



Distressed Pavements Identification

Three (3) Continuing Education Hours
Course #CV1103

Approved Continuing Education for Licensed Professional Engineers

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Course Description:

The Distressed Pavements Identification course satisfies three (3) hours of professional development.

The course is designed as a distance learning course that enables the practicing professional engineer to identify and measure distressed pavements.

Objectives:

The primary objective of this course is enable the student to understand, evaluate, and determine which type of pavement distress is taking place on the roadway, the severity level, and the standard means to measure and document the distress.

Grading:

Students must achieve a minimum score of 70% on the online quiz to pass this course. The quiz may be taken as many times as necessary to successful pass and complete the course.

A copy of the quiz questions are attached to last pages of this document.

1

DISTRESSES FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES / 1

A. Cracking / 2

1. Fatigue Cracking
2. Block Cracking
3. Edge Cracking
4. Longitudinal Cracking
5. Reflection Cracking at Joints
6. Transverse Cracking

B. Patching and Potholes / 13

7. Patch Deterioration
8. Potholes

C. Surface Deformation / 18

9. Rutting
10. Shoving

CI. Surface Defects / 21

11. Bleeding
12. Polished Aggregate
13. Raveling

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14. Lane-to-Shoulder Dropoff
15. Water Bleeding and Pumping

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DISTRESSES FOR PAVEMENTS WITH JOINTED PORTLAND CEMENT CONCRETE SURFACES / 28

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1. Corner Breaks
2. Durability Cracking (“D” Cracking)
3. Longitudinal Cracking
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5. Joint Seal Damage
- 5a. Transverse Joint Seal Damage
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6. Spalling of Longitudinal Joints
7. Spalling of Transverse Joints

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8. Map Cracking and Scaling
- 8a. Map Cracking
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CI. Miscellaneous Distresses / 44

11. Blowups
12. Faulting of Transverse Joints and Cracks
13. Lane-to-Shoulder Dropoff
14. Lane-to-Shoulder Separation
15. Patch/Patch Deterioration
16. Water Bleeding and Pumping

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 - 4a. Map Cracking
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5. Polished Aggregate
6. Popouts

C. Miscellaneous Distresses / 62

7. Blowups
8. Transverse Construction Joint Deterioration
9. Lane-to-Shoulder Dropoff
10. Lane-to-Shoulder Separation
11. Patch/Patch Deterioration
12. Punchouts
13. Spalling of Longitudinal Joints
14. Water Bleeding and Pumping
15. Longitudinal Joint Seal Damage

This section covers asphalt concrete-surfaced pavements (ACP), including ACP overlays on either asphalt concrete (AC) or portland cement concrete (PCC) pavements. Each of the distresses has been grouped into one of the following categories:

- A.** Cracking
- B.** Patching and Potholes
- C.** Surface Deformation
- D.** Surface Defects
- E.** Miscellaneous Distresses

Table 1 summarizes the various types of distress and unit of measurement. Some distresses also have defined severity levels.

TABLE 1. Asphalt Concrete-Surfaced Pavement Distress Types		
DISTRESS TYPE	UNIT OF MEASURE	DEFINED SEVERITY LEVELS?
A. Cracking / page 2		
1. Fatigue Cracking	Square Meters	Yes
2. Block Cracking	Square Meters	Yes
3. Edge Cracking	Meters	Yes
4a. Wheel Path Longitudinal Cracking 4b. Non-Wheel Path Longitudinal Cracking	Meters	Yes
5. Reflection Cracking at Joints		
Transverse Reflection Cracking	Not Measured	N/A
Longitudinal Reflection Cracking	Not Measured	N/A
6. Transverse Cracking	Number, Meters	Yes
B. Patching and Potholes / page 13		
7. Patch/Patch Deterioration	Number, Square Meters	Yes
8. Potholes	Number, Square Meters	Yes
C. Surface Deformation / page 18		
9. Rutting	Millimeters	No
10. Shoving	Number, Square Meters	No
D. Surface Defects / page 21		
11. Bleeding	Square Meters	No
12. Polished Aggregate	Square Meters	No
13. Raveling	Square Meters	No
E. Miscellaneous Distresses / page 25		
14. Lane-to-Shoulder Dropoff	Not Measured	N/A
15. Water Bleeding and Pumping	Number, Meters	No



DISTRESSES FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES

This section includes the following distresses:

1. Fatigue Cracking
2. Block Cracking
3. Edge Cracking
- 4a. Longitudinal Cracking—Wheel Path
- 4b. Longitudinal Cracking—Non-Wheel Path
5. Reflection Cracking at Joints
6. Transverse Cracking

Measurement of crack width is illustrated in Figure 1. Figure 2 depicts the effect on severity level of a crack, in this case block cracking, due to associated random cracking.



Cracking

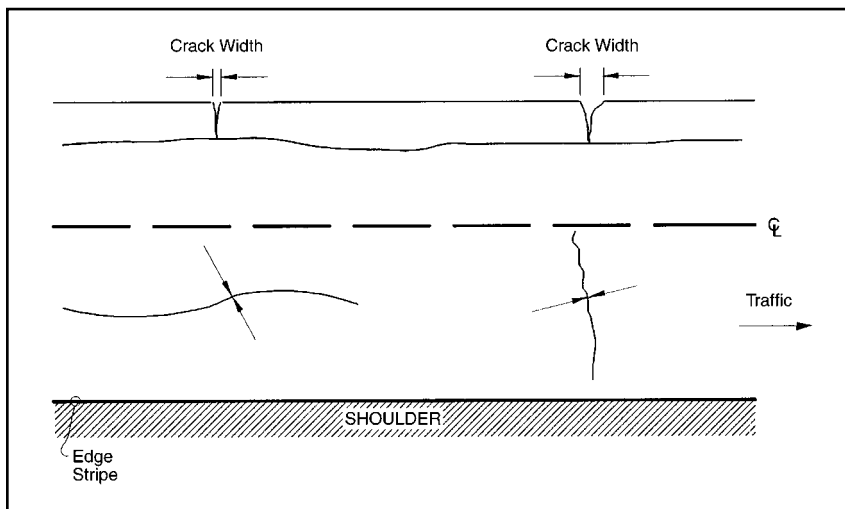


FIGURE 1
Measuring Crack Width in Asphalt Concrete-Surfaced Pavements

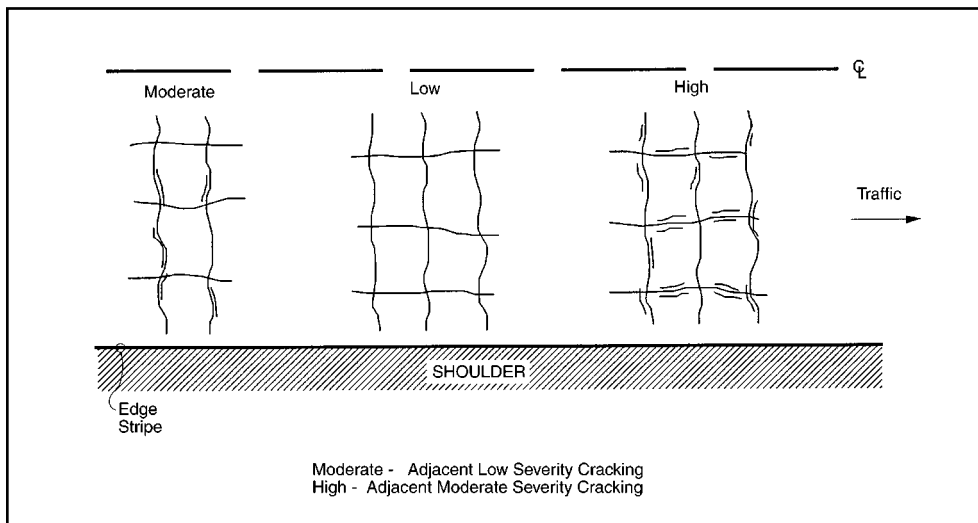


FIGURE 2
Effect on Severity Level of Block Cracking due to Associated Random Cracking

1

FATIGUE CRACKING

Description

Occurs in areas subjected to repeated traffic loadings (wheel paths). Can be a series of interconnected cracks in early stages of development. Develops into many-sided, sharp-angled pieces, usually less than 0.3 meters (m) on the longest side, characteristically with a chicken wire/alligator pattern, in later stages.

Must have a quantifiable area.

Severity Levels

LOW

An area of cracks with no or only a few connecting cracks; cracks are not spalled or sealed; pumping is not evident.

MODERATE

An area of interconnected cracks forming a complete pattern; cracks may be slightly spalled; cracks may be sealed; pumping is not evident.

HIGH

An area of moderately or severely spalled interconnected cracks forming a complete pattern; pieces may move when subjected to traffic; cracks may be sealed; pumping may be evident.

How to Measure

Record square meters of affected area at each severity level. If different severity levels existing within an area cannot be distinguished, rate the entire area at the highest severity present.

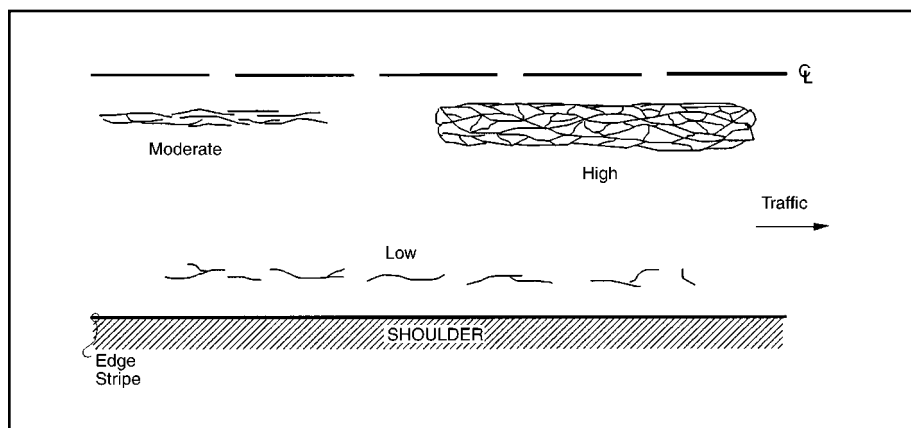


FIGURE 3
Distress Type ACP 1—Fatigue Cracking



FIGURE 4
Distress Type ACP 1—Chicken Wire/Alligator
Pattern Cracking Typical in Fatigue Cracking



FIGURE 5
Distress Type ACP 1—Low Severity Fatigue Cracking



FIGURE 6
Distress Type ACP 1—Moderate
Severity Fatigue Cracking



FIGURE 7
Distress Type ACP 1—High
Severity Fatigue Cracking with
Spalled Interconnected Cracks

Cracking

2

BLOCK CRACKING

Description

A pattern of cracks that divides the pavement into approximately rectangular pieces. Rectangular blocks range in size from approximately 0.1 m² to 10 m².

Severity Levels

LOW

Cracks with a mean width ≤ 6 millimeters (mm); or sealed cracks with sealant material in good condition and with a width that cannot be determined.

MODERATE

Cracks with a mean width > 6 mm and ≤ 19 mm; or any crack with a mean width ≤ 19 mm and adjacent low severity random cracking.

HIGH

Cracks with a mean width > 19 mm; or any crack with a mean width ≤ 19 mm and adjacent moderate to high severity random cracking.

How to Measure

Record square meters of affected area at each severity level. If fatigue cracking exists within the block cracking area, the area of block cracking is reduced by the area of fatigue cracking.

Note: An occurrence should be at least 15 m long before rating as block cracking.

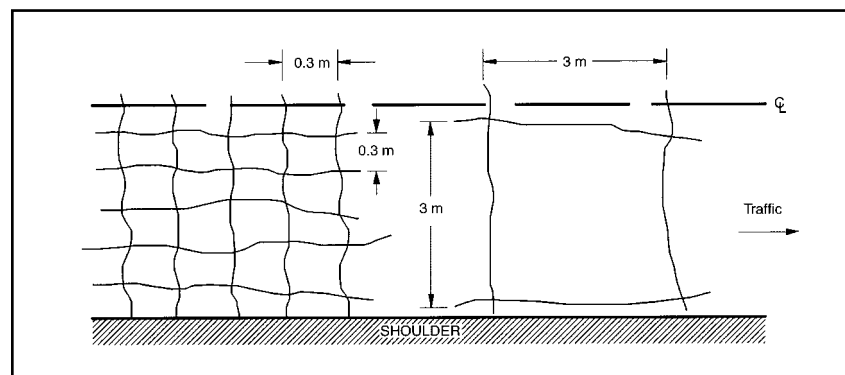


FIGURE 8
Distress Type ACP 2—Block Cracking



FIGURE 9
Distress Type ACP 2—Block Cracking
with Fatigue Cracking in the Wheel Paths



FIGURE 10
Distress Type ACP 2—High Severity
Block Cracking

EDGE CRACKING

Description

Applies only to pavements with unpaved shoulders. Crescent-shaped cracks which intersect the pavement edge and are located within 0.6 m of the pavement edge, adjacent to the shoulder. Includes longitudinal cracks outside of the wheel path and within 0.6 m of the pavement edge.

Severity Levels

LOW

Cracks with no breakup or loss of material.

MODERATE

Cracks with some breakup and loss of material for up to 10 percent of the length of the affected portion of the pavement.

HIGH

Cracks with considerable breakup and loss of material for more than 10 percent of the length of the affected portion of the pavement.

How to Measure

Record length in meters of pavement edge affected at each severity level. The combined quantity of edge cracking cannot exceed the length of the section.

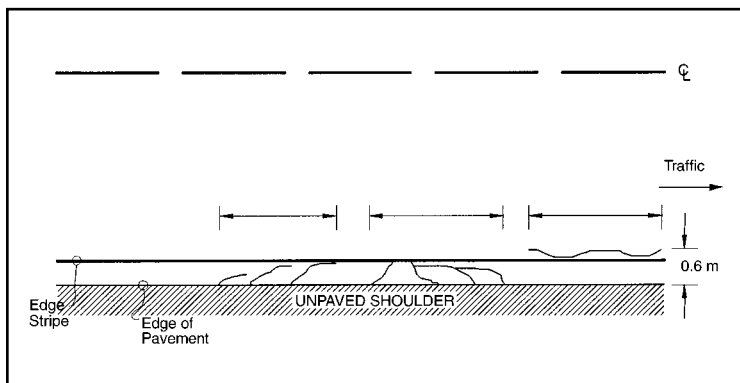


FIGURE 11
Distress Type ACP 3—Edge Cracking



FIGURE 12
Distress Type ACP 3—Low Severity Edge Cracking

4

LONGITUDINAL CRACKING

Description

Cracks predominantly parallel to pavement centerline. Location within the lane (wheel path versus non-wheel path) is significant.

Severity levels

LOW

A crack with a mean width ≤ 6 mm; or a sealed crack with sealant material in good condition and with a width that cannot be determined.

MODERATE

Any crack with a mean width > 6 mm and ≤ 19 mm; or any crack with a mean width ≤ 19 mm and adjacent low severity random cracking.

HIGH

Any crack with a mean width > 19 mm; or any crack with a mean width ≤ 19 mm and adjacent moderate to high severity random cracking.

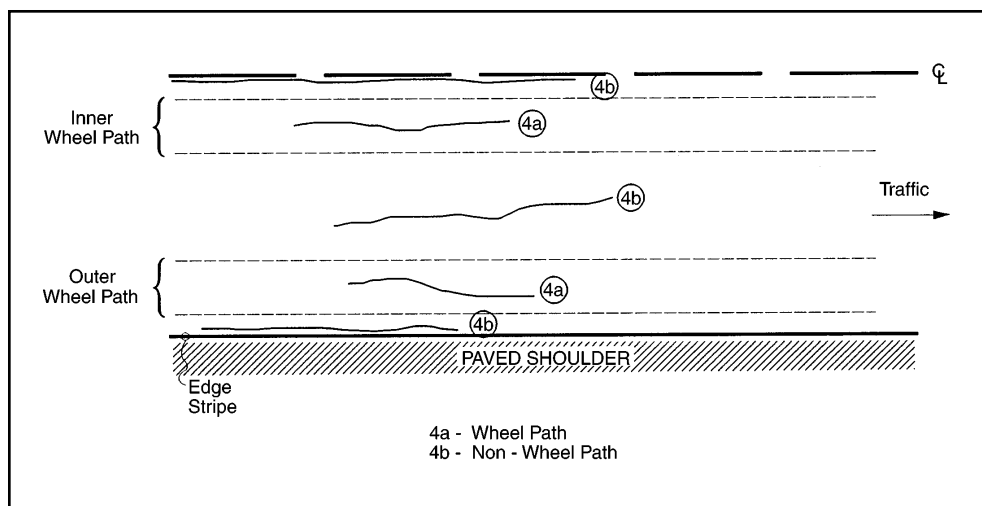


FIGURE 13
Distress Type ACP 4—Longitudinal Cracking

How to Measure

Record separately:

4A. WHEEL PATH LONGITUDINAL CRACKING

Record the length in meters of longitudinal cracking within the defined wheel paths at each severity level.

Record the length in meters of longitudinal cracking with sealant in good condition at each severity level.

Note: Any wheel path longitudinal crack that has associated random cracking is rated as fatigue cracking. Any wheel path longitudinal crack that meanders and has a quantifiable area is rated as fatigue cracking.

4B. NON-WHEEL PATH LONGITUDINAL CRACKING

Record the length in meters of longitudinal cracking not located in the defined wheel paths at each severity level.

Record the length in meters of longitudinal cracking with sealant in good condition at each severity level.



FIGURE 14
Distress Type ACP 4a—Moderate Severity
Longitudinal Cracking in the Wheel Path



FIGURE 15
Distress Type ACP 4b—High Severity Longitudinal
Cracking not in the Wheel Path

5

REFLECTION CRACKING AT JOINTS

Description

Cracks in asphalt concrete overlay surfaces that occur over joints in concrete pavements.

Note: The slab dimensions beneath the AC surface must be known to identify reflection cracks at joints.

Severity Levels

LOW

An unsealed crack with a mean width ≤ 6 mm; or a sealed crack with sealant material in good condition and with a width that cannot be determined.

MODERATE

Any crack with a mean width > 6 mm and ≤ 19 mm; or any crack with a mean width ≤ 19 mm and adjacent low severity random cracking.

HIGH

Any crack with a mean width > 19 mm; or any crack with a mean width ≤ 19 mm and adjacent moderate to high severity random cracking.

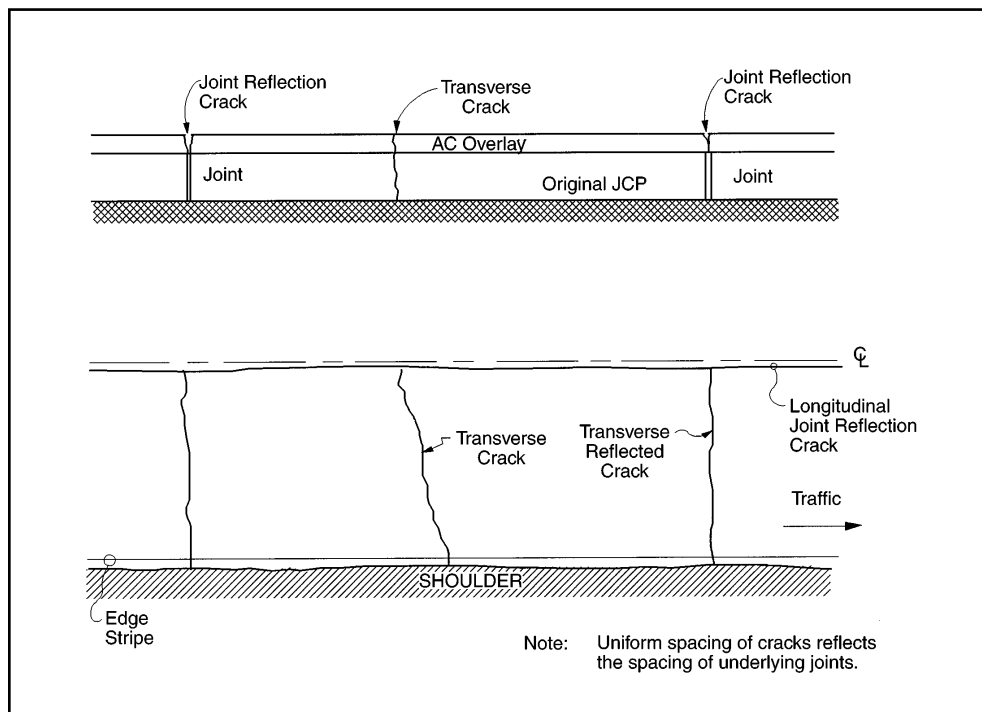


FIGURE 16
Distress Type ACP 5—Reflection
Cracking at Joints

How to Measure

Recorded as longitudinal cracking (ACP4) or transverse cracking (ACP6) on LTPP surveys.



FIGURE 17
Distress Type ACP 5—High Severity
Reflection Cracking at Joints

6

TRANSVERSE CRACKING

Description

Cracks that are predominantly perpendicular to pavement centerline.

Severity Levels

LOW

An unsealed crack with a mean width ≤ 6 mm; or a sealed crack with sealant material in good condition and with a width that cannot be determined.

MODERATE

Any crack with a mean width > 6 mm and ≤ 19 mm; or any crack with a mean width ≤ 19 mm and adjacent low severity random cracking.

HIGH

Any crack with a mean width > 19 mm; or any crack with a mean width ≤ 19 mm and adjacent moderate to high severity random cracking.

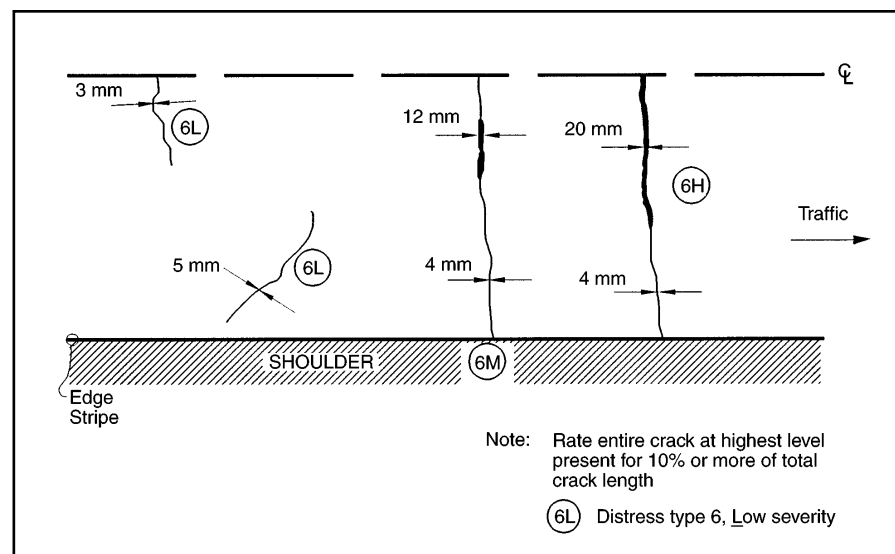


FIGURE 18
Distress Type ACP 6—Transverse Cracking Asphalt Concrete Surfaces

How to Measure

Record number and length of transverse cracks at each severity level. Rate the entire transverse crack at the highest severity level present for at least 10 percent of the total length of the crack. Length recorded, in meters, is the total length of the crack and is assigned to the highest severity level present for at least 10 percent of the total length of the crack.

Also record length in meters of transverse cracks with sealant in good condition at each severity level.

Note: The length recorded is the total length of the well-sealed crack and is assigned to the severity level of the crack. Record only when the sealant is in good condition for at least 90 percent of the length of the crack.

If the transverse crack extends through an area of fatigue cracking, the length of the crack within the fatigue area is not counted. The crack is treated as a single transverse crack, but at a reduced length.

Cracks less than 0.3 m in length are not recorded.



FIGURE 19
Distress Type ACP 6—Low Severity
Transverse Cracking



FIGURE 20
Distress Type ACP 6—Moderate
Severity Transverse Cracking



FIGURE 21
Distress Type ACP 6—High Severity Transverse
Cracking



B

This section includes the following distresses:

- 7. Patch/Patch Deterioration
- 8. Potholes

**Patching
and
Potholes**

7

PATCH/PATCH DETERIORATION

Description

Portion of pavement surface, greater than 0.1 m², that has been removed and replaced or additional material applied to the pavement after original construction.

Severity Levels

LOW

Patch has, at most, low severity distress of any type including rutting < 6 mm; pumping is not evident.

MODERATE

Patch has moderate severity distress of any type or rutting from 6 mm to 12 mm; pumping is not evident.

HIGH

Patch has high severity distress of any type including rutting > 12 mm, or the patch has additional different patch material within it; pumping may be evident.

How to Measure

Record number of patches and square meters of affected surface area at each severity level.

Note: Any distress in the boundary of the patch is included in rating the patch. Rutting (settlement) may be at the perimeter or interior of the patch.

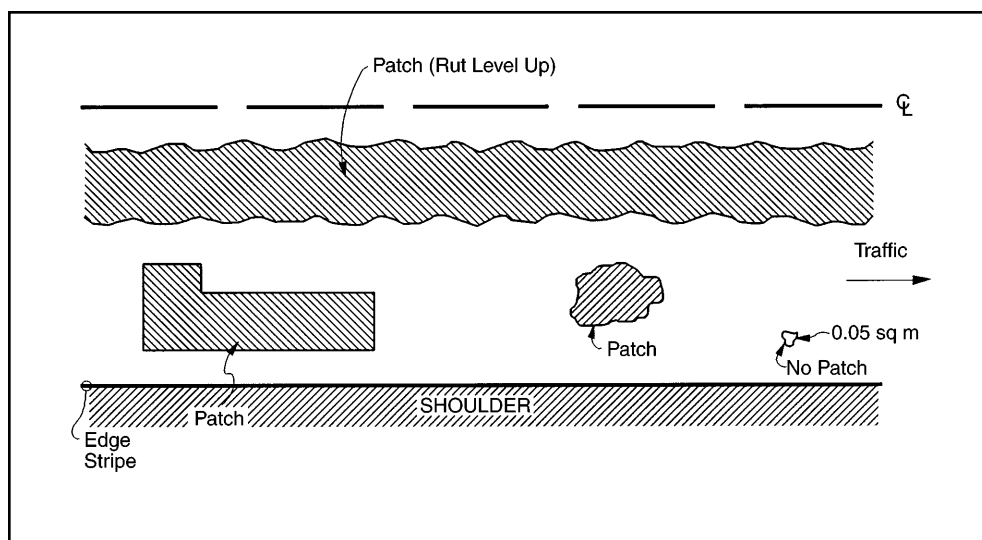


FIGURE 22
Distress Type ACP 7—Patch/Patch Deterioration



FIGURE 23
Distress Type ACP 7—Low Severity Patch



FIGURE 24
Distress Type ACP 7—Moderate Severity Patch



FIGURE 25
Distress Type ACP 7—High Severity Patch

8

POTHOLES

Description

Bowl-shaped holes of various sizes in the pavement surface. Minimum plan dimension is 150 mm.

Severity Levels

LOW

< 25 mm deep.

MODERATE

25 mm to 50 mm deep.

HIGH

> 50 mm deep.

How to Measure

Record number of potholes and square meters of affected area at each severity level. Pothole depth is the maximum depth below pavement surface. If pothole occurs within an area of fatigue cracking the area of fatigue cracking is reduced by the area of the pothole.

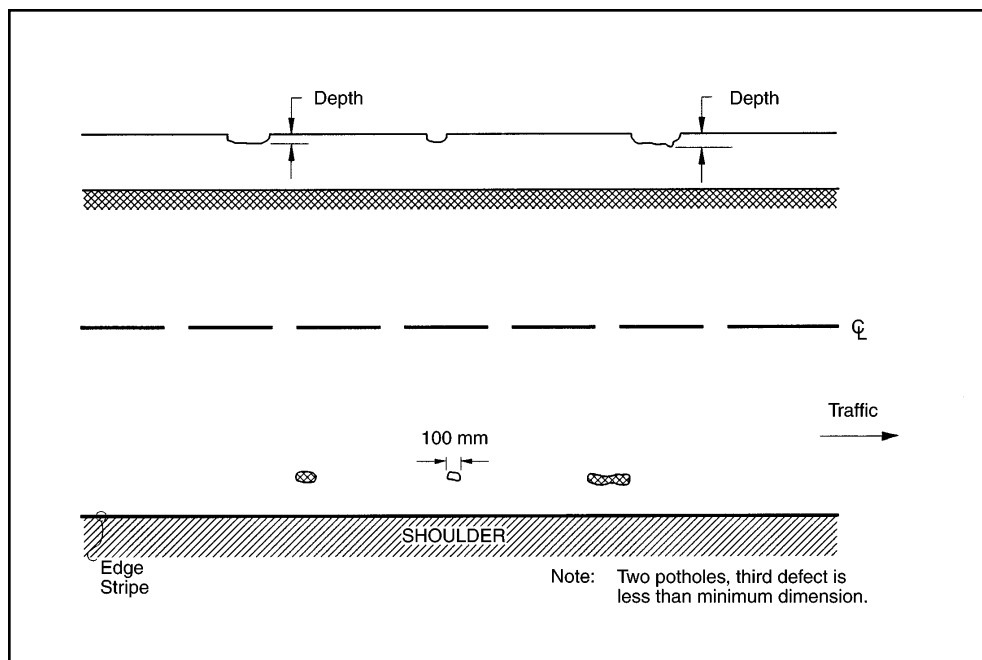


FIGURE 26
Distress Type ACP 8—Potholes



FIGURE 27
Distress Type ACP 8—Low Severity Pothole



FIGURE 28
Distress Type ACP 8—Moderate Severity Pothole



FIGURE 29
Distress Type ACP 8—Moderate Severity Pothole, Close-up View



FIGURE 30
Distress Type ACP 8—High Severity Pothole, Close-up View

**Patching
and
Potholes**



This section includes the following types of surface deformations:

- 9. Rutting
- 10. Shoving

Surface Deformation

9

RUTTING

Description

A rut is a longitudinal surface depression in the wheel path. It may have associated transverse displacement.

Severity Levels

Not applicable. Severity levels could be defined by categorizing the measurements taken. A record of the measurements taken is much more desirable, because it is more accurate and repeatable than are severity levels.

How to Measure

Specific Pavement Studies (SPS)-3 ONLY. Record maximum rut depth to the nearest millimeter, at 15.25-m intervals for each wheel path, as measured with a 1.2-m straight edge.

All other LTPP sections:
 Transverse profile is measured with a Dipstick® profiler at 15.25-m intervals.

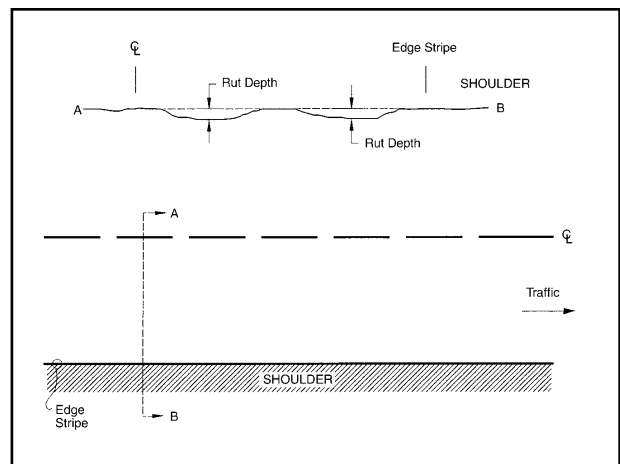


FIGURE 31
 Distress Type ACP 9—Rutting



FIGURE 32
 Distress Type ACP 9—Rutting



FIGURE 33
 Distress Type ACP 9—Standing Water in Ruts

SHOVING

Description

Shoving is a longitudinal displacement of a localized area of the pavement surface. It is generally caused by braking or accelerating vehicles, and is usually located on hills or curves, or at intersections. It also may have associated vertical displacement.

Severity Levels

Not applicable. However, severity levels can be defined by the relative effect of shoving on ride quality.

How to Measure

Record number of occurrences and square meters of affected surface area.

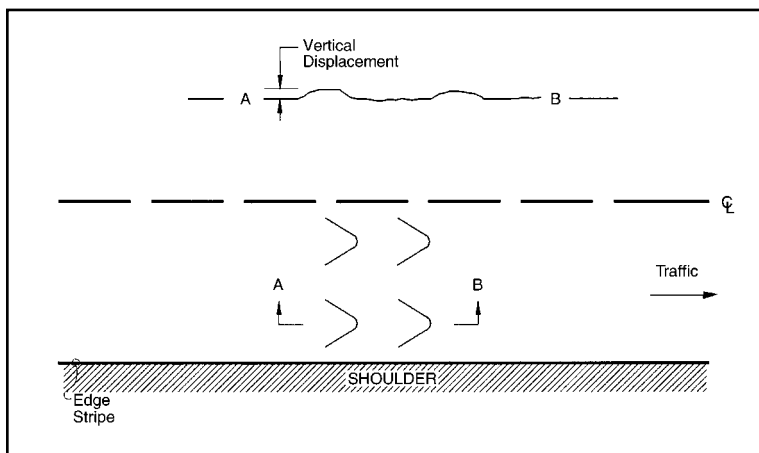


FIGURE 34
Distress Type ACP 10—Shoving



FIGURE 35
Distress Type ACP 10—Shoving in
Pavement Surface



D

**Surface
Defects**

This section includes the following types of surface defects:

- 11.** Bleeding
- 12.** Polished Aggregate
- 13.** Raveling

11

BLEEDING**Description**

Excess bituminous binder occurring on the pavement surface, usually found in the wheel paths. May range from a surface discolored relative to the remainder of the pavement, to a surface that is losing surface texture because of excess asphalt, to a condition where the aggregate may be obscured by excess asphalt possibly with a shiny, glass-like, reflective surface that may be tacky to the touch.

Severity Levels

Not applicable. The presence of bleeding indicates potential mixture related performance problems. Extent is sufficient to monitor any progression.

How to Measure

Record square meters of surface area affected.

Note: Preventative maintenance treatments (slurry seals, chip seals, fog seals, etc.) sometimes exhibit bleeding characteristics. These occurrences should be noted, but not rated as bleeding.



FIGURE 36
Distress Type ACP 11—Discoloration

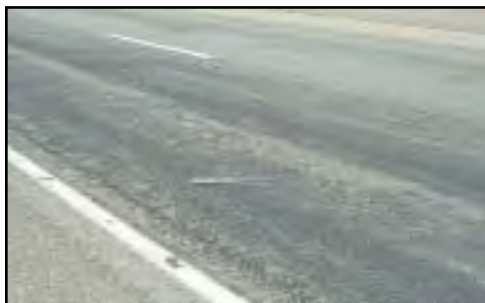


FIGURE 37
Distress Type ACP 11—Loss of Texture



FIGURE 38
Distress Type ACP 11—
Aggregate Obscured

POLISHED AGGREGATE

12

Description

Surface binder worn away to expose coarse aggregate.

Severity Levels

Not applicable. However, the degree of polishing may be reflected in a reduction of surface friction.

How to Measure

Record square meters of affected surface area. Polished aggregate should not be rated on test sections that have received a preventive maintenance treatment that has covered the original pavement surface.



FIGURE 39
Distress Type ACP 12—Polished
Aggregate

13

RAVELING**Description**

Wearing away of the pavement surface caused by the dislodging of aggregate particles and loss of asphalt binder. Raveling ranges from loss of fines to loss of some coarse aggregate and ultimately to a very rough and pitted surface with obvious loss of aggregate.

Severity Levels

Not applicable. The presence of raveling indicates potential mixture related performance problems. Extent is sufficient to monitor any progression.

How to Measure

Record square meters of affected surface. Raveling should not be rated on chip seals.



FIGURE 40
Distress Type ACP 13—Loss of Fine Aggregate



FIGURE 41
Distress Type ACP 13—Loss of Fine
and Some Coarse Aggregate



FIGURE 42
Distress Type ACP 13—Loss of
Coarse Aggregate



E

This section includes the following distresses:

- 14.** Lane-to-Shoulder Dropoff
- 15.** Water Bleeding and Pumping

**Miscellaneous
Distresses**

14

LANE-TO-SHOULDER DROPOFF

Description

Difference in elevation between the traveled surface and the outside shoulder. Typically occurs when the outside shoulder settles as a result of pavement layer material differences.

Severity Level

Not applicable. Severity levels could be defined by categorizing the measurements taken. A record of the measurements taken is much more desirable, however, because it is more accurate and repeatable than are severity levels.

How to Measure

Not recorded in LTPP surveys.

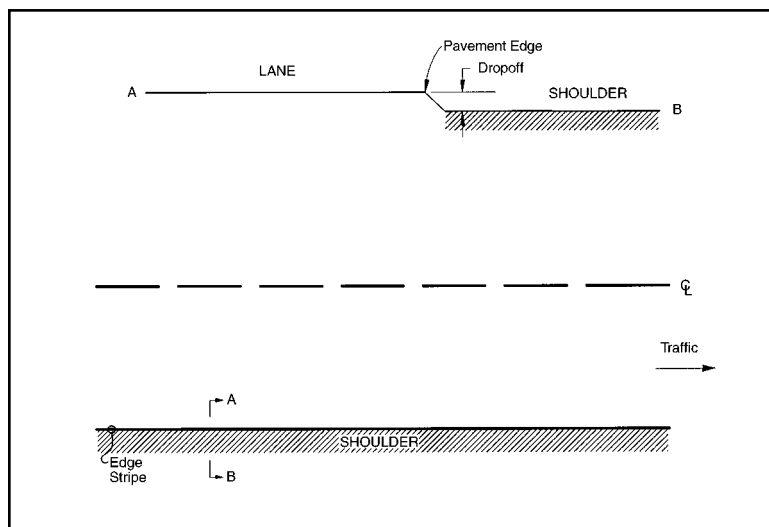


FIGURE 43
Distress Type ACP 14—Lane-to-Shoulder Dropoff



FIGURE 44
Distress Type ACP 14—Lane-to-Shoulder Dropoff

WATER BLEEDING AND PUMPING

15

Description

Seeping or ejection of water from beneath the pavement through cracks. In some cases, detectable by deposits of fine material left on the pavement surface, which were eroded (pumped) from the support layers and have stained the surface.

Severity Levels

Not applicable. Severity levels are not used because the amount and degree of water bleeding and pumping changes with varying moisture conditions.

How to Measure

Record the number of occurrences of water bleeding and pumping and the length in meters of affected pavement with a minimum length of 1 m.

Note. The combined length of water bleeding and pumping cannot exceed the length of the test section.



FIGURE 45
Distress Type ACP 15—Water Bleeding and Pumping



FIGURE 46
Distress Type ACP 15—Fine Material Left on Surface by Water Bleeding and Pumping

Miscellaneous
Distresses

This section covers jointed (plain and reinforced) portland cement concrete-surfaced pavements (JCP), including jointed concrete overlays on PCC pavements. Each of the distresses has been grouped into one of the following categories:

- A.** Cracking
- B.** Joint Deficiencies
- C.** Surface Defects
- D.** Miscellaneous Distresses

Table 2 summarizes the various types of distress and unit of measurement. Some distresses also have defined severity levels.

TABLE 2. Jointed Concrete-Surfaced Pavement Distress Types		
DISTRESS TYPE	UNIT OF MEASURE	DEFINED SEVERITY LEVELS?
A. Cracking / page 28		
1. Corner Breaks	Number	Yes
2. Durability Cracking (“D” Cracking)	Number of Slabs, Square Meters	Yes
3. Longitudinal Cracking	Meters	Yes
4. Transverse Cracking	Number, Meters	Yes
B. Joint Deficiencies / page 36		
5a. Transverse Joint Seal Damage	Number	Yes
5b. Longitudinal Joint Seal Damage	Number, Meters	No
6. Spalling of Longitudinal Joints	Meters	Yes
7. Spalling of Transverse Joints	Number, Meters	Yes
C. Surface Defects / page 40		
8a. Map Cracking	Number, Square Meters	No
8b. Scaling	Number, Square Meters	No
9. Polished Aggregate	Square Meters	No
10. Popouts	Not Measured	N/A
D. Miscellaneous Distress / page 44		
11. Blowups	Number	No
12. Faulting of Transverse Joints and Cracks	Millimeters	No
13. Lane-to-Shoulder Dropoff	Millimeters	No
14. Lane-to-Shoulder Separation	Millimeters	No
15. Patch/Patch Deterioration	Number, Square Meters	Yes
16. Water Bleeding and Pumping	Number, Meters	No



DISTRESSES FOR PAVEMENTS WITH JOINTED PORTLAND CEMENT SURFACES

A

Cracking

This section includes the following types of distresses:

1. Corner Breaks
2. Durability Cracking (“D” Cracking)
3. Longitudinal Cracking
4. Transverse Cracking

Figure 47 illustrates the proper measurement of crack width and width of spalling for cracks and joints.

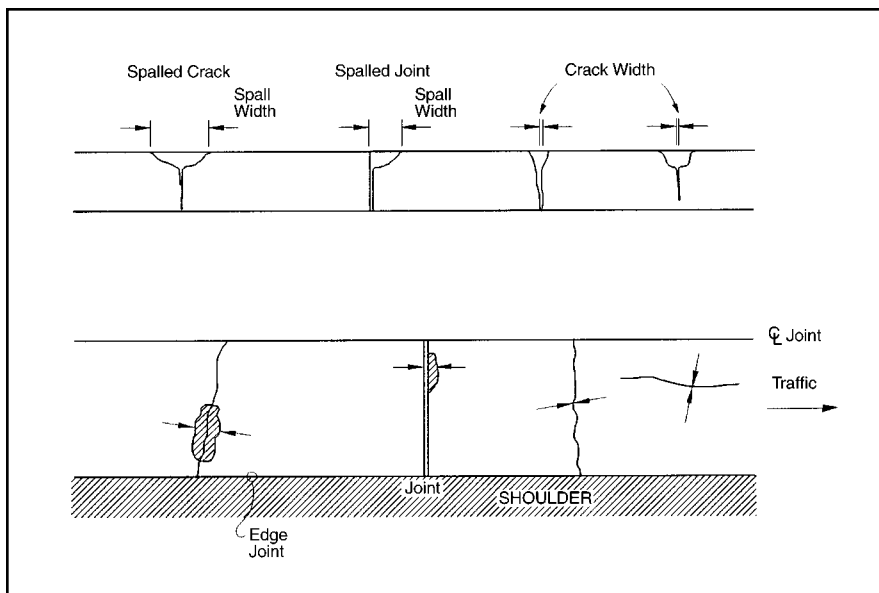


FIGURE 47
Measuring Widths of Spalls and Cracks in Jointed Concrete Pavement

1

CORNER BREAKS

Description

A portion of the slab separated by a crack, which intersects the adjacent transverse and longitudinal joints, describing approximately a 45-degree angle with the direction of traffic. The length of the sides is from 0.3 m to one-half the width of the slab on each side of the corner.

Severity Levels

LOW

Crack is not spalled for more than 10 percent of the length of the crack; there is no measurable faulting; and the corner piece is not broken into two or more pieces and has no loss of material and no patching.

MODERATE

Crack is spalled at low severity for more than 10 percent of its total length; or faulting of crack or joint is < 13 mm; and the corner piece is not broken into two or more pieces.

HIGH

Crack is spalled at moderate to high severity for more than 10 percent of its total length; or faulting of the crack or joint is ≥ 13 mm; or the corner piece is broken into two or more pieces or contains patch material.

How to Measure

Record number of corner breaks at each severity level. Corner breaks that have been repaired by completely removing all broken pieces and replacing them with patching material (rigid or flexible) should be rated as a patch. If the boundaries of the corner break are visible, then also rate as a high severity corner break. Note: This does not affect the way patches are rated. All patches meeting the size criteria are rated.

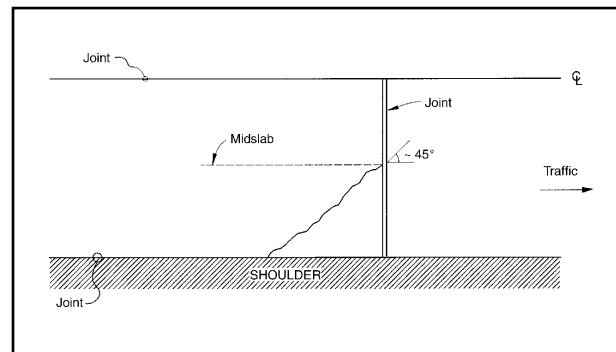


FIGURE 48
Distress Type JCP 1—Corner Breaks



FIGURE 49
Distress Type JCP 1—Low Severity
Corner Break



FIGURE 50
Distress Type JCP 1—Moderate Severity
Corner Break

DURABILITY CRACKING (“D” CRACKING)

Description

Closely spaced crescent-shaped hairline cracking pattern.

Occurs adjacent to joints, cracks, or free edges; initiating in slab corners. Dark coloring of the cracking pattern and surrounding area.

How to Measure

Record number of slabs with “D” cracking and square meters of area affected at each severity level. The slab and affected area severity rating is based on the highest severity level present for at least 10 percent of the area affected.

Severity Levels

LOW

“D” cracks are tight, with no loose or missing pieces, and no patching is in the affected area.

MODERATE

“D” cracks are well-defined, and some small pieces are loose or have been displaced.

HIGH

“D” cracking has a well-developed pattern, with a significant amount of loose or missing material. Displaced pieces, up to 0.1 m², may have been patched.

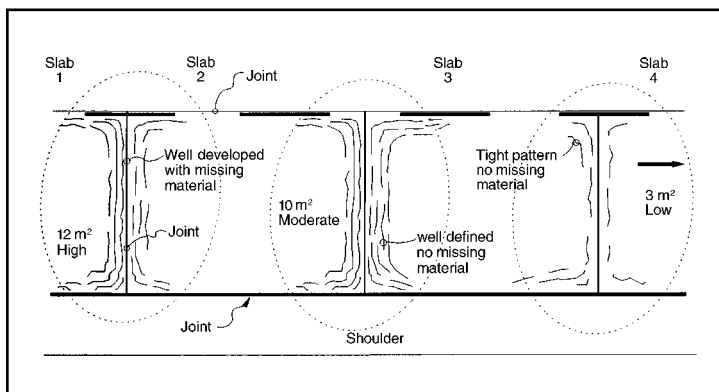


FIGURE 51
Distress Type JCP 2—Durability Cracking (“D” Cracking)



FIGURE 53
Distress Type JCP 2—High Severity “D” Cracking with Loose and Missing Material



FIGURE 52
Distress Type JCP 2—Moderate Severity “D” Cracking with Well-Defined Pattern

3

LONGITUDINAL CRACKING

Description

Cracks that are predominantly parallel to the pavement centerline.

Severity Levels

LOW

Crack widths < 3 mm, no spalling and no measurable faulting; or well-sealed and with a width that cannot be determined.

MODERATE

Crack widths ≥ 3 mm and < 13 mm; or with spalling < 75 mm; or faulting up to 13 mm.

HIGH

Crack widths ≥ 13 mm; or with spalling ≥ 75 mm; or faulting ≥ 13 mm.

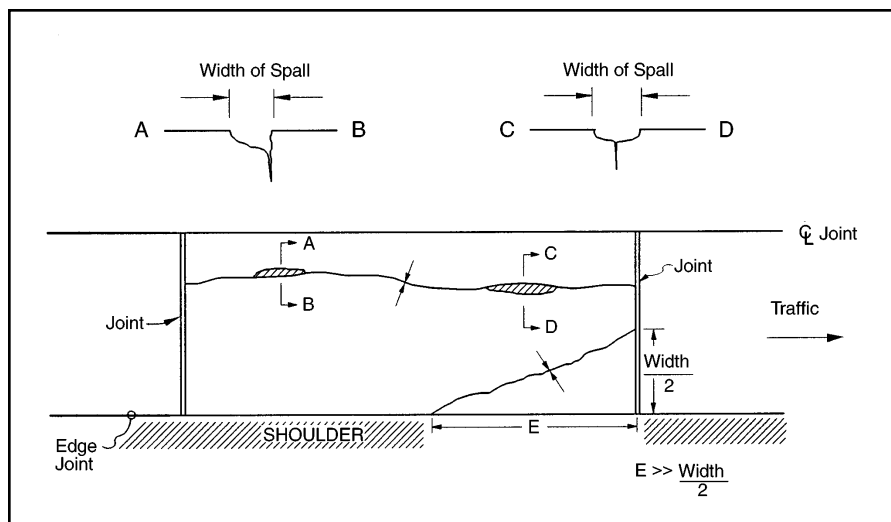


FIGURE 54
Distress Type JCP 3—Longitudinal Cracking

How to Measure

Record length in meters of longitudinal cracking at each severity level. Also record length in meters of longitudinal cracking with sealant in good condition at each severity level.



FIGURE 55
Distress Type JCP 3—Low Severity
Longitudinal Cracking



FIGURE 56
Distress Type JCP 3—Moderate Severity
Longitudinal Cracking



FIGURE 57
Distress Type JCP 3—High Severity
Longitudinal Cracking

4

TRANSVERSE CRACKING

Description

Cracks that are predominantly perpendicular to the pavement centerline.

Severity Levels

LOW

Crack widths < 3 mm, no spalling and no measurable faulting; or well-sealed and the width cannot be determined.

MODERATE

Crack widths ≥ 3 mm and < 6 mm; or with spalling < 75 mm; or faulting up to 6 mm.

HIGH

Crack widths ≥ 6 mm; or with spalling ≥ 75 mm; or faulting ≥ 6 mm.

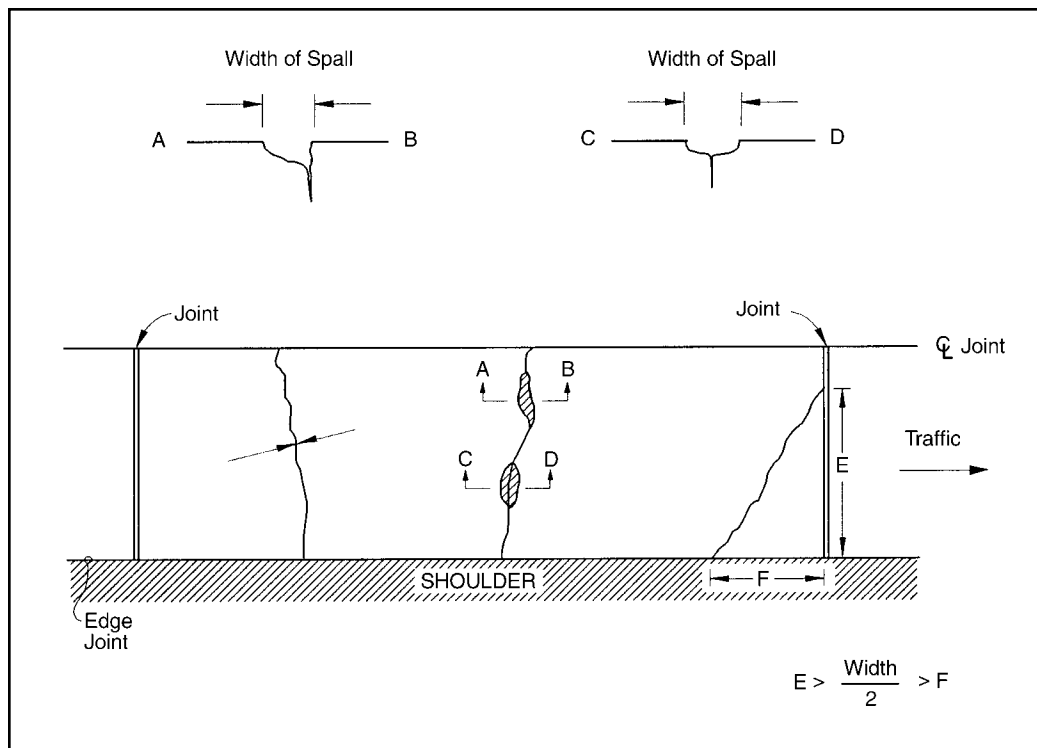


FIGURE 58
Distress Type JCP 4—Transverse Cracking

How to Measure

Record number and length of transverse cracks at each severity level. Rate the entire transverse crack at the highest severity level present for at least 10 percent of the total length of the crack. Length recorded, in meters, is the total length of the crack and is assigned to the highest severity level present for at least 10 percent of the total length of the crack.

Also record the length, in meters, of transverse cracking at each severity level with sealant in good condition. The length recorded, in meters, is the total length of the well-sealed crack and is assigned to the severity level of the crack. Record only when the sealant is in good condition for at least 90 percent of the length of the crack.



FIGURE 59
Distress Type JCP 4—Moderate Severity
Transverse Cracking



FIGURE 60
Distress Type JCP 4—High Severity Transverse
Cracking

B

This section includes the following types of distresses:

- 5a.** Transverse Joint Seal Damage
- 5b.** Longitudinal Joint Seal Damage
- 6.** Spalling of Longitudinal Joints
- 7.** Spalling of Transverse Joints

**Joint
Deficiencies**

5

JOINT SEAL DAMAGE

Description

Joint seal damage is any condition which enables incompressible materials or water to infiltrate the joint from the surface. Typical types of joint seal damage are:

Extrusion, hardening, adhesive failure (bonding), cohesive failure (splitting), or complete loss of sealant.

Intrusion of foreign material in the joint.

Weed growth in the joint.

5a. TRANSVERSE JOINT SEAL DAMAGE

Severity Levels

LOW

Joint seal damage as described above exists over less than 10 percent of the joint.

MODERATE

Joint seal damage as described above exists over 10-50 percent of the joint.

HIGH

Joint seal damage as described above exists over more than 50 percent of the joint.



FIGURE 61
Distress Type JCP 5—Low Severity
Joint Seal Damage

How to Measure

Indicate whether the transverse joints have been sealed (yes or no). If yes, record number of sealed transverse joints at each severity level. Any joint seal with no apparent damage is considered to be low severity.

5b. LONGITUDINAL JOINT SEAL DAMAGE

Severity Levels

None.

How to Measure

Record number of longitudinal joints that are sealed (0, 1, 2). Record total length of sealed longitudinal joints with joint seal damage as described above. Individual occurrences are recorded only when at least 1 m in length.



FIGURE 62
Distress Type JCP 5—Moderate Severity
Joint Seal Damage

6

SPALLING OF LONGITUDINAL JOINTS

Description

Cracking, breaking, chipping, or fraying of slab edges within 0.3 m from the face of the longitudinal joint.

Severity Levels

LOW

Spalls < 75 mm wide, measured to the face of the joint, with loss of material, or spalls with no loss of material and no patching.

MODERATE

Spalls 75 mm to 150 mm wide, measured to the face of the joint, with loss of material.

HIGH

Spalls > 150 mm wide, measured to the face of the joint, with loss of material or is broken into two or more pieces or contains patch material.

How to Measure

Record length in meters of longitudinal joint affected at each severity level. Only record spalls that have a length of 0.1 m or more. Spalls that have been repaired by completely removing all broken pieces and replacing them with patching material (rigid or flexible) should be rated as a patch. If the boundaries of the spall are visible, then also rate as a high severity spall. Note: All patches meeting size criteria are rated as patches.

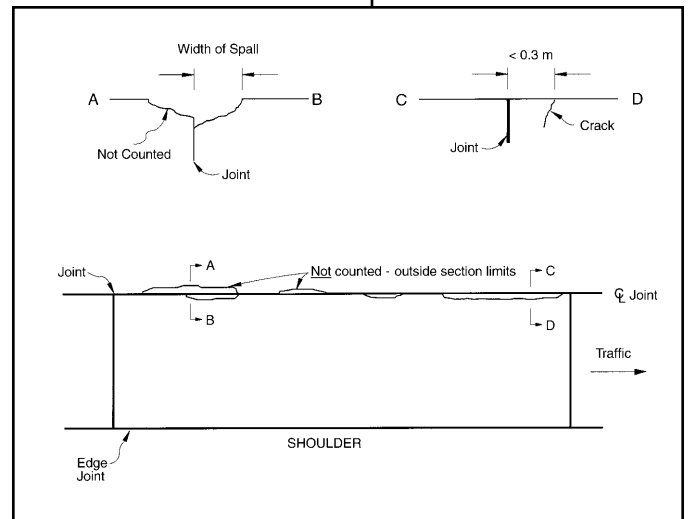


FIGURE 63
Distress Type JCP 6—Spalling of Longitudinal Joints



FIGURE 64
Distress Type JCP 6—Low Severity Spalling of Longitudinal Joint



FIGURE 65
Distress Type JCP 6—High Severity Spalling of Longitudinal Joint

7

SPALLING OF TRANSVERSE JOINTS

Description

Cracking, breaking, chipping, or fraying of slab edges within 0.3 m from the face of the transverse joint.

Severity Levels

LOW

Spalls < 75 mm wide, measured to the face of the joint, with loss of material, or spalls with no loss of material and no patching.

MODERATE

Spalls 75 mm to 150 mm wide, measured to the face of the joint, with loss of material.

HIGH

Spalls > 150 mm wide, measured to the face of the joint, with loss of material, or broken into two or more pieces, or contains patch material.

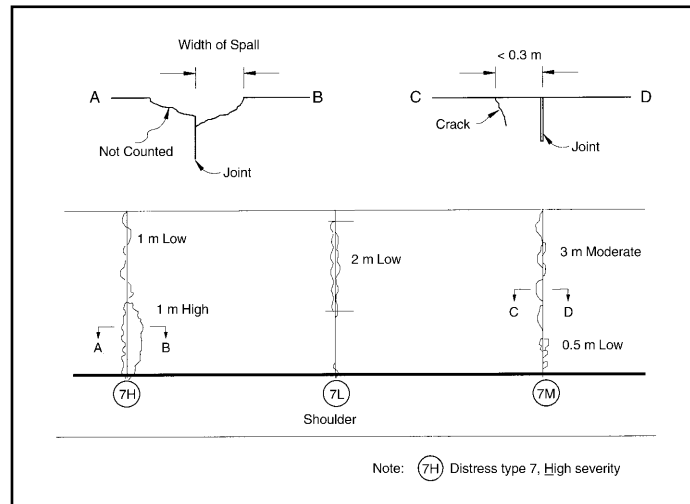


FIGURE 66
Distress Type JCP 7—Spalling of Transverse Joints

How to Measure

Record number of affected transverse joints at each severity level. A joint is affected only if the total length of spalling is 10 percent or more of the length of the joint. Rate the entire transverse joint at the highest severity level present for at least 10 percent of the total length of the spalling.

Record length in meters of the spalled portion of the joint at the assigned severity level for the joint. Spalls that have been repaired by completely removing all broken pieces and replacing them with patching material (rigid or flexible) should be rated as a patch. If the boundaries of the spall are visible, then also rate as a high severity spall. Note: All patches meeting size criteria are rated as patches.



FIGURE 67
Distress Type JCP 7—Moderate Severity Spalling of Transverse Joint, Far View



FIGURE 68
Distress Type JCP 7—Moderate Severity Spalling of Transverse Joint, Close-up View



This section includes the following types of distresses:

- 8a.** Map Cracking
- 8b.** Scaling
- 9.** Polished Aggregate
- 10.** Popouts

Surface Defects

8

MAP CRACKING AND SCALING**8a. MAP CRACKING****Description**

A series of cracks that extend only into the upper surface of the slab. Larger cracks frequently are oriented in the longitudinal direction of the pavement and are interconnected by finer transverse or random cracks.

Severity Levels

Not applicable.

How to Measure

Record the number of occurrences and the square meters of affected area.



FIGURE 69
Distress Type JCP 8a—Map Cracking

8b. SCALING**Description**

Scaling is the deterioration of the upper concrete slab surface, normally 3 mm to 13 mm, and may occur anywhere over the pavement.

Severity Levels

Not applicable.

How to Measure

Record the number of occurrences and the square meters of affected area.

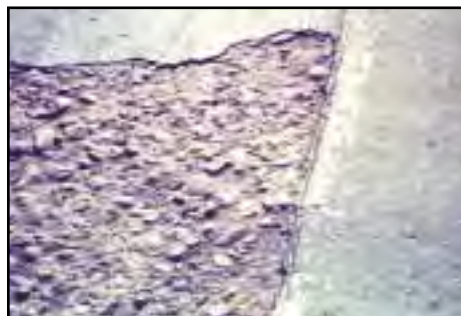


FIGURE 70
Distress Type JCP 8b—Scaling



FIGURE 71
Distress Type JCP 8b—Scaling, Close-up View

POLISHED AGGREGATE

Description

Surface mortar and texturing worn away to expose coarse aggregate.

Severity Levels

Not applicable. However, the degree of polishing may be reflected in a reduction of surface friction.

How to Measure

Record square meters of affected surface area.

NOTE: Diamond grinding also removes the surface mortar and texturing. However, this condition should not be recorded as polished aggregate, but instead, be noted by a comment.



FIGURE 72
Distress Type JCP 9—Polished
Aggregate

10

POPOUTS

Description

Small pieces of pavement broken loose from the surface, normally ranging in diameter from 25 mm to 100 mm, and depth from 13 mm to 50 mm.

Severity Levels

Not applicable. However, severity levels can be defined in relation to the intensity of popouts as measured below.

How to Measure

Not recorded in LTPP surveys.

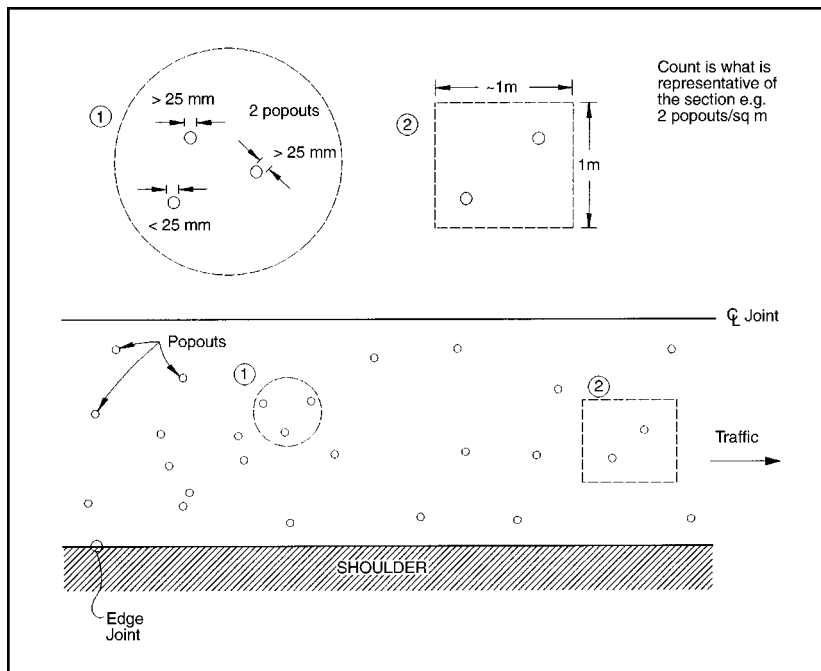


FIGURE 73
Distress Type JCP 10—Popouts



FIGURE 74
Distress Type JCP 10—A Popout



D

This section includes the following distresses:

- 11.** Blowups
- 12.** Faulting of Transverse Joints and Cracks
- 13.** Lane-to-Shoulder Dropoff
- 14.** Lane-to-Shoulder Separation
- 15.** Patch/Patch Deterioration
- 16.** Water Bleeding and Pumping

**Miscellaneous
Distresses**

11

BLOWUPS**Description**

Localized upward movement of the pavement surface at transverse joints or cracks, often accompanied by shattering of the concrete in that area.

Severity Levels

Not applicable. However, severity levels can be defined by the relative effect of a blowup on ride quality and safety.

How to Measure

Record the number of blowups.

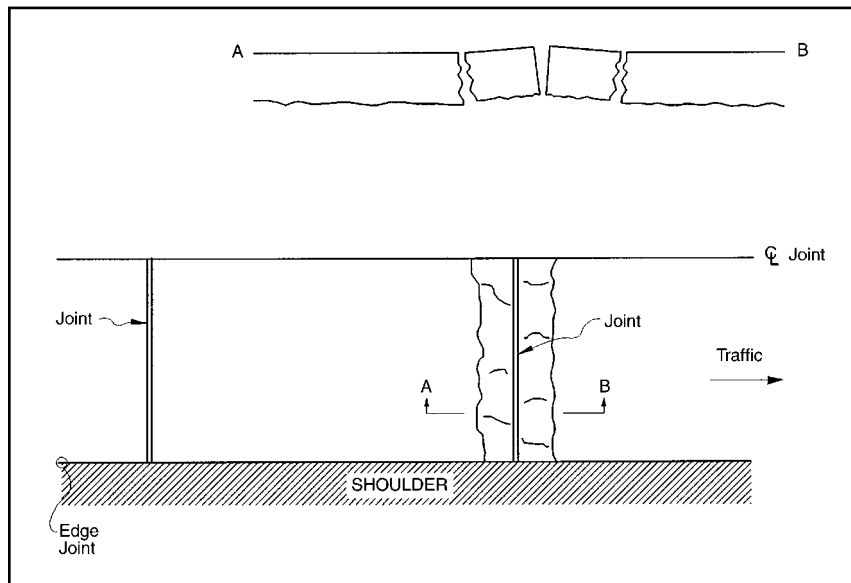


FIGURE 75
Distress Type JCP 11—Blowups



FIGURE 76
Distress Type JCP 11—A Blowup

FAULTING OF TRANSVERSE JOINTS AND CRACKS

Description

Difference in elevation across a joint or crack.

Severity Level

Not applicable. Severity levels could be defined by categorizing the measurements taken. A complete record of the measurements taken is much more desirable, however, because it is more accurate and repeatable than are severity levels.

How to Measure

Record in millimeters, to the nearest millimeter: 0.3 m and 0.75 m from the outside slab edge (approximately the outer wheel path). For a widened lane, the wheel path location will be 0.75 m from the outside lane edge stripe. At each location, three measurements are made, but only the approximate average of the readings is recorded.

If the “approach” slab is higher than the “departure” slab, record faulting as positive (+); if the approach slab is lower, record faulting as negative (-).

Faulting on PCC pavements is to be measured using a FHWA-modified Georgia Faultmeter. A representative reading from three distinct measurements at each location is to be used and recorded on sheet 6.

When anomalies such as patching, spalling, and corner breaks are encountered, the faultmeter should be offset to avoid the anomaly. The maximum offset is 0.3 m. A null value (“N”) should be recorded and entered into the database when the surveyor is unable to take a measurement due to an anomaly.

Surveyors must ensure that they have a working faultmeter with fully charged batteries prior to beginning a survey on a jointed PCC test section. Complete faulting measurements and survey sheet 6 at the beginning of the distress survey to ensure that this data is collected.

Point distance measurements entered on sheet 6 for joints and transverse cracks should be consistent between surveys of the same test section to an accuracy of less than 0.5 m. Evaluate newly observed distresses and point distance differences for previously identified distresses of 0.5 m and greater with a metric tape measure. Note: The precise start point of surveys must be clearly identified in the field.

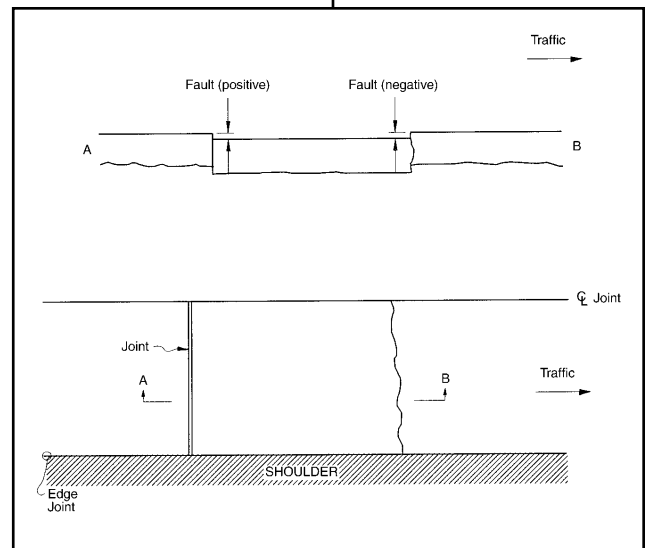


FIGURE 77
Distress Type JCP 12—Faulting of Transverse Joints and Cracks



FIGURE 78
Distress Type JCP 12—Faulting of Transverse Cracks

13

LANE-TO-SHOULDER DROPOFF

Description

Difference in elevation between the edge of slab and outside shoulder; typically occurs when the outside shoulder settles.

Severity Levels

Not applicable. Severity levels can be defined by categorizing the measurements taken. A complete record of the measurements taken is much more desirable, however, because it is more accurate and repeatable than are severity levels.

How to Measure

Measure at the longitudinal construction joint between the lane edge and the shoulder.

Record to the nearest millimeter at 15.25-m intervals along the lane-to-shoulder joint.

If the traveled surface is lower than the shoulder, record as a negative (-) value.

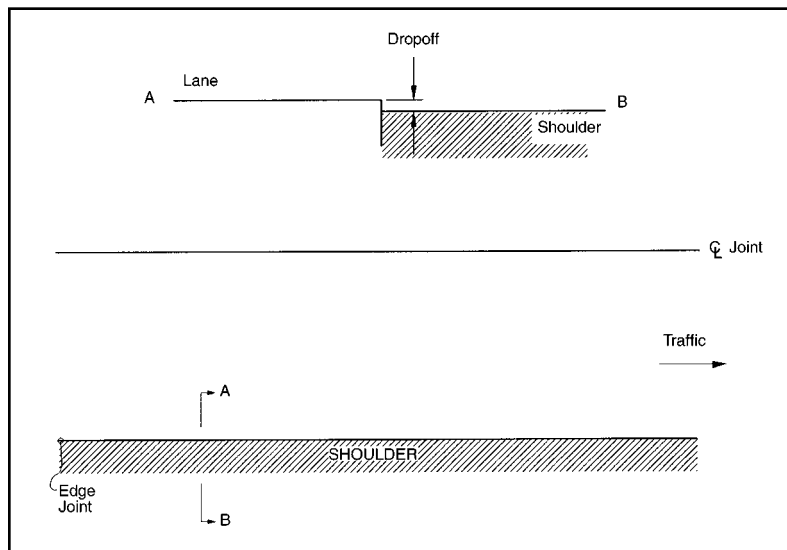


FIGURE 79
Distress Type JCP 13—
Lane-to-Shoulder Dropoff



FIGURE 80
Distress Type JCP 13—
Lane-to-Shoulder Dropoff

**JOINTED
PORTLAND
CEMENT
CONCRETE
SURFACES**

LANE-TO-SHOULDER SEPARATION

Description

Widening of the joint between the edge of the slab and the shoulder.

Severity Levels

Not applicable. Severity levels can be defined by categorizing the measurements taken. A complete record of the measurements taken is much more desirable, however, because it is more accurate and repeatable than severity levels.

How to Measure

Record to the nearest millimeter at intervals of 15.25 m along the lane-to-shoulder joint. Indicate whether the joint is well-sealed (yes or no) at each location.

Note: A null value (“N”) should be recorded and entered into the database when the surveyor is unable to take a measurement due to an anomaly such as sealant or patch material.

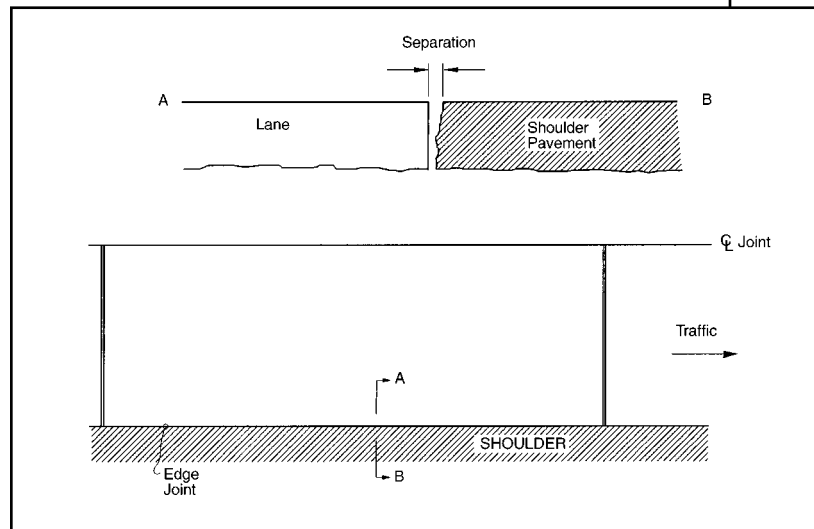


FIGURE 81
Distress Type JCP 14—Lane-to-Shoulder Separation



FIGURE 82
Distress Type JCP 14—Poorly Sealed Lane-to-Shoulder Separation



FIGURE 83
Distress Type JCP 14—Well-Sealed Lane-to-Shoulder Separation

15

PATCH/PATCH DETERIORATION

Description

A portion, greater than 0.1 m², or all of the original concrete slab that has been removed and replaced, or additional material applied to the pavement after original construction.

Severity Levels

LOW

Patch has low severity distress of any type; and no measurable faulting or settlement; pumping is not evident.

MODERATE

Patch has moderate severity distress of any type; or faulting or settlement up to 6 mm; pumping is not evident.

HIGH

Patch has a high severity distress of any type; or faulting or settlement ≥ 6 mm; pumping may be evident.

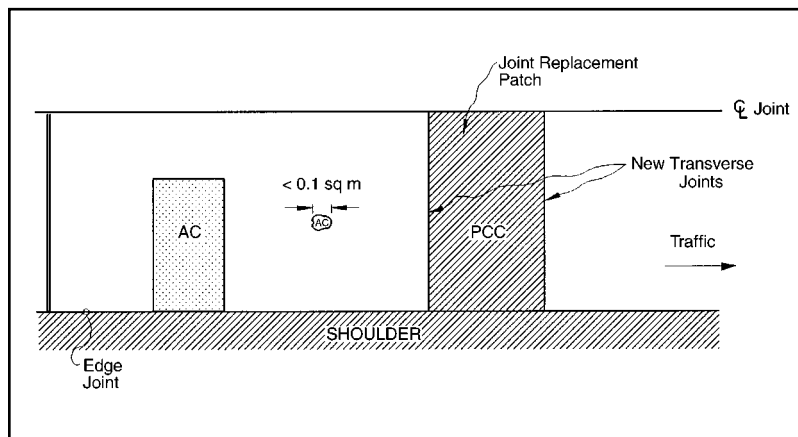


FIGURE 84
Distress Type JCP 15—Patch/Patch Deterioration



FIGURE 85
Distress Type JCP 15—Small, Low Severity Asphalt Concrete Patch

**JOINTED
PORTLAND
CEMENT
CONCRETE
SURFACES**

How to Measure

Record number of patches and square meters of affected surface area at each severity level, recorded separately by material type—rigid versus flexible. For slab replacement, rate each slab as a separate patch and continue to rate joints. Note: All patches meeting size criteria are rated.



FIGURE 86
Distress Type JCP 15—Large, Low
Severity Asphalt Concrete Patch



FIGURE 87
Distress Type JCP 15—Large, High
Severity Asphalt Concrete Patch



FIGURE 88
Distress Type JCP 15—Large, Low Severity
Portland Cement Concrete Patch

16

WATER BLEEDING AND PUMPING**Description**

Seeping or ejection of water from beneath the pavement through cracks. In some cases, detectable by deposits of fine material left on the pavement surface, which were eroded (pumped) from the support layers and have stained the surface.

Severity Levels

Not applicable. Severity levels are not used because the amount and degree of water bleeding and pumping changes with varying moisture conditions.

How to Measure

Record the number of occurrences of water bleeding and pumping and the length in meters of affected pavement with a minimum length of 1 m.

Note. The combined length of water bleeding and pumping cannot exceed the length of the test section.



FIGURE 89
Distress Type JCP 16—Water Bleeding
and Pumping

This section covers continuously reinforced concrete-surfaced pavements (CRCP), including continuously reinforced concrete overlays on PCC pavements. Each of the distresses has been grouped into one of the following categories:

- A. Cracking
- B. Surface Defects
- C. Miscellaneous Distresses

Table 3 summarizes the various types of distress and unit of measurement. Some distresses also have defined severity levels.

TABLE 3. Continuously Reinforced Concrete-Surfaced Pavement Distress Types		
DISTRESS TYPE	UNIT OF MEASURE	DEFINED SEVERITY LEVELS?
A. Cracking / page 53		
1. Durability Cracking (“D” Cracking)	Number, Square Meters	Yes
2. Longitudinal Cracking	Meters	Yes
3. Transverse Cracking	Number, Meters	Yes
B. Surface Defects / page 58		
4a. Map Cracking	Number, Square Meters	No
4b. Scaling	Number, Square Meters	No
5. Polished Aggregate	Square Meters	No
6. Popouts	Not Measured	N/A
C. Miscellaneous Distress / page 62		
7. Blowups	Number	No
8. Transverse Construction Joint Deterioration	Number	Yes
9. Lane-to-Shoulder Dropoff	Millimeters	No
10. Lane-to-Shoulder Separation	Millimeters	No
11. Patch/Patch Deterioration	Number, Square Meters	Yes
12. Punchouts	Number	Yes
13. Spalling of Longitudinal Joints	Meters	Yes
14. Water Bleeding and Pumping	Number, Meters	No
15. Longitudinal Joint Seal Damage	Number, Meters	No



DISTRESSES FOR PAVEMENTS WITH CONTINUOUSLY REINFORCED CONCRETE SURFACES



A

Cracking

This section includes the following distresses:

1. Durability Cracking (“D” Cracking)
2. Longitudinal Cracking
3. Transverse Cracking

1

DURABILITY CRACKING (“D” CRACKING)

Description

Closely spaced, crescent-shaped hairline cracking pattern.

Occurs adjacent to joints, cracks, or free edges. Initiates at the intersection, e.g., cracks and a free edge.

Dark coloring of the cracking pattern and surrounding area.

Severity Levels

LOW

“D” cracks are tight, with no loose or missing pieces, and no patching is in the affected area.

MODERATE

“D” cracks are well-defined, and some small pieces are loose or have been displaced.

HIGH

“D” cracking has a well-developed pattern, with a significant amount of loose or missing material. Displaced pieces, up to 0.1 m², may have been patched.

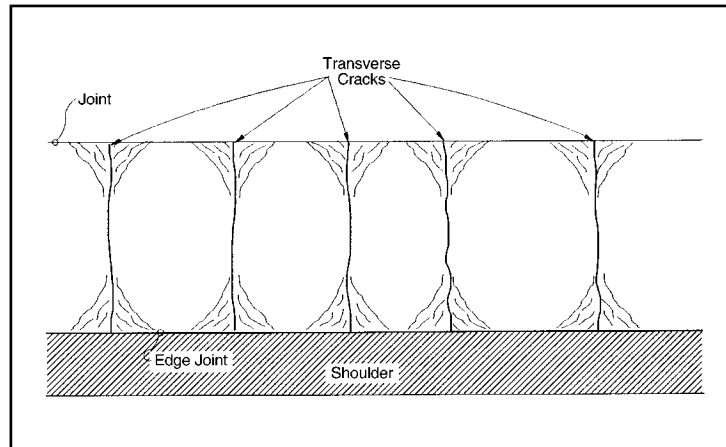


FIGURE 90
Distress Type CRCP 1—Durability Cracking (“D” Cracking)

How to Measure

Record number of affected transverse cracks at each severity level and the square meters of area affected at each severity level. The transverse crack and affected area severity rating is based on the highest severity level present for at least 10 percent of the area affected.



FIGURE 91
Distress Type CRCP 1—Moderate Severity
“D” Cracking at Transverse Crack



FIGURE 92
Distress Type CRCP 1—High Severity
“D” Cracking at Longitudinal Joint

**CONTINUOUSLY
REINFORCED
CONCRETE
SURFACES**

LONGITUDINAL CRACKING

Description

Cracks that are predominantly parallel to the pavement centerline.

Severity Levels

LOW

Crack widths < 3 mm, no spalling, and there is no measurable faulting; or well-sealed and with a width that cannot be determined.

MODERATE

Crack widths ≥ 3 mm and < 13 mm; or with spalling < 75 mm; or faulting up to 13 mm.

HIGH

Crack widths ≥ 13 mm; or with spalling ≥ 75 mm; or faulting ≥ 13 mm.

How to Measure

Record length in meters of longitudinal cracking at each severity level. Also record length in meters of longitudinal cracking with sealant in good condition at each severity level.

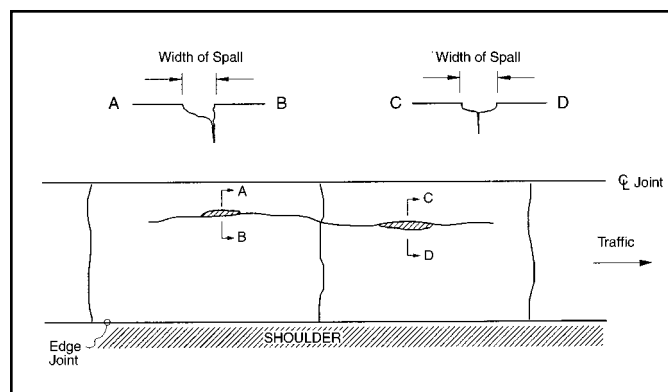


FIGURE 93
Distress Type CRCP 2—Longitudinal Cracking



Figure 94
Distress Type CRCP 2—Low Severity
Longitudinal Cracking



FIGURE 95
Distress Type CRCP 2—High Severity
Longitudinal Cracking

3

TRANSVERSE CRACKING

Description

Cracks that are predominantly perpendicular to the pavement centerline. This cracking is expected in a properly functioning CRCP. All transverse cracks that intersect an imaginary longitudinal line at midlane, and propagate from the pavement edges, shall be counted as individual cracks, as illustrated below. Cracks that do not cross midlane are not counted.

Severity Levels

LOW

Cracks that are not spalled or with spalling along ≤ 10 percent of the crack length.

MODERATE

Cracks with spalling along > 10 percent and ≤ 50 percent of the crack length.

HIGH

Cracks with spalling along > 50 percent of the crack length.

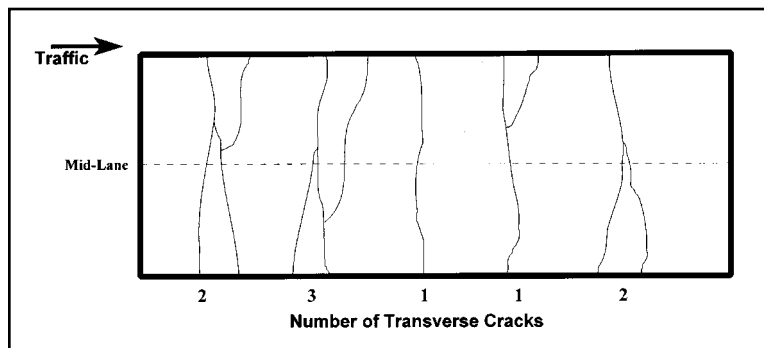


FIGURE 96
Distress Type CRCP 3—Transverse Cracking



FIGURE 97
Distress Type CRCP 3—Transverse Cracking Pattern

How to Measure

Record separately the number and length in meters of transverse cracking at each severity level. The sum of all the individual crack lengths shall be recorded. Then record the total number of transverse cracks within the survey section.

Note: Cracks that do not cross midlane, although not counted, should be drawn on the map sheets.



FIGURE 98
Distress Type CRCP 3—Low
Severity Transverse Cracking



FIGURE 99
Distress Type CRCP 3—Moderate
Severity Transverse Cracking



FIGURE 100
Distress Type CRCP 3—High Severity
Transverse Cracking

Cracking

B

**Surface
Defects**

This section includes the following:

- 4a.** Map Cracking
- 4b.** Scaling
- 5.** Polished Aggregate
- 6.** Popouts

4

MAP CRACKING AND SCALING**4a. MAP CRACKING****Description**

A series of cracks that extend only into the upper surface of the slab. Larger cracks frequently are oriented in the longitudinal direction of the pavement and are interconnected by finer transverse or random cracks.

Severity Levels

Not applicable.

How to Measure

Record the number of occurrences and the square meters of affected area. When an entire section is affected with map cracking, it should be considered one occurrence.



FIGURE 101
Distress Type CRCP 4a—Map Cracking
Attributable to Alkali-Silica Reactivity

4b. SCALING**Description**

Scaling is the deterioration of the upper concrete slab surface, normally 3 mm to 13 mm, and may occur anywhere over the pavement.

Severity Levels

Not applicable.

How to Measure

Record the number of occurrences and the square meters of affected area.



FIGURE 102
Distress Type CRCP 4b—Scaling

POLISHED AGGREGATE

Description

Surface mortar and texturing worn away to expose coarse aggregate.

Severity Levels

Not applicable. However, the degree of polishing may be reflected in a reduction of surface friction.

How to Measure

Record square meters of affected surface area.

NOTE: Diamond grinding also removes the surface mortar and texturing. However, this condition should not be recorded as polished aggregate but instead should be noted by a comment.



FIGURE 103
Distress Type CRCP 5—Polished
Aggregate

5

Surface
Defects

6

POPOUTS

Description

Small pieces of pavement broken loose from the surface, normally ranging in diameter from 25 mm to 100 mm and depth from 13 mm to 50 mm.

Severity Levels

Not applicable. However, severity levels can be defined in relation to the intensity of popouts as measured below.

How to Measure

Not recorded in LTPP surveys.

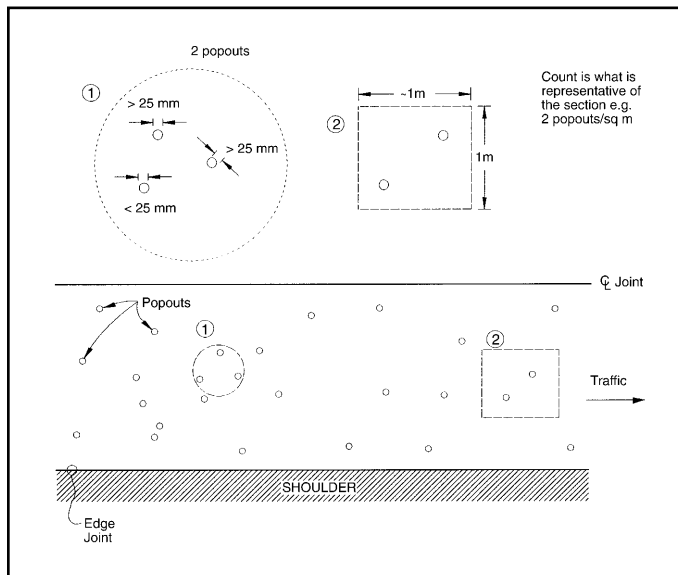


FIGURE 104
Distress Type CRCP 6—Popouts



FIGURE 105
Distress Type CRCP 6—Popouts

C**Miscellaneous
Distresses**

This section includes the following distresses:

7. Blowups
8. Transverse Construction Joint Deterioration
9. Lane-to-Shoulder Dropoff
10. Lane-to-Shoulder Separation
11. Patch/Patch Deterioration
12. Punchouts
13. Spalling of Longitudinal Joints
14. Water Bleeding and Pumping
15. Longitudinal Joint Seal Damage

7

BLOWUPS

Description

Localized upward movement of the pavement surface at transverse joints or cracks, often accompanied by shattering of the concrete in that area.

Severity Levels

Not applicable. However, severity levels can be defined by the relative effect of a blowup on ride quality and safety.

How to Measure

Record number of blowups.

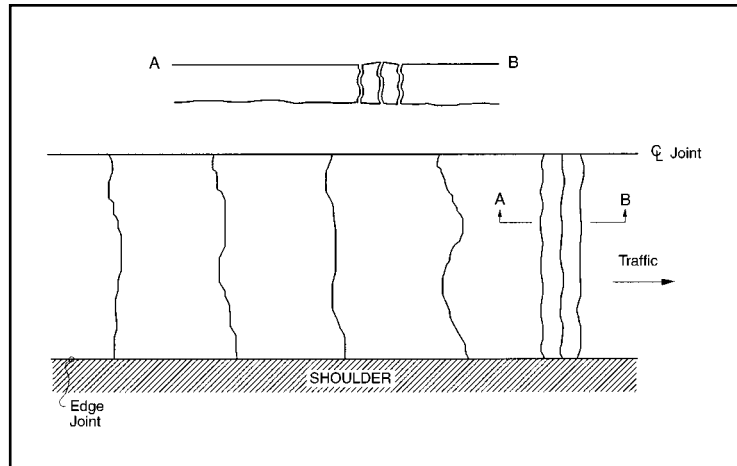


FIGURE 106
Distress Type CRCP 7—Blowups



FIGURE 107
Distress Type CRCP 7—A Blowup



FIGURE 108
Distress Type CRCP 7—Close-up View of a Blowup



FIGURE 109
Distress Type CRCP 7—Exposed Steel in a Blowup

TRANSVERSE CONSTRUCTION JOINT DETERIORATION

8

Description

Series of closely spaced transverse cracks or a large number of interconnecting cracks occurring near the construction joint.

Severity Levels

LOW

No spalling or faulting within 0.6 m of construction joint.

MODERATE

Spalling < 75 mm exists within 0.6 m of construction joint.

HIGH

Spalling \geq 75 mm and breakup exists within 0.6 m of construction joint.

How to Measure

Record number of construction joints at each severity level.

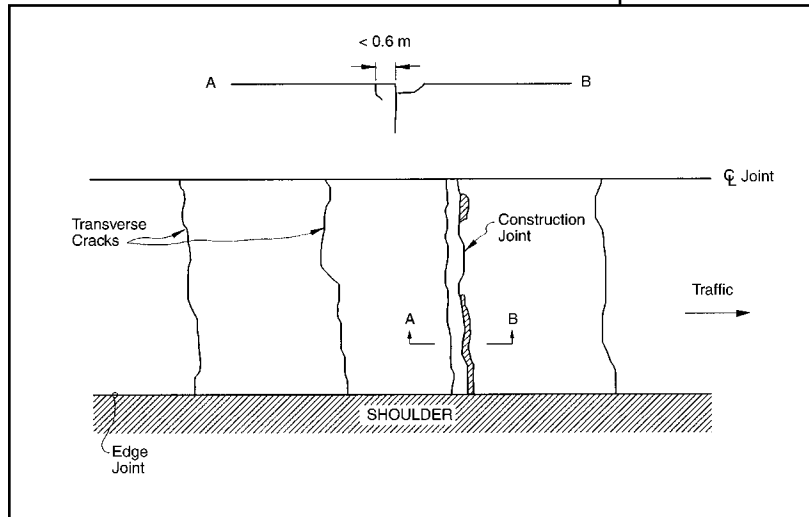


FIGURE 110
Distress Type CRCP 8—Transverse Construction Joint Deterioration



FIGURE 111
Distress Type CRCP 8—Low Severity
Transverse Construction Joint Deterioration



FIGURE 112
Distress Type CRCP 8—
Moderate Severity
Transverse Construction
Joint Deterioration



FIGURE 113
Distress Type CRCP 8—
Low Severity Transverse
Construction Joint
Deterioration

Miscellaneous
Distresses

9

LANE-TO-SHOULDER DROPOFF

Description

Difference in elevation between the edge of slab and outside shoulder; typically occurs when the outside shoulder settles.

Severity Levels

Not applicable. Severity levels could be defined by categorizing the measurements taken. A complete record of the measurements taken is much more desirable, however, because it is more accurate and repeatable than are severity levels.

How to Measure

Measure at the longitudinal construction joint between the lane edge and the shoulder.

Record in millimeters to the nearest millimeter at 15.25-m intervals along the lane-to-shoulder joint.

If the traveled surface is lower than the shoulder, record as a negative (-) value.

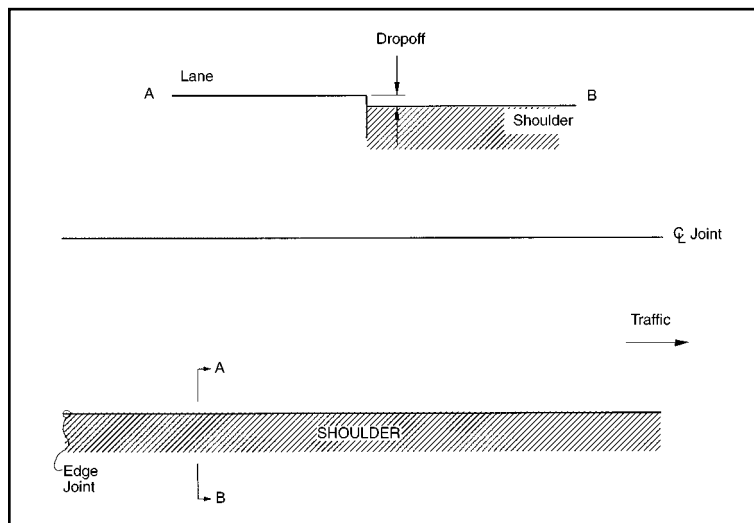


FIGURE 114
Distress Type CRCP 9—Lane-to-Shoulder Dropoff



FIGURE 115
Distress Type CRCP 9—Lane-to-Shoulder Dropoff

LANE-TO-SHOULDER SEPARATION

Description

Widening of the joint between the edge of the slab and the shoulder.

Severity Levels

Not applicable. Severity levels could be defined by categorizing the measurements taken. A complete record of the measurements taken is much more desirable, however, because it is more accurate and repeatable than are severity levels.

How to Measure

Record in millimeters to the nearest millimeter at intervals of 15.25 m along the lane-to-shoulder joint and indicate whether the joint is well-sealed (yes or no) at each location. Note: A null value ("N") should be recorded and entered into the database when the surveyor is unable to take a measurement due to an anomaly such as sealant or patch material.

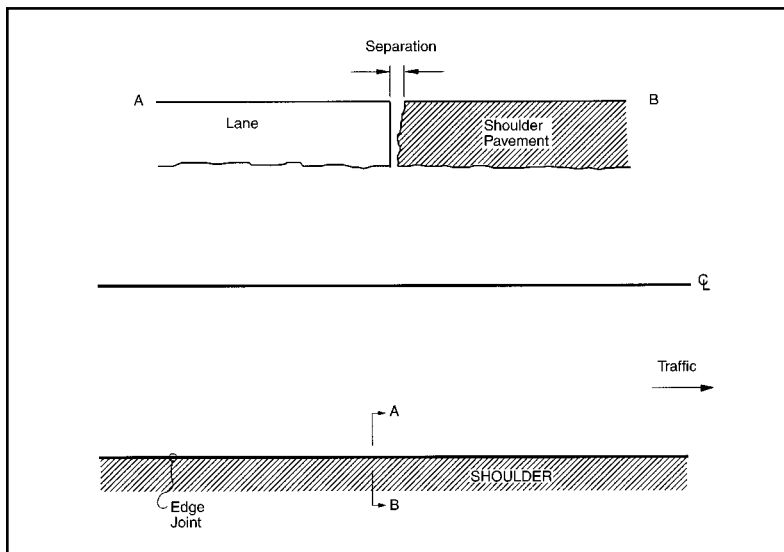


FIGURE 116
Distress Type CRCP 10—Lane-to-Shoulder Separation



FIGURE 117
Distress Type CRCP 10—Close-up View
of a Lane-to-Shoulder Separation

11

PATCH/PATCH DETERIORATION**Description**

A portion, greater than 0.1 m², or all of the original concrete slab that has been removed and replaced, or additional material applied to the pavement after original construction.

Severity Levels**LOW**

Patch has, at most, low severity distress of any type; and no measurable faulting or settlement; pumping is not evident.

MODERATE

Patch has moderate severity distress of any type; or faulting or settlement up to 6 mm; pumping is not evident.

HIGH

Patch has a high severity distress of any type; or faulting or settlement ≥ 6 mm; pumping may be evident.

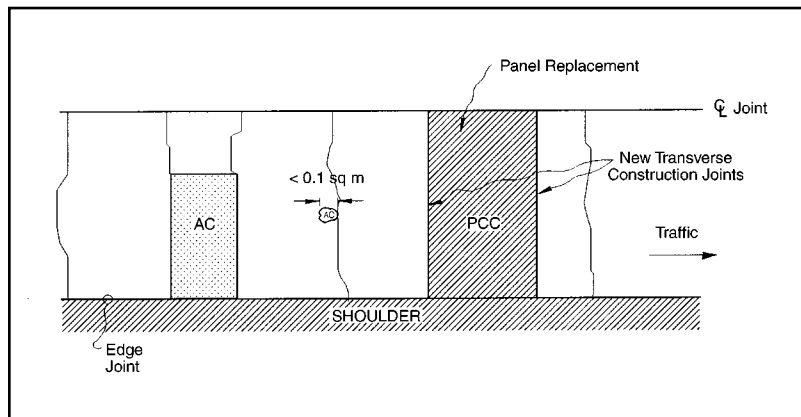


FIGURE 118
Distress Type CRCP 11—Patch/Patch Deterioration



FIGURE 119
Distress Type CRCP 11—Small, Low Severity Asphalt Concrete Patch

How to Measure

Record number of patches and square meters of affected surface area at each severity level, recorded separately by material type—rigid versus flexible.

Note: Panel replacement shall be rated as a patch. Any sawn joints shall be considered construction joints and rated separately. All patches are rated regardless of location.



FIGURE 120
Distress Type CRCP 11—Low Severity
Asphalt Concrete Patch



FIGURE 121
Distress Type CRCP 11—Moderate
Severity Asphalt Concrete Patch



FIGURE 122
Distress Type CRCP 11—Low Severity
Portland Cement Concrete Patch

**Miscellaneous
Distresses**

12

PUNCHOUTS

Description

The area enclosed by two closely spaced (usually < 0.6 m) transverse cracks, a short longitudinal crack, and the edge of the pavement or a longitudinal joint. Also includes “Y” cracks that exhibit spalling, breakup, or faulting.

Severity Levels

LOW

Longitudinal and transverse cracks are tight and may have spalling < 75 mm or faulting < 6 mm with no loss of material and no patching. Does not include “Y” cracks.

MODERATE

Spalling ≥ 75 mm and < 150 mm or faulting ≥ 6 mm and < 13 mm exists.

HIGH

Spalling ≥ 150 mm, or concrete within the punchout is punched down by ≥ 13 mm or is loose and moves under traffic or is broken into two or more pieces or contains patch material.

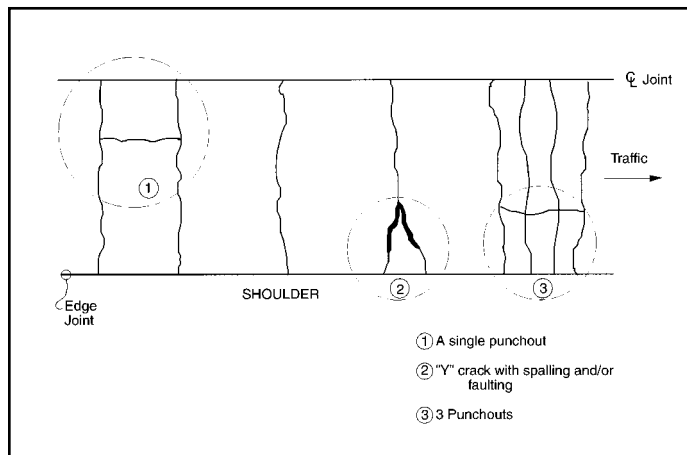


FIGURE 123
Distress Type CRCP 12—Punchouts



FIGURE 124
Distress Type CRCP 12—Low Severity
Punchout

How to Measure

Record number of punchouts at each severity level.

The cracks which outline the punchout are also recorded under “Longitudinal Cracking” (CRCP 2) and “Transverse Cracking” (CRCP 3).

Punchouts that have been repaired by completely removing all broken pieces and replacing them with patching material (rigid or flexible) should be rated as a patch. If the boundaries of the punchout are visible, then also rate as a high severity punchout.

Note: Areas between two transverse cracks spaced greater than 0.6 m but less than or equal to 1 m apart, and bounded by the edge of pavement (or longitudinal joint) and a longitudinal crack, are rated as punchouts if the cracks are exhibiting spalling, or the area is breaking up or faulting.



FIGURE 125
Distress Type CRCP 12—Moderate
Severity Punchout



FIGURE 126
Distress Type CRCP 12—High
Severity Punchout

Miscellaneous
Distresses

13

SPALLING OF LONGITUDINAL JOINTS**Description**

Cracking, breaking, chipping, or fraying of slab edges within 0.3 m of the longitudinal joint.

Severity Levels**LOW**

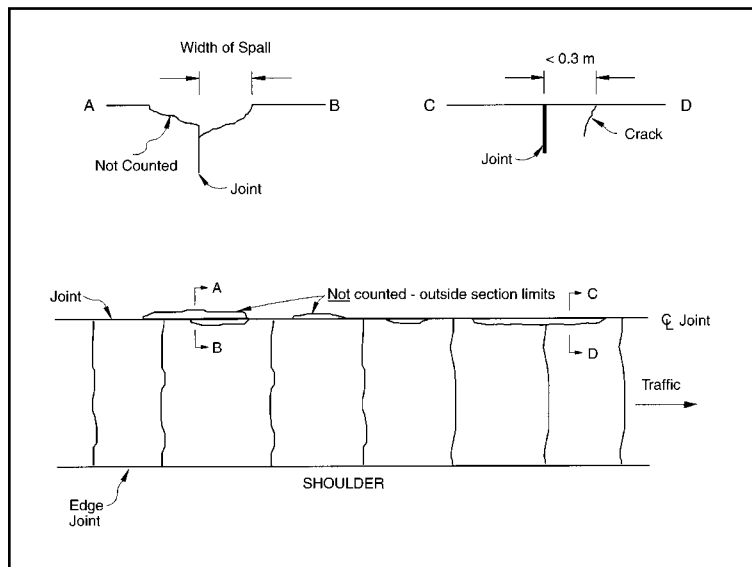
Spalls < 75 mm wide, measured to the face of the joint, with loss of material or spalls with no loss of material and no patching.

MODERATE

Spalls 75 mm to 150 mm wide, measured to the face of the joint, with loss of material.

HIGH

Spalls > 150 mm wide measured to the face of the joint, with loss of material or is broken into two or more pieces or contains patch material.

**FIGURE 127**

Distress Type CRCP 13—Spalling of Longitudinal Joints

How to Measure

Record length in meters of longitudinal joint spalling at each severity level. Only record spalls having a length of 0.1 m or more. Spalls that have been repaired by completely removing all broken pieces and replacing them with patching material (rigid or flexible) should be rated as a patch. If the boundaries of the spall are visible, then also rate as a high severity spall.

Note: All patches meeting size criteria are rated as patches.



FIGURE 128
Distress Type CRCP 13—Close-up View of Low Severity Spalling of a Longitudinal Joint



FIGURE 129
Distress Type CRCP 13—Low Severity Spalling of a Longitudinal Joint



FIGURE 130
Distress Type CRCP 13—Moderate Severity Spalling of a Longitudinal Joint

14

WATER BLEEDING AND PUMPING**Description**

Seeping or ejection of water from beneath the pavement through cracks or joints. In some cases detectable by deposits of fine material left on the pavement surface, which were eroded (pumped) from the support layers and have stained the surface.

Severity Levels

Not applicable. Severity levels are not used because the amount and degree of water bleeding and pumping changes with varying moisture conditions.

How to Measure

Record the number of occurrences of water bleeding and pumping and the length in meters of affected pavement with a minimum length of 1 m.

Note: The combined quantity of water bleeding and pumping cannot exceed the length of the test section.



FIGURE 131
Distress Type CRCP 14—Water
Bleeding and Pumping



FIGURE 132
Distress Type CRCP 14—Close-up View
of Water Bleeding and Pumping

LONGITUDINAL JOINT SEAL DAMAGE

15

Description

Joint seal damage is any condition that enables incompressible materials or a significant amount of water to infiltrate into the joint from the surface. Typical types of joint seal damage are:

Extrusion, hardening, adhesive failure (bonding), cohesive failure (splitting), or complete loss of sealant.

Intrusion of foreign material in the joint.

Weed growth in the joint.

Severity Levels

Not applicable.

How to Measure

Record number of longitudinal joints that are sealed (0, 1, 2). Record length of sealed longitudinal joints with joint seal damage as described above.

Individual occurrences are recorded only when at least 1 m in length.



FIGURE 133
Distress Type CRCP 15—Longitudinal
Joint Seal Damage

Miscellaneous
Distresses

ADHESIVE FAILURE

loss of bond (e.g., between the joint sealant and the joint reservoir; between the aggregate and the binder)

AGGREGATE INTERLOCK

interaction of aggregate particles across cracks and joints to transfer load

APPROACH SLAB

section of pavement just prior to joint, crack, or other significant roadway feature relative to the direction of traffic (see also leave slab)

BINDER

brown or black adhesive material used to hold stones together for paving

BITUMINOUS

like or from asphalt

BLEEDING

identified by a film of bituminous material on the pavement surface that creates a shiny, glass-like, reflective surface that may be tacky to the touch in warm weather

BLOCK CRACKING

the occurrence of cracks that divide the asphalt surface into approximately rectangular pieces, typically 0.1 m² or more in size

BLOWUP

the result of localized upward movement or shattering of a slab along a transverse joint or crack

CENTERLINE

the painted line separating traffic lanes

CHIPPING

breaking or cutting off small pieces from the surface

COHESIVE FAILURE

the loss of a material's ability to bond to itself. Results in the material splitting or tearing apart from itself (i.e., joint sealant splitting)

CONSTRUCTION JOINT

the point at which work is concluded and reinitiated when building a pavement

CORNER BREAK

a portion of a jointed concrete pavement separated from the slab by a diagonal crack intersecting the transverse and longitudinal joint, which extends down through the slab, allowing the corner to move independently from the rest of the slab

DURABILITY CRACKING

the breakup of concrete due to freeze-thaw expansive pressures within certain aggregates. Also called "D" cracking

EDGE CRACKING

fracture and materials loss in pavements without paved shoulders which occurs along the pavement perimeter. Caused by soil movement beneath the pavement

EXTRUSION

to be forced out (i.e., joint sealant from joint)

FATIGUE CRACKING

a series of small, jagged, interconnecting cracks caused by failure of the AC surface under repeated traffic loading (also called alligator cracking)

FAULT

difference in elevation between opposing sides of a joint or crack

FREE EDGE

pavement border that is able to move freely

HAIRLINE CRACK

a fracture that is very narrow in width, less than 3 mm

JOINT SEAL DAMAGE

any distress associated with the joint sealant, or lack of joint sealant

LANE LINE

boundary between travel lanes, usually a painted stripe



Glossary

LANE-TO-SHOULDER DROPOFF

the difference in elevation between the traffic lane and shoulder

LANE-TO-SHOULDER SEPARATION

widening of the joint between the traffic lane and the shoulder

LEAVE SLAB

section of pavement just past a joint, crack, or other significant roadway feature relative to the direction of traffic

LONGITUDINAL

parallel to the centerline of the pavement

MAP CRACKING

a series of interconnected hairline cracks in PCC pavements that extend only into the upper surface of the concrete. Includes cracking typically associated with alkali-silica reactivity

PATCH

an area where the pavement has been removed and replaced with a new material

PATCH DETERIORATION

distress occurring within a previously repaired area

POLISHED AGGREGATE

surface mortar and texturing worn away to expose coarse aggregate in the concrete

POPOUTS

small pieces of pavement broken loose from the surface

POTHOLE

a bowl-shaped depression in the pavement surface

PUMPING

the ejection of water and fine materials through cracks in the pavement under moving loads

PUNCHOUT

a localized area of a CRCP bounded by two transverse cracks and a longitudinal crack. Aggregate interlock decreases over time and eventually is lost, leading to steel rupture and allowing the pieces to be punched down into the subbase and subgrade

RAVELING

the wearing away of the pavement surface caused by the dislodging of aggregate particles

REFLECTION CRACKING

the fracture of AC above joints in the underlying jointed concrete pavement layer(s)

RUTTING

longitudinal surface depressions in the wheelpaths

SCALING

the deterioration of the upper 3-12 mm of the concrete surface, resulting in the loss of surface mortar

SHOVING

permanent, longitudinal displacement of a localized area of the pavement surface caused by traffic pushing against the pavement

SPALLING

cracking, breaking, chipping, or fraying of the concrete slab surface within 0.6 m of a joint or crack

TRANSVERSE

perpendicular to the pavement centerline

WATER BLEEDING

seepage of water from joints or cracks

WEATHERING

the wearing away of the pavement surface caused by the loss of asphalt binder

Distressed Pavements Identification Quiz

1. Which of the following is not a category of asphalt concrete-surface pavement distress?

- Fatigue defects
- Surface deformation
- Surface defects
- Miscellaneous distresses

2. Which of the following is a type of cracking?

- Block
- Transverse
- Fatigue
- All of the above

3. This type of cracking occurs when there is a pattern of cracks dividing the pavement into approximately rectangular pieces.

- Block cracking
- Fatigue cracking
- Longitudinal
- Edge

4. This type of cracking occurs when there are cracks predominantly perpendicular to the pavement centerline.

- Block
- Transverse
- Reflection
- Fatigue

Distressed Pavements Identification Quiz

5. What severity level is a 33 mm deep pothole?

- Moderate
- Low
- High
- It must be 150 mm deep to be considered a pothole

6. What is a longitudinal surface depression in the wheel path?

- A rut
- Shoving
- Bleeding
- Raveling

7. What typically occurs when the outside shoulder settles as a result of pavement layer material differences?

- Water bleeding
- Lane to shoulder drop off
- Water pumping
- None of the above

8. Which of the following is a distress category for jointed Portland cement concrete-surfaced pavements?

- Edge cracking
- Block cracking
- Fatigue cracking
- Joint deficiencies

Distressed Pavements Identification Quiz

9. What type of cracking is described by closely spaced crescent-shaped hairline patterns?

- Durability cracking
- Corner breaks
- Longitudinal cracking
- Transverse cracking

10. Spalling of longitudinal or transverse joints is any cracking or breaking within:

- .3 m
- .5 m
- .7 m
- .9 m

11. What is it called when you have small pieces of pavement broken loose from the surface?

- Pop outs
- Edge cracking
- Polished aggregate
- Blow ups

12. A "Y" crack is considered a:

- Pop out
- Punch out
- Blow up
- Scaling

13. True or False. Cohesive failure is the loss of a material's ability to bond to itself.

- True
- False

Distressed Pavements Identification Quiz

14. Which of the following equipment is necessary for performing field distress surveys of any pavement surface type?

- Pencil
- Pavement thermometer
- Faultmeter, calibration stand and manual for PCC test sections
- All of the above

15. The distress types and severity levels should be identified by using the:

- Longitudinal profile equipment
- Digital camera
- Data Sheet Map
- Distress Identification Manual