STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

MANUAL CHANGE TRANSMITTAL

NO. **12-5**

TITLE:	APPROVED BY:	DATE ISSUED:
Department of Transportation *Construction Manual*	Mark Leja Chief Division of Construction	October 29, 2012

SUBJECT AREA	ISSUING UNIT
Table of Contents and various sections of the *Construction Manual*	Division of Construction
SUPERSEDES	**DISTRIBUTION**
	All Requested Manual Holders

This manual change transmittal delivers the revisions of Chapter 4, Sections 4-74, 4-80, and 4-81 of the *Construction Manual*. Updated sections may contain updated language, information, corrections, and references resulting from updates to the 2010 *Standard Specifications*, and from policy, and procedural changes. Change bars in the margins of the revised sections indicate text that was changed, added, or moved.

Please update your manual according to the table below.

Section(s)	Incorporates	Remove Old Page(s)	Insert New/Revised Page(s)
Table of Contents	None	TOC.3 thru TOC.4	TOC.3 thru TOC.4
Chapter 3, Section 2, "Bidding"	None	3.2-3	3.2-3
Goldenrod, Chapter 4, Section 72, "Slope Protection"	None	4-72.i	4-72.i
Chapter 4, Section 72, "Slope Protection"	None	4-72.1 thru 4-72.4	4-72.1 thru 4-72.5
Chapter 4, Section 74, "Pumping Equipment and Controls"	None	4-74.1	4-74.1
Chapter 4, Section 80, "Fences"	None	4-80.1 thru 4-80.2	4-80.1 thru 4-80.2
Chapter 4, Section 81, "Monuments"	None	4-81.1	4-81.1
Chapter 5, Section 95, "Epoxy"	None	4-95.1	4-95.1

Section 3-2, “Bidding”

- Corrects web address in Section 3-206.

Section 72, “Slope Protection”

- Updates references to align with 2010 *Standard Specifications.*
- Updates cross reference within *Construction Manual*.
- Reorganized to accommodate new slope protection items within 2010 *Standard Specifications.*
- Updates reference to "Caltrans Bank and Shore Protection Committee."

Section 74, “Pumping Equipment and Controls”

- Updates references to align with 2010 *Standard Specifications*.
- Changed title of section from “Pumping Plant Equipment.”
- Change “working drawing” to “shop drawing.”

Section 80, “Fences”

- Updates reference to align with 2010 *Standard Specifications*.
- Provides *Standard Specifications* reference for Type ESA temporary fence.

Section 81, “Monuments”

- Updates reference to align with 2010 *Standard Specifications*.

Section 95, “Epoxy”

- Updates terminology (e.g., concrete pavement).
- Adds "sealing inductive loops" as one application using epoxy material.
- Revises measurement and payment section to correspond with 2010 *Standard Specifications* (i.e., no separate item payment for epoxy).

CONSTRUCTION MANUAL

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Chapter-Section

CONSTRUCTION MANUAL

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Chapter-Section

- Consider written bidder inquiries only when the bidder submits a completed "Bidder Inquiry" form when the contract requires one.
- Even if the contract does not require written bidder inquiries, Caltrans strongly encourages using the form to the extent practical because the form helps manage bidder inquiries and responses. Office of Office Engineer has samples of this form.

3-205 Disclosure of Construction Estimates

3-205 Disclosure of Construction Estimates

Until bids are opened, the engineer's estimate of the cost of each contract item, supplemental fund allocation, contingency fund allocation, state-furnished materials allocation, and any other portion of the project estimate are not public information.

Before bid opening, bidders may know only the total allocated funds available on a specific project. This information is available for minor A and major projects. The weekly advertisement for bid listing provides the information either in hard-copy form or on the internet:

http://www.dot.ca.gov/hq/esc/oe/

To get minor B project funds allocation information, call the Sacramento office at (916) 227-6075, send a fax request to (916) 227-1950, or use the internet:

http://www.caltrans-opac.ca.gov/refguide.pdf

3-206 Names of Prospective Bidders

3-206 Names of Prospective Bidders

For all projects except minor B construction projects, the names of prospective bidders can be obtained by requesting a "Plan Holders List" in writing or by fax from the Caltrans plans counter in Sacramento, fax (916) 654-7028, or from the internet:

http://www.dot.ca.gov/hq/esc/oe/planholders/

Section 72 Slope Protection

This manual is being updated to reflect changes from the 2006 to the 2010 *Standard Specifications*. Bracketed section numbers refer to the 2006 *Standard Specifications*.

Section 72 Slope Protection

Section 72 Slope Protection

4-7201 General

4-7201 General

Caltrans uses slope protection described in Section 72, "Slope Protection," of the *Standard Specifications*. The following common types of slope protection are covered under the heading "During the Course of Work":

- Rock slope protection
- Concreted-rock slope protection
- Small-rock slope protection
- Concrete slope protection
- Broken-concrete slope protection
- Slope paving
- Gabions
- Sacked-concrete slope protection

Other protective devices are used in conjunction with highway construction, and when used, they are included in the contract's special provisions.

If extensive slope protection problems are anticipated or encountered during construction, refer these to the design engineer and the project manager, who may in turn obtain the advice of the "Caltrans Bank and Shore Protection Committee."

Resident engineers should be familiar with the material contained in the publication, *California Bank and Shore Rock Slope Protection Design*, and Section 870, "Channel and Shore Protection—Erosion Control," of the *Highway Design Manual*.

4-7202 Before Work Begins

4-7202 Before Work Begins

Before construction of any type of slope protection, review the plans, *Standard Specifications*, special provisions, any pertinent preliminary test data, and the location of the installation. Note any changes that may have occurred between the preliminary design studies and the start of construction. Decide whether modifications are necessary as a result of changed conditions. In making such a decision, observe the following:

- High water elevations
- Direction of flow and angle of impingement at various water stages
- Capability of adjacent soil types to resist erosion from wash and eddy currents
- Type and security of trees or brush
- Any springs or water courses that might affect the stability of the design

- For the record, take pictures of existing conditions.
- Verify that Form CEM-3101, "Notice of Materials to Be Used," includes the materials for slope protection. Refer to Section 6-202, "Responsibilities and Procedures for Acceptance of Materials," of this manual for additional information. Obtain initial samples and have them tested for the specified attributes.

4-7203 During the Course of Work

4-7203 During the Course of Work

Take the following steps when inspecting the work and materials for slope protection:

- For tests on rocks, submit representative pieces of the rock that will be used in the work. The samples will be crushed in the laboratory to the sizes needed to perform the tests.
- Sample cement according to the procedure outlined in "Material Accepted on the Basis of a Certificate of Compliance," in Section 6-2, "Acceptance of Manufactured Material and Sampling Methods," of this manual.
- Obtain samples of the concrete aggregate for initial and acceptance tests. Testing must follow the frequencies shown in Section 6-1, "Sample Types and Frequencies," of this manual.
- Where applicable, inspect the footing areas and foundations for evidence of instability or areas where hydrostatic pressures may develop. Order corrective work when necessary. The plans indicate the minimum depths of foundations. When evidence exists that the foundation depth is inadequate, obtain both the design and hydraulics engineers' concurrence with a change order to deepen the foundation. Of the various types of instability problems, foundation failures are the most serious and most common.
- Check to ensure that slopes and foundation areas are graded and compacted to specified tolerances.
- When changes are made, maintain records of details, depths, heights, and other dimensions, and enter these on the as-built plans.
- Ensure that rocks of the specified sizes and shapes are being used. You may check the size of rock by roughly measuring the size and converting the volume to mass. To better control the contractor's selection of rocks for placing, ensure the contractor paints tonnage on large rocks used in foundation construction.
- Verify the types of measurements and records necessary to support payment for the work. Keep such records up to date.
- Ensure existing shrubs and trees are protected so that they continue to anchor the surrounding soil. Erosion control is an important element of successful slope protection.

In addition to the general functions discussed above, the following items apply to specific types of slope protection.

4-7203A Rock Slope Protection

The *Standard Specifications* provide two methods of placement for this type of protection: Method A and Method B. The contract will identify the designated method.

Method A is used where the stability of the rock slope protection is considerably dependent on the manner in which the individual rocks are placed. To ensure the success of Method A, ensure that the bearing of rocks from one to the other follows specifications and that the use of "chinking" rocks is limited to filling voids. When placing rocks, the contractor should ensure each placed rock is stable and not dependent on the one on top to hold it in place. Otherwise, placement could result in what is known as "rockers" or unstable rocks. Also, ensure the contractor does not drop rock into place; otherwise, cracking or breaking may occur.

Method B is not restrictive with respect to the placement of individual rocks.

When rock slope protection fabric is required for either method, ensure the contractor places the fabric before placing the rock slope protection. See Section 4-88, "Engineering Fabrics," of this manual for guidelines for inspecting and accepting rock slope protection fabric. Close observation is required during rock placement to detect any damage to the fabric.

4-7203B Concreted-Rock Slope Protection

The concreted-rock slope protection method is used where large rock is not economically available in large quantities, yet a heavy, service type of protection is required. Protection involves constructing a heavy mass of smaller rocks bound together by concrete.

To provide the desired cleanliness, the contractor may need to sluice the rock or facing. If the rock contains an excess of fines or inadequate voids, the desired results may be impossible to obtain.

The specifications stress the desirability of a roughened surface finish. If excess concrete remains on the surface, the finished product, when used in streams, will be too smooth and, along the protection, velocities will increase beyond those intended during design.

To compensate for the lack of flexibility in the completed structure, ensure an adequate foundation lies below this type of protection.

At the terminals of protection, ensure the contractor is particularly careful to avoid erosion and undercutting. The contractor must also ensure the construction of adequate "returns" and "keys" at the ends.

For details about concrete production, review Section 4-90, "Portland Cement Concrete," of this manual. The method for placing rock will either be Method A or Method B, whichever the contract designates, as discussed under Section 4-7203A, "Rock Slope Protection," earlier in this section.

Inspect the rock to ensure it has been cleaned of any adhering dirt and clay and is moistened before concrete placement.

Ensure the contractor brushes the surface, exposes the rocks as specified, and cures the work by one of the specified methods.

4-7203C Small-Rock Slope Protection

The small-rock slope protection method consists of excavating and backfilling the footing trench, placing rock slope protection fabric as shown, and placing small rocks on the slope.

The *Standard Specifications* provide three material gradations based on required rock layer thicknesses. The contract will designate the required rock layer thickness for each location.

Ensure that the contractor places the fabric before placing the rock slope protection. See Section 4-88, "Engineering Fabrics," of this manual for guidelines on inspecting and accepting rock slope protection fabric. Observe closely during rock placement to detect any damage to the fabric.

Ensure the equipment used during spreading does not crack the rock.

4-7203D Concrete Slope Protection

The concrete slope protection method consists of paving the embankment with portland cement concrete. The method is particularly adaptable to locations where high-velocity flow is not detrimental, but desirable, and the hydraulic efficiency of smooth surfaces is important.

Review Section 4-90, "Portland Cement Concrete," of this manual for details about concrete production. When shotcrete is to be used, review Section 4-53, "Shotcrete," of this manual.

Check the area to be protected to ensure that the required expansion joints are in place.

Review the plans for the location and number of weep holes. Decide whether an adequate number has been provided for the particular installation. If necessary, order additional weep holes.

Ensure that the contractor performs concrete finishing as specified and that the slope paving is cured by one of the specified methods.

4-7203E Broken-Concrete Slope Protection

Broken-concrete slope protection consists of placing broken concrete from job site locations identified within the contract.

Before placement of the broken concrete, inspect the material and be sure the reinforcement has been removed flush to the surface of concrete.

The method for placing rock will either be Method A or Method B, whichever the contract designates, as discussed in Section 4-7203A, "Rock Slope Protection."

4-7203F Slope Paving

Slope paving is a broader term that covers a variety of methods for paving slopes, including colored slope paving, exposed aggregate slope paving, and slope paving with concrete pavers. The contract will specify which type applies at each location. The *Standard Specifications* and special provisions provide the requirements for slope paving. Test panels may be specified for certain slope paving.

For details about concrete production, review Section 4-90, "Portland Cement Concrete," of this manual. When shotcrete is to be used, review Section 4-53, "Shotcrete," of this manual.

When specified, ensure coloring is added to the concrete.

Ensure the timber spacers are of the required material and spaced as planned.

Observe construction to ensure the contractor does the placing, finishing, and curing as specified.

When exposed aggregate slope paving is specified, ensure any concrete set retarders are used in accordance with manufacturer instructions.

When slope paving with concrete pavers is specified, ensure the special provision requirements are met.

4-7203G Gabions

The gabion method consists of placing wire mesh box-shaped baskets filled onsite with hard, durable rocks. The gabions are placed on filter fabric as detailed in the plans and specifications.

At the start of gabion placement, require the contractor to verify the minimum unit mass of the gabions to ensure it meets specifications. If you have any questions about the consistency of the gabions, you may also order the mass to be verified during the course of the work.

4- 7203H Sacked-Concrete Slope Protection

Sacked-concrete slope protection is used when a number of serious failures have occurred. The failures are usually associated with the foundation or water getting behind the slope protection and "peeling off" the protection.

At the terminals and intermediate points, the plans provide for the construction of endwalls, cutoffs, and end returns. These devices are intended to prevent erosion behind the protection, and depending on field conditions, may need to be extended.

When possible, the terminals of slope protection should be tied into existing, undisturbed natural features that resist erosion, such as large boulders or rock outcrops.

The bond between the burlap-type sacks and the courses results from the exuding of mortar through the sacks. Should the bond be inadequate, the contractor can strengthen the bond by driving steel dowels or reinforcing bars through the courses as they are constructed.

"Stretchers" are those sacks placed with their lengths parallel to the bank. "Headers" are placed at right angles to stretchers. Verify that the sacks are placed in the manner specified. Periodically measure the work to ensure that the face coverage is within allowable tolerances.

Observe the curing operation to ensure that water is sprayed onto the slope protection at the specified intervals and for the required length of time. Note such observations in the daily report.

Finally, for measurement purposes, perform California Test 518, "Unit Weight of Fresh Concrete," to determine the unit weight of the concrete.

4-7204 Measurement and Payment

4-7204 Measurement and Payment

For details of measurement and payment, review the contract specifications. Make necessary measurements.

For measuring concrete or shotcrete, refer to Section 4-90, "Portland Cement Concrete," or Section 4-53, "Shotcrete," of this manual.

This manual is being updated to reflect changes from the 2006 to the 2010 *Standard Specifications*. Bracketed section numbers refer to the 2006 *Standard Specifications*.

Section 74 Pumping Equipment and Controls

Section 74 Pumping Equipment and Controls

4-7401 General

4-7401 General

Section 74, "Pumping Equipment and Controls" of the *Standard Specifications* includes specifications for furnishing and installing drainage pumping equipment and pumping plant electrical equipment. For additional information regarding pumping plant equipment, see Section 161, "Pumping Plants," of the *Bridge Construction Records and Procedures Manual.*

4-7402 Before Work Begins

4-7402 Before Work Begins

In accordance with Section 5-1.23 "Submittals" and Section 74-1.01C(2) [*5-1.02*], "Shop Drawings," of the *Standard Specifications*, the contractor must submit for review and approval shop drawings and a list of proposed materials directly to the Office of Structure Design, documents unit. The Office of Structure Design and the Office of Structure Construction have the primary responsibility for reviewing and approving the shop drawings and materials list.

4-7403 During the Course of Work

4-7403 During the Course of Work

During the work, take the following steps:

- Verify that the equipment and materials installed by the contractor are the same as those approved on the materials list.
- Before the final acceptance of the work, the contractor must test the pumping plant equipment. Notify the Office of Electrical, Mechanical, Water and Wastewater Engineering of the upcoming tests so representatives from the office may be present to witness the testing.

4-7404 Measurement and Payment

4-7404 Measurement and Payment

For the basis of measurement and payment, refer to the appropriate sections of the special provisions and *Standard Specifications*.

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Section 80 Fences

4-8001 General

This section describes the work for constructing barbed wire fence, wire mesh fence, and chain link fence. When a Type ESA temporary fence is specified, refer to Section 14-1.03, "Type ESA Temporary Fence," of the *Standard Specifications*.

4-8002 Before Work Begins

Review the plans, special provisions, and right-of-way agreements for any special details. If it is necessary to revise, add, or delete fence on a contract, review the *Highway Design Manual* for the general policy on such actions and consult with the project engineer. Also do the following:

- Do not move, add, or delete gates or openings without first consulting the design project engineer, the maintenance engineer, and other interested parties. If federal funds are involved, ensure the Federal Highway Administration (FHWA) approves any changes.
- Be alert to the necessity of constructing fences to prevent livestock escaping from adjacent properties (Section 15-2.04B [*15-2.05B*], "Reconstruct Fences," of the *Standard Specifications*).
- Compare the planned location with actual field conditions to ensure that fences, gates, openings, and other fencing items will serve as intended.
- Fences should not obstruct flow in streams or drainage areas.
- Fences may be constructed on top of retaining walls and wing walls. Wherever this type of construction is necessary, check the location of postholes, and ensure provision is made for future post installation.
- Upon delivery of the materials to the job site, ensure that chain link fences with a protective coating system have a certificate of compliance for the system. All other fencing materials must be field inspected and released by the engineer. Complete Form CEM-4102, "Material Inspected and Released on Job."
- Arrange for necessary control staking when the contractor has submitted the required survey request.

4-8003 During the Course of Work

During work operations, take the following steps:

- Ensure that the areas where fence is to be placed have been graded and high points that may interfere with the placement of wire or mesh have been leveled. However, do not permit indiscriminate clearing where clearing and grubbing is restricted to the slope line.

Section 80 Fences

4-8001 General

4-8002 Before Work Begins

4-8003 During the Course of Work

- Observe the placing of fence posts. Also, measure the spacing of posts and measure the depth of holes to ensure placement to proper depths. Note such measurements in the daily report. Spacing should not exceed the spacing specified or shown on the plans.
- Observe the placement of corner posts and pull posts to ensure they are placed at required locations and according to specified details. Also, ensure that the proper type and number of brace posts and diagonal wires are used. The configuration of the brace posts depends on the distance between the corner post and the next corner, end, or pull post.
- Decide on which side of the posts the contractor should place fabric when the side is not specified. For barbed wire and wire mesh fence, the barbed wire or wire mesh is placed on the property owner's side of the posts, unless otherwise shown on plans or in right-of-way agreements. For chain link fence, the fabric generally is placed on the highway side of the posts. However, the wire or fabric may be placed on either side, and it is recommended that the maintenance superintendent be consulted for any preference.
- Inspect the fastening of wire or fabric to ensure the use of specified materials and methods.
- Ensure fencing is snubbed or guyed at all grade depressions as specified.

4-8004 Measurement and Payment

4-8004 Measurement and Payment

Keep records and make measurements of fence construction sufficient to support both partial and final payment. Pay only for completed lengths except for incidental work as covered in Section 3-9, "Measurement and Payment," of this manual.

Consider using a tracking system to help prevent duplication or omissions of quantities.

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Section 81 Monuments

4-8101 General

This section describes the work for constructing survey monuments.

4-8102 Before Work Begins

Before work begins, take the following steps:

- Upon delivery of the materials to the job site, material is field inspected and released by the engineer. Complete Form CEM-4102, "Material Inspected and Released on Job."
- Arrange for necessary control staking when the contractor has submitted the required survey request. Control staking must be sufficient to set the disk to the accuracy required in the specifications.

4-8103 During the Course of Work

Check materials, dimensions, details, finish, and cure for compliance with specifications. Many monuments that existed before construction must be preserved or reset. The surveys unit should perform any resetting. If previously undiscovered monuments are found during construction, request the surveys unit to investigate and handle or recommend action to be taken.

4-8104 Measurement and Payment

The contractor must pay for relocating monuments lost or damaged by the contractor's operation. See Section 5-1.36 [*7-1.11*], "Property and Facility Preservation," in the *Standard Specifications*.

This manual is being updated to reflect changes from the 2006 to the 2010 *Standard Specifications*. Bracketed section numbers refer to the 2006 *Standard Specifications*.

Section 95 Epoxy

Section 95
Epoxy

4-9501 General

4-9501
General

Epoxies specified under Section 95 of the *Standard Specifications* are two-component adhesives used for a number of applications, including the following:

- Bonding pavement markers to pavement
- Pressure grouting cracks in concrete
- Bonding new concrete to old concrete
- As a binder to produce epoxy concrete and epoxy mortar
- Sealing inductive loops

Bridge Construction Memo 135-1.0 of *Bridge Construction Records and Procedures* contains additional information on epoxy.

4-9502 Before Work Begins

4-9502
Before Work
Begins

Verify that Form CEM-3101, "Notice of Materials to Be Used." includes epoxy. Refer to Section 6-202, "Responsibilities and Procedures for Acceptance of Materials," of this manual for additional information.

4-9503 During the Course of Work

4-9503
During the Course
of Work

During the work, take the following steps:

- Determine that the epoxy used for application type is the material specified, and obtain necessary certificates of compliance.
- Make sure the epoxy is packaged and labeled as the specifications require for its intended use.

4-9504 Measurement and Payment

4-9504
Measurement and
Payment

Payment for epoxy is included in the contract unit price for items of work in which epoxy is specified.