

A Policy on Geometric Design of Highways and Streets
2018
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PREFACE

Public works projects of all scales are more sensitive to funding than ever before. In many cases, cost magnitude and cost effectiveness play increasingly large roles in scoping projects. Often, reconstruction projects are limited in scope or available funding, or may be affected by physical constraints or social or environmental considerations. In some locations, especially constrained locations, designing to the criteria recommended herein simply is not feasible. Adaptive, flexible, and cost-effective designs customized to each project context are encouraged. Flexibility in the application of design criteria herein is recommended to encourage a sustainable approach to highway design decision making by weighing and balancing choices among the environmental, economic, and social aspects while meeting the project's performance objectives.

Designers should recognize the joint use of transportation corridors by motorists, pedestrians, bicyclists, public transit, and freight vehicles. Designers are encouraged to consider not only vehicular movement, but also movement of people, distribution of goods, and provision of essential services. A more comprehensive transportation program is thereby emphasized.

A Policy on Geometric Design of Highways and Streets provides geometric design guidance based on established practices that are supplemented by recent research. This document is intended as a comprehensive reference manual to assist in administrative, planning, and educational efforts pertaining to design formulation. This policy is not intended to be a prescriptive design manual that supersedes engineering judgment by the knowledgeable design professional.

The design concepts and criteria in this policy are intended for use when designing new construction projects on new location or designing reconstruction projects on an existing location. Projects on existing roads particularly call for a flexible, performance-based approach to design. The policy also encourages flexible design, which emphasizes the role of the planner and designer in determining appropriate design dimensions based on project-specific conditions and existing and future roadway performance more than on meeting specific nominal design criteria. This publication is not intended as a policy for resurfacing, restoration, or rehabilitation (3R); traffic engineering; safety; and preventive maintenance-type projects that include very minor or no roadway work. When designing 3R projects, the designer should refer to the design guidelines presented in *NCHRP Report 876, Guidelines for Integrating Safety and Cost-Effectiveness into Resurfacing, Restoration, and Rehabilitation (3R) Projects*, for more information. *NCHRP Report 876* was developed as a replacement for *TRB Special Report 214, Designing Safer Roads: Practices for Resurfacing, Restoration, and Rehabilitation*.

The fact that new design values and concepts are presented herein does not imply that existing streets and highways are unsafe, nor does it mandate the initiation of improvement projects. The highway, vehicle, and individual users are all integral parts of transportation safety and efficiency. While this document primarily addresses geometric design issues, a properly equipped and maintained vehicle and reasonable and prudent performance by the user are also needed for safe and efficient operation of the transportation facility.

Chapter 1 of this edition has been rewritten entirely and provides a new framework for geometric design. It expands the land use contexts from two (urban or rural) to five (rural, rural town, suburban, urban, or urban core). It emphasizes design flexibility provided in this policy and encourages designers to take advantage of that flexibility. Chapter 1 also introduces a performance-based approach to geometric design which, when used, will allow practitioners to quantify and convey design tradeoffs in meaningful terms to a broad audience and, ultimately, for consideration by decision makers.

Design values are presented in this document in both U.S. customary and metric units and were developed independently within each system. The relationship between the U.S. customary and metric values is neither an exact (soft) conversion nor a completely rationalized (hard) conversion; and the use of brackets around metric values does not indicate as in some AASHTO publications that these are soft conversions. The U.S. customary values are those that would have been used if the policy had been presented exclusively in U.S. customary units; the metric values are those that would have been used had the policy been presented exclusively in metric units. Therefore, the user is advised to work entirely in one system and not attempt to convert directly between the two.

This publication supersedes the 2011 AASHTO publication of the same name. Because the concepts presented cannot be completely covered in this one document, references to additional literature are given at the end of each chapter. These references include works that were cited or consulted in the development of the chapter or are of interest to the discussion of the subject matter therein. Of these documents, only those balloted and published by AASHTO represent AASHTO policy.

The Committee on Design and the Technical Committee on Geometric Design would like to extend a special thank you to Doug Harwood of MRI Global for his technical editing expertise during the development of the seventh edition.

1 New Framework for Geometric Design

1.1 INTRODUCTION

This seventh edition of the *A Policy on Geometric Design of Highways and Streets* incorporates recent research that provides insight into the effect of specific geometric design elements of roads and streets for all transportation modes. This edition of the policy also introduces the consideration of five specific context classifications as an element of the geometric design process and emphasizes the consideration of multimodal needs in design. Together, context classification and functional classification constitute a new framework for geometric design. The policy also encourages flexible design, which emphasizes the role of the planner and designer in determining appropriate design dimensions based on project-specific conditions and existing and future roadway performance more than on meeting specific nominal design criteria. In the past, designers sought to assure good traffic operational and safety performance for the design of specific projects primarily by meeting the dimensional design criteria in this policy. This approach was appropriate in the past because the relationship between design dimensions and future performance was poorly understood. Traditional applications of this policy took the approach that, if the geometric design of a project met or exceeded specific dimensional design criteria, it would be likely to perform well. In some cases, this may have led to overdesign, constructing projects that were more costly than they needed to be or were inappropriate for the roadway context.

Recent research has improved our knowledge of the relationship between geometric design features and traffic operations for all modes of transportation and has developed new knowledge about the relationship of geometric design features to crash frequency and severity. Much of the recently developed information about assessing traffic operations for all transportation modes is presented in the TRB *Highway Capacity Manual* (25), while the recently developed information about estimating future crash frequencies and severities is presented in the AASHTO *Highway Safety Manual* (4, 7).

This edition of the policy introduces new definitions of project types—new construction, reconstruction, and projects on existing roads—and explains how design flexibility is provided for each project type as part of the project development process.

Project development is broader than just geometric design and should consider many factors for all transportation modes, including:

- Project purpose and need
- Existing and expected future traffic operational efficiency
- Existing and expected future crash frequency and severity
- Construction cost
- Future maintenance cost
- Context classification
- Service and ease of use for each transportation mode:
 - automobile
 - bicycle
 - pedestrian
 - transit
 - truck
- Accessibility for persons with disabilities
- Available right-of-way
- Existing and potential future development
- Operational flexibility during future incidents and maintenance activities
- Stakeholder input
- Community goals and plans and potential community impacts
- Historical structures
- Impacts on the natural environment:
 - air quality
 - noise
 - wetlands preservation
 - wildlife and endangered species
- Preservation of archeological artifacts

These factors are not necessarily presented in priority order and, indeed, the priorities placed on them vary from project to project. None of these factors is uniquely important and geometric design should complement other aspects of project development in seeking the appropriate balance among their potential effects.

A 2016 resolution of the AASHTO Standing Committee on Highways (8) has directed that geometric design policy and practice should become more flexible and performance-based to more fully address the needs of all transportation modes and the challenges to transportation agencies created by funding and right-of-way constraints. This AASHTO resolution is consistent with the direction set by Federal legislation in the *Fixing America's Surface Transportation (FAST) Act* (14). This seventh edition of the policy takes a first step toward implementing a new framework for geometric design to accomplish this goal. There was already substantial flexibility in the geometric design guidance presented in previous editions of this policy, and this seventh edition expands that flexibility. This chapter explains how the flexible, performance-based approach should be applied and describes how Chapters 2 through 10, together with other available resources, can be used in implementing the new framework and the performance-based approach for all transportation modes. The next edition of this policy will more fully incorporate this approach, with full implementation of the new framework and the flexible, performance-based approach in each chapter.

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