

Australian Standard™

Steel shoring and trench lining equipment

Part 1: Design



This Australian Standard was prepared by Committee ME/82, Shoring and Trench Lining. It was approved on behalf of the Council of Standards Australia on 4 August 2000 and published on 20 November 2000.

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Australian Industry Group
Civil Contractors Federation
Concrete Pipe Association of Australasia
Construction, Forestry, Mining and Energy Union
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This Standard was issued in draft form for comment as DR 99505.

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First published as AS 4744.1—2000.

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Published by Standards Australia International Ltd
GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 3556 8

PREFACE

This Standard was prepared by the Standards Australia Committee ME/82.

The objective of this Standard is to provide safe specifications for the design and rating of steel shoring and trench lining equipment for use in trench digging operations thus providing the knowledge necessary to minimize the likelihood of trench collapse resulting in fatality.

This Standard is based on draft CEN Standard prEN 13331-1, *Trench lining systems*, Part 1: *Product specifications*, and Part 2: *Assessment by calculation or test*. It differs from those documents in that a lower minimum shield rating of 20 kPa is allowed.

Published Standards in the series are:

AS

4744 Steel shoring and trench lining equipment

4744.1 Design

It is intended to publish the following part:

Safe use

Australian Standards are not intended, in their own right, to be retrospective. They usually apply to new plant. The relevant authorities in each State may or may not require that all existing plant comply with this Standard. Individual authorities should be consulted as to whether they require existing plant to comply with this Standard.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

CONTENTS

	<i>Page</i>
FOREWORD	4
 SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	5
1.2 APPLICATION	5
1.3 GENERAL	5
1.4 NEW DESIGNS AND INNOVATIONS	5
1.5 REFERENCED DOCUMENTS	5
1.6 NOTATION	6
1.7 DEFINITIONS	7
 SECTION 2 SYSTEM AND COMPONENTS—DESCRIPTION AND EXAMPLES	
2.1 COMMON TRENCH LINING SYSTEMS	9
2.2 SUPPORTING COMPONENTS	12
2.3 STRUT TO PANEL/SLIDE RAIL CONNECTION	14
2.4 PANEL TO PANEL CONNECTIONS	15
 SECTION 3 DESIGNATION	
3.1 PANEL DESIGNATION	17
3.2 STRUT DESIGNATION	17
3.3 SLIDE RAIL DESIGNATION	17
 SECTION 4 MATERIALS	
 SECTION 5 DESIGN REQUIREMENTS	
5.1 GENERAL REQUIREMENTS	19
5.2 MINIMUM RATED SYSTEM CAPACITY	20
5.3 MAXIMUM ELASTIC DEFLECTION	20
5.4 ATTACHMENT POINTS	20
5.5 STRUTS	21
5.6 STRUT TO PANEL OR SLIDE RAIL CONNECTION	24
 SECTION 6 INSTRUCTION MANUAL	
6.1 GENERAL REQUIREMENTS	25
6.2 PRINCIPAL CONTENTS	25
 SECTION 7 MARKING	
 SECTION 8 EVALUATION OF CONFORMITY	
8.1 DECLARATION	27
8.2 PROVISION OF SPECIFICATIONS	27
 APPENDICES	
A PARTIAL SAFETY FACTORS	28
B RELATIONSHIP BETWEEN LOADS AND RESISTANCE	29
C DETERMINATION OF EARTH PRESSURES AND STRUT LOADS USING EMPIRICAL PRESSURE ENVELOPES	30
D TYPICAL GROUND PARAMETERS	32
E ADDITIONAL LOADS	33

FOREWORD

Shoring and trench lining systems are intended for use in temporary works to protect the workers and the works from the effects of any trench collapse.

This Standard covers steel shoring and trench lining equipment because most shoring systems in use are steel. Very few shoring systems in the industry are made of other materials like wood, aluminium and fibreglass and, because such systems behave so differently to steel and require different design considerations, they were considered to be a different topic. Thus, shoring systems made of other materials were excluded from the Scope of this Standard to expedite the publication of this document.

STANDARDS AUSTRALIA

Australian Standard

Steel shoring and trench lining equipment

Part 1: Design

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the requirements for steel shoring and trench lining systems assembled completely from prefabricated components. It includes requirements for the design, construction and intended use of such systems.

1.2 APPLICATION

This Standard applies to all new shoring and trench lining systems. All systems shall comply with this Standard within 24 months of the publication date of this Standard.

1.3 GENERAL

Trench lining systems are intended for use in temporary works to protect workers and the works from the effects of any trench collapse or ground movement or both.

Drawings presented in this Standard are for illustrative purposes and are not intended for use as engineering drawings.

Manufacturers shall keep up to date records of all trench lining system components that have been manufactured and shall keep records of conformity of materials used.

1.4 NEW DESIGNS AND INNOVATIONS

This Standard is not intended to preclude novel materials, designs and the like, which do not comply with this Standard or are not mentioned in it but which can be shown to give equivalent or superior results.

1.5 REFERENCED DOCUMENTS

AS	
1163	Structural steel hollow sections
3679	Structural steel
3679.2	Part 2: Hot-rolled steel bars and sections
4100	Steel structures
1726	Geotechnical site investigation
AS/NZS	
1594	Hot-rolled steel flat products

1.6 NOTATION

The following symbols are used in this Standard:

Symbol	Description	Units
A_p	Area of the panel	m ²
B_k	Characteristic slide rail bending resistance	kNm
b	Trench width	m
b_c	Internal trench lining width	m
D_i	External diameter of the inner tube	mm
D_o	External diameter of outer tube	mm
e_d	Design load	kPa
e_k	Rated load	KPa
F_{ck}	Characteristic strut compression resistance	kN
F_{tk}	Characteristic strut tensile resistance	kN
h	Height of the panel	m
h_b	Distance between axis of the bottom strut and the lower edge of the panel	m
h_c	Bottom-strut clearance	m
h_m	Distance between the upper strut and the bottom strut	m
h_t	Distance between the axis of the upper strut and the top edge of the panel	m
L_s	Strut maximum working length	m
P_k	Characteristic panel resistance	KPa
R_d	Design system resistance	Kpa
R_{Ek}	Characteristic extracting, connecting and pulling points resistance (vertical direction)	kN
R_k	Characteristic system resistance	KPa
s	Thread depth	mm
s_r	Radial engagement of the thread	mm
t	Wall thickness of the tube	mm
α	Thread helix angel	Deg.
β	Telescoping strut angular misalignment	Deg.
γ_F	Partial safety factor for action	—
γ_{FS}	Strut partial safety factor for action	—
γ_{FP}	Panel partial safety factor for action	—
γ_M	Partial safety factor for resistance	—
Δ	Deflection of the panel due to earth pressure	—
ϕ	Angle of internal friction of soil (total stress)	—
ϕ'	Angle of internal friction of soil (effective stress)	—
μ	Coefficient of friction	—

1.7 DEFINITIONS

For the purposes of this Standard, the definitions below apply:

1.7.1 Characteristic system resistance (R_k)

Ultimate resistance to an external load of a complete assembly of components of a trench lining system.

NOTE: This is the key value for the trench lining system in a particular configuration. The value will be controlled by the weakest component used.

1.7.2 Connecting point

Point for connecting base panels to top panels, top panels to top panels and slide rails to slide rails in a vertical direction.

1.7.3 Connector

Unit that forms the connections between the lower and an upper module or between two upper modules.

1.7.4 Cutting edge

An edge of the panel that comes into contact with the ground, which is designed to aid passage of the panel during installation of the shoring system.

1.7.5 Dig and push

Term used to describe installation of the shoring system, whereby the shoring unit in contact with the soil face is pushed into the ground to refusal. The material on the excavation side is then removed, allowing the shoring to be pushed still further into the ground. The process is then repeated continuously until the shoring is at the required depth.

1.7.6 Extraction point

The point for attachment of a lifting device for removal of the trench lining system from the excavation.

1.7.7 Handling point

Point for handling components to aid the assembly of the system and for use in transportation.

1.7.8 Internal trench lining width (b_c)

Clear horizontal distance, b_c , between the panels of a trench lining system (see Figure 1).

1.7.9 Lifting point

A component or system fixed into the panel for later attachment to the lifting device.

1.7.10 Lower module

An assembly of panels, posts and struts which together form an integral shoring system which is installed in the ground first.

1.7.11 Panel connector

Component used to connect two vertically adjacent panels or slide rails (see Figures 9 and 10).

1.7.12 Post

Integral with the panel, the post allows connection between the panel and strut.

1.7.13 Pre-driven

Method of installation of slide rail posts which are driven into the ground to required depth, before the excavation process begins.

1.7.14 Professional engineer

A professional engineer is —

- (a) a person registered in a relevant area of practice on the National Professional Engineers Register administered by The Institution of Engineers, Australia, and covered by any required Professional Indemnity Insurance; or
- (b) where applicable, a Member of a Scheme established under Professional Standards Legislation in the relevant jurisdiction; or
- (c) a Chartered Professional Engineer (CPEng) or other persons providing satisfactory evidence to a responsible authority that they have the qualifications and experience to be competent to perform the required tasks, independently.

1.7.15 Pulling point

Point for horizontally pulling drag boxes.

1.7.16 Strut working length

The connected length of strut componentry between the centres of each point of strut to panel connection.

1.7.17 Racking

Action applied to trench lining equipment whereby alternate panels are individually and progressively pushed into the ground to facilitate installation, or are individually and progressively pulled out of the ground to facilitate extraction.

1.7.18 Slide rail

Discreet vertical member which has a groove or grooves at each side to engage with and guide panels. Opposite rails are connected by struts or supporting frames (see Figure 3).

1.7.19 Strut

A component that connects two opposing posts.

1.7.20 Trench lining systems

Pre-engineered systems that are designed to protect the workers and the works from the effects of any trench collapse or ground movement, or both.

1.7.21 Trench width (*b*)

Distance between the soil faces.

1.7.22 Bottom-strut clearance (*h_C*)

Vertical distance between the lowest point of the bottom strut and the lowest edge of a panel or slide rail (see Figure 1).

1.7.23 Upper module

An assembly of panels, posts and struts which together form an integral shoring system that is installed on top of lower or upper modules and connected together with connectors (see Figure 1).

1.7.24 Panel

The side walls of the unit which come into contact with the soil face (see Figure 1).

SECTION 2 SYSTEM AND COMPONENTS — DESCRIPTION AND EXAMPLES

2.1 COMMON TRENCH LINING SYSTEMS

2.1.1 General

Connection pins shall be secured with a suitable locking device.

2.1.2 Trench boxes

A trench box is an assembly of prefabricated panels and struts, which has been connected together to form a two- or four-sided shoring system. The system generally comprises lower and upper modules, which may be successively stacked on top of each other and connected together to enable the shoring to be used to greater depths. The strut/panel connection usually allows racking to facilitate installation by the dig and push method (see Figures 6 and 7).

Figures 1 and 2 illustrate typical trench boxes, Figure 1 showing a lower and upper module.

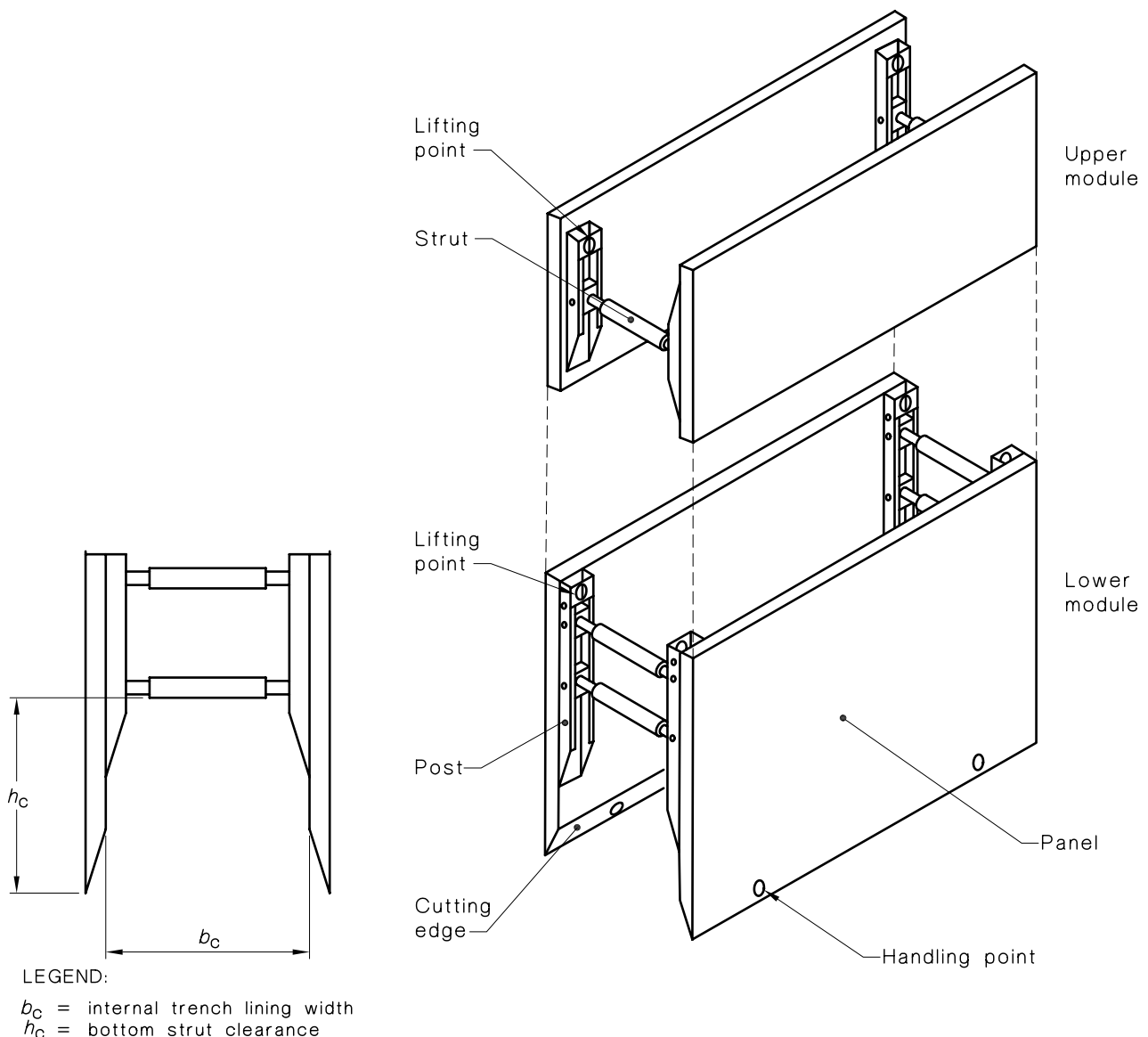


FIGURE 1 EXAMPLE OF A TYPICAL TRENCH BOX

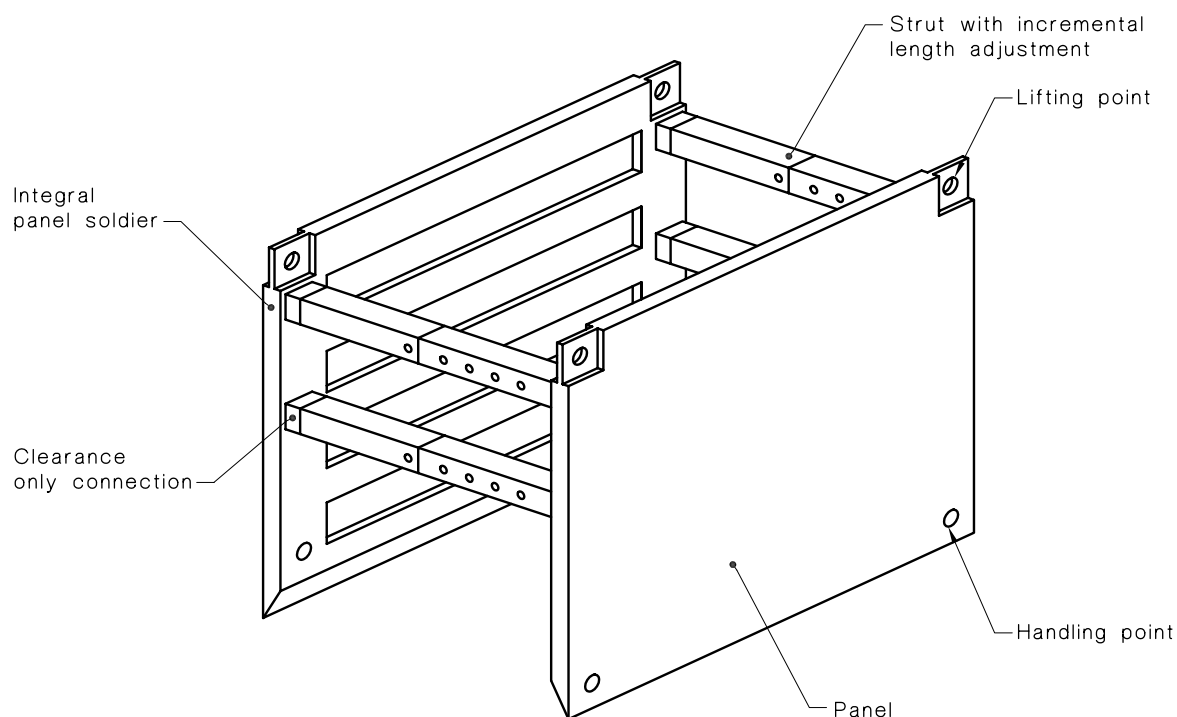


FIGURE 2 EXAMPLE OF A TYPICAL TRENCH LINING SYSTEM WITH AN INTEGRAL POST AND INCREMENTAL TELESCOPING STRUTS

2.1.3 Slide rail trench lining systems

Slide rail systems comprise modular panel sections which interlock at each end with grooved slide rail posts (see Figure 3).

Pairs of slide rails are used in conjunction with struts which together form a two-sided shoring system. The design of the rail is such that it limits movement to the vertical axis only, and the method of installation requires that the system be progressively installed forming a continuously shored area.