Speed Management and Engineering Related Issues

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Presentation Content *(per invitation)*

- Speed Management Concept
  - TRB Special Report 254 Managing Speed

- Engineering Aspects
  - Design Speed
  - Operating Speed
  - Speed Limit
Acknowledgements


- “Conceptual Approach to Relate Design Speed, Operating Speed, and Posted Speed Limits” with Kevin Mahoney and Eric T. Donnell, Pennsylvania Transportation Institute, Penn State University

MANAGING SPEED

REVIEW OF CURRENT PRACTICE FOR SETTING AND ENFORCING SPEED LIMITS

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Scope

- State of knowledge and practice re:
  - Setting speed limits
  - Speed : Safety
  - Road design : Speed limits

- New and emerging technologies for speed management and enforcement

- Guidance regarding current practices
Guidance

- Relevant studies and data did **not** provide sufficient support for quantifying the efforts of change in speed limits on driving speeds and safety.

- It was found that current practice of setting speed limits is a **reasonable balance** between speeds and risks under favorable operating conditions.

- **Periodic review** of driving speeds and crash experience to monitor changes over time.

- Speed limits in speed zones should be based on an **engineering study**.
Other speed management strategies

- **Roadway Design and Traffic Control**
  - Designing Roads to Manage Speed
  - Traffic Calming
  - Traffic Control Devices
  - Perpetual countermeasures (reduced lane width, pavement surface roughness, markings, chevrons, delineation…)

- **Vehicle and Highway Technologies**
  - In vehicle displays and controls
  - Variable message / variable speeds
  - Automated Vehicle / Highway System
Design Speed – Background Definitions

- AASHO (1940) … “maximum approximately uniform speed … by faster group of drivers.”


- AASHTO (2001 – 2004) … “a select speed used to determine the various geometric design features of a roadway.”
Design Speed ↔ Operating Speed

...while an anticipated operating speed is often a consideration in design, operating speeds are typically not predicted during design...
Design Process Flow

1. Select Functional Classification
2. Select Design Speed
3. Establish Design Criteria
   - Horizontal Alignment
   - Vertical Alignment
   - Cross Section Elements
4. Complete Final Design & Construction
5. Measure Operating Speed
6. Set Speed Limit

Topography Considerations

Land Use Considerations
Design elements with direct AASHTO design speed relationship:

- Stopping sight distance: ++
- Horizontal curve radius: +++
- Vertical grades: +++
- Lane widths: +
- Clear zone: +++
- Median type: +++
- Access density: +++
Relationship between Design and Operating Speed

Design Speed

Operating Speed

Low Speed

High Speed

Design Speed = Operating Speed

Observed Speeds
Speed Relationships
Selection of design speeds not directly related to operating speeds create dilemmas:

- Operating Speeds > Design speeds
- Design speeds ≠ Speed Limits
- Above minimum values increases operating speeds
- Design speed : safety relationship unknown
- Continued increase for design flexibility
- “Maximum safe speed” Tort issues
Design Speed Concepts Experience:

- “de facto” acceptance
- “set it” then “use it”
- Subjective (flexible?)
- Conservative (safe?)
- Inconsistency with operating and ported limits
- Inconsistent alignment / geometric features
- Tort liability implications / claims
Operating Speed Models (examples)

- Leisch & Leisch – Development of speed-profiles
- Lamm – degree of curve, tangents, 85\textsuperscript{th} percentile
- Krammes – Lamm + length of curve and deflection angle
- Collins & Krammes – speed reduction, tangents and curves
- Tarris, Poe, Mason – low speed urban area: curvature, grade, hazard rating, intersections and driveway and lane width
- Polus – tangent sections
- Fitzpatrick et al. – TWOPAS and speed – profile models
Proposed Framework to Improve Design Speed Concept

1. Functional Classification
2. Anticipated Operating or Target Speed
3. Design Speed Determination
4. Determine Geometric and Cross-section Elements
5. Check for Consistency among Design Elements
6. Final Design and Construction
7. Observe Actual Operating Conditions
8. Add Speed Data to Database
9. Predict Operating Conditions
10. Set Speed Limit

Land Use → Functional Classification → Anticipated Operating or Target Speed → Design Speed Determination → Determine Geometric and Cross-section Elements → Check for Consistency among Design Elements → Final Design and Construction

NO → Predict Operating Conditions

YES → Final Design and Construction

Set Speed Limit

Compare Subsequent Designs based on Functional Class, Intended Operating Speed, and Geometric Elements
...it is not customary U.S. practice to predict operating speeds as part of the highway geometric design process...