United States General Accounting Office

GAO

Report to the Chairman, Committee on Environment and Public Works, U.S. Senate

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SCENIC BYWAYS

States' Use of Geometric Design Standards

GAO/RCED-95-243

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

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September 19, 1995

The Honorable John H. Chafee
Chairman, Committee on
Environment and Public Works
United States Senate

Dear Mr. Chairman:

Thirty-six states and two federal agencies have recognized nearly 34,000 miles of roads as scenic byways. These byways provide access to scenic, historic, cultural, archeological, recreational, and natural resources (which we refer to collectively hereafter as scenic resources). Many of these roads were built years ago, often to specifications that fall short of today's recognized geometric design standards governing the physical layout of roads. These standards have been adopted from the American Association of State Highway and Transportation Officials' (AASHTO) guidance, commonly known as the green book. While state highway agencies may use the green book's standards to improve or reconstruct their scenic byways, they could, in so doing, damage the byway's scenic resources because the green book's standards focus on mobility and safety rather than preservation. To help prevent such damage, the Congress, in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), gave state highway agencies the flexibility to apply alternatives to the green book's standards for improving and reconstructing scenic byways. Such alternatives include other national, state, and project-specific standards.

Concerned that state highway agencies may not be taking advantage of the flexibility afforded by ISTEA, you asked us to determine (1) what design standards states use or plan to use to improve and reconstruct roads in scenic areas and (2) what national design standards or guidance is available to states for improving and reconstructing such roads. In addition, at your request, we are providing information on design approaches for reconstructing one scenic byway—Rhode Island's Ministerial Road—to illustrate the trade-offs involved in the choice of design standards. To accomplish our objectives, we gathered information from the 29 states we identified as having or planning to implement a scenic byway program and interviewed officials from 13 of these states. Appendix I contains a more detailed discussion of our scope and methodology.

Results in Brief

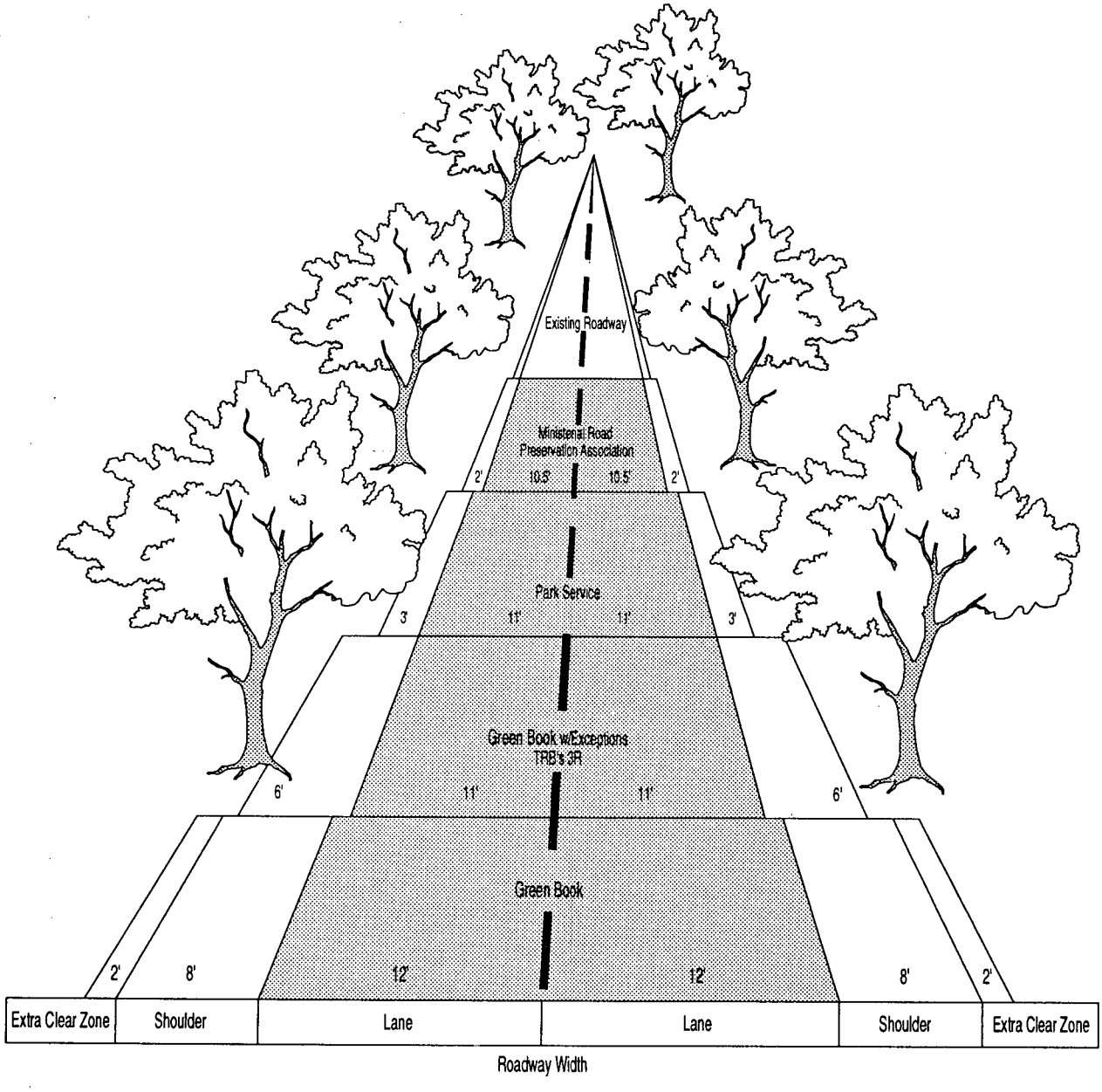
Twenty-four of the 29 states we contacted primarily use the green book as their standard for improving or reconstructing their scenic byways. According to transportation officials from some of these states, the green book, in conjunction with the option to take design exceptions, affords enough flexibility to preserve scenic resources while meeting the states' needs for mobility. States also seemed to rely on the green book, in part, because of concern that they might be sued for a deficient design if an accident occurred on a road that had been designed using an alternative to the nationally recognized green book. The remaining five states, driven by environmental or economic concerns, have developed or are planning to develop their own standards to avoid frequently having to take design exceptions.

Aside from the green book, national guidance on geometric design standards available to the states includes the National Park Service's Park Road Standards and the Transportation Research Board's report on criteria for resurfacing, restoring, and rehabilitating roadways—commonly referred to as 3R criteria.[1] Compared with the green book's standards, the Park Service's standards give higher priority to scenic preservation, while the 3R criteria emphasize preserving the existing roadway, thereby helping to preserve scenic resources. All of these design options cite safety as a primary design objective.

The issues involved in selecting the appropriate design standard for a particular scenic byway are illustrated by the long-standing debate over how to reconstruct Ministerial Road in rural Rhode Island. Differences between the state's Department of Transportation and local preservationists over this road's primary purpose have delayed the selection of a design standard for approximately 14 years. Currently, the road ranges in width from 23 feet to 30 feet. The state, which wants to accommodate anticipated increases in traffic, has proposed designs based on the green book that would widen the road up to 44 feet. The local Ministerial Road Preservation Association, which is concerned about the impact of the state's designs on the road's scenic resources, has proposed a design that would widen the road only slightly. While several design approaches exist, the selection of an appropriate design standard depends on the primary purpose of the road. Figure 1 displays the effect of applying the proposed alternatives on the width of Ministerial Road. For illustrative purposes only, the figure also includes an application of the Park Service's standards and the 3R criteria.

[1]The Transportation Research Board is an independent adviser to the federal government.

Figure 1: Application of Different Design Approaches to Ministerial Road



Note: The Park Road Standards and Transportation Research Board's (TRB) report on 3R criteria do not specify clear zone requirements for roadways. To determine the appropriate clear zone for Ministerial Road, highway designers applying these guidlines would have to consider site-specific conditions.

Background

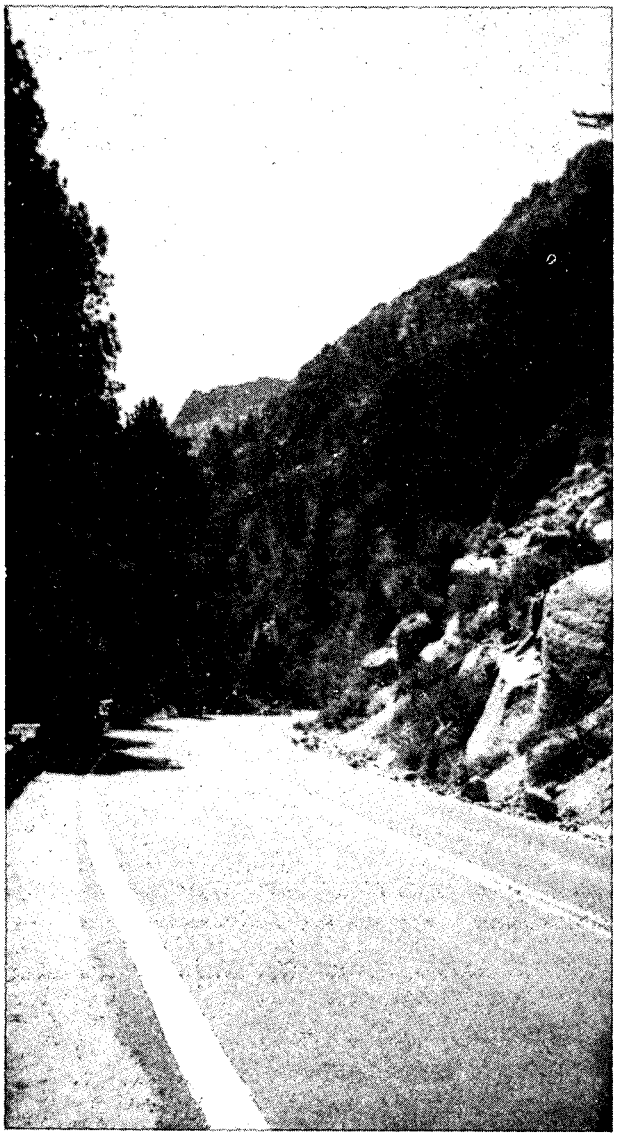
Geometric design standards provide guidelines for constructing or reconstructing the physical layout of a roadway. The Federal Highway Administration (FHWA) and the states recognize AASHTO's guidance entitled A Policy on Geometric Design of Highways and Streets, commonly called the green book, as the appropriate design standard for many of their roads. The primary purpose of the green book is to provide engineers with guidance on how to design roads that ensure the safe and efficient movement of vehicles, people, and goods. The green book recommends ranges for key design criteria, such as the width of travel lanes, to achieve this goal.[2] Freeways, for example, should have at least four travel lanes, each 12 feet wide, while rural, local roads usually have two lanes, ranging in width from 9 to 12 feet. The green book also includes guidance on designing curves.

To increase design flexibility, engineers can take exceptions to the minimum criteria recommended in the green book. To take an exception, they weigh a number of factors, including a road's accident history, the types of vehicles using the road (e.g., recreational vehicles, tour buses, and cars), and the cost and potential environmental impact of implementing the green book's standards. They then document their analysis to justify taking the exception. In addition to the green book, the National Park Service's Park Road Standards (1984) and the Transportation Research Board's (TRB) 3R report—Designing Safer Roads: Practices for Resurfacing, Restoration, and Rehabilitation (Special Report 214, 1987)—provide design options. State-developed standards and project-specific standards can also be used to design roads.

Throughout the country, states have identified many miles of roads as scenic byways. (App. II shows scenic byway mileage, by state.) Most of these scenic byways are two-lane, rural roads that meander through scenic areas. (See fig. 2.) Many of these roads were built before the current green book's standards were adopted and therefore have lower speeds and narrower lanes than roads designed to these standards. Citizens and interest groups are concerned that improving or reconstructing these roads to meet the green book's standards could damage the roads' scenic resources.

[2]The green book's other key criteria are design speed, horizontal alignment (curvature), shoulder width, vertical alignment, stopping sight distance, vertical clearance, horizontal clearance, grade, superelevation, cross-slope, structural capacity, and bridge width.

Figure 2: Examples of Rural, Scenic Roads in the United States



Most States Are Using the Green Book's Design Standards

Twenty-four of the 29 states we contacted use the green book as their primary source of guidance for scenic byway projects. Interviews with officials from eight of these states revealed two primary reasons for relying on the green book: First, according to these officials, it enables them to balance their needs for safety, mobility, and scenic preservation,

and, second, it protects them from claims of deficient design if accidents occur on their roads. Five of the 29 states we contacted have developed or are planning to develop their own standards to help them preserve scenic resources without routinely taking design exceptions. In addition, some states expect that using their own standards will help them lower the cost of reconstructing their roads. (App. III lists the states we contacted and the design standards they plan to use for their scenic byways).

Some State Officials Say the Green Book Is Flexible and Protects Them From Liability

Our interviews with officials from 8 of the 24 states that rely primarily on the green book showed that 6 states use the green book's standards because these standards, combined with the option to take design exceptions, give them enough flexibility to meet their needs. Officials from the other two states said that the green book's standards alone provide sufficient flexibility.

According to officials from the states that take design exceptions, this option allows their engineers to develop less stringent designs than the green book would require. An official from one state explained that the design exception process accommodates certain needs, such as scenic preservation, and allows states to respond to local groups' concerns. For example, by taking exceptions to allow for lower speeds, narrower pavement, and sharper curves, engineers can preserve mature trees and stone walls.

State officials also indicated that concern over tort liability was a primary influence on their decision to use the green book's standards. Seven of the eight officials we interviewed expressed concern that if drivers had accidents on roads that had been built to standards other than those set forth in the nationally recognized green book, the courts would be more likely to find the state negligent for using an inadequate design. As a result, officials from these states were greatly concerned that their payments for tort claims would increase. Officials from four of these eight states were also concerned that the courts would hold design engineers personally liable for negligence if they used alternative standards. Although concerned about potential liability, the states could not quantify the number and value of the tort claims that had arisen from design deficiencies because they do not track such data.

According to legal assessments published in TRB's Legal Research Digest, tort liability is a major concern for state highway agencies. However, these assessments indicate that the risk of liability for geometric design defects

is not as great as for deficiencies in other highway activities, such as maintenance. According to a TRB attorney, most states do not keep data on the number and value of tort claims; therefore, TRB cannot quantify the extent to which claims arise from geometric design defects. As funding becomes available, TRB plans to work with states to develop this type of data.

The officials we interviewed also cited other reasons for using the green book's standards. (See app. IV for the states' reasons.) An Arizona transportation official said, for example, that the state does not have enough staff available to develop separate standards. Officials from other states told us that although they have not needed to improve or reconstruct a scenic byway, they believe the green book's standards are sufficiently flexible to accommodate the reconstruction of scenic byways.

A Few States Use Their Own Standards to Enhance Scenic Preservation and Lower Costs

Five of the 29 states we contacted have developed or are planning to develop alternatives to the green book's standards for their scenic byways. Idaho has implemented its own standards; Colorado, Rhode Island, and Vermont are at various stages of developing standards; and South Carolina plans to develop its own standards.

These states have chosen to develop their own standards rather than frequently take design exceptions to the green book. According to officials from these states, having their own standards will generally make it easier for the states to preserve scenic resources and reduce costs because engineers will not have to repeatedly analyze and document similar design exceptions for each project. In addition, engineers in these states are concerned that taking numerous design exceptions to protect scenery will increase their risk of liability. Several officials anticipate that having a state-approved standard based on typical exceptions will alleviate engineers' concerns that taking design exceptions on a case-by-case basis will increase their risk of liability. This view contrasts with that of officials in other states who believe that relying on the green book's standards and an approved exception process provides adequate protection from liability.

Vermont is drafting standards to increase its design flexibility and reduce the number of design exceptions it takes. State officials found that the green book emphasized mobility and safety more than scenic preservation and did not provide guidance for reconciling these goals when they conflicted. Consequently, to preserve the rural character of its scenic

roads, the state was frequently taking exceptions to the green book's recommendations for design speed and pavement width. Now, as an alternative, Vermont is developing standards incorporating new minimum design criteria, such as design speeds and roadway widths, derived from the exceptions it was routinely using. According to a Vermont official, the state's standards should better preserve scenic resources and minimize the need for design exceptions. This official also anticipates that limiting the number of design exceptions will help alleviate concerns about liability if accidents do occur.

To help preserve its scenic byways and save money, Idaho has implemented state standards that should reduce its need for taking design exceptions. An Idaho transportation official said that the state tried to avoid repeatedly taking design exceptions when reconstructing scenic byways because the courts could perceive roads built under design exceptions as substandard. Accordingly, concern about liability was an important factor for Idaho in deciding to develop its own standards. In addition, the official said that Idaho does not have the financial resources available to reconstruct its scenic byways to the green book's standards. The state's new standards are less stringent than the green book's and the official expects them to better preserve scenic resources and accommodate financial constraints facing the state and local highway districts.

The financial benefits of reconstructing roads to less stringent standards than those contained in the green book were cited in a 1994 TRB study of roads with a low volume of traffic.[3] After assessing 4,100 miles of such two-lane roads in 10 states, TRB found that the roads could be reconstructed using standards that were less stringent than the green book's. More importantly, TRB found that the less stringent standards could save money without compromising safety.

One state, Connecticut, has taken a unique approach in developing an alternative standard for reconstructing a single highway—the Merritt Parkway, located in the southwestern part of the state. Instead of developing a statewide standard for scenic byways or taking design exceptions for this project, Connecticut is developing a project-specific standard to resolve concerns about the impact of using the green book's standards for this parkway. Specifically, state officials and residents alike were concerned that applying the green book's standards to the parkway,

[3]Roadway Widths for Low-Traffic-Volume Roads, TRB, National Cooperative Highway Research Program Report 362 (1994).

which was designed and constructed in the 1930s, would alter its parklike setting, majestic bridges, and scenic landscaping. State transportation officials said that the new standard will allow lower design speeds, narrower pavement widths, and a narrower clear zone than the green book would have required. An official expects this standard will allay concerns about potential increases in the state's risk of tort liability that could have been associated with taking numerous design exceptions to preserve the parkway's scenic resources.

Alternative Design Approaches Help Preserve Road's Scenic Resources

Aside from the green book's standards and state-developed alternatives, other design approaches available to preserve scenic resources include the National Park Service's standards and TRB's 3R criteria. In contrast to the green book, which can require major changes to a roadway's alignment, these alternative approaches allow engineers to preserve the roadway's existing features. Consequently, these alternatives generally allow for narrower roadways and require fewer changes to the roadway's alignment than the green book. In addition, FHWA is sponsoring the development of a companion guide to the green book that would show engineers ways of considering "aesthetic, historic, and cultural values" while using the green book.

National Park Service's Standards Are Aimed at Preserving Scenic Resources

The National Park Service has developed design standards for roads that afford access to scenic resources within national parks. Because these roads are designed to provide a leisurely drive rather than fast and convenient transportation, these standards give higher priority to scenic preservation than to mobility. In contrast to the green book's standards, these generally allow for narrower roadways and call for restrictions on traffic when changes to the roadway's geometry will adversely affect scenic resources. According to the Park Road Standards, "Park Roads are for leisurely driving only. If you are in a hurry, you might do well to take another route now, and come back when you have more time."

The planned reconstruction of the Mather Memorial Parkway in Washington's Mount Rainier National Park illustrates how the Park Service's design standards accommodate scenic preservation. Located in mountainous terrain, this two-lane parkway traverses national forests and Mount Rainier National Park. Its structurally deficient pavement has numerous cracks, warps, and depressions. The Washington State Department of Transportation, in conjunction with FHWA and the U.S. Forest Service, previously reconstructed a section of the parkway outside

the park's boundaries. This section was built using the state's standards, which, according to state officials, are based primarily on the green book. On this section, the state used gradually sloped clear areas that serve as a recovery zone and provide drainage. In a draft environmental assessment, the Park Service found that using similar clear areas to reconstruct the section of the parkway inside the park's boundaries would require extensive excavation, blasting, and the removal of over 6,000 trees—actions that would not be consistent with the Park Service's principal mission of preserving the park's scenic resources. Consequently, the Park Service is recommending the use of more steeply sloping clear areas, which would require the removal of a few hundred trees.

3R Criteria Help Preserve a Roadway's Existing Features

When a highway's pavement deteriorates to the point that routine maintenance (e.g., filling potholes) can no longer keep it serviceable, transportation officials can choose to either reconstruct or repair the road. Full reconstruction may not be justified if major revisions to the roadway's existing alignment are not required or desired to increase the road's capacity. Instead, repairs that generally follow the road's existing design parameters may suffice to extend the life of the pavement. The green book recommends TRB's 3R design criteria for such projects. Unlike the green book, which establishes new design parameters to increase mobility on new or reconstructed roads, the 3R criteria are designed to maintain roads cost-effectively and improve their safety within their existing design parameters. Because the characteristics and condition of roadways differ from one state to another, TRB's 3R report recommends that state highway agencies formulate their own specific criteria for features of their highways, such as the horizontal curvature and clear zone.

Because the 3R criteria are designed for use within an existing roadway, they also serve to preserve scenic resources along that roadway. According to a federal highway official, they are well suited for scenic byway projects because they can be tailored to each state's natural elements (e.g., mountains and trees). Virginia, for example, typically follows the green book's standards for its scenic byways, but it will also apply its own 3R criteria to help protect scenic resources on rural roads with a low volume of traffic. A Virginia transportation official said that 3R criteria help to protect resources such as trees and stone walls.

FHWA Is Developing Additional Design Guidance for Scenic Byways

ISTEA required the Secretary of Transportation to establish an advisory committee on scenic byways. The act required this advisory committee, among other things, to recommend an appropriate design standard for scenic byways. In 1993, the advisory committee reported that the green book's standards were acceptable for designing scenic byway projects, and it encouraged FHWA and the states to apply the standards flexibly.

In line with this recommendation, FHWA has contracted for the development of a companion guide to the green book that will show engineers ways to consider "aesthetic, historic, and cultural values" when designing highways. This guide is intended to be a tool to show state and local highway design engineers how to use the green book's standards flexibly to better preserve scenery along their roads. The guide will include examples of both successful and unsuccessful attempts to balance requirements for mobility and scenic preservation. An FHWA review team, which is helping the contractor develop the guide, includes representatives from state departments of transportation, AASHTO, the Park Service, and scenic and historic preservation groups. FHWA plans to hold classes for federal and state design engineers on the use of the resulting guide. Currently, FHWA plans to complete this project by August 1996.

Debate Over Standards for Rhode Island's Ministerial Road Illustrates Design Trade-Offs

The long-standing debate over the design of Ministerial Road in Rhode Island illustrates the link between agreeing on a road's primary purpose and selecting the appropriate design standards for improving the road. For approximately 14 years, the Rhode Island Department of Transportation and local preservationists have debated the choice of design standards for reconstructing this deteriorated, 6.4-mile road that winds through the Rhode Island countryside, bordered by a scenic canopy of trees. (Fig. 1 illustrates the effects of applying the design alternatives discussed in the following paragraphs.)

The state views Ministerial Road as a regional transportation corridor for travel to and from the University of Rhode Island and local recreation areas. It wants to use the green book's standards as a basis for reconstructing the road to meet anticipated growth in the area's traffic. In 1984, the state proposed a design that was generally consistent with the green book's standards. Under this design, the existing roadway, which ranges in width between 23 and 30 feet, would have been widened to 44 feet.

In contrast, preservationists consider this road a scenic route, primarily serving local traffic. Hence, in their view, reconstruction should not modify the road's layout. They objected to the state's design because it would have destroyed trees, rhododendron, and mountain laurel along the roadway. The state's original proposal would have required the removal of 261 trees. Subsequently, to mitigate damage to vegetation, the state proposed design exceptions to the green book, including ones that would reduce the width of the proposed roadway from 44 to 34 feet. This revised design would preserve 98 of the 261 trees. A state design official said that the agency cannot modify the design any further to preserve scenery without jeopardizing safety.

Preservationists have formed the Ministerial Road Preservation Association and hired a consultant to prepare an alternative design approach. The consultant's proposal calls for reconstructing the pavement to a uniform width of 25 feet. Improvements would be made within the roadway's existing layout and topography. To maintain adequate safety and keep the speed of traffic consistent with the existing alignment, the association proposes traffic-calming measures, such as speed humps and increased signage.

As of July 1995, the state and the preservation association had yet to agree on the primary purpose of Ministerial Road and, hence, on the appropriate design for reconstructing it. However, the state plans to resurface the road within the next year as an interim measure to maintain the existing roadway for approximately 5 years. Both the state and preservationists recognize that the resurfacing project is not a long-term solution. To assist in developing a design for Ministerial Road and the state's other scenic byways, FHWA has provided Rhode Island with $137,600 to develop design standards for scenic byways. Rhode Island transportation officials expect that these standards will be completed by the end of 1995.

Conclusions

As traffic increases and aging roads deteriorate, more states will face decisions about the appropriate design standards to use when improving or reconstructing their roads. Although many design alternatives exist, no one alternative is likely to simultaneously improve mobility, enhance safety, and preserve scenic resources. Given the emphasis on safety in highway design, a state's choice of standards depends on how the state balances the trade-offs between mobility and scenic preservation. If a state determines that a road's primary purpose is to provide mobility rather than a scenic drive, then the green book's standards would be appropriate. If a

state determines that scenic preservation is a higher priority than mobility, then alternatives such as the Park Service's standards, 3R criteria, state standards, or project-specific standards may be viable options.

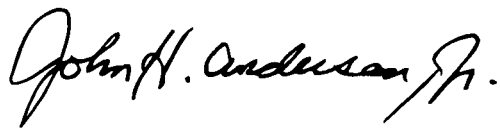
Agency Comments

We provided a draft of this report to the Department of Transportation (DOT) for review and met with DOT officials—including the Chief of the Geometric Design Branch and the Chief of the Environmental Programs Branch of the Federal Highway Administration—to discuss their comments on the draft. These officials generally concurred with the report's findings. However, they were concerned about the draft report's characterization of AASHTO's green book and TRB's 3R report as "standards." They said that although the green book is a recognized source of design guidance for many roads, FHWA requires its use only for roads on the National Highway System.[4] Accordingly, the final report does not refer to the green book's standards as nationally required for all roads. In addition, the officials said that the 3R report is not a standard; rather, it contains recommended criteria for designing projects that require minor repairs or improvements. According to the officials, these criteria are considered standards when the agency or state designing a road has adopted them as standards. Where appropriate, we modified the draft report to clarify the difference between 3R criteria and standards. We also incorporated editorial changes suggested by the agency officials.

We performed our review between October 1994 and July 1995 in accordance with generally accepted government auditing standards.

Please contact me at (202) 512-2834 if you or your staff have any questions. Major contributors to this report are listed in appendix V.

Sincerely yours,



John H. Anderson, Jr.
Director, Transportation and
Telecommunications Issues

[4]The National Highway System is a system of interconnected principal routes that will link significant locations, such as major population centers, ports, airports, and national defense locations throughout the country.

Contents

Figures

Abbreviations

AASHTO	American Association of State and Highway Transportation Officials
FHWA	Federal Highway Administration
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
TRB	Transportation Research Board

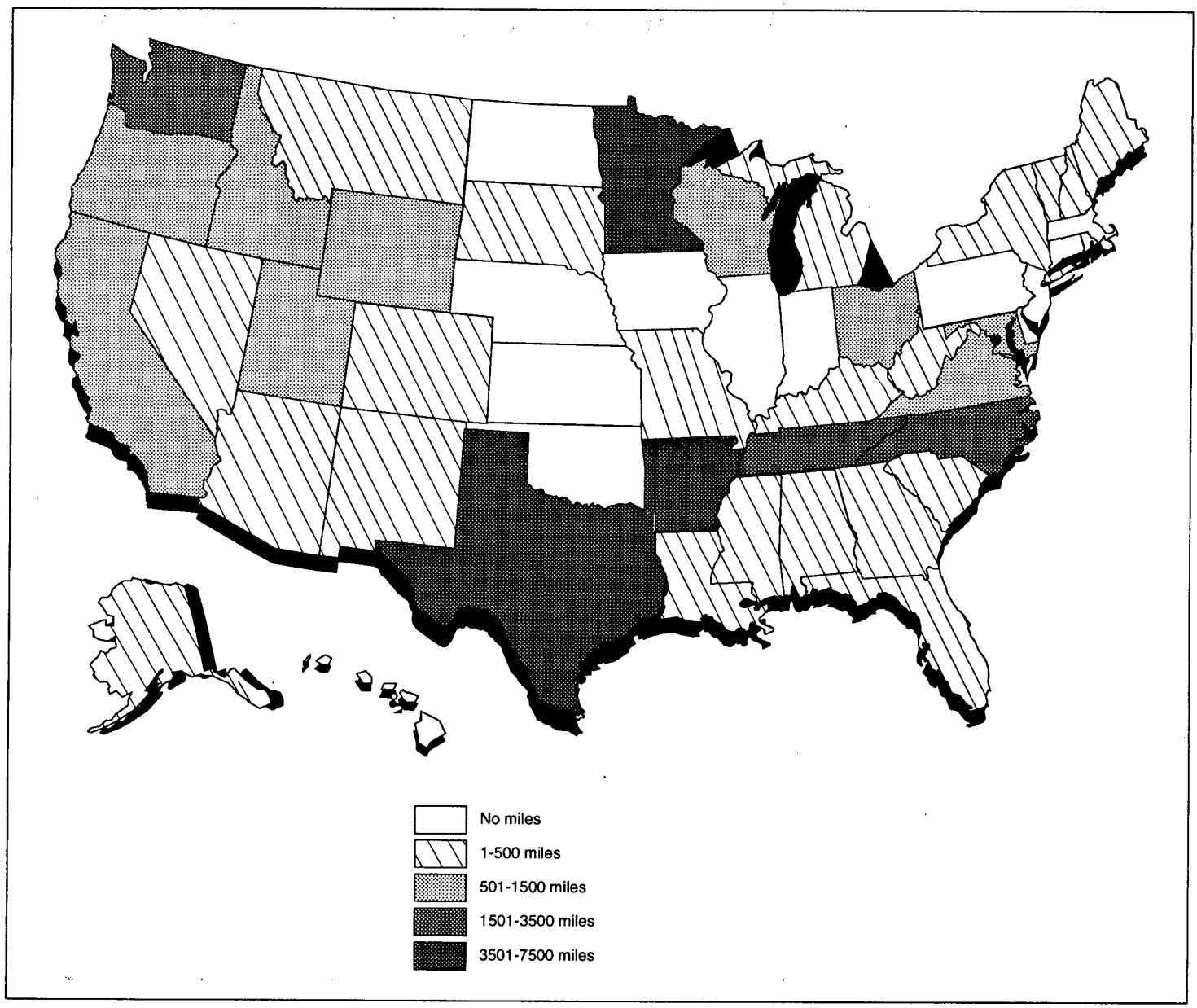
Scope and Methodology

To determine what geometric design standards states primarily use or plan to use to improve or reconstruct their scenic byways, we contacted 29 states identified as having or planning to implement scenic byway programs. These states were identified in a 1990 report from the Federal Highway Administration (FHWA) and a 1994 report from Scenic America, a national scenic preservation group. We then confirmed this information with each state. In addition, we obtained more detailed information from 13 of the 29 states. Specifically, we used a standard series of questions to conduct in-depth interviews with highway transportation officials from 10 of these states, which we selected judgmentally on the basis of (1) the significance of their scenic byway program (including at least 10 scenic byways or 100 miles of scenic byways) and (2) their geographic location. We also contacted officials in three other states that had been identified as using or developing standards other than the green book's. We asked these officials about the factors that had influenced their choice of standards. Finally, we interviewed representatives of and reviewed studies from FHWA, the American Association of State Highway and Transportation Officials (AASHTO), the Transportation Research Board (TRB) and national scenic and historic preservation groups, such as Scenic America, to obtain their perspectives on design standards for scenic byways.

To identify alternative design standards or guidance for highways in scenic areas, we interviewed officials from AASHTO and the National Park Service. In addition, we obtained the Park Service's Park Road Standards, TRB's 3R report (Special Report 214), and draft and final standards from the three states that had such standards. We also obtained project-specific design approaches for projects in Connecticut and Rhode Island. Finally, we interviewed FHWA officials responsible for monitoring the contract for developing guidance on how to use the green book's standards flexibly to better preserve scenery along roads.

To obtain information on design approaches for reconstructing Rhode Island's Ministerial Road, we contacted officials from FHWA's Rhode Island Division Office, the Ministerial Road Preservation Association, and several Rhode Island offices, including the Department of Transportation, the Department of Environmental Management, the Historic Preservation and Heritage Commission, and the Department of Administration-Office of Systems Planning. We reviewed project files at the state and federal highway offices. Finally, we reviewed the Park Service's standards and TRB's 3R report.

Scenic Byway Mileage, by State, 1990



Note: The most recent year for which FHWA has information on roads that states recognize as having scenic characteristics is 1990. FHWA is currently updating this information.

Source: FHWA.

Standards States Will Primarily Use for Scenic Byways

State	Green book	Other
Arizona	X	
California	X	
Colorado[a]		X
Connecticut[b]	X	
Georgia	X	
Idaho[a]		X
Illinois	X	
Kansas	X	
Kentucky	X	
Louisiana	X	
Maine	X	
Maryland	X	
Massachusetts	X	
Minnesota	X	
New Hampshire	X	
New York	X	
North Carolina	X	
Nevada	X	
Oregon	X	
Pennsylvania	X	
Rhode Island		X
South Carolina		X
South Dakota	X	
Utah	X	
Vermont		X
Virginia	X	
Washington	X	
West Virginia	X	
Wyoming	X	
Total	**24**	**5**

[a]Colorado and Idaho will have standards that can be used for all their roads, not only their scenic byways.

[b]Connecticut relies primarily on the green book's standards; however, it is working with FHWA to develop standards for a single road, the Merritt Parkway.

Reasons for States' Choice of Standards

Reason	States using the green book's standards	States using their own standards
Green book's standards provide sufficient flexibility	8	
State was concerned about liability	7	
State has not had to improve or reconstruct scenic byways	5	
State engineers were concerned about personal liability	4	
Developing own standards takes too much time	3	
Mobility and safety are higher priorities than scenic preservation	3	
Developing own standards costs too much	1	
Scenic resources are easier to preserve		5
State did not want to be found liable for taking design exceptions		5
State wanted to keep costs of projects low		2

Note: The number of responses exceeds the number of states interviewed (13) because the states provided all applicable reasons for their choice of standards.

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