MONTANA DEPARTMENT OF TRANSPORTATION
RESEARCH PROGRAM
August 1997

# EXPERIMENTAL PROJECT PROPOSAL FOR THE EVALUATION OF COLD IN-PLACE RECYCLING WITH A HOT MIX ASPHALT OVERLAY

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| **Location:** | U.S. 2, Two Medicine Bridge-East, from MP 210.9 to 218.8 (Glacier County) |
| **Project Number:** | NH 1-3(34)210F[1814] |
| **Type of Project:** | Cold In-Place Recycling with a Hot Mix Asphalt Overlay |
| **Principal Investigator:** | Construction: Dennis Leo/Engineering Project Manager<br>Annual and Final Reports: Research Management Unit |

## Objective

The purpose of this study is to evaluate and compare the performance and cost effectiveness of two cold in-place recycle (CIPR) treatments of different depths with a hot mix asphalt (HMA) overlay. The cost analysis will be made in comparison to a mill and fill of similar structural number (which assumes a similar surfacing life) to the CIPR treatments and the same overlay.

CIPR has many advantages as compared to the conventional HMA overlay as long as its cost effectiveness matches or exceeds that of the comparable treatment. In a CIPR, the old pavement is reused; this results in the conservation of raw materials and a decrease in waste. Both of these factors reduce the cost of CIPR as compared to the conventional mill and fill or overlay. Also, the pavement structure can be improved without changing the geometry and without reconstructing the shoulders. Alternatively, the profile, crown, and cross slope of the old pavement can be improved. Additionally, the production rate is high as compared to the conventional mill and fill or overlay. If the depth of pulverization and reprocessing is adequate, reflection cracking and localized roughness should be reduced or eliminated. This assumes the distress is limited to the surfacing. Finally, a thin overlay or chip seal may only be required on many CIPR projects.

CIPR may not always be the most effective treatment. CIPR is not recommended for use in areas that cannot accommodate the traffic volume during construction. It is also not recommended for use in cold, damp, or sunless conditions, or early or late in the season; these conditions might inhibit the breaking and curing of the emulsion.

Due to the cold, wet conditions in this area, weather conditions during construction will have to be monitored closely as will pavement performance over time.

## Experimental Design

This project consists of four treatments. All four treatments will be placed (1997) in the east and west driving lanes and right and left climbing lanes, as appropriate, from MP 210.9 to 218.8 on U.S. 2.

The first treatment involves a 60 mm (0.20') cold recycle and a 60 mm (0.20') grade D HMA overlay. The second treatment consists of a 75 mm (0.25') cold recycle and a 60 mm (0.20') grade D HMA overlay. Both cold recycle treatments specify an emulsified binder agent (CMS-2P) at 1.8% and Quicklime at 1.5%. Quicklime is added to the cold recycling process to increase the stability of the mix and accelerate the evaporation of moisture and compaction requirements. The cold recycling operation is to be performed between May 15 and August 15 with the temperature 18°C (65°F) and rising. The placement restrictions in the special provisions allow for the CIPR to be constructed under favorable curing conditions.

The last two treatments contain digouts. The first digout consists of a 615 mm (2') A-2-4 or better material with a geotextile sep/slab, 320 mm (1') crushed base course, 45 mm (0.15') crushed top surfacing, 45 mm (0.15') grade D plant mix bituminous surfacing (PMBS), and 60 mm (0.20') grade D PMBS. The second digout consists of 615 mm (2') removed, reprocessed, and recompacted into the fill, 550 mm (1.8') crushed base course, 45 mm (0.15') crushed top surfacing, 45 mm (0.15') grade D PMBS, and 60 mm (0.20') grade D PMBS.

The pavement design is as indicated in Figure 1 and Table 1. A minimum of three monitoring stations per test section will be established within the two cold recycle sections. Each station will extend approximately 50 m or 150_ on either side of its nominal delineator or milepost. Within the domain of each station, the annual evaluation will include crack counts, rut measurements, international roughness indices (IRI), and traffic data . Cores will be taken

periodically, or at least at the end of the formal evaluation period.
Figure 1: Two Medicine Bridge-East

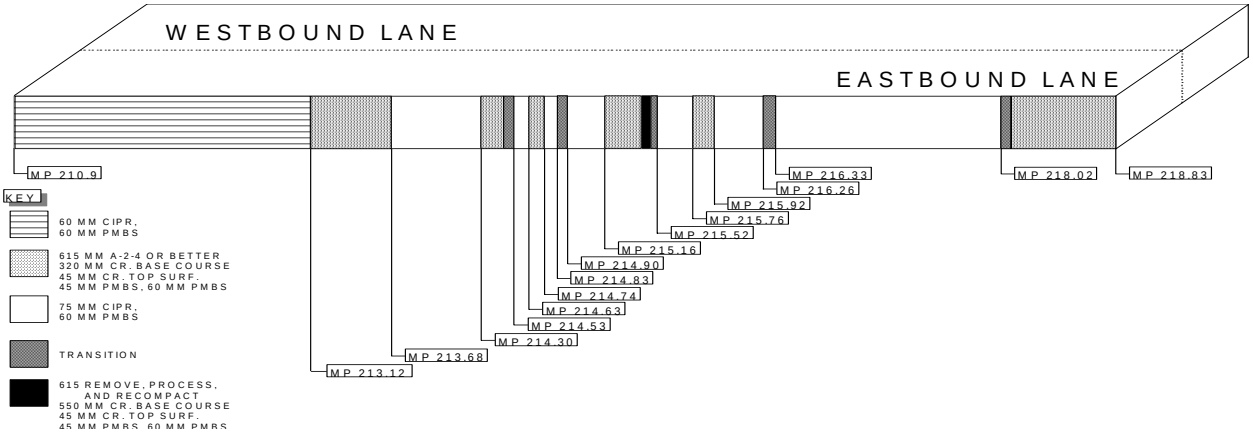


Table 1: Two Medicine Bridge-East Layout

| STATION (Metric) | MP | Treatment |
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| 27+73.68 - 63+45.51 | 210.9 - 213.12 | 60 mm CIPR, 60 mm HMA Overlay (existing surfacing was a "stage" construction in 1987) |
| 72+40.00 - 32+50.00<br>85+03.92 - 86+25.84 (transition)<br>86+25.84 - 87+76.00 (rt. climbing lane)<br>89+60.00 - 90+98.28 (rt. climbing lane)<br>90+98.28 - 92+20.20 (transition)<br>92+20.20 - 96+30.00<br>102+12.35 - 106+04.00<br>108+57.00 - 113+99.52<br>113+99.52 - 115+21.44 (transition)<br>115+21.44 - 142+34.16 (lt. climbing lane)<br>142+34.16 - 143+56.08 (transition)<br>143+56.08 only | 213.68 - 214.30<br>214.46 - 214.53<br>214.53 - 214.63<br>214.74 - 214.83<br>214.83 - 214.90<br>214.90 - 215.16<br>215.52 - 215.76<br>215.92 - 216.26<br>216.26 - 216.33<br>216.33 - 218.02<br>218.02 - 218.09<br>218.09 only | 75 mm CIPR, 60 mm HMA Overlay |
| 63+45.51 - 72+40.00<br>82+50.00 - 85+03.92<br>87+76.00 - 89+60.00 (rt. climbing lane)<br>96+30.00 - 100+59.32<br>106+04.00 - 108+57.00<br>143+56.08 - 155+38.39 | 213.12 - 213.68<br>214.30 -214.46<br>214.63 - 214.74<br>215.16 - 215.42<br>215.76 - 215.92<br>218.09 - 218.83 | Digout<br>615 mm A-2-4 or better<br>320 mm crushed base course<br>45 mm crushed top surfacing<br>45 mm PMBS<br>60 mm PMBS |
| 100+59.32 - 101+51.39<br>101+51.39 - 102+12.35 (transition)<br>102+12.35 only | 215.42 - 215.48<br>215.48 - 215.52<br>215.52 | Digout<br>615 mm remove, process, and recompact<br>550 mm crushed base course<br>45 mm crushed top surfacing<br>45 mm PMBS<br>60 mm PMBS |

**Estimated Quantities and Costs**

Table 2 shows the surfacing cost comparison for the two CIPR treatments (including the cold recycle, Quicklime processing and addition, and emulsified asphalt). These values, reported by the Great Falls District, represent the estimated cost of construction for the cold recycle process. Table 2 also shows the costs for a mill and fill (surfacing only, hauling charges are not included) of similar structural value, as reported by the Surfacing Design Unit.

Table 2: Cost Comparisons

| | 60 mm CIPR, 60 mm grade D Overlay (SN*=0.6) | 75 mm CIPR, 60 mm grade D Overlay (SN=0.75) | 46 mm mill/fill 60 mm grade D Overlay (SN=0.6) | 60 mm mill/fill 60 mm grade D Overlay (SN=0.8) |
|---|---|---|---|---|
| Cost/$m^2$ ($yd^2$) | $8.41 ($7.03) | $7.97 ($6.67) | $8.49 ($7.10) | $9.15 ($7.65) |
| Cost/km (mile) | $63,915 ($102,862) | $76,176 ($122,593) | $64,524 ($103,842) | $87,400 ($140,656) |

* SN=structural number, equals thickness(ft) * 3.0 for CIPR, equals thickness * 4.0 for mill/fill. A 57.15 mm (0.1875') mill/fill has a SN of 0.75; this thickness would never be built. Therefore, a 60 mm (0.2') will be used for comparison; SN equals 0.8.

It should be emphasized that the complexity of this project has probably resulted in higher costs for the CIPR. It should also be emphasized that this analysis does not take into account life-cycle costs, including the potential for extended pavement life and reduced maintenance. It should also be emphasized that the costs reported for this project may not be typical of costs that would be experienced elsewhere or by other contractors.

Construction will be in accordance with special provisions for CIPR as developed by the Montana Department of Transportation.

**Evaluation Schedule**

Performance will be monitored by the Research Management Unit (RMU) for a period of five years, in accordance with the Department's "Experimental Project Procedures." Annual reports are required, as well as a Final Project Report (responsibility of the RMU).

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| 1997: | Construction | Monitored and reported by the Engineering Project Manager and the RMU. |
| 1997: | Construction Report | Due in the Research Office 30 days following completion of construction. |
| 1998: | June-August | Conduct visual examination of overlays. Perform crack counts, measure ruts, obtain IRI and traffic data, prepare and submit report no later than Sept. 15. Submit completed prior to Sept. 30. |
| 1999-2001: | Same as 1998 | |
| 2002: | June-August | Conduct visual examination of overlays. Perform crack counts, measure ruts, obtain and analyze pavement cores and IRI and |

traffic data, prepare and submit report no later than Sept. 15. Complete final project report prior to Sept. 30.