CONSULTANCY STUDY FOR AIR VENTILATION ASSESSMENT SERVICES

Cat. A1– Term Consultancy for Expert Evaluation on Air Ventilation Assessment (PLN AVA 2015)

Final Report

For the Initial Scenario for Yau Ma Tei Planning Area

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INSTITUTE OF Future Cities

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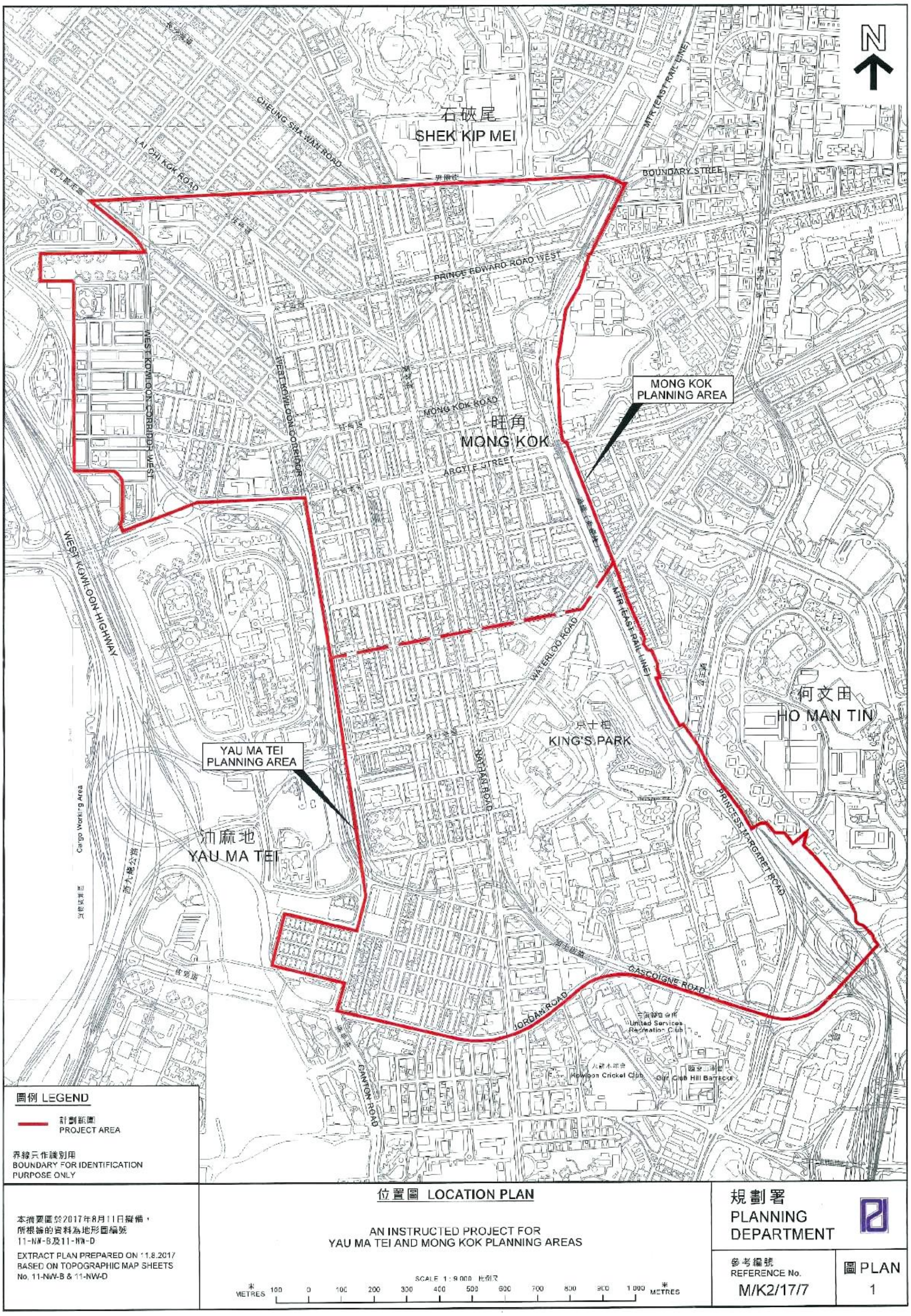
by Professor Edward Ng
School of Architecture, CUHK, Shatin, NT, Hong Kong
T: 39436515 F: 26035267
E: edwardng@cuhk.edu.hk W: www.edwardng.com

The Study Area (Mong Kok and Yau Ma Tei Planning Areas)



Expert Evaluation Report
for the Initial Scenario for Yau Ma Tei Planning Area

Executive summary

0.1 This Expert Evaluation (EE) on Air Ventilation Assessment (AVA) is conducted to review the development restrictions for the Yau Ma Tei Planning Area (YMT Area) with reference to the relevant court judgments on the judicial review application in respect of the draft Yau Ma Tei Outline Zoning Plan (OZP) No. S/K2/21.

0.2 Regarding the wind environment, annual winds of YMT Area mainly come from the east (E), east-northeast (ENE), and west (W), while summer winds mainly come from the southwest (SW) and east (E). Based on all available wind information and an understanding of the topography and land-sea breezes, it can be concluded that the major axes for pedestrian level wind in YMT Area are W, NE, and SE.

0.3 YMT Area can be divided into two parts: the eastern half mainly consists of large open spaces and "G/IC" sites on higher grounds, while dense urban building clusters concentrate on the western half. The latter is currently dominated by N-S oriented rectangular blocks of small residential sites, with commercial developments mainly along Nathan Road. Major roads/streets parallel or within 30 degrees from the important wind directions serve as effective air paths.

0.4 The Baseline Scenario refers to the scenario under the draft Yau Ma Tei OZP No. S/K2/22 with building height restrictions (BHRs), non-building areas (NBAs), building gaps (BGs), and building setbacks (SBs) requirements as imposed on the then draft Yau Ma Tei OZP No. S/K2/21. In the Initial Scenario, changes in BHRs for "C" and "R(A)" sites have been proposed to increase the design flexibility and allow for the implementation of the Sustainable Building Design Guidelines (SBDG). The air ventilation performance of the Initial Scenario is expertly assessed against that of the Baseline Scenario.

0.5 An analysis on building frontage (BF) is used to evaluate the potential impacts on air ventilation in YMT Area caused by the general increase of BH in the Initial Scenario. As a majority of sites in YMT Area have a two-tier BHR (based on site area), assumptions are made for the proportion of sites with areas larger than 400m^2 according to government information. The average increase in BF for the whole YMT Area in the Initial Scenario compared to the Baseline Scenario is found to be at most 10.8%. This is unlikely to cause any statistically significant difference in air ventilation impacts.

0.6 In the northern sub-area of YMT Area, when wind comes from the W and WSW, the penetration of sea breeze into YMT Area is allowed by the two strips of BGs aligned with Hamilton Street and the BG aligned with Wing Sing Lane. When wind comes from the easterly quarters (NE, E, and SE), wind flow and urban permeability are enhanced by the BG aligned with Man Ming Lane as well as the NBA to the south of 8 Waterloo Road. The SB of 6m for the commercial block abutting the northern curb of Kansu Street widens the bottleneck between Kansu

Street and Gascoigne Road and facilitates NW-SE air movement along the two main roads. The SBs of 3m on each side of Portland Street and Arthur Street reduce both the canyon height-to-width (H/W) and length-to-width (L/W) ratios. As a result, both downwash effects and lateral flow induced by corner eddies may be enhanced to improve the wind environment at pedestrian level.

0.7 The southern sub-area of YMT Area is a relatively stagnant area with narrow streets that are not perfectly aligned on the two sides of Nathan Road. When wind comes from the WSW and W, the four strips of BGs aligned with Ning Po Street and Nanking Street are particularly important for the penetration of westerlies into YMT Area. Similar to the SBs along Portland Street and Arthur Street, the SBs of 3m on each side of Parkes Street and Woosung Sung Street help improve the pedestrian level wind environment by enhancing downwash effects and lateral flow induced by corner eddies.

0.8 Therefore, the NBA, BGs, and SB requirements are all good features of district significance for air ventilation in YMT Area and should therefore be maintained as far as practically possible.

0.9 The potential for implementation of the SB and building separation requirements in the SBDG are also evaluated for YMT Area. The potential improvement on air ventilation caused by sites adopting SB can be quite significant for those streets which are currently less than 15m wide. However, only 14 individual building lots (assuming no site amalgamation upon redevelopment) are required to comply with the building separation requirement and the potential benefits on air ventilation are expected to be minor and localised. Therefore, site amalgamation should be encouraged to increase the implementation potential of the building separation requirements in the SBDG.

0.10 In summary, the Initial Scenario is unlikely to cause any statistically significant difference in air ventilation impacts for the whole YMT Area when compared to the Baseline Scenario. It is also noted that in compact high-rise building areas, the increase in BH may cease to be the key factor affecting air ventilation at pedestrian level when the H/W ratio of street canyons exceed a certain point. Nevertheless, it should be acknowledged that YMT Area, especially the western half, is now characterised by high average H/W ratios and is already suffering from a poor environment quality with severe urban heat island effects, and any future developments would inevitably worsen the existing conditions, thus good building design measures are important.

0.11 As a general principle, for better urban ventilation, it is important to consider breezeways/ air paths/ building permeability at different scales. Breezeways and air paths should be incorporated strategically into the urban district and planning level. Planners should make reference to Chapter 11 of the Hong Kong Planning Standard and Guidelines (HKPSG) for their design and disposition. Building porosity and permeability should be introduced at the building design level. In this regard, key building design elements are set out in the SBDG.

0.12 Besides incorporating air paths at different planning levels, future developments must be carefully planned and should follow other design principles set out in the HKPSG, especially those listed below:

- Introduce variations in BH across the area;
- Avoid long and continuous façades;
- Reduce site coverage at grade and minimise ground coverage of podia;
- Maintain “O” and “G/IC” sites as air spaces and connect breezeways; and
- Maximise planting of greenery in open spaces, preferably at grade.

0.13 The Government should also give more balanced considerations to S16 applications for building developments which require BH relaxation in order to incorporate more design features to improve air ventilation at pedestrian level. It is highly recommended that project proponents should conduct further assessments to demonstrate that the air ventilation performance of any future developments in YMT Area would be no worse off than the evaluated scenarios.

旺角規劃區初步方案的空氣流通專家評估報告

行政摘要

0.1 本空氣流通專家評估報告(報告)旨在檢討油麻地規劃區(油麻地區)的發展限制以跟進油麻地分區計劃大綱草圖圖則編號 S/K2/21 相關的司法覆核的法院判決。

0.2 就風環境而言，油麻地區的全年盛行風主要來自東面、東北偏東和西面，而夏季的盛行風則主要來自西南和東面。根據所有可用的風環境資料以及對地形和海陸風的了解，可以總結出油麻地區的行人水平風向主軸為西、東北和東南。

0.3 油麻地區可以分為兩個部分：東半部主要由位於較高地勢的大型休憩用地和政府、機構或社區用地組成，而密集的城市建築群則集中在西半部。後者現時主要為南北向的長方形小型住宅用地，以及沿彌敦道的商業發展。與重要的風向平行或在 30 度以內的主要道路/街道是有效的風道。

0.4 基準情況所指的是油麻地分區計劃大綱草圖圖則編號 S/K2/22 上的所有要求，包括在圖則編號 S/K2/21 上所規定的建築物高度限制、非建築用地、樓宇間距和樓宇後移要求。為增加設計彈性並落實可持續建築設計指引，初步方案建議改變「商業」和「住宅(甲類)」用地的建築物高度限制。本報告就初步方案及基準情況兩者的空氣流通表現作出專業評估。

0.5 本報告分析整體油麻地區建築物的臨街面以評估在初步方案中建築物高度的整體上升對油麻地區的空氣流通所造成的潛在影響。由於油麻地區的大部分用地採用兩級建築物高度限制(根據地盤面積)，評估時按照政府資料中地盤面積大於 400 平方米的用地的比例作出相應假設。在初步方案中，整個油麻地區的臨街面比起基準情況的平均增幅最高為 10.8%。這在統計角度上不大可能對空氣流通影響造成明顯差異。

0.6 在油麻地區的北部分區，當風來自西面和西南偏西，與咸美頓街並排的兩道建築物間距，以及與永星里並排的建築物間距，能讓海風進入和滲透油麻地區。當風來自東面(東北、東面和東南)，與文明里並排的建築物間距，還有窩打老道 8 號以南的非建築用地，都會加強風的流動和城市通透度。甘肅街北側路邊的商業街區的 6 米建築物後移，可擴闊甘肅街和加士居道之間的瓶頸路段，並有利於沿兩條主要道路的西

北—東南的空氣流通。砵蘭街和鴉打街兩側各 3 米的樓宇後移，能減少街峽的高寬比和長寬比，有可能因此促進氣流下洗效應和增強由角隅渦流引起的橫向氣流流動，以改善行人水平的風環境。

0.7　油麻地區的南部分區是比較空氣不流通的區域，彌敦道兩側的窄街並非完全對齊。當風來自西南偏西和西面，寧波街和南京街並排的四道樓宇間距對於西風吹進油麻地區尤其重要。與砵蘭街和鴉打街的樓宇後移相似，白加士街和吳松街兩側各 3 米的樓宇後移，促進氣流下洗效應和增強由角隅渦流引起的橫向氣流流動，有助改善行人水平的風環境。

0.8　因此，非建築用地、樓宇間距和樓宇後移等要求全都是對於油麻地區的空氣流通有地區性重要意義的良好元素，並應予以保留。

0.9　本報告同時就在油麻地區實施可持續建築指引所列的樓宇後移和樓宇間隔要求的可能性進行評估。在闊度少於 15 米的窄街，樓宇後移對空氣流通改善可以相當顯著。然而，現時只有 14 個地段(假設重建時沒有合併用地)須遵守建築物間隔要求，所以預期只會輕微及局部地改善空氣流通。因此，政府應鼓勵建議合併用地以增加落實可持續建築設計指引內有關樓宇間距要求的可行性。

0.10　總結而言，與基準方案比較，初步方案從統計角度上不大可能對整個油麻地區造成任何明顯的空氣流通影響。需要指出的是，在緊密的高層建築區域，當街峽的高寬比率超過某一水平，建築物高度的增加可能不再是影響行人水平的空氣流通的主要因素。然而，必須承認油麻地區，尤其是西半部，現時的平均高寬比偏高，環境質素已經很差而且城市熱島效應嚴重，因此任何未來發展都無可避免地會使現時情況惡化，而良好的建築物設計措施更顯得重要。

0.11　作為一般原則，為了改善空氣流通，必須考慮不同規模的通風廊/風道/建築物通透度。應該在市區和規劃層面策略性地納入通風廊和風道。規劃師應參考「香港規劃標準與準則」的第十一章來設計和規劃通風廊和風道。另外，應在建築設計層面引入建築物透風度和通透度。就這方面，可持續建築設計指引已列出主要的建築設計元素。

0.12　除了在不同規劃層面納入風道以外，未來發展亦必須謹慎規劃，並應遵從「香港規劃標準與準則」所羅列的其他設計指引，尤其是以下幾點：

- 在整個地區引入建築物高度的變化；
- 避免連續/過長的外牆；
- 減少地面的上蓋面積，將平台的地面覆蓋減至最少；
- 維持「休憩用地」和「政府、機構及社區用地」作為空氣流通的空間並連接通風廊；以及
- 盡量在休憩用地種植綠化植物，以地面為佳。

0.13 如未來油麻地區的個別建築項目，因為引入更多設計元素來改善行人水平的空氣流通而需要根據《城市規劃條例》第 16 條提出規劃許可申請以進一步放寬建築物高度限制，政府應更平衡考慮該申請的理據。項目倡議者亦應提供進一步評估，以證明該發展不會使油麻地區的空氣流通表現變得比評估方案更差。

Expert Evaluation Report
for the Initial Scenario for Yau Ma Tei Planning Area

1.0 The Assignment

1.1 The development restrictions for the Yau Ma Tei Planning Area (YMT Area) are being reviewed to take account of the relevant court judgements on the judicial review (JR) application including that of the draft Yau Ma Tei Outline Zoning Plan (OZP) No. S/K2/21. It is considered necessary to conduct an expert evaluation (EE) to assess the preliminary air ventilation impacts of the latest proposed development restrictions.

1.2 A JR application was filed by The Real Estate Developers Association of Hong Kong (REDA) (JR case HCAL No. 58 of 2011) against the Town Planning Board's (the Board) decisions on its representation in respect of the draft Yau Ma Tei OZP, in particular on the imposition of the building height restrictions (BHRs) and designation of non-building area (NBA), building gap (BG) and building setback (SB) requirements for various development zones. In the judgement of JR case HCAL No. 58 of 2011, the Court of First Instance ruled that the Board's decisions are quashed and have to be remitted to the Board for reconsideration. A review of the development restrictions on the draft Yau Ma Tei OZP is therefore conducted.

1.3 This expert evaluation report is based on previous AVA studies, court judgement of the JR case concerned, and other materials provided by Planning Department (PlanD) including:

Site Plan of Project Area
Wind information from Hong Kong Observatory and PlanD
Baseline analysis (including existing building heights, street widths, land use, planning restrictions) of YMT Area
Draft Yau Ma Tei OZP No. S/K2/21 and S/K2/22 (Plan, Notes and Explanatory Statements)
Digital map (2D) of YMT Area
Aerial photos of YMT Area
Initial Scenario (with reviewed building heights) of YMT Area
EE on AVA for Yau Ma Tei Area (October 2010)
HCAL No. 58 of 2011 – The Real Estate Developers Association of Hong Kong v. Town Planning Board
MPC Paper No. 24/10 dated 15.10.2010

TPB Paper No. 8810 dated 13.5.2011

1.4 Other reference materials include:

Hong Kong Buildings Department. (2016). Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers: Sustainable Building Design Guidelines (APP-152)
Hong Kong Planning Department. (2011). Hong Kong Planning Standards and Guidelines (HKPSG)
Hong Kong Town Planning Board. Application for Permission under Section 16 of the Town Planning Ordinance (CAP. 131) Guidance Notes
Ng, E., Yuan, C., Chen, L., Ren, C., Fung J.C.H. "Improving the wind environment in high-density cities by understanding urban morphology and surface roughness: a study in Hong Kong." Landscape and Urban Planning 101.1 (2011): 59-74
Theurer, W. Typical building arrangements for urban air pollution modelling. Atmospheric Environment 33.24-25 (1999): 4057-4066
Yuan, C. and Ng, E. "Building porosity for better urban ventilation in high-density cities–A computational parametric study." Building and Environment 50 (2012): 176-189
Simpson, J.E. (1994). Sea breeze and local wind. Cambridge University Press
Oke, T. R. (1987). Boundary layer climates. Routledge
A. Kovar-Panskus, P. Louka, J.-F. Sini, E. Savory, M. Czech, A. Abdelqari, P. G. Mestayer and N. Toy, "Influence of geometry on the mean flow within urban street canyons – A comparison of wind tunnel experiments and numerical simulations", Water, Air, and Soil Pollution: Focus 2: 365–380 (2002), Kluwer Academic Publishers
Yazid, A. W. M., Sidik, N. A. C., Salim, S. M., & Saqr, K. M. A review on the flow structure and pollutant dispersion in urban street canyons for urban planning strategies. Simulation 90.8 (2014): 892-916
Hong Kong Green Building Council Limited. (2018). HKGBC Guidebook on Urban Microclimate Study

1.5 The consultant has studied the foregoing materials. During the preparation of the report, the consultant has visited the site and conducted working sessions with PlanD.

2.0 Background

2.1 PlanD's study: "Feasibility Study for Establishment of Air Ventilation Assessment System" (Feasibility Study) has recommended that it is important to allow adequate air ventilation through the built environment for pedestrian comfort.

2.2 Given Hong Kong's high density urban development, the Feasibility Study opines that: "more air ventilation, the better" is the useful design guideline.

2.3 The Feasibility Study summarizes 10 qualitative guidelines for planners and designers. For the OZP level of consideration, breezeways/air paths, street grids and orientations, open spaces, non-building areas, waterfront sites, scales of podium, building heights, building dispositions, and greeneries are all important strategic considerations.

2.4 The Feasibility Study also suggests that Air Ventilation Assessment (AVA) be conducted in three stages: Expert Evaluation, Initial Studies, and Detailed Studies. The suggestion has been adopted and incorporated into Housing Planning and Lands Bureau (HPLB) and Environment, Transport and Works Bureau (ETWB) Technical Circular no. 1/06. The key purposes of Expert Evaluation are to the following:

(a) Identify good design features.
(b) Identify obvious problem areas and propose some mitigation measures.
(c) Define "focuses" and methodologies of the Initial and/or Detailed studies.
(d) Determine if further study should be staged into Initial Study and Detailed Study, or Detailed Study alone.

2.5 To conduct the Expert Evaluation systematically and methodologically, it is necessary to undertake the following information analyses:

(a) Analyse relevant wind data as the input conditions to understand the wind environment of the Area.
(b) Analyse the topographical features of the study area, as well as the surrounding areas.
(c) Analyse the greenery/landscape characteristics of the study area, as well as the surrounding areas.
(d) Analyse the land use and built form of the study area, as well as the surrounding areas.

Based on the analyses of site context and topography:

(e) Estimate the characteristics of the input wind conditions of the study area.
(f) Identify the wind paths and wind flow characteristics of the study area through slopes, open spaces, streets, gaps and non-building areas between buildings, and low rise buildings; also identify stagnant/problem areas, if any.
(g) Estimate the need of wind for pedestrian comfort.

Based on the analyses of the existing urban conditions:

(h) Evaluate the strategic role of the study area in air ventilation term.
(i) Identify problematic areas which warrant attention.

(j) Identify existing “good features” that needs to be kept or strengthened.

Based on an understanding of the existing urban conditions:

(k) Compare the prima facie impact, merits or demerits of the different development restrictions as proposed by PlanD on air ventilation.

(l) Highlight problem areas, if any. Recommend improvements and mitigation measures if possible.

(m) Identify focus areas or issues that may need further studies. Recommend appropriate technical methodologies for the study if needed.

2.6 In this particular AVA EE, the focus is put to assess the air ventilation performance of the proposed Initial Scenario against that of the Baseline Scenario, which refers to the scenario under draft Yau Ma Tei OZP No. S/K2/22 with BHRs, NBA, BGs, and SB as imposed on the then draft Yau Ma Tei OZP No. S/K2/21.

3.0 The Wind Environment

3.1 Hong Kong Observatory (HKO) stations provide useful and reliable data on the wind environment in Hong Kong (Figure 3.1). There are some 46 stations operated by HKO in Hong Kong. Together, these stations allow for a good general understanding of the wind environment especially near ground level.

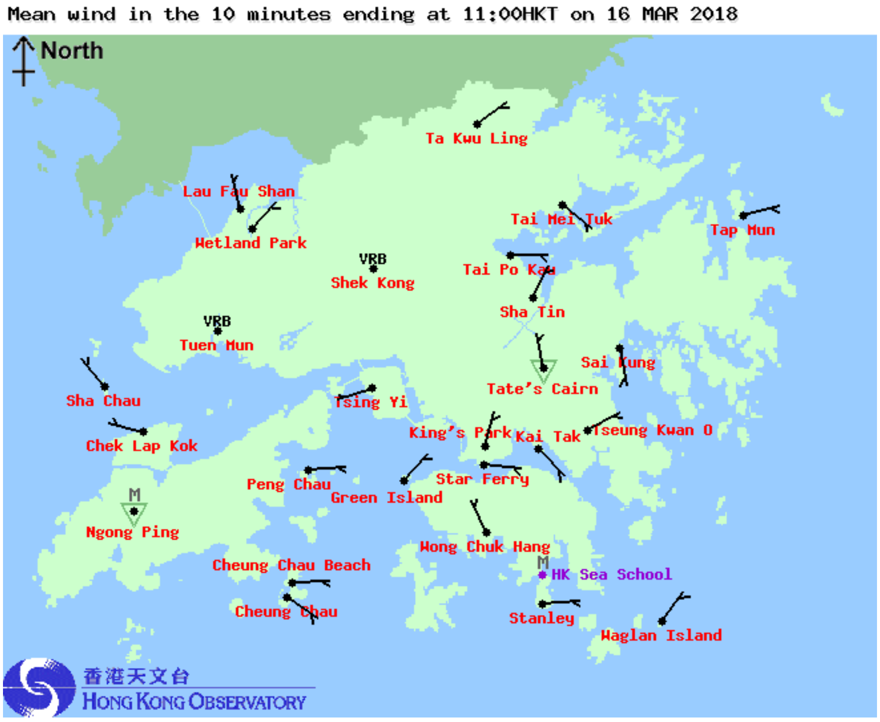


Figure 3.1 Some of the HKO stations in Hong Kong. This is a screen capture at 11:00 on 16 Mar 2018 from the HKO website. The arrows show the wind directions and speeds at the given time.

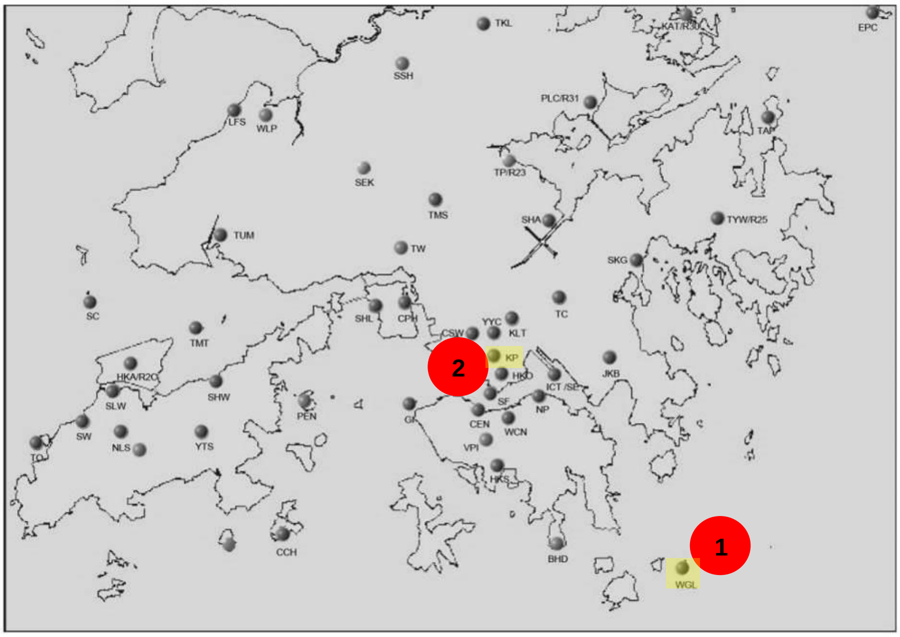


Figure 3.2 The HKO stations at 1: Waglan Island (WGL), 2: King's Park (KP).

3.2 The HKO station at Waglan Island (WGL) is normally regarded by wind engineers as the reference station for wind related studies (Location 1 in Figure 3.2). The station has a very long measurement record, and is unaffected by Hong Kong's complex topography. However it is known not to be able to capture the thermally induced local wind circulation like sea breezes very well. Based on WGL wind data, AVA studies are typically employed to estimate the site wind availability taking into account the topographical features around the site.

3.3 Based on the annual wind rose of WGL (Figure 3.3), it is apparent that the annual prevailing wind in Hong Kong is from the east. A major component of wind also comes from the northeast; and there is a minor, but nonetheless observable component from the southwest. WGL has weak to moderate wind (0.1m/s to 8.2 m/s) approximately 70% of the time.

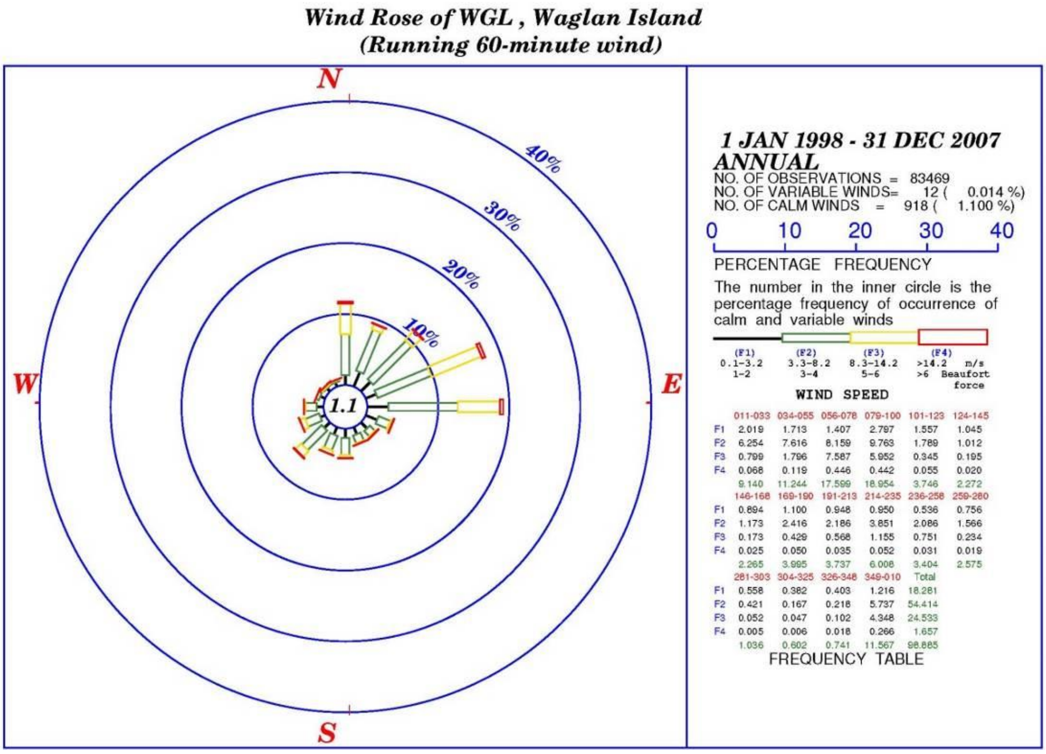


Figure 3.3 Wind rose of WGL from 1998 to 2007[1] (annual).

3.4 For the AVA study, seasonal or monthly wind environment should be understood (Figures 3.4 and 3.5). During winter, the prevailing wind comes from the northeast, whereas during summer, it comes from the southwest. As far as AVA is concerned, in Hong Kong, the summer wind is very important and beneficial for thermal comfort. Hence, based on WGL data, it is very important to plan our city, on the one hand, to capture the annual wind characteristics, and on the other hand, to maximize the penetration of the summer winds (mainly from the southwest) into the urban fabric.

[1] Wind data from 1998 to 2007 are the latest available 10-year data from HKO to the consultant.

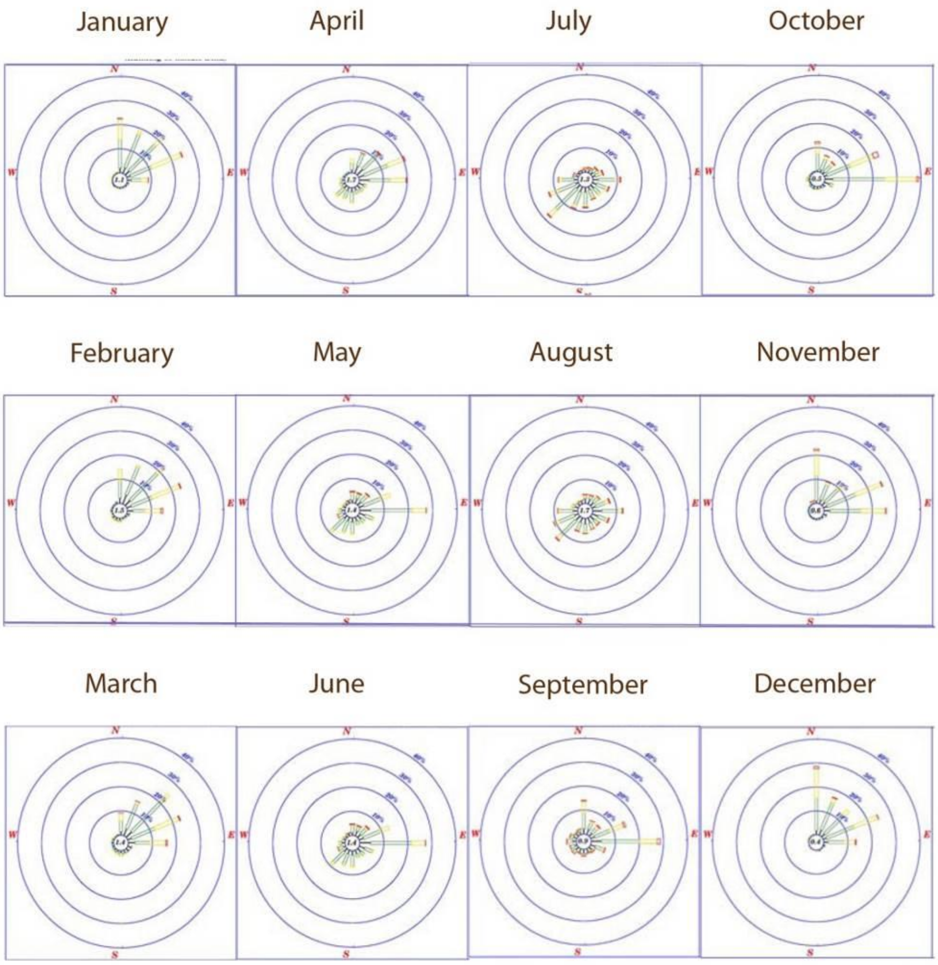


Figure 3.4 Monthly wind roses of WGL from 1998 to 2007.

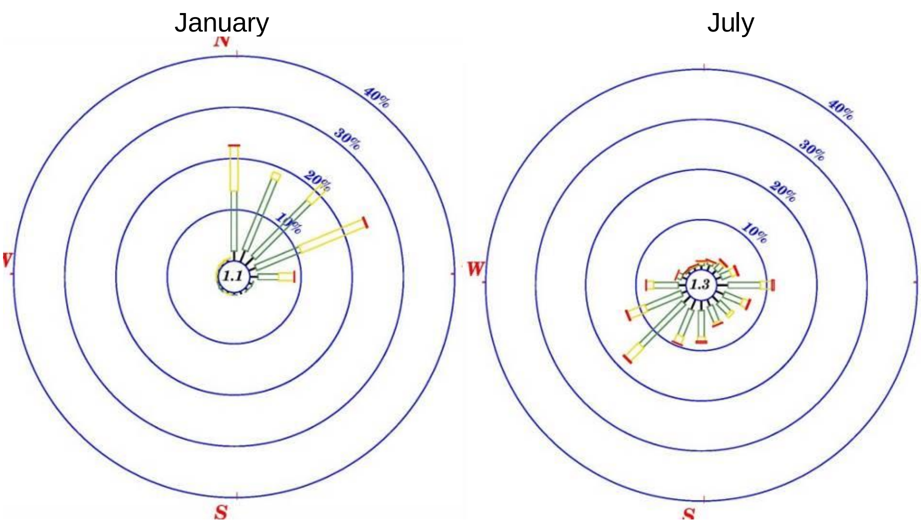


Figure 3.5 Wind roses of WGL from 1998 to 2007 (Jan and July).

3.5 Apart from WGL, the wind data of King's Park have also been extracted from HKO for reference (Figure 3.6 to Figure 3.9) as it is located within YMT Area and measures the wind environment for YMT Area. The measurement data at King's Park (with ground elevation of 65mPD) is affected by both building landscape and topography as it is situated within the building canopy and also lower than the higher ground elevation of Ho Man Tin district (up to around 100mPD) to the east. It can be observed that the annual prevailing winds are mainly from the east and east-southeast, with also significant wind components from the north and west. The summer prevailing winds are mainly from the east, west, and southerly quarters.

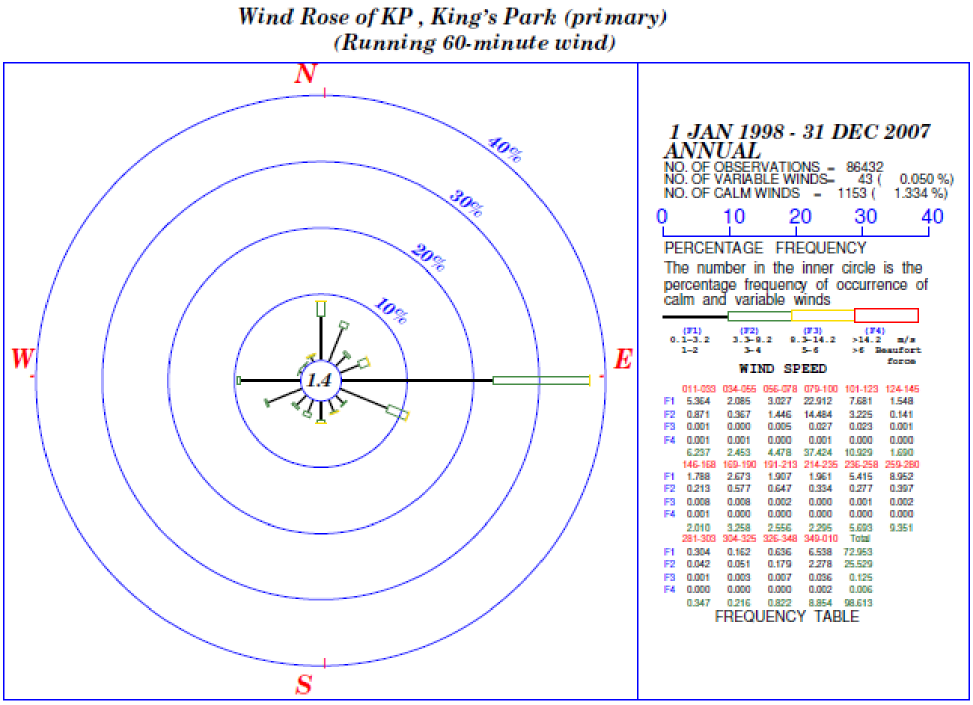


Figure 3.6 Wind rose of King's Park from 1998 to 2007 (annual).

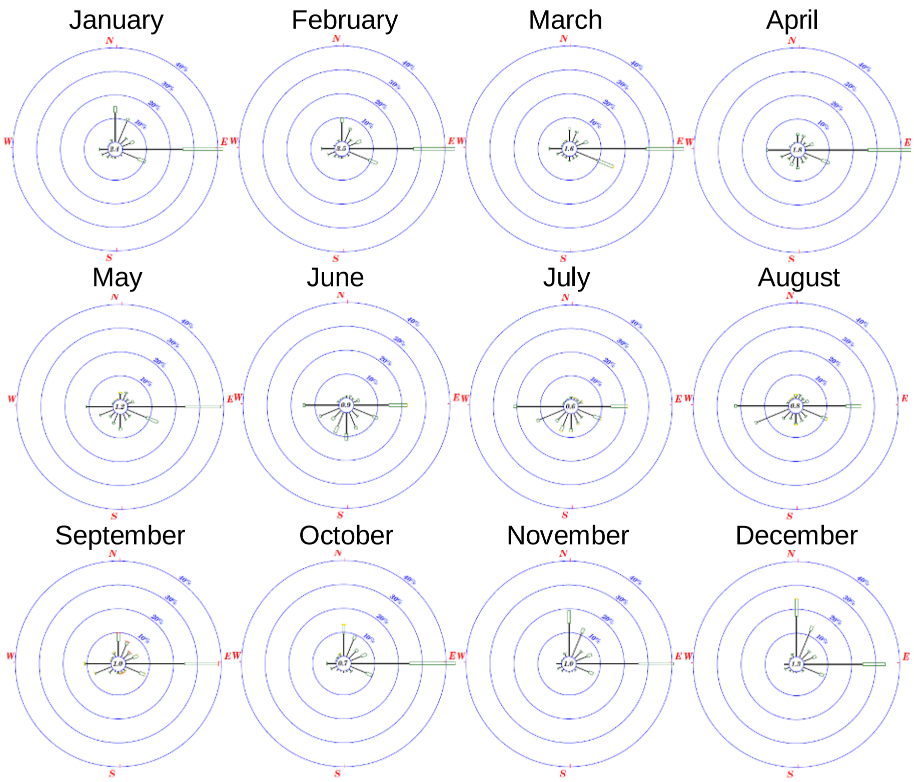


Figure 3.7 Monthly wind roses of King's Park from 1998 to 2007.

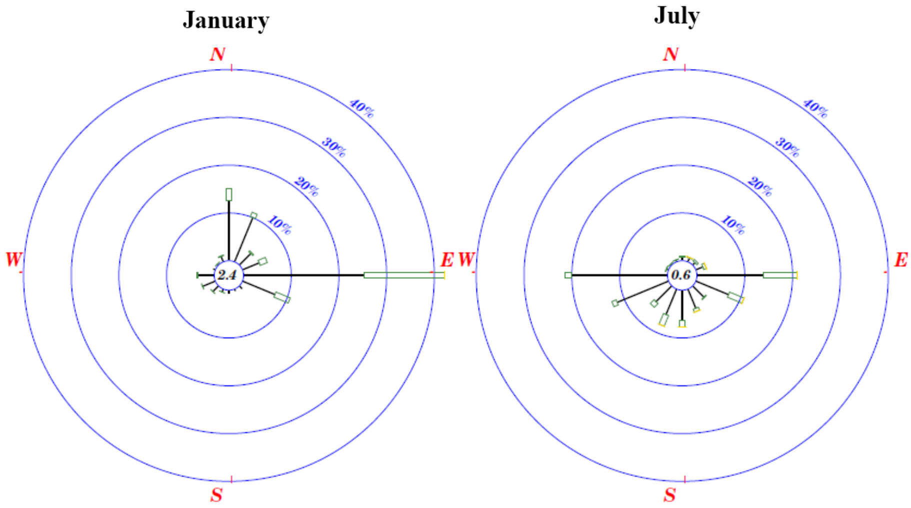


Figure 3.8 Wind roses of King's Park from 1998 to 2007 (Jan and July).

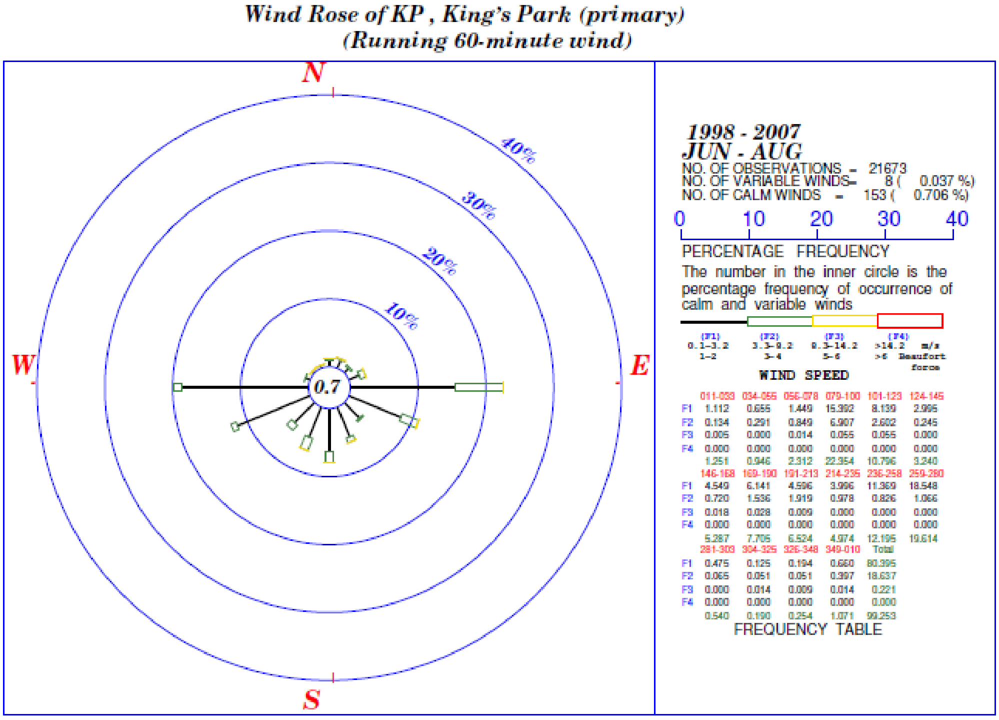


Figure 3.9 Wind rose of King's Park from 1998 to 2007 (Jun to Aug, summer).

3.6 Noting the limitation of the data of Waglan Island mentioned in para. 3.2, wind characteristics from the web-based database system provided by PlanD has also been referenced[1]. Data from five locations (x:079 y:041, x:080 y:041, x:079 y:040, x:80 y:040, x:079 y:039), which covers the YMT Area, were simulated at 200m, 300m and 500m above the ground (Figures 3.10 to 3.14). These locations, according to the application of Regional Atmospheric Modeling System (RAMS), were selected to reflect the general wind patterns within the YMT Area induced by topography. All five locations show similar wind availability. Annual and summer prevailing wind directions are summarised in Table 1. In general, the RAMS wind data from PlanD's website are consistent with that measured by HKO stations, but the RAMS data is limited to reflect the wind availability at higher elevations at or above 200m.

[1] http://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html

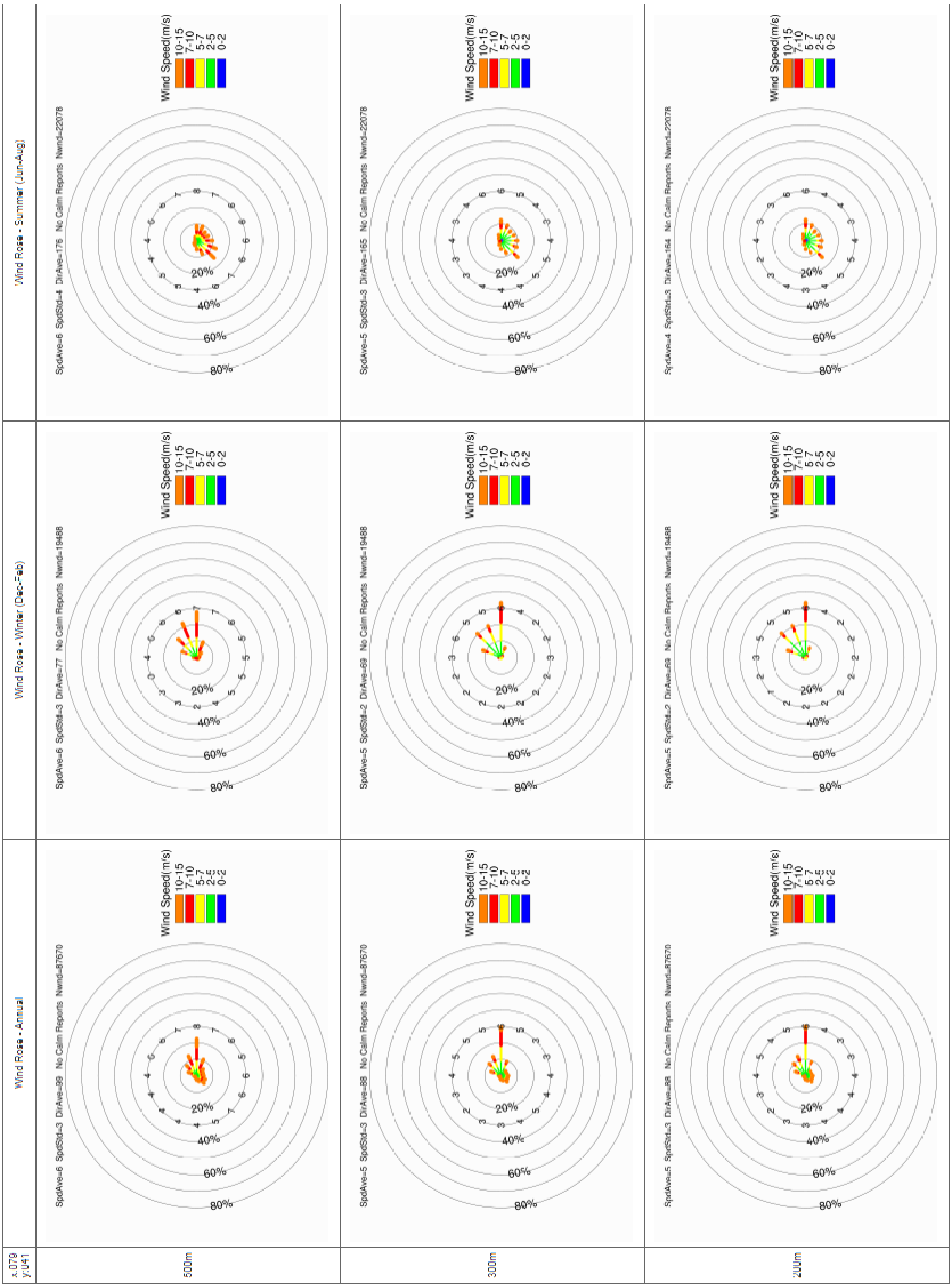


Figure 3.10 The wind data provided by PlanD for the YMT Area (x:079 y:041).

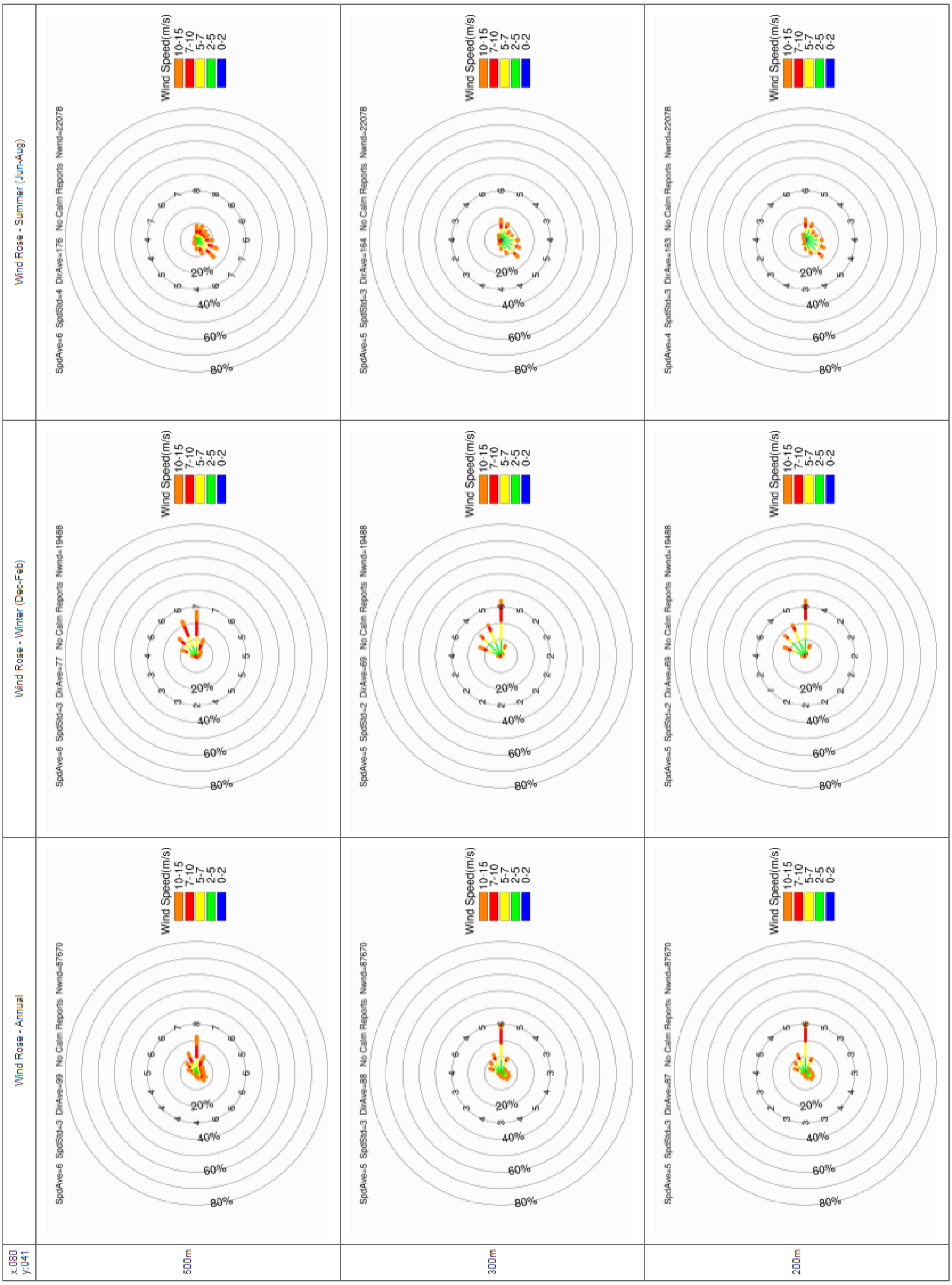


Figure 3.11 The wind data provided by PlanD for the YMT Area (x:080 y:041).

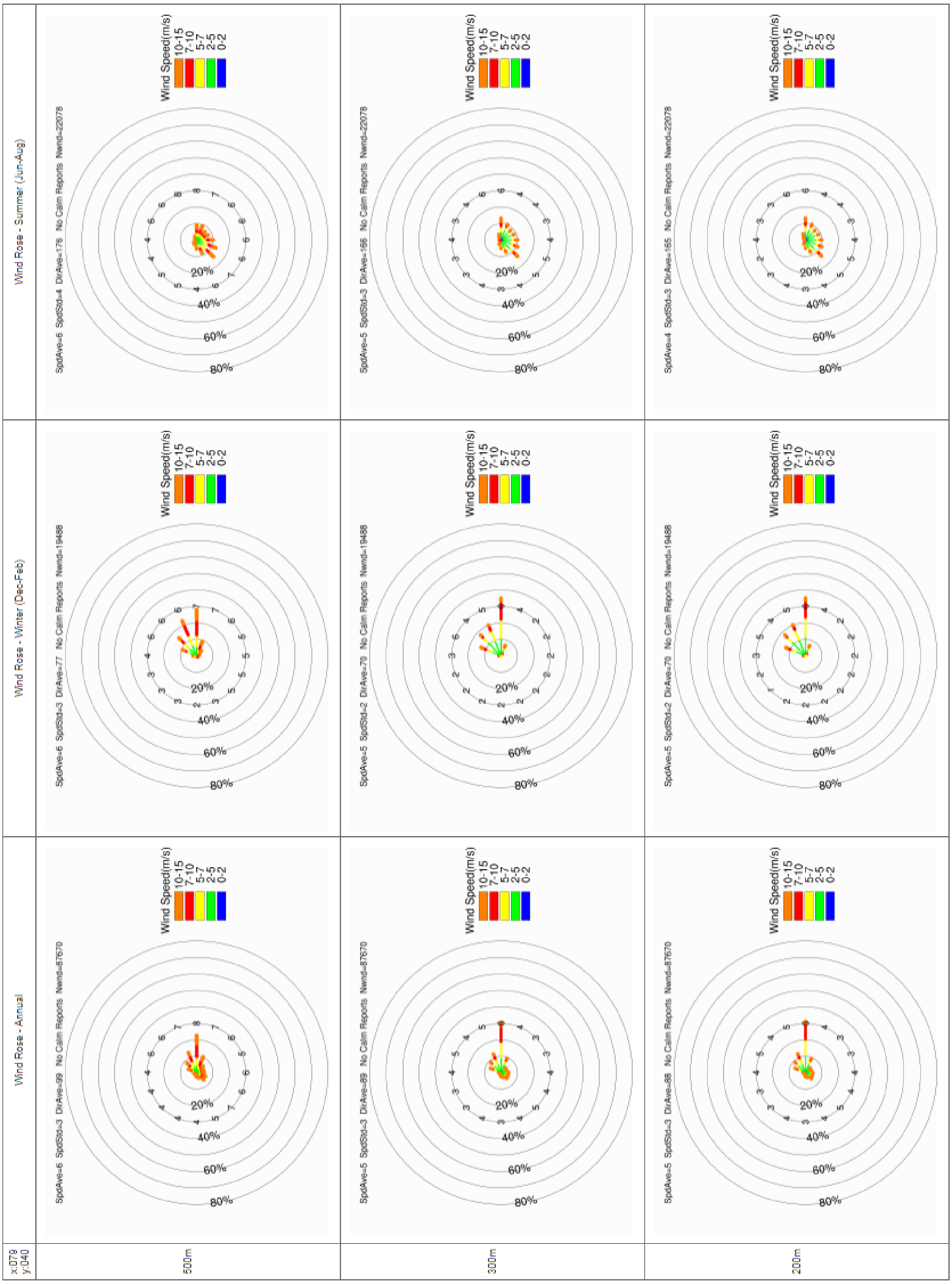


Figure 3.12 The wind data provided by PlanD for the YMT Area (x:079 y:040).

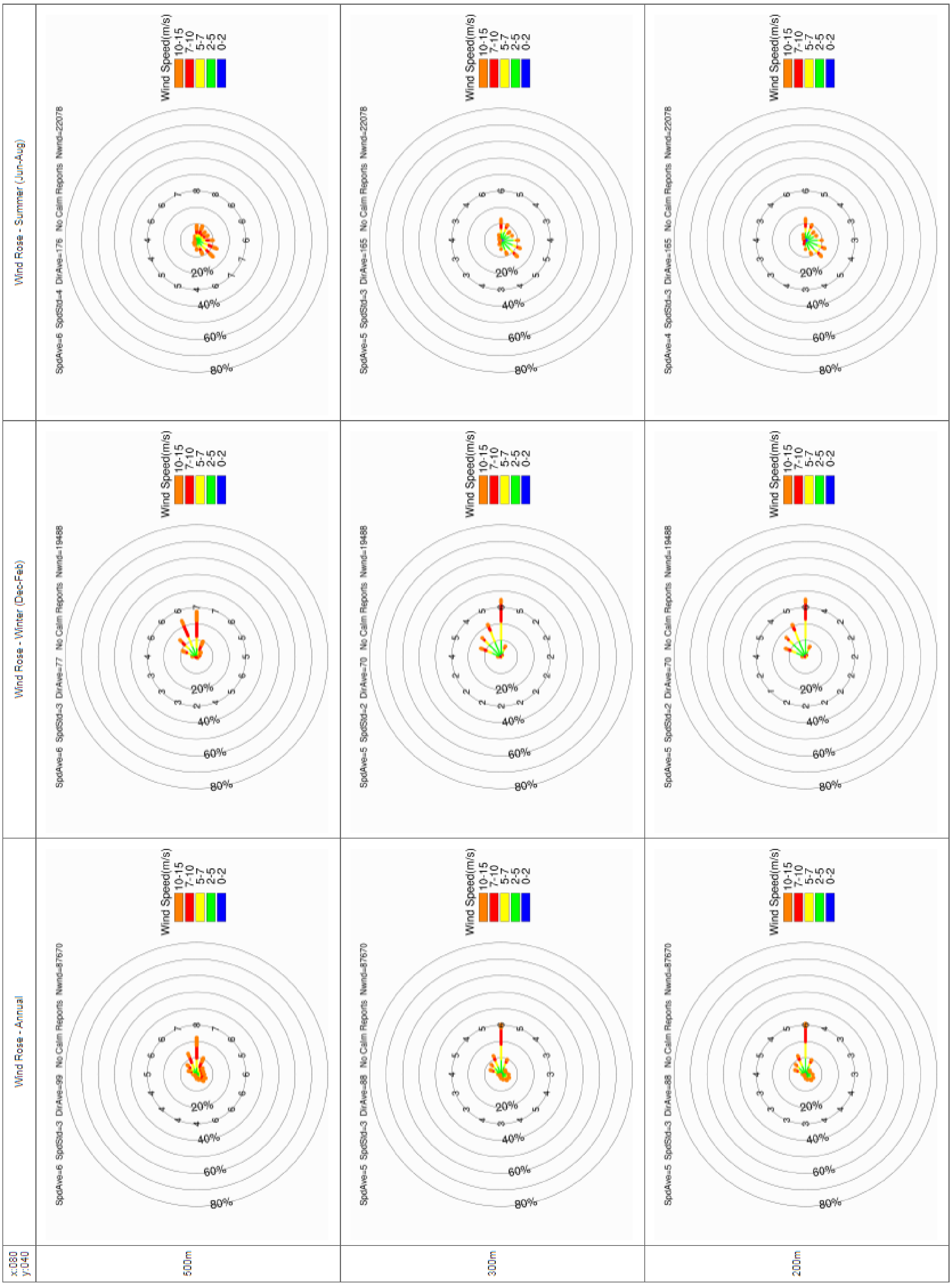


Figure 3.13 The wind data provided by PlanD for the YMT Area (x:080 y:040).

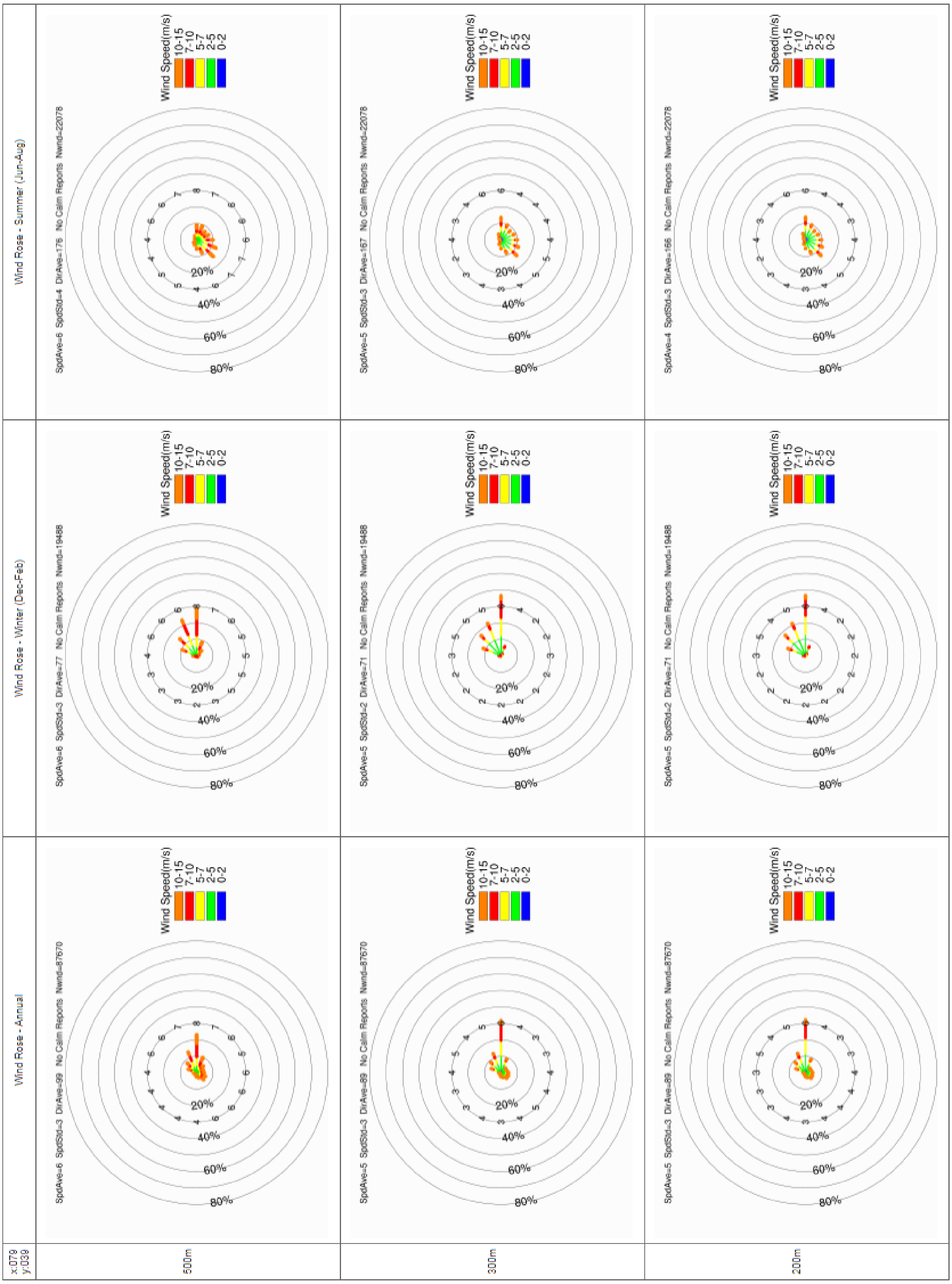


Figure 3.14 The wind data provided by PlanD for the YMT Area (x:079 y:039).

3.7 With reference to the previous AVA study for YMT area in October 2010[1], wind availability data were also obtained from MM5 simulation performed by HKUST. Based on simulated wind availability data, annual prevailing winds are identified from the northeast and east, while summer prevailing winds are identified from the east, southwest, southeast and the southerly quarters (Figure 3.15 and 3.16).

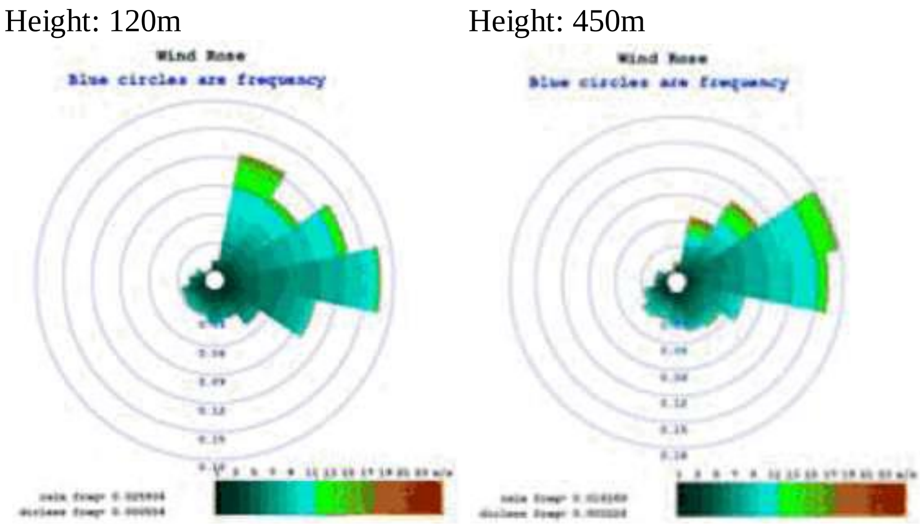


Figure 3.15 Annual wind rose based on MM5 simulation (taken from AVA EE 2010).

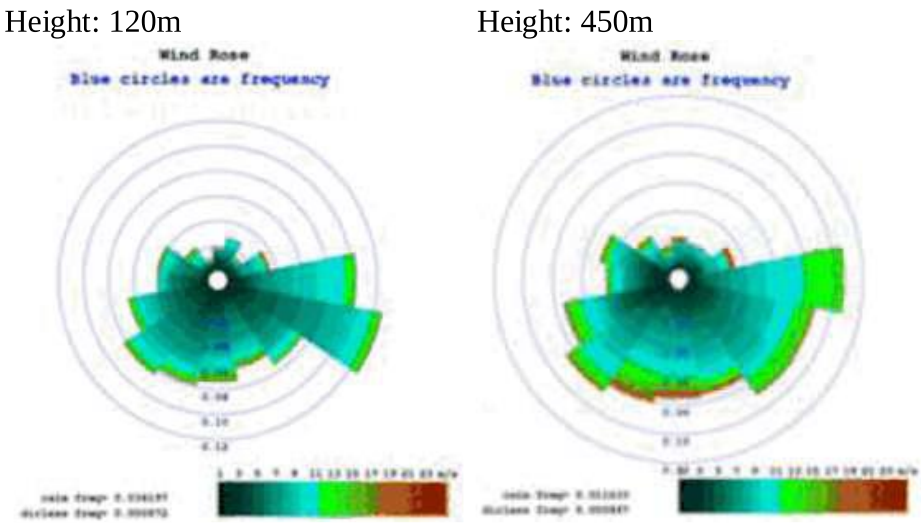


Figure 3.16 Summer wind rose based on MM5 simulation (taken from AVA EE 2010).

[1] https://www.pland.gov.hk/pland_en/info_serv/ava_register/ProjInfo/AVRG56_AVA_FinalReport.pdf

3.8 In summary, based on all available wind data (Table 1), it can be concluded that the prevailing annual winds mainly come from the E, ENE, and W[1]. Prevailing summer winds mainly come from the SW, E, and W[1], with some wind components from the southerly quarters (Figure 3.19).

Table 1 Summary of Prevailing Wind Directions (the three most frequent directions, listed in the order of prevalence).

Data	Location	Height (m)	Annual wind	Summer wind
HKO station	King's Park (KP)	90	E, ESE, W	E, W, WSW
RAMS (from PlanD)	x:079 y:041	200	E, ENE, NE	SW, E, S
		300	E, ENE, NE	SW, E, S
		500	E, ENE, ESE	SW, SSW, ESE
	x:080 y:041	200	E, ENE, NE	SW, E, SSW
		300	E, ENE, ESE	SW, E, SSW
		500	E, ENE, ESE	SW, SSW, ESE
	x:079 y:040	200	E, ENE, NE	SW, E, S
		300	E, ENE, NE	SW, E, S
		500	E, ENE, ESE	SW, SSW, S
	x:080 y:040	200	E, ENE, ESE	SW, E, SSW
		300	E, ENE, ESE	SW, E, SSW
		500	E, ENE, ESE	SW, SSW, S
	x:079 y:039	200	E, ENE, NE	E, SW, SSW
		300	E, ENE, ESE	E, SW, SSW
		500	E, ENE, ESE	SW, SSW, S
MM5 simulation (from AVA EE 2010)		120	E, ENE, NNE	ESE, E, SW
		450	ENE, E, NE	E, SE, SW

[1] Though W wind is only detected at the King's Park HKO station, it is given more consideration as the station is within the study area and is nearest to the pedestrian level among all available wind data sources. W wind is also one of the land-sea breeze components.

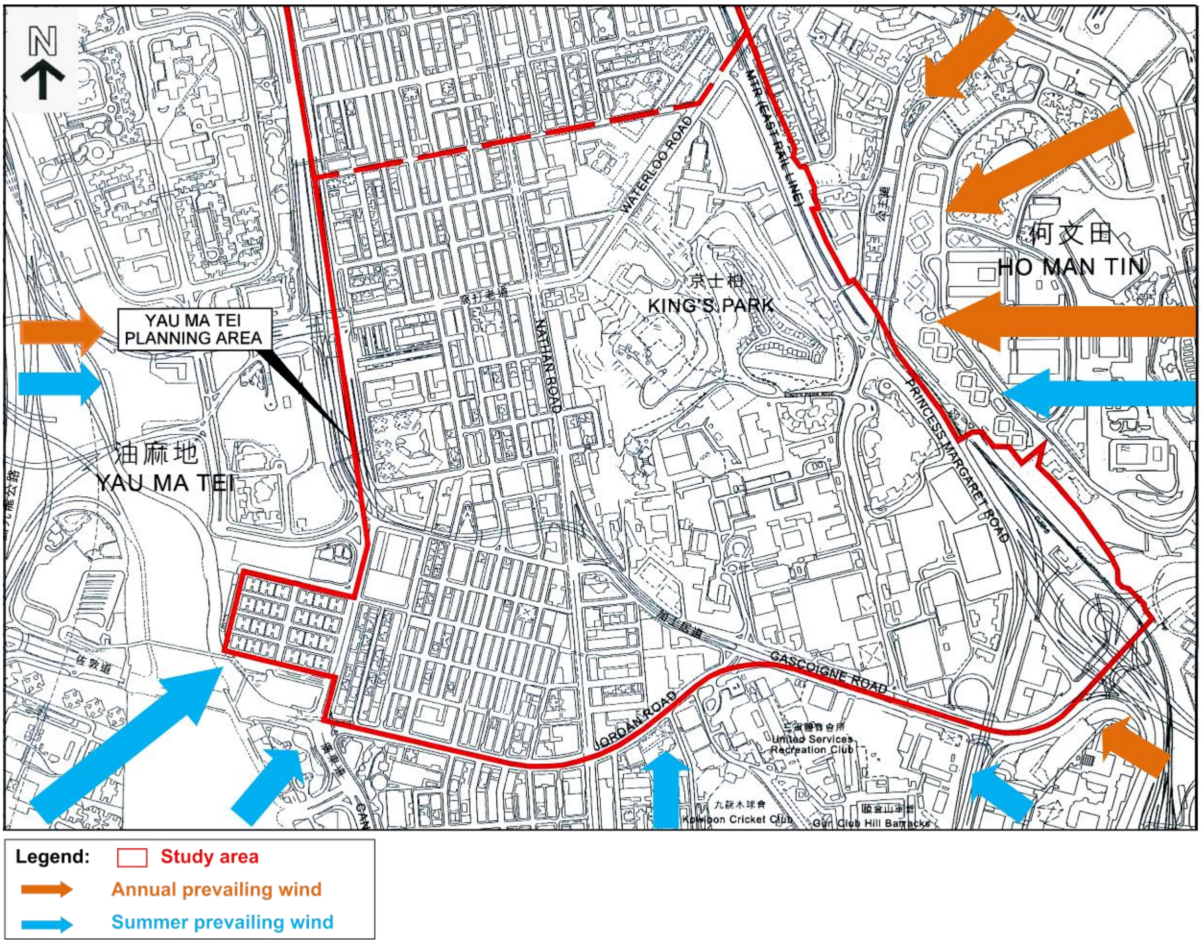


Figure 3.19 A summary of the prevailing winds for YMT Area (arrow sizes indicate the probabilities of corresponding wind directions).

4.0 Topography, Land-Sea Breezes and the Wind Environment

4.1 YMT Area is located in the central part of Kowloon Peninsula, between the Mong Kok (to the north) and Tsim Sha Tsui (to the south) OZPs. The western half of YMT Area has a flat topography (elevation up to 10m), while the eastern half of YMT Area is generally on higher grounds, with an elevation of around 65m at the King's Park meteorological station. To the east of YMT Area, there is a small hill in Ho Man Tin with an elevation of around 100m. The New YMT Typhoon Shelter and the western Victoria Harbour are around 600m to the west and southwest of YMT Area, respectively (Figure 4.1).

4.2 YMT Area is generally unaffected by katabatic (downhill) air movements from neighbouring topography. The summer prevailing wind mainly from the SW and southerly quarters can reach YMT Area unobstructed by topography. However, the small hill in Ho Man Tin may block easterly winds and create some turbulence on its leeward side. Annual and summer prevailing wind from the E needs to flow around Ho Man Tin, increasing the wind flow reaching YMT Area from the ENE and ESE directions (Figure 4.1), especially for wind at pedestrian level.

4.3 The YMT Area is subjected to thermally-induced weak air movements caused by the land-sea component at the coastline to the west and southwest of the YMT Area. Coupled MM5/CALMET simulations of the Hong Kong wind field show convergence over the Kowloon Peninsula (Figure 4.2). Observed winds also confirm wind flow from the SW and W into the western Kowloon Peninsula. These sea breezes may penetrate further inland via the east-west streets in YMT Area. With reference to the land-sea breeze formation mechanism (see Figure A-1 in Appendix A), the influence of sea breezes is expected to be more significant in the afternoon, especially under weak wind conditions.

4.4 Based on all available wind information and taking into account of the topography and land-sea breezes, it can be concluded that the major axes for pedestrian level wind in YMT Area are W, NE, and SE. This is not in contradiction with the wind directions identified in the previous EE on AVA for YMT Area[1].

[1] https://www.pland.gov.hk/pland_en/info_serv/ava_register/ProjInfo/AVRG56_AVA_FinalReport.pdf

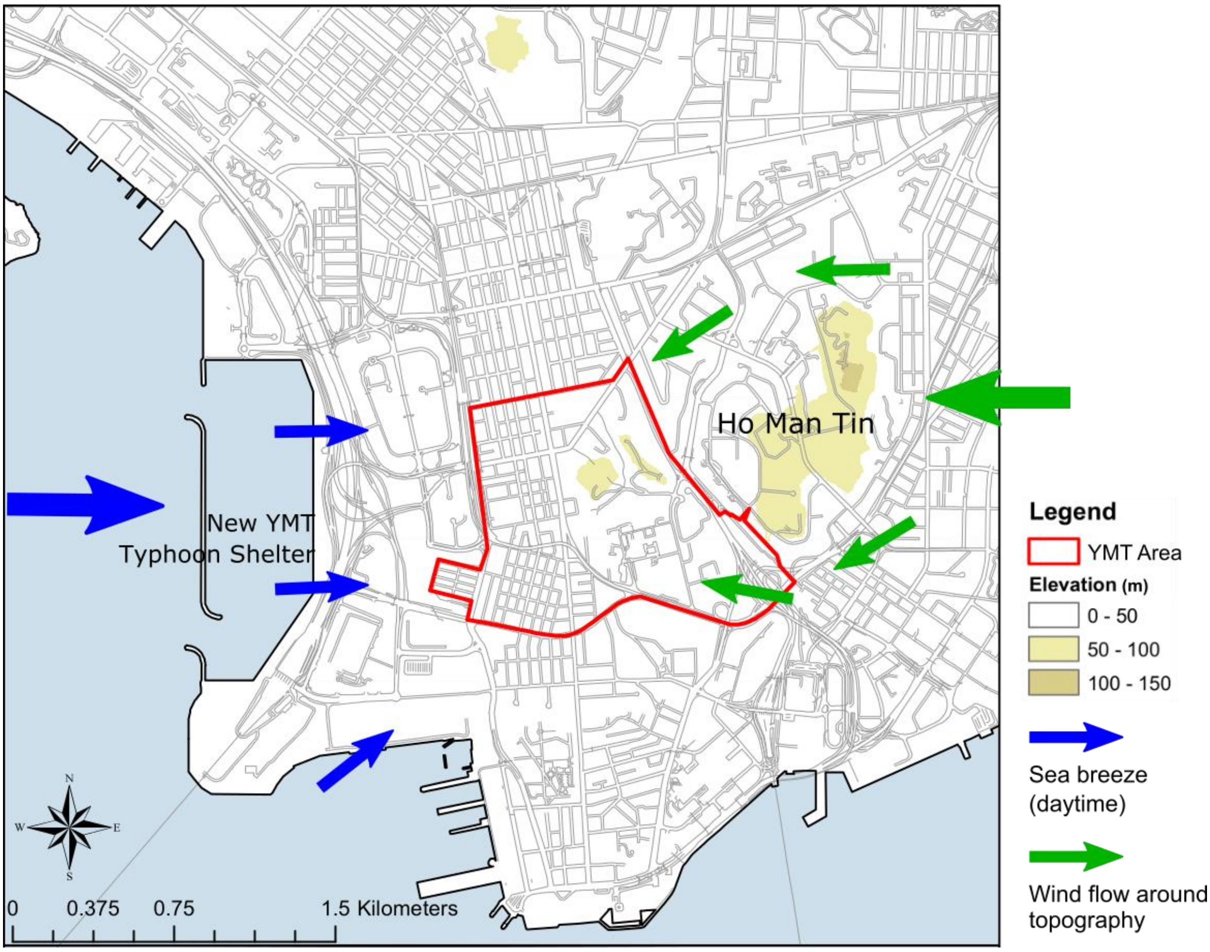


Figure 4.1 Wind flow affected by surrounding topography and sea breeze from the west for YMT Area.

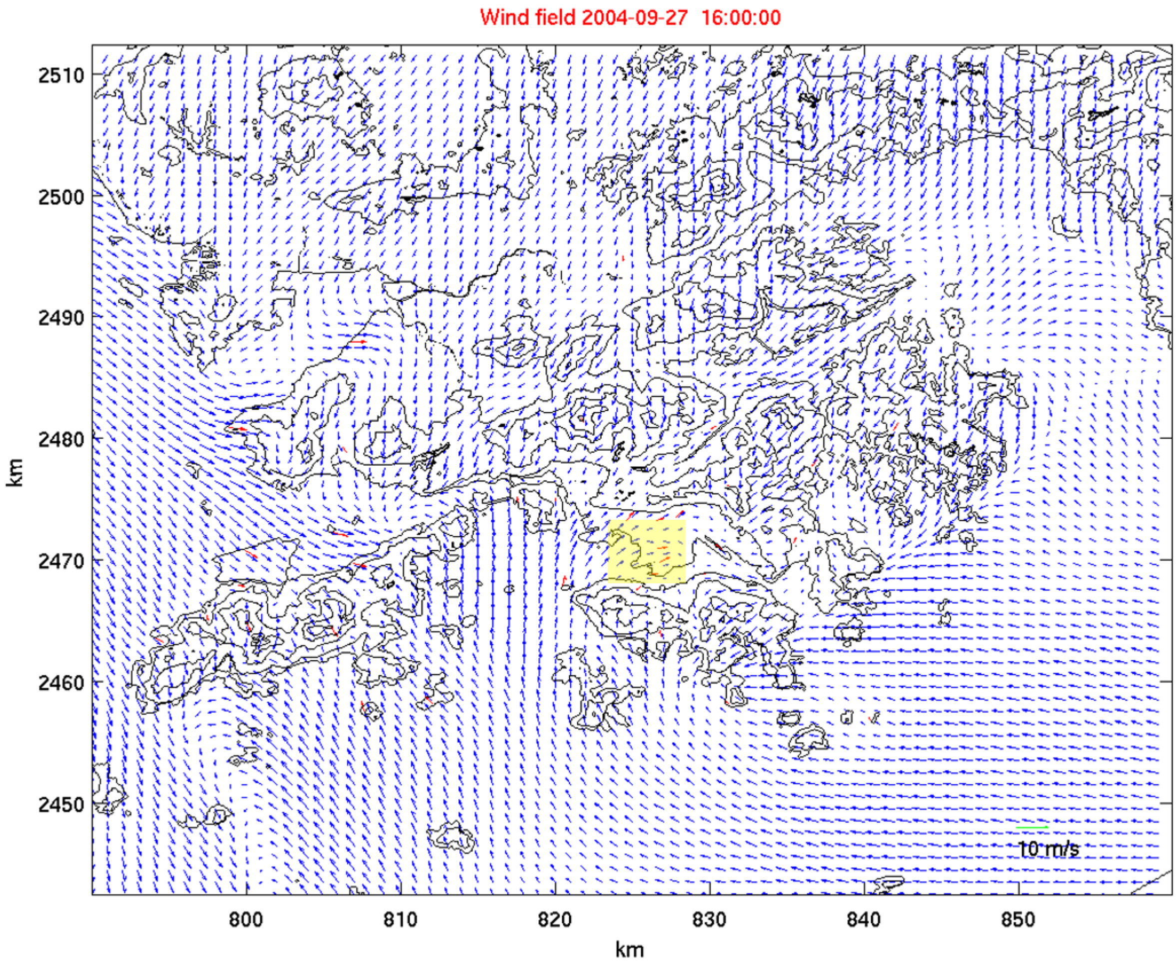


Figure 4.2 Observed winds (red arrows) vs. coupled MM5/CALMET simulated winds with 100m x 100m resolution at 10m above ground, following the contours (area of interest highlighted in yellow).

Urban Morphology and Major Ventilation Pathways

4.5 YMT Area can be divided into two parts with distinct characteristics: the eastern half (bounded by Waterloo Road, Nathan Road, Gascoigne Road, and Wylie Road/Princess Margaret Road) mainly consists of “Open Space” (“O”) and “Government, Institution or Community” (“G/IC”) sites on higher grounds, while dense urban building clusters concentrate on the western half which is relatively flat.

4.6 Large areas of open spaces in the eastern half of YMT Area is made up of King’s Park (including a “Green Belt” (“GB”) site), and various sports and recreation clubs. Built-up sites include Queen Elizabeth Hospital, Wah Yan College Kowloon, Methodist College, research offices of Hong Kong Polytechnic University, and scattered residential developments (“Residential (Group B)” (“R(B)”) sites including King’s Park Hill, King’s Park Villa, Parc Palais, Wylie Court) (Figure 4.4).

4.7 The western half of YMT Area is densely built with narrow streets and rectangular blocks aligned roughly N-S, most of which are ageing tenement buildings. These building sites are mainly zoned as “Residential (Group A)” (“R(A)”), “R(A)1” (Prosperous Garden), and “R(A)2” (the Man’s Building Area in the southwest corner of YMT Area), with commercial developments mainly along Nathan Road. The majority of building lots are small (site areas smaller than 400m^2).

4.8 Urban area relies on major roads, open space and low-rise building areas (provided by “O” and “G/IC” sites) to form breezeways and air paths. Roads connecting open spaces and low-rise building areas are important to facilitate air movement within the urban environment. Roads/streets parallel or within 30 degrees from the prevailing wind directions also form effective air paths. With consideration of the immediate surrounding built environment of YMT Area and the important wind directions (W, NE, and SE), the major breezeways and air paths are identified and shown in Figure 4.3.

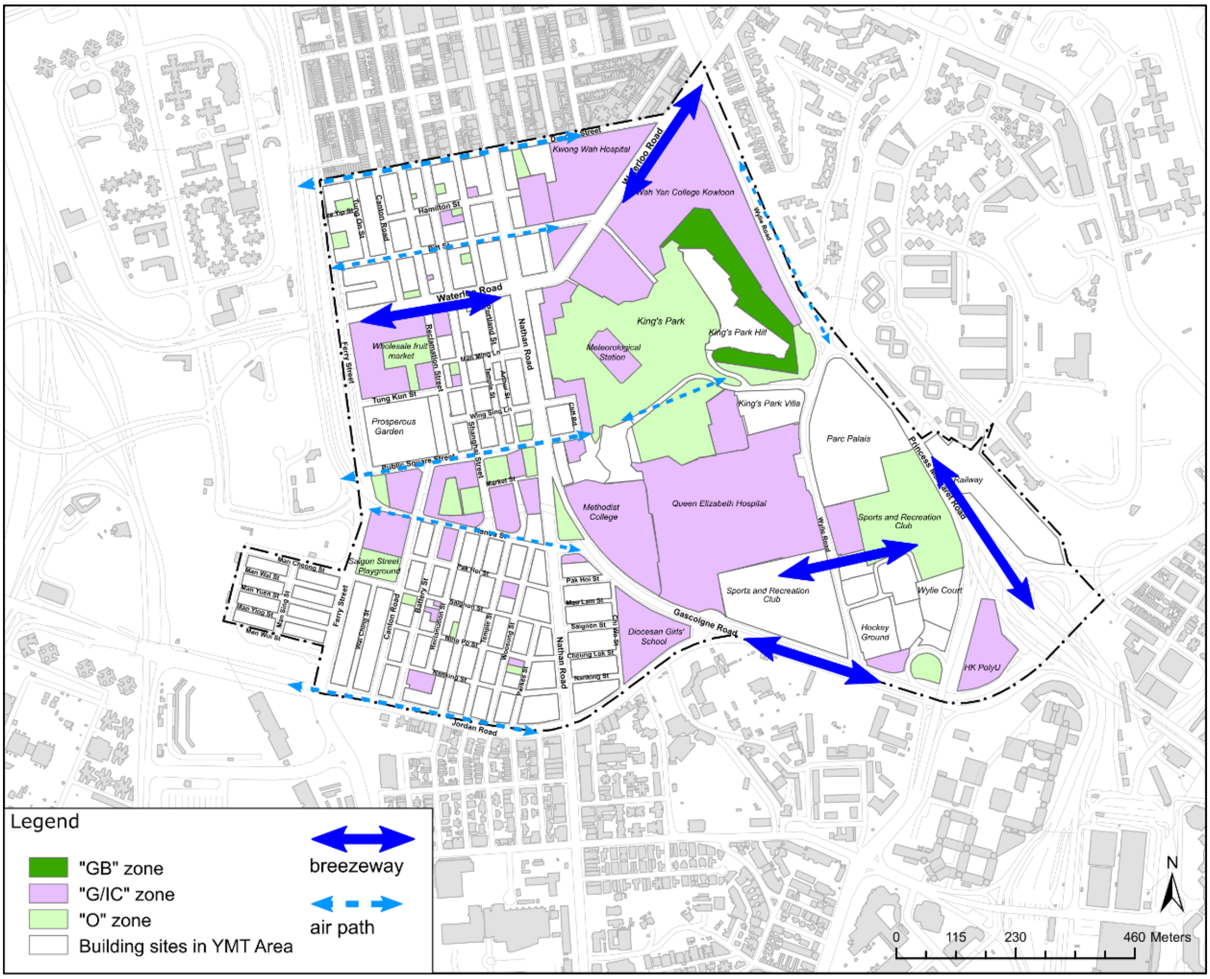


Figure 4.3 Major ventilation pathways identified in YMT Area.

4.9 When wind comes from the W and WSW (Figure 4.4), major roads such as Waterloo Road, Public Square Street, and Jordan Road act as air paths to allow wind penetration into YMT Area. Other streets (e.g. Pitt Street) with a roughly E-W orientation can facilitate air movements through YMT Area. Westerlies can also enter through the group of "O" and "G/IC" sites near the Yau Ma Tei Wholesale Fruit Market and those on the two sides of Kansu Street. However, it is more difficult for wind to flow into the narrow streets (e.g. Saigon Street, Man Wai Street, Man Yuen Street, Man Ying Street) in the southwestern part of YMT Area. Wind flow is also blocked by two long building clusters along Ferry Street and Canton Road.

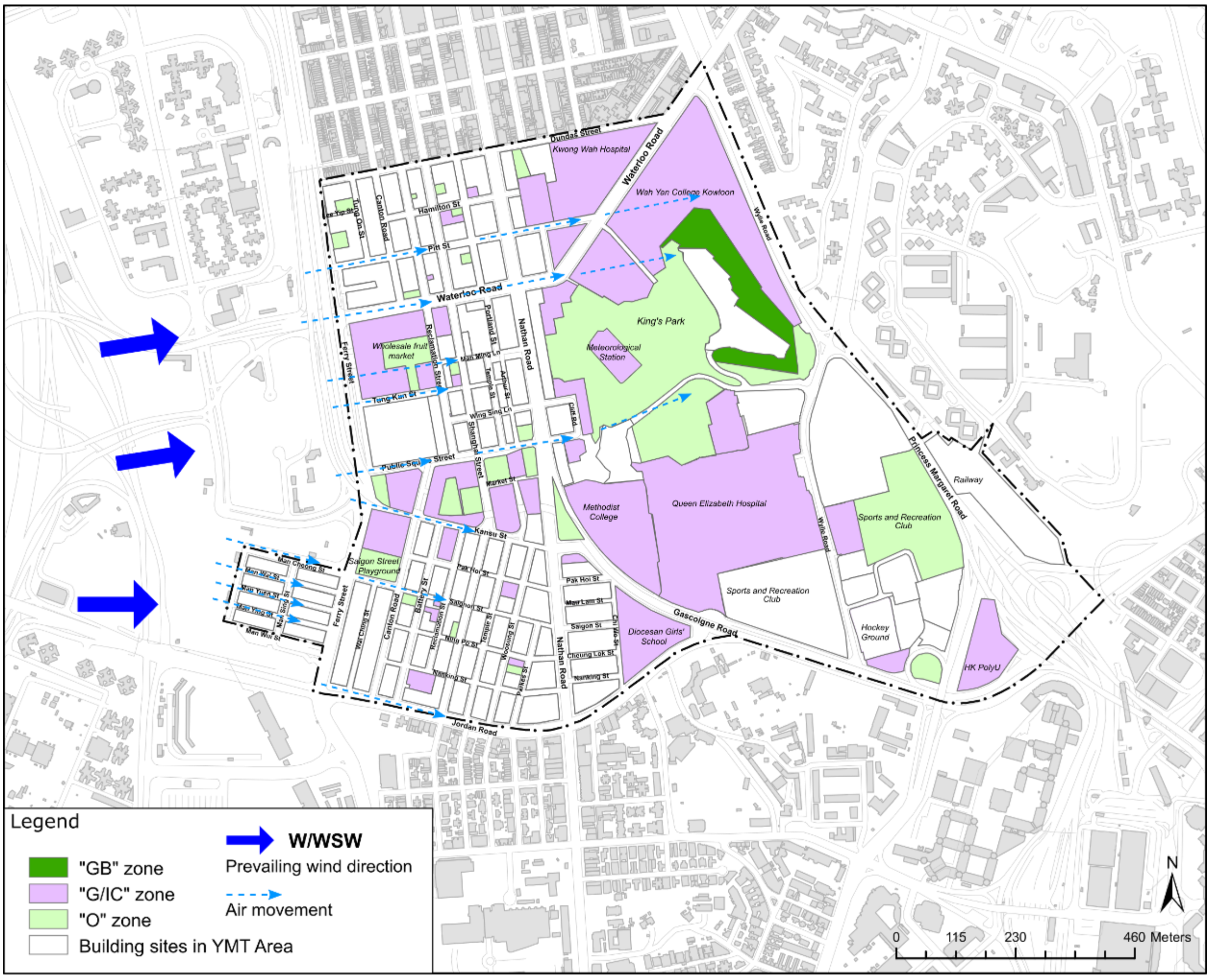


Figure 4.4 Air movement in YMT Area when wind comes from the W and WSW.

4.10 When wind comes from the NE (Figure 4.5), it flows through the northern part of YMT Area via air paths formed by Waterloo Road and Dundas Street, and open spaces at King's Park connected with Public Square Street. Wind can also flow freely through open spaces provided by the sports and recreation clubs in the southeastern part of YMT Area to reach Jordan Road. Some northerly wind can enter Wylie Road after flowing along Princess Margaret Road. However, the long commercial building cluster east of Nathan Road obstructs the flow of contour-following wind down the slopes of King's Park and prevents easterlies from reaching the western part of YMT Area.

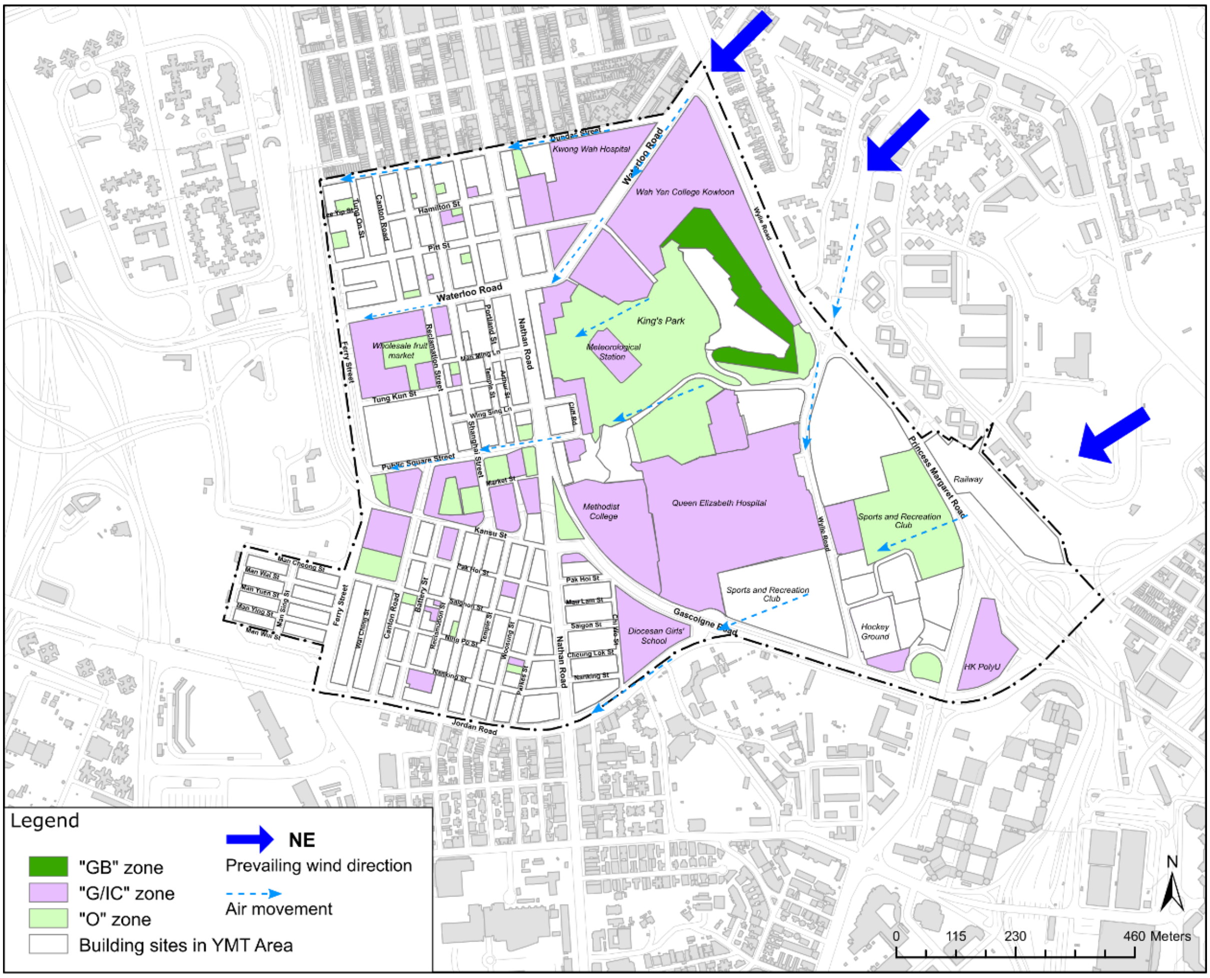


Figure 4.5 Air movement in YMT Area when wind comes from the NE.

4.11 When wind comes from the E (Figure 4.6), it passes through King's Park and the relatively open and low-rise building areas of Wah Yan College Kowloon and True Light Girls' College to reach Pitt Street, Waterloo Road, and Public Square Road, which are roughly oriented E-W. Wind can also flow freely through open spaces provided by the sports and recreation clubs in the southeastern part of YMT Area to reach Jordan Road. However, the easterlies are, again, blocked by the long commercial building cluster east of Nathan Road to reach the area in between Waterloo Road and Public Square Road.

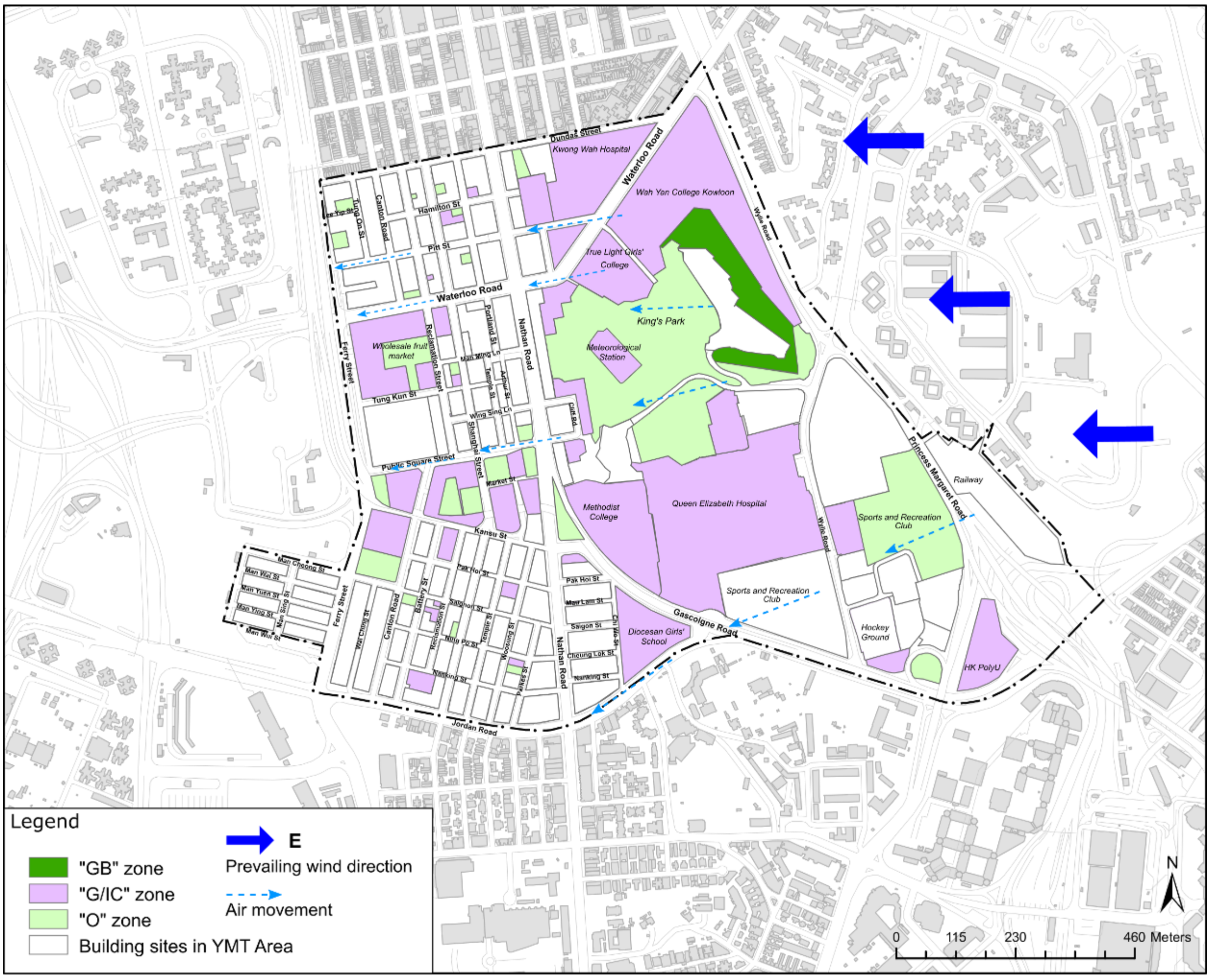


Figure 4.6 Air movement in YMT Area when wind comes from the E.

4.12 When wind comes from the SE (Figure 4.7), it flows along Gascoigne Road but air movement may be hindered at bottleneck along Kansu Street near Nathan Road and thus limiting wind penetration through YMT Area. Wind can also flow along Jordan Road at the southernmost part of YMT Area. Another major air path is formed by Princess Margaret Road and the connecting section of Wylie Road along the eastern border of YMT Area.

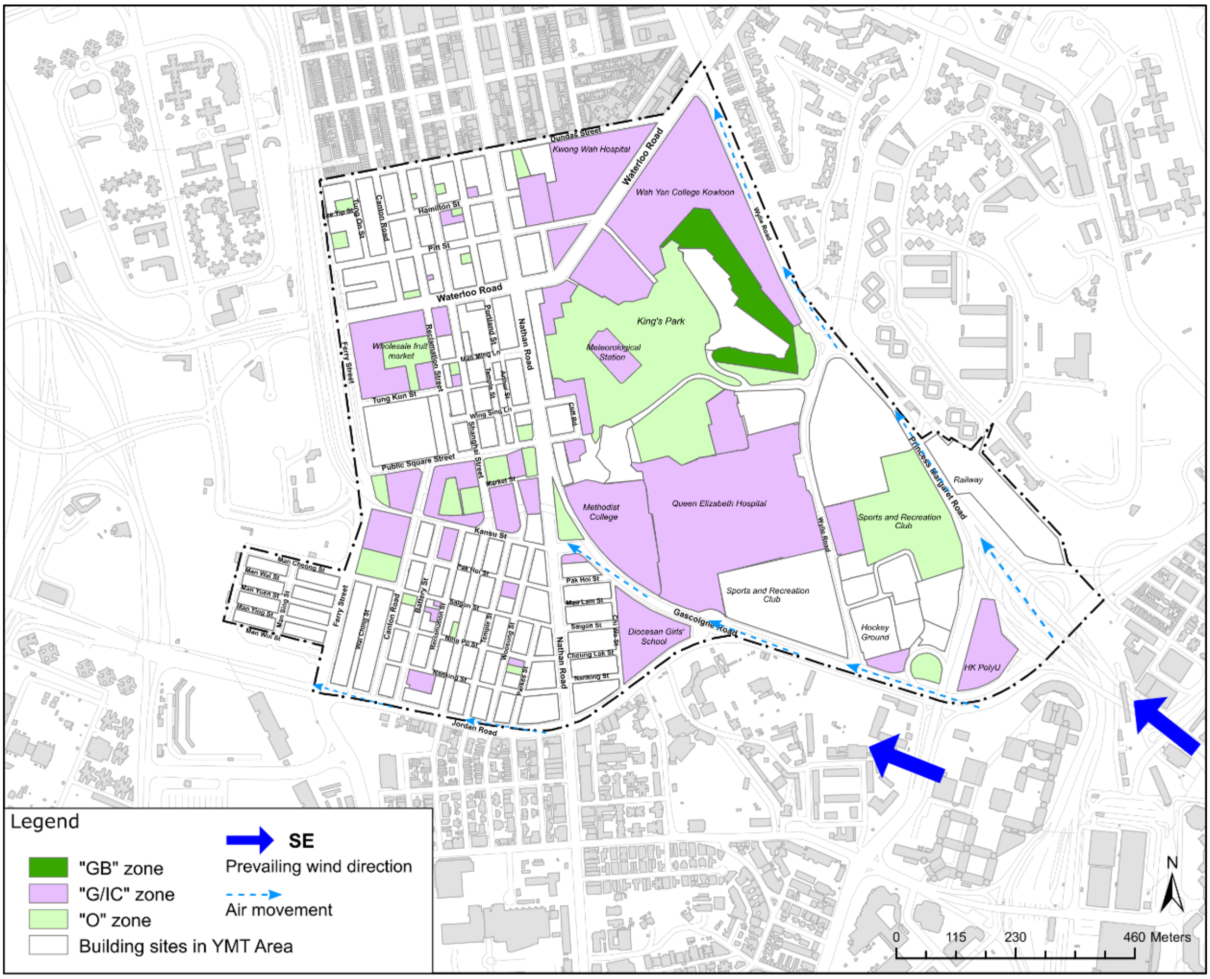


Figure 4.7 Air movement in YMT Area when wind comes from the SE.

4.13 Available wind data also show some wind components from the S for YMT Area. Although the wind flow reaching YMT Area from the S is greatly reduced by the rather dense and tall built-up areas in Tsim Sha Tsui upwind of YMT Area, major roads/streets along the N-S orientation, especially Nathan Road, provide permeability for air movements by diffusion within YMT Area. It is also possible to have some air movements along Ferry Street, Wylie Road, and other narrower streets (Figure 4.8).

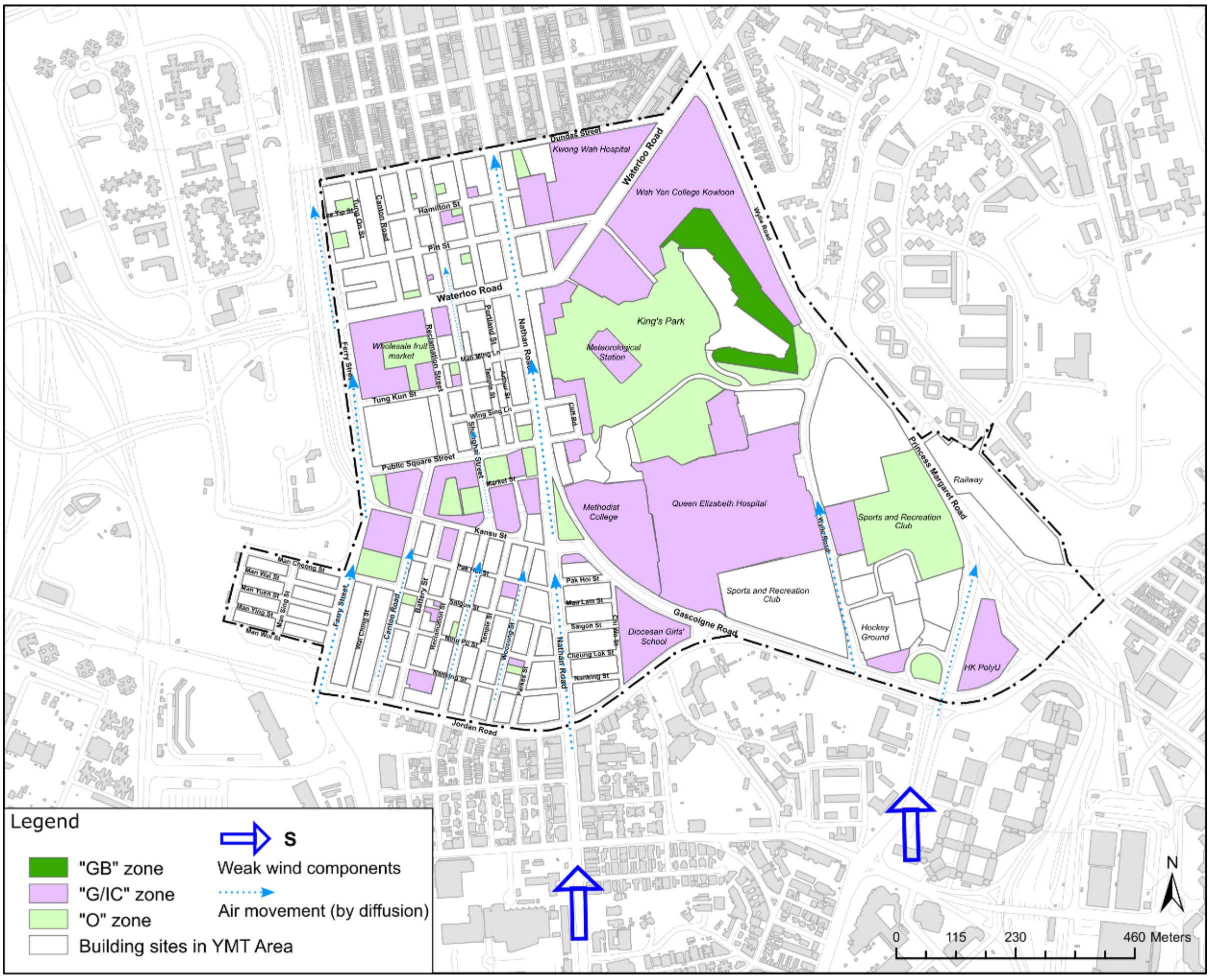


Figure 4.8 Air movement in YMT Area when weak wind comes from the S.

5.0 Baseline Scenario

5.1 The Baseline Scenario refers to the scenario under draft Yau Ma Tei OZP No. S/K2/22 with BHRs, NBA, BG, and SB requirements as imposed on the then draft Yau Ma Tei OZP No. S/K2/21.

General characteristics of YMT Area

5.2 YMT Area is located in the central part of Kowloon Peninsula with higher grounds in its eastern part. It is subjected to thermally-induced weak air movements caused by the land-sea component at the coastline to the west of the area. Annual prevailing winds come from the ENE and E, while summer prevailing winds mainly come from the SW. Important wind directions for pedestrian level wind in YMT Area are WSW, NE, and SE. The wind environment of YMT Area is detailed in Sections 3 and 4.

5.3 The eastern half of YMT Area consists of King's Park (including a "GB" site) and other large open spaces, as well as schools and hospitals with relatively lower BHs. It is bounded by Nathan Road on the east, Wylie Road and Princess Margaret Road on the west, and two diagonal main roads, namely Waterloo Road and Gascoigne Road.

5.4 The western half of YMT Area is made up of mostly residential sites with areas smaller than 400m^2. It has a largely regular street grid with major roads/streets oriented roughly north-south (e.g. Nathan Road, Portland Street, Woosung Street, Battery Street, Reclamation Street, Canton Road, Ferry Street) and east-west (e.g. Dundas Street, Pitt Street, Waterloo Road, Tung Kun Street, Public Square Street, Kansu Street, Saigon Street, Nanking Street, Jordan Road). The streets to the south of Kansu Street are generally narrow, with widths less than 15m. There are two main clusters of "O" and "G/IC" sites near the Yau Ma Tei Wholesale Fruit Market and in between Public Square Street and Kansu Street.

5.5 When wind comes from the WSW and W, it flows into YMT Area through roads/streets parallel or within 30 degrees from these directions in the western half of YMT Area. When wind comes from the easterly quarters, it is welcomed by the open spaces and main roads in the eastern half of YMT Area. When wind comes from the S, the wind flow reaching YMT Area is greatly reduced by the built-up areas in Tsim Sha Tsui to the immediate south of YMT Area.

5.6 In recent years, based on the available information provided by the Government, at least half of the newly approved building plans in the past 5 years have site areas larger than 400m^2.

Building Height Restrictions

5.7 Existing BHRs are as shown in Figure 5.1. According to the information provided by PlanD, although the development restrictions including BHRs for all "C", "R(A)", "R(B)", "G/IC" and "Other Specified Uses" ("OU") zones on the OZP have been reviewed, revised BHRs are only proposed for the “C”, “R(A)”, and “R(A)2” zones in YMT Area.

5.8 For “OU” and “G/IC” zones, upon completion of the review of development restriction, it is recommended that their BHs will remain unchanged. In addition, areas zoned “O” and “GB”, which aim to provide spatial and visual relief amidst the densely built urban environment and to conserve existing natural environments, are not the subject of the current review of development restrictions.

5.9 All “C” sites in YMT Area have a BHR of 100mPD in the Baseline Scenario.

5.10 “R(A)” sites in YMT Area generally have a two tier BHR of 80/100mPD (100mPD is allowed for site with an area larger than 400m^2), except for the “R(A)1” site at Prosperous Garden and the eight “R(A)2” sites at the Man’s Building Area in the southwest corner of YMT Area, which have a BHR of 80mPD.

Non-building areas, Building Gaps, and Building Setbacks

5.11 NBAs, BGs, and SB requirements specified in the Baseline Scenario of YMT Area are summarised in Figure 5.2.

5.12 A NBA, as shown on the Plan of the YMT OZP, with an area of around 1800m^2, is designated at the “OU” annotated “Residential Development with Historical Building Preserved” zone at the junction of Portland Street and Man Ming Lane. It is currently a public open space managed by the Leisure and Cultural Services Department. No structure is allowed from ground level.

5.13 SB requirements are stipulated in the Notes of the YMT OZP. A minimum SB of 6m from the lot boundary above 15m measured from mean street level is required for the “C” site abutting the northern curb of Kansu Street. Besides, SB requirements are also imposed for buildings along Parkes Street, Woosung Street (to the north of Saigon Street), Arthur Street, and Portland Street. A minimum SB of 3m from the lot boundary above 15m measured from mean street level is required for tower developments at these sites.

5.14 Apart from the statutory requirements as stated in paragraphs 5.12 and 5.13 above, BGs, as indicated in the Explanatory Statement (ES) of the YMT OZP, are defined at four locations: 1) a 15m-wide BG above podium level aligned with Man Ming Lane across the buildings at 502-512 Nathan Road, 2) two 15m-wide BGs above podium level aligned with Hamilton Road across the two “R(A)” zones bounded by Canton Road, Pitt Street, Ferry Street, and Dundas Street, 3) a 16m-wide BG above podium level aligned with Wing Sing Lane traversing the residential block to the east of Prosperous Garden, 4) four strips of 10m-wide BGs above podium level aligned with Ning Po Street and Nanking Street across the two “R(A)” zones bounded by Canton Road, Jordan Road, Ferry Street, and Saigon Street.

5.15 The potential impacts on air ventilation of the above BHRs, NGAs and SBs requirements as stated in the Notes of the OZP, as well as the BGs requirement as indicated in the ES of the OZP, have been evaluated in the previous EE on AVA for YMT Area[1]. This forms the Baseline Scenario of the current AVA EE. In subsequent sections, the Initial Scenario will be compared and evaluated against this Baseline Scenario.

[1] https://www.pland.gov.hk/pland_en/info_serv/ava_register/ProjInfo/AVRG56_AVA_FinalReport.pdf

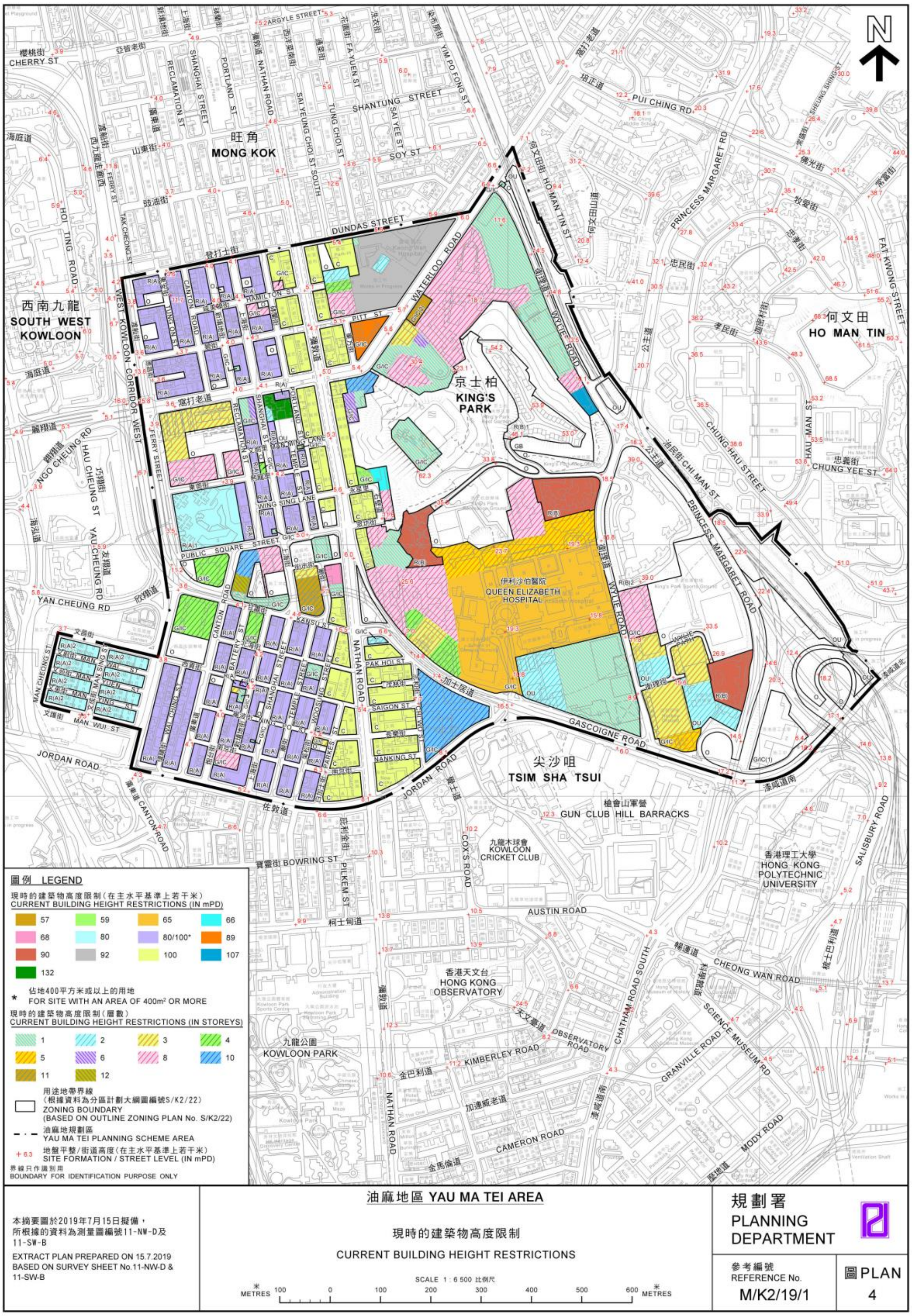


Figure 5.1 Current BHRs of the Baseline Scenario for YMT Area.

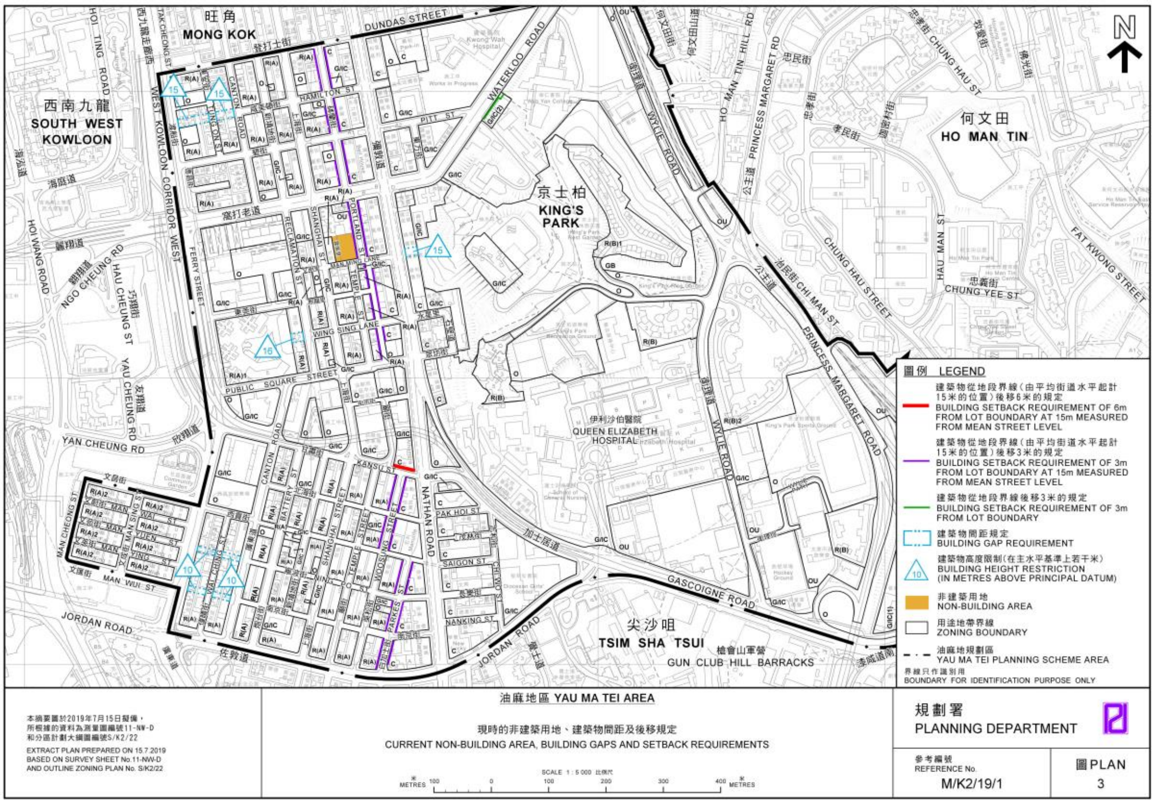


Figure 5.2 NBA, BGs, and SB requirements of the Baseline Scenario for YMT Area.

6.0 Expert Evaluation of the Initial Scenario

6.1 To follow up on the court judgements, PlanD has reviewed the development restrictions (including relevant BHRs and other ventilation measures such as NBAs and BGs) on the current OZP and come up with the Initial Scenario.

6.2 Compared to the Baseline Scenario (described in Section 5), the following aspects of the Initial Scenario are expertly assessed in this AVA EE:

- Changes in BHRs for different zonings to increase the design flexibility in building developments;
- The requirements on NBA, BGs and SBs;
- The potential for the implementation of key building design elements (in particular, building separation and SB) set out in the Sustainable Building Design Guidelines (SBDG)[1].

Key Characteristics of the Initial Scenario

6.3 For residential sites ("R(A)" and "R(A)2" zones), the BHR is proposed to be increased to 100mPD for all sites, based on the modern building design standard for composite development (which assumes 20% GFA concession, 4m podium floor height and 3m typical floor height), and to allow for the implementation of the SBDG.

6.4 For "C" sites, the BHR is proposed to be increased to 110mPD, based on the modern building design standard for commercial development (which assumes 25% GFA concession, 5m podium floor height and 4m typical floor height), the requirement for the provision of refugee floor, and to allow for the implementation of the SBDG.

6.5 Figure 6.1 shows the BHRs in the Initial Scenario. Figure 6.2 shows the proposed increases in BHRs for the sites involved compared to the Baseline Scenario.

6.6 The Initial Scenario maintains the NBAs, BGs and SB requirements (see Figure 5.1) defined in the Baseline Scenario.

[1] Hong Kong Buildings Department. (2016). Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers: Sustainable Building Design Guidelines (APP-152).

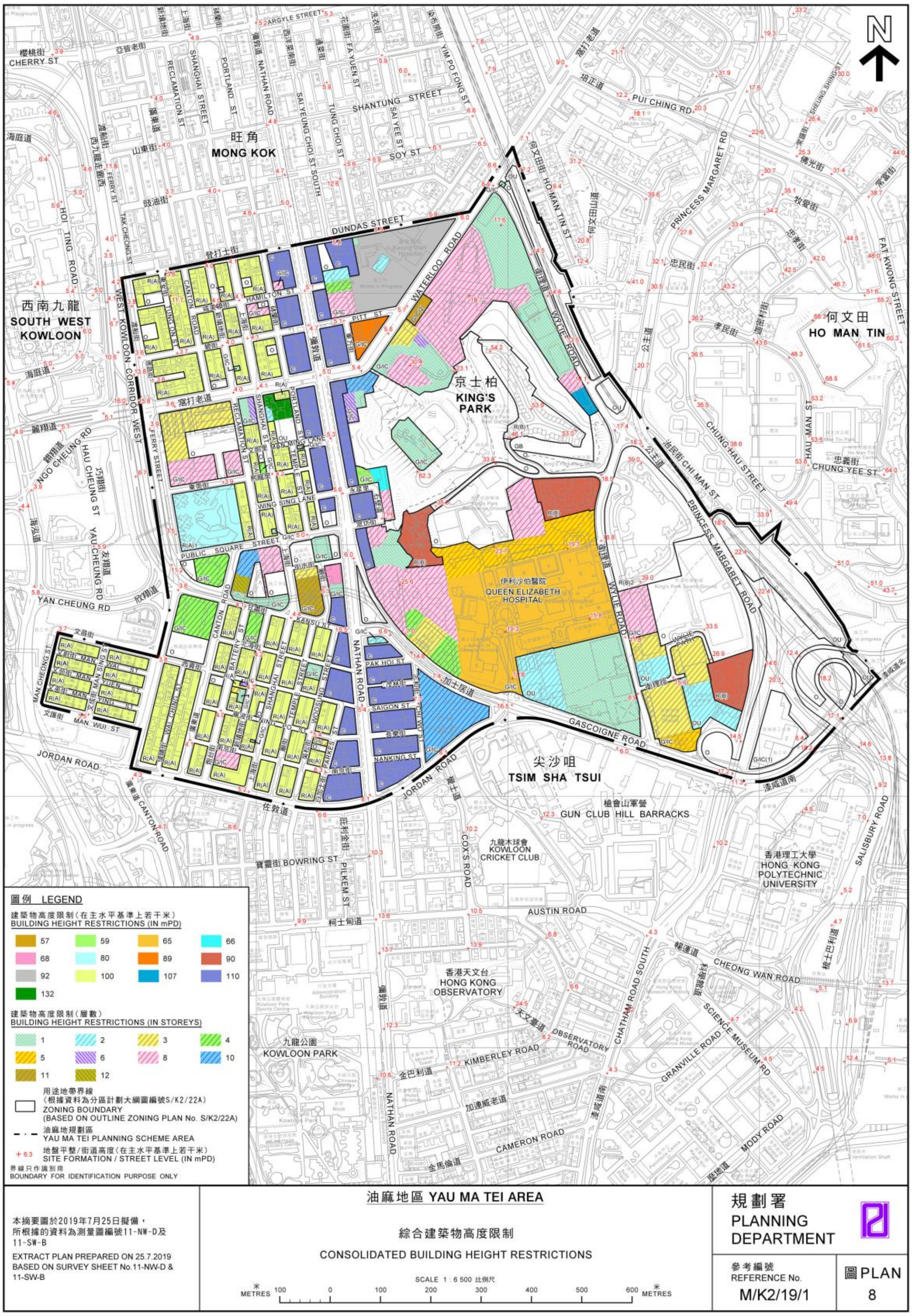


Figure 6.1 BHRs of the Initial Scenario for YMT Area.

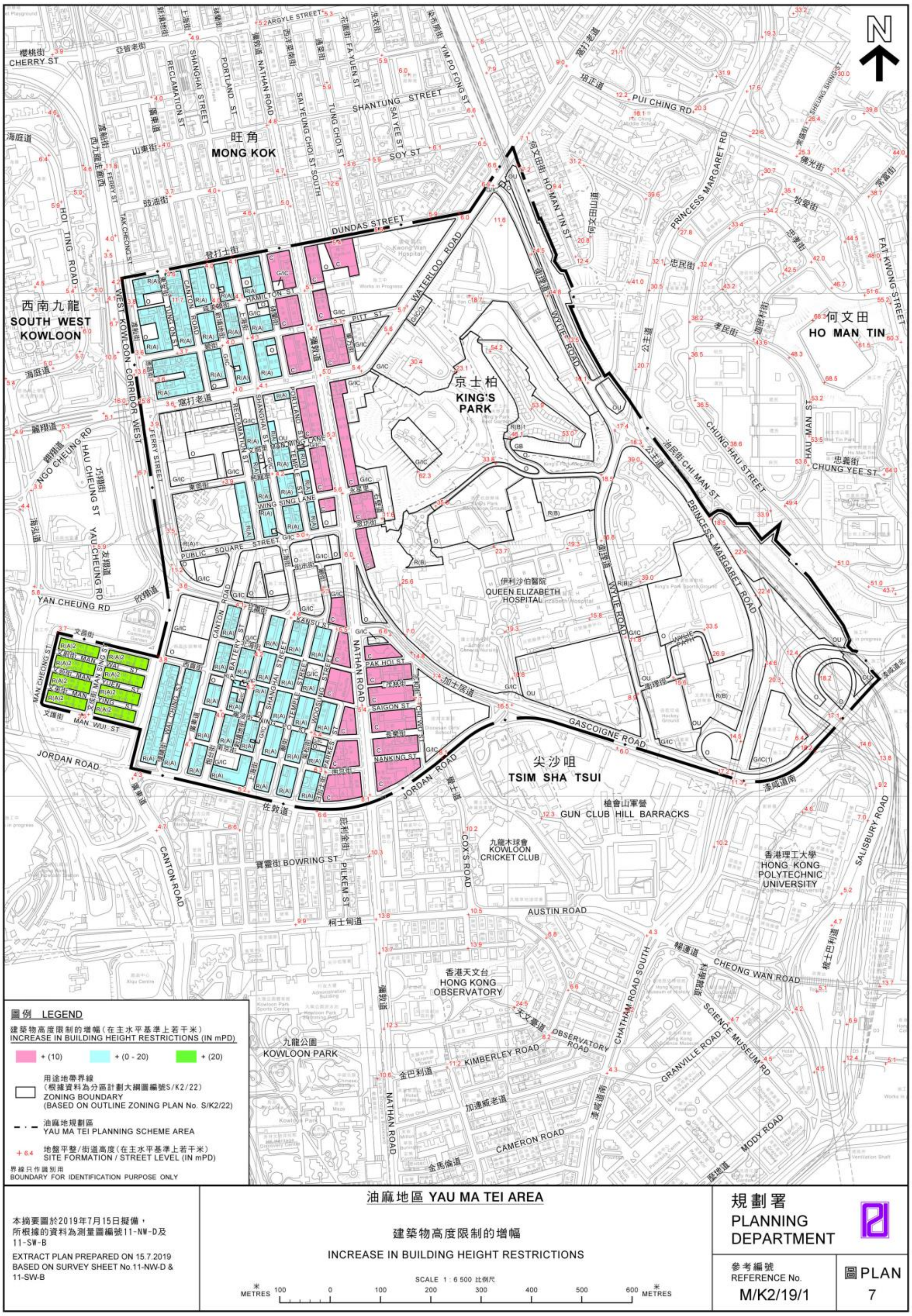


Figure 6.2 Proposed increases in BHRs of the Initial Scenario for YMT Area as compared to the Baseline Scenario.

Analysis of Building Frontage

6.7 On the whole, the proposed BHRs in the Initial Scenario of YMT Area are taller than the heights of the existing majority of buildings as well as the baseline BHRs. The proposed BHs for "C" sites are increased by 10m, while the proposed BHs for residential sites are increased by 0-20m. In general, taller buildings increase surface roughness, and thus reduce wind flow over the urban canopy. A scientific understanding of building heights for city planning can be found in Appendix B.

6.8 To facilitate the evaluation of the difference in potential impact on air ventilation between the Baseline and Initial Scenarios, the concept of building frontage (BF) needs to be introduced.

6.9 BF can be understood as the vertical surface area of a building façade as a percentage of the maximum possible surface area of that building façade (i.e. full façade length fronting a street x tallest BHR). It is dependent on the height, ground coverage, and permeability of a building façade. A graphical description of BF can be found in Appendix C (Figure C-1). Reducing BF effectively reduces the bulkiness of buildings and improves wind penetration within the city. It is a simplified representation of the frontal area density, which is widely used by researchers in urban canopy communities to help quantify drag effect caused by the built environment[1]. Therefore, the difference in BF between the Baseline and Initial Scenarios can serve as a good estimation of the difference in their potential impacts on air ventilation within YMT Area.

6.10 The change in BF between the Baseline and Initial Scenarios is calculated for the major façade (i.e. the longest side fronting a street) of each OZP zone in YMT Area. Detailed results can be found in Appendix C (Table C-1). Note that building SBs and permeability introduced by the potential implementation of the SBDG have not been accounted for in the BF analysis and will be separately discussed in Paragraphs 6.34 to 6.42.

6.11 As "R(A)" sites have a two-tier BHR (80/100mPD based on site area) in the Baseline Scenario, assumptions are made for the proportion of sites with areas larger than 400m^2. According to Government information, at least half (in terms of number of sites) of the newly approved building plans in the past 5 years have site areas larger than 400m^2. Based on this information, it can be assumed that the proportion of sites with areas larger than 400m^2 is likely greater than 50% in terms of site area. Therefore, the analysis on BF has been carried out for three cases, where 50%, 75%, and 100% (in terms of area) of the "R(A)" and "R(A)2" sites are assumed to have site areas larger than 400m^2, and thus are allowed the taller of the two BHRs.

[1] Ng, E., Yuan, C., Chen, L., Ren, C., Fung J.C.H. "Improving the wind environment in high-density cities by understanding urban morphology and surface roughness: a study in Hong Kong." Landscape and Urban Planning 101.1 (2011): 59-74.

6.12 There is generally an increase in BF in the Initial Scenario compared to the Baseline Scenario. The average increase in BF for the whole YMT Area is shown in Table 2.

Table 2 Average increase in building frontage (BF) in the Initial Scenario compared to the Baseline Scenario for the three cases, where 50% (Case 1), 75% (Case 2), and 100% (Case 3) (in terms of area) of the "R(A)" sites are assumed to have site areas larger than 400m^2.

Case 1 (50% large sites)	Case 2 (75% large sites)	Case 3 (100% large sites)
10.8%	7.7%	4.6%

6.13 Note that Case 1 (50% large sites, in terms of area) is a very conservative assumption regarding the proportion of sites with areas larger than 400m^2 upon redevelopment of YMT Area. Therefore, the average increase in BF in the Initial Scenario compared to the Baseline Scenario for the whole YMT Area is very likely to be less than 10.8%.

6.14 The slight average increase in BF for the whole YMT Area (between 4.6% and 10.8%) in the Initial Scenario is unlikely to have any statistically significant difference[1] in air ventilation impacts when compared to the Baseline Scenario.

Review of Non-building Areas, Building Gaps, and Building Setbacks

6.15 NBA and SB requirements as stipulated on the Notes of the OZP, as well as BG requirements as indicated in the ES of the OZP, have been defined in the Baseline Scenario (see Figure 5.1). They are reviewed with respect to the prevailing wind directions to evaluate their roles under the Initial Scenario.

6.16 The wind environment for YMT Area have been discussed in Sections 3 and 4. Annual prevailing winds come from the E, ENE, and W, while summer prevailing winds mainly come from the SW, E, and W. Important wind directions for pedestrian level wind in YMT Area are W, NE, and SE. Little wind can reach YMT Area from the S as the wind flow has been greatly reduced by the built-up areas in Tsim Sha Tsui. Major ventilation pathways in YMT Area have also been identified in Sections 4.5 to 4.12.

6.17 For the purpose of discussion, the western half of YMT Area is divided into the northern and southern sub-areas (SAN and SAS) based on the different orientations of street grids and building blocks (Figure 6.3).

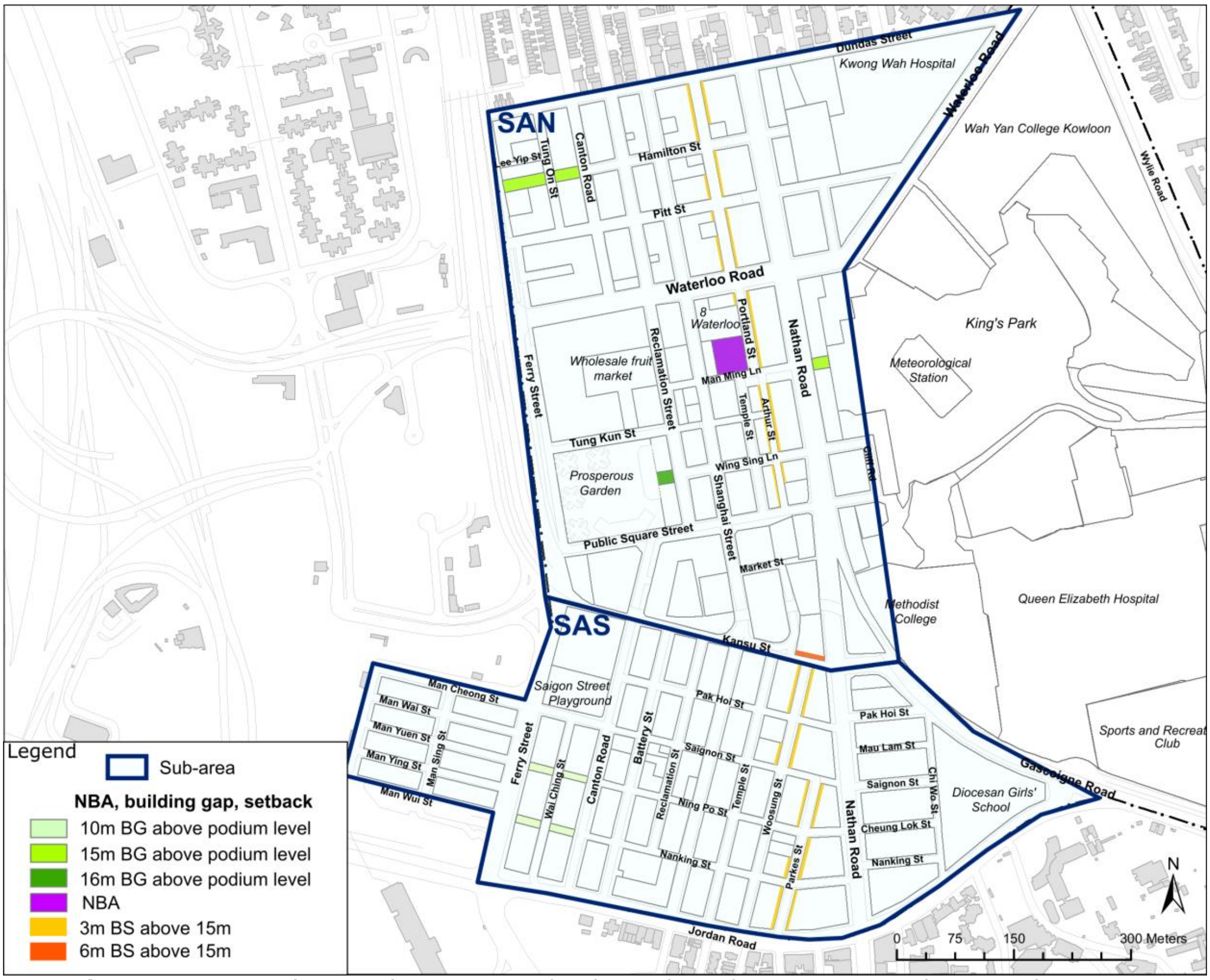


Figure 6.3 Sub-areas in YMT Area for the review of NBAs, BGs and SB requirements.

<u>Northern Sub-area (SAN)</u>

6.18 When wind comes from the W and WSW, it is important to allow the entry and ensure the penetration of sea breeze into YMT Area. Unobstructed streets (with widths of 15m or above) parallel to or within 30 degrees from the prevailing wind directions are effective in facilitating momentum-driven air movements through YMT Area. Hamilton Street and Wing Sing Lane are previously blocked by long building clusters to the west from receiving westerlies. With the two strips of BGs aligned with Hamilton Street and the BG aligned with Wing Sing Lane, sea breeze from the W and WSW can flow further into YMT Area (Figure 6.4). Furthermore, these BGs help provide permeability for diffusive air movements and break down excessively long continuous projected façade lengths (L_p as defined in the SBDG[1]) which are around 90-150m long originally.

6.19 Kansu Street is another major ventilation pathway for the penetration of westerly wind from the relatively unobstructed upwind areas through YMT Area. However, there is a bottleneck of less than 13m wide between two commercial

[1] Hong Kong Buildings Department. (2016). Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers: Sustainable Building Design Guidelines (APP-152).

blocks at the junction with Nathan Road. The SB of 6m for the commercial block abutting the northern curb of Kansu Street widens the street canyon above podium level to 19m and allows less constrained air flow to the connecting Gascoigne Road (Figure 6.4).

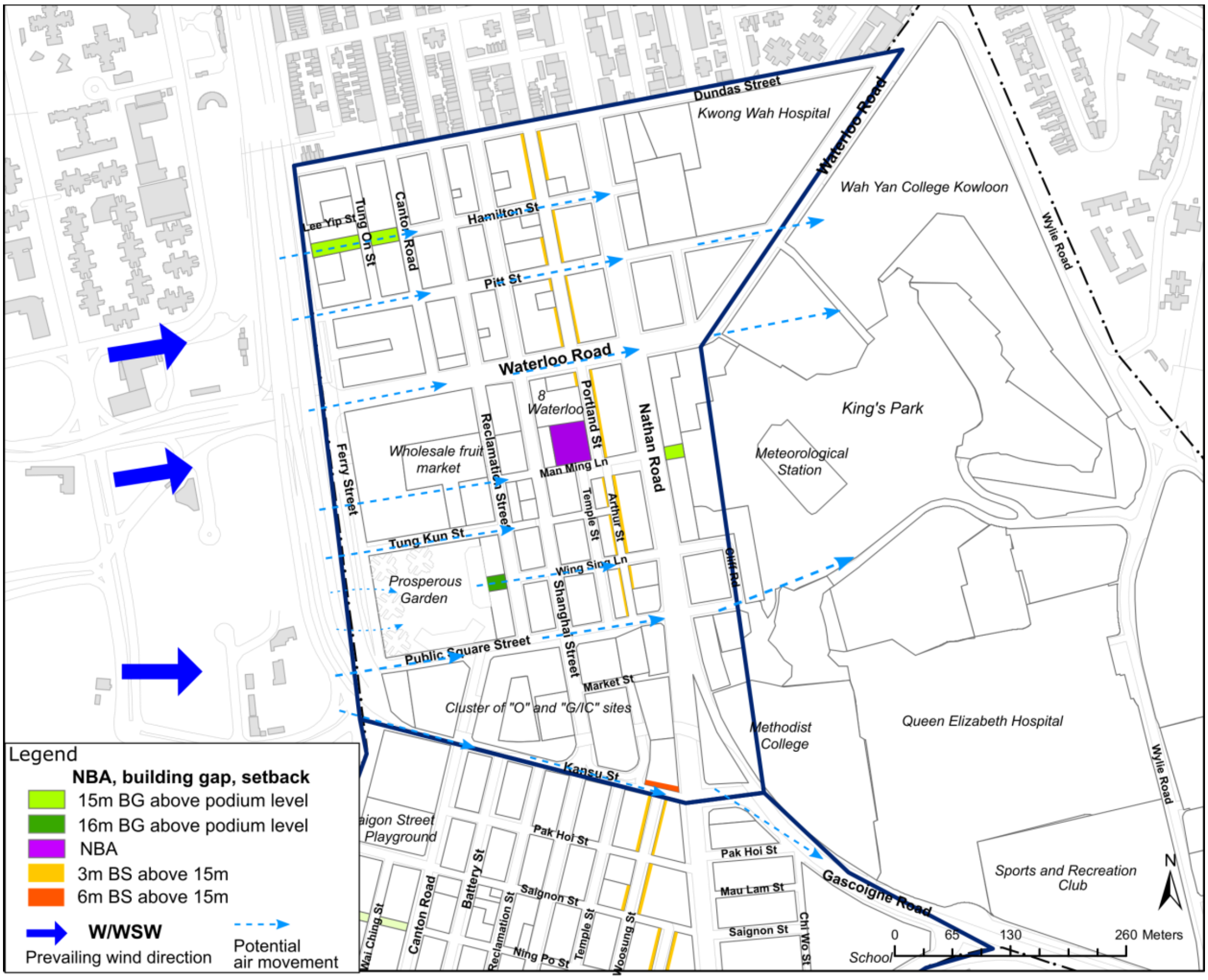


Figure 6.4 Potential air movement in the northern sub-area of YMT Area under the Initial Scenario when wind comes from the W and WSW.

6.20 When wind comes from the NE, E and SE (easterly quarters), it flows relatively unobstructed through the open areas (e.g. King's Park, Sports and Recreation Clubs, schools and other "G/IC" sites) in the eastern half of YMT Area. The two major roads oriented diagonally, namely Waterloo Road and Gascoigne Road, also serve as effective air paths to welcome the easterlies into YMT Area. The BG aligned with Man Ming Lane separates the excessively long L_p of 210m formed by the cluster of commercial buildings at 502-512 Nathan Road and allows easterly air flow from King's Park to benefit the street canyons in the SAN of YMT Area (Figure 6.5).

6.21 This air flow entering the SAN of YMT Area is further enhanced by the open space provided by the NBA at the northwestern corner of the junction of Portland Street and Man Ming Lane (Figure 6.5). The NBA is also important for providing permeability at pedestrian level to compensate the negative effects on air ventilation due to the massive structure at 8 Waterloo Road (with a height of 137mPD).

6.22 When wind comes from the SE, it enters YMT Area along Gascoigne Road. The SB of 6m for the commercial block abutting the norther curb of Kansu Street widens the road and facilitates air movement to flow further into the western half of YMT Area (Figure 6.5).

6.23 Westerly and easterly winds flow perpendicular to the roughly N-S street canyons in the SAN of YMT Area. Deep street canyons create skimming flows over the top of buildings and cause stagnant conditions at pedestrian level (see Figure A-2 in Appendix A). With a slight height difference of 10m between commercial and residential buildings on the two sides of Portland Street and Arthur Street (Figure 6.1), there could be weak downwashes when winds flow from the W (see Figure A-3 in Appendix A). SBs of 3m on each side of Portland Street and Arthur Street reduce the height-to-width (H/W) ratios from 6.5:1 to 5:1 and 11:1 to 6.5:1, respectively. Although this is still far from the ideal H/W ratio of 2:1 for pedestrian level wind environment, this may help to improve the ventilation along Portland Street and Arthur Street. The effect could be particularly noticeable for the latter since it only has a narrow width of 9m prior to the SB requirement.

6.24 The SBs of 3m on each side of Portland Street and Arthur Street can also aid the lateral flow induced by corner eddies (see Figure A-4 in Appendix A) to enter into the street canyon above 15m. For long street canyons, air ventilation effects by corner vortices fade with increasing length-to-width (L/W) ratios of streets[1]. Due to the tall height of buildings along Portland Street and Arthur Street, the downwashes, if any, mentioned in Section 6.23 are likely to be weak. Therefore, lateral flow induced by horizontal vortices at lower levels become important for the penetration of air movement into the N-S street canyons.

[1] Theurer, W. Typical building arrangements for urban air pollution modelling. Atmospheric Environment 33.24-25 (1999): 4057-4066.

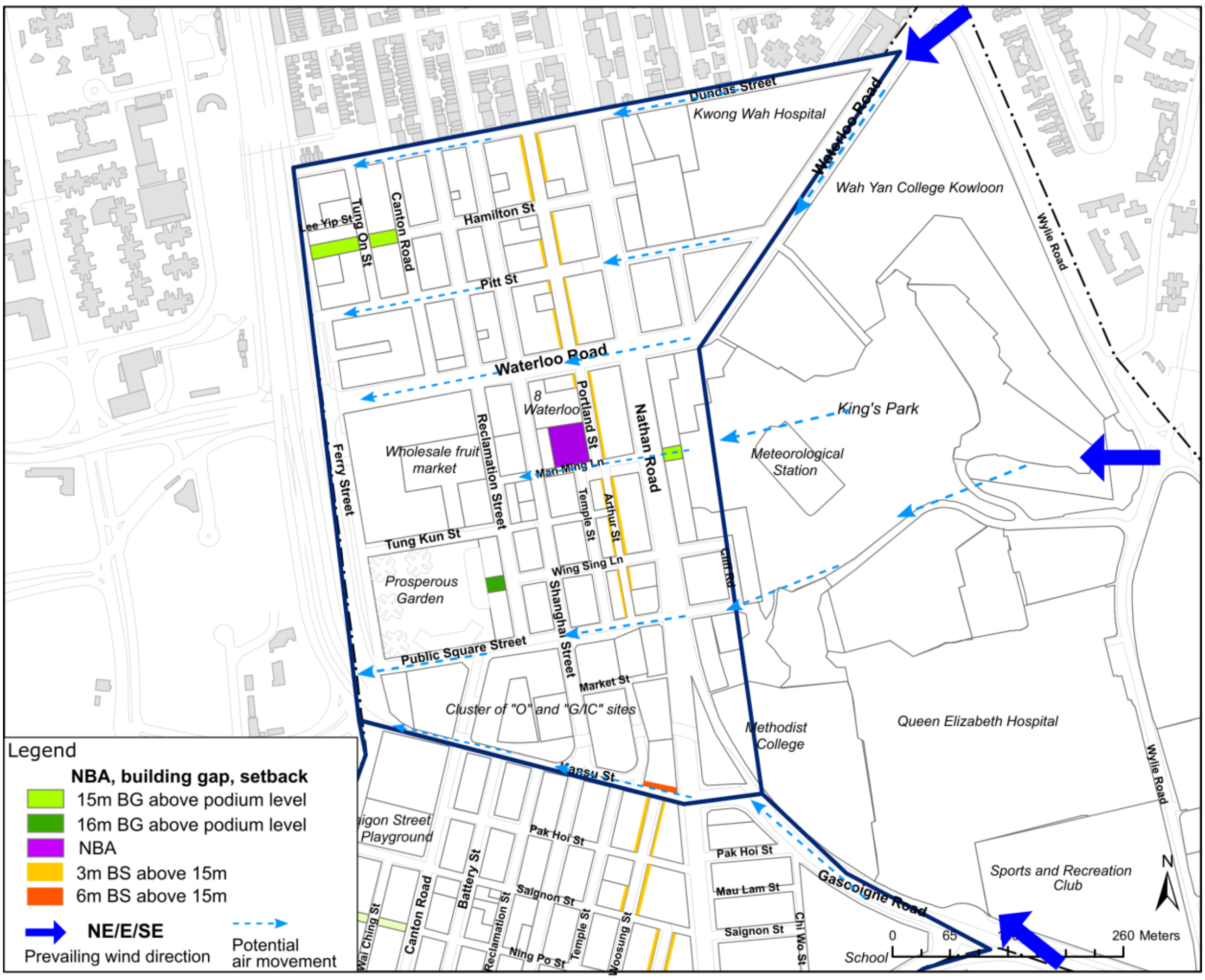


Figure 6.5 Potential air movement in the northern sub-area of YMT Area under the Initial Scenario when wind comes from the NE, E and SE.

6.25 Available wind data also show some wind components from the S for YMT Area. Although the wind flow reaching the SAN of YMT Area from the S is greatly reduced the upwind built-up areas in Tsim Sha Tsui and the SAS of YMT Area, major roads/streets along the N-S orientation provide permeability for air movements by diffusion within YMT Area. The 3m SB requirements along Portland Street and Arthur Street further increases urban permeability for air movements within the street canyons of YMT Area (Figure 6.6).

6.26 Besides, the NBA at the northwestern corner of the junction of Portland Street and Man Ming Lane helps connect Temple Street, Arthur Street, and Portland Street to allow penetration of N-S air movements to ameliorate the impacts on pedestrian level air ventilation due to the massive structure at 8 Waterloo Road.

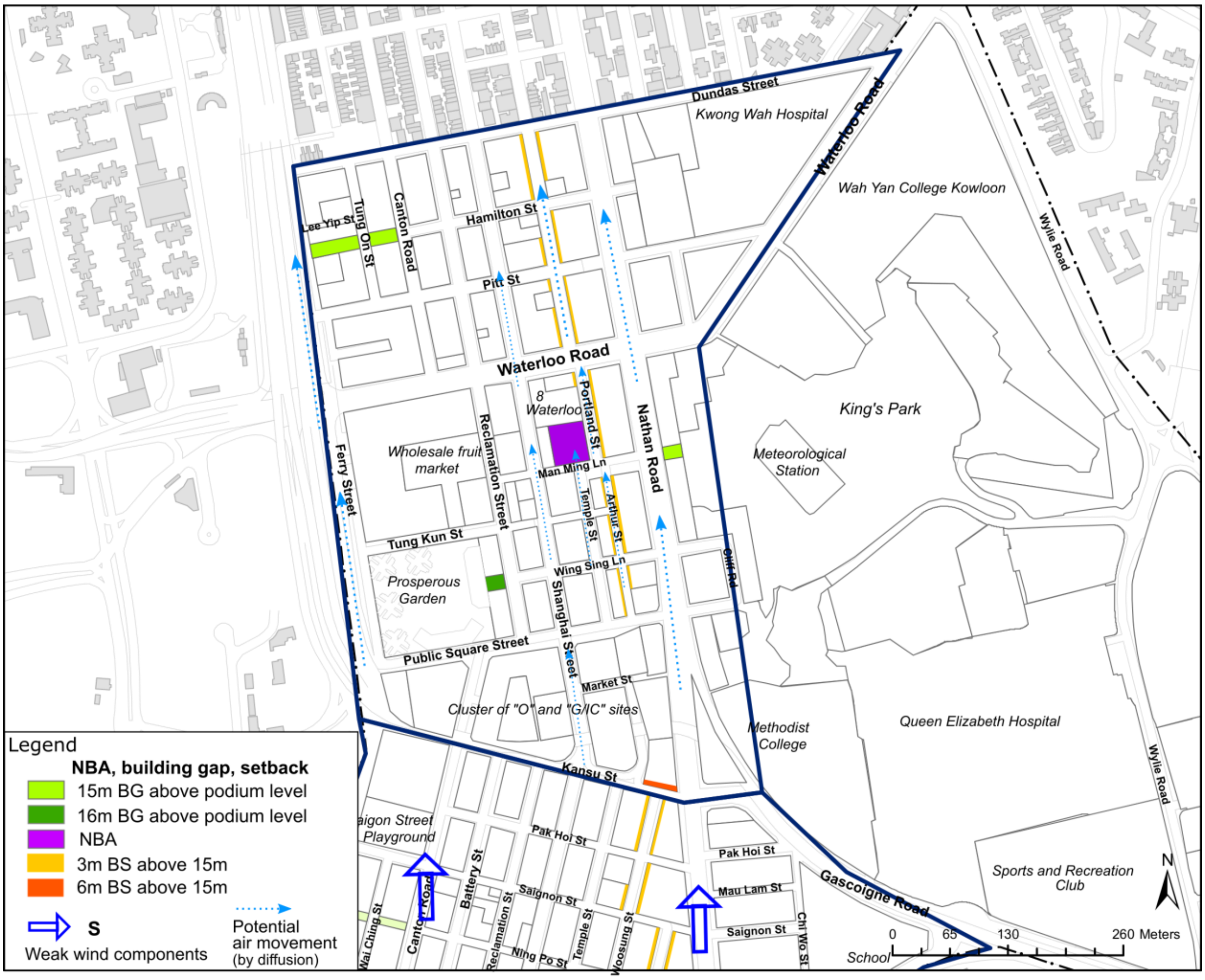


Figure 6.6 Potential air movement in the northern sub-area of YMT Area under the Initial Scenario when weak wind comes from the S.

<u>Southern Sub-area (SAS)</u>

6.27 The SAS of YMT Area is a relatively stagnant area with generally narrower streets when compared to the SAN. The misalignment and tilted orientation of the street grid west of Nathan Road makes it more difficult for wind from the easterly quarters to penetrate through the SAS. This area therefore mainly depends on the westerlies entering through the narrow streets in the southwestern corner of YMT Area for pedestrian level air ventilation.

6.28 When wind comes from the W and WSW, it flows from the relatively unobstructed upwind areas until the Man's Building Area. The four strips of BGs aligned with Ning Po Street and Nanking Street are important because they allow the penetration of westerlies through the SAS of YMT Area to facilitate momentum-driven air movements within the otherwise stagnant areas (Figure 6.7).

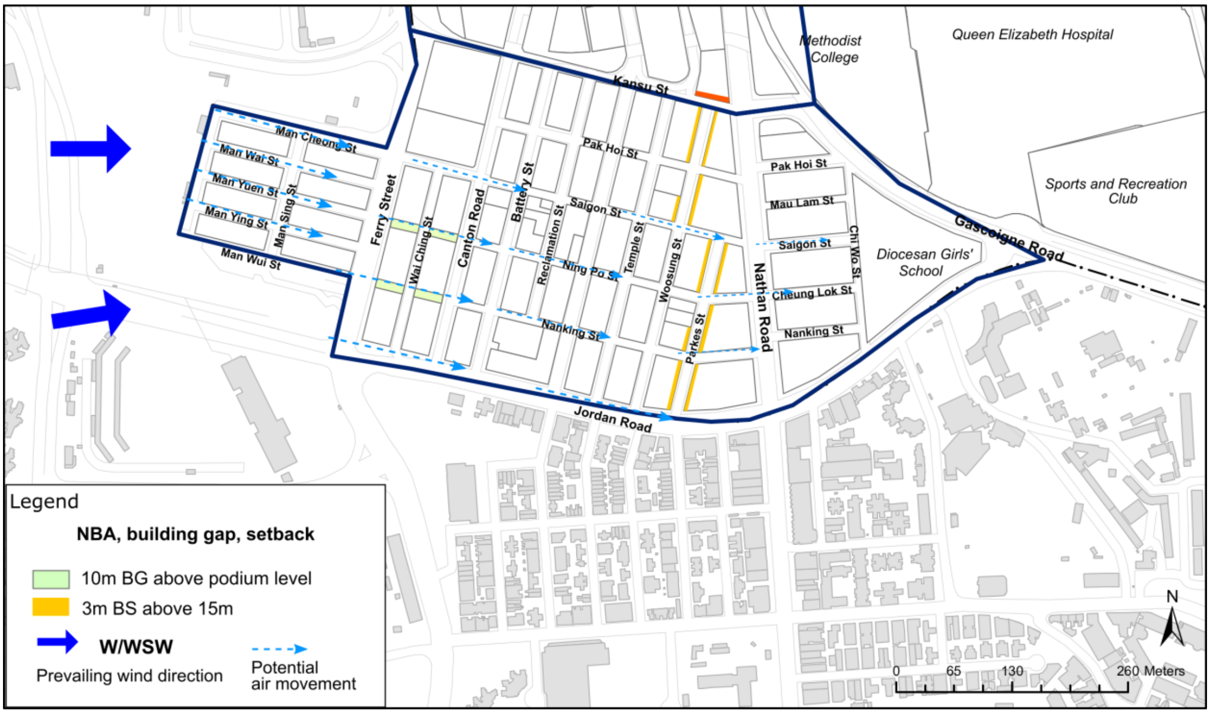


Figure 6.7 Potential air movement in the southern sub-area of YMT Area under the Initial Scenario when wind comes from the WSW and W.

6.29 When wind comes from the NE, E and SE (easterly quarters), it can flow along the two main roads bounding the SAS of YMT Area, namely Gascoigne Road and Jordan Road, after flowing through the relatively open areas and “G/IC” sites to the E and NE. The SB of 6m at Kansu Street facilitates air movement further into the YMT Area as discussed in Section 6.22. However, it is more difficult for easterly winds to reach the inner street grid of SAS of YMT Area due to the misalignment of streets on the two sides of Nathan Road (Figure 6.8).

6.30 Westerly and easterly winds flow perpendicular to the roughly N-S street canyons in the SAS of YMT Area. Similar to the discussion in Section 6.23, the slight height difference of 10m between commercial and residential buildings on the two sides of Parkes Street and Woosung Street (to the north of Saigon Street) could help create weak downwashes when winds flow from the W (see Figure A-3 in Appendix A). SBs of 3m on each side of Parkes Street and Woosung Street reduces the H/W ratios from 6.5:1 to 5:1. Although this is still far from the ideal H/W ratio of 2:1 for pedestrian level wind environment, this may slightly improve the ventilation along Parkes Street and Woosung Street.

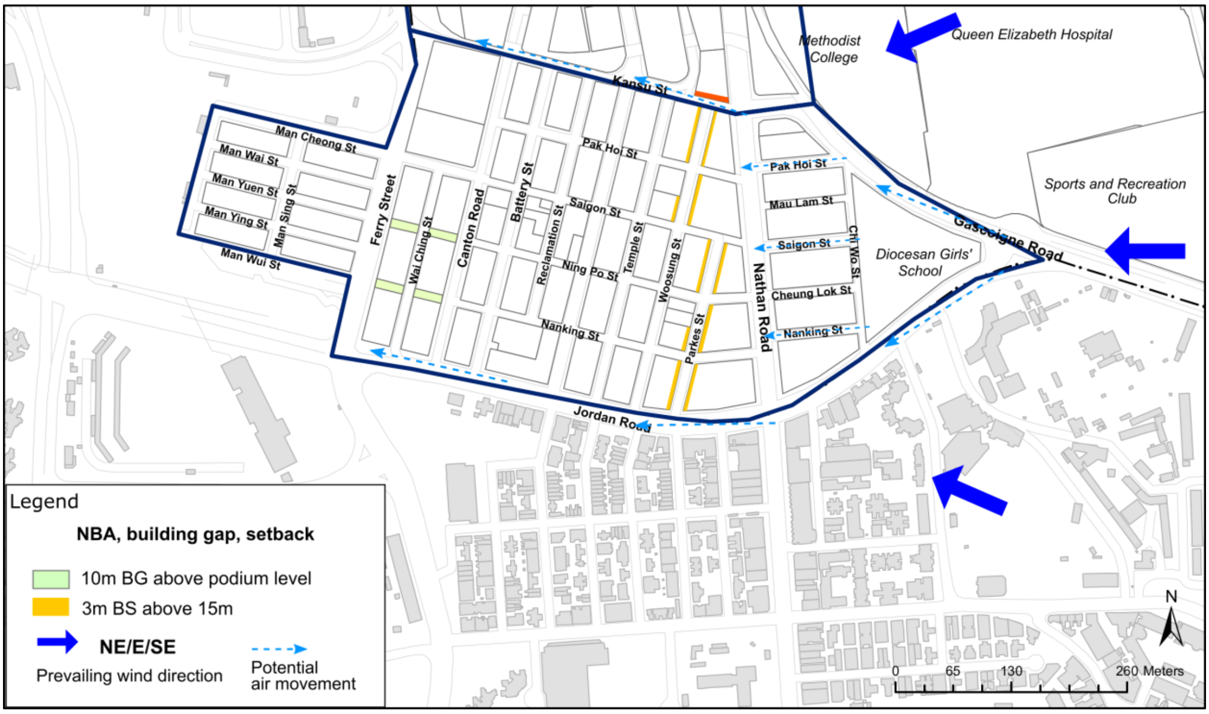


Figure 6.8 Potential air movement in the southern sub-area of YMT Area under the Initial Scenario when wind comes from the NE, E and SE.

6.31 Similar to the discussion in Section 6.24, the SBs of 3m on each side of Parkes Street and Woosung Street (to the north of Saigon Street) can also aid the lateral flow induced by corner eddies (see Figure A-4 in Appendix A) to enter into the street canyon above 15m. Due to the tall height of buildings along Parkes Street and Woosung Street, the downwashes, if any, mentioned in Section 6.29 are likely to be weak. Therefore, lateral flow induced by horizontal vortices at lower levels become important for the penetration of air movement into the N-S street canyons.

6.32 Available wind data also show some wind components from the S for YMT Area. Although the wind flow reaching the SAS of YMT Area from the S is greatly reduced the upwind built-up areas in Tsim Sha Tsui, major roads/streets along the N-S orientation provide permeability for air movements by diffusion within YMT Area. The 3m SB requirements along Parkes Street and Woosung Street (to the north of Saigon Street) further increases urban permeability for air movements within the street canyons of YMT Area (Figure 6.9).

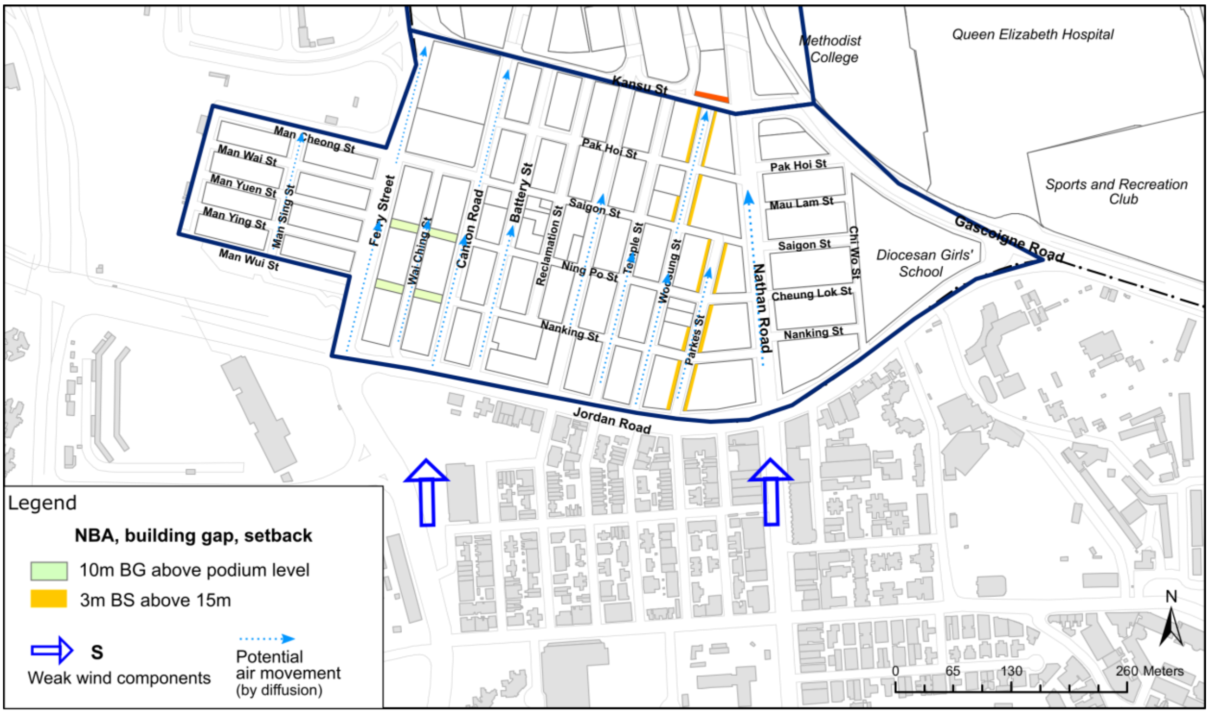


Figure 6.9 Potential air movement in the southern sub-area of YMT Area under the Initial Scenario when weak wind comes from the S.

6.33 In summary, the NBA and SB requirements are all good features of district significance for air ventilation in YMT Area because they align with the overall street grid to form connected air paths that benefit a large extent of area. Therefore, they should be maintained in the Initial Scenario. Regarding the similar measures (building separation and SB) set out in the SBDG (to be discussed in Paragraphs 6.34 to 6.43), their effects on urban ventilation are expected to be minor and localised due to the size of sites, as well as the lack of control on the desirable orientations/positions of the measures. Rather than momentum-driven air movements, their effects are likely limited to enhancing diffusive air movements at a smaller scale. Urban ventilation measures need to be applied at different scales in order to achieve complementary effects (refer to the general principles explained in Appendix D).

6.34 For the BGs, they are also considered beneficial to urban air ventilation as they can provide breezeways/ air paths/ building permeability at different scales and breakdown long and continuous projected façade. It would be more desirable if they can be maintained to enhance the air movements in the area. If they are difficult to be realised due to other practical concerns and thus are not proposed to be retained, in addition to the adoption of SBDG requirements, any future developments are also recommended to follow the design principles set out in the Hong Kong Planning Standards and Guidelines at the detailed design stage as the prevailing effort for the improvement in urban climate.

Implementation of the Sustainable Building Design Guidelines

6.35 The SBDG[1] aims to enhance the quality and sustainability of the built environment in Hong Kong by granting GFA concessions for new building developments that comply with the SBDG. It establishes three key building design elements, namely building separation, SB, and site coverage of greenery, to achieve better air ventilation, mitigate the heat island effect, and enhance the environmental quality of our living space.

6.36 The proposed changes in BHRs in the Initial Scenario increase design flexibility in building developments and allow for the implementation of the SBDG (in particular, the building separation and SB requirements) to improve air ventilation at pedestrian level.

6.37 SB benefits the pedestrian wind environment by widening streets to prevent the development of deep street canyons (see Figure A-5 in Appendix A). According to the SBDG, buildings fronting a street less than 15m wide should be set back so that no part of the building up to a level of 15m above the street level should be within 7.5m from the centreline of the street. Building lots that need to comply with the SB requirement are marked in Figure 6.10. The potential improvement on air ventilation caused by sites adopting SB can be quite significant for those streets which are currently less than 15m wide.

[1] Hong Kong Buildings Department. (2016). Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers: Sustainable Building Design Guidelines (APP-152).

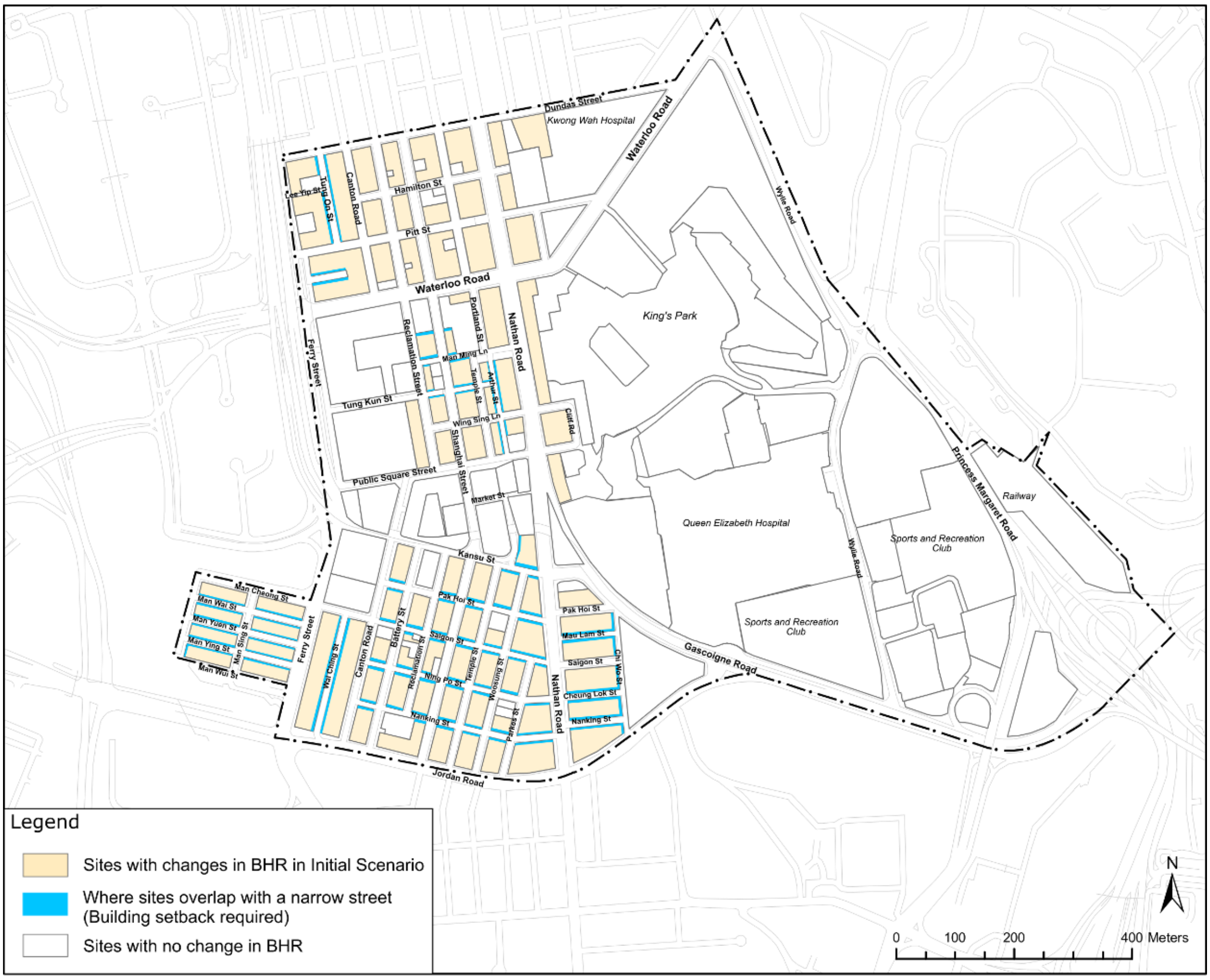


Figure 6.10 Building sites fronting narrow streets < 15m wide which should adopt SB as required by the SBDG in YMT Area.

6.38 Building separation increases permeability within the urban built environment to mitigate heat island effects arising from the undesirable screening effect of long buildings. Incorporating building porosity into building design promotes air movements amongst developments and enhances the diffusion and mixing of air (see Figure A-6 in Appendix A). Permeability in the low zone is particularly important for improving air ventilation at pedestrian level[1].

6.39 According to the SBDG, building sites that are (a) 20,000m^2 or above, or (b) less than 20,000m^2 and proposed with buildings having a continuous projected façade length (L_p) of 60m or above, should comply with the building separation requirements (see Figure A-7 in Appendix A). The maximum permissible L_p for such building sites should not exceed five times the mean width of street canyon (U) (see Figure A-8 in Appendix A). A minimum permeability (P) of 20% is required for each plane in each assessment zone (see Figure A-9 in Appendix A).

[1] Yuan, C. and Ng, E. "Building porosity for better urban ventilation in high-density cities–A computational parametric study." Building and Environment 50 (2012): 176-189.

6.40 As discussed in Section 5.4, most existing building sites in the western half of YMT Area are smaller than $400m^2$. There are currently no building lots amongst the sites evaluated in YMT Area exceeding $20,000m^2$. For sites less than $20,000m^2$, only 14 individual building lots have Lp of 60m or above. Assuming there is to be no site amalgamation upon redevelopment of YMT Area, Figure 6.11 shows the building lots that are required to comply with the building separation requirement of the SBDG.

6.41 When there is no site amalgamation, the sites that are required to comply with the building separation requirement of the SBDG are mainly concentrated in the Man’s Building Area with few other isolated sites. The potential benefits on air ventilation are thus expected to be very minor and localised.

6.42 As discussed in Section 5.6, at least half of the newly approved building plans in the past 5 years have site areas larger than $400m^2$.

6.43 There is an increasing potential for the implementation of building separation of the SBDG when sites amalgamate. If all sites in YMT Area amalgamate within the same street block, a majority of amalgamated building sites (except some groups of smaller sites on the southern side of Hamilton Street, around Wing Sing Land and Man Ming Lane, along Saigon Street, and along Parkes Street) are required to comply with the building separation requirement of the SBDG. In this case, although the proposed BHRs in the Initial Scenario are taller, the pedestrian level wind environment may be improved by the potential benefits brought by building permeability, especially at the low zone.

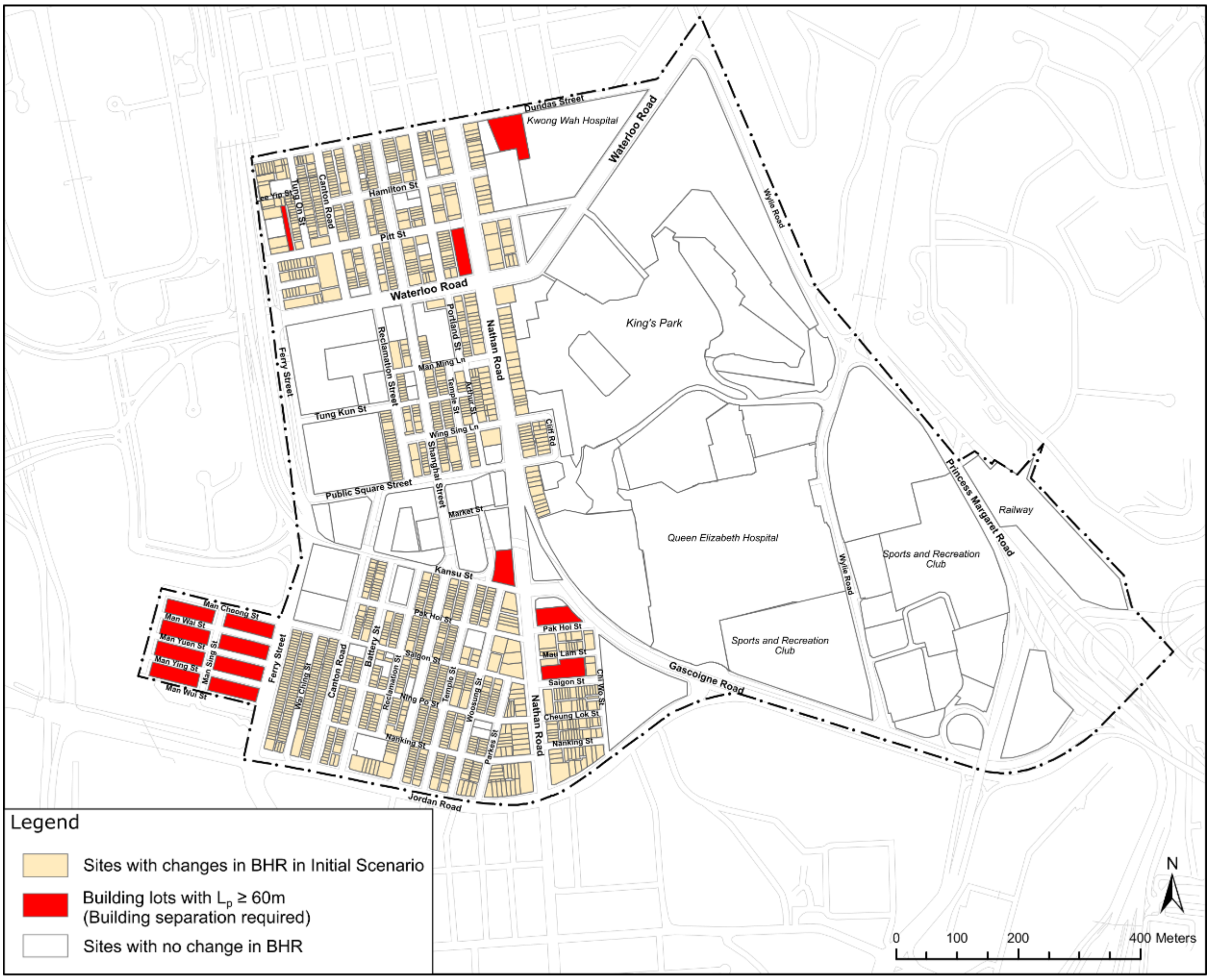


Figure 6.11 Existing building lots with Lp ≥ 60m which should adopt building separation as required by the SBDG in YMT Area.

7.0 Recommendations and Further Work

7.1 The Initial Scenario has been expertly evaluated in Section 6. The proposed changes in BHR cause a general increase in BH within YMT Area, but the slight average increase in BF for the whole YMT Area in the Initial Scenario is unlikely to have any statistically significant difference in air ventilation impacts when compared to the Baseline Scenario.

7.2 It should be noted that in compact high-rise building areas, skimming flow regime is often found over the top of buildings (see Figure A-2 in Appendix A), causing stagnant conditions at pedestrian level. When the H/W ratio of street canyons exceed a certain point, the increase in BH ceases to be the key factor affecting air ventilation at pedestrian level. Instead, focus should be put on district-wide measures such as NBAs, BGs, and SB requirements, as well as enhancing air movements amongst developments by improving building design.

7.3 For better urban air ventilation, it is important to consider breezeways/ air paths/ building permeability at different scales (refer to the general principles explained in Appendix D). From the district point of view, the NBAs, BGs, and SB requirements are all important features for air ventilation in YMT Area and should be maintained.

7.4 From the building design point of view, the SBDG establish key building design elements to increase urban permeability and improve the wind environment at pedestrian level. Site amalgamation should be encouraged to increase the potential of the implementation of the SBDG (in particular, the building separation requirements).

7.5 Nevertheless, with reference to the expert witness statement[1] of the judicial review case HCAL No. 58 of 2011, YMT Area, especially the western half, is now characterised by high average H/W ratio, high FAD, and is one of Hong Kong's most severe urban heat islands due to intensive developments in the narrow streets of the core areas in Yau Ma Tei in the past years. As a result, YMT Area is suffering from its poor environmental quality.

7.6 Any future developments/redevelopments would inevitably add stress to the already poor existing conditions in YMT Area. Therefore, developments must be carefully planned and should follow the design principles set out in the Hong Kong Planning Standard and Guidelines (HKPSG)[2] at the detailed design stage as the prevailing effort for improvement in urban climate. The five most important design principles are highlighted below (Paragraphs 7.7 to 7.11).

Further Design Principles

[1] NG Yan Yung. Witness Statement – REDA HCAL 58/2011. for Town Planning Board & Department of Justice HKSAR. 28 pgs. Hong Kong, 2011.11. <P118673> (see extract in Appendix E)
[2] Hong Kong Planning Department. (2011). Hong Kong Planning Standards and Guidelines (HKPSG).

7.7 Variations in BH should be introduced across YMT Area to help instigate wind flow throughout the district by encouraging downwashes and mixing of air due to pressure differences (see Figure A-10 in Appendix A). Low-rise buildings and open spaces should be located in the windward direction to allow the entry and penetration of prevailing winds. Tall buildings of uniform heights forming deep urban canyons should be avoided as they create skimming flows over the top of buildings and stagnant conditions at pedestrian level (see Figures A-2 and A-3 in Appendix A).

7.8 Long and continuous façades should be avoided, especially perpendicular to the prevailing wind direction and at street level. Suitable building disposition could help effective air flows around building in desirable directions (see Figure A-11 in Appendix A). Ground coverage for buildings, including any podium structures, should be minimized to no more than 65% of the site.

7.9 To increase the permeability of the urban fabric at street level, site coverage of the podia should be reduced to allow more open space at grade (see Figure A-12 in Appendix A). A terraced podium design should be adopted to direct downward airflow to the pedestrian level (see Figure A-13 in Appendix A).

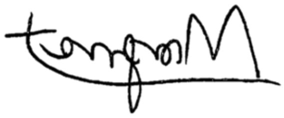
7.10 Existing "O" and "G/IC" sites should be maintained as "air spaces" where air ventilation can be relieved within the dense urban morphology. Open spaces, amenity areas, NBAs, SBs, and low-rise building corridors are important in providing urban permeability, moderating the city climate, and connecting breezeways and air paths (see Figures A-14 and A-15 in Appendix A).

7.11 Planting in open spaces should be maximized. Greenery (preferably tree planting) should cover no less than 30% for sites larger than 1 ha and 20% for sites below 1 ha at lower levels, preferably at grade.

7.12 When considering planning applications involving minor relaxation of BHR, the Government should also give more balanced considerations to S16[1] applications for building developments which require BH relaxation in order to incorporate more design features (such as those recommended in the HKPSG[2]) to improve air ventilation at pedestrian level. For such cases, it is highly recommended that project proponents should conduct further assessments to evaluate the potential air ventilation impacts on YMT Area and demonstrate that the performance of any future developments would be no worse off than the evaluated scenarios.

[1] Hong Kong Town Planning Board. Application for Permission under Section 16 of the Town Planning Ordinance (CAP. 131) Guidance Notes.
[2] Hong Kong Planning Department. (2011). Hong Kong Planning Standards and Guidelines (HKPSG).

Prepared by



Date: 8 September 2020

Kwok Yu Ting

Endorsed by

Date: 8 September 2020

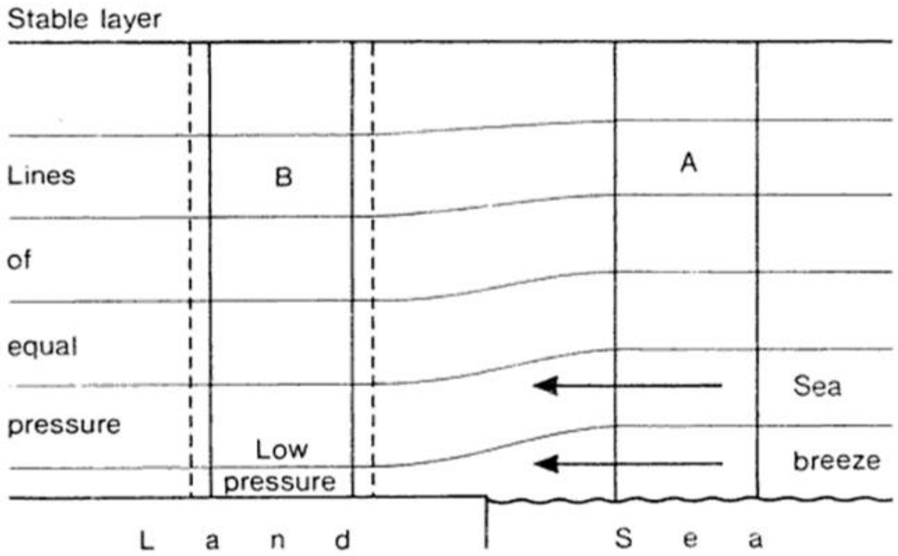
Professor Edward Ng
On behalf of technical experts in the term consultant term

The Chinese University of Hong Kong,
Shatin, NT, Hong Kong
T: 39436515 F: 26035267
E: edwardng@cuhk.edu.hk

Consultant team

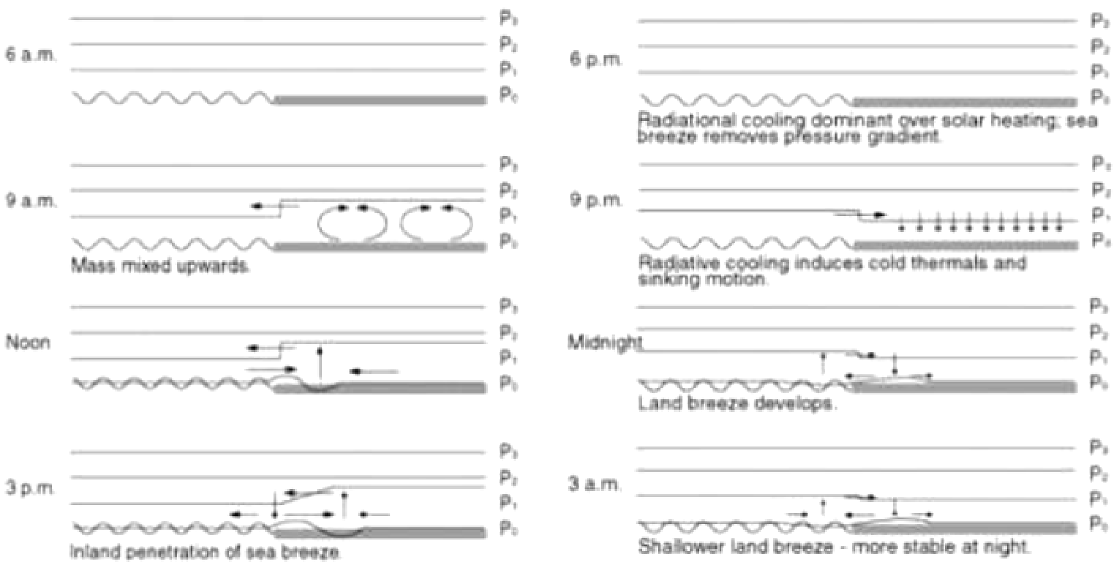
	Expertise
Professor Edward Ng CUHK, Hong Kong	Coordinator, Architect, Environmental scientist, AVA methodology
Professor Kevin Ka-Lun Lau CUHK, Hong Kong	Urban Climatologist, Environmental Scientist
Professor Jimmy Chi-Hung Fung HKUST, Hong Kong	Mathematician, Mesoscale wind simulation, Climatic studies
Professor Chao Ren CUHK, Hong Kong	Architect, Urban Climatologist
Miss Yu-Ting Kwok CUHK, Hong Kong	Environmental Scientist

Appendix A



(a) Formation of sea breezes.

Note: A column of air above the land (B) is heated by the sun and expands sideways, while a column of air above the sea (A) is unaltered. This causes a pressure difference at low levels which gives rise to sea breeze.



(b) The daily mechanism of land and sea breezes.

Figure A-1 Land and sea breezes.

[Reference: Simpson, J.E. 1994. Sea breeze and local wind. Cambridge University Press.]

Appendix A (Cont'd)

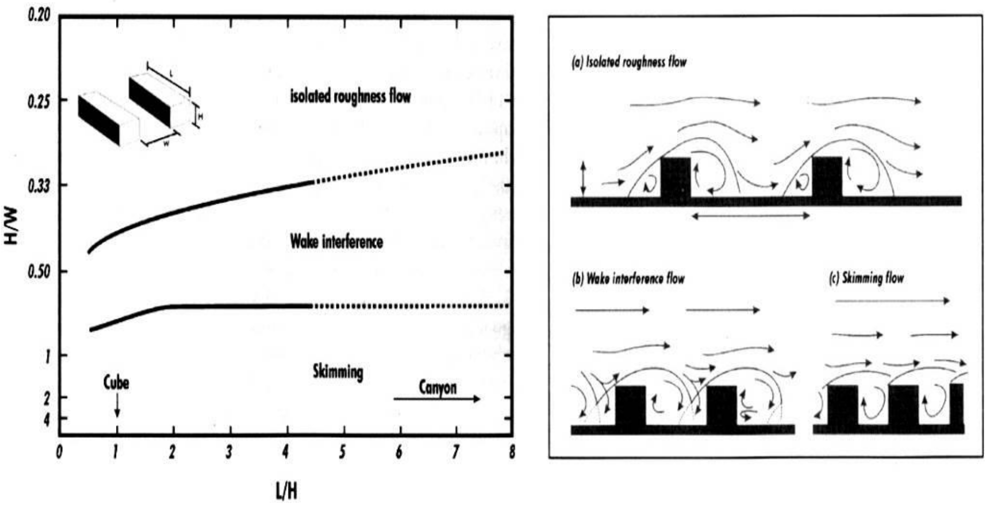


Figure A-2 The relationship between building height and street width ratio and the possible flow regimes.

[Reference: Oke, T. R. (1987). *Boundary layer climates*. Routledge.]

Appendix A (Cont'd)

With wind from directions perpendicular to the canyons, downwashes due to the differentials in building heights is occasionally likely when building heights are very different. Otherwise, with smaller building height differences, this is unlikely. It is known that for long and deep canyons with an H/W ratio of 2 and above, a double vortex phenomenon will be observed. However, beyond a H/W ratio of 2:1, the ground level of canyons, even with the so call downwash effects, will have very weak eddies and air ventilation.

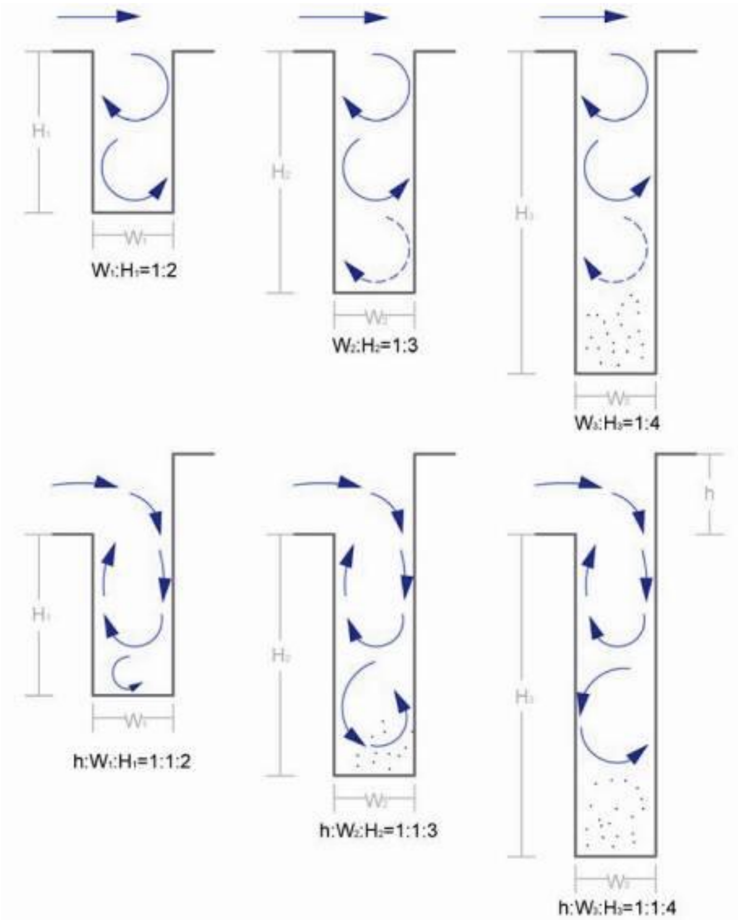


Figure A-3 The figure shows a generic understanding of the wind regimes in canyons, and canyons with downwashes.

[Reference: A. Kovar-Panskus, P. Louka, J.-F. Sini, E. Savory, M. Czech, A. Abdelqari, P. G. Mestayer and N. Toy, Influence of geometry on the mean flow within urban street canyons – A comparison of wind tunnel experiments and numerical simulations, Water, Air, and Soil Pollution: Focus 2: 365–380, 2002, Kluwer Academic Publishers.]

Appendix A (Cont'd)

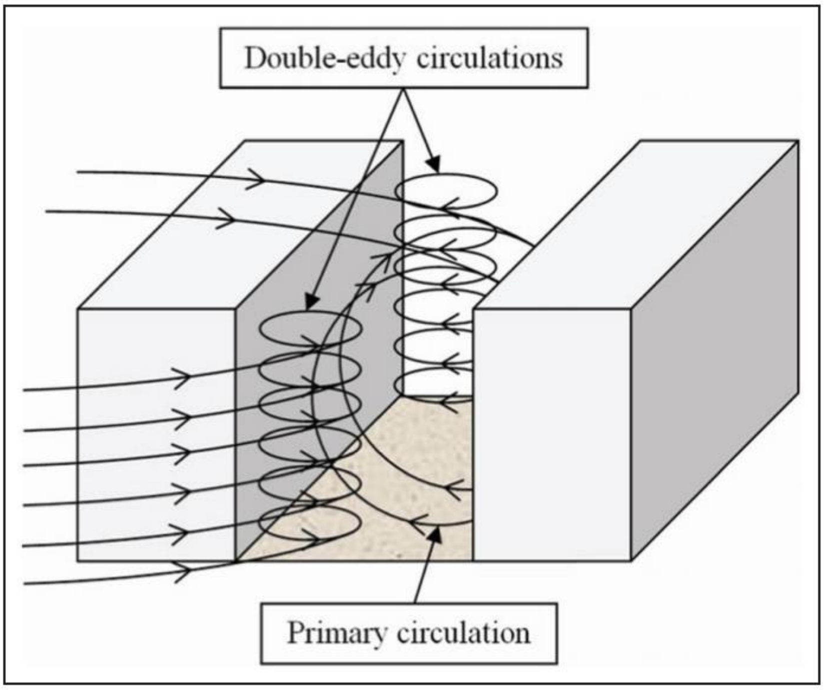
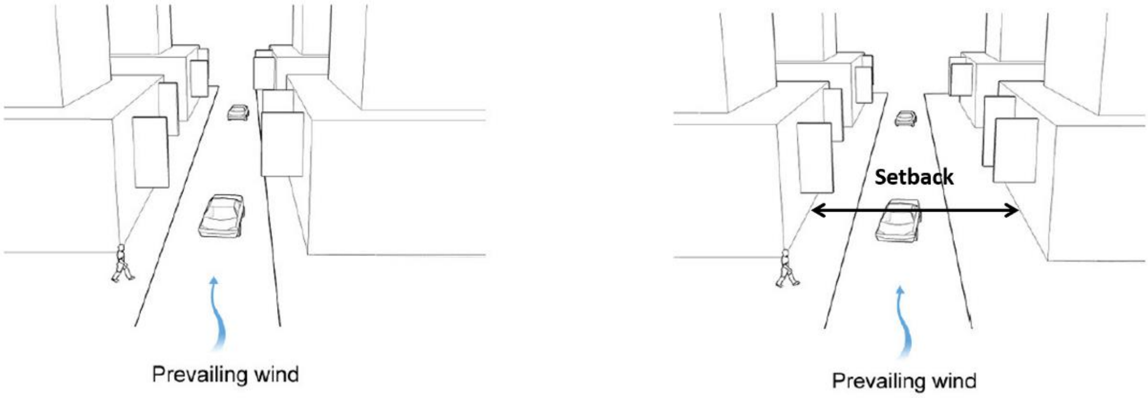


Figure A-4 Flow structures in an isolated street canyon with perpendicular air flow.

[Reference: Yazid, A. W. M., Sidik, N. A. C., Salim, S. M., & Saqr, K. M. A review on the flow structure and pollutant dispersion in urban street canyons for urban planning strategies. Simulation 90.8 (2014): 892-916.]

Appendix A (Cont'd)



To improve the air ventilation in the urban areas, the widening of streets along the prevailing wind direction is considered of high effectiveness. Especially for large sites facing narrow urban canyon as typically found in old urban district like Mong Kok, the building setback on each side of the street should be provided upon redevelopment or urban renewal.

Figure A-5. Street widening/ Building setback.

[Reference: Hong Kong Planning Standard and Guidelines]

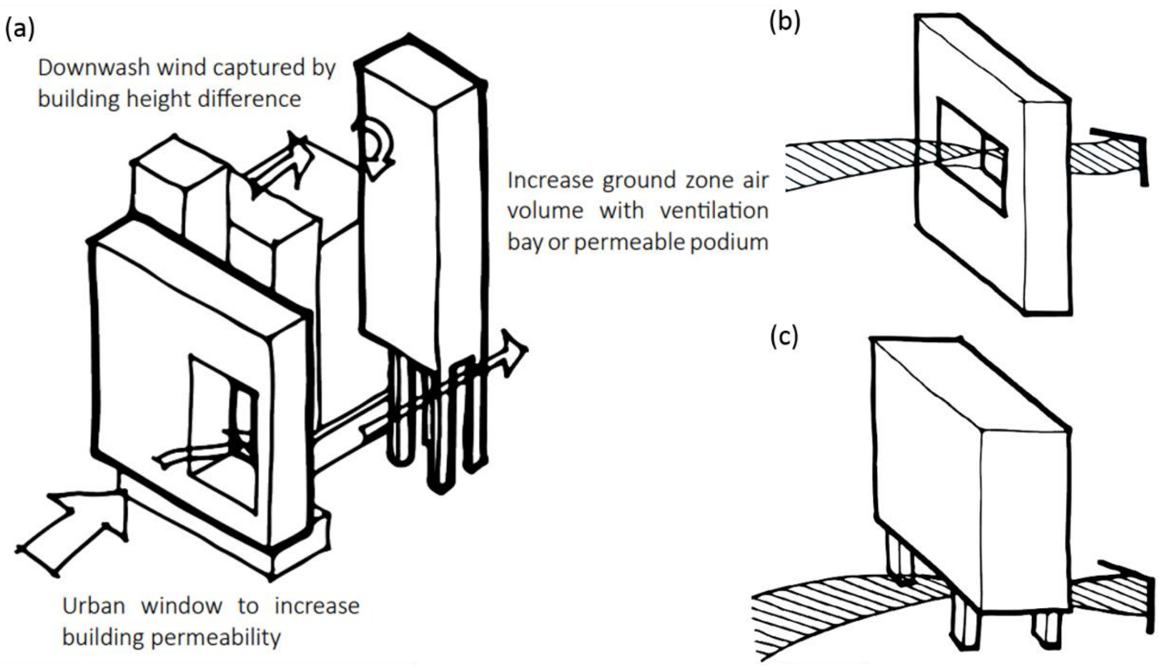
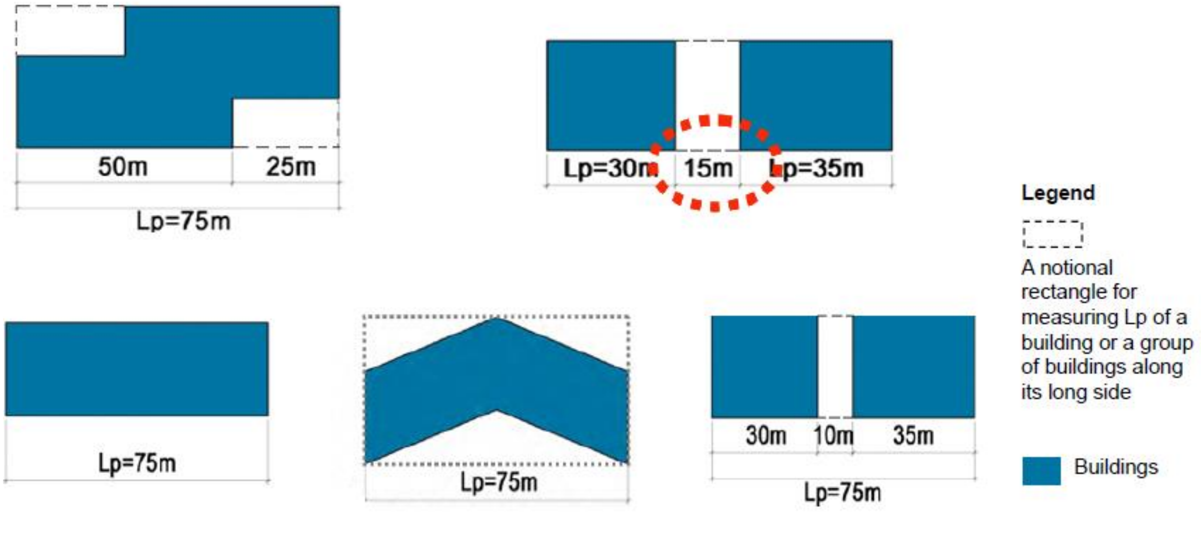


Figure A-6 (a) Increase ventilation with building design, (b) increase building permeability, and (c) increase ground zone air volume by permeable podium.

[Reference: HKGBC Guidebook on Urban Microclimate Study]

Appendix A (Cont'd)



Diagrammatic Plans of Buildings

Figure A-7 Determining L_p, i.e. the total projected length of façade of a building or a group of buildings if separation between them is less than 15m. Building portions at low zone of height ≤6.67m are disregarded in L_p.

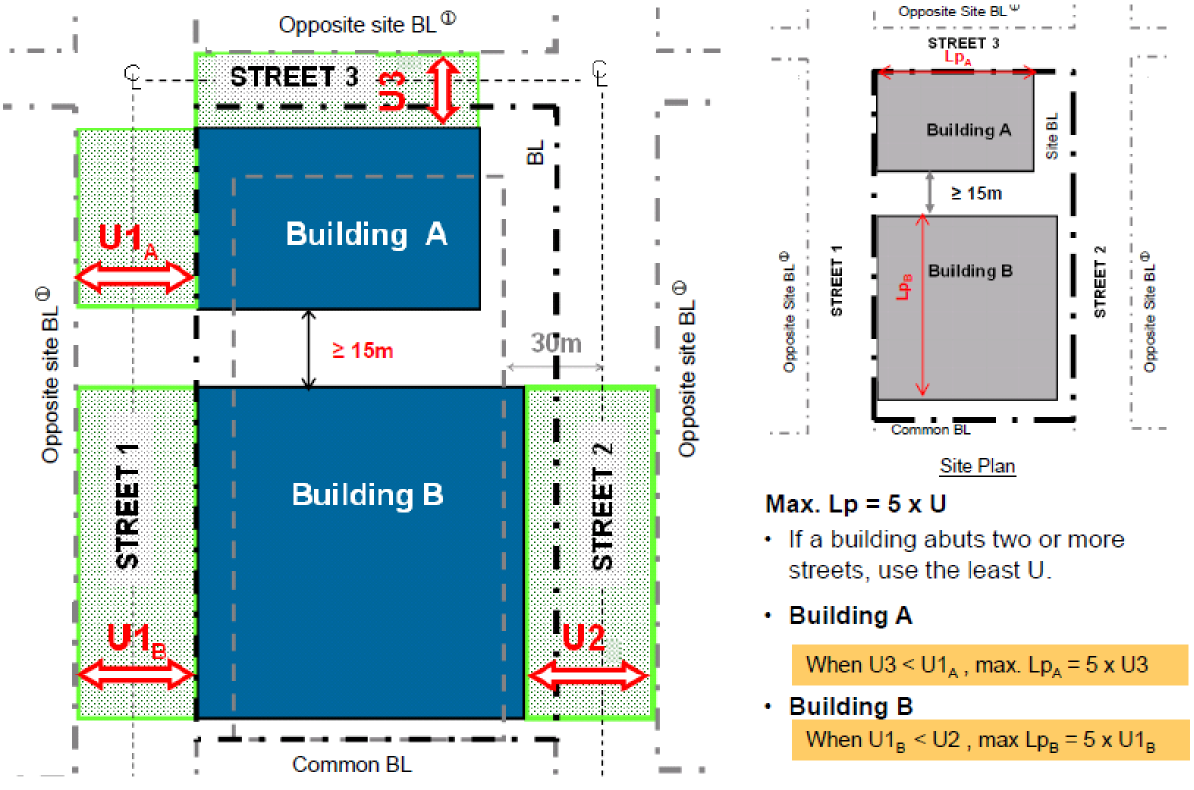


Figure A-8 Defining the mean width of street canyon (U) and the maximum permissible continuous projected façade length (L_p).

Appendix A (Cont'd)

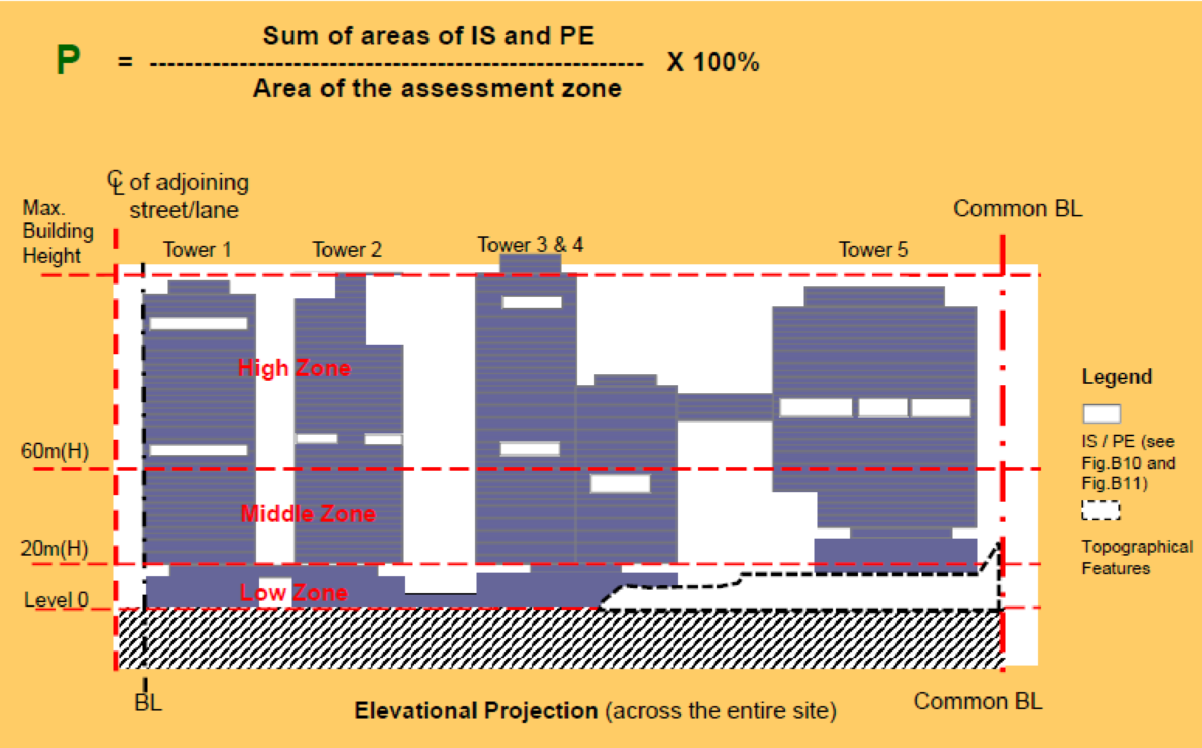
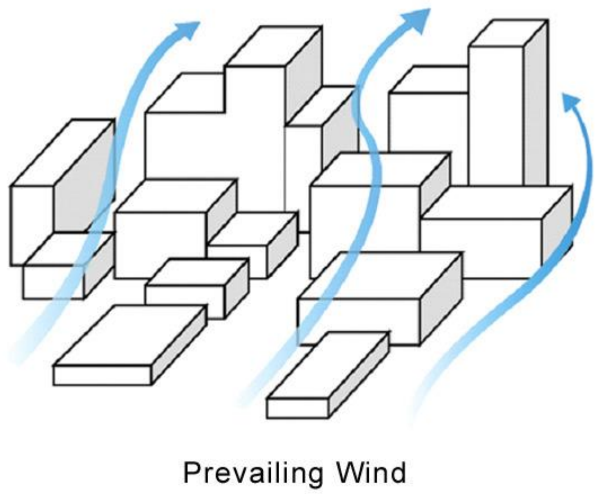


Figure A-9 Assessment of Permeability (P).

[Reference: Sustainable Building Design Guidelines (PNAP APP-152)]

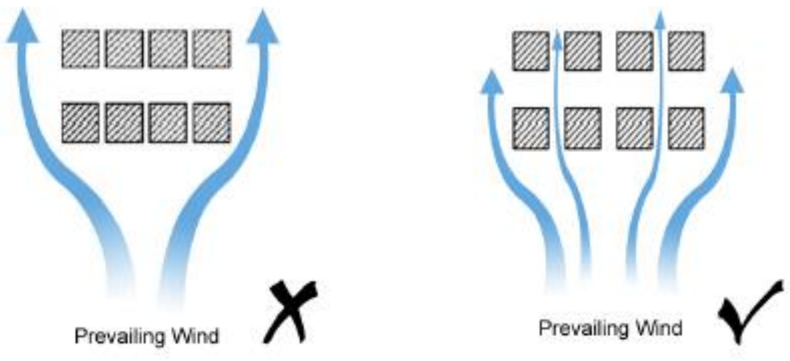


In general, gradation of building heights would help wind deflection and avoid air stagnation. Where appropriate, height variation across the district with decreasing heights towards the direction where the prevailing wind comes from should be adopted to promote air movements.

Figure A-10 Varying height profile to promote air movements.

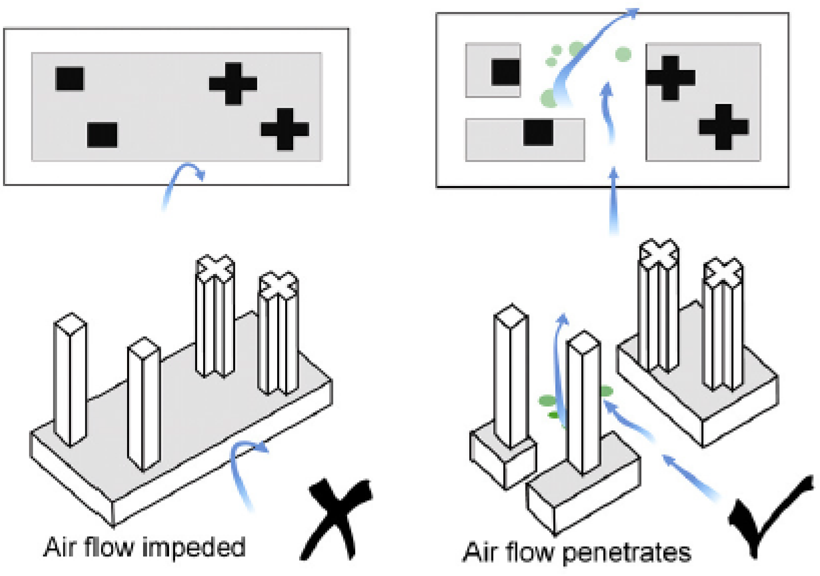
[Reference: Hong Kong Planning Standard and Guidelines]

Appendix A (Cont'd)



Where practicable, adequately wide gaps should be provided between building blocks to maximize the air permeability of development and minimize its impact on wind capturing potential of adjacent developments. The gaps for enhancing air permeability should be at a face perpendicular to the prevailing wind.

Figure A-11 Gaps between Building Blocks to Enhance Air Permeability.

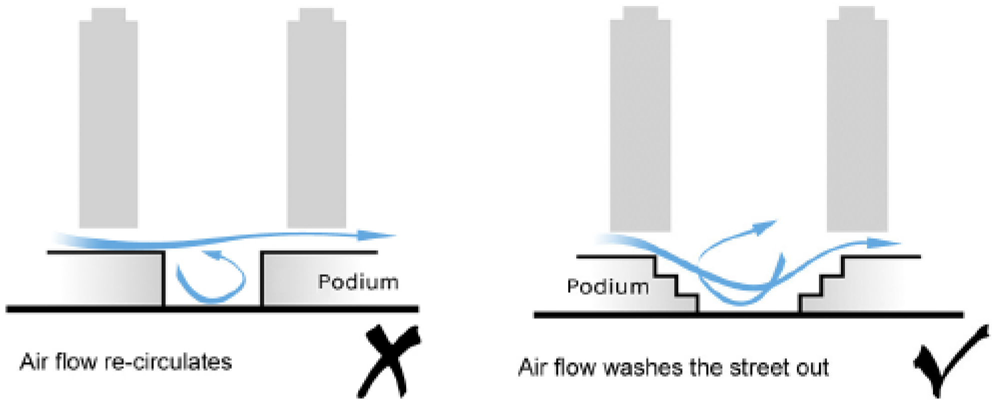


Compact integrated developments and podium structures with full or large ground coverage on extensive sites typically found in Hong Kong are particularly impeding air movement and should be avoided where practicable.

Figure A-12 Reducing Site Coverage of the Podia to Allow More Open Space at Grade.

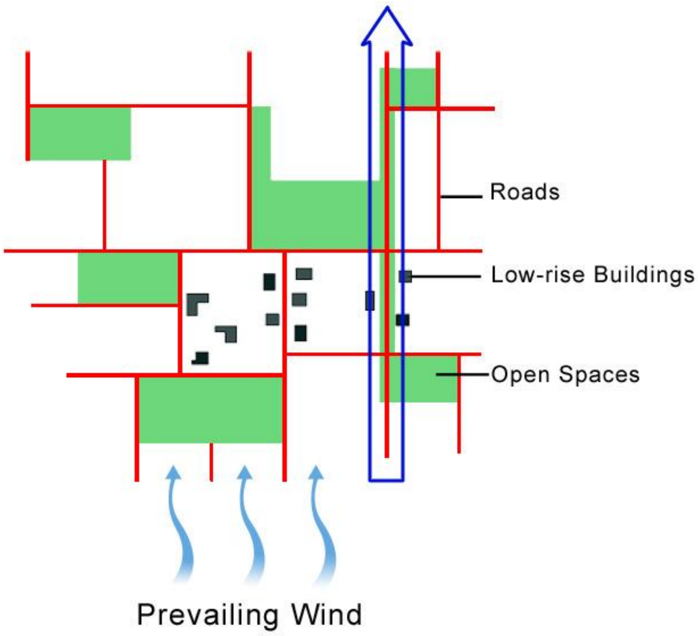
[Reference: Hong Kong Planning Standard and Guidelines]

Appendix A (Cont'd)



Where appropriate, a terraced podium design should be adopted to direct downward airflow to the pedestrian level.

Figure A-13 Terraced Podium Design.



Breezeways should be created in forms of major open ways, such as principal roads, inter-linked open spaces, amenity areas, non-building areas, building setbacks and low-rise building corridors, through the high-density/high-rise urban form. They should be aligned primarily along the prevailing wind direction routes, and as far as possible, to also preserve and funnel other natural air flows including sea and land breezes and valley winds, to the developed area.

Figure A-14 Linkage of Roads, Open Spaces and Low-rise Buildings to Form Breezeways.

[Reference: Hong Kong Planning Standard and Guidelines]

Appendix A (Cont'd)

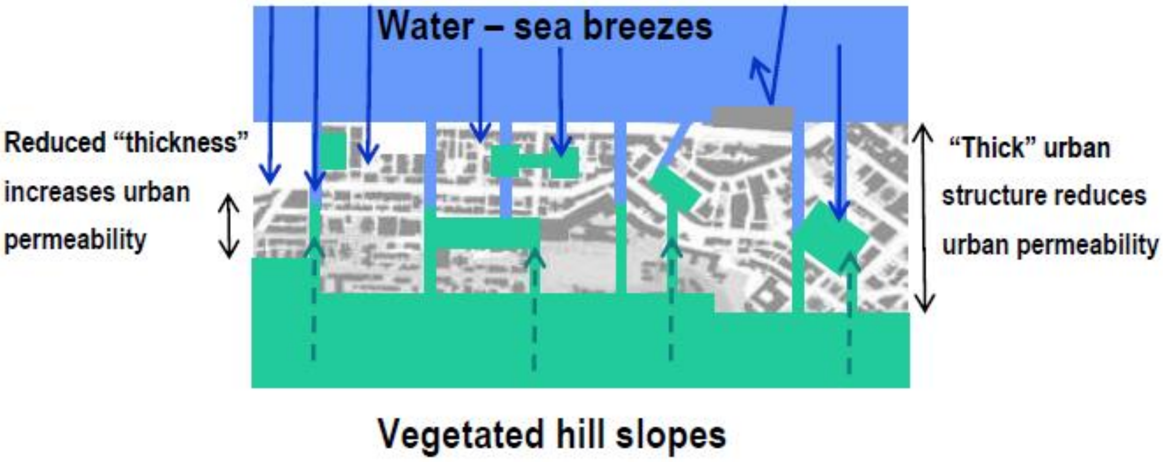


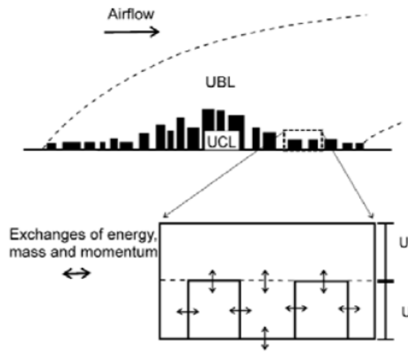
Figure A-15 Ways to create breezeways and air paths in the urban fabric to facilitate air ventilation connectivity.

[Reference: Hong Kong Planning Department. (2012). "Urban Climatic Map and Standards for Wind Environment - Feasibility Study" Final Report.]

Appendix B

A scientific understanding of building heights for City Planning

The air mass exchange of an urban area can be understood based on the Urban Boundary Layer (UBL) and the Urban Canopy Layer (UCL) interaction.



To optimize air ventilation of the UCL, which is the layer of human occupation including pedestrian at ground level, it is useful to maximize the energy, mass and momentum exchange between UBL and UCL. The vertical exchange is denoted by U_E and can be expressed with the following equations:

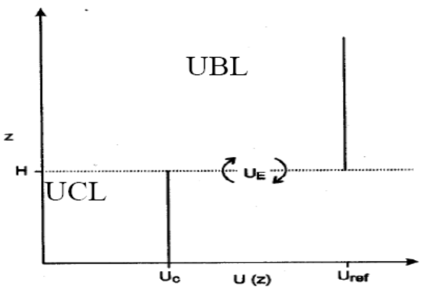
$$\frac{U_E}{u^*} = \left[\frac{1}{k}\ln\left(\frac{z_{ref} - d}{z_o}\right) - \frac{U_C}{u^*}\right]^{-1}$$

where

$$\frac{U_C}{u^*} = \left[\frac{\lambda_f}{2}\right]^{-0.5} \quad \text{for } \lambda_f > 0.2$$

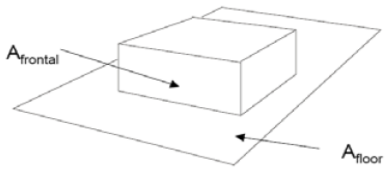
$$\frac{U_C}{u^*} = \left[\frac{z_o}{2H}\right]^{-0.5} \quad \text{for } \lambda_f < 0.2$$

Uc	the average flow within the canopy
U*	friction velocity
Zo	roughness length
d	displacement height
λf	frontal area density
H	average building height
K	von Karman constant = 0.4



λf frontal area density :-

$$\lambda_f = \left(\frac{\sum_{obstacles} A_{frontal}}{A_{floor}}\right)$$



Hence, to increase U_E , it is important to lower the displacement height (which is normally taken as 0.7*UCL, and UCL is commonly taken as 1.2*H). It is also important to increase the roughness length (Zo) by optimizing λf to around 0.1 to 0.3.

All else being equal, this means a collection of <u>tall buildings</u> in an urban area resulting in high UCL and high λf, and therefore higher displacement height, can lead to lower U_E. Lowering building heights can be a solution.

Furthermore, this also means that closely packed buildings of <u>uniform building height</u> (or small building height variation) can result in lower Zo and can lead to lower U_E. Creating large building height variations can be a solution. Having a building height to street width (H/W) ratio of less than 1.5 to 2 in order to avoid a skimming flow regime developing can also be a solution.

Professor Edward Ng, CUHK, 2009.

Appendix C

Details on the Analysis of Building Frontage

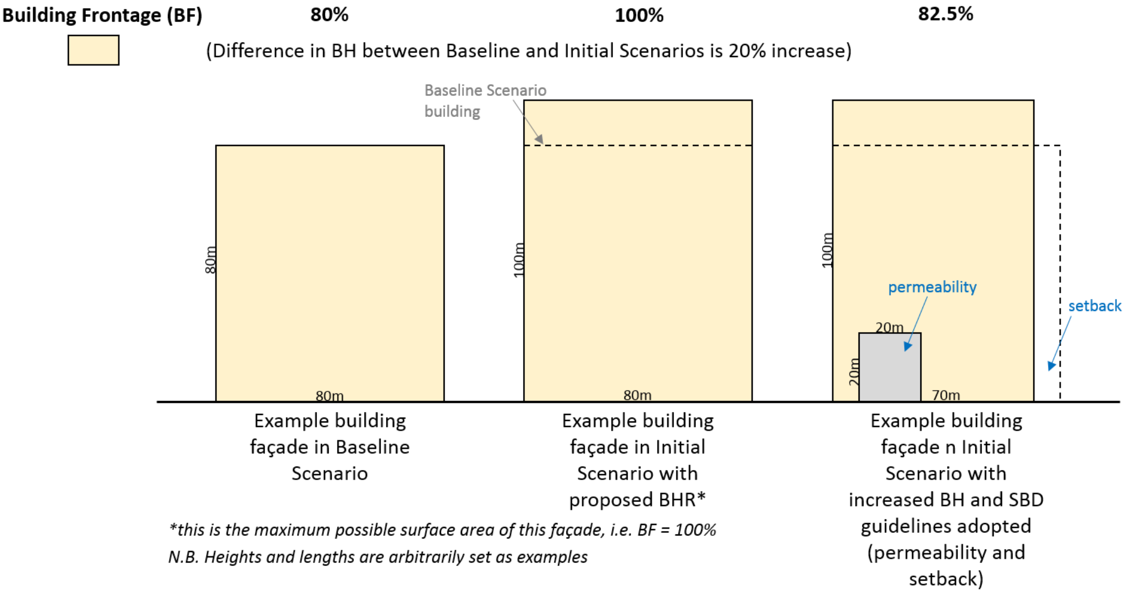


Figure C-1 Graphical description of building frontage.

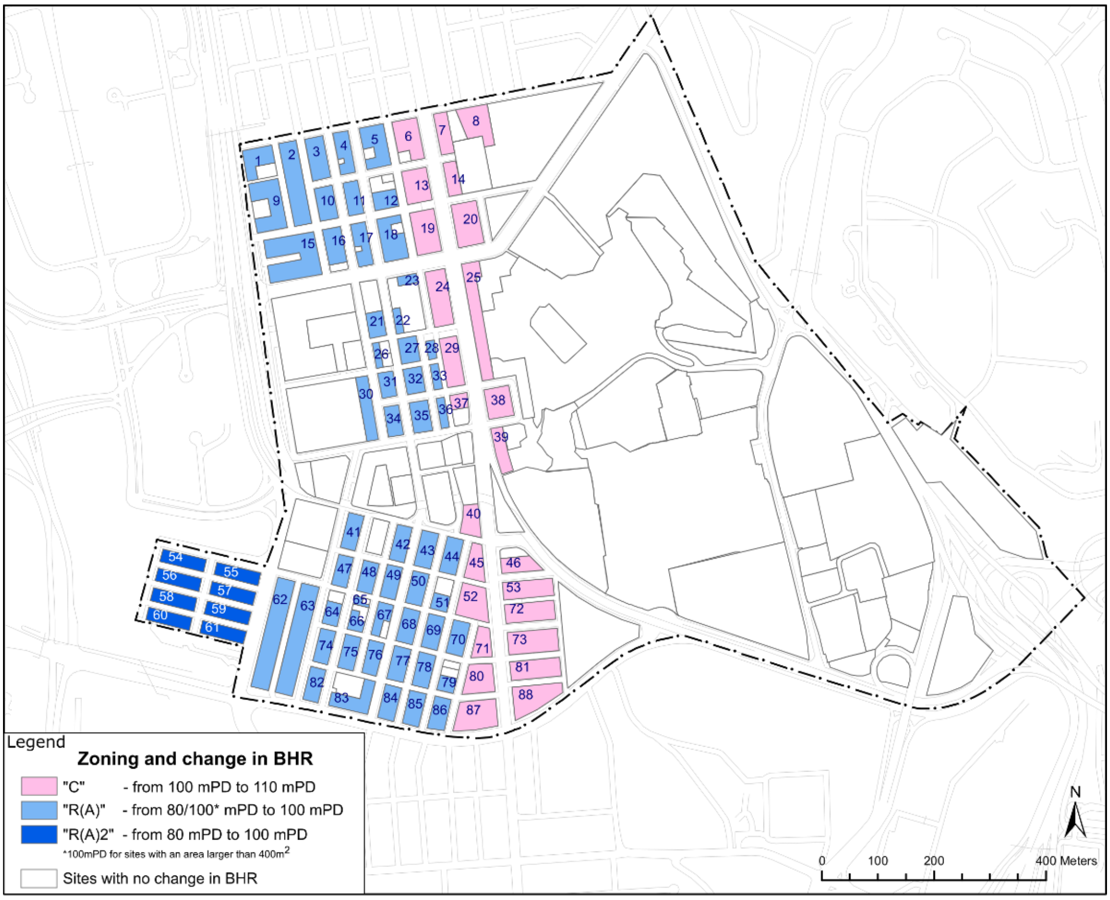


Figure C-2 Numbered OZP zones for the analysis of building frontage shown in Table C-1.

Appendix C (Cont'd)

Table C-1 Difference in building frontage between the Baseline and Initial Scenarios for each OZP zone (numbered as in Figure C-2). Analysis has been carried out for three cases, where 50% (Case 1), 75% (Case 2), and 100% (Case 3) (in terms of area) of the "R(A)" sites are assumed to have site areas larger than 400m^2 (except for zone number 65, which has an area of around 300m^2 only).

Zone no.	Difference in building frontage		
	Case 1 (50% large sites)	**Case 2 (75% large sites)**	**Case 3 (100% large sites)**
1	10%	5%	0%
2	10%	5%	0%
3	10%	5%	0%
4	10%	5%	0%
5	10%	5%	0%
6	9%	9%	9%
7	9%	9%	9%
8	9%	9%	9%
9	10%	5%	0%
10	10%	5%	0%
11	10%	5%	0%
12	10%	5%	0%
13	9%	9%	9%
14	9%	9%	9%
15	10%	5%	0%
16	10%	5%	0%
17	10%	5%	0%
18	10%	5%	0%
19	9%	9%	9%
20	9%	9%	9%
21	10%	5%	0%
22	10%	5%	0%
23	10%	5%	0%
24	9%	9%	9%
25	9%	9%	9%
26	10%	5%	0%
27	10%	5%	0%
28	10%	5%	0%
29	9%	9%	9%
30	10%	5%	0%
31	10%	5%	0%
32	10%	5%	0%
33	10%	5%	0%
34	10%	5%	0%
35	10%	5%	0%

Appendix C (Cont'd)

Table C-1 (cont'd)

36	10%	5%	0%
37	9%	9%	9%
38	9%	9%	9%
39	9%	9%	9%
40	9%	9%	9%
41	10%	5%	0%
42	10%	5%	0%
43	10%	5%	0%
44	10%	5%	0%
45	9%	9%	9%
46	9%	9%	9%
47	10%	5%	0%
48	10%	5%	0%
49	10%	5%	0%
50	10%	5%	0%
51	10%	5%	0%
52	9%	9%	9%
53	9%	9%	9%
54	20%	20%	20%
55	20%	20%	20%
56	20%	20%	20%
57	20%	20%	20%
58	20%	20%	20%
59	20%	20%	20%
60	20%	20%	20%
61	20%	20%	20%
62	10%	5%	0%
63	10%	5%	0%
64	10%	5%	0%
65	20%	20%	20%
66	10%	5%	0%
67	10%	5%	0%
68	10%	5%	0%
69	10%	5%	0%
70	10%	5%	0%
71	9%	9%	9%
72	9%	9%	9%
73	9%	9%	9%
74	10%	5%	0%
75	10%	5%	0%

Appendix C (Cont'd)

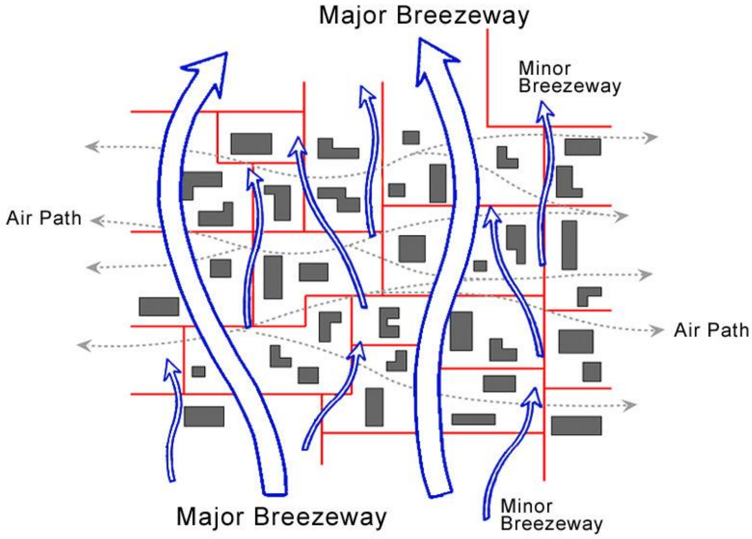
Table C-1 (cont'd)

76	10%	5%	0%
77	10%	5%	0%
78	10%	5%	0%
79	10%	5%	0%
80	9%	9%	9%
81	9%	9%	9%
82	10%	5%	0%
83	10%	5%	0%
84	10%	5%	0%
85	10%	5%	0%
86	10%	5%	0%
87	9%	9%	9%
88	9%	9%	9%
average	**10.8%**	**7.7%**	**4.6%**

Appendix D

General principles for providing urban ventilation at different scales

For better urban air ventilation, it is important to consider air paths at different scales.



[Figure reference: Hong Kong Planning Standard and Guidelines]

The major breezeways allow the incoming winds to penetrate deep into and through the urban areas directly. Breezeways are major primary arteries of urban air movement. They should be wide and preferably provided with vegetation. Their widths can range from a few hundred metres to 50-70 metres.

The air brought in by the breezeways are then filtered into the urban areas by a network of interconnected air paths. They should be evenly distributed in the urban areas and their widths can range from 20 to 50 metres. They help distribute air flow evenly throughout the urban areas so that more extensive areas may benefit from momentum-driven air movements.

Air movements are further enhanced at the next level by building porosity and permeability. They allow air mass exchanges (by turbulent diffusion) and air mixture, and are much needed in densely built-up areas.

Breezeways/ Air paths/ Building permeability at these three scales must work together for the provision of a quality and comfortable urban environment. Breezeways and air paths should be incorporated strategically into the urban district and planning level. Planners should make reference to Chapter 11 Urban Design Guidelines of the Hong Kong Planning Standard and Guidelines for their design and disposition. Building porosity and permeability should be introduced at the building design level. In this regard, key building design elements are set out in the Sustainable Building Design Guidelines.

Professor Edward Ng, CUHK, 2018.

Appendix E

Extract from Witness Statement of Ng Yan Yung
– REDA HCAL 58/2011. for Town Planning Board & Department of Justice HKSAR.

4.4 I have read the Applicant's representation submitted to the Board on 18 November 2010 **[LL-1:A6/12]**, and consider the arguments it contains invalid. The Applicant quoted the recommendations of the EE report out of context and in a piecemeal manner. It advocated taller buildings by increasing the height bands "…*by, say 10m to 20m to permit buildings of around 40 storeys, would provide for better urban design …*' (§3.1.4) and asked for deletion of all the NBAs and setbacks (§4.6 to 4.7), which were much needed to improve urban air ventilation of the area. The major justifications against the NBAs and setbacks are mainly related to whether such designation is permissible under the Ordinance, i.e. the spot restriction issue, and whether the Draft OZP is the most appropriate means to achieve the purpose. There is little substance on air ventilation aspect to justify its proposal.

4.5 In a nutshell, the Applicant's representation wished that neither the BH nor how the building sits on the site should be controlled hoping that *"good development design that benefits the public*" (§5.1) might come about if, and only if, "*incentive*" are given. However, in the absence of proper planning control, there is no guarantee that measures to improve air ventilation would be voluntarily incorporated in the private developments. The allowance for design flexibility, encouragement or incentive would simply turn into a quest for maximization of BH for better view and high profitability. The need to improve air ventilation for the public good will not be safeguarded.

4.6 In the EE report **[LL-1:A3/9(11)/493; §7.3]** the following is stated in this regard: "*All in all, given practical constraints and the need to respect 'development rights' of the land owner, the proposed mitigation measures have noted and responded to some of the major concerns we expressed on the Initial Planned Scenario. However, the overall need to reduce the Ground Coverage, Building Volume Density and building height has not been addressed. Besides, more non-building areas and greeneries are still highly encouraged to include. We regard this represents a small but important step towards creating a quality urban environment for the general public of Hong Kong.*"

Appendix E (Cont'd)

Yau Ma Tei and its urban air ventilation environment

4.8 When the narrow streets of Yau Ma Tei were laid out by Sir Patrick Abercrombie[1] during the postwar years, it was never meant for the kind of tall buildings we are seeing nowadays. A H/W ratio in the order of 1:1 was the norm in those days. Today, like Wan Chai area, the area has high average H/W ratio, high FAD, and one of Hong Kong's more severe UHII. The wind condition in the core area of Yau Ma Tei is weak. The relentless pursuit of maximising development intensity without due consideration of our built environment in the area in the past many years is one of the main causes of the poor-environment that we are now suffering from.

4.9 Again, like Wan Chai area, apart from human thermal consideration, the lack of urban air ventilation in Yau Ma Tei also means that anthropogenic wastes may not be properly and rapidly dissipated. I verily believe that it is important that we review the urban planning and building design of the area to improve, among other environmental factors, the air ventilation performance of the area.

4.10 The background of the review of the Yau Ma Tei OZP and consideration of the Applicant's representation by the Board are set out in the Affirmation of Chan Wai Shun. To recap, PlanD commissioned ENVIRON Hong Kong Limited to conduct an AVA by EE for the area. Taking into account the recommendations of the EE report **[LL-1:C2/7(3)]** as well as other planning considerations, PlanD proposed amendments to the Yau Ma Tei OZP to impose BHRs, NBA and setbacks, and the amendments were adopted by the Board and exhibited for public inspection under the Ordinance on 29 October 2010. The Applicant submitted a representation to the Board against most of the amendments to the OZP on 28 December 2010. After consideration of the representations on 13 May 2011, the Board decided not to uphold the Applicant's representation.

4.11 I have read the Applicant's representation submitted to the Board on 28 December 2010 **[LL-1:C4/10]**, which is quite similar to the one for Wan Chai, and consider the arguments it contains invalid. In principle, my view in Section 4.4 to 4.6 above applies to this present situation. In the absence of proper planning control for the area, the need to improve air ventilation for the public good will not be safeguarded. Thus, I consider the Board's decision not to uphold the Applicant's representation reasonable.

[1] Sir Patrick Abercrombie was an English architect and town planner. He is best known for the post-Second World War replanning of London. During the postwar years, he was commissioned by the British government to redesign Hong Kong. The Hong Kong Preliminary Planning Report 1948 prepared by him contains the first strategic plan for the territory, leaving great influence on the urban form and planning of Hong Kong.

Appendix E (Cont'd)

In summary

4.23 In sum, due to dense and tall urban developments and narrow streets, the built-up areas covered by these four OZPs are generally subject to poor air ventilation. Taking into account my views of the four OZP areas as outlined above, I verily believe that, all in all, the reviews of these OZPs for imposition of appropriate BHRs, NBAs, setbacks and building gaps are positives step towards the direction of providing a more livable built environment for the community.

4.24 I have read the Final Reports of the EE ("the EE Reports") prepared by myself [LL-1:A3/9(11)], CO2nnsulting Limited [LL-1:D2/7(4)] and ENVIRON Hong Kong Limited [LL-1:B3/9(3) & C2/7(3)]. The EEs were all conducted in accordance with the requirements of the Technical Guide. The EE Study process was iterative in its nature. They all started with an evaluation of the topography, urban morphology and local wind environment in the concerned areas with a view to identifying areas of air ventilation concern. With this in mind, the consultants then assessed the air ventilation impact of an initial planned scenario prepared by PlanD with the BHRs imposed. Various recommendations, e.g. adjustments to BHRs, provision of NBAs, setbacks and building gaps, were made by the consultants in order to improve the air ventilation performance of the areas, and there was discussion between PlanD and AVA consultants. In making the recommendations, apart from their expertise/experience and understanding of the local wind environment and urban morphology in the area, the consultants made reference to the established guidelines and quantitative indicators. Some examples are quoted below:

(b) in the Yau Ma Tei EE, the consultant has recommended the imposition of building setbacks on podium level along Portland Street, Woosung Street (between Kansu Street and Saigon Street), Parkes Street and Arthur Street to reduce the H/W ratio along these streets (§4.3.3);

4.25 Upon the recommendations of the consultants, PlanD incorporated various air paths, NBAs, building setbacks and/or BHRs (for the purpose of creating air paths). A couple of dimensions for the NBAs, setbacks and building gaps had been worked out based on the professional advice of the consultants with due regard to the practicality of the proposal (e.g. site constraint, and the impact on the development potential of the site as assessed by PlanD). The consultants then re-examined and confirmed whether the measures would improve air ventilation performance in the Area as compared with the initial scenario.

4.26 All in all, I consider that the EE Reports have provided a reasonable and sound basis to assist planners with their planning decisions. My reservation is that the recommendations that PlanD has incorporated into these Draft OZPs can only be considered as efforts to "slow down" the worsening air ventilation problem of the areas knowing that even with the BHRs, a lot of taller-and-bulkier buildings, compared to the existing buildings, will eventually be constructed. In my opinion, even more can and should be done.