

Complex Geological Conditions in Northshore Lantau

Key Messages: (i) A Designated Area has been established in Northshore Lantau, within which complex geological conditions have been identified.

(ii) The Geotechnical Engineering Office will undertake checking of foundation design for both government and private projects within the Designated Area.

Introduction

This note describes the locally complex geological conditions at the reclamation for Tung Chung New Town and along the North Lantau coast (Northshore Lantau).

The identification of complex geological conditions in the above areas has led to the establishment of the Designated Area of Northshore Lantau (Figure 1). The Geotechnical Engineering Office (GEO) will undertake checking of foundation designs within the designated area.

Geological conditions

The GEO completed in 2002 a series of studies on the geological conditions in the area. The studies identified the geological setting and the nature of the complex geological conditions. The area within which planned developments may be affected by the complex geological conditions is established as the Designated Area of Northshore Lantau (Figure 1).

The area is underlain mainly by medium-grained granite, intruded by numerous rhyolite dykes. These igneous rocks enclose blocks of marble, metasandstone and metasiltstone, ranging from one to more than 300 m across. Blocks of massive marble overlain by superficial deposits are also present in parts of the offshore area. The complex geological conditions comprise one or more of the following interrelated geological phenomena.

- (i) Metasedimentary rocks (including marble, metasandstone and metasiltstone) that are subject to dissolution and give rise to cavities, cavity-fill deposits and residual soils.
- (ii) Superficial deposits (weakly lithified siltstone, or soft or loose alluvial sediment) occupy depressions on top of the weathered rocks. Some of the depressions were found to be very deep, and most of which lie directly above or adjacent to metasedimentary rocks.
- (iii) Anomalously deep or steeply inclined rockhead.
- (iv) Massive marble, usually with an upper karstic surface displaying solution features, is overlain by superficial deposits in parts of the offshore area.

These geological conditions could have significant effects on foundation design and

construction. They have led in extreme cases in the past to the abandonment of two planned residential blocks at the Tung Chung New Town reclamation due to complex geological conditions.

Foundation design

The GEO will undertake geotechnical checking of foundation designs and relevant ground investigation proposals within the Designated Area.

Technical guidelines and requirements relating to foundation works in the Designated Area are given in GEO Technical Guidance Note No. 12 (TGN 12), GEO Technical Guidance Note No. 26 (TGN 26), and Environment, Transport and Works Bureau Technical Circular (Works) No. 4/2004.

For developments in the Designated Area where deep foundations are planned, developers, planners and engineers should be aware of the likely presence of marble with cavities and other associated complex geological conditions. They should also be aware of the potential impacts on their developments, in particular on cost, construction programme and the geotechnical input required. Adequate resources, time and technical input should be provided to ensure that deep foundations in the Designated Area are properly designed and constructed.

The following technical documents are available for use by the profession in relation to this subject:

- Hong Kong Geological Survey Sheet Report No. 6 (Sewell & Kirk, 2002), which describes the geology of Tung Chung and Northshore Lantau and includes a “logging guide” to assist in the description of complex core materials.
- The Geology of Tung Chung New Town (Gillespie et al, 1998) which describes in detail the complex geological conditions at Tung Chung.
- Environment, Transport and Works Bureau Technical Circular (Works) No. 4/2004 (ETWB TCW No. 4/2004) which outlines the policy on geotechnical control for foundation works in the Northwest New Territories, Ma On Shan and Northshore Lantau, in respect of government projects undertaken by Works Departments or their consultants.
- GEO Technical Guidance Note No. 12 (TGN 12) which outlines the establishment of the Designated Area of Northshore Lantau.
- GEO Technical Guidance Note No. 26 (TGN 26) which provides supplementary technical guidelines for foundation design in areas underlain by marble and marble-bearing rocks.
- Relevant ground investigation reports (e.g. Lam Geotechnics Limited, 1999) held in the Geotechnical Information Unit (GIU) of the Civil Engineering Library.

Interested parties can arrange to discuss the ground conditions, view reports and obtain data by

contacting the Chief Geotechnical Engineer/Planning of the GEO.

References

- Environment, Transport and Works Bureau Technical Circular (Works) No. 4/2004 (ETWB TCW 4/2004). Checking of Foundation Works in the Scheduled Areas of Northwest New Territories and Ma On Shan and the Designated Area of Northshore Lantau. Environment, Transport & Works Bureau, 15 p.
<<http://www.devb.gov.hk/filemanager/technicalcirculars/en/upload/81/1/c-2004-04-0-1.pdf>>
- GEO (2004). The Designated Area of Northshore Lantau (GEO Technical Guidance Note No. 12 (TGN 12)). Geotechnical Engineering Office, Civil Engineering and Development Department, 4 p.
<https://www.cedd.gov.hk/filemanager/eng/content_427/TGN12.pdf>
- GEO (2005). Supplementary Guidelines for Foundation Design in Areas Underlain by Marble and Marble-bearing Rocks (GEO Technical Guidance Note No. 26 (TGN 26)). Geotechnical Engineering Office, Civil Engineering and Development Department, 4 p.
<https://www.cedd.gov.hk/filemanager/eng/content_427/TGN26.pdf>
- Gillespie, M.R., Humpage, A.J. & Ellison, R.A. (1998). The Geology of Tung Chung New Town (GIU Ref. 30195), 41 p.
- Lam Geotechnics Limited (1999). Northshore Lantau Development Feasibility Study Marine Ground Investigation (GIU Ref. 30023).
- Sewell, R.J. & Kirk, P.A. (2002). Geology of Tung Chung and Northshore Lantau Island. Hong Kong Geological Survey Sheet Report No. 6, Geotechnical Engineering Office, Civil Engineering Department, 91 p.
<https://www.cedd.gov.hk/eng/publications/geo/hong-kong-geological-survey/sheet_g6/index.html>

Geotechnical Engineering Office
Civil Engineering and Development Department
November 2022

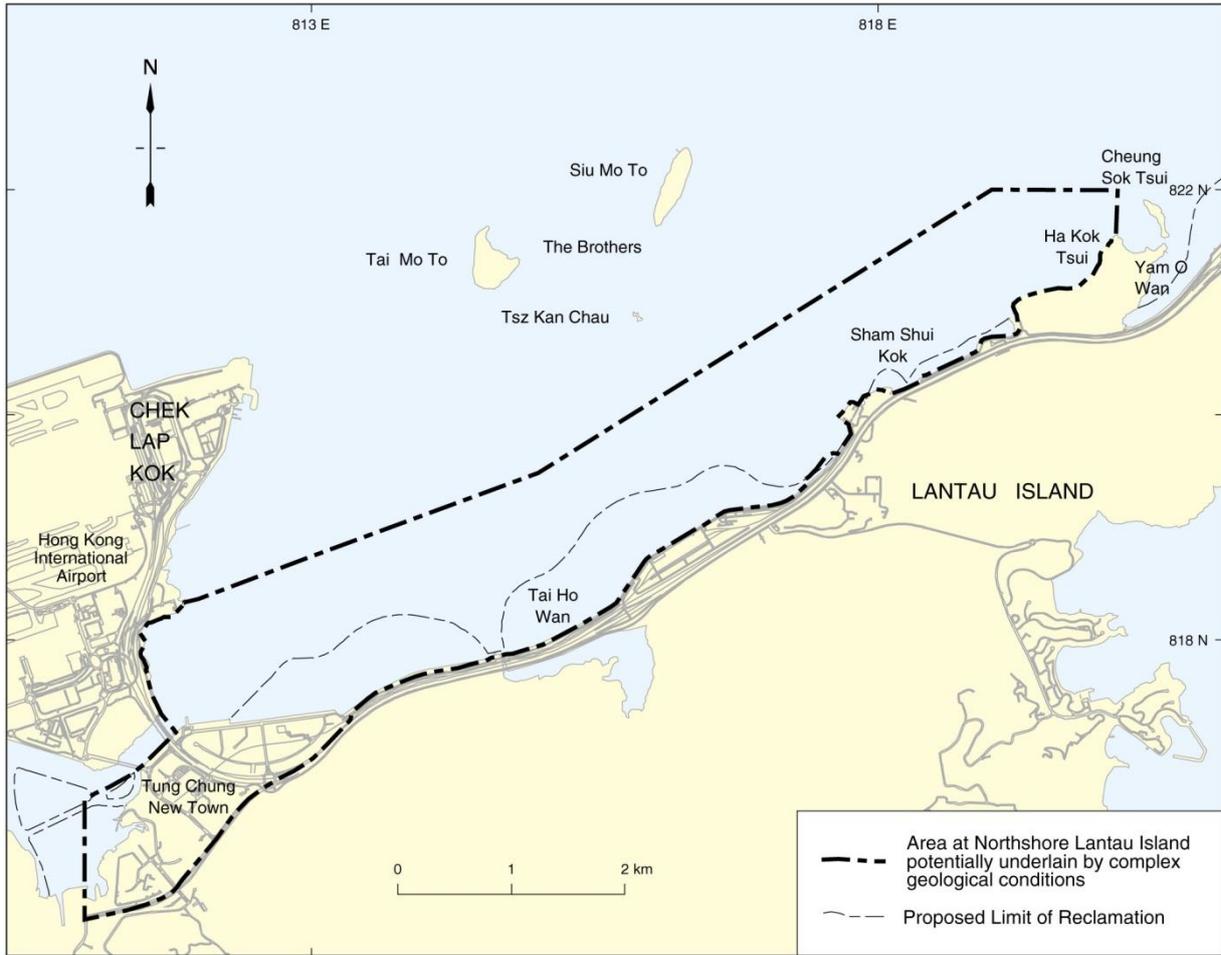


Figure 1 - The Designated Area of Northshore Lantau