Chapter 4 Construction Details

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Chapter 4 Construction Details

Section 41 Existing Concrete Pavement

4-4101 General

This section provides guidelines for inspecting existing concrete pavement repair for work specified under Section 41, “Existing Concrete Pavement,” of the *Standard Specifications*.

Multiple strategies are used to repair existing concrete pavements. The following common types of concrete pavement repair are covered in this section:

- Pavement subsealing consists of filling voids under the pavement without disturbing the elevation of the finished surface by drilling holes through the pavement and underlying base, cleaning the holes, injecting grout, and filling holes with mortar.
- Pavement jacking consists of filling voids under the pavement and raising the pavement's surface to a desired elevation by drilling holes through the pavement and underlying base, cleaning the holes, injecting grout, and filling holes with mortar.
- Spall repair consists of removing unsound or damaged concrete, filling the area with polyester concrete, and replacing existing joint seals.
- Sealing concrete pavement joints consists of constructing or replacing joint seals at transverse, longitudinal, or isolation joints with silicone, asphalt rubber, or preformed compression joint seal.
- Pavement transition taper may consist of grinding, removing, and replacing existing concrete pavement, or placing temporary hot mix asphalt.
- Dowel bar retrofit consists of placing dowel bars at transverse joints and cracks in existing concrete pavement.
- Individual slab replacement with rapid strength concrete consists of removing the existing concrete pavement and replacing it with rapid strength concrete. Replacing deteriorated underlying base with rapid strength concrete or lean concrete base rapid setting may be required.

The bid item list and plans will specify which concrete pavement repairs are to be performed.

- Additional background information concerning concrete pavement repairs may be found in the *Concrete Pavement Guide* at:

  https://dot.ca.gov/programs/maintenance/pavement/concrete-pavement-and-pavement-foundations

4-4102 Before Work Begins

4-4102A General

Include the following steps in the preliminary review and inspections:

- Verify that the water pollution control plan is authorized.
- Verify that Form DOT CEM-3101, "Notice of Materials to Be Used," includes all materials to be used. Refer to Section 6-202, "Responsibilities for Acceptance of Manufactured or Fabricated Materials and Products," of this manual for additional information.
- Verify that the materials the contractor plans to use comply with Section 41-1.02, "Materials," of the *Standard Specifications*. Where specified, check that the proposed products are on the current Authorized Materials Lists or laboratory test data is submitted.
- Require certificates of compliance for fly ash, admixtures, cement, joint sealant, dowel bars, chemical adhesive, compression seal, backer rods, joint filler materials, and epoxy powder coating.
- Make sure the contractor follows the manufacturer's instructions for materials.
- Inspect packaged fly ash, cement, or combined fly ash and cement to determine that these materials are labeled as required in the specifications. For proper labeling, also collect and review shipping invoices for fly ash and cement delivered in bulk.
- Examine the contractor's equipment to determine that it meets specified requirements.
- Discuss traffic handling with the contractor, and review the contractor's plan for lane closures. Refer to Sections 4-12, "Temporary Traffic Control," and 2-2, "Traffic," of this manual for a discussion of traffic handling devices and lane closure procedures.
- Check the existing condition of the pavement, and note areas to receive concrete repair as needed.
- Check for the presence of traffic loop detectors to prevent damage.
- Verify that the atmospheric and subgrade temperatures are above the specified minimums and that weather conditions are suitable before beginning concrete repairs.

4-4102B Pavement Subsealing or Jacking

- Check the plans for the pattern and location of injection holes.
- Check the contractor's actual layout of injection hole locations to see that it conforms to the planned pattern.
- Establish vertical control for monitoring pavement grades during subsealing or jacking operations.

4-4102C Joint Seals

- Confirm that a training class on joint seals placement techniques is attended by appropriate personnel.
- Inspect that pavement repairs, grinding, and grooving have been completed by the contractor before sealing joint work begins.

4-4102D Dowel Bar Retrofit

- Discuss dowel bar retrofit methods at the preconstruction meeting with personnel who perform the work.
- Verify that a training class on dowel bar placement techniques is attended by appropriate personnel or that the contractor has provided written verification of previous acceptable work experience and training involving dowel bar retrofit of existing concrete pavement.
- Evaluate dowel bar alignment, placement, and concrete consolidation of the required test section to assure conformance with the specification.
- Before slot cutting, survey the existing traffic striping, pavement markings, and pavement markers to determine where delineation repairs will be required.

4-4102E Individual Slab Replacement with Rapid Strength Concrete

For individual slab replacement with rapid strength concrete, do the following:

- Make sure contractor's quality control plan, which details the methods the contractor will use to assure quality of work, is submitted. Review the quality control plan for conformance with the *Standard Specifications* requirements.
- Verify that manufacturer's instructions for storage and installation of specified materials are submitted.
- Verify that samples of cement from each proposed lot and proposed admixtures are submitted.
- Verify submittal of mix design for rapid strength concrete including opening age, aggregate gradations, proportions of constituents, maximum time allowance between batching and placing, range of ambient temperatures over which mix design is effective, final set time, and any special requirements such as water temperature. Note that each mix design has a specified maximum ambient temperature range that may result in multiple mix designs for a single project. Modulus of rupture development data is required for each mix design and must include the following minimum age tests: 1 hour before opening age, opening age, 1 hour after opening age; and 24 hours, 3 days, 7 days, and 28 days after placement.
- Make sure quality control plan and methods of performing each item of the work are discussed with the specified personnel at the preconstruction meeting. Items to be discussed include processes for production, transportation, placement, replacing pavement, protecting the pavement before opening to traffic, contingency plan, sampling, and testing.

- Verify that the contractor successfully constructs trial slabs for each mix design. Assure the contractor is capable of constructing slab replacement in compliance with the specifications within the specified time periods, including delivery, placement, finishing, and curing times, and under similar atmospheric and temperature conditions expected during replacement operations. Additional time for pavement removal, base removal, base replacement, bond breaker, and dowel bar installation as required, must be factored into specified time periods. Trial slabs are not to be placed on the roadway or within the project limits. During trial slab construction, obtain a split sample of aggregate from the contractor for grading, cleanness value, and sand equivalent testing. Check that the contractor fabricates test beams in accordance with specification requirements for determining early age and 3-day modulus of rupture values. Verify the contractor's method for curing beams for early age testing. Verify the contractor's means to monitor and record internal temperatures of trial slabs and early age beams. Reject trial slabs not meeting early age and 3-day modulus of rupture requirements. Require the contractor to dispose of trial slabs.
- Verify that contingency plan equipment, materials, and personnel for temporary roadway pavement are at the job site during individual slab replacement operations.
- For projects with larger individual slab replacement quantities, the special provisions may include requirements covering just-in-time training, materials, construction, and payment. Be sure to review these requirements well in advance of the intended work.

4-4103 During the Course of Work

During the course of the work, do the following for each type of concrete pavement repair strategy:

4-4103A Pavement Subsealing or Jacking

- Verify that the colloidal mixer operates within the specified revolutions per minute.
- Verify that the pump can sustain the specified gauge pressure.
- Verify that the washing device contains the specified number of jets and that the contractor operates it as the specifications require.
- Make sure the contractor performs California Test 541, “Method for Flow of Grout Mixtures (Flow Cone Method),” to check that the efflux time is within the required range during grouting operations.
- Make sure the contractor performs California Test 551, “Method of Test for Suitability of Materials for Overlayment and Repair of Portland Cement Concrete Pavement and Structures,” as specified.
- Monitor the slab for movement during subsealing.

- Monitor the contractor's string lines during jacking to verify slab has been raised to the established grade.
- Monitor grout mixing so that grout not used within the specified time is disposed of properly.
- Check that grinding of noncompliant pavement surface conforms to Section 42, "Groove and Grind Concrete," of the *Standard Specifications*.
- Make sure that removal and replacement of noncompliant pavement conforms to Section 41-9, "Individual Slab Replacement With Rapid Strength Concrete," of the *Standard Specifications*.

4-4103B Spall Repair

- Verify that concrete removal is preceded by sawcutting at the required depth along the rectangular areas to be removed. Make sure that any contractor-damaged concrete outside the designated limits of repair is repaired at the contractor's cost and note these areas and quantities in the daily reports.
- Verify that exposed concrete surfaces are cleaned with equipment conforming to specification requirements.
- Before spall repair material placement, observe joint form board installation and check that any bonding agent is mixed in accordance with manufacturer's instructions and applied to concrete surfaces.
- Verify that spall repair material is mixed, placed, cured, and protected in accordance with specification requirements.
- Make sure removed or damaged joint sealant is repaired at spall locations in accordance with Section 41-5, "Joint Seals," of the *Standard Specifications*.

4-4103C Joint Seals

- Check that removal of existing joint sealant material does not damage the existing sealant reservoir or pavement.
- Where joint sealant reservoirs are constructed, assure concrete residue from sawing operations is collected, contained, and disposed of properly.
- Before backer rod installation, check that sealant reservoir is free of debris, dried, sandblasted, air blasted, and vacuumed in accordance with the specifications.
- Check that backer rod installation does not leave a residue or film on the reservoir walls that will later receive sealant.
- Verify that sealant is prepared and installed in accordance with manufacturer's instructions and specification requirements.
- Before opening to traffic, check that the sealant is tack-free and firm enough to prevent embedding of roadway debris into the sealant.

4-4103D Pavement Transition Taper

- Verify that removal operations do not damage concrete pavement to remain in place and do not create flying debris.
- Verify that grinding concrete pavement complies with Section 42-3, “Grinding,” of the *Standard Specifications*.
- Verify that concrete replacement complies with Section 41-9, “Individual Slab Replacement With Rapid Strength Concrete,” of the *Standard Specifications*.

If placing temporary hot mix asphalt is required, comply with Section 39-2.07, “Minor Hot Mix Asphalt,” of the *Standard Specifications*.

4-4103E Dowel Bar Retrofit

- Check that polyester concrete and joint sealants are stored and installed in accordance with manufacturer’s instructions.
- Verify that saw cut equipment conforms to requirements in the specifications and that saw cuts meet specified tolerances. Verify that concrete debris, water residue, and paste are immediately removed during saw cutting operations.
- Before concrete removal operations, verify that the contractor has sufficient temporary backfill material on hand in accordance with the specifications.
- Make sure concrete removal operations do not damage concrete pavement to remain in place. Verify that contractor’s removal equipment does not exceed the class specified.
- Check that the contractor has scheduled work shifts so removal of concrete for dowel bar slots, placement of dowel bars, and placement of polyester concrete with required cure time will occur before opening to traffic. Use of temporary backfill material is a back-up plan if anticipated production is not achieved. Subsequent work shift operations should be adjusted in consideration of actual production rates.
- Check that dowel bar slots are constructed and cleaned in accordance with specification requirements.
- Verify transverse joints are sealed with caulking filler material meeting specifications.
- Verify that dowel bars are clean before application of dowel bar lubricant. Make sure proper clearance is provided between the dowel bar and pavement surface and placement tolerances are maintained. Verify that expansion caps have been placed on dowel bars and will provide at least the minimum specified joint movement at each end of the bar.
- To assure proper performance of the dowel bars, pay particular attention to the foam core insert, which, when properly installed, helps isolate adjacent slabs. Leakage or displacement of the foam core insert during placement of polyester concrete may damage concrete pavement and shorten design life. Likewise,

dowel bar support chairs must securely hold dowel bars during placement and consolidation of polyester concrete or future problems may arise.

- Verify that polyester concrete is mixed in accordance with manufacturer's instructions. Make sure containers and tools are appropriate for mixing polyester concrete.
- Polyester concrete is to be placed while plastic and immediately consolidated with a small handheld vibrator that thoroughly consolidates the polyester concrete material. Retempering of polyester concrete is not allowed. Finishing tools should be dried thoroughly before use.
- Verify that the polyester concrete is cured under the manufacturer's instructions.
- The contractor grinds concrete pavement under Section 42, "Groove and Grind Concrete," of the *Standard Specifications* within 30 days from the initial saw cutting for the dowel bar slots and at least 12 hours after placing polyester concrete. Grinding is to be performed before any sawing and sealing of joints within the retrofit lanes. Make sure the contractor complies with pavement smoothness and finishing requirements.
- The contractor must perform random cores to verify proper alignment of dowel bars as specified in Section 41-8.03F, "Placing Dowel Bars," of the standard special provisions. If cores indicate dowel bars were installed incorrectly, stop dowel bar retrofit activities until the contractor has demonstrated that the problem causing the improper positioning has been corrected. Check that dowel bars identified as damaged or misaligned are replaced.
- Verify that pavement delineation removed or damaged because of dowel bar retrofit is repaired in accordance with Section 81, "Miscellaneous Traffic Control Devices," and Section 84, "Markings," of the *Standard Specifications*.

4-4103F Individual Slab Replacement With Rapid Strength Concrete

- Verify that contingency plan equipment, materials, and personnel for temporary roadway pavement structure are present at the job site.
- Check that saw cutting is done no more than 2 days before removing pavement. Saw cutting is perpendicular to the travelled way, but the contractor is allowed to saw cut parallel or diagonal to the travelled way if saw cutting and removing pavement is done during the same work shift.
- Before concrete removal, dowel bars and tie bars must be sawn. Make sure the contractor does not affect the surface within 18 inches of the pavement remaining in place.
- Verify that removal of the pavement and base does not damage pavement or base remaining in place. Assure that removed materials are disposed of by the contractor.
- Verify contractor prepares the finished surface of the remaining material in accordance with the specification requirements and to the established grade. Any

over-excavated areas are to be filled with base replacement material, in the same operation as the base replacement, at the contractor's cost.

- Examine base replacement layer to verify it has a smooth surface free of voids, porous areas, and projections such as mortar ridges.
- Before placement of bond breaker, verify that any foreign or loose materials are removed from the base surface. Make sure bond breaker is placed in accordance with specification requirements.
- Verify that installation of dowel bars at transverse construction joints conforms to specification requirements and manufacturer's instructions. Dowel bars must be supported during the chemical adhesive minimum cure time.
- Where rapid strength concrete will be placed against existing concrete, make sure joint filler is placed along the existing transverse and longitudinal joint faces and extending to the full depth, in accordance with the specifications. Depending on existing transverse joint spacing in adjacent lanes, additional transverse contraction joints may require construction as specified.
- Coordinate inspection of rapid strength concrete with plant inspection personnel. Make sure lines of communication are maintained between the plant and the field so contingencies can be used appropriately. Rapid strength concrete must conform to Section 90-3, "Rapid Strength Concrete," of the *Standard Specifications*.
- Spreading, compacting, shaping, and protecting rapid strength concrete must conform to specified requirements.
- Verify that the contractor samples and fabricates beam specimens to determine modulus of rupture at opening age and 3 days, which are used for contract acceptance and payment determination. The modulus of rupture value is determined under California Test 524, "Method of Test for Flexural Strength of Rapid Strength Concrete," by testing 3 beam specimens for each age. No single test represents more than that day's production or 130 cubic yards, whichever is less. Split samples for Caltrans' 3 days modulus of rupture testing.
- Verify that rapid strength concrete surface is finished in accordance with specification requirements.
- Check concrete pavement smoothness using a 12-foot straightedge placed parallel with and perpendicular to the centerline in accordance with the specifications. Verify that the contractor corrects pavement smoothness that is out of compliance.
- When needed, make sure temporary roadway pavement structure is placed, maintained, removed, and disposed of in accordance with specification requirements.

4-4104 Level of Inspection

Suggested levels of inspection for typical existing concrete pavement repair work activities are:

- Benchmark inspection of base.
- Intermittent sampling and testing of concrete pavement repair materials.
- Intermittent review and monitoring of contractor's quality control program including quality control test results.
- Continuous inspection of concrete delivery, placement, finishing, curing, and joint operations.
- Benchmark inspection of pavement smoothness.
- Benchmark inspection of finished surface texture.

4-4105 Quality Control

Guidance for quality control activities included in this section is summarized as follows:

- Make sure the contractor is actively performing quality control on concrete pavement repair materials throughout production operations by reviewing copies of quality control records, including quality control test results.
- The quality control plan must include, but not be limited to:
    - Frequency of quality control sampling and testing that meets or exceeds specification requirements in "Quality Control Testing," of the *Standard Specifications*, as follows:
        - Section 41-2.01D(2), "Quality Control," for subsealing and jacking
        - Section 41-9.01D(2), "Just-in-Time Training," for individual slab replacement with rapid strength concrete
    - Time and frequency of submitting test results.

4-4106 Payment

For measurement and payment, review the plans and quantity calculations in the resident engineer's file to determine if there is sufficient detail and accuracy to be used in the project records. Deduct for any areas that were repaired because of contractor's damage.

For subsealing and jacking, count the number of holes drilled. Verify that the holes to be paid for are only those holes shown on the plans or those ordered to be drilled.

Count bags of packaged fly ash and cement to determine pay quantities for grout by dry weight. During counting, make sure that duplication or omission does not occur. Collect weighmaster certificates for materials delivered in bulk, and remember to deduct quantities of materials wasted or not used. There are no unit price adjustments for an increase and decrease in subsealing and jacking quantity.

For spall repair, payment is measured by the authorized saw cut area. There are no unit price adjustments for an increase and decrease in spall repair quantity.

For sealing concrete pavement joints, measure the actual length of joints installed for seal, replace, or seal and replace concrete pavement joint quantity.

For pavement transition tapers, payment is measured from dimensions shown. No additional compensation is made when temporary hot mix asphalt is used.

For dowel bar retrofit, quantify the number of dowel bar retrofits performed. Do not pay extra for replacing noncompliant dowel bars. Payment for grinding pavement is not included.

For individual slab replacement, payment is based on field measurements. Drill and bond dowel bars and replacing base are not included in payment for individual slab replacement. Specified pay factor adjustments are applicable for low modulus of rupture of rapid strength concrete at 3 days. Rapid strength concrete not meeting the minimum opening age modulus of rupture is to be replaced at the contractor's expense.