

## **Appendix G**

### **Selection of Protective Systems**

#### ***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 8CCR Section 1541.1(b)(1), Section 1541.1(b)(2), Section 1451.1(b)(3), or Section 1541.1(b)(4) as follows:

#### (1) Option One: Allowable configurations and slopes

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.

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.

#### (2) Option Two: Determination of slopes and configurations

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 in 8CCR1541.1

#### (3) Option Three: Designs using other tabulated data

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

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

- Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;
- Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;
- Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
- 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 Four: Design by a registered professional engineer

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.

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

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

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 Cal/OSHA upon request.

## **Sloping and benching**

Scope and application: This section contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in 8 CCR 1541.1(b)

### **Actual slope**

The actual slope must not be steeper than the maximum allowable slope.

The actual slope must be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope must be cut back to an actual slope which is at least 1/2 horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope.

When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person must determine the degree to which the actual slope must be reduced below the maximum allowable slope, and must assure that such reduction is achieved. Surcharge loads from adjacent structures must be evaluated in accordance with criteria related to **Stability of Adjacent Structures** above.

### **Materials and equipment**

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

Manufactured materials and equipment used for protective systems must 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.

When material or equipment that is used for protective systems is damaged, a competent person must 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 must be removed from service, and

must be evaluated and approved by a registered professional engineer before being returned to service.

***Installation and removal of support***

Members of support systems must be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

Support systems must 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.

Individual members of support systems must not be subjected to loads exceeding those which members were designed to withstand.

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

Removal must begin at, and progress from, the bottom of the excavation. Members must 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.

Backfilling must progress together with the removal of support systems from excavations.

***Additional requirements for support systems for trench excavations***

Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system must 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.

Installation of a support system must be closely coordinated with the excavation of trenches.

***Sloping and benching systems***

Employees must 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.

***Shield systems*** - Shield systems must not be subjected to loads exceeding those which the system was designed to withstand. Shields must 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.

Employees must be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

Employees must not be allowed in shields when shields are being installed, removed, or moved vertically.

***Additional requirement for shield systems used in trench excavations***

Excavations of earth material to a level not greater than 2 feet (0.61 m) below the bottom of a shield must 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.