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Crack Treatments Workshop

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&
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Agenda

- Training will cover the following:
  1. Introduction to Crack Treatments
  2. Project Selection & Design
  3. Materials & Specifications
  4. Equipment & Proper Installation
- Knowledge Checks at the end of each module
  - Remote Controls

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Intro to Crack Treatments

Agenda

- What is a Crack Treatment?
- What is Crack Sealing?
- What is Crack Filling?
- Why do it?
- Benefits
- Use as a Pre-treatment

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Crack Treatments

- Crack Treatments – methods in which cracks are directly treated through sealing or filling operations.[1]
  - Crack Sealing
  - Crack Filling

- Crack Treatments are cost-effective pavement preservation methods that extend pavement life
  - Protect your investments (roads, bridges, parking lots, etc.)
  - Maintains pavement structure
  - Limits future deterioration, prevents potholes

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Crack Filling & Crack Sealing

- **Crack Sealing:**

  Placement of **specialized treatment materials (sealant)** above or into cracks using unique configurations to **prevent** the intrusion of water and incompressible materials into the crack

- **Crack Filling:**

  Placement of **ordinary treatment materials** into low-moving cracks to **reduce** infiltration of water and to reinforce the adjacent pavement

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Crack Sealing vs. Crack Filling

Crack Sealing	Crack Filling
Seals the crack to prevent the intrusion of water and incompressible materials	Fills some of the void in the crack to reduce intrusion of water and incompressible materials
Specialized treatment materials	Ordinary treatment materials
Highly-elastic and flexible material	Rigid material or semi rigid
Endures vertical & horizontal movement	Can not endure vertical & horizontal movement
Crack preparation to assure long service life of sealant	Cursory crack preparation
Sealant placement configuration	Fill crack void, then dust with sand
Considered semi-permanent	Considered temporary
Seals routed/working crack (Life average of 5 years. Up to 10 years on new pavements)	Filling not recommended for moving cracks, unable to accommodate movement
Seals overbanded/non-working crack (Life approximately 2 to 5 years)	Fills non-working crack (Life approximately a few months up to 1 year)
Modification to perform in a wide variety of climatic temperatures	More susceptible to environmental conditions

Crack Sealing vs. Crack Filling

Crack Sealing Materials	Crack Filling Materials
Asphalt rubber (ASTM D 5078 or State Specifications)	Asphalt cement (Paving Grade or Roofing Grade)
Rubberized asphalt (ASTM D 6690 type 1,2 & 3 or State Specification)	Asphalt cutback (MC-30, 70 and 250)
Low-modulus rubberized asphalt (ASTM D 6690 type 4 or State Specifications)	Asphalt emulsion (SS-1, SS-1h, CSS-1, and CSS-1h)
	Fiberized asphalt
	Mineral-filled (stone, lime, flyash dust) asphalt
	Sand-asphalt mixes

Different materials are used to crack seal or crack fill

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Crack Sealing vs. Crack Filling

Crack Sealing

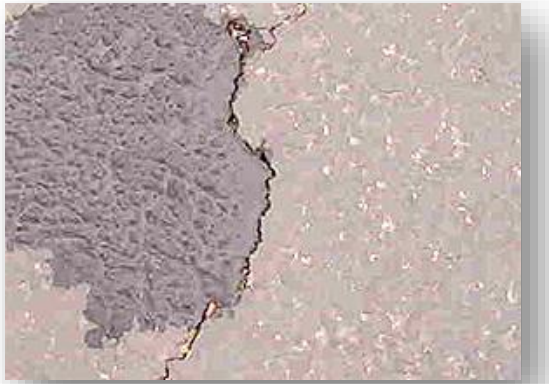
Crack Filling

Why Crack Seal?

"Crack Sealing is the single most cost effective preventive maintenance tool available" *~ FHWA*

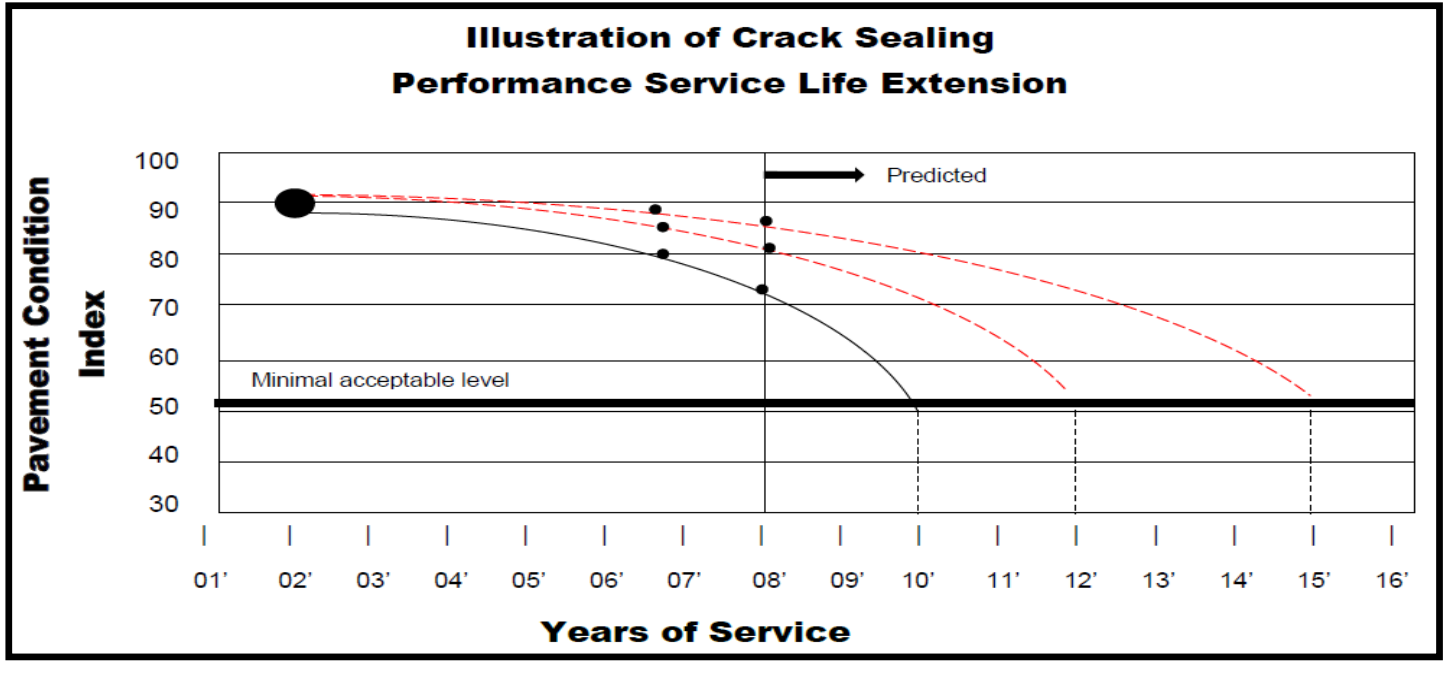
- Protect your investments (roads, bridges, parking lots, etc.)
- Maintains pavement structure
- Limits future deterioration, prevents potholes

Prevents water and incompressible intrusion



Why Crack Seal?

Slow deterioration and extend pavement service life up to 5 years. Crack treatment is the lowest cost preservation treatment, significantly less than other treatments and provides the most benefit for money spent.



Crack Sealing as a Pre-Treatment

- Crack Treatments are commonly used as a pre-treatment in conjunction with surface treatments

- Sealing prior to surface treatments enhances the treatment and further extends the pavement life.[9]

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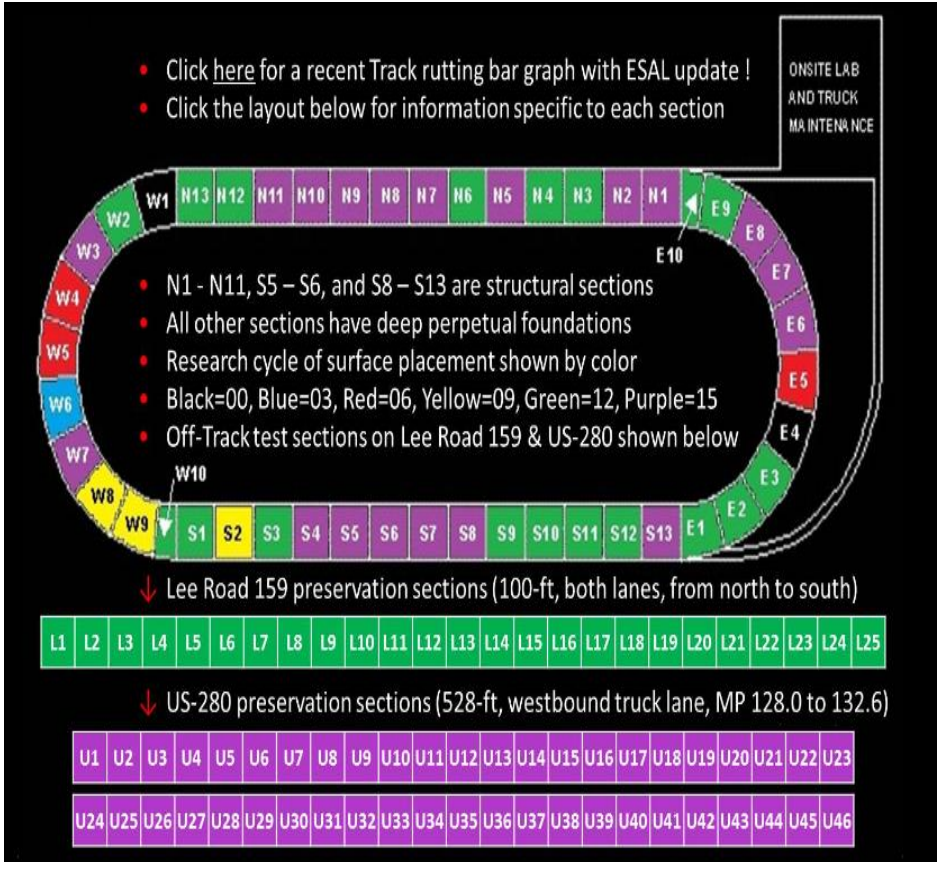
NCAT Preservation Study



- National Center for Asphalt Technology, Auburn University
- Lee Road 159, AL
- www.pavetrack.com
- 3-year Preservation Study
- 25 Treatments (2012-2015)
- Crack sealing reduced development of interconnected cracking, and reduced subgrade moisture levels
- Crack Sealing as pretreatment improved surface treatment results by reducing cracking through chip seals and microsurfacing

Preservation Group (PG) Experiment

- 25 sections on local county road (Lee Road 159)
  - ~5 ½” thick paved access road to quarry/asphalt plant
  - 2 control, 23 sections with treatments/combinations, Pretreatment condition varied by WP and direction
- Purpose of the Study
  - Quantify life extending benefit of study treatments
    - Time/traffic to return to pretreatment condition(s)
    - Test sections on the Track and Lee Road 159

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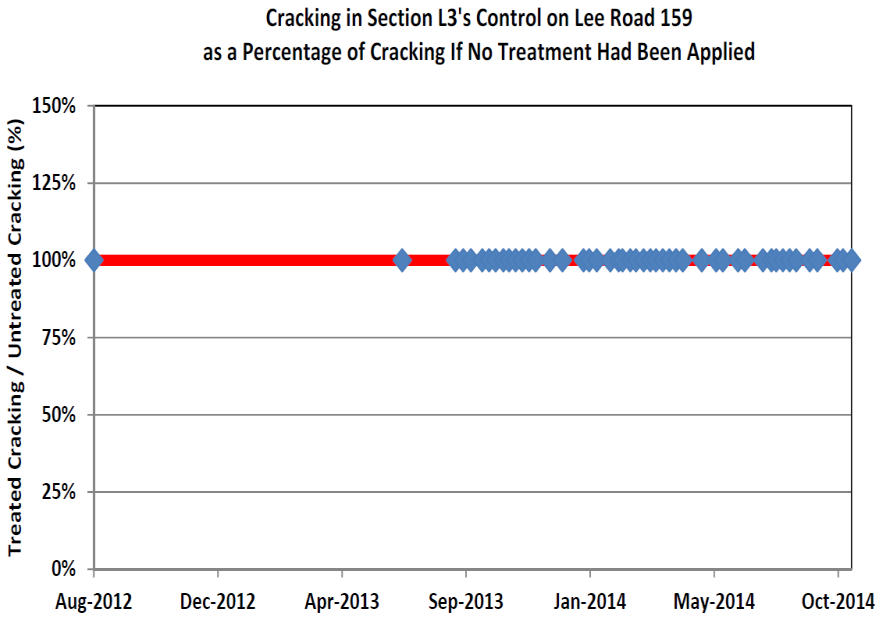
Results: Section L3 Control



- Control section has no treatment applied
- Performance measurement is the measured amount of cracking
- Changes from treatments will be compared to the control section

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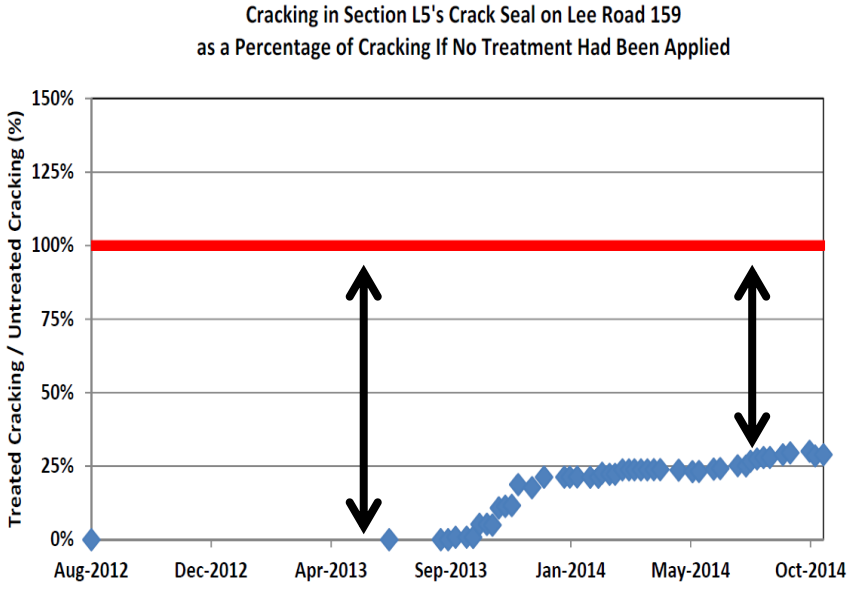
Results: Section L5 Crack Seal



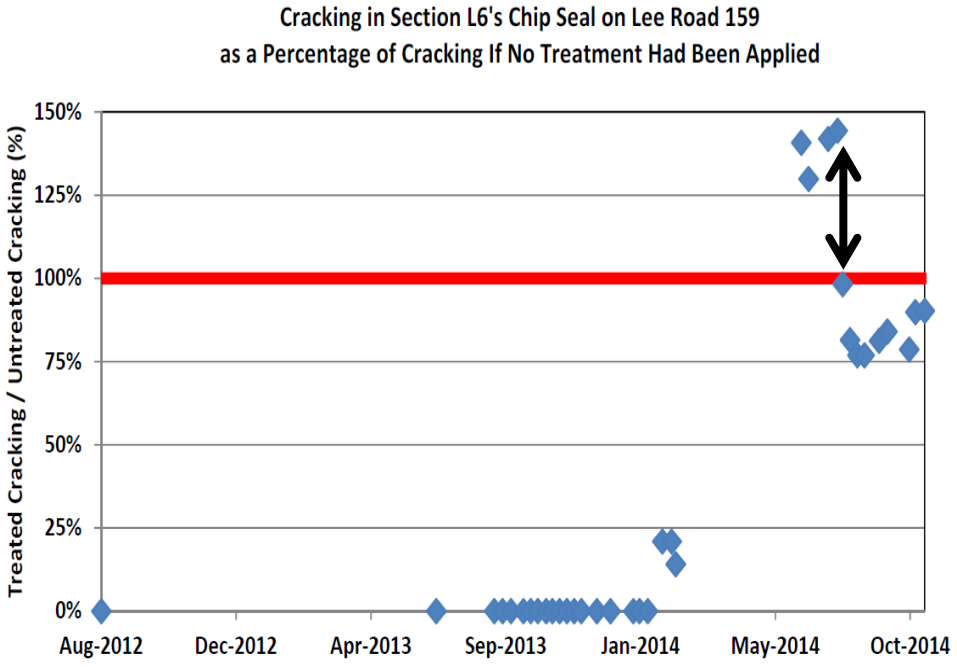
100% Less Cracking compared to Control Section

~75% Less Cracking compared to Control Section

- Crack sealing vs. NO treatment
- At year 1, there was 100% less cracking
- At year 2, there was 75% less cracking than with no treatment

L5 – Crack Sealing

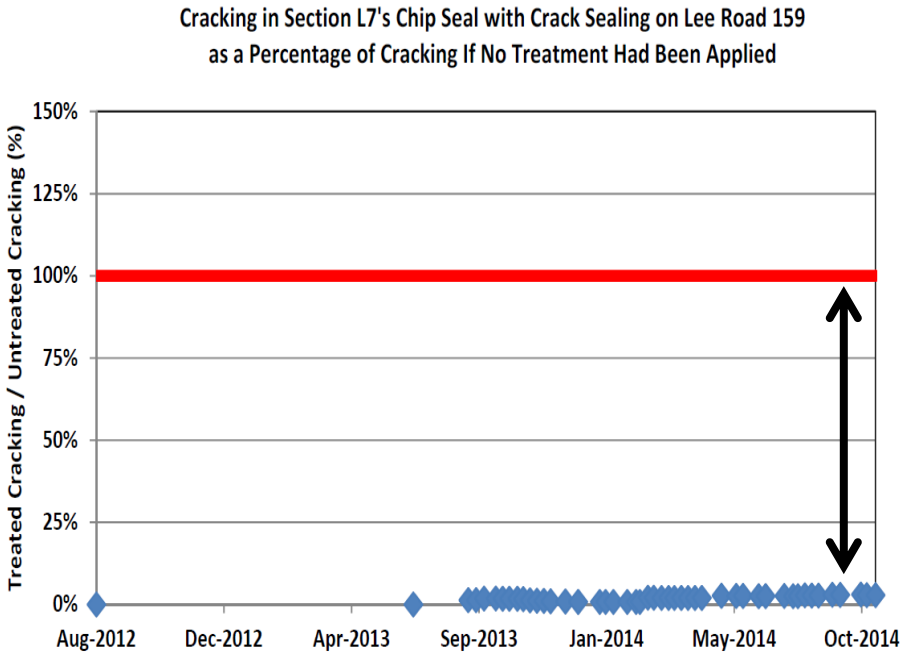
Results: Section L6 Chip Seal
(No Crack Seal pre-treatment)



- NO crack sealing pretreatment
- At year 1, there was 100% less cracking
- At year 2, same amount of cracking as the control section with no treatment

At year 2, same amount of cracking as Control Section

Results: Section L7 Chip Seal
(Over Crack Seal pre-treatment)

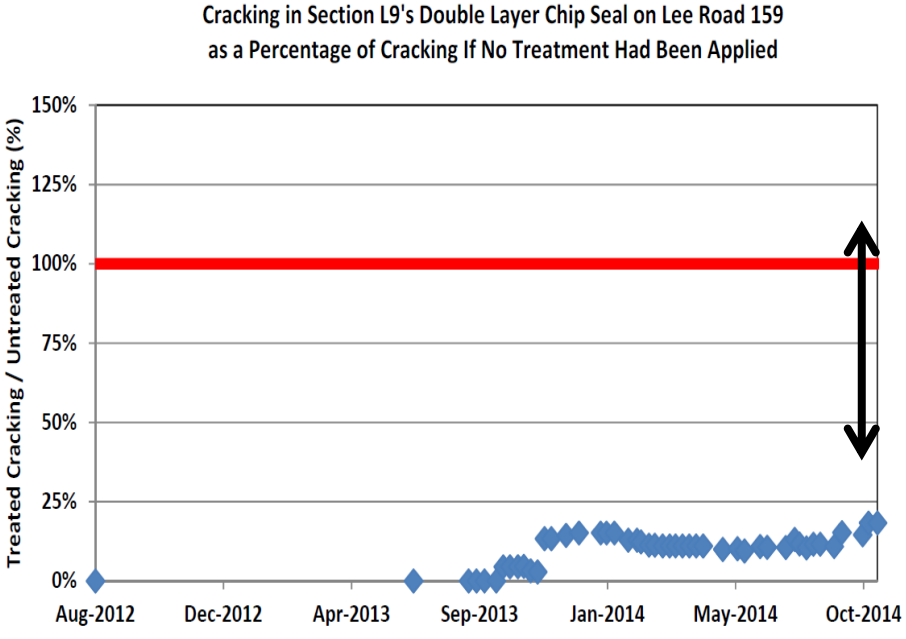


- WITH crack sealing pretreatment
  - At year 1, there was 100% less cracking
  - At year 2, there was 100% less cracking than control
- WITHOUT crack sealing pretreatment
  - Same amount of cracking as no treatment

~100% Less Cracking compared to Control Section!!

L7 – Chip Seal with Crack Sealing

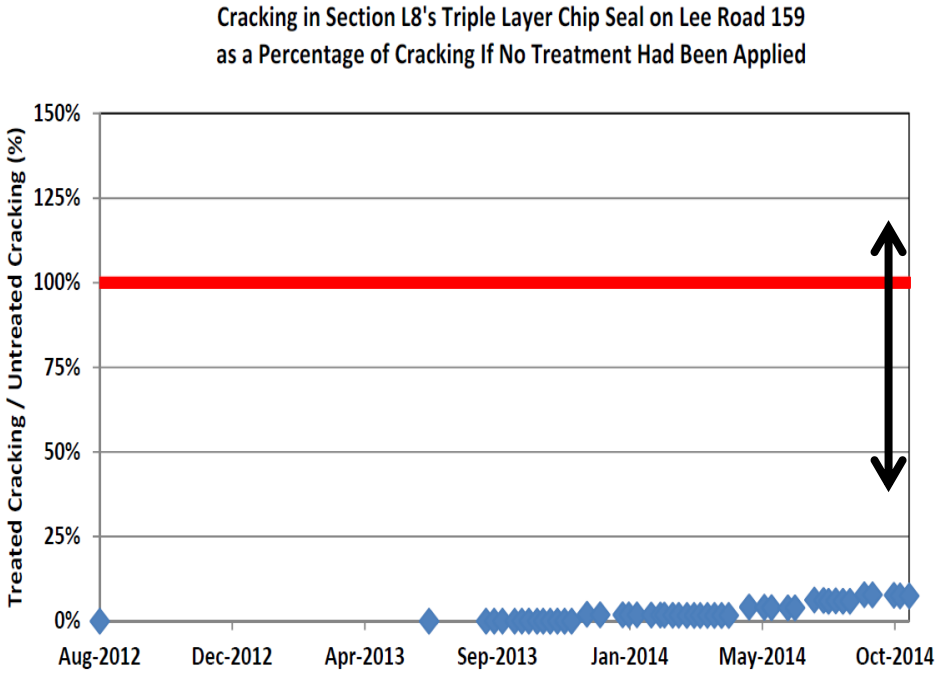
Results: Section L9 Double Layer Chip Seal



- NO crack sealing pretreatment
- At year 1, there was 100% less cracking
- At year 2, 75% less cracking than control
- The Single Chip Seal with crack sealing pretreatment performed better

~75% Less Cracking compared to Control Section

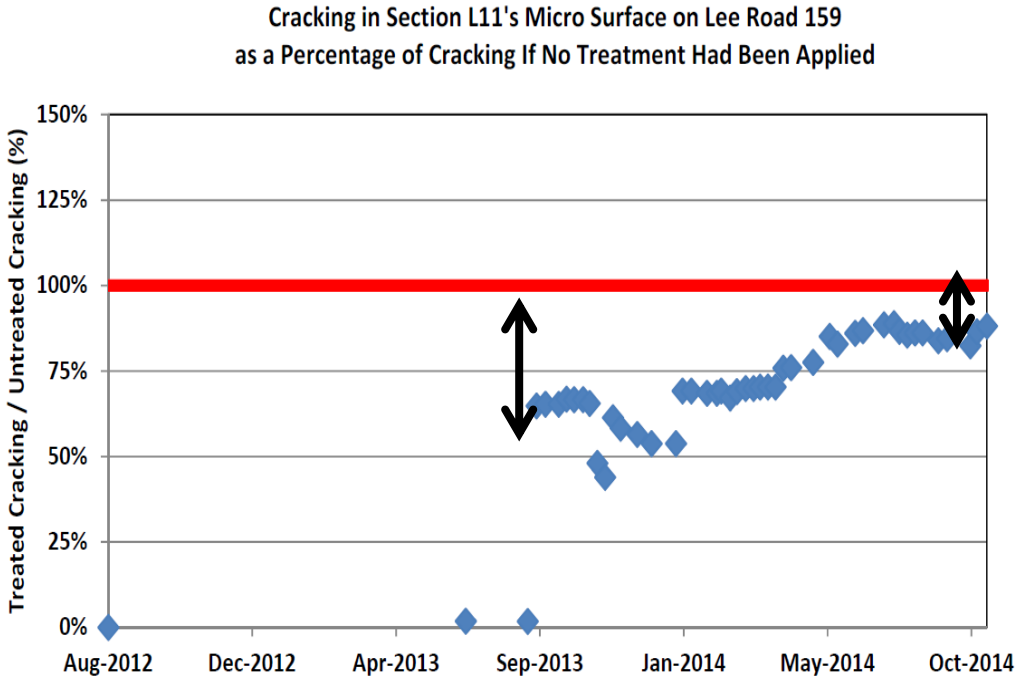
Results: Section L8 Triple Layer Chip Seal



- NO crack sealing pretreatment
- At year 1, there was 100% less cracking
- At year 2, 95% less cracking than control
- The Single Chip Seal with crack sealing pretreatment performed better

~95% less cracking compared to Control Section

Results: L11 Micro Surfacing
(No Crack Seal pre-treatment)

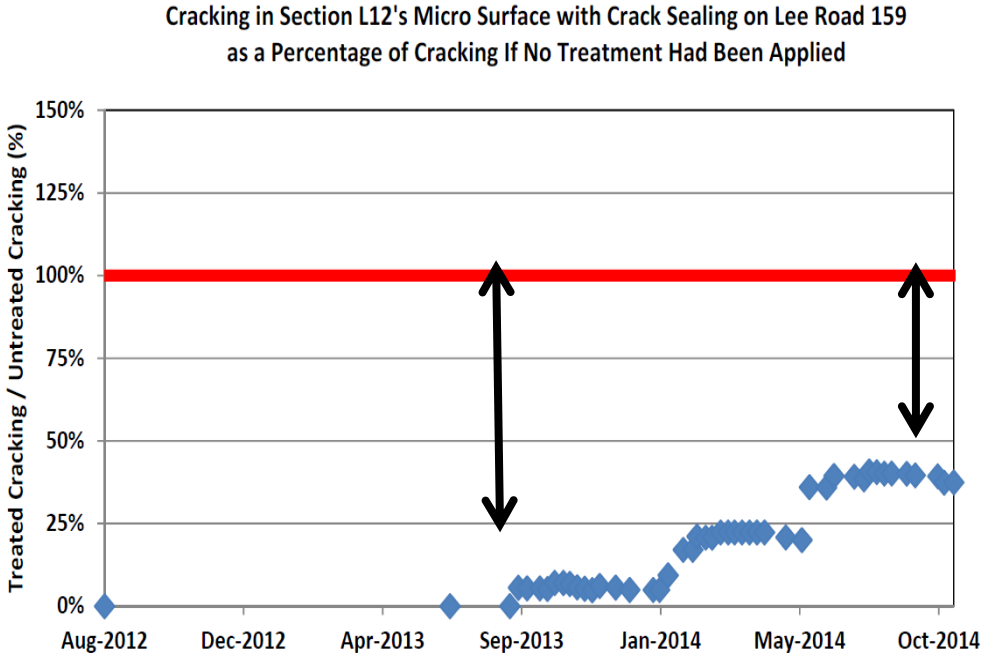


- NO crack sealing pretreatment
- At year 1, 50% less cracking than control
- At year 2, 15% less cracking than control

~50% Less Cracking compared to Control Section

~15% Less Cracking compared to Control Section

Results: L12 Micro Surfacing
(Over Crack Seal pre-treatment)



WITH crack sealing pretreatment:

- At year 1, there was 90% less cracking
- At year 2, there was 60% less cracking

WITHOUT crack sealing pretreatment:

- Only 15% less cracking at year 2

~90% Less Cracking compared to Control Section

~60% Less Cracking compared to Control Section

Impact of Crack Sealing

L12 – Micro Surface with Crack Sealing

Crack Sealing Effects Summary Over the 2 Year Evaluation

- **Crack Sealing alone**
  - Reduced cracking by 75% compared to no treatment
- **Crack Sealing as Chip Seal Pretreatment**
  - Reduced cracking by 100% compared to no pretreatment
- **Crack Sealing as Microsurfacing Pretreatment**
  - Reduced cracking by 45% compared to no pretreatment

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Questions?

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Intro to Crack Treatments Knowledge Check

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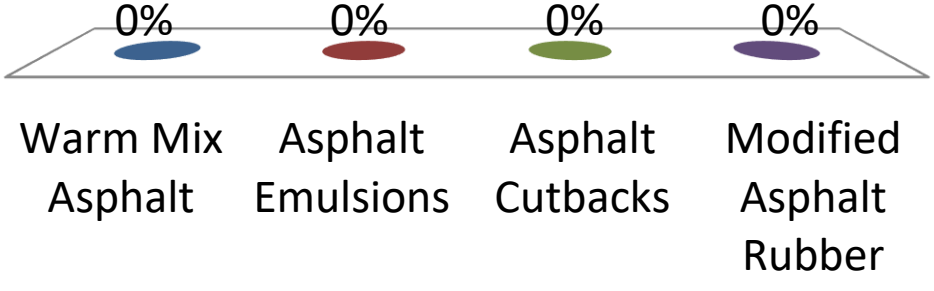
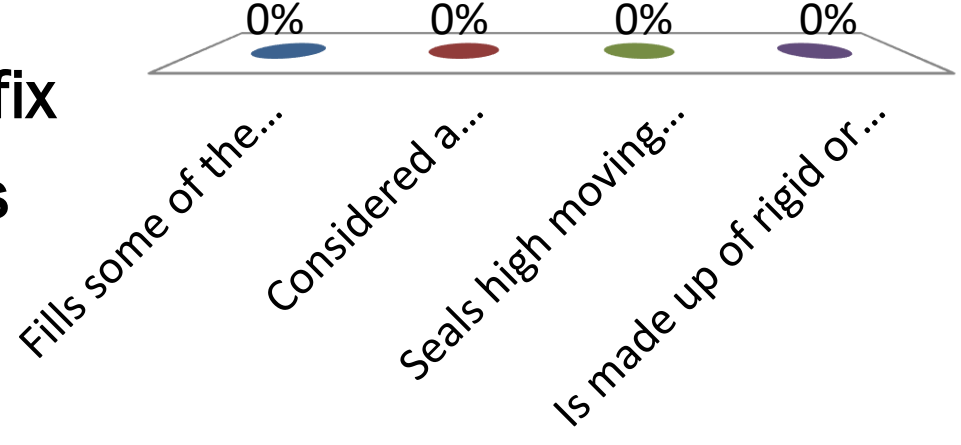
#1: Which of the following types of treatment materials are used for crack sealing?

A. Warm Mix Asphalt
B. Asphalt Emulsions
C. Asphalt Cutbacks
D. Modified Asphalt Rubber



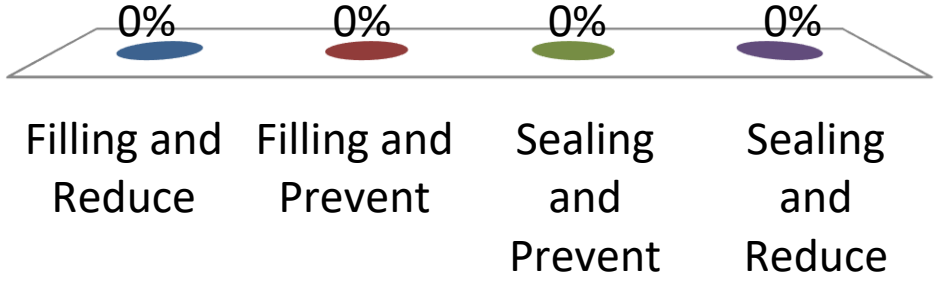
#2: Which of the following is NOT a characteristic of crack filling materials?

A. Fills some of the crack void to reduce the intrusion of water
B. Considered a temporary fix
C. Seals high moving cracks
D. Is made up of rigid or semi-rigid materials



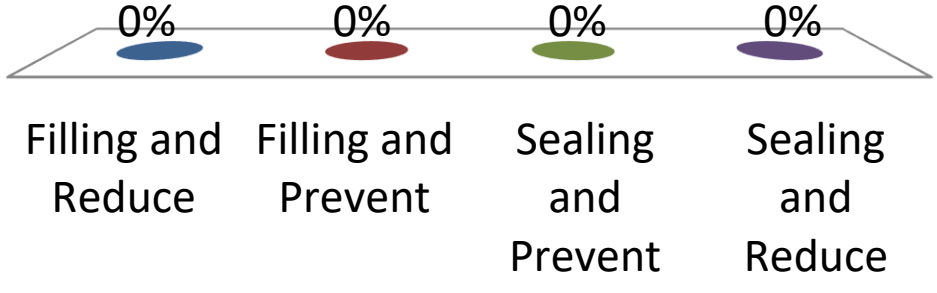
#3: Crack _____ is the placement of specialized treatment materials to _____ the intrusion of water and incompressible materials into the crack.

A. Filling and Reduce
B. Filling and Prevent
C. Sealing and Prevent
D. Sealing and Reduce



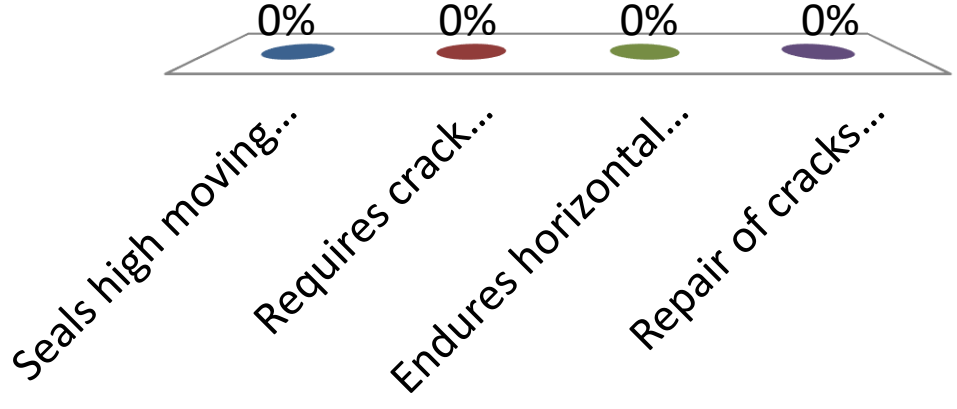
#4: Crack _____ is the placement of ordinary treatment materials to _____ the intrusion of water and reinforce the adjacent pavement.

A. Filling and Reduce
B. Filling and Prevent
C. Sealing and Prevent
D. Sealing and Reduce



#5: Which of the following is NOT a characteristic of crack sealing materials?

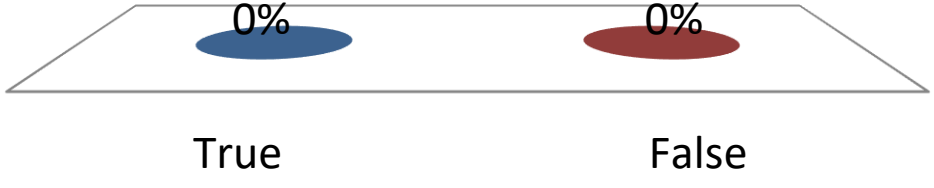
A. Seals high moving cracks and low moving cracks
B. Requires crack preparation to ensure long service life of the material
C. Endures horizontal and vertical movement
D. Repair of cracks greater than 1 ½" wide



#6: The graph below is accurate:

A. True
B. False

Crack Fillers:	Crack Sealants:
Asphalt Emulsion	Polymer Modified Asphalt
Liquid Asphalt	Asphalt Rubber



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Project Selection & Design

Agenda

Project Selection & Design

- Crack Movement
- Low Moving and High Moving Cracks
- Crack Growth
- Crack Formation and Types
- Pavement Condition
- Crack Density
- Crack Width
- When is pavement too far gone for crack treatment?

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Crack Movement

- Horizontal Thermal Movement
  - Temperature changes
  - Pavements contract during lower winter temperatures, opening cracks in the pavements
  - Pavements expand during higher summer temperatures, closing cracks in the pavements
- Vertical Movement
  - Up and down movement
  - Caused by traffic loads

Cracks can open up to 100% of original width as the pavement temperature changes from summer to winter extremes

Rate	0 - 0.004 mm/min
Daily	0 - 2 mm
Seasonal	0 - 25 mm

Low Moving Cracks

- Defined as annual movement less than 1/8” (3 mm) per year
- Types are typically:
  - Fatigue (alligator)
  - Block
- Low moving cracks grow average of 1mm annually

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High Moving Cracks

- Defined as annual movement greater than or equal to 1/8” (3mm)
- High Moving Cracks:
  - Transverse are always moving
  - Other moving cracks:
    - Reflective
    - Thermal
    - Longitudinal
    - Edge
- Can open up to 100% of original width as the pavement temperature changes from summer to winter extremes
- May move up to 1” each year

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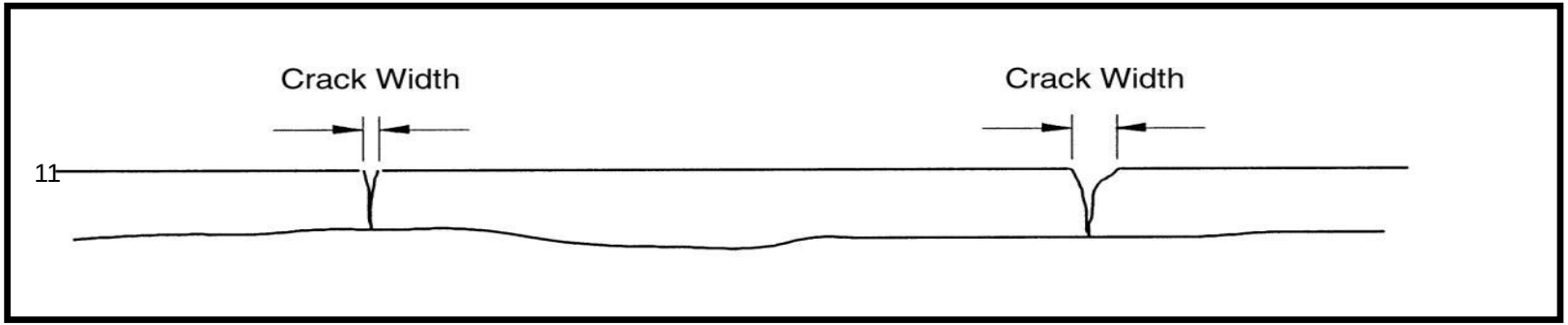
Crack Growth



- Cracks tend to widen or grow over time
  - Asphalt shrinkage with age
  - Thermal movement
  - Debris ravels crack face
- Proper crack sealing will delay and prevent further deterioration and growth of the crack

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Crack Formation & Types

- Cracks occur when the AC is no longer flexible enough to resist weather/traffic
  - Traffic loadings
  - Seasonal temperature changes
- Asphalt concrete is most flexible and resistant to cracking at construction

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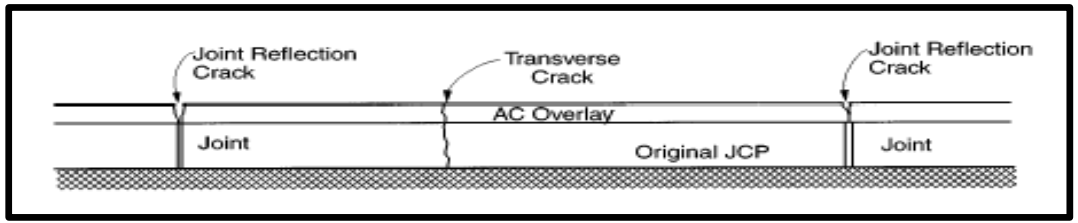
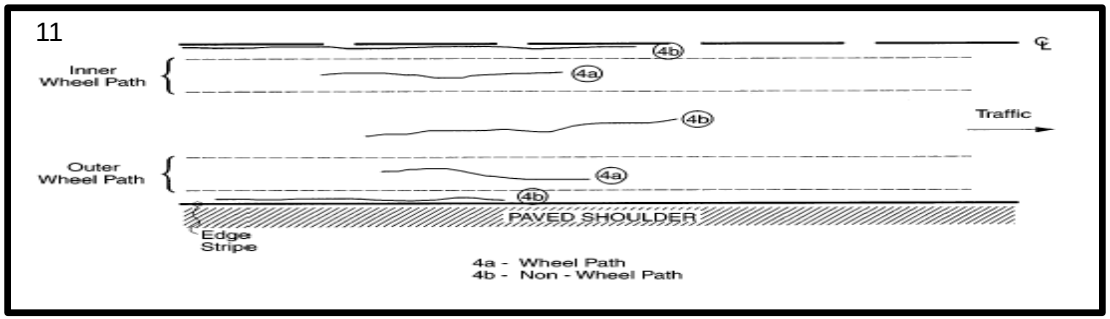
Transverse

- Transverse cracks form perpendicular to the pavement lane
  - Thermal
  - Reflective (Reflection)
- Typically caused by environmental factors and by reflection of underlying joints
- Often experience concentrated and extreme movement
- Crack Sealing (and routing when appropriate) is recommended to accommodate the expected crack movement



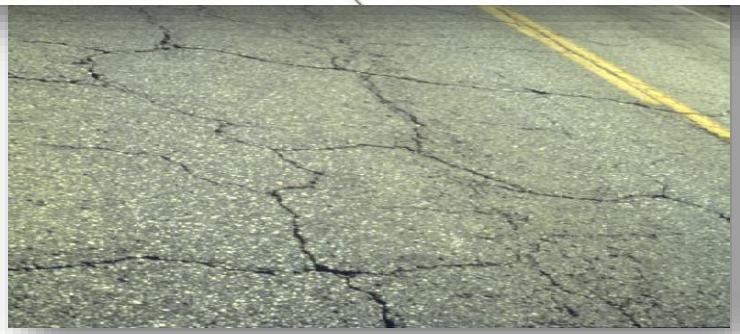
Longitudinal

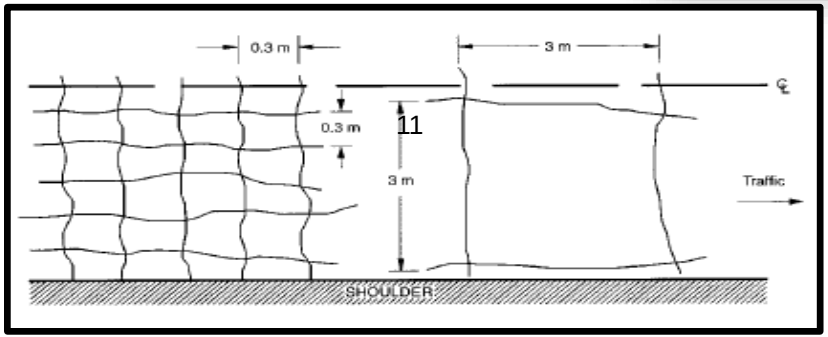
- Longitudinal cracks run parallel to the pavement lane
  - Construction Joint
  - Thermal/Reflective
  - Wheel path
- Typically caused by construction of pavement joint, thermal conditions, and traffic loading
- Crack Sealing (and routing when appropriate) is recommended to prevent intrusion of moisture and debris.



Block

- **Block cracks typically form in older pavement**
  - Hardening of asphalt
  - Thermal effects/shrinkage of asphalt during cold weather
  - Form in traffic and non-traffic areas
- **Effectively treated by crack sealing** [16]





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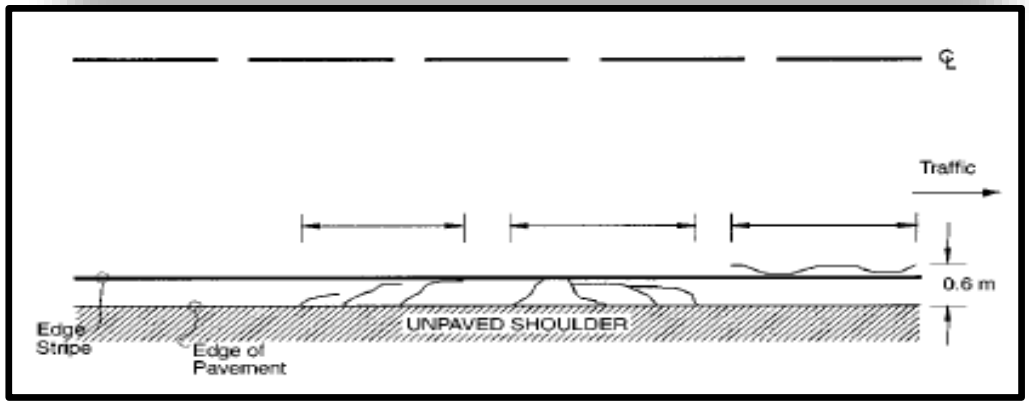
Edge

- Edge cracks typically form due to:
  - Lack of lateral support
  - Settlement of underlying material
  - Weak base
  - Heavy traffic along edge
- Prevent intrusion of run-off water and debris by crack sealing



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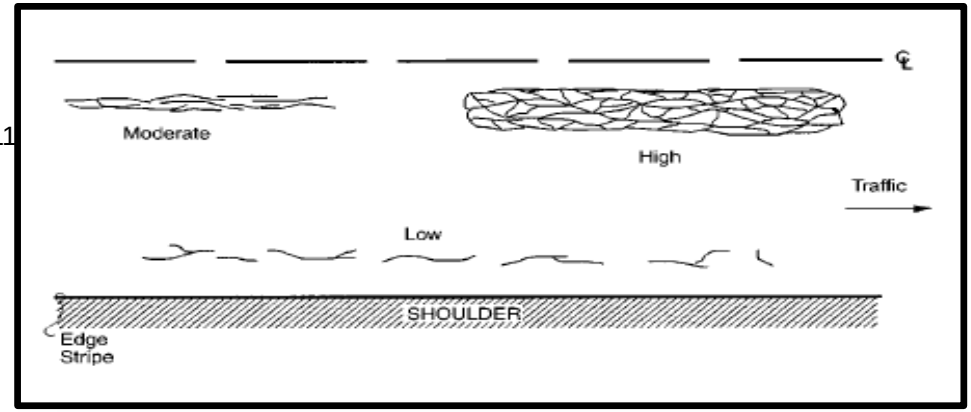
Fatigue

- Fatigue cracks are also known as “alligator” cracks
- Indication of structural failure
- Typically occurs later in a pavement’s life due to high traffic loads
- Crack seal or fill cracks larger than 1/8” (3mm) as a pre-treatment to other surface treatments



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Crack Density

Greater than 20% Crack Density

Less than 20% Crack Density

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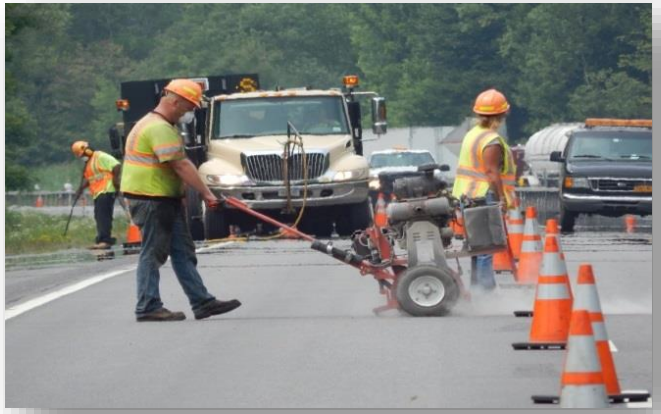
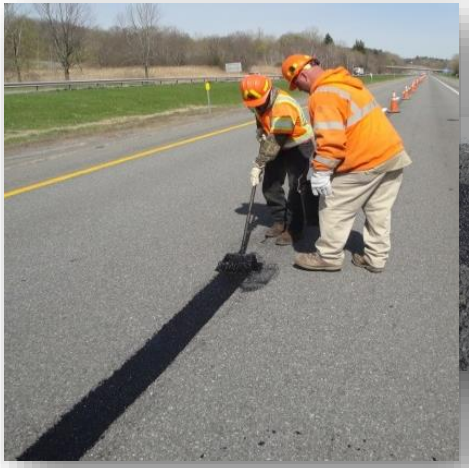
Crack density can be used as a general guideline to determine whether or not routing is appropriate. Dependent upon other pavement variables, routing may or may not be appropriate outside of these guidelines.

Crack	Crack Width	Crack Density Less than 20%	Crack Density Greater than 20%
Hairline to Large	≤ 1/8” (3mm) – 1 ½” (38mm)	Rout & Seal	Seal Rout to clean, if applicable
Wide	>1 ½” (38mm)		Seal with Mastic

Rout and Seal cracks up to 1 ½” (38mm) wide

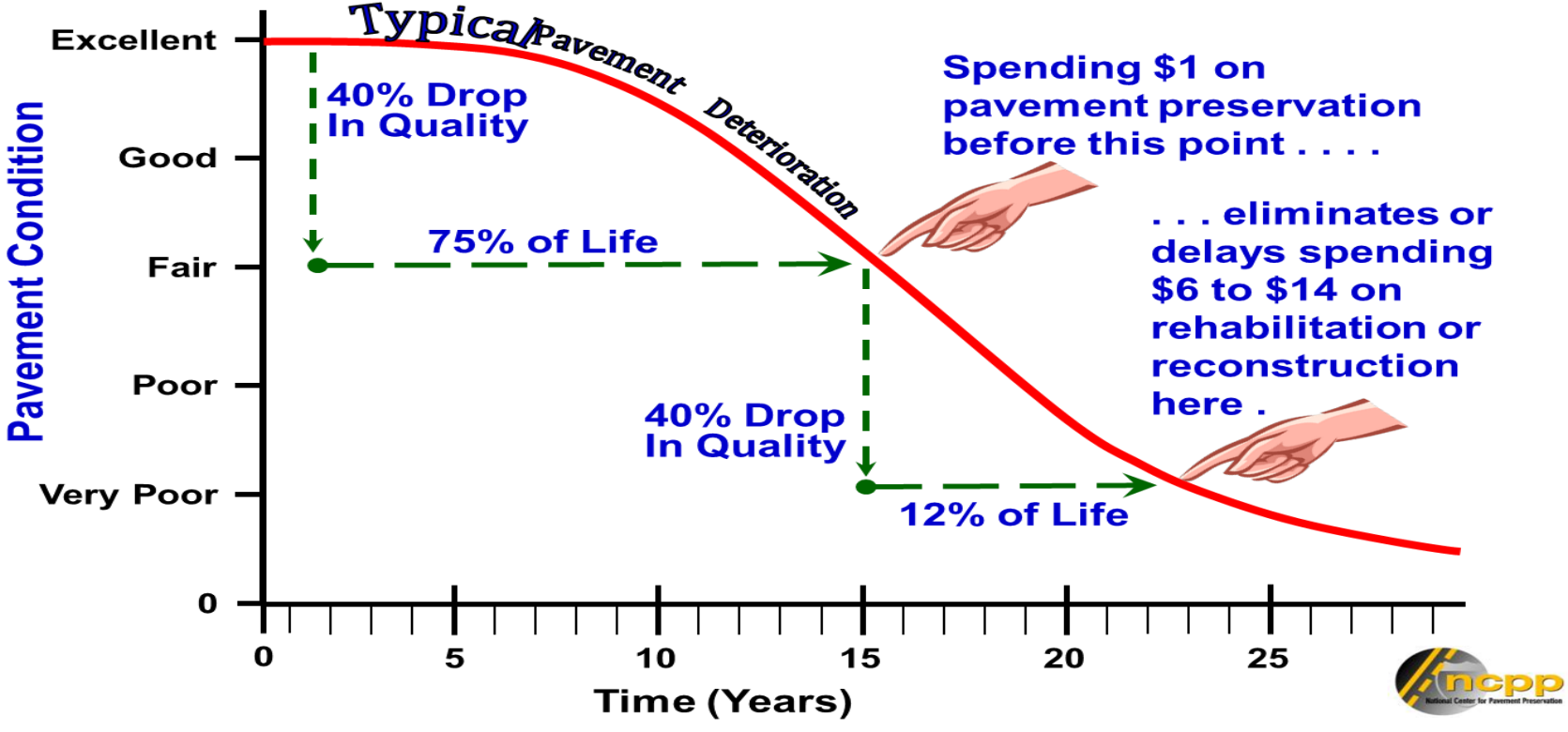


Use Mastics to seal wide cracks



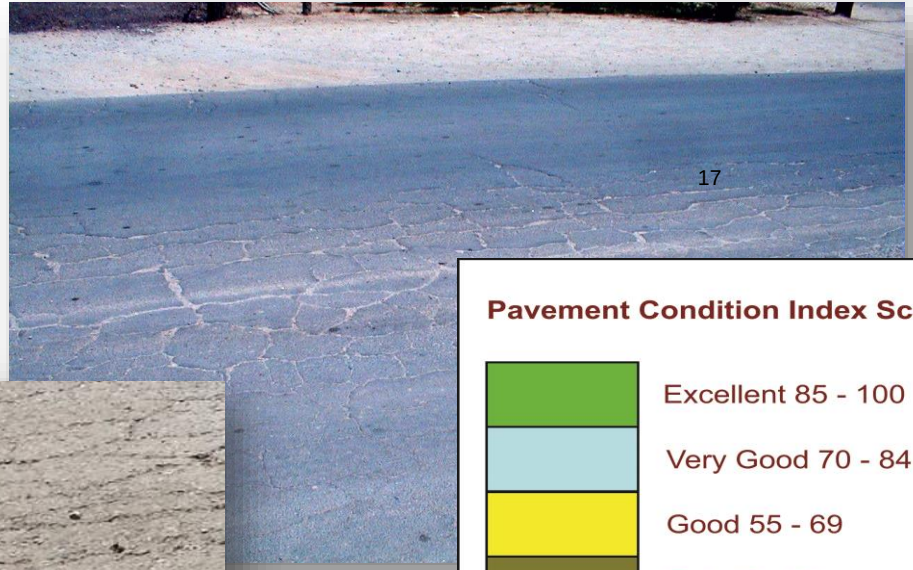
When to Crack Seal?

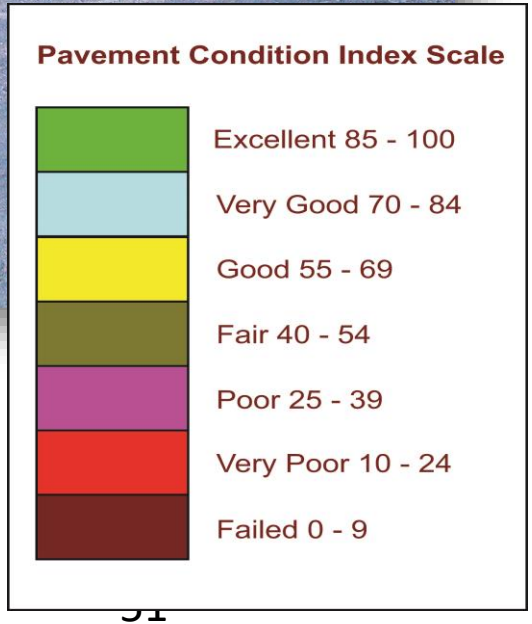
Pavement Preservation is Cost Effective



Pavements Too Far Gone for Crack Treatment

- **Extensive fatigue cracking**
- **Structural failure of underlying pavement base**
- **PCI**
  - Very Poor
  - Failed





Seasonal & Environmental Factors

Crack Sealing can be accomplished in all 4 seasons:

- Summer is typical/customary
- Spring & Fall are optimal
- Winter crack sealing can be done with proper care and if conditions are appropriate

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Seasonal & Environmental Factors

Winter Crack Sealing

- Winter is a good alternate
- Performed in virtually any outside air temperature
- Need dry crack warmed to 40°F
- Hot Air Lance
- Extend your preservation season! Crack seal when no other treatments can be performed

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Winter Crack Sealing

Winter Crack Sealing Tips

- Clean, dry cracks and proper temperature are the keys to effective crack sealing
- Having a dry road is even more important than air or pavement temperature
- When sealing in the winter, choose a softer, more flexible sealant
- Apply sealants at the upper-end of their recommended application temperature range.
- Ensure that your equipment is ready to work in the cold
- Keep the sealant narrow and tight to the pavement to minimize exposure and damage from traffic and snow plows

Seasonal & Environmental Factors

- Work force availability
- Traffic conditions
- Conjunction with other projects

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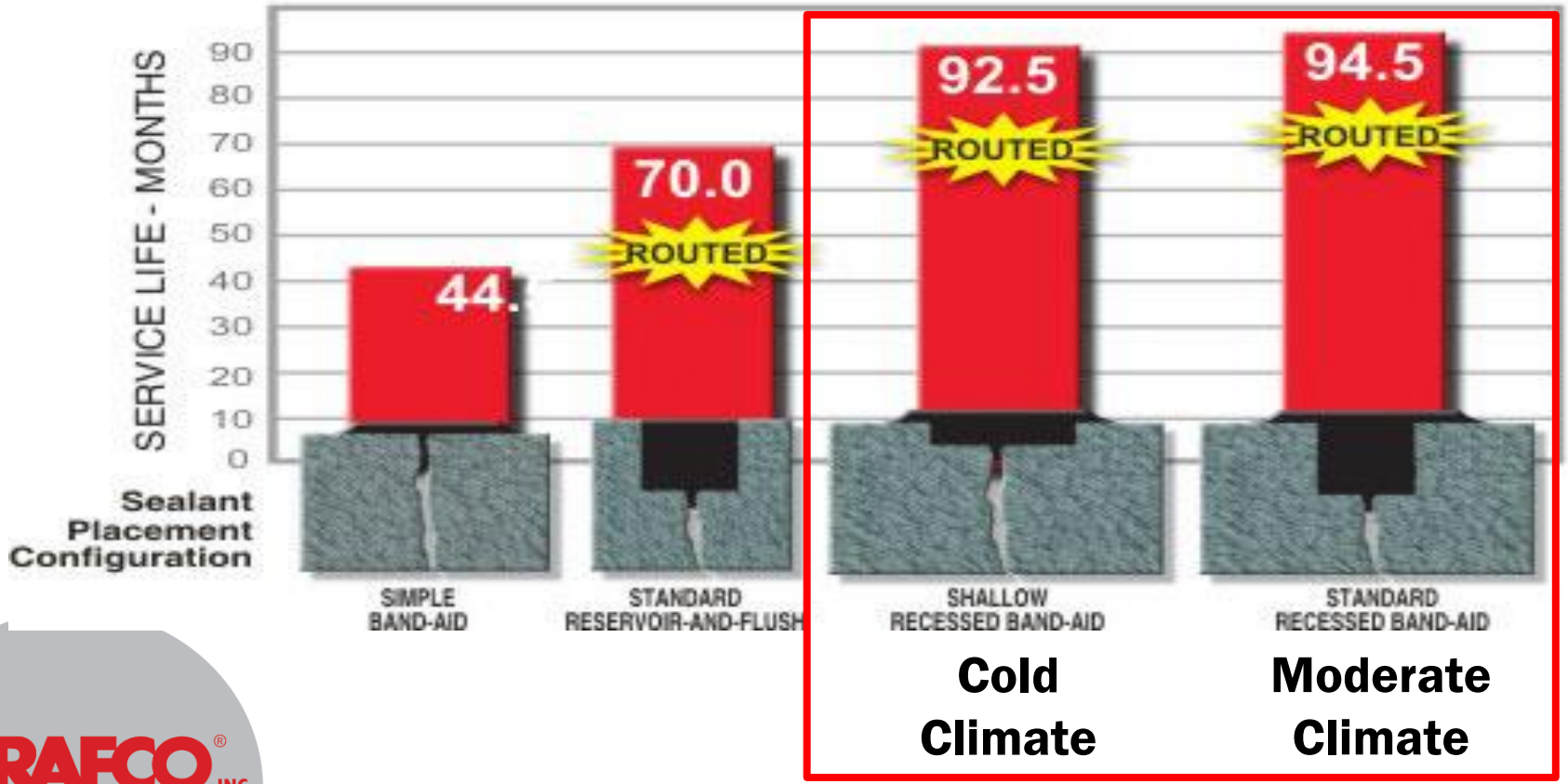
Reservoir Design Dimensions



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Questions?

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Project Selection & Design Knowledge Check

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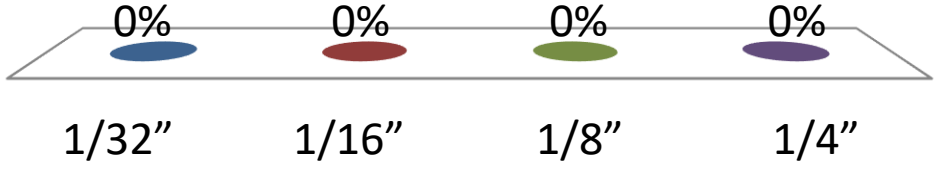
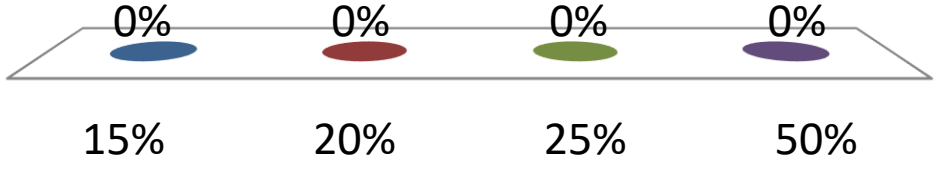
#7: Cracks that move less than _____ per year are considered to be “low moving” cracks

A. 1/32”
B. 1/16”
C. 1/8”
D. 1/4”



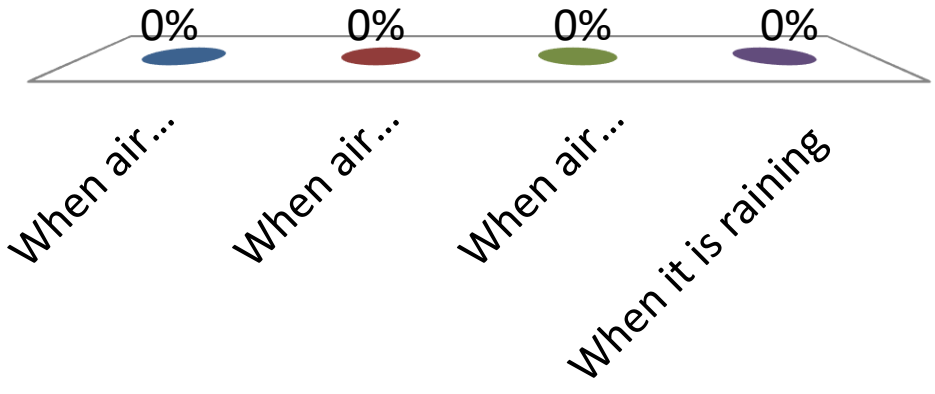
#8: Pavements with a crack density less than ___% are recommended for routing where appropriate

A. 15%
B. 20%
C. 25%
D. 50%



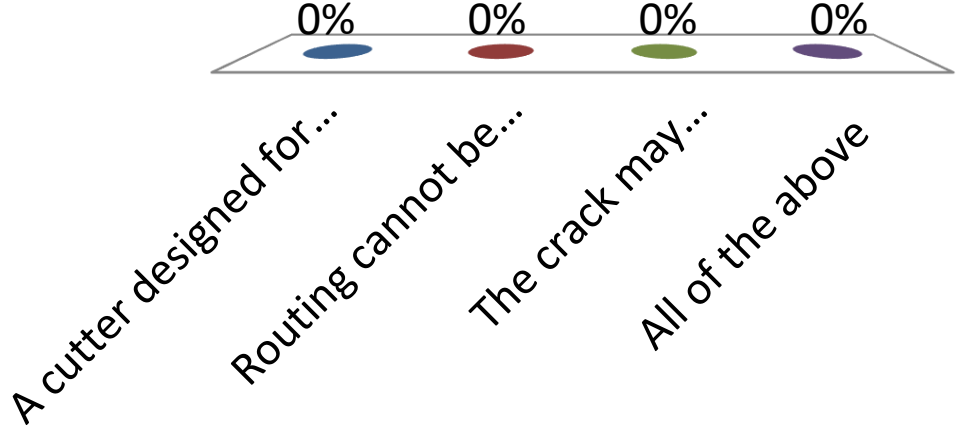
#9: Which of the following conditions are ideal for performing crack sealing?

A. When air temperatures are high and high moving cracks are all the way closed
B. When air temperatures are low and high moving cracks are all the way open
C. When air temperatures are moderate and high moving cracks are neither open nor closed
D. When it is raining



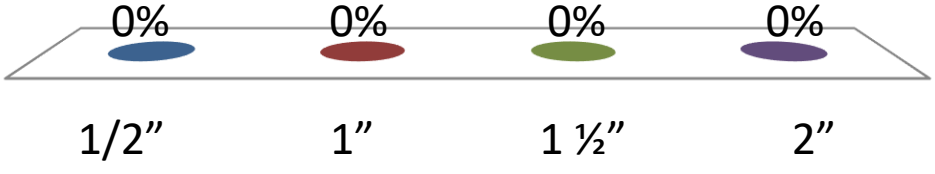
#10: Which of the following is true of routing in a cold weather climate?

A. A cutter designed for cold weather climates must be used
B. Routing cannot be performed when the pavement temperature is less than 50° F (10° C)
C. The crack may require a wide, shallow reservoir
D. All of the above



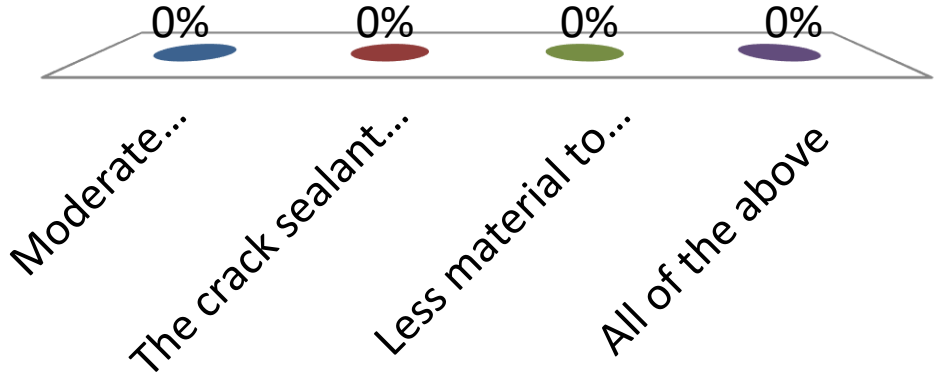
#11: A reservoir should never be greater than _____ inches wide

A. 1/2”
B. 1”
C. 1 ½”
D. 2”



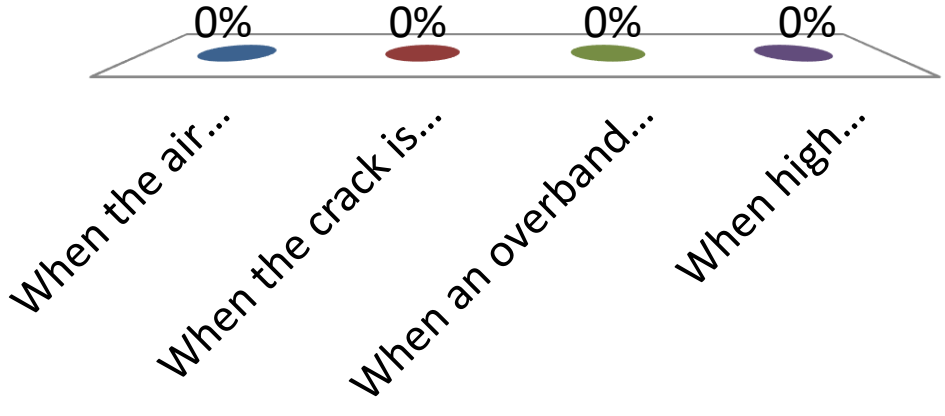
#13: Why are spring and fall the ideal time to perform crack sealing?

A. Moderate temperatures mean the crack is neither fully open nor closed
B. The crack sealant within the crack is under tension in the summer when expansion is at its greatest
C. Less material to remove from the crack such as weeds
D. All of the above



#14: Under what circumstance should a crack sealing mastic be used?

A. When the air temperature is below 40°F
B. When the crack is greater than 1 ½" wide
C. When an overband configuration is being placed
D. When high temperature stability is desired



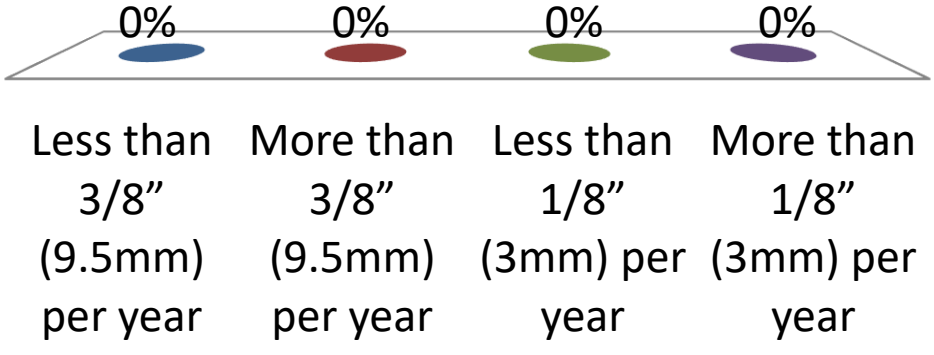
#16: A **high moving** crack is defined as having annual movement of _____

A. Less than 3/8” (9.5mm) per year

B. More than 3/8” (9.5mm) per year

C. Less than 1/8” (3mm) per year

D. More than 1/8” (3mm) per year



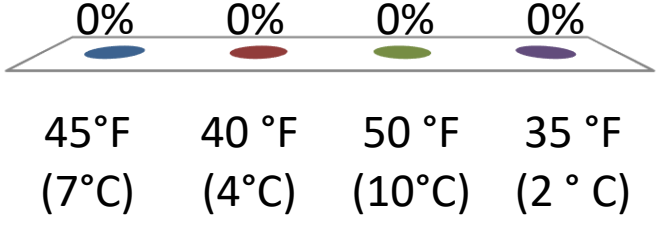
#17: It is recommended that the pavement temperature be at least ____ ºF/C when crack sealing. In colder climates or during winter crack sealing, this can often be achieved by using a hot air lance to heat the crack.

A. 45°F - (7°C)

B. 40 °F - (4°C)

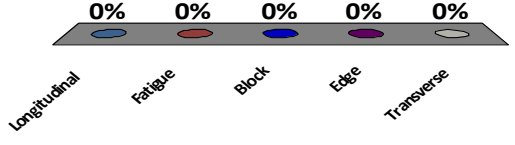
C. 50 °F - (10°C)

D. 35 °F - (2 ° C)



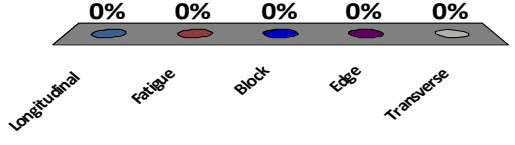
#19: Name that Crack!

A. Longitudinal
B. Fatigue
C. Block
D. Edge
E. Transverse



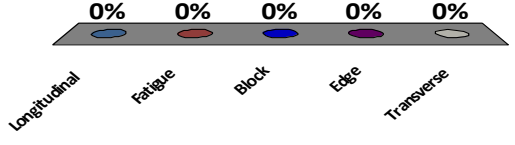
#20: Name that Crack!

A. Longitudinal
B. Fatigue
C. Block
D. Edge
E. Transverse



#21: Name that Crack!

A. Longitudinal
B. Fatigue
C. Block
D. Edge
E. Transverse



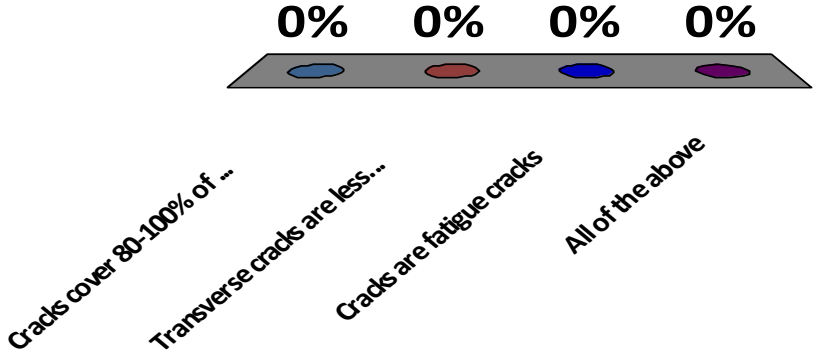
#22: Under which of the following circumstances is crack sealing not recommended?

A. Cracks cover 80-100% of the pavement

B. Transverse cracks are less than 30” apart

C. Cracks are fatigue cracks

D. All of the above



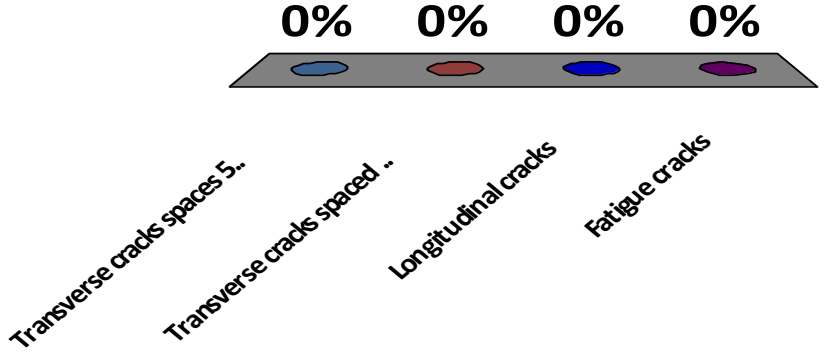
#23: Which of the following cracks is likely to experience the highest amount of movement?

A. Transverse cracks spaces 50’ apart on average

B. Transverse cracks spaced 5’ apart on average

C. Longitudinal cracks

D. Fatigue cracks



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Quality • Success • People • Integrity • Relationships • Innovation • Tidy

Materials

Agenda

Analyze factors that can influence sealant selection and performance.

- Stresses
- Climate
- Specifications
- Sealant Properties
- Pavement Conditions
- Construction/Installation

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Factors Influencing Sealant Selection

Crack Sealant is subjected to a variety of stresses:

- Horizontal expansion and contraction
- Vertical movement from traffic loads
- Exposure to water from rain and snow
- Aging environmental effects
- Abrasion (traffic, street sweeping, snowplows)
- Temperature extremes between seasons

Effective performance calls for sealant properties that will permit functionality under these stresses.

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Stresses

Traffic / Load Stresses

Seasonal / Environmental

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Climate

- Location High temperatures
- Location Low temperatures
- Installation time of the year

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Climate

Climate Considerations

- Sealant is subjected to the extreme high and low temperatures
  - Warmer climates require material stiffness to resist flow and tracking.
  - Cooler climates require a softer material for flexibility to allow pavement movement without sealant cracking-debonding.

- Sealant material performance is controlled by the relationships and interactions of:
  - low temperature
  - high temperature
  - adhesive and elastic properties over the entire range of temperatures and strains experienced.

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Project Specifications - ASTM

- ASTM = American Society for Testing and Materials
- AASHTO = American Association of State Highway Transportation Officials
- Agency, State, and Local Specifications
- Manufacturer Specifications
- Sealant specification are not exclusive to ASTM or AASHTO criteria

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Project Specifications - ASTM

- **ASTM D5329**: Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements
  - This explains how the tests are to be conducted.

- **ASTM D6690**: Standard Specification for Joint and Crack Sealants, Hot Applied for Concrete and Asphalt Pavements
  - This details the required tests that must be conducted (and fall within appropriate ranges as outlined in ASTM D5329) in order to meet the spec for Crack Sealants

- **ASTM D5078/D5078M**: Standard Specification for Crack Filler, Hot-Applied, for Asphalt Concrete and Portland Cement Concrete Pavements
  - This details the required tests that must be conducted in order to meet the spec for Crack Fillers

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ASTM D6690/AASHTO M324

Low Temperature	Specify
-34,-40	D6690 Type IV
-22,-28	D6690 Type II,III
-16	D6690 Type I
-10	State, local specs

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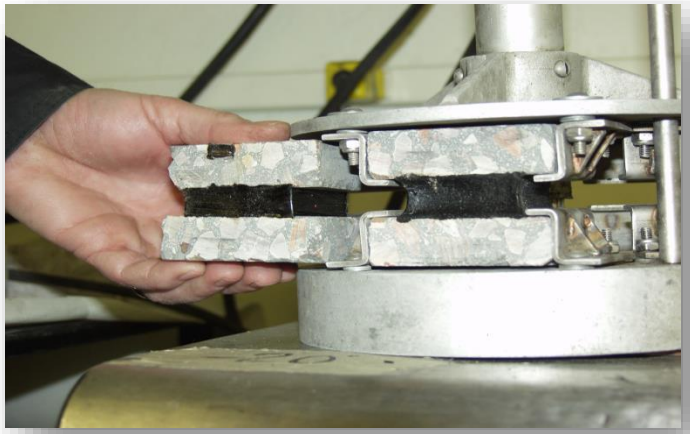
Adhesion - Bond Test



- Evaluates the ability of the material to remain adhered to concrete test block when extended multiple times.
- Temperature, # of cycles, block conditions, specimen size, and extension % can vary with the specification and grade of tested material.
- Failure shows as adhesive or cohesive separations when extended.

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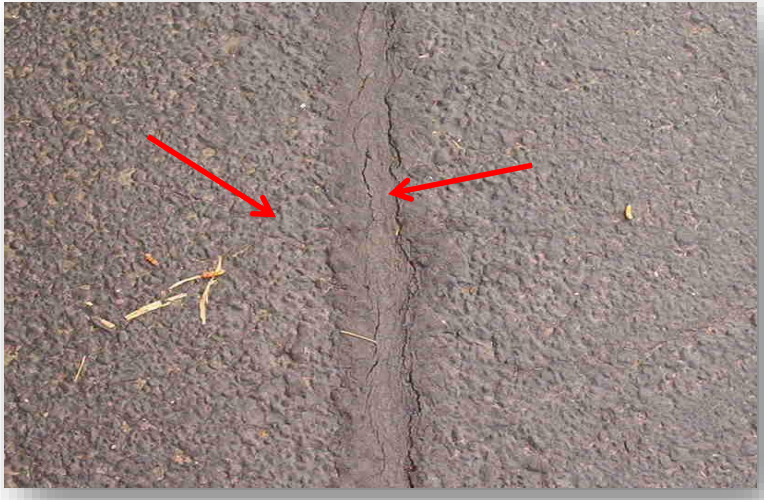
Adhesion

Adhesive Failure



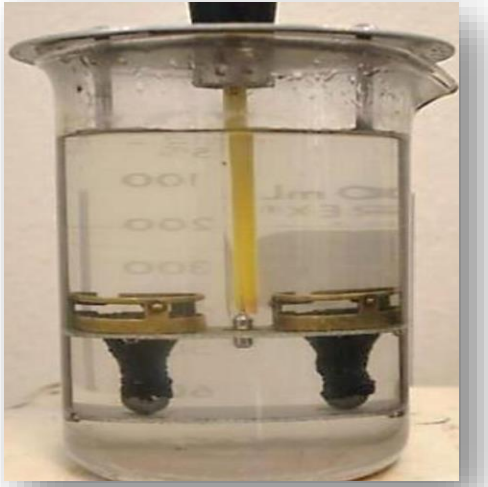
Adhesive failures occur when the sealant pulls away from the sides of the crack

Cohesive Failure

Cohesive failure occurs when the sealant remains adhered to the sides of the crack and the sealant itself pulls apart

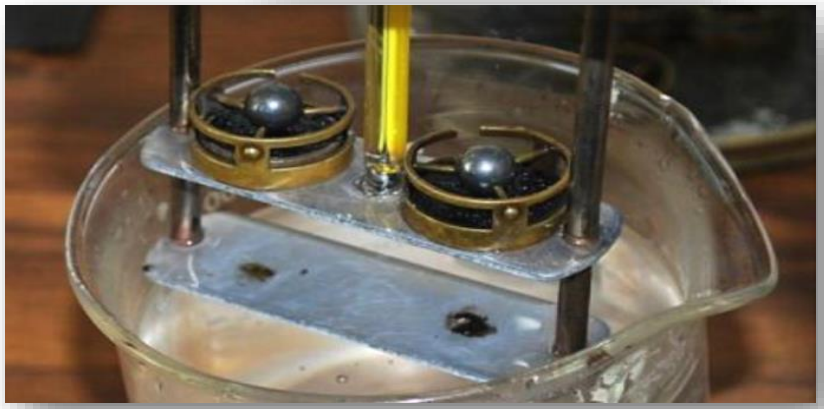
Softening Point

Indicates the temperature at which the material changes from a solid to viscous liquid. The higher the softening point, the more resistant to tracking the material is.



Materials that meet 176 F° minimum, are best for reservoir applications

Overbands require higher minimum softening temps. Best materials can be heated to 45 F° above pavement before softening.



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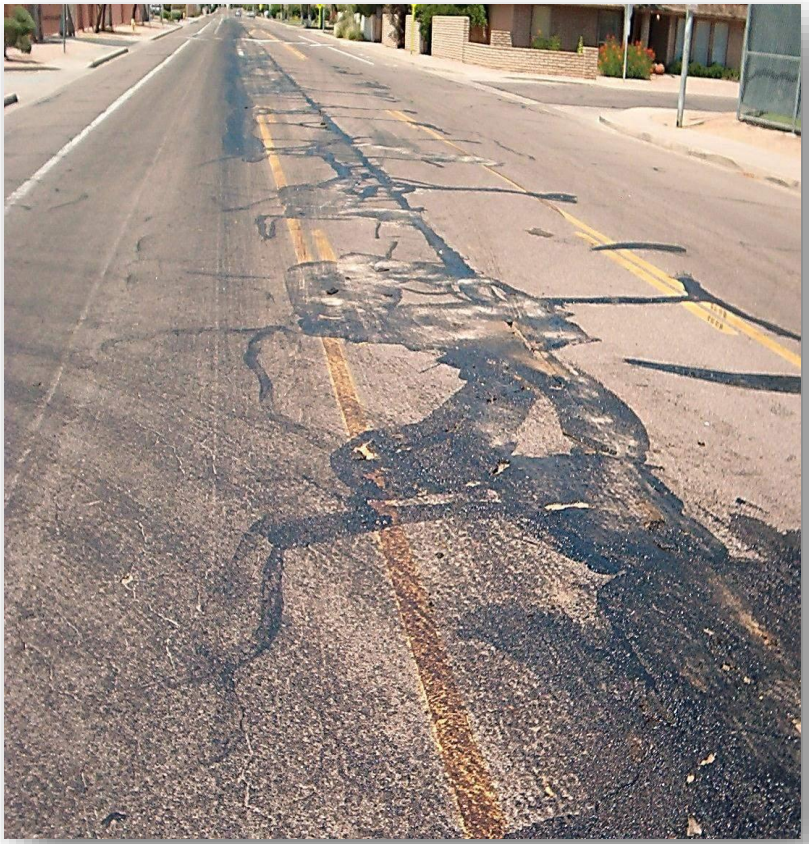
Tracking



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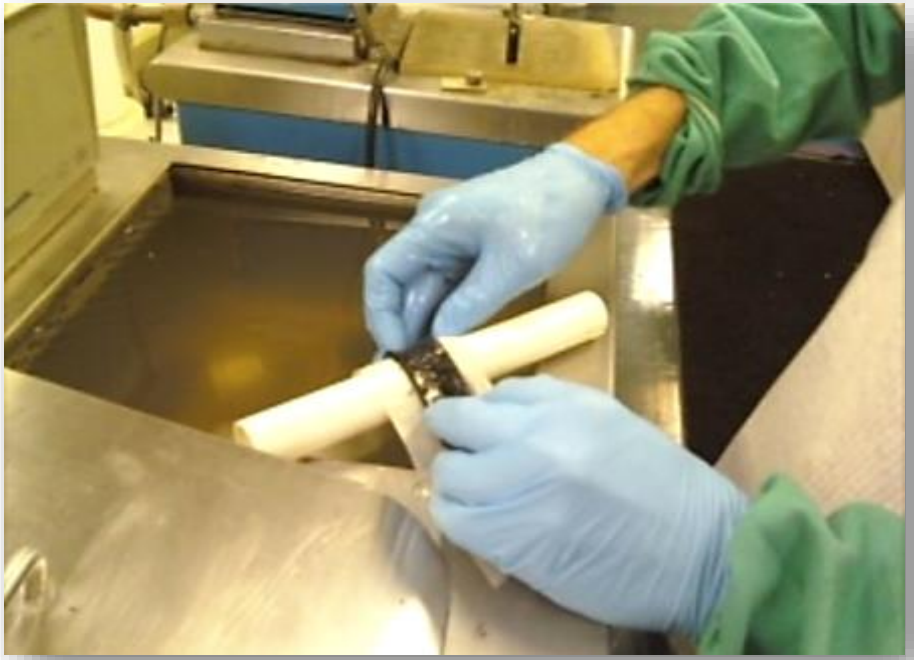
Flexibility

- Often called the bend or fracture test
- Indicates the ability of an 1/8” x 1”x4” specimen to be bent around a mandrel at specific temperatures without cracking
- Indicates the temperature at which sealant stiffens and loses flexibility



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Cone Penetration

- Indication of material hardness or stiffness at a specified temperature (77°F is standard).
- Measures the amount of indentation of a specified cone with a specific weight (150 grams is standard) for a specific time (5 seconds is standard).
  - Higher penetration indicates softer material.

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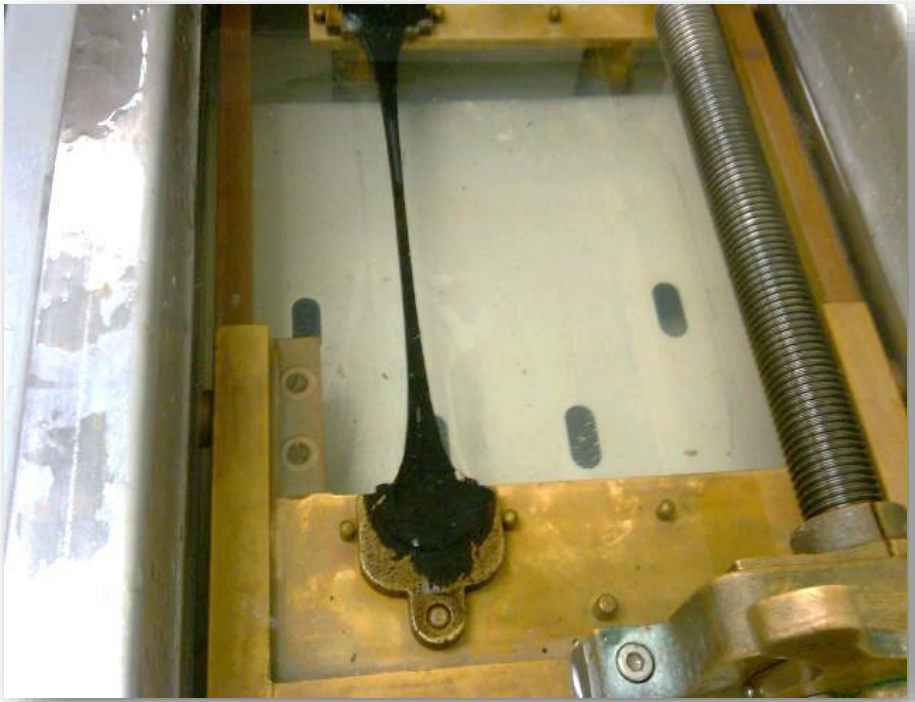
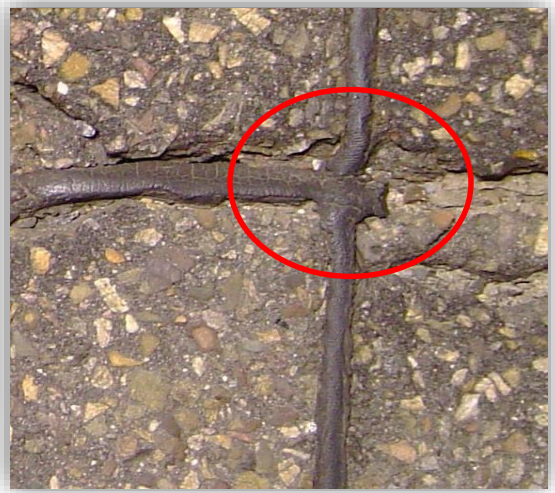
Ductility



Ductility - Measures the amount of extension a material will take at a specific temperature and rate of extension.



Sealant unable to elongate becomes brittle and fails

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Elasticity

- Higher resilience = higher elastic rebound and strength
- Lower resilience = less elastic rebound and resistant to elongation

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Viscosity

Viscosity is measured in units of centipoise with rotational Brookfield-type viscometers.

<u><1500 cp</u> -- Very flowable, very self leveling

Use *Crafco DF, Superflex*

<u>1500-4000 cp</u> -- Self leveling

Use *RoadSaver211, 221, 515*

<u>4,000-10,000 cp</u> -- Moderate high

Use *RoadSaver201*, *Polyflex, AR+*

<u>10,000cp - 15,000 cp</u> -- High

Asphalt Rubber, High Fiber materials

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Sinkers

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Sealant Properties - Review

Sealants must withstand various stresses to perform correctly.

9 desired properties exist – 5 of which are commonly included in crack sealant job specifications (specs).

Importance of the tests and resulting failures if sealant does not maintain said property.

Understanding desired properties to select the appropriate sealant for the job.

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Pavement Conditions

- Pavement Type – Asphalt, Concrete or Composite
- Crack Type: Longitudinal, Transverse, Reflection, etc
- Crack Spacing/Density
- Future maintenance-overlays, surface treatments
- Traffic: speed, loads, volume, parking lot, foot, snow plows
- Crack width
- Slopes / super elevation

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Installation/Construction

- Melter Type
- Cleaning Methods
- Installation Configuration
- Contractor Experience
- Traffic

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Questions?

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Materials Knowledge Check

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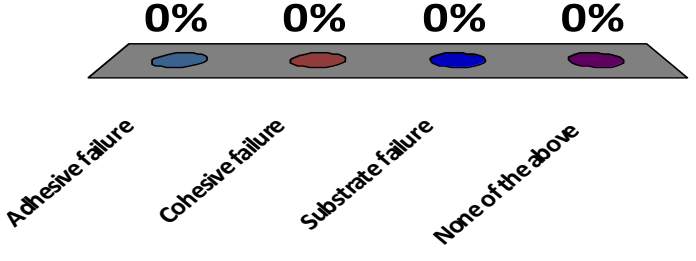
#36: What type of failure occurs when the sealant remains adhered to the walls of the crack but the sealant in the void of the crack splits?

A. Adhesive failure

B. Cohesive failure

C. Substrate failure

D. None of the above



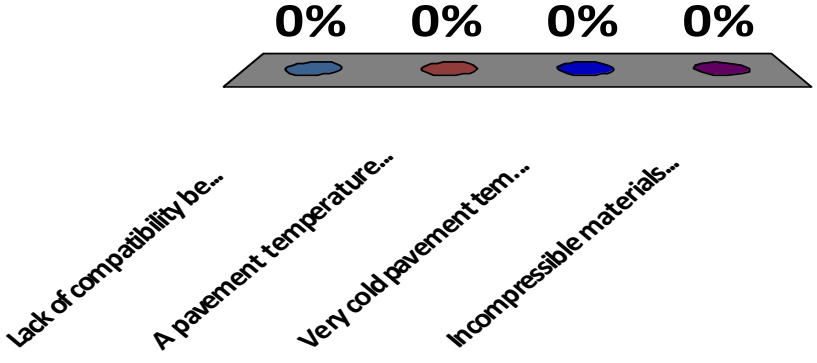
#37: The tracking of cured crack sealant by vehicles is most likely due to:

A. Lack of compatibility between crack sealant and asphalt

B. A pavement temperature higher than the sealant is designed to withstand

C. Very cold pavement temperature

D. Incompressible materials entering the crack



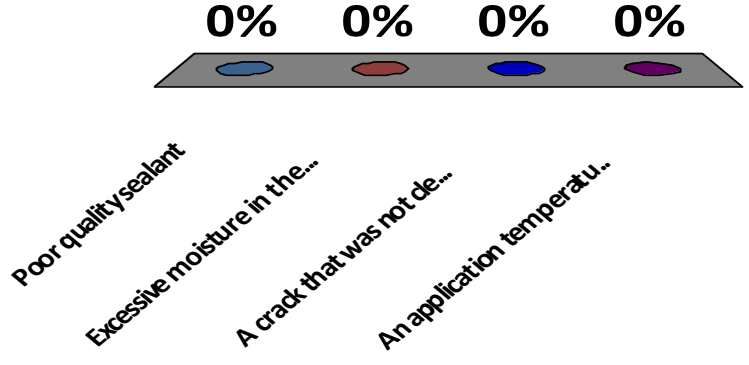
#39: The excessive bubbling of sealant is indicative of what?

A. Poor quality sealant

B. Excessive moisture in the crack

C. A crack that was not cleaned properly

D. An application temperature that is too high



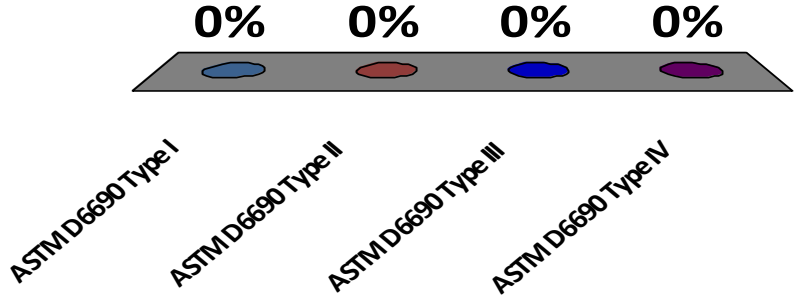
#41: Which classification of crack sealant is best suited for maintaining an effective seal in extremely low temperature environments?

A. ASTM D6690 Type I

B. ASTM D6690 Type II

C. ASTM D6690 Type III

D. ASTM D6690 Type IV



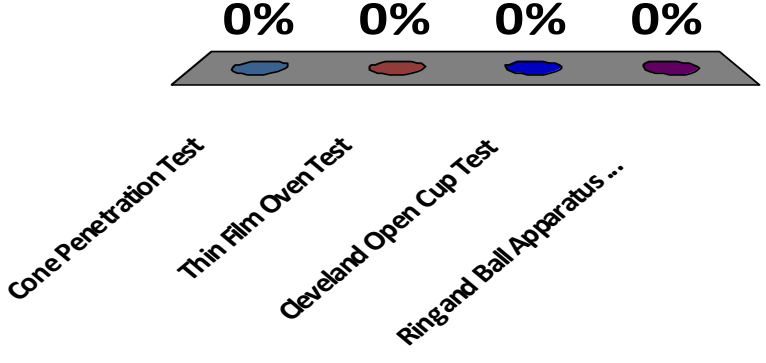
#42: Which of the following tests is used to determine the softening point of crack sealant?

A. Cone Penetration Test

B. Thin Film Oven Test

C. Cleveland Open Cup Test

D. Ring and Ball Apparatus Test



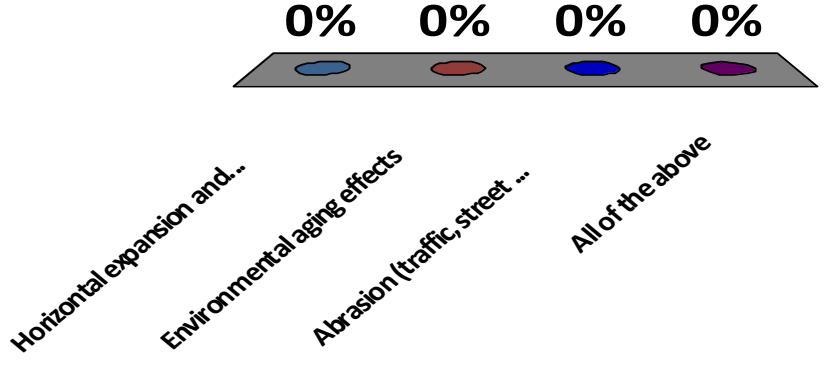
#43: Which of the following best describes the stresses to which crack sealant must withstand?

A. Horizontal expansion and contraction from seasonal temperature changes

B. Environmental aging effects

C. Abrasion (traffic, street sweeping, snowplows)

D. All of the above



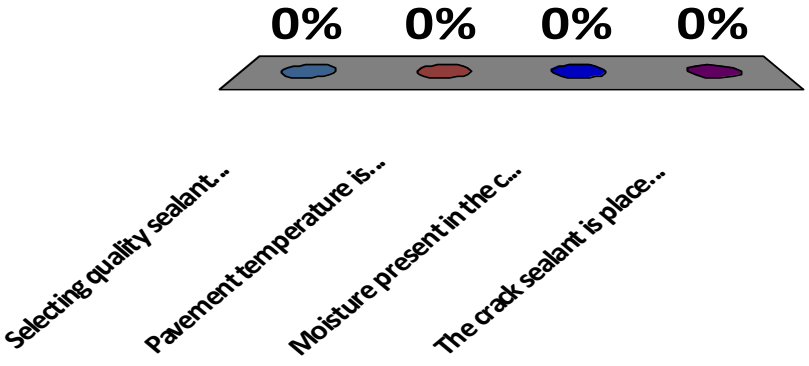
#44: Which of the following is NOT a cause of crack sealant adhesive failure?

A. Selecting quality sealant and completing a quality installation

B. Pavement temperature is too cold at application

C. Moisture present in the crack during application

D. The crack sealant is placed on weak or deteriorated pavement



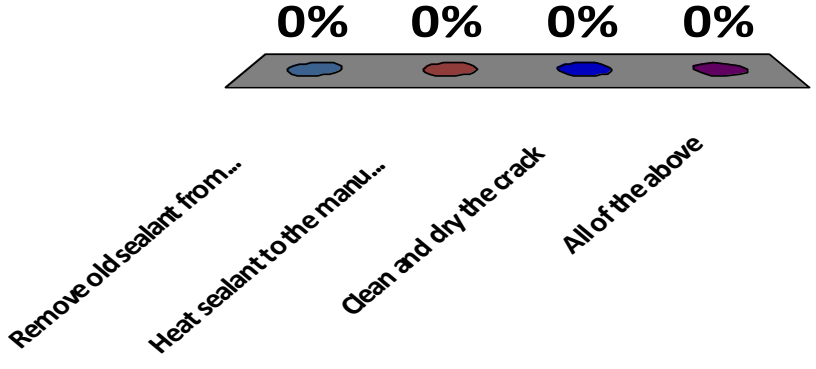
#45: Which of the following steps should be taken to avoid sealant adhesive failure?

A. Remove old sealant from the crack prior to resealing

B. Heat sealant to the manufacturer's recommended application temperature range

C. Clean and dry the crack

D. All of the above



Proper Installation

Overview

- Appropriate Sealant and Appropriate Application are the two most important factors for an effective crack treatment
- Cracks need to be Clean and Dry
- Pavement temperature and condition

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Agenda

Construction Best Practices

a. Preparation
b. Reservoir Cutting
c. Proper Sealant Heating
d. Maintaining Melter Temperatures
e. Equipment
f. Application Configurations
g. Finishing
h. Personnel, Traffic Control, Safety, Opening to Traffic, and Re-sealing

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Preparation Best Practices

- Structurally sound pavement
- Dry Crack
- **Clean Crack

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Structurally Sound Pavement

- Intact Bonding Surface
- Tight, strong surface
- No surface raveling
- No Loose aggregate

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Dry Crack

- Surfaces Need To Be *DRY*
- Dry pavement surface and crack interior
- *NO* dampness
- *NO* darkening or discoloration due to moisture
- *NO* frost or dew

Moisture will prevent proper adhesion and guarantee sealant FAILURE

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Weather Considerations

Ideal Conditions:

- Moderate to warm temperatures
- Little to no wind
- Spring and Fall

Weather Considerations:

- Wind
- Temperature
  - 40° F (4° C) and rising
  - Hot air lance in cooler conditions
  - Cloud coverage and shade
  - Rain

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Clean Crack

- Surfaces Need To Be Clean
- Pavement surface and crack walls free from dirt and debris
- Dirt will prevent proper adhesion

Unclean Crack

Clean Crack

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Crack Cleaning

- Compressed Air
- Vacuum in combination with compressed air
- Hot Air Lance
- Wire Brushing

**Cleaning operations should take place immediately before crack sealing*

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Compressed Air

Crack cleaning via Compressed Air:

- Blow out debris, dirt, weeds etc.
- Blow debris away from traffic and co-workers
- Ensure that operator is staying within the traffic control lane during cleaning
- Ensure sufficient pressure and velocity
  - Recommended air pressure minimum 90 PSI
- “Finger Test” inspection to determine if cleaning is sufficient

Compressed air is the most common method to clean and prepare cracks

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Compressors

- High pressure air compressors with hoses and wands
- Maintain your compressor according to manufacturer instructions:
  - Check oils
  - Drain air receiver
  - Oil and Air Filters

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Compressors

- High pressure air compressors are effective at cleaning out cracks prior to sealing; an important step in the application process
- Ensure compressor capacity to maintain effective high pressure

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Crack Cleaning w/ an Air Compressor

Vacuum Systems

- Vacuum systems
- Environmentally Friendly
- Required in certain areas that have PM10 regulations
- Injects compressed air into crack removing debris and then vacuums debris into vacuum. Fines are filtered and cleaner air is released into atmosphere

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Vacuum Systems

Truck mount Vacuum

Trailer mount Vacuum

- Vacuums debris out of crack; useful in areas that are sensitive to air quality
- Less dust than blowing out a crack with compressed air
- Cleaner work environment

Vacuum Systems

Hot Air Lancing

- Hot Air Lancing
  - Removes debris, burns weeds, removes moisture, and warms pavement
- NEVER to be used to continue work during rain or when pavement surface is saturated
- Conditions where hot air lancing is frequently recommended:
  - Moist climates
  - Nighttime crack treatment projects
  - Temperatures below the dew point

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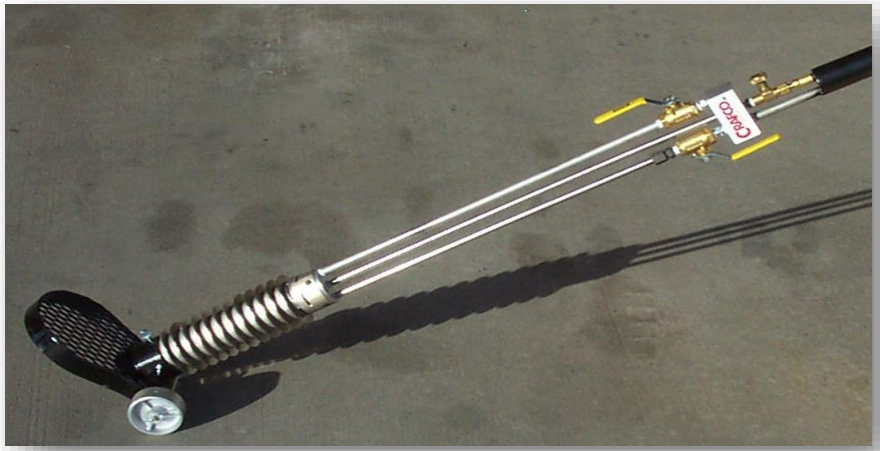
Hot Air Lances



- Dry crack
- Soften, warm pavement for increased adhesion
- One pass is usually sufficient
- Careful not to excessively heat pavement
  - Extreme darkening of pavement
  - Smoking
  - Dislodgement of aggregate

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Hot Air Lancing

Proper Use

- Slight darkening of pavement
- Do not apply direct flame to pavement
- Smoke is an indication of scorching – operator may be moving too slowly
- Crack seal immediately following heat lancing
- Excessive bubbling of sealant is indicator that pavement needs to be dried to a greater degree

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Wire Brushing

- Wire Brushing
- Wheel mounted units: rotating, narrow, round wire brush that runs through crack to remove debris
- May be used along with compressed air
- Brushes wear quickly, requiring frequent change

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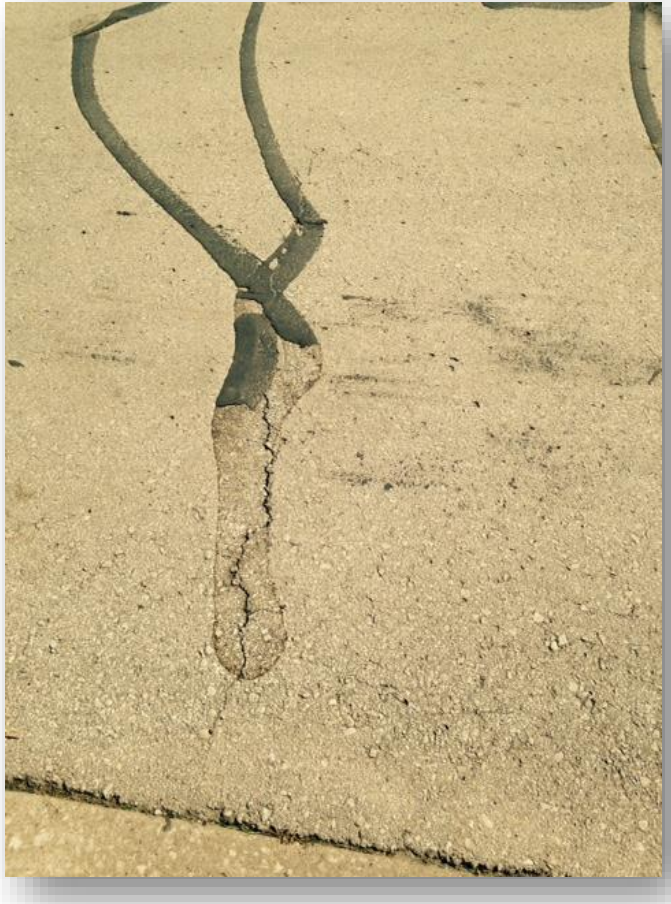
Improper Cleaning



Crack Cleaning Questions?

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Reservoir Cutting

- Routing is an effective method to cut a designed reservoir and is also an effective method to clean crack face, provides ability for sealant to accommodate crack movement
- Straight, uniform reservoir is best
- Production depends on pavement conditions but in studies has ranged from: 220 meters (~720 linear feet/hr) up to 300-600 meters (1,000-2,000 linear feet/hr)

Good Reservoir

Inappropriate Reservoir dimension

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Rotary Impact Router

- Most widely used reservoir cutting equipment
- High productivity of 600-800 linear feet per hour
- Follows meandering cracks well
- Depth control
- Variety of models and options available

Standard Router

Dust Control Router

Self Propel Router

Reservoir Cutting

Reservoir dimensions should follow the project design. Here are some general best practices for routing reservoirs:

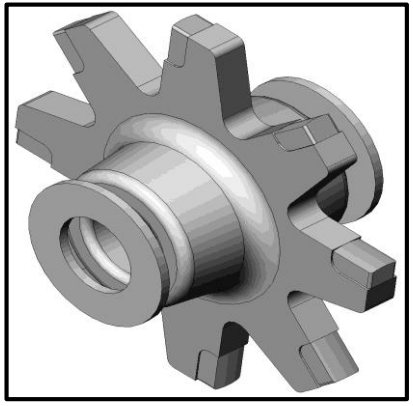
- Produce an equal cut centered over the crack for uniform bond on both sides of the crack
  - Rout at least 3mm (1/8”) from each side of the crack
- Cold weather climates may require wider reservoirs.
  - Reservoir should never be greater than 38mm (~1.5 in) wide and never less than 10 mm (~3/8 in) deep
- Stop if excessive spalling occurs
  - Router should follow crack without difficulty
  - Minimize spalling and cracking

Reservoir Cutting

Blade condition is key to production of a properly shaped reservoir!

<u>Best Practices</u>:

- Read operation instructions
- Wear PPE (personal protective equipment)
- Pre-check router to ensure good working condition
- Get router head up to speed and then lower into the crack
- Rout over the center of the crack
- Rout from centerline to shoulder to remain in traffic control lane/avoid traffic

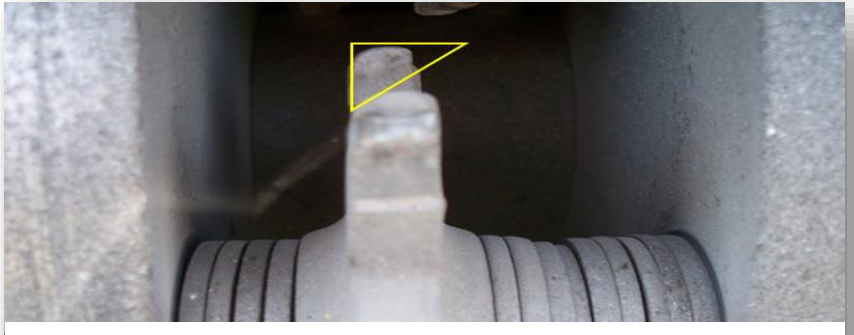


Cutters

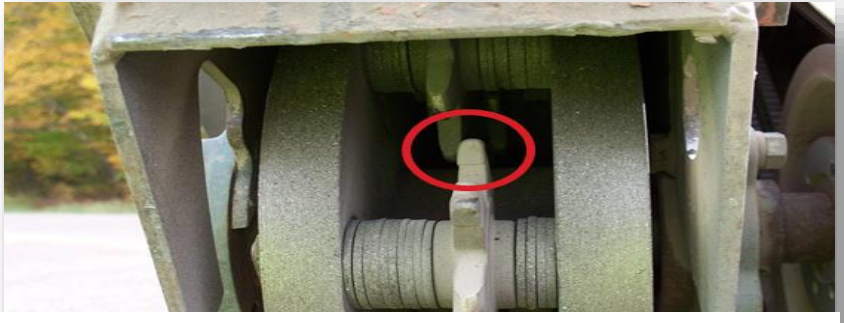
Rout from center lane to shoulder

Reservoir Cutting

- Check cutters frequently during use (rotate when appropriate)
- Pay attention during operation for any noise that indicates an issue or excessive vibration
- Have correct amount of washers/spacers to reduce ‘wobble’ – which reduces physical effort of operation and provides a cleaner cut
- Avoid routing alligatored areas or poor pavement conditions



This cutter is rounded and needs to be replaced



This cutter has rounded edges on the inside and shows how it was rotated to provide a square outside cutting edge

Rotary Impact Router Video

Router Maintenance

- Always refer to the Manufacturer's recommendations
- Change fuel filter
- Change engine oil
- Check lubrication
- Check belt tension
- Overall visual inspection of components

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Routing Questions?

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Proper Sealant Temperature

- Follow the Manufacturer's recommended application temperature range!!
  - *Common Minimum-Maximum application temperature range is 380ºF - 400ºF*
- Over-heating or under-heating the sealant will result in limited performance and/or failure

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Proper Sealant Heating

- Load and heat sealant prior to planned start of installation
- Always apply product within manufacturer's minimum and maximum temperature range
- Inspect your temperature regularly
- Overheating may damage product properties
- Under-heating may cause adhesion issues

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Maintaining Temperature

Agitator Paddles

- Agitation should be continuous; except when melter lid is opened to add sealant
- Agitation increases heating and maintains sealant temperature uniformity
- Add sealant blocks equal to installation rate to best maintain sealant temperature – avoid adding many blocks all at one time

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Maintaining Temperature

- Heating for too long at high temperatures can damage sealant
- Thickening or gelling (getting “stringy”) are signs of overheating
- In this case; sealant must immediately be drained from melter and disposed
- Using damaged sealant may result in: adhesion, tracking/bleeding issues
- Always follow manufacturer’s instructions for heating temperatures

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Proper Pavement Temperature

- Pavement Temperature 40°F minimum
- CAUTION should be observed when applying products below the dew point
- Hot Air Lance can be used to warm the pavement

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Re-Heating

- Some manufacturers recommend to attempt to use all sealant on the day of installation. Check manufacture recommendations to ensure you are following their instructions for re-heating.
- Some sealants can be reheated; check manufacturer's instructions
- **Crafco sealants application life is approximately 12-15 hours**
  - Product may be reheated once to application temperature, after initial heat up.

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Heating & Maintaining Questions?

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Sealant Melters

Melters

- For application of hot applied sealants
- Variety of manufacturers, capacities, fuel sources, melt rates and features
- Units range from small direct fire equipment to large dual pump and wand applicators with onboard air compressors

Oil jacketed double boiler melters

Direct Fire /Hand Agitated

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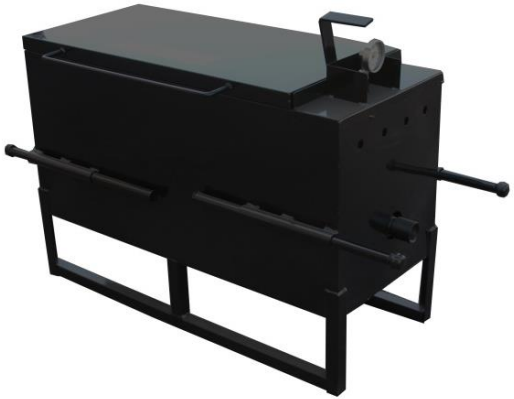
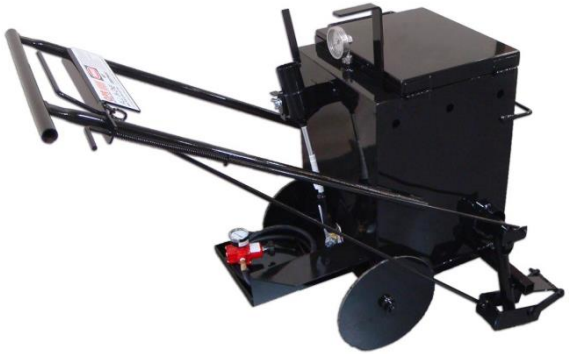
Small Direct Fired Melter





- For small project usage ONLY
  - Parking lots, residential driveways
- Manual propane burner and agitation
- Ensure sealant is appropriate for direct fire unit as not all sealants are compatible with this unit
- Maintain appropriate temperature and constant agitation to guard against overheating of sealant

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Small Direct Fired Melter

Operation:

- Light torch and insert into heating compartment
- Bring material to appropriate temperature (ensuring material is appropriate for a direct fire unit)
- Add additional block of material once unit reaches half capacity

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Oil Jacketed Melter

Most hot applied sealants are heated and installed using oil jacketed double boiler melters

- Heats and melts sealant to application temperature
- Agitates sealant inside tank
- Pumping system to feed material through hose, wand and into crack.
- Temperature control system provides safer and more controlled method of heating sealant

Oil Jacketed Melters

Standard Valve system

On-Demand Trigger system

- Variety of sizes and features
  - 50 - 400+ gallons
  - Towable trailer units
  - Skid mounts
  - Gravity
- Diesel or propane fired burners

“Gravity fed” system

Application Tools

- Hoses & Wands
- Wand tips
- Squeegees

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Hoses

- Hoses are available in heated and unheated versions
- Variety of manufacturers and lengths

Some larger melters are equipped to handle two hoses per unit for higher production.

Wands

- Wands attach to the hose in order to apply sealant to the ground
- Trigger and valve controlled wands are most common

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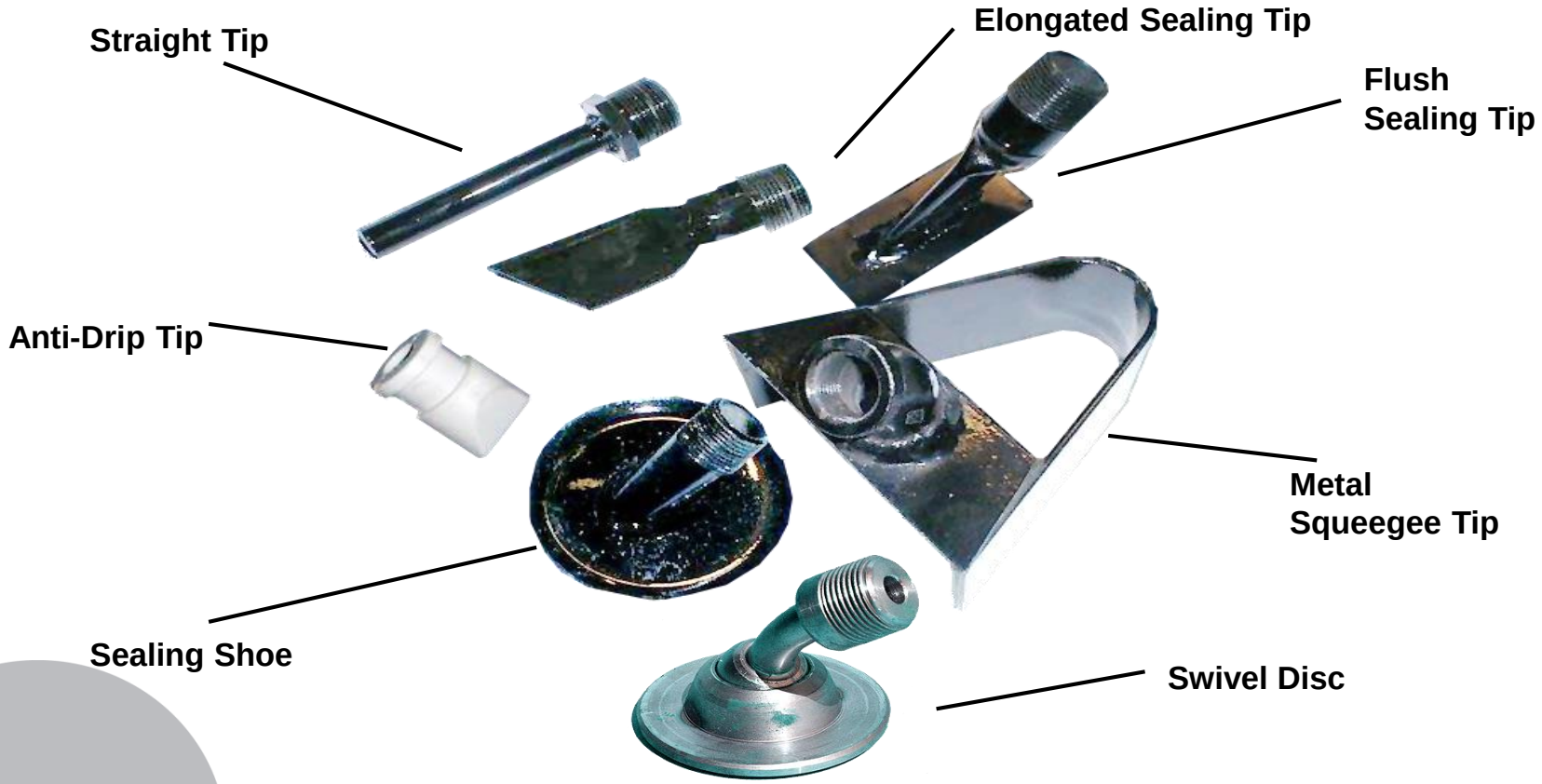
Wand Tips



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Squeegees

- Squeegees are commonly used for crack sealing
- Smooth and level sealant
- Form overbands
- Force sealant down into crack for greater contact/adherence to crack walls

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Squeegees Pictures

Squeegee

Typical overbands should extend 1”
beyond the crack on each side

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Equipment Questions?

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Application Configurations

Proper installation is a must![1]

Sealant shape and reservoir configurations influence performance and are the primary design considerations![1]

Maximize cost effectiveness by selecting a quality sealant and completing a quality application.

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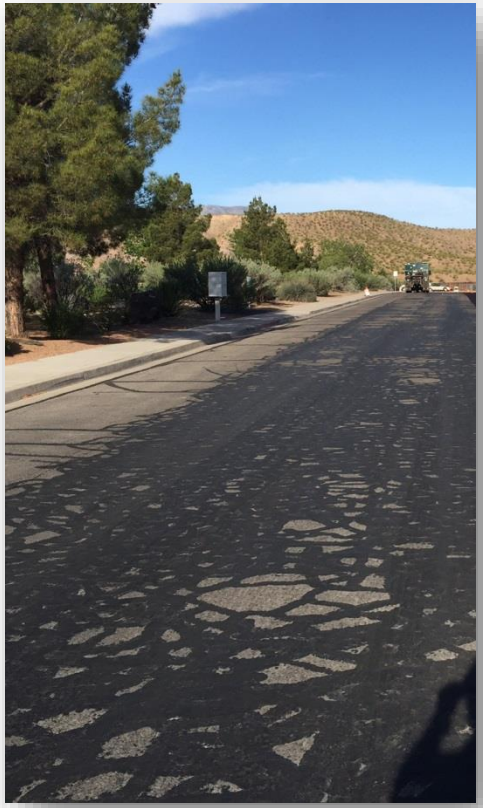
PROPER OVERBAND

- Narrow
- Tight to the pavement
- Pavement texture visible through sealant

Improper Application



What are Placement Configurations?

4 Categories of sealant placement configuration for crack sealing:

- Flush Fill
- Overband
- Reservoir
- Combination

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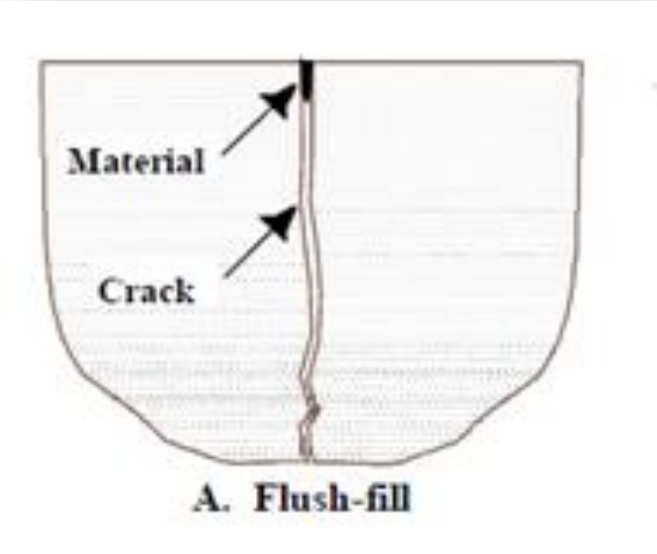
Flush Fill Configuration



- **Flush Fill (Figure A)**
  - Sealant placed into crack, flush with the pavement
  - Any excess is struck off

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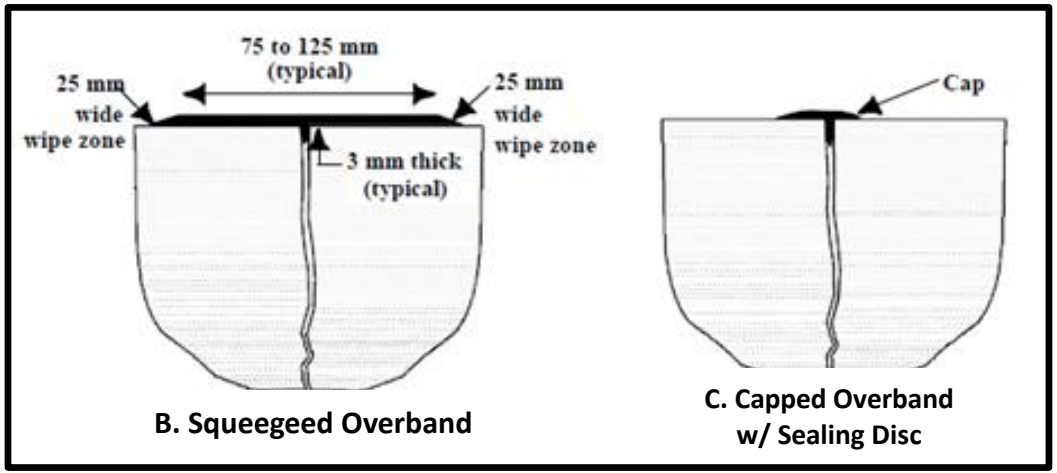
Overband Configuration

Overband Configurations



- Squeegeed overband (Figure B)
- Capped overband w/ sealing disc (Figure C)

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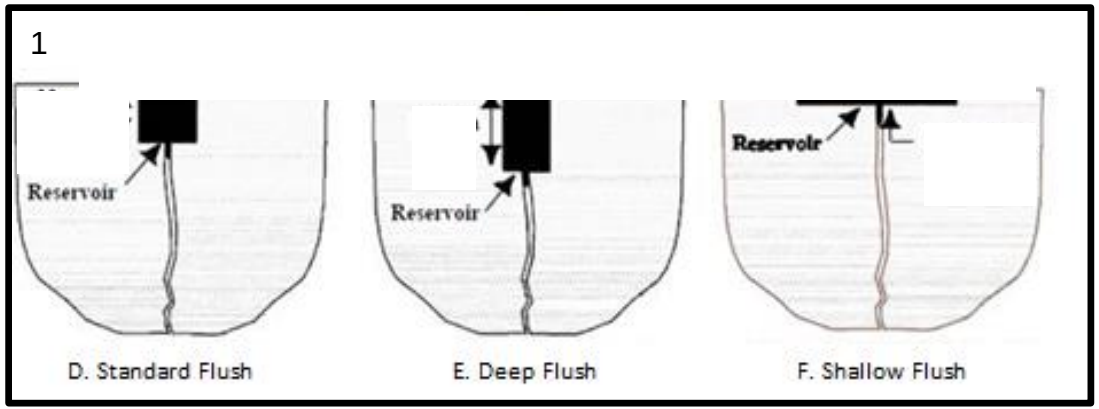
Proper Overband Application
(Blow and Go w/ Squeegee – No Routing)

Reservoir Configurations



Reservoir Configurations

- Standard Flush
- Deep Flush
- Wide/Shallow Flush (more common in extremely cold environments)
- Reservoir with Recess Fill

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Reservoir Pictures

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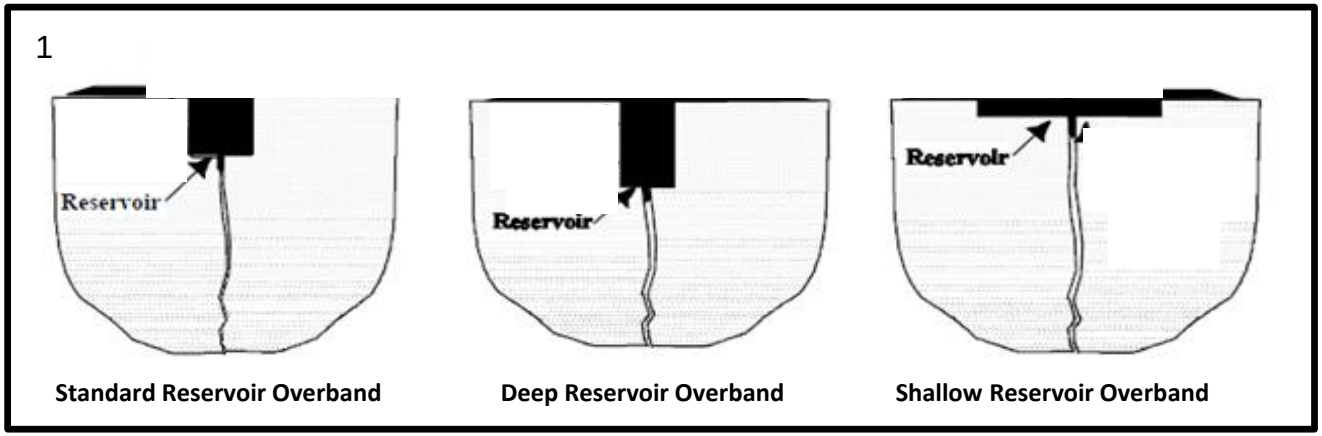
Combination Configurations



- **Combination Configurations**
  - Designed Reservoir
  - Material placed into and over the reservoir
  - Material shaped into an overband with squeegee or overband created by use of a sealing disc
  - Overband centered over crack reservoir

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Proper Combination Application (Routed Reservoir & Sealing Disc Overband)

Finishing

Good applications are achieved by:

1. Meeting the project design configuration: (Flush, Overbands, Reservoirs, Combination)
2. Performing good, clean applications free from drips, puddles, and excess sealant

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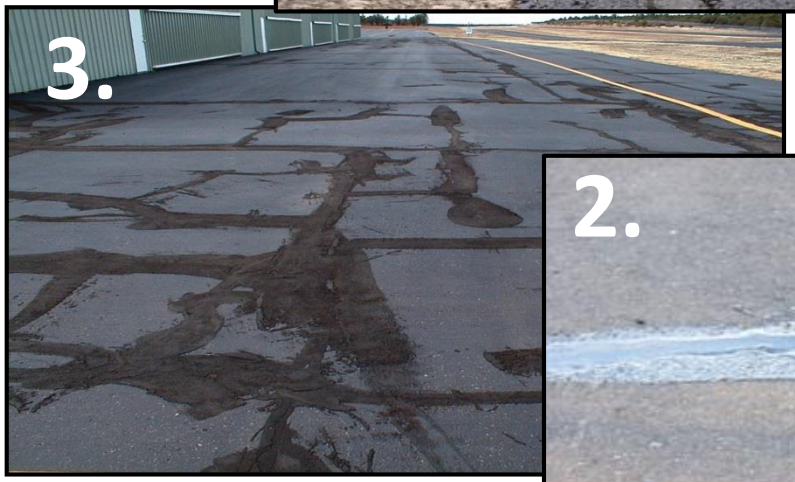
Common Finishing Issues

1. Sagging
   - Apply a second coat to achieve desired level
2. Puddling
   - Turn and go back over crack to make a smooth, even application
3. Drips and excessive application
   - Use a drip stopper
   - Avoid poor workmanship



Drip Stopper

Application Configuration Questions?

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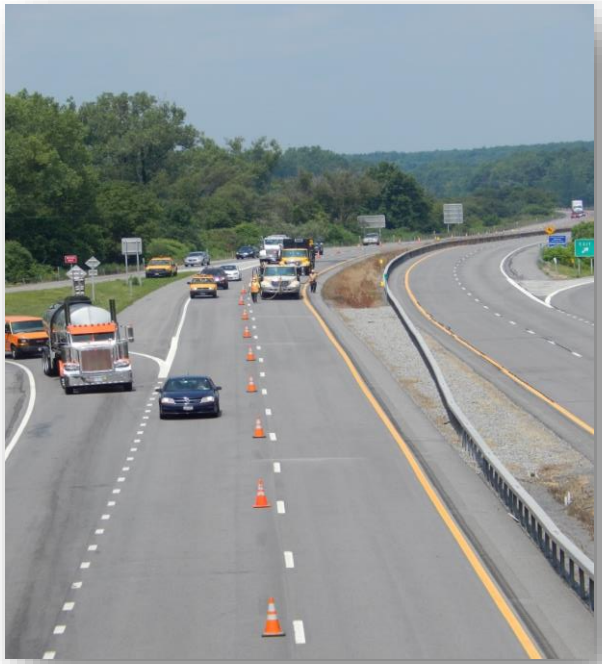
Traffic Control



Traffic control should be designed in accordance with part 6, Temporary Controls, of the FHWA Manual on Uniform Traffic Control Devices or as per the project specifications

- Treatments typically performed one lane at a time
- Traffic controls move as the work zone proceeds
- Lane closure time should be appropriate for product to cooled/cured to bear traffic

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Personnel Requirements

Typical Crack Treatment Crews have 4-5 workers. Additional personnel will be needed depending upon the requirements of the project. Here are some of the most common functions in a crack sealing operation:

- Traffic Control
- Router Operator
- Air Compressor Operator
- Driver
- Sealant Loader
- Sealant Operator
- Squeegee Operator
- Detack/Finishing
- Clean-up
- Maintenance

Inspections

Crack treatments need monitoring and inspection throughout the process to ensure installation proceeds as planned including:

- Equipment
- Sealant used
- Reservoir dimensions
- Crack cleanliness and dryness
- Application temperatures
- Weather conditions

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Clean Up

Portable
Backpack blower

Care should be taken to clean up all garbage, materials, traffic control items, and debris after any crack treatment

- Excessive sealant/spills should be removed
- Sealant boxes and packaging materials need to be disposed
- All debris must be removed: blowers, backpacks, street sweepers and/or vacuums may be used
  - blow away from traffic and people
- Traffic control items including cones and signs should be removed

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Opening to Traffic

- Crack treatment areas should not be opened to traffic or pedestrians until:
  - the sealant has cooled to the pavement surface temperature
  - Cured sufficiently to not be affected by traffic
- Application configurations should be taken into consideration
- De-tacking products may be used to open treatments to traffic more quickly

De-tack Application

Keep traffic off treatment until sufficiently cooled or cured

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Opening to Traffic

Blotting materials such as sand, portland cement, lime, slag, etc. are not recommended. These blotters can be abrasive and alter the properties of the sealant affecting flexibility and extension. Toilet paper is not recommended.

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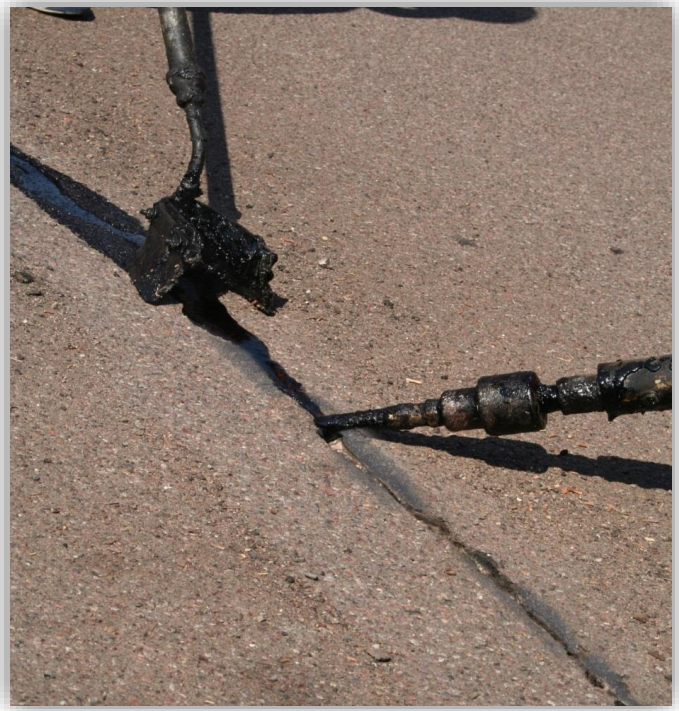
Re-Sealing Procedures



1. Remove old sealant
   - If old sealant is not removed; use a hot air lance on old sealant to help new sealant adhere
2. Remove debris and moisture; air compressor.
3. Hot air lance to remove moisture and heat old sealant to create a better bond between old and new sealant.
4. Fill the crack with sealant from bottom to top to ensure a complete seal.
5. Overband using a sealing disc or squeegee. Overbands should extend approximately 1” beyond each side of the crack.

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Safety Hazards

Hazards:

- Exposure to traffic
- Elevated temperature materials
- Proximity to powered equipment

Always read the manufacturer's operation and safety manuals prior to working with equipment and sealant materials.

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PPE of the Past

Dress for Safety! PPE!

When operating equipment and/or working with hot materials always wear the following or as required by your employer:

- Long pants
- Long sleeved shirt buttoned at wrist
- Heat resistant gloves
- EYE PROTECTION (safety glasses or face shield)
- HARD SOLED SHOES or BOOTS
- Traffic safety vest and hard hats

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For Some Perspective

Deep fryers and turkey fryers cook between 330-350 degrees. Most sealant is applied at 380-400 degrees.

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First Aid for Asphalt Cement Burns

1. Cool the asphalt cement and affected body part.

2. Do NOT apply ice directly on affected area.

3. Leave cooled asphalt cement on area. **DO NOT ATTEMPT TO PEEL OFF MATERIAL!**

4. **Mineral Spirits will dissolve crack sealant from skin**

5. Get to a doctor's office or hospital as soon as possible

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Safety Recommendations

Proper Installation Knowledge Check

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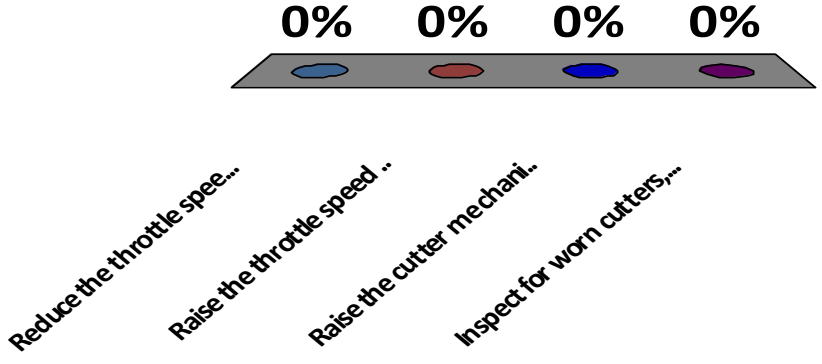
#45: What should the router operator do if spalling occurs?

A. Reduce the throttle speed of the engine

B. Raise the throttle speed of the engine

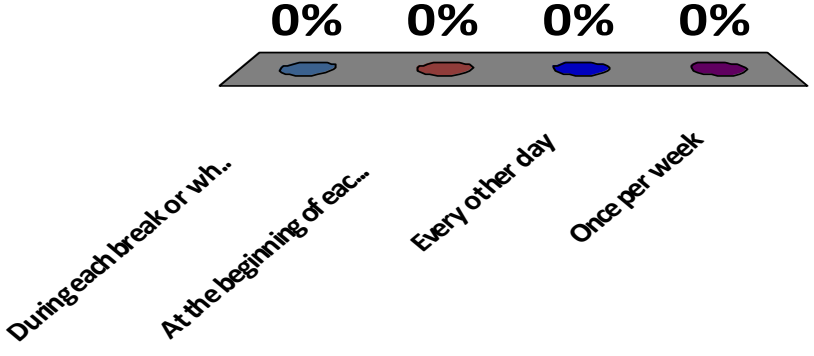
C. Raise the cutter mechanism on the router

D. Inspect for worn cutters, verify that the appropriate cutter is being used for the designed reservoir, verify pavement condition is appropriate for routing, and walk at a slower pace while routing



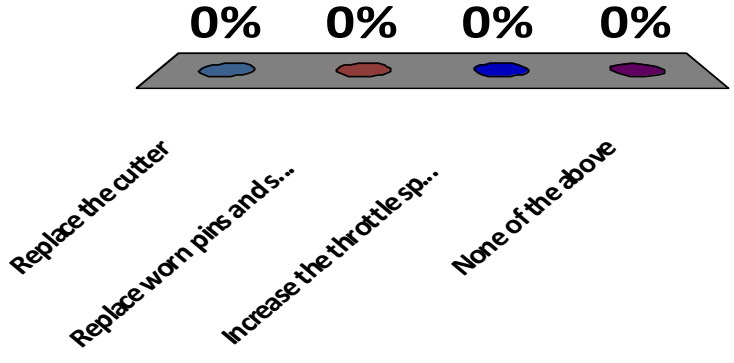
#46: At a minimum, how frequently should an operator check the cutters on a router for wear?

A. During each break or when excessive spalling occurs
B. At the beginning of each day
C. Every other day
D. Once per week



#47: What should the operator do to reduce wobble in the cutter?

A. Replace the cutter
B. Replace worn pins and spacers
C. Increase the throttle speed of the engine
D. None of the above



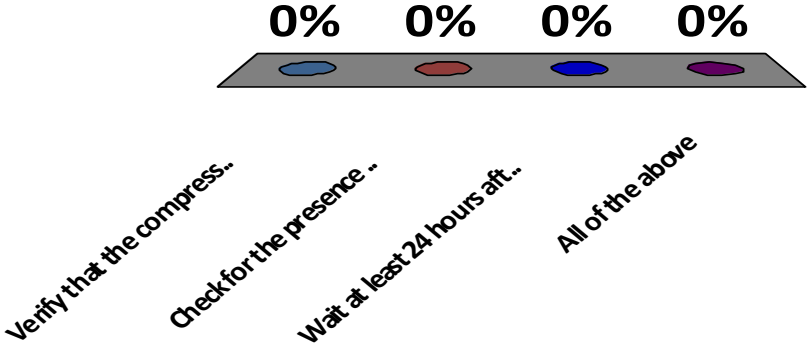
#48: Which of the following steps should be part of a procedure for cleaning cracks with an air compressor?

A. Verify that the compressed air is between 50 and 60 psi

B. Check for the presence of moisture or oil in the compressed air by blowing the airstream onto a piece of cardboard

C. Wait at least 24 hours after cleaning cracks before sealing them

D. All of the above



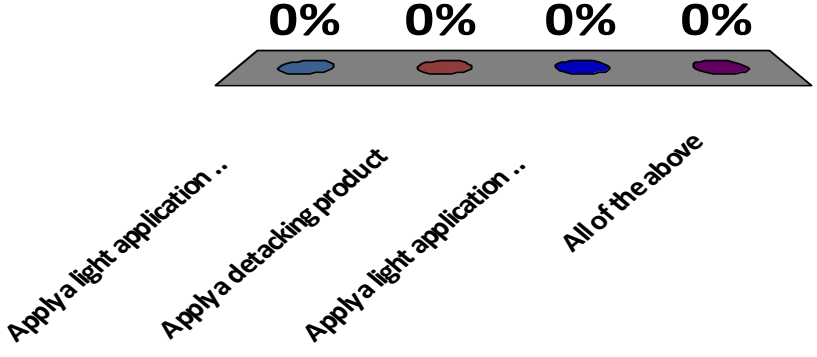
#51: How can the surface tack of sealant be reduced?

A. Apply a light application of 30 mesh sand

B. Apply a detacking product

C. Apply a light application of lime

D. All of the above



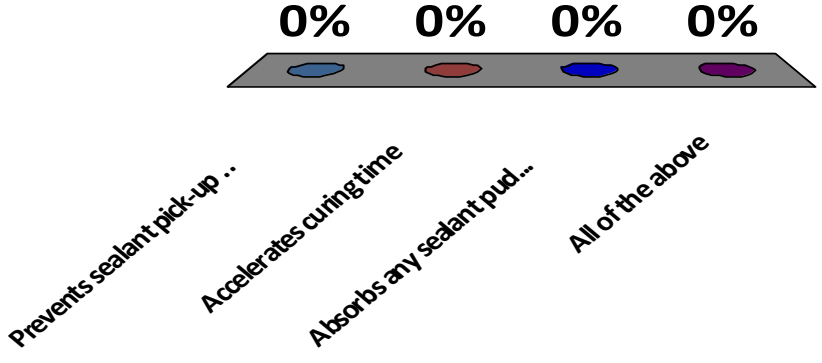
#52: What is the purpose of blotting material?

A. Prevents sealant pick-up on tires

B. Accelerates curing time

C. Absorbs any sealant puddles

D. All of the above



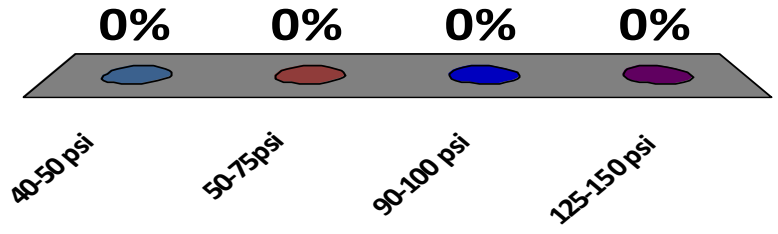
#53: What is the minimum recommended pressure range for an air compressor performing crack cleaning?

A. 40-50 psi

B. 50-75psi

C. 90-100 psi

D. 125-150 psi



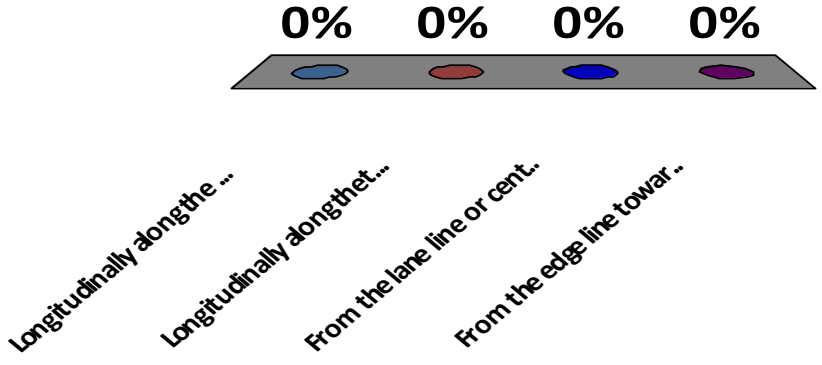
#54: Which direction should a crack cleaning operator ideally work when a lane closure is being used?

A. Longitudinally along the length of the road with the direction of traffic

B. Longitudinally along the length of the road against the direction of traffic

C. From the lane line or center line towards the edge line

D. From the edge line towards the lane line or center line



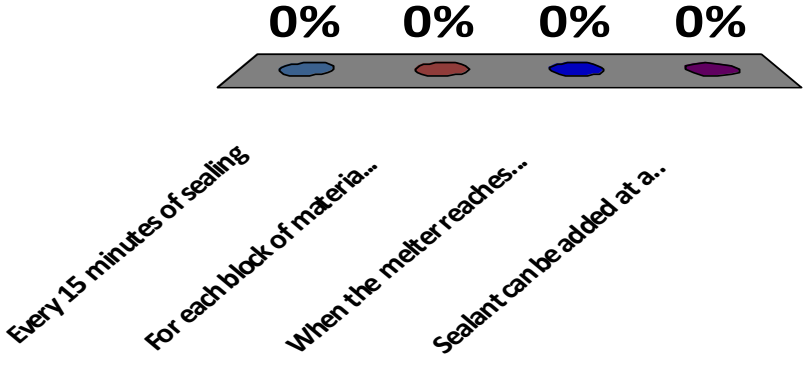
#55: When should sealant blocks be added to the melter?

A. Every 15 minutes of sealing

B. For each block of material placed, a block should be added

C. When the melter reaches half empty

D. Sealant can be added at any time as long as the melter maintains a steady flow of sealant



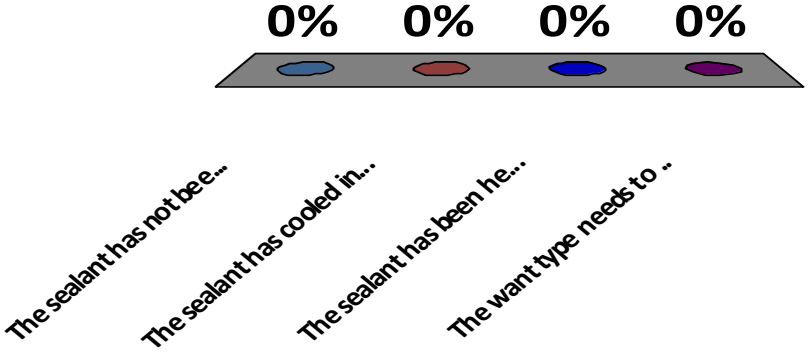
#56: Thickened, gelled, or stringy sealant coming out of the wand is a sign of what?

A. The sealant has not been properly heated in the melter

B. The sealant has cooled in the hose

C. The sealant has been heated to elevated temperatures beyond its pot life

D. The wand type needs to be changed



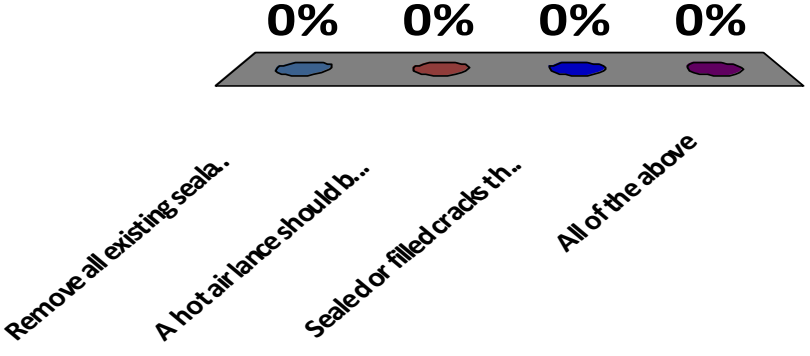
#57: Which of the following is a step that should be taken when resealing an existing crack?

A. Remove all existing sealant that is brittle

B. A hot air lance should be used to heat old crack sealant to bond with new crack sealant

C. Sealed or filled cracks that have deteriorated should be cleaned with an air compressor

D. All of the above



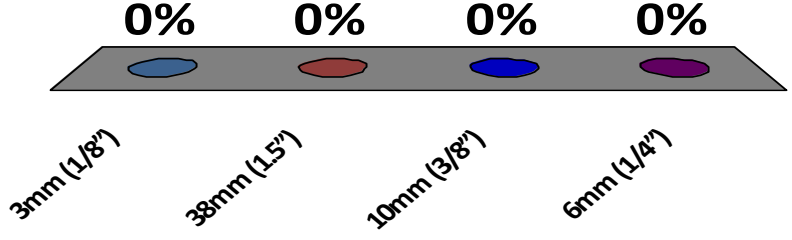
#58: When routing, it is recommended to produce a clean cut centered over the crack removing at least ____ from each side of the crack

A. 3mm (1/8”)

B. 38mm (1.5”)

C. 10mm (3/8”)

D. 6mm (1/4”)



#59: When loading sealant to the melter during crack treatment operations, it is recommended to let the melter empty completely, and then add many blocks all at once to refill and continue operation

A. True

B. False

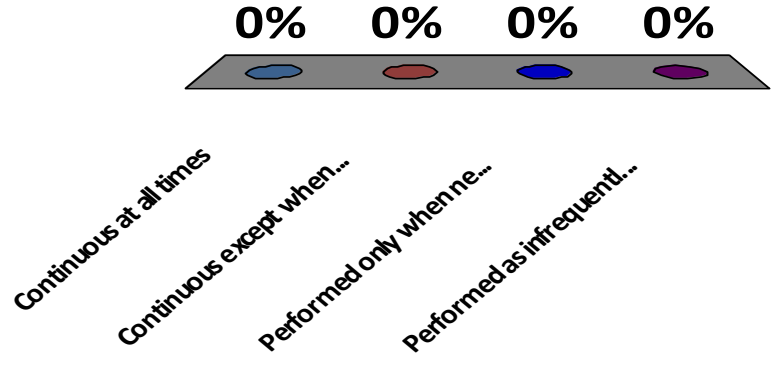
#60: During crack treatment operation AGITATION of material in the melter should be:

A. Continuous at all times

B. Continuous except when sealant is being added and lid is open

C. Performed only when necessary to mix material

D. Performed as infrequently as possible



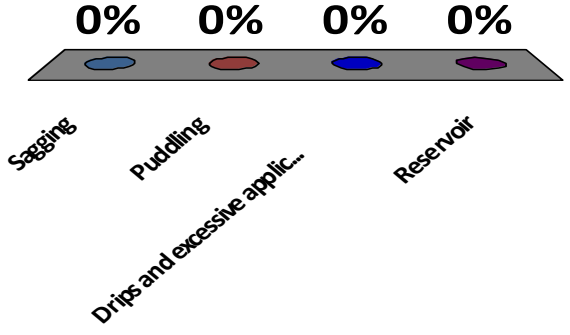
#61: Which of the following are common finishing issues to be avoided when installing sealant in crack treatments? Select all that apply:

A. Sagging

B. Puddling

C. Drips and excessive application

D. Reservoir



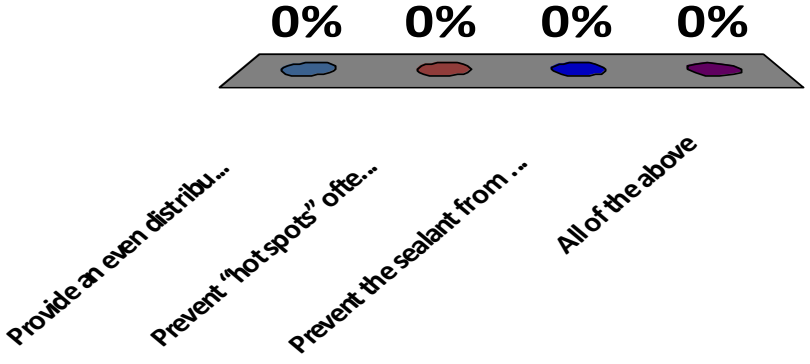
#25: The purpose of the oil jacketing system on a double boiler melter is to:

A. Provide an even distribution of heat around the walls of the tank

B. Prevent “hot spots” often associated with direct fire units

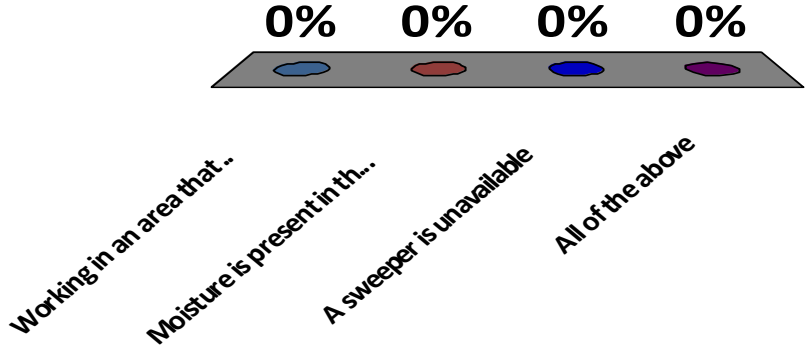
C. Prevent the sealant from losing its desired properties in the melter

D. All of the above



#26: A vacuum system should be used in a crack cleaning operation when:

A. Working in an area that is sensitive to air quality
B. Moisture is present in the crack
C. A sweeper is unavailable
D. All of the above



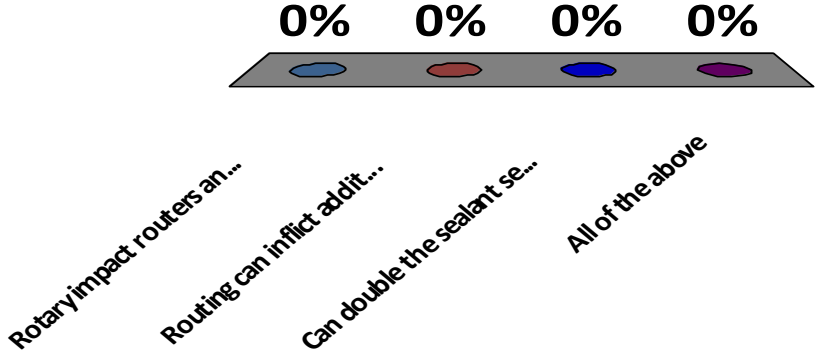
#27: Which of the following statements about crack routing are true?

A. Rotary impact routers should be used on high moving cracks

B. Routing can inflict additional damage to old, oxidized pavements

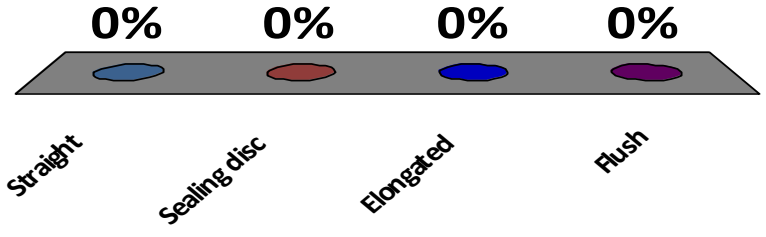
C. Can double the sealant service life

D. All of the above



#28: Which of the following wand tips are used to apply an overband?

A. Straight
B. Sealing disc
C. Elongated
D. Flush



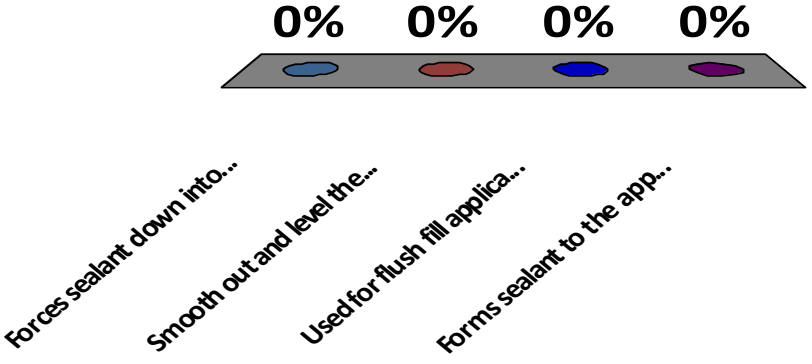
#29: Which of the following is NOT a function of a squeegee?

A. Forces sealant down into the crack for greater adherence to crack walls

B. Smooth out and level the sealant

C. Used for flush fill applications

D. Forms sealant to the appropriate width



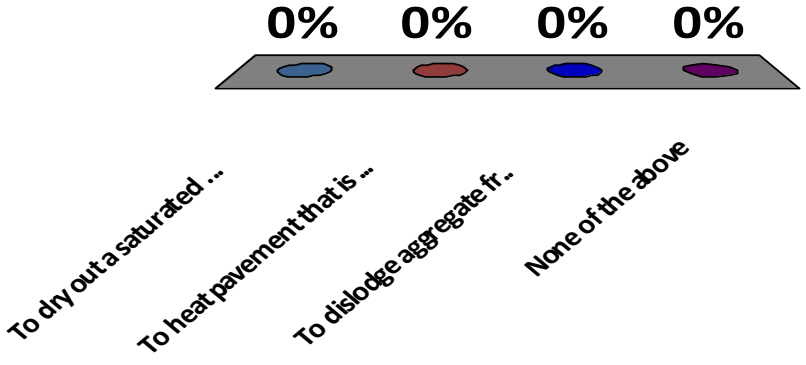
#30: Which of the following circumstances warrant the use of a hot air lance?

A. To dry out a saturated pavement

B. To heat pavement that is less than 40°F (4°C)

C. To dislodge aggregate from the edge of the crack

D. None of the above



#31: Oil jacketed double boiler melters are the most common equipment used in crack treatments:

A. True

B. False

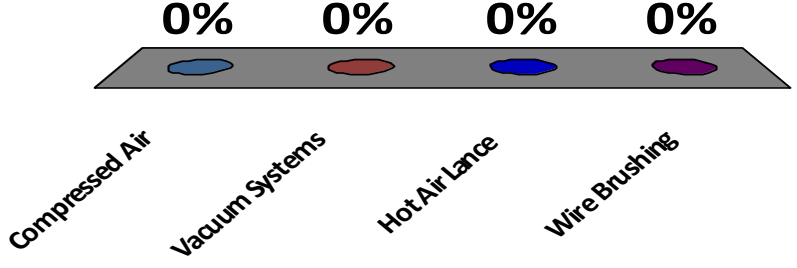
#32: Cracks that are routed and sealed achieve over 100% (2x) the service life vs. non-routed and sealed cracks:

A. True

B. False

#34: Select all that apply: which of the following are used in crack cleaning operations:

A. Compressed Air
B. Vacuum Systems
C. Hot Air Lance
D. Wire Brushing



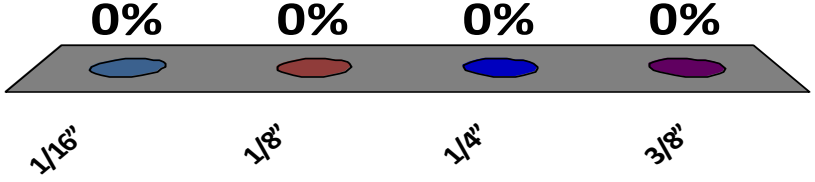
#35: To avoid sealant pick up, what should be the maximum thickness of an overband?

A. 1/16”

B. 1/8”

C. 1/4”

D. 3/8”



Questions?? Thank You!

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