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TECHNICAL REFERENCE

Deep excavation

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NOTE

1. Users of this Technical Reference should refer to the relevant professional or experts for any technical advice on the subject matter. SPRING Singapore shall not be liable for any damages whether directly or indirectly suffered by anyone as a result of reliance on this Technical Reference.

2. Compliance with this Technical Reference does not exempt users from legal obligations.

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Foreword

This Technical Reference was prepared by the Working Group on Deep Excavation appointed by the Technical Committee on Civil and Geotechnical Works under the direction of the Building and Construction Standards Committee (BCSC). The BCSC endorsed the Technical Reference on 3 February 2010.

Deep excavations are complex due to the following:

a) There is always an element of uncertainty concerning in-situ conditions because the ground is a product of nature;

b) Limitations in sampling and testing;

c) The intrinsic soil and rock behaviour is complex;

d) Limitations in modelling, e.g. on interfaces;

e) Methods of construction can be varied and difficult to anticipate;

f) Predicting building response is complex;

g) Nature and condition of existing foundations and structures;

h) Complex soil-structure interaction problems.

All deep excavations should be structurally safe and robust. The planning, design and construction processes in deep excavation projects are often not straightforward, involving many project parties and specialists. It is associated with higher risks, especially when implemented in urban built-up areas and in difficult ground conditions.

While this Technical Reference is not meant to be a design guide or manual on deep excavation, it aims to draw attention and provide references to the key aspects of design, construction and practices.

This Technical Reference is not to be regarded as a Singapore Standard; it is made available for provisional application over a period of two years but does not have the status of a Singapore Standard. The aim is to use the experience gained to modify the Technical Reference so that it can be adopted as a Singapore Standard. Users of the Technical Reference are invited to comment on its technical content, ease of use and any ambiguities or anomalies. These comments can be submitted using the feedback form provided at the end of the Technical Reference and will be taken into account in the review of the publication. At the end of two years, the Technical Reference will be reviewed by the WG to discuss the comments received and to determine its suitability as a Singapore Standard. Submission for approval by the Standards Council as a Singapore Standard will be carried out only upon agreement after review.

Acknowledgement is made to CIRIA for permission to reproduce in this TR, Figure 7.12 of CIRIA 517 – Temporary propping of deep excavations – Guidance on design (London, 1999), www.ciria.org.

At the time of publication, this Technical Reference is expected to be used by parties involved in deep excavation works, including designer, developer, owner and builder.

Attention is drawn to the possibility that some of the elements of this Technical Reference may be the subject of patent rights. SPRING Singapore shall not be held responsible for identifying any or all of such patent rights.

Technical Reference for deep excavation

Section One – General

1.1 Scope

The Technical Reference is specific to the design and construction of deep excavations.

Deep excavation refers to any excavates which has a retained height or excavation depth of 6 m or more. This includes shafts, trenches, cofferdams, marine or land retaining structures with walls, both temporary and permanent, ranging from free-standing gravity walls to multi-braced or anchored embedded walls. For a sloping ground behind the retaining wall, the height is taken to be from the excavated level to the top of slope. The excavation depth includes smaller but separate excavations or holes which extend beyond the main excavation level for construction of pile caps, pump sumps, lift pits etc.

This Technical Reference is also applicable to situations where the excavation depth or retained height is less than 6 m if any of the following conditions is met:

a) There are adjacent structures within a horizontal distance of less than the excavation depth from the excavation face that are vulnerable to or likely to be adversely affected by the excavation works;

b) Ground conditions are poor; or

c) Lowering of groundwater table will likely lead to significant consolidation settlements in surrounding ground.

1.2 Normative references

The following referenced documents are indispensable for the application of this Technical Reference. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

1.2.1 Code of practice for site investigations

BS 5930 : 1999	Code of practice for site investigations

1.2.2 Laboratory and field tests

BS 1377 : 1990	Methods of test for soils for civil engineering purposes
BS 4019 : 1993	Rotary core drilling equipment
BS ISO 14686 : 2003	Hydrometric determinations – Pumping tests for water wells – Considerations and guidelines for design, performance and use

1.2.3 Geotechnical structures or elements or processes

1.2.3.1 Codes of practice

BS 5950-1 : 2000	Structural use of steelwork in building Part 1: Code of practice for design – Rolled and welded sections
BS 8002 : 1994	Code of practice for earth retaining structures
BS 8081 : 1989	Code of practice for ground anchorages