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

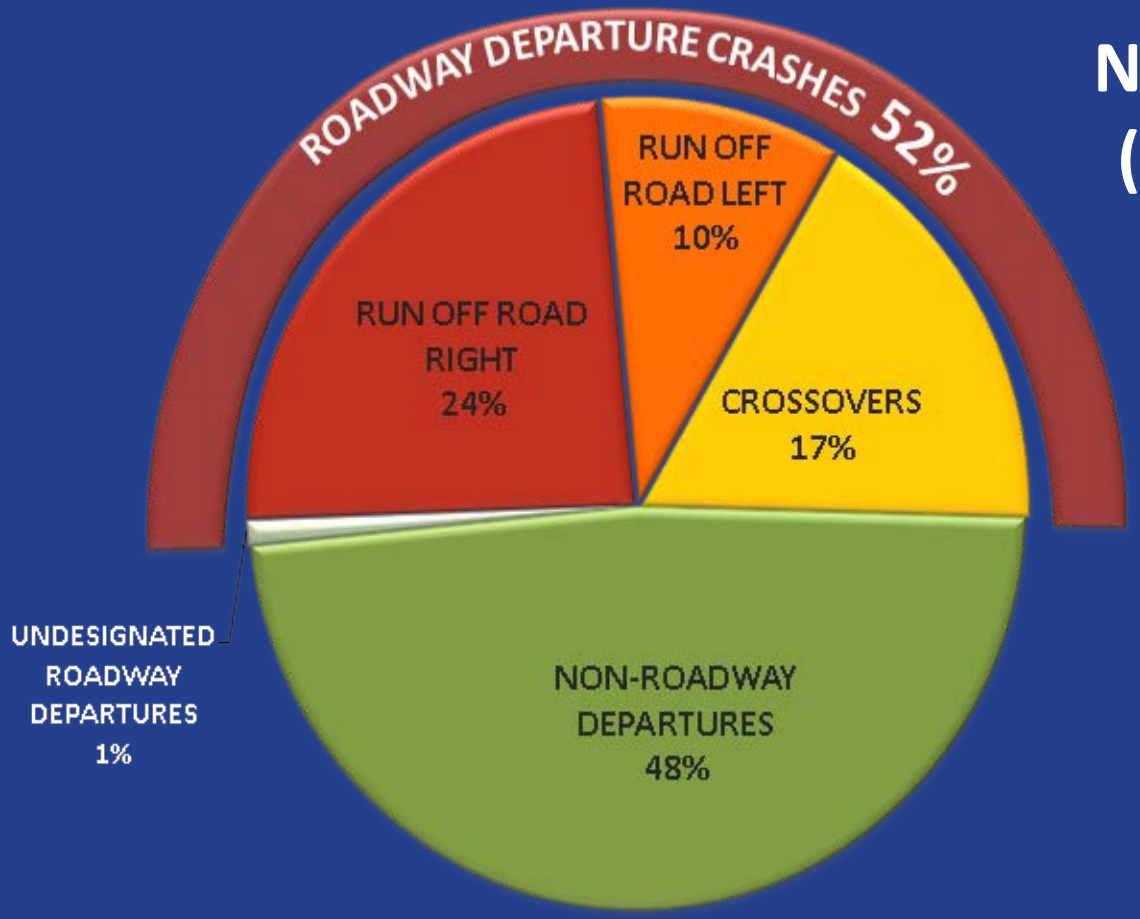
9 Proven Safety Countermeasures

Countermeasure	Description	Contact	Cost Range	Data, Benefits, and Additional Information
#1 **Enhanced Delineation and Friction for Horizontal Curves**	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.	Ken	**Low-cost:** Safety treatments vary by the severity of the curvature and the operating speed, but in general are low-cost.	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: http://safety.fhwa.dot.gov/provencountermeasures/fhwa_sa_12_009.htm

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 Crashes



National Fatal Crashes (Average 2009-2011)

30,305 Fatal Crashes/Year

15,783 Fatal RwD Crashes/Year

Source: NHTSA FARS

Roadway Departure Crash (RwD) - A non-intersection crash in which a vehicle crosses an edge line, a centerline, or otherwise leaves the traveled way.

Understanding California's Challenges & Opportunities

- 2008 - 2010: Average Fatalities: (3,080)
- State Highway System: (42%)
- Other (Local Roads): (58%)

High Friction Surfaces Treatments (EDC II) 2013

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 brakingdistances at high speed on wet and dry pavements

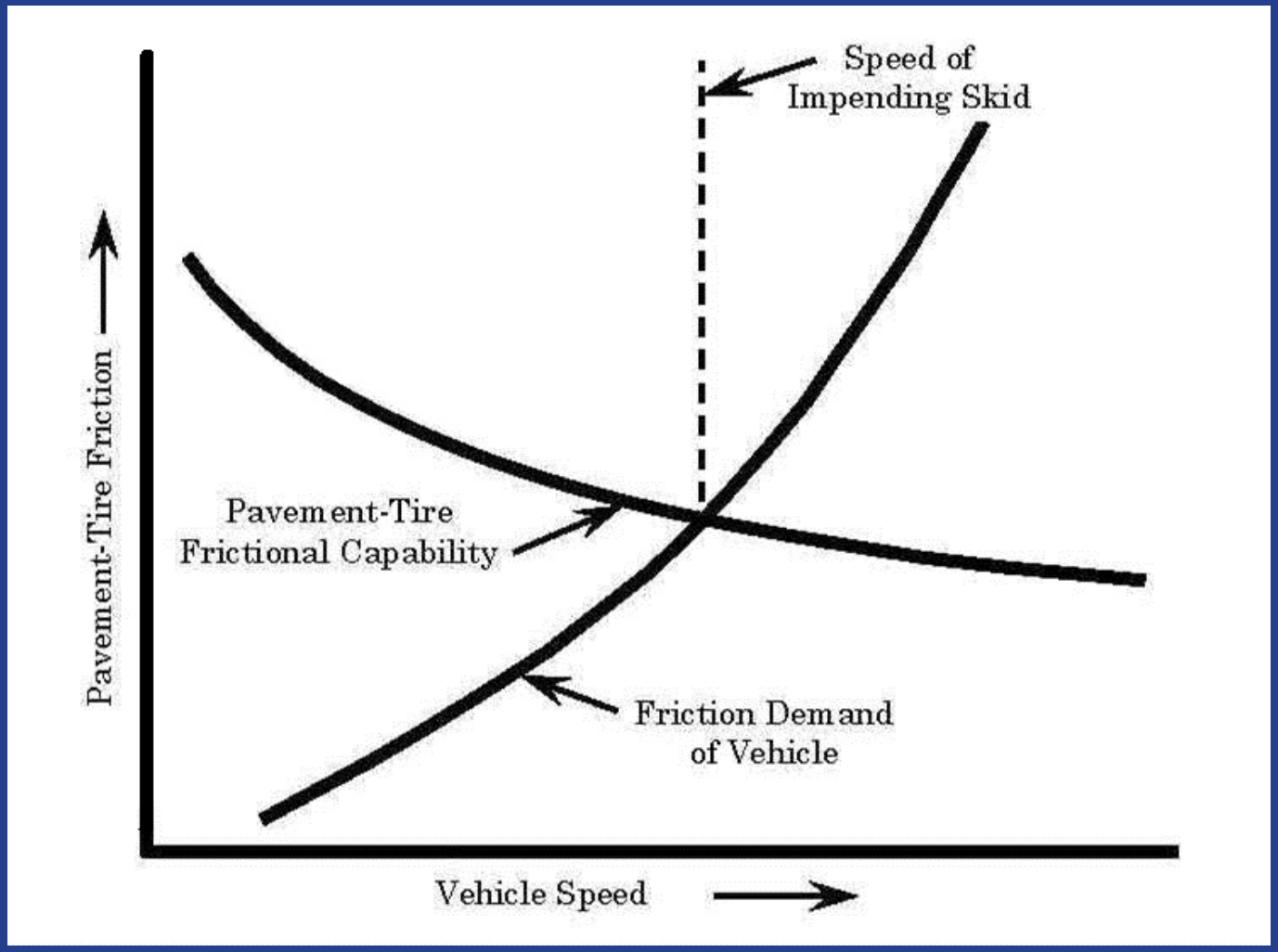
High Friction Surface Treatment

Product may be applied either manually or mechanically.

Ave Skid = High 70's - low 80's

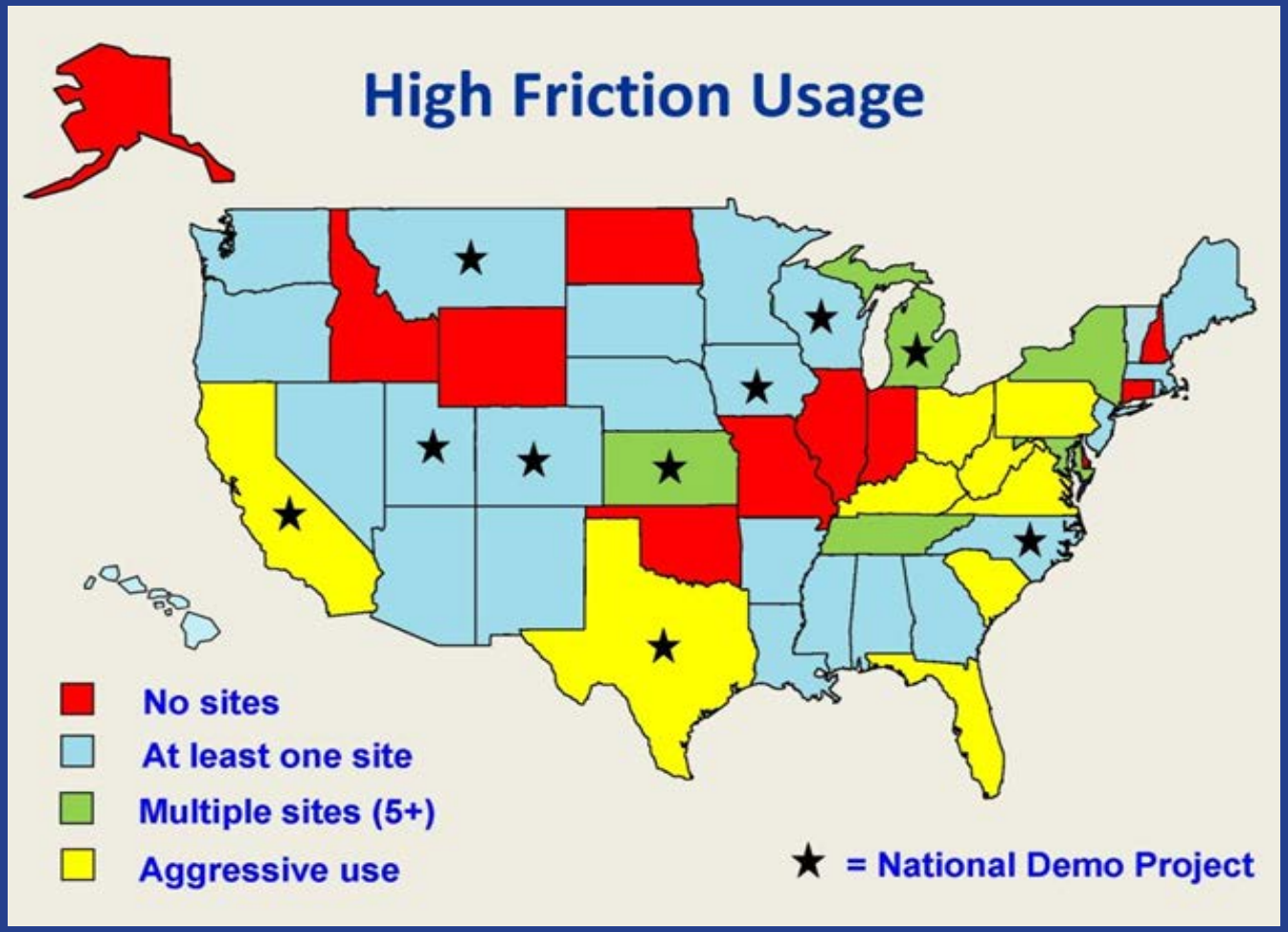
HFST Finished Product

Conceptual Relationship Between Friction Demand, Speed and Friction Availability



Source NCHRP 108

HFST Deployment Map



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! (https://s3.amazonaws.com/media.atssa.com/default-file/1480+ATSSA+High+Friction+LoRes.pdf)

High Friction Surface Treatment (HFST) Checklist for Locals

High Friction Surface Treatment Case Studies

HFST case study for the Penn DOT approval process

- 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

Route 611 installation requirements by Penn DOT

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

Begins at 8:30 AM 6/13/07

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.

30
30
NB 01-DN-199 PM 8.2

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

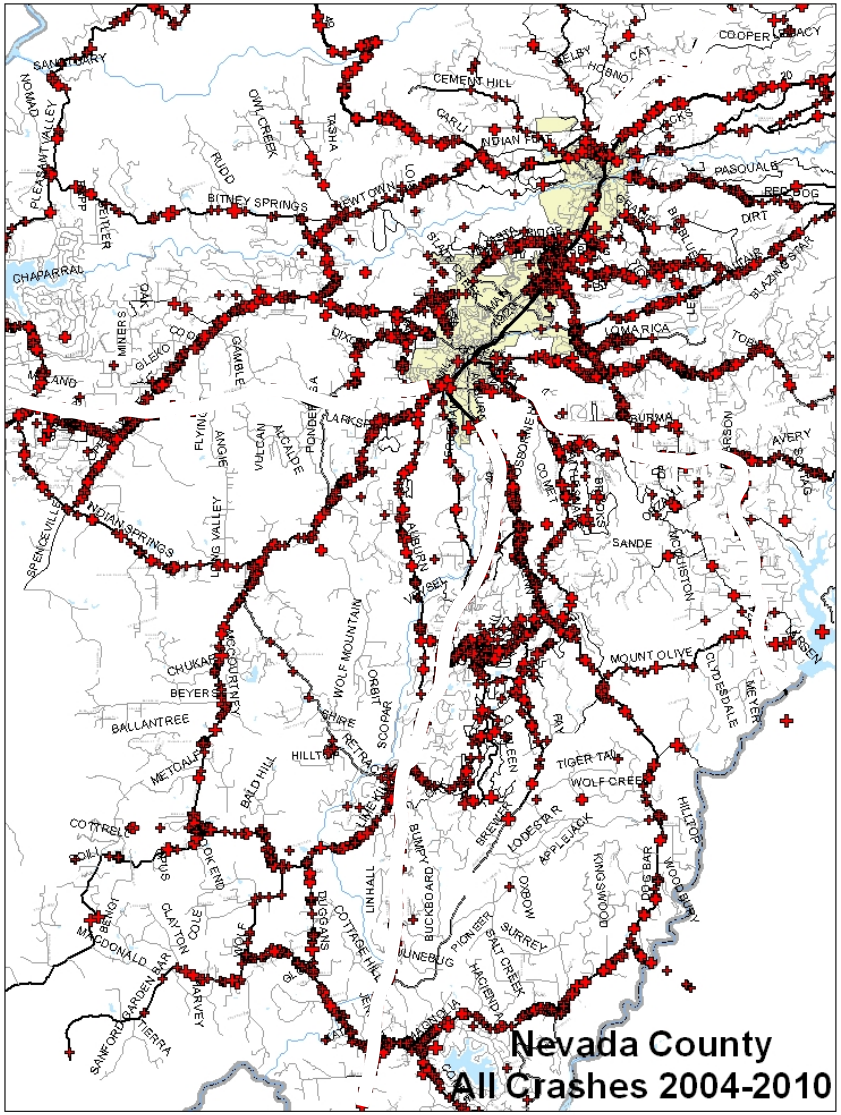
2) Placer County

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

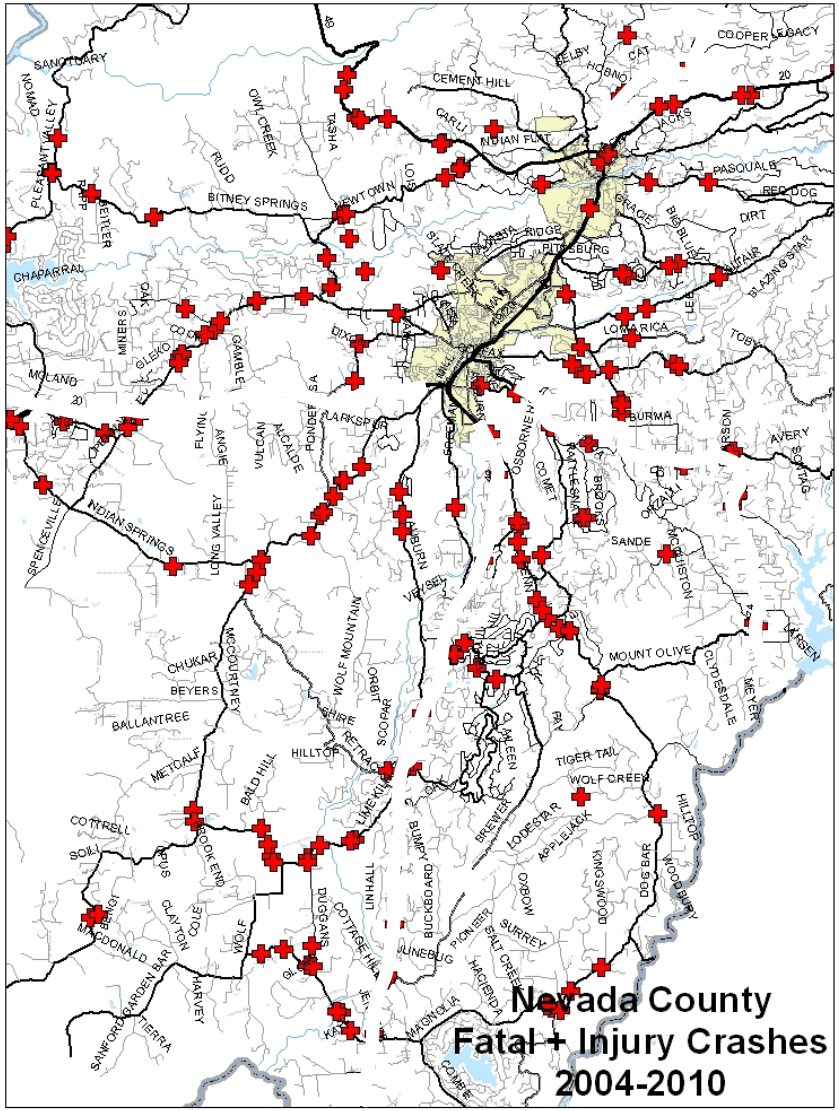
Nevada County experience



Starting with an overall crash diagram can be overwhelming

Lot of dots, no clear patterns

Nevada County experience



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Then we looked just at Fatal + Injury crashes

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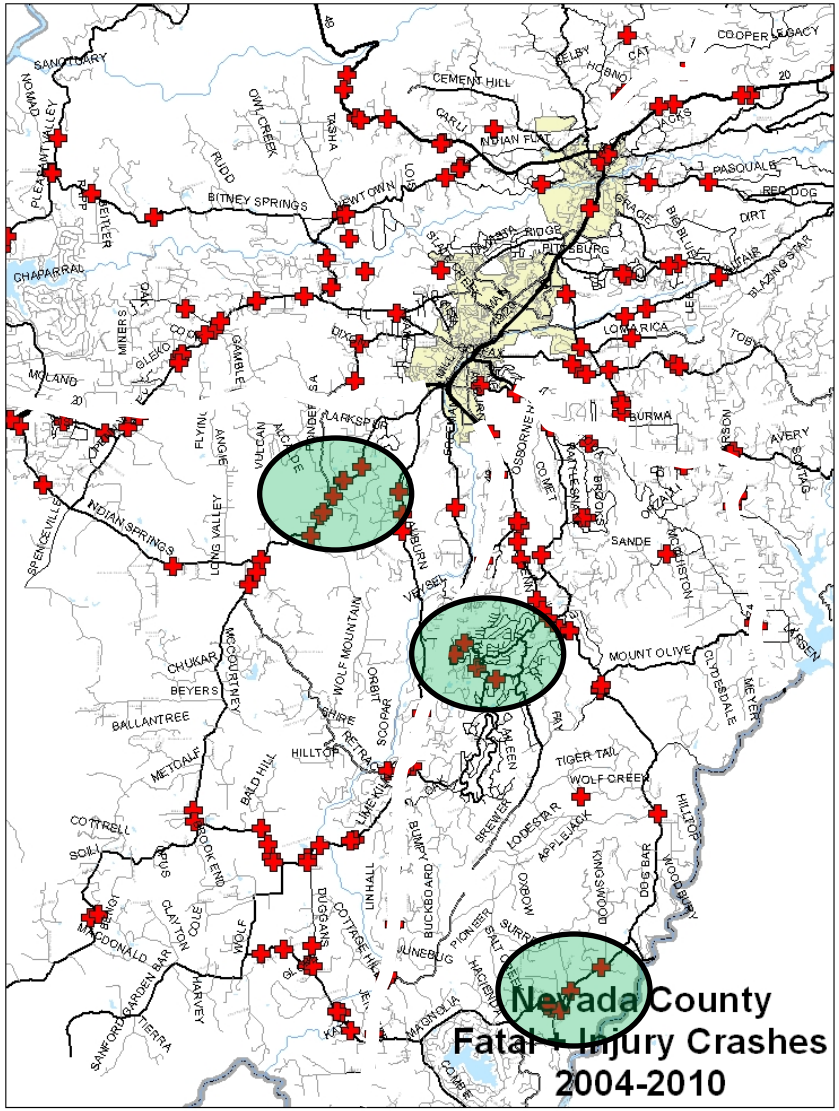


Starting with an overall crash diagram can be overwhelming

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)

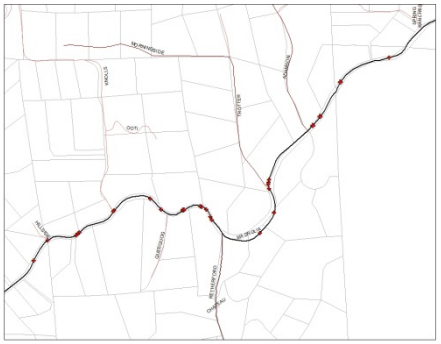
Weather Conditions
Dry (0)
Wet (2)
Icy (3)

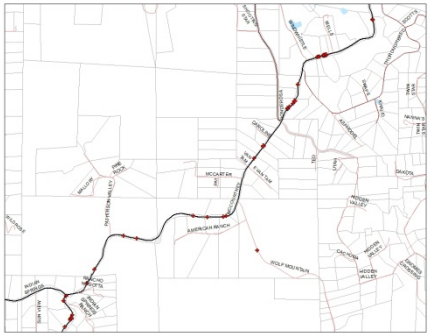
Posted Speed
< 50 mph (0)
> 50 mph (2)

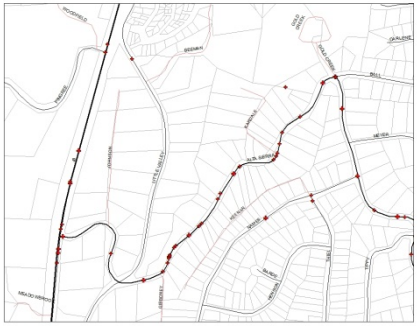
Total Points = _____

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

	Magnolia	McCourtney	Alta Sierra
Pavement Condition			
Open/Gap Graded (1)			
Dense Graded (2)	2	2	4
Pavement overlay < 3 years (2)			
Pavement overlay > 3 years (4)			
Roadside Hazards			
Adequate Clear Recovery Area (0)			
Embankment > 6:1 (2)	3	0	2
Trees/Utility Poles/Fixed Objects/Water (3)			
Types of Crashes			
PDO (2)	2	4	4
Injury (4)			
Fatal (6)			
Roadway Characteristics			
Tangent (0)			
Vertical Curve (1)			
Horizontal Curve/Intersection (3)	3	1	3
Weather Conditions			
Dry (0)			
Wet (2)	0	0	3
Icy (3)			
Posted Speed			
< 50 mph (0)	0	0	0
> 50 mph (2)			
Total Points = _____	10	7	16

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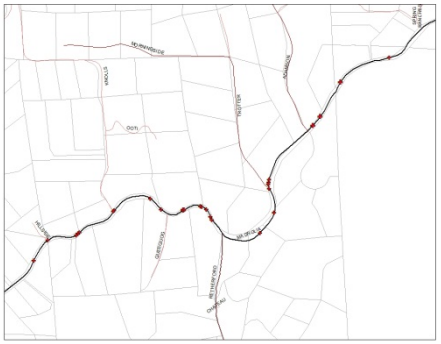

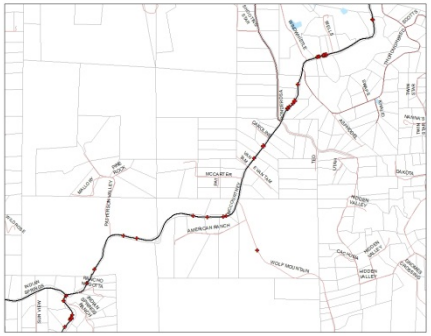

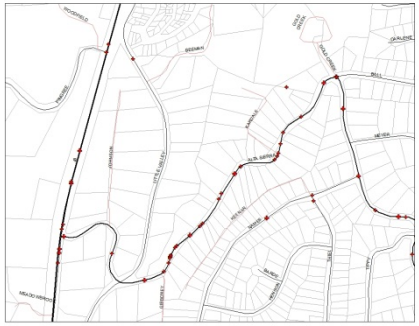

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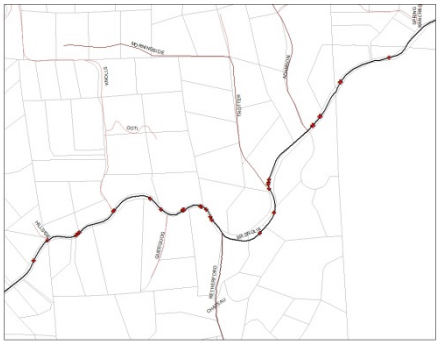

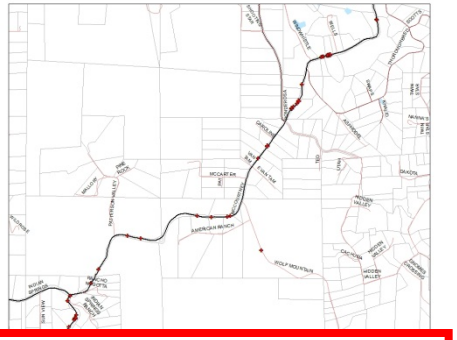

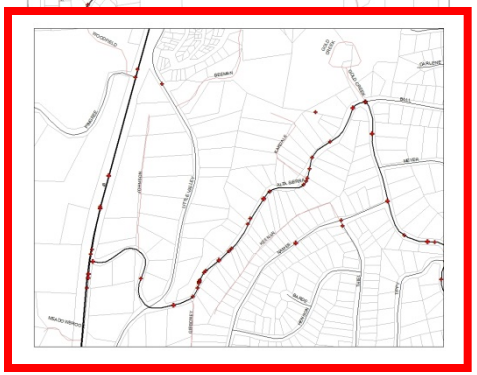

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Weather Conditions			
Dry (0)			
Wet (2)	0	0	0
Icy (3)			
Posted Speed			
< 50 mph (0)	0	0	0
> 50 mph (2)			
Total Points = _____	10	7	16

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Use Alta Sierra as a pilot to guide future projects

Two sets of curves targeted
BEEMAN
BALL
KARDALE
MEYER
JOHNSON
LITTLE VALLEY
ALTA SIERRA
KEENAN
NAMES
THIEL
HENSON
BARDE
TIPPY
GIBBONEY

Nevada County experience

ACCIDENT_N	LOCATION	DISTANCE	DIRECTION	DATE	TIME	COLL_TYPE	INVOLVED	EXTENT	REPNO	PCF	LIGHTING	NUMO_INJ	NUMO_KLD	PARTY1	PARTY2	DOT1	DOT2	MPC1	MPC2
8003140512744	Alta Sierra Drive at Kardale Court	4	East	11/29/2001	02:05 PM	Overturned	Non-Collision	Other Visible Injury		Unsafe Speed	Daylight	1	0	Driver		East		Other Unsafe Turning	
8348232013881	Alta Sierra Drive at Kardale Court	0	Not Stated	11/9/2002	11:20 PM	Hit Object	Fixed Object	Property Damage Only	0500470	Unsafe Speed	Dark - No Street Lights	0	0	Driver		East		Ran Off Road	
8491203012748	Alta Sierra Drive at Little Valley Road	200	East	4/1/2003	08:30 PM	Overturned	Non-Collision	Property Damage Only	0740281	Unsafe Speed	Dark - No Street Lights	0	0	Driver		West		Ran Off Road	
8621180513388	Alta Sierra Drive at Gibboney Lane	66	East	8/9/2003	06:05 PM	Hit Object	Fixed Object	Other Visible Injury	0954261	Driving Under Influence	Daylight	1	0	Driver		East		Ran Off Road	
8719145014478	Alta Sierra Drive at Gibboney Lane	50	East	11/15/2003	02:50 PM	Hit Object	Fixed Object	Other Visible Injury	1115203	Other Hazardous Movement	Daylight	1	0	Driver		East		Ran Off Road	
8994192512744	Alta Sierra Drive at Kardale Court	20	West	8/16/2004	07:25 PM	Hit Object	Fixed Object	Other Visible Injury	1585735	Driving Under Influence	Dusk - Dawn	1	0	Driver		West		Ran Off Road	
9209124011017	Alta Sierra Drive at Ball Road	792	West	3/19/2005	12:40 PM	Hit Object	Fixed Object	Property Damage Only	1957997	Unsafe Speed	Daylight	0	0	Driver		East		Proceeding Straight	
9249103009701	Alta Sierra Drive at Kardale Court	31	East	4/28/2005	10:30 AM	Hit Object	Fixed Object	Other Visible Injury	1996453	Other Hazardous Movement	Daylight	1	0	Driver		East		Proceeding Straight	
9256133013007	Alta Sierra Drive at Gibboney Lane	100	East	5/5/2005	01:30 PM	Hit Object	Fixed Object	Other Visible Injury	2024985	Unsafe Speed	Daylight	1	0	Driver		East		Proceeding Straight	
9406151512744	Alta Sierra Drive at Kardale Court	20	West	10/2/2005	03:15 PM	Hit Object	Fixed Object	Property Damage Only	2267080	Driving Under Influence	Daylight	0	0	Driver		East		Ran Off Road	
9546145514478	Alta Sierra Drive at Kardale Court	2	East	2/19/2006	02:55 PM	Hit Object	Fixed Object	Property Damage Only	2510987	Improper Turning	Daylight	0	0	Driver		East		Ran Off Road	
9581191214478	Alta Sierra Drive at Little Valley Road	190	East	3/26/2006	07:12 PM	Head-On	Other Motor Vehicle	Other Visible Injury	2566656	Wrong Side of Road	Dark - No Street Lights	3	0	Driver	Driver	East	West	Crossed Into Opposing Lane - Unplanned	Proceeding Straight
9632211513881	Alta Sierra Drive at Gibboney Lane	92	East	5/16/2006	09:15 PM	Overturned	Fixed Object	Other Visible Injury	2645199	Other Than Driver or Ped	Dark - No Street Lights	2	0	Driver		East		Ran Off Road	
9851220013903	Alta Sierra Drive at Gibboney Lane	200	East	12/21/2006	10:00 PM	Hit Object	Fixed Object	Property Damage Only	2973089	Improper Turning	Dark - Street Lights	0	0	Driver		East		Ran Off Road	
9907004213881	Alta Sierra Drive at Little Valley Road	136	East	2/15/2007	12:42 AM	Hit Object	Fixed Object	Severe Injury	3101617	Improper Turning	Dark - No Street Lights	1	0	Driver		East		Ran Off Road	
9998224010781	Alta Sierra Drive at Kardale Court	7	West	5/17/2007	10:40 PM	Hit Object	Fixed Object	Property Damage Only	3239805	Driving Under Influence	Dark - Street Lights	0	0	Driver		East		Ran Off Road	
10022012012700	Alta Sierra Drive at Kardale Court	66	East	6/10/2007	01:20 AM	Overturned	Non-Collision	Property Damage Only	3219450	Driving Under Influence	Dark - No Street Lights	0	0	Driver		East		Ran Off Road	
10189191512900	Alta Sierra Drive at State Highway 49	528	East	11/24/2007	07:15 PM	Rear-End	Other Motor Vehicle	Property Damage Only	3480981	Following Too Closely	Dark - No Street Lights	0	0	Driver	Driver	West	West	Proceeding Straight	Slowing/Stopping
10199124511000	Alta Sierra Drive at Gibboney Lane	190	East	12/4/2007	12:45 PM	Hit Object	Fixed Object	Other Visible Injury	3488155	Unsafe Speed	Daylight	1	0	Driver		West		Ran Off Road	
10615235014400	Alta Sierra Drive at Gibboney Lane	150	East	1/23/2009	11:50 PM	Overturned	Non-Collision	Property Damage Only	4038449	Unsafe Speed	Dark - No Street Lights	0	0	Driver		East		Other Unsafe Turning	
10692174013400	Alta Sierra Drive at Gibboney Lane	62	East	4/10/2009	05:40 PM	Rear-End	Other Motor Vehicle	Property Damage Only	4209206	Unsafe Speed	Daylight	0	0	Driver	Driver	East	East	Proceeding Straight	Slowing/Stopping

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

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8003140512744	Alta Sierra Drive at Kardale Court	4	East	11/29/2001	02:05 PM	Overturned	Non-Collision	Other Visible Injury		Unsafe Speed	Daylight	1	0	Driver		East		Other Unsafe Turning	
8348232013881	Alta Sierra Drive at Kardale Court	0	Not Stated	11/9/2002	11:20 PM	Hit Object	Fixed Object	Property Damage Only	0500470	Unsafe Speed	Dark - No Street Lights	0	0	Driver		West		Ran Off Road	
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9406151512744	Alta Sierra Drive at Kardale Court	20	West	10/2/2005	03:15 PM	Hit Object	Fixed Object	Property Damage Only	2267080	Driving Under Influence	Daylight	0	0	Driver		East		Ran Off Road	
9546145514478	Alta Sierra Drive at Kardale Court	2	East	2/19/2006	02:55 PM	Hit Object	Fixed Object	Property Damage Only	2510987	Improper Turning	Daylight	0	0	Driver		East		Ran Off Road	
9581191214478	Alta Sierra Drive at Little Valley Road	190	East	3/26/2006	07:12 PM	Head-On	Other Motor Vehicle	Other Visible Injury	2566656	Wrong Side of Road	Dark - No Street Lights	3	0	Driver	Driver	East	West	Crossed Into Opposing Lane - Unplanned	Proceeding Straight
9632211513881	Alta Sierra Drive at Gibboney Lane	92	East	5/16/2006	09:15 PM	Overturned	Fixed Object	Other Visible Injury	2645199	Other Than Driver or Ped	Dark - No Street Lights	2	0	Driver		East		Ran Off Road	
9851220013903	Alta Sierra Drive at Gibboney Lane	200	East	12/21/2006	10:00 PM	Hit Object	Fixed Object	Property Damage Only	2973089	Improper Turning	Dark - Street Lights	0	0	Driver		East		Ran Off Road	
9907004213881	Alta Sierra Drive at Little Valley Road	136	East	2/15/2007	12:42 AM	Hit Object	Fixed Object	Severe Injury	3101617	Improper Turning	Dark - No Street Lights	1	0	Driver		East		Ran Off Road	
9998224010781	Alta Sierra Drive at Kardale Court	7	West	5/17/2007	10:40 PM	Hit Object	Fixed Object	Property Damage Only	3239805	Driving Under Influence	Dark - Street Lights	0	0	Driver		East		Ran Off Road	
10022012012700	Alta Sierra Drive at Kardale Court	66	East	6/10/2007	01:20 AM	Overturned	Non-Collision	Property Damage Only	3219450	Driving Under Influence	Dark - No Street Lights	0	0	Driver		East		Ran Off Road	
10189191512900	Alta Sierra Drive at State Highway 49	528	East	11/24/2007	07:15 PM	Rear-End	Other Motor Vehicle	Property Damage Only	3480981	Following Too Closely	Dark - No Street Lights	0	0	Driver	Driver	West	West	Proceeding Straight	Slowing/Stopping
10199124511000	Alta Sierra Drive at Gibboney Lane	190	East	12/4/2007	12:45 PM	Hit Object	Fixed Object	Other Visible Injury	3488155	Unsafe Speed	Daylight	1	0	Driver		West		Ran Off Road	
10615235014400	Alta Sierra Drive at Gibboney Lane	150	East	1/23/2009	11:50 PM	Overturned	Non-Collision	Property Damage Only	4038449	Unsafe Speed	Dark - No Street Lights	0	0	Driver		East		Other Unsafe Turning	
10692174013400	Alta Sierra Drive at Gibboney Lane	62	East	4/10/2009	05:40 PM	Rear-End	Other Motor Vehicle	Property Damage Only	4209206	Unsafe Speed	Daylight	0	0	Driver	Driver	East	East	Proceeding Straight	Slowing/Stopping

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

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Nevada County experience

ACCIDENT_N	LOCATION	DISTANCE	DIRECTION	DATE	TIME	COLL_TYPE	INVOLVED	EXTENT
8003140512744	Alta Sierra Drive at Kardale Court	4	East	11/29/2001	02:05 PM	Overturned	Non-Collision	Other Visible Injury
8348232013881	Alta Sierra Drive at Kardale Court	0	Not Stated	11/9/2002	11:20 PM	Hit Object	Fixed Object	Property Damage Only
8491203012748	Alta Sierra Drive at Little Valley Road	200	East	4/1/2003	08:30 PM	Overturned	Non-Collision	Property Damage Only
8621180513388	Alta Sierra Drive at Gibboney Lane	66	East	8/9/2003	06:05 PM	Hit Object	Fixed Object	Other Visible Injury
8719145014478	Alta Sierra Drive at Gibboney Lane	50	East	11/15/2003	02:50 PM	Hit Object	Fixed Object	Other Visible Injury
8994192512744	Alta Sierra Drive at Kardale Court	20	West	8/16/2004	07:25 PM	Hit Object	Fixed Object	Other Visible Injury
9209124011017	Alta Sierra Drive at Ball Road	792	West	3/19/2005	12:40 PM	Hit Object	Fixed Object	Property Damage Only
9249103009701	Alta Sierra Drive at Kardale Court	31	East	4/28/2005	10:30 AM	Hit Object	Fixed Object	Other Visible Injury
9256133013007	Alta Sierra Drive at Gibboney Lane	100	East	5/5/2005	01:30 PM	Hit Object	Fixed Object	Other Visible Injury
9406151512744	Alta Sierra Drive at Kardale Court	20	West	10/2/2005	03:15 PM	Hit Object	Fixed Object	Property Damage Only
9546145514478	Alta Sierra Drive at Kardale Court	2	East	2/19/2006	02:55 PM	Hit Object	Fixed Object	Property Damage Only
9581191214478	Alta Sierra Drive at Little Valley Road	190	East	3/26/2006	07:12 PM	Head-On	Other Motor Vehicle	Other Visible Injury
9632211513881	Alta Sierra Drive at Gibboney Lane	92	East	5/16/2006	09:15 PM	Overturned	Fixed Object	Other Visible Injury
9851220013903	Alta Sierra Drive at Gibboney Lane	200	East	12/21/2006	10:00 PM	Hit Object	Fixed Object	Property Damage Only
9907004213881	Alta Sierra Drive at Little Valley Road	136	East	2/15/2007	12:42 AM	Hit Object	Fixed Object	Severe Injury
9998224010781	Alta Sierra Drive at Kardale Court	7	West	5/17/2007	10:40 PM	Hit Object	Fixed Object	Property Damage Only
10022012012700	Alta Sierra Drive at Kardale Court	66	East	6/10/2007	01:20 AM	Overturned	Non-Collision	Property Damage Only
10189191512900	Alta Sierra Drive at State Highway 49	528	East	11/24/2007	07:15 PM	Rear-End	Other Motor Vehicle	Property Damage Only
10199124511000	Alta Sierra Drive at Gibboney Lane	190	East	12/4/2007	12:45 PM	Hit Object	Fixed Object	Other Visible Injury
10615235014400	Alta Sierra Drive at Gibboney Lane	150	East	1/23/2009	11:50 PM	Overturned	Non-Collision	Property Damage Only
10692174013400	Alta Sierra Drive at Gibboney Lane	62	East	4/10/2009	05:40 PM	Rear-End	Other Motor Vehicle	Property Damage Only

No crashes in curve areas June, July, August, September or October

11 out of 21 crashes after dark

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ACCIDENT_N	LOCATION	DISTANCE	DIRECTION	DATE	TIME	COLL_TYPE	INVOLVED	EXTENT	REPNO	PCF	LIGHTING	NUMO_INI	NUMO_KLD	PARTY1	PARTY2	DOT1	DOT2	MPC1	MPC2
8003140512744	Alta Sierra Drive at Kardale Court	4	East	11/29/2001	02:05 PM	Overturned	Non-Collision	Other Visible Injury		Unsafe Speed	Daylight	1	0	Driver		East		Other Unsafe Turning	
8348232013881	Alta Sierra Drive at Kardale Court	0	Not Stated	11/9/2002	11:20 PM	Hit Object	Fixed Object	Property Damage Only	0500470	Unsafe Speed	Dark - No Street Lights	0	0	Driver		West		Ran Off Road	
8491203012748	Alta Sierra Drive at Little Valley Road	200	East	4/1/2003	08:30 PM	Overturned	Non-Collision	Property Damage Only	0740281	Unsafe Speed	Dark - No Street Lights	0	0	Driver		East		Ran Off Road	
8621180513388	Alta Sierra Drive at Gibboney Lane	66	East	8/9/2003	06:05 PM	Hit Object	Fixed Object	Other Visible Injury	0954261	Driving Under Influence	Daylight	1	0	Driver		East		Ran Off Road	
8719145014478	Alta Sierra Drive at Gibboney Lane	50	East	11/15/2003	02:50 PM	Hit Object	Fixed Object	Other Visible Injury	1115203	Other Hazardous Movement	Daylight	1	0	Driver		East		Ran Off Road	
8994192512744	Alta Sierra Drive at Kardale Court	20	West	8/16/2004	07:25 PM	Hit Object	Fixed Object	Other Visible Injury	1585735	Driving Under Influence	Dusk - Dawn	1	0	Driver		West		Ran Off Road	
9209124011017	Alta Sierra Drive at Ball Road	792	West	3/19/2005	12:40 PM	Hit Object	Fixed Object	Property Damage Only	1957997	Unsafe Speed	Daylight	0	0	Driver		East		Proceeding Straight	
9249103009701	Alta Sierra Drive at Kardale Court	31	East	4/28/2005	10:30 AM	Hit Object	Fixed Object	Other Visible Injury	1996453	Other Hazardous Movement	Daylight	1	0	Driver		East		Proceeding Straight	
9256133013007	Alta Sierra Drive at Gibboney Lane	100	East	5/5/2005	01:30 PM	Hit Object	Fixed Object	Other Visible Injury	2024985	Unsafe Speed	Daylight	1	0	Driver		East		Proceeding Straight	
9406151512744	Alta Sierra Drive at Kardale Court	20	West	10/2/2005	03:15 PM	Hit Object	Fixed Object	Property Damage Only	2267080	Driving Under Influence	Daylight	0	0	Driver		East		Ran Off Road	
9546145514478	Alta Sierra Drive at Kardale Court	2	East	2/19/2006	02:55 PM	Hit Object	Fixed Object	Property Damage Only	2510987	Improper Turning	Daylight	0	0	Driver		East		Ran Off Road	
9581191214478	Alta Sierra Drive at Little Valley Road	190	East	3/26/2006	07:12 PM	Head-On	Other Motor Vehicle	Other Visible Injury	2566656	Wrong Side of Road	Dark - No Street Lights	3	0	Driver	Driver	East	West	Crossed Into Opposing Lane - Unplanned	Proceeding Straight
9632211513881	Alta Sierra Drive at Gibboney Lane	92	East	5/16/2006	09:15 PM	Overturned	Fixed Object	Other Visible Injury	2645199	Other Than Driver or Ped	Dark - No Street Lights	2	0	Driver		East		Ran Off Road	
9851220013903	Alta Sierra Drive at Gibboney Lane	200	East	12/21/2006	10:00 PM	Hit Object	Fixed Object	Property Damage Only	2973089	Improper Turning	Dark - Street Lights	0	0	Driver		East		Ran Off Road	
9907004213881	Alta Sierra Drive at Little Valley Road	136	East	2/15/2007	12:42 AM	Hit Object	Fixed Object	Severe Injury	3101617	Improper Turning	Dark - No Street Lights	1	0	Driver		East		Ran Off Road	
9998224010781	Alta Sierra Drive at Kardale Court	7	West	5/17/2007	10:40 PM	Hit Object	Fixed Object	Property Damage Only	3239805	Driving Under Influence	Dark - Street Lights	0	0	Driver		East		Ran Off Road	
10022012012700	Alta Sierra Drive at Kardale Court	66	East	6/10/2007	01:20 AM	Overturned	Non-Collision	Property Damage Only	3219450	Driving Under Influence	Dark - No Street Lights	0	0	Driver		East		Ran Off Road	
10189191512900	Alta Sierra Drive at State Highway 49	528	East	11/24/2007	07:15 PM	Rear-End	Other Motor Vehicle	Property Damage Only	3480981	Following Too Closely	Dark - No Street Lights	0	0	Driver	Driver	West	West	Proceeding Straight	Slowing/Stopping
10199124511000	Alta Sierra Drive at Gibboney Lane	190	East	12/4/2007	12:45 PM	Hit Object	Fixed Object	Other Visible Injury	3488155	Unsafe Speed	Daylight	1	0	Driver		West		Ran Off Road	
10615235014400	Alta Sierra Drive at Gibboney Lane	150	East	1/23/2009	11:50 PM	Overturned	Non-Collision	Property Damage Only	4038449	Unsafe Speed	Dark - No Street Lights	0	0	Driver		East		Other Unsafe Turning	
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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	Project Type	Crash Type	CRF	Life
R24	Geometric Mod.	All	30	10

Crash Type	Fatality (Death)	Severe Injury	Injury - Other Visible	Injury - Complaint of Pain	Property Damage Only	Total
All	0	1	9	0	11	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

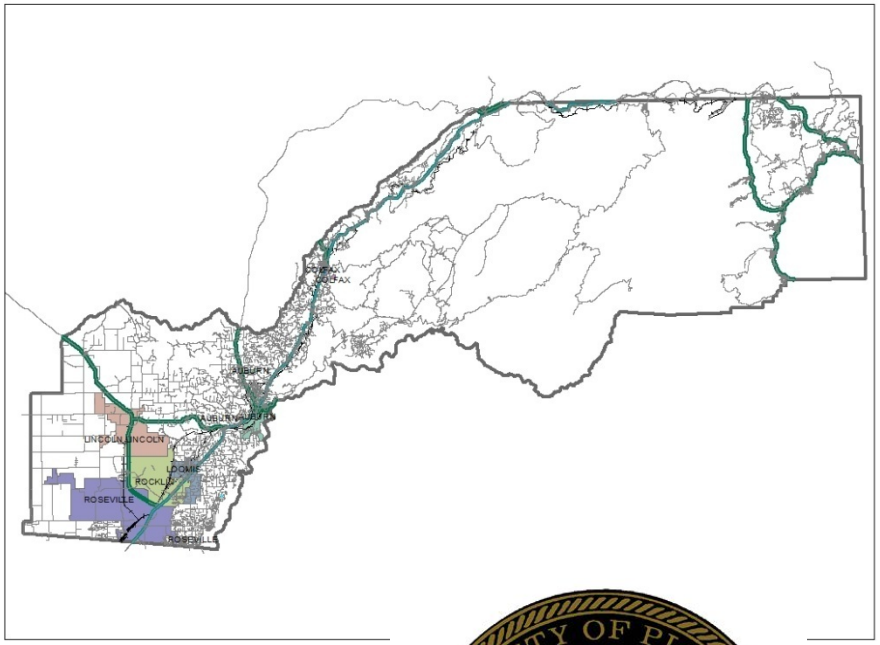
- **Hadn’t ever considered HFST but it may be a cost effective tool for problem ice and frost locations**
- **Ken and Ted’s help was critical to support and confirm our findings.**
- **Probably need 15 to 20 crashes for a project to compete**
- **It took approximately 8 hours of analysis to identify 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

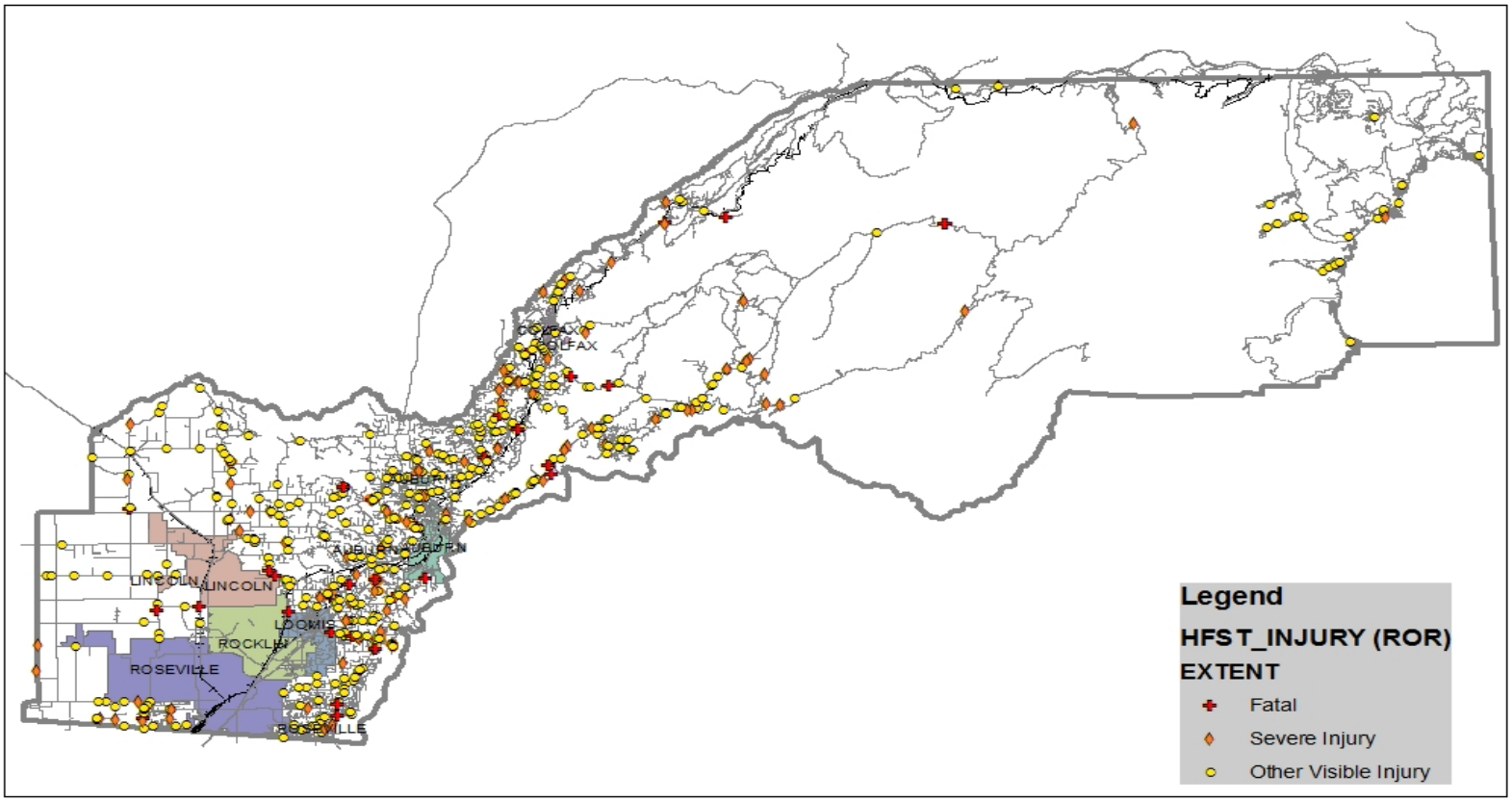


HFST
High Friction Surface Treatment

- 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



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

HFST
High Friction Surface Treatment Project

- Determine Segment Benefits
  - Assign a $ benefit for each segment
    - Appendix D of Local Roadway Safety Manual
    - Add in <u>all crashes</u>
  - Assign CM:
    - R24 – Improve pavement friction
      - CRF of 30% applies to all crashes
- Determine Project Benefit/Cost
  - Per segment – looking for highest segments

HFST
High Friction Surface Treatment Project

High Friction Surface Treatment --- HSIP - Cycle 6

	ROADNUM	Start PM	End PM	ROAD_NAME	Total Segment Length [mile]	Total Sement Length [ft]	Segment Width [ft]	Collision Life Benefit [$]	Cost per segment [$]	Segment Benefit/Cost
1	E0089	6.70	6.80	AUBURN FOLSOM RD	0.20	1056	12	$1,346,250	$29,568.00	45.53
2	E0089	7.3	7.7	AUBURN FOLSOM RD	1.00	5280	11	$1,474,650	$135,520.00	10.88
3	E0071	2.60	2.79	BARTON	0.16	845	11	$76,410	$21,683.20	3.52
4	E7106	2.0	2.2	DRY CREEK RD	0.40	2112	11	$156,030	$54,208.00	2.88
5	D3036	1.9	2.03	HORSESHOE BAR RD	0.18	950	11	$194,910	$24,393.60	7.99
6	D3036	2.66	3.31	HORSESHOE BAR RD	1.21	6389	11	$1,534,860	$163,979.20	9.36
7	D3040	3.2	3.42	KING RD	0.22	1162	11	$258,000	$29,814.40	8.65
8	C6037	5.15	5.45	McCOURTNEY RD	0.60	3168	11	$153,810	$81,312.00	1.89
9	C6037	1.19	1.52	McCOURTNEY RD	0.21	1109	11	$348,930	$28,459.20	12.26
10	E7099	4.7	4.9	MT VERNON RD	0.20	1056	18	$1,528,200	$44,352.00	34.46
	~~E7099~~	~~6.5~~	~~6.7~~	~~MT VERNON RD~~	~~0.20~~	~~0~~	~~0~~	~~$0~~	~~$0.00~~	~~#DIV/0!~~
11	E7099	7.35	7.52	MT VERNON RD	0.34	1795	11	$158,250	$46,076.80	3.43
12	E7099	7.8	8.1	MT VERNON RD	0.60	3168	11	$278,130	$81,312.00	3.42
13	E5091	2.19	2.4	NEWCASTLE RD	0.37	1954	11	$270,630	$50,142.40	5.40
	~~G1113~~	~~6.2~~	~~6.45~~	~~PLACER HILLS RD~~	~~0.25~~	~~0~~	~~0~~	~~$0~~	~~$0.00~~	~~#DIV/0!~~
14	G1113	7	7.13	PLACER HILLS RD	0.26	1373	11	$232,080	$35,235.20	6.59
15	G3126	0.6	1.03	W WEIMAR CROSS RD	0.86	4541	11	$302,520	$116,547.20	2.60
16	B0015	1.15	1.53	WALERGA RD	0.38	2006	16	$473,580	$74,905.60	6.32
17	C6068	1.38	1.48	VIRGINIATOWN	0.20	1056	11	$1,228,590	$27,104.00	45.33
18	C6068	1.65	1.75	VIRGINIATOWN	0.20	1056	11	$54,060	$27,104.00	1.99

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)
- Detemine total project **Costs**
  - Segment area = length x width

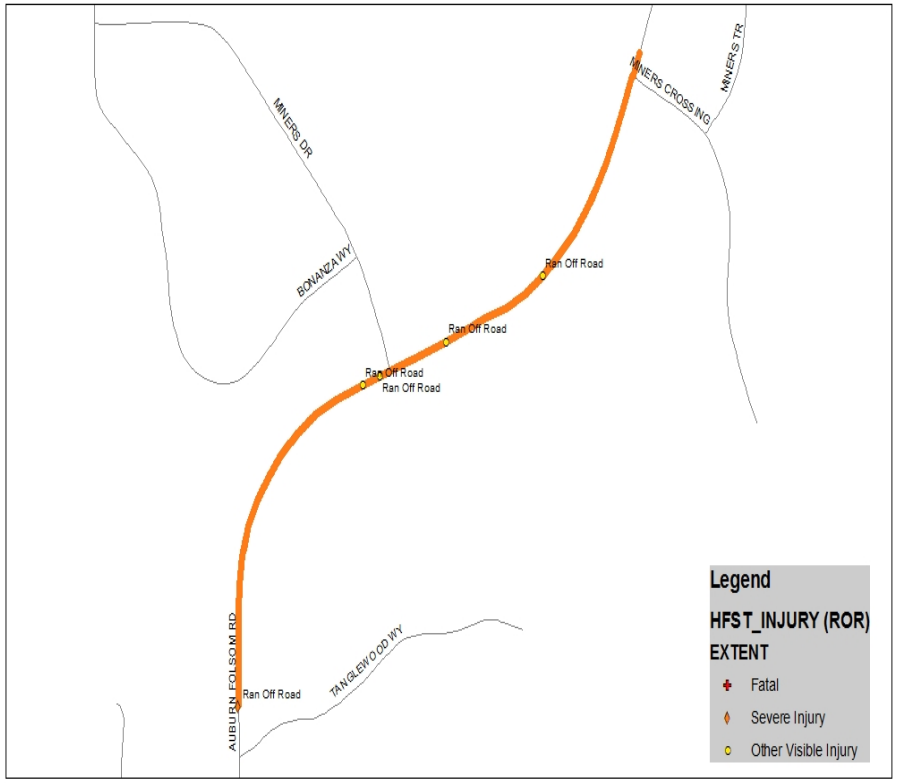
    (i.e. 939,541 yd^2)
  - Apply a unit cost to each segment ($21/$yd^2$)
  - Sum of segment costs (i.e. $1,210,000)
  - Total Project Costs = PS&E, ROW, Environment, Construction Insp. & Engineering (i.e. $1,500,000)

Auburn Folsom Road – Example

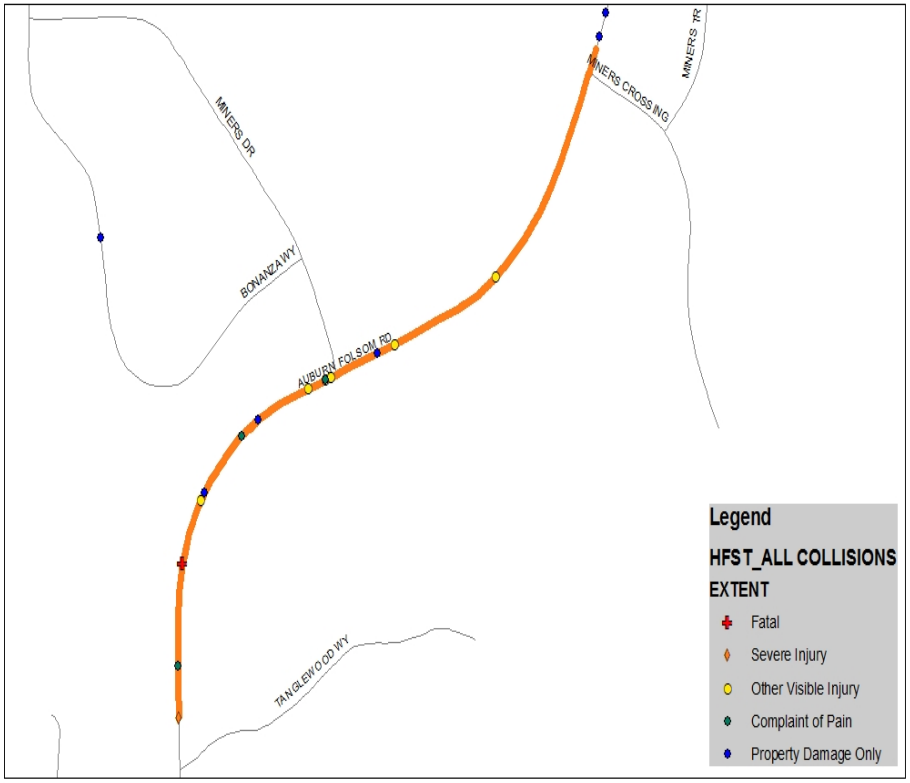
- Collision Data: 2003 – 2012 (10 years)
- Mostly rural, two lane, undivided

Corridor Example

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

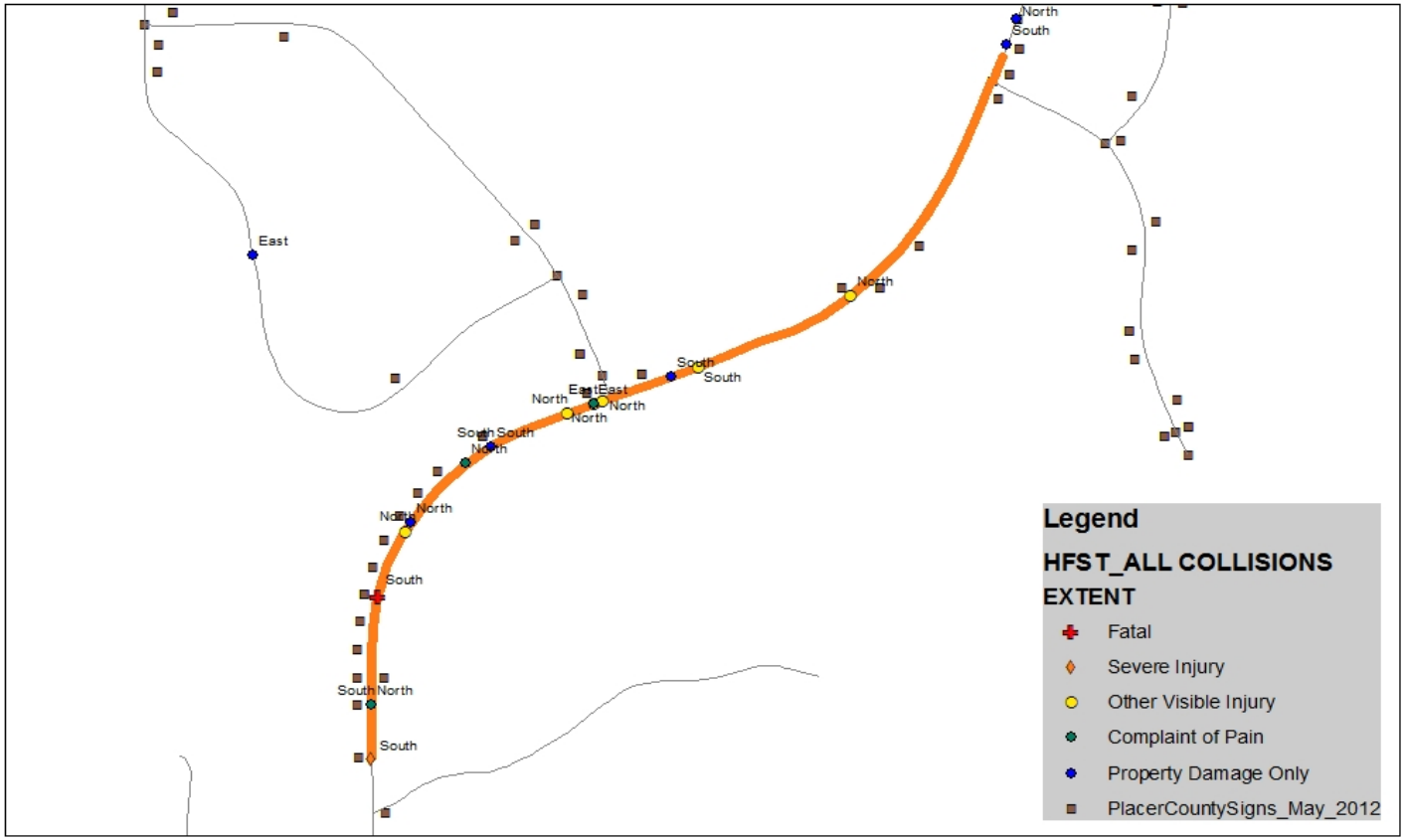


HFST - Auburn Folsom Road
All Collisions - 10 years



Determine Project Benefits

Auburn Folsom Road Example



Project Example Southbound

Project Example Northbound

HSIP Application Time

- 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

- **TIMS – Transportation Injury Mapping System**

  http://www.tims.berkeley.edu/

Contact Information

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Questions ??

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**