

LESSON

09

SHORING METHODS

Lecture: 02 Periods, Practical: 09 Periods Total: 11 Periods

LESSON OBJECTIVES

Upon completing this lesson,
you should be able to:

1. Define shoring and identify its components.
2. List the factors that determine the design and method of shoring.
3. Describe four types of shoring.
4. List the positions and functions of the members of a shoring team.
5. List the procedures for building a window/door shore and a vertical shore. Demonstrate these procedures in a practical exercise.

1 Shoring

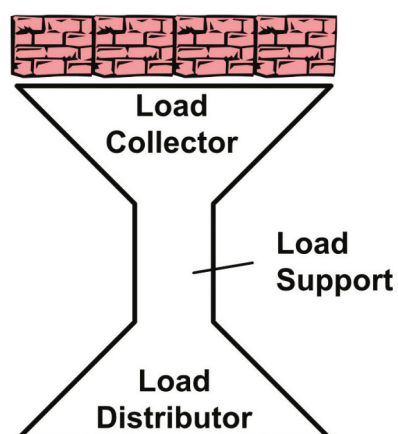
The temporary support of only that part of a damaged, collapsed, or partly collapsed structure that is required for conducting search and/or rescue operations at reduced risk to the victims and rescue team.

Shoring can also be applied to the following:

1. Structures with severely damaged panels
2. Structures with loose pieces of concrete
3. Cracked or broken pre-fabricated panels
4. Cracked masonry walls

Shoring follows a **Double-Funnel Principle**, which means that a shore collects a load, channels it and redistributes it safely to another surface or structure that can support it.

Figure 1 ▶
Double-funnel
principle



Notes

1

Shoring (Cont.)

Components of a Shore

Notes

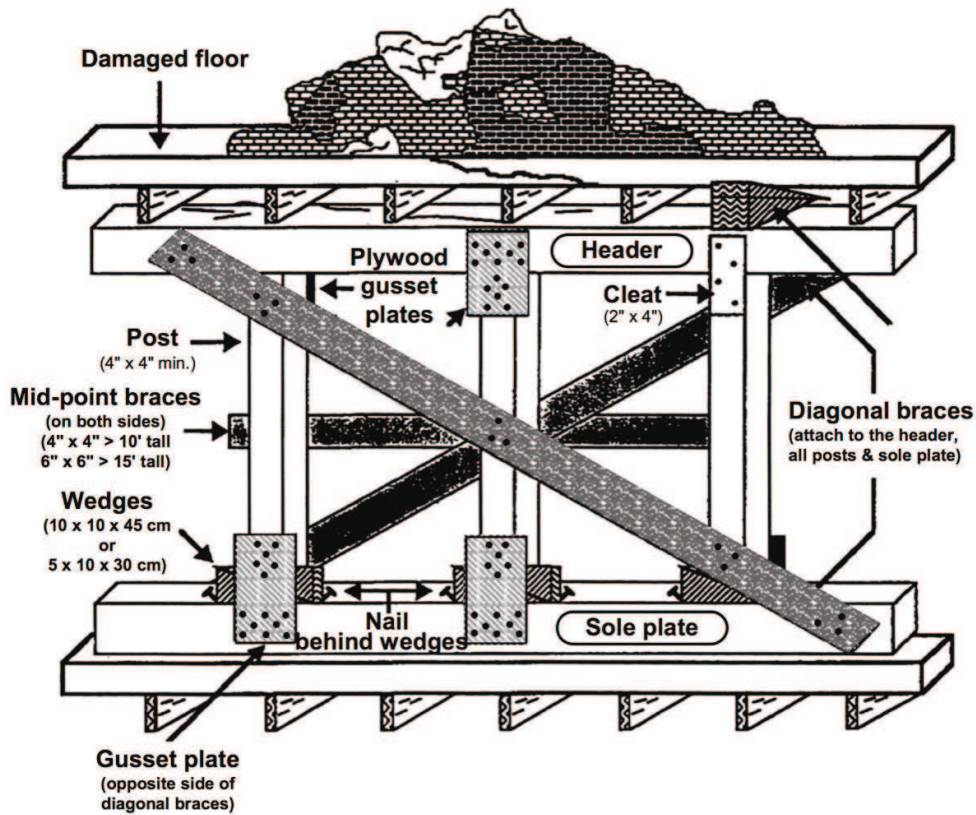


Figure 2 ▲
Sample
vertical shore

Label the components of the vertical shore above as the instructor describes them and write in their descriptions and functions below.

- **Sole plate:** provides a _____ for the shoring system by supporting the weight being transferred from above and _____ it over a wider area.

- **Header beam:** collects the weight from _____ and spreads it throughout the shoring system.

1

Shoring (Cont.)

Notes

- **Post:** supports the weight collected by the _____ and transfers it to the _____ where it is distributed.

- **Diagonal bracing:** locks the entire shoring system together as one unit, supporting against possible _____ loads. It is the last component to be installed.

- **Gusset plate:** a small piece of **13 mm** or **18 mm** plywood nailed to the _____ and _____ of posts to aid in placement of the header and secures the posts to the header and sole plate.

- **Wedges/shims:** two wooden inclined planes married together and placed under the bottom of the _____. These provide compression for the shoring system. The shim is a single wedge used to fill in gaps above the shoring system.

- **Cleat:** a 5 cm x 10 cm wooden piece nailed to the post and header or sole plate to secure the shoring; small pieces of wood used to secure other parts of a shoring system.

Determining Factors

A variety of factors will determine what method of shoring is required in a particular situation.

2.1 Weight of construction materials

2.2 Weight of the structural elements to be supported

2.3 The normal load capacity of the existing undamaged structure

2.4 Condition of the structure to be supported

2.5 Condition of the foundation and floor/surface angle to determine stability of shoring

2.6 Availability of shoring materials

2.7 Lateral and vertical instability

Notes

3.1. Vertical

The main purpose of the vertical shore is to _____ damaged floors, ceilings or roofs. It can also be used to _____ missing or unstable bearing walls or columns.

VERTICAL SHORE SPECIFICATIONS with 10x10 cm post, header and sole plate			
Maximum Height	Maximum Distance Between Posts	Maximum Overhang	Load-Bearing Capacity per Post
2.5 m (8'0")	1.25 m (4'0")	60 cm (2'0")	3,600 kg (8,000 lbs.)
3.0 m (10'0")	1.50 m (5'0")	80 cm (2'6")	2,270 kg (5,000 lbs.)
3.7 m (12'0")	1.80 m (6'0")	90 cm (3'0")	1,600 kg (3,500 lbs.)

- Tubular poles made up of mild steel of different diameters as used in form work, scaffolding may also be used as post for vertical shoring

Types of Shoring (Cont.)

3.2 Window/Door

This type of shore supports a window or door that is in danger of collapse. Diagonal braces are only used when the opening is **not** needed for _____ or _____.

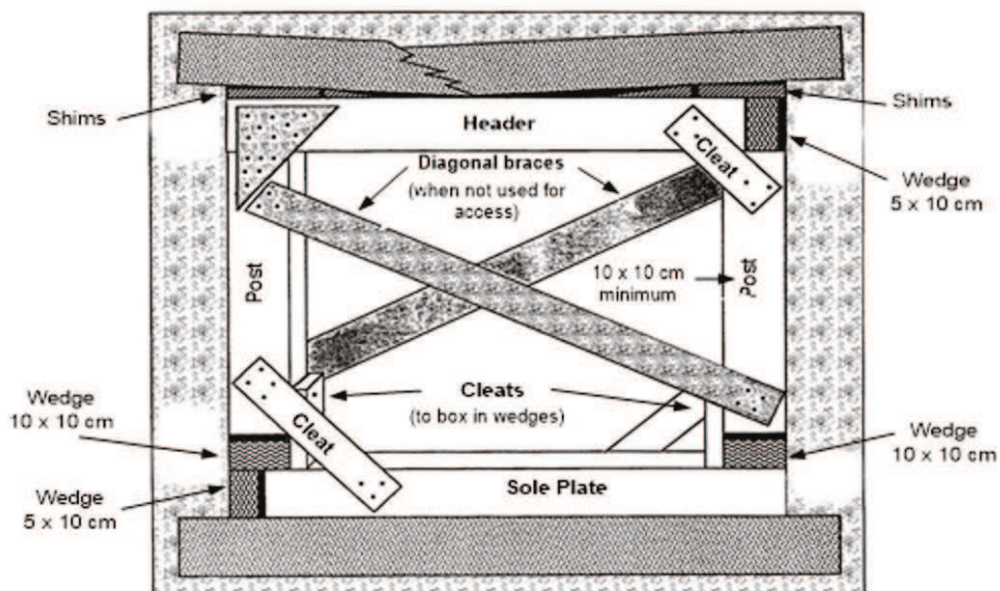


Figure 3 ▲
Typical window/door shore

3.3 Other Types of Shoring

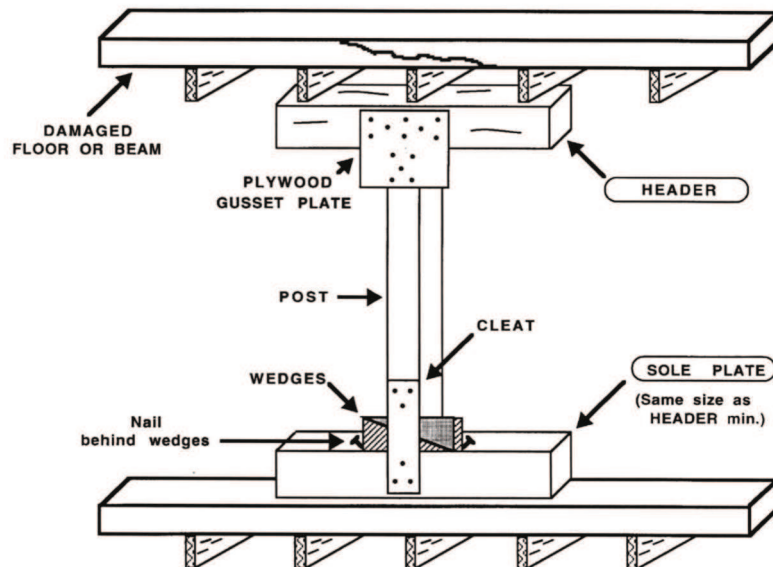
Several additional types of shores can be used in collapsed structures, though they will not be taught in this course. Your reference material discusses them in further detail. Some examples include:

Notes

Types of Shoring (Cont.)

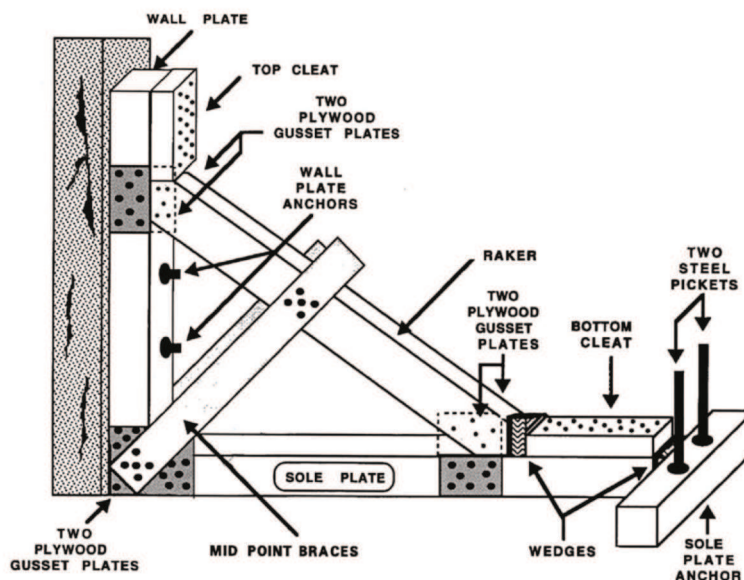
- **T-Spot Shore:** The main purpose of the T-shore is to initially stabilise damaged floors, ceilings or roofs, so that the more substantial shoring can be constructed at less risk. This shore is _____ and only _____, also used during quick extrication of a victim.

Figure 4 ▶
T-Spot shore



- **Raker Shore:** A triangular system of shoring used to support leaning or unstable walls or columns. Rakers must always be installed in series; at least _____ must be erected in any given situation.

Figure 5 ▶
Raker shore

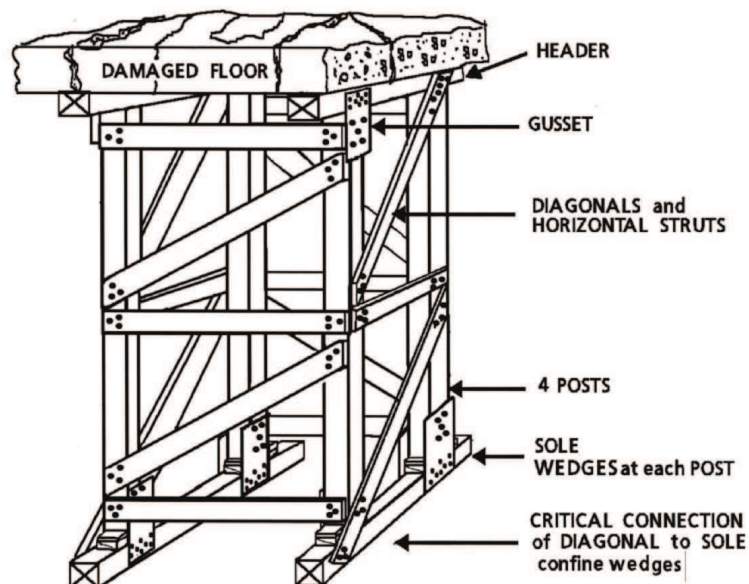


Notes

Types of Shoring (Cont.)

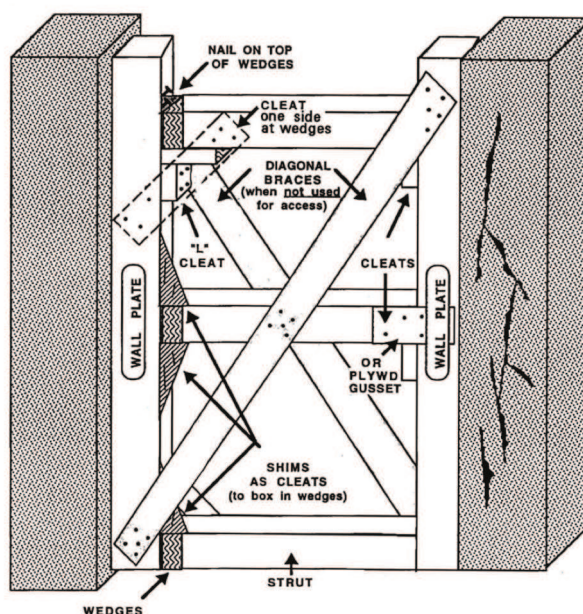
- **Laced Post Shore:** A high-capacity, four-post system that is used to support sagging floors and ceilings, or other overhead hazards. It can be used as a safe haven.

Figure 6 ▶
Laced post shore



- **Horizontal Shore:** Used to stabilise a damaged wall against another undamaged wall in hallways, corridors or between buildings.

Figure 7 ▶
Horizontal shore



Notes

Types of Shoring (Cont.)

Sometimes people have to improvise shoring methods, as dictated by the availability of materials. A building shored with bamboo is shown in the pictures below.

Figure 8 ►
*Improvise
bamboo
shores*



Notes

Members and Functions of a Shoring Team

If sufficient manpower were available, a shoring team could be organised using two separate 6 person squads, one squad as an assembly team and another as a cutting team. However, a single squad may be required to perform both sets of duties.

4.1 Assembly Group

Whenever possible, the members of the Assembly Group should be assigned the following functions:

- **Shoring Officer (Rescue Squad Officer):** is in charge of the operation. Also works with structural specialists (if available) to determine where to place shores. If a Safety cannot be designated, the Shoring Officer will also take on this role.

- **Measurer:** measures all shoring components and relays the information to the layout person of the cutting team.

- **Two Shorers:** these work together assembling and erecting shores in place.

- **Safety:** responsible for overall safety of the assembly team.

- **Runner:** Ensures tools, equipment and shoring materials are moved from the shoring operation primary access point to the shoring site and assists in the erection of shores as needed.

Notes

Members and Functions of a Shoring Team (Cont.)

Notes

4.2 Cutting Group

Whenever possible, the members of the Cutting Group should be assigned the following functions:

- **Cutting Group Officer (Rescue Squad Officer):** in charge of selecting the cutting site. The site should be close to the shoring operation. The Cutting Team Officer doubles as the Safety.

- **Layout:** sets up the cutting station and records measurements. Performs all measuring and layout of angles.

- **Feeder:** moves and feeds measured and marked shoring material from the Layout to the Cutter and helps secure it during cutting.

- **Cutter:** cuts the measured materials.

- **Tools and equipment person:** directs where materials and equipment are to be placed and moved, and is responsible for keeping track of all tools. This person is assigned to both the Cutting Group and the Assembly Group.

- **Runner:** ensures tools, equipment and shoring materials are moved from the cutting area to the shoring operation primary access point.

Members and Functions of a Shoring Team (Cont.)

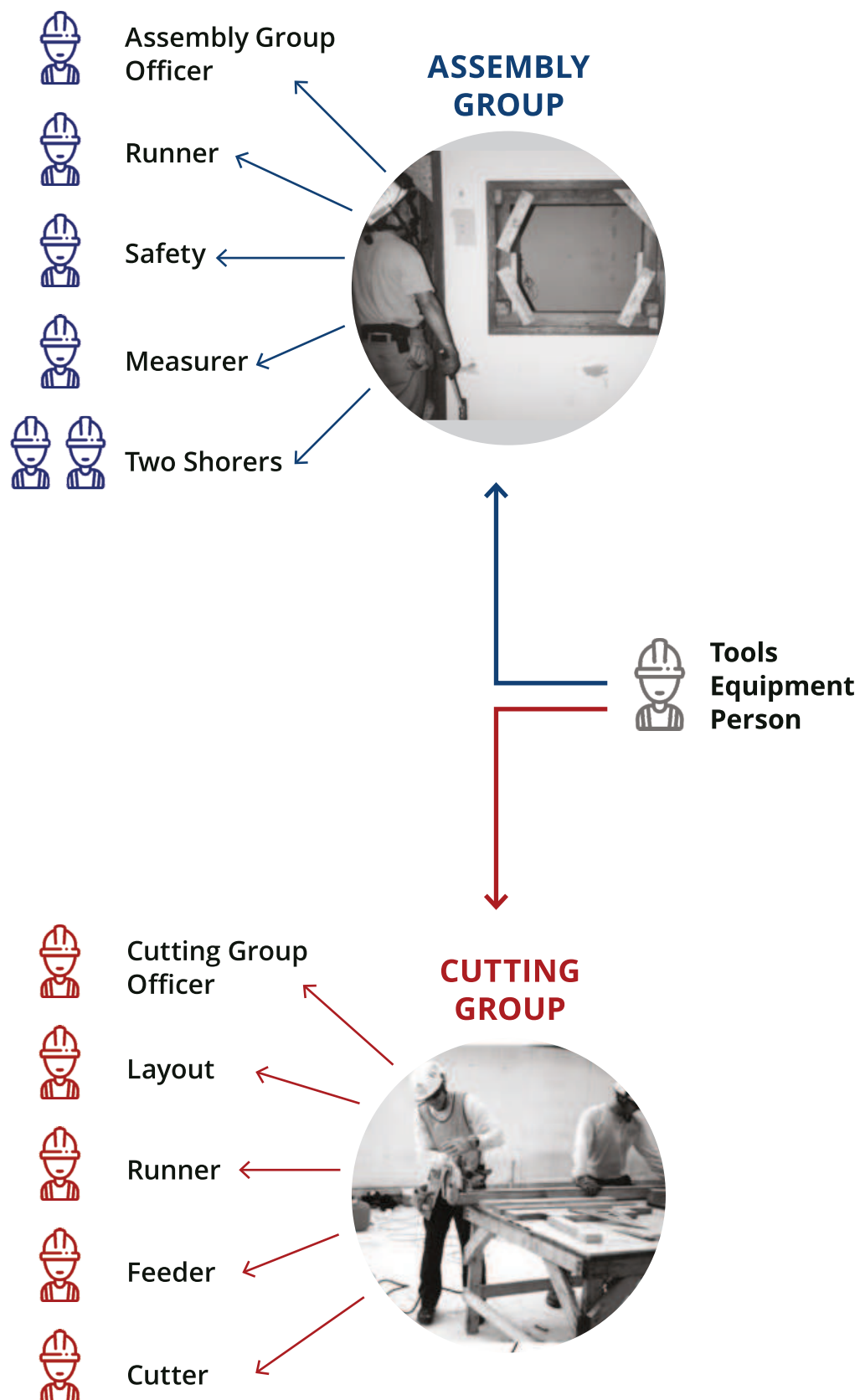


Figure 9 ▶
Assembly
Group
Organization

Building Shores (Two Types)

5.1. Nail Specifications

For the CSSR Course, duplex/common (double-headed) nails of two sizes will be used. Using these nails makes disassembly easier. However, under actual rescue conditions, common nails of a similar size can be used.

All plywood (gusset plates) must be nailed using 8d common nails only.

Figure 10 ►
8d nail,
approximately
actual size
(6.5 cm.)



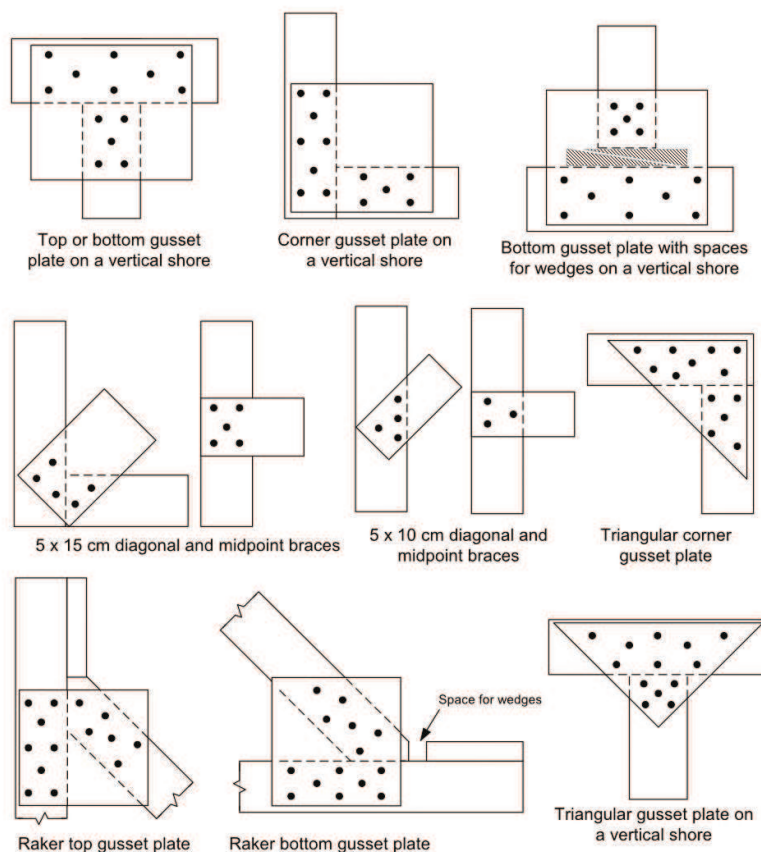
All dimensional wood must be nailed using 16d common nails only.

Figure 11 ►
16d nail,
approximately
actual size
(9 cm.)



The following diagrams show the correct nailing patterns that should be used when shoring:

Figure 12 ►
Nail patterns
for shoring



Notes

Building Shores (Two Types) Cont.

5.2 Vertical Shore

The two sizes of lumber most commonly used in vertical shoring are 10 x 10 cm and 15 x 15 cm. The estimated weight of the floor and its contents will help to determine the size of shoring materials and their spacing.

Businesses and commercial occupancies with heavier structural elements and greater floor height and/or loading may require 20 x 20 cm or even 30 x 30 cm lumber. The Structural Specialist should be used to help determine the correct size and placement of shoring materials.

STEP 1

Determine where to erect the vertical shore.

- After installing initial temporary shoring as needed, clear the area of debris, down to the floor, removing thick carpeting if necessary. A clearance of approximately one metre wide is usually adequate.

- If the vertical shore is to bear directly on soil, examine the ground for stability. If the earth is soft, you should install additional supports under the sole plate to transfer the load over a wider area.

Notes

5

**Building
Shores
(Two Types)**
Cont.

STEP 2

Measure and cut sole plate and header.

- Lay the sole plate on the floor or ground directly under and in line where the header will be installed.

- The sole plate should be as level as possible.

STEP 3

Measure and cut the posts to the proper height.

- Place the header on top of the sole plate.

- With the end of the tape measure on top of the header where the posts are to be installed, slide the tape up to the bottom of the structural element to be shored. Measure in at least three places deducting the width of the wedges to be used and use the **shortest** measurement.

Notes

Building Shores (Two Types) Cont.

STEP 4

Attach cleats or gusset plates to the header and posts, on opposite ends and opposing sides.

- The posts should be at least 30 cm, but less than 60 cm from each end of the header.

- This will allow the diagonal braces to be attached directly to the header, posts, and sole plate.

STEP 5

Install the posts and the header on top of the sole plate to support the damaged structural element.

- The first two posts are installed at opposite ends at least 30 cm, but less than 60 cm from each end of the sole plate.

- Keep the posts in line and plumb with header and sole plate.

- Shim the structural elements down to the header to keep it as level as possible.

Notes

STEP 6

Install a set of wedges under the bottom of each post.

- Tap them together simultaneously until the posts are under compression and tight.
 - Nail behind the wedges to secure them in place.
-

Note: *You may want to use duplex nails to allow for adjustment of the wedges later on.*

STEP 7

Attach cleats or gusset plates on opposite ends and opposing sides of the sole plate and posts and nail in place.

STEP 8

Attach the diagonal braces to each side of the vertical shore.

- Mid-point braces, when needed, should be installed prior to the diagonal braces (except when 5 cm material is used, and then the mid-point braces are placed over the diagonals)
-

- The diagonal braces should be long enough to span its entire length and be attached to the sole plate and header and each post.
-

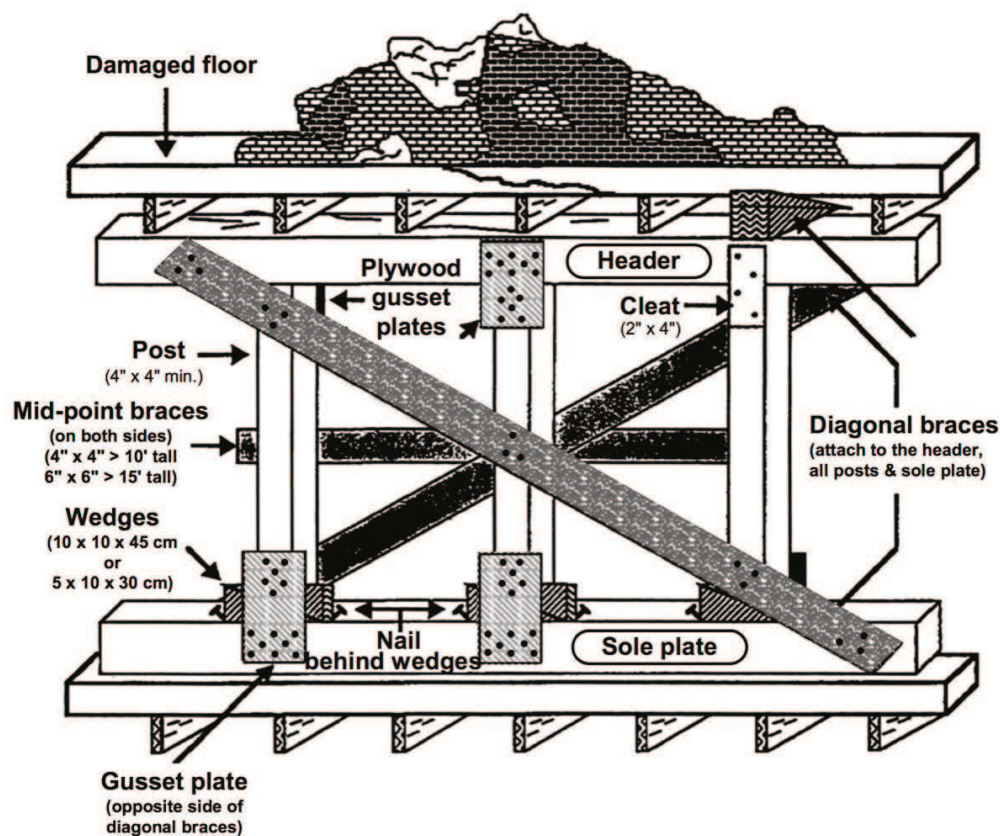
Building Shores (Two Types) Cont.

- If possible, diagonal braces should be installed in an X-pattern on opposite sides of the system.

- Vertical shoring systems that span a long area may require several sets of diagonal braces to connect multiple posts.

Notes

Figure 13 ▼
*Details of
a vertical shore*



Building Shores (Two Types) Cont.

5.3 Window/Door Shore

The window and door shore is usually installed in entry points intended for use by rescue personnel to hold up or stabilise loose headers or lintels that have lost their integrity.

Additional load stress is usually exerted from above and therefore, constructed similar to the vertical shore. If additional load stress is exerted from the side, the window and door shore is constructed similar to the horizontal shore.

STEP 1

Determine where to erect the window/door shore.
After initial temporary shoring has been installed, clear the area of debris or remaining framing material.

STEP 2

Measure and cut the sole plate to the proper length deducting the width of the wedges to be used.

STEP 3

Measure and cut the header to the proper length deducting the width of the wedges to be used.

- Prefabricate a built-up header, if required (see end of procedure).

Notes

Building Shores (Two Types) Cont.

STEP 4

Measure and cut the posts to the proper height.

- Place the header on top of the sole plate.
- With the end of the tape measure on top of the header where the posts are to be installed, slide the tape up to the bottom of the structural element to be shored on both sides deducting the width of the wedges to be used.

- If you get two different measurements, use the shorter of the two.

STEP 5

Install the sole plate with a set of wedges at one end and tap them together simultaneously until the sole plate is under compression and tight.

- The sole plate should be as level as possible, using shims as necessary under the sole plate.

STEP 6

Install the header with a set of wedges at the opposite end of the sole plate and tap them together simultaneously until the header is under compression and tight.

Notes

Building Shores (Two Types) Cont.

- The header should be as level as possible, use shims as necessary above the header.

STEP 7

Install the posts between the header and sole plate and against the sides of the opening.

- Install the first post under the wedge-side of the header to prevent accidental movement if the header wedges loosen up.

- Keep the posts in-line and plumb with the header and sole plate.

- Install a set of wedges under each post, on top of the sole plate. Then tighten the wedges to lock the shore in place.

STEP 8

Attach cleats or gusset plates to at least one side of the header and posts and nail in place.

Notes

Building Shores (Two Types) Cont.

STEP 9

Confine the wedges by placing a cleat against the inside face of each post at the bottom and nail them in place with five 16d nails to each post and two 16d toe-nails to the sole plate.

-
-
- Future adjustment of the wedges may be required. Duplex nails can be used to allow for this.
-
-

STEP 10

Install diagonal braces on the window and door shore when the opening is not used for access or egress.

Built-up Header

A built-up header is used when additional support is needed or if the opening is more than 1.8 metres wide and only 10 x 10 cm material is available.

Prior to installation of the header, cut two 10 x 10 cm beams to proper length for header and set them one on top of the other. Place 15 cm-wide plywood strips (same length as the headers) on each side to join the two pieces, and hammer 8d nails at 8 cm on-centre from each strip of plywood to each 10 x 10 beam.

- Total nailing will be two rows of 8d nails spaced at 8 cm on-centre, per side.
- The header will be 20 cm thick, equivalent to a 10 x 20 cm beam.

Additional notes on building a window shore:

Notes

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PRACTICAL EVALUATION

Lesson 9 Shoring Methods

Group #:

Activity*		Techniques for Cutting		
		Vertical	Window	Door
1	Described the characteristics of the TEA being used.			
2	Properly completed the steps for proper placement of the shore and taking measurements.			
3	Cut the lumber correctly using the appropriate technique.			
4	Properly followed the steps for assembling the shore.			
5	Properly adjusted the shore in general, including straightening the posts and levelling the sole plate and header.			
6	Properly secured the shore, including wedges, shims, braces and gusset plates.			
7	Followed proper technique when using TEA, as taught in this course.			
8	Followed all applicable safety rules while performing the work.			
9	Work was carried out as a team using proper task distribution.			

**Activities in bold type require satisfactory performance for a passing grade on this evaluation.*

Station 1 Pass: ☐ Fail: ☐ Notes: _____ Instructor: _____	Station 3 Pass: ☐ Fail: ☐ Notes: _____ Instructor: _____
Station 4 Pass: ☐ Fail: ☐ Notes: _____ Instructor: _____	

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POST-TEST | LESSON 9

Shoring Methods

ID #

1. Shoring can be defined as the _____ support of only that part of a damaged, collapsed, or partially collapsed structure that is required for conducting _____ and/or _____ operations at reduced risk to the victims and rescue team.

2. List at least four (4) main components of a shore.

3. List two factors that determine the design and method of shoring.

4. List the types of shores taught in this lesson.

5. Number the following steps (1–8) in the proper order for building a vertical shore.

- ___ Install the posts and header on top of the sole plate to support the damaged structural element.
- ___ Attach cleats or gusset plates on opposite ends and opposing sides of the sole plate and post and nail in place.
- ___ Measure and cut sole plate and header.
- ___ Determine where to erect the vertical shore.
- ___ Attach cleats or gusset plates to the header and posts on opposite ends and opposing sides.
- ___ Attach the diagonal braces to each side of the vertical shore.
- ___ Install a set of wedges under the bottom of each post.
- ___ Measure and cut the posts to the proper height.

6. Number the following steps (1 – 10) in the proper order for building a window/door shore.

- ___ Measure and cut the posts to the proper height.
- ___ Attach the cleats and/or gusset plates.
- ___ Determine where to erect the window/door shore.
- ___ Measure and cut the header.
- ___ Install diagonal braces (when applicable).
- ___ Install the sole plate with a set of wedges.
- ___ Measure and cut the sole plate.
- ___ Install the posts and wedges.
- ___ Confine the wedges.
- ___ Install the header with a set of wedges.

CSSR LESSON 9 EVALUATION

Course Location: _____ Dates: _____

Do not write your name on this form. Please complete a copy of this form at the end of every lesson. Your evaluations are very valuable towards improving the course. Please use the ratings below.

	1 VERY POOR	2 POOR	3 AVERAGE	4 GOOD	5 EXCELLENT
Please fill in the required information.	Lesson Number :		Lesson Name :		
	Instructor's Name				
Use a scale from 1 to 5 as described above to rate the various lesson components.	Lesson Rating (rate 1 to 5)				
	Content		Instructor		Method
	Workbook		Interaction		
Mark your selection with an "X"	Instruction Level ☐ Too basic		☐ Appropriate		☐ Too advanced
	Duration ☐ Too short		☐ Appropriate		☐ Too long
	Usefulness Was this lesson useful to you?				
	☐ Yes ☐ No				
Rate from 1 to 5	Overall Lesson Rating Taking all the above into consideration, I rate this lesson: _____				
If you need additional space, please use the back of the sheet.	Comments and Observations				

Thank you for your help. Your input is valuable.
Please turn in this completed form to the instructor.

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EXERCISE EVALUATION LESSON 9

Course Location: _____ Dates: _____

Do not write your name on this form. Please complete a copy of this form at the end of every lesson. Your evaluations are very valuable towards improving the course. Please use the ratings below.

1 VERY POOR	2 POOR	3 AVERAGE	4 GOOD	5 EXCELLENT
Lesson 9 Shoring Methods Use a scale from 1 to 5 as described above to rate the various lesson components.				
Station 3 Station Name: Window Shoring				
Instructor: _____				
Station Rating (rate 1 to 5) Instructor _____ Materials _____ Method _____ Location _____				
Instruction Level ☐ Too basic ☐ Appropriate ☐ Too advanced				
Duration ☐ Too short ☐ Appropriate ☐ Too long				
Comments and Observations _____ _____ _____				
Station 4 Station Name: Door Shoring				
Instructor: _____				
Station Rating (rate 1 to 5) Instructor _____ Materials _____ Method _____ Location _____				
Instruction Level ☐ Too basic ☐ Appropriate ☐ Too advanced				
Duration ☐ Too short ☐ Appropriate ☐ Too long				
Comments and Observations _____ _____ _____				

Thank you for your help. Your input is valuable.
Please turn in this completed form to the instructor.

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