



PAVEMENT MANAGEMENT FIELD HANDBOOK

**KYTC PAVEMENT DISTRESS
IDENTIFICATION MANUAL
&
GUIDELINE FOR PREVENTIVE
MAINTENANCE TREATMENTS
2009**



KYTC PAVEMENT DISTRESS IDENTIFICATION MANUAL

Introduction

Each year the Operations and Pavement Management Branch performs detailed pavement condition evaluations of all Interstate and Parkway pavements and one third of the remaining system (State Primary, State Secondary, and Supplemental Roads). The evaluations are used to document roadway deterioration, recommend pavement rehabilitation treatments, and prioritize projects. In order for evaluation data to be useful for predictive measures, consistent methods of distress identification and recording are critical.

Pavement Condition Evaluations

The Kentucky pavement network consists of bituminous, concrete and composite pavements ranging in condition, age, and performance. The Pavement Management System divides the network into logical sections and collects pavement performance data related to these sections. Pavement distresses are classified and rated according to type, severity, and extent.

Ideally, the extent of each severity of each type of distress would be measured and recorded using finite values. In the absence of automated survey techniques, data collection techniques need to be limited for reasonable application to extensive roadway networks.

The Kentucky Transportation Cabinet (KYTC) pavement condition evaluations record the predominant severity of each distress type. Distress extents are estimated using standardized ranges of values. KYTC applies a demerit point system to measure pavement distress. Pavements with higher demerit points exhibit greater deterioration.

Objective

The Pavement Distress Identification Manual will foster more uniform and consistent pavement distress evaluations by providing identification definitions and guidelines. The manual is intended to be a training aid for pavement raters and a field reference during the rating process. The manual can also be used with completed evaluations to describe the typical condition of a roadway section.

Pavement Condition Evaluation Considerations

- The time of year and weather conditions can affect the severity and visibility of certain distresses. Rate the roadways at similar times each year and only while the pavement is dry.
- The relative sun angle can greatly affect visual observation. Be sure to view the pavement from more than one direction during the evaluation.
- Use separate forms when opposite sides of the roadway are rated separately or when new sections are created based on definite pavement condition breaks.
- Verify the historical data provided.
- Previous year evaluation data should be provided when possible. Previous year data may aid borderline severity and extent ratings and help detect major changes or erroneous data.
- Observe the entire pavement surface area of the roadway section.
- The elements of pavement condition evaluations are: type of distress, severity of distress, extent to which the road surface is affected by the distress.
- For each distress record the predominant severity. Record the higher rated severity if approximately equal proportions of more than one severity exist. The purpose is to establish a severity that represents the typical condition of the roadway section.
- The extent recorded is the overall extent associated with all levels of severity for a given distress type.

- Note the occurrence of any level of severity that is significantly higher than rated.
- Measurement descriptions given in the manual are for estimation only. Manual crack measurements are not performed during pavement evaluations.

FLEXIBLE PAVEMENTS

Fatigue Cracking Cont'd

Severity

Slight 0-3 Points

Cracks are less than ¼" in width
No adjacent hairline cracking

Moderate 4-6 Points

Cracks are about ¼" in width
May have light spalling
Random adjacent cracking
Early stages of alligator cracking may be forming

Severe 7-9 Points

Cracks are greater than 3/8" in width
½" is the max allowable crack width
Edges are severely spalled
Significant adjacent cracking progressed into alligator cracking
Potholes are possible

Raveling Cont'd

Severity

Slight 0-1 Points

Slight loss of aggregate or binder

Small amounts of pitting

Pavement appears slightly aged or rough

Moderate 2-3 Points

Fine aggregate partially missing

Pitting is evident

Pavement appears moderately rough and loose particles may be present

Severe 4-5 Points

Aggregate and binder have worn away significantly

Pavement appears deeply pitted and very rough

Other Cracking Cont'd

Severity

Slight **0-1 Points**
Cracks are less than $\frac{1}{4}$ " in width

Moderate **2-3 Points**
Cracks are $\frac{1}{4}$ " to $\frac{1}{2}$ " wide
There may be slight secondary cracking
Edges may be spalled

Severe **4-5 Points**
Cracks are greater than $\frac{1}{2}$ "
 $\frac{3}{4}$ " is the max allowable crack width
Significant secondary cracking is present
Edges are severely spalled

Joint Separation

Description

Longitudinal cracks near the lane edges that are commonly associated with paving construction joints.

Note

Sealed cracks where the sealant remains in good condition should be rated as slight severity cracking. If the sealant is showing distress the original crack severity should be rated.

Extent

Few

0 Points

Less than 20% of the section length shows longitudinal cracking

Intermediate – Extensive Rate Severity

Greater than 20% of the section length shows longitudinal cracking

Joint Separation Cont'd

Severity

Slight **0-1 Points**
Cracks are less than $\frac{1}{4}$ " in width

Moderate **2-3 Points**
Cracks are $\frac{1}{4}$ " to $\frac{1}{2}$ " wide
There may be slight secondary cracking
Edges may be spalled

Severe **4-5 Points**
Cracks are greater than $\frac{1}{2}$ "
 $\frac{3}{4}$ " is the max allowable crack width
Significant secondary cracking is present
Edges are severely spalled

Out of Section

Note

Out of section is considered only for resurfacing program evaluations.

Description

Areas that are outside of the typical section are localized depressions or elevated areas of pavement that result from settlement, pavement shoving, or displacement.

Extent

Few

0-1 Points

Less than two localized sections per mile

Intermediate

1.5-2 Points

Two to four localized sections per mile

Extensive

2.5-3 Points

More than four localized sections per mile

Severity

Slight

0-1 Points

Noticeable effect on ride

Moderate

1.5-2 Points

Some discomfort

Severe

2.5-3 Points

Poor ride

Safety is a concern at maintained speed limit

Patching Cont'd

Severity

Slight 0-1 Points

Patch has nearly straight edges, rough texture, and surface contours which mimic the surface around the patch

Moderate 1.5-2 Points

Patch has edges shaped to contours of surrounding pavement and is of variable thickness with feathered edges

Severe 2.5-3 Points

Patch has loss of material and/or is settled

Appearance

Description

Appearance refers to the general aesthetic of the roadway to the public at large. This includes potholes, cracking, unsightly patching, etc.

0 Points

The pavement is in excellent condition. This typically represents new construction.

1-1.5 Points

The pavement is in good to acceptable condition. Slight amounts of low severity distresses and/or neat patches may be present.

2-2.5 Points

The pavement is in acceptable to poor condition. Moderate amounts of low or intermediate severity distresses and/or irregular patches may be present.

3 Points

The pavement is in unacceptable condition. Extensive amounts of distresses along with severe distresses and/or frequent patching may be present.

Note

If typical crack sealing is present add .5 point. If excessive crack sealing is present add 1 point.

Rutting

Description

A rut is a longitudinal surface depression in the wheel path.

Severity

The severity of rutting is measured by the depth of the rut depression. Rate the overall severity by using the average observed severity level. If a localized area is severe (often this occurs in intersections), add a note to the comments field.

Measurement

Lay a four foot or longer straight edge across the wheel path and measure the depth or distance between the straight edge and the pavement at the center of the wheel rut. Take measurements in as many locations as is practical and average them.

PORTLAND CEMENT CONCRETE

Joint Deterioration Cont'd

Severity

Slight

0-3 Points

Spalling occurs a minimum of 2" from the edge of the joint for a continuous length of less than 1' along the joint

Joint sealant is in good condition

Joints that have bituminous patches for less than 1'

D cracking and/or corner breaks are tight with no loose pieces

Moderate

4-6 Points

Spalling occurs a minimum of 2" from the edge of the joint for a continuous length of 1' – 3' along the joint

Joint sealant is beginning to come apart

Joints that have bituminous patches for 1' – 3'

D cracking and/or corner breaks are well defined with small loose pieces

Severe

7-9 Points

Spalling occurs a minimum of 3" from the edge of the joint for a continuous length of greater than 3' along the joint

Joint sealant is in poor condition

Joints that have more than 3' of bituminous patching

D cracking and/or corner breaks have developed into a pattern with significant amounts of loose material

Patching Cont'd

Severity

Slight 0-1 Points

Patch has nearly straight edges, rough texture, and surface contours which mimic the surface around the patch

Moderate 1.5-2 Points

Patch has edges shaped to contours of surrounding pavement and is of variable thickness with feathered edges

Severe 2.5-3 Points

Patch has loss of material and/or is settled

**KYTC GUIDELINE FOR
PREVENTIVE
MAINTENANCE
TREATMENTS**

Introduction

Preventive maintenance is a planned strategy of cost effective treatments to an existing roadway system that preserves the system, retards future deterioration, extends the service life, and maintains or improves the functional condition of the system without substantially increasing structural capacity. Consequently, preventive maintenance treatments should only be applied on pavements without underlying structural problems. Once a pavement begins to exhibit moderate to high levels of deterioration, the treatments outlined herein should not be considered viable options.

This guideline is to be used during pavement evaluations to recommend the most cost effective preventive maintenance treatment. Descriptions of each treatment follow and include materials, purpose, limitations, Pavement Management evaluation guidelines, and a feasibility chart.

TABLE 1: GUIDELINES FOR FLEXIBLE PAVEMENT TREATMENT SELECTION

	SEAL CRACKS	IMPROVE FRICTION	IMPROVE RIDEABILITY	REJUVENATE SURFACE	INHIBIT RAVELING	FILL RUTTING
CRACK SEALING	X					
CRACK FILLING	X					
FOG SEAL	X			X	X	
SAND SEAL	X	X		X	X	
SLURRY SEAL	X	X		X	X	
SCRUB SEAL	X	X		X	X	
MICROSURFACE	X	X	X	X	X	X
ULTRATHIN FRICTION COURSE	X	X	X	X	X	
ULTRATHIN OVERLAY	X	X	X	X	X	

TABLE 2:GUIDELINES FOR RIGID PAVEMENT TREATMENT SELECTION

	SEAL CRACKS	IMPROVE FRICTION	IMPROVE RIDEABILITY	REMOVE FAULTING	PREVENT INTRUSION OF MOISTURE AND INCOMPRESSIBLES
DIAMOND GRINDING		x	x	x	
CRACK SEALING	x				x
JOINT RESEALING					x
PAVEMENT REPAIR			x	x	x

TABLE 3:GUIDELINES FOR COMPOSITE PAVEMENT TREATMENT SELECTION

	SEAL CRACKS	IMPROVE FRICTION	IMPROVE RIDEABILITY	REJUVENATE SURFACE	INHIBIT RAVELING	FILL RUTTING
CRACK SEALING	x					
CRACK FILLING	x					
FOG SEAL	x			x	x	
MICROSURFACE	x	x	x	x	x	x
ULTRATHIN OVERLAY	x	x	x	x	x	

TABLE 4: OPERATIONS AND PAVEMENT MANAGEMENT BRANCH
CONDITION SURVEY SCALE

CONDITION SURVEY	EXTENT					SEVERITY																		
	Few	Intermediate	Extensive	Few	Intermediate	Extensive	Few	Intermediate	Extensive															
Blague Cracking / Joint Deterioration	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9				
Spalling / Patching	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
Other Cracking	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
Out-of-Section	0	1	1.5	2	2.5	3	0	1	1.5	2	2.5	3	0	1	1.5	2	2.5	3	0	1	1.5	2	2.5	3
Joint Separation	Total Points										5													

Routed Asphalt Crack Sealing

Crack sealing is the placement of a mixture of neat or modified binder mixed with polyester into existing cracks in the pavement.

Crack sealing prevents water and incompressibles from entering the pavement structure which slows the deterioration of moisture related distresses such as stripping, pumping of fines, and increased fatigue cracking.

Asphalt crack sealing is generally targeted to poor longitudinal construction joints or working cracks more than 1/8" but less than 1/2". **Working cracks are defined as those that experience significant horizontal movements. Typical working cracks include: transverse thermal cracks, transverse reflective cracks, diagonal cracks, and working longitudinal cracks.** Visible surface distresses should be fairly straight open longitudinal and transverse cracks with slight secondary cracking and slight raveling. Crack sealing is suitable for all traffic levels.

KYTC Pavement Management Evaluation Guidelines

Fatigue Cracking	Extent <= 5, Severity <= 3
Raveling	Total Score <= 5
Other Cracking	Extent and Severity both <=3
Joint Separation	Less than or equal to 3
Rutting	Less than or equal to 3/8"
Total Condition Points	Less than or equal to 30
Time to Next Overlay	Greater than or equal to 6 years

Overband Asphalt Crack Filling

The overband crack fill method involves blowing the crack clean with dried, compressed air and filling it with mixture of neat or modified binder mixed with polyester.

Crack filling prevents water from entering the pavement structure and reinforces the adjacent pavement

Asphalt crack filling is principally used for treating non-working cracks more than 1/8" but less than 1/2". **Typical non-working cracks include: longitudinal reflective cracks, longitudinal cold joint cracks, longitudinal edge cracks, and distantly spaced block cracks.** Visible surface distresses should be fairly straight open longitudinal and transverse cracks with slight secondary cracking and slight raveling at the crack face. Crack filling should not be used on longitudinal Fatigue cracking because of friction concerns. Crack filling is suitable for all traffic levels.

KYTC Pavement Management Evaluation Guidelines

Fatigue Cracking	Extent<=5, Severity <= 3
Raveling	Total Score <=5
Other Cracking	Extent and Severity both <=3
Joint Separation	Less than or equal to 3
Rutting	Less than or equal to 3/8"
Total Condition Points	Less than or equal to 30
Time to Next Overlay	Greater than or equal to 6 years

Fog Seal

A fog seal is a light application of diluted asphalt emulsion.

Fog seals are used to seal the small cracks, inhibit raveling, and provide some enrichment to a hardened and oxidized surface.

A fog seal is appropriate for aged or raveled pavements. Pavements that are not raveled will not adequately absorb the mixture, resulting in a slick surface. However, extremely raveled roads may be beyond the point where a fog seal is beneficial. Fog seals should not be used when cracking is extensive or for cracks greater than 1/8". Due to the time required before traffic is returned and current lack of experience, fog seals should be excluded from higher ADT routes.

KYTC Pavement Management Evaluation Guidelines

Fatigue Cracking	Extent \leq 5, Severity \leq 3
Raveling	Total Score \leq 8 and \geq 4
Other Cracking	Total Score \leq 3
Joint Separation	Less than or equal to 1
Rutting	Less than or equal to 1/4"
Total Condition Points	Less than or equal to 30
ADT	Less than or equal to 1500
Time to Next Overlay	Greater than or equal to 6 years

Sand Seal

A sand seal is the application of asphalt emulsion followed by a thin layer of sand to seal small cracks and protect pavements.

A sand seal is used to retard oxidation of an existing pavement, improve skid resistance and seal pavement surfaces on low volume roads.

Sand seals should be applied to roadway sections with moderate longitudinal and transverse cracking, minor amounts of secondary cracking, slight raveling, and slight to moderate polishing. Due to the current lack of experience with sand seals, they should be used only on low volume roads and on asphalt surfaced shoulders.

KYTC Pavement Management Evaluation Guidelines

Fatigue Cracking	Extent \leq 5, Severity \leq 3
Raveling	Total Score \leq 8 and \geq 4
Other Cracking	Total Score \leq 3
Joint Separation	Less than or equal to 1
Rutting	Less than or equal to $\frac{1}{4}$ "
Total Condition Points	Less than or equal to 30
ADT	Less than or equal to 1500
Time to Next Overlay	Greater than or equal to 6 years

Scrub Seal

A scrub seal is the application of asphalt emulsion followed by the broom scrubbing of the asphalt into cracks and voids, then the application of an even coat of sand or small aggregate, and finally a second brooming of the aggregate and asphalt mixture.

The treatment is used to retard oxidation of an existing pavement, improve skid resistance and seal pavement surfaces on low volume roads.

Scrub seals should be applied to roadway sections with moderate longitudinal and transverse cracking, minor amounts of secondary cracking, slight raveling, and slight to moderate polishing. Due to the current lack of experience with scrub seals, they should be used only on low volume roads and on asphalt surfaced shoulders.

KYTC Pavement Management Evaluation Guidelines

Fatigue Cracking	Extent \leq 5, Severity \leq 3
Raveling	Total Score \leq 8
Other Cracking	Total Score \leq 4
Joint Separation	Less than or equal to 2
Rutting	Less than or equal to $\frac{1}{4}$ "
Total Condition Points	Less than or equal to 30
ADT	Less than or equal to 150
Time to Next Overlay	Greater than or equal to 6 years

Slurry Seal

A slurry seal is a mixture of slow setting emulsified asphalt, well graded fine aggregate, mineral filler, and water.

A slurry seal used to fill cracks and seal areas of old pavements, restore a uniform surface texture, seal the surface against water and air intrusion, stop raveling, and to improve skid resistance.

A slurry seal is primarily used to fill non-working cracks in the pavement. Slurry seals should be applied to roadway sections with moderate longitudinal and transverse cracking, minor amounts of secondary cracking, slight raveling, and slight to moderate polishing. Due to the current lack of experience with slurry seals, they should be used only on low volume roads and on asphalt surfaced shoulders.

KYTC Pavement Management Evaluation Guidelines

Fatigue Cracking	Extent \leq 5, Severity \leq 3
Raveling	Total Score \leq 8
Other Cracking	Total Score \leq 5
Joint Separation	Less than or equal to 2
Rutting	Less than or equal to $\frac{1}{4}$ "
Total Condition Points	Less than or equal to 30
ADT	Less than or equal to 1500
Time to Next Overlay	Greater than or equal to 6 years

Ultrathin Friction Course

An ultrathin friction course is a gap-graded, polymer modified HMA placed on a heavy, polymer modified emulsified asphalt tack coat.

An ultrathin friction course is a functional overlay that can be used to improve friction and ride, reduce raveling and noise, and seal small non-working cracks. The heavy tack coat also serves as a barrier for the intrusion of water into the pavement surface.

Ultrathin friction course should be used on roadway sections with moderate longitudinal and transverse cracking, minor surface irregularities, rutting less than ½", polished surface, and moderate raveling. Ultrathin friction course is suitable for all traffic levels.

KYTC Pavement Management Evaluation Guidelines

Fatigue Cracking	Total Score <= 10
Raveling	Total Score <= 6
Other Cracking	Total Score <= 5
Joint Separation	Less than or equal to 3
Rutting	Less than or equal to ½"
Total Condition Points	Less than or equal to 35
Time to Next Overlay	Greater than or equal to 4 years and less than or equal to 8 years

Microsurfacing

Microsurfacing is a mixture of polymer-modified asphalt emulsion, mineral aggregate, mineral filler, water, and additives, properly proportioned, mixed, and spread on a paved surface.

A single course microsurfacing applied to a pavement will retard oxidization and improve skid resistance. A multiple-course microsurfacing application will correct certain pavement surface deficiencies including rutting, minor surface profile irregularities, polished aggregate or low skid resistance, and light to moderate raveling.

Microsurfacing should be used on roadway sections with moderate longitudinal and transverse cracking, rutting, minor surface irregularities, polished surface, and moderate raveling. Localized wheel path cracking or edge cracking should be repaired full depth. All existing cracks must be filled or sealed. Microsurfacing is suitable for all traffic levels.

KYTC Pavement Management Evaluation Guidelines

Fatigue Cracking	Total Score \leq 10
Raveling	Total Score \leq 6
Other Cracking	Total Score \leq 5
Joint Separation	Less than or equal to 3
Total Condition Points	Less than or equal to 35
Time to Next Overlay	Greater than or equal to 4 years and less than or equal to 8 years

Ultrathin Overlay

An ultrathin overlay is a plant-mixed combination of asphalt cement and aggregate applied to the pavement in thicknesses of 5/8" to 3/4".

An ultrathin overlay is a functional overlay that can be used to improve friction and ride, reduce raveling and noise, and seal small non-working cracks.

An ultrathin overlay should be used on roadway sections with moderate longitudinal and transverse cracking, minor surface irregularities, rutting less than 1/4", polished surface, and moderate raveling. Ultrathin overlays are suitable for all traffic levels. However, until there is a better understanding of its performance, ultrathin overlays should be limited to sections that are not expected to experience significant shear forces such as those caused by heavy trucks braking or turning onto the pavement.

KYTC Pavement Management Evaluation Guidelines

Fatigue Cracking	Extent <= 5, Severity <= 3
Raveling	Total Score <= 6
Other Cracking	Total Score <= 5
Joint Separation	Less than or equal to 3
Rutting	Less than or equal to 1/4"
Total Condition Points	Less than or equal to 30
Time to Next Overlay	Greater than or equal to 4 years and less than or equal to 8 years

Diamond Grinding

Diamond grinding is a process that uses a series of diamond tipped saw blades mounted on a shaft or arbor to shave off the upper surface (about 1/4") of a rigid pavement.

Diamond grinding benefits include improved ride quality, removal of joint and crack faults, removal of wheel ruts caused by studded tires, restoration of transverse drainage, and improvement of skid resistance.

Diamond grinding should be used on roadway sections with joint and crack faults on average not exceeding 1/4", rut depths less than 1/4", and moderate to severe polishing. Structural distress and drainage problems require repair before grinding is conducted. Diamond grinding is not recommended for pavements with significant slab cracking or severe durability distress, such as D-cracking, alkali-silica reactivity, or freeze-thaw damage. The effectiveness of diamond grinding may be limited if significant pumping or loss of support exists.

KYTC Pavement Management Evaluation Guidelines

Joint Deterioration	Extent <= 5, Severity <= 3
Faulting	Total Score <= 6
Other Cracking	Extent <= 4, Severity <= 3
IRI	Greater than 130
Remaining Service Life	Greater than or equal to 10 years

Concrete Crack Sealing

Concrete crack sealing involves sawing, cleaning and sealing of concrete pavement cracks that are longer than 3 feet and wider than 1/8". For cracks wider than 3/8", a backer rod must be used.

Concrete crack sealing is intended to prevent or reduce the ingress of moisture and incompressible material into cracks, thereby slowing deterioration.

Slowly deteriorating concrete pavements are appropriate for crack sealing. Crack sealing is commonly performed on working cracks that are wide enough to permit significant infiltration. The pavement should have a low severity level of longitudinal and transverse cracks that do not exhibit significant spalling. Crack sealing is not usually done on Continuous Reinforced Concrete Pavement.

KYTC Pavement Management Evaluation Guidelines

Joint Deterioration	Total Score ≤ 4
Faulting	Total Score ≤ 4
Other Cracking	Extent and Severity both ≤ 3
IRI	Less than or equal to 130
Remaining Service Life	Greater than or equal to 15 years

Concrete Joint Resealing

Concrete joint resealing includes the removal of existing deteriorated joint seals, and resealing the transverse and longitudinal joints with hot-poured rubber.

Concrete pavement joints are sealed to prevent water and incompressible materials from entering the pavement structure. An effective joint sealant system is expected to reduce moisture accelerated distresses (such as pumping and faulting) and pressure related distresses (joint spalling and blowups) that result when slabs are unable to expand into transverse joints filled with incompressible materials.

Resealing can be done where existing joint seals have failed. Joint faces must be in good condition with little or no spalling. Joints should not be open more than 1" at any temperature and joint widths should not vary by more than 1/8".

KYTC Pavement Management Evaluation Guidelines

Joint Deterioration	Total Score \leq 5
Faulting	Total Score \leq 2
Other Cracking	Extent and Severity both \leq 3
IRI	Less than or equal to 130
Remaining Service Life	Greater than or equal to 15 years

Concrete Pavement Repair

Partial depth repair is used to repair localized areas of surface deterioration within the upper one-third of the slab depth. Full depth concrete pavement repair consists of the removal and replacement of the concrete pavement at the deteriorated joint or open crack

Concrete pavement will restore pavement structural integrity and should maintain its existing ride quality. Secondary benefits include reducing the quantity of water entering the pavement structure and slowing the rate of distress.

The concrete pavement should be in good condition and deteriorating slowly. Transverse joints and cracks to be repaired should show severe spalling over their length. Other transverse joints and cracks with openings wider than ¼” or faulting more than 1/8” are appropriate for repairs. Repairs should not be performed on concrete pavements exhibiting significant levels of deterioration. It is most applicable to pavements in which deterioration is limited to a few joints and cracks and deterioration is not widespread over the length of the project.

KYTC Pavement Management Evaluation Guidelines

Joint Deterioration	Extent \leq 3, Severity \geq 3
Other Cracking	Total Score \leq 8
Remaining Service Life	Greater than or equal to 5 years