

1 Introduction

1.1 Purpose and Scope

Deep excavations are common in the urban area of Hong Kong and often adopted for construction of multi-level basements, railway and road tunnels. Excavation in such environments invariably presents challenges to planners, engineers and contractors, as there are always nearby buildings, structures and services to be protected. The consequences of any excavation collapse could be serious and costly. For this reason, excavation in soil generally requires sufficient lateral support to minimise any adverse effect on the surrounding environment.

The GEO Publication No. 1/90 “Review of Design Methods for Excavations” (GEO, 1990), published in 1990, gave the then state-of-the-art methods for the design of excavation support systems, as well as the prediction of ground deformation around excavations. The publication has been widely used by practitioners as a reference document for excavation design in Hong Kong. Since then, there have been many advances in the knowledge, technology and modern methods for designing and executing excavation and lateral support (ELS) works. In view of these developments, a Working Group on Revision of GEO Publication No. 1/90 was set up to update the publication. The purpose of this document is to give guidance for the design and construction of ELS works in Hong Kong, taking cognizance of latest advancements in pertinent subjects. This document also consolidates local practice and experience in the construction of ELS works in Hong Kong and provides recommendations for mitigating the geotechnical risks associated with excavations. The publication is intended for use by readers who have some general knowledge of ELS works.

New permanent earth retaining walls are not covered by this document and readers should refer to Geoguide 1: Guide to Retaining Wall (GEO, 2020) published by the GEO.

1.2 Overview

The content of this document is intended to cover the execution of temporary excavation works on land using embedded wall that facilitates the construction of underground structures. In this document, the term “excavation” is applied generally to cover all ELS works, whereas the term “deep excavation” refers to excavations deeper than 4.5 m, in conformity with the current distinction for the enhanced statutory control of ELS works under the Buildings Ordinance (PNAP APP-57) (BD, 2012).

Good practice for site investigation and selection of geotechnical parameters that are crucial for the design of ELS works and associated key considerations are presented in Chapter 2.

A review of common types of excavation support systems and technical considerations for the design and construction of ELS works are discussed in Chapters 3, 4 and 5. In particular, the discussions given in Chapter 5 highlight the construction aspects that should be carefully assessed and considered in the execution of ELS works.

Chapter 6 discusses the limit state design of ELS works. It outlines relevant requirements for checking the ultimate limit state (ULS) and serviceability limit state (SLS). The application of global factor and partial factor methods in limit state design are also discussed, along with recommended factors to be used in both methods. Methods for ULS and SLS design are presented in Chapters 7 and 8, respectively.

Chapter 9 discusses mechanisms for the control of ground deformation due to ELS works, including the recommended empirical and engineering approaches and the trigger values for initiating response actions to minimise adverse impact on sensitive receivers.

Adequate instrumentation and monitoring (I&M) are essential for the safe execution of ELS works. Chapter 10 sets out the considerations necessary to formulate an appropriate I&M plan and introduces new technology that could promote further advancement in local practices.

1.3 General Guidance

In this document, reference has been made to published codes, reference papers, textbooks, and other relevant information. Readers are strongly advised to consult the original publications for full details of any particular subject and to consider the appropriateness of using such methods in the design and construction of ELS works.

The various stages of site investigation, design and construction of ELS works require coordinated input from experienced designers and contractors. Continuous involvement of the designer of the ELS works is essential for verifying both the validity of the assumed ground conditions and the expected performance of the ELS works. The installation methods used to construct the embedded wall may significantly affect the performance of the ELS works, and the subsequent works that require strict adherence to agreed procedures. It is important that competent specialist contractors are employed and their works should be adequately supervised by suitably qualified and experienced engineers who are familiar with the design.

In common with all types of geotechnical works, professional judgement and engineering common sense must be exercised when designing and executing ELS works.