Are we there yet? Performance-based considerations and the Green Book 8 Vision

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Premise

- **Performance-based analysis in roadway planning and design is relatively new compared to other disciplines**
- **Assessing adherence to achieving "standards" is a common metric in roadway planning and design**
  - "Standards" are not necessarily based on research findings
- **Achieving "Standards" can be cost prohibitive and impacting while not always serving each user**
  - Historical metrics emphasized automobile capacity and speed.
- **Performance-based planning and design can more cost effectively meet project and design objectives**
  - "Performance-based Practical Design"

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What I hope to share…

- **Performance-based analysis in roadway planning and design is in its infancy and is here to stay**
- **Project performance measures and outcomes will increasingly guide and direct geometric design decisions**
- **Establishing project performance measures will become a more important focus**
- **Metrics will increasingly include:**
  - Quantified safety performance
  - Multi-modal quality of service
  - Equity
  - Service to historically disadvantaged communities
  - Public Health
  - Safe Systems
  - Consideration of emerging technologies
  - Effectiveness of investment

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Presentation overview

- Origins of Performance-based analysis
- Green Book 8
- Performance-based Documents
- Performance Considerations and Categories
- Closing

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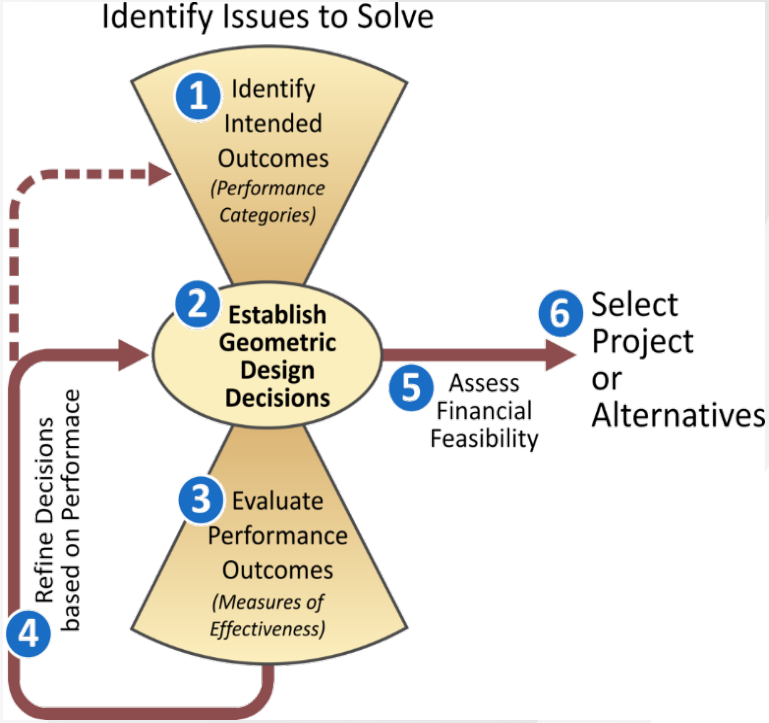
Performance-Based Design—Fundamental Model

1. Identify desired project outcomes
2. Establish design decisions
3. Evaluating the performance
4. Iterating and refining the design
5. Assessing the financial feasibility
6. Selecting a preferred alternative that aligns with the desired outcomes



Source: NCHRP Report 785

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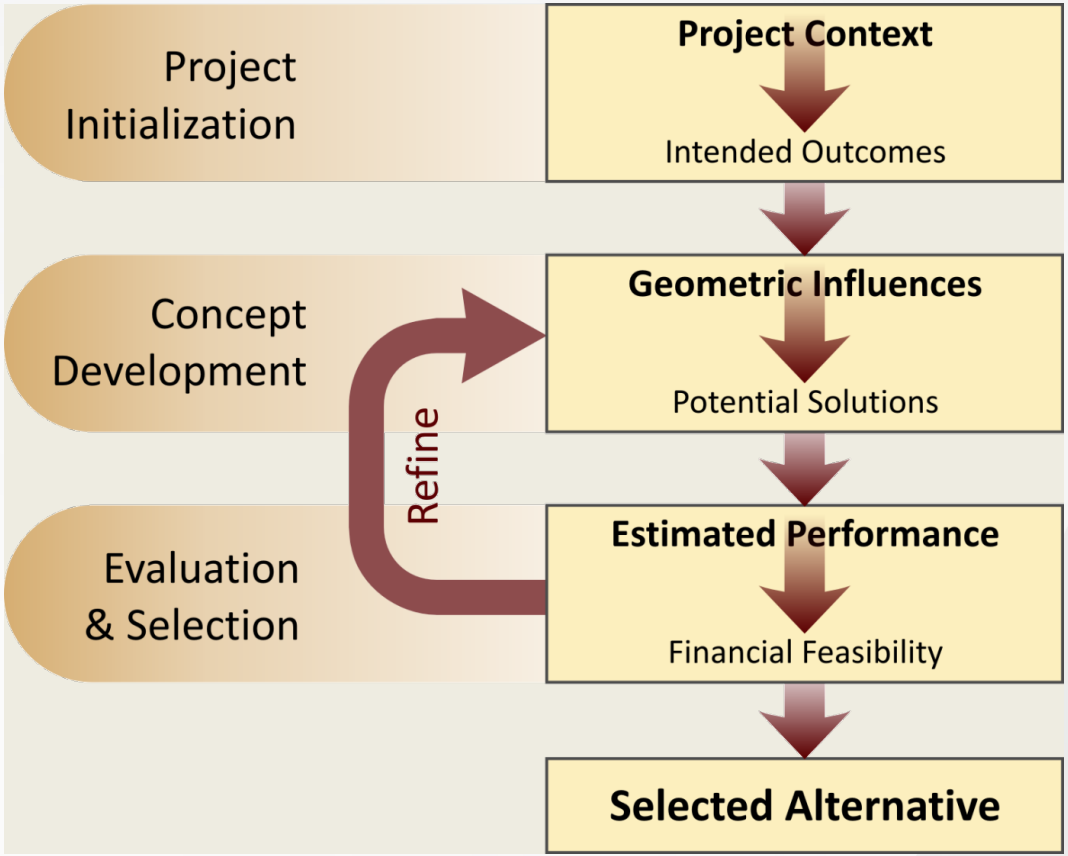
Performance-Based Design—Process Framework



Source: NCHRP Report 785

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Origins of performance-base analysis

- **1970s shift in thinking from "complies with/does not comply with code" approach to a "systems" approach for evaluating and designing systems**
  - Seismic retrofitting is more complex than new construction
- **1980s objective or performance-oriented regulations begun with British and Japanese countries**
- **Examples:**
  - Fire: How long until burn-through versus wall thickness or material?
  - Seismic: How to avoid catastrophic collapse despite economic total loss?
  - Pavement engineering: Loading cycles versus pavement thickness.

Performance-based analysis and AASHTO

- **AASHTO prioritized performance-based analysis in the 2000's to look ahead "beyond the Green Book"**
- **2004 *Strategic Geometric Design Research Needs* Workshop (AASHTO and TRB) identified performance-based research resulting in:**
  - *NCHRP Report 785: Performance-Based Analysis of Geometric Design of Highways and Streets*
  - *NCHRP Report 839: A Performance-Based Highway Geometric Design Process*
- **2016 AASHTO Standing Committee on Highways resolution emphasized flexible design approaches for multi-modal solutions**

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Presentation overview

- **Green Book 8**
  - Subcommittee on Highways (SCOH) Administrative Resolution: Direction on Flexibility in Design Standards
  - Relationship to Green Book 7th Edition
  - Green Book 8th Edition (GB8) Vision and Roadmap

Administrative Resolution: Direction on Flexibility in Design Standards

- WHEREAS, The AASHTO A Policy on Geometric Design of Highways and Streets (commonly referred to as the "Green Book") serves as the preeminent design guidance for streets and roadways in the United States; and
- WHEREAS, The Green Book is a research based, peer developed set of design standards, which serves as the basis of design for all roads on the National Highway System, as well as many state and local roads; and
- WHEREAS, The next edition of the Green Book is currently under development; and
- WHEREAS, Increases in bicycle and pedestrian volumes have been recorded nationwide in large cities, suburbs, and small towns, along with corresponding increases in collisions and fatalities; and
- WHEREAS, Funding and right-of-way constraints are a continual challenge for transportation facility owners; and
- WHEREAS, Additional, robustly-researched guidance is needed on how best to incorporate other modes of travel when designing safe and efficient roadways that serve all users; and
- WHEREAS, The design philosophy that incorporates a multi-faceted approach to street and highway design has been described using various terms, including flexibility in design, context sensitive solutions, practical design, and complete streets; and
- WHEREAS, Other publications provide examples for multi-modal street design, but there does not exist research-based, peer-reviewed design guidance that fully address the technical design-related aspects of these issues; and now, therefore, be it

Approved by the Standing Committee on Highways May 25, 2016 in Des Moines, IA

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Administrative Resolution: Direction on Flexibility in Design Standards

- RESOLVED, AASHTO should provide guidance to state DOTs and other users of the Green Book regarding flexibility in design; and be it further
- RESOLVED, This guidance should follow the AASHTO model of being research-based and peer-reviewed; and be it further
- RESOLVED, The Subcommittee on Design (SCOD) is tasked with developing this guidance, both in the short term (next Green Book edition) and the longer term; and be it further
- RESOLVED, This guidance should assist in educating engineers and designers on the flexibility inherent in the Green Book, as well as new and additional guidance on specific design issues; and be it further
- RESOLVED, This guidance should address designing in and for a multi-modal transportation system; and be it further
- RESOLVED, SCOD should coordinate with and possibly include other AASHTO publications in a future set of flexible design standards; and finally be it
- RESOLVED, SCOD should identify gaps in necessary research and develop a plan to fill those gaps.

Approved by the Standing Committee on Highways May 25, 2016 in Des Moines, IA

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Key Questions for the AASHTO Technical Committee on Geometric Design

1. What changes are needed in the Green book to implement the spirit of the SCOH resolution?

2. What is possible in the Green Book, 7th edition?

3. What can or should wait until the Green Book, 8th edition?

Presentation overview

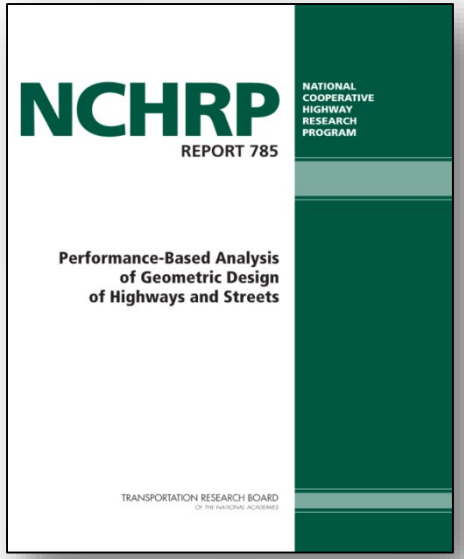
- Background
- Draft GB8 Vision and Roadmap
- Discussion and Future Research Needs

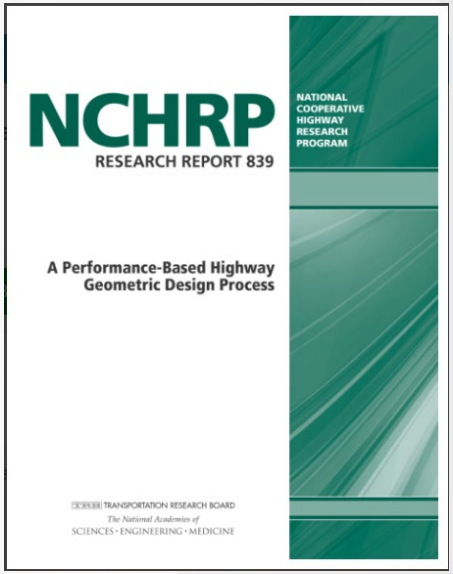
Project Scope

- **Task 1: Panel Meetings**
  - Screen-sharing conference calls to share findings and gather input
- **Task 2: Literature Review and Evaluation**
  - Prioritized resource documents
- **Task 3: Draft Roadmap and Proposed Approach**
  - Draft Vision and Roadmap topics
- **Task 4: In-Person Meetings**
  - National Conferences – TRB, AASHTO, NACTO
  - Conference calls and webinars
- **Task 5: Final Roadmap and Implementation Plan**
  - Final Green Book 8 Vision, Document Outline and Roadmap

Foundational Research Documents

- *NCHRP Report 785: Performance-Based Analysis of Geometric Design of Highways and Streets*
- *NCHRP Report 839: A Performance-Based Highway Geometric Design Process*





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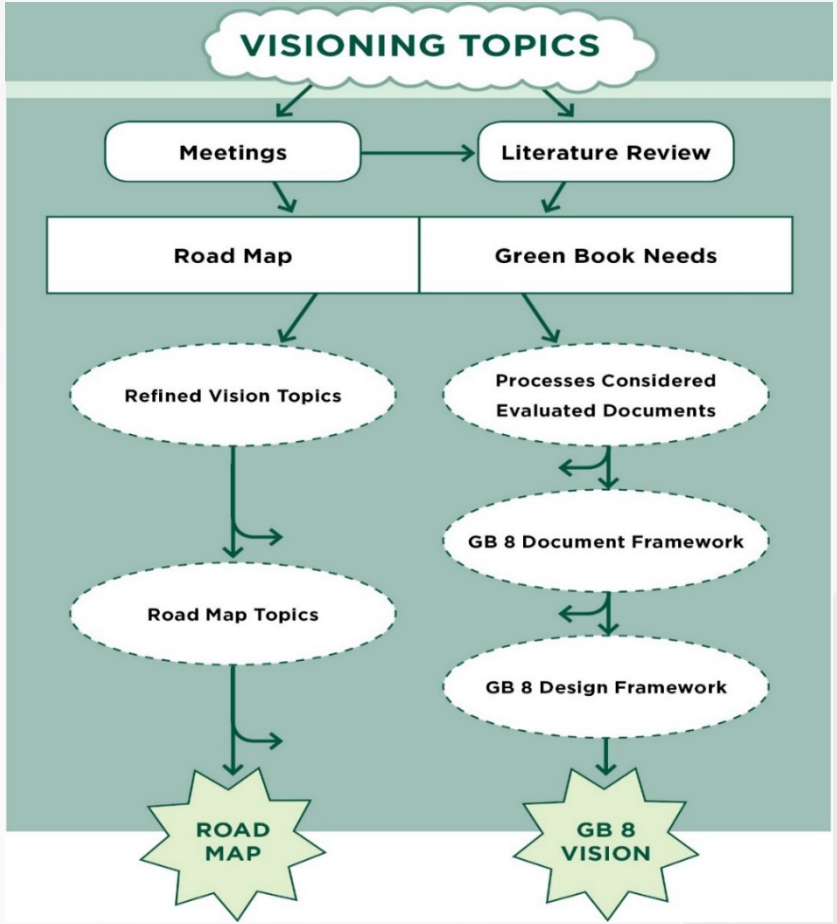
Adapted Project Approach to *meet outreach needs*



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Green Book 8 Vision

- **What we considered**
  - Input from Outreach Meetings
    - **Suggested documents and resources**
      - State planning and design documents
    - **Detailed guidance, suggested approaches, GB8 considerations**
      - NACTO, National Complete Streets Coalition, FHWA, and others
  - Explicit reference documents
    - **NCHRP Reports 785, 839, 855 etc.**
    - **AASHTO *A Guide for Achieving Flexibility in Highway Design***
    - **Many others**

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Green Book 8 Vision

- **There are two unique elements**
  - Document Framework – How is the GB8 document organized?
  - Design Framework – What is the design framework?

It became clear these two subjects became intermingled in GB8 Vision discussions.

It's imperative the actual Document Framework helps users apply the Design Framework

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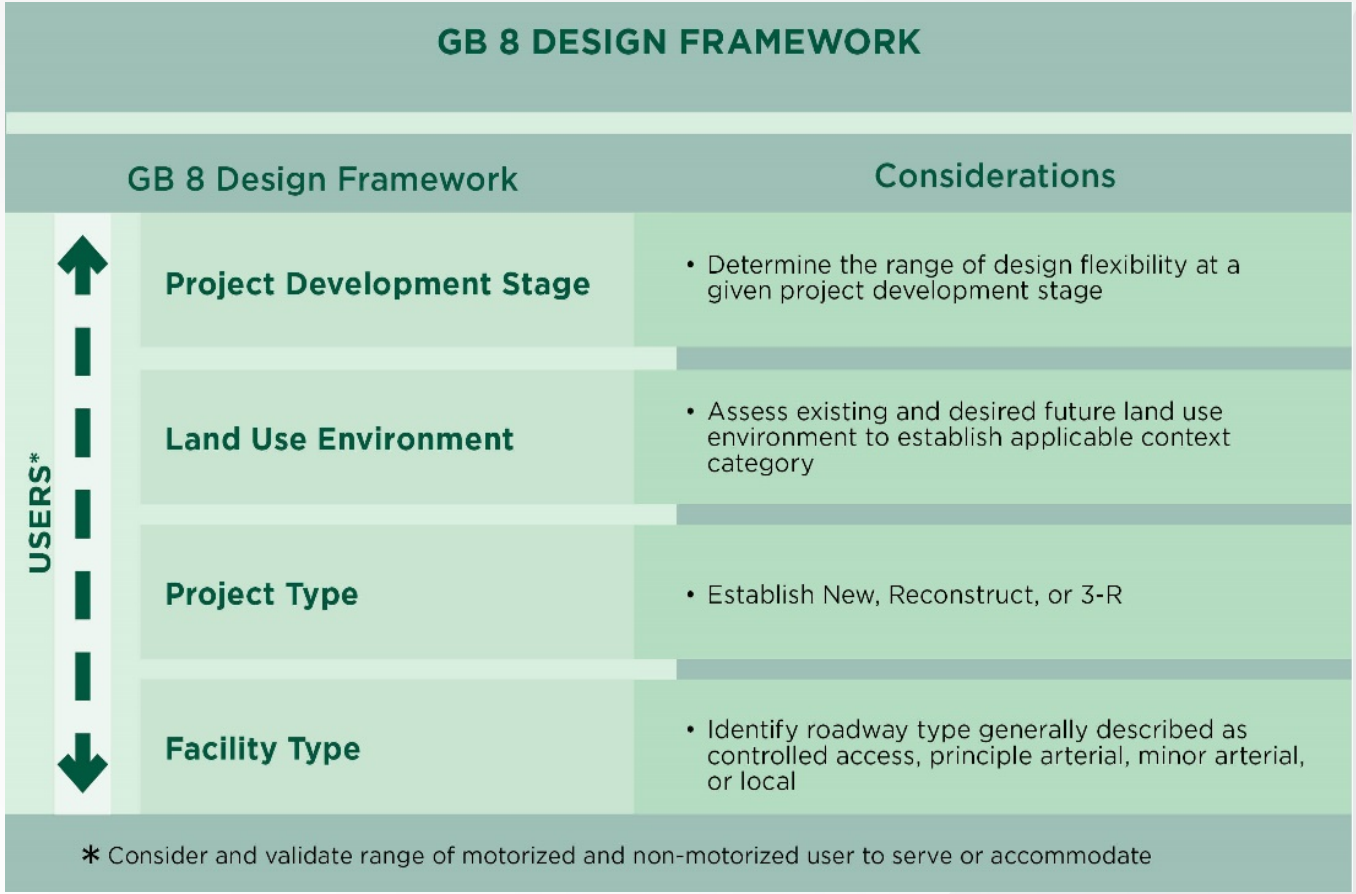
Document Framework—GB8 Concept

- Preface
- Introductory Chapter(s)
- Performance-based Framework
- Design Framework
- Facility Design Information**

**As presented: Based on adapting functional class to context.

Design Framework



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Green Book 8 Document Outline

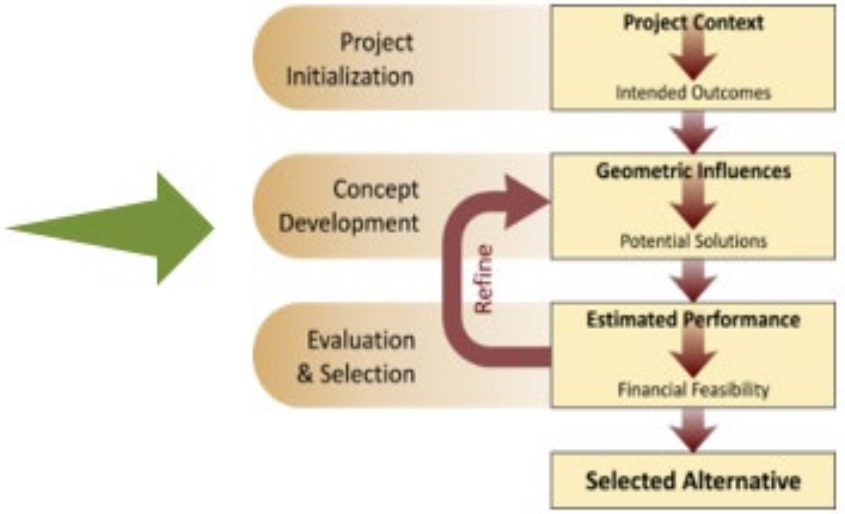
- Supporting initialization, development, evaluation and selection

GB 8 DESIGN MODEL

GB 8 Design Module	Considerations
Project Development Stage	• Determine the range of design flexibility at a given project development stage
Land Use Environment & Functional Class	• Assess existing and desired future land use environment to establish applicable context category • Consider functional class
Project Type	• Establish New, Reconstruct, or 3-R
Facility Type	• Identify roadway type generally described as freeway/controlled access, arterial, collector, or local

USERS*

* Consider and validate range of motorized and non-motorized user to serve or accommodate



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Design Framework—GB8 Concept

- **Design Framework**
  - Fundamental Design Framework
    - **Considering Users in each of the four topics**
      - Project Development Stage
      - Land Use Context
      - Project Type
      - Facility type
  - Establishing Performance Metrics
    - **Societal**
    - **Quantitative (i.e., safety, operations, quality of service, state of repair)**
  - Applying Functional Class Considerations
    - **While acknowledging there are various forms for each unique context**
  - Facility Design Information
    - **Published**
    - **Research Reports**
    - **Flexibility and engineering judgment**

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Facility Type Considerations

- **GB8 Design Framework (by roadway classification)**

- **Optional Approach (by land use context)**
  - Natural Areas
  - Rural Areas and Rural Towns
  - Suburban Roads
  - Urban Roads
  - Urban Core Roads
  - Industrial, Warehouse or Port Roads

…Look for those land use context themes in a few minutes!

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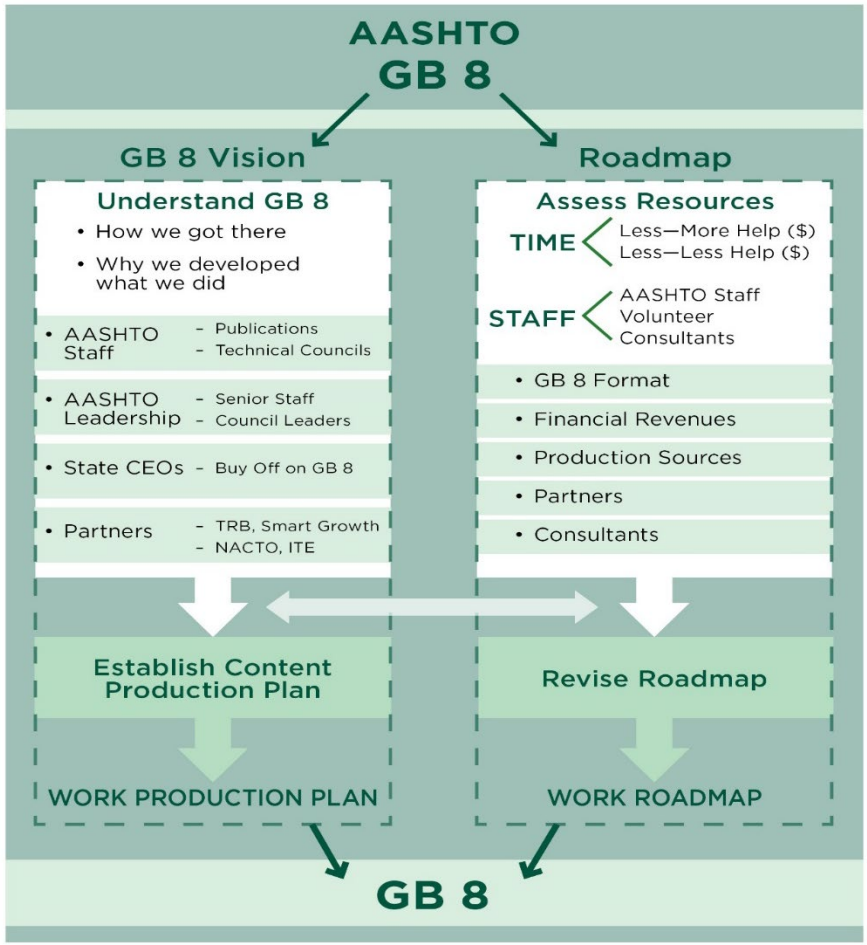
GB8 Vision—Summary Thoughts

- The Design Framework is the “engine” of the geometric design planning and design process.
- The Design Framework can apply at any stage of project development
- The actual “Green Book” content and framework would be complementary to support the Design Framework
- This concept applies in whatever forms or formats GB8 is produced

GB8 Roadmap--Starting a Conversation



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GB8 Roadmap Elements

- **Principles**
  - Fundamental role of GB8
  - Tort liability, risk management, and “red herrings” as GB8 limitations
  - Adapting to changing technology
- **Content**
  - GB8 document content
  - GB8 complementary resource documents
  - Technical guidance updates and research needs
  - Potential changes in AASHTO publishing approach
- **External Factors**
  - Document adoption/approval
  - Outreach and education
  - Partnerships for GB8 success

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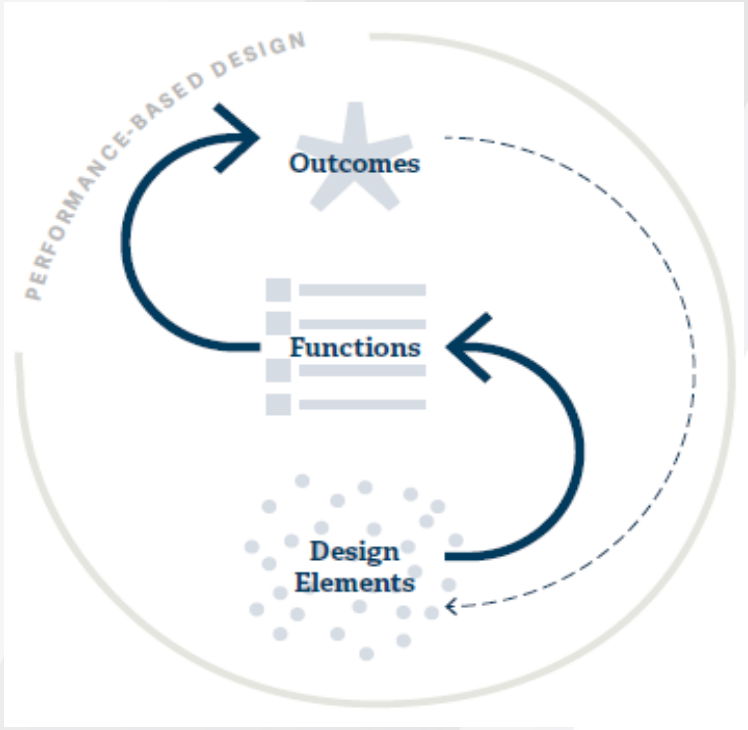
Metro *Designing Livable Streets & Trails Guide*

- Design Elements Support Functions to Achieve Outcomes
- Multidiscipline project teams improve decision-making
- A performance-based design decision-making framework contributes to systemwide networks and regional outcomes
- It starts with a well-defined project need and clear objectives



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Connecting to the land use

Land Use and Transportation Transect

LESS DENSITY — MORE DENSITY — SPECIAL DISTRICTS

Parks and Natural Areas	Neighborhoods	Main Streets	Town Centers	Corridors	Station Communities	Regional Centers	Central City	Employment and Industrial Lands
LAND USE								
Undeveloped natural areas including parks, natural areas, open spaces and scenic areas, rivers and streams, wetlands and floodplains.	Single-family and multi-family residences incorporating a mix of housing types including row houses, duplexes and accessory dwelling units. Newer neighborhoods are slightly more compact while some older neighborhoods have larger lots and fewer street connections.	Neighborhood scale commercial retail and housing in one to three-story buildings along multimodal streets with good transit service.	Two to five-story mixed use buildings with professional services and commercial retail outlets complimenting housing that is well served by transit.	One to three-story buildings containing commercial retail, small scale employment or housing along major transportation routes that link centers together and are well served by transit.	Areas around light-rail or high capacity transit stations outside of centers with significant employment development and numerous housing types.	Two to six-story compact employment and housing development with destination retail served by high capacity transit.	Center of business and cultural activities for the region with intensive employment and housing in high-rises served by numerous transit options.	A mix of large scale employment and industrial uses that include office parks, manufacturing, distribution centers, marine and airport facilities and railroad switching yards.
TRANSPORTATION DESIGN								
Transportation routes designed to protect and enhance natural features. In some cases a Parkway design overlay may be appropriate.	Regional and Community Streets	Regional and Community Boulevards	Regional and Community Boulevards	Regional and Community Streets	Regional and Community Boulevards	Regional and Community Boulevards	Regional and Community Boulevards	Industrial Streets, Regional and Community Streets

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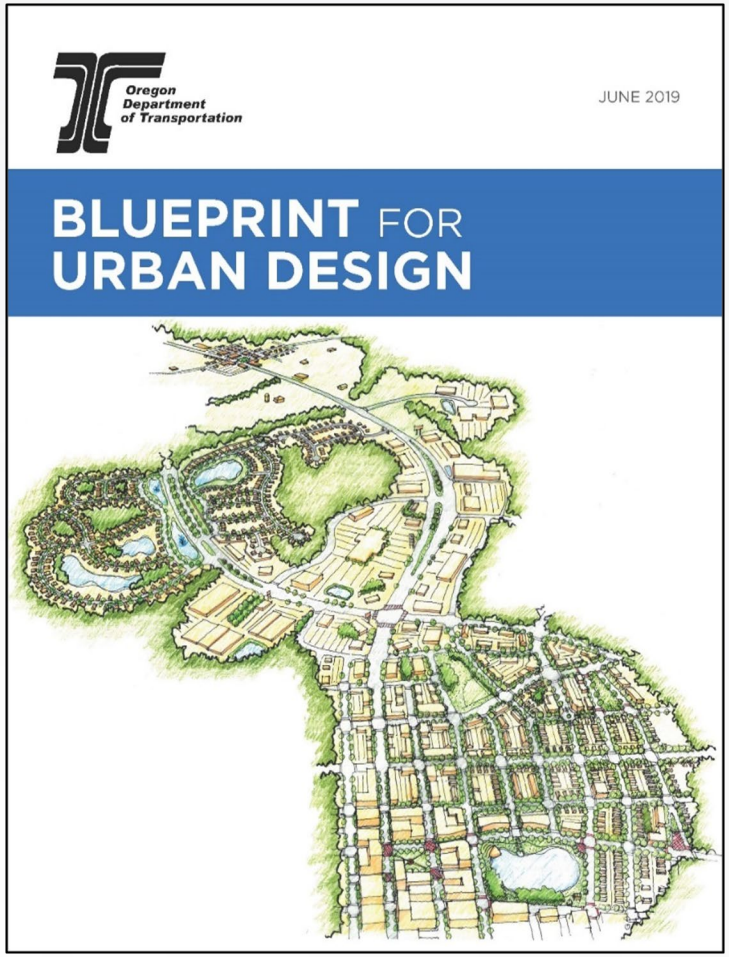
Oregon DOT *Blueprint for Urban Design*



- Outlines urban design practices and guidance for ODOT facilities.
- Highlights flexibility in ODOT's current design criteria.

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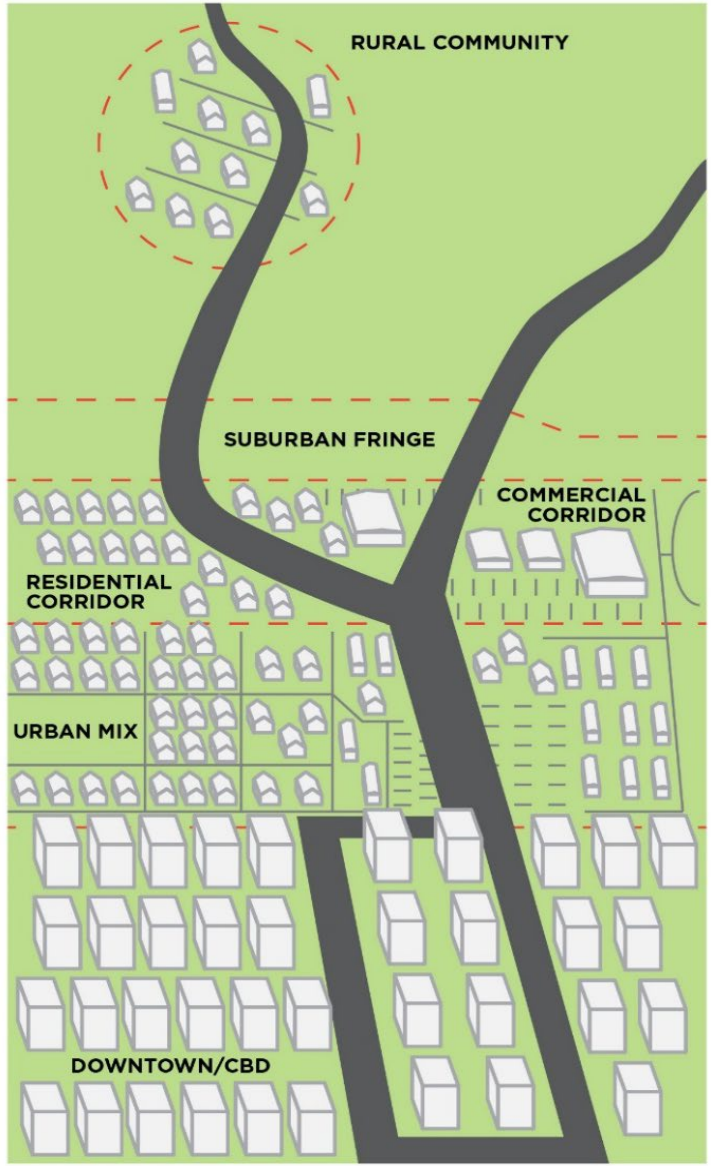
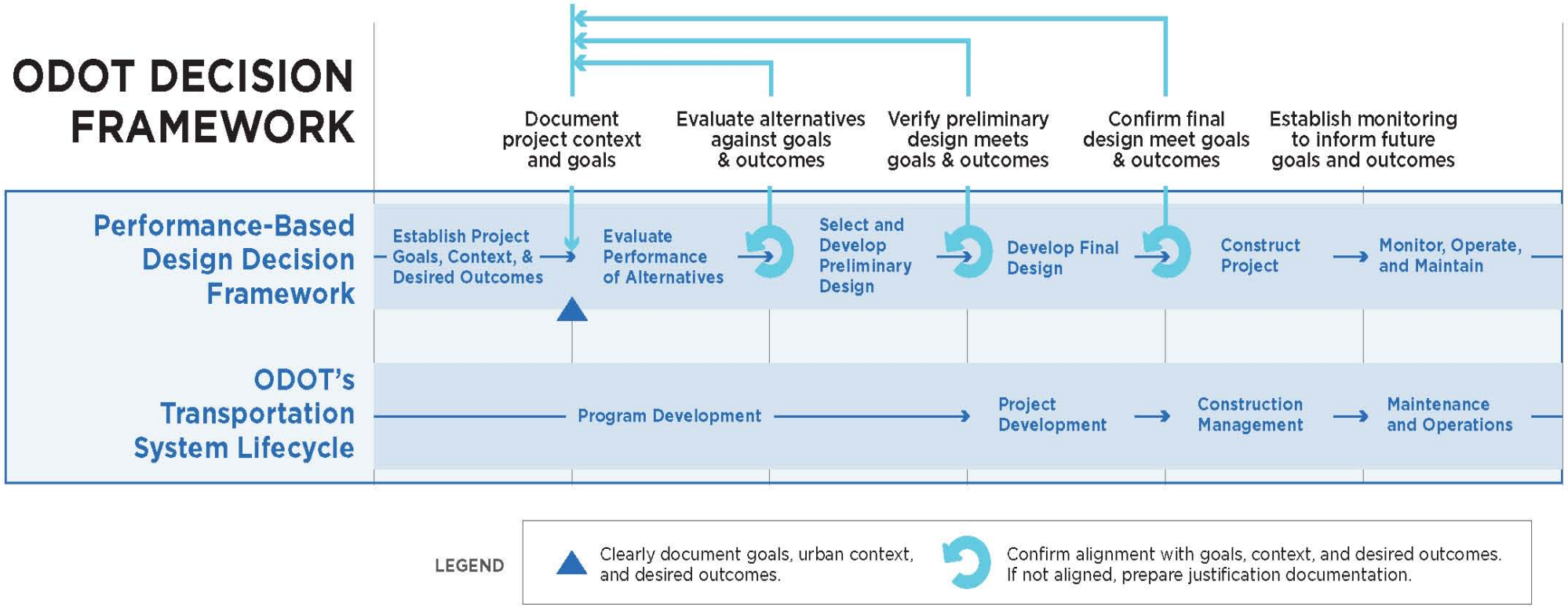
ODOT *Blueprint for Urban Design*

- **Urban Context is based on:**
  - Existing and future
  - Land uses characteristics
  - Development patterns
  - Roadway connectivity



ODOT *Blueprint for Urban Design*



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Design Framework Considerations

Fundamental Questions:

- What are the influences of design in project planning?
- When does design begin?

Geometric performance is guided by project outcomes

Source: NCHRP Report 785

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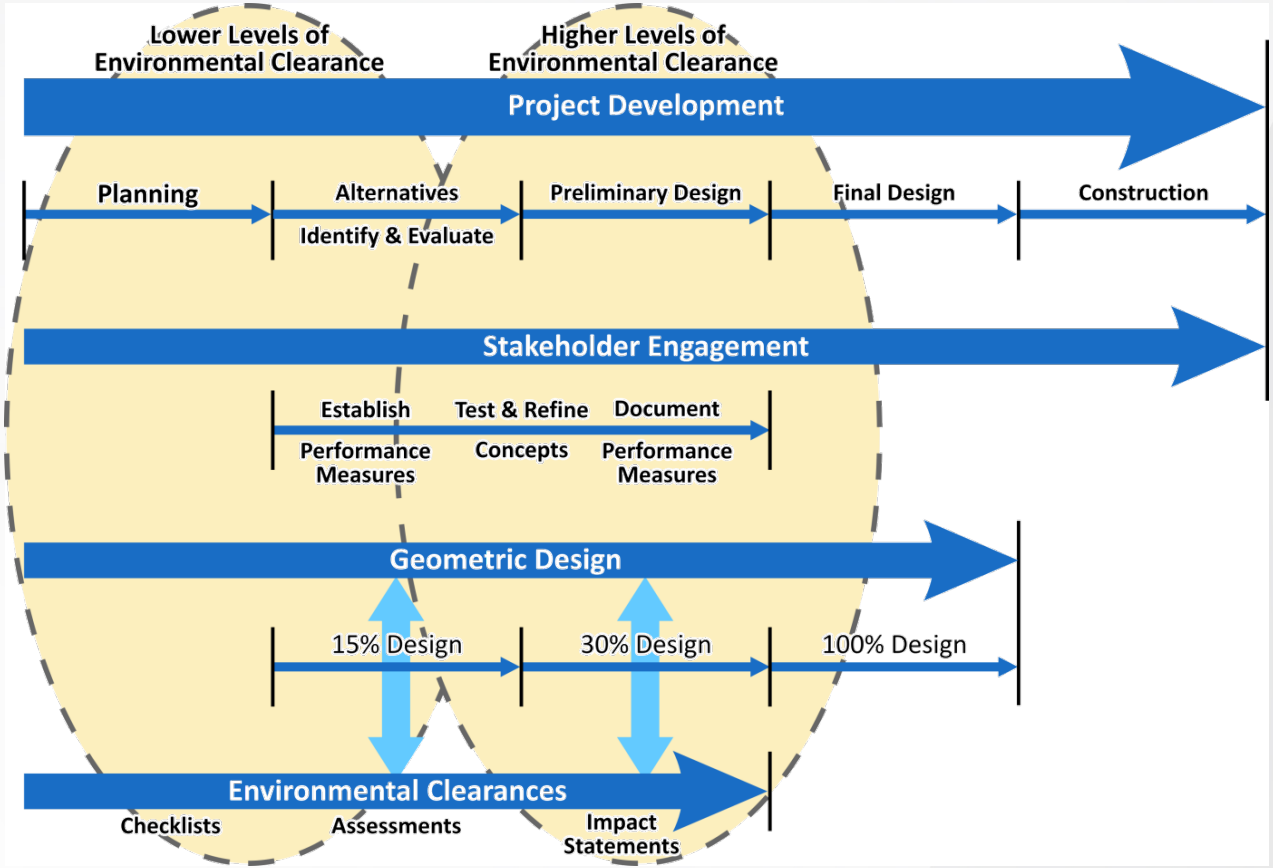
“Design” is often set in “Planning”



Source: NCHRP Report 785

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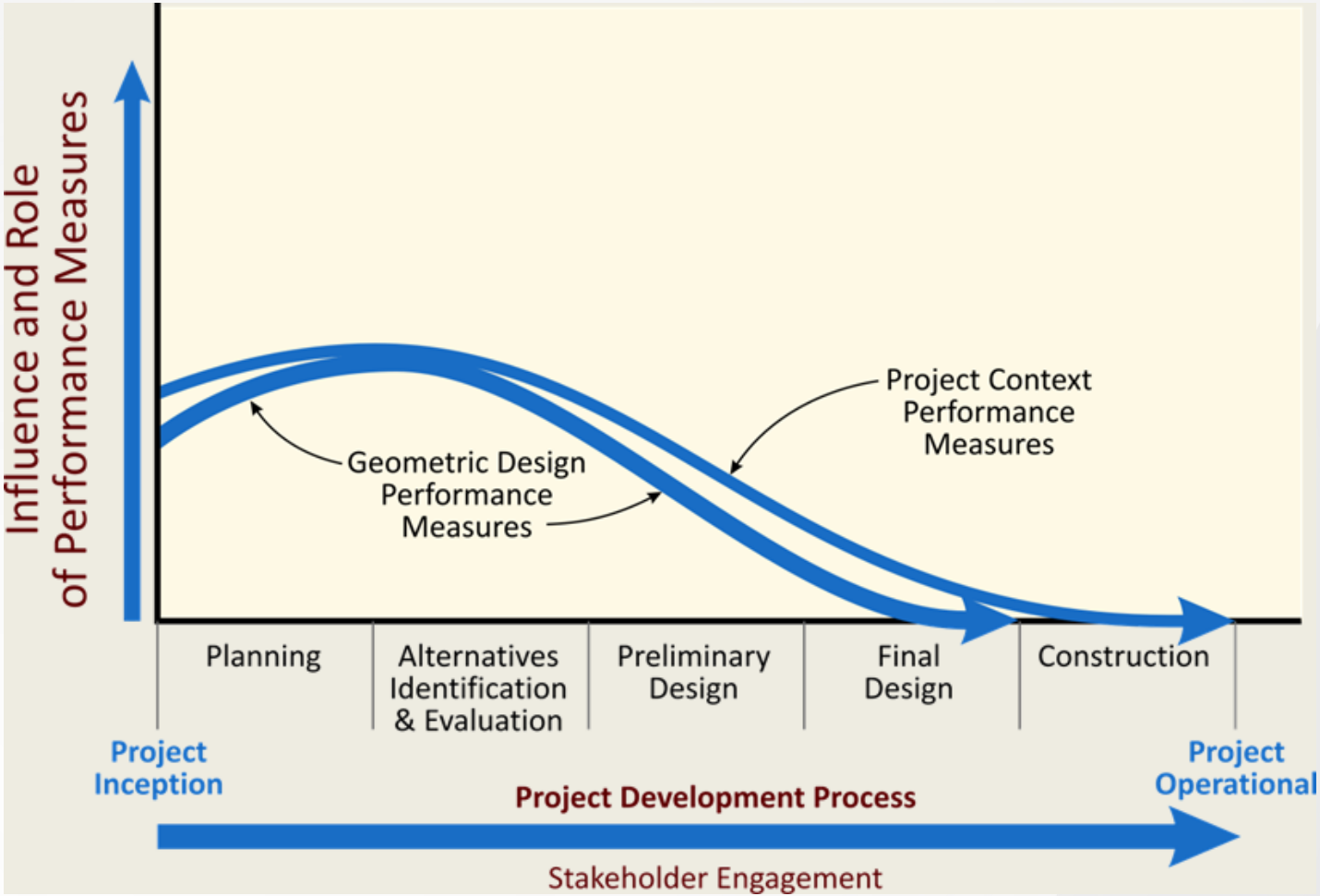
Performance metrics: When are we most impactful?



Source: NCHRP Report 785

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NCHRP Report 785 Performance Categories

- Accessibility
- Mobility
- Quality of service
- Reliability
- Safety

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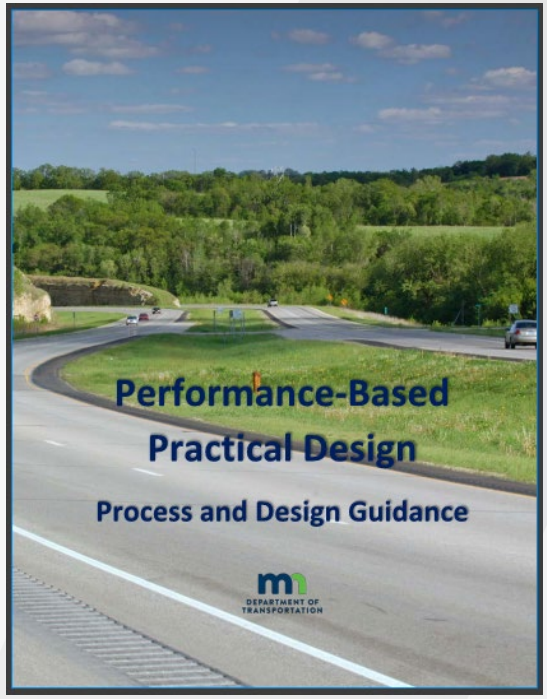
MNDOT PBPD Performance Categories

- Accessibility
- Ease/cost of maintenance, operation, and use
- Quality of service
- Reliability
- Safety



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Oregon Metro Performance Categories

- Safety
- Transportation Choices
- Reliable Travel
- Healthy People
- Security
- Healthy Environment
- Reduce CO2
- Sustainable Economic Prosperity
- Social Equity
- Vibrant Communities
- Resiliency
- Fiscal Stewardship

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Closing

- Our transportation industry is embracing performance-based approaches to guide decision making.
- AASHTO's SCOH resolution is a watershed moment in supporting flexible, multi-modal planning and design.
- The GB8 Vision represents a fundamental change in our industry.
- "Design" does not begin in "Design"; get started early.
- Overall project performance objectives will guide geometric design decisions.
- Geometric design decisions will become increasingly influenced by metrics farther from traditional engineering measures.

Thank you!

Questions?

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