APPENDIX C

Description of Distresses in Jointed Reinforced Concrete or Jointed Plain Concrete Pavements (JRC/JPC Pavements)
JRC/JPC PAVEMENT

Distress Type: Surface Deterioration

Description: Disintegration or loss of concrete from the surface of the pavement, includes scaling, abrasion, popouts, and high steel. 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. Popouts are cone shaped holes in the pavement surface with aggregates at the bottom and are unrelated to joint or crack spalling. High Steel is found in locations where the steel reinforcing mat was misplaced in the upper 2" of the slab. Rusting of the high steel creates spalling in the slab directly above the high steel, usually exposing the steel to traffic and weather. Map cracking should be rated as part of surface deterioration.

Severity Level: Low-- Very little aggregate is visible, or some popouts, or high steel.

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 affected; less than 2 high steel/mile (per 1.6km) if high steel is the only deterioration present.

Frequent-- Between 20 to 50 percent of the surface area affected; between 2 and 4 high steel/mile (per 1.6km) if high steel is the only deterioration present.

Extensive-- Equal to or greater than 50 percent of the surface area affected (this level includes continuous distress in both wheel tracks); greater than 4 high steel/mile (per 1.6km) if high steel is the only deterioration present.
Photo C-1. Surface Deterioration in Jointed Concrete Pavement, Medium Severity

Photo C-2. Surface Deterioration in Jointed Concrete Pavement, Popouts and High Steel
**JRC/JPC PAVEMENT**

**Distress Type:** Longitudinal Joint Spalling

**Description:** Longitudinal Joint Spalling is the cracking, breaking, chipping, or fraying of the concrete surface along the “as constructed” longitudinal joint.

**Severity Level:**
- **Low--** Total crack width less than 3 inches.
- **Medium--** Total crack width greater than 3 inches, less than 6 inches.
- **High--** Total crack width greater than 6 inches.

**Extent Level:**
- **Occasional--** Less than 10 percent of section length affected by distress.
- **Frequent--** Between 10 and 30 percent of section length affected by distress.
- **Extensive--** Greater than 30 percent of section length affected by distress.
Photo C-3. Longitudinal Joint Spalling in Concrete Pavement, High Severity
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 < 1 sq. ft (0.1 m²), and patches are not deteriorated.

Medium-- Patch size < 1 sq. ft (0.1 m²), with deterioration present.

High-- Patch size > 1 sq. ft (0.1 m²), regardless of deterioration.

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

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

Extensive-- Greater than 20 patches/per mile (1.6 km).
Photo C-4. Patching in Jointed Concrete Pavement, Low Severity

Photo C-5. Patching in Jointed Concrete Pavement, High Severity
**JRC/JPC 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 levels are not considered. Rater must be certain of pumping.

**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-- Greater than 25 percent of the joints and cracks exhibit pumping.
Photo C-6. Pumping in Jointed Concrete Pavement, High Severity

Photo C-7. Pumping in Jointed Concrete Pavement, Low Severity
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 1/4 inch (6 mm) fault.
               Medium— 1/4 to ½ inch (6 mm to 13 mm) fault.
               High-- Greater than ½ inch (13 mm) 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-- Greater than 50 percent of the joints and cracks are faulted.
Photo C-8. Sketch showing Faulting in Jointed Concrete Pavement

Photo C-9. Faulting in Jointed Concrete Pavement
JRC/JPC PAVEMENT

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 40 MPH (60 km/hour, 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 6 inches (150 mm). Waves cause rocking of vehicle similar to motion created at moderately faulted jointed crack pavements.

Extent Level: Occasional-- Less than 2 settlement/mile (per 1.6 km) of roadway.

Frequent-- 2 to 4 settlement areas/mile (per 1.6 km) of roadway.

Extensive-- Greater than 4 settlements/mile (per 1.6 km) of roadway.
Photo C-10. Settlements in Jointed Concrete Pavement, Medium Severity
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 4 inches (100 mm) wide, measured to the center of the joint, with loss of material, or spalls with no loss of material and no patching.

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

High-- Spalls greater than 9 inches (225 mm) 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-- Between 25 and 75 percent of the transverse joints are spalled.

Extensive-- More than 75 percent of the transverse joints are spalled.
Photo C-11. Transverse Joint Spalling in Jointed Concrete Pavement, Low Severity

Photo C-12. Transverse Joint Spalling in Jointed Concrete Pavement, High Severity
**JRC/JPC PAVEMENT**

<table>
<thead>
<tr>
<th>Distress Type:</th>
<th>Transverse Cracking - Plain Concrete  (Joint Spacing #20 ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>A crack or break at approximately right angles to the pavement centerline. Transverse cracking could be caused by repeated heavy traffic loading, thermal and moisture gradients and subgrade settlement or consolidation.</td>
</tr>
<tr>
<td></td>
<td>If various crack widths are observed, rate the severity of the crack width that is most frequently observed. The severity rated indicates that the observed cracks are of the severity’s specified width or wider for more than ½ of the length of the crack.</td>
</tr>
<tr>
<td></td>
<td>Cracks that do not extend the full lane width should not be rated.</td>
</tr>
<tr>
<td>Severity Level:</td>
<td>Low-- Hairline crack.</td>
</tr>
<tr>
<td></td>
<td>Medium-- Crack width is larger than hairline, but less than 3/16 inches.</td>
</tr>
<tr>
<td></td>
<td>High-- Crack width is greater than 3/16 inch.</td>
</tr>
<tr>
<td>Extent Level:</td>
<td>Occasional-- Less than 10 percent of the slabs are cracked at any severity.</td>
</tr>
<tr>
<td></td>
<td>Frequent-- Between 10 and 30 percent of the slabs are cracked at any severity.</td>
</tr>
<tr>
<td></td>
<td>Extensive-- Greater than 30 percent of the slabs are cracked at any severity.</td>
</tr>
</tbody>
</table>
Photo C-13. Transverse Cracking - Plain Concrete in Jointed Concrete Pavement, Medium Severity
JRC/JPC 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 6 to 12 inches (150 to 300 mm) long measured from the crack or joint and up to 12 inches (300 mm) 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 of a 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/mile (per 1.6 km).
- Frequent-- Between 1 and 3/mile (per 1.6 km).
- Extensive-- More than 3/mile (per 1.6 km).
Photo C-14. Pressure Damage in Jointed Concrete Pavement

Photo C-15. Pressure Damage in Jointed Concrete Pavement
JRC/JPC PAVEMENT

Distress Type:  Transverse Cracking - Reinforced Concrete (Joint Spacing > 20 ft)

Description: A crack or break at approximately right angles to the pavement centerline. Transverse cracks (hairline cracks) are expected in reinforced concrete pavements which have long transverse joint spacing. Additional transverse cracking could be caused by repeated heavy traffic loading, thermal and moisture gradients and subgrade settlement or consolidation. For reinforced concrete pavement, a failed crack is one that has a width greater than 3/16 inches for more than 1/4 of its length.

Cracks that do not extend the full lane width should not be rated.

Severity Level:  

Low-- Full lane width cracks exist, however, none are failed cracks.

Medium-- 1 failed crack exists.

High-- More than one failed crack exists.

Extent Level:  Use the following table to determine the extent levels:

<table>
<thead>
<tr>
<th>Severity Level</th>
<th>Extent Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Occasional</td>
</tr>
<tr>
<td>Low</td>
<td>&lt; 25% of slabs</td>
</tr>
<tr>
<td>Medium</td>
<td>5 to 10% of slabs</td>
</tr>
<tr>
<td>High</td>
<td>5 to 10% of slabs</td>
</tr>
</tbody>
</table>
Photo C-16. Transverse Cracking in Jointed Concrete Pavement, Low Severity

Photo C-17. Transverse Cracking in Jointed Concrete Pavement, High Severity
# JRC/JPC PAVEMENT

<table>
<thead>
<tr>
<th>Distress Type:</th>
<th>Longitudinal Cracking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>A crack or break approximately parallel to the pavement centerline. This type of cracking is usually associated with subgrade settlement or insufficient bearing support.</td>
</tr>
<tr>
<td><strong>Severity Level:</strong></td>
<td></td>
</tr>
<tr>
<td>Low--</td>
<td>Hairline or tight cracks with little crack spalling.</td>
</tr>
<tr>
<td>Medium--</td>
<td>Crack opened or spall at the surface to a width of 1/4 inch to 1 inch (6 mm to 25 mm) over a distance equal to at least one-half the crack length.</td>
</tr>
<tr>
<td>High--</td>
<td>Crack opened or spalled at the surface to a width greater than 1 inch (25 mm) over a distance equal to at least one-half the crack length.</td>
</tr>
<tr>
<td><strong>Extent Level:</strong></td>
<td></td>
</tr>
<tr>
<td>Occasional--</td>
<td>Less than 5 percent of the slabs have longitudinal cracking.</td>
</tr>
<tr>
<td>Frequent--</td>
<td>Between 5 and 20 percent of the slabs have longitudinal cracking.</td>
</tr>
<tr>
<td>Extensive--</td>
<td>More than 20 percent of the slabs have longitudinal cracking.</td>
</tr>
</tbody>
</table>
Photo C-18. Longitudinal Cracking in Jointed Concrete Pavement, Medium Severity

Photo C-19. Longitudinal Cracking in Jointed Concrete Pavement, Medium Severity
Distress Type: Corner Breaks

Description: A corner break is a crack that intersects transverse joints or cracks and a longitudinal edge diagonally. To be considered a corner break, the leg size of the triangular break must be greater than 12 inches (300 mm). Where the leg size is less than 12 inches (300 mm), the distress shall be rated as longitudinal joint spalling.

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

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

High-- Crack width greater than 1 inch (25 mm) 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/mile (per 1.6 km).

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

Extensive-- More than 10/mile (per 1.6 km).
Photo C-20. Corner Break in Jointed Concrete Pavement, Medium Severity

Photo C-21. Corner Breaks in Jointed Concrete Pavement, High Severity