
Excavations: Temporary protective structures

OHS information for employers, prime contractors and workers

This resource provides information about temporary protective structures and alternative methods of protection in relation to excavations at Alberta work sites, as specified in Part 32 of the OHS Code.

KEY INFORMATION

- In OHS legislation, a temporary protective structure is a structure or device designed to provide protection to workers in an excavation, tunnel, or underground shaft from cave-ins, collapses, or sliding or rolling materials.
- Temporary protective structures in excavations of three metres or less must have sufficient strength to prevent caving in.
- Temporary protective structures in excavations of more than three metres must be designed, constructed and installed in accordance with specifications from a professional engineer.

What is a temporary protective structure?

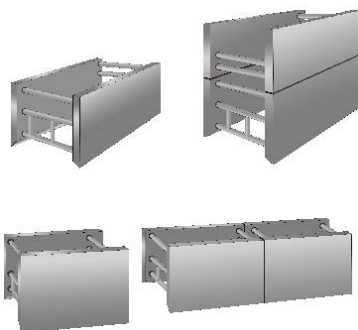
In OHS legislation, a temporary protective structure is defined as a structure or device designed to provide protection to workers in an excavation, tunnel, or underground shaft from cave-ins, collapses or sliding or rolling materials. These protective structures and devices include (but are not limited to) shoring, bracing, piles, planking, or cages.

What legislative requirements apply to temporary protective structures?

Section 456 of the OHS Code specifies requirements for temporary protective structures in all excavations, while Section 457 specifies alternatives to those requirements that are only allowed in trenches.

Requirements for temporary protective structures

In an excavation that is no more than three metres deep, a temporary protective structure must be of sufficient strength and design to prevent the walls from caving in or otherwise moving into the excavation. In common practice, protective structures are often prefabricated from steel, or built in place from wood materials (see below for illustrated examples).



Prefabricated steel



Wood materials

If an excavation is more than three metres deep, any temporary protective structure must be designed and certified by a professional engineer. The engineer's specifications must indicate all details related to the design, including:

- the size and specifications of the structure, including the type and grade of materials to be used in connection with its construction; and
- the calculated loads that the structure is designed to support.

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Also, before beginning an excavation, employers must ensure that any foundation that may be affected by the excavation is supported by a temporary protective structure designed, constructed and installed in accordance with the specifications of a professional engineer.

Alternatives to temporary protective structure requirements in trenches

In the OHS Code, a trench is defined as “a long, narrow dug out area of ground that is deeper than its width at the bottom.” Some alternatives to temporary protective structures are allowed in trenches.

In trenches that vary in depth from 1.5 to 6 metres deep, employers have the option to use shoring, stringers and bracing constructed of lumber (or alternate materials) that complies with Schedule 9 of the OHS Code. (Table 1 later in this bulletin shows Schedule 9, along with common lumber dimensions that are similar to those specified in Schedule 9.) If alternate materials are used, they must possess equal or greater strength properties than lumber.

Exterior grade plywood can be installed as a substitute for 38-millimetre shoring elements if:

- the plywood meets the requirements of CSA Standard O121-08, *Douglas Fir Plywood* or CSA Standard O151-04, *Canadian Softwood Plywood*;
- the plywood is at least 19 millimetres thick;
- the trench is not more than 2.7 metres deep;
- uprights are installed at intervals of not more than 600 millimetres centre-to-centre;
- cross braces do not bear directly on the plywood; and
- cross braces bearing on uprights or walers are located at all joints in the plywood sheathing.

Screw jacks, hydraulic equipment or other apparatus may be used as shoring, stringers or bracing if they are at least equivalent in strength and reliability to the shoring, stringers or bracing described in Schedule 9.

If a trench is less than 2.4 metres deep and in soil classified as “hard and compact,” employers do not have to use stringers.

Illustrated examples of the shoring components specified in Schedule 9 for different soil types are shown in Figures 1, 2, and 3 at the end of this bulletin.

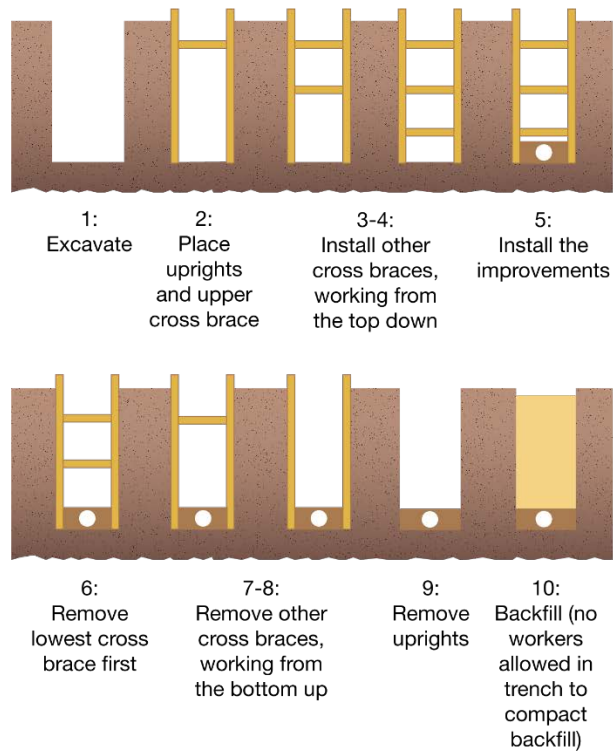
How are temporary protective structures installed and removed?

Employers must ensure that workers who install shoring, stringers or bracing use a ladder and work downward from the top of the trench, installing each brace in descending order.

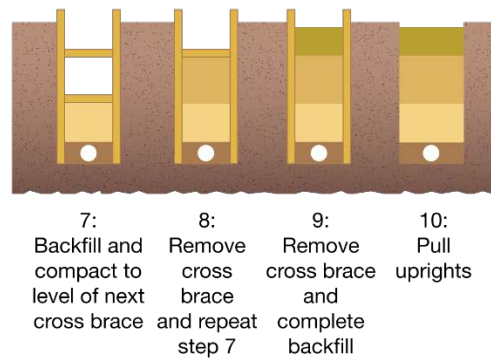
Similarly, employers must ensure that workers who remove shoring, stringers or bracing use a ladder and work upward from the bottom of the trench, removing each brace in ascending order.

However, if the quality of the ground in which a trench has been dug has deteriorated during operations to the extent that it is unsafe to use the method of removal required by the OHS Code, the employer must ensure that the shoring, stringers or bracing are removed using a method that does not require workers to be in the trench.

The required sequence for installation and removal of shoring is shown on the next page.



- OR -



Additional protections

Under Section 3(1) of the *Occupational Health and Safety Act* (OHS Act), employers are required to ensure the health, safety and welfare of workers. When assessing the risk to workers in relation to excavations, the employer must consider if any of the following will be within a distance equal to the depth of the excavation:

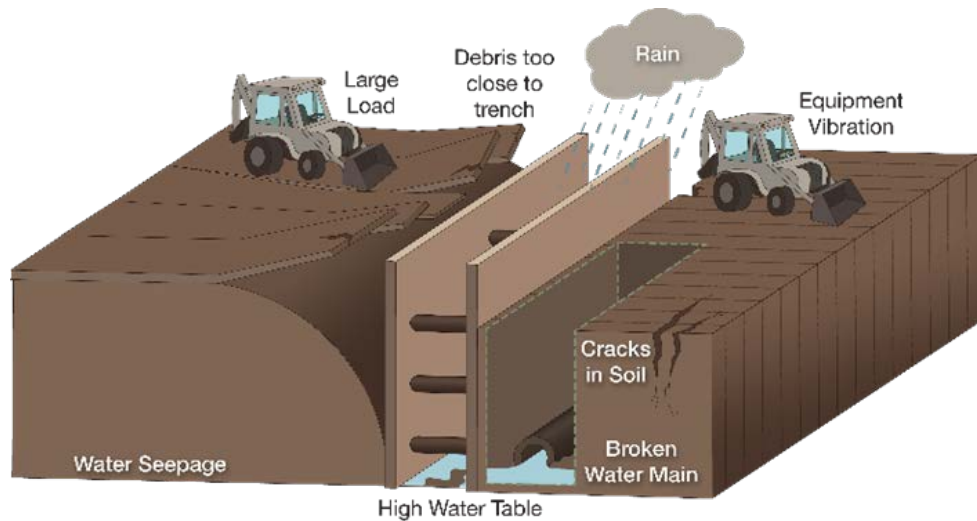
- Vehicular traffic.
- Machinery, which may include road compaction equipment or compaction equipment used during backfill activities close to the excavation.
- Heavy objects.

If there is a risk of additional stress, vibration or weight being placed on the walls of an excavation, additional protection certified by a professional engineer must be used to meet the employer's general obligation to protect workers and others.

Additional protection is also required to compensate for the stress, vibration or weight resulting from the excavation being adjacent to, or abutting, a building or other structure. The illustration on the next page shows factors that may cause cave-in of an excavation.

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Artificial soil stabilization

A number of artificial stabilization techniques are acceptable as alternatives to shoring an excavation.

Artificial methods such as freezing or grouting (injecting a chemical or cement grout into the voids of pervious soils, allowing the injected material to solidify and form an impervious barrier to groundwater), may require defined periods of time in which to “set.” Once “set,” the soil is stable.

Because of the critical role artificial soil stabilization plays in worker safety, Section 443(2) of the OHS Code requires that a professional engineer design any artificial soil stabilization process. The employer is responsible for ensuring that the professional engineer’s specifications are followed.

IMPORTANT

Natural freezing is subject to changing temperature and weather conditions, and cannot be controlled. Fluctuating temperatures could result in unexpected or unplanned thawing of surface layers. Natural freezing as a means of soil stabilization is therefore unacceptable under any circumstances.

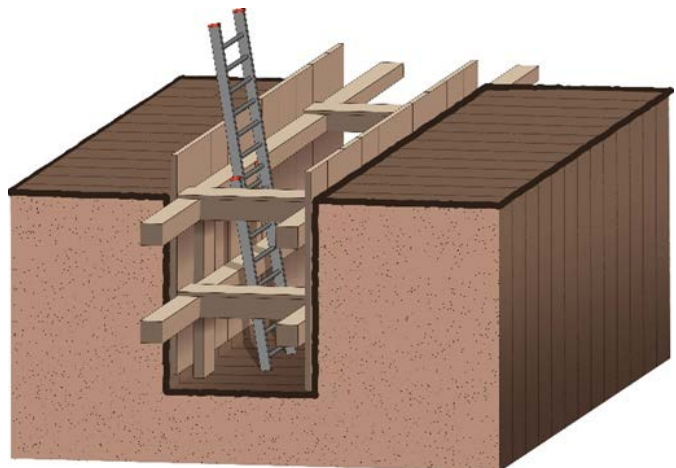
Safe entry and exit

Employers must ensure that workers required to enter an excavation have a safe means of entering and leaving the excavation.

This could include a ladder, scaffold, or a mechanical device such as a stairway. It could also include appropriate sloping of the ground or soil so that workers can safely walk into or out of the excavation.

If a trench is more than 1.5 metres deep, a safe point of entering and leaving must be located no more than 8 metres from the worker. The excavation walls located between the worker and the safe point of entering and leaving must be supported or sloped as required by the OHS Code.

A typical means of safely entering and leaving an excavation is pictured here.



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Other requirements

Prime contractor responsibility

As per Section 10(8) of the OHS Act, prime contractors must fulfill any employer obligations related to excavations if the excavations are conducted by, or on behalf of, the prime contractor.

These prime contractor obligations don't relieve other employers from any obligation they may have toward excavations, and do not absolve either the prime contractor or employers from their other legal responsibilities. Some work site excavations put in place by, or on behalf of, the prime contractor will be for shared use by site employers.

Marking an excavation

If there is a danger of workers or equipment falling into an excavation, the employer must ensure workers are made aware of the excavation through flagging, marking, safeguards, or other effective means.

Employers are required to ensure hazards at the work site do not affect people in the vicinity. Depending on the location and configuration of the work site and excavation, this may require barriers or fencing to ensure the safety of people in the area.

Spoil piles

Employers must ensure:

- the leading edge of any spoil pile (waste material from an excavation) is at least one metre from the edge of the excavation;
- the slope of a spoil pile adjacent to the excavation is at an angle of no more than 45 degrees from the horizontal; and
- loose materials are scaled and trimmed from a spoil pile.

Water hazards

If a worker might enter an excavation, the employer must ensure the excavation is kept free of an accumulation of water that may pose a hazard.

Power pole support

The collapse of a power pole could expose workers to a falling pole structure and one or more energized power line conductors. The employer must therefore ensure that when disturbing the ground near an overhead power line, doing so does not reduce the original support provided to the power pole.

Access for powered mobile equipment

The employer is required to ensure that the open side of an excavation, or a route used by powered mobile equipment to access an excavation, has a barrier high enough to stop equipment from sliding or rolling into the excavation.

Dumping blocks are required in places where powered mobile equipment may go over a bank or enter a dump opening when discharging a load. Section 460 of the OHS Code provides three options for employers to prevent powered mobile equipment from dumping hazards.

Buried facilities, cutting back walls

A number of provisions in Part 32 of the OHS Code apply to locating or exposing buried facilities, as well as to cutting back walls. For more information, read [Excavations: Locating buried facilities](#) and [Excavations: Cutting back walls](#).

Table 1**Schedule 9, OHS Code - shoring component dimensions**

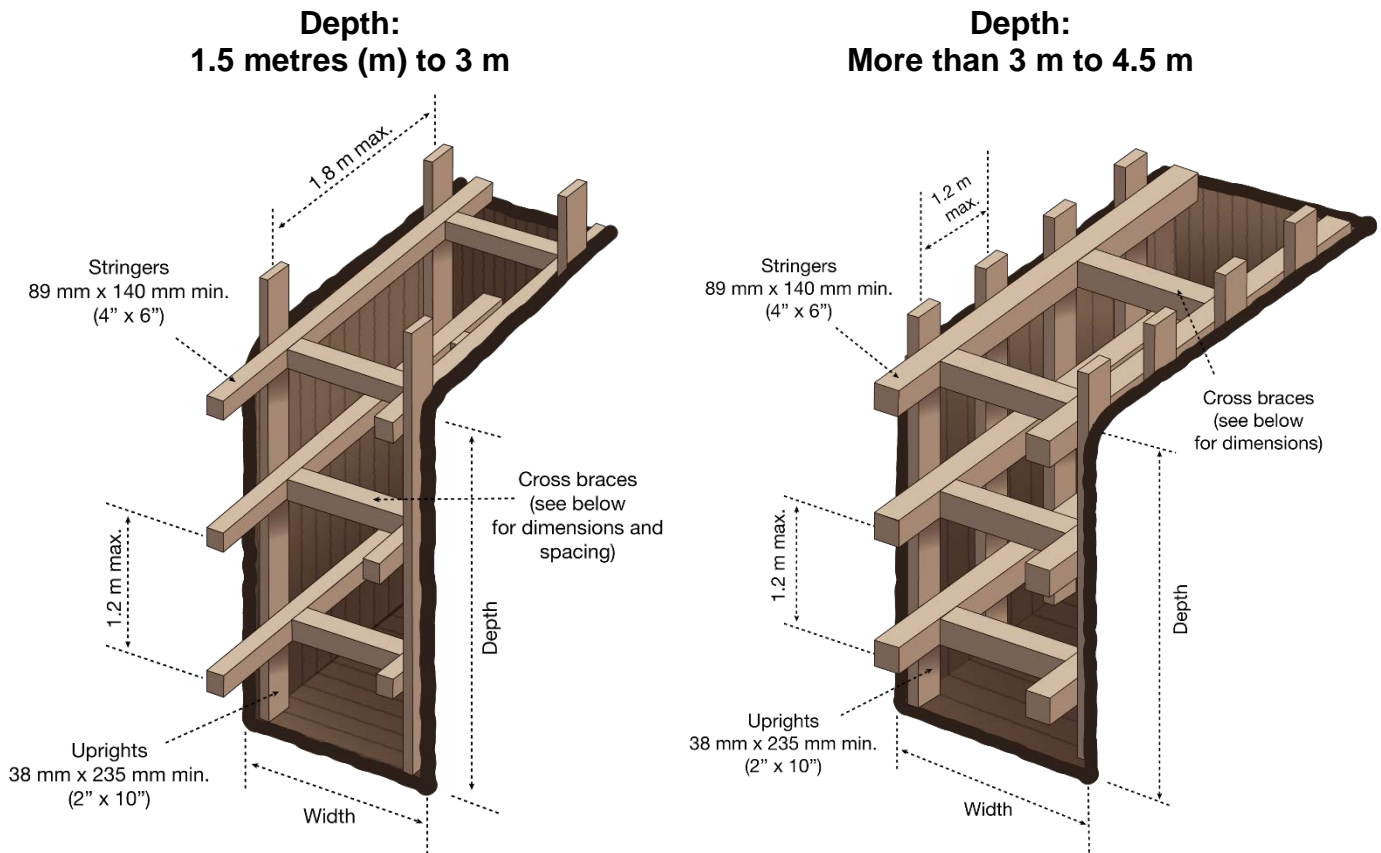
NOTE: common commercial lumber dimensions for uprights, stringers, and cross-braces are shown in parentheses below the legal minimum dimension requirements.

Soil type	Depth of excavation (metres)	Uprights		Stringers		Cross braces			
		Minimum dimensions (millimetres)	Maximum horizontal spacing (millimetres)	Minimum dimensions (millimetres)	Maximum vertical spacing (millimetres)	Minimum dimensions (millimetres)		Maximum spacing (millimetres)	
						Width of trench		Vertical	Horizontal
Less than 1.8 metres	1.8 to 3.7 metres								
Hard and compact	1.5 to 3.0	38 x 235 (2" x 10")	1800	89 x 140 (4" x 6")	1200	89 x 89 (4" x 4")	140 x 140 (6" x 6")	1200	1800
	More than 3.0 to 4.5	38 x 235 (2" x 10")	1200	89 x 140 (4" x 6")	1200	89 x 140 (4" x 6")	140 x 140 (6" x 6")	1200	1800
	More than 4.5 to 6.0	38 x 235 (2" x 10")	10	140 x 140 (6" x 6")	1200	140 x 184 (6" x 8")	140 x 184 (6" x 8")	1200	1800
Likely to crack or crumble	1.5 to 3.0	38 x 235 (2" x 10")	1200	89 x 140 (4" x 6")	1200	89 x 140 (4" x 6")	140 x 140 (6" x 6")	1200	1800
	More than 3.0 to 4.5	38 x 235 (2" x 10")	900	140 x 140 (6" x 6")	1200	140 x 140 (6" x 6")	140 x 184 (6" x 8")	1200	1800
	More than 4.5 to 6.0	38 x 235 (2" x 10")	10	140 x 184 (6" x 8")	1200	140 x 184 (6" x 8")	140 x 184 (6" x 8")	1200	1800
Soft, sandy or loose	1.5 to 3.0	38 x 235 (2" x 10")	10	140 x 140 (6" x 6")	1200	140 x 140 (6" x 6")	140 x 184 (6" x 8")	1200	1800
	More than 3.0 to 4.5	38 x 235 (2" x 10")	10	140 x 184 (6" x 8")	1200	140 x 184 (6" x 8")	184 x 184 (8" x 8")	1200	1800
	More than 4.5 to 6.0	38 x 235 (2" x 10")	10	184 x 184 (8" x 8")	1200	140 x 184 (6" x 8")	184 x 235 (8" x 10")	1200	1800

Figure 1

Examples of shoring components described in Schedule 9 for hard and compact soils

NOTE: Diagrams are not to scale. Common commercial lumber dimensions are shown in parentheses.



Cross brace dimensions:

Trench width 1.8 m or less:
89 mm x 89 mm (4" x 4")

Trench width from more than 1.8 m to 3.7 m:
140 mm x 140 mm (6" x 6")

Cross brace maximum spacing:

Vertical: 1,200 mm
Horizontal: 1,800 mm

Cross brace dimensions:

Trench width 1.8 m or less:
89 mm x 140 mm (4" x 6")

Trench width from more than 1.8 m to 3.7 m:
140 mm x 140 mm (6" x 6")

Cross brace maximum spacing:

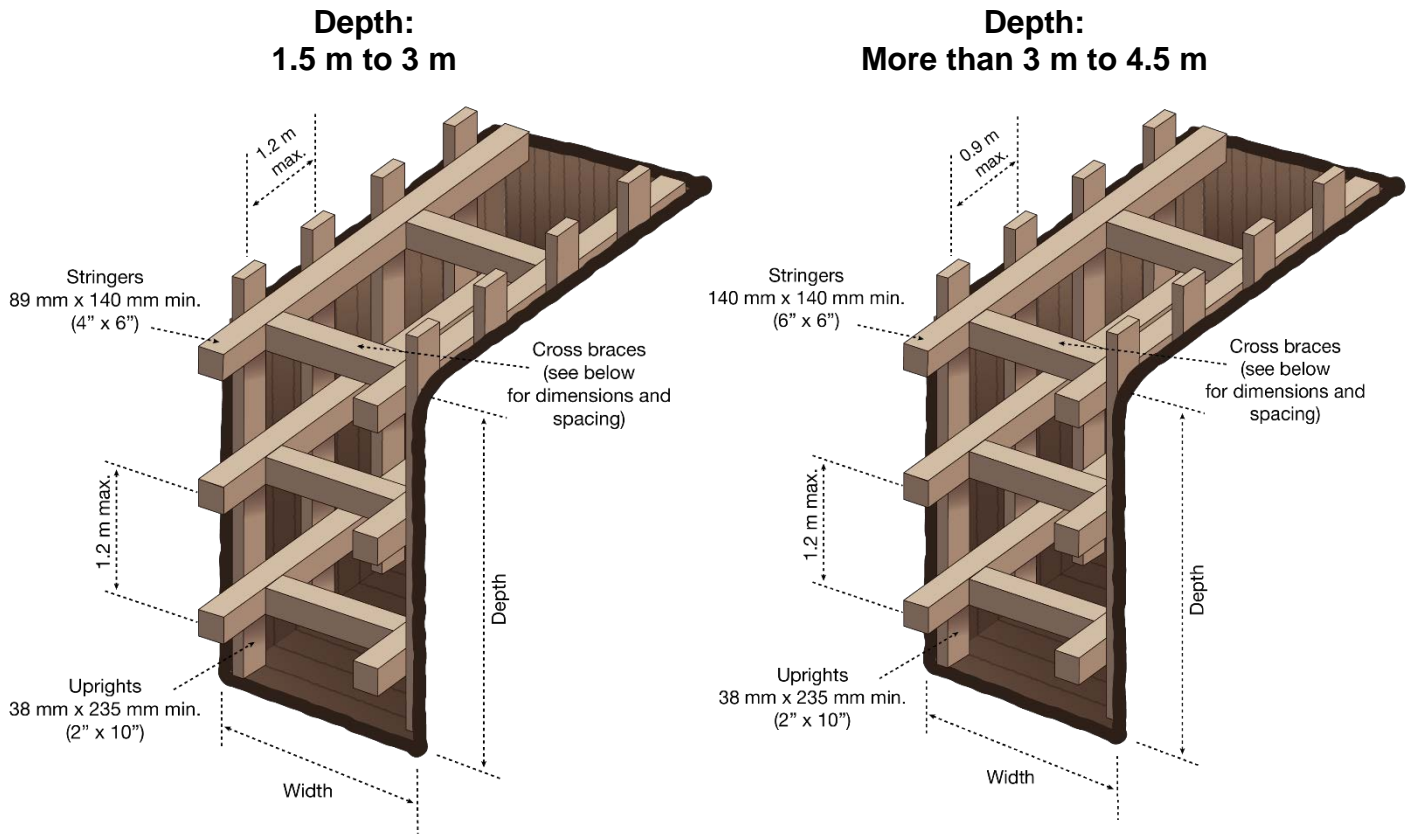
Vertical: 1,200 mm
Horizontal: 1,800 mm

**For excavations that are from more than 4.5 m to 6 m deep,
see Table 1 in this bulletin for size and spacing of shoring components.**

Figure 2

Examples of shoring components described in Schedule 9 for soils likely to crack or crumble

NOTE: Diagrams are not to scale. Common commercial lumber dimensions are shown in parentheses.



Cross brace dimensions:

Trench width 1.8 m or less:
89 mm x 140 mm (4" x 6")

Trench width from more than 1.8 m to 3.7 m:
140 mm x 140 mm (6" x 6")

Cross brace maximum spacing:

Vertical: 1,200 mm
Horizontal: 1,800 mm

Cross brace dimensions:

Trench width 1.8 m or less:
140 mm x 140 mm (6" x 6")

Trench width from more than 1.8 m to 3.7 m:
140 mm x 184 mm (6" x 8")

Cross brace maximum spacing:

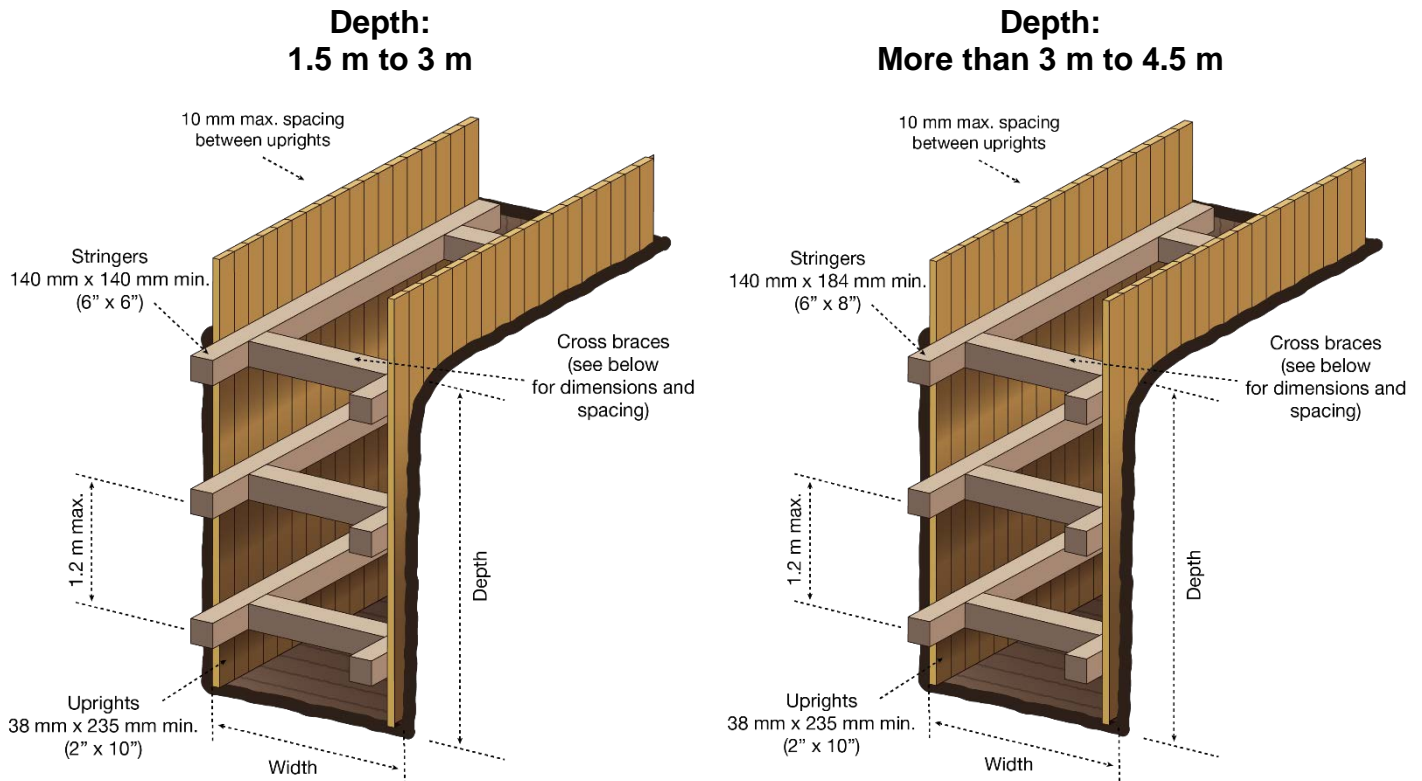
Vertical: 1,200 mm
Horizontal: 1,800 mm

**For excavations that are from more than 4.5 m to 6 m deep,
see Table 1 in this bulletin for size and spacing of shoring components.**

Figure 3

Examples of shoring components described in Schedule 9 for soft, sandy or loose soils

NOTE: Diagrams not to scale. Common commercial lumber dimensions are shown in parentheses.



Cross brace dimensions:

Trench width 1.8 m or less:
140 mm x 140 mm (6" x 6")

Trench width from more than 1.8 m to 3.7 m:
140 mm x 184 mm (6" x 8")

Cross brace maximum spacing:

Vertical: 1,200 mm
Horizontal: 1,800 mm

Cross brace dimensions:

Trench width 1.8 m or less:
140 mm x 184 mm (6" x 8")

Trench width from more than 1.8 m to 3.7 m:
184 mm x 184 mm (8" x 8")

Cross brace maximum spacing:

Vertical: 1,200 mm
Horizontal: 1,800 mm

**For excavations that are from more than 4.5 m to 6 m deep,
see Table 1 in this bulletin for size and spacing of shoring components.**

Contact us

OHS Contact Centre

Alberta toll-free

- 1-866-415-8690

Edmonton region

- 780-415-8690

Deaf or hard of hearing (TTY)

- 1-800-232-7215 (Alberta toll-free)
- 780-427-9999 (Edmonton region)

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Call the OHS Contact Centre if you have concerns that involve immediate danger to a person on a work site.

Report a workplace incident to OHS

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Website

alberta.ca/ohs

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