

PAVEMENT DISTRESS TYPES

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Correctly identifying the type and severity of pavement distresses is critical for determining the overall condition of a road. This tech sheet, which provides information about common pavement distress types, will help municipalities evaluate the condition of their roads and determine what maintenance or repair strategies may be appropriate based on the defects observed.

This guide reflects the most common distresses observed in asphalt pavements. For a full overview of pavement distresses for asphalt and concrete pavements, please refer to the *Federal Highway Administration's Distress Identification Manual* for the Long-Term Pavement Performance Program or the *LTPP InfoPave* smartphone app.

Longitudinal Cracking

Description: Cracks predominantly parallel to pavement centerline. Location within the lane (wheel path versus nonwheel path) is significant.

Cause: Commonly caused by poorly constructed pavement joints and temperature cycling.

Severity levels:

- **Low** – Any crack with a mean width $\leq 1/4$ -inch 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 $> 1/4$ -inch and $\leq 3/4$ -inch or any crack with a mean width $\leq 3/4$ -inch and adjacent low severity random cracking.
- **High** – Any crack with a mean width $> 3/4$ -inch or any crack with a mean width $\leq 3/4$ -inch and adjacent moderate to high severity random cracking.

Affected pavement layers: Longitudinal cracks typically begin as a surface defect, affecting only the wearing course but eventually if left unmaintained, will travel into the below pavement layers causing a more severe defect.



Transverse Cracking

Description: Cracks that are predominantly perpendicular to the pavement centerline.

Cause: Commonly caused by temperature cycling and subbase or subgrade movement.

Severity levels:

- **Low** – An unsealed crack with a mean width $\leq 1/4$ -inch 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 $> 1/4$ -inch and $\leq 3/4$ -inch or any crack with a mean width $\leq 3/4$ -inch and adjacent low severity random cracking.
- **High** – Any crack with a mean width $> 3/4$ -inch or any crack with a mean width $\leq 3/4$ -inch and adjacent moderate to high severity random cracking.

Affected pavement layers: Transverse cracks typically begin as a surface defect, affecting only the wearing course, but eventually if left unmaintained, will travel into the below pavement layers causing a more severe defect.



Reflective Cracking

Description: Cracks that begin in a base course of the pavement and work their way upward to the wearing course.

Cause: Commonly caused by cracking in the lower layers of the asphalt pavement structure.

Severity levels:

- **Low** – An unsealed crack with a mean width $\leq \frac{1}{4}$ -inch 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 $> \frac{1}{4}$ -inch and $\leq \frac{3}{4}$ -inch or any crack with a mean width $\leq \frac{3}{4}$ -inch and adjacent low severity random cracking.
- **High** – Any crack with a mean width $> \frac{3}{4}$ -inch or any crack with a mean width $\leq \frac{3}{4}$ -inch and adjacent moderate to high severity random cracking.

Affected pavement layers: As the cracking starts in the base layers, typically the base and wearing course are both affected.



Block Cracking

Description: A pattern of cracks that divides the pavement into approximately rectangular pieces. Rectangular blocks range in size from approximately 1 to 100 square feet.

Cause: Commonly caused by aging of the asphalt binder combined with temperature cycling.

Severity levels:

- **Low** – Cracks with a mean width $\leq \frac{1}{4}$ -inch or sealed cracks with sealant material in good condition and with a width that cannot be determined.
- **Moderate** – Cracks with a mean width $> \frac{1}{4}$ -inch and $\leq \frac{3}{4}$ -inch or any crack with a mean width $\leq \frac{3}{4}$ -inch and adjacent low severity random cracking.
- **High** – Cracks with a mean width $> \frac{3}{4}$ -inch or any crack with a mean width $\leq \frac{3}{4}$ -inch and adjacent moderate to high severity random cracking.



Affected pavement layers:

Over time, the asphalt binder will become brittle, as indicated by the surface becoming grayish in color. This brittleness combined with temperature cycling will cause cracking in the wearing course of the pavement.

Fatigue Cracking

Description: Cracking that occurs in areas subject to repeated traffic loadings (wheel paths). It can be a series of interconnected cracks in early stages of development. It then develops into many-sided, sharp-angled pieces, usually less than 1 square foot in size, characteristically with a chicken wire or alligator pattern in later stages.

Cause: Commonly caused by excessive volume or heavy vehicle traffic or an issue with the pavement subbase or subgrade.

Severity levels:

- **Low** – An area of cracks with no or only a few connecting cracks. Cracks are not spalled or sealed, and pumping is not evident.
- **Moderate** – An area of interconnected cracks forming a complete pattern.

Cracks may be slightly spalled and 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, and pumping may be evident.

Affected pavement layers: This is a complete failure of the asphalt pavement section down to the subbase and can indicate an issue with the stone subbase as well.



Edge Cracking

Description: Cracking that applies only to pavements with unpaved shoulders. Crescent-shaped cracks or fairly continuous cracks intersect the pavement edge and are located within 2 feet of the pavement edge adjacent to the shoulder.

Cause: Commonly caused by excessive traffic volumes or heavy vehicle traffic traveling near the edge of the pavement.

Severity levels:

- **Low** – Cracks with no breakup or loss of material.
- **Moderate** – Cracks with some breakup and loss of material for up to 10% of the length of the affected portion of the pavement.
- **High** – Cracks with considerable breakup and loss of material for more than 10% of the length of the affected portion of the pavement.

Affected pavement layers: Depending upon severity, edge cracking may begin as a surface defect and gradually affect the base course over time.

Potholes

Description: Bowl-shaped holes of various sizes in the pavement surface.

Cause: Commonly caused by a less severe defect in the pavement surface that is left untreated.

Severity levels:

- **Low** – < 1-inch deep.
- **Moderate** – 1-inch to 2-inches deep.
- **High** – > 2-inches deep.

Affected pavement layers:

The defect will continue to get worse over time and weaken the surrounding pavement structure, eventually causing pieces of the pavement to become detached.



Patching

Description: Portion of pavement surface greater than or equal to 1-square foot that has been removed and replaced or additional material applied to the pavement after the original construction.

Cause: Created where the original pavement structure has been replaced.

Severity levels:

- **Low** – Patch has, at most, low severity distress of any type, including rutting < ¼ inch. Pumping is not evident, and there is no loss of patching material.
- **Moderate** – Patch has moderate severity distress of any type or rutting from ¼ inch to ½ inch; pumping is not evident.
- **High** – Patch has high severity distress of any type, including rutting > ½ inch, or the patch has additional different patch material within it. Pumping may be evident.

Affected pavement layers: Patching creates additional points of entry for water to enter the pavement structure. If not maintained and done improperly, the patch can cause further issues with the surface of the pavement structure.



Rutting

Description: A longitudinal surface depression in the wheel path that may have associated transverse displacement.

Cause: Commonly caused by insufficient pavement compaction, leaving the vehicles traveling over the area to continue to compact the area unevenly, or poor subbase/subgrade conditions, which are not able to support the weight of traffic.

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.

Affected pavement layers: The layers affected by rutting will likely vary depending upon the cause and severity of the observed rutting. Rutting may only affect the surface layer but more commonly affects the entire pavement structure.



Shoving

Description: 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.

Cause: Commonly caused by an inadequate bond between any of the placed layers of pavement near a turn or stop sign where there is a significant stopping or turning force on the pavement structure.

Severity levels:

- **Not applicable** – Severity levels could be defined by the relative effect of shoving on ride quality.

Affected pavement layers: The layers affected by shoving will likely vary depending upon the cause and severity of the observed shoving. Shoving may only affect the surface layer (as shown) but can also affect the entire pavement structure.



Correctly identifying the type and severity of pavement distresses enables municipalities to determine which maintenance or repair strategies are most appropriate.



Bleeding

Description: Excessive asphalt binder occurring on the pavement surface, usually found in the wheel paths. It may range from a discolored surface compared 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.

Cause: Commonly caused by excessive binder or tack coat usage or over compaction.

Severity levels:

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

Affected pavement layers: Bleeding is only a surface defect, primarily creating a safety issue with reduced friction on the surface of the roadway.

Polished Aggregates

Description: Surface binder worn away to expose coarse aggregate. It is typically noted as a smooth pavement surface with visible aggregate.

Cause: Commonly caused by wear over time or an inadequate bond between the asphalt binder and the aggregate.

Severity levels:

- **Not applicable** – The degree of polishing may be reflected in a reduction of surface friction.

Affected pavement layers: Polishing will typically decrease the surface friction of the pavement, only affecting this layer.



Raveling

Description: The 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.

Cause: Commonly caused by concentrated water flows, which will wear away the binder material or an inadequate bond between the asphalt binder and aggregate. It can also be

caused by improper construction, either a lack of compaction of the pavement layer or placement of the asphalt material in colder temperatures.

Severity levels:

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

Affected pavement layers: Raveling only affects the surface of the pavement, but it may work its way down into the pavement structure if left unmaintained over time.