DEVELOPMENT OF CRITERIA FOR SCENIC ROADS

William J. Mulder, Jr., Edwards and Kelcey, Inc., Newark, New Jersey

This paper discusses the development of criteria used to determine highway improvement programs for three corridors through the Upper Great Lakes region of Michigan, Minnesota, and Wisconsin. These improvements would provide safe, efficient travel and foster new economic growth. One objective of the study was that the findings be applicable to future planning and development of comparable highway corridors in the region. Inasmuch as the tourism and recreation industry and scenic quality of the area held the greatest potentials for such growth, it was necessary to develop a procedure for comparative evaluation of scenic values. The aspects of the study included definition of operating speed as related to functional and scenic criteria; development of new design-hour and traffic service level criteria for planning highway improvements in rural recreation regions; and development of a method for comparing scenic values in the planning and design of scenic routes. The scenic evaluation feature uses a point system to assist in selecting an alignment that takes advantage of the best scenic potential. A table relating to traffic service function and to scenic viewing is presented. The route selection procedure is outlined in a flow chart indicating the elements of scenic inventory and evaluation plus the other considerations normally used in highway planning.

• THE Public Works and Economic Development Act of 1965 directed the formulation of plans and programs to revitalize the lagging economy of the northern portions of Michigan, Minnesota, and Wisconsin and, toward that end, established the Upper Great Lakes Regional Commission.

The Commission, proceeding in joint agreement with the highway departments of Minnesota and Michigan and the transportation department of Wisconsin, decided that the greatest potential for developing and expanding the economy lay in making the region more accessible. Consequently, further studies were centered around the common theme of fostering economic growth within the Upper Great Lakes region through an expanded and improved highway program. The tourism and recreation industry and the scenic quality of the region were immediately seen as the most promising sources of economic growth.

In July 1970, we began a multidisciplinary study to determine the most suitable types of highway improvements to safely and efficiently carry traffic and stimulate new economic activity within the region.

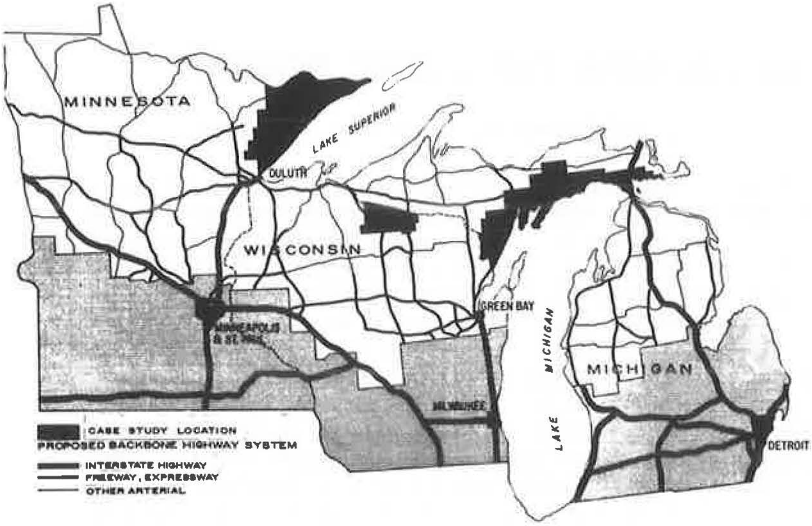
SELECTION OF CORRIDOR LOCATIONS

Three highway corridors, one in each state, were selected by the Joint Highway Planning Staff as case studies because of their immediate need for improvement and because they were representative of corridors throughout the region. An important objective was that the findings and recommendations be applicable to the planning and development of comparable highway corridors throughout the Upper Great Lakes region.

Locations of the three highway corridors selected for study were as follows (Fig. 1).

Publication of this paper sponsored by Committee on Roadside Environment.

Figure 1. Upper Great Lakes region.



Wisconsin—A Scenic Road Planning and Design Study

The 50-mile corridor formed by Vilas County trunk highways extending between US-51 near Woodruff and US-45 at Land O'Lakes was selected as a typical scenic route through an area of intensive recreational activity. This corridor is purely a scenic, pleasurable route of collector-level status and has no high-mobility traffic demands. Moreover, it is a scenic route to a major regional attraction—the Sylvania recreation area in Ottawa National Forest.

Study of this route demonstrates the application of scenic route planning and design standards, guidelines, and criteria developed under the overall planning program. Specific recommendations were made for an optimum scenic route through the corridor.

Minnesota—Compatibility of Leisure and High-Mobility Traffic in a Scenic Corridor

The US-61 northshore corridor from Duluth to the Canadian border was selected as representative of a high-mobility "backbone" highway through an area of outstanding scenic quality (along Lake Superior).

This study involved an assessment of the compatibility of casual pleasure or scenic driving with high-mobility travel and a determination of the types of improvements required to serve both types of traffic demand.

Michigan—Implications of Improved Backbone Highway Service on a Developed Corridor

The corridor formed by US-2 and Mich-35 extending along Lake Michigan from the Mackinac Bridge to Menominee on the Upper Peninsula was selected as representative of a high-mobility "backbone" highway serving medium-sized urban concentrations and having a well-developed local tourist economy.

This study concentrated on the types of improvements required to serve high-mobility demands and promote economic growth.

CHARACTERISTICS OF THE SCENIC ROUTE

Every road should take maximum advantage, consistent with traffic and safety needs, of the scenic qualities of its environment. Every road serves a function of point-to-point travel; roads passing through corridors containing outstanding scenic features (mountain or desert scenes, sweeping vistas, bodies of water, forests) are primarily scenic. The significant features of scenic roads relating to quality, variety, compatibility and other elements are as follows:

1. Quality—the scenic, historic, or cultural character of the highway corridor should have a quality that merits state or national recognition or should be of sufficient interest to be a destination for recreational purposes;
2. Variety—the terrain and land use along the highway should be varying and differ from those along other routes in the state so that a balance in scenic route types is provided; and
3. Compatibility—the highway should have a geometric design that fosters graceful, ground-fitting horizontal or vertical alignment, appropriate curves, and striking vistas and should accommodate the anticipated volume of traffic without undue hazard to highway users.

Any route, regardless of functional level, can be scenic. High-mobility routes can meet the criteria for scenic routes, e.g., the Minnesota US-61 corridor. Moreover, all highways should be developed along scenic road design principles to maximize the potential for a pleasant driving experience, even though the areas through which they pass may be quite average in visual quality.

Areas of attractive scenery normally exist in random patterns, which makes it difficult to predict whether a loop or linear road system is more appropriate in a given situation. Most of the roads proposed by the states for inclusion in a scenic highway system are parts of existing highway networks, making combinations of linear and loop routes possible in certain instances. This is particularly true in the Wisconsin area, where numerous intersecting routes form a linear-loop system. In the Minnesota study area, however, proposed scenic routes are primarily linear as a result of development patterns and topography.

If the distribution of scenic features or obstacles in the terrain does not permit the development of a scenic loop system or if the scenery is more suited to viewing at higher speeds, then a linear route, possibly combined with a high collector- or arterial-level traffic service, could be developed. If roads of this category pass near areas with high scenic appeal to tourists, it may be desirable to develop a lower speed loop to permit access to those areas. The two large peninsulas that form Big Bay de Noc and Little Bay de Noc on the southern shore of Michigan's Upper Peninsula provide excellent examples of areas in which a looped route might be used to advantage.

The lengths of a scenic drive are limited only by the availability of scenery and the amount of interest it evokes from the traveler. The interest varies with the individual and is the result of such factors as subject matter, age, weather conditions, physical limitations, and the mental attitude of the viewer.

It is probably not important to be concerned about an ideal length when linear roads are being considered. Such roads normally are parts of longer routes. Developing the scenic appeal of sections of such routes would not be detrimental to overall function, since the recommended design procedures ensure compatibility.

Length criteria are more applicable to the loop type of road, where more control can be exercised. Even with loop roads, however, the length often will be affected by such things as the distance from a particular site or area to the nearest point of access, the topographic limitations of the area, or the need to provide for limited land service in addition to scenic viewing.

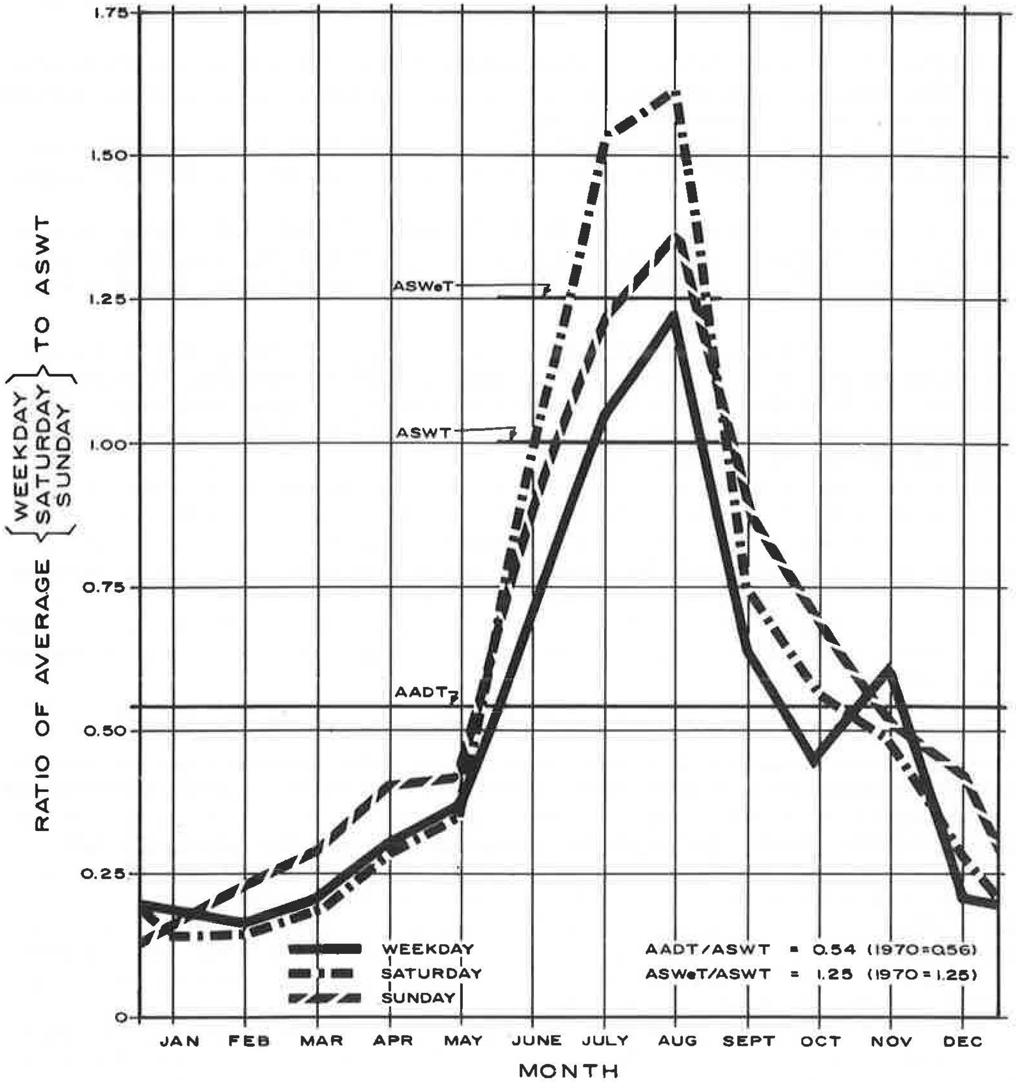
Although it is not uncommon for a person to travel hundreds of miles on a pleasure ride, figures from a national study indicate that 61 percent of all pleasure rides range from 5 to 30 miles in length. This suggests that a loop road provided solely for scenic viewing should average about 20 miles in length or should have exits to arterial highways at about 20-mile intervals.

TRAFFIC EVALUATION

Demand Analysis

Activity and travel patterns in any study area generally are investigated in terms of

Figure 2. 1968 monthly traffic distribution for US-2 near Brevort, Michigan.



average conditions, including trip generation for the functional planning of highway facilities. The common unit of measure for identifying and projecting the demand for highway facilities is annual average daily traffic volume. Average daily traffic characteristics provide the basis for relating existing and projected land use activities to the demand for the basic highway network. Average daily traffic volumes also provide the economic justification for the facility.

In the three study areas, average traffic conditions during the summer tourist season were considered a more suitable indicator of basic highway needs; therefore, average summer weekday traffic (ASWT) was used as the basic measure of demand. Where activity conditions vary, alternative measures may be appropriate. For example, average summer weekend traffic may be more suitable for highway studies in tourist or scenic areas close to metropolitan centers.

Design Service Levels

Level of service, a concept developed to provide a qualitative measure of operating conditions, is based on travel speed characteristics and volume-capacity relations associated with specified operating conditions. Speed and volume provide an indication of overall performance on a roadway, whereas capacity and operating conditions provide an indication of traffic densities and freedom to maneuver.

Design criteria appropriate to most rural arterials and generally accepted for design by the three states and the Federal Highway Administration provide operating conditions at level of service B during the 30th highest hourly volume of the year.

Level of service B, as defined in the Highway Capacity Manual (6), represents freedom for the driver to maneuver and to maintain desired travel speeds. For two-lane and multilane rural arterials, service level B is associated with minimum operating speeds of 50 and 55 mph respectively under design-hour flow conditions.

Investigations have led to the general acceptance of the 30th highest hour as the critical period for design; however, high seasonal fluctuations, as shown by the monthly traffic distribution for US-2 near Brevort, Michigan (Fig. 2), require special attention in areas of heavy recreational travel. Summer volumes and, in particular, peak-hour conditions far exceed off-season demands.

A review of this monthly traffic distribution chart indicates that a facility design under conventional procedures would be significantly underutilized during most of the year. For these studies, however, considerable thought was given to selection of design criteria that would reflect the objective of promoting recreational development by ensuring suitable operating conditions during periods of sustained tourist demand. Otherwise, tourism-recreation travel will be discouraged.

Combined recreational development objectives and investigation of traffic fluctuations led to the selection of dual design criteria for the highway planning studies in the Michigan and Minnesota "backbone" corridors. Instead of selecting a single design-hour volume (e.g., 30HV) as one design criterion, we chose a criterion based on a peak period to represent the critical tourist demand.

Summer weekday traffic patterns (Fig. 3) for the three survey locations along the Minnesota corridor provided a basis for selecting this additional criterion. Peak demands remain relatively stable for 4 to 6 hours during the midday and afternoon, with 8 to 9 percent of the daily demand occurring during each of the hours. This sustained demand condition was repeated on the average for nearly 400 weekday hours of the summer tourist season. Therefore, maintaining desirable operating levels during these hours, including level of service B for rural arterial highways, was considered essential to the economic well-being of the specific communities and to the region in general. The design must ensure that reduced, yet tolerable, operating conditions are maintained during the highest overall peak periods occurring on summer weekends or in special periods of peak off-season activity, such as the opening days of the hunting and fishing seasons. Therefore, 30HV demands were analyzed on the basis of a tolerable operating condition at service level C for rural arterial highways and found adequate.

Projected operating conditions can thus be identified and compared with selected minimum levels, both for the hours of highest overall demand and for those of the pe-

Figure 3. Hourly distribution of summer weekday traffic for the Minnesota study corridor.

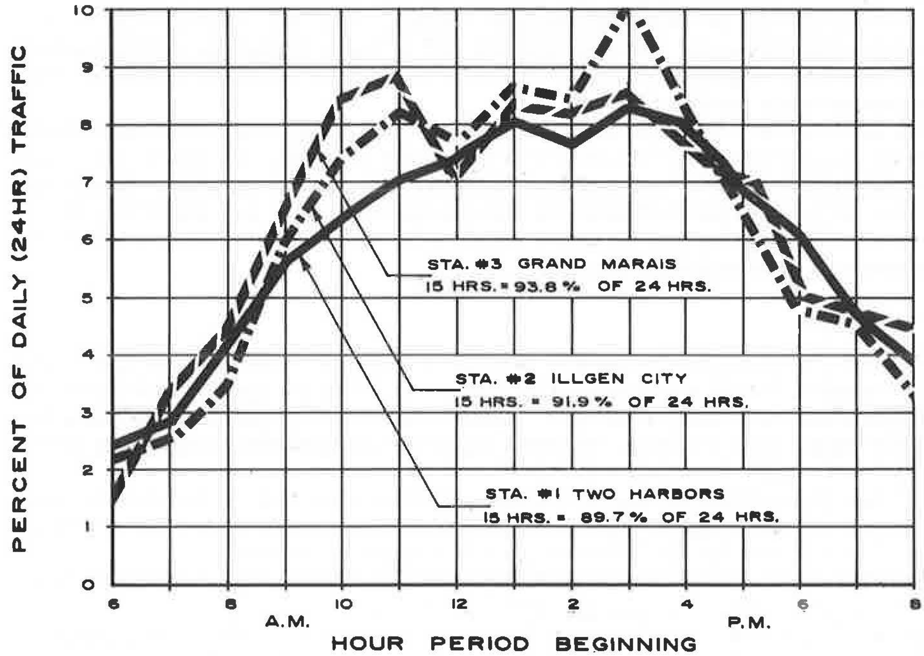
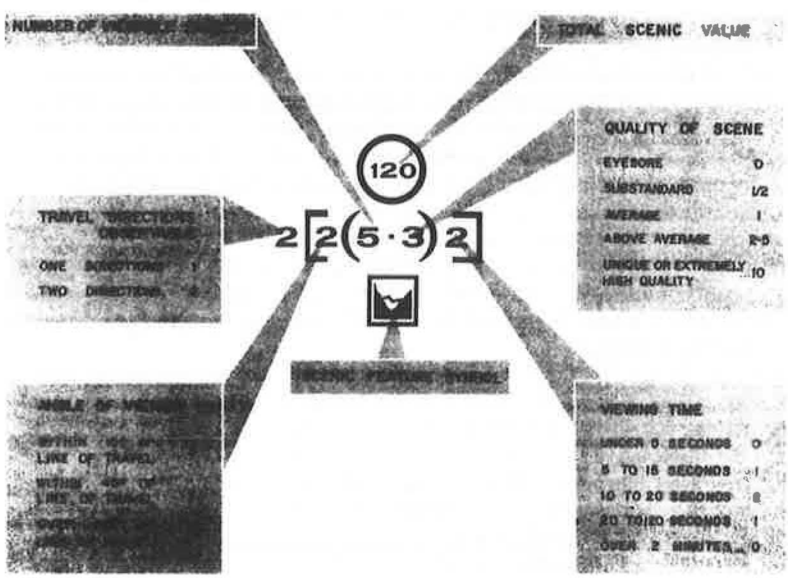


Figure 4. Scenic feature evaluation.



riod critical to the area involved. In addition, the necessary traffic data inputs are normally readily available or easily collected, and the basic analytic procedures familiar to highway and traffic engineers are maintained.

The same dual-criterion principle can be applied easily to areas characterized by heavy weekend recreation or scenic use, such as a Saturday or Sunday afternoon peak period of significance.

On urban connecting links of the rural arterials, where level of service C is commonly accepted as appropriate for 30HV operating conditions, this level was used to evaluate the sustained ASWT peak, with level of service D accepted as appropriate for 30HV operation. For example, where expressway design standards were considered necessary in rural areas, extension of the expressway design to the connecting link through or around urban areas was considered essential, even though minimum operating service level criteria could be met under requirements for an urban arterial of nonexpressway standards.

IDENTIFICATION AND EVALUATION OF SCENIC FEATURES

The technique for evaluation of scenic features was developed in response to the needs of the Minnesota and Wisconsin studies but has universal application in scenic route planning. All scenes must be compared to that that is typical of the region, whether natural or man-made, rather than to an arbitrary subjective standard. This technique assists the designer in locating the roads by indicating how he may take maximum advantage of the scenic values determined.

Initially, we conducted field and map reconnaissance of the study areas to determine their major scenic features. This macroscale analysis was used to determine alternative route locations. Scenic features of the area were then evaluated in greater detail in terms of a number of factors expressing the visual quality of the feature in itself and as viewed from alternative alignments.

Scenic Inventory Procedure

Once the most promising routes were determined, an inventory of scenic features within these corridors was made. The ideal procedure is to locate and evaluate all scenic features in the field. Unfortunately, conditions such as topography, tree cover, legal restrictions, project budget, and the like restrict the amount of information that can be obtained in this manner. But much information can be gathered through other means. Many topographic features—hills, streams, lakes, buildings—can be identified from detailed maps and vertical or oblique aerial photographs. An on-site inspection supplements the map information.

Evaluation Technique

Each scene is evaluated initially according to a set of established criteria. The method or technique of representing this evaluation is shown in Figure 4. A relative rating of all scenes in a particular corridor is established. An alignment that makes use of the best scenes available is then selected. The alignment scoring the highest points on a per-mile basis is generally considered the most appropriate scenic route through the corridor.

Factors to be considered in the evaluation of scenic quality are number of objects, quality of scene, angle of viewing, time in view, and travel directions.

All scenery is composed of recognizable objects or compositions that occur either singly or in groups. A single object is one that can be assimilated visually without a change in eye position. A picturesque tree in an open field, a solitary mountain, or a tall building are examples.

A more complex scene, such as a lake with cliffs and wooded hills in the background, a sandy beach, and groups of lakeside cottages, contains three to five objects, depending on their visual relations as seen from the viewing position. A complex scene such as this is usually considered by the average viewer to be more attractive, which leads to the conclusion that, the greater the number is of interesting objects that can be viewed, the greater the value of the scene is.

A second factor to be considered is the visual quality of scene. To evaluate this, the designer must be capable of determining how attractive an object is through its conformance to basic art principles (form, balance, harmony, etc.) and how well an object, as compared to other objects located within the region, satisfies these principles. Also to be considered in judging the quality of a scene is the frequency with which a given type of object occurs within the region. If it occurs occasionally, it is of more interest to the viewer than if it occurs frequently. When either the object is an outstanding example of its kind or its occurrence is so seldom that it is unique, it is of even higher scenic value.

Upon completion of this inventory and evaluation, the information is coded and the visual quality of scene is measured according to the numerical values shown in Figure 4. If the rating of the number of viewable objects in a scene and the quality of that scene are low, then it is discarded.

Factors other than the intrinsic features of a scene that enter into the scenic evaluation of a route are (a) direction from which it can be observed, (b) angle of viewing relative to the direction of travel, and (c) time in view. Such evaluation is made for each scenic feature relative to each alternative route. During the process, typical views of the area's dominant scenery are dropped from consideration but are noted as scenic augmentation of the road.

Many valuable scenes, such as panoramas, are viewable from one direction only. The design of the road, however, frequently determines whether other objects such as lakes, a village, or even a single tree may be observed from one or both directions. If the scenic rhythm and pattern permit, twice the scenic value may be obtained for a given route by adjusting the alignment to permit views of its scenic features from both directions of travel.

The angle of viewing factor represents the opportunity the average traveler will have to observe a scene under normal conditions and is based on the lateral field of vision. The highest value is given to those scenes that can be viewed without distracting the driver's vision from the road. The next lower rating is given to scenes that require the driver to turn his line of vision but still allow him to be aware of road conditions through peripheral vision.

When the viewing angle is so great that the driver's attention is completely diverted from the road, a value of zero is assigned, the scene is no longer considered in the roadway alignment, and it is considered, if suitable, as a scenic stop.

The values shown in Figure 3 are suitable for use at travel speeds of 40 to 60 mph. These should be adjusted for use at other speeds. Viewing time in Figure 4 indicates the period during which the scene might be viewed and the effect it might have on the viewer's attitude toward the scene. Unfortunately, little research has been conducted to determine how long a person will view scenic features, which depends on differences in the subject and quality of scenes and on the individual's reactions to varying light levels, atmospheric conditions, interests, etc.

Some laboratory tests have indicated that under controlled conditions the average person will view a design for slightly less than 5 seconds. Other observations indicate that the length of scenes in television and movie productions generally ranges from 2 to 10 seconds. Although these are not conclusive, they do indicate that the average person will view a scene for only a limited period of time before shifting his attention. Based on these conditions, values have been assigned to the average traveler's viewing time. The evaluator is required to exercise judgment when applying the factors to compensate for the scene's complexity and the frequency with which the scene occurs in the region.

The highest rating was given to a 10- to 20-second period. This time will permit the typical traveler to locate the scene, to view its various components to his satisfaction, and to have it leave his field of vision before becoming monotonous. Lower values were assigned to periods of 5 to 15 seconds and 20 to 120 seconds, thereby recognizing that insufficient time could cause the viewer to miss a portion of the scene or that excessive time could cause boredom or deprive him of interest created by other scenes. No values were assigned to periods of under 5 seconds because the viewer probably would be unable to locate or assimilate any but the most simple scenes. Also, it was

Figure 5. Route study plan for Wisconsin.

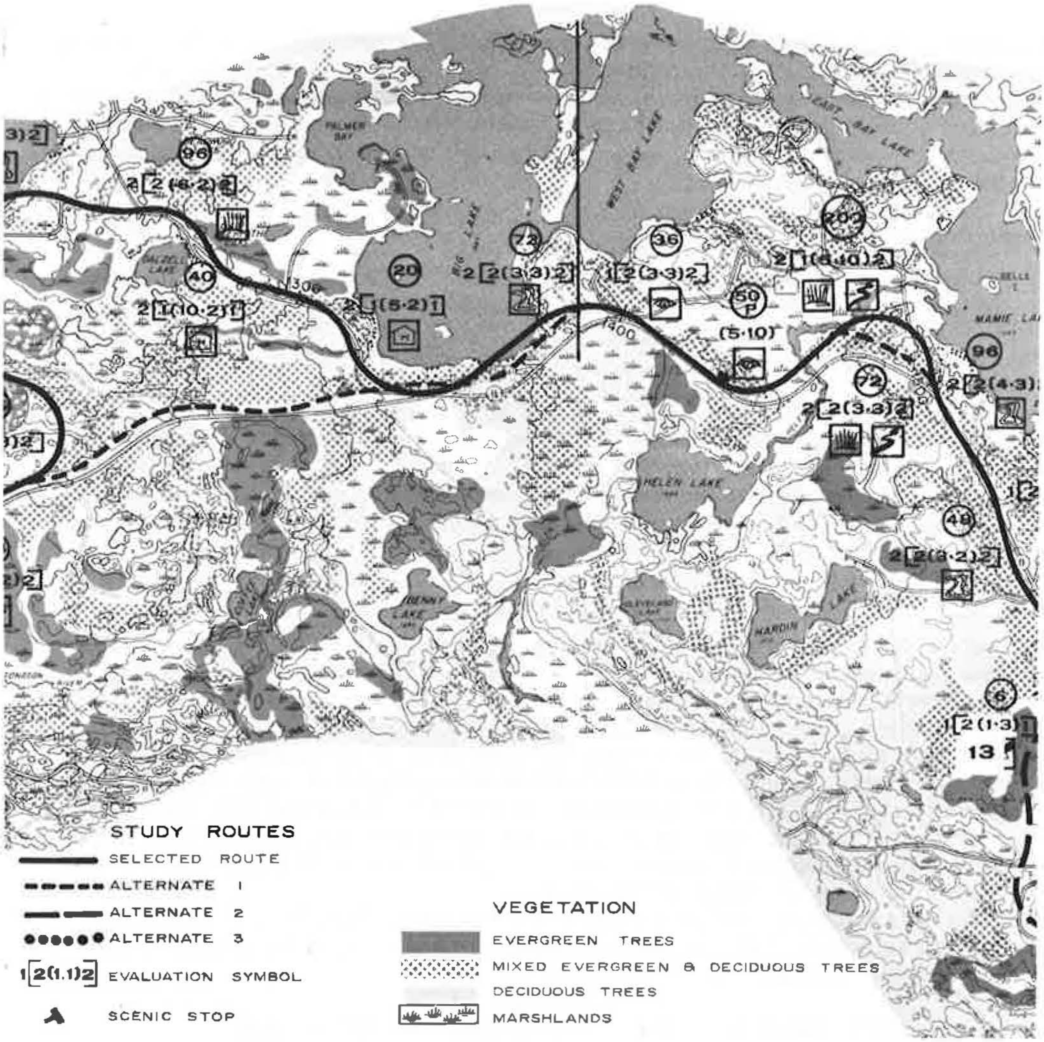
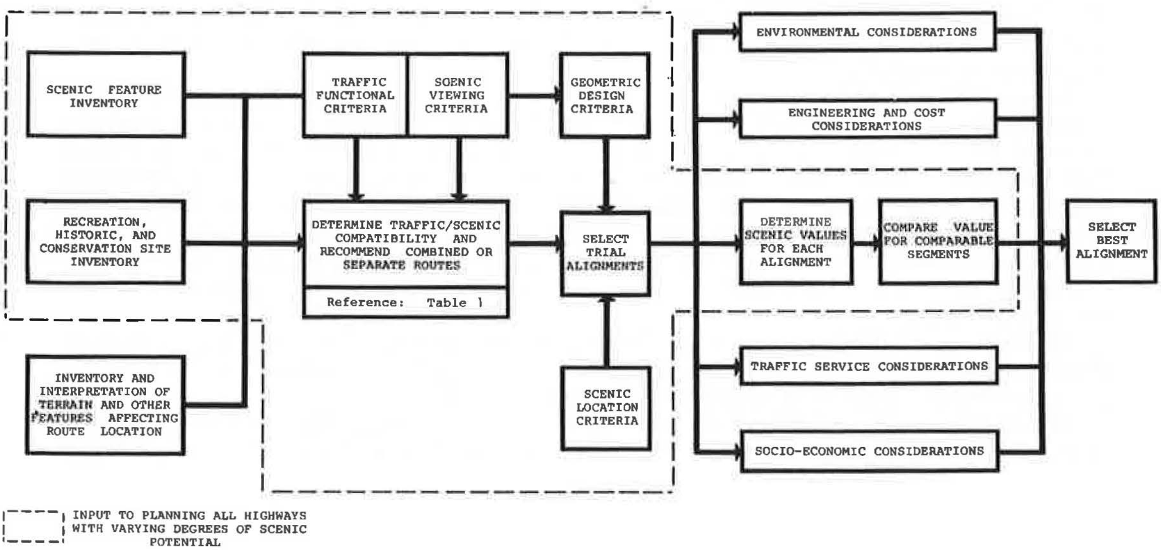


Figure 6. Selection procedure for scenic route.



felt that periods in excess of 2 minutes would produce reactions similar to those resulting from the typical scenery of the region.

Numerical ratings established for each of these factors are added to the identification and evaluation symbol previously plotted on the study map. All factors are then multiplied together to determine the total numerical rating for each scene, referred to as the total scenic value.

Stop Scene Determination

Stop scenes are those scenic features that cannot be viewed safely while the traveler is in motion because of (a) engineering or other considerations that prevent proper relation to the line of sight, (b) screening by an object that cannot be removed, or (c) insufficient viewing time. Where there is no practical solution to make views of features of above-average or unique quality available to vehicles in motion, stationary viewing locations (overlooks, rest areas, and the like) should be provided. Such scenic stops will bring out the full value of a scene. Features of lesser quality should be screened from view to prevent possible driver distraction.

In evaluation of stop scenes, the factors applying to motion scenes drop out, and the scene is evaluated only on its basic indexes, i.e., number of viewable objects and rated quality.

FINAL ROUTE EVALUATION

After scenic features were evaluated for each trial alignment, including motion and stop scenes, corresponding route segments were compared on a per-mile, point value basis. The final alignments should normally follow the highest averages as determined and developed within the context of engineering and traffic service feasibility.

The Wisconsin study (Fig. 5) illustrates the application of the procedure and shows alternative alignments, scenic feature evaluations associated with each, and a selected composite route resulting from the technique. It should be noted that this scenic route evaluation and selection procedure is designed for evaluating alternative routes within one corridor. The technique, however, can be adapted to evaluating alternative scenic corridors with the same or comparable termini.

Figure 6 shows the scenic inventory and evaluation described, the inputs affecting the function and selection of purely scenic routes, and the input of the scenic evaluation process to other highways having scenic potential.

SCENIC VIEWING-OPERATING SPEED RELATIONSHIPS

Highway travel speed determines the type of scenery that can be viewed. Thus, in the initial stages of route planning there is a need to determine whether scenic qualities of a route corridor can be viewed effectively at the desired level of traffic service. Frequently, there is no conflict, but occasionally the level of service desired is such that the scenic features will be barely viewable or even not seen when the necessary alignment is provided.

Functional criteria and scenic criteria are given in Tables 1 and 2; together, these tables provide a rapid means for determining the basic compatibility or incompatibility of these two elements in a given corridor. For example, a scenic inventory revealing that the predominant scenery within the corridor consists of small forms containing integral detail and traffic service requirements demanding a major arterial improvement are two basically incompatible elements. This does not mean, however, that a road using the scenic features of the area is out of the question; rather, it indicates that certain measures will have to be taken during the planning and design process to create compatibility.

Of course, we realize that, when the required service level lies below the level of dominant scenery, the scenic features theoretically can be developed to their fullest potential without adversely affecting the traffic function.

The first use of the table, then, is to determine the compatibility of basic traffic service and scenic viewing needs. If initial evaluations reveal a basic incompatibility

Table 1. Functional traffic criteria.

Functional Designation	Service Description	Average Trip Length (miles)	AADT	Desirable Minimum Rural Operating Speed (mph)
Major arterials	Interstate, interregional, and intraregional travel corridors generally connecting urban areas and forming a continuous system network	>50	>2,000	55[a] 50[b]
Minor arterials	Interarea travel corridors generally connecting cities and villages to supplement the major arterial system	15 to 100	1,000 to 3,500	50
High collectors	Provides intraarea travel, access to local areas, and feeders to the arterial system connecting communities generally in the 200 to 500 population range	10 to 75	<2,500	45
Low collectors	Provides intraarea travel, with an emphasis on land access; connects communities not otherwise served by high-level route	<30	<500	20
Local	Provides land access and local traffic service	<15	<500	20
Waysides and scenic stops	Provides access to rest area and picnic facilities, historic sites, overlooks, and so on	—	—	—

[a]Freeway expressway. [b]Other.

Table 2. Scenic viewing criteria.

Functional Designation	Desirable Operating Speed (mph)	View Angle From Line of Travel (deg)		Minimum Attracting Distance (ft)	Time Interval Between Scenes (min)	Scene Characteristics	Examples
		Desired	Maximum				
Major arterials	>60	10	20	900	2 to 5	Large mass forms, depend on outline shape	Lakes, rivers, tree groups, mountains, panoramas, large architecture
Minor arterials, High collectors, Low collectors	40 to 60	15	25	750	2 to 5	Smaller mass forms, may contain simple integral detail	Brooks, streams, specimen trees
Local	20 to 40	25	50	450	1 to 3	Forms of minor complexity whose attractiveness rely on surface texture, variations in outline; complex, contained detail	Residential properties, commemorative sculpture, roadside features
Waysides and scenic stops	—[a]	180[b]		Any distance	—[a]	High-quality views: insufficient viewing time or incomprehensible detail at any travel speed; alignment cannot be adjusted to permit proper viewing angle; view obstructed by immovable object	Large panoramas to detailed roadside features
						Special views: unique features whose setting would be destroyed by extensive construction	Wildlife, wild flowers, geologic or historic areas
						Activity areas not familiar to average visitor	Manufacturing, canal locks

[a]Not applicable. [b]If attention is directed to scene, 360 deg possible.

Table 3. Scenic improvements.

Viewing Time Description	Viewing Time Seconds	Method of Improvement
Less than ideal	<5	Above-average and high-quality scenes: Increase viewing time where possible by removing obstructions or modifying alignment; screen if scene is distracting and above steps are unfeasible; provide roadside scenic stop
		Typical or frequently occurring scenes: Generally no action; screen if distracting
Ideal	5 to 20	Provide acceptable viewing angle[a]; investigate use of quality improvements such as frame or background or an interruption to view; determine desirability of providing subsequent scenic stop
Greater than desirable	20 to 120[b]	Screen portion of scene to create additional views from varying viewing points; adjust alignments to reduce viewing time; alter shape of tree line; emphasize visual rhythm
	>120[c]	Consider alignment variations to alter viewing angles in addition to actions outlined above

[a]<40 mph, 0 to 25 deg desirable, 50 deg maximum; 40 to 60 mph, 0 to 15 deg desirable, 25 deg maximum; >60 mph, 0 to 10 deg desirable, 20 deg maximum.
[b]Or segments of neutral mass scenery.
[c]Or neutral mass scenery.

between functional and scenic requirements, several courses of action are open. One alternative, and the least desirable, is to ignore either the scenic or the functional requirements. A second option is to provide separate routes for each function; but, unless one route already exists, preferably the route with the greater scenic qualities, this may be an expensive solution and is justified only in locations of many complex or detailed scenes.

The most practical alternative is to design a road that satisfies the traffic requirements and at the same time offers to its travelers scenes that are compatible with the traffic function, i.e., providing scenic stops for viewing those scenes that are otherwise too complex to view at the desired travel speeds.

The selection of an alternative must be based on an in-depth study of all factors pertinent to the specific case under consideration, including (a) the potential economic impact of each of the alternatives, (b) topographic constraints that may favor or preclude one or more of the alternatives, (c) the general scenic quality of the particular route and its importance to an overall state scenic highways program, and (d) the availability of funds and the effect that each of the alternatives may have on eligibility for such funds.

The Minnesota case study illustrates how such factors were analyzed. Even though traffic and scenic requirements were found to be compatible along the US-61 corridor, the method of analysis used was applicable as well to the situation in which a basic incompatibility exists.

Once a decision has been made, a three-step approach is followed to develop the scenic potentials of the selected corridor:

1. Develop those individual scenic attractions compatible with operating speed criteria through alignment location, clearing, and so on to obtain desirable viewing time, angle, and distance from the roadway.
2. Develop those scenic attractions that require provision of loop, spur, or overlook facilities, as appropriate.
3. Provide screening for those scenic features in step 2 that would remain viewable from the roadway.

Table 1 indicates the desirable operating speed, viewing angle, attracting distance, and time interval between views as applicable to specific types of scenery. These criteria are used in selecting an alignment that will take maximum advantage of the available scenery. This represents the second use of the table.

Vision Factors in Scenic Viewing

The level of scenic viewing is a function of the eye's ability to perceive the details of scenes and objects coming into view and passing by at various travel speeds. Several basic factors govern this function.

1. Horizontal field of vision narrows and the point of focus moves further ahead as travel speed increases.

Speed (mph)	Focal Point (ft)	Horizontal Field (deg)
25	600	100
45	1,200	65
60	1,800	40

2. Rapidly moving objects cannot be seen readily. Foreground objects begin to blur when travel speed is approximately numerically equal to distance between the object and vehicle, and foreground detail is lost when travel speed is approximately one-half the distance.
3. Line of sight seldom varies more than a few degrees from the direction of travel; therefore, features must fall within a horizontal field of vision centered on this line of sight if they are to be noticed.

In addition, the period of attention of the viewer will vary. Thus, different scenic characteristics become important as travel speeds vary. For a traveler to notice a scene, he must have sufficient time to become aware of its existence and to view it long enough to be satisfied with his reaction to its content. In general, as the complexity and detail of a scene increase, a longer period of time is required to fully assimilate the scene.

Scenic Viewing Criteria

Viewing angles given in Table 1 describe the desirable relationship between the object and the line of sight. If the object lies within the limits shown, then it can be observed within a normal horizontal field of vision at the given speed of travel.

The minimum attracting distance is the distance from the viewer to the object and should provide approximately 10 seconds of viewing time within the specified viewing angle at the given speed of travel. In practice, this must be checked carefully against possible viewing interference, particularly along curves of minimum design radius in areas where there may be visual obstructions such as embankments, buildings, and woodlands. Conversely, because the normal point of focus is approximately twice the minimum attracting distance and normal eye movements extend this even further, objects frequently can be seen for a much longer time in open areas and along less restrictive alignments. Under these circumstances there may be a need to limit the viewing time to avoid monotony.

The purpose of the time interval is to establish a suitable frequency that will prevent boredom and at the same time discourage the driver's tendency to slow down for frequent high-interest scenes. The mind must have an opportunity to rest between periods of high interest or excitement. The spacing or time interval between scenic features pertains only to those relatively high-quality scenes that can be observed while driving. Views from roadside turnouts and more typical examples of roadside rhythms, while still important in the overall design, should not be considered in spacing the main scenic views.

The desirable spacing of scenes varies with their quality level. As the scene generates more excitement, the spacing should increase if the travel speed is to be maintained. If the frequency of quality scenes exceeds that shown in the table, then either the level of traffic service should be modified or some of the scenes should be removed from the field of vision. This can be accomplished by modifying the alignment to change the viewing direction and by screening certain features to obtain proper spacing.

SCENE TREATMENT AND VARIATIONS

An important consideration in the visual design of the road is the relationship between objects of visual interest and the line of sight. The eye is known to move constantly in an elliptical pattern when observing most scenes. When traveling as either driver or passenger in an automobile, most people concentrate approximately two-thirds of their sightings on nearby objects that are located along the axis of travel. Other sightings are normally within 6 degrees of this axis and consist of more distant stationary scenes. The problem thus becomes one of permitting the traveler to become aware of a scene and to enjoy it without distracting him from his primary task of vehicle control or without allowing him to lose interest through overexposure.

To accomplish this, the view must be pointed toward the scene, or its value will be diminished or completely lost. Sweeping curves or straight segments wherein the scene is located very near the line of sight are most commonly used for this purpose.

The scene should be terminated within the specified time interval to prevent boredom and to provide a period of mental relaxation. Several techniques are available for accomplishing this: properly located screens of buildings, trees, or earth. The most useful method, however, is to turn the roadway to direct attention away from the scene. Table 3 gives methods of exploiting scenes at various viewing times.

When a scene is of high enough quality to distract the driver, viewing must be concluded before the driver enters a minimum curve. If the scene is located slightly to one side of the travel direction, the driver can view it and still divert his attention to the road before he enters the curve.

CONCLUSION

This initial development of criteria for scenic roads is a vital step in the planning and design of such roads. These techniques are a fresh approach that will supplement normal planning and design procedures.

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