Pierce County

PIERCE COUNTY HIGH FRICTION SURFACE TREATMENT PROJECT

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Overview

- What is a High Friction Surface Treatment?
- What's its purpose?
- Pierce County HFST project
  - How we did it
  - What we learned for next time

What is HFST?

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- Skid resistant system applied to roadways to improve and restore pavement surface friction

  - Binder
    - Epoxy-, modified polyester-, or polyurethane-resin

  - Durable, high friction aggregate
    - Typically calcined bauxite
    - Other: flint, granite, basalt, steel slag
    - Generally about 3-4 mm maximum in size

Source: USDOT FHWA

What's the Purpose of HFST?

- Improve pavement friction
  - Sharp horizontal curves
  - Approaches to intersections

HFST Benefits

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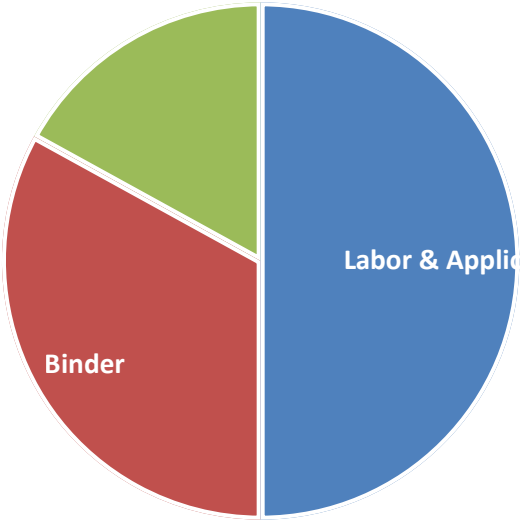
- Crash Reduction
  - Pennsylvania, Kentucky, and South Carolina have reported before/after crash reductions of 100%, 90% and 57% respectively

- Faster and less expensive with less environmental permitting and impacts than geometric improvements.

HFST Costs

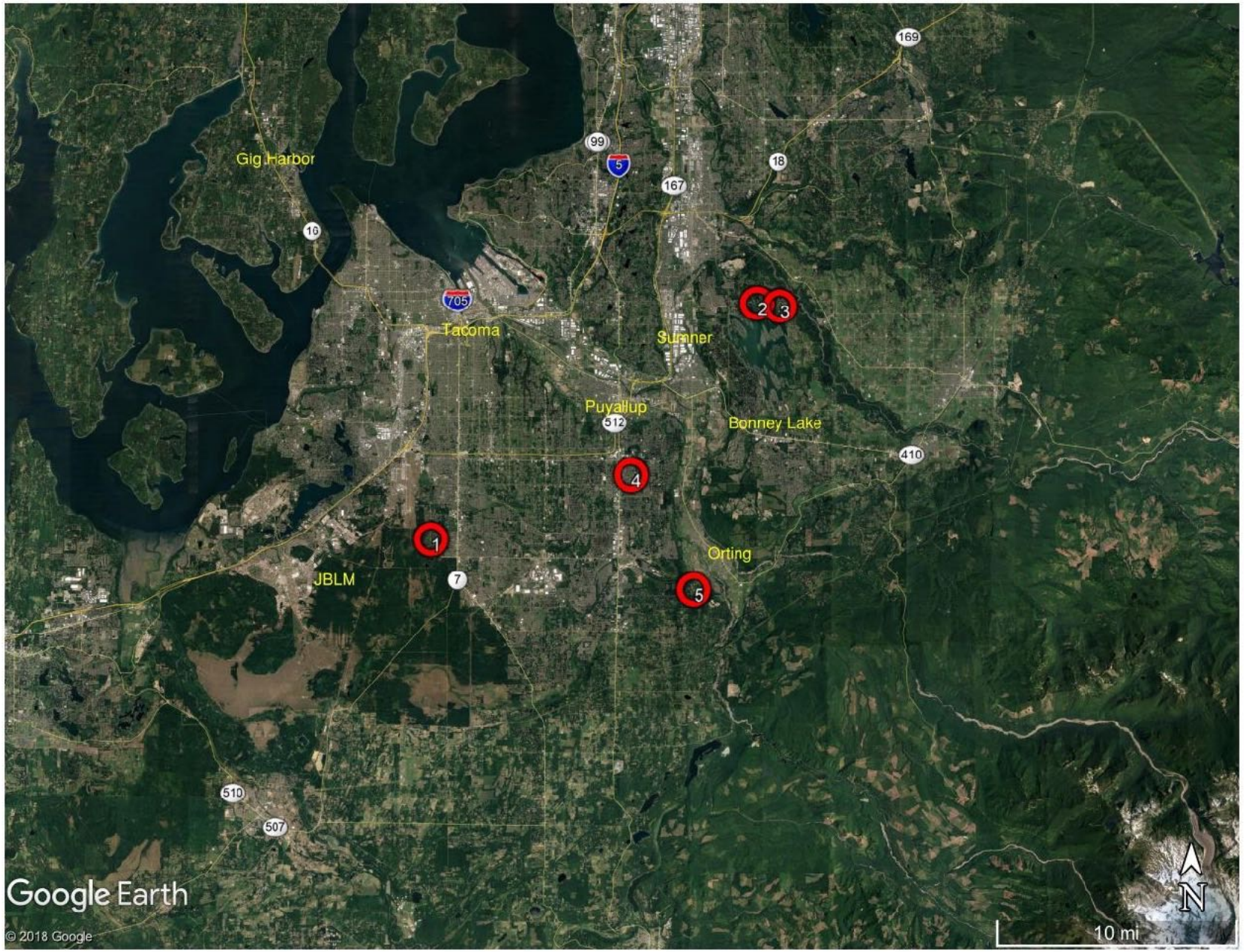
- Costs: HFST (only)
  - FHWA reporting for several state DOT's - $25 to $50/sy (FHWA 2017)
  - Six WA counties (2017 and 2018 installations)
    - Range: $22 to $37/sy
    - Average: ~$31/sy



- Life Cycle
  - International experience: ~7-12 years
  - US vendors:
    - 5-8 years for volumes ~15k vpd
    - Up to 5 years for volumes ~50k vpd
  - Depends on traffic volumes, chain/studded tire use, % trucks

Project By The Numbers

- 1st : HFST project in Pierce County
- 5 : road segments
- 7 : individual locations
- 7,083 : total HFST square yardage
- $357,510 : Contract cost
  - (includes cost of 465 lf of centerline rumble strip)
  - $35/sy HFST



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Schedule

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- PS&E initiation – March 15, 2017
- Contract Advertisement – April 26, 2017
- Bid Opening – May 19, 2017
- Notice To Proceed – August 18, 2017 (Specialized Pavement Marking, Inc)
- Substantial Completion – September 1, 2017

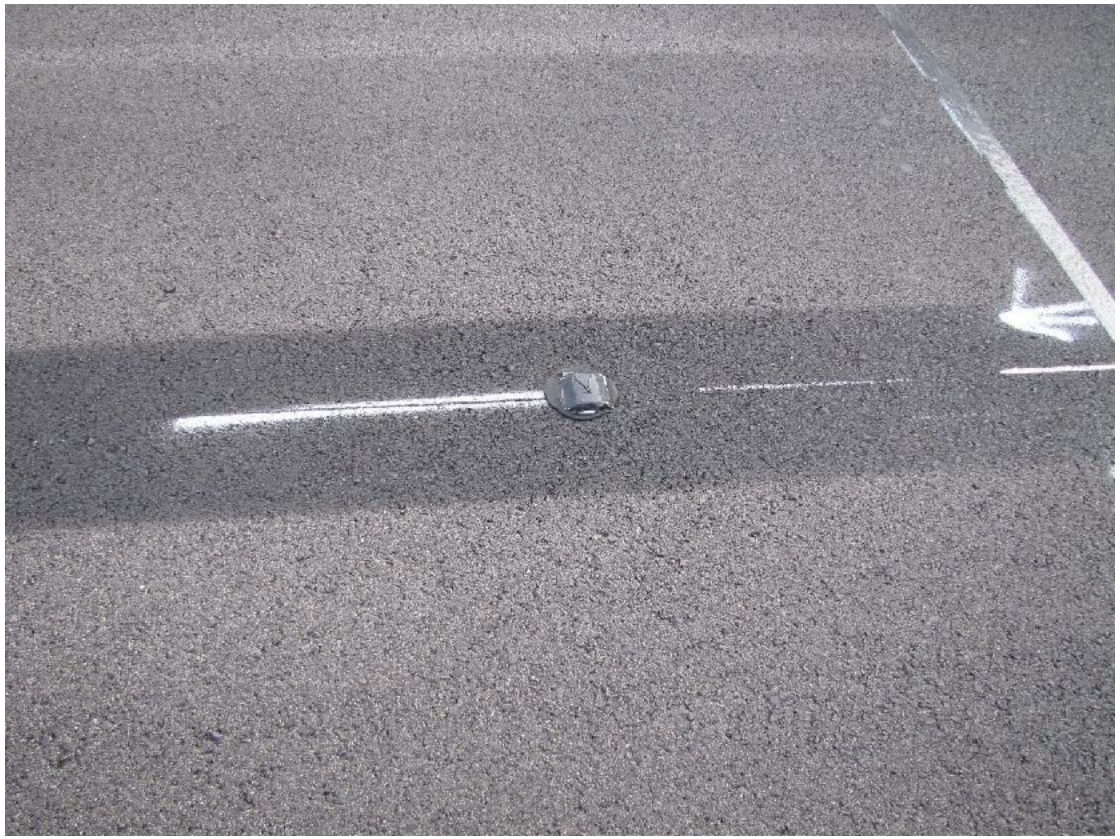
HFST Application Process

1) Surface Preparation
2) Apply Binder
3) Spread Aggregate
4) Cure
5) Sweep
6) Open to Traffic
7) Sweep
8) Acceptance Testing
9) Sweep

Surface Preparation

- Apply to new asphalt or concrete pavements after minimum 30 days
  - Weather restrictions
- Clean and treat joints > ¼” wide with epoxy resin and allow to gel
- Protect utility castings, RPM’s, paint lines, etc.
- Vacuum or sweep pavement

Masking surface features



Pavement cleaning

Apply Binder, Spread Aggregate, and Cure

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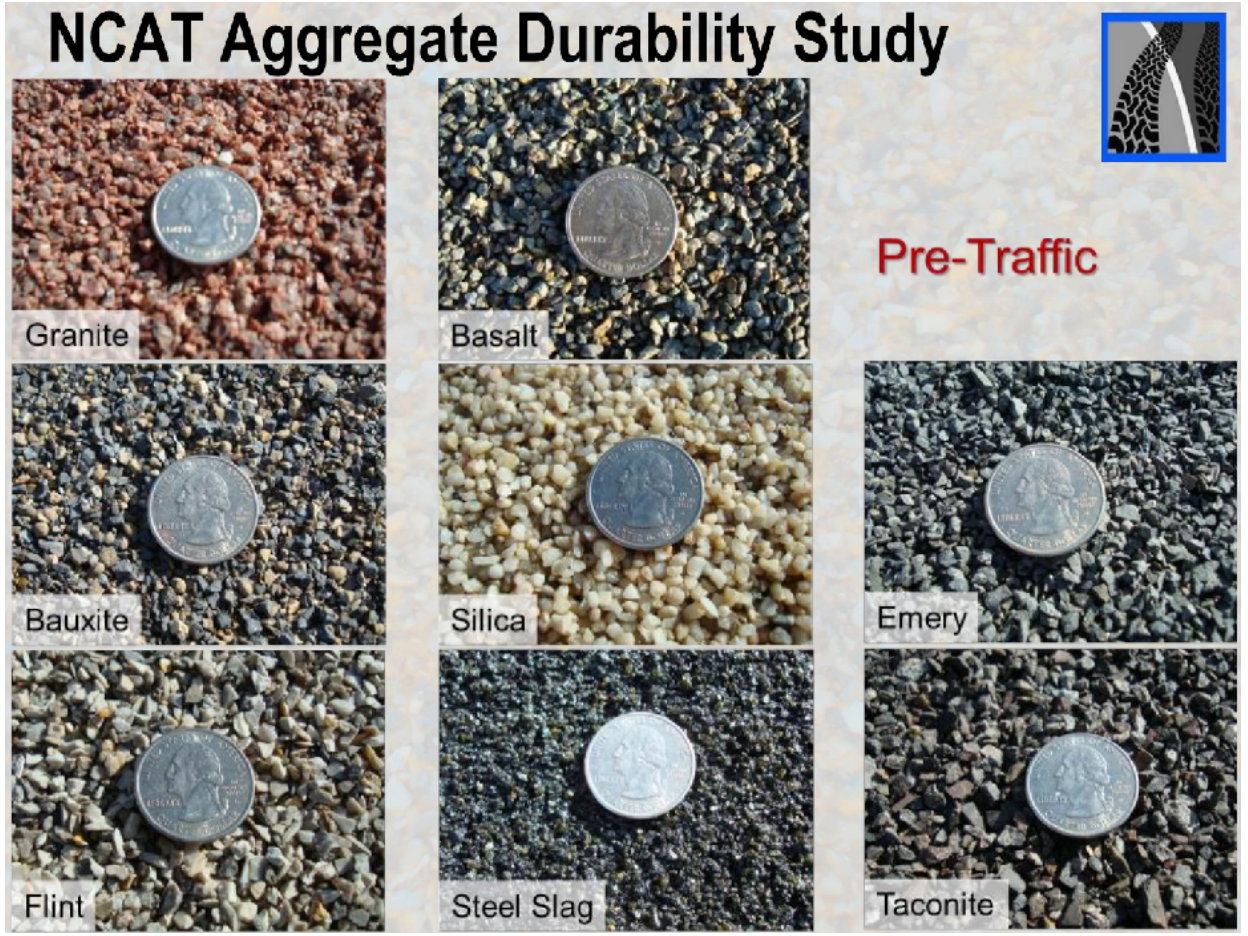
- Apply Binder
  - Two-part resin binder is mixed and applied at manufactures application rate and thickness
- Spread Aggregate
  - immediately after binder application, completely covering the binder
- Cure
  - HFST allowed to cure with no traffic
- Sweep
  - After the binder is set up sweep the roadway

Aggregate

- Aggregate
  - FHWA: NCAT Aggregate Durability Study (2013)
    - researched several alternate aggregate sources
    - Calcined bauxite – “premium” aggregate
    - Others promising but more testing required
  - basalt ($300/sack) vs calcined bauxite ($1,200/sack) (Source: PolyCarb 2017)



Source: 9/16/14 presentation, The Transtec Group/FHWA/NCAT

HFST Application Process - Binder

- Manual
  - mixing of epoxy
  - application epoxy with squeegee
  - hand spread aggregate
  - smaller areas
  - lower rates (~400 sy/hr)
- Automated (Semi- or Fully-)
  - machine mixing and application of epoxy
  - limited squeegee work
  - machine spread aggregate
  - larger areas
  - higher rates (~2,300 sy/hr)

HFST Application Process

HFST Application Equipment

Applying Binder

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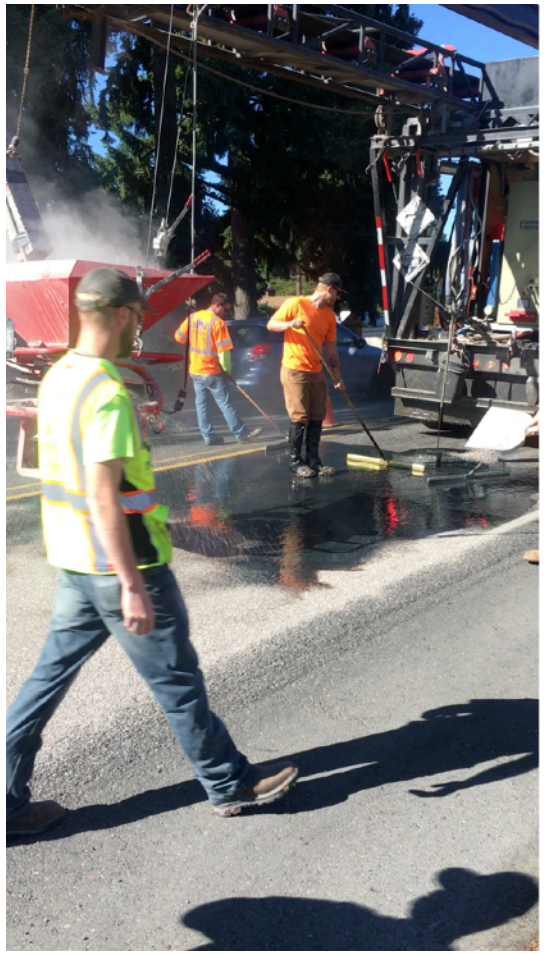

Applying Binder / Spreading Aggregate

Spreading Aggregate

Sweep and Open to Traffic

- Initial Sweeping: After curing and prior to allowing traffic on, vacuum/ sweep the loose aggregate
  - Recovered aggregate is recycled by blending with new aggregate
    - 2 parts new : 1 part recovered aggregate
- Open to traffic
  - Total time is temperature and quantity dependent, usually ~3 - 4 hours
- Second sweeping 3 - 5 days after opening to traffic

Cleanup, Cure, Initial Sweeping

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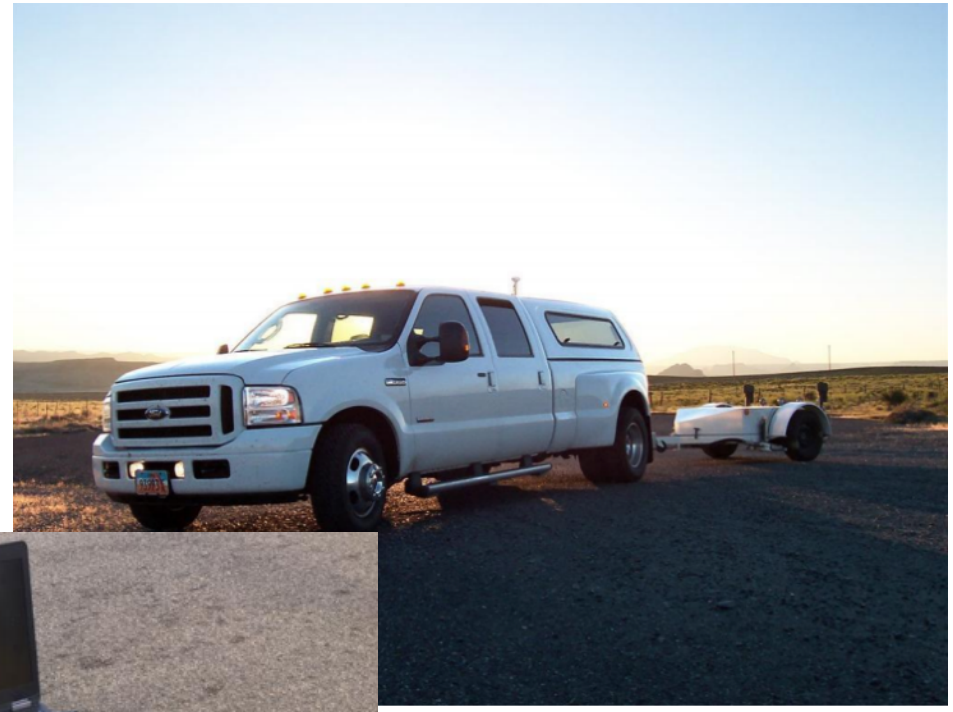
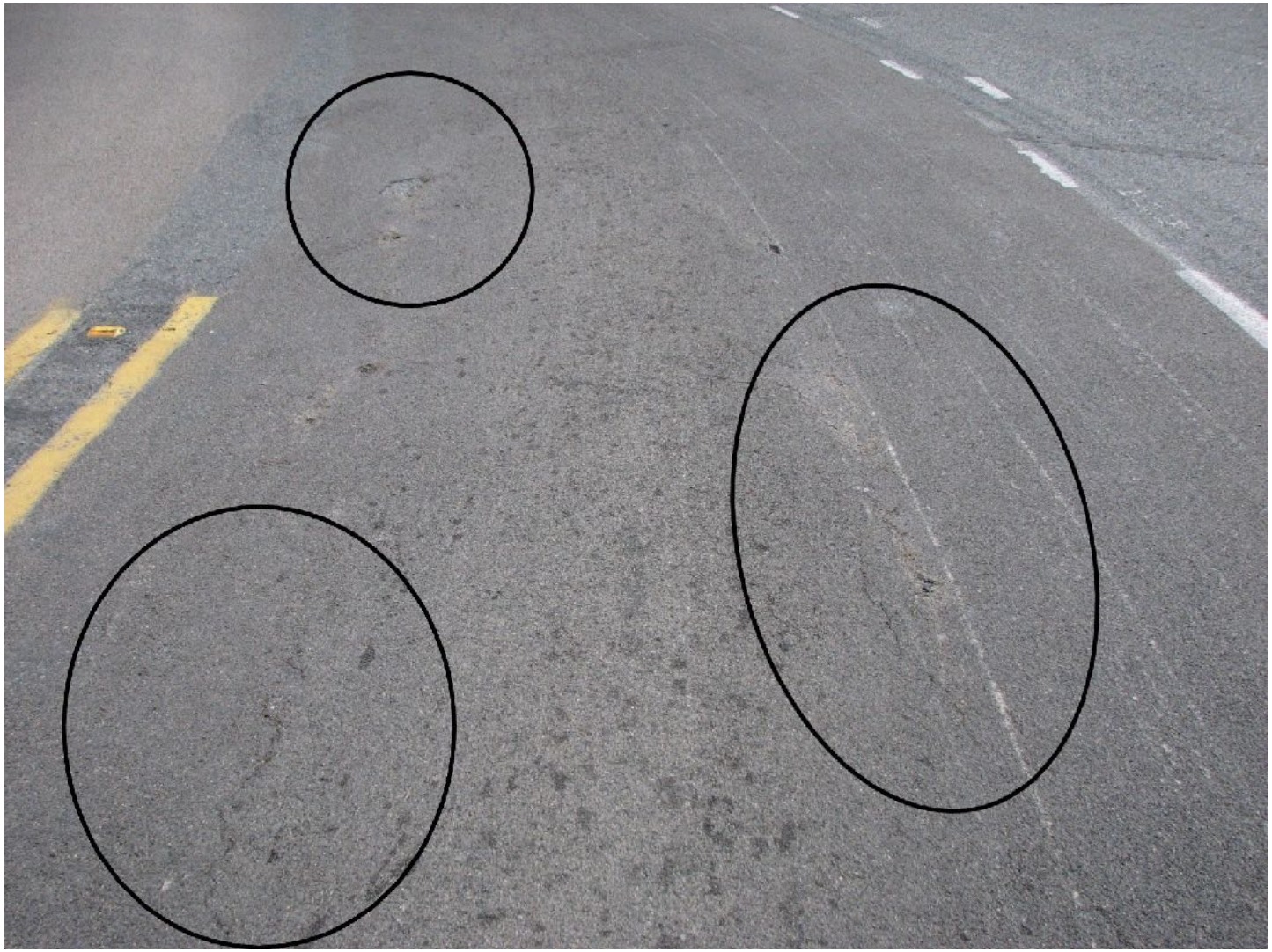
Acceptance Testing

- FN40R (Corrected FN corrected for speed) ASTM E274
  - 72 min
- Field Dynamic Friction Value ASTM E1911
  - 0.90 minimum
- Mean Profile Depth ASTM E2157
  - 1.0 minimum



Lessons Learned

- Better coordination for site selection, pavement rating/conditions and our Maintenance Section



Lessons Learned

- Acceptance Testing
  - Timing
    - ~~prior to opening~~
    - 10 to 15 days after placement
    - single traffic control set-up
  - Field Dynamic Friction Value
    - horizontal spinning disk with 3 spring loaded rubber sliders which contact the paved surface
    - rutting can cause erratic results

Lessons Learned

- Multiple locations
  - maintain appropriate Traffic Control at each location
- 2nd sweeping
  - ~~3 to 5~~ 10 to 15 days after HFST application
  - immediately before and same day as acceptance testing (single traffic control setup for both)
- Add 3rd sweeping 5 weeks after HFST application
  - HFST sheds aggregate weeks/months

4 months after application

The End?

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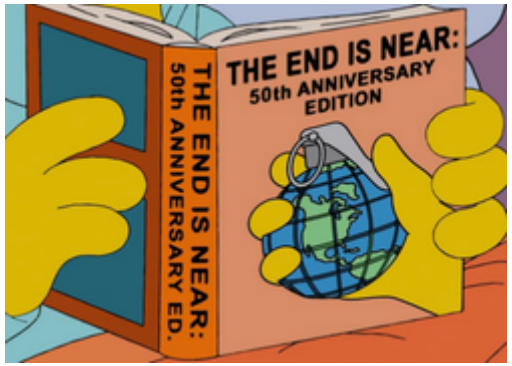
This should be the end of my presentation.



Failure of Binder

3 Months after placement

Suspected resin failure

Approximately the first 35’

Almost of the aggregate was gone

Concern of exposed resin

Ball Banked –
Found the resin to be no worst then older chip seal roadway

Repair Procedure

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Repair procedure:

- Grind to areas of exposed resin.
- Sweep area thoroughly.
- Blow off area utilizing compressed air
- HFST resin was hand mixed and applied (no truck was utilized)

Repair Procedure

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Repair procedure:

- Applying resin binder

Repair Procedure

Applying/Spreading Aggregate

- HFST aggregate was applied by hand (no truck was utilized)
- HFST patch once cured, was swept and TC was pulled
- There was no testing of the patch area

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QUESTIONS?

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