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
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 than 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)
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.htm)
  – 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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