

By post and by email at hwsun@cedd.gov.hk

15 September 2016

Ir Dr SUN Heph Wing
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Civil Engineering and Development Department
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Dear Ir Dr SUN

Geoguide 4 – Guide to Cavern Engineering (Second Edition)

Regarding the letter from Civil Engineering and Development Department dated 11 August 2016 on the captioned subject, the Hong Kong Institution of Engineers is pleased to provide herewith the views and suggestions for consideration.

Thank you.

Yours sincerely



Monica YUEN (Mrs)
Chief Executive and Secretary
The Hong Kong Institution of Engineers

Enc

MY/WC/PH

Enclosure

**Views from the Hong Kong Institution of Engineers on
Civil Engineering and Development Department's
Draft Geoguide 4 (Second Edition) – Guide to Cavern Engineering**

General

Underground cavern is identified as one of the means to increase usable land in Hong Kong. The last edition of Geoguide 4 was published in 1992, which has already been 14 years. This new Geoguide (i.e. Second Edition) summaries the local and overseas experiences in planning, design and construction of the last decade, and establishes a new set of guidelines and best practices that are applicable to future cavern projects. The Hong Kong Institution of Engineers (HKIE) would like to provide herewith the views from our Geotechnical Division on this draft document for consideration.

2. The revamp and publication of the new Geoguide is supported. Specific to individual sections of the Geoguide, the respective comments are listed as follows:

Section 1.1 – Introduction – Scope and Objective

As the Final Report and Executive Summary of the "Long-term Strategy for Cavern Development" (Arup, 2016) will be published in 2016, providing referencing of it is suggested if it is mentioned in this Section as well as other parts of the Geoguide document.

Section 5.5 – Planning of Ground Investigation

5.5.1 Approach

Regarding the last paragraph, a set of guidance notes on measures to minimise the environmental impacts of ground investigation for public works projects has been prepared by Civil Engineering and Development Department (CEDD). It is suggested to mention that the notes can be obtained from Geotechnical Engineering Office of CEDD.

5.5.3 Information to be Obtained – last paragraph

Regarding the last paragraph, it is suggested to check with the Hong Kong Observatory to see if there are more data on ground temperatures at depth.

Section 6.8 – Design for Cavern Structures

6.8.4 Stability Criteria

In the third paragraph, it is suggested that instead of Section 6.6.8, reference to empirical methods should be referred to Section 6.8.6.

Meanwhile, “factor of safety” of 2 for pillar stability appears to be high. Martin & Maybee (2000)’s study showed that pillars with a FOS < 1 fail while those with a FOS>1.4 are stable. FOS>2 is not their recommendation. Galvin et. al. (1999) found that for the probability of pillars failure when FOS = 1.38, it will be 2 in 100, i.e. 98% confident level. If FOS = 1.95, the probability of pillars failure will drop to 1 in 100,000. Thus FOS = 2 may be too stringent for design, and the separation between two openings would be greater than 1xSpan which may not be desirable from implementation point of view. Therefore, it is suggested to further review this section.

Section 6.9 – Design of Support Elements

6.9.2 Rock Bolts

It is suggested to replace the word “*dowel*” with “*bolt*” in the third paragraph.

Section 7.3 – Planning and Excavation

7.3.1 Equipment

It is suggested to add shovels which are commonly used in cavern excavation as configuration does not sometime permit the use of wheel loader in the third paragraph.

7.3.4 Benching

Vertical drillholes are not adequate for side benches along the walls, as good control of overbreak is required. It is therefore suggested to further elaborate in the third paragraph.

Section 7.4 – Top Heading and Bench Excavation

7.4.1 Drilling Blast Holes

Further elaboration in the third paragraph is suggested, as 10m is normal bench height in quarry, but not in cavern.

Section 7.5 – Rock Support

The section title overlaps with that in the preceding section of 7.4.6. It is suggested to re-arrange it for clarity.

Regarding the 15th paragraph, the dosage appeared to be high and may affect the workability. Review of this section is therefore suggested.

Section 7.6 – Blast Vibrations, Air Overpressure, Flyrock and Blast Design

7.6.3 Blast Ground Vibration Acceptance Criteria

It is suggested to use “*withstand*” instead of “*survive*” in the last paragraph.

Figures and Appendices

	Comments
Figure 7.2 <i>Access Tunnel for High, Long Caverns</i>	It is suggested to change the title to “Example of cavern access by dedicated transportation tunnel”.
Figure 7.3 <i>Excavation Stages for Top Headings in Caverns</i>	It is suggested to review “Span < 13m” in the top left corner as “Span up to 15m” is acceptable in good rock.
Figures 7.8 <i>Pre-treatment of Clayey Seams for Shotcreting</i> and Figure 7.9 <i>Drainage Installed prior to Shotcreting</i>	To allow flexibility, it is suggested to change “rock wool” to “compressible material”.
Figure 7.11 <i>Non-electric Shock Tubes Being Ignited for a Typical Production Blast</i>	Source of photo to the right should be cited as “Olofsson (1988)”.
Appendix A <i>Examples of Cavern Uses in Hong Kong and Overseas</i> Table A1 <i>Caverns in Hong Kong</i> (Sheet 3 of 4)	Dimensions of caverns are missing in MTR Mei Foo to Lai King Tunnels, MTR Mongkok to Jordan Tunnels, MTR Quarry Bay Congestion Relief Tunnels and MTR Pak Shing Kok Tunnels. It is suggested to make further attempt on the factual record.
Appendix A <i>Examples of Cavern Uses in Hong Kong and Overseas</i> Table A2 <i>Overseas</i>	It is suggested to replace “is set to be completed by 2014” with “was officially opened on 2 September 2014” in the 9 th line.