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Bracketed section numbers refer to the 2006 *Standard Specifications*.

Section 37 Bituminous Seals

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4-3701 General

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Section 37, “Bituminous Seals,” of the *Standard Specifications* covers seal coats, slurry seals, micro-surfacing, parking area seal and crack treatment.

Seal coats are either fog seals, an application of slow-setting asphaltic emulsion with added water, or asphaltic emulsion and screenings (commonly known as “chip seals”).

Flush coat is the application of a fog seal to the surface of a seal coat, followed by the application of sand.

Slurry seal is a mixture of graded fine aggregate, asphaltic emulsion or polymer modified asphaltic emulsion, water, and set-control additives. Micro-surfacing is a mixture of micro-surfacing emulsion, water, additives, mineral filler, and screenings.

This section discusses the duties of resident engineers and assistant resident engineers regarding seal coats, slurry seals, micro-surfacing, parking area seal and crack treatment.

Bituminous seals are primarily used to maintain existing asphalt concrete pavement. Bituminous seals on new work are generally limited to fog seal on asphalt concrete dikes, miscellaneous areas, and shoulders.

Refer to “Tack Coats for Bituminous Seals,” in the *Tack Coat Guidelines* at the following website:

<http://www.dot.ca.gov/hq/construc/publications/tackcoatguidelines.pdf>

4-3702 Seal Coats

4-3702 Seal Coats

The following covers the duties required throughout each phase of the project for seal coats.

4-3702A Before Work Begins

Before work begins, take the following steps:

- Review the contract to determine the type of bituminous seal required. Note the particular type of bituminous binder to be used, and the requirements for aggregates. Decide whether any conditions have changed from those upon which the design engineer based the requirements, and make any necessary changes.
- For asphalt rubber seal coats, verify that the contractor has submitted the permits issued by the local air quality agency for asphalt rubber binder:
 1. Field blending equipment
 2. Application equipment

If an air quality permit is not required by the local air quality agency for producing asphalt rubber binder or spray applying asphalt rubber binder, submit verification

from the local air quality agency that an air quality permit is not required for the contract.

- Verify that Form CEM-3101, “Notice of Materials to Be Used,” includes seal coat materials. Refer to Section 6-202, “Responsibilities for Acceptance of Manufactured or Fabricated Materials and Products,” of this manual for additional information.
- Ensure the aggregate material source complies with Section 7-105L (2), “Surface Mining and Reclamation Act,” of this manual.
- Obtain the name of the authorized laboratory in charge of quality control testing for modified emulsion seal coat.
- Obtain initial samples of screenings, asphaltic emulsions, modified emulsions, and test for all of the quality characteristics. Advise the contractor of test results.
- Examine the surface to be sealed. Prepare a change order to provide for any necessary corrective action, such as sealing cracks and repairing failed areas. At this stage, a joint review with the maintenance region manager or area superintendent would be helpful.
- Review the project to ascertain all requirements for handling traffic. Review with the contractor the required traffic control system and traffic control devices.
- Decide on and advise the contractor of the exact application rates of screenings and bituminous binder that will be used.
- For fog seal, decide on the water amount to be added to asphaltic emulsion. The quantity to be added must be based on the judgment and experience of field personnel. Take into account the permeability of the surface to be sealed, climatic conditions anticipated at the time of application, traffic, and desired spread rate. Unless circumstances dictate less, use the maximum amount permitted. This approach makes it easier to obtain a correct and uniform spread, especially when lighter spread rates are used.
- Determine temperatures and ensure that bituminous seals are not placed when the applicable atmospheric or pavement temperatures are below the minimum temperatures specified.
- Review the latest weather reports daily, and have a means established for making contact with the contractor’s authorized representative before 4:00 p.m. on the day before the intended workday. Note that the specification for notification of anticipated unsuitable day conditions applies to both fog seals and chip seals. Prepare a change order, if it becomes necessary, to pay for standby time.
- Determine whether the surface to be sealed is clean and dry. Ensure the contractor cleans the surface to remove all loose particles of pavement, dirt, and other extraneous material.
- Examine distributor trucks, chip spreaders, rollers, and other equipment to ensure that specifications are met.

4-3702B During the Course of Work

Once work begins, take the following steps:

- Obtain the required test report for each truckload of asphaltic emulsion. Compare the report with the specifications. Do not permit the emulsion to be used before testing unless a certificate of compliance accompanies it.
- Obtain samples of the asphaltic emulsion in accordance with the frequency tables in Section 6-1, “Sample Types and Frequencies,” of this manual. For emulsion used in fog seals, it is preferable to take samples of the emulsion before adding water. If this approach is impractical, note on the sample form the amount of added water (that is, how many parts of water to how many parts of emulsion).
- From the delivered aggregate material, obtain samples and test them for sieve analysis and cleanness value in accordance with the frequency tables in Section 6-1 of this manual.
- Just before spreading, determine the temperature of the liquid asphalt or emulsion to ensure it falls within the specified range. Note such temperatures in the daily report and also on source documents, if volumetric measurements are to be used to determine pay quantities.
- Obtain the weight slip for each load of liquid asphalt or emulsion. If the load has been hauled a long distance and job scales are available, it is good practice to weigh the load in using the job scales and, after spreading, to weigh the load out on these same scales.
- Unless the screenings are at the work site and ready to be applied, prohibit the contractor from spreading the emulsion.
- To check the spread rate for asphaltic emulsion, measure the volume in the distributor truck tank before and after spreading the asphaltic emulsion for the first few hundred feet. Then, calculate the rate for that distance. Calculate and record the overall daily spread rate in the daily report.
- Through observation, ensure the application of asphaltic emulsion is uniform, both transversely and longitudinally. If the spread does not appear to be uniform, order the correction of spreading equipment. If problems persist, perform California Test 339, “Field Test for the Determination of Distributor Spread Rate,” and before allowing the operation to continue, require corrective action.
- Require the contractor to keep the distributor truck close to the chip spreader. Good practice is to place screenings within 30 seconds after the bituminous binder has been spread. Screenings must be placed before setting or “breaking” of the asphaltic emulsion occurs. This setting or breaking is indicated by a change in color from brown to black.
- Determine whether screenings are damp at the time of application, as required in the specifications; when necessary, order wetting.

- Observe the coat of screenings behind the chip spreader. If necessary, order an adjustment in the screening spread rate. The figure below shows the desirable quantity of asphalt and void required to correctly embed the aggregate.
- If the chip spreader is moving excessively fast, chips will roll over as they come in



Correct asphalt quantity, voids
50% to 70% filled



Insufficient asphalt, screenings
not firmly held



Excess asphalt submerges chips
and causes bleeding

contact with the emulsion. As a result, public traffic and roller tires will pick up the chips. If chips are being turned over, check behind the spreader and order a reduced speed.

- Ensure the contractor does not spread the binder and screenings more than 2500 feet ahead of the initial rolling.
- Ensure the contractor performs the rolling in the specified order and required number of roller coverages.
- Adjust the spread rate of screenings to prevent pickup by rollers or traffic. However, prohibit a higher spread rate than necessary. Excessive screenings will increase cost and the difficulty of cleanup operations.
- Ensure the contractor discontinues spreading bituminous binder sufficiently early in the shift to permit the termination of traffic control before darkness.
- Ensure the contractor performs brooming as specified. Before allowing uncontrolled traffic in adjacent lanes, ensure the removal of all loose chips. The most common cause of damage by loose chips results from vehicles in an adjacent lane throwing the chips. During brooming, ensure lanes adjacent to chip-sealed lanes remain free of loose screenings. During maintenance, order the seal coat to be swept as often as necessary to keep the surface free of loose screenings.
- Decide whether excess screenings should be salvaged and stockpiled or otherwise disposed of, and advise the contractor of the decision. Unless they are economically useful, screenings should not be salvaged.
- Observe the completed application of screenings and order immediate application of additional screenings or clean sand to cover any excess bituminous binder that rises to the surface.
- For processing any related damage claims, consult with the district claims officer when the following conditions exist:

1. Damage has been caused by screenings or bituminous binder.
2. The contract contains provisions for deducting funds from contract payments to pay for damage claims.

4-3702C Measurement and Payment

For measurement and payment, do the following:

- Collect weight slips from each truck as it delivers screenings to the chip spreader. When screenings are stockpiled before spreading, obtain weight slips for trucks delivering screenings to stockpiles. Determine the weight of unused screenings remaining in stockpiles so that the weight of unused material may be deducted from the delivered weight. From the weight of screenings to be paid for, do not deduct the weight of excess screenings removed from the roadway and disposed of.
- Collect weight slips and “weigh-back” slips for trucks delivering asphaltic emulsion or liquid asphalt. When additional water is added to asphaltic emulsion, calculate the amount to be deducted from the original weight, using the ratio in the original mix of asphaltic emulsion to water.

For compensation adjustment for price index fluctuations for asphaltic emulsion, refer to Section 9-1.07, “Payment Adjustments for Price Index Fluctuations,” of the *Standard Specifications* and perform the following:

- Verify that the contractor has not opted out of payment adjustments for price index fluctuation at the time of bid.
- Process a change order to allow for payment increases and decreases.
- Calculate on a monthly basis the amount of asphalt used in asphaltic emulsion or polymer modified emulsion including flush coat.
- Calculate a paving asphalt adjustment if the California Statewide Crude Oil Index for the current month has fluctuated more than the specified amount from the same index for the month the bid opening occurred. Include the asphalt price adjustment in the monthly estimate.

4-3703 Slurry Seal

The following covers the duties required throughout each phase of the project for slurry seal.

4-3703A Before Work Begins

Before work begins, take the following steps:

- Verify that Form CEM-3101, “Notice of Materials to Be Used,” includes slurry seal materials. Refer to Section 6-202, “Responsibilities for Acceptance of Manufactured or Fabricated Materials and Products,” of this manual for additional information.
- Review the mix design and laboratory tests from the contractor. After determining that the mix design and test results conform to the requirements in Section 37-3.01D(4)(b) [37-2.03], “Mix Design,” of the *Standard Specifications*, authorize the mix design. Determine the percentage of asphalt binder to be used and notify the contractor.

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Slurry Seal

- Ensure the aggregate material source complies with Section 7-105L (2), “Surface Mining and Reclamation Act,” of this manual.
- Obtain the name of the laboratory authorized to perform International Slurry Surfacing Association tests and mix design.
- Obtain initial samples of the aggregate and test the aggregate for the specified quality characteristics. Advise the contractor of the test results.
- Examine the surface to be sealed. Prepare a change order to provide for any necessary corrective action, such as sealing cracks and repairing failed areas. At this stage, a joint review with the maintenance region manager or area superintendent would be helpful.
- Examine the proposed mixing equipment to ensure compliance with the specifications. Mixer-spreader trucks must be calibrated for each material source in accordance with the Caltrans *Material Plant Quality Program (MPQP)*. Request assistance from the district weights and measures coordinator for calibrating and checking the accuracy of weighing and metering devices.
- Discuss with the contractor the proposed operation, and determine the method for measuring the weight of aggregate and asphaltic emulsion.
- Determine whether the surface to be sealed is clean and dry. Ensure the contractor cleans the surface to remove all loose particles of pavement, dirt, and other extraneous material.
- Review the project to ascertain all requirements for handling traffic. Review with the contractor the required traffic control system and traffic control devices.
- Advise the contractor of the exact spread rate to be used.

4-3703B During the Course of Work

Once work begins, take the following steps:

- If required under the contract, ensure the pavement surface to be treated has been coated with the specified asphaltic emulsion. Advise the contractor of the exact application rate and water amount to be added.
- Obtain the required test report for each truckload of asphaltic emulsion. Compare the report with the specifications. Do not permit the emulsion to be used before testing unless a certificate of compliance accompanies it.
- Before mixing, take samples of the aggregate for testing.
- If the results of grading or sand equivalent tests fail to meet the specifications, order the removal of the slurry seal represented by the failing tests. When the contractor requests in writing that the material remain in place, decide whether to reject the represented material or to allow it to remain in place. If you allow the material to remain in place, your decision must be based on the results of a physical examination of the slurry seal. Look for evidence of bleeding, raveling, stripping, or other deficiencies. Notify the contractor in writing of your decision. Also, if you allow the material to remain in place, calculate the deduction based on the amount of material represented by the failing test result, and deduct the amount from future progress payments.
- Observe the mixing operation to ensure the ordered proportions are being used.

- To determine the bitumen ratio and uniformity of mixing, submit samples of the completed mix to the district laboratory. Place samples in tightly closed containers to prevent moisture loss before testing.
- Make the necessary measurements and calculations to ensure the contractor spreads the slurry seal at the ordered rate.
- Review the completed slurry seal to determine if it meets the requirements of Section 37-3.03B [37-2.04], “Proportioning,” of the *Standard Specifications*.
- As specified, order the contractor to protect fresh slurry seal from traffic damage. To protect the fresh slurry seal, sand may be applied to the surface at intersections and driveways as specified.

4-3703C Measurement and Payment

For measurement and payment, do the following:

- The quantity of slurry seal to be paid for is the combined quantity of asphaltic emulsion and aggregate. Because of the type of equipment used and the nature of the slurry seal operation, it is usually impossible to weigh both components together. Separately determine the mass of asphaltic emulsion and aggregate, and add the two results together to determine the pay quantity.
- As necessary to determine pay quantities, collect weight tickets for aggregate and asphaltic emulsion. You may use properly sealed and calibrated metering devices to determine pay quantities. When converting volume measurements of asphaltic emulsion to mass, make the appropriate corrections for temperature.
- When slurry seal is allowed to remain in place even though it failed the grading or sand equivalent tests, make the appropriate administrative deduction.

For compensation adjustment for price index fluctuations for slurry seal refer to Section 9-1.07, “Payment Adjustments for Price Index Fluctuations,” of the *Standard Specifications* and perform the following:

- Verify that the contractor has not opted out of payment adjustments for price index fluctuation at the time of bid.
- Process a change order to allow for payment increases and decreases.
- Calculate on a monthly basis the amount of asphalt used in slurry seal polymer modified emulsion.
- Calculate a paving asphalt adjustment if the California Statewide Crude Oil Index for the current month has fluctuated more than the specified amount from the same index for the month the bid opening occurred. Include the asphalt price adjustment in the monthly estimate.

4-3704 Micro-Surfacing

The following covers the duties required throughout each phase of the project for micro-surfacing.

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Micro-Surfacing

4-3704A Before Work Begins

Before work begins, take the following steps:

- Verify that Form CEM-3101, “Notice of Materials to Be Used,” includes micro-surfacing materials. Refer to Section 6-202, “Responsibilities for Acceptance of Manufactured or Fabricated Materials and Products,” of this manual for additional information.
- Obtain the name of the laboratory authorized to perform International Slurry Surfacing Association tests for mix design.
- Review the mix design and laboratory tests submitted by the contractor before start of the placement. The mix design report should include comparison of each material’s test result to the specification requirements. If the mix design and test results conform to the requirements in Section 37-3.01D(4)(c), “Micro-surfacing” of the *Standard Specifications*, authorize the mix design.
- Ensure the aggregate material source complies with Section 7-105L (2), “Surface Mining and Reclamation Act,” of this manual.
- Obtain the name of the authorized laboratory in charge of laboratory report and mix design testing.
- Obtain initial samples of the aggregate, and test for the specified quality characteristics. Advise the contractor of the test results.
- Obtain the name of the contractor’s authorized representative responsible for communicating about the unsuitable day which prevents micro-surfacing operations.
- Examine the surface to be sealed. Prepare a change order to provide for any necessary corrective action, such as sealing cracks and repairing failed areas. At this stage, a joint review with the maintenance region manager or area superintendent would be helpful.
- Examine the proposed mixing equipment to ensure compliance with the specifications. Mixer-spreader trucks must be calibrated for each material source in accordance with the Caltrans MPQP. Verify equipment MPQP certification or request assistance from the district weights and measures coordinator for calibrating and checking the accuracy of weighing and metering devices.
- Discuss with the contractor the proposed operation, and determine the method for measuring the weight of aggregate and asphaltic emulsion.
- Determine whether the surface to be sealed is clean and dry. Ensure the contractor cleans the surface to remove all loose particles of pavement, dirt, and other extraneous material.
- Review the project to ascertain all requirements for handling traffic. Review with the contractor the required traffic control system and traffic control devices.
- Advise the contractor of the exact spread rate to be used.

4-3704B During the Course of Work

Once work begins, take the following steps:

- Obtain the required test report for each truckload of micro-surfacing asphaltic emulsion. Compare the report with the specifications. Do not permit the emulsion to be used before testing unless a certificate of compliance accompanies it.
- Before mixing, take samples of the aggregate for testing.
- If the results of grading or sand equivalent tests fail to meet the specifications, order the removal of the micro-surfacing represented by the failing tests. When the contractor requests in writing that the material remain in place, decide whether to reject the represented material or to allow it to remain in place. A decision to allow the material to remain in place must be based on the results of a physical examination of the micro-surfacing. Look for evidence of bleeding, raveling, stripping, or other deficiencies. Notify the contractor in writing of the decision. Also, if the material is allowed to remain in place, calculate the deduction based on the amount of material represented by the test result, and deduct the amount from future progress payments.
- Observe the mixing operation to ensure the ordered proportions are being used.
- To determine the bitumen ratio and uniformity of mixing, submit samples of the completed mix to the district laboratory. Place samples in tightly closed containers to prevent moisture loss before testing.
- Make the necessary measurements and calculations to ensure the contractor spreads the micro-surfacing at the ordered rate.
- Review the completed micro-surfacing to determine if it meets the requirements of Section 37-3.03B(3), “Micro-Surfacing,” of the *Standard Specifications*.

4-3704C Measurement and Payment

For measurement and payment, do the following:

- The quantity of micro-surfacing to be paid for is the combined quantity of asphaltic emulsion and aggregate. Because of the type of equipment used and the nature of the micro-surfacing operation, it is usually impossible to weigh both components together. Separately determine the mass of asphaltic emulsion and aggregate, and add the two results together to determine the pay quantity.
- As necessary to determine pay quantities, collect weight tickets for aggregate and asphaltic emulsion. You may use properly sealed and calibrated metering devices to determine pay quantities. When converting volume measurements of asphaltic emulsion to mass, make the appropriate corrections for temperature.
- When micro-surfacing is allowed to remain in place even though it failed the grading or sand equivalent tests, make the appropriate administrative deduction.

For compensation adjustment for price index fluctuations for micro-surfacing seal refer to Section 9-1.07, “Payment Adjustments for Price Index Fluctuations,” of the *Standard Specifications* and perform the following:

- Verify that the contractor has not opted out of payment adjustments for price index fluctuation at the time of bid.
- Process a change order to allow for payment increases and decreases.

- Calculate on a monthly basis the amount of asphalt used in micro-surfacing emulsion.
- Calculate a paving asphalt adjustment if the California Statewide Crude Oil Index for the current month has fluctuated more than the specified amount from the same index for the month the bid opening occurred. Include the asphalt price adjustment in the monthly estimate.

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Parking Area Seal

The following covers the duties required throughout each phase of the project for parking area seal.

4-3705A Before Work Begins

Before work begins, take the following steps:

- Obtain the name of the authorized laboratory in charge of testing at least 10 days before the start of the placement.
- Obtain initial samples of the aggregate samples 15 days before starting the placement.
- Obtain the manufacturer's product data for oil seal primer and polymer at least 10 days before starting the placement.
- Obtain test results and mix design at least 7 days before the placement.
- Review the mix design and laboratory tests submitted by the contractor before start of the placement. The mix design report should include comparison of each material's test result to the specification requirements. If the mix design and test results conform to the requirements in Section 37-4.02, "Materials" of the *Standard Specifications*, authorize the mix design.
- Verify that Form CEM-3101, "Notice of Materials to Be Used," includes seal materials. Refer to Section 6-202, "Responsibilities for Acceptance of Manufactured or Fabricated Materials and Products," of this manual for additional information.
- Examine the surface to be sealed. Prepare a change order to provide for any necessary corrective action, such as sealing cracks and repairing failed areas. At this stage, a joint review with the maintenance region manager or area superintendent would be helpful.
- Discuss with the contractor the proposed operation, and determine the method for measuring the weight of aggregate and asphaltic emulsion.
- Determine whether the surface to be sealed is clean and dry. Ensure the contractor cleans the surface to remove all loose particles of pavement, dirt, and other extraneous material.
- Ensure all the utility inlets are covered with heavy paper or roofing felt adhered to the surface of the inlet.
- Review the project to ascertain all requirements for handling traffic. Review with the contractor the required traffic control system and traffic control devices.

4-3705B During the Course of Work

During the course of work, take the following steps:

- Obtain the required test report for each truckload of parking area seal. Compare the report with the specifications. Do not permit the seal to be used before testing unless a certificate of compliance accompanies it.
- Ensure the pavement surface to be treated has been dampened.
- Verify that a certificate of compliance accompanies each load of parking area seal.
- To determine the bitumen ratio and uniformity of mixing, submit samples of the undiluted parking area seal material to the district laboratory. Place samples in tightly closed containers to prevent moisture loss before testing.

4-3704C Measurement and Payment

For measurement and payment, do the following:

- The quantity of parking seal to be paid for is the combined weight of asphaltic emulsion and aggregate without added water and set control additive. Because the materials are mixed at a plant, it is important to have a proportioning record from the plant.
- As necessary to determine pay quantities, collect weight tickets for aggregate and asphaltic emulsion. You may use properly sealed and calibrated metering devices to determine pay quantities. When converting volume measurements of asphaltic emulsion to mass, make the appropriate corrections for temperature.

For compensation adjustment for price index fluctuations for parking area seal, refer to Section 9-1.07, "Payment Adjustments for Price Index Fluctuations," of the *Standard Specifications*, and perform the following:

- Verify that the contractor has not opted out of payment adjustments for price index fluctuation at the time of bid.
- Process a change order to allow for payment increases and decreases.
- Calculate on a monthly basis the amount of asphalt used in the asphaltic emulsion in the parking area seal.
- Calculate a paving asphalt adjustment if the California Statewide Crude Oil Index for the current month has fluctuated more than the specified amount from the same index for the month the bid opening occurred. Include the asphalt price adjustment in the monthly estimate.

4-3706 Crack Treatment

The following covers the duties required throughout each phase of the project for crack treatment.

4-3706A Before Work Begins

Before work begins, take the following steps:

- Verify that Form CEM-3101, "Notice of Materials to Be Used," includes crack treatment materials. Refer to Section 6-202, "Responsibilities for Acceptance of

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Crack Treatment

Manufactured or Fabricated Materials and Products,” of this manual for additional information.

- Verify the receipt of a certificate of compliance for each load of crack treatment material if it is on the authorized material list. If the crack treatment material is not on the authorized material list, obtain samples and authorized laboratory test results 20 days before use.
- Obtain the name of the laboratory authorized to perform material testing.
- Review laboratory tests from the contractor and determine if the material test results conform to the requirements in Section 37-5.02, “Materials,” of the *Standard Specifications*. Advise the contractor of the test results.
- Examine the proposed equipment to ensure compliance with the specifications and discuss with the contractor the proposed operation.
- Determine whether the crack to be treated is clean and dry. Ensure the contractor cleans the cracks to remove all loose particles of pavement, dirt, and other extraneous material.
- Review the project to ascertain all requirements for handling traffic. Review with the contractor the required traffic control system and traffic control devices.

4-3706B During the Course of Work

During the course of work, take the following steps:

- Verify the receipt of a certificate of compliance for each load of crack treatment material if it is on the authorized material list.
- Ensure the contractor removes crack material that is spilled or deposited on the pavement surface.
- Observe the application of crack treatment material using approved equipment.
- If the crack treatment is tacky before opening to traffic have the contractor apply sand or the manufacturer’s recommended detackifying agent.

4-3706C Measurement and Payment

For measurement and payment, do the following:

- Crack treatment is paid for by lane mile measured along the edge of each paved lane parallel to the pavement centerline.