

APPENDIX C

Description of Distresses in Jointed Reinforced Concrete or Jointed Concrete Pavements (JRC/JC Pavements)

JRC/JC PAVEMENT

Distress Type: **Surface Deterioration**

Description: Disintegration or loss of concrete from the surface of the pavement. Includes scaling and abrasion. Scaling is the flaking away of the concrete surface. Abrasion is similar to scaling in that a loss of fine, surface aggregate occurs. Abrasion is usually a result of weathering and traffic wear and is normally confined to the wheel track area.

Severity Level: **Low--** Aggregate visible.

Medium-- Surface has an open texture and is moderately rough with considerable loss of fine aggregate and some coarse aggregate removed.

High-- Surface rough or pitted.

Extent Level: **Occasional--** Less than 20 percent of the surface area.

Frequent-- 20 to 50 percent of the surface area.

Extensive-- Equal to or greater than 50 percent of the surface area. This level includes continuous distress in both wheel tracks.



Photo C-1. Surface Deterioration in Jointed Concrete Pavement, Medium Severity

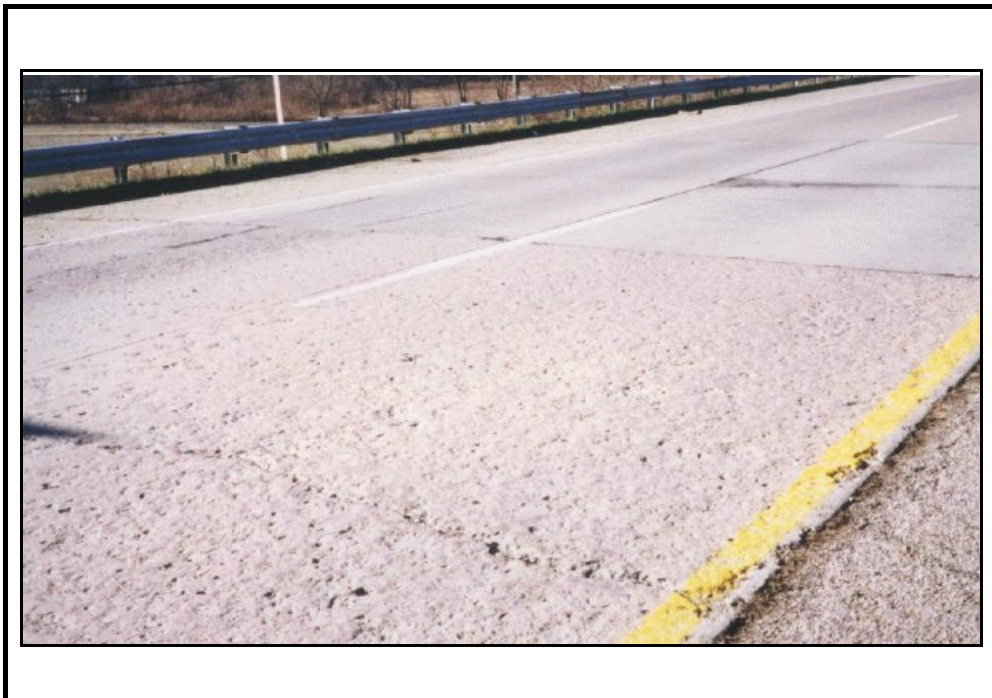


Photo C-2. Surface Deterioration in Jointed Concrete Pavement, High Severity

JRC/JC PAVEMENT

Distress Type: Popouts

Description: Cone shaped holes in the pavement surface with aggregates at the bottom and unrelated to joint or crack spalling. Aggregate quality is related to this type of distress. Popouts usually range from 25 to 100 mm (1 to 4 inches) in diameter and from 13 to 50 mm (½ to 2 inches) in depth.

Severity Level: Severity levels are not considered.

Extent Level: Occasional-- Less than 20 percent of the area is affected.

Frequent-- 20 to 50 percent of the area is affected.

Extensive-- More than 50 percent of the area is affected.

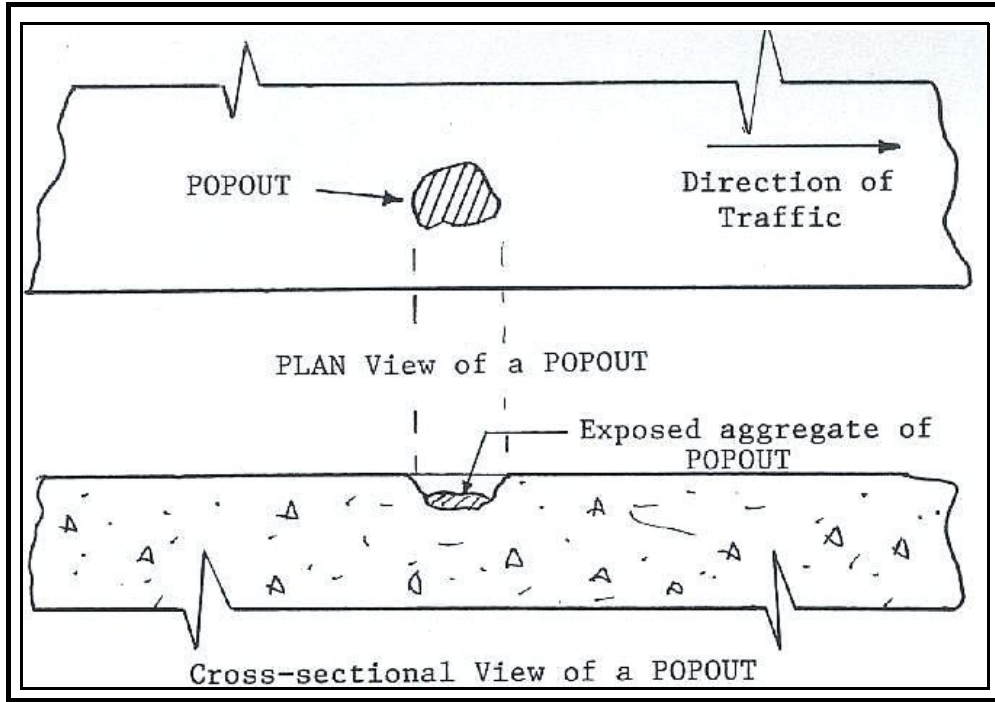


Photo C-3. Popout in a Concrete Pavement, Plan and Cross-sectional Views



Photo C-4. Popouts in a Jointed Concrete Pavement

JRC/JC PAVEMENT

Distress Type: Patching

Description: Patching is either the placing of additional material on the surface of the existing pavement or the replacement of existing pavement in isolated areas.

Deductions shall be made for all patches present in the pavement which are made with asphalt concrete material and are the result of deterioration and/or maintenance since the last construction project.

No deductions shall be made for existing patches which consist of sound concrete. Where deterioration exists with a concrete repair, the deterioration shall be rated as part of the pavement.

Multiple patches found along a transverse joint or crack which do not interconnect shall be added together to represent the size of one patch.

Multiple patches found along a longitudinal joint or crack which do not interconnect, but are within the same slab, shall be added together to represent the size of one patch.

Severity Level: Low-- Patch size $< 0.1 \text{ m}^2$ (1 sq. ft.), and patches are not deteriorated.

Medium-- Patch size $< 0.1 \text{ m}^2$ (1 sq. ft.), with deterioration present.

High-- Patch size $> 0.1 \text{ m}^2$ (1 sq. ft.), regardless of deterioration.

Extent Level: Occasional-- < 10 patches/1.6 km (per mile).

Frequent-- 10 to 20 patches/1.6 km (per mile).

Extensive-- > 20 patches/1.6 km (per mile).



Photo C-5. Patching in Jointed Concrete Pavement, Low Severity



Photo C-6. Patching in Jointed Concrete Pavement, High Severity

JRC/JC PAVEMENT

Distress Type: **Pumping**

Description: Pumping is the ejection of fine soil particles through pavement cracks, joints, or along pavement edges. Pumping can be identified by the presence of surface staining and base or subgrade material near joints or cracks. Shoulder disintegration at the pavement edge is often an indicator of pumping beneath the slab.

Severity Level: Severity is based upon the rater's degree of certainty that pumping is occurring as indicated by visual evidence.

L & M-- Some staining of the surface around cracks or joints is noted. Rater is quite certain that pumping exists.

High-- Clear evidence that pumping exists. Excessive staining, medium severity or greater, faulting, corner breaks or punchouts. Rater is quite certain that pumping exists.

Extent Level: **Occasional--** Less than 10 of the joints and cracks exhibit pumping.

Frequent-- 10 to 25 percent of the joints and cracks exhibit pumping.

Extensive-- More than 25 percent of the joints and cracks exhibit pumping.

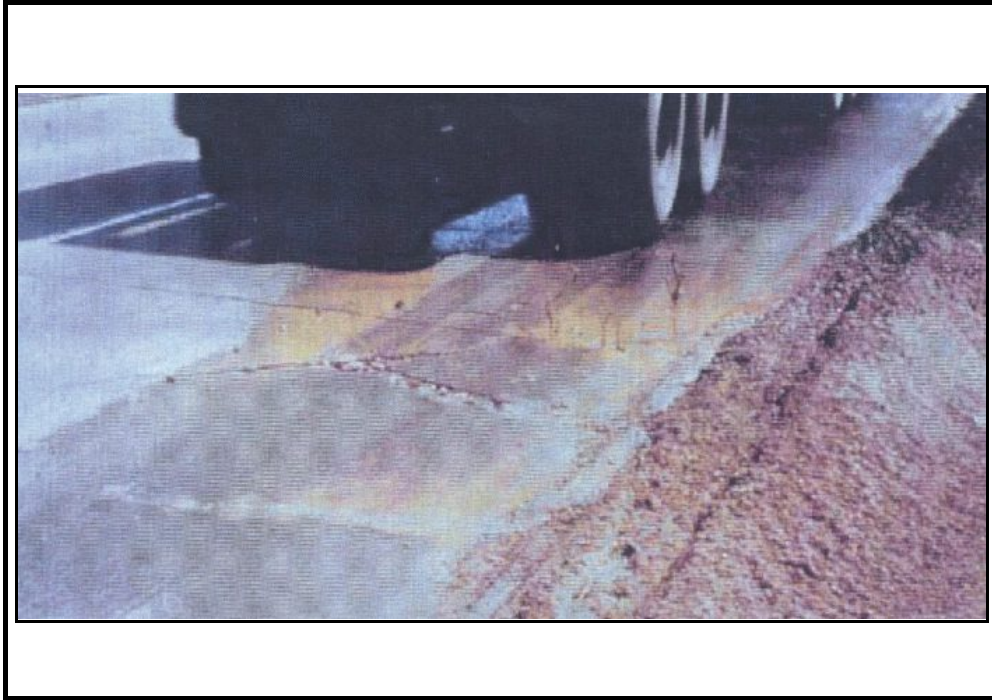


Photo C-7. Pumping in Jointed Concrete Pavement, High Severity



Photo C-8. Pumping in Jointed Concrete Pavement, Low Severity

JRC/JC PAVEMENT

Distress Type: **Faulting**

Description: Faulting is the difference in elevation between abutting slabs at transverse joints or cracks. Faulting is usually caused by a pumping action of underlying fine grained materials, settlement of soft subgrade, or from curling or warping of slabs due to temperature and moisture gradients.

Note: If transverse cracks are faulted, write the letter "C" on the rating form. If both cracks and joints are faulted, write the letter "B". Otherwise, faulting indicates only joints.

Severity Level: **Low--** Less than 6 mm (1/4 inch) fault.

Medium— 6 mm to 13 mm (1/4 to 1/2 inch) fault.

High-- Greater than 13 mm (1/2 inch) fault.

Extent Level: **Occasional--** Faulting occurs along less than 20 percent of the joints and cracks.

Frequent-- Faulting occurs along 20 to 50 percent of the joints and cracks.

Extensive-- More than 50 percent of the joints and cracks are faulted.

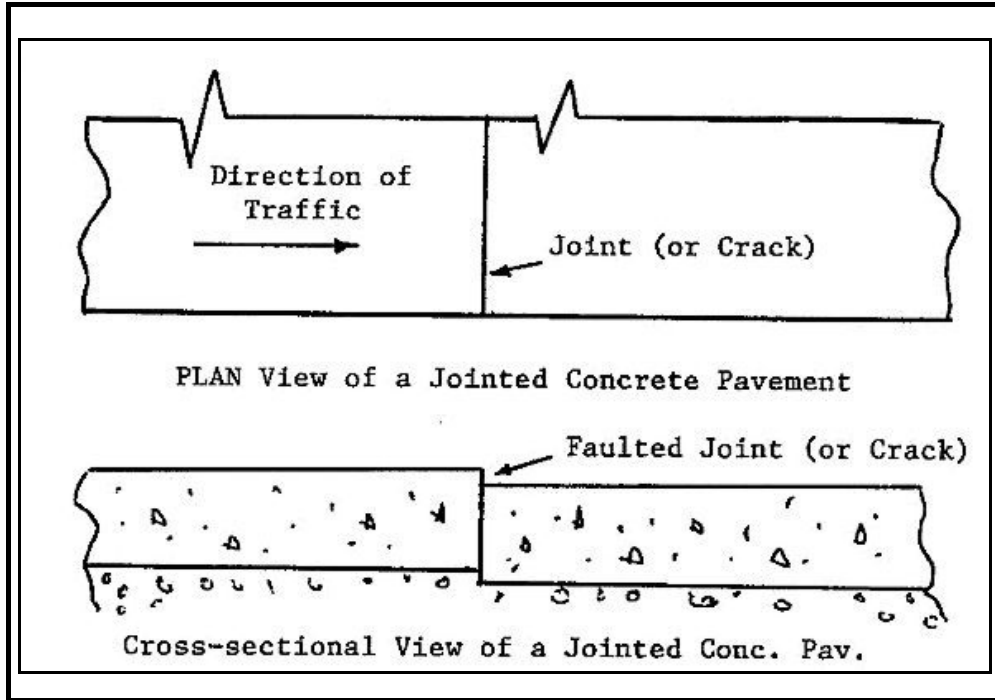


Photo C-9. Sketch showing Faulting in Jointed Concrete Pavement



Photo C-10. Faulting in Jointed Concrete Pavement

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Distress Type:	Settlement
Description:	Settlement is a dip or depression in the longitudinal profile of the pavement surface. Settlement should be considered a distress when it causes a noticeable effect upon riding quality.
Severity Level:	Severity is based upon the effect of the settlement or waves upon ride quality and vehicle control when traveling along the roadway at 60 km/hour (40 MPH, step 1 of the monitoring procedure).
	Low-- Noticeable effect upon ride, driver able to maintain vehicle control easily.
	Medium-- Some discomfort to passengers, driver able to maintain control with slight corrective action.
	High-- Definite effect upon ride quality. Noticeable profile dips in settlement areas greater than 150 mm (6 inches). Waves cause rocking of vehicle similar to motion created at moderately faulted jointed crack pavements.
Extent Level:	Occasional-- Less than 2 settlement/1.6 km (per mile) of roadway.
	Frequent-- 2 to 4 settlement areas/1.6 km (per mile) of roadway.
	Extensive-- More than 4 settlements/1.6 km (per mile) of roadway.



Photo C-11. Settlements in Jointed Concrete Pavement, Medium Severity

JRC/JC PAVEMENT

Distress Type: Transverse Joint Spalling

Description: Joint spalling is the break up or disintegration of the concrete at longitudinal or transverse pavement joints. A spall normally does not extend vertically through the slab but rather intersects the joint at an angle. Often joint spalling is the result of durability ("D") cracking of the pavement. The rater is asked to indicate on the rating form if the joint spalling is a result of "D" cracking. Durability ("D") cracking is a series of fine crescent-shaped cracks in the concrete surface which usually runs parallel to a joint or major crack and curve across slab corners. Cracking pattern is normally concave in relation to slab corners or joints. D-cracking can eventually lead to disintegration and spalling of the concrete near the joints or corners of the slab.

Severity Level: Low-- Spalls less than 100 mm (4 inches) wide, measured to the center of the joint, with loss of material, or spalls with no loss of material and no patching.

Medium-- spalls 100 mm to 225 mm (4 to 9 inches) wide, measured to the center of the joint, with loss of material.

High-- Spalls greater than 225 mm (9 inches) wide, measured to the center of the joint, with loss of material.

Extent Level: Occasional-- Less than 25 percent of the transverse joints are spalled.

Frequent-- 25 to 75 percent of the transverse joints are spalled.

Extensive-- More than 75 percent of the transverse joints are spalled.



Photo C-12. Transverse Joint Spalling in Jointed Concrete Pavement, Low Severity



Photo C-13. Transverse Joint Spalling in Jointed Concrete Pavement, High Severity

JRC/JC PAVEMENT

Distress Type: **Joint Sealant Damage**

Description: Joint sealant damage is any deterioration of the sealant which permits water or incompressibles to enter the joint. Damage includes disintegration, removal, pull out, hardening or debonding of the joint material from the adjoining slab edge.

Severity Level: Severity levels are not considered for this distress.

Extent Level: **Occasional--** Less than 20 percent of the joints are not effectively sealed.

Frequent-- 20 and 50 percent of the joints are not effectively sealed.

Extensive-- Greater than 50 percent of the joints are not effectively sealed.



Photo C-14. Joint Sealant Damage in Jointed Concrete Pavement



Photo C-15. Joint Sealant Damage in Jointed Concrete Pavement

JRC/JC PAVEMENT

Distress Type: Pressure Damage

Description: Pressure damage may be spalling, crushing, or upheaval at transverse joints or cracks resulting from expansion of the concrete layer. Pressure induced spalling is differentiated from other joint spalling by the shape of the spalled area. Pressure spalls are usually 150 to 300 mm (6 to 12 inches) long measured from the crack or joint and up to 300 mm (12 inches) wide.

Severity Level: Separate severity levels for pressure damage spalling are not defined. All pressure damage spalling is considered severe since this distress may be a predictor or more serious pressure distress (blow ups).

Extent Level: Extent is based upon the number of transverse joints which exhibit pressure damage spalling.

Occasional-- Less than 1/1.6 km (per mile).

Frequent-- Between 1 and 3/1.6 km (per mile).

Extensive-- More than 3/1.6 km (per mile).



Photo C-16. Pressure Damage in Jointed Concrete Pavement



Photo C-17. Pressure Damage in Jointed Concrete Pavement

JRC/JC PAVEMENT

Distress Type: Transverse Cracking

Description: A crack or break at approximately right angles to the pavement centerline. Some transverse cracks (hairline shrinkage cracks) are expected in reinforced concrete pavements which have large transverse joint spacing. Additional transverse cracking could be caused by repeated heavy traffic loading, thermal and moisture gradients and subgrade settlement or consolidation.

Severity Level:

Low--	Hairline or tight with little crack spalling.
Medium--	Crack opened or spalled at the surface to a width of 6 mm to 25 mm (1/4 inch to 1 inch) over a distance equal to at least one-half the crack length.
High--	Crack opened or spalled at the surface to a width greater than 25 mm (1 inch) over a distance equal to at least one-half the crack length.

Extent Level: Extent level is based upon average crack spacing (CS) between intermediate transverse cracks as given by the following expression:

$$CS = L / (Z + 1)$$

where:

CS	= average crack spacing, m (ft),
Z	= average number of transverse cracks per panel, and
L	= transverse joint spacing, m (ft).

Average CS is based upon step 2 observations.

Occasional-- CS > 4.5 m (15 ft).

Frequent-- 3 m (10 ft) < CS < 4.5 m (15 ft).

Extensive-- CS < 3 m (10 ft).



**Photo C-18. Transverse Cracking in Jointed Concrete Pavement,
Low Severity**



**Photo C-19. Transverse Cracking in Jointed Concrete Pavement,
High Severity**

JRC/JC PAVEMENT

Distress Type:	Longitudinal Cracking
Description:	A crack or break approximately parallel to the pavement centerline. This type of cracking is usually associated with subgrade settlement or insufficient bearing support.
Severity Level:	Low-- Hairline or tight cracks with little crack spalling.
	Medium-- Crack opened or spall at the surface to a width of 6 mm to 25 mm (1/4 inch to 1 inch) over a distance equal to at least one-half the crack length.
	High-- Crack opened or spalled at the surface to a width greater than 25 mm (1 inch) over a distance equal to at least one-half the crack length.
Extent Level:	Occasional-- Less than 5 percent of the slabs have longitudinal cracking.
	Frequent-- Between 5 and 20 percent of the slabs have longitudinal cracking.
	Extensive-- More than 20 percent of the slabs have longitudinal cracking.



Photo C-20. Longitudinal Cracking in Jointed Concrete Pavement, Medium Severity

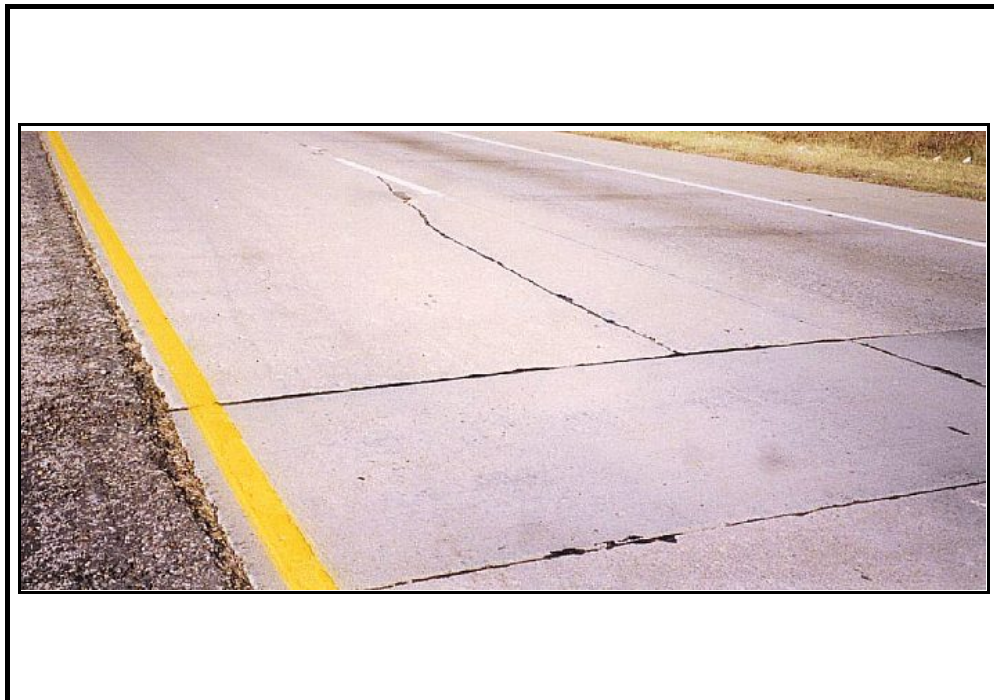


Photo C-21. Longitudinal Cracking in Jointed Concrete Pavement, Medium Severity

JRC/JC PAVEMENT

Distress Type: **Corner Breaks**

Description: A corner break is a crack that intersects transverse joints or cracks and a longitudinal edge diagonally. The leg size of the triangular break is usually greater than 300 mm (12 inches). Corner breaks can be differentiated from spalling by: (1) corner breaks extend vertically through the entire slab whereas spalls are only partial depth cracks, and (2) the triangle formed by a corner break is usually much larger than that of a spall.

Severity Level: **Low--** Crack width less than 6 mm (1/4 inch) with no spalling or settlement of the broken area.

Medium-- Crack width between 6 mm to 25 mm (1/4 inch to 1 inch) with some spalling and minor settlement of the broken area.

High-- Crack width greater than 25 mm (1 inch) and/or much spalling and settlement of the broken area. High severity may also be identified by shattering of the broken area by formation of smaller pieces within the corner break area.

Extent Level: **Occasional--** Less than 4 corner breaks/1.6 km (per mile).

Frequent-- 4 and 10 corner breaks/1.6 km (per mile).

Extensive-- More than 10 corner breaks/1.6 km (per mile).



**Photo C-22. Corner Break in Jointed Concrete Pavement,
Medium Severity**



Photo C-23. Corner Breaks in Jointed Concrete Pavement, High Severity