

# Utilization of the High Velocity Impact Method

Alaska Asphalt Pavement Summit  
October 31, 2011  
Dena'ina Center  
Anchorage, Alaska

Gary A. Billiard



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The High Velocity Impact Method  
The FAA AC 150/5320-12c definition:

Employs the principle of throwing abrasive particles at a very high velocity at the runway pavement surface. Additionally, the machinery that performs this operation can be adjusted to produce the desired surface texture.



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**STEEL ABRASIVE MATERIAL**



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**HVIM**  
**QUALITY**  
**PRODUCTION SURFACE ABRADING**  
**FOR OVER 30 YEARS**

- ▶ Concrete & Asphalt Surface Preparation
- ▶ Highway Texturing for Asphalt and PCC Pavements
- ▶ Runway Texturing for Asphalt and PCC Runway

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- ▶ Surface Preparation for PCC & ACC
- ▶ Pavement Preservation
- ▶ Test Methods for Skid and Texture
- ▶ PCC Texturing
- ▶ ACC Texturing
- ▶ Test Results for Completed Projects
- ▶ Conclusions

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**SURFACE PREPARATION**

For bridges bridge deck overlays, highway thin bonded overlays, skid enhancement for applications of sealers and rejuvenators, curing compound removal and slurry removal

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# VERIFIABLE REMOVAL

ASTM-E-965  
SAND PATCH TEST

ASTM-E-2380-05  
OUTFLOW METER STANDARD



Control 1500 to 2000 ft		Sect. 1 1000 to 1500 ft		Sect. 2 500 to 1000		Sect. 1 0 to 500	
Skidsteer	No	Skidsteer	Yes	Skidsteer	Yes	Skidsteer	Yes
Rockwite Rate	0 gal/sy	Rockwite Rate	0.7 gal/sy	Rockwite Rate	0 gal/sy	Rockwite Rate	0.6 gal/sy
Alginate	0	Alginate	0	Alginate	0.5 w/	Alginate	0.5 w/
Alginate M	0	Alginate M	0	Alginate M	0.5 w/	Alginate M	0
Transverse I	403 ft	Transverse I	85 ft	Transverse I	11.0 ft	Transverse I	27 ft
Longitudinal L	150 ft	Longitudinal L	99 ft	Longitudinal L	0 ft	Longitudinal L	64 ft
Longitudinal M	150 ft	Longitudinal M	15 ft	Longitudinal M	0	Longitudinal M	0
Slabs	0	Slabs	0	Slabs	1070 w/	Slabs	0
Slab No.	029	Slab No.	00	Slab No.	04	Slab No.	09
Sub.	0.11 ft	Sub.	0.15 ft	Sub.	0.10 ft	Sub.	0.10 ft
RI	02 u/s/s	RI	06.2 u/s/s	RI	10.2 u/s/s	RI	02 u/s/s
PCR	03	PCR	07	PCR	11	PCR	04

Control 0 to 500 ft		Sect. 1 500 to 1000 ft		Sect. 2 1000 to 1500 ft		Sect. 3 1500 to 2000 ft	
Skidsteer	No	Skidsteer	Yes	Skidsteer	Yes	Skidsteer	Yes
Rockwite Rate	0 gal/sy	Rockwite Rate	0.6 gal/sy	Rockwite Rate	0 gal/sy	Rockwite Rate	0.6 gal/sy
Alginate	0	Alginate	0	Alginate	0.5 w/	Alginate	0
Alginate M	0	Alginate M	0	Alginate M	0	Alginate M	0
Transverse I	142 ft	Transverse I	153 ft	Transverse I	171 ft	Transverse I	0
Longitudinal L	0	Longitudinal L	24 ft	Longitudinal L	0 ft	Longitudinal L	0
Longitudinal M	0	Longitudinal M	0	Longitudinal M	0	Longitudinal M	0
Slabs	0	Slabs	0	Slabs	0	Slabs	0
Slab No.	029	Slab No.	049	Slab No.	022	Slab No.	003
Sub.	0.12 ft	Sub.	0.14 ft	Sub.	0.10 ft	Sub.	0.10 ft
RI	01.2 u/s/s	RI	01.6 u/s/s	RI	02.3 u/s/s	RI	01.0 u/s/s
PCR	02	PCR	00	PCR	10	PCR	05

Collected on June 25 2010

To Carriage

Enter to Scott County

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WHY TEXTURING ?

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Need for Friction?  
1920's

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**Pavement Slipperiness - The Horse Era**  
Miles traveled by a horse on American pavements before an accident occurs  
Captain F.V. Green, 1885

Kind of Pavement	Falls on Knees	Falls on Haunches	Complete Fall	Accidents of any kind
Asphalt/ Artificial Sheet	1534	2180	1647	583
Granite Block	510	5934	3472	413
Wood	408	983	4901	272

Miles traveled by a horse on London pavements before an accident occurs  
Colonel W. Haywood, 1873

Kind of Pavement	Dry weather	Damp weather	Wet weather	Accidents of any kind
Asphalt/ Limestone	223	125	192	191
Granite Block	78	168	573	132
Rectangular Wood Block	646	193	432	330

**Slipperiness Alleviation:** Asphalt- Sprinkle coarse sand on surface  
Wood- Sprinkle pebbles on surface

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### THE LUNCH BOX FRICTION TEST

Accelerate up to 30mph then slam on the brakes, locking all 4 tires momentarily



if the pail fell off the seat, the tire/pavement friction was acceptable.



if the pail stayed on the seat, the friction level was not acceptable and remedial treatment of the pavement was needed. (i.e. removal of water, snow, or ice)

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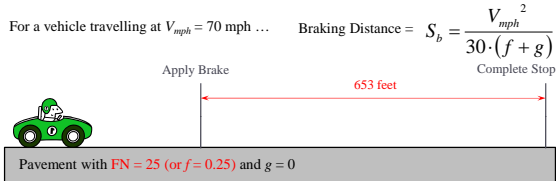
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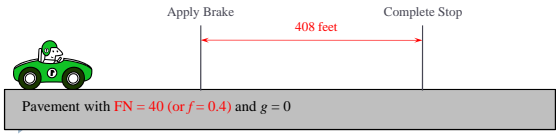
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### Why is Friction Important?

For a vehicle travelling at  $V_{mph} = 70$  mph ... Braking Distance =  $S_b = \frac{V_{mph}^2}{30 \cdot (f + g)}$



Pavement with  $FN = 25$  (or  $f = 0.25$ ) and  $g = 0$



Pavement with  $FN = 40$  (or  $f = 0.4$ ) and  $g = 0$

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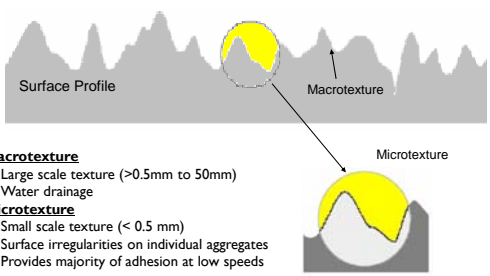
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### Roadway Texture



**Surface Profile**

**Macrotexture**

**Microtexture**

- ◆ **Macrotexture**
- ◆ Large scale texture (>0.5mm to 50mm)
- ◆ Water drainage
- ◆ **Microtexture**
- ◆ Small scale texture (< 0.5 mm)
- ◆ Surface irregularities on individual aggregates
- ◆ Provides majority of adhesion at low speeds

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**FRICTION NUMBER GUIDELINES**

Posted Speed Limit	ALL HIGHWAY SECTION SURFACES		
	Questionable <sup>1</sup>	Review <sup>2</sup>	Desired <sup>3</sup>
<= 45 MPH	FN 40	FN 40	FN 40
> 45 MPH	25	26-28	30
	27	28-30	35

1. EXISTING PAVEMENTS - WARRANTS INVESTIGATION TO DETERMINE IF CORRECTIVE ACTION IS NECESSARY. REVIEW PERCENT OF WET WEATHER ACCIDENTS, SURFACE CONDITIONS, TRAFFIC DENSITY, DRAINAGE, ETC.
2. EXISTING PAVEMENTS - WARRANTS REVIEW TO DETERMINE IF SECTION APPEARS ON 25% OR 50% WET WEATHER CRASH LIST. IF ON LIST, INVESTIGATE AS OUTLINED IN NOTE 1.
3. DESIRED VALUE FOR NEW PAVEMENT SURFACES

TABLE 1, APPENDIX E-1, HIGHWAY SAFETY IMPROVEMENT PROGRAM GUIDELINE

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**Projects over 250,000 to 1,800,000 Square Yards  
Asphalt And PCC Highway Texturing**

- I-20 Louisiana PCC
- I-20 Louisiana Asphalt
- I-10 Louisiana PCC
- Lake Ponchatrain Causeway Bridge PCC
- I-635 Texas PCC
- I-30 Texas PCC
- I-20 Texas PCC
- I-45 Texas PCC and Asphalt
- I-35 Texas PCC and Asphalt
- Rt 67 Texas PCC and Asphalt
- Rt.59 Texas PCC
- I-80 Wyoming PCC
- I-15 Utah PCC
- I-84 Utah PCC
- I-40 Montreal PCC
- I-15 Montreal, PCC
- New York City Holland and Lincoln Tunnels Asphalt
- Manhattan Expressway PCC
- I-5 California PCC
- I-5 Washington State PCC
- I-10 Arizona PCC
- I-15 Arizona Asphalt
- I-10 Arizona Asphalt
- Rt 1 New Jersey PCC and Asphalt

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**Lake Ponchatrain Causeway  
Wearing Surface Restoration**

**800,000 Square Yards, PCC  
23 Work Day Completion**




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**Test Results North and South Bound Bridges**

	<u>No. of Tests</u>	<u>Average</u>
Outflow Meter ASTM-2380-05	2350	4.04 secs
Sand patch ASTM-E-965	843	0.054 in
ASTM – E524 (Skid test blank tire)	96	43.52 sn
ASTM – E501 (Skid test treaded tire)	96	50.46 sn

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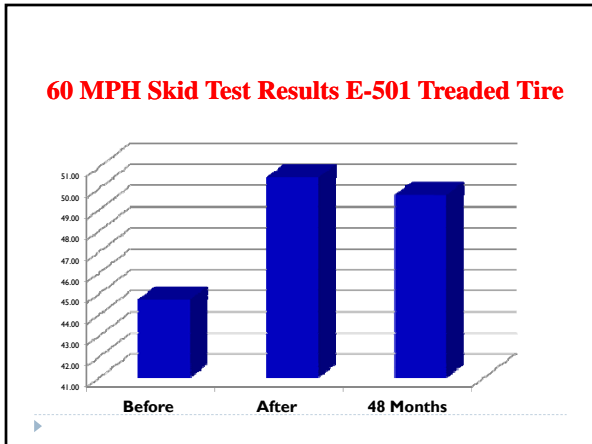
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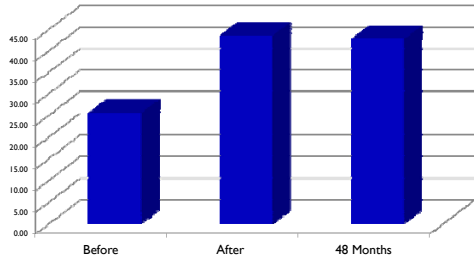
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**60 MPH Skid Test Results E-524 Bald Tire**



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**Louisiana Department of Transportation**

**PROJECT # I-10- 450-06-0053**

- PORTLAND CEMENT CONCRETE
- 500,664 SQUARE YARDS

*ACCIDENT REDUCTION AFTER 36 MONTHS*  
**58.1 PERCENT**

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**Louisiana Department of Transportation**

**Project # I-20-451-06-0107**

- Asphaltic Concrete On Limestone
- 190,000 Square Yards

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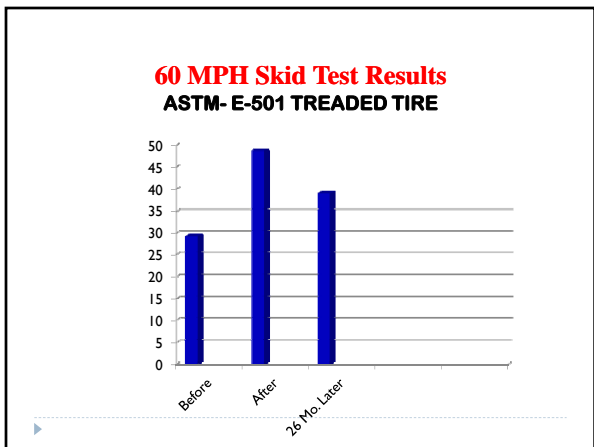
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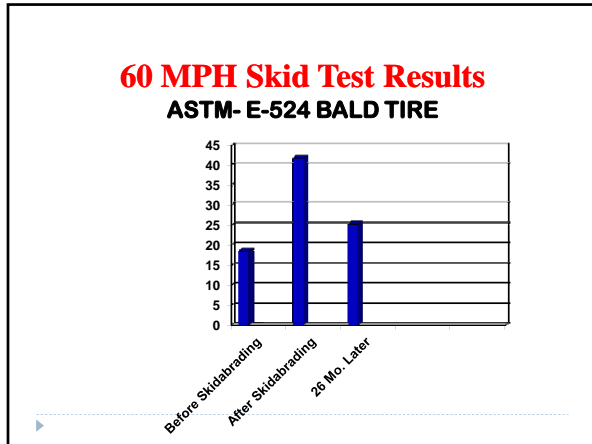
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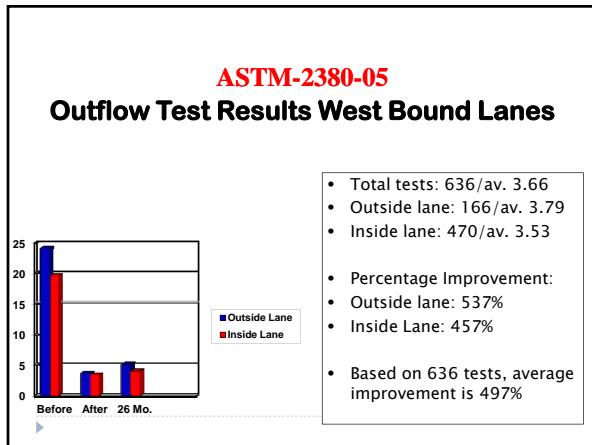
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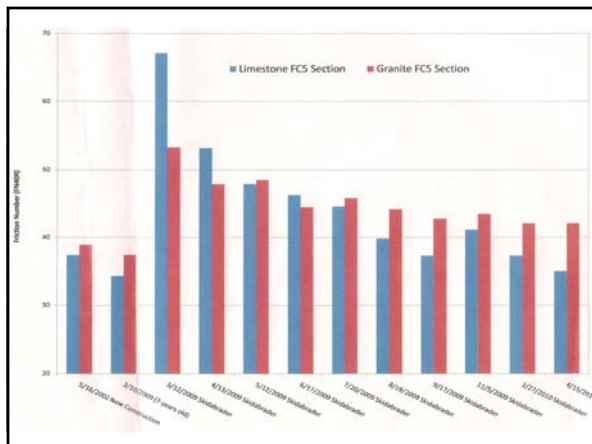
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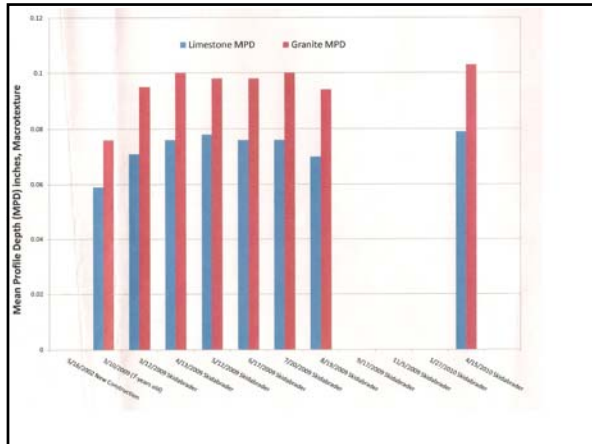
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**Louisiana Department of Transportation**  
**Project # 451-06-0107**

- Total tests: 636/av. 3.66
- Outside lane: 166/av. 3.79
- Inside lane: 470/av. 3.53
- Percentage Improvement:
  - Outside lane: 537%
  - Inside Lane: 457%
- Based on 636 tests, average improvement is 497%.

**ACCIDENT REDUCTION AFTER 36 MONTHS**  
**38.9 PERCENT**

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Runway Applications

- ▶ Where and how long it has been used
- ▶ Friction Guidelines
- ▶ Types of Pavements Textured
- ▶ FOD (Foreign Object Debris)
- ▶ Space Shuttle Runway Project
- ▶ Conclusions

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**PROVEN FRICTION RESTORATION ON THE WORLD'S LARGEST AIRPORT RUNWAYS**

1. PCC AND ASPHALT RUNWAYS
2. GROOVED AND NON-GROOVED RUNWAYS
3. BI-DIRECTIONAL ABRASION FOR UNIFORM TEXTURE ON GROOVED SURFACES
4. ENVIRONMENTALLY AND "FOD" CLEAN
5. HIGH PRODUCTION FOR LIMITED WINDOWS

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**AIRPORT RUNWAY TEXTURING PROVEN FRICTION RESTORATION ON SOME OF THE WORLD'S LARGEST RUNWAYS**

• Atlanta Hartsfield	• Salt Lake City
• Boston	• Seattle Sea-Tac
• Chicago O'Hare	• Calgary Inter
• Cincinnati	• Edmonton Inter
• Dallas-Ft. Worth	• Montreal Treaduo
• Denver	• Toronto Pearson
• Houston George Bush	• Andrews AFB
• Minneapolis-St. Paul	• Charleston AFB
• New York - JFK	• Grand Fork AFB
• New York - LaGuardia	• Boggatville AFB
• Newark Inter.	• Trenton AFB
• Oklahoma City	• Greenwood AFB
• Portland Inter	• Kennedy Shuttle Facility

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**Airport Runway Friction Evaluation**



	Mu @ 40 mph	Mu @ 40mph	Mu @ 40 mph
CFME	Minimum Mu	Maintenance Planning	New Design/ Construction
Dynatest RFT	.50	.60	.82

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**MAIN LANDING GEAR ON 747**




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**Friction Measuring Trailers**




IMAG Variable/Fixed Slip




Runar Variable/Fixed Slip




GripTester Fixed Slip



BV-11 Skiddometer



Mu-meter



E-274 Skid Trailer

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NASA Dryden Flight Research Center Photo Collection  
<http://www.dfrc.nasa.gov/gallery/photo/index.html>  
NASA Photo: EC93-41018-6 Date: Apr 1993

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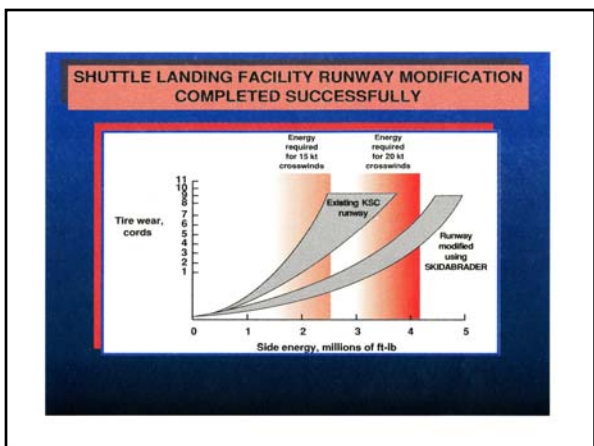
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**SKIDABRADING  
THE WORLD'S**



Major Interstates  
Longest Bridges  
Famous Tunnels  
Busiest Runways

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**FACTS ABOUT  
HVIM**

- (1) High Production Machinery
- (2) Equally Efficient on PCC and Asphalt Surfaces
- (3) Bi-Directional Texturing for un-equaled uniformity
- (4) Proven Accident Reduction
- (5) Environmentally Clean
- (6) Self-contained for Day and Nighttime Operations
- (7) High Production Means Fewer Traffic Disruptions
- (8) Cost Effective When Compared To Alternatives

On Time, on Budget, and According to Specifications

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Questions?

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**SKIDABRADER**  
**THE WORLD'S PRODUCTION AND QUALITY LEADER**  
**IN SURFACE ABRADING FOR OVER 25 YEARS!**

- ❖ HIGHWAY TEXTURING FOR ASPHALT AND PCC
- ❖ CONCRETE SURFACE PREPARATION
- ❖ HIGHEST PRODUCTION MACHINE IN THE WORLD
- ❖ EQUALLY EFFICIENT ON CONCRETE OR ASPHALT
- ❖ BI-DIRECTIONAL TEXTURING FOR UN-EQUALED UNIFORMITY
- ❖ PROVEN WET WEATHER ACCIDENT REDUCTION
- ❖ ENVIRONMENTALLY CLEAN
- ❖ SELF-CONTAINED FOR DAY OR NIGHT OPERATIONS
- ❖ MOST COST EFFECTIVE ALTERNATIVE TO RESURFACING
- ❖ MINIMAL TRAFFIC DISRUPTIONS / MOVING MOT!

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# HVIM

applications for and advantages for

- ❖ PORTLAND CEMENT HIGHWAYS
- ❖ ASPHALTIC CONCRETE HIGHWAYS
- ❖ SIGNIFICANT WET WEATHER ACCIDENT REDUCTION
- ❖ NO ADVERSE TIRE NOISE EFFECT
- ❖ MINIMAL TRAFFIC DISRUPTIONS
- ❖ NO ON-SITE TRANSFER OF ABRADED MATERIALS
- ❖ SELF-CONTAINED FOR DAY AND NIGHTTIME OPERATIONS

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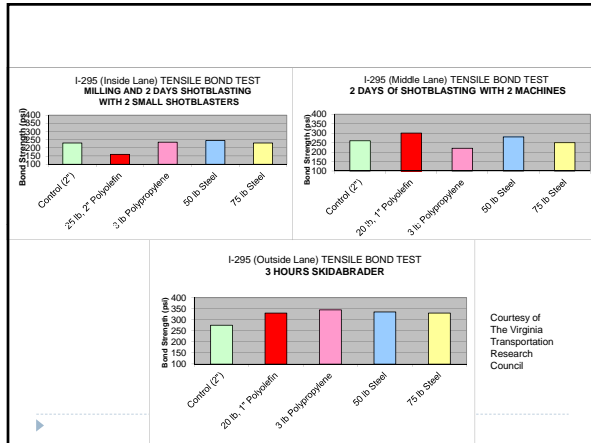
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