PAVEMENT TECHNOLOGY ADVISORY
- RUBBLIZING -
PTA-M1

WHAT IS RUBBLIZING?

Rubblizing is a rehabilitation process in which an existing deteriorated concrete pavement is broken into small pieces (maximum size 9 inches) while still in place. The "rubblized" concrete pavement, in effect, becomes an aggregate base for a hot-mix asphalt (HMA) or concrete overlay.

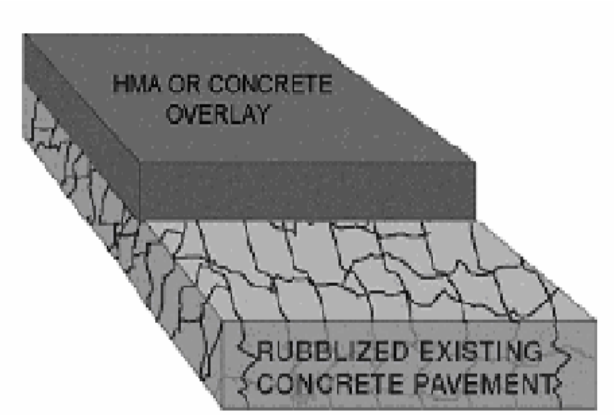

Figure 1: Rubblized Concrete with Overlay

The potential benefits of rubblizing include:

- Saving resources and transportation costs by utilizing in-place materials.
- Preparing a pavement for overlay more quickly than pavement patching.
- Minimizing disruption to traffic operations.
- Preventing reflective cracking in overlays.

Rubblizing can be an effective rehabilitation alternative when extensive pavement patching, a structural overlay, or reconstruction is necessary because of concrete pavement deterioration.

It can also be effective for deteriorated HMA-overlaid concrete pavements with extensive reflective cracking, or other distresses related to deteriorated concrete beneath the overlay.

STATUS IN ILLINOIS

The Bureau of Materials and Physical Research (BMPR) has closely monitored the construction and performance of several experimental rubblizing projects constructed since 1990. Various rubblizing equipment and HMA overlay thicknesses were employed in these projects. In some cases, conventional rehabilitation measures were placed at the same time to allow for a direct performance comparison. Detailed findings and observations from these study projects are documented in Illinois Department of Transportation (IDOT) Physical Research Report Number 137 (PRR #137). After 10 years, the overlaid rubblized pavements had performed well, typically showing fewer and less severe pavement distresses than conventional counterparts in the study. BMPR continues to monitor the performance of these projects.

IDOT recently employed rubblizing in a $44.8 million project to reconstruct approximately 9 miles of Interstate 70 (I-70) in Clark County. The deteriorated, HMA-overlaid concrete pavement was milled, rubblized, and then overlaid with a 17.5-inch HMA pavement containing innovative features to allow for a 30-year "extended" design life (see Spring 2004 Issue of *Asphalt Magazine*).

Two-way traffic separated by a movable concrete barrier was maintained on the eastbound roadway, allowing construction to progress unimpeded on the westbound roadway, and vice versa. The 37.5 lane-miles of milling, rubblizing, and paving were accomplished within the course of the 2003 construction season, while some preparatory work, which included raising several over-head structures, was performed in 2002. Pavement performance is being monitored, but no conclusions have been reached at this early date.

OVERLAY DESIGN

The required HMA overlay thickness for a rubblized pavement is based upon the Traffic Factor (TF) of the roadway. Established in Chapter 54 of the IDOT Bureau of Design and Environment Manual, the TF is a representation of the traffic loading that a pavement is expected to handle over its design period. The lower the TF value, the lower the expected traffic loading for the roadway. For a 20-year design period, TF values can range from less than 1.0 for low volume rural roads, to more than 100 for high truck traffic locations.

The minimum HMA overlay thickness currently allowed by IDOT for low TF rubblizing projects is 6 inches. Conversely, pavements with large TF values due to heavy truck traffic and/or extended design lives may require very thick HMA overlays. Because of the enormous costs and resource requirements, the current IDOT procedure for HMA overlay thickness design in rubblizing applications is being reviewed to determine if the output thicknesses may be reduced without adversely affecting the pavement performance. Contact the Pavement Technology Engineer if the thickness determined from the current procedure exceeds 10 inches.

Concrete overlays can be placed on rubblized concrete pavements, as well. IDOT classifies both HMA and concrete overlays used in conjunction with rubblizing as experimental features. Interested parties should contact BMPR for more information about either alternative.

CONSTRUCTION

Before rubblizing, longitudinal underdrains are installed, if necessary. Underdrains must be in place before rubblizing on interstates and high volume primary routes. Existing HMA overlays are then removed, and a full-depth saw cut is made to sever abutting concrete pavement that will not be rubblized. The concrete pavement is rubblized using one of the following methods:

1. A **Resonant Frequency Breaker** uses a high-frequency, low amplitude striking force to break the concrete. The breaker head covers a small area, requiring up to 20 passes per lane to cover the pavement width. Since one side of the machine travels on rubblized concrete, deformation of the underlying base or subgrade may occur.

Figure 2: Resonant Frequency Breaker

2. A **Multi-Head Breaker** (MHB) has a set of drop hammers keyed to impact the pavement in a specific pattern. The drop hammers are located at the rear, allowing the machine's weight to be supported by unbroken concrete. Full-lane coverage can be achieved in a single pass.

Figure 3: Multi-Head Breaker

A **Z-Pattern Steel Grid Roller**, with Z-shaped steel treads, follows the MHB to break flat and elongated particles into a more cubicle shape.

Figure 4: Z-Pattern Steel Grid Roller

Once rubblized, all protruding reinforcement is cut off below the surface. When soft areas or voids are encountered, they are removed and replaced with improved material. Finally, the rubblized concrete is compacted with vibratory and pneumatic rollers, and an HMA or concrete overlay is placed using normal construction methods.

SPECIAL CONSIDERATIONS

A complete evaluation of the existing pavement and subgrade soils is required for rubblizing projects.

The subgrade should demonstrate a minimum Immediate Bearing Value (IBV) of 3 to 5 before rubblizing with either breaker type (see *PTA-T4*). The designer may wish to limit the equipment to the MHB for a thin pavement with little or no base course. Contact BMPR if considering any such equipment restrictions.

Rubblizing can be performed while maintaining traffic in an adjacent lane, but the resonant frequency breaker may intrude partially into the adjacent lane when rubblizing near the centerline, causing traffic to use the shoulder. Additionally, if temporary lane openings are desired between placement of multiple HMA lifts, then a minimum pavement thickness must be in place before opening the rubblized lane to traffic. This minimum thickness depends on the volume and composition of traffic on the roadway.

Vertical clearance at overhead structures, and the presence of buried utilities are important considerations for determining if rubblizing is a suitable rehabilitation alternative. Rural sections without overhead structures are ideal locations for rubblizing. A detailed life-cycle cost comparison of available alternatives should be conducted.

PROJECT DEVELOPMENT

Approval for rubblizing must be obtained from the Central Bureau of Design and Environment. Additionally, an experimental features work plan must be filed with BMPR. Contact BMPR if assistance is desired in project selection, or for more information on the design process.

If you have any questions, please contact:

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