A study of plot ratio/building height restrictions in high density cities using 3D spatial analysis technology: A case in Hong Kong

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A B S T R A C T

Hong Kong is an international metropolis with a highly dense population. As a result, it faces enormous challenges in terms of land supply. As part of the Hong Kong Government’s initiative to increase land supply, the Civil Engineering and Development Department (CEDD) proposed minor relaxation of the maximum plot ratio/building height restrictions for 21 target sites in Kai Tak Development Area (KTDA). Although CEDD has explored the feasibility of increasing development intensity by assessing environmental impacts, infrastructure capacity and public consultation, these reviews and assessments were conducted based on the 2D GIS. Since the spatial distribution of land unit in the real world is three-dimensional, 3D GIS can help us look into the world in true perspective and make informed decisions. This study aims to investigate the viability of minor relaxation of maximum plot ratio/building height restrictions of 21 sites in KTDA through 3D modeling and 3D spatial analyses, including skyline, visual impact, shadow and solar exposure. Regarding to the 21 target sites, four scenarios with different plot ratios and building heights were built and compared. The results indicate that minor relaxation of maximum plot ratio and building height leads to (i) minor effect on skyline (ii) minor effect on visual impact and (iii) slight changes in shadow and solar exposure both in winter and summer. Therefore, in light of the findings from this study, scenario 4 is the recommended reasonable scale to relax the maximum plot ratio/building height restriction for the target sites in KTDA. Besides, this study can also be applied in the urban renewal studies and other new development areas in Hong Kong, or even in other densely populated cities.

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1. Introduction

As an international metropolis with a highly dense population, Hong Kong faces enormous challenges in terms of land supply. According to the Information Services Department of Hong Kong Special Administrative Region 2011, over seven million people lived in this tiny place of only 1104 km². Even worse, more than 75% of this land is covered with mountains or country parks, which are mostly unsuitable for commercial and residential development, which means some areas may have population densities of more than 400,000 people per km². Since land is a scarce and valuable resource in Hong Kong, the most imperative and difficult challenge is related to the land use. In addition, to meet the needs of both current and future developments, environmental and ecological factors should also be considered in the pursuit of sustainable land use (Shen et al., 2009).

With limited land and a huge population, Hong Kong has been struggling to develop every single piece of its land in the urban areas to maximum potential. In order to increase housing supply, the Hong Kong SAR Government has proposed to increase development density in the old Kai Tak Airport site. In Hong Kong, development intensity is mainly controlled by means of lease conditions, statutory outline zoning plans, and the Building (Planning) Regulations, which work inextricably to impose restrictions on site coverage, plot ratio, and building height of individual land lots. The Town Planning Board (TPB) is a statutory organization responsible for the approval of outline zoning plans and any subsequent amendments. In recent years there have been rising concerns over the possible undesirable effects of high-density

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development and objections for further relaxation of density control in the urban areas. The TPB therefore needs to consider applications to increase development intensity but at the same time ensure that density increase will not cause unacceptable environmental impacts on surrounding areas and that the proposed change will be in line with the Hong Kong Planning Standards Guidelines. To facilitate a more interactive debate on urban density and informed planning decisions toward better provision of urban space, the establishment of an objective and scientific instrument is necessary to help critically assess the actual environmental impact caused by changes in development density.

To achieve sustainable development and more efficient use of limited land resources in Hong Kong, the Government has adopted a multi-pronged approach to increase land supply in the short, medium and long term. In this regard, increasing development/redevelopment intensity of built-up areas by minor relaxation of
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