
GARFIELD HEIGHTS PROJECT A CASE STUDY IN RUTTING CORRECTION

High Stress HMA Pavement Cures Problem

The City of Garfield Heights is rehabilitating Broadway Street (SR 14). In planning the project the city's engineer, Wade-Trim of Ohio, sought suggestions from Flexible Pavements of Ohio on how best to correct the rutting, shoving and corrugations present on this heavily loaded street.

Tom Beutler, Bob Tomasek and Bob Bulk of Wade-Trim provided the following information: The existing pavement consisted of a 4 inches thick layer of bricks on a 9 inches thick concrete base which had been resurfaced twice over the last 40 years or so with a total of about 4-1/2 inches of asphalt concrete. The road carries about 36,000 vehicles per day with 8% trucks. From prior street excavations, the brick and concrete base was believed to be in good condition. The proposed project was conceived as a mill and fill asphalt overlay treatment. Wade-Trim asked the association's opinion as to what materials to specify for the overlay and whether this treatment would be sufficient to cure the rutting.

After reviewing the project and observing rut depths in the curb lane of over 2 inches depth, Flexible Pavements speculated that a mill and fill



The existing asphalt surface on Broadway Street was severely deformed from traffic and distressed from age.

deformation. Five sets of cores were taken at different locations on the project. The set of cores at a single cross section consisted of a core at the point(s) of maximum rutting, a point of maximum heaving and at an area, which showed no visible deformation. Coring was taken to the surface of the brick. These cores were then analyzed to determine which layers of the pavement were deforming.

Observation of the cores revealed 3 distinct layers of bituminous concrete over the bricks. The bottom most layers appeared to be a type 2 gradation with slag aggregate and a coal tar binder. Over that were 2 courses of type 1 mix with natural sand and gravel aggregate and asphalt binder. The overall thickness of the cores recovered varied from 2-1/4 inches to 4-3/4 inches. All the bituminous concrete layers showed deformation. All but one of the cores came cleanly off the brick, indicating little or no bond to the underlying bricklayer.

Based on the analysis of the cores and project conditions, Flexible Pavements offered the following suggestions for rehabilitation:

It is generally held that rutting of asphalt concrete materials within 4 inches of the surface cannot be positively prevented by simply covering with more stable materials. The present situation is compounded by the potential layer of weakness at the surface of the brick, which could allow even the most stable materials to slip on the brick. The only treatment, which could reliably be expected to prevent future rutting, would be to reconstruct the pavement by removing the existing asphalt and brick to the existing concrete base and placing a new overlay of stable asphalt materials. Although we did not have complete information upon which to base a pavement design, the 36,000 vehicles per day and 8% trucks suggests that 8 inches total asphalt over the 9-inch concrete base would



Comparison of cores taken across one lane show the extent of the deformation that has occurred.

treatment would likely be insufficient to correct the deformation, but that a coring or trench study should be conducted to verify the extent of the deformation. Accordingly, Wade-Trim hired Solar Testing Laboratories to take cores at locations of maximum

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seem a reasonable structural design. A suggested pavement build up could consist of 4 inches of item 301, 2-1/2 inches of item 446, type 2 heavy traffic design with a SBS polymer modified, PGM 76-22 binder and 1-1/2 inches of item 446, type 1H, PGM 76-22.

Alternatively, if funding is not available for major rehabilitation, consider removing all the existing asphalt to the surface of the bricks in areas that are severely rutted and replace with a total of 4 inches of intermediate and surface courses as described above. Conventional wisdom indicates using a rubberized tack coat (702.13) to improve adhesion to the bricks. However, in this case use of such tack could lead to a problem with the trucks and paver pulling up the bricks. Consideration should be given to placing the rubberized tack on the bricks as a seal coat application of 0.20 gal/sy with a #9 cover aggregate at a rate of 0.006 cy/sy (15 lbs/sy).

Existing areas that are only slightly rutted could be milled 1-1/2 inches and resurfaced with 1-1/2 inches of item 446, type 1H, PGM 76-22. While this treatment cannot be expected to completely preclude future rutting, performance should be greatly improved over the existing.

There are alternatives to the materials suggested above. ODOT District 12 has had success in preventing deformation using an item 448, type 1 mix modified with the addition of 3% polymer and 3 lbs/ton polyester fibers. The Turnpike has specified a rut-resistant mix for use at the toll plazas composed of all crushed aggregate and a heavy polymer



Severely distressed asphalt is milled to the bricks in the curb lane while the center lane is milled for a single course inlay.



Removal of the bricks down to the 9-inch concrete base proceeded rapidly.

modified PG 76-22 binder. Either of these materials could be substituted for the surface course if local experience recommends.

After considering these suggestions, Wade-Trim proposed a more extensive rehabilitation of Broadway Street. The City of Garfield Heights sought and received funding from the ODOT District 12 urban paving program equal to the cost of 80% of a mill and fill resurfacing and 50% project funding from State issue 2 funds. The contract was let to the Schloss

Paving Company in the spring of 2001 and work began on June 16th. Based on funding constraints and conditions, Garfield Heights chose to remove the bituminous concrete and bricks from I-480 to the south end of the bridge 5,000 feet north of I-480. After concrete base repair, the project will place 8 inches of new asphalt concrete consisting of 4 inches of 301, 2-1/2 inches of 446, type 2, and 1-1/2 inches of 446, type 1H. The surface and intermediate courses will have polymer-modified binders, PG76-22M.

On the balance of the project, Garfield Heights is using a more modest rehabilitation consisting of removal of the bituminous concrete overlay from the surface of the bricks, leaving the bricks in place. On this they are placing a heavy tack coat, 0.2 gal/sigh of rubberized liquid asphalt, 702.13, 2-1/2 inches of 446, type 2, PG76-22M and 1-1/2 inches of 446 type 1, with polymer and fiber modified binder. In the center lanes where deformation is negligible,

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they are only milling and placing the surface course.

Costs for the major items of work include:

Item	Cost
Removal of 4 inches of bituminous concrete	\$.75/sy
Removal of bricks	\$ 4.30/sy
Milling 2 inches of asphalt pavement	\$.65/sy
Concrete base removal	\$13.75/sy
9-inch concrete base replacement	\$43.75/sy
0.2 gal/sy rubberized tack coat 702.13	\$ 1.50/gal
446, intermediate course, type 2, PG76-22M	\$65.00/cy
446, surface course, type 1H, PG76-22M	\$80.00/cy
446, surface course, type 1, polymers and fibers	\$85.00/cy

Wade-Trim's engineering of this project provides an excellent case study of treating an existing rutting condition. Whether you follow the high stress guidelines in the Flexible Pavements of Ohio, Design and Construction Guide, the ODOT Pavement Design and Rehabilitation Manual, or the Asphalt Institute's High Performance Intersections, the process is pretty much the same:

1. assess the existing pavement distress conditions and future traffic loads,



Removal of the asphalt surface and bricks leaves room for 8 inches of new, rut-resistant asphalt.

2. take and analyze cores to determine the extent of the deformation,

3. specify removal of all the deforming asphalt layers, and

4. replace them with a structurally adequate thickness of rut-resistant asphalt materials.

Flexible Pavements of Ohio thanks the staff of Wade-Trim Ohio, Inc. for the opportunity to offer suggestions regarding this project.
