Pavement Distress Identification

Asphalt Pavements

Raymond Ong, Purdue University
William Flora, INDOT Planning
Joyce Stone, INDOT Pavement Engineering
Samy Noureldin, INDOT Research

Pavement Distress Categories

- Cracking
- Patching and Potholes
- Surface Deformation
- Surface Defects
- Miscellaneous Distresses
Distress Types

- Cracking
  - Fatigue Cracking
  - Block Cracking
  - Edge Cracking
  - Wheel-path Longitudinal Cracking
  - Non-wheel-path Longitudinal Cracking
  - Transverse Reflective Cracking at Joints
  - Longitudinal Reflective Cracking at Joints
  - Transverse Cracking

- Severity Level Determination
  - Crack Width
  - Crack Pattern

Distress Types

- Patching & Potholes
  - Patch/Patch Deterioration
  - Potholes

- Severity Level Determination
  - Distress within Patch
  - Depth of Pothole
Distress Types

- Surface Deformation
  - Rutting
  - Shoving

- Severity Level Determination
  - Severity Levels are Not Applicable

Distress Types

- Surface Defects
  - Bleeding
  - Polished Aggregate
  - Raveling

- Severity Level Determination
  - Surface Texture
Distress Types

- Miscellaneous Distresses
  - Lane-to-Shoulder Dropoff
  - Water Bleeding and Pumping
- Severity Level Determination
  - Severity Levels are Not Applicable; Use Direct Measurement

Cracking
Measuring Crack Width in Asphalt Pavements

Effect of Random Cracking on Severity Level

Moderate - Adjacent Low Severity Cracking
High - Adjacent Moderate Severity Cracking
Fatigue Cracking

- 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 m on the longest side
- Characteristically has chicken wire/alligator pattern in later stages
Fatigue Cracking

- A pattern of cracks that divide the pavement into approximately rectangular pieces or blocks
- Blocks range in approximately 1 to 100 ft$^2$
- Caused by shrinkage of HMA and daily temperature cycling (i.e. not load associated)
- Indication that the asphalt has hardened significantly

Block Cracking

- A pattern of cracks that divide the pavement into approximately rectangular pieces or blocks
- Blocks range in approximately 1 to 100 ft$^2$
- Caused by shrinkage of HMA and daily temperature cycling (i.e. not load associated)
- Indication that the asphalt has hardened significantly
Block Cracking

- Low Severity

[Diagram showing block cracking pattern with dimensions and traffic direction]
Edge Cracking

- Crescent-shaped cracks or fairly continuous 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 wheel path and within 0.6 m of pavement edge.
- NOTE: Applies only to pavements without paved shoulders.
**Edge Cracking**

Cracks predominantly parallel to pavement centerline. Location within the lane (wheel path vs non-wheel path) is significant. Could be load related (wheel path) or due to poorly constructed paving of a lane joint (non-wheel path).

**Longitudinal Cracking**

- Cracks predominantly parallel to pavement centerline.
- Location within the lane (wheel path vs non-wheel path) is significant.
- Could be load related (wheel path) or due to poorly constructed paving of a lane joint (non-wheel path).
Longitudinal Cracking

- Inner Wheel Path
- Outer Wheel Path

- Edge Stripe
- PAVED SHOULDER

4a - Wheel Path
4b - Non-Wheel Path
Reflection Cracking

- Cracks in asphalt concrete overlay surfaces that occur over joints in concrete pavements.
- Caused by movement of slab beneath the asphalt surface due to thermal and moisture changes.
- NOTE: Knowing slab dimensions beneath asphalt concrete surface helps identify reflection cracks at joints.
Reflection Cracking

- Cracks predominantly perpendicular to pavement centerline, and are not located over PCC joints.
- Primarily due to shrinkage of asphalt surface due to low temperature or hardening of asphalt.

Transverse Cracking

- Cracks predominantly perpendicular to pavement centerline, and are not located over PCC joints.
- Primarily due to shrinkage of asphalt surface due to low temperature or hardening of asphalt.
Transverse Cracking

Note: Rate entire crack at highest level present for 10% or more of total crack length.

6L Distress type 6, Low severity

Transverse Cracking

Moderate Severity

High Severity
Patching and Potholes

**Patch/Patch Deterioration**

- Portion of pavement surface, greater than 1 ft\(^2\), that has been removed and replaced or additional material applied to the pavement after original construction.
- Traffic load, material and poor construction practices can cause patch deterioration.
Potholes

- Bowl-shaped holes of various sizes in the pavement surface.
- Caused by broken pavement surface due to fatigue cracking, localized disintegration or freeze-thaw cycles.

Note: Two potholes, third defect is less than minimum dimension.
Potholes

Surface Deformation
Rutting

- A longitudinal surface depression in the wheel path.
- Stems from permanent deformation in any of the pavement layers or in subgrade.
- Caused by
  - Consolidation or lateral movement of materials due to traffic load;
  - Plastic movement of asphalt in hot weather or inadequate compaction during construction
Rutting

- 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, curves or at intersections.
- It also may have associated vertical displacement.

Shoving
Shoving

Vertical Displacement

A

B

Traffic

SHOULDER

Edge Stripe
Corrugation

Surface Defects
**Bleeding**

- Excess bituminous binder on pavement surface. May create a shiny, glass-like, reflective surface that may be tacky to the touch. Usually found in the wheel-paths.
- Caused by high asphalt content or low air void content.
- Result in low skid resistance.

**Bleeding**

- Discoloration
- Loss of texture
- Aggregate obscured
Polished Aggregate

- Surface binder worn away to expose coarse aggregate.
- Mainly occur on wheel paths and due to traffic load.
Raveling

- Wearing away of pavement surface in high-quality hot-mix asphalt concrete
- Caused by the dislodging of aggregate particles and loss of asphalt binder

Loss of fine & some coarse aggregates

Loss of coarse aggregates
Miscellaneous Distress

Lane-to-Shoulder Dropoff

- Difference in elevation between the traveled surface and outside shoulder.
- Typically occurs when the outside shoulder settles as a result of pavement layer material differences.
Lane-to-Shoulder Dropoff
Water Bleeding and Pumping

- Seeping or ejection of water from beneath the pavement through cracks.
- In most 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.
Debonding

Thank you for your attention!