Pavement Management for Your Airport

Colin Bible, PE

What is Pavement Management?

> The process of planning the maintenance and repair of a network of pavement facilities to optimize pavement conditions over the entire network.

Agenda

- What is a Pavement Management Plan?
- Why do you need to do this?
- How can this benefit your airport?
- What is the next step?

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A Pavement Management Plan is known by a lot of names...

- Pavement Management Program
- Pavement Maintenance-Management Program
- Pavement Management System

A Pavement Management Plan is a formalized set of procedures

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FAA requires effective pavement management programs

> For any project to replace or reconstruct pavement, the sponsor must provide assurance that they have implemented an effective pavement management program.

What are the minimum requirements mandated by the FAA?

Pavement Inventory

Inspection Schedule

Record Keeping

Information Retrieval

Pavement inventory identifies all Runways, Taxiways, and Aprons

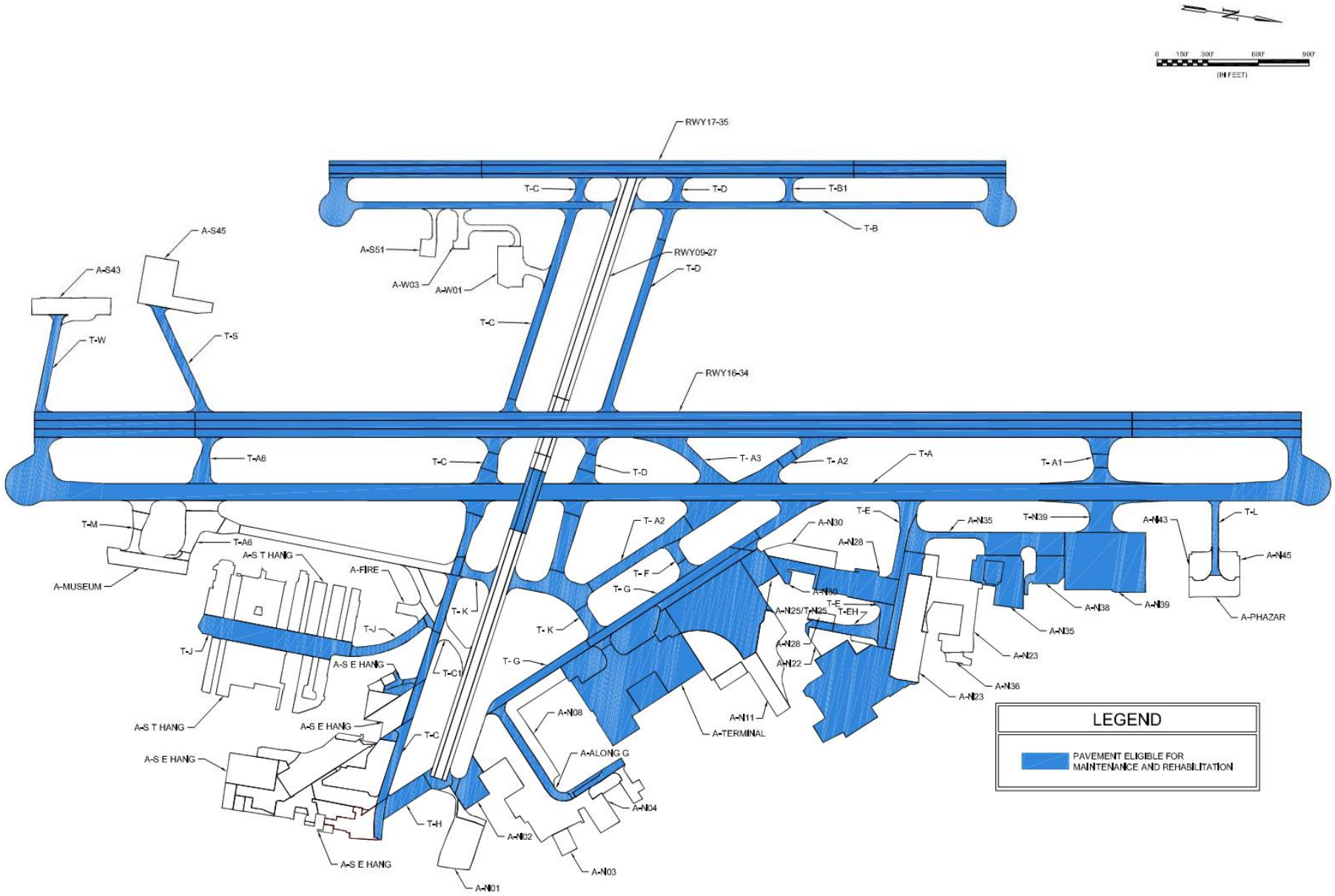
Dimensions

Type of pavement surface

Year constructed and/or most recent major rehabilitation

AIP funded?

Inventory Example – Meacham



Airports must perform a detailed inspection at least once a year

Inspection Schedule

If Pavement Condition Index (PCI) is performed, then the frequency can be reduced to once every 3 years.

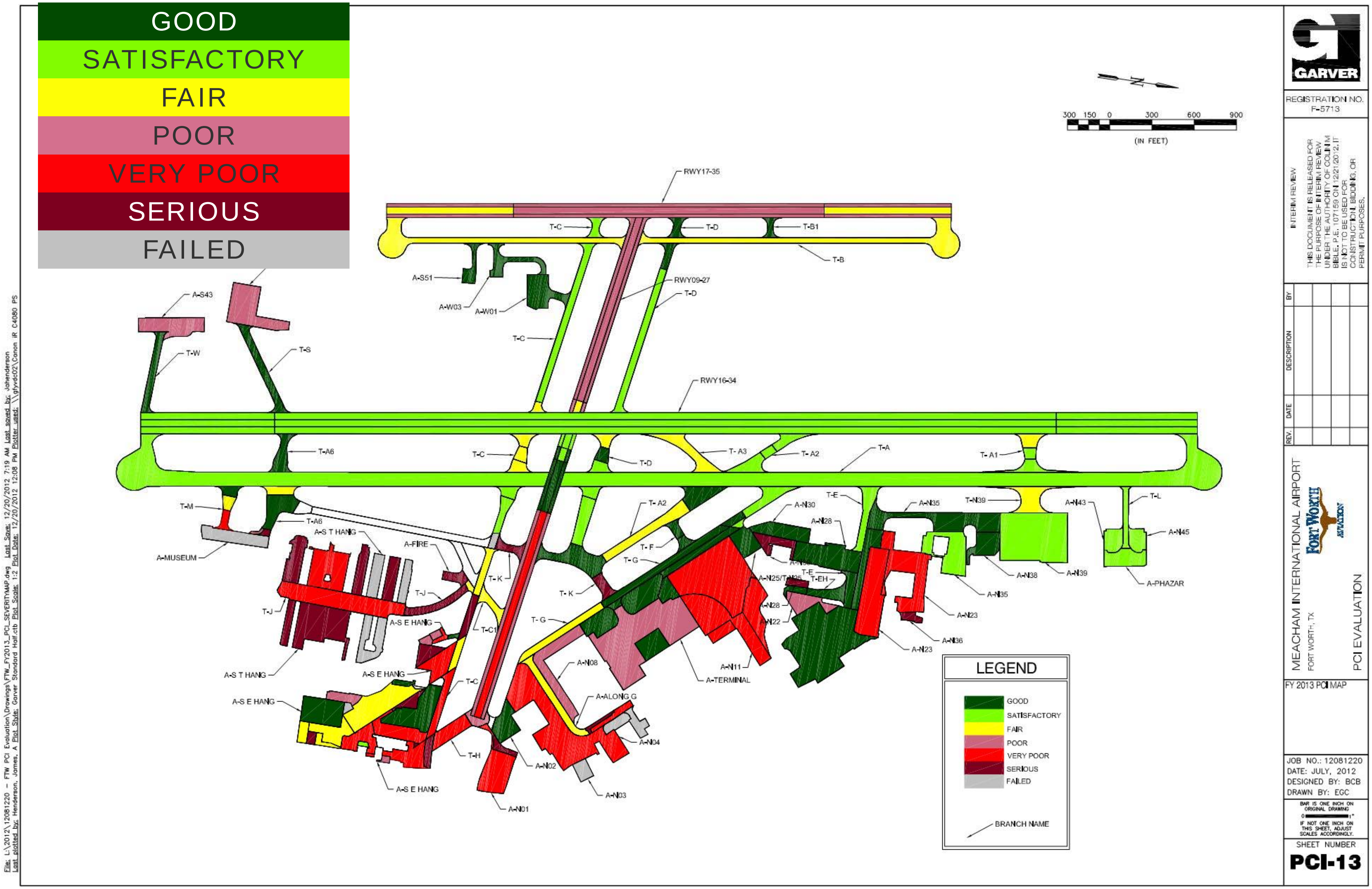
Less comprehensive routine maintenance inspections are also recommended.

Two Main Methods of Inspection

Pavement Condition Index (PCI)	Pavement Surface Evaluation and Rating (PASER)
Every 3 years	Every year
Inspect specific sample areas for specific distresses	Inspect larger sections of pavement for general condition
Intended to help program a plan	Intended to give assessment

Inspection Example – Meacham

GOOD
SATISFACTORY
FAIR
POOR
VERY POOR
SERIOUS
FAILED

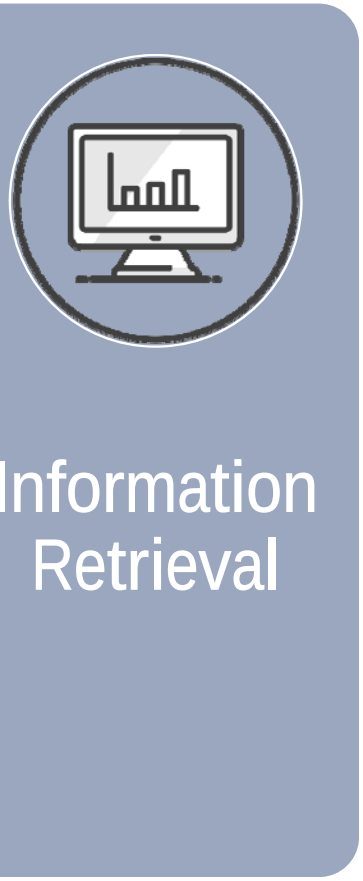


Accurate record keeping is necessary for auditing purposes

Record Keeping

- Inspection date
- Location
- Distress types
- Maintenance scheduled or performed

Maintain information to generate for reports as necessary



May keep records in any form

Easily accessed to generate reports as necessary

Agenda

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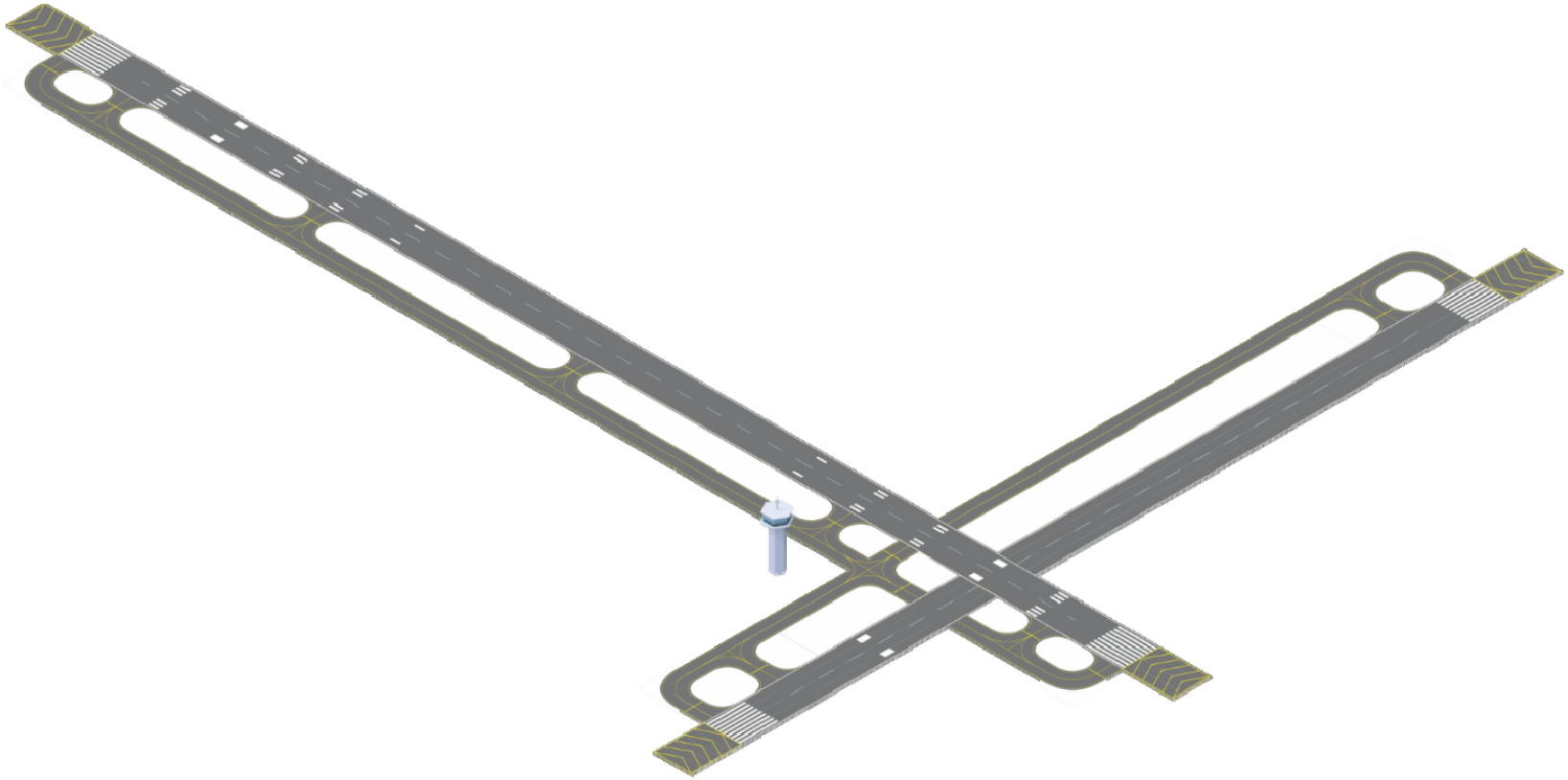
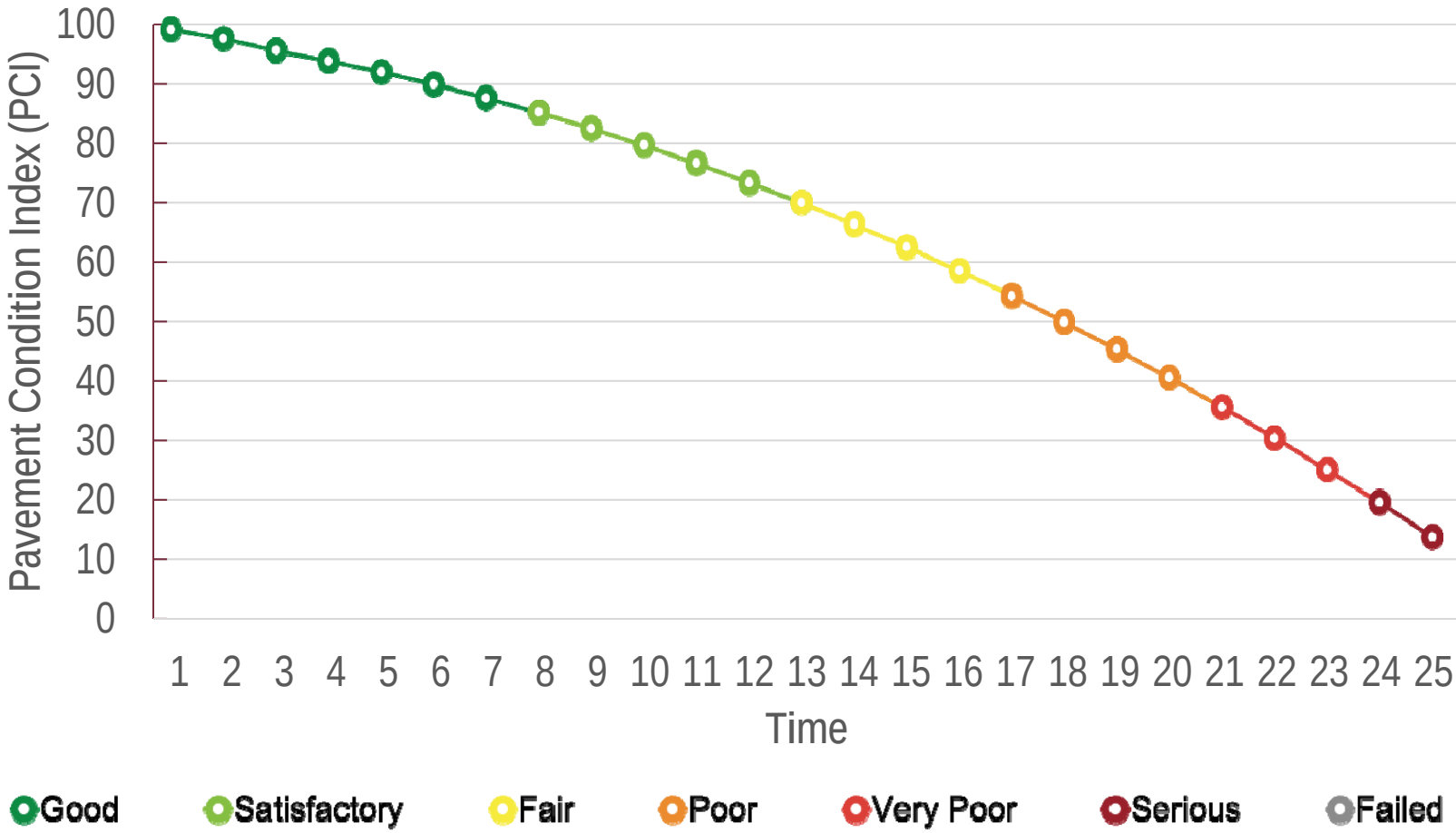
- Why do you need to do this?
- **How can this benefit your airport?**
- What is the next step?

Pavement Management Plans help protect your investment

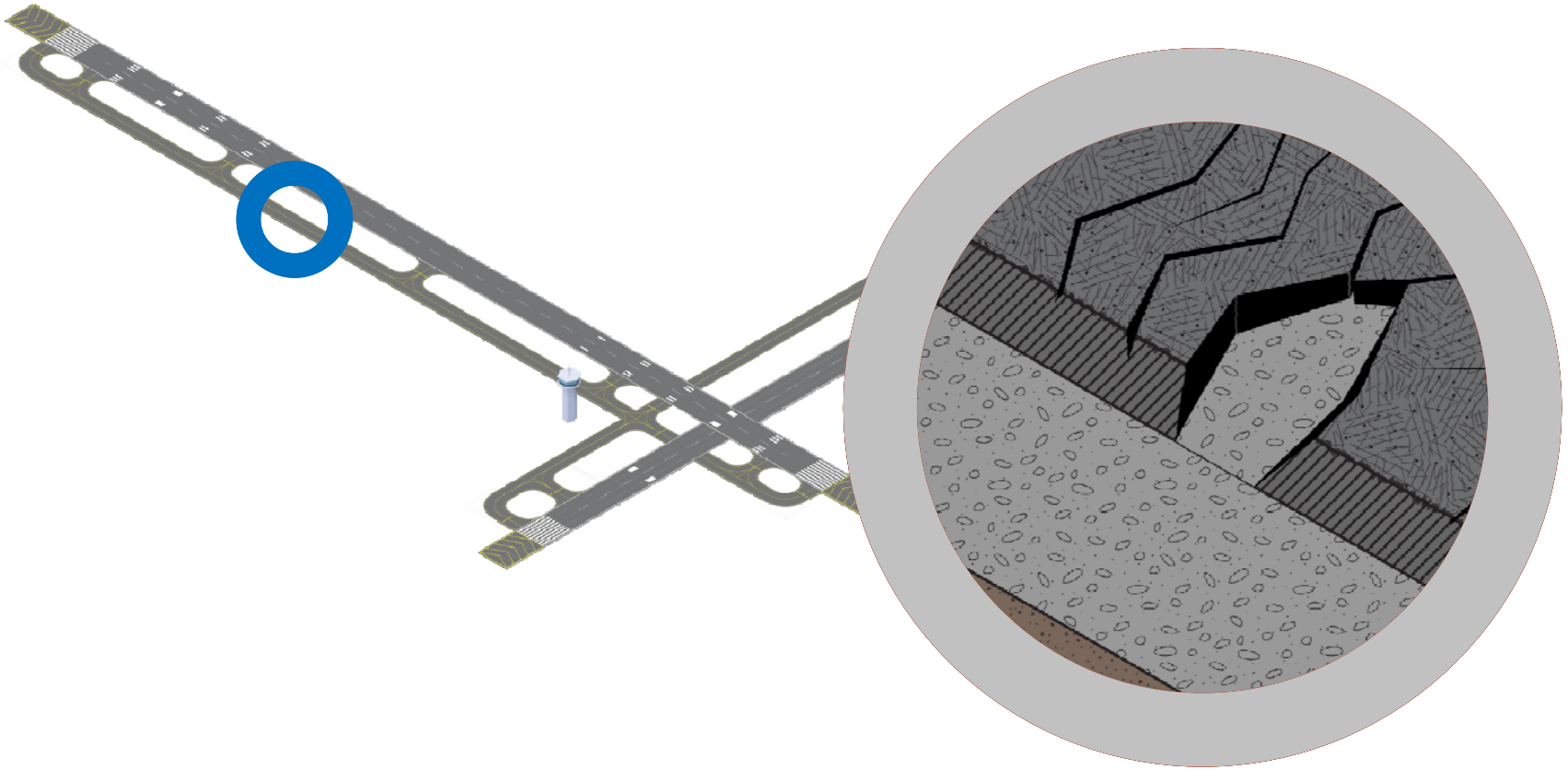


Typical deterioration of pavement according to PCI



Pavement deterioration over time

FAILED



Inspection Example – Meacham

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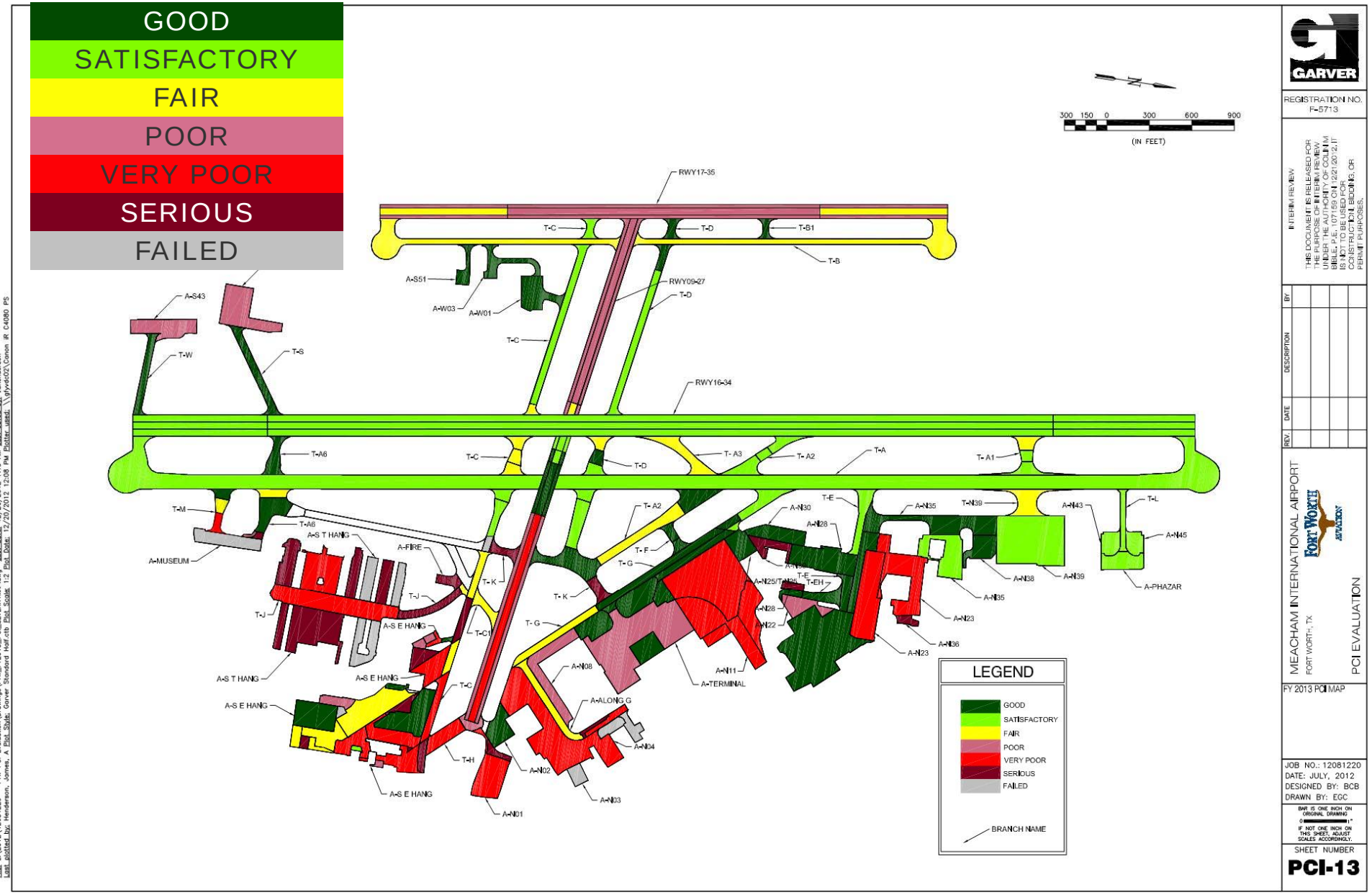


Project Examples

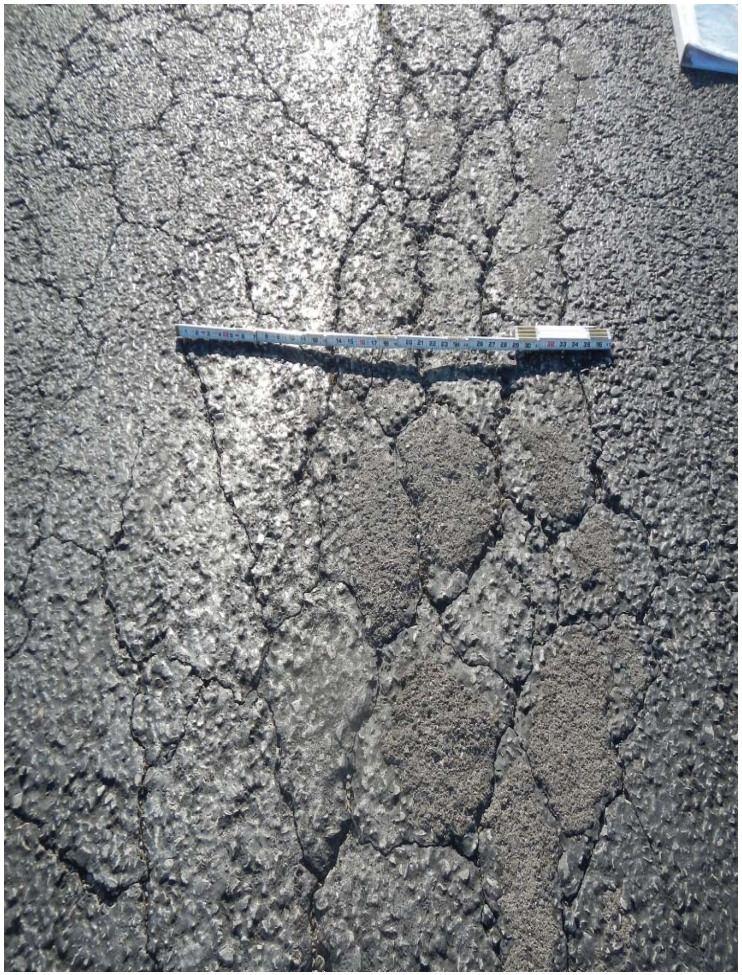
GOOD

Project Examples

SATISFACTORY

FAIR

Project Examples



POOR

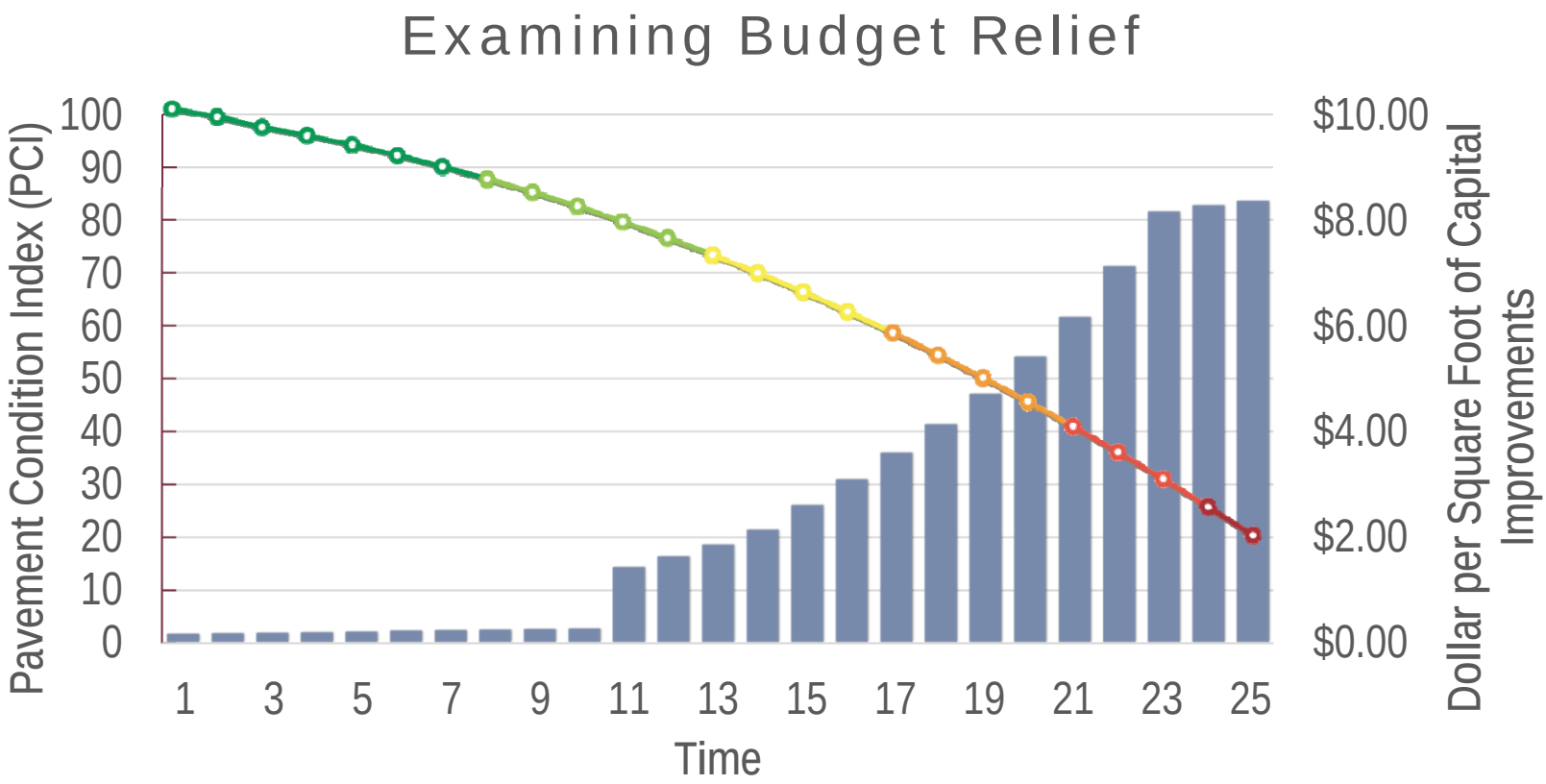
VERY POOR

Project Examples

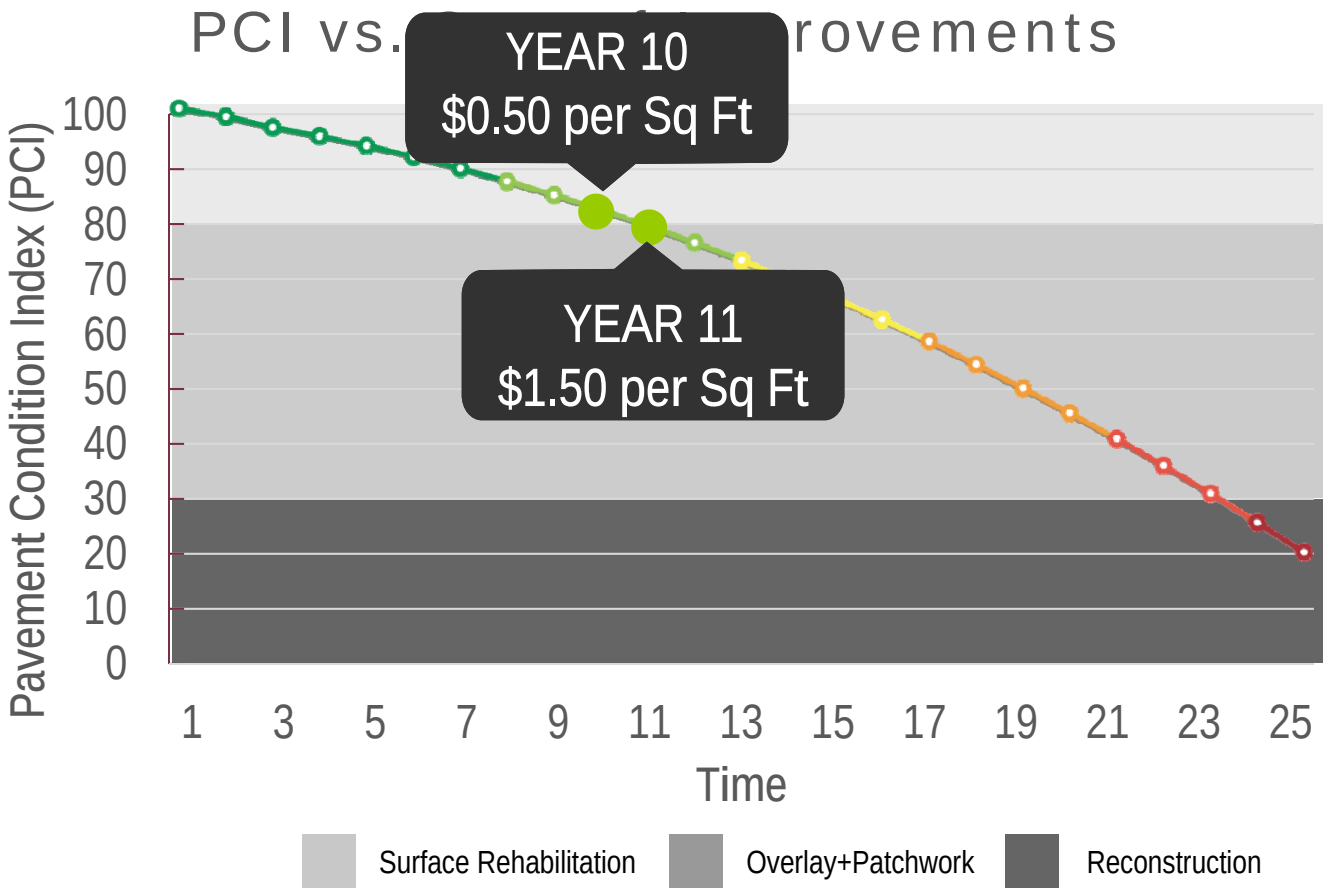
SERIOUS

FAILED

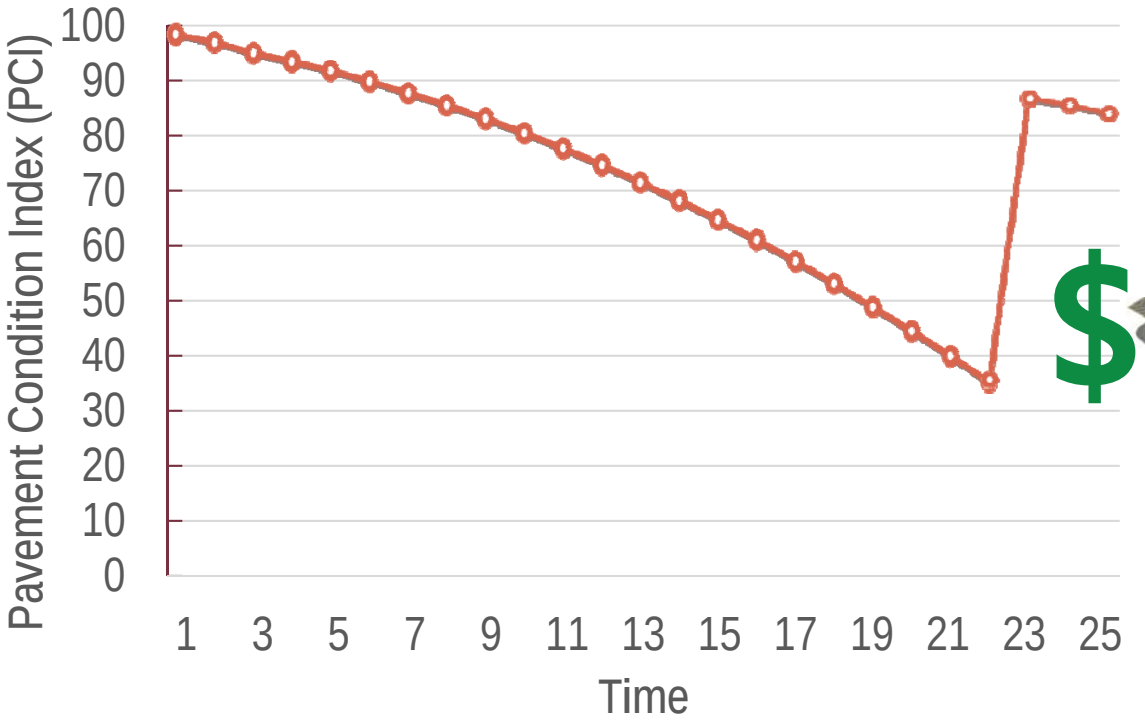
PCI and Cost of Repair



At a certain point, improvements cost significantly rises



Capital Cost Comparison



$

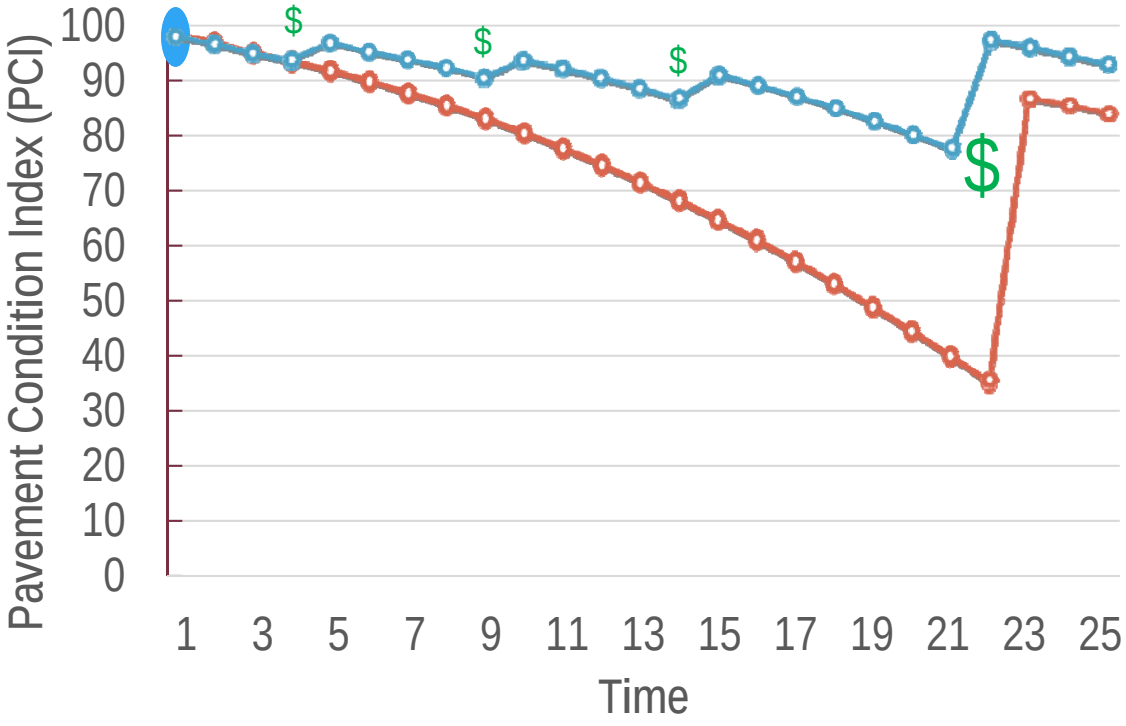
Improvements at Failure

$750,000

Scheduled Maintenance

$0

Capital Cost Comparison



Improvements at Failure

$750,000

Scheduled Maintenance

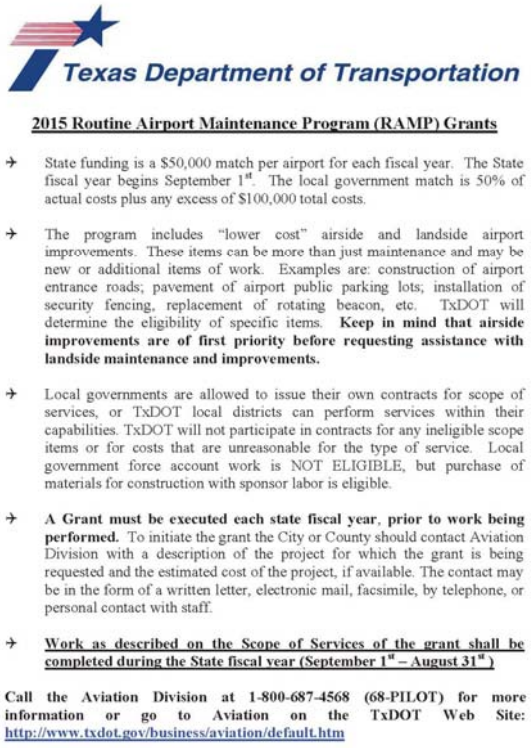
$320,000

$35,000

$45,000

$215,000

Routine Airport Maintenance Program (RAMP)



Texas Department of Transportation

2015 Routine Airport Maintenance Program (RAMP) Grants

- State funding is a $50,000 match per airport for each fiscal year. The State fiscal year begins September 1st. The local government match is 50% of actual costs plus any excess of $100,000 total costs.
- The program includes "lower cost" airside and landside airport improvements. These items can be more than just maintenance and may be new or additional items of work. Examples are: construction of airport entrance roads; pavement of airport public parking lots; installation of security fencing, replacement of rotating beacon, etc. TxDOT will determine the eligibility of specific items. **Keep in mind that airside improvements are of first priority before requesting assistance with landside maintenance and improvements.**
- Local governments are allowed to issue their own contracts for scope of services, or TxDOT local districts can perform services within their capabilities. TxDOT will not participate in contracts for any ineligible scope items or for costs that are unreasonable for the type of service. Local government force account work is NOT ELIGIBLE, but purchase of materials for construction with sponsor labor is eligible.
- **A Grant must be executed each state fiscal year, prior to work being performed.** To initiate the grant the City or County should contact Aviation Division with a description of the project for which the grant is being requested and the estimated cost of the project, if available. The contact may be in the form of a written letter, electronic mail, facsimile, by telephone, or personal contact with staff.
- **Work as described on the Scope of Services of the grant shall be completed during the State fiscal year (September 1st – August 31st)**

Call the Aviation Division at 1-800-687-4568 (68-PILOT) for more information or go to Aviation on the TxDOT Web Site: http://www.txdot.gov/business/aviation/default.htm

Routine Airport Maintenance Program (RAMP)

ELIGIBLE WORK ITEMS UNDER RAMP GRANTS

AIRSIDE MAINTENANCE
Pavement crack sealing
Pavement Slurry Seal/Fog Seal/Rejuvenator
Pavement markings
Limited pavement failure repairs
Drainage maintenance
Sweeping
Herbicide – fire ant control – mesquite tree eradication
Replacement bulbs/lamps for airside lighting fixtures and approach aids
Beacon, lighting, approach aids – repair and maintenance
Parts replacement for AWOS not covered under warranty
AFTER AIRSIDE MAINTENANCE HAS BEEN ADDRESSED
Seal coats/chip seal/crack seal for non-airside pavement, repair/maintenance of airport public auto parking
Hangar/terminal building painting and repairs -sponsor owned facilities only
Security camera systems
Game proof or security fencing and gates, electric gate openers
Access roads for AWOS installations
Navigational aids purchase and installation
AWOS NADIN interface monthly charge
Airport entrance signs & landscaping
Repairs to airport owned fuel systems, including replacement of tanks
Professional Services for preparation of Storm Water Pollution Prevention, Spill Prevention Control & Countermeasure Plans and maintenance/update of these plans
SMALL CAPITAL IMPROVEMENT PROJECTS
New public auto parking areas - engineering/design costs included
New entrance roads, hangar access roads - engineering/design costs included
Design and Construction of aircraft wash racks as indicated by SWPPP
Expansion of apron areas or new apron areas - engineering/design costs included
Pilot lounge/small general aviation terminal buildings
Drainage improvements - engineering/design costs included
Extension of runway lighting systems- engineering/design costs included
Beacon/tower replacements
Water wells, lines/sewer lines &septic systems - compliance with EPA and TCEQ responsibility of Sponsor
Preparation of FAA form 7460-1 "Notice of Proposed Construction or Alteration" for RAMP projects
INELIGIBLE WORK ITEMS UNDER RAMP GRANTS
Mowing - may be done by TxDOT or TxDOT contract forces but the cost is 100% Sponsor responsibility
Purchase of Capital Outlay Equipment except as allowed above
Operating Expenditures
Consumables - unless listed above
Force Account work by sponsor
Work performed or purchases made prior to the grant being fully executed

How this affects your budget

Improvements at Failure			
Total Cost	AIP	RAMP	Sponsor
$750,000	$675,000	-----	$75,000
$750,000	$675,000	-----	$75,000

Scheduled Maintenance			
Total Cost	AIP	RAMP	Sponsor
$25,000	----	$12,500	$12,500
$35,000	----	$17,500	$17,500
$45,000	----	$22,500	$22,500
$215,000	$193,500	-----	$21,500
$320,000	$193,500	$52,500	$74,000

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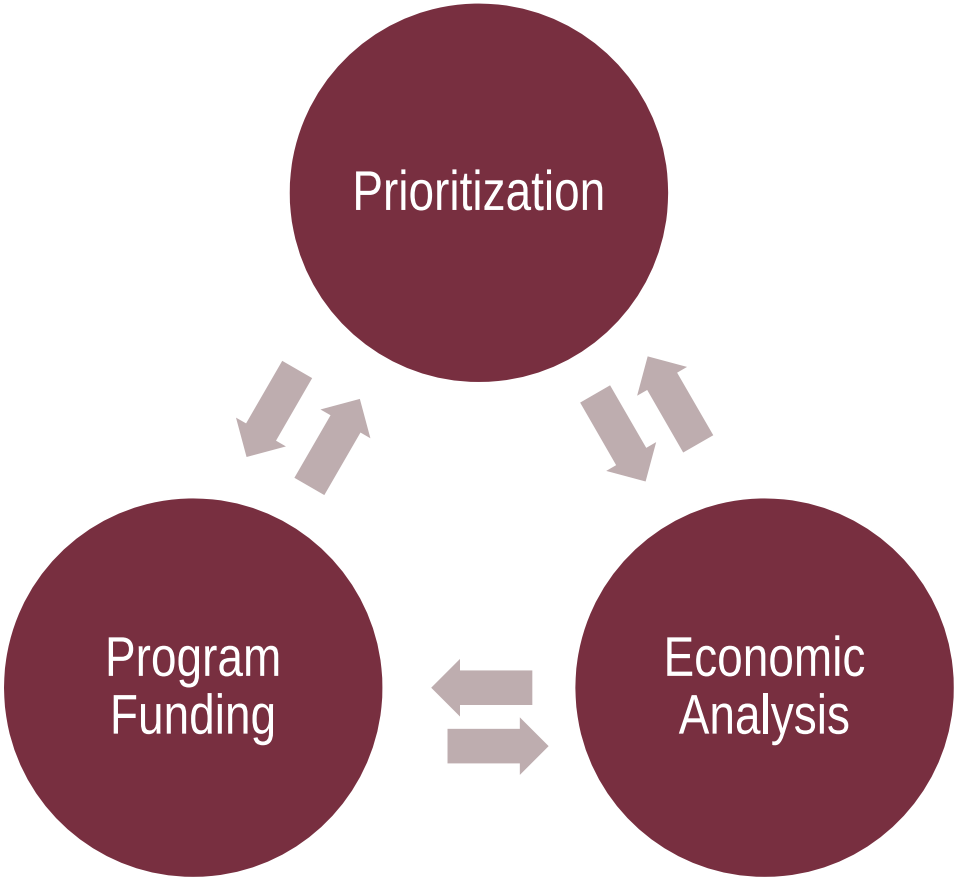
- **What is the next step?**

What is the next step?



Addressing the issues at your airport

- Resources
  - AC 150-5380-6C – Guidelines and Procedures for Maintenance of Airport Pavements
  - Asphalt Surfaced Airfields Distress Manual
  - Concrete Surfaced Airfields Distress Manual

Table 6-1. Quick guide for maintenance and repair of common flexible pavement surface problems

Problem	Repair	Probable Cause
Weathering/ Oxidation	- Apply surface treatment - Overlay	- Environment - Lack of timely surface treatments
Cracks	- Remove old sealer material if present - Clean and prepare cracks - Seal/reseal cracks - Joint heating may be an option for longitudinal cracks when under the direction of an engineer. (Operate heaters to avoid excessive heat on the pavement.)	- Age - Environmental conditions - Bitumen too hard or overheated in mix - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper crack preparation)
Alligator or fatigue cracking	- Remove and replace damaged pavement, including the base and/or subbase course if required.	- Base and/or Subgrade failure - Overload - Under-designed surface course (too thin)
Patches	- Remove/replace. - Repair and Resurface	- Inadequate/Improper repair detail/material - Age
Surface irregularities (e.g., rutting, wash-boarding, birdbaths)	- Remove and replace damaged areas - Surface grinding/milling	- Traffic - Age
Loss of Skid Resistance	- Remove rubber/surface contamination - Apply surface treatment	- Rubber deposits/surface contamination - Polished aggregate - Improper surface treatment
Bleeding	- Blot with sand and remove sand prior to resuming aircraft operations. Excessive bleeding may require removal and replacement of pavement.	- Overly rich mix/low air void content. Bleeding may be a precursor to other surface deformities forming, e.g., rutting, wash-boarding, etc.
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade

WEATHERING (SURFACE WEAR) - DENSE MIX ASPHALT (57)

Description

The wearing away of the asphalt binder and fine aggregate matrix from the pavement surface.

Severity Levels

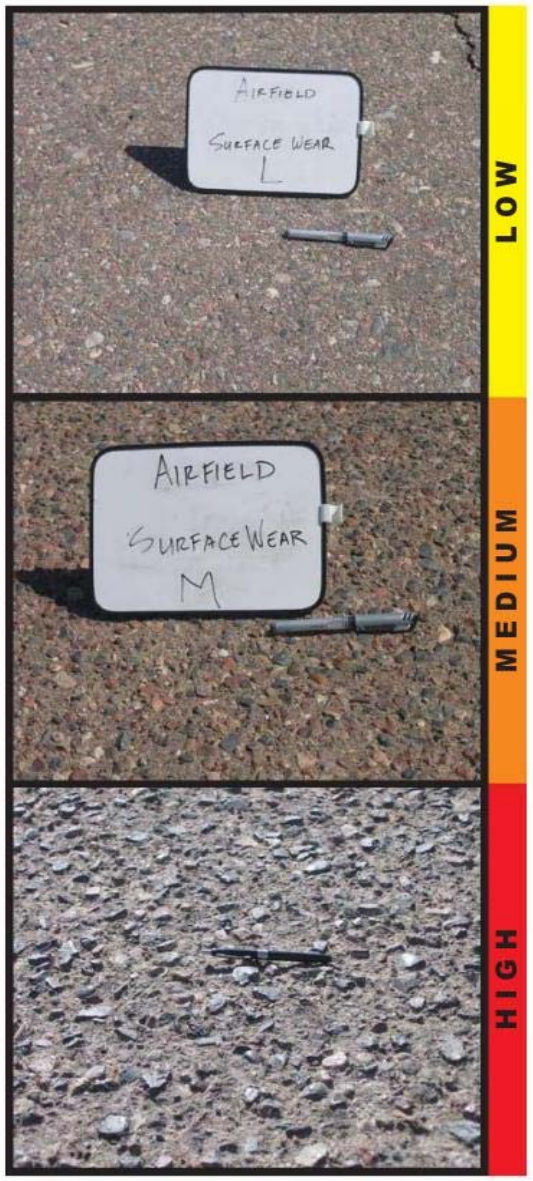
L Asphalt surface beginning to show signs of aging which may be accelerated by climatic conditions. Loss of the fine aggregate matrix is noticeable and may be accompanied by fading of the asphalt color. Edges of the coarse aggregates are beginning to be exposed (less than 0.05 inches or 1 mm). Pavement may be relatively new (as new as 6 months old).

M Loss of fine aggregate matrix is noticeable and edges of coarse aggregate have been exposed up to ¼ width (of the longest side) of the coarse aggregate due to the loss of fine aggregate matrix.

H Edges of coarse aggregate have been exposed greater than ¼ width (of the longest side) of the coarse aggregate. There is considerable loss of fine aggregate matrix leading to potential or some loss of coarse aggregate.

How To Measure

Surface wear is measured in square feet (square meters). Surface wear is not recorded if medium or high severity raveling is recorded.



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LONGITUDINAL AND TRANSVERSE CRACKING (48) (NON-PCC JOINT REFLECTIVE)

Description

Longitudinal cracks are parallel to the pavement's centerline or laydown direction. They may be caused by (1) a poorly constructed paving lane joint, (2) shrinkage of the AC surface due to low temperatures or hardening of the asphalt, or (3) a reflective crack caused by cracks beneath the surface course, including cracks in PCC slabs (but not at PCC joints). Transverse cracks extend across the pavement at approximately right angles to the pavement centerline or direction of laydown. They may be caused by items 2 or 3 above. These types of cracks are not usually load associated. If the pavement is fragmented along a crack, the crack is said to be spalled.

Severity Levels

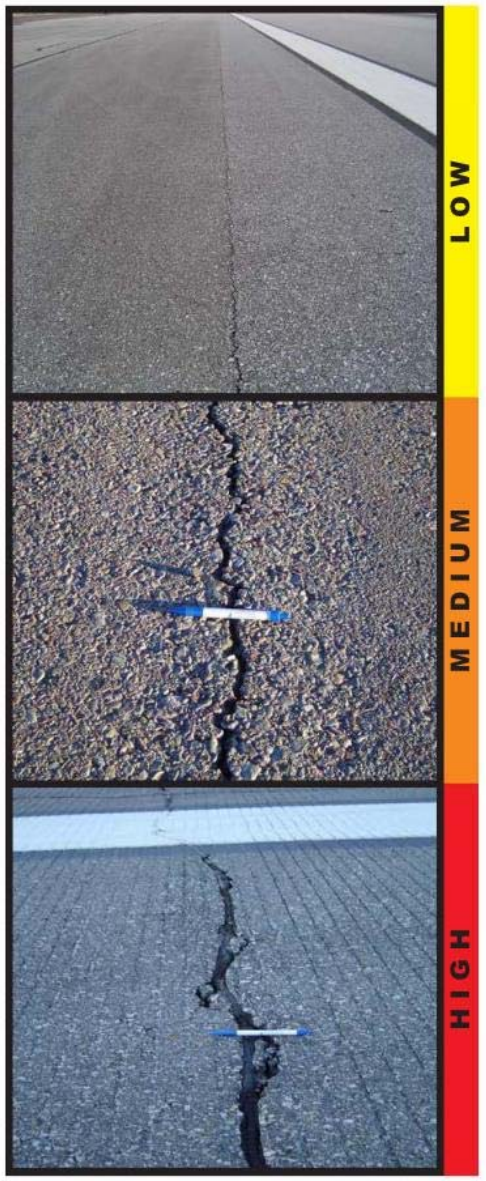
L Cracks have either minor spalling (little or no FOD potential) or no spalling. The cracks can be filled or non-filled. Non-filled cracks have a mean width of 1/4 inch (6 mm) or less; filled cracks are of any width, but their filler material is in satisfactory condition.

M One of the following conditions exists: (1) Cracks are moderately spalled (some FOD potential) and can be either filled or non-filled of any width; (2) Filled cracks are not spalled or are only lightly spalled, but the filler is in unsatisfactory condition; (3) Non-filled cracks are not spalled or are only lightly spalled, but mean crack width is greater than 1/4 inch (6 mm); or (4) Lightly random cracking exists near the crack or at the corners of intersecting cracks.

H Cracks are severely spalled, causing definite FOD potential. They can be either filled or non-filled of any width.

How To Measure

Longitudinal and transverse cracks are measured in linear feet (linear meters). The length and severity of each crack should be identified and recorded. If the crack does not have the same severity level along its entire length, each portion of the crack having a different severity level should be recorded separately. For an example, see joint reflection cracking. If block cracking is recorded, longitudinal and transverse cracking is not recorded in the same area.



48 LONG. CRACKING

A1. PROCEDURE FOR CRACK REPAIR OF FLEXIBLE PAVEMENT

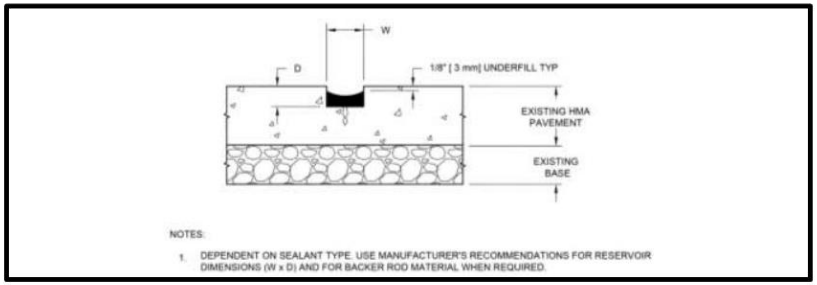


Figure A-1. Crack repair of flexible pavement

WEATHER AND TEMPERATURE REQUIREMENTS

- Do not begin crack repair during inclement weather.
- The pavement temperature should be 50°F (10°C) and rising or meet the manufacturer's recommendations at the time of application of the crack sealing material.
- Do not apply sealant if moisture is observed in the crack.

PREPARATION

To choose sealant:

- Consider your geographic area, climate, and past performance of the sealant
- Hot-applied sealants must meet the requirements of ASTM D6690
- Cold-applied sealants must meet the requirements of ASTM D977

REPAIR PROCEDURE

Use this procedure to repair cracks less than 1 inch (2.5 cm) in width in flexible pavements.

1. Review the construction safety and phasing plan (CSPP). Ensure all pavement closures have all required items in place, such as lighted Xs, barricades, signs, etc.; and all NOTAMS have been issued for affected areas of the airfield.
2. Mark the limits of the area of crack repair.
3. Use an air compressor with an operable oil and water trap to clean all cracks with compressed hot air.
4. If necessary, saw or rout the cracks to the required width and depth. Use the sealant manufacturer's specifications to determine the sealant reservoir dimensions (W × D).
5. Inspect the cracks for proper width, depth, alignment, and preparation. Make sure the crack surface faces are dry.
6. To obtain the width and depth ratio required by the sealant manufacturer's specifications may require installation of backer rod. Make sure the backer rod:
   - Meets the requirements of ASTM D5249
   - Is compatible with the sealant
   - Is 25% larger in diameter than the width of the sealant reservoir
7. Apply the sealant uniformly from the bottom to the top of the crack avoiding voids or entrapping air.
8. Make sure the surface of the sealant remains ¼ inch to ⅜ inch (6 mm to 9 mm) below the existing pavement surface.
9. Do not allow traffic until the sealants have cured.
10. Completely clean the work area before opening to aircraft traffic.

A2. PARTIAL DEPTH CRACK REPAIR IN FLEXIBLE PAVEMENT

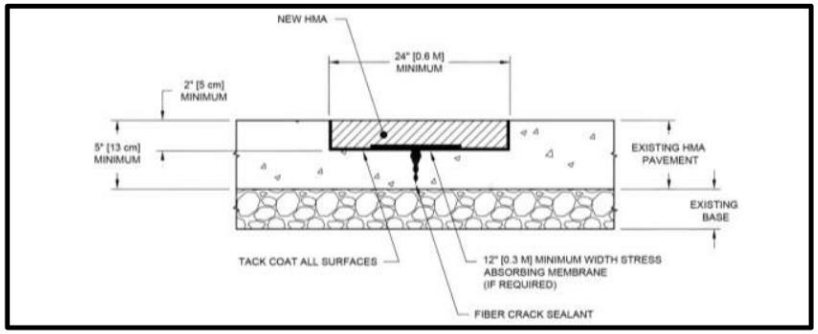


Figure A-2. Partial depth crack repair in flexible pavement

WEATHER AND TEMPERATURE REQUIREMENTS

- Do not begin crack repair during inclement weather.
- HMA should not be placed upon a wet surface or when the surface temperature of the underlying course is less than 45°F (7°C).
- The pavement temperature should be 50°F (10°C) and rising or meet the manufacturer's recommendations at the time of application of the crack sealing material.
- Do not apply sealant if moisture is observed in the crack.

REPAIR PROCEDURE

Use this procedure to repair HMA Pavements that are 5 inches (13 cm) or greater in thickness with cracks greater than 1 inch (2.5 cm).

1. Review the construction safety and phasing plan (CSPP). Ensure all pavement closures have all required items in place, such as lighted Xs, barricades, signs, etc.; and all NOTAMS have been issued for affected areas of the airfield.
2. Mark the limits of the area of crack repair.
3. Saw cut or mill out an area 24 inches (0.6 m) wide by 2 to 3 inches (5 to 8 cm) deep centered on the crack. Extend the saw cut or mill out the area a minimum of 12 inches (30 cm) beyond the limits of the distressed pavement area.
4. Use an air compressor with an operable oil and water trap to clean all cracks with compressed hot air.
5. Fill the crack flush with fiber crack filler per the sealant manufacturer's specifications. Apply the sealant uniformly from the bottom to the top of the crack avoiding voids or entrapping air.
6. Apply a 12 inch (30 cm) repair membrane centered over the crack. (Installation of the membrane is optional.)
7. Apply a tack coat to the bottom and sides of the repair area. Make sure the tack meets the requirements of P-603 and ASTM D3628.
8. Fill the patch area with HMA equivalent or better than the existing pavement. Use P-401, P-403 or equivalent State DOT dense mix and compact to the minimum density specified.
9. Use a straight-edge to verify the patch is flush with adjacent pavement.
10. Do not allow traffic until the HMA has cured.
11. Completely clean the work area before opening to aircraft traffic.

A3. FULL DEPTH CRACK REPAIR IN FLEXIBLE PAVEMENT

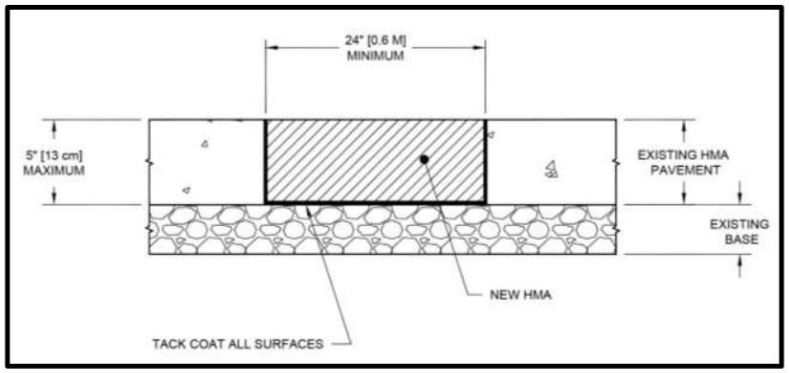


Figure A-3. Full depth crack repair in flexible pavement

WEATHER AND TEMPERATURE REQUIREMENTS

- Do not begin crack repair during inclement weather.
- HMA should not be placed upon a wet surface or when the surface temperature of the underlying course is less than 45°F (7°C).

REPAIR PROCEDURE

Use this procedure to conduct full depth repairs of flexible pavements and to repair cracks greater than 1 inch (2.5 cm) in flexible pavements 5 inches (13 cm) or less in thickness.

1. Review the construction safety and phasing plan (CSPP). Ensure all pavement closures have all required items in place, such as lighted Xs, barricades, etc.; and all NOTAMS have been issued for affected areas of the airfield.
2. Mark the limits of the area of crack repair.
3. Saw cut or mill out an area 24 inches (0.6 m) wide to the full depth of the HMA centered on the crack. Extend the saw cut or mill out an area a minimum of 12 inches (30 cm) beyond the limits of the distressed pavement area.
4. Repair and re-compact the base as necessary.
5. Apply a tack coat to the bottom and sides of the repair area. Make sure the tack meets the requirements of P-603 and ASTM D3628.
6. Fill the patch area with HMA equivalent to or better than the existing pavement. Use P-401, P-403 or equivalent State DOT dense mix and compact to the minimum density specified.
7. Use a straight-edge to verify that the patch is flush with adjacent pavement.
8. Do not allow traffic until HMA has cured.
9. Completely clean the work area before opening to aircraft traffic.

Table 6-1. Quick guide for maintenance and repair of common flexible pavement surface problems

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Weathering/ Oxidation	- Apply surface treatment - Overlay	- Environment - Lack of timely surface treatments
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Alligator or fatigue cracking	- Remove and replace damaged pavement, including the base and/or subbase course if required.	- Base and/or Subgrade failure - Overload - Under-designed surface course (too thin)
Patches	- Remove/replace. - Repair and Resurface	- Inadequate/Improper repair detail/material - Age
Surface irregularities (e.g., rutting, wash-boarding, birdbaths)	- Remove and replace damaged areas - Surface grinding/milling	- Traffic - Age
Loss of Skid Resistance	- Remove rubber/surface contamination - Apply surface treatment	- Rubber deposits/surface contamination - Polished aggregate - Improper surface treatment
Bleeding	- Blot with sand and remove sand prior to resuming aircraft operations. Excessive bleeding may require removal and replacement of pavement.	- Overly rich mix/low air void content. Bleeding may be a precursor to other surface deformities forming, e.g., rutting, wash-boarding, etc.
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade

ALLIGATOR OR FATIGUE CRACKING (41)*

Description

Alligator or fatigue cracking is a series of interconnecting cracks caused by fatigue failure of the asphalt surface under repeated traffic loading. The cracking initiates at the bottom of the asphalt surface (or stabilized base) where tensile stress and strain is highest under a wheel load. The cracks propagate to the surface initially as a series of parallel cracks. After repeated traffic loading, the cracks connect and form multi-sided, sharp-angled pieces that develop a pattern resembling chicken wire or the skin of an alligator. The pieces are less than 2 feet (0.6 meters) on the longest side. Alligator cracking occurs only in areas that are subjected to repeated traffic loadings, such as wheel paths. Therefore, it would not occur over an entire area unless the entire area was subjected to traffic loading. (Pattern-type cracking, which occurs over an entire area that is not subject to loading, is rated as block cracking, which is not a load associated distress.) Alligator cracking is considered a major structural distress.

Severity Levels

L Fine, longitudinal hairline cracks running parallel to each other with no or only a few interconnecting cracks. The cracks are not spalled.

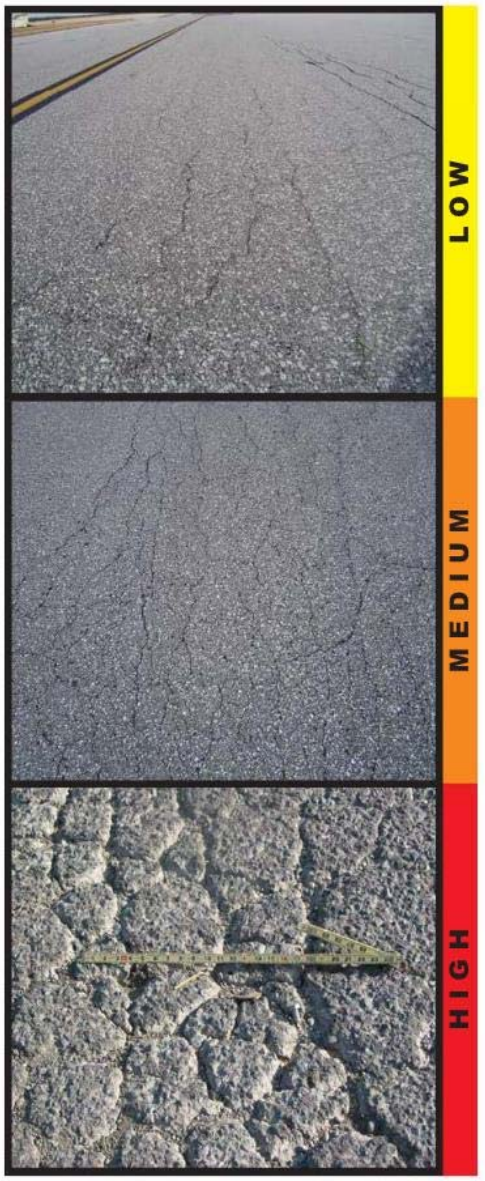
M Further development of light alligator cracking into a pattern or network of cracks that may be lightly spalled. Medium severity alligator cracking is defined by a well-defined pattern of interconnecting cracks, where all pieces are securely held in place (good aggregate interlock between pieces).

H Network or pattern cracking progressed so that pieces are well-defined and spalled at the edges; some of the pieces rock under traffic and may cause FOD potential.

How To Measure

Alligator cracking is measured in square feet (square meters) of surface area. The major difficulty in measuring this type of distress is that many times two or three levels of severity exist within one distressed area. If these portions can be easily distinguished from each other, they should be measured and recorded separately. However, if the different levels of severity cannot be easily divided, the entire area should be rated at the highest severity level present. If alligator cracking and rutting occur in the same area, each is recorded separately at its respective severity level.

**PAVER Distress Code*



41 ALLIGATOR

Table 6-1. Quick guide for maintenance and repair of common flexible pavement surface problems

Problem	Repair	Probable Cause
Weathering/ Oxidation	- Apply surface treatment - Overlay	- Environment - Lack of timely surface treatments
Cracks	- Remove old sealer material if present - Clean and prepare cracks - Seal/reseal cracks - Joint heating may be an option for longitudinal cracks when under the direction of an engineer. (Operate heaters to avoid excessive heat on the pavement.)	- Age - Environmental conditions - Bitumen too hard or overheated in mix - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper crack preparation)
Alligator or fatigue cracking	- Remove and replace damaged pavement, including the base and/or subbase course if required.	- Base and/or Subgrade failure - Overload - Under-designed surface course (too thin)
Patches	- Remove/replace. - Repair and Resurface	- Inadequate/Improper repair detail/material - Age
Surface irregularities (e.g., rutting, wash-boarding, birdbaths)	- Remove and replace damaged areas - Surface grinding/milling	- Traffic - Age
Loss of Skid Resistance	- Remove rubber/surface contamination - Apply surface treatment	- Rubber deposits/surface contamination - Polished aggregate - Improper surface treatment
Bleeding	- Blot with sand and remove sand prior to resuming aircraft operations. Excessive bleeding may require removal and replacement of pavement.	- Overly rich mix/low air void content. Bleeding may be a precursor to other surface deformities forming, e.g., rutting, wash-boarding, etc.
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade

PATCHING AND UTILITY CUT PATCH (50)

Description

A patch is considered a defect, regardless of how well it is performing.

Severity Levels

L Patch is in good condition and is performing satisfactorily. Little or no FOD potential.

M Patch is somewhat deteriorated and affects riding quality to some extent. Some FOD potential.

H Patch is badly deteriorated and affects riding quality significantly or has high FOD potential. Patch needs replacement.

The use of dense-graded AC patches in PCC surfaces causes a water damming effect at the patch that contributes to differential skid resistance of the surface. Low severity, dense-graded patches should be rated as medium severity because of the differential friction problem. Medium and high severity patches are rated the same as above.

How To Measure

Patching is measured in square feet (square meters) of surface area. However, if a single patch has areas of differing severity levels, these areas should be measured and recorded separately. For example, a 25 ft^2 (2 1/2 m^2) patch may have 10 ft^2 (1 m^2) medium severity and 15 ft^2 (1 1/2 m^2) of low severity. These areas would be recorded separately. Any distress found in a patched area will not be recorded; however, its effects on the patch will be considered when determining the patch's severity level.

A very large patch (area > 2500 ft^2 (230 m^2)), or feathered-edge pavement, may qualify as an additional sample unit or a separate section.

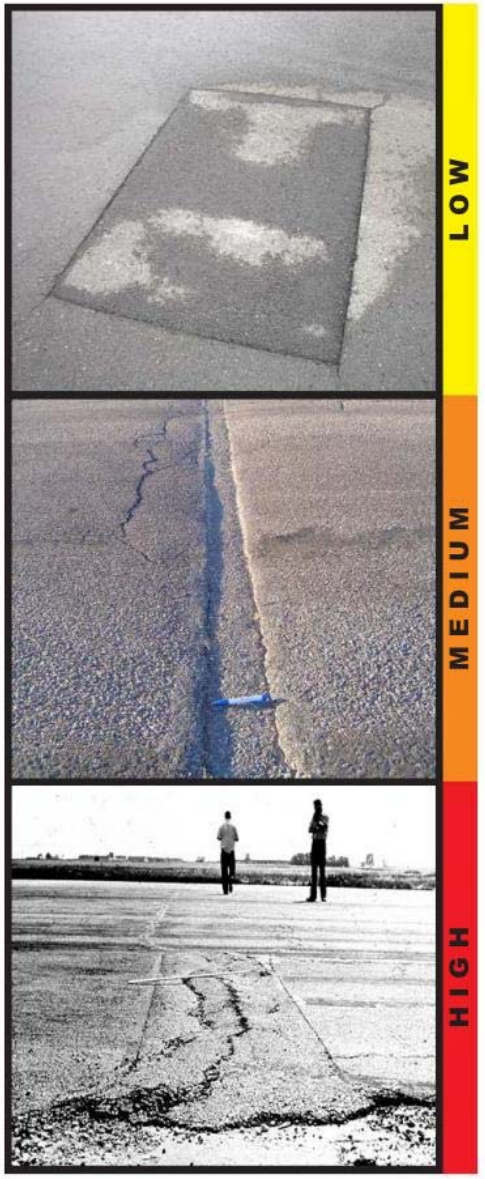


Table 6-1. Quick guide for maintenance and repair of common flexible pavement surface problems

Problem	Repair	Probable Cause
Weathering/ Oxidation	- Apply surface treatment - Overlay	- Environment - Lack of timely surface treatments
Cracks	- Remove old sealer material if present - Clean and prepare cracks - Seal/reseal cracks - Joint heating may be an option for longitudinal cracks when under the direction of an engineer. (Operate heaters to avoid excessive heat on the pavement.)	- Age - Environmental conditions - Bitumen too hard or overheated in mix - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper crack preparation)
Alligator or fatigue cracking	- Remove and replace damaged pavement, including the base and/or subbase course if required.	- Base and/or Subgrade failure - Overload - Under-designed surface course (too thin)
Patches	- Remove/replace. - Repair and Resurface	- Inadequate/Improper repair detail/material - Age
Surface irregularities (e.g., rutting, wash-boarding, birdbaths)	- Remove and replace damaged areas - Surface grinding/milling	- Traffic - Age
Loss of Skid Resistance	- Remove rubber/surface contamination - Apply surface treatment	- Rubber deposits/surface contamination - Polished aggregate - Improper surface treatment
Bleeding	- Blot with sand and remove sand prior to resuming aircraft operations. Excessive bleeding may require removal and replacement of pavement.	- Overly rich mix/low air void content. Bleeding may be a precursor to other surface deformities forming, e.g., rutting, wash-boarding, etc.
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade

RUTTING (53)

Description

A rut is a surface depression in the wheel path. Pavement uplift may occur along the sides of the rut; however, in many instances ruts are noticeable only after a rainfall, when the wheel paths are filled with water. Rutting stems from a permanent deformation in any of the pavement layers or subgrade. It is usually caused by consolidation or lateral movement of the materials due to traffic loads. Significant rutting can lead to major structural failure of the pavement.

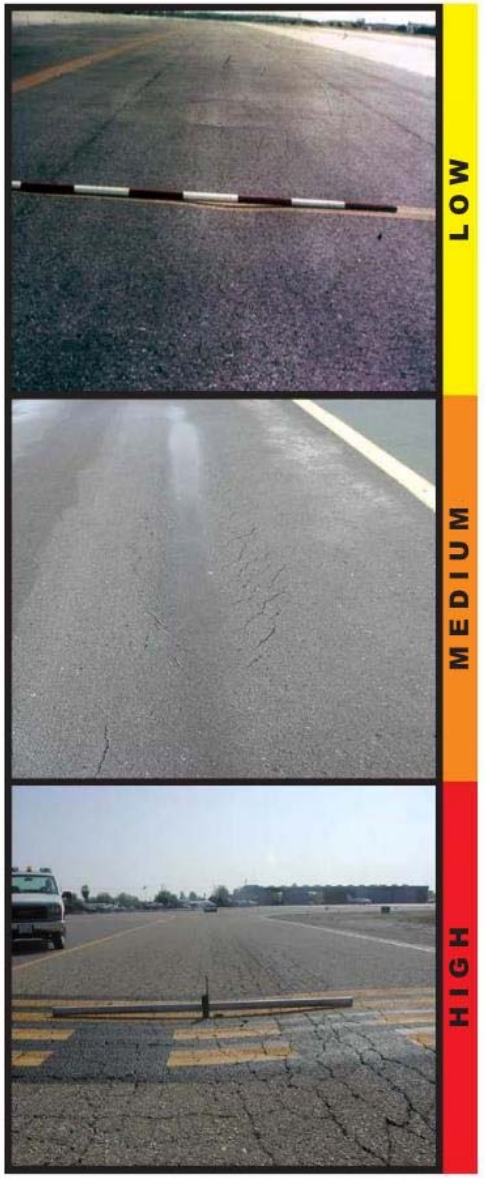
Severity Levels

Mean Rut Depth Criteria

Severity	All Pavement Sections
L	1/4 to 1/2 in. (6 to 13 mm)
M	1/2 to 1 in. (13 to 25 mm)
H	> 1 in. (> 25 mm)

How To Measure

Rutting is measured in square feet (square meters) of surface area, and its severity is determined by the depth of the rut. To determine the rut depth, a straightedge should be laid across the rut and the depth measured. The mean depth in inches (mm) should be computed from measurements taken along the length of the rut. If alligator cracking and rutting occur in the same area, each is recorded at its respective severity level.



53 RUTTING

Table 6-1. Quick guide for maintenance and repair of common flexible pavement surface problems

Problem	Repair	Probable Cause
Weathering/ Oxidation	- Apply surface treatment - Overlay	- Environment - Lack of timely surface treatments
Cracks	- Remove old sealer material if present - Clean and prepare cracks - Seal/reseal cracks - Joint heating may be an option for longitudinal cracks when under the direction of an engineer. (Operate heaters to avoid excessive heat on the pavement.)	- Age - Environmental conditions - Bitumen too hard or overheated in mix - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper crack preparation)
Alligator or fatigue cracking	- Remove and replace damaged pavement, including the base and/or subbase course if required.	- Base and/or Subgrade failure - Overload - Under-designed surface course (too thin)
Patches	- Remove/replace. - Repair and Resurface	- Inadequate/Improper repair detail/material - Age
Surface irregularities (e.g., rutting, wash-boarding, birdbaths)	- Remove and replace damaged areas - Surface grinding/milling	- Traffic - Age
Loss of Skid Resistance	- Remove rubber/surface contamination - Apply surface treatment	- Rubber deposits/surface contamination - Polished aggregate - Improper surface treatment
Bleeding	- Blot with sand and remove sand prior to resuming aircraft operations. Excessive bleeding may require removal and replacement of pavement.	- Overly rich mix/low air void content. Bleeding may be a precursor to other surface deformities forming, e.g., rutting, wash-boarding, etc.
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade

POLISHED AGGREGATE (51)

Description

Aggregate polishing is caused by repeated traffic applications. Polished aggregate is present when close examination of a pavement reveals that the portion of aggregate extending above the asphalt is either very small or there are no rough or angular aggregate particles to provide good skid resistance. Existence of this type of distress is also indicated when the number on a skid resistance rating test is low or has dropped significantly from previous ratings.

Severity Levels

No degrees of severity are defined. However, the degree of polishing should be significant before it is included in the condition survey and rated as a defect.

How To Measure

Polished aggregate is measured in square feet (square meters) of surface area. If bleeding is counted, polished aggregate is not counted in the same area.

51 POLISHED AGG.

Table 6-1. Quick guide for maintenance and repair of common flexible pavement surface problems

Problem	Repair	Probable Cause
Weathering/ Oxidation	- Apply surface treatment - Overlay	- Environment - Lack of timely surface treatments
Cracks	- Remove old sealer material if present - Clean and prepare cracks - Seal/reseal cracks - Joint heating may be an option for longitudinal cracks when under the direction of an engineer. (Operate heaters to avoid excessive heat on the pavement.)	- Age - Environmental conditions - Bitumen too hard or overheated in mix - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper crack preparation)
Alligator or fatigue cracking	- Remove and replace damaged pavement, including the base and/or subbase course if required.	- Base and/or Subgrade failure - Overload - Under-designed surface course (too thin)
Patches	- Remove/replace. - Repair and Resurface	- Inadequate/Improper repair detail/material - Age
Surface irregularities (e.g., rutting, wash-boarding, birdbaths)	- Remove and replace damaged areas - Surface grinding/milling	- Traffic - Age
Loss of Skid Resistance	- Remove rubber/surface contamination - Apply surface treatment	- Rubber deposits/surface contamination - Polished aggregate - Improper surface treatment
Bleeding	- Blot with sand and remove sand prior to resuming aircraft operations. Excessive bleeding may require removal and replacement of pavement.	- Overly rich mix/low air void content. Bleeding may be a precursor to other surface deformities forming, e.g., rutting, wash-boarding, etc.
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade

BLEEDING (42)

Description

Bleeding is a film of bituminous material on the pavement surface which creates a shiny, glass-like, reflecting surface that usually becomes quite sticky. Bleeding is caused by excessive amounts of asphalt cement or tars in the mix and/ or low air-void content. It occurs when asphalt fills the voids of the mix during hot weather and then expands onto the surface of the pavement. Since the bleeding process is not reversible during cold weather, asphalt or tar will accumulate on the surface.

Severity Levels

No degrees of severity are defined. Bleeding should be noted when it is extensive enough to cause a reduction in skid resistance.

How To Measure

Bleeding is measured in square feet (square meters) of surface area. If bleeding is counted, polished aggregate is not counted in the same area.

42 BLEEDING

Table 6-1. Quick guide for maintenance and repair of common flexible pavement surface problems

Problem	Repair	Probable Cause
Weathering/ Oxidation	- Apply surface treatment - Overlay	- Environment - Lack of timely surface treatments
Cracks	- Remove old sealer material if present - Clean and prepare cracks - Seal/reseal cracks - Joint heating may be an option for longitudinal cracks when under the direction of an engineer. (Operate heaters to avoid excessive heat on the pavement.)	- Age - Environmental conditions - Bitumen too hard or overheated in mix - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper crack preparation)
Alligator or fatigue cracking	- Remove and replace damaged pavement, including the base and/or subbase course if required.	- Base and/or Subgrade failure - Overload - Under-designed surface course (too thin)
Patches	- Remove/replace. - Repair and Resurface	- Inadequate/Improper repair detail/material - Age
Surface irregularities (e.g., rutting, wash-boarding, birdbaths)	- Remove and replace damaged areas - Surface grinding/milling	- Traffic - Age
Loss of Skid Resistance	- Remove rubber/surface contamination - Apply surface treatment	- Rubber deposits/surface contamination - Polished aggregate - Improper surface treatment
Bleeding	- Blot with sand and remove sand prior to resuming aircraft operations. Excessive bleeding may require removal and replacement of pavement.	- Overly rich mix/low air void content. Bleeding may be a precursor to other surface deformities forming, e.g., rutting, wash-boarding, etc.
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade

Table 6-2. Quick guide for maintenance and repair of common rigid pavement surface problems

Joint sealant damage	- Remove old sealant, clean joints, reseal	- Age - Environmental conditions - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper joint preparation)
Cracks	- Clean and seal cracks - Repair/replace slab - Evaluate adequacy of pavement structure; may require strengthening	- Loss of slab support - Load repetition; curling stresses; and shrinkage stresses
Corner Breaks	- Seal and maintain until full depth patch	- Loss of slab support - Load repetition and curling stresses
Joint spalling	- Remove lose material; refill with approved product; reseal - Partial depth repair	- Latent defects, i.e., excessive finishing - Incompressible matter in joint spaces - Snow plow damage
Slab blowup	- Replace slab in blowup area; clean and reseal joints.	- Incompressible material in joints preventing slab from expanding
Loss of Skid Resistance	- Remove rubber/surface contamination. - Grinding.	- Rubber deposits/surface contamination - Age, i.e., surface wear
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade
Popouts	- Remove FOD	- Material
Patches	- Remove/replace	- Inadequate/Improper repair detail/material - Age

JOINT SEAL DAMAGE (65)

Description

Joint seal damage is any condition which enables soil or rocks to accumulate in the joints or allows significant infiltration of water. Accumulation of incompressible materials prevents the slabs from expanding and may result in buckling, shattering, or spalling. A pliable joint filler bonded to the edges of the slabs protects the joints from accumulation of materials and also prevents water from seeping down and softening the foundation supporting the slab. Typical types of joint seal damage are (a) stripping of joint sealant, (b) extrusion of joint sealant, (c) weed growth, (d) hardening of the filler (oxidation), (e) loss of bond to the slab edges, and (f) lack or absence of sealant in the joint.

Severity Levels

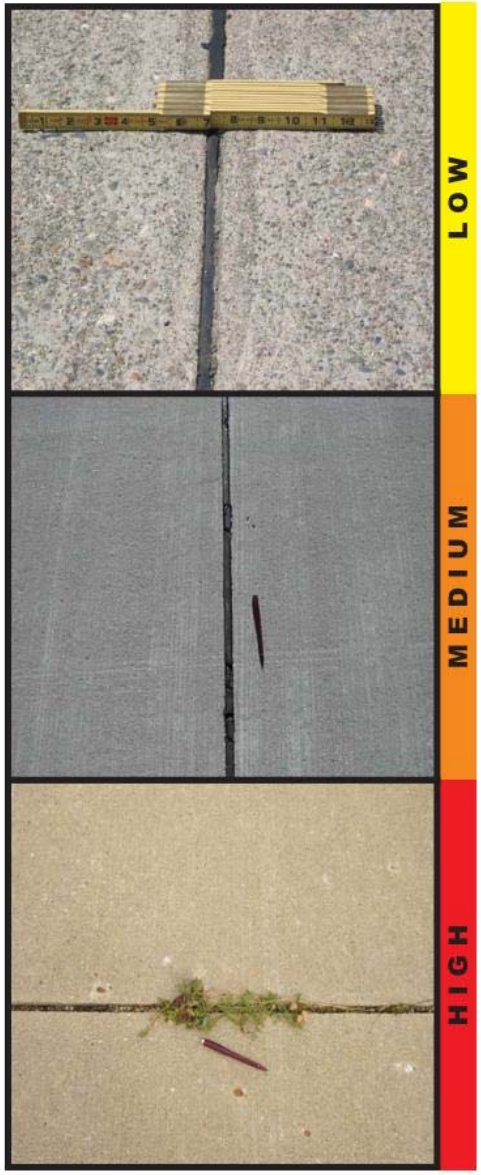
L Joint sealer is in generally good condition throughout the sample. Sealant is performing well, with only a minor amount of any of the above types of damage present. Joint seal damage is at low severity if a few of the joints have sealer which has debonded from, but is still in contact with, the joint edge. This condition exists if a knife blade can be inserted between the sealer and joint face without resistance.

M Joint sealer is in generally fair condition over the entire surveyed section, with one or more of the above types of damage occurring to a moderate degree. Sealant needs replacement within 2 years. Joint seal damage is at medium severity if a few of the joints have any of the following conditions: (1) joint sealer is in place, but water access is possible through visible openings no more than 1/8 inch (3 mm) wide. If a knife blade cannot be inserted easily between sealer and joint face, this condition does not exist; (2) pumping debris are evident at the joint; (3) joint sealer is oxidized and 'lifeless' but pliable (like a rope), and generally fills the joint opening; or (4) vegetation in the joint is obvious, but does not obscure the joint opening.

H Joint sealer is in generally poor condition over the entire surveyed section, with one or more of the above types of damage occurring to a severe degree. Sealant needs immediate replacement. Joint seal damage is at high severity if 10% or more of the joint sealer exceeds limiting criteria listed above, or if 10% or more of sealer is missing.

How To Count

Joint seal damage is not counted on a slab-by-slab basis but is rated based on the overall condition of the sealant in the sample unit. Joint sealer is in satisfactory condition if it prevents entry of water into the joint, it has some elasticity, and if there is no vegetation growing between the sealer and joint face. Premolded sealer is rated using the same criteria as above except as follows: (1) premolded sealer must be elastic and must be firmly pressed against the joint walls; and (2) premolded sealer must be below the joint edge. If it extends above the surface, it can be caught by moving equipment such as snow plows or brooms and be pulled out of the joint. Premolded sealer is recorded at low severity if any part is visible above joint edge. It is at medium severity if 10% or more of the length is above joint edge or if any part is more than 1/2 inch (12 mm) above joint edge. It is at high severity if 20% or more is above joint edge or if any part is more than 1 inch (25 mm) above joint edge, or if 10% or more is missing. Rate joint sealer by joint segment. Sample unit rating is the same as the most severe rating held by at least 20% of segments rated. In rating oxidation, do not rate on appearance. Rate on resilience. Some joint sealer will have a very dull surface, and may even show surface cracks in the oxidized layer. If the sealer is performing satisfactorily and has good characteristics beneath the surface, it is satisfactory.



65 JOINT SEAL DAMAGE

Table 6-2. Quick guide for maintenance and repair of common rigid pavement surface problems

Joint sealant damage	- Remove old sealant, clean joints, reseal	- Age - Environmental conditions - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper joint preparation)
Cracks	- Clean and seal cracks - Repair/replace slab - Evaluate adequacy of pavement structure; may require strengthening	- Loss of slab support - Load repetition; curling stresses; and shrinkage stresses
Corner Breaks	- Seal and maintain until full depth patch	- Loss of slab support - Load repetition and curling stresses
Joint spalling	- Remove lose material; refill with approved product; reseal - Partial depth repair	- Latent defects, i.e., excessive finishing - Incompressible matter in joint spaces - Snow plow damage
Slab blowup	- Replace slab in blowup area; clean and reseal joints.	- Incompressible material in joints preventing slab from expanding
Loss of Skid Resistance	- Remove rubber/surface contamination. - Grinding.	- Rubber deposits/surface contamination - Age, i.e., surface wear
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade
Popouts	- Remove FOD	- Material
Patches	- Remove/replace	- Inadequate/Improper repair detail/material - Age

CRACKS (LONGITUDINAL, TRANSVERSE, AND DIAGONAL) (63)

Description

These cracks, which divide the slab into two or three pieces, are usually caused by a combination of load repetition, curling stresses, and shrinkage stresses. (For slabs divided into four or more pieces, see Shattered Slab/ Intersecting Cracks.) Low severity cracks are usually warping or friction related and are not considered major structural distresses. Medium or high severity cracks are usually working cracks and are considered major structural distresses.

Hairline cracks that are only a few feet long and do not extend across the entire slab are rated as shrinkage cracks.

Non-reinforced PCC Severity Levels

L Crack has no spalling or minor spalling (no FOD potential). If non-filled, it is less than 1/8 inch (3 mm) wide. A filled crack can be of any width, but its filler material must be in satisfactory condition; or the slab is divided into three pieces by low severity cracks.

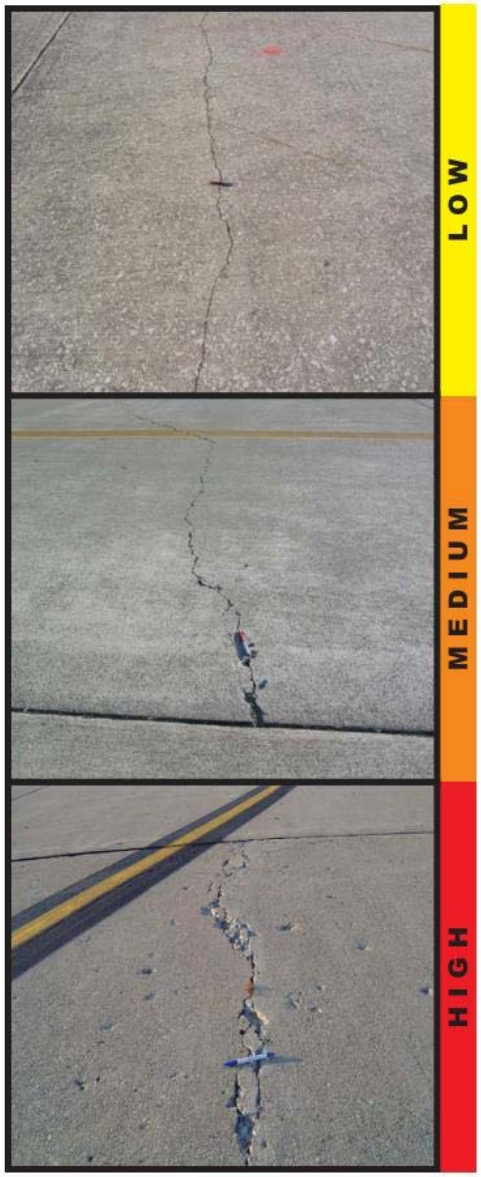
M One of the following conditions exists: (1) a filled or non-filled crack is moderately spalled (some FOD potential); (2) a non-filled crack has a mean width between 1/8 inch (3 mm) and 1 inch (25 mm); (3) a filled crack has no spalling or minor spalling, but the filler is in unsatisfactory condition; or (4) the slab is divided into three pieces by two or more cracks, one of which is at least medium severity.

H One of the following conditions exists: (1) a filled or non-filled crack is severely spalled (definite FOD potential); (2) a non-filled crack has a mean width approximately greater than 1 inch (25 mm), creating tire damage potential, or (3) the slab is divided into three pieces by two or more cracks, one of which is at least high severity.

How To Count

Once the severity has been identified, the distress is recorded as one slab. If a crack is repaired by a narrow patch (e.g., 4 to 10 inches wide (100 to 250 mm)), only the crack and not the patch should be recorded at the appropriate severity level.

Cracks used to define and rate corner breaks, "D" cracks, patches, shrinkage cracks, and spalls are not recorded as L/T/D cracks.



63 CRACKS

Table 6-2. Quick guide for maintenance and repair of common rigid pavement surface problems

Joint sealant damage	- Remove old sealant, clean joints, reseal	- Age - Environmental conditions - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper joint preparation)
Cracks	- Clean and seal cracks - Repair/replace slab - Evaluate adequacy of pavement structure; may require strengthening	- Loss of slab support - Load repetition; curling stresses; and shrinkage stresses
Corner Breaks	- Seal and maintain until full depth patch	- Loss of slab support - Load repetition and curling stresses
Joint spalling	- Remove lose material; refill with approved product; reseal - Partial depth repair	- Latent defects, i.e., excessive finishing - Incompressible matter in joint spaces - Snow plow damage
Slab blowup	- Replace slab in blowup area; clean and reseal joints.	- Incompressible material in joints preventing slab from expanding
Loss of Skid Resistance	- Remove rubber/surface contamination. - Grinding.	- Rubber deposits/surface contamination - Age, i.e., surface wear
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade
Popouts	- Remove FOD	- Material
Patches	- Remove/replace	- Inadequate/Improper repair detail/material - Age

CORNER BREAK (62)

Description

A corner break is a crack that intersects the joints at a distance less than or equal to one-half the slab length on both sides, measured from the corner of the slab. For example, a slab with dimensions of 25 by 25 feet (7 1/2 by 7 1/2 meters) that has a crack intersecting the joint 5 feet (1 1/2 meters) from the corner on one side and 17 feet (5 meters) on the other side is not considered a corner break; it is a diagonal crack. However, a crack that intersects 7 feet (2 meters) on one side and 10 feet (3 meters) on the other is considered a corner break. A corner break differs from a corner spall in that the crack extends vertically through the entire slab thickness, while a corner spall intersects the joint at an angle. Load repetition combined with loss of support and curling stresses cause corner breaks.

Severity Levels

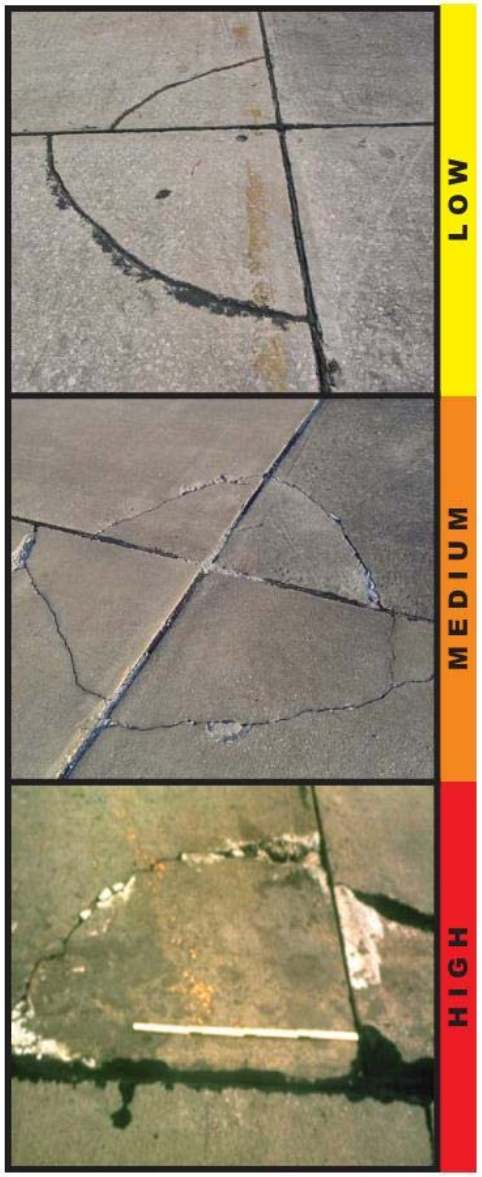
L Crack has either no spalling or minor spalling (no FOD potential). If non-filled, it has a mean width less than approximately 1/8 inch (3 mm); a filled crack can be of any width, but the filler material must be in satisfactory condition. The area between the corner break and the joints is not cracked.

M One of the following conditions exists: (1) filled or non-filled crack is moderately spalled (some FOD potential); (2) a non-filled crack has a mean width between 1/8 inch (3 mm) and 1 inch (25 mm); (3) a filled crack is not spalled or only lightly spalled, but the filler is in unsatisfactory condition; (4) the area between the corner break and the joints is lightly cracked. Lightly cracked means one low severity crack dividing the corner into two pieces.

H One of the following conditions exists: (1) filled or non-filled crack is severely spalled, causing definite FOD potential; (2) a non-filled crack has a mean width greater than approximately 1 inch (25 mm), creating a tire damage potential; or (3) the area between the corner break and the joints is severely cracked.

How To Count

A distressed slab is recorded as one slab if it (1) contains a single corner break, (2) contains more than one break of a particular severity, or (3) contains two or more breaks of different severities. For two or more breaks, the highest level of severity should be recorded. For example, a slab containing both light and medium severity corner breaks should be counted as one slab with a medium severity corner break. Crack widths should be measured between vertical walls, not in spalled areas of the crack. If the corner break is faulted 1/8 inch (3 mm) or more, increase severity to the next higher level. If the corner is faulted more than 1/2 inch (13 mm), rate the corner break at high severity. If faulting in corner is incidental to faulting in the slab, rate faulting separately. The angle of crack into the slab is usually not evident at low severity. Unless the crack angle can be determined, to differentiate between the corner break and corner spall, use the following criteria. If the crack intersects both joints more than 2 feet (600 mm) from the corner, it is a corner break. If it is less than 2 feet, unless you can verify the crack is vertical, call it a spall.



62 CORNER BREAK

A4. RIGID PAVEMENT REPAIR – PLAN VIEW

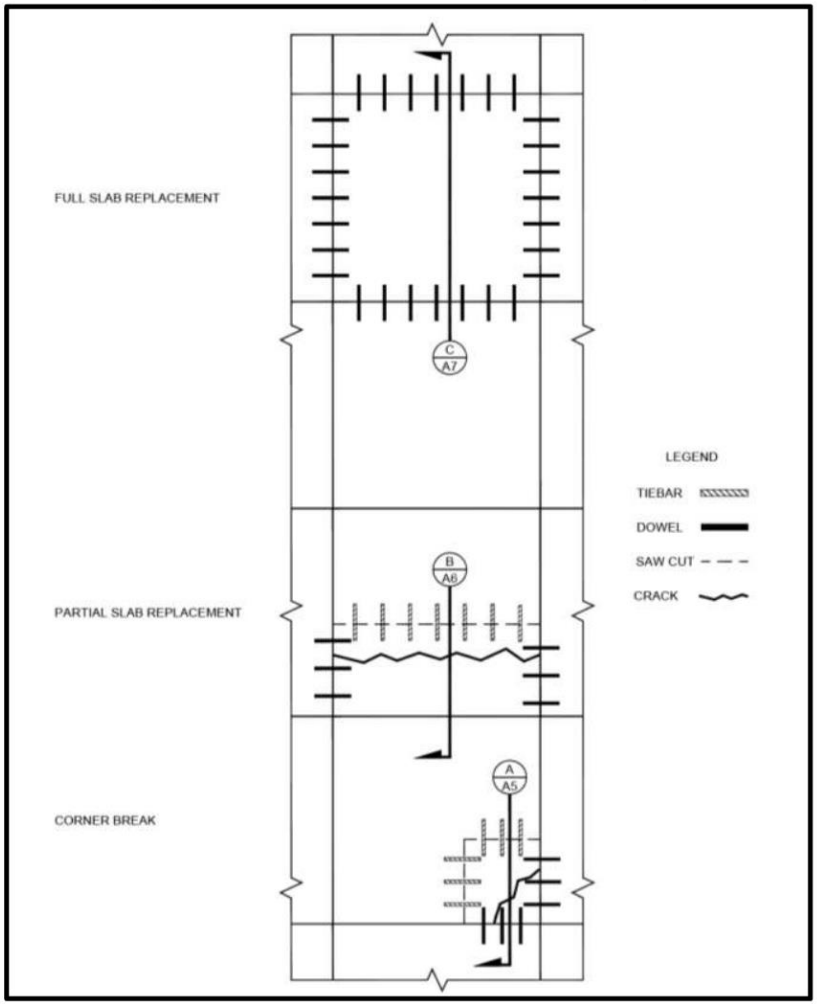


Figure A-4. Rigid pavement repair – plan view

A5. FULL DEPTH REPAIR IN RIGID PAVEMENT – CORNER BREAK

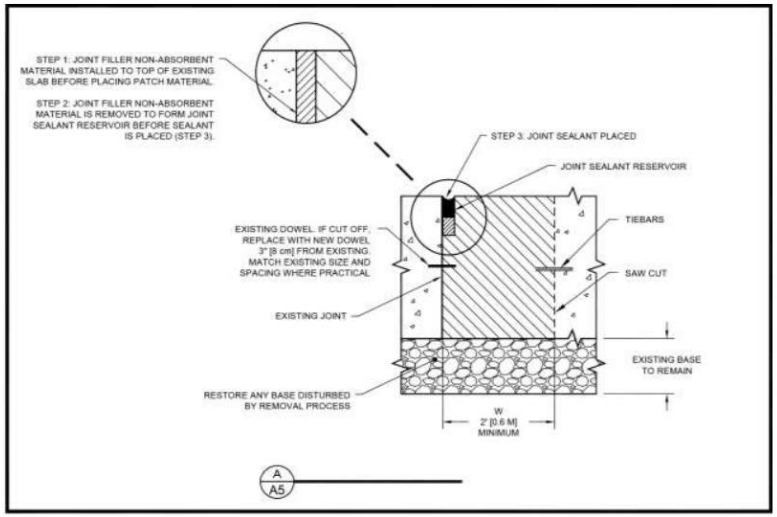


Figure A-5. Full depth repair in rigid pavement – corner break

Repair Procedure and Weather and Temperature Requirements are on the back of this page.

MATERIAL REQUIREMENTS

ASTM A1078	Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement
ASTM A615	Standard Specifications for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
P-501	Portland Cement Concrete (PCC) Pavement, AC 150/5370-10, Standards for Specifying Construction of Airports

State Department of Transportation specifications for pavements

A6. FULL DEPTH REPAIR IN RIGID PAVEMENT – PARTIAL SLAB REPLACEMENT

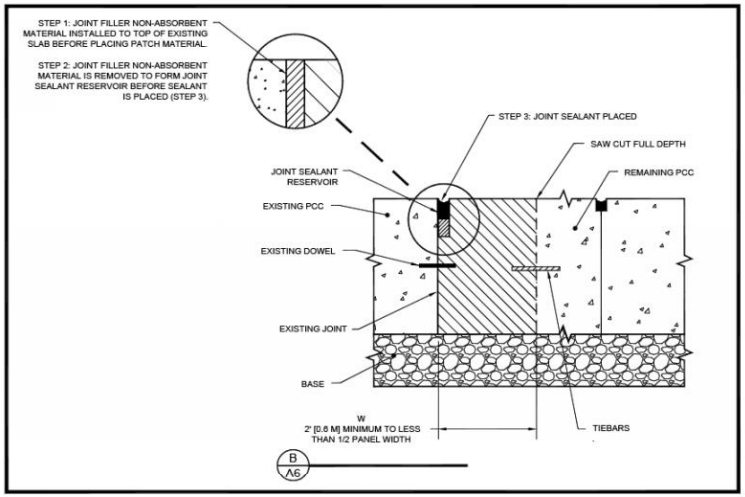


Figure A-6. Full depth repair in rigid pavement – partial slab replacement

Repair Procedure and Weather and Temperature Requirements are on the back of this page.

MATERIAL REQUIREMENTS

ASTM A1078	Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement
ASTM A615	Standard Specifications for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
P-501	Portland Cement Concrete (PCC) Pavement, AC 150/5370-10, Standards for Specifying Construction of Airports

State Department of Transportation specifications for pavements

A7. FULL DEPTH REPAIR IN RIGID PAVEMENT – FULL SLAB REPLACEMENT

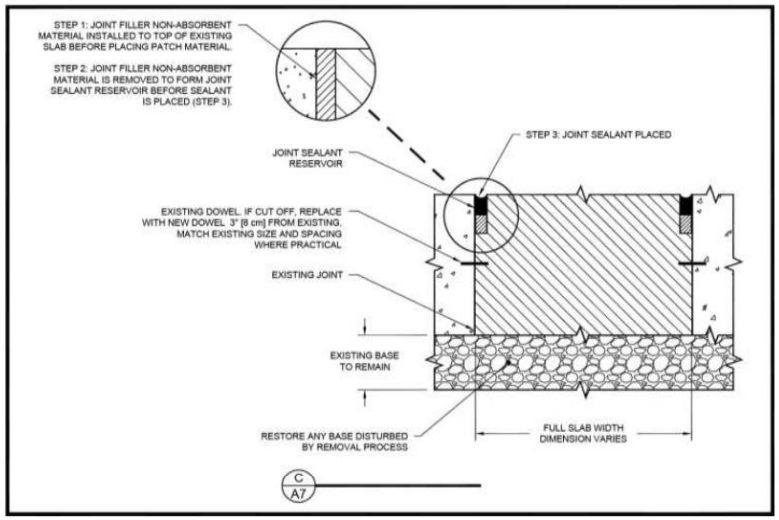


Figure A-7. Full depth repair in rigid pavement – full slab replacement

Repair Procedure and Weather and Temperature Requirements are on the back of this page.

MATERIAL REQUIREMENTS

ASTM A1078	Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement
ASTM A615	Standard Specifications for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
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State Department of Transportation specifications for pavements

Table 6-2. Quick guide for maintenance and repair of common rigid pavement surface problems

Joint sealant damage	- Remove old sealant, clean joints, reseal	- Age - Environmental conditions - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper joint preparation)
Cracks	- Clean and seal cracks - Repair/replace slab - Evaluate adequacy of pavement structure; may require strengthening	- Loss of slab support - Load repetition; curling stresses; and shrinkage stresses
Corner Breaks	- Seal and maintain until full depth patch	- Loss of slab support - Load repetition and curling stresses
Joint spalling	- Remove lose material; refill with approved product; reseal - Partial depth repair	- Latent defects, i.e., excessive finishing - Incompressible matter in joint spaces - Snow plow damage
Slab blowup	- Replace slab in blowup area; clean and reseal joints.	- Incompressible material in joints preventing slab from expanding
Loss of Skid Resistance	- Remove rubber/surface contamination. - Grinding.	- Rubber deposits/surface contamination - Age, i.e., surface wear
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade
Popouts	- Remove FOD	- Material
Patches	- Remove/replace	- Inadequate/Improper repair detail/material - Age

SPALLING (TRANSVERSE AND LONGITUDINAL JOINTS) (74)

Description

Joint spalling is the breakdown of the slab edges within 2 feet (60 mm) of the side of the joint. A joint spall usually does not extend vertically through the slab but intersects the joint at an angle. Spalling results from excessive stresses at the joint or crack caused by infiltration of incompressible materials or traffic loads. Weak concrete at the joint (caused by overworking) combined with traffic loads also causes spalling.

Frayed condition as used in this test method indicates material is no longer in place along a joint or crack. Spalling indicates material may or may not be missing along a joint or crack.

Severity Levels

	Spall Length	Description
L	< 2 feet (600 mm)	spall is broken into pieces or fragmented; little FOD or tire damage potential exists.
	> 2 feet (600 mm)	(a) spall is broken into no more than three pieces defined by low or medium severity cracks; little or no FOD potential exists; or (b) joint is lightly frayed; little or no FOD potential exists.
M	< 2 feet (600 mm)	spall is broken into pieces or fragmented, with some of the pieces loose or absent, causing considerable FOD or tire damage potential.
	> 2 feet (600 mm)	(a) spall is broken into more than three pieces defined by light or medium cracks; (b) spall is broken into no more than three pieces with one or more of the cracks being severe with some FOD potential existing; or (c) joint is moderately frayed, with some FOD potential.
H	> 2 feet (600 mm)	(1) spall is broken into more than three pieces defined by one or more high severity cracks with high FOD potential; or (2) joint is severely frayed, with high FOD potential.

How To Count

If the joint spall is located along the edge of one slab, it is counted as one slab with joint spalling. If spalling is located on more than one edge of the same slab, the edge having the highest severity is counted and recorded as one slab. Joint spalling can also occur along the edges of two adjacent slabs. If this is the case, each slab is counted as having joint spalling. If a joint spall is small enough to be filled during a joint seal repair, it should not be recorded.

74 SPALLING, JOINT

A8. JOINT SPALL REPAIR IN RIGID PAVEMENT

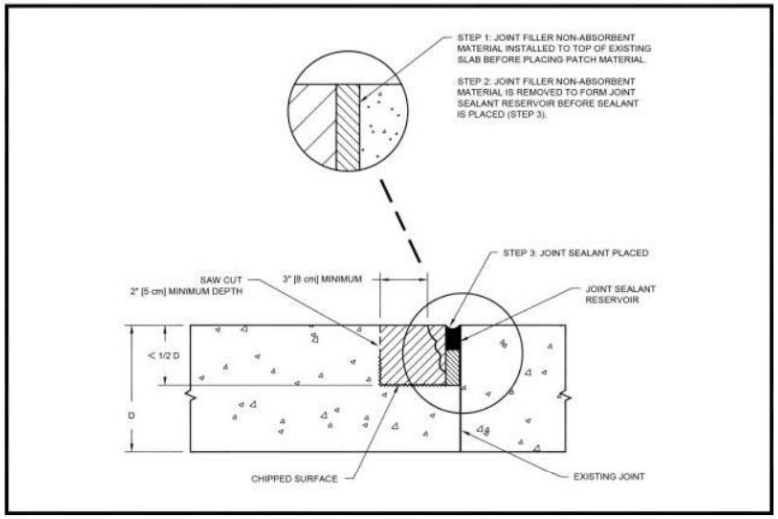

Figure A-8. Joint spall repair in rigid pavement

Repair Procedure and Weather and Temperature Requirements are on the back of this page.

MATERIAL REQUIREMENTS

ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C881	Standard Specifications for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
P-501	Portland Cement Concrete (PCC) Pavement, AC 150/5370-10, Standards for Specifying Construction of Airports

State Department of Transportation specifications for pavements

Table 6-2. Quick guide for maintenance and repair of common rigid pavement surface problems

Joint sealant damage	- Remove old sealant, clean joints, reseal	- Age - Environmental conditions - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper joint preparation)
Cracks	- Clean and seal cracks - Repair/replace slab - Evaluate adequacy of pavement structure; may require strengthening	- Loss of slab support - Load repetition; curling stresses; and shrinkage stresses
Corner Breaks	- Seal and maintain until full depth patch	- Loss of slab support - Load repetition and curling stresses
Joint spalling	- Remove lose material; refill with approved product; reseal - Partial depth repair	- Latent defects, i.e., excessive finishing - Incompressible matter in joint spaces - Snow plow damage
Slab blowup	- Replace slab in blowup area; clean and reseal joints.	- Incompressible material in joints preventing slab from expanding
Loss of Skid Resistance	- Remove rubber/surface contamination. - Grinding.	- Rubber deposits/surface contamination - Age, i.e., surface wear
Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade
Popouts	- Remove FOD	- Material
Patches	- Remove/replace	- Inadequate/Improper repair detail/material - Age

BLOWUP (61)*

Description

Blowups occur in hot weather, usually at a transverse crack or joint that is not wide enough to permit expansion by the concrete slabs. The insufficient width is usually caused by infiltration of incompressible materials into the joint space. When expansion cannot relieve enough pressure, a localized upward movement of the slab edges (buckling) or shattering will occur in the vicinity of the joint. Blowups can also occur at utility cuts and drainage inlets. This type of distress is almost always repaired immediately because of severe damage potential to aircraft. Blowups are included for reference when closed sections are being evaluated for reopening.

Severity Levels

L Buckling or shattering has not rendered the pavement inoperative, and only a slight amount of roughness exists.

M Buckling or shattering has not rendered the pavement inoperative, but a significant amount of roughness exists.

H Buckling or shattering has rendered the pavement inoperative.

(Note: For pavements to be considered operational, all foreign material from blowups must have been removed.)

How To Count

A blowup usually occurs at a transverse crack or joint. At a crack, it is counted as being in one slab, but at a joint, two slabs are affected and the distress should be recorded as occurring in two slabs.

**PAVER™ Distress Code*

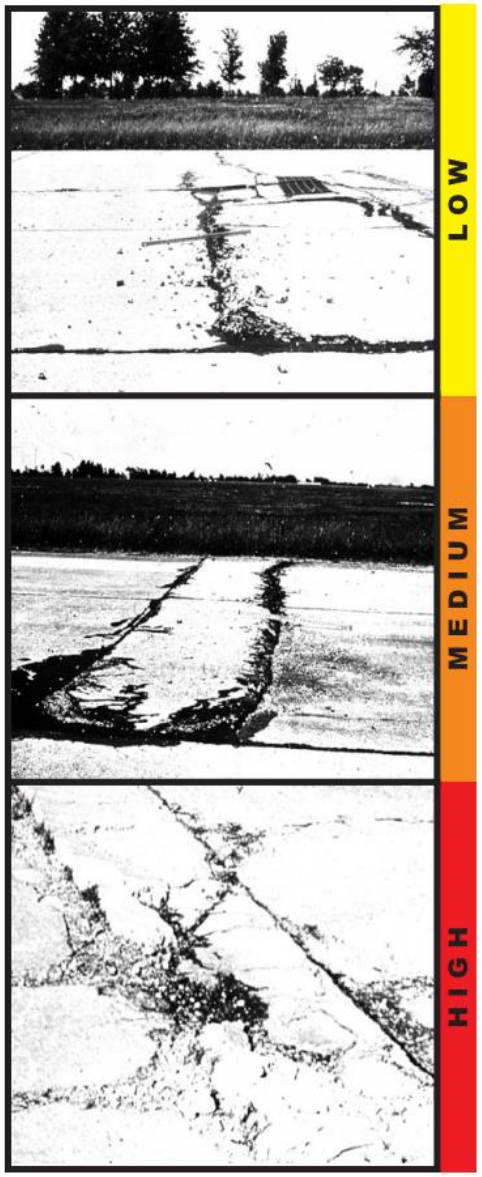

Table 6-2. Quick guide for maintenance and repair of common rigid pavement surface problems

Joint sealant damage	- Remove old sealant, clean joints, reseal	- Age - Environmental conditions - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper joint preparation)
Cracks	- Clean and seal cracks - Repair/replace slab - Evaluate adequacy of pavement structure; may require strengthening	- Loss of slab support - Load repetition; curling stresses; and shrinkage stresses
Corner Breaks	- Seal and maintain until full depth patch	- Loss of slab support - Load repetition and curling stresses
Joint spalling	- Remove lose material; refill with approved product; reseal - Partial depth repair	- Latent defects, i.e., excessive finishing - Incompressible matter in joint spaces - Snow plow damage
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Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade
Popouts	- Remove FOD	- Material
Patches	- Remove/replace	- Inadequate/Improper repair detail/material - Age

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Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade
Popouts	- Remove FOD	- Material
Patches	- Remove/replace	- Inadequate/Improper repair detail/material - Age

POPOUTS (68)

Description

A popout is a small piece of pavement that breaks loose from the surface due to freeze-thaw action in combination with expansive aggregates. Popouts usually range from approximately 1 inch (25 mm) to 4 inches (100 mm) in diameter and from 1/2 inch (13 mm) to 2 inches (50 mm) deep.

Severity Levels

No degrees of severity are defined for popouts. However, popouts must be extensive before they are counted as a distress; i.e., average popout density must exceed approximately three popouts per square yard (square meter) over the entire slab area.

How To Count

The density of the distress must be measured. If there is any doubt about the average being greater than three popouts per square yard (square meter), at least three, random, 1 square yard (1 square meter) areas should be checked. When the average is greater than this density, the slab is counted.

Table 6-2. Quick guide for maintenance and repair of common rigid pavement surface problems

Joint sealant damage	- Remove old sealant, clean joints, reseal	- Age - Environmental conditions - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper joint preparation)
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Drainage	- Grade pavement shoulders, clear drainage path - Clean out drainage structures, e.g., edge drains, outfalls, etc.	- Poor maintenance of drainage facilities - Poor maintenance of grade
Popouts	- Remove FOD	- Material
Patches	- Remove/replace	- Inadequate/Improper repair detail/material - Age

PATCHING, SMALL (LESS THAN 5.5 FT² (0.5 M²)) (66)

Description

A patch is an area where the original pavement has been removed and replaced by a filler material. For condition evaluation, patching is divided into two types: small (less than 5.5 square feet (0.5 square meters)) and large (over 5.5 square feet (0.5 square meters)). Large patches are described in the next section.

Severity Levels

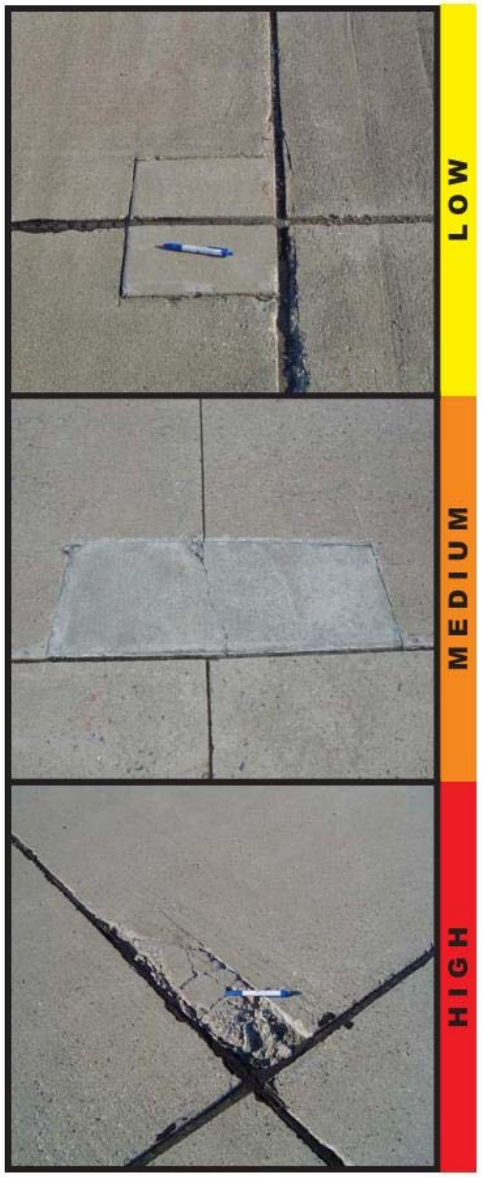
L — Patch is functioning well, with little or no deterioration.

M — Patch has deteriorated, and/ or moderate spalling can be seen around the edges. Patch material can be dislodged, with considerable effort (minor FOD potential).

H — Patch has deteriorated, either by spalling around the patch or cracking within the patch, to a state which warrants replacement.

How To Measure

If one or more small patches having the same severity level are located in a slab, it is counted as one slab containing that distress. If more than one severity level occurs, it is counted as one slab with the higher severity level being recorded. If a crack is repaired by a narrow patch (e.g., 4 to 10 inches (100 to 250 mm) wide), only the crack and not the patch should be recorded at the appropriate severity level. If the original distress of a patch is more severe than the patch itself, the original distress type should be recorded.



Thank you

Colin Bible, PE
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