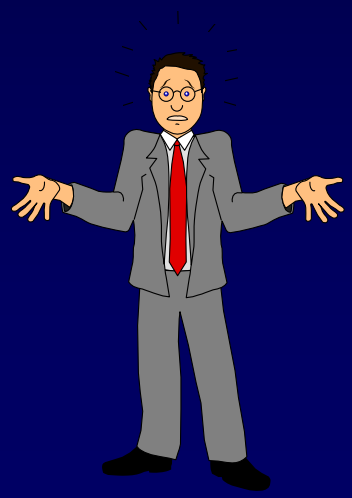
Concrete Pavement Maintenance and Rehabilitation

Northwest Pavement Management Association
October, 2015

THE ULTIMATE QUESTION!

How do I cost effectively preserve and extend the life of my concrete pavements?

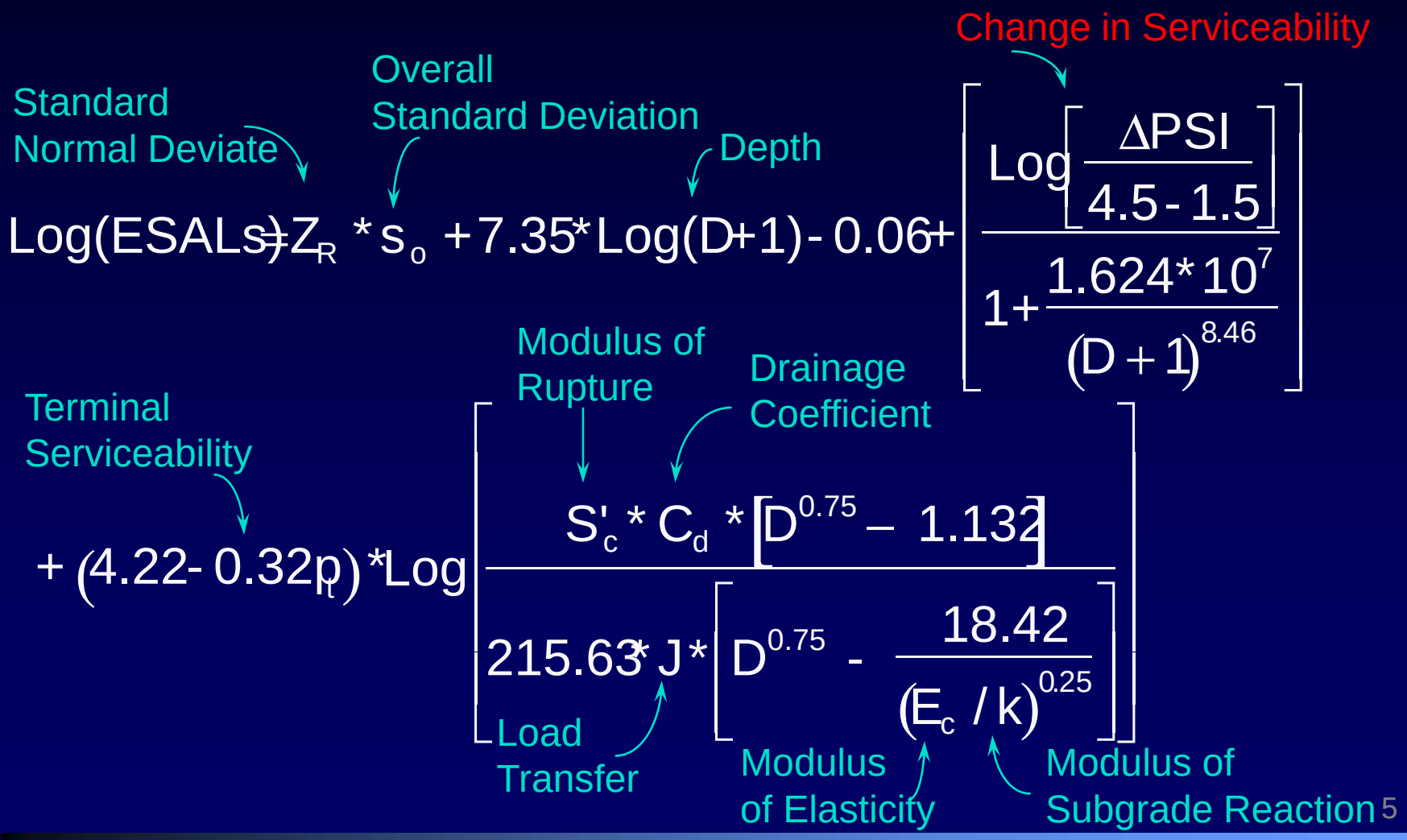


The Ultimate Answer:

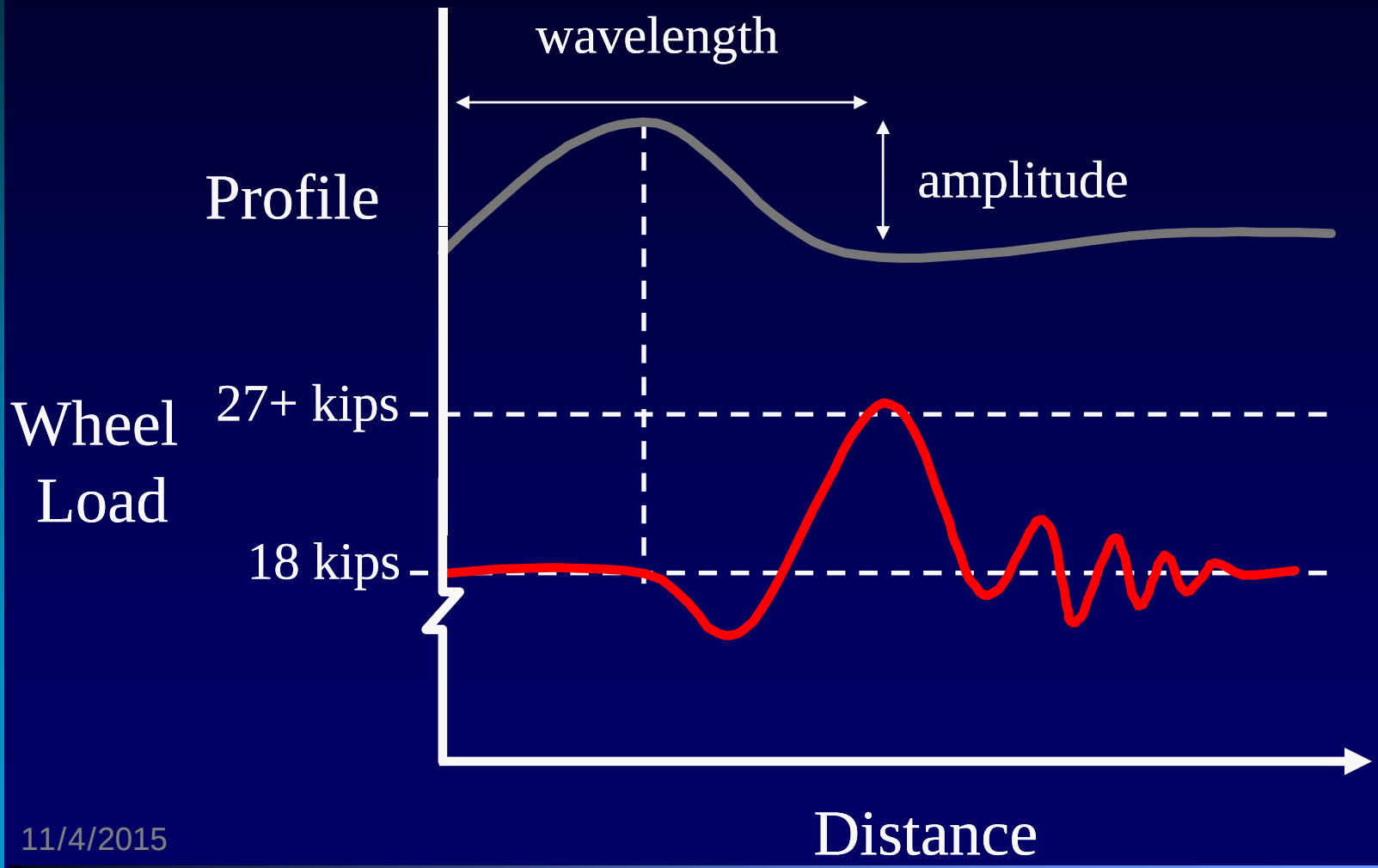
CPR

SMOOTH PAVEMENTS LAST LONGER!

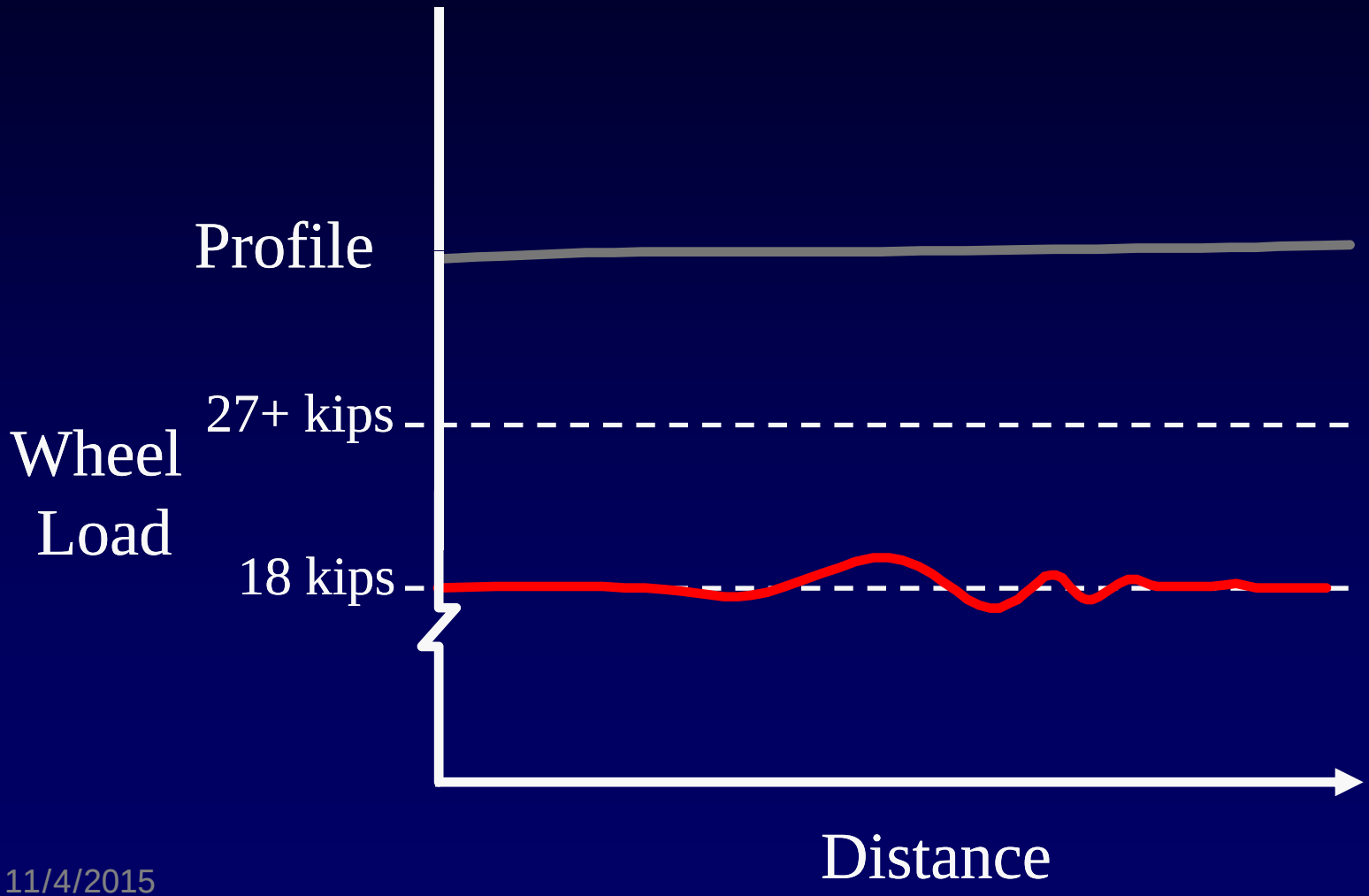
1986-93 Rigid Pavement Design Equation



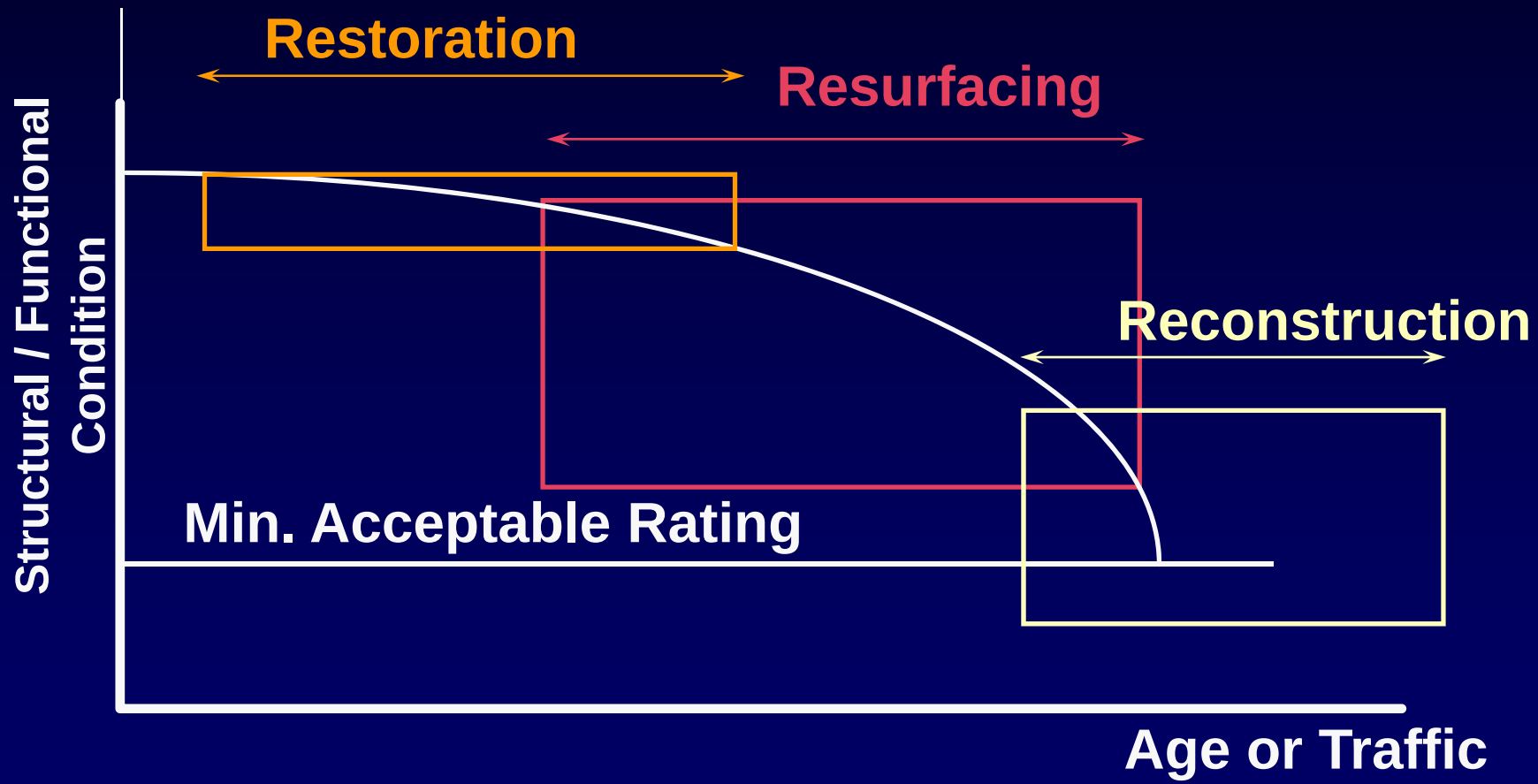
Rough Pavement



Smooth Profile



Rehabilitation Timing

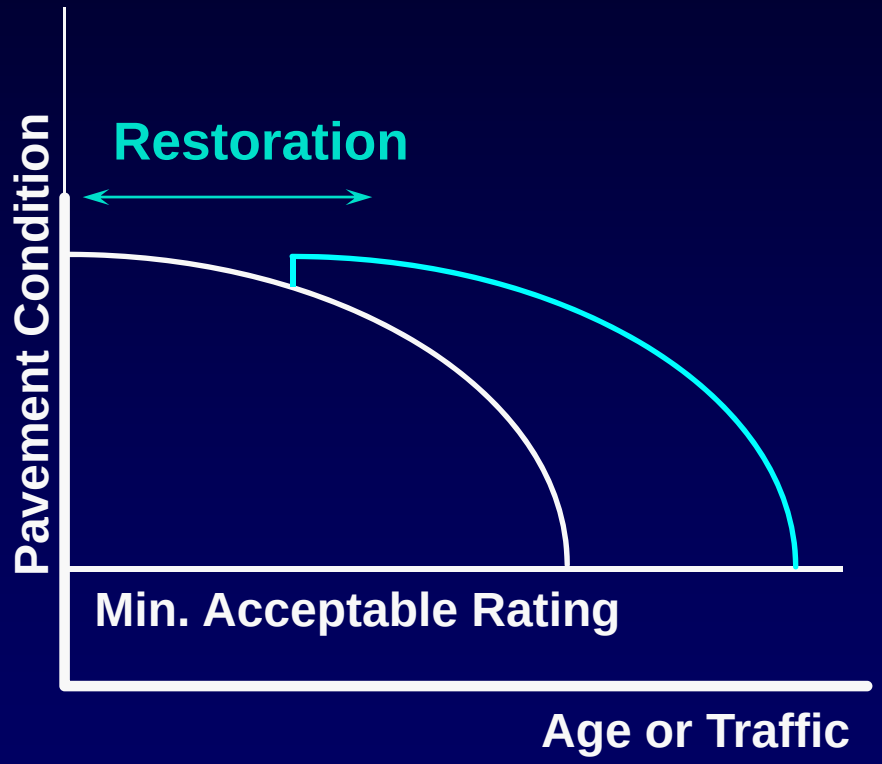


Restoration - CPR

- First level of response for deteriorating concrete pavements should always be CPR
  - Least cost
  - Best return on investment
  - Least service disruption

Purpose of CPR

- Used early when pavement has little deterioration.
  - Repairs isolated areas of distress.
  - Repairs some construction defects
  - Manage the Rate of Deterioration



Advantages of CPR

- Costs substantially less than overlay
- Enhances surface friction and safety
- Can be accomplished during off-peak hours with short lane closures and without encroaching into adjacent lanes
- CPR of one lane does not require addressing the adjacent lane
- Does not affect overhead clearances underneath bridges

Advantages of CPR

- CPR does not reduce the reservoir capacity of the gutter
- Curb reveal is not reduced
- Man-hole covers and drainage inlets do not require adjustment
- Guide-rails and overhead fixtures do not require adjustment
- Residential driveways do not require tie-in

Gutter Capacity Unaffected

Maintain Curb Reveal

Manholes Do Not Require Adjustment

No Additional Work at Driveway Entrances

Crack Sealing

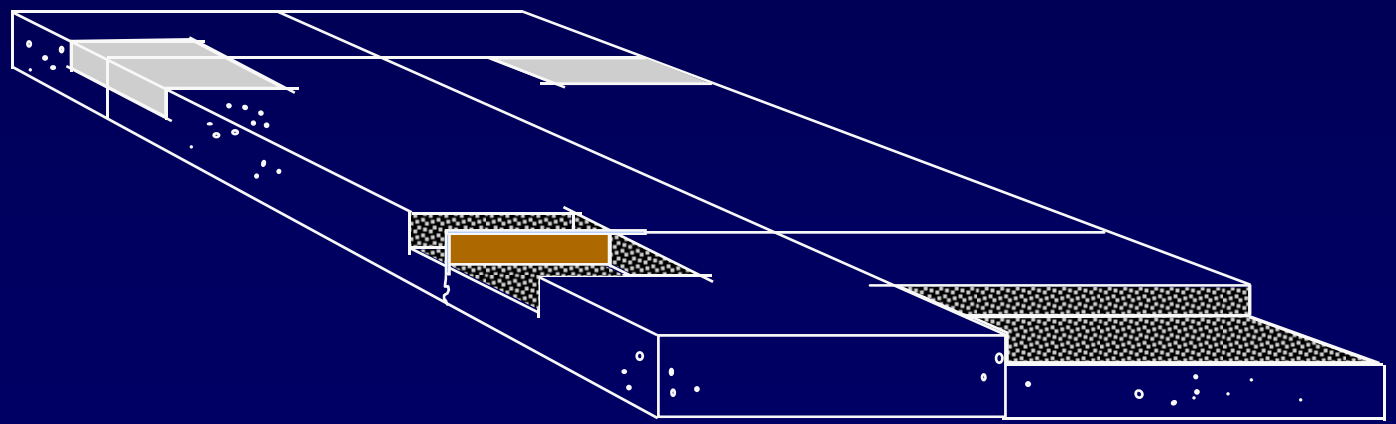
Restoration Techniques

Concrete Pavements

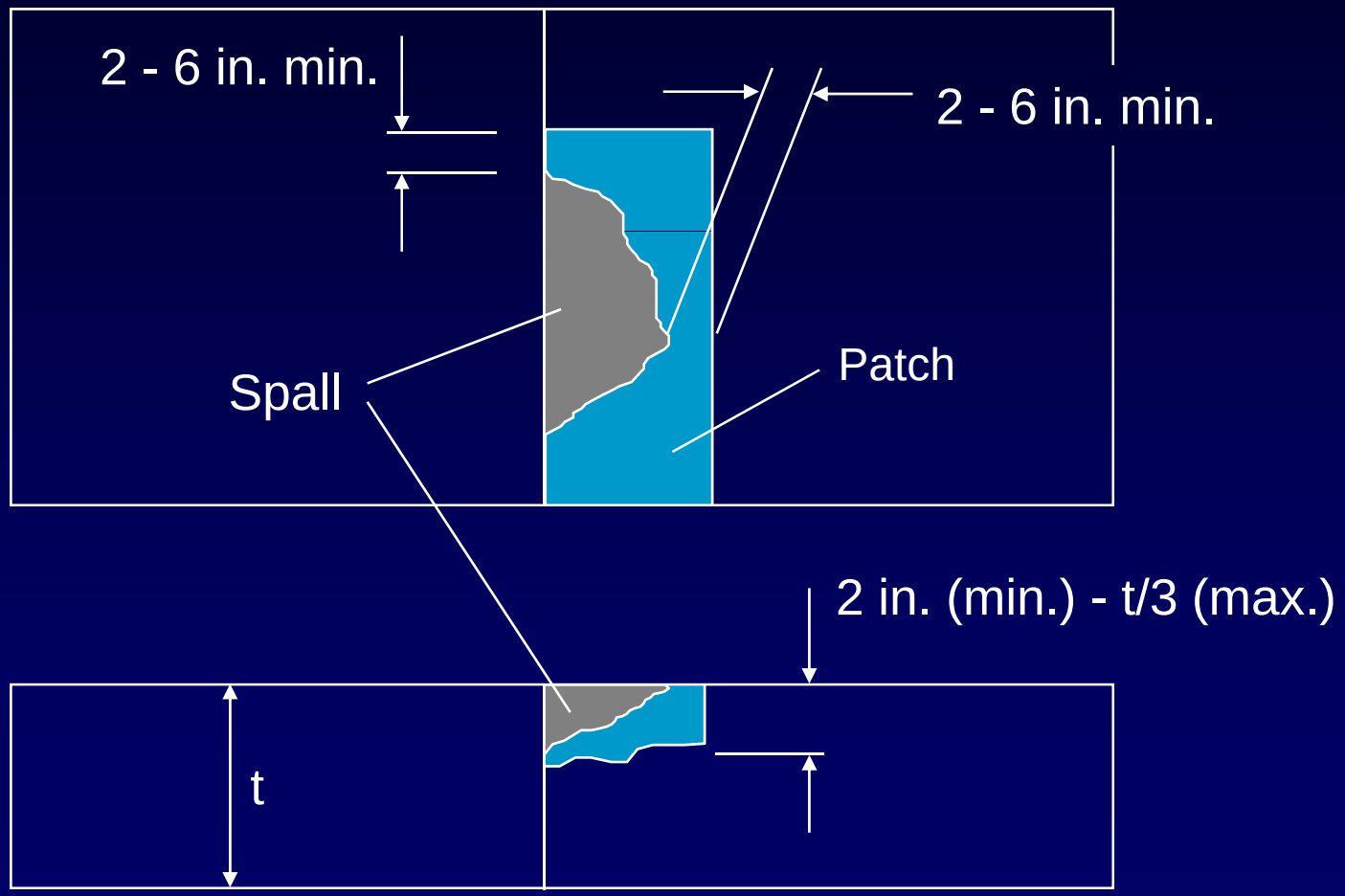
- Full-depth repair
- Partial-depth repair
- Diamond grinding
- Joint & crack resealing
- Slab stabilization
- Retrofitting dowels
- Cross-stitching longitudinal cracks/joints

Partial Depth Repairs

- Repairs deterioration in the top 1/3 of the slab.
- Generally located at joints, but can be placed anywhere surface defects occur.



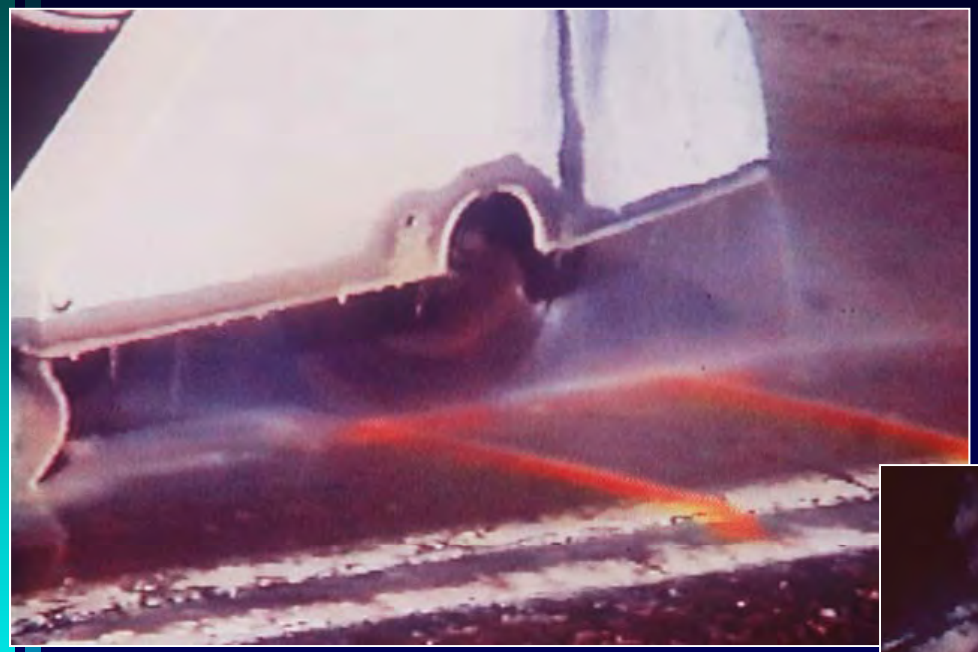
Partial-Depth Patch Layout

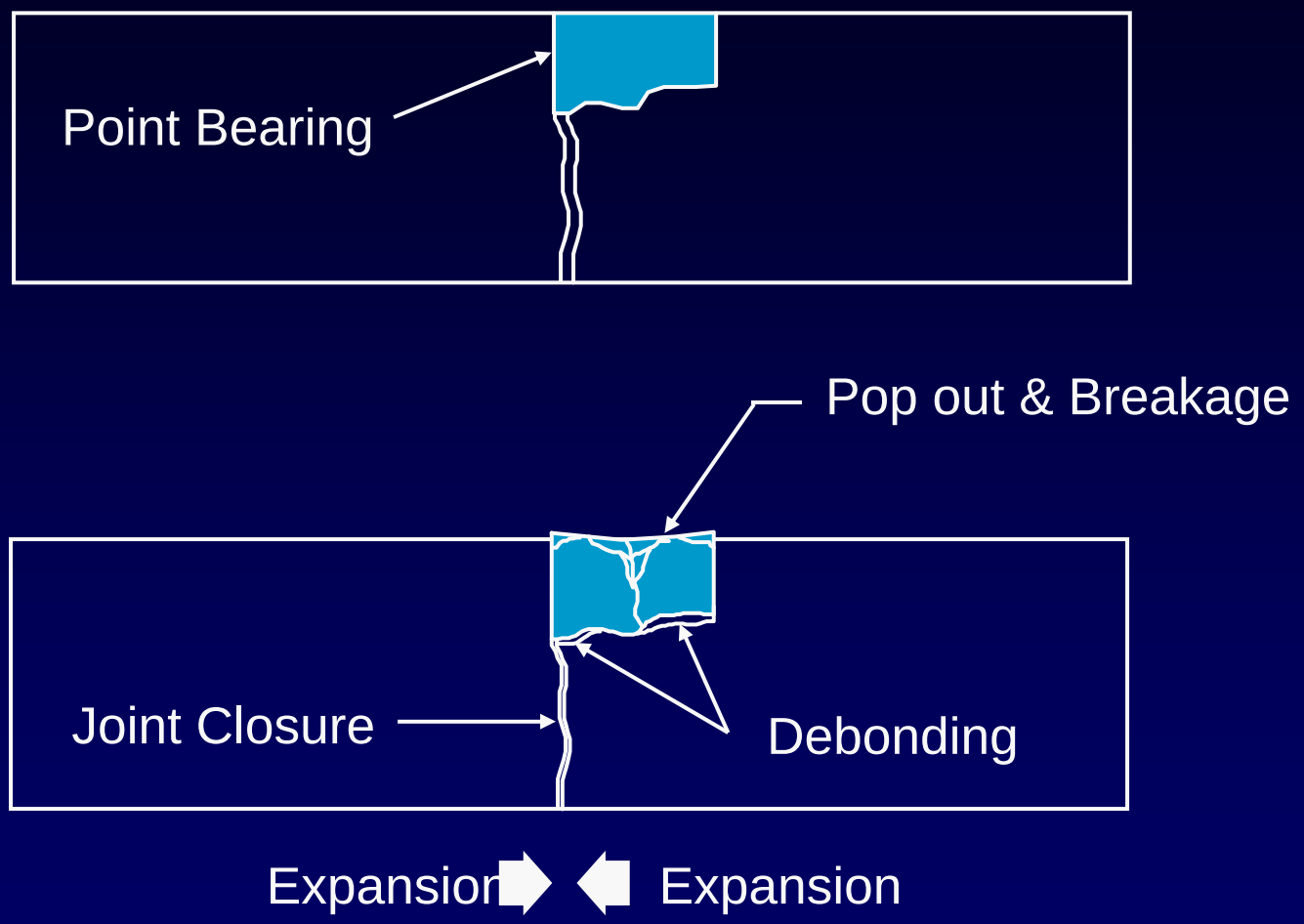


Partial Depth Concrete Removal

- Sawing and chipping
- Carbide milling
  - Transverse
  - Longitudinal

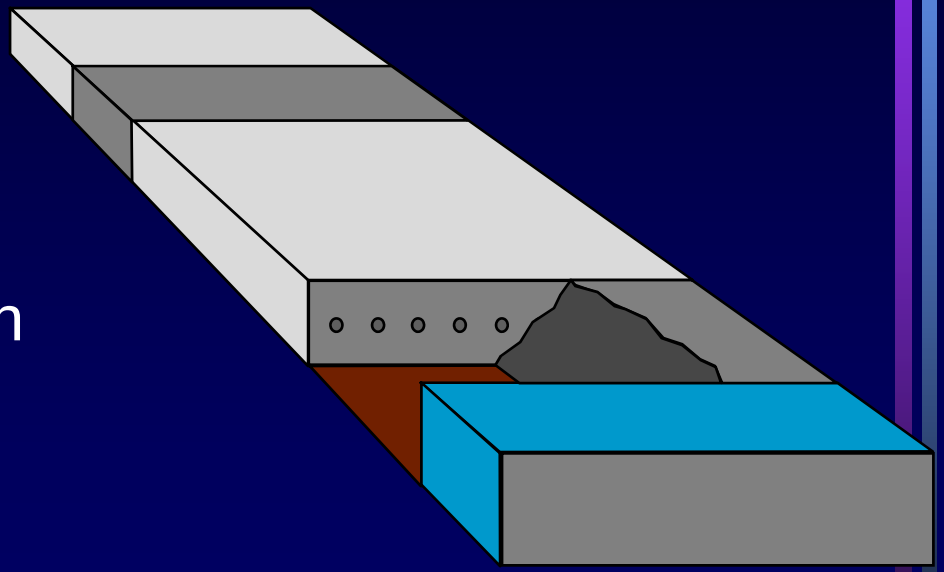
Sawing & Chipping




Point Bearing
Pop out & Breakage
Joint Closure
Debonding
Expansion
Expansion

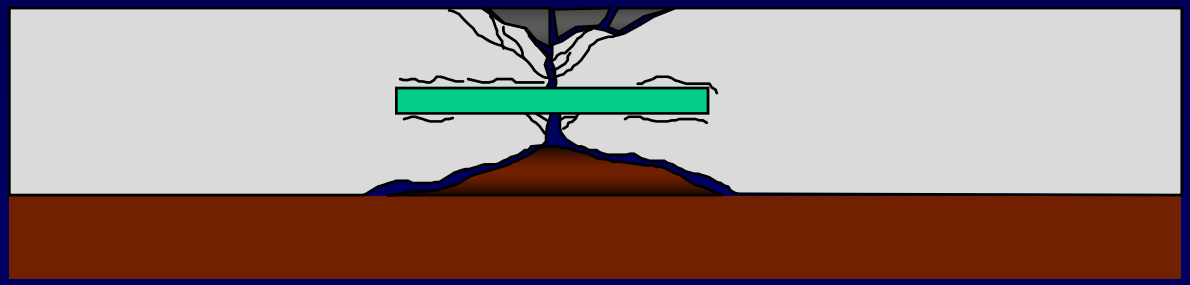
Full-Depth Patching

- Purpose
  - Restore structure
  - Restore ride
- Used for
  - Joint/crack deterioration
  - Broken slabs
  - Corner breaks



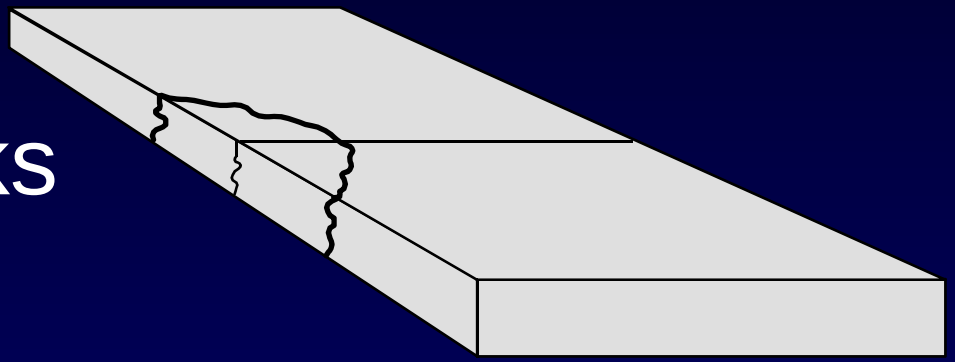
Full-Depth Patching

- Joint Deterioration
  - –Spalling (below surface)
  - –Cracking

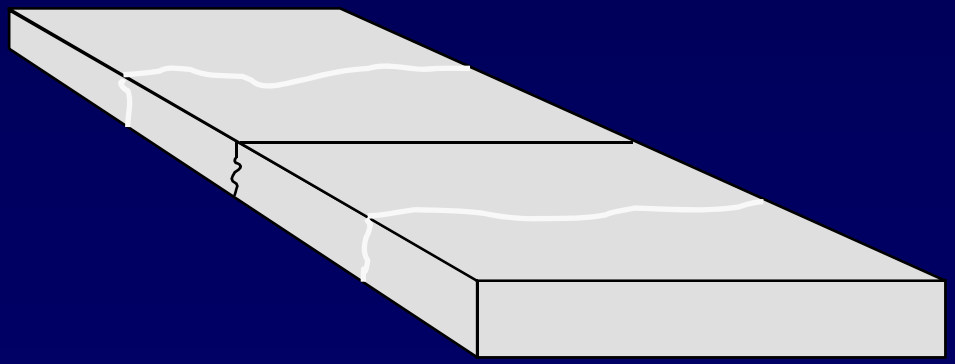


Full-Depth Patching

Corner Breaks

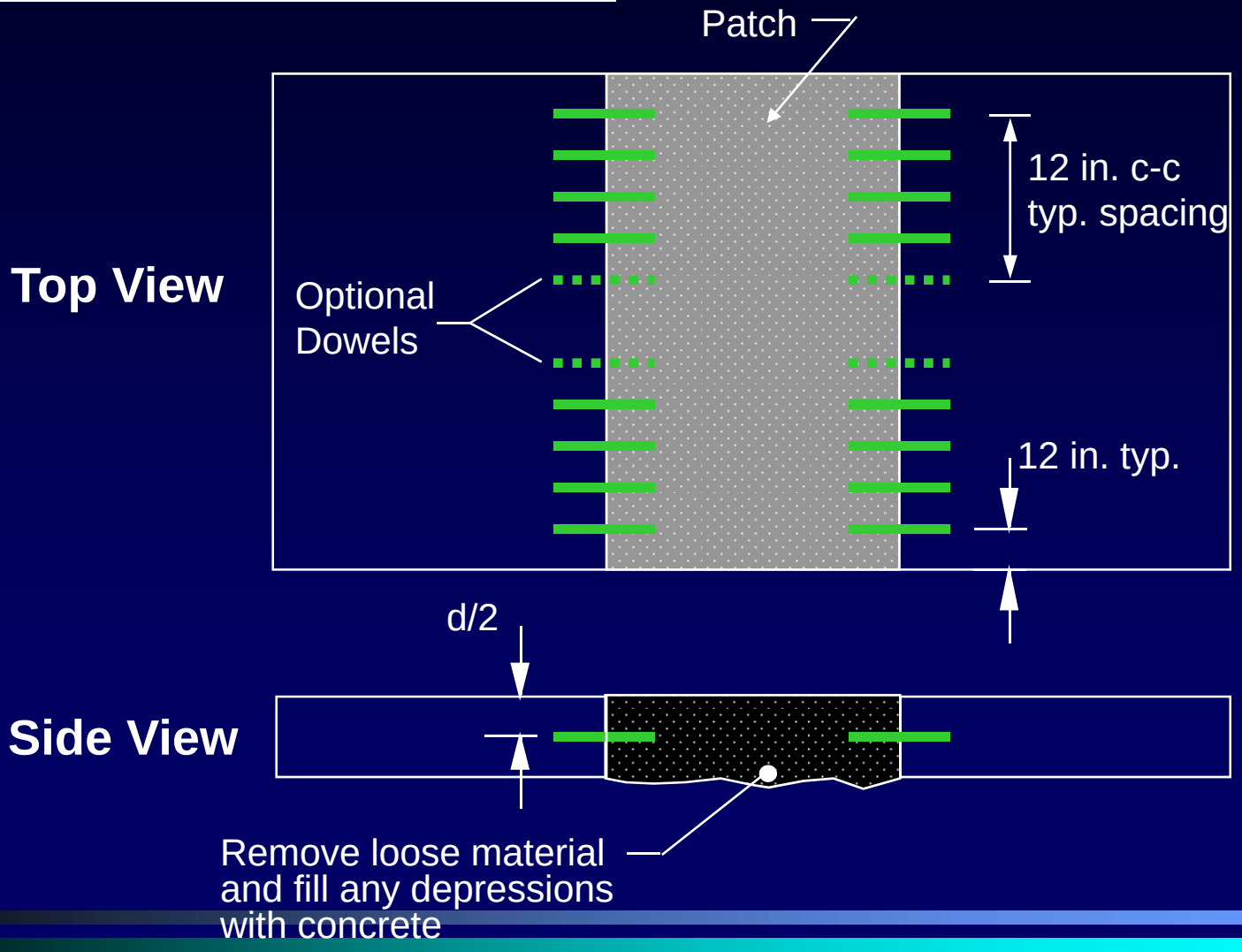


Transverse Cracks



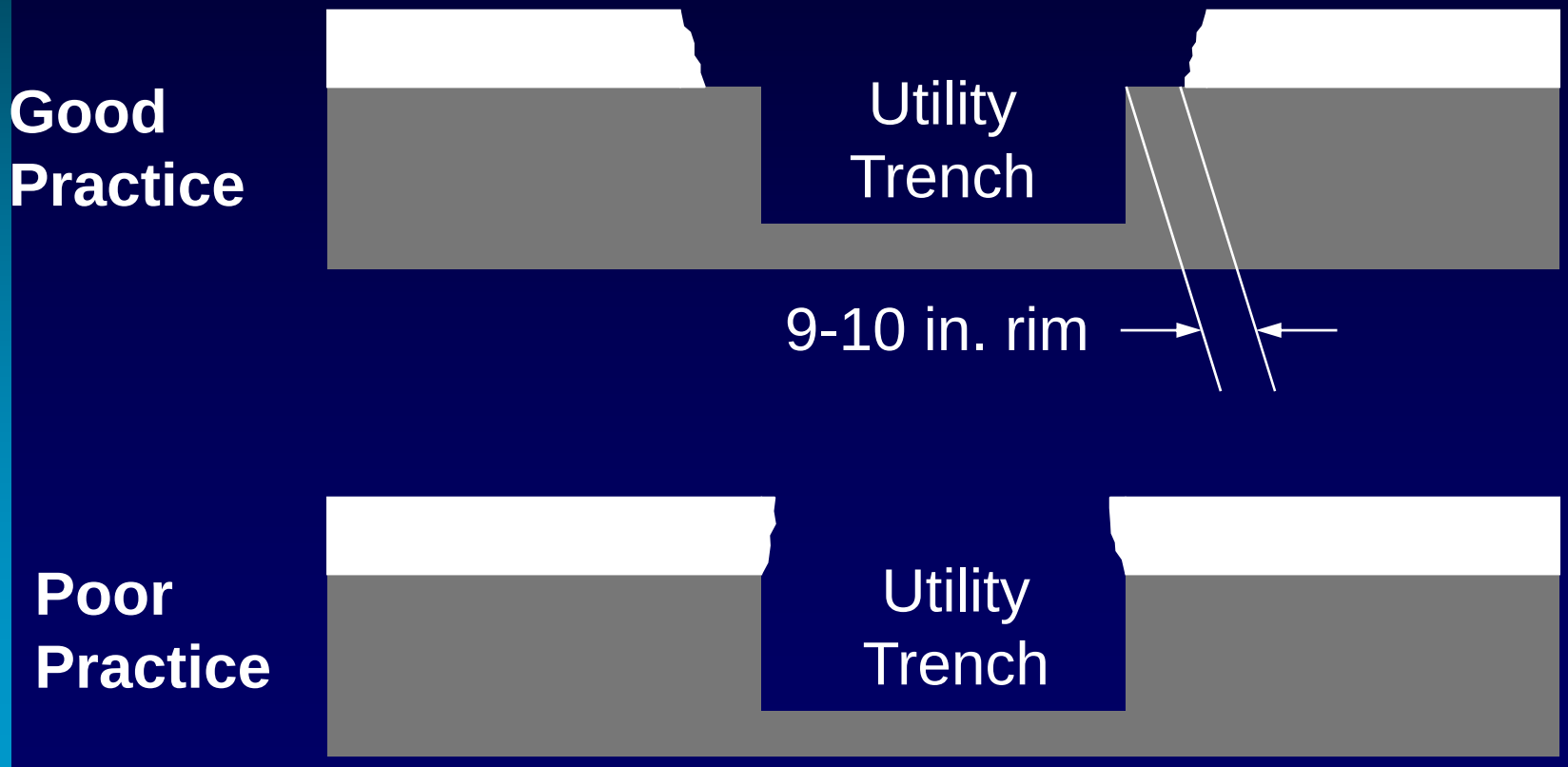
Load Transfer

Jointed Pavements:



Load Transfer

Utility Patches:



Placement of Bond-Breaking Board

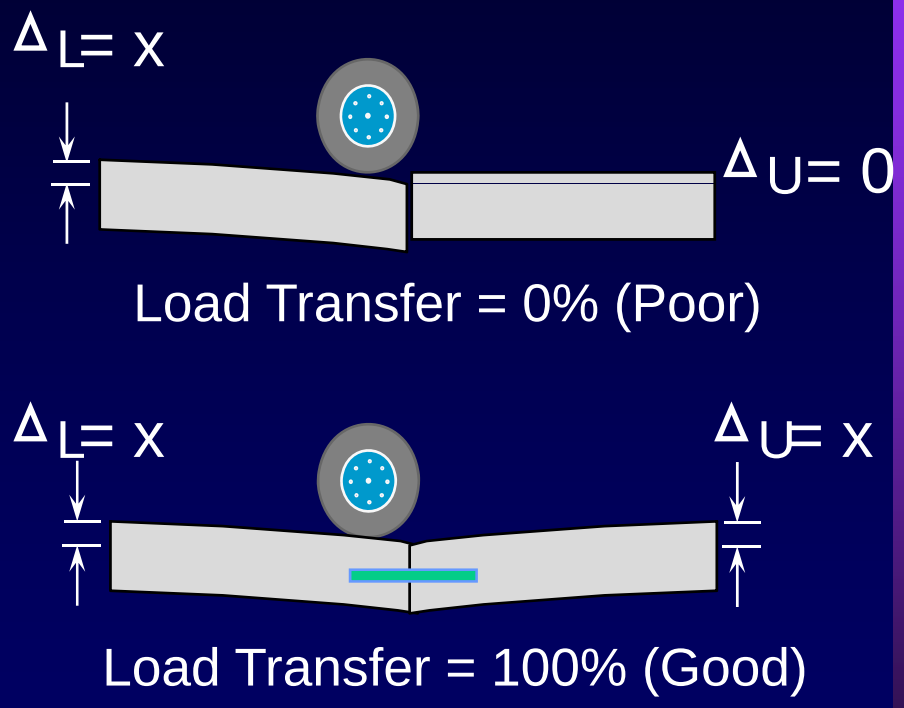
Completed patch becomes invisible when combined with diamond grinding!

LOAD TRANSFER RESTORATION

By
Dowel Bar
Retrofit

Purpose of Dowel Bar Retrofit

- Reestablish load-transfer across joints or cracks
  - Load-transfer is a slab's ability to transfer part of its load to its neighboring slab
- Used in JRC and JPC pavements to limit future faulting



Effectiveness of Load Transfer Restoration

- Ideal projects
  - Poor load transfer at joints or cracks
  - Onset of pumping and faulting
  - Significant remaining structural life
- No durability-related distress
- Often performed with diamond grinding

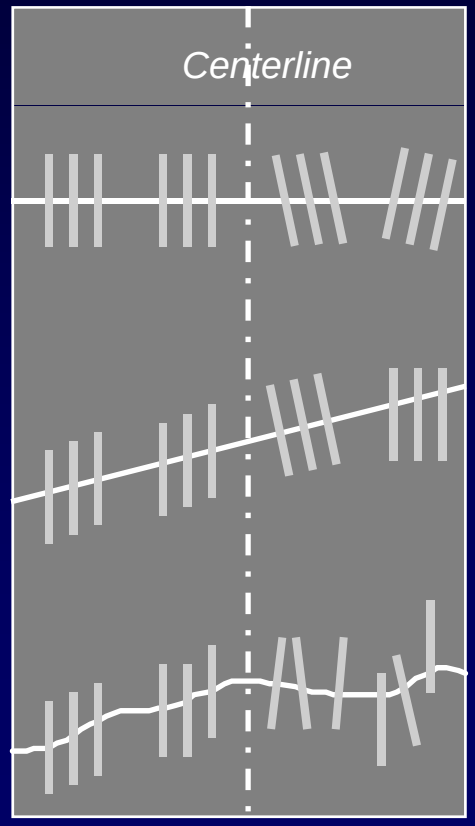

CORE
CUT
CC8000

Dowel Slot Alignment

- Must always be parallel to centerline
- Must be cut so at least one-half of dowel can be on each side of the joint or crack

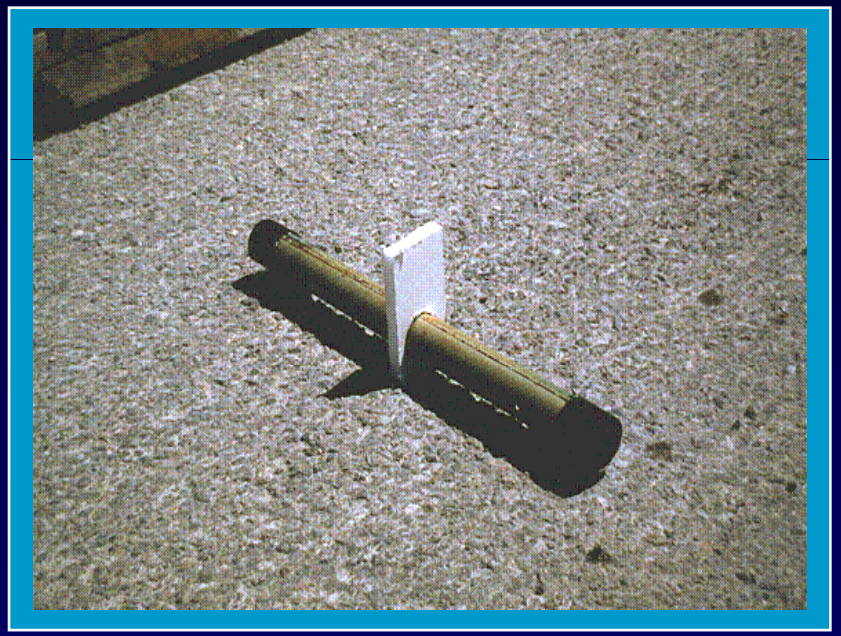
Correctly Aligned Dowel Slots

Incorrectly Aligned Dowel Slots



Preparing the Dowels

- Add joint former
  - Styrofoam
  - Fiber board
- Attach non-metallic expansion cap to one end
- Attach non-metallic chairs (sized for slot)

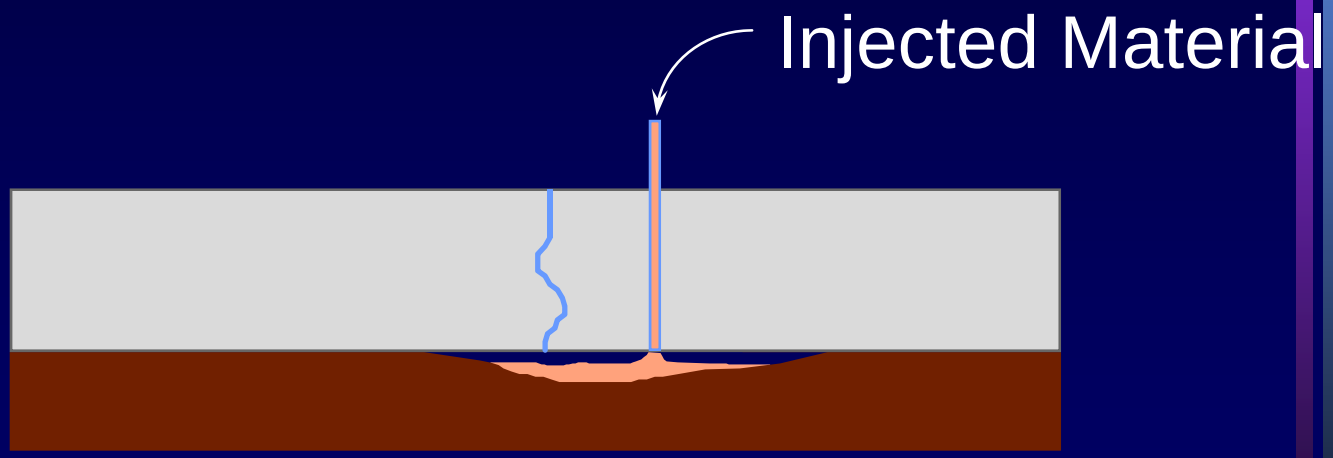


Final Steps

- Finish flush with surrounding surface
- Add curing compound as needed
- Saw over joint reformer

Slab Stabilization / Undersealing / Slab Jacking

- Fills voids underneath the pavement.
- Reestablishes uniform support.
- Reduces stresses and deflections.



Slab Stabilization

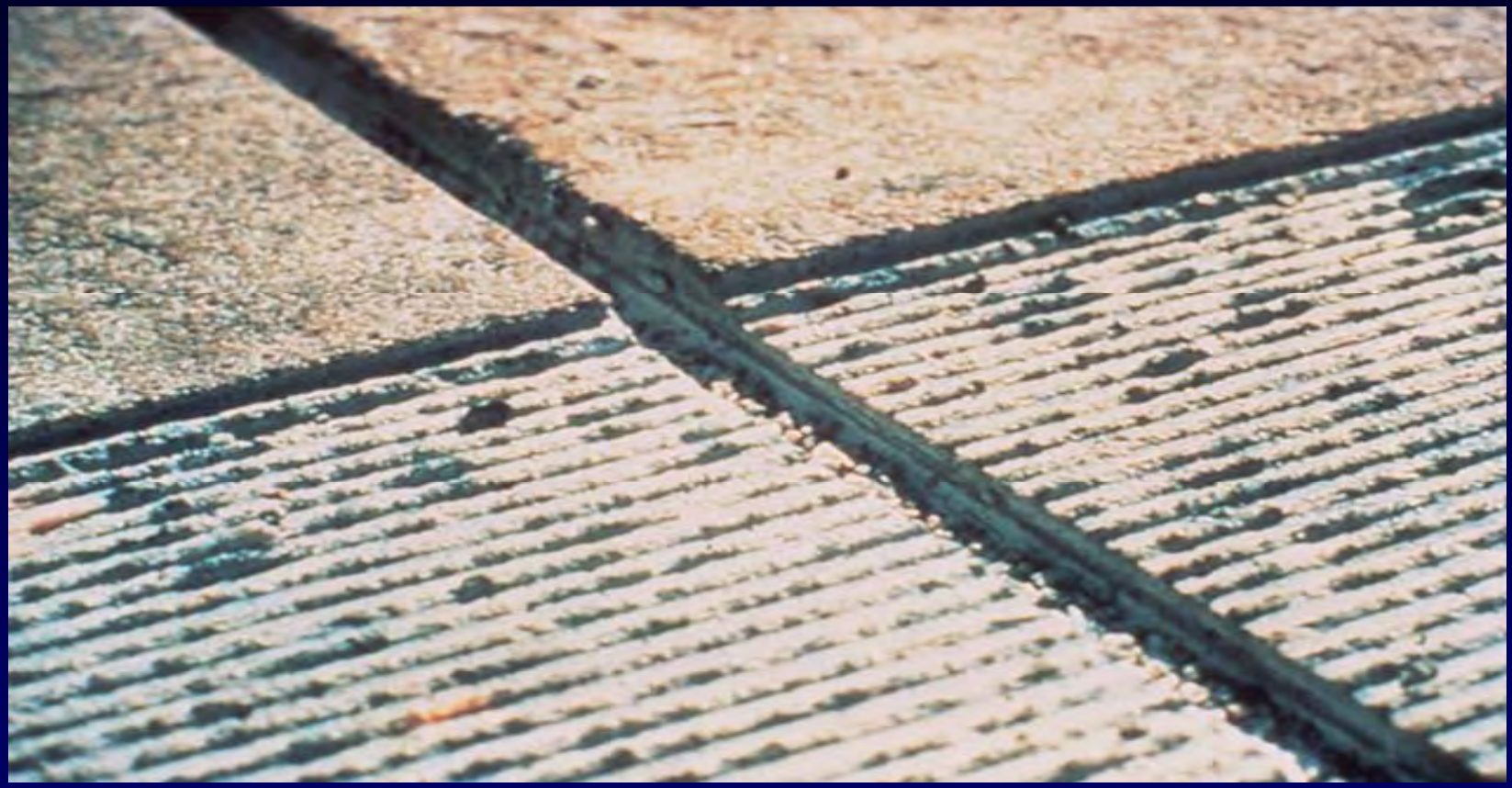
- Fills Voids From
  - Pumping under traffic
  - Consolidation from overloading
  - Subgrade bearing failure from saturation, settlement and erosion

Effectiveness of Undersealing

- Most effective on pavements with little structural damage
- Perform only where voids are known to exist
- Effective at reducing deflections for up to 10 years

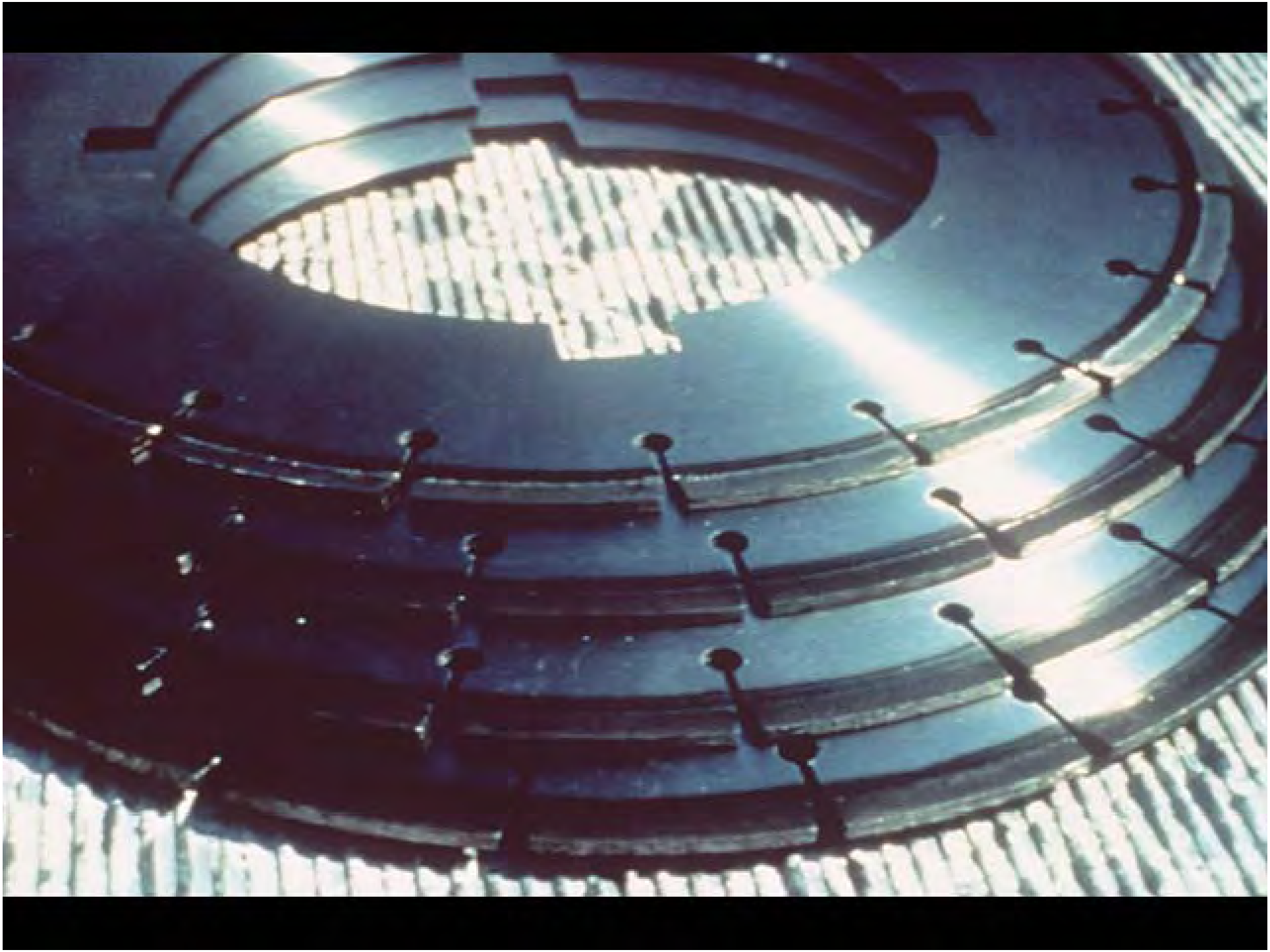
Longitudinal Crack Repair

Diamond Grinding

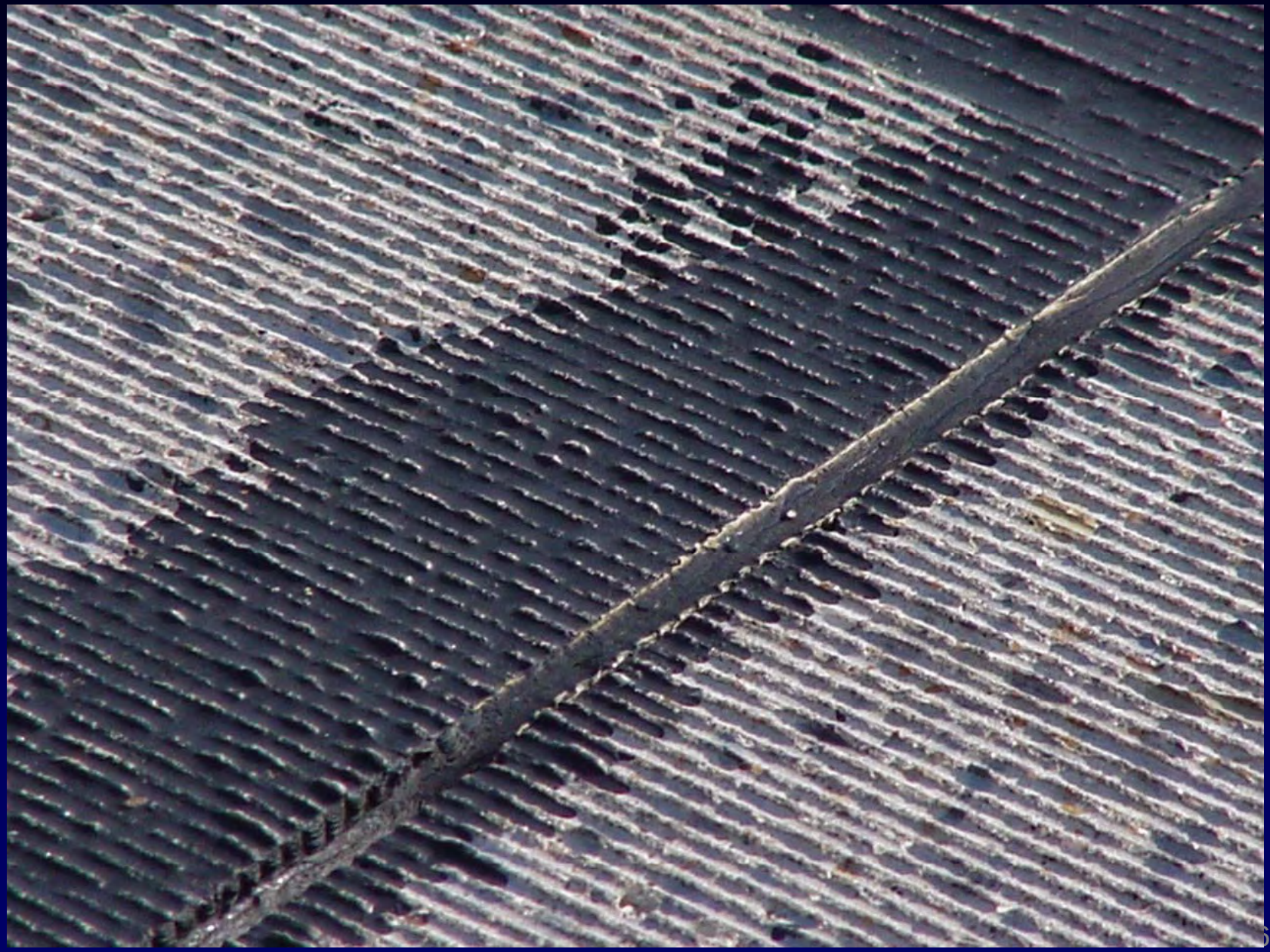


What is Diamond Grinding?

- Removal of thin surface layer of hardened PCC using closely spaced diamond saw blades
- Results in smooth, level pavement surface
- Longitudinal texture with desirable friction and low noise characteristics
- Frequently performed in conjunction with other CPR techniques, such as full-depth repairs, dowel bar retrofit, retrofit edgedrains




MITCHELL
- EXIT 332
LEFT 1/2
PRM3804



Advantages of Diamond Grinding

- Costs substantially less than AC overlays
- Enhances surface friction and safety
- Can be accomplished during off-peak hours
- Grinding of a rough area does not require grinding of adjacent areas
- Blends patching and other surface irregularities into a consistent, identical surface

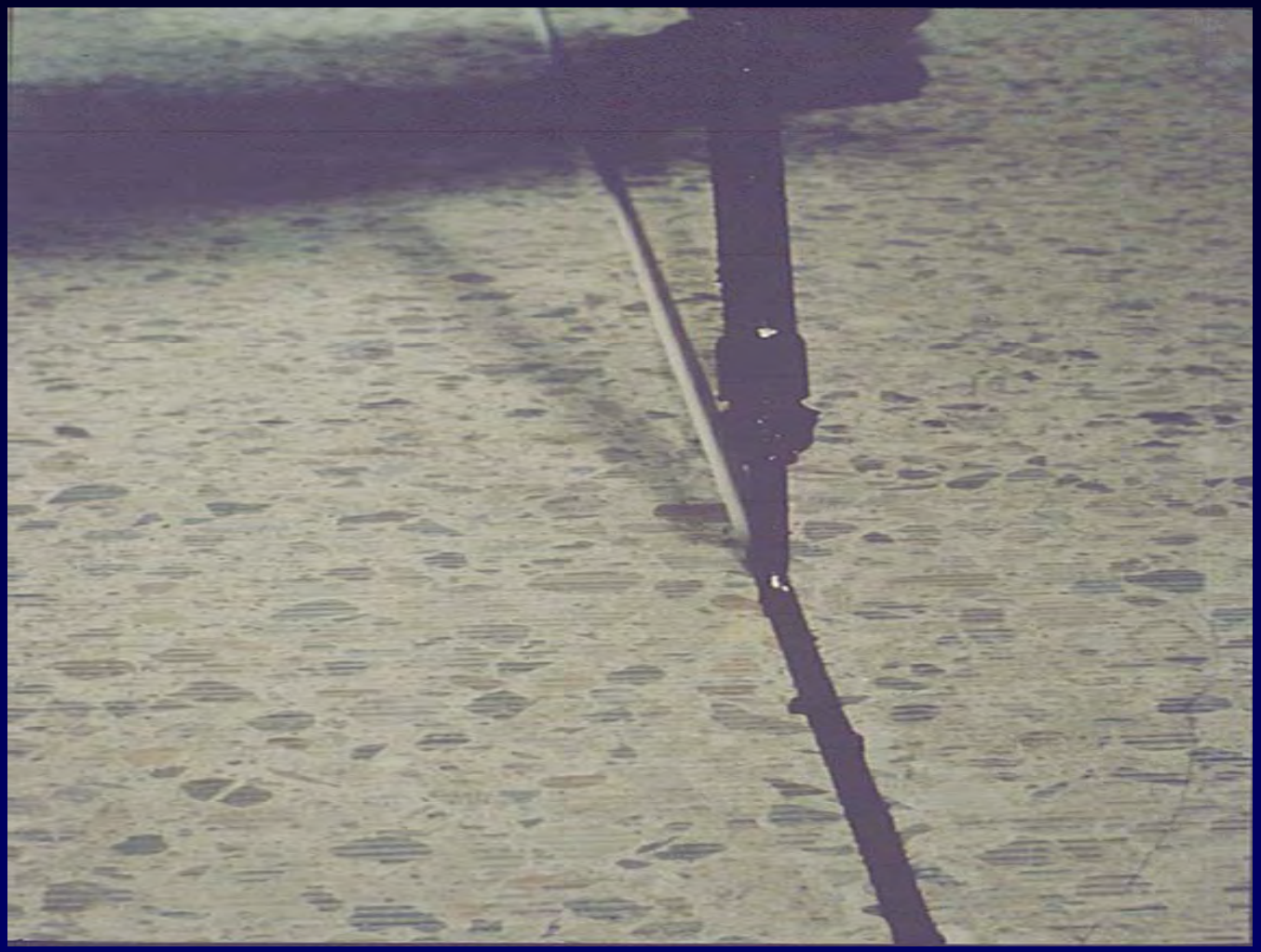
Pavement Problems Addressed

- Faulting at joints and cracks
- Built-in or construction roughness
- Polished concrete surface
- Wheelpath rutting
- Unacceptable noise level
- Permanent upward slab warping
- Inadequate transverse slope

Faulted Joints

Diamond grinding will provide a 65% to 70% improvement over the pre-grind profile!

Joint Resealing



Joint Resealing

- Purpose
  - Minimize moisture infiltration
  - Prevent intrusion of incompressibles
- Results
  - Reduce pumping and faulting
  - Reduce joint spalling and blowups

Summary

- Many available treatments for PCC pavements
- Each has advantages and limitations
- Performance and cost vary with given conditions
- Applying the right treatment to the right pavement *at the right time*
- No universal method available
- Take advantage of local contractor experience
- NW ACPA and IGGA ready to assist
- Visit www.pavement.com or www.igga.net