Quality Pavement Markings
Idaho Asphalt Conference
Moscow, Idaho
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WSDOT
Pavement Marking Engineer

Purpose of Pavement Markings
Provide the visual information needed by the driver to guide their vehicle

Driver Visibility Needs
Drivers need a certain threshold level of brightness
Visibility needs increase as drivers age

Retroreflectivity

Quality Pavement Marking
A pavement marking that exceeds the requirements of the MUTCD 24/365
A. Fulfill a need;
B. Command attention;
C. Convey a clear, simple meaning;
D. Command respect from road users; and
E. Give adequate time for proper response.
WSDOT Design Manual

- Delineation is a required safety item of work
- Service life
- Pavement markings must have a service life that will provide an adequate stripe until maintenance crews can restripe the line

FHWA Mandate

- The MUTCD currently states, “Markings that must be visible at night shall be retroreflective...”
- The FHWA has been directed by congress to adopt standards for minimum maintained retroreflectivity of both signs and pavement markings.
- Pavement marking proposed value: 125 mcd/m²/lux

WSDOT MAP (Maintenance Accountability Process)

- Targeted service level funded by legislature
- Stripe retroreflectivity is measured at the lowest point
- Retroreflectivity values are averaged to determine Regionwide/Statewide values
- Values are compared to proposed national guidelines

WSDOT’s Plan

- Inventory existing conditions (MAP)
- Test pavement marking materials and application techniques to determine service life (I-90 and other tests)
- Use more durable materials and improved application techniques in high wear areas to provide the MAP target year round (Striping Plan)

Pavement Marking Testing

- Transverse Test
  Relative performance
- Longitudinal Test
  Actual performance in a specific area

I-90 Pavement Marking Material Test

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WSDOT
Pavement Marking Engineer
Transportation Research Board
Session #491
January 24, 2006
I-90 Snoqualmie Pass

Problematic area for pavement markings
Reasons:
- Weather
- Traffic
- Snow removal operations

Test Objective

Find a pavement marking system that will provide year round delineation

Application

Information will be used on other mountain passes and highways in Washington State.

Test Plan - Phase 1

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept for Test</td>
<td>circa August 16, 2004</td>
</tr>
<tr>
<td>Finalize test plan - product and application requirements</td>
<td>September 10, 2004</td>
</tr>
<tr>
<td>Contract with groove cutter</td>
<td>September 15, 2004</td>
</tr>
<tr>
<td>Lay out test sections</td>
<td>September 21-24, 2004</td>
</tr>
<tr>
<td>Cut grooves</td>
<td>September 21-24, 2004</td>
</tr>
<tr>
<td>Apply material*</td>
<td>September 28 - October 7, 2004</td>
</tr>
<tr>
<td>Monitor material</td>
<td>Installation through April 20, 2005</td>
</tr>
<tr>
<td>Publish End of Winter Report</td>
<td>June 30, 2005</td>
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</table>

Test Plan - Phase 2

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
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<tbody>
<tr>
<td>Monitor material</td>
<td>April 20, 2005 to May 4, 2006</td>
</tr>
<tr>
<td>Continue to monitor</td>
<td>Until failure</td>
</tr>
</tbody>
</table>

Test Responsibilities

- WSDOT – Traffic control & groove
- WSDOT – Report on findings
- Manufacturers – Install material
Participating Manufacturers

1. Advance Traffic Markings (ATM) – two tapes
2. Ennis Paint – one MMA, one thermoplastic
3. EpoPLEX - Polyurea
4. Innovative Performance Systems (IPS) – Polyurea and Modified Urethane
5. Rainline – thermoplastic
6. TMT-Pathway – four MMA, one thermoplastic
7. 3M – three tapes
Experienced WSDOT Maintenance Crews
Required a two lane closure in 3 and 4 lane sections
Required two separate lane closures in 2 lane sections
  - Rumble strips on left shoulder
Snow Removal Policy

Policy was changed in 2004/05 to use deicers and anti-icers. Use of sand is only in unusual situations.

- Winter 05-06 0 cubic yards
- Winter 04-05 415 cubic yards
- Winter 03-04 6,250 cubic yards
- Winter 02-03 5,300 cubic yards
Section 2
M5-J
Flat tape
LL R 95 D 10

April 20, 2005

Section 2
M6-K
Profiled surface tape
LL R 874 D 10

April 20, 2005

Section 3
M2-C
Polyurea DD
LL R 156 D 9

April 20, 2005

Section 3
M4-H
Structured surface MMA
LL R 221 D 9

April 20, 2005

Section 3
M6-K
Profiled surface tape
LL R 83 D 8

April 20, 2005

Section 4
M2-C
Polyurea DD
EL R 268 D 10

April 20, 2005
I-90 Pavement Marking Material Test

Section 4
M4-H
Structured surface MMA
LL R 276 D 10

Section 4
M7-P
Inverted profile Thermoplastic
LL R 163 D 10

April 20, 2005

Section 5
M4-H
Structured surface MMA
LL R 356 D 9

Section 5
M2-C
Polyurea DD
EL R 231 D 9

Note: Line installed with pavement and air temperature at 32° F

April 20, 2005

Section 5
M3-E
Modified urethane DD
LL R 256 D 9
EL R 270 D 9

I-90 Pavement Marking Materials Test
Section 2 – Broken Lane Lines
Retroreflectivity (milli-candela/meter²/lux)
Retroreflectivity Results

Table 1. Pavement Marking Material Retroreflectivity

<table>
<thead>
<tr>
<th>Section</th>
<th>4/20/05</th>
<th>5/04/06</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>13/12</td>
<td>13/12</td>
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<tr>
<td>2</td>
<td>17/13</td>
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<tr>
<td>4</td>
<td>18/11</td>
<td>13/9</td>
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<tr>
<td>5</td>
<td>8/6</td>
<td>8/6</td>
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<tr>
<td>Total</td>
<td>&gt;250</td>
<td>&gt;125</td>
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</tbody>
</table>

Summary

It is possible to maintain a year-round pavement marking on I-90 Snoqualmie Pass.

Current Status

End of Second Winter Report - soon
Continue to monitor until all materials fail - ??
Develop pavement marking plan for I-90 Snoqualmie Pass - done

High Performance Pavement Markings

How good are they?

Cost

Waterborne Paint
- Contract $0.20/ft
- State Maintenance $0.10/ft

Plural Component Material
- Contract $0.20 – 0.75/ft
  Epoxy, Modified Urethane, Methyl Methacrylate, Polyurea
- State Maintenance N/A
Other benefits

Questions

Gunsight Aims Paint Truck at Target
Two drivers of this old vehicle lay a white line right down the center of the highway by aiming his truck like a rifle. Sights are mounted on a bracket attached to the front bumper, as shown above. Another man operates the control that features paint and primer, which is applied in a layer. The resulting paint is then fired into the air from two front nozzles. The driver aims at the center of the highway, and the resulting paint aid is white. The two trucks are now being used by the Connecticut Highway Dept. to put the white lines on the state's 2,000 miles of road.