# Section 28 Lean Concrete Base

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## 4-2801 General

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Lean concrete base is normally used under portland cement concrete pavement and is more rigid and less erodible than cement-treated base. The quality of aggregates for both bases is similar. However, lean concrete base is proportioned, mixed, and placed in a manner similar to portland cement concrete pavement while cement-treated base is not.

The contractor must proportion the aggregate so that it meets the specified grading requirements. The engineer determines the cement content to be used. For design considerations for lean concrete base, see Chapter 600 of the *Highway Design Manual*.

Resident engineers need to plan carefully to fully meet the requirements for inspecting and testing materials. When planning for the inspection of lean concrete base, consider the following:

- The production of lean concrete base
- The placing, finishing, and curing of the base
- The subgrade, specified equipment, and construction of joints for the base

At the mixing plant, plant inspection specialists and acceptance testers who are not directly assigned to the resident engineer usually perform inspection and testing duties. However, the resident engineer is as responsible for enforcing the specifications at the plant as at the job site. Thus, the resident engineer must ensure contract compliance at the mixing plant as well as on-site. Good communication is essential between plant inspection specialists and assistant resident engineers. The resident engineer must be kept informed of test results in a timely manner.

This section focuses on the resident engineer's on-site inspection duties. For information on producing and transporting lean concrete base, see Section 4-90, "Portland Cement Concrete," of the *Construction Manual* (manual).

## 4-2802 Before Work Begins

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Before work begins, take the following steps:

- For general requirements, review the *Standard Specifications* and plans. For any special requirements, review the special provisions.
- Review the engineer's estimate of quantities to verify accuracy.
- Verify the receipt and proper distribution of Form CEM-3101, "Notice of Materials to Be Used," which lists the aggregate, cement, and curing compound for lean concrete base.
- Section 28-1.01, "Description," of the *Standard Specifications*, specifies the cement content for lean concrete base. After testing the contractor's proposed

aggregate supply, the cement content may be increased. To test the proposed aggregates in accordance with Section 28-1.02, "Materials," of the *Standard Specifications*, take the following steps:

1. Obtain in writing the contractor's proposed grading and source of aggregate.
2. Check to ensure the aggregate's source site is permitted and complies with the Surface Mining and Reclamation Act of 1975. Mining operations determined to be in compliance are listed on the AB 3098 SMARA Eligible List. You can obtain this list from the Division of Construction or the Department of Conservation's web site at http://www.consrv.ca.gov/omr/SMARA/3098-list.
3. Well in advance of the 45-day requirement for making aggregates available for sampling, contact the Office of Engineering Materials and Testing Services (METS) to determine whether METS is reviewing the cement content for the base. It is the resident engineer's responsibility to ensure this process has begun. The district materials engineer may be a good initial contact.
4. METS may perform the required testing to determine cement content or it may establish the cement content based on previous aggregate testing from the same source.
5. If METS has received Form CEM 3101, "Notice of Materials to Be Used," it will probably have initiated action to determine the cement content. If METS needs aggregate testing samples, the resident engineer will be advised. Either district materials laboratory personnel or project personnel may obtain the samples.
6. METS will notify the resident engineer of the cement content to be used. In accordance with Section 28-1.10, "Payment," of the *Standard Specifications*, if the amount to be used is greater than the specified content, prepare a contract change order to provide an adjustment in compensation.

- Should the contractor change the supply source, repeat the procedure for determining cement content.
- Examine equipment or tools to be used for placement following the steps listed below. When obvious inadequacies exist, advise the contractor and enter the details in the daily report.

1. For sideform construction:
   a. Examine the forms to ensure they have the specified attributes for items such as composition, weight, dimensions, and rigidity. Before each use, ensure the forms are cleaned and oiled.
   b. Ensure the installation of the forms complies with specifications. Before the placement of concrete, order any necessary corrective work.
   c. Ensure the paving equipment complies with specifications.

2. For slipform construction, ensure the paver has the specified attributes. Require the specified demonstration of satisfactory operation and note such activity in the daily report.

3. To ensure the contractor meets the requirements for protecting the base, examine all equipment that will travel on the completed base.

- Just before the start of paving check the accuracy of the final grade stakes.
- Inspect the subgrade to ensure it conforms to the tolerances specified for compaction and elevations. Ensure that any low areas are identified and will be filled with additional base and that any high areas are trimmed as specified. Additional thickness is paid for as part of the lower layer and must not be included when calculating base thickness.
- When slipform pavers are used, inspect the grade upon which the paver will ride to determine if it is smooth enough to prevent abrupt vertical changes in the finished surface. When the paver controls the grade and alignment by a wire, sight along the wire for any obvious variations, and order necessary corrections. Ensure the wire is tensioned sufficiently so no measurable sag occurs between the supporting stakes. Advise the contractor if you anticipate any problems. Keep in mind that the contractor is responsible for compliance with thickness and grade requirements.
- Check the facilities proposed for producing and transporting lean concrete base. Section 4-90, "Portland Cement Concrete," of this manual covers the items involved.
- Ascertain the curing methods and type of material the contractor proposes to use. Discuss with the contractor the requirements for labeling and packaging the curing compound.
- The material specified for curing depends on whether the overlying surface will be portland cement concrete pavement or asphalt concrete pavement. When the overlying surface is portland cement concrete, the specifications require a much higher percentage of paraffin wax in the curing compound than that required for an overlying surface of asphalt concrete.
- The curing compound for an overlying surface of portland cement concrete serves a dual purpose. It both cures the lean concrete base and also, after the pavement is placed, provides a bond-breaking membrane between the pavement and base. The bond breaker is very important if cracks and the longitudinal weakened plane joint in the lean concrete base are to be prevented from reflecting through the pavement.
- Examine the equipment to be used for applying the curing compound to determine whether it meets specifications.
- Before paving begins, ensure equipment for constructing longitudinal weakened plane joints is onsite and conforms to specifications.
- Confirm placement dates with the contractor and arrange Caltrans personnel for plant inspection and testing.
- If paving or finishing operations will extend beyond daylight hours, ensure the project has adequate lighting before the contractor begins placing the lean concrete base.

- When the project requires long hauls, review the contractor's proposed placement method to ensure adequate time.
- Before placing the lean concrete base, ensure the subgrade is uniformly moist.

## 4-2803 During the Course of Work

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Once work begins, take the following steps:

- Before mixing, obtain samples of the aggregate. Also, in accordance with the frequency shown in Section 6-1, "Sample Types and Frequencies," of this manual, test for the specified attributes. Initially, and in the case of borderline material, take and save additional samples. In case the first samples tested do not meet the requirements for contract acceptance, the extra samples may be tested to determine the extent of the failing material.
- When the results of grading or sand equivalent tests, or both, are outside the limits for contract compliance, determine whether the lean concrete base represented by the tests is structurally adequate. When lean concrete base is left in place even though it does not comply with the contract, the specified payment by the contractor must be made by administrative deduction. Document the reasons for leaving the concrete in place, and notify the contractor of your decision and the deduction amount.
- For placing lean concrete base and applying curing compound, ensure the subgrade is not frozen and the ambient temperature is above the minimums required.
- As it is placed, observe the lean concrete base for any improper proportions or inadequate mixing. In the daily report, record the reasons for rejecting any lean concrete base and the approximate amount rejected.
- Ensure the contractor furnishes the required tachometer. Also, check to ensure that frequencies are as specified. Immediately replace inoperative vibrators.
- To ensure the correction of any problems related to mixing or hauling, maintain good communication with the engineers who inspect operations at the mixing plant. For more detailed information about transporting concrete and receiving load tickets at the delivery point, see Section 4-90, "Portland Cement Concrete," of this manual.
- Obtain samples of the plastic concrete, and perform penetration and air content tests in accordance with the frequencies shown in Section 6-1 of this manual.
- Compressive strength tests of the lean concrete base are only necessary to confirm design assumptions. For information, it is recommended that you test compressive strength near the start of placing lean concrete base.
- Ensure the material for longitudinal weakened plane joints is placed to the dimensions specified. Also, ensure the contractor vibrates the lean concrete base to cause an even flow of material about the joint.
- Ensure the construction of a contact joint whenever an interval exists that is greater than the specifications allow between the placement of any two successive loads of lean concrete base.
- When the contractor uses side form construction, ensure screeding and tamping conforms to the specifications. Where the hand-float method is permissible, ensure the contractor uses the specified floats and methods.

- Ensure the surface of the lean concrete base is textured as specified. Lean concrete base to be surfaced with asphalt concrete must have a rough texture to prevent slippage between surfacing and base. Lean concrete base to be surfaced with portland cement concrete pavement must have a smooth texture to allow the pavement to adjust for early thermal and moisture changes without forming random cracks.
- Ensure the contractor uses the proper material for curing the lean concrete base.
- Ensure shipments of curing compound are labeled and packaged as specified. If the compound is shipped in tanks or tank trucks, obtain a copy of the shipping invoice, and verify the invoice contains the specified information. Determine if the supplied material is on the approved list of curing compounds. (For a list of approved compounds, see the district materials engineer or the responsible unit.) Prohibit the use of an improperly identified curing compound until it has been sampled and tested. For details about these procedures, see Section 6-2, "Acceptance of Material and Sampling Methods," of this manual.
- As required under Section 6-1, "Sample Types and Frequencies," of this manual, obtain samples of the curing compound for acceptance tests.
- Ensure the curing compound is properly agitated before and during application to achieve complete mixing. Also, observe that the compound is applied as a uniform membrane at the specified time. Ensure any disturbed areas receive additional curing compound.
- Ensure that the curing compound is not contaminated, diluted, or altered in any way before application, that it is applied when surfaces are still visibly moist, and that the compound film remains unbroken during the specified curing period.
- To determine the curing seal's application rate, perform both measurements and calculations. You may also use California Test 535, "Determining the Application," to determine the application rate. Record such measurements in the daily report.
- After the curing seal has been applied, decide whether it is necessary to fog the lean concrete base as described in Section 90-7.02, "Curing Pavement," of the *Standard Specifications*.
- When specified, require additional applications of curing compound.
- Measure the finished surface of the lean concrete base. Record the measurements, and require the specified corrections for areas not meeting elevation requirements. Ensure high areas are addressed immediately. For high areas that have been ground, ensure the curing compound is reapplied as specified.
- Enforce the requirements in Section 7-1.02, "Load Limitations," of the *Standard Specifications*, which covers the use of the completed lean concrete base by traffic or the contractor's equipment.

## 4-2804 Measurement and Payment

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Using the dimensions shown on the plans, calculate the quantity of lean concrete base for which payment must be made. In these calculations, account for curves in alignment by using curve corrections.