Updates on NCHRP-Funded Geometric Design Research Projects

NCHRP Report 687
Guidelines for Ramp and Interchange Spacing

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Presentation Outline

- Project Overview
- Guidelines
- Conclusions
2004 Guidance is based on 1975 recommendations

Jack Leisch. Region 2 AASHTO Operating Committee on Design. 1975

Became Green Book Values
Project Overview

- Identify factors that influence ramp and interchange spacing needs:
  - Geometric Design
  - Traffic Operations
  - Safety
  - Signing
- Conduct operations and safety research
- Develop Guidelines for ramp and interchange spacing
- Document overall project research in a final report
Project Overview

Team
- KAI, Joel Leisch, John Mason, Roger Roess, TRA, and the University of Utah

Schedule
- June 2008 to December 2010

Final Products
- NCHRP Report 687
- NCHRP Web-Only Document
Presentation Outline

- Project Overview
- Guidelines
- Conclusions
Guidelines

- Chapter 1 – Introduction
- Chapter 2 – Ramp and Interchange Spacing Overview
- Chapter 3 – Design and Signing Considerations
- Chapter 4 – Operational and Safety Considerations
- Chapter 5 – Spacing Guidance
- Chapter 6 – Scenario-Based Case Studies
- References
- Appendix A – Traffic Operations Tools
Guidelines - Principles

- Avoid “one size fits all” spacing values
- Customize spacing recommendations based on factors that affect ramp and interchange context
- Apply a systematic approach that considers
  - Geometric design
  - Traffic operations
  - Safety
  - Signing
- Recommend replacing Exhibit 10-68 of Green Book
- Focus on ramp spacing
- Deemphasize interchange spacing
Definition of Spacing Used in Project 3-88

Project 3-88 focuses on “ramp spacing”
Definition of Spacing Used in Project 3-88

- 3-88 ramp spacing definition is consistent with HCM 2010’s “Base Length” ($L_B$)

- Measurement of ramp spacing eliminates variations due to ramp terminal design
- Next edition of Green Book will use this ramp spacing definition
Guidelines – Chapter 1 (Introduction)

Key points

– *Interchange spacing is measured between cross-street centerlines*

– *Ramp spacing is measured between painted gores (merging and diverging tips)*

– *Guidelines are intended to supplement, not supersede, major resource documents such as Green Book, HCM, HSM, MUTCD*
Guidelines – Chapter 2 (Ramp and Interchange Spacing Overview)

Key Points

- Spacing needs should be considered early in the project development process. As the process progresses, there is decreased flexibility in changing spacing.
- Many states have a process by which potential new interchanges are considered. Spacing to adjacent interchanges often a factor.
- FHWA has a separate policy for Interstate Highways (8 points).
- Green Book, HCM, and MUTCD all contain information relevant to spacing.
Guidelines Chapter 3 (Design and Signing Considerations)

Key Points

- Freeways are complex environments with many design features that affect spacing needs
  - Single- vs. multiple-exit designs
  - Lanes (number, type, configuration)
  - System vs. service interchanges
  - Ramp types
  - Interchange forms
  - Freeway ramp terminal (merge and diverge) design
  - Ramp terminal interchange design and queuing
  - Ramp metering and acceleration needs

- Techniques such as collector-distributor roadways and ramp braids are useful when ramps and interchanges are close together

- Consider signing and other human factors early in the design process
Key Points

- Traffic operations analysis should be conducted throughout project development.
  - Planning level tools should be used in the earliest stages
  - HCM procedures and/or microsimulation should be used at later stages

- Historically there was limited research on effects of ramp spacing on freeway speed – this project helps to fill gap
Key Points

– For EN-EX and EN-EN ramp combinations, total crash frequency increases as ramp spacing decreases.

– Crash frequency sensitivity is negligible when spacing is greater than 2200 to 2600 feet

– Similar trends observed for injury crashes
Guidelines – Chapter 5 (Spacing Guidance)

Consider each of these four elements when assessing ramp spacing:

- Geometric Design
- Traffic Operations
- Signing
- Safety
Spacing Guidance - Safety

- Example: Planners must choose between 1600’ and 1200’ EN-EX ramp spacing – will there be a safety impact?

Small impact – 10% more crashes with 1200’ spacing
Guidelines – Chapter 6 (5 Case Studies)

1) Converting an at-grade intersection to interchange on rural highway

2) New interchange on Interstate on edge of suburbs

3) New interchange on Interstate in built-out suburban area with one-mile arterial spacing

4) Modernizing an interchange on 1950’s vintage freeway

5) New interchange in urban area near system interchange
Conclusions

- NCHRP Report 687 provides ramp spacing guidance to replace values that originated in the mid 1970’s

- A one-size-fits-all approach of AASHTO Exhibit 10-68 is not sensitive to a wide range of project contexts

- **Ramp Spacing** values should guide ramp and interchange design considerations over interchange spacing

- Geometry, Operations, Safety, and Signing needs should be considered at the earliest project stages

- Performance based considerations should guide project decision making
Thank you...

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