Geotechnical Planning Review Report (GPRR) for Small technical room in Tai O Pier within the RGC project No. C5032-22EF - Hong Kong Coastal HF-Radar Network

1. Introduction

This document contains the geotechnical planning review for placing a small technical room atop the coastal defence wall adjacent to the Old Pier in Tai O. This installation will serve as server room to control and collect data from the new Radar network that will be deployed across Hong Kong waters to enhance the region's coastal resilience to flooding.

This report has been prepared to seek approval from the Town Planning Board under section 16 of the Town Planning Ordinance (cap. 131).

This report contains the following as listed.

(a) an outline of the topography and geology of the site;
(b) a general description of the proposed works and discussion of how the existing geotechnical features (such as slopes and retaining walls) and adjacent foundations will affect or be affected by such works.

2. Outline of the topography and geology of the site

The Tai O Pier is a significant feature of the Tai O fishing village on Lantau Island. The Tai O Pier has been a crucial part of the local community for many years, serving as a hub for transportation and trade. It has facilitated the movement of people and goods, connecting Tai O to other parts of Hong Kong and the mainland. The area of coastline behind Tai O Old Pier is not open to the public, with no designated entry points or infrastructure for public use.
The site is characterized by a gently sloping beach that reaches the base of the containment wall. This 2-meter-high vertical structure is built of squared rock; its schematic representation, along with the proposed installation, is shown in *Figure 1*.

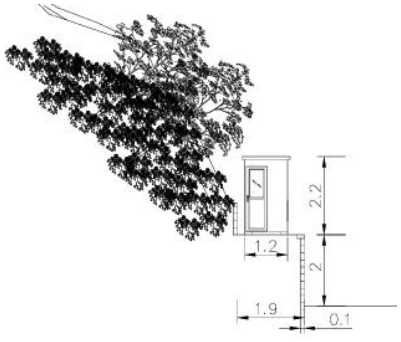

Figure 1 Schematic representation of the containment wall

The location site is shown in *Figure 2*.

Figure 2 Site layout

The ground investigation information belongs to previous works (LGL, 2001) and the results are summarized in *Table 1*.

Table 1 Nearby borehole information

Borehole ID	Depth range	Soil type
DH/14/1	16.85 to 15.85 meters	Fill
	15.85 to 12.95 meters	Colluvium
	12.95 to 12.75 meters	Colluvium
	12.75 to 10.55 meters	CDT
	10.55 to 5.95 meters	CDT/HDT
	5.95 to 5.83 meters	HDT/MDT
	5.83 to 4.25 meters	CDT/HDT
	4.25 to 4.10 meters	MDT
	4.10 to -3.15 meters	CDT/HDT
	-3.15 to -3.58 meters	MDT
TP/14/1	10.14 to 9.44 meters	Colluvium
	9.44 to 6.54 meters	CDT

The soil parameters employed for analysis and design are based on Halcrow, 2004. The unit weight γ, the effective cohesion c' and the effective angle of friction φ' for each type of soil in the area are listed in *Table 2*.

Table 2 Soil strength parameters

Soil Type	γ (kN/m^3)	c' (kPa)	φ' (degrees)
Fill	17	0	28

Colluvium	18	6	28
CDT	19	6	35

The design groundwater table is assumed at the toe of the slope according to previous monitoring records (the highest monitored groundwater level: +2.23 mPD).

The slope ground profile was established using the 2020 LiDAR data and field observations (https://sdportal.cedd.gov.hk/#/en/lidar).

3. Proposed works

Within the framework of the RGC Project, the primary objective is to deploy a network of low-impact pole-mounted antennas at strategic locations throughout Hong Kong

The data gathered by this network is critical for ongoing hydrological studies and, crucially, for enhancing emergency response protocols during flood events. The system is intended to provide vital real-time information that can support early warning systems, thereby improving public safety and resilience.

The small technical cabin, which is the subject of this geotechnical assessment, is an essential component of this network. Its fundamental purpose is to house on-site server equipment dedicated to the continuous collection, processing, and storage of the radar data transmitted by the antennas.

Based on a comprehensive site evaluation, the optimal location for this cabin has been identified atop the existing beach containment wall, without any foundation works given the temporary nature of the project. Consequently, a detailed assessment of the wall's structural integrity and overall stability is a prerequisite for the safe and feasible installation of this critical infrastructure.

The components are as follows:

- Portable cabin
- Server rack
- AC unit

The embedment depth of the masonry wall is assumed as 0.5 m and its thickness is about 0.1 m. The surcharge load is around 4 kPa with a footprint of the portable cabin of 1.2 m by 1.2 m.

The slope stability is evaluated based on the Category 1 (High) ‘Consequence-to-Life’ requirement.

The geological model was constructed based on the nearby boreholes and information from Section A-A of the feature No. 9SW-C/C 15 (Halcrow, 2004).

In *Table 3* a summary of the stability analysis is provided.

Table 3 Summary of stability analysis with and without surcharge load

Case	Critical FOS (Morgenstern-Price Method)		Acceptable
	Calculated	Required	
Without surcharge load	1.51	1.40	Yes
With surcharge load	1.46	1.40	Yes

Figure 3 and *Figure 4* present the results of the stability analysis for both the unloaded condition and the condition with the cabin surcharge load applied.

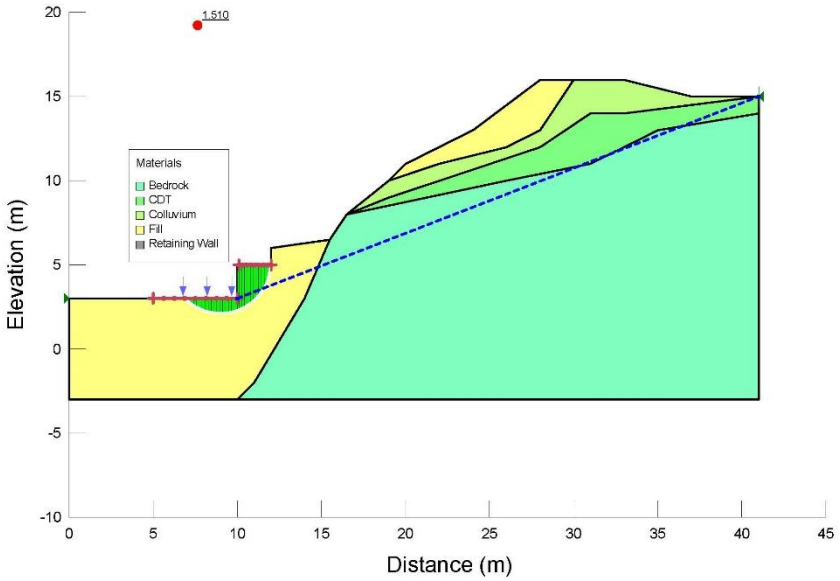

Figure 3 Slope stability analysis without surcharge load

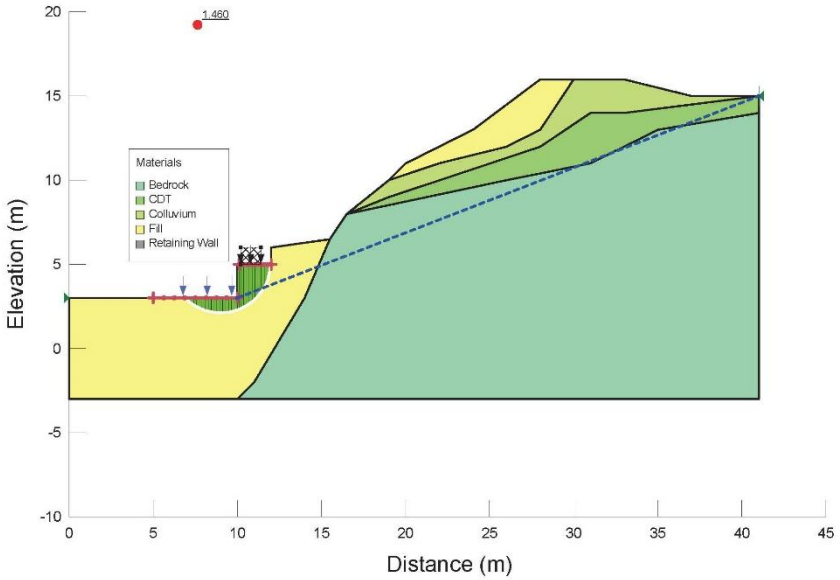

Figure 4 Slope stability analysis with surcharge load

4. Impact on adjacent premises/ geotechnical features

As the existing registered retaining walls and slope might be affected by the positioning of the

portable cabin, consideration shall be taken in the design of the proposed works.

Given the temporary nature of the proposed installation and the intrinsic characteristics of the structure, a lightweight, prefabricated outdoor cabin requiring no foundational excavation, its impact on adjacent structures is considered negligible. This assessment is based on the structure minimal weight and surface-mounted placement. The cabin will be positioned atop the existing wall as a fixed surface load.

Consequently, groundwater control measures are deemed unnecessary for this project, as no excavation or ground penetration works will be conducted.

5. Conclusion

Based on the available geotechnical information, the following conclusions and recommendations are drawn:

(a) The proposed installation as presented is considered as a geotechnical feasible scheme.
(b) No groundwater control scheme shall be considered in design.
(c) Stability of all slopes (man-made and natural terrains) and retaining walls within or in vicinity to the lot resulted not to be affected by the presence of the portable cabin.

Based on the current assessment, the proposed development is considered geotechnically feasible.

References

De la Varga, M., Schaaf, A., & Wellmann, F. (2019). GemPy 1.0: open-source stochastic geological modelling and inversion. *Geoscientific Model Development*, 12(1), 1-32.

LGL (2001). Ground investigation fieldwork report. *Works Order No. GE 2001/08/GI/14 Feature No. 9SW-C/C15. Contract No. GE/2001/08*.

Halcrow China Ltd (2004). Feature No. 9SW-C/C 15 Tai O police station, Tai O, Lantau. *CED Contract No. GE/2002/17*.