

STANDARD SPECIFICATIONS

STATE OF CALIFORNIA
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height before excavating for and installing culverts. Where embankments are constructed on a steep slope or at a difficult location, the Engineer may modify embankment heights before culverts are installed.

19-3.03B(2) Soldier Pile Walls

Excavate for and construct soldier pile walls in lifts from the top down.

Excavate in a way that minimizes voids requiring backfill behind the lagging.

Do not excavate more than 3 feet below any level of ground anchors that have not been stressed and grouted.

The Engineer determines whether boulders or portions of boulders that interfere with lagging must be removed. Perform any additional earthwork ordered. The additional earthwork is change order work.

Complete placing lagging to the full height of the exposed excavation face by the end of the work shift.

19-3.03B(3) Pier Column Excavation

Reserved

19-3.03C Cofferdams

Cofferdams for foundation construction must be (1) carried below the bottom of footings and (2) braced and as watertight as practicable. Interior dimensions of cofferdams must provide sufficient space inside wales for form construction and pile driving and allow pumping of water from outside foundation forms.

You may construct the cofferdam large enough to provide clearance to perform the work. The Department does not pay for the increase in quantities greater than 1 foot outside the footing dimensions.

Cofferdams tilted or moved out of position during sinking must be righted or enlarged to provide the required clearance and proper pier location.

In tidal waters or in streams that may flood, vent cofferdam walls at low water elevation to ensure equal hydrostatic head inside and outside the cofferdam when placing and setting seals.

No shoring is allowed in cofferdams that would induce stress, shock, or vibration in the permanent structure.

Cross struts or bracing may extend through foundation concrete if authorized. Struts or bracing below low water may remain in place except in navigable streams or when specified to be removed. Remove struts or bracing above low water. Fill resulting spaces with concrete of the type specified for the surrounding concrete.

Remove cofferdams with all sheeting and bracing to at least 2 feet below the streambed after completing substructure construction. Do not disturb or mar the finished concrete or masonry.

19-3.03D Water Control and Foundation Treatment

Select the method to remove and control water at excavations where seal courses are not shown. Methods may include well point systems, pumping sumps, cofferdams, or concrete seal courses. If you choose a seal course, (1) the 3rd paragraph of section 51-1.03D(3), does not apply for spread footings and (2) section 51-1.03D(3) does not apply for pile footings.

Where concrete seal courses are shown, use a cofferdam, concrete seal course, and dewatering pumps. Place seal course concrete under section 51-1.03D(3).

If no piles are used and footing concrete, culverts, or other structures are placed on an excavated surface other than rock, comply with the following:

1. Perform excavation without disturbing foundation material. Dewater the excavation if ground water is encountered and no seal course is used. Continue dewatering activities before or during subsequent excavation. Foundations must be free of water when footing concrete or pipes are placed. Continue dewatering activities as required to prevent damage to the work.
2. If foundation material is disturbed by excavation activities, damaged by water, or removed for your convenience in dewatering, restore the foundation to a condition at least equal to the undisturbed foundation. For culverts, use Class 2 aggregate base that complies with section 26 to replace

damaged or removed foundation material. Compact Class 2 aggregate base as specified for structure backfill in section 19-3.03E.

If the Engineer determines the undisturbed original material of the excavation is unsuitable, correct as ordered. Corrective work is change order work.

When footing concrete or masonry is placed on rock, the rock must be fully uncovered and the surface removed to sound rock. Rock must be leveled or cut to steps and then roughened.

Pressure grout or treat seams in rock as ordered. This work is change order work.

Except for arch culverts, if you encounter solid rock or other unyielding material when excavating for a culvert at the elevation of the culvert bottom, remove the material below the bottom of the culvert to a depth of 1/24 the height of embankment above the top of culvert. This removal must be a minimum of 1 foot to a maximum of 5 feet. Backfill the resulting space below the culvert using structure backfill under section 19-3.03E. Excavating and backfilling below the planned elevation of the bottom of the culvert is change order work.

For footings on piles, complete excavation to the bottom of footings before driving or drilling piling. If swell or subsidence results from pile driving, excavate or backfill the footing area to the grade of the bottom of the footing. If the material under footings would mix with footing concrete or would not support the weight of wet concrete, replace the material with suitable material, install soffit forms, or provide a platform using authorized means on which to cast the footing.

19-3.03E Structure Backfill

19-3.03E(1) General

Place structure backfill in uniform layers. Bring backfill up uniformly on all sides of structures. Backfill layers must be at most 0.67 foot thick before compacting except when compaction is done by ponding and jetting, the thickness must be at most 4 feet.

Do not use compaction equipment or methods that may cause excessive displacement or damage structures.

Do not place structure backfill until footings or other portions of the structure or facility are inspected by the Engineer and authorized for backfilling. Do not place backfill against the back of abutments, retaining walls, or outside walls of CIP concrete structures until concrete has attained a compressive strength of at least 2,500 psi or the concrete has been in place for 28 days.

Place backfill inside bridge wingwalls and abutments before railings on wingwalls are constructed.

Compaction by ponding and jetting may be authorized under the following conditions:

1. Backfill material is self-draining when compacted
2. Foundation materials will not soften or be damaged by water
3. Structures will not be damaged by hydrostatic pressure

Ponding and jetting of the upper 4 feet below finished grade is not allowed. Perform work without damaging the structure or embankment and such that water is not impounded. Supplement ponding and jetting with vibratory or other compaction equipment.

Compact structure backfill to a relative compaction of at least 95 percent except you may compact structure backfill to a relative compaction of at least 90 percent at the following locations:

1. Overside drains
2. Footings for slope protection, slope paving, and aprons
3. Headwalls, endwalls, and culvert wingwalls
4. Retaining walls, except for portions under any surfacing
5. Inlets in median areas or in traffic interchange loops
6. Footings and pumping plants not beneath surfacing

Where ordered, place a compacted impervious backfill material instead of structure backfill at the following locations:

1. Outer 2-foot portion of structure backfill adjacent to inlets and outlets for pipes and culverts
2. Structure backfill placed within 2 feet of finished grade at abutments, abutment wingwalls, retaining walls, and other portions of structures

For the impervious backfill material, use an authorized earthy material. The sand equivalent requirement does not apply.

Structure backfill placed at bridge supports in waterways and water channels not beneath any embankment, pavement, or slope protection:

1. Does not need to be compacted
2. Must be soil free of organic matter, trash, or other unsatisfactory material
3. Must be placed to the level of original ground or finished grade shown

If you excavate outside the designated pay limits, material placed in those excavation areas must comply with the material and compaction requirements of the adjacent structure backfill.

If the Contract includes an item for imported borrow, you may use imported borrow as structure backfill if it complies with the specifications for structure backfill. No deduction is made in the quantity of imported borrow paid if you provide replacement material for imported borrow placed as structure backfill.

Material from structure excavation not suitable for use as structure backfill may be used to replace imported borrow or other excavated material.

Material from structure excavation not used as structure backfill must be placed in roadway embankments under section 19-6 or disposed of under section 19-2.03B.

19-3.03E(2) Crib Walls

Backfill cells formed by crib members and the space between crib walls and limits for structure excavation. Include space from material removed outside excavation limits.

Structure backfill for crib walls must not sift or flow through the openings in the walls.

Backfill crib walls simultaneously during wall erection. Place material in uniform layers before compacting. Compact material by hand tamping, mechanical compaction, or other authorized compaction means.

19-3.03E(3) Soldier Pile Walls

Compact structure backfill behind lagging of soldier pile walls by hand tamping or mechanical compaction.

In fill areas behind the lagging, key structure backfill into the existing or excavated back slope.

Place and compact backfill behind the lagging at least 5 feet above the level of ground anchors before drilling for the anchors. Place and compact the remaining backfill behind the lagging after the anchors are drilled, stressed, and grouted.

19-3.03F Slurry Cement Backfill

Place slurry cement backfill within 1 hour of mixing. Place in a uniform manner without voids or segregation. Place in a manner that does not float or shift culverts. Remove foreign material that falls into trenches.

Do not backfill over or place material over slurry cement backfill until 4 hours after placement. Unless concrete sand is used as aggregate and the in-place material is free draining, you may start backfilling as soon as the surface water is gone.

If slurry cement backfill is used for structure backfill, you may reduce the excavation width so that the clear distance between the outside of the pipe and the side of the excavation on each side of the pipe is at least (1) 6 inches for pipes 42 inches or less in diameter or span or (2) 1 foot for pipes over 42 inches in diameter or span.

Place slurry cement backfill only for that portion of structure backfill (1) below the original ground or grading plane or (2) below the top of embankment placed before excavating for culvert pipe. Where

necessary, compact earth plugs at each end of the pipe before placing backfill to completely contain slurry in the pipe trench.

19-3.03G Pervious Backfill Material

Place pervious backfill material in layers along with and by the same methods specified for structure backfill. Pervious backfill material at any one location must have approximately the same grading. Cover pervious backfill material at locations exposed to erosion with a 1-foot layer of authorized earthen material.

Where shown, you may use the *Weep Hole and Geocomposite Drain* alternative instead of pervious backfill material. The alternative must comply with section 68-7.

19-3.03H Culvert Bedding

Shape trench beds to fit the bottom of the culvert and to provide uniform support along the entire culvert length. You may excavate the trench below the bottom of the culvert and construct shaped bedding by backfilling and compacting culvert backfill material. Shape beds using a template conforming to the outside shape of the culvert that is guided by headers set parallel to the culvert grade. Headers may be left in place.

Place soil cement bedding as specified in section 19-3.03F, except do not backfill over soil cement bedding until 8 hours after placing bedding.

19-3.03I Controlled Low-Strength Material

If a controlled low-strength material I is used as structure backfill, the excavation width may be reduced so that the clear distance between the outside of the pipe culvert and the side of the excavation on each side of the pipe culvert is at least (1) 6 inches for pipe culverts with 20 feet or less in height of cover or with 42 inches or less of diameter or span or (2) 1 foot for pipe culverts with over 20 feet in height of cover or over 42 inches in diameter or span.

Mix materials thoroughly by machine. Use a pugmill, rotary drum, or other authorized mixer. Mix until cement and water are thoroughly dispersed.

Place controlled low-strength material for that portion of structure backfill (1) below the original ground or grading plane or (2) below the top of embankment that is placed before excavating for the pipe. Compact earth plugs at each end of the pipe culvert before placing backfill to completely contain slurry in the pipe culvert trench.

For trenches in existing pavement, place controlled low-strength material no higher than the bottom of the existing pavement permeable drainage layer. Where a drainage layer does not exist, place the material no higher than 1 inch below the bottom of the existing AC surfacing or no higher than the top of the base below existing PCC pavement.

For rigid pipe culverts, the minimum height of controlled low-strength material relative to the pipe culvert invert must be 0.5 times the pipe culvert diameter or 0.5 times the pipe culvert height.

For flexible pipe culverts, the minimum height of controlled low-strength material must be 0.7 times the pipe culvert diameter or 0.7 times the pipe culvert height.

Whenever controlled low-strength material is placed within the travelled way or covered by paving or embankment materials, the controlled low-strength material must achieve a maximum indentation diameter of 3 inches as determined under ASTM D 6024 before covering and opening to traffic.

19-3.03J Soldier Pile Walls

Where necessary, remove lean concrete backfill from drilled holes and in front of pile flanges to install lagging.

19-3.03K Ground Anchor and Soil Nail Walls

Excavate in lifts from the top down.

Before you excavate for the installation of production or proof test soil nails in a wall zone:

1. Complete stability testing

2. Complete verification testing
3. Obtain authorization of test data

Clean the excavated face of loose materials, mud, rebound, and other materials that prevent or reduce shotcrete bond to the excavated face and soil nails.

Remove cobbles, boulders, portions of boulders, or debris at the final wall alignment that protrude more than 2 inches from the excavated face. Backfill the over excavation with shotcrete.

If stability testing is not performed, apply the shotcrete facing during the same work shift that the excavation is performed. You may delay placing the shotcrete facing up to 24 hours if you demonstrate the integrity of the excavated face is maintained.

Notify the Engineer immediately if raveling or instability of the excavated face occurs or the wall face moves horizontally more than 0.4 percent of the excavated wall height.

Stabilize unstable areas immediately by buttressing the excavated face with an earth berm or other authorized methods. Stop construction in unstable areas until remedial measures are authorized.

Protect installed soil nails and ground anchors during construction. Replace damaged soil nails and ground anchors.

Do not excavate to the next underlying excavation lift until the following conditions have been attained for the portion of the wall in the current excavation lift:

1. Soil nails or ground anchors are installed and grouted
2. Reinforced shotcrete facing is constructed
3. Soil nail grout and shotcrete facing have cured for 72 hours
4. The soil nail facing anchorages are attached
5. Representative soil nail tests are complete for that portion of wall and the results are authorized

Do not excavate beyond the horizontal limits of the overlying completed wall section. At the end of each excavation lift, maintain temporary slopes flatter than 2:1 (horizontal:vertical) to ensure slope stability.

19-3.04 PAYMENT

The Department does not pay for:

1. Removal of material coming into an excavation from outside the described limits
2. Removal of material resulting from heave caused by the driving of piles in an excavation
3. Volume of backfill occupied by the new structure
4. Furnishing and placing backfill material in an excavation that is below or outside the described limits

Unless otherwise shown, quantities for structure excavation and backfill for structures other than culverts are computed as follows:

1. Horizontal limits are vertical planes 1 foot outside neat lines of footings or structures without footings.
2. Upper limit for structure excavation is the ground surface before starting construction activities. Where structure excavation is performed within roadway excavation or ditch excavation area, the upper limit is the plane of the bottom and side slopes of the excavated area. In new embankments, the upper limit is the plane of the new embankment at the specified elevation. In no case is the upper limit above the plane of the new embankment.
3. The upper limit for structure backfill is the finished grading plane or the finished slope lines. If the Engineer authorizes a higher limit, the limit for payment is the authorized higher limit.
4. The lower limit is a plane at the bottom of the completed footings or structures or the lower outside surface of rods or deadmen.

If the Engineer authorizes an increase in depth or width of structure excavation for structures except culverts, excavation to a depth of 2 feet below and for a width up to 3 times the outside width of the footing is paid for at the bid price for structure excavation. Excavation to greater depths or widths is paid for at the contract price for structure excavation unless before removal activities, (1) the Engineer authorizes this excavation to be paid for as change order work or (2) you request this excavation be paid

as change order work. Payment for structure backfill is similarly increased and paid for at the bid price for structure backfill.

Where a seal course is shown, structure excavation for footings is measured as structure excavation (Type A). If the depth of the structure excavation is reduced due to a reduction or elimination of the seal course, no decrease in the quantity of structure excavation (Type A) is made.

The volume of pervious backfill material within the limits of structure backfill is deducted from the quantities of structure backfill.

Structure excavation or structure backfill for bridges not designated by type is paid as structure excavation (bridge) and structure backfill (bridge).

The actual depth of structure excavation for culverts is the vertical distance between the ground line before excavating and the bottom of the culvert trench. If the structure excavation depth is more than 0.5 foot from the depth shown and an adjustment is requested or ordered, the Department makes a payment adjustment under section 4-1.05B. Increased depth due to unsuitable material, rock, other unyielding material below the planned grade is not considered in determining the depth of structure excavation for culverts.

Where compaction is not required, payment for structure backfill is included in payment for the type of structure excavation involved.

Payment for shotcrete used on ground anchor and soil nail walls to fill voids created by the removal of cobbles and boulders or other obstructions is included in the payment for shotcrete.

19-4 RESERVED

19-5 COMPACTION

19-5.01 GENERAL

19-5.01A Summary

Section 19-5 includes specifications for obtaining required compaction for all earthwork except structure backfill.

19-5.02 MATERIALS

Not Used

19-5.03 CONSTRUCTION

19-5.03A General

Relative compaction specifications apply to material whether in excavation or embankment.

The moisture content of material to be compacted to at least 95 percent must be such that the specified relative compaction is obtained and the embankment is in a firm and stable condition.

Do not compact material that contains excessive moisture until the material is dry enough.

19-5.03B Relative Compaction (95 Percent)

Obtain a relative compaction of at least 95 percent for at least a depth of:

1. 0.5 foot below the grading plane for the width between the outer edges of shoulders
2. 2.5 feet below the finished grade for the width of the traveled way plus 3 feet on each side

Except for the outer 5 feet measured horizontally from the embankment side slope, compact the full width and depth of the embankment within 150 feet of each bridge abutment to at least 95 percent relative compaction. The 150-foot limit is measured horizontally from the bridge abutment and either parallel or concentric with the roadway centerline.

Obtain a relative compaction of at least 95 percent for embankments under retaining wall footings without pile foundations:

1. For the full depth

2. Within the limits established by inclined planes sloping 1.5:1 (horizontal:vertical) out and down from lines 1 foot outside the bottom edges of the footing.

19-5.03C Relative Compaction (90 Percent)

Obtain a relative compaction of at least 90 percent in embankment areas not required to be compacted to 95 percent.

19-5.03D Foundation Preparation

You are responsible for preparing the foundation to receive material.

If you elect to excavate and replace basement material to facilitate compaction, before replacement begins and if ordered, compact a layer below the excavated material to the depth, width, and degree of compaction ordered. The ordered work is change order work.

19-5.04 PAYMENT

If basement material is (1) placed in the embankment or used in other planned or authorized work and (2) replaced with planned excavated material or imported borrow, then the replaced material is paid for at the bid price for the type of excavation or imported borrow involved.

19-6 EMBANKMENT CONSTRUCTION**19-6.01 GENERAL**

Section 19-6 includes specifications for constructing embankments.

Embankment construction includes:

1. Preparing areas to receive embankment material
2. Placing and compacting embankment material including:
 - 2.1. Suitable material within roadway areas where unsuitable material has been removed
 - 2.2. Material in holes, pits, and other depressions within the roadway area
3. Constructing a temporary surcharge embankment above the grading plane
4. Constructing dikes on or off the job site

19-6.02 MATERIALS**19-6.02A General**

Use material from excavations or from local or imported borrow.

In embankment areas where piles are to be placed or driven, do not use material containing rocks, broken concrete, or other solid materials larger than 4 inches in greatest dimension.

Whenever selection of material is possible, do not place borrow or excavation material having a sand equivalent value less than 10 within 2.5 feet of finished grade. Use this material to construct the lower portions of embankments.

19-6.02B Geosynthetic Reinforced Embankment

Each geosynthetic reinforcement roll must be labeled with:

1. Manufacturer's name
2. Production identification
3. Roll dimensions
4. Lot number
5. Date of manufacture

Backfill for geosynthetic reinforced embankment must be free from:

1. Organic material
2. Shale, soft, or poor durability particles
3. Recycled materials such as glass, shredded tires, concrete rubble, or other unsuitable materials
4. Loose or extraneous material and sharp objects that may come in contact with the geosynthetic reinforcement

Backfill must comply with the requirements in the following 2 tables:

Sieve size	Percent passing
1-1/2"	100
3/4"	75-100
No. 4	20-100
No. 40	0-60
No. 200	0-50

Property	Requirement	California Test
Plasticity index	20 max	204
pH	5-9	643

The Engineer may authorize the use of backfill with grading larger than the specified size up to a 4 inches maximum if you submit, with your LTDS calculations, test results for installation damage reduction factors for each type of geosynthetic reinforcement under FHWA-NHI-00-044, section 5.1.

19-6.03 CONSTRUCTION

19-6.03A General

Compact embankment under section 19-5.

Construct embankment slopes under section 19-2.03G.

When constructing an embankment on an existing roadway, scarify, water, grade, and roll the existing roadbed before placing new material.

When constructing an embankment against an existing slope or when constructing 1/2 the embankment width at a time, prepare the slope by cutting into it at least 6 feet horizontally as you place the new embankment in layers. Compact the cut material along with the new embankment material. If ordered to cut more than 6 feet, the excavated material in excess of 6 feet is paid for as roadway excavation.

For bridge footings to be constructed in embankment, construct the embankment to the grading plane elevation and extend the finished slope to the grading plane before:

1. Excavating for footings
2. Driving piles or drilling holes for CIP piles

The grading plane of embankments beneath structure approach slabs and beneath the thickened portion of sleeper slabs must not project above the grade established by the Engineer.

Grade trenches, holes, depressions, and pits outside of areas where embankments are to be constructed to provide a presentable and well-drained area.

19-6.03B Subsidence

Reserved

19-6.03C Placing and Compacting

Do not construct embankments when material is frozen or a blanket of snow prevents proper compaction.

Construct embankment in layers. The loose thickness of each layer must not exceed 8 inches.

Break up clods or hard lumps of earth that are over 8 inches in greatest dimension before compacting material in the embankment, except if material, such as hardpan or cemented gravel, cannot be broken readily:

1. Distribute material throughout the embankment.
2. Place enough earth or other fine material around the larger material as you deposit it to fill the interstices and produce a dense, compact embankment.