



Matthew G. Bevin
Governor

**COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET**

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

Greg Thomas
Secretary

DESIGN MEMORANDUM NO. 03-17

TO: Chief District Engineers
Branch Managers for Preconstruction
Engineering Support Branch Managers
Design Consultants

FROM: William S. Gulick, P.E., Director
Division of Highway Design 

DATE: February 07, 2017

SUBJECT: Performance Based Flexible Solutions (PBFS)
Guidance for Project Development

This Design Memo is in reference to the recent State Highway Engineer memorandum (dated December 15, 2016) concerning the application of Performance Based Flexible Solutions (PBFS) in the project development process. The goal is to ensure that the appropriate criteria is being applied to KYTC projects, possibly freeing up funds to be used for other projects in the system. A copy of the State Highway Engineer Memo is attached for reference.

From the Foreword in the **2011 AASHTO A Policy on Geometric Design of Highways and Streets**:

"The fact that new design values are presented herein does not imply that existing streets and highways are unsafe, nor does it mandate the initiation of improvement projects. Specific site investigations and crash history analysis often indicate that the existing features are performing in a satisfactory manner. The cost of full reconstruction for these facilities, particularly where major realignment is not needed, will often not be justified".

Additional guidance for KYTC PBFS projects is as follows:

When choosing a design speed for proposed spot improvement type projects, one 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. The review of crash data, pavement condition, typical roadway and shoulder widths, sight distance restrictions, and possible drainage issues are just a few of the items that can be evaluated along the existing project corridor to help determine what solution best fits the purpose and need of the project. The "design up" approach encourages the decision makers to use this evaluation along with engineering judgement to build up improvements from the existing conditions to meet



the scope and budget of the project, along with consideration for the overall roadway system objectives.

For projects that are reconstruction or new construction, the starting place for the design criteria should be the minimums from the KYTC Design Manual and/or the current AASHTO Green book. The criteria can then be adjusted up or down with appropriate justification and/or 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 an undesirable result.

A Design Executive Summary (DES) will be required for exceptions to the controlling criteria. With an increased emphasis on the DES approval in order to move into Phase II (Final) Design or for the funding of new phases (R, U and C), it is imperative that the DES be submitted by the Project Manager to the Location Engineer as soon as possible once the PL&G Inspection has been held. Refer to Design Memorandum 01-17 which includes KYTC Design Manual Chapter HD-200 and HD-700 releases, for current guidance on the KYTC DES process for exceptions and variances.

Per the SHE memo, a Fast Look Exploration (FLEX) Team will be created to review projects selected by the SHE Office and assist Project Managers in developing value-based solutions with the objective of possible lower cost solutions that might allow the expedited delivery of the project. Both State and Federally funded projects will be identified.

Performance Based Flexible Solutions (PBFS) should be applied to all new project starts, as well as existing projects that have not progressed into Final Design. The Project Manager may decide to utilize PBFS on any project that they feel would benefit from this process. Projects that are greater than 115% over budget should also be reviewed and evaluated for PBFS.

WSG/RKC

TO: Chief District Engineers
District Project Development Branch Managers
Department of Highways Directors

FROM: Patty Dunaway, P.E. 
State Highway Engineer

DATE: December 15, 2016

SUBJECT: Guidance for the Application of "Performance Based Flexible Solutions" (PBFS) to Project Development Delivery

The mission of the Kentucky Transportation Cabinet KYTC is to *provide a safe, efficient, environmentally sound and fiscally responsible transportation system that delivers economic opportunity and enhances the quality of life in Kentucky*. In so doing, we are continually challenged with looking for ways to improve the products and services we deliver to the traveling public while minimizing cost. As a part of that continuous improvement process, efforts are underway to re-emphasize many of the fundamentals that go into the development and delivery of the Cabinet's Highway Plan construction projects. It must be noted that currently the majority of our project are fixes, replacements, repairs or modest add-ons, such as turn lanes and spot safety improvements (spot improvements and fixes). There are, of course, some corridor improvement projects but few "new highway" projects.

It is incumbent on us to find solutions for the Commonwealth's transportation issues that focus on repairing, improving and maximizing our existing system in lieu of expanding the system. In simpler terms, taking care of our existing roads and being very deliberate in the building of new ones. It is important that we maximize the value we derive from the investments we make in the highway system. Over-designing an improvement or fix on a given project denies other possible projects funding and may delay the project itself. We must strive to find the sweet spot that minimizes the investment and provides the most practical benefit while expediting the delivery of all needed improvement projects across the Commonwealth. This fundamental concept needs to be taken into consideration as an integral part of the decision-making process during all phases of project development and delivery. One of the first steps with any project is to identify the "Purpose and Need" and the subsequent project scope. It is at this early stage that we must focus our efforts to ensure that the project scope developed is minimized yet appropriate and substantially fulfills the intended purpose.

This concept is not something new to KYTC, components of the "Context-Sensitive Design" initiative emphasized the economics of projects and "right sizing" design parameters on projects that are compatible with other segments of the adjacent roadways and existing topography,

when appropriate. The betterment standards published in the 1980s were also an attempt to stretch our funds by minimizing scope and criteria.

The Performance Based Flexible Solutions (PBFS) initiative is intended to take these fundamentals to the next level. The Project Managers along with the Project Development Team will be given the task of addressing the 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 our *System* is adequate and appropriate. A good example of ways KYTC is already adopting this type of project approach is the rural bridge replacement projects. By focusing on replacement of the bridge and limiting work on the approaches, using the design exception process, KYTC has been able to replace more substandard bridges. It is hoped that through the use of a pragmatic approach KYTC will be able to use our limited resources to adequately address the purpose and need for all projects and for the whole roadway system.

It is the overt intent of this policy (PBFS) to cause projects to be developed at the minimum impact and cost that satisfy the goals, purpose, and need. Our basic premise must be to find the balance between operational efficiency, safety, and cost in order to design a suitable roadway that meets the transportation needs of Kentucky. It is also the intent of this office that future guidance and training be developed to assist in achieving this goal. However, due to the importance of this endeavor, every effort is being made to keep everyone informed of the progress we have made and need to make in order to be successful and to make the most of the resources we have available. The objective is for us to extend our available funds to address as many of the needs of the highway system as possible, thus resulting in overall system improvement.

The guidance that follows is intended to provide more detail on how Performance Based Flexible Design will be implemented at KYTC.

Performance Based Flexible Solutions Guidance

A typical approach to designing a highway project would include identifying the geometric design criteria to be used in the design process. The selection of the minimum radius for curves, maximum grade, width of lanes and shoulders, sight distance requirements as well as other features including design speed are key in developing the parameters of the project. Historically, this criteria is selected based on the conservative values for a new or reconstructed road of that classification, traffic volume, terrain, safety, adjacent land use, etc. This would be reflected in the selection criteria and then applying that criteria and resorting to compromises when justified. These compromises often manifest themselves as "Design Exceptions" which are justified decisions to utilize criteria that are lower than those specified in the Green Book (AASHTO's A POLICY ON THE GEOMETRIC DESIGN OF HIGHWAYS AND STREETS). Design Exceptions must be granted by FHWA and/or KYTC based on facility type, design speed and applicable FHWA-KYTC agreements. There are ten (10) different criterion for which a design exception may be required, only two of which apply to projects with a design speed under fifty (50) mph. The primary defining variable in the development and presentation of geometric design criteria is the "design speed" selected for the project.

The Controlling Criteria for which a design exception may be required is as follows:

50 mph and over

Design Speed	Lane Width
Shoulder Width	Horizontal Curve
Superelevation Rate	Stopping Sight Distance (SSD)
Maximum Grade	Cross-Slope
Vertical Clearance	Design Load (Structure Capacity)

Under 50 mph

Design Speed
Design Load (Structure Capacity)

With the implementation of this policy (PBFS) the starting point for spot improvement/fixes type projects should be the *existing* conditions. Establishing a floor for a bottom-up design process. Design Speed as well as other criteria should be derived from the existing roadway and then adjusted appropriately to provide solutions that satisfy the purpose and need of that particular project. Performance information such as pavement and structure conditions, crash rates, number of crashes, crash severity, capacity, level of service, v/c ratio, delay time, access issues, Crash Modification Factor (CMF), ongoing maintenance issues etc. should be used to justify changes to the design criteria developed from the existing conditions.

In general, the "design speed" must correlate with the functional classification, of the roadway, the actual and anticipated operating speeds, topography, anticipated land use, and the desirable degree of safety, mobility, and efficiency within the constraints of environmental quality, economics, aesthetics, and social or political impacts. In any event, the selected "design speed" should be influenced by both present and future driver expectations. For example, on routes with very little growth expected in the corridor, existing geometric features, as well as crash data, will prove beneficial in: (a) identifying locations and scope for possible needed safety or capacity improvements, (b) selection of a "design speed" for the project that will provide a consistent approach in relation to driver expectations as well as "match" the appropriate "design speed" criteria to the project and existing conditions.

The selection of the traffic volumes to be used for design purposes is also a primary component of the design. Traditionally, 20-year forecasts are used as the design year. The Project Manager and Project Team have the flexibility to utilize intermediate years, such as a 5, 10, or 15 year forecasts or in some cases the current traffic volumes, if it is consistent with the purpose and need for the project.

For projects that are reconstructions or new construction the starting place for the project design criteria should be the recommended minimums from the Highway Design Manual and or the Green Book. This criteria should then be considered in light of the purpose and need of the project, its context, scope, schedule and budget. The criteria should then be adjusted up or down, with appropriate justifications and/or design exceptions. Care should be taken to insure that the application of individual minimum features do not aggregate into an undesirable result.

Performance Based Flexible Solutions (PBFS)

Implementation Strategy

1. Guidance for the application of PBFS (See attached)
2. Create FLEX Team (Fast Look EXploration Team) to review data on projects selected by the SHE Office and assist Project Managers in developing value-based solutions.
 - a. Team located in Developmental Branch in Highway Design
 - i. Led by Bill Gulick and Gary Valentine
 - b. Project will be identified by SHE Office
 - i. Federal and State funded projects
 - ii. Preliminarily score favorably in Prioritization System
 - iii. Preliminarily score poorly but appear to have opportunity for scope change
 - c. Objective to determine if lower cost solutions can allow for expedited project delivery
 - d. Review Process
 - i. Team will review data and determine need for additional data
 - ii. Team will prepare preliminary recommendations
 - iii. Team will meet with Project Manager
 - iv. Team will provide recommendations to SHE Office
3. Require approval of Design Executive Summary (DES) prior to moving in to Phase II Design or for funding of new phases (RUC).
4. All funding requests (DRU) should flow through the Location Engineers.