Perceived Benefits and Constraints

The benefits of going underground are partly dependent on the type of facility to be housed. Bad neighbour facilities may attract less complaints as the facilities can be shielded from the community. Other benefits include more stable year round temperatures, security and release of land to align with the sustainable development goals of Hong Kong. Specific operation issues will need to be addressed for individual facilities such as ventilation, lighting, fire safety and evacuation in a similar manner to those for MTR facilities.

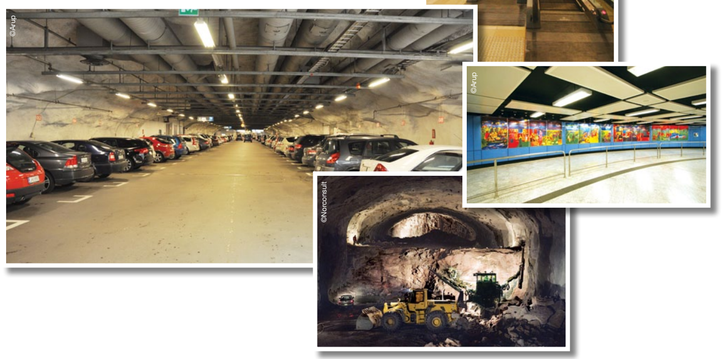
Environmental and land ownership issues need to be fully addressed and will depend on the land use to be placed in caverns. Engineering solutions and a legal framework can be considered to address the specific issues associated with cavern development.

The development of a rock cavern is a Designated Project under the Environmental Impact Assessment Ordinance (EIAO) and hence a statutory EIA is required for construction and operation of the cavern. Potential land uses such as sewage treatment works, refuse transfer station, power station, incinerator, etc. would also be Designated Projects under the EIAO.

How to Maximise the Opportunities?

To facilitate enhanced use of underground space in Hong Kong, key recommendations of the study include:

1. Policy steer be provided for government departments to consider the cavern option in project planning.
2. A strategy be developed to systematically relocate existing government facilities underground.
3. Signature cavern schemes be implemented that would promote the use of underground space.
4. A mechanism be established to ensure that the strategic cavern areas are not compromised by future development projects.
5. A policy framework be formulated to encourage private sector involvement.



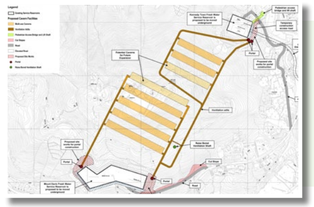
How to Realise the Benefits?

The preliminary feasibility of transferring existing government facilities to rock caverns has been explored so as to release land for the overall benefit of the community. A range of facility types were selected to showcase the broad approach by reviewing the technical challenges, constraints and possible solutions.

Sha Tin

The first scheme was chosen to showcase how a large sewage treatment works could be relocated to rock caverns. This scheme would:

- release about 28 ha of waterfront land
- reduce environmental and visual impacts
- enhance land value in the vicinity of the existing facility



Mount Davis and Kennedy Town

The second scheme considered relocating fresh water service reservoirs to rock caverns. This scheme would:

- release about 2 ha of prime land
- allow future expansion without extensive cutting of hillside

Mui Wo

The third scheme considered an integrated cavern scheme for a number of existing "bad neighbour" facilities including a sewage treatment works and refuse transfer station. This scheme would:

- release about 2.5 ha of waterfront land
- reduce environmental and visual impact
- revitalise 500 m of waterfront

Note: The above schemes are conceptual layouts to show the broad viability of what could be considered. Detailed consultation with various stakeholders and facility owners would be made if the schemes are to be considered further. Please refer all comments or questions relating to this Study to Chief Geotechnical Engineer/Planning, GEO/CEDD.

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1. Itäkeskus Swimming Complex, Helsinki, Finland
2. Oslo National Archives, Norway
3. Island West Transfer Station Tipping Hall, Hong Kong
4. 3D Model of Island West Transfer Station, Hong Kong
5. Stockholm Metro, Sweden
6. Hartwall Arena Practice Arena, Helsinki, Finland
7. Oslo National Archives, Norway
8. Gjovik Olympic Hall, Norway
9. KCRC East Rail Extensions,
Lok Ma Chau Spur Line, Hong Kong

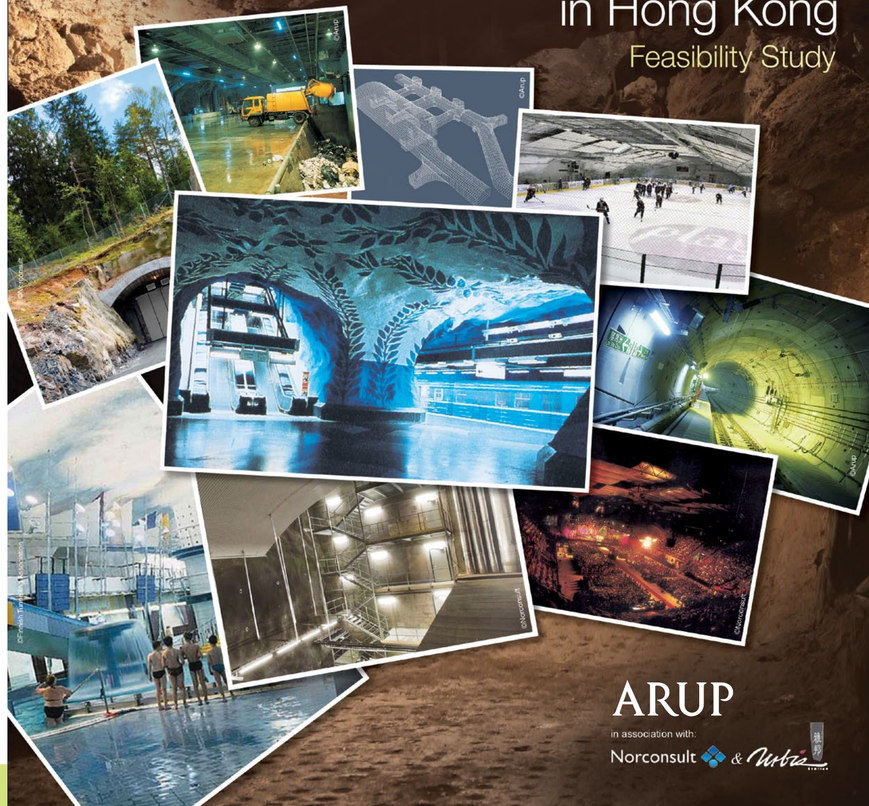
土木工程拓展署
土力工程處
Geotechnical Engineering Office
Civil Engineering and
Development Department

CE 66/2009 (GE)

Overview

Enhanced Use of Underground Space in Hong Kong

Feasibility Study



ARUP
in association with:
Norconsult & Mott

Why should we go Underground?

Whilst Hong Kong's steep hilly terrain limits the growth of the urban fringe, it also provides an opportunity for placing urban facilities underground. The strong granitic and volcanic rocks underlying 80% of Hong Kong are particularly suitable for cavern development.

Underground space is used extensively in Hong Kong for MTR stations, rail tunnels as well as utility and highway tunnels and property basements. A few facilities have been housed in rock caverns including a refuse transfer station, a sewage treatment plant, salt water service reservoirs and explosives magazines. Many of these facilities can be considered "bad neighbour" facilities. Placing them underground can result in significant benefits to the community and the environment.

Given the demand for surface land, the Hong Kong SAR Government has considered that developing greater use of underground space can increase land supply especially where suitable existing government facilities are transferred underground to release the land for other beneficial uses.

Overview of the Study

Arup, supported by Norconsult and Urbis, was commissioned by the Geotechnical Engineering Office of the Civil Engineering and Development Department to undertake a strategic planning and technical study on the 'Enhanced Use of Underground Space in Hong Kong'.

The study reviewed local and overseas experience to identify various facility types that could be transferred underground. Suitable areas for cavern development in Hong Kong were identified and recommendations were provided on the future development approach to promote the enhanced use of underground space in Hong Kong.

Where are the Opportunities?

Land uses

The study has identified land uses with potential for rock cavern development, in addition to those already listed in the Hong Kong Planning Standards and Guidelines (HKPSG).
It is proposed to expand the current set of potential land uses taking account of overseas examples and consideration of local circumstances.

Existing government facilities

The study reviewed over 400 government facilities and developed a set of preliminary criteria and a ranking scheme to explore the relative merits of those government facilities with potential to be placed in rock caverns.

Cavern suitability map

Sets of spatial data including ground conditions, existing tunnels and other constraints were combined to produce a preliminary map that classified the suitability of developing rock caverns throughout the territory. The map shows that areas of high to medium suitability for cavern development account for 64% of Hong Kong's land area. Facilities located close to these areas and in the urban fringe are particularly suited for relocation to rock caverns.

The study has also identified five strategic cavern areas that could accommodate multiple government facilities, with good accessibility and sufficient area to allow integrated strategic cavern development.

Potential Land Uses for Rock Cavern Development

Land Use Category	Potential Land Uses in the Current HKPSG	Potential Land Uses Proposed to be Added to HKPSG
Commercial	Retail	Food / Wine storage Warehousing
Industrial	Industry LPG bulk storage Oil bulk storage Storage / Warehousing	Dangerous goods Data centre Research laboratories Science park
Government, Institution & Community (GIC)	Civic centre Columbarium / Mausoleum / Mortuary Incinerator Indoor games / Sports hall Refuse transfer facility Sewage / Water treatment plant Service reservoir Slaughterhouse Transport connections & networks Wholesale market	Archives Bicycle park-and-ride Car / Vehicle parking Crematorium Refuse collection point Maintenance depot for rail and others Underground quarrying
Public Utilities	Power station	Substation