FROEHLING & ROBERTSON, INC.
Engineering Stability Since 1881

6181 Rockfish Gap Turnpike
Crozet, Virginia 22932-3330
T 434.823.5154 I F 434.823.4764

COLD PATCH EVALUATION

CLIENT:	Michael Wertheim Road Stone Production, LLC 1230 River Road Charlottesville, VA 22901 C:434-906-1273 Michael@slwilliamson.com	**PROJECT:** **Record No:** **Date:**	Cold Patch Evaluation 71R-3115 April 7, 2014

Froehling & Robertson, Inc. (F&R) was asked to evaluate two competing products used in pothole repairs as "High Quality Cold Patch Material" designed for applicable weather patching in wet, dry, or sub-freezing conditions. The two products are identified as Aquaphalt from Roadstone Production versus Bond-X from Seaboard Asphalt. It is our understanding that VDOT awards a yearly contract for asphalt cold patch material. There are two categories of material warranty, Type 1 (6 month warranty) and Type 2 (12 month warranty). Aquaphalt is categorized as a Type 2, however the contract was awarded to a Type 1 product (Bond-X) with the understanding they would provide a 12 month warranty. As per the attached specs, all products are supposed to be able to be installed in wet conditions, which are not proving to be the case according to VDOT. VDOT has asked Aquaphalt to perform testing showing why Bond-X fails in wet conditions and Aquaphalt does not. F&R has used the Final Report by Brian D. Prowell and Alan G Franklin, "Evaluation of Cold Mixes for Winter Pothole Repair," dated November 1995 and other FHWA reports to evaluate the performance of the two materials under similar conditions in a field trial under wet conditions.

The patches used the semi-permanent method described as: where water and debris are removed with the sides of the patched area chiseled to square up the edge of the patch to provide near vertical sides into sound pavement prior to the patch material being placed. The patch is then compacted using compaction equipment smaller than the patch area with the repair opened to traffic as soon as the maintenance workers and equipment are clear.

The cold patch repair will be judged on the following:

- **Stability**-how patch resists displacement by traffic
- **Stickiness**-adhesion when patch is feathered to thin edges
- **Resistance to water action**-to keep binder from stripping off the aggregate, and the result of freezing water at the bottom of the repair causing delamination of the patch from the original pavement
- **Durability**-resistance to disintegration

- **Workability**-to allow material to be easily shoveled and shaped, affected by temperature

On Friday, 2/7/2014, a site needing repair was chosen that is located at the gated entrance to Rockydale Quarry. This location was selected for a field evaluation using both cold patch products to repair a dished area (1.5 to 1.75 inches in depth) at the entrance (Refer to sketch). Note that location is such that the wheel track on the passenger side of unloaded tandem axle trucks entering the facility would traverse both products (the Seaboard Patch first followed by the Aquaphalt patch) and loaded tandem axle trucks leaving the quarry loaded with crushed rock would have the driver side wheels traverse both products (first the Aquaphalt, then the Seaboard Asphalt).

Figure 1. Site Map with rectangle showing dished area.

Both products required the following sequence of application:

- **Preparation**-sweep area to be repaired with broom to remove loose debris, dirt, ice, or standing water
- **Application**-No heating or mixing required, simply shovel into pothole straight from container. If fault is deep i.e. over 6 inches, apply in two inch layers, compacting each layer in succession. Shovel enough material into the fault to lightly crown the patch. When completed compress the "patch." Area can be opened to traffic immediately.

The edges of the dished area were chiseled to form more vertical edges, with loose material removed to a sound stable base. The area was wetted and broomed to remove standing water.

Figure 2. Hot Mix on left, chiseled area Cold patch evaluation

Figure 3. Area cleaned, wetted, & broomed near side Bond-X, far side Aquaphalt

Aquaphalt was spread and raked to same level towards the inside portion of the quarry with Bond-X raked and spread on the entrance side of the quarry. The finer Aquaphalt was slightly easier to rake and spread than the coarser Bond-X material, but both materials are deemed similar in **workability**.

Figure 4. Aquaphalt spread & raked

Figure 5. Bond-X spread & raked

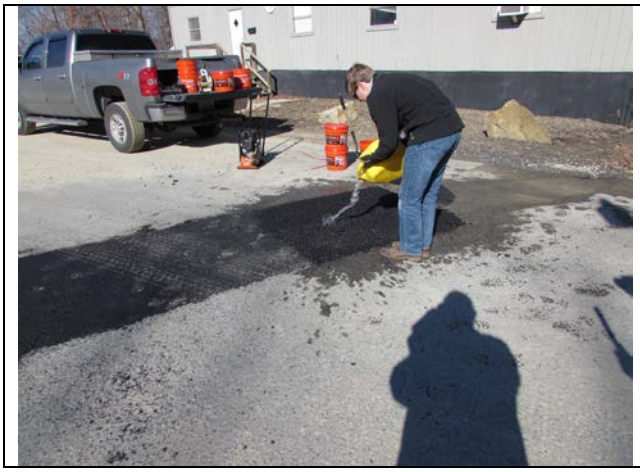

Figure 6. Both wetted 2 gallons water

Figure 7. Both Compacted with Flat Plate

After both areas were shoveled, raked to crown and compacted with same number of passes using a Makita flat plate compactor. Temperature during placement varied from 38°F to 40°F. After compaction, the Bond-X had 99 pcf wet density with 37% voids, had a coarser surface texture and had more sheen. The Aquaphalt had 104 pcf wet density with 34% voids and had a finer surface texture with less sheen. At this time a loaded tandem axle truck left the quarry with a 5/16" rut measured in both the Aquaphalt (quarry side) and Bond-X (gate side) of the patch. Both materials have similar **stability**.

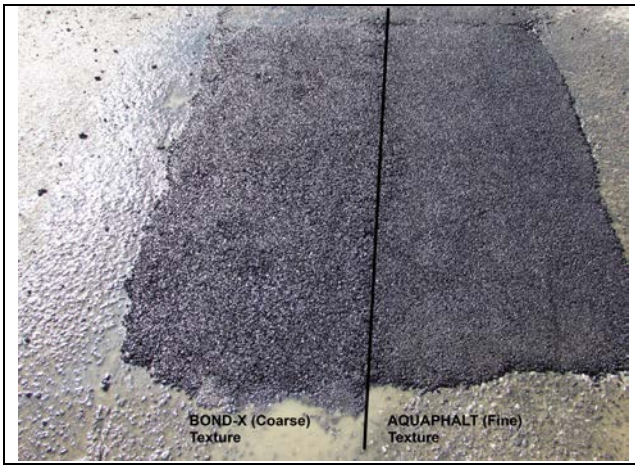

Figure 8. Surface Texture and Color

Figure 9. Loaded Tandem Axle Truck Rut

The first visit to evaluate the performance after installation was on Wednesday, 26 February, 2014, 19 days after installation of the cold patches. Temperatures ranged from an overnight low of 15°F to a daily high of 68°F with 6 days of snow and one day of rain. Approximately 260 empty tandem axle dump trucks arrived (average weight 12 to 14 tons) and these same 260 tandem axle dump trucks left weighing from 30 to 32 tons traversed both materials used for

the cold patch. The Bond-X side had one depression where patch material had been removed approximately 1.25 inches to the original dished pavement and a second area where a depression had started (**durability** and **resistance to water action** issues)..

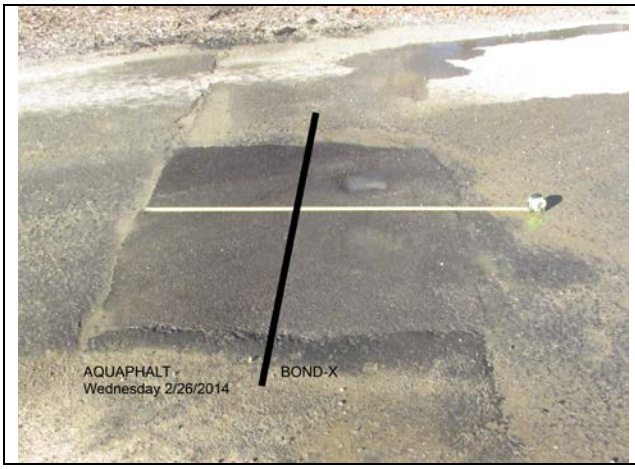

Figure 10. Patch loss of material

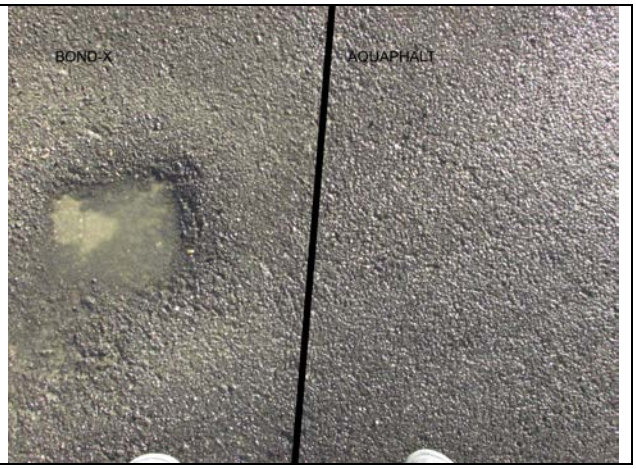

Figure 11. Close-up of Bond-X Patch

The Bond-X patch, probably due to overnight freeze and thaw cycles where water has frozen, is beginning to delaminate (see Figure 11) from the existing pavement.

The second visit to evaluate the performance after installation was on Friday, 21 March 2014, 23 days after installation of the cold patches. Temperatures ranged from an overnight low of 1°F to a daily high of 75°F with 4 days of snow and four days of rain. The Bond-X side had one depression where patch material had enlarged from the first visit to a depth of about 1.25 inches to expose the original dished pavement. The delamination had started to connect to the earlier second depression observed starting on the first visit. Both cold patches had some raveling on the surface where wheel path wear had removed some of the surface aggregate from the binder.

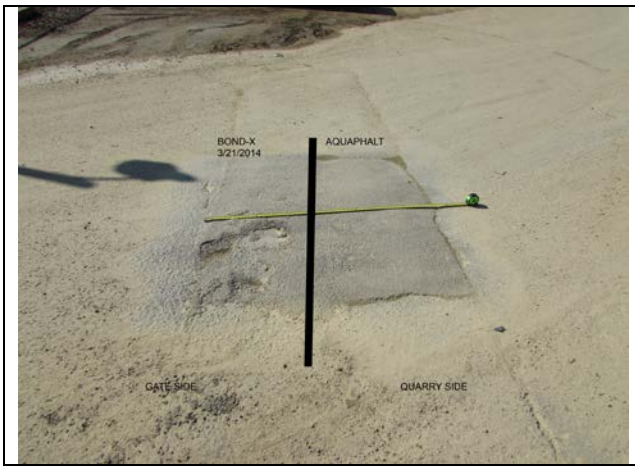

Figure 12. Both patches 3/21/2014

Figure 13. Bond-X delamination close up

Based on the above information where both materials were placed under the same wet conditions, had similar compactive effort, with equal ESAL loadings, equal snow/rain events, and equal freeze thaw cycles, the field conditions demonstrate that the Bond-X material delaminated due to **durability, stickiness** and **resistance to water action issues**, whereas the Aquaphalt material did not.

We have enjoyed working with you on this evaluation of the two cold patch materials. Please contact us if you have any questions regarding the test method or opinion presented in this report or if we may be of further service.

Respectfully yours,
Froehling & Robertson, Inc.

John L. Pappas, PE
Senior CMT Engineer

reviewed by
Clyde A. Simmons III, P.E.
Senior Geotechnical Engineer