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PAVEMENT REHABILITATION— PREPARATION FOR ASPHALT OVERLAYS

ADVANTAGES OF OVERLAYS

Asphalt overlays, used for the protection of original investment in roads and streets, afford the following advantages:

1. More miles of modern pavement for less cost than new construction.
2. Considerable savings of energy products.
3. Use of the roadway while modernization is in progress.
4. Savings of construction time—an old road usually can be improved and put into full service more rapidly than a new road can be built.
5. A pavement overlaid in proper fashion is a pavement stronger than new, effecting a reduction of subsequent maintenance requirements.

PAVEMENT EVALUATION

The key to successful rehabilitation is careful planning and programming. Evaluation of the road's condition is the first essential in planning the improvement. If the road is found adequate for present service it should be reevaluated periodically to determine the trend of changes affecting its future adequacy. Such a program provides a continuous inventory, and in this way developing problems can be detected and proper corrective action planned on the most effective basis.

Evaluation, which should extend to all roads in the system, includes consideration of geometric adequacy, surface condition, and structural adequacy for current and future use.

Geometric adequacy is evaluated by studying the construction plans, by field inspection, or both. However, surface condition must be evaluated by field inspection. Structural adequacy is evaluated by studying both surface condition and pavement components, or by measuring pavement deflection.

PREPARATION OF PAVEMENTS FOR OVERLAYS

The thickness of the overlay is designed to improve a lower-than-average pavement condition, but not to provide the extra structural strength needed for localized weak areas. Should the overlay thickness be based on the weakest condition in the section it would be over-designed for the rest of the section, and thus needlessly costly. The proper procedure, therefore, is to correct the weaker areas in advance to provide, as nearly as practicable, a uniform foundation for the overlay. Careful and correct preparation of the existing pavement, prior to the construction of smoothing or strengthening overlays, is essential for good construction and maximal overlay performance.

Requirements for correct preparation of existing pavements for overlays varies with the pavement type and, for this reason, each is discussed separately.

ASPHALT PAVEMENTS

Local Repairs. All weak areas should be repaired with proper patches. Structural patches should be designed and constructed with Full-Depth asphalt concrete to ensure strength equal to or exceeding that of the surrounding pavement structure and economy of time and material. Carefully placed and adequately compacted patches will produce a uniform supporting layer for the overlay, ensuring good performance.

The Asphalt Institute 5/74 2d PAVING & SURFACING

Leveling. When the surface is distorted, the construction of leveling courses and/or leveling wedges is required to restore proper line and cross-section. When thin surfacing courses are to be used it is especially important that prior correction of the surface contour be made. Heater-planing may be required in areas where maintenance of a minimum clearance and/or the matching of an existing elevation are necessary.

Leveling wedges are patches of asphalt plant mix used to level sags and depressions in an old pavement prior to the surfacing operation. The placing of leveling wedges is part of the leveling-course operation.

Leveling wedges should be placed in two layers if they are from 3 to 6 in. (7.5 to 15 cm) in thickness. Wedges thicker than 6 in. (15 cm) should be placed in compacted layers of not more than 3 in. (7.5 cm). In placing multiple layers the shortest length layer should be placed first, with the successive layer or layers extending over or covering the short ones. See Figure 1 for illustrations of the correct and incorrect ways of making leveling wedges. If the incorrect method were used, as shown in the lower illustration, there would be a tendency for a series of steps to develop at each joint because of the difficulty of feathering out asphalt mixtures at the beginning and end of a layer. A bump at these joints is apt to reflect through to the final surface.

Where wedging of dips requires multiple layers, sufficient levels should be taken to plot profiles and cross-sections accurately. From these, the grade of the proposed correction and the lineal limits of the successive layers should be determined so that the inspector and the contractor can be given definite stationing for starting and terminating the spreader or motor grader passes (Figure 2). Figure 3 illustrates the correct way to place leveling wedges for overcoming excessive crown.

Cleaning and Tack Coat. When repairs are completed, the surface to be overlaid must be thoroughly cleaned. A thin tack coat of asphalt is then applied to ensure uniform and complete adherence of the overlay. Lack of uniform thin-tack-coat coverage may result in slippage of the surface layer. Because they can be diluted safely with an equal amount of clean fresh water, asphalt emulsions SS-1, SS-1h, CSS-1, and CSS-1h are much used for tack coats. The diluted emulsion tack coat is applied at the rate of approximately 0.10 gal./yd^2 (0.45 l/m^2).

Emulsion Slurry Seal. When the old pavement's surface has a large number of cracks and scaled areas, but the structure is sound, a slurry seal may be placed in preparation for the overlay. The slurry will fill the wide cracks and scaled areas and seal the surface to prevent moisture and air intrusion into the pavement. If the slurry seal is placed shortly before the overlay, and is clean, a tack coat may not be needed.

Figure 1–Correctly placed leveling wedges ensure smoother pavements

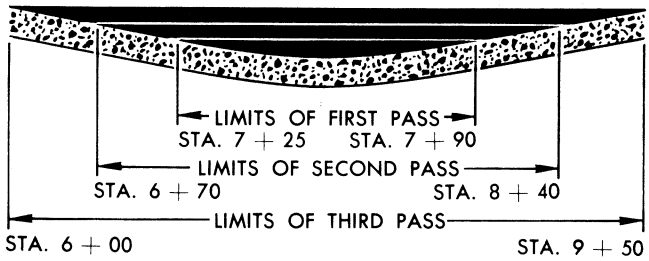

Figure 2–Limits for multiple-layer leveling wedges should be determined by level

Figure 3–Correctly placed leveling wedges for overcoming excessive crown

PORTLAND CEMENT CONCRETE PAVEMENTS

Careful Preparation Required. Preparation of rigid pavements for overlaying must be done carefully and thoroughly to obviate future distress in the overlay. Preparation may include one or more of the following:

Reducing slabs to small pieces and seating with heavy rollers.
Cracking and seating rocking slabs with heavy rollers.
Removing and replacing faulted and blown-up areas.
Undersealing to provide uniform support.
Patching disintegrated and spalled areas.
Scaling cracks to prevent subsurface water from reaching the overlay.

When the pavement has been rendered as uniformly stable as possible, it must be thoroughly cleaned and properly tacked with asphalt before the overlay is placed.

Reducing Reflection Cracking. Reflection cracks are caused by vertical or horizontal movement in the pavement beneath the overlay, brought on by traffic, earth movements, and by expansion and contraction with temperature or moisture changes. Employing one of the three methods of preparing rigid pavements for overlays, below, will reduce the probability and severity of reflection cracks appearing soon after construction. The first method is recommended as the most effective.

1. After undersealing and filling cracks, where required, placing a 3-1/2 in. (9.0 cm) crack-relief layer of coarse, open-graded hot-mix containing 25 to 35 percent interconnecting voids and made up of 100 percent crushed material. This first layer is covered with a dense-graded intermediate course, followed by a surface course. The total thickness should be from 7 to 9 in. (18 to 23 cm). With this method, positive drainage of the crack-relief layer is essential. *Preventing Reflection Cracks with an Asphalt Crack-Relief Layer* (CL-16), The Asphalt Institute, discusses this method in detail.
2. Breaking each slab into small pieces [average widest dimension about 2 ft. (0.6 m)] and seating them firmly on the subgrade or subbase with heavy [35-50 tons (32 - 45 tons metric)] pneumatic-tired rollers reduces the temperature effect and provides more uniform support for the overlay. Relatively thick overlays are required but reflection cracking is minimized, thus improving overlay performance and reducing future maintenance costs. This treatment is well adapted to planned stage construction. In Europe, reflection cracking has been virtually eliminated by reducing the rigid slabs to near rubble and treating it as granular base or subbase for the overlay. One problem with this method is the necessity to cut fabric or bars when breaking up reinforced pavement.
3. Breaking each slab into segments that can be firmly seated on the underlying course eliminates rocking, reduces deflection at joints and cracks, achieves some reduction in temperature effect, and improves support for the overlay. A leveling course should be placed, and the overlay thickness should be 4.5 in. (11.4 cm) or more, depending on traffic and subgrade conditions. This procedure may be used with planned stage construction.
4. Increasing overlay thickness without reduction of slab size will provide reasonably satisfactory service if the slabs are stable and are first undersealed to provide uniform support. Reflection cracking will be delayed but should be expected. Overlays of less than 4.5 in. (11.4 cm) thickness will develop reflection cracking rapidly. Thicknesses of 7 in. (18 cm) to 10 in. (25 cm) provide good service but some crack reflection might be anticipated.

The four methods described above are recommended as the best yet devised for alleviating the problem of reflection cracking. Of the four, the crack-relief layer has the best documented record of success. A number of other methods for preventing reflection cracking have been tried. None of them has been completely successful, although some have delayed crack appearance.

OVERLAY CONSTRUCTION

When the pavement has been prepared, placing the overlay to the predetermined thickness, whether for surface improvement or structural improvement, should proceed without delay. Usually, Mix Designations 3/4 in. (19.0 mm) through 3/8 in. (9.5 mm) (Table 1) or similar, are recommended for overlays, but some applications may call for Mix Designations No. 4 (4.75 mm) or No. 16 (1.18 mm) (Table 1) or similar. The specific mix should be selected to meet the requirements of thickness, aggregate availability and type of traffic.

Construction procedures for asphalt overlays are the same as for any other asphalt pavement construction.

For more detailed information on any of the subjects covered in this publication, please contact the nearest office of The Asphalt Institute.

TABLE 1. COMPOSITION OF ASPHALT PAVING MIXTURES

Sieve Size	Asphalt Concrete			Sand Asphalt	Sheet Asphalt
	Mix Designation and Nominal Maximum Size of Aggregate				
	3/4 in. (19.0 mm)	1/2 in. (12.5 mm)	3/8 in. (9.5 mm)	No. 4 (4.75 mm)	No. 16 (1.18 mm)
Grading of Total Aggregate (Coarse Plus Fine, Plus Filler if Required) Amounts Finer than Each Laboratory Sieve (Square Opening), weight percent					
1 in. (25.0 mm)	100				
3/4 in. (19.0 mm)	90 to 100	100			
1/2 in. (12.5 mm)		90 to 100	100		
3/8 in. (9.5 mm)	56 to 80		90 to 100	100	
No. 4	35 to 65	44 to 74	55 to 85	80 to 100	100
No. 8	23 to 49	28 to 58	32 to 67	65 to 100	95 to 100
No. 16				40 to 80	85 to 100
No. 30				25 to 65	70 to 95
No. 50	5 to 19	5 to 21	7 to 23	7 to 40	45 to 75
No. 100				3 to 20	20 to 40
No. 200	2 to 8	2 to 10	2 to 10	2 to 10	9 to 20
Asphalt Cement, weight percent of Total Mixture					
	4 to 10	4 to 11	5 to 12	6 to 12	8 to 12

From ASTM D 3515, Hot-mixed, Hot-laid Bituminous Paving Mixtures.
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