

ENDORSEMENT

This Guide was developed in cooperation with the South Dakota Municipal League and the South Dakota Chapter of the American Public Works Association who encourage its use in South Dakota towns and cities.

**South Dakota  
Pavement Condition  
Survey Guide for  
City Streets**

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# 1. INTRODUCTION

## Objective

This Guide has been developed to help provide a consistent means of assessing pavement conditions, both within a city and statewide. The pavement evaluation methodology described in this Guide will provide cities and towns with a more uniform and consistent means of defining pavement condition. By adopting a standard approach to rating the observable condition of a pavement similar to the one described in this Guide, cities and towns can uniformly and objectively compare pavement conditions. This Guide also presents standard guidance for determining a pavement's necessary level of repair.

When used in conjunction with the *Pavement Design, Maintenance, and Rehabilitation Guide for City Streets* and the *Pavement Management Guide for City Streets*, cities and towns will have a powerful and comprehensive tool to assist them in their decision-making process. This series of guides provides cities and towns with expertise throughout the entire pavement planning and design process.

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

## Approach

Each member of a rating panel rates the overall condition of a pavement surface on a scale from 0 to 100. The rating is a composite value that reflects the combination of distresses that are visible on the surface (subjectively identified by severity and extent) as well as 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 and 2. More specific guidelines for repair are provided in the *Pavement Design, Maintenance, and Rehabilitation Guide for City Streets*.

**Table 1. Flexible Pavement Rating and Evaluation Scheme.**

Rating	Surface Condition Description
100 - 91	Pavement surface in excellent condition, very smooth and generally free of any distress. At lower end rating category, minimal hairline cracks or depressions may be visible that do not have an adverse effect on ride. No other distresses are noted.
90 - 81	Pavement surface in excellent to very good condition; may be partially oxidized or weathered. Cracking may be present, generally at a low to medium severity level. Reflection cracking may be present, but cracks are tight.
80 - 71	Pavement surface still in very good condition, but surface deterioration is more prevalent. Transverse and longitudinal cracks are visible, crack widths are generally wider. Block cracking may be appearing, but cracks have not deteriorated greatly. Some minor spalling or faulting may be present along the cracks. Additionally, a few potholes may be present, or some minor rutting may be noticeable in the outer wheelpaths. The surface may also be weathered.
70 - 61	Pavement is generally classified in good condition. Surface is noticeably oxidized and raveling may be present. Transverse and longitudinal crack widths are between 1/4 and 1/2 in, or have deteriorated badly. Depressions in cracked areas or around utility repairs may be noticeable. Alligator cracking may begin 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.
60 - 51	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 1/2-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 100 lin ft of cracking per 1000 sq ft of pavement is present.
50 - 41	The pavement is showing signs of moisture and load damage. The presence of alligator cracking is more common, as is the amount of patching. Rutting is present in both wheelpaths, which are badly deteriorated. Crack widths are generally wider than 1/2-in, and deterioration along the cracks is prevalent.
40 - 31	The pavement is in poor condition. Alligator cracking is severe, with many pieces missing and potholes occurring. Rutting is common and the pavement is rough. The pavement edge may be deteriorated and over 200 lin ft of cracking per 1000 sq ft of pavement is present.
30 - 21	The pavement surface is approaching a condition in which traffic operation is difficult. Pieces of surface have fallen out in many areas and the majority of the surface exhibits alligator cracking. Rutting may now be over 3/4 in deep. The ride is very rough.
20 - 0	The pavement is in very poor to failed condition. The entire pavement surface is cracked and disintegrated. Traffic operations are severely affected.

**Table 1. Flexible Pavement Rating and Evaluation Scheme (cont.).**

Rating	Typical Rehabilitation	Level of Rehabilitation
100 - 91	None	None
90 - 81	Crack sealing, surface treatments	Routine/preventative maintenance
80 - 71	Pothole repairs, crack sealing, surface treatments.	
70 - 61	Chip seals, non-structural overlays	Minor rehabilitation
60 - 51		
50 - 41	Structural overlays, milling with overlays, partial-depth reconstruction	Major rehabilitation
40 - 31		
30 - 21	Reconstruction	Reconstruction
20 - 0		

**Table 2. Jointed Concrete Pavements Rating and Evaluation Scheme.**

Rating	Surface Condition Description
100 - 91	Pavement surface in excellent condition, typically a new pavement. There are no distresses present, with the possible exception of some minor hairline cracks.
90 - 81	Pavement surface in very good condition. Some slight surface distresses present, primarily spalling at some transverse joints. There are few if any cracks present; all cracks are low severity.
80 - 71	Pavement surface still in very good condition. Some transverse cracking present, but most cracks are less than 1/4 in wide. Up to 25 lin ft of cracking per 1000 sq ft of pavement may be present, and faulting is rare. Isolated spalling may be present.
70 - 61	Pavement is in good condition. The same amount of cracking may be present as in the preceding category, but there is more spalling and faulting present along the cracks and joints. In addition, crack widths are typically greater than 1/4-in wide. Some corner breaks may be present. If D-cracking is present, some discoloration of the pavement is starting to be visible.
60 - 51	Pavement continues to deteriorate and more cracking is present. 50 to 75 lin ft of cracking per 1000 sq ft of pavement may be present. Patched areas are becoming more common and the pavement is usually well weathered, with scaling and spalling possibly present. In addition, there is typically more faulting present. If D-cracking is present, it is becoming more noticeable.
50 - 41	Pavements are now in the fair category. 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 distresses areas.
40 - 31	At this level, pavements have deteriorated to a poor condition. A great deal of cracking and extensive patching are present. Both initial and secondary cracking is common and foundation failures, such as faulting, are very evident. Broken slabs are rocking and showing some movement.
30 - 21	Pavements within this category are severely deteriorated. Chunks of pavement are missing and driving conditions are unpleasant. Extreme levels of cracking are present, with most cracks and joints exhibiting spalling and/or faulting. Areas where D-cracking has occurred are deteriorated badly.
20 - 0	Approximately 50% of the slabs are cracked and the pavement is in very poor to failed condition. Traffic operations are severely affected.

**Table 2. Jointed Concrete Pavements Rating and Evaluation Scheme (cont).**

Rating	Typical Rehabilitation	Level of Rehabilitation
100 - 91	None	None
90 - 81	Crack sealing, joint resealing, partial depth spall repair	Routine/preventive maintenance
80 - 71		
70 - 61	Full-depth repairs, slab removal and replacement, grinding	Minor rehabilitation
60 - 51		
50 - 41	Full-depth repairs, slab removal and replacement, grinding, AC overlays	Major Rehabilitation
40 - 31		
30 - 21	Reconstruction	Reconstruction
20 - 0		

In addition to the overall pavement condition and rideability ratings, 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.

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. While differences of opinion amongst 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 (flexible pavements only) and identify whether or not polished aggregate conditions exist.

The following general approach should be used to attain uniformity in ratings.

#### Step 1: Locate section breaks.

Identify a section of pavement that is fairly consistent in terms of pavement surface type, traffic, and condition. In cities, a pavement section is typically defined as a block or, in the case of longer than average blocks, as a section approximately 500 ft long. Once identified, the general section information should be entered on the evaluation form. A sample form is shown on page 46.

#### Step 2: 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 uniform, typically the first 100 ft of each section is rated.

#### Step 3: 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 which indicates the level of riding comfort noticed by the travelling public. A simple rating ranging from 0 to 5 is recommended, as shown in Table 3.

**Table 3. Rideability Ratings.**

<b>Ride Rating</b>	<b>Description</b>
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 percent of the pavement section gives a rough ride.
3	Approximately 50 percent of the pavement section is rough. In a concrete section, almost every joint produces a pronounced bump.
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 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 their vehicle to conduct the survey. Each panel member should determine a rating independently.

Step 5: Compare 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 re-evaluate 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 flexible 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 5 representative locations. A simple rating from 0 to 4 is recommended, as outlined in Table 4.

Step 8: Identify whether or not aggregate polishing exists on the pavement surface.

Identify whether or not polished aggregate (flexible and rigid pavements) exists on the pavement surface. Use the simple rating form presented in Table 5.

**Table 4. Flexible Pavement Rutting Ratings.**

<b>Rut-Depth Rating</b>	<b>Description</b>
4	Average wheel-path rutting is less than 1/4 in.
3	Average wheel path rutting is at least 1/4 in, but less than 1/2 in.
2	Average wheel-path rutting is at least 1/2 in, but less than 3/4 in.
1	Average wheel-path rutting is greater than 3/4 in.
0	Wheel-path rutting was not evaluated.

**Table 5. Ratings for Polished-Aggregate Conditions.**

<b>Polished-Aggregate Rating</b>	<b>Description</b>
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.

### **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 right 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.

1. Pavement thickness and traffic levels should not influence the condition rating.
2. The presence of aggregates susceptible to D-cracking should not, in itself, affect the condition rating. However, if D-cracking has developed in the pavement, that should be taken into account during the rating process.
3. 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.
4. Judgement must be used in determining whether temporary pavement maintenance has influenced the rating. Recently placed patches which 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.
5. 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 6.
6. Construction defects, such as high manhole covers, are not considered in the pavement rating.

**Table 6. Railroad Crossing Ride Rating.**

<b>Ride Rating</b>	<b>Description</b>
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 10 mph, but uncomfortable at posted speeds.
2	Vehicle passengers are somewhat uncomfortable at speeds less than 10 mph.
1	Vehicle passengers are severely jolted at speeds less than 10 mph.
0	Railroad crossing rideability was not evaluated.

### **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 Table 7. The correlation between the numerical values and the descriptive condition rating is very similar to that used by the U.S. Army and the American Public Works Association (APWA) in the Pavement Condition Index (PCI) survey procedures.

**Table 7. Relationship Between Numerical Rating and Subjective Evaluation.**

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

## **2. 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 streets 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) streets. Therefore, the ratings for chip-sealed (blotter) streets will generally be less than those for asphalt concrete streets.

These guidelines are intended to provide the user with enough information to conduct the survey objectively without providing too much information to overwhelm the survey team. A general description of the surface condition is provided for each 10-point increment between 0 and 100, and descriptive pictures are provided to supplement the text. The descriptions are based on an approach which 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*.

### **Typical Distresses in Flexible Pavements**

Several distresses are common to flexible pavements. While individual distress type, quantity, or 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.

Block Cracking	Block cracking appears as rectangular pieces of asphalt surface ranging in size from approximately 1 sq ft to 100 sq ft. When present, it is usually visible over the entire surface of the pavement.
Edge Cracking	Edge cracking appears as crescent-shaped cracks, or fairly continuous cracks, parallel to and usually within 1 to 2 ft of the outer edge of the pavement. Edge cracking is more frequent in pavements without paved shoulders.
Longitudinal	Longitudinal cracks are cracks which occur relatively parallel to the pavement centerline.
Reflection	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.
Transverse	Transverse cracks occur relatively perpendicular to the pavement centerline.
Patching	Patches are portions of the pavement surface that have been removed and replaced, including utility trench patches. In general, the condition of the patch is considered in determining the condition of the section.
Potholes	Potholes are holes of various sizes in the pavement surface.
Rutting	Ruts are longitudinal surface depressions which occur in the wheel paths.
Shoving	Shoving appears as a longitudinal displacement of a localized area of the pavement surface caused by traffic pushing against the pavement.

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

Sketches of the various distresses found in flexible pavements are provided in Figure 1. These sketches are copied from SHRP's *Distress Identification Manual for the Long-Term Pavement Performance Studies*.

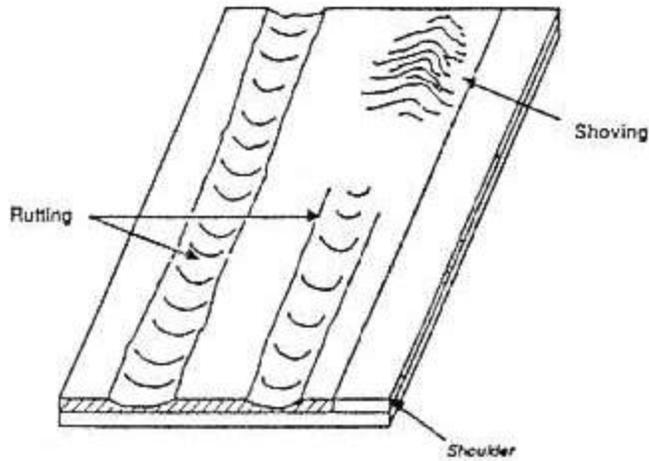
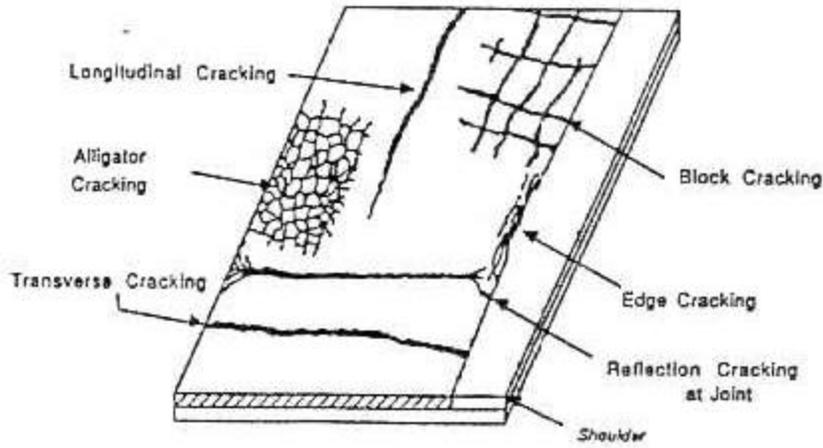


Figure 1. Sketches of Typical Distresses on Flexible Pavements.

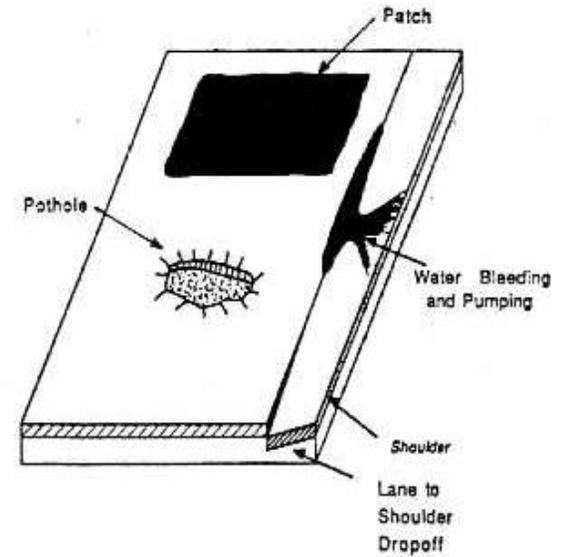
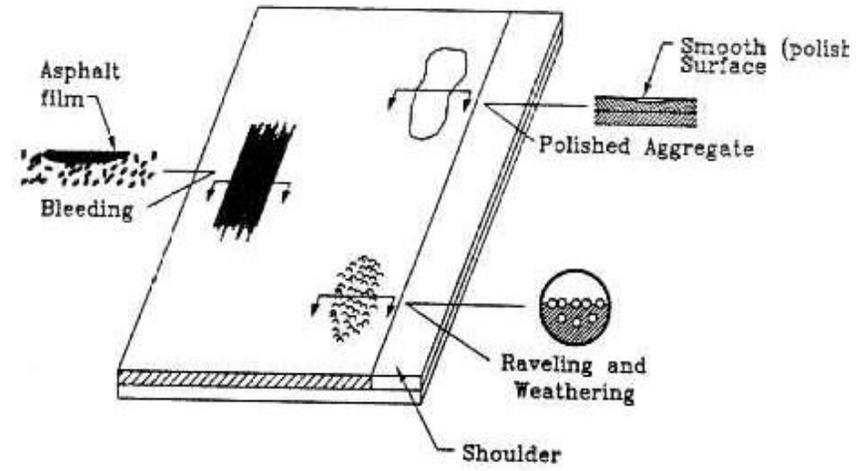


Figure 1. Sketches of Typical Distresses on Flexible Pavements (continued).

**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.

1. If more than 10 percent of the pavement area exhibits low-severity fatigue cracking, the overall pavement rating should not exceed 70.
2. The overall pavement rating should not exceed 55 if more than 10 percent of the pavement area exhibits moderate-severity fatigue cracking.
3. If minor rutting (0.25 to 0.50 in) is evident throughout the wheelpaths, the overall pavement rating should not exceed 75.
4. If rutting in excess of 0.5 in is present throughout the wheelpaths, the pavement rating should not exceed 60.
5. If low-severity block cracking exists over more than 20 percent of the total pavement area, the pavement rating should not exceed 90.
6. 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.

**Rating = 100 - 91**

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, minimal hairline cracks or depressions may be visible that do not have an adverse effect on ride. No other distresses are noted.

**Rating = 90 - 81**

The pavement surface is in excellent to very good condition, but may be partially oxidized or weathered. Cracking may be present, but is generally at a low to medium severity level. Reflection cracking may be present, but cracks are generally tight. No faulting is present along the cracks.



**Rating = 80 - 71**

The pavement surface is still in very good condition, but surface deterioration is more prevalent. Transverse and longitudinal cracks are visible and crack widths are generally wider. 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 begin to be present. Minor rutting may be noticeable in the outer wheelpaths. The surface may also be weathered.

**Rating = 70 - 61**

The pavement is generally in good condition. The surface is noticeably oxidized and raveling may be present. Transverse and longitudinal crack widths are between 1/4 and 1/2 in, or have deteriorated badly. Depressions in cracked areas or around utility repairs may be noticeable. Alligator cracking may also begin being noticed 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.



**Rating = 60 - 51**

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 1/2-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 100 linear ft of cracking per 1000 sq ft of pavement is present.

**Rating = 50 - 41**

The pavement is showing signs of moisture and load damage. The presence of alligator cracking is more common, as is the amount of patching present. Rutting is present in both wheelpaths, which are badly deteriorated. Crack widths are generally greater than 1/2 in, and deterioration along the cracks is prevalent.



**Rating = 40 - 31**

The pavement is in poor condition. Alligator cracking is severe, with many pieces missing and potholes occurring. Rutting is common and the pavement is rough. The pavement edge may be deteriorated and over 200 linear ft of cracking per 1000 sq ft of pavement is present.

**Rating = 30 - 21**

The pavement surface is approaching a condition in which traffic operation is difficult. Pieces of surface are missing in many areas and the majority of the surface exhibits alligator cracking. Rutting may now be over 3/4-in deep. The ride is very rough.



**Rating = 20 - 0**

The pavement is in very poor to failed condition. The entire pavement surface is cracked and disintegrated. Traffic operation is severely affected.





### 3. CONCRETE PAVEMENTS

#### Introduction

This condition survey procedure for concrete streets 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, without providing too much information to overwhelm the survey team. A general description of the surface condition is provided for each 10-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 which 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.

Corner Breaks	Corner breaks occur at the corners of the slabs. They intersect the joints less than 6 ft from the corner on each side. The corner break is generally a full-depth vertical break, as opposed to a corner spall, which typically has an angled failure plane that extends partial-depth into the slab.
D-Cracking	D-cracking is closely spaced, crescent-shaped, hairline cracking which occurs adjacent to joints, cracks, or free edges. D-cracking is caused by freeze-thaw expansion of certain types of coarse aggregates.
Longitudinal Cracks	Longitudinal cracks are cracks that occur parallel to the pavement centerline.

Transverse Cracks	Transverse cracks occur perpendicular to the pavement centerline.
Shattered Slabs	A shattered slab has intersecting cracks, caused by overloading or inadequate support, which divide the pavement into four or more pieces.
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.
Longitudinal Joint Spalls	Longitudinal joint spalls include the cracking, breaking, chipping, or fraying of slab edges within 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.
Transverse Joint Spalls	Transverse joint spalls include the cracking, breaking, chipping, or fraying of the slab edges within 2 ft of the transverse joint.
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 1/8 to 1/2 in, resulting in the loss of surface mortar.
Polished Aggregate	Polished aggregate occurs when the surface mortar and texturing is worn away to expose coarse aggregate which is glossy in appearance and smooth to the touch.
Popouts	Popouts are small pieces of coarse aggregate which have broken loose from the surface. They generally range in diameter from 1 to 4 in, and in depth from 1/2 to 2 in.

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.
Faulting	A fault is a difference in elevation across a joint or crack.
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.
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.
Pumping	Pumping occurs when there is a seepage or ejection of water or fine-grained material from beneath the slab through joints and cracks.

Sketches of the various distresses found in jointed portland cement concrete (PCC) pavements are provided in Figure 2. These sketches are copied from the SHRP *Distress Identification Manual for the Long-Term Pavement Performance Studies*.

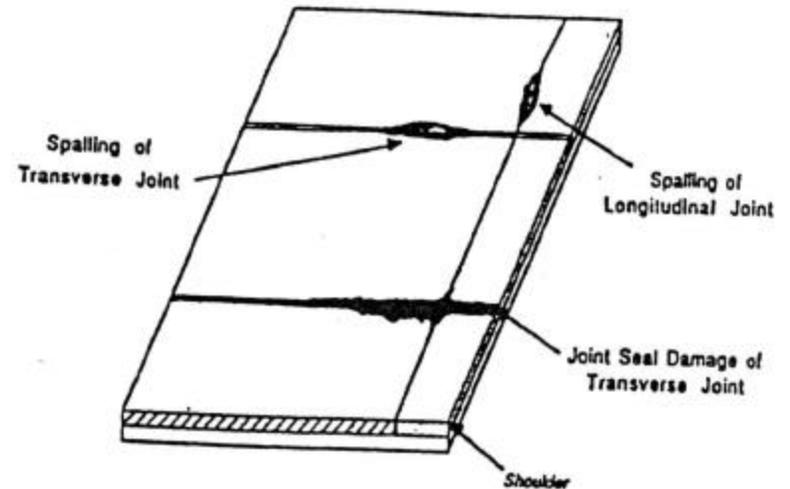
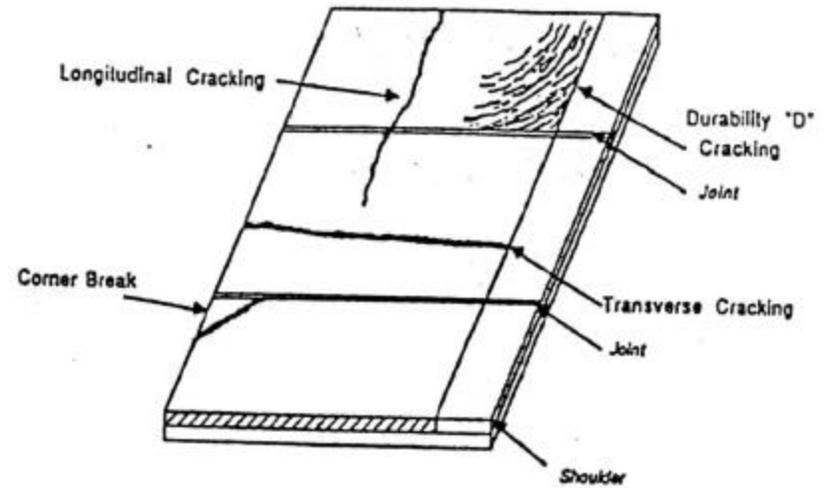


Figure 2. Sketches of Typical Distresses in Jointed PCC Pavements.

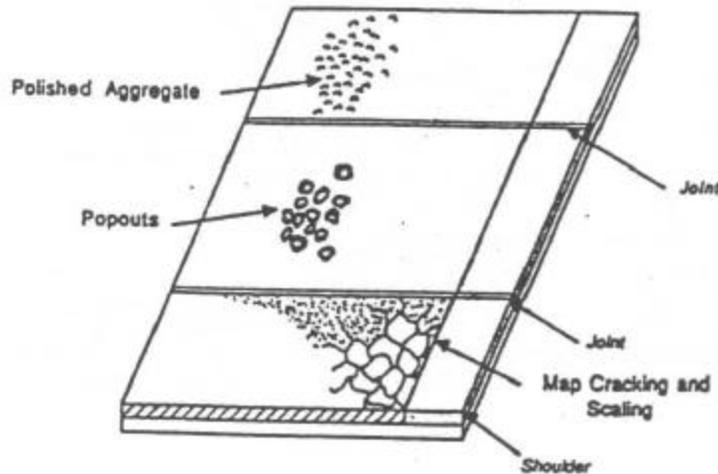
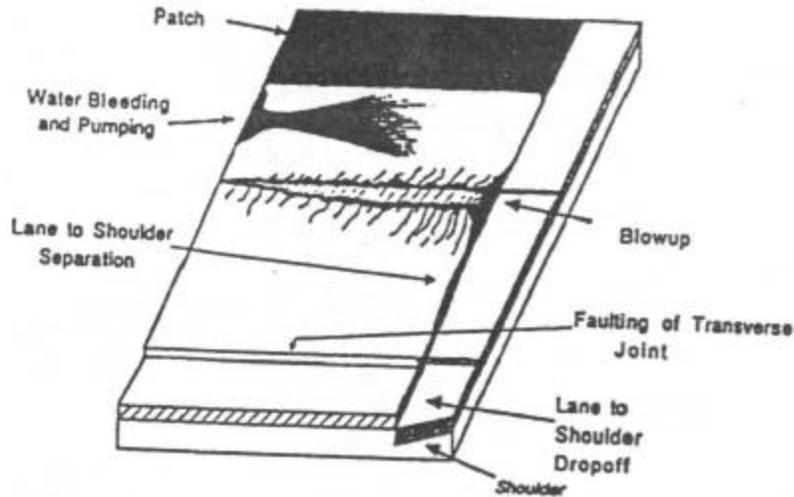


Figure 2. Sketches of Typical Distresses in Jointed PCC Pavements (continued).

**Jointed PCC Pavement Rating Guidelines**

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

1. If more than 20 percent of the PCC slabs exhibit medium-severity corner breaks, the overall pavement rating should not exceed 70.
2. If more than 20 percent of the PCC slabs are divided into four or more pieces, the overall pavement rating should not exceed 65.
3. If the average transverse joint faulting is 1/8 to 3/8 in, the pavement rating should not exceed 80. If the average transverse joint faulting is 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 3/4 in.
4. For PCC pavements which exhibit low, medium, or high severity joint sealant damage, the pavement ratings should not exceed 98, 96, or 92, respectively.
5. If longitudinal or transverse cracking exists, the following guidelines should be used.

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

6. 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 - 91**

The pavement surface is in excellent condition and may be a new pavement. There are no distresses present, with the possible exception of some minor, hairline cracking.

**Rating = 90 - 81**

The pavement surface is in excellent to very good condition. There are some slight surface failures present, primarily spalling at some transverse joints. There are few cracks, which are typically less than 1/4-in wide. All cracks are of minor severity, showing little deterioration.



**Rating = 80 - 71**

Pavements which fall into this category have some transverse cracking present, but most cracks are still less than 1/4-in wide. Up to 25 lineal ft of cracking per 1000 sq ft of pavement may be present, and faulting is rare. Isolated spalling may be present.

**Rating = 70 - 61**

Pavements are 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 1/4-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.



**Rating = 60 - 51**

As the pavements continue to deteriorate, more cracking becomes present. At this level, 50 to 75 linear ft of cracking per 1000 sq ft of pavement may be present. Patched areas are becoming more common and the pavement is usually well weathered, with scaling and spalling present. In addition, there is typically more faulting present. If D-cracking is present, it is becoming more noticeable.

**Rating = 50 - 41**

Pavements are in overall 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.



**Rating = 40 - 31**

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.

**Rating = 30 - 21**

Pavements within this category are severely deteriorated. Chunks of pavement are missing and driving conditions are unpleasant. Extreme levels of cracking are present, with most cracks and joints exhibiting spalling and/or faulting. Areas where D-cracking has occurred are deteriorated badly.



**Rating = 20 - 0**

Approximately 50 percent of the slabs are cracked and the pavement is in very poor to failed condition. Traffic operations are severely affected.



## 4. GRAVEL PAVEMENTS

The condition survey procedure for gravel pavements is based on the 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.

The rating procedure is subjective. In the procedure, the overall condition of the pavement is rated from 0 to 100 (100 is new condition, and 0 is completely failed) based on the apparent condition or presence of eight different items. These eight items are as follows:

- Roadside Drainage · Gravel Layer
- Pavement Crown · Corrugations (Washboarding)
- Potholes · Ruts
- Dust · Loose Aggregate

In general, the ratings that are developed should reflect the condition and the type of repairs that are required. A general guideline for relating pavement condition and repair requirements to the pavement's condition rating is as follows:

**Rating = 81 to 100:** Newly constructed road, excellent crown and drainage.

**Rating = 61 to 80:** Recently regraded road, good crown and drainage.

**Rating = 41 to 60:** Road needs routine regrading plus minor ditch maintenance.

**Rating = 21 to 40:** Road needs additional aggregate plus drainage maintenance.

**Rating = 0 to 20:** Travel is difficult, and the road needs complete rebuilding.

A more detailed procedure for determining the condition rating of a gravel pavement is provided in Table 8. This table is taken from the *Gravel PASER Manual*. Photographs of some of the various gravel pavement distresses and conditions that are identified in Table 8 are provided in Appendix B of the *Pavement Design, Maintenance, and Rehabilitation Guide for City Streets*.

**Table 8. Gravel Pavement Rating and Evaluation Scheme.**

Surface Rating	Visible Pavement Distresses
81 to 100 (Excellent)	No distress. Dust Controlled. Excellent surface condition and ride.
61 to 80 (Good)	Dust under dry conditions. Moderate loose aggregate. Slight washboarding.
41 to 60 (Fair)	Good crown (3 to 6 in). Ditches present on more than 50 percent of the roadway. Gravel layer is adequate, but additional aggregate is necessary in isolated areas. Some culvert cleaning is necessary. Moderate washboarding (1 to 2 in deep) over 10 to 25 percent of the area. Moderate dust, partial obstruction of vision. None or slight rutting (1 to 2 in). Occasional small pothole (< 2 in deep). Some loose aggregate (2 in deep).
21 to 40 (Poor)	Little or no roadway crown (< 3 in). Adequate ditches on less than 50 percent of the roadway. Some areas (25 percent) with little or no aggregate. Culverts partially full of debris. Moderate to severe washboarding (> 3 in deep) over 25 percent of area. Moderate rutting (1 to 3 in) over 10 to 25 percent of area. Moderate potholes (2 to 4 in deep) over 10 to 25 percent of area. Severe loose aggregate (> 4 in).
0 to 20 (Failed)	No roadway crown or road is bowl-shaped with extensive ponding. Little, if any, ditching. Filled or damaged culverts. Severe rutting (> 3 in deep) over at least 25 percent of the area. Severe potholes (over 4 in deep) over at least 25 percent of the area. Many areas (over 25 percent) with little or no aggregate.







