

Planning Department

**Term Consultancy for
Provision of Advisory
Services on Air
Ventilation Assessment
Submissions**

Expert Evaluation on Ma
Tau Kok Area

ISSUE 2

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Tau Kok Area

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1 Introduction

Ove Arup and Partners Hong Kong Limited (Arup) was commissioned by Planning Department to provide an expert evaluation on the proposed building heights of the development sites within the Ma Tau Kok from air ventilation perspective. This consultancy study is based on the methodology of Air Ventilation Assessment as set out in Technical Circular No. 1/06 issued jointly by Housing, Planning and Lands Bureau and Environment, Transport and Works Bureau and its Annex A – Technical Guide for Air Ventilation Assessment for Development in Hong Kong.

2 Objective of the Study

The objective of this assignment is to assess the likely impact of the proposed building height of the development sites within the study area on the pedestrian wind environment as compared to the existing condition.

3 Study Scope

The scope of work includes the tasks as follows.

- To identify any potential problem areas due to the proposed building heights;
- To provide recommendation on how the problems may be alleviated;
- To identify any key ventilation corridors should be preserved or reserved;
- To advise whether any more detailed study is required for focused areas and the scope of the detailed study required.

4 Study Area

4.1 Site boundary

The study area is the Ma Tau Kok Area in the eastern part of Central Kowloon (The Area). The Area covers about 152 hectares. It is bounded by Tung Tau Tsuen Road / Tung Tsing Road to the north; To Kwa Wan waterfront to the east; Ngan Hon Street / San Lau Street to the south; and Tin Kwong Road to the west. The study area boundary is shown in Figure 1.

The average street level of the Area is +4.2mPD. The northern side of the Area is Mei Tung Estate and Chinese Christian Cemetery, which are located at relatively high level area of approximately +30mPD; the eastern side is Kai Tak Development and To Kwa Wan Waterfront; the southern side is Hung Hom business area; the western side is another high level area - Ho Man Tin.



Figure 1 The study area (Source from GoogleEarth)

4.2 Site characteristic

The building height of most of the buildings in the Area are under +60mPD, except some tall residential buildings. Several open spaces are widely distributed over the Area. These include Kowloon Walled City Park, Carpenter Road Park, Olympic Garden, Sung Wong Toi Garden, Tin Kwong Road Recreation Ground, To Kwa Wan Recreation Ground, Ko Shan Road Park and Hoi Sham Park. Figure 2 and 3 show the open spaces and the major streets in the Area.

The Area has been substantially developed for private residential and public housing. Some industrial uses are concentrated in the east of the Area along Yuk Yat Street, To Kwa Wan Road and Sheung Heung Road (shown as Figure 1). To the immediate east of Kowloon City is the proposed Kai Tak Development, comprising residential, commercial, sport stadium and open space uses.



Kowloon Walled City Park



Carpenter Road Park



Olympic Garden



Sung Wong Toi Garden



Tin Kwong Road Recreation Ground



To Kwa Wan Recreation Ground

Figure 2 Open spaces in the Area



Ko Shan Road Park



Hoi Sham Park



Argyle Street



Yuk Yat Street



To Kwa Wan Road



Sheung Heung Road

Figure 3 Open spaces and major streets in the Area

5 Wind Availability

The wind availability of the site is an essential item to investigate the wind performance of the development. It can be achieved from Hong Kong Observation weather data or from mathematical model (i.e. MM5 simulation). Since there is no weather station of Hong Kong Observatory located nearby the study area, the wind rose of this site for Expert Evaluation is achieved by MM5 simulation.

5.1 Wind data from MM5 simulation result

To facilitate AVA expert evaluation study, the wind data of MM5 simulation for Year 2004 at various heights at Ma Tau Kok Area from HKUST¹, provided by Planning Department is utilised in this study.

As shown in Figure 4, it can be concluded that there is no major discrepancy in wind direction behaviour between 230 m and 450 m data. Further, Eastern (E) and North-Eastern (NE) winds dominate the annual wind frequency, while in summer period, the winds are mainly coming from South-western (SW) and South-eastern (SE) directions.

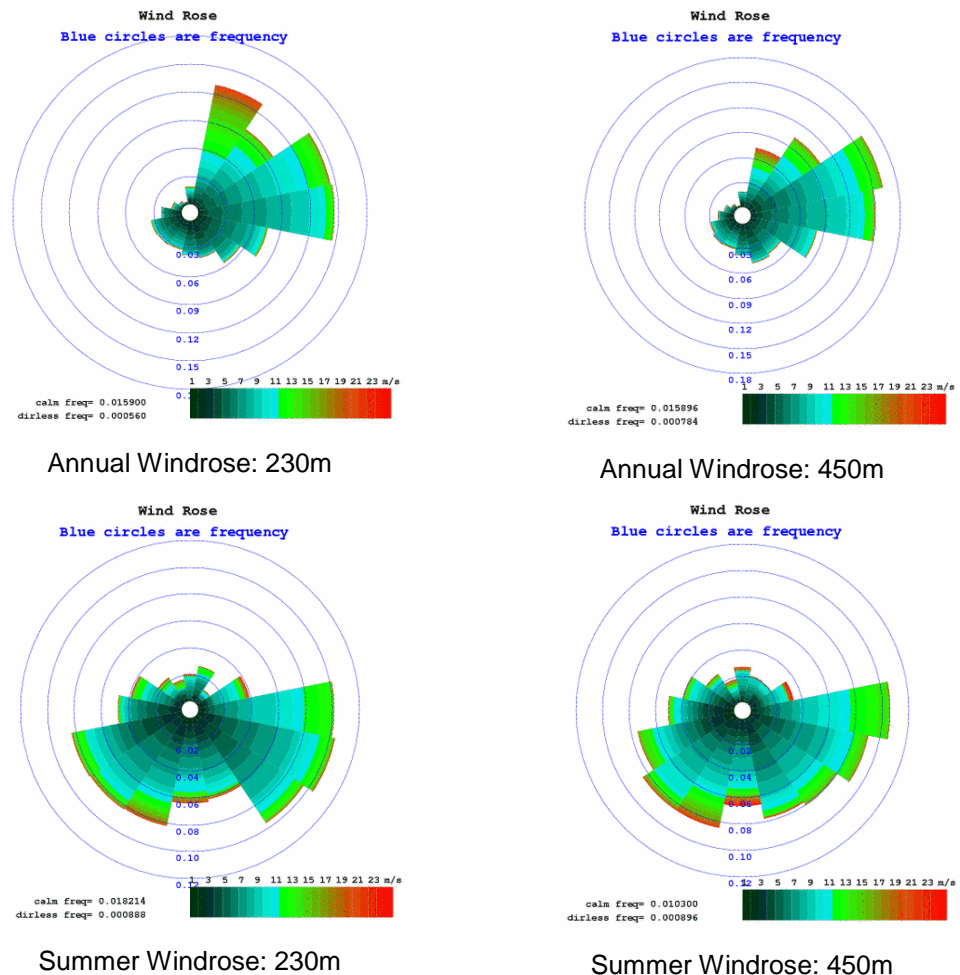


Figure 4 Annual and seasonal windrose from MM5 Data

¹ Acknowledgment: The MM5 wind data applied here was adopted from the Institute for the Environment (IENV), the Hong Kong University of Science and Technology (HKUST)

6 Expert Evaluation

Taking into account the proposed Kai Tak Development, the ventilation performance between the existing condition and the proposed scheme is conducted in this expert evaluation. The conditions under non-summer time and summer time are both considered. Figure 5 shows the study area and the proposed Kai Tak Development - OZP scheme.

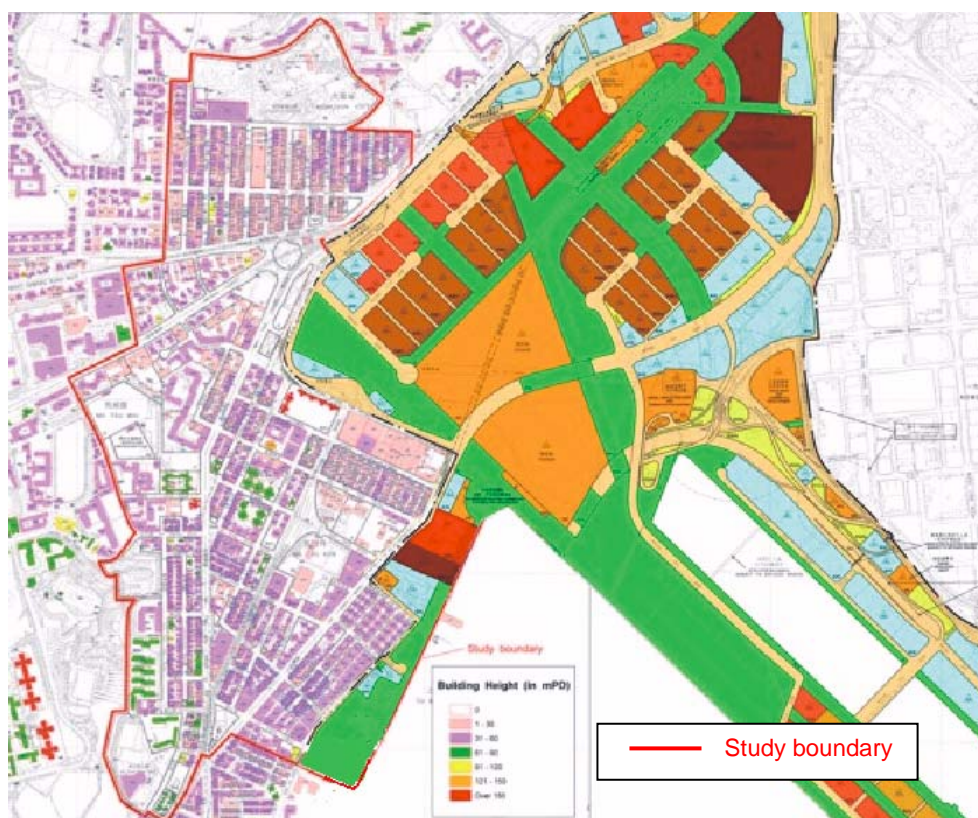


Figure 5 The proposed Kai Tak Development – OZP scheme

The Kai Tak Development has incorporated a number of design measures to improve the air ventilation performance. In particular, the following two are relevant to the subject area:

- Create several wind corridors from waterfront to inner area of Kowloon City through disposition of open spaces, alignment and widening of major streets in parallel with the prevailing wind direction (details will be described in section 6.1.1 and 6.1.2)
- Propose lots of open spaces, so as to reduce the possibility of wind blockage to Ma Tau Kok and To Kwa Wan.

6.1 Existing condition

The existing building heights of the site are shown in the Figure 6.

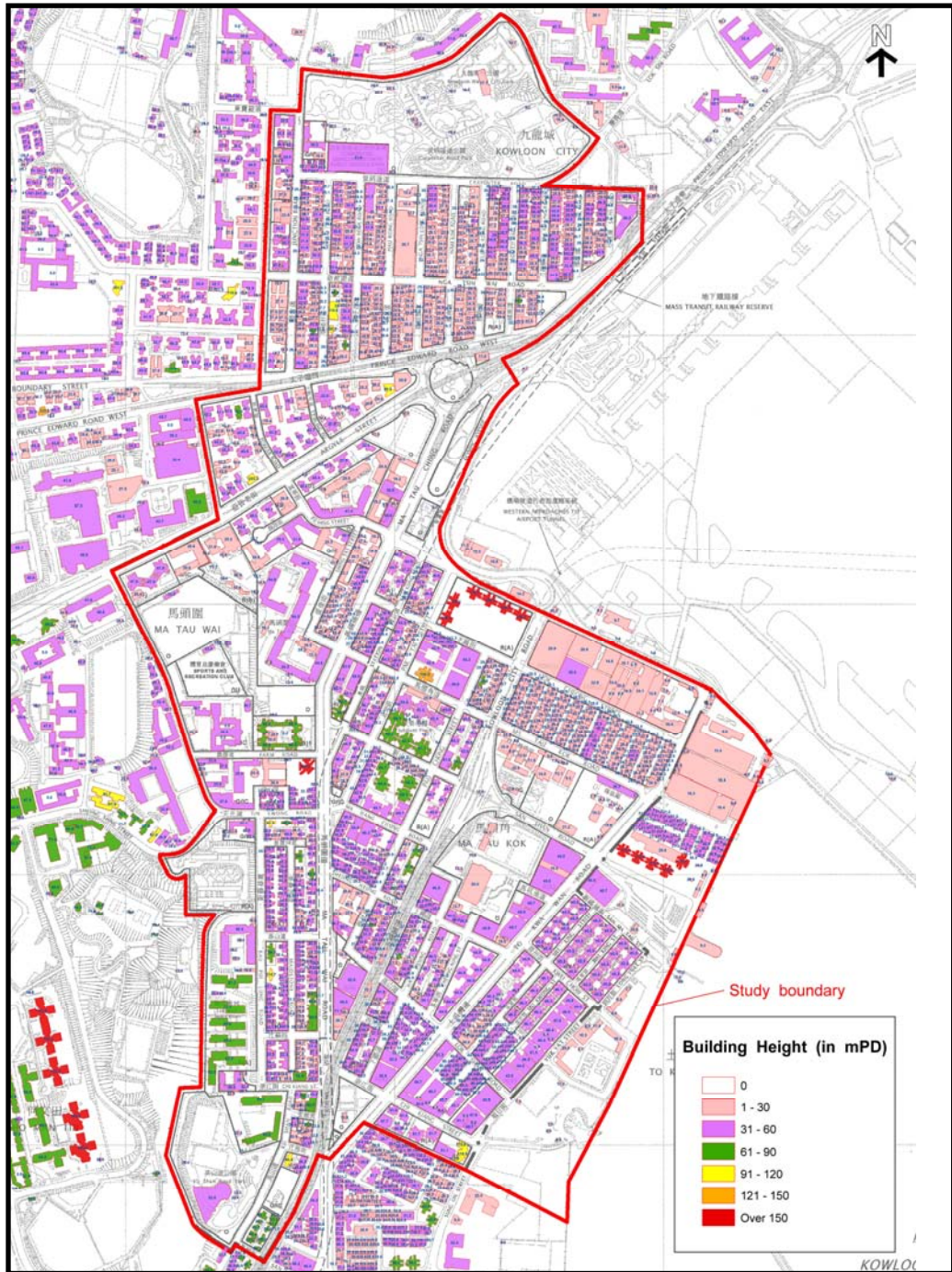


Figure 6 Existing building height of the site

The wind environment characteristics of the existing area are summarised as follows.

- Building heights of most of the existing buildings are under +60mPD, except few residential buildings near Kai Tak Area. The congested layout (large site coverage) and the similar building height at the south and north part of the Area may result in skimming flow regime, where the wind flow over the building’s canopy and hence less wind would be able to flow down to the street level.

- The street patterns at the south part of the Area are irregular, the connection between the streets is unsatisfactory, such as San Ma Tau Street and San Shan Street, Kwei Chow Street and Sheung Heung Road. This may reduce the smooth airpath along the streets.
- Several main roads (such as Prince Edward Road West, Argyle Street, Ma Tau Chung Road, Kowloon City Road and To Kwa Wan Road) within the study site may be the major wind corridors of the site.
- Most of the industrial buildings are built with high site coverage. Coupled with insufficient space between buildings, air ventilation is discouraged.
- Several open spaces are distributed over the Area. This may increase the wind penetration in the Area, so as to enhance air circulation.
- The eastern side of the Area is To Kwa Wan Waterfront and Kai Tak Development. The wind coming from waterfront with relatively high wind velocity is one of the main wind sources of the Area especially in summer period. The proposed Kai Tak Development has incorporated major wind corridors and achieved a high degree of permeability in the layout to facilitate wind penetrating into the hinterland.

6.1.1 Non-summer wind

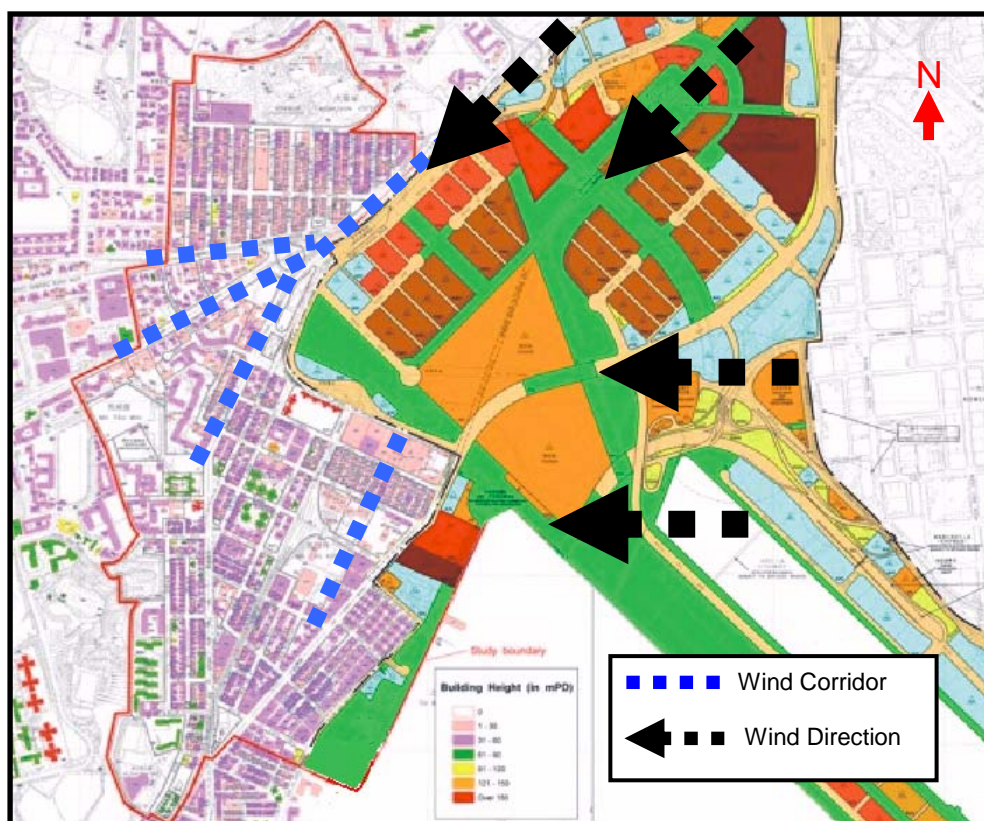


Figure 7 Wind Pattern in non-summer period

In non-summer period, the prevailing winds are from E and NE directions, as shown in above figure, the site wind performance can be summarized as following:

- Open spaces at northern part of the Area act as main wind entrances to the study Area
- Prince Edward Road East acts as the main wind corridor. Then, the wind disperses to inner area along Prince Edward Road West, Argyle Street and Ma Tau Chung Road.
- Kowloon City Road can also be regarded as a main wind corridor which introduces the wind from the large open spaces in Kai Tak Development to the inner area.
- The street pattern of Ma Tau Kok Area (southern part of the Area) is irregular. Poor street connectivity prevents wind from penetrating to hinterland. It may result in relative poor wind performance.
- For Kowloon City Area (northern part of the Area), although the street pattern is relatively regular, similar building height together with orientation of streets not aligned with the prevailing wind directions may result in relative poor air ventilation performance at that area, even under north-easterly wind direction, narrow streets also prevent the wind from penetrating deeply to the hinterland.
- There are two residential developments with height over +150mPD located near the waterfront. This may affect the ventilation performance of the area to its immediate behind. Fortunately, the problem would not be very serious when the nearby buildings are kept low in density and building height.

6.1.2 Summer wind

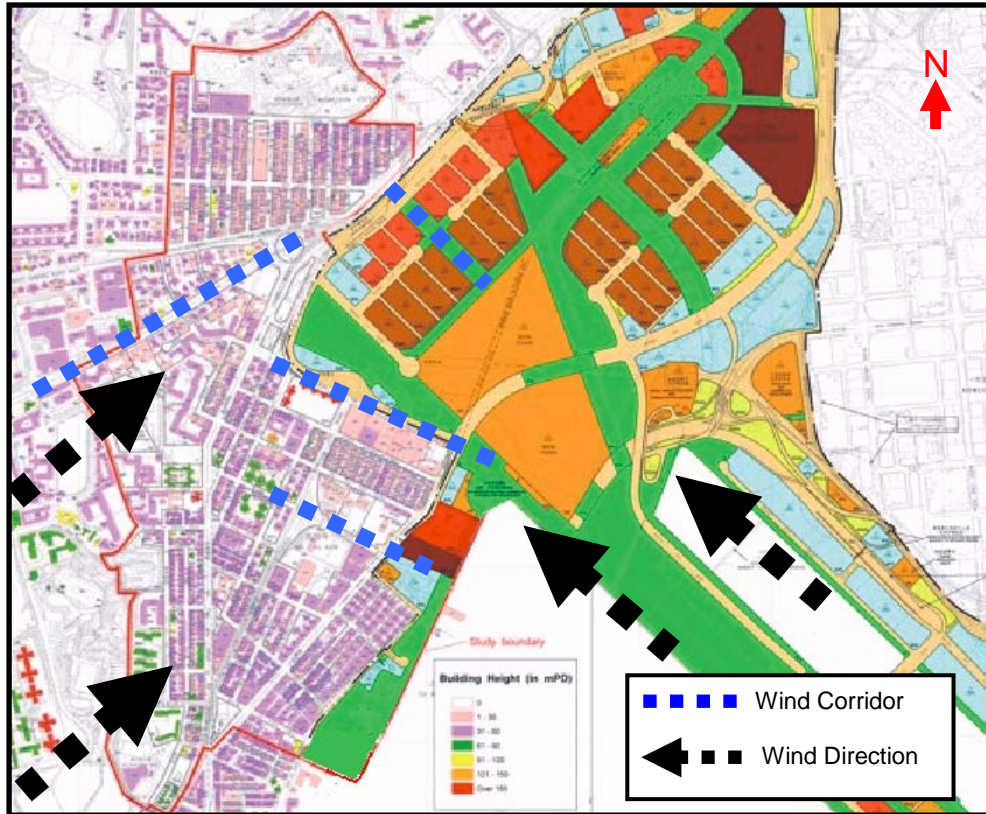


Figure 8 Wind Pattern in summer period

In summer period, the prevailing winds are from SE and SW directions. The proposed wind corridors of the Kai Tak Development allow the wind from SE direction reaching the Kowloon City Area. Sung Wong Toi Road is the major ventilation corridor from waterfront to the central of the Kowloon City Area.

Again, the existing pattern and orientation of streets cannot introduce the wind to hinterland. Aforementioned, there are the same skimming flow problems for Ma Tau Kok Area due to similar building height and congested layout.

For the prevailing wind from SW direction, it is mostly diverted and lessened by the building clusters. This may discourage the air circulation in the Area. Argyle Street can act as the ventilation corridor under such conditions. Wind tends to flow to Olympic Garden and disperses to neighbourhood.

6.2 Proposed building height

The air ventilation implications of the proposed building height plus committed/approved developments during non-summer and summer period are provided in this section. Figures 9 and 10 show the proposed building height and site coverage of committed/approved developments and proposed building height bands for Ma Tau Kok Area respectively. Key ventilation corridors and potential problem areas are also identified in the paragraph as follows.

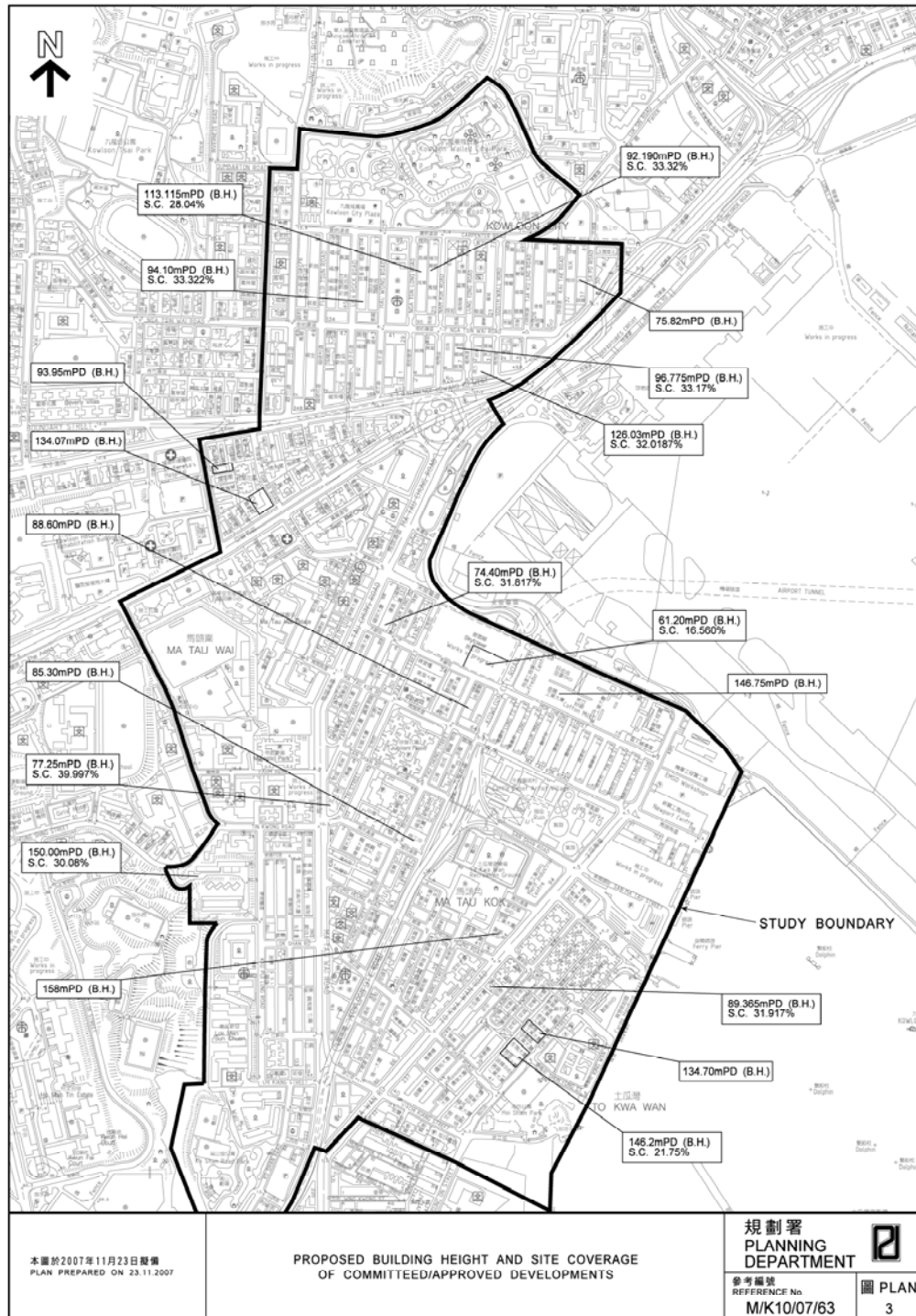


Figure 9 Proposed building height and site coverage of committed/approved developments

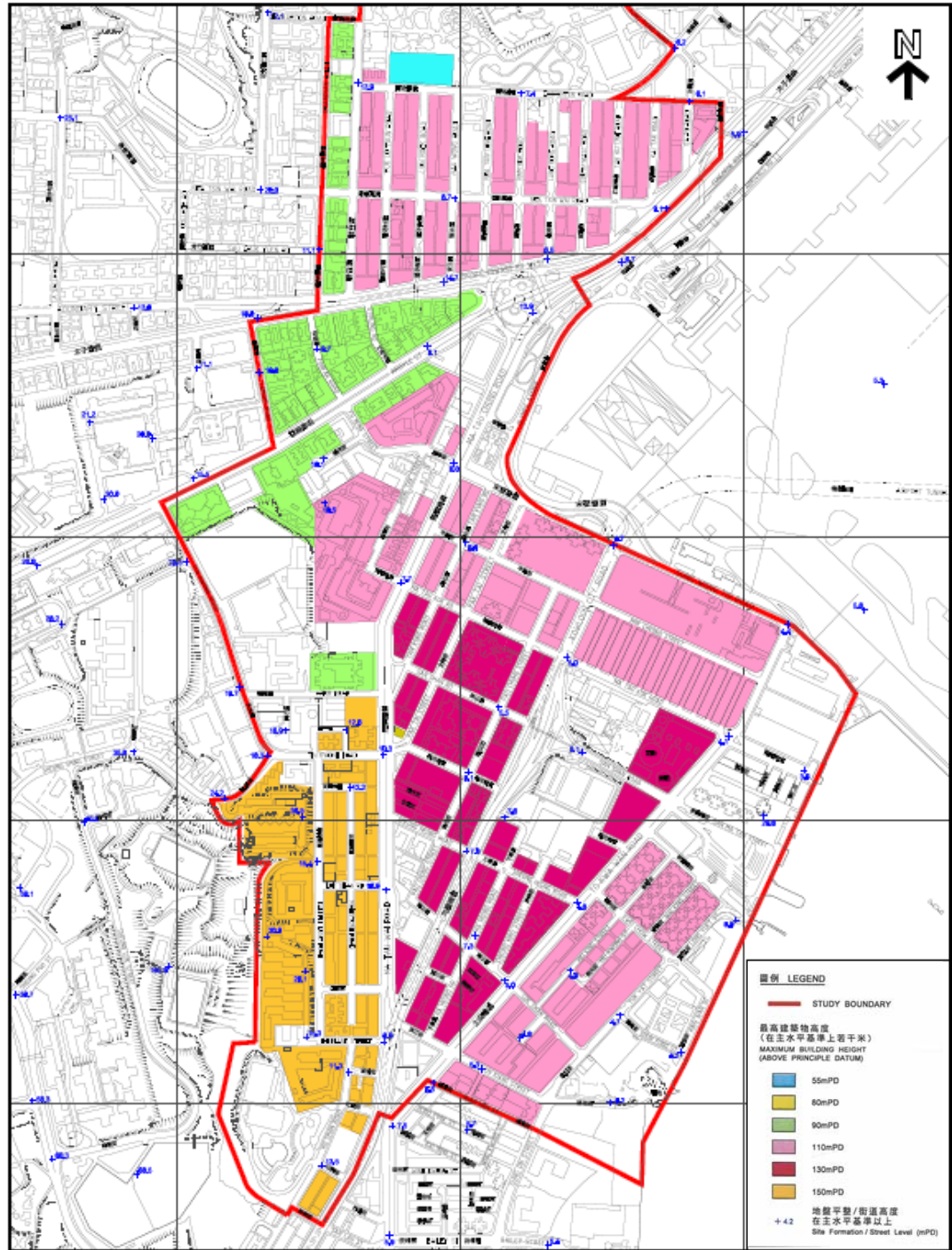


Figure 10 Proposed building height bands for Ma Tau Kok Area

The Area has been substantially developed for private residential and public housing. Most of the proposed building height restrictions in the Area range between +90mPD and +150mPD, where the average street level is +4.2mPD. Since the street arrangement cannot be changed, the major wind corridors shall remain the same in proposed scheme as in the existing condition.

6.2.1 Non-summer wind

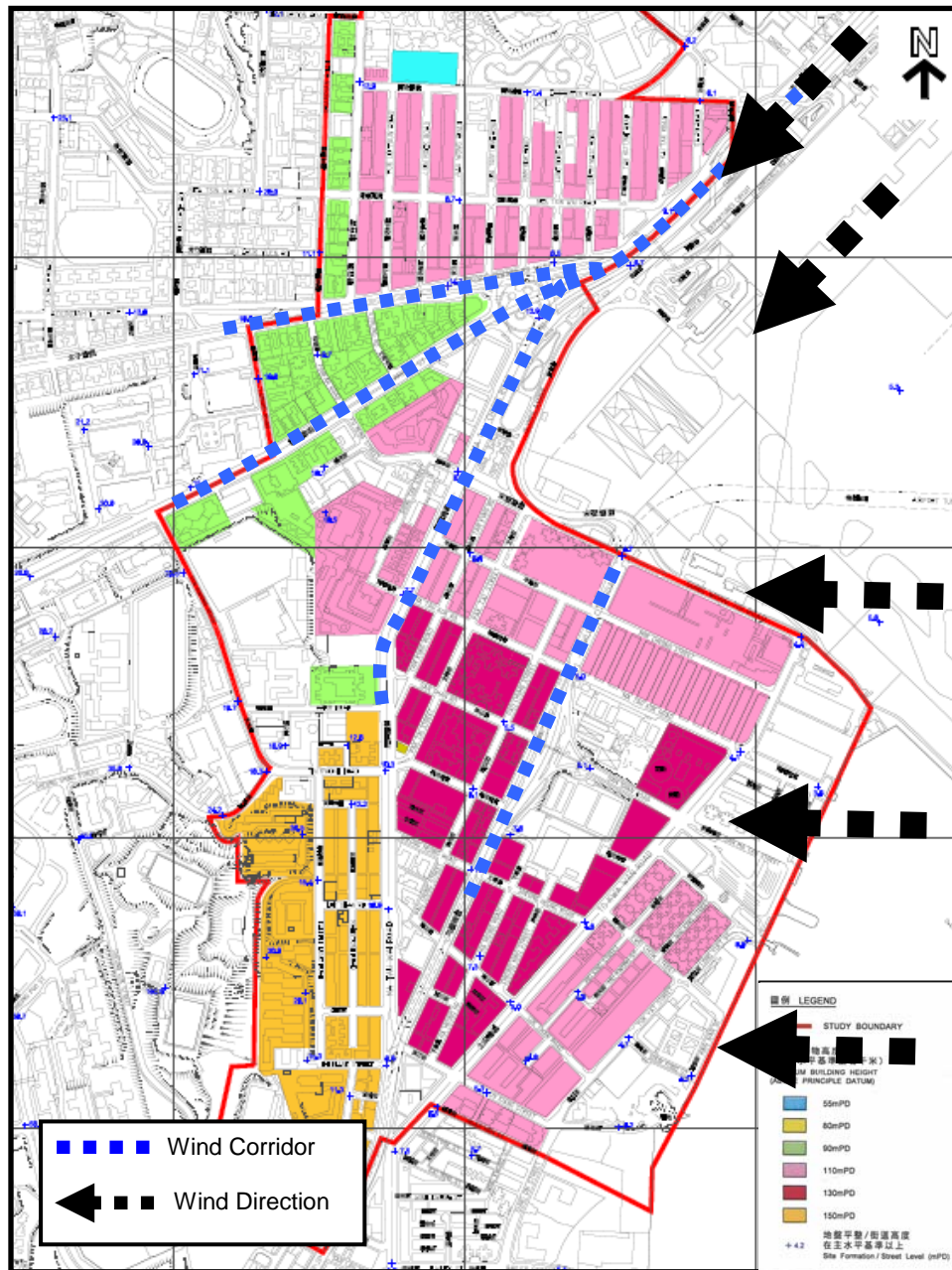


Figure 11 Wind Pattern in non-summer period

Aforementioned, the prevailing winds are from E and NE directions in non-summer period. Therefore, Prince Edward Road East still acts as the ventilation corridor with the wind dispersing to inner area along Prince Edward Road West, Argyle Street and Ma Tau Chung Road (as shown in the above figure).

Another wind corridor for NE wind direction is Kowloon City Road. The extensive open spaces in western part of proposed Kai Tak Development allow the wind blowing smoothly along Kowloon City Road.

Compared with the existing condition, the following could be observed:

- The proposed maximum building heights near the waterfront would be +110mPD. This may cause a negative effect to the pedestrian wind environment of the area bounded by To Kwa Wan Road and Ma Tau Wai Road.
- The major entrance for north-eastern wind to hinterland would be the open spaces near Sung Wong Toi Road. However, this air path may be blocked by the newly proposed development between Sung Wong Toi Road and Ma Tau Kok Road.
- For the northern part of the Area (Kowloon City Area), the existing problem created by the street pattern and orientation still persists under the proposed height restrictions. In addition, the proposed higher building height in the proposed planning scheme may make the air circulation worse.

6.2.2 Summer wind

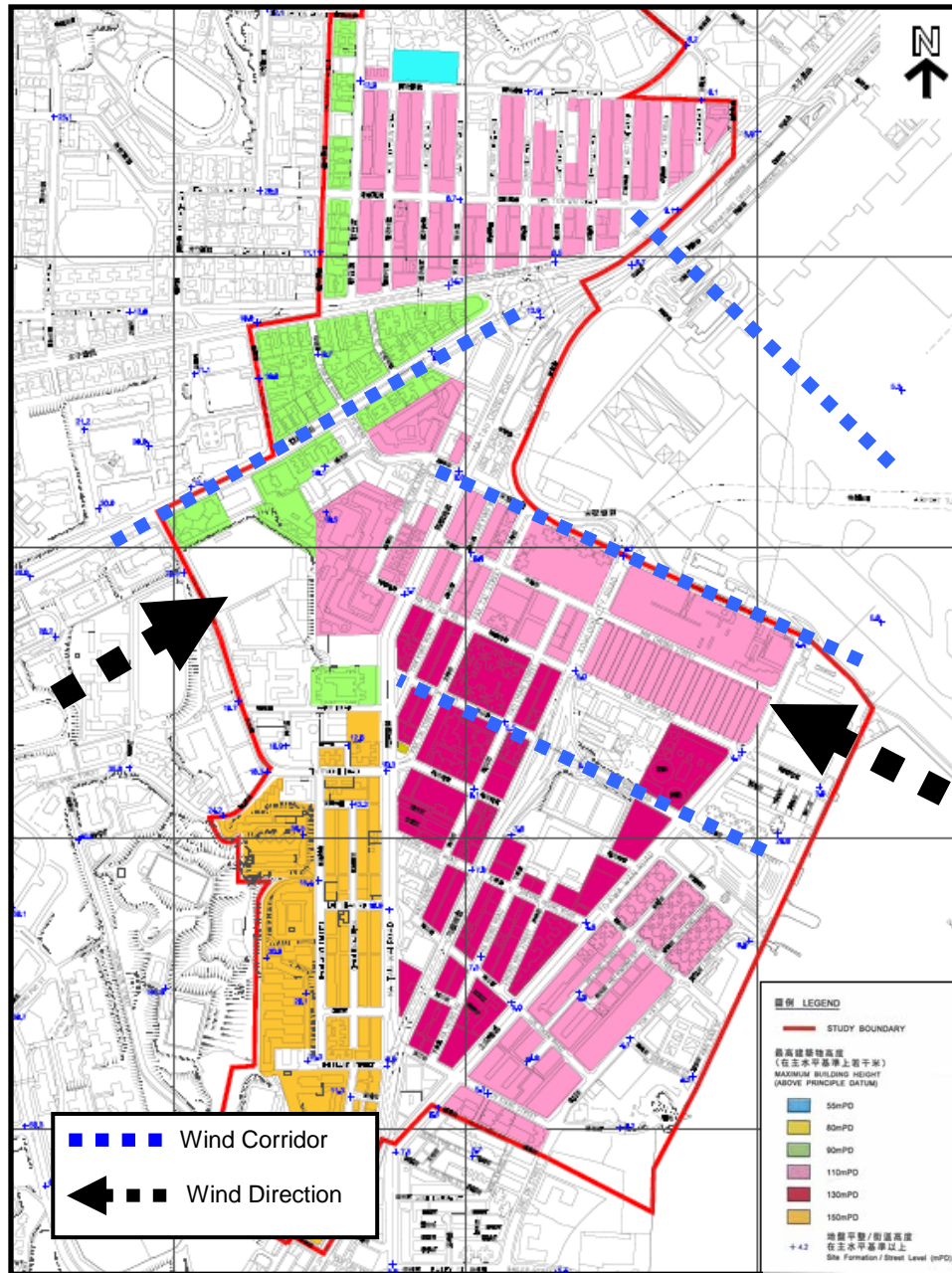


Figure 12 Wind Pattern in summer period

The prevailing winds are from SE and SW directions in summer period. As shown in above figure, some proposed ventilation corridors in Kai Tak Development Scheme are in function. The major ventilation corridor is Sung Wong Toi Road and San Shan Road, which allow wind flowing from waterfront to hinterland. The proposed tall buildings near the waterfront may block portion of wind from southeastern direction.

For the prevailing wind from SW direction, Argyle Street acts as the wind corridor which drives wind toward Kowloon City Area. The proposed maximum building heights of +150mPD at southwestern part of the Area may further hinder the wind penetrating to the hinterland.

6.3 Problematic areas and mitigation methods

The potential problem areas are identified in this section. Furthermore, the mitigation methods on problematic area are discussed as well.

6.3.1 Kowloon City Area near Nga Tsin Wai Road

Under existing condition, street pattern and orientation restrict the prevailing wind flowing through Kowloon City Area. In addition, the congested layout further discourages the air circulation. All of the above would result in relatively poor air ventilation performance.

The proposed building height scheme retains the street pattern, with maximum building height of 110 mPD which may result in even worse wind performance of that area. To moderate this condition, it is suggested to increase the porosity of buildings in such area, particularly at low level, while keeping the proposed height of the buildings as low as possible.

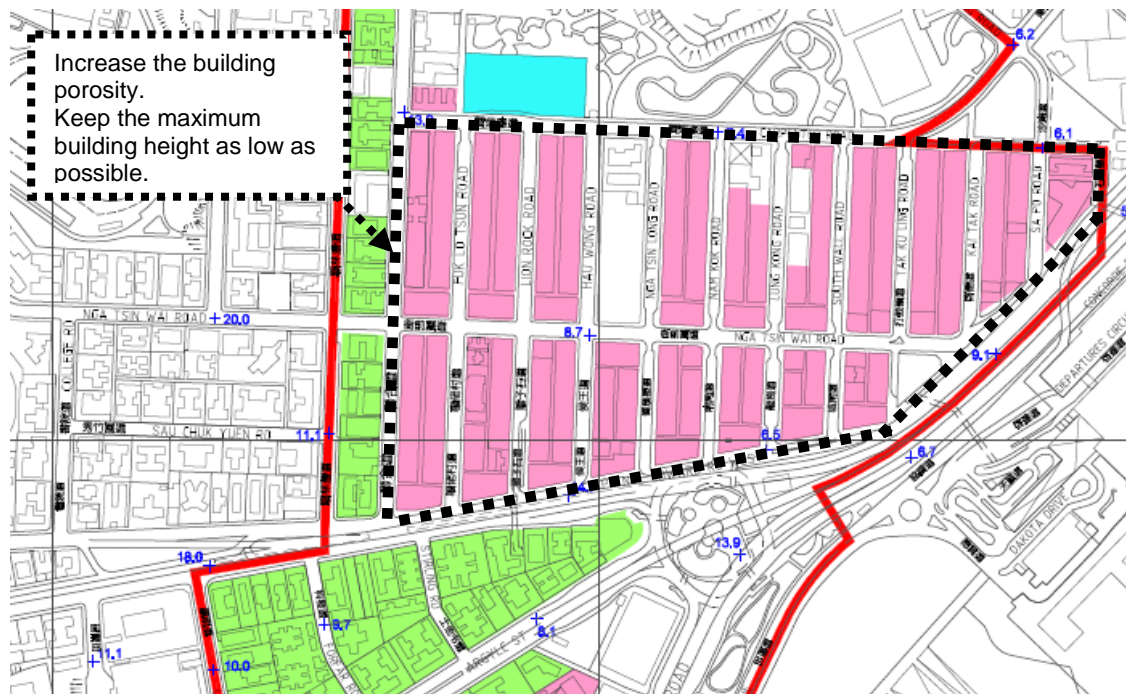


Figure 13 Kowloon City Area near Nga Tsin Wai Road

6.3.2 Area near Argyle Street

Under existing condition, two open spaces, namely Olympic Garden and Tin Kwong Road Recreation Ground (shown as Figure 2), could allow NE and SW wind penetration along the Argyle Street and its surrounding area. Therefore, in order to retain the wind corridor, it is suggested to reduce the maximum height of the area between these two open spaces and along Argyle Street as low as possible, especially Chun Seen Mei Chuen Area (shown in Figure 14) which is proposed with a higher building height (+110 mPD) than the surrounding buildings, so as to ensure that wind could reach the hinterland through the above path without significant blockage.

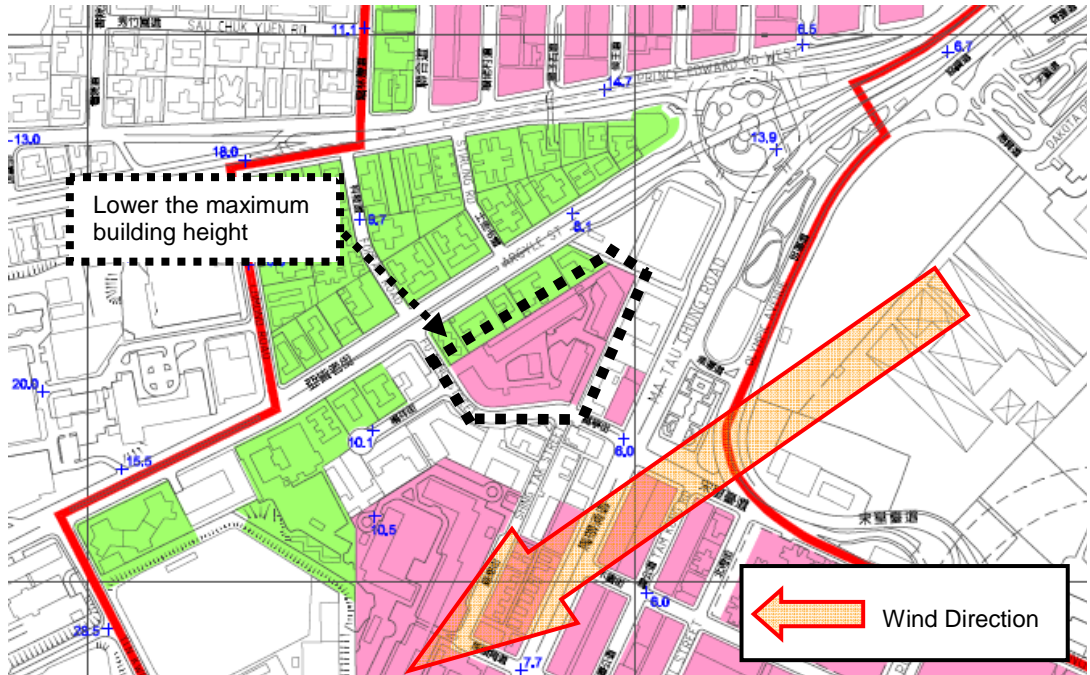


Figure 14 Area near Argyle Street

6.3.3 Area near southern part of Ma Tau Wai Road

Aforementioned, Ma Tau Wai Road is the major wind corridor in the study area. Under the proposed building height scheme, area near the southern part of Ma Tau Wai Road shall be surrounded by the developments of building height over +110mPD. The air ventilation performance may be unsatisfactory since it is difficult for the prevailing wind at high level flowing down to the pedestrian level. One mitigation method is to enhance the effectiveness of the major ventilation path. Lowering the maximum building height of the buildings near Tam Kung Road can reduce the blockage of wind from northeastern direction. Also, it is suggested to keep the same maximum building height of the buildings (150 mpD) at the west side of Ma Tau Wai Road. This may help to divert the wind from northeastern direction down to the pedestrian level of Ma Tau Wai Road, thus enhance the effect of the ventilation corridor. The figure below shows the aforementioned areas.

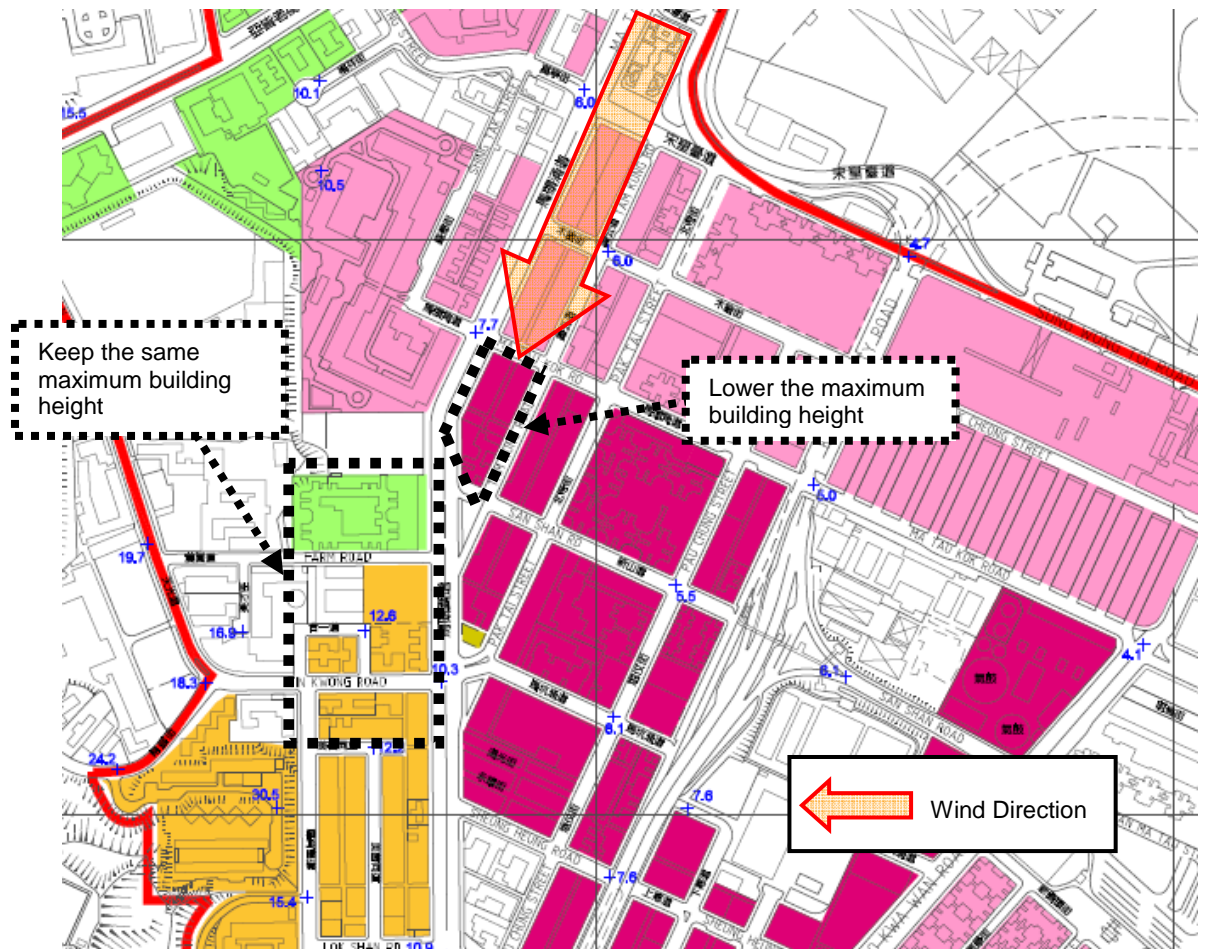


Figure 15 Area near southern part of Ma Tau Wai Road

6.3.4 Area near To Kwa Wan Recreation Ground

The public transport interchange near San Ma Tau Street is major entrance for Southeastern wind to the To Kwa Wan Recreation Ground. The proposed maximum building height of the captioned area (bounded in dotted line in the following figure) increases from +60 mPD under existing condition to approximately +130mPD. This may block the above wind entrance.

Therefore, it is suggested to keep the height of the buildings within the dotted area in Figure 16 as low as possible. This helps the wind to reach the open space of To Kwa Wan Recreation Ground without significant blockage, and hence enhance the air circulation nearby.

In addition, setting back of buildings along both sides of San Shan Road and Ma Hang Chung Road could also provide the path for wind penetration to the hinterland area and recommended.

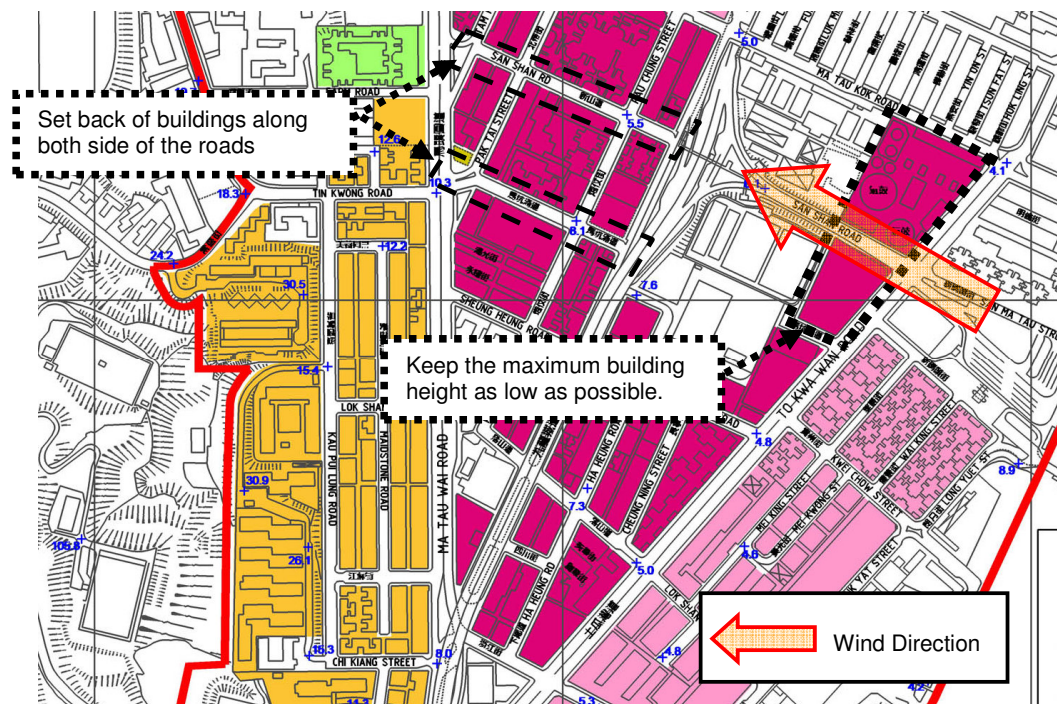


Figure 16 Area near To Kwa Wan Recreation Ground

6.3.5 Area near Mok Cheong Street

Locating at the upstream of To Kwa Wan Recreation Ground under prevailing northeasterlies, the captioned area may obstruct the wind from the Kai Tak Development towards To Kwa Wan Recreation Ground.

To permit the wind path extending from Kai Tak Area to Ma Tau Kok Area, it is suggested to keep the buildings adjacent to Mok Cheong Street as low as possible. The building design in the captioned area (shown in Figure 17) should also be especially considered to allow a wind corridor for wind penetration.

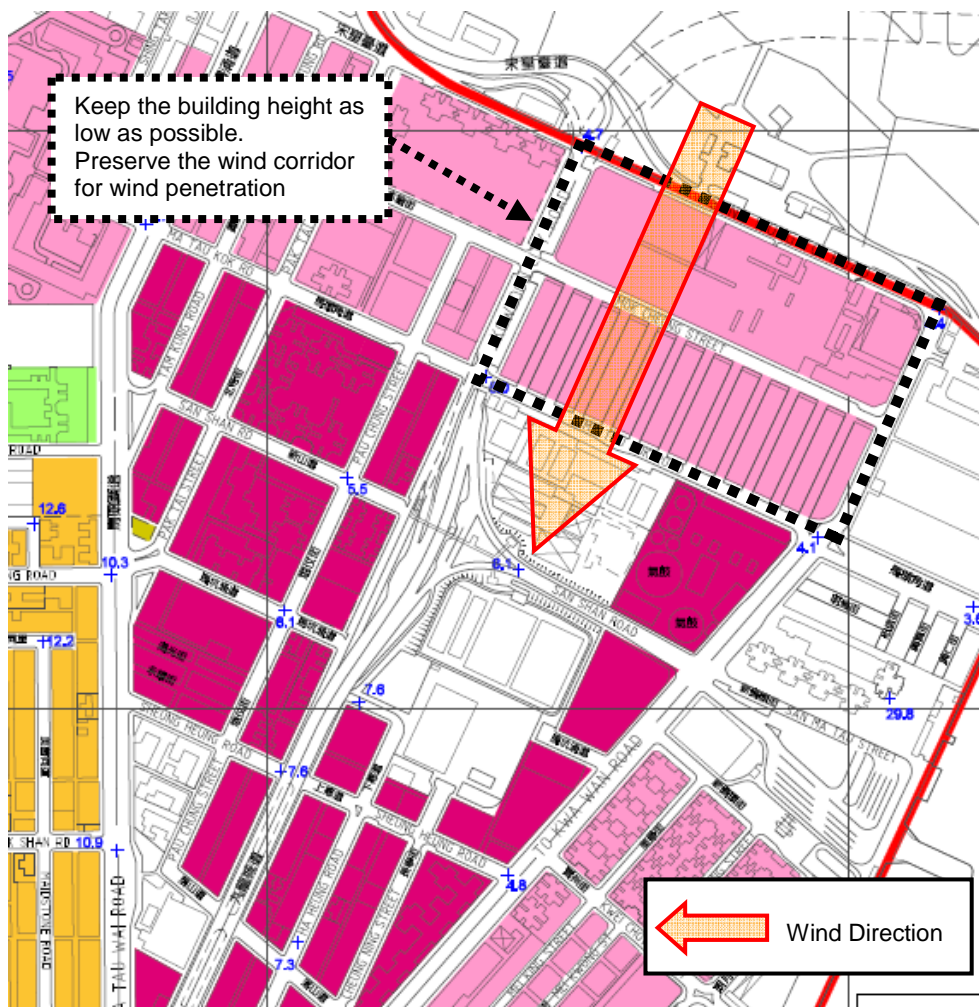


Figure 17 Area near Mok Cheong Street

6.4 Recommendation for further study

Aforementioned, one of the major ventilation problems of the proposed maximum building height is Ma Tau Kok Area. As shown in Figure 17, the buildings near Mok Cheong Street are critical to the local ventilation environment of Ma Tau Kok Area. Therefore, a quantitative AVA Study on the area near Mok Cheong Street is recommended, so as to assess the ability of wind penetration and to recommend design guidelines for future redevelopment from air ventilation perspective.

7 Conclusion

This report provides the expert evaluation on the AVA of the proposed building heights for the study area. It is a qualitative assessment of wind performance of the site under existing condition and proposed building heights. A preliminary assessment on site characteristic and wind availability is conducted. The expert evaluation indicates that:

For existing condition,

- Prince Edward Road East acts as the ventilation wind corridor during non-summer period. The wind disperses to inner area along Prince Edward Road West, Argyle Street and Ma Tau Chung Road;
- The major ventilation corridor during summer time is Sung Wong Toi Road and San Ma Tau Street with wind coming from waterfront;
- Several wind corridors and large open spaces, which are provided in proposed Kai Tak Development scheme, reduce the possibility of wind block to the study area;
- Congested building layout and high site coverage within the study area generally discourage the air circulation at pedestrian level;
- Several open spaces are distributed over the study area. This may enhance the wind penetration in the Area.

For proposed planning scheme,

- The major wind corridors shall be preserved in proposed scheme since no variations could be made on the street arrangement;
- The effectiveness of such corridors may be reduced because higher buildings would be permitted under the proposed building height scenario;
- The proposed building height for sites near waterfront may block portion of eastern wind which is the major prevailing over the year;
- The higher building height may further discourage the air circulation in congested building layout area.

Furthermore, some mitigation measures are recommended to enhance the ventilation performance of possible problem areas. However, the air ventilation performance at the pedestrian level is not merely determined by the building height. It is the combination effect of site characteristics and different design features, including the site location, building disposition and building height, surrounding building layout and building height, podium design, sky garden and podium garden design, site wind availability etc. Despite that the study area has been built up; opportunity should be explored in long term to enhance the wind performance through the following measures:

- Prince Edward Road East and Sung Wong Toi Road would serve as the main wind corridors, these two roads should be kept clear and wide as much as possible. The buildings at both sides of the roads are suggested to be set back as much as possible for widening air pathway;
- Large bulk podium design may obstruct the wind penetration and should be avoided;
- More open space should be provided at street level for air dispersion purpose;
- Buildings disposition should be oriented with their long axis parallel to the prevailing wind, and sufficient separation in between (the gap is suggested equivalent to the width of building, if possible) should be provided for better ventilation.

Because of the importance of the air circulation between Kai Tak Area and Ma Tau Kok Area, a quantitative AVA Study (Initial or Detailed AVA study) on the area near Mok Cheong Street is recommended, so as to assess the ability of wind penetration.