




MANUAL CHANGE TRANSMITTAL		NO. 02-2
TITLE: Department of Transportation <i>Construction Manual</i>	APPROVED BY:  Robert Pieplow Chief, Division of Construction	DATE ISSUED:
SUBJECT AREA Index and other areas of the <i>Construction Manual</i>	ISSUING UNIT Division of Construction	
SUPERSEDES 7-103D Surface Mining and Reclamation Act	DISTRIBUTION All Requested Manual Holders	

The purpose of this manual change transmittal is to provide updates and corrections to the 2001 edition of the Caltrans *Construction Manual*. Please update your manual in accordance with the table below. The relevant pages are indicated in the table.

Section(s)	Remove Old Page(s)	Insert New/Revised Page(s)
7-103D, "Disposal, Staging and Borrow Sites"	7-1.1 thru 7-1.18	7-1.1 thru 7-1.21
7-108 Certification of Environmental Compliance	None	7-1.22
Chapter 4 "Before Work Begins" Sections: 1602, 2702, 2802, 3702A, 3703A, 4002, 9002A	4-16.1 thru 4-16.3, 4-27.1 thru 4-27.3, 4-28.1 thru 4-28.5, 4.37.1 thru 4-37.5, 4-40.1, 4-90.1 thru 4-90.5	4-16.1 thru 4-16.3, 4-27.1 thru 4-27.3, 4-28.1 thru 4-28.5, 4.37.1 thru 4-37.5, 4-40.1, 4-90.1 thru 4-90.5
Chapter 3, Sections 607A, B, C and Section 708	3-6.5 thru 3-6.7 3-7.10	3-6.5 thru 3-6.7 3-7.10
Index	None	None
Golden Rod Ch.7, Section 1	7-1.i	7-1.i

Section 1 Environmental Rules and Requirements

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7-101 General

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This section provides information and guidelines for administering the various environmental requirements for Caltrans contracts.

The district construction deputy director is responsible for ensuring that environmental and permit requirements are enforced. To meet legal requirements, district construction staff must receive appropriate training, possess appropriate skills, and understand their role in successfully carrying out environmental measures. Within the district construction division, appropriate environmental coordinators must be appointed.

7-102 Sources of Information

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A variety of sources explain Caltrans' environmental procedures, methods, and commitments. These sources include the *Caltrans Environmental Handbook*, *Caltrans Storm Water Quality Handbooks*, and an Intranet page titled "The Caltrans Intranet for Environmental Planning and Engineering." The construction contract contains environmental requirements in the plans and specifications. In addition, the resident engineer's pending file contains a summary of all project commitments, copies of applicable permits, the environmental document, and other environmental documentation. Some districts produce special publications that detail the environmental requirements for each project. The district's environmental experts are also good sources for information or clarification about environmental commitments. These individuals are always available to explain commitments and lend assistance at the preconstruction conference or at any other time during construction.

7-103 Protection of Environmental Resources

7-103 Protection of Environmental Resources

The following are guidelines for fulfilling the responsibility for protecting and preserving various environmental resources during construction as required by law.

7-103A Archeological and Historical Resources

Mitigating a project's impact on historical and archaeological sites during construction may require the recovery of artifacts. Mitigation may also require Native Americans, archeologists, architects, and historians to monitor and coordinate the recovery process. Normally, archaeological work is done in advance of construction, but occasionally, finds are made during construction. If human remains or previously unknown historic and archaeological artifacts are unearthed, suspend work in the vicinity until the find can be evaluated and properly treated. Procedures and responsibilities are detailed in the *Caltrans Environmental Handbook*.

7-103B Endangered Species

Both state and federal laws are designed to protect designated plant and animal species along with their respective habitats. As a result, often very strict prohibitions exist on certain types of work, work during certain times of the year, or work at specific locations. Even inadvertently impacting protected species can result in fines or jail sentences. The contract will specify the necessary measures and restrictions, and the plans will show environmentally sensitive areas. However, during construction, project crews may discover protected species that were not anticipated in the contract. If such a discovery occurs, suspend work in the area and immediately notify the district environmental unit.

7-103C Migratory Bird Act

The Migratory Bird Act makes it illegal to interfere with migratory birds. Breeding and nesting seasons for these species can result in strict prohibitions or require working around nesting areas. The act may require avoidance or prohibit disturbance of many species of birds, such as swallows that roost or nest under highway structures. Should occupied nests be found, suspend work in the nests' vicinity until the birds abandon the nests.

7-103D Disposal, Staging and Borrow Sites (DSB)

The instruction contained in this section pertain to all contractor disposal, staging and borrow sites.

Caltrans construction projects often require contractors to make use of either State owned or private off-site lands and facilities for the disposal of excess materials, the acquisition of necessary borrow materials, and to stage equipment, store supplies, and to house their offices. Contract documents generally require the contractor to show that construction activities on these sites comply with all local, state and federal environmental and permitted use regulations. However, recent history has shown that in some geographic locations there have been issues regarding final compliance responsibility. To resolve these issues and to foster better cooperation with regulatory agencies, the option of designating DSB sites has been facilitated.

Those construction projects that cannot accommodate the disposal, staging, or borrow material needs of the project within the right of way may have designated sites for these purposes located outside the project limits. However even when such sites are made available, the contractor will continue to have the flexibility to use alternative sites. Alternative sites selected by the contractor require the contractor to prepare and submit to the engineer for approval a DSB site submittal. Requirements for this submittal are outlined below under "DSB Submittal."

The need for identifying and clearing a designated DSB will generally have been made by the project engineer on a case by case basis, considering historical and geographical issues and practices, project design requirements, environmental concerns, economic factors, and other aspects specific to projects and their locale. During project development, the project should have considered and identified sites readily available for use by the contractor. These sites would have included, but not be limited to, commercial dumpsites, recycling plants, private property and other local sites. If it was determined necessary that one or more DSB sites needed to be designated, then the project engineer would have the proposed sites evaluated during the environmental review process, and as necessary, included them in the environmental compliance documentation. To ensure their availability to the contractor, right of way agreements would have been obtained for private sites selected as designated DSB sites. Any necessary permits for selected DSB sites would have been included among those obtained during Plans Specifications and Estimate

development. Information or documents regarding arrangements made by Caltrans to ensure the availability of designated sites are provided to prospective bidders or contractors in a Materials Information handout.

Contractor use of designated sites is not mandatory unless otherwise stated in the special provisions. If the contractor chooses to use an alternate site, a DSB site submittal must be made by the contractor and approved by the resident engineer. The contractor can obtain the DSB Site Submittal information at:

<http://www.dot.ca.gov/hq/oppd/design/m121201.pdf>

Summaries are provided below of the minimum items expected in a: 1) DSB Site Submittal for a site designated by Caltrans; and 2) a summary of the minimum items expected in a DSB Site Submittal for a contractor to get approval for use of an alternate site. The submittal and support documents would then be filed under Category 18 (Borrow and Disposal Agreements and Permits).

DSB Submittal

DSB Submittal

1. For Caltrans Designated DSB Sites Caltrans Will:

- Provide a general site plan, including site limits and access roads
- Obtain temporary property owner agreements as necessary to “reserve” property
- Prepare California Environmental Quality Act or National Environmental Policy Act documentation as needed
- Verify the existence of or obtain the necessary permits, licenses, and agreements to satisfy regulatory agencies and ensure site availability
- Review and approve contractor’s submittal

The Contractor Will:

- Prepare a final grading plan in conformance with *Standard Specifications*
- Provide release of liability
- Provide final property owner agreements (see Section 3-607 Local Materials)
- Submit Water Pollution Control Plan

2. For Alternative Sites (Outside the Row) Selected by the Contractor, Caltrans Will:

- Review and approve contractor’s submittal

The Contractor Will:

- For borrow sites, demonstrate that the site is exempt or in compliance with Surface Mining and Reclamation Act (SMARA), (i.e., listed on the AB 3098 SMARA eligible list); and for all DSB sites,
- Provide a site plan, including site limits and access roads
- Obtain property owner agreements (see Section 3-607 Local Materials)

SMARA Compliance for Borrow Sites

- Provide release of liability
- Provide final property owner agreements
- Provide environmental documentation prepared by appropriately qualified environmental specialists
- Obtain or update all necessary permits, licenses, and agreements
- Determine final grading plan in conformance with *Standard Specifications*
- Submit Water Pollution Control Plan

SMARA Compliance for Borrow Sites

The State Contract Act prohibits Caltrans from buying aggregate or any other mined materials from sources not exempt or not compliant with the Surface Mining and Reclamation Act of 1975 (SMARA). 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>. Generally, Caltrans cannot accept material from unlisted sites. However, the State Mining and Geology Board may grant one-time exceptions. To comply with SMARA and the State Contract Act, imported materials from the following sources must be listed on the AB3098 list:

- Materials from mined sources.
- Materials from commercial vendors and suppliers.
- Materials from federally owned lands where an agreement exists between the federal landholding agency and the California Department of Conservation (DOC) that SMARA applies.
- Materials from Native American reservations where an agreement exists between the reservation and the DOC that SMARA applies or a nontribal mine operator is present.

In addition to the specific exemptions listed in SMARA (i.e., less than 1,000 cubic yards, etc), Caltrans has determined that imported material from the following types of sources comply with SMARA and do not require inclusion on the AB3098 list:

- Imported material from a development or other nonmining source where the material is a byproduct of construction and this source has approval in a local agency plan and through the California Environmental Quality Act.
- Excess material generated from a Caltrans project who's environmental approval appropriately considered the construction phase and met approval requirements for reclamation of the site.
- Materials from failures of natural or man-made slopes within Caltrans' Right-of-Way as a result of storms slides, or slipouts.

- Materials from outside the State of California.
- Materials originating from Native American reservations where no agreement exists between the reservation and the DOC that SMARA applies and a tribal mine operator is present.
- Materials from federal land where no agreement exists between the federal landholding agency and the DOC that SMARA applies.

For assistance with resolution, refer any challenges to the acceptance of materials to the construction field coordinator.

Other Contractor Uses of the State Right of Way

The contractor's use of Caltrans owned parcels that are not designated on the plans will be contingent upon successful approval by the resident engineer of: 1) the DSB Site Submittal; 2) the execution of a fair market rental agreement with Caltrans; and 3) the execution of an Encroachment Permit by the district permit engineer. The resident engineer should consult with the project engineer and environmental prior to approving the DSB Site Submittal.

The contractor may arrange for temporary storage of equipment and materials on Caltrans property with the resident engineer.

The contractor shall use authorized work areas and other approved Caltrans owned property at the contractor's own risk; the contractor will not hold Caltrans liable for damage to or loss of materials or equipment located within such areas.

The contractor shall maintain areas designated for contractor's use in a neat and presentable condition. Adequate measure shall be in place to protect soil, groundwater, noise, and air contamination.

Before final inspection of the work, the contractor shall remove equipment, materials, and rubbish from the work areas and other Caltrans owned property that the contractor occupies. The contractor shall leave the areas in a neat and presentable condition in conformance with the provisions in Section 4-1.02, "Final Cleaning Up," of the *Standard Specifications*.

Contractor Use of Areas Outside of the State Right of Way

If sufficient area is not available to the contractor within the contract limits or at the Caltrans owned sites outside the contract limits designated on the plans, the contractor shall secure, at the contractor's own expense, areas required for plant sites, storage of equipment or materials, or other purposes. Contractor shall complete the Disposal, Staging and Borrow (DSB) Site Submittal and obtain the resident engineer's approval.

The contractor's use of parcels outside of the Caltrans Right-of-Way and that are not designated on the plans will be contingent upon successful approval by the resident engineer of the DSB Site Submittal.

Other Contractor Uses of the State Right of Way

Contractor Use of Areas Outside of the State Right of Way

**7-104
Air, Water, and
Noise Pollution
Control**

7-104 Air, Water, and Noise Pollution Control

This section contains guidelines for administering the contract's air, water, and noise requirements.

7-104A Air Quality

All Caltrans projects must comply with the Clean Air Act. Permits are issued by local air quality management districts and require that the project create no smoke, offensive odors, or visible dust. Contractors must take appropriate measures to ensure their equipment is properly maintained and to apply water and other dust palliatives as frequently as necessary. Violations can result in fines and sanctions against the contractor and Caltrans.

In areas where naturally occurring asbestos has been identified, the specifications will set forth additional requirements to protect workers and the public. In this case, the resident engineer should include consideration of asbestos in the project code of safe practices.

7-104B Water Pollution Control

To ensure the control of pollutants in discharges of storm water runoff, Caltrans projects may be subject to federal law under the Clean Water Act and state law under the Water Code. The regulations require a National Pollutant Discharge Elimination System Permit (storm water permit), issued by the State Water Resources Control Board (SWRCB). The specifications require the contractor to conform to the permit's requirements.

For each construction project, the contractor must prepare a water pollution control program (WPCP) in accordance with Section 7-1.01G, "Water Pollution," of the *Standard Specifications, Caltrans Storm Water Quality Handbooks*, and the contract's special provisions. These documents describe the measures the contractor must implement to ensure that construction activities do not pollute the waters of the state. The resident engineer must approve all such preventive measures, and then the contractor's forces must implement and maintain the measures.

Successfully protecting from pollution the state's water resources (rivers, lakes, and streams) is critical to the project's success. These waters must be protected from chemical pollutants and from sediment in storm water runoff. Chemical pollutants include petroleum products, paint residues, and curing compounds. The Division of Environmental Analysis, in conjunction with the Division of Construction, has organized a task force (known as the "storm water task force"), consisting of construction environmental specialists. This task force visits the projects, reviews the contractor's WPCP, and acts as technical advisors to the resident engineer.

7-104B (1) District Construction Storm Water Coordinator Responsibilities

District construction must have a designated construction storm water coordinator who will carry out necessary administrative functions to prevent water pollution. The coordinator will work with other functional areas in the district, assist resident engineers to ensure compliance, and ensure that field construction personnel are appropriately trained.

7-104B (2) Resident Engineer Responsibilities

The resident engineer must use all available assistance and expertise in preventing water pollution. This assistance may come from the construction storm water coordinator, other functional areas in the district (such as the environmental and hydraulics units), or the storm water task force.



Before work begins, the resident engineer must do the following:

- Designate appropriate staff as storm water inspectors to assist in preventing storm water pollution.
- Review the construction contract and the resident engineer's pending file for instructions and commitments.
- Ensure that all proper forms have been filed with the Regional Water Quality Control Board (RWQCB).
- Meet with the appropriate environmental and engineering experts in the district to ensure a full understanding of the contract requirements for water pollution prevention.
- Conduct a preconstruction meeting with the contractor to discuss all required storm water measures and requirements. Depending on the project's size and complexity, this preconstruction conference may be used exclusively for discussing water pollution prevention or the topic may be included in a general preconstruction conference.
- Provide the contractor with a copy of the conceptual storm water pollution prevention plan (SWPPP) if one has been prepared, by the district design unit, for the project.
- Review and approve the contractor's SWPPP or WPCP as required by the specifications. The construction storm water coordinator and the storm water task force may assist in the review. Note that before the resident engineer has accepted the plan, the specifications prohibit any work that has the potential to cause water pollution.
- Before any earthwork begins, direct the contractor to deploy any storm water "best management practices" (BMPs) called for in the SWPPP or WPCP.

During the course of work, the resident engineer must do the following:

- In compliance with the storm water permit, maintain a copy of the SWPPP or WPCP on the project site.
- Inspect the contractor's operations for compliance with the specifications and the approved SWPPP or WPCP, including deployment of BMPs.
- Ensure the contractor adheres to the inspection schedule set forth in the SWPPP or WPCP and provides written reports of these inspections.
- Ensure the contractor maintains BMPs so that they will function as planned.
- Ensure the contractor has the necessary materials on hand to deploy any necessary additional BMPs in the event of a storm.
- Ensure the contractor uses appropriate measures to stabilize slopes at the times specified.
- In accordance with the specifications, ensure the contractor submits an implementation schedule for soil stabilization and sediment control for disturbed soil areas.
- Ensure the contractor complies with the provisions that restrict the size of the contractor's disturbed soil area.

- Ensure the contractor notifies the resident engineer and obtains the resident engineer's approval in advance for each first-time nonstorm water discharge, excluding exempted discharges.
- Monitor the contractor's active and nonactive disturbed soil areas. Ensure the contractor conducts soil stabilizing activities as specified.
- Ensure the contractor deploys storm water and nonstorm water BMPs whenever associated construction activities are taking place.
- Direct the contractor to correct any deficiencies in compliance efforts identified as a result of reviewing the contractor's or compliance task force's written reports.
- If any pollutants are discharged into the waters of the state, notify the construction storm water coordinator immediately. Review the storm water permit to determine the appropriate reporting timeframe, and provide a draft report of noncompliance to the construction storm water coordinator. The construction storm water coordinator will then forward the report to the RWQCB.
- Report to the construction storm water coordinator any illegal discharges or connections. Require the contractor to prepare a notice of discharge as specified in the SWPPP.
- If noncompliance occurs, take appropriate contractual sanctions against the contractor based on the nature and severity of the situation. Such sanctions include the following:
 1. Withholding funds from contract payment as specified in the contract.
 2. Suspending any work that would exacerbate the noncompliance or interfere with or prevent the contractor's efforts to correct the deficiency. For example, earthwork operations may be suspended until the contractor controls sediment or stabilizes soil as specified. Other work performed by a crew might be suspended if that crew is needed to install BMPs.
 3. Bringing in a separate contractor to complete the work and billing the contractor or the contractor's bonding company for all costs.
- Meet with personnel from regulatory agencies, such as the United States Environmental Protection Agency (EPA) and the RWQCB, and the storm water task force to discuss storm water issues and measures.
- Ensure the contractor submits an annual certification of compliance as specified. Sign, date, and file this certification in the project records.

Before accepting the contract, the resident engineer must do the following:

- As required by the contract, determine that all slopes are stabilized.
- Require the contractor to remove temporary BMPs such as silt fences or other measures that are not a part of permanent erosion control or that the district maintenance unit has not requested to be left in place.
- Conduct a final walk-through of the project area with the maintenance superintendent or region manager.

Upon acceptance of the contract, file Form CEM-2003, "Notification of Completion of Construction," with the RWQCB.

7-104B (3) *Storm Water Inspector's Responsibilities*

The resident engineer may assign an assistant resident engineer as the storm water inspector. The storm water inspector will assist the resident engineer in carrying out any or all of the inspection tasks and other work described above, as determined by the resident engineer. Typically, the storm water inspector will do the following:

- Review and become familiar with the *Standard Specifications* and special provisions pertaining to water pollution control.
- Review and become familiar with the approved WPCP or SWPPP.
- Conduct site inspections. Verify that BMPs are properly installed and meet the requirements in the *Caltrans Storm Water Quality Handbooks* and the contract specifications. Look for areas that may require BMPs that are not deployed or not addressed in the WPCP or SWPPP. Observe and identify any discharges, illicit connections, and illegal discharges. Take photographs of all areas.
- Prepare special daily reports on storm water pollution prevention. Record all storm water management activities, or inactivity, and conversations with the contractor regarding storm water pollution prevention. Record site visits from regulatory agencies, such as the (SWRCB), the RWQCB, or EPA, and any inspections the agencies perform.
- Monitor the weather reports of the National Weather Service for rainfall predictions. If rainfall is predicted, direct the contractor to deploy appropriate BMPs as identified in the SWPPP or the WPCP.
- Inform the resident engineer immediately of any problems with BMPs during the implementation of the WPCP or SWPPP and any observed discharges.
- Identify changes in construction that may require amendments to the WPCP or SWPPP, and notify the resident engineer of these findings.
- For sites covered by permits, ensure site access and the safety of representatives of regulatory agencies and local agencies when they are on site for any reason.

7-104B (4) *Contractor's Inspections*

The special provisions for water pollution control require the contractor to regularly inspect the construction site for the proper implementation, performance, and maintenance of BMPs identified in the WPCP or SWPPP. The contractor must follow the site inspection procedure specified in the *Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program Preparation (WPCP) Manual* (plan preparation manual). Trained personnel must conduct the site inspections, using the site inspection checklist, a copy of which must be provided to the resident engineer.

The contractor must notify the resident engineer whenever the SWPPP, WPCP, or BMPs may not reduce or have not reduced the discharge of sediment or other pollutants into a waterway. The contractor must follow the verbal notification with a written report. The contractor's report must conform to the provisions of Section 600.2, "Discharge Reporting," of the plan preparation manual.

If the situation constitutes noncompliance with the permit, the resident engineer must conduct a verification inspection, and if a noncompliance condition exists, report it to the construction storm water coordinator. The construction storm water coordinator will report it to the appropriate RWQCB. The resident engineer must require the contractor to amend the WPCP or the SWPPP, if necessary, to install additional BMPs.

7-104B (5) Amendment Review and Processing

During construction, conditions may occur that affect the ability of the contractor to implement the WPCP or SWPPP as initially approved or the ability of the approved WPCP or SWPPP to meet the objectives for water pollution control. A change in construction operations or site conditions may result in the discharge of significant quantities of pollutants to surface waters or municipal storm drain systems. These changes can include construction staging or schedule changes, staging area modifications, unanticipated offsite drainage impacts, and failures of BMPs. The contractor must amend the WPCP or SWPPP if either of these plan's effectiveness is diminished by any such changed condition. The SWPPP must also be amended if it violates any condition of the permit.

Upon the resident engineer's approval, the contractor must incorporate all WPCP or SWPPP amendments into the on-site documents. The contractor must prepare WPCP amendments in the format prescribed in Section 40, "Amendments," in Section 3 of the plan preparation manual. The contractor must prepare SWPPP amendments in the format prescribed in Section 200, "SWPPP Amendments," in Section 2 of the plan preparation manual. In addition, SWPPP amendments must be entered into an amendment log, as shown in Section 200.2, "Amendment Log," in Section 2 of the plan preparation manual.

The resident engineer must review the contractor's proposed WPCP or SWPPP amendment for completeness and conformance with the revised conditions, and give written approval to the contractor if the amendments are acceptable.

7-104B (6) Project Files

The resident engineer must keep copies of all documents related to storm water pollution prevention in category 20, "Water Pollution Control Plan or Storm Water Pollution Prevention Plan," of the project files. Retain all the required documents for at least three years after contract completion. These documents include the following:

- SWPPP or WPCP and all amendments.
- Daily reports and photographs related to the prevention of storm water pollution.
- The contractor's site-inspection checklists.
- The contractor's reports of discharge.
- All correspondence related to storm water pollution prevention, including notices of noncompliance.
- Inspection reports from the storm water compliance task force.
- Inspection reports from the resident engineer and assistant resident engineer.
- Copies of the certifications required by the specifications.
- Form CEM-2003, "Notification of Completion of Construction."

7-104B (7) Contractor's files

The specifications require the contractor to keep at the project site copies of the SWPPP or WPCP and all approved amendments.

7-104C Noise Control

Construction and traffic noise is often a sensitive issue in neighborhoods and communities adjacent to state highways. Major funding often has to be provided to pay for highway noise reduction through the construction of sound walls and other noise attenuation. Construction contractors are required to have appropriate noise attenuators in good working condition on all equipment. Special restrictions may be employed on night work in sensitive areas, such as residential neighborhoods, schools, or hospitals near the project site.

7-105 Permits

This section covers environmental related permits issued by regulatory agencies.

7-105A Special Use Permits

The U.S. Forest Service, Bureau of Land Management, and other federal agencies issue special use permits to Caltrans to construct and operate highway facilities across lands under their jurisdictions. Special use permits often require Caltrans to construct facilities in certain ways to protect the environment.

7-105B Fish and Game Code Sections 1601 and 5650

Section 1601 of the Fish and Game Code requires that public agencies such as Caltrans reach an agreement with the California Department of Fish and Game if the proposed work affects a waterway. The agreement this section of the code requires is known as the “Lake/Streambed Alteration Agreement,” also known as the 1601 agreement. Anything showing as a blue line on an U.S. Geological Survey (USGS) map is considered a waterway. The California Department of Fish and Game may also designate other areas as protected waterways, such as roadside ditches or ephemeral streams. When in doubt, consult with your representative from the California Department of Fish and Game. The 1601 agreement specifically prohibits polluting the waters of the state and may specifically prohibit certain activities at certain times of the year, such as work in the river during spawning season. The agreement may also require the contractor to undertake specific measures, such as installing fish ladders. Violations of the agreement are punishable by fine, imprisonment, or both.

Section 5650 of the Fish and Game Code prohibits the placement of specified materials in the waters of the state. Violations can result in major fines or even jail. Examples of violations include the following:

- Causing dirt and sediment to enter the waters of the state.
- Using creosoted timbers in the waters of the state.
- Placing petroleum products, such as asphalt or diesel, into, or where they can get into, the waters of the state.

Placing asphalt concrete grindings, chunks, and pieces in areas where they can pass into the waters of the state is also a violation of Section 5650 of the Fish and Game Code. A memorandum of understanding exists between the California Department of Fish and Game and Caltrans regarding the placement of asphalt concrete pavement grindings as shoulder backing and the placement of asphalt concrete pieces and chunks in embankments. For a discussion of reusing asphalt concrete as fill material and shoulder backing and a summary of the memorandum of understanding, refer to Section 611.11, “Conservation of Materials and Energy,” of the *Highway Design Manual*. If a question exists as to whether asphalt concrete grindings or chunks may get into the waters of the state, consult with your California Department of Fish and Game representative.

7-105 Permits

7-105C List of Potential Permits

The first table below may be used as a guideline for when permits or approval of contract plans may be required from state or local governmental agencies. The left-hand column lists the activity or a resource affected by construction activity. The second column lists the agency or agencies that may have jurisdiction in the area shown in the first column. The third column indicates the type of permit or plan approval that may be required by the agency or agencies. Most required permits and plan approvals should be obtained during the project's design phase. However, the table may be used as a reminder of the types of permits and plan approvals that may be required when making changes to the original plans.

The second table below lists federal environmental statutes and regulations. The first column lists resources or activities. The second column shows the federal agency having jurisdiction in the area, and the third column lists the statute or regulation that applies to the resource or activity.

Table 7-1.1 State and Local Agency Permits (1 of 3)

Resource or Activity	Agency	Permit or Approval
Commercial, industrial, and residential development	Local agency (county or city)	Land use, general plans, specific plan, conditional use, or subdivision
Conversion of timberland to nonforest uses through timber operations and immediate timberland production zone rezoning	California Department of Forestry	Timberland conversion permit
Power transmission lines, pipelines, and railroad crossings	Public Utilities Commission	Review of plans and approval
Solid waste disposal	California Integrated Waste Management Board	Disposal requirements
Sewage disposal	County health department	Disposal requirements
Waste discharge	State Water Resources Control Board; Regional Water Quality Control Board	Discharge requirements
Storing, treating, or disposing of hazardous waste	<div>Department of Toxic Substances Control</div> <hr/> <div>State Water Resources Control Board; Regional Water Quality Control Board; local agency</div>	Hazardous Waste Facilities Permit Hazardous waste discharge requirements; Underground Storage of Hazardous Substances Permit
Right-of-way across state parkland	California Department of Parks and Recreation	Right of-way permit, license, easement, joint agreement, or lease
Encroachment on or across a local street or highway	Local agency (county or city)	Encroachment permit
Encroachment on 100-year floodplain, intermittent streams, and desert washes	California Department of Fish and Game	Lake/Streambed Alteration Agreement (1601 agreement)
Encroachment on or across cove, bay, or inlet	Department of Boating and Waterways	Review of plans
Air quality	Air Resources Board or local air pollution control district	Authority to construct and permit to operate for activities emitting stationary source pollutants to the atmosphere
Fish and wildlife habitat	California Department of Fish and Game	Lake/Streambed Alteration Agreement for activities in lakes, streams, and channels and crossings

Table 7-1.1 State and Local Agency Permits (2 of 3)

Water	California State Lands Commission	Land use lease (for encroachments, crossings on tidelands, submerged lands, and so forth.)
	State Water Resources Control Board; Regional Water Quality Control Board	National Pollutant Discharge Elimination System Permit for storm water discharges to surface water;
	Department of Health Services, Division of Drinking Water and Environmental Management; or local health office	Waste discharge requirements for nonstorm discharges to surface water or groundwater to the waters of the state Permit to Operate a Public Water System
Dredging	California Department of Fish and Game State Lands Commission	Standard or special suction dredging permit dredging permit
Surface (material borrow sites, and so forth)	Local agency (county or city)	Surface Mining and Reclamation Act (SMARA) permit
Burning	Local air pollution control district; California Department of Forestry; local fire control agency	Burn permit
Grading	Local agency (county or city)	Grading permit
Entering private property ? to gather information ? for temporary use	Caltrans district right-of-way unit Caltrans district right-of-way unit Property owner right of entry approval	Property owner approval for temporary encroachment
Entering surface waters to gather information or for construction	Regional water quality control board	Water quality certification or waiver
All activities involving dams or reservoirs	California Department of Water Resources, Division of Safety of Dams	Approval of plans

Table 7-1.1 State and Local Agency Permits (3 of 3)

Resource or Activity	Agency	Federal Statute, Regulation or Executive Order
Water	US Army Corps of Engineers ; United States Environmental Protection Agency (EPA); Bureau of Reclamation; U.S. Fish and Wildlife Service; National Marine Fisheries Service	Federal Clean Water Act (Section 404) Regulations concerning the National Pollutant Discharge Elimination System (40 CFR)
Air	United States Environmental Protection Agency	Clean Air Act, Title 42, sections 7401 through 7414
Fish and Wildlife Habitat	U.S. Fish and Wildlife Service; U.S. Forest Service; The National Park Service; National Marine Fisheries Service	Endangered Species Act (Section 7)
Navigable Waters	US Army Corps of Engineers; U.S. Coast Guard	Rivers & Harbor Act
Federal Lands	U.S. Forest Service; Bureau of Land Management; National Park Service	
Historic Properties	Advisory Council on Historic Preservation	National Historic Preservation Act (Section 106)
Coastal Zone	US Army Corps of Engineers; U.S. Fish and Wildlife Service; National Oceanic and Atmospheric Administration	
Wild and Scenic Rivers	National Park Service	Code of Federal Regulations: 36 CFR 297; 43 CFR 8350
Wetlands	US Army Corps of Engineers; United States Environmental Protection Agency	Executive Order 11990 (Protection of Wetlands)
Floodplains	Federal Emergency Management Agency	Executive Order 11988 (Floodplains Management)
Dredging	US Army Corps of Engineers; U.S. Coast Guard	
Airport Airspace	Federal Aviation Administration	Federal Aviation Regulations, Part 77
Farmland	National Resources Conservation Service	Farmland Protection Policy Act

**7-106
Environmental
Hazards and Safety
Procedures**

7-106 Environmental Hazards and Safety Procedures

This section contains guidelines for handling and dealing with hazardous materials, hazardous waste, and hazardous spills on construction projects. See Table 7-1.1, “Unknown Hazards Procedures,” at the end of this section for properly handling underground tanks, gases, odors, and uncontained spills.

7-106A Hazardous Materials

Many hazardous materials are used in the construction of highway facilities. Employees must take appropriate precautions to minimize their exposure and use protective clothing and equipment. Contractors must submit material safety data sheets and obtain permission from the resident engineer before bringing any hazardous material onto the job site. For instructions, guidelines, and requirements for handling hazardous materials to ensure employee safety, see Chapter 16, “Hazardous Materials Communication Program,” of the *Caltrans Safety Manual*. For guidelines for the use of pesticides, see Section 4-20, “Erosion Control and Highway Planting,” of the *Construction Manual* (manual).

Some special permits are required for dealing with hazardous materials during construction. Demolishing a bridge, whether new, old, or temporary, requires an asbestos survey and a permit from the local air quality management district. Reusing soils contaminated with aerially deposited lead is generally prohibited. For low levels of lead contamination, Caltrans has a variance to this rule issued by the Department of Toxic Substances Control. This variance is not automatic. You must notify the department before working under the variance.

For guidance regarding special permit requirements, contact the district environmental unit.

7-106B Hazardous Waste

District construction division must have a designated district hazardous waste coordinator who will carry out necessary administrative functions for hazardous waste. The coordinator will work with other functional areas in the district and headquarters to do the following:

- Identify hazardous waste training needs.
- Ensure the proper notifications if unidentified waste is found during construction.
- Provide field personnel with procedures and other information so that the personnel may safely deal with known and unknown waste.

Caltrans construction employees must follow safe practices and minimize their exposure when dealing with hazardous wastes. Minimize potential risks during project construction by having all construction personnel follow the general procedures below:

- After unknown and potentially hazardous wastes (including underground tanks) are discovered, cease construction work in that area.
- Secure the vicinity of the find by cordoning off the area with barriers or fences, and evacuate the vicinity if the resident engineer deems such an action necessary.
- Prohibit construction personnel from any exploratory or investigative work that would result in further personal exposure. Such personnel are prohibited from taking samples or testing potentially hazardous waste. This prohibition includes activities such as the following:
 1. Touching, smelling, or ingesting suspected materials.



2. Climbing into trenches or enclosed areas where contamination is suspected.
 3. Reaching, looking, or placing a foreign object (such as a stick to probe or a rock to test depth or to determine the presence of a liquid) into exposed or leaking tanks or other enclosed spaces.
- For any necessary exploratory, investigative, or cleanup work, use specialized consultants or safety workers who are fully trained, licensed, and qualified for hazardous waste work in accordance with state and federal regulations.
 - Because of potentially catastrophic health effects, the Code of Federal Regulations, Title 29, Part 1910.120 (29 CFR1910.120) requires that no one enter the designated exclusion zones until the establishment of a complete and effective “hazardous waste worker protection program” or until the consultant has determined no exposure danger exists. (The designated exclusion zones are delineated in the consultant prepared hazardous waste site safety plans.)

7-106B (1) Hazardous Waste Disposal Contracts

When dealing with the identification, assessment, and mitigation of hazardous material or waste, the resident engineer must obtain technical assistance. This assistance is available from the district hazardous waste coordinator and staff in the Division of Environmental Analysis’ Noise, Air, and Hazardous Waste Management (NAHW) Office. The NAHW is responsible for providing construction hazardous waste emergency contracts and providing procedural direction. In addition, you may seek assistance from the maintenance hazardous spill coordinator.

When using the construction hazardous waste emergency contracts, the resident engineer must request all needed services and act as the contract manager. The resident engineer may not delegate this overall responsibility for the hazardous waste portion of the project. The resident engineer reports all expenditures for hazardous waste to the construction hazardous waste coordinator in the district construction office.

The resident engineer must also coordinate activities under the contract with other Caltrans functional units. When hazardous waste or underground tanks are found, the resident engineer notifies both the district and the Division of Construction. The resident engineer also notifies the district Proposition 65 coordinator and the NAHW in Sacramento.

As contract manager, the resident engineer must do the following:

- Provide funds for the work from project contingency funds or from supplemental funds obtained through a funds request.
- Request services under the contract.
- Prepare the work request.
- Process the work request authorization.
- Authorize the contractor to begin work.
- Ensure work is performed as stipulated in the work request and according to the contract terms.
- Review and approve invoices for payment.
- Review reports.
- Maintain project records in regard to the hazardous waste work.
- Evaluate contractor performance when work is not performed satisfactorily.

7-106B (2) *Removal of Yellow Traffic Stripe and Pavement Markings*

Follow the procedures below when assessing, removing, and disposing of yellow traffic stripe and pavement marking materials on all projects.

7-106B (2a) Construction contract review:

The resident engineer must review the construction contract to determine whether yellow traffic stripe and pavement marking material must be removed. If so, the resident engineer must also determine whether special handling as a hazardous waste is specified. The project may proceed as planned if one of the following situations exist:

- All yellow traffic stripe and pavement marking material to be removed has been previously assessed and found to be free of lead.
- Yellow traffic stripe or pavement marking material to be removed has been tested and found to contain lead, and its removal and disposal as a regulated or hazardous waste is specified.
- If yellow traffic stripe and pavement markings are to be removed and the removal has not been addressed in the contract, the resident engineer must consult with the district hazardous waste coordinator and have lead testing done.

7-106B (2b) Testing and removal requirements:

The resident engineer may order the prime contractor to test the striping and marking materials for lead. This testing should be paid for as extra work. Depending on the result of testing, proceed as follows:

- *Nonregulated levels of lead found:* If no lead is detected by the initial testing or is detected at levels less than 350 ppm total lead and less than 5 ppm soluble, no additional testing or collection of residues is required. The contractor can dispose of the residue as with any other construction debris.
- *Nonhazardous regulated levels of lead found:* When lead levels detected by testing are less than 5 ppm soluble and less than 1,000 ppm total but more than 350 ppm total, an employee safety and health plan does not have to be prepared. Measures to suppress dust and follow good personal hygiene are still required. All residue resulting from yellow traffic stripe and pavement marking removal, including any removal agent, must be collected and stored in sealed drums. The material must be retested and disposed of appropriately as set forth in “Retesting and Disposal,” later in this section.
- *Hazardous levels of lead found:* Should the lead levels detected by this initial testing be greater than 1,000 ppm total lead or greater than 5 ppm soluble lead, treat removal as lead abatement work. Even when not contemplated in the contract, the abatement of lead contained in striping by the construction contractor is allowable under Section 25914.2 of the Health and Safety Code and Section 7058.7(d) of the Business and Professions Code. The contractor must test the striping material when directed but may refuse to do the abatement work when it was not included in the original contract. If the contractor refuses the lead abatement work, one of the construction hazardous waste emergency contractors will perform the work. Proceed as follows when lead abatement is required.

- *Training:* The contractor responsible for lead abatement must provide a safety training program that meets the requirements in Section 1532.1, “Lead,” of the *Construction Safety Orders*. Before performing any yellow traffic stripe and pavement marking removal, personnel (including Caltrans employees) who have had no prior lead training must complete the safety training program.
- *Lead abatement program:* Work practices and worker health and safety must conform to Section 1532.1, “Lead,” of the *Construction Safety Orders*. The contractor must submit the written compliance programs required in Subsection (e)(2), “Compliance Program,” of Section 1532.1, to the engineer before starting to remove yellow traffic stripes and pavement markings and at such times when revisions to the programs are required. An industrial hygienist certified by the American Board of Industrial Hygiene must prepare the compliance programs. A competent person who is capable of taking corrective action must monitor the programs. Require that copies of all inspection reports made in accordance with Section 1532.1 are given to the resident engineer.
- *Storage of residue:* The contractor must store the residue from traffic stripe and pavement marking removal as follows:
 1. While waiting for any test results required by the disposal facility, store the collected residue in properly labeled containers approved for the transport of hazardous waste by the U.S. Department of Transportation.
 2. Cover and handle the containers in such a manner that no spillage will occur.
 3. Enclose the stored containers with temporary fencing at a location within the project limits approved by the engineer.
 4. Begin disposing of the contained residue no more than 90 days after accumulating 100 kg of residue.
- *Retesting and disposal:* Before disposal, retest the residue collected in the containers. The level of lead waste contained in the removed material will be diluted by pavement debris that has also been removed. Depending on the test results, dispose of the stored material as follows:
 1. The contractor can dispose of the stored material in the same manner as any other construction debris when the stored material’s lead content is detected at levels less than 350 ppm and less than 5 ppm soluble.
 2. The abatement contractor must take the stored residue to a Class 1 disposal site when its lead content is detected at levels greater than 350 ppm but less than 1,000 ppm total lead and less than 5 ppm soluble. However, in this case, the stored residue does not require hazardous waste manifesting or handling by a registered hauler. In the project files, retain the records of the testing and the amounts of residue tested and disposed.
 3. Treat the stored residue as hazardous waste when its lead content is detected to be at levels greater than 1,000 ppm total lead or greater than 5 ppm soluble. Keep records in accordance with current requirements for hazardous waste handling and disposal, and file them in the project files. The abatement contractor must dispose of all residues resulting from yellow traffic stripe and pavement marking removal at an approved

Class 1 disposal facility in accordance with the requirements of the disposal facility operator. A transporter currently registered with the Department of Toxic Substances Control using correct manifesting procedures must haul the yellow traffic stripe and pavement marking residue.

The abatement contractor must make all arrangements with the operator of the disposal facility and perform any testing of the yellow traffic stripe and pavement marking debris required by the operator. The abatement contractor must submit the name and location of the disposal facility along with the testing requirements to the engineer before starting removal of yellow traffic stripe and pavement markings on the project. The resident engineer must obtain the United States Environmental Protection Agency identification number and sign all manifests as the generator.

4. Unless the lead removal work was already contemplated in the construction contract, pay as extra work all work performed for testing, additional removal costs, retesting, and additional disposal.

7-107 7-107 Hazardous Spills

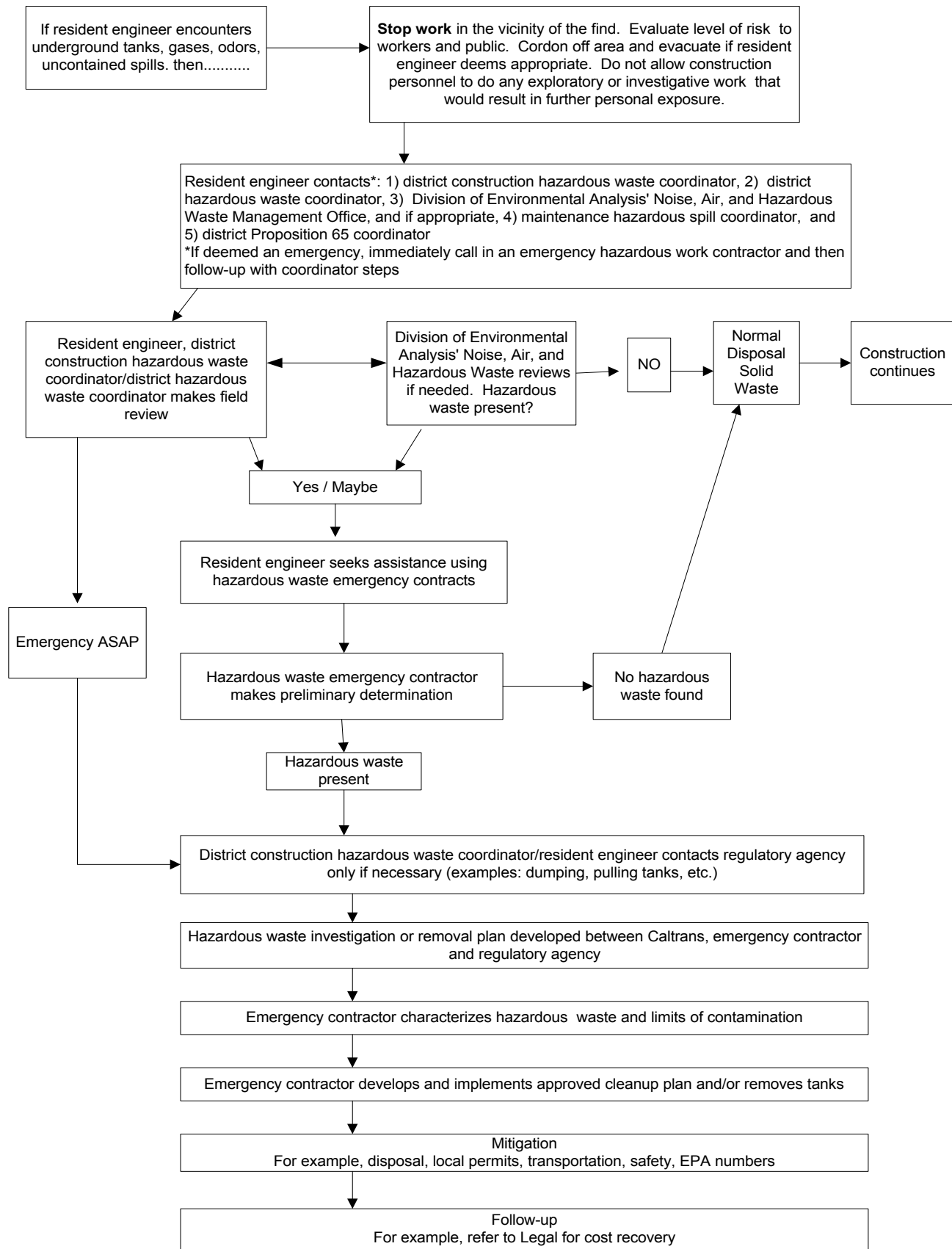
Hazardous Spills

Each district maintenance unit has a maintenance hazardous spill coordinator and other personnel trained in handling highway spills. When an unknown substance is deposited or spilled from a vehicle on a roadway because of a construction project, contact the maintenance hazardous spill coordinator for assistance in containment, identification, and cleanup. For instructions on reporting hazardous highway spills, see Section 2-3, "Major Construction Incidents," of this manual. If the contractor spills hazardous materials, the contractor must comply with applicable laws and regulations as well as cleanup and disposal.

If an unidentified spill is expanding and threatening adjacent sensitive areas, begin containment immediately if it can be done without personal exposure.

Conventional methods for containment include interception with dikes or ditches at sufficient distance downstream to avoid contact with the material. Prevent employees, workers, or the public from being exposed to any unknown spilled material.

Table 7-1.1 Unknown Hazards Procedures



7-108 Certification of Environmental Compliance

7-108 Certification of Environmental Compliance

A Certificate of Environmental Compliance (CEC) is prepared at the end of the project to document the mitigation monitoring and reporting program required under the California Environmental Quality Act for every construction project unless no mitigation measures were identified or undertaken. This requirement is shown in Section 270.50 of the *Guide to Caltrans Capital Work Breakdown Structure*. The basic purpose of the CEC is to certify that the mitigation measures were implemented in accordance with the contract.

The resident engineer is responsible for ensuring that the CEC is prepared and distributed. The CEC lists all mitigation measures for the project and includes a discussion of:

- The effectiveness of the constructed mitigation measures;
- Whether the mitigation measures were met and, if not, what measures were implemented;
- How well the contract specifications satisfied all environmental commitments and concerns; and
- Additional mitigation measures required as a result of project changes along with their outcomes.

If an Environmental Commitment “punch list” was prepared, this list can serve as the basis for the CEC documentation.

The CEC will need to be signed by all responsible parties including the Environmental Generalist, the Project Manager, and the Resident Engineer. If the District has an Environmental/Construction Liaison, then this person should also sign the CEC.

The CEC must be sent to the State Office of Planning and Research (1400 Tenth Street, Sacramento 95814) for review and filing. Copies of the CEC are to be provided to all of the district or regional organizational units responsible for the project including Environmental, Design, Project Management and Construction.

The CEC is to be fully discussed at the project close out meeting as it sets forth the lessons learned on the project and it identifies areas in environmental compliance that may need improvement.

Section 16 Clearing and Grubbing

Section 16 Clearing and Grubbing

4-1601 General

This section covers clearing and grubbing. Clearing and grubbing is usually one of the first work items and is generally paid as a lump sum item or by the hectare. During clearing and grubbing, pay special attention to the preservation of property and environmentally sensitive areas.

4-1601 General

4-1602 Before Work Begins

During this preliminary inspection, take the following steps:

4-1602 Before Work Begins

- Review the plans, special provisions, and right-of-way agreements for details that may require special staking or issuing contract change orders.
- Ensure the approval of the water pollution control plan. Review the plan to ensure clearing and grubbing conforms to the plan.
- Ensure the clear marking of features and facilities that are to be preserved.
- Discuss with the contractor such items as the marking of any special locations, such as environmentally sensitive areas and any additional areas to be cleared. Call the contractor's attention to any environmental commitments Caltrans made or any regulations or permits other agencies require, or both.
- Before disposing of material outside of the highway right-of-way, review any planned disposal sites and refer to Section 7-1.13, "Disposal of Material Outside of Highway Right of Way," of the *Standard Specifications* and Section 3-708 of the *Construction Manual*, to determine the contractor's necessary actions. Unless the disposal site is already available for state use, as per the Caltrans policy regarding "Disposal, Staging and Borrow," (DSB) as discussed in Section 7-103D of the *Construction Manual*, the contractor must obtain and present to the resident engineer any permits, environmental studies, and documentation, among other items, required by agencies having jurisdiction over the site. To ensure mutual understanding and agreement, hold a joint meeting between the resident engineer, contractor, environmental/construction liaison, and these regulatory agencies. If the contractor meets these requirements he should be provided with the required written permission for disposal outside the highway right-of-way.
- Before permitting the contractor to chip plant materials for disposal on the job site, investigate to determine if plant disease or insect pests will be spread to disease-free or insect-free areas. You can obtain technical advice on diseases and insects in cultivated trees from the county agricultural extension offices. For advice about natural forest trees, contact the California Department of Forestry or the U.S. Forest Service. If the decontamination of chips is advisable and the contract does not provide for pest control, ensure this work is done as an ordered change.

**4-1603
During the
Course of Work**

4-1603 During the Course of Work

During the work, take the following steps:

- Ensure the contractor's equipment has the required safety devices to protect personnel. In forest areas, ensure the use of the required spark arresters on equipment.
- Ensure the contractor's operation does not create a public hazard. If necessary, require traffic control during timber falling.
- Periodically observe the operation to ensure the prevention of damage to adjacent property and environmentally sensitive areas and to ensure the preservation of trees and facilities that are to remain. As set forth in permits and agreements, verify the contractor's adherence to environmental commitments and permits. For any deviations and violations, document and require corrective action by the contractor. The resident engineer should consult with the district environmental unit for review and comment.
- Determine the limits of clearing areas that do not require stump removal and check the height of stumps above natural ground.
- Determine if dead, dying, or otherwise unstable trees located in the right-of-way (but outside the clearing limits) constitute a hazard. Any such trees should be removed.
- The contract may state that merchantable timber is the property of other agencies. Check that any timber handling adheres to the agreement with these agencies.
- When burial of debris within the right-of-way is permitted, ensure the debris will not act as a permeable layer, does not block drainage, and will not interfere with maintenance. Also, ensure no material is buried within the roadway prism unless otherwise allowed in the special provisions.
- Ensure that the burial of debris, both on and off the right-of-way, is not aesthetically detrimental and does not create contamination problems. Keep accurate records whenever any solid wastes that might interfere with future work are disposed of by burying the solid wastes adjacent to the roadway. Also, show this information on the as-built plans.
- When burning is permitted, ensure the contractor has obtained a permit from the air pollution control officer of the local or regional authority. Prohibit burning at locations where the smoke will impede visibility for public traffic. Ensure the contractor takes adequate precautions, such as constructing fire trails and posting guards, to prevent the uncontrolled spreading of fires. When poison ivy, oak, or sumac is present in areas where burning is otherwise permitted, ensure the burning of such material complies with any local ordinances or safety regulations.
- Ensure that tree branches extending over the roadway are cut off as specified. During the removal of additional branches, direct the contractor to present a balanced appearance of the trees. Check that the contractor treats as specified any scars resulting from removal.
- A checklist showing locations where clearing is incomplete may be necessary in the final stages of the operation. Complete payment should not be made until all areas have a neat and finished appearance.

4-1604 Measurement and Payment

If the work is not to be completed within one pay period, determine a pay system that provides for periodic payments that represent the true percentage of the work completed.

Some contracts may have a limitation on payment for clearing and grubbing. Refer to section 5 of the special provisions.

4-1604 Measurement and Payment

Section 27 Cement Treated Bases**Section 27
Cement
Treated Bases****4-2701 General**

Cement-treated base (CTB) is composed of a mix of aggregate, portland cement, and water. CTB, specified as either Class A or Class B, is generally used only with asphalt pavements and can be either plant mixed or road mixed. However, plant mixed is most common.

**4-2701
General**

CTB can be spread by three allowable methods. The special provisions will specify the class, mix method, and possibly the spreading method.

4-2702 Before Work Begins**4-2702
Before Work Begins**

Before work begins, take the following steps:

- Hold a preproduction meeting with the contractor and the district materials unit to discuss the contractor's method of operations.
- From the special provisions or plans, determine the class of CTB required and the percent of cement to be added to the aggregate.
- For initial testing, obtain representative samples from the contractor's source of CTB aggregate, and test for the required quality. Compressive strengths of CTB can vary significantly because of variations in aggregate gradation and the type of cement used. The fine aggregate usually has the most variable effect on strength. Advise the contractor that any significant material change, including variations in gradation, must be covered by new tests for quality characteristics. Request strength tests at 5 percent of cement and other percentages above and below 5 percent (usually in 0.5 percent increments). For aggregates of borderline quality, consider making additional initial strength tests at varying gradations (within specifications), using 5 percent cement.
- For sources with reliable information on past performance, consider using such information in lieu of testing. However, a test should always be made at 5 percent for aggregate qualification.
- Based on test results, decide whether the percent of cement specified in the special provisions will produce the design strength in the finished product. When making the decision, consider that, because of production variables, a significant difference can exist between the strength indicated by a cylinder and the actual strength of the finished product. Allowable variations in cement content and compaction requirements are major contributors to differences between design and actual strength. If it is difficult to determine the effect of production variables on final strength, use the following guidelines:
 1. Increase cement content if the seven-day compressive strength of initial samples is less than approximately 6.9 Mpa.
 2. Decrease cement content if the seven-day compressive strength of initial samples at the percent specified is more than approximately 8.6 Mpa.

- Verify that safe and convenient facilities have been provided for sampling cement.
- In accord with the State Contract Act, verify that the material and aggregate source complies with the Surface Mining and Reclamation Act of 1975 (SMARA). 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>. Also, see Section 7-103D to determine if the proposed materials site is exempt from SMARA.
- If the contractor will be batch mixing, examine the mixer before use and call to the contractor's attention any excessively worn or missing paddles.
- Before spreading any CTB materials, ensure that the subgrade complies with specifications and that the grade is free of loose or extraneous material. Record the findings in the daily report, including any instructions to the contractor.
- Determine that the asphaltic emulsion used for curing seal is the material specified, and obtain necessary certificates of compliance and samples.
- Decide on the application rate for the curing seal to be used, and advise the contractor accordingly. Base the determination on an amount that will provide a complete membrane without appreciable thickness. Ensure the application rate conforms to requirements.

4-2703 During the Course of Work

During the work, do the following:

- Before mixing, obtain samples of the aggregate and test them for the specified attributes in accordance with the frequencies shown in Section 6-1, "Sample Types and Frequencies," of the *Construction Manual* (manual).
- To evaluate the compressive strength of Class A CTB, obtain samples during the first day of operation and approximately every fifth day of production thereafter. If these tests reasonably match the anticipated results based on the initial tests, you can reduce the frequency of the tests (unless a change in material is suspected or the material sources were changed).
- To determine compliance with permissible variations in cement content, obtain sufficient samples for California Test 338, "Determination of Cement or Lime Content in Treated Aggregate by the Titration Method." Section 6-1, "Sample Types and Frequencies," of this manual states the frequency should be "as necessary for control." This frequency may vary depending on the efficiency of the contractor's operation and rate of production. At a minimum, assign one inspector full time to run the titration tests while the operation is in full-time production. At the start of operations or when problems persist, more effort may be required.
- Determine whether compaction requirements are being met. It is Caltrans' policy to measure compaction separately for each lift whenever this separate measurement is physically possible.

4-2703A Road-Mixed CTB

For road-mixed CTB used during the course of work, do the following:

- If you think the quantity being placed obviously is not sufficient to complete the required structural section thickness, advise the contractor. Record any conversation in your daily report.



- Ensure the mixer introduces water by approved methods. To keep the resulting mixture uniformly moist, the mixer should be able to accurately vary the water rate. Advise the contractor to correct leaks or excessive water applications.
- Observe the mixing operation to ensure the uniform distribution of cement and water. When the mixer has a bottom shell or pan to pick up the material and separate it from the mixing table, ensure the shell or pan picks up all the material and doesn't cut into the subgrade.
- Ensure the cement is spread by mechanical equipment that can be calibrated to uniformly distribute the cement in the correct amount. Placing cement by hand methods, such as by sacks, is unacceptable.
- Take sufficient moisture tests to ensure the completed mixture's moisture content does not fall below one percentage point from optimum.
- For multilayer construction, ensure the contractor mixes and compacts each layer separately.

4-2703B Plant-Mixed CTB

For plant-mixed CTB used during the work, do the following:

- To calibrate and check the accuracy of weighing and metering devices, request assistance from the district weights and measures coordinator.
- Ensure the contractor is adding water by a method that permits the amount or rate to be verified. Obtain sufficient moisture tests to ensure the completed mixture's moisture content does not fall below one percentage point from optimum.
- To detect any obvious faults, observe the mixing operation and the mixture. Time the mixing operation to ensure it takes longer than 30 seconds. If observations or tests indicate poor cement distribution, require a longer mixing cycle.

4-2703C Depositing and Spreading CTB

During the depositing and spreading of CTB, do the following:

- Ensure the contractor uses the specified type of spreading operation.
- Generally, if loads are hauled in hot weather and if the haul takes more than 30 minutes, require covers on hauling units.
- Spreading can be a separate operation from depositing or it can be combined in a single operation with depositing. If spreading is a separate operation, ensure the contractor complies with the requirements for uniform placement.
- If you think the quantity being placed is insufficient to construct the required structural section thickness, advise the contractor. Record any conversation in the daily report.
- Immediately before placing CTB, ensure the underlying material is moist but not excessively wet.
- Observe whether significant segregation is occurring. If problems persist, perform additional tests to document the problem.
- Observe the surface condition of any lower layer of CTB. Ensure the contractor complies with moisture requirements for lower layers. Keep separate records for any curing seal placed on lower layers.

- Ensure the contractor uses satisfactory methods to place CTB in areas inaccessible to mechanical spreading equipment. The end product must be homogeneous, placed to the required thickness, and properly compacted.
- Ensure the contractor complies with temperature requirements for spreading CTB.

4-2703D Compacting CTB

During the compacting of CTB, do the following:

- Measure the operation's total time interval to ensure it conforms to Section 27-1.08, "Operation Time Requirements," of the *Standard Specifications*.
- To ensure compliance with compaction requirements, test each layer of multilayer construction.
- After the initial rolling, ensure the finished surface is within the specified tolerance. Require the contractor to trim high spots and to meet the requirements for filling low areas. Prohibit the contractor from filling low areas with loose material from the trimming operation.
- Ensure the equipment used for final compaction repairs any surface areas that the trimming has torn or segregated.
- To ensure compliance with the specified tolerance, measure the finished surface with a straightedge.

4-2704 Measurement and Payment

For measurement and payment, do the following:

- Use contract change orders to cover ordered changes in the cement content.
- Do not pay as CTB any excess material used at other locations.
- When CTB is paid for by the tonne, refer to the discussion of weighing and metering procedures in Section 3-9, "Measurement and Payment," of this manual. Make any appropriate deductions for excess moisture.
- When CTB is to be paid for by the cubic meter, obtain quantity calculations from the project engineer to determine if they are sufficiently detailed and accurate to be used in the project records. Make appropriate deductions for any lack of compliance with thickness specifications.
- For more information about measuring curing seal, refer to Section 4-94, "Asphaltic Emulsions," of this manual.

Section 28 Lean Concrete Base

Section 28 Lean Concrete Base

4-2801 General

4-2801 General

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

4-2802 Before Work Begins

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. In accord with the State Contract Act, check to ensure the aggregate’s source site is permitted and complies with the Surface Mining and Reclamation Act of 1975 (SMARA). 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>. Also, see Section 7-103D to determine if the proposed materials site is exempt from SMARA.
 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

4-2803 During the Course of Work

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

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.

4-2804

Measurement and Payment

Section 37 Bituminous Seals**Section 37
Bituminous Seals****4-3701 General****4-3701
General**

Section 37, “Bituminous Seals,” of the *Standard Specifications* covers seal coats and slurry seals.

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

Slurry seal is a mixture of graded fine aggregate, asphaltic emulsion, water, and set-control additives.

In addition to the bituminous seals provided for in the *Standard Specifications*, the special provisions may provide for hot-applied seal coat (polymer-modified asphalt), asphalt-rubber seal coat, parking lot seal coat, or asphalt rejuvenating agent. This section will discuss the duties of resident engineers and assistant resident engineers regarding seal coats and slurry seals.

For the most part, bituminous seals are 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.

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, the requirements for aggregates, and any special details. Special details may include local agency requirements with regard to air quality and other environmental restrictions. Decide whether any conditions have changed from those upon which the design engineer based the requirements, and make any necessary changes.
- Verify the receipt and proper distribution of Form CEM-3101, “Notice of Materials to Be Used,” which lists seal coat materials.
- In accord with the State Contract Act, ensure the aggregate comes from a permitted source site that complies with the Surface Mining and Reclamation Act of 1975 (SMARA). 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>. Also, see Section 7-103D to determine if the proposed materials site is exempt from SMARA.
- Obtain initial samples of screenings and test them for all of the specified attributes. Advise the contractor of the test results, with particular reference to any deficiencies that must be corrected.

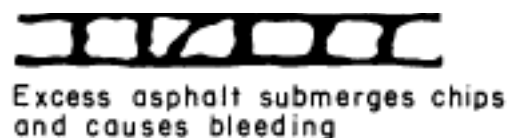
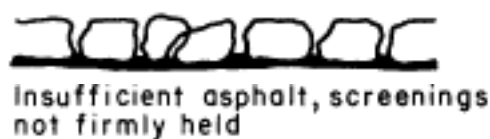
- Examine the surface to be sealed. Prepare a contract change order to provide for any necessary corrective action, such as sealing cracks and repairing failed areas. At this stage, a joint review with the maintenance region manager or area superintendent would be helpful.
- Review the project to ascertain 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 judgement 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 minimums specified.
- Be prepared to receive the latest weather reports, 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 weather conditions applies to both fog seals and chip seals. Prepare a contract 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 the *Construction Manual* (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 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, if volumetric measurements are to be used to determine pay quantities, on source documents.
- 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 meters. 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 the 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, and 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 relationship between the quantity of asphalt required to the size of the cover material.



- If the chip spreader is moving excessively fast, chips will roll over as they come in 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 performs the rolling in the specified order and for the required number of coverages. Also, ensure the contractor does not spread the binder and screenings more than 760 m ahead of the completion of the initial rolling.
- 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.
- Decide on the amount of water to be sprinkled on a fog seal that becomes tacky, and advise the contractor accordingly.
- 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.

4-3703 Slurry Seal

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

4-3703 Slurry Seal

4-3703A Before Work Begins

Before work begins, take the following steps:

- Verify the receipt and proper distribution of Form CEM-3101, “Notice of Materials to Be Used,” which lists slurry seal materials.
- Receive and review the mix design and laboratory tests from the contractor. After determining that the design and test results conform to the requirements in Section 37-2.03, “Mix Design,” of the *Standard Specifications*, approve the mix design in a timely manner. Determine the percentage of asphalt binder to be used and notify the contractor.
- In accord with the State Contract Act, ensure the aggregate comes from a permitted site that complies with the Surface Mining and Reclamation Act of 1975 (SMARA). 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>. Also, see Section 7-103D to determine if the proposed materials site is exempt from SMARA.
- Obtain initial samples of the aggregate, and test the samples for the specified attributes. Advise the contractor of the test results.
- Examine the surface to be sealed. Prepare a contract 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 California Test 109, “Test for Weighing and Measuring Devices.” 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 amount of material represented, 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 37-2.04, "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.

Supplemental Materials Site

Agreement (2)

Contract No. _____

District _____

Date _____

TO: _____

District Director, District _____
_____, California

Dear _____,

In accordance with Section 6.2, "Local Materials," of the *Standard Specifications*, here is the agreement for using the materials source for subject Contract, as required before removal of said materials:

WHEREAS, Contractor has entered into Contract No. _____ with the State of California, Department of Transportation, hereinafter called "Department," for the performance of _____ work on road _____, and

WHEREAS, pursuant to the authority of said Contract, _____, Contractor and _____, Owner, have entered into an agreement under which Contractor may obtain materials from Owner's property.

NOW THEREFORE, pursuant to said Contract No. _____, Contractor and Owner hereby notify Department that materials obtained by Contractor from Owner's property will be obtained pursuant to agreement between Contractor and Owner and not pursuant to the arrangement between Department and Owner, dated _____, 19____, and Owner specifically agrees that the Department is hereby released from any and all obligations to Owner under Department's said arrangement with Owner.

DATE _____

Owner

DATE _____

Contractor

By _____

Title _____

Authorized Agent

Origin. -Dist. Director

Dupl. -Contr.

Trip. -Prop. Owner

Quad. -Res. Engr.

When the contractor makes new agreements with property owners, revising the terms of the state-owner agreement, the new agreements supersedes Caltrans' agreement. The resident engineer must review these agreements to ensure that the state is relieved of its obligations under the terms of the original agreement.

The resident engineer must determine whether royalties should be deducted from payments to the contractor. Normally, under agreement (1) above, Caltrans will pay the owner of the materials site, and therefore, deductions must be made from estimates. In the case of county-consummated agreements, royalties usually are deducted in a similar way.

3-607A Compliance with Materials or Disposal Agreements

Designated sites may be made available for contractors use under Caltrans "Disposal, Staging and Borrow" (DSB) policy discussed in Section 7-103D. If designated sites are not available, the contractor must obtain and present to the resident engineer all documentation required by agencies having jurisdiction over the site. This required documentation may include permits, environmental studies, or other information. Ensure the arrangement of a joint meeting of the resident engineer, the contractor and other agencies that have an interest in clearing.

The specifications for both material sources and disposal sites state the resident engineer may require the contractor to submit written evidence that the owner is satisfied that the contractor has satisfactorily complied with the provisions of either agreement (1) or (2). The resident engineer must determine, preferably through written evidence, whether or not the owner is satisfied.

If the owner is not satisfied, the district must determine what additional work is necessary before recommending acceptance of the contract. The district must also advise the contractor accordingly. The district must not delay recommending acceptance if the resident engineer determines the contractor has complied with the terms of the agreement.

3-607B Public Interest Determination

Whenever local materials will be removed from mandatory sources, the resident engineer must write a public interest determination if the project includes federal financing. Mandatory sources include sources within state right-of-ways but outside the project's limits. Normally, the resident engineer makes the determination before advertising. The purpose of a public interest determination is to establish clearly that a mandatory material source will serve the public interest, versus simply public or private property.

Certain designated sites do not require preparation of a public interest determination if they meet all of the following criteria:

- the designated site was identified and included in the project's environmental studies and documents during project development;
- the site was identified as and included in the materials handout during the bidding as a designated site;
- agreements for use of the site were negotiated with the site's owner.

Occasionally it becomes necessary to obtain additional embankment material from outside the local area even though the contract does not contain a clause allowing the contractor to import non-local material. Thus, the contract does not have an item for "imported borrow." Under these circumstances, it is normal practice for Caltrans to locate a source for this material.

In accord with the State Contract Act, aggregate sources must comply with the Surface Mining and Reclamation Act of 1975 (SMARA). Refer to Chapter 7, “Environmental,” of this manual for further information on SMARA requirements.

If the contract change order directs the contractor to obtain material from Caltrans’ chosen source, the Federal Highway Administration (FHWA) considers the source mandatory. The FHWA then requires written approval of a public interest determination before approval of the contract change order.

At a minimum, the public interest determination, written by the resident engineer, must include the following:

- The reason the chosen source is the most economical. If the determination is not based on economy, other reasons such as public safety or convenience must be included.
- The alternatives considered.
- The effect on the value of the material site.

All such sites are subject to compliance with SMARA. Mining operations determined to be in compliance are listed on the AB 3098 SMARA Eligible List. This list can be obtained from the Division of Construction or at the Department of Conservation’s web site at <http://www.consrv.ca.gov/omr/SMARA/3098-list>. Also, see Section 7-103D to determine if the proposed materials site is exempt from SMARA.

The FHWA must then approve the resident engineer’s determination. One method of submitting a public interest determination for approval is to include the required statements on Form CEM-4903, “CCO Memorandum.” The Division of Construction will pursue approval of the public interest determination before approval of the contract change order. To expedite approval of the contract change order, the resident engineer should, whenever possible, send the public interest determination to the Division of Construction before submission of the contract change order.

The above requirements do not apply to “local borrow,” as defined in Section 19-7, “Borrow Excavation,” of the *Standard Specifications*.

3-607C Disposal of Material

Section 7-1.13, “Disposal of Material Outside the Highway Right of Way,” of the *Standard Specifications*, and Section 7-103D, “Environmental Rules and Requirements,” of this manual, cover the requirements for the contractor’s disposal of materials (unless modified by special provisions). When required to execute documents related to disposal sites, the contractor should use agreements similar to those shown earlier in this section for material sites, with the wording modified to indicate disposal sites instead.

3-608 Testing

The *Standard Specifications* contain references to the standards and tests of the American Association of State Highway and Transportation Officials (AASHTO) and the American Society for Testing and Materials (ASTM). These standards and tests may, or may not, be readily available to the resident engineer. Note any references to these tests well in advance of need, and obtain any necessary copies of them from the district materials engineer. It is not practical to supply each resident engineer with complete AASHTO and ASTM standard test procedures.

Whenever samples are taken from materials sites, the resident engineer must ensure the samples are representative of material being used. Degradation and segregation may occur in aggregates between the processing operation and their incorporation

3-608 Testing

in the work. The resident engineer cannot assume that material satisfactorily tested at the source or at the processing plant is still satisfactory at the job site. To ensure specification compliance, test at the frequencies shown in the specifications as the material is being incorporated into the work.

3-608A Operating Range and Contract Compliance

Section 25, “Aggregate Subbases,” Section 26, “Aggregate Bases,” Section 27, “Cement-treated Bases,” Section 28, “Lean Concrete Base,” Section 39, “Asphalt Concrete,” and Section 90, “Portland Cement Concrete,” of the *Standard Specifications*, all contain provisions for an acceptable range of test results and unacceptable results for aggregate gradation tests. If a test result fails to meet the requirements of the operating range but meets contract compliance, the contractor usually needs to make some change in operations to ensure subsequent test results meet the “Operating Range” requirements. The resident engineer should document the contractor’s actions and any off-site testing done before the next day’s work.

If a test result fails to meet the specified value for contract compliance, the result should be treated just like any other failing test result. However, if the contractor writes a request, the resident engineer may consider leaving the material in place and applying the specified deduction, if the specifications allow. The contractor’s written request, along with documentation for reasons for leaving the material in place and the contractor’s actions, is sufficient for the contract records. A contract change order accepting out-of-specification material is not required in this case because the specifications provide the procedure for acceptance.

The resident engineer must inform the contractor promptly of test results that indicate unacceptable or borderline work. The contractor must be advised that all test results are available for the contractor’s inspection. Accordingly, test results must remain in the project files for ready accessibility.

3-609 Testing by Contractor

The contractor must be satisfied at all times that the quality of materials entering the work and the work performed, regardless of who supplies the materials or performs the work, will meet the contract requirements. For acceptance of materials or work, resident engineers must not use as documentation any tests the contractor performs to control the work. Perform and record acceptance tests as required by Section 6-1, “Sample Types and Frequencies,” of this manual.

3-707B Railroad Insurance

State highway construction occasionally requires that a contractor's operations be performed on or near a railroad's operating properties. This proximity varies from minor side encroachments to work involving the direct crossing of a railroad's tracks. Section 13, "Railroad Relations and Insurance Requirements," of the special provisions defines the relationships between Caltrans, the contractor, and the railroad.

When work must be performed on or near a railroad's operating properties, the contractor must provide insurance to ensure the financial ability to meet legal liability for damage, and to cover the losses that a railroad might sustain because of the contractor's operations.

Although contract specifications regarding railroad insurance have been standardized, occasional changes occur because of special situations. Requirements for railroad protective liability insurance vary depending on the railroad company involved. In Section 13 of the special provisions, the Engineering Services, Railroad Agreements Branch will normally issue special instructions for irregular situations.

3-707B (1) Insurance Approvals

Deliver all railroad insurance policies and copies provided to cover the prime contractor in accordance with Section 13 of the special provisions. Allow a minimum of four weeks for the railroad's notice of approval of the insurance. In cases of emergencies, you can obtain verbal release and authority to start work after the railroad has received all the documents.

3-707B (2) Responsibility

The resident engineer must ensure the specified insurance is in force at all times when work is being performed that requires such insurance.

Prohibit work that involves encroachment on railroad property, either by a prime contractor or a subcontractor, until the following conditions have been met:

- The railroad or the Engineering Services, Railroad Agreements Branch, has advised the resident engineer that the contractor, subcontractor, or both, have furnished the specified insurance.
- The resident engineer has a copy of the certificate of insurance.

3-707B (3) Insurance Renewal

Approximately four weeks before the expiration date of an insurance certificate furnished by either a contractor or subcontractor, the resident engineer must notify the contractor, by letter, of the expiration date. If work is to continue on railroad property, request the contractor to obtain renewal insurance. At that time, determine whether work on the railroad property has been completed.

Renewals may be accomplished by endorsing the extension of existing certificates or by issuing new certificates.

Allow sufficient time for railroad approval after the submission of a new railroad protective policy.

**3-708
Disposal of Material
Outside the Highway
Right-of-Way**

3-708 Disposal of Material Outside the Highway Right-of-Way

Until the contractor has met all the requirements in Section 7-1.13, “Disposal of Material Outside the Highway Right of Way,” of the *Standard Specifications* and Section 7-103D of the *Construction Manual*, the resident engineer must not allow the contractor to dispose of material outside the right-of-way. When all other conditions have been met, the resident engineer must give the contractor written permission for disposal sites not covered by an agreement between the owner and Caltrans.

In the case of disposal of material on a property outside the highway right-of-way that is covered by an agreement between the property owner and Caltrans, the resident engineer must prepare the specified document to be executed by the contractor. Use agreements similar to those shown in Section 3-607, “Local Materials,” of this manual, with wording modified to indicate disposal sites.

Approval of the disposal of materials outside the highway right-of-way guards against disposal that would harm the highway or cause environmental damage, disposal site damage, or unsightliness.

**3-709
Relief From
Maintenance and
Responsibility**

3-709 Relief From Maintenance and Responsibility

Under conditions specified in Section 7-1.15, “Relief From Maintenance and Responsibility,” of the *Standard Specifications*, the contractor may be relieved from maintaining and protecting certain completed portions or sections of the work.

Caltrans policy recommends relief only for those portions of the work specifically mentioned in the specifications unless exceptions are fully justified in the request for relief.

For completed roadways, the specified length of 0.5 km is the minimum practical length of completed main roadway upon which a recommendation can be made for relief from maintenance and responsibility. However, shorter units of completed work, such as on-ramps, off-ramps, frontage roads, or approaches to undercrossings and overcrossings, may also be eligible for relief from maintenance and responsibility. Do not recommend relief from maintenance and responsibility on 0.5 km sections that contain exceptions within that length unless you provide a valid reason presented with and supporting the recommendation.

Exceptions, if any, must be defined by longitudinal sections of highway or certain specified areas. For example, it is unacceptable to recommend relief from maintenance for a total project except for the inlet ditch to the right of stations 20 to 25. It is acceptable to recommend relief for the total project except for stations 15 to 27 (the section of highway that could be affected by the uncompleted ditch to the right of stations 20 to 25).

The following describes what constitutes a “bridge or other structure of major importance”:

- For purposes of relief from maintenance and responsibility, a bridge is as defined in Section 1, “Definitions and Terms,” of the *Standard Specifications*. A structure will be considered a bridge if it is so identified in the plans or other portions of the contract.
- Other structures that are to be considered of major importance are culverts in excess of 2000 mm in diameter or of approximate equivalent area.

Section 40 Portland Cement Concrete Pavement

Section 40 Portland Cement Concrete Pavement

4-4001 General

4-4001 General

This section covers portland cement concrete pavement. A concrete paving operation includes the following:

- The production of the portland cement concrete
- The placing, finishing, and curing of the concrete pavement
- The concrete pavement subgrade
- The specified equipment
- The construction of joints
- The protection of the pavement

Plant inspection specialists and acceptance testers not directly assigned to the resident engineer usually perform inspection and testing duties at the concrete batch plant. However, in addition to on-site inspection, mix design and plant inspection are part of the resident engineer's responsibility. Good communication is essential between plant and inspection specialists and assistant resident engineers. The resident engineer must be kept informed of test results in a timely manner.

This section will mostly cover on-site inspection duties. For information on producing and transporting portland cement concrete, see Section 4-90, "Portland Cement Concrete," of the *Construction Manual* (manual).

4-4002 Before Work Begins

4-4002 Before work begins

Before work begins, do the following:

- Review the plans and specifications to determine the requirements for portland cement concrete pavement, including thickness requirements, joint and tie bar details, and cement content requirements.
- Verify the receipt and proper distribution of Form CEM-3101, "Notice of Materials to Be Used," which lists materials for portland cement concrete pavement.
- In accord with the State Contract Act, check to ensure the aggregate source is a permitted site in compliance with the Surface Mining and Reclamation Act of 1975 (SMARA). 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>. Also, see Section 7-103D to determine if the proposed materials site is exempt from SMARA.

- The specified cement content is based on the best information available to the project design engineer. The procedure to determine the actual cement content that will be used is as follows:
 1. To determine whether the cement content for the pavement is being reviewed, contact the Office of Materials Engineering and Testing Services (METS) at least 70 days before paving begins. The resident engineer must ensure the process has started. The district materials engineer may be a good initial contact.
 2. METS may perform the required testing to determine cement content or may establish cement content based on previous testing of aggregates from the same source. If METS has received Form CEM 3101, "Notice of Materials to Be Used," action will probably have been initiated to determine the cement content. If METS needs samples of aggregate for testing, the resident engineer will be advised. Either district materials laboratory personnel or project personnel may obtain the samples.
 3. The resident engineer will be advised of the recommended cement content. If the recommended cement content and the specified cement content are different, prepare a contract change order to provide an adjustment in compensation in accordance with Section 40-1.015, "Cement Content," of the *Standard Specifications*.
- Obtain initial samples and design the mix as covered in Section 4-90, "Portland Cement Concrete," of this manual. For assistance with the mix design process when needed, contact the district materials engineer or responsible unit.
- Well before paving begins, contact the district materials engineer to make arrangements for measuring pavement thickness. Personnel from the district materials laboratory or METS may take core samples for thickness measurements or you may need to initiate a service contract for taking core samples.
- Decide whether crossings will be necessary for the convenience of public traffic and whether Type III portland cement should be used for such crossings. Advise the contractor accordingly.
- Examine the equipment or tools to be used. When obvious inadequacies exist, advise the contractor and enter the details in the daily report. More specifically, do the following in examining equipment or tools:
 1. For side-form construction:
 - a. Examine the forms to ensure the specified attributes, including those for composition, weight, dimensions, and rigidity. Ensure the forms are cleaned and oiled before each use.
 - b. Ensure that installation of the forms complies with the specifications. Order any necessary corrective work before the placement of concrete.
 - c. Inspect the paving equipment for specification compliance.
 2. For slip-form construction, examine the paver for the specified attributes. Require the specified demonstration of satisfactory operation and note such activity in the daily report.

Section 90 Portland Cement Concrete

Section 90 Portland Cement Concrete

4-9001 General

This section covers portland cement concrete. The *Standard Specifications* designates concrete with the following descriptions:

- Class
- Cement content
- Compressive strength
- Minor concrete

This section does not cover specialty concrete such as polyester concrete and fast-setting hydraulic cement concrete. The resident engineer should contact the Division of Construction, the Office of Materials Engineering and Testing Services (METS), and the district materials engineer for guidance on specialty concrete.

For a complete discussion on various items using concrete, refer to Section 40, “Portland Cement Concrete Pavement,” Section 50, “Prestressing Concrete,” Section 51, “Concrete Structures,” Section 72, “Slope Protection,” and Section 73, “Concrete Curbs and Sidewalks,” among other sections of the *Standard Specifications*. Also refer to the corresponding Section 4-40, Section 4-51, Section 4-72, and Section 4-73 of the *Construction Manual* (manual). You can also obtain additional information on portland cement concrete from the Office of Structure Construction’s *Concrete Technology Manual* and the *Bridge Construction Records and Procedures Manual*.

4-9002 Before Work Begins

The *Standard Specifications* requires the contractor to determine the mix proportions for all concrete except for pavement concrete. To determine the various types of concrete that will be required, review the contract provisions. Pay particular attention to concrete designations such as “class,” “cement content,” “compressive strength,” or “minor concrete.” Also, note the type of cement to be used and any special requirements for the aggregate and use of admixtures. Make a list of the various mix designs the contractor will need to submit and a note of the concrete that needs to be prequalified before use. For your review, encourage the contractor to submit the mix designs early in the project.

Review the mix designs for compliance with the special provisions, *Standard Specifications*, and contract plans, or forward the mix designs to the district materials unit for review. Before the contractor places any concrete, the district materials unit will need an approved copy of the mix design for unit’s plant inspectors. If the concrete is designated by compressive strength, obtain certified test data or trial batch test results in advance of the concrete’s use to avoid delays. Review the data and results for contract compliance.

4-9001 General

4-9002 Before Work Begins

Review the current certifications of Caltrans field staff who will perform the acceptance testing of the concrete. Staff must be certified in the following:

- California Test 125, “Sampling Highway Materials and Products Used in the Roadway Structural Section”
- California Test 518, “Unit Weight of Fresh Concrete”
- California Test 523, “Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)”
- California Test 533, “Test for Ball Penetration in Fresh Portland Cement Concrete”
- California Test 540, “Making, Handling, and Storing Concrete Compressive Test Specimens in the Field”
- American Society for Testing and Materials (ASTM) C172, “Standard Practice for Sampling Freshly Mixed Concrete”

4-9002A Materials

Before work begins, do the following for materials:

- Verify the receipt and proper distribution of Form CEM-3101, “Notice of Materials to Be Used,” which lists concrete materials such as cement, fly ash, and aggregate.
- Cement is normally accepted on the basis of a Certificate of Compliance; therefore, initial samples are not taken. If special requirements exist for the cement or if it is obtained from an unusual source, consider initial testing. For more details about cement sampling and testing, see Chapter 6, “Sampling and Testing,” of this manual.
- In accord with the State Contract Act, verify that the aggregate source complies with the Surface Mining and Reclamation Act of 1975 (SMARA). Mining operations determined to be in compliance are listed on the AB 3098 SMARA Eligible List. This list can be obtained from the Division of Construction or at the Department of Conservation’s web site at <http://www.consrv.ca.gov/omr/SMARA/3098-list>. Also, see Section 7-103D to determine if the proposed materials site is exempt from SMARA.
- Verify with the district materials unit that current tests have been performed on aggregates as listed in Section 6-1, “Sample Types and Frequencies,” of this manual.
- You may omit initial sampling and testing if the specified aggregate is currently being used on another Caltrans contract with acceptable testing results. In the daily report, record any reasons for not taking initial samples.
- If current tests have not been performed, obtain initial samples of aggregate to be used and have them tested for all specified attributes. For reference, see the table in Section 6-1 of this manual. You can prevent unnecessary expense and delay if you send samples that can be made to conform to the specification grading. Indicate whether oversized material will be crushed or if any special blends are contemplated.

4-9002B Aggregate Gradings

From the contractor, obtain in writing the primary aggregate nominal sizes to be furnished. The Office of Structure Construction's *Concrete Technology Manual* has examples on how to check the contractor's proposed gradings. In addition, the Office of Structure Construction's web site has a spreadsheet available to assist in this review. When the requirement for furnishing the proposed gradation is unnecessary for the type or amount of concrete work, advise the contractor and note such a decision in the daily report.

4-9002C Admixtures

Before work begins, do the following for admixtures:

- Admixtures must be of a type allowed by the *Standard Specifications* or special provisions. In addition, they must be on the approved list of admixtures maintained by METS. You can access this list through the Engineering Service Center web site at:
http://www.dot.ca.gov/hq/esc/approved_products_list/AdmixList.html
Admixtures do not require initial tests if they are currently approved and a Certificate of Compliance is furnished.
- If you choose to test admixtures before using them, obtain samples of liquid admixtures and place them in clean liter cans or plastic bottles. Sample powdered admixtures in dry form (not after mixing with water on the job). Friction top cans or plastic bags similar to those used to sample cement are satisfactory.
- Send a completed Form TL-0101, "Sample Identification Card," with the sample. Include the manufacturer's lot number represented by the sample and the name of the product, including any prefix or suffix. Also, show the class of work for which the sample will be used, such as concrete pavement or prestressed concrete. The laboratory needs this information to determine the suitability and amount of admixture for use. For sampling admixtures, refer to California Test 125, "Sampling Highway Materials and Products Used in the Roadway Structural Sections."
- Air-entraining agents need not be sampled initially if the contractor presents evidence that the product meets specifications.
- Even when a contract specifically allows or requires admixtures, determine the rate of such use through consultation with METS for each specific product other than air-entraining agents.
- Section 100, "Concrete Materials and Mixing," of the *Bridge Construction Records and Procedures Manual* contains detailed information under Memo 100-4.0, "Admixtures for Portland Cement Concrete." Before making a final decision on the use of admixtures, review this data.

4-9002D Proportioning

The following is primarily a guide for the Caltrans plant inspector, but anyone who needs to verify that plant operations are contract compliant can also use this guide:

- Ensure that storage is as specified in the aggregate storage areas. When various sizes are to be stored separately, require physical separation, either by space between stockpiles or some type of wall that will provide positive separation. Pay particular attention to the method used to prevent contamination of the aggregate. In general, a hard surface, as specified in Section 90-5.01, "Storage of Aggregates," of the *Standard Specifications*, is required for storage of the aggregate stockpile.

- Determine whether the stockpiled aggregate is similar to material upon which the design was based.
- As a part of California Test 109, “Test for Weighing and Measuring Devices,” the district weights and measures coordinator will have completed a safety inspection of the plant facilities frequented by the Caltrans plant inspector for the plant in question. Review the sampling facilities to ensure they will deliver a sample in a safe manner that accurately represents the material. For sampling requirements, refer to California Test 125, “Sampling Highway Materials and Products Used in the Roadway Structural Sections.”
- Before use for Caltrans projects, the plant scales and meters must have a current Form CEM-4204, “California Test 109 Sticker.” The district weights and measures coordinator administers this test. Examine the plant to determine whether weighing equipment matches the testing results. Ensure that scales and meters have been sealed or tested as required. Request from the district weights and measures coordinator the material plant approval report. For additional details, see Section 3-903E, “Weighing and Metering Procedures,” of this manual.

The county sealer of weights and measures tests and seals weighing and metering devices at commercial plants. During the sealing of these plants, the county sealer does not test the interlocks. Therefore, even though the county sealer has sealed the scales and meters, the interlocks must be tested and approved as for noncommercial plants in accordance with California Test 109, “Test for Weighing and Measuring Devices.”

- Ensure that cement can be kept separate from the aggregate until discharged into the mixer.
- Ensure the plant or mixer has the specified automatic timing device. When automatic batching is used, the timing device must be interlocked with the mixer discharge mechanism as specified.
- Examine mixers to ensure that blades are not worn beyond specified tolerances. See that mixers are free of accumulations of hard concrete or mortar.
- Ensure truck mixers have the required metal plates containing the specified information. Also, check truck mixers to ensure they have the specified revolution counters.
- Ensure the contractor will not use equipment with aluminum or magnesium components if these components will contact plastic concrete.
- In addition to the above, check the following when the concrete to be produced is for portland cement concrete pavement:
 1. If specified, ensure the plant has a moisture meter. Be aware that any moisture determination is calculated “as a percent of the dry aggregate.” Commonly used moisture meters measure the total moisture in the material being tested. However, specifications for moisture content in the fine aggregate and batch proportion calculations are based on the free moisture rather than the total moisture content. Therefore, ensure the moisture meter is calibrated for the absorption of the aggregate upon which it is to be used.
 2. Ensure the system contains the specified proportioning interlocks. Determine whether the proportioning system is capable of full automatic operation.
 3. Determine whether the equipment is capable of accepting changes in proportions or sequence of weighing individual sizes without delay.

4-9002E Curing Concrete

Review the various methods of curing concrete contained in Section 90-7, “Curing Concrete,” in the *Standard Specifications*, and discuss with the contractor the proposed methods. Before concrete work begins, ensure the contractor has the required curing materials on-site. Such materials include rugs, a water supply, or a properly inspected curing compound.

The curing compound must be of the type specified by the special provisions, *Standard Specifications*, or both. Before the compound’s use, ensure METS inspects and releases the curing compound. If more than one year has passed since the METS inspection, ensure that before use the curing compound is sampled and tested again.

4-9002F Compressive Strength

When concrete is designated by compressive strength, the contractor must prequalify the concrete before its use as a compressive strength concrete. For additional details, see both Section 6-305D (2), “Trial Batches,” of this manual and also the *Bridge Construction Records and Procedures Manual*.

4-9002G Minor Concrete

When minor concrete is to be used, obtain from the contractor the proposed combined aggregate grading. In general, for minor concrete, you may approve any gradation that produces concrete that meets all other specified qualities.

4-9002H Design of Mix

Concrete mixes should be designed with proportions that will produce concrete with the following qualities:

- The stiffest consistency (lowest penetration) that can be placed efficiently
- Adequate mortar content to provide the required finish
- The lowest water demand consistent with the aggregate specified

4-9002H (1) Selecting Proportions

The following are guidelines to design a workable mix of concrete:

4-9002H (1a) Cement Content

For concrete designated by class, the cement content is fixed, and the design must be based on the specified amount. For concrete designated by cement content, determine whether the amount of cement applies to the source the contractor selected, and base the design on a cement content that will produce the quality the designer anticipated. For more details about concrete used for pavement, see Section 4-40, “Portland Cement Concrete Pavement,” of this manual.

4-9002H (1b) Water Content

The quantity of water per unit of concrete required to produce a mix of the desired consistency is influenced by the maximum size, particle shape, and grading of the aggregate and by the admixtures used. The quantity of water remains relatively unaffected by the quantity of cement.

The quantities of water shown in the Table 4-90.1, “Estimate of Free Water Content for Initial Design” should apply with sufficient accuracy for preliminary estimates or proportions. The values are near the maximal, which should be expected for fairly well shaped but angular aggregate graded within the limits

of the specification. Without specific knowledge to the contrary for the materials being considered, use the data in the table to determine the free water content of the initial mix designs.

The following table shows estimated free water content for different ranges of consistency (penetration) and maximum aggregate size. The free water content for crushed aggregate can be estimated at the upper limit of the listed water contents and rounded aggregates can be estimated at the lower limit of free water content. Additional cementitious material must be ordered, if the free water content exceeds the amount specified in Section 90-6.06 of the *Standard Specifications*. Notify the contractor of any ordered increase in the cementitious material. If the contractor elects to use a water-reducing agent, ensure that the proposed admixture is on METS' list of approved brands. Testing of the mix design must include the proposed admixtures to ensure that the desired concrete properties, such as strength, and air content are attained.

Table 4-90.1 Estimate of Free Water Content for Initial Design

Penetration (mm)	Free Water, (kg/m ³)		
	Max. Size Aggregate 25 mm	Max. Size Aggregate 37.5 mm	Max. Size Aggregate 63 mm
12.5 mm to 25 mm 37 mm to 50 mm 75 mm to 90 mm	180 to 190 190 to 200 210 to 220	160 to 170 170 to 185 185 to 195	140 to 155 160 to 170 165 to 180
Approximate amount of entrapped air in nonair-entrained concrete, percent	2	1	0.4

If the contractor elects to use a water-reducing agent, the admixture must be tested to ensure that it meets the criteria specified for drying shrinkage and strength. See Section 4-9002C, "Admixtures," earlier in this section.

4-9002H (1c) Combined Grading of Aggregate

In considering the use of 37.5 mm maximum size aggregate, the recommended procedure in selecting the fine aggregate content is to start with the median value of the percent passing the 4.75 mm sieve (38 percent) and then adjust this value in accordance with the following criteria:

If the fine aggregate is close to the fine side of the specification limits for the various sieve sizes, use two percentage points less fine aggregate in the mix.

If the fine aggregate is close to the coarse side of the specification limits for the various sieve sizes, use two percentage points more fine aggregate in the mix. This was done in the following Example 4-90.1, "Sieve Analysis and Combined Grading for Portland Cement Concrete, 37.5 mm Maximum."

Section 1 Environmental Rules and Requirements

7-101 General

7-102 Sources of Information

7-103 Protection of Environmental Resources

7-103A Archeological and Historical Resources

7-103B Endangered Species

7-103C Migratory Bird Act

7-103D Disposal, Staging and Borrow Sites

7-104 Air, Water, and Noise Pollution Control

7-104A Air Quality

7-104B Storm Water

7-104B (1) District Construction Storm Water Coordinator Responsibilities

7-104B (2) Resident Engineer Responsibilities

7-104B (3) Storm Water Inspector's Responsibilities

7-104B (4) Contractor's Inspections

7-104B (5) Amendment Review and Processing

7-104B (6) Project Files

7-104B (7) Contractor's files

7-104C Noise Control

7-105 Permits

7-105A Special Use Permits

7-105B Fish and Game Code Sections 1601 and 5650

7-105C List of Potential Permits

7-106 Environmental Hazards and Safety Procedures

7-106A Hazardous Materials

7-106B Hazardous Waste

7-106B (1) Hazardous Waste Disposal Contracts

7-106B (2) Removal of Yellow Traffic Stripe and Pavement Markings

7-106B (2a) Construction contract review

7-106B (2b) Testing and removal requirements

7-107 Hazardous Spills

7-108 Certificate of Environmental Compliance