High Friction Surface Treatment

King County's Experience

NW Pavement Management Conference
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Kennewick, WA

Dan Dovey, P.E.

King County

Our HFST Journey

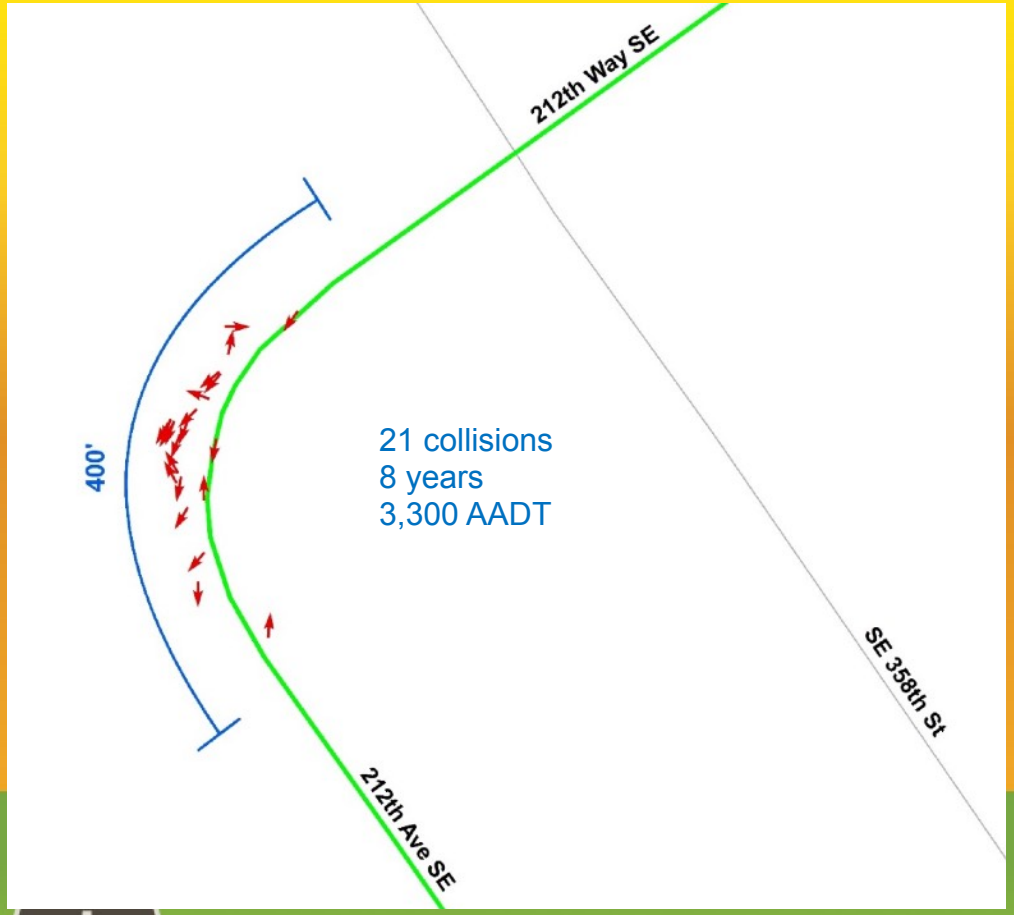
- Analysis
- Funding
- Design
- Construction
- Asset management
- Maintenance
- Lessons learned
- Effectiveness

Analysis - *Mapping Collisions*

- **Started in 2007**
- **Geospatial Data**
- **ArcGIS 10.3**

Analysis
Crash Rates

- Number of collisions over time
- Traffic volume, AADT
- Roadway length
- Threshold > 10 crashes/mvm
- Example: 28.8 crashes/mvm



Analysis

Crash Reduction Factors

Reduction in run-off-the-road collisions:

- Paved shoulders = 5-20%
- Raised pavement markers = 19%
- Shoulder rumble strips = 27%
- Warning signs = 41%
- High Friction Surface Treatment = **80%**

Analysis

Crash Reduction Factors

Reduction in rear end collisions at intersections:

- High Friction Surface Treatment = **50%**

Analysis
Early Examples

City of Bellevue – Forest Drive

- HFST installed in 2004
- Reapplied in 2007
- 5,000 AADT
- 15% Downgrade
- “T” intersection
- Icy conditions
- 78% crash reduction

Funding

Highway Safety Improvement Program

Federal grant administered by WSDOT

- Local agency safety plan
- Data driven approach
- Strategic implementation

$3.2 Million in 2014
$3.3 Million in 2016

Design

- Pavement evaluation
- Pavement restoration
  - Grind and overlay wearing course
  - Grind and overlay leveling & wearing courses
  - Replace crushed surfacing base course, pave new asphalt
- Coordination with paving projects
- Environmental review

Design

Special Provisions

- Temperature — 50°F and rising
- Time of year — June 1 to Sept 30
- Surface preparation — medium shot blast
- Epoxy
  - Cure time — 1-2 hours (varies w/temp)
  - Thickness — 50-65 mils
- Aggregate
  - Moisture content — 1.2% max.
  - Coverage — 13 lbs/SY
- Friction Number — 72 min.
- Materials — Two-part epoxy, calcined bauxite
- New pavement — 30 day period before HFST

Design
Cost estimate

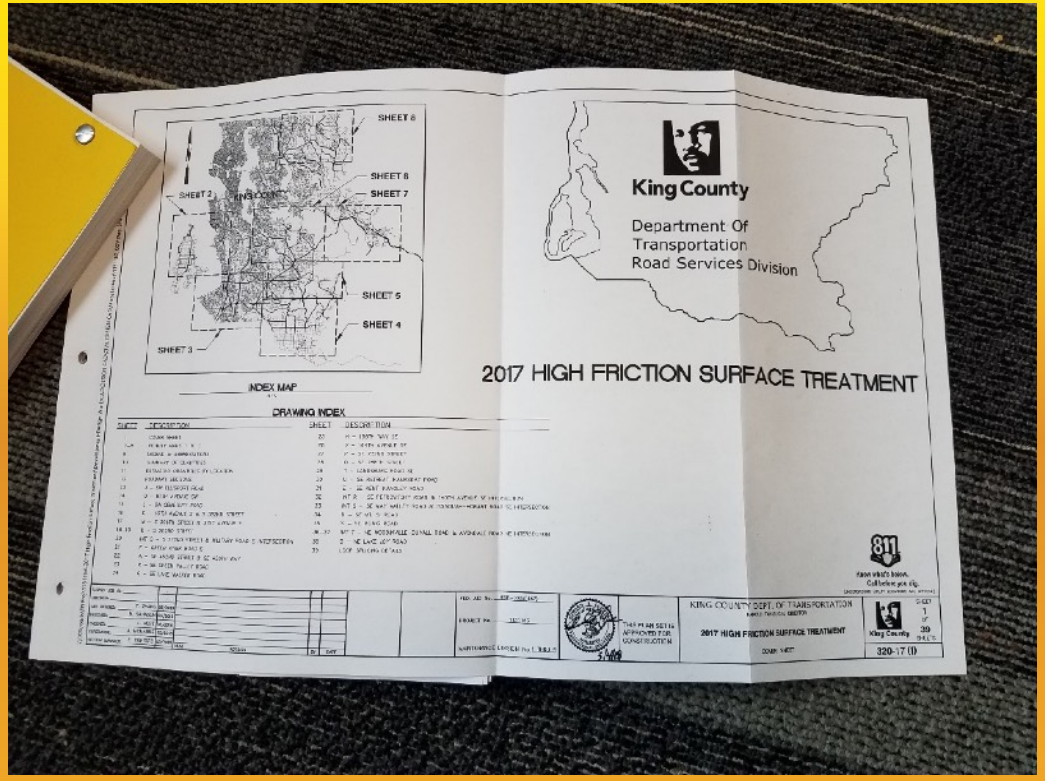
City of Bellevue, 2007: $75 per Square Yard

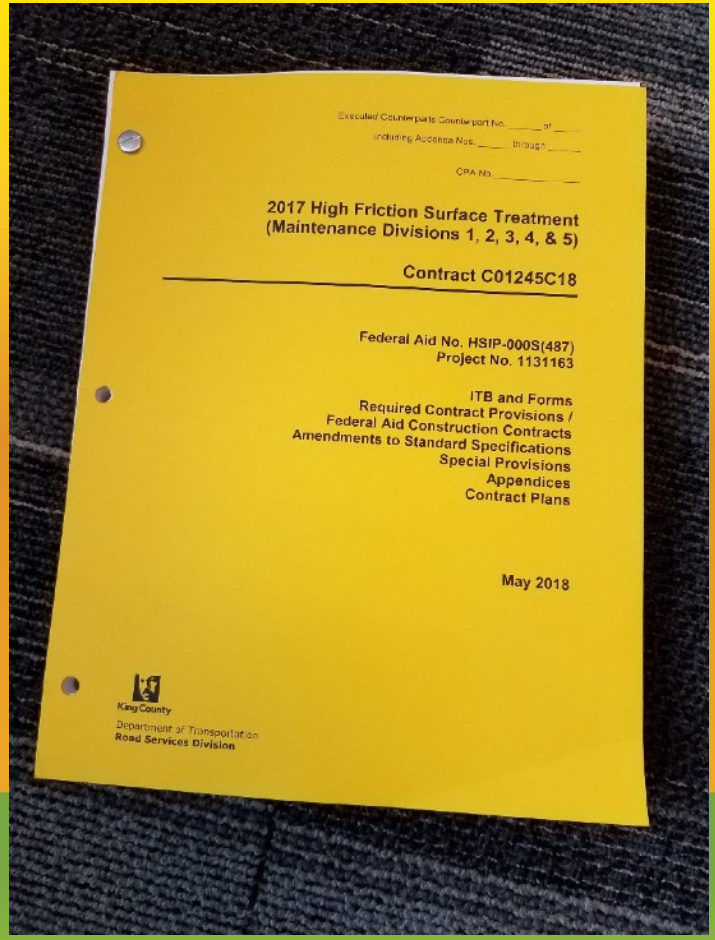
Engineer's Estimate: $50/SY

Low Bidder: 2016 $30/SY
2018 $34.75/SY

Design

Contract Advertisement





Construction

Subgrade Replacement

Construction

Pavement restoration

Construction

Surface preparation

Construction

Dust removal

Construction

Applying epoxy

Construction

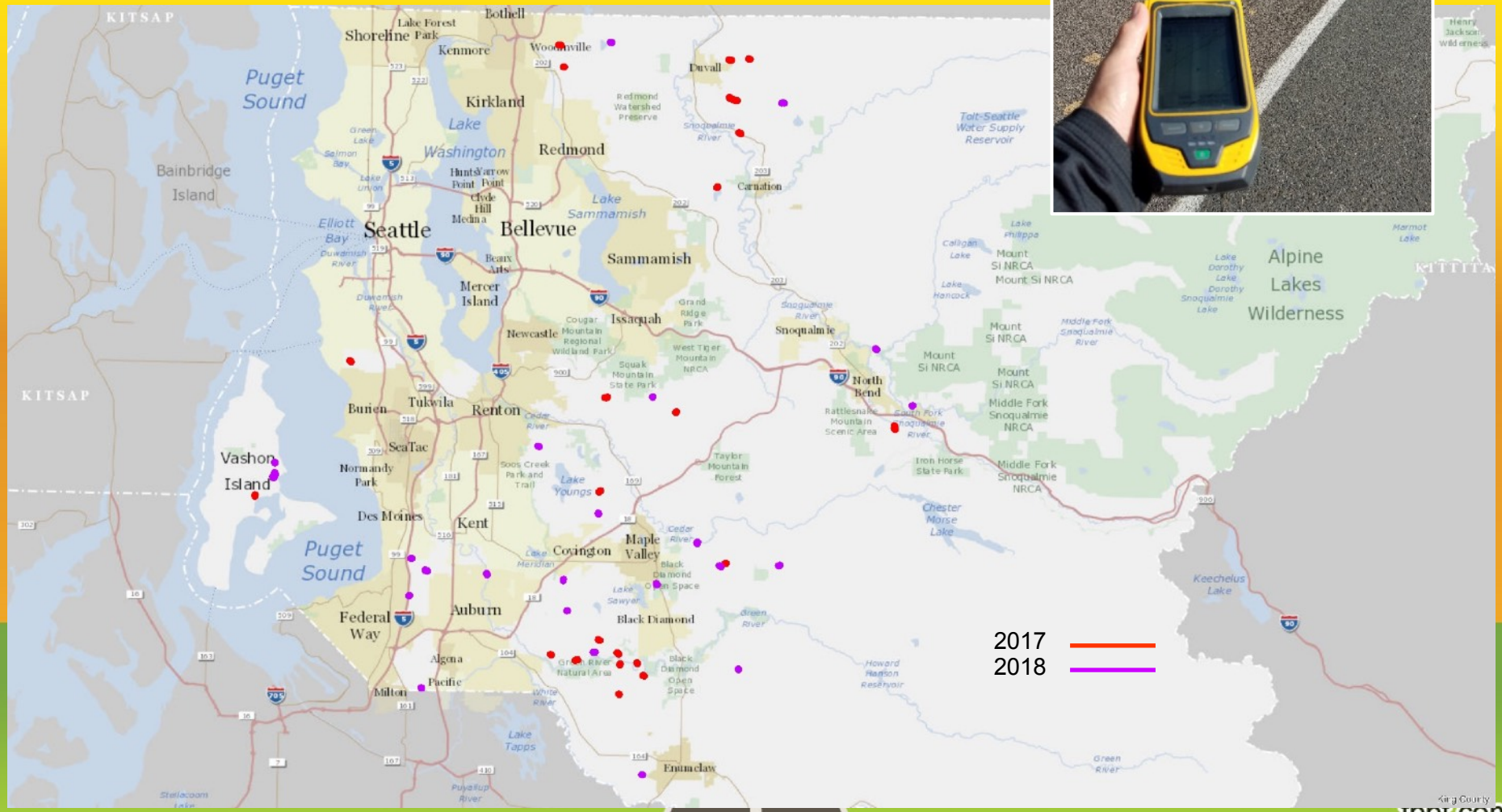
Applying calcined bauxite

Construction

Curing & Sweeping

Asset Management

- Trimble GPS Receiver
- ArcGIS & ArcPad
- CityWorks



Maintenance
Testing

- Locked Wheel Test
- Friction Number (FN)
- Tested annually

Maintenance

Underlying pavement must be in good condition for long term performance of HFST

Snowplowing

No evident damage to HFST or plow blades

Longevity

High traffic volume: 5-7 years (25,000+ ADT)

Low traffic volume: Life of pavement (under 10,000 ADT)

Maintenance

Potential problems

- Aggregate loss
- Delamination
- Uncured binder failure

Lessons Learned

Material availability

- Georgia
- Guyana
- China

Schedule

- Construction season
- Work zone coordination

Lessons Learned

Substrate Failure

Lessons Learned

Slipping Epoxy

Lessons Learned

Aggregate Loss

Effectiveness

- 15 months of “After” data
- 16 of 24 locations - zero crashes
- Motorcycles - 25% of crashes
- Contributing factors - DUI/drowsy/distracted driving
- Average crash rate reduction = **75%**

Questions?

Dan Dovey, P.E.
206-477-3692
Dan.Dovey@KingCounty.gov