

## PROJECT INFORMATION

**BACKGROUND:** During the past 30 years the use of reclaimed asphalt pavement (RAP) has become part of the daily practice in the construction of hot mix asphalt pavements. Preliminary results from Minnesota LRRB Investigation 842 show that roughly 50 percent of agencies using RAP restrict the use to non-wear courses. The use of RAP represents both a cost savings on materials and an environmentally positive method of recycling. Significant experimental work has been performed in the lab to evaluate the asphalt mixtures modified with RAP materials. However, there are few examples of studies focusing on the performance of pavements built with either RAP or incorporating fractionated materials at the mix plant. Many pavements have been built in Minnesota and around the United States using RAP, but very few have been monitored closely to provide useful performance data.

The University of Minnesota recently completed two studies involving RAP. The first was aimed toward investigating the effect of various types and percentages of RAP on asphalt binder and asphalt mixture properties. This is a first step in the more complex process of developing a rational design for asphalt mixtures containing RAP that may change Mn/DOT current specifications. The second project looked into developing a simple test that could be used to obtain asphalt binder properties required in developing blending charts, and applied the Hirsch model to mixture testing. Since then other research has compared binder properties obtained from the Hirsch model with properties performed on extracted binders in order to indicate the relative level of binder mixing present in the RAP HMA. The results of these studies also need to be verified with field sections, which is the reason for this project.

**OBJECTIVE:** MnROAD will conduct a five-year project to specifically study the performance of RAP under controlled testing conditions. Several asphalt concrete test sections will be built at the Minnesota Road Research Facility (MnROAD). The sections will have similar structural designs and contain 30 percent RAP but vary by binder grade and fractionated RAP content.

RAP is a widely used component in asphalt concrete. Current national trends promote the use of high-RAP asphalt concrete. The incorporation of fractionated RAP at the asphalt mix plant can potentially improve the quality of existing designs and also to enable higher percentages of RAP to be used in mixtures. The Minnesota Department of Transportation specifies the maximum amount of RAP allowed in a mix based on pavement layer and traffic level. Binder grade also affects the maximum allowed RAP percentage. Mn/DOT wishes to determine if the present limits on RAP are justified.

This pooled fund study will include laboratory, construction, and field monitoring components, and it is intended that the RAP research will be performed on newly built test sections at MnROAD.

*The 2009 amendment will allow for an additional three different mix designs to be included in this study to help fill in some comparisons to warm mix with RAP, Superpave with no RAP, and Superpave with 20% RAP.*

**SCOPE:** This study will include laboratory testing, construction, and field monitoring components, and it is intended that the RAP research will be performed on newly built test sections at MnROAD. The project will be coordinated with ongoing RAP research efforts at the Western Research Institute in Laramie, Wyoming.

### Summary of Research Methodology:

RAP research to be performed for newly built test sections at MnROAD:

1. Mixture designs available
  - a. 30 percent standard RAP control mixture, PG 58-28 (cell 20)
  - b. 30 percent fractionated RAP mixture, PG 58-28 (cell 21)
    - i. Outcome will establish fractionated RAP gradation
  - c. 30 percent fractionated RAP mixture, PG 58-34 (cell 22)
    - i. Mix contains aggregate and RAP components identical to fractionated PG 58-28
  - d. 20 percent standard RAP warm mixture, PG 58-34 (cells 15-19,23)
  - e. 20 percent standard RAP Superpave, PG 58-34 (cell 24)
  - f. 0 percent RAP Superpave, PG 64-34 (cell 4)
2. Construction (12.5 mm design)
  - a. Mixtures will use only RAP material milled from MnROAD cells
    - i. Separate RAP stockpiles will consist of non-fractionated, coarse, and fine RAP
    - ii. Stockpile samples will be obtained for gradation and binder testing (PG and %AC)

**MnROAD RAP Stockpile Descriptions**

RAP Stockpile	% passing 19mm	% passing 12.5mm	% passing 4.75mm
A	100	-	-
B	100	100	0
C	100	100	100

**Corresponding HMA Designs**

RAP design, PG 58-28 Control Mix	RAP design, PG 58-28 Fractionated Mix	RAP design, PG 58-34 Fractionated Mix	RAP Warm Mix PG 58-34	RAP SuperPave PG 58-34	No RAP SuperPave PG 64-34
30% pile A	X% pile B (30 - X)% pile C	X% pile B (30 - X)% pile C	20% pile A	20% pile A	No RAP

(\*) X% to be established during mixture design phase.

- b. Plant observation and production sampling of three mixtures
    - i. Sample aggregate feed for verification
    - ii. Sample mixture for laboratory testing (blended PG or other binder tests, mixture dynamic modulus, overlay tester or other)
  - c. Paving observation and sampling of six (3+3) mixtures
    - i. Core samples for volumetric testing
3. Long term performance monitoring
- a. Cracking - Ride - Rutting - FWD - Friction (if necessary)

**TASKS:**

Note (\*): upon approval of task 2 a summary of the design and construction conclusions will be delivered to the Mn/DOT Bituminous and Pavement Design Units to begin the implementation process. The appropriate course for implementation will be determined by these units. Mn/DOT will be paid by tasks completed and approved by the technical advisory panel.

- Task 1. Develop design specifications/special provisions for fractionated RAP sections. Specifications will be based on trial mixtures.  
Duration: Six months  
Deliverable: Chapter describing development of specification or special provisions as part of the Year 1 interim report.
- Task 2. Construct test sections.  
Task includes monitoring RAP stockpile and incorporation of RAP at the plant. Sampling will include component materials, RAP mixtures obtained at plant, and cores obtained from test sections.  
Duration: Six months  
Deliverable: MnROAD RAP cell construction report (\*)
- Task 3. Year One annual report.  
Duration: Twelve months  
Deliverable: Interim Report
- Task 4. Lab testing.  
Laboratory testing performed on construction samples.  
Duration: Six months  
Deliverable: Testing report
- Task 5. Year Two annual report.  
Report will include performance and monitoring results.  
Duration: Twelve months  
Deliverable: Interim Report
- Task 6. Year Three annual report.  
Report will include performance and monitoring results.  
Duration: Twelve months  
Deliverable: Interim Report

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| Task 7. | Year Four annual report.<br>Report will include performance and monitoring results.<br>Duration: <u>Twelve months</u><br>Deliverable: <u>Interim Report</u> |
| Task 8. | Draft final report.<br>Duration: <u>Two months</u><br>Deliverable: <u>Final Report including recommendations for specifications</u>                         |
| Task 9. | Final report.<br>Duration: <u>Four months</u><br>Deliverable: <u>Final Report publishing through CTS</u>  |