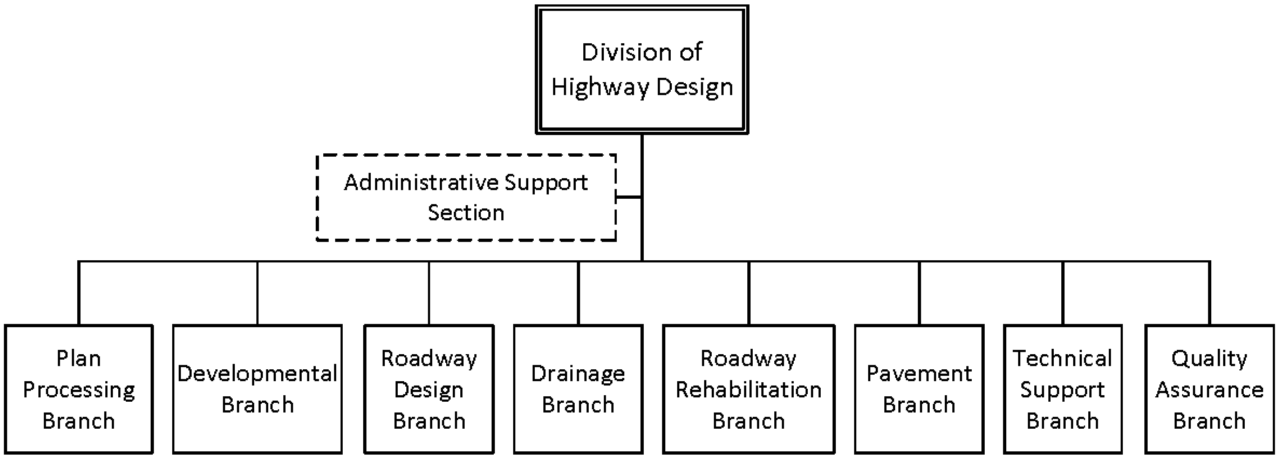
### KYTC Division Offices
### Central Office



The Division of Highway Design is one of the divisions under the responsibility of the Executive Director for the Office of Project Development. The Division of Highway Design, in conjunction with the district design offices, is responsible for the roadway design activities for the Cabinet's Highway Plan projects. This responsibility includes conducting the studies, computations, and analyses necessary to support the preparation, assembly, and production of the construction plans for a project's award.

## HD-104.1 ORGANIZATIONAL CHARTS (cont.)

### Division of Highway Design
### Central Office



## HD-104.2 CENTRAL OFFICE

The primary functions of the Division of Highway Design in the Central Office are:

- Assemble the contract plan set and deliver the plan set to the letting process
- Develop criteria, procedures, and policies for highway/roadway design and ensure consistency in their application
- Offer technical expertise and assistance
- Provide or facilitate training

The director's office includes the director and an assistant director, as well as the Administrative Support Section, which provides administrative support to the whole division. The Director of the Division of Highway Design is accountable for all procedures and quality assurance for all roadway design items.

The division comprises eight branches:

- Plan Processing Branch
- Developmental Branch
- Roadway Design Branch
- Drainage Branch
- Roadway Rehabilitation Branch
- Pavement Branch
- Technical Support Branch
- Quality Assurance Branch

## HD-104.2.1 Plan Processing Branch

This branch is responsible for delivering the contract plan set to the letting. The branch works with the Project Development Branch Manager (PDM) and contributing divisions for final assembly and review of the complete project plan set at the time of letting. The branch ensures that the contract plans are complete and suitable for letting and that all notes and standard drawings are current. The branch also works with the Division of Construction Procurement to ensure clarity and uniformity in the letting process.

## HD-104.2.2 Developmental Branch

This branch is responsible for the Statewide Highway Design Services Contract and the following three functions:

1. The **CADD (Computer-Aided Drafting and Design)** function is responsible for:

    - Highway Plan project design and management
    - Studies, reports, and displays requested by executive leadership
    - Technical support and software beta testing
    - CADD Standards

    CADD engineers and technicians provide design services and project management for the district offices and the State Highway Engineer’s office, on an as-needed basis and for aspects of the highway design process. They also provide technical assistance for the highway design software, in conjunction with the Technical Support Branch, and test new software prior to implementation. This includes managing the highway design preferences for the Cabinet’s CADD Standards.

2. **Standard Drawings** function is responsible for:

    - Standard Drawings and subsequent Sepia Drawings
    - Research for new products
    - Inspection of existing product performance
    - As-needed special detail drawings and specifications

    The Standard Drawings function maintains and updates the Standard Drawings on a four-year cycle and provides revisions in the interim through Sepia Drawings. The Standard Drawings function also works closely with other divisions and product manufacturers to evaluate existing products and materials and provide new drawings and specifications if needed.

3. **Survey Support** works closely with district survey crews and construction inspectors to provide appropriate equipment and training. Survey support also provides technical expertise for all aspects of survey services and manages professional service contracts to supplement in-house survey functions.

### HD-104.2.2 Developmental Branch (cont.)

These include:

- Technical support for software and equipment
- Management of Statewide Aerial & Photogrammetric Services Contract
- Management of Statewide Surveying Services Contract, including Subsurface Utility Engineering (SUE) Services
- Management of Survey Preferences for CADD Standards
- Maintenance/Management of KY Continuously Operating Reference Station (KY-CORS) Network

### HD-104.2.3 Roadway Design Branch

This branch is responsible for oversight of projects in the project development phase and working with the project development branch manager (PDM) to develop an appropriate design. The branch has the following responsibilities:

- Technical support and reviews
- Budget, scope, and schedule oversight
- Liaison (Central Office to/from districts) for project teams through all stages of design

Location engineers work on behalf of project managers to coordinate with outside agencies, such as the Federal Highway Administration (FHWA) and other state agencies, to facilitate design activities. Location engineers should participate in project meetings from the preliminary engineering phases through the final plan development phases.

### HD-104.2.4 Drainage Branch

This branch works with project managers and consultants to provide practical, cost-effective drainage solutions, and also reviews and approves drainage folders. A project drainage folder is a legal document that contains the hydrologic and hydraulic analysis, as well as other drainage-related rationale, which contributes to the design of each project. The branch is responsible for:

- Review of drainage design on roadway projects and encroachment permits
- Technical expertise and training to Cabinet and consultant technical staff
- Design recommendations for special drainage situations
- Assistance to the Office of Legal Services with drainage-related claims

### HD-104.2.5 Roadway Rehabilitation Branch

This branch is responsible for:

- Management and coordination of programs for the structural rehabilitation of pavements
- Management of a statewide contract for design of pavement rehabilitation projects
- Development of in-house pavement rehabilitation projects on interstates, parkways, and other National Highway System routes
- Design for the Interstate Widening Program
- Review of consultant prequalification submittals for purposes of prequalifying firms for engineering-related services in the areas of rural roadway design, urban roadway design, and surveying
- Management of the statewide contract for roadway sign design, which provides for the design of signing plans for interstates, parkways, and other high-volume roads where panel signs are needed

### HD-104.2.6 Pavement Branch

This branch:

- Prepares, oversees, and/or reviews the preparation of pavement designs on all highway projects
- Develops criteria and procedures used for design of pavements, including structural design, life-cycle cost analyses, and analyses for pavement type selection
- Provides technical assistance with pavement design issues in other areas such as construction, maintenance, and planning
- Works with other agencies in the development and refinement of structural design criteria and procedures for pavement designs

### HD-104.2.7 Technical Support Branch

This branch:

- Supports and provides training of the highway design software and correlated hardware for the Central Office and district offices
- Works closely with the Developmental Branch to evaluate engineering-based highway design software and hardware into the project design and development process
- Submits requests to Office of Information Technology (OIT) for software, hardware, and computer services
- Maintains document management system for projects
- Maintains historic files of completed projects

### HD-104.2.8 Quality Assurance Branch

This branch:

- Conducts and participates in constructability reviews of projects prior to letting
- Administers value engineering (VE) studies on special projects, projects over $50 million, and bridge projects over $40 million on the National Highway System
- Facilitates post construction reviews to “learn” from project experiences and to document and publish the results
- Maintains Lessons Learned geodatabase

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***Chapter***

ADMINISTRATIVE PROCEDURES

***Subject***

Introduction

## HD-201.1 OVERVIEW

This chapter provides guidance of administrative procedures related to design involvement throughout the project development process (PDP). Topics range from project inception to design participation in construction and project closeout. Duties include Central Office and district responsibilities, as well as procedures for consultant involvement. This chapter is organized chronologically for a typical project, but the design team should be familiar with its entirety to ensure no administrative duties are overlooked as the project progresses.

The “Project Delivery Core Processes” are discussed in the following chapters and are summarized in **Exhibit 200-01**.

## HD-201.2 RESOURCES

To ensure compliance with state and federal regulations and to ensure consistency, projects should be developed in a manner that uses the methods and controls adopted in manuals and policy statements as referenced herein.

The Code of Federal Regulations (CFR) Title 23, *Highways*; Chapter 1, *Federal Highway Administration, Department of Transportation*, should be consulted for all federal-aid projects.

The Division of Highway Design website references current design resources at:

http://transportation.ky.gov/Highway-Design/Pages/default.aspx

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***Chapter***

ADMINISTRATIVE PROCEDURES

***Subject***

Pre-Design Activities

## HD-202.1 PROJECT ORGANIZATION

Projects may be proposed by various entities including area development districts (ADDs), metropolitan planning organizations (MPOs), highway district offices, and local officials to address safety, operational, or other transportation system needs. When potential capital projects are identified, the district planning engineer, ADD or MP planner enters the proposed project into the Continuous Highway Analysis Framework (CHAF). The CHAF is used to:

- Collect, track and analyze transportation needs Provide characteristics of the existing conditions
- Identify an initial project description
- Provide a planning level estimate of environmental, design, right-of-way, utility, and construction costs for use in future project scoping and prioritization

Once the CHAF entry is completed, the project can be sponsored for consideration in the Strategic Highway Investment Formula for Tomorrow (SHIFT) maintained by the Division of Planning. SHIFT is a data-driven, objective approach to compare capital improvement projects and prioritize transportation spending. Each project is reviewed and scored on a scale of 0 to 100 with a formula that uses objective measures for five key attributes-safety, congestion, asset management, economic growth and benefit/cost. Projects of statewide significance-interstates, parkways and other major connecting routes – are scored first. The remaining projects, known as regional projects, are scored using a similar formula. More information about SHIFT can be found at https://transportation.ky.gov/SHIFT/Pages/default.aspx.

KYTC combines the statewide and regional priorities to help develop the Governor's Recommended State Highway Plan, which is presented to the General Assembly, in even numbered years. During the legislative session, lawmakers fine-tune the plan based on additional information and funding availability. The result is the Enacted State Highway Plan, which includes two years of funded projects in the biennium and spending priorities for the following four years.

## HD-202.1 PROJECT ORGANIZATION (cont.)

In addition to capital projects, there are also other programs of projects. Some of these include pavement rehabilitation and resurfacing, MPO projects with dedicated funding, projects identified through the Highway Safety Improvement Program (HSIP), and bridge rehabilitation or replacements

The approved Highway Plan is the culmination of decisions and legislation resulting in a schedule of proposed projects for planning, roadway design, right-of-way, utility, and construction phases within the years specified in the particular plan. Legislative action adopts the Highway Plan and provides the framework for project advancement for the biennium. After a project is identified and adopted in the Highway Plan, funding may be authorized for activities in the current biennium.

## HD-202.2 ASSIGNMENT OF PROJECT

Once the Highway Plan is approved, projects with an identified design phase, which includes the schedule, budget, and scope as defined in the highway plan, become the responsibility of the Project Development Branch Manager (PDM). The PDM should be involved in the project's pre-design activities, be responsible for the preliminary and final design phases, and also serve as an advisor during construction. In some cases, a special project manager may be assigned.

The PDM may choose to delegate project activities, including project management, based on available resources and workload within a district. This delegation should occur as early as possible, such as before requesting funding, and be entered into the Preconstruction Database. This allows designated individuals to be involved during the planning phase to ensure continuity and consistency through the preliminary and final design phase. These assignments should be reported to the location engineer early in the process.

## HD-202.3 PROJECT DATA

The PDM needs to obtain as much existing data as possible before beginning a project. It is important that the PDM review the Highway Plan so that project needs can be identified and scheduled in anticipation of the beginning of the design phase. **HD-202.3.1** through **HD-202.3.11** provides details of the data typically required in anticipation of the design phase. It should be obtained as soon as possible. The PDM should not wait on design authorization to begin this process.

A key source of data on existing facilities is KYTC's Highway Information System (HIS) located at:

http://datamart.business.transportation.ky.gov/edsb_solutions/hisextracts/

### HD-202.3.1 Planning Study Results

The PDM should request any information from the Division of Planning when previous studies may have been performed. Much of the data outlined in **HD-202.3.2** through **HD-202.3.11** may be found in the planning study. Previous studies should also include initial cost estimates, or similar documentation.

The Division of Planning website includes recently completed studies at:

http://transportation.ky.gov/Planning/Pages/Planning-Studies-and-Reports.aspx

### HD-202.3.2 Record Plans/Management System Reports/Other Information

The PDM should obtain copies of the record plans in the area of the new project. KYTC maintains record plans of previous highway projects on the Project Archives GIS website at:

http://maps.kytc.ky.gov/photolog/?config=ProjectArchives

Typically, plan sets are also maintained in the district office and in Central Office.

### HD-202.3.3 Traffic Data

The Division of Planning website includes historical traffic count data online at:

http://transportation.ky.gov/Planning/Pages/count-maps.aspx

### HD-202.3.4 Crash Data

Crash data is another key component in determining appropriate design solutions and/or safety improvement opportunities for a project. On all projects, crash history should be analyzed. It is recommended that a minimum of three years of crash data be reviewed but five years of crash data would be the optimum analysis period. A crash analysis by location, crash type, severity, contributing circumstances, environmental conditions and time period may help to identify project needs.

With the implementation of DDSA (Data Driven Safety Analysis) methodologies, designers will be able to analyze the existing crash data to determine if a project site has a high potential for crash reduction and will also be able to quantify the predicted safety benefits of specific safety countermeasures for any project. Roadway features and locations with a high potential for crash reduction should be identified to determine the appropriate safety enhancement. For more details, see KYTC's DDSA Implementation Plan.

### HD-202.3.4 Crash Data (cont.)

Sources of crash data include Kentucky's Open Portal Solutions (KyOPS) database, the Kentucky Collision Analysis for the Public website, Highway Information and View Extract Secure Interface (HIVEi), and the Crash Data Analysis Tool (CDAT). For more information on the sources of crash data and the levels of accessibility, see the DDSA Website:

https://business.kytc.ky.gov/work/DDSA/Pages/default.aspx

### HD-202.3.5 Project Mapping

Mapping can include aerial survey data, traditional ground-collected data, aerial and LIDAR, and data collected using other techniques. Existing mapping, such as terrain, topographic, hydrologic, etc., may be available. The latest published mapping can be found at http://kyfromabove.ky.gov/ and may be used for planning, preliminary engineering and supplemental mapping. Floodplain maps should be reviewed for local conditions. FEMA provides these maps online at:

https://msc.fema.gov/portal

### HD-202.3.6 Right of Way

The existing right-of-way limits should be obtained using the Project Archives GIS website, Property Valuation Administrator's (PVA) office, County Clerk's office, and district highway offices, as well as other sources.

### HD-202.3.7 Preliminary Budget

The Highway Plan establishes the preliminary budget, which should be based on the initial project scope and available funding. Requests for any needed additional funds should be made through the Division of Program Management as early as possible.

### HD-202.3.8 Existing Geotechnical Information

Results from completed KYTC geotechnical investigations are available through the Geotechnical Branch's online database. Additional geotechnical mapping and information may also be obtained from the Geotechnical Branch in the Division of Structural Design. The Geotechnical Branch's online database is located at:

http://kgs.uky.edu/kgsmap/kytcLinks.asp

### HD-202.3.9 Utilities

Utility information is critical to project development and should be obtained from the Kentucky Water Resource Information System (WRIS) and other GIS websites (http://kia.ky.gov/wris/), for potable water and sanitary sewer, GOOGLE EARTH Streetview (or similar), and BUD One Call, as well as direct contact with local utility providers.

### HD-202.3.9 Utilities (cont.)

Coordination with the district utility agent is essential to obtaining the appropriate data as early as possible in the process. The location of utilities within the project limits is the responsibility of the project manager. The appropriate level of accuracy for the utility location shall be commensurate with the potential for conflict and the stage of development of the project.

### HD-202.3.10 Agency Coordination

Any agency coordination that has previously occurred should be collected and reviewed. This information should be available from the district planning engineer.

### HD-202.3.11 Modal Considerations

Studies and other information concerning other transportation modes should be obtained and considered throughout the design process. Examples are:

- Transit bus stops
- Local master plans
- Connections to nearby destinations
- Inter-state modal routes (such as bicycle routes)

## HD-202.4 RESOURCE DETERMINATION

The PDM is responsible for progressing projects in the Highway Plan through the project development process. When initiating a project, the PDM reviews the workload and required expertise of the district design staff and determines how to best execute the project. The fiscal year that the construction phase is programmed in the Enacted Highway Plan is another key determinant in deciding how to perform the work. Issues that may influence these decisions include:

- Project schedule
- Milestones
- Project complexity
- Environmental Impact mitigation
- As funding is established for a project and shown in the Enacted Highway Plan, the fiscal year shown for right of way and construction phases will be key to deciding how to perform the work.
- Utility relocation

Fast-track or high-priority projects assigned to the districts may also influence the schedules of projects already in progress.

If resources are not available in the district, the design may be assigned to other internal resources, or consultant services may be utilized by statewide consultant contracts or by procuring other consultant services. HD-205 discusses consultant administration.

## HD-202.4 RESOURCE DETERMINATION (cont.)

**Project Teams**—Based on the resource determination and identified project needs, the PDM should assemble an appropriate project team. This team should utilize subject matter experts (SMEs) as required.

**Central Office Support**—The highway design location engineer provides technical support and serves as a liaison between the district design team, the Division of Highway Design, other Central Office divisions, and the Federal Highway Administration (FHWA). The location engineer also helps provide budget, scope, and schedule oversight to the project team.

## HD-202.5 PROJECT AUTHORIZATIONS

The PDM should file a request for funding authorization with the location engineer using the TC 90-122 form, *Request for Funding Authorization* (**Exhibit 200-02**), and *Project Spend-Down* (**Exhibit 200-03**). A *Design Funds Documentation Summary* (**Exhibit 200-04**) should be used to develop an estimate of needed funds.

The Division of Program Management prepares the TC 10-1 form, *Project Authorization* (**Exhibit 200-05**), and, when funds are authorized, distributes the form (and approved PR-1 for federal-aid projects) to the location engineer and PDM. Typically, authorizations are made for each phase of the project development process: Planning, Design, Right-of-Way, Utility, and Construction.

During the design process, there may be changes that require additional funding requests. These requests should be dealt with in the same manner as detailed above. It may be advantageous to initially request enough funds to complete the early project development. Once the transportation decision is made, the PDM would request additional funding for final design.

## HD-202.6 PRE-DESIGN COORDINATION

After project authorization, the PDM should coordinate with other project team members to review the issues faced by the project. The primary focus of this coordination is to address the following:

- Performance Measures
- Purpose and Need
- Project Scope
- Schedule and Milestones
- Additional Resources
- Additional Mapping

## HD-202.6 PRE-DESIGN COORDINATION (cont.)

- Environmental Overview
- Traffic Forecasting
- Public Involvement

**HD-202.6.1** through **HD-202.6.9** details these discussion points.

### HD-202.6.1 Performance Measures

Aspects of performance that may be considered in geometric design include any of the issues that affect the project development process such as:

- Existing and Expected Crash Frequency and Severity
- Capacity and Traffic Operation Efficiency
- Mobility/Connectivity/Accessibility
- Existing and Potential Development
- Asset Management (Pavement and Structures)
- Cost
- Impacts to the Environment
- Community Impacts
- Freight

When determining the performance measures that could be analyzed with the development of any given project, the project team will focus on addressing the identified needs for the project. The project team will also want to consider any other known performance issues within the project limits that could be identified within the purpose and need of the project. Some projects may not address every aspect of poor performance. Consideration should be given to the availability of funding and the overall effect the improvement will have on the project when deciding which performance measure will be addressed.

Non-compliance of geometric design criteria is not, in itself, a performance issue for the existing roadway. Non-compliant geometric design criteria only becomes an issue that needs to be addressed in the purpose and need if the assessment of past performance of the existing roadway indicates poor performance of the existing roadway and the poor performance could be addressed with a specific geometric design improvement.

### HD-202.6.2 Purpose and Need

A purpose and need statement is necessary for developing all projects. It is a requirement on projects that will include NEPA documentation, an environmental impact statement, or environmental assessment/FONSI. A clear, well-justified purpose and need discussion explains to the public and decision-makers that expenditure of funds is necessary and worthwhile.

**HD-202.6.2 Purpose and Need (cont.)**

The purpose and need statement should be built around an assessment of past performance and a forecast of future performance (as if no improvements are made to the existing roadway) and should clearly establish any limitations on the scope of the project. It should indicate what aspects of performance should be improved. In some cases, targets can be set. Both quantitative and qualitative performance measures may be used in defining the purpose and need for projects. The purpose and need statement shall be continuously evaluated during the development process and modified as needed based on information gained through the project development and public involvement process. FHWA provides guidance for the development of a purpose and need statement in their Environmental Review Toolkit available online at:

http://www.environment.fhwa.dot.gov/projdev/tdmelements.asp

### HD-202.6.3 Project Scope

Properly scoping a project is essential to its successful development. All projects regardless of size, location, complexity, or funding require scoping in order to discuss the needs and challenges associated with the project, develop the tasks and schedule for preliminary engineering, assess the level of environmental studies required to obtain clearances, and to estimate preliminary costs for comparison to programmed costs. The project should be clearly defined and should address the following:

- Type of project (New Route, Reconstruction, Construction of Existing Roads)
- Project description and limits (project location, study area including context, magnitude and length, classification, current AADT, etc.)
- Performance Based Flexible Design (aspects of roadway performance identified and need of improvement/s determined
- Draft purpose and need statement including clear description of objectives
- Roadway characteristics
- Potential options to consider (without preference to meet purpose and need and to fit context)
- Design criteria
- Proposed access control
- Current project estimate, programmed budget and possible funding types
- Potential environmental impacts and constraints
- Right-of-way requirements
- Utility impacts
- Constructability and MOT
- Number and types of structures anticipated

### HD-202.6.3 Project Scope (cont.)

For quantitative performance measures, it is imperative in determining a project’s scope to gather existing data (safety, traffic, etc.) to assess current performance and identify issues affecting the project. Future performance with improvements and without improvements should be forecasted to compare the impacts of the proposed improvements. For analyzing safety and capacity performance, please refer to methodologies in the Highway Safety Manual and the Highway Capacity Manual. Ultimately, the project manager should rely on the data and the resources available, and the engineering judgement of the project team and subject matter experts. Some projects may benefit from taking the time to scope different project types, i.e., reconstruction and spot improvements. This would allow the project team to compare the effectiveness of each project type and determine the appropriate value to address the identified needs.

### HD-202.6.4 Schedule and Milestones

The schedule and milestones should be established based on funding availability, complexity, and goals of the project. Milestones should be established for:

- Alternative Concepts
- Preliminary Line and Grade
- Final Inspection
- Right-of-Way Plans
- Final Plans

### HD-202.6.5 Additional Resources

During the initial phrase of each project, it is important to determine additional resources needed to complete the project.

### HD-202.6.6 Additional Mapping

If additional mapping is required, requests for project mapping should be submitted to the survey coordinator, Division of Highway Design. The PDM and survey coordinator should evaluate the information and area. Selection of the type and extent of coverage should be determined. Care should be taken to ensure sufficient coverage to avoid the need for subsequent mapping. Aerial survey~~s~~ requests are typically made prior to the "window of opportunity", during the months of December through March. The season, angle of the sun, vegetation, and other factors are critical to the scheduling of aerial mapping and should be considered when requesting this service.

Typically, the division survey coordinator requires information defining the project area, as well as the desired scale for the mapping. The survey coordinator should be contacted whenever questions arise. **HD-300** provides further details on surveying.

## HD-202.6.7 Environmental Overview

As soon as possible following project authorization, the PDM and environmental coordinator should examine the potential project area for environmental impacts. On federal projects with an anticipated CE Level 3 or above a scope verification meeting should be held with the project manager, FHWA, and other team members prior to the pre-design conference to discuss the scope and potential environmental impacts. These include but are not limited to:

- Air quality
- Aesthetics
- Cemeteries
- Cultural resources
- Endangered species
- Federal lands
- Floodplains
- Groundwater resources
- Hazardous materials and underground storage tanks (HazMat/UST)
- Noise
- Section 4(f) resources (cultural resources, recreational parks, wildlife refuges, etc.)
- Section 6(f) resources
- Socioeconomic concerns and environmental justice
- Streams
- Wetlands

If environmental concerns are detected or perceived, a request for investigation should be submitted to the Director of the Division of Environmental Analysis. The Division of Environmental Analysis will provide the results of its investigation and any recommendations for consideration. The project team is then responsible for evaluating this information and incorporating the recommendations into the project.

**HD-400** and **HD-500** provide additional information concerning environmental and permit concerns. Additional information may also be found in the KYTC *Environmental Analysis Guidance Manual*.

## HD-202.6.8 Traffic Forecasting

Traffic data is needed on projects to determine the number of lanes, the necessity for turn lanes, and the lengths of required turn lanes. Traffic data is also a major contributor to the purpose and need statement for the project. If after reviewing the existing traffic information the PDM deems additional traffic information is needed, a request should be sent to the Division of Planning.

### HD-202.6.9 Public Involvement

Public involvement is an essential component in the development of a project. The viewpoints and opinions of the public are important considerations in the transportation decision-making process.

The PDM and the district public information officer (PIO) should discuss how public involvement will be conducted on the project as early in the project development phase as possible. **HD-600** contains additional information concerning public involvement.

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*Chapter*

ADMINISTRATIVE PROCEDURES

*Subject*

Preliminary Design

## HD-203.1 OVERVIEW

Once a project is in the Highway Plan, the Project Development Branch Manager (PDM) is responsible for the movement of the project through the design process. The first step in the process is preliminary design. The critical product of preliminary design is the transportation decision **and rationale** documented in the environmental document and reflected in the preliminary line and grade plans. Design is only one component of the preliminary design phase; therefore, the PDM must work together with other disciplines (such as environmental analysis) to complete this phase.

## HD-203.2 KEY DECISION POINTS

There are key points during the development of all projects when decisions must be made by the PDM and the project development team (PDT). These decision points are required by NEPA, but are also critical in delivering any project. These key decision points are identified and discussed below.

- **Purpose and Need:** Purpose and need provides the foundation for successful decision-making and the basis for the evaluation and comparison of reasonable alternatives. For projects with completed planning studies, the PDT should use this as a starting point for further developing the purpose and need statement. For each project, the purpose and need will be utilized to establish the scope of the required work, including the study area and expected project deliverables. The outcome of this decision point is a draft purpose and need statement.

- **Range of Alternatives:** At the next point in the process, the PDT should develop a range of alternatives for consideration within the study area that meet the purpose and need of the project. Alternatives and corridors previously evaluated should be the beginning point. Alternatives and corridors eliminated during the development studies should not require further investigation if each alternative was developed adequately with sufficient documentation and rationale for its elimination.

## HD-203.2 KEY DECISION POINTS (cont.)

Key environmental features within the corridor should be identified and mapped before alignment studies begin. Alternatives may be eliminated from further consideration with adequate supporting documentation. While a preferred alternative may stand out, the PDT should resist making a recommendation until they understand relevant impacts and issues. Following the review of the alternatives, the subject matter experts (SMEs) would then proceed with an evaluation of alternatives left for consideration.

The SMEs will need to consider a corridor approach, as opposed to a given alignment, so that adjustments can be made to avoid or minimize impacts. They also need to remain involved in the decision-making process to ensure impacts are considered and offer suggestions on how to minimize or mitigate when necessary. Evaluation of the range of alternatives should also include preliminary information about total project costs. The PDT consists of members from the various functional areas of the Department of Highways. The input of these members should be solicited throughout the project development process. The output from the range of alternatives phase should consist of the list of possible, practical, and feasible alternatives that fulfill the purpose and need. This is the list of alternatives that should be further developed and evaluated.

The scope of impacts for each of these alternatives is critical in the progression of alternative analysis and shared transportation decision-making process. The SMEs should present to the PDT the results of their investigations, including the baseline studies and the corresponding impacts of each of the alternatives on the study area.

They should also offer suggestions on the risk associated with moving forward with each alternative and the time frame involved in resolving identified impact issues (such as 4(f) involvement that could take an additional 12 months to resolve, stream mitigation that would cost $450,000, or impact on endangered species habitat). Right-of-way and utility SMEs should also present their findings so that the PDT can fully consider the possible impacts that property acquisition and utility location, both public and private, might have on the transportation decision.

If the SMEs uncover subsequent information that could have a significant impact to the budget or schedule of the project, the SMEs and PDM should inform the PDT so that the new information can be given due consideration.

## HD-203.2 KEY DECISION POINTS (cont.)

When determining the impacts, the PDT must work through the decision-making process, including avoidance, minimization, mitigation, and possibly even enhancement efforts necessary to address the impact. The PDM and PDT shall always consider environment, economics, and engineering. The PDT could also may make decisions or determine that additional information is required to further investigate alternatives. Based on findings that detail the impacts and issues involved with each alternative, the PDT should discuss and possibly determine a preferred alternative.

All decisions are documented and included in the draft environmental document. The output from the scope-of-impacts phase may include the following:

- Draft environmental assessment or categorical exclusion
- Preliminary alternative plans
- Right-of-way and utility impacts with associated costs
- Possible mitigation measures
- Corresponding project costs and schedule impacts

When public and resource agency involvement is determined to have been sufficient, the PDT may identify a preferred alternate in the environmental document prior to conducting the public hearing.

- **Selected Alternative:** The PDT will select a preferred alternative based on environmental, economic, engineering issues, alternative performance, and engineering issues and public input. This is the final key decision point of shared transportation decision-making in the conceptual stage of the project. The final environmental document would then be prepared, reviewed, and approved. The output would be the final approved environmental document and the selected alternate to proceed into final design.

The purpose of these key decision points is to ensure that the environmental and design processes are integrated.

The PDT has the flexibility to combine these key decision points on a project-by-project basis. Smaller projects may offer the opportunity to combine the range of alternatives and scope of impacts. It is important that all PDT members and SMEs are aware of the intent to combine the decision points and are prepared to concurrently address the issues associated with each decision point. However, some projects may require further discussion of avoidance, minimization, and mitigation and require opportunities for the PDT to convene and discuss these topics. Each of these decision points should be discussed and considered before a final decision is made.

## HD-203.2 KEY DECISION POINTS (cont.)

These key decision points must be a model for all projects and therefore should be included in the consultant contracts as scheduled milestones.

The PDT with the appropriate input from SMEs must determine the time required for completing their respective responsibilities and set the schedule appropriately. As stated before, the transportation decision-making process requires the different functional divisions within the Cabinet to work together. The Division of Highway Design is an integral part of this process and must work with other divisions to ensure projects are delivered.

The key decision points include establishing purpose and need, identifying the range of alternates their impacts, evaluating the performance of the alternatives, and selecting a preferred alternative.

The process can change significantly from project to project. More public meetings may be necessary due to controversy on a particular project or the need to deal with a number of different alternatives. **HD-600** further details public involvement and discusses the possibility of having advisory committees, focus groups, etc.

In addition, the environmental impacts of the project may vary significantly, altering the project requirements. **HD-400** provides more details on types of environmental actions. Categorical exclusions (CE) projects are those projects or project actions that do not individually or cumulatively have a significant effect on the human environment. For these projects a number of meetings may be combined to expedite the process. A public hearing may not be required.

On other larger or controversial projects, an environmental impact statement (EIS) may be required. A process similar to the following example may be used; however, regulatory agencies require more input from interested agencies, and more documentation is required.

The following example provides a general overview of the steps that may occur during the preliminary design process. The example shown is for a typical capacity improvement project that requires a Finding of No Significant Impact (FONSI). For a flow chart of this example, see **Exhibit 200-06**.

1. Purpose and Need—The first key decision point involves defining the purpose and need which usually occurs in the planning phase. The purpose and need of the project is revisited during the pre-design coordination. At this meeting the PDT discusses the purpose and need for the project, determines the resources needed to complete the project, and begins developing a public information plan.

## HD-203.2 KEY DECISION POINTS (cont.)

2. Public Meeting #1—Sometimes it is necessary to have a public meeting very early in the process to address the purpose and need statement. This public meeting would typically be informal and act as a public kickoff for the project. The purpose of this meeting is to gather information, determine community support of the project, and understand community issues and desires.

3. Review of Alternatives—This meeting is held after substantial investigation and analysis by the design team to identify a **reasonable** range of **competitive** alternatives that meet the purpose and need of the project. The range of alternatives must include at least one option that meets the scope, budget, and timeline of the Highway Plan. Alternatives and corridors previously evaluated during the planning process should be the beginning point. An environmental overview should also be available before alignment studies commence.

   To meet the purpose and need of the project and to provide a reasonable and competitive alternative, concepts should be developed with attention to engineering and fiscal constraints. In addition, designers should ensure that alternatives meet the operational, safety, and other performance goals established by the purpose and need statement.

   The objective of the meeting is to refine the alternatives and provide a list of possible, practical, and feasible alternatives that fulfill the purpose and need. The study area and preliminary project costs for each alternative should also be defined. While a preferred alternative may stand-out, the PDT should resist making a recommendation until all alternatives are adequately explored and the impacts and issues surrounding each are understood.

   Following the review of the alternatives, the subject matter experts (SMEs) would then proceed with an evaluation of those alternatives left for consideration.

4. Scope of Impacts—After the SMEs have studied the range of alternatives, the PDT should come together to discuss the scope of impacts. The SMEs should present to the PDT the results of their investigations, including the baseline studies and the corresponding impacts of each of the alternatives on the study area. They should also offer suggestions on the risk associated with moving forward with each alternative and the time frame involved in resolving identified impact issues. Right-of-way and utility agents should also present their findings during this meeting so that the PDT may fully consider the possible impacts that property acquisition and utility location might have on the transportation decision.

## HD-203.2 KEY DECISION POINTS (cont.)

When determining the impacts, the PDT must work through the decision-making process, which includes avoidance, minimization, mitigation, and enhancement of the impact for each alternative. The decisions that are made will be documented. The output from the scope-of-impacts phase may include the draft environmental assessment or categorical exclusion, preliminary alternative plans, right-of-way and utility impacts with associated costs, possible mitigation measures, and corresponding project costs and schedule impacts. If public and resource agency involvement is determined to have been sufficient to do so, the PDT may identify a preferred alternative in the environmental document before the public hearing.

5. Public Meeting #2—Once the PDT has a reasonable number of feasible and competitive alternatives and understands the potential impacts and predicted performance of the alternatives, it may be appropriate to hold another public meeting to present the potential alternatives and gather public opinion. This meeting may be held before or after a preferred alternative is identified.

6. Preliminary Line and Grade Meeting—After the public meeting data have been accumulated, the PDT comes together to discuss the public input and the scope of impacts. The PDT uses the available data, analysis, and professional judgment to narrow down the alternatives to a preferred alternative. The primary goal of this meeting is to determine a preferred alternative and document the rationale used in reaching this decision.

7. Finalize Environmental Assessment—The environmental assessment (EA) is the document that accumulates all the information gathered for the project. This will include the base studies that are completed. The EA also documents the different alternatives considered. The EA should describe the proposed action in sufficient detail; the purpose and need for the proposed action; all alternatives; and the environmental, social, and economic impacts, along with the secondary and cumulative effects of the proposed action for each of the alternatives. Proposed mitigation measures should be documented in the EA. It should also have a list of the persons and agencies consulted during the early coordination process. Once the draft EA is completed and approved by FHWA, the opportunity for a public hearing may be advertised.

8. Public Hearing—The public hearing is the only public meeting that is required. **HD-600**, “Public Involvement,” details how to conduct a public hearing**.**

## HD-203.2 KEY DECISION POINTS (cont.)

9. Alternative Confirmed—Following the approval of the environmental assessment and the public hearing, the PDT should meet to select a preferred alternative based on environmental, economic, engineering issues, performance and public input. The final environmental document should then be prepared, reviewed, and approved. The output should be the final approved environmental document and the selected alternative to proceed into final design.

10. FONSI & Location Approval—For the example in **Exhibit 200-06** the FONSI is the final environmental document that details what decision was made. The FONSI focuses on the selected alternative and also responds to issues raised during the public hearing. The EA shall be attached to the FONSI, as it provides the supporting documentation for the decisions made for selecting the alternative. It should state that the proposed project will have no significant impacts on the environment. The FONSI should reflect compliance with all applicable environmental laws and regulations. The PDM will publish the location approval to inform the public of the decision. The announcement may be provided through whatever media is deemed appropriate (newspaper, web, etc.).

11. Final Design—The FONSI is signed, the design is detailed, and plans for right-of-way acquisition, utility relocation, and construction are prepared.

    **HD-400**, “Environmental Considerations,” and the *Environmental Analysis Guidance Manual* provide further information on CE and EIS projects.

## HD-203.3 TYPICAL CONSIDERATIONS FOR THE DEVELOPMENT OF ALTERNATIVES

During the preliminary design phase it is imperative that potential constraints, issues, performance measures and solutions be identified as early in the process as practical so that the best solution can be identified from the outset. The following identifies some of the resources and analysis requirements to assist the designer in developing these alternatives.

### HD-203.3.1 Geometric Design

All alternatives should be developed in accordance with guidance provided in **HD-700**, “Geometric Design Guidelines.”

### HD-203.3.2 Basic Number of Lane Determination

Number of lanes should be determined through capacity analysis, community input, cost, and desired function as well as other factors.

**HD-700**, “Geometric Design Guidelines,” provides more information on number of lane determination.

### HD-203.3.3 Safety

The Highway Safety Manual (HSM) and Data Driven Safety Analysis (DDSA) should be used to help evaluate geometric features and/or alternatives. The level of safety analysis in the early stages of a project depends on the purpose and need as well as the complexity of the project. Consider the guidance provided in Section 6.1.2 of the DDSA Implementation Plan located on the DDSA website when determining the minimum level of analysis needed to perform for a project. The DDSA website is found at:

https://business.kytc.ky.gov/work/DDSA/Pages/default.aspx.

### HD-203.3.4 Roadside Design

Roadside safety design is a very important component of the total highway design and should be thoroughly considered during the design process. The goal of roadside safety design is to create a "forgiving roadside," which allows for errant vehicles leaving the roadway and supports a roadside design where serious consequences are reduced.

**HD-800** provides more information on roadside safety design.

### HD-203.3.5 Intersection Design

The designer should use traffic capacity analysis, site data, crash data, and other pertinent data to determine the configuration and traffic control for intersections. Additionally, some traffic control designs such as signals and modern roundabouts require additional analysis and review procedures.

Tools that are available for intersection screening analysis, to evaluate alternative intersection control. The Safety Performance for Intersection Control Evaluation (SPICE) spreadsheet-based tool can be used to aide in the determination of a preferred alternative for any intersection project and can provide quantifiable safety performance comparisons for different intersection types. Also available is the Capacity Analysis for Planning of Junctions (CAP-X),a spreadsheet-based tool that can be used to evaluate various intersection types using peak flow volumes and lane configuration inputs to determine volume to capacity ratios for each intersection type. The SPICE and CAP-X tools can be downloaded at https://safety.fhwa.dot.gov/intersection/ice/.

**HD-900** provides more information on traffic engineering and intersection design**.**

### HD-203.3.6 Access Management

Access management includes several principles and techniques that help preserve mobility and improve safety. Designers should incorporate access management techniques into project designs.

**HD-1100** provides more information on access management.

### HD-203.3.7 Pedestrian & Bike Facilities

The project team shall consider the need to incorporate pedestrian and bicycle facilities on all new roadway construction and reconstruction projects. Pedestrian and bicycle facilities may be considered for other projects on a project-by-project basis.

**HD-1500** provides guidance on pedestrian and bicycle facilities.

### HD-203.3.8 Maintenance of Traffic & Constructability

Maintenance of traffic and constructability may preclude a given alternate. It is critical that these issues be examined during the development of alternatives.

### HD-203.3.9 Railroad Coordination

Coordination with railroad companies must be done when highway improvements have the potential for affecting railroad facilities. The Central Office railroad coordinator should be contacted as soon as possible, but no later than the selection of the preferred alternative, in order to facilitate the necessary approvals. The PDM should also ensure that the project records indicate the need for railroad involvement.

**HD-1400** provides more information on railroad coordination.

### HD-203.3.10 Interchange Justification Studies / Interstate Modification Reports (IJS/IMRs)

New access (interchanges and ramps) requests on the Interstate Highway System requires an Interchange Justification Study (IJS). This policy is applicable to new or revised access points to existing Interstate Highway facilities regardless of the funding type. Revised access is considered to be a change in the interchange configuration even though the number of actual points of access may not change. Studies for revised access are typically referred to as Interchange Modification Reports (IMRs). All IJS/IMRs should be developed consistent with FHWA's Interstate Access Policy and in conformance with KYTC guidance and/or procedures for their review and acceptance, to then be recommended to the FHWA for their federal action. FHWA's Interstate Access Policy provides more information on these type of Interstate Access Requests and is available online at:

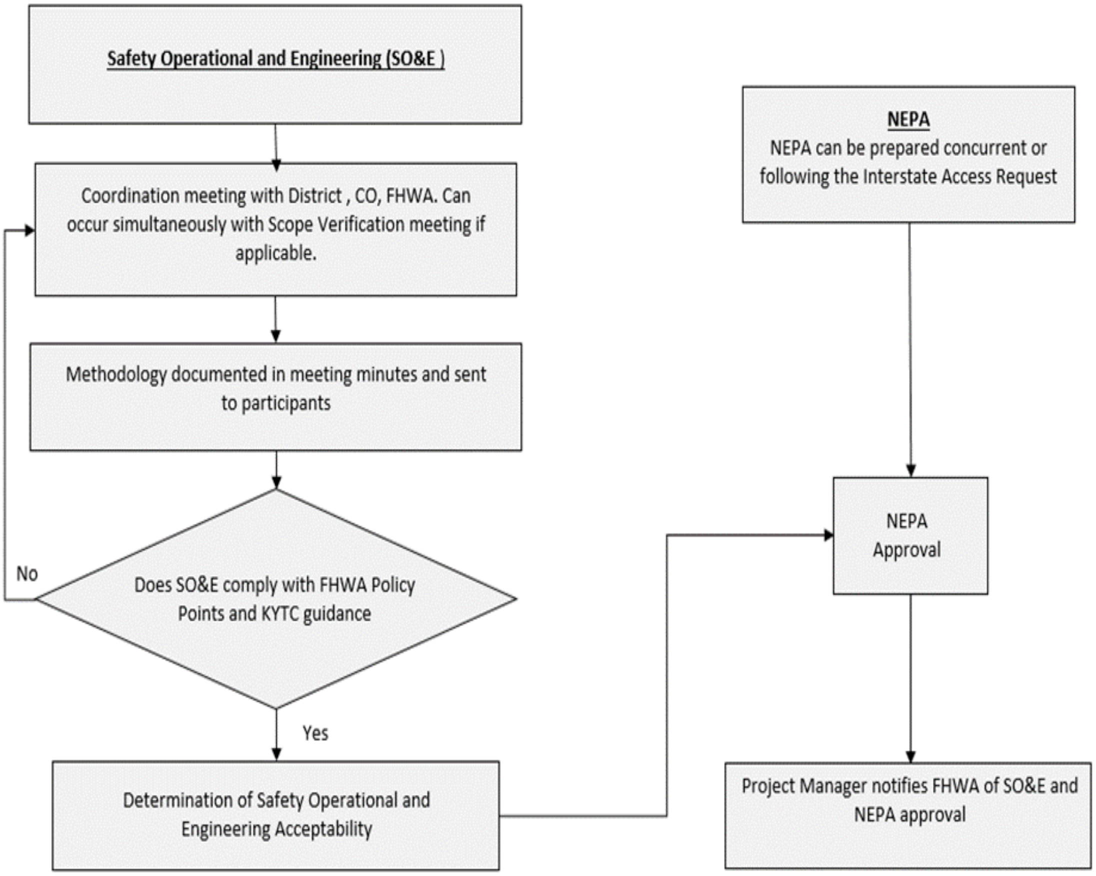
https://www.fhwa.dot.gov/design/interstate/170522.cfm

All requests for new or revised access points on Interstate Highways must be closely coordinated with the planning and environmental processes. There are two distinctive federal actions and parts to the approval process for new or revised interstate access: the determination of the safety, operational, and engineering (SO&E) acceptability analysis and subsequent completion of the NEPA document detailing location approval. These two steps could be performed simultaneously, or the SO&E acceptability determination can be completed prior to the environmental review.

### HD-203.3.10 Interchange Justification Studies / Interstate Modification Reports (cont.)

The PDT should obtain engineering and operational acceptability as early in the project development process as possible. Final approval of access requests cannot precede the completion of the NEPA process.

The following flowchart depicts the major steps involved in requesting a new or modified change of an existing Interstate access point.



The level of traffic operation and safety analysis needed to evaluate the request should be coordinated with FHWA very early in the scoping process. For the recommended level of safety analysis, consult KYTC's Data-Driven Safety Analysis (DDSA) Implementation Plan at:

https://business.kytc.ky.gov/work/DDSA/Pages/default.aspx

The traffic operational analysis should utilize Highway Capacity Manual (HCM) methodologies. A Level of Service (LOS) analysis is expected. It is recommended to first follow HCM methodologies when analyzing weaving, merging and/or diverging within the mainline interstate.

## HD-203.3.10 Interchange Justification Studies / Interstate Modification Reports (cont.)

In congested areas where adjoining interchanges may impact the traffic operation of the interchange being analyzed, a more detailed analysis (such as a traffic microsimulation) may be needed in addition to the LOS determination. A more detailed analysis may also be needed to determine if adjoining intersections on the cross street impact the ramp terminals resulting in queues onto the Interstate. Other items to consider for the operational analysis include area of influence, analysis years, and other operational performance measures.

The type of documentation required for interchange access should also be determined during the initial project coordination. An IJS is required for the following situations on the Interstate System:

- New system interchanges providing access between two limited access facilities
- New service interchanges providing access between a non-limited access local roadway network (e.g., arterial, collector or local road) and the limited access facility.

An IMR is required for a proposed action to modify configuration or travel patterns at an existing interchange. The extent and complexity of the proposed modification will determine the level of analysis and documentation required. This should be discussed and documented during the initial project coordination.

An IMR may be required for the following situations where examples are provided; they are not intended to be all-inclusive:

- Modification to the geometric configuration of an interchange
  - Adding new ramp(s)
  - Abandoning/removing ramp(s)
- Completion of basic movements at an existing partial interchange
- Modification of an existing interchange ramp to provide access to a different local road that requires a break in the limited access right-of-way
- Any changes that result in an increase in the number of lanes at the gore point of an on-ramp within a weaving area, as determined by the Highway Capacity Manual (HCM) weaving methodology

The following interstate improvement types may not require an IMR, but consultation should occur with FHWA early in the project to determine if an IMR is needed. If an IMR is not needed, it is recommended that a traffic and safety analysis for the improvement be completed and the results documented in meeting minutes, the Design Executive Summary (see HD-203.6) or in a separate report. These improvements include:

### HD-203.3.10 Interchange Justification Studies / Interstate Modification Reports (cont.)

- Addition of a lane (or lanes) to an existing on-ramp while maintain existing lanes at the gore point
- Any proposal that results in the shortening of an off-ramp
- Replacement of an unsignalized free-flow, right-turn lane on an off ramp with a signalized right turn or installation of a signal or roundabout to a stop-controlled ramp terminal intersection
- Extension of an acceleration lane, deceleration lane or recovery lane at the interstate connection point not within the weaving area of an adjacent interchange
- Extension of an on ramp as an auxiliary lane extending to the downstream interchange
- Widening of an existing off-ramp to add lane(s) at a diverge point from the mainline
- Relocation or shifting of the ramp termini along the same roadway, which does not result in a shortening of an off-ramp and/or maintains or improves ramp operations to ensure no ramp queueing onto Interstate mainline occurs.

The following improvements usually do not require an access request, but a notification by the PDM should be sent to FHWA describing the project scope and recommendation regarding the need for a federal determination of FHWA Interstate Access Policy compliance. FHWA involvement may still be required. These types of improvements include, but are not limited to:

- Addition of storage lanes at the terminus of existing off-ramps with the crossroad, not extending through the actual Interstate access point from the mainline Interstate highway (e.g., ramp gore)
- Construction of new signing, striping and/or resurfacing of an interstate on-ramp or off-ramp, where geometric features are not changed
- Installation of roadside guardrail and concrete barriers
- Addition of through lanes(s) on a crossroad at a ramp terminal
- “In-kind” bridge replacement/modifications
- Construction of overpasses without ramps

## HD-203.4 COMMUNICATING ALL PROMISES (CAP)

During project development, many commitments (promises) are made to project stakeholders and the general public. To ensure that commitments are kept, the PDM will accumulate and track all promises in the project database system. The information to be recorded includes:

- A description of the promise
- To whom the promise was made
- Source of the promise
- Date the promise was made
- Location of the work or activities to fulfill the promise

## HD-203.4 COMMUNICATING ALL PROMISES (CAP) (cont.)

All project promises require PDM approval before they are officially logged into the system. The extent to which project promises can be made by other individuals is to be determined by the PDM. The PDM shall retain the responsibility for ensuring that all promises (related to topics such as roadway features, environmental concerns, right of way, outstanding demolitions, utilities, structure design, etc.) are ultimately recorded in the system. CAP is intended but not limited to record commitments not in other project documents.

The system is designed to not allow deletions. If a promise is to be changed or countermanded, an additional entry will be required to document this change. The PDM should understand that the goal is not to increase the number of promises made but to ensure that the Cabinet delivers on made promises.

A CAP report shall be created and included in the documents submitted to the Division of Construction Procurement’s Plans, Specifications, and Estimates Branch (PS&E) for letting. The CAP report shall be included in the bid package and shall remain a part of the contract document.

## HD-203.5 PRELIMINARY LINE & GRADE (PL&G) MEETING MINUTES

The PL&G meeting minutes are a critical part of the Design Executive summary and will serve as the main body of the DES. These minutes should document most, if not all, of the design decisions prior to moving into final design.

The PL&G meeting minutes should include at a minimum:

- Project identification
- Meeting location and date
- Meeting attendees
- Purpose and need (needs should be documented with supporting data)
- Project overview and existing conditions
- Description of proposed alternatives (including no-build alternative)
- Consideration of Bicycle and pedestrian facilities discussion (**HD-1501**)
- Discussion of alternatives
    - Discussions that assist in the recommendation
    - Performance of each alternative (how well each alternative addresses the need, may include traffic analysis, safety analysis, etc., as applicable)
    - R/W, Utility, and Environmental impacts for each alternative
- Traffic control schemes
- Cost Comparison Tables for D, R, U, & C for each alternative (include Highway Plan Funding and potential environmental mitigation fees)
- Recommended Alternative

## HD-203.5 PRELIMINARY LINE & GRADE (PL&G) MEETING MINUTES (cont.)

- Reason for cost overrun (if estimated costs exceed the Six-Year Highway Plan budget costs for all phases by 15 percent or more)
- Discussion of Clear Zone
- Design Exceptions/Variances discussion (if applicable per **HD-704** guidelines) and mitigation strategies
- Discussion of low cost maintenance improvements while working toward long term solution (If applicable)
- Listing of considerations to address the Water Related Impacts Summary (BMP Discussion)
- Tentative list by station and size of all structures, if applicable

When considering environmental issues during the design process, it is recommended to avoid impacts to water resources whenever possible. If impacts are unavoidable, the next step is to minimize these impacts. Once these impacts have been determined, mitigation may be required in some cases. Where possible, enhancement of water resources may also be considered in a project.

The Water Related Impact Summary (**Exhibit 200-07**) was developed to aid the PDT in the decision-making process and is required for all projects. As described in the exhibit, “Section 1: Impact Checklist” shall be completed for each alternate considered in the conceptual design phase of the project. This will aid in the comparison of water-related impacts associated with each alternate. Completion of “Section 2: Impact Discussion” is only required for the selected alternate and is used to describe the avoidance, minimization, mitigation, or enhancement measures that have been considered in the project as noted in the Design Executive Summary.

The project manager shall submit the final PL&G minutes along with the DES form (**Exhibit 200-08**) to the location engineer for approval.

## HD-203.6 DESIGN EXECUTIVE SUMMARY (DES)

The Design Executive Summary (DES) is the record of engineering decisions related to the project and contains rationale concerning the identification of the preferred alternative and requested design exceptions. After the DES has been submitted and approved there may be instances that the design decisions are re-evaluated and changes are made. In this case the DES should be amended. See HD Section 203.6.2 for procedures to amend the approved DES. Projects administered by the KYTC Division of Highway Design shall require a DES unless an exemption is given by the division director. The Division of Highway Design uses this information to document the decision-making process, including preferred alternate selection and design exceptions or variances. The Division of Environmental Analysis uses this report in determining environmental actions that may be required. It is important that the DES document all pertinent information used in the decision process.

### HD-203.6.1 DES Contents

The DES (**Exhibit 200-08**) includes the summary form, which can be found on the Division of Highway Design webpage, location map, recommended typical section(s), and the Preliminary Line & Grade Minutes.

The project engineer submits the DES to the PDM when submitting the final PL&G minutes. The PDM or a designated representative is responsible for the content and recommendation of the DES to the location engineer. **HD-203.6.3** details DES review and approval processes.

### HD-203.6.2 DES Amendment Process

As stated above, changes to the controlling design criteria, project scope, or changes to the budget that result in the project being more than 15% over the Highway Plan budget that were not reflected in the approved DES will need to be documented in an amendment to the DES. The documentation for the addendum should identify the items that changed and the reason(s) why the items differ from the approved DES. Additionally, supporting information for the change(s) should be provided in the documentation. The addendum must be submitted in the form of a memo to the Location Engineer and will go through the same approval process and will be recorded with the originally approved DES.

### HD-203.6.3 DES Approval Processes

**Tier 1 DES Approvals**: Final approval requires the Location Engineer’s signature if all the following criteria are met:

- Environmental document type is any categorical exclusion (CE) level
- Design year ADT < 15,000
- Design exception for design speed is required, but the difference between the design speed and recommended speed is ≤ 10 MPH
- Design exception(s) is required for any controlling criteria (HD-704), and the project is not on the NHS
- Total project cost < $15M
- Alternative delivery methods are not anticipated

**Tier 2 DES Approvals**: Final approval requires signatures of the Location Engineer and Roadway Design Branch Manager for projects not meeting the Tier 1 criteria but that meet all the following parameters:

- Design year ADT< 50,000
- Total project cost < $50M
- All other non-NHS design exceptions
- Design exception(s) are required on the NHS, non-interstate roadways, if other criteria are met
- Alternative delivery methods are not anticipated

## HD-203.6.3 DES Approval Processes (cont.)

**Tier 3 DES Approvals**: Final approval requires signatures of the Location Engineer, Roadway Design Branch Manager, and Director of the Division of Highway Design if the following criteria are met:

- EA-FONSI, EIS, ROD projects
- Projects not meeting Tier 1 and 2 parameters

A DES may not be required on projects that (1) do not alter roadway geometrics (including bridge projects) or (2) are located on non-state routes. Contact the Location Engineer to determine if a DES is needed. Any project on the NHS that requires a design exception requires a DES.

Regardless of whether the parameters are met, a reviewer at a lower tier level may determine the DES needs to be reviewed at a higher tier.

If the total project cost estimate for the selected alternative is greater than 115% of the enacted Highway Plan estimate, the Location Engineer may elevate the approval to a higher tier. Alternatives with estimated costs that exceed the enacted Highway Plan budget may need to have their project scopes reevaluated.

A copy of the approved DES is returned to the PDM and the Location Engineer to be placed in the project file. On FHWA oversight projects the DES shall be provided to FHWA. FHWA’s approval for design exceptions shall be solicited under separate cover. FHWA design exception(s) approvals shall be placed in the project records.

## HD-203.7 POST CONCEPT ACTIVITIES

### HD-203.7.1 Advertisement of Location Approval

Advertisements of location approval are required for those projects that have an EIS or FONSI document. While there is no regulatory or statutory obligation to advertise the location approval for projects that have categorical exclusions (CEs) and categorical exclusions for minor projects (CEMPs), advertisements are encouraged as an indication of the Cabinet's willingness to share information with the public. It is important that every effort be made to keep the public involved and informed concerning environmental clearance and location approvals. The decision as to the manner of the advertisement is a matter of balancing the costs of advertising with the expected benefits to be derived. The PDM may advertise location approval notices for projects via the internet or other innovative advertisement means. Projects that require an EIS or a FONSI shall be advertised in local or regional newspapers and, when appropriate, one newspaper with statewide circulation.

## HD-203.7.2 Request for Geotechnical Investigation

A determination of the types and locations of geotechnical features is essential to the design and construction of a roadway. Typically, a request for analyses is made after preliminary line and grade approval. The *Geotechnical Guidance Manual* details the procedures to follow when soil and subsurface exploration is required. The designer is responsible for the submission of adequate information to the Division of Structural Design, Geotechnical Branch, concerning project alignment, grades and cross sections, and structure locations needing information for scour calculations and any changes that occur in them. The Geotechnical Branch will provide a report of its recommendations to the PDM for consideration on the project.

## HD-203.7.3 Utility Coordination & Subsurface Utility Information

Utility coordination should begin early in the preliminary design phase. The PDT should recognize that effective communication and collaboration with utility companies will ultimately benefit the decision making process, project delivery schedule, and project budget. Utility coordination will assist with minimizing utility impacts as well as early planning for any utility relocations needed for the project.

The Utility Conflict Matrix (UCM) is a tool administered through the Division of Right of Way and Utilities that can be utilized to document potential conflicts the preliminary roadway design may have with any utility facilities in the area of the project. The UCM allows for a more effective communication tool when discussing potential impacts with the affected utility owners.

After determining potential utility conflicts during the preliminary design phase there may be a need to more accurately locate existing utilities in the project area. The PDT should determine the quality level of utility locations that are needed to make the best decisions for the project. **HD-304** provides more information on subsurface utility locations.

For more detailed information on Utility Coordination and the Utility Conflict Matrix see the *Utilities & Rails Manual*.

## HD-203.7.4 Value Engineering (VE) Studies

A VE study is an independent, systematic, creative analysis to analyze a project’s design or reduce its cost while still meeting the purpose and need of the project. The PDM shall consult current FHWA requirements to determine which projects require a VE study. The PDT may request a VE study to optimize designs and project costs on significantly smaller projects.

A VE study should be conducted shortly after the preferred alternative has been identified. When a candidate project is identified, the Quality Assurance Branch should be contacted to schedule a VE study.

◆ ◆ ◆

*Chapter*

ADMINISTRATIVE PROCEDURES

*Subject*

Final Design

## HD-204.1 OVERVIEW

The project moves into the final design phase once a selected alternative has been chosen and the transportation decision has been made and documented. Resolutions of project-specific issues or special circumstances identified in the preliminary design phase must be carried through to the final design.

The details developed for the chosen alternative in the final design phase are utilized to prepare the plans needed for right-of-way acquisition, utility relocation, and construction.

## HD-204.2 PAVEMENT DESIGN

The responsibility for designing the pavement depends on the length and type of project, facility type, and average annual daily truck traffic (AADTT).

**HD-1000** provides more information on pavement design.

## HD-204.3 ROADWAY SIGN DESIGN

Signing plans shall be completed to a conceptual stage in time for delivery prior to the joint inspection for detailed review by a traffic subject matter expert (SME) and to accommodate right-of-way and utility needs. Conceptual signing plans should be reviewed for the necessity of structural design, such as overhead trusses and sign piers. Conflicts between roadway design elements and sign placement also need to be addressed. Signing plans should be incorporated into the contract plan set before the letting.

**HD-1200** provides more information on signing.

## HD-204.4 SOIL & SUBSURFACE EXPLORATION

Geotechnical report recommendations should be utilized in the preparation of the contract plans.

## HD-204.4 SOIL & SUBSURFACE EXPLORATION (cont.)

Such recommendations include cut and fill slopes, rock roadbed, CBR values, rock disintegration zones, etc. The Project Development Branch Manager (PDM) may request additional geotechnical investigations as recommended by SMEs during final design for roadway and structural design elements.

## HD-204.5 SUBSURFACE UTILITY INFORMATION & CONTINUED COORDINATION

As more details are being refined throughout the roadway design plans, the PDT should begin to gain a clearer understanding of the impact the design will have to existing utility facilities. It may be necessary to investigate the utilities that could be in conflict with the proposed construction of the roadway, including temporary maintenance of traffic, at a higher quality level to determine the extent of the impacts. Higher quality level survey data, when collected early in the final design phase, can assist the PDT in determining whether the utility impacts can be avoided or minimized and help facilitate the necessary continued utility coordination with the utility owners.

As stated in **HD-203.7.3** the Utility Conflict Matrix (UCM) is a tool available that will allow for a more effective communication tool when collaborating and coordinating impacts with the utility owners.

## HD-204.6 ROADSIDE SAFETY DESIGN

Roadside safety design is an important component of highway design and should be thoroughly considered during the design process. The goal of roadside safety design is to create a “forgiving roadside” for errant vehicles leaving the roadway and reduces serious consequences.

**HD-800** provides more information on roadside safety design.

## HD-204.7 INTERSECTION DESIGN & SIGNAL PLANS

The designer should use traffic capacity analysis, site data, and crash data to prepare studies of alternative configurations and alignments for intersecting roadways. Intersection’s configuration and use of traffic control devices should be discussed by the project development team (PDT) on an intersection-by-intersection basis.

For intersections deemed unconventional or complex, the project manager should determine the need to request approval of the intersection geometrics. See **HD-901** for more information.

## HD-204.7 INTERSECTION DESIGN & SIGNAL PLANS (cont.)

When the PDT identifies locations that may require signal, signing, or lighting plans, the district traffic engineer should notify the Division of Traffic Operations in writing and provide appropriate supporting information to obtain concurrence.

The project manager is responsible for making sure the appropriate traffic plans are identified and included in the total plan set. To facilitate this process, the project manager should notify the district traffic engineer of PDT meetings and inspections as early in the process as feasible.

**HD-900** provides more information on intersection design and signal plans.

## HD-204.8 RAILROAD COORDINATION

Coordination with railroad companies is required when highway improvements may involve railroad facilities. The Division of Right of Way and Utilities' railroad coordinator should be contacted as soon as possible, but no later than the selection of the preferred alternative. The railroad coordinator will facilitate the necessary approvals and identify what additional considerations should be made concerning potential impacts of the highway on those facilities. The PDM should ensure that the project database system documents the need for railroad involvement, which is typically accomplished by adding "Railroad Involvement" in the "Project Concerns" area.

**HD-1400** provides more information on railroad coordination.

## HD-204.9 ACCESS MANAGEMENT

Access management encompasses several principles and techniques designed to increase the capacity of roads, manage congestion, and reduce crashes. These are goals in the planning and design of new roads and reconstruction of existing roads, and designers should consider all access management tools available and choose which are to be incorporated into the project designs.

**HD-1100** provides more information on access management.

## HD-204.10 MAINTENANCE OF TRAFFIC

The traffic management plan (TMP) should be developed as an inherent part of the final design. **HD-206** provides more details on the TMP.

## HD-204.11 INNOVATIVE BID PROCESSES

The designer should carefully consider the impacts of construction on the traveling public. Innovative bid processes are recommended when:

- The public will experience extreme disruption and delays
- The time of completion for a project or an individual phase is particularly critical
- There is a significant cost savings

If the designer chooses to use innovative bid processes, a well-developed maintenance-of-traffic plan may be necessary. Established practices for road user delay costs should be used to determine benefit/cost ratios for the processes in **HD-204.11.2** through **HD-204.11.4**. The Division of Planning may help in the development of these ratios. For lane or partial road closures, the Kentucky User Cost Program (KyUCP) may be utilized to determine road user delay and costs. This program is maintained by the Division of Highway Design's Rehabilitation Branch.

### HD-204.11.1 Design-Build

On design-build (DB) projects, a designer and builder work together under a single contract to provide the Kentucky Transportation Cabinet (KYTC) design and construction services. This differs from design-bid-build project delivery, where design and construction services are awarded under separate contracts. At minimum, a design-build team (DBT) consists of a highway contractor and consultant firm(s) responsible for the final design work and project construction. Other contractors, designers, and other entities that will work on a project may also be included on a DBT. For more information please see the Design Build Guidance Manual.

### HD-204.11.2 Incentive/Disincentive

It is common to charge liquidated damages against all project completion dates. Liquidated damages may be charged in excess of rates established in the *Standard Specifications* when deemed appropriate and when expected impacts to the public may be considered greater than the damages established by specification. Liquidated damages may be charged against individual phases of a contract, particularly when the phase is deemed to be critical to the operation of the highway or the safety of the motoring public. However, the use of incentives/disincentives described in the paragraph below is probably a more effective method to handle impacts of individual phases.

## HD-204.11.2 Incentive/Disincentive (cont.)

Incentives/disincentives should be considered on projects having high traffic volumes and involving construction requirements that will greatly restrict or even shift traffic away from the existing facility. The incentive/disincentive contract compensates a contractor the same amount per day for early completion of a contract or phase or penalizes the contractor for late completion. If a decision is made to apply a different incentive and disincentive cost, the incentive rate shall not be greater than the disincentive rate. The amount applied for the incentive/disincentive is based on the following:

- Traffic safety
- Traffic maintenance
- Road-user delay costs

Generally, incentives/disincentives are applied only to work that directly affects motorists. This frequently does not replace normal contractual liquidated damages. The incentive/disincentive provision should be sufficient to motivate a contractor to complete the project or phase ahead of schedule. Disincentives may be used without incentives. The use of contract incentives requires approval of the State Highway Engineer.

In considering the use of incentives/disincentives or any of the other innovative practices that follow, the designer must assure the work zone will be free of delays beyond the contractor's control. The use of incentive/disincentive contracts should be based on a calendar day completion or a fixed completion date rather than a workday completion. Therefore, the proposal must address or waive any contractual language that suggests a conflict with the times established for the incentive/disincentive. This includes the end of construction seasons or other seasonal construction limitations and impacts by holidays. Incentive/disincentive contracts should allow for a contractor working beyond a normal 40-hour work week to accomplish the work.

The project team should also consider how the construction engineering and inspection (CEI) will be accomplished. The project team and the Division of Construction should develop a workload schedule. On occasion, the Cabinet may need to obtain the services of a contractor for CEI.

## HD-204.11.3 Cost Plus Time Bidding (A+B Bidding)

Cost plus time bidding is used when it is desired for the contractor to develop the timeliest method of completing a project. Bidding is developed for this type of project by using the formula:

### HD-204.11.3 Cost Plus Time Bidding (A+B Bidding) (cont.)

A + B = C

A = traditional bid for contract items; actual contractual amount

B = product of the total number of calendar days required to complete the project multiplied by a road user cost per day established for the project

**Note:** The B component may also be measured in hours for very rapid construction projects on high-type facilities. A maximum value for the B component or a fixed completion date may still be established to limit contract time or to guarantee a completion date.

C = total bid made by the contractor

A disincentive is included in the contract. It is based on the established road-user costs and is placed in effect if the number of days bid by the contractor is exceeded. Similarly, an incentive amount may be included in the contract to reward the contractor for completing the work earlier than the time bid. The use of contract incentives requires approval of the State Highway Engineer.

Cost plus time bidding is effective when multiple bidders are involved. If the designer determines that there may be a single bidder for a project, it is more appropriate to use one of the other two described innovative bidding processes.

### HD-204.11.4 Lane Rental

The lane rental concept is used to encourage contractors to minimize road-user impacts during construction, while permitting them the flexibility to decide the appropriate time frames for lane closures and restrictions. There is no specific bid item for lane rental. The award of the project is based solely on the contractor's estimated bid price. However, a provision for a lane rental fee assessment based on a road-user cost is included in the contract and is assessed against the contractor's contract on his or her monthly contract payments. The fee is assessed for the time that the contractor occupies or obstructs any part of the roadway. The fee may be specific to certain segments of the contract.

The designer may base rental fees on weekly, daily, hourly, or fractions-of-an-hour rates. The lengths of lane closures may also be considered. Greater fees may be charged for times when traffic may be greater (such as during rush hours when hourly rates are bid or during holidays when a daily rate is bid). The designer may make restrictions on lane closures for special events or holidays. Generally, the department should limit the restrictions placed on the contractor and allow the contractor to decide the best times for lane closures.

### HD-204.11.4 Lane Rental (cont.)

Critical path method scheduling of this type of an operation is essential for the contractor to assure the economic impact to his or her contract and for the department's complete understanding of the schedule on which the contractor will complete the work.

Lane rentals should be considered on projects that greatly affect the traveling public. Major urban projects are prime candidates. Lane rentals are used to encourage contractors to schedule work to minimize lane restrictions in terms of duration and number of closures or other obstructions. Lane rentals also encourage lane closures at low-volume times.

### HD-204.11.5 Pre-Bid Conferences

When using innovative bidding methods, pre-bid conferences should be considered to allow the contractor to understand established restrictions, time frames involved with the overall project, and specific phases that require extra control and effort.

### HD-204.11.6 Workzone Capacity

The determination of workzone capacity is essential to determine user delay. The *Highway Capacity Manual* and FHWA's *Life Cycle Cost Analysis in Pavement Design* (FHWA-SA-98-079, chapter 3) are two reference documents that are used to determine workzone capacity. The Kentucky User Cost Program (KyUCP) developed by the Kentucky Transportation Center was based on Chapter 3, "Workzone User Costs," in the FHWA publication. For lane closures, not including complete road closure, the KyUCP should be used to determine roadway user delays and costs. For workzones that include complete road closure and detours, the Division of Planning should be consulted to provide detour analysis and delay costs.

Workzone capacity is primarily affected by roadway geometry, construction intensity (such as lane width, workzone traffic control, proximity, etc.), and the composition of the traffic stream (such as percent of passenger cars, single unit trucks, and combination unit trucks). The designer should understand each of these factors and how they affect capacity.

The Transportation Research Board completed a series of studies that measured the actual flow of traffic in work zones.

### HD-204.11.6 Workzone Capacity (cont.)

The following chart is an indication of expected impacts to traffic flow when lane reductions occur:

| Number of Normal Lanes | Number of Open Lanes | AVERAGE VPH | CAPACITY (PCPHPL) |
|---|---|---|---|
| 2 | 1 | 1340 | 1340 |
| 3 | 2 | 2980 | 1490 |
| 3 | 1 | 1170 | 1170 |
| 4 | 3 | 4560 | 1520 |
| 4 | 2 | 2960 | 1480 |
| 5 | 2 | 2740 | 1370 |

The average capacities shown are for the expected total traffic on open lanes in the construction zone and the traffic per vehicle lane. As shown in the chart above, the more merging that is required in a construction zone, the less traffic can pass through the work area. Additionally, the composition of the traffic stream will impact these numbers. These numbers should be used to determine a rough prediction of encountering expected delays due to lane closures. The presence of ramps within the construction zone increases the impact to the traffic flow.

The impact to traffic occurs at the merge point. As traffic flows into the reduced lanes, traffic counts as shown above may be expected. Length of closure has no impact on the amount of traffic that can pass any roadway segment, as the reduced lanes control the number of vehicles that may pass. Avoid lengthy lane closures, particularly if no apparent work is visible to the motorist, to reduce frustration to travelers. Establish lengths of closures based on a reasonable period to accomplish work activities.

As previously discussed, lane rentals based on a per-mile basis of closure may be an effective method to allow the contractor the maximum closure he or she deems feasible in an established period. The designer may consider complete closures of roadways or ramps to finish construction in the shortest periods possible where alternate routes exist. Another consideration would be to allow closures on only one side of the highway at a time.

The use of two-lane, two-way operation (TLTWO) on one roadway of a normally divided highway should be determined only after careful consideration of other available methods of traffic control. The PDT should consider the use of a median barrier wall for positive separation of traffic on TLTWO. Generally, a TLTWO should be used on urban-type streets or other low-speed operations where the driver can see the transition back to normal one-way operations. There may be some reason the PDT may choose using TLTWO in circumstances other than those cited without the use of a barrier wall. In these cases, the lanes should be separated by tubular markers and paid in accordance to guidance found in the *Standard Specifications*.

### HD-204.11.7 Traffic References

The *Traffic Control through Highway and Street Work Zones Manual*, the *Standard Drawings Manual,* and the *Manual on Uniform Traffic Control Devices* provide more information on traffic control methods.

## HD-204.12 DETERMINATION OF EXCESS EXCAVATION AREAS

The balance of excavation and embankment within economic limits should be considered in conjunction with all alternate alignments and grades studied. Opportunities to correct any imbalances should also be examined.

Beneficial utilization of excess excavation material within or adjacent to the right of way is almost limitless. On projects where earthwork distribution indicates excess excavation material, consideration should first be given to further adjustment of horizontal alignments, vertical grades, and road geometrics to achieve a balanced distribution. Special attention should be given to areas where elimination of guardrail using techniques such as flattening slopes or false cuts may enhance safety. There may be opportunities to adjust the alignment to improve horizontal sight distance, by moving into more of a fill situation or less of a cut. Vertical sight distances may be improved beyond minimum standards by flattening or alternatively raising grades to reduce or lengthen vertical curves, which may subsequently reduce or increase excavation to meet embankment requirements.

Areas for filling between the proposed roadway and existing roads should be explored for opportunities to eliminate hazards or drainage structures, reduce flooding in the area, or enhance overall drainage characteristics. Filling of depressions or depressed properties adjacent to the roadway may enhance drainage and also facilitate utility relocations. Local governments and public agencies may have economically accessible property to fill.

At the earliest stage of project development, the PDT should assess earthwork distribution and determine the best method for handling any excess excavation. Due to the economic and time issues involved, this must be part of the decision-making process during preliminary design.

If it is determined that off-site disposal of excess material is necessary, a sufficient number of potential disposal sites to accommodate the volume of excess material should be identified and presented to the project team. These sites should be reasonably located and economically accessible. Property owners should be contacted to gauge their interest in providing potential disposal sites. Environmental, constructability, and utility relocation issues should be considered for these sites.

## HD-204.12 DETERMINATION OF EXCESS EXCAVATION AREAS (cont.)

A determination should be made to (a) designate all or part of the fills as part of the plans, or (b) allow the contractor to provide his or her own disposal sites. That determination must be based upon an economic benefit to construction of the highway and be supported by an analysis that economically justifies selection of the particular identified fill areas.

Whether or not designated disposal sites are included in the plans, permits required under Sections 401 and 404 of the Clean Water Act should be obtained from the U.S. Army Corps of Engineers (USACE) and the Kentucky Division of Water (DOW) during project development for all of the identified sites. USACE permit applications, including necessary plans, environmental baselines, and other data, should be prepared and ready for submission to the appropriate USACE district and the DOW at least by the time of right-of-way plan submission to the Central Office. A permit may be obtained whether or not the department intends to purchase the property. For federally funded projects or projects impacting jurisdictional streams, the environmental document needs to include the impacts of the disposal sites as well.

If the earthwork distribution and economic assessments indicate sufficient available fill areas and adequate storage, the preferred choice should be to not designate off-site permanent disposal areas in the plans. However, appropriate permits should be obtained for the potential sites. The sites should be identified in the plans, but it should be the contractor's discretion to dispose of the excess material in accordance with the *Standard Specifications* available at:

http://transportation.ky.gov/Construction/Pages/Kentucky-Standard-Specifications.aspx

If the contractor chooses not to use the permitted sites, he or she will be responsible for obtaining the necessary permits and for completing the project within the specified contract completion time.

For projects with enough interested owners, permits may be obtained for multiple sites to allow flexibility to bidders. However, additional notes or details in the plans may be needed to minimize the disturbed areas.

If an adequate number of storage areas are not available that would prevent an individual property owner or bidder from adversely affecting the project cost, or otherwise control the bidding process~~,~~ the PDT should consider including the disposal sites in the plans. KYTC prefers not to condemn for excess material disposal sites unless they are vital to the project or there are not enough sites available without placing an "undue and unreasonable burden on an individual property owner." This will require early contact with interested property owners.

## HD-204.12 DETERMINATION OF EXCESS EXCAVATION AREAS (cont.)

Plans will include details showing the original and final configuration of the fill area, any site preparatory work such as benching, and both surface and subsurface drainage. Designated disposal sites may be acquired as a temporary construction easement or acquired in fee simple.

- **Temporary construction easement**—Disposal sites that have geological accessibility or physical characteristics that may severely limit or preclude enhancement of the property upon construction of the fill should be acquired as a temporary construction easement. Upon completion of the project and expiration of the easement term, control of the property will revert to the landowner. Early agreement and acquisition should be practiced.

- **Fee simple**—Excess excavation disposal sites that will be enhanced by construction of the fill should be purchased in fee simple and constructed in an engineered, controlled manner. Material placed in disposal sites that are selected for development should be:

    - Constructed with stabilization methods to reduce significant differential settlement
    - Graded and compacted to facilitate the future development
    - Contoured to minimize water runoff and erosion

Section 205 of the *Standard Specifications* provides more details.

In accordance with KRS 176.050 and KRS 176.525, the department shall consult with all legislative bodies affected by a project when disposal sites resulting from new road construction projects have a potential for industrial-site development. Solicitation of local government officials' preference of sites is also required. It is essential to obtain an agreement or resolution early that details how the property will be transferred. If there is no interest and the property is still vital to construction, the site can be acquired through the easement process.

## HD-204.13 DRAINAGE DESIGN & PRELIMINARY DRAINAGE FOLDER SUBMITTAL

Any item related to a proposed drainage plan for a highway project for which the Division of Highway Design has responsibility is to be coordinated through the Central Office Drainage Branch for approval. This coordination takes the form of the submittal of a drainage folder. Chapter 3 of the Division of Highway Design's *Drainage Manual* details the contents of drainage folders and is available online at:

http://transportation.ky.gov/Highway-Design/Pages/Drainage.aspx

### HD-204.13.1 Drainage Folders

Drainage design is documented in a drainage folder to support the development of plans and serves as a permanent record of the drainage design process for a highway project. The folder must contain the basis of the total proposed drainage plan for the project. The Transportation Cabinet's policies, specifications, and standards must be reflected through economical and hydraulically feasible alternatives for a proposed drainage plan.

Each project should have a drainage inspection that may be included with the final inspection or held separately. The minutes of the drainage inspection may be included in the final inspection report.

Drainage folders are required on all projects that contain major drainage structures. This includes structures used to transport water directly through or to delay the flow of water into or away from the highway system. This includes extensions to existing structures or improvement of those structures or drainage systems.

There are two Division of Highway Design drainage folders: preliminary and final. A third folder, the advance situation folder, is primarily used by the Division of Structural Design. Chapter 202 of the *Division of Structural Design Guidance Manual* contains requirements for the advance situation folder and is available online at:

http://transportation.ky.gov/Structural-Design/Pages/Manuals-Downloads.aspx

**Exhibit 200-09** shows the drainage review process.

### HD-204.13.2 Submitting Preliminary Drainage Folders

A preliminary folder shall be assembled at the district prior to the drainage inspection. Consultant project preliminary folders shall be submitted to the district prior to the drainage inspection. Typically, preliminary drainage folders are not required unless the drainage features include bridges, bridge-sized culverts, storm sewers, major channel changes, etc.

The district shall review all drainage folders and place them in the appropriate ProjectWise folder for review and approval by the Drainage Branch. This allows the drainage engineer ample opportunity to review the folder and coordinate scheduling of the drainage inspection with the project manager. Early submission of the preliminary drainage folder for minor-impact projects affords the drainage engineer the opportunity to conduct the drainage inspection with the joint inspection. The *Drainage Manual* summarizes items to be included in each drainage folder type. A request for a drainage inspection may be included in the submittal process. The project manager will set a date for the inspection. Consultant firms shall send all folders to the district office for review.

## HD-204.14 EROSION CONTROL

The erosion control plan (ECP) is an essential component of the plan development process and is required by the Kentucky Point Discharge Elimination System (KPDES). Site-specific erosion control plans for any particular phase of construction is usually a designer's educated guess. As the job progresses, the contractor and the section engineer are in the best position to generate effective erosion control plans. To assist the section engineer and contractor, the designer should include the disturbed drainage area (DDA) information and probable best management practices (BMP) devices and quantities for bid purposes. Modifications and additions may be needed during construction to achieve the BMPs.

The KPDES permit states that the BMP shall include all requirements that have been approved by the local storm water programs. The initial BMP and notice of intent (NOI) (for one or more acres of disturbance) shall be included in the final plan submittal. The Division of Highway Design's *Drainage Manual* provides details on the development of the erosion control plan, appropriate forms, and additional ECP information. The manual is available online at:

http://transportation.ky.gov/Highway-Design/Pages/Drainage.aspx

## HD-204.15 INITIAL/ULTIMATE DESIGN PLANS

It may be beneficial for some projects to develop a typical section calling for two-lane initial and four-lane ultimate construction. Steps for plan development are listed below.

1. Centerline and grade should be established to fit both initial and ultimate construction and to ensure the median and superelevation rates and transitions conform to geometric criteria.

2. Initial and ultimate construction should be shown using differing symbology for all drainage, structures, special detail sheets, and cross-section templates.

3. Construction notes, quantities, earthwork distribution, and general summary included in the plans should be developed for initial construction only.

4. Disturbance limits should be shown for initial construction; however, the outside limits must be determined for the ultimate construction to identify right-of-way needs.

5. Right-of-way acquisition and utility relocation, if necessary, should be included for ultimate construction.

## HD-204.16 FINAL INSPECTIONS

All projects should have a final inspection. This inspection should be held when the contract plans are approximately 80 percent complete. The plans should include all right-of-way and utility information including identified relocations, detailed MOT information, and traffic plans and reflect approved decisions from the DES. The project manager may combine other design review meetings with the final inspections (such as bridge replacement projects). The project manager should make the contract plans available to the PDM and the location engineer. The final inspection should be scheduled to ensure the PDT has at least two weeks to review the plans. When appropriate, the contract plans should also be made available to the FHWA and the city or county. A construction cost estimate detailing biddable quantities should be included.

### HD-204.16.1 Final Inspection Report

The final inspection report shall document comments of all final inspection party members. The report will document the maintenance-of-traffic methodology and any specific comments made about that plan. In addition, the report will provide the following:

- A complete list of all box culverts and bridges
- A cost estimate comparing the current estimate to the Highway Plan
- Recommendations for any roads to be conveyed to local jurisdictions
- Notes on environmental effects that might be different from those previously identified and need to be further addressed by DEA
- Recommendations for traffic devices that do not currently exist

Required estimates shall be shown in the inspection reports as follows:

| | **Current Project Estimate** | **Highway Plan Budget** |
|---|---|---|
| Right-of Way | | |
| Utility | | |
| Construction | | |
| **Total** | | |

For projects with a construction estimate greater than $1 million, 10 percent engineering and contingency should be added. For projects less than $1 million construction, 15 percent engineering and contingency should be added. The *State Highway Engineer Guidance Manual* establishes the policy for project authorization overrun and modifications to project authorization.

### HD-204.16.1 Final Inspection Report (cont.)

At the final inspection stage, the project development team discusses construction time and documents it as part of the report. The project manager is responsible for setting the number of construction workdays and/or completion dates for all projects. The project manager is required to submit the construction time as part of the final plans submission. The district construction office should review the recommended construction time.

### HD-204.16.2 Drainage Inspection

The final inspection and drainage inspection are usually held at the same meeting. The persons responsible for writing the final inspection report shall also be responsible for writing the drainage inspection report. The drainage report will preferably be included as part of the final inspection report, with drainage comments following final inspection comments. All drainage should be addressed in the report. Those individuals responsible for the review of the drainage, both in the district and in Central Office, shall review and provide necessary comments to the inspection. Review and approval of nonmajor structures (< 54 inches) shall be the responsibility of the district drainage engineer. The project manager shall ensure that the Central Office drainage engineer's endorsement of the comments is included with the report.

The drainage inspection will document any needed scour analysis developed from the geotechnical investigation described in **HD-203**, “Preliminary Design.” This report will also contain the recommended location, span arrangement, abutment type, and the sounding layout for the piers and abutments.

A separate drainage inspection report may be written when the drainage inspection is held at a different time than the final inspection or when otherwise deemed appropriate by the project manager.

### HD-204.16.3 Right-of-Way Plan Inspection

Due to time constraints involving the acquisition of right-of-way parcels, the PDM may decide to conduct a right-of-way inspection months prior to the final inspection. A right-of-way inspection should be utilized at the discretion of the PDM to expedite the right-of-way process, such as in aiding project authorization, initiating total takes, or to accomplish some advance acquisition of properties.

A right-of-way inspection differs from a final inspection in that the final plan design is not as complete. This should be the exception on the majority of projects. A final inspection is required on these projects at a later date.

**Note:** Some right-of-way activities (such as title search, preliminary appraisals, and comp sales) may be performed during the design phase utilizing design funds.

### HD-204.16.4 Submittal of Inspection Reports

The consultant or district design engineer prepares the report and sends it to the PDM. The project manager sends it to all invited inspection team members for comment and/or endorsement. The draft report should be sent within 10 working days after the meeting or inspection. Comments should be returned to the project manager within 2 weeks. The project manager will then finalize the report with assistance from the consultant and PDT. Copies of the inspection report shall be sent to the project inspection team members and other involved divisions such as the Divisions of Structural Design, Environmental Analysis, or Traffic Operations. On federal full-oversight projects, submittal to the FHWA is required for their comments before distribution.

## HD-204.17 SUBMISSION OF RIGHT-OF-WAY PLANS

Final right-of-way plans shall be submitted after the final inspection. Under special circumstances and with approval from the Director of the Division of Highway Design, right-of-way plans can be submitted prior to final inspection. At the time of submission, the final design needs to be complete enough to ensure that adequate right of way or easements are available for side slopes, drainage structures, signs, utilities, waste sites, staging areas, MOT, etc.

**HD-1305** and **HD-1306** provide more information on right-of-way submittal.

## HD-204.18 UTILITY RELOCATION PLANS

The relocation of existing utilities is a primary concern during project development. For utilities to be relocated as part of the highway contract, the PM is responsible for incorporating the final utility relocation plans with the final roadway plans.

When utility relocation is not part of the roadway contract, the PM may determine that it is necessary to include the utility relocation plans in the roadway construction documents for informational purposes only. The Utilities Section in the District Office may be able to assist in providing these utility relocation plans.

## HD-204.19 PERMIT REQUEST FOR WATER-RELATED IMPACTS

Permits are always required for state and federally funded projects that involve waters of the United States (lakes, rivers, streams, or wetlands) in the Commonwealth of Kentucky.

**HD-500** provides more information on permits.

## HD-204.20 ADVANCE FOLDER & FINAL DRAINAGE FOLDER SUBMITTAL

The advance folder should be submitted prior to the delivery of the right-of-way plans after the final inspection report has been approved. The district shall notify the Central Office Drainage Branch when they have completed their review of the advance folder. The Drainage Branch will complete their review. Upon completion of the advance folder, the Drainage Branch shall notify the Division of Structural Design and other pertinent Central Office personnel of the folder's availability. The advance folder is considered the "order form" for the Division of Structural Design to begin structure design. The advance folder should contain any explicit requirements as decided by the PDM and the project team.

The final drainage folder shall be prepared by or submitted to the district prior to the submittal of final plans. The final folder shall be reviewed in the district office prior to submittal to the Drainage Branch.

The final drainage folder shall reflect the recommendations of the review process and becomes the permanent record document for the project drainage plan. It shall contain all required information to support the selection of drainage items proposed on the plans and document final resolution of the drainage inspection comments. Where variations of current practices and standards are incorporated into the drainage plan, those variations shall be fully documented in the final drainage folder.

Chapter 300 of the *Drainage Manual* provides more information and is available online at:

http://transportation.ky.gov/Highway-Design/Pages/Drainage.aspx

**Exhibit 200-09** outlines the drainage review process.

## HD-204.21 REVIEW OF STRUCTURE PLANS

Project managers should review early-stage and final-structure plans to ensure that the structure is in agreement with the intent of the project and does not conflict with other project details (such as utilities, MOT, environmental concerns, etc.).

## HD-204.22 CHECK PRINTS TO PLAN PROCESSING

The project manager shall submit check prints, a cost estimate, and estimated completion date to the Plan Processing Branch of the Division of Highway Design approximately 5 months before the scheduled letting date. The Plan Processing Branch will return the plans with corrections and comments to the project manager for inclusion of appropriate items in the plan set.

## HD-204.23 CONSTRUCTIBILITY REVIEWS

The Constructability Review (CR) Program is managed by the Quality Assurance Branch in the Division of Highway Design. *Constructability* is defined by AASHTO as "a process that utilizes construction personnel with extensive construction knowledge early in the design stages of projects to ensure that the projects are constructible, while also being cost effective, biddable, and maintainable." A CR allows those with construction expertise to examine design decisions and provide advice in construction phasing, traffic control, ease of construction, environmental considerations, and construction scheduling. The goal of this program is to minimize the need for costly change orders that result from design errors and omissions and to evaluate the “buildability” of the record plans prior to letting. To obtain maximum benefits from CR, the review should occur at key stages of the design process. Project managers are encouraged to utilize CRs.

All KYTC projects are eligible to be reviewed for constructability issues utilizing the CR Program. The extent of the review will depend on the complexity of the project. Requests for CRs should be submitted directly to the Quality Assurance Branch as early as possible to ensure timely reviews. From that point, the review will be assigned to a CR staff member for commentary. Upon completion of the independent review, a CR report will be generated and sent to the PDM for consideration. Participation from construction personnel is essential as part of the project team throughout the life of a project, and constructability reviews are **not** intended to replace or supplant this participation. The CR program is intended to be an independent resource to the project team to identify issues from a constructability standpoint.

Constructability reviews will focus on the following areas:

- Feasibility of alternatives
- Lessons learned from previous projects
- Potential waste or borrow sites
- Maintenance of traffic (detours, traffic control devices, etc.)
- Staging and phased construction
- Local access during construction
- Schedule
- Bidability
- Drainage issues
- Erosion control and seeding issues
- Future work and maintenance issues

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HIGHWAY Design

*Chapter*

ADMINISTRATIVE PROCEDURES

*Subject*

Consultant Contract Administration

## HD-205.1 OVERVIEW - SELECTION & MANAGEMENT OF CONSULTANTS

Two general types of consultant contracts are available for use: statewide and project-based. Various statewide contracts utilize on-call consultant services and have a predetermined upset limit. Through these contracts on a case-by-case basis, assignments are made for individual projects using letters of agreement. The PDM may choose to use statewide contracts as needed and should coordinate with the statewide contract manager. The notice to proceed on statewide contracts is immediate and consultants can begin work once the assignment has been made by the statewide contract manager. The Division of Professional Service's webpage provides a list of statewide contract managers and other information at:

http://transportation.ky.gov/Professional-Services/Documents/Statewide%20services%20advertising%20schedule.pdf

## HD-205.2 ADVERTISING FOR CONSULTANT SERVICES

When project-based consultant services are necessary to complete the project, the PDM will submit project information to the location engineer for preparing a request for proposals (RFP) for consultant services. The RFP includes, but is not limited to the following:

- County
- Route
- District
- Item Number
- Project Description
- Project Manager
- User Divisions
- Approximate Fee
- Type of Contract

**Note:** Section 15-05.0400 of the *Professional Services Guidance Manual* provides information on the type of contract.

## HD-205.2 ADVERTISING FOR CONSULTANT SERVICES (cont.)

- Purpose and Need
- Scope
- Project Length
- Method of Design
- Available KYTC Studies
- Funding Source
- Deliverables
- Special Instructions
- Project Schedule Milestones
- Environmental Information
- Evaluation factor recommendations (when appropriate)

The location engineer and PDM are responsible for coordinating project information with other divisions to determine services the selected consultant needs to provide. The PDM should include services that may be required from the consultant at a later time for the completion of the project. The location engineer will provide the following information:

- User Division Committee Members
- Prequalification Requirements

Information on prequalification requirements is available at:

http://transportation.ky.gov/Professional-Services/Pages/Prequalified-Firms.aspx

On or before the first Monday of the expected project posting month, the location engineer will forward the required information through the Director of the Division of Highway Design to the Director of the Division of Professional Services. The Division of Professional Services will provide the following information:

- Disadvantaged Business Enterprise (DBE) Requirement
- Procurement Schedule
- Evaluation Factors
- Secretary and Governor's pool members

## HD-205.3 CONSULTANT SELECTION COMMITTEE

In accordance with the *Professional Services Guidance Manual*, Chapter 15-04, "Selection Process," a consultant selection committee determines which consultant will be offered a contract for a specific project. The selection committee comprises five members, including two from the user division, two from the Secretary's pool, and one from the Governor's pool.

## HD-205.3 CONSULTANT SELECTION COMMITTEE (cont.)

**Note:** The procurement and contracting process can take several months, which should be considered by the PDM in scheduling.

## HD-205.4 PRE-DESIGN CONFERENCE

Once a consultant is selected, the PDM arranges a pre-design conference (generally within 10 days of selection) and invites the appropriate SMEs. During the pre-design conference, project data is reviewed to refine the purpose and need of the project, to review the consultant's scope of work, and to discuss proposed work units for the consultant contract. **Exhibit 200-10** provides sample minutes for a pre-design conference.

## HD-205.5 SUBMISSION OF UNITS & NEGOTIATIONS

After the PDM and consultant reach an agreement on the work units and document them on Professional Services web application or the Production Hour Worksheet (**Exhibit 200-11**)**,** both should independently prepare a production-hour estimate for each work unit. If the consultant's production hour estimate is less than 500 hours per discipline, the PDM can negotiate directly with the consultant. For projects in excess of 500 production hours per discipline, the consultant shall submit the independent production-hour estimates to the Division of Professional Services. Unless otherwise directed by the Director of the Division of Highway Design, the PDM shall submit his or her independent production hour estimates to the location engineer for concurrence. The location engineer will forward these estimates to the Division of Professional Services.

The Division of Professional Services will determine which types of negotiations are appropriate and coordinate those negotiations with the PDM and consultant.

The PDM shall ensure that the following items are submitted with the approved production-hour estimate:

- Pre-design conference minutes
- Complete listing of target dates
- Recommended percentages for payment in accordance with the established target dates
- Verification that funding is available
- Type of contract (lump sum, cost plus, etc.)

The Division of Professional Services will use the above information to negotiate a design fee with the consulting engineer.

## HD-205.6 CONTRACT & NOTICE TO PROCEED

After completion of the negotiations, the consultant shall submit the necessary information to the Division of Professional Services. The Division of Professional Services prepares the contract for the consultant's and appropriate Cabinet management's signatures. The Division of Professional Services notifies the consultant of the notice to proceed when the contract is approved. After receiving approval from the Legislative Research Commission (LRC) Contract Review Committee, the Division of Professional Services notifies the consultant of the notice to bill.

## HD-205.7 PAY ESTIMATES & CONSULTANT MONITORING

All services included in the contract performed by consultants will be under the supervision of the applicable PDM. The consultant will submit a pay estimate as progress is made (typically on a monthly basis) using the TC 40-408 form, *Engineering Services Pay Estimate*. The Personal Service Contract (PSC) Invoice Form must be submitted with each invoice. The Division of Professional Services provides specific pay estimate instructions online at:

http://transportation.ky.gov/Professional-Services/Pages/Forms.aspx

The consultant will complete and attach the *Consultant Monthly Report* (**Exhibit 200-12**) to all pay estimate~~s~~ submissions. The first submission of the *Consultant Monthly Report* shall include all established project milestones.

Milestones shall include those provided in the consultant contract and departmental obligations or other items such as time frames expected for outside review that might be on a project's critical path. Inclusion of milestone pages is required with the first submission and when the milestone dates are changed or milestone completions are met. Milestones shall show a date, unless the milestones are not applicable. Milestones that are not applicable should show the date as "not required."

The consultant shall provide statements reporting progress or advising of required actions by KYTC (for example, "Conceptual Design Report submitted June 10 – awaiting approval.") Similarly, the PDM shall provide a response to the information submitted within one week of its receipt and indicate needed actions by the consultant. The History and Project Documentation listing at the back of the monthly report should be used to provide a chronological order of events. If necessary, the consultant or the PDM can include attachments of additional pages. Once items are addressed by both parties, the PDM should approve the *Consultant Monthly Report* and send copies to the consultant, location engineer, and involved KYTC divisions and branches (for example, the discussion of environmental issues should be sent to the Division of Environmental Analysis).

## HD-205.7 PAY ESTIMATES & CONSULTANT MONITORING (cont.)

The *Consultant Monthly Report* is considered supplemental information to the pay estimate submittal. The PDM is responsible for determining if the pay estimate is consistent with the consultant's progress detailed in the report and with the project milestones. If the monthly report notes outstanding issues, the pay estimate can be approved based on the consultant work completed if the work pending (per the monthly report) is not reflected in the consultant's pay estimate. If the pay estimate is consistent with the *Consultant Monthly Report* and the PSC, the PDM should email the pay estimate and supporting documentation for further payment processing to the KYTC Consultant Estimate Accounts group with appropriate signatures and statements of approval. As mandated by KRS 45.453, all invoices should be paid within 30 working days of receipt. The only exception is written notification to the consultant of a problem with the invoice.

A location within ProjectWise under Project Documents can be used to store pay estimates and Consultant Monthly Reports.

## HD-205.8 CONTRACT MODIFICATIONS

It may become necessary to change the amount of work or time allotted in the contract for a project. The PDM and the location engineer should be judicious when requiring additional work that may need additional charges.

After careful consideration of requesting additional work, the same process used to initiate the contract should be used to develop the contract modification. When a contract modification is requested, the consultant shall be responsible for providing a brief explanation (desirably less than one page) for its need. The explanation must be written such that someone not familiar with the project may understand the purpose of the request. It must make clear why the requested work was not covered by the original agreement or in previous modifications Chapter 15-06 of the *Professional Services Guidance Manual* details the policy on contract modifications and is available at:

http://transportation.ky.gov/Organizational-Resources/Policy%20Manuals%20Library/Professional%20Services.pdf

The modification must address whether current contracted dates will be affected by the change and, if so, must provide new projected dates of completion. This information is to be provided to the PDM, who will endorse it to the location engineer and the Division of Professional Services. Timely responses should be made to all requests for contract modifications. A 90-day period must pass between subsequent contract modifications. The consultant should maintain a chronology of all the project's modifications to be submitted with each request.

## HD-205.8 CONTRACT MODIFICATIONS (cont.)

The Division of Professional Services contacts the location engineer and the PDM to advise the contract modification amount. At this time, the PDM communicates with divisions affected by the proposed contract modification (such as the Divisions of Environmental Analysis, Structural Design, etc.) to ascertain additional funding that may be required to facilitate the additional work. The location engineer should advise the PDM to consider funding needs of other agencies.

If current funding will not cover the added expenses, the PDM completes the *Request for Funding Authorization* form (**Exhibit 200-02**) indicating the need for additional funds. The PDM develops a spend-down plan for funds required. The *Request for Funding Authorization* form and the spend-down plan are transmitted to the location engineer for review and forwarding to the Division of Program Management. See **HD-202.5** for more information on requesting funds.

The Division of Program Management will review the request. If the additional funds are approved, the Division of Program Management will issue a TC 10-1 form, *Project Authorization*, for the additional funds, and send a copy to the Division of Professional Services, the location engineer, and the PDM.

Upon receipt of the TC 10-1 form, the Division of Professional Services will prepare the contract modification and solicit the appropriate signatures for submittal to LRC.

## HD-205.9 CONSULTANT EVALUATIONS

It is necessary to evaluate the consultant's performance at appropriate milestones (such as conceptual design approval, joint inspection approval, and contract plan submittal). Forms and instructions for evaluations are available on the Division of Highway Design’s intranet website at:

https://intranet.kytc.ky.gov/org/DHD/Pages/default.aspx

The location engineer and the PDM, with input from SMEs, shall complete independent evaluations as needed for the appropriate disciplines. Consideration should be given for items like pay estimates, DES, constructability reviews, check prints, inspection minutes, etc. The evaluation comments section should reflect reasons for scores on an evaluation, such as the degree of complexity of a project. When completed, the Roadway Design Branch Manager shall provide the consultant with the evaluation. If the consultant disagrees with the rating, he or she may request an appeal within 30 days through the Director of the Division of Highway Design. The director will discuss the evaluation with the project manager and location engineer and assess whether a reevaluation is warranted. If applicable, the director will communicate reevaluation results to the consultant.

## HD-205.10 CLOSEOUT OF CONSULTANT PROJECTS

The project closeout process is the responsibility of the respective location engineer and should ensure all contract deliverables are met, including the final drainage folder. The closeout process should begin with the award of the contract for construction. Soon after the award, the project manager should request a final pay estimate.

## HD-205.11 FINAL PAY ESTIMATE

Final pay estimates must be submitted by the PDM or project manager to the Division of Professional Services using the TC 40-408 form, *Engineering and Engineering Related Services Pay Estimate,* and a copy forwarded to the Roadway Design Branch Manager.

For remaining encumbrances being liquidated, the consultant should send a letter stating all work is complete and that no additional changes will be made. For example, for geotechnical work that is not billed 100 percent in a lump sum contract, a copy of the final geotechnical project charges and work performed should be submitted with the letter.

In addition, if available budget funding is negative, a funding request must be sent to the Division of Program Management. The funding request should be sufficient to cover the negative amount.

Upon receipt of the final pay estimate, the Roadway Design Branch Manager will request an evaluation from the location engineer. The average of district and Central Office evaluations shall become the final rating for the consultant's performance. The Roadway Design Branch Manager will notify the consultant with a copy to the PDM, summarizing the evaluation and the average final rating. The Roadway Branch will also notify Professional Services of the scores stating the all “design” work for the project has been completed by the consultant and no further charges are needed. When applicable, also request that the design phase program be closed once payment is made.

Cost-plus contracts require an audit before being closed by the Division of Professional Services.

The Division of Professional Services provides specific pay estimate instructions online at:

http://transportation.ky.gov/Professional-Services/Pages/Forms.aspx

## HD-205.12 CHECKLIST FOR CLOSING CONSULTANT CONTRACT

The project manager and location engineer may use the following checklist in preparation for consultant design contract close-out.

- Has all "design" work been accomplished? --Determination made by Location Engineer and or Project Manager after conferring with all appropriate Central Office divisions. (For example, Divisions of Highway Design, Structural Design, and Environmental Analysis and Geotechnical Branch)

- Are there consultant contract modifications not completed? (For example, Divisions of Highway Design, Structural Design, and Environmental Analysis and Geotechnical Branch)

- Have all necessary consultant evaluations been completed? (For example, Divisions of Highway Design, Structural Design, and Environmental Analysis and Geotechnical Branch)

- Has an audit of cost plus components of the consultant contracts been issued by the Division of Professional Services?

- Have all payments been processed?

There is also a checklist on Roadway Design's intranet site.

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*Chapter*

ADMINISTRATIVE PROCEDURES

*Subject*

Maintenance of Traffic

## HD-206.1 OVERVIEW

During preliminary line and grade inspection, the project team considers and discusses potential traffic control schemes for each alternative and addresses this discussion in the inspection report. The designer should develop detailed construction phasing plans of the preferred alternate for review at the joint inspection. Traffic control schemes should be developed and included as drawings and notes on temporary traffic control sheets within the plans. The traffic control plan (TCP) shall be developed using the current editions of the *Manual on Uniform Traffic Control Devices* (MUTCD), *Standard Specifications for Road and Bridge Construction*, and *Standard Drawings* as a basis.

## HD-206.2 TRAFFIC CONTROL PLAN (TCP)

The TCP should outline specific requirements for proper maintenance and control of traffic.

The TCP will vary in scope depending on the size and complexity of the project. Some projects will require site-specific phasing of construction activities to allow for continuous safe passage of the traveling public. Other projects may only require a reference to established documents such as the Standard Drawings and the MUTCD. To ensure consideration is given to traffic control, the proposed concept should be discussed at the preliminary line & grade inspection. With the recommendations made, the designer should develop the TCP in conjunction with a construction phasing plan and present it for further review at the final inspection meeting. At this time the project team should carefully consider the TCP to clearly identify concerns that may be addressed in final plan production. A “Maintenance of Traffic” section should be developed within the plans and include the TCP and pertinent information from the public information plan (PIP).

The TCP should outline time or construction limitations. Liquidated damages may be utilized by the project team to encourage compliance when deemed appropriate.

## HD-206.2 TRAFFIC CONTROL PLAN (TCP) (cont.)

Developing strategies that limit impact to the traveling public is encouraged. If practical, the existing number of lanes should be maintained throughout a construction project, particularly on interstates and other major routes. If lane restrictions are necessary, options that limit closures should be considered. Some considerations for these decisions may include restricting work during peak periods of traffic flow and the use of nighttime construction or other innovative methods. In unison with Section 105, "Cooperation by Contractor," of the *Standard Specifications for Road and Bridge Construction*, the TCP should also consider other adjacent roadway sections that may be under construction and avoid conflict between competing phases of adjacent projects.

### HD-206.2.1 Traffic Impact Guidelines

When developing the TCP, the following traffic impact guidelines should be utilized:

**Interstate Projects**

1. Expected queue length due to lane closures should be analyzed and should not exceed 3 miles more than what would normally be expected without the construction project.
2. 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.
3. User costs should be analyzed and the use of incentives/disincentives (**HD–204.11.2**) should be considered to encourage timely completion of the total project or critical phases.

**Non-Interstate Projects**

1. Expected queue length due to lane closures should be analyzed and should not exceed 3 miles more than what would normally be expected without the construction project.
2. Total closures of a segment should not be considered unless there is a detour available that can handle the expected increased traffic. Adverse travel should not be excessive and should be kept to a minimum whenever practical.

### HD-206.2.2 Work Vehicles & Equipment

When developing a TCP, project teams should address issues such as ingress and egress for work vehicles, equipment, and material deliveries. The project team should refer to the current editions of the MUTCD *Standard Drawings*, and Standard *Specifications for Road and Bridge Construction* for additional guidance.

### HD-206.2.3 TCP Review

The project team should review and discuss appropriate documentation for the TCP. When a traffic management plan (TMP) is utilized, the final TCP should be incorporated in the TMP.

## HD-206.3 TRAFFIC MANAGEMENT PLAN (TMP)

For the purposes of traffic management plans, projects are separated into two classifications: significant and other.

Significant projects are defined as follows:

- Any project on the interstate system which is anticipated to occupy a location for more than 3 days
- Any project on a multilane roadway which is anticipated to occupy a location for more than 3 days where the existing DDHV is over 1,000 vehicles per hour and would close a lane during the peak hours
- Any project on a 2-lane roadway which is anticipated to occupy a location for more than 3 days where the existing DHV is over 1,000 vehicles per hour and would close a lane during the peak hours
- Any project on the Interstate or National Highway System that would involve a detour

For significant projects, a TMP (**Exhibit 200-13**) includes a TCP and a PIP. The PDM should work closely with the district public information officer (PIO) and the district project delivery and preservation (PD&P) staff to provide accurate and timely information to the public. The TMP shall be approved by the PDM, the Project Delivery and Preservation Branch Manager, and the Engineering Support Branch Manager (and FHWA on interstate or oversight projects.). A copy should be provided to the location engineer.

For other projects, the TMP will only consist of a TCP unless the project team determines that a PIP is necessary.

Major revisions of the TMP at any point during the life of the project (pre- and post-letting) require review and approval by the signatories. This documentation should be placed in the project file within the district, with a copy to the location engineer.

### HD-206.3.1 Traffic Control Devices & Pavement Markings

The PDM is responsible for the development or coordination of all temporary striping plans and the use of pavement markings if required for the project. **HD-1201** provides more information on pavement markings. Coordination with the district traffic engineer and the Division of Traffic Operations is imperative in the development of the TCP or TMP, especially on projects with signalized intersections. All other traffic control devices deemed necessary for the TCP should be established and quantified for the project. **HD 206.7**, "Maintenance of Traffic Bid Items," provides additional information.

### HD-206.3.2 Diversion Geometric Design

On-site diversions should desirably adhere to the standards, design speed, and pavement widths present on the existing facility. When this is not feasible, the appropriate speed warning signs should be included in the traffic control plan. Additional advanced warning devices may be desirable and the PDM may elect to enhance the traffic control devices if the situation warrants such enhancements.

### HD-206.3.3 Detours

Considerations for projects involving road closures include the length and condition of the detour route, weight limits of structures, and costs of conditioning and maintaining the detour route. A detour map will be included in the plans showing required detour routes and signs. Project plans should delegate the responsibility for posting the project's detour signs.

### HD-206.3.4 Positive Protection and Separation Devices

In some highway work zones, separation devices or positive protection devices may be beneficial. Positive protection devices are defined as devices that contain and/or redirect vehicles. Separation devices typically do not have redirecting capabilities. However, both should meet the crashworthiness evaluation criteria contained in AASHTO's *Manual for Assessing Safety Hardware (MASH), 2009*. Specification details for the type of devices available and typical placement schemes are available in the MUTCD, *Standard Drawings*, *Standard Specifications for Road and Bridge Construction*, and *AASHTO's Roadside Design Guide*. Positive protection devices in highway work zones are intended to minimize or reduce the risk of worker exposure to motorized traffic and to emphasize road user safety. Under conditions deemed short term or mobile in nature, the project team should evaluate the risk of placement of temporary barrier walls in lieu of portable channelization devices combined with "truck mounted attenuators" or other mobile crashworthy devices.

### HD-206.3.5 Exposure Control Measures

Exposure control measures are defined as traffic management strategies implemented to avoid work zone crashes involving workers and motorized traffic by eliminating or reducing traffic through the work zone, diverting traffic away from the work space, or reducing the time to construct. Exposure control measures shall be considered where appropriate while providing adequate consideration to the potential impacts on mobility. A wide range of measures may be appropriate for use on individual projects, such as:

- Full road or ramp closures
- Median crossovers
- Full or partial detours or diversions
- Protection of work zone setup and removal operations using rolling road blocks
- Performing work at night or during off-peak periods when traffic volumes are lower
- Accelerated construction techniques

## HD-206.4 GUIDANCE FOR THE USE OF UNIFORMED LAW ENFORCEMENT OFFICERS (LEOs) IN HIGHWAY WORK ZONES

A number of conditions may indicate the need for uniformed LEOs in highway work zones. The presence of uniformed LEOs and marked law enforcement vehicles in view of motorized traffic on a highway project may benefit driver behavior and alertness, helping to maintain appropriate speeds within the highway work zone.

The use of uniformed LEOs to assist in the maintenance of traffic for highway construction and maintenance work zones is considered on a project-by-project basis. Specific conditions include, but are not limited to, the following:

- Workers are present adjacent to high-speed traffic without positive protection devices.
- Traffic control setup or removal presents significant risk to workers.
- Complex or very short-term traffic pattern changes create significant potential for road user confusion.
- Night operations create substantial safety risks.
- Existing conditions or crash history indicates a potential for safety or congestion impacts that can be improved with driver awareness.
- Operations that require stoppage of traffic.
- High-speed roadways where traffic queuing is anticipated to extend a considerable distance from the work zone.
- Other site conditions where traffic poses a high risk for workers and road users.

## HD-206.5 ROADSIDE DESIGN IN WORK ZONES

The forgiving roadside concept as discussed in AASHTO's *Roadside Design Guide* should be applied to all work zones as appropriate for the type of work and to the extent roadside conditions allow. Due to the limited horizontal clearance available and the heightened awareness of motorists through work zones, clear-zone requirements should be more flexible than those for permanent conditions.

Engineering judgment must be used in applying clear zone concepts to the work zones. Whenever feasible, determination of the width of a work zone's clear zone should be based on the following:

- Traffic speeds and volumes
- Roadway geometrics
- Available right-of-way width
- Cost
- Duration of work, whenever feasible

Depending on site restrictions, it may be feasible to provide only an operational clearance. AASHTO's *Roadside Design Guide* provides specific information for determining clear zones in work zones.

Pavement edge drop-offs may occur during highway work. When not properly addressed, drop-offs may lead to the loss of control of an errant vehicle and the potential for a serious crash.

No vertical drop-off greater than two inches should occur between adjacent lanes where traffic is expected to cross in a lane-change maneuver. Warning signs should be placed in advance of the area in accordance with the MUTCD.

When contending with pavement edge drop-offs in construction zones, the designer should consider the following guidance:

- **Less than two inches**—no protection required

  **Note:** Warning signs should be placed in advance of and throughout the drop-off area.

- **Two to four inches**—plastic drums, vertical panels, or barricades every 100 feet on tangent sections for speeds of 50 mph or greater

  **Note:** Cones may be used in place of plastic drums, vertical panels, or barricades during daylight hours. For tangent sections with speeds less than 50 mph and for curves, devices should be placed every 50 feet. Spacing of devices on tapered sections should be in accordance with the MUTCD.

## HD-206.5 ROADSIDE DESIGN IN WORK ZONES (cont.)

- **Greater than four inches**—positive separation or wedge with 3:1 or flatter slope needed

  **Note:** Place channelizing devices along the traffic side of the drop-off and maintain, if practical, a 3 feet wide buffer between the edge of the travel lane and the drop-off. If the drop-off is greater than 12 inches, positive separation is strongly encouraged. If concrete barriers are used, special reflective devices or steady-burn lights should be used for overnight installations.

For temporary conditions, drop-offs greater than four inches may be protected with plastic drums, vertical panels, or barricades for short distances during daylight hours while work is performed in the drop-off area.

Flare rates for temporary barriers should be selected to provide the most cost-beneficial safety treatments possible. Benefit/cost analyses of temporary concrete barriers indicate that total accident costs appear to be minimized for flare rates ranging from 4:1 to 8:1.

AASHTO's *Roadside Design Guide* and the *Standard Drawings* provide specific information about roadside design in work zones.

## HD-206.6 PEDESTRIAN ACCOMMODATIONS IN THE WORK ZONE

Pedestrian flow along roadways must be considered in the TMP. When there is obvious evidence of pedestrians within a proposed work zone, the project team should discuss their presence and determine if a custom TCP should be developed with explicit direction of how to phase pedestrian traffic when pedestrian facilities are impacted. It may be more beneficial to allow district PD&P staff along with the contractor to develop the plan based on their agreed construction phasing plan. The PDM will ultimately determine how to address pedestrian traffic in the work zone. In accordance with Chapters 6D, 6F, and 6H of the current edition of the MUTCD, it is the general view of KYTC that pedestrian access in a work zone shall be provided. The provided access shall replicate as nearly as practical the existing pedestrian facility, including ADA-compliant ramps where necessary. Occasionally, work zones may necessitate closure of the pedestrian facility. When this occurs, appropriate detouring or construction of a temporary pedestrian facility should be provided to maintain mandatory access. The following statement should be inserted into the MOT's "General Notes" for projects where pedestrian access is not restricted:

## HD-206.6 PEDESTRIAN ACCOMMODATIONS IN THE WORK ZONE (cont.)

**Pedestrian Consideration:**
Take note of obvious evidence of pedestrian use within the project limits. Evidence may consist of pedestrians moving along the roadway on a permanent or non-permanent pedestrian facility. If pedestrians are present the Contractor shall comply with the *Manual of Uniform Traffic Control Devices*, current edition, chapter 6D, 6F and 6H. If pedestrians are present, the pedestrian access shall remain available at all times, either by reasonable detour or diversion. The temporary facility must replicate the existing facility as nearly as practical including ADA compliance where necessary. Appropriate signage for the control of pedestrian access will be measured and paid under the bid item “Temporary Signs”. Payment for construction, maintenance and subsequent removal of the temporary facility or detour and all other incidentals shall be included in the bid item “Maintain & Control Traffic”.

## HD-206.7 MAINTENANCE-OF-TRAFFIC BID ITEMS

The designer is encouraged to read the *Standard Specifications for Road and Bridge Construction* to become familiar with requirements for each bid item. Section 112 specifically involves maintenance-of-traffic issues. Bid items for the TCP should be established in conformance with this section and in compliance with the MUTCD and *Standard Drawings*.

All projects shall include a bid item for "Maintain and Control Traffic." The unit shall be lump sum. All traffic control items shall be bid in accordance with Section 112 of the current edition of the *Standard Specifications for Road and Bridge Construction*.

All roadway projects that contain diversions in the plans shall include a bid item for each diversion. The lump-sum bid item includes all necessary grading, culverts, and bridges to construct the diversion and shall include removal per the *Standard Specifications*. Earthwork shall be computed for all diversions shown on the plans, and quantities of excavation and embankment are noted on the plans for the contractor's information only. These quantities should not be included in the pay items for earthwork. Drainage structure openings are noted in square feet for the contractor's information. The *Drainage Guidance Manual* details the proper sizing of drainage structures for a diversion.

## HD-206.7 MAINTENANCE-OF-TRAFFIC BID ITEMS (cont.)

As TCPs become more extensive and complex, separate pay items may be required. These pay items apply to traffic signals, stationary signs, flashing arrows, temporary barrier walls, temporary guardrail, temporary crash cushions, temporary pavement markers, temporary striping, and other items as needed. If their use evolves in future construction phases, the designer should consider bid items needed for relocating the above features when detailed on the maintenance-of-traffic plans. In addition to the “Maintain and Control Traffic” item, other pay items may include variable message signs and other special or unusually expensive items unique to the project.

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HIGHWAY Design

*Chapter*

ADMINISTRATIVE PROCEDURES

*Subject*

Miscellaneous Administrative Issues

## HD-207.1 QUANTITY & FUNDING BREAKOUTS

When a roadway project crosses boundaries, such as county or rural-urban, funding separations may be required. Federal project funds are separated by county or by rural-urban boundaries, with different federal project numbers when two or more are required, and by participating (eligible for federal funds) and nonparticipating (not eligible for federal funds) quantities when applicable.

A roadway project crossing county boundaries requires separation of funds. All boundary lines are tied to the project centerline by station and bearing. Quantities are separated and summarized for each section.

When FHWA declares expenditures on a federal-aid project nonparticipating, notify the Office of Program Management and the Division of Accounts. When the department retains salvageable material, federal participation decreases the cost of dismantling by the value of the salvaged materials.

## HD-207.2 REMOVAL ITEMS

Items included in the description of “Roadway Excavation” in the *Standard Specifications for Road and Bridge Construction* should not be included as separate bid items on plans, but noted as "Remove." *Standard Specifications for Road and Bridge Construction* are available at:

http://transportation.ky.gov/Construction/Pages/Kentucky-Standard-Specifications.aspx

## HD-207.3 ROCK QUANTITIES

The designer should determine the quantities of rock available from roadway excavation and the quantity needed for rock roadbed, embankment, and channel lining class IV. The Division of Structural Design’s *Geotechnical Manual* provides forms and outlines procedures to follow to determine accurate quantities. This manual is available online at:

http://transportation.ky.gov/Organizational-Resources/Policy%20Manuals%20Library/Geotechnical.pdf

## HD-207-4 EMBANKMENT IN PLACE

"Embankment in Place" is the preferred bid item any time additional material (borrow excavation) is needed for embankment construction, including hydraulic embankments, except when unusual circumstances may dictate otherwise.

## HD-207.5 CHANNEL LINING CLASS IV

Channel lining class IV is a separate direct pay item. In addition, after determining the quantity of material, that quantity is included in the project's "Roadway Excavation" or "Embankment in Place," as applicable.

## HD-207.6 EARTHWORK CALCULATIONS

The designer should provide an approximate "balanced" grade; however, some situations preclude this possibility. The pay items for earthwork are "Roadway Excavation" or "Embankment in Place" and are the design quantities. Earthwork calculations on summary sheets shall show the distribution of various quantities for the entire project. It does not matter whether the pay item is “Roadway Excavation” or “Embankment in Place,” except when involving large quantities of rock excavation. Common excavation is the material above the rock disintegration zone (RDZ) line when one is present, or above the solid rock line when indicating no RDZ on the cross sections. Summary sheets should note that the estimate for earthwork calculations is for information only. Assumptions for shrinkage and swell factors are the contractor's responsibility.

On projects requiring alternate pavement designs, variations in earthwork quantities should be documented.

## HD-207.7 WATER FOR DUST CONTROL

Water, as a contract bid item, is used for the control of dust created partially or entirely by the traveling public. Water used for the control of dust created by the contractor or used to obtain compaction is considered incidental to construction.

## HD-207.8 FILLING & CAPPING

A bid item must be established for filling and capping wells, manholes, catch basins, etc. Structures under 24 inches in diameter will be itemized as "each." The units for structures 24 inches and over will be square yards. All structures are plotted and appropriately noted on the plans.

## HD-207.9 ENTRANCES

Plan notes for the construction of entrances should include the width, type, and area in square feet but shall not contain the word *private.*

## HD-207.10 DIVIDE OR BREAKOUT PROJECT SECTIONS

Sometimes it is necessary to divide a project into smaller design, right-of-way, or construction sections. Descriptions, mile points, and phase costs for each section should be provided to the Division of Program Management.

## HD-207.11 STRUCTURES

Consultant-developed structural designs for bridges, box culverts, tunnel liners, retaining walls, and noise barriers will be submitted to the Division of Structural Design for review and approval. For department projects, the project manager shall furnish all necessary data to the Division of Structural Design for analysis and design.

## HD-207.12 FARM UNDERPASSES & OVERPASSES

Farm animal underpasses and overpasses are a right-of-way consideration. These structures shall not show on the plans until determined feasible by the Division of Right of Way and Utilities. An estimated cost of the proposed structure should be used to help determine the feasibility.

When one of these structures is to be designed for the project, a separate situation folder for transmittal is submitted to the Division of Structural Design.

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*Chapter*

ADMINISTRATIVE PROCEDURES

*Subject*

# Preparation of Contract Roadway Plans

Contract plan sets are the highway plans awarded through the letting process. The contract plan sets are a product of the project development process and are comprised of the roadway, structures, traffic, and/or utility relocation plans.

The CAD Standards for Highway Plans (version 4.X) establishes the required standards for all electronic files representing submittals of Contract Plans and Proposals to the Kentucky Department of Highways (KDOH). These standards are effective with any new design starts after November 1, 2019 with a Letting Date after November 1, 2020. They may also apply to any older projects that were converted to use OpenRoads Designer as the civil design software package. The primary goal of these standards is to ensure the best possible use of this Electronic Engineering Data (EED) in the review, publication, bidding, construction and archive processes. Specifics for creating and submitting the contract plan set and EED can be found at the following link:

https://transportation.ky.gov/CAD-Standards/Pages/default.aspx

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|---|---|
| | ***Chapter***<br>ADMINISTRATIVE PROCEDURES |
| | ***Subject***<br>Submittal of the Final Contract Plans |

## HD-209.1 SUBMITTAL DEADLINES

Submitting final contract plans on time is essential to prevent scheduling problems and delayed lettings. The project manager shall submit final contract plans to the Director of the Division of Highway Design (with copies of the submittal to the location engineer and the Plan Processing Branch Manager) a minimum of 90 days in advance of all lettings requiring PS&E (plans, specifications, and estimates) and 60 days in advance for all other projects. The Plan Processing Branch shall be advised at that time of any additional information that they will need to be inserted into the plans as identified by the Final Plan Submittal Form (**Exhibit 200-14**).

## HD-209.2 SIGNATURE REQUIREMENTS

All final contract plans shall bear the electronic signature of the State Highway Engineer. Final contract plans prepared by consulting engineering firms shall bear the electronic signature and electronic stamp of the seal of a professional civil or highway engineer licensed by the Commonwealth of Kentucky and his or her digital signature.

## HD-209.3 SUBMITTAL CONTENTS & GENERAL REQUIREMENTS

The PDM or designee includes the following items with the submission of final contract plans to the Central Office Division of Highway Design:

- Final contract plans created and submitted in a full-size PDF as called for in the latest CADD Standards policy as the legally binding set

- A Final Plan Submittal form (**Exhibit 200-14**)

- Information needed to create the proposal, including the following, when applicable:

## HD-209.3 SUBMITTAL CONTENTS & GENERAL REQUIREMENTS (cont.)

- Communicating All Promises (CAP) report (even if the CAP has no entries)
- Final estimate (including all items in the complete contract plans)
- Project construction schedule (fixed completion date or maximum work days)
- Permit/water-quality certification
- Utility impact notes
- Right-of-way certification
- Special provisions for protection of railroad interest
- Project-specific special notes or specifications
- Best Management Practices (BMP) documents
- Notice of Intent (NOI) documents

➢ The supplemental electronic files (delivered via ProjectWise) as required by the *CADD Standards for Highway Plans*

**Note:** There shall be an overt distinction between the files that represent the contract plan and supplemental files. Supplemental files are given for informational purposes only.

➢ On projects with FHWA oversight, the Project Development Checklist (PDC) (**Exhibit 200-15**)

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*Chapter*

ADMINISTRATIVE PROCEDURES

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Design Participation in Construction Phase

## HD-210.1 OVERVIEW

The project manager’s involvement with a project does not end with the letting and award. During the construction of a project, issues often arise that require clarification of the designer’s intent. Unforeseen circumstances may necessitate changes to the original design. Project manager responsibilities include:

- Attending preconstruction meetings
- Assisting with change orders
- Assisting with construction revisions
- Participating in post-construction review

## HD-210.2 PRECONSTRUCTION MEETING

The project manager should attend the preconstruction meeting to explain notes and nonstandard bid items and to report on any important or unusual project information that has occurred during the development of the plans. The project manager should provide updates on right-of-way acquisition, utility relocation, and special environmental concerns. The project manager shall report any special commitments (such as CAPs and environmental mitigation measures) that were agreed to.

## HD-210.3 CONSTRUCTION CHANGE ORDER

The project manager may be asked to review a proposed construction change order and advise the section engineer. He or she may determine if the intent of the original design and conformance to the appropriate design standards are met.

## HD-210.4 CONSTRUCTION REVISION

A construction revision may occur for several reasons. Construction staff may ask project development staff to assist in the development of a revision by providing data files, drawing revisions to plans, reviewing revisions, or advising on design standards.

## HD-210.4 CONSTRUCTION REVISION (cont.)

Project development staff may be asked to arrange project team meetings or coordinate plan revisions. Electronic files of the plan revisions shall be posted in the appropriate project folder in ProjectWise.

## HD-210.5 POST-CONSTRUCTION REVIEW

Annually, the Quality Assurance Branch (QAB) conducts post-construction reviews of projects in each district. Project development staff, the design consultant, construction staff, and the construction contractor meet to discuss issues that occurred on the project. The review takes place near the end of construction or after the project is complete.

Post-construction reviews help to better understand how the design process and design standards can be improved to minimize errors and omissions during construction. Reviews assist to create better designs for future highway projects. The review team develops suggestions on how issues could have been avoided and proposes suggestions for improvements to design standards and processes. QAB staff documents and enters information into the Lessons Learned Database.

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***Chapter***

ADMINISTRATIVE PROCEDURES

***Subject***

Use, Distribution, & Retention of Plans

## HD-211.1 SHOW PLANS

Prior to the letting, an electronic copy of the contract plan is stored in the Transportation Cabinet's file management system for use by the district offices. This plan set is comprised of the roadway, structures, traffic, utility relocation, and/or building plans. It does not contain any addenda.

## HD-211.2 CONTRACT LETTING PLANS

Upon award of the contract, the contract letting plans, which includes the roadway, structures, traffic, utility relocation, and/or building plans with incorporated addenda, shall be marked as "Record Set" and shall be distributed as follows:

- Two contract plan sets are identified as "Contract Letting Plans." The district office receives one full-sized contract letting plan set. The Division of Construction receives a half-size contract letting plan set and a complete electronic contract plan set including supplemental information.

- In addition to the full-size contract plan set noted above, the chief district engineer receives:

    - Two complete, full-size sets
    - Seven complete, half-size sets
    - Two complete, electronic contract plan sets including supplemental information

- An electronic copy of the contract plan set is maintained in the Transportation Cabinet's file management system. The contract plan set shall be moved to an "Awarded" folder in the Transportation Cabinet's file management system.

## HD-211.3 POST CONSTRUCTION

Upon completion of the project, a copy of the plans shall be placed in the Project Archives website, “Project Plan Archive (1909-Present)” at:

http://maps.kytc.ky.gov/photolog/?config=ProjectArchives

## HD-211.4 LOCATION FIELD INFORMATION

The Division of Highway Design shall retain the location field information in the Transportation Cabinet’s file management system. Data collected and stored by electronic data collecting methods (electronic or hard copy) is treated as standard field information.

## HD-211.5 RETENTION SCHEDULE FOR FILES

The Transportation Cabinet Records Retention Schedule provides guidance on the retention of highway design documents and is maintained by the Kentucky Department for Libraries and Archives, Public Records Division. The schedule is available at:

http://kdla.ky.gov/records/recretentionschedules/Documents/State%20Records%20Schedules/kytransportation.PDF

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*Chapter*

ADMINISTRATIVE PROCEDURES

*Subject*

Coordination with Outside Agencies

## HD-212.1 OVERVIEW

The design of a roadway often involves other state, federal, and local agencies. The Project Development Branch Manager (PDM) shall be responsible for ascertaining the extent of other agency involvement and initiating the department's requirement for gaining agreement or cooperation as necessary. Highway design should focus on avoiding and minimizing impacts on public, historic, and natural resources. When these types of resources are impacted, coordination with external agencies is critical and should take place early in the process to help ensure a successful project.

## HD-212.2 NATIONAL PARKS & FORESTS

National parks and forests are under the jurisdiction of the U.S. Forest Service. When these resources are impacted by a transportation project, coordination with the U.S. Forest Service should be initiated through the district environmental coordinator or the Division of Environmental Analysis (DEA).

## HD-212.3 DAMS & JURISDICTIONAL WATERWAYS

Generally, the U.S. Army Corps of Engineers (USACE) and the Kentucky Division of Water (DOW) are involved with projects involving dams and jurisdictional waterways. **HD-502** provides guidance for such projects. Agencies such as the U.S. Coast Guard, Federal Emergency Management Agency (FEMA), and Tennessee Valley Authority may also be involved. Coordination should be initiated through the district environmental coordinator or DEA.

## HD-212.4 AIRPORTS

Highway projects located within two miles of an airport require coordination with the Department of Aviation. Nonfederal airports are under the control of the Department of Aviation.

## HD-212.5 KENTUCKY ENERGY & ENVIRONMENT CABINET (EEC)

Consult the DOW’s Wastewater Branch in the development of plans for projects:

- Involving sanitary facilities for rest areas
- Utilizing combined sewers to outlet highway drainage
- Adjusting or relocating existing sanitary sewers

## HD-212.6 REST AREAS, LOADOMETER STATIONS, & WELCOME CENTERS

Rest areas, loadometer stations, and welcome centers shall be designed for the needs and safety of the traveling public and personnel who staff, operate, and maintain the facilities.

The design of these facilities must be coordinated with other divisions. The Division of Maintenance staffs and operates rest areas. The Department of Vehicle Regulation oversees loadometer stations. The Division of Maintenance and the Tourism, Arts and Heritage Cabinet oversee welcome centers.

FHWA issued a study, FHWA-1P-81-1, on safe rest area planning, location, and design as a general guide and exchange of information. (AASHTO’s *Guide for Development of Rest Areas on Major Arterials and Freeways*).

The Division of Highway Design's current design criteria will govern the design of exit and entrance ramps, pavement, drainage, etc.

## HD-212.7 TRAFFIC COORDINATION WITH CITIES FOR CONSTRUCTION

Construction or reconstruction projects within incorporated city limits should be coordinated with the appropriate city agency.

## HD-212.8 CLOSING OF PUBLIC ROADS & STREETS

The Department of Highways has the authority to close, alter, or relocate any public road or street involved with the construction of a limited access facility. The construction of any state highway that is not a limited access facility requires initiation of legal proceedings by the local governing body having jurisdiction over the street or road to affect such closings. Each district has the responsibility of maintaining a liaison and informing local officials when projects involve limited access facilities. The Director of the Division of Highway Design shall forward the district's report and recommendation along with the director’s recommendations and endorsements to the Commissioner of the Department of Highways.

## HD-212.8 CLOSING OF PUBLIC ROADS & STREETS (cont.)

If closure is endorsed, the director shall include an official order to implement the closure recommendations. The official order should be routed through the Deputy State Highway Engineer for the Office of Project Development, the State Highway Engineer, and the Office of Legal Services for approval.

For projects that require a design public hearing, all design work should be completed with the time necessary for the department to determine its position on the closure prior to the hearing date. On projects that do not require a design public hearing, the department's position on road closures should be determined before approving the plans-in-hand inspection report. Permanent ingress or egress ramps on the state primary road system on fully controlled access facilities shall not be closed, except for repairs, unless a public hearing is first held in the area to be affected by the closing. At least 20 days before the hearing, the department shall advertise in a newspaper of general circulation in the affected area notifying interested persons of the date, time, and place of the hearing.

## HD-212.9 SANITARY LANDFILLS AFFECTED BY HIGHWAYS

When a proposed highway crosses or interferes with a sanitary landfill, the PDM shall furnish applicable information to the Director of the Division of Highway Design by the preliminary line and grade stage. Concurrence and approval of a recommended alignment will not be given until review and consultation with the Solid Waste Branch of the Division of Waste Management, Energy and Environment Cabinet. The review must indicate whether the potential problems of removal and disposal of unsuitable materials and/or relocation of the landfill can be satisfactorily resolved.

## HD-212.10 RETURN OF RECONSTRUCTED FACILITIES TO COUNTY JURISDICTION

If it is desirable to return reconstructed facilities to county jurisdiction, it will be the responsibility of the project development team (PDT) to make this recommendation during the joint inspection. This will require conveying to the county the completed facility, including the right of way, thereby eliminating the responsibility for maintenance by state forces.

When the PDM recommends that the appropriate facilities be transferred to the county, the chief district engineer will be responsible for initiating and coordinating the activities required to transfer these facilities.

## HD-212.10 RETURN OF RECONSTRUCTED FACILITIES TO COUNTY JURISDICTION (cont.)

It is the policy of the Transportation Cabinet to convey to local jurisdictions (county/city) maintenance responsibility and associated rights of way for the following facilities:

- All segments of state roads left to serve as frontage or local access roads following construction
- All frontage or access roads constructed with the new highway
- All segments of local roads that are relocated with the new highway construction, and for which right of way was purchased by the Cabinet
- All segments of sidewalks and multiuse paths (adjacent and nonadjacent)

With the design and construction of any new facility, the functional classification system in the general area affected by the new construction should be reexamined. A determination should be made whether the facilities being replaced are relevant to the state road system as defined by their functional usage.

Before the final inspection, the district office planning engineer, with assistance from the Division of Planning, will prepare a highway systems map of the general area showing the new alignment. At the final inspection, the inspection party reviews each abandoned state road, frontage road, access road, and relocated local road. In addition, a review of newly classified or existing supplemental road facilities is made to ensure it is in the best interest of the Cabinet to convey the facilities to the local jurisdiction. The PDT will make a recommendation accordingly.

The designer shall prepare deed descriptions for right of way for all portions of the state road, access road, frontage road, or local road that lies outside the normal right-of-way limits required for maintenance of the new roadway. The chief district engineer and his or her staff, in consultation with the Division of Planning, will initiate and coordinate the activities required to transfer maintenance responsibilities and associated rights of way for these facilities to local jurisdictions.

## HD-212.11 ACCESS AT STREAMS

During the early stages of plan development, review access to streams. Existing entrances to the area adjacent to streams need to be reconstructed or relocated as appropriate. Use of abandoned roadbeds for access shall be limited to providing reasonable access to the area. Boat launching ramps, parking areas, and access to these facilities may be provided only with an agreement with the Department of Fish and Wildlife Resources.

## HD-212.12 U.S. ARMY CORPS OF ENGINEERS (USACE) PROJECTS

USACE projects involving the relocation, rearrangement, or alteration of any state or county highway requires the approval of the Department of Highways. The *State Highway Engineer Guidance Manual* contains policies and procedures for coordinating these projects.

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**Exhibit 200-01**

# Project Delivery Core Processes

## ("Project ID + Scope" Thru "Road Building" and Maintenance)

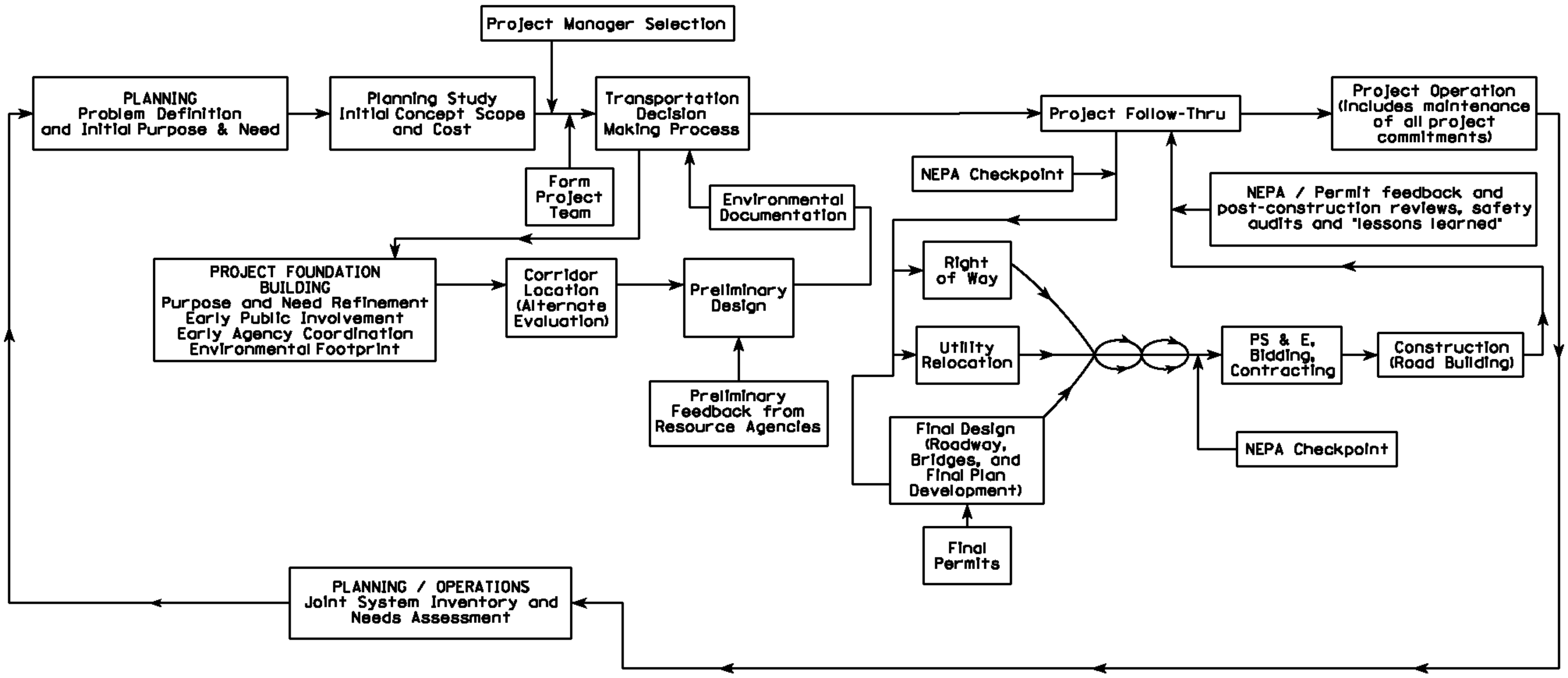


**Exhibit 200-02**

TC 90-122
1/2015

**TRANSPORTATION CABINET**
**DEPARTMENT OF HIGHWAYS**
**DIVISION OF PROGRAM MANAGEMENT**
## REQUEST FOR FUNDING AUTHORIZATION

County McMartin    Road Name KY 12 & KY 99    Project Manager Brad Travis

Six Year Item No 11-155.00    eMars No. 8799901D    Authorization No. ______

Funding: ☐ FHWA    ☑ State    ☐ Local ______    ☐ Other ______

| Project Phase and Responsibility: | | Planning | Design<br>Consultant | Right of Way |
|---|---|---|---|---|
| Utilities | Construction | Title Deeded To | Other | |

| Type of Request and Amount Requesting | FUNDING FOR PHASES INDICATED | Previous Amount Authorized |
|---|---|---|

**PLANNING AND DESIGN**

Initial ● Partial ○ Additional ○
$1,500,000

☐ Special Agreement    ☑ PE & Environmental
☐ Scoping Study    ☑ Phase II Design

Anticipated Environmental Doc.
☑ CE Level 2 or below
☐ Above CE Level 2

**RIGHT OF WAY**

Initial ○ Partial ○ Additional ○

☐ Advance R/W Acquisition

No. of Parcels ______
Acquisition Cost ______
Relocation Cost ______

*Relocation Assistance*
______ Residences ______
______ Businesses ______
______ Miscellaneous ______
______ Grave Relocation ______

☐ Hardship
☐ Corridor Preservation ______
☐ Other ______

| *Parcel No* | *Owner* |
|---|---|
| | |
| | |
| | |

**UTILITIES**

Initial ○ Partial ○ Additional ○

☐ Utility Adjustment
☐ Railroad Adjustment
☐ Railroad Protective Devices

PE ______
Right of Way ______
Construction ______

| *Name of Utilities or Railroad Company* | *Amount* |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

***Applicable when requesting Authorization of Funding:***

☐ *Yes* ☑ *No* R/W Plans submitted to Program Management
☐ *Yes* ☑ *No* Environmental Cleared

| Six-Year Plan Amount | Total Estimated Phase Cost | Phase Cost Overrun/(Underrun) | Percent Overrun/(Underrun) | Projected Phase End Date |
|---|---|---|---|---|
| $2,300,000 | $1,500,000 | ($800,000) | (34.78%) | 6/30/2016 |

***Comments/Remarks:***

District 11 is requesting initial funding to be placed in the D phase in order to advertise for consultant design services. These funds will also include state forces to complet necessary tasks. Preliminary engineering will be advertised and final design may be added by contract modification.

Apr 27, 2014
Date

Brad Travis, PE
Request Submitted by:

Project Spend Down

# Exhibit 200-03

**Item Number:** 11-155.00 **Phase: DESIGN**
**MARS #**
County: McMartin
Job: Reconstruct KY 12 from US 66 to US 88 in Billtown

| DATE | | EXPENDITURE $$$ | Running Total | |
|---|---|---|---|---|
| 2014 | January | | | |
| | February | | | |
| | March | | | |
| | April | | | |
| | May | | | |
| | June | | | |
| | July | $ 75,000 | $ 75,000 | |
| | August | $ 75,000 | $ 150,000 | |
| | September | $ 75,000 | $ 225,000 | |
| | October | $ 75,000 | $ 300,000 | |
| | November | $ 75,000 | $ 375,000 | |
| | December | $ 75,000 | $ 450,000 | |
| 2015 | January | $ 50,000 | $ 500,000 | |
| | February | $ 50,000 | $ 550,000 | |
| | March | $ 75,000 | $ 625,000 | |
| | April | $ 75,000 | $ 700,000 | |
| | May | $ 75,000 | $ 775,000 | |
| | June | $ 75,000 | $ 850,000 | |
| | July | $ 60,000 | $ 910,000 | |
| | August | $ 60,000 | $ 970,000 | |
| | September | $ 60,000 | $ 1,030,000 | |
| | October | $ 60,000 | $ 1,090,000 | |
| | November | $ 75,000 | $ 1,165,000 | |
| | December | $ 75,000 | $ 1,240,000 | |
| 2016 | January | $ 75,000 | $ 1,315,000 | |
| | February | $ 65,000 | $ 1,380,000 | |
| | March | $ 60,000 | $ 1,440,000 | |
| | April | $ 60,000 | $ 1,500,000 | TOTAL |
| | May | | | |
| | June | | | |
| | July | | | |
| | August | | | |
| | September | | | |
| | October | | | |
| | November | | | |
| | December | | | |
| 2017 | January | | | |
| | February | | | |
| | March | | | |
| | April | | | |
| | May | | | |
| | June | | | |
| | July | | | |
| | August | | | |
| | September | | | |
| | October | | | |
| | November | | | |
| | December | | | |

**Exhibit 200-04**

## Example Design Funds Documentation Summary

| | | | | | |
|---|---|---|---|---|---|
| County: | McMartin | District: | 11 | eMars Number: | 8799901D |
| Item Number: | 11-155.00 | | | UPN: | |
| Route: | KY12 & KY99 | | | Federal Number: | |
| Description: | Reconstruct KY12 and KY99 from US66 to US88 in Billtown | | | | |
| Project Length: | | 3.9 | in miles | Type of Project: | Reconstruction (O) |
| Prepared By: | Brad Travis | Date: | April 27, 2014 | Geotech | |

| Line | Unit | Cost Centers | | | Item | Charge Centers | In-House / Consultant | In-House Man-Hours | Total Project Cost |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PM | Surveying | | | N | District | $15,000 | 1,200 | $60,000 |
| 2 | | Design by District Personnel | | | N | District | $40,000 | 0 | $0 |
| 3 | | Public Involvement Program | | | N | District | $2,000 | 0 | $0 |
| 4 | | Design by consultant | | | N | Consultant | $450,000 | | $1,000,000 |
| 5 | | Consultant Supervision by Project Manager (15%) | | | | Consultant/ HDO | $150,000 | 3,000 | $150,000 |
| 6 | DEA | Environmental activities in design | | | N | District/CO | $5,000 | 400 | $10,000 |
| 7 | | Environmental CEMP (CE for minor projects) | | | N | District/CO | $5,000 | 0 | $0 |
| 8 | | Environmental CE Levels 1 & 2 | | | N | District/CO | $15,000 | 0 | $0 |
| 9 | | CE Project Field studies for one study | | | N | District/CO | $13,500 | 0 | $0 |
| 10 | | Programmatic 4(f) issues | | | N | District/CO | $10,000 | 0 | $0 |
| 11 | | EA/FONSI for projects 0-1 mile in length or CE 3 | | | N | Consultant | $250,000 | | $0 |
| 12 | | EA/FONSI for projects 1-5 miles in length | | | N | Consultant | $500,000 | | $0 |
| 13 | | EA/FONSI for projects over 5 miles in length | | | N | Consultant | $850,000 | | $0 |
| 14 | | Environmental EIS | | | N | Consultant | $1,500,000 | | $0 |
| 15 | | Phase II Archeology | | | N | Consultant | $60,000 | | $0 |
| 16 | | Phase III Archeology | | | N | Consultant | $300,000 | | $0 |
| 17 | | Environmental permits (per Nationwide permit) | | | N | District/CO | $3,000 | 0 | $0 |
| 18 | | Mitigation | N | Total acreage: | 0 | Consultant | $72,000 | | $0 |
| 19 | Bridges | Bridge activities in design | | | N | CO | $2,000 | 70 | $3,500 |
| 20 | | Bridges in house design for one span | 0 | Additional spans | 0 | CO | $25,000 | 0 | $0 |
| 21 | | Culverts (single barrel, no bends, no extensions) | 0 | Add. bends: | 0 | CO | $1,000 | 0 | $0 |
| 22 | | Culverts (multiple barrels) | 0 | Add. barrels/bends | 0 | CO | $10,000 | 0 | $0 |
| 23 | | Culverts (extension with one barrel) | 0 | Add. barrels/bends | 0 | CO | $8,000 | 0 | $0 |
| 24 | | Retaining wall | | Total length | 0 | CO | $5,000 | 0 | $0 |
| 25 | | Bridges for one span | 0 | Additional spans | 0 | Consultant | $60,000 | | $60,000 |
| 26 | | Culverts (single barrel, no bends, no extensions) | 0 | Add. barrels/bends | 0 | Consultant | $27,000 | | $0 |
| 27 | | Retaining wall - Consultant | | Total length | 0 | Consultant | $18,000 | | $0 |
| 28 | Geotech | Geotech activities in design | | | N | CO | $6,000 | 800 | $40,000 |
| 29 | | Roadway per mile | 3.9 | Additional mile | 0 | CO | $80,000 | 0 | $0 |
| 30 | | Bridge (base = single span) No. of spans: | 0 | Additional pier | 0 | CO | $25,000 | 0 | $0 |
| 31 | | Culvert core holes | | Length (ft) : | 0 | CO | $16,000 | 0 | $0 |
| 32 | | Retaining Wall | | Length (ft) : | 0 | CO | $23,000 | 0 | $0 |
| 33 | | Landslide Investigation | | | N | CO | $30,000 | 0 | $0 |
| 34 | | Roadway per mile - consultant | 0 | Additional mile | 0 | CO | $176,000 | 0 | $0 |
| 35 | | Bridges core holes - consultant | 0 | Additional piers | 0 | Consultant | $55,000 | | $0 |
| 36 | | Culvert core holes - consultant | | Length (ft) : | 0 | Consultant | $38,000 | | $0 |
| 37 | | Retaining Wall - consultant | | Length (ft) : | 0 | Consultant | $54,000 | | $0 |
| 38 | | Landslide - consultant | | | N | Consultant | $75,000 | | $0 |
| 39 | Design | Central Office Drainage | | | N | CO | $12,000 | 240 | $12,000 |
| 40 | | Central Office Location | | | N | CO | $10,000 | 200 | $10,000 |
| 41 | | Constructability Review | | | N | CO | $5,000 | 120 | $6,000 |
| 42 | | Estimating - charged to OVERHEAD now | | | N | CO | $5,000 | 0 | $0 |
| 43 | | Pavement Design | | | N | CO | $5,000 | 100 | $5,000 |
| 44 | | Phototech - charged to OVERHEAD now | | | N | CO | $5,000 | 0 | $0 |
| 45 | | Plan Processing & Printing | | | N | CO | $10,000 | 200 | $10,000 |
| 46 | | Plans, Specifications & Estimates (PS&E) | | | N | CO | $5,000 | 100 | $5,000 |
| 47 | | Railroad Agreements | | | N | District/CO | $10,000 | 0 | $0 |
| 48 | | Signing Panel Signs | | | N | CO | $1,000 | 0 | $0 |
| 49 | | Survey Coordination | | | N | CO | $5,000 | 0 | $0 |
| 50 | | Value Engineering Projects - NHS | | | N | CO | $60,000 | 0 | $0 |
| 51 | Planning | Basic planning activities in design | | | N | District/CO | $5,000 | 0 | $0 |
| 52 | | Alternate studies by planning in design | | | N | CO/Consultant | $500,000 | | $0 |
| 53a | | Pre-design scoping studies (IPS) | | | N | District/CO | $75,000 | 0 | $0 |
| 53b | | DNA Studies (in-house) | | | N | District/CO | $12,000 | 0 | $0 |
| 53c | | Project specific forecasts for design | | | N | CO/Consultant | $5,000 to $35,000 | 0 | $0 |
| 53d | | Project specific models for design | | | N | CO/Consultant | $25,000 to $150,000 | 0 | $0 |
| 54 | | Safety Analysis | | | N | CO/Consultant | $1,200 to $45,000 | 120 | $6,000 |
| 55 | Other Divisions | Project Delivery & Preservation activities in design | | | N | District/CO | $0 | 120 | $6,000 |
| 56 | | Legal activities in design | | | N | District/CO | $0 | 0 | $0 |
| 57 | | **Right of way activities in highway design** | | | N | District/CO | $4,000 to $400,000 | 0 | $10,000 |
| 58 | | **Utilities activities in highway design** | | | N | District/CO | $4,000 to $400,000 | 300 | $15,000 |
| 59 | | Traffic Operation activities in design | | | N | District/CO | $4,000 | 80 | $4,000 |
| 59 | | Lighting design | | | N | CO | $12,000 | 240 | $12,000 |
| 60 | | Signal design | | | N | District/CO | $6,000 | 120 | $6,000 |
| 61 | | Man-Hour Cost (average) | $50 | $ / hour | | | Total Man Hours | 7,410 | |
| | | | | | | | Total Project Cost (based on hourly estimate) | $370,500 | $1,430,500 |

# Exhibit 200-05

## PROJECT AUTHORIZATION

PACKET ID: PMT-KEPB

| CONTRACT ID | EMARS PROGRAM CODE | AUTHORIZATION NO: |
|---|---|---|
| | 1169601D: $250,000.00 | 11696 0 |

It is hereby ordered that the project herein described be undertaken and accomplished within the funding level authorized.

| PROJECT ID | PROJECT ID NUMBER | FEDERAL PROJECT NUMBER | 6 YR PLAN ITEM NUMBER | 6 YR PLAN ITEM PARENT NUMBER |
|---|---|---|---|---|
| | 093 071 011-025 | 0711125 | 5-9020 | 99-911.08 |

| PROJECT TYPE | PROJECT LENGTH | NUMBER OF BRIDGES | SYSTEMS |
|---|---|---|---|
| 089-ROADWAY SAFETY-M&P | MI | | |

| | | | | |
|---|---|---|---|---|
| PROJECT PHASE & RESPONSIBILITY | PLANNING | DESIGN | RIGHT OF WAY | UTILITIES |
| | | DOH/CONSULTANT | | |
| | CONSTRUCTION | TITLE DEEDED TO: | MAINTENANCE | OTHER |
| | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FUNDING & TIME ACCOUNTABILITY | PARTICIPATING AGENCIES | | | | | | | |
| | FEDERAL | FHWA | STATE | DOH | LOCAL | | OTHER | |

**REQUESTED FUNDS FOR THIS AUTHORIZATION**

| ITEM NUMBER | PHASE | FUND | PROGRAM | FISCAL YEAR FEDERAL | FISCAL YEAR STATE | FEDL APPR CODE | CURRENT FUNDING REQUEST |
|---|---|---|---|---|---|---|---|
| 5-9020.00 | D | 1100 | FD52 | | 2020 | | $25,000.00 |
| 5-9020.00 | D | 1200 | FD52 | 2020 | 2020 | MS3E | $225,000.00 |

Current Funding Request Total: **250,000.00**

**AUTHORIZATION SUMMARY FOR THIS 10-1 SERIES**

| PHASE | TOTAL AUTHORIZATION TO DATE (INCL. CURRENT REQUEST) |
|---|---|
| Planning | $0.00 |
| Design | $250,000.00 |
| Right-of-Way | $0.00 |
| Utilities | $0.00 |
| Construction | $0.00 |
| Non-Highway | $0.00 |
| **Total:** | **$250,000.00** |

**REMARKS:** THIS AUTHORIZATION PROVIDES INITIAL $225,000 FD52 HSIP DESIGN FUNDS FOR THE PROJECT, $25,000 STATE FUND MATCH.

**Project Approval Recommended By:**

State Highway Engineers Office , Date

**Signed and Approved By:**

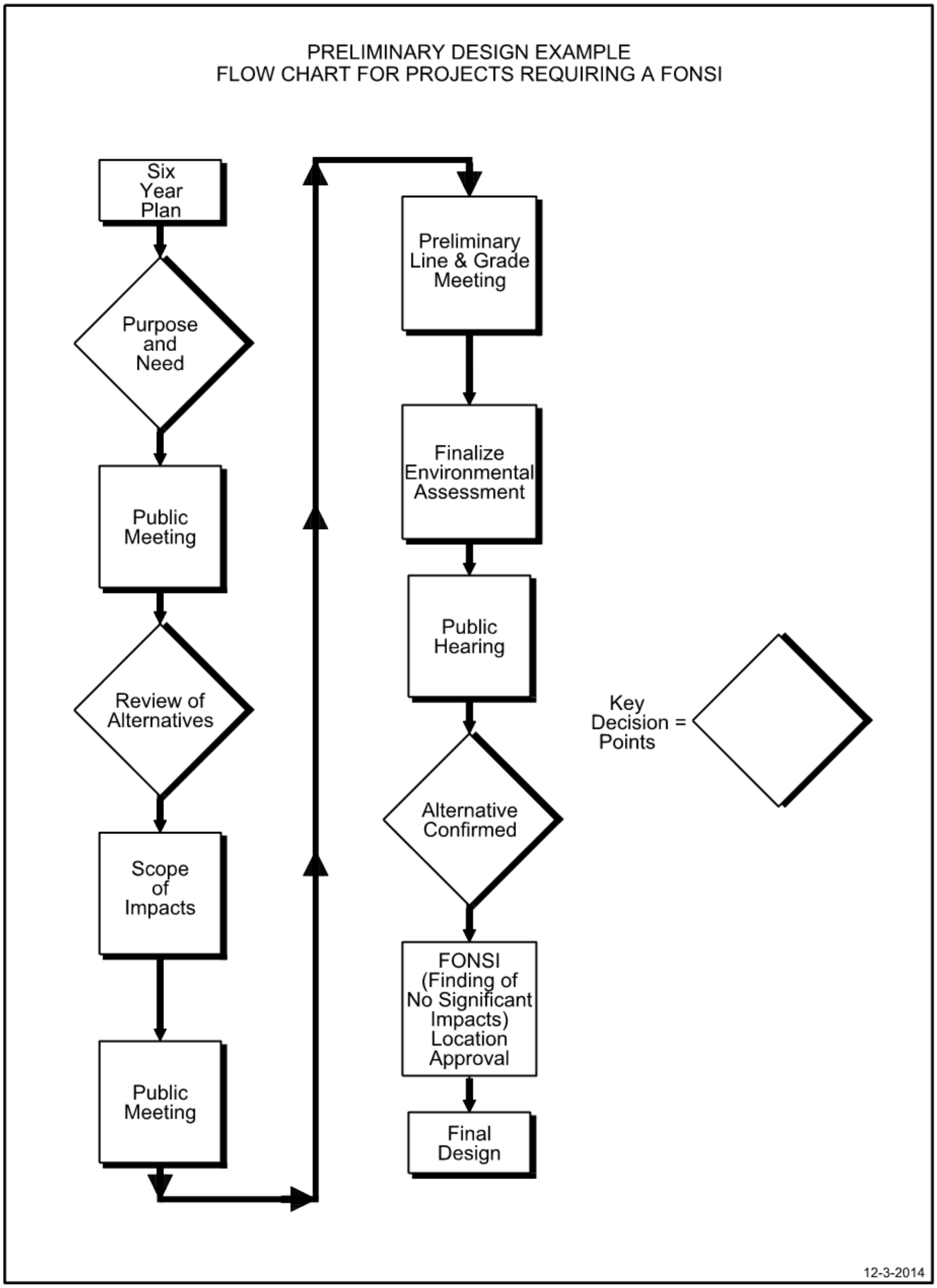
State Highway Engineer , Date

**AUTHORIZATION LOCATION**

| ITEM NUMBER | COUNTY | DIST | FACILITY NAME | ROUTE | LENGTH | SCOPE |
|---|---|---|---|---|---|---|
| 5-9020.00 | Oldham | 5 | I-71 | I 71 | 11.315 - 24.727<br>(13.412 ) | STUDY, DESIGN, AND CONSTRUCT SAFETY IMPROVEMENTS ALONG I-71 IN OLDHAM COUNTY. (2018BOP) |

Page 1 of 1

Preliminary Design Example Flowchart for Projects with a FONSI **Exhibit 200-06**



## WATER RELATED IMPACTS SUMMARY

| | | | | | |
|---|---|---|---|---|---|
| **County** | Sampson | **Route No.** | KY 900 | **Item No.** | 1-315.00 |
| **Date** | 9-12-2014 | **Program #** | 8689901D | | |
| **Federal Project No.** | | | | | |
| **State Project No.** | 108 0900 016-020 | | | | |
| **Location Engineer** | Sarah Kate Bradley | | | | |

### Section 1: Impact Checklist

Complete this section for each alternative considered at the conclusion of Phase 1 design.

**Alternate 1**

| FLOODPLAIN IMPACTS | | |
|---|---|---|
| **FEMA Study Type** | **Yes** | **Community No.** |
| Detailed FEMA Study with delineated floodway* | X | 21213C, 29003C |
| Detailed FEMA Study without delineated floodway* | | |
| Approximate FEMA Study | | |
| No FEMA Study | | |
| * May require initiation of the map revision process if impacts to water surface elevations cannot be avoided. Potential impacts to floodplains and/or floodways shall be assessed early in the project. Refer to Sections DR 203 and DR 204 of the Drainage Manual. | | |

The project is located on the FEMA Flood Map Panel 21213C0225C (Sampson County) & FEMA Flood Map Panel 29003C0225C (Allen County) and the project is in a "Zone A" flood area.

| SIGNIFICANT RESOURCE IMPACTS | | | | |
|---|---|---|---|---|
| Are open sinkholes impacted?<br>If so, how many sinkholes are impacted? | Yes | | No | X |
| Are wetlands impacted?<br>If so, how many total acres are estimated? ______ acres | Yes | | No | X |
| Are any of the streams in the project area designated "Special Use Waters" (e.g. Wild Rivers, Exceptional Waters, Outstanding State Resource Water, etc.)? | Yes | | No | X |
| | | | | |

Where possible, alignments should be developed that avoid significant resources. When it becomes impossible to avoid a significant resource, the project should be designed to minimize these impacts. Significant resource impacts are discussed in DR 202 of the drainage manual. Wetland impacts and their costs are also discussed in DR 500 of the Drainage Manual.

Projects that impact special use waters may require an individual KPDES Erosion Control Permit. Contact the Division of Environment analysis for more information.

| **STREAM CHANNEL IMPACTS** | | | | |
|---|---|---|---|---|
| Will stream relocations (channel changes) be needed?<br>If so, how many total linear feet are estimated? ______ LF | Yes | | No | X |
| | | | | |
| Will new culverts or culvert extensions be constructed?<br>If so, how many total linear feet are estimated? _1300_ LF | Yes | X | No | |
| | | | | |
| Will temporary stream crossings be needed? | Yes | | No | X |
| | | | | |
| Will excess material sites that require permitting be needed? | Yes | | No | X |
| | | | | |
| Will bridges be constructed? | Yes | X | No | |

On highway projects that involve stream crossings such as bridge and culverts, it is often not feasible to totally avoid stream channel impacts. In these cases, design the project to minimize the impacts. Stream relocations should be avoided if possible. If stream relocations are unavoidable design to project to minimize their impacts. Stream channel impacts are discussed in DR 506, 601-3, 608-2, and 802-3 of the drainage manual.

**Alternate 1A**

| **FLOODPLAIN IMPACTS** | | |
|---|---|---|
| **FEMA Study Type** | **Yes** | **Community No.** |
| Detailed FEMA Study with delineated floodway* | X | 21213C, 29003C |
| Detailed FEMA Study without delineated floodway* | | |
| Approximate FEMA Study | | |
| No FEMA Study | | |

* May require initiation of the map revision process if impacts to water surface elevations cannot be avoided. Potential impacts to floodplains and/or floodways shall be assessed early in the project. Refer to Sections DR 203 and DR 204 of the Drainage Manual.

The project is located on the FEMA Flood Map Panel 21213C0225C (Sampson County) & FEMA Flood Map Panel 29003C0225C (Allen County) and the project is in a “Zone A” flood area.

**Exhibit 200-07**

| SIGNIFICANT RESOURCE IMPACTS | | | | |
|---|---|---|---|---|
| Are open sinkholes impacted?<br>If so, how many sinkholes are impacted? | Yes | | No | X |
| Are wetlands impacted?<br>If so, how many total acres are estimated? ______ acres | Yes | | No | X |
| Are any of the streams in the project area designated “Special Use Waters” (e.g. Wild Rivers, Exceptional Waters, Outstanding State Resource Water, etc.)? | Yes | | No | X |
| | | | | |

Where possible, alignments should be developed that avoid significant resources. When it becomes impossible to avoid a significant resource, the project should be designed to minimize these impacts. Significant resource impacts are discussed in DR 202 of the drainage manual. Wetland impacts and their costs are also discussed in DR 500 of the Drainage Manual.

Projects that impact special use waters may require an individual KPDES Erosion Control Permit. Contact the Division of Environment analysis for more information.

| STREAM CHANNEL IMPACTS | | | | |
|---|---|---|---|---|
| Will stream relocations (channel changes) be needed?<br>If so, how many total linear feet are estimated? ______ LF | Yes | | No | X |
| Will new culverts or culvert extensions be constructed?<br>If so, how many total linear feet are estimated? _1400_ LF | Yes | X | No | |
| Will temporary stream crossings be needed? | Yes | | No | X |
| Will excess material sites that require permitting be needed? | Yes | | No | X |
| Will bridges be constructed? | Yes | X | No | |

On highway projects that involve stream crossings such as bridge and culverts, it is often not feasible to totally avoid stream channel impacts. In these cases, design the project to minimize the impacts. Stream relocations should be avoided if possible. If stream relocations are unavoidable design to project to minimize their impacts. Stream channel impacts are discussed in DR 506, 601-3, 608-2, and 802-3 of the drainage manual.

**Alternate 1B**

| FLOODPLAIN IMPACTS | | |
|---|---|---|
| **FEMA Study Type** | **Yes** | **Community No.** |
| Detailed FEMA Study with delineated floodway* | X | 21213C, 29003C |
| Detailed FEMA Study without delineated floodway* | | |
| Approximate FEMA Study | | |
| No FEMA Study | | |
| * May require initiation of the map revision process if impacts to water surface elevations cannot be avoided. Potential impacts to floodplains and/or floodways shall be assessed early in the project. Refer to Sections DR 203 and DR 204 of the Drainage Manual. | | |

The project is located on the FEMA Flood Map Panel 21213C0225C (Sampson County) & FEMA Flood Map Panel 29003C0225C (Allen County) and the project is in a "Zone A" flood area.

| SIGNIFICANT RESOURCE IMPACTS | | | | |
|---|---|---|---|---|
| Are open sinkholes impacted?<br>If so, how many sinkholes are impacted? 1 | Yes | X | No | |
| Are wetlands impacted?<br>If so, how many total acres are estimated? ______ acres | Yes | | No | X |
| Are any of the streams in the project area designated "Special Use Waters" (e.g. Wild Rivers, Exceptional Waters, Outstanding State Resource Water, etc.)? | Yes | | No | X |
| Where possible, alignments should be developed that avoid significant resources. When it becomes impossible to avoid a significant resource, the project should be designed to minimize these impacts. Significant resource impacts are discussed in DR 202 of the drainage manual. Wetland impacts and their costs are also discussed in DR 500 of the Drainage Manual.<br>Projects that impact special use waters may require an individual KPDES Erosion Control Permit. Contact the Division of Environment analysis for more information. | | | | |

| STREAM CHANNEL IMPACTS | | | | |
|---|---|---|---|---|
| Will stream relocations (channel changes) be needed?<br>If so, how many total linear feet are estimated? ______ LF | Yes | | No | X |
| Will new culverts or culvert extensions be constructed?<br>If so, how many total linear feet are estimated? 2050 LF | Yes | X | No | |

| | | | | |
|---|---|---|---|---|
| Will temporary stream crossings be needed? | Yes | | No | X |
| | | | | |
| Will excess material sites that require permitting be needed? | Yes | | No | X |
| | | | | |
| Will bridges be constructed? | Yes | X | No | |

On highway projects that involve stream crossings such as bridge and culverts, it is often not feasible to totally avoid stream channel impacts. In these cases, design the project to minimize the impacts. Stream relocations should be avoided if possible. If stream relocations are unavoidable design to project to minimize their impacts. Stream channel impacts are discussed in DR 506, 601-3, 608-2, and 802-3 of the drainage manual.

**Alternate 2**

| **FLOODPLAIN IMPACTS** | | |
|---|---|---|
| **FEMA Study Type** | **Yes** | **Community No.** |
| Detailed FEMA Study with delineated floodway* | X | 21213C, 29003C |
| Detailed FEMA Study without delineated floodway* | | |
| Approximate FEMA Study | | |
| No FEMA Study | | |

* May require initiation of the map revision process if impacts to water surface elevations cannot be avoided. Potential impacts to floodplains and/or floodways shall be assessed early in the project. Refer to Sections DR 203 and DR 204 of the Drainage Manual.

The project is located on the FEMA Flood Map Panel 21213C0225C (Sampson County) & FEMA Flood Map Panel 29003C0225C (Allen County) and the project is in a “Zone A” flood area.

| **SIGNIFICANT RESOURCE IMPACTS** | | | | |
|---|---|---|---|---|
| Are open sinkholes impacted?<br>If so, how many sinkholes are impacted? 1 | Yes | | No | X |
| | | | | |
| Are wetlands impacted?<br>If so, how many total acres are estimated? _______ acres | Yes | | No | X |
| | | | | |
| Are any of the streams in the project area designated “Special Use Waters” (e.g. Wild Rivers, Exceptional Waters, Outstanding State Resource Water, etc.)? | Yes | | No | X |
| | | | | |

**Exhibit 200-07**

Where possible, alignments should be developed that avoid significant resources. When it becomes impossible to avoid a significant resource, the project should be designed to minimize these impacts. Significant resource impacts are discussed in DR 202 of the drainage manual. Wetland impacts and their costs are also discussed in DR 500 of the Drainage Manual.

Projects that impact special use waters may require an individual KPDES Erosion Control Permit. Contact the Division of Environment analysis for more information.

| STREAM CHANNEL IMPACTS | | | | |
|---|---|---|---|---|
| Will stream relocations (channel changes) be needed?<br>If so, how many total linear feet are estimated? _200__ LF | Yes | X | No | |
| Will new culverts or culvert extensions be constructed?<br>If so, how many total linear feet are estimated? _1460_ LF | Yes | X | No | |
| Will temporary stream crossings be needed? | Yes | | No | X |
| Will excess material sites that require permitting be needed? | Yes | | No | X |
| Will bridges be constructed? | Yes | X | No | |

On highway projects that involve stream crossings such as bridge and culverts, it is often not feasible to totally avoid stream channel impacts. In these cases, design the project to minimize the impacts. Stream relocations should be avoided if possible. If stream relocations are unavoidable design to project to minimize their impacts. Stream channel impacts are discussed in DR 506, 601-3, 608-2, and 802-3 of the drainage manual.

## Section 2 : Impact Discussion

The alternates that were considered for this project cross several small drainage areas but the two crossing of main concern are an intermittent stream and a perennial river. Due to the length of the streams and the fact that the proposed construction must stay close to the existing KY 900 route these stream crossing are unavoidable. The preferred Alternate 1A will cross the intermittent stream with a 60” culvert pipe and will cross the perennial river with an approximately 250’ long bridge. As a temporary measure to minimize impacts to the stream and river during construction, erosion and sediment control structures will be utilized. These structures will include temporary diversion ditches, silt traps, and silt fences. Permanent solutions to minimize erosion and thereby lessening any long-term effects to the affected stream will include, but not be limited to: permanent seeding, turf reinforcement, mat protection, culvert outlet scour protection. It is believed that the proposed construction impact to the environment, specifically the stream, will be minimal.

**Exhibit 200-08**

Updated 11/02/16

## DESIGN EXECUTIVE SUMMARY

| | | | |
|---|---|---|---|
| **County:** | Young | **Item #:** | 1-2345 |
| **Route Number(s):** | KY 900 | **State Program #:** | 1234501D |
| **BMP/EMP:** | 0.16 to 8.57 | **Federal Project #:** | STP 0000 000 |
| **Type of Work:** | Major Widening | **State Project #:** | FD52 121 0900 000-009 |

**Highway Plan Project Description:** Major widening from Bass Street to Fishermans Loop in Youngstown.

### EXISTING CONDITIONS

**ADT (current):** 9,920 (2016)

**Truck Class:** AAA

**Trucks: 10%**

**Existing Functional Classification:** ☐ Urban ☑ Rural Arterial

**Terrain:** Rolling

**Route is on (check all that apply):** ☐ NHS ☑ NN ☐ Ext Wt ☐ None

**Posted Speed Limit:** 55 mph **"or"** **Statutory Speed Limit:** ☐ 35 mph (urban) ☐ 55 mph (rural)

**Existing Bike Accommodations:** None

**Ped:** ☐ Sidewalk ☑ Other:____N/A______

### PROPOSED CONDITIONS

**Design Functional Classification:** ☐ Urban ☑ Rural Arterial

**Design ADT (2040):** 12,000 **DHV:** 1,800

**Access Control:** By Permit

**Min. Spacing:**____________

| **CONTROLLING CRITERIA:** | **EXISTING CONDITIONS (Estimated based upon existing geometrics.)** | **AASHTO Guidance (for design speed)** | **Recommendation** | **Design Exception** (check if needed for Design Speed) |
|---|---|---|---|---|
| Design Speed | **55 mph** | Minimum: 50 mph<br>Selected: 55 mph | **55 mph** | ☐ |

Note: For any remaining controlling criteria that are less than AASHTO recommended guidance: If recommended design speed is ≥ 50 mph, exceptions are needed; If recommended design speed is < 50 mph, variances are needed.

| | | | | **Exception (≥ 50 mph)** | **Variance (< 50 mph)** |
|---|---|---|---|---|---|
| Lane Width, No. of Lanes | 12', 2 lanes | 12' | 12', 2 lanes | ☐ | ☐ |
| Shoulder Width (Minimum Usable) | Varies: 2' - 10' | *8' typical 4' where passing lanes added | 6' shoulders, 4' paved** | ☑ **<br>Left Turn Lanes | ☐ |
| Horiz. Curve Radius (Minimum) | 1,146' | 960' | 1,146'<br>(Match existing) | ☐ | ☐ |
| Max. Superelev. Rate (emax= %) | 5.25% | 8% | 5.25%<br>(Match existing) | ☐ | ☐ |
| Stopping Sight Distance (Minimum) | 615' (calculated) | 495' | 615' | ☐ | ☐ |
| Max. Grade (%) | 4.00% | 5.00% | 4.00% | ☐ | ☐ |
| Normal Cross Slope (%) | 2.00% | 2.00% | 2.00% | ☐ | ☐ |
| Vert. Clearance (ft.) | N/A | N/A | N/A | ☐ | ☐ |

| **OTHER CRITERIA:** | | | | **Design Variance** |
|---|---|---|---|---|
| Border Area (urban) | N/A | N/A | N/A | ☐ |
| Sidewalk Width, slope | N/A | N/A | N/A | ☐ |
| Bike Lane Width, slope | N/A | N/A | N/A | ☐ |

Updated 11/02/16

## DESIGN EXECUTIVE SUMMARY

| | | | | |
|---|---|---|---|---|
| Shared Use Path Width | N/A | N/A | N/A | ☐ |
| Other: | N/A | N/A | N/A | ☐ |

**Design Criteria Notes: As a widening project, this alternative does not alter existing horizontal or vertical curvature, nor revise superelevation utilized when originally constructed.**
*** Per section 7.2.8 of the 2018 AASHTO Green Book, where truck climbing lanes are added to the right of through-traffic lane of travel, a somewhat reduced shoulder width of 4' or greater is generally acceptable.**
**** See Section 6. Design Exceptions/Variances for discussion of shoulder width through left turn lanes**

**Environmental Action:** CE Level 2

**Completion Date: May 2020**
☑ scheduled ☐ actual

**Existing Pavement Depths: Based on 1968 KY 900 highway plans: 11" DGA, 5" Class I Asphalt Base, 1.5" Asphalt Surface**

**Include:**

1. Typical Sections, including bridges (on 8.5X11 inch paper)
2. Map showing project location
3. Preliminary line & grade meeting minutes
    - Purpose and Need Statement
    - Project overview and existing conditions
    - Discussion of Alternatives (including preferred and no build) with respective traffic control schemes, utility and right of way impacts, environmental impact, and performance (traffic analysis, safety analysis, etc.)
    - Consideration of Bicycle and pedestrian facilities discussion **(HD-1501)**
    - Cost comparison table of alternatives vs. Highway plan (include D, R, U, & C)
    - Discussion if preferred alternative cost is >115% than the highway plan
    - Discussion of clearzone
    - Discussion of design exceptions and mitigation strategies
    - Discussion of low cost maintenance improvements
    - Additional Comments and action items
4. Water related impact summary

**Submitted by Project Engineer:** ☐ KYTC ☑ Consultant **Date:**

**Recommended by Project Manager:** **Date:**

**Tier Level Approval** ☐ Tier 1 ☐ Tier 2 ☑ Tier 3

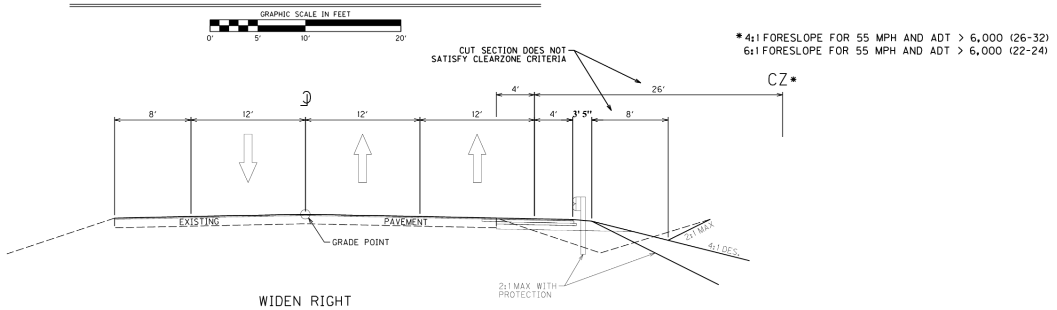
**Location Engineer:** **Date:**

**Roadway Design Branch Manager:** **Date:**

**Geometric Approval Granted by:** Director, Div. of Hwy. Design **Date:**

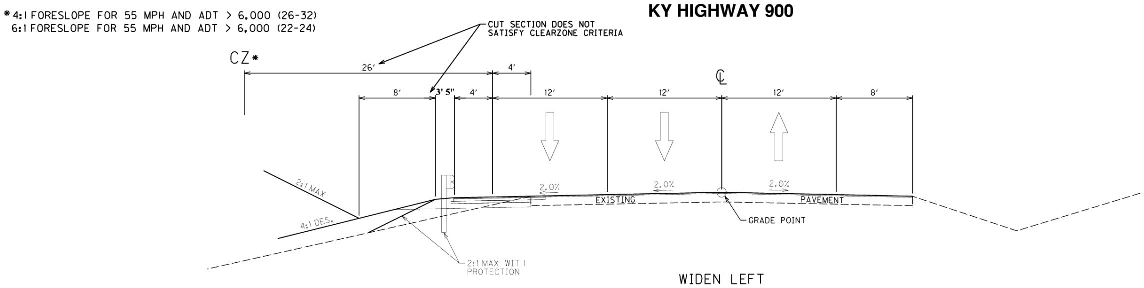
**Exhibit 200-08**

# TYPICAL SECTIONS



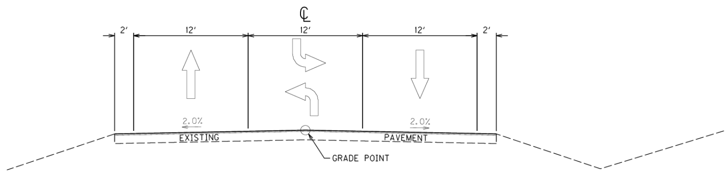
WIDEN RIGHT

**KY HIGHWAY 900**



WIDEN LEFT

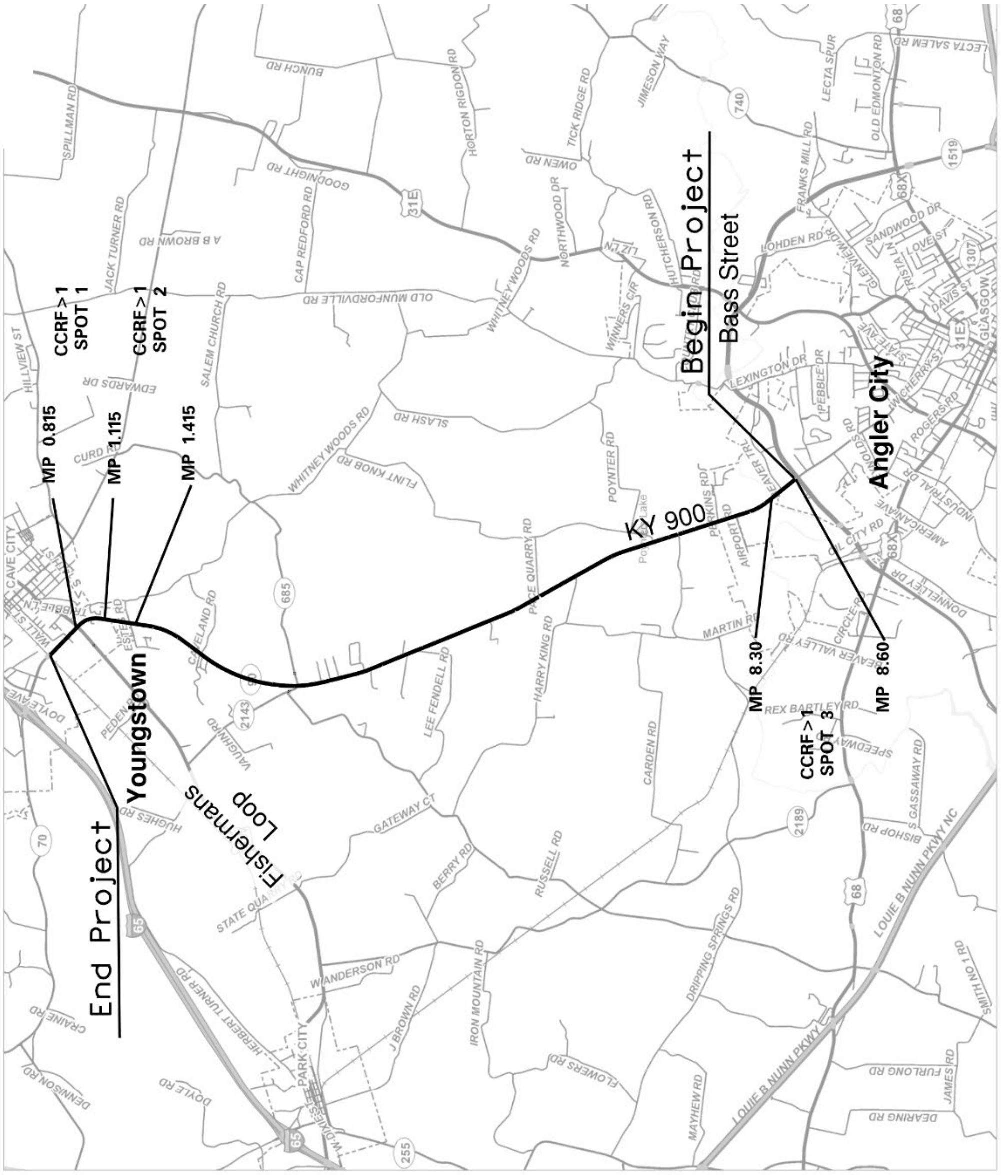
**KY HIGHWAY 900**

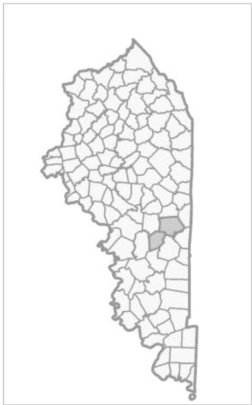


RESURFACE AND STRIPING TWLTL SECTION

**KY HIGHWAY 900**

**Exhibit 200-08**





# PRELIMINARY LINE AND GRADE MEETING MINUTES

Project: KY 900 Widening
Young County
Item No. 1-2345

Purpose: Preliminary Line & Grade
Review

Place: Young County District Office

Meeting Date: December 6, 2019

Prepared By: Consultant

In Attendance: Project Manager
CDE
Project Dev. Manager
Geotech
ROW
Planning
Utilities
Highway Design
KTC
Consultant Team

Meeting minutes are accompanied by Attachments A (Agenda), B (Handouts), and C (PL&G Sign in Sheet).

The meeting opened with a welcome by the project manager, followed by participant introductions. The consultant then provided a brief overview of project history. This project originated from a 2016 planning study that evaluated widening KY 900 to four lanes but ultimately recommended 2+1 widening as the preferred alternative. Although all phases were funded in the FY16-22 Highway Plan and the project scored well in the 2018 SHIFT process, no project phases were funded in the FY18-24 Highway Plan.

The team met in November 2018 to review conceptual Symmetric and Asymmetric 2+1 alternatives. These alternatives were refined then presented at an August 2019 project team meeting. A third, Performance-Based Flexible Solutions (PBFS) Alternative resulted from this meeting. As developed, this alternative represents a low cost solution addressing the most pressing corridor needs (expanding passing opportunities and safety), while minimizing costs and impacts.

The stated purpose of this PL&G meeting is to review build alternatives and select a preferred alternative to advance to final design when funding becomes available.

# Project Overview and Existing Conditions

This eight mile project connects KY 900 from Bass Street in Angler City to Fishermans Loop in Youngstown near I-65, and is driven by the need to more efficiently link Angler City to Youngstown and I-65.

Karst topography is prevalent through the project corridor, and the project primarily lies within a known watershed. KY 900 is classified as a Rural Minor Arterial with 45 mph posted speed limits near both termini, and 55 mph throughout the majority of the corridor. KY 900's existing typical section consists of two -12' driving lanes with 10' paved shoulders (reducing to 2' where truck climbing lanes are present), currently carrying 9,920 vehicles per day (VPD) and projected to carry 12,000 VPD by 2040. This stretch of existing KY 900 has 2 north (north) bound truck climbing lanes totaling 1 mile in length (0.74 miles + 0.26 miles), and 3 south (south) bound existing truck climbing lanes totaling 1.2 miles in length (0.51 miles + 0.3 miles + 0.39 miles).

The KYTC traffic model was used to determine existing corridor travel speeds, and resulted in a north bound average corridor travel speed of 48.7 mph, and 49.3 mph south bound. To verify these results, actual travel speeds as indicated by HERE speed data obtained from KYTC Division of Planning was used as an independent check. This data revealed an average speed of 49.2 mph north bound and 49.0 mph south bound. The closeness of these two independent approaches to average travel speed provides a high degree of confidence in the results, and verifies the traveling public isn't able to travel this section of KY 900 at the posted 55 mph speed limit. However, in areas where passing lanes are constructed, vehicle operating speeds increase to 55 mph; additionally, operational benefits are realized downstream beyond the passing lanes (see Figure 1 below).

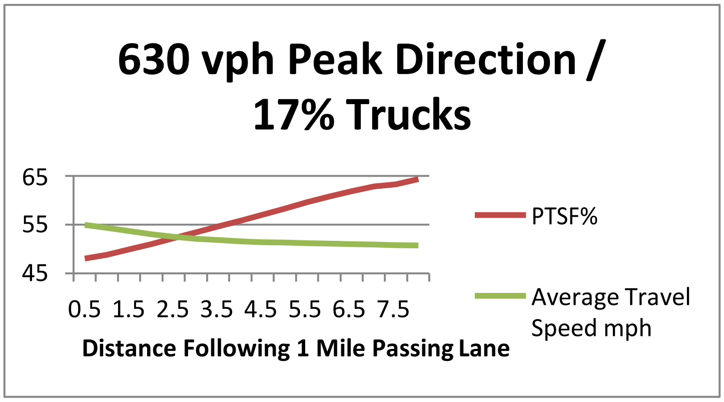


Figure 1: Speed/distance relationship following 1 mile passing lane

During a previous project phase, a public meeting was held on June 28, 2016 in Youngstown to inform the public about the study and project alternatives under consideration. At that time, alternatives under consideration included major widening (four-lanes with depressed median), as well as a 2+1 concept.

Ninety-eight members of the public attended this meeting, with 89% of the respondents expressing that improvements are needed, with safety and lack of passing opportunities receiving the most responses for what drives project needs. Additionally, 58% of the public favored the 2+1 alternative.

This project evaluated alternatives to supplement existing dedicated passing opportunities through both symmetrical and asymmetrical 2+1 alternatives. These alternatives, in addition to the No-Build, are discussed within this document.

## Project Purpose and Need

**Project Purpose:**
The purpose of the project is to improve capacity, improve safety, and enhance regional mobility on KY 900 between Bass Street in Angler City and Fishermans Loop in Youngstown.

**Project Need:**

- **Improve capacity.** Today KY 900 carries between 9,100 and 9,900 vpd, including 10-16% trucks, with 2040 traffic estimated to grow to 12,000 vpd and 19% trucks and reduces level of service (LOS) from C and D today, to D and E in 2040.
- **Improve Safety.** 216 reported crashes occurred 2015-2017, broken down as follows: 171 property damage, 45 injury, and 0 fatal crashes resulting in 3 high crash locations along the project corridor (MP. 0.815-1.115, MP. 1.115-1.415, and MP. 8.3-8.6).
- **Enhance Regional Mobility.** KY 900 provides the most direct link between Angler City and I-65 to the north, and serves regional motorists accessing Youngstown, Youngstown Lake, and other area attractions. KY 900 is a state and federally designated truck route and arterial linkage between Youngstown and Angler City. Rolling terrain combined with truck traffic and limited passing opportunities degrade corridor operations.

## Discussion of Alternatives

**Alternatives Overview:** This project evaluated four primary alternatives in addition to a No Build alternative. Two of the analyzed alternatives incorporate a Performance Based Flexible Solution (PBFS) approach. Alternatives evaluated include:

- No Build
- Symmetric 2+1
- Asymmetric 2+1
- PBFS Asymmetric 2+1
- PBFS+ Asymmetric 2+1

Satisfactory horizontal and vertical geometry exists throughout the project corridor. Therefore alternatives presented widen along the existing alignment, and do not revise horizontal or vertical geometry.

Each of these PL&G alternatives is discussed in more detail below.

**No-Build Alternative:** The No-Build Alternative is one in which the KYTC would take no action to improve the existing roadway; only routine maintenance would occur. Overall, however, selection of the No-Build Alternative would not meet the stated purpose and need of the proposed project.

**Symmetric 2+1 Alternative:** This alternative widens existing KY 900 to create a consistent three-lane typical section from south of the railroad bridge near Angler City to just north of the Carp Creek bridge near Youngstown, providing alternating passing opportunities north (north) bound and south (south) bound. This alternative is the typical "2+1" alternative that provides alternating passing opportunities, and further described as:

Beginning in Youngstown, the existing 0.74-mile north bound climbing lane (MP 7.41 – MP 8.15) largely remains in place before transitioning to a north bound left turn lane to an approach road. Continuing north, it transitions to a 1.2-mile south bound passing lane, then to a 1.1-mile north bound passing lane south of Rock Road (which eliminates an existing 0.39 mile south bound truck climbing lane from MP 5.1 to 5.4). Another lane transition leads to a 1.12 mile south bound passing lane before transitioning to left turn lanes at a major intersection. Continuing northward, an additional 1.3 mile south bound passing lane is added to 1) prevent adding a passing lane approaching the built up area near Angler City, and 2) to prevent eliminating a second south bound truck climbing lane. The improvements continue with a transition to a 0.8-mile two-way left turn lane (TWLTL) beginning south of a cross street and ending just south of KY 900's existing railroad bridge.

The Symmetric Alternative results in a total southbound dedicated passing length of 3.6 miles, and total northbound dedicated passing of 1.9 miles.

This alternative impacts approximately 40 parcels (strip takings), with a total of 8.7 acres of new right of way and 1 residential relocation.

**Asymmetric 2+1 Alternative:** This alternative also widens existing KY 900 to create dedicated passing opportunities. However, rather than constructing a uniform 3 lane typical section, passing lanes are independently placed through the corridor based on existing conditions and need. The resulting passing lane configurations may overlap, resulting in the following possible typical sections:

- 4 lane undivided (2.1 miles)
- 3 lane (2.8 miles)
- 2 lane unimproved (1.6 miles)
- TWLTL (1 mile)

This approach offers the benefit of fully utilizing and/or lengthening existing truck climbing lane configurations. It also permits passing lanes to be considered independently - providing the flexibility to subdivided into smaller improvement sections, if desired, thereby reducing project costs. North and south bound passing lanes are discussed independently below.

- North bound: Three north bound passing lanes are proposed. From Youngstown, the existing north bound truck climbing lane just north of Carp Creek Bridge would be lengthened slightly from 0.74 miles to 0.8 mile, before transitioning to a left turn lane at an approach road. A 1.7-mile stretch of no dedicated north bound passing ensues before reaching the next existing north bound truck climbing lane (MP 5.42-5.68) beginning just north of Rock Road. The existing 0.26 mile truck climbing lane is lengthened to an overall passing lane length of 1.25 miles. Following another 1.5- mile length of no north bound passing, which includes a left turn lane at a major intersection, the next passing opportunity begins just north of a state route intersection. This last north bound passing lane is 1-mile long with a 0.4-mile gap provided before introducing a TWLTL through the project's developed area approaching Angler City.

- South bound: Three south bound passing lanes are proposed. Beginning at the northern project terminus, the project's TWLTL extends approximately 0.8 miles south, tying to an existing 0.5 mile south bound truck climbing lane (MP 1.5-2.0). The northern 0.2 mile of this truck climbing lane (on an existing 2% up-grade) is converted to a TWLTL; however, the passing lane is extended southward and results in a 1.1-mile south bound passing lane. A 1-mile gap follows, which includes a left turn lane to KY 685. Next a 1.7 mile south bound passing lane is developed that joins 2 existing south bound truck climbing lanes (MP. 3.76-4.07, MP 5.10 – 5.48). A 1.2-mile gap follows, and a 1.3-mile south bound passing lane is introduced beginning approximately 0.4 mile north of Flint Knob Road, extending south to the airport.

The Asymmetric Alternative results in a total southbound dedicated passing length of 4.0 miles, and total northbound dedicated passing of 3.1 miles.

This alternative impacts approximately 52 parcels (strip takings) with a total of 9.3 acres of new right of way with 3 residential relocations.

**PBFS Asymmetric 2+1 Alternative:** This Asymmetric Alternative variation resulted from the August 7, 2018 Alternative Review Meeting. Addressing concerns expressed by the district pertaining to overlapping segments of south and north bound passing lanes (effectively resulting in 4 lane undivided highway), this alternative takes a minimalist approach that does not improve upon the three existing southbound truck climbing lanes, but does provide additional northbound passing by lengthen an existing 0.26 mile truck lane (MP 5.42 – 5.68) to 1.25 miles near the project's midpoint (immediately north of Rock Road). North and south bound passing lanes provided with this alternative are discussed below.

- North bound: Two north bound passing lanes are provided. From Youngstown, an existing 0.74 mile north bound truck climbing lane (NB1) just north of Carp Creek Bridge (MP 7.41 – 8.15) would be shortened 0.07 miles introducing a left turn lane at approach road. A 1.73-mile stretch of no dedicated north bound passing follows before reaching the next existing north bound truck climbing lane just north of Rock Road (NB2). This existing 0.26 mile truck climbing lane (MP 5.42 – 5.68) is extended northward, providing an overall passing lane length of 1.25 miles. Following this passing opportunity, 2.85 miles separates the end of north bound passing and the beginning of the proposed TWLTL through the project's developed area near Angler City.

The PBFS alternative provides a net increase of 0.92 miles of northbound dedicated passing opportunities.

- South bound: Three south bound truck lanes currently exist as follows:
    - Southbound 1 (SB1): Beginning just south of this project's TWLTL (MP 1.50 – 2.01), SB1 is 0.51 miles long. However, this alternative converts the northern most 0.2 mile of existing SB1 to a TWLTL (on 2% upgrade), but extends passing opportunity

southward by an equivalent 0.2 mile. The net result is no passing net loss or gain.

- Southbound 2 (SB2): Located 1.55 miles south of the end of SB1, SB2 (MP 3.77 – 4.07) is 0.3 miles in length and remains unchanged.
- Southbound 3 (SB3): Located 1 mile south of the end of SB2, SB3 (MP 5.10 – 5.49) is 0.39 miles long and remains unchanged.

Additionally, the PBFS Alternative constructs left turn lanes at: 1) An approach road, and 2) Rock Quarry Road. The state route approach intersection has an existing left turn lane.

The PBFS alternative does not increase or decrease southbound passing opportunities, retaining the current total southbound dedicated passing length of 1.2 miles, while northbound dedicated passing increases to 1.92 miles, a 0.92 mile increase over existing northbound dedicated passing opportunities.

This alternative impacts approximately 12 parcels (strip takings) with a total of 1.7 acres of new right of way and no residential relocations.

**PBFS + Asymmetric 2+1 Alternative:** The PBFS+ includes all aspects of the PBFS Alternative, in addition to the following:

- Lengthen SB1 (MP 1.50-2.01) from 0.51 miles to 0.75 miles
- Lengthen SB2 (MP 3.77-4.07) from 0.3 miles to 0.75 miles
- Construct left turn lane at Queen Road

The PBFS+ Alternative results in a total southbound dedicated passing length of 1.89 miles, and a total northbound dedicated passing of 1.92 miles. This is a net increase of 0.69 miles in dedicated southbound passing, and 0.92 miles in dedicated northbound passing.

PBFS+ Alternative impacts approximately 19 parcels (strip takings) with a total of 2.9 acres of new right of way and no residential relocations.

## Utilities

Utility companies present on/near the project include: Three different natural gas companies with transmission lines, telecommunications company, two water districts, sewer company, a rural electric company, Youngstown Electric, Southern Kentucky Electric, Utilities of Kentucky, Volunteer Valley Authority (power), and Bi-County Electric.

## Environmental

This project consists of widening along the existing corridor, thereby minimizing environmental impacts.

**Natural Environment**: Karst topography is prevalent throughout the corridor, with overland water flow frequently draining to depressions, sinkholes, and caves. This project also lies primarily within a major watershed. The combination of Karst topography and proximity to this watershed require additional consideration. There are no Wild and Scenic Rivers, Outstanding National Resource Waters, or Exceptional and Reference Reach Waters of Kentucky within this study area.

**Land Use:** The study area is primarily a mix of low-density rural residential, farmland, and scattered commercial uses through the central section of the corridor, transitioning to higher density residential, commercial, and industrial uses approaching either terminus. The project does not impact churches or cemeteries.

**Socioeconomic:** Alternatives under consideration require minimal residential relocations (0 to 3). A review of comparable housing indicates ample supply of available comparable housing – therefore, a need for Last Resort Housing is not anticipated.

**Historic Architecture Resources:** Four NRHP sites were found within the project area. However, no adverse effects from any build alternative are anticipated.

**Archaeological Resources:** Phase I archaeological baseline studies are currently being undertaken.

## Recommended Alternative

The project team recommended advancing the **PBFS+ Asymmetric 2+1 Alternative** for the following reasons:

- Addresses purpose and need issues of increased passing opportunities and improved safety
    - Constructs TWLTL through two consecutive high crash spots that were identified near Angler City. Through this area, analysis indicates rear end crashes account for 41% of all crashes. The TWLTL addresses this crash type by removing left turning vehicles from conflict with advancing traffic.
- Provides increased passing opportunities over the existing for both north and south bound traffic.
- Reduces southbound percent time spent following below 50%, with an average travel speed of approximately 54 mph
- With an additional southbound passing opportunity provided, PBFS+ Alternative should be more appealing to the general public than the PBFS Alternative.
- With a total project cost of $9.085M, the PBFS+ Alternative presents an alternative that addresses the project's purpose and need at a total cost of only 23.2% of the Highway Plan estimate. The reduced project cost may assist in project advancement.

## Design Exceptions/Variances & Mitigation Strategies

Following AASHTO guidance for rural arterials with ADT greater than 2,000, an 8' usable shoulder is typically desired.

However, section 7.2.8 of the 2018 AASHTO Green Book makes an exception for truck climbing lanes. The Green Book states that while truck climbing lanes are normally provided to prevent an unreasonable reduction in upgrade operating speed, it acknowledges these lanes provide opportunity for passing in areas where passing would not otherwise be permitted. Further, it is noted that truck climbing lanes are permitted to have a somewhat reduced shoulder width, and states that a usable shoulder width of 4' or greater is generally acceptable. Additionally, an evaluation of crashes through the project corridor document crash problems **do not** currently exist along existing truck climbing lanes that have a reduced 4' shoulder.

This project's preferred alternative introduces additional dedicated directional passing opportunities by extending existing truck climbing lanes. The preferred alternative utilizes 6' shoulders (4' paved) through areas where truck lanes are extended. Thus, a design exception for shoulder width is not required.

Additionally, the project constructs new left turn lanes at Approach Road (Station 145+40 to 155+60), Queen Road (Station 202+60 to 223+60), and Rock Quarry Road (Station 229+40 to 243+75). The project team decided to continue use of 6' shoulders through these short sections to provide shoulder width consistency among corridor improvements. The reduced shoulder width also helps minimize or eliminate impacts to natural gas transmission line crossings near Approach Road. This reduced shoulder width is less than the 8' shoulders recommended by AASHTO, and therefore constitutes a design exception.

This project, therefore, requires one design exception and no design variances.

**Cost Comparison Table of Alternatives vs. Highway Plan**

| Alternative | Design | Right of Way | Utility | Construction | Total |
|---|---|---|---|---|---|
| Symmetric | $1,600,000 | $800,000 | $2,230,000 | $10,300,000 | $14,930,000 |
| Asymmetric | $1,500,000 | $1,210,000 | $3,960,000 | $12,800,000 | $19,470,000 |
| PBFS | $1,100,000 | $255,000 | $810,000 | $4,600,000 | $6,765,000 |
| **(Preferred) PBFS+** | **$1,200,000** | **$410,000** | **$1,475,000** | **$6,000,000** | **$9,085,000** |
| 2016 Highway Plan | $2,200,000 | $6,000,000 | $3,500,000 | $27,500,000 | $39,200,000 |
| | Authorized (2017) | STP (2017) | STP (2017) | STP (2019) | |

## Discussion if Preferred Alternative is > 115% more than Highway Plan

As illustrated above, all alternatives are within the funding level established in the 2016 Highway Plan.

**Exhibit 200-08**

## Discussion of Clear Zone

This project was designed using a 55 mph design speed. The 2040 ADT is projected to be 12,000 VPD. Utilizing 6' graded shoulders (4' paved) and 8' roadway ditch (4:1 slope) results in a clear zone of 14' to the ditch bottom. As established in the July 2015 Roadside Design Guide errata, a 26'-32' clear zone is recommended for a highway with this ADT, design speed, and 4:1 ditch slopes.

The project team concluded that this project would not be designed to meet clear zone due to:

- Project is comprised of spot improvements through widening along existing KY 90
- Crash history doesn't indicate the existing clear zone creates a crash problem
- Areas of improvement increase clear zones (14' vs. 10' existing)

## Consideration of Bicycle and Pedestrian Facilities

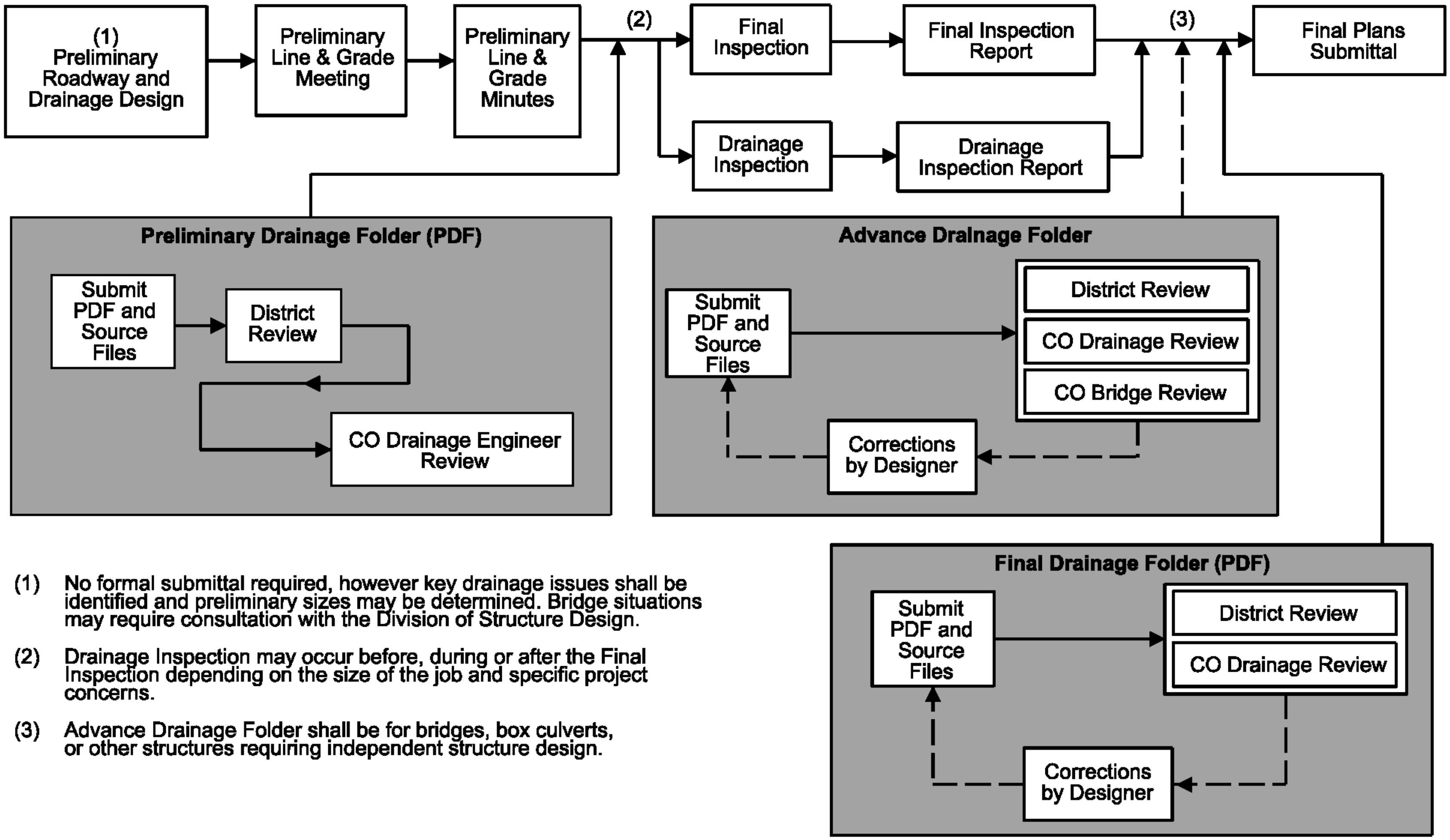
Following guidance provided in the KYTC Highway Design Manual, Section HD 1501.3 Pedestrian Facilities on Rural Roadways, this project does not appear to satisfy the recommendations for inclusion of pedestrian facilities.

## Additional Comments and Action Items

- The utility coordinator noted that a telecommunications company has recently added their facilities to the existing poles along the project route. They will need to be notified and included for utility relocation.
- The Engineering Support Branch Manager noted that the existing box culverts were in good shape and may only need to be extended rather than have a full replacement. The Project Manager will contact the Division of Structural Design in order for them to take a look at the existing plans. The Branch Manager also noted that they would contact the Geotechnical Branch to start drilling.
- The Right of Way Supervisor noted that the property for Parcel ## slated for relocation in the preferred alternate is up for sale. They will prioritize this parcel for clearance.
- The environmental coordinator discussed the need and scheduling for stakeholder and public involvement meetings.
- The Location Engineer noted that the shoulder should be widened 2' beyond the back of the post per Design Memo 2-19.

**Exhibit 200-09**

# DRAINAGE REVIEW PROCESS



(1) No formal submittal required, however key drainage issues shall be identified and preliminary sizes may be determined. Bridge situations may require consultation with the Division of Structure Design.

(2) Drainage Inspection may occur before, during or after the Final Inspection depending on the size of the job and specific project concerns.

(3) Advance Drainage Folder shall be for bridges, box culverts, or other structures requiring independent structure design.

**Exhibit 200-10**

# PRE-DESIGN CONFERENCE AGENDA

Item No.: Insert Item Number County: Insert County/Counties Route: Insert Route/Road Name
Consultant Name: Insert Consultant's Name Pre-Design Conference Date: Insert Date
Consultant Project Manager: Insert Manager's Name
Dept. Project Manager: Insert Manager's Name Length: Insert Length BMP/EMP: Insert BMP/EMP
Type of Work: Insert Type of Work Environmental Type: Choose an item.
Description: Insert Project Description

The consultant is to provide engineering and related services for this project for the following items (check all that apply):

[ ] Pre-design scoping study
[ ] Preliminary Roadway Design
[ ] Final Roadway Design

## Scoping Studies

The type and extent of studies necessary for any given project will be defined at the Pre-design conference. The Department reserves the right to solicit other firms to complete the actual design of the project after studies are completed. The project may be split into design sections or may require the selection of another consultant to perform activities specifically identified during the study phase.

## Design Related Services

The following design related services shall be performed as checked below:

| | Not | Department | Consultant | Statewide |
|---|---|---|---|---|
| Photogrammetry: | [ ] | [ ] | [ ] | [ ] |
| Surveying: | [ ] | [ ] | [ ] | [ ] |
| Environmental: | [ ] | [ ] | [ ] | [ ] |
| Geotechnical: | [ ] | [ ] | [ ] | [ ] |
| Right of Way & Utility Estimates: | [ ] | [ ] | [ ] | [ ] |
| Traffic Engineering Analysis: (Basic; Highway Capacity Manual) | [ ] | [ ] | [ ] | [ ] |
| Traffic Engineering Analysis: (Advanced; Micro-simulation) | [ ] | [ ] | [ ] | [ ] |
| Traffic Forecasting: | [ ] | [ ] | [ ] | [ ] |
| Safety Analysis: | [ ] | [ ] | [ ] | [ ] |
| Project Schedule: | [ ] | [ ] | [ ] | [ ] |
| Pavement Design: | [ ] | [ ] | [ ] | [ ] |
| Structure Plans: | [ ] | [ ] | [ ] | [ ] |
| Signing Plans: | [ ] | [ ] | [ ] | [ ] |
| Signal Plans: | [ ] | [ ] | [ ] | [ ] |

| | | | | |
|---|---|---|---|---|
| Lighting Plans: | [ ] | [ ] | [ ] | [ ] |
| Landscaping Plans: | [ ] | [ ] | [ ] | [ ] |
| Utility Design: | [ ] | [ ] | [ ] | [ ] |
| Utility Coordination: | [ ] | [ ] | [ ] | [ ] |
| Right of Way Coordination: | [ ] | [ ] | [ ] | [ ] |

Unless otherwise specified in the Pre-design Conference Minutes, the Department shall provide:

(1) All existing and projected traffic counts, including intersection turning movements.

(2) The project's photogrammetry will be provided in DGN format, in English units. Additionally, the mass point and breakline files will be provided to aid the consultant in creating a digital terrain model. Ortho-rectified aerial photographs will also be provided.

(3) Copies of any available record plans of existing roads and construction plans of any proposed road projects as details are finalized and become available.

(4) Copies of any previous pertinent studies, reports or project documentation.

## Purpose and Need

The Purpose and Need statement is used to determine the scope of work. Goals and objectives should be identified within the Purpose and Need.

*The guidance for defining Purpose and Need is available on the Highway Design website. http://transportation.ky.gov/Highway-Design/Documents/Purpose%20and%20Need%20Statement%20Guidance%20and%20Instructions.pdf*

## Scope of Work

The consultant's responsibility for scope of work shall include:

*A description of the scope of the project and alternatives to be considered or developed, typical sections, public involvement, etc.*

## Surveying

The consultant's responsibility for surveys shall include:

*Explanations of work in most cases are identified within the Production-Hours Documentation, which*

**Exhibit 200-10**

*is to be included with these Pre-design minutes.*

*Specific notes pertaining to surveying not specified in the Production-Hour Documentation.*

## Preliminary Design

**The consultant shall provide and update a Project Development schedule. Updates to the timeline shall be made monthly and submitted to the Project Manager.**

The consultant shall be responsible for all alternatives and construction cost estimates necessary to make a determination of a recommended alternative. These alternatives should generally include the following items:

*Explanations of work in most cases are identified within the Production-Hours Documentation.*

*Specific notes pertaining to preliminary design not specified in the Production-Hour Documentation.*

Preliminary hydraulic studies, including stream sections, stream profile, and necessary channel changes. Consideration of avoidance and minimization of effects on blue-line streams must be included in accordance with Section 404 and 401 of the Clean Water Act. The consultant shall be responsible for obtaining all floodway studies and other pertinent drainage information to be utilized in their design.

**The consultant shall perform a safety analysis as directed by the Project Manager. At a minimum, consultant shall analyze the crash history for the project. The Project Manager may request the consultant to present a report on benefit/cost as a decision matrix to the Project Development Team at PL&G or other team meeting. Level of effort should be discussed and documented here.**

## Environmental

If the consultant is responsible for the required environmental documentation, the Environmental Coordinator will review the project scope with the Director of the Division of Environmental Analysis to determine the level of environmental documentation that will be required (Overview, CE or EA/FONSI). The consultant will prepare the Production-Hour estimate (for environmental work only) based upon this determination and submit the estimate to the Director of the Division of Environmental Analysis for review and approval.

The environmental consultant shall provide a general environmental footprint to the Project Development Team as soon as possible so alternative alignments can be developed.

The District Environmental Coordinator shall be notified upon the discovery of any environmental issue or condition which may influence alignment design or preferred alignment recommendation.

The Division of Environmental Analysis and the District Environmental Coordinator shall be notified should it become necessary to change an environmental services milestone date.

A preliminary “Purpose and Need Statement” of the project is to be defined early in the initial design and environmental review stages of the project and developed more extensively during the public involvement process. If a Purpose and Need Statement has been developed during the planning phase of the project it will serve as the preliminary Purpose and Need Statement. The Purpose and Need Statement shall be continuously evaluated during the development process and modified as needed based on information gained through the public involvement process. The development of the projects “Purpose and Need Statement” will be the responsibility of the project team.

The consultant or their sub-consultant shall notify the District Environmental Coordinator prior to initiating any fieldwork for the environmental baseline studies.

## Public Involvement

If necessary, public meetings or hearings will be held as discussed at the pre-design conference. The consultant will be responsible for providing all necessary exhibits and attending any public meetings or hearings that may be held.

*The extent of Public Involvement is to be identified in these Pre-design Minutes.*

## Final Design

In the case of a federally funded Preliminary Roadway Design contract, the consultant may not advance into the final design stages until such time that all public hearing requirements are met and a final environmental document has been approved.

The consultant shall be responsible for the development of all final details necessary for the complete design of Grade, Drain, and Surfacing Plans suitable for the letting to contract of the project. Plan scales for this project are as follows:

1) Plan and Profile - 1” =
2) Cross Sections - 1” =
3) Cross Section Spacing -
4) Pipe Sections - 1” =
5) Right of Way Strip Maps - 1” =
6) Soil Profile Sheets - 1” =
7) Coordinate Control Sheets - 1” =
8) Erosion Control Sheets - 1” =

Detail sheets shall be provided as required or as otherwise specified in the Pre-design Conference Minutes.

The consultant is responsible for providing an acceptable plan for the maintenance of traffic. This plan shall include, as necessary:

(1) A written description of all required phases and notes to adequately explain the activities required of the contractor during construction to address maintenance of traffic.
(2) Plan and profile views of diversions, part-width construction or other necessary maintenance of traffic items.
(3) Cross-sections to depict the location of traffic in various phases.

A Final Plans-In-Hand Inspection will be held when the right of way taking, plan construction notes and drainage items are shown on the plans. A detailed maintenance of traffic scheme shall also be available. An updated cost estimate based on all established bid items will be required. Details of Avoidance, Minimization and Mitigation Alternatives for blue-line streams shall be presented. A Drainage Inspection will also be held, frequently concurrent with the Final Plans-in-Hand Inspection. Finalization of plans shall not occur until the approvals of the Final and Drainage Inspection Reports are given by the Department.

A separate Right of Way Inspection may be held, at the discretion of the Department, in order to expedite the Right of Way phase. The Project Manager will make the determination if adequate details have been developed and included within the plans to hold an inspection. Upon approval of the inspection report and incorporation of inspection recommendations into the plans, the Right of Way Plans will be submitted.

It shall be the consultant's responsibility to see that all comments addressed in all inspection reports have been resolved before submission of Final Plans. Any item that may affect right of way should be resolved prior to the submission of Final Right of Way Plans.
Approximately 6 months prior to the letting date, a complete set of full-size final plans in PDF format will be submitted to the Project Manager, to be forwarded to the Plan Processing Section in the Central Office. The Plan Processing Section shall review the plans and return the plans with comments, corrections and revisions necessary to be made to the original plans. The consultant, prior to submittal of the original PDF file of the final construction plans, will perform the required changes to the final plans. The submittal of the final plans, all electronic plans, terrain models, geometric files, etc. shall be submitted to the Project Manager.

## General

(1) The consultant shall be represented at all inspections and meetings. Any plans or exhibits required shall be the responsibility of the consultant.

(2) Any sub-consultants utilized must have approval of the Department prior to their performance of any work.

(3) The consultant is responsible for having obtained and being knowledgeable of all Department Manuals including, but not limited to, Design, Drainage, Standard Drawings and Bridges. All

work shall be performed in accordance with those manuals or other memos issued subsequent to the publication of those manuals unless otherwise explicitly stated.

(4) The consultant shall submit the Production-Hour Worksheet, listing only the involved units of work, including supporting documentation of units obtained to the Project Manager to be reviewed. Upon agreement of the Production-Hour units, the consultant shall submit the fee proposal with detailed production-hours on the Department's Standard Production-Hour Worksheet to the Director of Professional Services. The Department's Project Manager shall also submit the Department's Production-Hour estimate.

(5) Change orders to this project will not be permitted except in such cases that:

- The project limits have been substantially revised from those initially indicated in the Pre-design Minutes.
- A change of scope has occurred.
- The consultant is requested to revise the plans as a result of a direction change by the Department.

(6) The consultant is responsible, at all times, for correction of any errors or omissions that they may have made in the preparation of the plans. The consultant shall immediately notify the Project Manager of any item that they feel requires extra work. The consultant shall not proceed with that item of work until such time that the matter of extra work has been resolved.

(7) All original submissions, including pay estimates and consultant monthly reports, shall be sent to the Project Manager. The pay estimate and monthly report may be electronically submitted to the Project Manager. The consultant monthly report shall be submitted even if a pay estimate is not being submitted. All correspondences pertinent to this project shall have the County, Item No. and Project Description noted.

(8) Hardcopy sets of plans shall be provided for inspections and meetings, as requested by the Project Manager.

(9) The consultant will be responsible for preparation of all minutes of meetings, including this Pre-design Conference.

(10) Periodic progress meetings will be held with the District as discussed during the Pre-design Conference.

(11) All design work and development of plans, preliminary and final, shall be prepared in MicroStation DGN format in accordance with current KYTC CADD Standards.

(12) The Department's Project Manager assigned to this project is insert name.

(13) The current schedule for this project, as described in the enacted Six Year Plan is as follows:

| Phase | FY | Funding | Cost |
|---|---|---|---|
| Final Design | 20xx | | |
| Right of Way | 20xx | | |
| Utilities | 20xx | | |
| Construction | 20xx | | |

## Milestones

The consultant shall provide milestone dates for the following activities:

1) Preliminary Roadway Design
    - a) Alternate Alignments ready for a Project Team Meeting -
    - b) Hold Public Hearing -
    - c) Hold PL&G Inspection -
    - d) Submit DES -
    - e) Submit Preliminary Right of Way Plans -
    - f) Submit Electronic Plans -

2) Environmental Services
    - a) Submittal of Environmental Base Studies -
    - b) Approval of Environmental Base Studies -
    - c) Submittal of Draft EA to KYTC -
    - d) Approval of EA by FHWA -
    - e) Receipt of FONSI by KYTC -
    - f) FHWA Approval of FONSI or EIS -

3) Final Roadway Design
    - a) Submission of Critical Cross Sections to Geotechnical Branch for obtaining back slopes -
    - b) Submit Preliminary Drainage Folder -
    - c) Drainage Inspection -
    - d) Final Plans-in-Hand Inspection -
    - e) Advanced Situation Folders -
    - f) Right of Way Plans Submittal -
    - g) Submittal of Review Plans/Check Prints -
    - h) Final Roadway Plans & Final Drainage Folder Submittal -
    - i) Final Structure Plans Submittal -

*Other milestones may be added to this list as deemed necessary by the Department or consultant.*

Milestone dates are based on receiving Notice to Proceed by insert date and aerial photogrammetry and digitization by insert date.

Exhibit 200-10

Consultant Date

Project Manager Date

Project Development Branch Manager Date

Location Engineer Date

**Exhibit 200-11**

KENTUCKY TRANSPORTATION CABINET

Rev. 7/14

# PRODUCTION-HOUR WORKSHEET (revised 7/14)

COUNTY ____________

ROUTE ____________

DESC ____________

____________

ITEM NO. ____________

PROJECT TYPE ____________

CONSULTANT ____________

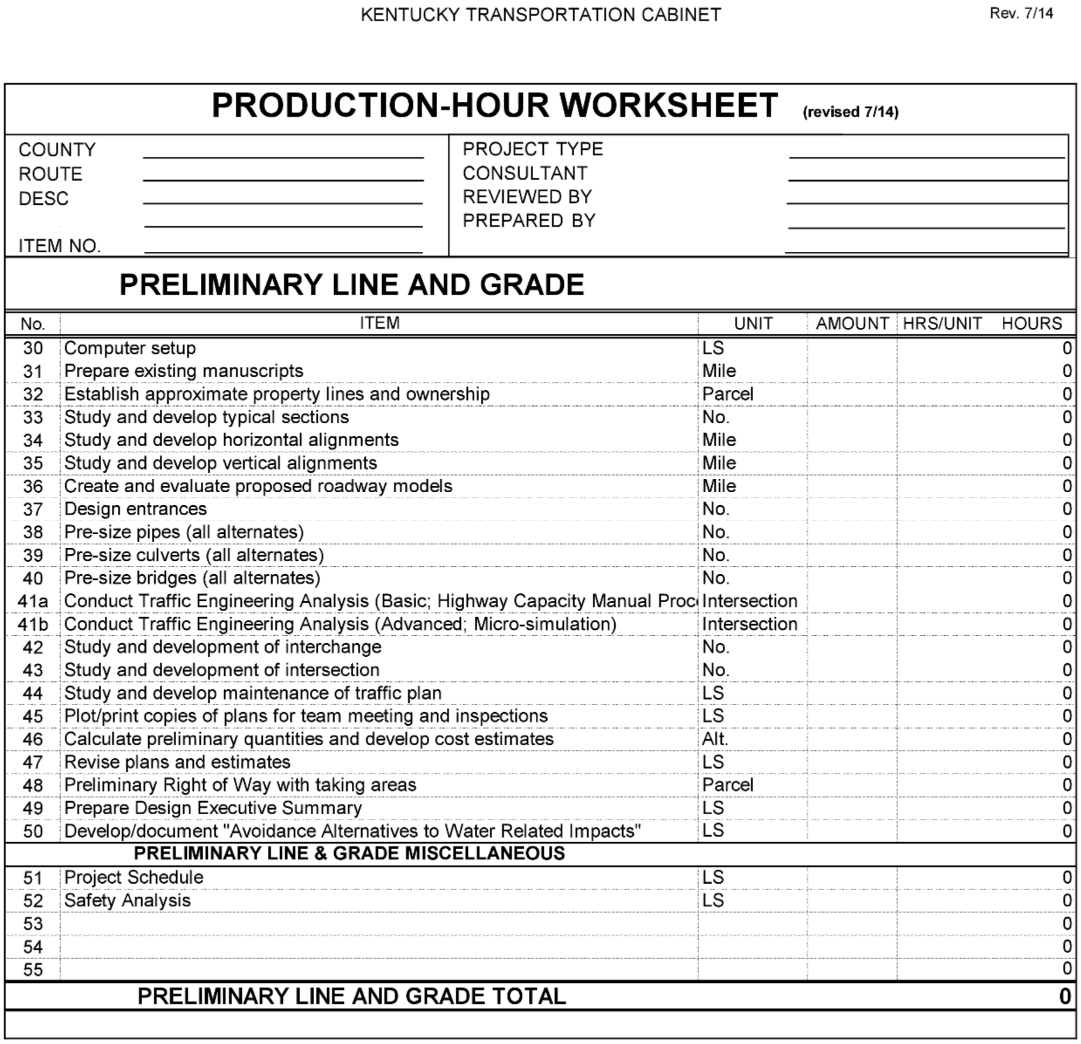
REVIEWED BY ____________

PREPARED BY ____________

## SURVEY

| No. | ITEM | CREW | UNIT | AMOUNT | HRS/UNIT | HOURS |
|---|---|---|---|---|---|---|
| | **RECONNAISSANCE** | | | | | |
| 1 | Control - (existing) | 1 | Mile | | | 0 |
| 2 | Utilities - (data gathering, identification & contact) | 1 | No. | | | 0 |
| 3 | Drainage - (sink holes, streams, pipes, etc.) | 1 | Mile | | | 0 |
| | **CONTROL** | | | | | |
| 4 | Horizontal | 2 | Mile | | | 0 |
| 5 | Vertical | 2 | Mile | | | 0 |
| 6 | Process data | 1 | Mile | | | 0 |
| | **PLANIMETRIC SURVEY** | | | | | |
| 7 | Planimetric location *(specify complete, pickup or update)* | 2 | Mile | | | 0 |
| 8 | Subsurface Utility Engineering, Quality Levels C & D | 1 | Mile | | | 0 |
| 9 | Subsurface Utility Engineering, Quality Level B | 1 | LS | | | 0 |
| 10 | Subsurface Utility Engineering, Quality Level A | 1 | LS | | | 0 |
| 11 | Process data | 1 | Mile | | | 0 |
| | **TERRAIN SURVEY** | | | | | |
| 12 | DTM data collection *(Items 11-18 not required if used)* | 2 | Acre | | | 0 |
| 13 | Verify terrain model accuracy | 2 | Mile | | | 0 |
| 14 | Tie-ins | 2 | No. | | | 0 |
| 15 | Drainage situations survey (Bridge) | 2 | No. | | | 0 |
| 16 | Drainage situations survey (Culvert) | 2 | No. | | | 0 |
| 17 | Drainage pipe section (non-situation size) | 2 | No. | | | 0 |
| 18 | Flood plain data | 2 | No. | | | 0 |
| 19 | Railroad Surveys | 2 | No. | | | 0 |
| 20 | Additional necessary DTM data *(specify pickup or update)* | 2 | Acre | | | 0 |
| 21 | Process data | 1 | Mile | | | 0 |
| | **ESTABLISH PROPERTY LINES & OWNERSHIP** | | | | | |
| 22 | Contact & Interview Property Owners | 1 | Parcel | | | 0 |
| 23 | Field tie property lines/corners | 2 | Parcel | | | 0 |
| | **STAKING** | | | | | |
| 24 | Stake centerlines, approaches, detours | 2 | Mile | | | 0 |
| 25 | Stake core holes - structures *(unit is per structure)* | 2 | No. | | | 0 |
| 26 | Stake core holes - roadway *(unit is per core hole)* | 2 | No. | | | 0 |
| | **SURVEY MISCELLANEOUS** | | | | | |
| 27 | Determine roadway elevations (Crown and EP) | 2 | Mile | | | 0 |
| 28 | Environmental areas | 2 | No. | | | 0 |
| 29 | | | | | | 0 |
| | **SURVEY TOTAL** | | | | | **0** |

**Exhibit 200-11**



KENTUCKY TRANSPORTATION CABINET
Rev. 7/14

## PRODUCTION-HOUR WORKSHEET (revised 7/14)

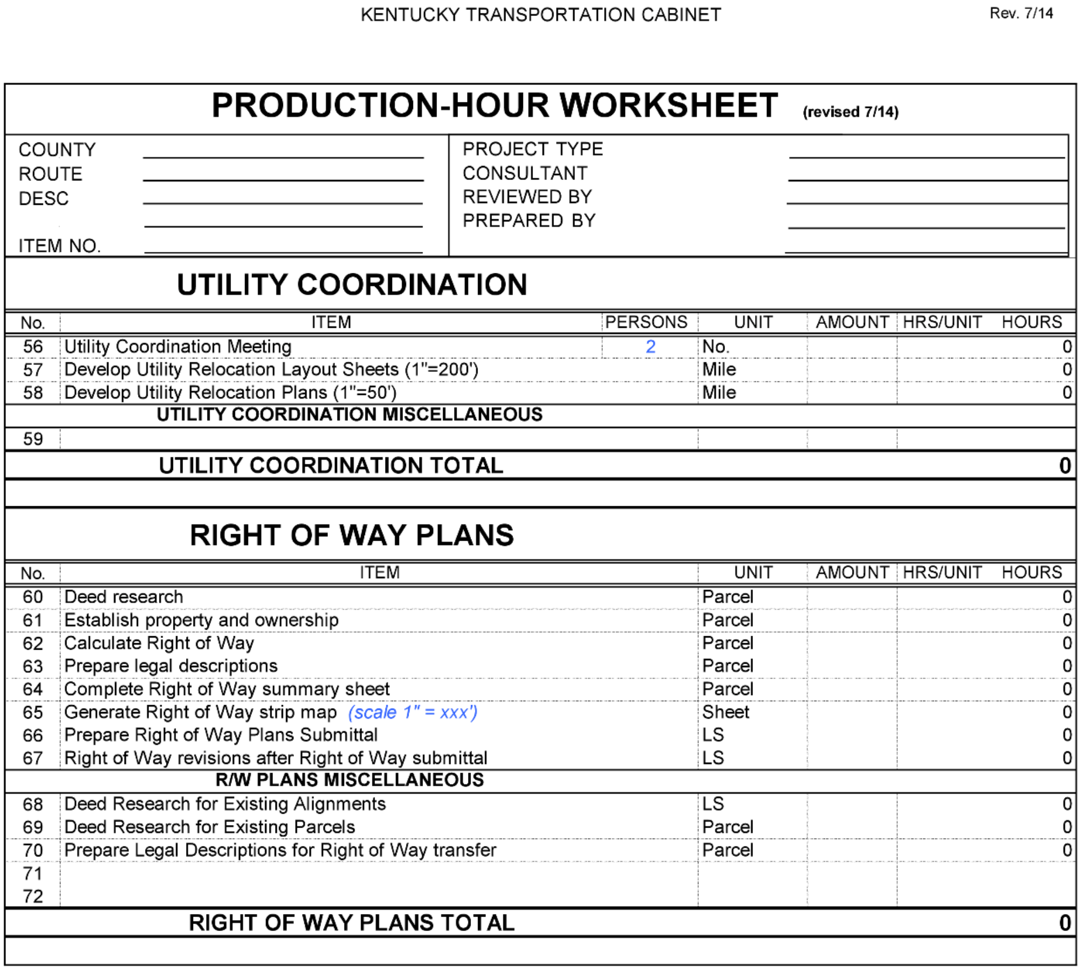
COUNTY ____________________
ROUTE ____________________
DESC ____________________
____________________
ITEM NO. ____________________

PROJECT TYPE ____________________
CONSULTANT ____________________
REVIEWED BY ____________________
PREPARED BY ____________________
____________________

### PRELIMINARY LINE AND GRADE

| No. | ITEM | UNIT | AMOUNT | HRS/UNIT | HOURS |
|---|---|---|---|---|---|
| 30 | Computer setup | LS | | | 0 |
| 31 | Prepare existing manuscripts | Mile | | | 0 |
| 32 | Establish approximate property lines and ownership | Parcel | | | 0 |
| 33 | Study and develop typical sections | No. | | | 0 |
| 34 | Study and develop horizontal alignments | Mile | | | 0 |
| 35 | Study and develop vertical alignments | Mile | | | 0 |
| 36 | Create and evaluate proposed roadway models | Mile | | | 0 |
| 37 | Design entrances | No. | | | 0 |
| 38 | Pre-size pipes (all alternates) | No. | | | 0 |
| 39 | Pre-size culverts (all alternates) | No. | | | 0 |
| 40 | Pre-size bridges (all alternates) | No. | | | 0 |
| 41a | Conduct Traffic Engineering Analysis (Basic; Highway Capacity Manual Proc | Intersection | | | 0 |
| 41b | Conduct Traffic Engineering Analysis (Advanced; Micro-simulation) | Intersection | | | 0 |
| 42 | Study and development of interchange | No. | | | 0 |
| 43 | Study and development of intersection | No. | | | 0 |
| 44 | Study and develop maintenance of traffic plan | LS | | | 0 |
| 45 | Plot/print copies of plans for team meeting and inspections | LS | | | 0 |
| 46 | Calculate preliminary quantities and develop cost estimates | Alt. | | | 0 |
| 47 | Revise plans and estimates | LS | | | 0 |
| 48 | Preliminary Right of Way with taking areas | Parcel | | | 0 |
| 49 | Prepare Design Executive Summary | LS | | | 0 |
| 50 | Develop/document "Avoidance Alternatives to Water Related Impacts" | LS | | | 0 |
| | **PRELIMINARY LINE & GRADE MISCELLANEOUS** | | | | |
| 51 | Project Schedule | LS | | | 0 |
| 52 | Safety Analysis | LS | | | 0 |
| 53 | | | | | 0 |
| 54 | | | | | 0 |
| 55 | | | | | 0 |
| | **PRELIMINARY LINE AND GRADE TOTAL** | | | | **0** |

**Exhibit 200-11**



KENTUCKY TRANSPORTATION CABINET

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## PRODUCTION-HOUR WORKSHEET (revised 7/14)

COUNTY ____________
ROUTE ____________
DESC ____________
____________
ITEM NO. ____________

PROJECT TYPE ____________
CONSULTANT ____________
REVIEWED BY ____________
PREPARED BY ____________

### UTILITY COORDINATION

| No. | ITEM | PERSONS | UNIT | AMOUNT | HRS/UNIT | HOURS |
|---|---|---|---|---|---|---|
| 56 | Utility Coordination Meeting | 2 | No. | | | 0 |
| 57 | Develop Utility Relocation Layout Sheets (1"=200') | | Mile | | | 0 |
| 58 | Develop Utility Relocation Plans (1"=50') | | Mile | | | 0 |
| | **UTILITY COORDINATION MISCELLANEOUS** | | | | | |
| 59 | | | | | | |
| | **UTILITY COORDINATION TOTAL** | | | | | **0** |

### RIGHT OF WAY PLANS

| No. | ITEM | UNIT | AMOUNT | HRS/UNIT | HOURS |
|---|---|---|---|---|---|
| 60 | Deed research | Parcel | | | 0 |
| 61 | Establish property and ownership | Parcel | | | 0 |
| 62 | Calculate Right of Way | Parcel | | | 0 |
| 63 | Prepare legal descriptions | Parcel | | | 0 |
| 64 | Complete Right of Way summary sheet | Parcel | | | 0 |
| 65 | Generate Right of Way strip map *(scale 1" = xxx')* | Sheet | | | 0 |
| 66 | Prepare Right of Way Plans Submittal | LS | | | 0 |
| 67 | Right of Way revisions after Right of Way submittal | LS | | | 0 |
| | **R/W PLANS MISCELLANEOUS** | | | | |
| 68 | Deed Research for Existing Alignments | LS | | | 0 |
| 69 | Deed Research for Existing Parcels | Parcel | | | 0 |
| 70 | Prepare Legal Descriptions for Right of Way transfer | Parcel | | | 0 |
| 71 | | | | | |
| 72 | | | | | |
| | **RIGHT OF WAY PLANS TOTAL** | | | | **0** |

**Exhibit 200-11**

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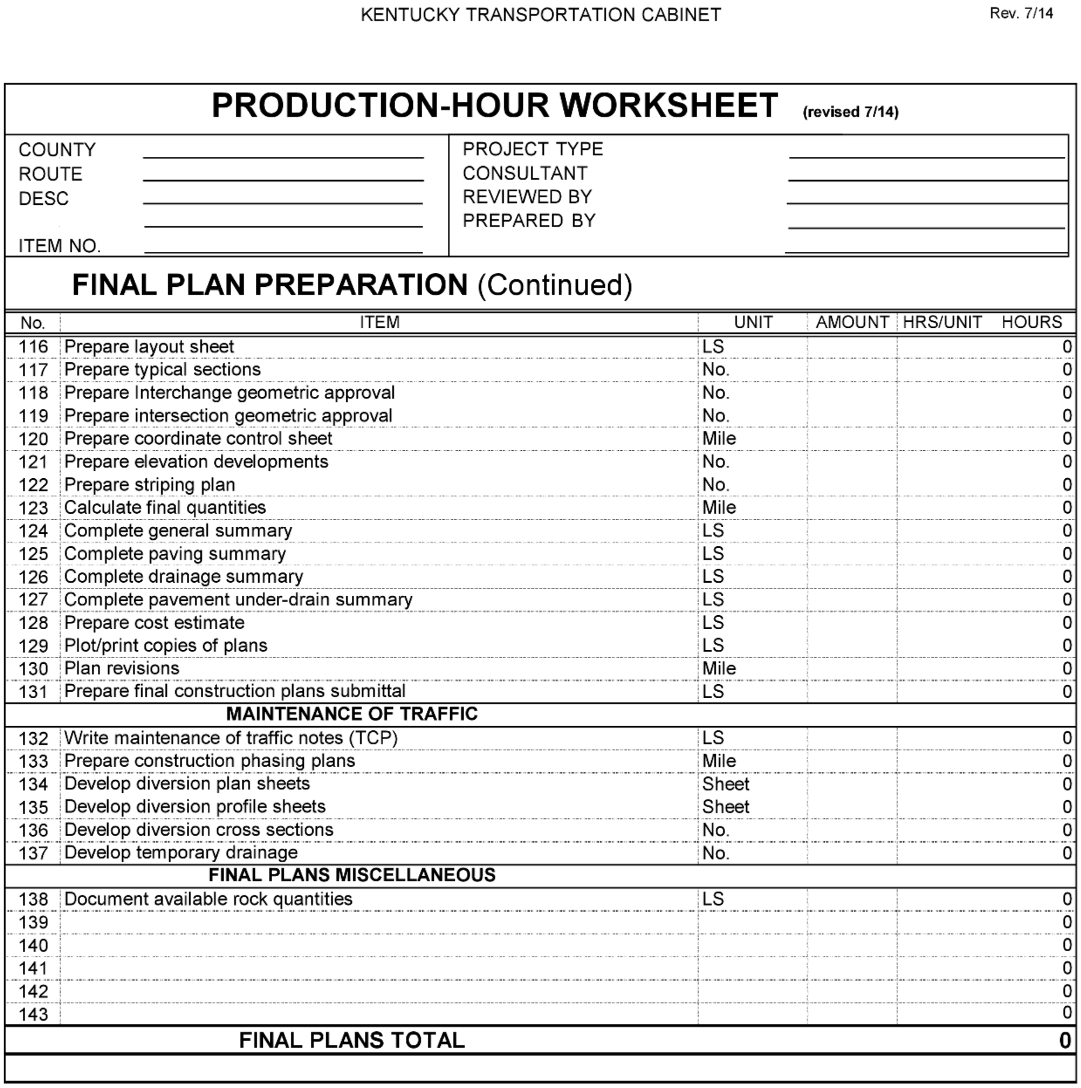
# PRODUCTION-HOUR WORKSHEET (revised 7/14)

COUNTY ____________________
ROUTE ____________________
DESC ____________________
____________________
ITEM NO. ____________________

PROJECT TYPE ____________________
CONSULTANT ____________________
REVIEWED BY ____________________
PREPARED BY ____________________

## FINAL PLAN PREPARATION

| No. | ITEM | UNIT | AMOUNT | HRS/UNIT | HOURS |
|---|---|---|---|---|---|
| 80 | Computer setup | LS | | | 0 |
| 81 | Update existing topography and terrain model | Mile | | | 0 |
| 82 | Refine alignments (horizontal & vertical) | Mile | | | 0 |
| 83 | Develop pavement design | No. | | | 0 |
| 84 | Finalize templates & transitions | No. | | | 0 |
| 85 | Develop final roadway model | Mile | | | 0 |
| 86 | Develop proposed design | Mile | | | 0 |
| 87 | Generate plan sheets *(scale 1" = xxx')* | Sheet | | | 0 |
| 88 | Generate profile sheets *(scale 1" = xxx')* | Sheet | | | 0 |
| 89 | Detail cross sections *(scale 1" = xxx')* | No. | | | 0 |
| 90 | Design entrances | No. | | | 0 |
| 91 | Revise roadway plans from soils report | Mile | | | 0 |
| | **DRAINAGE** | | | | |
| 92 | Develop pipe sections (< 54") | No. | | | 0 |
| 93 | Develop drainage system map | Mile | | | 0 |
| 94 | Develop drainage situation (bridge) | No. | | | 0 |
| 95 | Develop drainage situation (culvert) | No. | | | 0 |
| 96 | Develop blue line stream channel change ( => 200') | No. | | | 0 |
| 97 | Drainage analysis (entrance pipes) | No. | | | 0 |
| 98 | Drainage analysis (A < = 200 acres) | No. | | | 0 |
| 99 | Drainage analysis (200 acres < A < 1.0 sq. mile) | No. | | | 0 |
| 100 | Drainage analysis (A = > 1.0 sq. mile) level 1 analysis | No. | | | 0 |
| 101 | Drainage analysis (A = > 1.0 sq. mile) level 2 analysis | No. | | | 0 |
| 102 | Drainage analysis (A = > 1.0 sq. mile) level 3 analysis | No. | | | 0 |
| 103 | Special drainage studies | No. | | | 0 |
| 104 | Roadway ditches and channels | Mile | | | 0 |
| 105 | Develop Erosion Control Plan | Mile | | | 0 |
| 106 | Inlet spacing calculations | No. | | | 0 |
| 107 | Storm sewers calculations | No. | | | 0 |
| 108 | Perform scour analysis | No. | | | 0 |
| 109 | Assemble preliminary and final drainage folders | LS | | | 0 |
| 110 | Prepare advanced situation folder - bridge | No. | | | 0 |
| 111 | Prepare advanced situation folder - culvert | No. | | | 0 |
| | **DRAINAGE MISCELLANEOUS** | | | | |
| 112 | | LS | | | 0 |
| 113 | | | | | 0 |
| 114 | | | | | 0 |
| 115 | | | | | 0 |



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## PRODUCTION-HOUR WORKSHEET (revised 7/14)

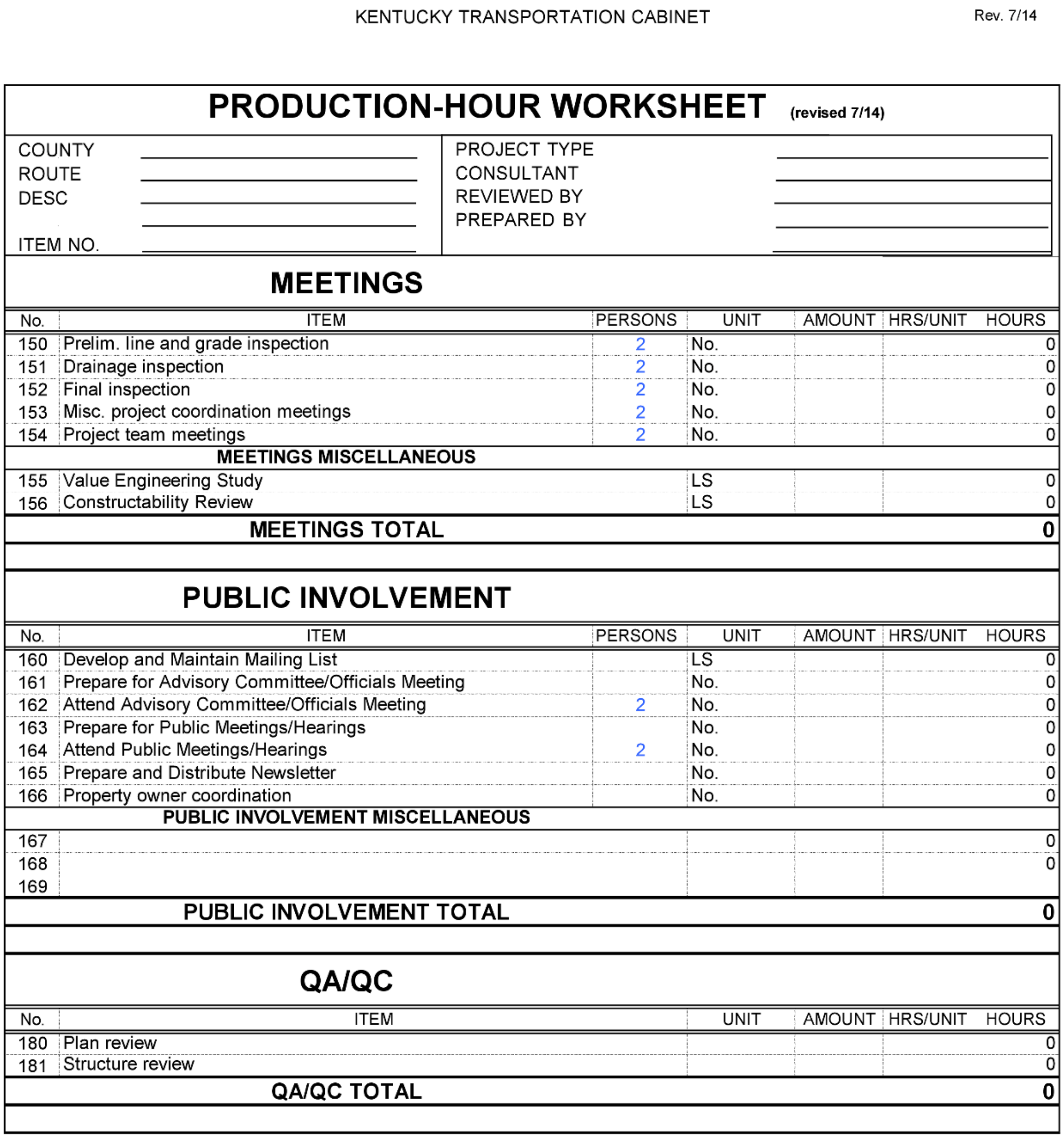
COUNTY ______________________
ROUTE ______________________
DESC ______________________
______________________
ITEM NO. ______________________

PROJECT TYPE ______________________
CONSULTANT ______________________
REVIEWED BY ______________________
PREPARED BY ______________________
______________________

### FINAL PLAN PREPARATION (Continued)

| No. | ITEM | UNIT | AMOUNT | HRS/UNIT | HOURS |
|---|---|---|---|---|---|
| 116 | Prepare layout sheet | LS | | | 0 |
| 117 | Prepare typical sections | No. | | | 0 |
| 118 | Prepare Interchange geometric approval | No. | | | 0 |
| 119 | Prepare intersection geometric approval | No. | | | 0 |
| 120 | Prepare coordinate control sheet | Mile | | | 0 |
| 121 | Prepare elevation developments | No. | | | 0 |
| 122 | Prepare striping plan | No. | | | 0 |
| 123 | Calculate final quantities | Mile | | | 0 |
| 124 | Complete general summary | LS | | | 0 |
| 125 | Complete paving summary | LS | | | 0 |
| 126 | Complete drainage summary | LS | | | 0 |
| 127 | Complete pavement under-drain summary | LS | | | 0 |
| 128 | Prepare cost estimate | LS | | | 0 |
| 129 | Plot/print copies of plans | LS | | | 0 |
| 130 | Plan revisions | Mile | | | 0 |
| 131 | Prepare final construction plans submittal | LS | | | 0 |
| | **MAINTENANCE OF TRAFFIC** | | | | |
| 132 | Write maintenance of traffic notes (TCP) | LS | | | 0 |
| 133 | Prepare construction phasing plans | Mile | | | 0 |
| 134 | Develop diversion plan sheets | Sheet | | | 0 |
| 135 | Develop diversion profile sheets | Sheet | | | 0 |
| 136 | Develop diversion cross sections | No. | | | 0 |
| 137 | Develop temporary drainage | No. | | | 0 |
| | **FINAL PLANS MISCELLANEOUS** | | | | |
| 138 | Document available rock quantities | LS | | | 0 |
| 139 | | | | | 0 |
| 140 | | | | | 0 |
| 141 | | | | | 0 |
| 142 | | | | | 0 |
| 143 | | | | | 0 |
| | **FINAL PLANS TOTAL** | | | | **0** |

# Exhibit 200-11



KENTUCKY TRANSPORTATION CABINET

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## PRODUCTION-HOUR WORKSHEET (revised 7/14)

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DESC ______________________
______________________
ITEM NO. ______________________

PROJECT TYPE ______________________
CONSULTANT ______________________
REVIEWED BY ______________________
PREPARED BY ______________________
______________________

### MEETINGS

| No. | ITEM | PERSONS | UNIT | AMOUNT | HRS/UNIT | HOURS |
|---|---|---|---|---|---|---|
| 150 | Prelim. line and grade inspection | 2 | No. | | | 0 |
| 151 | Drainage inspection | 2 | No. | | | 0 |
| 152 | Final inspection | 2 | No. | | | 0 |
| 153 | Misc. project coordination meetings | 2 | No. | | | 0 |
| 154 | Project team meetings | 2 | No. | | | 0 |
| | **MEETINGS MISCELLANEOUS** | | | | | |
| 155 | Value Engineering Study | | LS | | | 0 |
| 156 | Constructability Review | | LS | | | 0 |
| | **MEETINGS TOTAL** | | | | | **0** |

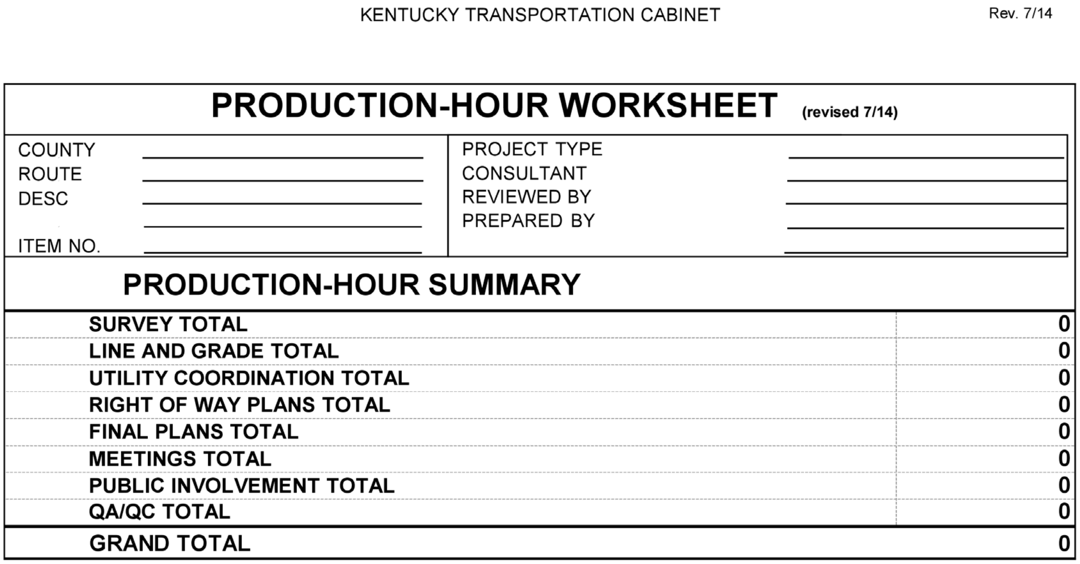
### PUBLIC INVOLVEMENT

| No. | ITEM | PERSONS | UNIT | AMOUNT | HRS/UNIT | HOURS |
|---|---|---|---|---|---|---|
| 160 | Develop and Maintain Mailing List | | LS | | | 0 |
| 161 | Prepare for Advisory Committee/Officials Meeting | | No. | | | 0 |
| 162 | Attend Advisory Committee/Officials Meeting | 2 | No. | | | 0 |
| 163 | Prepare for Public Meetings/Hearings | | No. | | | 0 |
| 164 | Attend Public Meetings/Hearings | 2 | No. | | | 0 |
| 165 | Prepare and Distribute Newsletter | | No. | | | 0 |
| 166 | Property owner coordination | | No. | | | 0 |
| | **PUBLIC INVOLVEMENT MISCELLANEOUS** | | | | | |
| 167 | | | | | | 0 |
| 168 | | | | | | 0 |
| 169 | | | | | | |
| | **PUBLIC INVOLVEMENT TOTAL** | | | | | **0** |

### QA/QC

| No. | ITEM | UNIT | AMOUNT | HRS/UNIT | HOURS |
|---|---|---|---|---|---|
| 180 | Plan review | | | | 0 |
| 181 | Structure review | | | | 0 |
| | **QA/QC TOTAL** | | | | **0** |

# Exhibit 200-11



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## PRODUCTION-HOUR WORKSHEET (revised 7/14)

COUNTY ____________________
ROUTE ____________________
DESC ____________________
____________________
ITEM NO. ____________________

PROJECT TYPE ____________________
CONSULTANT ____________________
REVIEWED BY ____________________
PREPARED BY ____________________
____________________

## PRODUCTION-HOUR SUMMARY

| | |
|---|---|
| **SURVEY TOTAL** | **0** |
| **LINE AND GRADE TOTAL** | **0** |
| **UTILITY COORDINATION TOTAL** | **0** |
| **RIGHT OF WAY PLANS TOTAL** | **0** |
| **FINAL PLANS TOTAL** | **0** |
| **MEETINGS TOTAL** | **0** |
| **PUBLIC INVOLVEMENT TOTAL** | **0** |
| **QA/QC TOTAL** | **0** |
| **GRAND TOTAL** | **0** |

**Exhibit 200-12**

REVISED 11/1/13

# CONSULTANT MONTHLY REPORT

**CONSULTANT** JAM Engineering, Inc

**COUNTY** McMartin **ITEM NO.** 11-155.00

**STATE PROJECT NO.** 9999901D **KYTC CONTRACT NO.** 201299
(Program code per precon report + project id no. per TC10)

**PROJECT DESCRIPTION:**
Provide Phase I Roadway Design services for improvements to Grant Road (KY 3) from Jamestown Road interchange to near the Springfield Road Interchange. The Consultant will evaluate improvements to the interchange of Billtown Road that will improve the operation and capacity of the interchanges to meet future traffic volumes.

The Consultant was change ordered to provide Phase II Final Design Plans.

| | CURRENT COST ESTIMATE | DATE OF CURRENT COST |
|---|---|---|
| RIGHT-OF-WAY | $1,200,000 | 1/1/13 |
| UTILITIES | $9,000,000 | 1/1/13 |
| CONSTRUCTION | $19,500,000 | 1/1/14 |

| | |
|---|---|
| DATE OF NOTICE TO PROCEED FOR STUDIES | N/A |
| DATE OF NOTICE TO PROCEED PHASE I | March 8, 2012 |
| DATE OF NOTICE TO PROCEED PHASE II | April 4, 2013 |
| DATE OF RECEIPT OF MANUSCRIPT | February 10, 2012 |
| LETTING DATE (FY OR ACTUAL) | July 11, 2014 |
| CONTRACT COMPLETION DATE | October 31, 2014 |

**REPORT OF MONTHLY ACTIVITIES (SUBMISSIONS, ACTIONS NEEDED, ETC.):**

- 3/10/14 Held Project Meeting to discuss Springfield Road improvements.

**RECOMMENDED BY:** Molly Meade **DATE** 5/30/14
*CONSULTANT*

**APPROVED BY:** *Brad Travis* **DATE** *6/14/14*
*KTC PROJECT MANAGER*

**Exhibit 200-12**

REVISED 11/1/13

**CONSULTANT MONTHLY REPORT**
**PAGE 2**

CONSULTANT JAM Engineering, Inc
ITEM NO. 11-155.00

| ACTIVITY | SCHEDULE | | |
|---|---|---|---|
| | CONTRACT | REVISED | ACTUAL |
| I. ENVIRONMENTAL | | | |
| A. SUBMIT BASE STUDIES | | | |
| 1. AIR | 10/1/12 | | 11/15/12 |
| 2. NOISE | 10/1/12 | | 11/15/12 |
| 3. WATER | 10/1/12 | | 11/15/12 |
| 4. BIOLOGICAL | 10/1/12 | | 11/15/12 |
| 5. CULTURAL / HISTORICAL | 10/1/12 | | 11/7/12 |
| 6. ARCHAEOLOGICAL | 10/1/12 | | 1/31/13 |
| 7. TERRESTRIAL | 10/1/12 | | 11/15/12 |
| 8. SOCIO-ECONOMIC | 10/1/12 | | 11/15/12 |
| 9. HAZMAT/UST (Phase 1) | 10/1/12 | | 11/6/12 |
| B. SUBMIT EA / DRAFT EIS FOR REVIEW | N/A | | N/A |
| C. SUBMIT EA / DRAFT EIS TO FHWA | 12/15/12 | | 3/20/13 |
| D. APPROVAL OF EA / DRAFT EIS BY FHWA | N/A | | N/A |
| E. HOLD PUBLIC HEARING (APPROX. 90 DAYS AFTER EA APPROVAL) | 10/15/12 | | 11/29/12 |
| F. FONSI / EIS APPROVAL (APPROX. 60 DAYS AFTER HEARING) | 3/1/13 | | 4/18/13 |

**Exhibit 200-12**

REVISED 11/1/13

## CONSULTANT MONTHLY REPORT

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CONSULTANT JAM Engineering, Inc.

ITEM NO. 11-155.00

| ACTIVITY | SCHEDULE | | |
|---|---|---|---|
| | CONTRACT | REVISED | ACTUAL |
| II. PRELIMINARY ROADWAY DESIGN | | | |
| A. SUBMIT P. L. & G. PLANS | 8/31/12 | | 9/12/12 |
| B. HOLD P. L. & G. (APPROX. 14 DAYS AFTER SUBMITTAL) | 9/14/12 | | 10/9/12 |
| C. SUBMIT P. L. & G. REPORT (APPROX. 7 DAYS AFTER INSPECTION) | 9/21/12 | | 10/18/12 |
| D. P. L. & G. REPORT APPROVAL (APPROX. 21 DAYS AFTER SUBMITTAL) | 10/12/12 | | 11/1/12 |
| E. SUBMISSION OF CRITICAL CROSS SECTIONS TO GEOTECH | N/A | | N/A |
| F. SUBMIT DESIGN EXECUTIVE SUMMARY | 11/16/12 | | 1/31/13 |
| G. SUBMIT PRELIMINARY R/W PLANS | 12/1/12 | | 2/28/13 |
| H. CONSULTANT EVALUATION RECEIVED | YES [ x ] NO [ ] | DATE: | 11/1/12 |
| III. FINAL ROADWAY DESIGN | | | |
| A. SUBMISSION OF FINAL CROSS SECTIONS TO GEOTECH | 1/3/13 | | 1/3/13 |
| B. SLOPE RECOMMENDATIONS RECEIVED FROM GEOTECH | 4/26/13 | 5/31/13 | 5/31/13 |
| C. SUBMIT PAVEMENT DESIGN | 5/15/13 | 6/15/13 | 6/15/13 |
| D. SUBMIT PRELIMINARY DRAINAGE FOLDER (INCLUDING SOURCE DATA) | 6/14/13 | 9/17/13 | 11/4/13 |
| E. HOLD DRAINAGE INSPECTION (APPROX. 14 DAYS AFTER SUBMITTAL) | 6/28/13 | 10/1/13 | 11/22/13 |
| F. SUBMIT FINAL INSPECTION PLANS | 6/14/13 | 9/17/13 | 11/4/13 |
| G. HOLD FINAL INSPECTION (APPROX. 14 DAYS AFTER SUBMITTAL) | 6/28/13 | 10/1/13 | 11/22/13 |
| H. CONSULTANT EVALUATION RECEIVED | YES [x ] NO [ ] | DATE: | 2/1/14 |

REVISED 11/1/13

**CONSULTANT MONTHLY REPORT**
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CONSULTANT JAM Engineering, Inc.
ITEM NO. 11-155.00

| ACTIVITY | SCHEDULE | | |
|---|---|---|---|
| | CONTRACT | REVISED | ACTUAL |
| **III. FINAL ROADWAY DESIGN CONTINUED:** | | | |
| I. SUBMIT FINAL INSPECTION REPORT (APPROX. 7 DAYS AFTER INSPECTION) | 7/5/13 | 10/8/13 | 12/17/13 |
| J. FINAL INSPECTION REPORT APPROVAL (APPROX. 21 DAYS AFTER SUBMITTAL) | 7/26/13 | 10/29/13 | 1/2/14 |
| K. SUBMIT FINAL RIGHT OF WAY PLANS | 4/26/13 | 6/15/13 | 7/10/13 |
| L. SUBMIT ADVANCE SITUATION FOLDER | 6/1/13 | 6/1/13 | 6/21/13 |
| M. SUBMIT REVIEW SET OF FINAL PLANS | 7/26/13 | 3/28/14 | |
| N. FINAL REVIEW COMMENTS RECEIVED (APPROX. 30 DAYS AFTER SUBMITTAL) | 8/15/13 | 4/28/14 | |
| O. SUBMIT FINAL PLANS & FINAL DRAINAGE FOLDER (INCLUDING SOURCE DATA) | 8/23/13 | 5/23/14 | |
| P. CONSULTANT EVALUATION RECEIVED | YES [ ] NO [ ] | DATE: | |
| Q. SUBMIT FINAL PAY ESTIMATE | YES [ ] NO [ ] | DATE: | |
| **IV. STRUCTURAL DESIGN** | | | |
| A. RECEIVE GEOTECH INFORMATION (APPROX. 180 DAYS AFTER RECEIPT OF ADVANCED SITUATION FOLDER) | N/A | 6/14/13 | 8/9/13 |
| B. SUBMIT STAGE I PRELIMINARY PLANS | N/A | 7/15/13 | 8/29/13 |
| C. SUBMIT STAGE II PRELIMINARY PLANS | N/A | 9/1/13 | |
| D. SUBMIT PHASE I FINAL PLANS | N/A | 12/1/13 | |
| E. SUBMIT FINAL STRUCTURAL PLANS | 8/23/13 | 2/14/14 | |

REVISED 11/1/13

**CONSULTANT MONTHLY REPORT**
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CONSULTANT JAM Engineering, Inc.
ITEM NO. 11-155.00

**HISTORY and PROJECT DOCUMENTATION**

**October, 2011**
- 10/18/11: Held Pre-Design Conference Meeting.

**February, 2012**
- 2/10/12: Received Mapping and Survey Information.

**March, 2012**
- 3/8/12: Received Notice to Proceed.

**May, 2012**
- 5/21/12: Held Team Alignment Review Meeting.
- 5/31/12: Submitted Cultural Historic Determination of Eligibility Study.

**August, 2012**
- 8/10/12: Held coordination meeting JAM Engineering who is designing the Grant Road Interchange.

**September, 2012**
- 9/12/12 Submitted Preliminary Line and Grade Plans.

**October, 2012**
- 10/9/12 Held Preliminary Line and Grade Meeting.
- 10/18/12 Submitted Preliminary Line and Grade Meeting Minutes for review.

**November, 2012**
- 11/1/12 Submitted Final Preliminary Line and Grade Meeting Minutes.
- 11/6/12 Submitted UST/Hazmat Baseline Report.
- 11/7/12 Submitted Assessment of Effect to Historic Properties.
- 11/13/12 Held Public Officials Meeting
- 11/15/12 Submitted Noise Baseline Study.
- 11/29/12 Held Public Meeting

**December, 2012**
- 12/11/12 Submitted plans and cross sections to geotech.

**January, 2013**
- 1/31/13 Submitted the Design Executive Summary.
- 1/31/13 Submitted the Archaeological Survey.

**February, 2013**
- 2/8/13 Negotiated Phase II design.

**April, 2013**
- 4/18/13 Submitted the final Categorical Exclusion Level 2 document.

**June, 2013**
- 6/21/13 Held Project Team Meeting to discuss proposed retaining walls.
- 6/21/13 Submitted the final advance Situation Folder for the bridges.

**July, 2013**
- 7/10/13 Submitted final right of way plans.

**August, 2013**
- 8/22/13 Submitted Right of Way revision No. 1.

**November, 2013**
- 11/4/13 Submitted Final Plans In Hand Inspection plans.
- 11/6/13 Submitted revised Interchange Geometric Approval Sheet.
- 11/22/13 Held Final Plans in Hand Inspection meeting.

**December, 2013**
- 12/17/13 Submitted the Final Plans in Hand Inspection minutes.

**March, 2014**
- 3/10/14 Held Project Meeting to discuss Springfield Road improvements.

Kentucky Transportation Cabinet
**Division of Highway Design**
**TRAFFIC MANAGEMENT PLAN**

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12/2010
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County: Milton Item No.: 9-1065.00

Federal Project No.: BRO 8703 (001)

Project Description:

Replace bridge and approaches over Beargrass Creek on East Main Street (US 24) 0.25 mile east of US 31E (Baxter Ave) (B347) (SR=25.3) (056B00347N)

Roadway Classification: ☒ Urban ☐ Rural

☐ Local ☐ Collector ☒ Arterial ☐ Interstate

ADT (current) 8100 AM Peak Current 514vph* PM Peak Current 1011vph* (*4 Lanes)

% Trucks 8.3

Project Designation: ☐ Significant ☒ Other: _____

**Traffic Control Plan Design:**

Taper and Diversion Design Speeds 35 mph

Minimum Lane Width 12’ Minimum Shoulder Width N/A

Minimum Bridge Width 15’ MOT Lane Phase1 / 12.75’ MOT Lane Phase 2

Minimum Radius 655’ Maximum Grade 2.25%

Minimum Taper Length 100’ Minimum Intersection Level of Service N/A

Existing Traffic Queue Lengths N/A Projected Traffic Queue Lengths No Delay

Comments:

US 24 (E. Main St.) over Beargrass Creek bridge replacement project is on the NHS.

The US 24 (E. Main St.) over Beargrass Creek bridge replacement project is not designated as “Significant” due to the existing DHV count being less than 1000 VPH per lane and no detour on a NHS route, however a Public Information Plan (PIP) will be included for this project.

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12/2010
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Item No. 9-1065.00

**Discussion:**

## 1) Public Information Plan

a) Prepare with assistance from ☒ KYTC or ☐ ______

| | | | |
|---|---|---|---|
| b) Identify Trip Generators | N/A | f) Railroad Involvement | N/A |
| c) Identify Types of Road Users | Referenced | g) Address Pedestrians, Bikes Mass Transit | Referenced |
| d) Public Information Message | Referenced | h) Address Timing, Frequency, Updates, Effectiveness of Plan | N/A |
| e) Public Information Strategies to be used | Referenced | i) Police & Other Emergency Services | Referenced |

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## 2) Temporary Traffic Control Plan (For Each Phase of Construction)
## Phase I

| **Exposure Control Measures** | | **Positive Protection Measures** | |
|---|---|---|---|
| a) Is Road Closure Allowed Type: | N/A | a) Address Drop Off Protection Criteria | Referenced |
| b) Detour Conditions | N/A | b) Temporary Barrier Requirements | Referenced |
| c) Working Hour Restrictions | Referenced | c) Evaluation of Existing Guardrail Conditions | N/A |
| d) Holiday or Special Event Work Restrictions | N/A | d) Address Temporary Drainage | N/A |
| e) Evaluation of Intersection LOS | N/A | **Uniformed Law Enforcement Officers** | N/A |
| f) Evaluation of Queue Lengths | N/A | **Payment for Traffic Control*** | |
| g) Evaluation of User Costs and Incentives/Disincentives | Referenced | a) Method of Project Bidding | N/A |
| h) Address Pedestrians, Bikes, Mass Transit | Referenced | b) Special Notes | Referenced |
| **Work Vehicles and Equipment** | N/A | *Payment for traffic control items shall be in accordance with the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction | |

Comments:

**US 24 (E. Main St.) over Beargrass Creek – Phase 1**

Phase 1 construction includes: Structure removal, relocation of 36” water main and relocation of underground telephone, construction of abutment caps, beams, bridge slab, bridge railing, subgrade, asphalt base/surface pavements, standard header curbs, inlet adjustments, sidewalks and concrete entrance.

- Traffic will be maintained on existing facilities and remaining existing bridge structure.
- See attached TTCP sheet for Phase 1 Construction.

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Item No. 9-1065.00

## 2) Temporary Traffic Control Plan (For Each Phase of Construction)
## Phase 2

| | | | |
|---|---|---|---|
| **Exposure Control Measures** | | **Positive Protection Measures** | |
| a) Is Road Closure Allowed Type: | N/A | a) Address Drop Off Protection Criteria | Referenced |
| b) Detour Conditions | N/A | b) Temporary Barrier Requirements | N/A |
| c) Working Hour Restrictions | Referenced | c) Evaluation of Existing Guardrail Conditions | N/A |
| d) Holiday or Special Event Work Restrictions | N/A | d) Address Temporary Drainage | N/A |
| e) Evaluation of Intersection LOS | N/A | **Uniformed Law Enforcement Officers** | N/A |
| f) Evaluation of Queue Lengths | N/A | **Payment for Traffic Control*** | |
| g) Evaluation of User Costs and Incentives/Disincentives | Referenced | a) Method of Project Bidding | Referenced |
| h) Address Pedestrians, Bikes, Mass Transit | Referenced | b) Special Notes | Referenced |
| **Work Vehicles and Equipment** | N/A | *Payment for traffic control items shall be in accordance with the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction | |
| Comments: | | | |

**US 24 (E. Main St.) over Beargrass Creek – Phase 2**

Phase 2 construction includes: Tie relocated 36” water main to existing facility, remaining structure removal, construction of abutment caps, beams, bridge slab, bridge railing, subgrade, asphalt base/surface pavements, standard header curbs, inlet adjustments, and sidewalks.

- Traffic will be maintained on existing and new facilities.
- See attached TTCP sheet for Phase 2 Construction.

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**Division of Highway Design**
**TRAFFIC MANAGEMENT PLAN**

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## 2) Temporary Traffic Control Plan (For Each Phase of Construction)
## Phase 3

| | | | |
|---|---|---|---|
| **Exposure Control Measures** | | **Positive Protection Measures** | |
| a) Is Road Closure Allowed Type: | N/A | a) Address Drop Off Protection Criteria | Referenced |
| b) Detour Conditions | N/A | b) Temporary Barrier Requirements | N/A |
| c) Working Hour Restrictions | Referenced | c) Evaluation of Existing Guardrail Conditions | N/A |
| d) Holiday or Special Event Work Restrictions | N/A | d) Address Temporary Drainage | N/A |
| e) Evaluation of Intersection LOS | N/A | **Uniformed Law Enforcement Officers** | N/A |
| f) Evaluation of Queue Lengths | N/A | **Payment for Traffic Control*** | |
| g) Evaluation of User Costs and Incentives/Disincentives | Referenced | a) Method of Project Bidding | Referenced |
| h) Address Pedestrians, Bikes, Mass Transit | Referenced | b) Special Notes | Referenced |
| **Work Vehicles and Equipment** | N/A | *Payment for traffic control items shall be in accordance with the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction | |

Comments:

**US 24 (E. Main St.) over Beargrass Creek – Phase 3**

Phase 3 construction includes: While maintaining at least two (2) lanes of traffic through the new approaches and bridge structure complete the construction of final asphalt overlay on newly constructed base pavements performed in previous construction phases, final stripping, seeding/protection and final clean-up.

- Traffic will be maintained on new facilities.
- See attached TTCP sheet for Phase 3 Construction.

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**TRAFFIC MANAGEMENT PLAN**

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Item No. 9-1065.00

**APPROVAL:**

Tim Jones **1/13/14**

Project Manager Date

Alex Washington 1/13/14

Project Delivery and Preservation Manager Date

Maria Johnson 1/14/14

Engineering Support Manager Date

FHWA Representative Date

**Revisions to the TMP require review/approval by the signatories.**

**Exhibit 200-13**

## Item No. 9-1065.00

## Milton County

## US 24 (East Main Street) over Beargrass Creek

## TRAFFIC MANAGEMENT PLAN OVERVIEW

PROJECT GOALS AND OBJECTIVES

The purpose of this project is to replace the existing bridge and approaches on US 24 (East Main Street), a state maintained urban road over Beargrass Creek near downtown Louisville. The sufficiency rating of the current bridge is 20.7. A bridge with a sufficiency rating below 50 is considered substandard.

The following goals and objectives were developed to balance community issues with transportation issues.

- The new bridge is to be constructed in the same location as the existing structure using the same horizontal alignment and vertical alignment. Utilizing a two phase construction approach replace the existing bridges superstructure, sidewalks and railings only with a new superstructure incorporating the existing stone masonry abutments, stone masonry wingwalls and stone masonry railings into the proposed bridge design. Existing stone masonry abutments will be retrofitted with new abutment caps to accommodate the new beam layout of the proposed superstructure. Geotechnical Report S-078-2012 performed by KYTC Geotechnical Branch confirmed the structural viability of reusing and retrofitting the existing stone masonry abutments. This bridge alternate will require a Level 1 drainage analysis. With this alternate the approaches to the bridge will be replaced and existing sidewalks will be improved.

- *Right of way impacts:* There are four parcels that are adjacent to the proposed bridge replacement. It is not anticipated that the bridge replacement project will require the acquisition of permanent right-of way or temporary easements. There are no relocations required. There are no historic properties that will be impacted by this project.

- *The impacts to the Utilities:* This project would impact the following utilities in the area: Acme Water Company has a 36" Water Main that is located in a concrete vault on the underside of the upstream side of existing structure. The 36" Water Main is to be relocated to the downstream underside of the proposed structure and incorporated into the bridge design. Approximately 150' to 300' of water line will need to be relocated. Acme Phone Co. has an existing communication duct line located on the underside of the downstream side of existing structure leased to Level 3. A proposed utility vault is to be incorporated into the downstream underside of the proposed structure to house existing and future communication lines. ACME GAS CO. has an 8" Gas Main located on the underside of the existing structure which is to be removed and capped on either side of the proposed structure. The existing gas main will not be relocated back on the bridge. No other utilities or overhead facilities on the project will be affected.

- *Environmental impacts:* The request for environmental analysis has been submitted and a CE LVL 1 is anticipated. Existing stone masonry abutments, stone masonry wingwalls and stone masonry railings are being incorporated into the design of the proposed structure as requested by SHPO. The SHPO has determined the original structure had a metal railing and is to be replaced using a modern type metal railing (Rail Type 8). Concrete elements of the proposed Rail Type 8 and sidewalks on this project shall use "Metro Historic Mix" for construction. The inclusion of these elements into the new design leads to a "No Adverse Effect to Historic Properties" for this bridge replacement project. Wetlands, endangered species or sensitive aquatic habitats are not expected to be affected by this project. Beargrass Creek, a blue-line stream which is concrete lined in this section of the creek, is a tributary of the Ohio River.

- *Pedestrian facilities:* Along this section of US 24 (E. Main Street) there are existing sidewalks along the west approach to the bridge and deteriorated sidewalks on the existing bridge structure ending at the east end of the bridge. No sidewalks are directly present leaving the structure at the east approach of the bridge, however there is foot traffic crossing the bridge and further east of the projects limits there are sidewalks present on US 24 (E. Main Street). The Project Team took this into consideration along with this being a spot improvement bridge replacement project and has decided to tie in the existing approach sidewalks to the west, include sidewalks on the proposed structure and construct sidewalks on the east approach of the proposed structure within the limits of the project only. Sidewalks on this project shall use "Metro Historic Mix" for construction.

- The existing drainage pattern will remain virtually unchanged. The four existing curb inlets (Two on each approach to the bridge) shall be adjusted to the new curbs to allow for new transitions to the proposed bridge structure. Each existing/adjusted curb inlets will drain to Beargrass Creek as originally designed.

- The construction period for this project is anticipated to be 3 to 4 months. Due to the existing DHV on this project being less than 1000 VPH per lane and no detour on a NHS route, *this project is not considered significant,* however a Public Information Plan (PIP) will be included for this project.

**Exhibit 200-13**

TMP (Additional Information)
Page 3 of 11

# BRIDGE REPLACEMENT ON US 24 OVER BEARGRASS CREEK BETWEEN US 31E AND SPRING STREET (M.P. 0.26)
## ITEM # 9-1065
## PUBLIC INFORMATION PLAN

The primary goal of the Public Information Plan (PIP) is to inform the motoring public and area stakeholders of project information including Maintenance of Traffic (MOT) which includes lane closures. The KYTC District 9 Public Information Officer (PIO) will coordinate and disseminate to stakeholders and the media appropriate information regarding the construction plans.

### LOCAL STAKEHOLDERS

- Elected Officials
    - State Senator John Doe – (502) 555-5500; john.doe@lrc.ky.gov
    - State Senator Alexander Hamilton – (502) 555-5501; Al.Hamilton@lrc.ky.gov
    - State Representative Ben Franklin – (502) 555-5502; ben.franklin@lrc.ky.gov
    - State Representative Abraham Livingston – (502) 555-5503; Abe.Livingston@lrc.ky.gov
    - Mayor Roger Gilman – (502) 555-5504 ; Roger.Gilman@milton.gov
    - Metro Councilwoman Olivia Baldwin (502) 555-5505; liv.baldwin@milton.gov
    - Metro Councilman George Sherman – (502) 555-5506; G.Sherman@Milton.gov

- Local Agencies
    - Jesse Ingersoll, Director of Transportation for Milton County Public Schools – (502) 555-5507; J.Ingersoll@Milton.kyschools.us
    - Wilma Few, Transit Authority – (502) 555-5507; Wilma@rideta.org
    - Lt. Sam Morris, Milton Police Department Traffic Division – (502) 555-5508; sam.morris@Milton.gov
    - Sheila Paterson, Milton Visitors and Convention Bureau – (502) 555-5509; spaterson@gotomilton.com

- Utility Companies
    - Local utility companies are kept apprised of this project at the monthly utility coordination meetings hosted by District 9

### TRUCKING FIRMS AND OUT OF STATE STAKEHOLDERS

Information will be distributed electronically to trucking firms via Ryan Jackson at the Department of Vehicle Regulation (502-555-5510; Ry.Jackson@ky.gov). Information will also be posted on the 511 website (www.511.ky.gov) and on the 511 telephone information system.

**PRESENTATIONS**

A project description including anticipated schedule will be provided to the media, stakeholders and other emergency service agencies via e-mail prior to construction. Information will be provided to these groups via traffic advisories, press releases, the District 9 website, District 9 Facebook page and the weekly District 9 Road Show of Construction and Maintenance Activities.

**MEDIA RELATIONS**

The District PIO will prepare an initial news release regarding the contract award for the project.
The PIO will conduct interviews with the media throughout the project duration to keep the public informed of construction progress. Traffic advisories will be submitted to the media when a change in the MOT occurs. The contractor must provide to the PIO via the Resident Engineer notification of any change in the MOT at least five (5) days prior to the change.

# MAINTENANCE OF TRAFFIC

## Item No. 9-1065.00

## Milton County

## US 24 (East Main Street) over Beargrass Creek

# GENERAL NOTES

## TRAFFIC CONTROL

Traffic shall be maintained in accordance with the plans, these notes, and Section 112 of the current *Standard Specifications for Road and Bridge Construction.* Except for the roadway and traffic control bid items listed, all items of work necessary to maintain and control traffic will be paid at the lump sum bid price to "Maintain and Control Traffic". All traffic lane shifts and temporary lane closures used on the Project will be in compliance with the appropriate Standard Drawings and MUTCD requirements. Do NOT use Cones for traffic lane shifts, temporary lane closures or shoulder closures.

Contrary to Section 106.01, traffic control devices used on this project may be new, or used in like new condition at the beginning of the work and maintained in like new condition until completion of the work. Traffic Control Devices will conform to current MUTCD.

The Contractor will be responsible for the continuous maintenance and upkeep of all traffic control devices.

Traffic speeds are to be reduced from 35 M.P.H to 25 M.P.H through project limits and for the duration of the construction project.

All advanced construction approach signing shall be in place before any traffic lane shifts.

Channelizing devices (Drum) shall be placed at a spacing of no greater than twenty (20) feet in all tapers and at a spacing of no greater than fifty (50) feet for use in tangent channelizing sections.

# PROJECT PHASING

## PHASE 1

### STEP 1

### US 24 (East Main Street)

Install all advanced construction approach signing. Beginning at the intersection of US 24 (E. Main St), Story Avenue and Baxter Avenue place channelizing drums as shown on the Phase One Construction Plan to Station 1+40 and Station 1+94 to Station 6+07 to facilitate the merging of all eastbound traffic on US 24 (E. Main St) from Baxter Avenue, Story Avenue, N. Johnson St and S. Johnson St to form one lane to the right. Place channelizing drums from Station 6+07 to Station 9+19 and from Station 7+70 to Station 11+02 as shown on the Phase One Construction Plan to form a shifted lane for eastbound traffic on US 24 (E. Main St) from Bickel Avenue to merge into traffic on the above one lane right. Place temporary concrete traffic barrier (Type T) beginning at Station 10+17 utilizing a 4:1 Flare to Station 11+02 and continuing across the existing structure over Beargrass Creek to Station 13+58 as shown on the Phase One Construction Plan forming one 15’ lane right across the existing structure. Place channelizing drums from Station 13+58 to Station 16+36 at end of Phase One Construction maintenance of traffic (MOT).

Existing traffic signals located at the intersection of US 24 (E. Main St) and Johnson Street are to remain operational for the duration of Phase One Construction traffic lane shifts.

### STEP 2

### US 24 (East Main Street)

While maintaining traffic on shifted MOT lane to the right on US 24 (E. Main St) begin the removal of the existing superstructure over Beargrass Creek as shown on the Phase One Construction section of bridge. Once removed begin construction of abutments placed in the stone masonry, bridge deck, bridge sidewalks and bridge railing as shown in Phase One construction. Relocate the 36” water main on proposed structure and in the roadway bridge approaches to facilitate tie-ins to the existing 36” water main to be completed in Phase Two construction. Construct all standard header curbs to the left and adjust to existing inlets. Construct all concrete sidewalks to the left and concrete entrance at Lt Station 13+58. Construct all subgrade, asphalt base and asphalt surfaces in bridge roadway approaches as shown on Phase One Construction Plan.

## PHASE 2

### STEP 1

**US 24 (East Main Street)**

Begin relocation of channelizing drums to shift traffic to the newly completed left half of structure constructed in Phase One. Beginning at the intersection of US 24 (E. Main St), Story Avenue and Baxter Avenue place channelizing drums as shown on the Phase Two Construction Plan to Station 1+40 and Station 2+00 to Station 5+00 to control the movement of eastbound traffic on US 24 (E. Main St) from Story Avenue and N. Johnson St to remain in the furthest left lane. Place channelizing drums from Station 5+73 to Station 11+03 as shown on the Phase Two Construction Plan to merge eastbound traffic on US 24 (E. Main St) from Baxter Avenue, S. Johnson Street and Bickel Avenue to form one lane left. Place temporary concrete traffic barrier (Type T) beginning at Station 10+33 utilizing a 4:1 Flare to Station 11+03 and continuing across the newly constructed structure over Beargrass Creek to Station 13+59 as shown on the Phase Two Construction Plan forming one 12.75’ lane left across the newly constructed structure. Place channelizing drums from Station 13+59 to Station 15+61 at end of Phase One Construction maintenance of traffic (MOT).

Existing traffic signals located at the intersection of US 24 (E. Main St) and Johnson Street are to remain operational for the duration of Phase Two Construction traffic lane shifts.

### STEP 2

**US 24 (East Main Street)**

While maintaining traffic on shifted MOT lane to the left on US 24 (E. Main St) finalize the tie-ins from the newly relocated 36” water main to the existing 36” water main. After the 36” water main has been reconnected to its new location and online, begin the removal of the remaining existing superstructure over Beargrass Creek and the abandoned 36” water main. Once removed begin construction of remaining abutments placed in the stone masonry, bridge deck, bridge sidewalks and bridge railing as shown for the Phase Two Construction. Construct all standard header curbs to the right and adjust to existing inlets. Construct all concrete sidewalks to the right. Construct all subgrade, asphalt base and asphalt surfaces in bridge roadway approaches as shown on the Phase Two Construction Plan.

## PHASE 3

### STEP 1

**US 24 (East Main Street)**

Remove Phase Two traffic control and maintain traffic on the newly constructed roadway approaches and structure over Beargrass Creek which were completed in Phase One and Phase Two. Utilizing temporary lane closures and maintaining at least one twelve (12) foot lane of one-way traffic, construct final roadway striping, seeding/protection and final project clean-up.

# SPECIAL NOTES

## VARIABLE MESSAGE SIGNS

Provide variable message signs on US 31E (Baxter Avenue) and Story Avenue in advance of the proposed bridge construction at locations to be determined by the Engineer. Variable message signs are to inform the traveling public of the dates of proposed construction, times of the proposed temporary lane shifts and should be in place seven (7) days before the actual beginning of construction. The locations designated may vary as the work progresses. The messages required to be provided will be designated by the Engineer. The variable message signs will be in operation at all times. In the event of damage or mechanical/electrical failure, the Contractor will repair or replace the Variable Message Sign immediately. Variable Message Boards will be paid for once, no matter how many times they are moved or relocated. The Department **WILL NOT** take possession of the signs upon completion of the work.

## PAVEMENT EDGE DROP-OFFS

*Difference in Elevation for Travel Lanes*
A pavement edges that traffic is expected to cross in a lane change situation should not have an elevation difference greater than one and one-half inches. This may be increased to two inches for low speed situations. Warning signs should be placed in advance and throughout the drop-off area.

*Pavement Drop-off*
Pavement edges that traffic is not expected to cross, except accidentally, should be treated as follows:

Less Than Two Inches – No protection required. Warning signs "Shoulder Drop Off" (W8-9a) shall be placed at each end of the project preceding the drop-off area

Greater Than Two Inches – In addition to the warning signing requirements for less than two inches, protect drop-off with wedge of 3:1 or flatter slope when work ceases for periods of time exceeding three (3) hours.

For temporary conditions, drop-off greater than two inches may be protected with plastic drums, vertical panels, or barricades for short distances during daylight hours while work is being done in the drop-off area.

## ROADWAY CLOSURES

US 24 (East Main Street) is to remain open to eastbound through traffic and maintain a minimum of one twelve (12) foot lane of one-way traffic during all phases of construction at all times throughout the project limits. A roadway closure with a signed detour route will not be allowed on this project.

Lane closures and lane reductions shall be in accordance with Standard Drawing Number ***TTC-120-02 (LANE CLOSURE MULTI-LANE HIGHWAY CASE II),*** current ***MUTCD*** requirements, ***MOT Plans*** and as directed by the resident engineer.

## TRAFFIC COORDINATOR

Designate an employee to be traffic coordinator. The Traffic Coordinator will inspect the project maintenance of traffic once every hour during the Contractor's operations and at any time a temporary lane closure is in place. The Traffic Coordinator will report all incidents throughout the work zone to the Engineer on the project. The Contractor will furnish the name and telephone number where the Traffic Coordinator can be contacted at all times.

During any period when a temporary lane closure is in place, the Traffic Coordinator will arrange for personnel to be present on the project at all times to inspect the traffic control, maintain the signing and devices, and variable message boards. The personnel will have access on the project to a radio or telephone to be used in case of emergencies or accidents. Payment of the Traffic Control Coordinator will be incidental to MOT.

## SIGNS

Contrary to section 112, Individual signs will be measured only once for payment, regardless of how many times they are set, reset, removed, and relocated during the duration of the project. Replacements for damaged signs or signs directed to be replaced by the Engineer due to poor legibility or reflectivity will not be measured for payment.

## PEDESTRIAN CONSIDERATION

Take note of obvious evidence of pedestrian use within the project limits. Evidence may consist of pedestrians moving along the roadway on a permanent or non permanent pedestrian facility. If pedestrians are present the Contractor shall comply with the Manual of Uniform Traffic Control Devices, current edition, chapter 6D, 6F and 6H. If pedestrians are present, the pedestrian access shall remain available at all times, either by reasonable detour or diversion. The temporary facility must replicate the existing facility as nearly as practical including ADA compliance where necessary. Appropriate signage for the control of pedestrian access will be measured and paid under the bid item “Temporary Signs”. Payment for construction, maintenance and subsequent removal of the temporary facility or detour and all other incidentals shall be included in the bid item “Maintain & Control Traffic”.

## BLASTING PROHIBITED

Blasting shall be prohibited on this project. Rock structure excavation shall be performed in a method approved by the Engineer.

## TEMPORARY ENTRANCES

The Contractor will not be required to provide continuous access to **residential properties** during the working day. However, at the end of each day the Contractor shall provide reasonable egress and ingress to each property. The time during which a residential entrance is blocked shall not exceed six (6) hours. The Contractor will be required to maintain at least one (1) entrance on **commercial properties**.

The Contractor shall notify all property owners twenty-four (24) hours in advance of any driveway or entrance closings. Payment will be allowed at the unit price bid for all surfacing materials required to construct and maintain any temporary entrances which may be necessary, to provide access to the residential properties. However, no direct payment will be allowed for excavation and/or embankment.

## ON STREET PARKING RESTRICTIONS

The Contractor shall coordinate with Milton Public Works to obtain the necessary parking restriction signage required to temporarily close all on street parking affected by this project. Signs must be obtained from John Smith (502-555-5510) at the Milton Metro Public Works/Urban Roads Division, 5014 Farmers Road, Milton, KY 97412. Payment for obtaining, installing, maintaining and removing these signs shall be incidental to bid item "Maintain and Control Traffic".

## LIQUIDATED DAMAGES

Liquidated Damages as shown in Section 108.09 of the current Standard Specifications will be assessed for each day work remains uncompleted beyond the Specified Completion Date. This project has a Fixed Completion Date of September 15th, 2014.

In addition to the Liquidated Damages specified above, Liquidated Damages in the following amounts will be charged when US 24 (East Main Street) is closed for more than two consecutive hours to eastbound through traffic throughout the project limits.

| | |
|---|---|
| US 24 Roadway Closures: | $ 1,000 for the first hour or fraction thereof |
| | $ 2,000 for the second hour or fraction thereof |
| | $ 10,000 any additional hour or fraction thereof |

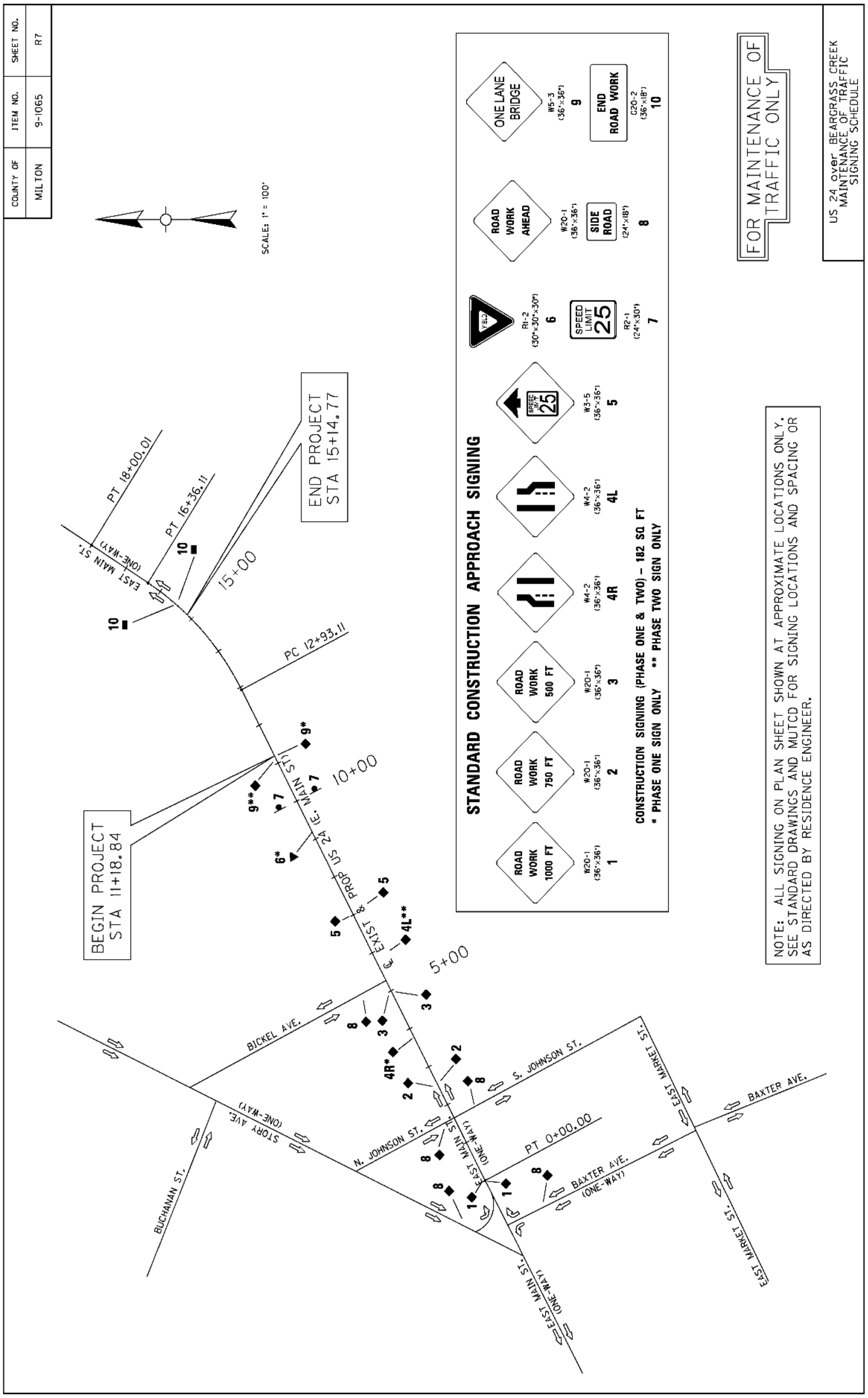
If work is delayed by inclement weather, the minimum work required to allow removal of the lane closure, as directed by the Engineer, shall be resumed immediately as soon as weather permits or the Department will begin to assess Liquidated Damages as specified herein.

Contrary to Section 108.09 of the current Standard Specifications, **the disincentive fee will be charged during those periods when seasonal limitations of the Contract prohibit the Contractor from working on a controlling item or operation. This includes the months from December through March.**

All liquidated damages will be applied cumulatively.

All other portions of Section 108 apply.

**Exhibit 200-13**

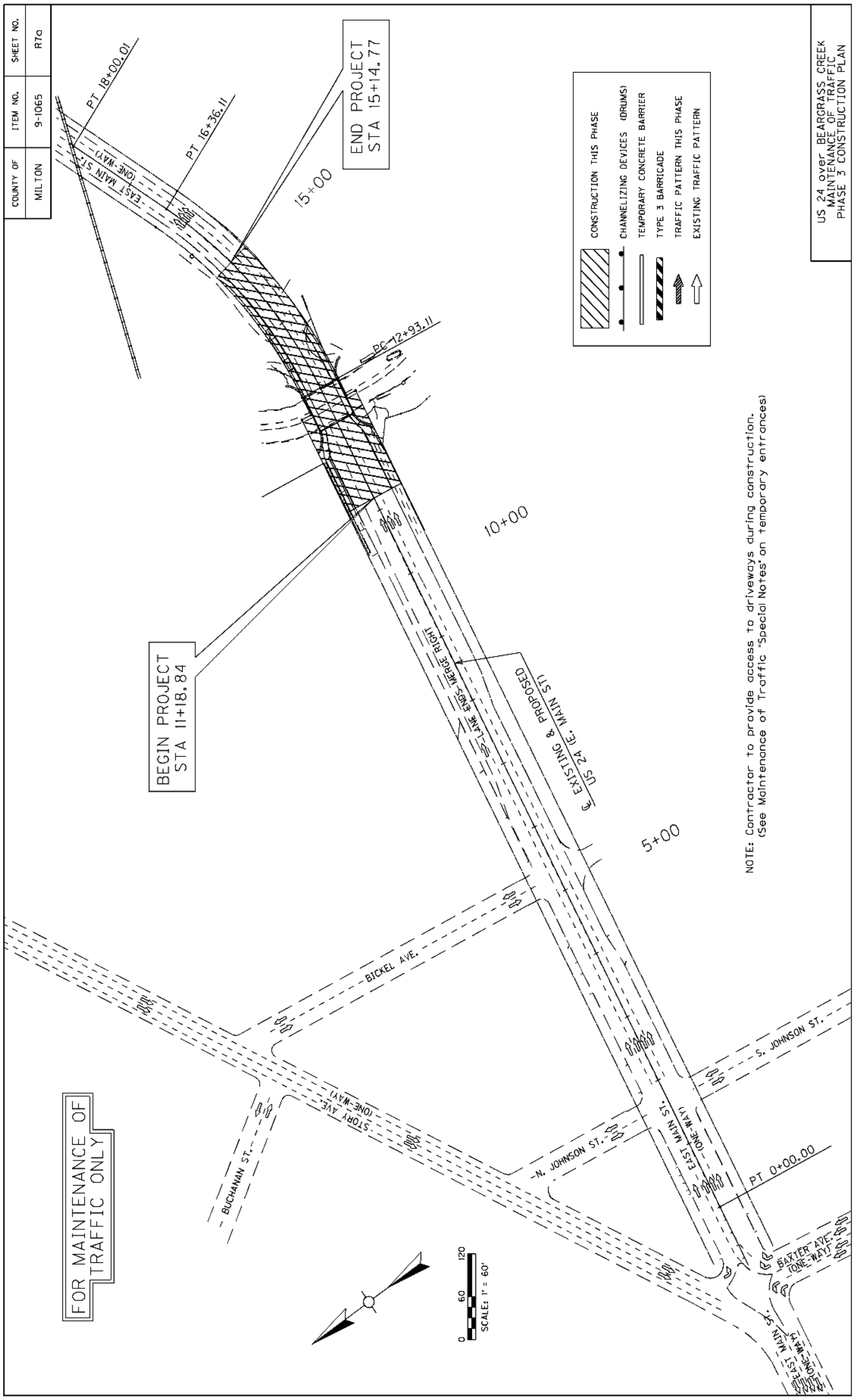


CONSTRUCTION SIGNING (PHASE ONE & TWO) – 182 SQ FT

* PHASE ONE SIGN ONLY  ** PHASE TWO SIGN ONLY

NOTE: ALL SIGNING ON PLAN SHEET SHOWN AT APPROXIMATE LOCATIONS ONLY. SEE STANDARD DRAWINGS AND MUTCD FOR SIGNING LOCATIONS AND SPACING OR AS DIRECTED BY RESIDENCE ENGINEER.

**Exhibit 200-13**



NOTE: Contractor to provide access to driveways during construction.
(See Maintenance of Traffic 'Special Notes' on temporary entrances)

**Exhibit 200-13**

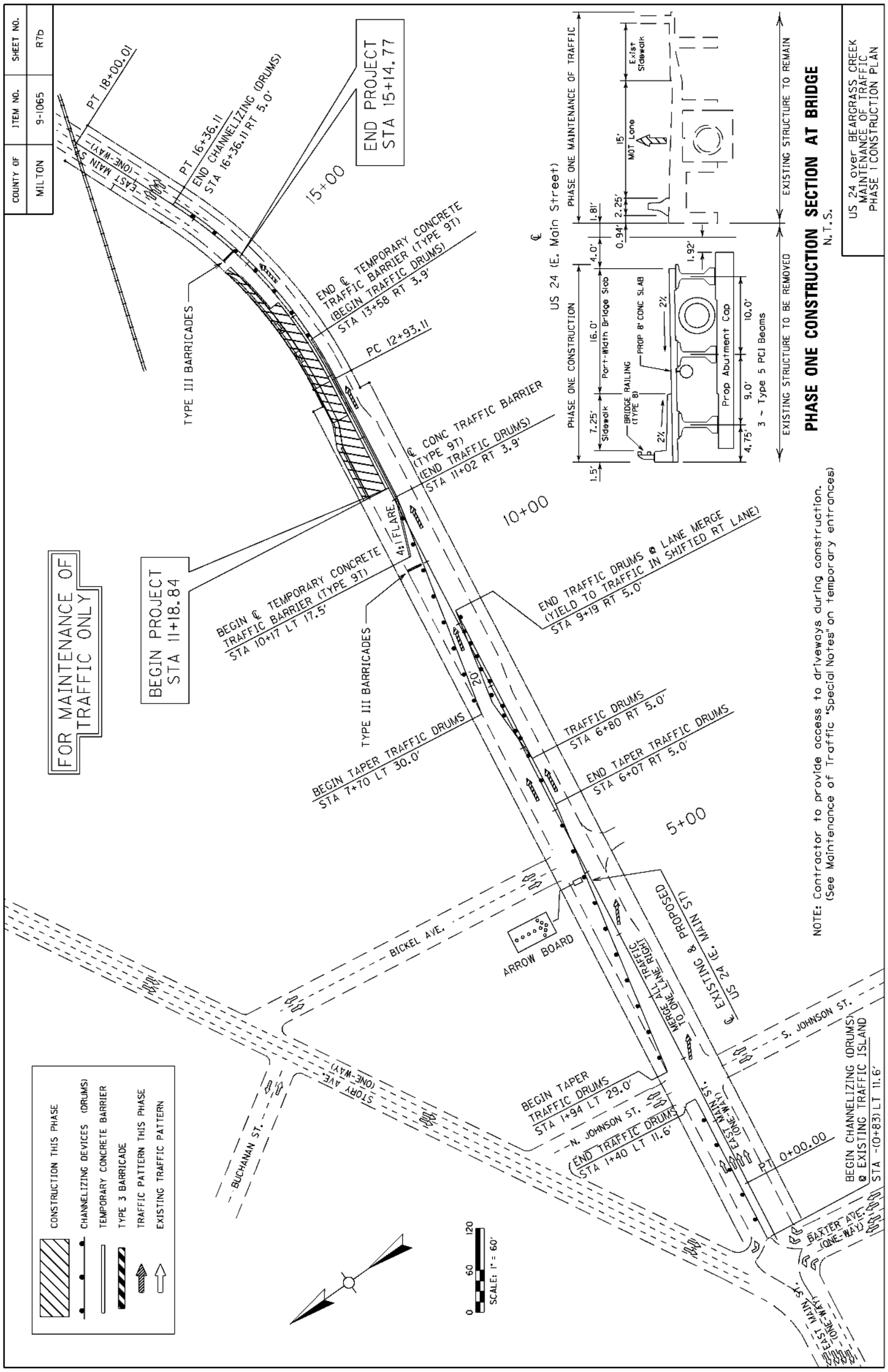


**Exhibit 200-13**

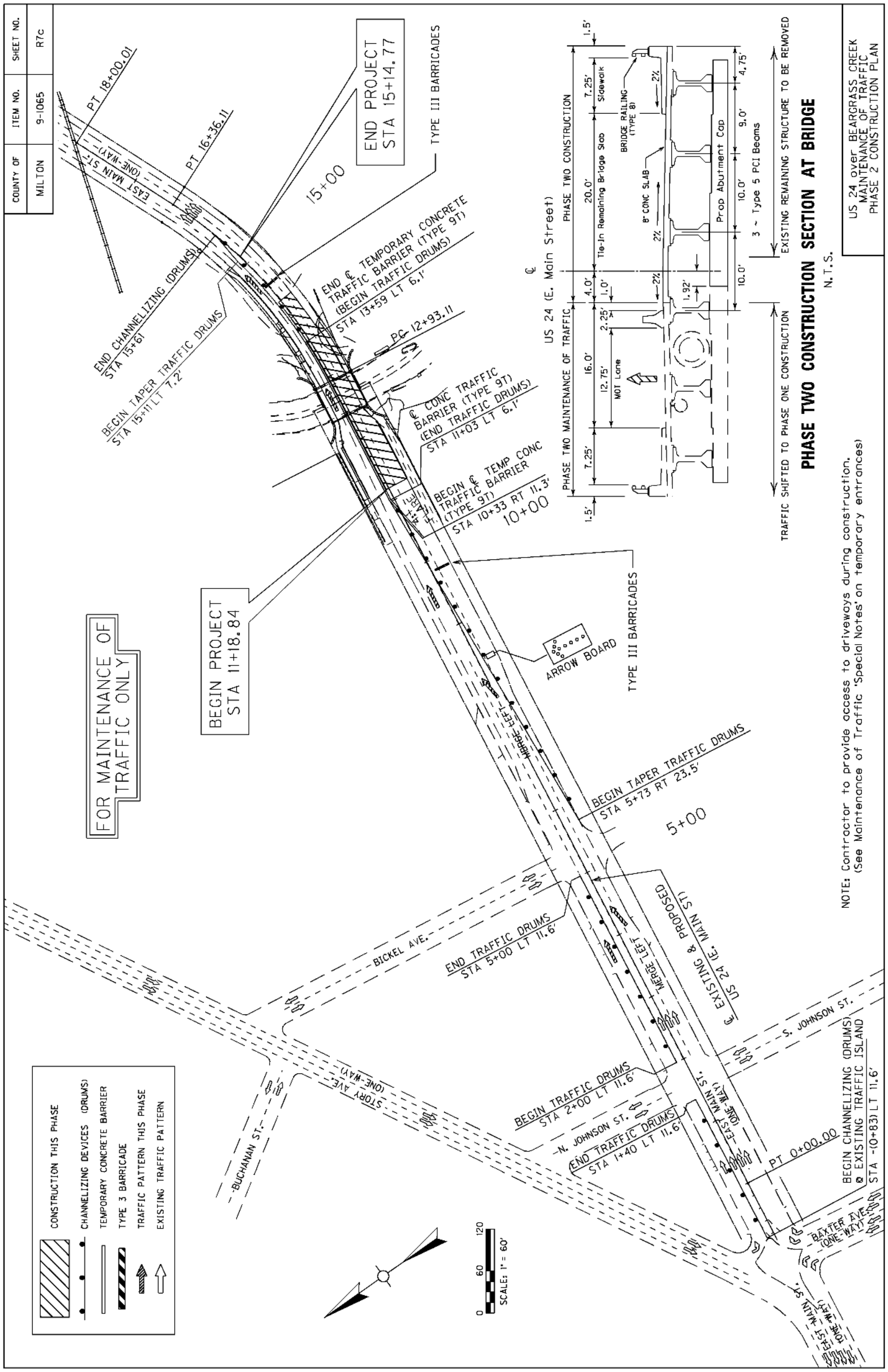


**Exhibit 200-14**

Kentucky Transportation Cabinet
Division of Highway Design

## FINAL PLAN SUBMITTAL

2/13/2018
Page 1 of 3

| | | | |
|---|---|---|---|
| **SYP Item Number:** | | **County:** | |
| **Final Plans Due Date:** | | **Date Submitted:** | |
| **Authorization Number:** | | **Project Manager:** | |
| **Link to Data in ProjectWise:** | | | |

| Submittal | Status | Comments |
|---|---|---|
| **Contract Plans:** | | |
| Roadway | | |
| Structures | | |
| Traffic: | | |
| Lighting | | |
| Signals | | |
| Signs | | |
| Utility: | | |
| Relocation Plans | | |
| Specifications | | |
| | | |
| | | |
| | | |
| | | |
| **Misc. Documents:** | | |
| **Estimate:** | | |
| Roadway | | |
| Structures | | |
| Traffic | | |
| Utility | | |
| Environmental Impact Mitigation Fees | | |
| Contract Time:<br>○ Fixed Completion Date<br>○ Working Days<br>○ Calendar Days | | |
| Project Development Checklist | | |
| | | |
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| | | |

NOTE: Highlighted cells require comment.

**Exhibit 200-14**

**Kentucky Transportation Cabinet**
**Division of Highway Design**
**FINAL PLAN SUBMITTAL**

2/13/2018
Page 2 of 3

| | | | |
|---|---|---|---|
| **SYP Item Number:** | | **County:** | |
| | | | |
| | | | |

| Submittal | Status | Comments |
|---|---|---|
| **Proposal Documents:** | | |
| Cap Report | | |
| Permit/water quality certification/KPDES: | | |
| Section 404 Permit (NW, LOP, Individual) | | |
| Section 401 Permit (WQC) | | |
| KPDES (General, Individual) | | |
| Utility impact notes | | |
| R/W Certification | | |
| Railroad Impact Notes | | |
| Project Specific Special Notes and Specifications | | |
| BMP/NOI Documents | | |
| Asbestos Report | | |
| | | |
| | | |
| **Electronic Engineering Data** | | |
| DGN Container Files | | |
| Existing Manuscript and Proposed Corridor (.dgn files) | | |
| EX Terrain, PR Finished and Subgrade and Geometry XML files | | |
| Superelevation report (.xml file) | | |
| Earthwork Calculations (.xslx file) | | |
| Template Library (.itl file) | | |
| Existing Manuscript and Proposed Corridor Graphics (.dxf files) | | |
| | | |

NOTE: Highlighted cells require comment.

**Kentucky Transportation Cabinet**
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**FINAL PLAN SUBMITTAL**

2/13/2018
Page 3 of 3

| | | | |
|---|---|---|---|
| **SYP Item Number:** | | **County:** | |
| | | | |
| | | | |

NOTE: Highlighted cells require comment.

Exhibit 200-15

# Kentucky Transportation Cabinet (KYTC) / Federal Highway Administration (FHWA)

## KYTC Project Development Checklist (PDC)

Revised January 21, 2015

## *Project Information*

**KYTC Item No.:** 11-155

**Federal Project No.:** NH 67-1(73)30

**County:** McMartin

**Route:** I-67

**Description:** Construction of a new interchange on I-67 and Access Road

**Contract ID:**

**Advertisement for Bids Date:**

**Letting Date:** 11/22/2014

## *Introduction*

This Project Development Checklist (PDC) is intended to assist in development of projects which conform to FHWA Federal-aid regulations, policies, and guidance.

**State Administered Federal-aid Projects:**
The PDC should be completed and signed by KYTC. Completion of the PS&E Package and PDC will allow the KYTC Division of Program Management to request a FHWA Construction Authorization for the project.

**Projects of Corporate Interest (PoCI) and of Division Interest (PoDI) using federal-aid funds:**
The PDC should be completed by the KYTC and submitted to the FHWA with the complete Plans, Specifications, and Estimate (PS&E) package for review and approval. Approval of the PS&E package and concurrence with the PDC by the FHWA will allow the KYTC Division of Program Management to request a FHWA Construction Authorization for the project.

The PDC is composed of a series of yes/no questions in categories including Planning, Environment, Right-of-Way & Utilities, Plans & Specifications, Proposal, and Estimate. Answer all questions by checking ‘Yes’, ‘No’, or ‘N/A’ and providing support information. If additional documentation or comments are needed to address a question or satisfy a requirement, please note accordingly in the ‘Comments’ column and provide attachments as necessary.

Notes:

1. See the current version of the KYTC/FHWA Stewardship Plan for authority, role, and responsibility delegations of program and project activities in implementing the Federal-aid Highway Program.
2. The PDC is not an all inclusive list as it does not address all Federal-aid requirements and regulations. However, the PDC does account for several major Federal-aid requirements and provides references to source documents for further review.

**Exhibit 200-15**

## *Planning*

| Checklist Item | Yes | No | N/A | Comments |
|---|---|---|---|---|
| 1. **Is the project programmed in the Statewide Transportation Improvement Program and/or approved amendments or modifications?** (23 CFR 450.216) | ☒ | ☐ | | |
| 2. **Is this project located within a Metropolitan Planning Organization area and programmed in the Metropolitan Transportation Plan, Transportation Improvement Program, and/or approved amendments or modifications?** (23 CFR 450.322 & 450.324) | ☒ | ☐ | | |

## *Environment*

| Checklist Item | Yes | No | N/A | Comments |
|---|---|---|---|---|
| 1. **Has the environmental documentation for the project been approved?**<br>(23 CFR 771)<br>☐ **Programmatic Categorical Exclusion (PCE)**<br>Date Approved: _____<br>☐ **Categorical Exclusion Level 1 (CE-1)**<br>Date Approved: _____<br>☐ **Categorical Exclusion Level 2 (CE-2)**<br>Date Approved: _____<br>☐ **Categorical Exclusion Level 3 (CE-3)**<br>Date Approved: _____<br>☐ **Environmental Assessment / FONSI**<br>Date FONSI Approved: _____<br>☒ **Environmental Impact Statement / ROD**<br>Date ROD Approved: 03/13/2011 | ☒ | ☐ | | |
| 2. **Is a re-assessment or re-evaluation of the environmental document needed?** (23 CFR 771.129)<br>Date of most recent re-assessment/re-evaluation: 12/11/2012 | ☐ | ☒ | | |
| 3. **Have environmental commitments been incorporated into the final design and contract documents?**<br>Y☐ N☐ N/A☒ **Historic Preservation** (36 CFR 800)<br>Y☐ N☒ N/A☐ **Stream/Wetland Mitigation** (23 CFR 777)<br>Y☐ N☐ N/A☒ **Noise Abatement** (23 CFR 772)<br>Y☐ N☐ N/A☒ **Section 4f** (23 CFR 771.135)<br>Y☒ N☐ N/A☐ **Endangered Species Act** (50 CFR 402.12(c))<br>Y☐ N☐ N/A☒ **Other:** _____ | ☒ | ☐ | ☐ | There could be possible stream/wetland mitigation The consultant is working on jurisdictional delination.<br>There will be a CAP stating Should blasting be required near Moore Cave, KYTC has committed to using the minimum charge necessary with prudence as a measure to minimize potential indirect effects of distrubing the gray bats using this cave during migration. |

**Exhibit 200-15**

| Checklist Item | Yes | No | N/A | Comments |
|---|---|---|---|---|
| **4. Have <u>all</u> permits for the project been secured?**<br>Y☐ N☒ N/A☐ **Section 401 - Water Quality**<br>Y☐ N☒ N/A☐ **Kentucky Pollutant Discharge Elimination System (KPDES)**<br>Y☐ N☐ N/A☒ **Section 404 - USACE Individual Wetlands Permit** (23 CFR 777)<br>Y☐ N☒ N/A☐ **Section 404 - USACE Nationwide Permit** (23 CFR 777)<br>Y☐ N☐ N/A☒ **Coast Guard** (23 CFR 650 Subpart H)<br>Y☐ N☐ N/A☒ **Other: _____** | ☐ | ☒ | ☐ | KYTC is currently working on permit requirements. The Consultant is working on permit application. |

## *Right-of-Way & Utilities*

| Checklist Item | Yes | No | N/A | Comments |
|---|---|---|---|---|
| **1. Has <u>all</u> Right-of-Way for the project been secured and have <u>all</u> relocates been relocated to decent, safe, and sanitary housing? If 'No', please provide a detailed explanation.** (23 CFR 635.309)<br>☒ **Right-of-Way Certificate** Date Approved: <u>10/01/2014</u><br>***Provide a copy of the Right-of-Way Certificate with the PDC*** | ☒ | ☐ | | |
| **2. Is the project located within 2 miles of an airport?** (23 CFR 620.103)<br>Y☐ N☐ N/A☐ **Coordinated with Federal Aviation Administration** | ☐ | ☒ | | |
| **3. Does the project require adjustment or relocation of utilities?**<br>Y☐ N☒ N/A☐ **<u>All</u> Utility Agreements approved** | ☒ | ☐ | | |
| **4. Have <u>all</u> utilities affected by this project been relocated or will be relocated prior to advertisement for bids?**<br>Y☐ N☒ N/A☐ **Utility work included in this contract** | ☐ | ☒ | ☐ | |
| **5. If all utilities have not been relocated prior to advertisement and are not included in the contract, do contract documents include utility impact notes specifying a relocation completion date and contract administration terms and conditions?** | ☒ | ☐ | ☐ | Utility Impact notes have not been submitted yet, but they will be submitted prior to letting. |
| **6. Does the project require use of or adjustment of railroad facilities?** (23 CFR 646)<br>Y☐ N☒ N/A☐ **Railroad Agreement approved**<br>Y☐ N☒ N/A☐ **Liability Insurance requirements provided in proposal** | ☒ | ☐ | | Railroad Agreement is in the works. |

**Exhibit 200-15**

## *Plans & Specifications*

| | Checklist Item | Yes | No | N/A | Comments |
|---|---|---|---|---|---|
| 1. | **Are any design exceptions incorporated into this project?** (23 CFR 625.3(f))<br>Y☐ N☐ N/A☒ **Reviewed and Approved by KYTC**<br>Y☐ N☐ N/A☒ **Reviewed and Approved FHWA (if applicable per current KYTC/FHWA Stewardship Plan)**<br>Date Approved: 05/16/2012 | ☐ | ☒ | | The DES was approved by KYTC and FHWA. There were no design exceptions. |
| 2. | **Does the project involve new or revised Interstate Access?**<br>Y☒ N☐ N/A☐ **Interchange Justification/Modification Study Approved by FHWA** Date Approved: _____ | ☐ | ☐ | | |
| 3. | **Is a Transportation Management Plan (TMP) provided and consistent with regulations on Work Zone Safety & Mobility in Title 23 Code of Federal Regulations Part 630 Subpart J and the KYTC Policy and Procedures for the Safety and Mobility of Traffic Through Work Zones?**<br>Y☒ N☐ **Project classified as "Significant"**<br>Y☒ N☐ N/A☐ **TMP Approved by KYTC**<br>Y☐ N☒ N/A☐ **TMP Approved by FHWA (if applicable per current KYTC/FHWA Stewardship Plan)**<br>Date Approved: _____ | ☒ | ☐ | ☐ | TMP is currently being submitted to FHWA for review and approval. |
| 4. | **Are pedestrian facilities and appurtenances designed in accordance with Americans with Disabilities Act requirements?** (www.access-board.gov) | ☐ | ☐ | ☒ | |
| 5. | **Is Value Engineering required for the project?** (23 CFR 627)<br>Y☒ N☐ **Project total costs > $50 Million** ($40 Million for bridges)<br>Y☒ N☐ **Value Engineering Study**<br>Date Approved: 11/01/2012 | ☒ | ☐ | | |
| 6. | **Are any materials (excluding those supplied by a utility company for utility relocation) to be supplied by a public agency?** (23 CFR 635.407)<br>Y☐ N☐ N/A☐ **Public Interest Finding Approved by KYTC**<br>Y☐ N☐ N/A☐ **Public Interest Finding Approved by FHWA (if applicable per current KYTC/FHWA Stewardship Plan)**<br>Date Approved: _____ | ☐ | ☒ | | |
| 7. | **Are patented or proprietary materials shown in the plans or specifications?** (23 CFR 635.411)<br>Y☐ N☐ N/A☐ **Use of Material Approved by KYTC**<br>Y☐ N☐ N/A☐ **Use of Material Approved by FHWA (if applicable per current KYTC/FHWA Stewardship Plan)**<br>Date Approved: _____ | ☐ | ☒ | | |

**Exhibit 200-15**

| Checklist Item | Yes | No | N/A | Comments |
|---|---|---|---|---|
| 8. **Is State or local force account construction work to be utilized on this project?** (23 CFR 635.204)<br>Y☐ N☐ N/A☐ **Cost Effective Determination Approved by KYTC**<br>Y☐ N☐ N/A☐ **Cost Effective Determination Approved by FHWA (if applicable per current KYTC/FHWA Stewardship Plan)**<br>Date Approved: _____ | ☐ | ☒ | | |
| 9. **Are experimental features utilized on this project?**<br>(Federal-aid Policy Guide G 6042.4)<br>Y☐ N☐ N/A☐ **Work Plan Approved by KYTC**<br>Y☐ N☐ N/A☐ **Work Plan Approved by FHWA (if applicable per current KYTC/FHWA Stewardship Plan)**<br>Date Approved: _____ | ☐ | ☒ | | |

## *Proposal*

| Checklist Item | Yes | No | N/A | Comments |
|---|---|---|---|---|
| 1. **Is the Form FHWA-1273 "Required Contract Provisions for Federal-Aid Construction Contracts" included?** (23 CFR 633.102) | ☒ | ☐ | | |
| 2. **Are Equal Employment Opportunity (EEO) special provisions included?** | ☒ | ☐ | | |
| 3. **Does the proposal contain a Disadvantaged Business Enterprise (DBE) goal?** (23 CFR 635.107 & 49 CFR 26) DBE Goal: 10% | ☒ | ☐ | | |
| 4. **Are the minimum wage rates determined by the United States Department of Labor (DOL) included?** (23 CFR 635.117(f)) | ☒ | ☐ | | |
| 5. **Is the contract time/completion date included?** (23 CFR 635.121)<br>Y☒ N☐ N/A☐ **Completion Date:** 07/31/2016<br>Y☐ N☐ N/A☐ **Work Days:** _____<br>Y☐ N☐ N/A☐ **Calendar Days:** _____ | ☒ | ☐ | | |

## *Estimate*

| Checklist Item | Yes | No | N/A | Comments |
|---|---|---|---|---|
| 1. **Has an official Engineer's Estimate been developed based upon all bid items included in the contract documents?** | ☒ | ☐ | | |

**Exhibit 200-15**

## *Signatures and Concurrence*

**State Administered and FHWA *Projects of Corporate or Division Interest* with federal-aid funds:**

The information provided on this Project Development Checklist is complete and accurate. The contract documents for this project have been prepared in accordance with FHWA programmatically approved processes and procedures and conform to all applicable Federal-aid laws, regulations, and policies.

Kentucky Transportation Cabinet (KYTC)

Signed: ______________________________ Print: ______________________________

Title: ______________________________ Date: ______________________________

---

**FHWA Concurrence *(Projects of Corporate or Division Interest Only)*:**

Signed: ______________________________ Print: ______________________________

Title: ______________________________ Date: ______________________________

**Once FHWA has authorized federal-aid funds for the project, the KYTC may advertise the project for construction bids. A project must be advertised for construction bids for a minimum of 21 calendar days prior to opening bids and letting the contract. As a recipient of federal-aid funds, the KYTC is responsible for advertising and administering the construction of the project in accordance with all applicable federal-aid laws and regulations.**

**Chapter**

SURVEYING

**Subject**

Operations

## HD-301.1 OVERVIEW

Surveying is used throughout the design process from initial topographic data collection, which identifies features that need to be accommodated by the project design, to construction staking to assist in properly building the highway project. In addition, other survey activities may be used by the project team to provide additional data, including, but not limited to, boundary surveys, environmental surveys, cemetery relocations, and hydrologic surveys.

For additional references on survey-related items, see the Division of Highway Design Survey Coordination online at:

http://transportation.ky.gov/Highway-Design/Pages/Survey-Coordination.aspx

## HD-301.2 STANDARDS

- Deliverables from KYTC consultants shall be MicroStation (.dgn) files with all graphics submitted according to the current KYTC CADD standards referenced online at:

  http://transportation.ky.gov/CADD-Standards/Pages/default.aspx

- LiDAR will be tested to meet the 95% Confidence Interval root-mean-square error (RMSE) for the type of data collected by either airborne, mobile mapping, or stationary scanners.
- The default KYTC standard for design mapping is a scale of 1 inch = 50 feet with 2-foot contours. Other scales and intervals may be acceptable based on the request of the project manager and the design team.
- Topographic survey data shall meet accuracies outlined in the “Standards of Practice” as specified by the Commonwealth of Kentucky, State Board of Licensure for Professional Engineers and Land Surveyors *Table of Specifications by Class: Classification of Surveys* (**201 KAR 18:150**).

## HD-301.2 STANDARDS (cont.)

- Right of Way Monumentation shall be set with a horizontal closure of 1:15,000 relative to primary control. Right-of-Way Monumentation is further discussed in **HD-307**.

- KYTC standards for survey accuracy are based on standards set by the Federal Geographic Data Committee's (FGDC) Geospatial Positioning Accuracy Standard (**Exhibits 300-01**, **300-02**) and are referenced at:

  http://transportation.ky.gov/Highway-Design/Pages/Survey-Coordination.aspx

- Positional Accuracy and Relative Closure Ratio Accuracy are two types of accuracies that may be specified. Surveys conducted using Global Navigation Satellite System (GNSS) techniques use positional accuracy standards while conventional techniques use relative accuracy standards. See **Exhibits 300-01** and **300-02** for more information.

- All control shall meet specifications as prescribed in **HD-302**.

## HD-301.3 GNSS PROCEDURES & TECHNIQUES

- Global Navigation Satellite System (GNSS) survey technology is evolving. The specifications described in **HD-302** are not intended to discourage the development of new GNSS procedures and techniques. New procedures and techniques may be used with prior approval from the KYTC State Survey Coordinator.

- GNSS equipment and software must be of survey grade and meet the accuracy specifications for the various survey activities discussed in this chapter. See **HD-302** for GNSS survey control specifications.

- Whenever feasible, GNSS survey methods shall be used for establishing horizontal control. GNSS methods may be used to bring NAVD88 elevations to a project area provided 2nd Order accuracy (unless otherwise specified) can be achieved and conventional leveling techniques are used for densification.

## HD-301.4 KENTUCKY SINGLE ZONE

The State Plane Coordinate system known as Kentucky Single Zone shall be used for the survey and development of all projects. The Kentucky Single Zone is defined as:

## HD-301.4 KENTUCKY SINGLE ZONE (cont.)

- Datum=NAD83/GRS80 Ellipsoid
- Central Meridian=85°45’ West Longitude
- Parallel of Grid Origin (Base Parallel)=36°20’ North Latitude
- Southern Standard Parallel=37°05’ North Latitude
- Northern Standard Parallel=38°40’ North Latitude
- False Northing=1,000,000 meters (3,280,833.333 feet*)
- False Easting=1,500,000 meters (4,921,250.000 feet*)

*The Kentucky Single Zone is to be used with the U.S. Survey linear foot of measure.

All design and construction mapping and surveying products will be delivered in Kentucky Single Zone State Plane coordinates (parameters defined in FIPS 1600, and units of U.S. Survey Feet), NAD83* geometric datum (most current adjustment), and NAVD88 vertical datum. The most current adjustment and geoid model available from the National Geodetic Survey (NGS) shall be used when approved by KYTC.

## HD-301.5 KENTUCKY CONTINUOUSLY OPERATING REFERENCE STATIONS (KYCORS)

KYTC has established a network of continuously operating fixed GNSS reference base stations commonly known as KYCORS. The network provides real-time, three-dimensional GNSS network corrections via the internet 24/7. Real time positional accuracy of +/-1cm horizontally and +/2cm vertically can be obtained when precision GNSS equipment is used following GNSS best practices.

A map of the current KYCORS stations and their status can be viewed online at http://kycors.ky.gov/. Access to the network is free, but does require user registration. Where practical, use of the network is recommended when referencing highway projects.

## HD-301.6 SURVEY REPORTS

All projects should use Kentucky single zone coordinates. It is unacceptable to use assumed coordinate systems. Project specific survey deliverables shall be listed in the project scope.

The final Survey Report shall contain:

- Project name & identification: County, Route, Mile Post, E.A., or Project Identification, etc.
- Survey date, limits, and purpose

## HD-301.6 SURVEY REPORTS (cont.)

- A scaled map (e.g. KML file) of the project area, showing all primary and supplemental (horizontal and vertical) control monumentation established with appropriate designation
- Datum realization, epoch, geoid model, and units
- Project datum factor, if used, that relates to the Kentucky State Plane Coordinates
- Dated signature and seal of the Kentucky Professional Land Surveyor in charge
- Number of intervisible monuments set and any supplemental physical feature points (e.g. aerial target locations)
- Description of all primary and project control found, held, or established
- Validation points
- Closures of all traverses
- Unadjusted and adjusted information of traverses
- Adjustment report for control
- Dates of observations
- Time interval of each observation
- Number of times occupying each control point
- Personnel, equipment, and surveying methods used
- Any other pertinent information such as GNSS observation logs
- Problems encountered

Submit the report as a PDF document to the Project Development Branch Manager (PDM).

Document all pertinent information of all control on Control Monument Data Sheets available online at http://transportation.ky.gov/Highway-Design/Pages/Survey-Coordination.aspx and submit with the final control survey report.

Unless otherwise described in the project scope, the survey report will not be accepted from any non-KYTC source unless signed, dated, and stamped by a Kentucky Professional Land Surveyor certifying the accuracy of the report submitted and the accuracy of all control monuments set for the Department.

## HD-301.7 CONTRACT DOCUMENTS

Survey deliverables must be submitted electronically and include, at a minimum:

- Property Entry Documentation
- Survey Report
- Digital Terrain Model (DTM) Surfaces-Existing
- Boundary and Right of Way (ROW)
  - Deed Research Packet
  - Related Plats and Exhibits

## HD-301.7 CONTRACT DOCUMENTS (cont.)

- ROW Field Monumentation
- ROW Monument Control Plan
- ROW Acquisition Plat

**Note:** All maps must be submitted as PDFs.

## HD-301.8 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Quality of the survey data is integral to the quality of highway design and roadway construction. Each section of the survey chapters includes key items for quality review and checking. The survey party chief is responsible for daily quality assurance.

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*Chapter*

SURVEYING

*Subject*

Survey Control

## HD-302.1 OVERVIEW

Project control establishes a consistent network of accurate horizontal and vertical control for use in all subsequent project surveys—photogrammetric, mapping, planning, design, construction, and right of way.

Projects will have the following types of control. Each has slightly different requirements as described in the appropriate section.

- Primary Control
- Project Control
- Supplemental Control

## HD-302.2 FIELD CONTROL RECONNAISSANCE

The traditional geodetic reference system consists of horizontal and vertical control monuments, typically metal disks set in concrete pillars or on rods driven in the ground. Many of these monuments have been destroyed and the National Geodetic Survey (NGS) is not replacing or further maintaining physical markers. Physical, passive markers may continue to be recoverable and useable, but that is not guaranteed.

The surveyor should make every effort to obtain information for any existing control in the project area. If any primary control exists from the NGS database or project control from previous Department of Highways projects, it is highly recommended that this control be used for further densification of the project. Recovered control monuments must be evaluated before being used as a basis for new control surveys.

## HD-302.3 PRIMARY CONTROL

Primary control monuments, both horizontal and vertical, are monuments included in the NGS National Spatial Reference System (NSRS). NGS Continuously Operating Reference Station (CORS) and Kentucky Geodetic Reference Network (KGRN) monuments are examples of this type of control. NGS monuments used as primary control must be of an equal or higher order than the survey being performed.

## HD-302.3 PRIMARY CONTROL (cont.)

Recovered and destroyed NGS monuments shall be reported using the NGS GPS on Bench Marks Reporting available online at:

http://www.ngs.noaa.gov/GPSonBM/Report.shtml

## HD-302.4 PROJECT CONTROL

Project control monuments should last at least the lifetime of a project and have a positional network accuracy of 1cm, 95% confidence or better. Project control must have their locations determined with ties to primary control monuments.

### HD-302.4.1 Project Control Monumentation

Project control monuments shall be set as described in the NGS *Bench Mark Reset Procedures, Attachment B. New or Replacement Survey Monuments* available on the NGS Website at:

https://www.ngs.noaa.gov/PUBS_LIB/pub_index.html

The monuments shall have aluminum, brass, or bronze geodetic control disks inscribed with "KYTC Survey Monument," an identifier, and the date the monument was set. A 48-inch minimum Carsonite witness post labeled "KYTC Survey Control" will witness each monument.

The surveyor should locate the monuments to avoid destruction or disturbance during construction.

Global Navigation Satellite System (GNSS) shall be the standard method of developing control. Control extended from GNSS shall be derived by post-processed networked static GNSS procedures as recommended by NGS.

If control is not possible to be established by GNSS or is proposed to be established using conventional methods for unique circumstances, the KYTC State Survey Coordinator should be contacted for approval.

The Control Monument Information Sheet (**Exhibit 300-08**) will be submitted with new or replacement survey monuments. The form can be accessed from the Division of Highway Design's Survey Coordination at:

http://transportation.ky.gov/Highway-Design/Pages/Survey-Coordination.aspx

### HD-302.4.2 Horizontal Project Control

Set monuments as required by project conditions, generally no more than 2640 feet apart and preferably intervisible with at least two other monuments. Minimum spacing for monuments is 1000 feet when using GNSS methods or 500 feet when using conventional survey methods.

If conventional methods must be used, horizontal surveys may be specified as Second Order Class I or Second Order Class II depending on the precision required (such as, bridge or tunnel control).

### HD-302.4.3 Vertical Project Control

Set monuments as required by project conditions, generally no more than 1500 feet apart. When feasible, utilize horizontal project control monuments as vertical control monuments.

The 1 centimeter equivalent for conventional vertical surveys is Second Order Class I. See **Exhibit 300-03** for more information.

## HD-302.5 SUPPLEMENTAL CONTROL

Supplemental control should have a 2 centimeter network accuracy, 95 percent confidence, and be tied to project control monuments. Supplemental control points may be used for establishing photogrammetric control, Light Detection and Ranging (LiDAR) control, and right-of-way survey control unless specified otherwise.

### HD-302.5.1 Supplemental Control Monumentation

Supplemental control monumentation may be pipe or rebar (18 inches in length), PK nails in pavement, chiseled crosses in concrete, or similar material. Plastic caps should be used for horizontal control and metal caps should be used for vertical control. "KYTC" shall be legible on all caps.

### HD-302.5.2 Aerial Mapping Control

All control set for KYTC Aerial Mapping shall be tied to primary control and spaced as required by project conditions. Project control may be used if no primary control is available.

### HD-302.5.2.1 Photogrammetric Panel Points

Control points utilized in photogrammetry are commonly referred to as "panel points" and are designated by an "x," "v," or open center cross with approximately 5 feet legs. The legs of the cross are made of cloth, plastic, or paint. The panels are usually white in order to contrast with the ground; however, on concrete pavements and extremely colored barren soils, it is best to use dark gray or black materials. Control points should be paneled in advance of flying to ensure visibility in the acquired photography.

### HD-302.5.2.2 LiDAR Ground Control Points (GCP)

Aerial LiDAR differs from photogrammetry in that features are not visible in LiDAR datasets as in photography. (For example, a manhole would not be a discernible feature in an aerial LiDAR dataset.) For that reason, control placed for Aerial LiDAR projects do not need to be paneled and can be placed after the LiDAR acquisition is complete, assuming ground conditions have not changed between LiDAR acquisition and control survey. GCP preference should be given to points associated to permanent, recoverable structures which may be used in future survey work. Examples include manholes, curbs, utility structures, etc.

### HD-302.5.3 Mobile Terrestrial Laser Scanning (MTLS) Control

Global Navigation Satellite System (GNSS) control stations used to control the post-processed kinematic adjustment of the MTLS data shall be placed at a maximum of 5-mile intervals. In no case should the processed baseline exceed 5 miles in length. Short baselines contribute to the best possible positional accuracy outcome. Dual redundant GNSS base stations are highly recommended to guard against the possibility of wasted effort and useless data from base station failure due to equipment, accident, or human error in station setup. Dual base stations also allow redundant post-processing and 10-mile baseline post-processing in case of a base station failure.

Locate one base station near the beginning of the project and another near the end of the project. The horizontal accuracy standard of control stations shall be second order or better, and the vertical accuracy standard shall be third order or better as defined for project and supplemental control.

Mobile Mapping control falls under the categories of “Transformation” or “Validation” control points. Transformation points serve as control for processing of the point clouds. Validation points are used to check the geospatial data adjustment to the transformation points and allow for Quality Assurance/Quality Control (QA/QC) checks of the adjusted scan data. Both types of points should be placed throughout at even intervals. Transformation points should be placed before and after expected obstructions, such as bridges.

For MTLS surveys, the scanned area shall have control on both sides of the roadway with transformation points at a maximum of 1500-foot roadway centerline stationing intervals and validation points at a maximum of 500-foot roadway centerline stationing intervals. MTLS surveys require local points to have surveyed local positional accuracies of Hz ≤ 15mm and Z ≤ 15mm or better. Differential digital leveling is the preferred method of establishing transformation and validation point elevations.

### HD-302.5.4 Stationary Terrestrial Laser Scan (STLS) Control

Total station targets reduce pointing error when placed at long distances. Laser scanning targets, however, are designed for a specific distance. Most laser scanners do not have telescopes to orient the instrument to a backsight. Vendor-specific targets tuned for the laser scanner frequency are recommended.

Best results are typically seen when the targeted control stations are evenly spaced horizontally throughout the scan. Variation in target elevations is desirable. Targets should be placed at the recommended optimal distance from the scanner and scanned at high-density as recommended by the STLS manufacturer.

Hard surface topographic STLS surveys require control and validation point surveyed local positional accuracies of Hz ≤ 15mm and Z ≤ 15mm.

## HD-302.6 DELIVERABLES

Files shall have non-proprietary format point data showing applied corrections. All point, elevation, and metadata data used to calibrate, process, and validate control points shall be submitted on portable media. A Surveyor’s Report is required (**HD-301.6**).

## HD-302.7 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Quality of the control data is essential to the quality of the entire survey and, by extension, the entire project. Minimally, the following items should be verified and submitted:

- Correct coordinate system
- Correct elevation datum
- Project Datum Factor, if used
- Unedited raw files
- Rotation
- Translation
- Correction Factors
- Shown ties to existing Primary Control
- Labeled types of monuments

**NOTE:** Due to the evolving software and mapping techniques for LiDAR technology, the procedures listed in the previous pages may be altered with approval from the KYTC State Survey Coordinator.

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HIGHWAY Design

*Chapter*

SURVEYING

*Subject*

Data Collection

## HD-303.1 OVERVIEW

The degree of precision of all surveys is determined by the final intended use of the data. Generally, when new surveys are being undertaken, a preliminary survey should be to the same order as that required for the final survey. In some situations, a preliminary survey for mapping or reconnaissance studies may be to a lesser order with approval of the KYTC State Survey Coordinator.

## HD-303.2 SURVEY FIELD CREW RESPONSIBILITIES

For all KYTC projects, survey field crews are responsible for processing their data and delivering a design (.dgn) file, digital terrain model (.dtm) file, and geometry (.alg) file. KYTC field crews are responsible for final checking and the assurance of the accuracy of all survey products delivered to the design office. Consultants may follow their internal Quality Assurance/Quality Control (QA/QC) procedures.

## HD-303.3 SAFETY

Surveyors work in hazardous environments, such as rugged terrain or in the vicinity of high-speed traffic and construction equipment. Working in these conditions requires a constant awareness of the need for safety.

When working in or near traffic, survey crew signing must be in place before survey work begins. Survey signing should comply with the recommendations in the most recent *Manual on Uniform Traffic Control Devices* (MUTCD) and will be coordinated with the district. Survey conditions should be suspended when uncontrollable hazards develop, and work may be resumed only when safe working conditions have been restored. Personnel must be particularly aware of avoiding the creation of hazards when working on private property.

## HD-303.4 ELECTRONIC DATA COLLECTORS

The electronic data collectors (electronic field books) selected for use shall not allow the data to be deleted until it has been sent to a printer or a computer. If an error is made in the field, the data collector retains both the error and the correction.

## HD-303.4 ELECTRONIC DATA COLLECTORS (cont.)

As standard procedure to ensure that a permanent record of the original fieldwork is available, any agent of KYTC using electronic data collectors should comply with the following practices:

- Download the original data into a computer and copy (unedited) to a permanent medium.
- Produce a hard-copy printout of the data before any editing takes place.
- Do any editing or subsequent changes to the data on copies of the original data. Never alter the original data.
- In any subsequent submittals of project information, treat the permanent medium and the hardcopy printout, cited before, as a traditional field book.
- Electronic data files should be submitted in the approved KYTC format. If submitted in a text file, the following format shall be used: point number, Northing, Easting, elevation, feature code.

**Note:** All survey and Digital Terrain Model (DTM) information for KYTC projects shall utilize the KYTC feature codes list. The current feature codes list can be found on the KYTC Highway Design website under Survey Coordination:

http://transportation.ky.gov/Highway-Design/Pages/Survey-Coordination.aspx

## HD-303.5 DIGITAL TERRAIN MODEL (DTM)

A DTM is a three-dimensional representation of the surface of the earth. The accuracy of the DTM should reflect its intended use.

Cross-sections and profiles needed for plan development and documentation shall be derived from the DTMs.

DTMs are created from breaklines and random points. Breaklines are linear features that locate “breaks” (changes) in the earth’s surface, such as changes in slope. Examples of breaklines are the crown of pavement, edge of pavement, edge of shoulder, flow line, top of curb, bottom of slope, top of slope, bottom of ditch, and top of ridge.

Random points are used to define the surface between breaklines. These points are spot elevations at various or key locations. Random points are generally collected in a grid with a nominal spacing of 25 to 50 feet. Additional points may be added to define high and low spots in terrains as needed. This spacing can vary widely depending on the regularity of the surface being surveyed.

The surveyor shall be responsible for adequate breaklines and random points to ensure that the DTM accurately reflects the surface. Additional care shall be taken in the collection of breaklines in areas around bridges and other structures, streams, and other sensitive locations.

## HD-303.5 DIGITAL TERRAIN MODEL (DTM) (cont.)

At bridge abutments, wing walls, ends of pipes and culverts, curbs, retaining walls, and any other vertical-type situation, breaklines at both the top and bottom of the feature are necessary for the definition of the surface.

Take breakline data in a directional sequence. Do not jump back and forth on the same breakline. The rodman should be knowledgeable of the data collection process and how the collected data influences the quality of the DTM. Thus, the rodman is key to the collection process.

The surveyor is responsible for the processing, final checking, and validating of the DTM.

## HD-303.6 TOPOGRAPHIC FEATURES

Topography is defined as the graphic delineation of all natural and manmade features of an area. Collect all topographic feature data within the project area. Where appropriate, elevations should be collected. For overhead utilities, identify the ownership, pole number(s), and low wire elevation(s). Collect the major topographic features of the area such as buildings, septic systems, existing roads, drainage structures, and utilities. The types of construction and descriptions for all buildings and existing roadway surfaces shall be noted. In addition, collect any item that may influence project decisions.

## HD-303.7 EXISTING STRUCTURES

Accurate depiction of existing structures is particularly important to the design process. Field information should completely define the structure and surrounding terrain. Additional information should be collected to describe the components of the structure (beam depths, pier heights, bridge seats, headwalls, abutments, wing walls, etc.). A written description of the structure should also be documented.

## HD-303.8 PROPERTY LINE FEATURES

All property lines, easement lines, lease lines, and special agreement lines, as well as KYTC permits and agreements, etc., within the limits of the project (and in some instances in the general proximity) must be identified. All monuments and features that aid in the description of property lines should be located.

Other information to be collected to help locate property lines may include deed descriptions, PVA maps, plats, and subdivision plans.

The names of all property owners are to be collected as recorded in the deed book, along with the deed book and page numbers and acreage or square footage.

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*Chapter*

SURVEYING

*Subject*

Utility Location

## HD-304.1 OVERVIEW

The location of aboveground and underground utilities is a primary concern during project development. Complete and concise locations of existing utilities shall be obtained early in the design process. Utility company archives may not be sufficient to identify all utilities within the project corridor.

The quality level that is utilized in the location of existing utilities should be based on the stage of development for a roadway project. During the corridor study to determine potential alternatives, the use of existing records or verbal information from utility companies typically will suffice.

The quality level utilized in locating existing utilities should improve as alternatives are developed and their subsequent location refined. Location of utilities should include the horizontal position (and vertical position when appropriate) of the utility, the material of which it is composed, the size, and any other pertinent data concerning the facility.

The following is a description of the differing quality levels of aboveground and underground utility location. Quality level “D” and “C” apply to aboveground. Quality level “B” and “A” apply to underground utility location, but use level “D” and “C” for initial location.

The quality levels for utility location are as follows:

- **Quality Level D (QL D)**: Information derived solely from existing records or verbal recollections
- **Quality Level C (QL C)**: Information obtained by surveying and plotting visible aboveground utility features and by using professional judgment in correlating this information to Quality Level D information
- **Quality Level B (QL B)**: Information obtained through the application of appropriate surface geophysical methods to identify the existence and approximate horizontal position of subsurface utilities

## HD-304.1 OVERVIEW (cont.)

**Note:** Quality Level B data should be reproducible by surface geophysics at any point of the utility's depiction. This information is surveyed to applicable tolerances and reduced onto plan documents.

- **Quality Level A (QL A)**: Information obtained by the actual exposure (or verification of previously exposed and surveyed utilities) of subsurface utilities using (typically) minimally intrusive excavation equipment to determine their precise horizontal and vertical positions, as well as their other utility attributes

  **Note:** This information is surveyed and reduced onto plan documents. Accuracy should be to applicable horizontal survey and mapping accuracy and should be within ± 0.05 foot vertical.

## HD-304.2 PROCEDURES

Project Development Managers direct where Subsurface Utility Engineering (SUE) work is to be conducted. Locating existing utilities to a certain level should occur as early as the Pre-Design and/or Conceptual Design phase of a project whenever there are large concentrations of utilities or a major utility facility. At any stage of design, the utility companies should be an integral part of the design process and should be invited to key meetings to be advised of and consulted about impacts of the proposed roadway improvements to their facilities. Utility companies should also be invited to attend and provide input at public involvement meetings. The choice of alternatives for the proposed roadway should reflect this information in an effort to first, avoid the utility conflict; second, minimize the effect; and third, mitigate the conflict.

The project team shall determine the quality level (QL) of utility locations for the various stages of project development conceptual design. QL A will be done as needed, based on potential conflicts.

To more adequately and expeditiously effect the location of utilities, the project team should specify in the advertisement for consultant services that the consultant will be required to locate utilities to the differing levels dictated by the project development stages. It may appear fiscally advantageous to place the brunt of relocation costs on private companies, while avoiding publicly-owned utilities, simply to avoid the direct cost of utility relocation by the Cabinet. The ultimate cost in time and money to the public should compel the designer to consider all the impacts of utility relocation whenever decisions are made regarding roadway location.

## HD-304.2 PROCEDURES (cont.)

All quality level work shall be completed in accordance with Section 5: Utility Quality Level Attributes as documented in CI/ASCE 38-02, the *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data* by the American Society of Civil Engineers.

## HD-304.3 DELIVERABLES

The utilities must be identified and located on plan documents. All underground utilities depicted shall be QL B unless the particular utility is labeled “QL C” or “QL D” (**Exhibit 300-05**). QL A is applicable only where direct observations of the exposed utility are made.

A summary sheet will be included in the plans to document the QL A horizontal and vertical locations noted. The QL A data shall be documented by station, offset, northing, easting, and elevation (**Exhibit 300-06**). The Quality Level and specific locations for QL A should be chosen for each project and listed during scoping on the Features Checklist.

## HD-304.4 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Emphasis and care should be given in the following areas to establish complete and accurate location of underground utilities:

- The urban highway construction project with high potential for anticipated utility conflicts
- Projects with complex utility networks, either aged or of significantly high potential for expensive utility relocations
- Limited, narrow, and congested existing rights of way
- High-profile highway projects that have critical schedule.

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*Chapter*

SURVEYING

*Subject*

Preconstruction Activity on Private Property

## HD-305.1 PROPERTY ENTRY

As with all field activities, ground survey crews should respect the rights of individual property owners and ask permission before entering their property. For more information, see **HD-306**, “Other Survey Activities.”

### HD-305.1.1 Surveyor Responsibility

The Cabinet’s intent is that all property owners be contacted and informed about any need to access their property. During the survey function, it is the surveyors’ responsibility to assure that property owners are advised of when, where, and why their property will be accessed. Property owners are more likely to grant permission for entry if they receive a complete explanation, a promise not to cause undue damage, and an assurance to repair damages caused by the activity.

### HD-305.1.2 Contact Procedures

The individual property owners are to be contacted before entry upon their property. Contact should be made face-to-face, via phone, or by certified mail. The Project Development Branch Manager (PDM) is responsible for determining how and when this contact is made and who will make the contact for field surveys, sounding work, and other activities. The individual assigned this responsibility shall maintain a log of these contacts, which will be provided to the project manager. The log shall include names, addresses, and telephone numbers of persons contacted; dates contacted; and a synopsis of each discussion.

**Note:** Consultants contracted by the department for engineering and related work must follow this same procedure.

### HD-305.1.3 Refusal of Entry

If the property owner refuses permission for entry, the state has the right to enter private property for studies and related activities and may exercise its rights over refusal by the owner as allowed by **KRS 416.560(4)**:

### HD-305.1.3 Refusal of Entry (cont.)

> "(4) Prior to the filing of the petition to condemn, the condemnor or its employees or agents shall have the right to enter upon any land or improvement which it has the power to condemn in order to make studies, surveys, tests, soundings, and appraisals, provided that the owner of the land or the party in whose name the property is assessed has been notified ten (10) days prior to entry on the property. Any actual damages sustained by the owner of a property interest in the property entered upon by the condemnor shall be paid by the condemnor and shall be assessed by the court or the court may refer the matter to commissioners to ascertain and assess the damages sustained by the condemned, which award shall be subject to appeal."

When property owners refuse permission for entry upon their property, the PDM shall be responsible for initiating action. This action may include personal contact, contact with local officials for assistance, alternative methods of obtaining data, or other efforts as appropriate. Ultimately, the use of **KRS 416.560(4)** may be necessary to ensure timely completion of planned activities. A certified letter providing 10-day notice shall be given before entry upon private property to initiate this process. The PDM will be responsible for action. The date of entry should be included in the letter along with a commitment to exercise care while obtaining the necessary data.

## HD-305.2 DAMAGES

Compensation will be afforded for substantiated damages. An incident report should be filed as soon as feasibly possible. Payment for damages generally occurs after the actual damage is determined and a value has been assigned.

### HD-305.2.1 Damages ≤ $1000

The PDM shall initiate the process of compensation for damages. For amounts up to $1,000, the PDM shall submit appropriate documentation and a request for payment directly to the Division of Accounts.

### HD-305.2.2 Damages > $1000

For amounts over $1,000, the PDM shall request a damage assessment from the district right of way office which shall determine the value of the damage. The damage value and supporting documentation shall be submitted to the director of the Division of Highway Design for approval and endorsement to the Division of Accounts for payment.

In such instances, the PDM shall submit the following to the director of the Division of Highway Design:

### HD-305.2.2 Damages > $1000 (cont.)

- A memorandum explaining the necessity for entering the property and a description of the damage
- Documentation describing the property and location of the damage (include parcel number when applicable)
- Property owner's name, address, and phone number
- A copy of the release agreement

### HD-305.2.3 Damage Assessment & Payment

The district's right-of-way personnel will compute an assessment of losses and obtain necessary agreements and releases. The Location Engineer will be responsible for taking this request and preparing a letter of transmittal from the director, Division of Highway Design, to the director, Division of Accounts, requesting payment from design funds. The check should be forwarded to the PDM, who will present the check to the designated payee upon obtaining the property owner's signature on the release agreement. This agreement, along with a copy of the check, is to be placed in the project file.

### HD-305.2.4 Damages by Consultants

Consultants performing work for the department are encouraged to schedule and conduct their work in such a way as to avoid damages to private property. Unjustified damages caused by consultant personnel shall remain the responsibility of the consultant.

In the event that time constraints placed upon the consultant do not allow for normal scheduling of work, unavoidable damages are compensated through the PDM in the manner described in **HD-305.2.1** and **HD-305.2.2**. The consultant shall contact the PDM and obtain approval prior to initiating actions that will cause damage. Such damage must be minimized to the extent practicable and should generally be outlined in direct communication with the property owner before the damage.

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HIGHWAY Design

*Chapter*

SURVEYING

*Subject*

Other Survey Activities

## HD-306.1 PROPERTY BOUNDARY SURVEYS

Occasionally, it becomes necessary to perform a property boundary survey. Boundary surveys are to be conducted in accordance with requirements defined by the Commonwealth of Kentucky, State Board of Licensure for Professional Engineers and Land Surveyors. Tie the boundary survey to the roadway centerline on active design projects; to the centerline or right-of-way line on existing highway; or, to the state-plane coordinate system, whichever is requested by the Project Development Manager (PDM).

All boundary surveys are to be performed under the supervision of a Kentucky Professional Land Surveyor in accordance with Kentucky Board of Engineers and Surveyors (**201 KAR 18:150**). Consultant contracts are available to accomplish this work, if needed.

## HD-306.2 GENERAL ORDER SURVEYS

Once the Project and Supplemental Control has been established, a General Order Survey can be done. These types of surveys can be done to Third-Order Specifications. Applications for these surveys may be additional topographic points, staking points from a radial method, GIS surveys, and environmental surveys.

## HD-306.3 CEMETERY

Cemetery relocation requires a boundary survey. Any gravesites within the right of way must be located in relation to the roadway centerline or boundary-survey base line.

All gravesite locations and boundary surveys of cemeteries are to be performed under the supervision of a registered land surveyor. All survey work for these surveys shall meet or exceed the “minimum standards of practice” as specified by the Kentucky Board of Engineers and Surveyors (**201 KAR 18:150**).

## HD-306.4 DRAINAGE

Major drainage situations that impact roadway location require sufficient fieldwork for a hydraulic analysis. Methods and procedures to follow can be found in the *Drainage Design Guidance Manual* available at:

http://transportation.ky.gov/Highway-Design/Pages/Drainage.aspx

Appropriate densification of terrain and topographic data is required for all bridges, box culverts, and structures 54 inches or greater in diameter (or equivalent). Additional fieldwork may be necessary for other drainage features. Complete details for the requirements for densification of data are contained in the *Drainage Design Guidance Manual*.

The necessary drainage baselines, sections, and profiles (and flood plain cross sections when practical) should be extracted from the Digital Terrain Model (DTM). Densification and/or additional data are normally required.

In order for hydraulic analysis to be completed, obtain all pertinent information on existing stream (such as, top of bank, bottom of bank, flow line, edge of water). This includes sufficient terrain data to accurately describe bridge and culvert ends. DTM data shall be taken at regular intervals (depending on the size and the uniformity of the stream) and at any point the water velocity changes. The type of material in the streambed shall be described, and it shall be noted if banks are subject to scour.

When collecting field data for the hydraulic analysis, include a reach of two flood plain widths up and down stream. Obtain information about the flood plain from available mapping, such as Federal Emergency Management Agency (FEMA).

High and normal water information shall be collected and recorded with a description of how these levels were determined (include event date, if possible). If the high-water level is a result of backwater, then the source should be identified.

## HD-306.5 RAILROADS

Typically, the location and topography of a railroad can be obtained from project mapping. When the location of the rail is critical, densification and/or additional survey data may be needed. In order to index the railroad mapping to the project mapping, the distance to the nearest railroad milepost on each side of the highway centerline shall be measured and the information on the mileposts recorded.

## HD-306.5 RAILROADS (cont.)

When the location of the rail is critical, the surveyor shall be responsible for adequate breaklines and random points to ensure that the DTM accurately reflects the railroad in the project area. When collecting additional data, locate all topography for 500 feet on each side of the highway centerline.

For railroad detour plans, locate topography for a minimum of 1,500 feet on each side of the centerline. The topographic features include:

- Railroad switches
- Signal equipment
- Flashers
- Gates
- Pole lines (with number of wires)
- Switch-points
- Right-of-way limits
- Drainage features
- Size and type of all structures

Additionally, each rail of the tracks shall be located with the elevations taken at 50-foot intervals. If drainage is diverted toward railroad right of way, additional data may be needed through the affected area.

All survey stakes within 15 feet of the centerline of the tracks shall be driven flush to the existing grade to avoid interference with railroad train traffic; guard stakes are not to be used within this area.

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Right-of-Way Monumentation

## HD-307.1 OVERVIEW

The right-of-way boundaries for newly acquired right of way shall be established and monumented for all projects. The existing right-of-way boundaries are not required to be permanently monumented. The intent is to define new right-of-way boundaries on plans and in the field.

## HD-307.2 STANDARD MONUMENTATION TYPES

Monumentation shall be placed in accordance with the *Standard Drawings* (RGX-005) available online at:

http://transportation.ky.gov/Highway-Design/Pages/Standard-Drawings.aspx

### HD-307.2.1 Monumentation

- Type 1 and 1A – KYTC R/W disk (See standard drawing for application.)
- Type 2 – (witness) - KYTC W-R/W disk (See standard drawing for application.)
- Witness posts – 48-inch Carsonite post or 6-foot orange fiberglass post with KYTC decal
- Temporary – 36-inch wood stakes
- Supplemental – 24-inch rebar with plastic or aluminum KYTC cap

### HD-307.2.2 Non-KYTC Routes

- Type 3 and 3A – **no** KYTC label, R/W disk (See standard drawing for application.)
- Type 4 – (witness) – **no** KYTC label, W-R/W disk (See standard drawing for application.)

In instances where KYTC will be purchasing right of way for a Local Public Agency (LPA), the Project Development Branch Manager (PDM) may decide that setting right-of-way monuments is not necessary. In these situations, or if there are extenuating circumstances, the PDM can request an exception from setting right-of-way monuments. Such requests must be submitted to the KYTC State Survey Coordinator.

## HD-307.3 RIGHT OF WAY LOCATION

Right-of-way monuments and witness monuments shall be flagged on the plan sheets with station and offset, and documented on the coordinate control sheets with Northing, Easting, station, and offset. Coordinate control sheets shall be included in the right-of-way and construction plans.

All right-of-way monumentation (including witness monuments) shall be established from the monumented Project control with an accuracy of 1:15,000 or better and shall be set under direct supervision of a Kentucky Licensed Professional Land Surveyor.

### HD-307.3.1 Placement of Witness Posts

To aid others in the field location of the right-of-way or witness monuments, a 6-foot orange witness post may be used. The land surveyor in charge of monumentation is encouraged to place a witness post for the right-of-way monuments where practical and feasible. If possible, a minimum of three witness posts per project should be placed. A witness post is to be set within 1 foot of the monument location and shall be set on the property of the Transportation Cabinet. A witness post shall have a label indicating that the point is Kentucky Right of Way.

### HD-307.3.2 Placement Exceptions

Occasionally, several monuments may be in close proximity to one another (for example, when the right-of-way lines are making several short 90-degree turns) or may be in someone’s “front yard” that becomes unsightly to property owners. In such situations, it is recommended that only 36-inch wooden stakes be set within one foot of the monument. This gives the property owner notice of where the property line is.

### HD-307.3.3 Permanent Monumentation

Preferably, monumentation should be completed before construction. However, if there is a high probability that a right-of-way monument will be disturbed by construction, the PDM may choose to have the permanent monument(s) set after construction is complete. In this situation, the surveyor shall set a temporary 36-inch stake and a temporary ½-inch diameter (#4 or greater) steel rebar at the location until a permanent monument can be placed.

**Note:** The stake and rebar are for **temporary purposes only** and will not, under any circumstances, be considered the final monumentation**.**

The project manager is still encouraged to request that right of way be staked during the right-of-way process, if deemed necessary to communicate right-of-way locations to property owners.

## HD-307.4 COORDINATE CONTROL SHEETS

The coordinate control sheets document the control information that facilitates the field survey process. Right-of-way monuments and witness monuments are documented on the coordinate control sheets with Northing, Easting, station, and offset. Coordinate control sheets shall be included in the right-of-way plans so that monumentation can be established during the project's right-of-way phase.

**Note:** If a project has a project datum factor that relates the State Plane Coordinates and the project coordinates for the right of way, it shall be published on the coordinate control sheets.

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Aerial Mapping

## HD-308.1 OVERVIEW

As a result of statewide interagency coordinated efforts, aerial mapping methods are used most commonly for statewide data collection. Project Development Branch Managers (PDMs) should check for available data before requesting new data. Base Resolution Aerial Light Detection and Ranging (LiDAR), Orthophotography, and Photogrammetry data is widely available for planning level accuracy. Higher Resolution Orthophotos, Aerial LiDAR, and Photogrammetry for design grade data may be available from KYTC or other state agencies or may be obtained through the inter-agency statewide aerial photography and LiDAR contract.

Typically, aerial surveys are most cost effective for design projects over 2 miles in length. For shorter projects, conventional or Global Navigation Satellite System (GNSS) ground surveys are suggested as they are generally more cost effective. Ground surveys are usually necessary to supplement aerial surveys when locating underground or obscured items such as sizes of pipes and inverts for inlets. See **HD-302** for methods on establishing ground control for aerial surveys.

When requesting aerial mapping, the limits of work should be clearly specified for each project and include a buffer on all sides (typically 1,000 feet). It is best to request project limits with wide buffers to allow for unforeseen design decisions nearby. Sending survey crews to pick up items later is expensive and can be avoided with reasonable buffers for data collection at the beginning and end limits, as well as corridor width.

### HD-308.1.1 Definition of Terms

- *Aerial Photography* does not have a uniform scale. It is not possible to measure distances. It is not considered a map because it contains image displacements caused by the tilting of the camera and terrain relief (topography).

- *Aerial Light Detection and Ranging (LiDAR)* is an optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target.

### HD-308.1.1 Definitions of Terms (cont.)

- *Digital Elevation Model* (DEM) is a digital model or 3-D representation of a terrain's surface created from terrain elevation data. KYTC uses DEMs for planning purposes.

- *Digital Surface Model* (DSM) represents the earth's surface and includes all objects on it.

- *Digital Terrain Model* (DTM) represents the bare ground surface without any objects such as plants or buildings. KYTC uses DTMs for design purposes.

- *Orthophoto* is a uniform-scale photograph. It is a photographic map from which measurements are possible. It can serve as a base map.

- *Orthorectified imagery* is created using National Grid control points and a DTM. This means that the distortions inherent in a flat photograph of a three-dimensional object (the earth's surface) are more completely and accurately corrected. An orthorectified image is positionally more accurate, and geometric fidelity (shape) is retained in all terrain, including hilly areas.

- *Photogrammetry* has been defined by the American Society for Photogrammetry and Remote Sensing (ASPRS) as "the art, science, and technology of obtaining reliable information about physical objects and the environment through processes of recording, measuring and interpreting photographic images."

## HD-308.2 PROCEDURES

Requests for aerial surveys are submitted to the KYTC Survey Coordinator, however supplemental photography, mapping, etc. can be downloaded from statewide/regional files at http://kygeonet.ky.gov or designers can download project level photos, surveys, etc. from ProjectWise.

### HD-308.2.1 Photogrammetry

Photogrammetry is a time and cost effective way to gather survey data on large projects. Photogrammetry begins with aerial photography that is either captured on film or captured by high resolution digital cameras. The film is then scanned on a special high resolution photogrammetric scanner into a digital file. Certified Photogrammetrists (CP) then identify the ground control targets in the files and use a special aerotriangulation (AT) software package, which uses a "least squares" adjustment. The software and experienced operator then fix problems and complete the AT process. AT is used for all design grade data.

## HD-308.2.1 Photogrammetry (cont.)

Orthophotos or planning grade images captured with digital cameras should use Exterior Orientations (EOs) for each mission from the GNSS data collected from: CORS stations, GNSS unit in the plane, and POS data from the Inertial Measuring Unit (IMU) in place of AT. AT may still be used to fix problems or for high accuracy projects; however, it is not a required process with good digital data. The post-processed digital file is then used to create a base map in as much detail as the scope of work requires.

All aerial photography and photogrammetry services are to comply with the conditions and specifications described in the *Reference Guide Outline, Specifications for Aerial Surveys and Mapping by Photogrammetric Methods for Highways* (Photogrammetry for Highways Committee 1968). They are also to comply with the U.S. Department of Transportation, Federal Highway Administration, and the terms and conditions of the contract agreement between the Department of Highways and the company furnishing the aerial and photogrammetric services.

## HD-308.2.2 Digital Orthophotos

The intended use of Orthophotography includes design level mapping, especially when combining it with Geographic Information System (GIS) data. Orthophotos begin with the DTMs and other planimetric files created by photogrammetry and then are tied together geographically to make photo mosaics. The geographically rectified mosaics are then color balanced. Seams and artifacts are removed.

Some special considerations in collecting digital orthophotos are listed below:

- Leaf Off Data Collection
- Minimal shadow and cloud conditions
- Interfering weather

## HD-308.2.3 Aerial Light Detection & Ranging (LiDAR)

Aerial Light Detection and Ranging (LiDAR) data may be used for KYTC projects. LiDAR is best for fast and detailed collection of 3-D point clouds of the earth for the production of true orthophotos and DTMs. Higher Resolution LiDAR may be available by data mining the statewide LiDAR consultant contract. Base Resolution LiDAR is helpful in planning level documents.

Traditional orthophoto generation does not use a digital surface model (DSM) and often suffers from obscured areas and indistinct edges. By improving the surface modeling, more accurate, true orthophotos can be produced. LiDAR is best used for increased accuracy on a project.

### HD-308.2.3 Aerial Light Detection & Ranging (cont.)

The use of Aerial LiDAR and/or photogrammetry will still require limited field survey methods, especially for items not visible from the sky (i.e. manhole depth, underside of bridge, headwall pipe diameter, etc.)

LiDAR data collection, processing, and delivery shall be consistent with the most recent version of the LAS file specification as defined by the American Society for Photogrammetry & Remote Sensing (ASPRS) and be in agreement with the specifications set forth by the Kentucky Division of Geographic Information (DGI). For a full list of applicable specifications, refer to the KYTC Survey Coordination site at:

http://transportation.ky.gov/Highway-Design/Pages/Survey-Coordination.aspx

## HD-308.3 DELIVERABLES

Aerial mapping deliverables shall be produced in MicroStation and delivered as .dgn files with all graphics adhering to the current KYTC graphic standards. All mapping products will be delivered in Kentucky Single Zone State Plane coordinates and United States National Map Accuracy Standards (USNMAS). For the current listing of required geometric and vertical datums, adjustments, and geoids, refer to the KYTC Survey Coordination site link in **HD-308.2.3**. For more information on the USNMAS see **Exhibit 300-04**.

The horizontal accuracy of the orthorectified imagery shall be better than 2-foot RMSEXY (1.41 foot RMSE - X or Y) in the case of 12-inch spatial resolution, and 1-foot RMSE (0.7 foot RMSE - X or Y) in the case of 6-inch spatial resolution.

The plotted position of each control point shall lie to an accuracy of one one-hundredth (1/100) of an inch of its true position as expressed by the State Plane coordinate for that point. Control point coordinates will be submitted as a dataset (**HD-302**).

The default KYTC standard for design mapping is a scale of 1 inch = 50 feet with 2-foot contours. Other scales and intervals may be acceptable based on the request of the project manager and the project development team (PDT).

A survey report, as described in **HD-301.6**, shall be prepared by the responsible party and submitted to the project manager. The consultant project manager shall submit a .pdf copy of the survey report to the KYTC Survey Coordinator for review.

Specific deliverables shall be specified by the PDT as necessary to meet the individual scope of the project. General requirements for each deliverable are as follows:

## HD-308.3.1 Digital Orthophotos

In addition to the processed imagery, deliverables for orthophotos may be included in the survey report and should include source imagery information such as the following:

- Calibration Reports
- Camera Station Control
  - Airborne GPS
  - IMU Data
- Supplemental Ground Control (**HD 302.5**)
- Flight Diagram
- Photography and Supplemental Reports
- Digital Frames

## HD-308.3.2 Aerial LiDAR

LiDAR Survey Reports shall contain the following information:

- Survey Report detailing the collection of control and reference points used for calibration and QA/QC
- Processing Report detailing calibration, classification, and product generation procedures including methodology used for breakline collection and hydro-flattening
- QA/QC Reports detailing the analysis, accuracy assessment, and validation of:
  - The point data (absolute, within swath, and between swath)
  - The bare-earth surface (absolute)
  - Other optional deliverables, as appropriate
- Control and Calibration points: all control and reference points used to calibrate, control, process, and validate the LiDAR point data

LiDAR data may be requested with various levels of post processing, depending upon the specific project needs. Each of these deliverables is presented briefly below.

### HD-308.3.2.1 Raw Point Cloud

Raw point cloud data are mass irregularly-spaced points with each containing 3D coordinates (x, y, and z). Raw point clouds can be used to determine surface elevations within a project.

### HD-308.3.2.2 Classified Point Cloud

Classified point clouds are processed based on the intensity return of the laser pulse to classify the point as bare earth, vegetation, hard surface, etc. Classified point clouds are necessary to determine elevations in developing a digital elevation or digital terrain model as it allows the differentiation of earth from vegetative readings. A brief listing is shown in the following table. A full listing of point cloud classifications is provided in **Exhibit 300-07.**

**HD-308.3.2.2 Classified Point Cloud (cont.)**

***Point Cloud Code Description***

| Code | Description |
|---|---|
| 0 | Never classified |
| 1 | Unassigned |
| 2 | Ground |
| 3 | Low vegetation |
| 4 | Medium vegetation |
| 5 | High vegetation |
| 6 | Building |
| 7 | Noise |
| 8 | Model key |
| 9 | Water |

All point cloud data shall be submitted in compliance with LAS file format requirements as defined by ASPRS. Refer to the KYTC State Survey Coordinator for identification of the current LAS file version in use.

A Surface Raster Digital Elevation Model (DEM) is a grid of z-values at regularly spaced intervals in x and y directions. DEMs may be used for a large variety of automated analyses, mathematical models, and 3D simulations and visualization.

Breaklines are linear features that describe a change in the smoothness or continuity of a surface. Breaklines are typically used to define edges of hard surfaces, such as roadways, and may be placed from either orthophoto processing or field survey measurements.

The project team may also request hydroflattening of LiDAR data to define the surface of lakes, streams, and rivers which may be undefined in DEMs and DTMs due to triangulation patterns when hydroflattening is not used.

In the absence of hydroflattening, field survey data collection may be required to better define contours near water features.

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Terrestrial Mapping

## HD-309.1 OVERVIEW

Terrestrial Mapping includes the use of Mobile and Stationary Light Detection and Ranging (LiDAR) systems.  LiDAR uses lasers to make measurements from a tripod or other stationary mount, a mobile surface vehicle, or an aircraft. The term LiDAR is sometimes used interchangeably with laser scanning, but is more often associated with the airborne method (performed from an airplane, helicopter, or other aircraft).

**Note:** Terrestrial Laser Scanning (TLS) as discussed in this chapter does not pertain to airborne LiDAR or Airborne Laser Scanning (ALS). See **HD-310** for further explanation of these terms.

Terrestrial LiDAR (a specialty survey) has the potential to acquire millions of survey points in a short time, especially in dangerous areas that are not conducive to traditional methods of data collection. Every detail of an overpass that is visible can be picked up from one short field trip with Stationary Scanning or Mobile Mapping without inverted survey rods, negative sign errors, requisite field sketches, or climbing on and around pilings or bents. While the scanning collects the data very quickly, the post-processing can be very difficult and time consuming.

**Note:** Safety, higher levels of accuracy, and efficiency of data collection are compelling reasons to use terrestrial laser scanning for some projects.

Mobile Mapping is also known as Mobile Terrestrial Laser Scanning (MTLS). Mobile Mapping is an emerging technology that uses laser scanner technology in combination with Global Navigation Satellite Systems (GNSS) and other sensors to produce accurate and precise geospatial data from a moving vehicle. MTLS platforms may include sport utility vehicles, pick-up trucks, hi-rail vehicles, boats, and other types of vehicles.  Data collection on 20 miles of highway per day is achievable.

## HD-309.1 OVERVIEW (cont.)

Stationary Terrestrial Laser Scanning (STLS) is commonly referred to as Tripod Scanning. Stationary Scanning has many of the same advantages of Mobile Mapping, but is generally applied to smaller projects or spot improvements. Currently, there are many more providers of Stationary Scanning than Mobile Mapping because Stationary Scanning has a broader range of applications outside of KYTC work than corridor Mobile Mapping.

## HD-309.2 CONSIDERATIONS FOR USE OF MTLS

The following are a few factors to consider when determining if MTLS is appropriate for a particular project:

- Safety of in-lane survey crews for project area—MTLS reduces the exposure of surveyors to traffic.

  **Note:** Traditional survey methods are still required for the placement of transformation and validation points.

- Project time constraints—MTLS may be faster than traditional crews, if equipment is available.

- Length/size of project—Projects less than 2 miles without an overpass may not be as cost effective for MTLS. Long corridors and repairs of overpasses or critical cross slope areas are excellent candidates for MTLS. Shorter corridors with a high level of complexity are also excellent candidates for MTLS.

- High traffic volumes in project area—With MTLS, a project crew has the ability to survey during congestion or at night.

  **Note:** Photos are not included in nighttime data collection so some value is lost in this scenario, but the point cloud accuracy is unaltered in night time conditions.

- Projects requiring high precision—These projects are excellent candidates for MTLS surveys; however, traditional survey crews may be adequate.

- Complexity of project—Corridors of nearly any length with a high level of complexity (such as a full Right-of-Way survey) are excellent candidates for MTLS due in part to the ability to extract additional data from an MTLS point cloud, which reduces the need for additional data gathering. This is highly beneficial in remote project sites.

## HD-309.3 CONSIDERATIONS FOR USE OF STLS

STLS is utilized in the same situations as MTLS, but is typically most efficient for smaller projects. The following are examples of where STLS may be preferred over MTLS for a particular project:

- Safety of in-lane or railroad right-of-way survey crews for critical spot improvement
- Bridge rehab projects and box culverts
- Project time constraints
- Pavement analysis scans
- Structures and bridge clearance surveys
- Architectural and historic preservation surveys
- Intersections or other small-site surveys

## HD-309.4 TLS ACCURACY

Terrestrial Laser Scanning accuracy for KYTC is the same as other survey methods. For unique projects where higher accuracy is considered, contact the KYTC State Survey Coordinator for requirements.

Survey field crews are necessary to set survey control points to adequately tie down both the vertical and horizontal values to a coordinate system with either technology (**HD-302**).

Post-processing of LiDAR involves transformation of scan data using control points. Multiple checks for accuracy and precision should be performed. Post-processed LiDAR is utilized to generate the deliverables requested, such as 3D CADD files.

All of the equipment used to collect scanning data shall meet American Society for Photogrammetry and Remote Sensing (ASPRS) and National Standard for Spatial Data Accuracy (NSSDA) standards.

## HD-309.5 PROCEDURES

GNSS equipment used in conjunction with STLS and MTLS must correspond with the requirements stated in **HD-301.3**. TLS kinematic post-processing must comply with ASPRS and NSSDA standards. MTLS kinematic GNSS/IMU data must be post-processed in forward and reverse directions (from beginning-to-end and end-to-beginning).

### HD-309.5.1 Calibration

Sensor alignment (bore sighting) procedures shall be performed prior to scanning if the system has been disassembled for transport. Following scanning, collected data shall be adjusted to transportation points collected for the project.

### HD-309.5.2 Data Collection

Monitoring various component operations during the scan session is an important step in the Quality Assurance/Quality Control (QA/QC) process. The system operator should note when the system encountered the most difficulty and be prepared to take appropriate action in adverse circumstances.

The scanning equipment shall be monitored throughout the data collection. If a fault is detected, additional scanning may be necessary to provide the accuracy of the project scope.

## HD-309.6 LANE CLOSURES

Lane closure and time-of-day requirements shall be made at the district level and might change during the project. It is important to specify these details in the scope of services and contracts. *Manual on Uniform Traffic Control Devices* (MUTCD) standards for rolling or fixed-lane closures will be followed when lane closures are deemed necessary due to expected high volumes of traffic; vehicles operating continuously or in close proximity to the collection vehicle, which results in breaks in scan coverage; or high volumes of tractor trailers on route causing satellite breaks. Traffic control for vehicular data collection should be consistent with MUTCD requirements.

## HD-309.7 PLANNING AN MTLS PROJECT

Before the scanning project commences, a mission planning session should be conducted to assure that manufacturer recommendations for satellite availability and Positional Dilution of Precision (PDOP) requirements can be met. During the data collection, there shall be a minimum of 5 satellites in view for the GNSS Control Stations and the GNSS unit in the MTLS system. Similarly, the maximum PDOP value during acquisition shall be 5.

### HD-309.7.1 Project Site Visit

A project area site visit shall be conducted to determine the best time to collect data to minimize artifacts from surrounding traffic or other factors and identify obstructions that may cause GNSS signal loss. Planning for data collection shall also include the use of classification schema as shown in **Exhibit 300-07.**

### HD-309.7.2 Data Collection

MTLS data shall be collected so that there is an overlap (more than one pass in the same direction on the project, overlapping passes in opposite directions, or both). Data collection shall have a minimum of 20 percent sidelap. Optimize station spacing to meet accuracies as described in **HD-302.5.3**.

Data points collected using scanning are checked by various means, including comparing scan points to validation points, reviewing the digital terrain model, reviewing data terrain lines in profile, and comparing redundant measurements.

**Note:** Redundant measurements with MTLS or STLS can only be accomplished by multiple scans that offer overlapping coverage.

## HD-309.8 PLANNING AN STLS PROJECT

Before the STLS project commences, a project area site visit shall be conducted to determine the best time to collect data so that excessive artifacts from traffic or other factors are minimized, and to identify obstructions that may cause data voids or shadows. Check weather forecast for fog, rain, snow, smoke, or blowing dust.

Additional stationary setups may be used to help reduce artifacts and obstructions from traffic and pedestrians. Areas of the project that will be difficult to scan should be identified and a plan developed to minimize the effect on the final data through additional set-ups or alternate methods of data collection. Safety should always be taken into consideration when selecting setup locations.

STLS data collection shall have between 5 percent and 15 percent overlap. Optimize measurement distance to meet positional accuracies as described in **HD-302.5.4.**

## HD-309.9 DELIVERABLES

The project team shall specify deliverables necessary to meet the individual scope of the project. General requirements for each deliverable are as follows:

### HD-309.9.1 Point Cloud

The simplest form of the processed TLS data is a point cloud, which can be saved in an LAS format (v1.2 or later). If image overlay data is available, the post-processed point cloud may be delivered with an RGB value for each collected point.

### HD-309.9.1 Point Cloud (cont.)

While a point cloud is the simplest deliverable form, it is also the largest and most difficult to manipulate. A typical TLS point cloud can include billions of individual XYZ positions, which most software cannot work with. All points collected shall be included in the final report, even though some points will not be used in the production of deliverables for various reasons.

Point cloud data can be imported into various software packages. Further data manipulation, infusing other types of data, and the use of analytical tools with the imported point cloud create a variety of value-added products. It is anticipated that raw point clouds will rarely be requested by KYTC. Rather, classified point clouds will be the more common deliverable.

### HD-309.9.2 Classified Point Cloud

A classified point cloud contains all TLS point data collected, but differs from a point cloud in that each point is assigned to a classification indicative of the type of feature reflecting the laser beam. If a classified point cloud is required, classification specifications should be noted with reference to **Exhibit 300-07**.

**Note:** Not all classifications are required for all projects, and only classifications usable on a specific project should be requested.

### HD-309.9.3 Metadata

A geospatial metadata file specifying the units, datum adjustment, and geoid model of the point cloud should be provided with all scopes for this type of work.

### HD-309.9.4 Imagery/Video

Video or image files should also be delivered, if available. If delivered, files must be in common (non-proprietary) format.

**Note:** Imagery collected with a TLS sensor is from the perspective of the scanning equipment and does not include aerial photography.

### HD-309.9.5 Survey Report

A survey report, as described in **HD-301**, shall be prepared by the responsible party and submitted to the project manager. The consultant project manager shall submit a PDF of the survey report to the KYTC Survey Coordinator for review.

The documentation of TLS projects must show clear data lineage from the published primary control to the final deliverables. The data path of the entire process must be defined, documented, accessible, and allow for identifying adjustment or modification. 3D data without a documented lineage is susceptible to imbedded mistakes and is difficult to adjust or modify to reflect changes in control. An additional concern is that a poorly documented data lineage would not be legally supportable.

**HD-309.9.5 Survey Report (cont.)**

The Terrestrial LiDAR Survey Narrative Report, completed by the person in charge of the survey, shall contain specific information required by each survey method, any appropriate supplemental information (including geospatial metadata files conforming to the current KYTC standard), and the following general information:

- Control lineage or pedigree
- Primary and project control held or established
- Local transformation points
- Validation points
- Adjustment report for control and validation points
- Base station observation logs (occupation data, obstruction diagram, atmospheric conditions, etc.)
- Control for scanner registration and QC
- Local transformation points
- Validation points
- GNSS accuracy report (GNSS satellite visibility and PDOP IMU accuracy report)
- Trajectory reports
- Registration reports
- Results of target and cloud-to-cloud registration
- Results of finished products to validation points
- Geospatial metadata files conforming to current KYTC standards
- QA/QC reports

## HD-309.10 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The TLS data provider shall provide a Quality Management Plan (QMP) that includes descriptions of the proposed quality control and quality assurance plan. The QMP shall address the requirements set forth in HD308 as well as other project specific QA/QC measures.

For an STLS survey, the QA/QC report shall list (at a minimum):

- Control survey reports
- STLS system reports
- Statistical comparison of point cloud data and transformation points
- Statistical comparison of adjusted point cloud data and validation points

For an MTLS survey, the QA/QC report shall list (at a minimum):

- Control survey reports
- MTLS system reports
- PDOP values during the survey

## HD-309.10 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) (cont.)

- Separation of forward and reverse solutions (difference between forward and reverse post-processed roll, pitch, yaw, and XYZ positions solution).

  **Note:** Forward and reverse refers to time: processing from beginning-to-end and end-to-beginning.

- Areas of the project where data collected exceeded the maximum elapsed time or distance traveled of uncorrected IMU drift due to degraded, lost, or obstructed GNSS signal reception
- Comparison of elevation data from overlapping (sidelap) runs
- Comparison of points at the area of overlap (endlap) if more than one GNSS base is used
- Statistical comparison of point cloud data and finished products to validation points
- Statistical comparison of adjusted point cloud data and redundant validation points

## HD-309.11 ACCURACY

*Accuracy* has commonly been used in the industry to refer to the tested Root Mean Square Error in Z (RMSEZ) of the LiDAR data. Technically, this is improper usage. NSSDA accuracy is defined as the 95% confidence level equal to (RMSEZ*1.96) in a set of errors to be normally distributed. In keeping with common usage to reduce confusion, this specification’s use of the term *accuracy* is indicative of the RMSE value and will be annotated as such.

KYTC will not accept deliverables that do not meet the defined project scope. If errors exist, it is incumbent on the consultant to re-collect or re-process the data without additional fee.

Common issues include:

- Smoothed Contours—There is either so much editing that detail is lost, or there is not enough smoothing for it to look right. It is suggested that this issue be discussed during scoping.
- Point Cloud misunderstandings—Discuss expectations in scoping.
- Requesting a consultant to provide an unclassified point cloud as a cost savings without an understanding of what to do with it or how to process it.

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***Chapter***

SURVEYING

***Subject***

Acronyms & Terms

## HD-310.1 OVERVIEW

This chapter provides expanded acronyms and definitions of surveying terms used within HD-300.

## HD-310.2 ACRONYMS

| | |
|---|---|
| ACSM | American Congress on Surveying and Mapping |
| ASPRS | American Society of Photogrammetry and Remote Sensing |
| DEM | Digital Elevation Model |
| DMI | Distance Measuring Instrument |
| DTM | Digital Terrain Model |
| FGDC | Federal Geographic Data Committee |
| GNSS | Global Navigation Satellite System |
| HDGM | Highway Design Guidance Manual |
| LiDAR | Light Detection and Ranging |
| NGS | National Geodetic Survey |
| NSSDA | National Standard for Spatial Data Accuracy |
| MTLS | Mobile Terrestrial Laser Scanning, also known as Mobile Mapping |
| PDOP | Position Dilution of Precision |
| ROW | Right of Way |

## HD-310.2 ACRONYMS (cont.)

| | |
|---|---|
| RTK | Real Time Kinematic (GNSS Survey) |
| STLS | Stationary Terrestrial Laser Scan, also known as Tripod Scanning |
| TIN | Triangulated Irregular Network |
| TLS | Terrestrial Laser Scan, including MTLS and STLS |

## HD-310.3 DEFINITIONS

| | |
|---|---|
| Artifacts | Erroneous data points that do not correctly depict the scanned area. Objects moving through the scanner's field of view, temporary obstructions, highly reflective surfaces, and erroneous measurements at the edges of objects (also known as "Edge Effects") can cause artifacts. Erroneous depiction of features can be due to inadequate or uneven scan point density. |
| Data Voids | Gaps in scan data caused by temporary obstructions or inadequate scanner occupation positions. Overlapping scans and awareness of factors causing data shadows can help mitigate data voids. Some data voids are caused by temporary obstructions such as pedestrians and vehicles. |
| Decimation | Reduction of the density of the point cloud. |
| Global Navigation Satellite System | Global Navigation Satellite System (GNSS) refers to the constellations of satellites providing signals from space transmitting positioning and timing data. The USA's NAVSTAR Global Positioning System (GPS) and Russia's Globalnaya Navigatsionnaya Sputnikovaya Sistema (GLONASS) are examples of GNSS. |
| Inertial Measurement Unit (IMU) | A device that senses and quantifies motion by measuring the forces of acceleration and changes in attitude in the pitch, roll, and yaw axes using accelerometers and gyroscopes. |

## HD-310.3 DEFINITIONS (cont.)

| | |
|---|---|
| Intensity | A value indicating the amount of laser light energy reflected back to the scanner. |
| Noise | Erroneous measurement data resulting from random errors. |
| Phantom Points | See *Artifacts.* |
| Point Cloud | The 3D point data collected by a laser scanner from a single observation session. A point cloud may be merged with other point clouds to form a larger composite point cloud. Data from within a point cloud may be used to produce traditional survey products, and point clouds may be specified as a deliverable. |
| Point Density | The average distance between XYZ coordinates in a point cloud, typically at a specified distance from the scanner. The point density specified by the client or selected by the contractor should be understood as the maximum value for the subject in question and should be dense enough to achieve extraction of detail at the scales specified for the project. |
| Registration | The process of joining point clouds together or transforming them onto a common coordinate system. Registration can be by use of known coordinates and orientations, target transformation, or surface matching algorithms. |
| Resolution | The ability to detect small objects or object details in the point cloud. See: "Investigating Laser Scanner Accuracy," W. Boehler, M. Bordas Vicent, A. Marbs, i3mainz, Institute for Spatial Information and Surveying Technology, April 2004. |
| Scan | The acquiring of point cloud data by a LiDAR system. |
| Detail Scan | A higher point density scan. |
| Overview Scan | A scan to gather general details of an area. |
| Scan Density | See *Point Density*. |

**HD-310.3 DEFINITIONS (cont.)**

| | |
|---|---|
| Scan Speed | The rate at which individual points are measured and recorded. |
| Time-of-flight Measurement | Distance measurements based on the time between emitting a pulse of light and detecting the reflection of the pulse. |
| Trajectory report | MTLS system and positional performance data from each scanning pass produced by post-processing software. Reported parameters may include satellites in view, PDOP, GDOP, uncorrected IMU distance, uncorrected IMU duration, difference in positional solutions between forward and backward processing, and estimated positional accuracy. |
| Wave-form Processing | Also called “echo digitization.” Scanner system that uses the pulsed time-of-flight technology and internal real-time processing capabilities of multiple returns to identify multiple targets. |
| XYZI | ASCII format showing X & Y coordinate, Z elevation and reflection Intensity values from NSSDA. |
| XYZIRGB | ASCII format showing X & Y coordinate, Z elevation, reflection Intensity, and Red, Green, Blue color values from NSSDA. |

# Exhibit 300-01

Federal Geographic Data Committee FGDC-STD-007.4-2002
Geospatial Positioning Accuracy Standards
PART 4: Standards for A/E/C and Facility Management
APPENDIX A Recommended A/E/C Surveying and Mapping Standards

**Table A-1**
**Minimum Closure Standards for Engineering and Construction Control Surveys**

| **Classification Order** | **Closure Standard** | |
|---|---|---|
| **Engr & Const Control** | **Distance** | **Angle** |
| | **(Ratio)** | **(Secs)** |
| Second-Order | Class I 1:50 | 000 3√N1 |
| Second-Order | Class II 1:20 | 000 5√N |
| Third-Order | Class I 1:10 | 000 10√N |
| Third-Order | Class II 1: 5 | 000 20√N |
| Construction 1: 2 | 500 60√N | |
| (Fourth-Order)___________________________________ | | |

1N = Number of angle stations

**Table A-2**
**Minimum Elevation Closure Standards for Vertical Control Surveys**

| **Classification Order** | **Elevation (ft)1** | **Closure Standard (mm)** |
|---|---|---|
| First-Order, Class I | 0.013√M | 3√K |
| First-Order, Class II | 0.017√M | 4√K |
| Second-Order, Class I | 0.025√M | 6√K |
| Second-Order, Class II | 0.035√M | 8√K |
| Third-Order | 0.050√M | 12√K |
| Construction Layout | 0.100√M | 24√K |

---

1 √M or √K = square root of distance in Miles or Kilometers

**Exhibit 300-02**

FGDC- STD-007.2-1998

**Table 2.1 – Positional Accuracy Standards**

**Horizontal, Ellipsoid Height, and Orthometric Height**

----------------------------------------------

| **Accuracy Classification** | **95-Percent Confidence** |
|---|---|
| | ***Less Than or Equal to:*** |
| | |
| 1-Millimeter | 0.001 meters |
| 2-Millimeter | 0.002 meters |
| 5-Millimeter | 0.005 meters |
| 1-Centimeter | 0.010 meters |
| 2-Centimeter | 0.020 meters |
| 5-Centimeter | 0.050 meters |
| 1-Decimeter | 0.100 meters |
| 2-Decimeter | 0.200 meters |
| 5-Decimeter | 0.500 meters |
| 1-Meter | 1.000 meters |
| 2-Meter | 2.000 meters |
| 5-Meter | 5.000 meters |
| 10-Meter | 10.000 meters |

**Exhibit 300-03**

Standards and Specifications for Geodetic Control Networks, Federal Geodetic Control Committee (1984)

When a vertical control point is classified with a particular order and class, NGS certifies that the orthometric elevation at that point bears a relation of specific accuracy to the elevations of all other points in the vertical control network. That relation is expressed as an elevation difference accuracy, b. An elevation difference accuracy is the relative elevation error between a pair of control points that is scaled by the square root of their horizontal separation traced along existing level routes.

**Table 2.2 Elevation Accuracy Standards**

| Classifications | Maximum elevation difference accuracy |
|---|---|
| First-order, class I | 0.5 |
| First-order, classs II | 0.7 |
| Second-order, class I | 1.0 |
| Second-order, class II | 1.3 |
| Third-order | 2.0 |

An elevation difference accuracy, b, is computed from a minimally constrained correctly weighted, least squares adjustment by

$$b = S/\sqrt{d}$$

*where*

*d* = approximate horizontal distance in kilometers between control point positions traced along existing level routes.

*S* = propagated standard deviation of elevation difference in millimeters between survey control points obtained from the least squares adjustment. Note that the units of *b* are $(mm)/\sqrt{\phantom{x}}(km)$.

**Exhibit 300-04**

### *United States National Map Accuracy Standards*

With a view to the utmost economy and expedition in producing maps which fulfill not only the broad needs for standard or principal maps, but also the reasonable particular needs of individual agencies, standards of accuracy for published maps are defined as follows:

**1. Horizontal accuracy.** For maps on publication scales larger than 1:20,000, not more than 10 percent of the points tested shall be in error by more than 1/30 inch, measured on the publication scale; for maps on publication scales of 1:20,000 or smaller, 1/50 inch. These limits of accuracy shall apply in all cases to positions of well-defined points only. Well-defined points are those that are easily visible or recoverable on the ground, such as the following: monuments or markers, such as bench marks, property boundary monuments; intersections of roads, railroads, etc.; corners of large buildings or structures (or center points of small buildings); etc. In general what is well defined will be determined by what is plottable on the scale of the map within 1/100 inch.

Thus while the intersection of two road or property lines meeting at right angles would come within a sensible interpretation, identification of the intersection of such lines meeting at an acute angle would obviously not be practicable within 1/100 inch. Similarly, features not identifiable upon the ground within close limits are not to be considered as test points within the limits quoted, even though their positions may be scaled closely upon the map. In this class would come timber lines, soil boundaries, etc.

**2. Vertical accuracy,** as applied to contour maps on all publication scales, shall be such that not more than 10 percent of the elevations tested shall be in error more than one-half the contour interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error for a map of that scale.

**3. The accuracy of any map may be tested** by comparing the positions of points whose locations or elevations are shown upon it with corresponding positions as determined by surveys of a higher accuracy. Tests shall be made by the producing agency, which shall also determine which of its maps are to be tested, and the extent of the testing.

**4. Published maps meeting these accuracy requirements** shall note this fact on their legends, as follows: “This map complies with National Map accuracy Standards.”

**5. Published maps whose errors exceed those aforestated** shall omit from their legends all mention of standard accuracy.

**6. When a published map is a considerable enlargement** of a map drawing (manuscript) or of a published map, that fact shall be stated in the legend. For example, “This map is an enlargement of a 1:20,000-scale map drawing,” or “This map is an enlargement of a 1:24,000-scale published map.”

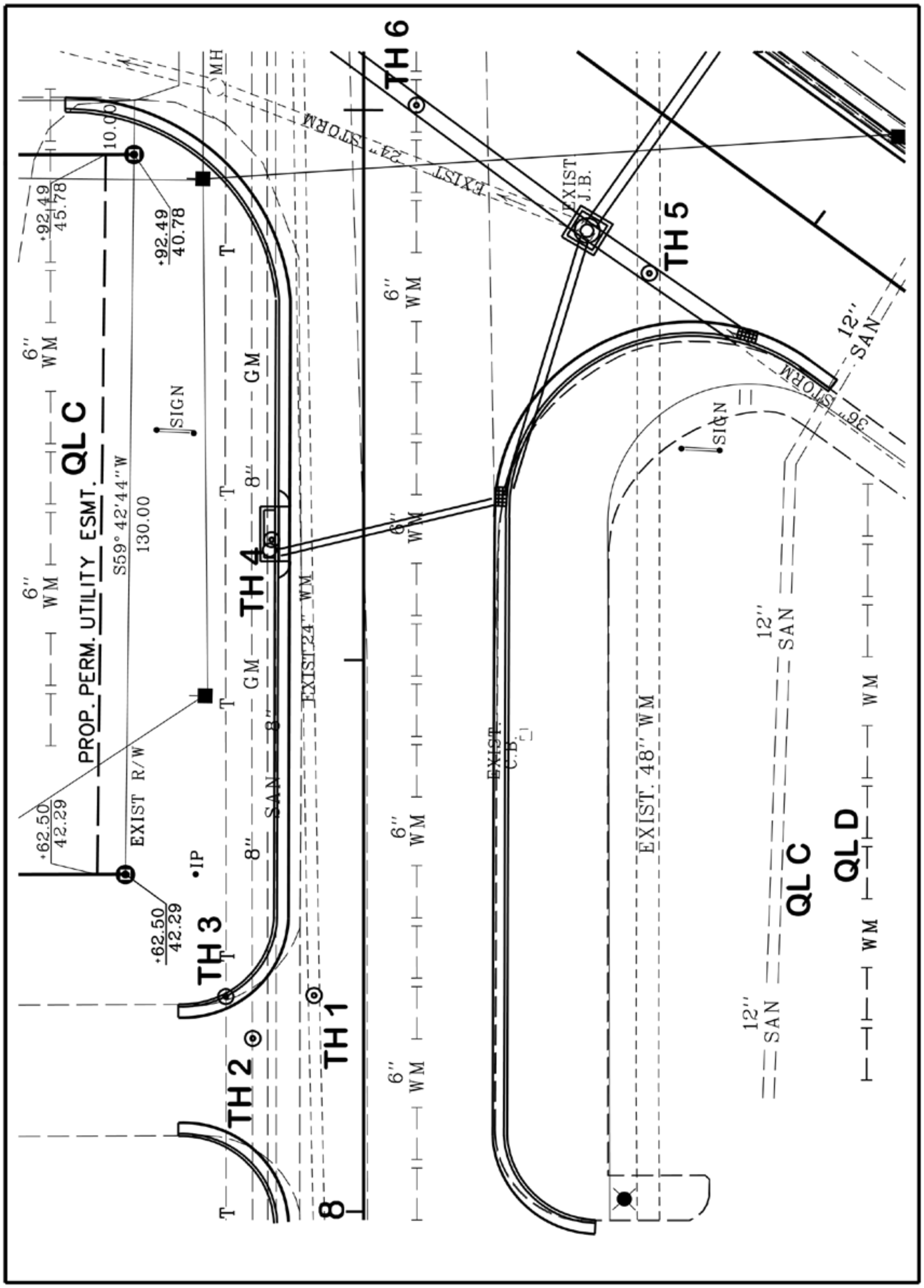
**7. To facilitate ready interchange and use of basic information for map construction** among all Federal mapmaking agencies, manuscript maps and published maps, wherever economically feasible and consistent with the uses to which the map is to be put, shall conform to latitude and longitude boundaries, being 15 minutes of latitude and longitude, or 7.5 minutes, or 3-3/4 minutes in size.

*Issued June 10, 194l* U.S. BUREAU OF THE BUDGET
*Revised April 26, 1943*
*Revised June 17, 1947*

**Exhibit 300-05**

EXHIBIT 300-05

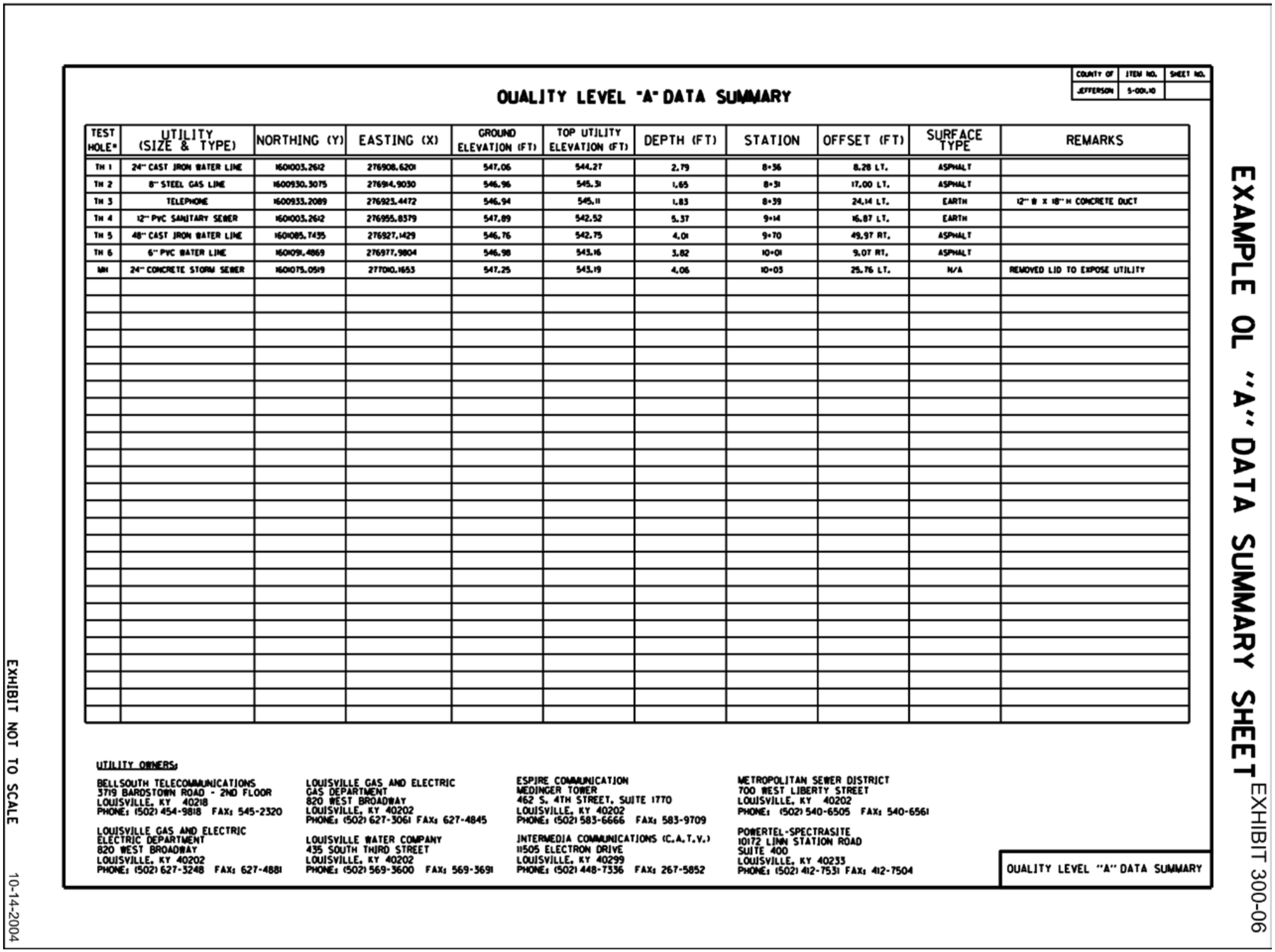
# EXAMPLE QUALITY LEVEL "D" and "C" PLAN SHEET



**TEXT REPRESENTING TEST HOLES AND QUALITY LEVELS ARE BOLDED FOR EXHIBIT PURPOSES.**

**DRAWING NOT TO SCALE** 10-20-2015

# Exhibit 300-06



## EXAMPLE QL "A" DATA SUMMARY SHEET

EXHIBIT 300-06

| COUNTY OF | ITEM NO. | SHEET NO. |
|---|---|---|
| JEFFERSON | 5-001.10 | |

### QUALITY LEVEL "A" DATA SUMMARY

| TEST HOLE* | UTILITY (SIZE & TYPE) | NORTHING (Y) | EASTING (X) | GROUND ELEVATION (FT) | TOP UTILITY ELEVATION (FT) | DEPTH (FT) | STATION | OFFSET (FT) | SURFACE TYPE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| TH 1 | 24" CAST IRON WATER LINE | 1601003.2612 | 276908.6201 | 547.06 | 544.27 | 2.79 | 8+36 | 8.28 LT. | ASPHALT | |
| TH 2 | 8" STEEL GAS LINE | 1600930.3075 | 276914.9030 | 546.96 | 545.31 | 1.65 | 8+31 | 17.00 LT. | ASPHALT | |
| TH 3 | TELEPHONE | 1600933.2089 | 276923.4472 | 546.94 | 545.11 | 1.83 | 8+39 | 24.14 LT. | EARTH | 12" W X 18" H CONCRETE DUCT |
| TH 4 | 12" PVC SANITARY SEWER | 1601003.2612 | 276955.8379 | 547.89 | 542.52 | 5.37 | 9+14 | 16.87 LT. | EARTH | |
| TH 5 | 48" CAST IRON WATER LINE | 1601085.7435 | 276927.1429 | 546.76 | 542.75 | 4.01 | 9+70 | 49.97 RT. | ASPHALT | |
| TH 6 | 6" PVC WATER LINE | 1601091.4869 | 276977.9804 | 546.98 | 543.16 | 3.82 | 10+01 | 9.07 RT. | ASPHALT | |
| MH | 24" CONCRETE STORM SEWER | 1601075.0519 | 277010.1653 | 547.25 | 543.19 | 4.06 | 10+03 | 25.76 LT. | N/A | REMOVED LID TO EXPOSE UTILITY |
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**UTILITY OWNERS:**

BELLSOUTH TELECOMMUNICATIONS
3719 BARDSTOWN ROAD - 2ND FLOOR
LOUISVILLE, KY 40218
PHONE: (502) 454-9818 FAX: 545-2320

LOUISVILLE GAS AND ELECTRIC
ELECTRIC DEPARTMENT
820 WEST BROADWAY
LOUISVILLE, KY 40202
PHONE: (502) 627-3248 FAX: 627-4881

LOUISVILLE GAS AND ELECTRIC
GAS DEPARTMENT
820 WEST BROADWAY
LOUISVILLE, KY 40202
PHONE: (502) 627-3061 FAX: 627-4845

LOUISVILLE WATER COMPANY
435 SOUTH THIRD STREET
LOUISVILLE, KY 40202
PHONE: (502) 569-3600 FAX: 569-3691

ESPIRE COMMUNICATION
MEDINGER TOWER
462 S. 4TH STREET, SUITE 1770
LOUISVILLE, KY 40202
PHONE: (502) 583-6666 FAX: 583-9709

INTERMEDIA COMMUNICATIONS (C.A.T.V.)
11505 ELECTRON DRIVE
LOUISVILLE, KY 40299
PHONE: (502) 448-7336 FAX: 267-5852

METROPOLITAN SEWER DISTRICT
700 WEST LIBERTY STREET
LOUISVILLE, KY 40202
PHONE: (502) 540-6505 FAX: 540-6561

POWERTEL-SPECTRASITE
10172 LINN STATION ROAD
SUITE 400
LOUISVILLE, KY 40233
PHONE: (502) 412-7531 FAX: 412-7504

QUALITY LEVEL "A" DATA SUMMARY

EXHIBIT NOT TO SCALE

10-14-2004

# Exhibit 300-07

| Classification | Terrestrial Schema |
|---|---|
| processed not otherwise classified | 101 |
| bare-earth ground | 102 |
| low vegetation | 103 |
| medium vegetation | 104 |
| high vegetation | 105 |
| Reserved | 106 |
| noise (low or high, manually identified if needed) | 107 |
| Reserved | 108 |
| Water | 109 |
| ignored ground (proximity to breakline) | 110 |
| Centerline | 111 |
| Lane Line | 112 |
| Edge of Pavement | 113 |
| Long Line Striping | 114 |
| Other Pavement Marking | 115 |
| Railroad Tracks | 116 |
| Signage (incl. Structural Members) | 117 |
| Visible Utility Items | 118 |
| Drainage Visible (incl. Centerlines) | 119 |
| Limit of Trees/Maintenance | 120 |
| Guardrail/Barriers | 121 |
| Fences (ID types) | 122 |
| Retaining Walls | 123 |
| Bridge Members | 124 |
| Building Faces | 125 |
| Curb Top of Face, ID Type in Codes | 126 |
| Curb, Bottom of Face | 127 |
| Curb, Top of Back | 128 |
| Front of Sidewalk | 129 |
| Back of Sidewalk | 130 |
| HC Ramps | 131 |
| Signal/Strain Poles/Mast Arms | 132 |
| Traffic Signal Equipment/Controller | 133 |
| Traffic Signal Loops/Pullboxes | 134 |
| Point Cloud, Classified | 135 |
| DTM, ___m grid | 136 |
| DEM | 137 |
| TIN | 138 |
| Contours, Major Interval _____ | 139 |
| Contours, Minor Interval _____ | 140 |
| Cross Slope | 141 |
| Existing Best Fit Vertical Alignment | 142 |
| Pavement Type: Concrete/Asphalt | 143 |
| Earthwork Volume | 144 |
| Rock Volume | 145 |
| Edge of Water | 146 |
| Driveways, ID Type in Codes | 147 |
| Mailboxes | 148 |
| Trees in ROW, ID Diameter | 149 |
| PVA lines, owners | 150 |
| Storm Drain Invert Elev. | 151 |
| Storm Drain Size | 152 |
| Bridge Deck | 153 |
| Above Ground Tanks or Pumps, ID Type | 154 |
| Cemeteries | 155 |
| Video | 156 |
| Photo Mosaic Files | 157 |
| Intensity images (8-bit gray scale, tiled) | 158 |
| Billboards | 159 |
| Edge of Graded Shoulder | 160 |

**Exhibit 300-08**

KENTUCKY TRANSPORTATION CABINET
Department of Highways
**DIVISION OF HIGHWAY DESIGN**

Rev. 08/2016

## CONTROL MONUMENT INFORMATION SHEET

| | | | | | |
|---|---|---|---|---|---|
| **STA. DESIGNATION** | **STAMPING ON MARK** | **STATE**<br>KY | **COUNTY** | **USGS QUAD MAP** | |
| **SET OR RECOVERED** | **DATE SET OR RECOVERED** | **SET OR RECOVERED BY** | **CONDITION** | **ITEM NO/CID** | **PERSON FILLING OUT FORM** |

**STATION DESCRIPTION** *(complete description required: type, size, depth set, etc.)*

| | | | | |
|---|---|---|---|---|
| **NORTH LATITUDE** | **WEST LONGITUDE** | **ELLIPSOID HT.(MTR)** | **DATUM & EPOCH** | **SURVEY METHOD** |
| **STATE PLANE SYSTEM & ZONE** | **GRID SCALE FACTOR** | **ELEVATION SCALE FACTOR** | **COMBINED SCALE FACTOR** | |
| **VERTICAL DATUM** | **VERTICAL ORDER** | **VERTICAL METHOD** | **GEOID MODEL** | **GEOID HT (MTR)** |

| | | |
|---|---|---|
| **NORTHING (STATE PLANE) U.S. SURVEY FEET** | **EASTING (STATE PLANE) U.S. SURVEY FEET** | **ELEVATION (ORTHO. HT.) U.S. SURVEY FEET** |
| **NORTHING (STATE PLANE) METERS** | **EASTING (STATE PLANE) METERS** | **ELEVATION (ORTHO. HT.) METERS** |

| | | | |
|---|---|---|---|
| **BACK STA I.D.** | **GRID BEARING & DISTANCE TO BACK STATION** | **AHEAD STA I.D.** | **GRID BEARING & DISTANCE TO AHEAD STATION** |

| | |
|---|---|
| **KY. LICENSED PROFESIONAL LAND SURVEYOR IN CHARGE OF MONUMENTATION** | **KENTUCKY SURVEYORS LICENSE NUMBER** |

**RELATIONSHIP OF MARK TO IDENTIFIABLE LOCAL FEATURES (REFERENCE DISTANCES)**

**Exhibit 300-08**

KENTUCKY TRANSPORTATION CABINET
Department of Highways
**DIVISION OF HIGHWAY DESIGN**

Rev. 08/2016

## CONTROL MONUMENT INFORMATION SHEET

| STA. DESIGNATION | STAMPING ON MARK | STATE | COUNTY | USGS QUAD MAP |
|---|---|---|---|---|
| | | KY | | |

Chapter

ENVIRONMENTAL CONSIDERATIONS

Subject

Introduction

## HD-401.1 OVERVIEW

Environmental considerations are a key component of the project development process. This chapter outlines the following topics related to environmental considerations:

- Integration of environmental stewardship in the project development process
- Description of various environmental issues
- Description of documentation
- Permits and certifications required in project development

## HD-401.2 GENERAL INFORMATION

Part of the Cabinet's mission is to develop projects in an environmentally sensitive manner by identifying and evaluating potential impacts to the natural and human environment. Untimely identification of affected areas and environmental issues for the entire reach of the project can jeopardize project goals and schedule. At a minimum, an environmental overview or identification of environmental constraints within the project area is recommended prior to studying alternative alignments.

Foremost, projects should be developed in a manner that avoids any adverse impact. If avoidance is not practical, the impact should be minimized or mitigated. Opportunities to enhance the natural and human environment should always be a consideration when developing a project.

Federal and state laws require the evaluation of a project's potential adverse effects on the natural and human environment, as well as the development of alternatives to minimize such effects.

**Note:** Applying for and obtaining the appropriate environmental clearances, permits, and certifications early in the design phase is essential for maintaining project schedules.

◆ ◆ ◆

*Chapter*

ENVIRONMENTAL CONSIDERATIONS

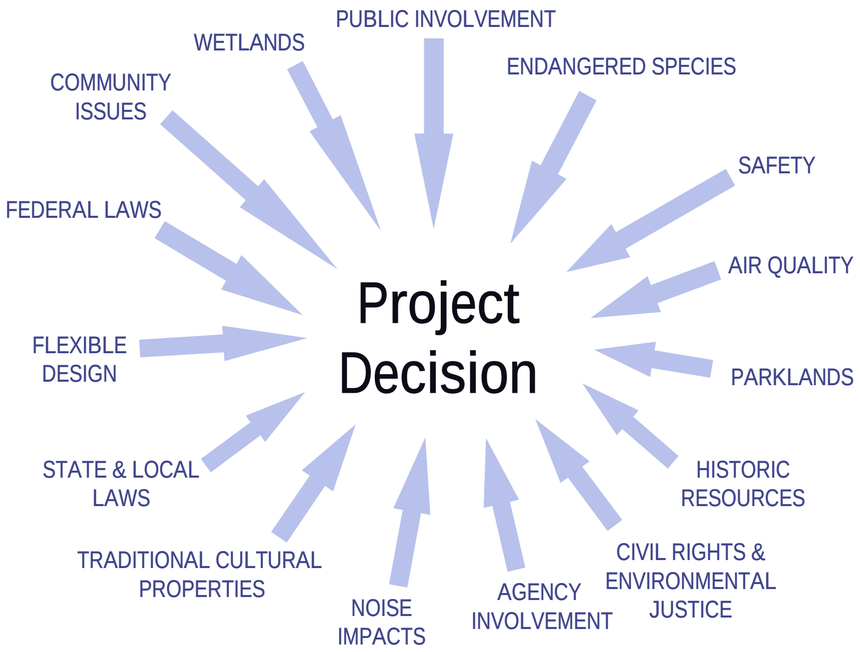
*Subject*

Environmental Issues

## HD-402.1 OVERVIEW

Along with economic and engineering factors, environmental issues require early identification and consideration during the project development process. Project managers and project teams must be knowledgeable of these issues, understand the interrelationship between the environment and the project, and be cognizant of appropriate policies and procedures to contend with these issues.

**Project Decision Considerations**



## HD-402.1 OVERVIEW (cont.)

If any of the topics below are identified as an issue of concern during project development, the project manager or designee should consult with the district environmental coordinator, Department of Environmental Analysis (DEA) subject matter experts, or the *Environmental Analysis Guidance Manual* located online at:

http://transportation.ky.gov/Organizational-Resources/Policy%20
Manuals%20Library/Environmental%20Analysis.pdf

These issues include, but are not limited to:

- Air Quality
- Aesthetics
- Cemeteries
- Cultural Resources
- Endangered Species
- Federal Lands
- Floodplains
- Ground Water Resources
- Hazardous Materials and Underground Storage Tanks HZM/UST)
- Noise
- Section 4(f) Resources
  - Cultural Resources
  - Recreational Parks
  - Wildlife Refuge
- Section 6(f) Resources
- Socio-Economic Concerns and Environmental Justice
- Streams
- Wetlands

The following sections provide a general overview of specific environmental issues that may be encountered on a project. For detailed policy and procedures, refer to the *Environmental Analysis Guidance Manual*.

## HD 402.2 AIR QUALITY

The Clean Air Act (CAA) and the National Environmental Policy Act (NEPA) require that air quality be considered for any proposed project. The CAA also requires that all programs, plans, and projects conform to the State Implementation Plan (SIP) and that priority be given to implementing those portions of the plan that are to achieve and maintain the national primary ambient air quality standards. Transportation projects must also be included in the State Transportation Implementation Plan (STIP).

## HD 402.2 AIR QUALITY (cont.)

The level of detail in an air quality analysis will vary considerably according to the size of the project, the existing level of air quality in the area, and the degree of controversy. Alterations to the project and scope may require a SIP/STIP amendment.

## HD 402.3 AESTHETICS

The appearance of highway facilities will have an impact on the scenic and visual quality of an area. During project development, opportunities to enhance aesthetics should be explored and should align with public input, community goals, resource agency input, etc.

## HD-402.4 CEMETERIES

Efforts should be made to identify and avoid cemeteries within the project corridor. Local public agencies and residents should be contacted for potential information that may reveal the location of cemeteries that may not be readily visible or delineated. The historical significance of the cemetery will be determined by the appropriate resource agencies. A historic cemetery is potentially subject to Section 4(f) requirements as discussed in **HD-402.12**. **HD-300**, "Surveying," and **HD-1300, "**Right of Way," provide more information concerning surveying and documentation of cemeteries.

## HD-402.5 HISTORIC PROPERTIES

Avoiding historic properties, both archeological and above-ground structures, must be considered in the decision-making process of transportation projects. Establishing area(s) of potential effect (APE) and appropriate levels of investigation of historic properties should be accomplished early in the project development process. The investigation should be commensurate with the significance of the historic properties and the magnitude of the project's impacts on the resources. Historic properties must be considered when examining potential alternatives.

Section 106 of the National Historic Preservation Act outlines the requirement to consider the effect of a project with federal involvement (FHWA, USACE, etc.) on historic properties. The Act requires consultation with consulting parties and appropriate resource agencies. Consulting parties must include local government; the State Historic Preservation Officer (SHPO); and may also include local historical groups, preservation groups, recognized Native American Tribe(s), or others who have a demonstrated interest in the resource. Due consideration of these concerns should be given when developing state-funded projects.

## HD-402.5 HISTORIC PROPERTIES (cont.)

Federal regulations require that agencies consider that historic properties of religious and cultural significance to an Indian tribe may be located on ancestral, aboriginal, or ceded lands of that tribe. Accordingly, agencies must make a *reasonable and good faith effort* to identify Indian tribes that attach such significance but that may now live at great distances from the undertaking's area of potential effect. This requires consultation regarding any archeological investigation involving prehistoric (pre-European contact) resources.

Archaeological sites should not be shown on maps that are included in publicly available documentation unless critical in understanding why an alignment was selected, modified, or dismissed. If archeological sites are depicted on plans, exhibits, etc. that are for public viewing, the location **should not** be precisely shown. A subject matter expert should be consulted to determine how to show these areas for public viewing.

## HD-402.6 ENDANGERED SPECIES

The presence of endangered species, both plants and animals, are always to be considered a possibility in the project area. The Endangered Species Act requires consultation with U.S. Fish and Wildlife Service to ensure that actions do not jeopardize threatened or endangered species or their critical habitat. Decisions as to location, construction activities, and letting schedules may be greatly influenced by the presence of these species and should be investigated as early as practical.

## HD-402.7 FEDERAL LANDS

Unique uses and aspects of federal lands should be considered before utilizing them in a project and, if practical, avoided. Effects upon federal lands may result in unique permitting requirements and other considerations that may result in lengthy delays. Contact with representatives for these federal lands should be early and often to facilitate development of agreements, permits, and access to the property.

## HD-402.8 FLOODPLAINS & FLOODWAYS

Floodplain encroachments should be avoided when practical. If an encroachment cannot be avoided, the degree of the encroachment should be minimized. Generally, any increase in the 100-year water-surface elevation produced by an encroachment on a National Flood Insurance Program (NFIP) floodplain cannot exceed one foot. Likewise, floodway encroachment should be avoided where feasible.

## HD-402.8 FLOODPLAINS & FLOODWAYS (cont.)

If an encroachment into the floodway cannot be avoided, then either a No Rise Certificate (sometimes referred to as "No Impact") should be submitted or a map revision with Federal Emergency Management Agency (FEMA) will be required.

## HD-402.9 GROUND WATER RESOURCES

Aquifers and springs may provide drinking water to individuals or communities via recharge areas receiving surface drainage from sinkholes or other groundwater supplies (water tables, etc.) The trend for many large communities nationwide is to obtain their drinking water from ground water resources because they are safer and require less chemical purification than surface water. The Safe Drinking Water Act and Underground Injection Control Program are the laws and regulations that pertain to this issue. Designated well-head protection areas may also have state or local regulations that must be considered.

## HD-402.10 HAZARDOUS MATERIALS & UNDERGROUND STORAGE TANKS

The potential impacts of hazardous material (HazMat) and underground storage tanks (UST) should be considered when developing projects. If it becomes necessary to acquire contaminated property, the Cabinet may assume liability and responsibility for cleanup which may lead to exorbitant costs and/or project delays. It is imperative that the project team take adequate measures to identify and avoid, when possible, HazMat and UST sites before the initiation of final design and plan preparation. All known HazMat and UST sites should be shown prominently on the roadway plans. The Division of Environmental Analysis (DEA) has a list of property uses that may potentially include UST/HazMat conditions.

## HD-402.11 NOISE

Baseline studies are used to determine the potential need for mitigation of adverse noise impacts to the community. This determination shall include a weighing of the benefits achieved; the overall adverse social, economic, and environmental effects; and the costs of the abatement measures. The Federal Highway Administration (FHWA) regulations for mitigation of highway traffic noise in the planning and design of federally aided highways require the following during the planning and design of a highway project:

- Identification of traffic noise impacts
- Examination of potential mitigation measures
- The incorporation of reasonable and feasible noise mitigation measures into the highway project
- Coordination with local officials to provide information on compatible land use planning and control

## HD-402.11 NOISE (cont.)

The regulations contain noise abatement criteria which represent the upper limit of acceptable highway traffic noise for different types of land uses and human activities. The regulations do not require that the abatement criteria be met in every instance. Rather, they require a reasonable and feasible effort be made to provide noise mitigation when the criteria are approached or exceeded. Designers should look for ways to minimize noise intrusion into highway surroundings by utilizing noise barriers, earthen berms, vegetation, manipulating geometrics, and other context-sensitive methods.

The designer should also keep in mind that noise impacts during construction may be mitigated by using alternative construction practices, and should include them, when practical, by notes on the plans or in the proposal.

KYTC’s *Noise Analysis and Abatement Policy* can be viewed at:

http://transportation.ky.gov/Environmental-Analysis/Pages/Noise.aspx

## HD-402.12 SECTION 4(f) RESOURCES

Federal Department of Transportation (US DOT) regulations afford protection to any publicly owned park, recreation area, wildlife or waterfowl refuge, or significant historic properties. These protections are commonly referenced as Section 4(f). This protection is only afforded under federal DOT regulations and does not apply to actions taken by other federal agencies (USACE, US Coast Guard, etc.) or state and local agencies.

FHWA may only approve the use of land from any of these properties if it is determined that:

- There is no feasible and prudent alternative to the use of land from the property; and,
- The action includes all possible planning to minimize harm to the property resulting from such use.

Information supporting such determination must demonstrate there are unique problems or unusual factors involved in the selection of avoidance alternatives, or the cost, social, economic and environmental impacts or community disruption resulting from such alternatives reach extraordinary magnitudes.

Minor impacts that do not adversely affect the qualities that make the resource significant (such as strip takings) may be addressed through a programmatic Section 4(f) consultation or as a *de minimis* impact.

## HD-402.12 SECTION 4(f) RESOURCES (cont.)

All federal-aid projects or projects requiring FHWA approval should be closely examined early in the project development process for potential Section 4(f) impacts. All reasonable measures should be taken to avoid such resources regardless of funding source.

## HD-402.13 SECTION 6(f) RESOURCES

Section 6(f) resources are public parks or recreational lands that have used money provided by the National Park Service Land and Water Conservation Fund. No property acquired and/or developed under this section shall, without approval from the National Park Service, be converted to other than public outdoor recreation uses. Approval of such a conversion is granted only if it is in accord with the existing comprehensive statewide outdoor recreation plan and only upon such conditions as deemed necessary to assure the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location.

## HD-402.14 SOCIO-ECONOMIC CONCERNS & ENVIRONMENTAL JUSTICE

Federal agencies are required by executive order to avoid, minimize, and—if unavoidable—mitigate disproportionately high adverse effects on minority and low-income populations. Additional consideration may be appropriate for low-income family clusters. Effects would include impacts upon human health, environmental resources, and social and economic conditions. Efforts should be made to encourage the full and fair participation by all potentially affected communities in the transportation decision-making process.

Environmental justice, when properly implemented, affects all levels of transportation decision-making. This approach will:

- Result in transportation decisions that better meet the needs of all people
- Lead to transportation facility designs that fit more harmoniously into communities
- Enhance the public-involvement process, strengthen community-based partnerships, and provide minority and low-income populations with opportunities to improve their quality of life
- Minimize and/or mitigate unavoidable impacts by identifying concerns early in the process and provide offsetting initiatives and enhancement measures to benefit affected communities and neighborhoods

## HD-402.14 SOCIO-ECONOMIC CONCERNS & ENVIRONMENTAL JUSTICE (cont.)

The total project should be reviewed to ensure actions resulting from transportation decisions do not result in a disproportionately high adverse effect on minority and low-income populations. For example, no decisions should be made as to location of transportation facilities simply because it's “cheaper” to affect lower cost housing as opposed to more expensive areas.

## HD-402.15 STREAMS

When developing projects, the project team should consider and document the avoidance of stream impacts and stream channelization. Streams are generally defined as:

- Perennial (flow year around)
- Intermittent (flow during certain times of the year when groundwater provides water for stream flow)
- Ephemeral (flow only during and for a short time after rainfall events)

Placement of culverts or channelization resulting in stream loss can create long- and short-term impacts on water quality, as well as aquatic and riparian ecosystems, and may adversely affect domestic, municipal, and agricultural water supplies. Additionally, stream mitigation for these impacted waters is costly and time consuming. Avoiding or minimizing stream impacts can benefit the aquatic environment while minimizing project costs and effects to project schedule.

Stream losses exceeding 300 feet or channelization exceeding 100 feet require a Section 401 Water Quality Certification from the Kentucky Energy and Environment Cabinet (KEEC), Division of Water, and General (Nationwide) or Individual Section 404 Permits from the U.S. Army Corps of Engineers (USACE). See **HD-503**, “Types of Permits & Certifications,” for additional details.

The information required for the development of permit applications should be provided early in the project development process, but no later than right-of-way plan submittal in order to obtain approval from the necessary resource agencies. Plans depicting mitigation of impacted streams should be developed and included with the project, as advised by the subject matter experts. This mitigation plan development should be initiated during the development of right-of-way plans.

## HD-402.16 WETLANDS

Wetlands are defined as “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (EPA, 40 CFR 230.3 and COE, 33 CFR 328.3). The basic premise is that no discharge of dredged or fill material can be permitted if a practicable alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. When applying for a permit, the following must be shown:

- Steps are taken to avoid wetland impacts where practicable
- An attempt has been made to minimize potential impacts to wetlands
- Mitigation is provided for any remaining, unavoidable impacts through activities to restore or create wetlands

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*Chapter*

ENVIRONMENTAL CONSIDERATIONS

*Subject*

Environmental Documents

## HD-403.1 OVERVIEW

The environmental document records the project decision-making process. It documents the evaluation and selection of project alternatives, including consideration of engineering, environmental, and economic factors.

Per the National Environmental Policy Act (NEPA), federal regulations identify three means of documenting a project and analyzing the effects. The most appropriate type of document to use is dependent on project scope, scale of impacts, project complexity, and potential for controversy. The forms of NEPA documentation include:

- Categorical Exclusion (CE)
- Environmental Assessment (EA) and Finding of No Significant Impact (FONSI)
- Draft and Final Environmental Impact Statement (DEIS and FEIS) and Record of Decision (ROD)

For state-funded projects, environmental resources are typically documented in an Environmental Overview. The *Environmental Analysis Guidance Manual* provides a comprehensive description of these documents and can be accessed online at:

http://transportation.ky.gov/Organizational-Resources/Policy%20Manuals%20Library/Environmental%20Analysis.pdf

Development of federally funded projects must adhere to the “Federal Highway Environmental Decision Tree” shown in **Exhibit 400-01**. A federally funded project is defined as a project in which any phase or part thereof includes federal funding. Projects requiring federal land transfers/easements and federal permits (ACE, Coast Guard, etc.) can also qualify as federal undertakings and must comply with the NEPA process.

## HD-403.2 CATEGORICAL EXCLUSION (CE)

CEs are defined as actions that do **not** result in the following:

- Significant impacts to planned growth or land use
- Relocation of significant numbers of people
- Significant impacts on natural, cultural, recreational, or historic features
- Significant impacts to air, noise, or water quality

CEs, individually or cumulatively, do not have any significant environmental impacts and are excluded from the requirements typically necessary to prepare an EA or draft/final environmental impact statement (EIS).

Through a programmatic agreement with the Federal Highway Administration (FHWA)-Kentucky Division, CEs are processed as one of four types or levels. The appropriate type or level is dependent upon the context of the project and intensity of the impact~~s~~. Projects with little to no impact are processed using either a Categorical Exclusion for Minor Projects (CEMP) or a CE Level 1, which is typically prepared in the district office and approved by the environmental coordinator and project manager. A specific list of CEs that do not require any approval from FHWA is found at **23 CFR 771.117(c)** and in the KYTC *Categorical Exclusion Evaluations Users Manual* available online at:

http://transportation.ky.gov/Environmental-Analysis/Environmental%20 Resources/CE%20Guidance%20Manual%20Final%202015.pdf

Additional project types requiring more comprehensive documentation may also be processed without FHWA approval as either a CE Level 1 (prepared in the district) or as a CE Level 2 (prepared by the DEA). Projects having greater impact to the environment may be processed using a CE Level 3 if the projects meet the criteria established in 23 CFR 771.117(d) and have FHWA approval.

Depending upon the potential for project impacts and the necessity to consult with outside resource agencies, CEMP development may require a few days or two to three months. CE Level 1 documentation typically requires 2-6 months depending upon the resources affected, especially historic properties including archaeological resources. CE Level 2 or 3 documentation typically requires 6-24 months depending upon the complexity of the project, resources affected, securing resource agency agreements for mitigation, etc.

CE approvals expire after two years but may require reevaluation during that period if the project scope changes.

## HD-403.3 ENVIRONMENTAL ASSESSMENT (EA)

The primary purpose of an EA is to help the Transportation Cabinet and FHWA decide if an EIS is needed. Baseline environmental studies are typically developed to assess the potential environmental impact of proposed project alternatives. The decision-making process is documented by inclusion of the results of the baseline studies, as well as engineering and economic considerations. This process concludes with the determination of the final documentation as a CE, FONSI, or EIS. The document oftentimes, but not always, identifies the preferred alternative.

The project team, in consultation with FHWA, should determine the level of effort needed for determining the range of alternatives and EA documentation. EAs typically require 18-36 months to complete. Completion is dependent upon project complexity, range of alternatives analyzed, resources impacted, resource agency agreements required, and other factors.

## HD-403.4 FINDING OF NO SIGNIFICANT IMPACT (FONSI)

Following a public hearing, the FONSI serves as FHWA's approval of the EA's finding that the project will not result in any significant impacts. This document is preceded by an EA. The FONSI approval expires after two years but may require reevaluation during that period if the project scope changes. The development of a FONSI may require 6-15 months to complete. Completion is dependent upon necessary archaeological work, scope of the public comments received, and additional alternatives or studies required as a result thereof.

## HD-403.5 ENVIRONMENTAL IMPACT STATEMENT (EIS)

Under the National Environmental Policy Act (NEPA), an EIS must be prepared when it is determined that a proposed action may significantly affect the quality of the human environment. An EIS is not merely a disclosure document, but is used in conjunction with other relevant information to plan actions and make decisions.

Following the publication of a Notice of Intent in the Federal Register, the EIS process results in three documents: the Draft EIS (DEIS), the Final EIS (FEIS), and the Record of Decision (ROD). Designers should consult with DEA and the project team regarding the time frame necessary to complete this process. A minimum of three years for this process should be anticipated with as many as two additional years, depending upon the complexity of the project and scale of the impacts.

## HD-403.5 ENVIRONMENTAL IMPACT STATEMENT (EIS) (cont.)

The DEIS and FEIS approvals expire after three years but may require reevaluation during that period if the project scope changes. Reevaluation of an FEIS is required prior to any major project action (right of way, utilities, or construction).

## HD-403.6 ENVIRONMENTAL REEVALUATIONS

Before advancing a project into any major phase, FHWA regulation **23 CFR 771.129** requires a reevaluation of environmental documents. The intent is to assess the project's current conditions and identify any changes that may affect previous project decisions. Changes to any of the following should be considered during reevaluations:

- Project Scope
- Project Area
- Regulation

Project changes that occur after approval of an environmental document must be clearly communicated among all project team members to assure project decision documents are properly updated.

## HD-403.7 STATE-FUNDED PROJECTS

An Environmental Overview is typically adequate to address environmental issues for state-funded projects. The project team should consider project impacts and determine avoidance and mitigation measures protective of resources as required by the involved federal agencies or to the extent deemed appropriate.

State-funded projects do not require the approval of FHWA but may require an approval or permit from another federal agency subject to NEPA requirements. Examples of such actions include:

- US ACE permits
- Coast Guard permits
- Easements on purchase of federally-owned property or from within federally-designated lands such as the Daniel Boone National Forest

These agencies must prepare their own NEPA document based upon project information provided by KYTC.

## HD-403.7 STATE-FUNDED PROJECTS (cont.)

For state-funded projects where there is federal agency involvement, the project must be developed in a manner consistent with all NEPA requirements. NEPA requirements include:

- Analysis of alternatives
- Compliance with the National Historic Preservation Act (Section 106)
- Compliance with the Endangered Species Act

The project is not required to comply with FHWA-specific regulations or provisions, especially Section 4(f). Regardless of funding source, other environmental factors such as underground storage tanks, relocations, hazardous waste or cleanup sites, noise, etc. must be considered.

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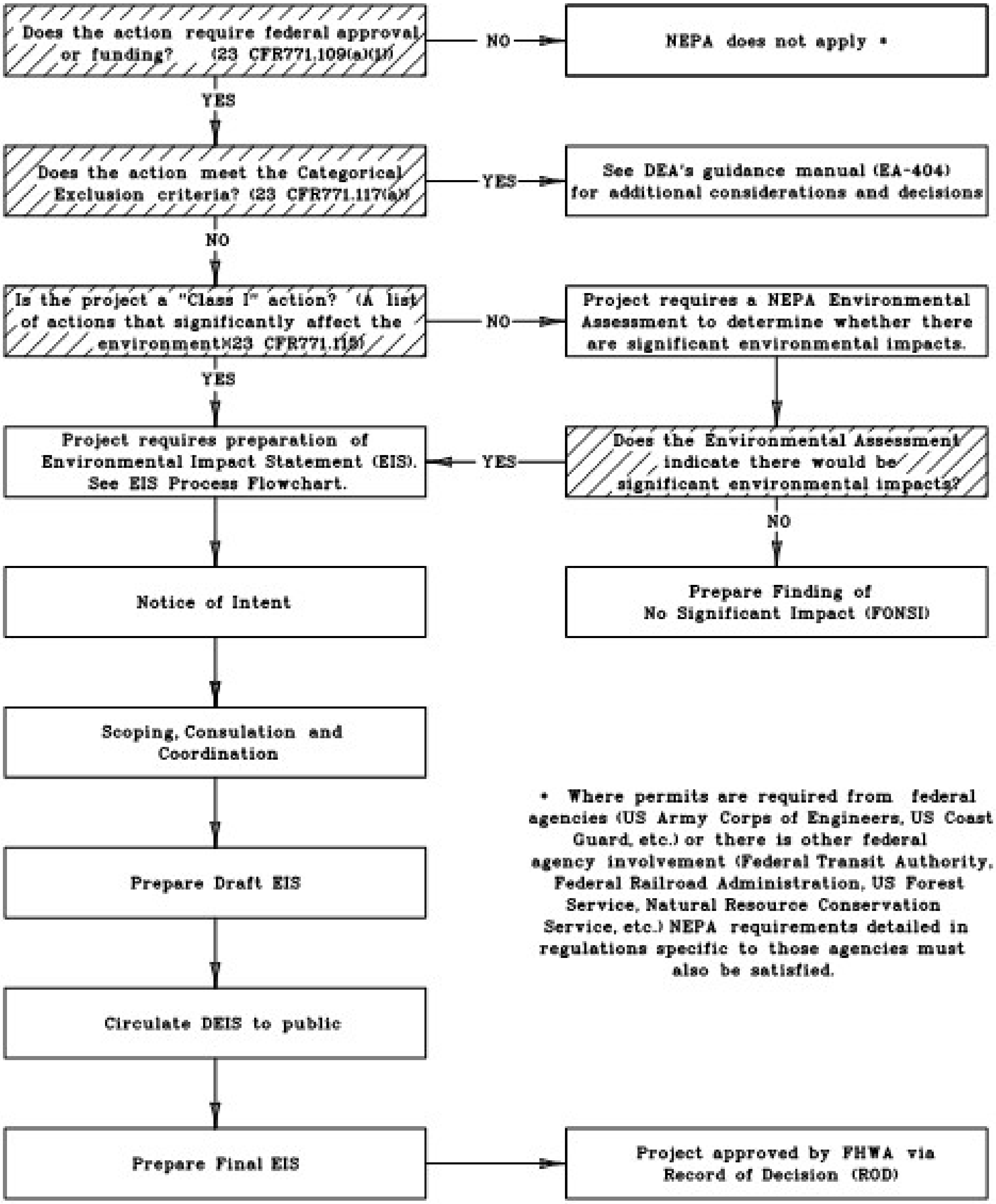
**Exhibit 400-01**

# FEDERAL HIGHWAY ENVIRONMENTAL DECISION TREE



* Where permits are required from federal agencies (US Army Corps of Engineers, US Coast Guard, etc.) or there is other federal agency involvement (Federal Transit Authority, Federal Railroad Administration, US Forest Service, Natural Resource Conservation Service, etc.) NEPA requirements detailed in regulations specific to those agencies must also be satisfied.

Chapter

PERMITS & CERTIFICATIONS

Subject

Introduction

Federal and state laws require the Kentucky Department of Highways to obtain the appropriate permit and/or certification prior to construction. Permits are always required for state and federally funded projects that involve waters of the United States (lakes, rivers, streams, or wetlands) in the Commonwealth of Kentucky. This chapter outlines these permits and certifications, as well as the responsibilities and accountability of the designer and project manager in the permit process.

It is critical that the designer and project manager be aware of the types of waterways, potential impacts, and the permit process. The project team should avoid or minimize water impacts when developing the project and must understand the quality of the waterways and magnitude of physical impact. Constructability issues such as temporary stream crossings, equipment pads, waste areas, etc. must be considered in determining the impact. Awareness of impact to waterways is essential for developing a project sensitive to the environment, budget, and schedule.

Impacted resources should be identified as early in the project process as practical. Early communication should be established with the subject matter experts (SMEs) responsible for obtaining the permit(s).

This chapter discusses the decisions used to determine impacts and the resulting permits issued by four agencies: U.S. Army Corps of Engineers, Kentucky Division of Water, U.S. Coast Guard, and the Tennessee Valley Authority.

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*Chapter*

PERMITS & CERTIFICATIONS

*Subject*

Impact Determination

## HD-502.1 OVERVIEW

When developing the range of alternatives, there must be a broad understanding of the quality of the waterways and magnitude of physical impact. Judgments need to be made about the qualitative characteristics of each waterway on any project. After the qualitative characteristics are assessed, the magnitude of impact can be measured and the type of permit identified.

The types of waterways typically dealt with are:

- Perennial, intermittent, and ephemeral streams
- Wetlands
- Tributaries to perennial, intermittent, or ephemeral streams
- Waters having a significant nexus to these waters

This chapter provides the qualitative and associated measurement of physical impacts.

The impacts of the alternatives to the jurisdictional waters defined below must be taken into consideration. In addition to the effect on schedule that may result while securing permits, impact costs in terms of dollars for mitigation and adverse environmental effects can be high. Every reasonable effort should be made to avoid and minimize waterway impacts when analyzing the range of alternatives and throughout alternative selection and development.

## HD-502.2 STREAMS

Jurisdictional waters include:

- Perennial: Flows year-round during a typical year. The water table is above the streambed for most of the year with runoff from rainfall supplementing the stream flow.

## HD-502.2 STREAMS (cont.)

- Intermittent: Flows during certain times of the year when groundwater provides water for stream flow. During dry periods, they may not have flowing water. Runoff from rainfall supplements stream flow.

- Ephemeral: Flows only during and for a short time after rainfall events. Ephemeral streambeds are located above the water table year-round and have a defined channel. Groundwater is not a source of water; rainfall is the primary source for stream flow.

- Tributaries: Can be natural or man-made water, including wetlands, and may include water such as rivers, streams, lakes, ponds, impoundments, and ditches.

## HD-502.3 WETLANDS

Wetlands are areas inundated or saturated by water sufficient to support vegetation typically adapted for life in saturated soil conditions. Wetlands generally include, but are not limited to, swamps, marshes, bogs, and similar areas.

## HD-502.4 SPECIAL USE WATERS

Special use waters have a special designation by a federal or state agency. The agency with direct management responsibilities for a designated river or stream determines whether adverse effects will occur. Primarily, the Kentucky Division of Water makes these designations.

It is the designer's responsibility to contact Division of Environmental Analysis subject matter experts (DEA SMEs) to determine whether a project encroaches upon a special use water. A listing of special use waters within Kentucky can be found under **401 KAR 10:026** and is also available from the Kentucky Division of Water.

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*Chapter*

PERMITS & CERTIFICATIONS

*Subject*

Types of Permits & Certifications

## HD-503.1 U.S. ARMY CORPS OF ENGINEERS (USACE) PERMITS

The USACE authorizes permits in accordance with Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) and Section 404 of the Clean Water Act (33 U.S.C. 1344). Permits must be obtained for any design feature that creates an obstruction or alteration by excavating, filling, or crossing any of the waters of the United States.

Per USACE permit guidelines, an application must be judged on its own merits separate from mitigation considerations and include a statement of project need, as well as an exploration of alternatives. The USACE must perform a public interest review to determine if there are "no practicable alternatives" with less impact and "no unacceptable adverse impacts" on aquatic resources. The USACE may only permit the Least Environmentally Damaging Practicable Alternative (LEDPA).

The USACE decision-making process may allow for other balancing factors such as cost, the presence of endangered species, cultural resources, and economic factors~~,~~ or social impacts. If there are overriding considerations that make other alternatives unpractical in light of the project's purpose, such factors could result in an alternate selection with greater wetland/stream impacts.

USACE permits primarily used by KYTC for authorization of its projects include:

- Nationwide Permits (NWP)
- Individual Permits (IP), including Letter of Permission (LOP)

The type of permit required is determined by the extent and significance of the impact on the Waters of the United States. Four Corps of Engineers Districts have the jurisdictional responsibility for waters within the Commonwealth of Kentucky. Under a streamlining agreement, permits are generally issued by the Corps of Engineers—Louisville District. The Corps of Engineers—Memphis District maintains permitting authority for areas under their jurisdiction.

## HD-503.2 NATIONWIDE PERMITS (NWP)

Nationwide permits (NWP) are classified as “General” permits and are issued every five years on a nationwide basis for a category or categories of substantially similar activities that cause minimal individual and cumulative environmental impacts.

NWPs are issued for specific activities throughout the nation and allow certain activities to occur with little, if any, delay. NWPs are only valid if meeting the conditions applicable to that permit.

There are 52 separate activities covered by NWPs. Only five activities are routinely used for roadway projects and are specific to a proposed impact or need as described below.

| NATIONWIDE PERMIT ACTIVITIES ROUTINELY USED FOR ROADWAY PROJECTS | | |
|---|---|---|
| **No.** | **Title** | **Use and Restrictions** |
| 3 | Maintenance | • Repair, rehabilitation, or replacement of a structure or fill, including those damaged by a storm event, flood, or other event<br>• Sediment and debris removal<br>• Based on the type of activity or impact to a resource, a Pre-Construction Notification (PCN) may be required. |
| 13 | Bank Stabilization | • Bank stabilization activities for erosion prevention<br>• Limited to 500 feet<br>• Cannot exceed one cubic yard of material placed below the ordinary high water mark per running foot of stream<br>• Limits can be exceeded with special notification to USACE<br>• Based on the type of activity or impact to a resource, a Pre-Construction Notification (PCN) may be required. |
| 14 | Linear Transportation Projects | • Construction, expansion, modification, or improvement of a linear transportation crossing, such as bridge and culvert placement or replacement<br>• Permit cannot be used if impacts exceed 0.5 acres loss of waters and/or 500 linear feet at each impact site<br>• Pre-Construction Notification (PCN) is required for impacts to wetlands, stream impacts exceeding 300 linear feet, or impacts to other special aquatic sites<br>• Impacts may not result in loss of more than 0.1 acre of Waters of the United States without a PCN to the USACE<br>• A PCN may also be required if there are adverse impacts to historic resources or endangered species. |

## HD-503.2 NATIONWIDE PERMITS (NWP) (cont.)

**NATIONWIDE PERMIT ACTIVITIES ROUTINELY USED FOR ROADWAY PROJECTS (cont.)**

| No. | Title | Use and Restrictions |
|---|---|---|
| 15 | U.S. Coast Guard Approved Bridges | • Bridges in navigable waters previously approved by the U.S. Coast Guard<br>• Does not cover causeways or approach fills |
| 33 | Temporary Construction, Access, and Dewatering | • Temporary crossings (i.e. detours), cofferdams, and dewatering of construction sites<br>• Normal flows must be maintained to downstream areas and flooding minimized<br>• Requires complete removal and restoration of disturbed areas |

## HD-503.3 GENERAL CONDITIONS FOR NATIONWIDE PERMITS

The 2012 issuance of the USACE NWPs includes thirty-one general conditions. Of particular concern are requirements for compliance with Section 106 of the National Historic Preservation Act and Section 7 of the Endangered Species Act. Permit applications are not considered complete until Section 7 and Section 106 concerns are resolved. A complete listing of these conditions can be found at:

http://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Nationwide-Permits/

## HD-503.4 INDIVIDUAL PERMITS (IP)

Individual Permits (IPs) are required for activities not specifically covered by, or that exceed the coverage limits of, NWPs or their general conditions. Activities that may require an IP approval include:

- Channel changes
- Excess material sites
- Wetland impacts exceeding 0.1 acre
- Stream impacts exceeding 500 linear feet
- Other impacts to waters of the U.S. not authorized under a NWP

Individual permits may also be required if there are adverse effects to endangered aquatic species, special use waters, or historic resources or if there is the potential for significant public controversy. Individual permits are subject to a 30-day public notice/comment period.

## HD-503.5 LETTER OF PERMISSION (LOP)

The Letter of Permission (LOP) is a type of an IP issued by the USACE for activities conducted by KYTC or their agents on Kentucky roadways.

## HD-503.5 LETTER OF PERMISSION (LOP) (cont.)

The LOP is unique in that it requires that KYTC engage stakeholder resource agencies (U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, State Historic Preservation Officer, etc.) early in the design process to assure impacts to resources are avoided or minimized to the maximum extent practicable. This coordination must occur early during the NEPA process to assure the consideration of stakeholder concerns. An LOP permit must not impact more than seven acres of combined stream and wetland. If impact thresholds are exceeded, an IP is required. An LOP requires a 21-day notice to stakeholder resource agencies before USACE issues a permit.

## HD-503.6 OTHER REQUIRED PERMITS

The Department of Highways, in compliance with state and federal laws, shall apply for and obtain the following permits when required:

- Tennessee Valley Authority Permits - These permits are authorized by the Tennessee Valley Authority's Board of Directors through the Division of Land and Forest Resources and are issued in accordance with Section 26a of the Tennessee Valley Authority Act of 1933, as Amended (49 State. 1079, 16 U.S.C. sec. 831y-1). These permits are obtained before the construction, operation, or maintenance of any structure and/or obstruction affecting the Tennessee River or its tributaries.

- State Water Quality Certifications - These certifications are authorized by the Kentucky Energy and Environment Cabinet through the Division of Water. They are issued in accordance with Section 401 of the Clean Water Act (33 U.S.C. 1341) and certify that permitted Section 404 activities, authorized by the USACE, will not violate Kentucky water quality standards. These certifications are obtained before conducting any activity that discharges a pollutant into a water of the Commonwealth. Activities that require an individual water quality certification include:

    - Any activity that may result in a violation of Kentucky water quality standards
    - Discharges into and causing or resulting in the loss of or adverse impact (impoundment, excavation, or drainage) to one acre or more of wetlands
    - Impacts of 300 feet or more to any intermittent or perennial stream or stream bank (below ordinary high water)
    - Channel relocations exceeding 100 linear feet
    - Any activity that will result in a discharge into special use water

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***Chapter***

PERMITS & CERTIFICATIONS

***Subject***

Procedures & Responsibilities

## HD-504.1 OVERVIEW

The Project Development Branch Manager (PDM) is responsible for contacting the Division of Environmental Analysis (DEA) for a determination of permitting requirements early in the project development process. Notification should occur during the range of alternative analysis and must identify an estimate of each stream/wetland impact with a description of the anticipated construction activity. DEA will provide comments or recommendations as required. Should any of the topics below be considered an issue of concern, the PDM or designee should consult the *Environmental Analysis Guidance Manual* or a DEA subject matter expert (SME) for permitting. The *Environmental Analysis Guidance Manual* is available online at:

http://transportation.ky.gov/Organizational-Resources/Policy%20
Manuals%20Library/Environmental%20Analysis.pdf

After a preferred alternative is selected, the project manager will provide DEA with plans and a Water Related Impacts Summary for the chosen alternative, identifying each stream impact and describing anticipated construction activity. If an Individual Permit (IP) is required, a detailed mitigation plan must be included.

As early as possible, the project manager—with guidance and support from DEA—shall identify:

- Mitigation needs (such as additional right of way)
- Opportunities for further avoidance or minimization of impacts
- Means for addressing mitigation requirements (such as on-site, off-site, mitigation bank, in-lieu-of fee)

Any required mitigation design work shall begin at this phase.

## HD-504.1 OVERVIEW (cont.)

Before or when right-of-way plans are submitted, the project manager will provide DEA a copy of the plans, the drainage folder, and permit drawings (**Exhibit 500-01**). NWPs may require up to six months for processing. In certain cases, a pre-construction notification (PCN) may be required before construction begins. The PCN involves a 30-day review by the USACE and includes information similar to the requirements of an IP application. IPs typically require 12 to 18 months, or more, for processing which includes a 30-day public notice and opportunity for comment. Letters of Permission (LOP) generally require six to eight months for processing.

Once a permit is approved, DEA will notify the project manager; the Division of Construction Procurement's Plans, Specifications, and Estimates Branch (PS&E); and, the district office providing copies as required. Any plan changes that affect the waterway or conditions of the permit after issuance may require additional review and approval by the USACE. In the case of an approved IP, another 30-day public notice may be required. Impacts not identified on the approved plans (such as temporary stream crossings) may require a separate permit or permit modification before construction may begin. Surplus excavation sites affecting streams or wetlands will often require an LOP or IP.

It is critical that early project reviews identify permit requirements and consider these project needs. Permitting needs should be periodically revisited after preliminary requirements are determined and design details and project revisions are developed that may affect streams or wetlands. Significant changes/additions not identified during preliminary permit review may result in a project requiring an IP or LOP permit rather than a NWP. Securing these more complex permits would require several additional months.

## HD-504.2 REQUIRED INFORMATION FOR PERMIT APPLICATION

The Division of Environmental Analysis (DEA) Permits Coordinator needs the information outlined in **HD-504.2.1** through **HD-504.2.5** to prepare the permit application.

### HD-504.2.1 Purpose & Need, & Alternatives Analysis

For federally funded projects, the approved environmental document should provide the information needed to satisfy USACE requirements for discussion of the project purpose and analysis of alternatives considered.

On projects without an approved environmental document (state-funded projects), evaluated alternatives must be documented. The documentation should include the environmental impacts for each alternative with an emphasis on streams and wetlands, and the basis for selection of the preferred alignment.

### HD-504.2.1 Purpose & Need, & Alternatives Analysis (cont.)

The designer may accomplish this by documenting the decision process—specifically documenting how water-related issues were considered in the evaluation of alternatives. The information should include, at a minimum:

- Purpose and need for the project
- Alternative analysis
- Scope of impacts
- Constructability
- Other environmental considerations

### HD-504.2.2 Site-Specific Minimization & Mitigation Narrative

When no practicable avoidance alternative exists, minimization of impacts should be addressed. Lengthening bridges, steepening slopes, reducing the lengths of channel changes, and minor alignment shifts are just a few examples. A narrative describing the minimization and mitigation efforts used at each specific site shall be provided.

After consideration and identification of implementable minimization measures, appropriate mitigation should be considered. Mitigation includes, but is not limited to:

- Using stream and/or wetland credits from a KYTC bank
- Paying an “in-lieu-of” mitigation fee to the Kentucky Department of Fish and Wildlife Resources
- Instream habitat replacement (such as restoration, enhancement, and/or creation of wetlands)

The Division of Environmental Analysis is responsible for providing guidance in this area.

### HD-504.2.3 Permit Drawings

The permit drawings (**Exhibit 500-01**) shall contain the following:

- Plan view
- Elevation and/or cross-section view (typical channel section and/or structure section)
- Stream profile (optional, except for channel changes)
- Rock line soundings (along proposed channel change locations)
- Vicinity map

All permit drawings shall be submitted on a KYTC sheet cell “SCOE” located in cell library “KYTC_SHEET.CEL” (**Exhibit 500-02**).

### HD-504.2.4 Volume of Displacement & Area of Impact

The volume of displacement (only below the ordinary high-water elevations) and area of impact (at the ordinary high-water elevations) shall be estimated and shall include, but not be limited to, the following, as applicable:

- Excavation
- Embankment
- Piers, footers, etc.
- Channel lining (Rip Rap)
- Temporary equipment crossings or pads
- Old channel fills (fill placed in abandoned streams)
- In-stream structures (stone riffles and deflectors)
- Area of impact (measured surface disturbed)

### HD-504.2.5 Plan Set

One set of plans is to be furnished. These plans shall contain the following:

- Layout Sheet
- Typical Channel Sections
- Plan and Profile Sheets
- Structure and/or Pipe Sections
- Stream Profile

## HD-504.3 PERMIT REVISIONS & POSTING

The permit coordinator is responsible for reviewing this material and notifying the project manager of any additional information required or corrections to be made. The project manager shall submit revised drawings and/or plans to the permit coordinator when making revisions affecting any activity requiring a permit.

DEA will furnish the environmental documentation and expertise necessary to coordinate and fulfill the obligations concerning all social, economic, biological, historical, and archaeological conditions of a permit. DEA will submit all correspondence to the USACE, Kentucky Division of Water, and the TVA (as appropriate) for obtaining required permits.

A copy of the permit is inserted into the contract bid proposal after approval and issuance of the permit, with additional copies forwarded to the Division of Construction and other appropriate personnel and/or agencies. After the letting procedures have been concluded, the Division of Construction will furnish a copy to the contractor who was awarded the project. The contractor will post a copy of the permit in a conspicuous place at the project site for the duration of the project construction or as directed by the permit. The contractor will perform work in compliance with the terms and conditions of the permit.

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*Chapter*

PERMITS & CERTIFICATIONS

*Subject*

Definitions

## HD-505.1 OVERVIEW

This chapter provides definitions to aid the designer's understanding of the terms associated with permits.

## HD-505.2 WATERS OF THE UNITED STATES

For the purpose of considering impacts of KYTC projects, the designer should assume that all water not clearly characterized as sheet flow may be a Water of the United States. This would include all water flowing as a result of rain events (ephemeral streams) or within a channel having a base groundwater flow (intermittent or perennial streams), wetland areas, and tributaries to these water features. This definition may also include certain roadside ditches and man-made impoundments, such as ponds or lakes.

## HD-505.3 WETLANDS

Wetlands are areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

## HD-505.4 LAKE

A lake is a standing body of open water that occurs in a natural depression fed by one or more streams. Lakes occur due to the widening, natural blockage, or cutoff of a river or stream, but may also occur in an isolated natural depression not part of a surface river or stream. A lake is also defined as a standing body of open water created by artificially blocking or restricting the flow of a river, stream, or tidal area. As used in this manual, the term does not include artificial lakes or ponds created by excavating and/or diking dry land to collect and retain water for such purposes as stock watering, irrigation, settling basins, cooling, or rice growing.

## HD-505.5 ORDINARY HIGH-WATER (OHW) MARK

The OHW mark is defined as the line on the shore established by the fluctuations of water and indicated by physical characteristics. These may include:

- A clear, natural line impressed on the bank
- Shelving
- Changes in the character of soil
- Destruction of terrestrial vegetation
- Presence of litter and debris
- Other appropriate means that consider the characteristics of the surrounding areas

## HD-505.6 DREDGED MATERIAL

Dredged material is defined as material excavated or dredged from waters of the United States, including, but not limited to:

- Channel Changes
- Channel Widening
- Bridge Piers
- Abutments
- Box Culverts
- Retaining Walls

## HD-505.7 DISCHARGE OF DREDGED MATERIAL

The discharge of dredged material is defined as any addition of such material into the waters of the United States. The term includes, without limitation, the addition of dredged material to a specified discharge site located in waters of the United States and the runoff or overflow from a contained land or water disposal area. This term does not include discharges of pollutants into waters of the United States resulting from onshore processing of dredged material extracted from any commercial use (other than fill). Discharging of dredged materials is subject to Section 402 of the Clean Water Act, although the extraction and deposit of such material may require a permit from the U.S. Army Corps of Engineers. The term does not include plowing, cultivating, seeding, and harvesting for the production of food, fiber, and forest products.

## HD-505.8 FILL MATERIAL

Fill material is used for the primary-purpose of replacing an aquatic area with dry land or of changing the bottom elevation of a water body. The term does not include any pollutant discharged into the water to dispose of waste as regulating the activity under Section 402 of the Clean Water Act.

## HD-505.9 DISCHARGE OF FILL MATERIAL

The discharge of fill material is defined as the addition of fill material into waters of the United States. The term generally includes, without limitation, the following activities:

- Placement of fill necessary to the construction of any structure or impoundment requiring rock, sand, dirt, or other material for its construction
- Site-development fills for recreational, industrial, commercial, residential, and other uses
- Property protection and/or reclamation devices such as riprap, groins, breakwaters, and revetments
- Fill for structures such as sewage treatment facilities
- Intake and outfall pipes associated with power plants and subaqueous utility lines
- Causeways or roadfills, dams, dikes, artificial islands, beach nourishment, levees, and artificial reefs

The term does not include plowing, cultivating, seeding, and harvesting for the production of food, fiber, and forest products.

## HD-505.10 SPECIAL AQUATIC SITES

Special aquatic sites are defined as wetlands, mudflats, vegetated shallows, coral reefs, riffle and pool complexes, sanctuaries, and refuges.

## HD-505.11 SPECIAL USE WATERS

Special use waters are defined as rivers, streams, and lakes listed in the Kentucky Administrative Regulations or Federal Register as Cold Water Aquatic Habitat, Exceptional Waters, Reference Reach Waters, Outstanding State Resource Waters, Outstanding National Resource Waters, State Wild Rivers, and Federal Wild and Scenic Rivers.

## HD-505.12 TRIBUTARY

A tributary is water physically characterized by the presence of a bed and banks and ordinary high water mark, as defined at **33 CFR 328.3(e)**, which contributes flow either directly or through another water. In addition, wetlands, lakes, and ponds are tributaries (even if they lack a bed and banks or ordinary high water mark) if they contribute flow, either directly or through another water.

## HD-505.12 TRIBUTARY (cont.)

A water that otherwise qualifies as a tributary under this definition does not lose its status as a tributary if, for any length, there are one or more man-made breaks (such as bridges, culverts, pipes, or dams), or one or more natural breaks (such as wetlands at the head of or along the run of a stream, debris piles, boulder fields, or a stream that flows underground), so long as a bed and banks and an ordinary high water mark can be identified upstream of the break.

A tributary, including wetlands, can be natural, man-altered, or man-made water and includes waters such as rivers, streams, lakes, ponds, impoundments, canals, and certain ditches.

## HD-505.13 SIGNIFICANT NEXUS

Significant nexus is defined as a water, including wetlands, either alone or in combination with other similarly situated waters in the region that significantly affects the chemical, physical, or biological integrity of a water.

For an effect to be considered significant, it must be more than speculative or insubstantial. Other waters, including wetlands, are similarly situated when they perform similar functions, are located sufficiently close together or sufficiently close to a water of the United States, and can be evaluated as a single landscape unit with regard to their effect on the chemical, physical, and biological integrity of another water.

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# EXAMPLE VICINITY MAP

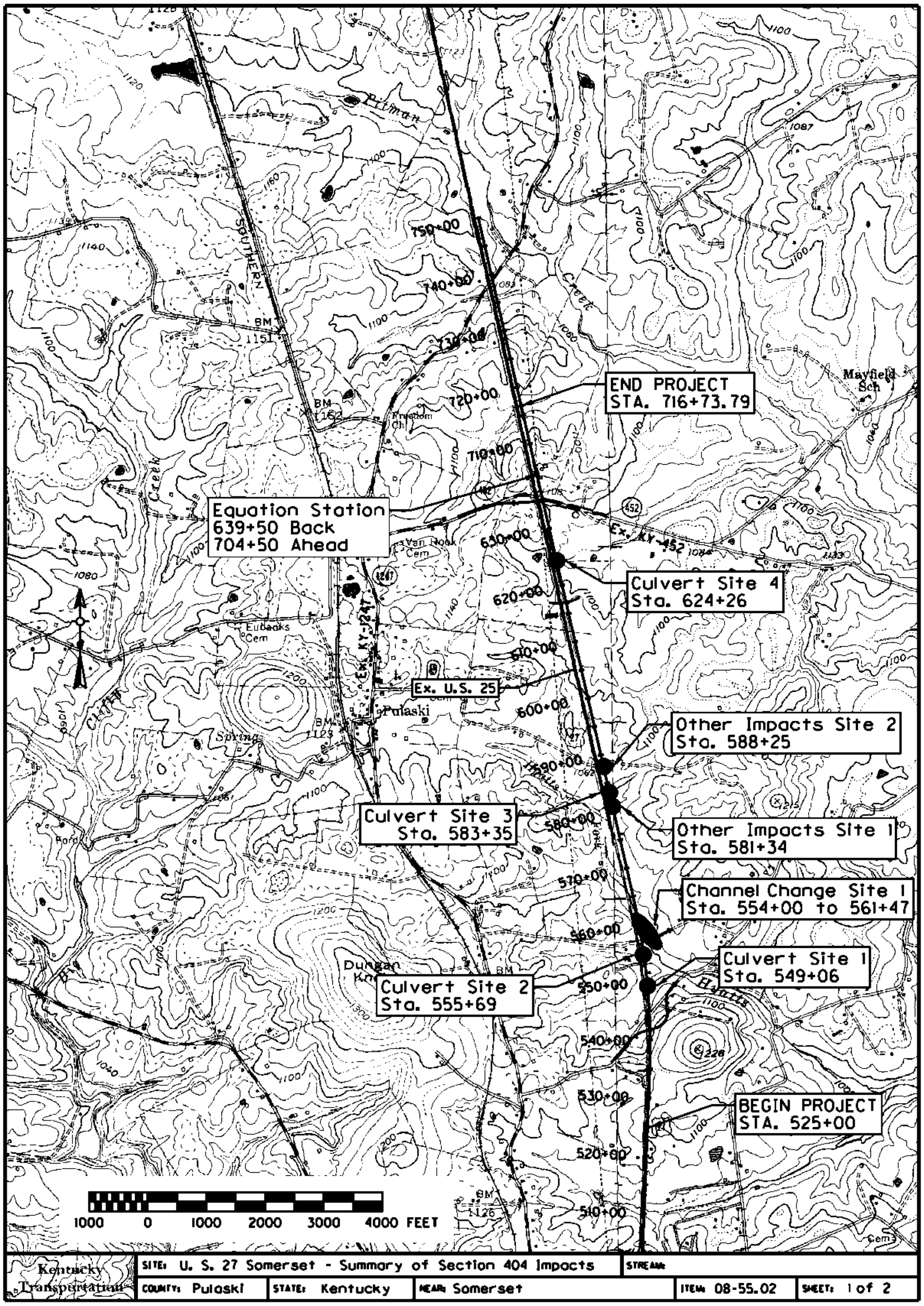
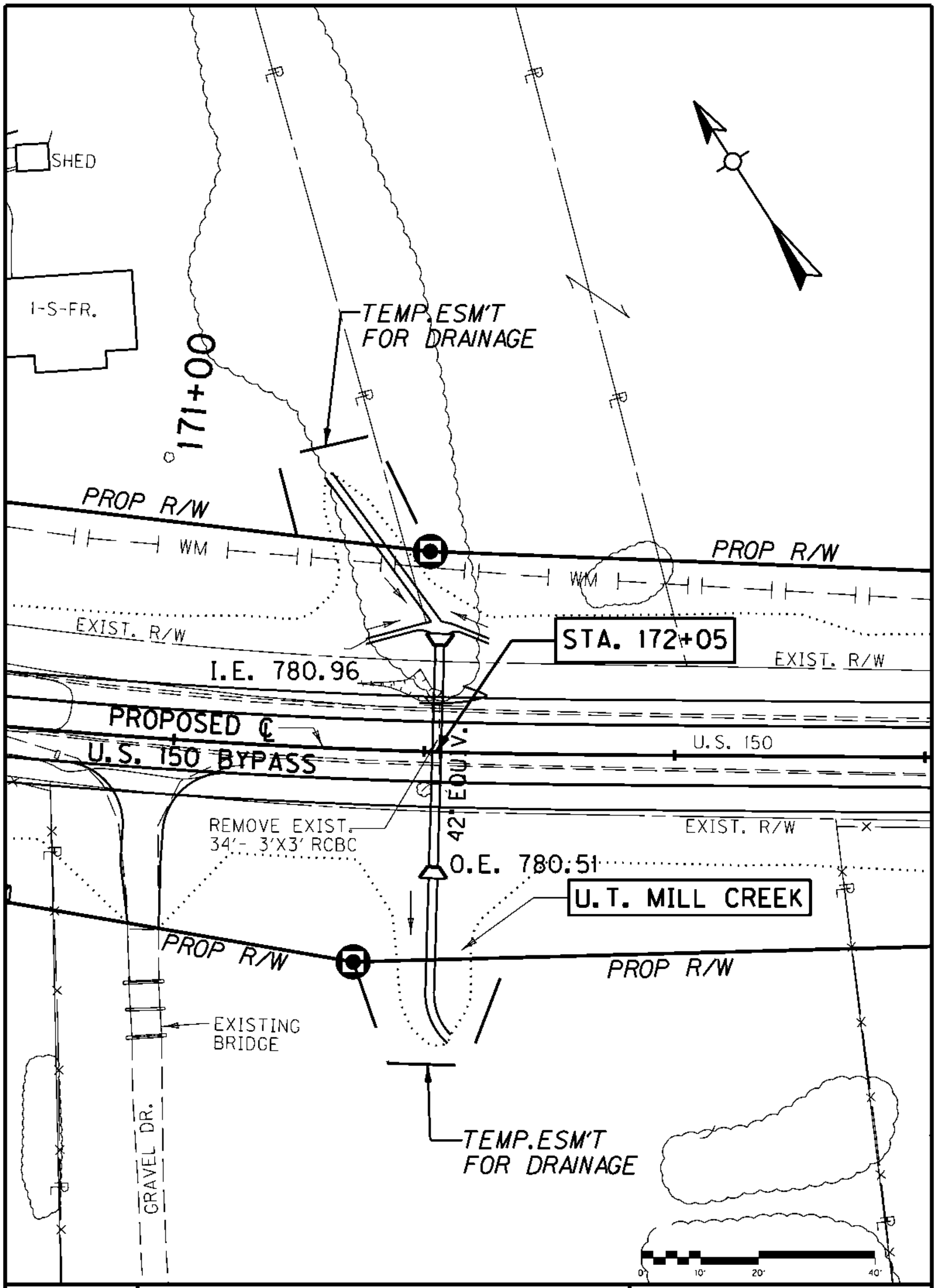


EXHIBIT NOT TO SCALE

**Exhibit 500-01**

## EXAMPLE PIPE PLAN SHEET



Kentucky Transportation

SITE: Sta. 172+05 - 42" Pipe, Ephemeral Stream

STREAM: U.T. Mill Creek

COUNTY: Washington

STATE: Kentucky

NEAR: Springfield

ITEM: 04-103.05

SHEET:

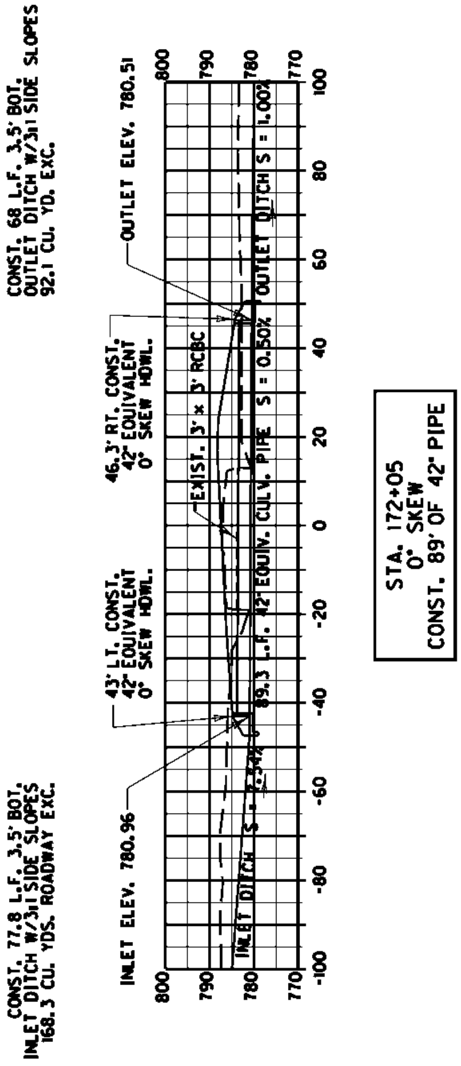
EXHIBIT NOT TO SCALE

**Exhibit 500-01**

# EXAMPLE PIPE PROFILE SHEET

FLOOD EVALUATION DATA

| | RETURN INTERVAL (YRS) | Q (CFS) | HW ELEV (ft) |
|---|---|---|---|
| DESIGN | 25 | 43.55 | 785.21 |
| CHECK | 100 | 54.57 | 785.70 |



| Kentucky Transportation | SITE: Sta. 172+05- Pipe Sheet | | | STREAM: U.T. Mill Creek | |
|---|---|---|---|---|---|
| | COUNTY: Washington | STATE: Kentucky | NEAR: Springfield | ITEM: 04-103.05 | SHEET: |

EXHIBIT NOT TO SCALE

**Exhibit 500-01**

# EXAMPLE BRIDGE PLAN SHEET

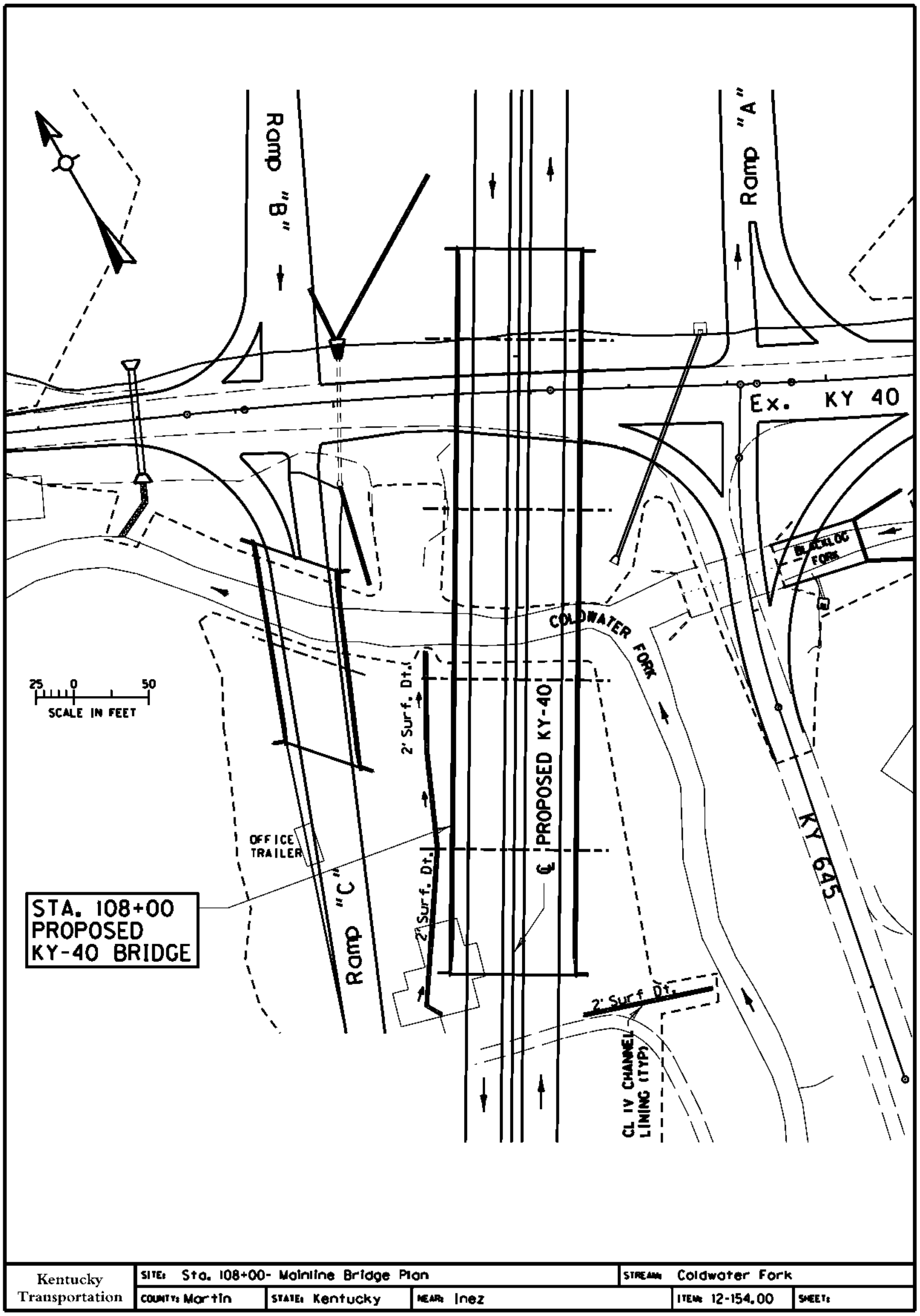
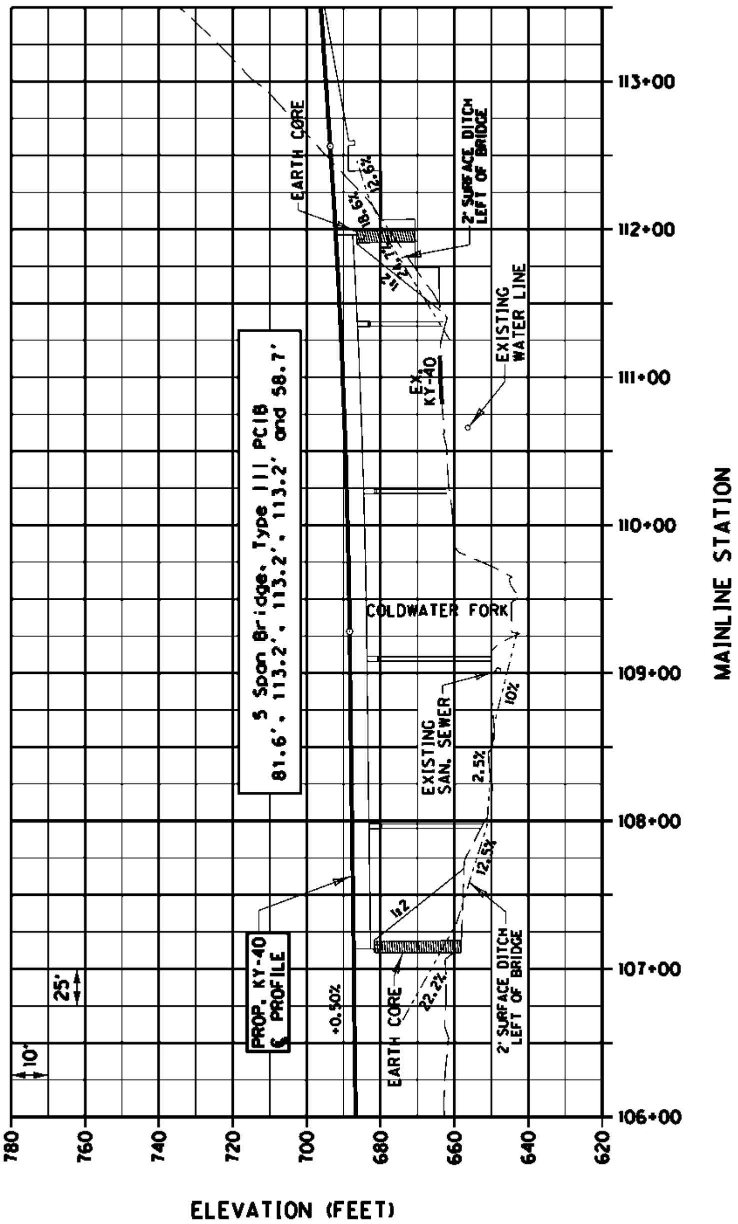


EXHIBIT NOT TO SCALE

**Exhibit 500-01**

# EXAMPLE BRIDGE PROFILE SHEET



| | | | | | |
|---|---|---|---|---|---|
| Kentucky | SITE: Sta. 108+00- Bridge Profile | | | STREAM: Coldwater Fork | |
| Transportation | COUNTY: Martin | STATE: Kentucky | NEAR: Inez | ITEM: 12-154.00 | SHEET: |

EXHIBIT NOT TO SCALE

**Exhibit 500-02**

# EXAMPLE EXHIBIT SHEET CELL

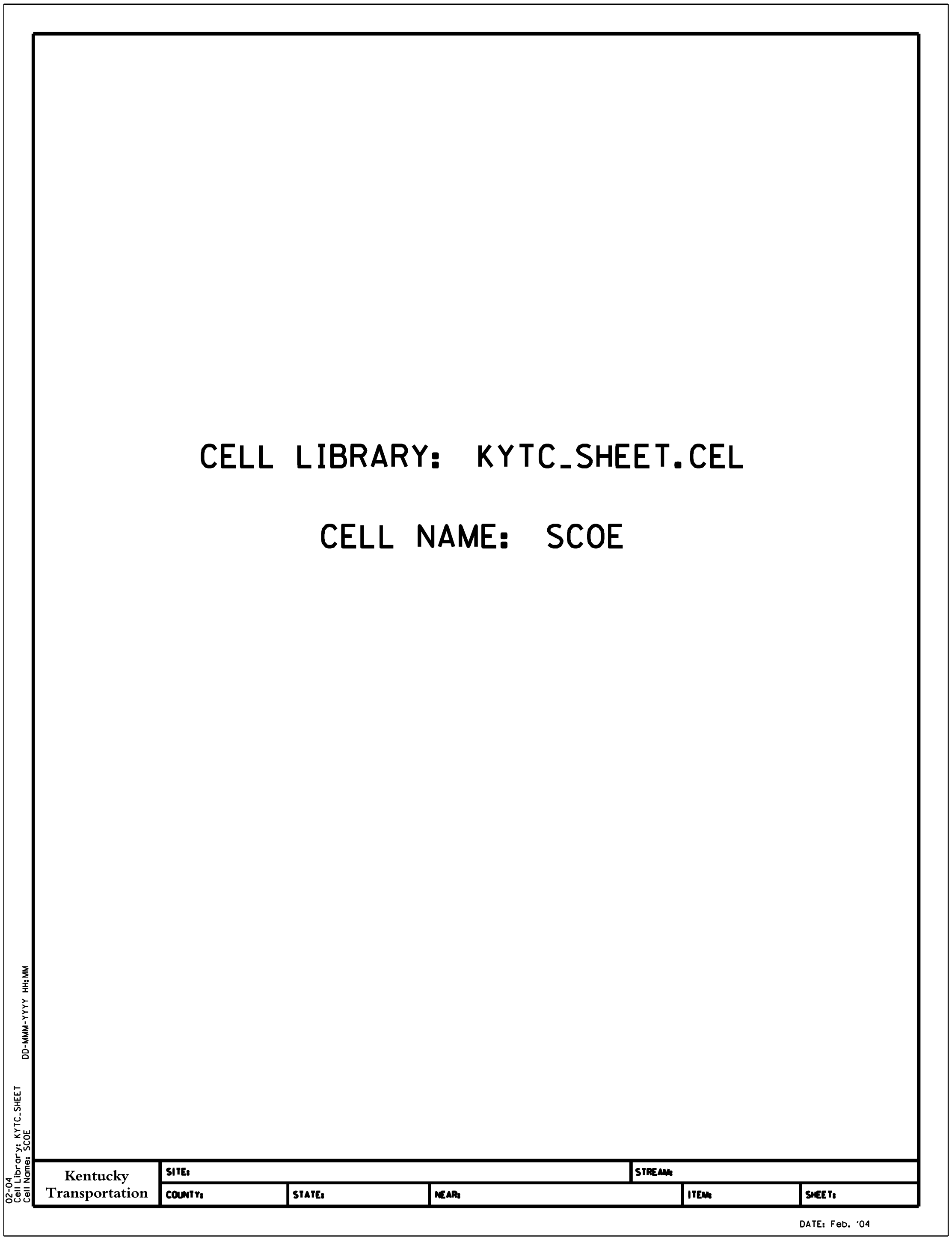


EXHIBIT NOT TO SCALE

*Chapter*

PUBLIC INVOLVEMENT

*Subject*

Introduction

## HD-601.1 OVERVIEW

Public involvement is essential to the development of a project. This section provides guidance and procedures on public involvement during the development of a highway project.

## HD-601.2 GENERAL PHILOSOPHY

Public involvement is more than just a hearing or one meeting near the end of the project development process. Public involvement should begin early and be continuous. It is essential to understand the community's values in order to avoid, minimize, and mitigate impacts as well as to narrow the range of alternatives. Community awareness of the tradeoffs and constraints involved in the process should encourage public acceptance of the project. If involved early, the public can provide significant direct or indirect insight into the project’s goals, needs, and effects on their community.

Public outreach for highway projects is dependent on project location, type of project, and magnitude. In project areas where demographics indicate a population of non-English speaking individuals, public involvement will include a mechanism to access project information. Efforts shall be made to identify and accommodate any ADA or other special need participants.

The public’s viewpoints and opinions are important considerations in the transportation decision-making process. The public includes:

- ➢ Users of the facility
- ➢ Those affected by the project
- ➢ Elected officials
- ➢ Others interested in the outcome of the project

## HD-601.2 GENERAL PHILOSOPHY (cont.)

The seven basic steps for effective public involvement in any decision or activity are:

1. Create a plan for public involvement activities. Costs for public involvement should be accounted for in the project budget. When public involvement is significant, a separate budget should be created.
2. Identify the interested and affected public.
3. Provide information and outreach to the public.
4. Provide assistance to the public to facilitate involvement. This can include, but is not limited to, interpreters and transportation needs.
5. Conduct public involvement activities. If significant time lapses between the public involvement meetings and the letting of the project, consider updating the public through media, newsletters, websites, or other means as appropriate.
6. Review and consider input, and provide feedback to the public.
7. Evaluate public involvement activities.

## HD-601.3 PUBLIC INVOLVEMENT PLAN

The project development team (PDT) should consider creating a public involvement plan (PIP) for every project advanced through project development. A PIP is required on Environmental Impact Statement (EIS) level projects. The plan should be based on the needs of each project. The plan may range from individual property owner contacts for small projects to a series of public involvement meetings or public hearings for more complex projects. Some public involvement plans may include formation of a citizens' advisory committee to involve a large number of property owners or special interest groups when significant environmental issues or concerns must be addressed. The key is to create a plan that allows the Cabinet to communicate with the public in order to make the best transportation decision.

The PDT should establish an outline of the public involvement plan early in the project development phase. The plan must include any federally required public hearings and may be supplemented by additional public involvement meetings–that will contribute to better decisions on the location or detail of a project. This plan may be adjusted as the project advances and should be reviewed by the PDT at critical stages in project development. The plan should also consider other means of communication to obtain public input such as telephone surveys, newsletters, social media, web sites, and focus groups.

## HD-601.3 PUBLIC INVOLVEMENT PLAN (cont.)

The following template suggests a framework for creating a public involvement plan:

1. Purpose of the plan
    a. What transportation decisions are to be made?
    b. What is the desired level of involvement/influence?
2. Status of the project development process
3. History of public involvement related to this project
4. Description of the affected communities/public
    a. Community profile (social, economic, and political structures)
    b. Key community issues and interests
    c. Assessment of community awareness/knowledge about this project
    d. Identification of special sensitivities and/or requirements related to public involvement methods and activities
5. Description of overall approach for public involvement
    a. Outreach
    b. Education
    c. Gathering of input
    d. Opportunities for direct involvement
    e. Pathways for incorporating input into decision-making
    f. Feedback to public about decision-making
    g. Plan for monitoring, evaluating, and readjusting the PIP
6. Specific action steps, techniques, and timing (who will do what, within what timeline, and with what resources)

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HIGHWAY Design

*Chapter*

PUBLIC INVOLVEMENT

*Subject*

Types of Public Involvement

## HD-602.1 OVERVIEW

Historically, public hearings and meetings have been the primary tool used to gather input from, provide information to, and establish communication with the public. However, the project development team (PDT) should not be limited to traditional public involvement activities. **HD-605** outlines other methods that should be utilized when feasible and beneficial. The following information provides guidance to the PDT on conducting public hearings and meetings.

A clear objective must be established for public hearings and meetings. A strategy should be established and format selected that provides for effective communication among all participants. The PDT is encouraged to use creativity in determining the most effective way to conduct a public hearing or meeting to address project-specific needs. The district public information officer (PIO) can assist the PDT in determining and implementing the most effective public involvement strategy.

With chief district engineer approval, the Project Development Branch Manager (PDM) will be directly responsible for initiating all public meetings, public hearings, or other public involvement early in the design process. The PDM will determine the level of public involvement for state-aid projects. The PDM has the responsibility and authority to schedule and hold public meetings and public hearings or offer the opportunity to request a public hearing. The public involvement coordinator in the Division of Highway Design may provide assistance to the PDT. The public involvement coordinator shall be notified when public meetings or hearings are scheduled, and shall be given the opportunity to review the legal notice or advertisement.

A primary objective of early public meetings is to identify issues and concerns as the project advances. A primary objective of public hearings or meetings during later stages is to provide details for public review and comment and to discuss the resolution of the issues and concerns that were developed in the earlier meetings, particularly when involved with environmental commitments.

## HD-602.2 HEARINGS & MEETINGS

The public hearing and public meeting processes are discussed separately in **HD-603** and **HD-604**.

### HD-602.2.1 Public Hearings versus Public Meetings

Formal and informal meetings are the backbone of a public participation program. People expect and need opportunities to discuss agency programs and plans.

Public hearings are required when the environmental document for the project is an Environmental Assessment/Finding of No Significant Impact (EA/FONSI) or an Environmental Impact Statement (EIS). Projects approved as a categorical exclusion (CE) may utilize a public meeting. When no major relocations are involved and little controversy appears likely, a project approved as a CE may not require any direct public involvement. Public hearings are more regulatory in nature than public meetings. Public meetings may be conducted the same way as public hearings, but this is not a requirement.

### HD-602.2.2 Coordination

The PDM will notify the public involvement coordinator on a timely basis of all authorizations to advertise for “Opportunity to Request a Public Hearing,” “Public Hearings,” and “Public Information Meetings” and the proceedings that follow.

The public involvement coordinator shall be responsible for, but not limited to, the following:

- Monitoring state and federal regulations concerning public involvement for state and federally funded highway projects
- Advising, when appropriate or upon request, the highway district offices (chief district engineers or assigned representatives) of the procedures for developing and conducting public hearings and public meetings
- Assisting the district offices, upon request, in the preparation of hearings and meetings and with technical assistance, such as the need for an interpreter
- Posting hearing and meeting information onto the Cabinet’s web site and into the preconstruction database
- Examining all hearing and meeting announcements and records and informing the district office of any needed corrections
- Transmitting approved hearing and meeting records to appropriate personnel
- Keeping files on public hearings and meetings

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*Chapter*

PUBLIC INVOLVEMENT

*Subject*

Public Hearings

## HD-603.1 OVERVIEW

In compliance with **23 CFR 771.111 (h)(2)(iii)**, the Cabinet will provide the opportunity to request a public hearing or will hold a corridor and/or design public hearing for any major federal-aid project. The code specifies that the Transportation Cabinet is to submit a copy of the hearing along with the certification and report transcript to FHWA.

Before scheduling a public hearing, the Project Development Branch Manager (PDM) may elect to offer an “Opportunity to Request a Public Hearing.” Offering the opportunity for a public hearing may be appropriate if a public meeting was recently held and additional information would not be gained.

A public hearing or the opportunity to request a public hearing shall be required on any federal-aid project that:

- May require significant amounts of right of way
- May substantially change the layout or functions of connecting roadways or of the subject facility
- May have a substantial adverse impact on abutting property
- May have a significant social, economic, environmental, or other effect
- The FHWA has determined that a public hearing is in the public interest

Procedures for holding a public hearing or offering the opportunity to request a public hearing on state-aid projects are in accordance with **KRS 13B** and **KRS 174.100**. On federal-aid projects, procedures must be consistent with public involvement/public hearing program requirements pursuant to **23 United States Code 128** and **40 CFR 1500-1508** and in accordance with **23 CFR Part 771**.

## HD-603.2 DOCUMENTATION FOR OPPORTUNITY TO REQUEST A PUBLIC HEARING

Opportunities to request a public hearing shall be documented by memo and submitted to the public involvement coordinator in the Division of Highway Design. The memo shall contain the project information (e.g., county, route, item number, project description), the date the legal notice was published, and the deadline given. It shall also contain the number of requests received. The public involvement coordinator shall forward this memo to the appropriate personnel and FHWA as certification that an opportunity to request a public hearing was given.

## HD-603.3 PUBLIC HEARING FORMAT

When the chief district engineer and/or the PDM is required to conduct a public hearing they will choose between the following public hearing formats:

- **Formal**—A formal hearing has an established starting time and oral presentations. The entire hearing, presentations, and any comments need to be recorded, transcribed, and made a part of the hearing record. A court reporter may be used if desired.

  Formal public hearings with a specific agenda and speakers will require special accommodations (seating, sound system, etc.) which must be considered on a project-by-project basis.

- **Informal (Open)**—An informal hearing has a range of hours for public visitation at the public's convenience. Representatives of the department are available to answer questions and explain any of the information provided. Any oral comments received at the hearing must be recorded, transcribed, and made a part of the hearing record. A court reporter may be used if desired. If requested, the attendees shall be given an opportunity to comment publicly to other attendees.

## HD-603.4 PREPARATION FOR PUBLIC HEARINGS

A public hearing should be held no later than 60 days after the district is advised of the approval of the environmental assessment. This date should not conflict with holidays, local activities, or other scheduled programs.

The PDM shall be responsible for, but not limited to, the following:

- Arranging for the building and other facilities to accommodate the physically impaired and as many persons may be reasonably expected to attend. The selected site should be readily accessible for those attending and located near the center of the area affected by the proposed project. Signs should be placed at strategic locations such as parking lots and entrances to give guidance to attendees on the location of the hearing or meeting.

## HD-603.4 PREPARATION FOR PUBLIC HEARINGS (cont.)

- The Americans with Disabilities Act requires making an effort to select a facility that provides reasonable access for those physically impaired. If there are no facilities adequate to meet this requirement within a reasonable proximity of the project, the reason for selecting a noncompliant site must be documented and a copy provided to the public involvement coordinator.

- Recommending the format (formal or informal) to conduct the public hearing

- Preparing the announcements for the hearing

- Ensuring the preparation of exhibits, plans, photos, etc. that clearly and concisely explain the proposed project

- Providing project information and an identification of major concerns through presentations, handout material, displays, and/or discussions with the public

  Handouts typically include:

  - Purpose and need statement
  - Highway Plan scope, schedule, and budget
  - District contact information
  - Location map
  - Any other pertinent project information

  Handouts provided at the public hearing may be made available for review and copying. The public may view the displays not included in the handouts at the district office.

- Confirming that any displays or illustrations, including those shown in the handouts, used at the public hearing are labeled “Preliminary: Subject to Change” or equivalent.

- Adding the following statement to the handout:

  > "All exhibits, displays, and materials presented at this hearing are available to the public upon their request from the district office. A nominal charge may be made for the reproduction of these displays."

- Providing the public an opportunity and a mechanism to comment on the proposed project through comment sheets, questionnaires, stenographers, and/or discussions between department personnel and the public. If requested, an opportunity to comment publically should be accommodated.

## HD-603.4 PREPARATION FOR PUBLIC HEARINGS (cont.)

To track public comments and afford accountability, the comment sheets and information packet should be sequentially numbered to coincide with the sign-in sheet. Those in attendance should be encouraged to use the comment sheet provided to them. The use of colored paper may assist in the integrity/tracking of the comment sheets.

The following statement should be written on the comment sheets:

> "Under KRS 516.030, falsely completing, making, or altering this document with the intent to defraud, deceive, or injure another is forgery in the second degree, a Class D felony."

- Preparing the agenda for formal meeting formats. The agenda should include discussing subjects in proper order.

## HD-603.5 ANNOUNCEMENT FOR PUBLIC HEARINGS

The public involvement process goal is to ensure that interested citizens, stakeholders, and public officials have the opportunity to participate. In order to ensure participation, the Cabinet should announce public hearings. Historically, a legal notice in the newspaper has been the most prominent method of communication. With the advent of new technology, the project development team (PDT) is encouraged to consider using other media in addition to newspapers to announce and advertise public hearings. Examples of other media include variable message signs, web sites, flyers, property owner invitations, social media, and public service announcements.

After review by the public involvement coordinator, it may be appropriate to mail a copy of the legal notice to the following people:

- All affected or nearby property owners or occupants
- Other federal, state, or local government offices
- Public officials
- Civic groups

## HD-603.6 LEGAL NOTICE FOR PUBLIC HEARINGS

The public involvement coordinator in the Division of Highway Design shall be provided a copy of all public hearing notices at least seven working days in advance of submittal for publication and will provide assistance and request changes as required before the notice is submitted to the newspaper or any other contact.

## HD-603.6 LEGAL NOTICE FOR PUBLIC HEARINGS (cont.)

All newspaper notices required for a public hearing or opportunity to request a public hearing shall be published at least twice in the legal section of a newspaper with general circulation in the immediate area of the proposed project. The chief district engineer and regulatory or management personnel may request the notice be placed in a newspaper with statewide circulation.

The first newspaper notice for a public hearing or an opportunity to request a public hearing shall be advertised no less than 30 days prior to the established deadline or date. The second newspaper notice shall be advertised no less than 7 days prior to the established deadline or date.

All legal notices placed in a newspaper for a public hearing shall be of a consistent format (**Exhibit 600-01**) and shall include:

- County name, route number, road name, and item number (to be placed at the top of the notice directly under the heading)
- Date, time, and location of the public hearing
- Project description
- Specific information to be available for review at the hearing (to include the environmental document)
- A statement announcing the availability of the environmental document and where to obtain or review it (usually at the local highway district office or Central Office when appropriate)
- A contact name, telephone number, address, and email address of someone responsible for project information
- A location map (optional)
- The following statement:

> “Once compiled, the hearing record will be made available for review and copying only after an Open Records Request has been received and approved. All Open Records Requests must be submitted to the Office of Legal Services, Transportation Cabinet Office Building, 200 Mero Street, Frankfort, Kentucky 40622.”

## HD-603.6 LEGAL NOTICE FOR PUBLIC HEARINGS (cont.)

- The following statement:

  > "In accordance with the Americans with Disabilities Act (ADA), if anyone has a disability and will require assistance, please notify (contact name) of the necessary requirements no later than (deadline date). This request does not have to be in writing. Please call (phone #) or mail request to (address)."

  The deadline date for ADA requests should allow time to arrange any necessary accommodations and should not be on a weekend or holiday.

In addition to the legal notice, it may be beneficial to utilize advertising space elsewhere in the newspaper to announce a public hearing (**Exhibit 600-02**).

All legal notices placed in a newspaper for an opportunity to request a public hearing shall be of a consistent format (**Exhibit 600-03**) and shall include:

- County name, route number, road name, and item number (to be placed at the top of the notice directly under the heading)
- Project description
- A statement announcing the availability of the environmental document and where to obtain or review it (usually at the local highway district office or Central Office when appropriate)
- A contact name, telephone number, address, and email address of someone responsible for project information
- A deadline to make the request for a hearing to be held. This date must be at least 30 days from the date of the first newspaper notice.

## HD-603.7 CONDUCTING A FORMAL PUBLIC HEARING

The chief district engineer or an appointed representative shall preside over the hearing and select a panel of speakers to give specific presentations. The hearing moderator shall open the hearing in an atmosphere that shows attendees the department is earnestly seeking the opinion and suggestion of any individual concerning the project. It should be stated that the presented proposal is not final and the Transportation Cabinet considers all statements made at the hearing. If the proposal is a federal-aid project, the hearing moderator shall state that FHWA will also consider statements before making final decisions.

## HD-603.7 CONDUCTING A FORMAL PUBLIC HEARING (cont.)

The reason for the hearing shall be stated in terms all can understand, as well as the discussion of federal aid as applied to federal-aid highway construction. Brochures, pamphlets, statements, or other means should be used to communicate project objectives.

Alternate studies including engineering and social, economic, and environmental impacts should be discussed. If available, design features (such as roadway width, number of lanes, type of surface, right of way taken, and type of access control) shall be presented so all present will understand. Use of electronic presentations, exhibits, plans, or a combination of these methods is helpful.

A question-and-answer period should be provided for the public in advance of any statements made for the record, enabling those wishing to speak to make more informed statements. A right-of-way representative explaining right-of-way acquisition and relocation assistance should be available at all hearings.

The Department of Highways representative conducting the hearing will officially close the hearing, stating:

- All present had the opportunity to comment.

- The Department of Highways district office will accept written statements for 15 days after the close of the hearing.

- The department will accept open records requests for the hearing record through the Office of Legal Services. The hearing record will include oral proceedings, completed comment sheets, and other material made available in the handouts. The open records request form is available at:

  http://transportation.ky.gov/Legal-Services/Pages/Open-Records.aspx

## HD-603.8 CONDUCTING AN INFORMAL (OPEN) HEARING

The chief district engineer or a designated representative shall preside over the hearing and shall have a handout packet prepared and distributed at the hearing. The packet shall contain:

- Information about the project’s purpose and need
- An explanation of right-of-way acquisition and relocation procedures
- A brief summary of the environmental impacts, if any
- Other pertinent project information

## HD-603.8 CONDUCTING AN INFORMAL (OPEN) HEARING (cont.)

- Information describing the type of format in which the hearing will be conducted
- A brief explanation of the procedures

The chief district engineer (CDE) or designee shall give a brief explanation at the beginning of the hearing, and thereafter as necessary, to ensure that the public understands the format and proceedings. This may be accomplished by including a letter to those in attendance from the CDE in the hearing packet.

At the hearing, the chief district engineer or their designee shall provide and have on display project plans and various exhibits along with the environmental document and right-of-way acquisition material.

Cabinet representatives and the consultant engineer (if applicable) will be present to answer the public's questions and explain the project and the provided information. A right-of-way representative explaining right-of-way acquisition and relocation assistance should be available at all hearings.

All public statements must be recorded (by court reporter, stenographer, or tape recorder), transcribed, and made a part of the official hearing record. The hearing notice or handout packet shall explain how to give oral and written comments at the hearing and how to submit a written statement to the highway district office within 15 calendar days after the hearing.

## HD-603.9 OPTIONAL FORMAT HEARING

Another option that has proven to be effective is to use a combination of the two hearing formats. It may be advantageous to have a formal presentation at the beginning of the hearing and then provide an informal format for the public to examine the exhibits and ask specific questions. To accommodate differing arrival times of the public, it may be best to repeat the presentation during the hearing.

## HD-603.10 DOCUMENTATION FOR A PUBLIC HEARING

Public hearings shall be documented by producing a hearing record. Any public hearing record is considered an open records document and therefore must contain the material provided for public review and comment and any responses received to that material. Public responses may include written statements or petitions offered during the public hearing or within the identified comment period following the hearing. Public responses may also include oral statements offered during the public hearing through a court reporter or recording device made available for that purpose.

## HD-603.10 DOCUMENTATION FOR A PUBLIC HEARING (cont.)

The hearing record should be on 8 ½ x 11-inch paper, bound, and compiled in the following order:

1. Cover sheet (to be captioned as the Corridor or Design Public Hearing; county; item number; road name; and date, time, and place of hearing)
2. Table of contents
3. Notification to manager of advertising section of newspaper
4. Legal notice
5. Tear sheet from newspaper
6. Sketch map showing the project on which the hearing was held (This may be on an NGS (USGS or USC & GS) map with the line sketched thereon.)
7. Copy of handout
8. Sign-in sheets, including Cabinet personnel, consultants, FHWA, and all persons attending
9. Transcript of the entire proceedings of a formal hearing or of oral statements received for an informal hearing (The record will include all statements made properly identified as to the persons making them. The record should show throughout that all pertinent subjects were open to discussion and that everyone was given an opportunity to speak.)
10. Certification that the transcript is a true, complete, and accurate record of the hearing and/or oral statements received
11. Written statements, endorsements, etc. (Copies should be obtained and made a part of the hearing record.)
12. Copies of replies to statements made
13. Copies of the statements and exhibits used or filed concerning the public hearing

After the hearing record has been prepared, the original will remain in the district office with four copies furnished to the public involvement coordinator in the Division of Highway Design, within 45 days after the public hearing. The public can obtain copies of the hearing record once it is filed with the Division of Highway Design. Anyone desiring a copy of the record must submit a written open records request to the Executive Director of the Office of Legal Services. The form is available at:

http://transportation.ky.gov/Legal-Services/Pages/Open-Records.aspx

The public involvement coordinator will distribute copies of the hearing record and summary/recommendation to the proper agencies as follows:

## HD-603.10 DOCUMENTATION FOR A PUBLIC HEARING (cont.)

- Federal Highway Administration (both)
- Division of Environmental Analysis (both)
- Division of Planning (summary/recommendation only)
- Division of Right of Way and Utilities (summary/recommendation only)

The public involvement coordinator shall keep a copy of the hearing record on file and, upon request, supply a copy or allow persons interested to make copies. When it is determined that a potential controversy may exist, the Division of Highway Design will forward the information to the State Highway Engineer's Office for comment and/or approval.

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*Chapter*

PUBLIC INVOLVEMENT

*Subject*

Public Meetings

## HD-604.1 OVERVIEW

A primary objective of public meetings is to identify issues and concerns that-develop as a project advances. Public meetings can be conducted using a number of different methods. Whether the format is informal or formal, the meeting should be tailored to specific objectives and adequately accommodate the number of anticipated participants.

For small projects with few stakeholders, public involvement can occur through individual contacts or small, informal group discussions. For larger projects or those with several stakeholders, it may be necessary to hold a more formal meeting.

## HD-604.2 TYPES OF PUBLIC MEETINGS

There are a number of different approaches that can be used for gathering and distributing information. These may include, but are not limited to:

- Citizens’ advisory committees
- Stakeholder groups
- Public information meetings
- Property owner meetings

More complex projects may warrant other public meetings, including resource agency and consulting party meetings. There may be opportunities to make presentations to selected local public officials, neighborhood groups or associations, civic associations, business associations, and private individuals.

### HD-604.2.1 Citizens’ Advisory Committee

For some projects, it may be beneficial to form a citizens’ advisory committee of local citizens and officials with a significant interest in the project. This group of volunteers meets periodically to exchange ideas and viewpoints on issues involving the project. The committee can serve as a forum for hearing and recording points of view. A representative from KYTC should participate on the committee as an agency member who provides information, support, and opinion.

### HD-604.2.2 Stakeholder Groups

A stakeholder group is a specific group that has a unique interest in some aspect of the project (e.g., landscaping, pedestrian movements, and traffic management). Stakeholder groups are targeted audiences that meet periodically for comment and distribution of information. If more direct involvement with the project development team (PDT) is needed, a subset of the stakeholder group (a focus group) may be utilized.

### HD-604.2.3 Public Information Meetings

The purpose of these meetings is to inform the public of a proposed project in their area and to receive their comments. These meetings can be held at different stages of project development. The number of meetings will vary based upon the informational needs of the affected community.

### HD-604.2.4 Property Owner Meetings

It may be beneficial to conduct a property owner meeting in order to obtain the most accurate property ownership information and address property owner concerns. An objective of these meetings should be to ensure that property owners' perspectives are understood. Meeting in the project area with potentially impacted property owners gives the PDT the opportunity to explain the purpose and need, as well as describe the study alignments. The meeting provides for an open exchange of information to solicit property owners' comments and answer their questions.

## HD-604.3 PREPARATION FOR PUBLIC MEETINGS

The scheduled date for a public meeting should not conflict with holidays, local activities, or other scheduled programs.

The project development branch manager (PDM) shall be responsible for, but not limited to, the following:

- ➢ Arranging for the building and other facilities to accommodate the physically impaired and as many persons may be reasonably expected to attend. The selected site should be readily accessible for those attending and located near the center of the area affected by the proposed project. Signs should be placed at strategic locations such as parking lots and entrances to give guidance to attendees on the location of the hearing or meeting.

- ➢ The Americans with Disabilities Act requires making an effort to select a facility that provides reasonable access for those physically impaired. If there are no facilities adequate to meet this requirement within a reasonable proximity of the project, the reason for selecting a noncompliant site must be documented and a copy provided to the public involvement coordinator.

## HD-604.3 PREPARATION FOR PUBLIC MEETINGS (cont.)

- Recommending the format (formal or informal) to conduct the public meeting

- Preparing announcements for the meeting

- Ensuring the preparation of exhibits, plans, photos, etc., that clearly and concisely explain the proposed project

- Providing project information and an identification of major concerns through presentations, handout material, displays, and/or discussions with the public

  Handouts typically include:

  - Purpose and need statement
  - Highway Plan scope, schedule and budget
  - District contact information
  - Location map
  - Any other pertinent project information

  Handouts provided at the public meeting may be made available for review and copying. The public may view the displays not included in the handouts at the district office.

- Confirming that any displays or illustrations, including those shown in the handouts, used at the public hearing are labeled “Preliminary: Subject to Change” or equivalent.

- Adding the following statement to the handout:

  > "All exhibits, displays, and materials presented at this meeting are available to the public upon their request from the district office. A nominal charge may be made for the reproduction of these displays."

- Providing the public an opportunity and a mechanism to comment on the proposed project through comment sheets, questionnaires, stenographers, and/or discussions between department personnel and the public

- Providing the public an opportunity and a mechanism to comment on the proposed project through comment sheets, questionnaires, stenographers, and/or discussions between department personnel and the public. If requested, an opportunity to comment publically should be accommodated.

## HD-604.3 PREPARATION FOR PUBLIC MEETINGS (cont.)

To track public comments and afford accountability, the comment sheets and information packet should be sequentially numbered to coincide with the sign-in sheet. Those in attendance should be encouraged to use the comment sheet provided to them. The use of colored paper may assist in the integrity/tracking of the comment sheets.

The following statement should be written on the comment sheets:

> "Under KRS 516.030, falsely completing, making, or altering this document with the intent to defraud, deceive, or injure another is forgery in the second degree, a Class D felony."

- Preparing the agenda, if selecting a formal format

## HD-604.4 ANNOUNCEMENTS FOR PUBLIC MEETINGS

The public involvement process goal is to ensure that interested citizens, stakeholders, and public officials have the opportunity to participate. In order to ensure participation, the Cabinet should announce public meetings. Historically, an advertisement in the newspaper has been the most prominent method of communication. With the advent of new technology, the project development team (PDT) is encouraged to consider using other media in addition to newspapers to announce and advertise public meetings. Examples of other media include variable message signs, web sites, flyers, property owner invitations, social media, and public service announcements (**Exhibit 600-02**).

After review by the public involvement coordinator, it may be appropriate to mail a copy of the advertisement to the following people:

- All affected or nearby property owners or occupants
- Other federal, state, or local government offices
- Public officials
- Civic groups

## HD-604.5 ADVERTISEMENTS FOR PUBLIC MEETINGS

The public involvement coordinator in the Division of Highway Design shall be provided a copy of all public meeting advertisements in advance and will provide assistance or request changes as required before the advertisement is submitted to the newspaper or any other contact.

## HD-604.5 ADVERTISEMENTS FOR PUBLIC MEETINGS (cont.)

All newspaper advertisements required for a public meeting shall be published at least twice in a newspaper with a general circulation in the immediate area of the proposed project. The chief district engineer or regulatory or management personnel may request that the advertisement be placed in a newspaper with statewide circulation.

The first newspaper advertisement should be published no less than 15 days prior to the established meeting date, while the second newspaper advertisement should be published no less than 7 days prior to the established meeting date.

All public meeting advertisements should include the following:

- County name, route number, road name, and item number
- Date, time, and location of the public meeting
- Project description
- Specific information that is available for review at the meeting (including the environmental document, if applicable)
- A contact name/number/address of someone responsible for project information
- A location map
- The following statement:

> "Once compiled, the meeting record will be made available for review and copying only after an Open Records Request has been received and approved. All Open Records Requests must be submitted to the Kentucky Transportation Cabinet, Office of Legal Services, Transportation Cabinet Office Building, 200 Mero Street, Frankfort, Kentucky 40622."

The request form is available at:

http://transportation.ky.gov/Legal-Services/Pages/Open-Records.aspx

## HD-604.5 ADVERTISEMENTS FOR PUBLIC MEETINGS (cont.)

- The following statement:

> "In accordance with the Americans with Disabilities Act (ADA), if anyone has a disability and will require assistance, please notify (contact name) of the necessary requirements no later than (deadline date). This request does not have to be in writing. Please call (phone #) or mail request to (address)."

The deadline date for ADA requests should allow time to arrange any necessary accommodations and should not be on a weekend or holiday.

## HD-604.6 CONDUCTING PUBLIC MEETINGS

Public meetings may be conducted the same way as public hearings, but this is not a requirement. Please refer to Conducting Public Hearings in **HD-603**.

## HD-604.7 DOCUMENTATION FOR A PUBLIC MEETING

Documentation is required for any public involvement meeting or contact that is part of the decision-making process for that project. The documentation for small projects when the basic form of public involvement is accomplished through individual contacts or small, informal group discussion, shall be through memorandum to the project files. This material may be referenced during the project development process.

In some cases, compilation of a meeting record containing more information may be desired. A public meeting record may be compiled as described under Documentation for Public Hearings in **HD-603**.

A summary of the public meeting should be compiled and include:

- County
- Item number
- Road name
- Project description
- Date, time, and place of the meeting
- Summary of attendees and comments received

The summary should be forwarded to the public involvement coordinator in the Division of Highway Design within 30 to 45 days after the date of the public meeting. Neither the summary nor the preliminary recommendation shall be made part of a meeting record, if applicable.

## HD-604.7 DOCUMENTATION FOR A PUBLIC MEETING (cont.)

Should a meeting record be compiled, the original will be kept at the district and four copies should be forwarded to the public involvement coordinator. The public involvement coordinator shall undertake a quality assurance review of the material and then forward it to the appropriate office for final use on the project. If a potential controversy exists, the Division of Highway Design will forward the information to the State Highway Engineer's Office for comment and approval.

The public involvement coordinator will distribute copies of the meeting record to the proper agencies as follows:

- Federal Highway Administration (both)
- Division of Environmental Analysis (both)
- Division of Planning (summary/recommendation only)
- Division of Right of Way and Utilities (summary/recommendation only)

The public involvement coordinator shall keep the copy of the summary/recommendation and meeting record on file and, upon request, supply a copy or allow those interested to make copies.

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*Chapter*

PUBLIC INVOLVEMENT

*Subject*

Other Types of Public Involvement

## HD-605.1 NEWSLETTERS

A newsletter may be helpful to keep agencies, individuals, groups, institutions, advocacy groups, and others abreast of project progress and current issues. Newsletters should include all necessary information, but be as brief as possible. A monthly or quarterly publishing schedule is reasonable for a large-scale controversial project. A mailing list of stakeholders should be made for this purpose.

## HD-605.2 MEDIA

The public information officer is responsible for all releases to the media (such as newspapers, radio, and television). A productive relationship with the media helps to present a clear and accurate message. News releases should be up-to-date, credible, informative, and concise.

## HD-605.3 SOCIAL MEDIA

Social media platforms may be utilized to further engage the public during the development of the project. Public meetings may be advertised through social media. Project updates and links to additional information may be included.

## HD-605.4 WEB SITE

The Transportation Cabinet keeps an up-to-date web site of all projects scheduled in the highway plan. The project can be located on a map that links to project information such as description, status, and contact person. Maps are available at:

http://maps.kytc.ky.gov/photolog/?config=ActiveHighwayPlan

The web site also has information on scheduled public meetings and hearings available at:

http://transportation.ky.gov/Highway-Design/Pages/Scheduled-Public-Meetings.aspx

## HD-605.4 WEB SITE (cont.)

Larger projects with more public interest could have their own web sites with information on road closures, detours, and construction hours. Comments and requests can be made through these sites via email.

## HD-605.5 ON-PROJECT SITE

A project site visit allows stakeholders to see the site under the same conditions at the same time. Project concerns can be pointed out, leading to a better understanding of existing conditions. A site visit can also illustrate how certain areas will be affected, and stakeholders can see project constraints.

## HD-605.6 INVOLVEMENT OF COMMUNITY & CIVIC ORGANIZATIONS

**HD-602**, "Types of Public Involvement," explains that a citizens' advisory committee is used to gain citizen input in a structured way. This committee is a group of volunteers who meet periodically to exchange ideas and viewpoints on issues involving the project. The committee can serve as a forum for hearing and recording points of view. A KYTC representative should participate on the committee as an agency member, providing information, support, and opinion. Making presentations at regularly scheduled meetings for local civic organizations is another method of community involvement.

There are many ways to gain public input. The project development team (PDT) should utilize the Cabinet's toolbox of public involvement techniques available at:

http://transportation.ky.gov/Public-Involvement-Toolbox/Pages/default.aspx

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# LEGAL NOTICE OF A PUBLIC HEARING

**Kenton County**
**KY16, Taylor Mill Road**
**Item No. 6-344.00**

The Kentucky Transportation Cabinet, Department of Highways, has scheduled a Public Hearing on the above referenced project to be held ***(date, time and place).*** This project is the ***(project description).*** This hearing has been scheduled to afford all interested persons an opportunity to become better informed and to express their views concerning the proposed project.

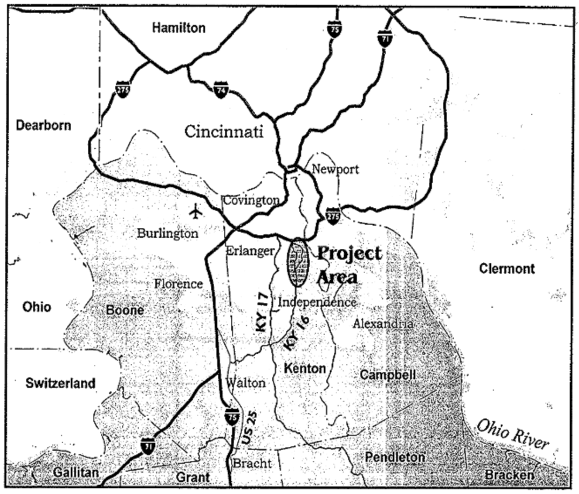
The Informal Format ***(use Formal Format and description of activities if applicable)*** will allow interested persons to attend anytime between the hours of 5:00 PM to 7:00 PM. A handout, containing project information, plans, exhibits and the approved environmental document for the project will be displayed at the hearing. Representatives from the Transportation Cabinet and their consultants will be available to answer questions.

The Federal Highway Administration and the Transportation Cabinet approved the project's Environmental Assessment (EA) on ***(date)***. Copies of the EA will be available at the hearing, as well as at the District Highway Office at the address listed below.

Oral and written statements will be accepted during the hearing. Written statements will be accepted, and information made available, for a period of fifteen (15 days) after the Public Hearing at the address listed below. All written and oral comments will become part of the official hearing record. Once compiled, the hearing record will be made available for review and copying only after an Open Records Request has been received and approved. All Open Records Requests must be submitted to Office of Legal Services, Transportation Cabinet Office Building, 200 Mero Street, Frankfort, Kentucky 40622.

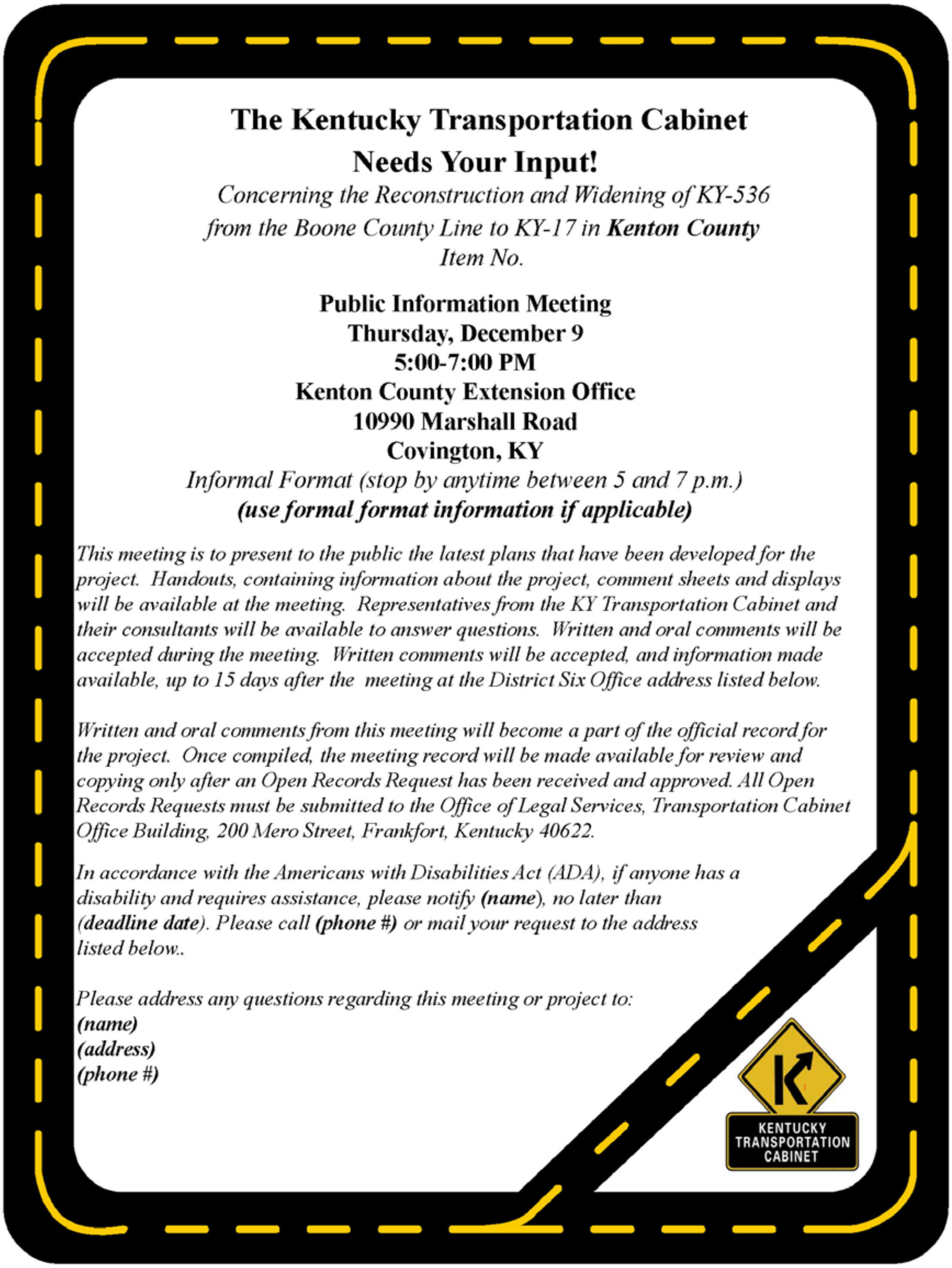
In accordance with the Americans with Disabilities Act (ADA), if anyone has a disability and will require assistance, please notify ***(name)*** of the necessary requirements no later than ***(deadline date)***. This request does not have to be in writing. Please call ***(phone #)*** or mail request to the address listed below.

Please address any questions regarding this hearing, or project information, to:
***(name)***
***(address)***



***(map optional)***

# Exhibit 600-02



## The Kentucky Transportation Cabinet
## Needs Your Input!

*Concerning the Reconstruction and Widening of KY-536*
*from the Boone County Line to KY-17 in* ***Kenton County***
*Item No.*

**Public Information Meeting**
**Thursday, December 9**
**5:00-7:00 PM**
**Kenton County Extension Office**
**10990 Marshall Road**
**Covington, KY**
*Informal Format (stop by anytime between 5 and 7 p.m.)*
***(use formal format information if applicable)***

*This meeting is to present to the public the latest plans that have been developed for the project. Handouts, containing information about the project, comment sheets and displays will be available at the meeting. Representatives from the KY Transportation Cabinet and their consultants will be available to answer questions. Written and oral comments will be accepted during the meeting. Written comments will be accepted, and information made available, up to 15 days after the meeting at the District Six Office address listed below.*

*Written and oral comments from this meeting will become a part of the official record for the project. Once compiled, the meeting record will be made available for review and copying only after an Open Records Request has been received and approved. All Open Records Requests must be submitted to the Office of Legal Services, Transportation Cabinet Office Building, 200 Mero Street, Frankfort, Kentucky 40622.*

*In accordance with the Americans with Disabilities Act (ADA), if anyone has a disability and requires assistance, please notify* ***(name)****, no later than* ***(deadline date)****. Please call* ***(phone #)*** *or mail your request to the address listed below..*

*Please address any questions regarding this meeting or project to:*
***(name)***
***(address)***
***(phone #)***

**Exhibit 600-03**

# LEGAL NOTICE OF OPPORTUNITY TO REQUEST A PUBLIC HEARING

## COUNTY
## ROUTE #, ROAD NAME
## ITEM NO.

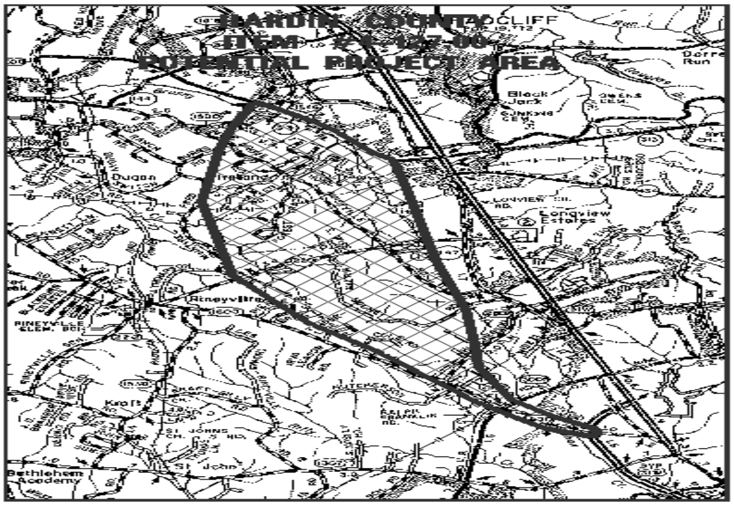
The Kentucky Transportation Cabinet offers to the public and any affected agencies an opportunity to request a Public Hearing concerning ***(type of work on the route, i.e.)*** construction of a new connector.

***(complete description, i.e.)*** The proposed project is a new road that would link the cities of Elizabethtown and Radcliff. The project corridor is located west of US31W, and begins with a new junction (interchange or intersection) with the Elizabethtown US31W Bypass and continues north to the Joe Prather Highway (KY313), a distance of approximately 7.5 miles. The southern 1.9 miles involves the reconstruction of KY1600, the remaining 5.6 miles traverses new alignment.

The Environmental Assessment approved by the Federal Highway Administration, maps, plans and other relevant project data are available for public inspection from 8:00 AM to 4:30 PM, Monday through Friday at the Department of Highways District Office at the address below. Information is also available by calling ***(phone #)*** during the work hours noted above.

A Public Hearing will not be scheduled unless a written request(s) is received on or before (date that is 30 days from publication date).

***(name)***
Kentucky Transportation Cabinet
***(address)***



***(map optional)***

***Chapter***

GEOMETRIC DESIGN GUIDELINES

***Subject***

Introduction

## HD-701.1 INTENT OF USE

This chapter includes geometric design guidelines that the Transportation Cabinet commonly uses. Unless otherwise indicated, these guidelines are not intended to be mandatory. They are to provide guidance in safety, operational efficiency, convenience, and environmental quality. The American Association of State Highway and Transportation Officials' (AASHTO) *A Policy on Geometric Design of Highways and Streets* and engineering judgment are to be used in the design process. This chapter is not to supersede the application of sound engineering principles by experienced design professionals.

An emphasis on the involvement of the public and local communities in our decision-making process has increased. Situations that require increased flexibility in the design process will arise. Goals of the local community, such as environmental quality, aesthetics, and historic preservation, as well as goals of the Cabinet, need to be addressed.

## HD-701.2 CHAPTER TOPICS

This chapter contains information on:

- Primary design elements
- General design considerations
- Design exception process
- Design guidance for truck-climbing lanes and emergency escape ramps
- Kentucky Common Geometric Practices sheets (**Exhibits 700-01** through **700-04**)
- Example typical sheets (**Exhibits 700-05** through **700-08**)

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***Chapter***

GEOMETRIC DESIGN GUIDELINES

***Subject***

Primary Design Elements

## HD-702.1 OVERVIEW

Contained within this section are several elements typically used in highway design, including basic number of lanes, sight distance, horizontal alignment, superelevations, vertical alignment, and cross-section. Each of these elements is important in the development of a highway design project and is further explained in the American Association of State Highway and Transportation Officials (AASHTO)'s *A Policy on Geometric Design of Highways and Streets*.

## HD-702.2 NUMBER OF LANES

The basic number of lanes is the number of designated and maintained lanes over the whole of a highway route or over a significant length of it, irrespective of the changes in traffic volume and requirements of lane balance. It is the constant number of lanes assigned to a route, exclusive of auxiliary lanes.

Additional lanes may be utilized on any given segment of highway based upon analyses such as volume/capacity ratios (V/C). The addition and termination of lanes should be predicated on capacity or lane balance principles.

## HD-702.3 SIGHT DISTANCE

Sight distance is the length of highway that is visible ahead of the driver. In highway design, there are four types of sight distance.

Chapter 3 of *A Policy on Geometric Design of Highways and Streets* shows methods for computing these four distances:

- **Stopping Sight Distance:** This is the distance required for a vehicle traveling at or near the design speed to stop safely. It is the sum of brake reaction time and braking distance. In computing and measuring stopping sight distance, the height of the driver's eye is estimated to be 3.5 feet and the object height 2 feet.

## HD-702.3 SIGHT DISTANCE (cont.)

- **Decision Sight Distance:** There are cases when stopping sight distance is not sufficient for the driver to avoid unforeseen or unusual occurrences. Typical examples of such occurrences are lane drops, areas of high traffic concentration, and traffic control devices. Under these circumstances, it is recommended that the designer consider decision sight distance. This is the distance required for the driver to detect an unexpected or unusual occurrence, recognize it as a hazard, and initiate and complete a maneuver that will allow the driver to safely and efficiently avoid the hazard. Decision sight distance is based on the same criteria of driver's eye height and object height as stopping sight distance.

- **Passing Sight Distance:** As defined by the *Highway Capacity Manual* (HCM), passing sight distance is the length of highway required to complete normal passing maneuvers in which the passing driver can determine that there are no potentially conflicting vehicles ahead before beginning the maneuver. This is the distance required for a vehicle to safely and successfully pass another vehicle, typically on a two-lane highway. Adequate horizontal and vertical passing sight distances are to be provided frequently. For computing and measuring passing sight distance, the height of the driver's eye is estimated to be 3.5 feet; and the object height, which is based on average vehicle height, is also 3.5 feet.

  Another definition of passing sight distance relates to the level of service and design capacity concepts. Reference to the *Highway Capacity Manual* (HCM) may be made for a complete discussion of passing sight distance.

- **Intersection Sight Distance:** This type of sight distance is explored in **HD-900**.

## HD-702.4 HORIZONTAL ALIGNMENT

Several components comprise the horizontal alignment design of a highway, including circular curves, tangents, and, in many cases, spiral curves. Considerations such as safety, existing conditions, environmental considerations, economics, and highway classifications influence the horizontal alignment.

### HD-702.4.1 Circular Horizontal Curves

Circular curves enable a change in roadway direction. The minimum radius of a curve used for a given design speed is shown in Chapter 3 of *A Policy on Geometric Design of Highways and Streets*. The laws of mechanics that govern vehicle operation on curves, such as friction factors, speed, and the amount of superelevation, help to establish this minimum. The designer is to strive to exceed the minimum radius.

### HD-702.4.1 Circular Horizontal Curves (cont.)

If compound curves are used on the main line, the radius of the flatter curve is not to be more than 1.5 times greater than the radius of the adjacent sharper curve. It is preferable to avoid compound curves.

Horizontal curves in the same direction separated only by a short tangent ("broken-back" curves) and horizontal curves in the opposite direction separated only by a short tangent (reverse curves) should be avoided. Generally, it is preferable to use flatter curves connected by transition curves.

See **HD-900** for information concerning Interchange Ramp Design.

### HD-702.4.2 Spiral Transition Curves

In some instances a designer may include a spiral transition curve. A spiral curve is a curve with a variable radius.

Advantages of using spiral curves include:

- Providing a natural path for drivers
- Minimal encroachment on adjoining traffic lanes
- Providing a place to transition superelevation runoff
- Facilitating pavement widening through a curve
- Enhancing the appearance of a highway

On highways with a design speed of 45 mph or greater, spirals are recommended to make the transition from tangent to curve as smooth as possible. As noted in Chapter 3 of AASHTO's *A Policy on Geometric Design of Highways and Streets*, the effect of spiral curve transitions on lateral acceleration is likely to be negligible for larger radii.

### HD-702.5 SUPERELEVATION

Maximum rates of superelevation for use on roadways are controlled by the following factors:

- Climate conditions (snow and ice occurrences)
- Terrain (flat, rolling, or mountainous)
- Urban or rural facilities
- Amount of slow-moving traffic

In general, a maximum rate of no greater than 8 percent is to be used on rural roadways due to Kentucky's snow and ice frequencies. A maximum rate between 4 and 6 percent is recommended for use in urban areas, especially on low- speed, high-volume facilities. On low-speed, low-volume facilities superelevation may not be appropriate.

## HD-702.5 SUPERELEVATION (cont.)

Superelevation tables in Chapter 3 of *A Policy on Geometric Design of Highways and Streets* determine the amount of superelevation to use for a given design speed and radius of curvature. The design engineer is to recommend on a project-by-project basis which values will best suit the conditions of the facility. The accepted method of attaining superelevation may be found by referring to *Standard Drawings* RGS-001 and RGS-002. Due to the tendency of bridges freezing before roadways, the designer should consider limiting grades and superelevation rates on longer bridges.

**Note:** Truck-climbing lanes and auxiliary lanes are to be superelevated at the same rate as the adjacent through lanes.

If spiral curves are not used, follow the minimum superelevation runoff lengths are as shown in Chapter 3 of *A Policy on Geometric Design of Highways and Streets*. The transitions between the tangent section and the curve are typically divided as follows:

- Locate 2/3 of runoff length (L) on the tangent section.
- Extend 1/3 of L onto the horizontal curve.
- The point of curvature (P.C.) will be the control for this situation and will apply and applies to both ends of the curve.

When spirals are utilized, the superelevation runoff length (L) may be the same as the length of spiral. Once the spiral runoff length (L) is determined, the tangent runout can be calculated. The runout (R) is the transition from a normal crown section to one in which the outside lane(s) are rotated to a flat section. The formula for this transition length is:

$$\mathbf{R} = \frac{\mathbf{Lc}}{\mathbf{e}}$$

**R** = Runout length
**L** = Length of spiral or length of runoff
**c** = Normal rate of pavement crown (commonly 2 percent)
**e** = Superelevation rate

Once the roadway is transitioned to this flat section, the template is rotated to full superelevation utilizing the runoff length (L) as the transition length.

**Note:** The inside lane(s) do not begin to rotate until the outside lane(s) exceed the normal cross-slope of the inside lane(s). At this point, inside and outside lanes rotate together to full superelevation.

## HD-702.5 SUPERELEVATION (cont.)

After the normal shoulder cross-slope is exceeded, the full width of the inside shoulder is rotated to match the roadway superelevation.

- For shoulder widths less than or equal to 4 feet, the full width of the outside shoulder is rotated to match the roadway superelevation.
- If the shoulder width is greater than four feet, a portion of the outside shoulder (the shoulder on the high side) is not superelevated to match the main line rate. The nonsuperelevated shoulder remains sloped away from the roadway.
- For shoulder widths greater than 4 feet and less than or equal to 6 feet, the nonsuperelevated shoulder width should be 2 feet.
- For shoulder widths greater than 6 feet, the shoulder "break" should occur at the midpoint of the shoulder width. This may not apply to inside shoulders of median sections and multilane facilities.
- For the "roll-over" between superable and nonsuperable shoulder, the algebraic difference in rate of cross-slope is not to exceed 12 percent.

## HD-702.6 PAVEMENT WIDENING ON CURVES

Offtracking is common to all vehicle types. When traversing a horizontal curve, the rear wheels of a motor vehicle track inside the front wheels, thereby making it difficult for a driver to hold the vehicle in the center of the lane. These problems become more pronounced when lane widths are narrow and curves are sharp.

A common practice to help offset these conditions is to widen pavement on horizontal curves. Since widening is costly and little is gained from a small amount of widening, a minimum of 2 feet is to be used.

*Standard Drawing* RGS-001 and Chapter 3 of *A Policy on Geometric Design of Highways and Streets* are to be used to determine the amount of widening for a particular radius of a curve. When spiral transition curves are used, the widening between the inside and outside edges of pavement is typically divided equally. Widening may be done on the inside edge of the spiral when appropriate. Normally, the widening is to transition over the length of the spiral curve.

When spiral transition curves are not used, all the widening is to be done on the inside edge of pavement. The widening is to transition from zero at the beginning of the tangent runoff (L) to full widening at the point of full superelevation. Transition ends to avoid an angular break at the edge of pavement.

## HD-702.7 SIGHT DISTANCE ON HORIZONTAL CURVES

The sight distance on a horizontal curve is measured along the center line of the curve's inside lane. Objects such as walls, longitudinal barriers, cut slopes, vegetation, or buildings may obstruct the sight distance. When designing the horizontal alignment, the designer should try to obtain adequate sight distance on horizontal curves. In some instances, additional right of way may be required.

For horizontal curves, both passing sight distance and stopping sight distance are to be considered. Passing sight distance is recommended for consideration on tangents and very flat curves only; sight distance restrictions prohibit its consideration on sharper curves. Sight distance for horizontal curves is to be coordinated with the sight distance for vertical curves (**HD 702.9**).

Intersection sight distance for roads with at-grade intersections should also be considered. See **HD-902** and AASHTO's *A Policy on Geometric Design of Highways and Streets* for more information.

## HD-702.8 VERTICAL ALIGNMENT

The terrain of the traversed land influences the design of the roadway. Terrain is generally classified into three categories: level, rolling, and mountainous. Like horizontal alignment, vertical alignment consists of tangent sections and curves.

### HD-702.8.1 Grades

*A Policy on Geometric Design of Highways and Streets* suggests a maximum grade based upon the Functional Classification, terrain, and design speed (See **Exhibits 700-01**, **700-02**, **700-03**, and **700-04** for suggested maximum grades.)

Vehicle type expected on the roadway and critical length of grade must also be considered in the design process, as the effect of grade is far more pronounced on truck speeds than on the speeds of passenger cars. In addition to the grade percentage, the length of grade is also very important. Chapter 3 of *A Policy on Geometric Design of Highways and Streets* shows how to determine critical lengths of grade, which are used to indicate the maximum length of a designated upgrade on which a loaded truck can operate without an unreasonable reduction in speed.

The maximum design grade is not, however, the most desirable grade for a roadway. Where feasible, it is recommended that grades be less than the maximum allowable. However, grades less than 500 feet in length and one-way downgrades may be approximately 1 percent steeper than the maximum. Such a grade may be increased by 2 percent if on a low-volume rural highway.

### HD-702.8.1 Grades (cont.)

Steeper grades may also be used where extremely high construction costs would be encountered to produce flatter grades. Care is to be taken when increasing grade in rural areas because the increase may introduce the need for truck-climbing lanes. The project team is to discuss the use of grades steeper than the maximum, and the PDM is to document the use in the Preliminary Line and Grade meeting minutes and Design Executive Summary.

It is necessary to maintain a minimum grade in order to provide adequate drainage. Level grades may be used on uncurbed, nonsuperelevated roadways as long as there is an adequate crown. It is recommended that curbed roadways maintain a minimum grade of 0.50 percent. A grade of 0.30 percent may be considered if there is a high-type, adequately-crowned pavement.

The maximum suggested grades for entrances 50 feet or greater in length are shown in *Standard Drawing* RPM-110.

### HD-702.8.2 Vertical Curves

The introduction of vertical curves affects the transition from one rate of grade to another and usually consists of a parabolic curve. Vertical curves are either the crest or sag type, depending on the positive or negative slopes of the intersecting grades.

### HD-702.8.3 Curve Length

A common means to determine the minimum length of curve needed for various design speeds is K, the rate of curvature. K is determined by dividing the length of vertical curve (L) by the algebraic difference (A) in grades (L/A). K is the horizontal distance required to effect a 1 percent change in gradient. Special attention is needed to provide proper pavement drainage near the low point of sag vertical curves and the high point of crest vertical curves. When the *K* value of 167 feet per percent grade or greater is used, pavement drainage should be more carefully designed.

After K is found, the minimum length of vertical curve (L) can be calculated by using information in Chapter 3 of *A Policy on Geometric Design of Highways and Streets.* Suggested lengths of vertical curve for a given design speed are based on sight distance for crest vertical curves and on headlight sight distance for sag vertical curves.

In addition to sight distance, the designer should consider appearance and riding comfort when selecting a length of vertical curve. Long vertical curves give a more pleasing appearance and provide a smoother ride than short vertical curves.

## HD-702.9 SIGHT DISTANCE ON VERTICAL CURVES

The design of both crest and sag vertical curves are dependent on stopping sight distance calculations:

- **Crest Vertical Curves:** The stopping sight distance is based on the height of eye of 3.5 feet and the height of object of 2 feet.

- **Sag Vertical Curves:** The stopping sight distance is based on a 2-foot headlight height and a 1-degree angle of light spread upward from the headlight beam.

The stopping sight distance values for various design speeds listed in Chapter 3 of *A Policy on Geometric Design of Highways and Streets* are to be considered minimum values.

## HD-702.10 TYPICAL CROSS SECTIONS

To determine the typical cross-section for a given highway, designers are to use seven basic design controls:

- Functional classification
- Context classification – rural, rural town, suburban, urban, urban core
- Project Type – New Construction, Reconstruction, Construction on existing roads (spot improvements)
- Multimodal considerations
- Volume of traffic
- Design speed
- Overall project context

The Common Geometric Practices (**Exhibits 700-01** through **700-04** of this manual) AASHTO’s *A Policy on Geometric Design of Highways and Streets,* and AASHTO’s *Guidelines for Geometric Design of Low-Volume Roads* should be used to determine the typical section. **Exhibits 700-05** through **700-08** show example typical sections.

Typical section items include, but are not limited to, the following:

- Traveled way width and slope
- Shoulder width and slope
- Barrier placement
- Curb placement
- Typical slopes in cuts and fills
- Medians
- Bicycle/Pedestrian Facilities (see **HD-1500**)

### HD-702.10.1 Traveled Way Width and Slope

Traveled ways located in tangent sections usually have a crown or high point located in the center and a cross-slope down to the edges of pavement. Divided multilane highways may be crowned separately as a two-lane highway, or they may have a unidirectional cross-slope across the entire width of the traveled way. The rate of pavement cross-slope is important. Steep slopes minimize ponding of water, but they may be uncomfortable to the driver. The recommended normal pavement cross-slope is 2 percent. Refer to Chapter 4 of AASHTO's *A Policy on Geometric Design of Highways and Streets* for additional information.

Lane widths affect the comfort and safety of driving. The Common Geometric Practices (Exhibits 700-01 through 700-04 of this manual) along with AASHTO's *A Policy on Geometric Design of Highways and Streets* should be used to determine lane width.

It may not be practical to design lane widths of Local and Collector roads and streets that have < 2000 ADT utilizing the same criteria that is applicable to higher volume roads. For these low-volume roadways, it is recommended to refer to AASHTO's *Guidelines for Geometric Design of Low-Volume Roads (ADT ≤ 2000 ADT)*.

### HD-702.10.2 Shoulder Width and Slope

A shoulder is the portion of the roadway contiguous to the travel way that serves purposes such as accommodation of stopped vehicles, emergency use, lateral support of the pavement, increased horizontal sight distance, and in certain situations, accommodation of bicycle traffic.

KYTC definitions of the various shoulder components are as follows:

- **Usable Shoulder:** The actual width available for vehicles to make an emergency or parking stop.

- **Graded Shoulder:** Distance from the edge of the travel lane to the normal slope break. Typically, this distance is the usable shoulder unless guardrail is present.

- **Paved Shoulder:** The width of the shoulder paving. This distance may be any portion of the usable shoulder up to the face of the barrier (if present) or to within 2 feet (1 foot minimum) of the normal slope break. Typically the paved portion of the shoulder is constructed on a 4% grade. However, the shoulder slope may vary depending on superelevation requirements.

### HD-702.10.2 Shoulder Width and Slope (cont.)

As part of the Typical Section development for a project, the Designer, along with help from the PDT, must decide on the Usable Shoulder Width desired for the project based upon the Classification of the facility, the design speed, the type of project, and the volume and composition of the traffic. Various guidance is available to assist in the determination of the Usable Shoulder Width for a particular project, including AASHTO's *A Policy on the Geometric Design of Highways and Streets*, current edition; *Roadside Design Guide*, current edition; *A Guide for Achieving Flexibility in Highway Design*, Section 3.6.2, 2004; *Guidelines for Geometric Design of Low-Volume Roads*, current edition; *A Policy on Design Standards Interstate System*, current edition; Guide for the Development of Bicycle Facilities, current edition and, the *KYTC Highway Design Manual*, current edition.

### HD-702.10.3 Guardrail Placement

Once the usable shoulder width is established for a project and it is determined that guardrail is required, then the graded shoulder will need to be widened 3 feet 5 inches beyond the usable shoulder width to accommodate the guardrail installation. With the face of the guardrail located along the outside of the usable shoulder, the additional graded width will provide 2 feet of stability behind the guardrail posts. If it is not practical to achieve 2 feet behind the posts, then longer guardrail posts can be utilized. (See Exhibits; 700-05, 700-07, and 700-08 for recommended guardrail placement.)

### HD-702.10.4 Curb Placement and Border Area

Curbs are often used on low-speed urban highways. On such highways it is preferable to offset the curb 1 to 2 feet from the edge of traveled way. If curbs are used on high-speed rural highways, they are to be located outside the edge of the usable shoulder. It is recommended that curbs utilized along the outside edge of the usable shoulder of a high-speed facility be of the mountable type and be limited to a 4-inch height. This design is especially important if the curb is being used in conjunction with other types of traffic barriers. When the use of curbs with guardrail is unavoidable, the following guidance can assist in curb type and guardrail placement:

- For design or posted speeds of 45 mph and less
  - Construct the guardrail so its face is flush with the curb’s face. Avoid locating a curb in front of a guardrail. Reduce the curb height to 4 inches and consider stiffening the rail to reduce vaulting.
  - If it is not practical to install the guardrail flush with the face of curb, construct the guardrail with a minimum offset of 6 feet from the curb’s face to the guardrail’s face.

### HD-702.10.4 Curb Placement and Border Area (cont.)

- For design or posted speeds greater than 45 mph
  - Facility design should omit curbs. However, a mountable curb may be used at the edge of the shoulder if necessary. If guardrail is needed in this situation, construct it so the rail's face is flush with the curb's face.

When curbs are used along a roadway, the space between the face of curb and the right of way line is known as the border area. This space serves as a buffer between vehicular traffic and those within the border area, such as pedestrians and bicyclists. This space can include a sidewalk, shared use path, raised cycle track, both aboveground and underground utilities, mailboxes, and other transportation infrastructure (traffic signal poles, traffic signs, parking meters, etc.). It is desirable to place non-breakaway features as far from the curb as practical to reduce the likelihood of them being struck by a vehicle that runs off the road (utility poles, traffic signal poles, fire hydrants, etc.).

### HD-702.10.5 Typical Slopes in Cuts & Fills

Ditches and embankment slopes are not geometric design elements, therefore they are not subject to the design exception process. Roadside ditches are to be evaluated on the basis of their ability to function hydraulically. The choices of fill slopes and ditch configurations must consider the effects on roadside safety. The AASHTO *Roadside Design Guide* defines 4:1 slopes as recoverable, 3:1 slopes as non-recoverable, and steeper than 3:1 slopes as critical. Flatter fill slopes are desirable whenever practical. The effect of slope combinations on the potential trajectories of vehicles that run off the road is also an important consideration of designing the roadside. **HD-800** and AASHTO*'s Roadside Design Guide* provide additional information.

The PDM in consultation with the geotechnical branch is to determine the level of geotechnical investigation required. Typically this varies from advisory to full-scale geotechnical analysis. Generally, when embankments are to be constructed over existing ground slopes of 15 percent or greater, embankment foundation and/or transverse (profile) benches are to be constructed in the existing slopes. The Transportation Cabinet's *Standard Drawings Manual* provides specific details. Ditch benching and overburden and/or weathered zone benching details are outlined in the Transportation Cabinet's *Geotechnical Manual.*

### HD-702.10.6 Medians

A median is the portion of a highway separating opposing directions of travel. The median width is the dimension between the edges of the traveled way and includes any left, inside shoulders. It has been demonstrated that there is a benefit derived from any type of traffic separation on multilane facilities. Wider medians are desirable at rural, unsignalized intersections; however, at urban/suburban signalized intersections, medians wider than 60 feet may lead to inefficient signal operation.

### HD-702.10.6 Medians (cont.)

Further detailed information on median design can be found in Chapter 4 of AASHTO's *A Policy on Geometric Design of Highways and Streets.* For recommended median widths on Interstates, see FHWA's *A Policy on Design Standards – Interstate System*.

Below are some of the various functions of medians:

- Separate opposing traffic flow
- Provide a recovery area for out-of-control vehicles
- Provide a stopping area in case of emergencies
- Minimize headlight glare from oncoming vehicles
- Provide width for future turn lanes
- Provide storage for left-turning or crossing vehicles from an approach road
- Open green space (urban areas)
- Refuge for pedestrians (urban areas)
- Control of left-turning/U-turning movements
- Provide area for plowed snow

There are three types of medians: depressed, flush, and raised. The details of the project (environmental, maintenance, right of way, utilities, pedestrians, cost, and other considerations) will affect selection of the median type. Described below are the different types of medians:

- **Depressed Medians:** Depressed medians provide traffic separation, accommodate roadway drainage, facilitate maintenance activities, and provide storage for snow and ice removed from the roadway. Depressed medians are generally utilized in areas where there is sufficient right of way available, the need for constructed median crossovers are relatively few, and the roadway has either partially or fully-controlled access. A depressed median can also be used with partial control facilities where access is fairly limited or is restricted to right turns in and out, with the exception of specific median crossover locations. The median side-slopes and any drainage structures located within the median area should follow the recommendations of AASHTO's *Roadside Design Guide.* Depressed medians should have a minimum width of 36 feet.

- **Flush Medians:** Flush medians provide traffic separation, accommodate traffic movement, facilitate maintenance activities, and provide storage for snow and ice removed from the roadway. Flush medians are generally utilized on urban facilities with widths varying from 4 feet minimum to 16 feet maximum. The median should be sloped to accommodate drainage. (See AASHTO's *A Policy on Geometric Design of Highways and Streets*.) Flush medians should be delineated according to guidance found in the *Manual on Uniform Traffic Control Devices (MUTCD).*

### HD-702.10.6 Medians (cont.)

**Note:** Flush medians and two-way left-turn lanes (TWLTLs) have different functional characteristics and are to be addressed accordingly. The TWLTL operation may be appropriate where the speed on the roadway is relatively low (45 mph or less) and there are no heavy concentrations of left-turning traffic. Desirably, a 12-foot to 14-foot flush median should be utilized for a TWLTL. TWLTLs shall be striped according to guidance found in the *MUTCD*. See **HD 900** for more information on TWLTLs.

- **Raised Medians:** There are three types of raised medians:
  - **Mountable Medians:** Mountable medians may be utilized to address channelization, aesthetics, or drainage issues. *Standard Drawings* RPM-011, RPM-012, and RPM-015 show specific details of mountable medians.
  - **Nonmountable Medians:** Nonmountable medians (barrier medians) are typically utilized for traffic separation, pedestrian havens, channelization, or access management. Barrier medians typically use curbs to separate the median from the traveled way. Standard Drawing RPM-010 shows details. When used in close proximity to traffic (≤ 2'), barrier medians may create safety concerns at higher speeds (> 45mph) and are to be considered in context with other project design elements and costs.
  - **Median Barriers**: Median barriers typically may be used in high-speed applications to address traffic separation and channelization. Median barriers are detailed in Standard Drawings RBM-001, RBM-003, RBM-006, RBM-050, and RBM-053. AASHTO's *Roadside Design Guide* shows use and placement of median barriers.

## HD-702.11 CROSSOVERS

Emergency/maintenance crossovers are breaks in the median to allow emergency and maintenance traffic to cross. To avoid extreme adverse travel for emergency, law-enforcement, and maintenance vehicles, emergency/maintenance crossovers on rural freeways are normally provided where interchange spacing exceeds five miles. Care should be taken in the design of these to ensure they do not present an undue hazard for through traffic. The "Intersection" chapter of AASHTO's "*A Policy on Geometric Design of Highways and Streets"* gives design details.

## HD-702.12 BRIDGE WIDTHS

The approach roadway width should be maintained across all new structures. The minimum width of a bridge on a two-lane bidirectional roadway is 22 feet. For roads with ADT≤400, see AASHTO's AASHTO's *Guidelines for Geometric Design of Low-Volume Roads.*

## HD-702.12 BRIDGE WIDTHS (cont.)

The minimum usable shoulder widths should be continued across all new structures. Per AASHTO Guidance, on long bridges in excess of 200 feet where cost per square yard is greater than the cost on short-span structures, widths that are less than ideal may be acceptable; however, economy alone should not be the governing factor in determining structure widths. The structure width should be evaluated based on incremental structure costs. For example, determine how much shoulder can be provided before an additional support beam is necessary. Any exceptions are to be documented in the Design Executive Summary and detailed in the Advanced Situation Folder.

A 4-foot minimum inside shoulder is required across bridges on four-lane divided highways. This requirement means that the inside shoulder on the roadway is to be widened near the bridge end to accommodate barriers (see *Standard Drawing* RBB-002). The width of the outside shoulder on the bridge is to be equal to the distance from the roadway shoulder to the face of the barrier.

Refer to the Transportation Cabinet's *Bridge Design Manual* concerning detailed bridge geometric design information.

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**HIGHWAY Design**

*Chapter*

GEOMETRIC DESIGN GUIDELINES

*Subject*

General Design Considerations

## HD-703.1 OVERVIEW

While the criteria differ for each functional classification of roadway, certain factors are always important in the design process. The suggested design criteria for each classification can be found in AASHTO's *A Policy on Geometric Design of Highways and Streets*. The policy also references roadway context classification, project type classification, and multimodal needs that are to be considered along with functional classification to provide a framework for design. A flexible design and performance based approach is encouraged. AASHTO's *Guidelines for Geometric Design of Low-Volume Roads* provides guidelines for local and collector roads that have a design average daily traffic volume of 2,000 vehicles per day or less. Criteria for interstates shall adhere to AASHTO's *A Policy on Design-Standards Interstate System*, current edition.

In the early stages of a project, typically after the preliminary line and grade approval, a Design Executive Summary (DES) is submitted that documents the design decisions made on a project. **HD-203** provides specific information on the DES submittal.

## HD-703.2 DESIGN CONTROLS & CRITERIA

For any highway project, the design controls and design criteria establish the minimum values for the primary elements of a particular highway. The following design controls and design criteria are normally considered in the design of a highway:

- Design functional classification (proposed project)
- Area (urban or rural)
- Context classification
- Project Type (new construction, reconstruction, existing roadways)

## HD-703.2 DESIGN CONTROLS & CRITERIA (cont.)

- Operational and safety performance, including crash history and type
- Volume of traffic (DHV [design hourly volume], and ADT [average daily traffic], turning movements, percent trucks)
- Design vehicle
- Design speed
- Topography (flat, rolling, or mountainous terrain)
- Highway capacity (See Chapter 2 in AASHTO's *A Policy on Geometric Design of Highways and Streets* and the *Highway Capacity Manual.*)
- Environmental Impacts
- Other modes of transportation (bicycles, pedestrians, transit, etc.)
- Economic considerations
- Scope, schedule, and budget
- Special considerations such as the length of the project, the condition of roads in the vicinity of the project, access management, and the likelihood of adjoining segments being improved in the foreseeable future

## HD-703.3 OTHER FACTORS AFFECTING DESIGN

There are other factors to consider during the design process. The following are suggestions that promote good design practices:

- Do not design horizontal and vertical alignments independent of each other. The coordination of these elements is to begin early in the design process.
- Create alignments consistent with the existing topography and preserving property and community values.
- A flowing line that conforms generally to the natural topography is preferable to one with long tangent sections that cuts through the terrain.
- An alignment is to be as consistent as possible. If possible, avoid introducing sharp curves at the end of long tangents and sudden shifts from flat curvature to sharp curvature.

## HD-703.3 OTHER FACTORS AFFECTING DESIGN (cont.)

- Vertical curves that fall within the limits of horizontal curves, or vice versa, generally result in a more pleasant roadway facility.

- Create horizontal and vertical alignments as straight and flat as practical at intersections due to the need to provide appropriate sight distance along both intersecting roadways.

- Do not automatically utilize the minimum suggested values for design elements.

## HD-703.4 FUNCTIONAL CLASSIFICATION

The “functional classification” of a roadway is the grouping together of roadways by the type of service they provide based upon land use and type of traffic being generated along a corridor. This classification has been developed as a means of communication within the transportation industry. The determination of a facility’s functional classification is one of the first steps in the design process.

**Note:** Over time, the functional classification of a highway can change depending on the intensity of development and the type of traffic being generated by the development of the corridor. Recognizing this, the designer can choose to use a different functional classification to better fit the intended function of the highway. Any changes to the existing functional classification should be documented in the DES.

The basic types of functional classifications are:

- **Rural/Urban Local Roads and Streets:** Local roads and streets have relatively short trip lengths, and because property access is their main function, there is limited need for mobility or high operating speeds. The use of a lower design speed and level of service reflects this function. Local roads and streets are discussed in Chapter 5 of AASHTO's *A Policy on Geometric Design of Highways and Streets.*

- **Rural/Urban Collectors:** Collectors serve a dual function in accommodating shorter trips and feeding arterials. They must also provide some degree of mobility and serve abutting property. Thus, an intermediate design speed and level of service are appropriate. Collectors are discussed in Chapter 6 of AASHTO's *A Policy on Geometric Design of Highways and Streets.*

## HD-703.4 FUNCTIONAL CLASSIFICATION (cont.)

- **Rural/Urban Arterials:** Arterials provide a high degree of mobility for longer trip lengths. Therefore, they may provide a high operating speed and level of service. Since access to abutting property is not their primary function, some degree of access control is desirable to enhance mobility. Arterials are discussed in Chapter 7 of AASHTO's *A Policy on Geometric Design of Highways and Streets.*

- **Freeways:** A freeway is normally classified as a principal arterial that has unique geometric criteria. Freeways are discussed in Chapter 8 of AASHTO's *A Policy on Geometric Design of Highways and Streets.*

- **Interstate:** The interstate system in the most important highway system in the United States. It carries more traffic per mile than any of the other comparable highway systems. Interstates are designed to provide safety and mobility with fully controlled access. For guidance on interstates refer, to AASHTO's *A Policy on Design Standards Interstate System*, current edition.

The geometric design of -low-volume roads presents a unique challenge, as the very low traffic volumes and reduced frequency of crashes make designs normally applied on higher-volume roads less cost-effective. The guidance by AASHTO's *Geometric Design of Low-Volume Roadways* addresses the unique needs of such roads and the geometric designs appropriate to meet those needs. These guidelines can be considered on local and collector roads that have a design average daily traffic volume of 2,000 vehicles per day or less

Chapter 1 of AASHTO's *A Policy on Geometric Design of Highways and Streets* gives a more detailed discussion of roadway classifications.

## HD-703.5 CONTEXT CLASSIFICATION

There are five contexts to consider for geometric design criteria:

- Rural
- Rural town
- Suburban
- Urban
- Urban Core

These contexts are defined based on development density, land uses, and building setbacks. The context classifications supplement, but do not replace, the functional classification system used in geometric design. Chapter 1 of AASHTO's *A Policy on Geometric Design of Highways and Streets* gives a more detailed discussion of context classifications.

## HD-703.6 PROJECT TYPES

The design process considers three general types of projects:

- New Construction – These projects are those that construct roads on new alignment where no existing roadway is present.

- Reconstruction – These projects utilize an existing roadway alignment (or make only minor changes to an existing alignment), but involve a change in the basic roadway type. Changes in basic roadway type include widening a road to provide additional through lanes or adding a raised or depressed median where none currently exists, and where these changes cannot be accomplished within the existing roadway width (including shoulders). The change in roadway type means that performance measures for the existing roadway may not be relevant to forecasting the performance of the future reconstructed roadway. However, retaining the existing alignment means that existing constraints in the current roadway environment will influence design decisions. Reconstruction projects often create the most difficult design decisions because a new facility type is being adapted to an existing alignment.

- Construction on existing roads (spot improvements) – These projects on existing roads keep the existing roadway alignment (except for minor changes) and do not change the basic roadway type. These types of projects typically include repairing an infrastructure condition, reducing current or anticipated traffic operational congestion, and reducing current or anticipated crash patterns.

Chapter 1 of AASHTO's *A Policy on Geometric Design of Highways and Streets* gives a more detailed discussion of project types.

## HD-703.7 PERFORMANCE BASED FLEXIBLE SOLUTIONS (PBFS)

A flexible design approach that establishes design criteria based on project specific conditions and also on existing and future roadway performance is encouraged. Projects should be developed at the minimum impact and cost that will satisfy the goals, purpose, and need. The Project Manager and Project Development Team are given the responsibility of addressing the project purpose and need, while at the same time refining the project scope and subsequent design such that the cost and impact of the Project is minimized while the contribution of the Project to the roadway system is adequate and appropriate.

PBFS is comprised of two parts; Flexible Design and Performance Based Design.

## HD-703.7 PERFORMANCE BASED FLEXIBLE SOLUTIONS (PBFS) (cont.)

A Flexible Design approach is critical since each project has a specific purpose and need, has specific context and constraints, serves a unique set of users, and fills a distinct position in the transportation network. Every project is unique, therefore, no single set of design criteria is applicable to or meets the needs of all projects. The use of Design Flexibility does not mean that the designer can arbitrarily use discretion when selecting design criteria and elements. The Designer should recognize that flexibility is used in order to better meet specific project goals or to work within defined constraints.

Performance Based Design is a design approach in which key design decisions are made with consideration of their anticipated effects on aspects of future project performance that are relevant to the project purpose and need. The analysis of performance is used as a tool to help the designer make informed design decisions, and allows the designer to take a flexible design approach by documenting the anticipated performance of design criteria used. Various quantitative and qualitative performance measures are available for the designer to analyze and should be selected based on the project purpose and need. **HD-202.6.1** provides further information on performance measures. The designer is to compare the effects of future performance if the project is built to the effects of future performance if the project is not built.

## HD-703.8 DESIGN SPEED

Design speed is the selected speed used to determine the various geometric design features of the roadway. Factors that are considered when selecting the design speed for a project include, but are not limited to, project type, anticipated operating speed, topography, functional classification, context classification, and modal mix. When selecting the design speed every effort should be made to attain a desired combination of safety, mobility, and efficiency within the constraints of environmental quality, economics, aesthetics, and social or political impacts. AASHTO's *A Policy on Geometric Design of Highways and Streets* provides further discussion on the philosophy of design speed.

Below is the method of selecting the design speed based on project type (**HD 703.6**):

- For projects that are considered new construction the starting place for selecting a design speed should be the minimum design criteria as set forth in AASHTO's *A Policy on Geometric Design of Highways and Streets*, AASHTO's *Guidelines for Geometric Design of Low-Volume Roads*, or AASHTO's *A Policy on Design Standards-Interstate System*, whichever is applicable.

**HD-703.8 DESIGN SPEED (cont.)**

The design criteria can then be adjusted up or down with the appropriate justification and/or design exceptions to the controlling criteria. It is important to utilize engineering judgement when considering the use of "all" minimums for the geometric criteria of a project, which could result in a project that does not meet the purpose and need.

- For projects that are considered reconstruction projects the designer must first determine the existing and proposed functional classification and context classification of the roadway within the project area.
  - If the project proposes keeping the existing functional and context classification the designer should first evaluate the project area and determine the existing design speed based upon the existing geometrics. This should be the starting point for evaluating and choosing the proposed design speed. After a review of crash data, typical roadway widths and shoulder widths, sight distance restrictions, possible drainage issues, and a review of the existing corridor the designer can then use engineering judgement to "design up" from the existing conditions to better meet the purpose and need of the project. Any changes in design speed from existing should also consider the overall roadway system.
  - If the project proposes changing the functional and/or context classification from the existing conditions then the starting place for selecting a design speed should be the minimum design criteria as set forth in AASHTO's *A Policy on Geometric Design of Highways and Streets*, AASHTO's *Guidelines for Geometric Design of Low-Volume Roads*, or AASHTO's *A Policy on Design Standards-Interstate System*, whichever is applicable. The design criteria can then be adjusted up or down with the appropriate justification and/or design exceptions to the controlling criteria. It is important to utilize engineering judgement when considering the use of "all" minimums for the geometric criteria of a project, which could result in a project that does not meet the purpose and need.
- For projects that are considered construction on existing roads (spot improvements), the designer should first evaluate the project area and determine the existing design speed based upon the existing geometrics. This should be the starting point for evaluating and choosing the proposed design speed. After a review of crash data, typical roadway widths and shoulder widths, sight distance restrictions, possible drainage issues, and a review of the existing corridor the designer can then use engineering judgement to "design up" from the existing conditions to better meet the purpose and need of the project. Any changes in design speed from existing should also consider the overall roadway system.

## HD-703.8 DESIGN SPEED (cont.)

Designers should be aware of context classification transitional zones between rural collector or arterial roads and rural town contexts. These transitional areas should be effectively designed to encourage speed reduction because, if drivers do not appropriately reduce speeds, they may create conflicts with other vehicles, pedestrians, and bicyclists and may adversely affect community livability. AASHTO's *A Policy on Geometric Design of Highways and Streets* provides further guidance and design treatments that may be implemented to help high-speed to low-speed transition zones function more effectively.

Justification for design speeds should be documented in the Design Executive Summary (**HD-704**). This justification should consider all project conditions including maximum service and safety benefits for the dollar invested, compatibility with adjacent sections of the existing roadway, and the probable time before reconstruction of the adjacent sections due to increased traffic demands or changed conditions. When requesting exceptions, include a discussion of safety analysis and the related crash data associated with the site. Mitigation measures should be considered when the design speeds are less than the regulatory or posted speed.

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***Chapter***

GEOMETRIC DESIGN GUIDELINES

***Subject***

Design Exception Process

## HD-704.1 USE OF DESIGN EXCEPTION PROCESS

Although the range of values suggested in this design manual and in AASHTO's *A Policy on Geometric Design of Highways and Streets* provide a flexible range of design features, there will be situations in which the use of the minimum suggested criteria would result in unacceptable right-of-way, utility, environmental, historical impacts, and project costs. For these situations, the design exception process is to be utilized to determine and document the reasons or justifications for the exceptions.

## HD-704.2 CONTROLLING CRITERIA

The Federal Highway Administration has established 10 controlling criteria. All 10 controlling criteria apply to high speed, $\geq$ 50 MPH, National Highway System (NHS) routes.

- Design speed
- Lane width
- Shoulder width
- Horizontal curve radius
- Superelevation rate
- Stopping sight distance (SSD), which applies to horizontal and vertical alignment except in the case of sag vertical curves
- Maximum grade
- Cross-slope
- Vertical clearance
- Design loading structural capacity

FHWA only applies two of these criteria to NHS routes with design speeds <50 MPH.

- Design speed
- Design loading structural capacity

## HD-704.2 CONTROLLING CRITERIA (cont.)

KYTC applies these controlling criteria as follows:

- Controlling criteria for high-speed roadways, defined as Interstates, other freeways, and roadways with a design speed $\geq$ 50 mph are:
  - Design speed
  - Lane width
  - Shoulder width
  - Horizontal curve radius
  - Superelevation rate;
  - Stopping sight distance (SSD), which applies to horizontal and vertical alignment except in the case of sag vertical curves
  - Maximum grade
  - Cross-slope
  - Vertical clearance
  - Design loading structural capacity
- Controlling criteria for all other roadways (design speed < 50 mph) are:
  - Design speed
  - Design loading structural capacity

**Exhibits 700-01** through **700-04** represent Kentucky Common Geometric Practices. The values in these exhibits are not to be construed as a basis for determining design exceptions. The designer is to refer to AASHTO's *A Policy on Geometric Design of Highways and Streets*, AASHTO's *Geometric Design Guidelines for Very Low-Volume Local Roads (ADT≤400),* and AASHTO's *A Policy on Design Standards Interstate System*.

## HD-704.3 EXCEPTION PROCESS

Exceptions to the controlling criteria, as applied above to projects, should be identified early in the design process. Documentation of recommendations and discussions are to be included in meeting or inspection reports and should include the following:

- Specific design criteria that will not be met
- Existing roadway characteristics
- Alternatives considered
- Comparison of the safety and operational performance of the roadway and other impacts
- Proposed mitigation measures
- Compatibility with adjacent sections of roadway

## HD-704.3 EXCEPTION PROCESS (cont.)

The Project Development Manager (PDM) is to document design exceptions in the Design Executive Summary (DES) when submitted for approval by including a detailed, written discussion of the recommendation and justification for the exceptions. When design exceptions are pursued, mitigation strategies to abate the effect of the exceptions should be considered in the design process.

**Note:** On Projects of Divisional Interest (PODIs) and Projects of Corporate Interest (POCIs), design exceptions must be submitted to FHWA. HD-203 provides specific information on the DES submittal and approval procedures.

## HD-704.4 VARIANCE PROCESS

Any deviation from the common geometric practices of items that are not part of the controlling criteria should be considered a variance and justified with any mitigation strategies in the DES.

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*Chapter*

GEOMETRIC DESIGN GUIDELINES

*Subject*

Truck-Climbing Lanes &
Emergency Escape Ramps

## HD-705.1 TRUCK-CLIMBING LANES

Besides being limited to passing sections, heavily loaded vehicles on sufficiently long upgrades adversely affect the safety and operating speed of traffic on two-lane highways. Truck-climbing lanes are commonly included in original construction or added on existing highways as safety- and capacity-improvement projects. AASHTO's *A Policy on Geometric Design of Highways and Streets,* and the *Highway Capacity Manual* contain additional information on truck-climbing lanes.

### HD-705.1.1 Warrants for Truck-Climbing Lanes

The following three criteria, reflecting economic considerations, should be satisfied to justify a truck-climbing lane:

1. Upgrade traffic flow rate more than 200 vehicles per hour

2. Upgrade truck flow rate more than 20 vehicles per hour

3. Meet one of the following conditions:
    - Expect a 10-mph or greater speed reduction for a typical heavy truck
    - Ensure that a level of service E or F exists on the grade
    - Experience a reduction of 2 or more levels of service when moving from the approach segment to the grade

**Note:** Safety considerations alone may justify the addition of a climbing lane regardless of grade or traffic volumes.

The Project Development Manager (PDM) is to consider justification for climbing lanes when exceeding the critical length of grade based on a highway capacity analysis.

### HD-705.1.2 Shoulders on Truck-Climbing Lanes

Preferably, the shoulder on the outer edge of a climbing lane should be as wide as the shoulder on the normal 2-lane section, particularly where there is bicycle traffic. When adding the climbing lane to an existing highway and conditions dictate, a usable shoulder width of 4 feet or greater is acceptable.

## HD-705.2 EMERGENCY ESCAPE RAMPS

On long descending grades, an emergency escape ramp should be considered. The type of escape ramp is dependent on the existing conditions. See AASHTO'S *A Policy on Geometric Design of Highways and Streets* for further discussion on selection and methods of design.

Factors to be considered in selecting specific sites for an escape ramp on new or existing facilities include:

- Topography
- Length and percent of grade
- Potential speed
- Economics
- Environmental impacts
- Crash experience/data

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**Exhibit 700-01**

## COMMON GEOMETRIC PRACTICES
## RURAL LOCAL ROADS

| | TERRIAN | TRAFFIC VOLUME<br>UNDER 50 A.D.T. | 50-250 A.D.T. | 250-400 A.D.T. | 400-2000 A.D.T. | OVER 2000 A.D.T. |
|---|---|---|---|---|---|---|
| MINIMUM DESIGN SPEED (M.P.H.) ⑥ ⑦ | LEVEL | 30 | | 40 | 50 | |
| | ROLLING | 20 | 30 | | 40 | |
| | MOUNTAIN | 20 | | | 30 | |

| | DESIGN SPEED | UNDER 400 A.D.T. | 400-2000 A.D.T. | OVER 2000 A.D.T. |
|---|---|---|---|---|
| LANE WIDTH (FEET) ④ ⑧ | 15 MPH | 9 | 10 ⑨ | 11 |
| | 20 MPH | | | |
| | 25 MPH | | | |
| | 30 MPH | | | |
| | 40 MPH | | | |
| | 45 MPH | 10 | 11 | |
| | 50 MPH | | | |
| | 55 MPH | 11 | | 11 ⑩ |
| | 60 MPH | | | |
| MIN. USABLE SHOULDER WIDTH (FEET) ⑤ | ALL SPEEDS | 2 | 3 ⑨ | 6 |
| MIN. CLEAR ROADWAY WIDTH OF NEW AND RECONSTRUCTED BRIDGES | ALL SPEEDS | TOTAL WIDTH OF LANES +2' (EACH SIDE) | TOTAL WIDTH OF LANES +3' (EACH SIDE) | TOTAL WIDTH OF LANE + USABLE SHOULDER WIDTHS ⑪ |

| | DESIGN SPEED | eMAX. 4% | eMAX. 6% | eMAX. 8% |
|---|---|---|---|---|
| MINIMUM RADIUS (FEET) | 20 MPH | 86 | 81 | 76 |
| | 25 MPH | 154 | 144 | 134 |
| | 30 MPH | 250 | 231 | 214 |
| | 35 MPH | 371 | 340 | 314 |
| | 40 MPH | 533 | 485 | 444 |
| | 45 MPH | 711 | 643 | 587 |
| | 50 MPH | 926 | 833 | 758 |

| | |
|---|---|
| NORMAL PAVEMENT CROSS SLOPES ③ | RATE OF CROSS SLOPE = 2% |
| NORMAL SHOULDER CROSS SLOPES | EARTH = 8% PAVED = 4% |

| | M.P.H. | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MAXIMUM GRADE (PERCENT) | LEVEL | 9 | 8 | 7 | | | | | 6 | | 5 |
| | ROLLING | 12 | 11 | | 10 | | | 9 | 8 | 7 | 6 |
| | MOUNTAIN | 17 | 16 | 15 | 14 | | 13 | 12 | 10 | | — |
| MINIMUM STOPPING SIGHT DISTANCE ① | (FEET) | 80 | 115 | 155 | 200 | 250 | 305 | 360 | 425 | 495 | 570 |
| MINIMUM PASSING SIGHT DISTANCE ② | (FEET) | — | 400 | 450 | 500 | 550 | 600 | 700 | 800 | 900 | 1000 |

① MINIMUM STOPPPING SIGHT DISTANCE BASED ON AN EYE HEIGHT OF 3.5 FT AND AN OBJECT HEIGHT OF 2.0 FT. CONSIDER BOTH HORIZONTAL AND VERTICAL ALIGNMENTS.

② MINIMUM PASSING SIGHT DISTANCE BASED ON AN EYE HEIGHT OF 3.5 FT AND AN OBJECT HEIGHT OF 3.5 FT. CONSIDER BOTH HORIZONTAL AND VERTICAL ALIGNMENTS.

③ NORMAL PAVEMENT CROSS SLOPES ON BRIDGES IS 2%.

④ CONSIDER CURVE WIDENEING ON PROJECT WHEN TRUCKS AND/OR HORIZONTAL CURVATURE INDICATE A NEED.

⑤ FOR SLOPES 4:1 OR FLATTER, USABLE WIDTH IS GRADED WIDTH, FOR SLOPES STEEPER THAN 4:1, USABLE WIDTH TERMINATES AT THE SLOPE ROUNDING.

⑥ WHERE SELECTED DESIGN SPEED IS > 50 MPH, USE COMMON GEOMETRIC PRACTICES EXHIBIT 700-02 FOR RURAL COLLECTOR ROADS.

⑦ JUSTIFICATION FOR THE CHOSEN DESIGN SPEED SHOULD BE DOCUMENTED IN THE DESIGN EXECUTIVE SUMMARY.

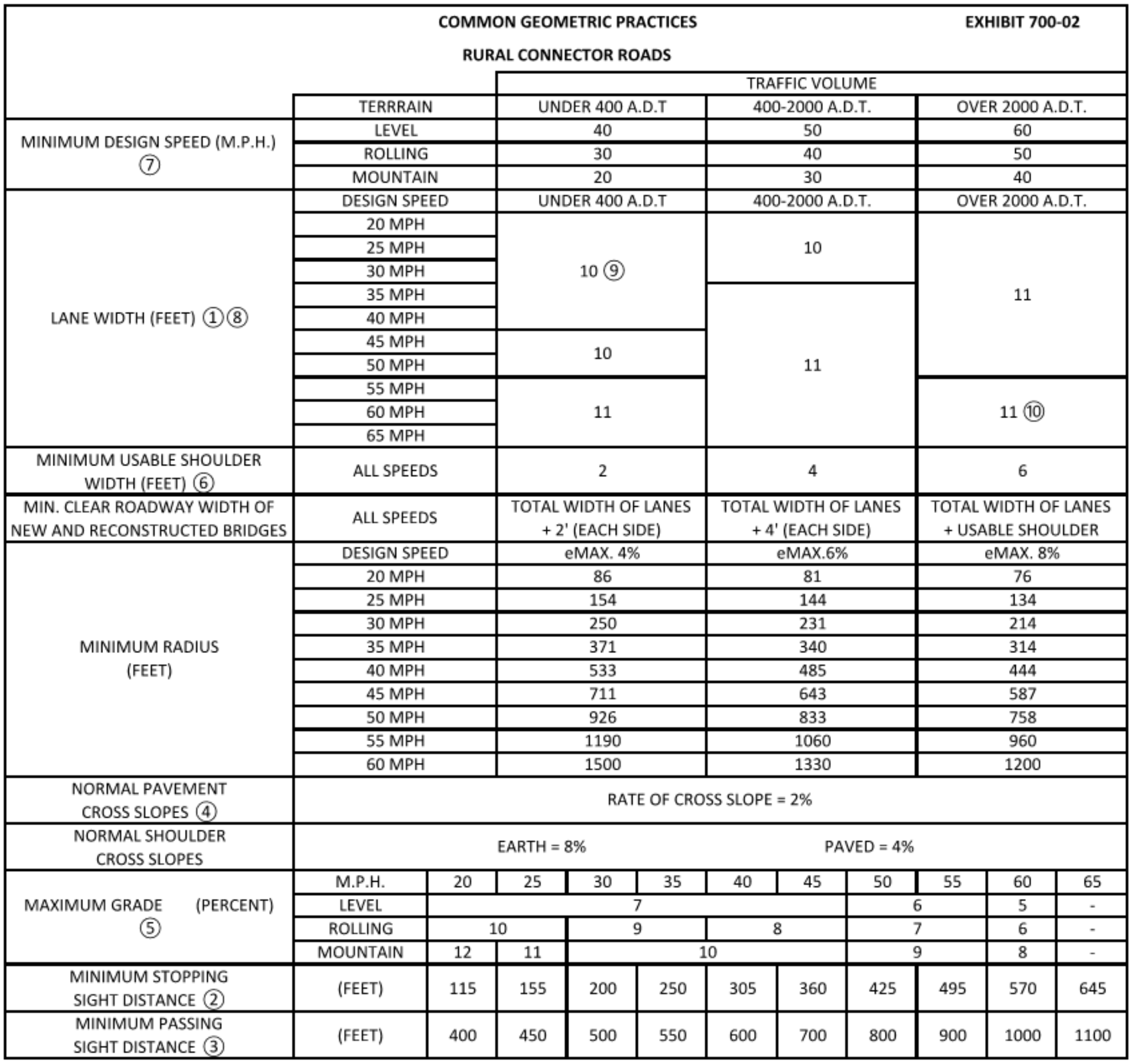
⑧ FOR ROADS ≤ 2000 ADT, REFER TO AASHTO'S "GUIDELINES FOR GEOMETRIC DESIGN OF LOW-VOLUME ROADS.

⑨ FOR ROADS IN MOUNTAINOUS TERRAIN WITH DESIGN VOLUME OF 400 TO 600 VEH/DAY, 9 FT LANE WIDTH MAY BE USED.

⑩ CONSIDER USING A LANE WIDTH OF 12 FT WHERE SUBSTANTIAL TRUCK VOLUMES ARE PRESENT OR AGRICULTURAL EQUIPMENT FREQUENTLY USES THE ROAD.

⑪ FOR BRIDGES IN EXCESS OF 100 FT IN LENGTH, THE MINIMUM WIDTH OF LANES + 3 FT (ON EACH SIDE) MAY BE ACCEPTABLE.

**Exhibit 700-02**



COMMON GEOMETRIC PRACTICES EXHIBIT 700-02

RURAL CONNECTOR ROADS

| | | TRAFFIC VOLUME | | |
|---|---|---|---|---|
| | TERRAIN | UNDER 400 A.D.T | 400-2000 A.D.T. | OVER 2000 A.D.T. |
| MINIMUM DESIGN SPEED (M.P.H.) ⑦ | LEVEL | 40 | 50 | 60 |
| | ROLLING | 30 | 40 | 50 |
| | MOUNTAIN | 20 | 30 | 40 |
| | DESIGN SPEED | UNDER 400 A.D.T | 400-2000 A.D.T. | OVER 2000 A.D.T. |
| LANE WIDTH (FEET) ①⑧ | 20 MPH | 10 ⑨ | 10 | 11 |
| | 25 MPH | | | |
| | 30 MPH | | | |
| | 35 MPH | | 11 | |
| | 40 MPH | | | |
| | 45 MPH | 10 | | |
| | 50 MPH | | | |
| | 55 MPH | 11 | | 11 ⑩ |
| | 60 MPH | | | |
| | 65 MPH | | | |
| MINIMUM USABLE SHOULDER WIDTH (FEET) ⑥ | ALL SPEEDS | 2 | 4 | 6 |
| MIN. CLEAR ROADWAY WIDTH OF NEW AND RECONSTRUCTED BRIDGES | ALL SPEEDS | TOTAL WIDTH OF LANES + 2' (EACH SIDE) | TOTAL WIDTH OF LANES + 4' (EACH SIDE) | TOTAL WIDTH OF LANES + USABLE SHOULDER |
| MINIMUM RADIUS (FEET) | DESIGN SPEED | eMAX. 4% | eMAX.6% | eMAX. 8% |
| | 20 MPH | 86 | 81 | 76 |
| | 25 MPH | 154 | 144 | 134 |
| | 30 MPH | 250 | 231 | 214 |
| | 35 MPH | 371 | 340 | 314 |
| | 40 MPH | 533 | 485 | 444 |
| | 45 MPH | 711 | 643 | 587 |
| | 50 MPH | 926 | 833 | 758 |
| | 55 MPH | 1190 | 1060 | 960 |
| | 60 MPH | 1500 | 1330 | 1200 |
| NORMAL PAVEMENT CROSS SLOPES ④ | RATE OF CROSS SLOPE = 2% | | | |
| NORMAL SHOULDER CROSS SLOPES | EARTH = 8% | | PAVED = 4% | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MAXIMUM GRADE (PERCENT) ⑤ | M.P.H. | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 |
| | LEVEL | 7 | | | | | | 6 | | 5 | - |
| | ROLLING | 10 | | 9 | | 8 | | 7 | | 6 | - |
| | MOUNTAIN | 12 | 11 | 10 | | | | 9 | | 8 | - |
| MINIMUM STOPPING SIGHT DISTANCE ② | (FEET) | 115 | 155 | 200 | 250 | 305 | 360 | 425 | 495 | 570 | 645 |
| MINIMUM PASSING SIGHT DISTANCE ③ | (FEET) | 400 | 450 | 500 | 550 | 600 | 700 | 800 | 900 | 1000 | 1100 |

① WIDEN PAVEMNT ON CURVES IN ACCORDANCE WITH APPROVED DESIGN STANDARDS. REFER TO CURRENT STANDARD DRAWING FOR ADDITIONAL DETAIL.
② MINIMUM STOPPING SIGHT DISTANCE BASED ON AN EYE HEIGHT OF 3.5 FT AND AN OBJECT HEIGHT OF 2.0 FT. CONSIDER BOTH HORIZONTAL AND VERTICAL ALIGNMENTS.
③ MINIMUM PASSING SIGHT DISTANCE BASED ON AN EYE HEIGHT OF 3.5 FT AND AN OBJECT HEIGHT OF 3.5 FT. CONSIDER BOTH HORIZONTAL AND VERTICAL ALIGNMENTS.
④ NORMAL PAVEMENT CROSS SLOPES ON BRIDGES IS 2%.
⑤ MAY USE ONE PERCENT STEEPER MAXIMUM GRADES ON SHORT LENGTHS (LESS THAT 500 FT) AND ON ONE-WAY DOWN GRADES; FOR LOW-VOLUME RURAL COLLECTORS (AADT LESS THAN 2,000 VEH/DAY), THE MAXIMUM GRADE MAY BE 2% STEEPER.
⑥ FOR SLOPES 4:1 OR FLATTER, USABLE WIDTH IS GRADED WIDTH. FOR SLOPES STEEPER THAN 4:1 USABLE WIDTH TERMINATES AT THE SLOPE ROUNDING.
⑦ JUSTIFICATION FOR THE SELECTED DESIGN SPEED SHOULD BE DOCUMENTED IN THE DESIGN EXECUTIVE SUMMARY.
⑧ ON ROADSWAYS TO BE RECONSTRUCTED, 11 FT LANES MAY BE RETAINED WHERE SAFETY RECORDS AND ALIGNMENT ARE SATISFACTORY.
⑨ 18 FT MINIMUM WIDTH (9 FT LANES) MAY BE USED FOR ROADWAYS WITH DESIGN VOLUMES UNDER 250 A.D.T.
⑩ CONSIDER USING A LANE WIDTH OF 12 FT WHERE SUBSTANTIAL TRUCK VOLUMES ARE PRESENT OR AGRICULTURAL EQUIPMENT FREQUENTLY USES THE ROAD.
⑪ FOR BRIDGES IN EXCESS OF 100 FT IN LENGTH, THE MINIMUM WIDTH OF LANES + 3 FT (ON EACH SIDE) MAY BE ACCEPTABLE.

**COMMON GEOMETRIC PRACTICES** **EXHIBIT 700-03**

**RURAL ARTERIAL ROADS (OTHER THAN FREEWAYS) ④⑦**

| | | | | |
|---|---|---|---|---|
| | TERRAIN | | | |
| DESIGN SPEED (M.P.H.) ⑥ | LEVEL | 50-75 | | |
| | ROLLING | 50-65 | | |
| | MOUNTAIN | 45-60 | | |
| | | TRAFFIC VOLUME | | |
| LANE WIDTH (FEET) ⑧ | DESIGN SPEED | UNDER 400 A.D.T. ⑪ | 400-2000 A.D.T | OVER 2000 A.D.T |
| | 40 MPH | 10 | 11 | 12 |
| | 45 MPH | | | |
| | 50 MPH | 11 | | |
| | 55 MPH | | 12 | |
| | 60 MPH | | | |
| | 65 MPH | | | |
| | 70 MPH | | | |
| | 75 MPH | | | |
| MIN. USABLE SHOULDER WIDTH (FEET) ⑤⑨ | ALL SPEEDS | 4 | 6 | 8 |
| MIN. CLEAR ROADWAY WIDTH OF NEW AND RECONSTRUCTED BRIDGES | ALL SPEEDS | TOTAL WIDTH OF LANES + USABLE SHOULDER WIDTHS ⑩ | | |
| MINIMUM RADIUS (FEET) | DESIGN SPEED | eMAX. 4% | eMAX. 6% | eMAX. 8% |
| | 30 MPH | 250 | 231 | 214 |
| | 35 MPH | 371 | 340 | 314 |
| | 40 MPH | 533 | 485 | 444 |
| | 45 MPH | 711 | 643 | 587 |
| | 50 MPH | 926 | 833 | 758 |
| | 55 MPH | 1190 | 1060 | 960 |
| | 60 MPH | 1500 | 1330 | 1200 |
| | 65 MPH | --- | 1660 | 1480 |
| | 70 MPH | --- | 2040 | 1810 |
| | 75 MPH | --- | 2500 | 2210 |
| NORMAL PAVEMENT CROSS SLOPES ③ | RATE OF CROSS SLOPES = 2% | | | |
| NORMAL SHOULDER CROSS SLOPES | EARTH = 8% | PAVED = 4% | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAXIMUM GRADE (PERCENT) | M.P.H. | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| | LEVEL | 5 | | | | | | 4 | | 3 | | | | |
| | ROLLING | 8 | | 7 | | 6 | | 5 | | 4 | | | | |
| | MOUNTAIN | 10 | 9 | 8 | | | 7 | | 6 | | 5 | | | |
| MINIMUM STOPPING SIGHT DISTANCE ① | (FEET) | 115 | 155 | 200 | 250 | 305 | 360 | 425 | 495 | 570 | 645 | 730 | 820 | 910 |
| MINIMUM PASSING SIGHT DISTANCE ② | (FEET) | 400 | 450 | 500 | 550 | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 | 1300 | 1400 |

① MINIMUM STOPPING SIGHT DISANCE BASED ON AN EYE HEIGHT OF 3.5 FT AND AN OBJECT HEIGHT OF 2.0 FT. CONSIDER BOTH HORIZONTAL AND VERTICAL ALIGNMENTS.

② MINIMUM PASSING SIGHT DISTANCE BASED ON AN EYE HEIGHT OF 3.5 FT AND AN OBJECT HEIGHT OF 3.5 FT. CONSIDER BOTH HORIZONTAL AND VERTICAL ALIGNMENTS.

③ NORMAL PAVEMENT CROSS SLOPES ON BRIDGES IS 2%.

④ FOR GUIDANCE ON FREEWAYS, REFER TO AASHTO'S, "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS", CURRENT EDITION.

⑤ FOR SLOPES 4:1 OR FLATTER, USABLE WIDTH IS THE SAME AS GRADED WIDTH, FOR SLOPES STEEPER THAN 4:1, USABLE WIDTH TERMINATES AT SLOPE ROUNDING.

⑥ JUSTIFICATION FOR THE SELECTED DESIGN SPEED SHOULD BE DOCUMENTED IN THE DESIGN EXECUTIVE SUMMARY.

⑦ FOR GUIDANCE ON INTERSTATES, REFER TO AASHTO, "A POLICY ON DESIGN STANDARDS INTERSTATE SYSTEM", CURRENT EDITION.

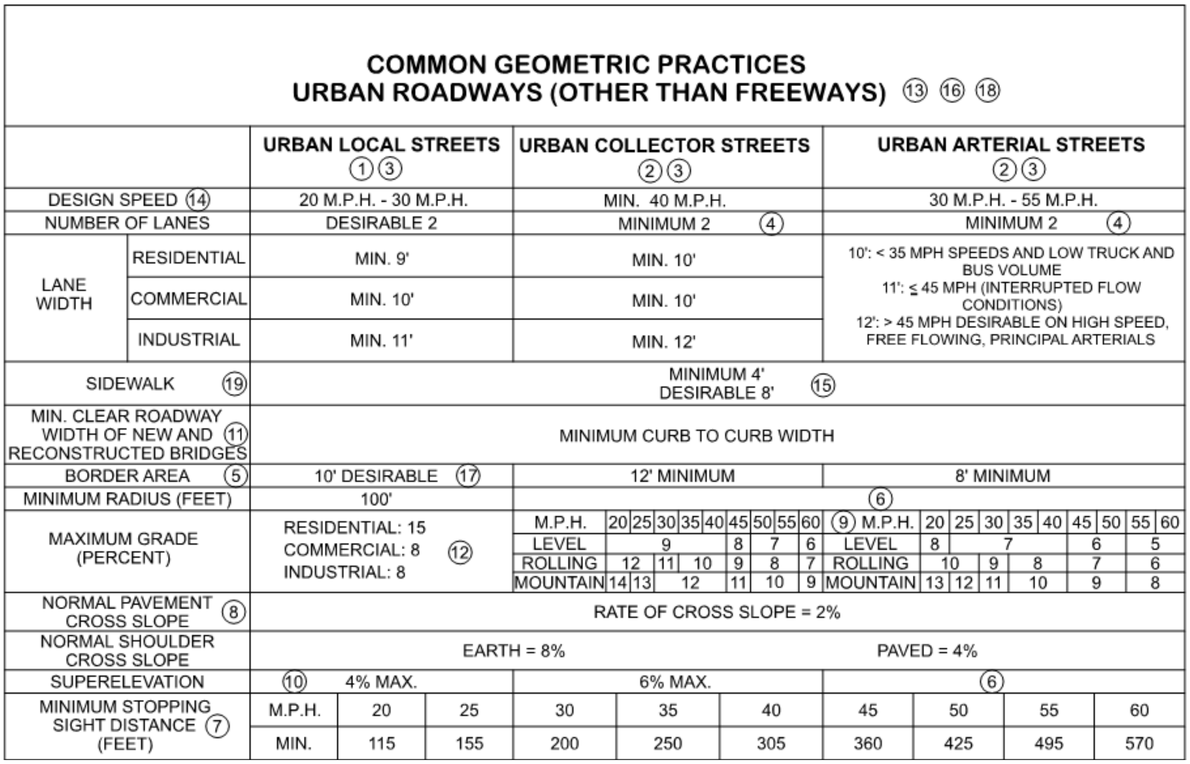
⑧ ON ROADWAYS TO BE RECONSTRUCTED, EXISTING 11FT LANES MAY BE RETAINED WHERE THE SAFETY RECORDS AND ALIGNMENT ARE SATISFACTORY.

⑨ PREFERABLY, USABLE SHOULDERS ON ARTERIALS SHOULD BE PAVED; HOWEVER, WHERE VOLUMES ARE LOW OR IN AREAS WHERE WIDE PAVED SHOULDERS ARE UNDESIRABLE, THE PAVED PORTION MAY BE A MINIMUM OF 2FT, PROVIDED BICYCLE ACCOMMODATIONS ARE NOT BEING PROVIDED.

⑩ ON BRIDGES IN EXCESS OF 200FT IN LENGTH, OFFSET TO PARAPET, RAIL, OR BARRIER MAY BE AT A MINIMUM OF 4FT FROM EDGE OF TRAVELED WAY ON BOTH SIDES.

⑪ WHERE FREQUENT USE BY TRUCKS IS ANTICIPATED, ADDITIONAL TRAVELED-WAY SHOULD BE CONSIDERED.

**Exhibit 700-04**



## COMMON GEOMETRIC PRACTICES
## URBAN ROADWAYS (OTHER THAN FREEWAYS) ⑬ ⑯ ⑱

| | | URBAN LOCAL STREETS ①③ | URBAN COLLECTOR STREETS ②③ | URBAN ARTERIAL STREETS ②③ |
|---|---|---|---|---|
| DESIGN SPEED ⑭ | | 20 M.P.H. - 30 M.P.H. | MIN. 40 M.P.H. | 30 M.P.H. - 55 M.P.H. |
| NUMBER OF LANES | | DESIRABLE 2 | MINIMUM 2 ④ | MINIMUM 2 ④ |
| LANE WIDTH | RESIDENTIAL | MIN. 9' | MIN. 10' | 10': < 35 MPH SPEEDS AND LOW TRUCK AND BUS VOLUME<br>11': ≤ 45 MPH (INTERRUPTED FLOW CONDITIONS)<br>12': > 45 MPH DESIRABLE ON HIGH SPEED, FREE FLOWING, PRINCIPAL ARTERIALS |
| | COMMERCIAL | MIN. 10' | MIN. 10' | |
| | INDUSTRIAL | MIN. 11' | MIN. 12' | |
| SIDEWALK ⑲ | | MINIMUM 4'<br>DESIRABLE 8' ⑮ | | |
| MIN. CLEAR ROADWAY WIDTH OF NEW AND RECONSTRUCTED BRIDGES ⑪ | | MINIMUM CURB TO CURB WIDTH | | |
| BORDER AREA ⑤ | | 10' DESIRABLE ⑰ | 12' MINIMUM | 8' MINIMUM |
| MINIMUM RADIUS (FEET) | | 100' | ⑥ | |
| MAXIMUM GRADE (PERCENT) | | RESIDENTIAL: 15<br>COMMERCIAL: 8<br>INDUSTRIAL: 8 ⑫ | | |
| NORMAL PAVEMENT CROSS SLOPE ⑧ | | RATE OF CROSS SLOPE = 2% | | |
| NORMAL SHOULDER CROSS SLOPE | | EARTH = 8% | | PAVED = 4% |
| SUPERELEVATION | | ⑩ 4% MAX. | 6% MAX. | ⑥ |

| M.P.H. | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | ⑨ M.P.H. | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LEVEL | 9 | | | | | 8 | 7 | | 6 | LEVEL | 8 | 7 | | | | 6 | | 5 | |
| ROLLING | 12 | | 11 | 10 | | 9 | 8 | | 7 | ROLLING | 10 | | 9 | 8 | | 7 | | 6 | |
| MOUNTAIN | 14 | 13 | 12 | | | 11 | 10 | | 9 | MOUNTAIN | 13 | 12 | 11 | 10 | | 9 | | 8 | |

| MINIMUM STOPPING SIGHT DISTANCE ⑦ (FEET) | M.P.H. | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|
| | MIN. | 115 | 155 | 200 | 250 | 305 | 360 | 425 | 495 | 570 |

① TURNING LANES: 9' MINIMUM-12' DESIRED; PARKING LANES: RESIDENTIAL- 7' MINIMUM; COMMERCIAL & INDUSTRIAL- 8' MINIMUM.

② TURNING LANES: 10' MINIMUM- 12' DESIRED: PARKING LANES: RESIDENTIAL- 7'-8'; COMMERCIAL & INDUSTRIAL- 8'-11'.

③ VERTICAL CURBS WITH HEIGHTS OF 4" OR GREATER ADJACENT TO TRAVELED WAY SHOULD BE OFFSET A MINIMUM OF 1 FOOT. WHEN A CURB AND GUTTER SECTION IS PROVIDED, THE GUTTER PAN WIDTH, NORMALLY 2 FEET, SHOULD BE USED AS THE OFFSET DISTANCE.

④ THE NUMBER OF LANES TO BE PROVIDED ON STREETS WITH CURRENT ADT OF 2000 OR GREATER SHOULD BE DETERMINED BY A HIGHWAY CAPACITY ANALYSIS OF THE DESIGN TRAFFIC VOLUMES. SUCH ANALYSIS SHOULD BE MADE FOR FUTURE DESIGN TRAFFIC. (DESIRABLE)

⑤ THE BORDER AREA, MEASURED FROM THE FACE OF CURB, BETWEEN THE ROADWAY AND THE RIGHT-OF-WAY LINE SHOULD BE WIDE ENOUGH TO SERVE SEVERAL PURPOSES, INCLUDING SERVING AS A BUFFER SPACE BETWEEN PEDESTRIANS AND VEHICULAR TRAFFIC; A SIDEWALK; AND AN AREA FOR UTILITIES.

⑥ REFER TO CHAPTER 3 OF AASHTO'S "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS", CURRENT EDITION.

⑦ MINIMUM STOPPING SIGHT DISTANCE BASED ON AN EYE HEIGHT OF 3.5 FT AND AN OBJECT HEIGHT OF 2.0 FT. CONSIDER BOTH HORIZONTAL AND VERTICAL ALIGHMENTS.

⑧ NORMAL PAVEMENT CROSS SLOPES ON BRIDGES SHALL BE 2%.

⑨ ARTERIALS WITH LARGE NUMBER OF TRUCKS AND OPERATING NEAR CAPACITY SHOULD CONSIDER GRADES FLATTER THAN THOSE IN RURAL SECTIONS TO AVOID UNDESIRABLE REDUCTIONS IN SPEED.

⑩ SUPERELEVATION MAY NOT BE REQUIRED ON LOCAL STREETS IN RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL AREAS.

⑪ THE BRIDGE WIDTH FOR URBAN ROADWAYS WITH SHOULDERS SHOULD NOT BE LESS THAN WIDTHS SHOWN FOR RURAL ROADS APPROVED ROADWAY WIDTHS.

⑫ MAXIMUM GRADES OF SHORT LENGTHS (LESS THAN 500') AND ON ONE-WAY DOWN GRADES MAY BE TWO PERCENT STEEPER.

⑬ FOR GUIDANCE ON FREEWAYS, REFER TO AASHTO'S, "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS", CURRENT EDITION.

⑭ INTERMEDIATE DESIGN SPEEDS (5 MPH INCREMENTS) MAY BE APPROPIRATE WHERE TERRAIN AND OTHER ENVIRONMENTAL CONDITIONS DICTATE.

⑮ REFER TO AASHTO'S "GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES", CURRENT EDITION, WHEN COMBINING A PEDESTRIAN SIDEWALK WITH A BICYCLE PATH.

⑯ FOR GUIDANCE ON INTERSTATES, REFER TO AASHTO'S "A POLICY ON DESIGN STANDARDS INTERSTATE SYSTEM", CURRENT EDITION.

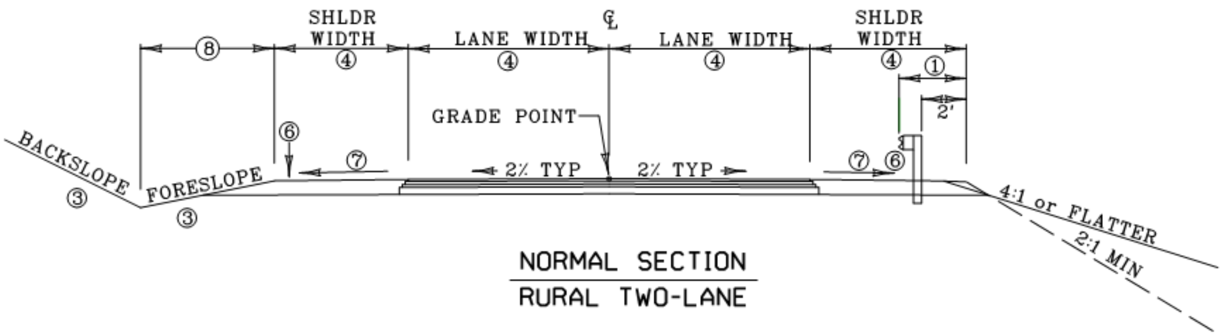
⑰ WHERE RIGHT-OF-WAY IS LIMITED, A BORDER AREA OF 2 FT MAY BE TOLERATED WHERE NO SIDEWALK IS PRESENT.

⑱ FOR ADDITIONAL GUIDANCE FOR ROADS < 2000 ADT, REFER TO "GUIDELINES FOR GEOMETRIC DESIGN OF LOW-VOLUME ROADS", 2019 EDITION.

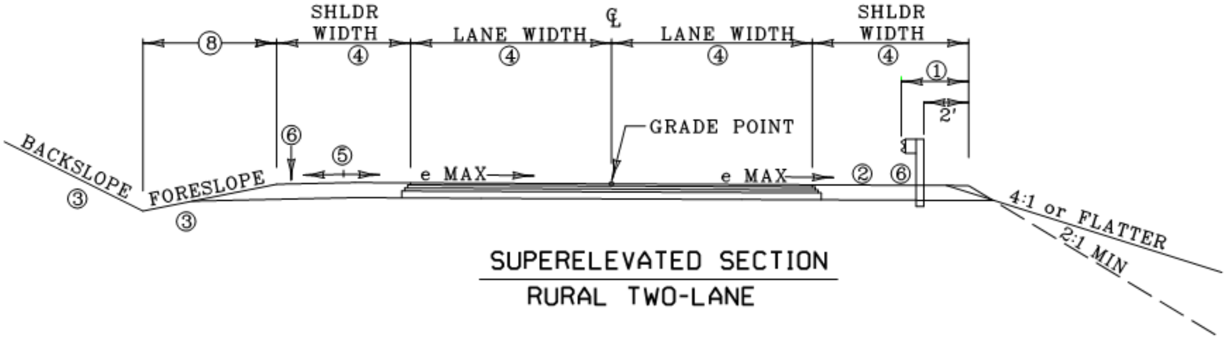
⑲REFER to AASHTO'S "GUIDE FOR THE PLANNING, DESIGN, AND OPERATION OF PEDESTRIAN FACILITIES”, CURRENT EDITION.

**Exhibit 700-5**

# TYPICAL SECTIONS



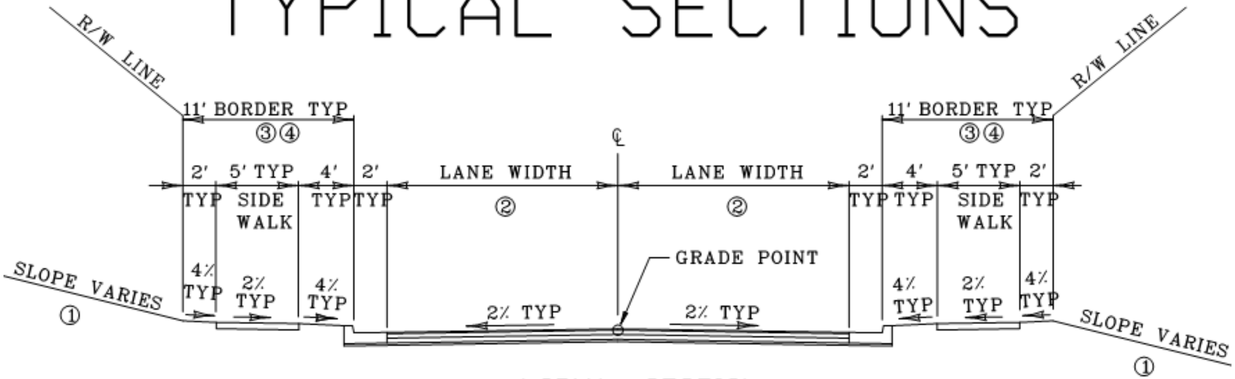
NORMAL SECTION
RURAL TWO-LANE



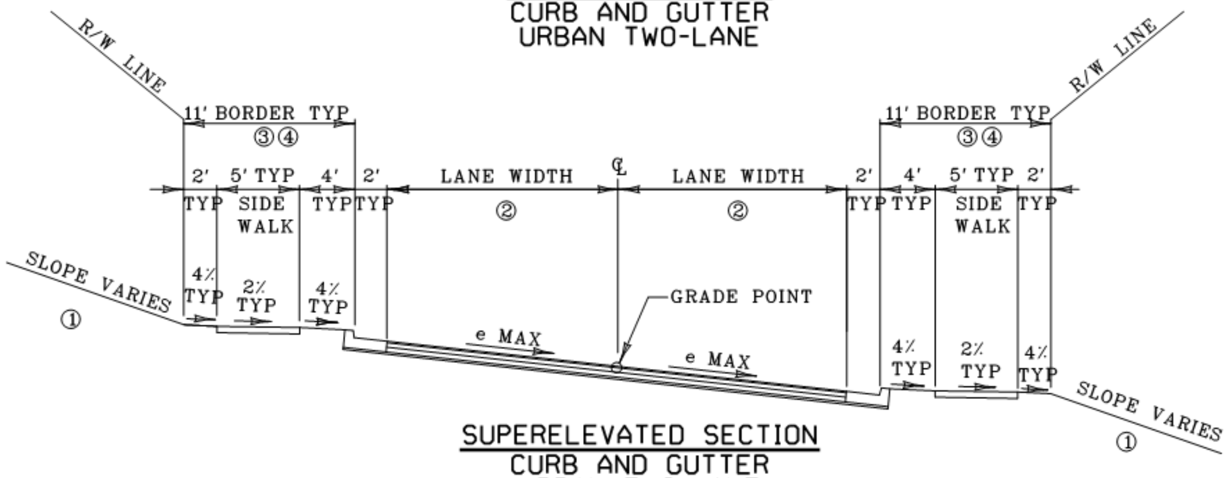
SUPERELEVATED SECTION
RURAL TWO-LANE

① SHOULDERS SHALL BE WIDENED 3 FEET 5 INCHES WHERE GUARDRAIL IS TO BE INSTALLED ALLOWING FOR 2 FEET OF FILL BEHIND THE POSTS. IF IT IS NOT PRACTICAL TO WIDEN THE SHOULDER BY 2 FEET, THEN LONGER POSTS MAY BE USED.
② SUPERELEVATED SHOULDERS - CONSTRUCT TO STANDARD SUPERELEVATION, EXCEPT NOT FLATTER THAN THE SLOPE INDICATED FOR NORMAL SECTION.
③ REFER TO AASHTO'S "ROADSIDE DESIGN GUIDE", CURRENT EDITION, FOR SPECIFIC SLOPE GUIDANCE FOR FORSLOPE AND BACK SLOPE.
④ REFER TO KYTC COMMON GEOMETRIC PRACTICE EXHIBITS 700-01 TO 700-04 AND AASHTO'S "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS", CURRENT EDITION, FOR RECOMMENDED LANE AND SHOULDER WIDTHS OF THE VARIOUS ROADWAY CLASSIFICATIONS. FOR LOCAL AND COLLECTOR ROADWAYS WITH ADT EQUAL TO OR LESS THAN 2000, REFER TO AASHTO'S "GUIDELINES FOR GEOMETRIC DESIGN OF LOW-VOLUME ROADS".
⑤ FOR A PAVED SHOULDER WIDTH LESS THAN OR EQUAL TO 4 FEET, NO BREAK IN SLOPE IS REQUIRED. FOR A PAVED SHOULDER WIDTH GREATER THAN 4 FEET, THE BREAK IN SLOPE ON THE HIGH SIDE IS TO OCCUR AT THE MIDPOINT, OR AS APPROPRIATE, WITH A MAXIMUM ROLL-OVER OF 12 PERCENT.
⑥ SHOULDER MAY BE PAVED TO WITHIN 2 FEET (1 FOOT MINIMUM) OF THE SLOPE BREAK OR TO THE FACE OF THE BARRIER.
⑦ NORMAL SHOULDER CROSS SLOPE: EARTH = 8%, PAVED = 4%
⑧ WIDTH VARIES PER DRAINAGE/"ROADSIDE DESIGN GUIDE" REQUIREMENTS.

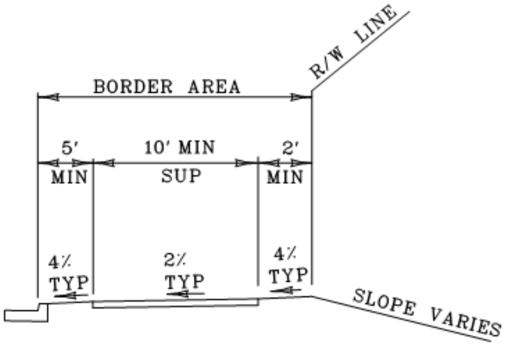
# TYPICAL SECTIONS



NORMAL SECTION
CURB AND GUTTER
URBAN TWO-LANE



SUPERELEVATED SECTION
CURB AND GUTTER
URBAN TWO-LANE



④ SHARED-USE PATH (SUP)

① REFER TO AASHTO’S "ROADSIDE DESIGN GUIDE", CURRENT EDITION, FOR SPECIFIC SLOPE GUIDELINES.

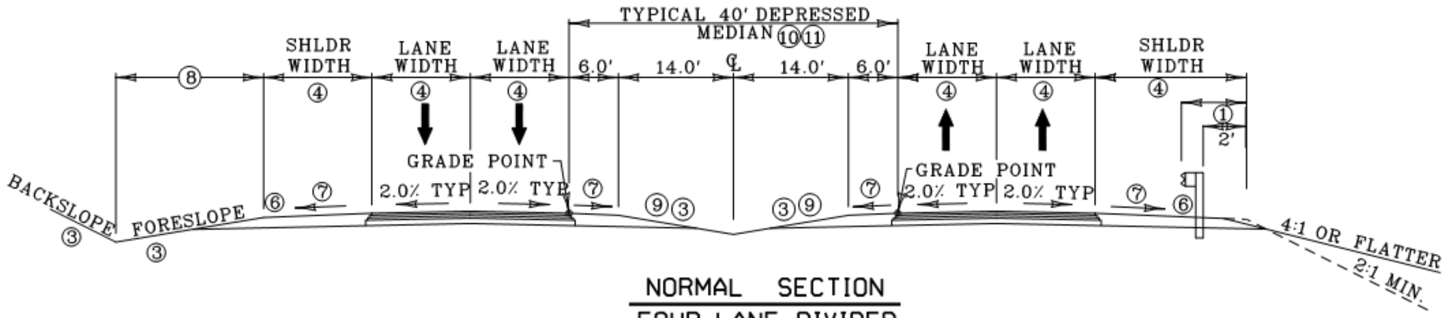
② REFER TO KYTC COMMON GEOMETRIC PRACTICES EXHIBITS 700-01 THRU 700-04 AND AASHTO'S "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS", CURRENT EDITION, FOR SUGGESTED LANE WIDTHS OF THE VARIOUS ROADWAY CLASSIFICATIONS. FOR ROADWAYS WITH ADT 2000 OR LESS, REFER TO AASHTO'S "GUIDELINES FOR GEOMETRIC DESIGN OF LOW-VOLUME ROADS".

③ BORDER AREA IS WIDTH FROM FACE OF CURB TO RIGHT OF WAY. THE BORDER AREA CAN VARY DEPENDING ON THE ROADWAY CLASSIFICATION. REFER TO AASHTO'S "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS", CURRENT EDITION.

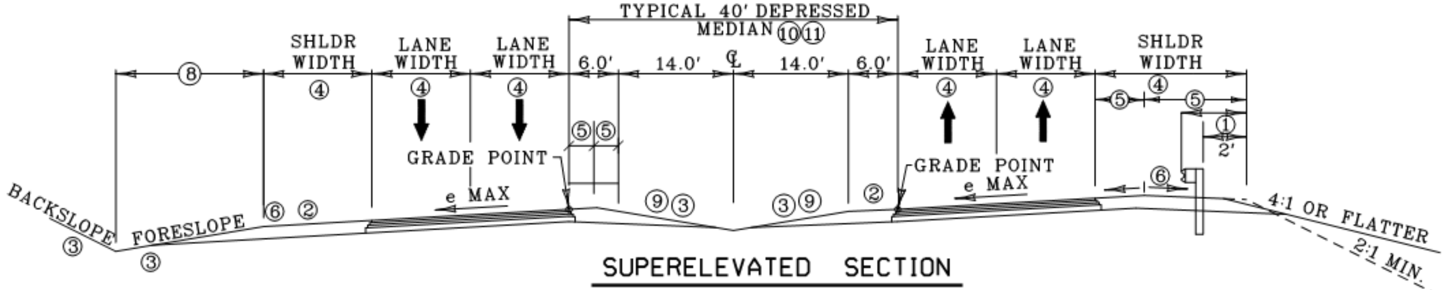
④ REFER TO "GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES", CURRENT EDITION, FOR SUP GEOMETRIC GUIDELINES, CHAPTER 5.

**Exhibit 700-07**

# TYPICAL SECTIONS



NORMAL SECTION
FOUR-LANE DIVIDED



SUPERELEVATED SECTION
FOUR-LANE DIVIDED

① SHOULDERS SHALL BE WIDENED 3 FEET 5 INCHES WHERE GUARDRAIL IS TO BE INSTALLED ALLOWING FOR 2 FEET OF FILL BEHIND THE POSTS. IF IT IS NOT PRACTICAL TO WIDEN THE SHOULDER BY 2 FEET, THEN LONGER POSTS MAY BE USED.

② SUPERELEVATED SHOULDERS - CONSTRUCT TO STANDARD SUPERELEVATION, EXCEPT NOT FLATTER THAN THE SLOPE INDICATED FOR NORMAL SECTION. AFTER THE NORMAL SHOULDER CROSS-SLOPE IS EXCEEDED, THE FULL WIDTH OF THE INSIDE SHOULDER IS ROTATED TO MATCH THE ROADWAY SUPERELEVATION.

③ REFER TO AASHTO'S "ROADSIDE DESIGN GUIDE", CURRENT EDITION, FOR SPECIFIC SLOPE GUIDANCE FOR FORESLOPE AND BACKSLOPE.

④ REFER TO KYTC COMMON GEOMETRIC PRACTICE EXHIBITS 700-1 THRU 700-4 AND AASHTO'S "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS", CURRENT EDITION, FOR RECOMMENDED LANE AND SHOULDER WIDTHS OF THE VARIOUS ROADWAY CLASSIFICATIONS. FOR LOCAL AND COLLECTOR ROADWAYS WITH ADT EQUAL TO OR LESS THAN 2000, REFER TO AASHTO'S "GUIDELINES FOR GEOMETRIC DESIGN OF LOW-VOLUME ROADS".

⑤ FOR A PAVED SHOULDER WIDTH LESS THAN OR EQUAL TO 4 FEET, NO BREAK IN SLOPE IS REQUIRED.
FOR A PAVED SHOULDER WIDTH GREATER THAN 4 FEET, THE BREAK IN SLOPE ON THE HIGH SIDE IS TO OCCUR AT THE MIDPOINT, OR AS APPROPRIATE, WITH A MAXIMUM ROLL-OVER OF 12 PERCENT.

⑥ SHOULDER MAY BE PAVED TO WITHIN 2 FEET (1 FOOT MINIMUM) OF THE SLOPE BREAK OR TO THE FACE OF THE BARRIER.

⑦ NORMAL SHOULDER CROSS SLOPE: EARTH - 8%, PAVED - 4%

⑧ WIDTH VARIES PER DRAINAGE/"ROADSIDE DESIGN GUIDE" REQUIREMENTS.

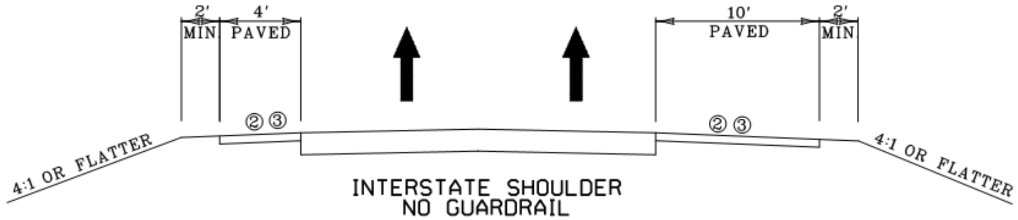
⑨ 4:1 MINIMUM; 6:1 DESIRABLE

⑩ WHEN MEDIANS ARE LESS THAN 40 FEET, BARRIERS SHOULD BE CONSIDERED.

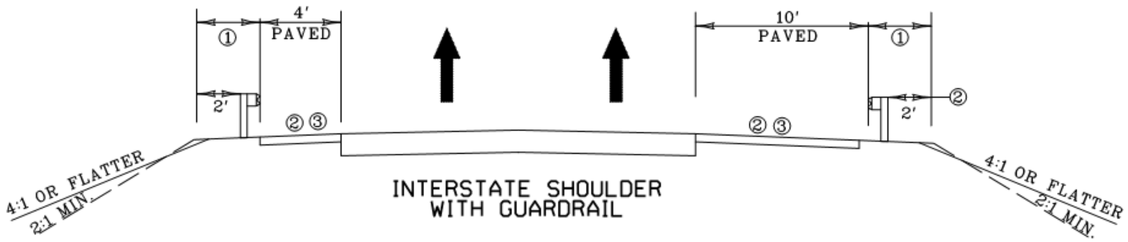
⑪ WHEN LEFT TURN LANES OCCUPY A PORTION OF THE MEDIAN, SEE CROSSROAD PROFILE EXHIBIT 900-01.

**Exhibit 700-08**

# INTERSTATE SHOULDER WIDTHS

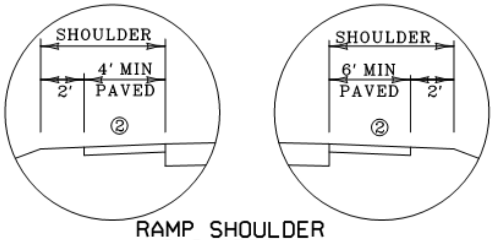


INTERSTATE SHOULDER
NO GUARDRAIL

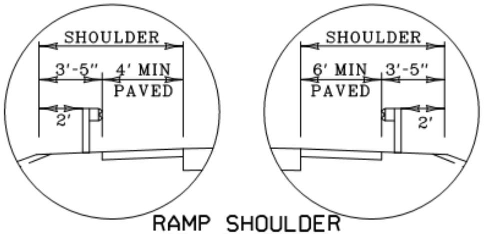


INTERSTATE SHOULDER
WITH GUARDRAIL

① SHOULDERS SHALL BE WIDENED 3 FEET 5 INCHES WHERE GUARDRAIL IS TO BE INSTALLED ALLOWING FOR 2 FEET OF FILL BEHIND THE POSTS. IF IT IS NOT PRACTICAL TO WIDEN THE SHOULDER BY 2 FEET, THEN LONGER POSTS MAY BE USED.
② CONSULT FHWA'S "A POLICY ON DESIGN STANDARDS - INTERSTATE SYSTEM" FOR SHOULDER WIDTHS ON SECTIONS WITH SIX LANES OR MORE.
③ WHERE TRUCK TRAFFIC EXCEEDS 250 DDHV A PAVED WIDTH OF 12' CAN BE CONSIDERED.



RAMP SHOULDER
NO GUARDRAIL



RAMP SHOULDER
WITH GUARDRAIL

*Chapter*

ROADSIDE DESIGN

*Subject*

Design Elements

## HD-801.1 OVERVIEW

AASHTO's *Roadside Design Guide* and engineering judgment should be used for roadside safety design.

The roadside is the area between the outside edge of the usable shoulder and the right-of-way limits. The area between roadways of a divided highway may also be considered the roadside. The roadside is as vital to the safe operation of a vehicle as the pavement itself.

Roadside safety design is an essential component of the total highway design and should be thoroughly considered during the design process. The goal of roadside safety design is to create an unencumbered roadside recovery area which allows for errant vehicles to recover and supports a roadside design where serious consequences are reduced.

When feasible, the designer should follow the suggested roadside safety options listed below:

- Remove the obstacle.
- Redesign the obstacle so that it can be safely traversed.
- Relocate the obstacle to a point where it is less likely to be struck.
- Reduce impact severity by using an appropriate breakaway device.
- Shield the obstacle with a traffic barrier or a crash cushion.
- Delineate the obstacle if the above alternatives are not appropriate.

## HD-801.2 CLEAR ZONE

An important concept in roadside design is the clear zone. Clear zone is the total roadside area available for safe use by errant vehicles, starting at the edge of the traveled way. The traveled way is the portion of the roadway for movement of vehicles, exclusive of the shoulders and bicycle lanes.

## HD-801.2 CLEAR ZONE (cont.)

Clear-zone width is not a geometric design element subject to the Design Exception Process; however, a discussion of clear zone is required in the Design Executive Summary (DES).

Clear-zone width is dependent upon traffic volumes, design speed, and roadside geometry. The designer should consider the context of the existing and adjacent roadways, as well as associated crash data when selecting a clear-zone width. The clear zone should be consistent within the project corridor. (See AASHTO's *Roadside Design Guide* for specific information.) For clear zones on low volume and low speed roads, see the FHWA Publication No. FHWA-CFL/TD-05-009, *Barrier Guide for Low Volume and Low Speed Roads*.

The clear-zone area may consist of a shoulder, a recoverable slope, a nonrecoverable slope, and/or a clear runout area. Foreslopes parallel to the flow of traffic may be identified as recoverable, nonrecoverable, or critical.

- A *recoverable slope* is a slope on which a motorist may retain or regain control of the vehicle. Slopes 4:1 and flatter are generally considered recoverable.
- A *nonrecoverable slope* is a slope that is considered traversable, but on which the errant vehicle will continue to the bottom. Slopes between 3:1 and 4:1 may be considered traversable, but nonrecoverable.
- A *critical slope* is a slope on which the vehicle is likely to overturn. Slopes steeper than 3:1 are generally considered critical.

**Note:** If an area is not likely to be maintained free of fixed objects, it should not be considered part of the clear-zone area.

In addition to side slopes, there are slopes created by median crossovers, berms, driveways, or intersecting side roads. The *Roadside Design Guide* refers to these slopes as "transverse slopes." These are generally more critical to errant motorists than foreslopes or backslopes because they are typically struck head-on. Transverse slopes of 6:1 or flatter are suggested for high-speed roadways.

Another important consideration when evaluating clear zone is configuration of the roadside ditches in cut situations. The designer should refer to AASHTO's *Roadside Design Guide* for specific information concerning suggested foreslope and backslope combinations of proposed ditches.

## HD-801.3 ROADSIDE BARRIERS

The primary goal of the road designer is to provide an adequate clear zone free of any rigid obstacles. When it is not practical to provide a full clear zone, traffic barriers should be considered.

## HD-801.3 ROADSIDE BARRIERS (cont.)

**Note:** Barriers are hazards in and of themselves and should only be used when the barrier is less of a hazard than the object itself. Barriers should comply with the National Cooperative Highway Research Program (NCHRP) *Report 350* or AASHTO's *Manual for Assessing Safety Hardware* (MASH) guidelines.

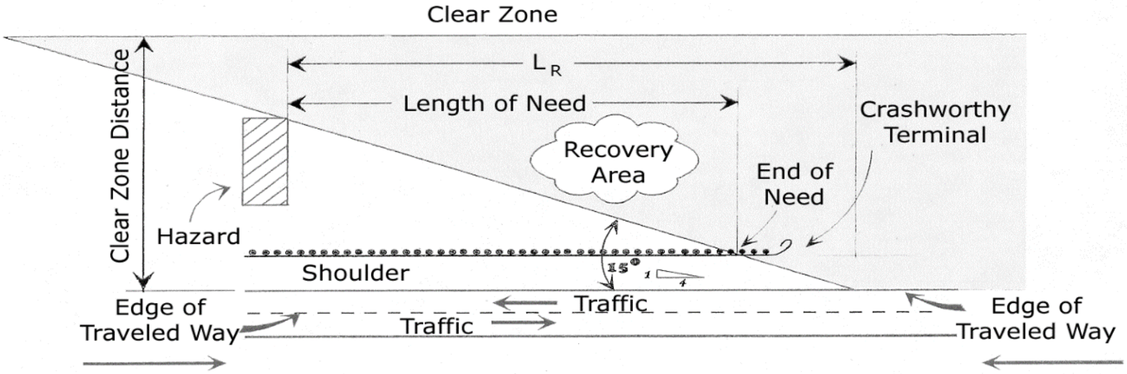
A roadside barrier is a longitudinal barrier used to shield motorists from either natural or manmade obstacles located along either side of the traveled way. There are occasions when barriers may be used for reasons other than shielding motorists from obstacles (for example, road closure barricades and barriers protecting pedestrians or sensitive areas).

Through judicious arrangements and a balance of geometric features, every highway should be designed to preclude or minimize the need for barriers or other protective devices. When it is determined that a barrier is to be utilized, the designer should refer to the Transportation Cabinet's *Standard Drawings* and to AASHTO's *Roadside Design Guide* for specific information concerning lateral offsets, barrier deflection, terrain effects, flare rates, and length of need.

When determining the placement of a roadside barrier, the designer should note that the Transportation Cabinet utilizes a fixed vehicle encroachment (divergence) angle of 15 degrees from the edge of the traveled way to the obstacle. This calculation derives the "Length of Need" for the barrier.

**Note:** "Length of Need" begins with the first non-breakaway portions of the barrier. The following figure is an illustration of "Length of Need":

**Length of Need**



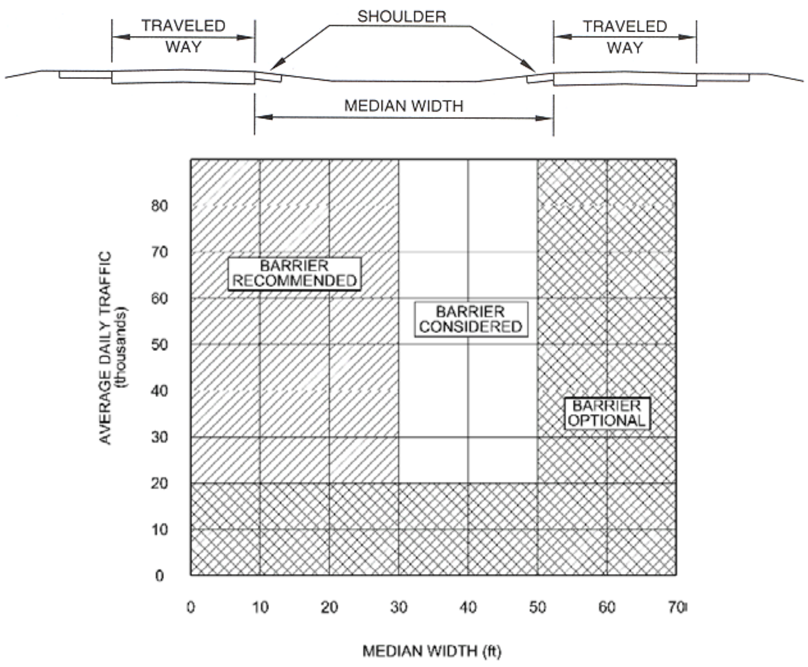
## HD-801.4 CURBS

Except for impacts at very low operating speeds, curbs typically have no redirectional qualities. When a curb is adjacent to the traveled way, the minimum operational clearance shall be 2 feet. For roadways with design speed ranging between 30 and 45 mph and with a curb adjacent to the traveled way, the border should be free of obstacles. The use of guardrail within the border area should be carefully evaluated. If guardrail is utilized in the border area, it should present less of a hazard than the obstacle being shielded. For clear zones in urban areas, see Chapter 10 of AASHTO's *Roadside Design Guide* for further guidance.

## HD-801.5 MEDIAN BARRIERS

A median barrier is a longitudinal barrier used to separate traffic on a divided highway and prevent an errant vehicle from crossing the highway median. Although similar to roadside barrier designs, most median barriers are designed to redirect vehicles striking either side of the barrier. As with all other types of traffic barriers, a median barrier should be installed only if the consequences of striking the barrier are expected to be less severe than if no barrier existed. Median barriers should comply with NCHRP Report 350 or MASH guidelines. AASHTO's *Roadside Design Guide* has guidelines for median barrier application. The following figure shows suggested guidelines for median barriers on high-speed roadways:

**Suggested Guidelines for Median Barriers on High-Speed Roadways**



*Based on a 5-year projection

## HD-801.5 MEDIAN BARRIERS (cont.)

When it is determined that a median barrier is to be utilized, the designer can refer to the Transportation Cabinet's *Standard Drawings* and to AASHTO's *Roadside Design Guide* for placement guidelines. KYTC's *Standard Drawings* also provides median barrier selection guidelines.

## HD-801.6 END TREATMENTS & CRASH CUSHIONS

End treatments and crash cushions are frequently used to minimize the severity of impacts with fixed objects by gradually decelerating an impacting vehicle to a stop or redirecting it around the object of concern. Barrier end treatments and crash cushions should comply with NCHRP Report 350 or MASH guidelines.

An end treatment or terminal is normally used at the end of a roadside barrier where traffic passes on only one side of the barrier and in one direction only. A crashworthy end treatment is considered essential if a barrier terminates within the clear zone or is located in an area where it is likely to be struck by an errant motorist. A "crashworthy" feature is one that has been proven acceptable for use under specified conditions through crash-testing and in-service performance.

When selecting a leading-end barrier end treatment, the designer should consider the following guideline hierarchy:

- ➢ Barrier anchored in backslope—When properly designed and located, this type of anchor provides full shielding for the identified hazard, eliminates the possibility of an end-on impact with the barrier terminal, and minimizes the likelihood of the vehicle passing behind the rail.

- ➢ Flared terminals—A flared breakaway guardrail end treatment with adequate clear zone behind the gating device is used to provide recovery.

- ➢ Straight-line terminals—A straight-line delineated breakaway end treatment with adequate clear zone behind the gating device is used to provide recovery.

The grading between the traveled way and the terminal and the approach in front of the terminal should be essentially flat (typically this is the shoulder slope extended). The grading behind any gating end treatment should be properly addressed to allow errant vehicle recovery.

When considering various end treatments for the trailing end of guardrail, the designer should also consider the potential of vehicles traveling in the opposite direction and impacting the guardrail. KYTC's *Standard Drawings* provides details on typical guardrail installations and general applications for end treatments.

## HD-801.6 END TREATMENTS & CRASH CUSHIONS (cont.)

Guardrail End Treatment Type 7 shall not be used on the high-speed National Highway System (NHS) routes. Guardrail End Treatment Type 7 can be considered on low-speed/low-volume facilities when an adequate recovery zone is unavailable or where conditions preclude the desired performance of other end treatment types. Appropriate justification should be retained in the project file whenever Guardrail End Treatment Type 7s are included on a project.

A crash cushion is normally used to shield the end of a barrier or a fixed object. Its function is to gradually decelerate a vehicle to a safe stop or to redirect a vehicle away from the object.

When providing a crash cushion to be installed on paved surfaces, Crash Cushion Type VI is preferred. This device requires a concrete pad and a bolt-down system, as detailed in KYTC's *Standard Drawings*.

Crash Cushion Type IX or IXA is preferred on earth surfaces. This device requires posts and soil tubes, as detailed in *Standard Drawings*.

At-median piers (depressed medians) use a Crash Cushion Type IX attached to a concrete backup with a concrete wall between the piers.

AASHTO's *Roadside Design Guide* provides specific information concerning barrier end treatments and crash cushions. *Standard Drawings* gives specific details and applications of commonly used barrier end treatments and crash cushions.

## HD-801.7 ALTERNATIVE BARRIERS

In Kentucky, standard guardrail is Strong Post W-Beam. Standard barrier wall is New Jersey-shape, which may also be used for roadside protection. Other approved systems may be used where appropriate and justified. AASHTO's *Roadside Design Guide* provides specific information for alternative barriers.

*Chapter*

INTERSECTIONS

*Subject*

General Design Considerations
& Objectives

## HD-901.1 OVERVIEW

By definition, an intersection is the area in which two or more highways join or cross. This includes the roadway and the appurtenances associated with the intersecting roadways. Intersection design is a key component in the design of a highway system and affects the overall performance, efficiency, safety, speed, operating costs, and capacity of the roadway system.

The three general types of intersections are:

- At-grade intersections
- Grade separations without ramps
- Interchanges

The main goal of intersection design is to facilitate the safety, convenience, ease, and comfort of motorists, bicyclists, and pedestrians utilizing the intersection. Projects intended to improve existing intersections differ from newly constructed intersections in that the performance of the existing intersection is known and can guide the design process. Key design decisions can be made by considering the anticipated effects on future project performance and its relevance to the project purpose and need.

Four basic elements should be considered in intersection design:

- Human factors
- Traffic movement considerations
- Physical elements
- Economic factors

## HD-901.2 HUMAN FACTORS

Human factors affecting intersection design include:

- Driving habits
- The driver’s ability to make decisions
- Driver expectancy
- Decision and reaction time
- Conformance to natural paths of movement
- Pedestrian use and habits
- Bicycle traffic use and habits

## HD-901.3 TRAFFIC CONSIDERATIONS

Traffic issues to consider include:

- Classification of each intersecting roadway
- Existing and expected future crash frequency and severity
- Design performance and actual capacities
- Design-hour turning movements
- Size and operating characteristics of vehicles and modes
- Potential conflicts between transportation modes
- Variety of movements (diverging, merging, weaving, and crossing)
- Vehicle speeds
- Transit usage and stop locations
- Railroad crossing accommodation

## HD-901.4 PHYSICAL ELEMENTS

Several physical elements also affect intersection design. Important issues are:

- Character and use of the adjoining property
- Available right-of-way
- Pedestrian and bicycle facilities
- Transit facilities
- Vertical and horizontal alignments at the intersection
- Sight distance
- Angle of the intersection
- Functional area
- Auxiliary lanes
- Geometric design features
- Traffic control devices
- Lighting equipment

### HD-901.4 PHYSICAL ELEMENTS (cont.)

- Roadside design features
- Environmental factors (wetlands, conservation areas, etc.)
- Crosswalks (marked and unmarked)
- Adjacent driveways within the functional area
- Access management treatments
- Drainage considerations
- Provision for utilities

### HD-901.5 ECONOMIC FACTORS

The costs of intersection improvements and anticipated benefit should be considered as well as the effects of controlling or limiting rights of way on adjoining commercial and residential properties where channelization restricts or prohibits vehicular movements and energy consumption.

### HD-901.6 INTERSECTION APPROVAL

As referenced in **HD-204.7**, intersections approvals should be completed during or immediately after approval of the Design Executive Summary. These are typically done for intersections that are deemed unconventional, complex, or innovative. Refer to **HD-902** for submittal of conceptual report and approval process for roundabouts and **HD-904** for submittal of Geometric Layout Sheets (GLS) and approval for interchanges.

For other unconventional, complex, or innovative intersections submit to project team:

- Plan and profile details of the intersection roadways
- Traffic analysis
- Performance Evaluation (Safety and Operational) See **HD-203.3.5** Intersection Design
- Cost Estimates
- Discussion of the pros and cons of each alternative
- Other information the team believes to be beneficial

If recommended, submit to the Director of Highway Design for review and/or approval.

◆ ◆ ◆

*Chapter*

INTERSECTIONS

*Subject*

At-Grade Intersections

## HD-902.1 OVERVIEW

The basic types of at-grade intersections are three-leg (T), four-leg, multi-leg, and roundabouts. These basic intersection types can also include variations such as unchannelized, flared, and channelized intersections. Designers should avoid proposing new multi-leg intersections (more than four legs).

At a minimum, the following should be considered at each intersection:

- Number of intersecting legs
- Topography of the area
- Character of the intersecting highways
- Traffic volumes and movements
- Speeds
- Desired type of operation

The design criteria selected should result in a balanced and cost-effective intersection design that provides efficient future operations and low crash frequencies and considers the needs of all user groups.

The following design elements are critical to the layout and operation of at-grade intersections:

- Horizontal and vertical alignment
- Cross-sectional elements
- Sight distance
- Drainage issues

## HD-902.2 HORIZONTAL & VERTICAL ALIGNMENT

The horizontal alignment and vertical grades of an intersection should be designed to permit users to visually recognize the intersection and the other vehicles using it, and to readily perform the needed maneuvers to pass through the intersection safely.

Generally, the alignments should be as straight and the gradients as flat as practical. Major grade changes should be avoided at intersections, and adequate sight distance should be provided along both intersecting roads. Ideally, grades exceeding 3 percent in the vicinity of the intersection should be avoided. Where this is not practical, 6 percent grades should not be exceeded without adequate justification.

Each intersection should be reviewed thoroughly and appropriate solutions identified. In the design of an intersection, the main line grades/cross-slopes generally are carried through the intersection, and the approach roadways are adjusted to match the main line geometrics. It is preferred that major intersections be developed as a site design allowing for smooth and continuous traffic movements through the intersection.

The design may need to address intersection characteristics, such as:

- Land use activity
- Conflict Points
- Traffic Control
- Design Speed Capacity

As necessary, each intersection is to be adjusted at all intersecting legs to accommodate adequate sight distance requirements, user comfort during maneuvers, and drainage concerns. This adjustment might be accomplished by modification of the main line/approach grade points, cross-slopes, etc.

The goals for an intersection include:

- Smooth and continuous intersection elements
- Reduce vehicle speeds through the intersection as appropriate
- Provide appropriate number of lanes and lane assignment to achieve adequate capacity, lane volume and lane continuity
- Grades as level as practical
- Provide channelization that operates smoothly

## HD-902.2 HORIZONTAL & VERTICAL ALIGNMENT (cont.)

- Provide adequate accommodation for design vehicles
- Meet the needs of pedestrians and bicyclists
- Provide sufficient sight distance and visibility to allow drivers to prepare for and avoid potential conflicts

For safety and economic reasons, the intersecting roadways should meet at right angles when feasible. Although a 90-degree intersection is desired, some deviation from this is permissible. Generally, intersection angles between 75 and 90 degrees are preferred. Intersection angles should not be less than 60 degrees.

Change from one cross slope to another should be gradual. Intersections where a minor road crosses a multilane divided highway with a narrow median on a superelevated curve should be avoided whenever practical because of the difficulty in adjusting grades to provide a suitable crossing.

The use of Pavement Development Sheets may be helpful in detailing the pavement transitions through the interchange (**Exhibit 900-01)**.

## HD-902.3 TURNING ROADWAY ELEMENTS

Turning roadways are typically used at high-speed and/or high-volume intersections, including intersections at ramp terminals (**HD-904**). It is important to provide a turning roadway design that is consistent with the speed and volume characteristics of the turning vehicles.

The primary design elements of a turning roadway are as follows:

- Volumes of turning traffic
- Types of vehicles to be accommodated
- Geometry and lane configuration of approach roadways

The relationships between speed and curvature may be found in Chapter 3 of AASHTO's *A Policy on Geometric Design of Highways and Streets*. Kentucky's common practice is to use a maximum superelevation of 8 percent. Special care should be taken with superelevation in transitions for turning roadways (See AASHTO's *A Policy on Geometric Design of Highways and Streets*).

## HD-902.3 TURNING ROADWAY ELEMENTS (cont.)

Three-centered, compound curves may also be considered when determining an intersection radius. Three-centered, compound curve information is available in the exhibit “Typical Designs for Turning Roadways” in Chapter 9 of AASHTO’s *A Policy on Geometric Design of Highways and Streets*.

The turning path of the design vehicle and the angle of turn determine the widths of turning roadways. Chapter 2 of AASHTO’s *A Policy on Geometric Design of Highways and Streets* details the various types of design vehicles with their dimensions and turning radii. Chapter 9 of the policy summarizes the values for various design vehicles and turning angles.

## HD-902.4 ROUNDABOUTS

Modern roundabouts are an alternative to traffic signals and multi-way stop control intersections. To ensure successful operation, roundabouts must be placed appropriately and be designed properly for conditions. (See AASHTO’s *A Policy on Geometric Design of Highways and Streets* and *NCHRP Report 672 Roundabouts: An Informational Guide*). Roundabouts operate with the lowest crash frequencies when their geometry forces traffic to enter and circulate at slow speeds (typically less than 30 mph).

Roundabouts can be classified into three basic categories:

- Mini-roundabouts
- Single-lane roundabouts
- Multilane roundabouts

Each category is classified according to the size (diameter or total width) of the roundabout and the number of lanes required for specified performance and design constraints. Any of the categories may be appropriate for rural, suburban, or urban areas.

For a roundabout to be identified as a viable alternative, the Project Development Manager (PDM) shall submit a conceptual report to the Division of Highway Design through the Location Engineer for review by the Director. This submittal should occur prior to public involvement activities that depict the roundabout, and no later than the preliminary line and grade meeting.

## HD-902.4 ROUNDABOUTS (cont.)

This report shall include at a minimum:

- Operational analysis
  - Volume to capacity (V/C) ratio of each lane
  - Delay by lane, approach and intersection
  - Lane group queue estimates
- Lane configuration
- The design vehicle
- Primary layout, including inscribed circle diameter and other basic elements (**Exhibit 900-02**)

The following information shall be submitted with the Intersection Approval Sheet (IAS) in a roundabout report:

- Vehicle turning path
- Fastest path
- Entry angles
- Sight distances

Lighting, signing, and pavement markings shall be presented at the final inspection.

Final plans shall include a plan view with base/centerlines for each approach and pavement development sheets sufficient to depict the entire roundabout.

## HD-902.5 ISLANDS & CHANNELIZATION

An island is the area between traffic lanes that is used for:

- Channelization - Control and direct traffic movements (usually turning)
- Division – Divide opposing or same direction traffic streams
- Refuge – Provide refuge for pedestrians and/or bicyclists

Within an intersection, a median is also considered an island.

Channelizing islands are used at certain intersections to control and direct traffic movements into the proper paths. If an intersection area is spacious, a channelizing island may decrease the confusion of the traffic movements. Channelizing islands may be of many shapes and sizes. A common form is the corner triangular shape, which separates right-turning movements.

## HD-902.5 ISLANDS & CHANNELIZATION (cont.)

Central islands may serve as a separation for turning vehicles to operate around.

Divisional islands are often included on undivided highways at intersections to alert and regulate traffic through the intersection. They may also control the location of left-turning vehicles.

Splitter islands are typically utilized for roundabout intersections to provide separation of the entering and exiting traffic on the approaches. Raised splitter islands are typically utilized.

Refuge islands are predominantly utilized in urban areas to aid and protect pedestrians and bicyclists crossing a roadway. Generally, any of the types of islands mentioned above could also serve as a refuge island as long as Americans with Disabilities Act (ADA) criteria are met.

The dimensions and details of an island depend on each intersection’s configuration, but should always be of significant size to command attention. Islands can be delineated or outlined by a variety of treatments, depending on the size, location, and function. Island design is also controlled by the type of facility (rural versus urban) in which the intersection is located.

Flush islands should be used in intersections to accommodate the off-tracking of large vehicles. Exceptions may be made when the island is large and may shield pedestrians, or where special signing or poles may be placed in the island. It may be decided to utilize a raised island in this case. If a raised island is used, it should be designed as a mountable island where practical.

Interchanges represent special median channelization design considerations. An inherent problem of interchanges is the possibility of a vehicle entering one of the exit terminals from the crossroad and proceeding along the major highway in the wrong direction. For this reason, medians on the crossroad should be strongly considered to facilitate proper channelization. While this median can be painted, a depressed or raised median should be considered.

Where practical, large islands should be depressed to avoid water and snow melt draining across the pavement. (See Chapter 9 of AASHTO’s *Policy on Geometric Design of Highways and Streets* and **HD-702**).

## HD-902.6 SUPERELEVATION

Normally, the superelevation rates for the through roadway at an intersection should comply with the appropriate values obtained in Chapter 3 of AASHTO's *A Policy on Geometric Design of Highways and Streets.* The designer may elect to modify the superelevation rates through the intersection area to achieve an acceptable design.

The designer should first consider:

- A vehicle’s ability to stop and accelerate during periods of ice and snow
- Right-of-way damages
- Grade on existing street approaches and entrances
- Drainage

The desirable maximum superelevation for horizontal curves through intersections is 4 percent.

**Exhibit 900-03** shows a procedure to reduce the sharp breaks in the profile of roads crossing a roadway with a depressed median. It depicts how adjustment of the grade points on the roadway having the depressed median can reduce the severity of the breaks at the inside edges of pavement. The decision of whether to use this or a similar procedure should be made on an intersection-by-intersection basis.

Superelevated areas adjacent to a through lane having a normal crown or a different superelevation result in a "cross-over line" between adjacent lanes which can cause a hazardous pitch or sway in a vehicle. (See Chapter 9 in AASHTO's *A Policy on Geometric Design of Highways and Streets*.)

Breaks in approach grades traversing mainline cross-slopes should be minimized whenever practical.

When introducing or removing superelevation, refer to Chapter 3 of AASHTO's *A Policy on Geometric Design of Highways and Streets*.

## HD-902.7 TRAFFIC CONTROL DEVICES

Traffic control devices regulate, inform, warn, and guide drivers. Such devices include signals, lighting, signing, arrow panels, and changeable message signs. The decision to utilize traffic control devices or lighting should be made on an intersection-by-intersection basis and guided by existing performance and analysis of proposed devices.

The project manager is ultimately responsible for making sure the appropriate traffic plans are identified and included in the total plan set. To facilitate this process, the project manager should notify the District Traffic Engineer of project meetings and inspections as early in the process as feasible.

When locations are identified that might require signal, signing, and/or lighting plans, notify the District Traffic Engineer and copy Central Office Traffic Operations. The District Traffic Engineer will send a written request and provide appropriate supporting information to Central Office Traffic Operations.

## HD-902.8 INTERSECTION SIGHT DISTANCE

The driver of a vehicle approaching an intersection should have an unobstructed view of the entire intersection, including any traffic-control devices, and sufficient lengths along the intersecting highway to permit the driver to anticipate and avoid potential collisions.

When determining whether an object or structure is obstructing sight distance at an intersection, the designer should consider both horizontal and vertical sight lines for both intersecting roadways. The designer assumes that the driver’s eye height is 3.5 feet above the roadway and that the object height is also 3.5 feet above the surface of the roadway. Using 3.5 feet for both the driver’s eye and the object height ensures that each driver can see the other’s vehicle.

The minimum stopping sight distance at any point within an intersection shall be consistent with the speed at that point (see Common Geometric Practices, Chapter 700).

The recommended dimensions of the sight triangles vary with the type of traffic control. Procedures to determine sight distances at intersections are presented in Chapter 9 of AASHTO's *A Policy on Geometric Design of Highways and Streets*.

## HD-902.8 INTERSECTION SIGHT DISTANCE (cont.)

At intersections where cross traffic is controlled by a stop sign, additional stopping sight distance must be provided for the vehicles on the major highway due to the possibility of conflicts between vehicles on the through road and the cross road.

The desired intersection sight distance is a function of the following:

- Type of control
- Design vehicle
- Acceleration rate of design vehicle
- Perception and reaction time
- Width of pavement and, in cases of divided highways, width of median
- Design speeds
- Skew angle of intersection and gradient of roadways
- Gap acceptance

AASHTO's *A Policy on Geometric Design of Highways and Streets*, Section 9.5 contains a thorough discussion of intersection sight distance.

## HD-902.9 MEDIAN OPENINGS (CROSSOVERS)

Median openings are breaks in the median to allow traffic to cross. These openings facilitate traffic movement and access management. Spacing of the openings should be consistent with the type of access control along the roadway. Median openings should be situated where there is adequate sight distance.

The design of a median opening and the shape of the median ends should be based on traffic volumes, urban/rural characteristics, types of turning vehicles, and guided by performance and analysis. The median width; location and length of opening; and the design of the median-end shape, are developed in combination to fit the character and volume of both through and turning traffic.

For three- or four-leg intersections on a divided highway, the length of median opening should be as great as the width of the crossroad, including shoulders and median. There are two common shapes utilized at the ends of a median:

- Semicircle, which is satisfactory for narrow medians
- Bullet nose, which closely fits the path of the inner wheel of the design vehicle

**Note:** Bullet nose is the preferred shape at approach intersections and should be used for median widths 10 feet or greater.

## HD-902.9 MEDIAN OPENINGS (CROSSOVERS) (cont.)

AASHTO's *A Policy on Geometric Design of Highways and Streets*, Section 9.8 provides specific details of median opening shapes.

## HD-902.10 AUXILIARY LANES

An auxiliary lane is the section of the roadway adjacent to the through lanes that are utilized for:

- Speed changes
- Left- and right-turning movements
- Storage
- Weaving maneuvers
- Truck-climbing lanes
- Other various purposes

Auxiliary lanes may also be added to improve the safety and the capacity of an intersection. Warrants for the use of auxiliary lanes cannot be stated definitely. Many factors should be considered such as speeds, traffic volumes, percentage of trucks, capacity, type of roadway, effects on pedestrian and bicyclists, availability of right-of-way, service provided, and the arrangement and frequency of intersections.

The most common types of auxiliary lanes are left- and right-turning lanes. These lanes have three common features:

- Bay taper
- Deceleration length
- Storage length

## HD-902.11 LEFT TURN LANES

The following are guidelines for left turn lane recommendations at intersections:

### HD-902.11.1 Signalized Intersections

- Left-turn lanes should be considered on designs of arterial and collector roadways at signalized intersections where performance analysis or history indicates a need.

### HD-902.11.1 Signalized Intersections (cont.)

- Capacity analysis should be used to evaluate the need for left-turn lanes at signalized intersections for local roadways, unclassified minor street approaches, and public or private access points (driveways).

- Capacity analysis should be used to evaluate when multiple left-turn lanes are recommended.

- Left-turning traffic should be removed from the through lanes for safety, operational, or other considerations as guided by performance and analysis. Provisions for left turns (such as, left-turn lanes) have a widespread application. Innovative designs work with signalized intersections including Displaced Left Turn (DLT) and Quadrant Roadway or Jughandle designs.

### HD-902.11.2 Unsignalized Intersections

- Left-turn lanes should be considered at median openings on divided roadways where performance is an issue or analysis identifies a need. Designers may also consider innovative U-turn based intersection designs where left-turns are replaced by a series of right-turns and U-turns. Left-turn lanes are not typically provided at median crossovers on freeways and interstates.

- Left-turn lanes should be considered when traffic is not under stop control at unsignalized intersections where performance analysis or history indicates a need.

- Capacity analysis should be used to evaluate the need for left-turn lanes at stop controlled approaches of unsignalized intersections.

- Left-turning traffic should be removed from the through lanes for safety, operational, or other considerations as guided by performance and analysis. Provisions for left turns (such as, left-turn lanes) have a widespread application. Innovative designs work with unsignalized intersections including Restricted Crossing U-Turn (RCUT) and Roundabouts.

### HD-902.11.3 Left Turn Evaluations

Figures 1 and 2 are provided below to aid in evaluating the need for left turn lanes. As shown on Figure 1, if the intersection of the advancing and opposing volumes is to the right of the corresponding L% (percent of left turns of advancing traffic) line, then there is a greater than 2% (1% for Figure 2) chance of an advancing vehicle arriving at the intersection while it is blocked by a turning vehicle, indicating the value of providing a left turn lane.

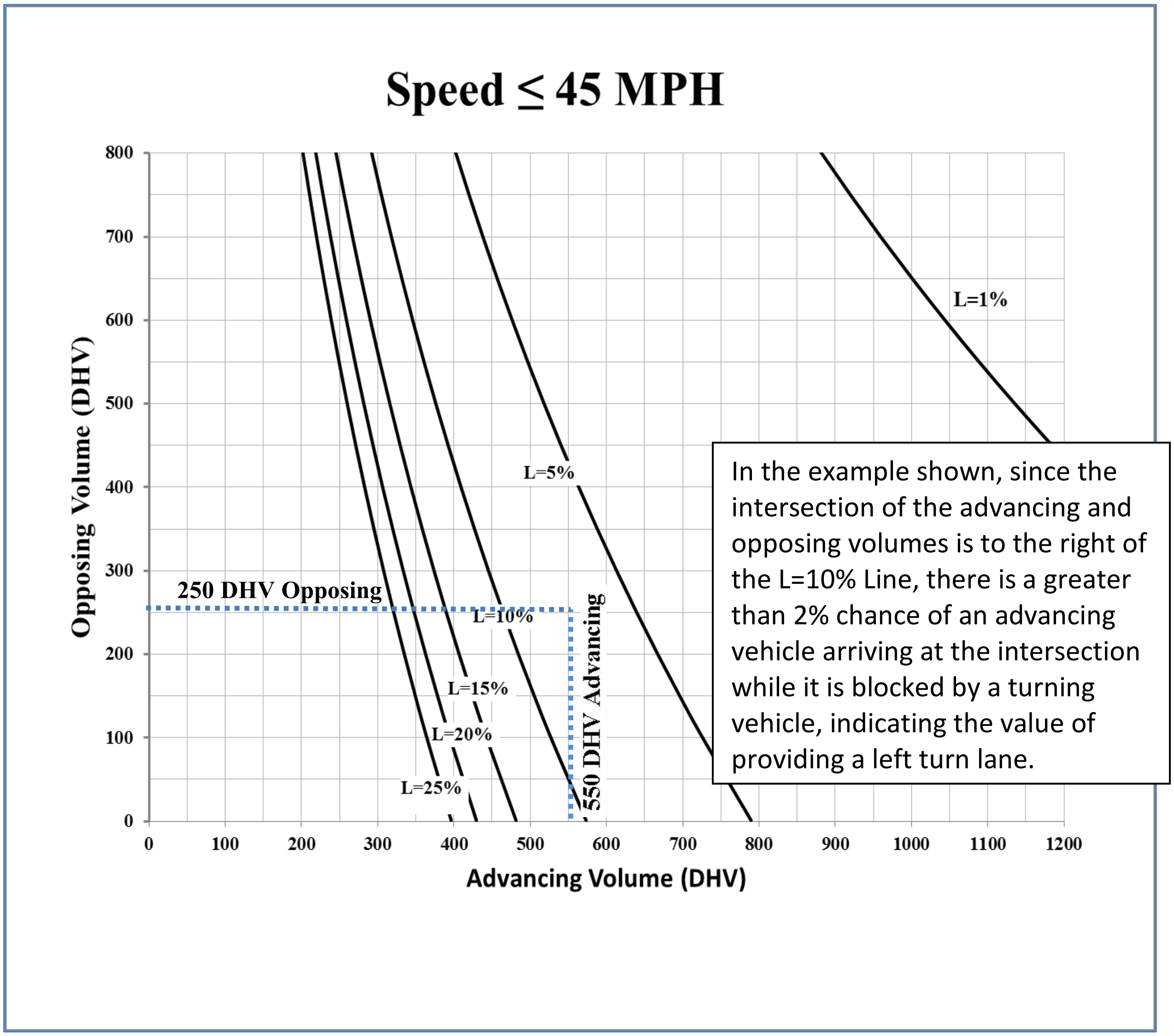
### HD-902.11.3 Left Turn Evaluations (cont.)

For example, on a roadway with a 35 MPH operating speed, 550 DVH advancing volume, 250 DHV opposing volume, and 10% lefts, the intersection of the advancing and opposing volumes is to the right of the corresponding L=10% line. In this example, there is a greater than 2% chance of an advancing vehicle arriving at the intersection while it is blocked by a turning vehicle, indicating the value of providing a left turn lane.

For more information see AASHTO's *A Policy on Geometric Design of Highways and Streets*, Section 9.7.3.

## HD-902.11.3 Left Turn Evaluations (cont.)

Figure 1: Uncontrolled Approach; Left-Turn Lane Evaluation for Low Speed Roadways (Speed ≤ 45 MPH)



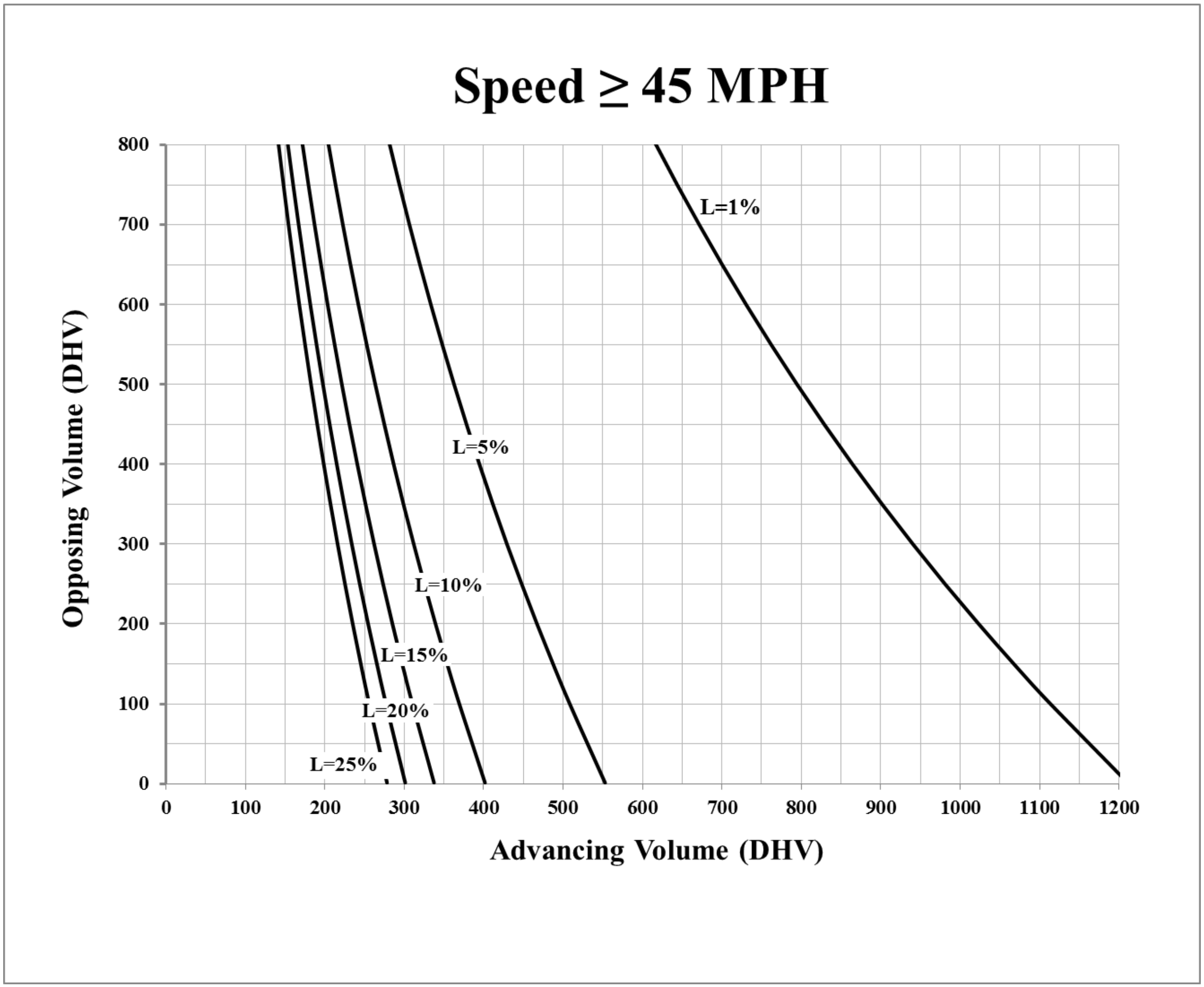
In the example shown, since the intersection of the advancing and opposing volumes is to the right of the L=10% Line, there is a greater than 2% chance of an advancing vehicle arriving at the intersection while it is blocked by a turning vehicle, indicating the value of providing a left turn lane.

*Notes:* *L = Percent Left-Turns of Advancing Traffic*
*Advancing Volume = Through + Left + Right-Turn Traffic*
*Opposing Volume = Through + Left + Right-Turn Opposing Traffic*

*Heavy Vehicle Advancing Volume Adjustment*
$v_A' = v_A [1+P_{HV}(E_{HV})]$
*where:* $v_A'$ = *Adjusted advancing traffic volume*
$v_A$ = *Unadjusted advancing traffic volume*
$P_{HV}$ = *Percent heavy vehicles (decimal percent)*
$E_{HV}$ = *Passenger car equivalency factor*
= *0.00035* ($v_O$) *(two-lane facilities)*
= *0.0007* ($v_O$) *(four and six-lane facilities)*
$v_0$ = *Opposing traffic volume*

## HD-902.11.3 Left Turn Evaluations (cont.)

Figure 2: Uncontrolled Approach; Left-Turn Lane Evaluation for High Speed Roadways (Speed ≥ 45 MPH)



*Notes:* *L = Percent Left-Turns of Advancing Traffic*
*Advancing Volume = Through + Left + Right-Turn Traffic*
*Opposing Volume = Through + Left + Right-Turn Opposing Traffic*

*Heavy Vehicle Advancing Volume Adjustment*
$v_{A}' = v_{A}\,[1+P_{HV}(E_{HV})]$
*where:* $v_{A}'$ = *Adjusted advancing traffic volume*
$v_{A}$ = *Unadjusted advancing traffic volume*
$P_{HV}$ = *Percent heavy vehicles (decimal percent)*
$E_{HV}$ = *Passenger car equivalency factor*
= 0.00035 ($v_{O}$) *(two-lane facilities)*
= 0.0007 ($v_{O}$) *(four and six-lane facilities)*
$v_{0}$ = *Opposing traffic volume*

## HD-902.12 RIGHT TURN LANES

The following are guidelines for right turn lane recommendations at intersections:

### HD-902.12.1 Signalized Intersections

- Right-turn lanes should be considered on designs of arterial and collector streets where performance analysis or crash history indicates a need.
- Capacity analysis should be used to evaluate the need for right turn lanes.
- Right-turn lanes may also be considered as a safety measure to abate deficient sight distances, special vehicle needs, etc. where a history of crashes indicates a problem or where safety issues are predicted from analysis.

### HD-902.12.2 Unsignalized Intersections

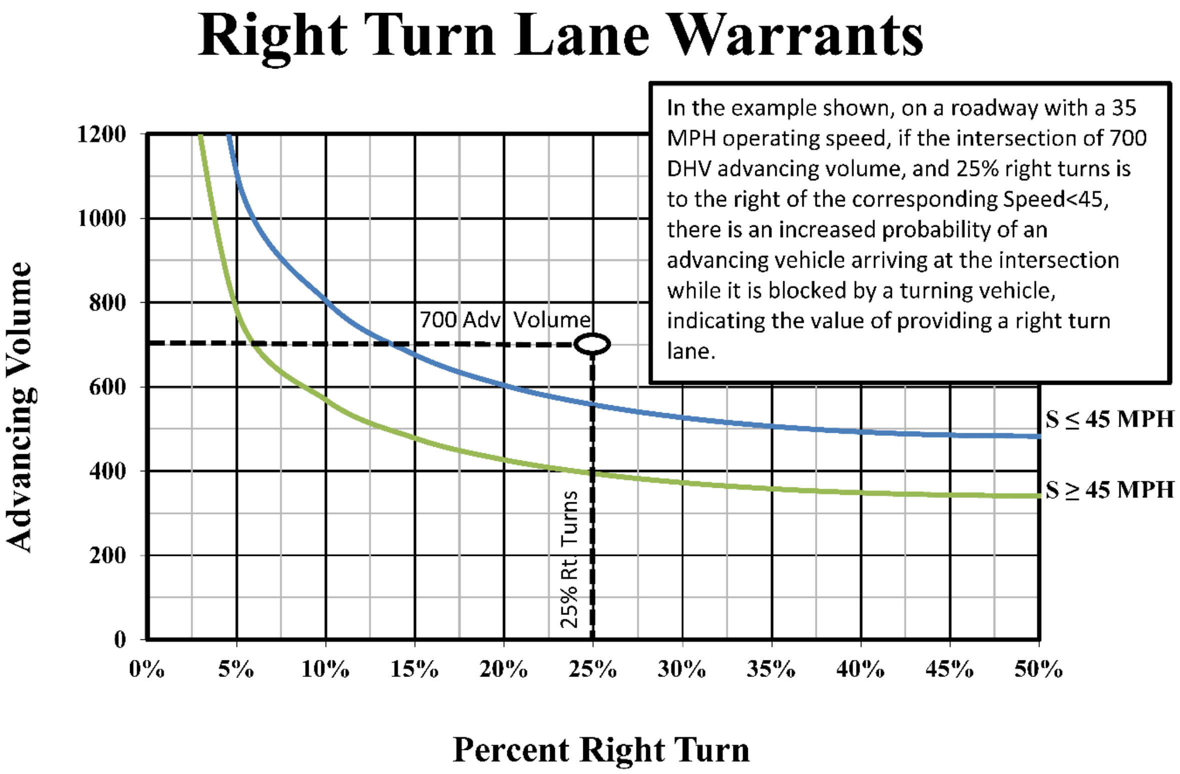
- Right-turn lanes should be considered on non-stopping approaches where performance is an issue. See Figure 3 to evaluate the need for a right turn lane.

  As shown on Figure 3, if the intersection of the advancing volumes and right-turn percentage is to the right of the corresponding line, then there is an increased probability of an advancing vehicle arriving at the intersection while it is blocked by a turning vehicle, indicating the value of providing a right turn lane.

  For example, on a roadway with a 35 MPH operating speed, if the intersection of 700 DVH advancing volume and 25% right turns is to the right of the corresponding Speed≤45, there is an increased probability of an advancing vehicle arriving at the intersection while it is blocked by a turning vehicle, indicating the value of providing a right turn lane.
- Capacity analysis should be used to evaluate the need for right-turn lanes at stop controlled approaches.
- Right-turn lanes may also be considered as a safety or operational measures to abate deficient sight distances, special vehicle needs, etc. where a history of crashes or congestion indicates a problem or where safety and/or congestion issues are predicted from analysis.

## HD-902.12.2 Unsignalized Intersections (cont.)

Figure 3: Uncontrolled Approach; Right-Turn Lane Evaluation



In the example shown, on a roadway with a 35 MPH operating speed, if the intersection of 700 DHV advancing volume, and 25% right turns is to the right of the corresponding Speed<45, there is an increased probability of an advancing vehicle arriving at the intersection while it is blocked by a turning vehicle, indicating the value of providing a right turn lane.

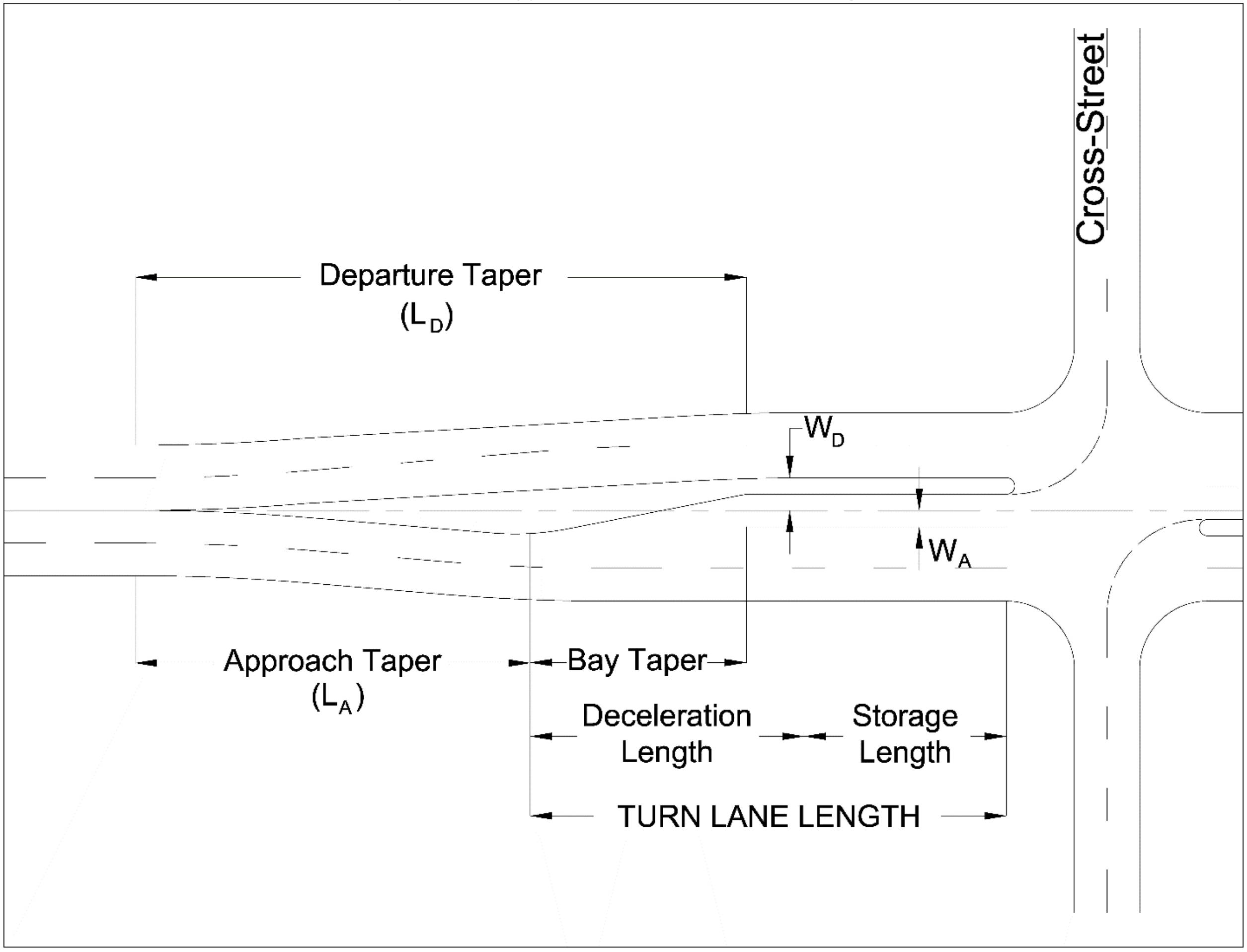
## HD-902.13 TURN LANE DESIGN

Auxiliary left-turn lanes have 3 primary components as shown in Figure 4:

- Approach Taper
- Bay Taper
- Turn Lane Length
  - Deceleration Length
  - Storage Length

## HD-902.13 TURN LANE DESIGN (cont.)

Figure 4: Typical Left-Turn Lane Design

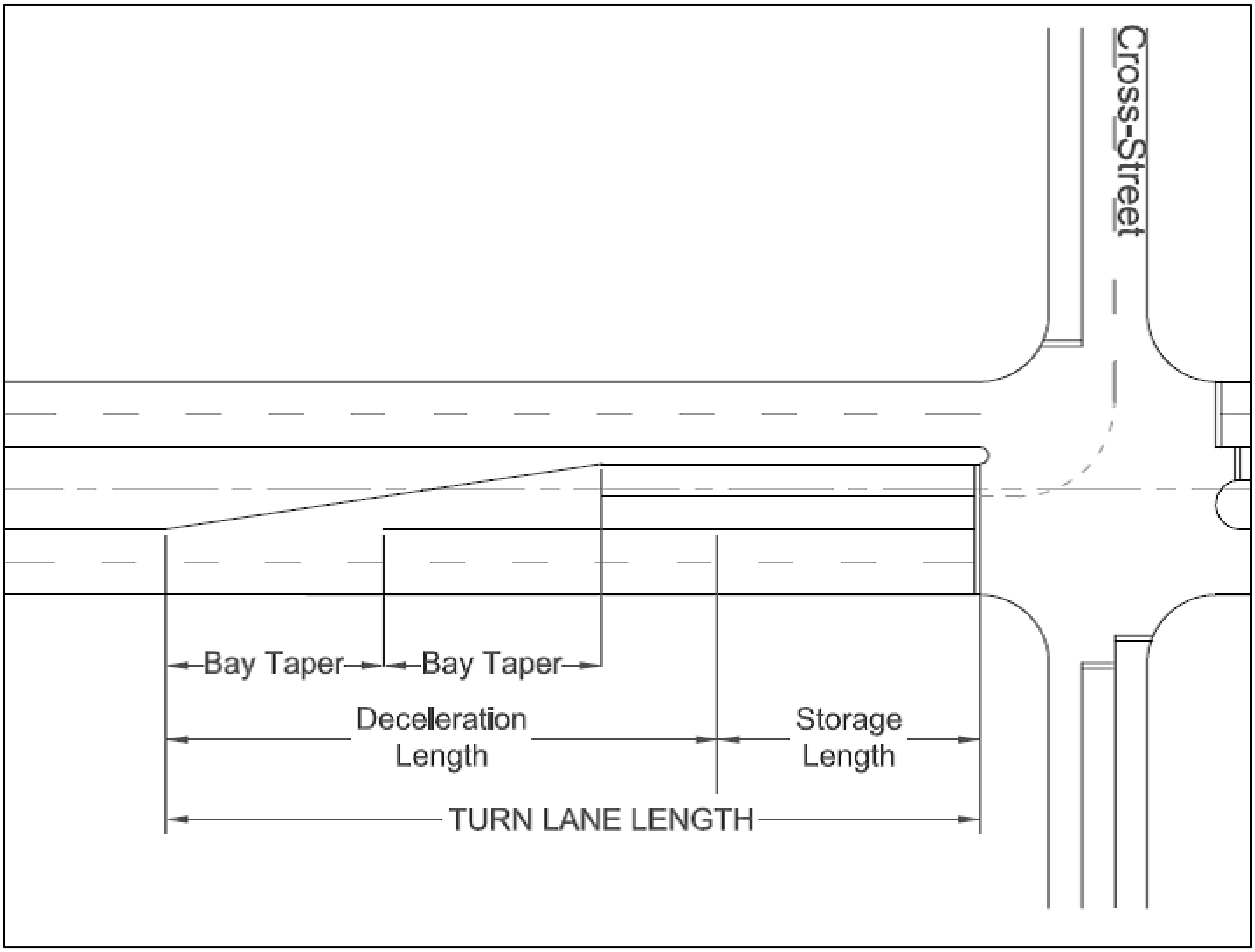


Note: $W_D$ = Departure taper width; $W_A$ = Approach taper width; $L_D$ = Departure length; $L_A$ = Approach length

Dual left turn lanes may be formed in two ways, as shown in Figures 5 and 6. Figure 5 shows a simple design where the bay taper length is doubled as both lanes are formed simultaneously. The design in Figure 6 uses a single deceleration lane and then forms the dual storage lanes through the use of a second bay taper. This alternative may provide the opportunity to reduce overall pavement area on high speed approaches, which require long deceleration lengths. For both design options, the storage length shown is ½ the calculated storage length for a single left-turn lane.

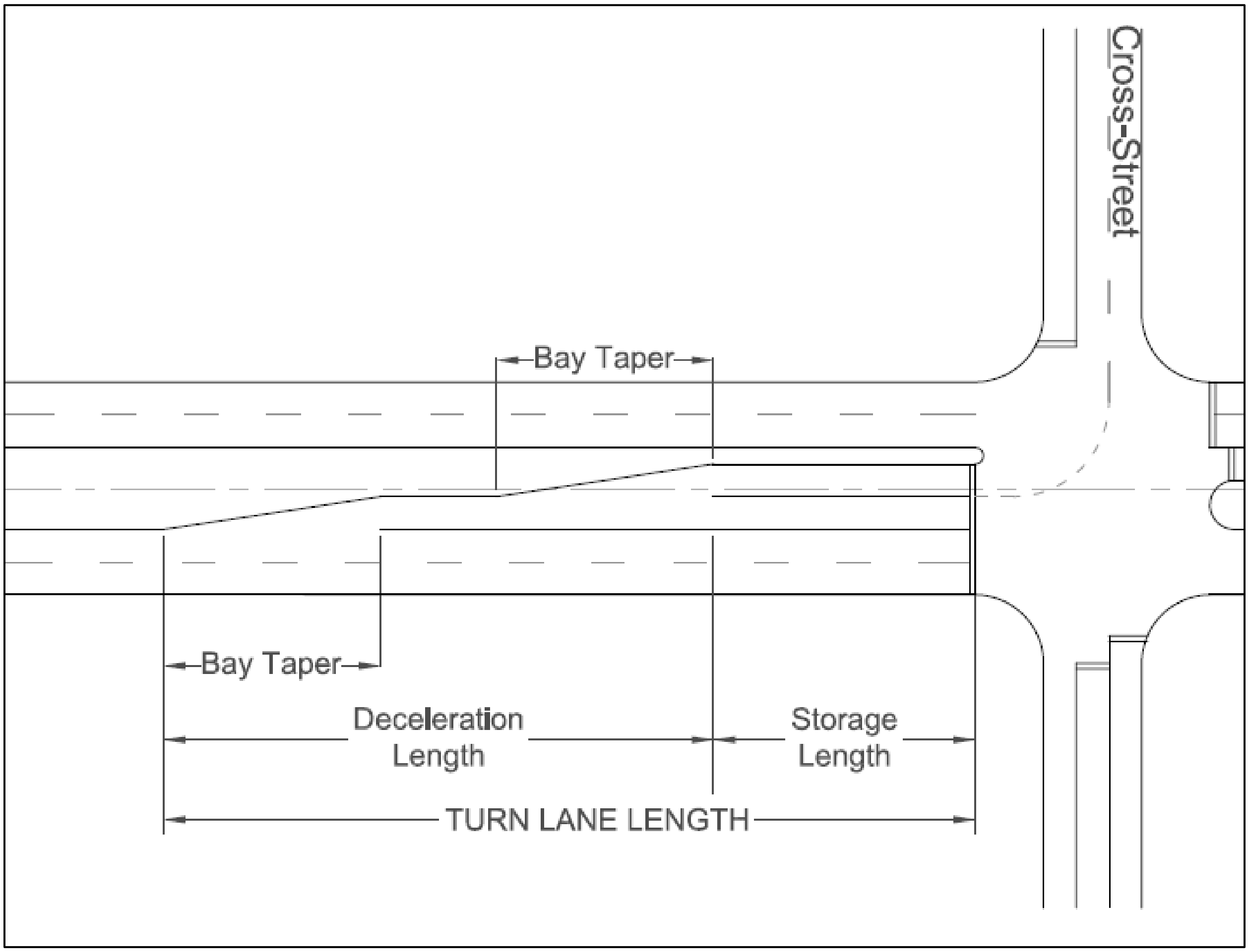
## HD-902.13 TURN LANE DESIGN (cont.)

Figure 5: Dual Left-Turn Lane Design (Option1)



## HD-902.13 TURN LANE DESIGN (cont.)

Figure 6: Dual Left-Turn Lane Design (Option2)

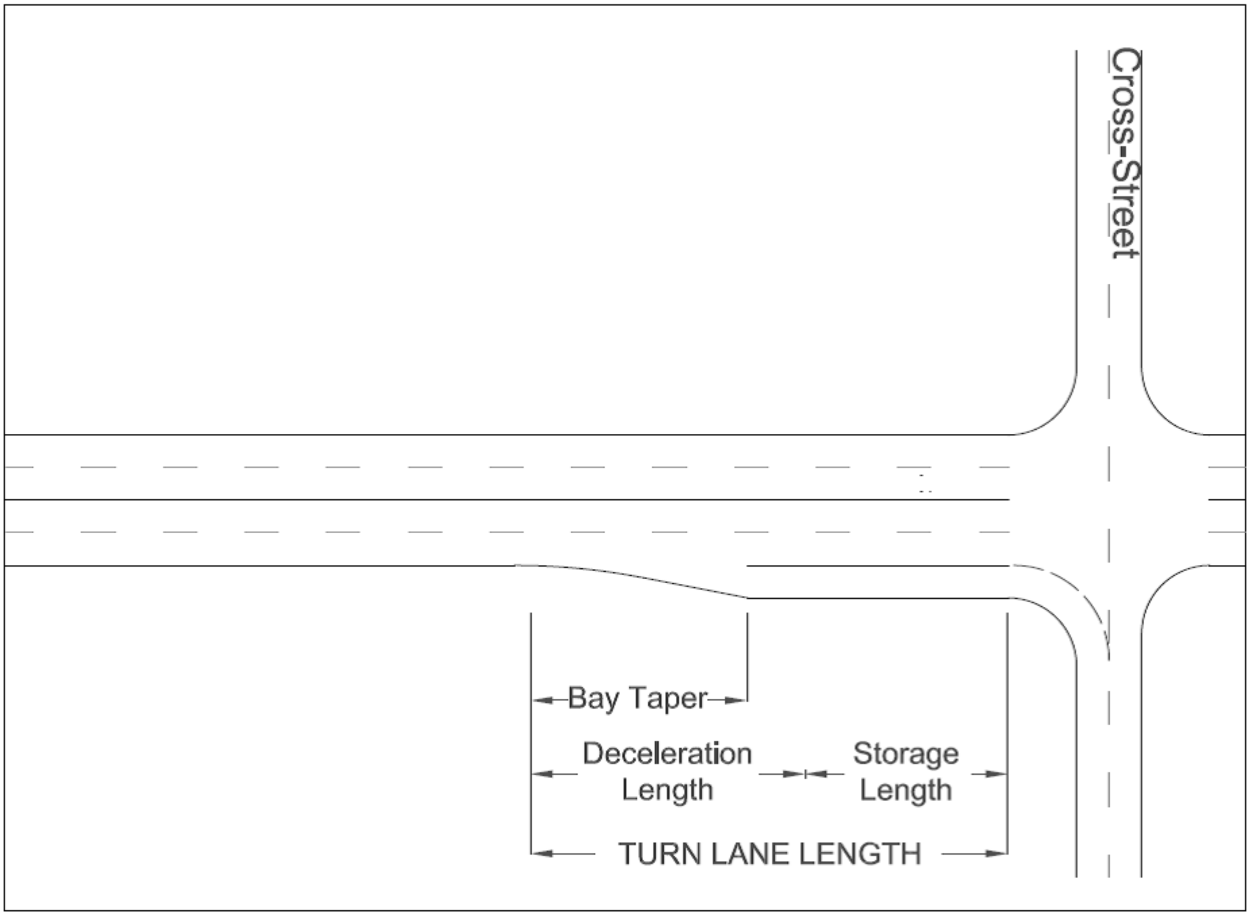


Auxiliary right-turn lanes only have 2 primary components as shown in Figure 7:

- Bay Taper
- Turn Lane Length (deceleration and storage lengths)

## HD-902.13 TURN LANE DESIGN (cont.)

Figure 7: Typical Right-Turn Lane Design



## HD-902.14 DEPARTURE/APPROACH TAPER

When adding a left-turn lane, the designer shall use an approach and departure taper to widen the pavement to the required width based on the roadway speed. The approach and departure taper length should be calculated as follows:

Speed: $\geq 45$ MPH, $L = W \times S$

$< 45$ MPH, $L = \frac{WS^2}{60}$

Where:

*L = Taper length in feet*
*W = Width of roadway offset for taper in feet*
*S = Speed in miles per hour (MPH)*

## HD-902.15 BAY TAPER

Bay tapers are utilized to direct turning vehicles into the auxiliary lane. For left and right-turn lanes, a standard bay taper length based on the speed of the roadway should be used:

Speed: 45 MPH or greater, Bay Taper length = 100 feet

< 45 MPH, Bay Taper Length = 50 feet

## HD-902.16 TURN LANE LENGTH

The length of an auxiliary turn lane should be influenced by the intersection control type (See Table 1).

## HD-902.16 TURN LANE LENGTH (cont.)

Table 1: Auxiliary Turn Lane Length Methodology

| **Intersection Control** | **Turn Type** | **Turn Lane length** |
|---|---|---|
| Uncontrolled | Left-Turn | Greater of Method 1[A] or Method 2[A] |
| | Right-Turn | Method 1[A,] |
| Stop Controlled | Left-Turn | Storage + Bay Taper |
| | Right-Turn | Storage + Bay taper |
| Signal Control | Left-Turn | Greater of Method 1 or Method 2[A,] |
| | Right-Turn | Greater of Method 1 or Method 2[A,] |

*Notes: A: See Table 2 below.*
*Full deceleration plus storage may be considered for high speed roadways (See Chapter 9, Table 9-20, Green Book)*

Table 2: Turn Lane Length by Speed

| **Speed (MPH)** | **Method 1: Deceleration Only[A]** | **Method 2: Moderate Deceleration + Storage[A]** |
|---|---|---|
| 20 | 125 ft | Storage + Bay Taper |
| 25 | 125 ft | Storage + Bay Taper |
| 30 | 125 ft | Storage +Bay Taper |
| 35 | 125 ft | Storage +Bay Taper |
| 40 | 160 ft | 70 ft + Storage |
| 45 | 215 ft | 110 ft + Storage |
| 50 | 275 ft | 160 ft + Storage |
| 55 | 345 ft | 215 ft + Storage |
| 60 | 425 ft | 275 ft + Storage |
| 65 | 510 ft | 345 ft + Storage |

*A: At signalized intersections the length of turn lanes should be extended so that it is not blocked by the queue of adjacent through traffic.*

## HD-902.16 TURN LANE LENGTH (cont.)

The deceleration lengths provided in Table 2 assume an approach grade of 3 percent or less. For approaches with grades greater than 3 percent, the deceleration length ($L_D$) should be adjusted by applying Equation 2:

EQ 2. $L_D' = L_D\,[-0.046*(G)+0.822]$

Where: $L_D'$ = Adjusted deceleration length
$L_D$ = Unadjusted deceleration length (from Table 2)
$G$ = Percent grade

Designers should consider using full length distances for lane change and deceleration on auxiliary lanes as shown in Table 9-20 of AASHTO's *A Policy on Geometric Design of Highways and Streets* at uncontrolled intersections on high-speed rural arterials where there is a history of crashes involving the turning movement and speed.

Storage needs, distance between intersections, and restricted right-of-way may constrain the designer from providing lengths as shown in Table 2. However, furnishing a left and/orright-turn lane at any intersection approach has shown to substantially reduce crashes. Designers should install turn lanes where warranted.

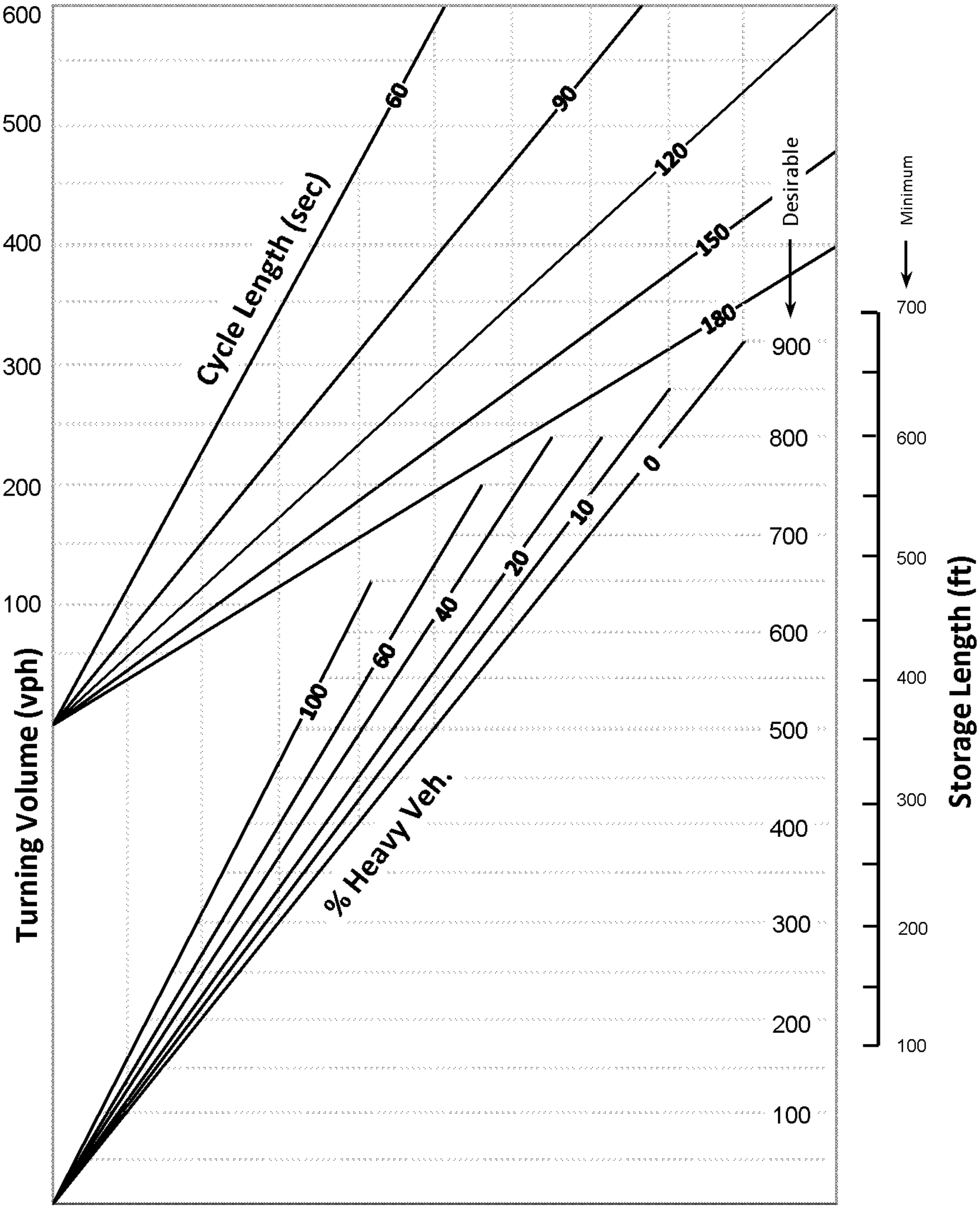
## HD-902.17 STORAGE LENGTH

The storage length of auxiliary turn lanes may be determined based on the traffic control of the approach and on the intersection volumes. It should be sufficient to avoid spillback of turning vehicles into through-travel lanes in order to maintain performance and prevent crashes. The minimum storage length shall be 75 feet.

- On uncontrolled approaches, minimum storage length should be 75 feet. If left turn volume at an uncontrolled approach exceeds 200 vehicles per hour, detailed storage length analysis should be conducted.
- On stop controlled approaches, storage length should be determined by Figure 8, assuming a cycle length of 60 seconds.
- At signalized intersections, storage length may be determined by Figure 8. More detailed storage length requirements may be provided by capacity analysis.

## HD-902.17 STORAGE LENGTH (cont.)

Figure 8: Controlled Intersection; Left-Turn Lane Storage Lengths



*Note: Stop controlled intersections should assume a cycle length of 60 seconds.*

## HD-902.18 ALTERNATIVE TURN LANE DESIGNS

It is possible that situations may exist that do not meet these guidelines for left-turn lanes, but safety and/or operational performance issues exist. In such cases, an alternative to a full turn lane may be considered. See AASHTO's *A Policy on Geometric Design of Highways and Streets*, Section 9.9 and the website https://safety.fhwa.dot.gov/intersection/alter_design/ for further guidance on alternative left and U-turns.

These alternative or innovative intersection designs include:

- Medians with U-turn Crossover (MUT)
- Restricted Crossing U-turn (RCUT)
- Jughandle

The U-turn based MUT and RCUT are median opening type intersections that prevent left turns and replace with a series of right and U-turns. The Jughandle intersection provides one-way access to eliminate left turns. Designers may consider these or other types of innovative intersections. All alternative designs must be submitted for review by the Division of Highway Design similar to roundabouts.

## HD-902.19 POSITIVE OFFSET OF TURN LANES

Left-turning vehicles can restrict the sight distance of opposing left-turns. Improved sight distance can be provided if the opposing lanes are positively offset to the right. Providing this positive offset will result in the separation of left-turning traffic and adjacent through traffic which can improve operational performance and safety. Available sight distance should be checked. See Chapter 9 in See AASHTO's *A Policy on Geometric Design of Highways and Streets* for details.

## HD-902.20 TWO-WAY LEFT-TURN LANES

Two-way left-turn lanes (TWLTL) may be used to mitigate delay to through traffic on low speed corridors resulting from the cumulative impact of consecutive access points. As such, they may be used to address those scenarios when individual turn movements do not require a dedicated left-turn lane, but consecutive access points have a detrimental impact on traffic flow. The source of delays should be understood before implementation. The nature and types of crashes should likewise be understood. An operational and safety analysis should be performed on existing and proposed intersection configurations in order to evaluate potential impacts.

## HD-902.21 DRIVEWAYS & ENTRANCES

Ideally, driveways and entrances are not to be located within the functional area of an intersection, including the limits of any auxiliary lanes being utilized as they adversely affect operational performance and safety.

As with other types of intersections, driveways and entrances are to intersect the roadway at a 90-degree angle whenever practical. KYTC *Standard Drawings* RPM-110, RPM-150, and RPM-152 show details. Also, Chapters 4 and 9 of AASHTO's *A Policy on Geometric Design of Highways and Streets* contain further discussions concerning driveways.

## HD-902.22 PEDESTRIANS & BICYCLES

The Department of Highways promotes the safe and efficient movement of vehicles, pedestrians, and bicycles. Safety performance measures including non-motorized fatalities and serious injuries should be evaluated when designing intersections that accommodate Pedestrians and Bicycles. Also see the Cabinet's *Pedestrian and Bicycle Travel Policy* and **HD-1500.** For detailed design discussion see AASHTO's *Guide for the Development of Bicycle Facilities*, FHWA's *Separated Bike Lane Planning and Design Guide*, and AASHTO's *Guide for the Planning, Design, and Operation of Pedestrian Facilities*.

In areas where sidewalk is utilized, the facility is to comply with the Americans with Disabilities Act (ADA). The United States Access Board's *Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way* may also be a valid reference. Sidewalk ramp types and details are shown in KYTC *Standard Drawings* RPM-170 and RPM-172. The *Manual of Uniform Traffic Control Devices* should also be consulted for details of intersection striping and signing for pedestrian traffic.

◆ ◆ ◆

**Chapter**

INTERSECTIONS

**Subject**

Grade Separation Without Ramps

## HD-903.1 OVERVIEW

Grade-separation facilities provide for the safest and most efficient movement of vehicles, pedestrians, and bicycles across intersecting roadways. Conflict points between the facilities are eliminated when one of the roadways is taken over or under the other facility. The ability to use this type of facility is usually based upon:

- Type of terrain
- Type of facility being constructed
- Type of access control being utilized on the facility
- Economic considerations

There is no minimum spacing along a corridor and no limit to the number of grade-separated facilities along a roadway.

## HD-903.2 VERTICAL CLEARANCE

In selecting the alignment and grades of intersecting roadways, a major control is vertical clearance under overpasses. For various types of roadways, the following minimum vertical clearances apply:

| TYPE OF ROADWAY | MINIMUM CLEARANCE* (Feet) | DESIRABLE CLEARANCE (Feet) |
|---|---|---|
| Interstate, federal aid primary in rural areas | 16.5 | 17.5 |
| Strategic Highway Network | 16.5 | 17.0 - 17.5 |
| All others | 14.5 | 17.0 - 17.5 |

**For rehabilitation/reconstruction work involving existing bridges, vertical clearance can be reduced by 0.5 feet from above minimum clearances.*

## HD-903.2 VERTICAL CLEARANCE (cont.)

The Strategic Highway Network (STRAHNET) comprises all rural interstates and selected urban interstates or other routes. In Kentucky, the selected urban interstates and other routes are the following:

- Louisville: I-65, I-71, I-264 from I-64 to I-71
- Covington: I-75 north to I-275 east, I-275 east to I-75 north in Ohio
- Christian Co.: US 41A from Screaming Eagle Blvd. to I-24
- Hardin/Meade Co.: KY 313 and US 31W from I-65 to Brandenburg Station Rd.
- Madison Co.: US 421, US 25, and KY 2872 from Bluegrass Army Depot entrance to I-75

The chart on the preceding page applies to both grade-separation and interchange facilities. The minimum clearances are required across the entire roadway width, including the usable shoulder.

Where practicable, the desirable clearance under bridges on the interstate should be used to accommodate future overlays.

## HD-903.3 HORIZONTAL CLEARANCE

Minimum horizontal clearances vary depending upon the functional classification of the roadways. The designer shall consult AASHTO's *Policy on Geometric Design of Highways and Streets* and the KYTC *Bridge Design Manual* for specific details and design criteria. Horizontal clearance and clear zones are not interchangeable. For clear zones, the designer should consult the AASHTO *Roadside Design Guide*.

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*Chapter*

INTERSECTIONS

*Subject*

Interchanges

## HD-904.1 DEFINITION

According to AASHTO, an interchange is “a system of interconnecting roadways in conjunction with one or more grade separations that provides for the movement of traffic between two or more roadways or highways on different levels.”

## HD-904.2 DESIGN CONSIDERATIONS

Specific dimensional design criteria are applicable for new construction. The improvement of existing interchanges should be guided by the performance of the current facility. Aspects of the existing design that are performing well may remain unchanged, while improving those that are performing poorly.

Once it is determined that an interchange is going to be utilized (based upon highway classification, traffic types and movements, design speeds, access control type, economics, etc.) alternative configurations should be studied and discussed at the project meetings. Generally, minor roadways should pass over major roadways. This configuration takes advantage of the ability of off-ramp traffic to decelerate on the upgrade and of on-ramp traffic to accelerate on the downgrade.

Every interchange is unique. The project team should take great care in deciding the most appropriate interchange configuration based upon, but not limited to, the following:

- Route continuity and lane balance
- Capacity of interchange
- Existing and expected crash frequency and severity
- Uniform and consistent exit patterns
- Weaving considerations
- Cost
- Impacts to surrounding properties
- Environmental considerations
- Maintenance of traffic issues
- Proper signing

## HD-904.2 DESIGN CONSIDERATIONS (cont.)

Basic interchange configurations that may be considered when designing an interchange are:

The Three-Leg Interchange (T and Y configurations) may be considered when future expansion to the unused quadrant is either impossible or highly unlikely.

The Diamond Interchange is the most common interchange and can be designed in both rural and urban areas. In areas where there is moderate to large traffic volumes, traffic control, signalization or roundabout(s) may be required to prevent improper use of the ramps.

The Roundabout Interchange is a diamond interchange with roundabouts at each crossroad ramp terminal. This interchange provides a narrower bridge and eliminates the need for signal control at the interchange. Special consideration needs to be given to traffic volumes when analyzing roundabout operations.

The Single Point Urban Interchange (SPUI) or Single Point Diamond Interchange (SPDI) is primarily suited for urban areas with all four turning movements controlled by traffic signals which results in the elimination of traffic conflicts and the potential to improve traffic operations. This interchange configuration typically has much higher construction costs than other interchanges.

The Diverging Diamond Interchange, DDI, also called a Double Crossover Diamond Interchange (DCD), may be considered for economic, safety, and operational benefits where higher volumes and greater congestion occurs. The DDI is an innovative crossover based design where traffic crosses over to the left-hand side of the road for unopposed left turn movements. Consult FHWA's *Diverging Diamond Interchange Informational Guide* for details.

The Full or Partial Cloverleaf Interchange involves the design of loop ramps to accommodate left turning movements. This interchange configuration is better adapted to suburban or rural areas where the left turning volumes are relatively light. The major disadvantage of the Cloverleaf Interchange is the weaving maneuver that is generated with this design. A weaving analysis would be required.

A general guideline for minimum spacing of interchanges is one mile in urban areas and three miles in rural areas. For design standards for interchanges on interstate routes, the designer can refer to AASHTO's *A Policy on Design Standards—Interstate System*.

## HD-904.3 HORIZONTAL & VERTICAL ALIGNMENT

The horizontal and vertical alignments of the intersecting roadways are controlled by the design speed and class of road for each roadway, as detailed in **HD-700** of this manual and in AASHTO's *A Policy on Geometric Design of Highways and Streets*. Ideally, the roadways should intersect at 90 degrees in tangent sections with grades as flat as practical.

## HD-904.4 RAMPS

Ramps are turning roadways that connect two or more legs at an interchange. In general, the horizontal and vertical alignments of ramps are designed on the basis of a design speed lower than those of the intersecting roadways.

- **Horizontal Alignment:** The minimum radius of 215 feet is to be used at any point on a non-loop ramp, which corresponds to a 30-mph design speed. However, the desirable design speed of the first curve on the exit ramp and the last curve on the entrance ramp should be no less than 70 percent of the main line design speed (See **Exhibit 900-04)**. If this is not practicable, other design speeds are permissible if appropriate acceleration and deceleration tapers are provided. Chapters 3 and 10 in AASHTO's *A Policy on Geometric Design of Highways and Streets* provides additional information.

  Loop ramp designs can vary greatly. If the designer uses compound simple curves, compound spiral curves, or a single radius curve, the design should provide the maximum visibility practical and avoid challenging the driver's expectation. (See "Loop Ramps" in AASHTO's *A Policy on Geometric Design of Highways and Streets*)

- **Vertical Alignment:** Ramp grades are dependent on several factors, including design speeds, type of facilities, nature of traffic, etc. KYTC common practice is to limit ramp grades to 6 percent when practical and to 4 percent when a large volume of trucks or sharp horizontal curvature is present. Chapter 10 in AASHTO's *A Policy on Geometric Design of Highways and Streets* provides additional information.

- **Ramp Lane Widths:** Single-lane ramps should have a minimum pavement width of 15 feet, with a 6-foot usable shoulder right and a 4-foot usable shoulder left. Two-lane ramps should have a minimum pavement width of 24 feet, with a 6-foot usable shoulder right and a 4-foot usable shoulder left (See **Exhibits 900-05** and **900-06**).

  Pavement widths can vary depending on ramp radii, traffic conditions, etc. Therefore, the designer is advised to refer to Chapter 10 in AASHTO's *A Policy on Geometric Design of Highways and Streets* for additional guidance.

## HD-904.5 RAMP TERMINALS

Ramp terminals often create an intersection with the cross road. Ramp terminals should be designed as intersections, given due consideration to turning roadways, turn lanes, intersection geometry, access control, etc. See HD 900-03 and AASHTO's *A Policy on Geometric Design of Highways and Streets* for additional guidance. For more information on ramp terminals see **Exhibits 900-07** and **900-08**.

## HD-904.6 SUPERELEVATION

Superelevation on the main line, minor roadway, and ramp proper is to be in accordance with **HD-702** and/or AASHTO's *A Policy on Geometric Design of Highways and Streets*.

## HD-904.7 SPEED-CHANGE LANES

To minimize interference with through traffic and to decrease accident potential, deceleration and acceleration lanes should be provided within the interchange area. These lanes are generically referred to as speed-change lanes.

The speed-change lane should be of sufficient length to allow the driver to maneuver comfortably and safely from the roadway to the ramp. The two general types of speed-change lanes are taper and parallel.

Chapter 10 of AASHTO's *A Policy on Geometric Design of Highways and Streets* provides detailed discussions of speed-change lanes.

## HD-904.8 GEOMETRIC LAYOUT SHEET (GLS)

For interchanges, the project manager is to approve the geometric layout and recommend the chosen alternative to the Director of the Division of Highway Design by submitting a Geometric Layout Sheet (GLS). The GLS should include a block for a recommendation signature of the project manager and approval signatures of the directors of the Division of Highway Design and the Division of Traffic Operations. This layout sheet should show all ramps, lane widths, tapers, curve data, typical sections, access control information, and superelevation transitions of all roadways. For grade-separation and interchange projects on interstates, the Federal Highway Administration (FHWA) shall be involved in the decision process, and the geometric layout sheet shall be submitted to that agency for approval. For additional information on interchange submittals to FHWA, including the Interchange Modification Report (IMR) and the interchange Justification Study (IJS). See **HD-203** and **Exhibit 900-09**.

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# Exhibit 900-01

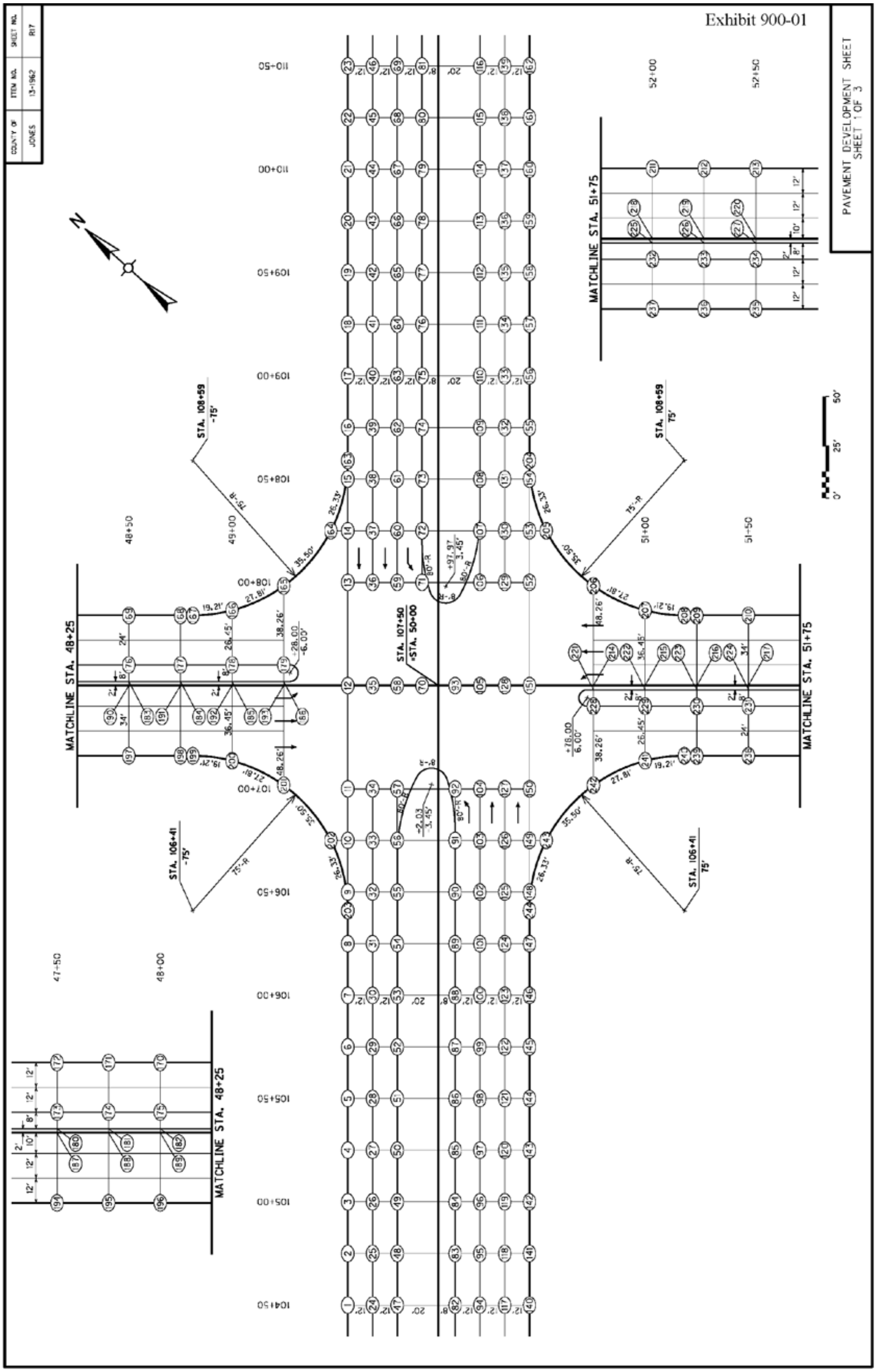
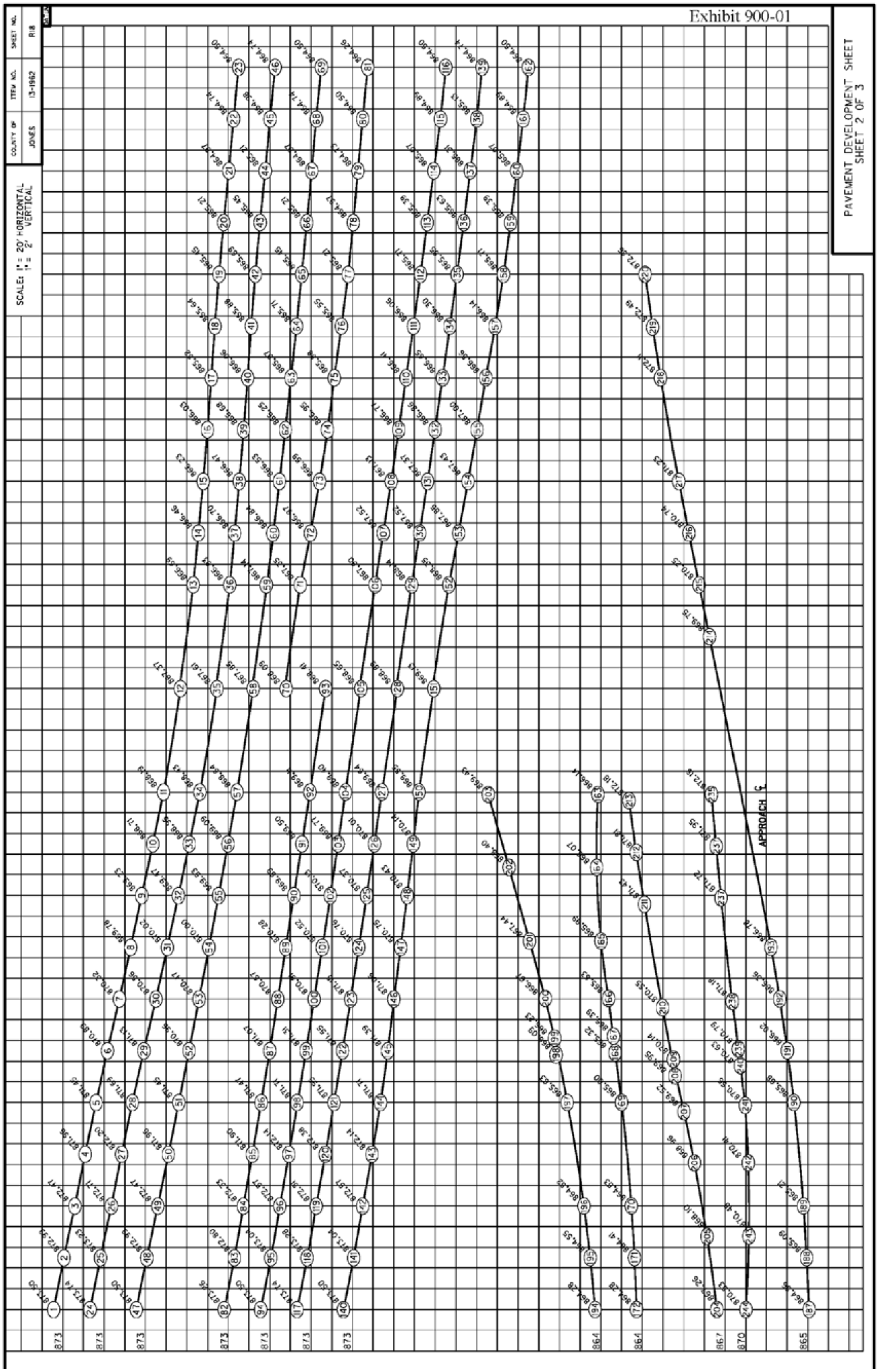


**Exhibit 900-01**



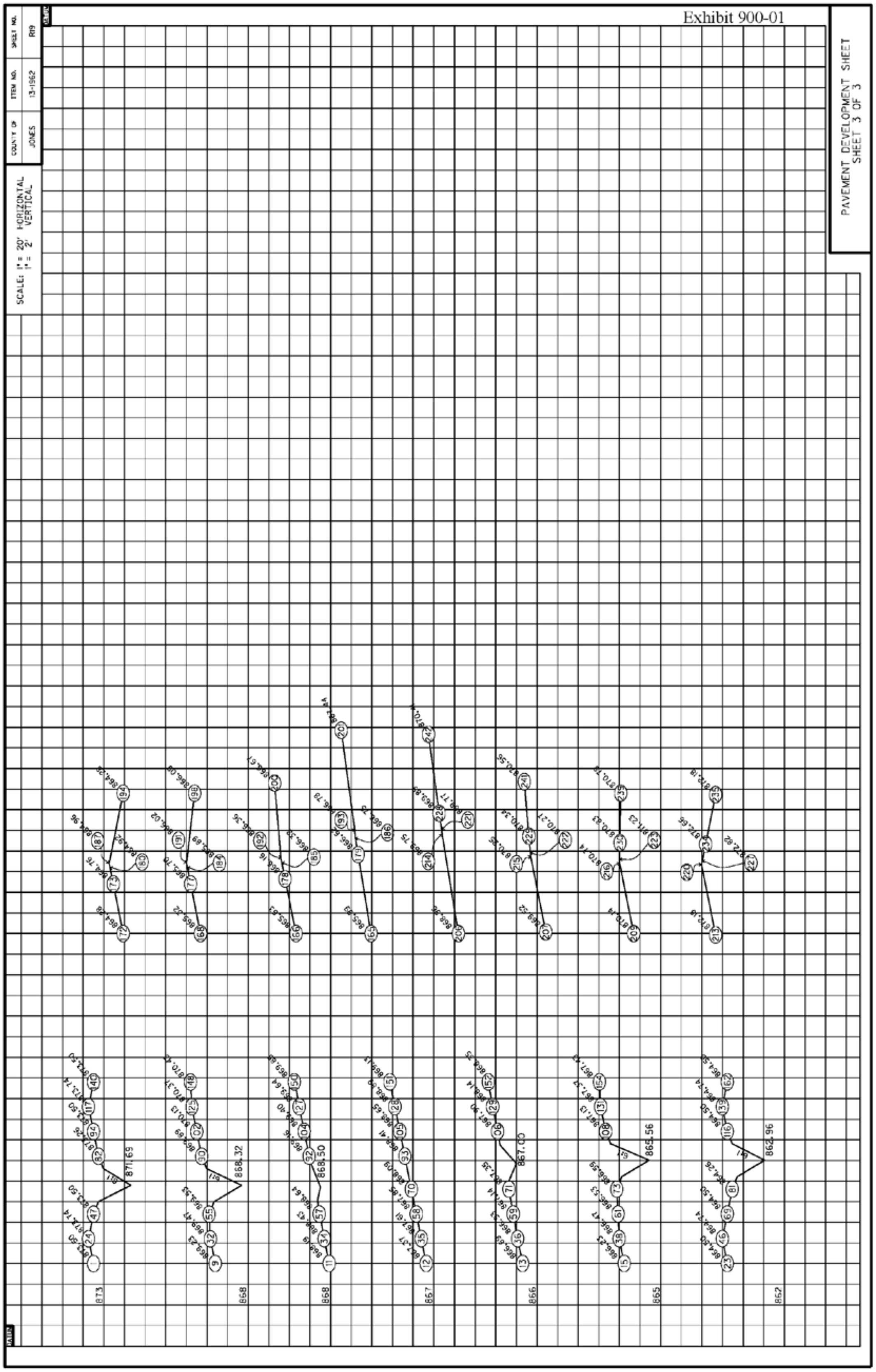


Exhibit 900-01
PAVEMENT DEVELOPMENT SHEET
SHEET 3 OF 3
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL
COUNTY OF
JONES
ITEM NO.
13-1962
SHEET NO.
R19

Basic Geometric Elements of a Roundabout

# Exhibit 900-02

Exhibit 900-02

## BASIC GEOMETRIC ELEMENTS OF A ROUNDABOUT

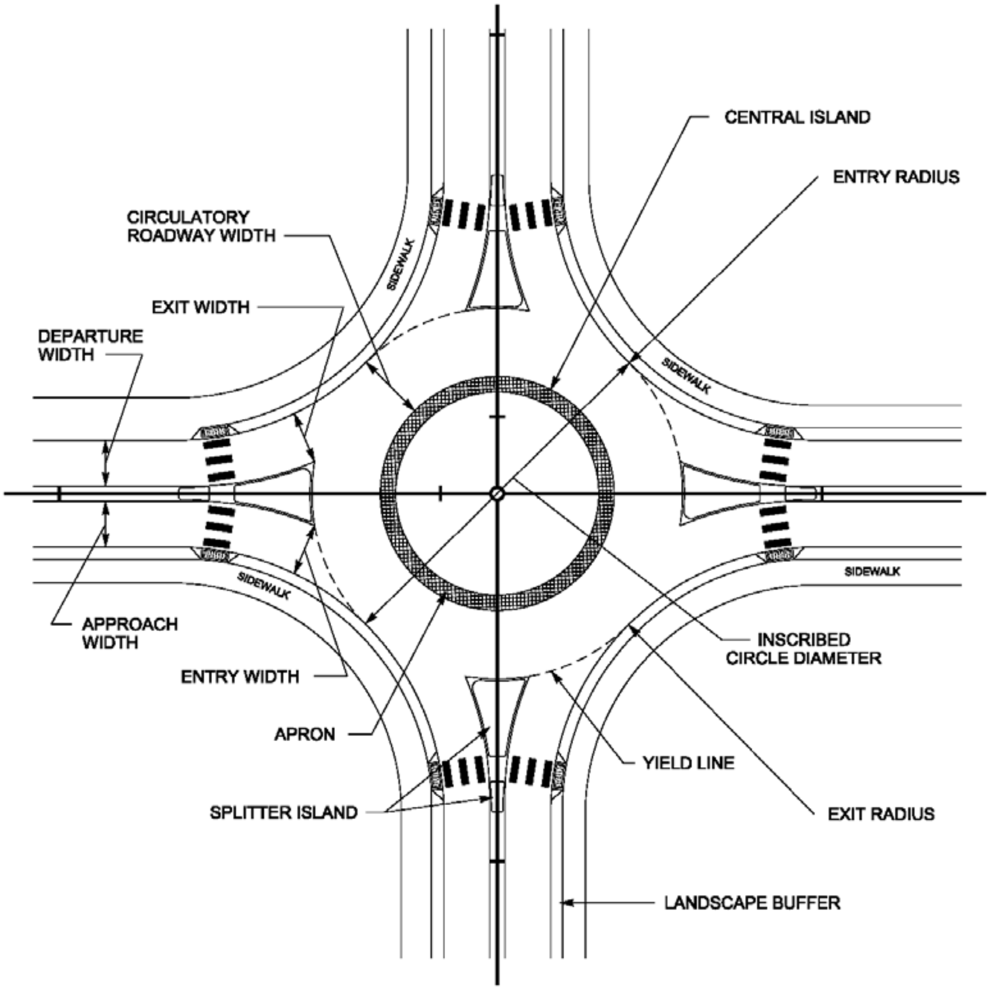
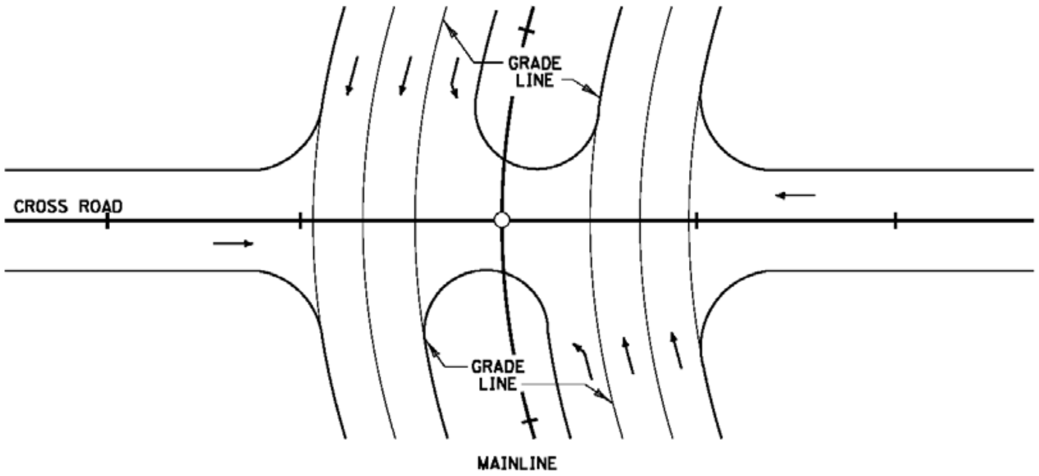
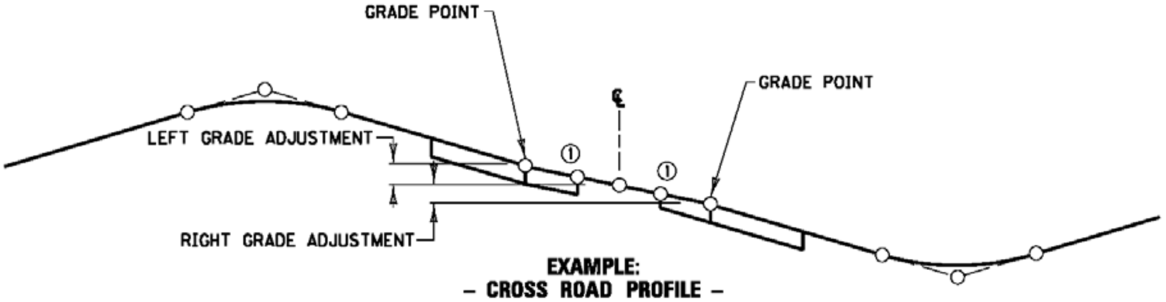


Exhibit 900-03

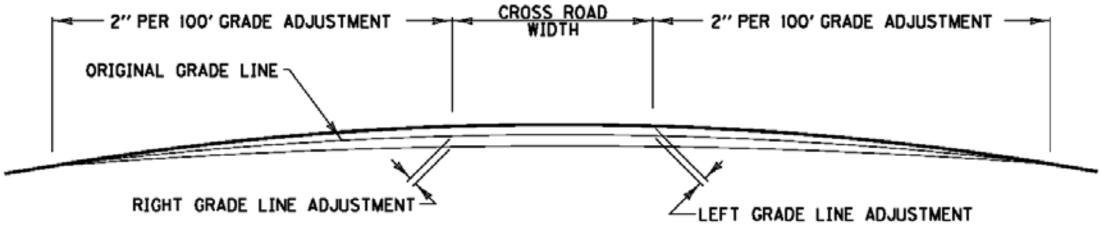
# EXAMPLE: CROSS ROAD PROFILE ADJUSTMENT



**– PLAN –**



**EXAMPLE:**
**– CROSS ROAD PROFILE –**
**(ADJUSTED)**



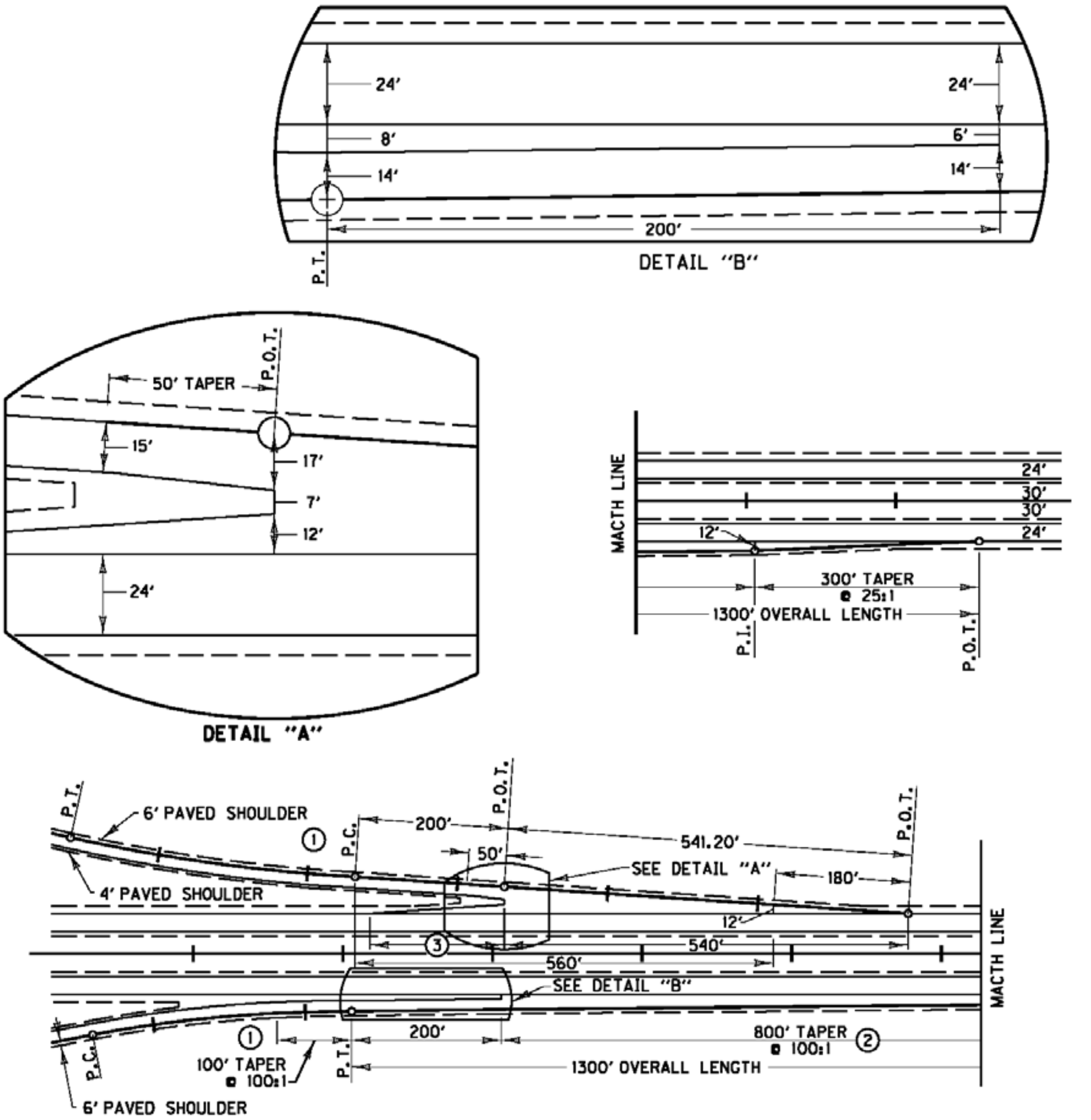
**EXAMPLE:**
**– MAINLINE PROFILE –**
**(ADJUSTED)**

① IF LEFT TURN STORAGE IS UTILIZED, THE SUPERELEVATION OF THE LEFT TURN LANE MAY BE TRANSITIONED FROM THE SUPERELEVATION OF THE CURVE TO THE SUPERELEVATION CREATED BETWEEN THE TWO MAINLINE PAVEMENTS AT THE CROSS ROAD.

DRAWING NOT TO SCALE

Exhibit 900-04

# COMMON PRACTICE FOR RAMP TAPERS



① DESIRABLE DESIGN SPEED OF CURVE IS ≥ .7 OF MAINLINE DESIGN SPEED, IF DESIGN SPEED OF CURVE IS < .7 OF MAINLINE DESIGN SPEED, MAKE AN ANALYSIS (IN ACCORDANCE WITH THE CURRENT AASHTO GREEN BOOK CRITERIA) WITH APPROPRIATE LENGTHENING OF SPEED CHANGE LANE.

② WHEN USING MAINLINE DESIGN SPEED IF ≥ 60 MPH AND MAINLINE GRADE OF ≥ 4% CONCURRENTLY. MAKE AN ANALYSIS (IN ACCORDANCE WITH THE CURRENT AASHTO GREEN BOOK CRITERIA) WITH APPROPRIATE LENGTHENING OF SPEED CHANGE LANE.

③ REQUIRED LENGTH OF NOSE TAPER BASED ON DESIGN SPEED OF MAINLINE:

| MAINLINE DESIGN SPEED | LENGTH OF NOSE TAPER |
|---|---|
| ≥ 30 MPH | 180 FT. |
| 40 MPH | 240 FT. |
| 50 MPH | 300 FT. |
| ≥ 60 MPH | 360 FT. |

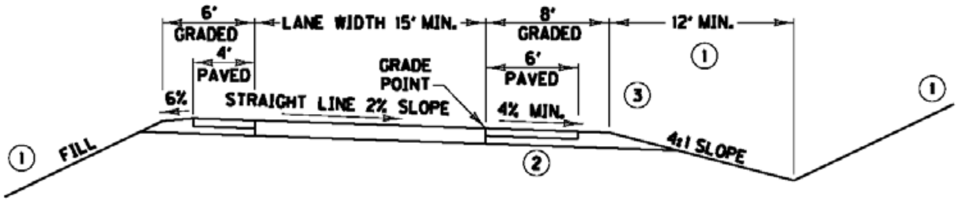
DRAWING NOT TO SCALE

**Exhibit 900-05**

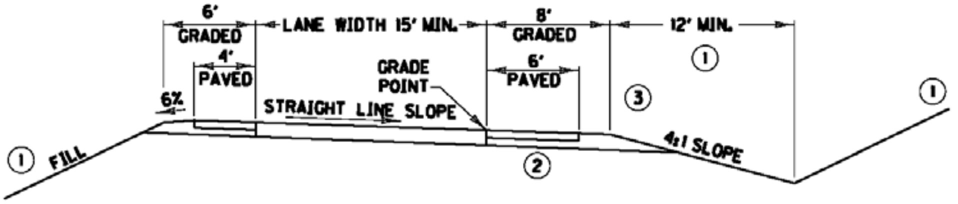
Exhibit 900-05

# TYPICAL SECTIONS

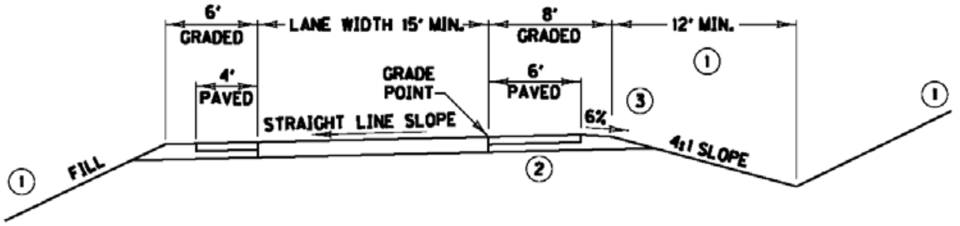
## ONE LANE RAMPS



NORMAL SECTION



SUPERELEVATED RIGHT



SUPERELEVATED LEFT

THESE TYPICALS ARE COMMONLY UTILIZED IN THE DESIGN OF RAMP TEMPLATES FOR NORMAL OR SUPERELEVATED SECTIONS IN FILL, EARTH CUT OR ROCK CUT SITUATIONS. THE DESIGN ENGINEER IS DIRECTED TO USE THE CURRENT EDITION OF AASHTO'S "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" FOR PROJECT SPECIFIC INFORMATION.

① SEE AASHTO ROADSIDE DESIGN GUIDE. CONTOUR GRADING PLANS SHALL GOVERN SLOPES AND DIMENSIONS OUTSIDE THE SHOULDER POINT WHERE NOT IN CONFLICT WITH AASHTO ROADSIDE DESIGN GUIDE.

② USABLE SHOULDER SHALL BE PAVED WITHIN INTERCHANGE.

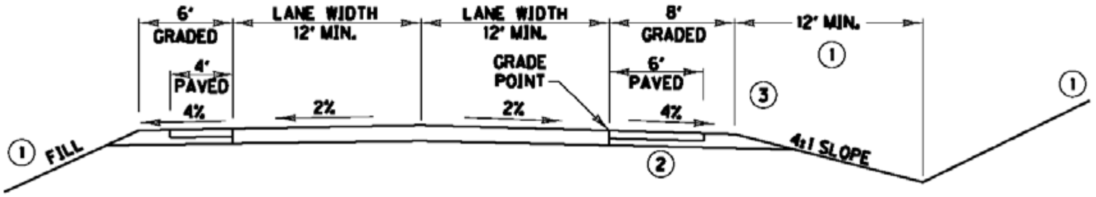
③ REFER TO EXHIBIT 700-08 FOR GUARDRAIL PLACEMENT DETAILS.

DRAWING NOT TO SCALE

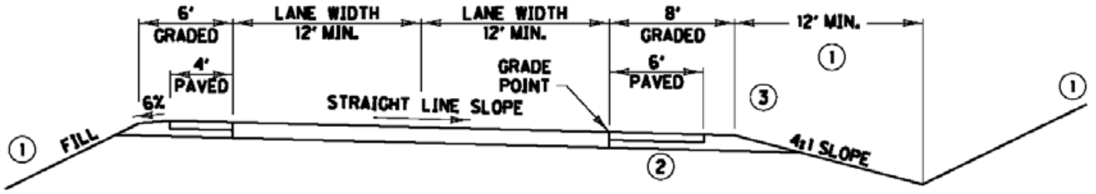
Exhibit 900-06

# TYPICAL SECTIONS

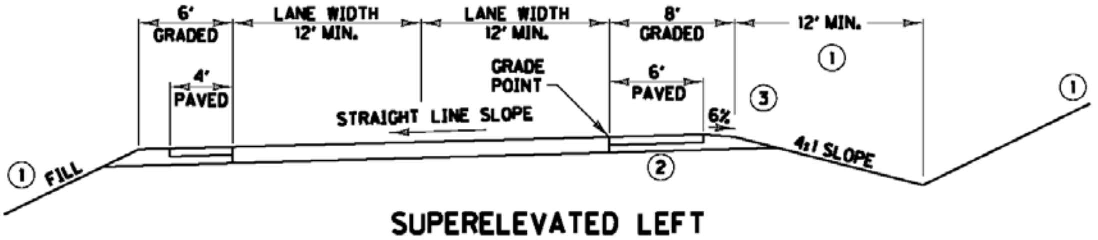
## TWO LANE RAMPS



NORMAL SECTION



SUPERELEVATED RIGHT



SUPERELEVATED LEFT

THESE TYPICALS ARE COMMONLY UTILIZED IN THE DESIGN OF RAMP TEMPLATES FOR NORMAL OR SUPERELEVATED SECTIONS IN FILL, EARTH CUT OR ROCK CUT SITUATIONS. THE DESIGN ENGINEER IS DIRECTED TO USE THE CURRENT EDITION OF AASHTO'S " A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" FOR PROJECT SPECIFIC INFORMATION.

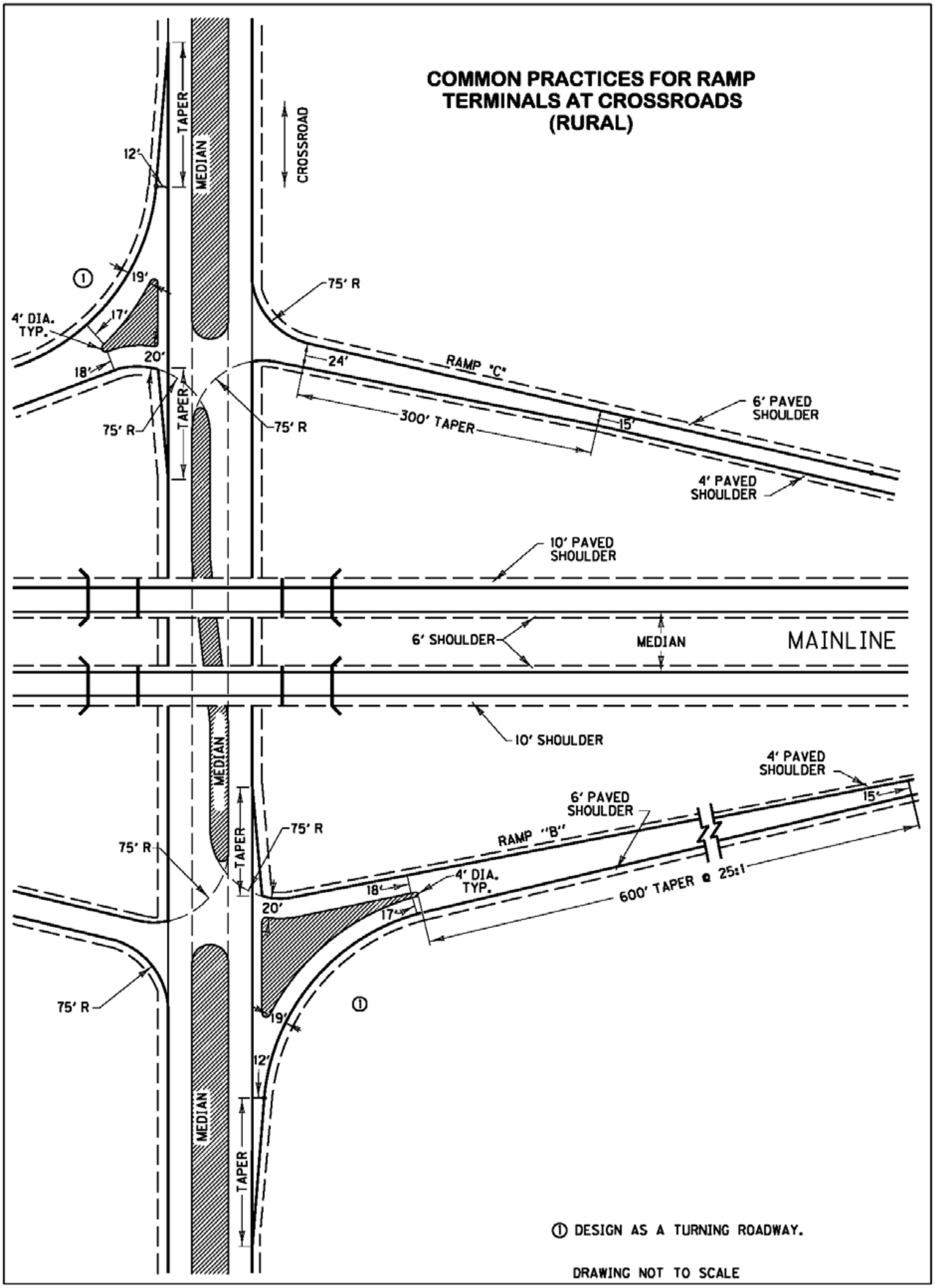
① SEE AASHTO ROADSIDE DESIGN GUIDE. CONTOUR GRADING PLANS SHALL GOVERN SLOPES AND DIMENSIONS OUTSIDE THE SHOULDER POINT WHERE NOT IN CONFLICT WITH AASHTO ROADSIDE DESIGN GUIDE.

② USABLE SHOULDER SHALL BE PAVED WITHIN INTERCHANGE.

③ REFER TO EXHIBIT 700-08 FOR GUARDRAIL PLACEMENT DETAILS.

DRAWING NOT TO SCALE

Exhibit 900-07



① DESIGN AS A TURNING ROADWAY.

DRAWING NOT TO SCALE

## Common Practices for Ramp Terminals at Crossroads (Urban) **Exhibit 900-08**

Exhibit 900-08

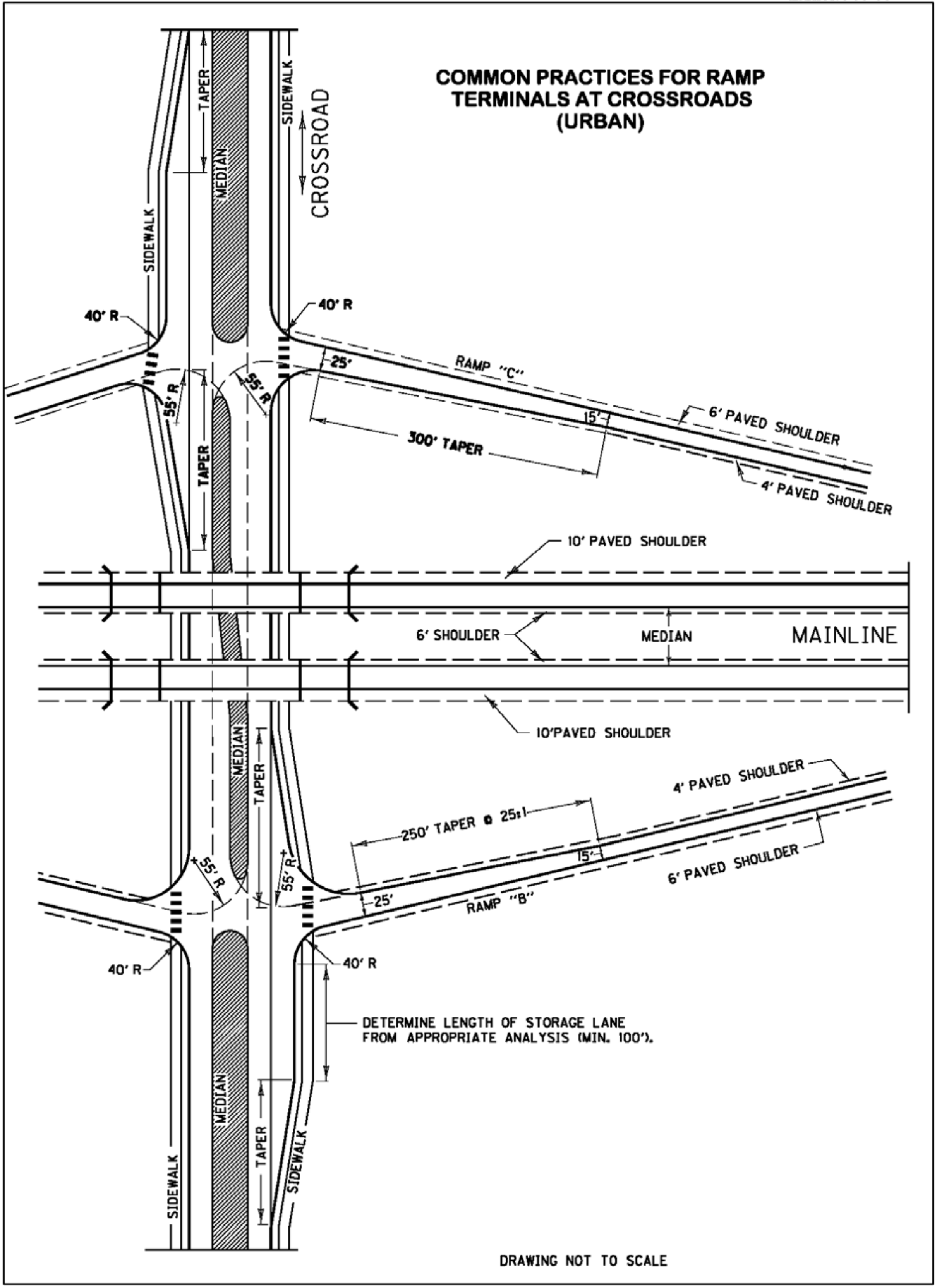
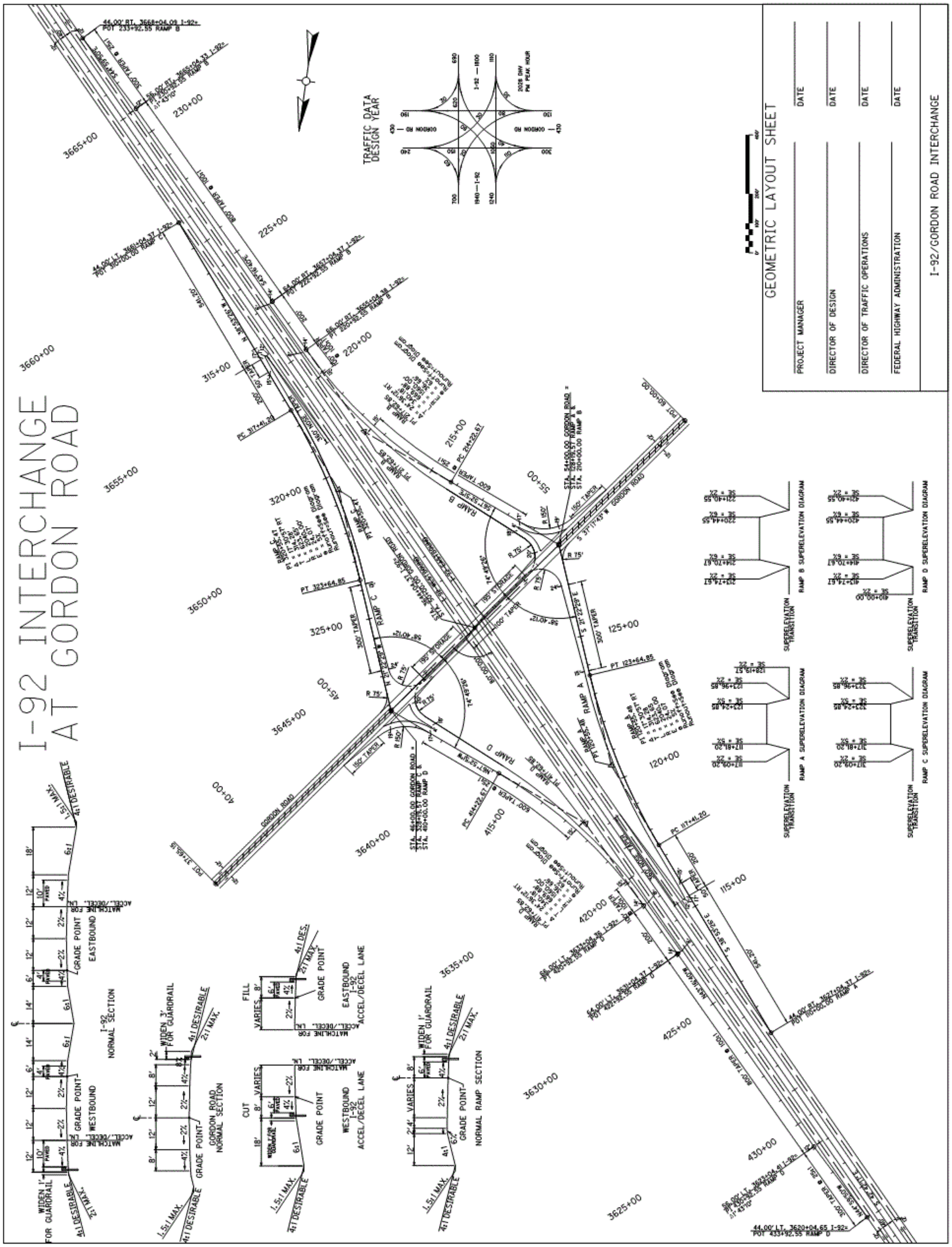


**Exhibit 900-09**



*Chapter*

PAVEMENT

*Subject*

Pavement Design

## HD-1001.1 OVERVIEW

Pavement design is an integral part of the project decision process. The project team discusses, considers, and documents the pavement design as it relates to the overall project. The pavement is typically one of the major costs of a project. Pavement design affects project cost, maintenance of traffic, constructability, the environment, and other aspects of the project.

This chapter outlines policies determining:

- Who designs a pavement structure
- Who approves the design
- Accepted practices for pavement type selections

The pavement design for a project is determined by:

- Traffic volume and composition
- Soil conditions
- Materials availability
- Historical pavement performance
- Existing conditions
- Maintenance of traffic considerations
- Initial and life cycle costs

Information required for pavement design includes data on traffic information, soil properties, and project specific information. The designer is advised to request this information as soon as possible in order to develop a proposed pavement design at the earliest possible stage of the project. The procedures for determining pavement layer thickness and composition are provided in the *Pavement Design Guide* issued by the Division of Highway Design and available at:

http://transportation.ky.gov/Highway-Design/Pages/Pavement-Design.aspx

## HD-1001.2 PAVEMENT DESIGN RESPONSIBILITY

The project manager determines who will develop the pavement design, but the submission and approval must be done according to the following criteria:

| **Criteria*** | **Submitted By** | **Approved By** | **Type Selection Justification and LCCA** Required** | **Type Selection Determined By** |
|---|---|---|---|---|
| On the NHS | Central Office TEBM for Pavement Branch | State Highway Engineer & if required, FHWA | Yes | State Highway Engineer |
| Structural Overlay or AADTT > 4,000 | C.O. Pavement Branch Staff or Project Manager | C.O. TEBM for Pavement Branch | Yes *** | State Highway Engineer |
| AADTT ≥ 1,000 and ≤ 4,000;<br>or ≥ 5 Lane Miles | Project Manager | C.O. TEBM for Pavement Branch | Yes | State Highway Engineer |
| < 1,000 AADTT and < 5 Lane Miles | Project Manager | District TEBM for Project Development | No | Project Manager |

** Average Annual Daily Truck Traffic (AADTT) is current year data. NHS is the National Highway System.*
*** LCCA – Life Cycle Cost Analysis*
**** Structural Overlay requires Type Selection Justification and LCCA if overlay is adding more than 4 inches of new pavement.*

The project manager may request pavement designs from the Central Office Pavement Branch by submitting a request to the Transportation Engineering Branch Manager (TEBM) of the Pavement Branch.

### HD-1001.2.1 On a NHS Route, or Structural Overlay, or ≥ 4,000 AADTT

The project manager may submit a pavement design to the TEBM of the Pavement Branch or request a pavement design from the TEBM by email. The TEBM of the Pavement Branch is responsible for submitting to the State Highway Engineer's Office when required. Any geotechnical or traffic information as well as any other documentation pertinent to the pavement design should be placed in the working pavement design folder in ProjectWise to help expedite the pavement design process. The Pavement Branch staff is responsible for notifying the project manager of the pavement design approval and providing a link to the documentation.

### HD-1001.2.2 Off the NHS with AADTT ≥ 1,000 & < 4,000 or ≥ 5 Total Lane Miles

The Project Manager should submit a pavement design to the TEBM of the Pavement Branch or request a pavement design from the TEBM by email.

### HD-1001.2.2 Off the NHS with AADTT ≥ 1,000 & < 4,000 or ≥ 5 Total Lane Miles (cont.)

Any geotechnical or traffic information, as well as any other documentation pertinent to the pavement design, should be placed in the working pavement design folder in ProjectWise to expedite the pavement design process. The Pavement Branch staff is responsible for notifying the project manager of the pavement design approval and providing a link to the documentation.

### HD-1001.2.3 Off the NHS with AADTT < 1,000 & < 5 Total Lane Miles

The project manager is responsible for the development of the pavement design and placing the signed pavement design in ProjectWise. The project manager shall notify the TEBM of the Pavement Branch when the document is available and provide a link to the documentation.

## HD-1001.3 PAVEMENT DESIGN SUBMITTAL

Prior to final inspection, the project manager should submit the pavement design for approval to the TEBM of the Pavement Branch. The project manager shall provide a link to the appropriate documentation.

The Plan Processing Branch will ensure that all projects with new pavement have an approved pavement design. Projects must have an approved pavement design before proceeding to a letting.

All pavement design submittals should include or reference each of the following:

- Completed, current version of the *Pavement Design Catalog* spreadsheet, including:
  - Pavement Design Folder Cover (**Exhibit 1000-01**)
  - Life Cycle Cost Analysis of alternatives (if required)
  - Pavement type selection justification (if required)
  - Signed Pavement Design Form (**Exhibit 1000-02**)
- Typical sections and details
- Geotechnical information
- Traffic Forecast Request Form from planning (**Exhibit 1000-03**)
- Special notes and provisions (if applicable to pavement)
- Subsurface drainage details
- Overlay taper details (project specific)
- Other documentation (if available and applicable)

## HD-1001.4 PAVEMENT QUANTITIES

The Department of Highways' standard summary sheets for "Paving Areas" and "Paving Quantities" are to be used in the preparation of plans. See "Weight Factors" (**Exhibit 1000-04**) and "Example Pavement Details" (**Exhibits 1000-05** and **1000-06**) for estimating pavement quantities.

## HD-1001.4 PAVEMENT QUANTITIES (cont.)

When there are multiple pavement mixtures and the quantity of any specific mixture is less than 1,000 tons, substitute a similar mixture on the project that has a quantity greater than 1,000 tons or use the mainline mixture type.

## HD-1001.5 STRUCTURAL OVERLAYS

A structural overlay is intended to extend the structural life of the pavement; therefore, it will consist of two or more courses of asphalt or a Jointed Plain Concrete (JPC) course. The project manager shall submit an email request for a structural overlay design to the TEBM of the Pavement Branch, Division of Highway Design. The Pavement Branch will coordinate with the project manager to determine if the existing pavement can be salvaged.

## HD-1001.6 ENTRANCES, ACCESS ROADS, & APPROACHES

The paving limits for entrances, access roads, and approaches should be a tie-down point, limits of the right of way, or other points as determined by the project team. For more guidance on paving limits, see *Standard Drawing* RPM-110.

The existing pavement type is generally used for entrances. Entrances with 10 percent or greater grade shall be paved. Use the following *Pavement Design* table for minimum pavement depths. When greater pavement depths are warranted, refer to the *Pavement Design Guide*.

For curb and gutter sections with sidewalks, use Portland Cement Concrete (PCC) entrance pavement in accordance with the current *Standard Drawing*. From the back of the sidewalk line, replace the existing pavement with one of the same type and depth if it exceeds the following *Pavement Design* table.

For access roads and minor approaches, it is generally desirable to pave with the mainline design to the back of the radius or touchdown point if the distance from the end of the radius to the touchdown point is less than 100 feet. For distances greater than 100 feet, refer to the *Pavement Design Guide* or the following *Pavement Design* table. The selected pavement design is to be structurally equivalent to or better than the existing.

## HD-1001.6 ENTRANCES, ACCESS ROADS, & APPROACHES (cont.)

| PAVEMENT DESIGNS[*] FOR ENTRANCES, FRONTAGE ROADS, ACCESS ROADS, & MINOR APPROACHES | | | | |
|---|---|---|---|---|
| DESCRIPTION | AGGREGATE BASE[**] (inches) | ASPHALT[***] | | RIGID PCC (inches) |
| | | BASE (inches) | SURFACE (inches) | |
| **ENTRANCES** | | | | |
| RESIDENTIAL | 4 | 2¼ | 1¼ | 8 on 4 DGA |
| COMMERCIAL | 6 | 2¼ | 1¼ | 8 on 4 DGA |
| **FRONTAGE ROADS, ACCESS ROADS, & MINOR APPROACHES** | | | | |
| RESIDENTIAL or COMMERCIAL & MINOR APPROACH ROADS | 8 | 3 | 1¼ | |

* The pavement designs shown are suggested minimums.

** The same aggregate type as used on the main line is to be used.

*** Surface and base mixture designs should be consistent with other designs used on the project. Small quantities (generally less than 1,000 tons) of mixtures different from that used on the project are to be avoided.

## HD-1001.7 SMALL PAVEMENT PROJECTS

Projects involving small quantities where paving or resurfacing is not necessarily the primary project goal (such as bridge or culvert replacements, turn lanes, and horizontal or vertical curve realignments) may be considered small pavement projects.

Pavement lengths involved will generally be on the order of a few hundred feet for a bridge or culvert replacement, or a thousand feet for turn lanes or curve realignments. Pavement typicals, pavement types, nominal aggregate sizes, paving area summaries, and plan notes should be consistent with normal pavement design warrants and plan preparation procedures.

**Note:** This section is **not** meant to apply to larger realignment projects involving more than one horizontal or vertical curve, nor should it apply to bridge ends and turn lanes located within larger pavement projects. It should not be used to attempt to "short cut" normal pavement design procedures where required. This section is intended to apply to isolated situations that happen to affect small amounts of pavement.

## HD-1001.7 SMALL PAVEMENT PROJECTS (cont.)

It is highly recommended to obtain cores to determine the existing pavement thickness. Typically for asphalt, the proposed pavement should be one inch thicker than the existing pavement. Concrete pavement should match the existing concrete thickness or the maximum thickness of the concrete if the concrete thickness is variable. If traffic and soils data are available or can be reasonably estimated, normal pavement design procedures should be used to determine the design thickness. If no data is available, values in the table below may be used (assuming the proposed depths meet the minimum requirement stated above).

**MINIMUM PAVEMENT DESIGNS FOR SMALL PAVEMENT PROJECTS**

| DESCRIPTION ** | AGGREGATE BASE (inches) | ASPHALT BASE (inches) | ASPHALT SURFACE (inches) | RIGID PCC (inches) |
|---|---|---|---|---|
| HIGH TYPE | 4 | 12 | 1¼ | 10 on 4 DGA |
| LOW TYPE | 4 | 9 | 1¼ | 8 on 4 DGA |
| VLV ROUTE | 6 | 3 ½ | 1¼ | 8 on 4 DGA |

** High Type - >2 lanes or ≥4,000 AADTT
Low Type - >400 ADT, <4,000 AADTT
Very Low Volume Route (VLV) - ≤400 ADT (very minor, sometimes aggregate or chipseal type routes).

**Note:** These loose descriptions are a judgment call and a project could be a higher volume county route that should have pavement thickness matching the Low or High Type descriptions.

Subsurface drainage (drainage blanket and/or edge drains) should be used when it exists on the existing pavement. If no subsurface drainage exists, then no drainage will be required for these small projects. In this case, use dense graded asphalt (DGA) only and no crushed stone base (CSB) unless the CSB can be daylighted.

Provide the Pavement Branch Manager with a link to any documents relating to the pavement design. For projects qualifying as “Small Pavement Projects,” provide the Pavement Branch Manager with a link to the Pavement Design Form (**Exhibit 1000-02**) in the Pavement Design folder in ProjectWise. In the note section of the form, state which of the standard designs from this section was used.

## HD-1001.8 CONCRETE PAVEMENT JOINTS

The Non-Reinforced Concrete Pavement (RPN) and Standard Reinforced Concrete Pavement (RPS) series of *Standard Drawings* depict the typical conditions for cement concrete pavement joint types and spacing. For projects where standard joint placements are impractical or undesirable, joint details shall be a required component of the construction plans. For more detail, see *Pavement Design Guide* and *Standard Specifications for Road and Bridge Construction*.

## HD-1001.9 PAVEMENT DRAINAGE & AGGREGATE BASE SELECTION

Adequate drainage must be provided to the pavement structure to insure a successful pavement service life is achieved. DGA should always be used when using a drainage blanket and piping system.

**Note:** Anytime CSB is used, it must be daylighted or a piping system must be used.

## HD-1001.10 SHOULDERS

Show the shoulder pavement thickness in the pavement design document. The cross-slope for a 2-foot paved shoulder is to be the same as the mainline pavement. For shoulders greater than 2 feet, use a 4 percent cross-slope in normal sections. Full-width DGA shoulders are not recommended and should not be utilized without prior approval from the Pavement Branch Manager. For paved shoulders 4 feet or less in width, specify the same mix as used for the mainline pavement. Thickness should be determined to insure adequate structural support is provided to meet any anticipated shoulder traffic. Typically, shoulders should be designed to accommodate a minimum of 20 percent of the mainline Equivalent Single Axle Loads (ESALs). This generally correlates to carrying the top asphalt base and surface courses onto the shoulder with full-depth DGA below.

**Note:** Extend the surface course under the guardrail wedge curb as required. When the useable shoulder is paved and guardrail is used, consideration should be given to extending the pavement to the face of the guardrail.

When using aggregate at the outside edge of the paved shoulders, an asphalt seal is required from the outside edge of the paved shoulder to a point at least two feet down the ditch or fill slope. See *Pavement Design Guide* for more details.

### HD-1001.10.1 Paved Shoulders at Bridge Ends

Paved shoulders are to be used at bridge ends for all bridge and approach projects as a means of minimizing erosion at bridge ends. See *Standard Drawings* RBB-001 and RBB-002 for details on shoulder paving at bridge ends.

## HD-1001.11 INTERSECTIONS

Intersections may require special design consideration when developing the pavement design. Contact the Pavement Branch Manager for more details.

## HD-1001.12 ON-SITE DETOURS (DIVERSIONS)

The pavement design of detours should be determined from project-specific conditions such as duration and traffic. A minimum pavement design is 1 inch of asphalt surface, 1½ inches of asphalt binder, and 4 inches of DGA base. Traffic-bound base (approximately 6 to 8 inches) is permitted for detours with less than 400 Average Daily Traffic (ADT) and a service life of less than 30 days. If any single course type (base, binder, or surface) amounts to less than 1,000 tons total for the project, the mainline mixture type (or the minimum mixture type used on the project) is to be substituted for that course type.

## HD-1001.13 PROJECT TIE-INS

Example project tie-ins are shown in **Exhibits 1000-07**, **1000-08**, **1000-09**, and **1000-10**. These drawings should be modified to project specific dimensions.

Project tie-ins shall be as follows:

- Tapers at entrances**:** Tie into the existing entrance at a 1-inch to 15-inch taper (**Exhibit 1000-07**).

- Speed less than 45 mph**:** The asphalt concrete surface is to be carried full thickness into the existing pavement or bridge end. Mill the existing asphalt pavement to tie into the existing pavement surface course at a 1-inch to 10-foot taper (**Exhibit 1000-10**).

- Speeds between 45mph and 65mph**:**
    - Rigid pavement (existing): Remove the existing pavement through the taper area, backfill as necessary, and pave as shown in the pavement design at a 1-inch to 50-foot taper.
    - Flexible pavement (existing): Mill the surface as required to extend the asphalt surface course full depth into the existing adjacent pavement at a 1-inch to 50-foot taper (**Exhibit 1000-08**).

- Speed greater than or equal to 65 mph**:**
    - Rigid pavement (existing): Remove the existing pavement through the taper area, backfill as necessary, and pave as shown in the pavement design at a 1-inch to 100-foot taper.

## HD-1001.13 PROJECT TIE-INS (cont.)

- Flexible pavement (existing): Mill the surface as required to extend the asphalt surface course full depth into the existing adjacent pavement at a 1-inch to 100-foot taper (**Exhibit 1000-09**).

## HD-1001.14 PARKING LOTS

Pavement designs for parking lots should be addressed on a project-by-project basis. Contact the Pavement Branch Manager for further assistance.

◆◆◆

**Exhibit 1000-01**

# KENTUCKY TRANSPORTATION CABINET

## PAVEMENT DESIGN FOLDER

**County** ____________ **Item No.** ____________ **UPN** ____________

**Road** ____________ **Route** ____________

**Sta. to Sta.** ____________ **MP to MP** ______ to ______

**Designed By** ____________ **Project Length** ______ miles

**Type Selection** **Design ESAL's** ____________

AC ☐
PCC ☐ ☐ **Requires Pavement Section Approval**

**DOCUMENTATION**

- ☐ **Design Executive Summary**
- ☐ **Pavement Design Form**
- ☐ **Special Notes and Provisions**
- ☐ **Type Selection Justification**
- ☐ **Geotechnical Information**
- ☐ **Traffic Information**
- ☐ **Typical Sections and Details**
- ☐ **Comparison of Alternatives**
  - ☐ Initial Cost
  - ☐ Life Cycle Cost
- ☐ **Other Documentation**

List:

**Submittal Date:** ____________

**Exhibit 1000-02**

## PAVEMENT DESIGN FORM

### Pavement Design <4,000 AADTT
### & off the National Highway System

County ______________________ Item ____________ UPN ____________

Description _________________________________________________________________

_____________________________________________________________________________

Current ADT ___________ Current AADTT __________ 20-yr ESALs ______________

Existing Type _____________________ Existing Thickness _______________

Length __________Miles Design Speed __________M.P.H. CBR ________

FOR TYPICAL SECTION SEE ATTACHED SHEET(S)

**ROADBED PREPARATION:**

**ASPHALT ALTNERNATE:**

Traffic Lanes

Shoulders

DESIGNED ___________________ DATE __________ Designer

APPROVED ___________________ DATE __________ Project Manager

APPROVED ___________________ DATE __________ TEBM Pavement(As Required)

**CONCRETE ALTNERNATE:**

Traffic Lanes

Shoulders

**PLAN NOTE NO.:**

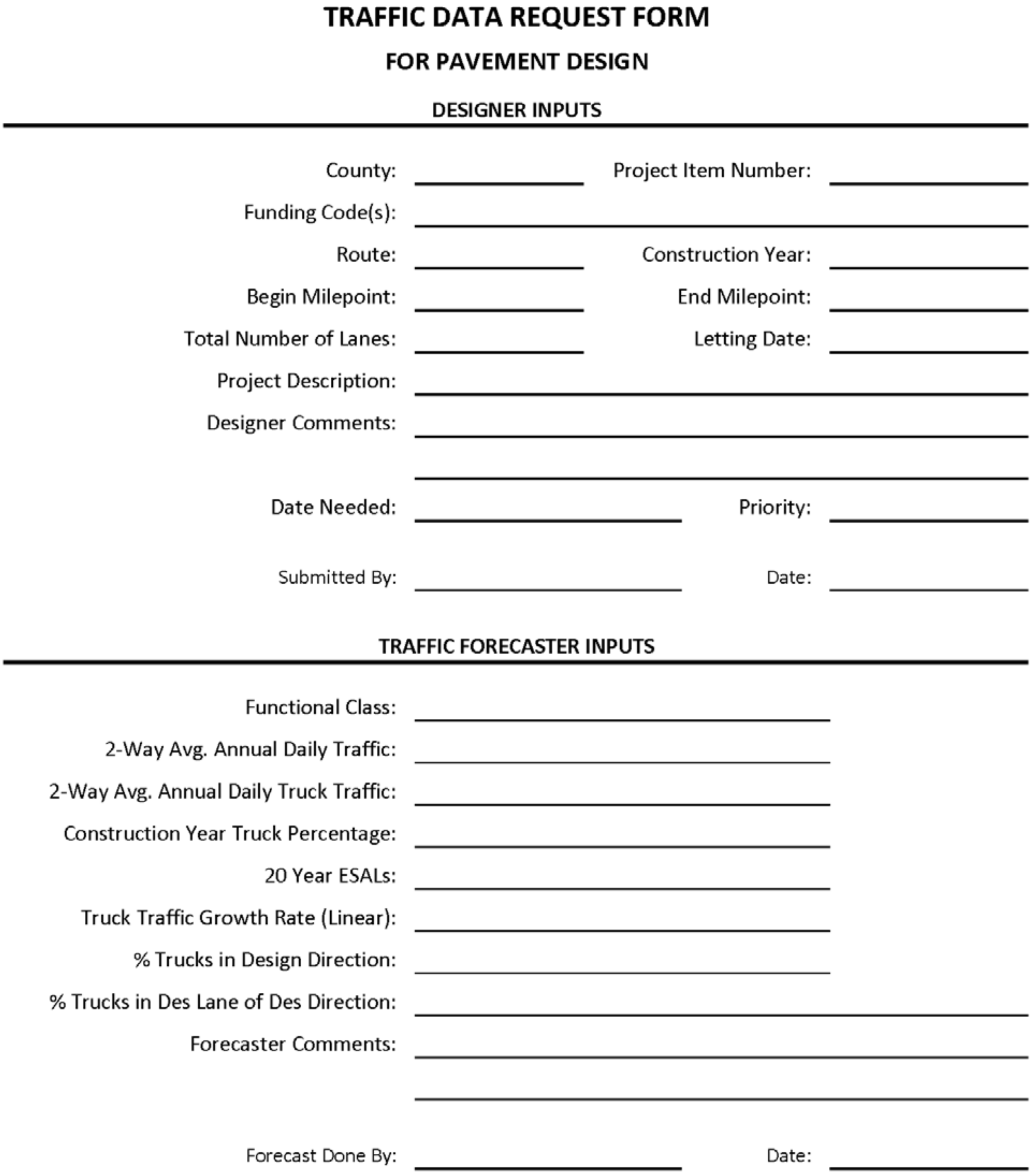
**SPECIAL NOTE FOR:**

**SPECIAL PROVISION FOR:**

**COMMMENTS:**

Page 2 of 2

**Exhibit 1000-03**



# TRAFFIC DATA REQUEST FORM

## FOR PAVEMENT DESIGN

### DESIGNER INPUTS

County: ____________ Project Item Number: ____________

Funding Code(s): ________________________

Route: ____________ Construction Year: ____________

Begin Milepoint: ____________ End Milepoint: ____________

Total Number of Lanes: ____________ Letting Date: ____________

Project Description: ________________________

Designer Comments: ________________________

________________________

Date Needed: ____________ Priority: ____________

Submitted By: ____________ Date: ____________

### TRAFFIC FORECASTER INPUTS

Functional Class: ________________________

2-Way Avg. Annual Daily Traffic: ________________________

2-Way Avg. Annual Daily Truck Traffic: ________________________

Construction Year Truck Percentage: ________________________

20 Year ESALs: ________________________

Truck Traffic Growth Rate (Linear): ________________________

% Trucks in Design Direction: ________________________

% Trucks in Des Lane of Des Direction: ________________________

Forecaster Comments: ________________________

________________________

Forecast Done By: ____________ Date: ____________

**Exhibit 1000-04**

## WEIGHT FACTORS FOR PAVING MATERIALS

| ITEM | LBS./SQ. YD./IN. OF DEPTH |
|---|---|
| Asphalt Concrete Surface, Base or Binder | 110 |
| Asphalt Concrete Surface, Base or Binder - Slag * | 102 |
| Drainage Blanket, Type I (Untreated) | 95 |
| Drainage Blanket, Type II and III Asphalt & Cement Treated) | 100 |
| Dense Graded Aggregate Base | 115 |
| Crushed Stone Base | 115 |
| Gravel Base Type I, II and III | 110 |
| Portland Cement for Gravel Base Type III (2.5% by weight) | 2.75 |
| Crushed Sandstone Base for Shoulders and Medians (Plant-Mixed, Untreated) | 107 |
| Crushed Sandstone Base (Plant-Mixed, Cement-Treated) | 110 |
| Portland Cement (5% by weight) | 5.5 |
| Asphalt Curing Seal (one application) | 1.6 |
| Sand for Blotter (one application) | 5.0 |

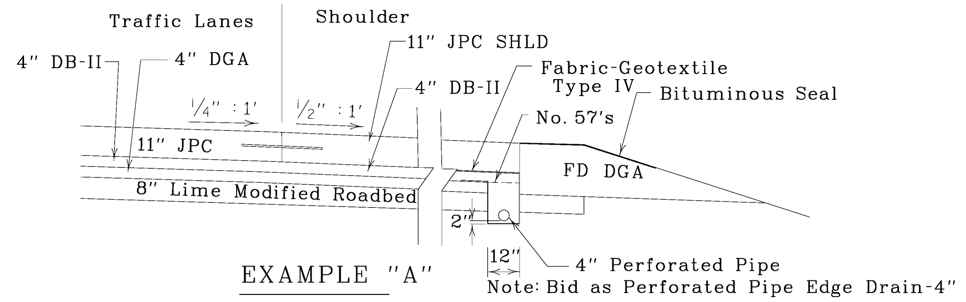
* Selected Counties - Boyd, Greenup, Lawrence, Lewis, Carter

In addition, use the following reference note for Asphalt Concrete Base or Binder in the selected counties:

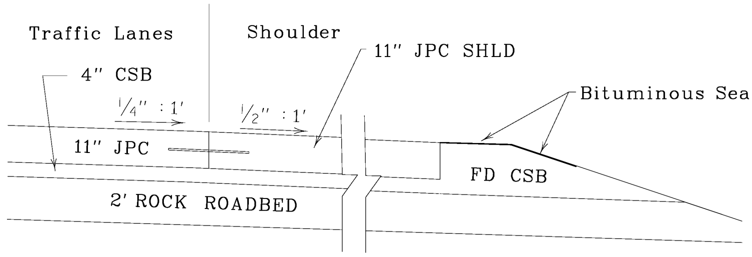
"Blast furnace slag may be utilized in an aggregate blend in these items in accordance with approved mix designs and current specifications. Estimate at 110 pounds per square yard per inch of depth for Asphalt Base or Binder, and Estimate at 102 pounds per square yard per inch of depth for Asphalt Surface."

Example Pavement Details with Shoulders **Exhibit 1000-05**

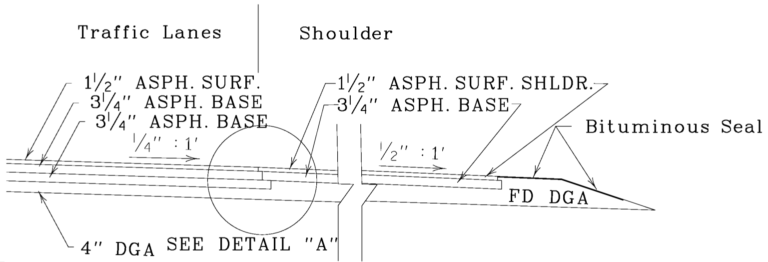
# EXAMPLE PAVEMENT DETAILS WITH SHOULDERS



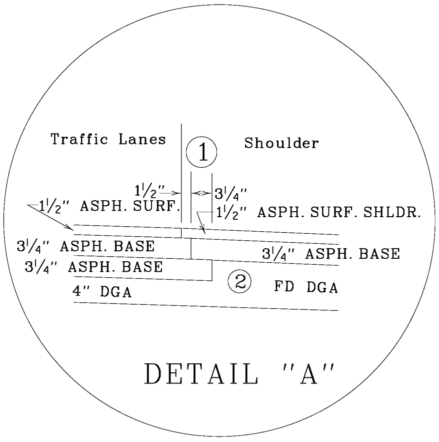
EXAMPLE "A"



EXAMPLE "B"



EXAMPLE "C"



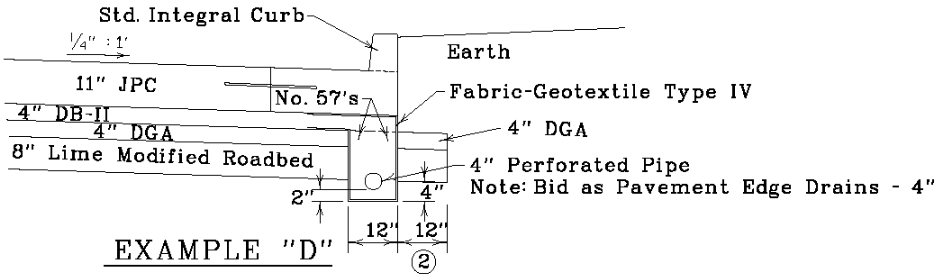
DETAIL "A"

## NOTE

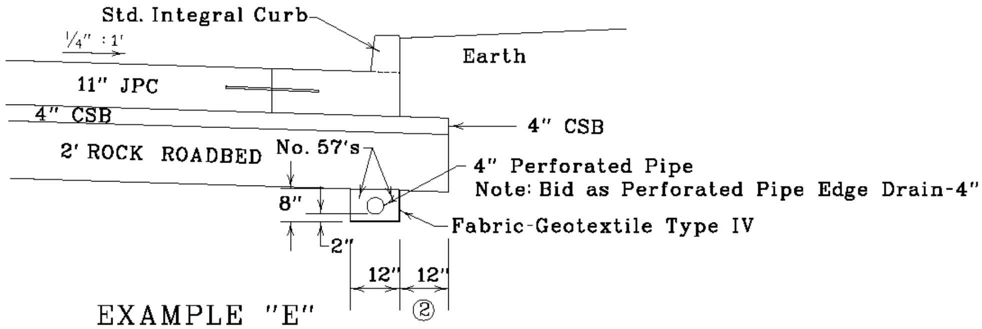
① Use the same step-out width as the thickness of the course above that course.

② Use full depth drainage blanket on 4" DGA where drainage blanket is used.

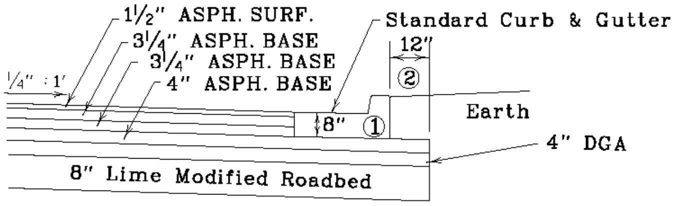
# EXAMPLE PAVEMENT DETAILS WITH CURB AND GUTTER



EXAMPLE "D"



EXAMPLE "E"



EXAMPLE "F"

## NOTES

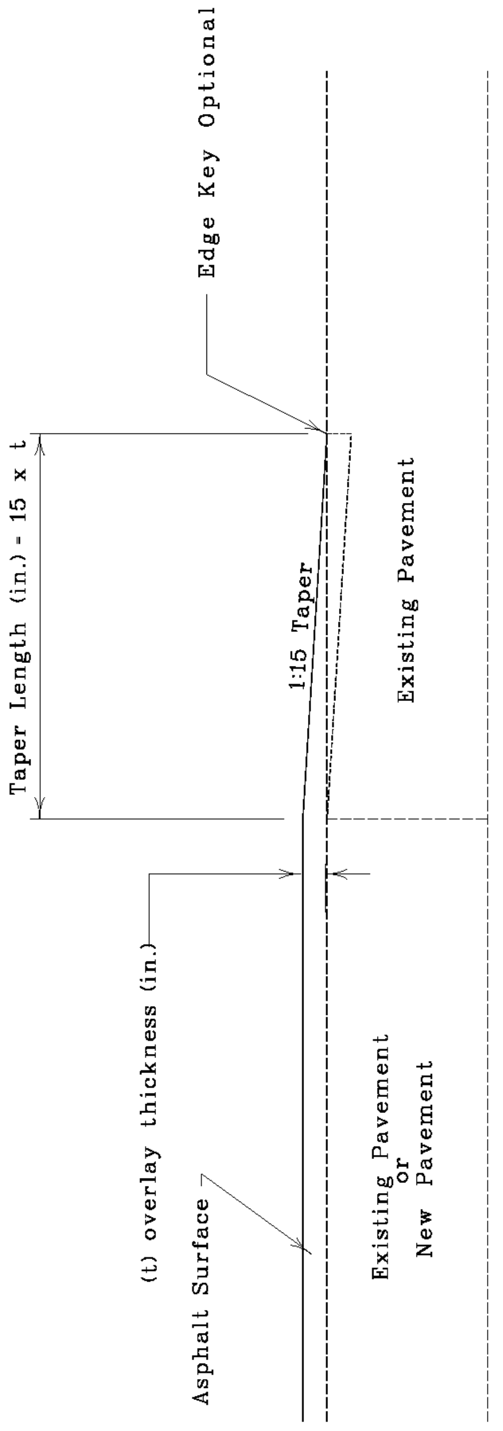
① Adjust asphalt courses such that a course "boundary" occurs at 8" with the standard 8" gutter thickness otherwise use modified curb and gutter.

② The step-out is 12" from the edge of PCCP or from the back of the curb and gutter, to facilitate form placement.

**Exhibit 1000-07**

# TAPER AT ENTRANCES

NOTE TO DESIGNER: DO NOT COPY THIS DRAWING TO THE PLANS, DIMENSION IT WITH APPROPRIATE DIMENSIONS.



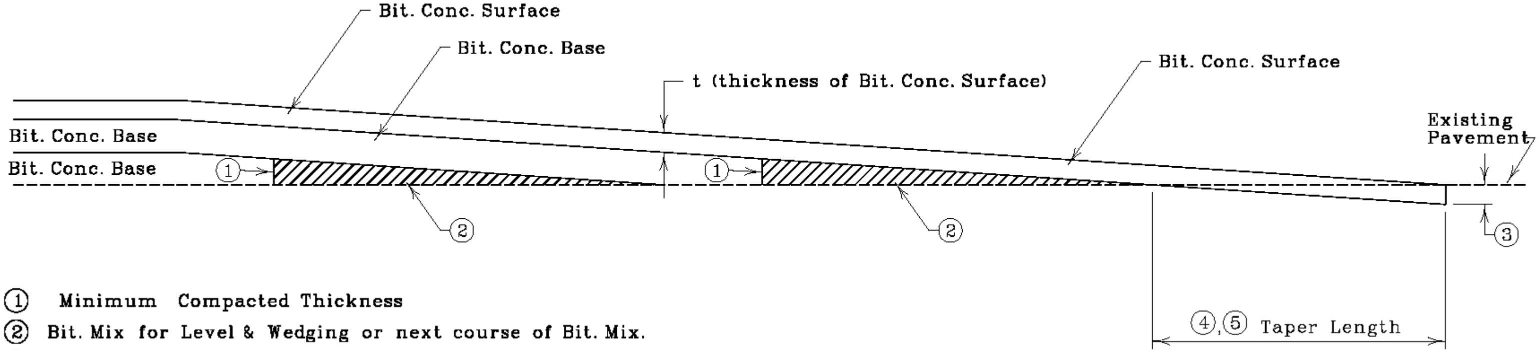
DRAWING NOT TO SCALE

5-28-2015

**Exhibit 1000-08**

# TAPERING OF OVERLAYS ON MEDIUM SPEED FACILITIES (45mph to 65mph)

## RECOMMENDED TAPER RATE 1:600 (1" : 50')



① Minimum Compacted Thickness
② Bit. Mix for Level & Wedging or next course of Bit. Mix.
③ Bit. Surface thickness (Full Depth)
④ Mill existing pavement to receive Bit. Surface full depth (Edge Key)
⑤ Taper Length (ft) = $\frac{\text{t(in.) x Taper Rate}}{12}$

For a Taper Rate of 1:600 (1" :50')

Taper Length = 62.5 feet when t = 1.25 inches
Taper Length = 75 feet when t = 1.50 inches

## TAPERING OF THICK OVERLAYS

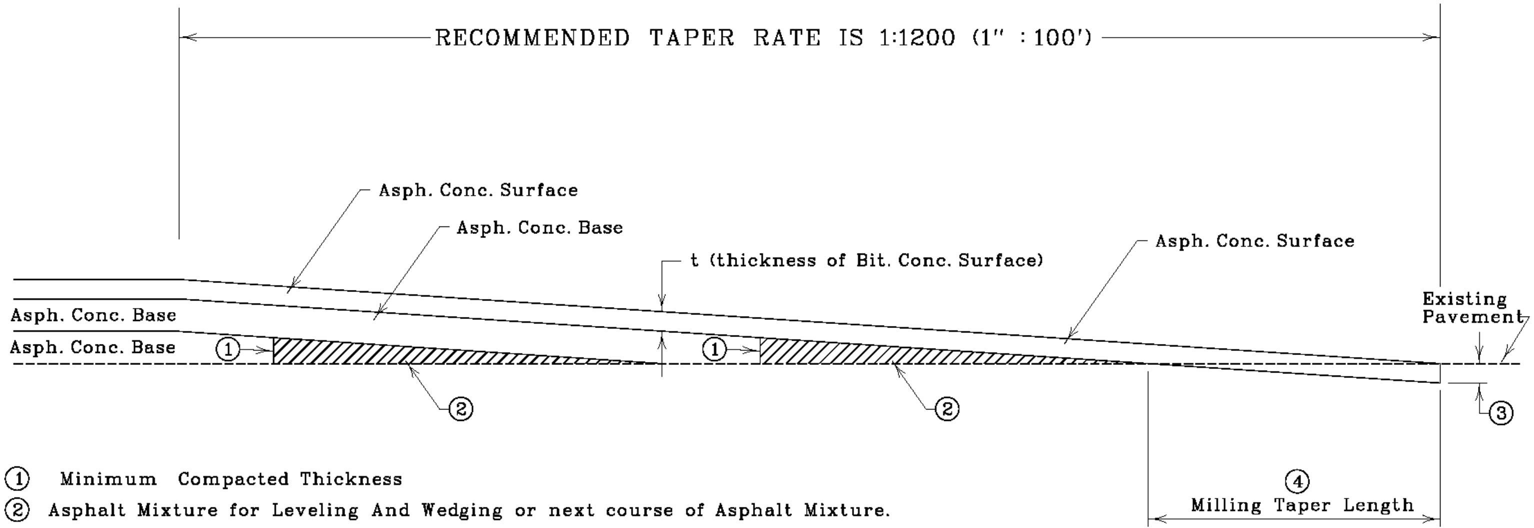
(PROJECT TERMINI, BRIDGE ENDS &
CLEARANCE UNDER STRUCTURES)

NOTE TO DESIGNER: DO NOT COPY THIS DRAWING TO THE PLANS
DIMENSION IT WITH APPROPRIATE DIMENSIONS AND NUMBER OF COURSES

**Exhibit 1000-09**

5-28-2015

# TAPERING OF OVERLAYS ON HIGH SPEED FACILITIES (65mph or higher)



① Minimum Compacted Thickness
② Asphalt Mixture for Leveling And Wedging or next course of Asphalt Mixture.
③ Asphalt Surface thickness (Full Depth)
④ Mill existing pavement to receive Asphalt Surface full depth

$$\text{Taper Length (ft)} = \frac{\text{t(in.)} \times \text{Taper Rate}}{12}$$

For a Taper Rate of 1 :1200 (1" : 100')

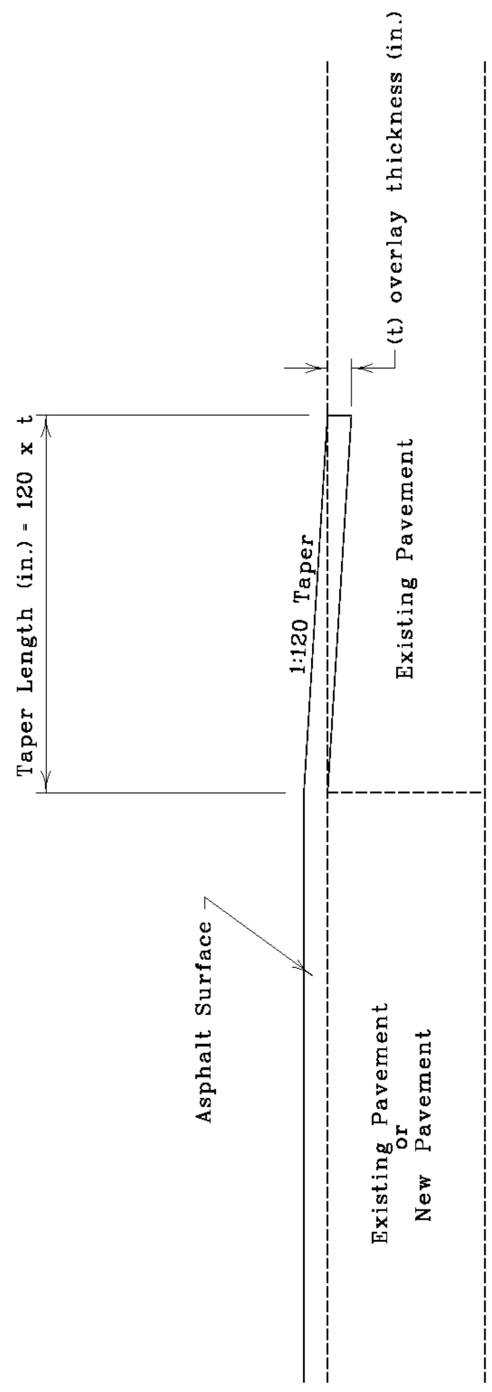
Taper Length = 125 feet when t = 1.25 inches
Taper Length = 150 feet when t = 1.50 inches

NOTE TO DESIGNER: DO NOT COPY THIS DRAWING TO THE PLANS
DIMENSION IT WITH APPROPRIATE DIMENSIONS AND NUMBER OF COURSES

DRAWING NOT TO SCALE

**Exhibit 1000-10**

# TAPERING OF OVERLAYS ON LOW SPEED FACILITIES (< 45 MPH)



NOTE TO DESIGNER: DO NOT COPY THIS DRAWING TO THE PLANS, DIMENSION IT WITH APPROPRIATE DIMENSIONS.

DRAWING NOT TO SCALE

5-28-2015

***Chapter***

ACCESS MANAGEMENT

***Subject***

Policies & Procedures

## HD-1101.1 OVERVIEW

Access management is the systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and connections to a roadway. Access management involves providing or managing access to adjacent properties while simultaneously preserving the flow of traffic on the surrounding road system in terms of safety, capacity, and speed. Access management includes several principles and techniques that are designed to increase the capacity of roads, manage congestion, and reduce crashes.

There are many decisions that affect access control. These decisions may include the type of access control and where it is to be utilized. The project team should refer to the Transportation Research Board's *Access Management Manual* and AASHTO's *A Policy on Geometric Design of Highways and Streets*. Neither the Project Development Branch Manager (PDM) nor the project team has the latitude to violate the access control policies documented in the Kentucky Revised Statutes (KRS) and Kentucky Administrative Regulations (KAR).

This chapter addresses the policies and procedures that should be followed in applying access control.

## HD-1101.2 ACCESS CONTROL

**603 KAR 5:120** contains guidelines for developing and altering access control on state-maintained highways. The following pages draw from this KAR and KRS for guidance to aid the designer:

*KRS 177.315 Spacing of access control points on limited access facilities for those having limited rights or easement of access.*

> *(1) As used in this section, "partial control of access" means the limited right or easement of access granted by the Transportation Cabinet under subsection (2) of this section.*

## HD-1101.2 ACCESS CONTROL (cont.)

*(2) The Transportation Cabinet shall establish minimum spacing requirements for partial control of access to a limited access facility, and the manner that the access is to be provided, for the owners or occupants of land or other persons who have a limited right or easement of access under KRS 177.220. Minimum spacing between access points shall be one thousand two hundred (1,200) feet in rural areas and six hundred (600) feet in urban areas.*

*(3) The Transportation Cabinet may change the spacing of access control points if:*

- *(a) 1. An owner or occupant of land abutting a limited access facility requests the Cabinet for the change; or*
  - *2. A local government requests the Cabinet for the change; and*
- *(b) The change in spacing of access points is supported by an engineering and traffic study approved by the state highway engineer.*

When requesting a change in spacing, the project manager should send a written request, justification, and corresponding plans through the district’s PDM to the Deputy State Highway Engineer for Project Development in order to obtain approval from the State Highway Engineer.

Some useful definitions from **603 KAR 5:120** are:

*Urban*—Areas of residential, commercial, or industrial developments of sufficient concentration that they constitute or are characteristic of a city, which necessitates, for safety reasons, reduced highway speed limits to 45 mph or less, excluding interstate systems.

*Rural*—All areas other than urban.

*Department's plans*—The Department of Highways' current plans, which are based upon plans made at the time of contract letting together with any subsequent changes in access control made in accordance with applicable laws and regulations.

*Access control*—Access control shall be one of two types: by permit or limited. *By permit* refers to all highways designated as access-by-permit on the department's plans. *Limited access* refers to all highways designated as such on the department's plans and shall be of the following two types:

1. A *fully controlled access highway*, which gives preference to through traffic and which shall have access only at selected public roads or streets and which shall have no highway grade crossings or intersections. The termini for control of access shall be as shown on the department's plans.

## HD-1101.2 ACCESS CONTROL (cont.)

2. A *partially controlled access highway*, which gives preference to through traffic. However, it may provide access to selected public roads and streets, and there may be some highway at-grade intersections and private driveway connections as shown on the department's plans. The termini for control of access shall be as shown on the department's plans.

**Plan Access Notes:** Place one of the following boxes with applicable notes inserted on the layout sheet and right-of-way summary sheet of the plans for all state and federal-aid projects:

THIS PROJECT IS A FULLY CONTROLLED
ACCESS HIGHWAY

THIS PROJECT IS A PARTIALLY CONTROLLED
ACCESS HIGHWAY. ACCESS SHALL BE ALLOWED
ONLY WHERE SPECIFICALLY SHOWN ON PLANS.

THE CONTROL OF ACCESS ON THIS PROJECT
SHALL BE BY PERMIT

## HD-1101.3 DEED OF CONVEYANCE

Every deed of conveyance for right of way acquired by the department on any state or federal project shall show, in addition to the Official Order number, the type of highway access. Types of access control are:

- Fully controlled access
- Partially controlled access
- Control of access by permit

There may be different types of access control within the same parcel. The deed of conveyance shall clearly set forth the limits of each access control type, as well as the type of control for the project.

## HD-1101.4 STRIP MAP

A strip map shall be prepared showing all access points on partially controlled access facilities. Typically, this is combined with the right-of-way strip map. The strip maps shall show all points of access by station (**Exhibit 1300-04**). A copy of the strip map shall be included in the right-of-way plans.

## HD-1101.5 CONTROL OF ACCESS ON CROSSROAD, INTERCHANGE VICINITY

For interstate and other freeway-type interchanges, full control of access shall extend along the intersecting crossroad a minimum of 100 feet (desirable 300 feet) in urban areas and 300 feet (desirable 600 feet) in rural areas. However, in areas of high traffic volume where the potential for development exists which would create operational or safety problems, longer lengths of access control should be provided.

Maximizing the distance between the ramp terminal and entrances and signalized intersections is encouraged. The point of measurement shall be from the ramp terminal to the nearest edge of the access point along the outside edge of through traveled way (**Exhibits 1100-01** and **1100-02**). The limits of access on the crossroad should terminate opposite each other, using the farthest point as control.

Other access management techniques may be considered in unique circumstances. Please refer to **HD-1102**, “Principles & Techniques,” for example applications.

## HD-1101.6 CORNER CLEARANCE

Corner clearance is the distance between an intersection and the nearest driveway. Inadequate corner clearances can result in traffic-operation, safety, and capacity problems. These problems can be caused by blocked driveway ingress and egress, insufficient weaving distances, and backups from a downstream driveway into an intersection. It is desirable to locate the access as far from the intersection as practical to reduce conflicts from overlapping movements.

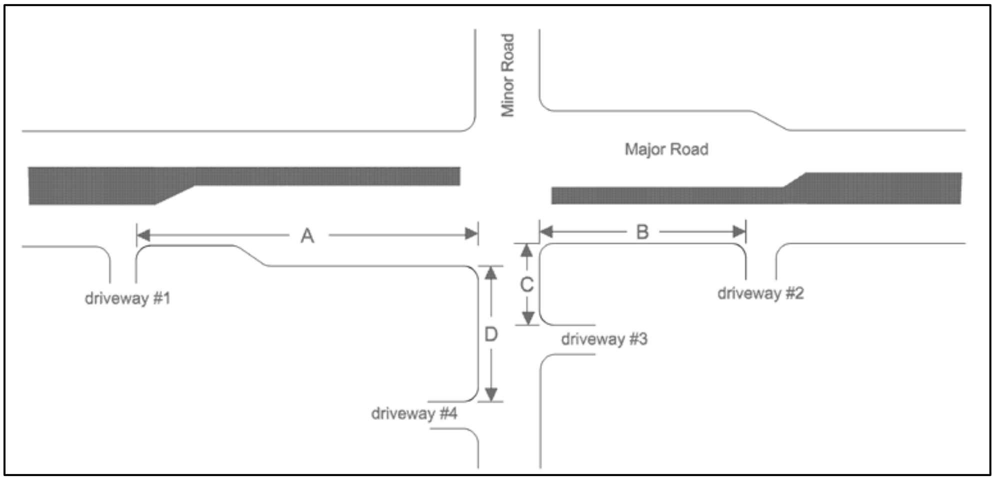
There are four types of intersection corner clearance that should be evaluated during a design. (See the **Intersection Corner Clearances** diagram.) Criteria used to derive the minimum corner clearance distances include:

- Perception reaction
- Queue storage
- Functional intersection area
- Stopping sight distance
- Maneuver distance
- Right-turn conflicts

It is important to evaluate the potential influences of any driveways/access points on the operation of an intersection. A detailed traffic engineering analysis of the intersection should be considered prior to any driveway design that may impact intersection operation.

## HD-1101.6 CORNER CLEARANCE (cont.)

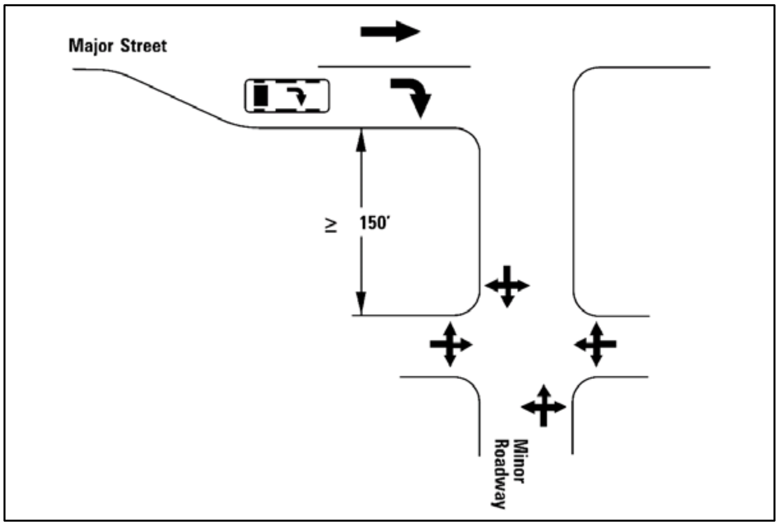
**Intersection Corner Clearances**



The following four types of intersection corner clearances are shown above:

A. Upstream on the major roadway
B. Downstream on the major roadway
C. Approach side on the minor roadway
D. Departure side on the minor roadway

**Corner Clearance on Minor Crossroad**
**(Corner Clearance Type C and D)**



Corner clearance on minor crossroads should not be less than 150 feet. A right-in/right-out entrance may be considered on the minor roadway within 150 feet from the major street, provided a nontraversable median is constructed to prevent left turns.

## HD-1101.6 CORNER CLEARANCE (cont.)

For information and guidelines for deriving the access spacing for the four types of intersection corner clearances, refer to the Transportation Research Board's *Access Management Manual*.

## HD-1101.7 FENCING CONTROLLED ACCESS HIGHWAYS

Fencing can be used to control indiscriminate entry or crossing of the roadways by vehicles, pedestrians, or livestock. Fencing also deters right-of-way encroachment. Fencing should be considered in areas that may be susceptible to encroachment by businesses, buildings, utility companies, farming, or entrances.

The Design Executive Summary (**Exhibit 200-08**) will indicate the control of access required on a project. Fencing is generally required on fully controlled or partially controlled access highways. Although not always justified, it has become common practice to fence the entire length of fully controlled and partially controlled access highways. The use and location of fence should be reviewed on a project-by-project basis, particularly where access is restricted by terrain issues in mountainous areas, certain urban areas, or similarly restricted situations.

The *Standard Drawings* include typical drawings for chain link and woven wire fence. Normally, woven wire fence should be used for rural areas and chain link for highly developed urban areas. Other types of fence may be used where conditions warrant. The first consideration of the use of fence must be the control of access. However, aesthetics, right-of-way effects, and maintenance should also be considered. In some instances, the right-of-way agreement between the property owner and the department may place the responsibility for the construction and/or the maintenance of fencing with the property owner.

## HD-1101.8 INDICATING CONTROL OF ACCESS FENCE ON PLANS

All plan sheets shall show the control of access fence using the standard symbols shown on the first plan and profile sheet.

## HD-1101.9 OFFSET FENCE

Fences may deviate from the permanent right-of-way line where necessary, such as at stream crossings (**Exhibit 1100-03**).

◆ ◆ ◆

*Chapter*

ACCESS MANAGEMENT

*Subject*

Principles & Techniques

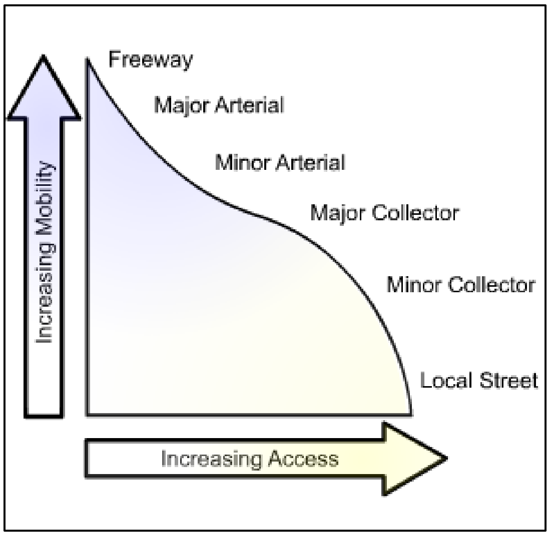
## HD-1102.1 OVERVIEW

Access management includes several principles and techniques that are designed to preserve the capacity of roads, manage congestion, and improve safety. Since these are goals in the planning and design of new roads and the reconstruction of existing roads, designers should incorporate access management techniques into project designs. For more information, refer to the Transportation Research Board's *Access Management Manual*.

## HD-1102.2 ROADWAY SYSTEMS

Roadways are classified according to the functions they are expected to serve; therefore, it is important to design and manage roadways according to their anticipated primary function. It helps a designer to determine the priority placed on access as compared to through-traffic movement. For example, high-speed arterials require more access control to preserve their primary function, which is the through-movement of traffic. Conversely, local roads are intended to provide frequent, direct access to properties and the movement function is secondary.

**Roadway Mobility vs Access**



## HD-1102.3 DRIVEWAY SPACING, LOCATION, & DESIGN

Consideration should be given to the location of access points in relationship to intersection sight distance and appropriate spacing from other intersections. If access points are needed on opposite sides of the roadway, they should be located directly opposite each other. However, in highly urbanized roadways with numerous low-volume commercial or residential entrances, this may not be feasible. For more information on the location and spacing of driveways see AASTHO's *A Policy on Geometric Design of Highways and Streets*.

It is essential that access connections be located and designed to ensure safe ingress and egress for the development and to minimize adverse impacts on the roadway. Driveways should not be located within the functional area of an intersection. Driveway width and throat length should accommodate safe, efficient ingress and egress to adjacent properties. The project team is encouraged to:

- Eliminate driveways that are not necessary for reasonable property access
- Combine driveways (maintaining access rights)
- Provide cross access between properties
- Maximize the spacing between driveways

For divided roadways, each side may be considered independently in determining the distance between access points on the outside of the roadway. If access points are offset, then right-in/right-out entrances shall be utilized. Median openings allowing full access shall not be evaluated independent of direction. Crossovers are allowed only when spacing requirements can be met for both sides of the roadway (**Exhibit 1100-04**).

## HD-1102.4 TRAFFIC SIGNAL LOCATION

Spacing of signals has a direct effect on roadway efficiency and safety. Adequate signal spacing is important to minimize stopping and provide two-way progression.

## HD-1102.5 TURNING LANES

Turning lanes allow vehicles to decelerate and wait in a protected area away from through traffic.

- **Left Turns—**Left-turn lanes at intersections reduce rear-end crashes and improve the roadway capacity.

- **Indirect Turns—**Indirect turns reduce conflicts in intersections because vehicles do not cross traffic. Jug handles require a right turn onto a feeder street followed by a left turn onto a cross street. Indirect U-turns require a U-turn past an intersection followed by a right turn instead of a left turn.

## HD-1102.5 TURNING LANES (cont.)

- **Right Turns—**Right-turn lanes segregate right-turning traffic from the through lanes and improve the roadway capacity. Access to roadways may be limited to right turns in and out to keep vehicles from crossing traffic and to improve capacity.

- **Flush Medians—**Flush medians, including two-way left-turn lanes (TWLTL), allow turn movements in multiple directions from a center lane.

- **Nontraversable Medians—**Raised barrier medians or depressed medians can prevent movements, such as left turns, across the roadway.

For more information, please refer to AASHTO's *A Policy on Geometric Design of Highways and Streets* and **HD-900**.

## HD-1102.6 SUPPORTING NETWORK OF ROADWAYS

- **Alternate Access—**When feasible, it is more appropriate to provide access from the secondary road than from the primary route. Providing reasonable access does not necessarily mean providing direct access to a state highway system.

- **Frontage Roadways—**Frontage roads segregate local traffic from the higher-speed through traffic and intercept driveways of residences and commercial businesses along a roadway.

  Frontage roads may cross a number of different properties in order to provide access. The area necessary to facilitate the frontage road should be acquired as right of way. Right of way can be acquired from properties to serve other properties. There are also opportunities where a frontage road can be built and turned over to a developer as part of his or her right-of-way settlement.

  It is desirable to construct frontage roads 150 feet from the main road measured from the mainline edge of pavement. This may not be attainable in urban situations.

- **Backage Road/Reverse Frontage Road—**A backage road/reverse frontage road is an access road located to the rear of lots fronting on a major roadway.

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**Chapter**

ACCESS MANAGEMENT

**Subject**

Access Additions & Alterations

## HD-1103.1 ACCESS CONTROL BY PERMIT

On all highways where access control is by permit, the department shall establish criteria for modifying existing access and allowing additional access points. Proposals for modification to access should always consider the safety and interest of the highway users. The department may issue permits for additional access points provided they conform to established department criteria. Please reference the *Permits Guidance Manual* for additional information.

## HD-1103.2 FULLY CONTROLLED ACCESS

On all highways where access is fully controlled or proposed to be fully controlled, additional access may be provided only by constructing new interchanges with grade separations. An interchange justification study is required on interstate projects.

## HD-1103.3 PARTIALLY CONTROLLED ACCESS

When any of the following conditions are met on partially controlled highways, the department may permit relocating, shifting, or eliminating existing access points; adding new access points; or modifying the access control:

- May relocate or shift an access point by mutual consent of the property owner and the department. The access:
    - Shall remain on the same side of the highway
    - Cannot go beyond another existing entrance
    - Shall meet minimum spacing within the Cabinet's current design standards
    - Shall not be detrimental to traffic operations based on standard engineering practices and safety criteria.

## HD-1103.3 PARTIALLY CONTROLLED ACCESS (cont.)

- May permit additional access points under the following circumstances after processing a permit request as described in **PE-400**, “Entrances,” *Permits Guidance Manual.*
  - The original design and/or subsequent revisions represent overly restrictive control in light of current state design criteria for access points on partially controlled access highways; and
  - The centerline of the requested access shall not be closer than 1,200 feet to the centerline of the nearest existing point of access in rural areas; or
  - The centerline of the requested access shall not be closer than 600 feet to the centerline of the nearest existing point of access in urban areas; and
  - The property to be affected is not served by a frontage road or other public way; and
  - For divided roadways, each side can be considered independently in determining the distance between access points on the outside of the roadway. If access points are offset, then right-in/right-out entrances shall be utilized. Median openings allowing full access cannot be evaluated independent of direction. Median openings are allowed only when spacing requirements can be met for both sides of the roadway (**Exhibit 1100-04**).

## HD-1103.4 ALTERING ACCESS CONTROL

When a previous decision specifying access control is no longer applicable, the department may change the access control designation to the extent justified, in accordance with procedures outlined in **PE-400**, “Entrances,” *Permits Guidance Manual.*

## HD-1103.5 PROCEDURES FOR ALTERING ACCESS CONTROL ON AN EXISTING HIGHWAY FACILITY

Access Management techniques should be considered for every project. When access control is altered from existing conditions, the following procedures should be followed:

- **Modification of Plans and Deeds—**The department shall modify the plans and deeds when applicable.
- **Modifications for Changed Access Control**—In situations where access control is becoming more restrictive, the department shall modify the plans and indicate the type of new access control. When access is being changed to less restrictive, the procedures outlined in **PE-400**, “Entrances,” *Permits Guidance Manual*, shall be followed.

## HD-1103.5 PROCEDURES FOR ALTERING ACCESS CONTROL ON AN EXISTING HIGHWAY FACILITY (cont.)

- **Restrictive Control Established**—In situations where more restrictive control is imposed, the department shall provide reasonable access or shall compensate the property owner(s) for loss of reasonable access.

- **Exceptions to Procedures for Access Control**—Exceptions to the procedures set forth in this section may be necessary in order to comply with all applicable federal and state laws and regulations.

- **Access Shown on Deed**—The deed of conveyance for right of way acquired by the department on any state or federal project shall include the Official Order number and the type of highway access designation. If allowing new access and if deemed necessary by the department, modify the deed of conveyance by filing a deed of correction at the expense of the property owner.

- **Access Records**—The department shall maintain records of all completed state and federal projects, as well as the designation of the type of access allowed on the project, for public inspection at its office in Frankfort, Kentucky.

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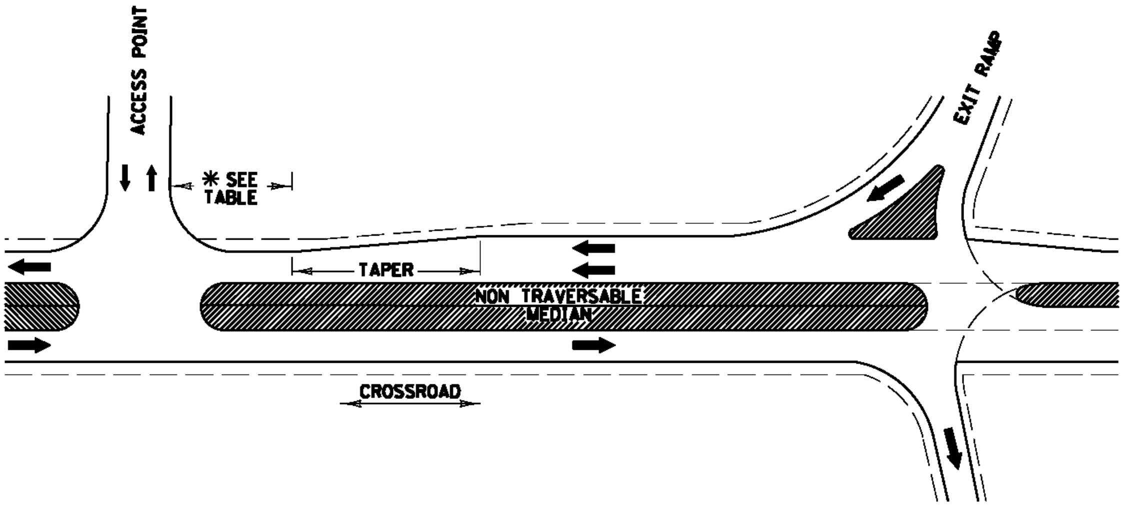
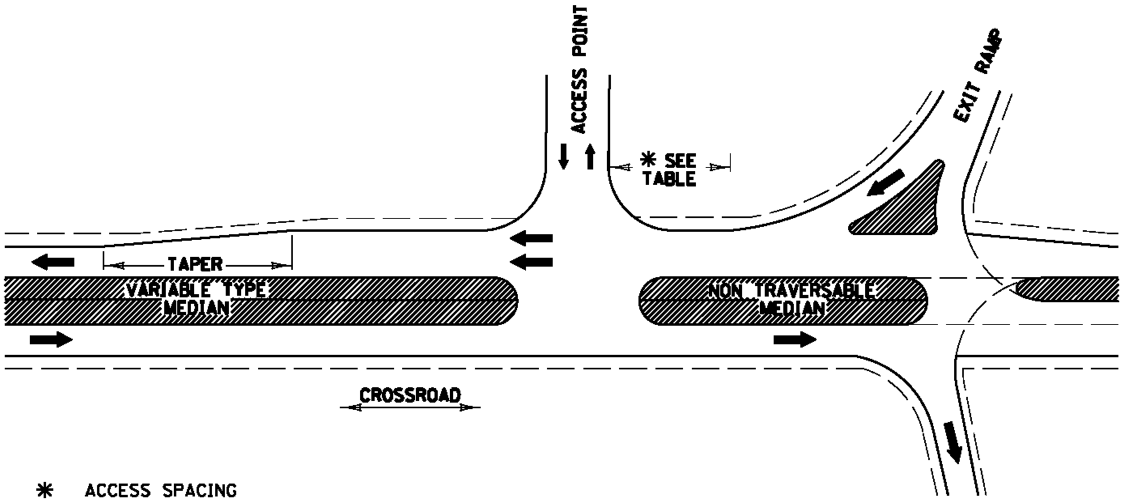
# CONTROL OF ACCESS ON CROSSROAD AND INTERCHANGE EXIT RAMP



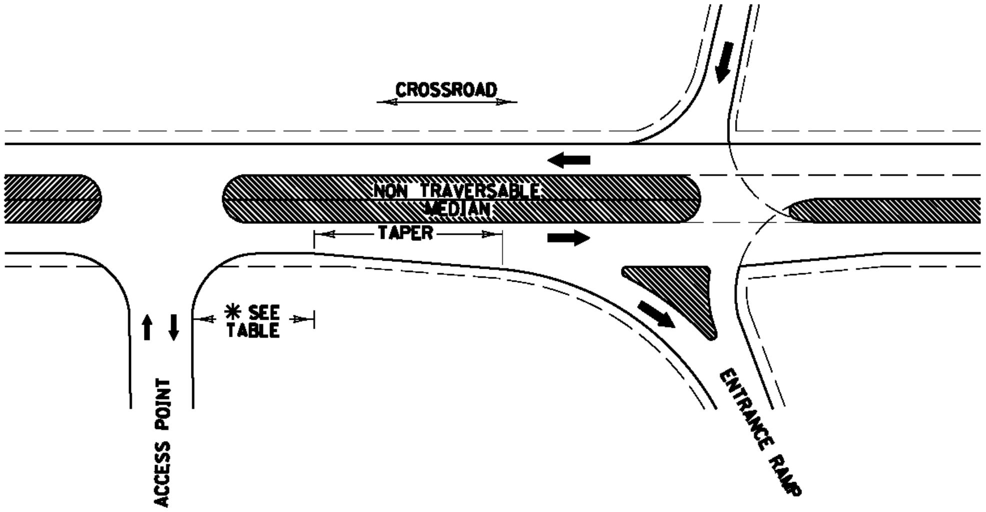


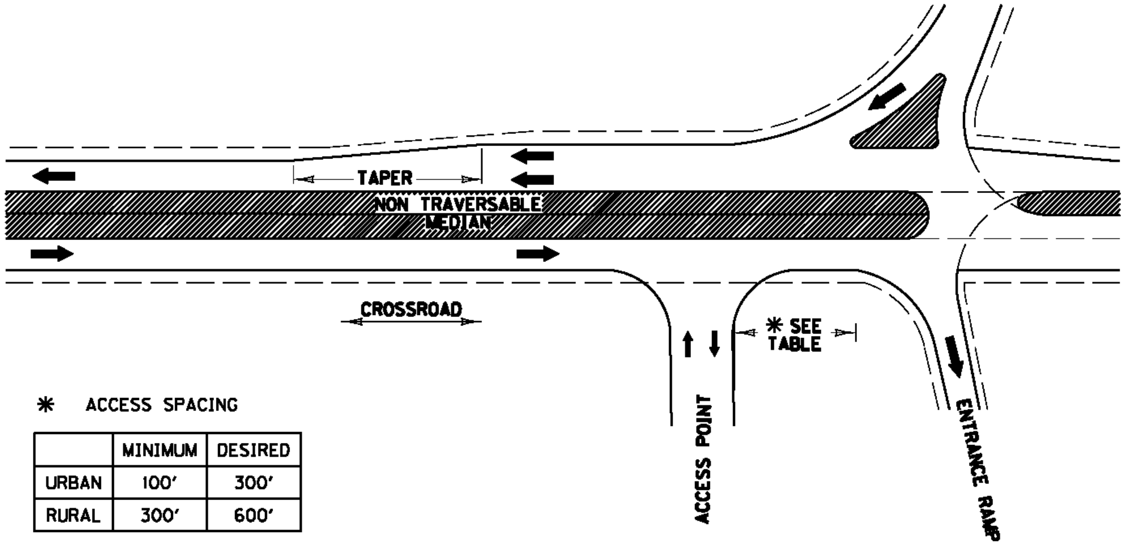
* ACCESS SPACING

| | MINIMUM | DESIRED |
|---|---|---|
| URBAN | 100' | 300' |
| RURAL | 300' | 600' |

**DRAWING NOT TO SCALE**

## CONTROL OF ACCESS ON CROSSROAD AND INTERCHANGE ENTRANCE RAMP





✱ ACCESS SPACING

| | MINIMUM | DESIRED |
|---|---|---|
| URBAN | 100′ | 300′ |
| RURAL | 300′ | 600′ |

DRAWING NOT TO SCALE

# Exhibit 1100-03

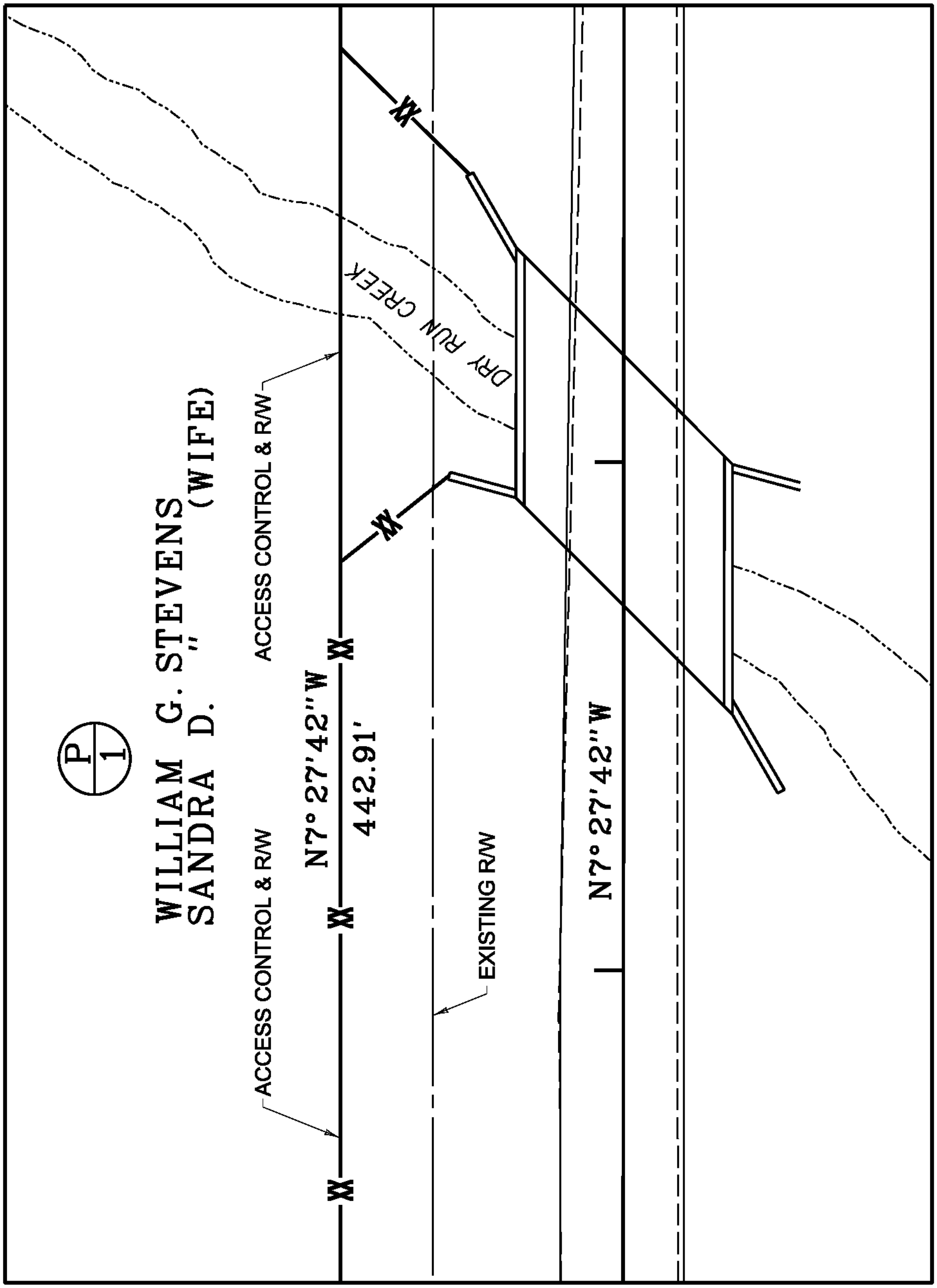
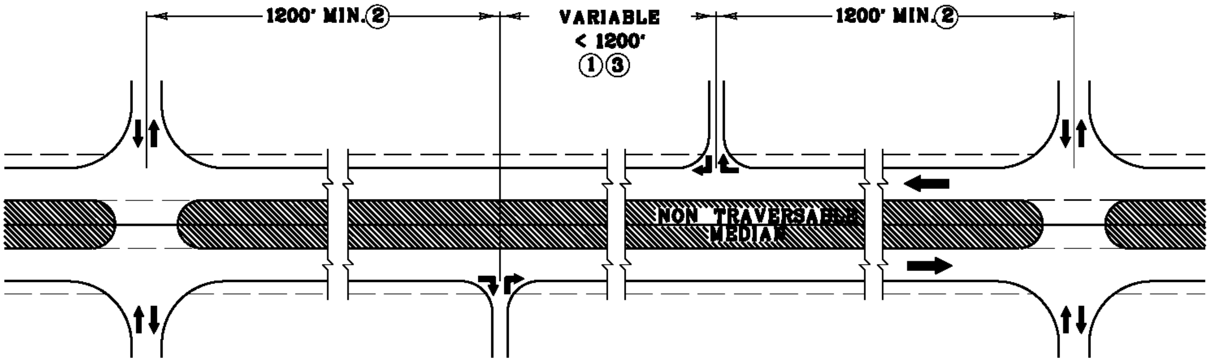
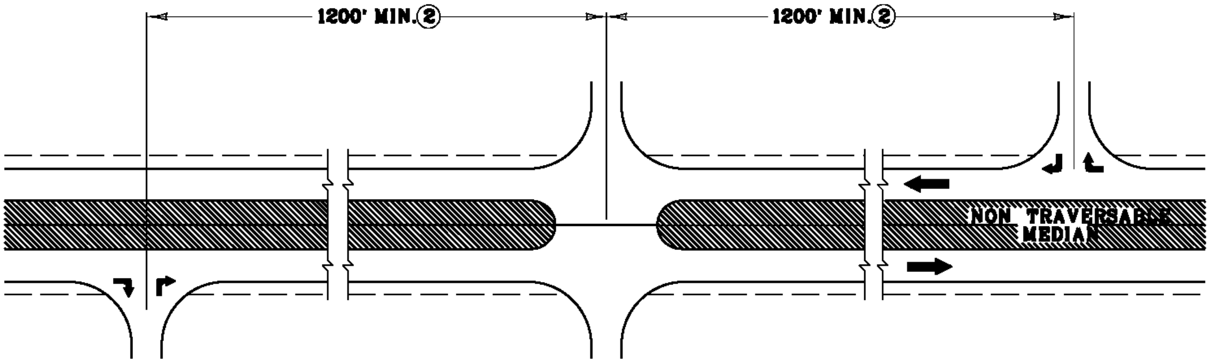


EXHIBIT NOT TO SCALE 04-05-2005

**Exhibit 1100-04**

# COMMON PRACTICES FOR PARTIALLY CONTROLLED ACCESS (RURAL)





① IN THIS CASE, CROSSOVER NOT PERMITTED BECAUSE SPACING REQUIREMENTS NOT MET FOR BOTH SIDES OF ROADWAY.
② 600' MIN. FOR URBAN CONDITIONS (≤ 45 MPH)
③ VARIABLE < 600' FOR URBAN CONDITIONS

DRAWING NOT TO SCALE

***Chapter***

SIGNING & PAVEMENT MARKINGS

***Subject***

Signing

## HD-1201.1 OVERVIEW

Plans will be prepared for new sign installations and pavement markings for interstates, parkways, and other high-volume, limited-access roads that include interchanges. When applicable, signing plans will also be included for the portion of all crossroads affected by new construction and/or improvements. Striping plans will be developed for projects that deviate from the exhibits in the *Manual on Uniform Traffic Control Devices (MUTCD)* and the *Traffic Operations Manual*.

Signing plans may also be required on other projects. Central Office Highway Design should be consulted when the project team believes signing plans are needed.

Signing and marking shall be performed in accordance with the *Manual on Uniform Traffic Control Devices* (MUTCD) and the *Traffic Operations Manual*.

## HD-1201.2 SIGNING PLANS

The project manager should contact the Division of Highway Design to determine whether the signing plans for the project can be prepared by the Division of Highway Design or should be prepared by a consultant and reviewed by the Cabinet. If the signing plans are to be developed by a consultant, a preliminary meeting may be held to determine the necessary signing involved in the project. The decision to utilize a consultant should be made prior to negotiating Phase II design.

Signing plans shall be completed to a conceptual stage and delivered to the project team prior to the joint inspection so that right-of-way and utility needs may be accommodated. All signing plans prepared by consultants will have two reviews—conceptual plans prior to joint inspection and final plans prior to the project letting. The final signing plans shall be submitted with check prints for roadway plan review.

## HD-1201.2 SIGNING PLANS (cont.)

Signing plans should contain the necessary quantities sheets, standard detail sheets, plan sheets, and sign detail sheets, and should be delivered to the project manager. Panel signs shall be numbered P-1 through P-XX, and Sheeting signs shall be numbered S-1 through S-XX (see signing sheet cells in the latest version of the **KYTC CADD Standards**).

## HD-1201.3 SIGN LOCATION

The locations of signs shall comply with the *Manual on Uniform Traffic Control Devices*, *Roadside Design Guide*, and the *Traffic Operations Manual*.

## HD-1201.4 SIGN SUPPORTS

All sign supports located in the clear zone shall be of “breakaway” design or shall be shielded by crashworthy barriers. When possible, coordinate the placement of signs with the barrier systems already determined to be needed for the project. The design for “breakaway” supports or crashworthy barriers shall comply with AASHTO’s *Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals* and the *Roadside Design Guide*. New installations of these “breakaway” design supports shall be omnidirectional breakaway and be based on the current AASHTO wind design load recommendations.

The structural design of sign supports shall be coordinated with the Division of Structural Design.

## HD-1201.5 PLANS FOR PAVEMENT MARKINGS

Plans for pavement markings (including striping) shall be developed for purposes of quantities. In instances where markings are considered to be complex, the Division of Traffic Operations will review, assist, or develop plans. It will be the responsibility of the project manager to recommend the appropriate roles of the Division of Highway Design and the consultant, when applicable. Plans shall be delivered prior to the joint inspection to allow for a concurrent review.

## HD-1201.6 PAVEMENT MARKERS

Raised pavement markers will typically not be shown on the striping plans but will be designated by note on the plans. However, for projects or portions of projects where the pavement markers’ placement is complex, the Division of Traffic Operations will review, assist, or develop plans. The Type V markers and the use of Type IV-A markers on bridge decks shall be included on projects for roads that are identified on the Raised Pavement Marker System as defined by the *Traffic Operations Manual.*

## HD-1201.6 PAVEMENT MARKERS (cont.)

For those projects not identified on the Raised Pavement Marker System and where the project team has identified the need for markers, the project manager will request the Division of Traffic Operations to add that section of roadway to the Raised Pavement Marker System. Pavement markers shall also be included on typical sections with flush medians or a continuous left-turn lane/two-way left-turn lane (CLTL/TWLTL). Proper spacing and arrangement shall adhere to the KYTC *Standard Drawings* for permanently installed pavement markers.

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HIGHWAY Design

***Chapter***

RIGHT OF WAY

***Subject***

General Information

## HD-1301.1 OVERVIEW

The procurement of right of way that accommodate construction, adequate drainage, and maintenance of a highway is an integral part of the overall project. Traffic requirements, topography, environmental issues, utilities, land use, costs, intersection design, and extent of ultimate expansion influence the width of right of way for the complete development of a roadway.

## HD-1301.2 RIGHT OF WAY

Right of way should be sufficient to accommodate construction and the continued maintenance and operation of the facility. Avoiding right-angle breaks in the right-of-way line, as well as irregularities in widths, optimizes land use and facilitates maintenance operations and fencing.

In urbanized areas, consider the use of curb-and-gutter sections for the reduction of right of way and compatibility with adjacent development. The use of right of way, permanent easements, and temporary easements should be determined on a site-specific basis in order to facilitate the construction, operation, and maintenance of the facility and adjacent land use. Typically, permanent right of way should be acquired to the back edge of the berm on curb-and-gutter projects with easements used for that portion beyond the right of way for construction, operation, and maintenance of drainage structures.

## HD-1301.3 EASEMENTS

It is common practice to use two types of easements on proposed highway projects: temporary and permanent.

### HD-1301.3.1 Temporary Easement

A temporary easement is the use of a tract of land for a specified duration (typically the duration of construction), with the land reverting to the owner's exclusive use at the end of the period. The plans and the deed descriptions require a stated purpose for the easement.

### HD-1301.3.1 Temporary Easement (cont.)

Use the following example in designations for temporary easements:

"Temporary easement for (specify use such as entrance construction, detour/diversion construction, slope construction, building removal, etc.)" See **Exhibit 1300-01**. When utilizing temporary easements for the removal of buildings, a minimum of 15 feet should be secured around the entire structure unless constrained by the limits of the property boundary or by other nearby features designated to remain in place (**Exhibit 1300-02**). Temporary easements can be used for drainage structures, such as yard drains, if they have little impact on roadway drainage.

### HD-1301.3.2 Permanent Easement

A permanent easement is designated for a specific, ongoing, and continuous purpose. The plans and the deed descriptions require a stated purpose for the easement.

Use the following example in designations for permanent easements:

"Permanent easement for (specify use such as drainage, utilities, water line, sewers, electric, etc.)" See **Exhibit 1300-01**. It is not necessary to segment the descriptions for permanent easements for differing utility uses. The permanent easement should list all uses on the plans and deed descriptions. Permanent easements for utility relocation should include the types of utilities included in the easement. Metes and bounds descriptions are required for permanent easements.

## HD-1301.4 PARCEL NUMBERS

Assign a parcel number to each individual parcel, starting with the number 1 at the beginning of the project and numbering consecutively to the end of the project (**Exhibit 1300-01**). If a project's magnitude warrants breaking it into sections, the numbering system would continue; however, a gap should be included to allow for additional parcels that may arise as the project plans are developed.

For example:

Section #1—parcels might be numbered 1 through 40

Section #2—parcels might be numbered 50 through 110

Section #3—parcels might be numbered 120 through 170

**Note:** Once a parcel number has been used, it should never be reused on the same project. Unused parcel numbers should be noted on the summary sheet as "not used" (**Exhibit 1300-03**).

## HD-1301.4 PARCEL NUMBERS (cont.)

Numbers may occupy up to a maximum of four spaces. Do not use dashes and periods to separate characters. Letters should not be used in parcel numbers except for explicit reasons such as in the case of leased parcels. Leased parcels or leased portions of parcels shall have parcel numbers followed by the letter L (i.e., 4L, 4L1, 4L2, etc., where L1 means first lease, L2 means second lease, etc.) See **Exhibit 1300-04**.

## HD-1301.5 RIGHT-OF-WAY MONUMENTATION

The right-of-way boundaries for the entire project shall be established and monumented for all projects according to guidance provided in **HD-300**.

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|---|---|
| | *Chapter*<br>RIGHT OF WAY |
| | *Subject*<br>Right-of-Way Plans |

## HD-1302.1 OVERVIEW

Procedures for dealing with right-of-way plan submittals and revisions are given in this chapter and in **HD-1305** and **HD-1306.** Preliminary right-of-way plans are not required unless specifically requested. Right-of-way plans shall consist of the following:

- Layout sheet
- Right-of-way revision sheet (if required)
- Typical sections
- Plans and profiles
- Right-of-way summaries
- Right-of-way strip maps
- Any detail sheets that affect right of way (i.e., detours, maintenance of traffic, access control sheets, railroad detail sheets)
- Coordinate control sheets

## HD-1302.2 LAYOUT SHEET

The layout sheet for right-of-way plans should contain the project location, description, and identification features. Provide a location map with enough information to easily locate the project. This layout sheet shall bear a signature block for the project manager and the state highway engineer. The type of access control proposed for the project and highways on the National Highway System shall also be noted on the layout sheet. See **HD-1100** for different types of access control.

## HD-1302.2 LAYOUT SHEET (cont.)

The following note shall be used on partial-access-control projects: "Access shall be provided only where specifically shown on the plans." The layout sheet shall be designated "Right-of-Way Plans" and include an index of sheets. Refer to **Exhibit 1300-05** for details.

## HD-1302.3 RIGHT-OF-WAY REVISION SHEET

When a revision occurs, a right-of-way revision sheet is added to the right-of-way plans. This sheet is labeled "Right of Way Revision Sheet" and inserted directly after the layout sheet. This sheet shall be numbered as sheet number "R1a" (**Exhibit 1300-06**).

## HD-1302.4 TYPICAL SECTIONS

The typical sections sheets included in the right-of-way plans shall depict the typical cross-section of the mainline roadway. If applicable, a normal crown and a superelevated section should be shown, along with a bridge typical section. Typical sections of approach roads and entrances should also be included.

## HD-1302.5 PLAN & PROFILE

The right-of-way plan and profile sheets typically are generated from grade and drain plans. These sheets should typically depict the following:

- Existing planimetrics
- Proposed right of way
- Existing right of way
- Existing and proposed easements
- Right-of-way monumentation
- Property lines
- Existing utilities
- Construction limits (disturbed limits)
- Entrances
- Access control lines (if applicable)
- Locations of wells, cisterns, and septic systems
- Signs (both on and off existing right of way)
- Any other pertinent features
- Parcel numbers and names of the owners (including marital status) for each affected parcel

When deemed appropriate, right-of-way information may be depicted on separate detail sheets.

## HD-1302.5 PLAN & PROFILE (cont.)

Ownership of all utilities affected by the project should be listed in tabular form on the first plan sheet, along with the address and phone number of the company plus the name of the appropriate contact person (if available). Existing utility locations should be shown on the plan sheet. Existing overhead utilities should be referenced by type and be shown connected to the respective poles that carry them. Existing underground utilities are to be shown and referenced by type, size, material, and location. For more information, see **HD-300**.

Label all lines that describe permanent takings with bearings and distances. Label existing right-of-way lines with bearings and distances.

Right-of-way monumentation shall be shown on the plan sheets. The monuments shall be flagged on the plan sheets with station and offset.

The profile view should show the location of utilities where they cross the centerline. For more information, see **HD-300**.

## HD-1302.6 RIGHT-OF-WAY SUMMARY SHEETS

The right-of-way summary sheets (**Exhibit 1300-03**) shall show all parcel numbers, the names of the owners, and total areas either in acres or square feet. Parcels with total areas greater than one acre shall be shown on the summary sheet in acres, while parcels with areas less than one acre shall be shown in square feet. When a parcel is severed more than once (e.g. mainline and approach might leave property in three or more pieces), each area remaining should be shown. Regardless of parcel size, easements shall be shown in square feet.

- The “Basis of Determination” should be indicated on the total area of the tract.
- “Portion Remaining” is intended to document the remaining areas of affected properties
- The “Portion Remaining” is the “Total Area of Tract” minus the “Permanent Right of Way Acquired”
- The “Source of Title” column shall indicate the deed book and page number or other title source.
- The “Remarks” column should show any other information that may be useful to the right-of-way agents during the acquisition process. For example, when a parcel is severed more than once, then each remaining area can be noted.

## HD-1302.7 RIGHT-OF-WAY STRIP MAPS

At a minimum, the right-of-way strip maps (**Exhibit 1300-04**) shall show the centerlines, existing and proposed right-of-way lines, permanent easement lines, control-of-access lines, property lines, property owners, and parcel numbers. On limited control-of-access projects, breaks in access shall be shown. The right-of-way strip map should be drawn to a scale that best depicts the boundaries of the parcels. This may not be practical in all cases due to excessively large parcels. The right-of-way strip map should be included in the right-of-way plans unless the requirement is waived by the district right-of-way supervisor. Using aerial photos, GIS systems, and other imagery with right-of-way strip maps is encouraged.

## HD-1302.8 DETAIL SHEETS

Detail sheets necessary for clarity and understanding should be included in the right-of-way plans. Some examples might be maintenance of traffic, erosion control, pipe sheets, and environmental mitigation plans. Detail sheets that are specifically related to railroad involvement should be developed according to guidance provided in **HD-1400**. Mineral ownership detail sheets may be desirable on isolated projects. See **HD-1303** for more details on mineral plans.

## HD-1302.9 COORDINATE CONTROL SHEETS

The coordinate control sheets document the control information that facilitates the field survey process. Right-of-way monuments and witness monuments are documented on the coordinate control sheets with Northing, Easting, station, and offset. Coordinate control sheets shall be included in the right-of-way plans so that monumentation can be established during the project's right-of-way phase (**HD-300**).

## HD-1302.10 CROSS-SECTION SHEETS

Typically, cross-sections are not included in right-of-way plans, but they should be furnished when requested by the Division of Right of Way and Utilities. It must be noted that the cross-sections are typically not complete when right-of-way plans are prepared/published. When cross-sections are requested, they will be provided reflecting their current stage of completion.

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**Chapter**

RIGHT OF WAY

**Subject**

Other Right-of-Way
Considerations

## HD-1303.1 CEMETERIES

A separate survey must be conducted when a proposed roadway requires right-of-way acquisition from a cemetery (**HD-305**).

Include a separate sheet showing:

- Accurate boundary of the entire cemetery, labeled with distance and bearing
- Segment to be acquired
- Graves that will be relocated
- Locations of the graves adjacent to those being relocated
- Grave numbers
- Name of the remains in each grave, when known (otherwise labeled “Unknown”)

The Division of Right of Way and Utilities submits this information to the Vital Statistics Branch of the Division of Epidemiology and Health Planning in the Cabinet for Health and Family Services as outlined in the *Right of Way Guidance Manual*.

## HD-1303.2 OIL, WATER, AND GAS WELLS

All oil or gas wells and appurtenant lines, tanks, and pumps within the proximity of the project are to be shown on the right-of-way plans with the company name and well number. If ownership is different than the surrounding property, a separate parcel number shall be used and recorded on the right-of-way summary sheet.

Water well locations should be shown on the plans with accompanying lines, etc. For all water wells within the construction limits of the project, a note should be added as to their disposition (filling and capping, etc.).

## HD-1303.3 ENCROACHMENTS ON RIGHT OF WAY

Encroachments should be identified, precisely located, and shown on the plans. Encroachments should be identified as early in the design process as possible so that necessary legal actions can be taken to clear the property and to avoid delays.

## HD-1303.3 ENCROACHMENTS ON RIGHT OF WAY (cont.)

The project manager, through the project development manager (PDM), should inform the chief district engineer of any encroachments. The project manager should also coordinate with the Division of Right of Way and Utilities.

## HD-1303.4 MINERAL PLANS

Mineral plans are detail sheets showing subsurface mineral ownership boundaries that may be required on some projects. Property owners for surface and subsurface rights often vary and overlap. Separate sheets and summaries should be prepared to facilitate acquisition of mineral rights. Mineral ownerships shall be designated with an "M" before the parcel number (for example, M9). Overlapping mineral owners are designated with a hyphenated number after the previously cited nomenclature (for example, M9-1 and M9-2). The project manager shall consult with the Division of Right of Way and Utilities to determine the need for mineral plans.

## HD-1303.5 FEDERAL LANDS

Special care should be taken when impacting federal lands. Early coordination with the appropriate federal agency is essential**.**

## HD-1303.6 UTILITY RELOCATION

It is imperative that communication with the utility companies begin as early as possible in the plan development process. During these communications, the companies should be encouraged to identify methodologies that will expedite the relocations or allow the relocation plans to be included with the roadway plans. Early coordination may be appropriate to aid in the acquisition of parcels that are critical to utility locations.

## HD-1303.7 EXISTING RIGHT OF WAY

Existing right of way as defined by the Kentucky legislature (**KRS 178.025**) is as follows:

1. *Any road, street, highway or parcel of ground dedicated and laid off as a public way and used without restrictions by the general public for fifteen (15) consecutive years, shall conclusively be presumed to be a public road.*

2. *In the absence of any record, the width of a public road right of way shall be presumed to extend to and include that area lying outside the shoulders and ditch lines and within any landmarks such as fences, fence posts, corner stones or other similar monuments indicating the boundary line.*

## HD-1303.7 EXISTING RIGHT OF WAY (cont.)

3. *In the absence of both record and landmark, the right of way of a public road shall be deemed to extend to and include the shoulders and ditch lines adjacent to said road, and to the top of cuts or toe of fills where such exist.*

For county road right-of-way widths, see **KRS 178.040**.

## HD-1303.8 RETURN OF RECONSTRUCTED FACILITIES TO COUNTY JURISDICTION

For more information on the return of reconstructed facilities to county jurisdiction, refer to **HD-212.10**.

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HIGHWAY Design

*Chapter*

RIGHT OF WAY

*Subject*

Right-of-Way Deed Descriptions

## HD-1304.1 OVERVIEW

In addition to the information required on the plan sheets, submit deed descriptions of the property to be acquired and a copy of the property's existing deed of record when submitting the right-of-way plans for the project. Designers are not responsible for the preparation of deeds of conveyance but are responsible for the preparation of the metes and bounds deed descriptions. The Division of Right of Way and Utilities has designated the district right-of-way supervisor as the responsible party for the deed of conveyance.

## HD-1304.2 DEED DESCRIPTIONS

Deed descriptions shall contain an opening statement. This statement will provide a general location of the property including a tie to a major landmark whenever practical. Each description shall also contain a closing statement. This statement should indicate the area contained in the tract and the type of acquisition (for example, fee simple, permanent easement, or temporary easement). Consider the following when preparing the metes and bounds deed descriptions:

- The description for property acquired in fee simple shall be by metes and bounds, referenced to the highway centerline by station and offset distance, and should be written in a clockwise direction.

- When a property is a lot described on a recorded plat on file in the county clerk's office, the metes and bounds description will include reference to the lot number and subdivision name, plus plat book and page number.

- If the project includes an existing roadway right of way and there is an absence of information otherwise, it should be assumed that the Commonwealth of Kentucky holds title to the existing right of way and that those areas should not be included in the descriptions.

- The Division of Right of Way and Utilities may request additional property descriptions, land areas, etc., to facilitate the acquisition process.

## HD-1304.2 DEED DESCRIPTIONS (cont.)

- The controlled access lines shall be specifically described in deed descriptions for “limited access highways.” When providing openings in the controlled access line, state the beginning and ending of access control in the appropriate deed descriptions.

During completion of the construction plans, review of deeds, and acquisition of rights of way, it may be necessary to amend the deed descriptions.

## HD-1304.3 PARCEL NUMBERING

Assign each individual parcel a number starting with number 1 and number consecutively to the end of the project. Consider this parcel number the identifier of the existing property. Assign a tract letter (right of way or easement) to each portion of acquired land. Append the letter to the parcel number. For example, Parcel 4, Tract A, may be the right of way to be acquired from Parcel 4; Parcel 4, Tract B, may be the permanent easement to be acquired from Parcel 4. Therefore, each subsequent description would receive a tract letter.

Descriptions should be in the following order:

1. Fee-simple right of way descriptions
2. Permanent easement descriptions
3. Temporary easement descriptions

## HD-1304.4 EXCESS PROPERTY

The designer will not identify excess property at the time of submittal of right-of-way plans. A later modification to the plans will be required when the district right-of-way supervisor advises that an excess parcel will be acquired. Descriptions for excess property are to be provided when requested.

◆◆◆

*Chapter*

RIGHT OF WAY

*Subject*

Submission of Right-of-Way Plans

The project manager shall submit right-of-way plans to the Director of the Division of Right of Way and Utilities along with a memo stating the plans are submitted and can be found in the appropriate Projectwise folder as per **KYTC CADD Standards Policy for Highway Plans**.

The project manager should include the following with the submission of right-of-way plans:

- Memo including the Item Number, Description, Program Number, County, and Route, with the following individuals copied:
  - Project development branch manager (PDM)
  - District utility supervisor
  - Location engineer
  - Environmental project manager (EPM)
  - District environmental coordinator (EC)
- Right-of-way plans in .pdf format signed by the project manager
- Deed descriptions of the acquiring property

  **Note:** All deed descriptions shall be prepared in Microsoft Word or equivalent and shall be located electronically in ProjectWise at \\KYTC\Documents\Projects\District#\Item No.\Milestones & Submittals\Right of Way\ (Current) Deed Descriptions. Any revisions should be merged into the original document and updated in ProjectWise as a combined document.
- Source deeds

  **Note:** Copies of source deeds and plats shall be in .pdf format and located electronically in ProjectWise at \\KYTC\Documents\Projects\District#\Item No.\Milestones & Submittals\Right of Way\Source Deeds (PDF only).

See **HD-1306** if right-of-way revisions become necessary.

◆ ◆ ◆

*Chapter*

RIGHT OF WAY

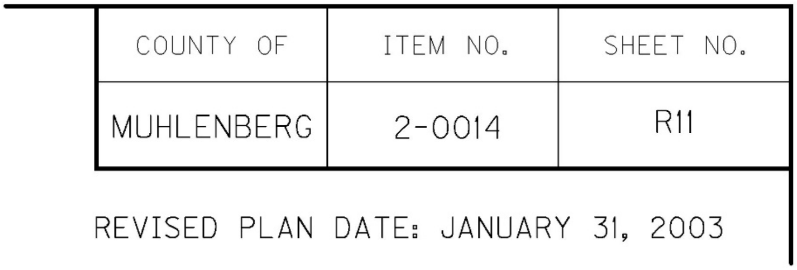
*Subject*

# Revision of Right-of-Way Plans

When a revision to right-of-way plans is necessary, a revision sheet shall be added to the plans. This sheet shall be labeled “Right-of-Way Revision Sheet,” inserted directly after the layout sheet, and numbered “R1a.”

Each time a right-of-way revision is processed on the project, a block shall be added to the new sheet showing right-of-way revision number, plan revision date, sheets revised, parcels involved, and any relevant remarks (**Exhibit 1300-06**). If desired, the right-of-way revision sheet may be updated electronically, reprinted, and inserted into the plans each time a revision is processed.

In addition to the right-of-way revision sheet, each revised sheet shall show the revised plan date in the upper-right corner, below the “County of,” “Item No.,” and “Sheet No.” blocks as shown below.



| COUNTY OF | ITEM NO. | SHEET NO. |
|---|---|---|
| MUHLENBERG | 2-0014 | R11 |

REVISED PLAN DATE: JANUARY 31, 2003

**Note:** Only the last revised plan date should be shown on the revised plan sheets.

The project manager shall:

- Notify the Director of the Division of Right of Way and Utilities when revisions are complete and the plans and deeds have been updated to reflect the revision
- Include a brief description detailing the need for the changes
- Place the updated electronic plans and deed descriptions in the appropriate Projectwise folder under \\KYTC\Documents\Projects\ District#\Item No.\Milestones & Submittals\Right of Way.
- Copy the PDM, district utility supervisor, location engineer, environmental project manager (EPM), and the district environmental coordinator (EC) on all correspondence

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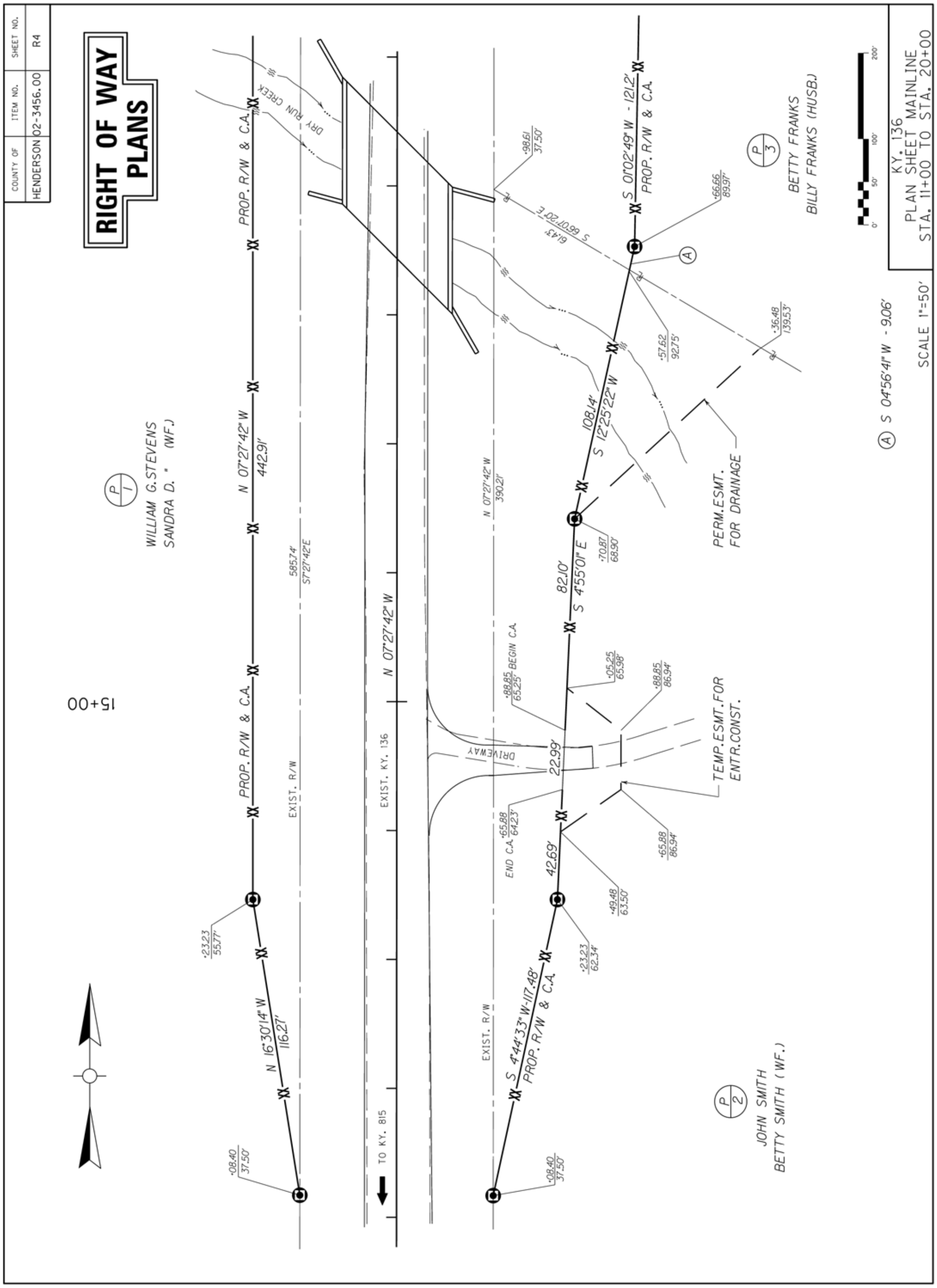
Example R/W Plan Sheet

**Exhibit 1300-01**

EXAMPLE R/W PLAN SHEET

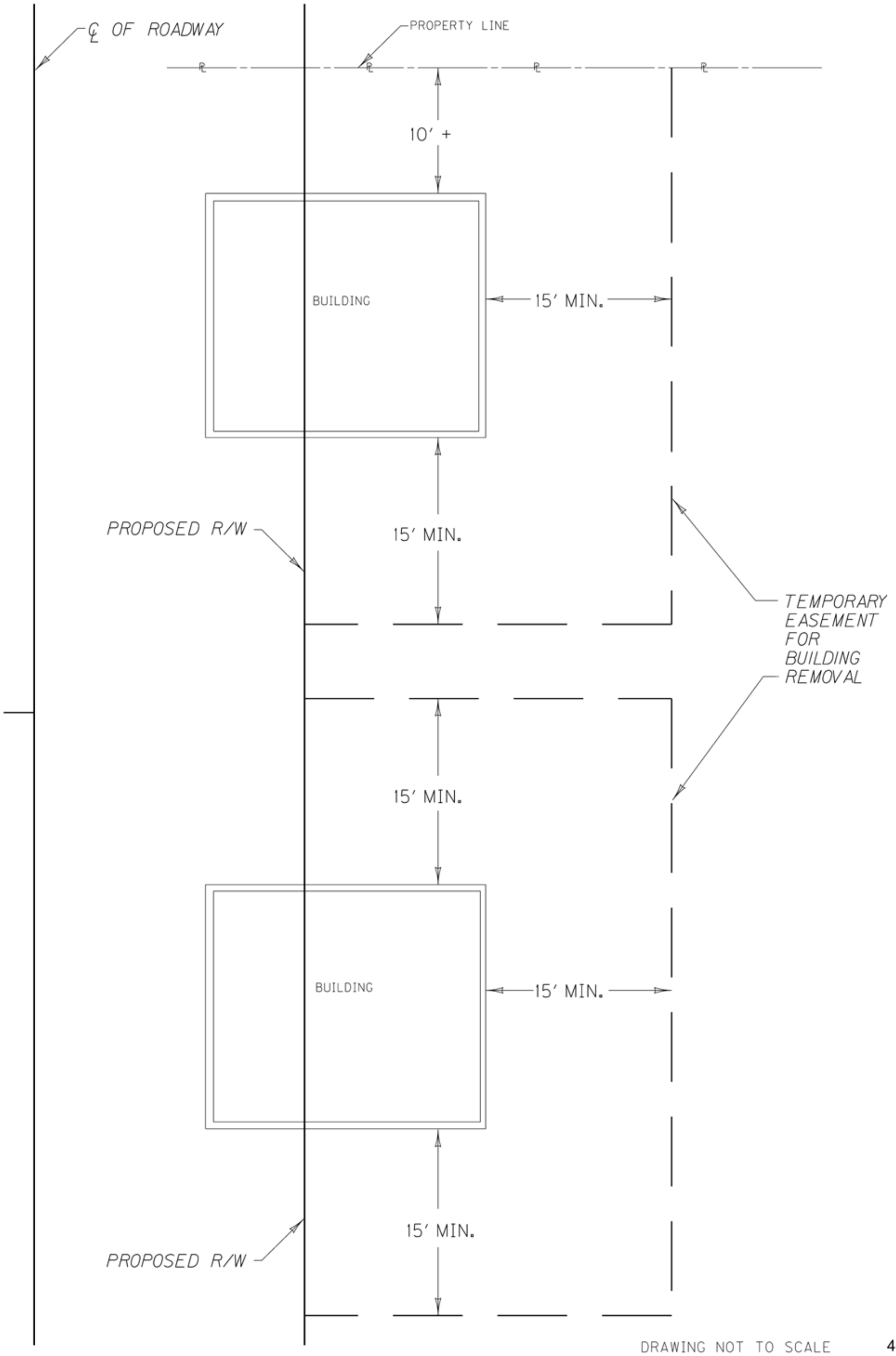


● R/W MONUMENT

EXHIBIT NOT TO SCALE 4-5-2016

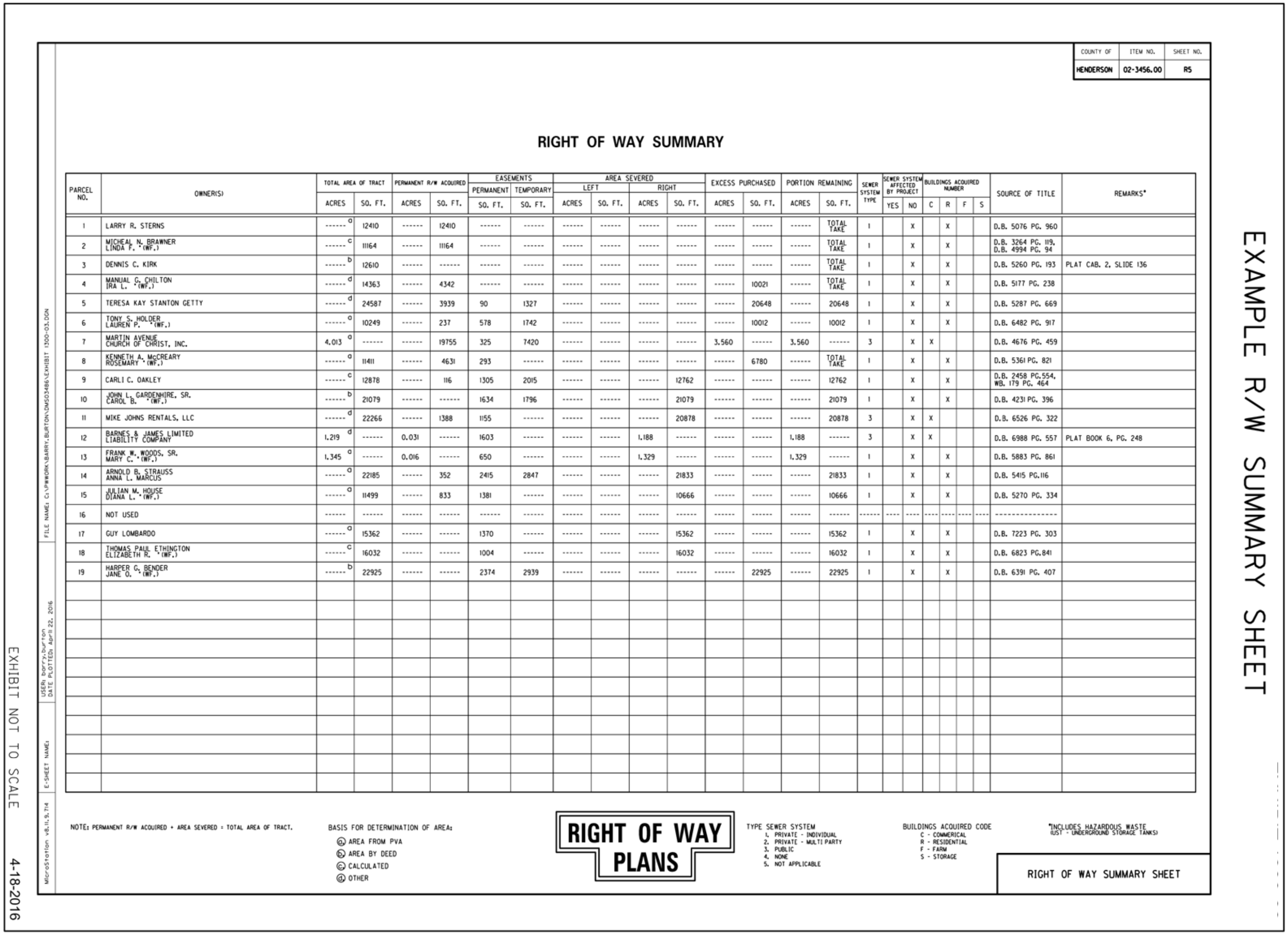
**Exhibit 1300-02**

# EXAMPLE TEMPORARY EASEMENT FOR BUILDING REMOVAL



DRAWING NOT TO SCALE 4-06-2016

**Exhibit 1300-03**



# EXAMPLE R/W SUMMARY SHEET

| COUNTY OF | ITEM NO. | SHEET NO. |
|---|---|---|
| HENDERSON | 02-3456.00 | R5 |

## RIGHT OF WAY SUMMARY

| PARCEL NO. | OWNER(S) | TOTAL AREA OF TRACT | | PERMANENT R/W ACQUIRED | | EASEMENTS | | AREA SEVERED | | | | EXCESS PURCHASED | | PORTION REMAINING | | SEWER SYSTEM TYPE | SEWER SYSTEM AFFECTED BY PROJECT | | BUILDINGS ACQUIRED NUMBER | | | | SOURCE OF TITLE | REMARKS* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | PERMANENT | TEMPORARY | LEFT | | RIGHT | | | | | | | | | | | | | | |
| | | ACRES | SQ. FT. | ACRES | SQ. FT. | SQ. FT. | SQ. FT. | ACRES | SQ. FT. | ACRES | SQ. FT. | ACRES | SQ. FT. | ACRES | SQ. FT. | | YES | NO | C | R | F | S | | |
| 1 | LARRY R. STERNS | ------[a] | 12410 | ------ | 12410 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | TOTAL TAKE | 1 | | X | | X | | | D.B. 5076 PG. 960 | |
| 2 | MICHEAL N. BRAWNER<br>LINDA F. *(WF.) | ------[c] | 11164 | ------ | 11164 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | TOTAL TAKE | 1 | | X | | X | | | D.B. 3264 PG. 119,<br>D.B. 4994 PG. 94 | |
| 3 | DENNIS C. KIRK | ------[b] | 12610 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | TOTAL TAKE | 1 | | X | | X | | | D.B. 5260 PG. 193 | PLAT CAB. 2, SLIDE 136 |
| 4 | MANUAL G. CHILTON<br>IRA L. *(WF.) | ------[d] | 14363 | ------ | 4342 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 10021 | ------ | TOTAL TAKE | 1 | | X | | X | | | D.B. 5177 PG. 238 | |
| 5 | TERESA KAY STANTON GETTY | ------[d] | 24587 | ------ | 3939 | 90 | 1327 | ------ | ------ | ------ | ------ | ------ | 20648 | ------ | 20648 | 1 | | X | | X | | | D.B. 5287 PG. 669 | |
| 6 | TONY S. HOLDER<br>LAUREN P. *(WF.) | ------[a] | 10249 | ------ | 237 | 578 | 1742 | ------ | ------ | ------ | ------ | ------ | 10012 | ------ | 10012 | 1 | | X | | X | | | D.B. 6482 PG. 917 | |
| 7 | MARTIN AVENUE<br>CHURCH OF CHRIST, INC. | 4.013[a] | ------ | ------ | 19755 | 325 | 7420 | ------ | ------ | ------ | ------ | 3.560 | ------ | 3.560 | ------ | 3 | | X | X | | | | D.B. 4676 PG. 459 | |
| 8 | KENNETH A. McCREARY<br>ROSEMARY *(WF.) | ------[a] | 11411 | ------ | 4631 | 293 | ------ | ------ | ------ | ------ | ------ | ------ | 6780 | ------ | TOTAL TAKE | 1 | | X | | X | | | D.B. 5361 PG. 821 | |
| 9 | CARLI C. OAKLEY | ------[c] | 12878 | ------ | 116 | 1305 | 2015 | ------ | ------ | ------ | 12762 | ------ | ------ | ------ | 12762 | 1 | | X | | X | | | D.B. 2458 PG.554,<br>WB. 179 PG. 464 | |
| 10 | JOHN L. GARDENHIRE, SR.<br>CAROL B. *(WF.) | ------[b] | 21079 | ------ | ------ | 1634 | 1796 | ------ | ------ | ------ | 21079 | ------ | ------ | ------ | 21079 | 1 | | X | | X | | | D.B. 4231 PG. 396 | |
| 11 | MIKE JOHNS RENTALS, LLC | ------[d] | 22266 | ------ | 1388 | 1155 | ------ | ------ | ------ | ------ | 20878 | ------ | ------ | ------ | 20878 | 3 | | X | X | | | | D.B. 6526 PG. 322 | |
| 12 | BARNES & JAMES LIMITED<br>LIABILITY COMPANY | 1.219[d] | ------ | 0.031 | ------ | 1603 | ------ | ------ | ------ | 1.188 | ------ | ------ | ------ | 1.188 | ------ | 3 | | X | X | | | | D.B. 6988 PG. 557 | PLAT BOOK 6, PG. 248 |
| 13 | FRANK W. WOODS, SR.<br>MARY C. *(WF.) | 1.345[a] | ------ | 0.016 | ------ | 650 | ------ | ------ | ------ | 1.329 | ------ | ------ | ------ | 1.329 | ------ | 1 | | X | | X | | | D.B. 5883 PG. 861 | |
| 14 | ARNOLD B. STRAUSS<br>ANNA L. MARCUS | ------[a] | 22185 | ------ | 352 | 2415 | 2847 | ------ | ------ | ------ | 21833 | ------ | ------ | ------ | 21833 | 1 | | X | | X | | | D.B. 5415 PG.116 | |
| 15 | JULIAN M. HOUSE<br>DIANA L. *(WF.) | ------[a] | 11499 | ------ | 833 | 1381 | ------ | ------ | ------ | ------ | 10666 | ------ | ------ | ------ | 10666 | 1 | | X | | X | | | D.B. 5270 PG. 334 | |
| 16 | NOT USED | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ---- | ---- | ---- | ---- | ---- | ---- | -------------- | |
| 17 | GUY LOMBARDO | ------[a] | 15362 | ------ | ------ | 1370 | ------ | ------ | ------ | ------ | 15362 | ------ | ------ | ------ | 15362 | 1 | | X | | X | | | D.B. 7223 PG. 303 | |
| 18 | THOMAS PAUL ETHINGTON<br>ELIZABETH R. *(WF.) | ------[c] | 16032 | ------ | ------ | 1004 | ------ | ------ | ------ | ------ | 16032 | ------ | ------ | ------ | 16032 | 1 | | X | | X | | | D.B. 6823 PG.841 | |
| 19 | HARPER G. BENDER<br>JANE O. *(WF.) | ------[b] | 22925 | ------ | ------ | 2374 | 2939 | ------ | ------ | ------ | ------ | ------ | 22925 | ------ | 22925 | 1 | | X | | X | | | D.B. 6391 PG. 407 | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
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NOTE: PERMANENT R/W ACQUIRED + AREA SEVERED = TOTAL AREA OF TRACT.

BASIS FOR DETERMINATION OF AREA:
ⓐ AREA FROM PVA
ⓑ AREA BY DEED
ⓒ CALCULATED
ⓓ OTHER

RIGHT OF WAY
PLANS

TYPE SEWER SYSTEM
1. PRIVATE - INDIVIDUAL
2. PRIVATE - MULTI PARTY
3. PUBLIC
4. NONE
5. NOT APPLICABLE

BUILDINGS ACQUIRED CODE
C - COMMERICAL
R - RESIDENTIAL
F - FARM
S - STORAGE

*INCLUDES HAZARDOUS WASTE
(UST - UNDERGROUND STORAGE TANKS)

RIGHT OF WAY SUMMARY SHEET

FILE NAME: C:\PWWORK\BARRY.BURTON\DMS03486\EXHIBIT 1300-03.DGN
USER: barry.burton
DATE PLOTTED: April 22, 2016
E-SHEET NAME:
MicroStation v8.11.9.714

EXHIBIT NOT TO SCALE

4-18-2016

Example R/W Strip Map

**Exhibit 1300-04**

# EXAMPLE R/W STRIP MAP

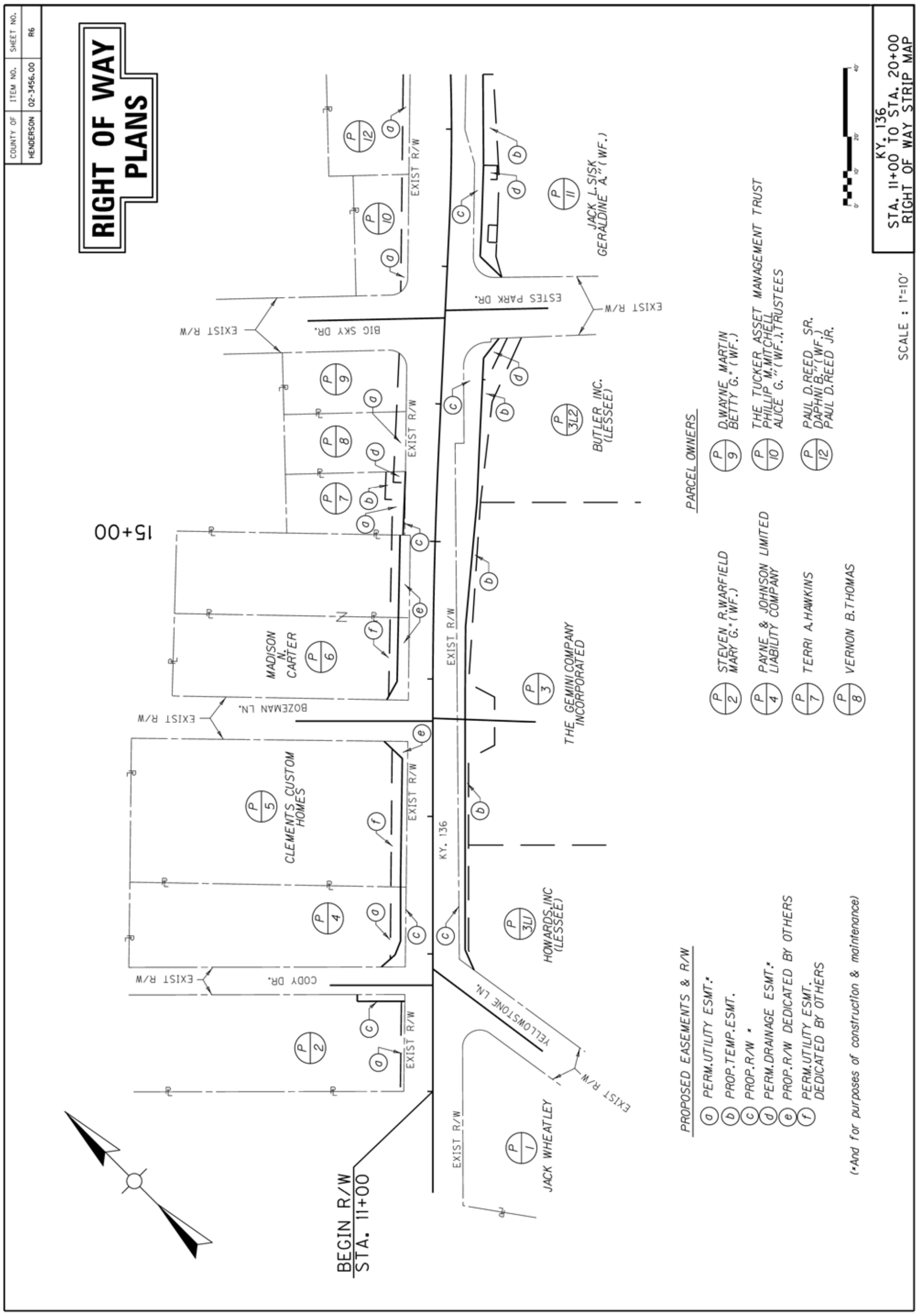
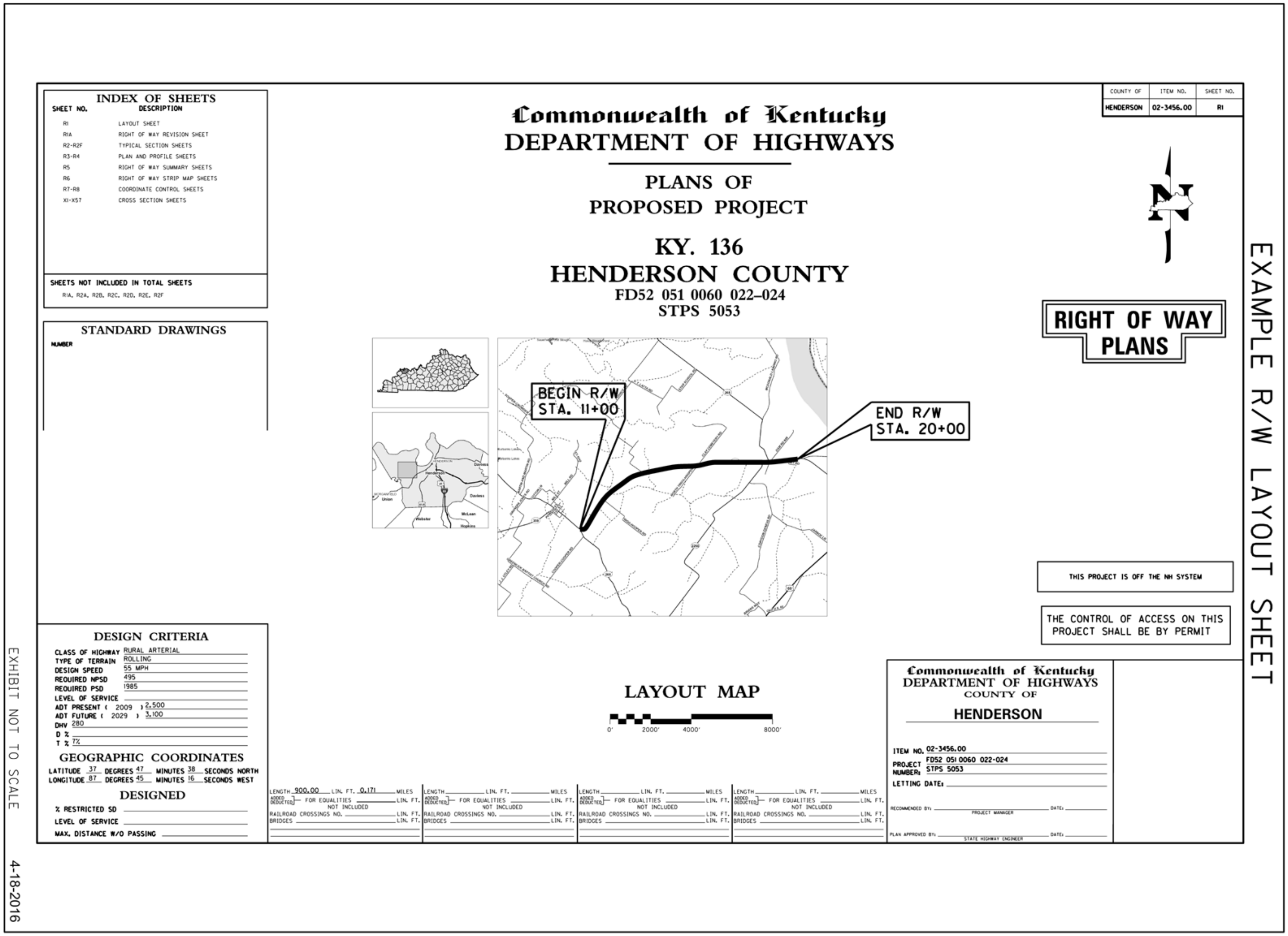


EXHIBIT NOT TO SCALE 4-12-2016



# EXAMPLE R/W LAYOUT SHEET

| COUNTY OF | ITEM NO. | SHEET NO. |
|---|---|---|
| HENDERSON | 02-3456.00 | R1 |

**Commonwealth of Kentucky**
**DEPARTMENT OF HIGHWAYS**

PLANS OF
PROPOSED PROJECT

KY. 136
HENDERSON COUNTY
FD52 051 0060 022–024
STPS 5053

**RIGHT OF WAY PLANS**

THIS PROJECT IS OFF THE NH SYSTEM

THE CONTROL OF ACCESS ON THIS PROJECT SHALL BE BY PERMIT

## INDEX OF SHEETS

| SHEET NO. | DESCRIPTION |
|---|---|
| R1 | LAYOUT SHEET |
| R1A | RIGHT OF WAY REVISION SHEET |
| R2-R2F | TYPICAL SECTION SHEETS |
| R3-R4 | PLAN AND PROFILE SHEETS |
| R5 | RIGHT OF WAY SUMMARY SHEETS |
| R6 | RIGHT OF WAY STRIP MAP SHEETS |
| R7-R8 | COORDINATE CONTROL SHEETS |
| X1-X57 | CROSS SECTION SHEETS |

SHEETS NOT INCLUDED IN TOTAL SHEETS
R1A, R2A, R2B, R2C, R2D, R2E, R2F

## STANDARD DRAWINGS

NUMBER

## LAYOUT MAP

## DESIGN CRITERIA

CLASS OF HIGHWAY RURAL ARTERIAL
TYPE OF TERRAIN ROLLING
DESIGN SPEED 55 MPH
REQUIRED NPSD 495
REQUIRED PSD 1985
LEVEL OF SERVICE
ADT PRESENT ( 2009 ) 2,500
ADT FUTURE ( 2029 ) 3,100
DHV 280
D %
T % 7%

## GEOGRAPHIC COORDINATES

LATITUDE 37 DEGREES 47 MINUTES 38 SECONDS NORTH
LONGITUDE 87 DEGREES 45 MINUTES 16 SECONDS WEST

## DESIGNED

% RESTRICTED SD
LEVEL OF SERVICE
MAX. DISTANCE W/O PASSING

LENGTH 900.00 LIN. FT. 0.171 MILES
ADDED / DEDUCTED — FOR EQUALITIES LIN. FT.
NOT INCLUDED
RAILROAD CROSSINGS NO. LIN. FT.
BRIDGES LIN. FT.

LENGTH LIN. FT. MILES
ADDED / DEDUCTED — FOR EQUALITIES LIN. FT.
NOT INCLUDED
RAILROAD CROSSINGS NO. LIN. FT.
BRIDGES LIN. FT.

LENGTH LIN. FT. MILES
ADDED / DEDUCTED — FOR EQUALITIES LIN. FT.
NOT INCLUDED
RAILROAD CROSSINGS NO. LIN. FT.
BRIDGES LIN. FT.

LENGTH LIN. FT. MILES
ADDED / DEDUCTED — FOR EQUALITIES LIN. FT.
NOT INCLUDED
RAILROAD CROSSINGS NO. LIN. FT.
BRIDGES LIN. FT.

**Commonwealth of Kentucky**
**DEPARTMENT OF HIGHWAYS**
COUNTY OF
**HENDERSON**

ITEM NO. 02-3456.00
PROJECT NUMBER: FD52 051 0060 022-024
STPS 5053
LETTING DATE:

RECOMMENDED BY: PROJECT MANAGER DATE:

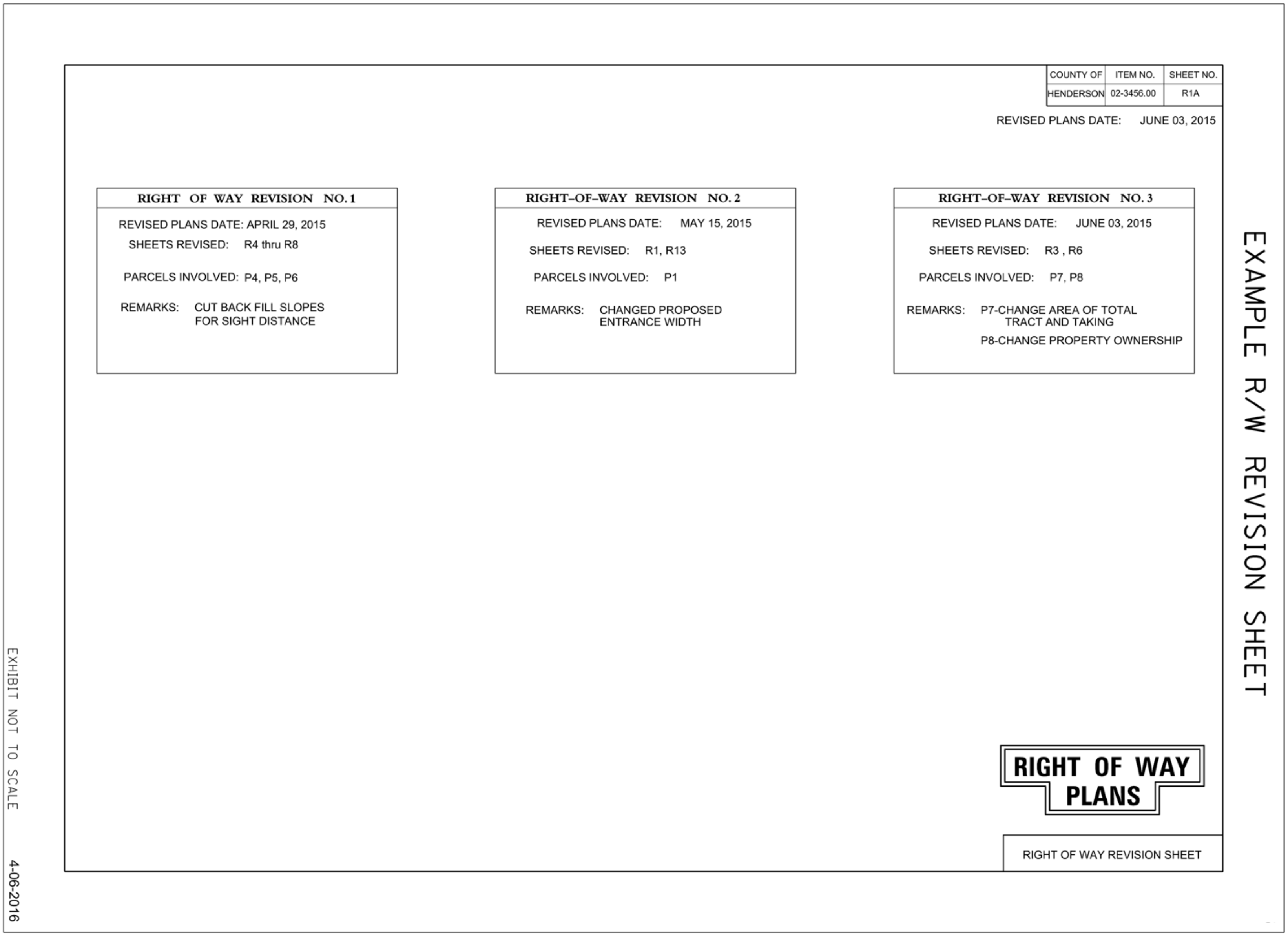
PLAN APPROVED BY: STATE HIGHWAY ENGINEER DATE:

EXHIBIT NOT TO SCALE

4-18-2016

Example R/W Revision Sheet

**Exhibit 1300-06**



EXAMPLE R/W REVISION SHEET

| COUNTY OF | ITEM NO. | SHEET NO. |
|---|---|---|
| HENDERSON | 02-3456.00 | R1A |

REVISED PLANS DATE: JUNE 03, 2015

**RIGHT OF WAY REVISION NO. 1**

REVISED PLANS DATE: APRIL 29, 2015
SHEETS REVISED: R4 thru R8
PARCELS INVOLVED: P4, P5, P6
REMARKS: CUT BACK FILL SLOPES FOR SIGHT DISTANCE

**RIGHT–OF–WAY REVISION NO. 2**

REVISED PLANS DATE: MAY 15, 2015
SHEETS REVISED: R1, R13
PARCELS INVOLVED: P1
REMARKS: CHANGED PROPOSED ENTRANCE WIDTH

**RIGHT–OF–WAY REVISION NO. 3**

REVISED PLANS DATE: JUNE 03, 2015
SHEETS REVISED: R3 , R6
PARCELS INVOLVED: P7, P8
REMARKS: P7-CHANGE AREA OF TOTAL TRACT AND TAKING
P8-CHANGE PROPERTY OWNERSHIP

RIGHT OF WAY PLANS

RIGHT OF WAY REVISION SHEET

EXHIBIT NOT TO SCALE

4-06-2016

*Chapter*

RAILROADS

*Subject*

Design Procedures

## HD-1401.1 OVERVIEW

The following information is provided to highway designers for use when highway improvements encroach upon railroad facilities. References to specific design criteria for railroads are contained in the *American Railway Engineering and Maintenance of Way Association (AREMA) Manual.* Additional criteria may be available from individual railroads.

The project manager should contact the Central Office railroad coordinator as soon as possible, but no later than the selection of the preferred alternative, in order to facilitate the necessary approvals with the railroad company and identify additional considerations that should be made concerning the potential impacts of the highway on their facilities. For example, planned railroad expansions may not be discovered until the overpass or underpass structure is well into final design. Contacting the owner can yield this type of information so that these additional needs are addressed.

The following are common practices used by the Kentucky Transportation Cabinet (KYTC), as well as specific criteria accepted by railroads operating in Kentucky.

**Note:** General requirements for surveying procedures can be found in **HD-300**.

## HD-1401.2 ROADWAY PLAN REQUIREMENTS

When a project affects a railroad, a railroad plan and profile sheet should be included in the plan set. The following information is required:

- Alignment and profile of railroad
- Angle measurement between the roadway and railroad centerlines of the at-grade crossing (Angle measurement is not necessary for grade-separated crossings.)
- Existing and proposed horizontal and vertical clearances
- Name of railroad
- Type of track (mainline, siding, spur)
- Railroad valuation station
- Distance to railroad milepost on each side of highway centerline
- Existing drainage features under the railroad and in the vicinity of the crossing

## HD-1401.2 ROADWAY PLAN REQUIREMENTS (cont.)

- Limits of existing railroad and roadway rights of way and proposed roadway right of way and easements

**Note:** The proposed roadway right of way and easements, along with the existing railroad valuation data, should also be shown.

**Exhibits 1400-01** and **1400-02** show examples of a railroad plan and profile sheets for grade-separated and at-grade crossings.

Railroad overpasses and underpasses of the roadway at railroad crossings shall be treated as any other structure.

Railroad at-grade crossings should be thoroughly investigated in the preliminary engineering phases to determine whether an at-grade crossing is acceptable. The railroad coordinator in the Division of Right of Way and Utilities will contact the railroad company for input on all crossings.

To the extent practical, the highway alignment should intersect the railroad track at right angles, and crossings should not be located on either highway or railroad curves.

For railroad at-grade crossings, a pavement development sheet shall be included (**Exhibit 1400-03**). If the roadway is on a curve or the limits of superelevation extend through the crossing, the pavement development sheet should include all the appropriate data for the roadway. With the concurrence of the railroad, track elevations in some instances may be adjusted to meet the proposed roadway elevations. When evaluating these cases, the project manager should consult the Central Office railroad coordinator.

### HD-1401.2.1 Clearance Requirements

The following are typical clearance requirements for the construction of permanent or temporary facilities encroaching on or across railroad right of way at railroad-highway crossings:

- The railroad company establishes horizontal clearance from the centerline of track to the face of a pier, abutment, or other obstacle. The Division of Structural Design shall be contacted for the exact information prior to the beginning of the bridge design process.

- Crashwalls are required when the face of the pier is closer than 25 feet from the centerline of the track, measured perpendicular to the track. When crashwalls are required, the project manager should consult the Division of Structural Design.

### HD-1401.2.1 Clearance Requirements (cont.)

- A standard vertical clearance of 23 feet shall be provided. Measure vertical clearance beginning at the top of the high rail and proceeding to the lowest point of the structure in the horizontal clearance area of the railroad. The *AREMA Manual*, Chapter 28-1, provides additional information.

### HD-1401.2.2 Width of Crossing

New crossings shall be constructed 2 feet beyond the edge of the graded (full) shoulders.

### HD-1401.2.3 Profile & Alignment of Crossings & Approaches

The surface of the highway shall be in the same plane as the tops of the rails for a distance of 2 feet outside the rails for either multiple- or single-track crossings. Where crossings involve two or more tracks, the tops of the rails for all tracks should be brought to the same plane where practicable. The surface of the highway should be no more than 3 inches higher nor 6 inches lower than the top of the nearest rail at a point 30 feet from the rail, measured at right angles thereto, unless track superelevation dictates otherwise. Typically, railroad crossings are constructed by the railroad. The crossing distance should not be included in the length of project on the layout sheet.

## HD-1401.3 RIGHT-OF-WAY CONSIDERATIONS

All parcels of land within railroad right of way that are needed for highway construction are to be taken as either permanent or temporary easements. The descriptions shall be tied to both highway and railroad stationing. Information about valuation maps, which show railroad stationing, should be requested from the railroad coordinator in the Division of Right of Way and Utilities. When the project’s right-of-way plans are submitted, the railroad sheets (including all survey information, proposed railroad deeds, and cost appraisals) shall be submitted to the railroad coordinator.

In general, with the exception of crossings, railroads will not allow any permanent construction work or occupancy within 25 feet of the centerline of the nearest track. Certain work at lesser distances may be permitted with concurrence of the railroad. As necessary, the Central Office railroad coordinator can provide more information.

The above limitations will not affect the use of the right of way on a temporary basis to permit construction of the permanent crossing facilities. The railroad generally grants temporary easements within 10 feet of the centerline of the nearest track.

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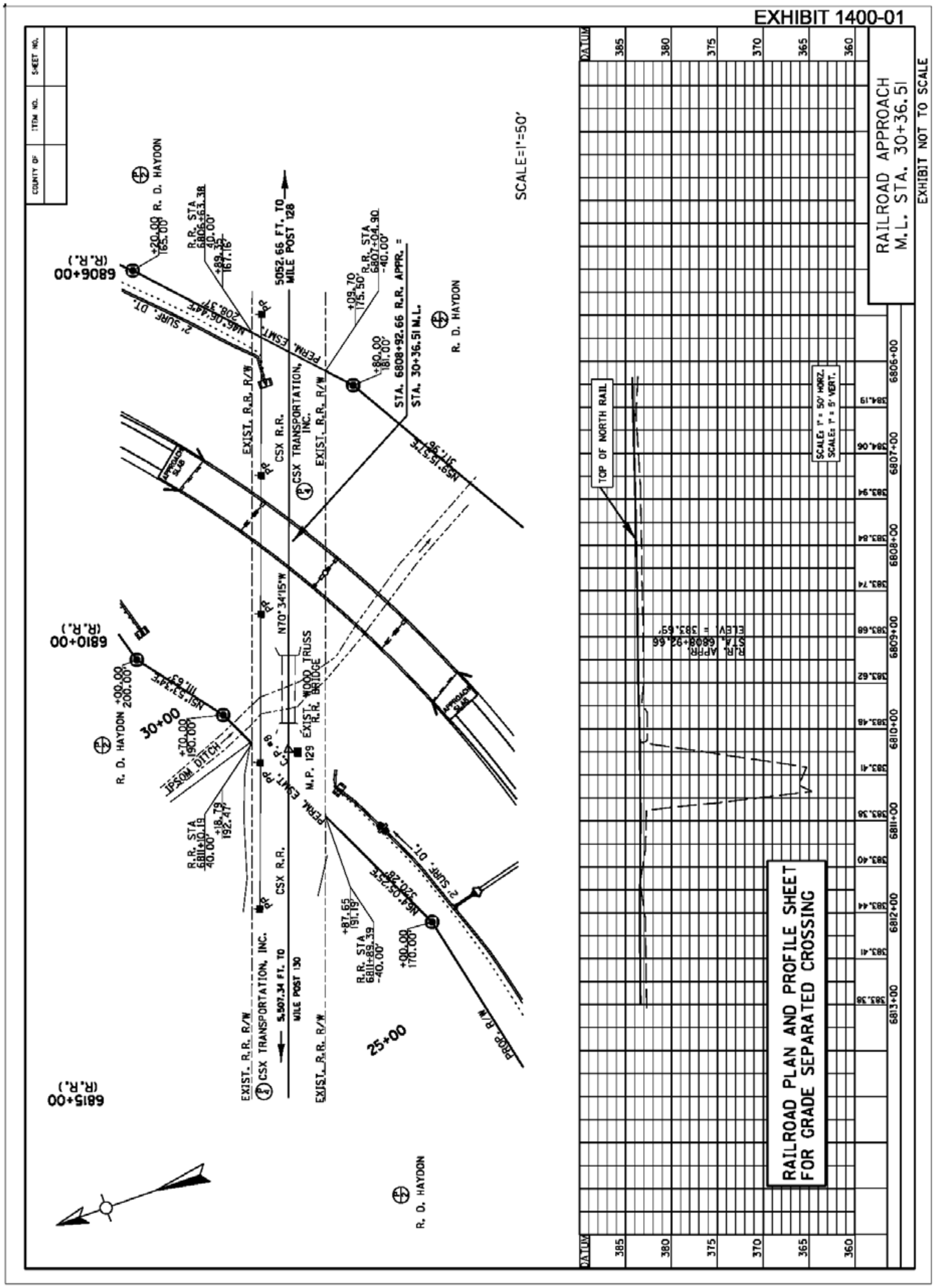


EXHIBIT 1400-01
RAILROAD APPROACH
M.L. STA. 30+36.51
EXHIBIT NOT TO SCALE
RAILROAD PLAN AND PROFILE SHEET FOR GRADE SEPARATED CROSSING
SCALE=1"=50'
COUNTY OF
ITEM NO.
SHEET NO.
DATUM
385
380
375
370
365
360
TOP OF NORTH RAIL
SCALE: 1" = 50' HORZ.
SCALE: 1" = 5' VERT.
R.R. APPR.
STA. 6808+92.66
ELEV. = 383.69'
384.19
384.06
383.94
383.84
383.74
383.68
383.62
383.48
383.41
383.38
383.40
383.44
383.41
383.38
6806+00
6807+00
6808+00
6809+00
6810+00
6811+00
6812+00
6813+00
6806+00 (R.R.)
6810+00 (R.R.)
6815+00 (R.R.)
R. D. HAYDON
5052.66 FT. TO MILE POST 128
5,507.34 FT. TO MILE POST 130
EXIST. R.R. R/W
CSX R.R.
CSX TRANSPORTATION, INC.
PERM. ESMT.
2' SURF. DT.
STA. 6808+92.66 R.R. APPR. =
STA. 30+36.51 M.L.
N70° 34'15"W
EXIST. WOOD TRUSS R.R. BRIDGE
M.P. 129
APPROACH SLAB
30+00
25+00
JPSOM DITCH
PROP. R/W
R.R. STA 6806+63.38 40.00'
R.R. STA 6807+04.90 -40.00'
R.R. STA 6811+10.19 40.00'
R.R. STA 6811+89.39 -40.00'
+20.00 165.00'
+89.35 167.16'
+09.70 175.50'
+80.00 181.00'
+00.00 200.00'
+70.00 190.00'
+18.79 192.47'
+87.65 191.19'
+00.00 170.00'
208.37'
311.96'
111.63'
320.28'

Detail Sheet Railroad Approach

# Exhibit 1400-02

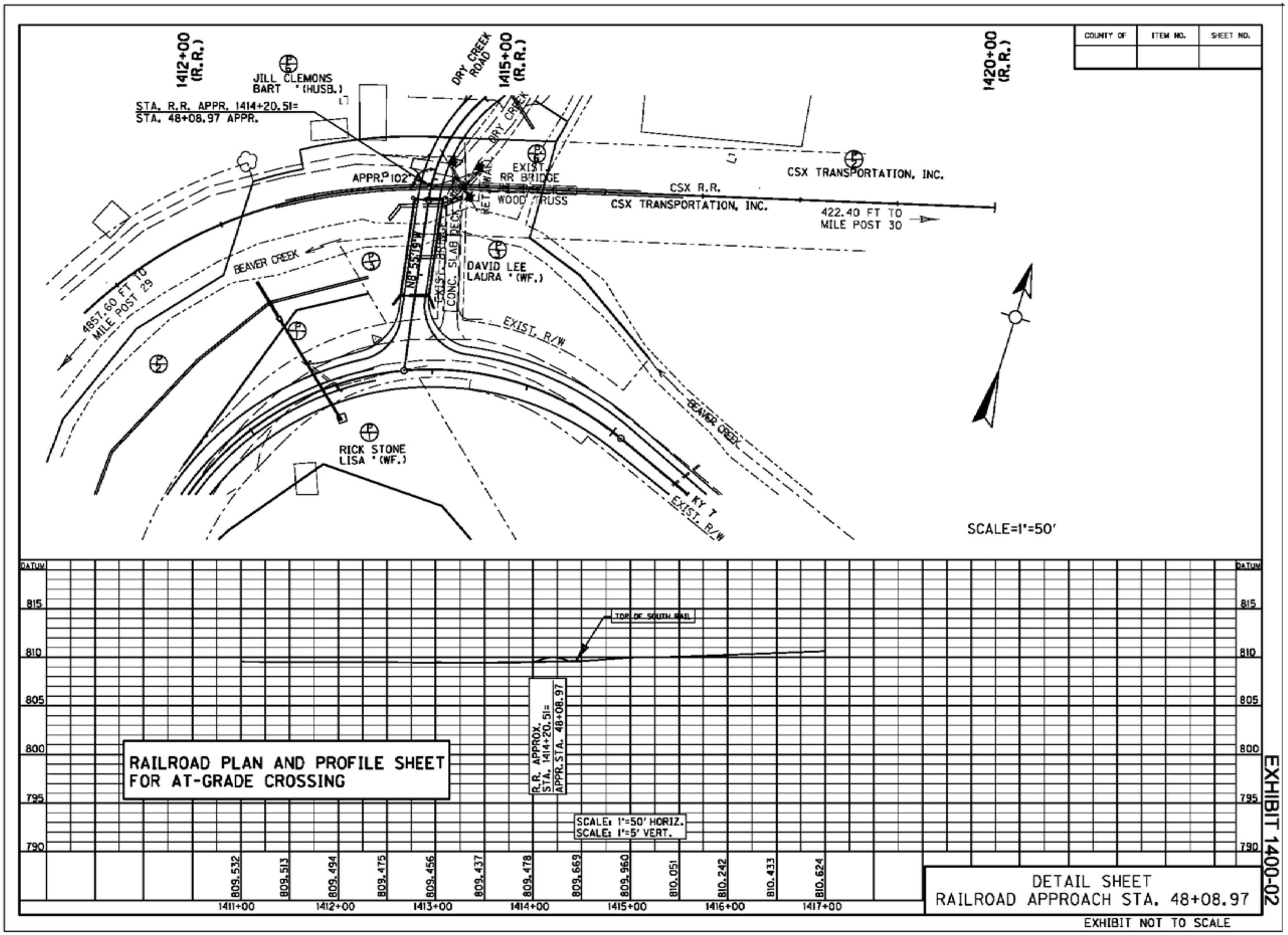
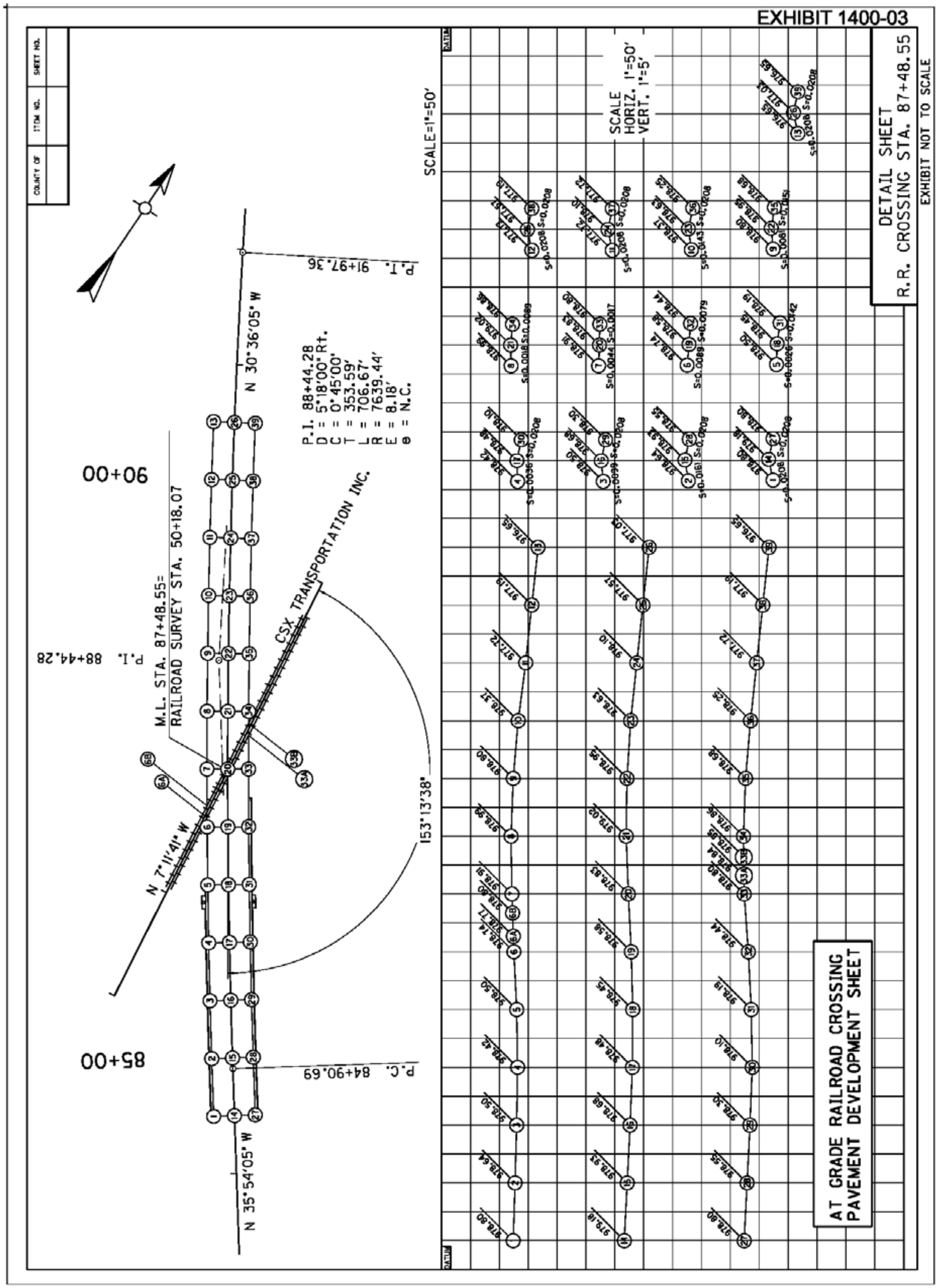


**Exhibit 1400-03**



*Chapter*

PEDESTRIAN & BICYCLE ACCOMMODATIONS

*Subject*

Guidelines for Pedestrian & Bicycle Accommodations

## HD-1501.1 OVERVIEW

It is the Kentucky Transportation Cabinet's policy to enhance operational efficiency, promote program goals, and enrich the quality of life through the implementation of the *Pedestrian and Bicycle Travel Policy*. The following guidance describes the most appropriate inclusion of pedestrian and bicycle facilities for roadway projects. The design executive summary (DES) should document the decision of whether or not to include pedestrian and bicycle facilities.

AASHTO's *Guide for the Planning, Design, and Operation of Pedestrian Facilities* and *Pedestrian Right of Way Access Guidance* (PROWAG) should be consulted for the design of pedestrian facilities. AASHTO's *Guide for the Development of Bicycle Facilities* provides guidance on the design of bicycle facilities.

## HD-1501.2 PEDESTRIAN FACILITIES ON URBAN ROADWAYS

Incorporation of pedestrian facilities will be considered on all new or reconstructed state-maintained roadways in existing and planned urban and suburban areas if the roadway project involves one or more of the following factors:

- A pedestrian facility already exists on the current roadway.
- The recommended roadway cross-section is urban (curb and gutter).
- Project limits are adjacent to an existing residential, commercial, industrial, institutional, public, or semi-public use area, or are adjacent to an area planned to develop one of these uses within the next 20 years. Planned development may be determined by zoning designations, a local comprehensive plan, or the public-involvement process.
- A state, locally, or regionally adopted pedestrian network or policy has designated pedestrian improvements in the area of the specific roadway project or for that classification of roadway.

## HD-1501.2 PEDESTRIAN FACILITIES ON URBAN ROADWAYS (cont.)

- A KYTC Small Urban Transportation Study has specific pedestrian improvements recommended for the roadway project.

- Pedestrian traffic exists along the current roadway. This may be determined by the observation of pedestrian traffic or by the public-involvement process.

- Public interest in and demand for pedestrian facilities are determined at the planning and preliminary engineering public-involvement stages.

Other factors that should be considered when determining the need for pedestrian facilities include the following:

- Project-level decisions will complement local pedestrian plans to the maximum reasonable extent.

- Project-level decisions will evaluate future connections to close gaps in parallel connectivity between projects and developed areas/community destinations or existing pedestrian facilities within 300 feet beyond normal project limits and within existing publicly owned rights of way.

- Project-level decisions will evaluate future connections to close gaps in perpendicular connectivity to developed areas/community destinations or existing pedestrian facilities within 100 feet of the roadway edge of pavement and within existing publicly owned rights of way.

- Project-level decisions will consider pedestrian access to existing and planned transit stops.

## HD-1501.3 PEDESTRIAN FACILITIES ON RURAL ROADWAYS

Incorporation of pedestrian facilities will be considered on all new or reconstructed roadways in rural areas if the roadway project involves one or more of the following factors:

- Pedestrian traffic exists along the current roadway. This may be determined by the observation of pedestrian traffic or by the public-involvement process.

- Project limits are adjacent to planned or anticipated development within the next 20 years of residential subdivisions; commercial, industrial, institutional, public, or semi-public use area; or other projects necessitating pedestrian connectivity. Planned development may be determined by zoning designations from a local comprehensive land use plan, interviews with local political and economic leaders to gauge anticipated growth in the project area, or the public-involvement process.

## HD-1501.3 PEDESTRIAN FACILITIES ON RURAL ROADWAYS (cont.)

- A state, locally, or regionally adopted pedestrian network or policy has designated pedestrian improvements in the area of the specific roadway project or for that classification of roadway.
- Gaps in connectivity exist between two or more developed areas/community destinations currently separated by no more than 1.5 miles.
- Public interest in and demand for pedestrian facilities are determined at the planning and preliminary engineering public-involvement stages.

## HD-1501.4 CHOOSING TYPES OF PEDESTRIAN FACILITIES

After determining that a pedestrian facility is necessary, the type of facility will be selected and common practices for both urban and rural areas will be considered.

### HD-1501.4.1 Common Practices for Urban Areas

- 5’ sidewalks with 2’ buffer strip on both sides of the roadway (desirable)
- 5’ minimum, 6’-10’ desirable for sidewalks in heavily-traveled pedestrian areas, Central Business Districts (CBDs), and other special applications
- 10’ desirable, 8’ minimum shared use path (two-way directional travel)
- Shoulders (for rural cross-section in urban areas): minimum width based on KYTC policy as stated in **HD-700**, “Geometric Design Guidelines”
- 10’ shared use path with 5’ sidewalk on opposite side

### HD-1501.4.2 Common Practices for Rural Areas

- Shoulders: minimum width based on KYTC policy as stated in **HD-700**, “Geometric Design Guidelines”
- 10’ desirable, 8’ minimum shared use path (two-way directional travel)
- 5’ sidewalk with 2’ buffer strip on both sides of the roadway (desirable for urban cross-section in rural areas)

### HD-1501.4.3 Options to Common Practices

Other options may be chosen if they satisfy a need supported by data or public input. Additional guidance concerning pedestrian facilities may be found in AASHTO’s *Guide for the Planning, Design, and Operation of Pedestrian Facilities,* AASHTO’s *Guide for the Development of Bicycle Facilities,* and *Pedestrian Right of Way Access Guidance* (PROWAG).

## HD-1501.5 SHARED USE PATH

A shared use path serves as part of a transportation circulation system and supports multiple modes, such as walking, bicycling, and inline skating. A shared use path typically has a surface that is asphalt, concrete, or firmly packed crushed aggregate. The AASHTO *Guide for the Development of Bicycle Facilities Current Edition* defines a shared use path as being physically separated from motor vehicular traffic with an open space or barrier. Shared use paths are best utilized in areas where driveway and road access crossings are limited in order to minimize the number of motor vehicle–path-user conflicts.

## HD-1501.6 BICYCLE FACILITIES

In the Commonwealth of Kentucky, bicycles are considered by statute to be legal vehicles and as such are permitted on all roadways within the state, except on those where they are specifically prohibited (e.g., parkways and interstate highways). Bicycles can safely share the roadways with motor vehicles when appropriate consideration is made during the design and construction of new or reconstructed roadways. Bicycle traffic may be expected on all roadways except interstate highways and other fully controlled access highways, but each location merits a different type of accommodation. Accommodation includes signage, rumble-strip design, bicycle-friendly grates, wide curb lanes, shoulder bikeways, bicycle lanes, and shared use paths.

Incorporation of bicycle facilities will be considered on all new or reconstructed roadways (including the resurfacing of roadways and shoulders) in existing and planned urban, suburban, and rural areas when the roadway project involves one or more of the following factors:

- A bicycle facility already exists on the current roadway.
- Project limits are adjacent to an existing residential, commercial, office, industrial, institutional, public, or semi-public use area or adjacent to an area planned to develop into one of these uses within the next 20 years. Planned development may be determined by a local comprehensive plan or the public-involvement process.
- A state, locally, or regionally adopted bicycle plan has designated bicycle improvements or a bikeway in the area of the specific roadway project or for that classification of roadway.
- A KYTC Small Urban Transportation Study has specific bicycle improvements recommended for the roadway project.

## HD-1501.6 BICYCLE FACILITIES (cont.)

- Bicycle traffic exists along the current roadway. This may be determined by the observation of bicycle traffic or by the public-involvement process.
- Public interest in and demand for bicycle accommodations are determined at the planning and preliminary engineering public-involvement stages.

Other factors that should be considered when determining the need for bicycle facilities include:

- Project-level decisions will complement local bicycle plans to the maximum reasonable extent.
- Project-level decisions will evaluate future connections to close gaps in parallel connectivity between projects and developed areas/community destinations or existing bicycle facilities within 300 feet beyond normal project limits and within existing publicly owned rights of way.
- Project-level decisions will evaluate future connections to close gaps in perpendicular connectivity to developed areas/community destinations or existing bicycle facilities within 100 feet of the roadway edge of pavement within existing publicly owned rights of way.

## HD-1501.7 CHOOSING TYPES OF BICYCLE FACILITIES

After determining that a bicycle facility is necessary, the type of facility will be selected. Following are brief descriptions of typical bicycle facilities.

### HD-1501.7.1 Shared Lanes

Width is the most critical variable affecting the ability of a roadway to accommodate bicycle traffic. In order for bicycles and motor vehicles to share the roadway without compromising the level of service and safety for either, the facility should provide sufficient paved width. Bicycle-safe drainage inlets shall be used when bicyclists are anticipated in roadways with curb and gutters.

### HD-1501.7.2 Paved Shoulders

Adding or improving paved shoulders often can be the best way to accommodate bicyclists in rural areas and benefit motor vehicle traffic.

### HD-1501.7.3 Kentucky Shoulder Bikeways

*Bikeway* is a generic term for any road, street, path, or way that in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.

### HD-1501.7.3 Kentucky Shoulder Bikeways (cont.)

- Shoulder bikeways should have a minimum of 4 feet of paved surface beyond rumble strips, 5 feet when guardrail is present; however, 6 feet is preferred.

- No additional striping should be applied to designate a shoulder bikeway. See the MUTCD for appropriate signing.

- The bicycle lane symbol should not be used as pavement marking on a shoulder bikeway. The bicycle lane symbol is used to designate facilities exclusive to bicycle use and is not appropriate on a shoulder bikeway.

### HD-1501.7.4 Wide Curb Lanes

It may be appropriate to add additional width to the outside lane to accommodate bicycles. Wide curb lanes for bicycle use are usually preferred where shoulders are not provided, such as in restrictive urban areas. An outside or curb lane wider than 12 feet can better accommodate both bicycles and motor vehicles in the same lane. In many cases where there is a wide curb lane, motorists will not need to change lanes to pass a bicyclist. Bicycle-safe drainage inlets shall be used in conjunction with widened pavements.

In general, 14 feet of usable lane width is the recommended width for shared use in a wide curb lane. Usable width normally would be from edge stripe to lane stripe or from the longitudinal joint of the gutter pan to lane stripe (the gutter pan should not be included as usable width).

Restriping to provide wide curb lanes may also be considered on some existing multi-lane facilities by making the remaining travel lanes and left-turn lanes narrower. An engineering analysis based on applicable design criteria and a careful review of traffic characteristics will be provided to aid any decision for restriping existing facilities.

### HD-1501.7.5 Bicycle Lanes

Bike lanes can be incorporated into a roadway when it is desirable to delineate available road space for preferential use by bicyclists and motorists and to provide for more predictable movements by each. Bike lanes should be one-way facilities and carry bike traffic in the same direction as adjacent motor vehicle traffic. On one-way streets, bike lanes should generally be placed on the right side of the street. Bike lanes on the left side are unfamiliar and unexpected to most motorists.

The recommended width of a bike lane is generally 5 to 6 feet from the face of a curb or guardrail to the lane stripe (the width of the gutter pan is included). For roadways with no curb and gutter or guardrail, the minimum width of a bike lane should be 4 feet.

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HIGHWAY Design

# ALPHABETICAL INDEX