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**METHYL METHACRYLATE (MMA) LANE LINES**

I-90  
Asahel Curtis I/C To  
Kachess River

by

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**Experimental Feature WA92-02**  
Final Report

Prepared for  
Washington State Department of Transportation  
and in cooperation with  
U.S. Department of Transportation  
Federal Highway Administration

**August 1996**

## **DISCLAIMER**

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Washington State Transportation Commission, the Washington State Department of Transportation, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

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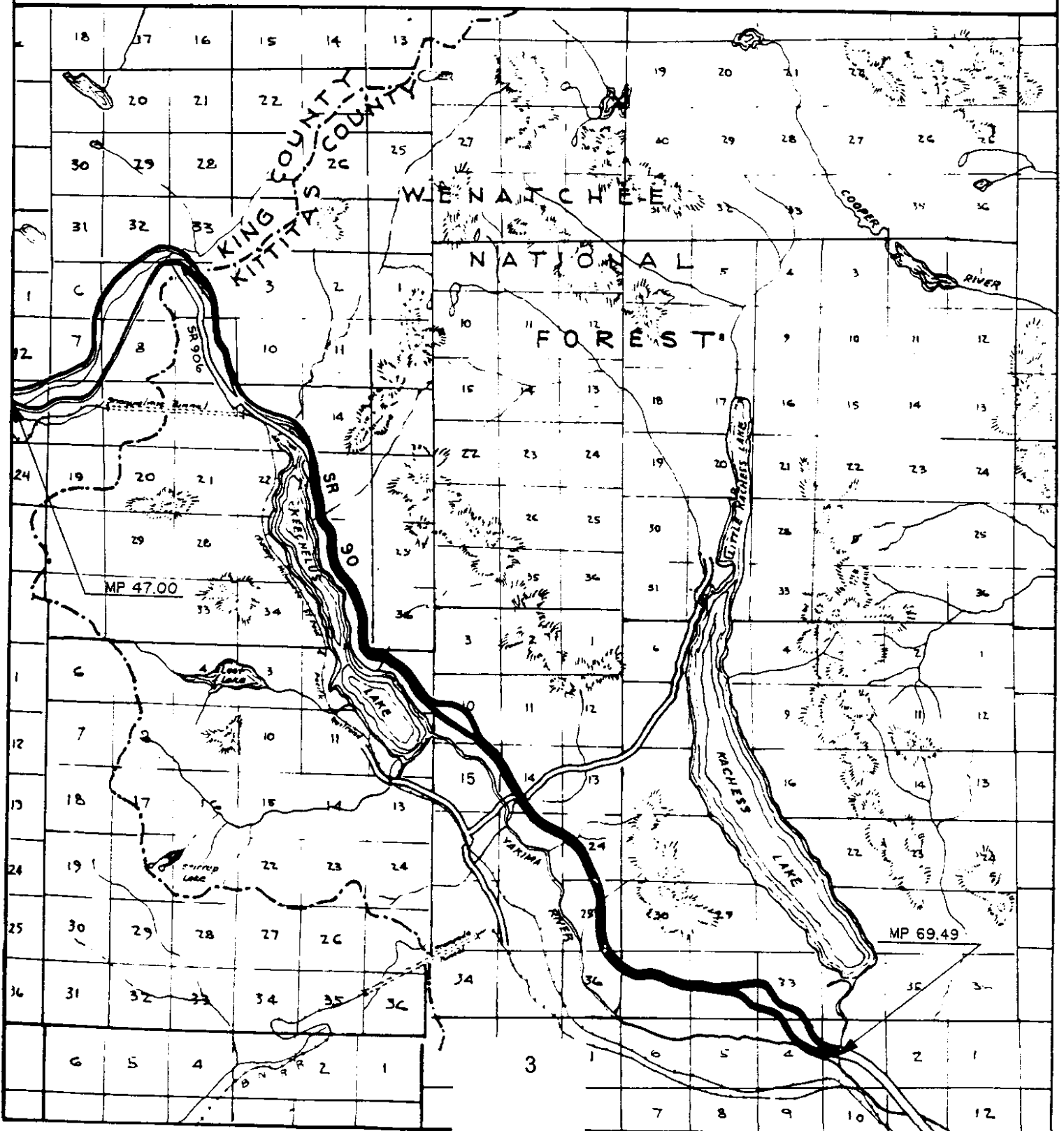
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WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

OLYMPIA, WASHINGTON

MAP OF STATE HIGHWAYS

KING AND KITTITAS COUNTIES



## **Introduction**

The objective of this experimental feature was to evaluate the installation and materials cost, the ease of application, the degree of reflectivity, and the service life of methyl methacrylate (MMA) lane lines placed in insets on I-90 in a mountain pass environment.

## **Study Site**

The South Central Region contract for the placement of the MMA lane lines is describe below in tabular form for easy reference.

Contract Number: 004123  
Location Project Number: 0L 0807  
Title: Asahel Curtis I/C to Kachess River  
Route Number: I-90  
County: Kittitas  
Milepost Limits: MP 47.00 to MP 69.49  
Number of Lanes: 4 NB and 4 SB, with some sections of 6 lane  
Plan Quantities: 328,500 L.F.

## **Project Description**

The MMA striping material was placed in 90 mil deep grooves cut into the pavement. The lane stripes completely filled the grooves and were extruded at a thickness of 100 mils (10 mils above the pavement surface). In addition, from MP 47.00 to MP 47.07, eastbound and westbound, test sections (each with 2 stripes for 3 lanes) were constructed to see if the MMA lines could survive when not installed in grooves. In these test sections, the pavement was prepared only by cleaning with a Blastrac machine prior to extruding the 90 mil thick striping material.

Additional work was done on this project as a result of a change order issued because of the early failure of the stripes placed directly on the pavement surface. Contract Change Order No. 5 replaced those stripes, as well as one of the the lane line stripes from MP 69.41 to MP 69.49 eastbound, and from MP 66.54 to MP 66.62 westbound. This change order added MMA striping materials placed in 250 mil deep grooves cut into the pavement. These stripes completely filled the grooves as well, and were extruded at a thickness of 260 mils (again 10 mils above the pavement surface).

### **Construction Costs**

Degussa Corporation of Allentown, New Jersey was the supplier of Dagudur methyl methacrylate resin to Norris Paint Company, who supplied the following lengths of MMA lane lines which has the product name Dura-Stripe:

Inset Methyl Methacrylate Lane Stripe	170,780 L.F. @ \$0.57 per foot
Methyl Methacrylate Steel Shot Blasted Stripe	1,280 L.F. @ \$0.32 per foot

#### **Added by Change Order No. 5**

Inset Methyl Methacrylate 250 MILS	2,532 L.F. @ \$2.65 per foot
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### **Construction Summary**

The placement of the MMA went well except for a couple of construction operation problems and a weather problem. The main problem involved the sawcutting equipment used for the insets, which tended to slide toward the low side of the superelevation in curves. This in turn caused the cutting blades (approximately a stack of 10) to thin out, or feather out, one side of the inset and deepen the other side of the 90 mil inset grooves. As an example of this, in an October, 1993 stripping inventory, the Project Engineer reported that the 250 mil insets were measured at an actual depth of 200 to 250 mils.

A smaller problem involved the mixture of the MMA material. On a few occasions, the reaction in the buckets of MMA mixture became too hot which caused the material to set before it could be placed.

The weather posed the most frustrating problem. The contract documents required that the inserts be free from moisture for a minimum of 48 hours before application, which consequently caused a long delay in project completion. In general, however, the application of the MMA was accomplished without major problems and was completed in August, 1993.

### **Performance Observations**

A striping inventory was conducted in October, 1994, approximately one year after installation. From MP 47.00 to MP 47.07, eastbound and westbound, the MMA stripes installed directly on the pavement surface did not survive. These particular stripes were gone after only 6 months. However, the Project Engineer reported in the inventory that the MMA placed in 250 mil deep grooves held up well, with most of the MMA material remaining in the insets.

From MP 47.00 to PM 54.00, eastbound and westbound, all lane stripes were painted over due to the deterioration of the inset stripes. In the westbound lanes, the insets varied from 0 to 50 mils, with 20 to 50 percent of the MMA materials remaining in the inset. In the eastbound lanes, the insets varied from 0 to 70 mils, with 20 to 100 percent of the MMA material remaining in the inset.

The Project Engineer's Office reported that, similarly from MP 54.00 to MP 67.49, eastbound and westbound, all lane stripes were MMA but they all were painted over due to the deterioration of the inset stripes. Also, throughout the entire project length, the reflectivity of the beads in the 90 mil MMA material held through the first winter, but deteriorated along with the stripes thereafter.

### **Performance Evaluation**

The MMA lane stripes, originally installed at 90 mils, deteriorated so bad that they had to be resprayed with paint to make the lane stripes visible. Most insets that were applied at this depth no longer exist. The equipment used to sawcut the inset grooves contributed to the problem, so it should be improved to avoid the feathering out of insets caused by sliding toward the low side of curve superelevations.

Also, according to the WSDOT Chemical Engineer, salt used over the years to deice the roadway probably interfered with the bond between the MMA and the 90 mil inset grooves. Therefore, the grooves should have been thoroughly flushed out to remove all salt prior to extruding the MMA insets.

### **Conclusions**

The WSDOT Chemical Engineer suggests that salt used over the years to deice the roadway may have penetrated the surface deep enough to have interfered with the bond between the 90 mil inset grooves and the extruded MMA. Thoroughly flushing out the inset grooves prior to placing the MMA is essential because salt inhibits MMA from bonding to the pavement. Consequently, snow plows, and possibly vehicles with chains or studs, pulled the poorly bonded MMA lane stripes out of the inset grooves.

The 250 mil inset grooves probably penetrated the roadway surface deeper than the deicing salt. Therefore, since the MMA bond probably was not inhibited by salt and since the MMA material was more than twice as thick at 250 mils, most of this material remained in the insets.



The Chemical Engineer also indicated that the reflectivity of the MMA was most likely deteriorated by the combination of snow plows, vehicles with chains and studs, and deicing chemicals. The reflectivity of lane stripes at night is an essential need of drivers. Therefore, either snowplowable RPM's must be placed along with the lane stripe (preferably every 40 feet on curves and tangents), and/or the service life of the MMA lane stripe reflectivity must be improved to provide positive delineation for driving in darkness, especially during heavy rain. Recessed reflective Type 2 RPMs are not an option because sand and dirt fill up the recess groove, rendering them ineffective.

As a result of this evaluation, the recommended thickness of MMA lane line insets in a mountain environment is no less than 250 mils. However, since deicing salt probably interfered with the bond between the MMA and the inset groove in the roadway, 90 mil MMA insets may be found to be acceptable provided that salt is completely removed from the inset groove prior to extruding the MMA inset.

**APPENDIX - Contract Special Provisions**

Special Provisions from the Contract 4250,  
Nisqually River Bridge to Gravelly Lake I/C

## **DURABLE PAVEMENT MARKINGS**

### **Description**

Pavement marking shall be placed where designated in the Plans in accordance with the requirements of Section 8-22 and these Special Provisions.

### **Materials**

The durable edge stripe and durable gore stripe shall be a spray application, and the durable lane stripe shall be an extruded application each using an ambient temperature curing, two component methyl methacrylate system for application on either asphalt or cement concrete surfaces. The material shall be free from defects and imperfections which might adversely affect the serviceability of the finished product. It shall be free from dirt and other foreign materials and cure to a tough, serviceable film.

Approved materials and sources for durable pavement marking materials are as follows:

#### Manufacturer

Morton International  
PO Box 2023  
Salem, OR 97308  
1-800-835-3357  
Attn: Steve Van DeWalker  
or Ben Farrar  
Telephone: (206)838-4393

#### Name Brand

Dura-Stripe Type V (sprayed)  
Dura-Stripe Type III (extruded)

#### Distributor

Alpine Chemical  
1321 South Central  
Kent, WA 98032  
Attn: Bart  
Telephone: (206)852-3157

### **Construction Requirements**

The roadway areas to receive the pavement markings shall be prepared in accordance with the requirements of Section 8-22.3(2) and the manufacturer's recommendations.

The durable lane stripe shall be applied as shown in the Plans, with each stripe 12 feet long, 4 inches wide, and 90 mils (+/-15%) thick, measured without the glass beads. The profiles shall be 4 inches long and a minimum

of 500 mils thick. Durable lane stripe and glass beads shall be applied simultaneously from the direction opposite that of normal traffic, with the flat side of the profile facing oncoming traffic

Durable edge and gore stripe will be applied at the rate of 40 mils thick. The thickness will be measured without the glass beads.

A manufacturer's representative shall be present on the first day of striping for each type (sprayed and extruded) and as determined by the Engineer afterward.

Striping shall not be applied to new asphalt until the asphalt has cured to the satisfaction of the manufacturer's representative.

The second sentence of Section 8-22.3(4) is supplemented by the following:

The application rate of beading on sprayed markings shall be 20 pounds of beads per gallon and 12 pounds of beads per 100 square feet for extruded markings.

Glass beads for drop on shall be those recommended in writing by the striping material manufacturer as approved by the Engineer.

The surface temperature of the roadway shall be in the range of 30 to 105 degrees Fahrenheit for stripe application. The roadway surface shall be thoroughly dry.

Durable stripe material shall be applied with equipment designed and capable of properly mixing at the point and time of application in accordance with the manufacturer's recommendations.

Section 8-22.3(3) is supplemented by the following:

One durastripe will be required on all durable stripe markings.

**Measurement**

Measurement for durable pavement marking will be in accordance with Section 8-22.4.

**Payment**

The unit contract prices per lineal foot for "Durable Edge Stripe", "Durable Gore Stripe", and "Durable Lane Stripe" shall be full pay for performing the work as specified.