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## **Subchapter 4. Construction Safety Orders**

### **Article 6. Excavations**

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#### **§1541.1. Requirements for Protective Systems.**

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##### **(a) Protection of employees in excavations.**

(1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with Section 1541.1(b) or (c) except when:

(A) Excavations are made entirely in stable rock; or

(B) Excavations are less than 5 feet in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) Design of sloping and benching systems. The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of Section 1541.1(b)(1), Section 1541.1(b)(2), Section 1541.1(b)(3), or Section 1541.1(b)(4), as follows:

##### **(1) Option (1) - Allowable configurations and slopes.**

(A) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(B) Slopes specified in Section 1541.1(b)(1)(A) shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this article.

(2) Option (2) - Determination of slopes and configurations using Appendices A and B. Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in Appendices A and B to this article.

(3) Option (3) - Designs using other tabulated data.

(A) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(B) The tabulated data shall be in written form and shall include all of the following:

1. Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;
2. Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;
3. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
4. At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Division upon request.

(4) Option (4) - Design by a registered professional engineer.

(A) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under Section 1541.1(b) shall be stamped and signed by a registered professional engineer.

(B) Designs shall be in written form and shall include at least the following:

1. The magnitude of the slopes that were determined to be safe for the particular project;
2. The configurations that were determined to be safe for the particular project;
3. The identity of the registered professional engineer approving the design.

(C) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Division upon request.

(c) Design of support systems, shield systems, and other protective systems. Designs of support systems, shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of Section 1541.1(c)(1); or, in the alternative, Section 1541.1(c)(2); or, in the alternative, Section 1541.1(c)(3); or, in the alternative, Section 1541.1(c)(4) as follows:

(1) Option (1) - Designs using Appendices A, C and D. Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in Appendices A and C to this article. Designs for aluminum hydraulic shoring shall be in accordance with Section 1541.1(c)(2), but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with Appendix D.

(2) Option (2) - Designs Using Manufacturer's Tabulated Data.

(A) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(B) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(C) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Division upon request.

(3) Option (3) - Designs using other tabulated data.

(A) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(B) The tabulated data shall be in written form and include all of the following:

1. Identification of the parameters that affect the selection of a protective system drawn from such data;
2. Identification of the limits of use of the data;
3. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(C) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Division upon request.

(4) Option (4) - Design by a registered professional engineer.

(A) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2, or Option 3, above, shall be approved by a registered professional engineer.

(B) Designs shall be in written form and shall include the following:

1. A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and
2. The identity of the registered professional engineer approving the design.

(C) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Division upon request.

(d) Materials and equipment.

(1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) Installation and removal of supports.

(1) General.

(A) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(B) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(C) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(D) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(E) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(F) Backfilling shall progress together with the removal of support systems from excavations.

(2) Additional requirements for support systems for trench excavations.

(A) Excavation of material to a level no greater than 2 feet below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(B) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) Sloping and benching systems. Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) Shield systems.

(1) General.

(A) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(B) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(C) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(D) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) Additional requirements for shield systems used in trench excavations. The sides of the shield shall extend a minimum of 18 inches above the vertical walls of compound excavations as shown in Appendix B, figures B-1, B-1.2 and B-1.3. On vertically cut trenches, the shield shall extend to at least the catch point of the trench. Excavations of earth material to a level not greater than 2 feet below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

(h) Uprights shall extend to the top of the trench with the lower end of the upright not more than 2 feet from the bottom of the trench.

Note: Authority cited: [Section 142.3, Labor Code](#). Reference: [Section 142.3, Labor Code](#).

## HISTORY

1. New section including Appendices A-F filed 8-26-91; operative 9-25-91 (Register 92, No. 13).
2. Change without regulatory effect amending Appendix B, subsection (c)(3)(C) filed 6-29-92; operative 7-29-92 pursuant to [section 100, title 1, California Code of Regulations](#) (Register 92, No. 27).
3. Change without regulatory effect amending Appendix A, subsection (b), Soil classification system filed 10-22-92 pursuant to [section 100, title 1, California Code of Regulations](#) (Register 92, No. 43).
4. Change without regulatory effect amending subsection (b)(1)(B) filed 12-18-95 pursuant to [section 100, title 1, California Code of Regulations](#) (Register 95, No. 51).
5. Editorial correction restoring subsection (g)(1)(A) (Register 97, No. 6).
6. Amendment of subsections (b) and (b)(4)(A), new subsection (g)(1)(A), and amendment of subsection (g)(2) filed 3-5-97; operative 4-4-97 (Register 97, No. 10).
7. New subsection (h) and amendment of Appendix D, subsection (g)(7) filed 4-9-2001; operative 5-9-2001 (Register 2001, No. 15).

8. Change without regulatory effect clarifying graphics in Appendices B and E filed 7-14-2008 pursuant to [section 100, title 1, California Code of Regulations](#) (Register 2008, No. 29).
9. Editorial correction of Appendix A, subsection (d)(1)(B) (Register 2010, No. 34).
10. Editorial correction of Appendix A, subsection (d)(2)(E)2. (Register 2010, No. 50).
11. Change without regulatory effect amending Appendix A, subsection (d)(2)(B) filed 12-12-2011 pursuant to [section 100, title 1, California Code of Regulations](#) (Register 2011, No. 50).

[Appendix A](#)

[Appendix B](#)

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