CalTrans Pavement Preservation

Crack/Joint Sealing Task Group

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General Outline

-***What*** is our subtask group working on?

-***Why*** is this work needed?

-***Who*** is our target audience?

-***How*** are we going to accomplish our goals? Our Challenges?

-***When*** would our work be done?

Expected Deliverables

-Revised 37-400 to not only include AC but also PCC.

-MTAG Crack Treatment Ch3 (AC) and Ch4 (PCC). Separated for clarity.

-Final presentation.

-Training Workshop to train field maintenance staff in proper crack treatment procedure.

Why Crack Treatment?

-Prevents water intrusion into subbase

-Prevents incompressible intrusion

-Improves ride quality smoothness

-Slows down pavement deterioration

Crack treatment is a key preventive maintenance strategy that when done properly is expected to considerably extend the life of the pavement structural section.

Why Treat Cracks?

"Cracks are inevitable, and neglect leads to accelerated cracking and potholing, further reducing pavement serviceability."

(FHWA-RD-99-147)

Problem Statement

Caltrans crack treatment, *including* material selection and installation procedures, is not providing the expected benefits.

Crack Treatment Materials Performance Survey
(D-10 Maintenance Regions)

Material	*680 Stockton* *(25-110 F°)*	*660 Sonora* *(0-100 F°)*	*690 Merced* (30-110 F°)	*650 High Elevs.* *(0-100 F°)*	*670 Modesto* *(25-110 F°)*
Emulsion (unmodified)	Not used.	Not used.	Not used.	Not used.	Not used.
Emulsion (polymer modified)	Not used often due to lack of storage capabilities. But works well as crack sealer with sand.	Used with average/good performance.	Yes, but not much. Average performance.	Used very much. Good performance.	Not used.
Asphalt Rubber	Not used.	Not used.	Not used.	Not used.	Not used.
Crafco like material	Use Crafco/Poly Flex2 because it is workable and performs well with proper crack preparation. *Problems stopped traffic pulling material out on a hot day.*	Used with average/good performance. *Problems when overlaying over crack treated surface. Pulled out material causes bumps.*	Used very much. Average performance. *Problems with kettles not heating materials fast enough to keep up with production.*	Used not much due to poor performance. *Problems with paving/grinding after crack treatment and sticks to tires on hot days.*	Used very much with good performance. *Problems with paving/grinding after crack treatment and sticks to tires on hot days.*
Fiber modified binder	Not used.	Not used.	Not used.	Not used.	Not used.
Other not Included above	Not used.	Not used.	Not used.	Not used.	Not used.

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Who is our target Audience?

-Primarily Caltrans Field Maintenance crews and also contractors.

-Most crack treatment is done in-house.

Each Caltrans Maintenance Superintendent must meet a minimum Crack treatment quota of 100 Lane Miles per Year.

Our Goal

To provide *practical* and *implementable* installation procedures and methods of material selection for the optimal performance that would decrease frequency of crack re-treatment, which in turn will reduce public inconvenience and increase everyone's safety.

Ideal Material Performance

-Must be flexible at the lowest temperature

-Must remain intact at the highest temperature

-Viscosity for adequate flow without draining

-Resilience

-Adhesion

These **properties vary significantly** depending on California's geographic areas.

Crack Types

Transverse Cracking (Thermal)

Longitudinal Cracking

Block Cracking

Reflection Cracking

Fatigue Cracking

Edge Cracking

Slippage Cracking

FHWA Sealing vs. Filling

SEALING: “Working” (High horizontal movement) ≥ 3mm movement

FILLING: “Non-working” (Low or no horizontal movement) < 3mm movement

Our Challenge-*Caltrans does not have the resources to measure the annual horizontal movement of a crack to determine if a crack should be sealed or filled.*

Excerpts from ***FHWA-RD-99-147***

FOREWORD- "The manual presents guidelines and recommendations to assist highway maintenance agencies…"

NOTICE- "This report does not constitute a standard, specification, or regulation."

2.4 Determining Whether to SEAL or FILL- "…several different types of cracks my appear at one time. In these cases,one treatment, using a material appropriate for the most demanding crack type, is desirable."

Excerpts from ***FHWA-RD-99-147***

"…amount of annual horizontal movement of the targeted crack type should be the principal basis for this decision."

"Whether a crack is working or non-working can generally be determined by its type. Working cracks are usually transverse in orientation; however, some longitudinal and diagonal cracks may meet the 3-mm movement criteria."

Excerpts from ***FHWA-RD-99-147***

"Non-working cracks typically diagonal cracks, most longitudinal cracks, and some block cracks."

2.4.1 When to Seal and When to Fill- "Durable filler materials should be used to reduce the number of repeat applications."

"Historically, most crack filling has been performed on a routine basis with inappropriate materials that provide less than desirable performance. …rarely cost-effective."

Excerpts from ***FHWA-RD-99-147***

"In addition, the safety of the workers and traveling public is compromised, since the filling operation must be repeated frequently."

Why not use "sealing" material and installation methods to increase useful life of treatment.

Cost Comparison (estimated)

Crack **Sealing** (10 – 15% cracking)			
Project size	Daytime (normal)	Night (premium)	Short work (< 4 hours)
Small	**$0.75 - $0.90**	$0.95 - $1.15	$1.80 - $2.00
Medium	$0.65 – $0.80	$0.85 - $1.05	$1.80 - $2.00
Large	$0.55 – $0.70	$0.75 - $0.95	

Percentage of feet of crack per 100 square feet of road surface converted into ***cost per square yard***.

Traffic Control is **not included**. Cost of traffic control can vary by more than 200% depending on level of traffic and location of the road.

Traffic Control can be a large percentage of the cost of crack treatment.

Crack **Filling** (10 – 15% cracking)			
Project Size	Daytime (normal)	Night (premium)	Short work (< 4 hours)
Small	**$0.71 - $0.86**	$0.91 - $1.11	$1.15 - $1.35
Medium	$0.61 - $0.76	$0.76 - $0.96	$1.15 - $1.35
Large	$0.51 - $0.66	$0.64 - $0.84	

CalTrans 37-400 Crack Treatment Material

Pavement Temperature Grade Requirement						
Test (Note 1)	ASTM Designation	76-4*	70-10	64-10	64-16	64-28
Softening Point, min	D36	96˚C	90˚C	84˚C	84˚C	84˚C
Cone Penetration, max	D5329	50	60	70	80	90
Resilience, %	D5329	20 – 60	25-65	30-70	35-75	40-80
Flexibility (Note 2)	D3111	-4˚C	-10˚C	-10˚C	-16˚C	-28˚C
Viscosity, max poise (Note 3)	D4402	75	75	75	75	75
Tensile Adhesion, % min	D5329	400	400	400	400	500
Bitumen Content, Min %	D4	60	60	60	60	60
Asphalt Compatibility	D5329	Pass	Pass	Pass	Pass	Pass
Minimum Application Temperature		----- As specified by Manufacturer-----				
Maximum Heating Temperature		----- As specified by Manufacturer-----				

Table Notes

1. All specimens except viscosity are to cure at standard lab conditions of 23+/- 2 °C and 50 +/- 10% RH for 24 +/- 2 hours prior to testing.

2. Flexibility specimen size is 6.4 mm thick by 25 mm wide and 150 mm long, test mandrel diameter is 6.4 mm, bend arc is 180 degrees, and bending rate is 2 seconds. At least 4 of 5 test specimens must pass at the specified test temperature without fracture, crazing or cracking.

3. Test sample is poured from the heated material and tested for viscosity at the listed maximum heating temperature.

4. The table is set up for most California Crack Treatment situations. In the case of closely spaced block cracking in high traffic areas, (The crack treatment in this case is known to the FHWA as crack filling), the grade should be “bumped up to the next grade in the table.

*It is understood that there are no -4 grades in the PG grading system, however a -4 flex is appropriate in regions of California which do not experience temperatures of -10°C.

Softening Point

20˚C Higher than high temperature in grade based on ASTM D 6690 Flow Test specification.

Cone Penetration

Consistency Measure

Higher pen, generally better low temperature

Pen decreases by 10 per grade giving better high temperature properties

Resilience

- Measure of the materials ability to recover and reject incompressibles
- Minimum Resilience required
- Resilience too high – too cohesive will cause aggregate pull out and seal failure

Flexibility at Low Temperature

The flex test is the low temperature performance test for the materials. The materials must remain extensible and flexible at the lowest temperature they are expected to perform. The flex test represents a rapid elongation to 60% without cracking.

Viscosity

The viscosity was chosen because crack treatment materials must be able to penetrate smaller cracks.

Tensile Adhesion

Adhesion between concrete blocks

Grade range greater than 80˚C, adhesion needs are greater for greater movement.

Specification

Working toward the varied sealant needs for CalTrans

Thank you!