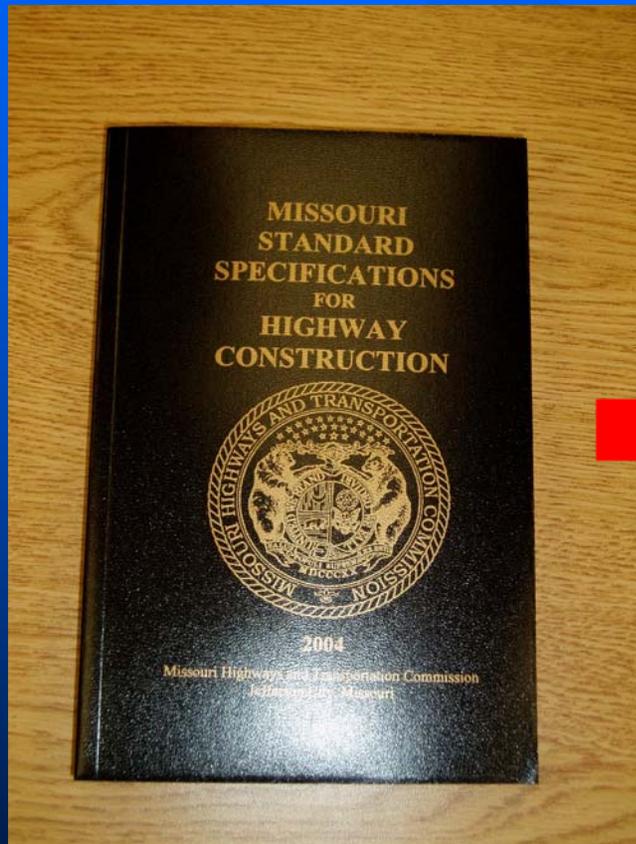


MoDOT Specification Update

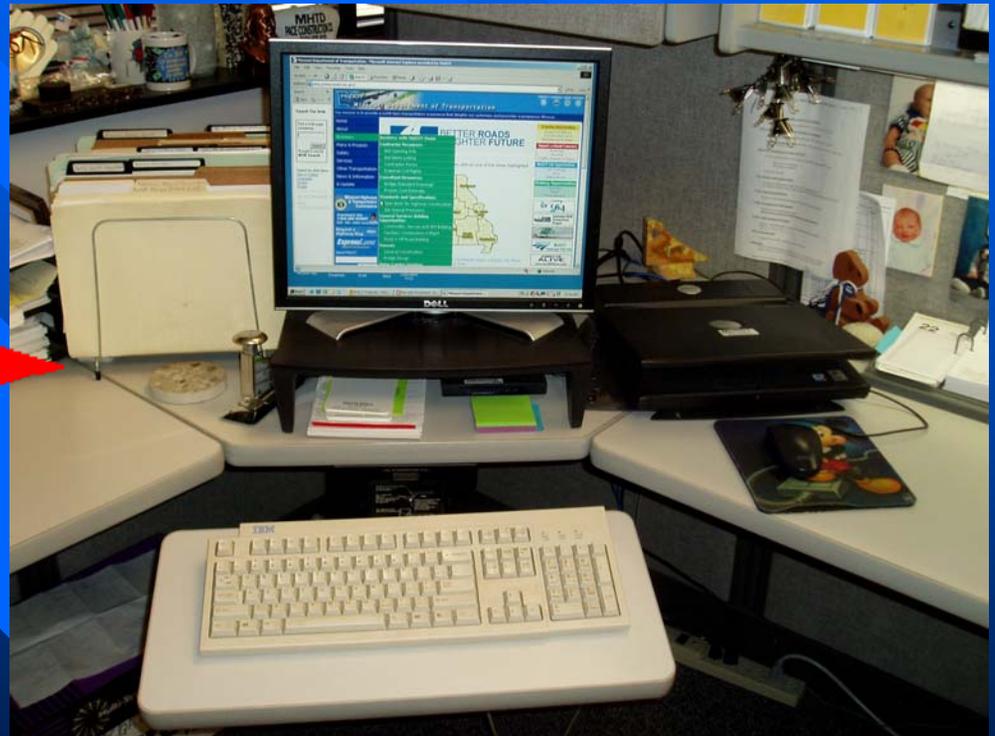


**AGC/MoDOT Annual Coop Meeting
Concrete Paving Division
December 2, 2008**

Specifications



Be careful



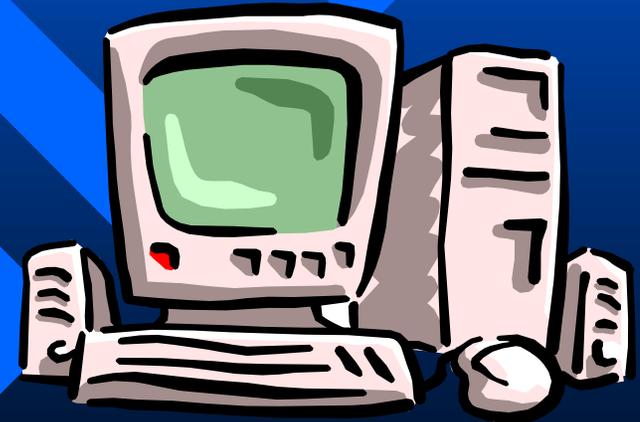
**Strongly
Recommend**

Outline

- 1) Mix Design Adjustments
- 2) Longitudinal Joint Forming Device
- 3) Manufactured Sand in Portland Cement Concrete Pavement
- 4) Optional Roller Compacted Concrete Shoulders



Concrete Mix Design Adjustments [Section 502.11.8]



Concrete Mix Adjustments

- Field Adjustment
 - Constituents changed by no more than 5.0% from the approved mix design
 - Water/Cement ratio changed by no more than 0.02 from the approved mix design
- Additional fractions of material or new material not permitted as a field adjustment
- Adjusted mix complies with Sec 501



Concrete Mix Adjustments

- Field Redesign
 - Constituents changed by more than 5.0% from approved mix design
 - Water/Cement ratio changed by more than 0.02 from approved mix design
 - New material used
- New mix design submitted immediately to District for approval
- Contractors can continue production while mix design is reviewed

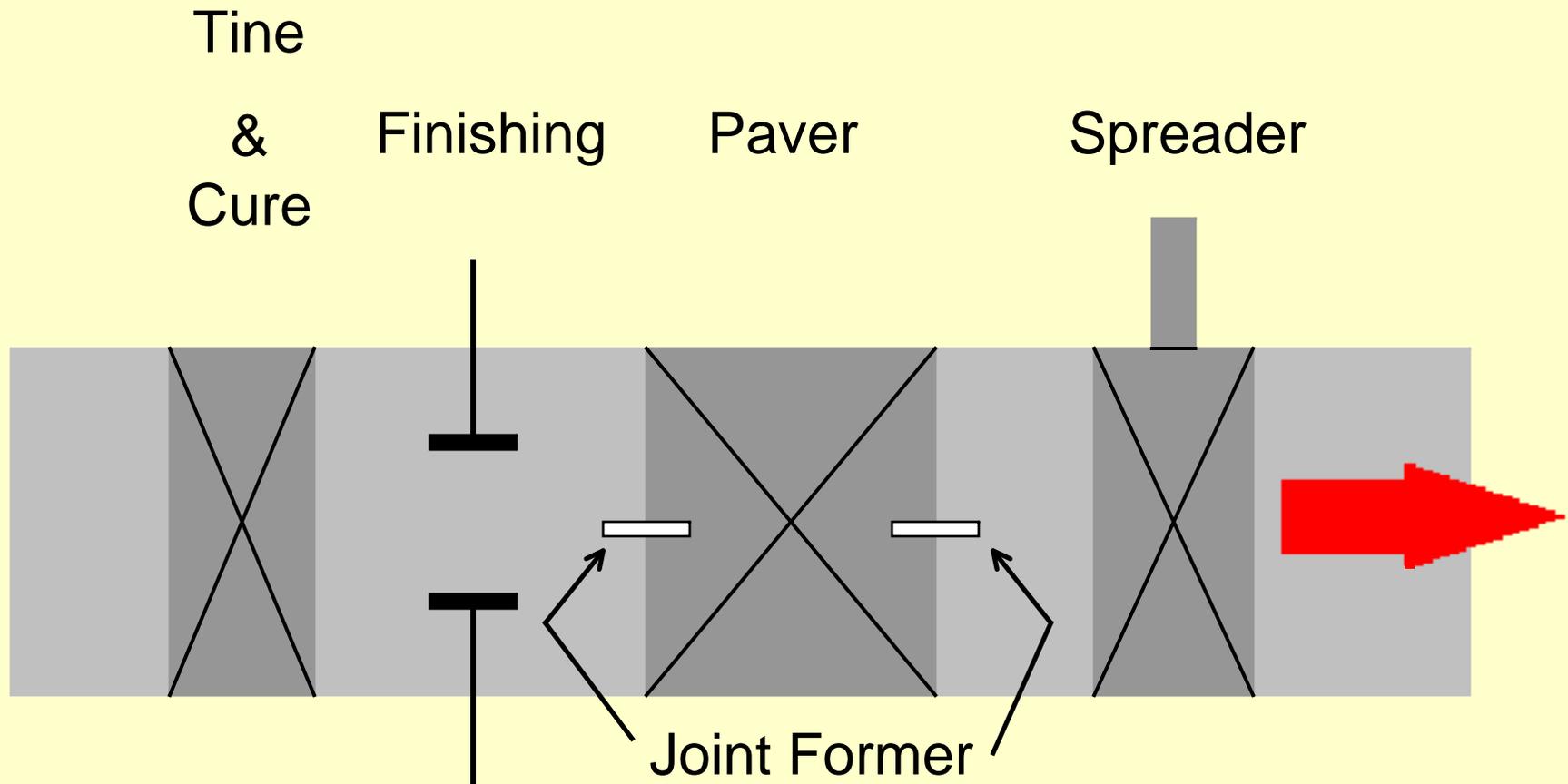


Longitudinal Joint Forming Device

[Section 502.5.3.1]



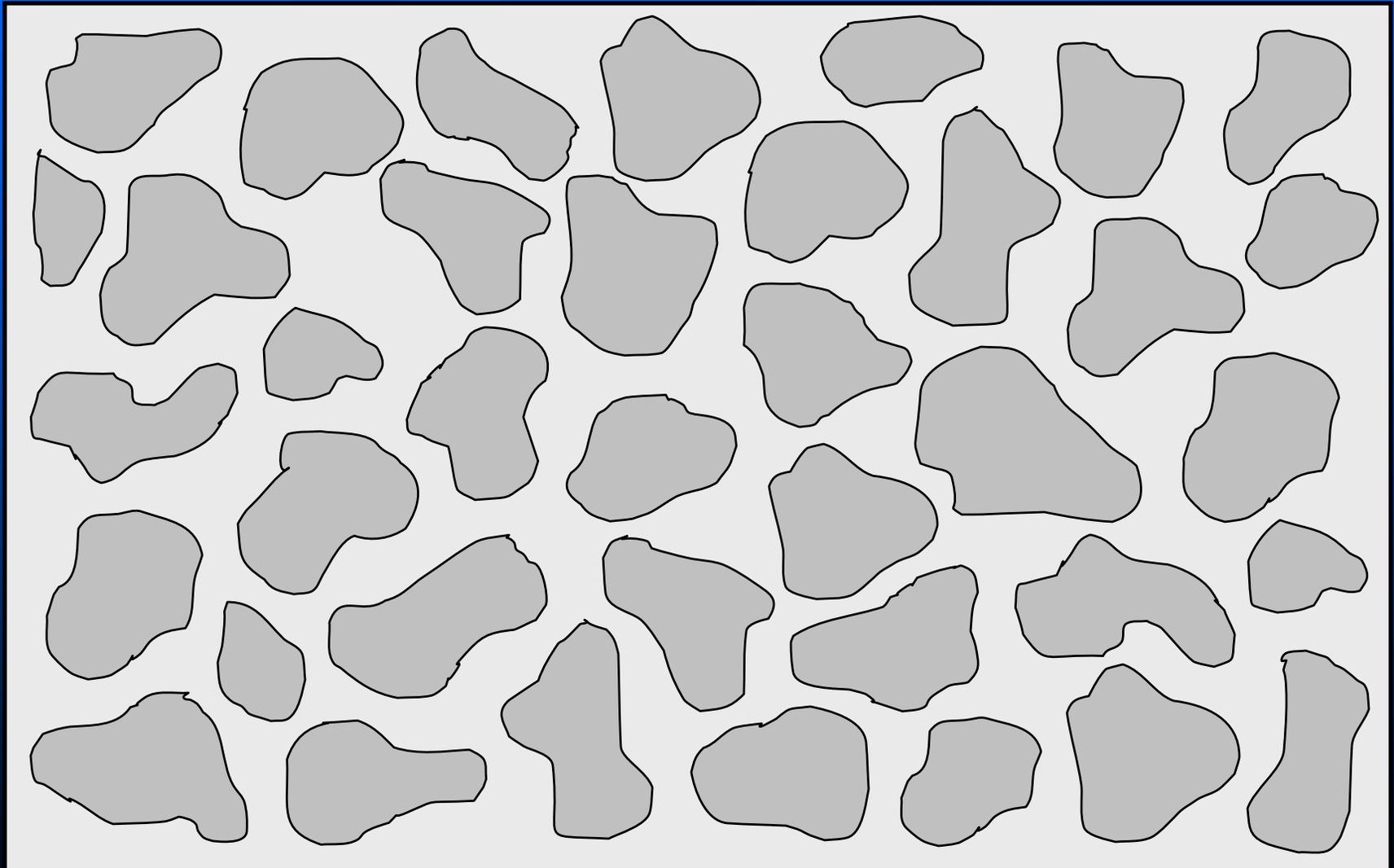
Longitudinal Joint Forming Device



Paving Train

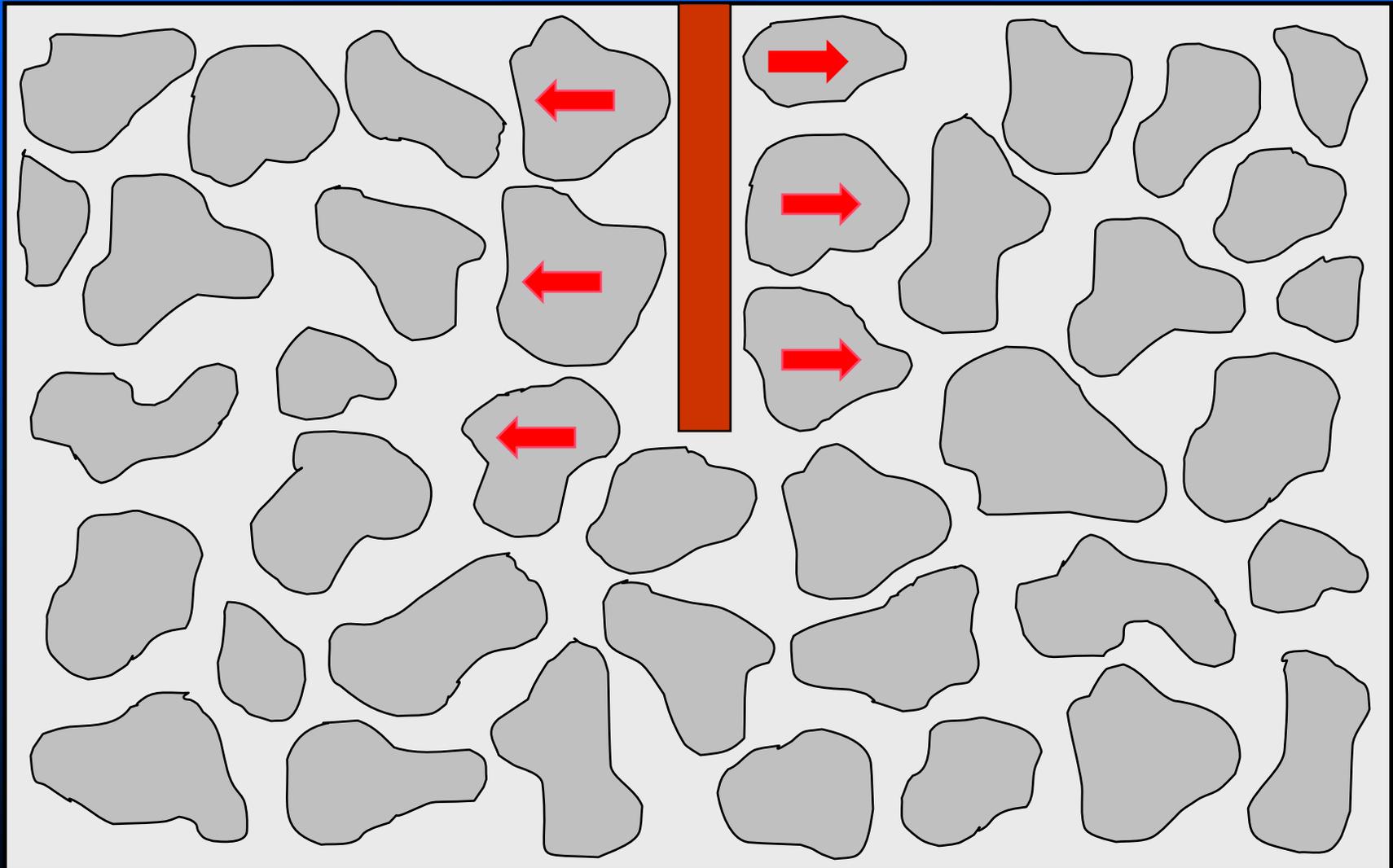
How it works

Fresh concrete



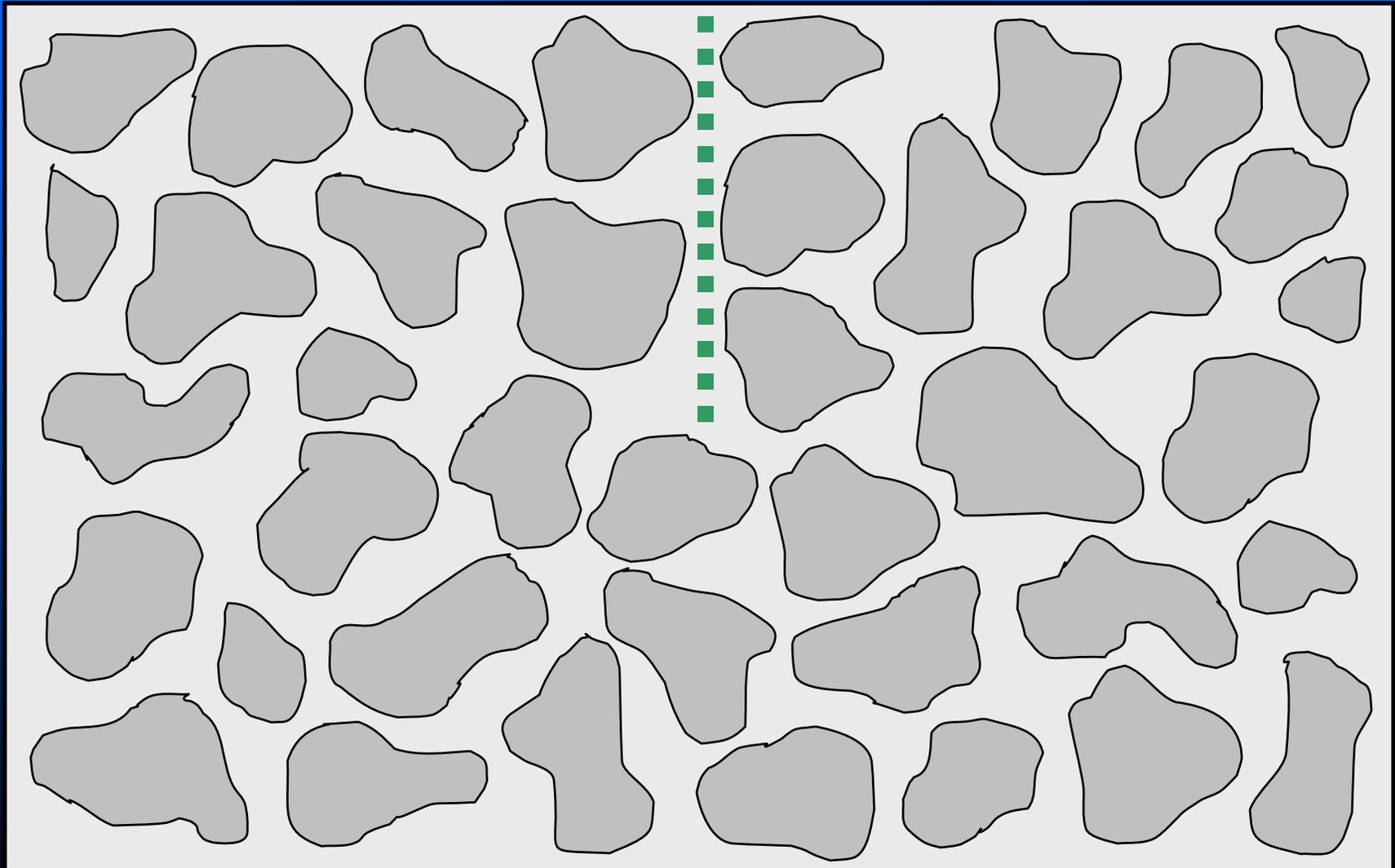
How it works

Blade 

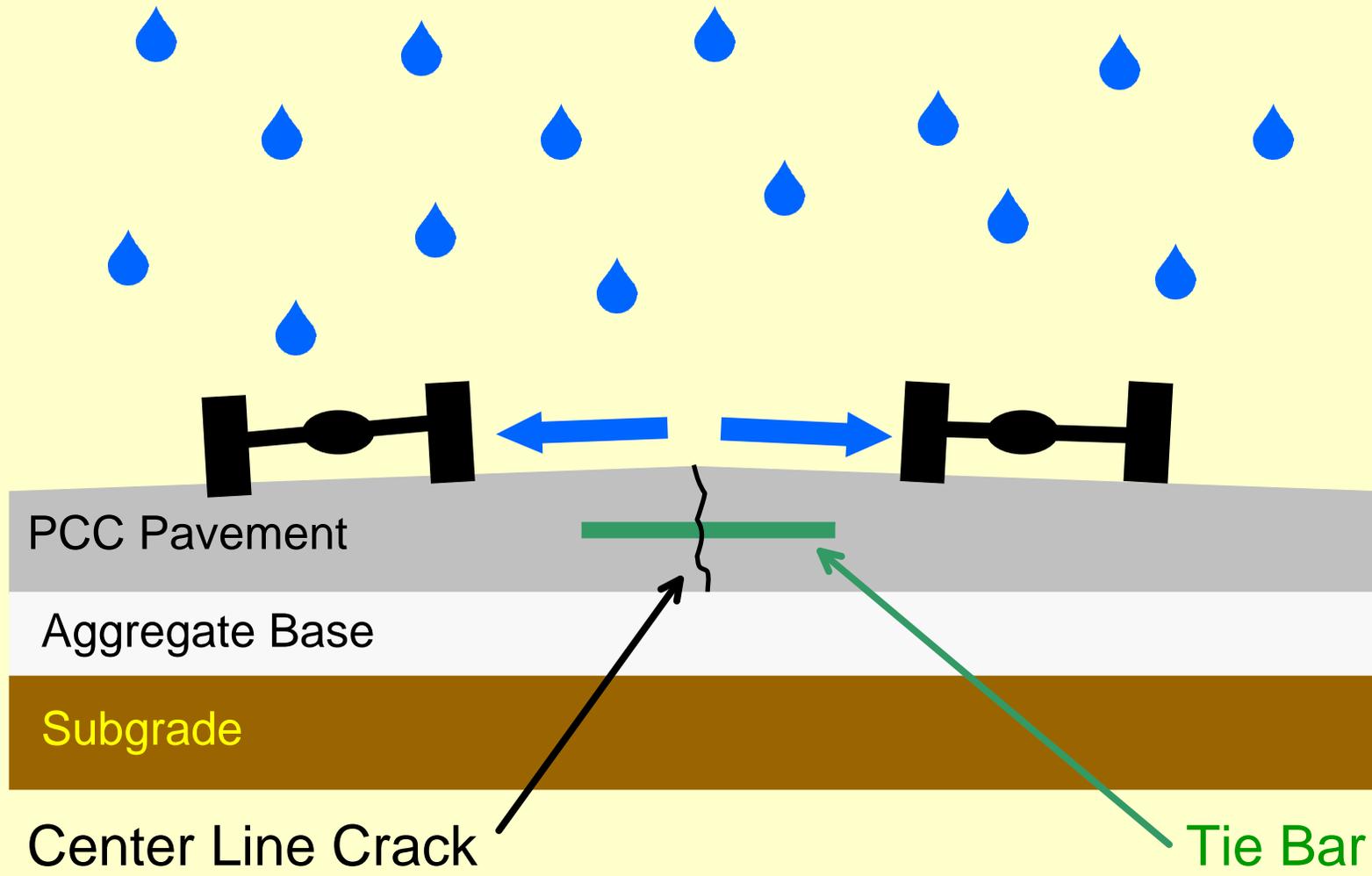


How it works

Weak Plane 



Why it works



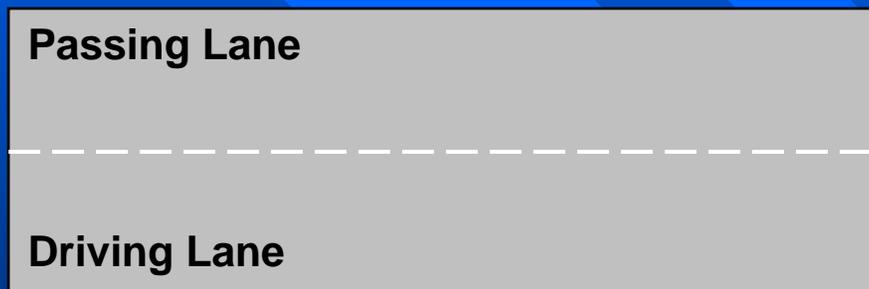
Longitudinal Joint Forming Device

■ End Result

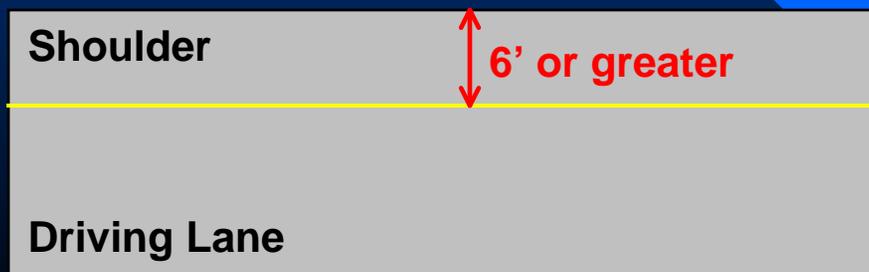


Longitudinal Joint Forming Device

- Incorporated into specifications
- Limitations on use
 - Plan thickness 8 inches or greater
 - Establish longitudinal joint between travel lanes



- Establish longitudinal joint between driving lane and shoulder 6 ft wide of greater



Longitudinal Joint Forming Device

■ Notification

- Contractor shall indicate in QC Plan if going to use

■ Joint Continuity

- Contractor shall ensure joint continuity between consecutive day's paving



Longitudinal Joint Forming Device

■ Device Requirements

- Two straight blades
- First blade on primary pan
- First blade extends forward between the vibrators
- Second blade on finishing pan
- Blade depth equal to one-third of the slab thickness



Longitudinal Joint Forming Device

■ Depth Verification

- Engineer allowed access to behind the paver
- Random locations checked
- Check by inserting a thin metal strip (i.e. putty knife) into formed joint



Longitudinal Joint Forming Device

■ Weak Plane Verification

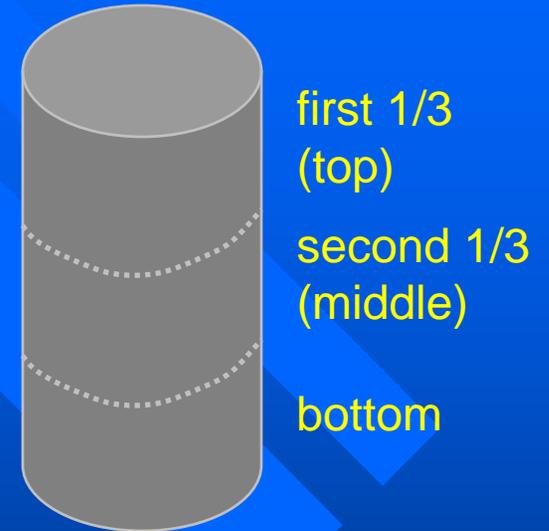
- Extract four 4-inch diameter cores
- Sample and test the following day after the first day of paving
- Random sample location determined by Engineer
- Core within +/- 1/2 inch of the formed joint



Longitudinal Joint Forming Device

■ Weak Plane Verification

- Cut the core into thirds
- Determine split tensile strength in the vertical position on the first third and the second third
- The average strength ratio of the first third and second third shall be 1/3 or less



Longitudinal Joint Forming Device

■ Testing Frequency

- Sample and test each successive day after the first day of paving
- Extract two 4-inch diameter core
- Random sample locations determined by Engineer
- Determine split tensile strength in vertical position
- Engineer may reduce the number cores if satisfactory results achieved



Manufactured Sand in Portland Cement Concrete Pavement

[Job Special Provision – District 8]



Manufactured Sand in PCCP

- Reasons for allowing
 - Districts 7, 8 & 9 have limited natural sand sources
 - Hauling sand a great distance
 - Increased shipping costing
 - MoDOT looking to build a quality project at a reduced price



Manufactured Sand in PCCP

■ Material Requirements

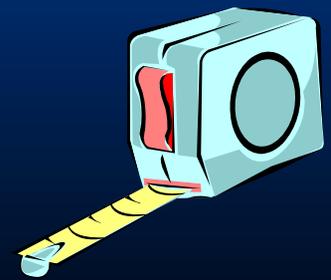
- Complies with Section 1005.3, except that requirements for gradation and percent passing the No. 200 sieve shall not apply
- Perform methylene blue test in accordance with AASHTO T 330; not to exceed 10 mg/g



Manufactured Sand in PCCP

■ Test Section

- If manufactured sand used, a test section consisting of 100% natural sand shall be constructed
- Test section at least 2000 feet in length
- Test section constructed in travel way
- Alignment typical for project
- Contractor selects location subject to Engineer approval



Manufactured Sand in PCCP

■ Notification

- Engineer to contact the Construction and Materials Division
- Four weeks prior to opening the pavement
- This allows the pavement to be reviewed prior to opening



Optional Roller Compacted Concrete Shoulders

[General Provision – Division 500]



Optional Roller Compacted Concrete Shoulders

■ Aggregate Requirements

- Coarse Aggregate Quality → Sec 1005.2
- Fine Aggregate Quality → Sec 1005.3
- Plasticity Index (PI) not to exceed 5
- Conform to the following combined gradation:

Sieve Size	% Passing
1 inch	100
1/2 inch	70 – 90
3/8 inch	60 – 85
No. 4	40 – 60
No. 200	0 - 8



Optional Roller Compacted Concrete Shoulders

- Mix Design
 - Submit to Engineer 30 days prior to use
 - Required information:
 - 1) Material Sources (aggregate, cement, etc...)
 - 2) Aggregate Properties (bulk sp. gr., absorp., etc...)
 - 3) Material Batch Weights
 - 4) Maximum Laboratory Density
 - 5) Laboratory Proctor Curves



Optional Roller Compacted Concrete Shoulders

- Trial Batch
 - Prepared and tested at the mix facility
 - In the presence of the Engineer
- Production
 - Does not begin until mix design is approved and mix design verified by a trial batch



Optional Roller Compacted Concrete Shoulders

- Mix Design Requirements
- Design Strength
 - Minimum compressive strength of 3500 psi at 28 days
 - Compact specimens in accordance with ASTM C 1176 or ASTM C 1435



ASTM C 1176



ASTM C 1435

Optional Roller Compacted Concrete Shoulders

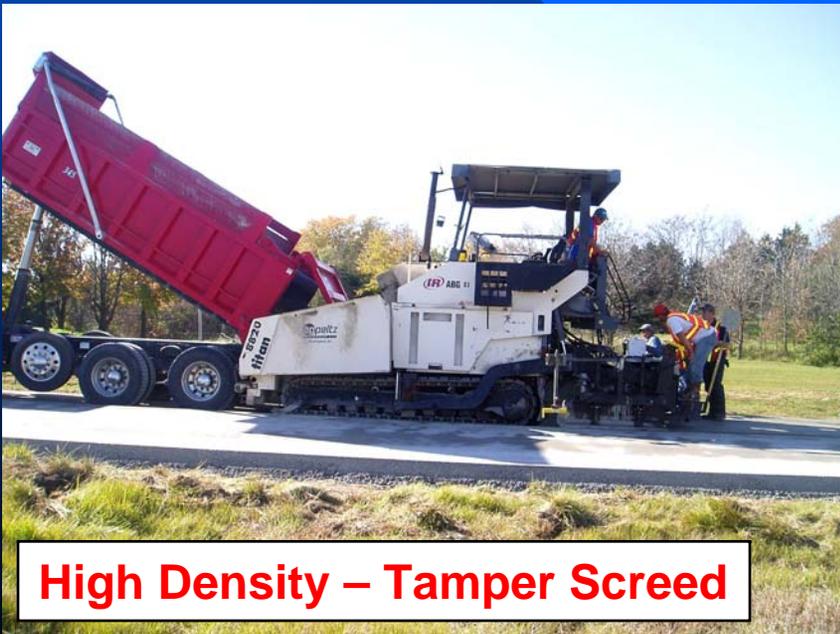
- Mix Design Requirements
- Minimum Water Content
 - Water cement ratio not lower than 0.25
- Minimum Cementitious Content
 - Total amount of cementitious materials not lower than 400 pounds per cubic yard



Optional Roller Compacted Concrete Shoulders

■ Paver

- May use either a high density or conventional asphalt type paver
- Paver needs to be of suitable weight and stability to spread and finish the RCC



High Density – Tamper Screed



Asphalt Paver – Vibrating Screed

Optional Roller Compacted Concrete Shoulders

■ Haul Equipment

- Trucks shall be smooth, mortar-tight, metal containers
- Shall have a retractable cover to protect mix from weather and excessive evaporation



Optional Roller Compacted Concrete Shoulders

■ Mixing Time

- Concrete shall be homogeneous with no segregation
- In no case shall the mixing time be less than 90 seconds



Optional Roller Compacted Concrete Shoulders

■ Curing

- Either wet cure or white curing compound
- Apply white curing compound at a rate of 1 gallon for each 100 square feet
- No more than 10 linear feet exposed without curing compound



Optional Roller Compacted Concrete Shoulders

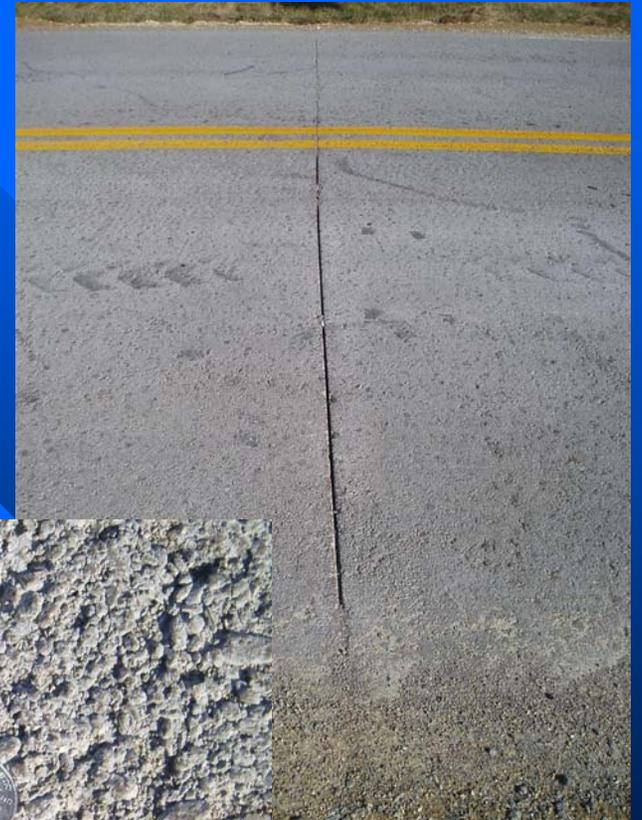
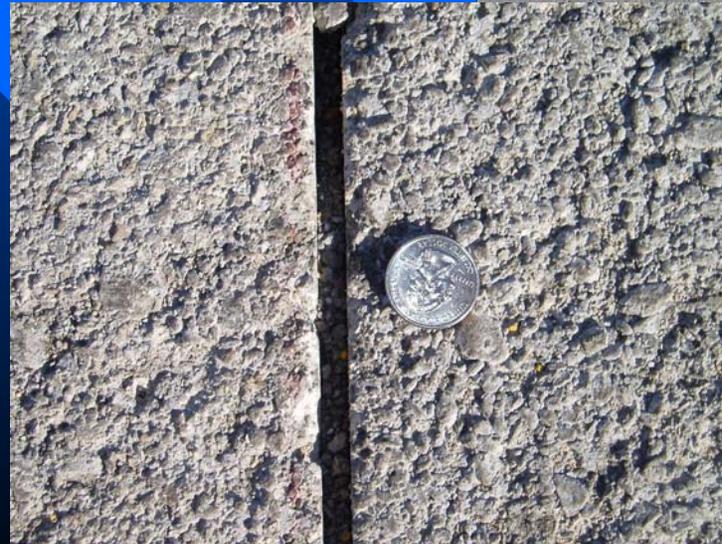
■ Segregation

- If segregation occurs during paving operations, placement shall cease until corrective measures taken



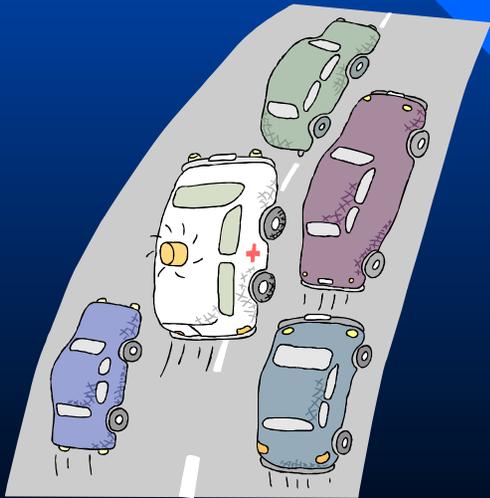
Optional Roller Compacted Concrete Shoulders

- Control Joints
 - Match adjacent 15-foot mainline joints
 - Tooled or cut to $\frac{1}{3}$ the depth of the RCC
 - Joints not sealed



Optional Roller Compacted Concrete Shoulders

- Opening to Traffic
 - Protect from traffic during curing period
 - Open to light traffic after 3 days
 - Open to unrestricted traffic after 14 days



Optional Roller Compacted Concrete Shoulders

- Extracting Cores
 - Core RCC in accordance with AASHTO T24
 - Random sample locations determined by engineer
 - Core diameter shall be no less than 3 inches and no more than 4 inches
 - Cores not taken within 6 inches of an unconfined joint



Optional Roller Compacted Concrete Shoulders

- Testing Cores
- Thickness determined in accordance with AASHTO T 148
- Density determined in accordance with ASTM C 642
- Density test performed at 28 days
- One test per 7500 square yards



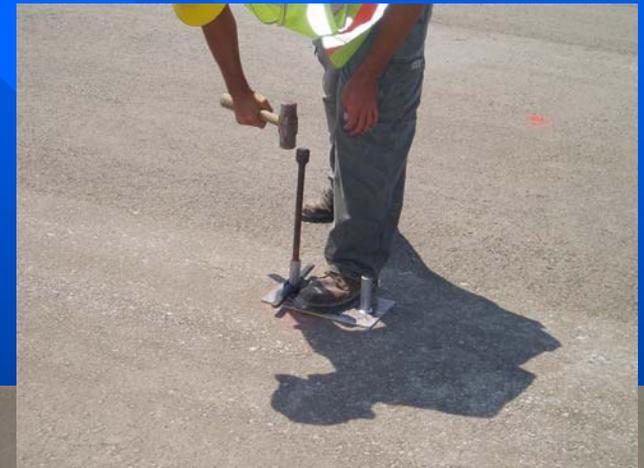
Optional Roller Compacted Concrete Shoulders

- Acceptance of Density
- Shall not be less than 95.0 percent of the maximum laboratory density



Optional Roller Compacted Concrete Shoulders

- Optional Testing [Proposed]
- Density
 - In lieu of ASTM C 642, may determine in accordance with AASHTO T 310, direct transmission
 - Perform no later than 30 minutes after rolling
 - Wet density evaluated
 - Random sample locations determined by Engineer
 - One test per 7500 sq. yards



Optional Roller Compacted Concrete Shoulders



- Optional Testing [Proposed]
- Thickness
 - In lieu of AASHTO T 148, may determine thickness by testing the fresh concrete
 - Test procedure is reviewed and approved by the Engineer
 - Random sample locations determined by Engineer
 - One test per 7500 sq. yards



Optional Roller Compacted Concrete Shoulders

- Low Density Results [Proposed]
 - Cores required when RCC does not meet density requirements but RCC was properly placed and compacted
 - Determine compressive strength
 - Compressive strength testing shall be completed within 7 days of density testing
 - Full pay when compressive strength ≥ 3500 psi
 - Concrete unacceptable when compressive strength < 3500 psi



Questions

