Statewide Local Safety Training

Webinar

High Friction Surface Treatment

(HFST) Applications

for Cycle 6 Call-for-Projects

May 23, 2013

Stephanie Holloway, Placer County

Steven Castleberry, Nevada County

Ted Davini, Caltrans Local Assistance

Ken Kochevar, FHWA Division Office
Agenda

• Introductions and Objectives
• Why this is an Area of Concern
• What is High Friction Surface Treatment
• Assistance offered (WIIFU)
• HFST applications
• Examples of HFST
• Q&A Throughout
Objectives

1) What are HFSTs
2) Where and how to use HFSTs
3) How to apply through Cycle 6
4) Overall increased comfort level with HFST
# 9 Proven Safety Countermeasures

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Description</th>
<th>Contact</th>
<th>Cost Range</th>
<th>Data, Benefits, and Additional Information</th>
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<tbody>
<tr>
<td><strong>#1 Enhanced Delineation and Friction for Horizontal Curves</strong></td>
<td>Installing chevron signs, curve warning signs, sequential flashing beacons, advisory speed signs or high friction surface treatments can have a positive affect on reducing vehicles that leave the roadway on horizontal curves.</td>
<td>Ken</td>
<td>Low-cost: Safety treatments vary by the severity of the curvature and the operating speed, but in general are low-cost.</td>
<td>Recent data shows that 28% of all fatal crashes occur on horizontal curves and about three times as many crashes occur on curves than in tangential sections of roadways. The listed countermeasures can reduce crashes from 13% to 43%. More information can be found at: <a href="http://safety.fhwa.dot.gov/provencountermeasures/fhwa_sa_12_009.htm">http://safety.fhwa.dot.gov/provencountermeasures/fhwa_sa_12_009.htm</a></td>
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Every Day Counts (EDC) Innovative Initiative

• Started in 2009 with EDC I (14 initiatives)
• EDC II started in 2012 (13 initiatives)
  – Shortening Project Delivery
  – Accelerating Technology
  – Innovative Deployment
• http://www.fhwa.dot.gov/everydaycounts
Roadway Departure Crash (RwD) - A non-intersection crash in which a vehicle crosses an edge line, a centerline, or otherwise leaves the traveled way.

National Fatal Crashes (Average 2009-2011)

30,305 Fatal Crashes/Year

15,783 Fatal RwD Crashes/Year

Source: NHTSA FARS
Understanding California’s Challenges & Opportunities

• 2008 - 2010: Average Fatalities: (3,080)

• State Highway System: (42%)

• Other (Local Roads): (58%)
Horizontal curves make up only 5 percent of the nation’s highway miles. Yet, more than 25 percent of all fatal crashes occur on horizontal curves.

High friction surface treatments (HFST) is a technology that dramatically and immediately reduces crashes and the related injuries and fatalities.

With friction values far exceeding conventional pavement friction, high friction surface treatments are applied to existing high-crash location to help motorists maintain better control in dry and wet driving conditions.
High Friction Surfacing Treatment (HFST) being tested for braking distances at high speed on wet and dry pavements.
High Friction Surface Treatment

Product may be applied either manually or mechanically.

Ave Skid = High 70’s - low 80’s
HFST Finished Product
Conceptual Relationship Between Friction Demand, Speed and Friction Availability

Source NCHRP 108
HFST Deployment Map

High Friction Usage

- Red: No sites
- Light Blue: At least one site
- Green: Multiple sites (5+)
- Yellow: Aggressive use

★ = National Demo Project
Key Messages

• **HFSTs reduce crashes** → **Reduce injuries and fatalities**

• Additional messages include:
  – the durability and longevity of the pavement surface
  – customizable to specific state and local safety needs
  – the return on investment
  – minimal impact to traffic during construction
  – negligible environmental impact
Key Messages cont.

– CRF typically in 30 – 40% range
– costs typically in the $20 - $40 per sq. yd. range
– Engineering judgment calls
  – Rt/Lf shoulders?
  – Begin/End?
  – One lane/Both lanes?
  – Will HFST help?
– On-line tool searches!
High Friction Surface Treatment (HFST) Checklist for Locals
High Friction Surface Treatment
Case Studies
Pennsylvania Department of Transportation identified a location on route 611 as one of their worst crash sites in Northampton County.

This location has a sharp right turn with vehicles skidding into north bound lane during wet and dry conditions.

This location averages 2.48 crashes per year and includes head on, side swipe, and hitting a fixed object.

With 3 deaths and 20 injury crashes in under 8 years a different course of action had to be attempted to reduce and avert further injuries on this rural route.
The HFST treatment was installed on 600 linear feet of 12 foot wide roadway in the spring of 2007:

- The pavement surface friction reading taken by Penn DOT before the application was 33

- The pavement surface friction reading taken by Penn DOT after the application was over 95

- The condition of the HFST treatment after four winters of constant snow plowing is excellent performing with no failures

- No reported crashes or skid off the road incidents since the HFST application the spring of 2007
Mixed 2 part epoxy resin is hand spread with a serrated squeegee.
2:30 PM, Swept, Dry and Ready for Traffic
Kentucky Results

High Friction Surface Treatment

• 32 sites selected and installed in 2009/10
• Preliminary evaluation of 26 projects shows a 69% reduction in crashes.
• KYTC instigated a three year HFST program which concludes in the summer of 2013 with over 120 HFST installations statewide.
One particular HFST installation in KY reported 55 wet weather and 3 dry weather crashes over a three period prior to the installation of HFST, in the 2.5 year period after the installation at the same location 5 wet weather and 1 dry weather crashes were reported.

To quote an official from the KYTC “this one project paid for all the other projects in the state”
California’s Experience with HFST
Planned Projects (State)

- 13 locations completed
- 37 locations are in the planning/design stage
- Roadway Departure Safety Implementation Plan
  - 179 locations
- Total - 229 locations
Planned Projects

• Typical locations:
  – Curves on rural highways and freeway connectors
  – End of loop on ramps
  – Intersections
Planned Projects DN-199

• All 28 collisions in 3 years occurred under wet pavement conditions

• District had used many low cost countermeasures with little change collision pattern.
Planned Projects DN-199

• Initial proposed project was to realign curve.
  – $14 million project
  – Project would take 5-6 years to get environmental approval and construct.

• Realignment project has been put on hold to install HFST (~$250K)
What’s in it for you (WIIFU)!!

- FREE technical assistance over the phone
- FREE presentations as available
- FREE field review as available
- FREE demo assistance as available
- Another proven safety countermeasure
- Overall reduction in crashes!!
Questions ??

On Objectives

1) What is High Friction Surface Treatments
2) Where and how to use HFST
Objectives

1) What is High Friction Surface Treatments
2) Where and how to use HFST
3) How to apply through Cycle 6
4) Overall increased comfort level with HFST
How to apply through Cycle 6

1) Time is of the essence! Applications Due 7/26/13
   a) Crash Analysis and location identification
      • TIMS Tools vs. Crossroads/Local Data
   b) Field review and project scoping (Using R24)
   c) Application Preparation
   d) Formal Approvals

2) Caltrans, Local Assistance HSIP webpage:
   a) Guidelines, Application, Instructions, Examples, etc.
      http://www.dot.ca.gov/hq/LocalPrograms/HSIP/apply_now.htm
   b) Recent Training Webinars (recordings and handouts)
      http://www.dot.ca.gov/hq/LocalPrograms/HSIP/training.html
Local Agency HFST Examples

1) Nevada County

2) Placer County
Potential HFST Projects in Nevada County
(or, Confessions of an HFST skeptic)

Steve Castleberry, Director
Nevada County Public Works Department
steven.castleberry@co.nevada.ca.us
Nevada County experience

Starting with an overall crash diagram can be overwhelming

Lot of dots, no clear patterns
Nevada County experience

Starting with an overall crash diagram can be overwhelming
Lot of dots, no clear patterns
Then we looked just at Fatal + Injury crashes
Nevada County experience

Starting with an overall crash diagram can be overwhelming

Lot of dots, no clear patterns

Then we looked just at Fatal + Injury crashes

Then we zeroed in on a couple of areas where we had some chronic crashes, and where we had tried some signing and striping with no apparent effect
High Friction Surface Treatment (HFST) Checklist for Locals

Pavement Condition
- Magnolia
- McCourtney
- Alta Sierra
Open/Gap Graded (1)
- Dense Graded (2)
Pavement overlay < 3 years (2)
Pavement overlay > 3 years (4)

Roadside Hazards
- Adequate Clear Recovery Area (0)
- Embankment > 6:1 (2)
- Trees/Utility Poles/Fixed Objects/Water (3)

Types of Crashes
- PDO (2)
- Injury (4)
- Fatal (6)

Roadway Characteristics
- Tangent (0)
- Vertical Curve (1)
- Horizontal Curve/Intersection (3)

Weather Conditions
- Dry (0)
- Wet (2)
- Icy (3)

Posted Speed
- < 50 mph (0)
- > 50 mph (2)

Total Points = _______

Guide to HFST as a safety countermeasure:
- < 7     HFST not recommended
- 7<x>14 HFST considered
- >14     HFST highly recommended
### High Friction Surface Treatment (HFST) Checklist for Locals

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- Tangent (0)
- Vertical Curve (1)
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**Total Points = __________**

10 | 7 | 16

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Adequate Clear Recovery Area (0) | Embankment > 6:1 (2) | Trees/Utility Poles/Fixed Objects/Water (3)
3 | 0 | 2

Types of Crashes
PDO (2) | Injury (4) | Fatal (6)
2 | 4 | 4

Roadway Characteristics
Tangent (0) | Vertical Curve (1) | Horizontal Curve/Intersection (3)
3 | 1 | 3

Weather Conditions
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Total Points = _______                       | 10       | 7          | 16          |

Guide to HFST as a safety countermeasure:

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- >14 HFST highly recommended

Use Alta Sierra as a pilot to guide future projects
Two sets of curves targeted
Nevada County experience

21 crashes, none in curve areas
June, July, August, September or October

11 out of 21 crashes after dark

16 out of 21 crashes were in the same, uphill direction

Few crashes in wet weather
Nevada County experience

21 crashes, none in curve areas
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16 out of 21 crashes were in the same, uphill direction

Few crashes in wet weather

Conversation with Road Superintendent highlighted road is north facing, likely icy
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Conversation with Road Superintendent highlighted road is north facing, likely icy
**Benefit / Cost Calculation Result**

1. **Project Information**
   - Application ID: 03-Nevada County-1
   - Version: 1

2. **Countermeasures and Crash Data**
   - **Crash Data Time Period:** 01/01/2002 to 07/01/2011
   - **Years:** 9.5
   - *Improve pavement friction (overlay or grooving)*
     - **CM Number:** R24
     - **Project Type:** Geometric Mod.
     - **Crash Type:** All
     - **CRF:** 30
     - **Life:** 10
     - **Fatality (Death):** 0
     - **Severe Injury:** 1
     - **Injury - Visible:** 9
     - **Other Injury - Pain:** 0
     - **Complaint:** 11
     - **Property Damage Only:** 21
     - **Total:** 21
     - **Annual Benefit:** $31,844
     - **Cost:** $105,000
     - **Life Benefit:** $318,442
     - **B/C Ratio:** 3.03

3. **Benefit Cost Result**
   - **Total Benefit:** $318,442
   - **Total Cost:** $105,000
   - **B/C Ratio:** 3.03
Nevada County experience – lessons learned

• Hadn’t ever considered HFST but it may be a cost effective tool for problem ice and frost locations

• Ken and Ted’s help was critical to support and confirm our findings.

• Probably need 15 to 20 crashes for a project to compete

• It took approximately 8 hours of analysis to identify a location and another 4 hours to do the HSIP application

• Still tinkering with B/C
Systemic Application of HFST
Placer County
**Introduction**

- Stephanie Holloway, P.E.
- Placer County Department of Public Works
  - Traffic Safety Engineer
- Placer County
  - Sacramento to Tahoe: I-80
  - 30,000 roadway signs
  - 1,000+ miles of road – rural and urban
HFST
High Friction Surface Treatment

- Looking for Run off Road type collision patterns
- Challenge Area 2 – SHSP – Rural
- Analyzing collision history and applying Counter Measures (CM) to crash location(s)
- Systemic - Typically lower cost solutions applied to many locations
Determine Initial Application Locations

Ran off Road - 10 years Injury Collisions

Legend
HFST_INJURY (ROR) EXTENT
- Fatal
- Severe Injury
- Other Visible Injury
HFST
High Friction Surface Treatment Project

- Determine Initial Project Limits
  - Query Collision Data – run off road crashes (MPC)
    - Fatal, Severe Injury and Other Visible Injury
  - Plot ROR Collision Data (via TIMS or Other mapping tools, GIS)
  - Identify high concentration corridors – Segment Analysis Tool

- Refine Project Limits
  - Field Review all locations
    - Start and stop of application
    - Determine single or double lane treatment - i.e. crashes occur NB only
  - Use HFST Checklist for Locals based on field observations

- Assign a cost per segment for each location
  - $20 to $30 per square yard
Determine Segment Benefits
- Assign a $ benefit for each segment
  - Appendix D of Local Roadway Safety Manual
  - Add in all crashes
- Assign CM:
  - R24 – Improve pavement friction
    - CRF of 30% applies to all crashes

Determine Project Benefit/Cost
- Per segment – looking for highest segments
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Final Benefit/Cost

- **Benefit:**
  - Life = $10,070,000

- **Cost:**
  - $1,210,000 construction costs
  - $1,500,000 total delivery costs

- **B/C:**
  - 6.71
Final Benefit / Cost

- **Project Benefit**
  - Sum of individual segment benefits within final segments (i.e. 10,070,000)

- **Determine total project Costs**
  - Segment area = length x width
    - (i.e. 939,541 yd\(^2\))
  - Apply a unit cost to each segment ($21/\text{yd}^2$)
  - Sum of segment costs (i.e. $1,210,000$)
  - Total Project Costs = PS&E, ROW, Environment, Construction Insp. & Engineering (i.e. $1,500,000$)
Auburn Folsom Road – Example

- Collision Data: 2003 – 2012 (10 years)
- Mostly rural, two lane, undivided
Corridor Example

HFST - Auburn Folsom Road
ROR - Injury Collisions only - 10 years

HFST - Auburn Folsom Road
All Collisions - 10 years

Legend
- Fatal
- Severe Injury
- Other Visible Injury
- HFST_ALL COLLISIONS EXTENT
  - Fatal
  - Severe Injury
  - Other Visible Injury
  - Complaint of Pain
  - Property Damage Only
Determine Project Benefits

Auburn Folsom Road Example

Legend

- Fatal
- Severe Injury
- Other Visible Injury
- Complaint of Pain
- Property Damage Only
- PlacerCountyRoads_May_2012
Project Example Southbound
Project Example Northbound
Crash analysis: - 2 hr
Location Identifications - varies (8 – 12 hrs)
Project Scoping & Location refinement – 8 hr
  - Including field review of locations
CM identification – 0 hr
Engineer’s and Total Project Cost Estimate - 4 hrs
Application Attachment Preparation – 4 hr
  - extra time it takes produce attachments
Filling out the Application – 4 hr
  - including Narrative Questions
Packaging and Submitting the application – 2 hr

Total Application Time – (32 hr – 36 hr)
  - 60% Analysis; 40% Application
Resources

- **Caltrans Local Assistance:**
  - HSIP Call for Project Information
  - Local Roadway Safety Manual for California Local Road Owners
    [http://www.dot.ca.gov/hq/LocalPrograms/hsip.htm](http://www.dot.ca.gov/hq/LocalPrograms/hsip.htm)

- **TIMS – Transportation Injury Mapping System**
  [http://www.tims.berkeley.edu/](http://www.tims.berkeley.edu/)
Placer County Department of Public Works
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Richard Moorehead, P.E., T.E.
Senior Civil Engineer
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(530) 745-7533

Stephanie Holloway, P.E.
Associate Civil Engineer/Safety Engineer
shollow@placer.ca.gov
(530) 745-7551
Local Agency Applications

- Nevada County
  - Steve Castleberry

- Placer County
  - Stephanie Holloway
Questions ??

Objectives

1) What is High Friction Surface Treatments
2) Where and how to use HFST
3) How to apply through Cycle 6
4) Overall increased comfort level with HFST