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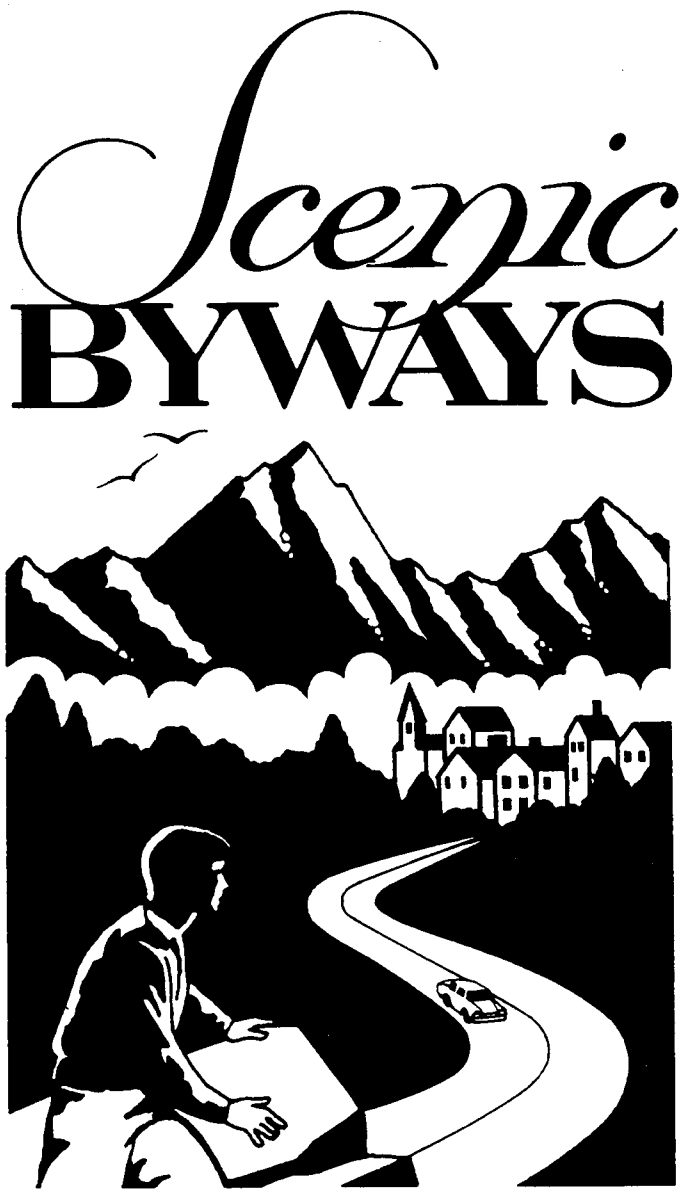
Final Case Study for the National Scenic Byways Study

Safety Impacts, Design Standards and Classification Systems for Scenic Byways



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NOTICE

Final Case Study

for the

National Scenic Byways Study

SAFETY IMPACTS, DESIGN STANDARDS and CLASSIFICATION SYSTEMS FOR SCENIC BYWAYS

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Prepared for

The Federal Highway Administration

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1. INTRODUCTION

In ever-increasing numbers, people of all ages are taking to America's highways for recreation and leisure enjoyment. These activities range from a "Sunday drive in the country", to a "weekend get-a-way", to a "grand cross-country tour". They travel mostly in the family car, but frequently on bicycle, motorcycle, campers and oversized motor homes and tour buses. Some 15 percent of all vehicle miles driven is for pleasure driving.

People seek views of the Nation's diverse scenery and of its historic and cultural treasures. These opportunities are being provided through what has become known as "Scenic Byways". Both labels and definitions vary. Some prefer distinctions made among scenic, historic, cultural, etc. for the label prefix and some prefer road or highway to the byway term. The label "The American Road" was suggested by an attendee at the National Scenic Byways Workshop held on July 11-12, 1990 in Washington D.C.

A definition offered in Scenic Byways (1) is:

> " A scenic road or byway is a road having roadsides or corridors of high natural beauty and cultural or historic value. It gives the traveler glimpses of nature, history, geology, landscaping, and cultural activities along the road. Campgrounds, picnic areas, or other recreational sites may be built within the scenic corridor, or the road may provide a pleasant access to such facilities."

Scenic road programs have been in existence for some time in one form or another. A number of states have implemented programs for scenic roads under different names such as scenic highways, scenic byways, scenic backways, rustic roads, etc. Most of the roads within the National Park System are considered scenic roads by their setting, design, operation and maintenance. The U.S. Forest Service also has implemented a scenic byways program that includes roads in the Forest Highway System which are under state and local jurisdictions, and forest development roads which are under the Forest Service's jurisdiction. Basically, the goal of all such programs is to preserve and promote the scenic quality of roads. The concept of a national scenic road program was first discussed in 1962 by the Recreational Advisory Council established under Executive Order 11017, and subsequently in 1964, the council issued a policy statement recommending such a national program of scenic roads and parkways be developed. With the issuance of the Report of the President's Commission on

Americans Outdoors (2), renewed interest has been created in a nationwide scenic road program that would include qualifying road segments from all public roads. This report describes the many benefits that would result from such a program. Among the recommendations from this report are:

- local and state government participation in creating a network of scenic byways,
- the establishment of an incentive program by the Congress which would provide matching grants to local and state governments to encourage scenic byways designations, and
- the dissemination of information on scenic byways through private and public sector partnerships.

All existing roads under different jurisdictions are eligible for such designation provided they meet certain qualifying criteria. These criteria, which now vary among those states and Federal agencies that have adopted formal programs, relate mostly to the quality and significance of the scenery, historical and cultural features but also consider factors such as development controls, local support, and the physical characteristics of the road to include provisions for motorist safety. These roads could range in type of facility from freeways and expressways to single-lane unpaved roads.

By designating certain roads as scenic or historical, public agencies (Federal, State and local government) are inviting, even enticing the motoring public onto these roads. The users are likely to be unfamiliar with the road and are likely to be traveling slower and in larger sized vehicles. Therefore, in order for the program to carryout its objective successfully, it is necessary to assess the implications of designation from an engineering and design perspective and identify mitigating measures to minimize such impacts. Therefore, concerns regarding the level of safety provided by the roadside features may even require incorporating some minimum safety standards into scenic road eligibility criteria. The goal of this paper is to address these issues and concerns. It is accomplished through the following objectives:

- To develop alternative classification systems for scenic roads.
- To assess the impacts of designation as a scenic road.
- To consider minimum design standards required for safety on scenic roads.
- To suggest scenic road eligibility criteria related to safety.

2. CLASSIFICATION SYSTEMS FOR SCENIC & RECREATIONAL ROUTES

2.1 Purpose and Rationale

The necessity for a classification system for scenic roads arises out of three primary needs. First, the proposed classification should provide sufficient information to the scenic and recreational traveler on:

- The type of roadway and support facilities to be expected.
- Level of safety provided by the scenic road.

This could be accomplished through indication of the scenic classification on maps and brochures.

Next, it should reflect travel and roadway characteristics unique to each class as far as possible. This would render the classification useful for transportation planning activities, similar to the role played by a functional classification for highways. Lastly, a classification should provide a sufficient framework within which minimum design standards can be specified for safety, operation and maintenance.

A classification would also prove useful for assessment of the impact of designating an existing road as a scenic road. By definition, a functional classification would define classes of highways by the character of service they provide. For example, the functional classification for highways developed by the American Association for State Highway and Transportation Officials (AASHTO) (3) is based on the degree of land access and mobility provided by the facility for all trip purposes. An examination of the role of scenic routes indicate some similarity in the characteristics of service provided by the scenic role of the road. However, most roads that would qualify for a scenic roads program would continue to provide service for all trip purposes in their current role. The distributions of the type of trip purposes, users and vehicles would depend on the specific location. Appropriate classification systems for scenic roads may be based on any or all of the purposes stated above.

2.2 Existing Functional Classification Systems

The following sections describe the existing functional classification systems for public road systems by jurisdiction or agency responsible for each system. For purposes of assessing the impact of scenic road designation, a functional classification has been described for those road systems which do not have one. These have been defined based on the predominant travel purpose served by the road.

2.2.1 State and Local Road Systems

All roads and highways owned and operated by state and local public agencies fall within the functional classification defined by AASHTO. These include all Federal-Aid highways with a mileage of approximately 843,000 miles. This classification is based on the character of service intended to be provided by each class of highways. Factors defining the functionality of a highway are land access and mobility.

This classification defines four primary functional classes as follows:

- Urban and Rural Principal Arterial System.
- Urban and Rural Minor Arterial System.
- Collector Road System.
- Local Road System.

2.2.2 National Park Service Roads

This classification is used for all park roads and parkways within the National Park System. These roads account for 7,975 miles. The three main classes of park roads -- Public Use, Administrative and Urban roads -- are further divided into sub-classes as follows:

Public Use Park Roads

Class I:	Principal Park Road / Rural Parkway
Class II:	Connector Park Road
Class III:	Special Purpose Park Road
Class IV:	Primitive Park Road

Administrative Park Roads

Class V: Administrative Access Road

Class VI Restricted Road

Urban Parkways and City Streets

Class VII: Urban Parkway

Class VIII: City Street

Only the first and third categories of park roads are open for unrestricted public use.

2.2.3 U.S. Forest Service Roads

The forest development road (FDR) system consists of 344,000 miles of roadway. These are either two-lane or single-lane roads designed to provide access within the National Forest System. The FDR system is made up of many types of roads which are classified into three functional classes. They are arterial roads which constitute about five percent of the system, collector roads which constitute about 20 percent of the mileage in the system, and local roads which are single lane roads with minimum standards. Arterial roads are generally two-lane paved and can handle unrestricted traffic at moderate speeds. Collector roads have median standards with either minimum two lanes or one lane with turnouts, and carry mixed, timber and recreation traffic during normal season.

2.2.4 Bureau of Indian Affairs (BIA) Roads

Roads within the jurisdiction of the BIA account for nearly 21,000 miles of federally owned roads. More than half of these roads are low volume, two-lane roads with unimproved surface. There are only two classes of roads; Urban or Rural Roads and Special Purpose Roads. The Special Purpose Roads are those roads that provide access to logging, fishing and dump areas. All other roads fall within the first classification.

2.2.5 Bureau of Land Management (BLM) Roads

BLM is responsible for the 67,000 mile public land development road system. Of this 51,000 miles are one lane roads with unimproved surface, and 16,000 miles are aggregate or paved roads. Three functional classes exist for these roads: 1)Collector roads, 2)Local roads, and 3)Resource roads. The design and maintenance standards for the public land development road system is similar to the previously described forest development road system.

2.3 Alternative Classification Systems for Scenic Roads

Four alternate classification systems are presented in this section.

2.3.1 Classification System Based on Design, Safety and Operational Elements

The first classification system proposed for scenic roads groups the roads depending on their design elements, safety features, operating conditions and the level of support facilities available. This classification attempts to address all three primary purposes identified earlier. A system with five scenic route categories is suggested. Identified by letters A through E, this classification would give an indication of the type of service provided by the road for activities related to scenic and recreational travel. The five scenic road categories proposed would include the entire spectrum of roads that would be included in the program.

Category A: Roads in this category would be urban and rural principal arterials, and would consist of all interstate, freeway and expressway type facilities with full control of access. These scenic roads would accommodate activities such as scenic drives, scenic overlooks etc., while maintaining the minimum design standards required on such highway facilities. These roads are not likely to provide direct access to other outdoor recreational activities such as camping, hiking, and boat launching.

Category B: These scenic roads would consist of urban and rural principal arterials with partial control of access, parkways and principal park roads. They would typically be roads with two or more lanes and design speeds exceeding 45 miles per hour.

Category C: This category of scenic roads would include all urban and rural minor arterials and major collectors with no control of access. All urban and rural roads under the jurisdiction of the Bureau of Indian Affairs would also be included in this category. Typically, category C roads would consist of two-lane paved roads with design speeds of 40 miles per hour or greater. Most state primary routes would be classified in this category. Most of the scenic road mileage is likely to be on two-lane roads. The inventory conducted for the 1990 National Scenic Byways Study indicated that over 80 percent of all scenic roads are two-lane roads.

Category D: These scenic roads would include all state secondary routes, urban and rural local roads. Most scenic roads within the jurisdiction of Forest Service, BIA and BLM would also be included in this category. Typically, they would have two-lanes with design speeds of 50 miles per hour on level terrain and 30 miles per hour on mountain terrain. The pavement of category D roads would be intermediate type bituminous or treated surfaces with little or no shoulder.

Category E: These scenic roads would include Primitive Park Roads in the National Park Service, Local Roads in the Forest Development Road System, Special Purpose Roads on the Indian Reservation Road System, and Local and Resource Roads on the Federal Lands Development Roads. It would also include state and local roads similar to those in Wisconsin's Rustic Roads Program. In general, all these roads would have the lowest design standards among all public roads. They would typically have one or two lanes of gravel or natural graded surface and no shoulders. The design speeds could be as low as 10 miles per hour. The visitors on these roads would be advised to expect a degree of difficulty with respect to driving on such roadways and the availability of amenities. Category E scenic roads would provide access, though difficult at places, to locations of most interesting and diverse outdoor experience. Activities such as cycling and hiking could also be expected on these roads.

Table 1 shows the different existing functional classifications and their relationship to this primary classification system.

2.3.2 Classification Systems Based on Driver Expectancy

Three alternative classification systems based on driver expectancy or the level of expectation can be suggested. At the July 1990, workshop on scenic byways, a number of participants expressed the

opinion that a classification system based on engineering and safety expectations of road users may also be appropriate for scenic roads. The classification systems suggested here would also address these comments. All these classification systems would serve only the first purpose identified earlier, which is to provide information to the user on type of roadway, support facilities and the level of safety provided by the road. Each of the suggested systems classify scenic roads based on different levels of motorist expectations with respect to engineering, traffic and safety characteristics.

Table 1. Scenic Byway Classification System Based on Existing Functional Classifications

Scenic Route Category	AASHTO	National Park Service	U.S. Forest Service	Bureau of Indian Affairs	Bureau of Land Management
A	Urban/Rural Principal Arterials with full control of access				
B	Urban/Rural Principal Arterials with partial control access	Urban/Rural Parkway Principal Park Road			
C	Urban/Rural Minor Arterials	Connector Park Road	Arterial Roads	Urban/Rural Roads	
D	Urban/Rural Collectors, Local Roads	City Street, Special Purpose Park Roads	Collector Roads	Rural Roads	Collector Roads
E		Primitive Park Roads	Local Roads	Special Purpose Roads	Local Roads Resource Roads

Driver Expectancy

Driver Expectancy is defined as drivers readiness to respond to situations, events, and information in predictable and successful ways. Driver expectancy manifests itself at three levels:

1. Control Level -- At this level the expectancies are mainly related to vehicle handling characteristics.

2. Guidance Level -- At the Guidance Level the expectancies are related to highway design and traffic operations. They also affect how a driver negotiates a curve, responds to traffic, selects a safe path, perceives hazards and avoids them.

3. Navigation Level -- At this level the expectancies relate to driver's trip plans, use of route markers and guide signs, selection of interchanges, streets and intersections. They also affect route choice and in- trip route diversion decisions.

Long and Short Term Expectancies

Driver expectancies that guide decision making during the driving task belong to one of two groups depending on how these expectancies are formed. The first group consists of long term expectancies. These expectancies can be described as rules of thumb or heuristics that drivers have acquired, based on past experience and learning, which are useful in the decision making process related to the task of driving. The other consists of short term expectancies which are formulated by the drivers from site specific conditions encountered in-transit.

Road Classification Based on Driver Expectancy

The classification systems suggested here are based primarily on long term expectancies. These expectancies are the most reinforced with very few violations experienced. Driver expectancies influence scenic and recreational travel during initial trip planning and route selection stage as well as during actual travel. Therefore, the following described classification systems are developed such that driver expectancy violations are minimized during all stages of decision making related to scenic travel.

Answers and information related to some basic questions on trip planning were used as a framework to define what these systems must provide. One of the first questions answered or decisions made by a would be scenic and recreational traveller is what type of vehicle such as large camper, mobile home, 4-wheel drive vehicle etc., will be used for travel. The answer would restrict the routes to those suitable for travel by the selected or available vehicle and would also have a bearing on the

ease of the driving task. Conversely, if the route is pre-selected based on desired destination or activity, a suitable vehicle may be selected based on the physical conditions likely to be encountered while travelling.

The second likely question or decision would be which route is selected, given a wide choice of routes. This decision is made based on information available on:

- expected average speed of travel;
- availability and access to supporting and complimentary facilities;
- length of route;
- difficulty or ease of the driving task on the selected route; and,
- expected level of safety.

In order to make a decision on route selection, the traveller would also seek information that would give an indication of physical features and the operation of the road. Most of this information would be obtained from maps and other available literature. Information would also be deduced based on the driver's level of expectation for certain features on different classes of routes. These are features such as:

- access control;
- number of lanes;
- type of traffic control;
- the frequency of signs and markings;
- interchanges, intersections;
- presence or absence of median;
- availability of rest areas, tourist information centers;
- type of road surface (an indication of smoothness of the riding surface); and,
- alignment (both horizontal and vertical).

The following are some of the key road elements and associated driver expectancies:

- alignment - the frequency and sharpness of road curve and grades affect driver expectancies regarding speed, degree of attention to driving, warning signs.

- width - lane or roadway width also has an effect on driver's attention and level of safety expected.

- pavement - the type and condition of pavement has associated expectancies regarding safe speeds and signs. On unpaved roads motorists expect low traffic volumes, slow speeds and no warning signs.

- signs and markings - upon entering a road with signs and markings, a driver expectancy is established for a continuation of similar features.

The suggested classification systems attempt to categorize scenic roads in a manner that would be consistent with all driver expectancies discussed above. Driver expectancy violations may also be minimized by using familiar terminology to describe each class of scenic road. This would be done such that the physical characteristics and traffic operations on any class or category of scenic roads would closely resemble similar features on corresponding highways.

The first alternative classification system is shown in Table 2. This classification utilizes terminology with which most users have some familiarity and as a result, have associated long term expectancies.

Table 2. Scenic Byway Classification System Based on Road Designation

Class	Description
1	Interstate Routes or Freeways
2	US Primary Routes
3	State Primary
4	State Secondary
5	County Roads
6	Local Roads and Streets
7	Rustic Roads and Backways

It is also suggested that comparable terminology used by the individual jurisdiction be used for scenic roads within such jurisdiction in order to avoid confusing the driver by introducing a new classification terminology. The resulting scenic classification is obtained by simply adding the prefix "scenic" to current classification terminology that is presently used together with the addition of the last category of roads which may not be included in an existing classification. This last category of roads may be described as Scenic Backways or some similar terminology currently in use by the agency responsible for these roads. These roads may have certain restrictions imposed on vehicles due to difficult terrain and substandard engineering and safety features.

Another appropriate classification system would be one based purely on the type of highway facility and number of lanes. Such a classification system is shown in Table 3. This classification would give an indication of the type of facility and the number of lanes.

Table 3. Scenic Byway Classification Based on Roadway Type

Class	Description
1	Multi-lane Divided Routes
2	Multi-lane Undivided Routes
3	2-lane Primary Routes
4	2-lane Secondary Routes
5	2-lane Unimproved Routes
6	Rustic Roads and Backways

The third alternative classification system suggested is one based on four factors related to driver expectation. These factors are:

- Average Speed.
- Vehicle Restrictions.
- Availability of Signs and Markings.
- Type of Pavement Surface.
- Standard of Roadside Safety Features.

The first factor, average speed would also take into account other road characteristics such as alignment, grades, lane widths etc. Information on vehicle restrictions give a clear indication of the level of difficulty to be expected on routes so signed or designated. The level of signs, markings and roadside safety features would give an indication of these features with reference to some standard criteria. The type of pavement surface would indicate the quality of the riding surface. Table 4 below shows how each of these factors are related to the suggested classification system.

Table 4. Scenic Byway Classification Based on Driver Expectation of Major Road Features

Class	Average Speed (MPH)	Vehicle Restrictions	Standard Signs & Markings	Pavement Surface	Level of Safety Features
1	>50	None	Yes	Paved	High
2	40-50	None	Yes	Paved	Medium to High
3	30-40	Possible	Variable	Variable	Variable
4	<30	Likely	Not Likely	Variable	Mostly Sub-standard

3. GENERALIZED IMPACTS DUE TO DESIGNATION AS A SCENIC AND RECREATIONAL ROUTE

The designation of a highway as a scenic road may attract more tourist and recreational traffic than prior to such designation. The magnitude of this increase in traffic will depend to a large extent on:

- The existence of parallel routes from which tourist traffic may be attracted;
- The location of the route with reference to large urban population centers; and,
- The current level of publicity given to the scenic and recreational aspects of the route (such as existing scenic programs or scenic routes designated by the American Automobile Association (AAA) or other similar traveler clubs).

An increase in traffic on designated roads is likely to result in impacts related to safety and engineering that would depend on many factors ranging from the type of highway facility to driver and vehicle characteristics. The most significant factor is the existing condition and operation of the highway. Many states have implemented scenic road programs and have designated scenic roads. Since these roads already function as scenic roads, their designation in a national program is likely to have a minimal impact. The greatest impact will be felt by those roads that are not part of any scenic or recreational road program at present. These roads are likely to attract more traffic through publicity gained as a result of the program. The ability of a designated road to handle the additional traffic and possibly different vehicle types with the existing design and operational features will determine the extent of impact. For example, designating a freeway segment as a scenic road is likely to have minimal impact for the following reasons:

1. Freeways have the best physical features and highest safety standards;
2. Freeway operation is not likely to be affected, mainly due to restrictions on permissible traffic operations; and,
3. Due to higher maintenance standards, freeways can handle the extra demand created by designation.

At the other extreme are roads with the lowest level of design and operational features, such as rustic roads and scenic backways designated by some states, and the federal land management agencies. The increase in traffic on these roads, in general, is not likely to be significant if proper restrictions are placed on vehicle types allowed to use the facility. Nevertheless, any sudden growth

of traffic on these roads could significantly impact operations, safety and maintenance without commensurate improvements and maintenance investments.

The mid-range of highway facilities, such as two-lane rural highways, are likely to experience the highest impact. Most of the scenic road mileage would also occur on these roads.

The road user characteristics are an important factor to consider when assessing traffic impacts brought about by designating scenic byways. Changes would most likely be brought about as a result of increases in:

- Older drivers -- Since a large percentage older drivers are retired they have more leisure time and therefore represent a significant percentage of users of scenic roads. It has been shown that older drivers are over-represented in accident statistics.

- Unfamiliar drivers -- A large percentage of scenic road users will be unfamiliar with the road and, therefore, will rely on information systems, i.e. signs and markings, for guidance and warnings of potentially hazardous situations.

- Distracted and inattentive drivers -- The scenic vistas and historical or cultural sites will themselves be a source of distraction to the drivers making them inattentive to the driving task.

- Recreational vehicles and tour buses -- Larger size recreational vehicles and buses can be 102 inches wide and 40 feet or longer which can present problems for even standard width two lane roads. They also have lower performance characteristics which is problematic on mountainous terrain.

- Bicycle activity -- Bicycle usage is usually heavier on scenic roads. Conflicts with motor vehicles occur when a separate travel lane or separated bikeway is not provided.

- Pedestrian and hiking activity -- As motorists leave their vehicles and become pedestrians, vehicle conflict situations will occur.

Changes would also occur in roadside land use due to tourist related recreational and commercial activities. This would result in increased turning movements to and from pulloffs, intersecting roads, and driveways, unless controlled. The following assessment of the impacts show their relationship to traffic safety, traffic operation, facility maintenance and the availability of complementary facilities.

3.1 Safety Impacts

The increase in recreational travel activity on designated scenic roads is likely to result in safety impacts on all such roads. The level of impact would depend on the ability of the physical features of the road to handle such activities without compromising existing levels of safety. These impacts and their causes are discussed and appropriate mitigating measures are suggested below.

Speed Differences: Large variations in vehicle stream speeds is known to be a factor in accidents. Hence an increase in speed differences likely to be caused by slow moving tourist vehicles would increase accident risk. This effect can be mitigated by creating a driver expectancy or an awareness among all drivers of the presence of slower vehicles. This can be accomplished through signs and warning messages placed at appropriate locations. On facilities with higher operating speeds and on steep upgrades consideration may be given to providing an additional lane for slower traffic.

Unauthorized parking on the roadside creates a safety hazard specially at locations with minimum or no shoulder width. To minimize such impacts it is necessary to provide emergency pullover locations with adequate signing on roads with minimum or no shoulder. Arrangements for prompt emergency towing services for disabled vehicles on narrow roadways would also minimize delay and accident risks.

Signs: Due to the increased proportion of older drivers in the driver population, brighter and larger signs may be required on these roads to compensate for increased reaction times and reduced legibility. Also, the fact that many of the scenic road users will be unfamiliar with the road, they will place greater reliance on signs for directions, destinations, and warnings. For the lower class of scenic roads which would have a high concentration of restricted width sections, steep grades and winding sections and other potentially hazardous situations, this would represent a safety impact if the appropriate signing and other guidance and delineation systems were not installed.

Also, there is likely to be increased pressure for tourist oriented directional signs (TODS) which are defined in the Manual on Uniform Traffic Control Devices.(4) When TODS signs are overused, sign proliferation occurs making it more difficult for directional, control and warning signs to be noticed by the motorist. Strict controls by the operating agency will be required to preclude this safety impact.

The conflicts between through and tourist traffic at entrances and exits of roadside attractions are likely to require additional signs and traffic control measures. Mitigating measures include location of entry and exit points to parking and other areas with adequate sight distance, and provide sidewalk space with properly signed and marked crosswalks.

Clear Zone: The concept of providing a clear zone beyond the edge of traveled way is to allow sufficient maneuvering room for errant vehicles to recover. The width of this zone is related to speed, traffic volume and embankment slope. On freeways and rural arterials the available clear zone meets AASHTO requirements. For low-speed rural collectors and local roads a minimum clear zone of 10 feet is specified by AASHTO. On comparable park roads, these AASHTO requirements for clear zones are not provided. This is a clear conflict between AASHTO specifications and Park Road Standards on perceived safety provided by clear zones.

Barriers: The adequacy of existing curbs and guardrail as safety devices for the protection of pedestrians and vehicles need to be evaluated. At locations of high pedestrian activity the exposure of pedestrians to traffic may need to be minimized through the provision of curbs and barriers. AASHTO criteria requires the installation of barriers where adequate clear zones cannot be provided. On Park Roads, the criteria for the requirement of barriers is essentially an assessment of the presence of unusual danger, which is subjective except in an obvious case. Any criteria to determine such needs on the different types of roads results in the issue of what is adequate safety for a roadway.

Pedestrians: On routes where hiking and biking activities are permitted, the interaction of these activities with traffic must be minimized. This may be accomplished through the physical separation of these activities from the travelled way by locating paths and trails sufficiently away from the road. Where such activities are permitted on the shoulder, minimum shoulder widths should be provided.

Emergency Vehicles: With an increase in visitors expected on designated scenic routes adequate access for emergency vehicles should be considered. As a mitigating measure, feasible access routes for police, medical and fire emergency vehicles may be identified.

Grades: On steep down grades where escape ramps are not provided at present, it may be necessary to provide escape ramps to decelerate heavy vehicles which may lose braking ability and endanger other traffic.

Curves: The safety hazard posed by the presence of sharp curves with inadequate sight distances on designated routes may be addressed in one of two ways. The first is to improve the curve to provide sufficient sight distance as specified by AASHTO standards. Where it is not possible to do so, safety may be maintained by reducing approach speed limits, and by adding curve warning signs and delineation devices for positive guidance.

Vehicle Restrictions: On rough terrain certain recreational vehicle categories may not meet operational requirements. The operation of such vehicles may be hazardous on routes with particularly difficult alignment. Certain restrictions on vehicle type should be well publicized, properly signed and enforced.

Structures: The inability of existing highway structures to carry additional traffic load created by designation or the inadequacy of clearances at structures may need to be investigated even prior to designation of the road as a scenic route. The mitigating measures available for such impacts are limited. Either the structure must be replaced or rehabilitated as needed. If such action is not feasible, it may be necessary to seek short detours, enforce vehicle restrictions or consider the immediate segment of road ineligible for scenic road classification. In the case of inadequate horizontal clearances, the primary alternatives are to increase clearances at structures, reduce speed limits on approaches and provide positive guidance measures.

Railroad Crossings: Due to increased traffic volumes at these locations, protection devices may need to be upgraded.

Liability: The possibilities for highway safety related tort liability on designated scenic routes needs to be studied further. A long term research effort including data collection would serve a valuable purpose for a continuing scenic byway program.

3.2 Operational Impacts

Delay and Congestion: Increased delays and congestion could occur due to increased traffic on newly designated scenic routes. Table 5 shows an example of the likely effects.
Some of the mitigating measures would be to:

- Encourage high occupancy vehicles such as tour buses, shuttle services;
- Encourage visits during off-peak times;
- Implement traffic system management measures; and,
- Increase the capacity of roadway.

Parking: The increase in visitors to sites of attraction could result in parking inadequacies. Possible mitigating measures are:

- Increase parking space at site;
- Add larger spaces for tour buses;
- Limit parking time; and,
- Restrict roadside developments that create parking demand.

Traffic Control Devices: Due to increased traffic control needs created by larger volumes, additional signs, signals and pavement markings would be required.

Enforcement: Additional personnel may be required for enforcement of reduced speed limits, vehicle restrictions and parking restrictions.

Signs: Additional directional and guidance signs may be required to direct tourist traffic to information centers, rest areas and picnic areas.

3.3 Maintenance Impacts

Increased physical deterioration of pavement and shoulders is likely due to increased traffic, which would include recreational vehicles and buses. Additional maintenance would also be required for the new signs, signals and markings. Maintenance of new tourist information centers, rest areas and picnic areas would also be a responsibility of the highway operating agency.

Table 5. Traffic Congestion Due to Tourist Activities.

Tourist Traffic	Normal Traffic: Low	Normal Traffic: Medium	Normal Traffic: High
Low	Congestion very unlikely	Congestion likely	Congestion possible
Medium	Congestion unlikely	Congestion possible	Congestion likely
High	Congestion possible	Congestion possible	Congestion highly probable

Assumptions

Normal traffic classifications:

Low-10% of ADT (one-way) <50% of effective capacity at level of service E

Medium-10% of ADT ≥50% <90% of effective capacity

High-10% of ADT ≥90% of effective capacity

Tourist traffic classifications:

Low-<750 tourist autos per average day in peak month (about 350,000 annual tourists)

Medium-≥750 <2250 tourist auto (350,000 to 1,000,000 annual tourists)

High-≥2250 tourist autos (over 1,000,000 annual tourists)

Maximum tourist automobiles using streets at peak hour - 20%

Maximum tourist automobiles on any one access route - 50%

Source: Tourist Traffic in Small Historic Cities
U.S. DOT Report No. DOT-TST-77-2, 1976

Pavement and Structures: Additional maintenance would be required for highway structures due to increased traffic. At some locations it may be necessary to impose restrictions on heavy and larger vehicles to prevent excessive damage to road surface and structures.

Maintenance of traffic control devices is extremely important from a liability aspect. Court decisions on tort liability suggest that failure to know that a device is defective does not reduce the agency liability unless there is a reasonable on-going program to uncover and correct ineffective devices.

4. IMPACT ON ROAD DESIGN ELEMENTS

4.1 Design Speed

The design speed for a highway is determined based on many factors. Primarily it is based on the type of function the highway is expected to provide. Other considerations such as the average trip length and terrain also determine the appropriate design speed. The characteristics of scenic travel does not require any minimum design speed provided sufficient consideration has been given to safety requirements. However, where a scenic road carries non-recreational through traffic, the primary function of the road would determine design speed requirements.

4.2 Vertical Alignment

Curves: The two types of curves used in vertical alignment, (i.e., sag and crest curves) must provide adequate sight distance for the design speed. On all such curves minimum stopping sight distances must be provided. Except on roads designed for higher speeds, vertical curves on all scenic roads may be designed for stopping sight distance as a minimum condition. The rate of vertical curvature (K value) or the length of curve per percent of grade change defines the total length of a vertical curve. The minimum K values for sag and crest curves specified by AASHTO could be used.

Grades: The maximum allowable grade on scenic roads would depend on the terrain, type of pavement surface and the type of vehicles permitted on the road. On roads constructed for higher design speeds, large numbers of tour buses and recreational vehicles can adversely affect the operation on grades, unless a climbing lane has already been provided. Locations at which a climbing lane is not warranted at present due to low truck and total traffic volumes may, however, require one if a significant number of recreational vehicles are attracted due to designation as a scenic road. In such cases the critical length of grade for the requirement of a climbing lane may be determined based on a 10 MPH speed reduction as specified in AASHTO guidelines. The provision of a climbing lane is important for reducing the interaction between slower tourist traffic and through traffic.

Steeper grades may be permitted on roads with lower design speeds and lower ADT. The steepest grades may be permitted on the most rugged type of scenic roads, provided that certain restrictions are imposed on the type of vehicles permitted access to these roads. For example, on the steepest roads only four wheel drive vehicles with high clearance may be permitted.

Seasonal effects would also need to be considered in determining travel restrictions on roads with steep grades. On forest development roads carrying mixed traffic, the operation on grades may not be safe or efficient during timber sales and other periods of heavy truck travel.

4.3 Horizontal Alignment

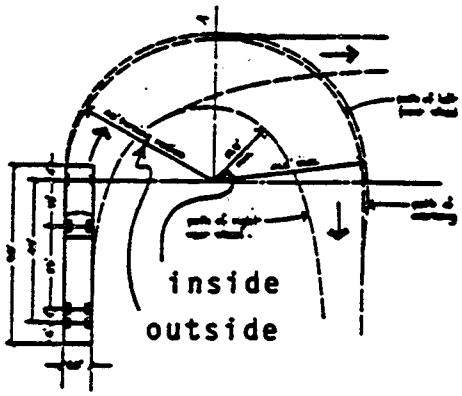
The most critical elements of horizontal alignment of scenic roads are the minimum radius for the design speed and the available sight distances for stopping and passing.

Minimum Radius: On most scenic roads the existing conditions would meet minimum radius requirements as they already provide access for recreational vehicles. Exceptions to this may be found on many of the lower classes of Federal roads such as resource and local BLM roads. Prior to designating roads on these systems as scenic roads, the adequacy of available turning radius on curves need to be examined and restrictions on the type of vehicles allowed should be determined. In general, the minimum radii for a particular design speed, superelevation and surface type specified by AASHTO would be sufficient for all scenic roads.

At locations where an existing road curve of substandard radius needs to be preserved for scenic reasons, adequate measures need to be provided to ensure safety. Such measures may consist of reduced speed limits and warning signs such as arrows, chevrons and in extreme cases flashing lights.

The minimum turning radius for different vehicle types are shown in Figure 1.

Superelevation Rates: On all paved roads with design speeds greater than 20 MPH, superelevation rates should comply with AASHTO standards. Scenic roads with stabilized or loose earth surfaces provide lower side friction and therefore require lower superelevation rates and larger radii. However, by imposing lower speed limits, curves with smaller radii may be accommodated.



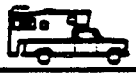
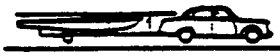
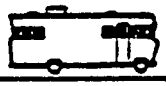
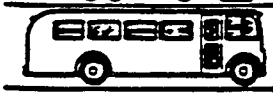
Type Type	Dimensions	Turning Radius - Inside - Outside
	6' x 18'	15' - 25'
	6' x 16'	15' - 25'
	6' x 15'	15' - 25'
	8' x 20	15' - 25'
	7' x 30'	20' - 35'
	6' x 35'	20' - 35'
	8' x 40	20' - 35'
	8' x 27'	20 - 35'
	8' x 40'	20' - 35'
	9' x 28'	25' - 40'
	9'-6 x 38'	28' - 45'

Figure 1. Minimum Turning Radii for Vehicles.

Source: Campground Manual, Parks Canada

4.4 Sight Distance

There are three types of sight distance requirements related to highway safety. They are minimum stopping, minimum passing and intersection sight distance. Both stopping and passing sight distances are directly related to the design speed.

Stopping Sight Distance: Stopping sight distance is the length of road traversed by a vehicle from the moment the driver sights an object in his path up to the moment the vehicle comes to a complete stop. AASHTO specified minimum stopping sight distances should be provided on all paved scenic roads. On road pavements constructed of stabilized earth or loose material substantially longer stopping sight distances would be required due lower coefficients of friction. However, on roads with these type of surfaces the lower design and operating speeds generally compensate for this.

Passing Sight Distance: Minimum passing sight distance is the length of road required for safe completion of a passing maneuver involving one vehicle passing another. This would be an essential consideration on roads which would also serve as through routes for non-recreational travelers. Minimum passing sight distances as recommended by AASHTO or the Manual on Uniform Traffic Control Devices for two-lane roads would be adequate for scenic routes.

Intersection Sight Distance: This is the sight distance required to permit a vehicle on the minor approach to cross the travelled way without any slowing down of the through traffic. A large increase of slower tourist traffic on a minor approach may require intersections to be assessed for sight distance. AASHTO defined corner sight distances for rural intersections shown in would be sufficient for all scenic routes. Depending on the volumes of turning traffic consideration must be given to the provision of turning lanes and adequate turning radii for larger recreational vehicles.

4.5 Number of Lanes

The number of lanes is determined for the design traffic volume. For most low volume scenic roads two lanes would be adequate. The designation of primitive park roads and collector forest development roads, with single-lane two-way operation, as scenic roads would not pose any significant

impact on the operation or safety provided adequate turnouts are provided and adequate warnings are provided to the motorist. Restrictions may need to be imposed on larger vehicles due to narrow roadway width. AASHTO criteria for recreational roads specify a maximum distance between turnouts to be 1000 feet. Turnouts should also be provided at all blind curves. Figure 2 shows typical design for turnouts on tangents and curves.

4.6 Structures

The design features of bridges, culverts, walls, tunnels and ancillary structures should be in accordance with AASHTO standard specifications for highway bridges. The minimum design loading should be H-15. Since all structures on public roads are designed to these standards, there would be no impact due to scenic road designation. However, scenic designation of a road segment containing a bridge with weight limitations or is substandard would require measures such as detours and advance warnings signs of vehicle and weight restrictions. If a significant increase is anticipated in traffic on the road a replacement bridge may be warranted. In extreme cases where it is felt that safety to road users may be compromised, scenic designation may be with held until adequate structural improvements are made.

On routes carrying truck traffic the existing horizontal and vertical clearances would be adequate. On truck restricted routes these clearances may need to be checked for adequacy prior to designation. The following minimum clearances used on park roads would be adequate for all scenic roads:

- Minimum Vertical Clearance - 14 feet
- Minimum Horizontal Clearance - 4 feet + Roadway Width

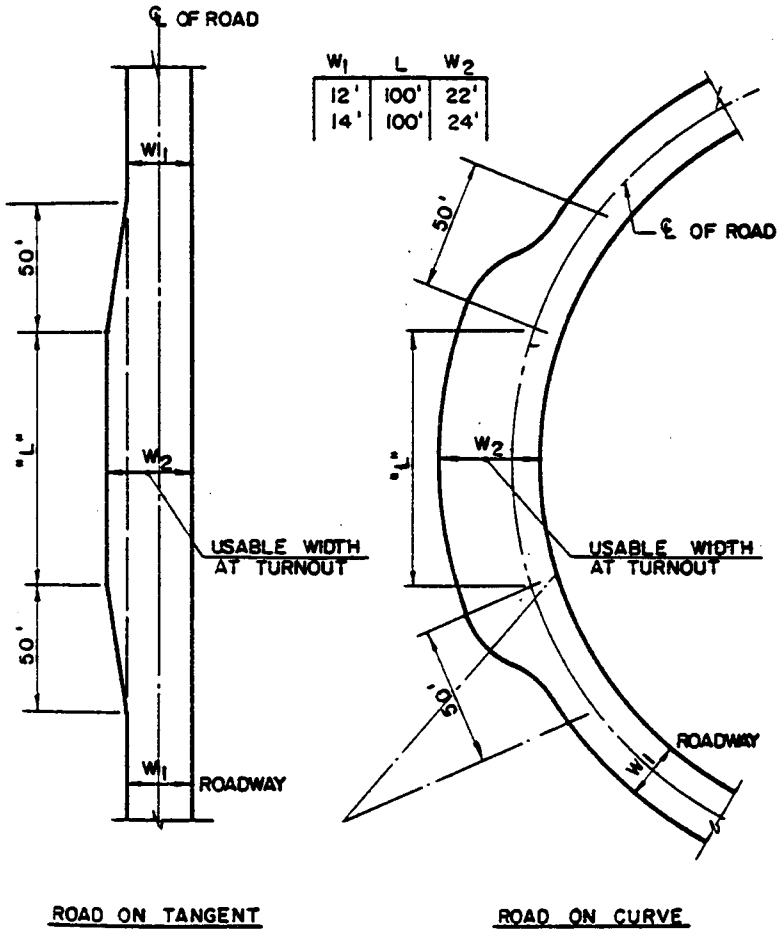


Figure 2. Typical Turnout Design.

Source: A Policy on Geometric Design of Highways and Streets. American Association of State Highway and Transportation Officials, 1984.

5. DESIGN CRITERIA AND MAINTENANCE STANDARDS FOR PUBLIC ROADS

The design criteria and maintenance standards for all public roads that may qualify for scenic designation are highlighted in the following sections.

5.1 State, Local and City Roads

These include all Federal Aid routes, state, city and local roads that fall within the AASHTO functional classification. These roads are designed and maintained according to standards specified in the AASSTO "Green Book" (3) and the Manual on Uniform Traffic Control Devices (MUTCD)(4) or similar standards established by the operating agency.

5.2 Park Roads

All park roads are designed according to criteria specified in Park Road Standards (5). These standards provide criteria for design elements necessary to accommodate vehicular and pedestrian use of Park Service facilities. Most of these standards are based on AASHTO criteria, with a few exceptions noted below.

Maximum posted speed limit for any park road is 45 miles per hour, unless determined to be less than safe. The design speed may be up to 10 mph higher than posted limit.

The design vehicle is based on the type of vehicle permitted by park management to use the facility. The minimum turning radii of the specific vehicle determines the minimum radii for road curves.

The maximum design grades for park roads may be as high as 17 percent in mountainous terrain. These maximum grades may be increased by as much as 2 percent under certain conditions. There are no criteria for determination of the critical length of grade.

Guardrails and guardwalls are required to be installed at points of unusual danger. However, there is no clear guidance or criteria to determine guardrail needs.

Minimum clearance required at underpass structures is 14 feet. The clear roadway width required on bridges is equal to the width of travelled way and shoulders plus 4 feet.

All signs and markings are based on guidelines provided in the MUTCD and the National Park Service Sign Manual (6).

Maintenance of all park roads are based on guidance provided for resurfacing, restoration and rehabilitation (3R) in FHWA's Direct Federal Manual (7).

5.3 Forest Service Roads

These roads consist of two-lane and single-lane unpaved roads designed for low speed operations with minimum safety features. The design criteria are specified in the Forest Service Road Preconstruction Handbook (8). These criteria are mostly based on AASHTO standards for rural two-lane roads.

The maximum grades for forest roads are specified depending on the type of traffic expected:

1. Recreational traffic: 12 percent
2. Motor homes or vehicles pulling trailers: 12 percent
3. High clearance and 4 wheel drive vehicles: 18 percent

Maintenance of these roads are also based on guidelines provided in the handbook.

5.4 Bureau of Indian Affairs (BIA) Roads

These roads consist mostly of two-lane roads. They are designed and maintained according to guidelines specified in the Bureau's Highway Engineering Handbook (9). These guidelines are based on publications by AASHTO, Federal Highway Administration (FHWA), U.S. Forest Service standards and various state highway agencies. Most of the specified standards meet AASHTO specifications.

5.5 Bureau of Land Management (BLM) Roads

These roads consist of low volume, two-lane and single-lane roads. The design and maintenance standards specified in the BLM Manual (10) are primarily based on the AASHTO standards. The key design standards for these roads are shown in Table 6.

On single-lane roads turnouts are required for opposing traffic. A minimum spacing of 700 feet is recommended for high volume or higher speed roads.

The maintenance standards for these roads follow guidance provided in the manual. The level of maintenance is based on the functional classification and also may vary from year to year depending on resource management needs.

Table 6. Design Standards for BLM Roads.

Functional Classification	Est. 20 Yr. ADT	Terrain	Design Speed		Travelway Width		Maximum Grade	
			Pref.	Min.	Pref.	Min.	Pref.	Max.
Resource	Less than 20	Level & Rolling	30	*	14	*	8	10
		Mountainous	15	*	14	*	*	16
Local	Less than 100	Level & Rolling	40	30	20	20	6	10
		Mountainous	20	15	14	12	8	15
	More than 75	Level & Rolling	50	40	24	20	6	10
		Mountainous	30	15	24	20	8	14
Collector	50-150	Level & Rolling	50	30	24	20	6	8
		Mountainous	30	20	20	20	8	12
	More than 100	Level & Rolling	50	40	24	20	6	8
		Mountainous	30	20	24	20	8	12

Note: Design speeds and surface widths chosen are limited to values shown, except that greater widths are allowed when oversize traffic justifies wider widths. Maximum acceptable grade must never be exceeded and maximum preferred grade should be exceeded only when preferred value is not feasible.

* If preferred design speed and travelway width are not feasible for specific resource roads, alternate values are determined by the Chief, Branch of Engineering State Office.

Source: BLM Manual

6. ANTICIPATED IMPACTS ON SPECIFIC SCENIC ROUTE CATEGORIES

The impact on any specific category of scenic road would depend on the typical highway facility in that category, the type of recreational activities likely to occur, and the likely composition of vehicular traffic. The typical highway facility for each category is defined in the classification. The type of recreational activities would depend on the recreation facilities accessed on these roads. The composition of traffic would depend to a large extent on the location of the highway. The tourist traffic could be mainly generated at nearby urban centers, in which case it will be predominantly automobile traffic. On the other hand, if it is a rural location, the amount of recreational vehicles can be expected to be considerable. Other factors, such as the road providing access to rivers or lakes, may also determine the composition of traffic.

The following discussion addresses the anticipated impacts on each category of scenic routes, taking into account the conditions likely to be encountered based on the first of the various classification schemes suggested in Section 2.

6.1 Category A Scenic Roads

These roads would experience the least impact due to designation as a scenic road due to their ability to carry the additional traffic. This is chiefly due to their superior design standards. However, in order to maintain the safety and operational standards on these routes, it may be necessary to impose certain restrictions, such as no parking on shoulders except in case of an emergency. Such restrictions may be necessary to discourage recreational travelers using shoulders for temporary parking to view scenery, take photographs etc. This may be accomplished through warning signs and enforcement. On the other hand, if complementary facilities such as scenic overlooks and rest areas are not available, enforcement of such restrictions may not be very successful. Therefore, it may be necessary to specify minimum levels of complementary facilities in the qualifying criteria or guidelines for selecting for scenic roads.

On Class A roads, the following types of scenic and recreational travel activities are likely to take place:

1. A leisurely drive in order to enjoy the scenic sights;
2. Pull over at scenic overlooks; and,
3. Exit and entry to safety rest areas and information centers.

Provided that the highway and support facilities have been designed to meet required standards, these activities should not result in any major impact on the normal operation of these routes.

The first type of activity would result in tourist traffic driving at a slower speed than all other traffic, resulting in speed differentials in the traffic stream. Large differences in speed can lead to unsafe operating conditions. Therefore, measures that could be taken to minimize the resulting impacts would be purely of an operational nature. With adequate signs and warning messages to travellers on these roads, it may be possible to create an awareness of the presence of slower drivers. Other considerations that would determine the level of impact and requirement of mitigating measures are:

- Routes in mountainous terrain that may require climbing lanes;
- Truck traffic; and,
- Traffic volumes, average speeds, through traffic, peak periods.

The second type of activity would result in vehicles leaving and entering the highway at scenic overlooks. The design of overlooks with adequate sight distance, deceleration/acceleration lanes, parking and signing would minimize the impacts.

The third type of travel activity would result in visitors stopping at supporting facilities. In the absence of existing facilities which may be upgraded to handle increased visitors, new facilities may need to be provided according to the AASHTO Guide on Safety Rest Areas (11). Such requirements should be determined on the basis of the number of visitors expected and the level of service provided by the existing facilities.

6.2 Category B Scenic Roads

The type of tourist travel activities anticipated on these routes will include some access to recreational areas such as picnic areas, camping and boat launching sites. The amount of interaction between tourist traffic and other traffic is likely to be greater on these routes than on Category A routes but not to an extent to have any significant impacts.

In the absence of adequate shoulder width, as the case may be on certain Park Roads, restrictions on shoulder use may need to be imposed for safety reasons. The issue of providing guard rail at locations considered a potential safety hazard needs to be addressed. Better criteria to determine

such needs could be established. On all roads that carry a large number of through traffic in comparison to scenic traffic, sufficient safe passing opportunities should be provided.

The operation on grades would be affected by slower vehicles on two-lane Park Roads where climbing lanes are not usually provided. On other arterials carrying truck traffic, such effects are likely to have been addressed already. In general, the safety and operation of these roads are not likely to be impacted to any significant level due to scenic designation.

These roads would need additional resources for maintenance due to faster deterioration of roadway and shoulders due to increased traffic volumes and wider recreational vehicles. The additional signs and supporting facilities provided would also require more maintenance effort.

6.3 Category C Scenic Roads

These roads are likely to be affected by nearly all types of travel activities resulting from scenic designation. For this reason, these roads are also likely to experience considerable impact. The type of travel activities would range from non-stop through traffic attracted from nearby roads that run parallel to the scenic road, to recreational activities such as hiking and biking.

Since most scenic roads are likely to be in this category, it is reasonable to expect most of the increased travel resulting from scenic designation to take place on these routes. Safety impacts on these roads are likely to result due to:

- The influx of slower and larger vehicles such as recreational vehicles and tour buses;
- Interaction between through and local traffic;
- Increased turning movements;
- Increased pedestrian activity and hiking; and,
- Increased bicycle use.

Roads that carry a significant percentage of large trucks and have no practical bypass route are likely to experience significant safety and operational impacts due to designation. Some programs, such as the Virginia Byway Program, attempt to locate scenic roads bypassing major roads so that they provide opportunity to leave high speed roads for leisurely motoring. Such scenic roads are also less likely to experience the impacts mentioned earlier.

The likely results of scenic and recreational travel on the operation of these roads are:

- Traffic congestion;
- Parking inadequacies;
- Needs for additional traffic control devices such as signals, signs and pavement markings;
- Need for traffic management plans;
- Intersection and parking requirements for tour buses, recreation vehicles; and,
- Needs for additional directional and informational signs.

These roads are likely to experience the highest increase in maintenance costs. The type of pavements on these facilities, usually adequate for low truck and traffic volumes may need shorter maintenance cycles. A likely impact would be more shoulder damage and pavement edge raveling due to wider vehicles. The additional traffic signals, signs and markings required for efficient and safe traffic management would also require more maintenance effort. The additional supporting facilities would also require additional resources for maintenance.

6.4 Category D Scenic Roads

The type of travel activities likely to occur on these roads would depend on the location and type of road. On Urban and Rural Local Roads, the travel activities would consist of:

- Access to locations of scenic and recreational interest.
- Visits to urban scenic locations.

On all other roads in this category, the entire spectrum of scenic and recreational activities are likely to take place. However, some of these roads which may already have restrictions on large vehicles, such as trucks, for safety reasons may need to be evaluated prior to designation.

The impact on safety due to scenic designation is likely to be relitavely high on these roads. The reasons for this are:

- Existing safety features being substandard in comparison to AASHTO requirements;
- The unforgiving nature of the roadside;
- The intended function of these roads;
- Changes in the typical traveler and vehicle; and,
- A significant number of anticipated users.

As a result, careful screening of candidate road segments and some safety improvements would be necessary. The concerns regarding inadequate clear zones and guard rail provisions need to be addressed. In many instances upgrading of these roads to provide a high level of safety maybe

impractical. Therefore, either the candidate road should be upgraded to some acceptable level of safety, or if such action is cost prohibitive, or not feasible for environmental reasons, the route should be disqualified for scenic program consideration. An acceptable level of safety on these roads needs to be analyzed and agreed upon by the operating agency.

The operational impact of designating these roads as scenic would be felt most on the local roads. All other roads in this category operate at low speeds, carry low volumes and would not be affected by the increased scenic and recreational travel.

The maintenance of these roads at levels sufficient for their current functional role may not be adequate after designation due to increase in traffic volumes and larger vehicles. The exact nature of the impact of designation on maintenance would be location specific. Urban and rural local roads would require additional maintenance related to signs and other traffic control devices. Forest Service, BLM and BIA roads would require increased maintenance of the pavement, shoulders, signs and supporting facilities.

6.5 Category E Scenic Routes

With regard to safety, these routes would have the most unforgiving roadside features. The width, surface type, horizontal and vertical alignment and level of signing on these routes would only accommodate slower driving. Therefore, it would be essential to develop an expectation in the motorist of the unforgiving nature of these roads. A motorist made aware of these conditions would drive cautiously, slower and would not expect to be given all the warnings one would expect on better roads. The driver expectation needs to be created from the beginning at trip planning stage through brochures or short descriptive legends on scenic road maps describing the typical road characteristics. This would help prevent unprepared visitors from embarking on trips on these roads. This also needs to be followed up through information and signs at key entrances, where the largest volumes are expected. Some signing along the road would be necessary to provide some warning of hazardous conditions. Typical examples for these are signs such as:

Sharp Curves Next 10 Miles

or

Steep Slopes No Guard Rail

The scenic byway programs of the Forest Service and BLM includes some single-lane roads which may be included in a proposed program. The adequacy of sight distance, turnouts and signing may need to reviewed on these roads.

The operational impacts of designating these roads as scenic would primarily be those due to delay and hazards resulting from introducing unfamiliar drivers into difficult road conditions. The other vehicular operations on these roads, such as those during timber sales and heavy logging operations, may be affected by recreational travelers unfamiliar with the surroundings. Where such operations are anticipated, it may be necessary to impose seasonal or other restrictions on recreational visitors. Due to the presence of steep grades, restrictions such as limiting the use of certain routes only to four-wheel drive vehicles may also be required.

The maintenance impacts on these roads would be largely related to the additional signs that may be required. No significant impacts on other roadside features are expected if traffic volumes are not significantly increased.

7. MINIMUM STANDARDS FOR DESIGN ELEMENTS AND AUXILIARY FEATURES

A primary purpose of the suggested classification system for scenic roads is to create a sufficiently accurate expectation in the traveler on driving conditions and support facilities. In order to achieve this, minimum standards must be defined for important design elements and auxiliary features. Such requirements were determined taking into consideration the existing functional classification of these roads and the type of travel activities likely to occur as a result of scenic designation.

7.1 Design Features

For the purpose of scenic designation the following design elements are considered most important from a safety and operational standpoint:

- Design speed;
- Maximum grade;
- Number of lanes;
- Lane width;
- Pavement surface type;
- Shoulder width; and,
- Safety barriers.

For all above elements, except safety barriers, suggested minimum standards are shown in Table 7. Appropriate criteria to determine safety barriers requirements need to be established in concurrence with all the operating agencies affected.

The design speeds are based mainly on the current functional classification. Maximum grades specified for scenic roads depend on the type of facility and terrain. The highest grades permissible would be on category E roads. Minimum standards for other features have been determined based on AASHTO and other standards for roads currently catering to recreational traffic.

Table 7. Suggested Design Guides and Standards for Scenic Roads.

Scenic Route Category	Terrain	Design Speed (mph)	Maximum Grade %	Number of Lanes	Minimum Lane Width (feet)	Pavement Surface Type	Minimum Shoulder Width (feet)
A	Level	70	3	≥4	12	H	10
	Rolling	60	4	≥4	12	H	10
	Mountain	50	7	≥4	12	H	10
B	Level	70	3	2-4	12	H	8
	Rolling	60	4	2-4	12	H	8
	Mountain	50	7	2-4	12	H	8
C	Level	60	8	2	8	H	8
	Rolling	50	8-12	2	8	H	6
	Mountain	40	12	2	8	H	6
D	Level	50	7	2	8	I	2
	Rolling	40	11	2	8	I	2
	Mountain	30	16	2	8	I	2
E	Level	15	10	1-2	14*	I,L	0
	Rolling	15	10-16	1-2	14*	I,L	0
	Mountain	10	16	1-2	14*	I,L	0

* - Minimum Travelway Width

Pavement Surface Type

H - High (Concrete, Bituminous)

I - Intermediate (Surface Treatments, Bituminous)

L - Low (Earth Roads of Stabilized or Loose Material)

7.2 Auxiliary Features

A uniform system of directional and informational signs, and route markers for scenic roads needs to be developed. Such a system would provide consistent guidance to the traveler on routes which pass through multiple jurisdictions.

Support facilities such as rest areas and information centers would be required at different levels on all scenic routes. For example, on popular scenic routes where a high number of visitors are anticipated, the highest level of such facilities should be provided. On Category E routes, only roadside information and interpretive signs may be necessary. On routes that currently serve as scenic routes, the adequacy of available facilities should be evaluated. For this purpose, some criteria need to be established for the provision of these facilities. Such criteria may be based on the number of visitors, the scenic, cultural and historic features, and some minimum spacing to determine the number of facilities required.

8. SUMMARY

A classification system consisting of five categories are proposed for scenic roads. Because a scenic road program would include all public roads, this classification reflects a certain amount of overlap in terms of roadway characteristics.

The impact of designation as a scenic road would be felt greatest on category C and D roads. Roads that belong in Categories A and B are designed and operated at levels that are likely to be least affected by scenic designation. Most of the designated scenic road mileage would belong in categories B, C and D. Category E roads, though relatively unsafe for normal operations, would not be greatly affected due to certain restrictions likely to be imposed for safety reasons.

8.1 Safety Impacts

The level of safety provided by a roadway for tourist activities needs to be measured against some benchmark for safety standards. The AASHTO standards for design provide guidance for minimum standards for roadside safety features. However, a significant percentage of scenic road mileage would occur on roadways that are built and maintained to standards which are sometimes below AASHTO requirements. Therefore, in order to provide an adequate level of safety on these routes, it may be necessary to take appropriate measures depending on the existing conditions. Some of the options available are:

- Improve the road to minimum standards.
- Allow lower standards provided the volumes and speeds are low and sufficient levels of driver expectancy can be created through signs, brochures etc.

It is suggested that if adequate safety cannot be provided due to cost, environmental or historic considerations, such a road should be considered ineligible for scenic designation unless it is placed in a classification category commensurate with the prevailing conditions and operating restrictions.

The highest impact on safety is likely to be felt on Category C routes due to the fact that most scenic and recreational activities are likely to occur on these routes. The next highest impact would be on Category D routes where the range of scenic and recreational activities likely to occur may exceed the ability of existing roadside features to provide adequate safety.

On all other routes, the impact on safety is less likely to be significant due to either higher safety standards, in the case of A and B, or lower and controlled levels of activity, on Category E routes.

8.2 Operational Impacts

The impact of scenic designation on the operation of a road will be felt greatest on category C roads. The increase in traffic volumes, larger vehicles together with a larger percentage of unfamiliar drivers are likely to impede the normal operation of these roads. Some of the likely effects are increased delay and congestion, parking inadequacies and need for additional traffic control devices.

8.3 Maintenance Impacts

The additional maintenance efforts required as a result of scenic designation are those related to:

- Pavement and shoulder maintenance due to higher traffic volumes and larger recreational vehicles.
- Additional signs and traffic control devices required for safe and efficient operation and interpretive signs.
- New or additional support facilities and amenities.

Category C routes are likely to experience the highest impact on maintenance followed by Category D. The least impact is likely to be on Category A and B routes, which have better design and maintenance standards.

A summary of the most likely impacts based upon the proposed route classification system is shown in Table 8.

8.4 Criteria for Qualifying Scenic Roads

As a final point, the issue of setting criteria for qualifying a road as a scenic high(by)way is examined. Certainly, the primary criterion relates to the quality of the scenery or the historic/cultural/recreational opportunities provided to the user and the controls that are needed to insure their longevity. That taken for granted, the guidelines presented below deal with engineering issues related to safety, operations, and maintenance.

Table 8. Likely Impacts Due to Scenic Designation.

Scenic Road Category	Safety	Operational	Maintenance
A			
B			
C			
D			
E			

Legend

 High

 Moderate

 Low

 None

Scenic roads should be no different than any other public road -- a minimum level of safety should be provided commensurate with the class or type of road. For reasons discussed earlier, a case can be made for insisting that "designated" scenic roads should have more than just the "minimum level" given that unfamiliar drivers are being enticed onto these roads. As a general guideline, a qualifying criterion could require that the safety features provided on a scenic road satisfy the individual state's requirements for similarly classified roads. AASHTO and/or the State's adopted standards can be the benchmark for this assessment. This qualifying criteria should be reasonable for all scenic road classes except for the lower class, two-lane and even one-lane scenic roads. In many situations, there will be a conflict between maintaining the "pristine" character of the road and roadside features and the provision of minimum safety features such as minimum widths, turn-outs, clear zones, safety barriers, etc. In these cases, where retention of the scenic character of the road is deemed of priority, then provisions for restricting certain vehicles, periods of operation, speed controls and appropriate warning systems (signing, markings and delineation) should be in place.

Along with the provision of minimum safety for the user, a designated scenic road should include certain operational features. One of these features is signing of the facility to indicate that it is a scenic road. A consideration in this regard is the use of a national standard sign that would allow for a state, regional or agency scenic logo and a designation of the "class" of scenic road. The latter component, when coordinated with highway maps and tourist guides, would give the motorist and indication of the engineering quality of the road.

Another feature is the signing for guidance, warning and regulatory purposes. The adherence to the Manual on Uniform Traffic Control Devices should be a prerequisite for inclusion as a scenic road.

The commitment to maintaining the road and its features to the level when adopted as a scenic road should be required as a qualifying criteria. Assignment of maintenance responsibility should be established at the outset.

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