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American Standard Safety Code for
Building Construction

SPONSORS

American Institute of Architects
National Safety Council

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PART 2

Excavation Work

SECTION 0 Definitions

0.1 Equipment. "Equipment" shall mean ladders, scaffolds, ramps, runways, railings, barricades, sheet piling, shoring, bracing, and any such safeguards, protective construction, and devices used in affording protection to the men engaged in excavating work.

0.2 Jack. A "jack" shall mean a mechanical or hydraulic device to lift, lower, or move a load by man power applied through leverage.

0.3 Ramp. A "ramp" shall mean any inclined runway including those constructed entirely of dirt.

0.4 Runway. A "runway" shall mean any planked over walkway or drive constructed and maintained as a passageway for workmen or rolling equipment. (See rule 5.6 in Part 2.)

0.5 Shaft. A "shaft" shall mean a hole sunk into the ground at an angle of forty-five (45) degrees or less with the vertical.

0.6 Trench. A "trench" shall mean a narrow excavation made below the surface of the ground. In general the depth will be greater than one of the horizontal dimensions.

0.7 "c to c." "c to c" shall mean center to center.

SECTION 1 General

1.1 This Part on "Excavation Work" provides for the protection of the public, employees, and property during all excavation work in connection with building and trenching operations, including related sub-surface or below grade-level work such as the underpinning, shoring, and bracing of foundations, retaining walls, and the like.

1.2 Any device or equipment used in connection with excavation work shall be constructed, installed, inspected, maintained, and operated by the owner or user as specified in applicable parts of this code.

1.3 Where applicable, federal, state, or local codes, rules, regulations, and ordinances governing any and all phases of excavation work shall be observed at all times.

1.4 Trees, boulders, and other surface encumbrances located so as to create a hazard at any time

during operations shall be removed before excavating is started.

1.5 If the stability of adjoining buildings or walls is endangered by excavations, shoring, bracing, or underpinning shall be provided as necessary to ensure their safety. Such shoring, bracing, or underpinning shall be frequently inspected by a competent person and the protection effectively maintained.

1.6 Excavations shall be inspected after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins increased if necessary.

1.7 If it is necessary to place or operate power shovels, derricks, trucks, material, or other heavy objects on a level above and near an excavation, the side of the excavation shall be sheet-piled, shored, and braced as necessary to resist the extra pressure due to such superimposed loads.

1.8 The sides of every excavation four (4) feet or more in depth, where there is danger of slides or cave-ins, shall be supported by substantially braced sheet piling or shoring unless the sides of the excavation are sloped to the angle of repose of the material being excavated.

1.9 Whenever any part of an excavation is protected by a masonry wall, such wall shall be braced to ensure stability. This shall not include reinforced concrete walls known to be of ample strength.

1.10 Temporary sheet piling which has been installed to permit the construction of a retaining wall shall not be removed until such wall has acquired its full strength.

1.11 Except in hard rock, excavations below the level of the base or footing of any foundation or retaining wall shall not be permitted unless the wall is underpinned and all other precautions taken to ensure the stability of the adjacent walls for the protection of the men.

1.12 Undercutting of earth banks shall not be permitted unless they are adequately shored.

1.13 Excavated material shall not be placed on the ground surface nearer than eighteen (18) inches from the edge of the excavation.

1.14 All fixed-in-place ladders and stairways giving access to levels twenty (20) or more feet apart shall be provided with landing platforms at vertical intervals of twenty (20) feet. Every landing

platform shall be equipped with standard railings and toe boards.

1.15 Lumber sizes, when used in this Part, refer to nominal sizes.

SECTION 2

Protection to the Public

2.1 All public walkways, sidewalks, and thoroughfares bordering on or running through any construction site shall be provided with substantial guardrails or board fences. In addition, temporary footwalks beyond the curb shall be substantially constructed and provided with protection on both sides.

2.2 Sidewalks and walkways shall be kept clear of excavated material or other obstructions and no sidewalks shall be undermined unless shored to carry a live load of one hundred and twenty-five (125) pounds per square foot.

2.3 If planks are used for sidewalks or raised walkway protection, they shall be laid parallel to the length of the walk and fastened together against displacement.

2.4 Planks shall be uniform in thickness and all exposed ends shall be provided with beveled cleats to prevent tripping.

2.5 Raised walkways shall be provided with plank steps on strong stringers. Ramps used in lieu of steps shall be provided with cleats to insure safe walking.

2.6 A flagman or watchman shall be designated to warn the public of the approach of trucks and to direct the trucks in and out of the property. Danger or warning signs shall be posted at all truck entrances and exits.

2.7 During the hours of darkness, all public sidewalks and walkways shall be adequately illuminated, and warning lights or flares shall be placed about the property to ensure safety for pedestrian and vehicular traffic.

2.8 The public shall not be required or permitted to travel under loads handled by power shovels, derricks, or hoists, unless ample side barricades and overhead protection are provided.

SECTION 3

Sheet Piling, Shoring, and Bracing

3.1 All shoring, bracing, or sheet piling shall be consistent with the magnitude of the work and the character of the soil or material in which the excavation is made.

3.2 If workmen are engaged near the face of an excavation, where the ground is cracked or of such

character that caving is likely to occur, sheet piling with shoring and bracing necessary to prevent caving shall be provided.

3.3 All material used for shoring, bracing, and sheet piling shall be sound straight-grained timber equal to long leaf yellow pine, Douglas fir, or other material of equal strength. All timber shall be free from splits, shakes, large or loose knots, and shall be of the required dimensions throughout.

3.4 Wooden sheet piling shall be not less than two (2) inches in thickness and the thickness shall be increased as may be necessary to adequately support the sides of the excavation. (See rule 6.13.)

3.5 Where temporary sheet piling is used during excavation work, the shoring and bracing to be provided shall comply with the following requirements.

3.6 When shores and braces are required they shall be placed at intervals or not more than eight (8) feet measured parallel with the sheet piling.

3.7 Shores or braces shall bear at the earth against a footing of sufficient area to keep within the allowable soil pressure, "dead men" being buried when necessary to resist the thrust of the braces.

3.8 Shores or braces at the sheet piling shall not be cut to a bevel but shall be held by wedges and the wedges shall be nailed.

3.9 The timber shores or braces shall be designed as columns, the following formula being recommended:

$$P = A \left(1300 - 20 \frac{L}{D} \right)$$

where:

P = total permissible load in pounds.

A = cross sectional area of timber in square inches.

L = unbraced length of timber in inches.

D = least dimension of cross section of timber in inches.

3.10 The shores or braces shall make an angle not greater than thirty (30) degrees with the horizontal.

NOTE: For excavations more than sixteen (16) feet in depth, or when heavy lateral pressures are encountered, the use of interlocking steel sheet piling is recommended. Choice of piling should be made from recognized standard tables. Piling must be driven sufficiently below the bottom of the excavation to resist the overturning moment. Steel or timber bracing can be added where necessary.

SECTION 4

Jacks

A. General

4.1 The rated capacity of every jack shall be legibly marked in a prominent location on the jack by casting or stamping.

4.2 To prevent loading beyond the rated capacity, the manufacturer shall designate in printed matter, or otherwise, the intended supporting point of the load and the maximum permissible length of lever and force applied.

4.3 If auxiliary load-supporting points are provided, the manufacturer shall also designate the rated capacity for these points.

4.4 The design of all jacks shall incorporate a positive stop to prevent over-travel or an indicator where a positive stop is impracticable.

4.5 The design shall be such that parts may be replaced without requiring special adjustment of either the replacement part or other parts of the jack.

4.6 Printed instructions concerning the lubrication and operation of the jacks shall be secured from the manufacturer.

4.7 Lubrication instructions furnished by the jack manufacturer shall be closely followed.

4.8 When the object has been lifted to the desired height, blocking or cribbing shall be immediately placed under it.

4.9 A capable man shall be appointed and held responsible for the inspection of all jacks at regular intervals. The inspection shall be made in accordance with rules governing "Inspection of Jacks," below.

B. Inspection of Jacks

4.10 Jacks shall be examined for cracked, distorted, or worn parts and to ensure that they are receiving proper lubrication. Time of examination shall depend upon service conditions as follows:

- (a) For constant or intermittent use at one locality, thorough inspection once every week,
- (b) For jacks shipped between shop and job, thorough inspection when sent out and when returned,
- (c) For jacks upon which abnormal load or shock has occurred, thorough inspection immediately, by foreman in charge.

4.11 Jacks which are found to have cracked, distorted, or badly worn parts shall be tagged "out of order" and not re-used until repairs are made.

4.12 Repair or replacement parts shall be examined for possible defects, and only parts which fit perfectly shall be used.

4.13 Before being returned to service, repaired jacks shall be subjected to test and shall meet the same requirements as when new.

SECTION 5

Ramps and Runways

5.1 Ramps or runways used for vehicles shall have a width of not less than twelve (12) feet. Timber guards not less than eight (8) inches by eight (8) inches shall be securely fastened on top of the runway along each of the outside edges.

5.2 Ramps or runways, when used as passageways for workmen, shall be provided with standard railings.

5.3 All ramps and runways shall be maintained in a safe and serviceable condition. When ramps and runways are formed on hard ground without the use of planking, ruts and holes greater than two (2) inches deep shall not be permitted.

5.4 When the pitch of the ramp requires it, a man shall be alongside a loaded truck with a chock provided with a strong handle for blocking a rear wheel if the truck is stalled or otherwise forced to stop on the ramp.

5.5 Workmen, other than chockers, shall be instructed to stay off ramps and runways when trucks are passing over them.

5.6 Where the incline of the ramp is too steep for safe walking, foot cleats, not more than sixteen (16) inches apart, shall be provided to prevent slipping.

SECTION 6

Trenches

A. General Requirements

6.1 In all trench operations where men are at work or where they must pass to and from their work, sufficient light, either natural or artificial, shall be provided at all times.

6.2 Pick and shovel men working in trenches shall be kept a sufficient distance apart to prevent injury to one another.

6.3 All trenches four (4) feet or more in depth shall at all times be supplied with at least one (1) ladder for each one hundred (100) feet in length or fraction thereof. The ladder shall extend from the bottom of the trench to at least three (3) feet above the surface of the ground.

6.4 Red lanterns or torches shall be placed along the exposed sides of all trenches at night as required for necessary warning to the public.

6.5 Guardrailings or barricades shall be provided at or near the sides of trenches as necessary to protect the workmen and the public.

6.6 The sides of all trenches which are four (4) feet or more in depth, and where the earth is not sloped to the angle of repose, shall be securely held by timber bracing. The bracing shall be carried along with the excavation and must in no case be omitted unless the trench is cut in solid rock or hard shale.

6.7 Where a mechanical digger is used, the bracing shall be placed as close as possible [a maximum of six (6) feet is recommended] to the lower end of the boom.

6.8 The bracing shall be held in place by screw jacks or by cross braces cleated and wedged in place. Where the width of the trench prevents this, the lower end of the cross brace shall bear against a footing in the earth at the bottom of the trench, provided adequate means are taken to keep it from kicking out.

6.9 When the sloping of trenches to the angle of repose does not extend to the bottom of the trench, the timbering shall be as required to support the vertical part of the trench. The sheeting shall extend not less than twelve (12) inches above the bottom of the slope and, if necessary, to boards shall be placed behind the timbering to prevent material from sliding into the trench. The surface of the slope shall be cleaned of boulders, stumps, or other hard masses of earth to eliminate the danger of their sliding into the trench.

6.10 Excavated material and superimposed loads shall not be placed nearer than eighteen (18) inches from the sides of the trench, unless bracing has been installed and designed to withstand the load.

6.11 When trenches are undercut, they shall be shored to safely support the overhanging material.

6.12 If a trench is cut alongside an existing structure and the footings of the structure are nearer to the trench than the plane of repose for the soil, they shall be underpinned or the side wall of the trench rigidly supported.

6.13 Considering the planks used for sheet piling as beams to support the load imposed by the lateral earth pressure, the maximum allowable distance between the horizontal stringers or wales shall be such as will keep the planks within their safe bending stress. (See rule 3.4.)

6.14 Where the cross section of the horizontal stringer or wale is not square, the greater dimension shall be placed in a horizontal plane to gain the maximum strength of the member.

6.15 Braces shall be considered as column or struts and shall be of adequate dimension for stiffness. (See rule 3.9.)

6.16 In hand excavated trenches, cleats shall be spiked or bolted to join the ends of braces to stringers to prevent the braces from being knocked out of place. In mechanically excavated trenches, all cleats shall be bolted.

6.17 When the depth of the trench requires two (2) lengths of sheet piling, one above the other, the lower length shall be set inside the bottom stringers or wales of the upper length and driven down and braced as the excavation continues.

B. In Trenches of Varying Widths and Depths

In trenches of varying widths and depths the use of the following timbers is recommended and any deviations therefrom shall be on the side of safety.

6.18 For trenches from four (4) feet to ten (10) feet in depth and not more than forty-two (42) inches in width:

(a) In hard solid soil

Uprights: 2×6 in. planks spaced approximately 6 ft apart c to c

Stringers: None

Cross Braces: Two 2×6 in. planks for depths less than 7 ft
Three 2×6 in. planks for depths 7 ft to 10 ft

If the nature of the soil or parallel excavations close to trenches necessitate the spacing of uprights closer than six (6) ft, they may be held in place by two by six (2×6) in. horizontal stringers or wales and cross braces spaced not more than six (6) ft apart c to c.

(b) In soil likely to crack

Uprights: 2×6 in. planks spaced approximately 3 ft apart c to c

Stringers: 2×6 in. planks placed near bottom and top of trench

Cross Braces: Two 2×6 in. planks for depths less than 7 ft
Three 2×6 in. planks for depths 7 ft to 10 ft
Cross braces spaced horizontally not more than 6 ft apart c to c

(c) In soft sandy soil or filled ground

Uprights: 2×6 in. close sheeting

Stringers: 4×6 in., two for depths less than 7 ft, three for depths 7 ft to 10 ft

Cross Braces: 4×6 in., spaced horizontally not more than 6 ft c to c

6.19 For trenches from ten (10) feet to fifteen

(15) feet in depth and not more than forty-two (42) inches in width:

(a) *In hard solid soil*

Uprights: 2×6 in. planks spaced approximately 4 ft apart c to c
Stringers: None
Cross Braces: Three 2×6 in. planks for depths less than 13 ft
Four 2×6 in. planks for depths 13 ft to 15 ft

In lieu of one cross brace to each upright, and where the nature of the soil or nearby parallel excavations makes the spacing of uprights closer than four (4) ft, they may be held in place by two by six (2×6) in. stringers or wales, and cross braces spaced not to exceed six (6) ft c to c.

(b) *In soil likely to crack*

Uprights: 2×6 in. planks spaced 3 ft apart c to c
Stringers: 2×6 in. planks, three in the height of the trench
Cross Braces: Three 2×6 in., for depths less than 13 ft
Four 2×6 in., for depths 13 ft to 15 ft
Cross braces spaced horizontally not more than 6 ft apart c to c

(c) *In soft sandy soil or filled ground*

Uprights: 2×6 in. close sheeting
Stringers: 4×6 in., three for depths less than 13 ft, four for depths 13 ft to 15 ft
Cross Braces: 4×6 in., spaced horizontally not more than 6 ft apart

6.20 For trenches more than fifteen (15) feet in depth and not more than forty-two (42) inches in width:

(a) *In soil of all kinds*

Uprights: 2×6 in. close sheeting
Stringers: 4×12 in., spaced vertically not to exceed 4 ft c to c
Cross Braces: 4×12 in., spaced horizontally not to exceed 6 ft c to c

6.21 For trenches from four (4) to ten (10) feet in depth, and more than forty-two (42) inches in width:

(a) *In hard solid soil*

Uprights: 2×6 in. planks spaced approximately 6 ft apart c to c
Stringers: 4×6 in., spaced vertically 4 ft apart c to c
Cross Braces: 4×6 in., spaced horizontally 6 ft apart c to c

(b) *In soil likely to crack*

Uprights: 2×6 in. planks spaced 3 ft apart c to c

Stringers: 4×6 in., spaced vertically 4 ft apart c to c

Cross Braces: 4×6 in., spaced horizontally 6 ft apart c to c

(c) *In soft sandy soil or filled ground*

Uprights: 2×6 in. close sheeting
Stringers: 4×6 in., two for depths less than 7 ft, three for depths 7 ft to 10 ft
Cross Braces: 4×6 in., spaced horizontally 6 ft apart c to c

6.22 For trenches from ten (10) to twenty (20) feet in depth, and more than forty-two (42) inches in width:

(a) *In soil of all kinds*

Uprights: 2×6 in. close sheeting
Stringers: 6×6 in., spaced vertically 4 ft apart c to c
Cross Braces: 6×6 in., spaced horizontally 6 ft apart c to c

6.23 For trenches more than twenty (20) feet in depth, and more than forty-two (42) inches in width:

(a) *In soil of all kinds*

Uprights: 2×6 in. close sheeting
Stringers: 6×8 in., spaced vertically 4 ft apart c to c
Cross Braces: 6×6 in., spaced horizontally 6 ft apart c to c

C. In Trenches with Hydrostatic Pressure

6.24 For trenches not more than eight (8) feet in depth:

Uprights: 2×6 in. tongued and grooved close sheeting
Stringers: 6×8 in., spaced vertically 4 ft apart c to c
Cross Braces: 6×8 in., spaced horizontally 6 ft apart c to c

6.25 For trenches more than eight (8) feet in depth:

Uprights: 3×6 in. tongued and grooved close sheeting
Stringers: 8×10 in., spaced vertically 4 ft apart c to c
Cross Braces: 6×8 in. or 6×10 in., spaced horizontally 5 ft apart c to c

The greater dimension of the stringers shall be placed at right angles to the sheeting

6.26 Where desired, steel sheet piling and bracing may be substituted for wood.

SECTION 7 Power-Driven Shovels

A. General Requirements

7.1 The operator of every shovel shall be protected by a cab, screen, or other suitable means in case a cable should break or material fall from a dipper when racked in close to the machine at a high level.

7.2 No unauthorized person shall be allowed on the operating platform when the shovel is in operation, and the machine operator shall not converse with anyone while operating the machine.

7.3 A suitable ladder or steps and handholds shall be provided to afford safe and easy access to the operating platform.

7.4 All shovels when not in use shall be left with the dipper on the ground.

7.5 In case of a breakdown, the shovel should, if practicable, be moved well away from the foot of the slope before repairs are made.

7.6 All persons shall be warned to keep away from the range of the shovel's swing, and to avoid being struck by the cab as it rotates.

7.7 Workmen shall not be permitted to stand back of the shovel or in line with the swing of the dipper when the shovel is in operation or being moved.

7.8 The trucks of all power shovels shall be inspected regularly, particular consideration being given to brakes and steering gear. All defects shall be promptly repaired.

7.9 Shovels shall be inspected each morning before starting work.

7.10 All oiling and greasing of equipment shall be done when the machine is shut down.

7.11 Operators shall not be permitted to leave the cab while the master clutch is engaged.

7.12 Whenever it is necessary to move the shovel under electric wires, ample clearance shall be provided, together with such precautions as may be necessary to prevent contact between any part of the shovel and the wires.

7.13 The wire rope on power-operated shovels shall be regularly inspected and shall be changed when ten (10) percent of the wires in any three (3) foot length are broken.

B. Electric Shovels

7.14 All wiring and electrical apparatus shall be installed, equipped, and maintained according to the rules of the local code governing such equipment and all applicable rules of the National Elec-

trical Code and the National Electrical Safety Code.

7.15 Temporary wiring shall be properly grounded to minimize the danger of shock.

7.16 In the handling of electrical equipment, experienced electricians and operators shall be employed to do the work.

C. Steam Shovels

7.17 Steam boilers shall be installed, equipped, and maintained as provided in the boiler code of the American Society of Mechanical Engineers, and tested in accordance with the rules of local authorities.

7.18 The boiler and all steam pipes shall be insulated, and all other necessary precautions taken to protect workmen from burns.

7.19 Before starting, the drip cocks in the pipes leading from the boiler to the engine shall be opened and the cylinders and pipes drained.

7.20 Drains and blow-offs shall discharge under the shovel or the discharge pipe shall be shielded to protect persons passing or working near the shovel.

7.21 Every boiler shall be provided with safety valves, gage cock, and steam pressure gage.

D. Compressed-Air and Gasoline Shovels

7.22 The compressor, air receiver, and other parts of the compressed-air equipment shall be installed, equipped, and maintained as prescribed by the local code and regulations governing such equipment, and the receiver shall comply with the ASME Code On Unfired Pressure Vessels.

7.23 Every compressor shall be provided with approved safety devices, including a safety valve, pressure gage, and fusible plug.

7.24 Only a mineral oil having a high flash point shall be used for lubricating air compressors, and the quantity carefully regulated.

7.25 All automatic controls shall be inspected daily and kept in first class working condition.

7.26 Compressors shall always be supplied with a plentiful supply of cooling water kept in continuous free circulation, unless the compressors are air cooled.

7.27 Smoking in the vicinity of gasoline shovels shall be prohibited.

7.28 No lights other than approved vapor-proof incandescent electric lights shall be used in connection with gasoline shovels.

7.29 Gasoline shovels shall be effectively grounded and otherwise protected against the hazards of static electricity.

7.30 When transporting gasoline from the general supply to the equipment in five (5) gallon quantities or less, safety cans of the non-spill type shall be used.

7.31 If tank truck service is not available, gasoline in quantities in excess of five (5) gallons shall be transported in steel drums or barrels. All bungs shall be tight, and the drum checked to prevent movement.

7.32 No open lights shall be used when transporting gasoline. Electric flash lamps only shall be used.

7.33 When gasoline is pumped from drum to storage tank on the equipment, a hose with a metallic nozzle shall be used. The pump must be of a type which does not create pressure inside the drum.

7.34 When gasoline is being pumped into the storage tank, the engine of the shovel shall be shut down.

7.35 A fire extinguisher of suitable type shall be placed on or convenient to every shovel or other similar piece of operating equipment.

SECTION 8

Trucks

8.1 Only experienced and physically fit drivers shall be allowed to operate automobile trucks.

8.2 Brakes, steering gear, tires, and all operating parts of trucks shall be inspected daily; such inspections should, preferably, be made before trucks are taken from the garage or storage area for the day's work.

8.3 All employees shall be strictly prohibited from:

- (a) Riding on trucks unless specifically authorized to do so,
- (b) Riding anywhere on a truck except in the seat beside the driver, unless the truck body is equipped with fixed-in-place seats, a rear gate, and a safe means of getting on and off,
- (c) Getting on or off moving vehicles.

8.4 Truck engines shall never be allowed to run idle in closed garages or other enclosed places.

8.5 All parts and accessories of trucks shall be kept in good repair and safe condition. Trucks with broken or cracked parts or defective tires shall be

removed from service until the defects have been corrected.

8.6 On material which projects beyond the rear end of any truck using a public highway there shall be tied or fastened to the projecting end of the material:

- (a) A red flag during the daylight hours
- (b) A red light during the hours of darkness

8.7 No person shall be permitted to remain on a truck when it is being loaded by a power shovel or to remain within reach of the swing of the dipper.

8.8 Material shall never be loaded on a truck so as to project horizontally beyond the sides of the body nor so that it can be jarred off due to vibration during transit.

8.9 Trucks while being loaded shall be properly blocked where there is a possibility of their moving by gravity, vibration from blasts, or other causes.

8.10 Loads not fully contained within the body of the truck shall be secured by means of chains, cables, ropes, or other effective devices.

8.11 The backing up of trucks shall be controlled by a signal man who shall have a clear view of the driver and the area behind the truck during each backing-up operation.

8.12 Completely deflated tires on trucks shall never be inflated until after the load has been removed by jacking up the truck. Truck drivers and mechanics shall be instructed in this procedure.

8.13 Dump bodies of dump trucks shall be blocked or cribbed before inspecting, servicing, or repairing while hoisted.

SECTION 9

Wheelbarrows

9.1 Wheelbarrows with split or cracked handles shall not be used.

9.2 Wheels shall be strong, true running, and well secured to the frame.

9.3 When wheelbarrows are used in narrow passageways, knuckle guards shall be provided.

9.4 Workmen shall not be permitted to run with empty wheelbarrows with the handles in an upright position.

9.5 Wheelbarrows shall never be left in such a position that they can readily tip over or fall.