Job Report Cold Recycling

WR 2500: Rehabilitation project, Helena National Forest, Montana / USA

Wirtgen Cold Recycling:

WR 2500: Foamed asphalt rehabilitation project Helena National Forest, Montana

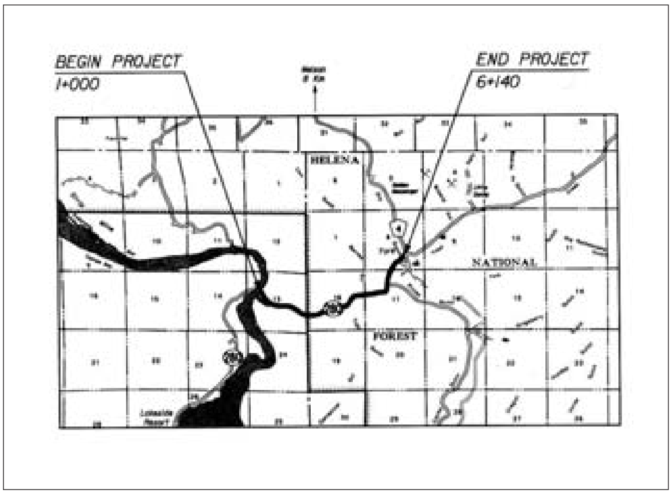
Mike Marshall, June 2004

1. Project outline

1.1 General

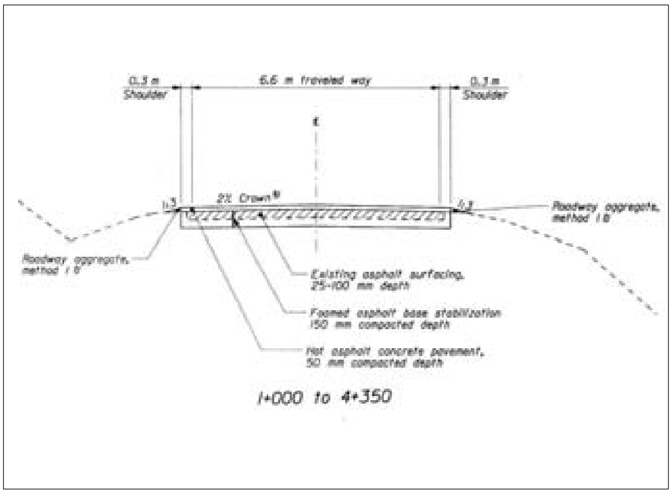
FHWA, Western Federal Lands Foamed Asphalt Base Stabilisation Project: MT PFH 29-1(1)
Lakeside to Nelson Road, Helena National Forest, Lewis and Clark County, Montana. Project length: 5.14 kilometers

1.2 Location



280 Lakeside to Nelson Road

1.3 Typical section

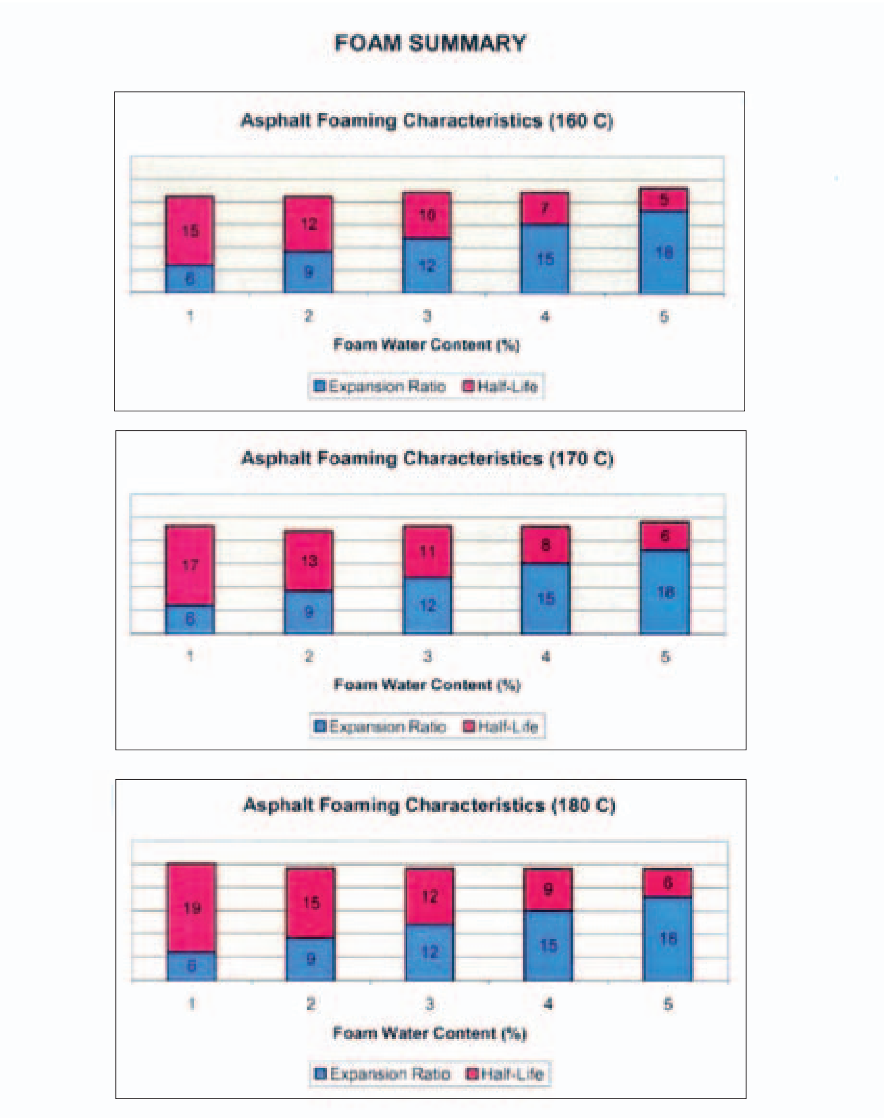


1.4 Site investigation / Mix design

The site investigation and mix design work was carried out by Earth Engineering Consultants Inc, Fort Collins, Colorado. EEC follow the design protocol developed by Wirtgen, including:

Foaming characteristics

A sample of PG 58-28 asphalt obtained from the Montana Refining Company in Great Falls, Montana was evaluated to determine foaming characteristics. The Montana Refining Company asphalt was evaluated at 160, 170 and 180 °C to develop expansion ratio and half - life information. Results of the completed foam index evaluation are included in the following summary sheet.



Based on the results of laboratory testing, it was recommended to add 3.0 % injection water to induce foaming and a minimum asphalt temperature of 160 °C be maintained in the field. For the provided mix designs, a minimum asphalt temperature of 160 °C and 3.0 % injection water was utilized.

Sampling and sample preparation

Samples of the asphaltic concrete surfacing and aggregate base from the proposed reconstruction area were delivered to the EEC laboratory for use in the mix design. The samples were taken from station 2 + 475.

As a part of the completed laboratory testing, a gradation analysis was completed on the proportioned and blended sample of aggregate base and RAP prior to cement addition to develop grain size distribution information. In addition, Atterberg limits and a modified Proctor test were completed on the blend. Results of the outlined testing are indicated on the following summary sheets.

Samples of the asphalt pavement were softened by heating and broken down to obtain material representing recycled asphaltic concrete. The RAP and aggregate base materials were blended in proportion to the layer thicknesses and assumed in-situ densities as outlined below in table I. A 6-inch recycling depth is proposed for this roadway.

TABLE I – Proportioning summary (Section A)

Material	Weight Per Square Meter (kg)	Per 10 kg Sample (g)
Asphaltic Concrete (38.1 mm @ 2403 kg/m^3)	91.55 kg (27.77 %)	2777 g
Aggregate Base (114.3 mm @ 2083 kg/m^3)	238.09 kg (72.23 %)	7223 g
Total Blend	329.64 kg	10,000 g

Atterberg limits tests indicated the proportioned materials were non-plastic. Based on the results of completed Atterberg limits tests, the addition of lime was not explored. Two percent (2.0 %) Portland cement by unit weight was added to the blend to supplement fine content and add cementatious qualities to the blend. Augmenting the fine content is necessary to provide a sufficient amount of material for development of asphalt foam mortar. Two percent (2.0%) compaction moisture was added to the blend prior to treatment with foamed bitumen.

Foamed bitumen was added to the proportioned blend for sections A at 3.0, 3.5, 4.0 and 4.5% based on the sample dry unit weight. The treated samples were then compacted into 4 inch diameter specimens using 75-blow Marshall compactive effort. The molded specimens were cured at 104 F for 3 days. The cured samples were tested for indirect tensile strength under treated and untreated conditions. Untreated conditions consist of allowing samples to remain at room temperature for 24 hours after curing. Treated conditions consist of soaking the samples in room temperature water for 24 hours after curing.

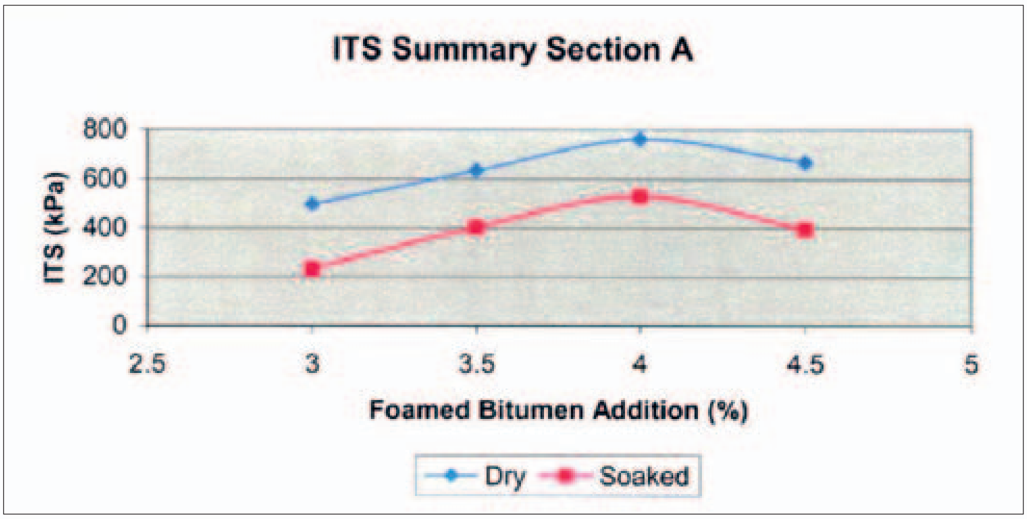
Results

A summary of the completed indirect tensile strength test results is outlined below in table II. Graphic representations of the percent foam versus soaked and unsoaked strengths for the proposed mix are included with this report.

TABLE II – ITS testing summary

% Foamed Asphalt Added	3.0	3.5	4.0	4.5
Additives & %	2% Portland cement	2% Portland cement	2% Portland cement	2% Portland cement
Molded Density (kg/m^3)	2198	2155	2155	2124
ITS Dry (kPa)	494	633	761	667
ITS Soaked (kPa)	234	403	530	396
Retained Strength (%)	47%	64%	70%	59%

Summary of its testing



Recommendations

The recommended foam and Portland cement addition rates are outlined below in table III. Based on the dry and soaked strengths achieved with the addition of 2% Portland cement, a recommended Portland cement addition of 1.5% was completed in the field. It is considered reducing the amount of cement to 1.5% could result in an increase in retained strength and reduce the potential for development of brittle materials. The blended materials should be compacted to be at least 95% of modified Proctor maximum dry density.

Table III – Recommendations

	Section A
Foam Addition	4.0 % ± 0.3 %
Additives	1.5 % Portland Cement

2. Pavement condition prior to recycling

2. 1 Pavement failure

Typical view of pavement failure, extensive alligator cracking and associated base failure.

3. Foamed asphalt base stabilisation process:

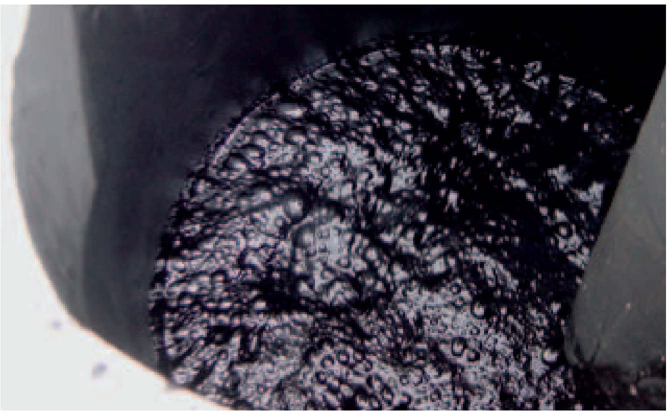
3.1 Base stabilisation

Prior to starting, a sample of foamed asphalt is taken from the external test nozzle on the WR 2500.

A foam sample injected into a container is checked for:

- Expansion ratio
- Half life

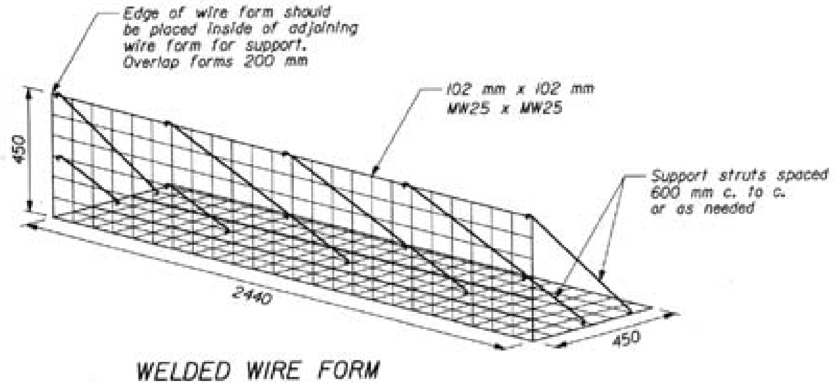
Once the foaming characteristics of the asphalt have been verified against mix design requirements the stabilisation process can commence.

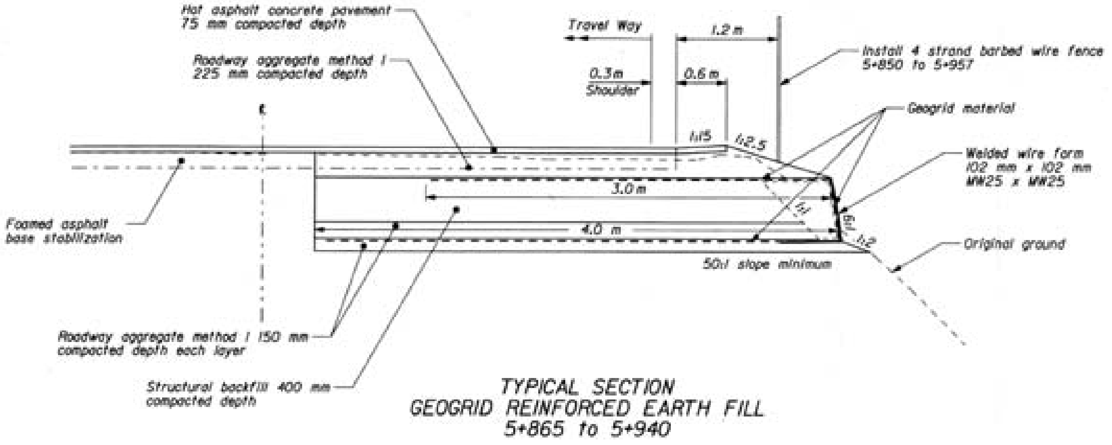


The Wirtgen WR 2500 pushes the combined oil, water and cement tanker, simultaneously:

- Pulverises the pavement
- Mixes in 1.5 % cement
- Injects 4.0 % foamed asphalt
- Injects required amount of moisture for compaction
- Maintains a 150 mm stabilisation depth

To completely eliminate the base failure problems it is essential the recycler be capable of cutting through the asphalt pavement into the base material creating a homogeneous mix of materials that can be bound with the foamed asphalt, forming a fully flexible bound base.





Additional work included building up sections of roadway with negative elevation using earth / fill base and geogrid reinforcing.

The built up sections were then foamed asphalt stabilised and cut to correct grade.

3.2 Initial compaction

Initial compaction with a vibratory padfoot compactor, to ensure full depth compaction.

12 – 15 tonne capacity up to 200 mm depth, recommended.

3.3 Grader

Following initial compaction, a motor grader is used to cut the stabilised material to the desired levels.

3.4 Final compaction

A steel drum vibratory compactor follows the motor grader after the final levels have been cut. The design densities should be achieved after the required number of passes with the steel drum compactor.

3.5 Lightly water

The finished compacted surfaces are lightly watered.

It is recommended that light watering is applied 2 or 3 times throughout the day, while traffic is riding on the stabilised base to help prevent ravelling.

3.6 Surface finish

While the surface is moist a pneumatic tyred roller is used to achieve surface finish.

The rolling action of the tyres creates a surface slush, bringing some fines to the surface which form a closely knit surface finish for traffic to run on.

3.7 Finished section

Right hand lane shows finished stabilised base, with all cracking eliminated from the pavement.

The stabilised base will be overlaid with 50 mm of hot mix asphalt.

4. Quality control

The contractor, Son Haul Inc of Fort Morgan, provided on site laboratory equipment.

Daily samples of the stabilised base mix were taken and run through the lab to verify field results against lab mix design results.

An essential element of the onsite lab equipment is the Wirtgen WLB 10 mobile foamed bitumen laboratory.

The WLB 10 is used to:

- Determine the foaming properties of different bitumen types.
- Producing samples by injecting foamed bitumen directly into the laboratory mixer.
- The quality of mixtures to be produced in the field can be defined exactly.
- Information on the material properties such as load bearing capacity can be obtained before the construction work starts.

FHWA, MT DoT, County & Forestry Engineers receive safety briefing before entering work zone.

Visiting Engineers inspect the foamed asphalt base stabilisation process.

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