Job Report Cold Recycling

WR 2500: Cold foam in place recycling project, Route 8, Maine / USA

Wirtgen Cold Recycling:

Cold foam in place recycling project
Route 8, Maine

Mike Marshall, September 2001

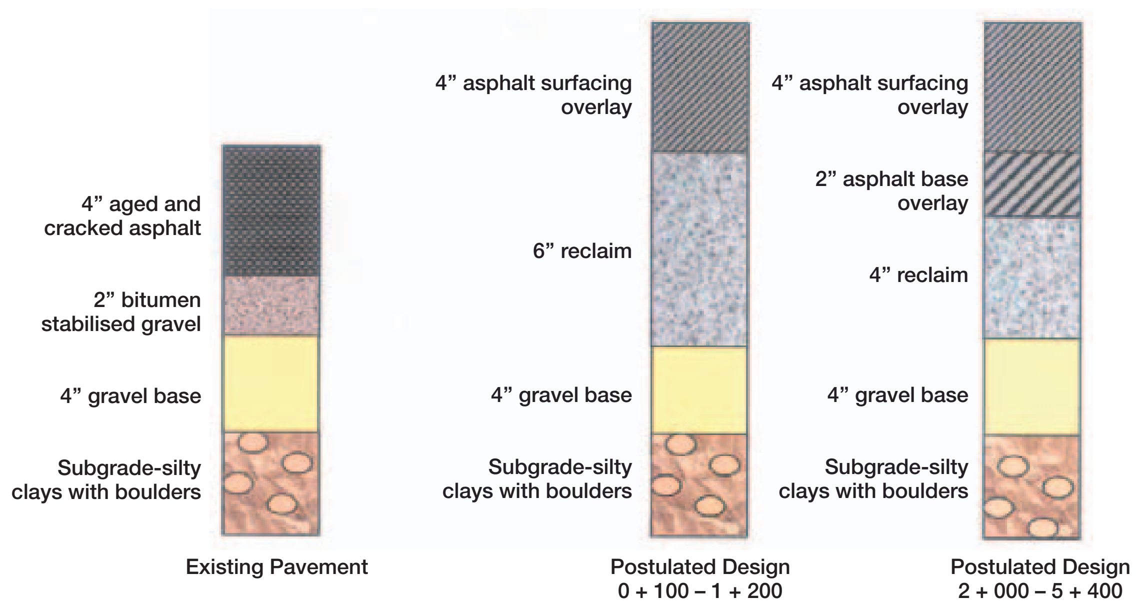
1. Brief description

1.1 Background

On the 8th May 2001, Wirtgen opened discussions with the Maine Department of Transportation, to explore the possibility of developing a Cold Foam In Place Recycling (CFIPR) project.

The DoT had identified a section of Route 8 that was due for rehabilitation and suggested that this be a good candidate for a recycling project.

There were two current rehabilitation design strategies for the section under consideration, including emulsion stabilization and overlaying with hot mix asphalt base and resurfacing.



The initial benefits of CFIPR over the current design thinking were identified as:

- Structural integrity: The process produces a thick bound layer.
- Subgrade is not disturbed.
- Shorter construction window required than full reconstruction.
- All of the pulverized existing AC and aggregate base would be recycled, thereby saving considerable "virgin" aggregate from being hauled to the site.
- Cold foam treated base can be immediately trafficked.

In order to progress the project it was agreed that Wirtgen would employ the expertise of A.A.Loudon & Partners to carry out initial site investigations to establish if the proposed section was suitable for CFIPR and if so to determine a mix design compatible with the existing materials and the DoT design requirements.

1.2 Site investigation / mix design

Pavement investigation concerns the gathering of available information, traffic analysis and the implementation of appropriate methods of investigation in order to provide sufficient data to carry out the pavement design. These include:

- Study of available information.
  In this instance the DoT was able to provide, as built data, traffic estimates, pavement deflection data and core samples from the existing pavement.

- Analysis of design traffic.
  For the section on Route 8, the required design traffic was 992 800 ESAL's, with a design life requirement of 20 years.

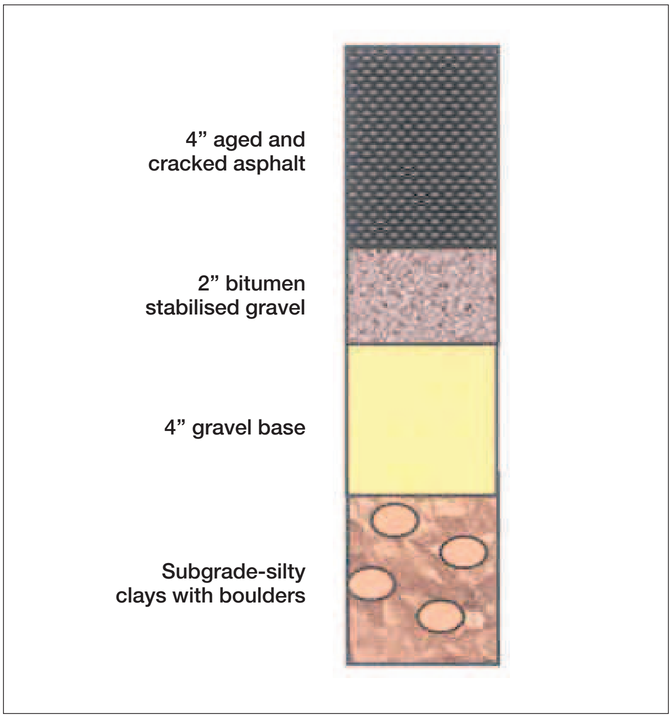
- The methods of investigation used, included:

Visual assessment:

The distress found along the road was mainly severe crocodile cracking and deformation. Transverse and longitudinal cracks were evident in some sections, possibly due to the effects of freezing and thawing of the subgrade materials. The crocodile cracks were evidence of fatigue failure of the upper pavement layers due to lack of subgrade support, especially when the subgrade was excessively moist. With water ingress through the cracks the failure of the pavement is accelerated.

The ruts evident along most parts of the section under investigation were fairly wide indicating settlement or movement within the subgrade.

Testpits:



Three testpits were excavated along the length of the section in order to obtain representative samples to carry out the foamed bitumen mix designs and to visually assess the materials found within the pits.

The original pavement was constructed by placing a gravel layer on shaped in-situ material and in time some bituminous material was used to stabilize this gravel layer. Subsequent to this the gravel layer was overlaid with thin lift asphalt surfacings.

The in-situ material was a silty clay matrix with boulders ranging in size from 4” to 12”.When the moisture content of this material exceeded the optimum, this material would provide no support to the upper pavement layers.

Representative samples of the asphalt and underlying gravel were taken for the mix design procedure.

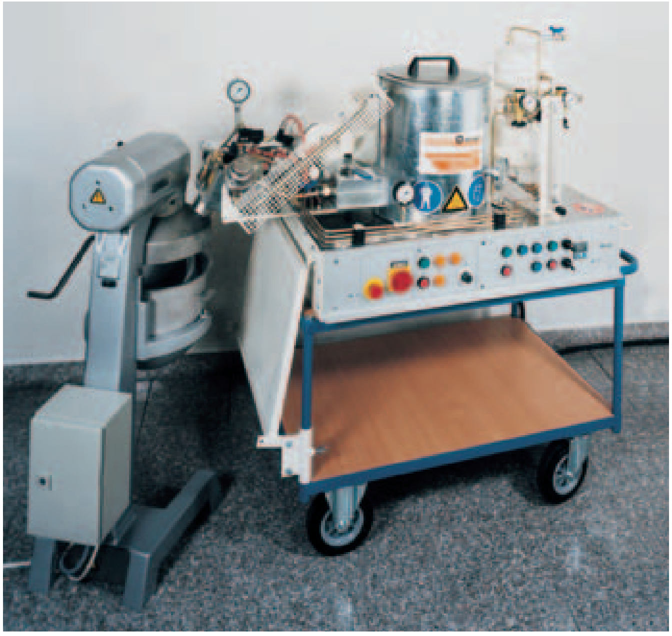
Laboratory testing / mix design:

Samples from the testpits were subjected to laboratory testing, to establish the quality of the materials in the existing pavement layers, and in the underlying subgrade.

Typical tests include, sieve analysis, plasticity and CBR.

The results from these tests together with samples of the materials were used to formulate the mix design.

Using a Wirtgen WLB 10, foamed bitumen laboratory portions of the samples were prepared by mixing them with various percentages of foamed bitumen to determine the optimum percentage of foamed bitumen to be added to meet the desired design requirement.



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.

The original mix design was conducted using only in-situ samples taken from the test pits, which were blended (80 % asphalt / 20 % gravel base, by volume) and tested with foamed bitumen.

The bitumen used for testing was 68-22 grade, supplied by the DoT and showed suitable foam characteristics with the addition of 3 % water.

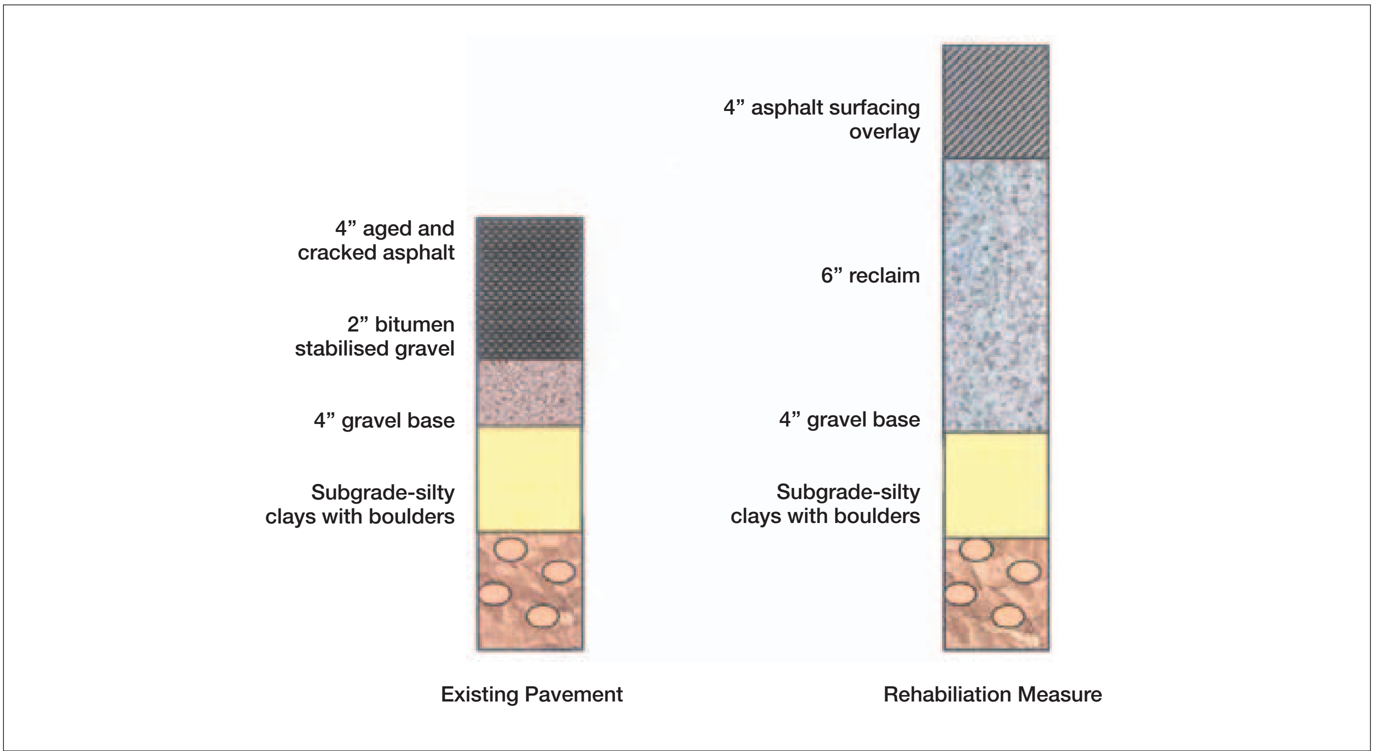
The blended samples were stabilsed with foamed bitumen contents ranging from 2.0 % to 3.5 %, in 0.5 % increments, together with 1.5 % cement. The cement is mainly for a distribution agent and was added due to the lack of fines in the material blend.

Briquettes manufactures using the WLB 10 at the different foamed bitumen contents were cured and then tested for indirect tensile strength, under dry and soaked conditions.

In addition to the above laboratory tests consideration was also given to practicalities of recycling this particular section of road. The large boulders in the gravel base were found at varying depths from the surface, ranging from 6” (150 mm) to 8” (200 mm) deep. As an average a foam recycled layer of 8” (200 mm) was required to meet the design criteria. It was decided to add 2” (50 mm) of crusher dust onto the road surface prior to recycling.

The final mix design for the CFIPR project was determined to be:

- Addition of 2” (50 mm) imported crusher dust.
- Add 1.5 % cement by mass
- Add foamed bitumen to the pulverized material at a rate of 2.5 % by mass
- Recycle the existing pavement with the imported crusher dust to a depth
- of 8” (200 mm)



2. Road condition prior to recycling

Route 8, mid section looking South.

Longitudinal and transverse crack pattern evident.

Typical failure, with large stone in gravel base near to surface.

3. Location / project

3.1 Location

Route 8 is located between the towns of Belgrade Lakes and Smithfield, N.E of Augusta, Maine.
The foam bitumen recycling project consisted of approx 5.4 miles of Route 8.

4. Construction plan

- Clean out & re-cut side drainage channels
- Add 2" (50 mm) locally sourced crusher dust onto existing road pavement
- Pre-pulverise entire section
- Roughly shape and compact to accommodate traffic
- Spread 1.5 % cement
- Recycle entire road width, 3 passes with WR 2500, addition of foam bitumen 2.5 %
- Compact & finish
- Seal with 3.2" (80 mm) asphalt wearing course

5. Pavement preparation

The cement was initially laid out by hand.

The hand laid cement was then uniformly spread over the pre-pulverized surface.

6. Cold foam in place recycling (CFIPR) process

6.1 Recycling train

The WR 2500 recycler was coupled with:

- Bitumen supply tanker, in front, bitumen heated to a temperature of 350 deg F. The supply tanker is pushed by the WR 2500 recycler.
- Water cart, in rear. The water cart is pulled by the WR 2500 recycler.

The road width to be recycled was 21 ft (6.6 m), then number of passes with the recycler was 3. Working in 450 m linear sections the passes were as follows:

Pass 1. Curb towards centre – South bound lane
- 8 ft (2.5 m) full cutter width, with full foam spray bar open.
- Recycling direction – South

Pass 2. Curb towards centre - North bound lane
- 8 ft (2.5 m) full cutter width, with full foam spray bar open.
- Recycling direction – South

Pass 3. Centre of road
- End nozzles closed on spray bar to allow a 6 ft (1.88 m) foam treatment width. (this allows for a 6” (150 mm) overlap of foam treated material on each longitudinal joint)
- Recycling direction – South

By this method there were NO longitudinal joints in the outer wheel paths. Average recycling speed 44 ft/min (14 m/min).

6.2 Compaction / shaping

Vibrating padfoot compactor follows immediately behind the recycling train for compaction of the recycled material.

Once compacted the recycled material is cut to level using a motor grader.

A steel drum compactor follows the motor grader for final compaction.

6.3 Water

While the recycled surface is moist, the pneumatic tyred roller is used to create a surface slush effect, which knits together the finer particles at the surface.

This process locks in the larger particles and avoids surface raveling.

The resulting finish provides an excellent smooth surface for traffic to run on.

7. Summary CFIPR process

Foam recycling

Padfoot compactor

Cut levels with motor grader

Steel drum compactor

Water cart

Pneumatic tyred roller

Finished foam stabilized base

8. Before & after views

May 2001
Route 8 mid section looking south

September 2001
Route 8 mid section looking south

Wirtgen GmbH
Hohner Str. 2 · 53578 Windhagen · Germany
Tel.: +49 (0) 26 45 / 131-0 · Fax: +49 (0) 26 45 / 131-242
Internet: www.wirtgen.com · E-Mail: info@wirtgen.com