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# Special Specification 3054

## Bonded Concrete Pavement Overlay (Mill and Inlay)

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### 1. DESCRIPTION

Mill existing concrete pavement to the depth shown on the plans, and construct thin bonded concrete pavement overlay in accordance with the typical sections shown on the plans. This Specification references and incorporates current special provisions to the following Items.

- Item 354, "Planning and Texturing Pavement,"
- Item 360, "Concrete Pavement,"
- Item 422, "Concrete Superstructures," and
- Item 421, "Hydraulic Cement Concrete."

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### 2. MATERIALS

Furnish materials in accordance with Item 360, "Concrete Pavement," and Item 421, "Hydraulic Cement Concrete," unless otherwise noted in this Specification.

- 2.1. **Hydraulic Cement Concrete.** Provide Class K concrete in accordance with Item 421, "Hydraulic Cement Concrete." Design Class K to meet a minimum average compressive strength of 2,600 psi in 12 hr., unless other early strength and time requirements are shown on the plans or are allowed. The maximum water to cementitious ratio is increased to 0.45. Use a Grade 5 coarse aggregate to produce concrete with a rated coefficient of thermal expansion (CoTE) value of  $4.3 \times 10^{-6}$  in./in./F or less as listed in the Concrete Rated Source Quality Catalog.
- 2.2. **Curing Materials.** Provide Type 2 membrane curing compound conforming to DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants." Provide cotton mats in accordance with Section 422.2.7, "Curing Materials."

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### 3. EQUIPMENT

Provide equipment in accordance with Item 360, "Concrete Pavement." Provide enough concrete mixing, delivery, and paving equipment to meet the requirements of this Specification. Equipment is supplemented by the following:

- 3.1. **Milling Equipment.** Provide milling equipment in accordance to Item 354, "Planning and Texturing Pavement."
- 3.2. **Existing Concrete Pavement Surface Preparation Equipment.** Provide power-operated water blasting or shot blasting equipment capable of removing dirt, oil, paint, membrane curing compound, and other foreign material, as well as any laitance or loose concrete from the surface receiving the new concrete. Provide self-contained, portable vacuum unit to dispose of waste generated from these operations.

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### 4. CONSTRUCTION

Construct thin bonded concrete pavement overlay with thicknesses shown on the plans.

Adequately light the active work areas for all nighttime operations. Provide and maintain tools and materials to perform testing.

- 4.1. **Paving and Quality Control Plan.** Submit a paving and quality control plan for approval before beginning pavement construction operations. Include details of all operations in the concrete paving process, including longitudinal construction joint layout, sequencing, curing, lighting, early opening, leave-outs, sawing, inspection, testing, construction methods, other details, and description of all equipment. List certified personnel performing the testing. Submit revisions to the paving and quality control plan for approval.
- 4.2. **Job-Control Testing.** Perform all fresh and hardened concrete job-control testing at the specified frequency unless otherwise shown on the plans. Provide job-control testing personnel meeting the requirements of Item 421, "Hydraulic Cement Concrete." Provide and maintain testing equipment, including strength testing equipment at a location acceptable to the Engineer. Use of a commercial laboratory is acceptable. Maintain all testing equipment calibrated in accordance with pertinent test methods. Make strength-testing equipment available to the Engineer for verification testing.

Provide the Engineer the opportunity to witness all tests. The Engineer may require a retest if not given the opportunity to witness. Furnish a copy of all test results to the Engineer daily. Check the first few concrete loads for slump and temperature to verify concrete conformance and consistency on start-up production days. Sample and prepare strength-test specimens (2 specimens per test) on the first day of production and for each 3,000-sq. yd. or fraction thereof of concrete pavement thereafter. Prepare at least 1 set of strength-test specimens for each production day. Perform slump and temperature tests each time strength specimens are made. Monitor concrete temperature to ensure that concrete is consistently within the temperature requirements. The Engineer will direct random job-control sampling and testing. Immediately investigate and take corrective action as approved if any Contractor test result, including tests performed for verification purposes, does not meet specification requirements.

The Engineer will perform job-control testing when the testing by the Contractor is waived by the plans; however, this does not waive the Contractor's responsibility for providing materials and work in accordance with this Item.

- 4.2.1. **Job-Control Strength.** Use 2,600 psi at 12-hr. job-control concrete strength in accordance with Tex-418-A unless otherwise shown on the plans or permitted. Investigate the strength test procedures, the quality of materials, the concrete production operations, and other possible problem areas to determine the cause when a job-control concrete strength test value falls below the required job-control strength. Take necessary action to correct the problem, including redesign of the concrete mix if needed. The Engineer may suspend concrete paving if the Contractor is unable to identify, document, and correct the cause of low-strength test values in a timely manner. The Engineer will evaluate the structural adequacy of the pavements if any job-control strength is more than 15% below the required job-control strength. Remove and replace pavements found to be structurally inadequate at no additional cost when directed.
- 4.2.2. **Split-Sample Verification Testing.** Perform split-sample verification testing with the Engineer on random samples taken and split by the Engineer at a rate of at least 1 for every 10 job-control samples. The Engineer will evaluate the results of split-sample verification testing. Immediately investigate and take corrective action as approved when results of split-sample verification testing differ more than the allowable differences shown in Table 1, "Verification Testing Limits," or the average of 10 job-control strength results and the Engineer's split-sample strength result differ by more than 10%.

**Table 1**  
**Verification Testing Limits**

Test Method	Allowable Differences
Temperature, <a href="#">Tex-422-A</a>	2°F
Compressive strength, <a href="#">Tex-418-A</a>	10%

- 4.3. **Repair Distresses in Existing Pavement.** Repair existing distresses as detailed on the plans or as directed in accordance with Item 361, "Repair of Concrete Pavement."

- 4.4. **Prepare Surface of Existing Pavement.** Prepare the existing concrete surface to provide adequate surface texture for bonded overlay.
- 4.4.1. **Milling Concrete Surface.** Mill the pavement surface to the depth, width, grade, and cross-slope as shown on the plans. Mill the pavement surface so that surface irregularities do not exceed 1/4 in. under a 10-ft. straightedge laid transversely and longitudinally. Mill the existing pavement to a depth not shallower than 1/4-in. of the depth shown on the plans. Re-mill sections that do not meet this requirement. After milling to the depth shown on the plans, sweep or vacuum clean the milled area with equipment approved by the Engineer. Clean the milled area as approved by the Engineer. Avoid disturbing or damaging existing drainage or utility structures on the project. Repair damage resulting from the milling operations at no additional cost to the Department. Keep the milled pavement surface free of all loose materials and dust.
- 4.4.2. **Clean Concrete Surface Prior to Paving.** Remove all dirt, oil, paint, laitance and loose concrete by shotblasting or hydrocleaning the entire concrete pavement surface to be overlaid. Begin concrete placement within 8 hr. following cleaning operation unless otherwise directed by the Engineer. Re-clean the surface if it becomes contaminated. Vacuum the waste generated from this operation. Do not push, shove, or drag the waste material over the cleaned surfaces.
- 4.5. **Joints.** Install joints as shown on the plans. Clean and seal joints in accordance with Item 438, "Cleaning and Sealing Joints." Repair excessive spalling of the joint saw groove using an approved method before installing the sealant. Seal all joints before opening the pavement to all traffic.
- Install a rigid transverse bulkhead shaped accurately to the cross-section of the pavement when placing of concrete is stopped.
- 4.6. **Concrete Delivery.** Clean delivery equipment as necessary to prevent accumulation of old concrete before loading fresh concrete. Use agitated delivery equipment for concrete designed to have a slump of more than 5- in. Segregated concrete is subject to rejection.
- Begin the discharge of concrete delivered in agitated delivery equipment conforming to the requirements of Item 421, "Hydraulic Cement Concrete." Place non-agitated concrete within 45 min. after batching. Reduce times as directed when hot weather or other conditions cause quick setting of the concrete.
- 4.7. **Concrete Placement.** Ensure that the surface of the existing concrete pavement is in damp condition with no free water on the surface when placing the new concrete overlay. Place the concrete as near as possible to its final location, and minimize segregation and rehandling. Distribute concrete using shovels where hand spreading is necessary. Do not use rakes or vibrators to distribute concrete.
- 4.7.1. **Consolidation.** Consolidate all concrete by approved mechanical vibrators operated on the front of the paving equipment. Use immersion-type vibrators that simultaneously consolidate the full width of the placement when machine finishing. Keep vibrators from dislodging reinforcement. Use hand-operated vibrators to consolidate concrete along forms, at all joints and in areas not accessible to the machine-mounted vibrators. Do not operate machine-mounted vibrators while the paving equipment is stationary. Vibrator operations are subject to review.
- 4.7.2. **Temperature Restrictions.** Place concrete that is between 40°F and 95°F when measured in accordance with [Tex-422-A](#) at the time of discharge, except that concrete may be used if it was already in transit when the temperature was found to exceed the allowable maximum. Take immediate corrective action or cease concrete production when the concrete temperature exceeds 95°F.
- Do not place concrete when the ambient temperature in the shade is below 40°F and falling unless approved. Concrete may be placed when the ambient temperature in the shade is above 35°F and rising or above 40°F. Protect the pavement with an approved insulating material capable of protecting the concrete for the specified curing period when temperatures warrant protection against freezing. Submit for approval proposed measures to protect the concrete from anticipated freezing weather for the first 72 hr. after placement. Repair or replace all concrete damaged by freezing.

Do not place concrete when the anticipated 24-hr. ambient temperature is expected to change by more than 25°F from the ambient temperature at the time the first load of concrete is placed.

4.8. **Spreading and Finishing.** Spread and finish the final concrete surface to the depth, width, grade, and cross-slope as shown on the plans. Finish all concrete pavement with approved self-propelled equipment. Use power-driven spreaders, power-driven vibrators, power-driven strike-off, screed, or approved alternate equipment. Use the transverse finishing equipment to compact and strike-off the concrete to the required section and grade without surface voids. Use float equipment for final finishing. Use concrete with a consistency that allows completion of all finishing operations without addition of water to the surface. Use the minimal amount of water fog mist necessary to maintain a moist surface. Reduce fogging if float or straightedge operations result in excess slurry.

4.8.1. **Finished Surface.** Perform sufficient checks with long-handled 10-ft. and 15-ft. straightedges on the plastic concrete to ensure the final surface is within the tolerances specified in Surface Test A in Item 585, "Ride Quality for Pavement Surfaces." Check with the straightedge parallel to the centerline.

4.8.2. **Maintenance of Surface Moisture.** Prevent surface drying of the pavement before application of the curing system by means that may include water fogging, the use of wind screens, and the use of evaporation retardants. Apply evaporation retardant at the manufacturer's recommended rate. Reapply the evaporation retardant as needed to maintain the concrete surface in a moist condition until curing system is applied. Do not use evaporation retardant as a finishing aid. Failure to take acceptable precautions to prevent surface drying of the pavement will be cause for shutdown of pavement operations.

4.8.3. **Surface Texturing.** Complete final texturing before the concrete has attained its initial set. Drag the carpet longitudinally along the pavement surface with the carpet contact surface area adjusted to provide a satisfactory coarsely textured surface. Prevent the carpet from getting plugged with grout. Do not perform carpet dragging operations while there is excessive bleed water.

A metal-tine texture finish is required unless otherwise shown on the plans. Provide longitudinal tining unless otherwise shown on the plans. Immediately following the carpet drag, apply a single coat of evaporation retardant, if needed, at the rate recommended by the manufacturer. Provide the metal-tine finish immediately after the concrete surface has set enough for consistent tining. Operate the metal-tine device to obtain grooves approximately 3/16-in. deep, with a minimum depth of 1/8-in., and approximately 1/12- in. wide. Do not overlap a previously tined area. Use manual methods to achieve similar results on ramps, small or irregular areas, and narrow width sections of pavements. Repair damage to the edge of the slab and joints immediately after texturing.

Target a carpet drag texture of 0.04- in., as measured by [Tex-436-A](#), when carpet drag is the only surface texture required on the plans. Ensure adequate and consistent macro-texture is achieved by applying enough weight to the carpet and by keeping the carpet from getting plugged with grout. Correct any location with a texture less than 0.03- in. by diamond grinding or shot blasting. The Engineer will determine the test locations at points located transversely to the direction of traffic in the outside wheel path.

4.8.4. **Small, Irregular Area, or Narrow Width Placements.** Use hand equipment and procedures that produce a consolidated and finished pavement section to the line and grade where machine placements and finishing of concrete pavement are not practical.

4.8.5. **Emergency Procedures.** Use hand-operated equipment for applying texture, evaporation retardant, and cure in the event of equipment breakdown.

4.9. **Curing.** Keep the concrete pavement surface from drying as described in Section 3054.4.8.2., "Maintenance of Surface Moisture," until the curing material has been applied. Maintain and promptly repair damage to curing materials on exposed surfaces of concrete pavement continuously for at least 3 curing days or until pavement is opened to traffic. A curing day is defined as a 24-hr. period when either the temperature taken in the shade away from artificial heat is above 50°F for at least 19 hr. or the surface temperature of the concrete is maintained above 40°F for 24 hr. Curing begins when the concrete curing system has been applied. Stop concrete paving if curing compound is not being applied promptly and maintained adequately.

Other methods of curing in accordance with Item 422, "Concrete Superstructures," may be used when specified or approved.

- 4.9.1. **Membrane Curing.** Spray the concrete surface uniformly with 2 coats of membrane curing compound at an individual application rate of no more than 180- sq. ft. per gallon. Apply the curing compound before allowing the concrete surface to dry.

Manage finishing and texturing operations to ensure placement of curing compound on a moist concrete surface, relatively free of bleed water, to prevent any plastic shrinkage cracking. Time the application of curing compound to prevent plastic shrinkage cracking.

Maintain curing compounds in a uniformly agitated condition, free of settlement before and during application. Do not thin or dilute the curing compound.

Apply additional compound at the same rate of coverage to correct damage where the coating shows discontinuities or other defects or if rain falls on the newly coated surface before the film has dried enough to resist damage. Ensure that the curing compound coats the sides of the tining grooves.

- 4.9.2. **Curing Class K Concrete.** Provide membrane curing in accordance with Section 3054.4.9.1, "Membrane Curing," for all Class K concrete pavement. When shown on the plans, promptly follow by wet mat curing in accordance with Section 422.4.8., "Final Curing," until opening strength is achieved but not less than 12 hours.

- 4.10. **Sawing Joints.** Saw joints to the depth shown on the plans as soon as sawing can be accomplished without damage to the pavement regardless of time of day or weather conditions. Some minor raveling of the saw-cut is acceptable. Use a chalk line, string line, sawing template, or other approved method to provide a true joint alignment. Provide enough saws to match the paving production rate to ensure sawing completion at the earliest possible time to avoid uncontrolled cracking. Reduce paving production if necessary to ensure timely sawing of joints. Promptly restore membrane cure damaged within the first 72 hours. of curing or until opening to traffic.

- 4.11. **Protection of Pavement and Opening to Traffic.** Testing for early opening is the responsibility of the Contractor regardless of job-control testing responsibilities unless otherwise shown on the plans or as directed. Testing result interpretation for opening to traffic is subject to approval.

- 4.11.1. **Protection of Pavement.** Erect and maintain barricades and other standard and approved devices that will exclude all vehicles and equipment from the newly placed pavement for the periods specified. Protect the pavement from damage due to crossings using approved methods before opening to traffic. Where a detour is not readily available or economically feasible, an occasional crossing of the roadway with overweight equipment may be permitted for relocating equipment only but not for hauling material. When an occasional crossing of overweight equipment is permitted, temporary matting or other approved methods may be required.

Maintain an adequate supply of sheeting or other material to cover and protect fresh concrete surface from weather damage. Apply as needed to protect the pavement surface from weather.

- 4.11.2. **Opening Pavement to All Traffic.** Do not open the pavement to traffic, including vehicles of the Contractor, until the last concrete placed is at least 12 hr. old and meets a minimum compressive strength of 2,600 psi.

Such opening, however, in no manner relieves the Contractor of his/her responsibility for the work in accordance with Item 7, "Legal Relations and Responsibilities."

Before opening sections of the pavement to traffic, seal the joints and clean the pavement.

- 4.11.2.1. **Strength Testing.** Test concrete specimens cured under the same conditions as the portion of the pavement involved.

- 4.12. **Pavement Thickness.** The Engineer will check the thickness in accordance with [Tex-423-A](#) unless other methods are shown on the plans. The Engineer will perform 1 thickness test consisting of 1 reading at approximately the center of the paving equipment every 500- ft. or fraction thereof.
- 4.13. **Ride Quality.** Measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

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**5. MEASUREMENT**

This item will be measured as follows:

- 5.1. **Bonded Concrete Pavement Overlay (Mill and Inlay).** The bonded concrete pavement overlay will be measured by the square yard of surface area in place.

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**6. PAYMENT**

- 6.1. **Bonded Concrete Pavement Overlay.** The work performed and materials furnished in accordance with this Specification and measured as provided under "Measurement" will be paid for at the unit price for "Bonded Concrete Pavement Overlay (Mill and Inlay)" of the depth specified. This price is full compensation for surface preparation of the existing concrete pavement, furnishing materials for sealing joints; for mixing, placing, finishing, curing, and sawing concrete; for cleaning and sealing concrete joints; and for manipulations, labor, tools, equipment, and incidentals necessary to complete the work.