Fly Ash Slurry Injection (FASI) of Bituminous Thermal Cracks
Schedule

• What is Fly Ash Slurry Injection (FASI)
• Thermal Cracks and Why They Depress
• Pavement Rehab Strategies
• Special Provisions
• Upcoming Projects
• Questions
Brief Overview of FASI

• What is FASI?
  – FASI consists of injecting a fly ash slurry into the voids beneath thermal cracks, stabilizing the soil and filling the voids.
  – Initially used in Kansas along I-70 in the 1990s
  – Kansas reported it to be a cost effective treatment for thermal cracks
  – Used on a Dawson County project in 2010
    • Overton to Sumner Road and Road 756
Brief Overview of FASI

• Goal of FASI
  – Reduce the reflective cracks
  – Prevent cracks from depressing, in a cost effective way.

• Where it will be used
  – Districts 5, 6, 7, and 8 initially.
  – Currently 2 projects planned for each district
  – Statewide eventually.
Schedule Update

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Reason Cracks Depress

- Initially caused by a large temperature difference between the base and surface of the pavement, creating tensile forces.
- Tensile forces > AC strength, crack forms, water enters and weakens the subgrade.
- Moisture eventually degrades base pavement.
- Traffic loading causes the cracks to depress.
Schedule Update

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• **Pavement Rehab Strategies**
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Pre FASI - Limited Rehab Options

- **Surface Sealants and Patching**
  - Short term fixes
  - Slows the development of the cracks

- **Mill/Fill**
  - Cleans up surface distresses
  - Medium term fix. Cracks reappear at a rate of 1” per year.

- **Mill/Fill with a Geo-textile**
  - Retards crack reappearance and potentially seals crack from further moisture.
  - Geo-textiles can be difficult to work with.
  - Similar cost per Sq Yd as 1-2” of asphalt

- **Partial or Full depth recycles**
  - Full depth recycle only way to permanently eliminate cracks
  - Long term fix. Costly, grade raise, not always practical or desired (high traffic, thick pavement)
Incorporating FASI into the Rehab

• Initially, looking to use this strategy on mill/fill projects.
• Expand to more armor coat surfacing type projects if effective.
  – Pavements we would target:
    • Structurally sound
    • Thermal cracks the main distress
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Special Provisions

Material Requirements

– Fly Ash Slurry mix design report submitted to M&R a minimum 15 days prior to beginning construction.

– Minimum 7 day Compressive Strength of 400 psi

– Traffic will not be placed on driving lanes until the material has reached initial set.
  • Initial set has been reached when it can be stepped on without sticking.
Special Provisions

Construction Methods

Injection Holes

• Department will determine which cracks will be filled
  – Not looking to treat every crack, mainly the depressed ones.
• Drill a minimum of 2 holes per 12’ of crack length
• Holes shall be approximately 6” from the crack and 12” from the pavement edge or center line.
  – Expect outside holes closer to the wheel paths.
FLY ASH SLURRY INJECTION DETAIL

STATION TO STATION

* - *
Special Provisions

Construction Methods

Slurry Injection

• Temporarily plug adjacent hole if doing so will force slurry into the crack. Also used to prevent back flow.

• Control injection operation to prevent pavement lift greater than ½”. Check with a 10’ straight edge.
  – Intent of injection is to fill the void and remove depressions while being able to open to traffic without immediate milling.

• If pavement lift produces an unacceptable ride, pavement will be milled prior to opening to traffic, at no cost to the department.
Special Provisions

Construction Methods

Clean Up

• Any overflow material shall be squeegeed from the surface as directed by the Engineer
Special Provisions

Construction Methods

Weather Limitations

• Do not perform FASI if the air temperature is 50° F or below or if the ground if frozen.

• Do not perform FASI if weather conditions prevent proper handling and placement of materials.
Special Provisions

Sampling and Testing

• Determine the density of the slurry prior to starting work each day.
  – Density calculated in lb/gal by using Gardner Cup
    • Used as a measure of consistency
    • Used for calculating total slurry applied (T).

• Use provided table to record the daily densities and calculate the (T) values.
  – Include table in project file and submit to M&R.
Special Provisions

Sampling and Testing

• Department will mold a minimum of one set of test cylinders per day
  – Set consists of four cylinders, two of which will be tested on the 7\textsuperscript{th} day and two held in reserve.
  – The average of two compressive strength tests will be used to determine payment.
### Fly Ash Slurry Injection of Bituminous Thermal Cracks

<table>
<thead>
<tr>
<th>Cylinder Records</th>
<th>Required Daily Cylinder ID (1 set)</th>
<th>Average Compressive Strength (psi)</th>
<th>Additional Cylinder ID (Optional)</th>
<th>Average Compressive Strength (psi)</th>
<th>Pay Factor (Lowest Average Strength)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date</td>
<td>Station Range</td>
<td>Gardner Cup Density (lbs/gal)</td>
<td>Total Daily Volume (gal)</td>
<td>Total Daily Weight = A*B (lb)</td>
</tr>
</tbody>
</table>
Special Provisions

Sampling and Testing

• Pay Schedule
  • 400+ psi = 100% pay
  • 300-399 psi = 80% pay
  • <300 psi = 40% pay
Special Provisions

Method of Measurement

• Pay Items
  • Fly Ash Slurry Injection
    – Paid for by the Ton
    – Water, Cement, and Admixtures are subsidiary
  • Injection Holes
    – Measured by the number of holes drilled.
    – Monitoring for pavement lift subsidiary to the injection holes

• No adjustment in contract unit prices are made regardless of amount of over/under-runs
Additional Special Provisions

• 1/2” pre-mill due to residual fly ash slurry
  – Anticipating the Contractor’s preference to not incorporate this material into the RAP

• 14 days between FASI and first Mill
  – Due to public complaints on County project

• 30’ ski on milling machine for smoothness

• Will Include a core report if available
Schedule Update

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Upcoming Projects

Projects for 2012

– Agate South, STP-29-4(107), CN 51361 – FASI w/ District Armor Coat
  • 3” AC on 6” crushed rock base, 220 ADT 10% trucks
  • 10.5 miles in length
  • Low cost maintenance strategy was desired

– Hyannis North, STP-61-3(109), 61473 – FASI and Mill/Fill 3”
  • 4” AC on 4” Bit Sand, 400 ADT, 10% trucks
  • 7 miles in length
Upcoming Projects

Projects for 2013

– N Jct US 83 West, STP-23-2(125), CN 61475
  • FASI and Mill/Fill 3.5”

– Sparks West, STP-12-2(105), CN 80877
  • FASI and Mill 3”/Fill 4”
Upcoming Projects

**Beyond 2013**

- Danbury to Lebanon, STPD-BH-89-2(110), CN 70890, FY 2014
- Wauneta to Hamlet, STP-6-2(130), CN 71127, FY 2015
- Burwell North, STP-BH-11-3(118), CN 80798, FY 2015
- I-80 North, STPD-27-2(104), CN 51277, FY 2017
- Additional projects likely
Questions?