This manual is a part of a series of documents being prepared to compile information being used in our Pavement Management program. These documents will replace our 1998 Pavement Management and Pavement Design manual. Separate design manuals are being prepared to replace that section and provide guidance on the mechanistic design method.

The focus for this manual will be information about the pavement condition data collected and the types of distress seen in our pavements.

Pavement Preservation Manuals:
Part 1 – Pavement Preservation and Rehabilitation Program
Part 2 – Pavement Condition Data
Part 3 – Preservation Treatments
Part 4 – Pavement Condition Modeling with dTIMS

Until this past year our Condition data was collected with UDOT staff and equipment. During 2008 some of our condition data was collected under contract. It is expected that this way of collecting condition data will continue.

Our Distress data was collected via manual surveys. The first tenth of a mile was inspected annually and rated. During 2008 our Distress data was extracted from pavement images. It is expected that our future distress data will continue to be collected this way.

This manual will provide an overview of the condition data collected and each of the principal asphalt and concrete pavement distresses, how they’re measured, why they occur and how best to treat them.

Much of the information in this manual has been taken from other States, the Federal Highway Administration, and our pavement Industry. This information has been taken and adjusted to meet our needs.

See our UDOT Pavement Management web page for additional information about our Pavement Management program.

See our UDOT Pavement Design and Materials Manuals for mix design and other material specifications.
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Introduction

This manual provides information about the condition data being collected and used for pavement management. UDOT owns and operated a high speed profiler for roughness, rutting and faulting data, a locked-wheel skid tester, a falling weight deflection tester, and a photolog van.

In 2008 we used a vendor to collect our pavement condition data. This included front and side photolog images, high resolution pavement images, IRI, rutting, faulting, and GPS data. The images were then analyzed for the distress. A similar data collection contract has been awarded for the 2009 data collection. Appendix A has the data items collected with this contract.

Information about how this data is used in the condition modeling is in the Part 4 manual. A lot more detail about the pavement condition is collected than we can use for modeling or forecasting condition. The model works with section level average condition, using Index values. The collected data provides measured condition at 0.1 mile or 1 mile intervals. Treatment decisions should be based on both, along with actual observed condition and construction history.

The collected data is available through multiple sources depending on what it is used for. The UDOT collected data is loaded into our Pavement Condition System for processing and Quality Control checking. This is an Oracle database that also has the historical condition data. This data is all managed in 1 mile intervals. The Vendor collected data is available in an MS Access database in 0.1 mile intervals. The process data is then loaded into our modeling database and converted to section level Index values.

This Manual also provides a replacement for our Distress Manual 2003. This has information about common distresses seen on our pavements, for both asphalt and concrete. Each distress has a description of how it appears, a little information about what causes it, how we measure the extent and define the severity of it, and a list of appropriate treatments typically used. At the end of this section is a copy of the access database form that was used for the manual distress surveys.
Condition Data

Condition data is collected, processed and updated annually. The data is available by request or thru our web page. Traditionally the data has been summarized in 1 mile intervals. Currently the data is available in 0.1 mile intervals. Section level data is available from the condition modeling; however this data has been converted into the Index value.

Information about the equipment, testing procedures and data processing is available on the web page through technical bulletins for each piece of equipment.

The Oracle Pavement Condition Database has mile by mile data back to 1997.

Caution should be used when using historical data, as Route numbers have changed, and with the reposting effort of 2003, a lot of mileage has changed.

General Information

Linear Referencing
State highways are referenced by a 4 digit route number (i.e. 0006), direction and mileage. Data records have the route, direction, begin mileage and end mileage for each section of data. Direction is coded with a P for increasing mileage, or N for decreasing mileage.

All routes have a positive and negative direction, but condition data will only be collected in one direction, except for the Interstate system where both directions will be collected. (Except for the one way streets – which only have one direction)

Multilane Roadways
Only one lane of condition data is being collected. The data is typically collected in the outside travel lane. This should be the through lane, and not the deceleration or acceleration lanes. The condition data will then be used as representing the entire pavement section.

Shoulders
Separate condition data for shoulders is not collected for pavement management. Maintenance and rehabilitation of ramps will typically be performed in conjunction with mainline projects.

Ramps
At this time System level condition data is not being collected on ramps. Maintenance and rehabilitation of ramps will typically be performed in conjunction with mainline projects.

Bridges
Condition data on bridge decks will not be included in the pavement sections.

The IRI data used for pavement condition will not include the bridge decks. However, the new HPMS data reporting is asking for the bridge decks to be included. This will require 2 sets of IRI data, one for UDOT pavement management and one for HPMS.
Gravel Roads
Condition data is not recorded for gravel roads. GPS data and roadway image data should be collected.

Lane widths and wheel paths
Lanes are generally 12’ wide, with 30” wide wheel path areas, ~ 68” center to center apart. However, there are pavements with lanes less than 12 feet. The data collection vehicle is expected to be where the majority of the travel is, in the center of the lane with the wheel path sensors in the wheel paths.

Traffic Volumes
Annual Average Daily Traffic volumes are published for each traffic section, every other year. The publication has a three year history for the AADT, along with truck volumes. Actual hourly volumes are available for any of the permanent traffic recorders.

Roughness
Surface roughness is an important measure used in evaluating pavement condition because of its effects on ride quality and vehicle operating costs. Pavements start out smooth and increase in roughness as they deteriorate. Cracking and patching have a big effect on roughness.

The International Roughness Index (IRI) is used to indicate the amount of roughness. This is measured at least every 3” and summarized at 6” intervals, for both wheel paths with a high speed profiler – in accordance with ASHTO standard practice PP 37-04.

Data is not collected over cattle guards or railroad crossings. Data will be collected over bridge decks for HPMS data, and removed for UDOT data.

The IRI is reported for both wheel paths, as well as for the average of both wheel paths, in .1 mile intervals, in inches/mile.

IRI 1 or IRI_LT: Left wheel path IRI
IRI 2 or IRI_RT: Right wheel path IRI
HRI or HCS: Half-Car IRI

Ride Quality is based on the amount of roughness. Asphalt values are shown (add 20” for concrete pavements). Previously separate ranges were used for each pavement family.
Good: IRI < 95
Fair: IRI > 95 & < 170
Poor: IRI > 170

Faulting
Faulting is the difference in elevation across a joint or crack in concrete pavements. This is an important measure of pavement condition because of its effect on ride quality, as an indication of
loss of load transfer across the joints, and as an indication of loss of slab support. Faulting continues to increase as more material under the slab is lost. Ride quality can be restored with grinding. Dowel bars are typically used to prevent this.

Concrete joint faulting is measured in the outside wheel path across each joint – in accordance with AASHTO standard practice designation PP39-00.

The number of faults > 0.1" is reported for the fault total for each 0.1 mile interval. These are also reported by severity.
- Low: Faulting < 0.3"
- Medium: Faulting 0.3" to 0.5"
- High: Faulting > 0.5"

Rutting
Rutting is the distortion of the surface where one or both wheel paths are lower than the rest of the pavement. This can be caused by poor material, weak subgrade, or wear on the surface – especially where chains are frequently used. This is an important measure due to the potential for holding water and reducing vehicle control. It is important to determine the cause before correcting this condition.

Rutting is measured in each wheel path independently, with maximum values recorded at each location, with the average of the values summarized for each .1 mile interval. Several methods are being used to simulate a string line measurement. UDOT’s profiler has 3 lasers. The current technology uses a transverse scanning laser to record the surface across the full lane, and summarizes them over 100 times per mile.

Condition rating is based on the average depth of rutting, and varies by type of road.
- Good: Rut depth < 0.2"
- Fair: Rut depth > 0.2" to 0.5"
- Poor: Rut depth > 0.5"

Surface Friction
Surface friction is dependant on the type of pavement and amount of wear of the aggregate. This can be an important safety measure – especially when the pavement is wet. Bleeding, or sometimes new seals with excess oils can cause low values. Concrete pavements also tend to have lower values. Many other factors need to be considered to determine if there is a safety issue when a location has a low test value.

This data is collected with a locked-wheel skid tester, using the ASTM E 274 method, with a ribbed tire. The measured skid number (SN) is adjusted to 40 mph and reported as the SN40.

This system level data is collected at 1 mile intervals on a 2 year cycle.

Condition rating is based on the SN40 values
Sufficient: SN40 > 45  
Approaching need for further evaluation: SN40 > 35 & < 45  
Needs further evaluation: SN40 < 35

**Surface Deflection**  
Surface deflection data is collected to measure the pavement and subgrade strength. Asphalt pavements are generally designed for a fatigue life of 20 years. This can usually be extended with overlays and routine maintenance. Deflection data can be used to estimate the remaining life, as is or after rotomilling several inches.

An array of sensors is lowered onto the pavement to record the surface deflection as a 12" diameter plate is loaded with a range of forces to simulate an 18,000 pound axle load. The deflections are normalized for a 9,000 load and adjusted for a pavement temperature of 68 degrees.

Concrete joints are also tested to measure load transfer efficiency across the joint.

Testing has been performed at 1 mile intervals, on a 3 to 4 year cycle.

The raw deflection files are available by request. The normalized deflections, along with some commonly used pavement properties are available in the PCS database.

**Ground Penetrating Radar**  
Several hundred miles were collected in 2003, 2004 & 2005.

Detailed files are available with the raw scanned interfaces graphed. These are useful to investigate consistency in thickness and locate questionable areas to assist with selecting coring locations.

The web page has a GPR map showing the HMA thickness ranges for the routes with data available. The second GPR map shows the years the data was collected. The list shows the mile-by-mile thickness interpretations for the pavement and base.

**Load Transfer Efficiency**  
Concrete pavements had the joint load transfer tested in the spring of 2006. Data was collected in the right wheel path of the outside lane.

The FWD was positioned with the load plate past the joint so the number 1 (0") sensor was 6" on the leave slab. The number 3 (12") sensor was then 6" onto the approach slab. Several un-cracked slabs were tested each mile in each direction.

The LTE was calculated for each test using the ratio of the number 1 / number 3 deflections. No adjustments were included. Similar deflections indicate a good load transfer across the joint.
A Good, Marginal, and Poor qualitative value was included for each test. These were set with Poor for < 50% LTE & Good for > 70% LTE. This data is available in an excel file.

Maps for each Region are available in .pdf files. These show the locations tested, and the lowest condition measured. Consult the list file for actual data.

**Distress Data**

Distress data is collected to identify and quantify the types, extent and severity of surface cracking. Additional surface information is also collected to record the presence of bleeding, oxidation, raveling, and edge drop off.

Annual distress surveys have been conducted for the first 500’ of each mile. Starting in 2008 the distress data was generated from continuous pavement images.

Asphalt pavements have an Environmental Cracking Index using transverse, longitudinal and block cracking data. A Wheel Path Cracking Index is also used, using the fatigue cracking data.

Concrete pavements have a combined Cracking Index using corner break data and shattered slab data.

**Pavement Images**

Starting in 2008, pavement images were collected along with the condition data. The 2008 images were collected with two high resolution line scan cameras, stitched together for the full lane width, and trimmed for 200/mile. The 2009 images are being collected with two high resolution digital cameras synchronized with strobe lights.

**Related Information**

Starting in 2008 additional data was collected along with the pavement condition data. This includes roadway images, GPS coordinates, elevation, grade, cross slope, and curvature.
Pavement Distress

Asphalt Pavement Distress

Cracking
Transverse
Longitudinal – non wheel path
Block
Wheel Path / Fatigue (Alligator)
Edge
Reflective

Other Surface Defects
Bleeding
Raveling
Polished Aggregate
Rutting
Shoving
Delamination
Potholes
Patching
Edge Drop Off

Concrete Pavement Distress

Cracking
Corner Breaks
Transverse
Longitudinal
Map
Durability
Shattered Slabs

Other Surface Defects
Transverse Joint Spalling
Faulting
Scaling
Pop Outs
Polished Aggregate
Joint Seal Damage
Potholes and Patch Deterioration
Punchouts
Edge Drop Off
Asphalt Pavement Distress

On the following pages are descriptions of various distresses that occur in Asphalt pavements, their causes, how they are measured and preservation treatments to address them.

Transverse Cracking

Description: Transverse cracks are cracks that are predominantly perpendicular to the pavement centerline and are not located over joints or cracks in an underlying Portland Cement Concrete Pavement layer.

![Figure 1: Transverse Cracking](image)

Causes: Pavement expansion and contraction due to temperature changes, shrinkage of asphalt binder with aging. They may extend partially or fully across the roadway. Record only those cracks > 4' in length.

Severity: Rated according to crack width
- Low: unsealed cracks < 0.25” or well sealed cracks with unknown width
- Medium: cracks 0.25” to 0.75” width, or secondary cracks < 0.25”
- High: cracks > 0.75” width, or secondary cracks > 0.25”

Extent: Number of cracks, for each severity level. Percent well sealed should also be recorded. Used as percent of area with cracks. 10 cracks / 0.1 mile = 100%
Potential Actions:
- Crack Fill if the cracks exhibit little movement (less than 0.1 inch), the pavement is only slightly or moderately deteriorated, the pavement is not fatigue-cracked and the cracking distress are minimal.
- Crack Seal if the cracks are working cracks, if the pavement is in good condition, the pavement is not fatigue-cracked and cracking distress is minimal. Cracks greater than 0.25 inch wide should be cleaned routed and sealed prior to any pavement preservation action.
- Chip Seal, Fog Seal, Slurry Seal, Scrub Seal or Microsurfacing can fill small cracks (less than 0.25 inch wide) if the cracks are non-working, there is no excessive bleeding and there is little structural deterioration such as structural rutting or fatigue cracking.
- Thin or Ultra-Thin Hot Mix Asphalt Overlay if cracking is of low or medium severity (less than 0.5 inch wide) and there are no subgrade or base failures.
- Milling and Hot Mix Inlay/Overlay or In-Place Recycling if cracking is due to aging pavement and is confined to upper layers and there are no subgrade or base failures.
- Crack Fill if the pavement is badly deteriorated until rehabilitation can be undertaken.
Longitudinal Cracking

Description: Longitudinal cracks are cracks that are parallel to the pavement centerline. The types of Longitudinal Cracking include wheel path & non-wheel path.

Causes: If on centerline or outside of wheel path – usually poorly constructed paving joint, and not load associated. If in wheel path – usually excessive deflection due to loading or loss of foundation support probably due to water, insufficient pavement structure or weak support material. Longitudinal cracks within the wheel path are load associated and much more serious.

Severity: Rated according to crack width – non wheel path
• Low: unsealed cracks < 0.25” or well sealed cracks with unknown width
• Medium: cracks 0.25” to 0.75” width, or secondary cracks < 0.25”
• High: cracks > 0.75” width, or secondary cracks > 0.25”

Extent: Feet of length, for each severity level. Percent well sealed should also be included. Used as percent of area with cracking. 528 feet / 0.1 mile = 100%

Potential Actions: - non wheel path
• Crack Fill if the cracks exhibit little movement (less than 0.1 inch), the pavement is only slightly or moderately deteriorated, the pavement is not fatigue-cracked and the cracking distress are minimal.
- Crack Seal if the cracks are working cracks, if the pavement is in good condition, the pavement is not fatigue-cracked and cracking distress is minimal. Cracks greater than 0.25 inch wide should be cleaned, routed and sealed prior to any pavement preservation action.
- Chip Seal, Fog Seal, Slurry Seal, Scrub Seal or Microsurfacing can fill small cracks (less than 0.25 inch wide) if the cracks are non-working, there is no excessive bleeding and there is little structural deterioration such as structural rutting or fatigue cracking.
- Thin or Ultra-Thin Hot Mix Asphalt Overlay if cracking is of low or medium severity (less than 0.5 inch wide) and there are no subgrade or base failures.
- Milling and Hot Mix Inlay/Overlay or In-Place recycling if cracking is due to aging pavement and is confined to upper layers and there are no subgrade or base failures.
- Crack Fill if the pavement is badly deteriorated until rehabilitation can be undertaken.

> See Wheel Path / Fatigue (Alligator) Cracking for longitudinal cracks in the wheel path
Block Cracking

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

![Figure 3: Block Cracking](image)

**Causes:** Inability of the pavement to expand and contract with normal temperature changes, due to shrinkage of the asphalt binder and loss of pavement flexibility with aging. Block cracking is aggravated by a lower grade of asphalt binder in the mix design.

**Severity:** Rated according to crack width
- Low: unsealed cracks < 0.25” or sealed cracks
- Medium: cracks 0.25” to 0.75” width, or secondary cracks < 0.25”
- High: cracks > 0.75” width, or secondary cracks > 0.25”

**Extent:** Feet of length, for each severity level. Used as percent of length with cracking. 528 feet / 0.1 mile = 100%

**Potential Actions:**
- Crack Fill if the cracks exhibit little movement (less than 0.1 inch), the pavement is only slightly or moderately deteriorated, the pavement is not fatigue-cracked and the cracking distress are minimal.
- Crack Seal if the cracks are working cracks, if the pavement is in good condition, the pavement is not fatigue-cracked and cracking distress is minimal. Cracks greater than 0.25 inch wide should be cleaned, routed and sealed prior to any pavement preservation action.
- Chip Seal, Fog Seal, Slurry Seal, Scrub Seal or Microsurfacing can fill small cracks (less than 0.25 inch wide) if the cracks are non-working, there is no excessive bleeding and there is little structural deterioration such as structural rutting or fatigue cracking.
- Thin or Ultra-Thin Hot Mix Asphalt Overlay if cracking is of low or medium severity (less than 0.5 inch wide) and there are no subgrade or base failures.
- Milling and Hot Mix Inlay/Overlay or In-Place Recycling if cracking is due to aging pavement and is confined to upper layers and there are no subgrade or base failures.
- Crack Fill if the pavement is badly deteriorated until rehabilitation can be undertaken
Wheel Path / Fatigue (Alligator) Cracking

Description: Fatigue cracking is a series of interconnected cracks that develops into many-sided, sharp-angled pieces, usually less than 1 foot on the longest side, characteristically with a chicken wire/alligator skin pattern. Typically in the wheel paths, but may also be outside of the wheel paths.

![Figure 4: Wheel Path / Fatigue (Alligator) Cracking](image)

Causes: Inadequate structural design, poor construction (inadequate compaction), inadequate structural support due to higher than normal traffic loadings, normal loadings on aged and brittle pavement or excessive deflection due to loading or loss of foundation support due to water, insufficient pavement structure or weak support material. Small, localized fatigue cracking is indicative of a loss of subgrade support. Large fatigue cracked areas indicative of general structural failure.

Severity: Rated according to pattern and material loss
- Low: longitudinal cracks in the wheel paths, few secondary cracks
- Medium: interconnected cracks
- High: moderately or severely spalled interconnected cracks, well developed pattern

Extent: Square feet of area, for each severity level. Used as percent of area with cracking. Use 1.5’ wide wheel path area for 100% cracking. 1,584 square feet / 0.1 mile = 100%  If outside of the wheel paths record as Block cracking.
Potential Actions:

- If the area is small remove the cracked pavement area then dig out and replace the area of poor subgrade. Patch over the repaired subgrade.
- If the area is large blade patch over the entire pavement surface. The overlay must be strong enough structurally to carry the anticipated loading because the underlying fatigue cracked pavement most likely contributes little or no strength.
- Chip Seal, Fog Seal, Scrub Seal can fill small cracks if the cracks are small (less than 0.25 inch wide) and have not yet begun to interconnect or spall (Chip Seal, Fog Seal or Scrub Sealing will not improve the pavement’s structural capacity and fatigue cracking may continue).
- Crack Fill if the pavement is badly deteriorated until substantial rehabilitation can be undertaken.
- Milling and Hot Mix Inlay/Overlay or In-Place Recycling if the load associated cracking is minor.
- Otherwise, not a candidate for preservation and Major Rehabilitation needed.
**Edge Cracking**

**Description:** Edge cracking is crescent-shaped cracks or fairly continuous cracks that intersect the pavement edge and are located within 2 feet of the pavement edge, adjacent to the shoulder. Edge Cracking includes longitudinal cracks outside of the wheel path and within 2 feet of the pavement edge. The term Edge Cracking only applies to pavements with unpaved shoulders.

![Figure 5: Edge Cracking](image)

**Causes:** Edge Cracking is caused by loss of foundation support due to water, insufficient pavement structure, weak support material or unstable shoulder.

**Severity:** Rated according to integrity
- Low: cracking with no breakup or loss of material
- Medium: cracks with some breakup and loss of material for < 10% of length
- High: cracks with considerable breakup and loss of material for > 10% of length

**Extent:** Feet of length, for each severity level

**Potential Actions:**
- Crack Fill if the cracks exhibit little movement (less than 0.1 inch) and the cracking is minor.
- Chip Seal, Fog Seal, Scrub Seal can fill small cracks (less than 0.25 inch wide).
- Otherwise, not a candidate for preservation
Reflective Cracking

Description: Cracks in an upper asphalt pavement layer that occurs over cracks or joints in a supporting (usually concrete) pavement layer.

Causes: Working Cracks in underlying pavement layers.

Severity & Extent: Record as Transverse & Longitudinal. Typically not an issue for UDOT

Potential Actions:
- Crack Seal if the pavement is in good condition, the pavement is not fatigue-cracked and cracking distress is minimal.
- Crack Fill if the pavement is badly deteriorated until rehabilitation can be undertaken.
- Not a candidate for Slurry Seals or Microsurfacing.
**Bleeding**

**Description:** Bleeding is excess bituminous binder on the pavement surface. It may create a shiny, glass-like, reflective surface that may be tacky to the touch. It is usually found in the wheel paths.

![Figure 7: Bleeding](image)

**Causes:** Bleeding is usually caused by too much asphalt binder in the pavement mix, excessive prime coat or tack coat or by too low an air void content in the pavement mix. Bleeding can also result by using too much oil during Fog Seal or Chip Seal operations or from not using enough oil during Chip Seal operations resulting in rock loss and a pavement surface covered with oil. Bleeding is aggravated by hot weather which causes the softening and expansion of the asphalt binder. Can reduce surface friction.

**Severity:** Rated according to loss of surface texture
- Low: noticeable discoloration of surface due to excess asphalt
- Medium: obvious excess asphalt and surface loosing texture
- High: shinny surface with signs of tire marks

**Extent:** Length of area, for each severity level.

**Potential Actions:**
- Minor bleeding can often be corrected by applying coarse sand to blot up the excess asphalt binder.
- Chip Seal
- Not a candidate for Slurry Seal or Microsurfacing
Raveling

**Description:** Raveling is the wearing away of the pavement surface because of dislodged aggregate particles and loss of asphalt binder.

![Figure 8: Raveling](image)

**Causes:** Oxidation, aged pavement surface, bad workmanship or materials. Raveling is aggravated by hot and wet weather which causes oxidation and stripping of the asphalt binder.

**Severity:** Rated according to loss of surface aggregate
- Low: noticeable loss of binder or aggregate
- Medium: obvious rough or pitted surface, loss of fine aggregate and some loss of coarse aggregate
- High: aggregate and/or binder worn away, very rough surface texture

**Extent:** Square feet of area, for each severity level (use highest level if combined)

**Potential Actions:**
Fog Seal, or Scrub Seal can reduce raveling.
Chip Seal if the raveling is not severe.
Slurry Seal, In-Place Hot or Cold Recycling or Thin Hot Mix Overlay if the raveling is limited to the upper layers.
Polished Aggregate

**Description:** Aggregate polishing is the wearing away of the surface mortar and texturing to expose coarse aggregate.

![Figure 9: Polished Aggregate](image)

**Causes:** The wearing away of the pavement surface due to soft aggregate. Can reduce surface friction.

**Measure:** Square feet of area. Not typically recorded.

**Potential Actions:**
- Chip Seal, Microsurfacing
- Tack Coat and Thin Hot Mix Overlay
Rutting

Description: A longitudinal depression in the wheel path. Rutting is sometimes associated with shoving.

Causes: Permanent deformation of any layer due to weakened support layers, poorly compacted layers and unstable wearing surface or overloading. Severe rutting is often caused by excessive asphalt binder in the pavement mixture. Aggregates in these mixtures do not have aggregate-on-aggregate contact so the material flows instead of being locked in place. Rutting is aggravated by hot weather which causes the softening of the asphalt binder.

Measure: Typically collected along with the IRI data using high speed profiler. Record inches of maximum rut depth for each wheel path. Use higher value for either wheel path. Average the measurements for length of test section.

Potential Actions:
- Microsurfacing – double application, use first lift to fill ruts
- Chip Seal if rutting is minor and non-structural.
- Milling and Hot Mix Inlay/Overlay, or In-Place Recycling if rutting is limited to the upper surface layers and there are no subgrade or base failures
Shoving

Description: Shoving is a longitudinal displacement of a localized area of the pavement surface. It is generally caused by braking or accelerating vehicles and is often located on hills or curves, or at intersections. It may also have associated vertical displacement. Shoving is aggravated by hot weather which causes the softening and expansion of the asphalt binder.

Causes: Poor mix design coupled with large horizontal pressure due to structural failure on straight stretches and turning traffic at intersections and on curves. Shoving is usually associated with rutting.

Measure: Square feet of area affected

Potential Actions:
- Shoving is a material problem and Milling and action to fill ruts is a temporary fix until a substantial rehabilitation can be undertaken.
Delamination

Description: Delaminating pavement layers.

Causes: The most common cause of delamination is water seeping into cracks in the surface of the road during wet, freezing weather. The water freezes, expands, and pushes the upper layer up from the lower layers. The vibration of vehicle tires over the cracked area and stresses to the pavement by the weight of trucks causes the pavement to break up and come out of the pavement.

Delamination is often caused by layers with different properties resulting in the layers not working as a unit, uneven or insufficient binder application, loss of asphalt binder due to aging or poor mix design and deterioration of the upper pavement layer due to oxidation and weathering. Delamination is also caused by aging of the upper pavement layer and poor.

Measure: Square feet of area affected

Potential Actions:
- Patching or Skin patching with hot or cold patching material is required before any pavement preservation action can be taken.
- In-Place Recycling if separation is confined to the upper layers.
- Mill and seal, or overlay.
Potholes

**Description:** Potholes are bowl shaped holes that usually have raveled edges and can be up to 10 inches deep. They occur when the top layer or asphalted surface of the roadway has worn away, exposing the road subbase.

![Figure 13: Potholes](image)

**Causes:** The most common cause of potholes is water seeping into cracks in the surface of the road during wet freezing weather. The water causes the roadbed to weaken. The water freezes, expands, and pushes down on the weakened roadbed under the asphalt. The vibration of vehicle tires over the cracked area and stresses to the pavement by the weight of traffic causes the pavement to sink. The vibration of vehicle tires over the cracked area and stresses to the pavement by the weight of trucks causes the pavement to break up and come out of the pavement and a pothole results.

Potholes can also be caused by bad workmanship or materials or by deterioration of the upper pavement layer. Potholes can occur under dry conditions when trucks pass over weak spots in the subsurface causing structural failure.

Another common way of pothole formation is when water seeps into cracks in the surface of the road and, combined with the vibration of the tires over the cracks, causes the asphalt to fail. That is why there are more potholes after it rains.
Potholes are also created when the roadway is stressed by trucks and buses, which can cause a movement of the subsurface. Once there is a weak spot, every car that travels over it makes the problem worse, and eventually a section of the material will fail, causing a pothole

**Measure:** Each. Severity not recorded.

**Potential Actions:**
- Patching or blade patching with hot or cold patching material is required before any pavement preservation action can be taken. The weakened area must be completely removed and the pavement restored to match the surrounding pavement.
- In-Place Recycling if separation is confined to the upper layers.
Patching / Skin Patching

Description: An area of pavement where part of the original pavement has been replaced or covered with new material to repair the existing pavement. A patch is considered a defect no matter how well it performs. Skin Patching is a patch typically for a full lane width.

Figure 14: Patching

Causes: Previous localized pavement deterioration that has been removed and patched, utility cuts.

Measure: Each, with square feet of area

Potential Actions: Patches are themselves a repair action. The only way they can be removed from a pavement's surface is by either a structural or non-structural overlay.
Edge Drop Off

**Description:** A drop in elevation between the edge of the outside traveled lane and the shoulder, or for narrow shoulders a drop off at the edge of the pavement.

![Figure 15: Edge Drop Off](image)

**Causes:** Typically occurs when the shoulder settles as a result of pavement layer material differences. For narrow shoulders, drop offs occur when the adjacent ground erodes away. Drop offs are aggravated by traffic, inadequate drainage and erosion.

**Measure:** Feet of length, where drop off is > 1”

**Potential Actions:**
- Shoulder dressing
- Adding structure to the surface with the lower elevation.
### Summary of Asphalt Pavement Distress

<table>
<thead>
<tr>
<th>Distress</th>
<th>Probable Cause</th>
<th>Structural</th>
<th>Functional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse Cracking</td>
<td>Climate, Durability</td>
<td>Y</td>
<td>S</td>
</tr>
<tr>
<td>Longitudinal Cracking</td>
<td>Climate, Durability</td>
<td>Y</td>
<td>S</td>
</tr>
<tr>
<td>Block Cracking</td>
<td>Climate, Durability</td>
<td>Y</td>
<td>S</td>
</tr>
<tr>
<td>Wheel Path / Fatigue (Alligator) Cracking</td>
<td>Load, Moisture, Drainage</td>
<td>Y</td>
<td>S</td>
</tr>
<tr>
<td>Edge Cracking</td>
<td>Load</td>
<td>Y</td>
<td>S</td>
</tr>
<tr>
<td>Bleeding</td>
<td>Materials, Climate, Durability</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Raveling</td>
<td>Climate, Durability</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Polished Aggregate</td>
<td>Materials, Traffic</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Rutting</td>
<td>Load, Materials, Moisture, Drainage</td>
<td>S</td>
<td>Y</td>
</tr>
<tr>
<td>Shoving</td>
<td>Load, Materials</td>
<td>S</td>
<td>Y</td>
</tr>
<tr>
<td>Delamination</td>
<td>Materials, Climate</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Potholes</td>
<td>Load, Climate</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Patching / Skin Patching</td>
<td>All</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Water Bleeding and Pumping</td>
<td>Moisture, Drainage</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Corrugation</td>
<td>Load, Materials</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Swelling</td>
<td>Moisture, Drainage</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Depression</td>
<td>Load, Moisture, Drainage</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

Y = Distress type has an effect on Structural integrity or Functional performance of pavement  
S = the effects depend on the severity level
Concrete Pavement Distress

On the following pages are descriptions of various distresses that occur in Concrete pavements, their causes, how they are measured and preservation treatments to address them.

Corner Breaks

Description: The separation of the corner portion of the panel by a crack that intersects the joint and the side of the panel. The lengths along each side of the corner are from 1’ to half of the panel width. Cracks extend thru the full thickness of the slab.

Causes: Loss of support often due to infiltration of water through cracks and damaged joint seals. Corner breaks are aggravated by loading, pumping, inadequate drainage and erosion.

Severity: Rated according to number of pieces, spalling and vertical movement
- Low: one piece and no spalling or settlement
- Medium: one piece and spalling < 3” or > 0.5” of faulting
- High: two or more pieces or spalling > 3” and > 0.5” of faulting

Measure: Number of panels that have corner breaks

Potential Actions:
- Full depth repair
Transverse Cracks

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

Causes: Unbalance loading on slab. Shrinkage, fatigue, settlement and loss of support.

Severity: Rated according to crack width, spalling and vertical movement
- Low: < 0.125", no spalling or settlement
- Medium: width 0.125" to 0.25" or spalling < 3" or < 0.25" of movement
- High: width > 0.25" or spalling > 3" or > 0.25" of movement

Measure: Number of panels that have transverse cracks

Potential Actions:
- Crack sealing if there is minimal structural deterioration and the cracks are less than 0.5 inch wide and have minimal spalling.
- Dowel bar retrofit if there is minimal structural deterioration and the cracks have minimal spalling
- Full-depth repairs, slab replacement or structural enhancement (such as an overlay) are recommended for cracks of moderate and high severity.
- Full-depth repairs are recommended for cracking caused by compressive stress buildup, improper joint construction techniques or working cracks caused by shrinkage, fatigue or foundation movement.
- Diamond grinding can mitigate crack faulting if the faulting is not progressive and if it is done before the faulting reaches critical levels.
Longitudinal Cracks

Description: Cracks that are predominately parallel to the pavement centerline.

Causes: Unbalance loading on panel. Shrinkage, fatigue, settlement and loss of support.

Severity: Rated according to crack width, spalling and vertical movement
- Low: < 0.125", no spalling or settlement
- Medium: width 0.125" to 0.5" or spalling < 3" or < 0.25" of faulting
- High: width > 0.5" or spalling > 3" or > 0.25" of faulting

Measure: Number of panels that have longitudinal cracks

Potential Actions:
- Crack sealing if there is minimal structural deterioration and the cracks are less than 0.5 inch wide and have minimal spalling.
- Stitching if there is minimal structural deterioration and the cracks have minimal spalling.
- Full-depth repairs, slab replacement or structural enhancement (such as an overlay) are recommended for cracks of moderate and high severity.
- Full-depth repairs are recommended for cracking caused by compressive stress buildup, improper joint construction techniques or working cracks caused by shrinkage, fatigue or foundation movement.
- Diamond grinding can mitigate crack faulting if the faulting is not progressive and if it is done before the faulting reaches critical levels.
Map Cracking

Description: Shallow random pattern of hairline cracks.

Causes: Freeze – thaw susceptible aggregates.

Measure: Number of panels that have each defect

Potential Actions:
• Repairs other than slab replacement will only provide temporary relief.
Durability Cracking

Description: Closely spaced crescent shaped hairline cracking pattern occurring adjacent to joints or free edges. The cracks initiate at the slab corners.

Causes: Freeze – thaw susceptible aggregates.

Measure: Number of panels that have each defect

Potential Actions:
- Repairs other than slab replacement will only provide temporary relief.
Shattered Slabs

**Description:** Panels broken into 3 or more pieces. Once a panel is rated as a shattered slab, don’t record any other distress for that panel.

![Figure 21: Shattered Slab](image)

**Causes:** Loss of support often due to infiltration of water through cracks and damaged joint seals. Aggravated by loading, pumping, inadequate drainage and erosion.

**Severity:** Rated according to number of pieces
- Low: 3 pieces
- Medium: 4 pieces
- High: 5 or more pieces

**Measure:** Number of panels. Do not double count panel for transverse or longitudinal cracking.

**Potential Actions:**
- Crack sealing if there is minimal structural deterioration and the cracks are less than 0.5 inch wide and have minimal spalling.
- Full-depth repairs, slab replacement or structural enhancement (such as an overlay) are recommended for cracks of moderate and high severity.
Transverse Joint Spalling

Description: Cracking, breaking or chipping of slab edges along the transverse joint. Spalling typically doesn’t extend full depth, but meets the joint at an angle. Spalled area may be filled with patching material.

Causes: Spalling is usually caused by excessive stresses at the joint due to infiltration of incompressible materials, and subsequent thermal expansion (can also cause blow ups). Misplacement of dowel bars. Poor consolidation during construction.

Severity: Rate joint according to width of spall. Length of joint with spalling not considered.
- Low: < 3"
- Medium: > 3" & < 6"
- High: > 6"

Measure: Number of joints for each severity.

Potential Actions:
- Spalling less than 3 inches from the crack face can generally be repaired with a partial-depth patch. Partial-depth repair is recommended for low severity spalling of longitudinal and construction joints where slab deterioration is located primarily in the upper one-third of the slab and the existing load transfer devices (if any) are still functional.
- Partial-depth repair is recommended if there is intrusion of incompressible materials into the joints (in conjunction with removal of incompressible materials and joint resealing) or for localized areas of scaling, weak concrete, clay balls or high steel.
- Full-depth repair is recommended for medium or high-severity spalling of longitudinal and construction joints or for spalling involving compressive stress buildup in long-jointed pavements, dowel bar misalignment or lock-up, durability cracking, reactive aggregate, or an inadequate air
void system. Spalling greater than 3 inches from the crack face may indicate spalling at the joint bottom and should be repaired with a full-depth patch.

- If spalling is due to a material problem, repairs other than slab replacement will only provide temporary relief.
- Joint Resealing will prevent further intrusion of water or incompressible materials into joints.
Faulting of Transverse Joints and Cracks

**Description:** A difference in elevation across a joint or crack usually associated with undoweled Jointed Plain Concrete Pavement. Usually the approach slab is higher than the leave slab due to pumping, the most common faulting mechanism. Faulting is noticeable when the average faulting in the pavement section reaches about 0.1 inch.

![Figure 23: Faulting of Transverse Joints and Cracks](image)

**Causes:** Most commonly, faulting is a result of slab pumping. Faulting can also be caused by slab settlement, curling, warping and loss of support often due to infiltration of water through cracks and damaged joint seals. Faulting is aggravated by loading, pumping, inadequate drainage and erosion.

**Severity:** rated according to height of fault.
- Low: > 0.1” & < 0.3”
- Medium: 0.3” to 0.5”
- High: > 0.5”

**Measure:** Number of joints for each severity – measured with high speed profiler.

**Potential Actions:**
- Any pumping area should be repaired with a full depth patch to remove any deteriorated slab areas. Consideration should be given to using dowel bars to increase load transfer across any transverse joints created by the repair. Consideration should be given to stabilizing any slabs adjacent to the pumping area as significant amounts of their underlying base, subbase or subgrade may have been removed by the pumping. Any sources of water or cause of poor drainage should be addressed.
- Load transfer restoration if there is none.
- Slab replacement or a structural enhancement (such as an overlay) is recommended if the faulting is due to structural failure.
- Diamond grinding can mitigate low severity (less than 0.3 in) slab faulting if the faulting is not progressive. Diamond grinding addresses serviceability problems but it will not address the cause of faulting, nor will it prevent roughness in the future as a result of additional faulting.
- Slab jacking can sometimes mitigate loss of slab support.
- Under sealing can sometimes stop further faulting by filling voids under the slab.
Scaling

**Description:** This is the loss of surface mortar.

**Causes:** Freeze – thaw susceptible aggregates.

**Measure:** Number of panels that have each defect

**Potential Actions:**
- Repairs other than slab replacement will only provide temporary relief.
Pop Outs

**Description:** Small pieces of pavement broken loose from the pavement surface, normally ranging in diameter from 1 inch to 4 inches and from \( \frac{1}{2} \) inch to 2 inch deep. Pop outs themselves are not serious but they can spall into potholes.

![Pop Cuts](image)

**Figure 25: Pop Cuts**

**Causes:** Pop outs usually occur as a result of poor aggregate durability. Poor durability can be a result of a number of items such as:
- Poor aggregate freeze-thaw resistance
- Expansive aggregates
- Alkali-aggregate reactions

**Measure:** Not measured in distress surveys

**Potential Actions:**
- Isolated low severity pop outs may not warrant repair.
- Medium pop outs can be filled with epoxy patching material before they can spall into potholes.
- Larger pop outs or a group of pop outs can generally be repaired with a partial-depth patch.
Polished Aggregate

Description: Aggregate polishing is the wearing away of the surface mortar and texturing to expose coarse aggregate.

Causes: The wearing away of the pavement surface due to soft aggregate. Can reduce surface friction.

Measure: Square feet of area. Not typically recorded.

Potential Actions:
- Diamond Grinding
Joint Seal Damage

**Description:** Any condition which allows incompressible materials or water to infiltrate into the joint from the surface. Types of joint seal damage include joint sealant stripping, joint sealant extrusion, weed growth, hardening of filler, and loss of bond to slab edges or absence of joint sealant.

![Joint Seal Damage](image)

**Figure 27: Joint Seal Damage**

**Causes:** Deterioration or damage to joint seals due to improper installation, incompatibility with the concrete or contamination.

**Measure:** Number of Joints. Severity not rated.

**Potential Actions:** Joint resealing whenever the existing material is damaged or is no longer performing its intended function.
Potholes and Patch Deterioration

Description: Bowl shaped holes in the pavement surface where the original concrete or patch material has deteriorated.

Causes: The most common cause of potholes and patch deterioration is water seeping into cracks in the surface or under a patch during wet, freezing weather. The water freezes, expands, and pushes up from below the cracked area. The vibration of vehicle tires over the cracked area and stresses to the pavement by the weight of trucks causes the pavement to break up and come out of the pavement.

Measure: Each. Severity not recorded.

Potential Actions:
- Small potholes and deteriorated cracks can be fixed temporarily using patch material.
- Potholes or patch deterioration can be permanently repaired by full-depth repairs, partial depth repairs or slab replacement depending on the reason for and the size and depth of the pothole or deteriorated patch.
Punchouts

Description: Localized slab portion broken into several pieces. The area enclosed by two closely spaced (usually less than 2 feet) transverse cracks, a short longitudinal crack and the edge of the pavement or a longitudinal joint. Also includes “Y” cracks that exhibit spalling, breakup and faulting.

Causes: Construction defects such as insufficient design or inadequate consolidation. Overloading. In CRCP, punchouts can be caused by steel corrosion, inadequate amount of steel, excessively wide shrinkage cracks or excessively close shrinkage cracks.

Measure: Record panel as a shattered slab. Severity not rated.

Potential Actions:
- Selective slab replacement.
- Full depth repair.
**Edge Drop Off**

**Description:** A difference in elevation between the edge of the slab and the shoulder; typically occurs when the shoulder settles.

![Figure 30: Edge Drop Off](image)

**Causes:** Typically occurs when the shoulder settles as a result of pavement layer material differences. For narrow shoulders, drop offs occur when the adjacent ground erodes away. Drop offs are aggravated by traffic, inadequate drainage and erosion.

**Measure:** Feet of length, where drop off is > 1”

**Potential Actions:**
- Shoulder repair.
- Milling of the surface with the higher elevation
- Adding structure to the lower surface.
## Summary of Concrete Pavement Distress

<table>
<thead>
<tr>
<th>Distress</th>
<th>Probably Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corner Breaks</td>
<td>Load</td>
</tr>
<tr>
<td>Transverse Cracks</td>
<td>Load, Climate</td>
</tr>
<tr>
<td>Longitudinal Cracks</td>
<td>Load</td>
</tr>
<tr>
<td>Map Cracking</td>
<td>Climate, Durability</td>
</tr>
<tr>
<td>Durability Cracking</td>
<td>Material, Climate</td>
</tr>
<tr>
<td>Shatters Slabs</td>
<td>Load</td>
</tr>
<tr>
<td>Faulting</td>
<td>Lack of Load Transfer</td>
</tr>
<tr>
<td>Scaling</td>
<td>Materials, Climate Moisture</td>
</tr>
<tr>
<td>Pop Outs</td>
<td>Materials, Climate</td>
</tr>
<tr>
<td>Polished Aggregate</td>
<td>Materials, Traffic</td>
</tr>
<tr>
<td>Joint Seal Damage</td>
<td>Climate</td>
</tr>
<tr>
<td>Potholes and Patch Deterioration</td>
<td>Climate</td>
</tr>
<tr>
<td>Punchouts</td>
<td>Load</td>
</tr>
<tr>
<td>Edge Drop Off</td>
<td>Materials, Drainage, Traffic</td>
</tr>
<tr>
<td>Blowups</td>
<td>Climate</td>
</tr>
<tr>
<td>Lane to Shoulder Separation</td>
<td>Climate</td>
</tr>
<tr>
<td>Water Bleeding and Pumping</td>
<td>Moisture, Drainage</td>
</tr>
<tr>
<td>Reactive Aggregate</td>
<td>Materials</td>
</tr>
</tbody>
</table>
Manual Distress Survey

Manual distress surveys were conducted using these Access database data entry forms. The first 500’ of each mile was surveyed annually.

Figure 31: Manual Distress Survey Form
Appendix A:
The following table has the condition data collected in 2009. This data was collected in the Negative direction and both directions for the Interstate. This data is available in 0.1 mile intervals. dTIMS converts the measured 0.1 mile values to section level Index values.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Definition</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route</td>
<td>Route name</td>
<td>N/A</td>
</tr>
<tr>
<td>Direction</td>
<td>Direction of ARAN collection</td>
<td>N/A</td>
</tr>
<tr>
<td>From_MP</td>
<td>Milepoint at start of segment to 3 decimals.</td>
<td>Miles</td>
</tr>
<tr>
<td>To_MP</td>
<td>Milepoint at end of segment to 3 decimals.</td>
<td>Miles</td>
</tr>
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<td>Pavement_Type</td>
<td>Pavement type</td>
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</tr>
<tr>
<td>Conc_Shattered_Low</td>
<td>Slab broken into 3 pieces</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Shattered_Med</td>
<td>Slab broken into 4 pieces</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Shattered_High</td>
<td>Slab broken into 5 or more pieces</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Long_Low</td>
<td>Crack widths &lt; 1/8&quot; and crack lengths &gt;= 2 feet</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Long_Med</td>
<td>Crack widths 1/8&quot; to 1/2&quot; and crack lengths &gt;= 2 feet</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Long_High</td>
<td>Crack widths &gt; 1/2&quot; and crack lengths &gt;= 2 feet</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Trans_Low</td>
<td>Crack widths &lt; 1/8&quot; and crack lengths &gt;= 2 feet</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Trans_Med</td>
<td>Crack widths 1/8&quot; to 1/4&quot; and crack lengths &gt;= 2 feet</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Trans_High</td>
<td>Crack widths &gt; 1/4&quot; and crack lengths &gt;= 2 feet</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_CrnBrk_Low</td>
<td>One Corner Break with no Spalling or Faulting</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_CrnBrk_Med</td>
<td>One Corner Break AND Spalling &lt; 3&quot; OR Faulting &lt; 1/2&quot;</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_CrnBrk_High</td>
<td>Two or more Corner Breaks OR One Corner Break along with either Spalling &gt; 3&quot; or Faulting &gt; 1/2&quot;</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_JntSpl_Low</td>
<td>Spalling &lt; 3&quot; wide</td>
<td># of Transverse Joints Affected</td>
</tr>
<tr>
<td>Conc_JntSpl_Med</td>
<td>Spalling 3&quot; to 6&quot; wide</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_JntSpl_High</td>
<td>Spalling &gt; 6&quot; wide</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Asphalt_Patch</td>
<td>Count # of slabs with asphalt patches</td>
<td># of Slabs</td>
</tr>
<tr>
<td>Conc_Faulting_Low</td>
<td>Faults &lt; 0.3&quot;</td>
<td># of Faults</td>
</tr>
<tr>
<td>Conc_Faulting_Med</td>
<td>Faults 0.3&quot; to 0.5&quot;</td>
<td># of Faults</td>
</tr>
<tr>
<td>Conc_Faulting_High</td>
<td>Faults &gt; 0.5&quot;</td>
<td># of Faults</td>
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<tr>
<td>Conc_Faulting_Total</td>
<td>Total number of faults</td>
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</tr>
<tr>
<td>Asph_WhlPath_Low</td>
<td>Longitudinal cracks with no or only a few secondary cracks. No spalling.</td>
<td>Square Feet</td>
</tr>
<tr>
<td>Asph_WhlPath_Med</td>
<td>Interconnected cracks starting to form an alligator pattern, dimensions generally &gt; 12&quot; length</td>
<td></td>
</tr>
<tr>
<td>Asph_WhlPath_High</td>
<td>Alligator pattern with dimensions &lt; 12&quot; length or pieces missing</td>
<td></td>
</tr>
<tr>
<td>Asph_Block_Low</td>
<td>Unsealed cracks &lt; 1/4&quot; wide or sealed cracks</td>
<td>Feet</td>
</tr>
<tr>
<td>Asph_Block_Med</td>
<td>Widths 1/4&quot; to 3/4&quot; or secondary crack widths &lt; 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Asph_Block_High</td>
<td>Widths &gt; 3/4&quot; or secondary cracks widths &gt;= 1/4&quot;</td>
<td></td>
</tr>
</tbody>
</table>
| Asph_Long_Low      | Sealed cracks or unsealed cracks < 1/4" wide                               | Feet (Note:
<table>
<thead>
<tr>
<th>Asph_Long_Med</th>
<th>Unsealed or poorly sealed cracks with widths &gt; 1/4&quot; and &lt; 3/4&quot; or secondary crack widths &lt; 1/4&quot;</th>
<th>Max can be &gt; 528'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asph_Long_High</td>
<td>Widths &gt; 3/4&quot; or secondary cracks widths &gt; 1/4&quot;, unsealed or poorly sealed.</td>
<td></td>
</tr>
<tr>
<td>Asph_Trans_Low</td>
<td>Unsealed cracks &lt; 1/4&quot; wide or sealed cracks</td>
<td>Count (Number of cracks)</td>
</tr>
<tr>
<td>Asph_Trans_Med</td>
<td>Unsealed or poorly sealed cracks with widths &gt; 1/4&quot; and &lt; 3/4&quot; or secondary crack widths &lt; 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Asph_Trans_High</td>
<td>Widths &gt; 3/4&quot; or secondary cracks widths &gt; 1/4&quot;, unsealed or poorly sealed.</td>
<td></td>
</tr>
<tr>
<td>Asph_Bleed_High</td>
<td>Shiny appearance due to excess asphalt. Aggregate obscured by excess asphalt.</td>
<td>Feet</td>
</tr>
<tr>
<td>Asph_Patch</td>
<td>Area of patching and utility cuts over one square foot in size.</td>
<td>Square Feet</td>
</tr>
<tr>
<td>IRI_Left</td>
<td>IRI in left wheelpath</td>
<td>in / mile</td>
</tr>
<tr>
<td>IRI_Right</td>
<td>IRI in right wheelpath</td>
<td></td>
</tr>
<tr>
<td>IRI_Average</td>
<td>Average of left and right IRI</td>
<td></td>
</tr>
<tr>
<td>Rut_Left</td>
<td>Rutting in left wheelpath</td>
<td>inches</td>
</tr>
<tr>
<td>Rut_Right</td>
<td>Rutting in right wheelpath</td>
<td></td>
</tr>
</tbody>
</table>