PAVEMENT DESIGN GUIDE
January 2018 Revision

For Full Depth Projects

DIVISION OF HIGHWAY
DESIGN PAVEMENT BRANCH

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1. Background and Scope

This guide is exclusively for new construction or full-depth reconstruction projects. The methodology it presents draws from the *AASHTO Guide for Design of Pavement Structures, AASHTO MEPDG*, and Kentucky's mechanistic-empirical pavement design systems, which historically have been used for structural pavement designs in the state.

The methodology presented uses Traffic forecasts and subgrade strength estimates as well as historical pavement performance measures. The Division of Planning will provide traffic forecast values such as:

- Average Annual Daily Truck Traffic (AADTT)
- Average Daily Traffic (ADT)
- Percent Trucks (%T)

The Division of Structural Design's Geotech Branch will provide subgrade strength values such as:

- Resilient Modulus (MR)
- California Bearing Ratio (CBR)

This guide is self-sufficient except for: (1) Traffic Forecasts from the Division of Planning; (2) Subgrade Recommendations from the Geotechnical Branch; (3) Special Notes and Special Provisions not included in the Standard Specifications or Standard Drawings; and (4) Pavement Policy Guidelines, which may be subject to periodic modifications such as updating guidelines for surface type selection. **Appendix C** lists Special Notes and Special Provisions most typically used in pavement design. Relevant policy documents are also included in the appendices.

The guide discusses the roadway designer's responsibilities for documenting pavement design computations and related submittals. It also reviews what assistance the Division of Highway Design's Pavement Branch provides for implementing this guide.

2. Subgrade Stabilization

Most pavements constructed in Kentucky are built on fine-grained soils. Approximately 85 percent of these soils consist of clay and silt. When first compacted, fine-grained soils usually have sizeable bearing strength. If pavements are constructed immediately after fine-grained soils are compacted, major problems are not typically encountered when the layers of paving materials are emplaced and compacted. Problems arise, however, when surface and subsurface water penetrates compacted fine-grained soils. Principally, water from rainfall, snow melt, and groundwater seepage enters fine-grained soil subgrades, causing swelling and reducing the subgrade's bearing capacity. Soils are most vulnerable to a reduction in bearing capacity after exposure to wetting during winter and early spring. Before paving, rutting may develop in the softened subgrade, which can slow or halt

construction traffic. This also may impede compaction of the pavement structure's lifts, resulting in a weaker pavement structure than initially designed. Therefore, the weakened subgrade slows construction and limits the long-term life of the pavement structure.

Recent experience in Kentucky has demonstrated the benefits of stabilized subgrades for providing a stable platform for placement of pavement layers and extending the pavement structure's life.

2.1 Subgrade Stabilization Methods

Most subgrades should be considered for stabilization. Typically, the stabilized subgrade soil layer is treated as both an improved subgrade layer, which establishes a stable paving platform, as well as a structural layer for extending the life of the pavement structure. The following stabilization methods are recommended when a rock roadbed on the jobsite is not available. Each of the following stabilization methods is considered to be structurally equivalent and equal to 3 inches of asphalt:

- 8 inches (minimum) of chemical stabilization using cement or lime, as applicable.
- 12 inches (minimum) of coarse aggregate (2's, 3's, or 23's) underlain with a Type V High Strength Fabric and a TY 4 Geotextile Fabric on top separating it from the DGA/CSB layer.
- An additional (6) inches of Dense Graded or Crushed Stone Base (minimum 10 inches total) underlain with a Geogrid and a Type IV Geotextile Fabric.

2.2 Chemical Stabilization

Generally, chemical stabilization is the most cost-effective stabilization method for new builds. The Division of Structural Design's Geotechnical Branch will determine whether cement or lime is the appropriate treatment material. It will also provide the dry weight and percentage of chemical to use in determining quantities.

3. Catalog of Pavement Designs

Both the Catalog of Asphalt Structural Designs and the Catalog of PCC Structural Designs are incorporated within the pavement design web application. Hundreds of AASHTOWARE Pavement ME runs were made using the common inputs developed for use in Kentucky. The two primary inputs of these runs were traffic loading and underlying subgrades strength. **Appendix G** includes the catalogs used in the web-based application.

4. Pavement Design Computations

Typical Pavement layer comparisons:

Initial			Equivalent	
Thickness	Pavement Layer		Thickness	Pavement Layer
1.0 Inch	Chemically Stabilized Subgrade	~	1.1 Inch	DGA/CSB
1.0 Inch	Asphalt Base	~	3.0 Inch	DGA/CSB
1.0 Inch	Asphalt Base	~	2.0 Inch	Treated Drainage Blanket
8.0 Inch	Chemically Stabilized Subgrade	~	3.0 Inch	Asphalt Base

4.1 Shoulder Design

Pavement shoulder designs should meet appropriate geometric criteria. Pavement thickness must be sufficient to ensure there is adequate structural support to handle any anticipated shoulder traffic. Typically, shoulders should be designed to accommodate a minimum of 25% of the mainline AADTTs. Achieving this generally entails carrying the top asphalt base and surface courses onto the shoulder with full-depth DGA/CSB below. If earth shoulders are warranted, providing an additional paving width of 2 feet with full depth pavement may be necessary to ensure adequate edge support.

NOTE: Paved shoulders less than 4 feet in width should use the same asphalt mix types shown on the driving lanes.

4.2 Development of Alternate Pavement Designs

Developing alternative pavement designs typically involves preparing an asphalt design and a concrete design for comparative analyses. Consider alternative pavement designs where specific project considerations indicate a need. **Appendix D**, Pavement Type Selection Policy, provides instructions on calculating life cycle costs and determining type selection.

When developing alternative pavement designs, take care to ensure a specific maintenance of traffic plan is tailored to each pavement type. Paving summaries and typical sections should clearly detail each pavement type being bid.

5. AASHTOWARE Pavement ME Design Input Guide

For most pavement designs, the designer should use the web-based application (see next section). However, with approval from the Branch Manager for the Pavement Branch in Highway Design, the designer can run AASHTOWARE Pavement ME software to develop

pavement designs. Users running Pavement ME should use the inputs provided in **Appendix F**, AASHTOWARE Pavement ME Design Input Guide.

6. KYTC Web-based Pavement Design Application

The web-based pavement design application is located at:
http://kytcpavementdesign.engr.uky.edu/.

It is intended for all routine pavement designs. This site contains current version of the catalogs of asphalt and concrete pavement designs based on Pavement ME runs.

The followings steps provide a quick start guide for developing a new pavement design in the web-based application:

1. Go to http://kytcpavementdesign.engr.uky.edu/ and click REGISTER link. Create an account and establish a username and password. Register as a *Designer*.

2. Click the LOGIN link in top right corner. Log-in with your username and password.

3. Click the NEW DESIGN link.

4. Fill in information under the TITLE & INFO and SUBGRADE tabs. Data must be entered in the starred fields before pavement design can be saved. Click Save after the information is filled in.

5. Under the AC and/or PCC tab, review and, if needed, edit the recommended pavement designs.

6. Review information under the COST ANALYSIS tab, and then go to the DESIGN SECLECTION & NOTES tab and select Pavement type. The pavement type must be in accordance with the current Pavement Type Selection Policy.

7. Select all applicable notes. Some notes are automatically selected, but the pavement designer should review all notes to ensure the correct ones are selected. Click SAVE.

8. Click SUBMIT. The Pavement Design will go to the person listed on the TITLE & INFO tab as the Project Manager. If the Project Manager approves the design, it then goes to the Project Development Branch Manager for that district.

To assist the users of the web application, a user manual is located in the *Instructions* link of the web application.

7. Submittals and Approvals

All pavement designs shall be submitted electronically via the web-based pavement design application.

See the current Highway Design Manual's Pavement Chapter for pavement design responsibility. The submittal process detailed in the manual is built into the web-based pavement design program.

NOTE: The Project Manager is responsible for placing the approved Pavement Design Form in the appropriate folder in ProjectWise before final plans are submitted to the Central Office.

7.1 Technical Assistance

Division of Highway Design staff can assist roadway designers with the application and implementation of these guidelines.

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