

ROADSIDE RATING SCALES

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WHY SAFETY QUALITY MEASURES

There are many variables involved in accident causes other than road features. Weather conditions, drivers, vehicles, and seat belt use are examples of non-roadway variables which may influence a particular accident incidence and severity more than physical road features. As a result, it is not practical to evaluate the safety performance of a highway based solely on accident history. A rating system like the one the Oregon Department of Transportation is developing will provide a measure of how well the department is doing in constructing and maintaining roads for safety.

Already in use for state highway management in Oregon are priority ratings based on pavement conditions, bridge conditions, and accident frequency and severity. The additional priority ratings based on quality measures for road features such as signs, signals, pavement markings, delineation, guardrail, and vegetation control will bring consideration of these factors into project development and scheduling maintenance to enhance the safety performance of the state highway system.

Promoting Safer Roadsides

Oregon's state highway system includes over 7,500 miles of roadway. More than 6,000 miles of these roads are rural non-freeways, many through winding and rugged terrain. Run-off road type accidents are one-sixth of all accidents in Oregon and fixed object crashes result in nearly a quarter of the fatal accidents on the state system. During the years 1988, 1989, and 1990, the percent of fatal crashes involving fixed objects on the state system were 23.9 percent, 23.3 percent and 29.2 percent respectively. In 1988, Oregon ranked 19th among the 50 states in a descending-order listing of percent of fatal crashes involving fixed objects on state, county, and city roads. Oregon ranked 18th in 1989 and 25th in 1990. Systematic rehabilitation of problem road features should result in fewer fixed object and run-off-road accidents.

Roadway and roadside features warrants and design are specified in the Oregon Department of Transportation *Highway Design Manual*(1), which refers to and is based on *A Policy on Geometric Design of*

Highways and Streets(2), and the *Manual on Uniform Traffic Control Devices (MUTCD)*(3). The Oregon design manual is updated regularly as research and experience indicates, with the latest complete revision dated June, 1988. However, current criteria are applied on a project basis, so existing installations may never have been evaluated. The periodic inventory and evaluation of road features of the Road Features Rating System will establish where possible problems are considering both design and condition, and a system-wide priority ranking assigned.

Developing the Idea of Quality Measures

The first conception of a road features rating system in Oregon involved the idea of a field review when developing the scope of a proposed project. Ratings were to be based on a four point, excellent to poor scale. As the department looked at means of more directly and effectively involving safety enhancement in the decisions to initiate and fund projects, a safety engineering review was devised. A more comprehensive look at road features was discovered desirable as part of this review. The decision process for selecting areas to receive maintenance work also needed a systematic way of evaluating and setting priorities for rehabilitation over all the highway sections within a maintenance district.

Use of the safety engineering review was stymied by the amount of data necessary to collect, bring together and report on. Recent efforts within the department to identify all the data collected, by whom, and how and where data is stored and then to link the databases together have fostered the ability to reduce the time and storage demands of a comprehensive inventory and condition rating. Many of the criteria for rating features which must be considered in project initiation, funding levels and design, can be researched and gleaned from data already collected. A periodic field review is still desirable to track the wear, aging and condition of some road features.

DESIGNING THE RATING SYSTEM

The Road Features Rating System is designed to fit in with the current high accident location priority ratings.

The priority rating system based on accident data, known as the Safety Priority Index System or SPIS, produces a number which is calculated from factoring accident frequency and severity together for set segment lengths of roadway from beginning to ending milepoints for each highway. For rural highway sections the segment length is 0.1 mile, while on urban sections the segment length is 0.05 mile. The process is designed to overlap segments thus bracketing the area of the highest SPIS calculation. A report is issued annually listing the top ten percent SPIS sites by highway and milepost. These reports are distributed to the Region offices and a review of every site is done by maintenance and traffic engineering personnel. The Road Features Rating System (RFRS) will also produce results by highway and milepost for review with the SPIS data and aid in decisions of where to most effectively use highway funding.

The design of the individual quality measures can be summed up as defining the best condition of each component related to the safe functioning of a highway feature to be compared against the actual condition. Each feature can have several factors affecting its total safety function. Specific questions have been designed for each of these factors. The decision for each question is what percent of the full intent is now functioning. Interpreting the percentage of function (quality measure) will depend on written standards and thorough training in these standards.

This quality inventory will cover the entire state highway system. A minimum listing of inventory items includes: horizontal and vertical alignment, cross section, sight distances, signing, striping and pavement markings, railroad crossings, channelization, signals and other traffic control, illumination, guardrail and median barrier, delineation, sidewalks, crosswalks, curbs and islands, and bicycle and pedestrian facilities.

Some ratings will only be considered in project initiation and/or design. These are qualities that change little over time and are generally part of project design, such as roadway geometrics and the warrant for barrier. Other ratings are important for consideration in maintenance activities. These are qualities subject to deterioration with use and exposure, such as sign reflectivity and guardrail condition. The latter ratings are best established by field review, while the data are available and ratings of the physical features can often be calculated. The criteria, then, are divided into two uses, a set of design review ratings and one of field review ratings.

Design Review Ratings

The design review is to cover the safety aspects of horizontal and vertical alignment, cross section, traffic control, bridge appurtenances, bicycle and pedestrian facilities, and roadside design. These ratings rely on engineering data. Design measures are categorized as alignment, roadway, traffic control, or roadside related. Any one of the categories could be reported separately or an overall rating requested. All features within the beginning and ending mileposts of the requested highway section will be considered in the ratings, with areas of ratings less than 1.00 reported. A rating of 1.00 indicates the feature is acceptable. The questions outlined in Appendix A are a preliminary listing and subject to review, revision, additions and deletions.

Field Review Ratings

The objective for the field review is a judgment of the maintained quality of existing road features. These ratings will attempt to assess the safety and security of driving the highway as perceived by the driver. The field review will be conducted by video log and field inspection by a multi-disciplinary team. The video log of state highways is updated every two years for each highway. This log will be the basis for these ratings except for night visibility of features and areas where maintenance or construction activities may have caused a change in condition. Only areas with a rating less than 1.00 will be recorded, by highway and beginning and ending mileposts. Again, a 1.00 rating indicates the features is acceptable. Appendix B is the list of preliminary questions.

Implementation of the Road Features Rating System

The lists of questions are the result of combining expertise and research from throughout the Transportation Department, and also incorporate comments from other sources such as local agencies and state highway enforcement officials. This list will be distributed for a final critique on the appropriateness of each question. Along with the questions, the data and/or criteria that will decide each rating will also be distributed. Comments will be solicited on the completeness, appropriateness, and practicality of each

individual criteria. The results will become the written guidelines for the Road Features Rating System.

Written guidelines and training to provide standards for interpretation constitute one aspect of implementation. Another critical area is the development of procedures and assignment of responsibilities. These decisions will result from data management development and the assessment of those responsible for the affected activities.

LOOKING FORWARD

The inventories necessary to support a rating system such as the Road Features Rating System have become possible with the increased sophistication in electronic data management. The more we know about what exists and in what condition on our highways, the better we can plan effective use of our resources.

There are many arenas in which to promote safe travel. The Oregon Department of Transportation is responsible for statewide multi-modal transportation planning and for state highway, motor vehicle and driver licensing, public transit, air travel and traffic safety programs administration. The Road Features Rating System will be an asset to managing the engineering portion of constructing and maintaining highways.

REFERENCES

1. *Highway Design Manual*, Oregon Department of Transportation, Highway Division, Transportation Building, Salem, Oregon. July 1988 Revision.

2. *A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials, Washington, D.C. 1984.

3. *Manual on Uniform Traffic Control Devices, 1988 Edition*, FHWA, U.S. Department of Transportation, Washington, D.C. 1989.

OTHER STUDIES

R. H. Kehr, Jr., J. Kizer, R.D. Layton, *Field Manual for Identifying Highway Safety Hazards*, Transportation Research Institute, Oregon State University, Corvallis, Oregon. April 1979.

Local Highway Safety Studies User's Guide, National Highway Institute, FHWA, U. S. Department of Transportation, Washington, D. C., July 1986.

Relationship Between Safety and Key Highway Features, State Of The Art Report 6, TRB, National Research Council, Washington, D. C. 1987.

Roadside Design Guide, American Association of State Highway and Transportation Officials, Washington, D.C. October 1988.

Synthesis of Safety Research Related to Traffic Control and Roadway Elements. Report FHWA-TS-82-232. FHWA, U. S. Department of Transportation, Washington, D. C., December 1982.

**APPENDIX A
DESIGN REVIEW RATINGS**

Category 1: Alignment Ratings

Horizontal Alignment:

1.00

Section is tangent or curve with recommended safe speeds equal to or greater than the design speed of the highway for a distance between 1/2 and 5 miles each direction, or

- Section with alignment having recommended safe speeds equal to or greater than the design speed of the highway longer than 5 miles either direction has features to keep the driver alert Yes = (0) / No ___%
 - A single curve or reverse curve with tangent for 1/4 mile either direction has a safe speed not less than 5 mph under the posted speed Yes = (0) / No ___%
 - In a multiple curves section, none of the curves have recommended safe speeds less than 5 mph under the posted speed Yes = (0) / No ___%
- AVERAGE** ___%

Vertical Alignment:

Vertical grade is 2% or less for the entire section, or 1.00

- All grades are on tangents or curves with design speeds equal to or greater than the design speed for the highway Yes = (0) / No ___%
 - Any grade between 3-5% doesn't exceed 1/4 mile in length Yes = (0) / No ___%
 - No grade is 6% or greater without passing lane or provision for runaway trucks Yes = (0) / No ___%
- AVERAGE** ___%

Sight Distance:

1.00

Stopping sight distance and passing sight distance, including perception/reaction distances, are greater than the minimum required for the design speed of the section for all vehicles and all approaches, or

- % of min. stopping sight distance available for approaching vehicles ___%
 - % of min. stopping sight distance available for turning movements ___%
 - % of min. passing sight distance (if applicable) ___%
 - % of min. stopping sight distance available for pedestrians and cyclists both to see and be seen ___%
- AVERAGE** ___%

Accesses (not including controlled intersections):

No access within or at either end of the section, or 1.00

- % of accesses with adequate sight distances ___%
 - % of accesses which are hard-surfaced, maintained accesses ___%
 - % of accesses with good stopping sight distances on the highway ___%
- AVERAGE** ___%

Category 2: Roadway Related Ratings

Cross Section:

Cross section meets all design standards for this classification, or 1.00

- Superelevation/crown sections are as designed Yes = (0) / No ___%
 - Lane widths are current standard Yes = (0) / No ___%
 - Shoulder/bike lane widths are current standard Yes = (0) / No ___%
 - There is 6-8 ft. of stabilized shoulder for recovery Yes = (0) / No ___%
 - No side slope are greater than 3:1 in the clear zone w/o protection Yes = (0) / No ___%
 - No obstructing terrain, including non-traversable ditch, is in the clear zone without protection under current standards Yes = (0) / No ___%
- AVERAGE** ___%

Structures:

Section has no structures, or 1.00

- Structure has the same pavement width as the roadway connections Yes = (0) / No ___%
 - Guard rail is properly constructed and designed Yes = (0) / No ___%
 - Bridge rail is properly constructed and designed Yes = (0) / No ___%
 - Bridge is well illuminated, if warranted Yes = (0) / No ___%
 - Sidewalks/bike lanes, if applicable, are designed to current standards Yes = (0) / No ___%
- AVERAGE** ___%

Bicycle Facilities:

Bicycle facility isn't provided and not needed, or 1.00

- Bicycle facility is warranted and provided as specified Yes = (0) / No ___%
 - Facility is well signed and marked according to current standards Yes = (0) / No ___%
- AVERAGE** ___%

Category 3: Traffic Control Ratings

Striping/Markings:

No striping or pavement markings are needed according to The Manual on Uniform Traffic Control Devices (MUTCD) and Oregon Policy, or 1.00

- All markings are warranted and as specified in the MUTCD and Oregon policy Yes = (0) / No ___%
 - All markings which are warranted exist Yes = (0) / No ___%
- AVERAGE** ___%

Channelization:

No channelization and none is needed, or 1.00

- Channelization is warranted Yes = (0) / No ___%
 - Storage is adequate for free-flowing conditions Yes = (0) / No ___%
 - Storage is adequate for peak hour conditions Yes = (0) / No ___%
 - Standard lane width Yes = (0) / No ___%
 - Vehicles queued to turn don't conflict with other turning movements Yes = (0) / No ___%
- AVERAGE** ___%

Curbs/Raised Islands:

No curb or raised islands and none needed, or 1.00

- Curb and/or islands offer necessary protection/channelization not adequately served by pavement markings and/or delineators
- Curb is appropriate type

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Signing:

No signing is warranted and none is in place, or 1.00

- All signing is placed as specified by the MUTCD and Oregon policy
- Signs are installed on breakaway posts

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Signals/flashing beacons:

No signalization in the section and none warranted, or 1.00

- Signal warrants have been met
- Signal is installed and warrants are still valid
- There is adequate stopping sight distance
- Signal heads are oriented for maximum visibility by approaching vehicles
- All poles are properly mounted on current standard base

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Cross walks:

No cross walks and none needed, or 1.00

- Markings are needed to delineate crossing area
- Advance signing is in place, if school crossing
- Conflicts with turning vehicle movements are minimal

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Railroad crossing:

There are no rail crossings, or 1.00

- Crossing is at grade, rubberized or surface is smooth and flat
- Crossing has signals and gates in high volume locations
- There is adequate stopping sight distance to the crossing and for 1,000 ft. each direction along the tracks

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Delineation:

No delineators are necessary, or 1.00

- Delineators improve driver information and are in place
- Delineators are adequately spaced and eliminate conflicting information

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Illumination:

No illumination is necessary, or 1.00

- Lighting is warranted and in place
- Light levels are evenly distributed and within design standards

Yes = (0) / No ___ %
 Yes = (0) / No ___ %

- Poles are placed according to current policy and guidelines
- Poles are mounted on current standard bases and properly installed

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Category 4: Roadside Related Ratings

Guardrail/Median Barrier:

No guardrail and none needed, or

1.00

- Barrier is warranted to protect motorists from a greater hazard than itself
- Barrier type and installation is current Oregon standard
- Barrier is adequately delineated, if warranted

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Utility Installations:

There are no above ground utilities, or

1.00

- Utility installations are located out of the clear zone or beyond the sidewalk
- No facilities obstruct the view of oncoming vehicles, accesses or intersections, or of pedestrians, cyclists or vehicles parked on the shoulder
- Manholes, if existing, are at grade

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Obstructions:

There are no obstructions within the clear zone, or

1.00

- Any trees within the clear zone are less than 6" diameter
- Any culvert ends are safely traversable
- Any retaining walls are necessary
- Drainage is provided to eliminate standing water in low areas
- Rockfall areas are adequately controlled

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Sidewalks:

There are no sidewalks and none warranted, or

1.00

- The need for pedestrian facilities exists and they are in place
- Sidewalk width is adequate to allow passing, wheelchair use and pedestrian volumes
- Accesses are visible to pedestrians
- Sidewalk traffic is visible to vehicles turning across it

Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

Culture:

- Roadside is clean, pleasant and varied and doesn't require distraction from the roadway for drivers to find destinations
- Roadside attractions/destinations are signed adequately in advance and at accesses
- Traversable landscaping provides beauty and interest

1.00
 Yes = (0) / No ___ %
 Yes = (0) / No ___ %
 AVERAGE ___ %

**APPENDIX B
FIELD REVIEW RATINGS**

The questions as outlined reflect what answers have been determined as important in this assessment. The final wording on the field checklist will be designed to answer easily from field observation.

Sight Distance: 1.00
Stopping sight distance and passing sight distance are comfortable for the posted speed of the section for all approaches, or

- % of stopping sight distance available of and for approaching vehicles ___%
 - % of stopping sight distance available of and for turning movements ___%
 - % of stopping sight distance available for pedestrians and cyclists both to see and be seen ___%
 - % of passing sight distance (if applicable) ___%
- AVERAGE ___%

Cross Section:
No problems are apparent with the cross section, or 1.00

- Lane widths are wide enough and consistent Yes = (0) / No ___%
 - Pavement edge is flat and smooth Yes = (0) / No ___%
 - Stabilized shoulder is in good condition for recovery Yes = (0) / No ___%
 - No obstructing terrain, including non-traversable ditch, is close to the road without protection Yes = (0) / No ___%
- AVERAGE ___%

Structures:
Section has no structures, or 1.00

- Guard rail is in undamaged condition Yes = (0) / No ___%
 - Bridge rail is in undamaged condition Yes = (0) / No ___%
 - Structures and all supports are well delineated Yes = (0) / No ___%
 - Bridge illumination is in good condition Yes = (0) / No ___%
 - Sidewalks/bike lanes, if applicable, are in good condition Yes = (0) / No ___%
- AVERAGE ___%

Bicycle Facilities:
No bicycle facility, or 1.00

- Surface is in excellent condition, free of ruts and potholing, heaving, cracking or other surface deterioration Yes = (0) / No ___%
 - Facility is free of debris Yes = (0) / No ___%
 - Facility is clearly signed and marked Yes = (0) / No ___%
- AVERAGE ___%

Striping/Markings:
No striping or pavement markings, or 1.00

- All markings exhibit good condition and visibility: day No ___% dark/dusk No ___%
 - Striping and pavement markings are easily understood and followed Yes = (0) / No ___%
- AVERAGE ___%

Curbs/Raised Islands:

No curb or raised islands, or 1.00

- Curb/islands are well delineated Yes = (0) / No ___%
- All curb is smooth and in good repair Yes = (0) / No ___%
- Surfaces are in good condition Yes = (0) / No ___%
- AVERAGE** ___%

Signing:

No signing is in place, or 1.00

- Signing is clearly legible under all light/weather conditions Yes = (0) / No ___%
- Signs appear to be properly installed Yes = (0) / No ___%
- Signs are undamaged and unobscured Yes = (0) / No ___%
- AVERAGE** ___%

Signals/flashing beacons:

There are no signals/flashing beacons in the section, or 1.00

- Orientation of signal heads are clear to approaching vehicles Yes = (0) / No ___%
- Aall lenses are working Yes = (0) / No ___%
- Signal lenses are unobscured and visibly bright Yes = (0) / No ___%
- AVERAGE** ___%

Cross walks:

No cross walks, or 1.00

- Advance signing is noticeable, if school crossing Yes = (0) / No ___%
- Surface is smooth and clean Yes = (0) / No ___%
- Cross walks are visible from all directions Yes = (0) / No ___%
- AVERAGE** ___%

Railroad crossing:

There are no rail crossings, or 1.00

- Crossing surface is smooth and flat Yes = (0) / No ___%
- The crossing and each direction along the tracks are unobscured Yes = (0) / No ___%
- AVERAGE** ___%

Delineation:

No delineators are necessary, or 1.00

- Delineators are adequately spaced and easy to follow information Yes = (0) / No ___%
- Delineators are functioning and in good condition Yes = (0) / No ___%
- AVERAGE** ___%

Illumination:

No illumination is necessary, or 1.00

- Enough lamps are working to ensure good night time visibility Yes = (0) / No ___%
- Poles and bases are in good condition Yes = (0) / No ___%
- Sign illumination is in good condition Yes = (0) / No ___%
- AVERAGE** ___%

Guardrail/Median Barrier:

No guardrail, or	1.00
● Barrier is undamaged	Yes = (0) / No ___%
● Guard rail face is at bumper height from the pavement	Yes = (0) / No ___%
● Posts appear securely installed	Yes = (0) / No ___%
● Barrier is adequately delineated in all light/weather conditions	Yes = (0) / No ___%
	AVERAGE ___%

Utility Installations:

There are no above ground utilities, or	1.00
● No facilities obstruct the view of the road, intersections or shoulder	Yes = (0) / No ___%
● All facilities are undamaged, showing no signs of collision	Yes = (0) / No ___%
● Manholes, if existing, are properly covered and at grade	Yes = (0) / No ___%
● All utilities are set back a safe distance from the shoulder	Yes = (0) / No ___%
	AVERAGE ___%

Obstructions:

There are no obstructions directly in the path of straying vehicles, or	1.00
● Any trees close to the shoulder are less than 6" diameter	Yes = (0) / No ___%
● Any culvert ends are traversable and in good condition	Yes = (0) / No ___%
● Any retaining walls are well delineated	Yes = (0) / No ___%
● There is no standing water in low areas	Yes = (0) / No ___%
● Rockfall areas are adequately signed and controlled	Yes = (0) / No ___%
	AVERAGE ___%

Sidewalks:

There are no sidewalks, or	1.00
● Surface is smooth and even, free of cracks, heaving or other damage	Yes = (0) / No ___%
● Accesses are visible to pedestrians	Yes = (0) / No ___%
● Sidewalk traffic is visible to vehicles turning across it	Yes = (0) / No ___%
	AVERAGE ___%

Culture:

Roadside is clean, pleasant and varied and doesn't require distraction from the roadway for drivers to find destinations	1.00
● Roadside attractions/destinations are signed adequately	Yes = (0) / No ___%
● Landscaping provides beauty and interest	Yes = (0) / No ___%
	AVERAGE ___%