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Strategic use of rock caverns and underground space for sustainable urban development of Hong Kong

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Abstract

Hong Kong's steep hilly terrain poses significant constraints on its urban development. The shortage of developable land forms a key driver to explore other sustainable and innovative approaches to expand land resources. Rock caverns and underground space are viable sources of land supply, which can provide solution space for a broad variety of land uses and help address problems encountered in the congested urban environment. The enhanced use of these 'hidden' land resources can offer new opportunities for Hong Kong's planning and development gains. Since 2010, the Government of the Hong Kong Special Administrative Region has launched a number of strategic studies and pilot projects to unleash the potential of systematic utilization of rock caverns and underground space. The overall strategy is to formulate a holistic and long-term plan for wider application of rock caverns at the urban fringes and underground space in the urban areas. This paper aims to present the findings of the on-going studies to date, with particular focus on the initiatives being developed to take forward the long-term strategy for cavern development in Hong Kong. Notable overseas examples are cited to illustrate the benefits yielded by this innovative approach. Challenges and solutions with respect to the implementation will also be discussed.

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1. Introduction

Hong Kong is a world-class city, renowned for its modernized developments in the urban areas, in particular along its harbor front (Figure 1). Despite its signature cityscape, only about one fourth of the land in Hong Kong has been developed. Its topographical setting with steep natural hillsides significantly limits the extent for urban expansion. For sustainable city development, further substantial land formation on the hillsides is not preferred though it is technically feasible. In view of limited developable land, there is a pressing need to explore new sources of land supply to support social and economic development of Hong Kong. Strategic use of underground space is considered a viable solution that can create space for a broad variety of land uses and help address problems encountered in the congested urban environment. The scope is not only confined to better utilizing underground space in the urban areas, but also enhancing the planned use of rock caverns at the urban fringes (Figure 2). It is a paradigm shift by seeking land mass from a three-dimensional instead of two-dimensional perspective, with a view to optimizing the use of these ‘hidden’ land resources so as to bring new opportunities for Hong Kong’s planning and development gains.



Figure 1. Aerial view of Hong Kong Island

Hong Kong has been using underground space for commercial, community, transport and utility facilities for many years. Most of them are planned on individual project basis, including: (i) basements, which have been incorporated into individual developments to accommodate plant rooms and car parks as well as provide space for retail and commercial activities; (ii) pedestrian links, e.g. subways and pedestrian connections of Mass Transit Railway stations; (iii) transportation, e.g. road and railway tunnels; (iv) utilities, e.g. underground networks of water, sewerage, drainage and cable tunnels; and (v) other innovative uses, e.g. flood storage tanks, landslide mitigation measures, etc. There are also a few government facilities purposely built in rock caverns, viz. a refuse transfer station, a sewage treatment plant, two salt water service reservoirs and an explosives depot, which are primarily NIMBY facilities. Wallace and Ng (2016) gave a comprehensive review of the development and application of underground space in Hong Kong.

Underground space development is not a new concept in Hong Kong. Notwithstanding this, its applicability is generally restricted to a narrow range of land uses and the usage has been either out of necessity, or reactive and only considered where over-riding circumstances exist. A more proactive and holistic approach is thus called for to enable it to become a sustainable means of increasing long-term land supply. Since 2010, the Civil Engineering and Development Department (CEDD) of the Government of the Hong Kong Special Administrative Region (HKSAR) has launched a number of strategic studies and pilot projects with a view to unleashing the potential of systematic utilization of rock caverns and underground space in Hong Kong. The overall strategy is to formulate a visionary plan for wider application of rock caverns at the urban fringes and underground space in the urban areas. This paper aims to present the findings of the on-going studies to date, with particular focus on the initiatives developed to take forward the long-term strategy for cavern development in Hong Kong. Notable overseas examples are cited to illustrate the benefits yielded by different applications. Challenges and solutions with respect to the implementation will also be discussed.

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