

Safety and Engineering

Pavement Maintenance & Preservation

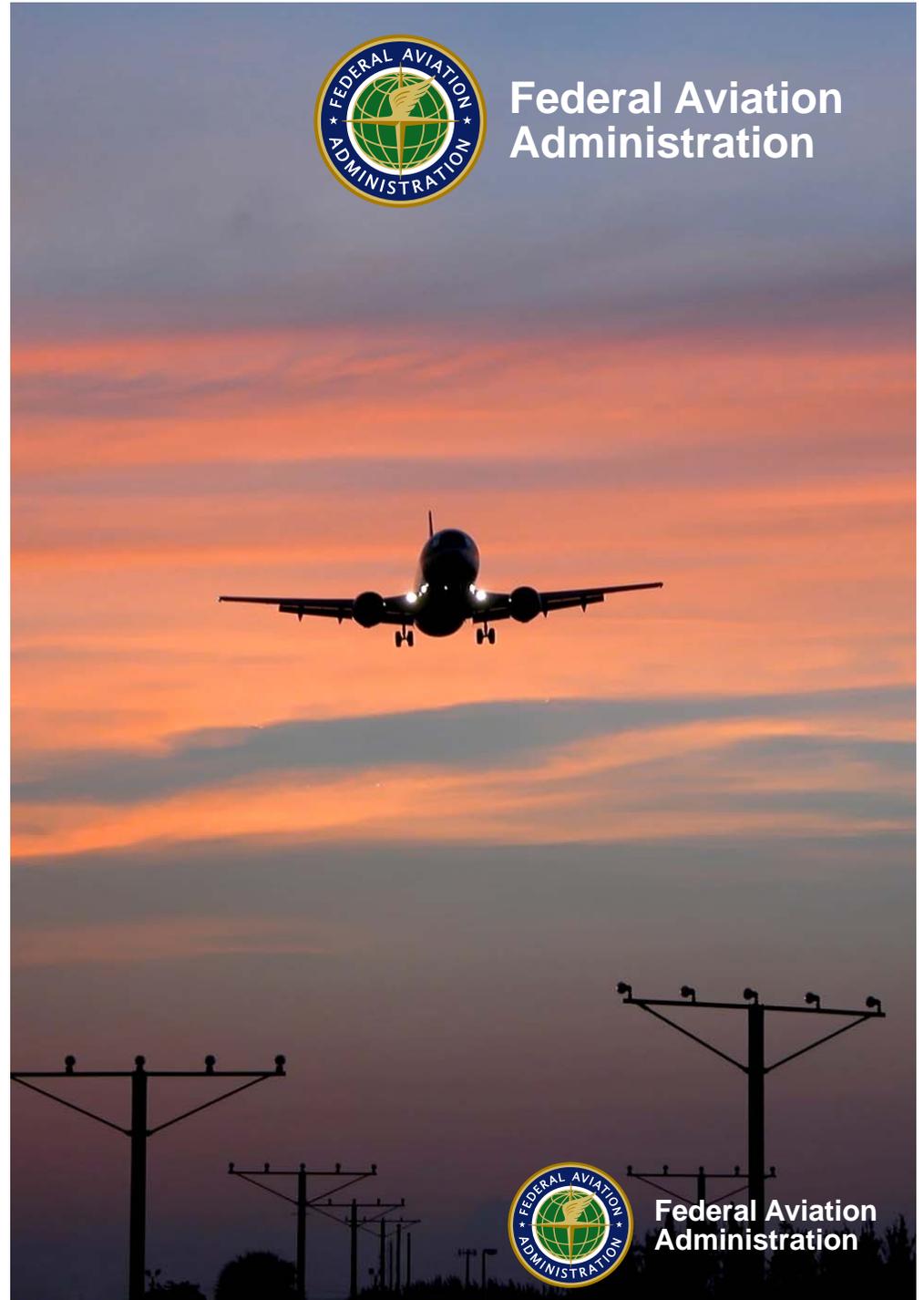
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FAA's Definition of Maintenance

- **Maintenance includes any regular or recurring work necessary to preserve existing airport facilities in good condition, work involved in the care or cleaning of existing, and any incidental or minor repair work on existing airport facilities.**



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Pavement Maintenance

- **Maintenance is responsibility of Airport/Owner:**
 - Grant Assurance **C. Sponsor Certification. 3. Sponsor Fund Availability:**
 - The Sponsor hereby assures and certifies, with respect to this grant that: **“It has sufficient funds available to assure operation and maintenance of items funded under this grant agreement which it will own or control.”**
 - Grant Assurance **19. Operation and Maintenance:**
 - “...It will suitably operate and maintain the airport and all facilities thereon which would interfere with its use for airport purposes...”
- **AC 150/5380-6C, “Guidelines and Procedures for Maintenance of Airport Pavements”**



FAA AC 150/5380-6C, “Guidelines and Procedures for Maintenance of Airport Pavements”

- **General guidance for maintenance and repairs**
 - Neither binding nor regulatory
- **Use of this AC is NOT mandatory**



Maintenance Projects

Maintenance includes preventive and remedial work necessary to preserve existing airport pavements in good condition.

- For Major Maintenance Projects:
 - Utilize P&S developed under the direction of an engineer
 - If AIP must follow AC 150/5370-10
- For Routine & Preventative Maintenance Projects:
 - Utilize AC 150/5380-6C, Guidelines and Procedures for Maintenance of Airport Pavements
 - Table 6-1 Quick Guide for M&R of Flexible
 - Table 6-2 Quick Guide for M&R of Rigid



Pavement Maintenance

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	- Age - Environmental conditions - Bitumen too hard or overmixed in mix - Sealant defects (e.g., incorrect application temperature, improper sealant selection, improper
Alligator or fatigue cracking		
Patches		
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

Problem	Repair	Probable Cause
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
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

Problem	Repair	Probable Cause
Weathering/ Oxidation	- Apply surface treatment - Overlay	- Environment - Lack of timely surface treatments



Routine & Preventative Maintenance for Flexible Pavements

- **Flexible Pavement Routine Maintenance**
 - Crack Cleaning and Sealing
 - Seal coating
 - Overlay
 - Partial & Full Depth Repair
 - Maintenance of Drainage Systems
 - Grading of Pavement Shoulders
 - Removal of Rubber or Surface Contamination
 - Restoration of Pavement Markings



Flexible Pavement Distresses

- **Cracking**
 - Longitudinal & Transverse
 - Block
 - Reflection
 - Alligator or fatigue
 - Slippage
- **Disintegration**
 - Raveling
 - Weathering
 - Potholes
 - Stripping
 - Patching
- **Distortion**
 - Rutting
 - Corrugation
 - Shoving
 - Depressions
 - Swelling
- **Loss of Skid Resistance**
 - Polished Aggregate
 - Contaminants
 - Bleeding
 - Fuel/oil spillage



Flexible Pavement Distresses

- **Cracking – Water Infiltration is #1 Enemy**



Flexible Pavement Distresses

- Oxidation & Raveling – **Sun's UV Rays is #2 Enemy**



Flexible Pavement Distresses

- **Thermal Cracking – Temperature Change is #3 Enemy**



Flexible Pavement Distresses



Alligator cracks

Interconnected cracks forming small pieces ranging in size from about 1" to 6". This is caused by failure of the entire pavement due to traffic loading (fatigue) and usually due to inadequate base or subgrade support. Repair by excavating and replacing failed sub-grade base and surface. Large areas require reconstruction. Improvements in drainage may often be required.

◀ Alligator crack pattern. Tight cracks and one patch.



◀ Alligator cracking near pavement edge.



◀ Alligator cracking and pothole.

- **Structural failure of pavement**
- **Reconstruction required to repair (if localized possibly just a small area)**
- **Flexible pavement relies on layer below to protect, so if top failed must fix bottom**



Routine & Preventative Maintenance for Rigid Pavements

- **Rigid Pavement Routine Maintenance**
 - Crack Sealing
 - Joint Seal Repair/Replacement
 - Full Depth Repair
 - Partial Depth Repair
 - Maintenance of Drainage Systems
 - Grading of Pavement Shoulders
 - Removal of Rubber or Surface Contamination
 - Restoration of Pavement Markings



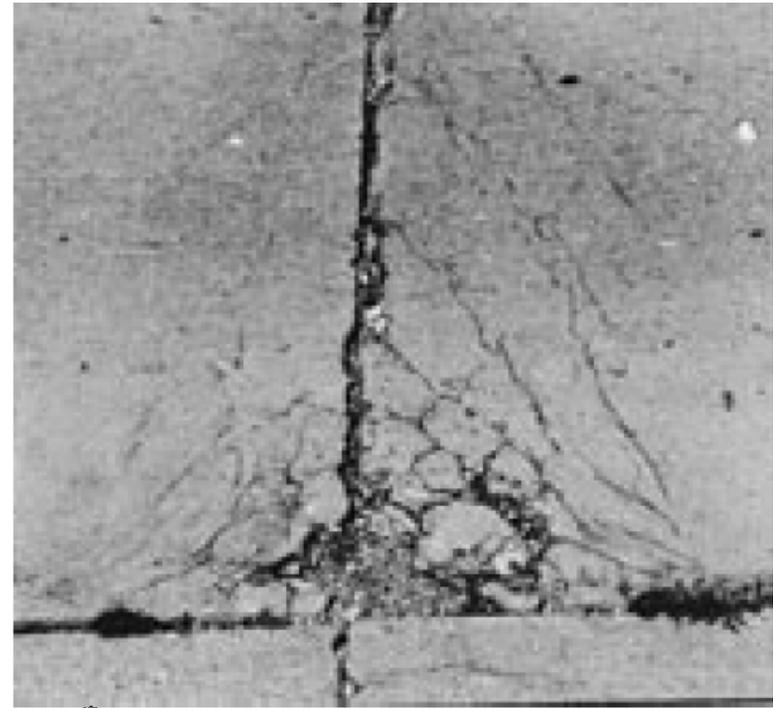
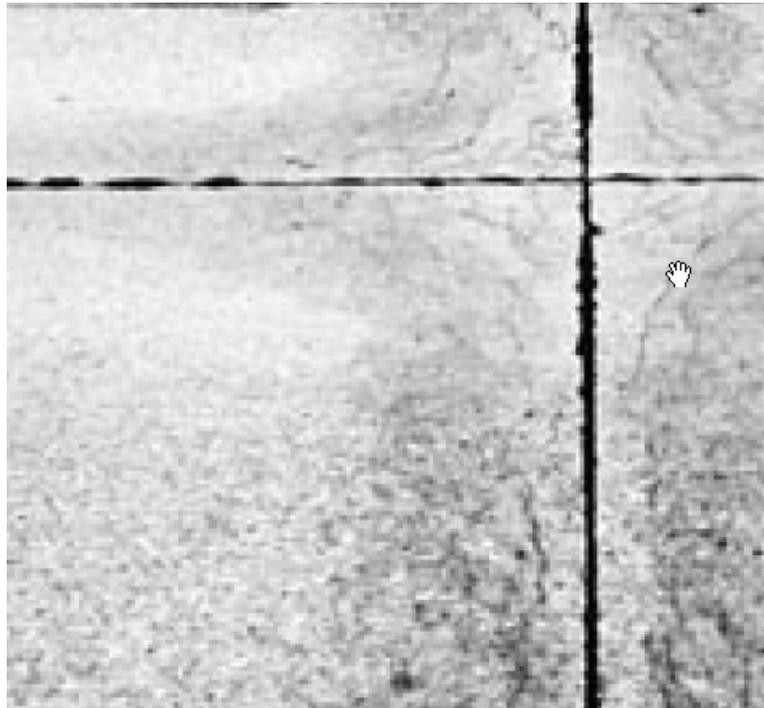
Rigid Pavement Distresses

- **Cracking**
 - Longitudinal & Transverse
 - Corner and D-cracking
 - Durability
 - Shrinkage
 - Shattered Slab
- **Joint Seal Damage**
- **Loss of Skid Resistance**
 - Polished Aggregates
 - Contaminants
- **Surface Defects**
 - Scaling & Map Cracking
 - ASR
 - Joint Spalling
 - Corner Spalling
 - Blow-up
 - Popout
 - Patches & Potholes
- **Distortion**
 - Pumping
 - Settlement



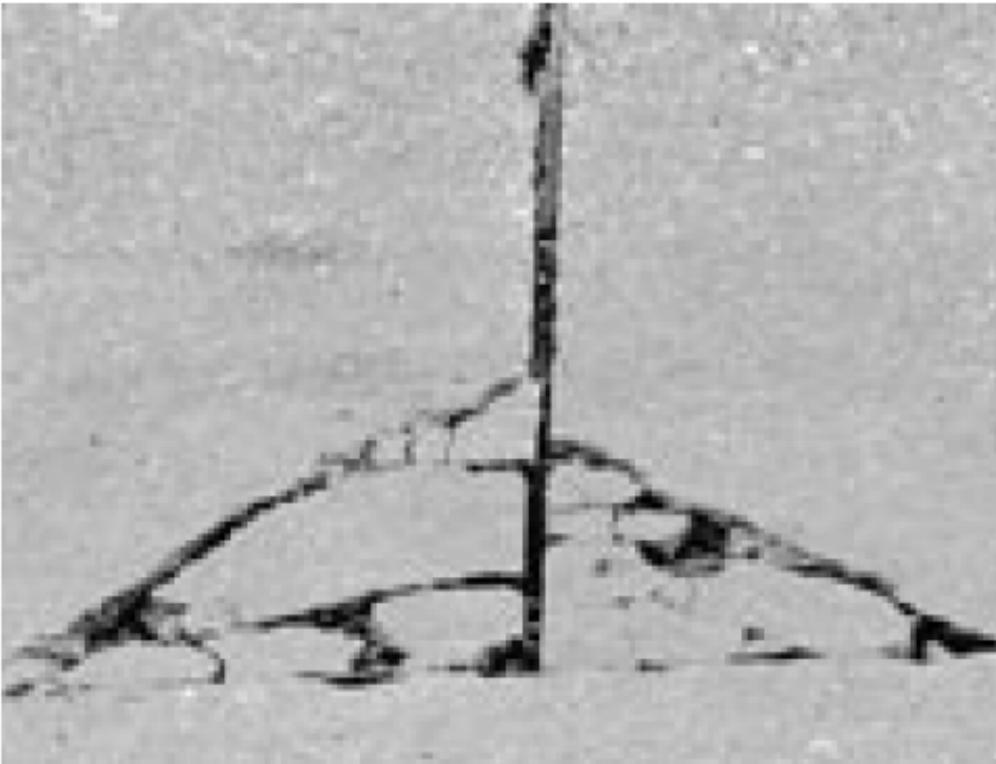
Rigid Pavement Distresses

- **D-Cracking – Poor Quality Aggregates subjected to freeze-thaw cycles**



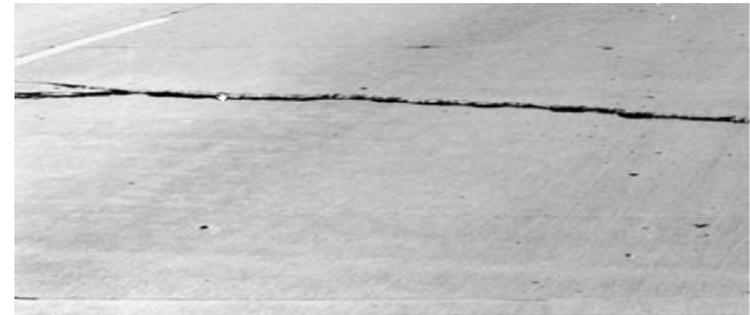
Rigid Pavement Distresses

- **Corner Cracking** – **Loss of support thermal slab movements**



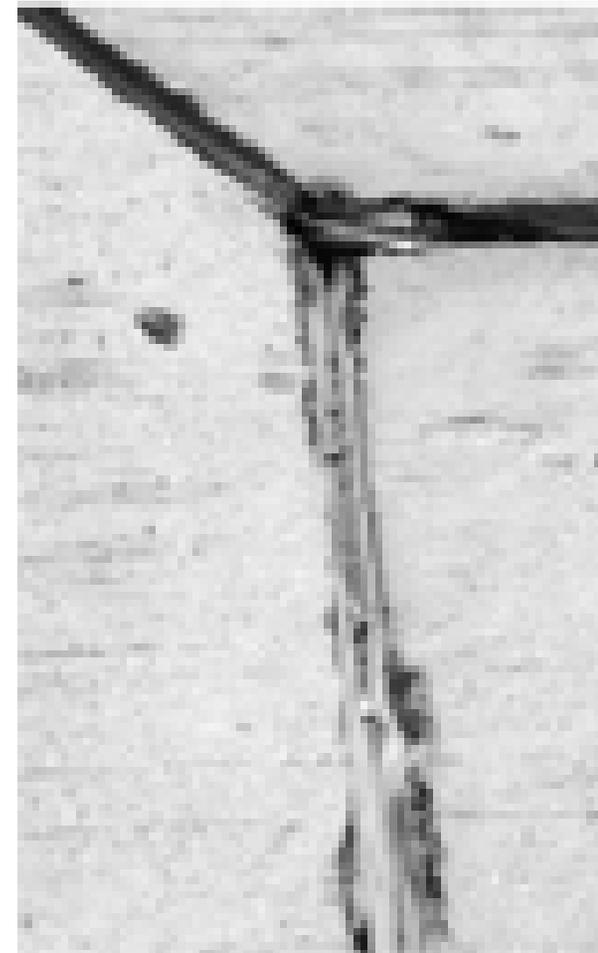
Rigid Pavement Distresses

- **Cracking – Longitudinal, Transverse & Meandering**



Rigid Pavement Distresses

- Joint Seal Damage - **Aging**



Rigid Pavement Distresses



- **Structural failure of pavement**
- **Reconstruction required to repair**
- **Rigid pavement relies on concrete strength, so if bottom of slab is cracked, pavement has failed.**



What is Pavement Preservation?

- **What**: Strategy of planned & organized **maintenance** to retard deterioration
- **When**: Sooner is better.. Most effective when performed on relatively new pavements
- **Where**: To the Right Pavement
- **Why**:
 - Maintain or Improve Pavement Functionality
 - Improve Overall Pavement Inventory/Network/System
- **How**: With the Right Treatment



Airport Pavement Preservation

- Preservation of airport pavements is significantly more cost effective, and less disruptive to users and owners, than corrective maintenance or reconstruction.
Preventive Maintenance << than Corrective Maintenance
- FAA Studying ways to achieve longer Pavement Life
- ~ 460 Million SY of Pavement at NPIAS Airports



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Fed Hwy System to NPIAS Pavement Comparison



Federal Hwy System
45 Billion Annual Budget



AIP
3.3 Billion Annual Budget



Pavement Maintenance & Management Program (PMMP=PMP)

- Required by Grant Assurance 11, Pavement Preventative Maintenance, & Grant Condition 11.

11. Pavement Preventive Maintenance.

With respect to a project approved after January 1, 1995, for the replacement or reconstruction of pavement at the airport, it assures or certifies that it has implemented an effective airport pavement maintenance-management program and it assures that it will use such program for the useful life of any pavement constructed, reconstructed or repaired with Federal financial assistance at the airport. It will provide such reports on pavement condition and pavement management programs as the Secretary determines may be useful.

- AC 150/5380-7B Airport Pavement Management Program (PMP)



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AC 150/5380-7B, Airport Pavement Management Program (PMP)

- **Describes PMP Concept and Components**
- **PMP used to make cost-effective decisions about pavement maintenance and rehabilitation**
 - Maintenance consists of work planned, budgeted, and performed on a regular basis to maintain and preserve the condition of airport pavements.
 - By projecting the rate of deterioration, a PMP can help you select the best M&R alternative at the optimal time to avoid higher costs in the future
 - Routine maintenance must occur for the pavement to achieve its design life.

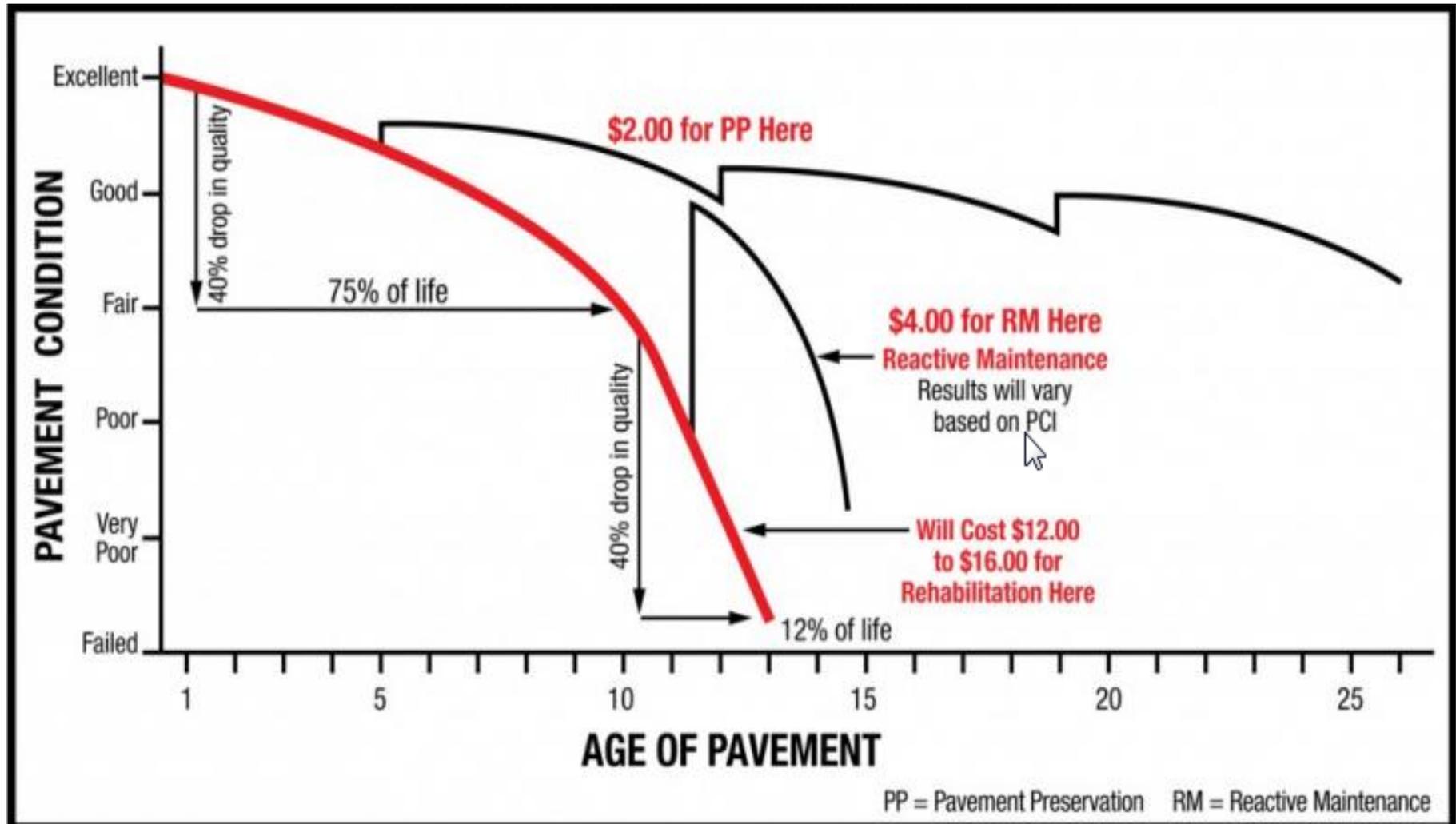


Pavement Life

- **Structural Life = Design Life**
 - Minimum 20 Years, # fatigue cycles for load
 - Rare today to see structural failures, material failures more common
- **Service Life = Functional Life**
 - Acceptable Service to Performing Task
 - FOD
 - Skid Resistance or
 - Roughness
- **Actual Life** function of airplane mix and use, quality of materials and construction, routine & preventative maintenance, and climate



PMP Preservation Concept



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Benefits of a PMP

- **Increased Pavement Useful Life**
- **Objective & consistent evaluation of the condition of the pavement inventory**
- **Documented engineering basis for determining M&R needs**
- **Identifies budgetary needs to maintain pavement functionality**
- **Life cycle cost analysis for M&R alternatives**
- **Identifies the impact on the pavement if no major repairs are performed.**



Min. PMP Components (Appendix A)

- **Identify funding sources for maintenance**
- **Pavement Inventory**
 - ID pavement areas & dimension by structural sections
 - Type of surface
 - Year of Construction or Major Rehab – M&R History & Cost
 - Note whether AIP/PFC funds used
- **Inspection Schedule**
- **Records** (maintain until pavement replaced)
 - Inspection Date
 - Location of distress and type
 - Maintenance scheduled and/or performed and its cost
- **Information Retrieval System**



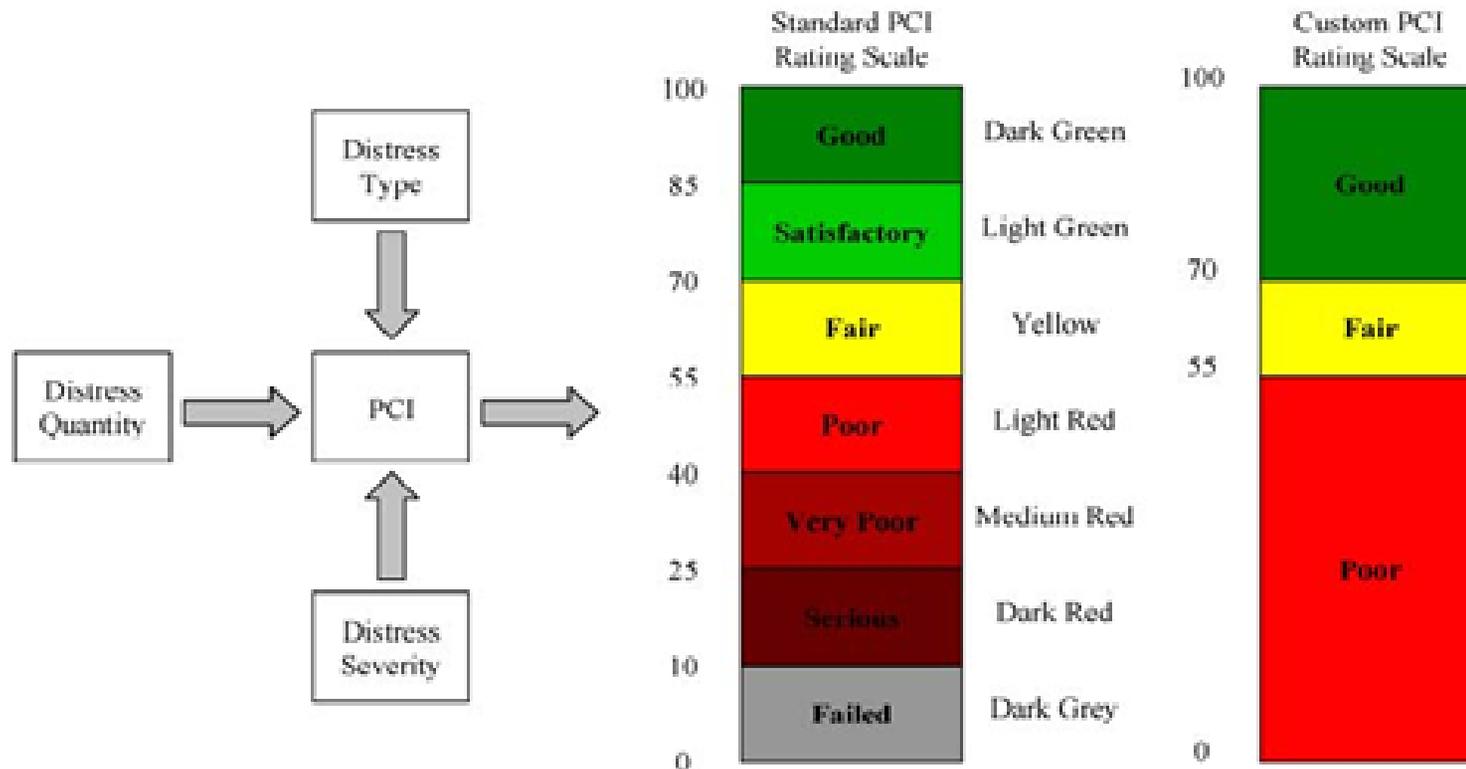
Advisable PMP Components

- **Pavement Structural Data** (FAARFIELD, Project As-Builts, Boring Logs/Geotech Reports, and NDT)
- **Maintenance & Rehabilitation History & Costs**
- **Traffic Data (Fleet Mix and Operations)**
- **Software such as PAVER™ or FAA PAVAIR**
- **Pavement Condition Index (PCI) Data**
 - PCI by ASTM D 5340 vs just PASER Surface Evaluation
 - Maintain Pavement System > 70 PCI
 - PCC decreases ~ 1 - 1.5 Pts / year
 - AC decreases ~ 3 - 4 Pts / year
 - AC + Surface Treatment ~ 1.5 – 0.5 pts / year

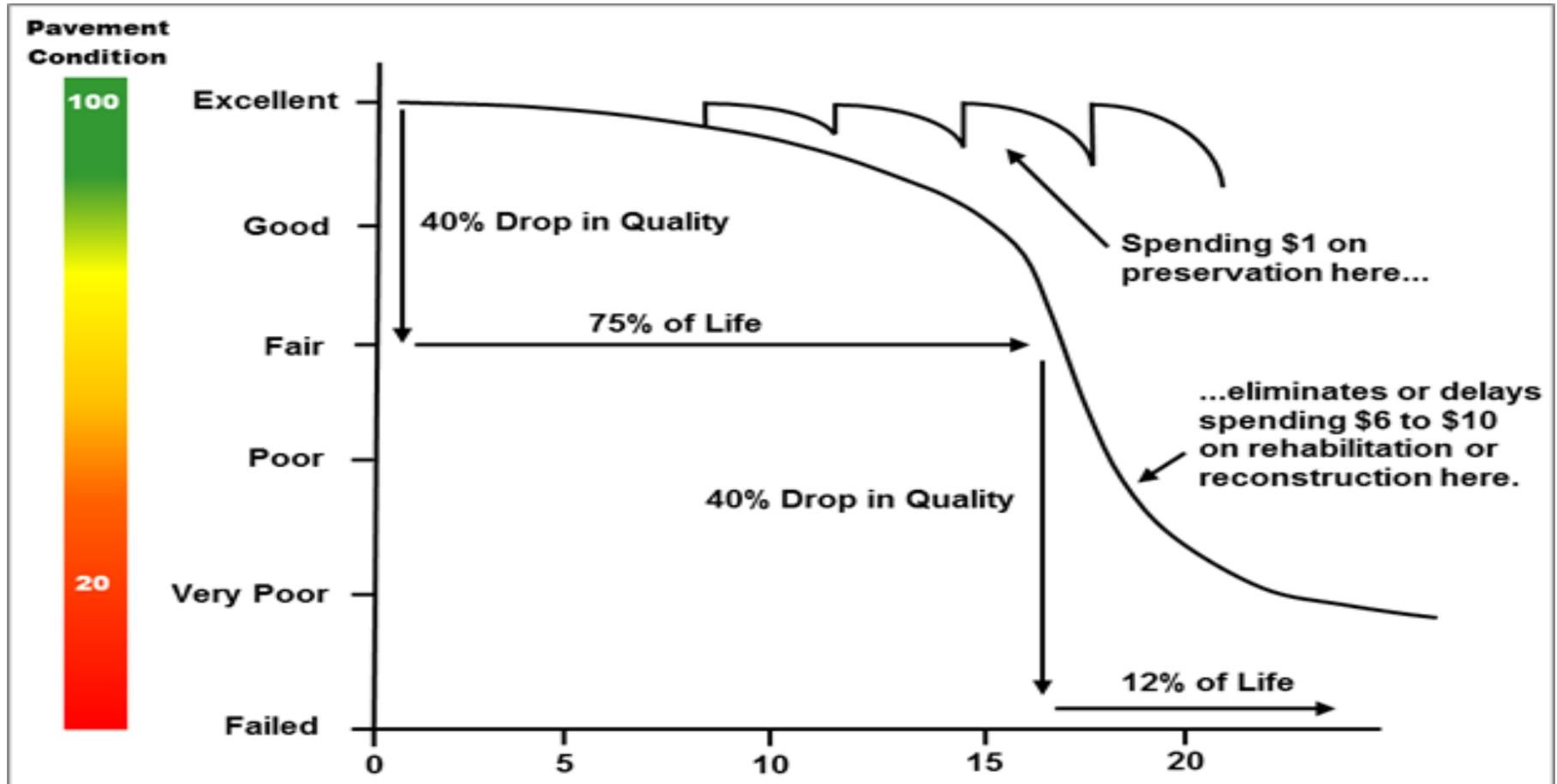


Pavement Condition Index (PCI)

- PCI provides a measure of the present condition of a pavement based upon the number and types of distresses observed on its surface.



When Preservation Maintenance Must Occur



Pavement Preservation



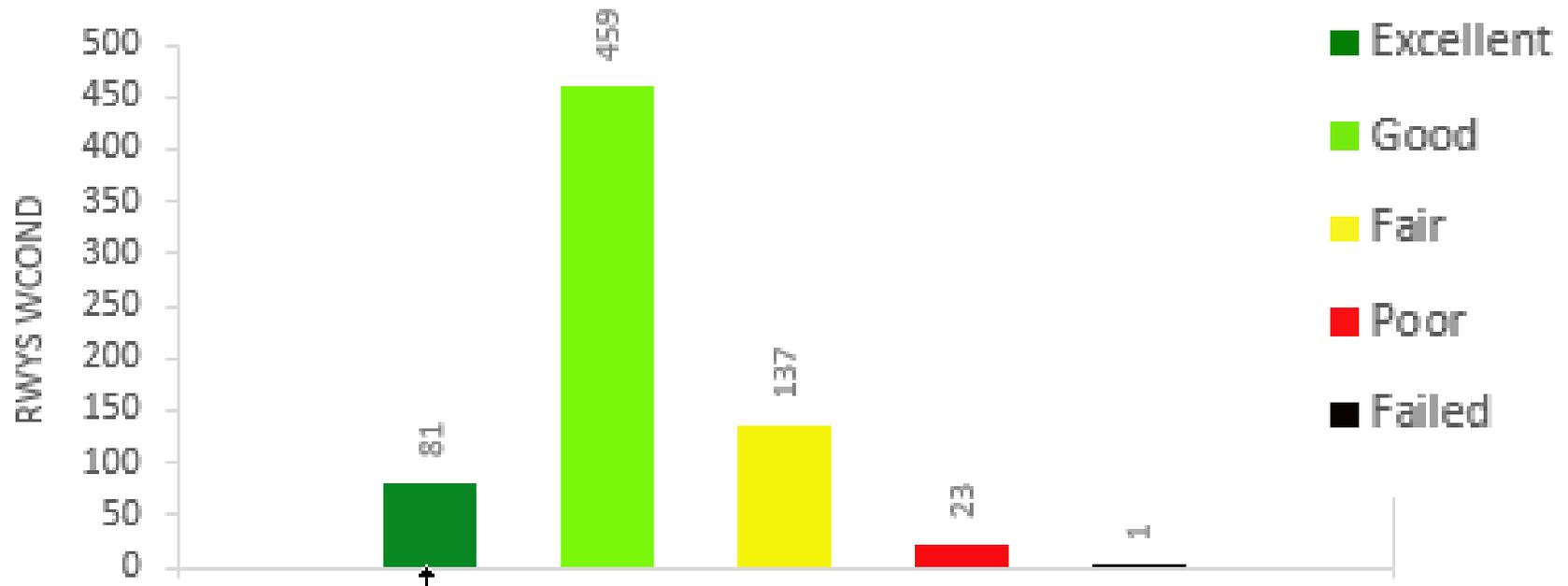
Applying the right treatment
to the right pavement
at the right time



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How Are We Doing?

ASW NPIAS Runway Pavement Condition



- **97% Fair and Above Condition vs 98% Nationally**



Advisory Circulars & Standards

Advisory Circular	Title
AC 150/5320-6F	Airport Pavement Design & Evaluation
AC 150/5370-10G/H	Standards for Specifying Construction of Airports
AC 150/5335-5C	Standardized Method of Reporting Airport Pavement Strength (PCN)
AC 150/5320-12C	Measurement, Construction & Maintenance of Skid Resistant Airport Pavement Surfaces
ASTM 5340	Standard Test Method for Airport Pavement Condition Index Surveys
AC 150/5370-11B	Use of Non Destructive Testing in the Evaluation of Airport Pavements
AC 150/5380-6C	Guidelines & Procedures for Maintenance of Airport Pavements
AC 150/5380-7B	Airport Pavement Management Programs (PMP)

Questions?

