M&R for Rigid (Portland Cement Concrete) Airfield Pavement Surfaces

ACPA

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Count on Concrete PAVEMENT

Performance Issues

- Airfield Functional Condition
  - FOD potential
  - Friction/Hydroplaning
  - Profile

- Airfield Distress
  - cracking **(crack and joint sealing, repair)**
  - corner breaks, shattered panels **(full-depth repair)**
  - spalling **(partial-depth repair)**
  - roughness / polishing **(diamond grinding)**

Assess Airfield Condition

Pavement Evaluation

- Collected as-built info, perform distress surveys, NDT (?), sampling (?)
- Determine causes of deterioration
- Develop appropriate alternatives
- Also provides quantitative information for quantity estimates, LCCA

What is Preventive Maintenance?

- Planned strategy of cost effective treatments
- Applied to structurally sound pavements with significant remaining life
- Maintain or improve functional condition

What is Pavement Preservation?

- Long-term strategy for enhancing pavement performance
- Focus on extending pavement life and restoring functional condition
- Accomplished with a collection of preventive maintenance treatments and a few minor rehabilitation and routine maintenance treatments

Source: National Concrete Pavement Technology Center

Reference Materials

- http://www.cptechcenter.org/technical-library/documents/preservation_guide_2nd_ed_508_final.pdf
- Numerous ACPA technical bulletins and publications

Concrete Slab Repairs

Cracks and Causes

- Full Width of Panel (Slab Cracking)
  - Often a result of design, joint layout deficiencies
    - Load plus environmental (curl/warp, shrinkage) stresses
  - Rout-and-seal plus DBR may be cost-effective
- Corner Cracks (Diagonal Cracking)
  - Load-related distress
  - Full-depth repair or panel replacement is required
- Shattered Slabs - More than Four Pieces
  - Full-depth panel replacement is required

Width-based Rule-of-Thumb Treatment Guidelines for Concrete Cracking
(Environmental/Non-load-related)

Up to 1/4-inch	Do Nothing
1/4 to 1-1/2-inch (no spalls)	Rout (Saw) and Seal (+DBR?)
1/4 to 3/4-inch (spalled)	Partial-Depth Repair (+DBR?)
3/4 to 1-1/2 inch (spalled)	Full-Depth Repair
More than 1-1/2 inches	Full-Depth Repair

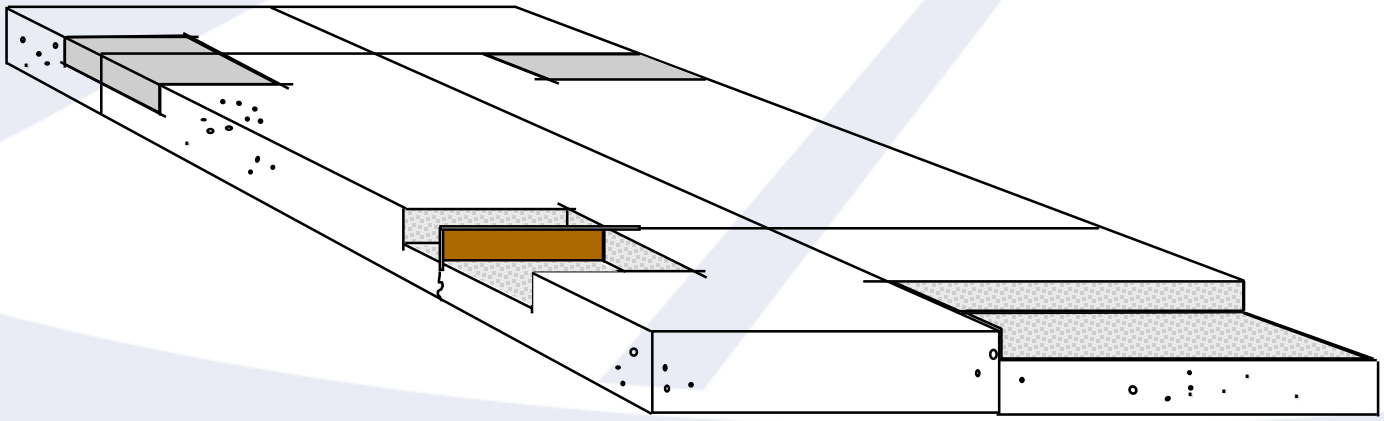
Depth of Repairs

- Partial Depth - Intent is to bond repair material to existing concrete and be compatible in characteristics

- Full Depth - Intent is to make the repair a functional part of the existing pavement.

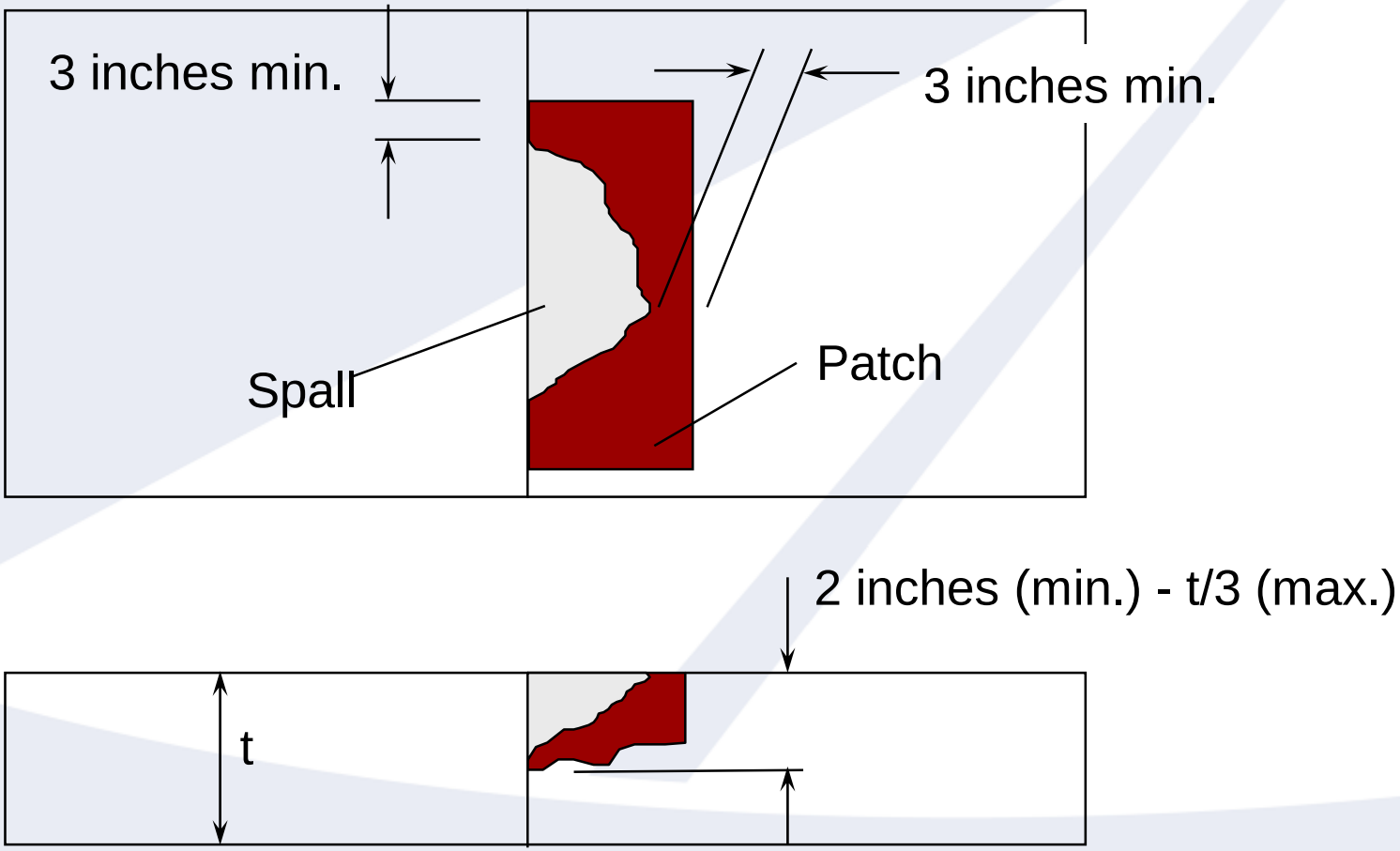
Partial-Depth Repairs

- Generally spall repairs
- Repairs localized distress in the top 1/3 of the slab
- Generally located at joints, but can be placed anywhere surface defects occur



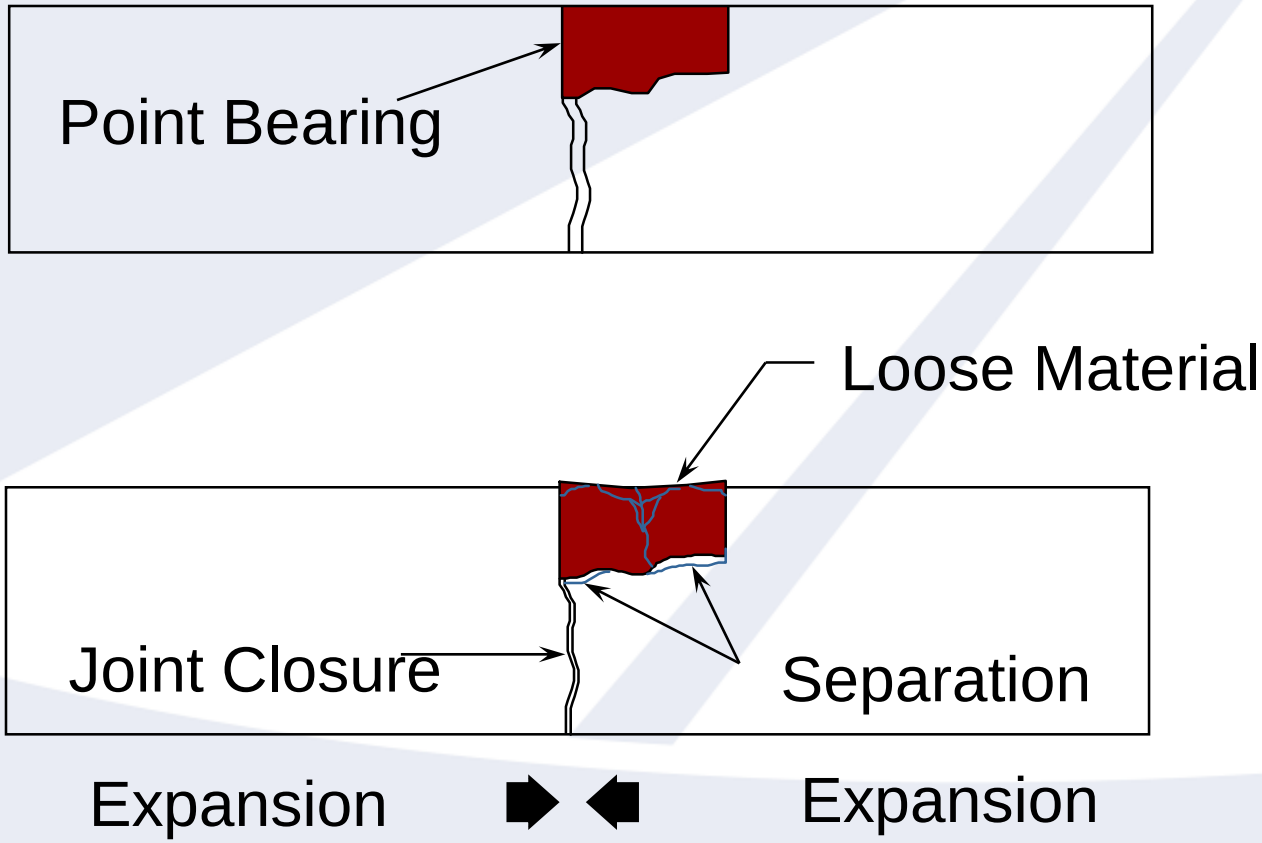
Partial Depth Repairs

Defining Repair Boundaries



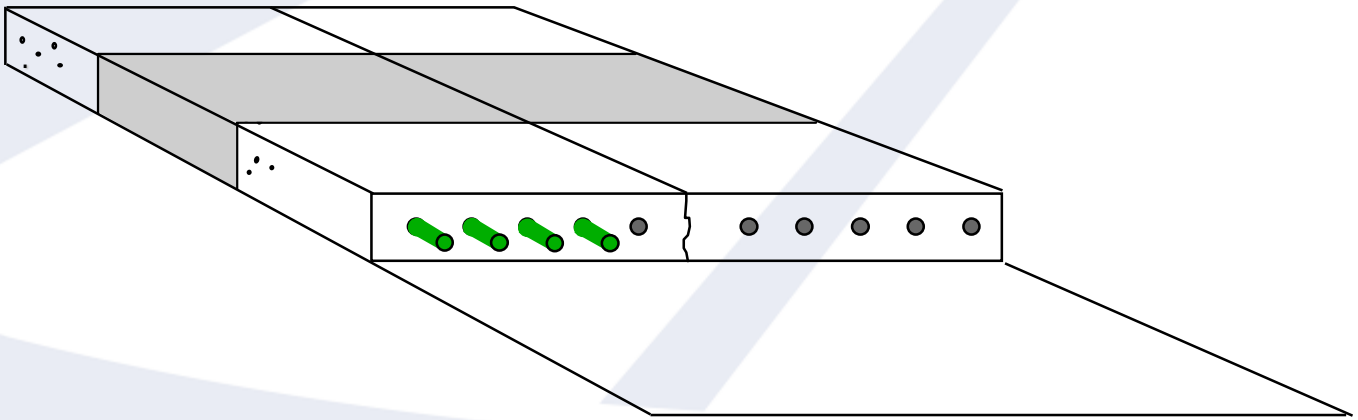
Partial-Depth Repairs

Repair Failure



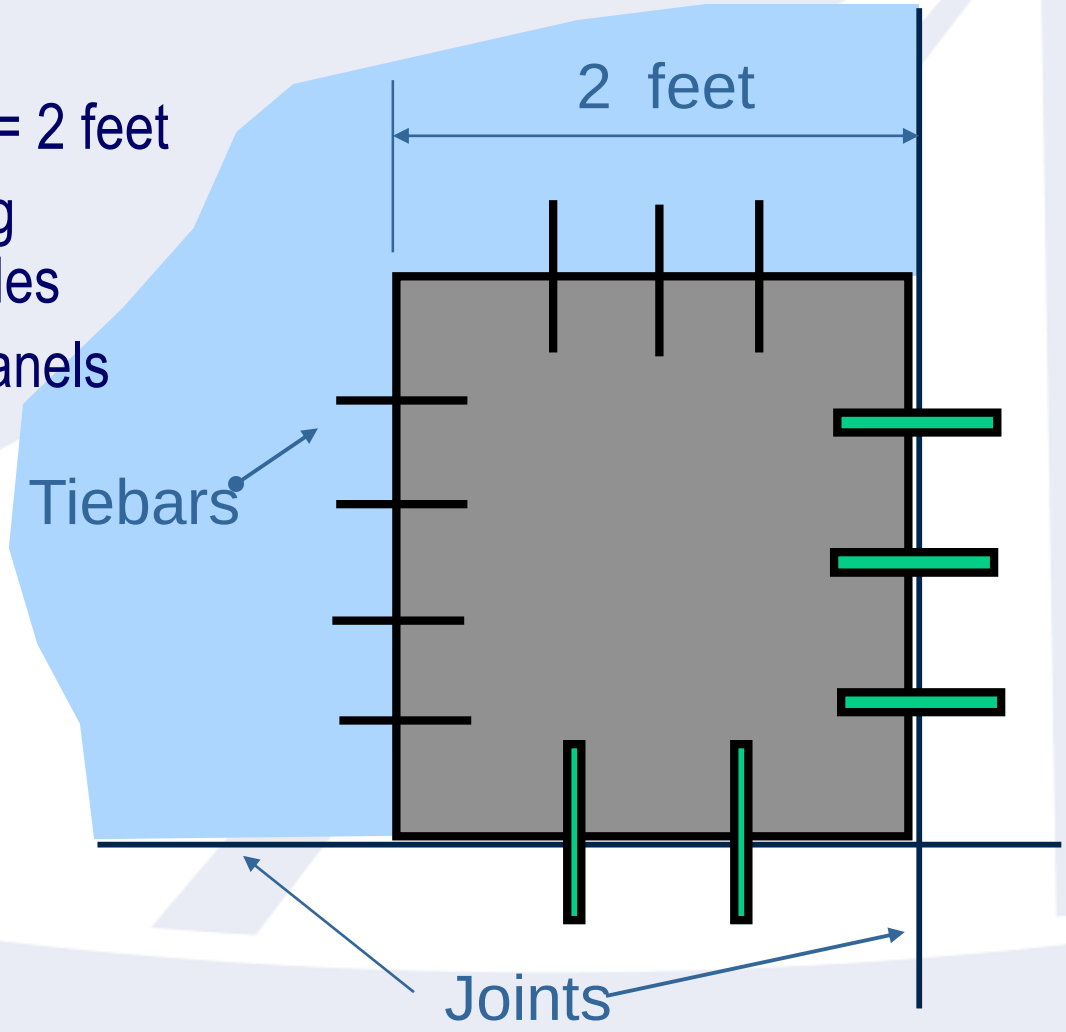
Full-Depth Repairs

- Repairs distresses greater than 1/3 the slab depth.
- Consists of removing and replacing at least a portion of the existing slab to the bottom of the concrete.

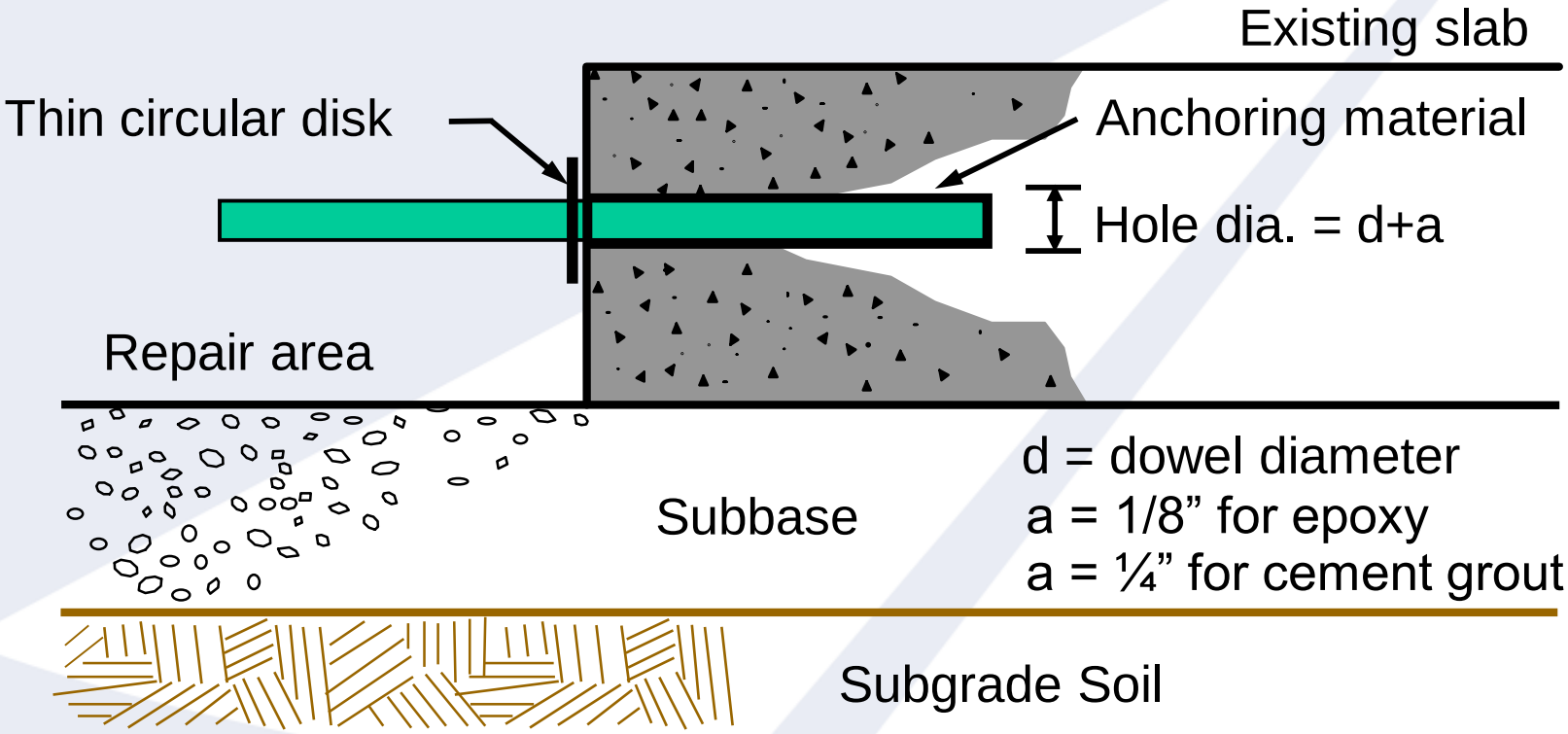


Full Depth Repairs

- Minimum repair dimension = 2 feet
- Full-depth cut at joints using diamond-segment saw blades
- Tie and dowel to existing panels



Dowel Bar Placement
for Full Depth Repairs



Concrete Placement, Finish, Cure

- Mixture depends on required curing time
  - Opening to traffic
  - High early strength
  - Regular mixture
- Vibrate around fixtures and reinforcement
- Rapid-set or proprietary materials
- Curing is critical (burlap, membranes, etc.)
- Joint sealing – same as for new construction

Precast panels

The Fort Miller Precast System in Dulles Airport Taxiways (2002)

Source: Peter Smith (The Fort Miller Company)

Count on Concrete PAVEMENT

The PANYNY Precast Concrete System at LaGuardia Airport

Source: Buch and Tayabji (SHRP R05 Study)

Precast Concrete in Japan Airports

Source: Buch and Tayabji (SHRP R05 Study)

Diamond Grinding

- Improves safety by:
  - Smoothing the ride
  - Reestablishing the friction properties
  - Correcting the cross-slope
- Improves aesthetics

Diamond Grinding

Grinding Machine

Grinding

Tech Center

Basic Consideration for Joint Sealing

- Water-related pavement damage
  - Subgrade or subbase softening
  - Erosion
  - Pumping
  - Lost of support
- Joint seal minimizes the passage of water
  - Watertight pavement not practical to construct
- Incompressible material

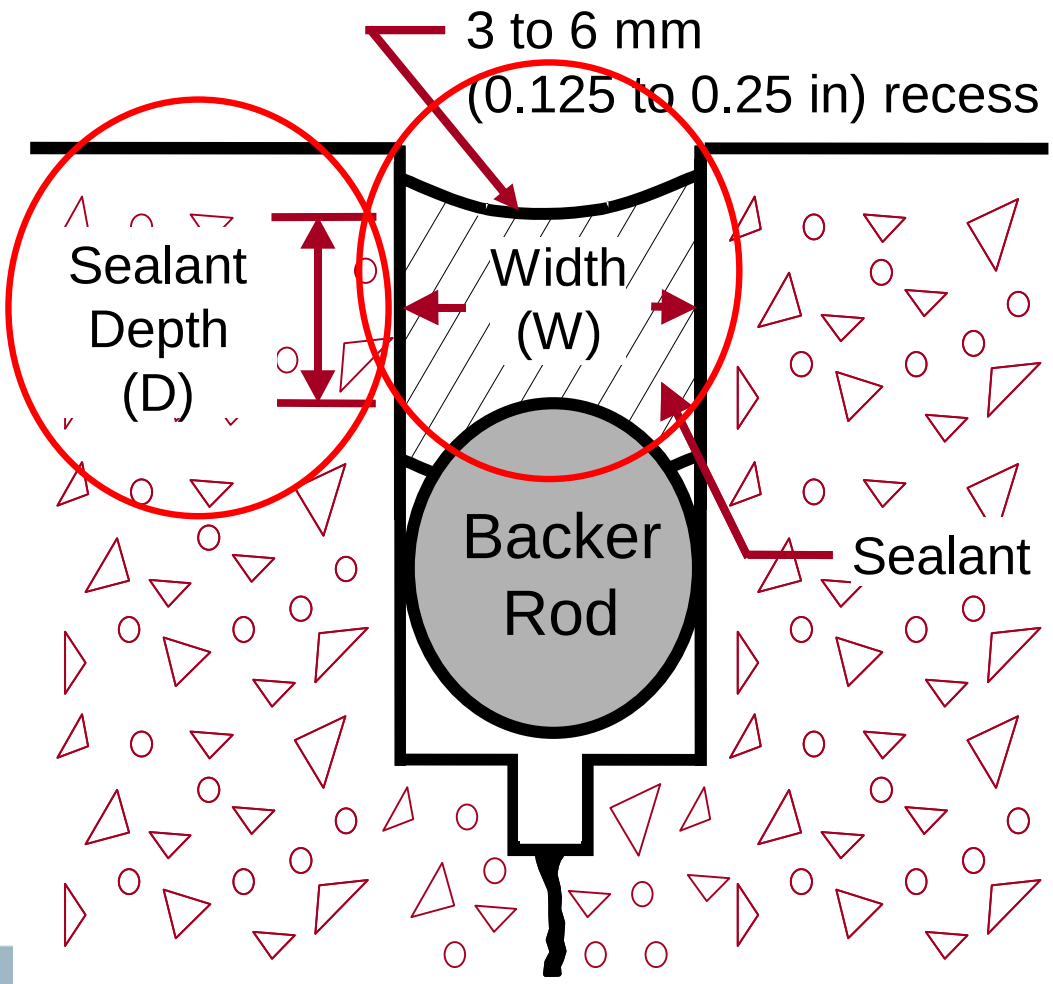
Construction: Joint Resealing

Procedures

1. Old sealant removal
2. Joint refacing
3. Joint reservoir cleaning
4. Backer rod installation
5. New sealant installation

Tech Center

Example Joint Reservoir



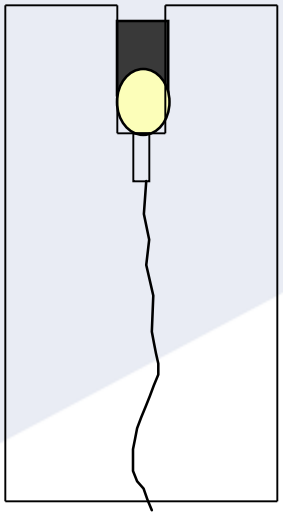
Shape Factor = W:D

Fig. 10.4 on p. 216

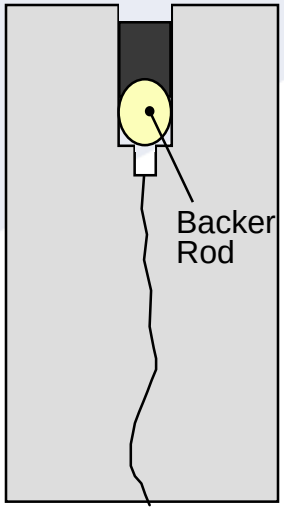
Cleaning the Reservoir

- Most important aspect of joint sealing
- Faces require a thorough cleaning
  - Free of dust, dirt and visible traces of old sealant
- Do not use chemical solvent to wash reservoir

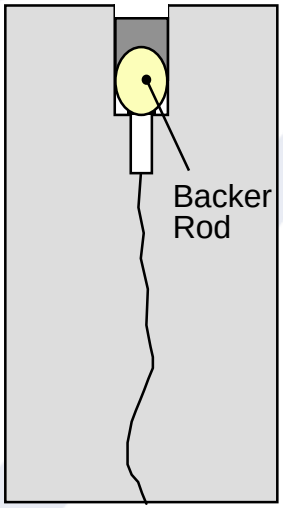
Joint Sealant Materials



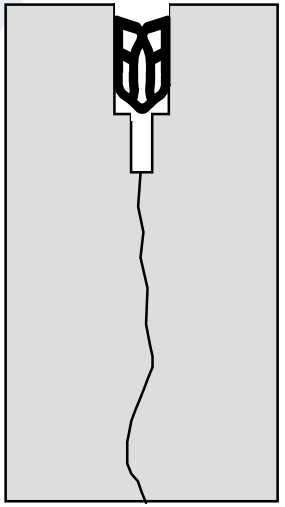
Cold-Pour
JFR



Hot-pour
JFR/non-JFR



Silicone
JFR?



Compression
JFR

Introduced in 1960's

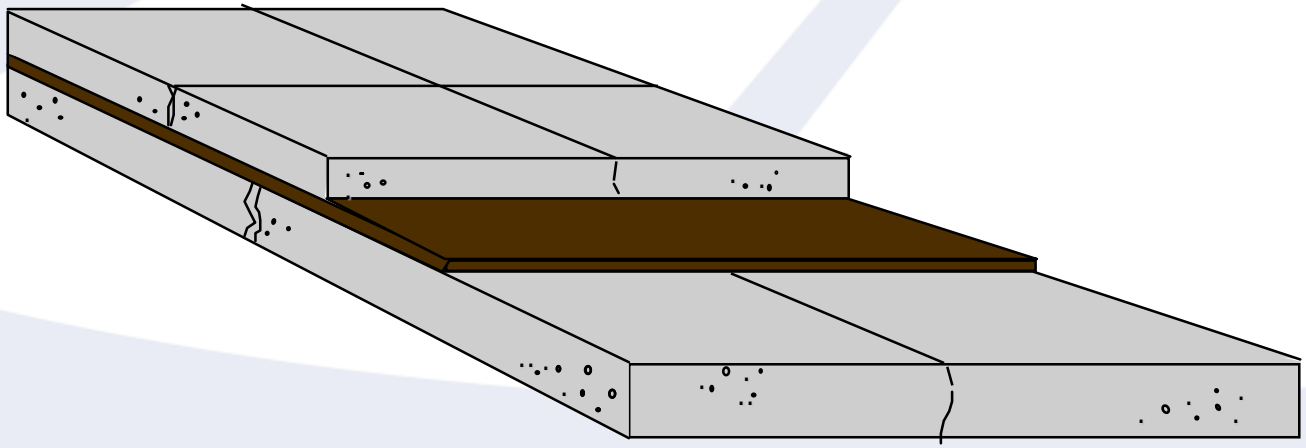
Concrete Overlays

AC 150/5320-6F

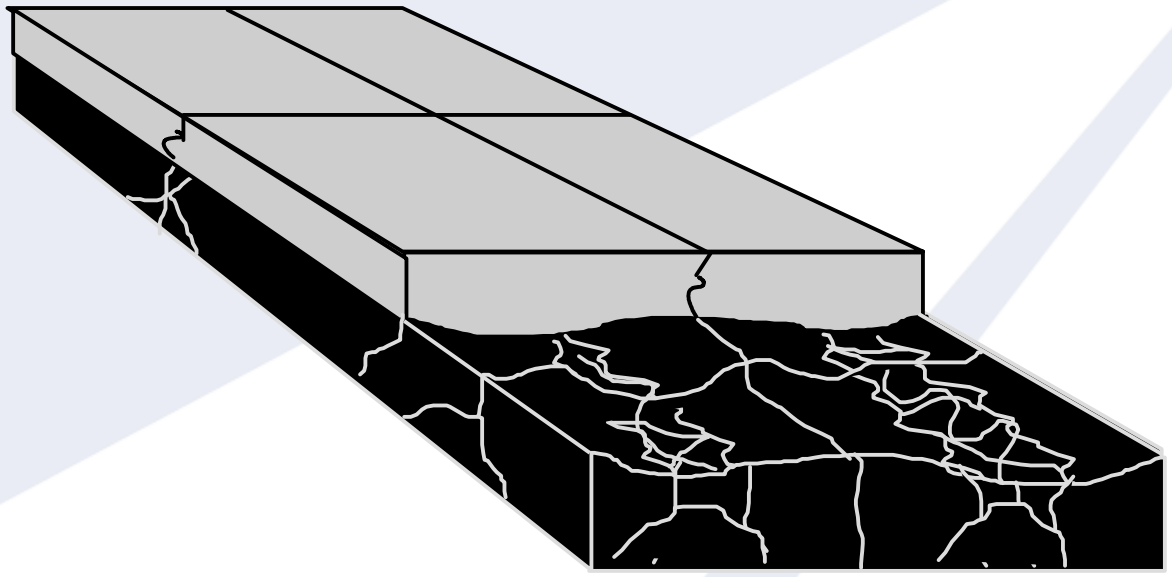
- With Leveling Course (Unbonded)
- Bonded
- Without Leveling Course (Partially Bonded)
- Whitetopping

Unbonded Overlay

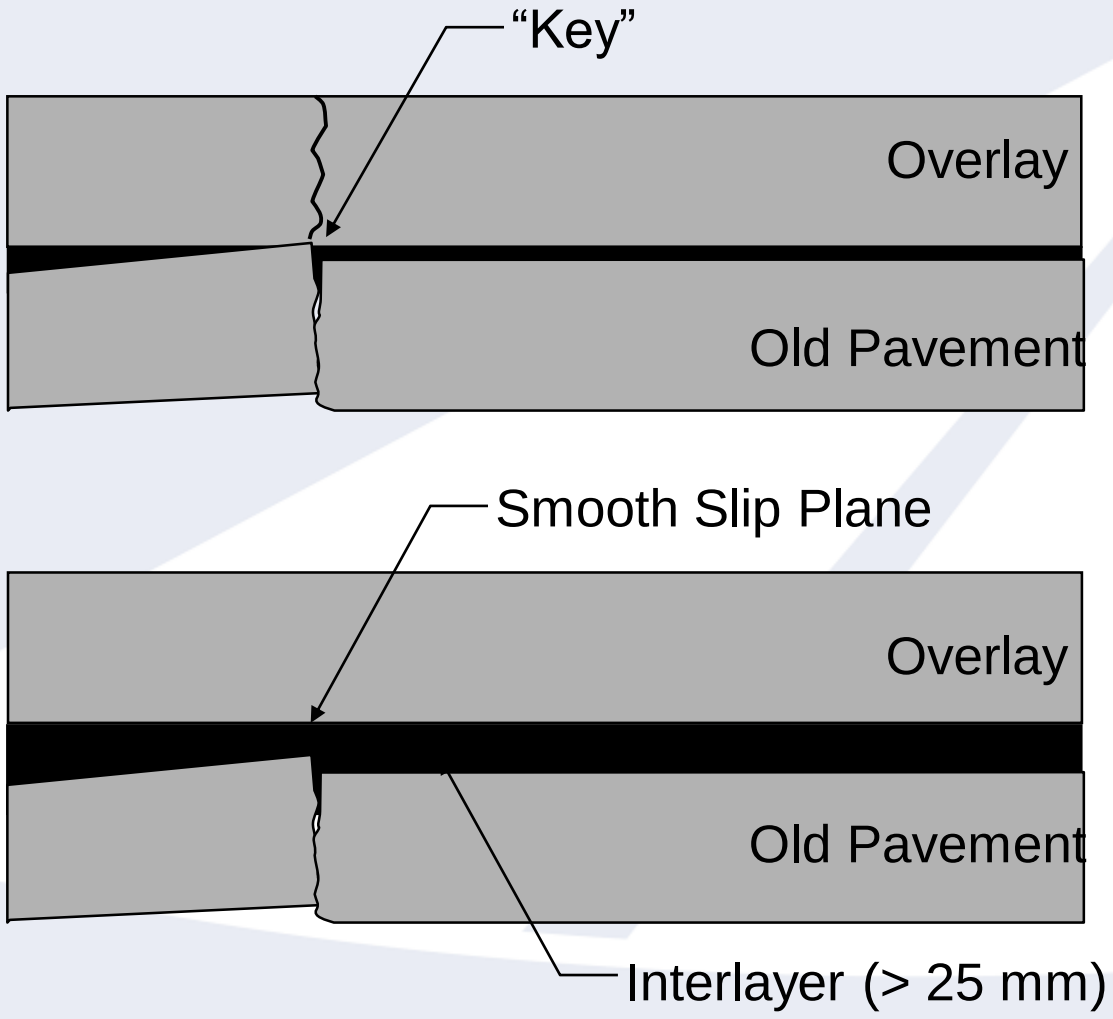
- Consists of thick concrete layer on top of an existing concrete pavement
- Uses a “separation interlayer” to isolate new overlay from existing concrete (prevent reflection of cracks and other distresses



Whitetopping



Separation Interlayer



Questions

American Concrete
Pavement Association

www.pavement.com