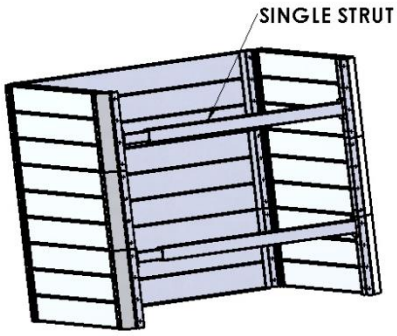
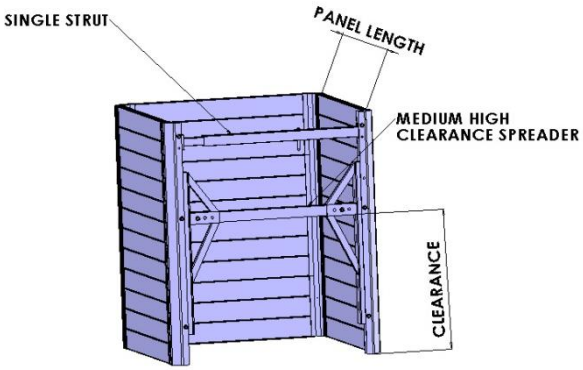
MODULAR ALUMINUM BUILDABLE BOX

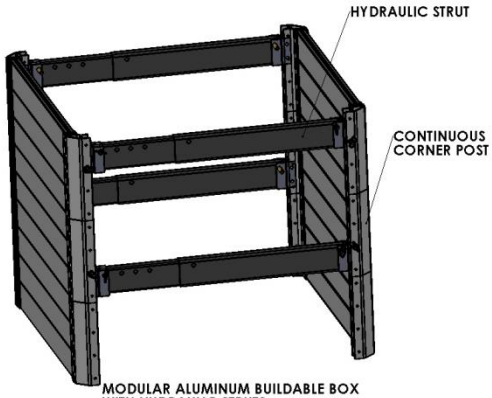
TABULATED DATA
Effective March 22, 2017
RED



MODULAR ALUMINUM BUILDABLE BOX
WITH SINGLE STRUTS



MODULAR ALUMINUM BUILDABLE BOX
WITH MEDIUM HIGH CLEARANCE SPREADER



MODULAR ALUMINUM BUILDABLE BOX
WITH HYDRAULIC STRUTS

PSH

PACIFIC SHORING, LLC
265 Roberts Avenue
Santa Rosa, Ca. 95407
(707) 575-9014

Construction Engineering Resource
1837 Wright Street
Santa Rosa, Ca. 95404
jmtengr2@aol.com
(707) 484-4704

Contents

Description

The Pacific Shoring Modular Buildable Box is an aluminum shoring system consisting of 2'8" x 8" T&G panels, corner posts, and a strut system at the ends. The system can be constructed in 2 sided, 3 sided, and 4 sided configurations. The posts, panels, and struts are pinned in place. This allows construction and modification of the box at the site. Hydraulic aluminum struts are also available thereby allowing the buildable box system to become a hydraulic shoring system. The panel lengths are available from 3 ft to 16 ft long. Corner posts vary in length from 2 ft to 12 ft. Boxes may be stacked and have allowable depths to 25 ft. Additional depths may be achieved thru design by a registered engineer. Hand adjustable struts, static struts, and hydraulic struts adjusting to maximum 12 ft may be used with the system. Pacific Shoring also manufactures a medium high clearance strut and a high clearance strut for two and three sided boxes. A 4 sided configuration may be used up to 16 ft x16 ft. These boxes may be used in a static or dynamic configuration. A static configuration assumes that the box wall does not necessarily touch the sides of the excavation and that there is no pressure being exerted on the soil. A dynamic configuration requires that the shield walls are pressurized against the soil. Pressurization sets up soil arching and delivers some of the soil pressure directly to the corners and therefore results in less pressure on the box walls. With this configuration, slightly longer wall lengths can be achieved and the possibility of shoring wall collapse and surrounding existing facility damage can be prevented.

This shoring system is generally used in utility work where differing conditions and excavation geometry occur on a daily basis. The system can be easily loaded onto a truck and constructed at the site as the excavation dimensions and obstructions reveal themselves. Parts may be handled by one person and constructed boxes can be handled with a backhoe.

General Information for use of Pacific Shoring Modular Aluminum Buildable Box

1. The buildable box shoring system tabulated here is based on requirements of Federal OSHA 29CFR, Part 1926, Subpart P-Excavations, and Trenches

   1926.652(c)(2)-Option (2) - Designs Using Manufacturer's Tabulated Data.
   1926.652(c)(2)(i) -Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

   All provisions of Subpart P apply when utilizing this tabulated data. The contractor's competent person shall use this data to select allowable trench depth, box wall, and strut configuration. The competent person utilizing this tabulated data shall be experienced and knowledgeable of all requirements of Subpart P, and trained in the use and safety procedures for shoring box applications.

2. Use of this tabulated data is dependent on first classifying the soil in accordance with OSHA Appendix A, Soil Classification. Classification shall be just prior to installing shoring box. Soil conditions may change at a later date and require revaluation of the strength and allowable depth.

3. Modular aluminum buildable boxes are tabulated based on the effect of a 20,000 lb surcharge load set back 2 ft from the edge of the trench and the equivalent weight effect of the OSHA soil type, see classification of soil types, 2.

4. The depth and spacing given in **Tables 1, 2,** and **3** governs the use of Pacific Shoring Buildable Boxes and not tabulations given by other manufacturers. This tabulated data applies to buildable boxes manufactured by Pacific Shoring, LLC; however, all parts are interchangeable with Speed-Shore Modular Aluminum Panel Shields, "MAPS". Speed-Shore MAPS parts may be interchanged and used with Pacific Shoring Buildable Boxes under this tabulated data. Any alterations to the boxes or variance from this tabulated data shall be indicated in a site-specific plan prepared and approved by a registered engineer.

5. Faces of excavations shall be vertical and the shoring walls shall be within 12" of the excavation wall.

6. Aluminum Buildable Boxes may be stacked or longitudinally connected.

7. Aluminum Buildable Boxes shall be installed and removed from outside the trench, see installation and removal procedure.

8. The competent person shall continually monitor the shored excavation for changed conditions such as water seepage, soil movement cracks at the surface, sloughing or raveling, proper surcharge load weight less than 20,000 lbs and setback a minimum of 2 ft that may damage the shores.

9. Workers shall always enter, exit, and work inside the shored area of the trench.

10. Aluminum Buildable Boxes may be stacked as long as they are pinned together.

11. Aluminum Buildable Boxes may be set a maximum of 2 ft from the bottom of the excavation. The trench depth is the full distance to the bottom of the excavation.

Classification of Soil Types

1. Soil classification shall be in accordance with OSHA Appendix A and classified just prior to installing hydraulic vertical shores. Soil conditions may change at a later date and require hydraulic vertical shores to be reset at a different spacing.

2. The equivalent weight of OSHA soil types* is assumed to be as follows:

• OSHA Type "A" Soil	25 PSF per ft of depth
• OSHA Type "B" Soil	45 PSF per ft of depth
• Type "C-60" Soil	60 PSF per ft of depth**
• OSHA Type "C" Soil	80 PSF per ft of depth

* These equivalent weights were adapted from OSHA 1926 Subpart P App C, Timber Shoring for Trenches, Tables C-1.1, C-1.2, and C-1.3

** Type C-60 soil is not identified or classified in OSHA Appendix A

3. Type C-60 soil is soil that does not qualify as OSHA Type A, or Type B, can be cut with vertical walls and will stand up long enough to safely insert and pressurize the hydraulic shore.

4. Buildable boxes may be used in C-80 soil provided they are dug into the excavation and not driven into the soil.

Determining Aluminum Buildable Box Shoring Configurations

Shoring use and configurations shall be determined by the user (employer and designated competent person). The following steps are necessary to properly configure and construct a buildable box shoring system:

1. Define soil type in accordance with OSHA Appendix A

2. Determine surcharge loading. All shoring equipment is designed for a maximum of a 20,000 lb surcharge load set back 2 ft from the edge of the trench. Larger loads shall be set back further or reduced. The competent person shall have training and knowledge in proper determination of surcharge loads.

3. Determine length, width, and depth of shoring requirement.

4. Determine existing facilities and depths that they will enter into the shoring configuration.

5. Determine depths, locations, and clearance requirements of facilities that will be constructed inside the shoring.

6. Determine components of the Buildable Box system needed to fit the requirements of the system. These components will at a minimum consist of:

   - Wall panels
   - Corner posts
   - Strutting for 2 and 3 sided boxes
   - High clearance strutting for constructed facilities entering or exiting the shoring system

7. Determine allowable depths and settings for components as follows:

   a) Wall Panels - **Table 1 - Allowable Depth for Buildable Box wall Panels**

   b) Corner posts - **Table 2 - Allowable Corner Post Spans**.
   Corner posts have an allowable cantilever span and allowable strut spacing span based on the depth of the excavation. These tables apply to hydraulic spreaders, pinned end struts, and screw jack struts.

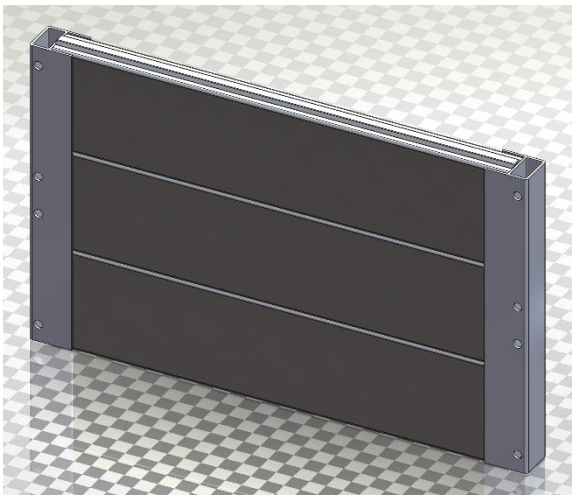
   c) Struts - **Table 3 - Allowable Strut Lengths**

   d) High clearance strutting - **Table 4 - Allowable Depth using Medium High Clearance Spreader**
   Table 5 - Allowable Depth using High Clearance Spreader

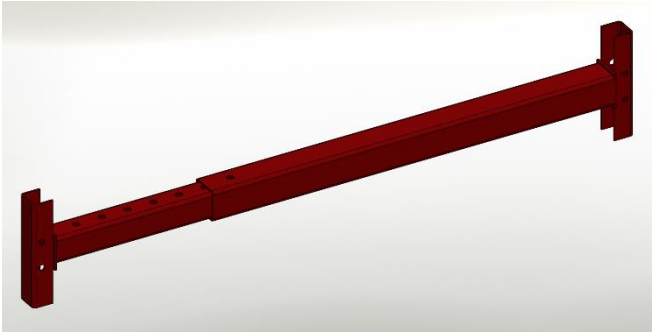
   Note - The medium high clearance spreader allows more depth than the high clearance spreader

8. Determine approximate shoring system weight before rigging. Rigging equipment and connections should have a 5:1 factor of safety.

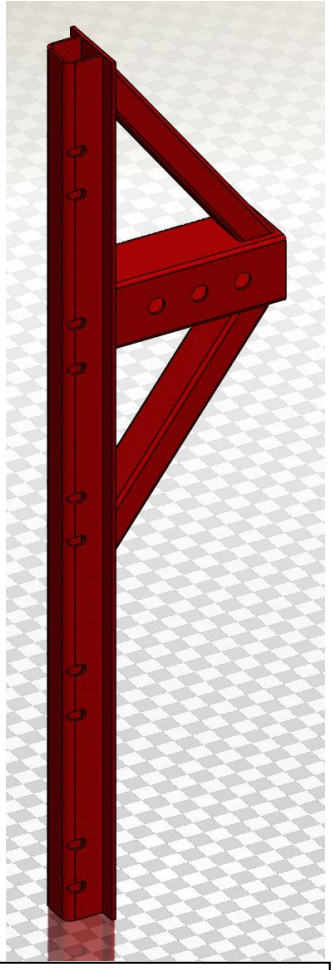
Buildable Box Components



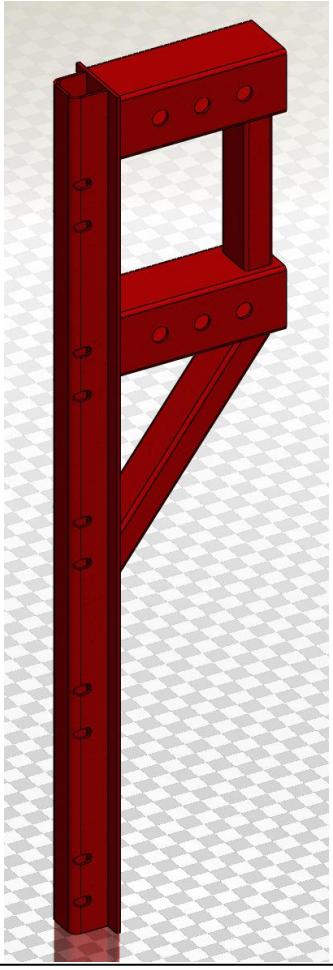
2ft High Panel



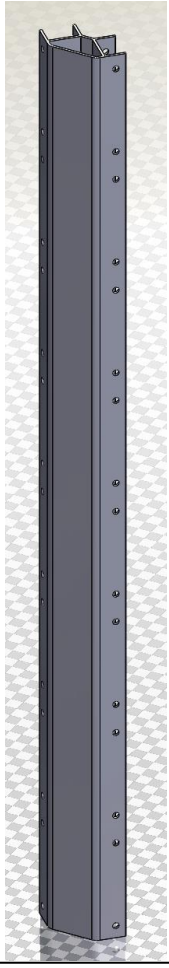
End Strut



High Clearance Arch - A



High Clearance Arch - B



Corner Post

Buildable Box components are manufactured in several different sizes that can then be pinned together in practically any size box. Sizes available are as follows:

2ft Wall Panel	4 ft	6 ft	8 ft	10 ft	12 ft	16 ft
Corner Post	2 ft	4 ft	8ft	10 ft	12 ft	
End Strut	4 ft to 6 ft		6 ft to 8 ft		8 ft to 12ft	
Medium Clearance Strut	4 ft to 6 ft		6 ft to 8 ft		8 ft to 12ft	

Determining Buildable Box Weight

To determine the weight of the constructed box use the weights given in **Tables W1** and **W2**.

Example - Determine the weight of a Buildable Box
8 ft deep x 12 ft long x 6 ft wide

Total Weight of 3 Sided Box						
length	12	ft				
width	6	ft				
sides	3	ea	12' long x 6' wide			
struts	2	ea	End Strut			
qty	Description		Unit Weight		qty Weight	
8	2'x12' Wall Panels		172	lbs ea	1379	lbs
4	2' x 6' wall panels		89	lbs ea	356	lbs
32	lf corner post		6.57	lbs / lf	210	lbs
24	pins		1	lbs ea	24	lbs
12	lf end strut		17	lbs/lf	204	lbs
			Total Weight		**2173**	lbs

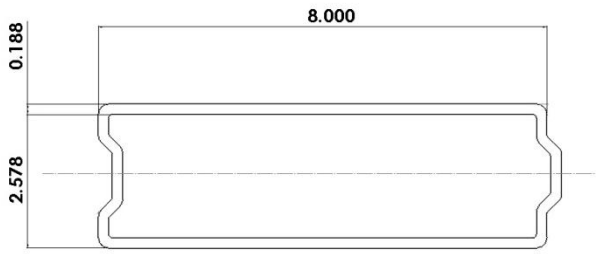
TABLE W-2		
Miscellaneous Parts Weight		
Corner posts	6.57	lbs/lf
Pins*	1	lbs ea
Screw Jack	10	lbs/lf
End strut	17	lbs/lf
*Allow 2 pins per 2 ft panel		

TABLE W-1		
Panel Weights		
Depth (ft)	Length (ft)	Weight (lbs)
2	3	47
2	4	61
2	5	75
2	6	89
2	7	103
2	8	117
2	10	145
2	12	172
2	13	186
2	14	200
2	16	228

Geometric Properties for Engineering Design

MATERIAL

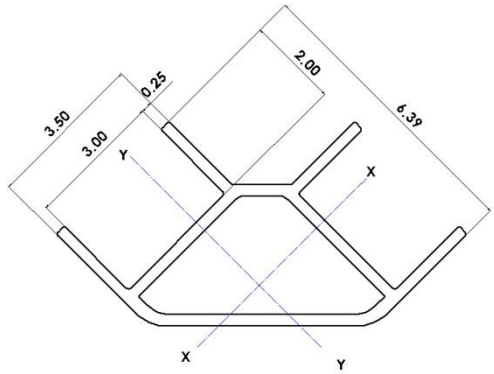
Extruded Aluminum 6061-T6
Ultimate Tensile Strength F_{tu} = 45,000 psi
Tensile Yield Strength F_{ty} = 40,000 psi
Modulus of Elasticity = 10,000 ksi



BUILDABLE BOX PANEL (RED)

Buildable Box Panel Properties per foot

AREA =	5.83	IN^2
WEIGHT =	6.94	LB/LF
MOMENT OF INERTIA =	6.94	IN^4
SECTION MODULUS =	5.38	IN^3



CORNER POST (RED)

Corner Post Properties per

AREA =	5.28	IN^2
WEIGHT =	6.58	LB/LF
MOMENT OF INERTIA =	17.64	IN^4
SECTION MODULUS =	4.96	IN^3

Allowable Buildable Box Wall Panel Spans

To determine the allowable depth for a buildable box panel length use **Table 1** below.

Example - If the longest wall panel element is 12 ft long and to be used in C-60 soil, from **Table 1** the box may be used to a depth of 11 ft.

Table 1: Allowable Depth for Buildable Box Wall Panels					
Panel Length (ft)	Panel Capacity (PSF)	Allowable Depth (ft)			
		OSHA Soil Type			
		A-25	B-45	C-60	C-80
3	13691	25	25	25	25
4	7303	25	25	25	25
5	4530	25	25	25	25
6	3082	25	25	25	25
7	2232	25	25	25	25
8	1680	25	25	25	21
10	1072	25	24	18	13
12	744	25	17	12	9
13	632	25	14	11	8
14	544	22	12	9	7
16	416	17	9	7	5

Table 1 Notes

1. Wall panels are Pacific Shoring Buildable Box Panels as detailed in this tabulated data.
2. The longest box wall in the constructed box shall govern the allowable depth given in **Table 1**
3. Two and three sided boxes shall be strutted. See **Table 2** for allowable corner post spans and **Table 3** for allowable strut lengths.
4. If the box is used with hydraulic struts and is pressurized against the trench wall, the allowable depth may be increased by 2 ft but may never be set more than 25 ft deep.
5. Panel lengths are overall dimension from outside of corner post to outside of opposite corner post. Panel lengths are the minimum excavation length required to fit the box inside the excavation.
6. Tabulated Depths are limited to 25 ft deep. Additional depth may be achieved when the design is by a registered civil engineer.

Allowable Corner Post Spans

On two and three sided boxes, use **Table 2** to determine the allowable corner post cantilever and strut spacing.

Example- If the longest wall panel element on a 3-sided box is 12 ft long and to be used in C-60 soil at 11 ft deep, from **Table 2-12**, the maximum corner post cantilever can be 2 ft and the maximum strut spacing can be 4 ft.

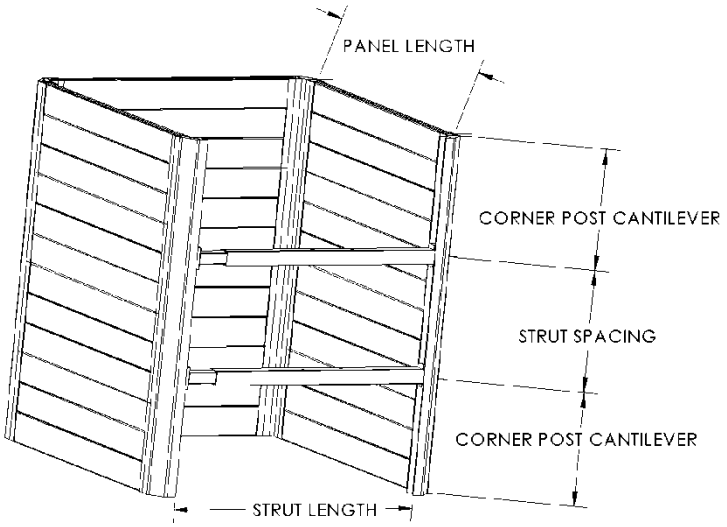


TABLE 2-3 ALLOWABLE CORNER POST SPANS FOR WALL PANEL LENGTH = 3 ft

Depth	Corner Post Cantilever(ft)				Strut Spacing (ft)			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
6	7	5	5	4	16	12	11	9
8	6	5	4	4	14	11	9	8
10	6	4	4	3	13	9	8	7
12	5	4	3	3	12	9	7	6
14	5	4	1	3	11	8	3	6
16	4	3	1	2	10	7	3	6
18	4	3	3	2	9	7	6	5
20	4	3	3	2	9	7	6	5

TABLE 2-4 ALLOWABLE CORNER POST SPANS FOR WALL PANEL LENGTH = 4 ft

Depth	Corner Post Cantilever(ft)				Strut Spacing (ft)			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
6	6	5	4	4	14	11	9	8
8	5	4	4	3	12	9	8	7
10	5	4	3	3	11	8	7	6
12	4	3	3	2	10	7	6	6
14	4	3	1	2	9	7	3	5
16	4	3	1	2	9	6	3	5
18	4	3	2	2	8	6	5	5
20	3	3	2	2	8	6	5	4

TABLE 2-5 ALLOWABLE CORNER POST SPANS FOR WALL PANEL LENGTH = 5 ft

Depth	Corner Post Cantilever(ft)				Strut Spacing (ft)			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
6	6	4	4	3	13	9	8	7
8	5	4	3	3	11	8	7	6
10	4	3	3	2	10	7	6	5
12	4	3	3	2	9	7	6	5
14	4	3	1	2	8	6	3	5
16	3	3	1	2	8	6	3	4
18	3	2	2	2	7	5	5	4
20	3	2	2	2	7	5	4	4

TABLE 2-6 ALLOWABLE CORNER POST SPANS FOR WALL PANEL LENGTH = 6 ft

Depth	Corner Post Cantilever(ft)				Strut Spacing (ft)			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
6	5	4	3	3	12	9	7	6
8	4	3	3	2	10	7	6	6
10	4	3	3	2	9	7	6	5
12	4	3	2	2	8	6	5	5
14	3	3	1	2	8	6	3	4
16	3	2	1	2	7	5	3	4
18	3	2	2	2	7	5	4	4
20	3	2	2	2	6	5	4	4

TABLE 2-8 ALLOWABLE CORNER POST SPANS FOR WALL PANEL LENGTH = 8 ft								
Depth	Corner Post Cantilever(ft)				Strut Spacing (ft)			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
6	4	3	3	2	10	7	6	6
8	4	3	2	2	9	6	6	5
10	3	3	2	2	8	6	5	4
12	3	2	2	2	7	5	5	4
14	3	2	1	2	7	5	3	4
16	3	2	1	2	6	5	3	3
18	3	2	2	1	6	4	4	3
20	2	2	2	1	5	4	4	3

TABLE 2-10 ALLOWABLE CORNER POST SPANS FOR WALL PANEL LENGTH = 10 ft								
Depth	Corner Post Cantilever(ft)				Strut Spacing (ft)			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
6	4	3	3	2	9	7	6	5
8	3	3	2	2	8	6	5	4
10	3	2	2	2	7	5	4	4
12	3	2	2	2	6	5	4	4
14	3	2	1	1	6	4	3	3
16	2	2	1	1	5	4	3	3
18	2	2	1	1	5	4	3	3
20	2	2	1	1	5	4	3	3

TABLE 2-12 ALLOWABLE CORNER POST SPANS FOR WALL PANEL LENGTH = 12 ft								
Depth	Corner Post Cantilever(ft)				Strut Spacing (ft)			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
6	4	3	2	2	8	6	5	5
8	3	2	2	2	7	5	5	4
10	3	2	2	2	6	5	4	4
12	3	2	2	1	6	4	4	3
14	2	2	1	1	5	4	3	3
16	2	2	1	1	5	4	3	3
18	2	2	1	1	5	4	3	3
20	2	1	1	1	4	3	3	2

TABLE 2-14 ALLOWABLE CORNER POST SPANS FOR WALL PANEL LENGTH = 14 ft								
Depth	Corner Post Cantilever(ft)				Strut Spacing (ft)			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
6	3	3	2	2	8	6	5	4
8	3	2	2	2	7	5	4	4
10	3	2	2	1	6	4	4	3
12	2	2	2	1	5	4	3	3
14	2	2	1	1	5	4	3	3
16	2	2	1	1	5	3	3	3
18	2	1	1	1	4	3	3	2
20	2	1	1	1	4	3	3	2

TABLE 2-16 ALLOWABLE CORNER POST SPANS FOR WALL PANEL LENGTH = 16 ft								
Depth	Corner Post Cantilever(ft)				Strut Spacing (ft)			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
6	3	2	2	2	7	5	5	4
8	3	2	2	2	6	5	4	3
10	2	2	2	1	5	4	4	3
12	2	2	1	1	5	4	3	3
14	2	2	1	1	5	3	3	3
16	2	1	1	1	4	3	3	2
18	2	1	1	1	4	3	3	2
20	2	1	1	1	4	3	2	2

Table 2 Notes

1. These tables apply to all strut types, hydraulic struts, pinned end strut, and screw jack strut.
2. Always use a minimum of two struts per corner post.
3. Short sectional corner posts shall have a strut top and bottom.
4. Long corner posts shall have strutting spaced as shown in these tables.
5. Interpolation between tables is OK
6. Two sided and three sided boxes shall have continuous corner post, for example an 8 ft tall two sided box must have an 8 ft long corner posts. Strut spacing shall be as shown in **Table 2**.

Allowable Strut Lengths

Table 3 gives the maximum strut length allowed for any Buildable Box configuration. Longer lengths may be allowed as determined by a registered engineer.

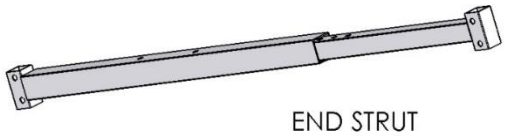


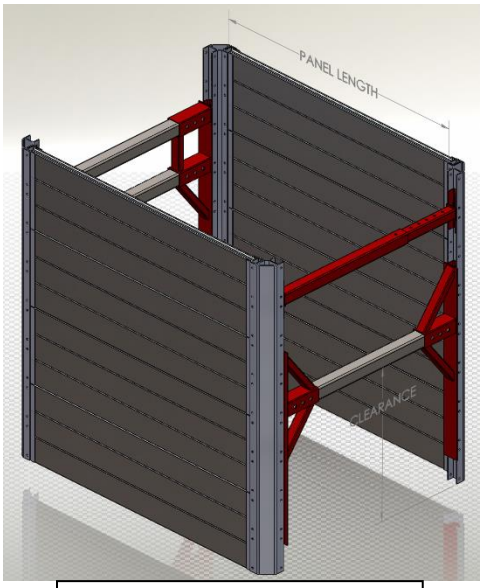
TABLE 3-1	ALLOWABLE END STRUT LENGTH			
Depth	Soil Type			
(FT)	A25	B45	C60	C80
10	16	14	12	10
16	14	12	10	8
20	12	10	8	6

Table 3 Notes

1. Struts shall be pinned in place.
2. End Struts and Screw Jacks may be either aluminum or steel.

Buildable Box High Clearance Spreader Applications

The high clearance arch is used to achieve additional clearance below the strut. This strut can be used with buildable boxes constructed 6 ft and 8 ft high. Additional boxes may be stacked above the medium clearance strutted box.



High Clearance Arch - A

High Clearance Arch - B

TABLE 4-1 ALLOWABLE DEPTH WHEN USING MEDIUM HIGH CLEARANCE SPREADER (ft)								
Panel Length	Clearance = 4 ft				Clearance = 6 ft			
	Soil Type				Soil Type			
(ft)	A25	B45	C60	C80	A25	B45	C60	C80
3	20	20	20	16	20	20	20	16
4	20	20	20	16	20	20	20	16
5	20	20	20	16	20	20	18	16
6	20	20	20	16	20	20	16	14
8	20	20	20	16	20	18	14	10
10	20	20	18	14	14	14	10	8
12	20	18	14	8	8	8	8	6
14	20	12	8	6	6	6	6	6
16	16	8	6	0	0	0	0	0

Table 4 Notes

1. End posts must be continuous from bottom of box to top strut.
2. There must always be a single strut used on the same end post set above the medium clearance strut.
3. On excavations to 10 ft deep and maximum 10 ft wide in A, B & C-60 soil, it is allowable to use sheet pile and timber lagging set against the spreaders at the ends.

Buildable Box Installation and Removal

Installation Procedure

Buildable boxes must be constructed prior to setting inside the trench.

Step 1 Pin panels into corner posts. Build in a stable configuration starting from corners and setting panels in opposite directions.

Step 2 Pin in and adjust spreaders into the corner posts.

Step 3 Lower shore into trench with lifting equipment such as backhoe, boom truck or crane.

Removal Procedure

Step 1 Remove the box using equipment operated from outside the trench. Workers are not allowed inside the box when it is being set, moved, or removed from the trench.

Safe Handling and Use of Buildable Box Shoring System

- When Buildable Boxes are set in trenches that are sloped above, extend the box 18" above the hinge point. Slopes shall be in accordance with OSHA Appendix B sloping and benching.
- When there is sloping beyond the top of the box depth of the excavation is limited to 20 ft without a design by a registered engineer.
- Workers are not allowed inside the box when it is being set, moved, or removed from the trench.
- Provide safe access such as ladders for workers to enter and exit the shoring system.
- Use cables and slings for lifting that have a 5:1 factor of safety. A competent person is to determine the total lift weight.
- Pacific Shoring provides handrail with gate systems for Buildable Box systems under separate tabulated data.