

***PAVEMENT TECHNOLOGY ADVISORY
- BONDED CONCRETE OVERLAY -
PTA-M3***

WHAT IS A BONDED CONCRETE OVERLAY?

A bonded concrete overlay (BCO) consists of a new concrete overlay placed directly on top of an existing concrete pavement. The overlay bonds to the existing concrete to create a monolithic slab. Saw cuts are placed in the overlay at locations of underlying joints, patches, and working cracks in order to accommodate movements and prevent reflective cracking.

A BCO is a technique intended for use on a good-performing pavement to extend its life. It is not intended for use on a pavement at the end of its service life. A proper application for a BCO may be to increase the structural capacity of a relatively new concrete pavement that was under-designed for in-service loading (see [PTA-D1](#)). Another application may be to restore the riding surface of a severely spalled pavement, or one with high steel, that shows otherwise good performance.

STATUS IN ILLINOIS

Five BCOs have been constructed and documented in Illinois. The first was a 4-inch BCO constructed in 1994 and 1995 on Interstate 80 (I-80) near Moline. The second was a 3-inch BCO constructed in 1996 on Interstate 88 (I-88) west of Erie. A detailed account of these two projects is presented in Illinois Department of Transportation (IDOT) [Physical Research Report No.143](#).

In 1998, three additional projects were constructed at intersections. Two of the projects were constructed in Decatur, and one in Carbondale. These projects included thin BCOs, placed in conjunction with a study on whitetopping (see [PTA-M4](#)). The BCO thicknesses ranged from 2.5 to 3.5 inches. IDOT [Physical Research Report No.144](#) provides further details of these three projects.

Four of the five BCOs have performed poorly. Most developed moderate to severe distresses within three to five years of construction. Debonding of the overlay and transverse cracking have been the most common problems. The remaining project (I-88) displayed good early performance, but has shown some deterioration with time.

Most of the original pavements were in service for more than 20 years and contained areas of severe distress prior to placing the BCO. This contrasts with the intended uses of a BCO as described earlier, and may provide somewhat of an explanation for the performance problems that were observed in the study pavements.

THICKNESS DESIGN

The American Association of State Highway and Transportation Officials (AASHTO) and others have developed procedures for determining the required BCO thickness to meet a pavement's structural needs. Most procedures establish the required BCO thickness as

the thickness of the existing concrete pavement subtracted from the thickness required for a new concrete pavement at the same location. These thicknesses are found using specific design inputs, which vary depending on the design procedure used. IDOT has not adopted an official design procedure for BCOs, but recommends a minimum thickness of 2 inches regardless of which design procedure is used.

CONSTRUCTION

Before constructing a BCO, it is necessary to patch all areas of major distress with either full-depth or partial-depth concrete patches. The type of patch will depend on the nature and severity of the pavement distress. Drainage problems also must be addressed beforehand. Underdrains may need to be added or replaced.

The existing concrete surface is next prepared to ensure proper bonding of the BCO. The existing surface may be shotblasted or milled. If milled, light secondary shotblasting is recommended to remove loose particles and dust. Once the milling and/or shotblasting is completed, equipment and other vehicles must stay off the pavement as much as possible. The prepared surface is blown clean just before placing the BCO.

Note: Materials such as grout (a mixture of cement, sand, and water) are sometimes applied to promote bonding; however, the Bureau of Materials and Physical Research (BMPR) has observed minimal improvements when bonding agents are used.

Overlay paving is similar to that of new concrete construction. A slipform paver places the concrete overlay full-depth and full-width. The concrete can be supplied to the paver by backing trucks over the prepared surface, or the shoulder can be used as a haul road with concrete distributed to the paver by a spreader.

When the concrete can support the weight of a lightweight saw and operator, saw cuts are made at locations of underlying joints, patches, and working cracks. Hot-mix asphalt (HMA) wedges are then placed at each end to taper down to the existing pavement surface.

SPECIAL CONSIDERATIONS

The existing pavement condition is an important consideration to determine if a BCO will be a suitable alternative. Pavements having D-cracking; pavements with greater than 2 percent patching; and pavements with existing HMA overlays should not be considered. In general, pavements with Condition Rating Survey values less than 6.5 are not suitable candidates for a BCO.

Pavements with short spacing between joints or cracks should be considered carefully because every joint or working crack in the existing concrete pavement must be matched in the BCO. This operation can be time consuming and costly. Additionally, overhead structures and embankment slopes may require expensive adjustments to meet design standards. A comparison of the life-cycle costs for each alternative should be performed.

PROJECT DEVELOPMENT

Approval for a BCO must be obtained from the Central Bureau of Design and Environment, and an experimental features work plan filed with BMPR. Contact BMPR for assistance in developing a BCO thickness design.

If you have any questions, please contact:

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