

## CHAPTER 640 COMPOSITE PAVEMENTS

### Topic 641 - Types of Composite Pavement

#### Index 641.1 - Asphalt Over Concrete Composite Pavement

This configuration consists of an asphalt layer over concrete surface layer (typically jointed plain concrete pavement or continuous reinforced concrete pavement) where the asphalt layer is used to protect or enhance the performance of the concrete pavement. (Asphalt layers over lean concrete base or cement treated base are considered to be flexible pavements for the purposes of this manual.) The function of the asphalt layer is to act as a thermal and moisture blanket to reduce the vertical temperature and moisture gradient within the concrete surface layer and decrease the deformation (curling and warping) of concrete slabs. In addition, the asphalt layer acts as a wearing course to reduce wearing effect of wheel loads on the concrete surface layer.

Asphalt over concrete composite pavements are found most often on older pavements that have had asphalt overlay such as hot mix asphalt, open graded friction course, or rubberized hot mix asphalt, placed over previously built jointed plain concrete pavement (JPCP) or continuously reinforced concrete pavement (CRCP.) New or reconstructed composite pavements with asphalt layer over JPCP or CRCP typically have not been built in the past on State highways because they have been viewed as combining the disadvantages of rigid pavements (higher initial cost) and flexible pavements (more frequent maintenance).

Thin flexible layers (i.e. sacrificial wearing course) have sometimes been placed over JPCP or CRCP to improve ride quality or friction of the rigid layer. Because ride quality and friction can also be improved by grooving or diamond grinding the existing concrete layer, the Engineer should perform a life-cycle cost analysis (LCCA) to determine if diamond grinding/grooving or an asphalt nonstructural overlay is more cost effective before deciding which option to select.

Some cases in which the asphalt over concrete composite pavement option is used include:

- To match the existing pavement structure when widening;
- When adding truck lanes to an adjacent flexible pavement;
- To provide a nonstructural surface course to an existing rigid pavement that is still structurally sound but is worn out on the surface.

#### 641.2 Concrete Over Asphalt Composite Pavement

Because of the minimum 0.70 foot thickness requirements for concrete surface course, all pavements with concrete surface course are engineered according to the standards and procedures for rigid pavements in Chapter 620.

### Topic 642 - Engineering Criteria

#### 642.1 Engineering Properties

The engineering properties found in Index 622.1 for rigid pavement and Index 632.1 for flexible pavement apply to composite pavements. Care should be taken in selecting materials in the asphalt layer to resist reflective crack propagation from the underlying concrete layer and facilitate construction of generally thin asphalt layers.

#### 642.2 Performance Factors

Flexible layers placed over rigid surface layers need to be engineered and use materials that will meet the following requirements:

- (1) *Reflective Cracking.* Joints or cracks from the underlying concrete surface layer should not reflect through the asphalt layer for the service life of the composite pavement.
- (2) *Smoothness.* The asphalt layer should be engineered to provide an initial IRI of 60 inches per mile and maintain an IRI that is less than 170 inches per mile throughout its service life.
- (3) *Bonding.* A major factor in the effectiveness and service life of the composite pavement is the condition of the bond between the asphalt and concrete layers. For a good bond, the

thickness of the asphalt layer does not play an important role in its service life.

Therefore, for practical purposes, if there is no thickness requirement from the structural/constructibility point of view, the minimum thickness of the asphalt layer should be based on material factors such as, gradation and aggregate structure, type of binder, etc. To achieve the maximum bond between asphalt and concrete layers, consult the District Materials Engineer or Headquarters Office of Asphalt Pavement for options on effective bonding methods.

### 642.3 Overlay Limits

**On overlay projects, the entire traveled way and paved shoulder shall be overlaid.** Not only does this help provide a smoother finished surface, it also benefits bicyclists and pedestrians when they need to use the shoulder.

## Topic 643 - Engineering Procedures for New Construction and Reconstruction

### 643.1 Empirical Method

Before deciding to construct a new composite pavement, a LCCA should be completed to determine whether the composite pavement is more cost effective over the long term than asphalt or concrete pavement alternatives.

At present, there is no comprehensive procedure to engineer a structural layer of asphalt surface course over a concrete surface course layer of JPCP or CRCP. Research is under way to provide guidelines for engineering and construction of composite pavements. When engineering composite pavements using JPCP or CRCP, the rigid pavement structure is engineered using the procedures in Index 623.1. No reduction is made to the thickness of the concrete layer on account of the asphalt overlay layer. The asphalt pavement is treated as a nonstructural wearing course, and thus has no structural value.

When enough information is not available, the thickness requirement for placing an asphalt layer over an existing rigid pavement can be used as a

conservative thickness for a new pavement. See Index 625.1 for further details.

### 643.2 Mechanistic-Empirical Method

For engineering an asphalt on concrete composite pavement using Mechanistic-Empirical Design follow the procedures and requirements in Index 606.3 and 633.2.

## Topic 644 - Engineering Procedures for Pavement Preservation

### 644.1 Preventive Maintenance

Preventive Maintenance is used to maintain the asphalt surface course layer or to replace thin asphalt layers (i.e., non-structural wearing courses) placed over concrete surface course layer. If work is needed to repair the underlying concrete layer, it should be developed as a CAPM (Index 644.2) or roadway rehabilitation (Topic 645) project. Additional information on preventive maintenance of the asphalt layer of a composite pavement is the same as for the flexible pavements, which can be found in the "Maintenance Technical Advisory Guide (MTAG)" available on the Department Pavement website.

### 644.2 Capital Preventive Maintenance (CAPM)

The CAPM warrants for concrete and asphalt pavements in Index 624.2 and 634.2 apply to composite pavements. The procedures and designs for asphalt over concrete composite pavement CAPM projects are the same as those for flexible pavements (see Index 634.2) except digouts may require concrete slab replacement and/or base repair. In the case of previously constructed crack, seat, and asphalt overlay projects, it may be beneficial to mill a portion of the existing asphalt layer prior to overlaying. Milling will reduce the thickness of the existing cracked pavement and therefore provide added life to the overlay.

The roadway rehabilitation requirements for overlays (see Index 645.1) and preparation of existing pavement surface (Index 645.1(3)) also apply to CAPM projects. Additional details and information regarding CAPM policies and strategies can be found in Index 603.3, PDPM

Appendix H, and Design Information Bulletin 81 “Capital Preventive Maintenance Guidelines.”

## Topic 645 - Engineering Procedures for Pavement Rehabilitation

### 645.1 Empirical Method

Procedures for engineering rehabilitation projects for asphalt over concrete composite pavement using empirical methods are as follows:

Because the asphalt surface layer is considered to have no structural value, only reflective cracking and ride quality need to be considered.

(1) *Reflective cracking.* If the asphalt layer is placed over an existing concrete pavement, the thickness is calculated based on the procedure outlined for rigid pavement rehabilitation. The thickness depends on the design life of asphalt surface course, as well as mix gradation, type and percentage of the binder.

For additional information on rehabilitation of composite pavement with rigid surface courses refer to the Concrete Pavement Guide available on the Department Pavement website.

(2) *Ride Quality.* When the smoothness of the existing roadway is 170 inches per mile or greater as measured by the International Ride Index (IRI), a minimum 0.25 foot consisting of 0.10 foot HMA (leveling course) followed by a minimum of 0.15 foot HMA or RHMA surface course layer. A nonstructural wearing course may be placed on top lift. Pavement interlayers between the leveling course and surface course may also be considered. Note that in some cases, existing pavement will need to be repaired to assure the roadway smoothness will remain below 170 inches per mile throughout the life of the overlay.

(3) *Preparation for Placing Asphalt Layer Over Existing Concrete Pavement.* Existing pavement distresses should be repaired before overlaying the pavement. Cracks wider than 3/8 inch should be sealed or repaired. Undesirable material such as bleeding seal coats or excessive crack sealant should be removed before paving. Existing thermoplastic

traffic striping and raised pavement markers also should be removed. Spalls in rigid pavement should be repaired and broken slabs or punchouts replaced. Grind existing concrete pavement as needed to eliminate rough ride and faulting. Consider dowel bar retrofit when it will help keep faulting from re-emerging. Loose asphalt wearing course should be removed and replaced, and potholes and localized failures repaired. Ideally, existing non-structural wearing courses should be removed and, if needed, underlying pavement repaired prior to placing a new asphalt wearing course. In some cases it may be more practical to overlay over the existing layer. (A LCCA of the two options will help determine which of these options is more cost effective. Note that when doing a LCCA, the need to ultimately remove asphalt layers in the future should be identified and included in the costs for the analysis.)

### 645.2 Mechanistic-Empirical Method

For information on Mechanistic-Empirical Design and requirements, see Index 606.3.