The Future of Interstate Program and Project Development to Enhance Safety Performance

Presentation to the TRB Future Interstate Highway System Study Committee B0150

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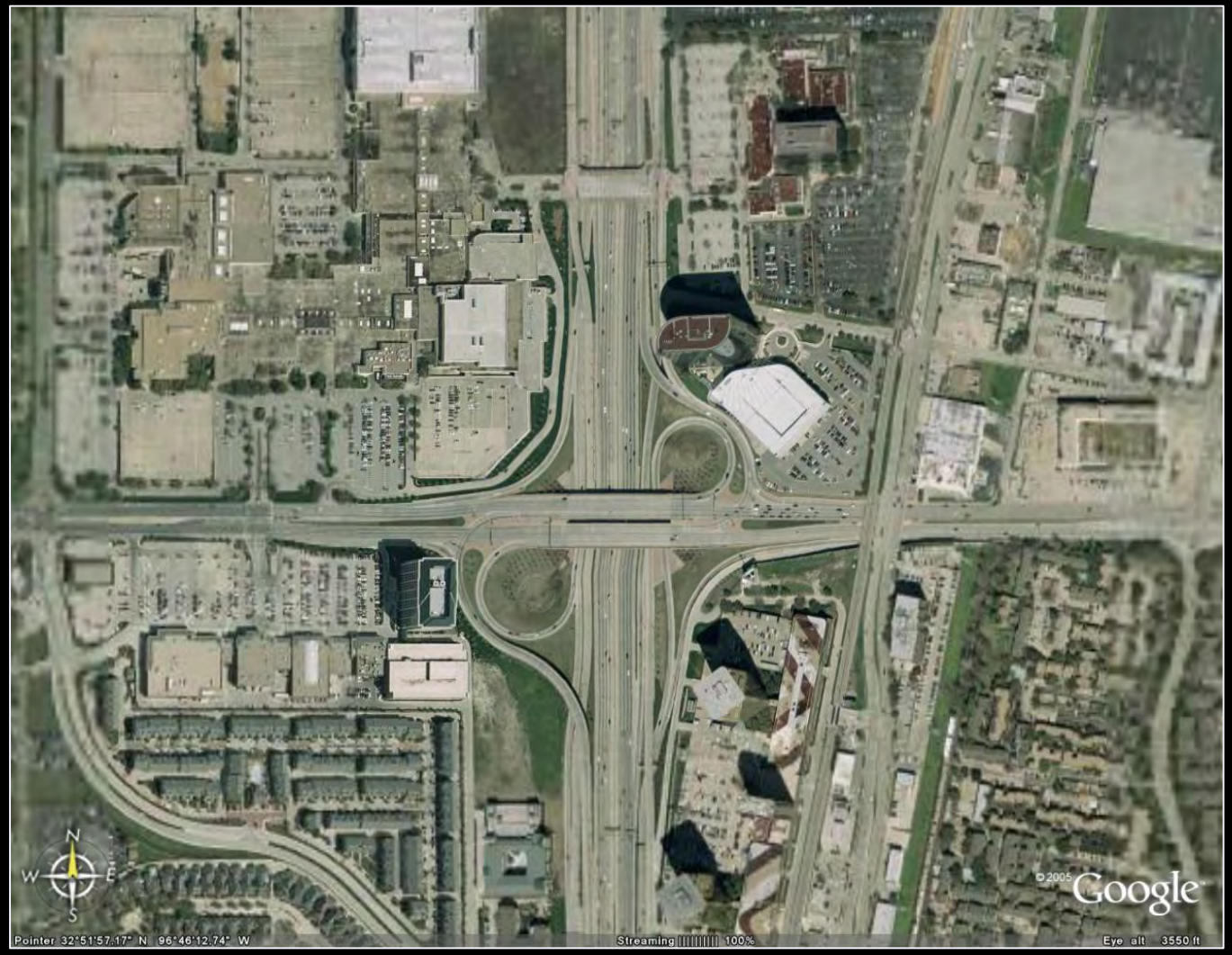
Overview

- Interchanges Drive Safety Performance
- Interstate Project Development in the 21st Century
- Program and Project Level Decisions Must Employ Best Safety Science
- Freight and Goods Movement
- Role of Technology in Enhancing Safety Performance

Interstate safety performance (crashes and their severity) is largely a function of interchange frequency, type, design features and location



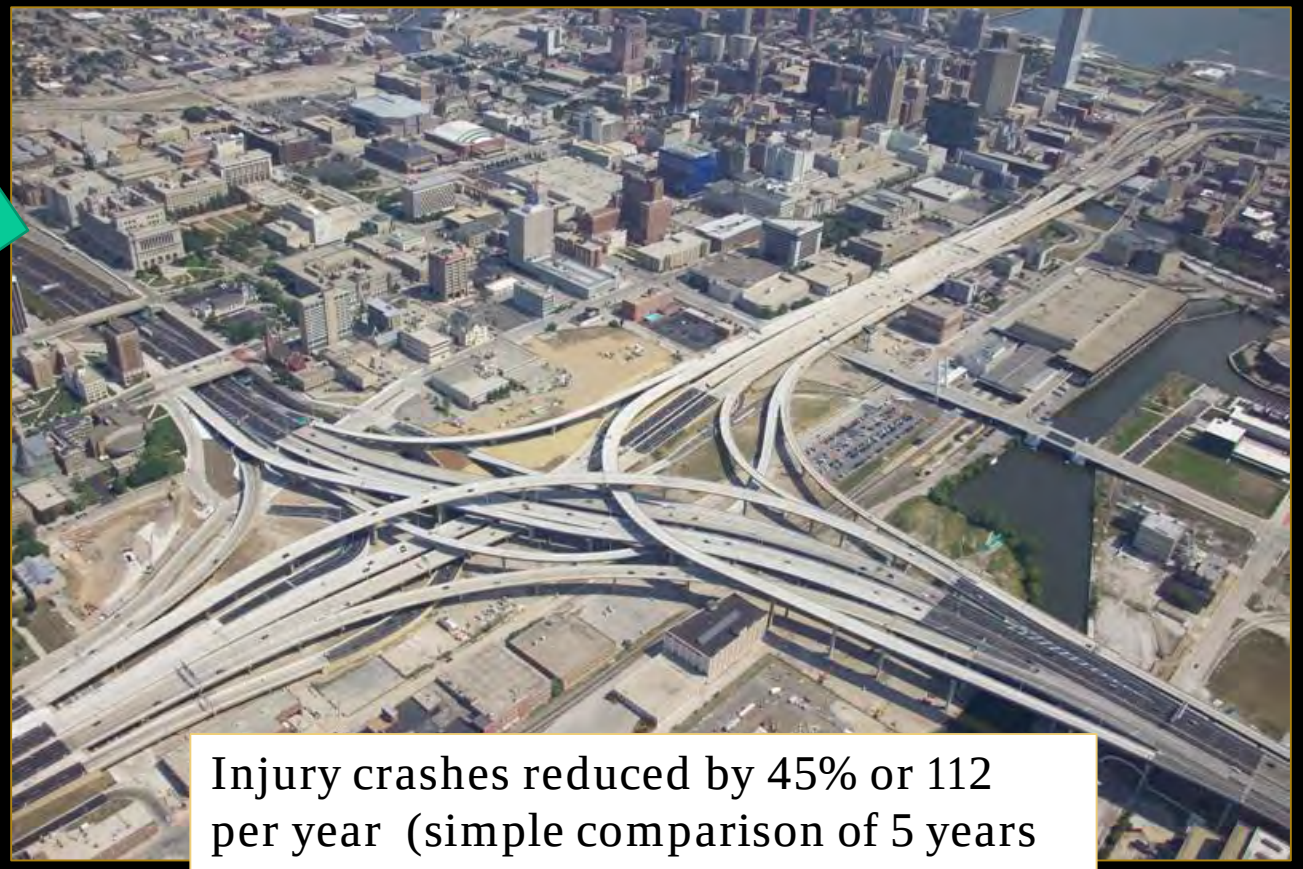
Project Development for Reconstruction of the Interstate – A Completely Different Challenge from Its Origins

- Reconstruction is significantly more time consuming and costly than on new alignment (e.g., original interstate construction)
- NEPA and attendant concerns constrain that which is doable/acceptable (and DOTs must overcome their legacy actions)
- Knowledge gained from past design mistakes and safety research should be applied to reconstruction projects
- Context matters – reconstruction projects reflect site-specific costs, constraints and opportunities
- ***Actual safety performance must be quantified and compared with expected or typical performance to drive design solutions***

$810M Marquette Interchange Project Demonstrates the Importance of Context, Challenges and Opportunities

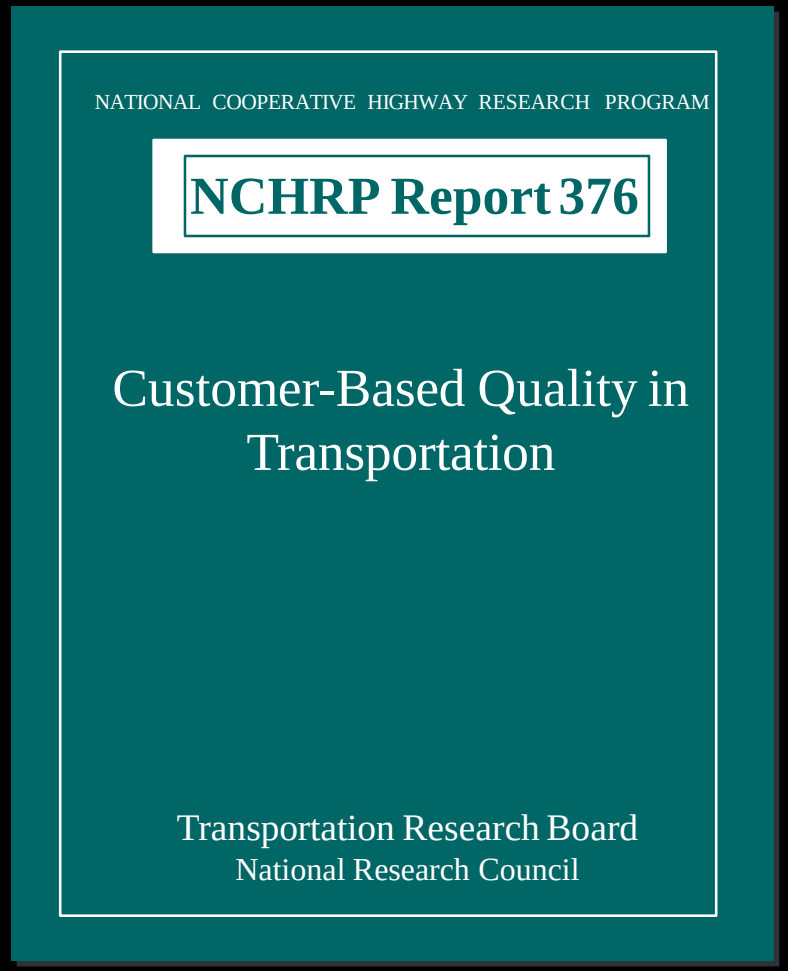
- Rebuild deteriorating infrastructure
- Be sensitive to local access and other needs (work with the community)
- Maintain traffic during construction
- Avoid key land use conflicts
- Address identified safety problems through proven design solutions

15 year total project timeline



Injury crashes reduced by 45% or 112 per year (simple comparison of 5 years before and 5 years after reconstruction)

Our ‘customers’ -- the traveling public, highly value safety

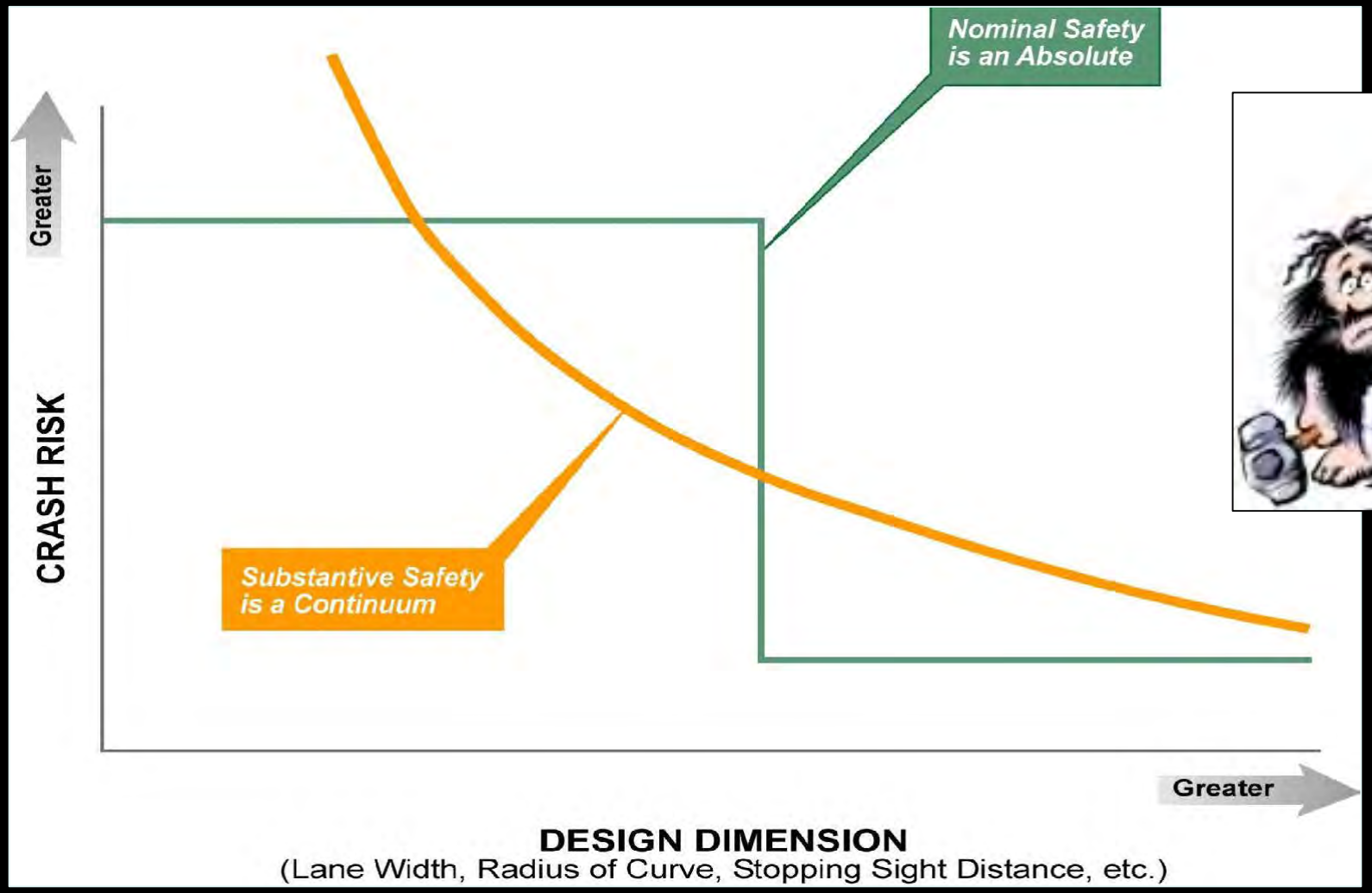


“Participants from focus groups agreed that safety is the most important transportation concern.”

Project Development Paradigm Shifts are in Order

- Reconstruction (which constitutes much of Interstate project work) presents unique challenges and requires different project development processes
- AASHTO Geometric Design Policies provide incomplete and in some cases counterproductive guidance to addressing safety for freeway and interchange projects (see NCHRP Report 839)
- DOTs need to demonstrate substantive safety benefits of projects that are expensive and locally disruptive
- Addressing known safety problems needs to drive solutions

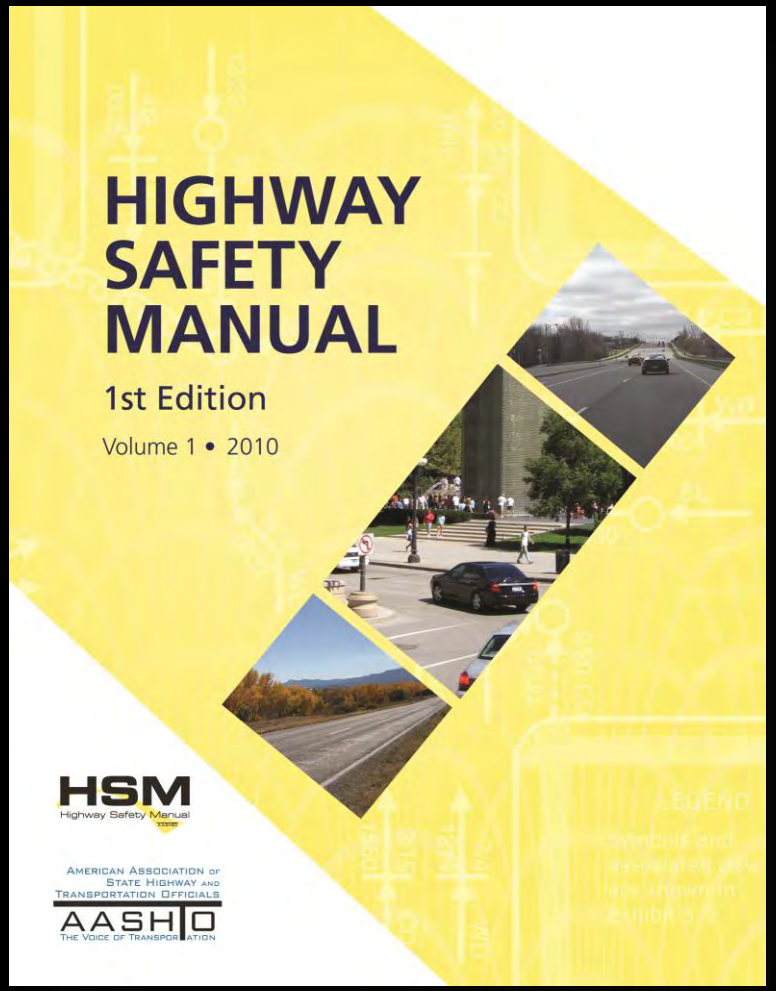
The current mental model of freeway designers – 'Design Standards = Safety' or 'nominal safety' – must change



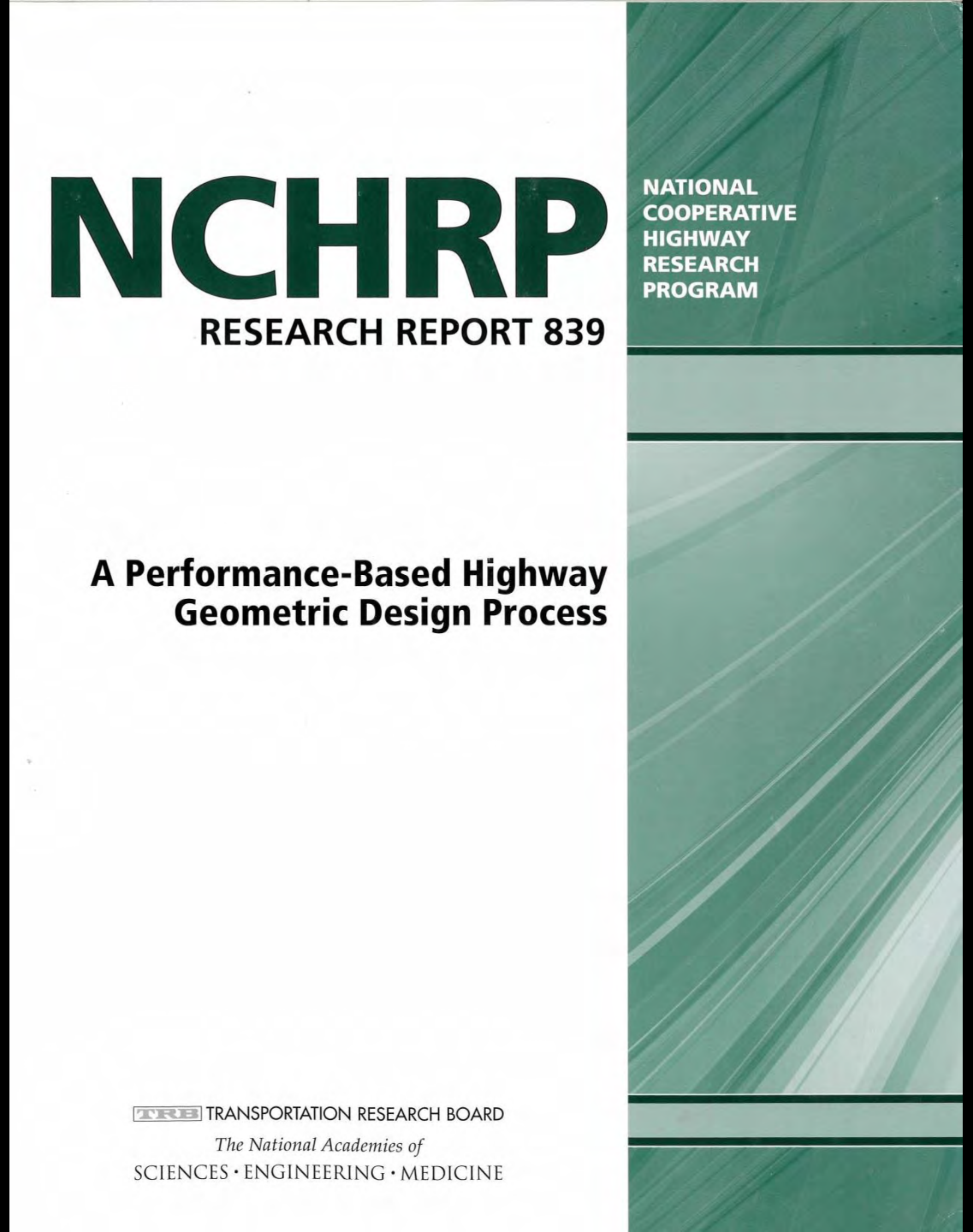
Interstate Projects Demand Context Sensitive Approaches and Trade-offs

- Reconfiguration of interchanges, widening and re-alignment are costly and disruptive
- Societal values such as noise, air and water quality, social justice, T&E species and socioeconomic effects are all measured and considered
- Traffic operational effects can be quantified
- ***Quantifying safety effects of proposed solutions is essential lest it be lost in the wash***

The Highway Safety Manual and Safety Performance – A Significant Advance for Interstate Project Development



- Safety performance is measured by crashes (for a given time over a given roadway)
  - Frequency
  - Types
  - Severity
- *The HSM provides methods for predicting the safety performance of freeway segments and interchanges (Ch. 18 & 19)*



NCHRP Report 839 provides a wealth of detail and specific recommendations on incorporating safety performance analysis for projects involving all road types, including freeways and interchanges, with a new project development process.

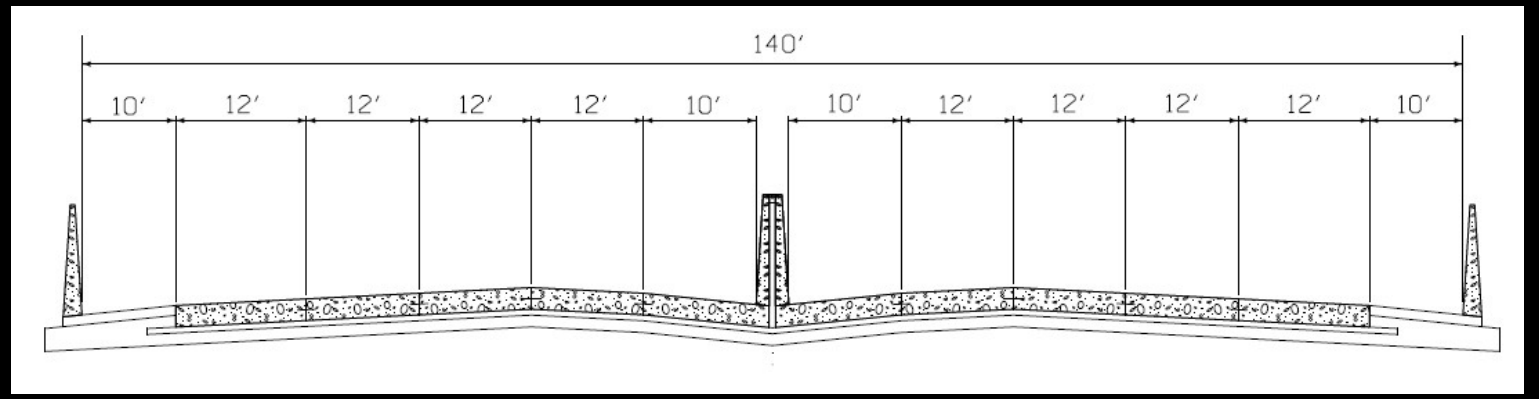
The process differentiates reconstruction projects from those on new alignment.

Case study comparison of four lane standard and five lane reduced width cross sections within fixed ROW

Meets AASHTO Design Policy Criteria ('Nominal Safety')

Alternative 1:

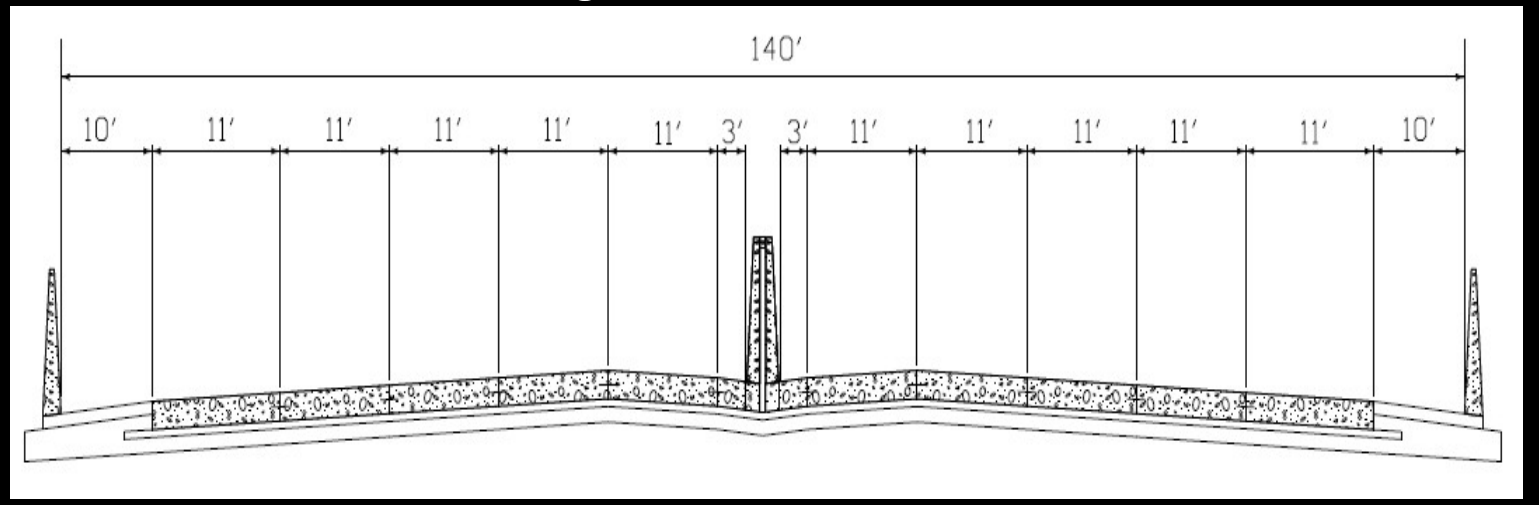
4 – 12 ft lanes with 10 ft right shoulders and 10 ft left shoulders



Requires a 'Design Exception' ('Nominally unsafe?')

Alternative 2:

5 – 11 ft lanes with 10 ft right shoulders and 3 ft left shoulders



Case study comparison of four lane standard and five lane reduced width cross sections

Alternative	Capacity Analysis results		
	Level of Service	Density (pc/mi/ln)	Speed (mph)
1	F	61.3	43.7
2	E	35.5	60.5

LOS was determined using HCS 2010 Freeways Version 6.60

Alternative	Predicted Crashes per mile per year					
	Total	K	A	B	C	PDO
1	46.8	0.2	0.6	3.2	9.7	33.2
2	40.1	0.3	0.6	3.5	8.1	27.7

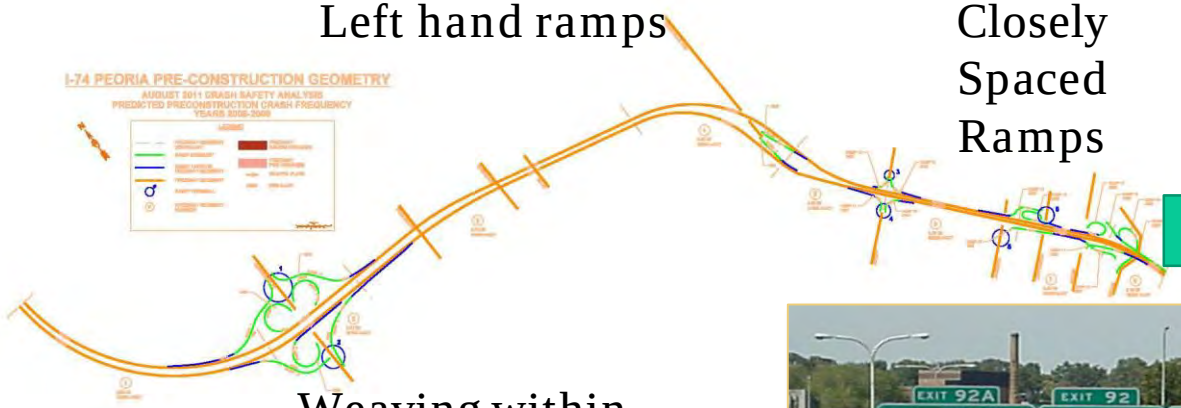
Predicted crashes were determined using ISATe (Build 6.10) (uncalibrated model without crash data input)

Example Application of Crash Prediction Models from Highway Safety Manual for I-74 Reconstruction, Peoria, IL

BEFORE

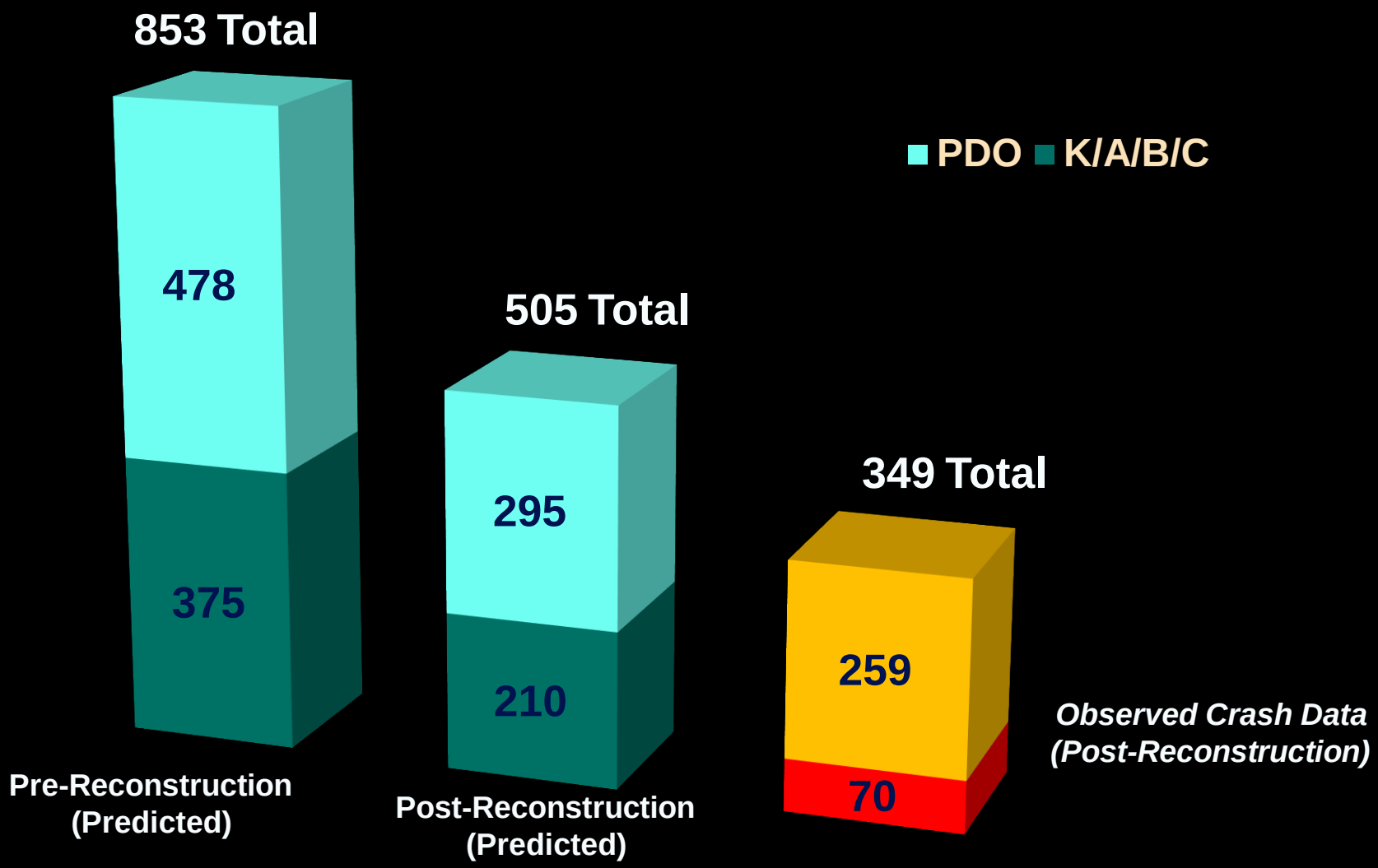
Left hand ramps

Closely Spaced Ramps

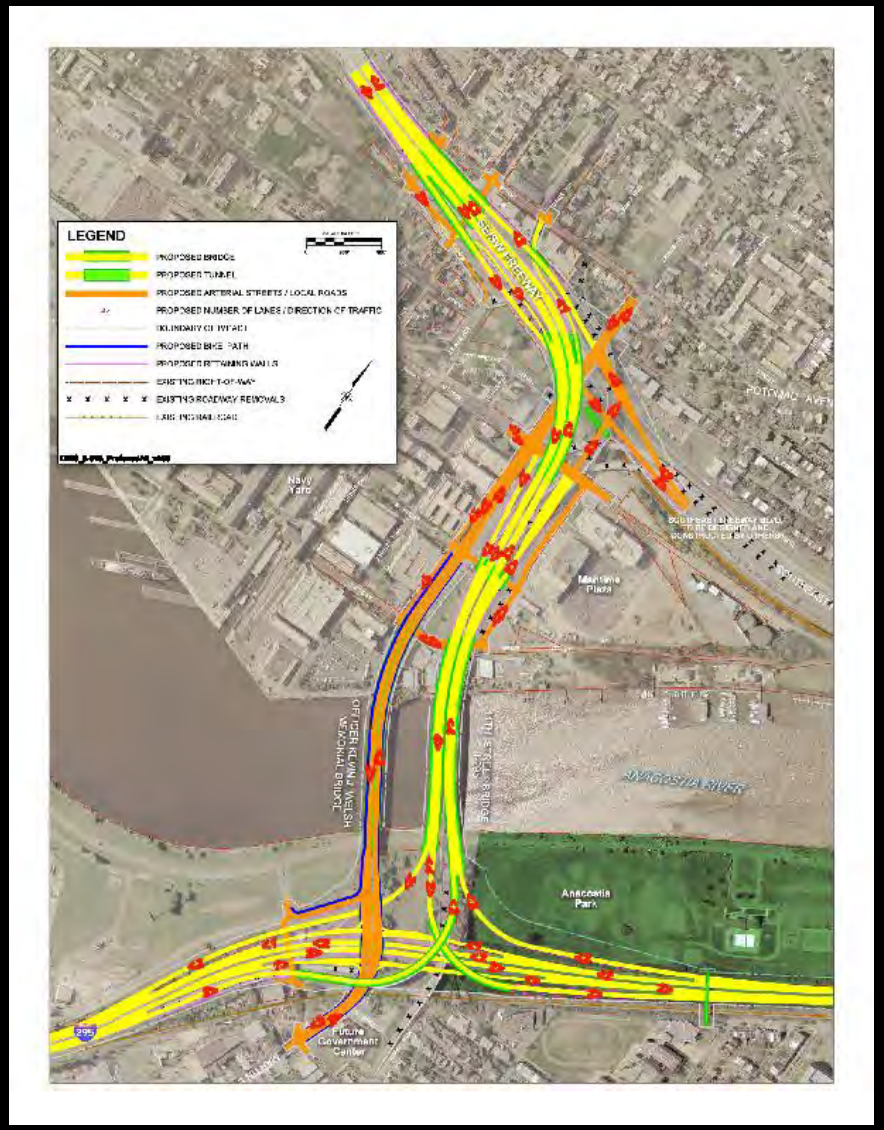


Weaving within interchange

I-74 Peoria Reconstruction
Total Crashes: 2006-2009



Substantive Safety and Interstate Project Development



- FHWA's Interstate Access Policy should require use of approved methods and data (e.g., the HSM) for access change approvals
- Interstate projects subject to NEPA should require substantive (i.e., quantitative) analyses of expected safety performance
- 'Upgrade to Standards' (i.e., 'nominal safety') does NOT address a problem and should NOT be included in a purpose and need statement

Freeway and Interchange Design Criteria Need ‘Science-based’ Updating (see NCHRP Report 839)

- More flexibility in lane widths to enable enhanced capacity
- Consideration of no or narrow shoulders to enable enhanced capacity
- More flexibility in ramp horizontal alignment
- Consideration of truck operations in ramp design criteria
- Greater emphasis on appropriate minimum ramp spacing and weaving section lengths
- Greater flexibility in vertical clearance requirements (< 16.5 ft is clearly justified)
- New approach to design for sight distance that reflects freeway operations

I 70/I 75 Interchange
Dayton, OH

Freight and Goods Movement

- Interactions among varying vehicle sizes pose special safety problems
- Connected vehicle truck operations offer substantial benefits
- Separate truck lanes/facilities within key urban corridors should be considered

Technology's Role in Interstate Safety

- Real-time variable speed limits and traveler information
- Corridor monitoring with tow truck/driver assistance (especially with no shoulders)
- Automated speed enforcement
- Wrong way driving detection and mitigation
- Driver-assist technologies (automated braking, lane tracking)

Questions and Further Discussion