# FHWA Approach to Design Flexibility

Mn/DOT Flexible Design Forum

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**Federal Highway Administration**

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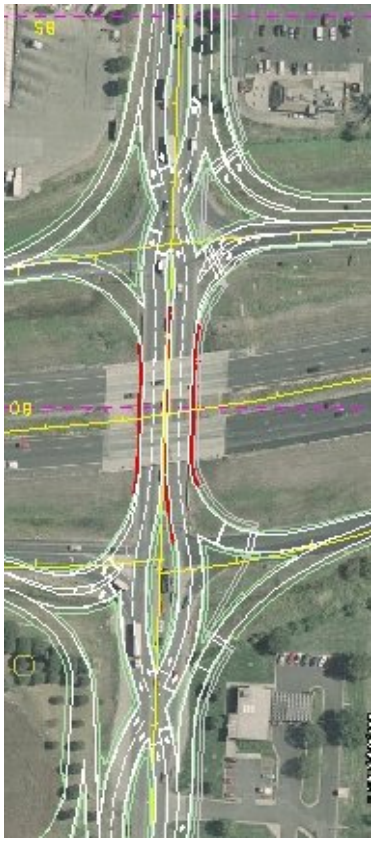
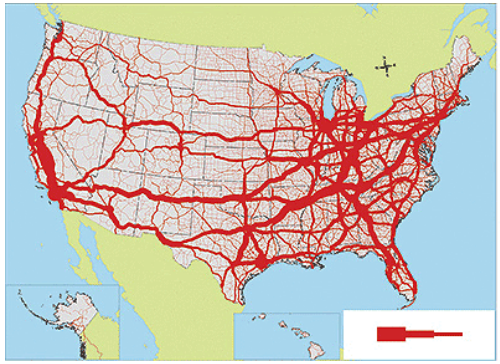
# Why Flexible Design?

- Helps program delivery and achieving Environmental Stewardship goals
- Promotes CSS philosophy and principles (an FHWA national leadership priority)
- Allows consideration of a wider range of design options and alternatives
- Facilitates cost-effective designs that increase safety and efficiency



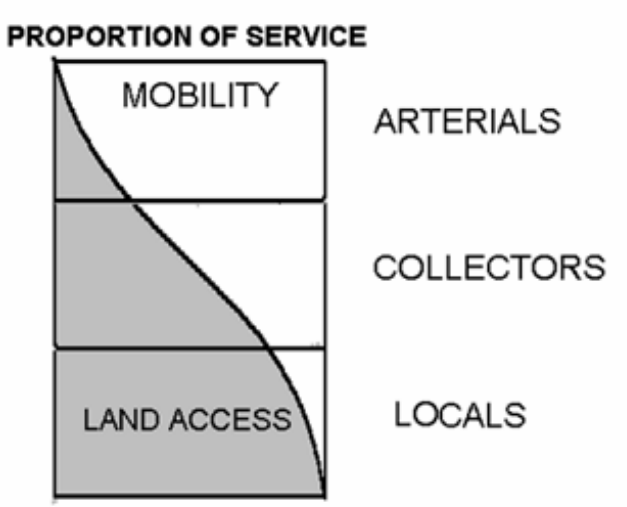
# Federal Interests



- National perspective includes economic health, safety, mobility, security, environment, social justice, and other goals established by Congress and the President.
- Federal interests are primarily in maintaining the safety and operational integrity of the NHS, particularly the Interstate System. The integrity and performance of all highways receiving Federal funding are a responsibility and concern for stewardship and oversight.
- FHWA works in full partnership with the States and local agencies to fulfill the goals and requirements of the Federal transportation programs - this is a fully collaborative effort.

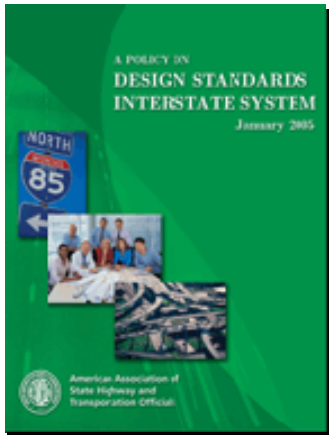
# Functions and Flexibility

- The hierarchy of functional classification has a parallel relationship with the degree of flexibility in application of geometric design criteria
- Beyond the roadway geometrics, there is ample opportunity for flexible design regardless of the roadway function



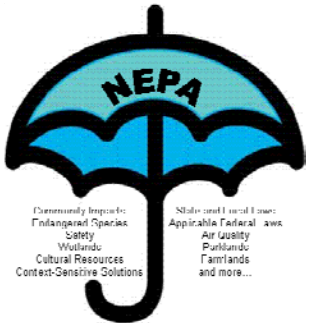

# NHS and I-System Flexibility

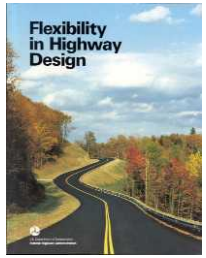
- Title 23 USC 109 outlines the parameters for design flexibility on the NHS
- NS 23 CFR 630C – Interstate Access Approvals
  - Balanced approach to decision making
  - Adequate analysis and understanding of the relevant technical factors, safety and operational risks, as well as consideration of the non-technical issues involved
  - A systematic analysis of effects and planning of surrounding land uses, transportation demands, and investments in regional system/network facilities




# Progress in Flexibility

- 1969 – NEPA implementation
- 1991 ISTEA legislation emphasizes Federal commitment to environmental resources
- 1995 - NHS Designation Act [NHS flexibility]
- 1997 - FHWA published *Flexibility in Highway Design*
- 1998 – sponsor with AASHTO and MdDOT "Thinking Beyond the Pavement" National Workshop
- 1999 – FHWA CSD website and FLH participation with 5 pilot states




# Progress in Flexibility

- 2002 – CSD policy memo issued by FHWA Administrator Mary Peters
- 2003 – Inclusion of CSS in FHWA Vital Few Goal for Environmental Stewardship objectives
- 2004 - FHWA and partners launch *www.ContextSensitiveSolutions.org*, the web-based national CSS clearinghouse and community of practice
- Recent years FHWA:
  - Implements a national CSS outreach effort including peer exchanges, training, technical assistance, research, and more
  - Promotes integration of CSS and design flexibility with stewardship, oversight and risk assessment principles
  - Applies >$5 M funding on CSS research and outreach activities

# Achieving Flexibility is a Balance of Many Factors

- We routinely balance many factors in the design decisions we make
- Tradeoffs we routinely consider:
  - Economics (agency and user costs)
  - Stakeholder and agency preferences
  - Environmental and social impacts and enhancements
  - Capacity and speed
  - Ease of maintenance

Dave Gonzalez, Mn/DOT

# Flexible Design Key Concepts

- Achieving appropriate balance requires information, evaluation, risk assessment, and a structured decision process
- The level of evaluation should reflect the scope of potential effects
- Design consistency and flexibility have different, but related, goals
- Consideration for both technical and non-technical factors

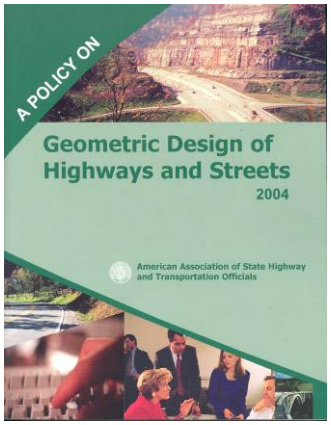

# Flexible Design Philosophy

- Recognize that flexibility is a necessary and desired aspect of the design process
- Use a risk assessment and risk management approach for all aspects of the design
- Apply performance criteria in evaluating flexible design decisions, as well as condition criteria
- Applying flexibility involves understanding the risks and consequences for design decisions – this typically requires more information and higher level analysis then simply applying criteria “by the book”

# Flexible Design:

- Applying inherent flexibility in determining the:
  - Context and using it as a key design *control*
  - Appropriate design *controls* (example: functional classification, design vehicle, LOS)
  - Appropriate design *criteria* to choose for the project standard (example: design speed)
  - Optimum design *values* within a range of acceptable values (example: curve radii)

LOS E - Source: TRB Highway Capacity Manual 2000



# Flexible Design (cont'd):

- Evaluating design exceptions in determining whether:
  - An appropriate *criterion* to use for a corridor is less than the minimum normally applicable (design speed, roadway width)
  - An appropriate design *value* to use at a location is less than the minimum adopted standard (curve radius, gradient)

# Design Risk Assessment:

- Using best available information to fully understand design issues and risks, and to establish the level of risk tolerance
- Determining the degree of uncertainty, confidence, or sensitivity of the factors (including human factors) influencing design decisions:
  - Rapidly changing land development
  - Predominant traffic type, familiarity
  - Multimodal aspects of users
  - Peak vs. off-peak traffic/safety implications

# Risk Assessment (cont'd):

- Applying the project's purpose and need to define performance goals and criteria, and their relative importance
- Applying available performance prediction tools and technologies to quantify the probability and assess the severity of adverse consequences
- Applying engineering knowledge, best practice, experience and judgment to evaluate design trade-offs
- Mitigating risks to the extent practical

# Risk Assessment (cont'd):

- Using an interdisciplinary process for assessing diverse and/or competing interests such as:
  - Cost (life cycle, user and agency)
  - Operational efficiency
  - Safety performance
  - Environmental issues
  - Social concerns
  - Enhancement opportunities

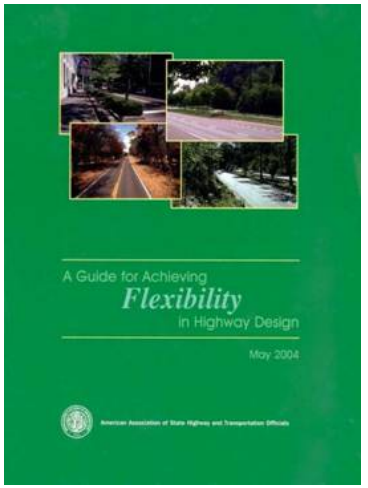
- Applying risk assessment in a structured decision making process
- Gaining endorsement, approval, and documentation of risk decisions

# Design Performance Goals:

- Substantive safety performance (crash frequency and severity)
  - Current history
  - Future predictions
- Operational performance (current and future)
  - LOS
  - Corridor travel time
  - Delay
  - Congestion
- Serviceability (overall transportation effectiveness)

# Recommended Approach

- Apply a consistent national approach – such as the AASHTO Flexibility Guide; and statewide guidance such as in design manuals and project development guides.
- Use a corridor approach for establishing design criteria based on the purpose, need, context, function, users, and other factors that are key controls for design of the facility; then be consistent throughout the corridor.

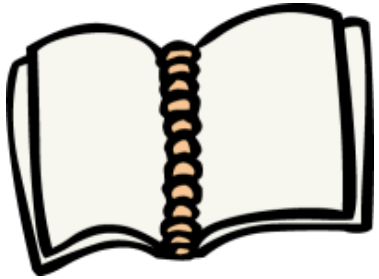



# Rec’d Approach (cont’d)

- Differentiate between appropriate (professional) and inappropriate (cavalier) methods for applying flexibility in the design process.
- A process for making and approving and documenting the rationale for all key design decisions is necessary to address professional responsibility and tort liability.

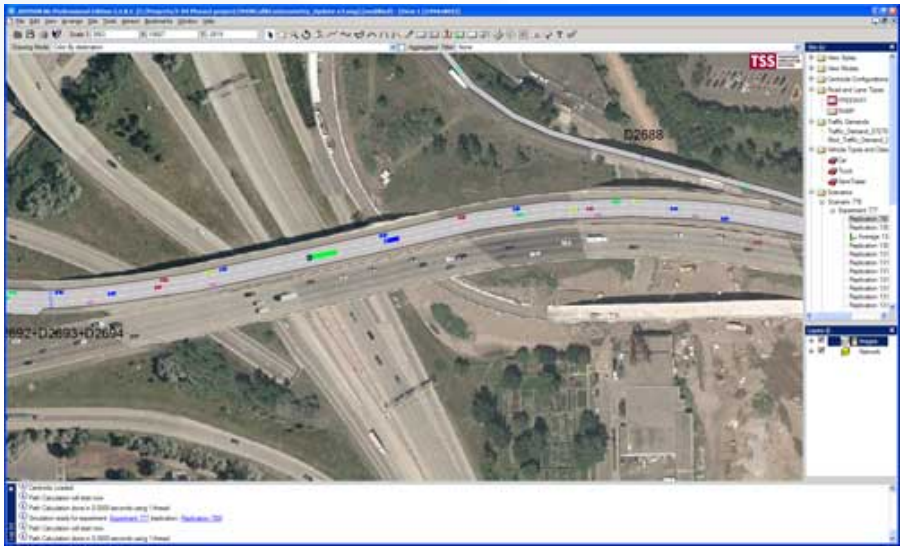
# Recommended Practices

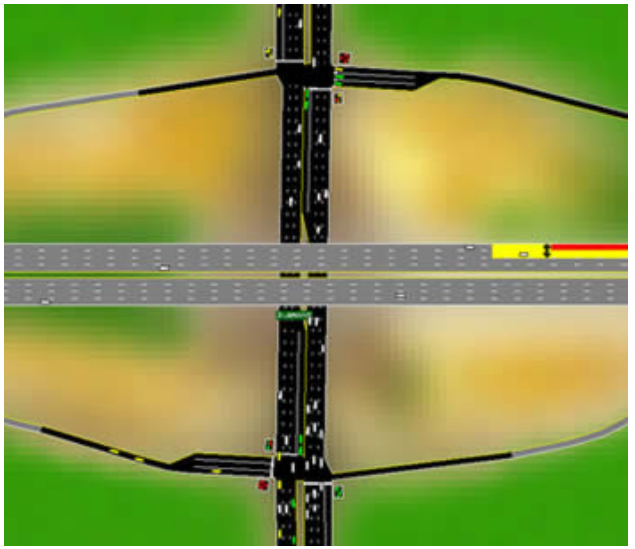
- Involve program and project stakeholders in developing guidance and processes for applying design flexibility - for statewide use, corridors and individual projects
- Address flexible design processes formally within the State DOT design manual, project development guide; and informally within design practitioner resources, tools, training, and agency “culture”
- Address flexibility in partnership agreements including the Federal-aid stewardship agreements and local agency agreements



# Rec’d Practices (cont’d)

- Support statewide programs to collect and analyze performance data, user characteristics, and contextual information, as well as condition data, to support *performance-based* analysis and decision-making.
- Use latest tools to evaluate safety and operational effects of design decisions, such as the IHSDM and upcoming Highway Safety Manual, traffic operational analysis/capacity tools, visualization, simulation, etc.



# Resources Available

- FHWA Design Discipline Team
  - Headquarters Office of Infrastructure
  - Resource Center Safety and Design Technical Services Team
  - Research, Development and Technology (Turner-Fairbanks Design Lab)
  - Federal Lands Highway Design Group
  - Division Office Design Coordinators
- FHWA Environment Discipline Team
  - Headquarters Office of Planning, Environment & Realty
  - RC Environment Technical Services Team
  - Federal Lands Highway Environment Team
  - Division Office Environmental Coordinators
- FHWA Interdisciplinary CSS Team

# Resources Available (cont'd)

- Policies, Guidance and Tools:
  - FHWA Design website (*www.fhwa.dot.gov/design*)
  - Resource Center Safety and Design website (*www.fhwa.dot.gov/resourcecenter*)
  - FHWA CSS website (*www.fhwa.dot.gov/context*)
  - IHSDM website (*www.tfhrc.gov/safety/ihsdm/ihsdm.ht*m)
  - Federal Lands Highway *Design Resources* websites
  - ContextSensitiveSolutions.org
- Training:
  - NHI *Context Sensitive Solutions*
  - FHWA *Geometric Design Applying Flexibility & Risk Management*
  - FHWA *Geometric Design – Introduction to the Green Book*
  - NHI *Safety and Operational Effects of Geometric Design Features for Two-Lane Rural Highways*

# Thank You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