



Increasing Design Flexibility in the AASHTO Green Book

Presentation to
AASHTO Subcommittee on Design
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Green Book Chapter 1—New Framework for Geometric Design

- Replacement for Chapter 1 presents a new framework for geometric design that addresses:
 - explicit statement of project purpose and need
 - existing functional classification system
 - new context classification system
 - multimodal considerations
 - revised design process for specific project types
 - design flexibility
 - performance-based design

Project Purpose and Need

- Purpose and need should be explicitly stated for every project
- Purpose and need can be presented as:
 - purpose and need statement required by the NEPA process
 - project objectives statement
 - both types of statements
- Purpose and need statement is the method for agency management to tell planners and designers what will and what will not be included in the project scope
- Purpose and need/project scope should be defined considering:
 - past performance
 - anticipated future performance if no project is implemented

Examples of Performance Issues That May Need to be Addressed in Particular Projects

- Existing and expected future traffic operational efficiency
- Existing and expected future crash frequency and severity
- Service and ease of use for each transportation mode
- Accessibility for persons with disabilities
- Impacts of existing and potential future development
- Operational flexibility during future incidents and maintenance activities
- Impacts on the natural environment:
 - air quality
 - noise
 - wetland preservation
 - wildlife and endangered species

Project Purpose and Need

- Purpose and need addresses performance issues that have a documented need for improvement
- Noncompliance with geometric design criteria is not, by itself, a performance issue and should not appear in a project purpose and need statement
- Noncompliance with geometric design criteria only becomes a performance issue:
 - past (or anticipated future) performance is an issue
 - poor performance can be corrected by a geometric design improvement
- This approach is intended to avoid project expenditures that have no impact on performance

Functional Classification System

- Traditional presentation of functional classification system
- Retains current four functional classes
 - local roads and streets
 - collector roads and streets
 - arterial roads and streets
 - freeways
- Text emphasizes that these functional classes characterized how a specific roadway is intended to serve motor vehicles

Context Classification System

- Traditional geometric design has addressed two roadway contexts: rural and urban
- New approach addresses five roadway contexts:
 - rural
 - rural town
 - suburban
 - urban
 - urban core

Context Classification System

- Contexts are defined based on:
 - development of density (existence of structure and structure types)
 - land uses (primarily residential, commercial, industrial, and/or agricultural)
 - building setbacks (distance from structures to adjacent roadways)
- Context classification system uses easy to assess measures:
 - can utilize review of aerial photographs

Framework for Geometric Design

Functional Class	Context Class				
	Rural	Rural Town	Suburban	Urban	Urban Core
Local Road or Street					
Collector Road or Street					
Arterial Road or Street					
Freeway					

Photos of Context Classes



Rural Context



Rural Town Context

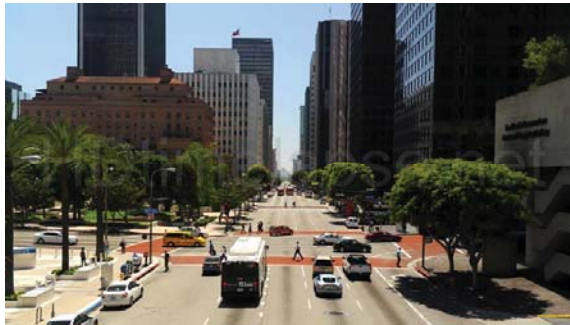
Photos of Context Classes



Suburban Context



Urban Context



Urban Core Context

Multimodal Considerations

- Consider needs of all transportation modes in every project
 - automobiles
 - bicyclists
 - pedestrians
 - transit
 - trucks
- Consideration does not necessarily mean that dedicated facilities are provided for every mode in every project
- Appropriate balance among transportation modes may vary widely between specific roads and streets
- Balance among transportation modes should be a conscious decision considering:
 - needs of and travel demands for each mode
 - local and regional transportation agency master plans
 - community needs

Multimodal Considerations

- Purpose and need for project provides a perspective on the appropriate balance among transportation modes
- Additional considerations:
 - demand volumes
 - community and stakeholder input

Revised Design Process for Specific Project Types

- Three project types are addressed in design procedures:
 - new construction projects
 - reconstruction projects
 - projects on existing roads

Revised Design Process for Specific Project Types

NEW CONSTRUCTION PROJECTS

- New alignment where no existing roadway is present
 - could be an undeveloped site or site with existing development
- Design guidance in Chapters 2 through 10 is primarily intended for new construction projects
 - new construction projects often have fewer constraints than projects on existing roads
- Projects are designed within the framework defined by functional and context classes and should consider needs of all transportation modes
- Performance of an existing road is not a factor in design, but forecast performance of design alternatives in future years may strongly influence design decisions

Revised Design Process for Specific Project Types

RECONSTRUCTION PROJECTS

- Projects that utilize an existing roadway alignment (or make only a minor change in alignment), but involve a change in the basic roadway type
- Changes in basic roadway type include the following where these cannot be accomplished within the existing roadway width (including shoulders):
 - widening to provide additional through lanes
 - adding a raised or depressed median where none currently exists
- Projects on existing alignment do not change the basic roadway type but replace the existing pavement structure down to the subgrade are no longer classified as reconstruction

Revised Design Process for Specific Project Types

RECONSTRUCTION PROJECTS

- Design decisions in reconstruction projects are often difficult to adapt new facility type to the existing alignment and fit is within the community context
- Like all projects, reconstruction projects are designed within the framework defined by functional and context classes and should consider needs of all transportation modes
- Design guidance in Chapters 2 through 10 is desirable, but may be impractical due to project constraints and may not be relevant to project purpose and need
- Design decisions should be made using a flexible, performance-based approach

Revised Design Process for Specific Project Types

PROJECTS ON EXISTING ROADS

- Projects that utilize an existing roadway alignment (or make only a minor change in alignment) and do not involve a change in the basic roadway type
- Projects on existing roads are classified by the primary reason the project is being undertaken:
 - repair infrastructure condition
 - reduce current or anticipated traffic operational congestion
 - reduce current or anticipated crash patterns
- Like all projects, projects on existing roads are designed within the framework defined by functional and context classes and should consider needs of all transportation modes
- A flexible, performance-based approach is utilized

Revised Design Process for Specific Project Types

PROJECTS ON EXISTING ROADS

- Projects undertaken to improve infrastructure condition should follow guidelines developed in NCHRP Project 15-50.
- Projects undertaken because of traffic operational congestion should be designed based on the HCM or applicable models
- Projects undertaken because of crash patterns should be designed based on the HSM or applicable models
- Make geometric design changes only to address identified needs

Design Flexibility

- Design flexibility is of critical importance because each project:
 - has a specific purpose and need
 - has specific context and constraints
 - serves a unique set of users
 - fills a distinct position in the transportation network
- No single set of geometric design criteria meets the needs of all, or even most, projects
- Designers are responsible for considering a range of factors when applying design criteria, making tradeoffs among possible design options to best serve the traveling public and the community at large
- Design flexibility removes an unnecessary layer of constraints to achieving the most appropriate design

Design Flexibility

- There is substantial flexibility in Green Book Chapters 2 through 10
- Performance-based analysis can help exercise that flexibility and identify when alternative design criteria should be used
- Design flexibility does not mean that designers can use arbitrary discretion in the design of projects. Flexibility should be exercised to better meet specific project goals or to work within defined constraints
- Designers are expected to balance competing needs
- Documentation of how flexibility was exercised to meet competing needs is needed to show:
 - why proposed design is an appropriate solution
 - how it meets the needs of each transportation mode
 - how it is expected to perform in the future
 - how it fits within available funding

Performance-Based Design

- Performance measures demonstrate how a project meets its purpose and need
- Performance measures can be used to select among design alternatives
- Performance measures can be used in economic analysis
- Both quantitative and qualitative performance measures can be used:
 - not every potential project effect can be quantified

Performance-Based Design

- Alternative approaches to performance-based design:
 - set performance goals for a project by establishing quantitative targets for improvement in specific measures of future performance relative to the no-build condition
 - set performance goals that specify performance measures that will be improved from the no-build condition (without necessarily saying how much) and other performance measures that will, at least, remain unchanged in comparison to the no-build condition
- Guidance and performance analysis tools:
 - NCHRP Report 785, *Performance-Based Analysis of Geometric Design of Highways and Streets*
 - TRB *Highway Capacity Manual* and other operation models
 - AASHTO *Highway Safety Manual* and other crash prediction methods

Implementation of Revisions in the Green Book

- 7th Edition of the Green Book incorporates:
 - a new Chapter 1 on the revised design framework
 - revisions to Chapters 2 through 10 implementing the framework where possible without major restructuring of the document
- Major restructuring of design policy (e.g., reorganization of design criteria by context classes as well as functional classes) will be considered for the 8th Edition