Performance Based Design at LA DOTD

History and Future
Today’s Agenda

- History of performance based design
  - Practical Design
  - Louisiana Beginnings
  - Practical to Performance
- Continuing Evolution
- Changes to AASHTO guidance
- Current Practice in LA
Grass Roots

- 2005 Missouri DOT
  - Forecasting serious funding shortfalls for the transportation system
  - "But MoDOT could still control how it spent the limited funds it did have"
  - CEO > Put design manuals away for 1 year and rely solely on common sense
Practical Design is Born

2006 Missouri DOT Practical Design Manual
- Maximizing improvements to the roadway system as a whole, rather than maximizing improvements to a few locations
- Practical design focuses on low-cost solutions that can make a big impact system-wide, as opposed to high-cost solutions in individual locations
Practical Design is Not...

Maintain quality – no corner cutting

Kathy Harvey - MoDOT
Practical Design / Solutions

- Focus on the problem (project scope)
- Directly fits into a context sensitive approach
- Every project improves safety (no compromise)
- Make strategic decisions that benefit the overall system
- Use engineering judgment and experience to evaluate design tradeoffs and to mitigate risks (within reason)
Grass Roots

- Missouri was not the only DOT thinking about practical design or flexibility in design.
- As early as the 1970s, FHWA was promoting the concept of flexibility to meet the challenges of modern highway systems in sensitive areas.
Louisiana Beginnings

- 2011 AASHTO Sub-Committee on Design
  - MoDOT Presentation
  - 5 years of performance data
  - “safety would never be compromised”
Look Familiar?

This project met design standards.

But, is the roadway safer?
LA DOTD “Study”

- 3 bridge replacement projects evaluating the differences of implementing a “practical design” vs. typical design
- The practical designs matched the existing conditions “where practical” (roadway/shoulder widths, foreslopes, etc.)
- Comparative designs met design standards
- The safety performance was reviewed for each project
  - HSM => no significant difference
DOTD Practical Design Study

Himalaya Canal Bridge
LA 1012, RL-3
Although this was a limited pool for study, the 3 projects illustrated the potential for 30% costs savings by implementing practical design.

For bridge replacement projects, this could mean replacing an extra bridge for every 3 projects.
Philosophy in LA

- 2013 Began to apply “practical approach” to BR projects
- No policy, but philosophy
- All decisions and trade-offs would be documented and approved through the design exception process.
Philosophy for LA

- Safety performance should be a significant factor in determining what improvements should be made.
- Projects utilizing a practical design philosophy must maintain or improve upon the existing safety performance.
- A safety analysis should be performed for all locations. Poor safety performance would require additional improvements to address safety concerns.
Nationwide Movement

- 2013 NCHRP Synthesis 443: Practical Highway Design Solutions
- 29 States were utilizing a Practical Design approach
  - Including Louisiana
From Practical to Performance

  - Can now evaluate relative performance of geometric values
  - This is the beginning of performance based decision making
National Studies

- NCHRP Report 783: Evaluation of the 13 Controlling Criteria for Geometric Design
  - Reviews the impact of the controlling roadway design criteria on safety and operational effects
  - 2014
  - FHWA revised criteria to 10 in 2016
NCHRP Research Report 839: A Performance-Based Highway Geometric Design Process

- suggestions for a new highway geometric design process
- process focuses on the performance of the design rather than the selection of values from tables
- Suggested revisions to the AASHTO Policy on Geometric Design
- 2017
Other Studies

- NCHRP Project 15-47, *An Improved Highway Design Process*
- NCHRP Project 15-50, *Guidelines for Integrating Safety and Cost-Effectiveness Into 3R Projects*
- NCHRP Report 785, *Performance-Based Analysis of Geometric Design of Highways and Streets*
- NCHRP Report 855, *An Expanded Functional Classification System for Highways*
From Practical to Performance

- Focus on scoping projects to stay within the core purpose and need
- “Design up” approach, exercise engineering judgment to build up the improvements from existing conditions to meet both project and system objectives
- Eliminate nonessential project design elements resulting in lower cost and improved value
From Practical to Performance

Nominal vs. Substantive
Any expenditure for alignment or cross section features that does not produce a measurable benefit is wasteful. If a policy or design model cannot prove substantive value it should be changed or deleted from guidance.

A Vision for the Future of Highway Projects
Timothy R. Neuman, PE
Evolution of Performance Based Design

- 2017
- LA DOTD Design Guidelines were completely overhauled
  - New approach to design criteria selection
  - Choose criteria from a range of values to match context and performance goals
  - Decisions must be documented and based on sound engineering principles
Evolution of Performance Based Design

- 2018
- Finalizing updates to the AASHTO “Green Book”
  - New Chapter 1, “New Framework for Geometric Design”
  - Changes to Chapters 2 through 10 as appropriate
- Recognizes no single set of geometric design criteria meets the needs of all, or even most, projects
Chapter 1 presents a new framework for geometric design:
- explicit statement of project purpose and need
- existing functional classification system
- new context classification system
- multimodal considerations
- revised design process for specific project types
- design flexibility
- performance-based design
Functional classes characterize how a roadway is intended to serve users

- New approach addresses 5 roadway contexts based on:
  - development of density (existence of structure and structure types)
  - land uses (primarily residential, commercial, industrial, and/or agricultural)
  - building setbacks (distance from structures to adjacent roadways)
New - Roadway Context

Rural

Rural Town

DOTD

LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT
New - Roadway Context

Suburban

Urban
New - Roadway Context

Urban Core
Balance among transportation modes should be a conscious decision considering

The approach is intended to avoid project expenditures that have no impact on performance
Next Edition Green Book

- Project types are addressed specifically
  - new construction projects
  - reconstruction projects
  - projects on existing roads
Revised design speed guidance to encourage right sized and context sensitive designs in urban and suburban settings
– Away from ‘the higher the better’
We want designers to be thinkers,
In consideration of context,
Not just choose values from a book or table …
To be Engineers.