

APPENDIX B

Description of Distresses in Composite Pavements

**[Composite Pavements have rigid bases (concrete or brick)
and asphaltic surfaces]**

COMPOSITE PAVEMENT

Distress Type:	Raveling
Description:	Disintegration of the pavement from the surface downward due to the loss of aggregate particles. Raveling may occur as a result of asphalt binder aging, poor mixture quality segregation, or insufficient compaction.
Severity Level:	Low-- very little coarse aggregate has worn away. Loss of fine aggregate. Coarse aggregate exposed. Medium-- surface has an open texture and is moderately rough with considerable loss of fine aggregate and some coarse aggregate removed. High-- most of the surface aggregate has worn away or become dislodged. Surface is severely rough and pitted and may be completely removed in places.
Extent Level:	Occasional-- less than 20 percent of the surface area is raveling. Frequent-- between 20 and 50 percent of the surface area is raveling. Extensive-- more than 50 percent of the surface area is raveling.



Photo B-1. Raveling in Composite Pavement, Medium Severity



Photo B-2. Raveling in Composite Pavement, High Severity

COMPOSITE PAVEMENT

Distress Type:	Bleeding
Description:	Bleeding or flushing is the presence of free asphalt binder on the pavement surface. Bleeding is caused by an excess amount of bituminous binder in the mixture and/or low air void content.
Severity Level:	Only 2 severity levels are defined. Medium-- both coarse aggregate and free bitumen are noticeable at the pavement surface. High-- surface appears black with very little aggregate noticeable.
Extent Level:	Occasional-- less than 10 percent of the length exhibits bleeding. Frequent-- between 10 and 30 percent of the length is bleeding. Extensive-- bleeding occurs in more than 30 percent of the length.



Photo B-3. Bleeding, High Severity



Photo B-4. Close-up view of Bleeding, High and Medium Severity
High Severity on left shows most aggregates covered with asphalt and Medium Severity
on right shows less aggregates covered with asphalt

COMPOSITE PAVEMENT

Distress Type: Patching

Description: Patching is either the placing of asphalt concrete on the surface of the existing pavement or the replacement of the existing pavement in small isolated areas.

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

Large patched areas [greater than 12.5 m² (15 S.Y.)], such as spot overlays or wedge courses, shall be rated for condition as a part of the existing pavement rather than as patches.

Severity Level: Low-- patch size < 0.1 m² (1 sq. ft.).

Medium-- patch size < 0.8 m² (1 sq. yd.).

High-- patch size > 0.8 m² (1 sq. yd.).

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

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

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



Photo B-5. Patching in Composite Pavement, Medium Severity



Photo B-6. Patching in Composite Pavement, High Severity

COMPOSITE PAVEMENT

Distress Type: **Surface Disintegration or Debonding**

Description: Loss of surface by debonding is the removal of the asphaltic surface layer from the underlying layer. The problem is most common with thin asphalt surface layers [less than 50 mm (2 inches)] and is caused by freeze-thaw action or poor bonding of the two layers during construction.

Severity Level: Use the following table:

Depth of Debonded Area	Debonded Area <0.8 m² (1 sq. yd.)	Debonded Area >0.8 m² (1 sq. yd.)
< 25 mm (1")	Low	Medium
> 25 mm (1")	Medium	High

Extent Level: **Occasional--** <5 debonded areas per 1.6 km (per mile).

Frequent-- 5 - 10 debonded areas per 1.6 km (per mile).

Extensive-- >10 debonded areas per 1.6 km (per mile).

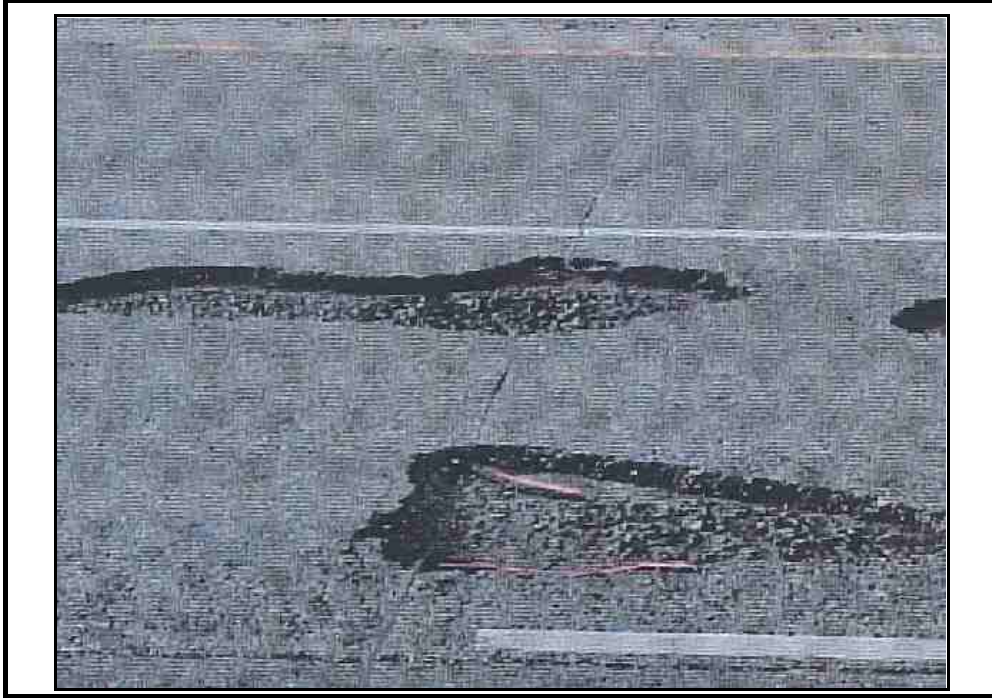


Photo B-7. Surface Disintegration in Composite Pavement



Photo B-8. Debonding in Composite Pavement, Medium Severity

COMPOSITE PAVEMENT

Distress Type: **Rutting**

Description: Ruts are vertical deformations in the pavement surface along the wheel tracks. In severe cases pavement uplift may occur along the sides of the rut, but in most instances only a depression is noticeable. Rutting is caused by consolidation or lateral movement of any or all pavement layers, including subgrade, under traffic.

Severity Level: Rutting severity is based upon rut depth, as approximated visually.

Low-- barely noticeable, depth less than 6 mm (1/4 inch).

Medium-- readily noticeable, depth more than 6 mm (1/4 inch), less than 25 mm (1 inch).

High-- definite effect upon vehicle control, depth greater than 25 mm (1 inch).

Extent Level: **Occasional--** less than 20 percent of the section length is rutted.

Frequent-- between 20 and 50 percent of the section length is rutted.

Extensive-- more than 50 percent of the section length is rutted.



Photo B-9. Rutting, Medium Severity



Photo B-10. Rutting, High Severity

COMPOSITE PAVEMENT

Distress Type: **Corrugations**

Description: Corrugations are a series of transverse ridges and valleys (or ripples) occurring at regular intervals along the pavement. Unstable bituminous mixture is associated with this distress.

Severity Level: **Low--** noticeable effect upon ride, but no significant reduction in comfort.

Medium-- moderate ride discomfort is noticeable, driver able to maintain vehicle control easily.

High-- vehicle vibration is severe, speed reduction is necessary for comfort and to maintain vehicle control.

Extent Level: **Occasional--** less than 10 percent of the section length is affected by this distress.

Frequent-- between 10 and 30 percent of the section length is affected by this distress.

Extensive-- greater than 30 percent of the section length is affected by this distress.

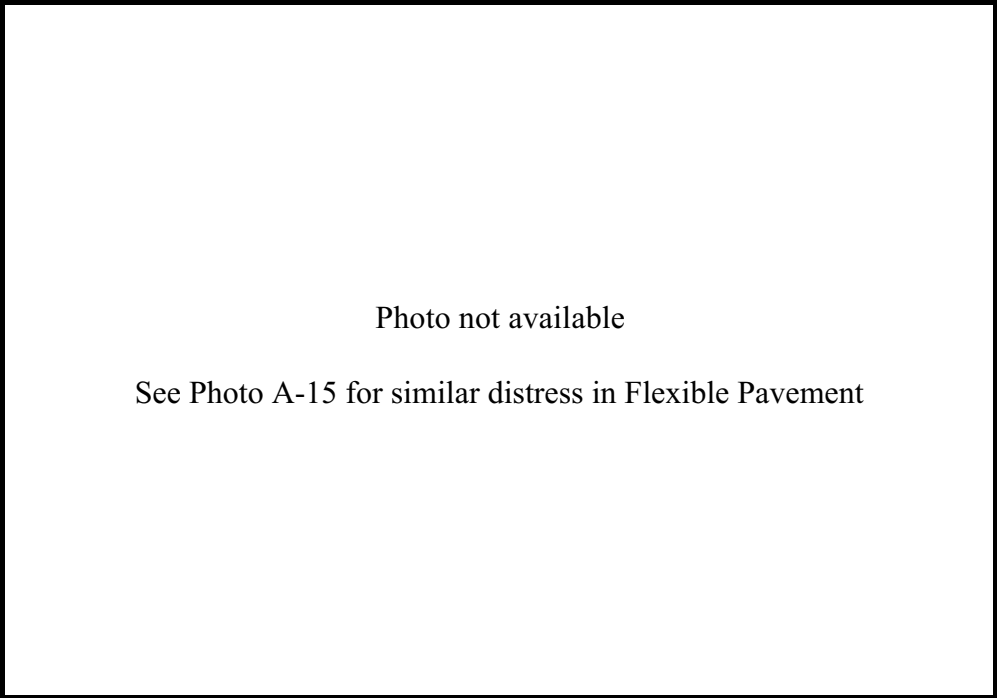


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See Photo A-15 for similar distress in Flexible Pavement

Photo B-10a. Corrugations in Composite Pavement

COMPOSITE 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 B-11. Pumping in Composite Pavement, Medium Severity



Photo B-12. Pumping in Composite Pavement, High Severity

COMPOSITE PAVEMENT

Distress Type: **Shattered Slab**

Description: Shattered slab is the breakup of the underlying rigid base made evident by surface reflection cracking and/or distortion. Reflection cracks in the asphaltic layer forming rectangular areas less than 1.5 m by 1.5 m (5 ft. by 5 ft.) may indicate that the underlying slab is broken up. Diagonal reflection cracks at transverse joints are indicative of corner breaks in the rigid base. Progressive deterioration will include distortion and faulting of the shattered area. This distress is caused by poor base support or fatigue of the concrete layer.

Severity Level: **Low--** cracks defining the shattered area are tight [less than 3mm (1/8 inch in width)] with little or no spalling. There is no faulting of the shattered area.

Medium-- crack width greater than 3 mm (1/8 inch) with some spalling. Moderate distortion which does effect ride quality somewhat.

High-- severe distortion and poor ride quality over the shattered area. Crack pattern indicates break up of the slab into small pieces [less than 0.8 m² (1 yd²)].

Extent Level: **Occasional--** less than 2 shattered slab areas/1.6 km (per mile) of section length.

Frequent-- between 2 and 5 shattered slab areas/1.6 km (per mile) of section length.

Extensive-- more than 5 shattered slab areas/1.6 km (per mile) of section length.



Photo B-13. Shattered Slab of Composite Pavement, High Severity

COMPOSITE PAVEMENT

Distress Type: Settlement

Description: Settlement is a dip in the longitudinal profile of the pavement surface. Settlement shall be considered a distress when it causes a noticeable effect upon riding quality. Settlement should not be confused with corrugation, which is another type of surface profile deficiency.

Severity Level: Severity is based upon the effect of the settlement on vehicle control when traveling along the roadway at 60 km/hour (40 MPH), as discussed in 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 dip generally greater than 150 mm (6 inches). Poor ride, corrective action needed.

Extent Level: **Occasional--** less than 2 settlements/1.6 km (per mile) of road way.

Frequent-- 2 to 4 settlements/1.6 km (per mile) of road way.

Extensive-- more than 4 settlements/1.6 km (per mile) of road way.



Photo B-14. Settlement in Composite Pavement, Medium Severity

COMPOSITE PAVEMENT

Distress Type: **Transverse Cracking**

Description: A crack or break at approximately right angles to the pavement centerline. For composite pavements where the rigid base layer does not have transverse joints (CRC pavements for instance) all transverse cracking is evaluated regardless of location. For jointed bases, a separate evaluation is made of reflective cracks at 1) the joints; and 2) other (non-joint) transverse cracking. Usually all underlying base cracks and joints are eventually reflected through the flexible surface. Additional transverse surface cracking may result from thermal shrinkage and age hardening of the asphaltic layer.

Note 1: A significant amount of joint repair and bituminous overlay of Jointed Concrete (JC) pavement has been completed in Ohio. The repair method usually included removal of original pavement at the joint for ± 1 m (3 feet) in each adjacent slab and replacing it with an asphalt or concrete patch. For projects which contain this type of repair, both transverse joints will be evaluated if visible.

Note 2: Crack width is defined as the sum of all cracks if more than one is present at the location of measurement (measured as a continuous length from the beginning of the first crack to the end of the last crack).

Severity Level: **Unjointed Base or Jointed Base**

Low-- crack width less than 6 mm (1/4 inch) with no spalling or distortion along crack edges.

Medium-- crack opened or spalled to a width between 6 mm and 25 mm (1/4 and 1 inch) over at least one half its length.

High-- crack opened or spalled to a width greater than 25 mm (1 inch) over at least one half its length.

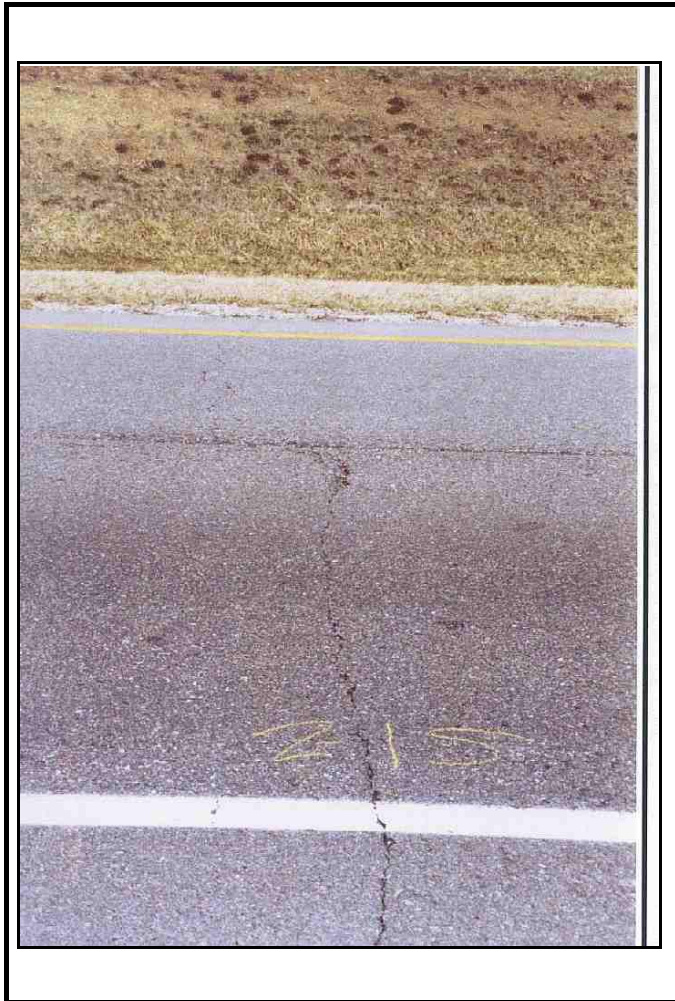


Photo B-15. Unjointed Base, Transverse Cracking in Composite Pavement, Low Severity

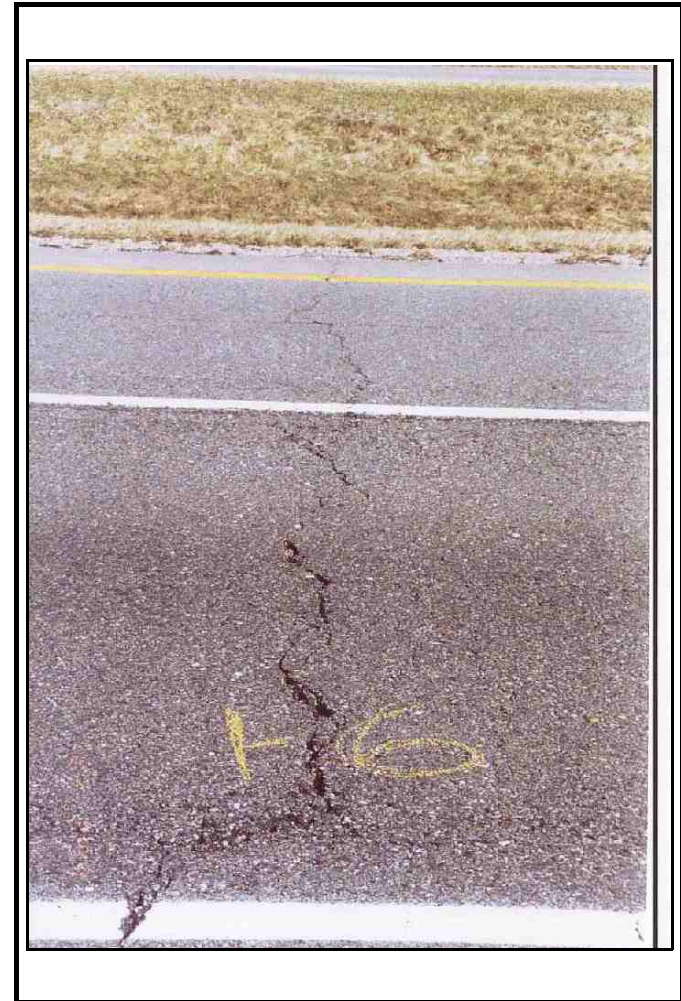


Photo B-16. Unjointed Base, Transverse Cracking in Composite Pavement, High Severity

COMPOSITE PAVEMENT

Extent Level: **Jointed Base - Intermediate Transverse Cracking**

Extent level is based upon average crack spacing (CS) as given by the following formula:

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

Where:

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

(Please Note: average CS is based on Step 2 observations).

Occasional-- average transverse crack spacing greater than 4.5 m (15 feet).

Frequent-- average spacing 3 to 4.5 m (10 to 15 feet).

Extensive-- average crack spacing less than 3 m (10 feet).

Extent Level: **Unjointed Base**

Occasional-- average intermediate transverse crack spacing greater than 4.5 m (15 feet).

Frequent-- average intermediate transverse crack spacing 3 to 4.5 m (10 to 15 feet).

Extensive-- average intermediate transverse crack spacing less than 3 m (10 feet).

Extent Level: **Jointed Base-Joint Reflection Cracks**

Extent is based upon the estimated percentage of transverse joint length which has reflected through the asphalt surface. Except for new pavements or overlays the extent will likely be extensive.

Occasional-- less than 20 percent.

Frequent-- between 20 and 50 percent.

Extensive-- more than 50 percent.



Photo B- 17. Jointed Base, Reflection Cracking in Composite Pavement, Medium Severity



Photo B- 18. Jointed Base, Reflection Cracking in Composite Pavement, High Severity

COMPOSITE PAVEMENT

Distress Type: **Longitudinal Cracking**

Description: A crack or break approximately parallel to the pavement centerline. Longitudinal joints and pavement edges of underlying rigid base usually reflect through the asphalt surface as a result of thermal movement in the underlying slab. Poor paving lane joint construction can also result in a longitudinal crack. All types of longitudinal cracking (random, centerline, edge, etc.) are included in this distress classification for composite pavements.

Note: Crack width is defined as the sum of all cracks if more than one is present at the location of measurement.

Low-- crack width less than 6 mm (1/4 inch) with no spalling or distortion along crack edges.

Medium-- crack opened or spalled to a width between 6 mm and 25 mm (1/4 and 1 inch) over at least one half its length.

High-- crack opened or spalled to a width greater than 25 mm (1 inch) over at least one half its length.

Extent Level: Based upon the average linear feet of longitudinal cracking per 30 m (per station of 100 feet length).

Occasional-- less than 15 m/30 m (50 feet per station).

Frequent-- between 15 and 45 m/30 m (50 and 150 feet per station).

Extensive-- more than 45 m/30 m (150 feet per station). Complete reflective longitudinal cracking along the pavement centerline and edge [60 linear m/ 30 m (200 linear feet per station)] is termed extensive.



**Photo B- 19. Longitudinal Cracking in Composite Pavement,
High Severity**

COMPOSITE PAVEMENT

Distress Type:	Pressure Damage/Upheaval
Description:	Upheaval is a bump or hump in the pavement surface at a transverse joint or crack. The upheaval is a result of thermal expansion in the underlying concrete base creating compressive forces.
Severity Level:	Low-- bump height less than 13 mm ($\frac{1}{2}$ inch), barely noticeable effect upon ride. Medium-- bump height 13 to 25 mm ($\frac{1}{2}$ to 1 inch) with a readily noticeable effect upon ride quality. High-- bump height greater than 25 mm (1 inch) severely reducing ride quality.
Extent Level:	Occasional-- upheaval is present along less than 20 percent of the joints. Frequent-- upheaval occurs along 20 to 50 percent of the joints. Extensive-- greater than 50 percent of the joints exhibit upheaval.



**Photo B- 20. Pressure Damage/Upheaval in Composite Pavement,
Medium Severity**

COMPOSITE PAVEMENT

Distress Type: Crack Sealing Deficiency

Description: Crack sealing deficiency is crack sealing which is no longer effective in preventing intrusion of water or cracks which have never been sealed.

Severity Level: Severity levels are not considered.

Extent Level: Extent is based upon the percentage of crack length in the pavement surface which is not effectively sealed.

Occasional-- less than 20 percent of the cracks along the pavement section are not effectively sealed.

Frequent-- between 20 and 50 percent of the cracks along the pavement section are not effectively sealed.

Extensive-- more than 50 percent of the cracks along the pavement section are not effectively sealed.



Photo B-21. Crack Sealing Deficiency, Unsealed Cracks



Photo B-22. Crack Sealing Deficiency, Cracks not sealed properly