

Pavement Distresses

Pavement Distress

- Pavements and paving materials, are subject to a variety of distresses as a usual phenomena.
- As pavements approach their design life, distresses are expected to occur as a result of the environment and repeated traffic loads
- Distresses could occur in a pavement due to:
 - unstable mixes
 - consolidation under traffic loading, or higher wheel loads than those considered in design
 - environmental effects
- Cause of the problem must be identified for effective remedial action

Pavement Distress

- **Distress** is a condition of the pavement structure that reduces serviceability or leads to a reduction in service life
- **Distress** is any indication of poor or unfavorable pavement performance or signs of impending failure; any unsatisfactory performance of a pavement .

Pavement Distress

- Surface distress modes can be broadly classified into the following three groups:
 - **Fracture.** This could be in the form of cracking or breaking, generally due to excessive loading, fatigue, thermal changes
 - **Distortion.** This is in the form of deformation, which can result from such things as excessive loading, densification, consolidation or subgrade issues.
 - **Disintegration.** This is in the form of stripping or raveling or removal of paving materials, which can result from such things as loss of bonding, chemical reactivity, traffic abrasion, aggregate degradation or binder aging.



Cracking



Distortion



Disintegration

Pavement Distresses

- Pavement Failure is excessive fracture or distortion or disintegration that causes an immediate (short term) and long term reduction in serviceability.



Flexible Pavement Distresses



Alligator Cracking

- **Chicken-wire cracking; Spider web cracking, map cracking, etc.**
- **Indicative of Fatigue Failure of Pavement due to repeated traffic loads**

Flexible Pavement Distresses

Alligator cracking

- Alligator cracking may be considered a combination of fatigue and block cracking.
- It is a series of interconnected cracks of various stages of development.
- Alligator cracking develops into a many-sided pattern that resembles chicken wire or alligator skin.
- Occurs in areas subjected to repeated traffic loadings.

Flexible Pavement Distresses

Block Cracking

- A pattern of cracks that divides the pavement into approximately rectangular pieces, with sides generally longer than one foot.
- Rectangular blocks range in size from approximately 0.1 m² to 10 m².
- *Possible cause:* Shrinkage of asphalt.



Flexible Pavement Distresses

Longitudinal Cracking

Description

Cracks predominantly parallel to pavement centerline. Location within the lane (wheel path versus non-wheel path) is significant.

- Possible causes:
Expansion and contraction of pavement material,
roadbed settlement,
poorly constructed paving joints



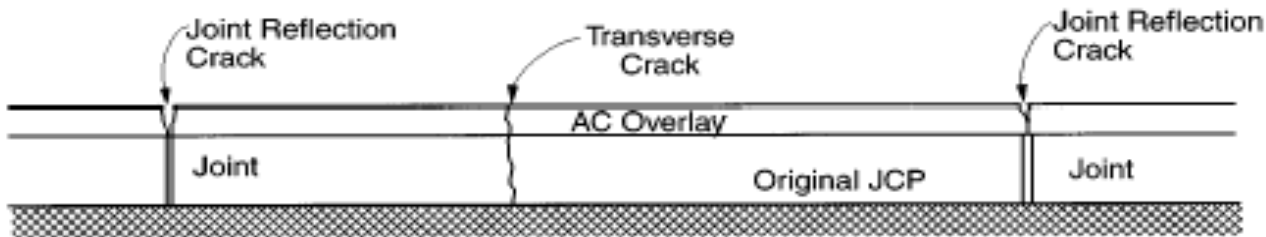
Flexible Pavement Distresses



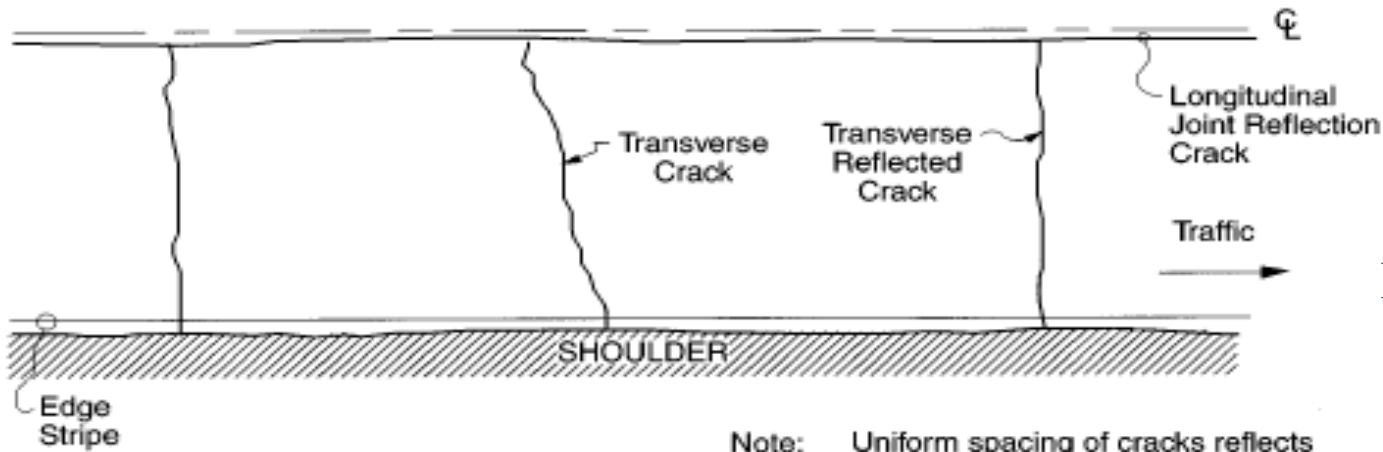
Reflection Cracking

Cracking of overlying AC layer due to PCC joint beneath

Flexible Pavement Distresses



Longitudinal cross section



Plan view

Reflection Cracking

Flexible Pavement Distresses

- Cracking across the centerline, not due to reflection cracking

- Possible causes:
Expansion and contraction of pavement material,
roadbed settlement,
poorly constructed paving joints



Transverse Cracking

Flexible Pavement Distresses

Causes of Cracks

- **Fatigue Stresses**
- **Thermal stresses**
- **Lack of bearing support or settlement**
- **Poor drainage**
- **Existing discontinuities: Cracks, joints,**
- **Asphalt mix design issues, e.g. inappropriate bitumen content, etc.**

Flexible Pavement Distresses

Raveling



- Surface is wearing away from dislodging of aggregate particles (raveling), or traffic has abraded surface over a period of time (surface wear)

- Possible causes: Insufficient binder, poor gradation, top size aggregate too large for layer thickness, poor compaction

Flexible Pavement Distresses



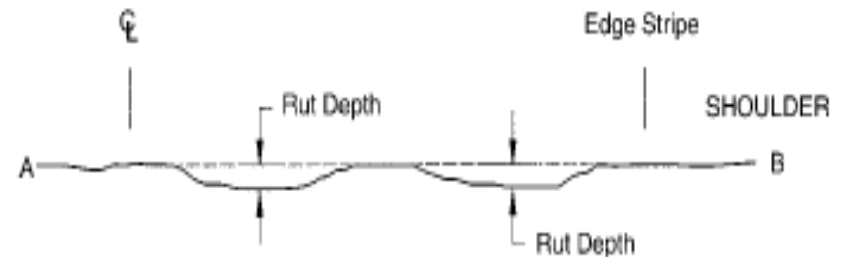
- Bowl-shaped depressions in which pavement material has been broken up and removed

- Possible causes: Poor surface drainage, Traffic loads over weakened spots in surface pavement or in underlying material

Pothole

Flexible Pavement Distresses

Rutting



- Depression in the wheel path of traveling vehicles
- Possible causes: Pavement base inadequate for maintaining traffic loads and/or the plastic flow of surface material resulting from tire friction or asphalt mix design issues

Flexible Pavement Distresses

Shoving



• **Corrugations, Shoving, Slippage:** Plastic movement resulting in ripples across surface (corrugations), bumps formed on downstream side of traffic tire forces (shoving)

• **Possible causes:** Surface course too soft or too weakly bonded with base to resist horizontal pressure of traffic moving across it, Unstable underlying layers.

Rigid Pavement Distresses



Rigid Pavement Distresses

- Durability cracking is series of closely spaced, crescent-shaped cracks near a joint, corner or crack
- It is caused by freeze-thaw effect



D-cracking

Transverse Cracking

- **Causes:**
 - Slab longer than required
 - Excessive thermal stresses
- **Cures:**
 - Crack Sealing
 - Full-depth rigid repair
 - Dowel bar retrofit



Longitudinal Cracking

- **Causes:**
 - Subsoil settlement
- **Cures**
 - Joint Sealing
 - Full Depth replacement
 - Subsurface stabilization



Rigid Pavement Distresses



Pothole

- Bowl-shaped depressions in which pavement material has been broken up and removed
- Possible causes: Poor surface drainage, Traffic loads over weakened spots in surface pavement or in underlying material

Rigid Pavement Distresses

- **Crack intersects the PCC slab joints near the corner. Caused by high corner stresses**
- **Possible Causes: Severe corner stresses caused by load repetitions combined with a loss of support, poor load transfer across the joint, moisture infiltration etc.**



Corner Breaks

Rigid Pavement Distresses

Faulting



A difference in elevation across a joint or crack usually associated underlying course/soil settlement.

Rigid Pavement Distresses

Scaling and Spalling

- **Causes:**
 - De-icing chemicals
 - Improper finishing technique
- **Cures:**
 - Grinding
 - Asphalt overlay
 - Partial depth patch



Rigid Pavement Distresses

Wear & Polishing

- **Causes:**
 - Traffic wears off surface aggregate
- **Cures:**
 - Grinding
 - Asphalt Overlay



Rigid Pavement Distresses

- **Movement of material underneath the slab or ejection of material from underneath the slab as a result of water pressure**
- **Move from underneath one slab to underneath an adjacent slab. This type of movement leads to faulting.**



Pumping

Rigid Pavement Distresses

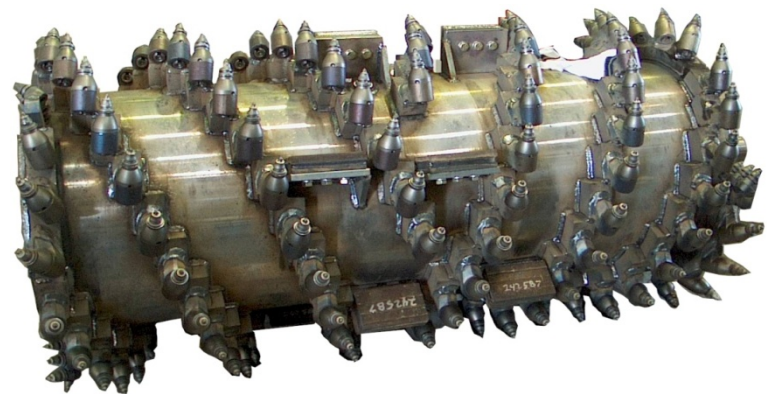
Blow-ups



- **Caused by expansion of concrete to the point where the stress causes the concrete to be raised.**

Flexible Pavement Treatments

Milling



Flexible Pavement Treatments



HMA Overlay

After Milling of Prior Surface

M-2 Rehab

Inlay



Milling of Prior Surface

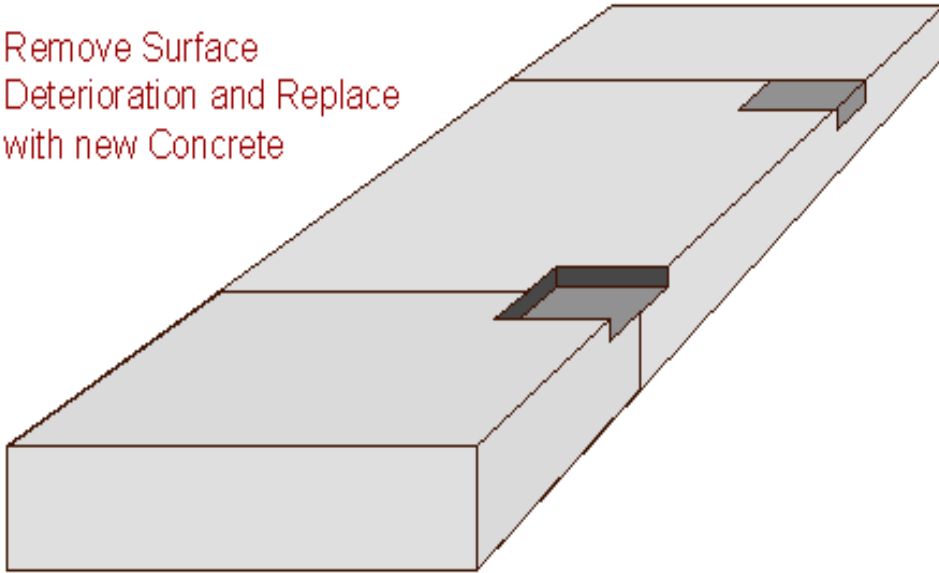
Rigid Pavement Treatments



Joint and Crack Sealing

Rigid Pavement Treatments

Remove Surface
Deterioration and Replace
with new Concrete



Shallow Partial Depth Patching

Rigid Pavement Treatments



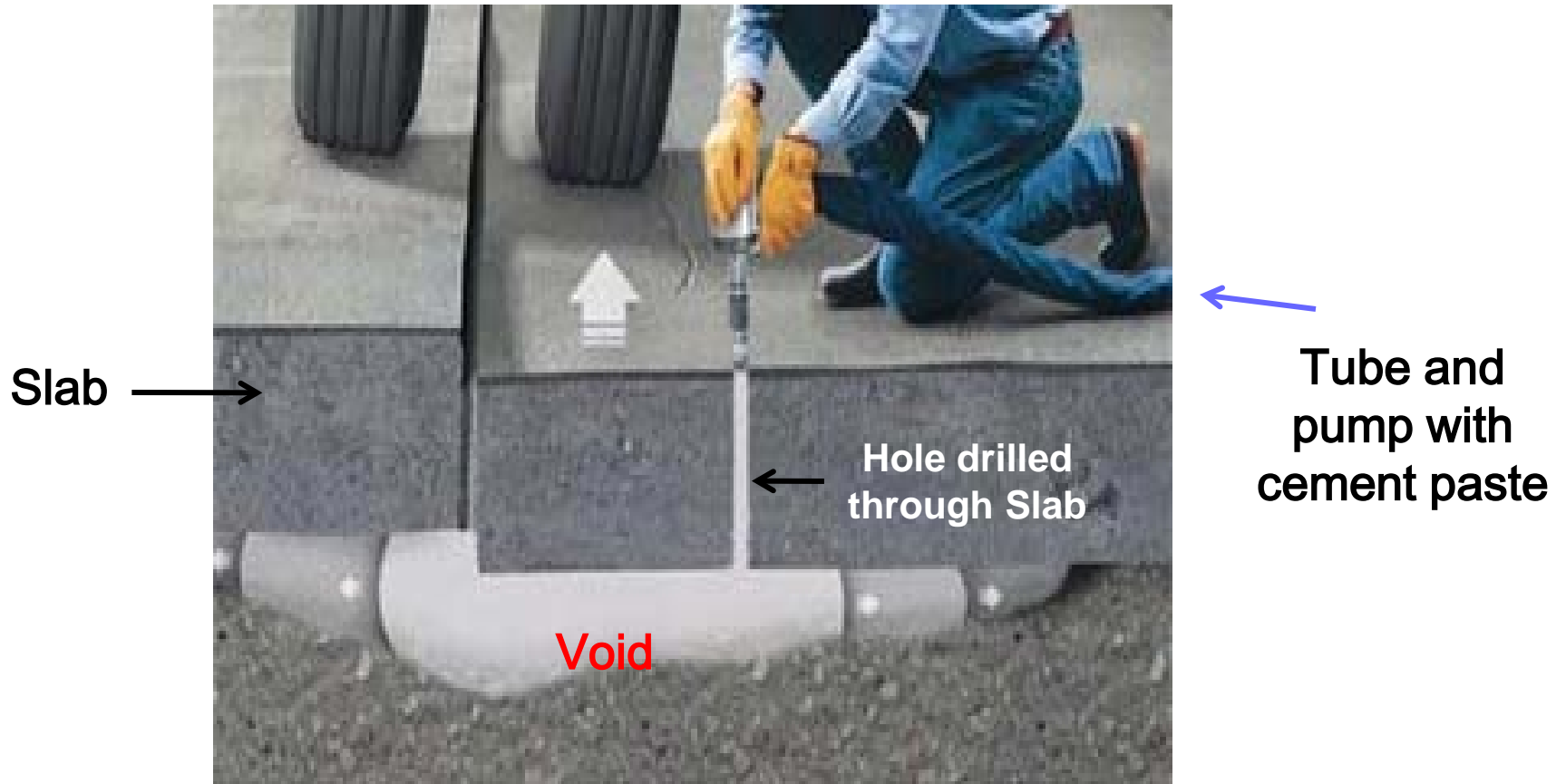
Deep Patching (Full Depth Repair)

Rigid Pavement Treatments



Slab Replacement (Full Depth Repair)

Rigid Pavement Treatments



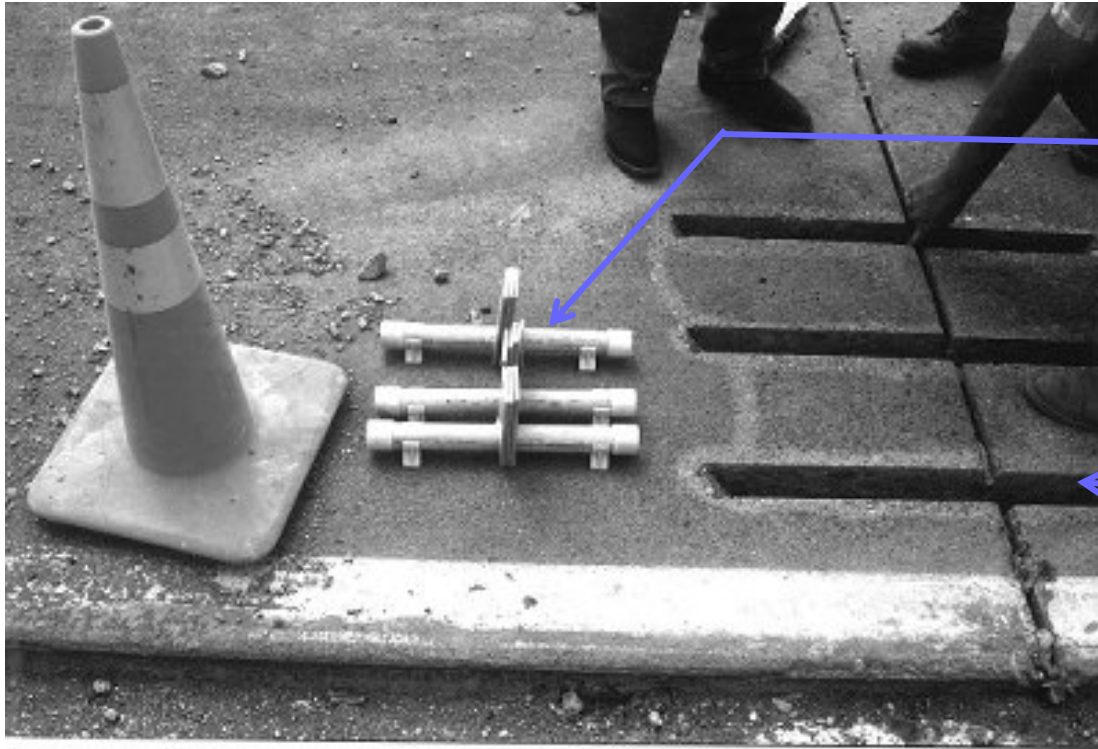
Undersealing

Rigid Pavement Treatments



Stitching - Dowel Bar Retrofit

Rigid Pavement Treatments



These dowel bars are ready for installation in jointed concrete pavement for load transfer restoration

Grooves sawed into the existing concrete across the joint or crack

Stitching - Dowel Bar Retrofit

Rigid Pavement Treatments



Stitching - Dowel Bar Retrofit