SCENIC BYWAYS: THEIR SELECTION, DESIGNATION, PROTECTION AND SAFETY

Prepared by the
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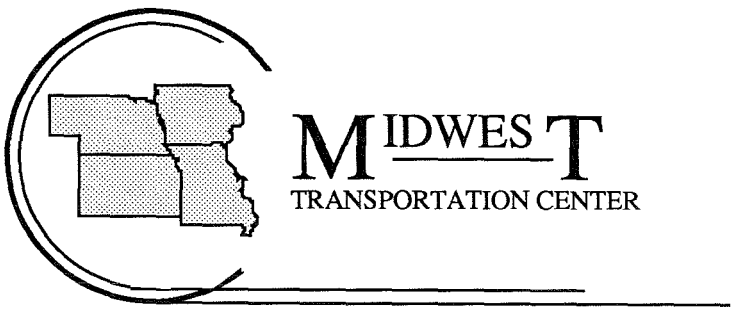

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A joint project with the Department of Economics titled
"Economic Analysis of Scenic Byways in Iowa, Kansas, Missouri, and Nebraska"
by

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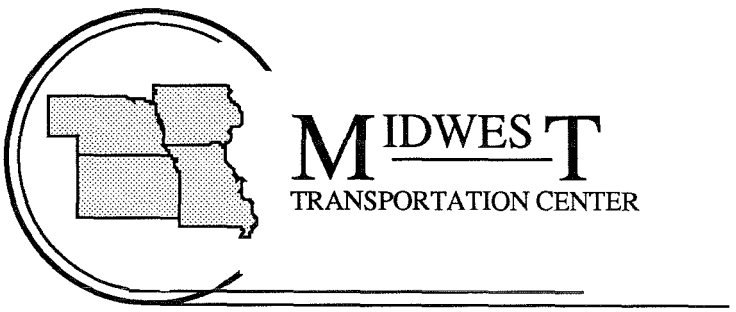

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PREFACE

This report is the product of a 1989-1990 research project in the University Transportation Centers Program. The Program was created by Congress in 1987 to "contribute to the solution of important regional and national transportation problems". A university-based center was established in each of ten federal regions following a national competition in 1988. Each center has a unique theme and research purpose, although all are interdisciplinary and also have educational missions.

The Midwest Transportation Center (Center) is one of the ten centers; it is a consortium that includes Iowa State University (lead institution) and the University of Iowa. The Center serves Federal Region VII which includes Iowa, Kansas, Missouri, and Nebraska. Its theme is "transportation actions and strategies in a region undergoing major social and economic transition". Research projects conducted through the Center bring together the collective talents of faculty, staff and students within the region to address issues related to this important theme.

The Principal Investigator was Professor Bob L. Smith, Department of Civil Engineering, Kansas State University.

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Members of the Project Advisory Committee included: Harry Budd, P.E., of the Iowa Department of Transportation; Keith Herbster, P.E., of the Nebraska Department of Roads; Carroll L. Morgenson of the Kansas Department of Transportation; Project Monitor Jim Murray, P.E., of the Missouri Highway and Transportation Department; and Bert Stratmann, P.E., of the Kansas Department of Transportation.

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EXECUTIVE SUMMARY

INTRODUCTION

"A scenic road or byway has roadsides or corridors of aesthetic, cultural or historic value. An essential part of this road is its scenic corridor. The corridor may contain outstanding scenic vistas, unusual geologic formations, dramatic urban scenes, scientific features or other elements all providing enjoyment for the highway traveler."(1)

There is now a nationwide effort (Scenic Byways Movement) to focus attention on the need to develop scenic byways and on their potential for enhancing tourism and recreation; to create coalitions and strategies to actually develop the byways; and, alternatively, to see that the job gets done.

As part of this nationwide effort, the Transportation Departments of Iowa, Kansas, Missouri and Nebraska sponsored this project so they might obtain guidance related to Scenic Byways programs that may be developed in each state.

If there is to be a successful Scenic Byways Program in a state or region, the following issues should be addressed:

- SCENIC QUALITY

  Criteria and methods for assuring some minimum level of scenic quality and doing so in a uniform, consistent fashion.

- ROAD SAFETY

  Criteria and methods for evaluating critical road safety matters.

- SCENIC BYWAY DESIGNATION

  Nomination of potential byways
  Appropriate conditions for byway designation
  Scenic corridor enhancement
  Scenic corridor protection

- SCENIC BYWAY INFORMATION

  Signing, maps, interpretation of items of interest, marketing a byway, information needs of the byway driver.

The above issues are discussed in the following sections.

SCENIC QUALITY

Recommended Study Procedure

The scenic quality of a route is based on the visual quality of the type of view, panorama, scene or focal point, with some 15 items for each type of view. The quality of view (1-outstanding to 5-poor, highly detracting) is recorded for each item.

The quality of presentation or display of view (1-straight ahead to 5-out the side window) is also recorded. The distance over which the view can be seen is also recorded. The quality of roadway alignment can also be recorded.

A measure of the visual quality of a route can be observed by plotting, for each viewed item or event, the normalized quality of view (3 minus the recorded quality of view), adjusted for presentation quality, as the ordinate vs. the distance over which the item is viewed (abscissa). A measure of the visual quality at any point is the total height of the cumulative plot for all viewed items and the quality of any section is the average height of the cumulative plot for the length of section being considered.

System for Gathering Field Information

The physical system, carried on-board the driven vehicle, consists of:

- A Distance Measuring Device (DMD) which is connected to the vehicle transmission and is ported for the lap top computer.

- A Lap-top Computer with a specially-coded and colored keyboard for inputting verbal comments. Certain keystrokes poll the DMD to collect distance, speed and time.

- A Software Package for input/output and analysis of collected byway information.

- A Video Camera which captures the verbal comments of the commentator as well as desired roadway views. It also displays the instantaneous distance, speed and time.

- A VCR (video-cassette-recorder) Unit

The system operating team consists of:

- A Commentator (usually the driver) who comments on the panoramas, scenes or focal points with materials/color, the scenic quality (1 to 5), and the quality of presentation (1 to 5).

- A Keyboard Operator (usually in the front passenger seat) inputs the remarks of the commentator.

- An Equipment Operator sits near the VCR, etc. and notes whether all systems are on and functioning properly. The operator is also responsible for panning the video to record the views which are being described by the commentator.

Training

It will take two to five days to train the Commentator, the Keyboard Operator and the Equipment Operator. There will be both in-office and actual field operation training.

Rating Team Qualifications/Size

Qualifications:

Commentator - must possess a good sensitivity to scenic byway quality. Knowledge about scenic byway quality can be taught in the training program.

Equipment Operator/Video Camera Planner - should have a good sensitivity to scenic byway quality in order to reinforce and assist the commentator in his task of assessing the level of scenic quality of any route.

Keyboard Operator - must be reasonably proficient in operating a computer keyboard. Good sensitivity to scenic byway quality would be an asset.

The same team should be used for rating all potential byways in a state.

Data Collection

To aid in achieving consistency in the visual quality rating of a route, there are 5 plates, each containing 6 pictures, showing various scenic elements or items and their suggested quality ratings.

Special techniques are suggested for evaluating historic sites or districts and scenic overlooks.

Analysis of Data

The field data are analyzed by studying computer generated plots of the quality vs. distance curves coupled with computer calculated quality ratings of the route.

Recommendations - Scenic Quality

1. The route and corridor should be studied prior to formal scenic evaluation to determine the location of scenic/ethnic historic sites or districts and the need for scenic overlooks, turnouts or selective clearing.

   Many of these items will probably be specified in documentation submitted by groups that have nominated a given route for scenic byway designation. This will allow the rating team to anticipate locations in which to use the suggested special techniques of evaluating historic/ethnic sites or districts and special techniques for turnouts/overlooks, selective clearing (see the Data Collection section).

2. The American Automobile Association (AAA), long a leader in showing scenic routes on their maps, uses five categories of routes:

   Quintessential
   Natural beauty
   Cultural beauty
   Uniqueness
   Public land scenic byways.

   (See Table 15 for a description of each category.)

   It is suggested the concept of the five categories may be helpful in the designation process of a system of scenic byways in the states.

3. A data bank of Scenic Byways studied, rejected or designated should be developed.

4. It is recommended that routes with average quality ratings of 4.0 or higher be considered for Scenic Byway designation. As each state gains experience in byway designation they may want to adjust the threshold quality rating. Each state should build a "data bank" of data collected on rated byways and use the data bank for retaining or changing the 4.0 quality rating. The qualitative rating of a route by a good, experienced rating team is an important adjunct to the quantitative rating.

SAFETY EVALUATION

Safety Evaluation Should be Made

Prior to any route being given a Scenic Byway designation, there should be a safety evaluation of the route. Potentially hazardous locations should be identified and improved as necessary. It will also be helpful if numbers of future accidents are predicted and it will be especially helpful if the effects of changes in traffic volumes, shoulder types and widths, etc. on estimated numbers of future accidents are determined.

Potentially hazardous locations can be identified using the Expectancy Commentary Driving Technique, commonly called "Commentary Driving". During "Commentary Driving", the driver states his "expectancies" of the road and "comments" on locations which violate his expectancy. Any location which violates the driver's expectancy is a potentially hazardous one.

The prediction of future numbers of accidents on the studied routes was made using an accident predicting equation developed through FHWA. Data for the equation such as the type terrain (flat, rolling, mountainous) roadway width, shoulder type and roadside hazard ratings can be obtained while driving the route. Average Daily Traffic (ADT) of each route can usually be obtained from the state. The Commentary Driving expectancy violation types and locations and the data for the prediction equation are collected on a laptop computer/distance measuring device system similar to that used in gathering the scenic quality data.

The data output shows the location and types of expectancy violations and a computer program calculates the numbers of predicted accidents (AOMY). One of the uses of the accident predicting methodology is to play "what-if" games i.e., what if the ADT were to increase, what if the shoulders or roadway were widened, etc. The numbers of accidents can be predicted using the "what if" conditions and compared to the accidents predicted for the existing situation.

The details of conducting a safety study are described. The process is sound and workable.

Recommendations - Safety

1. Routes which have qualified for byway designation under the scenic quality criteria should have a commentary driving/safety evaluation to identify potentially hazardous locations and related accidents-per-mile-per-year (AOMY). A route should be driven in both directions in the safety evaluation because expectancy violations, in particular, can be considerably different depending on the direction of travel. The commentary driving should be done at typical roadway operating speeds.

2. The highway agency, probably the state, should develop relationships between the predicted AOMY's and that agency's current accident file on similar type/volume roads. Thus one could get a good indication from the predicted AOMY's whether the road is:

   a) low in numbers of accidents

   b) about average

   c) high in numbers of accidents

   This comparison could work well with Reference (5) in making decisions regarding whether safety improvements should be made on a route.

3. If the highway agency does not have a good sign inventory for the route, one should be made. The video/computer system used in the safety evaluation was originally developed for use in roadway condition/maintenance/signing and can be easily used to gather roadway surface conditions and signing. This can be accomplished in two ways: one, make a separate run to inventory signs and surface conditions or two, enter the sign/roadway surface information via the keyboard while viewing the videotape of the safety run in a stop-go type of operation. An existing computer program will output a typical sign inventory/surface condition report. Note that poor surface conditions, notably riding comfort, might well be used to deny Scenic Byway Designation to a route.

SCENIC BYWAY DESIGNATION

Nomination of Potential Byways

If there is to be a scenic byway program, then one can expect nominations of roads for scenic byway designation from many groups.

(1) groups or individuals who want their road to be one of the designated scenic byways primarily because of the perceived, and often real, economic benefits of byway designation.

(2) The state or a "Scenic Byways Task Force" (private/government entity) could decide it is in the best interest of the citizens to search out, nominate and designate "Scenic Byways - Scenic/Historic Byways" and mark such routes on state maps, as a minimum.

(3) There might even be some citizens who have found a lovely scenic road on a day or weekend leisurely sightseeing trip and would like others to know of the route. They would hope that others with similar interests would share "their" discovered roads so all could easily find the scenic roads in the region.

There should be a well-defined mechanism for receiving and reacting to such nominations.

Scenic Corridor Enhancement and Protection

Included in this section are summaries of five case studies from the FHWA 1990 National Scenic Byways Study.

- *Common Elements of State and National Scenic Byways Programs (part II)*
  by the American Recreation Coalition

- *Scenic Resource Protection Techniques and Tools*
  by Scenic America

- *Protection Techniques for Scenic Byways: Four Case Studies*
  by the National Trust for Historic Preservation

- *Roles of Local Planning Agencies in Scenic Byways Programs*
  by the American Planning Association

- *Creative Landscape Design Solutions in Scenic Byways*
  by the American Society of Landscape Architects

Scenic Byways Information

Those who purposely drive Scenic Byways do so for the pleasure of recreational driving as opposed to trying to get from point A to point B.

There are two general categories of Scenic Byways Users, sometimes called Byway Recreationists:

1. Those who want to find roads in their region for weekday and weekend pleasure driving.

2. Those who would like to plan a trip "across country" with all or portions of the trip on Scenic Byways.

The following information is needed:

- Roadmap or guide showing the location of Scenic Byways

- Information about the route's scenic, historic, cultural, geologic, vegetative, etc. attributes and their level of excellence.

- Is the road paved or gravel and how smooth is the surface.

- Is it in operation all year or closed in the winter.

- Is it suitable for all vehicles or are large RV's or tour buses excluded.

- Does it require a 4-wheel drive vehicle (there probably won't be many such roads in the four-state region for which this study was made).

- What are the amenities along or near the route, e.g., food, fuel, lodging, (especially "bed and breakfast" inns) historic sites or districts.

- The user will assume the road is reasonably safe for reasonably prudent drivers. They will expect reasonable signing with no expectancy violations, even for a stranger to the road.

For an excellent brochure on all of the above, see Utah's *Scenic Byways and Backways* (Reference 13).

Scenic Byway Signing

The author urges the four states in this region to develop one basic logo that meets the desires of each of the four states.

Thanks to Joe Mickes, Missouri Highway and Transportation Department we have a prime candidate. A print of a sign proposed for Missouri's adoption is shown in the body of this report. Note that Missouri's state bird and flower is on the logo. It is suggested that a similar procedure be followed in each state i.e., use the state bird and flower but leave the remainder of the sign as it is.

SUMMARY

During the Byways Study, it was tacitly agreed that Scenic Byway designation of a road would probably be made only after its nomination by some group with a special interest in the road. A primary impetus for developing the quantitative techniques for evaluating byway scenic or historic quality was to assure that all requests for byway designation would be evaluated in a uniform, consistent fashion to assure some minimum level of scenic quality. The following recommendations are based on the assumption that a state agency such as the highway department and/or perhaps a Scenic Byways Task Force will make the final decision whether a route receives Scenic Byway designation.

Suggested Process

1) The designating agency should develop a criteria and a process for scenic or historic byway <u>designation</u> and also for <u>de-designation</u> if the resources of the corridor are compromised or destroyed.

2) Based on the designated criteria, the local group nominating (nominators) a byway would prepare <u>preliminary</u> documentation in support of the route.

3) The designating agency should review the preliminary request in a timely fashion indicating to the nominators whether the route is acceptable, can be made acceptable or is unacceptable. At this time a formal scenic quality study using the procedures described earlier should be made to determine if the scenic quality rating meets a threshold quality level of, say, 4.0.

4) At this stage the nominators must decide if they can or still desire to implement the required local management plan to protect the scenic and/or historic resources of the nominated byway.

5) At about this stage in the sequence, a safety study of the proposed route should be made. If the road is local, a safety study should probably have been made just after determining that the scenic quality requirements were met. The costs and methods of financing any necessary safety upgrading could determine whether the nominators choose to continue to work for byway designation.

6) Assuming the project continues, a guide signing system, clearly showing the road is a Scenic Byway, should be developed. The costs, who will bear them, and who will design the sign system is an important consideration.

7) A byway marketing plan is now necessary. As a minimum, the potential byway user:

- must be informed of the existence of the route
- must know enough about the route and its quality and amenities to decide to drive or not drive it.
- must be able to find the route and stay on it until deciding intentionally to leave it.

End of Executive Summary

Scenic Byways: Their Selection/ Designation/Protection and Safety

INTRODUCTION

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Signing, maps, interpretation of items of interest, marketing a byway, information needs of the byway driver.

The above issues are discussed in the following sections.

SCENIC QUALITY

Background

In order to achieve consistency in the selection of future designated Scenic Byways, one must be able to promise some minimum level of "scenic quality" or "scenic/historic quality". It is generally believed that many groups will want "their" road to be one of the designated Scenic Byways primarily because of the perceived economic benefits of byway designation.

Some organization such as a state or local road agency or state byway committee must be able to accept or reject the request for Scenic Byway designation for a given road. Vermont (2), New York (3), Arizona (4), and Colorado have well-defined procedures for scenic/historic byway designation.

The organizations responsible for designating scenic/historic byways need quantitative criteria to assure minimum acceptable levels of scenic or scenic/historic quality. Vermont (2), New York (3) and Arizona (4) have guidelines which are somewhat quantitative but are principally qualitative. In the evaluation of a potential scenic road in Vermont and New York, for example, the evaluators are to check positive values for scenic road criteria such as vegetation, landscape features, road characteristics, waters, buildings, other manmade structures and others. Each of the criteria listed above has several subcategories, e.g., under landscape features there are such items as panoramic and other distant views; scenic terrain (near and middle distance); natural focal point; cliffs,, boulders and rock outcrops. There is also a list of negative criteria such as landscape scars, buildings; other man-made structures and a category, other. Each criterion has several specific items as in the positive criteria. In the recommended procedures, checks are made on a checksheet for each 1/10 mile for the various positive or negative values. It is recommended that a minimum net score of 10 for each mile is generally needed to qualify that road as a "scenic byway".

Recommended Study Procedure

Background

Many of the basic concepts from New York (3) and Vermont (2) were used in developing the study procedure for the quantification of byway quality.

The following items are important in rating potential Scenic Byways:

- What one sees.
- What one does.
- What one learns.
- The quality of what one sees.
- How long (distance) one sees a particular view or element.
- How the view is presented or displayed, i.e., straight ahead or out the side window.
- Types of activities along the road.
- Visual character of the road itself, i.e., how well it fits the terrain, how smooth and flowing is the "ribbon-of-roadway".
- Measures of variety or lack of variety (degree of monotony).

In order to relate the above items to "what we can see and do when driving the roads", two basic rating systems are used. The first system deals with the evaluations of the "visual" road or corridor. The second system deals with the identification of the "social" road or corridor. The "social" aspects of the roadway deal with the cultural, historic, educational and recreational activities that exist along the road corridor. The "visual" road or corridor is divided into the following elements for evaluation:

(a) Type of View

. Panoramas	. Scenes	. Focal Points
A panorama is a sweeping, distant view that fills a wide arc of the road traveler's vision. Such views normally occur at high spots in the road where trees and brush have been cut to provide a wide overlook.	A scene can be any one of a wide variety of views which are generally closer than a panorama. A scene usually covers a much smaller portion of the traveler's vision.	Focal points are those views that are so framed that one's eyes are inevitably are inevitably drawn to them. A focal point covers only a few degrees of the field of vision - a lone tree or building are common focal points.
For panoramas there are 13 items related to Materials/Color	For scenes there are 13 items related to Materials/Color	For focal points there are 16 items related to Materials/ Color

(b) Quality of View -

The following "quality of view" ratings (1 to 5) for each type of view are used:

"1" excellent

"2" good

"3" average - so-so (typically a "3" rating is not identified in driver commentary)

"4" less than desirable/detracts, distracts

"5" poor/highly detracting

Note that "1" and "2" ratings are the equivalent of positives and "4" and "5" ratings are the equivalent of negatives when normalized (i.e. subtracted from 3) e.g., 3-1 = +2, 3-2 = +1, 3-3 = 0, 3-4 = -1, 3-5 = -2.

(c) Quality of Presentation

A "quality of presentation" or display of view rating 1-5 for each type view is used. The quality of presentation is based on the relative ease of "seeing" the various views as the road is driven. As shown in Figure 1 those views which are straight ahead are easiest to "see" and are therefore given a score of "1".

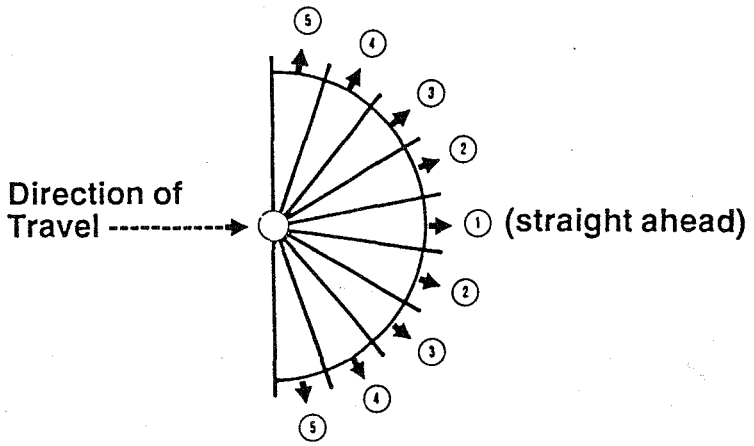


Figure 1. Quality of Presentation Rating Scheme

There are several conditions which can result in a presentation score of "1". The obvious condition is near view of the ribbon of roadway which is always straight ahead. A straight road which rises to a crest and allows the driver to

overlook a valley straight ahead as the road falls and turns away would provide a presentation score of "1" for the view of the valley. Curving roads offer the most opportunities for presentation ratings of "1". As the road curves, the straight ahead views coincide with the tangents to the curve as the driver moves along the curve. These tangent or straight ahead views, as shown in Figure 2, are given presentation ratings of "1".

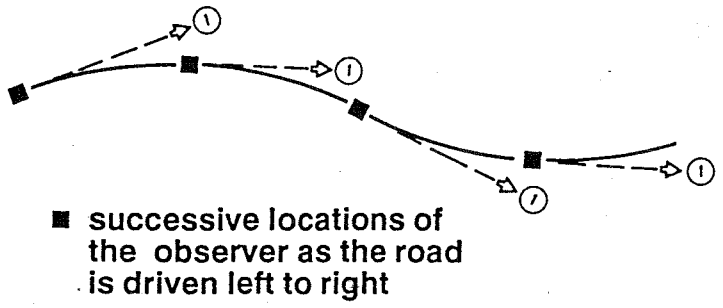


Figure 2. Plan View of a Curving Road Showing Opportunities for Presentation Ratings of "1"

Those views which can be seen only by looking out the side-window, the most difficult to "see", are given a "5".

(d) How long (distance) a given view is visible. This is measured automatically by the system used in the study.

The "social" road corridor is identified by the type and number of the amenities within the corridor and the visual character of the roadway alignment. The "social" road or corridor is divided into following elements for evaluation:

1. Visual and functional character of the roadway alignment

   i) quality of roadway appearance or presentation (quality of view rating of 1 to 5 is used). This is called "Ribbon of Roadway".
   ii) roadway character resulting from good coordination of highway geometry was reflected through the ribbon of roadway element. This is called "Road Fits Terrain" with a quality of view of 1 to 5.
   iii) traffic
   iv) intersection and roadside activities.

2. Education and cultural elements that exist along the roadway corridor or can be accessed from the corridor

   i) historic structures, examples of ethnic activities or museums.

3. Natural features, including wildlife, geologic and vegetation

4. Amenities along the roadway such as motels, parks or rest areas

Measuring Visual Quality

A measure of the visual quality of a route can be observed by plotting, for each view item or event, the normalized quality of the view (3 minus quality of view), adjusted for the presentation quality (ordinate) vs. the distance (abscissa) over which the item is viewed. A measure of the quality at any point is the total height of the cumulative plot for all viewed items or events and a measure of the quality of any section of the route is average height of the cumulative plot for the length of section being considered.

The following are factors which were usually used to adjust the presentation quality:

Presentation Quality	Presentation Adjustment Factor
1	1.00
2	0.90
3	0.80
4	0.70
5	0.60

Table 1 illustrates the computations ranging from normalizing the view quality to determining the value of the ordinate to determining the area of the event (i.e., ordinate x distance).

TABLE 1. SAMPLE COMPUTATIONS

Event Seq.	Quality of View	Quality of Presentation	Normalized View Quality	Presentation Adjustment Factor	Ordinate Normalized View Quality X Presentation Factor	Distance Begin Distance Minus End Distance	Area for Event Ordinate X Distance
010	1	1	3 - 1 = +2	1.00	+2 x 1.00 = +2.00	2930	+5860.0
011	2	2	3 - 2 = +1	0.90	+1 x 0.90 = +0.90	686	+617.4
012	2	3	3 - 2 = +1	0.80	+1 x 0.80 = +0.80	1801	+1440.8
013	5	5	3 - 5 = -2	0.60	-2 x 0.60 = -1.20	14,425	-17,310.0
014	4	3	3 - 4 = -1	0.80	-1 x 0.80 = -0.80	1801	-1440.8

If one would plot all the ordinates vs. distance throughout the route and sum the areas under the curve for, say, the first mile, the quality rating factor would be the summed area divided by 5280 ft.

Computer programs, discussed later, were developed to plot the view quality adjusted for presentation vs. distance along the route. The program allows the user to change the presentation factors. Other computer programs were developed to compute the visual quality rating for selected segment lengths (usually one mile) as well as the average rating for the entire route.

Scenic Byway Field Data Collection

Each state was asked to nominate 15 to 20 potential byways for use as study byways in the research project. Definitions of scenic roads and a number of guidelines and criteria for scenic byway selection were sent to each state. Each state had established a Scenic Byways Task Force prior to the request and the Task Forces participated in nominating the study byways. The Task Force membership generally consisted of persons with responsibilities and interest, both public and private, in the designation of future Scenic Byways.

In order to assure consistency in the field study one four-person study team was designated to carry out all of the field work. One person from each state served on the team. The team was responsible for selecting, in each state, five study routes from the 15-20 potential byways nominated by each Task Force.

The team also selected approximately 10 miles of each study route for detailed study. A 10 mile sequence of "nothing" route, generally nearby, was also selected for detailed study. This assured that there would be a fairly wide range in visual quality, i.e., outstanding to boring. A range of visual quality was necessary if the quality ratings were to be meaningful.

The team attended a two day training period on identifying the various scenic view items (panoramas, scenes, or focal points) (see Tables 3 to 6), rating the quality of the items and making presentation ratings (see Figures 1,2) of the view items. The team was also trained in the use of the laptop computer with its special keyboard, the video camera, the VCR unit and calibration of the distance measuring device (see Figures 3,4,5).

The team spent about a week in each state collecting the "scenic" data on the selected 10 mile segments of the five study routes and the five "nothing" routes. The team also made a "safety" run on the entire length of each study route. The "safety" methodology will be described later.

Analysis of Field Data

The "quality curves", i.e., the quality ratings (1 to 5) vs. each item viewed, for the study routes and companion "nothing" routes were plotted. The visual quality of each element was normalized (subtracted from 3) and multiplied by the presentation adjustment factors, as noted earlier, of 1.00, 0.90, 0.80, 0.70, and 0.60 respectively for presentation quality ratings of 1 to 5.

The plots served a very valuable purpose in that one could quickly see the effect of elements such as the over-rated negative effect of power lines. The plots with large areas under the quality curves were of the good quality routes and plots with small areas were the average and boring routes.

The study team had rated each route, qualitatively, as outstanding, good, average or boring. The ratings were recorded when the survey of each route was completed.

The data and plots were spot checked by viewing the videotapes. The videotapes were extremely helpful in confirming quality and presentation ratings. The videotapes closely simulated "being there". The commentary recorded on the tape coupled with the quality of views and presentation quality of views enabled one to change the data file as necessary. It is feasible, not easy, but feasible to make a data file entirely from a video with commentary, distances and panned views.

The data files were corrected for obvious discrepancies and the nearly universal problem of over-rated negative effect of power poles. The editing of the data files was greatly aided by an excellent commercial editing program.

Computer-generated quality ratings were calculated for each route and the ratings were compared to the survey team qualitative rating for the routes. The comparisons are shown in Table 2.

Missouri Route 4A (MO4A in Table 2) was rated outstanding by the team but was a bit low (3.10) in computer generated rating. An examination of the videotape indicated a substantial number of high quality views that were missed or were commented on but not rated and input into the computer. The likely reason for the missed views is that this route was rated during the second day of the field study and the team was still "feeling it's way" with the commentary/laptop computer system. In one instance a route was rated "good" by the team but the computer generated rating was quite low. In viewing the videotape it was apparent the route was, in fact, a "good" one. The survey team had not given a rating to "road flows with terrain" when in fact the road quality was quite good. The rating change was made in the data file, re-analyzed in minutes and the new quality ratings were well up into the "good" area.

TABLE 2. STUDY ROUTE RATINGS: COMPUTER GENERATED VS. SURVEY TEAM RATING

Team Rating:	Outstanding	Good	Average	Boring
	IA[1].4A[2](6.22)[3]	NB.15A(2.75)	IA2N(1.96)	NE2N(1.25)
	IA.3A(5.54)	NB.14A(2.68)	IA5N(1.90)	NE14N(1.09)
	NB.6A(4.91)	MO.3A(2.59)	IA4N(1.87)	IA5N(1.07)
	NB.11A(4.08)	MO.2A(2.20)	IA2A(1.86)	NE3N(1.01)
	NB.3A(3.95)	NB.2A(2.14)	MO4N(1.69)	IA1N(0.85)
	MO.4A(3.10)	KS.9A(1.83)	IA3N(1.67)	KS4N(0.66)
[1]IA = Iowa Route		KS.3N(1.72)	MO3N(1.54)	MO1N(0.65)
KS = Kansas Route		KS.16A(1.59)	IA1A(1.47)	MO2N(0.63)
MO = Missouri Route		KS.9N(1.47)	KS3A(1.36)	NB11N(0.50)
NB = Nebraska Route			MO17A(1.27)	NB6N(0.48)
			KS14A(1.08)	
[2]Study Route Designation			MO1X(0.99)	
[3]Computer generated quality rating			MO17N(0.84)	
			KS16N(0.63)	

Recommended Quality Rating

Based on the study, it is recommended that routes with average quality ratings of 4.0 or higher be considered for Scenic Byway designations. As each state gains experience in Byway Designation they may want to adjust the threshold quality rating. The qualitative rating of a route by a good rating team is an important adjunct to the computer - assisted quantitative rating.

System for Gathering Field Information

The physical system, carried on-board the driven vehicle, consists of:

- A Distance Measuring Device (DMD) which is connected to the vehicle transmission and is ported for the lap top computer.

- A Lap-top Computer with a specially-coded and colored keyboard for inputting verbal comments. Certain keystrokes poll the DMD to collect distance, speed and time.

- A Software Package for input/output and analysis of collected byway information.

- A Video Camera which captures the verbal comments of the commentator as well as desired roadway views. It also displays the instantaneous distance, speed and time.

- A VCR (video-cassette-recorder) Unit.

The physical system is an adaptation of the Route Inventory Information Management System (RIIMS) developed by Decision Data, Inc., Topeka, KS.

The system operating team consists of:

- A Commentator (usually the driver) who comments on the panoramas, scenes or focal points with materials/color, the scenic quality (1 to 5), and the quality of presentation (1 to 5). Tables 3, 4 and 5 list the various elements related to materials/color under each type of view. Table 6 lists additional events. A number of types of views can be carried simultaneously. The system can also capture the travel distance in which a certain scene or panorama continues to be visible.

- A Keyboard Operator (usually in the front passenger seat) inputs the remarks of the commentator. Figure 3 shows the keyboard operator with the lap top computer and the adjacent video camera. Figure 4 shows the coded keys for the input from commentator's remarks. The computer screen shows and holds the quality of a given view until the commentator tells the operator to take it off or "scene ends". For example, power poles along a roadway might run for a mile or so, the commentator would say "focal point, man-made color/pattern/symbol, 4 (detracts), presentation 2, start now" - a mile later, at end of power poles "take off power poles".

- An Equipment Operator sits near the VCR, etc. and notes whether all systems are on and functioning properly. The operator is also responsible for panning the video to record the views which are being described by the commentator. Figure 5 shows the equipment operator with the VCR, etc. in the background.

TABLE 3. PANORAMA ITEMS RELATED TO MATERIALS AND COLOR

COMPUTER KEYBOARD OVERLAYS		PANORAMA
1		TYPICAL LANDFORM
2		UNIQUE LANDFORM
3		WATER BODY
Q		TYPICAL NATIVE VEGETATION
W		UNIQUE NATIVE VEGETATION
E		TYPICAL AGRICULTURAL
R		UNIQUE AGRICULTURAL
A		MAN-MADE SINGLE STRUCTURE
S		MAN-MADE MULTI-STRUCTURE
D		UNIQUE MAN-MADE
Z		COLOR NATIVE VEGETATION
X		PATTERNS NATIVE VEGETATION
C		MAN-MADE COLOR/PATTERNS

TABLE 4. SCENE ITEMS RELATED TO MATERIALS AND COLOR

COMPUTER KEYBOARD OVERLAYS		SCENE
4		CLIFF/BLUFF/DRAW/DEPRESSION
5		ROCK OUTCROP
6		UNIQUE LANDFORM
7		MOVING WATER
8		WATER BODY
T		VEGETATION EDGE
Y		ISOLATED NATIVE VEGETATION
U		VEGETATION PATTERNS
I		CROPS AND CROP PATTERNS
O		AGRICULTURE NATIVE EDGE PATTERN
F		AGRICULTURAL ACTIVITY
G		AGRICULTURAL STRUCTURES
H		NON-AGRICULTURAL STRUCTURES
J		UNIQUE STRUCTURE
V		COLOR/NATIVE VEGETATION
B		PATTERNS NATIVE VEGETATION
N		MAN-MADE COLOR/PATTERN

TABLE 5. FOCAL POINT ITEMS RELATED TO MATERIALS AND COLOR

COMPUTER KEYBOARD OVERLAYS		FOCAL POINT
9		LANDFORM EDGE
0		ROCK/ROCK PATTERN
-		UNIQUE LANDFORM
=		MOVING WATER
P		WATER-VEGETATION EDGE
{[		NATIVE VEGETATION EDGE
}]		UNIQUE VEGETATION
\		VEGETATION STRUCTURE EDGE
K		AGRICULTURAL OPERATIONS
L		AGRICULTURAL UNIQUE
:;		MAN-MADE STRUCTURE
M		COLOR NATIVE VEGETATION
,<		PATTERNS/FORMS NATIVE VEGETATION
.>		MAN-MADE COLOR/PATTERN/SYMBOLS
/		MAN-MADE UNIQUE

TABLE 6. ADDITIONAL EVENTS

COMPUTER KEYBOARD OVERLAYS		ADDITIONAL EVENTS
!		TRAVEL ACCOMMODATIONS
@		NATURAL TOURS
#		MUSEUMS
$		REFUGE/NATIONAL LANDS
%		HISTORIC DISTRICT (SITE)
^		HISTORIC/ARCHEOLOGICAL/ETHNIC
&		PARKS/RECREATION AREA
*		REST AREAS
(		ROAD FLOWS WITH TERRAIN
)		ROAD RIBBON
_		ROAD SIDE
+		TRAFFIC

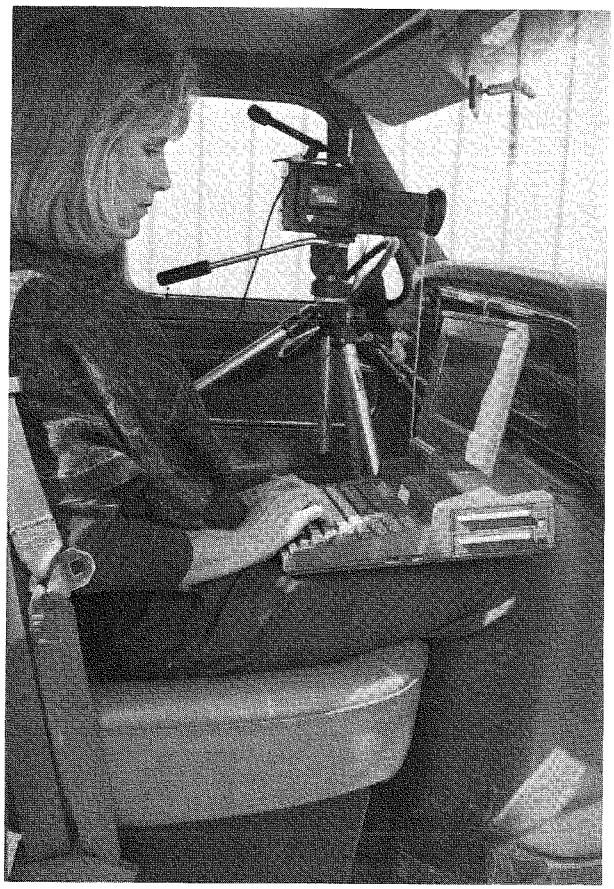


FIGURE 3 Keyboard operator with lap-top computer.

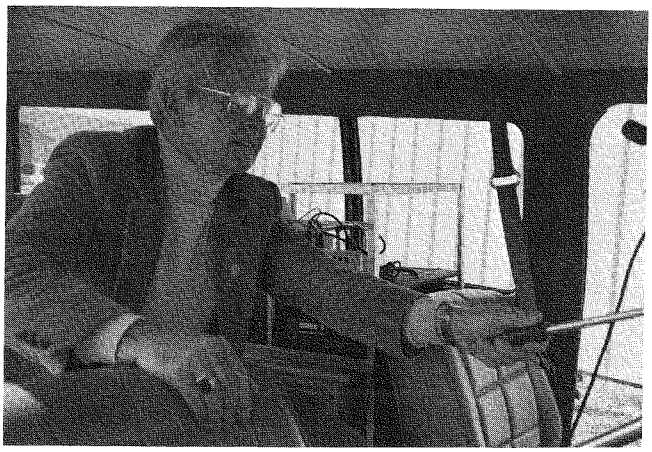
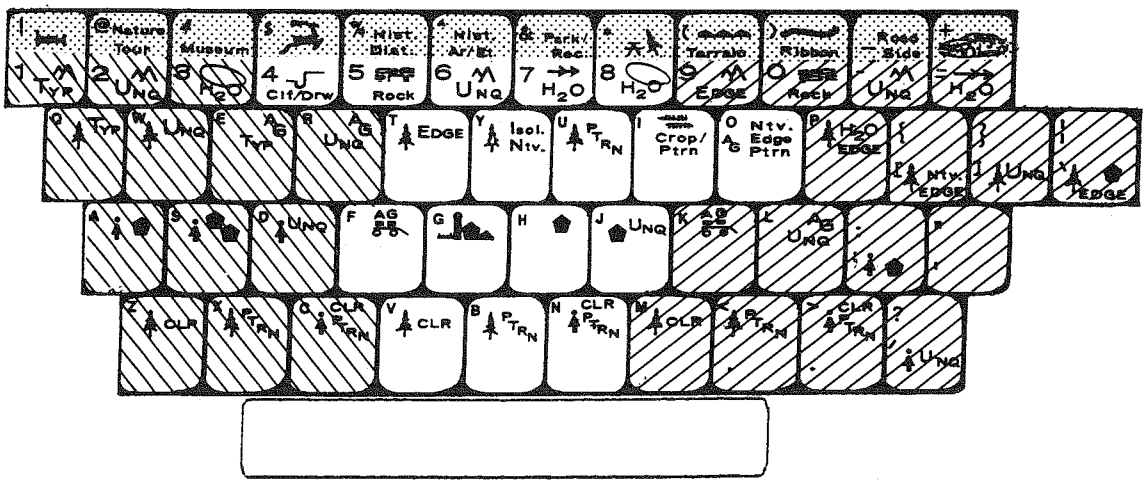


FIGURE 5 Equipment operator.



[ ] (orange) ADDITIONAL EVENTS [ ] (pink) SCENE

[ ] (green) PANORAMA [ ] (blue) FOCAL POINT

FIGURE 4 Coded computer keyboard.

Table 7 shows the computer printout of the data gathered on a run. In this example the events were printed out in order of occurrence. The output can also be printed by type of event, by distance, etc.

Table 7 shows the quality of view (range 1 to 5) and the quality of presentation (range 1 to 5) for any "event", i.e. various items viewed for panoramas, scenes and focal points. Note that the distance over which the item was in view was also recorded automatically.

In Table 7 the events are listed in order by time of entry into the computer, i.e., the time the view is first seen. Consider the 12th event, the code for the event is 176, the quality of view is 2 (good) (1 is best, 5 is poor, highly detracting) and the quality of presentation 3 (about 40 degrees left or right of straight ahead) (see Figure 1). The view was first "seen" at distance 15,605 feet from the beginning of the route and went out of view (drove past it) at 17,406 ft. It was "in sight" for 1801 ft. (17,406 - 15,605 = 1801). The speed at the time of first view was 33 mph and the time was 10 min. 39.6 sec. after the start of the "run". The "Event activity description" column shows the type of view was a scene (S) and the item was a vegetation edge. Note that the first letter P, S or F stands for Panorama, Scene or Focal point, respectively.

TABLE 7. PRINTOUT OF DATA

Route 4B
Thu, May 3, 1990
9:25 am
Missouri - 79, PIKE & RALLS COUNTIES
NORTHBOUND FROM SCENIC OVERLK, NO. OF RT. T TO RT. N

Event	Note	Event	Quality of View	Quality of Presentation	Distance (ft)		Speed (mph)	Time	Event Activity Description
Seq		Code			Begin	End			
001	*	211	2		000000	031281	00	00:01:06:44	Road ribbon = [Shift] 0
002	*	176	2	3	000000	009956	00	00:00:47:56	S:Vegetation edge = t
003	*	152	2	3	001153	001390	2*	00:02:05:03	P:Water = 3
004	*	170	2	3	002827	003224	19	00:03:12:26	S:Cliff/Bluff/Draw/Depression = 4
005	*	170	2	3	003700	004024	3*	00:03:59:36	S:Cliff/Bluff/Draw/Depression = 4
006	*	216			005870	005870	19	00:05:36:93	Parks/Recreation areas = [Shift] 7
007	*	176	2	3	010256	015102	32	00:07:13:05	S:Vegetation edge = t
008	*	172	2	1	011290	012963	7*	00:08:02:69	S:Unique land form = 6
009	*	190	2	1	011415	012890	9*	00:08:12:61	F:Rock, rock pattern = 0
010	*	172	1	1	012976	015906	4*	00:09:08:44	S:Unique land form = 6
011	*	190	2	2	013399	014085	21	00:09:56:14	F:Rock, rock pattern = 0
012	*	176	2	3	015605	017406	33	00:10:39:62	S:Vegetation edge = t
013	*	204	5	5	016856	031281	32	00:11:04:10	F:Man made color/pattern/symbol = .
014	*	182	4	3	017539	019218	18	00:11:19:21	S:Agricultural structures = g
015	*	172	2	1	020607	022105	25	00:12:46:75	S:Unique land form = 6
016	*	170	2	3	021195	021945	8*	00:13:03:17	S:Cliff/Bluff/Draw/Depression = 4
017	*	170	2	3	022161	022356	1*	00:13:51:03	S:Cliff/Bluff/Draw/Depression = 4
018	*	170	2	3	022383	022954	9*	00:14:15:28	S:Cliff/Bluff/Draw/Depression = 4
019	*	172	2	1	024657	027839	25	00:15:23:66	S:Unique land form = 6
020	*	176	2	3	026511	031281	34	00:16:00:66	S:Vegetation edge = t
021	*	172	1	2	027900	029391	28	00:16:28:18	S:Unique land form = 6
022	*	179	2	3	028134	030989	27	00:16:33:53	S:Crops and crop patterns = i

Training

It will take three to five days to train the Commentator, the Keyboard Operator and the Equipment Operator. There will be both in-office and actual field operation training.

Instructional Staff:

- Bob Smith
- One or two persons from Decision Data Inc, the developer of the basic data collection system.

Rating Team Qualifications/Size

Qualifications:

Commentator - must possess a good sensitivity to scenic byway quality. Knowledge about scenic byway quality can be taught in the training program.

Equipment Operator/Video Camera Panner - should have a good sensitivity to scenic byway quality in order to reinforce and assist the commentator in his task of assessing the level of scenic quality of any route.

Keyboard Operator - must be reasonably proficient in operating a computer keyboard. Good sensitivity to scenic byway quality would be an asset.

The same team should be used for rating all potential byways in a state. It would probably be desirable if one to three additional persons were trained in order to have an "extra hand" or a substitute in case of illness, etc. It is assumed that the team will be generally made up of state personnel. There are other options:

- One state person plus others.
- Two or more state persons plus others.
- A team made up of outside consultants.

Data Collection System

The Distance Measuring Device (DMD)/Laptop Computer and software package/Video camera/VCR system, which was described earlier, should be installed in a van. The equipment can be purchased or leased from Decision Data, Inc.

It is possible, but not feasible, to collect all the data by hand and to transfer it to the computer format for use in analysis or to even do all the analysis "by hand".

Data Collection

The data collection from the field is simplified considerably by the use of the data collection system. Recall that there are some 50 possible visual items related to Panoramas, Scenes, Focal Points and Additional Events (Tables 3 to 6), that can be evaluated and entered into the laptop computer during the evaluation of a route. The difficulty of this task is considerably reduced by training and experience. In addition, a "board" with large print, can be prepared showing the items commonly viewed or evaluated. This board provides a handy reference for the team members during a run.

Plates 1 to 5, which show pictures of selected events, can be used both in training and as an on-board aid in achieving consistency in the visual quality rating of routes. The captions below the pictures on each plate are taken from the list of items in Tables 3 to 6, for Panoramas (P), Scenes (S), Focal Points (F) or Additional Events (Road Ribbon or Road Flows with Terrain in the plates). The last number, in parenthesis, (1 to 5), is the scenic quality of the viewed item. Recall that 1 is outstanding, 2 is good, 3 is so-so, 4 detracts and 5 is poor or highly detracting.

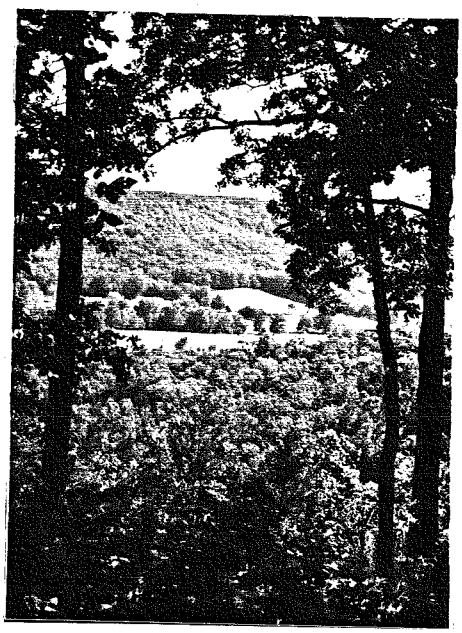
In Plate 1, upper left, note the turnout with parking, picnic tables and clearing of underbrush on this ridge road to enable one to see in the valley, upper right, middle left. There were several locations along this route where selective clearing allowed one to see into the valley.

Most pictures and captions are self explanatory. The variable effect of power poles on view quality is shown in Plate 3, upper left, upper right and middle right. The road ribbon is illustrated in plate 4 upper left, upper middle, upper right, lower left and lower middle.

Historic/Ethnic Sites or Districts - The quality rating of a historic/ethnic site or district can be included in a route rating by evaluating the various historic scenes and focal points as one drives through the area. These ratings are entered into the laptop computer in the usual fashion. The historic designation, from "additional events", will be helpful in alerting a route analyst that the ratings are associated with historic items. The commentary on the videotape should also include a description of the historic site or district.

Turnout and Clearing for Valley View

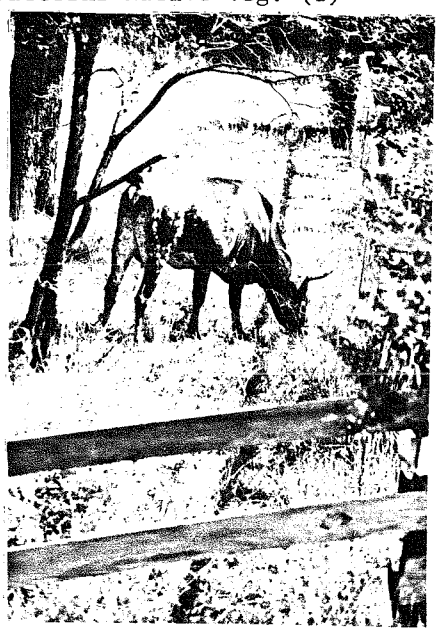
170 S: Cliff/Bluff/Draw/Depr. (1)



View Through Cleared Area
170 S: Cliff/Bluff/Draw/Depression (1)
178 S: Vegetation Patterns (1)

176 S: Vegetation Edge (1)
185 S: Patterns Native Veg. (1)

176 S: Vegetation Edge (2)
179 S: Crops

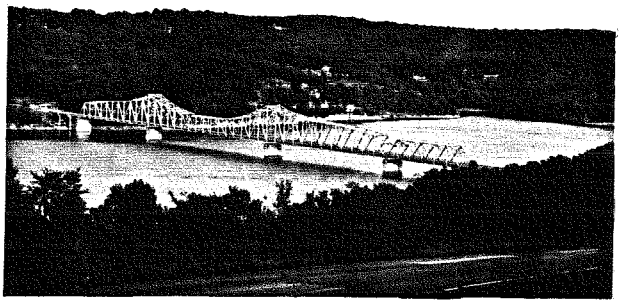


199 F: Agriculture Unique (1)

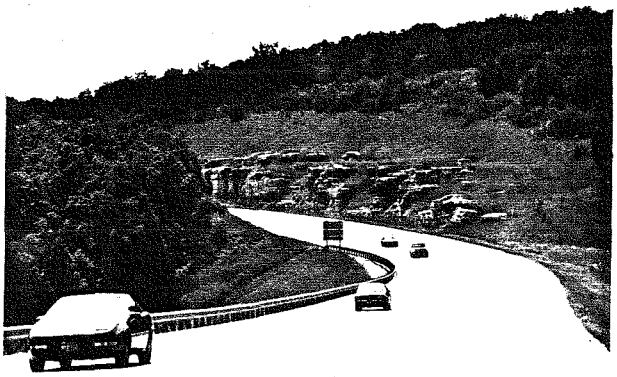
Plate 1. Turnout/Clearing, S: Scenes, F: Focal Points

150 P: Typical Landform (1)

150 P: Typical Landform (2)
170 S: Cliff/Bluff/Draw/Depression (2)



170 S: Cliff/Bluff/Draw/Depression (2)
174 S: Water Body (1)
200 F: Manmade Structure (1)

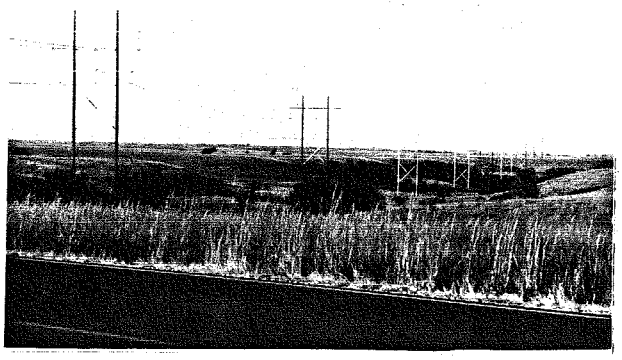


171 S: Rock outcrop (1)
Ribbon of Roadway (1)

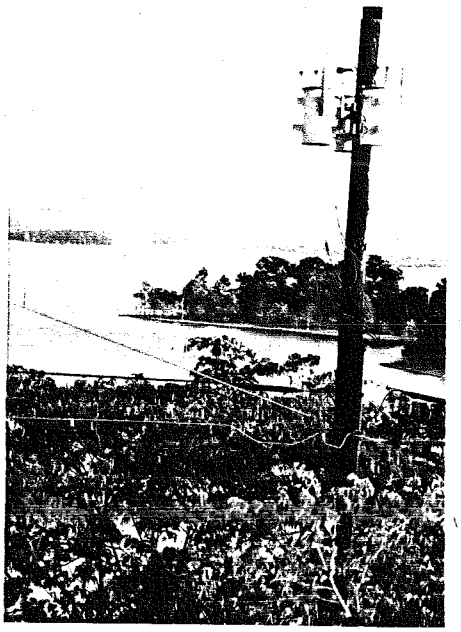
174 S: Water Body (2)
176 S: Vegetation Edge (2)

174 S: Water Body(2)
185 S: Patterns Native Vegetation (2)

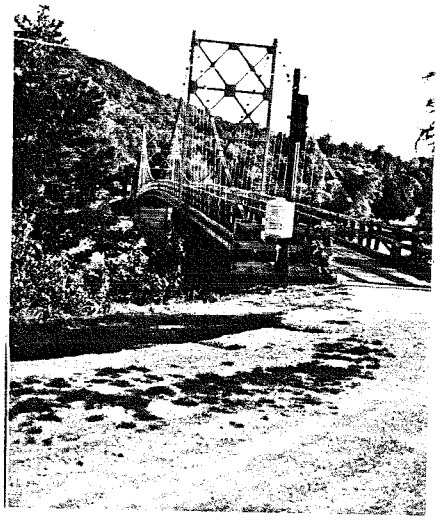
Plate 2. P: Panoramas, S: Scenes, F: Focal Points



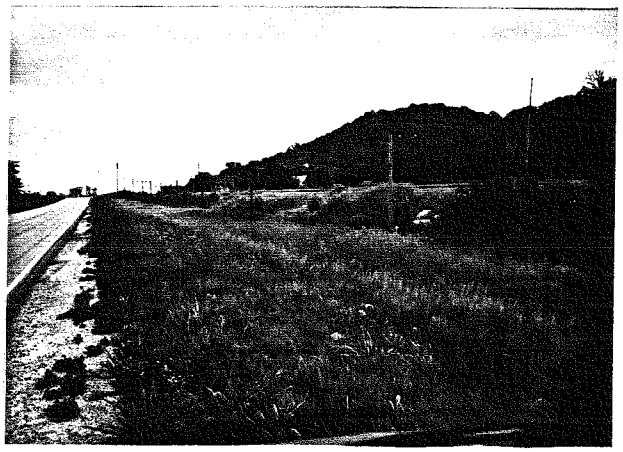
204 F: Manmade Color/Pattern/Symbol -
Power Poles may rate a (3) (no effect)
170 S: Cliff/Bluff/Draw/Depression (2)



174 S: Water Body (1)
204 F: Manmade Color/Pattern/
Symbol (power pole)(5)(bad)

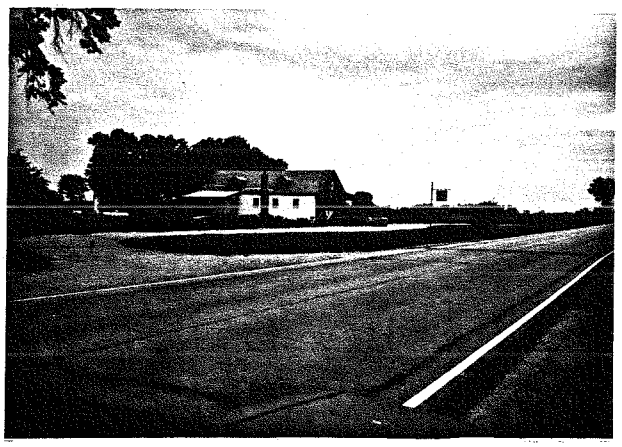


200 F: Manmade Structure (1)
or 205 F: Manmade Unique (1)



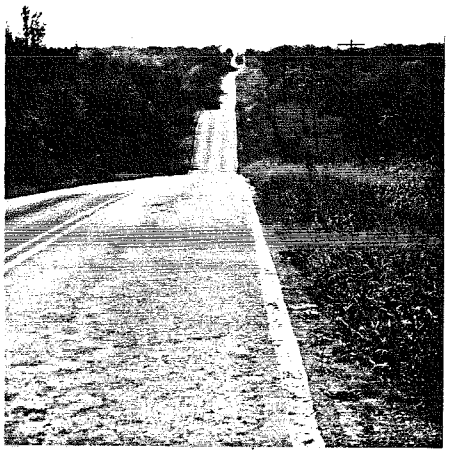
204 F: Manmade Color/Pattern/Symbol
(Power poles/Railroad)(4) or (5)

204 F: Manmade Color/Pattern/Symbol (1)



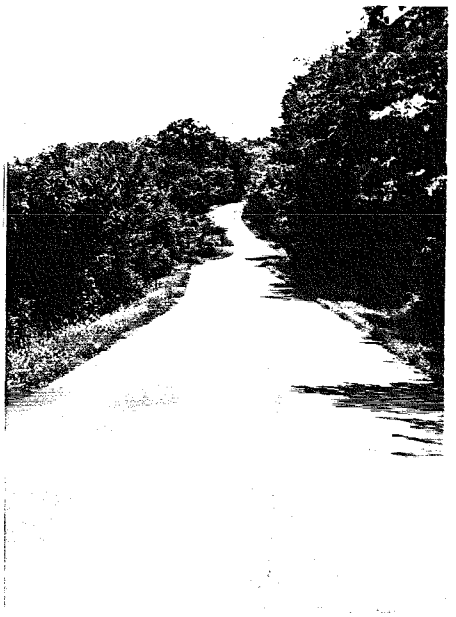
186 S: Manmade Color/Pattern (building
and trash)probably (5)

Plate 3. Manmade Elements

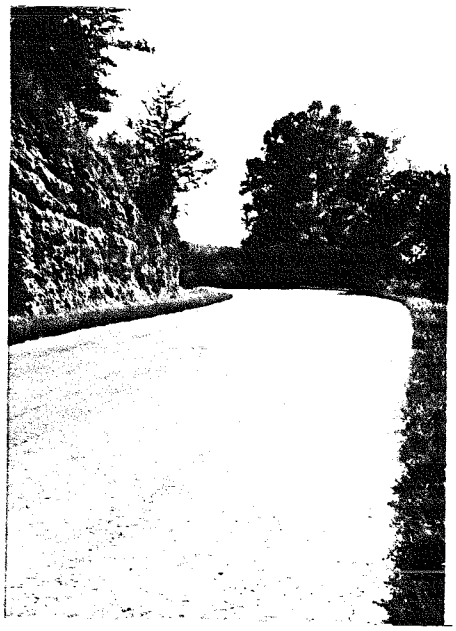


Road Flows with Terrain (1)

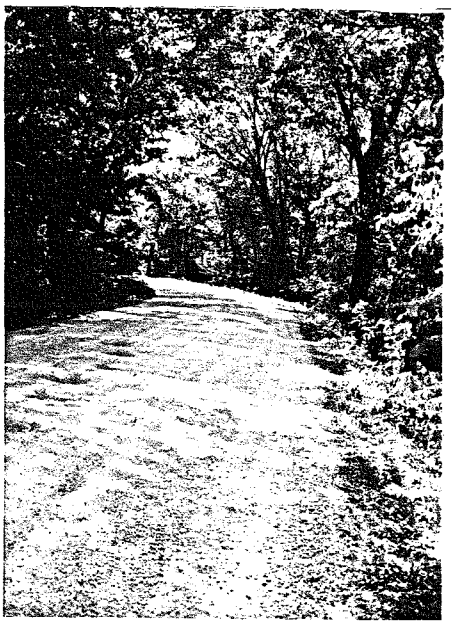
Road Flows with Terrain (2)



Road Ribbon (1)



190 F: Rock, Rock Pattern (1)
203 F: Patterns/Forms Native Veg. (2)
Road Ribbon - maybe (2)



203 F: Patterns/Forms Native Veg. (1)
Road Ribbon (1)

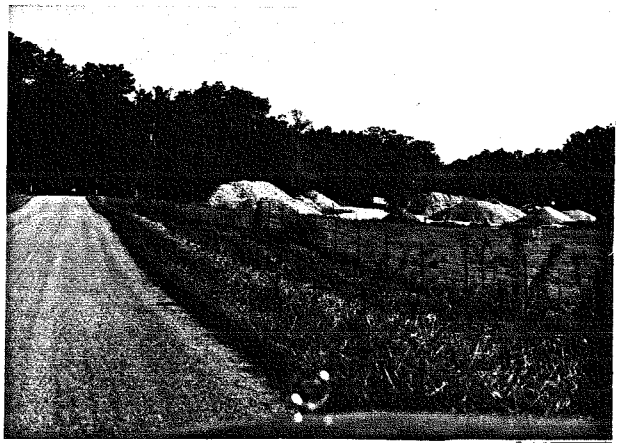
195 F: Unique Vegetation(1
(Largest Elm in US)

Plate 4. Road Ratings

181 S: Agricultural Activity (2)

179 S: Crops and Crop Patterns (Haybales) (1)
or 181 S: Agricultural Activity (1)

176 S: Vegetation Edge (1)
177 S: Isolated Native Veg. (group of) trees (1)



186 S: Manmade Color/Pattern (4)
(Aggregate Storage)

200 F: Manmade Structure (1)

172 S: Unique Land Form (Hills) (1)

Plate 5. Scenes and Focal Point

Special Technique for Turnouts/Overlooks/Selective Clearing - As one drives the road it is often reasonably apparent that there are some good views that are hidden or partially hidden by trees or hills. At other locations there may be such a large number of superb panoramas, scenes or focal points that one can neither describe them adequately "on-the-fly", nor fully enjoy them as a byway user at reasonable speeds.

A large number of "1" quality ratings with "5" presentations for short distances is a good indicator of a potential overlook site or a location for selective clearing of trees and brush.

Scenic turnouts or overlooks and/or selected clearing should add considerably to the quality rating of a route. The problem lies in how to enter the ratings of the views into the computer if one can't see them or capture most or all of them while driving the route. The study rating team experienced this periodically and would comment "there are some nice views out there but we see them only for an instant. Mark this site for possible overlook".

The following evaluation procedure for "overlook" or "clearing" situations is suggested:

The vehicle usually can't be driven to a place where one can see the views from a potential "overlook" or "clearing". In these cases the video camera and laptop computer can be taken to where one can video and comment on the view from the potential "overlook". The video and laptop continue to carry time. The commentator will verbally describe (on the video) the panoramas, scenes and focal points with their quality ratings. The presentation ratings should always be "1" (straight ahead). The appropriate entries are made in the laptop computer. The distances will be recorded as zero since we are not connected with the distance measuring device.

Recall that the determination of a quality rating for a section of road requires one to determine the area under a "view quality x distance" curve divided by the distance. The distance, as noted, is missing. One could calculate an "equivalent distance" (feet) to be entered into the data file by multiplying the time (in seconds) from the video tape, that one viewed, say, a particular panorama, by the estimated highway speed, in feet per second. For example if one viewed the panorama for 15 seconds and the speed of most vehicles on the road was 40 mph (about 60 ft./sec.) the "equivalent distance" would be 15 sec. x 60 ft./sec. = 900 ft.

This evaluation procedure for potential overlooks has not been tried but the reasoning is sound and it should work very well. It should be tried.

Editing the Data

A printout of the data should be examined while reviewing the route videotape. Missed entries or entry errors will usually be mentioned on the videotape. The data file can be edited quite easily with good commercial editing software. The Newton Commander Edit program was used in the project.

Analysis of Data

The analysis of the data is greatly aided by the use of "BYWAYS 7", a battery of computer analysis programs, and a computer plot program "BWPLOT". The computer programs are very user friendly and well documented. The programs were developed for IBM compatible micro-computers. They were developed with project funds and will be delivered to any of the sponsoring states upon request.

A printout of the options from "BYWAYS 7" is shown below:

1 - Print out the data file
2 - Print out the Byways map information
3 - Print out the frequency map information
4 - Print out the Event list
5 - Display the Byways map information
6 - Display the Frequency map information
7 - Perform Byways statistical analysis
8 - Perform Byways statistical analysis mile by mile
9 - Do 7 followed immediately by 8
Q - Quit program

PRINTOUT OF DATA FILE (See Table 8 - Route 3N Nebraska)

As stated earlier this printout can be examined for data omissions or errors. Desired data changes can be noted and the data file changed as desired.

TABLE 8. DATA FOR ROUTE 3N

```
3  N
Mon, May 21, 1990
 1:34 pm
Nebraska - N 121 NORTHBOUND PIERCE COUNTY
FROM JCT N 13 TO US 20
20
001  * 185 2   2 000000 000746 00 00:01:18:89 S:Patterns native veg. = b
002  * 204 5   2 000000 042965 00 00:00:52:95 F:Man made color/pattern/symbol =
003  * 177 2   2 001137 002592 30 00:02:07:45 S:Isolated native veg. = y
004  * 179 2   3 002066 007806 34 00:02:25:33 S:Crops and crop patterns = i
005  * 181 2   3 003276 004940 33 00:02:48:80 S:Agricultural activity = f
006  * 176 2   3 004541 005233 36 00:03:12:82 S:Vegetation edge = t
007  * 180 2   2 005890 007403 36 00:03:37:42 S:Ag. native edge pattern = o
008  * 176 2   3 008620 010083 33 00:04:25:46 S:Vegetation edge = t
009  * 179 2   2 009219 042965 36 00:04:36:35 S:Crops and crop patterns = i
010  * 180 2   4 010619 012478 34 00:05:00:99 S:Ag. native edge pattern = o
011  * 150 2   3 013343 015016 32 00:05:52:24 P:Typical landform = 1
012  * 181 4   3 016272 018029 35 00:06:45:52 S:Agricultural activity = f
013  * 200 4   4 023445 023733 23 00:08:51:93 F:Man made structures = ;
014  * 182 2   5 025490 025633 25 00:09:39:85 S:Agricultural structures = g
015  * 180 2   3 028053 028625 31 00:10:34:86 S:Ag. native edge pattern = o
016  * 181 2   3 031911 033502 35 00:11:44:34 S:Agricultural activity = f
017  * 200 2   3 035734 036093 34 00:12:57:57 F:Man made structures = ;
018  * 182 4   4 037249 037527 21 00:13:28:47 S:Agricultural structures = g
019  * 205 2   3 038389 039104 21 00:13:56:94 F:Man made unique = /
020  * 182 4   2 041209 042606 28 00:15:20:73 S:Agricultural structures = g
```

BYWAYS MAP INFORMATION (Table 9 - Route 3N Nebraska)

This function will print out the Byways map information, i.e. the information that could be used to prepare a plot of quality rating vs. distance for the entire route or any desired portion.

TABLE 9. BYWAYS MAP INFORMATION FOR ROUTE 3N

3 N
Mon, May 21, 1990
1:34 pm
Nebraska - N 121 NORTHBOUND PIERCE COUNTY
FROM JCT N 13 TO US 20

Quality Rating	Starting Distance	Ending Distance	Total Distance
-0.90	000000	000746	000746
-1.80	000747	001136	000389
-0.90	001137	002065	000928
-0.10	002066	002592	000526
-1.00	002593	003275	000682
-0.20	003276	004540	001264
0.60	004541	004940	000399
-0.20	004941	005233	000292
-1.00	005234	005889	000655
-0.10	005890	007403	001513
-1.00	007404	007806	000402
-1.80	007807	008619	000812
-1.00	008620	009218	000598
-0.10	009219	010083	000864
-0.90	010084	010618	000534
-0.20	010619	012478	001859
-0.90	012479	013342	000863
-0.10	013343	015016	001673
-0.90	015017	016271	001254
-1.70	016272	018029	001757
-0.90	018030	023444	005414
-1.60	023445	023733	000288
-0.90	023734	025489	001755
-0.30	025490	025633	000143
-0.90	025634	028052	002418
-0.10	028053	028625	000572
-0.90	028626	031910	003284
-0.10	031911	033502	001591
-0.90	033503	035733	002230
-0.10	035734	036093	000359
-0.90	036094	037248	001154
-1.60	037249	037527	000278
-0.90	037528	038388	000860
-0.10	038389	039104	000715
-0.90	039105	041208	002103
-1.80	041209	042606	001397
-0.90	042607	042965	000358

FREQUENCY MAP INFORMATION (Table 10 - Route 3N Nebraska)

This function will print out the positive events and the negative events in each quarter mile or shorter intervals if desired. This information may be helpful in analyzing roads for "change-of-pace", a generally accepted requisite for excellent scenic quality. Table 10 shows a partial listing for Route 3N.

TABLE 10. FREQUENCY MAP INFORMATION - ROUTE 3N

```
3  N
Mon, May 21, 1990
 1:34 pm
Nebraska - N 121 NORTHBOUND PIERCE COUNTY
FROM JCT N 13 TO US 20

Quarter mile number:  1

Positive Events:
    185  2  2  0746 ft  Con't  S:Patterns native veg. = b
    177  2  2  0183 ft         S:Isolated native veg. = y

Number of positive events:  2
Negative Events:
    204  5  2  1320 ft  Con't  F:Man made color/pattern/symbol = .

Number of negative events:  1


Quarter mile number:  2

Positive Events:
    177  2  2  1272 ft  Con't  S:Isolated native veg. = y
    179  2  3  0574 ft         S:Crops and crop patterns = i

Number of positive events:  2
Negative Events:
    204  5  2  1320 ft  Con't  F:Man made color/pattern/symbol = .

Number of negative events:  1


Quarter mile number:  3

Positive Events:
    179  2  3  1320 ft  Con't  S:Crops and crop patterns = i
    181  2  3  0684 ft         S:Agricultural activity = f

Number of positive events:  2
Negative Events:
    204  5  2  1320 ft  Con't  F:Man made color/pattern/symbol = .

Number of negative events:  1
```

(partial listing)

EVENT LIST (Table 11 - Route 3N Nebraska)

This function will printout the event list. This list is similar to the Data Output except that the times are removed and the quality ratings are included.

TABLE 11. EVENT LIST - ROUTE 3N

3 N
Mon, May 21, 1990
1:34 pm
Nebraska - N 121 NORTHBOUND PIERCE COUNTY
FROM JCT N 13 TO US 20

001	185	2	2	0.900	000000	000746	S:Patterns native veg. = b
002	204	5	2	-1.800	000000	042965	F:Man made color/pattern/symbol
003	177	2	2	0.900	001137	002592	S:Isolated native veg. = y
004	179	2	3	0.800	002066	007806	S:Crops and crop patterns = i
005	181	2	3	0.800	003276	004940	S:Agricultural activity = f
006	176	2	3	0.800	004541	005233	S:Vegetation edge = t
007	180	2	2	0.900	005890	007403	S:Ag. native edge pattern = o
008	176	2	3	0.800	008620	010083	S:Vegetation edge = t
009	179	2	2	0.900	009219	042965	S:Crops and crop patterns = i
010	180	2	4	0.700	010619	012478	S:Ag. native edge pattern = o
011	150	2	3	0.800	013343	015016	P:Typical landform = l
012	181	4	3	-0.800	016272	018029	S:Agricultural activity = f
013	200	4	4	-0.700	023445	023733	F:Man made structures = ;
014	182	2	5	0.600	025490	025633	S:Agricultural structures = g
015	180	2	3	0.800	028053	028625	S:Ag. native edge pattern = o
016	181	2	3	0.800	031911	033502	S:Agricultural activity = f
017	200	2	3	0.800	035734	036093	F:Man made structures = ;
018	182	4	4	-0.700	037249	037527	S:Agricultural structures = g
019	205	2	3	0.800	038389	039104	F:Man made unique = /
020	182	4	2	-0.900	041209	042606	S:Agricultural structures = g

PERFORM BYWAYS STATISTICAL ANALYSIS (Table 12 - Route 3N Nebraska)

This function calculates the weighted average of the quality rating, as well as the minimum/maximum values, over the entire route or a portion of the route.

A companion function will calculate the weighted quality rating for each mile or shorter interval, giving the maximum/minimum values of quality rating for each interval. Study of this output is helpful in locating very good or very poor visual quality segments.

TABLE 12. BYWAYS STATISTICAL ANALYSIS

3 N
Mon, May 21, 1990
1:34 pm
Nebraska - N 121 NORTHBOUND PIERCE COUNTY
FROM JCT N 13 TO US 20

The interval begins at 0 and ends at 42965 feet.
The weighted average over the interval is: -0.784001
The maximum weighted Quality Rating over the interval is: 0.600000
The minimum weighted Quality Rating over the interval is: -1.800000

For mile number 1,
The weighted average is: -0.58
The maximum weighted value is: 0.60
The minimum weighted value is: -1.80

For mile number 2,
The weighted average is: -0.71
The maximum weighted value is: -0.10
The minimum weighted value is: -1.80

For mile number 3,
The weighted average is: -0.40
The maximum weighted value is: -0.10
The minimum weighted value is: -0.90

For mile number 4,
The weighted average is: -1.17
The maximum weighted value is: -0.90
The minimum weighted value is: -1.70

For mile number 5,
The weighted average is: -0.92
The maximum weighted value is: -0.30
The minimum weighted value is: -1.60

For mile number 6,
The weighted average is: -0.81
The maximum weighted value is: -0.10
The minimum weighted value is: -0.90

For mile number 7,
The weighted average is: -0.60
The maximum weighted value is: -0.10
The minimum weighted value is: -0.90

For mile number 8,
The weighted average is: -1.00
The maximum weighted value is: -0.10
The minimum weighted value is: -1.80

For mile number 9,
The weighted average is: -1.35
The maximum weighted value is: -0.90
The minimum weighted value is: -1.80

BYWAY PLOTS (Figure 6 - Route 3N Nebraska)

This program will plot each item for which data were recorded. It also plots a cumulative or summation graph. The plots are very helpful in determining, almost at a glance, the elements contributing to very high or very low ratings. Note that the summation graph is almost entirely negative.

The negative quality ratings from Table 12 and the negative summation graph of Figure 6 imply the entire route is visually detracting if one applies the earlier definitions of quality ratings of "4" or "5" (i.e. normalized ratings of 3-4 = -1, 3-5 = -2). In other words the overall rating of the route, -0.78, is somewhere between so-so, 3, and detracting, 4. The video tape showed pretty clearly that while this was not a road with spectacular views neither was it a road with many, many detracting views. The road was just so-so, a bit boring. An examination of the data (Table 8) shows that data entry number 2, item 204, "Focal Point, manmade color pattern symbol" was given a quality of view rating of 5 (highly detracting) and a presentation rating of 2, i.e., just left or right of center. Further note that this Focal Point was apparently present at the beginning of the route and continued through the entire 42,965 ft. of the route. The visual problem was power poles along the entire length of the route. In Figure 6 the plot of item 204 F:Manmade color/ pattern/symbol shows a very large negative area with a -1.8 rating the entire route. Clearly, the reason for the negative ratings throughout the route is item 204. Upon studying the videotape, which contained the instantaneous distance, speed and time and verbal commentary, it was clear the power poles were not highly destructive to one's enjoyment of the road. The study team had been instructed to include the negative or detracting effects of power lines in the evaluation. At a meeting after all data were gathered, the team agreed that many power pole situations such as small telephone poles were barely noticeable and only slightly, if at all, destructive to the visual quality of a route. In the case of the existing data, the data file was changed to reflect the more realistic situation.

The visual quality rating of item 204 was changed to "3" thus, the normalized quality rating became zero and the entire effect of the power poles was removed. The visual quality rating could have been reduced to a "4" and the presentation rating could have been changed to "5" this would have resulted in a rating of (3-4) x 0.6 = -0.6 as opposed to the -1.8 as shown in item 204, Figure 7. This action would result in a 67% reduction in the negative effect of the power poles as rated in the field. This method "lies" a little in that one actually sees the power poles at a "2" or "3" presentation rather than "5", out the side window.

There will usually be relatively few "5" presentations in a route. If this is the case another technique to lessen the effect of, say, the power poles is to rate the poles "4" on quality, "5" on presentation and then change the visual presen-

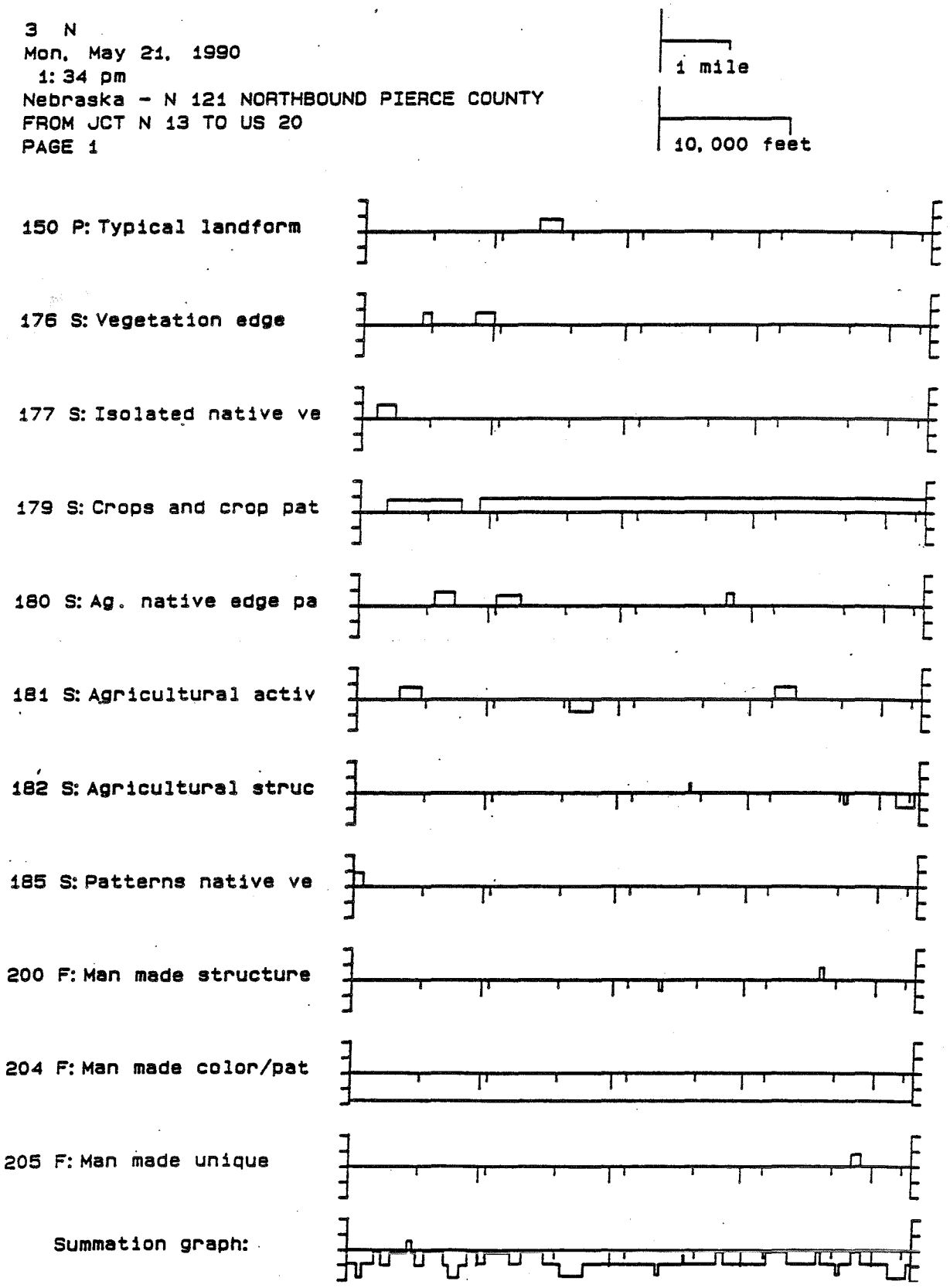


Figure 6. Route 3N - Plots of Various Scenic Items

tation adjustment for "5" to, say 0.2. This would give a rating of (3-4) x 0.2 = -0.2 giving about a 90% reduction in the negative effect of the power poles as rated in the field.

In the case of Route 3N, the power poles were subsequently given a quality of view rating of "3" which entirely removed the effect of the power poles. The data change was recorded in a data file "3NCh19" (See Table 13). Note that the quality of view of the second entry is now "3" which entirely removes the effect of the power poles.

TABLE 13. NEW DATA (3N CH. 19) WITH QUALITY OF VIEW ITEM 204 (SECOND ENTRY) CHANGED FROM ROUTE 3N

```
3  Nch19
Mon, May 21, 1990
 1:34 pm
Nebraska - N 121 NORTHBOUND PIERCE COUNTY
FROM JCT N 13 TO US 20
20
001   * 185 2    2 000000 000746 00 00:01:18:89 S:Patterns native veg. = b
002   * 204 3    3 000000 042965 00 00:00:52:95 F:Man made color/pattern/symbol =
003   * 177 2    2 001137 002592 30 00:02:07:45 S:Isolated native veg. = y
004   * 179 2    3 002066 007806 34 00:02:25:33 S:Crops and crop patterns = i
005   * 181 2    3 003276 004940 33 00:02:48:80 S:Agricultural activity = f
006   * 176 2    3 004541 005233 36 00:03:12:82 S:Vegetation edge = t
007   * 180 2    2 005890 007403 36 00:03:37:42 S:Ag. native edge pattern = o
008   * 176 2    3 008620 010083 33 00:04:25:46 S:Vegetation edge = t
009   * 179 2    2 009219 042965 36 00:04:36:35 S:Crops and crop patterns = i
010   * 180 2    4 010619 012478 34 00:05:00:99 S:Ag. native edge pattern = o
011   * 150 2    3 013343 015016 32 00:05:52:24 P:Typical landform = i
012   * 181 4    3 016272 018029 35 00:06:45:52 S:Agricultural activity = f
013   * 200 4    4 023445 023733 23 00:08:51:93 F:Man made structures = ;
014   * 182 2    5 025490 025633 25 00:09:39:85 S:Agricultural structures = g
015   * 180 2    3 028053 028625 31 00:10:34:86 S:Ag. native edge pattern = o
016   * 181 2    3 031911 033502 35 00:11:44:34 S:Agricultural activity = f
017   * 200 2    3 035734 036093 34 00:12:57:57 F:Man made structures = ;
```

The new quality ratings, all positive, were computed and are shown in Table 14. Note in Figure 7 that item 204 no longer exists since the normalized visual quality is 3-3=0. The summation graph, as expected, is positive, i.e. entirely above the "zero" line.

TABLE 14. QUALITY RATINGS AFTER REMOVAL OF EFFECT OF POWERLINES

```
3  Nch19
Mon, May 21, 1990
 1:34 pm
Nebraska - N 121 NORTHBOUND PIERCE COUNTY
FROM JCT N 13 TO US 20
```

The interval begins at 0 and ends at 42965 feet.
The weighted average over the interval is: 1.014491
The maximum weighted Quality Rating over the interval is: 2.400000
The minimum weighted Quality Rating over the interval is: 0.000000

For mile number 1,
The weighted average is: 1.22
The maximum weighted value is: 2.40
The minimum weighted value is: 0.00

For mile number 2,
The weighted average is: 1.09
The maximum weighted value is: 1.70
The minimum weighted value is: 0.00

For mile number 3,
The weighted average is: 1.40
The maximum weighted value is: 1.70
The minimum weighted value is: 0.90

For mile number 4,
The weighted average is: 0.63
The maximum weighted value is: 0.90
The minimum weighted value is: 0.10

For mile number 5,
The weighted average is: 0.88
The maximum weighted value is: 1.50
The minimum weighted value is: 0.20

For mile number 6,
The weighted average is: 0.99
The maximum weighted value is: 1.70
The minimum weighted value is: 0.90

For mile number 7,
The weighted average is: 1.19
The maximum weighted value is: 1.70
The minimum weighted value is: 0.90

For mile number 8,
The weighted average is: 0.79
The maximum weighted value is: 1.70
The minimum weighted value is: 0.00

For mile number 9,
The weighted average is: 0.44
The maximum weighted value is: 0.90
The minimum weighted value is: 0.00

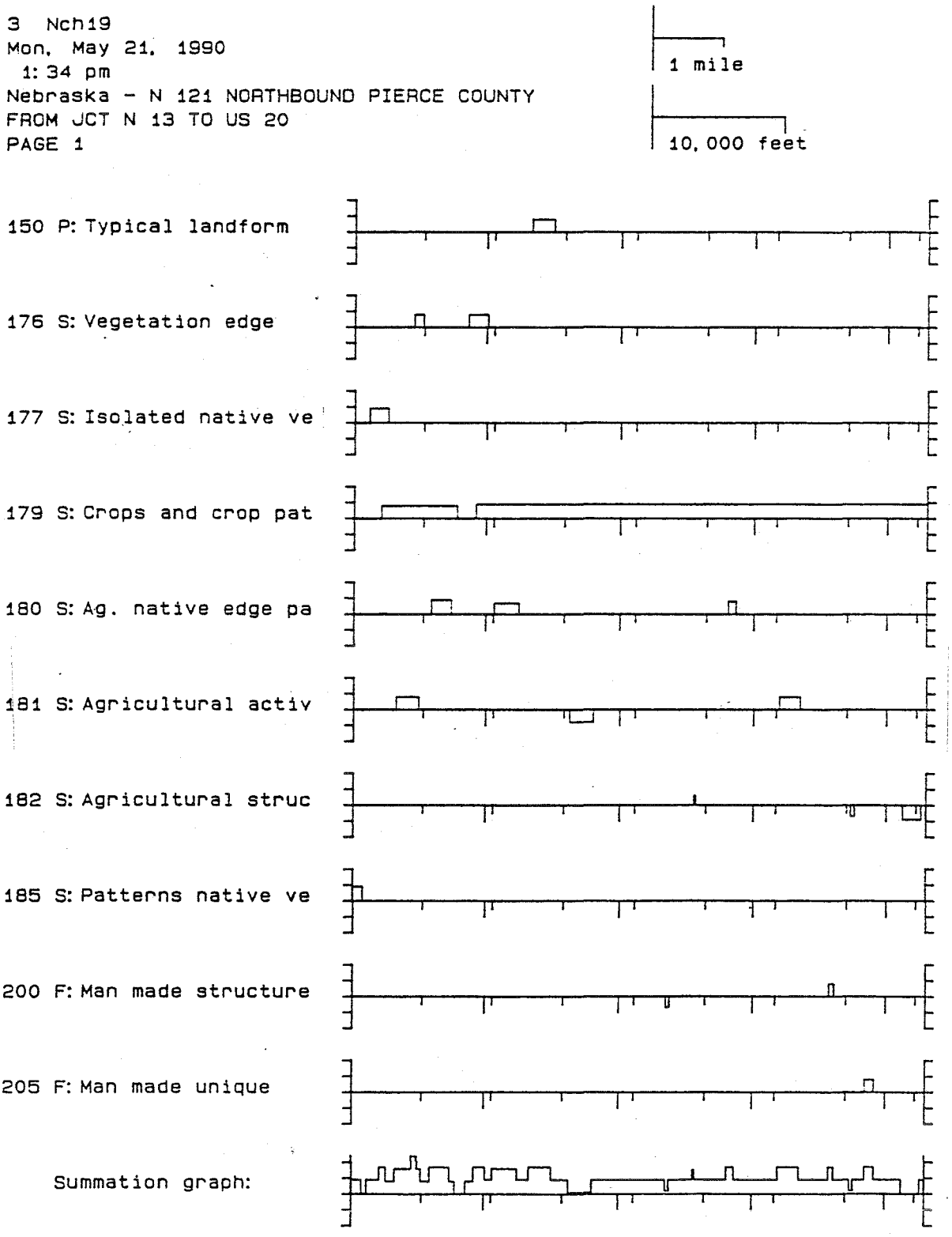


Figure 7. Route 3NCh19 - Plots of Various Scenic Items

Recommendations - Scenic Quality

1. The route and corridor should be studied prior to formal scenic evaluation to determine the location of scenic/ethnic historic sites or district and the need for scenic overlooks, turnouts or selective clearing.

   Many of these items will probably be specified in documentation submitted by groups that have nominated a given route for scenic byway designation. This will allow the rating team to anticipate locations in which to use the suggested special techniques of evaluating historic/ethnic sites or districts and special techniques for turnouts/overlooks, selective clearing (see the Data Collection section).

2. The American Automobile Association (AAA), long a leader in showing scenic routes on their maps, uses five categories of routes:

   Quintessential
   Natural beauty
   Cultural beauty
   Uniqueness
   Public land scenic byways.

   (See Table 15 for a description of each category.)

   It is suggested the concept of the five categories may be helpful in the designation process of a system of scenic byways in the states.

3. As noted earlier, a data bank of Scenic Byways studied, rejected or designated should be developed.

4. It is recommended that routes with average quality ratings of 4.0 or higher be considered for Scenic Byway designation. As each state gains experience in byway designation they may want to adjust the threshold quality rating. The data bank should be used for retaining or changing the 4.0 quality rating. As noted before, the qualitative rating of a route by a good, experienced rating team is an important adjunct to the quantitative rating.

SAFETY EVALUATION

Safety Evaluation Should be Made

Prior to any route being given a Scenic Byway designation, there should be a safety evaluation of the route. Potentially hazardous locations should be identified and improved as necessary. It will also be helpful if numbers of future accidents

TABLE 15. AAA CATEGORIES OF SCENIC ROADS

a. **Quintessential** - "best of the characteristic features or scenery of a State or region". This is the category in which we rely almost entirely on Road Reporter input to select. We are looking for a golden nugget of a road, unheralded by reputation or promotion, that best represents a particular state or region.

b. **Natural Beauty** - "strikingly scenic natural features - canyons, rivers, mountains, deserts, forests, mesas and shoreline scenery". This category is self-explanatory but the key word is striking. There should be something that sets it apart from the same kind of scenery nearby.

c. **Cultural Beauty** - "architectural, historic or economic activities, farming, ranching, fishing villages". These types of routes are either distinguished by park personnel invovlement or by a reputation that precedes the actual tour. The scenic route should be the portion of these areas that is the most concentrated or the best laid out of these features.

d. **Uniqueness** - "usually a limited area that is unique to the region but differs from the general scenery". Reserved for those routes that pass a feature that - while not necessarily strikingly beautiful - is unique enough to draw in itself. The road itself should be one in which the unique feature is presented in a pristine fashion.

e. **Public Lands Scenic Byways** - "byways designated by agencies of the Federal Government". A growing number of Federal Government Agencies (besides the National Park Service) have been designating and signing sections of roads in their disparate jurisdictions as Scenic Byways. AAA will designate these as scenic routes if:

   (1) they are well signed and trailblazed and
   (2) they can be negotiated with little difficulty by a standard, American-made, family sedan vehicle.
   (3) they meet basic scenic route standards. Programs now in effect include:

      (a) U.S. Forest Service - "National Forest Scenic Byways"
      (b) Bureau of Land Management - "Back Country Byways"

are predicted and it will be especially helpful if the effects of changes in traffic volumes, shoulder types and widths, etc. on estimated numbers of future accidents are determined.

Potentially hazardous locations can be identified using the Expectancy Commentary Driving Technique, commonly called "Commentary Driving". During "Commentary Driving", the driver states his "expectancies" of the road and "comments" on locations which violate his expectancy. Any location which violates the driver's expectancy is a potentially hazardous one (6,7).

The prediction of future numbers of accidents can be made using the procedure described in Reference (5).

Commentary Driving Procedure (6,7)

The information that a driver receives from the road must be correct, pertinent, concise and presented in such a way that it is readily understood and usable to the driver. In many cases, however, this information is not consistent with what he expects to receive or should receive. If the driver's expectancy of the roadway environment is violated, a potentially hazardous situation exists. The Commentary Driving Procedure was developed by R. S. Hostetter et. al. (6) and is highly useful in doing safety evaluations on all levels of roads. Commentary Driving is a procedure in which at the beginning of a section or road to be evaluated for potentially hazardous locations, the driver (evaluator) states his "expectancies" of the road and as he proceeds along the road he "comments" on locations/conditions which violate his expectancy.

After doing the "commentary" on a section of road, the evaluator (or others) returns (at a later date) and does a more detailed study of problem locations identified in the "commentary". Note that the problem locations, those which violate a drivers expectancy, are also locations with information deficiencies:

missing information
incomplete information
inappropriate message
misleading/confusing
inappropriate location
obstructed by weeds, brush, etc.
inconsistent information

This study is greatly aided by the use of Information Deficiency Checklists (6,7). The checklists have been developed for 9 typical situations and "other".

1. Stop-controlled intersection
2. Narrow/one-lane bridge
3. Horizontal curve
4. Tangential intersection
5. Intersection which requires a turn
6. Railroad-highway grade crossing
7. Uncontrolled Y-intersection
8. Low water stream crossing
9. Height/weight limit restrictions
10. Other

DETAILS OF PROCEDURE

Establish Initial Expectancies. For any road section being evaluated for information deficiencies or potentially hazardous locations. The driver (evaluator) makes statements (within first 1/2 to 2 miles) concerning the general nature of the roadway environment and initial expectancies. Included are:

surface quality
existing positive guidance
predicted safe driving speeds
presence of warning signs
presence of stop or yield signs on cross roads
initial expectancies

Positive guidance is the concept that a driver can be given sufficient information where he needs it and in a form he can best use to safely avoid a hazard. Positive guidance can be given the driver through a combination of signs, hazard markers, safe speed advisory signs, and most important of all, the view of the road ahead.

It is important to realize that even though motorists have certain expectations for typical types of road, these expectations can be and are modified by what the driver experiences along any given section of road. These latter expectancies are short lived, constantly being modified by a few minutes of driving or exposure to several similar situations. Therefore, if a motorist has been consistently provided curve warning with speed advisory plate for sharp curves, the same treatment will be expected at the next similar curve. If not provided, this expectancy is violated. If, then, the next few curves do not have signing, the motorist's expectations will be modified to not expecting curve warning signs.

The expectancies that the motorist has and further develops or modifies for a given road will affect overall attention to driving and the ability to handle situations requiring a change in speed and/or path. In assessing the information defi-

ciencies it is important, then, to consider the expectancies that an unfamiliar driver has for a given road. Therefore, it is recommended that as part of the information deficiency survey, expectancies about the road be explicitly stated by the driver (evaluator). These expectancies should be stated early into the site, typically after driving a 1/2 mile or so.

The principal elements upon which expectancies could be established are:

Alignment - the presence or absence of horizontal curves and vertical curves, crests, etc. establishes how much sight distance will be available and the need for warning signs. Drivers establish expectancies regarding their speed, need for speed changes, attention to driving, and their overall level of comfort based on design features.

Width - the lane width or the full pavement or travel width also has an effect on the driver's attention and feeling of comfort. On narrow roads, especially those without centerlines, the motorist is more concerned about the vehicle's position on the road when there is opposing traffic.

Shoulder - The presence or absence of a shoulder, and to some extent, the type of shoulder (paved, stabilized gravel, grass, dirt) will influence the driver's expectancy.

Pavement - Drivers establish expectancies based on the type and condition of the pavement. In general, for unpaved roads motorists expect little traffic, slow speeds and few or no warning signs. On a smooth paved surface, motorists may expect to have better geometrics and perhaps to go faster.

Speed and Speed Changes - Based on the geometrics (alignment, width, shoulder, etc.) and pavement condition, the driver establishes expectancies about the safe speed, which may or may not be confirmed by the speed limit, and the need for speed changes.

Signs and Markings - The mere presence or absence of signs and markings along the first part of a road establishes an expectancy of what the driver will experience for the remainder of the road. For example, if the first two curves are appropriately signed with curve warning signs, then the driver could reasonably expect the remainder of the curves to be signed as well. Roads with well marked centerlines and edgelines establish an expectancy that the road will have ample signing and markings whenever needed.

There is no precise way these expectancies should be stated. Two hypothetical examples to illustrate how one might comment on initial expectancies are presented below.

"Now traveling on Rt. 101, Northbound. The road has a smooth surface with a 2-4 foot paved shoulder and open terrain. The road is generally straight with a few gentle curves and short crests with generally good sight distance. The road is marked with centerline and edgeline. I expect to be able to travel at 55 mph even though a speed limit is not posted. I am not concerned about on-coming traffic. If there are curves or other situations requiring a speed reduction, I expect to be warned through appropriate signing."

"Now traveling on Jones Bridge Road, Southbound. The road is paved but there are occasional breaks in the pavement. There is no shoulder or centerline and I am not certain as to my lane limits. The road is curvilinear with several crests and dips which limit the sight distance. Except for some locations my safe speed is about 50 mph. There will be several occasions where I will have to reduce my speed but I expect to receive curve warning signs with speed advisory only at those locations that are really severe."

Running Commentary

Following the statement of initial expectancies concerning the road, the driver continues through the section providing continuous (running) commentary as a method to identify potential information deficient locations. (Obvious information deficient locations located within the first mile or two should be identified as a result of the expectancy statement commentary.) This procedure is recommended because it forces the driver/ evaluator to verbally state what is expected of the road ahead and how it should be handled. By doing so, the driver becomes more sensitive to locations and situations where the road is not as expected and needed warning information was not provided.

The comments should be oriented towards:

a) what the drivers expect of the road ahead relative to any of the following items:

- direction - straight, curve left, curve right
- sharpness of curve
- approaching vehicles
- bridge width
- right-of-way at intersection
- other roadway conditions - e.g., pavement condition, shoulders, etc.

b) what actions are required of the driver regarding speed changes, turns, passing, etc., and

c) if there is any uncertainty as to any item related to a) or b).

A few hypothetical examples of the type of commentary suggested are presented in Table 16.

The commentary need not be long or continuous. On very long straight sections of road with good sight distance there may not be any need for comments except for an occasional restating of the general expectancies for the road. The driver should travel at the speed limit or as close to it as is comfortable.

At first, the driver/evaluator might be reluctant to comment or will be awkward or verbose in the comments made. However, it does not require much exposure to the procedure to become relaxed and able to comment concisely.

Whenever the driver/evaluator comes across a situation where it is felt that an information deficiency exists this fact should be noted by an appropriate comment.

Accident Prediction

The following accident predictive model or equation is used (5):

$$AO/M/Y = 0.0019\ (ADT)^{0.8824}(0.8786)^{W}(0.9192)^{PA}(0.9316)^{UP}(1.2365)^{H}$$

$$(0.8822)^{TER1}(1.3221)^{TER2}$$

Where:

AO/M/Y = related accidents (i.e., single-vehicle plus head-on plus opposite direction sideswipe plus same direction sideswipe accidents) per-mile-per-year,

ADT = average daily traffic,

W = lane width,

PA = average paved shoulder width,

UP = average unpaved (i.e., gravel, stabilized, earth, or grass) shoulder width,

H = median roadside hazard rating (range 1 to 7) (Range 1 to 5 in this study)

TER1 = 1 in flat, 0 otherwise, and

TER2 = 1 if mountainous, 0 otherwise

The ADT's for the route or segments of the route can probably be obtained from each state. The remaining variables are determined while driving the route. More detailed definitions of the variables follow:

TABLE 16. EXAMPLE COMMENTARIES

Item	Possible Commentary
	Example A
Approach to Crest Vertical Curve	"Crest curve ahead," view of road limited... tree line indicates that road goes straight ahead... not concerned about on-coming traffic...wide enough pavement...can maintain cruising speed...
On Vertical Curve Crest	"Confirmed" [continue with next section] or "Expectation violated...tree line went straight but road curved left...not sharp enough to cause any problem...no need for warning sign." [continue with next section] or "Expectation violated...tree line went straight but road turned left sharply...needed to reduce speed...should have had curve warning sign at least...possibly speed advisory...mark site for study."
	Example B
Approach to Horizontal Curve	"Curve left ahead...see curve warning sign, no speed advisory...should be able to take curve at cruising speed...looking out for opposing vehicles because of narrow width."
Point of Curvature or Within Curve	"Curve sharper than anticipated...speed reduction necessary especially if on-coming vehicles...mark site for speed advisory check..."
	Example C
Approach to Narrow Bridge on Curve	"Curve right ahead...see curve warning sign ...assume I can maintain speed..."
Closer to Curve/Bridge	"See bridge headwalls...narrower pavement ...not certain if wide enough for two vehicles...need to slow down...can't see across bridge for opposing vehicles..."
At Bridge	"Curve sharper than expected, bridge width narrower than expected...two vehicles couldn't cross if truck...needed speed advisory...mark for study..."

Terrain - A description of the vertical and/or horizontal curvature, along a highway section, is defined as the following:

- Flat Terrain - Terrain where highway sight distances are generally long and there are few vertical curves or slopes present.

- Rolling Terrain - Terrain with natural slopes which consistently rise above and fall below the highway grade line. Occasionally these slopes restrict normal sight distance.

- Mountainous Terrain - Terrain with abrupt longitudinal and transverse changes in the elevation of the ground with respect to the highways.

Lane Width - The distance measured from the middle of the roadway centerline to the outside edge of the edgeline, or if no edgeline is visible, to the visible joint separating the lane from the paved shoulder. If no paved shoulder exists, the lane width is measured to the edge of the paved surface. (The roadway surface width was measured and later was divided by two for use in the formula.)

Paved Shoulder Width - The width of the concrete or bituminous surface adjacent to the lane.

Unpaved Shoulder Width - The width of the prepared surface of grass, dirt, gravel, stone, or gravel with tar (i.e., stabilized) surface adjacent to the travel lanes (or adjacent to a paved shoulder in some cases).

Roadside Hazard Rating - A subjective measure of the hazard associated with the roadside environment. The rating values indicate the accident damage likely to be sustained by errant vehicles on a scale from one (low likelihood of an off-roadway collision or overturn) to seven (high likelihood of an accident resulting in a fatality or severe injury).

In reference (5), it is suggested that the ratings be determined from a 7-point rural pictorial scale. The data collector should choose the rating value (1 through 7) that most closely matches the roadside hazard level for the roadway section in question. Since the hazard ratings in the Byway Research Project were to be called out "on the fly", the 7 suggested categories or rating values have been reduced to 5 to simplify the rater's task. A 20 in. x 20 in. display board showing the pictorial scales from reference (5) for each of the 5 categories (rating values) should be made. The display board can be used on-board the survey vehicle during the evaluation runs to assist the rater in making consistent hazard ratings. Figure 8 shows pictures of each of the 5 hazard rating categories recommended for use in the safety evaluation study. Figures 9-13 show enlarged views of pictures, from reference (5), for each of the 5 hazard rating categories shown in Figure 8.

ROADSIDE HAZARD RATINGS

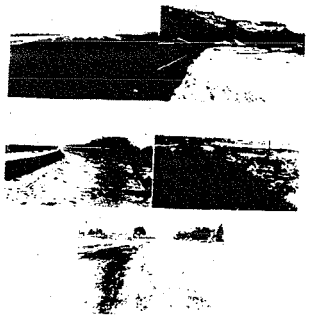


Figure 1

Low likelihood of off-roadway collision or overturn (if it's a "1" out to 30 ft. from edge of traveled way, give it a "1" even if obstacles exist outside 30 ft.)

Hazard Rating = 1

Figure 2

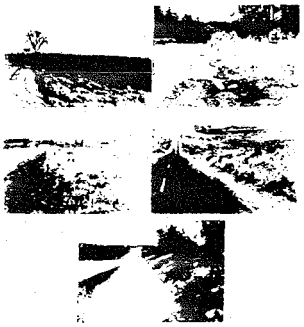


Figure 3

Hazard Rating = 2

Figure 4

Example: Typical guardrail = 3

Hazard Rating = 3

Figure 5

Example: Old cable guardfence = 4

Hazard Rating = 4

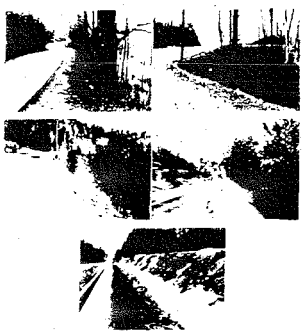


Figure 6

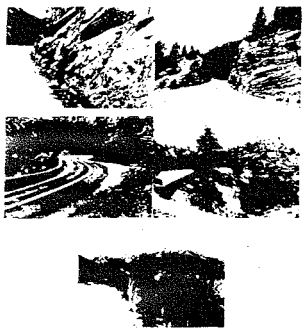


Figure 7

High likelihood of off-roadway accident resulting in a fatality or severe injury.

Hazard Rating = 5

Source: Safety Cost-Effectiveness of Incremental Changes in Cross-Section Design - Information Guide

FHWA RD-87/094

Figure 8. Roadside Hazard Rating Pictures for 5 Hazard Categories

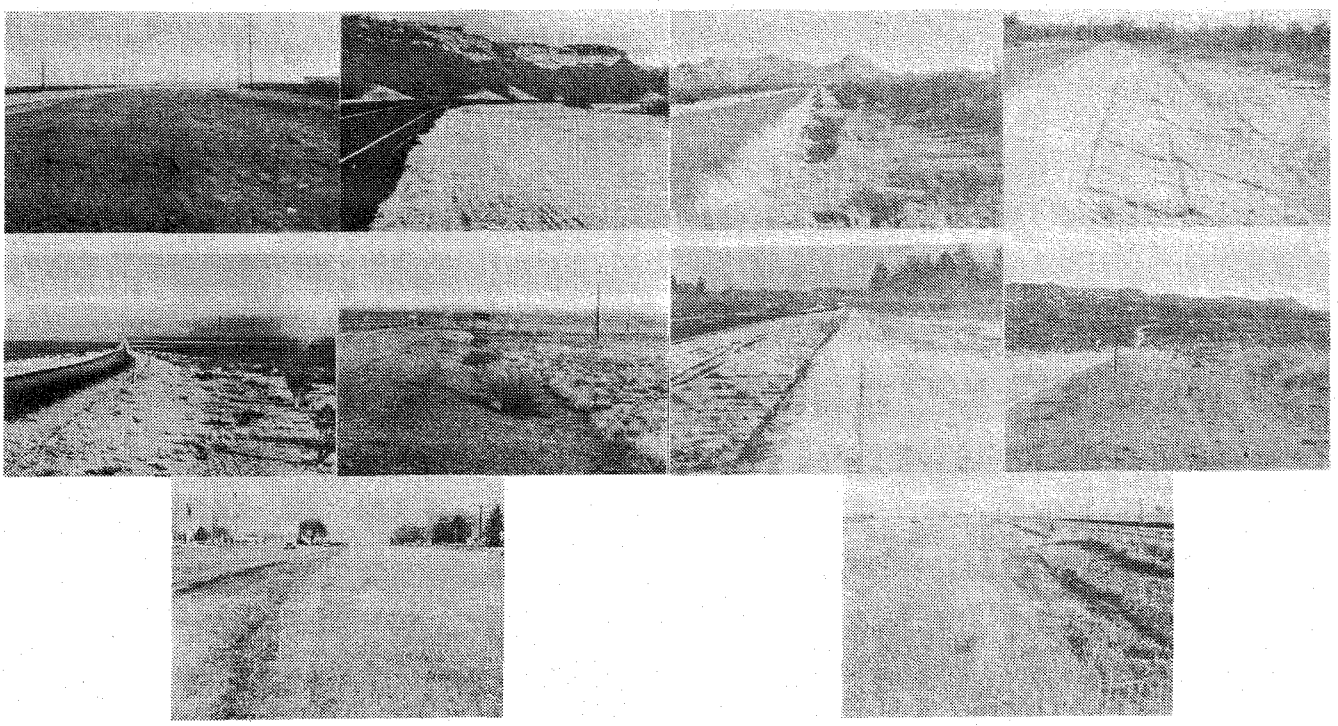


Figure 1. Rural roadside hazard rating of 1.

Figure 2. Rural roadside hazard rating of 2.

Low likelihood of off-roadway collision or overturn (if it's a "1" out to 30 ft. from edge of traveled way, give it a "1" even if obstacles exist outside 30 ft.)

Hazard Rating = 1

Figure 9. Enlarged View of Pictures for Hazard Rating = 1

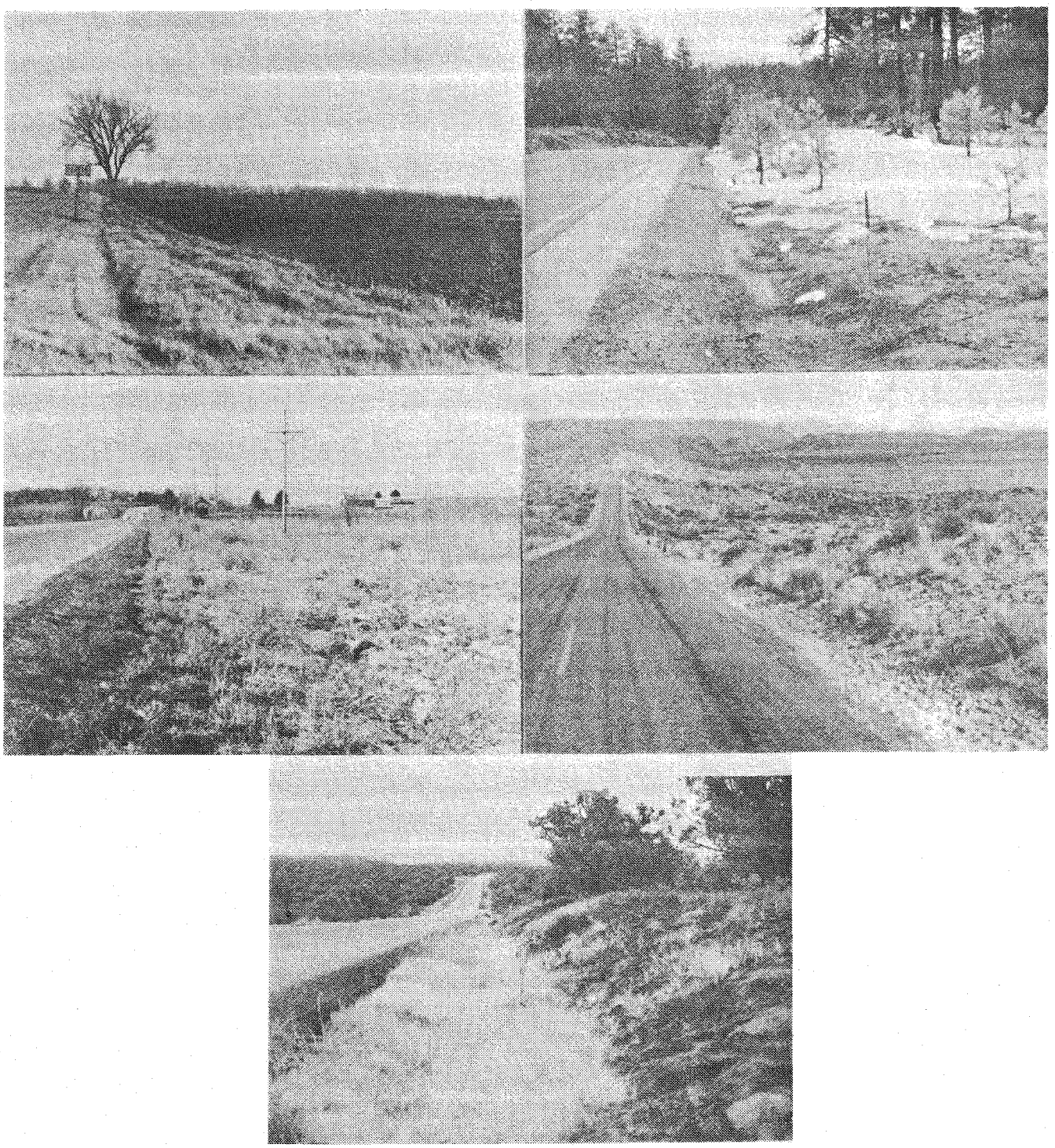


Figure 3. Rural roadside hazard rating of 3.

Hazard Rating = 2

Figure 10. Enlarged View of Pictures for Hazard Rating = 2

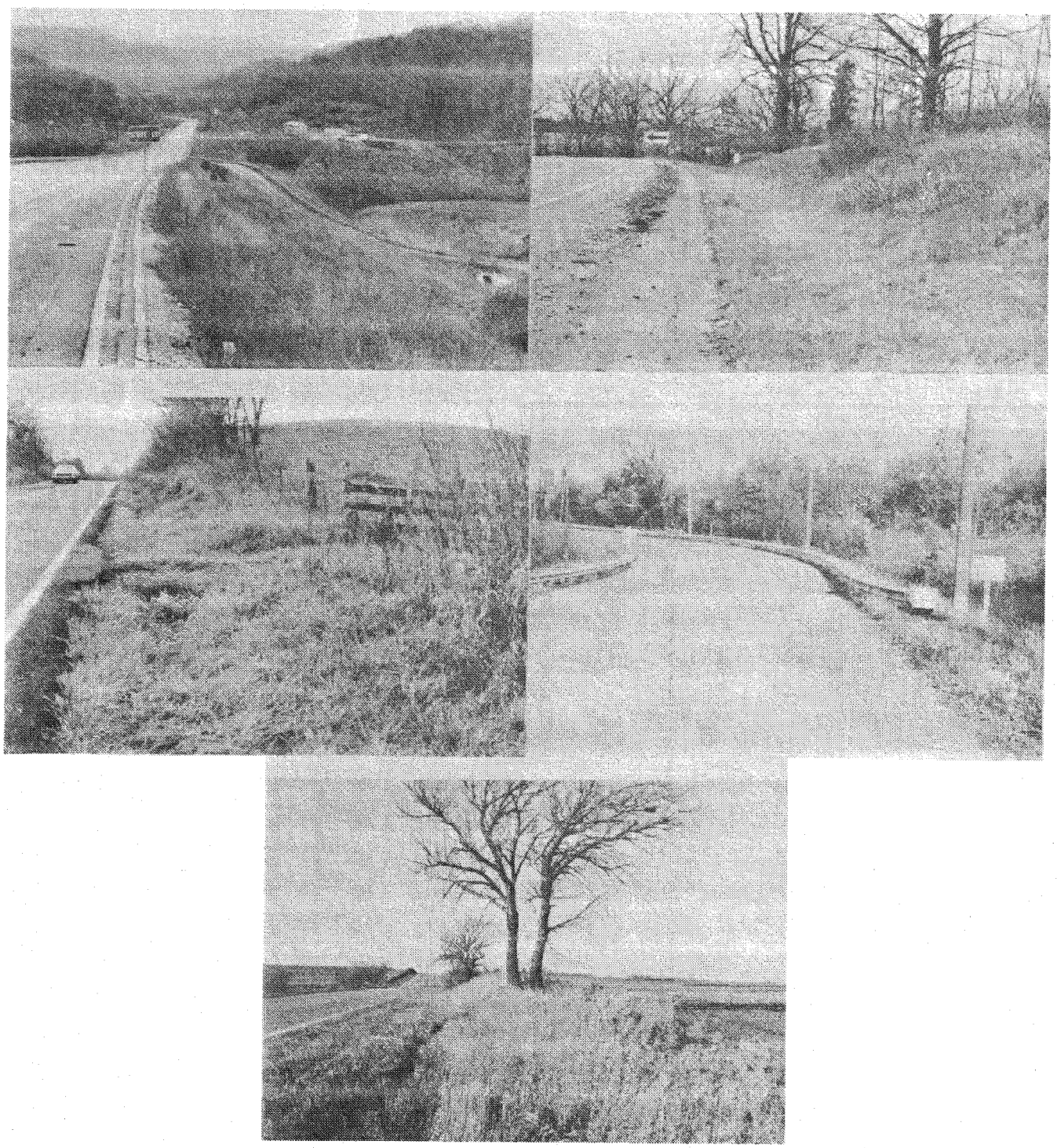


Figure 4. Rural roadside hazard rating of 4.

Example: Typical guardrail = 3

Hazard Rating = 3

Figure 11. Enlarged View of Pictures of Hazard Rating = 3

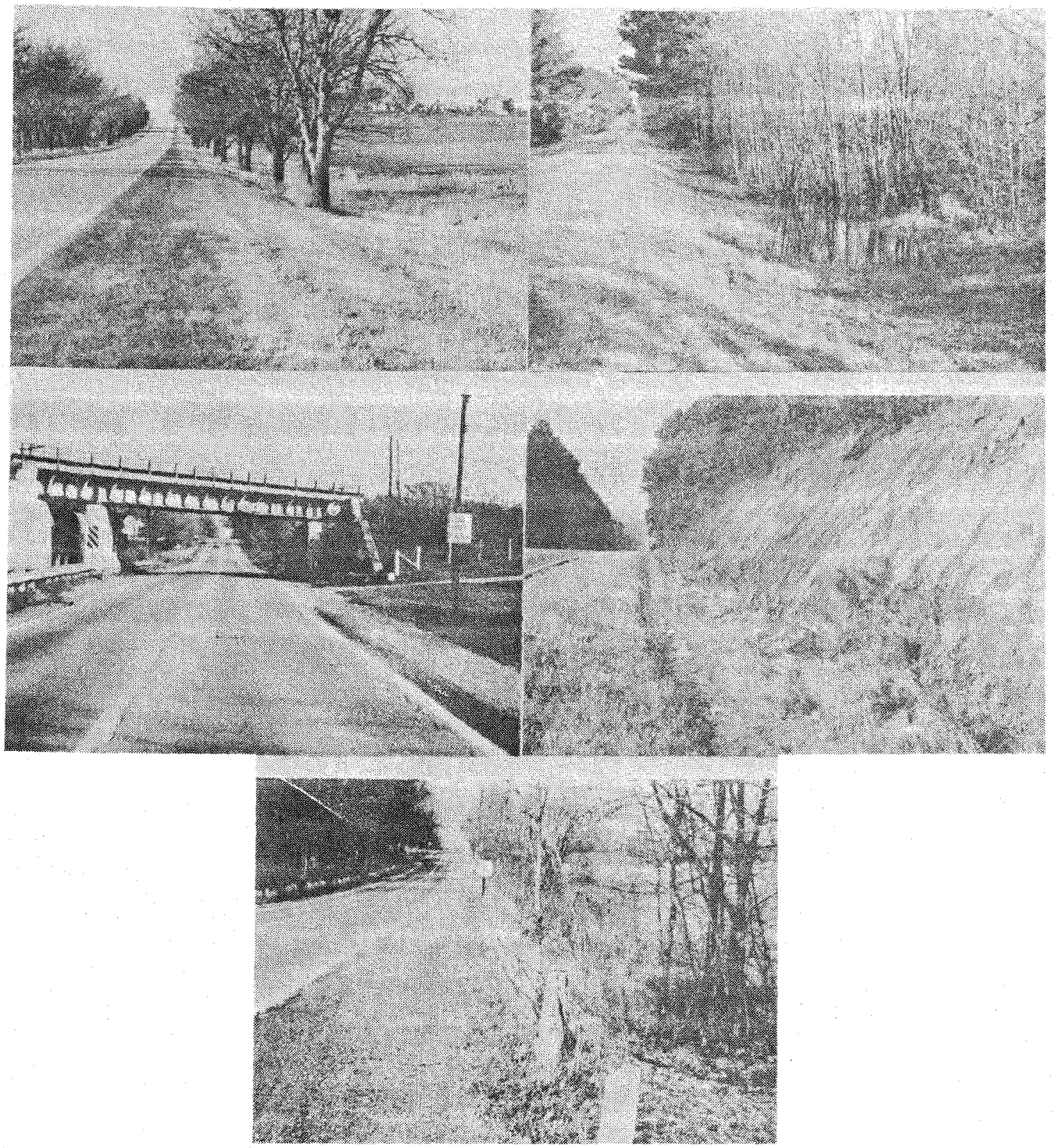


Figure 5. Rural roadside hazard rating of 5.

Example: Old cable guardfence = 4

Hazard Rating = 4

Figure 12. Enlarged View of Pictures for Hazard Rating = 4

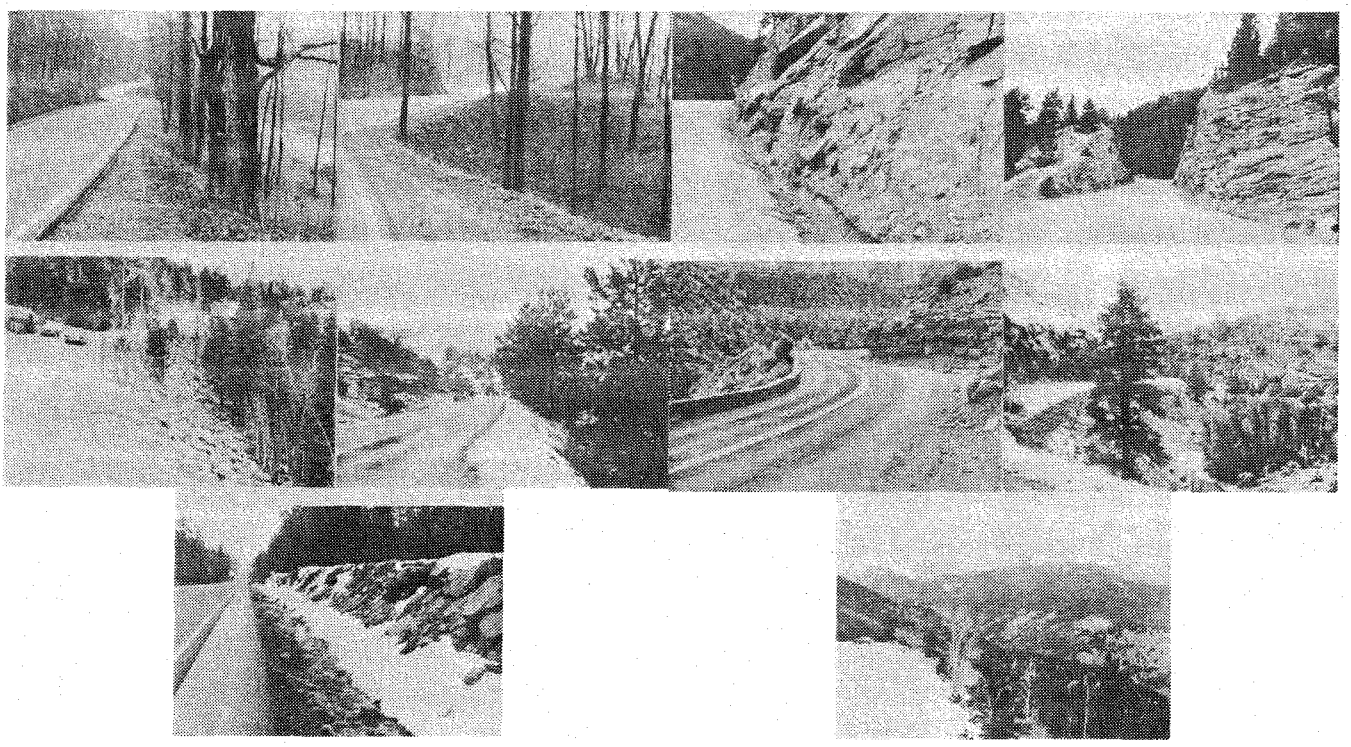


Figure 6. Rural roadside hazard rating of 6.

Figure 7. Rural roadside hazard rating of 7.

High likelihood of off-roadway accident resulting in a fatality or severe injury.

Hazard Rating = 5

Figure 13. Enlarged View of Pictures for Hazard Rating = 5

The recorded hazard ratings (1 to 5) are adjusted for use in the accident prediction formula as shown below:

Recorded Hazard Ratings	Conversion Factor for use in Prediction Formula
1	1.50
2	3.00
3	4.00
4	5.00
5	6.50

Safety Evaluation Procedure

The survey team should conduct a safety evaluation on the entire length of route, in both directions. The team should use the Commentary Driving Technique and gather field data for use in the accident prediction equation of reference (5).

The survey team is made up of a keyboard operator, the driver and the equipment operator.

The Scenic Byway equipment (video camera/DMD/VCR/Laptop Computer) is used but with different software and computer - key designations.

Details

The following are the instructions for the team activities:

1. Prior to Starting a Route:

   a) Number the intersecting roads (intersections) in consecutive order on the road map.

   b) Enter the description of the route on the "safety" computer program.

   c) Be sure the starting point is a well-defined point that can easily be located if one returns to the route for any reason.

   d) Enter the "Terrain Type" (this can change as one moves down the road). 1 - flat, 2 - hilly, and 3 - mountainous

   e) Record surface type. Measure and record surface width and shoulder width. (This can change as one moves down the road.)

2. The Duties and Activities of the Keyboard Operator, the Driver, Equipment Operator and Fourth Person as the Road is Driven:

THE KEYBOARD OPERATOR: Enters the data into the laptop computer.

THE DRIVER: is the commentator for (expectancy) Commentary Driving.

Try to drive at "acceptable" speed - enter the acceptable speed (mph) via laptop.

Initially: During first 1/2 mile or so make statements regarding:

1) surface quality and type (asphalt, P.C. concrete, gravel)
2) predicted safe driving speed
3) presence of warning signs
4) presence of stop or yield signs on cross-roads
5) initial expectancies
6) terrain type
   1 - flat
   2 - hilly
   3 - mountainous

Running Commentary:

1. Specifically make statements of expectancy
2. Whether expectancy is met or violated
3. If expectancy is violated, state associated condition:

   i) associated with stop condition
   ii) associated with intersection
   iii) associated with a bridge
   iv) miscellaneous (anything else)

Verbally describe the expectancy violation on the video tape - enter the expectancy violation type on the keyboard

(Exp. - Stop)
(Exp. - Int.)
(Exp. - Brdg.)
(Exp. - Misc.)

If you can say - "Better have this... checked for necessary changes or correction", it's probably an expectancy violation.

If surface/shoulder type changes, enter the new type in computer. If surface width/shoulder width changes noticeably - stop, measure and enter into the computer.

When the terrain type, 1-flat, 2-hilly, 3-mountainous, changes, enter into computer; the rating in the computer is held until it is changed, thus we get the distance over which a particular terrain type exists.

EQUIPMENT OPERATOR AND THE FOURTH PERSON: Share the following duties:

1. Periodically scan all equipment for proper operation.

2. Call out "Hazard Rating" and give the hazard rating (1 to 5) (See the board with pictures showing roadside hazard ratings (1 to 5) for an errant vehicle).

   1 = Low likelihood of an off-roadway collision or overturn

   5 = High likelihood of an off-roadway accident resulting in a fatality or severe injury.

Remember - the Hazard Rating is held until it is changed - thus we get the distance over which a particular hazard rating exists.

3. Pan the camera on curves. Pan the camera to pick up signs. Pan the camera to pick up "expectancy violation" locations.

4. Call out "Cross Road Ahead". Call "Mark" and "Cross Road Number" when the vehicle is at the cross road. The cross road location (distance and time) appears in the printout and makes it much easier to find the expectancy violations (potentially hazardous locations) in the field when someone returns later to analyze the potential safety problem.

Data Recording

Figure 14 shows the coded laptop computer keyboard for the safety evaluation. The keyboard is color-coded for ease of use, most of the keys are self explanatory. Note that keys 5, 6, 7 and 8 are for the types of expectancy violation. When these keys are struck the location of the expectancy violation type is recorded. Key 9 records the hazard rating (1 to 5) and records the distance and time at which the hazard rating is first called and carries the distance and time until the hazard is changed. Key m records the terrain type (1, 2 or 3) and records the distance and time at which the particular terrain type started and carries the distance and time until the terrain type is changed.

The safety evaluation data is recorded using an existing program for road conditions, maintenance and signing. The coded keyboard is shown in Figure 15. Note that keys 5 to 8 are coded "your spot A", "your spot B", "your spot C", "your spot D", key 9 is "continuous Event A", and key m is "continuous event B".

The printout of the safety evaluation data is shown in Table 17. Note that the "event activity description" is based on key titles in Figure 15 rather than the key titles in Figure 14 which are used in the field. Thus, in Table 17, "Your Continuous Event A" is the hazard rating (1 to 5) recorded under "R/S/W" Column and the distance at which the particular rating started and ended is shown in the distance begin/end columns. "Your Continuous Event B" is the terrain type (1, 2 or 3) recorded under "R/S/W" and the beginning and ending distance is shown. "Your Spot A = 5" gives the location of "Stop Sign related expectancy violation". "Your Spot B = 6" gives the location of an intersection related expectancy violation. Similarly, "Your Spot C" and "Your Spot D" on a printout shows the locations of expectancy violations associated with bridges and miscellaneous, i.e. all other types of expectancy violations. The event activity description shown in Table 17 changes to agree with the coded Keyboard shown in Figure 14.

Analysis of Safety Data

For expectancy violation locations, the analyst will first identify the locations (potentially hazardous locations) from the printout of safety evaluation data. The videotape will be examined at these locations for recorded comments on the nature of the expectancy violation. The video camera should have been panned across the site so that the problem area is clearly shown on the tape. Following the study of the videotape, it is likely that a trip to the site will be necessary for making a detailed study of the expectancy problem. References (6) and (7) contain a set of very helpful worksheets for use in ameliorating expectancy problem locations. Note that the location of nearby intersections on the printout and intersection location comments on the video coupled with the intersection numbers placed on the roadmap will greatly aid in finding the location of the expectancy problem in the field.

A computer program (BWSAFETY) was developed to calculate the related accidents (i.e., single-vehicle plus head-on plus opposite-direction sideswipe plus same-direction sideswipe accidents) per mile per year, AOMY. The program, using the field data recorded via the laptop computer and the section-by-section ADT's inputted via the keyboard will calculate the average as well as the AOMY for each mile of the route. Table 18 shows the output for Nebraska Route 15S. Note that the section length, average ADT, lane width, shoulder width and roadside hazard rating are also given. BWSAFETY can also print out the data used in calculating AOMY as well as the mile by mile AOMY showing high and low AOMY values for various segments within each mile. The printout could give some insight into the location and cause of predicted high-accident locations along

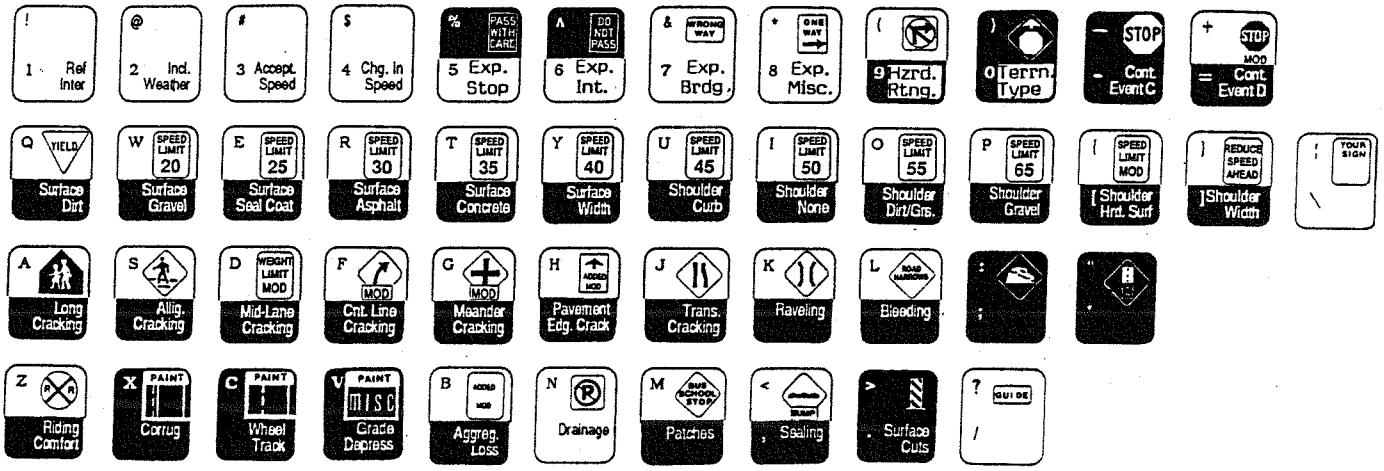


Figure 14. Coded Computer Keyboard for Field Safety Evaluation

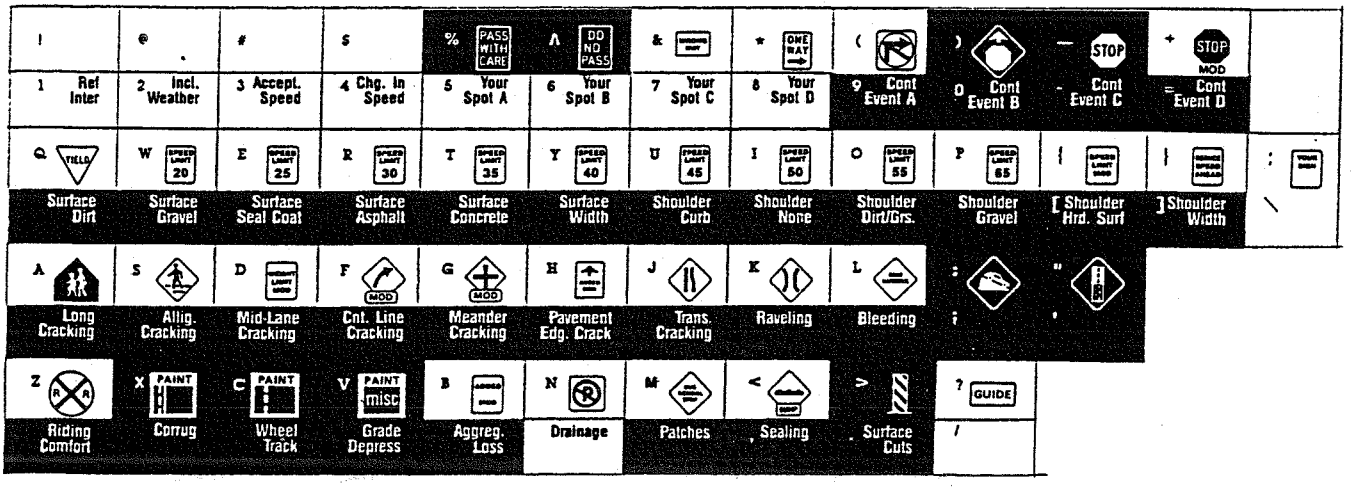


Figure 15. Coded Computer Keyboard for Road Condition/Maintenance/Signing Program

TABLE 17. PRINTOUT OF SAFETY EVALUATION DATA

2 S
Mon, May 21, 1990
9:22 am
Nebraska - N31 West and Northbound
from N50 to Jct US 6

Event Seq	Note	Event Code	R/S/W [1]		Distance (ft) Begin	End	Speed (mph)	Time	Event Activity Description
001	*	095	4	0	000000	000874	00	00:03:25:26	Your cont. event "A" = 9
002	*	126			000000	061506	00	00:02:58:22	50 mph speed limit = Shift + i
003	*	090	2	0	000000	006546	00	00:01:58:68	Inclement weather = 2
004	*	061			000000	028274	00	00:01:17:58	Gravel road surface = w
005	*	071	3		000000	007164	00	00:01:03:97	Shoulder surface width =]
006	*	065	24		000000	006043	00	00:00:46:52	Road surface width = y
007	*	091	35		000000	046196	00	00:02:15:50	Acceptable speed = 3
008	*	096	1	0	000000	061506	00	00:01:31:43	Your cont. event "B" = 0
009	*	069			000000	029131	00	00:01:00:05	Gravel shoulder = p
010	*	250			000945	000945	25	00:05:26:66	Your spot "A" = 5
011	*	095	5	0	001128	002766	24	00:05:31:55	Your cont. event "A" = 9
012	*	033	0	0	001912	061506	25	00:05:51:86	Center line cracking = f
013	*	080	9		002225	002225	23	00:05:59:92	Reference = 1
014	*	095	4	0	002873	003291	27	00:06:16:60	Your cont. event "A" = 9
015	*	095	5	0	003681	009151	32	00:06:33:68	Your cont. event "A" = 9
016	*	065	22		006043	006806	28	00:07:25:94	Road surface width = y
017	*	065	22		006806	010606	30	00:07:42:53	Road surface width = y
018	*	071	6		007164	022508	27	00:07:50:66	Shoulder surface width =]
019	*	251			007324	007324	26	00:07:54:38	Your spot "B" = 6
020	*	251			007780	007780	30	00:08:04:49	Your spot "B" = 6
021	*	095	4	0	009225	011922	31	00:08:36:03	Your cont. event "A" = 9
022	*	065	22		010606	011512	24	00:09:05:53	Road surface width = y
023	*	114			011249	011249	18	00:09:23:66	Narrow bridge = Shift + k

[1] Ratings/speeds/widths

TABLE 18. BWSAFETY PROGRAM OUTPUT

15 S
Wed, May 23, 1990
1:55 pm
Nebraska - N 88 East and Northbound
from Redington to Bridgeport

```
The AOMY (Related Accidents Per-mile Per-year) for each mile are:
For mile number  1 ..... 0.054
For mile number  2 ..... 0.053
For mile number  3 ..... 0.053
For mile number  4 ..... 0.053
For mile number  5 ..... 0.062
For mile number  6 ..... 0.091
For mile number  7 ..... 0.084
For mile number  8 ..... 0.071
For mile number  9 ..... 0.082
For mile number 10 ..... 0.096
For mile number 11 ..... 0.131
For mile number 12 ..... 0.137
For mile number 13 ..... 0.106
For mile number 14 ..... 0.133
The Average Daily Traffic for this section of 13.87 miles is:.. 350.697
The Average Lane Width is:..... 12.000
The Average Paved Shoulder Width is:..... 0.000
The Average Unpaved Shoulder Width is:..... 4.000
The Average Roadside Hazard Rating is:..... 2.829
The Average AOMY is..... 0.086
```

the route. It is expected that a highway agency desiring to use the technique would develop relationships between the predicted AOMY's and that agency's current accident file on similar-type roads. The program allows one to play a number of "what-if" games easily and quickly. For example, what if the ADT were to double because of increased traffic due to byway designation? The ADT's could be doubled on each section thus generating new mile by mile AOMY's as well as the average AOMY; the route average ADT could be doubled giving a new average AOMY, for the route. This might be very helpful in allaying the fears of a county engineer that designating one of his county roads a "Scenic Byway" would drive the accident rate skyhigh due to added traffic.

Other "what if" games could be played:

- pave the non-paved shoulders
- widen the roadway by encroaching on the unpaved shoulders (increase lane width while decreasing unpaved shoulder width)

The primary purpose of Reference (5) is to assist in making economic benefit analyses of various road improvements. This allows one to compare the benefits (cost savings due to reduced numbers of accidents) to the estimated improvement costs.

Special note: The Accident Predictive Equation was developed for paved roads. It is suggested that the equation be used in the safety evaluations of gravel roads since it is the best accident predictor available. One would expect that the predicting equation probably underestimates the AOMY on gravel roads.

Training

It will take two to five days to train the keyboard operator, the driver and the equipment operator.

If the keyboard operator is the same person as the keyboard operator on the Scenic Quality team, the training time will be somewhat reduced. There will be both in-office and actual field operation training.

Instructional Staff:

- Bob Smith

- One or two persons from Decision Data Inc., the developer of the basic data collection system.

Rating Team Qualifications/Size

Qualifications:

Keyboard Operator - must be reasonably proficient in operating a computer keyboard. Experience in highway safety could be helpful.

Driver/Expectancy Commentator - Should be an engineer with experience in highway signing and safety.

Equipment Operator and Fourth Person - Should be an engineer(s) with experience in highway safety.

The same team should be used for rating all byways meeting the scenic quality criteria in a state. One person might be able to handle both "equipment operator and fourth person" duties. On the other hand it would be desirable if one to three additional persons were trained in order to have an "extra hand" or a substitute in case of illness, etc.

It is assumed the team will generally be made up of state personnel. There are other options:

- One state person plus others.
- Two or more state persons plus others.
- Team made up of outside consultants.

Data Collection System

The Distance Measuring Device (DMD)/Laptop Computer and software package/Video camera/VCR system, which was described earlier should be installed in a van. The equipment can be purchased or leased from Decision Data, Inc.

It is possible, but not feasible, to collect all the data by hand and to transfer it to the computer format for use in analysis or to even do all the analysis "by hand".

Data Collection

The data collection from the field is simplified considerably by the use of the data collection system. The difficulty of this task is considerably reduced by training and experience. In addition, a "board", (Figure 8), can be prepared showing the hazard ratings and can provide a handy reference for the team members during a run.

Editing the Data

A printout of the data should be examined for missed entries or entry errors. Viewing the videotape can be of great assistance in checking missed or questionable data such as shoulder types and widths, terrain type and hazard rating numbers. A good editing program is essential.

Recommendations - Safety

1. Routes which have qualified for byway designation under the scenic quality criteria should have a commentary driving/safety evaluation to identify potentially hazardous locations and related accidents per-mile-per-year (AOMY). A route should be driven in both directions in the safety evaluation because expectancy violations, in particular, can be considerably different depending on the direction of travel. The commentary driving should be done at typical roadway operating speeds.

2. The highway agency, probably the state, should develop relationships between the predicted AOMY's and that agency's current accident file on similar type/volume roads. Thus one could get a good indication from the predicted AOMY's whether the road is:

    a) low in numbers of accidents
    b) about average
    c) high in numbers of accidents

This comparison could work well with Reference (5) in making decisions regarding whether safety improvements should be made on a route.

3. If the highway agency does not have a good sign inventory for the route, one should be made. The video/computer system used in the safety evaluation was originally developed for use in roadway condition/maintenance/signing and can be easily used to gather roadway surface conditions and signing. This can be accomplished in two ways: one, make a separate run to inventory signs and surface conditions or two, enter the sign/roadway surface information via the keyboard while viewing the videotape of the safety run in a stop-go type of operation. An existing computer program will output a typical sign inventory/ surface condition report. Note that poor surface conditions, notably riding comfort, might well be used to deny Scenic Byway Designation to a route.

SCENIC BYWAY DESIGNATION

Nomination of Potential Byways

If there is to be a scenic byway program, then one can expect nominations of roads for scenic byway designation from many groups.

(1) groups or individuals who want their road to be one of the designated scenic byways primarily because of the perceived, and often real, economic benefits of byway designation.

(2) The state or a "Scenic Byways Task Force" (private/government entity) could decide it is in the best interest of the citizens to search out, nominate and designate "Scenic Byways - Scenic/Historic Byways" and mark such routes on state maps, as a minimum.

(3) There might even be some citizens who have found a lovely scenic road on a day or weekend leisurely sightseeing trip and would like others to know of the route. They would hope that others with similar interests would share "their" discovered roads so all could easily find the scenic roads in the region.

There should be a well-defined mechanism for receiving and reacting to such nominations.

Byway Designation - Suggested Procedures and Conditions

Background - The Federal Highway Administration (FHWA), under a mandate from Congress, conducted a "1990 National Scenic Byways Study". FHWA used the results of the study in the presentations to congress relative to a Scenic Byway program for inclusion in the Intermodel Surface Transportation Efficiency Act of 1991 (ISTEA). Many portions of the study were made under contract with their prime consultant Greenehorne and O'Mara, Inc., Greenbelt, MD. Greenehorne and O'Mara subsequently subcontracted the conduct of a large number of the studies. The Case Study Summaries of all the studies were reported by Greenehorne and O'Mara at a conference in Washington, DC, on July 11 and 12, 1990. One purpose was to share the studies, with a wide spectrum of selected public and private sector persons. A second purpose, probably the most important to FHWA, was for the participants to discuss the wide variety of issues addressed in the studies and voice their views on the various issues. Participants were divided into groups to hammer out consensus positions or responses to the many issues raised.

FHWA has made available copies of the 27 case studies for the National Scenic Byways Study. Orders should be sent to: Office of Planning and

Environment, Room 3301, Federal Highway Administration, 400 7th Street, SW, Washington, DC 20590. References 8 through 12 are from the 27 case studies.

How Four States Established New Scenic Byway Programs: Part II, (A summary of Reference (8))

A variety of forces come into play and ignite the fires that spark the creation of state scenic byways programs. In the four states considered in this case study, Colorado, Maryland, North Carolina and Utah, forces behind the development of new scenic byways programs included Governors, federal land managing agencies, citizens groups, state legislators, and the President's Commission on Americans Outdoors.

The climate for the development of scenic byway program in the late 1980's was very good. States had an increasing awareness of the importance of tourism to their economies, and were looking for new ways to entice travelers to visit their state and spend time and money. Many communities in rural areas were becoming more aware of their recreational, historical and cultural treasures, and realized the need to protect these resources, both for the enjoyment of future generations and the immediate potential to attract tourists. And all over the nation, people were looking for scenic touring opportunities. A study for the President's Commission on Americans Outdoors in 1987 found that driving for pleasure and sightseeing was enjoyed sometimes, often, or very often by 77% of Americans.

When the pressure to develop a scenic byways plan came to a head in these four states, key people were tapped to lay the groundwork for the program. Colorado established a commission: Utah organized a task force of federal, state and local officials; North Carolina drew together key state agencies; and Maryland's DOT worked closely with the Governor's office. Once decision-makers were identified, the processes of developing criteria and selecting roads was begun. Various amount of public input were encouraged by the four states.

The final steps in the process of establishing an on-going scenic byways program involved actual "on-the-ground" work, such as road improvements and signing; the development of marketing tools such as maps, brochures and publicity campaigns; and the creation of a plan for managing the established scenic byways system.

Colorado, Maryland, North Carolina and Utah all have "different" scenic byways programs. They have different methods for designating roads, have similar but unique criteria, and measure their success in different ways. One program is not inherently better than another; instead each has responded to different circumstances and different political leadership. The paper describes in detail the forces which led to each state's developing a scenic byways program, and the key features of each program.

Scenic Corridor Protection and Enhancement

References 9, 10 and 11 describe a number of corridor protection techniques currently in use across the U.S. A summary of each reference follows.

Scenic Resource Protection Techniques and Tools (9)

In an effort to protect the scenic, cultural and historic resources found along designated scenic corridors, many communities have adopted a wide variety of scenic resource protection techniques under the the overarching principle of conservation. Communities throughout the nation are coming to recognize that places of outstanding beauty and character often occur naturally, however these places do not remain that way without determined efforts to sustain them. Increasingly, communities are taking conscious steps to protect the scenic, cul-tural, and historic resources found within their boundaries.

This study identifies a range of scenic resource protection techniques now being used in support of scenic byway programs and other related resource management programs. The techniques are portrayed in a manner that informs state highway departments, local governments, and community organizations of their application in scenic byway programs. The study's analytic approach creates a framework for relating the various techniques and tools to a range of scenic environments, and to a series of applicability criteria. This framework then forms the basis of a matrix which identifies where a scenic resource protection tool might be applicable, how effective it might be in a given circumstance, what costs are involved, and what requirements are needed for its implementation.

Scenic components cross-referenced in the matrix are:

1. Foreground (scenic focal points), middleground (scenic "viewshed"), the background (panorama) scenic view types as found in the scenic environ-ments which are consistent with the AAA's classification of scenic land-scapes. These scenic environments include: Quintessential Landscape Scenery (the "best" characteristic features of scenery in a given region), Natural Landscape Features (strikingly scenic natural features), Cultural Landscapes (areas within a region that are unique compared to the general scenery in the remainder of a region), and Historic Landscapes (sites commemorating historic events or architectural features).

2. Tool applicability criteria, including its perceived effectiveness, cost to implement, time frame, administrative feasibility, legal or practical precedent, form of management, and level of government.

3. The scenic resource protection tools themselves, including the categories of Land Acquisition Approaches, Land Transfer Controls, Land Use Controls, Land Development Controls, Tax Incentives, Planning Techniques, View Protection, Sign Control, and Voluntary Approaches.

This study serves as a "primer" on scenic resource protection tools for scenic highways. Tools in each of the categories outlined above are described and placed within the application framework to allow for both an understanding of how the tool works as well as where the tool might readily be applied.

Based upon communications with successful scenic highway program administrators and polled members of the conservation community, in order to protect the scenic, historic and cultural characteristics of designated scenic highways, the following steps should be taken when developing a scenic highway program or designating new scenic highway corridors:

1. Develop a Corridor Management Plan: Communities located along designated scenic highways and road ways should develop management plans which outline ways in which the scenic, historic and cultural characteristics of the road corridor will be maintained while accommodating new development and increased tourism. Corridor Management Plans should include:

    - inventory and viewshed mapping to identify important scenic, historic and cultural resources to be protected
    - comprehensive plans that identify future development zones
    - commercial and residential site development requirements and design guidelines
    - reconstruction guidelines
    - roadway safety improvement guidelines

2. Establish a Tree Protection Policy - The clear cutting of trees immediately adjacent to the roadside should be prohibited along designated scenic highways. However, the clearing of vegetation to create or restore obscured scenic views should be allowed if such clearing is consistent with the objectives outlines in visual inventory identified in the Corridor Management Plan.

3. Visual Pollution Controls - New off-premise outdoor advertising structures (other than approved uniform motorist information signs) should be prohibited on designated scenic highways. Limitations on size, height and number of new on-premise signs should also be developed. Likewise, junkyards, gravel pits, mines, etc., within the scenic corridor viewshed should also be prohibited or buffered.

4. Establish a System of Uniform Motorist information and Directional Signage - A uniform motorist information system should be developed to provide tourists with needed information about services and attractions. Highly successful motorist information signage programs now exist in Maine and Vermont.

5. Identify Source of Funds for Acquisition of Scenic Easements in Key Resource Protection Zones - In order to protect certain critical parcels within the scenic viewshed, it may be necessary to acquire scenic easements or purchase critical "gateway" parcels along the designated scenic corridor.

6. Purchase Developments Rights or Scenic Easements as part of Right-of-Way Acquisition in Road Expansion or New Construction

Protection Techniques for Scenic Byways: Four Case Studies (10)

This study of the techniques used to protect scenic byways is part of the Federal Highway Administration's comprehensive feasibility study of a national system of scenic byways. Its focus is on the historic qualities of byways that complement or contribute to natural scenic qualities. Through case studies of four highways, the techniques that have been used to protect scenic and historic byways are documented and analyzed. The efficacy of the techniques is evaluated over time, and specific recommendations for the protection of scenic byways are made.

The techniques that have been used to protect scenic byway corridors range from fee-simple acquisition of land to designating a road as scenic. Like fee-simple ownership, easements are a strong protective technique. Comprehensive planning and zoning ordinances, especially those that incorporate a highway corridor overlay district, can be effective techniques. Less effective are public policy statements, tax incentives, and local initiative. All have been used with varying degrees of long-term success.

Scenic byways have been designated through both federal and state systems. The National Park Service (NPS) created some of the first U.S. scenic highways. The U.S. Forest Service (USFS) and the Bureau of Land Management (BLM) both have systems of designated scenic highways. A number of states also have scenic highway systems, although their designation criteria and protection techniques vary widely.

This study focuses on four highways: NPS's Blue Ridge Parkway; Idaho Route 75, a state designated byway within the Sawtooth National Recreational Area (SNRA), Sawtooth National Forest; Virginia's Route 5 between Richmond and Williamsburg; and Route J40 in Van Buren County, Iowa.

The Blue Ridge Parkway, a 470-mile roadway joining the Shenandoah National Park in Virginia and the Great Smoky Mountains National Park in North CArolina and Tennessee, was created in 1936. Although its principal resource is natural scenic vistas, the Parkway also exhibits and interprets aspects of early mountain life and, in itself, is a historic resource. It is protected largely by federal ownership of some 77,000 acres of adjacent lands. The Blue Ridge Parkway represents one of the first and most widespread uses of scenic easements for road protection, with over 2,000 acres of easements acquired. Although they were loosely written and have resulted in management difficulties over the years, the easements have, for the most part, served their purpose well. Threats to the Blue Ridge Parkway come principally from the private lands adjacent to the park, where land-use controls are weak to nonexistent. These private lands represent a challenge to future public-private protection efforts.

Idaho's Route 75 through the Sawtooth National Recreation Area (SNRA) provides vistas to magnificent snow-capped mountains as well as valleys where ranching and small towns tell of the settlement of the West. It is protected largely by federal ownership. Although over 18,500 acres are also protected by scenic easements, acquired during the 1980s when the SNRA was created. Approximately 10% of the land in the SNRA remains in private hands. USFS has developed a management plan for easement lands and private lands within the SNRA and has worked actively with the local communities on compatible development plans. Although USFS has condemned one uncooperative community through eminent domain and has had difficulty with others, for the most part protection of Route 75 has been successful.

Route 5 between Richmond and Williamsburg was designated a Virginia Byway in 1975. Joining the state capital with the colonial capital

by way of the James River plantations, the Route 5 corridor is rich with sites and structures of colonial history. Although all the five jurisdictions through which the byway passes have had comprehensive planning and zoning ordinances sign designation, these tools protect the road with different degrees of effectiveness. The areas nearest to Richmond and Williamsburg have experienced considerable commercial and residential development, and--except for the most remote portion of the road--the scenic qualities of the historic highway are threatened. The "greenbelt" policies of some of the counties have not provided an adequate buffer. Route 5 represents a major challenge to state and local authorities to prevent further deterioration of a nationally significant byway corridor.

Route J-40 in Van Buren County, Iowa is not a designated scenic highway but has been protected and promoted through local initiative. Running along the Des Moines River and joining several river communities with National Register historic districts, J-40 has been promoted by local organizations for an annual bike ride, scenic drive, and tourist route. Although J-40 has not yet been threatened with adverse development, the communities of Van Buren county are working on a comprehensive plan and, perhaps, future zoning ordinance that will protect their historic districts and the road.

Overall, evident from the four case studies suggests that the most effective protection techniques for scenic easements. These provide the greatest land-use control. Short of these relatively more expensive techniques, strong zoning ordinances with highway corridor overlay districts can provide protection. Highway corridor overlay districts specify architectural guidelines, setbacks, height limitations, signage, vegetation control, and other design details for a specified road corridor that supersede other zoning restrictions. Local incentive can also be effective in protecting scenic and historic resources, as Route 5 and Route J-40 illustrate; however, the greater the development pressure, the less effective they are.

The National Trust for Historic Preservation Recommends:

1. Congress should enact a program to create a national system of Scenic and Historic Byways. Federal funds should be available to states and federal agencies that participate in the system. The national program will also provide uniform signage and promotion off designated scenic and historic roads.

2. States would participate in the national system voluntarily and would be responsible for administering their own scenic and historic byway programs under national policy guidance. State departments of transportation would work with state departments of historic preservation and departments of natural resources to administer the program.

3. Minimum federal standards for Scenic and Historic Byways should be developed as a state-federal cooperative effort, with the participation of the National Governors Association, AASHTO, the National Trust for Historic Preservation, and the Department of Transportation. These standards should apply to both designation criteria and minimum protection standards.

4. Participating states should designate a scenic and historic byway only if and when a local management plan is in place for the entire area relevant to the byway under consideration. The management plan should be based upon a comprehensive survey of the scenic and historic attributes of the area and should include identification and documentation of all sites eligible for listing in the National Register of Historic Places and for state or local historic designa-tion. The management plan must, at a minimum, provide specific mechanisms for protection of the resources of the byway. Most commonly this would be done through comprehensive planning and zoning ordinance. The National Trust strongly recommends the protection technique of a highway corridor overlay district. This supplements a zoning ordinance and addresses protection of historic sites, setbacks, height limitations, vegetation controls, signage, and similar specific con- cerns for a defined byway corridor. There overlay district may be combined with the use of easements or fee-simple acquisition to protect sites or vistas of particular importance.

5. Participating states must develop criteria and a process for de-designating scenic and historic byways if the resources of the corridor are compromised or destroyed.

6. Funding for the National Scenic and Historic Byway system may be structured either as a categorical set-aside or as an incentive program, for example, so that state participation would ensure a higher percent of federal highway funding. Scenic and Historic Byway funds could be applied toward acquisition in fee simple and easement of property of open space, natural, or historical signi-ficance; toward state planning and planning grants to local governments; toward the administration of the byway program and enforcement of its pro-tection plan; and toward promotion and interpretation of designated byways.

7. A National Scenic and Historic Byway Center should be established to develop and provide educational and training assistance to state and local officials who administer scenic byway programs. The Center would serve as a clearinghouse for information on the various programs undertaken by federal agencies, state and local governments, nonprofit organizations, and others.

Roles of Local Planning Agencies in Scenic Byway Programs (11)

This study identifies key relationships between local planning agencies and statewide and/or regional scenic byway programs, and provide information guidance and information for local planning agencies in support of these programs. Representative scenic byway programs are reviewed as they affect local planning agencies, and relationships are identified. Based on these planning relationships, a process is described which portrays how local citizens and planning agencies can participate in planning a scenic byway.

Local governments and their planning agencies can have a significant role in the designation and management of a scenic byway. Depending on the nature of enabling state legislation, designation may be done at the state level, and scenic corridor management and maintenance at the local level. Usually, states will supported the preparation and implementation of a scenic byway plan. In some cases, however, local governments prepare such plans on their own or with the assistance of consultants, citizen groups, private organizations, or other local government agencies. Principal roles for a local planning agency to participate in a scenic byway plan would include:

1. Performing an inventory or significant local natural, cultural, and scenic resources;
2. Performing an inventory of local land uses adjacent to byways;
3. Stating local development objectives along with the roles that scenic resources and tourism play in local growth;
4. Stating management goals for protection, preservation, and enhancement of scenic resources;
5. Identifying potential management issues, problems, and needs;
6. Developing a detailed scenic corridor management program, including plans for responses to development pressures, legal authorities and tools to implement the program, and a schedule for implementation;
7. Furnishing appropriate illustrations and maps to document, clarify and explain the program.

It is clear that unless the scenic qualities of byways are actively protected, their scenic value will be destroyed. Planners are especially equipped to carry out scenic byway programs and serve as an important "connection" between a state level program and its actual implementation at the local level. Where no planning capability exists locally, states should provide planning assistance and advice for local communities interest in establishing as scenic byway. Ultimately, it is important that local planning agencies by viewed as allies in the effort to establish and protect scenic byways, especially where development is occurring.

Local community groups and even individual citizens can play significant roles in planning a scenic byway by employing this document and understanding the planning process. Participating in planning advisory groups, assisting in scenic inventories, initiating petitions to sponsor designation of a scenic byway, and monitoring the effectiveness of scenic protection tools are but a few of the roles citizens can play in scenic byway planning, especially where a community does not have an extensive professional planning staff.

Creative Landscape Design Solutions in Scenic Byways (12)

This study identifies examples of landscape design which accommodate development while enhancing scenic highway environments. It describes design and planning considerations which can help incorporate creative landscape design solutions in scenic highways. The analytic approach identifies a range of notable and award-winning examples of landscape design solutions for scenic highways, analyzes how positive and negative scenic values associated with those highway environments were handled in the design process, and describes the key factors which led to creative landscape design solutions in case study examples.

Critical landscape design elements found in a range of notable scenic highway design solutions include: The notion of a "landscape unit" associated with a given road segment as experienced by different travelers moving in different directions; scenic components such as distinct landforms, patterns of vegetation, vistas, water bodies, cultural and manmade elements, and the prominence of each of these components as seen in the view from the road; the "unity" or harmony of these components with one another in the scenic landscape; the "intactness" -- integrity or extent to which development is handled or allowed to encroach into the scenic environment; and the uniqueness, or relative scarcity, of a given scenic resource along a road segment or within a landscape unit.

Effective landscape design approaches for scenic highways are those which enhance positive scenic values and mitigate negative scenic values. These values are typically determined by survey methods which incorporate highway users, local residents, and visual resource planners. Some of the positive scenic values examined in this study include: vegetation (forest patterns and edges, agricul-tural patterns, spatial definition by trees, (etc.), landscape features (panoramas, rock outcrops, skylines, etc.), roadway characteristics (conformance to topography, surface, design speed, etc.) water bodies (lakes, rivers, wetlands, etc.), and cultural and manmade structures (buildings, walls, bridges, etc.). Some of the negative scenic values examined in this study include: landscape scars (erosion, clear-cuts, etc.), clutter development (uncontrolled strip development, conflicting land uses, etc.), and encroachment in the scenic landscape (inappropriate sign-age, dilapidated buildings, landfills, etc.)

Landscape design factors considered in the scenic highway planning process include; landscape analysis in the scenic resource inventory, recog-nition of landscape interest by the motorist/user, landscape design consid-erations in determining roadway geometry, creative design treatment of roadside and corridor development, and design of roadway structures consistent with surrounding scenic landscapes.

Case examples reviewed include: Arkansas S. H. 7 (Harrison to Hot Springs), U.S. 285 (Morrison CO to Taos NM), the Colorado Peak-to-Peak Highway (Estes Park to Central City), Colorado Mining Frontier Roads, Oklahoma/ Kansas Prairie Route (Pawhuska to Manhattan, KS), Texas Hill Country (U.S. 281/290), and Vail Pass (I-70, CO).

Scenic Byways Information

Those who purposely drive Scenic Byways do so for the pleasure of recreational driving as opposed to trying to get from point A to point B.

There are two general categories of Scenic Byways Users, sometimes called Byway Recreationists:

1) Those who want to find scenic roads in their region for weekday/weekend pleasure driving.

2) Those who would like to plan a trip "across country" with all or portions of the trip on Scenic Byways.

The following information is needed:

- Roadmap or guide showing the location of Scenic Byways
- Information about the route's scenic, historic, cultural, geologic, vegetative, etc. attributes and their level of excellence.
- Is the road paved or gravel and how smooth is the surface.
- Is it operational all year or closed in the winter.
- Is it suitable for all vehicles or are larger RV's or tour buses excluded.
- Does it require a 4-wheel drive vehicle (there probably won't be many such roads in the four-state region for which this study was made).
- What are the amenities along or near the route, eg., food, fuel, lodging, (especially "bed and breakfast" inns) historic sites or districts.

The user will assume the road is reasonably safe for reasonably prudent drivers. They will expect reasonable signing with no expectancy violations, even for a stranger to the road.

Additional Comments

It may not be sufficient to simply mark the byway on a map or brochure. The user must be able to find the route on the map or in the brochure and must be able to locate it while driving in unfamiliar country. Perhaps there should be trail blazers of some sort to clearly indicate the way to the byway. The beginning of the byway should be clearly marked. Once the driver is on the route it should be clearly marked so it is easy to stay on the route and difficult to inadvertently leave it. The end of the route should be clearly marked. In some cases directional signs or trailblazers should be placed to help the stranger get back to "major" roads. State highway personnel are experts at doing the above guide "signing". Keep in mind those users out there are strangers to the area. One of the Byway Project Advisory Committee members suggested the mile marker symbols should be little versions of the scenic byways signs.

The brochure or map should clearly state the length of route, surface type, restrictions to travel, etc. but one should keep in mind that not everyone gets on the route by pre-planning and those that do may not have the brochure or map handy - it may have been left at the last gas stop or it may be under or in the suitcases in the trunk. In any case at the beginning of a route there should be information about the route, any restrictions, it's attributes, etc. by sign at a pullout or by "tune your radio to xx and hear about scenic route zz". One group promoting the San Juan Scenic Byway in Colorado has prepared an audiotape as a part of their "Marketing their Byway" program.

If the route restricts the use of larger vehicles be certain there is a properly designed and marked turnaround area for such vehicles.

For an excellent brochure on all of the above, see Utah's "Scenic Byways and Backways" (13).

In a July 11, 12, 1990 Byway Conference there was a consensus: There should be a common background, shape, etc. on a Nationwide Byway Sign. Such signing should meet generally accepted criteria for target value, conspicuity etc. Each state should be able to "do their own thing" on some portion of or supplement to the Nationwide Byway Sign. It is very important that a Scenic Byway sign be recognized as such "at a glance". It would be highly desirable if one could distinguish between Scenic Byways and Historic Routes by a variation in the logo. The author urges the four states in this region to develop one basic logo that meets the desires of each of the four states.

Thanks to Joe Mickes, Missouri Highway and Transportation Department we have a prime candidate. See Figure 16, a print of a sign proposed for Missouri's adoption. The proposed sign is in color and Missouri's State bird and flower is on the logo. It is suggested that a similar procedure be followed in each state i.e. use the state bird and flower but leave the remainder of the sign as it is.

Figure 16. Proposed Scenic Byway Sign

SUMMARY

During the Byways Study, it was tacitly agreed that Scenic Byway designation of a road would probably be made only after its nomination by some group with a special interest in the road. A primary impetus for developing the quantitative techniques for evaluating byway scenic or historic quality was to assure that all requests for byway designation would be evaluated in a uniform, consistent fashion to assure some minimum level of scenic quality. The following recommendations are based on the assumption that a state agency such as the highway department and/or perhaps a Scenic Byways Task Force will make the final decision whether a route receives Scenic Byway designation.

Suggested Process

1) The designating agency should develop criteria and a process for scenic or historic byway designation and also for de-designation if the resources of the corridor are compromised or destroyed. The agency would make the criteria and process available to local groups and would provide guidance in preparation of Scenic Byway Designation requests. The criteria should include scenic and/or historic quality requirements as well as the requirement of a management plan for protecting the resources of the byway after designation.

2) Based on the designated criteria, the local group nominating (nominators) a byway would prepare preliminary documentation in support of the route. This should include the description of scenic or historic elements and a proposed resource-protection management plan.

3) The designating agency should review the preliminary request in a timely fashion. At this time a formal scenic quality study using the procedures described earlier should be made to determine if the scenic quality rating meets a threshold quality level of, say, 4.0

   If the quality rating does not meet the requirements and it appears there is very little that can be done to raise the quality rating or level, for example, by cleaning up or screening eyesores, clearing trees for vistas or providing scenic overlooks, then the designation process would stop. The road would not be designated a Scenic Byway. The process to this point would be relatively inexpensive to both the nominators and the designating agency. If the quality rating did not meet the requirements but the potential was there for improving the quality to meet the requirements then the designating agency should inform the nominators of the likely effort needed. At this

point the designating agency should assist the nominators by suggesting improvement or enhancement techniques, funding sources or other ways to accomplish the needed improvement. The nominators could now decide to continue to pursue designation or withdraw the application.

If the quality was acceptable or could be made acceptable as noted in the preceding paragraph then the process would move to the next stage.

4) At this stage the nominators must decide if they can or still desire to implement the required local management plan to protect the scenic and/or historic resources of the nominated byway.

5) At about this stage in the sequence, a safety study of the proposed route should be made. If the road is local, a safety study should probably have been made just after determining that the scenic quality requirements were met. The costs and methods of financing any necessary safety upgrading could determine whether the nominators choose to continue to work for byway designation.

6) Assuming the project continues, a guide signing system, clearly showing the road is a Scenic Byway, should be developed. The costs, who will bear them, and who will design the sign system are important considerations.

7) A byway marketing plan is now necessary. As a minimum, the potential byway user:

- must be informed of the existence of the route
- must know enough about the route and its quality and amenities to decide to drive or not drive it.
- must be able to find the route and stay on it until deciding intentionally to leave it.

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