The Challenge: Thousands of Curved Roadway Fatalities
The map shows the number of fatal crashes on curved roadways per state in 2010.

These types of incidents still account for more than 27% of the nation’s roadway fatalities.

The Solution: High Friction Surface Treatment (HFST)
HFST technology is an affordable and highly effective lifesaving solution to reducing roadway departure incidents by creating considerable surface friction on the road, particularly on wet or curved surfaces.

“Like a crash barrier or slip base for a sign, the purpose of an HFST is to make the road more forgiving to drivers by increasing the friction at locations where the demand for friction is great.” The Texas Transportation Institute of The Texas A&M University System, published in July, 2012.

HFST application consists of blending an epoxy binder and applying it evenly to either asphalt or concrete road surfaces. Aggregate is then immediately applied over the binder, increasing the texture depth of the pavement. The improved texture depth allows more friction or grip to be formed between vehicle tires and the pavement. This increased traction can greatly reduce accident and fatality rates on hazardous roadways.
The High Friction Surface Treatment Advantage

1. **Reduces stopping distance.**
   At 60 MPH (on wet or dry pavement), HFST can reduce stopping distances up to 40%. According to the FHWA, 70% of wet pavement crashes can be affected by friction improvements.

2. **Only low cost, active protection solution suggested by the FHWA not dependent on driver response.**
   The FHWA has identified multiple low cost solutions, such as; signage, warning indicators, warning combinations and pavement markings, to increase safety effectiveness levels for horizontal curves. Most of these require action/response from the vehicle driver. Only HFST is capable of providing safer navigation of dry or wet high-risk roadways without additional response from the driver.

3. **Low cost, HFST is classified by the FHWA as a low cost safety solution that qualifies for 100% safety funding under highway safety improvement programs.**

4. **Long lasting. “It is reasonable to expect them to maintain high friction values for 10 years of service.”**
   Virginia Transportation Research Council

5. **“Can bring about a 43% reduction in all fatal and serious injury crashes.”**
   U.S. DOT Federal Highway Administration (FHWA)

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### Crash Reductions and Economic Benefits

The table shows the potential cost savings of hypothetical crash reduction scenarios of 20%, 30% and 40% after HFST is applied to a roadway. In every scenario, the HFST shows crash reductions and cost effectiveness.

#### Hypothetical Scenarios of Crash Reductions and Economic Benefits

<table>
<thead>
<tr>
<th>Crash Frequency Before Treatment</th>
<th>Crash Reduction, Economic Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20% Reduction</td>
</tr>
<tr>
<td></td>
<td>1 Year</td>
</tr>
<tr>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>$31,635</td>
</tr>
<tr>
<td>3</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>$94,906</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>$158,177</td>
</tr>
<tr>
<td>7</td>
<td>1.4</td>
</tr>
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<td></td>
<td>$221,448</td>
</tr>
</tbody>
</table>

Source: Using High Friction Surface Treatments To Improve Safety At Horizontal Curves (published July 2012). The Texas Transportation Institute of The Texas A&M University System. According to The Texas Transportation Institute, the table demonstrates that if prior to application the site experienced an average of 1 crash per year and after application that average is reduced by even 20%, the HFST remains a cost-effective solution in crash reduction. The Texas Transportation Institute utilized the economic values of crash scenarios set forth by an FHWA study that found the average cost of all classifications of fatal and injury crashes is estimated at $158,177. However, the cost of one fatal crash is considered to be more than $4 million.
The Unitex® by Dayton Superior® Product Solution

State Departments of Transportation across the U.S. turn to Unitex by Dayton Superior for epoxy product solutions used in HFST applications on America’s roadways and bridges.

Unitex by Dayton Superior was among the first to apply advanced polymer technologies to develop a high tensile strength epoxy binder for skid-resistant bridge overlays. Unlike rigid epoxies, Unitex’s Pro-Poxy Type III DOT was engineered to offer the flexibility to expand and contract with the concrete in all weather conditions on bridge overlays and elevated slabs.

The high tensile strength and low modulus, low viscosity properties of Pro-Poxy Type III DOT make it the bonding product solution of choice for HFST applications across the country.
HFST and Pro-Poxy Type III DOT Case Studies

FLORIDA – Curved Freeway Ramp Treatment
The Florida Department of Transportation (FDOT) used HFST on a curved freeway ramp to improve skid-resistance.

The skid resistance value went from a 35 before HFST application to 104 after HFST was applied.

KENTUCKY – Statewide HFST Application Program
Route 21
Kentucky’s Route 21 at mile marker 12, is notorious for weekly crashes. In wet weather, multiple crashes in a single day were not uncommon.

Since applying HFST to the eastbound lane of Route 21 in 2010, only one eastbound crash has been recorded along that section of roadway. HFST was applied to the westbound lane in 2011.

William Natcher Parkway
Over a six month span, the high-speed westbound ramp at Exit 60B on William Natcher Parkway saw over 50 off-road skidding and other related accidents.

In one morning, the ramp was treated with HFST, increasing the friction rating dramatically and has reduced skidding accidents at Exit 60B significantly.

NEW YORK – Statewide Improvement, Skid-Resistant Roads
New York State Department of Transportation (NYSDOT) treated 36 sites.

- HFST reduced annually recurring wet road crashes by more than 800.
- Treating wet-road crash locations can reduce this type of crash by 50%.
- Total crashes (including dry pavement) can be reduced by 20% or more.

WEST VIRGINIA – Statewide Safety Enhancements
West Virginia is recognized for mountainous and curvy highways and roadways that can present hazards for drivers.

The State is a leader in adopting HFST for high speed super highways and rural two-lane highways as a low cost, site specific safety solution.

Prior to HFST application along a section of Route 3, the pavement friction was measured at 29. After HFST application, the same section achieved a friction number of 70.
How to specify Unitex by Dayton Superior Pro-Poxy Type III DOT
Part 2 - Products

2.01 Manufacturer
A. Pro-Poxy Type III DOT, as manufactured by Dayton Superior, 3101 Gardner Ave, Kansas City, MO 64120, 800-821-5846

2.02 Materials
A. Epoxy resin adhesive binder:
   1. Epoxy resin system shall be a 100% solids, exothermic curing system. Solvents or jobsite added flexibilizers are not permitted.
   2. The ratio of Component “A”: Component “B” shall be 1:1 by volume.

2.03 Performance Criteria
A. Epoxy Binder Characteristics

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>REQUIREMENTS</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Ratio</td>
<td>1:1 by volume</td>
<td>ASTM D2393, Brookfield RVT Spindle No. 3 at 20 rpm</td>
</tr>
<tr>
<td>Viscosity</td>
<td>7-25 poises</td>
<td></td>
</tr>
<tr>
<td>Gel time</td>
<td>15-45 min.</td>
<td>ASTM C881, para. 11.2</td>
</tr>
<tr>
<td>Compressive strength</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Minimum of 6.9 MPa (1,000 psi) at 3 hrs.</td>
<td>ASTM C579 modified (with plastic inserts)</td>
</tr>
<tr>
<td></td>
<td>Minimum of 34.4 MPa</td>
<td></td>
</tr>
<tr>
<td>Tensile strength (neat)</td>
<td>13.8-34.4 MPa (2,000-4,000 psi) at 7 days</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Elongation (neat)</td>
<td>40-80% at 7 days</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Adhesive strength (mixed with aggregate)</td>
<td>Minimum of 1.7 MPa (250 psi) or concrete failure at 24 hrs.</td>
<td>ACI 503R, Appendix A, VTM 92</td>
</tr>
<tr>
<td>Permeability to chloride ion</td>
<td>Maximum of 100 coulombs at 28 days</td>
<td>AASHTO T277</td>
</tr>
<tr>
<td>Absorption</td>
<td>Maximum of 1% at 24 hrs.</td>
<td>ASTM D570</td>
</tr>
<tr>
<td>Shore D Hardness</td>
<td>65-75</td>
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<tr>
<td>Thermal compatibility (mixed with aggregate)</td>
<td>No delamination of overlay</td>
<td>ASTM C884</td>
</tr>
</tbody>
</table>

Note: Values are based on specimens or samples cured or aged and tested at 75°F (24°C).

1. Aggregate shall be bauxite and flint having less than 0.2% moisture and free of dirt, clay, etc.
2. The bauxite and flint shall have a minimum MOHS scale hardness of 7 unless otherwise approved,
3. The bauxite and flint shall conform to the following gradation:

<table>
<thead>
<tr>
<th>PERCENT BY WEIGHT OF PASSING INDICATED SIEVE</th>
<th>No. 4 Sieve</th>
<th>No. 8 Sieve</th>
<th>No. 16 Sieve</th>
<th>No. 30 Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>20-75%</td>
<td>Max. 5%</td>
<td>Max 1%</td>
<td></td>
</tr>
</tbody>
</table>

For more information, visit www.daytonsuperior.com/dot3.
Unitex Pro-Poxy Type III DOT can be used as part of HFST on the following asphalt or concrete pavement surfaces:

- Horizontal Curves
- Intersections
- Parking Areas
- Rural Roadways
- Industrial Sites
- Bridge Decks
- On-ramps
- High Occupancy Lanes
- School Zones
- Toll Authority Entrances
- Hospital Entrances
- Bike Lanes
- Bus Lanes
- Pedestrian Walkways

For more information about HFST and Pro-Poxy Type III DOT, view the YouTube video at www.youtube.com/watch?v=_s67F2lvQsl&t=31s or contact our High Friction Surface Professionals at 800-821-5846.