

NCHRP Project 7-29

Development of an 8th Edition of the AASHTO Green Book (GB8)

TRB Safety Performance and Analysis Committee (ACS20)
Midyear Meeting

June 28, 2023



Project Objective

- Develop a draft 8th Edition *Green Book* (GB8) suitable for balloting through AASHTO processes.

GB8 Goals

- Increased design flexibility
- Performance-based approach (in situations where performance measures are available)
- Multimodal considerations
 - address all transportation modes for every project
- Based on context classifications
 - rural and natural context
 - rural town context
 - suburban context
 - urban context
 - urban core context
 - special contexts

Research Approach

PHASE II

- Task 8—Develop First Draft of GB8
- Task 9—Develop Second Draft of GB8
- Task 10—Prepare Other Final Deliverables

Ingrid Potts



GB8 Outline

Top-Level GB8 Outline

- Part I—Introduction
- Part II—Performance-Based Design Process
- Part III—Design Controls and Criteria
- Part IV—Tailoring Geometric Design to Roadway Context

Outline for Part I—Introduction

- Chapter 1—Overview
- Chapter 2—Key Concepts in Geometric Design
- Chapter 3—Overview of Performance-Based Design
- Chapter 4—Project Needs and Objectives Statement

(First drafts of these chapters have been completed.)

Outline for Part II—Performance-Based Design Process

- Chapter 5—Performance Analysis Tools
- Chapter 6—Steps in Performance-Based Design

(First drafts of these chapters will begin soon.)

Outline for Part III—Design Controls and Criteria

- Chapter 7—Design Controls*
- Chapter 8—Roadway Alignment*
- Chapter 9—Cross-Section Elements*
- Chapter 10—At-Grade Intersections
- Chapter 11—Freeways*
- Chapter 12—Interchanges
- Chapter 13—Other Elements Affecting Geometric Design*

*(First drafts of these chapters have been completed)

Outline for Part IV—Tailoring Geometric Design to Roadway Context

- Chapter 14—Rural and Natural Context
- Chapter 15—Rural Town Context
- Chapter 16—Suburban Context
- Chapter 17—Urban Context
- Chapter 18—Urban Core Context
- Chapter 19—Special Contexts

Goal: Increased Design Flexibility

- Change emphasis on rigidly applied design criteria or “one size fits all” design.
- Design decision-making should account for site- and project-specific considerations.
- Design flexibility does not imply discretion to make arbitrary design decisions.
- Performance analysis provides a basis for a more flexible design process.

Goal: Performance-Based Approach

- Quantitative vs. qualitative performance estimation
- Performance analysis can provide a basis for design decision making including:
 - crash frequency and severity measures (HSM)
 - traffic operational measures (HCM/reliability)
 - other (air quality, noise, energy consumption, community impacts, environmental impacts)

Goal: Performance-Based Approach

- Performance analysis applications include:
 - Past performance for reconstruction and 3R projects on existing roads
 - Existing geometrics may be retained if the project site is performing well and expected to continue performing well in the future.
 - Expected performance in the future for project design alternatives
 - Compare expected performance and costs of design alternatives.

Goal: Performance-Based Approach

- HSM2 will be a key tool for crash frequency and severity analysis.
- GB8 will present CMFs for design elements and facility types for which performance is known.
- Sources will include:
 - HSM2 Part C adjustment factors
 - CMFs from the FHWA CMF Clearinghouse

Goal: Performance-Based Approach

- Traditional *Green Book* design guidance and criteria will be retained for application where performance measures are not applicable or not available.

Goal: Performance-Based Approach

- GB8 will present available CMFs (tables, equations, values, figures).
- GB8 will acknowledge where CMFs are not available
- Full HSM2 predictive methods will be referred to, but not presented:
 - Presentation of CMFs is intended to make designers aware of what performance knowledge is available and not available.
 - Use of CMFs by themselves will be discouraged; use of full predictive methods is preferred.

Example: Lane Width on Rural Two-Lane Highways

Table 9-2. CMF for Lane Width on Roadway Segments of Rural Two-Lane Highways (AASHTO, 2010)

U.S. Customary			
Lane Width	Two-Way AADT (veh/day)		
	< 400	400 to 2,000	> 2,000
9 ft or less	1.05	$1.05 + 2.81 \times 10^{-4} (AADT - 400)$	1.50
10 ft	1.02	$1.02 + 1.75 \times 10^{-4} (AADT - 400)$	1.30
11 ft	1.01	$1.01 + 2.50 \times 10^{-5} (AADT - 400)$	1.05
12 ft or more	1.00	1.00	1.00
Metric			
2.7 m or less	1.05	$1.05 + 2.81 \times 10^{-4} (AADT - 400)$	1.50
3.0 m	1.02	$1.02 + 1.75 \times 10^{-4} (AADT - 400)$	1.30
3.3 m	1.01	$1.01 + 2.50 \times 10^{-5} (AADT - 400)$	1.05
3.6 m or more	1.00	1.00	1.00

NOTE: This table is based on HSM Table 10-8. The target crash types related to lane width to which this CMF applies include single-vehicle run-off-the-road and multiple-vehicle head-on, opposite direction sideswipe, and same-direction sideswipe crashes.

Example: Lane Width on Rural Two-Lane Highways

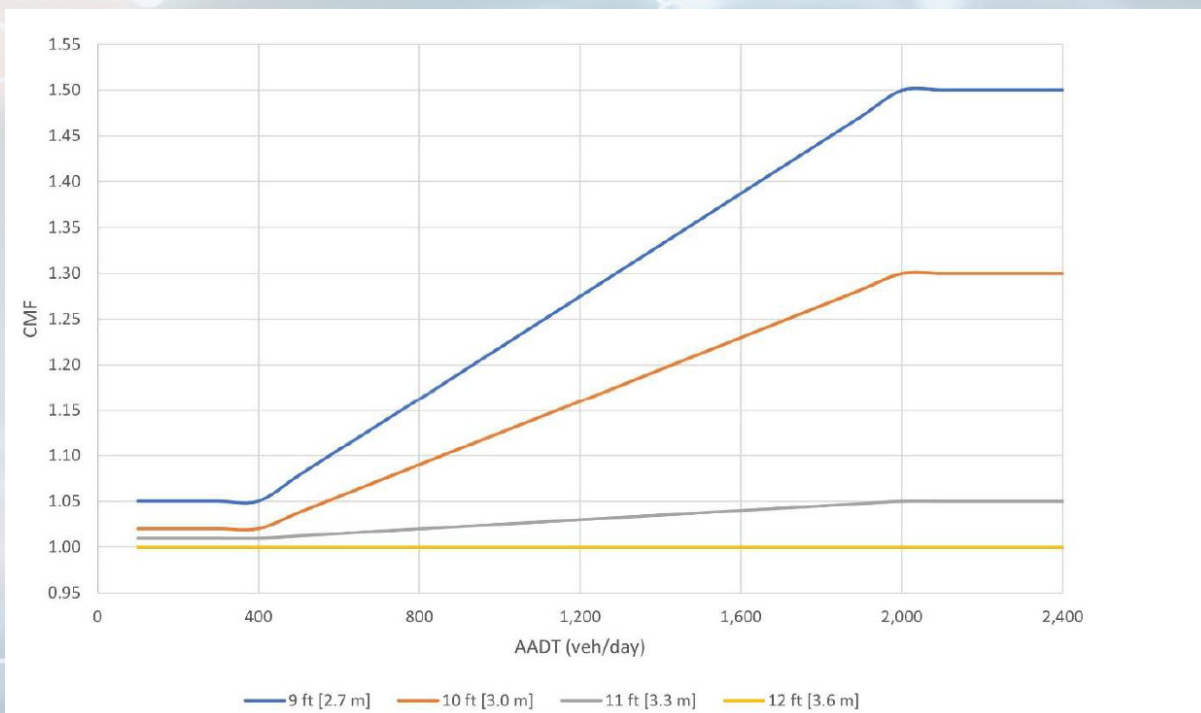


Figure 9-4. CMF for Lane Width on Roadway Segments of Rural Two-Lane Highways (AASHTO, 2010)

Implementing a Performance-Based Approach

- Shift from look-up tables to performance-based design = more inherent flexibility and use of judgement
 - What does this mean for training needs?
 - What does this mean for level of experience needed?
 - More responsibility and need for documentation?

Implementing a Performance-Based Approach

- Should roadway designers be expected to perform safety evaluations, or simply be aware of when they need to engage with safety staff?
- Culture change!
 - Will this performance-based approach be easier for newer designers or more experienced designers?
 - How can this Committee help facilitate this culture change?

Goal: Multimodal Considerations

- Much greater emphasis on design for pedestrians and bicyclists
- Consideration of target speed vs. design speed, especially for urban facilities that serve pedestrians and bicyclists as well as motor vehicles.
- Tailoring geometric design to specific context classes leads naturally to a greater emphasis on design for pedestrians and bicyclists.

Goal: Design for Context Classes

- GB8 Part III includes both performance measures (e.g., CMFs) and traditional design guidance and criteria
- GB8 Part IV will have a separate chapter for each context class and will show how the traditional design guidance and criteria can be adapted to each context class

Timeline

- First complete draft of GB8: ~ February 28, 2024
- Second complete draft of GB8: ~ July 31, 2024
- Complete project: ~ October 31, 2024

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