

Chapter Ind 6

TRENCH, EXCAVATION AND TUNNEL
CONSTRUCTION

Ind 6.01	Scope	Ind 6.13	Shaft protection
Ind 6.02	Definitions	Ind 6.14	Ladders, stairways, and cages in shafts and caissons
Ind 6.03	Inspections	Ind 6.15	Hoist for workmen
Ind 6.04	Care of injured	Ind 6.16	Hoisting engineer
Ind 6.05	General safety	Ind 6.17	Hoisting rules and equipment
Ind 6.06	Timbering requirements and procedures for trenches and other excavations	Ind 6.18	Communications
Ind 6.07	Flammable material and fire protection	Ind 6.19	Hoisting ropes, hooks and sheaves
Ind 6.08	Shaft and tunnel lighting	Ind 6.20	Cages for hoisting
Ind 6.09	Electrical equipment	Ind 6.21	Timbering requirements for tunnels
Ind 6.10	Sanitation	Ind 6.22	Mechanical haulage
Ind 6.11	Ventilation	Ind 6.23	Sumps
Ind 6.12	Timbering requirements for shafts		

History: Chapter Ind 6 as it existed on December 31, 1962 was repealed and a new chapter Ind 6 created effective January 1, 1963.

Part I

GENERAL

Ind 6.01 Scope. These rules shall apply to all tunnels, caissons, accessory shafts and trenches while under construction with the exception of tunnel construction in connection with mines. The following types of construction are understood to be included: lateral trenches (house connections), water taps and connections, sanitary and storm sewers, welded pipe lines, water mains, basements, footings, dry well excavations, manholes, shafts, storage tunnels, and all other excavations.

History: Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.02 Definitions. For the purpose of these rules the following items are defined.

(1) "Tunnel" is a subterranean passage or chamber constructed without the removal of a superincumbent material.

(2) "Shaft" is an excavation made from the surface of the ground, the longer axis of which is steeper than 45 degrees. Widening of a trench to accommodate a manhole shall be considered a trench.

(3) "Trench" means a longitudinal excavation made from the surface of the ground.

(4) "Constructor" means a person, firm or body corporate in immediate control of the construction of any excavation and subsequent construction and as such responsible for the condition and management thereof.

(5) "Superintendent" means a person resident on the work having general supervision and responsibility.

(6) "Foreman" means a person in charge of a subdivision of the work or of the entire work at any one time and under the instructions of the superintendent or constructor.

(7) "Works" or "Workings" means any or all parts of any project excavated or being excavated as well as shafts and approaches, power houses, lumber yards, storage yards and structures of all kinds, which are in the immediate vicinity of and used in connection with the excavation or the immediate disposal of excavated material or in connection with any phase of the construction project.

(8) "Person" means a firm or body corporate as well as natural persons.

(9) "Underground" means within the limits of any shaft or tunnel.

(10) "Employes" or "Persons Employed" means all persons receiving compensation from the constructor or others for labor or services performed on the works.

(11) "Approved" (unless otherwise specified) means approval by the department.

(11a) "Department" means the department of industry, labor and human relations.

(12) "Pressure" means gauge pressure in pounds per square inch.

(13) "Open Air" shall be defined as well ventilated under normal atmospheric pressure.

(14) "Tight Sheathing" means planks shall be abutting.

(15) "Safety Screen" is an air-tight diaphragm placed across the upper part of the tunnel between the shield and the emergency air lock. The function of the safety screen is to prevent flooding of the upper part of the tunnel between the screen and the lock by forming in effect a diving bell in which the air is retained, preventing the water from rising above a certain level. The lower edge of the screen should be placed at a horizontal plane below the entrance to the emergency lock.

(16) "Timber Sizes." Timber sizes required in this code are stated as nominal sizes.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (11) and cr. (11a), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.03 Inspections. (1) The authorized inspectors of the department, upon presenting appropriate credentials to the owner, operator, or agent in charge, are authorized—

(a) To enter without delay and at reasonable times any factory, plant, establishment, construction site, or other area, workplace or environment where work is performed by an employe of an employer; and

(b) To inspect and investigate during regular working hours and at other reasonable times, and within reasonable limits and in a reasonable manner, any such place of employment and all pertinent conditions, structures, machines, apparatus, devices, equipment, and materials therein, and to question privately any such employer, owner, operator, agent or employe.

(2) The inspector before making an inspection shall contact a representative of the employer and a representative authorized by the employes who shall be given an opportunity to accompany the inspector during the physical inspection of any workplace under subsection (1) for the purpose of aiding such inspection.

(a) Where there is no authorized employe representative, the inspector shall consult with a reasonable number of employes concerning matters of health and safety in the workplace.

Note: The department policy is not to give advance notice, but in the scheduling and in the act of inspecting it may not always be possible to avoid advance notice or to obtain accompaniment as, for example, inside boilers or in precarious locations of elevator installations, but otherwise these rules will be diligently observed.

(3) All excavations, timbering and equipment shall be inspected daily. All dangerous conditions or defects shall be made safe. The constructor or his representative shall be responsible for these inspections and the safety of all workmen at all times.

(4) Frequent inspections of rock excavations, including tunnels, shafts and trenches shall be made by the constructor or a representative and loose rock which may fall shall be removed.

(5) After a blast is fired these requirements for inspection and removal of loose rock shall be complied with before proceeding with the work.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; renum. (1), (2), (3) to be (3), (4), and (5) and cr. (1) and (2), Register, April, 1973, No. 208, eff. 5-1-73; am. (2) (intro.) and (4), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.04 Care of the injured. (1) It shall be the duty of employers to keep at such place or places as shall be convenient and accessible to employes in shafts or tunnels a wire basket stretcher and a woolen blanket for use in carrying any person who may be injured.

(2) An approved supply of first aid material shall be kept and maintained at all times in a dust and moisture-proof box.

(3) Information regarding emergency handling of the injured shall be posted whenever possible.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.05 General safety. (1) **PROJECTING NAILS.** All spikes and nails with points projecting shall be bent down or removed from lumber lying in or about working places.

(2) **SAFETY BELTS.** Approved, tested and regularly inspected safety belts or harnesses and ample lengths of $\frac{3}{4}$ inch diameter rope shall be provided for emergency use.

Note: Lists of approved safety belts can be secured from the department.

(3) **PROTECTIVE HATS.** All workers on tunnel, shaft, trench, and caisson projects shall wear protective hats or caps of approved design and manufacture.

(4) **PROTECTIVE FOOTWEAR.** It is recommended that approved hard toed boots or shoes be worn by all underground or surface workers exposed to toe injury hazards.

(5) **SOLITARY EMPLOYMENT.** No person shall be allowed to work in any trench, except one which is properly side sloped, shaft, tunnel, caisson, or appurtenance over 4½ feet in depth without another person being present at the surface.

Note: Any casual entrance into an excavation such as retrieving fallen objects shall not be construed as work under this section.

(6) **BLASTING.** All blasting procedure shall comply with the provisions of the Wis. Adm. Code, chapter Ind 5, Explosives.

(7) **HOUSEKEEPING.** All change houses, passageways, ladders and working areas shall be kept clean and unobstructed to provide reasonably secure footing according to the needs of the operation. Materials for distribution and use shall be piled and stacked as safe as circumstances will permit. Supplies, materials and tools shall not be stored in change houses.

(8) **WORKERS.** Every reasonable precaution shall be taken to insure the safety of the worker in all cases whether or not provided for in these rules.

Note: Attention is directed to the provision of Wis. Stats. 66.047, relative to protecting underground facilities in streets, highways, etc., and informing the utility concerned.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (5) and (8), Register, September, 1978, No. 273, eff. 10-1-78.

Part II

TRENCHES AND EXCAVATIONS

Ind 6.06 Timbering requirements and procedures for trenches and other excavations. (1) **BRACE OR SLOPE.** All areas in trenches in which persons are permitted to work shall be adequately and securely timbered or sloped as follows.

(a) *Depth. Exception.* Trenches cut in hard solid soil need not be braced or sloped if less than 4½ feet in depth. Trenches cut in loose or sandy soil need not be braced or sloped if less than 3 feet in depth.

(b) *Rock. Exception.* Trenches need not be timbered if excavated in solid rock and if there have been no previous known excavations within the minimum lateral distance of the depth of the trench being excavated. The total depth of the trench must be in rock or any over burden must be sloped or braced.

(c) *Sloping. Exception.* Trenches need not be timbered if the sides are cut down to the angle of repose. The angle of repose shall not be considered greater than one to one-half (measuring one foot of rise to each ½ foot horizontal) for dry or moist soils and not more than one to one for wet or heavy soils.

(2) **PARTIAL SLOPE AND BENCHES.** When the sloping of trench walls to the angle of repose does not extend to the bottom of the trench, level benches 2 feet wide shall be provided between the toe of the slope and the top edge of the vertical walls. The vertical part of a partially sloped trench shall be braced according to its vertical depth below the bench. If benches are not provided as in case of the necessary trimming back of loose material at the surface, the trench shall be braced according to its

total depth. Upright braces in all partially sloped excavations shall extend not less than 2 feet above the vertical portion of the trench. Toeboards with a total of 12 inches in height shall be placed behind all uprights to prevent material from falling into the vertical portion. The spoil pile adjacent to a partially sloped trench shall be kept at least 2 feet from the top of the slope at the surface.

(3) **UNDERCUTTING.** All trenches shall be cut with vertical walls unless side sloped to required minimums. Undercutting or trenches sloped to less than required minimums shall not be permitted.

(4) **BASEMENT EXCAVATION.** All basement excavations shall comply with the provisions of the Wis. Adm. Code, chapter Ind 35, Safety in Construction.

(5) **TIMBERING TABLES.** Timbers shall be installed according to tables of trench timbering requirements contained in this code.

(6) **GOOD INSTALLATIONS.** In using tables 1, 2, 3, 4 and 5, the maximum distance from the top of the trench to the top cross brace shall be 2 feet. The maximum distance from the bottom of the trench to the bottom cross brace shall be 3 feet. All sheathing shall extend from the ground surface to at least within 6 inches of the bottom of the trench. If any cross braces are removed to install pipe or other conduits, persons shall not be allowed to work in these unprotected areas except to replace the cross braces.

(7) **GOOD TIMBER.** All timbers used for supporting sides of trenches shall be of good quality, reasonably straight grained and free from weakening knots and other defects.

(8) **DRIVING SHEATHING.** When sheathing is driven by power equipment, drivers especially designed for the purpose shall be used.

(9) **PLANS FOR APPROVAL.** For trenches and other excavations exceeding 40 feet in depth or 12 feet in width, plans for timbering shall be submitted to the department for approval.

(10) **EQUIVALENCY APPROVAL.** Other methods of supporting the walls of an excavation may be approved if designed and constructed to afford equivalent protection.

(11) **BARRICADE.** A temporary guard railing or other effective guard or barricade shall be provided at or near the sides of excavations and shall be kept in place at all times, except at such times when safeguards will interfere with excavation or other work except in places not frequented by the public.

(12) **NIGHT LIGHTS.** All trenches exposed at night shall have lighted red lanterns, torches, or flashers placed along the exposed side or sides.

(13) **LADDERS.** A substantial ladder shall be provided for access to all trenches more than 6 feet in depth. The ladder shall project out of the trench at least 36 inches.

(14) **BRACE REMOVAL.** While removing trench bracing, workers shall be required to work only in that portion of the trench where bracing is still in place.

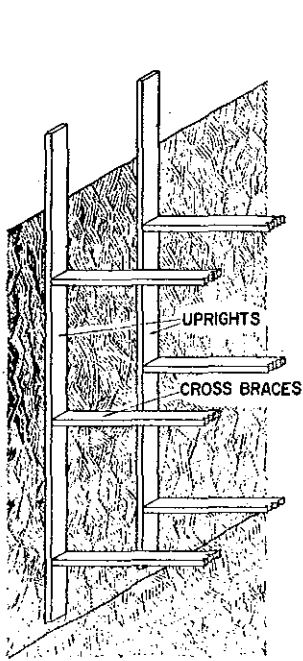


Fig. 1.—Trench Timbering—
Solid Soil

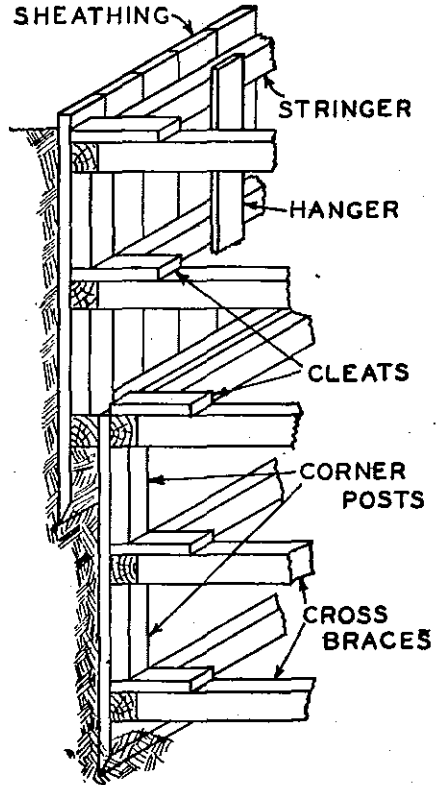


Fig. 2.—Trench Timbering—
Loose Soil

TABLE 1—TRENCH TIMBERING REQUIREMENTS
For trenches not exceeding 10 feet in depth and width not exceeding 42 inches

	Kind of Soil	Uprights	Cross Braces	Stringers**
Where no parallel excavations exist or have existed within 10 ft.	Hard, solid soil	2x6 inch planks spaced 6 ft. c—c	*2—2x6 inch planks or equivalent for depths under 7 ft.; 3 for depths 7 ft. to 10 ft.	None
Previous excavations 5-10 ft. from trench	Hard, solid soil	2x6 inch planks spaced 4 ft. c—c	*2—2x6 inch planks or equivalent for depths under 7ft.; 3 for depths 7 ft. to 10 ft.	None
Previous excavations less than 5 ft. from trench	Hard, solid soil	2x6 inch planks spaced 3 ft. c—c	*2—2x6 inch planks or equivalent for depths under 7 ft.; 3 for depths 7 ft. to 10 ft.	None
Irrespective of any previous excavation	Soil that splits easily	2x6 inch planks spaced 3 ft. c—c	*2—2x6 inch planks or equivalent for depths under 7ft.; 3 for depths 7 ft. to 10 ft.	1x6 inch boards placed back of uprights near top of trench
Irrespective of any previous excavation	Gravelly or filled in ground	2x6 inch planks spaced 2 ft. c—c	*2—2x6 inch planks or equivalent for depths under 7 ft.; 3 for depths 7 ft. to 10 ft.	1x6 inch boards placed back of uprights near top of trench
Irrespective of any previous excavation	Sand or very wet soil	2 inch tight sheathing	3x6 inch timbers or equivalent horizontally spaced not exceeding 6 feet	3x6 inch timbers or equivalent—2 for depths 7 ft.; 3 for depths 7 ft. to 10 ft.

Note: c—c means center to center.

* In lieu of these cross braces for each upright, 3x6 inch stringers may be used with substantial cross braces spaced horizontally sufficient to support the stringers.

TABLE 2—TRENCH TIMBERING REQUIREMENTS
For trenches over 10 feet and not exceeding 15 feet in depth and width not exceeding 42 inches

	Kind of Soil	Uprights	Cross Braces	Stringers**
Where no parallel excavations exist or have existed within 15 ft.	Hard, solid soil	2x6 inch planks spaced 4 ft. c—c	*3—2x6 inch planks or equivalent for depth under 13 ft.; 4 for depths 13 ft. to 15 ft.	None
Previous excavations 10 to 15 ft. from trench	Hard, solid soil	2x6 inch planks spaced 3 ft. c—c	*3—2x6 inch planks or equivalent for depths under 13 feet; 4 for depths 13 ft. to 15 ft.	None
Previous excavations less than 10 ft. from trench	Hard, solid soil	2x6 inch planks spaced 2 ft. c—c	*3—2x6 inch planks or equivalent for depths under 13 ft.; 4 for depths 13 ft. to 15 ft.	None
Irrespective of any previous excavations	Soil that splits easily	2x6 inch planks spaced 2 ft. c—c	*3—2x6 inch planks or equivalent for depths under 13 ft.; 4 for depths 13 ft. to 15 ft.	1x6 inch boards placed back of uprights near top of trench
Irrespective of any previous excavations	Sand, gravel filled in ground or very wet soil	2 inch tight sheathing	3x6 inch timbers or equivalent, spaced 6 ft. c—c	6x6 inch timbers or equivalent—3 for depths under 13 ft.; 4 for depths 13 ft. to 15 ft.

Notes:c—c means center to center

*In lieu of these cross braces for each upright, 3x6 inch stringers may be used with substantial cross braces spaced horizontally sufficient to give equivalent protection, but in no case exceeding 6 feet.

**Stringers shall be properly supported by posts or cleats.

TABLE 3—TRENCH TIMBERING REQUIREMENTS
For trenches over 15 feet in depth and width not exceeding 42 inches

	Kind of Soil	Uprights	Cross Braces	Stringers**
Irrespective of any previous excavations	Hard, solid soil	2"x6" 2' c—c 15'-17' 2"x6" 1' c—c 17'-20'	Use Table No. 4	Use Table No. 4
	Soil that splits easily, sand, gravel, filled in ground, or very wet soil	2"x6" tight over 20' 2" tight sheathing		

Note: c—c means center to center.

**Stringers shall be properly supported by posts or cleats.

TABLE 4—TRENCH TIMBERING REQUIREMENTS

For trenches over 42 inches in width up to and including 12 feet in width

Depth of Trench	Uprights	Cross Braces	Stringers
Over 4½ ft. to 10 ft. incl.	(*)	4x6 inch timbers spaced horizontally 7 ft. face to face	4x6 inch timbers spaced 4 ft. c—c
		6x6 inch timbers spaced horizontally 11 ft. face to face	6x6 inch timbers spaced 4 ft. c—c
Over 10 ft. to 20 ft. incl.	(*)	6x6 inch timbers spaced horizontally 7 ft. face to face	6x6 inch timbers spaced 4 ft. c—c
		8x8 inch timbers spaced horizontally 11 ft. face to face	8x8 inch timbers spaced 4 ft. c—c
Over 20 ft. to 30 ft. incl.	(*)	6x8 inch timbers spaced horizontally 7 ft. face to face	6x8 inch timbers spaced 3 ft. c—c
		8x8 inch timbers spaced horizontally 11 ft. face to face	8x8 inch timbers spaced 3 ft. c—c
Over 30 ft. to 40 ft. incl.	(*)	8x8 inch timbers spaced horizontally 7 ft. face to face	8x8 inch timbers spaced 3 ft. c—c
		12x12 inch timbers spaced horizontally 11 ft. face to face	12x12 inch timbers spaced 3 ft. c—c

(*) Uprights shall consist of 2 inch planks and spaced to comply with specifications for trenches less than 42 inches in width.

TABLE 5—TRENCH TIMBERING REQUIREMENTS

For trenches 4½ to 15 feet in depth, 3½ to 12 feet in width, and cut in hard soil*

Depth (ft.)	Width (ft.)	Uprights	Cross Braces
4½- 8	3½-12	2x6 inch planks spaced 4 ft. c—c	2—3x6 inch struts spaced 4 ft. c—c
8 -12	3½-12	2x6 inch planks spaced 4 ft. c—c	3—4x6 inch struts spaced 4 ft. c—c
12 -15	3½-12	2x6 inch planks spaced 4 ft. c—c	4—4x6 inch struts spaced 4 ft. c—c

*In case unstable soil is encountered, bracing shall immediately revert back to that outlined in Table 4.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am (1) (intro.), (6) and (9), Register, September, 1978, No. 273, eff. 10-1-78.

Part III**SHAFTS AND TUNNELS**

Ind 6.07 Flammable material and fire protection. (1) Every reasonable precaution shall be taken against fire in and about tunnels and adequate fire protection shall be provided as hereafter required.

(2) Gasoline, naphtha, distillate, fuel oils and other dangerous flammable materials shall be stored in a building kept solely for such storage and the location of which is at least 100 feet away from any shaft, tunnel or approaches, or any building directly connected with the tunnel opening and at least 300 feet distant from any explosive magazine.

(3) If oil or gasoline storage places are so located that leakage would permit oil or gasoline to flow in the direction of the shaft means to prevent such flows shall be provided.

(4) Not more than a one day supply of lubricating oil or grease shall be kept in underground workings.

(5) The storage of gasoline, naphtha and other distillates in underground workings is prohibited.

(6) Waste or decayed timbers shall not be stored in the tunnel, but shall be promptly removed therefrom. Empty boxes, wooden chips, paper and combustible rubbish of all kinds shall not be allowed to accumulate underground.

(7) When welding or flame cutting is being done in compressed air, a watchman with a fire hose or approved extinguisher shall stand by until such operation is completed. Acetylene shall not be used in compressed air at acetylene pressures exceeding 15 pounds per square inch gauge, or 30 pounds per square inch absolute.

(8) Combustible materials in an amount greater than a one day normal requirement shall not be stored or kept within 20 feet of tunnel shafts.

(9) Any container used for pouring gasoline shall be provided with a closed top, flexible spout and a safety screen and no open light shall be permitted within a 10 foot radius of the gasoline tank, while filling operations are in progress.

(10) Fire hose connections with at least 50 feet of hose attached shall be provided at the shaft opening if water pressure is available.

(11) Fire extinguishers of 2½ gallon capacity protected against freezing shall be installed in all power plants and at shaft openings.

(12) Head frames built of combustible material shall be of open framework. At or about the surface landing there may be a head house if built of fire resistive material.

(13) Where fire is used for heating hoppers, any enclosure shall be of incombustible material.

(14) All incandescent lamps shall be so placed that they cannot come in contact with any combustible material.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.08 Shaft and tunnel lighting. (1) All lighting in tunnels and shafts shall be by electricity only. While work is in progress tunnels, stairways, shafts, ladderways and all places on the surface shall be illuminated by bulbs of no less than 60 watts at intervals of no more than 25 feet. All incandescent lamps shall be enclosed in a protective basket guard.

(2) The exterior of all lamp sockets shall be entirely non-metallic with the exception that for flood lamps the supporting shell may be of metal.

(3) Lamp cord, where used for temporary lighting connections, shall have extra heavy insulation. Portable electric hand lamps, if used shall be equipped with a keyless socket of non-combustible, non-absorbent insulating material, large handle of non-absorbent insulating material and a basket guard.

(4) When wires used for light and power in tunnels and shafts are uncased, heavy type S rubber covered cable or equivalent shall be used. Cables shall be supported on insulators except when not possible to do so in tunnel headings or when used in connection with portable hand lamps.

(5) On a tunneling project, wires which are not armored shall have mechanical protection wherever exposed to injury.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.09 Electrical equipment. (1) DEFINITIONS.

(a) *Voltage of a circuit.* The greatest effective difference of potential between any two conductors of the circuit concerned.

(b) *Grounding.* Grounding any part of an electrical system shall consist in so connecting such part to the earth that there shall be no material difference of potential between such part and the earth.

(c) *Underground station.* The term "underground station" as used herein shall mean any place where electrical machinery is permanently installed in a tunnel.

(d) *Carrying capacity.* The term "carrying capacity" shall mean the current carrying capacity of a given wire as limited by the Wisconsin State Electrical Code.

(e) *Guarded.* The term "guarded" shall mean effectually covered, enclosed or otherwise guarded by means of suitable covers, casings, screens or barriers so as to prevent accidental contact with live parts of apparatus or circuits. Wires which are insulated, but not otherwise protected are not construed to be guarded.

(2) **SCOPE.** Except where the provisions of section Ind 6.09 apply the provisions of the Wisconsin State Electrical Code shall apply.

(3) **CARE OF EQUIPMENT AND PRACTICES.** No persons shall be allowed to install or handle electric lights, or conductors, or work on or with electrically driven apparatus, unless they shall be competent and shall have been previously instructed in the performance of their duties by the tunnel superintendent, tunnel foreman, or a person authorized by either.

(4) **GROUNDING.** All non-current carrying metal parts of electrical equipment, including frames and bed plates of generators, transformers,

compensators, rheostats and motors shall be permanently and effectively grounded. All metallic fittings, coverings and armoring of cables are included. The neutral conductor of a three wire system and some point of any low voltage system (300 volts or less) shall be grounded. See Wisconsin State Electrical Code.

Note: This section requires the grounding of the non-current carrying parts of portable tools, such as drills. An additional conductor in the portable cord and a grounding contact in the plug and receptacle will provide the best means of permanent and effective grounding.

(5) **SUPPORT OF CABLES AND WIRES.** All underground cables and wires, unless provided with grounded metallic covering, shall be supported by insulators. The conductors connecting lamps to the power supply shall in all cases be insulated.

(6) **OVERHEAD LINES ABOVEGROUND.** Overhead transmission lines between the generating station or sub-station and the tunnel entrance shall be supported upon insulators which shall be adequate in quality, size and design for the voltage transmitted. Where such line is more than 500 feet in length, lightning arresters shall be installed in connection therewith. All overhead lines, except in the case of trolley wires, shall be maintained not less than 14 feet above the ground at the lowest point, except at the point of entrance to the tunnel.

Note: If wires cross areas accessible to vehicles or if the voltage exceeds 300, greater clearances shall be provided as required by the Wisconsin State Electrical Code.

(7) **BRANCH CIRCUITS.** Every branch circuit shall be provided with a switch of ample carrying capacity and suitable fuses on each phase within 50 feet of the point where it leaves the main circuit.

(8) **POWER WIRES AND CABLES.** (a) In all shafts, whose angle of inclination is more than 45 degrees from the horizontal, and in all hoisting shafts or manway compartments, all power wires and cables shall be amply protected by insulation and substantially fixed in position. All shaft cables shall be supported on insulators that cannot cause abrasion of the covering or insulation, so spaced that no part of the cable shall be under a tension greater than $\frac{1}{4}$ of its ultimate strength. The cable shall be held in position at points between the insulators by grips or cleats that cannot cause abrasion of the covering or insulation. Where the cables are not completely boxed in and protected from falling material, space shall be left between them and the side of the shaft so that they may yield and lessen a blow from falling material.

Note: Section Ind 6.09 (8) (a) shall not be construed to prevent the installations of insulated wires in metal conduit to transmit power underground.

(b) Where the cables or feed wires in tunnels cannot be kept at least 12 inches from car or locomotive, they shall be protected by guards. Any trolley wires shall be guarded if less than 6 feet above track.

(9) **CABLES. ENTERING FITTINGS.** (a) The exposed ends of cables where they enter the fittings of any description shall be so protected and finished off that moisture cannot enter the cables.

(b) Where unarmored cables or wires pass through metal frames or into boxes or motor castings, the holes shall be lined with insulation bushings.

(10) **JOINTS IN CONDUCTORS.** All joints in conductors shall be mechanically and electrically efficient. Permanent joints shall be soldered. All

joints in insulated wire shall, after the joint is complete, be reinsulated to the same extent as the remainder of the wire.

(11) **JOINTS IN CABLES.** Where cables are joined, suitable junction boxes shall be used or the joints shall be soldered and the insulation, armoring or lead covering replaced in as good condition as it was originally.

(12) **FUSES, CIRCUIT-BREAKERS AND SWITCHES.** (a) Fuses and automatic circuit-breakers shall be constructed so as to interrupt the current when a short circuit occurs or when the current through them exceeds their rated capacity. No open type or link fuses shall be used.

(b) Fuses shall be stamped or marked, or shall have a label attached, indicating the maximum current that they are intended to carry. Fuses shall be adjusted or replaced only by an authorized and competent person.

(c) The capacity of fuses used to protect feeders shall not exceed the current capacity of the feeder by more than 10%.

(d) All points at which a circuit has to be made or broken shall be provided with suitable switches, which shall be so installed that they cannot be closed by gravity.

(e) All switches, circuit-breakers and fuses shall have non-combustible bases and shall be properly enclosed.

(f) All cartridge fuses, and plug fuses larger than 15 amperes capacity, shall always be so arranged that they may be disconnected from the supply circuit by properly placed switches. An individual switch shall be installed in each branch circuit of capacity larger than 15 amperes.

(g) All manual switches, including service switches, shall have suitable enclosures of such design as to permit of operation without opening the enclosure. Enclosures shall be locked, sealed or made inaccessible by other suitable methods to other than qualified persons. 1. *Exception.* Switches or switchboards and panelboards that are properly guarded or locked or located in underground stations or other similar places not accessible to other than qualified persons are exempt from provisions of section Ind 6.09 (12) (g).

(13) **MOTORS.** Every motor together with its starting device shall be protected by fuses or a circuit breaking device on at least one line of direct current systems and on two phases of three-phase alternating current system and by switches arranged to cut off entirely the power from the motor. The above devices shall be installed in a convenient position near the motor and in sight of it.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (3), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.10 Sanitation. (1) One outside toilet and urinal shall be provided for every 20 persons employed on each shift and protection from the weather shall be provided. For any construction project occupying a location for 60 days or more, the toilet facilities shall be of a chemical type, or a flush toilet system connected to a septic tank or a sewerage system, if no other facilities are available.

Register, September, 1978, No. 273
Trench, Excavation and Tunnel Construction

(2) Potable drinking water shall be provided for all employees. Drinking water shall be protected from contamination. Common drinking cups are prohibited.

(3) A dressing room or change house shall be provided for the purpose of drying clothing of persons employed in and about the tunnel. Not less than 4 square feet of floor area shall be available for each employe. Adequate means of heating and lighting shall be provided and a temperature of not less than 70° F. shall be maintained at all times. Dressing rooms or change houses shall be cleaned daily. Lockers or hangers shall be provided for clothing. Tools, equipment or other supplies shall not be kept in change houses.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (1), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.11 Ventilation. (1) During all shifts and after blasting the atmosphere shall be tested for explosive gases and sufficient oxygen with a safety lamp. If any indication of air pollution appears, tests shall be taken to determine the amount of noxious gases. At no time when men are working in the shaft or tunnel will the gases exceed the following concentration:

Carbon monoxide to be less than01 %
Carbon dioxide to be less than50 %
Methane to be less than.....	.25 %
Hydrogen sulphide to be less than001%
Oxygen to be more than.....	19.00 %

(2) If repeated tests show an excess of these concentrations for any of the gases, mechanical ventilation shall be provided and operated which will give a minimum of 1,000 cubic feet of free air per minute in each tunnel and sufficient air in addition to dilute said gases with free air to comply with the limitations of the above table.

(3) Internal combustion engines shall be so located that the exhaust gases will not enter the shaft or the air intake of compressors. Internal combustion engines shall not be operated in any tunnel or shaft.

(4) Harmful dust concentrations shall be controlled to maintain safe air in the breathing zone.

(5) The maximum silica dust concentration in the normal breathing zone shall not exceed 15 million particles under 10 microns in longest dimensions per cubic foot of air when the quartz content of the dust is 35%. Variations in free silica content will make proportional inverse changes in this standard.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.12 Timbering requirements for shafts. (1) **SHAFT TIMBER REQUIRED.** Shafts exceeding 6 feet in depth in which men are permitted to work shall be timbered, except where located in solid rock. Shaft sections shown in figures 3 and 4 may be used in accordance with the shaft timbering requirements as follows.

(2) **SHEATHING (tight).** Under normal conditions, 2 x 6 inch hardwood shall be used. When unusually wet or unstable soil is encountered, steel sheathing shall be used.

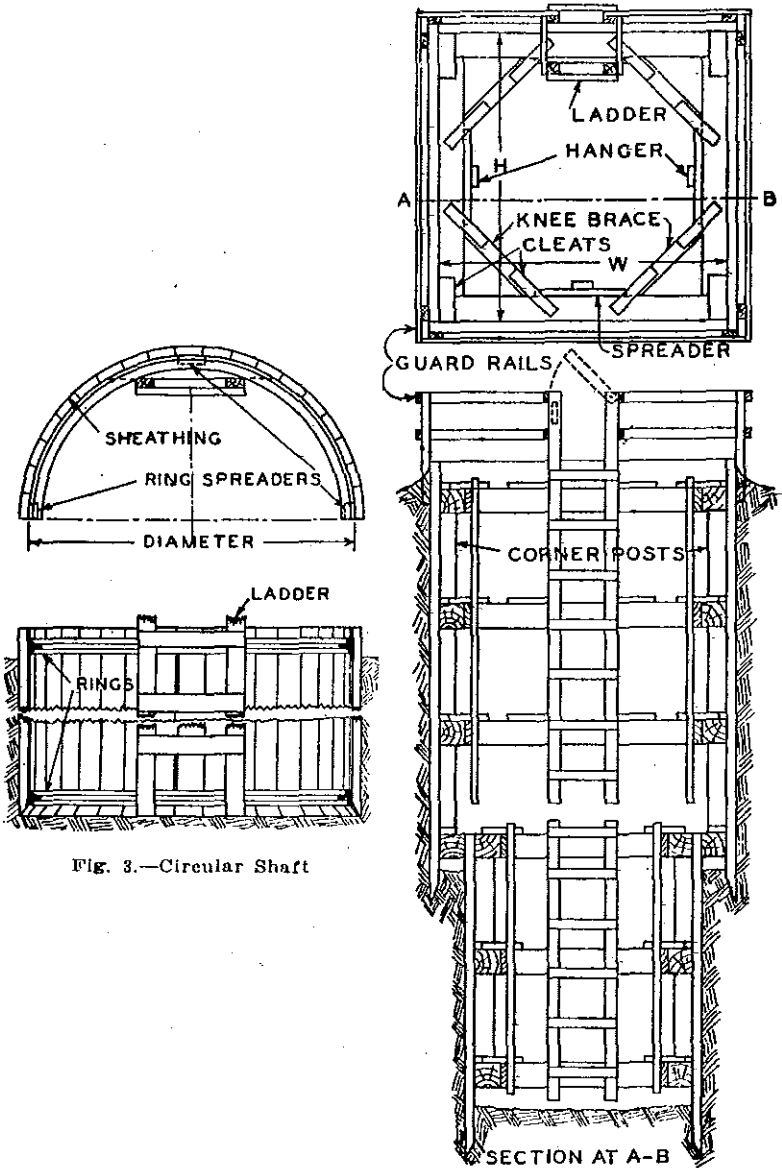


Fig. 3.—Circular Shaft

Fig. 4.—Rectangular Shaft Timbering

(3) **SHAFT CUTTING.** Shaft excavation shall be cut to substantially the shaft size. Overcutting and backfilling behind the sheathing shall not be permitted.

TABLE 6.—BRACING OF CIRCULAR SHAFTS

Diameter	Depth	Steel Rings Required 4 feet O.C.
8' Maximum	16' Maximum	2½" x 2½" x ¼"
10' Maximum	16' Maximum	2½" x 2½" x 5/16"
12' Maximum	16' Maximum	3" x 3" x ¼"
8' Maximum	Over 16'	2½" x 2½" x ¼"
10' Maximum	Over 16'	3" x 3" x ¼"
12' Maximum	Over 16'	3" x 3" x 5/16"

Note 1: For depths over 16 feet, decrease ring spacing when unusually wet or unstable soil is encountered. The top ring shall be placed not more than 2 feet below ground surface.

Note 2: Other member sections may be used if it would provide equivalent section modulus.

(4) **UNUSUAL CONDITIONS AND ALTERNATE DESIGNS.** The requirements set forth in section Ind 6.12 are minimum. Bracing of greater strength shall be used when unusual soil conditions prevail. If shafts are constructed of greater dimensions than those set forth in the Wis. Adm. Code section Ind 6.12, drawings and design calculations for bracing shall be presented for approval to the department. Alternate designs for those set forth in this section also shall be presented to the department for approval.

(5) **STAGING AND SCAFFOLDS.** Staging or scaffolds shall be provided in shafts for workers when installing equipment or driving sheathing. All scaffolds shall be constructed or installed so as to support any maximum material load which may be placed on them as well as weight of the workers.

(6) **CLAM SHELL BUCKETS.** No person shall be permitted to work in a shaft when excavation is being done with a clam shell bucket unless the longest horizontal dimension of the shaft is at least twice the length of the bucket when fully opened.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (4), (5) and (6), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.13 Shaft protection. (1) During shaft sinking operations, the tops of all shafts shall be guarded by a suitable barricade that will keep unauthorized persons away from the opening. At night there shall be additional protection of torches or red lights. When sheathing is installed and it does not project at least 36 inches above the surface a standard guard rail with toe boards shall be provided and equipped with necessary gates. The gates shall be kept closed when not used for access to the shaft.

TABLE 7.—BRACING OF RECTANGULAR SHAFTS

Longest Dimension of Timber Between Knee Braces or Cross Braces**	Depth	Timber or Steel Beam Required 4' O.C.	Timber or Steel Beam Required 3' O.C.	Timber Knee Braces
3' Maximum	10' Maximum	4" x6" Hardwood or 6" x6" Softwood	4" x6" Hardwood or 6" x6" Softwood	6" x6" Hardwood
4' Maximum	16' Maximum	6" x6" Hardwood or 8" x8" Softwood	6" x6" Hardwood or 8" x8" Softwood	6" x6" Hardwood
6' Maximum	14' Maximum	10" x10" Hardwood or 10" x10" Softwood	10" x10" Hardwood or 10" x10" Softwood	6" x6" Hardwood
6' Maximum	Over 14'	10" x10" Hardwood or 12" x12" Softwood or 8 WF 20*	10" x10" Hardwood or 12" x12" Softwood or 6 WF 20*	6" x6" Hardwood
8' Maximum	Any	12" x12" Hardwood or 8 WF 31*	12" x12" Hardwood or 8 WF 24*	6" x6" Hardwood
10' Maximum	Any	12 WF 36*	12 WF 27*	8" x8" Hardwood 61 12.5 or 6C13

*WF beams shall be placed with web horizontal.

**Assuming knee braces shall lap 1/4 of the span on each leg of the corner, the maximum outside dimensions of sheathing will be approximately 6', 10', 14', 18' and 23'.

Note 1: For depths over 16 feet, decrease spacing of timber or steel sets when unusually wet or unstable soil is encountered.

Note 2: For intermediate sizes of sets, members providing proportionate area and section modulus may be used.

(2) Where cages are installed in shafts, automatic gates shall be used at the top landing. All intermediate landings shall be provided with a fence and gate or gates, the members of which shall not be more than 4 inches apart and not less than 5 feet high. The gates at such landings shall be not more than 12 inches from the openings. The gates shall be kept closed at all times except when persons or material are entering or leaving the cage.

(3) Cars shall be blocked at all landings and on the cage.

(4) Landing dogs shall be provided at all landings where cars enter or leave cage or where material is taken on or off cages.

(5) The tops of all bins or hoppers around which persons are required to work shall be provided with a guardrail.

(6) Guardrail installations, if of wood construction, shall comply with the following specifications:

(a) Guardrails of not less than nominal 2x4 inch material fastened to posts and not more than 42 inches or less than 36 inches above the working level;

(b) Posts of not less than nominal 2x4 inch material, spaced not more than 8 feet apart, fastened and braced in place;

(c) Where the top of the guardrail is more than 36 inches above the working level, an intermediate rail of not less than nominal 1x6 inch material is to be placed midway between the top guardrail and the working level.

(d) Equivalent strength and stiffness is to be provided if material other than wood is used.

(7) Collars of all shafts shall be provided with efficient dams to prevent influx of water during heavy rains. Dams shall be formed by extending shaft lining not less than 10 inches above surface ground level and banking with clay or other plastic material.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (5), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.14 Ladders, stairways, and cages in shafts and caissons. (1) All shafts where persons work shall at all times be provided with ladders, stairways, or cages which shall be kept clean and in good condition.

(2) A shaft less than 10 feet in depth shall be provided with an inclined portable ladder.

(3) A shaft 10 to 30 feet in depth shall be provided with an approved ladder as described in subsection (7) and with an offset at a platform approximately 6 feet in area if the rise is over a maximum of 20 feet.

(4) A shaft 30 to 45 feet in depth shall be provided with an inclined or spiral stairway. This stairway shall be equipped with standard handrails.

(5) A shaft over 45 feet in depth shall be provided with a cage for access. This cage shall conform to section Ind 6.20. A ladder is also required as described in subsection (6).

(6) In shafts intended only as manholes, or in shafts in which the ladder is installed as an auxiliary to a cage, the minimum requirement shall be a vertical ladder without offsets, but equipped with a back rest.

(7) Every vertical ladder shall be provided with an enclosed back rest. The back rest shall have not less than 24 inches nor more than 36 inches clear distance to the ladder. The distance between centers of rungs of a ladder shall not exceed 14 inches and shall not vary more than one inch in any one ladder length. The rungs of the ladder shall in no case be less than 6 inches from the wall or any obstruction in the shaft or opening in which the ladder is used. Under no circumstances shall a ladder inclining backward from the vertical be installed. Should it be necessary to offset any section of a ladderway, the top of the ladder section shall extend not less than 3 feet above the bottom of the section above, or hand holds shall be provided.

(8) In no case will sloping or stepping down be allowed to be used to reduce the depth of a shaft.

(9) Fixed ladders of standard construction shall be provided for access to cable sheaves on head frames located over tunnel shafts. A catwalk or platform equipped with guard rails and toeboards shall also be provided next to the cable sheaves.

(10) Ladders shall be provided at all times during shaft sinking operations.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (1), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.15 Hoists for workers. Hoists on which workers are permitted to ride shall be of approved design. Approval shall be obtained in advance of installation from the department.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.16 Hoisting engineer. Only experienced operators familiar with details of hoisting equipment shall be employed to operate and be responsible for such equipment. Learners shall be prohibited from operating of hoisting equipment when any person is on the cage.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.17 Hoisting rules and equipment. (1) All power driven equipment shall be maintained and adjusted in a reasonably safe mechanical condition. This includes booms, drums, clutches, brakes, sheaves and gears.

(2) When hoisting signals are used the signal code shall be posted in the engine room in sight of the hoisting engineer.

(3) The hoist shall be provided with brakes and distance marks on hoisting ropes or cables.

(4) No unauthorized persons shall be permitted in the hoist room.

(5) There shall be no conversation in the engine room while the engine is in motion or while signals are being given or received.

(6) Persons shall not be hoisted or lowered into any tunnel or shaft at a speed greater than the rate posted in the engine room.

(7) After any stoppage of hoisting for repairs, the conveyance shall be run up and down the working part of the shaft at least once. The conveyance shall not be used for hoisting or lowering persons during this test nor until the hoisting machinery and shaft shall have been found to be safe.

(8) There shall be no hoisting in any compartment of a shaft while under repair except as may be necessary for the repair work.

(9) The hoisting engineer shall not change shift while the bucket, skip, cage or other conveyance is in motion.

(10) The superintendent of the tunnel shall establish for each shaft rates of speed for the conveyances. Established speed shall not be exceeded in the hoisting or lowering of persons. The superintendent shall post a notice of such established speed in a conspicuous place near each hoisting engine; such rates of speed shall not exceed the maximum approved by the department.

(11) The superintendent of the tunnel shall determine the maximum number of persons that may safely ride on the conveyance used in the tunnel under the superintendent's supervision, and shall post in a conspicuous place near each shaft a notice stating the maximum number of persons so permitted to ride and forbidding the carrying of any greater number. The number of persons permitted to ride, as determined by the superintendent, shall not exceed the maximum approved by the department.

(12) No person shall ride upon any conveyance that is loaded with tools, timber, powder or other material, except for the purpose of handling such material while in transit and then only after a special signal has been given. When tools, timber or other material are being lowered or hoisted in a shaft, means shall be taken to prevent their shifting while the conveyance is in motion.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (6), (7), (10) and (11), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.18 Communications. (1) Every shaft shall be provided with an efficient means of interchanging distinct and definite communications between the top of the shaft and the lowest level and the intermediate levels from which hoisting is being done.

(2) When signals are used a code shall be printed and copies thereof shall be kept posted in a conspicuous place near entrances to work places and in such other places as may be necessary to bring them to the attention of all persons affected thereby.

(3) Some form of signalling, such as blinking lights or use of horn or intercom, shall be provided from the shaft to the tunnel face if the heading is more than 500 feet from the shaft.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.19 Hoisting ropes, hooks and sheaves. (1) Ropes or cables for hoisting or lowering persons, when such hoisting or lowering is done by power hoists, shall be composed of metal wires.

(2) The factor of safety of all such ropes or cables shall be not less than 5.

(3) No head or angle sheave of a diameter less than 40 times the diameter of the rope or cable shall be used for hoisting or lowering persons.

(a) *Exception.* This subsection does not apply to sheaves on standard equipment approved for hoisting and lowering persons.

(4) Cables are considered unsafe and shall be removed when through broken wires, wear, rust, undue strain, or other deterioration the strength has decreased 25%.

(5) All ropes or cables used for hoisting or lowering persons shall be thoroughly inspected once each week by some competent person designated for the purpose by the superintendent. If upon an inspection such hoisting rope, or cable shall be found to be below the requirements set forth in these rules, it shall be discontinued for such purpose forthwith.

(6) Every rope or cable used for hoisting or lowering persons shall be securely fastened at both ends and when in use shall never be fully unwound; at least 2 full turns shall remain always on the drum or reel. The end of the rope attached to the conveyance in the shaft shall be bound around an oval thimble and then fastened to itself by the use of 3 or more clamps, or shall be securely fastened with a tapered socket.

(7) Every sheave and every idler under which is led any hoisting cable shall be provided with a guard that will keep the cable on the sheave or idler if the cable becomes slack.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (1), (3), (5) and (6), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.20 Cages for hoisting. (1) In all shafts or excavations over 45 feet in depth cages shall be provided for hoisting and lowering persons. The cage requirement, however, does not apply to the following:

(a) Shafts in the process of sinking. Sinking of a shaft shall include the construction of sumps or other dewatering devices, and the "turning of eyes." If but one "eye" is turned and mining started, this shall be construed as the end of shaft sinking operations. In tunnels where blasting is necessary, a mining advance of 100 lineal feet from the heading portal will be allowed. Meeting the above conditions will conclude the interpretation of a shaft in the process of sinking.

(b) Shafts being dismantled after work in tunnel is substantially completed.

(2) In all shafts under 45 feet in depth cages are not required but approved ladders or stairways shall be provided as required in Wis. Adm. Code section Ind 6.14. That portion above or below a shaft air lock structure or above a caisson shall be considered a separate shaft in determining the requirements for a stairway or a cage. However, in no case will a cage be required below a vertical lock.

(3) In any caisson or excavation regardless of depth, too small to accommodate a cage, a ladder or a stairway, persons may be lowered or hoisted by a bucket or other device but only when approved by the department.

(4) Cages shall be provided with bonnets consisting of 2 steel plates not less than 3/16 of an inch in thickness sloping toward each other and so arranged that they may be readily pushed upward to afford egress to

persons therein, and such bonnet shall cover the top of the cage in such manner as to protect the persons on the cage from falling objects.

(5) Cages shall be entirely enclosed on two sides with solid partitions or wire mesh not less than No. 8 U. S. standard gauge, no opening in which shall exceed 2 inches.

(6) Cages shall be provided with hanging chains or similar devices for hand holds.

(7) Every cage shall be provided with an approved safety catch of sufficient strength to hold the cage with its maximum load at any point in the shaft.

(8) Cars shall be blocked while on cage.

(9) All parts of hoisting apparatus, cables, brakes, guides and fastenings shall be of the most substantial design and shall be arranged for convenient inspection. The efficiency of all safety devices shall be established by satisfactory tests before the cages are put in service and at least once every three months thereafter and a record thereof kept.

(10) The test of the safety catch shall consist of releasing the cage suddenly in such manner that the safety catches shall have an opportunity to grip the guides.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.21 Timbering requirements for tunnels. (1) Every shaft or tunnel excavation not located in solid rock in which persons are permitted to work shall be kept adequately and securely timbered to prevent injury to any person from falling materials, or collapse of the sides or roof of the working place.

(2) All timbers used in the support of shafts and tunnels shall be of good quality, reasonably straight grained and free from weakening knots and other defects.

(3) All timbers shall, when placed for the support of the roof and sides of the tunnel or in the shaft, be properly fitted and wedged in place. Timber sets in tunnels and sheathing planks in shafts shall be abutting. All void spaces in back of timbers shall be filled with blocking or other suitable material.

(4) Face boards shall be placed in all tunnel headings at end of mining shifts. (a) *Exception.* Face boards need not be placed in stable ground if mining operations are continued without interruption by the succeeding shift.

(5) Knee braces, cleats and spreaders shall be nailed in place with not less than two nails for any one piece. No nail smaller than the following shall be used for the various thicknesses of materials as follows:

- 1 inch (nominal) 8d common (2½ inches x No. 10¼)
- 2 inch (nominal) 16d common (3½ inches x No. 8)
- 3 inch (nominal) 30d common (4½ inches x No. 5)
- 4 inch (nominal) 50d common (5½ inches x No. 3)

(6) In tunnels using timber bracing and liner plates, no excavation shall be carried more than 24 inches in advance of bracing. In tunnels using steel rings and lagging, the advance may be 4 feet in good soil.

(7) In solid stable soil tunnel sections shown in figures 5 to 10 may be used if timbered within the following limitations.

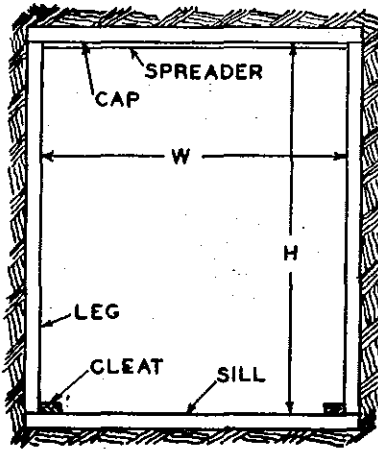


Fig. 5.—Box Type of Timbering.

Width Maximum in Feet W	Height Maximum in Feet H	Dimensions of Timbering			
		Caps, Sills Thickness in Inches	Legs Thickness in Inches	Spreaders (One in every set) Inches	Cleats Inches
3	4	2	2	1 x 4	2 x 4
4	4	3	2	1 x 4	2 x 4
5	5	3	3	1 x 4	2 x 4
5	6	3	3	1 x 4	2 x 4

Note: The use of either spreaders or cleats in Figure 5 is required. Cleats shall consist of 2 x 4 inch lumber not exceeding 3 feet in length.

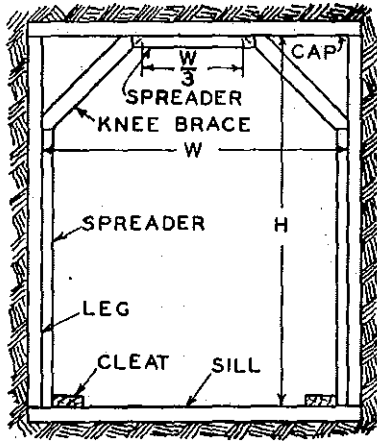


Fig. 6.—Box Type of Timbering.

Width Maximum in Feet W	Height Maximum in Feet H	Dimensions of Timbering		
		Caps, Legs, Sills, Knee Braces, Thick- ness in Inches	Spreaders (One to every set) Inches	Cleats Inches
8	8	3	2 x 6	2 x 6
10	10	4	2 x 6	2 x 6

Note: Knee braces shall be spaced not exceeding 2 feet center to center and may be removed immediately preceding concrete or masonry work at that point.

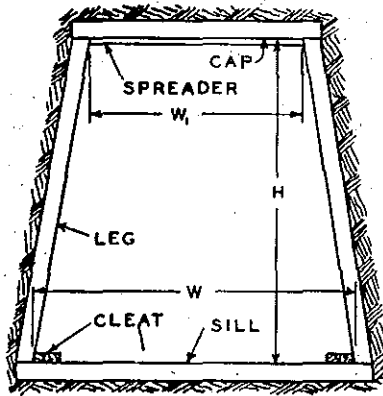


Fig. 7.—Modified Box Type of Timbering.

Width Maximum in Feet		Height Maximum in Feet H	Dimensions of Timbering		
W'	W		Caps, Legs, Sills Thickness in Inches	Spreaders one to every set Inches	Cleats Inches
3	5	4	2	1 x 4	2 x 4
5	7	7	3	2 x 6	2 x 6
8	10	10	4	2 x 6	2 x 6

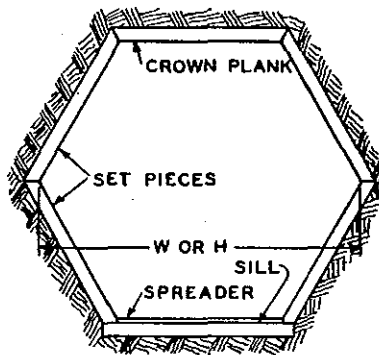


Fig. 8.—Hexagonal Type of Timbering.

Width Maximum in Feet W	Height Maximum in Feet H	Dimensions of Timbering	
		Crown Planks, Set Pieces, Sills Thickness in Inches	Spreaders (One to every set) Inches
10	10	3	2 x 6

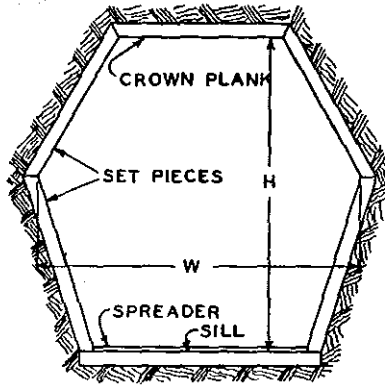


Fig. 9.—Modified Hexagonal Type of Timbering.

Width Maximum in Feet W	Height Maximum in Feet H	Dimensions of Timbering	
		Crown Planks, Set Pieces, Sills Thickness in Inches	Spreaders (One to every set) Inches
10	10	3*	2 x 6

*Use 4 inch plank if length of any piece exceeds 6 feet.

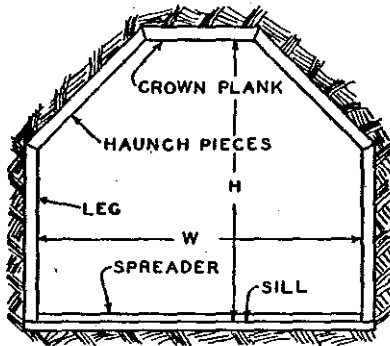


Fig. 10.—Arched 6-Piece Timber Set.

Width Maximum in Feet W	Height Maximum in Feet H	Dimensions of Timbering	
		Crown Planks, Legs, Haunch Pieces, Sills Thickness in Inches	Spreaders (One to every set) Inches
5	6	3*	2 x 6
10	10	3*	2 x 6

* Use 4 inch plank if any piece exceeds 6 feet.

(8) In excavating heavy soil which cannot be held in place with timber sections shown in Figures 5 to 10, inclusive, timber sections shown in Figures 11 and 12 shall be used with the following limitations.

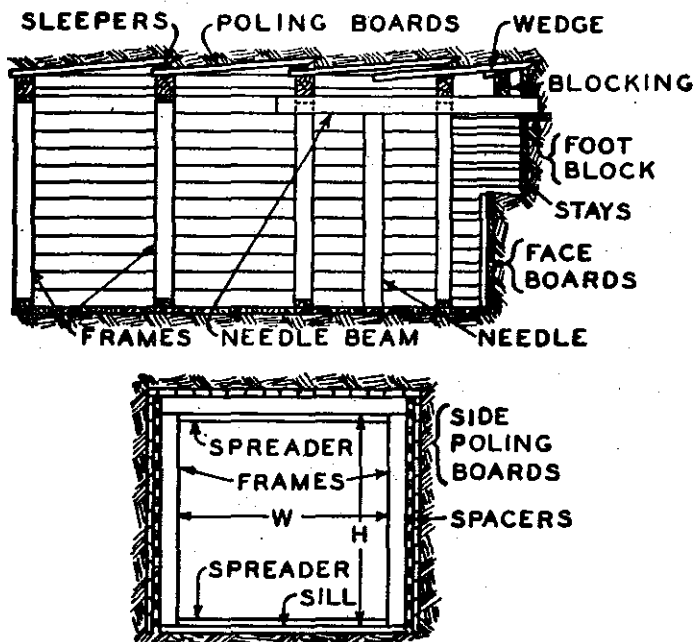


Fig. 11.—Poling Board Method of Timbering.

Width Maximum in Feet W	Height Maximum in Feet H	Sheathing Thickness in Inches	Framing Timbers	
			Dimensions in Inches	Maximum Spacing in Feet
5	5	2	6x6	4
7	7	2	8x8	4
8½	8½	2	10x10	4
10	10	2	10x10	3½

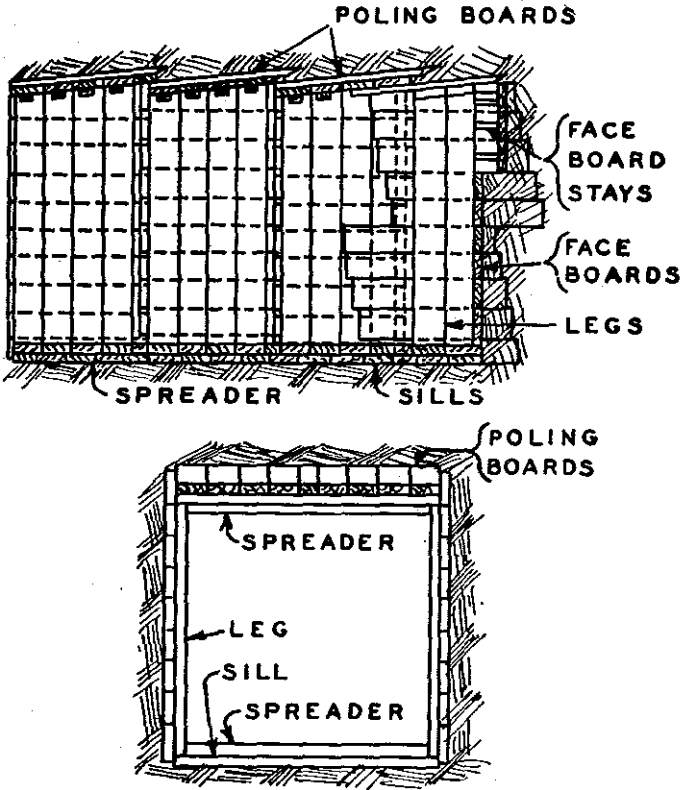


Fig. 12.—Poling Board Method of Timbering.

Width Maximum in Feet W	Height Maximum in Feet H	Sheathing Thickness in Inches	Set Pieces Thickness in Inches	Spreaders Inches	Cleats Inches	Knee Braces Inches
4	3	1	2	1 x 4	2 x 4	—
5	6	1	3	1 x 4	2 x 4	—
8	8	1	4	1 x 4	2 x 6	3
10	10	1	6	1 x 4	2 x 6	4

(9) For tunnels of greater dimensions than indicated in figures 5 to 12, or for modifications or combination of sections of timbering for the same, drawings and design calculations shall be submitted to the department for approval. The use of metal liners is subject to the approval of the department.

(10) Tunnel excavations in which men are permitted to work shall not be less than 3 feet wide nor less than 4 feet in height. These measurements apply to distance between timbers.

(11) Any metal shield used for tunnel work shall be of a design subject to the approval of the department.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (1), (9), (10) and (11), Register, September, 1978, No. 273, eff. 10-1-78.

Ind 6.22 Mechanical haulage. (1) When mechanical haulage is used, care shall be taken that the speed is not excessive depending upon the grades and condition of the tracks. No cars shall be pushed underground where it is practical to draw and all locomotives shall be equipped with headlights and gongs. Trolley poles shall be trailed whenever it is possible to do so. No locomotive shall be operated by a person under 18 years of age. No gas locomotive shall be used in any tunnel.

(2) Standing cars shall be blocked.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.23 Sumps. All sumps shall be securely covered or fenced except when being cleaned or repaired.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

NOTICE

FOR RULES COVERING WORK UNDER COMPRESSED AIR SEE WIS. ADM. CODE CHAPTER IND 12, WORK UNDER COMPRESSED AIR.