Performance Based Practical Design (PBPD)
2016 ODOT D08 LPA Day

PBPD

PBPD – Presenter
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PBPD – What, Why & When

**WHAT is PBPD?**

- FHWA – PBPD is defined as modifying a traditional design approach to a "design up" approach where transportation decision makers exercise engineering judgment to build up the improvements from existing conditions to meet both project and system objectives.

- ODOT - A Planning & Design philosophy that will guide our decision making process to ensure that we are making the best possible investments in our transportation system **AS A WHOLE.**

PBPD Fundamental Shift in Philosophy

- The philosophy, long held by most government agencies, that meeting design standard, (which often involved adding capacity) should be the primary option to address traffic problems, has become cost prohibitive.

- Designed to “standard” does not always solve the transportation problems we face.
What PBPD is not......

- PBPD is not a way to avoid using current design standards;
- Existing design standards, and/or regulatory requirements, are not eliminated or modified and safety is not compromised;
- PBPD is based upon *sound engineering judgement*

Does not permit unsafe designs.................examples:
What PBPD is not.....

Does not permit unsafe mitigation........examples

PBPD – What, Why & When

WHAT is PBPD?

- Beginning at the Planning level, PBPD (also cited as Performance Based Project Development) focuses upon both the individual project and overall system performance needs and objectives when scoping and developing individual projects.

- Potential traditional and non-traditional (PBPD) improvements are identified BEFORE applied to a location/corridor

- KEY: - Allows for sound decisions based upon the best available information/performance analysis tools
  - Design Traffic
  - Crash Analysis Tools
  - HCM/HSM/Simulation Analysis Tools
  - Addresses project Purpose and Need

- Emphasis is on “improvement” as opposed to only meeting the “Standard”
PBPD - Benefits

PBPD provides a platform upon which agencies can now:

• Provide greater focus on specific problem areas
• Have the flexibility to consider less-traditional strategies
• Better utilize the existing infrastructure
• Recognize and accept reality of limited funding
• Develop “right-sized”, fundable-scale projects
• Provide for greater stakeholder and public involvement

PBPD – What, Why & When

PBPD at ODOT - Guiding Principals

• “Design Up” from the existing condition;
• Design should be consistent with corridor context;
• Optimize mobility/operations/modes;
• Involve public in development of solutions (NEPA);
• Provide for a greater return on investment (B/C);
• No single project is more important than the system;
  • Many “good” projects are better than just a few “built to standard” projects
  • A greater number are projects can be delivered.
PBPD – What, Why & When

• **WHY NOW:**
  
  • FHWA is unified in support of PBPD;
    
    • Fixing America’s Surface Transportation (FAST) Act
      
      • [http://www.fhwa.dot.gov/design/standards/161006qa.cfm](http://www.fhwa.dot.gov/design/standards/161006qa.cfm)
    
    • FAST Act, builds on FHWA’s Every Day Counts initiative (EDC). EDC is designed to identify and deploy innovation aimed at shortening project delivery, enhancing the safety of our roadways, and protecting the environment. The increased federal share for innovative techniques will incentivize use of such innovation to help deliver projects more efficiently and to deploy rapidly proven solutions that make a difference.
  
  • Flexibility in the design process provides designers with the freedom to develop projects that meet the functional and operational characteristics of drivers, pedestrians, bicyclists, and transit in a way that fits their local context, maintains the desires of and the connections between communities, and is safe for travel.
  
  • Funding is vastly insufficient to meet our needs;
  
  • New Tools – Until recently meeting standard was the proxy measure of a design's safety. HSM can now quantify the expected safety implications of many situations.
  
  • New Controlling Criteria flexibility (Design Exceptions)

PBPD & the FAST ACT

FAST Act - Highway Design

• On NHS, design "shall consider" (previously "may take into account")—
  
  o constructed/natural environment
  o environ., scenic, aesthetic, historic, community, & preservation impacts
  o access for other modes
  o cost savings via flexibility in current design guidance/regulations | NEW

• DOT to consider AASHTO Highway Safety Manual, NACTO Urban Street Design Guide

• Encouragement for States/MPOs to adopt standards for Fed. projects that accommodate motorized and non-motorized users

• Locality may use different roadway publication than State (with State approval) in certain circumstances

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PBPD – What, When & Why

**WHEN** will PBPD be “official”:

- ORE has drafted a PBPD chapter for L&D Volume 1;
- Districts and industry partners are to be canvased for comments;
- PBPD will be published in January 2017 Standards Release;
- Principals can be applied now.

Potential PBPD Opportunities

**Geometrics**
- Cross/Typical Section
- Controlling Criteria
- Ramp terminal spacing
- Upgrade of entrance ramp terminals including additional acceleration length if needed
- Upgrade of exit ramp terminals by providing the standard diverging curvature
- Providing the minimum ramp design speed
- Removal of inside merges and left exits or entrances
- Median width
- Left hand ramps
- Roadside grading schemes (safety, clear zone, common or barrier)
- Providing the standard designs for multi-lane entrances and exits (mainly the length of the auxiliary lanes)
- Cross slope corrections

**Operational Performance**
- LOS Criteria
- Design Year
- Design Volumes
- Design Speed (Context of Adjacent Corridor)
- 600’ of access control along the crossroad for diamond ramps

**Alternatives**
- Facility Type (expressway, freeway, super2, etc.)
- Grade Separation versus unconventional intersection
- Rehab versus replace
- Addressing secondary needs.

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More "Traditional" fix = $3.4M (added capacity)

Comments:
- If the majority of the Traffic wanting to go to I-275 preposition themselves in the drop lane, there may still be a bottle neck with a LOS "F".
+ The proposed exit lane, with the additional pavement will allow I-275 traffic to sort itself out more easily and potentially result in less backups.

• Interim Fix
• Analysis: HCS, Vissim
• PBPD = $2.6M
• Result: May not last 20 years but it will get rid of existing DAILY multi-mile queue on the mainline.
• Comments: Although still a LOS "F", density is reduced from existing conditions, due to better lane utilization; EB I-275 traffic will not preposition in the drop lane, because has a separate exit with a deceleration pocket.
Design exceptions are a useful tool for employing practicality and flexibility in design decisions in a design-up approach.

Implementation of PBPD should not necessitate changes in the existing procedures for requesting and approving design exceptions.

As described in the FHWA Mitigation Strategies for Design Exceptions, an effective design exception process includes the following tasks:
- Determine the costs and impacts of meeting the design criteria;
- Develop and evaluate multiple alternatives;
- Evaluate risk;
- Document, review, and approve exceptions; and
- Monitor and evaluate in-service performance.

Under existing design exception procedures, agencies could include system-wide costs, benefits, and risks in the development, evaluation, and justification for approval of design exceptions.

Evaluation of risk is a key feature that is common to both design exceptions and PBPD.
Updates for Design Exceptions

Presenter: Katie DeStefano, P.E., DO8 Design Engineer

Design Exceptions 101:

History:
- April 15, 1985 - FHWA issues a policy memorandum which identified 13 controlling criteria
- July 2007 - FHWA publishes Mitigation Strategies for Design Exceptions
- 2010 - AASHTO publishes Highway Safety Manual 1stEdition
- 2014 - NCHRP publishes Report 783
- May 5, 2016 - FHWA issues Revisions to the Controlling Criteria for Design and Documentation for Design Exceptions
  [https://www.fhwa.dot.gov/design/standards/160505.pdf](https://www.fhwa.dot.gov/design/standards/160505.pdf)
- May 2016 - AASHTO publishes the updated “A Policy on Design Standards — Interstate System”

ODOT DO8 — LPA Day 2016
Changes to the Controlling Criteria:

I. Removed 3 Controlling Criteria
   1. Bridge Width
   2. Horizontal/Lateral Clearance
   3. Vertical Alignment

II. Renamed Controlling Criteria
   • Horizontal Alignment is now **Horizontal Curve Radius**
   • Grade is now **Maximum Grade**
   • Structural Capacity is now **Design Loading Structural Capacity**

III. Changes in terminology from NDC to design controlling criteria.

IV. Proposed revisions to Figures 301-3, 301-4 and 302-1. Going back to 10’ paved shoulders on the Interstate, etc. to match the 2016 AASHTO Interstate Design Guide.

➤ 2014 - NCHRP publishes Report 783

For rural two-lane highways, rural multilane highways, and rural and urban freeways:

“There does not appear to be any need, based on their traffic operational and safety effects, for the following design criteria to be retained as controlling criteria: bridge width, sag vertical curve length, and horizontal clearance/lateral offset. This does not imply that bridge width, sag vertical curve length, and horizontal clearance/lateral offset are not important or that they do not need to be addressed in the Green Book, in highway agency design manuals, and during the design process. Rather, it means that the traffic operational and safety effects of these design criteria do not appear to rise to the level that requires an administrative control involving management review like the design exception process.”
Current Controlling Criteria:

**Current Design Controlling Criteria**

(High Speed Roadways, i.e., interstates, freeways, roadways with design speeds ≥ 50 mph):
1. Lane Width
2. Shoulder Width
3. Horizontal Curve Radius
4. Maximum Grade
5. Stopping Site Distance (Horizontal and Crest Vertical Curves)...(does not include sag vertical curves)
6. Superelevation Rate
7. Vertical Clearance
8. Pavement Cross Slope
9. Design Loading Structural Capacity

(Low Speed Roadways with design speeds < 50 mph):
1. Design Loading Structural Capacity

Design Exceptions on Local Projects:

Key Points:

1. Local-Let Projects – Follow the Local Programs Manual (Project Development & Design)
2. Local ODOT-Let Projects – Follow the L&D Volume 1, Section 105.5.1
3. All local projects (local-let and ODOT-let) must be approved by the District P&E Administrator
4. All design exceptions on all local projects will be retained by the District in the District Project File
Design Exceptions and Crash Analysis:

Notes:

- Advances in data collection technology have improved the availability and reliability of data.

- The Performance Analysis Tools, such as the crash analysis tools used by ODOT (GCAT, SIP Maps, CAMTool, ECAT) aid in the examination and measurement of all such data.

- The use of appropriate analysis tools, allow agencies to effectively evaluate, visualize and compare the performance of various design alternatives.

- Which, ultimately allows for the ability to re-examine traditional, long held approaches to design. Agencies have the ability to be more flexible in the decisions made because the data is available to justify and defend the decisions made.

- For ODOT, this translates into fewer design exceptions being required, saved time.
Design Exception Process now On-line

Questions????

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CRASH ANALYSIS TOOLS
District 8 LPA Day
November 9, 2016
Bree Hetzel, D8 Traffic Planning Department

OVERVIEW

L & D Manual
New section of the L&D manual and what it says about crash analysis in projects

Crash Analysis Tools
SP Maps
GCAT
CAM Tool
ECAT

Crash Analysis Process
Countermeasure evaluation based on priority of the location
Crash Analysis Documentation
GOOD NEWS!

- Crashes have been going down for decades

1974 2016
½ as likely to die in crash than you were in 1974

FACTORS

3% Travel increase in Ohio and nationally
30% Lower Gas Prices
SECTION 106 – CRASH ANALYSIS

• Purpose: determine if there is a trend of crashes within the project limits that can be realistically addressed through countermeasures added to the project.
• Factors that can affect adding countermeasures to the project include:
  • Cost
  • Environmental or R/W impacts
  • Compatible countermeasure work types
  • Schedule impacts
• The crash analysis should be performed early in the project development process.
APPLICABLE PROJECTS

• ODOT let projects
  • Local let LPA projects are exempt from performing the Crash Analysis
• Widening and lane additions
  • Reconstruction
    • New bridge decks
    • Bridge overlays
      • Resurfacing/Mill-Fill
        • Traffic installations and upgrades
        • Cross section changes

NON-APPLICABLE PROJECTS

• Maintenance projects (guardrail repair, mowing, striping, signing, etc.)
• Pavement surface treatment projects (Section 550 of Pavement Manual)
  • Spot Repairs
  • Slot paving
    • Projects where the safety has already been reviewed (safety studies, feasibility studies, etc.)
CRASH ANALYSIS TOOLS

Based upon two sources of information
• SIP Maps
• GCAT/CAM Tool

SAFETY INTEGRATED PROJECT MAPS (SIP MAPS)

• Utilize Highway Safety Manual methodologies to highlight segments and intersections that have a potential for crash reductions
  • Blue locations = lower priority
    • Potential to reduce 3-5 crashes per year
    • Low cost countermeasures funded by the project
  • Red locations = higher priority
    • Potential to reduce 5 or more crashes per year
    • Low or higher cost countermeasures
    • Eligible for supplemental project funding by the ODOT safety program

http://www.dot.state.oh.us/Divisions/Planning/ProgramManagement/HighwaySafety/GCATPages/MapRoom.aspx
HIGH PRIORITY LOCATIONS

- Countermeasure is $500,000 or less
  - SP Map abbreviated application
  - $1.93 million in safety funds since May
- Countermeasure is over $500,000
  - Bi-annual safety funding cycle
  - $114 million annual budget

GIS CRASH ANALYSIS TOOL (GCAT)

- Uses GIS to produce data that is spatially located
- Allows user to query crashes based on a number of categories
- Allows user to input location or draw boundaries for analysis
- Data is downloaded to the CAM tool for further analysis
GIS CRASH ANALYSIS TOOL (GCAT)

- Highlights crash locations and existing trends
- Tool should be used for the 3 most recent years
- Encompass 250’ in advance and past the project limits
- Locations or patterns noted solely based upon the GCAT/CAM tools (i.e. not a red SIP map location) should be considered low priority and countermeasures funded by the project

http://www.dot.state.oh.us/Divisions/Planning/ProgramManagement/HighwaySafety/HSIP/Pages/GCAT.aspx

CRASH ANALYSIS PROCESS
EVALUATE COUNTERMEASURE

• Based upon the SIP Maps and GCAT/CAM tools, determine if there are reasonable and practical countermeasures that can be incorporated into the project

• For high priority locations (red), there may be situations when the best countermeasures can’t be added in the project due to schedule, funding, or work type
  • Consideration should be given to creating a standalone safety project to address the location

CRASH ANALYSIS DOCUMENTATION

- No requirement to incorporate countermeasures into a planned project
- Goal is to determine if there is a reasonable and practical countermeasure(s) that can be incorporated into the project
- Document decisions related to the crash analysis on the “Crash Analysis Documentation” form and retain with project files
OTHER CRASH ANALYSIS TOOLS

• Based on Highway Safety Manual methodologies and calculations
• Calculates predicted crash frequencies
• Completes empirical bayes calculations
• Predicts crash frequencies for proposed conditions
• Conducts alternatives analyses
• Completes a benefit-cost analysis

http://www.dot.state.oh.us/Divisions/Planning/ProgramManagement/HighwaySafety/HSIP/Pages/ECAT.aspx
HIGHWAY SAFETY IMPROVEMENT PROGRAM PRIORITY LISTS

- Every year, ODOT prioritizes roadway locations for safety study or review
- Recommendations from the study are used to make safety improvements to the roadway, such as upgrading signs, signals or pavement markings, or reconfiguring and rebuilding intersections and roadway segments
- ODOT uses Safety Analyst to prioritize roadway locations with the highest potential for reducing crashes
  - The system flags spot locations and road segments that have higher than predicted crash frequencies
  - Also flags locations based on crash severity
- ODOT studies up to 300 locations across the state each year

QUESTIONS?

THANK YOU!

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