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SD Department of Transportation
Office of Research

Rural Road Condition Survey Guide

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The *Rural Road Condition Survey Guide* (SD95-16-G1) is part of a three-document series. The other two documents are the *Rural Road Design, Maintenance, and Rehabilitation Guide* (SD95-16-G2), and the *Rural Road Management Guide* (SD95-16-G3).

16. Abstract

The *Rural Road Condition Survey Guide* was developed to provide an easy, consistent means of assessing rural pavement and gravel road conditions, both within a local agency statewide. The guide includes an easy-to-use subjective condition rating methodology that defines pavement and gravel roadway condition ratings from 0 to 100. In addition, guidance for determining a road's necessary level of repair is provided.

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1. INTRODUCTION

Objective

This Guide has been developed to help provide a consistent means of assessing rural roadway conditions, both within a county and statewide. The roadway evaluation methodology described in this Guide will provide county highway agencies with a uniform and consistent means of defining pavement and roadway conditions. By adopting a standard approach to rating the observable condition of a pavement or gravel-surfaced road, local road agencies can uniformly and objectively compare pavement conditions.

This Guide provides methodologies for assessing roadway conditions and provides guidance for identifying a roadway's necessary level of repair. When used in conjunction with the *Rural Road Design, Maintenance, and Rehabilitation Guide* and the *Rural Road Management Guide*, counties will have a comprehensive tool to assist them in their decision-making process. This series of guides provides counties with expertise throughout the entire pavement and roadway planning and design process.

The guides are intended to be interactive; the results obtained from the use of one guide are intended as inputs for another. For instance, the pavement condition ratings obtained through the use of the *Rural Road Condition Survey Guide* are used as inputs in the *Rural Road Design, Maintenance, and Rehabilitation Guide* to determine appropriate repair techniques.

The guides each address asphalt-surfaced (asphalt concrete and blotter), portland cement concrete, and gravel-surfaced roads. Although the vast majority of South Dakota's rural roads are gravel-surfaced, some asphalt pavements and an occasional PCC pavement do exist.

Approach

Members of a rating panel rate the overall condition of a roadway surface on a scale from 0 to 100. The rating reflects the combination of distresses visible on the surface (subjectively identified by severity and extent) and the overall rideability of the section. A general relationship can be made between the ratings and the appropriate types of rehabilitation, as shown in Tables 1, 2, and 3. More specific guidelines or repair are provided in the *Rural Road Design, Maintenance, and Rehabilitation Guide.*

Table 1. Gravel Roadway Rating and Evaluation Scheme.

Surface Rating	Visible Distresses and Overall Roadway Condition
100 to 81 (Excellent)	Roadway surface is in excellent condition with very good rideability. Good gravel thickness and excellent drainage. No distresses in the roadway, with the exception of dusting in dry conditions.
80 to 61 (Good)	Adequate gravel thickness, good pavement crown, and good drainage. Moderate loose aggregate and slight washboarding. Slight rutting (< 25 mm [1 in]) in some areas during wet weather.
60 to 41 (Fair)	Good crown of 75 to 150 mm (3 to 6 in). Primary ditches present on more than 50 percent of the roadway. Some culvert cleaning is necessary. Secondary ditches beginning to develop along portions of the shoulder line. Gravel layer is adequate, but additional aggregate is necessary in isolated areas. Moderate washboarding (25 to 50 mm [1 to 2 in] deep) over 10 to 25% of the area. Moderate rutting (25 to 50 mm [1 to 2 in] deep), especially in wet weather. Occasional small potholes (< 50 mm [2 in] deep). Some loose aggregate (50 mm [2 in] deep).
40 to 21 (Poor)	Travel at slow speeds (< 40 kph [25 mph]) is required. Little or no roadway crown (< 75 mm [3 in]). Adequate primary ditches on less than 50 % of the roadway. Deep secondary ditches located along more than 50 % of the roadway length. Some areas (up to 25 %) with little or no aggregate. Culverts partially filled with debris. Moderate to severe washboarding (> 75 mm [3 in] deep) over 25 % of area. Severe rutting (> 75 mm [3 in]) in 10 to 25 % of roadway during wet weather. Moderate potholes (50 to 100 mm [2 to 4 in] deep) over 10 to 25 % of area. Severe loose aggregate (> 100 mm [4 in]).
20 to 0 (Failed)	Travel on roadway is very difficult. No roadway crown, or the road is bowl-shaped with extensive ponding. Little, if any, primary ditches. Deep secondary ditches are located along most of the roadway. Culverts are damaged or filled with debris. Severe rutting (> 75 mm [3 in]) on more than 25 % of area, especially in wet weather. Severe potholes (over 100 mm [4 in] deep) over at least 25 % of the area. Many areas (over 25 %) with little or no aggregate.

Table 1. Gravel Roadway Rating and Evaluation Scheme (cont.).

Surface Rating	Typical Repair	Level of Repair
100 to 81 (Excellent)	Little or no maintenance needed. Routine blading.	None
80 to 61 (Good)	Routine blading. Cut out washboard areas and relay the gravel when moisture is present.	Routine/preventive maintenance.
60 to 41 (Fair)	Regrading of the surface is necessary to eliminate washboarding and secondary ditch. The regrading should be done when moisture is present. Some areas may need additional gravel. Some ditch improvement and culvert cleaning may be necessary.	Heavy maintenance.
40 to 21 (Poor)	Reshaping of the roadway surface and shoulders is necessary, along with the placement of additional aggregate. Major ditch reconstruction and culvert maintenance are also required.	Rehabilitation.
20 to 0 (Failed)	The entire roadway cross section must be reshaped, and a new gravel layer must be constructed. Ditches must be reestablished, and new culverts are typically needed.	Reconstruction.

Table 2. Flexible Pavement Rating and Evaluation Scheme.

Rating	Surface Condition Description
100 to 86 (excellent)	The pavement surface is in excellent condition. The pavement appears to be very smooth and is generally free of any distress. As the pavement nears a rating closer to the lower end of this category, some oxidation of the pavement surface may be present, and minimal amounts of low-severity hairline cracks or depressions may be visible.
85 to 71 (very good)	The pavement surface is in very good condition, but surface deterioration is more evident. The pavement surface may be partially oxidized or weathered. Transverse and longitudinal cracks are visible, and crack widths are generally less than 3 mm (1/8 in) wide. Block cracking patterns may be appearing, but cracks have not deteriorated greatly. Some minor spalling or faulting may be present along the cracks. Additional types of surface deterioration may be present. Minor rutting may be noticeable in the outer wheel paths.
70 to 56 (good)	The pavement surface is generally in good condition. The surface is noticeably oxidized and raveling may be present. Transverse and longitudinal cracks are between 6 and 12 mm (0.25 and 0.50 in) wide and may exhibit some deterioration (spalling). Depressions in cracked areas or around utility repairs may be noticeable. Alligator cracking may be evident in the wheel paths. Rutting is becoming more pronounced, and some shoving may occur at intersections. Minor patching may be present as a result of surface distresses or utility settlements.
55 to 41 (fair)	The pavement surface is in fair condition. Pavement deterioration is much more advanced. Many reflective cracks are present on overlaid pavements. Block cracking is common and weathering is noticeable, with detrimental effects to the pavement. Some reflective cracks may be faulted or have medium- to high-severity spalls.
40 to 26 (poor)	The pavement surface is in poor condition with poor rideability. Alligator cracking is severe, and potholes may be present. Rutting is common and, in some instances, is greater than 20 mm (0.75 in). The pavement edge may be deteriorated, and over 60 m (200 ft) of cracking per 90 square meters (1,000 sq ft) of pavement is present.
25 to 0 (very poor to failed)	The pavement surface is in very poor to failed condition. The vast majority of the pavement surface is severely cracked and disintegrated. Traffic operations are severely affected.

Table 2. Flexible Pavement Rating and Evaluation Scheme (cont.).

Rating	Typical Repair	Level of Repair
100 to 86 (excellent)	Crack sealing	Routine/preventive maintenance
85 to 71 (very good)	Pothole repairs, crack sealing, surface treatments	
70 to 56 (good)	Chip seals, non-structural overlays	Minor rehabilitation
55 to 41 (fair)	Structural overlays, milling with overlays, partial-depth reconstruction	Major rehabilitation
40 to 26 (poor)		
25 to 0 (very poor to failed)	Reconstruction	Reconstruction

Table 3. Jointed Concrete Pavements Rating and Evaluation Scheme.

Rating	Surface Condition Description
100 to 86 (excellent)	The pavement surface is in excellent condition. There are no distresses present, with the possible exception of some minor hairline cracking and joint sealant deterioration.
85 to 71 (very good)	The pavement surface is in very good condition. Pavements that fall into this category have some transverse cracking present, but most cracks are still less than 6 mm (0.25 in) wide. Up to 7 m (25 ft) of cracking per 90 square meters (1,000 sq ft) of pavement may be present, and faulting is rare. Isolated joint and crack spalling may be present.
70 to 56 (good)	The pavement surface is in good condition. The same amount of cracking may be present as in the previous category, but there is more spalling and faulting present along the cracks and joints. In addition, crack widths are typically greater than 6 mm (0.25 in) wide. Some corner cracks may begin to occur. Some discoloration of the pavement due to the presence of D-cracking may begin to be seen.
55 to 41 (fair)	The pavement surface is in fair condition. Cracking, patching, and spalling are very common. Patching may be extensive, and the patches may be exhibiting fairly severe deterioration. Faulting is more noticeable in these sections, and secondary cracking may be occurring around other distressed areas. At this condition level, 15 to 23 m (50 to 75 ft) of cracking per 90 square meters (1,000 sq ft) of pavement may be present.
40 to 26 (poor)	At this level, pavements have deteriorated to a poor condition. A great deal of cracking and extensive patching are present. Secondary cracking (cracks that extend from the original crack) is common and foundation failures, such as faulting, are very evident. Broken slabs are rocking and showing some movement.
25 to 0 (very poor to failed)	Pavements within this category are severely deteriorated and in very poor to failed condition. Chunks of pavement are missing and driving conditions are unpleasant. Extreme levels of cracking (50 percent or more cracked slabs) are present, with most cracks and joints exhibiting spalling or faulting. Areas where D-cracking has occurred are deteriorated badly. Traffic operations are severely affected.

Table 3. Jointed Concrete Pavements Rating and Evaluation Scheme (cont).

Rating	Typical Repair	Level of Repair
100 to 86 (excellent)	None	None
85 to 71 (very good)	Crack sealing, joint resealing, partial depth spall repair	Routine/preventive maintenance
70 to 56 (good)	Full-depth repairs, slab removal and replacement, grinding	Minor rehabilitation
55 to 41 (fair)	Full-depth repairs, slab removal and replacement, grinding, AC overlays	Major rehabilitation
40 to 26 (poor)		
25 to 0 (very poor to failed)	Reconstruction or crack and seat followed by an AC overlay	Reconstruction

INTRODUCTION

Note that Table 1 was developed based on guidelines presented in the 1989 *Gravel-PASER Manual, Pavement Surface Evaluation and Rating*, developed by the Transportation Information Center at the University of Wisconsin-Madison. Some modifications to the *Gravel-PASER* guidelines were made to reflect actual conditions in the State of South Dakota.

For the asphalt-surfaced and jointed concrete pavements, the extent of two specific pavement distresses is noted—rutting (flexible pavements) and polished aggregate (flexible and rigid pavements). The magnitude of these two distresses can have a significant impact on vehicular safety. These distresses are not specifically noted in the gravel road evaluation procedures.

The survey is conducted by a rating team of at least two members. The function of the team is to evaluate the pavements in accordance with the guidelines established in this manual. Although differences of opinion among raters are possible, it is suggested that the team members discuss any discrepancies that occur and reach a consensus for handling the variation.

The rating is obtained after driving over the entire length of a selected pavement section. After the initial drive-over, a representative portion of the section is selected. The raters then exit the vehicle, and each rater evaluates the area of the section that is identified as representative of the typical condition of the entire section. Each rater's rating should be derived independently, but the rating of each team member should be compared to the ratings of the other team members to ensure that little variation occurs. If one member of the team consistently ranks the pavements more than 10 points above or below the other team members, the team should discuss the reasons for these differences. Any refinements to these guidelines that are developed as a result of a discussion by the team can be added to the manual for future reference. Finally, the rating panel should estimate, via selected measurements with a straight edge, the typical depth of rutting in the wheel paths (asphalt-surfaced pavements only) and identify whether polished aggregate conditions exist (asphalt-surfaced and jointed concrete pavements only).

Because asphalt-surfaced and PCC pavement conditions do not change significantly over short periods of time or fluctuate with changes in the weather, the condition surveys on these types of pavements can be performed at almost any time during the year. However, it is suggested that

the surveys be performed at about the same time each year so that the annual rate of pavement deterioration can be estimated accurately.

On the other hand, gravel-surfaced road conditions are significantly affected by weather conditions and changing traffic patterns (i.e., fall harvest traffic). Therefore, care should be taken to rate the surface when the roadway is in "average" condition. Rating the roadway immediately after grading would result in an inappropriately high condition rating, and rating the roadway immediately after it was exposed to severe weather and traffic would result in an inappropriately low condition rating. On many gravel roads, average conditions probably exist a few days (or weeks) after the road has been regraded. During this time period, many of the roadway's reoccurring distresses, such as washboarding and loose aggregate, will be present. However, the roadway will not have deteriorated to its most severe condition.

Prior to performing the actual pavement ratings, the rural road network must be subdivided into branches and sections. Definitions of branches and sections are as follows (Eaton and Beaucham 1992):

> *Branch*: A branch is an identifiable part of the roadway network that is a single entity with a distinct function. For example, individual roads and parking areas are separate branches of a network.
>
> *Section*: A section is a division of a branch. A section has uniform structural composition (thickness and materials), construction history, traffic patterns, and surface condition.

An example of network branches and sections is shown in Figure 1. In this figure, Boot Hill Road would be defined as a branch. Within this branch, four sections are identified—BHR1, BHR2, BHR3, and BHR4. In many instances, sections will occur between intersections. An example of this scenario is Dodge Road, shown in Figure 1. However, there will be cases where multiple sections exist between intersections.

Once the network has been divided into branches and sections, the following general approach should be used to attain uniformity in ratings.

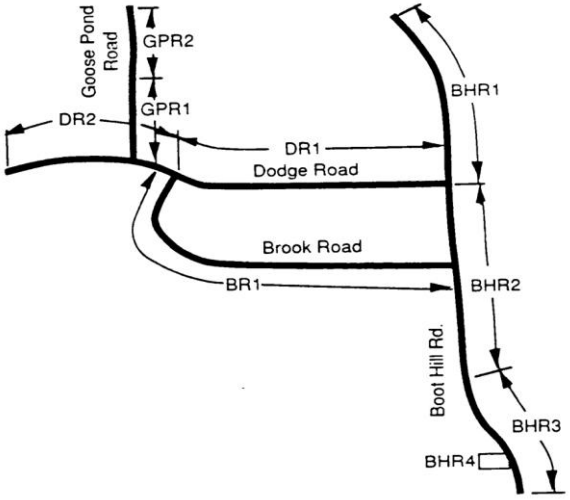


Figure 1. Typical network sections (Eaton and Beaucham 1992).

Step 1: Locate section breaks.

Using the previously outlined criteria, the pavement network is divided into pavement sections. As noted before, a section is fairly consistent in terms of pavement surface type, structural composition (thickness and materials), traffic, and condition. Once identified, the general section information should be entered on the inventory data form. A sample form is shown on page 60.

Step 2: Drive over the entire section.

To verify uniformity, the rating panel should drive slowly over the entire section. The panel should evaluate whether the first 100 ft of the section are representative of the entire section, or select another area that may be better to inspect. At the same time, the panel should agree upon a subjective rating that indicates the level of riding comfort noticed by the traveling public. A simple rating ranging from 0 to 5 is recommended, as shown in Table 4.

Table 4. Rideability Ratings.

Ride Rating	Description
0	Ride not known or not determined.
1	Passengers notice a very uncomfortable ride. The road is rough enough to easily knock the vehicle out of alignment. The vehicle must be slowed considerably.
2	Approximately 70 % of the pavement section gives a rough ride.
3	Approximately 50 % of the pavement section is rough. In a concrete section, almost every joint produces a pronounced bump. The highest rideability rating for a gravel road should be a 3.
4	Occasional isolated areas of roughness are present, as in the case of a few joints being faulted or a few bumps being present.
5	There are no areas that are rough. Passengers observe a smooth ride.

Step 3: Identify a representative area of the section to evaluate.

Within each section, an area that is fairly representative of the condition of the worst lane of pavement should be identified by the panel. If the section's condition is not uniform, it may be necessary to subdivide the section into multiple sections.

Step 4: Return to representative area and evaluate pavement condition.

The panel should return to the representative section and determine a condition rating using the rating scheme presented in this manual. Unless the pavement is in excellent condition, the raters should exit the vehicle to conduct the survey. Each panel member should determine a rating independently.

Step 5: Compare rating results.

After each rater has determined a rating for the section, results should be compared. If any rater is more than 10 points above or below the other raters, the panel should discuss the reasons and reevaluate the section.

Step 6: Determine the average rating.

After each rater has determined a rating for the section and the variation between raters has been determined to be acceptable (within 10 points), the average of the ratings should be determined and recorded on the rating form (at the back of this document) as the condition rating for that particular section.

Step 7: Estimate the average rut depth.

For asphalt-surfaced pavements, estimate the average depth of wheel path rutting. The overall average depth of rutting can be estimated by averaging the measured rut depths (via the use of a straight edge) obtained at a minimum of five representative locations. A simple rating from 0 to 4 is recommended, as outlined in Table 5.

Step 8: Identify whether aggregate polishing exists on pavement surface.

Identify whether polished aggregate (asphalt-surfaced and concrete pavements) exists on the pavement surface. Use the simple rating form presented in Table 6.

Guidelines for Conducting Surveys

It is strongly recommended that the rating team be comprised of at least two members. The driver of the survey vehicle is primarily responsible for safely driving over the pavement section and observing the section limits. The driver may or may not be a condition rater, but will at least be able to contribute to rating the rideability of a given section.

The second member of the rating team sits in the front passenger seat of the vehicle and is responsible for rating the condition and rideability of the section. This member is also responsible for recording the ratings of any other team members and providing directions to the driver to locate each pavement section being surveyed. If there are additional members of the rating panel, they should be responsible for evaluating surface condition and rideability.

The following list of general rules should be considered by the panel as ratings are being determined for each section:

Table 5. Flexible Pavement Rutting Ratings.

Rut Depth Rating	Description
4	Average wheel path rutting is less than 6 mm (0.25 in).
3	Average wheel path rutting is at least 6mm (0.25 in), but less than 12 mm (0.5 in).
2	Average wheel path rutting is at least 12 mm (0.5 in), but less than 20 mm (0.75 in).
1	Average wheel path rutting is greater than 20 mm (0.75 in).
0	Wheel path rutting was not evaluated.

Table 6. Ratings for Polished Aggregate Conditions.

Polished Aggregate Rating	Description
3	Polished aggregate condition not apparent.
2	Low to moderate polished aggregate condition.
1	Moderate to high polished aggregate condition.
0	Polished aggregate condition not evaluated.

- Pavement thickness and traffic levels should not influence the condition rating.

- The presence of aggregates susceptible to D-cracking should not, in itself, affect the condition rating of PCC pavements. However, if D-cracking has developed in the pavement, that should be taken into account during the rating process.

- Concrete joint deterioration is based on the overall condition of all the joints within a section. The deterioration along each joint is not rated separately.

- Judgement must be used in determining whether temporary pavement maintenance has influenced the rating. Recently placed patches that are intended to cover-up deterioration, rather than remedy it, should be disregarded. Also, the rater should consider the frequency at which patching has occurred on the section, as well as the past performance of the patches.

- Railroad crossing rideability should not be considered in the section rating but may be evaluated separately. A simple rating ranging from 0 to 5 is recommended, as described in Table 7.

Surface Condition Rating Scheme

The objective of the condition survey is to determine the rating that represents the collective judgement of the survey team with respect to the current condition of each pavement section being inspected. Using the guidelines established in this manual, a numerical value is assigned to each pavement section. These ratings are a subjective description of the overall condition of the pavement, as shown in Tables 8 and 9. The correlations between the numerical values and the descriptive ratings shown in Table 8 for gravel roads are similar to those used the 1989 *Gravel-PASER Manual, Pavement Surface Evaluation Rating*. The correlations between the numerical values and the descriptive condition ratings shown in Table 9 for asphalt-surfaced and jointed concrete pavements are similar to those used by the U.S. Army and the American Public Works Association (APWA) in the Pavement Condition Index (PCI) survey procedures.

Table 7. Railroad Crossing Ride Rating.

Ride Rating	Description
5	Crossing is very smooth and virtually unnoticed by vehicle passengers at posted speeds.
4	A bump is felt, but vehicle passengers are comfortable at posted speeds.
3	Vehicle passengers are comfortable at speeds less than 16 kph (10 mph) but uncomfortable at posted speeds.
2	Vehicle passengers are somewhat uncomfortable at speeds less than 16 kph (10 mph).
1	Vehicle passengers are severely jolted at speeds less than 16 kph (10 mph).
0	Railroad crossing rideability was not evaluated.

Table 8. Relationship Between Numerical Rating and Subjective Evaluation for Gravel Roads.

Numerical Rating	Subjective Evaluation
100 to 81	Excellent
80 to 61	Good
60 to 41	Fair
40 to 21	Poor
20 to 0	Failed

Table 9. Relationship Between Numerical Rating and Subjective Evaluation for Asphalt-Surfaced and Jointed Concrete Pavement.

Numerical Rating	Subjective Evaluation
100 to 86	Excellent
85 to 71	Very Good
70 to 56	Good
55 to 41	Fair
40 to 26	Poor
25 to 11	Very Poor
10 to 0	Failed

2. GRAVEL-SURFACED ROADS

Introduction

The condition survey procedure for gravel-surfaced roads is based on the subjective approach outlined in the 1989 *Gravel-PASER Manual, Pavement Surface Evaluation and Rating*, which was developed by the Transportation Information Center at the University of Wisconsin-Madison. In the procedure, the overall condition of the gravel road is rated from 0 to 100 (100 is new condition, and 0 is completely failed).

Typical Distresses in Gravel-Surfaced Roads

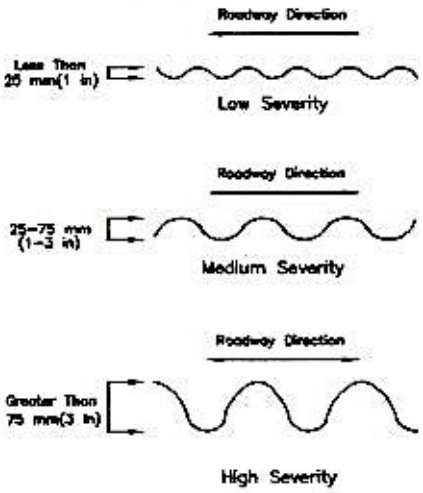
There are seven primary distress types in gravel-surfaced roads (Eaton and Beaucham 1992). These seven distress types are as follows:

- Corrugations (Washboarding)
- Dust
- Improper cross section
- Improper roadside drainage
- Loose aggregate
- Potholes
- Ruts

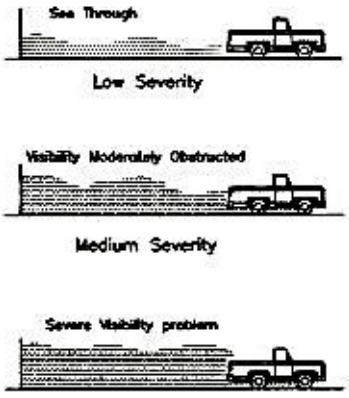
Sketches of these seven distress types are provided in Figure 2, and a description of each distress type is provided below. The distress type descriptions are from the U.S. Army Corps of Engineers Cold Regions Research & Engineering Laboratory (CRREL) publication *Unsurfaced Road Maintenance Management* (Eaton and Beaucham 1992).

Corrugations: Corrugations (also known as washboarding) are closely spaced ridges and valleys at fairly regular intervals. The ridges are perpendicular to the traffic direction. This type of distress is usually caused by traffic and loose aggregate, especially in prolonged dry periods. These ridges usually form on hills, on curves, in areas of acceleration or deceleration, or in areas where the road is soft or potholed.

Dust: The wear and tear of traffic on gravel roads will eventually loosen the larger particles from the soil binder. As traffic passes, dust clouds create a danger to trailing or passing vehicles and cause significant environmental problems.

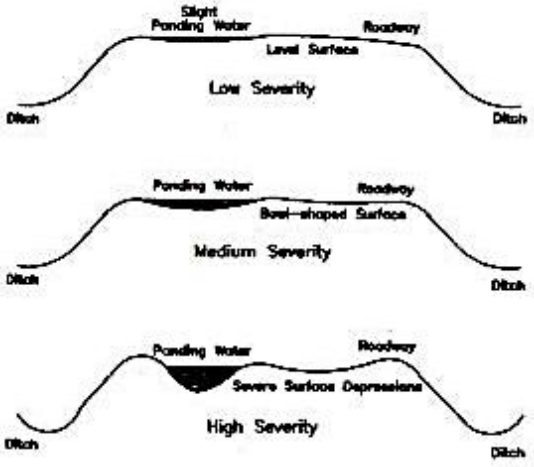


a. Corrugations

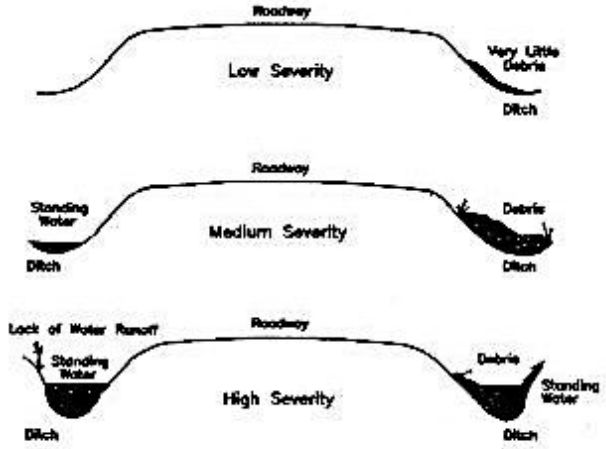


b. Dust

Figure 2. Sketches of Typical Distresses on Gravel Roads.

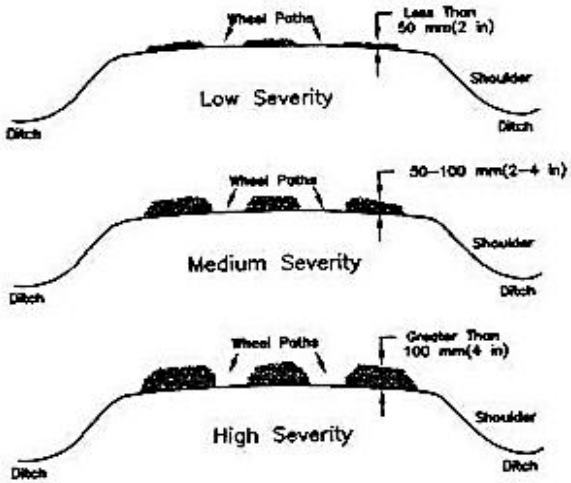


c. Improper cross section

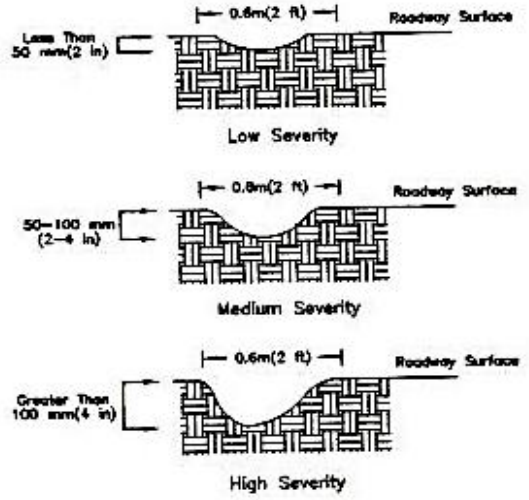


d. Inadequate roadside drainage

Figure 2. Sketches of Typical Distresses on Gravel Roads (continued).

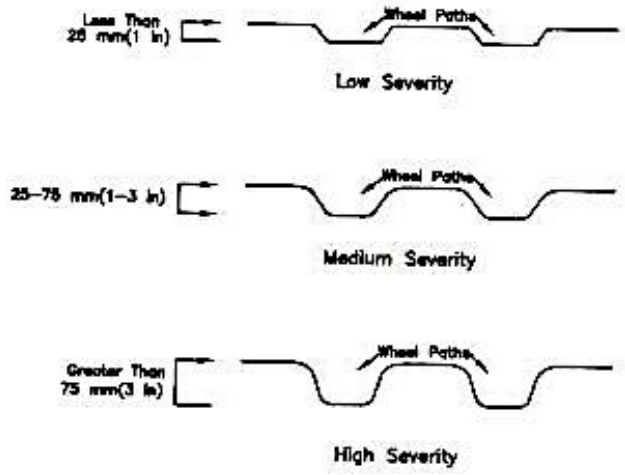


e. Loose aggregate



f. Potholes

Figure 2. Sketches of Typical Distresses on Gravel Roads (continued).



g. Ruts

Figure 2. Sketches of Typical Distresses on Gravel Roads (continued).

GRAVEL-SURFACED ROADS

Improper cross section: An unsurfaced road should have a crown with enough slope from the centerline to the shoulder to drain all water from the road's surface. No crown is used on curves, because they are usually banked. The cross section is improper when the road surface is not shaped or maintained to carry water to the ditches.

Improper roadside drainage: Poor drainage causes water to pond. Drainage becomes a problem when ditches and culverts are not in good enough condition to direct and carry runoff water because of improper shape or maintenance.

Loose aggregate: The wear and tear of traffic on gravel roads will eventually loosen the larger aggregate particles from the soil binder. This leads to loose aggregate on the road surface or shoulder. Traffic moves loose aggregate particles away from the normal wheelpath and forms berms in the center of the roadway or along the shoulder.

Potholes: Potholes are bowl-shaped depressions in the roadway surface. They are usually less than 1 m (3 ft) in diameter. Potholes are produced when traffic wears away small pieces of the road surface. They grow faster when water collects inside the hole. The road then continues to disintegrate because of loosening surface material or weak spots in the underlying soils.

Ruts: A rut is a surface depression in the wheelpath that is parallel to the roadway centerline. Ruts are caused by permanent deformation in any of the road layers or subgrade. They can result from repeated vehicle passes, especially when the road is soft. Significant rutting can destroy a road.

Gravel-Surfaced Roadway Rating Guidelines

Consider the following guidelines when rating the condition of gravel roads. They address the most common forms of distresses in gravel-surfaced roads.

1. Corrugations: If low-severity corrugations exist over at least 10 percent of the roadway, the condition rating should not exceed 80. If more than 10 percent of the roadway has medium-severity corrugations, the maximum rating for the roadway is 70. A rating of no more than 60 should be assigned to a roadway that has high-severity corrugations over more than 10 percent the roadway surface.

2. Dusting: The maximum condition ratings for roadways with dusting conditions are as follows:

Dust severity	Maximum condition rating
Low	98
Medium	96
High	85

3. Improper cross section: If small amounts of ponding water or a flat roadway surface (no cross slope) exist along more than 10 percent of the roadway, the condition rating should not exceed 80. If more than 10 percent of the roadway has moderate amounts of ponding water or a bowl-shaped cross section, the condition rating should not exceed 70. The condition rating should not exceed 60 if there are large amounts of ponding water and several severe depressions in the roadway.

4. Inadequate roadside drainage: If small amounts of ponding water or overgrowth and debris occur in more than 10 percent of the roadside ditches, the condition rating should not exceed 80. If moderate amounts of either ponding water or overgrowth and debris occur in more than 10 percent of the roadside ditches, the condition rating should not exceed 70. The maximum condition rating is 60 if there are large amounts of ponding water, overgrowth, and debris in the ditches or erosion of the ditches into the shoulders and roadway.

5. Loose aggregate: The maximum condition ratings for roadways with low-, medium-, and high-severity loose aggregates conditions are 80, 75, and 65, respectively.

6. Potholes: The maximum condition ratings for roadways with several potholes are as follows:

Pothole severity	Maximum condition rating
Low	70
Medium	50
High	30

7. Rutting: The maximum condition ratings for roadways with low-, medium-, and high-severity rutting are 70, 65, and 50, respectively.

Rating = 100 to 81

Roadway surface is in excellent condition with very good rideability. The roadway has a good gravel thickness and excellent drainage. The only distress that is typically present is dusting in dry conditions.

(Photographs of gravel-surfaced roadways in excellent condition)

Rating = 80 to 61

The roadway has adequate gravel thickness, a good pavement crown, and good drainage characteristics. Distresses that may be present include medium-severity loose aggregate and low-severity washboarding. Some slight rutting (< 25 mm [1 in]) may exist in some areas during wet weather.

(Photographs of gravel-surfaced roadways in very good condition)

Rating = 60 to 41

The pavement has a good crown (75 to 150 mm [3 to 6 in]). Primary ditches are present on more than 50 percent of the roadway. Secondary ditches are evident along the shoulder line, and some culvert cleaning is necessary. The gravel layer is adequate, but additional aggregate is needed in isolated areas. Moderate washboarding (25 to 50 mm [1 to 2 in] deep) exists over 10 to 25 percent of the area, and moderate rutting (25 to 50 mm [1 to 2 in]) occurs in wet weather. Occasional small potholes (< 50 mm [2 in] deep) and some loose aggregate are present.

(Photographs of gravel-surfaced roadways in good condition)

Rating = 40 to 21

Travel at slow speeds (< 40 kph [25 mph]) is required. There is little or no roadway crown, moderate to severe washboarding, severe loose aggregate, and moderate potholing. Up to 25 percent of the roadway has little or no aggregate. More than 50 percent of the ditches are inadequate, secondary ditches exist along most of the roadway, and the culverts are partially filled with debris.

(Photographs of gravel-surfaced roadways in poor condition)

Rating = 20 to 0

Travel on the roadway is very difficult. There is either no roadway crown or the roadway is bowl-shaped with extensive ponding. Severe ruts and potholes exist over more than 25 percent of the roadway, and many areas (more than 25 percent) have little or no aggregate. There are few if any primary ditches, and secondary ditches are evident along most of the roadway. Culverts are either damaged or filled with debris.

(Photographs of gravel-surfaced roadways in failed condition)

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3. FLEXIBLE PAVEMENTS

Introduction

The condition survey procedure for flexible pavements has been developed primarily to evaluate pavements that consist of at least one asphalt concrete mat. However, the same general procedures can be used on roads that are comprised of a series of chip seals. It must be recognized that load- and drainage-related distresses are more prevalent on chip-sealed (blotter) pavements. Therefore, the ratings for chip-sealed (blotter) pavements will generally be less than those for asphalt concrete pavements.

These guidelines are intended to provide the user with enough information to conduct the survey objectively. A general description of the surface condition is provided for each 15-point increment between 0 and 100, and descriptive pictures are provided to supplement the text. The descriptions are based on an approach that has been used by the Illinois Department of Transportation (IDOT) for over 10 years. The IDOT approach is outlined in the 1992 IDOT *Condition Rating Survey Manual*. A similar approach is also used in the South Dakota Department of Transportation (SDDOT) *Pavement Condition Survey Guide for City Streets*.

Typical Distresses in Flexible Pavements

Several distresses are common to flexible pavements. Although individual distress type, quantity, and severity are not measured/rated in this procedure, it is important that the rating panel understands and distinguishes between each of the distress types to better rate the overall pavement condition. The following definitions, taken from the Strategic Highway Research Program's (SHRP) *Distress Manual for the Long-Term Pavement Performance (LTPP) Studies*, are meant to provide the necessary background.

Alligator Cracking: Also known as fatigue cracking, alligator cracking appears as a series of interconnected cracks, usually found in areas subjected to repeated traffic loadings (usually in the wheelpaths). Initially, alligator cracking appears as fine, longitudinal cracks. These gradually deteriorate to more of a chicken wire/alligator pattern.

Bleeding: Bleeding appears as a film of bituminous material on the pavement surface. The surface may be shiny, glass-like, or reflective, and may be tacky to the touch.

Block Cracking: Block cracking appears as rectangular pieces of asphalt surface ranging in size from approximately 1 to 9 square meters (10 to 100 sq ft). When present, it is usually visible over the entire pavement surface.

Edge Cracking: Edge cracking appears as crescent-shaped cracks, or fairly continuous cracks, parallel to and usually within 300 to 600 mm (1 to 2 ft) of the outer edge of the pavement. Edge cracking is more frequent in pavements without paved shoulders.

Lane/shoulder drop off: A lane/shoulder drop-off is a difference in elevation between the traffic lane and outside shoulder.

Lane/shoulder separation: A lane/shoulder separation is present when the joint between the traffic lane and the shoulder has widened.

Longitudinal cracking: Longitudinal cracks are cracks that occur relatively parallel to the pavement centerline.

Patching: Patches are portions of the pavement surface that have been repaired or replaced, including utility trench patches. In general, the condition of the patch is considered in determining the condition of the section.

Polished aggregate: Polished aggregates appear where the pavement surface has worn away to expose the coarse aggregate. The exposed aggregates are glossy in appearance and smooth to the touch.

Potholes: Potholes are holes of various sizes in the pavement surface.

Pumping: Pumping is observable as a seeping or ejection of water or fine-grained particles from beneath the pavement through cracks, joints, or along the pavement edge.

Reflection cracking: Reflection cracking occurs in asphalt overlays over jointed concrete pavements or in asphalt overlays of cracked flexible

pavements. The reflection cracks occur over the original joints or cracks in the underlying pavement.

Rutting: Ruts are longitudinal surface depressions that occur in the wheelpaths.

Shoving: Shoving appears as a longitudinal displacement of a localized area of the pavement surface caused by traffic pushing against the pavement.

Transverse cracking: Transverse cracks occur relatively perpendicular to the pavement centerline.

Weathering/raveling: Weathering or raveling appear as a wearing away of the asphalt pavement surface in which aggregate particles are dislodged (raveling) and asphalt binder is lost (weathering).

Sketches of the various distresses found in flexible pavements are provided in Figures 3 and 4. The sketches in Figure 3 are copied from SHRP's *Distress Identification Manual for the Long-Term Pavement Performance Studies*. Photographs of the various levels of severity of flexible pavement distresses are also included in this SHRP manual.

Flexible Pavement Rating Guidelines

The following guidelines should be considered when conducting the pavement condition ratings. They address the most common forms of distresses in asphalt pavements.

- If more than 10 percent of the pavement area exhibits low-severity fatigue cracking, the overall pavement rating should not exceed 70.

- The overall pavement rating should not exceed 55 if more than 10 percent of the pavement area exhibits moderate-severity fatigue cracking.

- If minor rutting (6 to 12 mm [0.25 to 0.50 in]) is evident throughout the wheelpaths, the overall pavement rating should not exceed 75.

- If rutting in excess of 12 mm (0.5 in) is present throughout the wheelpaths, the pavement rating should not exceed 60.

- If low-severity block cracking exists over more than 20 percent of the total pavement area, the pavement rating should not exceed 90.

- If medium- or high-severity block cracking exists over more than 20 percent of the total pavement area, the pavement rating should not exceed 80.

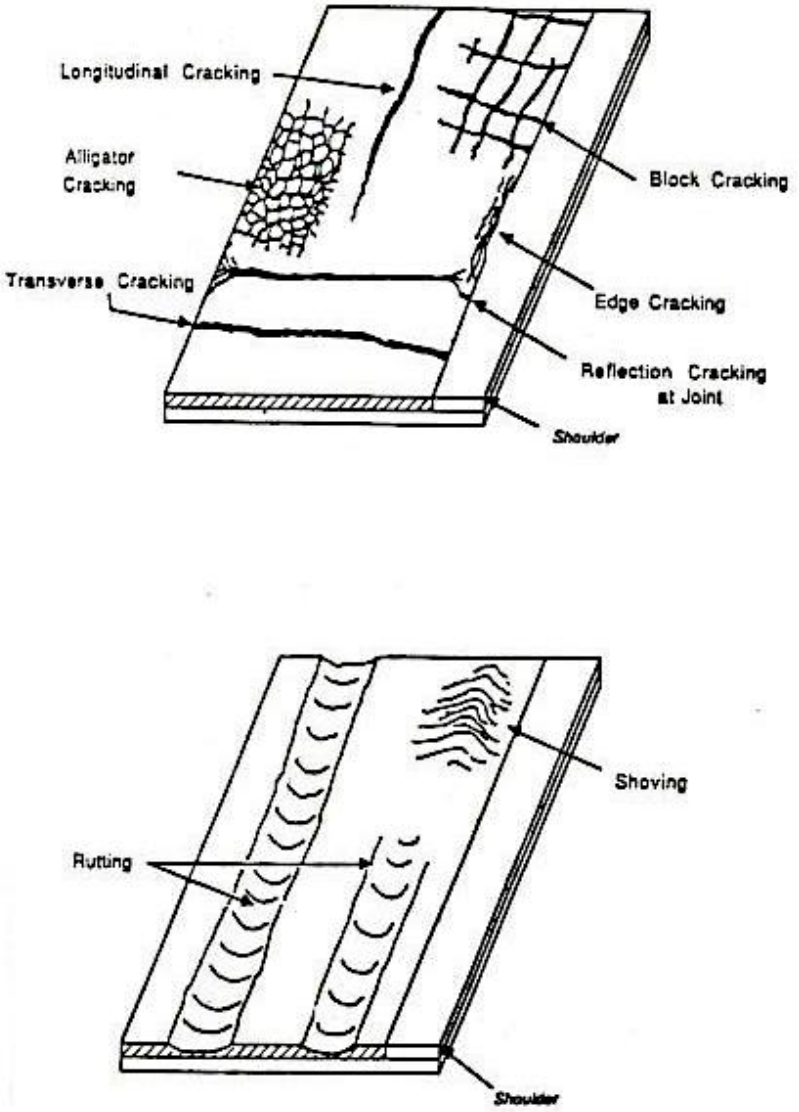


Figure 3. Sketches of Typical Distresses on Flexible Pavements.

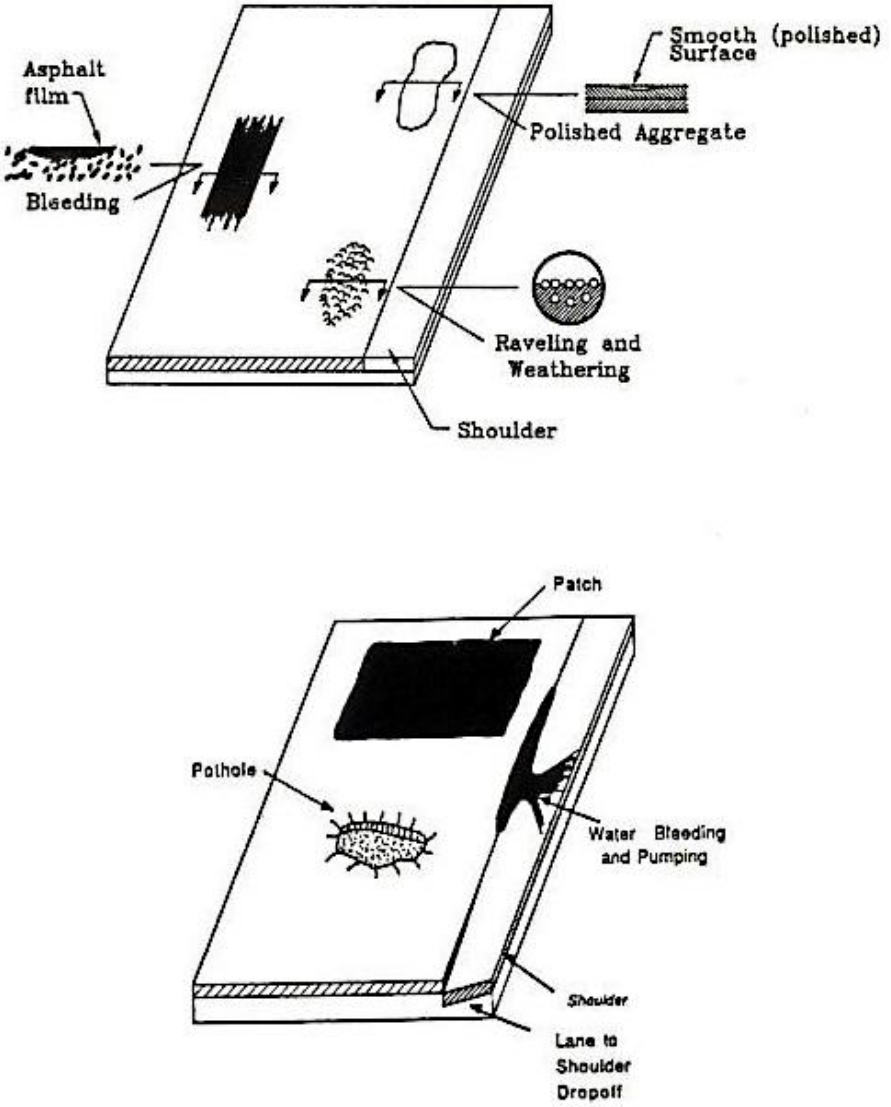


Figure 3. Sketches of Typical Distresses on Flexible Pavements (continued).

Figure 4. Photograph of an AC surface with a polished-aggregate condition.

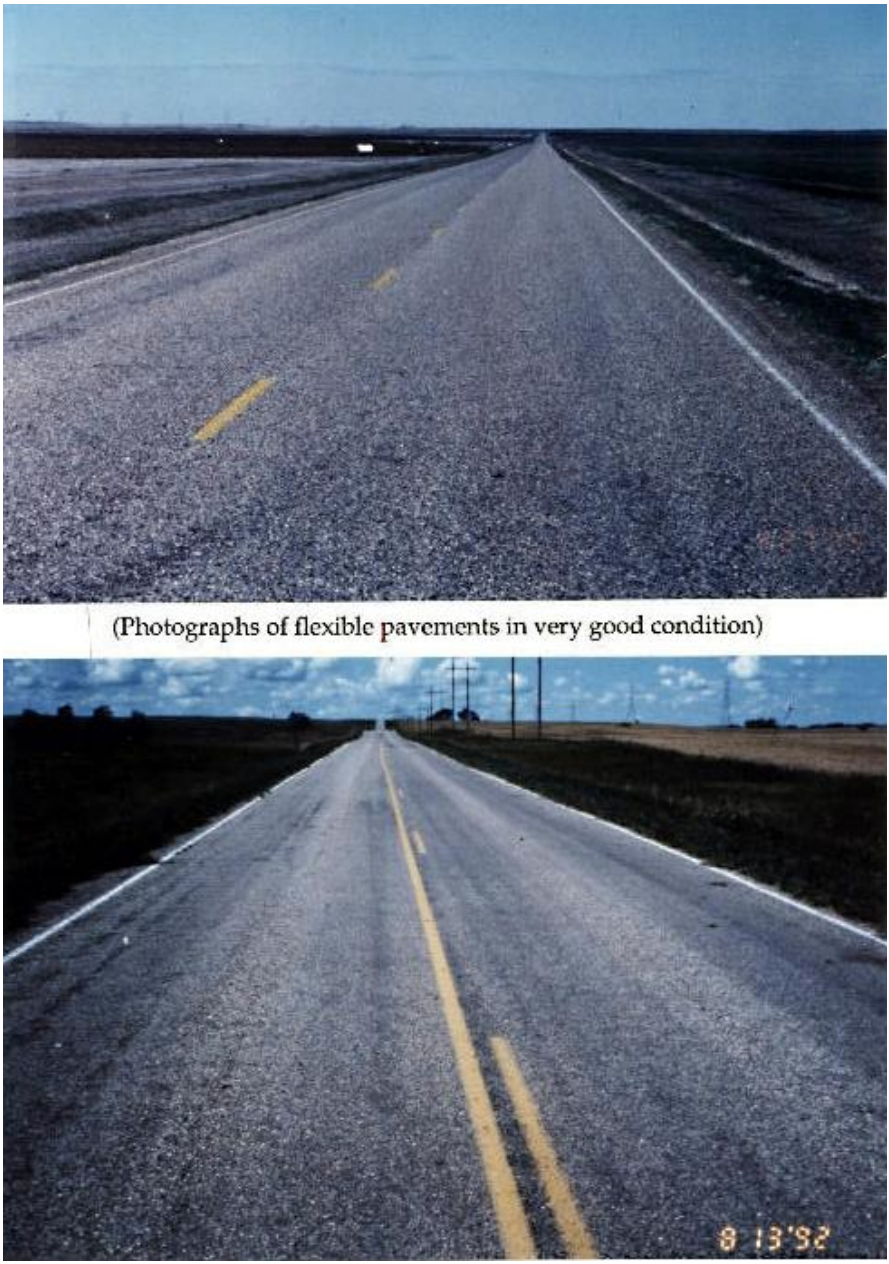
Rating = 100 to 86

The pavement surface is in excellent condition. The pavement appears to be very smooth and is generally free of any distress. As the pavement nears a rating closer to the lower end of this category, some oxidation of the pavement surface may be present, and minimal amounts of low-severity hairline cracks or depressions may be visible.

(Photographs of flexible pavements in excellent condition)

Rating = 85 to 71

The pavement surface is in very good condition, but surface deterioration is evident. The pavement surface may be partially oxidized or weathered. Transverse and longitudinal cracks are visible, and crack widths are generally less than 3 mm (1/8 in) wide. Block cracking patterns may be appearing, but cracks have not deteriorated greatly. Some minor spalling or faulting may be present along the cracks. Additional types of surface deterioration may be present. Minor rutting may be noticeable in the outer wheelpaths.



(Photographs of flexible pavements in very good condition)

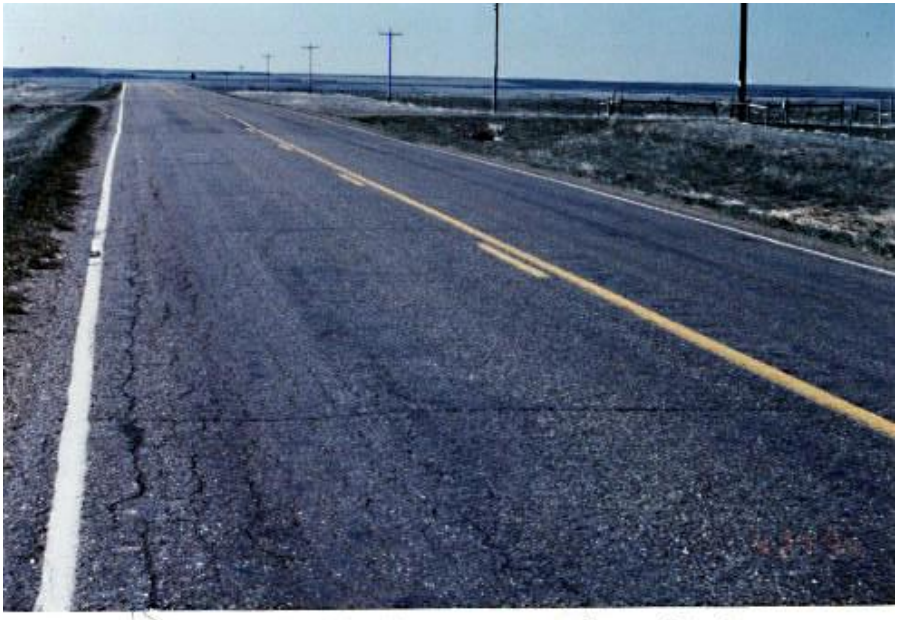
Rating = 70 to 56

The pavement surface is generally in good condition. The surface is noticeably oxidized and raveling may be present. Transverse and longitudinal cracks are between 6 and 12 mm (0.25 and 0.5 in) wide and may exhibit some deterioration (spalling). Depressions in cracked areas or around utility repairs may be noticeable. Alligator cracking may also be evident in the wheelpaths. Rutting is becoming more pronounced, and some shoving may occur at intersections. Minor patching may be present as a result of surface distresses or utility settlements.

(Photographs of flexible pavements in good condition)

Rating = 55 to 41

The pavement surface is in fair condition. Pavement deterioration is much more advanced. Many reflective cracks are present on overlaid pavements. Block cracking is common and weathering is noticeable, with detrimental effects to the pavement. Some reflective cracks may be faulted or have medium- to high-severity spalls. Rutting is more observable and may now be over 12 mm (0.5 in) deep. Areas of medium- to high-severity alligator cracking are present in addition to the rutting. Any block cracking has progressed to at least a medium severity and approximately 30 m (100 ft) of cracking per 90 square meters (1,000 sq ft) of pavement is present. Cracks are typically greater than 12 mm (0.5 in) wide, and deterioration of the cracks is prevalent.



(Photographs of flexible pavements in fair condition)

Rating = 40 to 26

The pavement surface is in poor condition with poor rideability. Alligator cracking is severe, and potholes may be present. Rutting in excess of 12 mm (0.5 in) is common and, in some instances, is greater than 20 mm (0.75 in). The pavement edge may be deteriorated, and over 60 m (200 ft) of cracking per 90 square meters (1,000 sq ft) of pavement is present.

(Photographs of flexible pavements in poor condition)

Rating = 25 to 0

The pavement is in very poor to failed condition. The vast majority of the pavement surface is severely cracked and disintegrated. Traffic operations are severely affected.

(Photographs of flexible pavements in very poor to failed condition)

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4. CONCRETE PAVEMENTS

Introduction

This condition survey procedure for concrete pavements addresses jointed (plain and reinforced) concrete pavements.

The format of these guidelines is intended to provide the user with enough information to conduct the survey objectively. A general description of the surface condition is provided for each 15-point increment between 0 and 100, and descriptive pictures are provided to supplement the text.

Typical Distresses in Concrete Pavements

There are several predominant distress types that are observable on concrete pavements. Each individual distress type is not measured in this procedure. However, it is important that the rating panel understand and distinguish between each of the distress types in order to better rate the overall pavement condition. The following definitions, taken from the *Distress Manual for the Long-Term Pavement Performance (LTPP) Studies*, are meant to introduce these distresses to each member of the rating team.

Blowups: Blowups result from a localized upward movement of the pavement surface at transverse joints or cracks, often accompanied by shattering of the concrete in that area.

Corner Breaks: Corner breaks occur at the corners of the slabs. They intersect the joints less than 1.8 m (6 ft) from the corner on each side. The corner break is generally a full-depth vertical break, as opposed to a corner spall, that typically has an angled failure plane that extends partial-depth into the slab.

D-Cracking: D-cracking is closely spaced, crescent-shaped, hairline cracking that occurs adjacent to joints, cracks, or free edges. D-cracking is caused by freeze-thaw expansion of certain types of coarse aggregates.

Faulting: A fault is a difference in elevation across a joint or crack.

Joint seal damage: Any deterioration of the joint sealant in transverse joints is included in this category, including extrusion, hardening, adhesive failure

(loss of bond), cohesive failure (splitting), or complete loss of the sealant. The presence of weed growth in the joint is also an indication of joint seal damage. If joints have not been sealed, that should be noted.

Lane/shoulder drop off: A lane/shoulder drop-off is a difference in elevation between the traffic lane and outside shoulder.

Lane/shoulder separation: A lane/shoulder separation is when the joint between the traffic lane and the shoulder has widened.

Longitudinal cracks: Longitudinal cracks are cracks that occur parallel to the pavement centerline.

Longitudinal joint spalls: Longitudinal joint spalls include the cracking, breaking, chipping, or fraying of slab edges within 50 mm (2 in) of the longitudinal (lane-to-lane) joint. Spalls are distinguishable from corner breaks by the angle at which they crack below the pavement surface.

Map cracking/scaling: Map cracking is a series of cracks that do not extend beneath the upper surface of the slab. Scaling is the deterioration of the slab surface to a depth of approximately 3 to 12 mm (1/8 to ½ in), resulting in the loss of surface mortar.

Patch deterioration: A patch is a portion of the original concrete slab that has been removed and replaced. When a patch is present, the pavement section is considered to have some deterioration. The patch is considered more severe when it is deteriorated, faulted, or settled.

Polished aggregate: Polished aggregate occurs when the surface mortar and texturing is worn away to expose coarse aggregate that is glossy in appearance and smooth to the touch.

Popouts: Popouts are small pieces of coarse aggregate that have broken loose from the surface. They generally range in diameter from 25 to 100 mm (1 to 4 in), and in depth from 12 to 50 mm (0.5 to 2 in).

Pumping: Pumping occurs when there is a seepage or ejection of water or fine-grained material from beneath the slab through joints and cracks.

Shattered slabs: A shattered slab has intersecting cracks, caused by overloading or inadequate support, that divide the pavement into four or more pieces.

Transverse cracks: Transverse cracks occur perpendicular to the pavement centerline.

Transverse joint spalls: Transverse joint spalls include the cracking, breaking, chipping, or fraying of the slab edges within 600 mm (2 ft) of the transverse joint.

Sketches of the various distresses found in jointed portland cement concrete (PCC) pavements are provided in Figures 5 and 6. The sketches in Figure 5 are copied from the SHRP *Distress Identification Manual for the Long-Term Pavement Performance Studies*. Photographs of the various severity levels of concrete pavement distresses are also included in this SHRP manual.

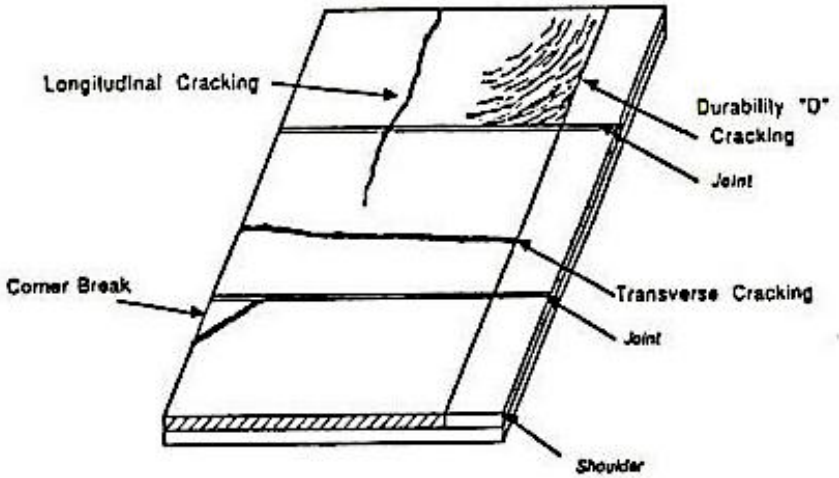
Jointed PCC Pavement Rating Guidelines

The following guidelines should be considered when conducting pavement condition ratings. They address the most common forms of distresses in jointed PCC pavements.

- If more than 20 percent of the PCC slabs exhibit medium-severity corner breaks, the overall pavement rating should not exceed 70.

- If more than 20 percent of the PCC slabs are divided into four or more pieces, the overall pavement rating should not exceed 65.

- If the average transverse joint faulting is 3 to 9 mm (1/8 to 3/8 in), the pavement rating should not exceed 80. If the average transverse joint faulting is 9 to 20 mm (3/8 to 3/4 in), the pavement rating should not exceed 60. The pavement rating should not exceed 40 if the average transverse joint faulting is greater than 20 mm (3/4 in).



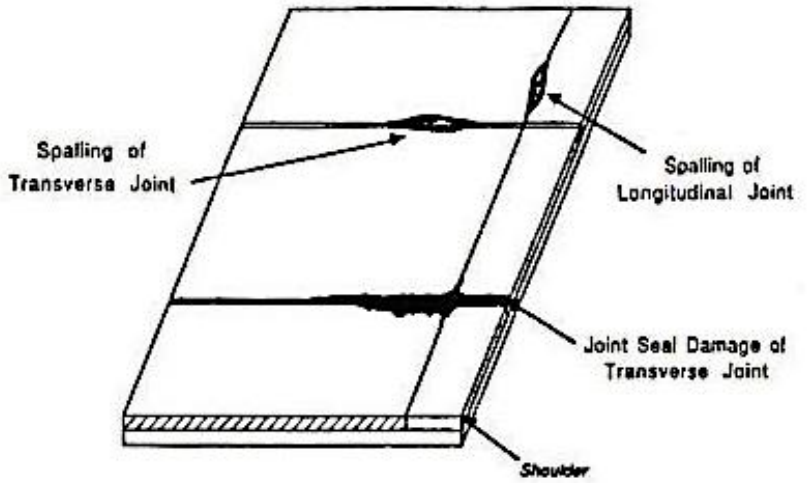


Figure 5. Sketches of Typical Distresses in Jointed PCC Pavements.

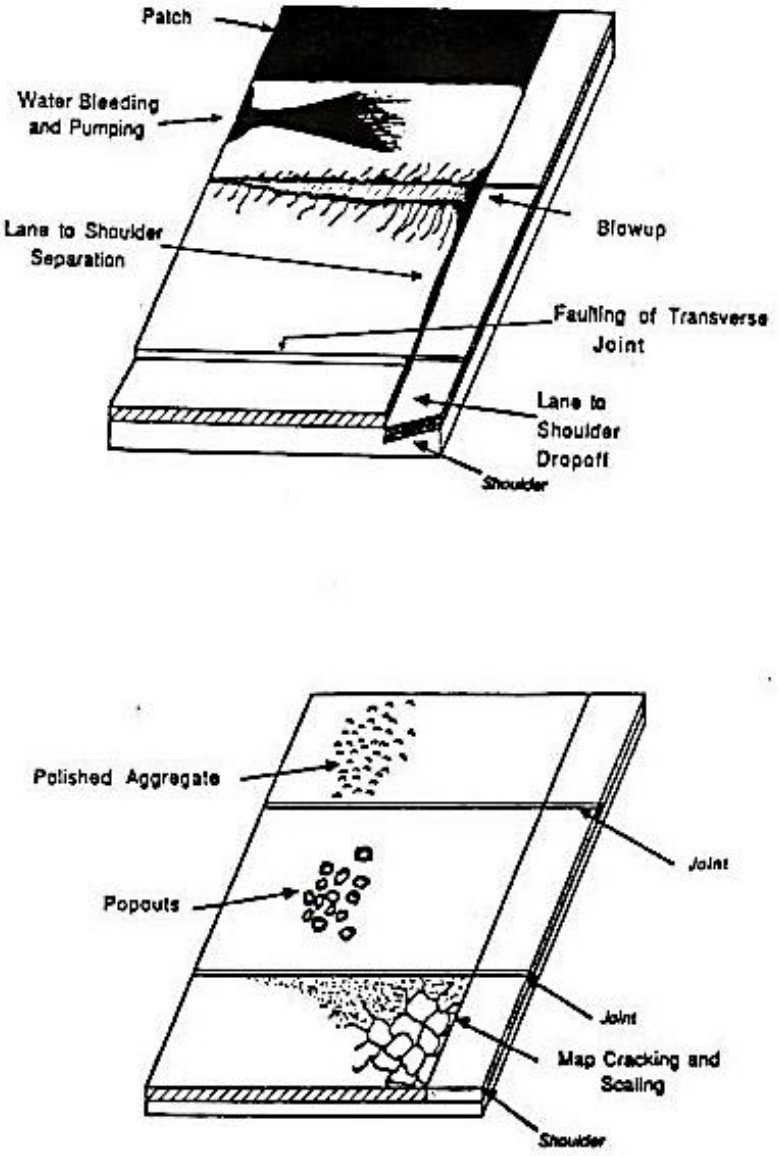


Figure 5. Sketches of Typical Distresses in Jointed PCC Pavements (continued).

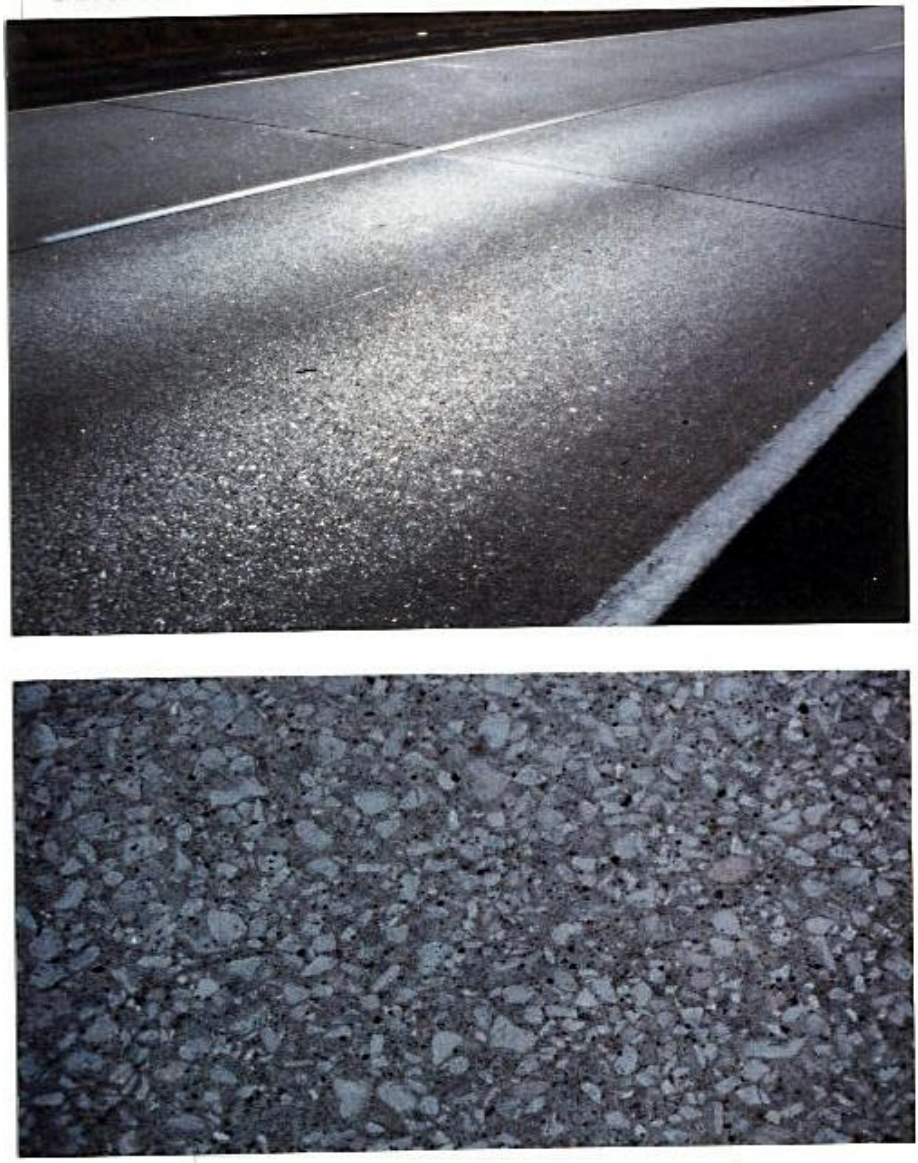


Figure 6. Photograph of a PCC surface with a polished aggregate condition.

- For PCC pavements that exhibit low-, medium-, or high-severity joint sealant damage, the pavement ratings should not exceed 98, 96, or 92, respectively.

- If longitudinal or transverse cracking exists, the following guidelines should be used.

Crack Severity	Percent Slabs Cracked	Maximum Pavement Rating
Low	10	95
	20	90
	50	80
Medium	10	90
	20	85
	50	70
High	10	80
	20	70
	50	55

- If more than 20 percent of the joints exhibit low- or medium-severity spalling, the pavement rating should not exceed 90. If high-severity joint spalling is present at over 20 percent of the joints, the pavement rating should not be greater than 75.

Rating = 100 to 86

The pavement surface is in excellent condition. There are no distresses present, with the possible exception of some minor hairline cracking and joint sealant deterioration.

(Photographs of jointed concrete pavements in excellent condition)

Rating = 85 to 71

The pavement surface is in very good condition. Pavements that fall into this category have some transverse cracking present, but most cracks are still less than 6 mm (0.25 in) wide. Up to 7 m (25 ft) of cracking per 90 square meters (1,000 sq ft) of pavement may be present, and faulting is rare. Isolated joint and crack spalling may be present.

(Photographs of jointed concrete pavements in very good condition)

Rating = 70 to 56

The pavement surface is in good condition. The same amount of cracking may be present as in the previous category, but there is more spalling and faulting present along the cracks and joints. In addition, crack widths are typically greater than 6 mm (0.25 in). Some corner cracks may begin to occur. Some discoloration of the pavement due to the presence of D-cracking may begin to be seen.

(Photographs of jointed concrete pavements in good condition)

Rating = 55 to 41

The pavement surface is in fair condition. Cracking, patching, and spalling are very common. Patching may be extensive, and the patches may be exhibiting fairly severe deterioration. Faulting is more noticeable in these sections, and secondary cracking may be occurring around other distressed areas. At this condition level, 15 to 23 m (50 to 75 ft) of cracking per 90 square meters (1,000 sq ft) of pavement may be present.

(Photographs of jointed concrete pavements in fair condition)

Rating = 40 to 26

At this level, pavements have deteriorated to a poor condition. A great deal of cracking and extensive patching are present. Secondary cracking (cracks that extend from the original crack) is common and foundation failures, such as faulting, are very evident. Broken slabs are rocking and showing some movement.

(Photographs of jointed concrete pavements in poor condition)

Rating = 25 to 0

Pavements within this category are severely deteriorated and in very poor to failed condition. Chunks of pavement are missing, and driving conditions are unpleasant. Extreme levels of cracking (50 percent or more cracked slabs) are present, with most cracks and joints exhibiting spalling or faulting. Areas where D-cracking has occurred are badly deteriorated. Traffic operations are severely affected.

(Photographs of jointed concrete pavements in very poor or failed condition)

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5. RATING FORMS

Overview

The rating forms that follow provide a medium for organizing, collecting, and storing pavement information for each section evaluated. The inventory data form may be filled out before conducting the condition survey if the routes being inspected are known. The inventory information includes section identification, street classification, traffic data, and pavement cross section data.

The condition rating form is used by the rating panel in the field. Information to be entered on this form includes the panel's average pavement condition rating, the pavement and railroad crossing rideability, the rut depth rating, and the polished aggregate rating. On gravel roads, only the surface condition rating is determined.

Illustration of the rating forms are provided in Figures 7 and 8. Full-sized ($8^1/_2$ in x 11 in) forms are provided in the *Rural Road Management Guide*.

The results of the condition survey may be input into a pavement management system to facilitate the selection and timing of appropriate maintenance and rehabilitation treatments for given funding levels. For more information on the use of condition information in pavement management systems, please refer to the *Rural Road Management Guide*.

INVENTORY DATA FORM

Inventory date_____
By_____

Section Identification
Section ID No._____
Road name_____ Length, m (ft)_____
From_____ To_____

Roadway Classification and Traffic Data
Functional classification of road _____
Average daily traffic _____
Percent heavy trucks_____
Roadway Inventory Data
Traveled surface width, m (ft)_____ Shoulder width, m (ft)_____

ROW width, m (ft)_____ Number of lanes_____
Surface type (circle one): AC, PCC, Blotter, or Gravel
Shoulder type (circle one): AC, PCC, Blotter, Gravel, Turf, None, or Other
Curb and gutter (circle one): yes/no
Comments_____
_____

Cross Section Information

Layer	Material	Thickness, mm (in)	Construction Date	Other Information

Figure 7. Illustration of Sample Inventory Data Form.

CONDITION RATING FORM

Section Identification

Section ID No._____ Roadway name_____

From_____ To_____Length, m (ft)_____

Roadway surface type (circle one): AC, PCC, Blotter, or Gravel

Condition Rating

Date	Members of rating team	Average surface condition rating (0 to 100)	Surface rideability rating (0 to 5)	Railroad crossing rideability rating (0 to 5)	AC rut depth rating (0 to 4)	Polished aggregate rating (0 to 3)	Comments

Figure 8. Illustration of Sample Condition Rating Form.

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6. REFERENCES

Eaton, R.A. and R.E. Beaucham, December 1989, *Unsurfaced Road Maintenance Management*, United States Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Transportation Information Center, University of Wisconsin–Madison, May 1989, *Gravel – PASER Manual, Pavement Surface Evaluation and Rating*, Madison, WI.

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