TERRA Transportation Engineering and Road Research Alliance
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Concrete Overlays

With fewer dollars available for construction of new roads, preserving existing roads as long as possible is more important than ever. Equally important is finding pavement preservation options that help extend pavement life at a reasonable cost. For more than 70 years, concrete overlays have provided one solution in that search. Because of the growing emphasis on pavement preservation and the rising cost of alternatives, interest in concrete overlays is increasing.

Concrete overlays fall into two main categories: bonded overlay systems and unbonded overlay systems. Both bonded and unbonded concrete overlays can be placed on existing concrete pavements, asphalt pavements, or composite pavements.

Bonded overlays help add structural capacity to and eliminate surface distresses on existing pavements that are in good to fair structural condition. From 2 to 6 inches thick, these overlays generally provide resurfacing solutions for routine or preventive pavement maintenance or for minor rehabilitation. As a minor or major rehabilitation strategy, unbonded overlays help restore structural capacity to existing pavements that are moderately to significantly deteriorated. Unbonded overlays are typically 5 to 11 inches thick and include an interlayer to prevent bonding, provide drainage, and relieve stress.

The work of TERRA members and others nationally is helping advance the research and implementation of concrete overlays. This fact sheet briefly highlights recent and emerging research, innovative projects, and resources for additional information.

Benefits

Key benefits of concrete overlays include the following:

- *Cost-effective and sustainable.* The National Concrete Pavement Technology Center (CP Tech Center) at Iowa State University recently compiled cost information from 33 projects in the *Concrete Overlay Field Application Program Engineer Packet*. The conclusion was that concrete overlays consistently provide cost-effective solutions and are one of the most effective long-term preservation options for existing pavement.
- *Quick and convenient construction.* Concrete overlays can be constructed quickly and conveniently without removing the existing pavement. Contractors use normal concrete pavement construction practices and need no special equipment. In some cases, traffic can be opened within 24 hours of placement.
- *Easy to repair.* Concrete overlay repairs, which involve replacement of an individual panel or isolated area, tend to be much easier than repair of a conventional pavement section. Thin overlays, which typically are not reinforced, also can be effectively milled out and replaced with a new concrete surface.
- *Durable and versatile.* Concrete overlays can be used as complete preventive maintenance or rehabilitation solutions and in conjunction with spot repairs of isolated distresses if needed. The wide range of concrete overlay types offers a solution for almost any pavement type and condition, desired service life, and anticipated traffic load.

State of the Art

As a result of their long history of use, many concrete overlays have been in service for decades. Throughout the years, concrete overlay thickness has evolved from thicker to thin or very thin. Current research continues to evaluate the use of thinner concrete overlays and the effectiveness of differing interlayer materials, as well as the further development of design guidelines. Highlights of several research initiatives follow.

• *Development of the Guide for the Design of Concrete Overlays using Existing Methodologies*

The Federal Highway Administration (FWHA) and CP Tech Center are completing a guide, available in July 2011, on design and application procedures for current software programs for the six types of concrete overlays. The guide will include a detailed explanation of each design procedure and design examples for each type of overlay.

• *Development of a Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements*

The University of Pittsburgh is conducting this FWHA pooled-fund study (TPF 5-165). Funded by six departments of transportation—Minnesota, Mississippi, Missouri, New York, Pennsylvania, and Texas—the products will

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Implementation

Evaluating the condition of an existing pavement is a crucial first step before selecting and implementing a concrete overlay solution. Information from a pavement evaluation helps determine whether to use a concrete overlay and which is the optimal concrete overlay type.

The following innovative examples reinforce the trend toward the successful application of thinner concrete overlays:

- *Illinois*: A structural-fiber-reinforced 4-inch concrete overlay bonded to asphalt was used to rehabilitate five industrial service roads. These roads carry up to 1,250 vehicles per day with 12 percent truck traffic. Contractors and consultants implemented a construction staging plan to minimize interruptions.
- *Iowa*: An 18.9-mile concrete unbonded overlay project on U.S. 18 was recently let. The project is one of the first of this size to be constructed on a two-lane highway under traffic using innovative staging developed in partnership with industry. The contractor also will use stringless paving (using GPS instead of the conventional string-line method) to construct the overlay.
- *Michigan*: Unbonded overlays 6 to 8 inches thick have been used on the interstate since 1984. They continue to perform well. Michigan also has used 4-inch unbonded concrete overlays on arterial roads and 4-inch bonded whitetopping on city intersections and streets.
- *Minnesota*: In 1997, three thin and three ultra-thin bonded concrete overlay test sections (over asphalt) were constructed at MnROAD. After enduring more than 6 million concrete equivalent-single-axle loads (CESALs), the ultra-thin concrete overlay sections were replaced with four new thin concrete overlay test sections. After more than 10 million CESALs, the three thin concrete overlay sections continue to perform with little distress. Performance data from these sections are helping develop a rational design method for thin and ultra-thin concrete overlays of existing asphalt pavement.
- *Missouri*: Geotextile fabric is being used as a separator layer in lieu of the traditional 1 inch of bituminous material for a 5-inch unbonded concrete overlay on a badly cracked section of 22-year-old concrete roadway. Constructed in 2008, the cost-effective overlay is performing well and providing a smooth ride with no visible distress. The Missouri DOT recently used the same design on another project.
- *North Dakota*: An overlay project at Camp Grafton used 4-inch bonded concrete on 20-year-old highly degraded asphalt that carries heavy loads. The project received the North Dakota Ready Mix and Concrete Products Association Award for Innovation.
- *Wisconsin*: A bonded concrete overlay was used to resurface 4.25 miles of asphalt pavement on County Highway A near Beaver Dam, the first renovation of the road in 40 years. The process minimized public inconvenience by shortening the overall construction period.

More Information

Many resources offer guidance on the application of concrete overlays. Links to those mentioned here as well as additional resources are on the TERRA website at www.TerraRoadAlliance.org.

For more information about the research in this fact sheet, please contact:

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More about TERRA, including contact information for program representatives **Stephanie Malinoff** (Center for Transportation Studies) and **Maureen Jensen** (Minnesota Department of Transportation), is online at www.TerraRoadAlliance.org.

State of the Art *continued*

be available in early 2012. To date, existing projects throughout the country have been reviewed, exploring the differences and strengths in design methods and incorporating the impact of climate variability on design. Work remains to complete a design tool (spreadsheet) and best practice guidelines that will help designers implement such projects.

• *Improving Concrete Overlay Construction (Research Report TR-600)*

Iowa State University selected four ongoing construction projects in Iowa to study ways for improving concrete overlay construction. The project resulted in a number of recommendations in areas such as milling, machine control, and traffic control.

• *Concrete Overlay Field Application Program*

To help increase awareness and knowledge of concrete overlay applications among state departments of transportation (DOTs), FHWA and CP Tech Center are in the third year of a national concrete pavement training program. The program involves the formation of expert teams that assist in concrete overlay selection, design, construction, and evaluation, including field visits by team members to review individual projects and develop recommendations. The center will incorporate the lessons from the project, set for completion in 2011, to update its current version of the *Guide to Concrete Overlays*.

• *National Concrete Overlay Explorer*

This online tool from the American Concrete Pavement Association provides construction and performance details from concrete overlay projects across the United States. Information is organized geographically as well as by applications. Technical details about the original construction, information about the current condition of the overlay pavement, and photos included.