Types of Concrete Overlays

Regardless of whether an existing pavement consists of concrete, asphalt, or a composite of several different materials, there is a concrete overlay option that can be used. Bonded concrete overlays are used to add structural capacity or eliminate surface distresses in existing pavements that are in relatively good structural condition and unbonded concrete overlays are used to rehabilitate pavements with greater structural deficiencies (Figure 1).

Concrete Overlay Use

Even though the first concrete overlays date back to the early 1910s and at least 375 concrete overlays had been constructed by 1981, the use of concrete overlays did not become a nationally accepted practice until the mid-2000s. As of 2004, the total square yards of concrete overlays thinner than 6 in. (150 mm) in the U.S. was approximately 1.2 million (1.0 million square meters). Due largely to a sustained education and implementation effort by industry and FHWA, the widespread adoption of thin concrete overlay technologies across the country led to over 8 million square yards (6.7 million square meters) of concrete overlays thinner than 6 in. (150 mm) having been constructed in the U.S. in 2009 and 2010.

Design and construction details for over 1,000 concrete overlays are available in the ACPA’s online National Concrete Overlay Explorer (http://overlays.acpa.org), as well as the National Cooperative Highway Research Program’s (NCHRP’s) Synthesis 99 and 204. Of the 1,000+ overlays catalogued, about 57% were on concrete, 41% on asphalt, and 2% on composite. For overlays on concrete and asphalt, about 25% were bonded and 75% were unbonded.

Service Life of Concrete Overlays

Like any pavement design for a new construction or reconstruction, a concrete overlay can be designed to serve any number of years; see Table 1 for typical expected service lives.

Table 1. Typical Overlay Service Lives [FHWA, Portland Cement Concrete Overlays – State of the Technology Synthesis, 2002, FHWA-IF-02-045]

<table>
<thead>
<tr>
<th>Concrete Overlay Type</th>
<th>Typical Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonded on Concrete</td>
<td>15-25 years</td>
</tr>
<tr>
<td>Unbonded on Concrete</td>
<td>20-30 years</td>
</tr>
<tr>
<td>Bonded on Asphalt/Composite</td>
<td>5-15 years</td>
</tr>
<tr>
<td>Unbonded on Asphalt/Composite</td>
<td>20-30 years</td>
</tr>
</tbody>
</table>
Support Condition Considerations

For a concrete overlay, the existing pavement will serve as support for the overlay. Thus, the condition of the existing pavement and the impact it might have on design decisions is of great importance when designing a concrete overlay.

Some design methods, such as those for a bonded concrete overlay on concrete, might employ a modification to the existing concrete pavement thickness (based on existing pavement factors such as number of joints/cracks, fatigue life consumed, and presence of material-related distresses) to derive an effective concrete pavement thickness for use in determining the required concrete overlay thickness. Other design methods, such as those for a bonded concrete overlay on asphalt or composite, might require that the existing asphalt surface course be in moderate- to good-condition after any necessary pre-overlay repairs and milling of the surface for the concrete overlay thickness design method to be valid. For unbonded concrete overlays on concrete, a separation layer (e.g., asphalt, fabric, etc.) is required to prevent bonding of the concrete overlay to the existing concrete pavement; a very thin separator layer under an unbonded concrete overlay on concrete might warrant a decrease in the maximum joint spacing to minimize the risk of random cracking caused by keying of the overlay with any faulted joints/cracks in the existing concrete pavement. Thus, the link between support condition and design of a concrete overlay cannot be overemphasized. See the Additional Resources section of this document for references that discuss these and other pre-construction and construction related design considerations for concrete overlays.

Concrete Pavement and Overlay Design Software

ACPA offers several concrete overlay thickness design software, including:

- StreetPave (streets, roads, highways): Bonded and Unbonded JPCP Overlays
- WinPAS (roads, highways; based on AASHTO 93 Method): Bonded and Unbonded JPCP Overlays

Other commercially available concrete thickness design methods and software include the 1993 AASHTO Guide (Bonded and Unbonded JPCP, JRCP, and CRCP Overlays), AASHTO’s DARWinME™ (Bonded and Unbonded JPCP and CRCP Overlays). Several state agencies also have customized design methods or software for specific types of concrete overlays.

Additional Resources

While much research and many publications have been completed on concrete overlays in the 100 years since their inception, here are a few key resources if you would like to learn more:

General Information on Concrete Overlays


Information on Design of Concrete Overlays


*Design Details and Performance History of Existing Concrete Overlays*

- The National Concrete Overlay Explorer, ACPA, [http://overlays.acpa.org](http://overlays.acpa.org)
- NCHRP Synthesis 99, Resurfacing with Portland Cement Concrete, 1982
- NCHRP Synthesis 338, Thin and Ultra-Thin Whitetopping, 2004
- PCA/ACPA, Continuously Reinforced Concrete Overlays – 1975 Condition Survey, 1976, SR180.01P
- PCA/ACPA, 1977 Condition Survey of Concrete Resurfacing, 1978, SR211.01P