Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment Services under Agreement No. PLNQ 35/2009

Expert Evaluation and Advisory Report for

Proposed Amendments to Ngau Tau Kok and Kowloon **Bay Outline Zoning Plan**

Final

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EXECUTIVE SUMMARY

CO₂nnsulting was commissioned by the Planning Department of HKSARG under the Term Consultancy for Expert Evaluation on Air Ventilation Assessment Services to assess the air ventilation impacts of the building height restrictions incorporated in the draft Ngau Tau Kok and Kowloon Bay Outline Zoning Plan No. S/K13/25 and recommend mitigation measures to alleviate the impacts.

The methodology adopted here follows that for an expert evaluation in the "Technical Guide for Air Ventilation Assessment for Developments in Hong Kong" as well as those requirements in the Project Brief.

The wind data in Ngau Tau Kok and Kowloon Bay is obtained from the CLP Power Wind / Wave Tunnel Facility (WWTF) at The Hong Kong University of Science and Technology. The annual prevailing wind directions for the Project Area are: north-easterlies, easterlies and south-easterlies. The summer prevailing wind directions for the Project Area are: easterlies, south-easterlies, southerlies, and south-westerlies.

The Project Area of Ngau Tau Kok and Kowloon Bay is hilly on the east and flat on the west. Region 1 of the Project Area is located at the east of Kai Tak Planning Area (former airport), adjacent to the Kwun Tong Typhoon Shelter, includes Kowloon Bay Business Area (KBBA) with maximum building height restriction of 170 mPD, and large-scale public housing estates and substantial private residential developments. Region 1 enjoys abundant sea breeze due to its proximity to the harbour. The majority of streets in Region 1 run north-south and east-west, channeling cooler sea breeze to the redevelopment area. As Region 1 is the gateway to sea breeze, it is essential that the OU and G/IC sites at the waterfront are maintained at 40mPD or below to allow permeability of sea breeze to Kowloon Bay. This strategy has already been adopted in the committed plan. Numerous sites in form of Residential, Commercial, G/IC and OU are planned to be developed in Kai Tak which is just southwest of Region 1, outside the Project Area. The majority of the buildings are in the range of 15mPD to 65mPD. Care should be exercised in the arrangement of building blocks in the Kai Tak area to minimise the adverse impact of air ventilation to the Kowloon Bay area.

The KBBA is densely packed with medium to high-rise commercial and industrial buildings (120 mPD to 170 mPD). Narrow roads are found in the KBBA. Given the maximum

building height and the width of the blocks, the negative impact on air ventilation cannot be mitigated unless the effective road spacing (measured from building face-to-building face) is increased from 10m - 25m to 30m or beyond. Since this mitigation measure is not practical, it is recommended to introduce and maintain several urban linear parks and open space within KBBA, as well as practical setbacks from the roads. These ventilation pockets include the CICTA Sheung Yuet Road Training Ground, Lam Wah Street Playground, Kowloon Bay Park, Kowloon Bay Sports Ground, Kowloon Bay Playground, a series of "linear open space", as well as numerous low-rise G/IC sites with building height restriction of 40mPD, help to improve air ventilation in the Kowloon Bay Area, and should be maintained.

The committed linear open spaces from Kai Cheung Road to Wang Yuen Street would better serve the business area if the further redeveloped building(s) are set back from Wang Mau Street by 5m. A building gap of around 15m is recommended along Sheung Yee Road and Lam Hing Street to extend the breezeway for better permeability in KBBA. Widening breezeways, Wang Kwong Road and Wang Chiu Road, by setting back three meters on each side of the road will improve the effectiveness of the major breezeways. The KBBA area lacks breezeways to funnel easterlies and sea breeze. The introduction of a non-building area at the proposed International Mail Centre to connect to the breezeway provided by Wang Tai Road and Lam Wah Street would improve the air ventilation in the KBBA. The site of Enterprise Square V is sizable with unfavourable slab-type towers. As Enterprise Square V sits on the waterfront, it presents an obstacle to permeability to KBBA. A slanting alignment of the 15m building gap is recommended at the 22mPD podium level of Enterprise Square V to introduce a wind corridor for the oncoming sea breeze. A permeable podium is recommended for the Enterprise Square V. It is also recommended that the building disposition should adopt a similar arrangement shown in the study report for air ventilation improvement.

Outside of the KBBA, the majority of the land consists of large-scale housing estates and residential developments, such as the Kai Yip Estate, the committed Lower Ngau Tau Kok Estate Redevelopment Project, and Richland Gardens. In general, building disposition should not form a wind wall to improve permeability. Furthermore, low-rise facilities should be located in the centre of these developments to maximise the size of the open courtyard to improve local ventilation. Recommendations for such sites have been provided in the study report.

Region 2 of the Project Area is hilly, with the majority of open space in the form of G/IC sites, green belts and open space areas, such as Jordan Valley Playground, Jordan Valley Leisure

Pool Complex, Ping Shek Recreational Ground, Former Jordan Valley Landfill Site, Service Reservoir, Shun Lee Tsuen Park, which provide pleasant air ventilation to the region, and should be maintained. Areas of larger-scale medium-rise residential developments are located along the eastern and western boundaries of Region 2, with maximum height from 80mPD to 250mPD. In general, there are no significant negative air ventilation impacts due to these estates because of the abundance of the surrounding open space, green belt and/or low-rise G/IC developments. These areas shall be maintained for better air ventilation. However, better arrangements in terms of air ventilation have been proposed in the study report for future redevelopments.

In the proposed plan, the proposed maximum building height of Telford Gardens remain unchanged (60mPD and 100mPD). The proposed plan also indicates that two corridors have been proposed to be introduced on the podium (22mPD). This strategy will help to provide a wind corridor connecting Wang Tai Road and Sheung Yuet Road. A 15m to 20m building gap is also recommended to connect Kwun Tong Road to Tai Yip Street to improve air ventilation.

The proposed maximum building height of Kai Yip Estate increased from 60mPD to 80mPD and 100mPD. The increased maximum height is acceptable, however it is recommended that the building disposition should adopt a similar arrangement shown in the study report for air ventilation improvement.

The maximum building height of 100mPD is retained for the site of Richland Gardens. The current disposition includes sizable building gaps in the range of 60m to 85m, maintenance of this space together with the unchanged building height will give a positive impact on air ventilation.

The proposed maximum building height of Shun Chi Court and Shun Tin Estate are kept at 170mPD and 160mPD/170mPD respectively. When the building disposition adopts a similar arrangement shown in the study report, the air ventilation effectiveness will be improved.

For specific sites where large-scale development or redevelopment may be possible, detailed AVAs on a site-by-site basis should be undertaken.

The baseline scenario and alternative option of Kai Tak Mansion site have been compared in terms of AVA. It is concluded that the alternative option with a building gap of 20m to 24m wide at 15mPD and non-building areas of 10m provides better air ventilation compared to the baseline option.

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1. INTRODUCTION

CO₂nnsulting was commissioned by the Planning Department of HKSARG under Category A Service of the Term Consultancies for Air Ventilation Assessment Services (AVAs). The objective is to assess the air ventilation impacts of the plot ratio / gross floor area and building height restrictions under the draft Outline Zoning Plan (OZP) No. S/K13/25 Ngau Tau Kok and Kowloon Bay Area and recommend mitigation measures to alleviate the impacts.

The main tasks are to provide the followings:

- Site inspection and analysis of the wind data and environment of the Project Area;
- A qualitative evaluation of the air ventilation impacts of the development as illustrated under the planned scenario as compared to the existing scenario;
- Recommendations of mitigation and improvement measures.

Figure 1 shows the boundary of the Project Area. Figure 2 shows satellite images of the Project Area. Figure 3 shows various views within the Project Area. The methodology adopted here follows that for an expert evaluation in the "Technical Guide for Air Ventilation Assessment for Developments in Hong Kong" as well as those requirements in the Project Brief.

2. SITE INFORMATION

The Project Area covers Ngau Tau Kok and Kowloon Bay area which is located at the South-east Kowloon within the Kwun Tong District, with an area of approximately 341 hectares (according to S/K13/25). See Figure 1. The Project Area descends from the foothills of Fei Ngo Shan and Tan Shan in the north and east respectively to the Kwun Tong Typhoon Shelter in the southwest. It is bounded by New Clear Water Bay Road and Clear Water Bay Road in the north, Kwun Tong By-pass in the west, Shun Yip Street and Chun Wah Road in the south, and Hong Ning Road, Sau Mau Ping Road and Lee On Road in the east. Kai Tak, Ngau Chi Wan and Kwun Tong (South) are the adjacent districts, outside of the Project Area, in the west, north-west and south-east directions respectively.

For the purpose of expert evaluation, the total Project Area is dissected into the following regions of similar topography, as shown in Figure 1.

Sub areas	Location	Descriptions	Terrain
Region 1	Bounded by Kwun Tong Road,	Mixed land use of residential developments, in	flat (4.6 mPD
	Ngau Tau Kok Road, Shun Yip	terms of Residential (R(A)) and Other	to 5.8 mPD)
	Street and Kwun Tong Bypass	Specified Uses (OU); business developments,	
		in terms of Commercial (C) and Other	
		Specified Uses (OU); and Government	
		/Institution or Community (G/IC), with some	
		Open Space (O).	
Region 2	Bounded by Kwun Tong Road,	Majority are open space, in terms of Green Belt	hilly (8.5
	Ngau Tau Kok Road, Chun Wah	(GB), Open Space (O), Government /	mPD to
	Road, Hong Ning Road, Sau Mau	Institution or Community (G/IC); Residential	175.2 mPD)
	Ping Road, Lee On Road, New	developments (R(A), R(B)).	
	Clear Water Bay Road and Clear		
	Water Bay Road.		

Table 1 Characteristics of Sub-Regions within Project Area



Figure 1 The Project Area of Ngau Tau Kok and Kowloon Bay

(Image source: Google maps, <u>http://maps.google.com.hk</u>)





b) Region 2: Residential Developments with Abundant Open Space Areas

J9008-07 Ngau Tau Kok and Kowloon Bay

Shun On Road

Shun Lee Tsuen

Sau Mau Ping Road

Road

Image © 2010 DigitalGlobe © 2010 MapKing Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Image © 2010 GeoEye

Figure 2 Satellite Images of the Project Area

(Image source: Google maps, http://maps.google.com.hk)



Figure 3a Views of Ngau Tau Kok Road (a key breezeway) Looking Southeastward Showing Amoy Garden

(Image source: CO2nnsulting Ltd.)



Figure 3b Views of CICTA Sheung Yuet Road Training Ground (a ventilation pocket)

(Image source: CO2nnsulting Ltd.)





Figure 3c Views of Ping Shek Recreational Ground (ventilation pocket) on New Clear Water Bay Road (a key breezeway)

(Image source: CO₂nnsulting Ltd.)



Figure 3d Views of Shun On Road (a key breezeway) Looking Southeastward Showing Shun Tin Estate (right) and Foothill of Tan Shan (left)

(Image source: CO₂nnsulting Ltd.)





Figure 3e Views of Ventilation Pockets such as Jordan Valley Playground (left) and Jordan Valley Leisure Pool Complex (right)

(Image source: CO₂nnsulting Ltd.)



Figure 3f Views of Kwun Tong Road (a key breezeway) Looking Southward Showing Lower Ngau Tau Kok Estate (left)

(Image source: CO₂nnsulting Ltd.)





Figure 3g Views of Wai Yip Street (a key breezeway) Looking Southward

(Image source: CO₂nnsulting Ltd.)



Figure 3h Views of Wang Hoi Road (a key breezeway) Looking Northward

(Image source: CO₂nnsulting Ltd.)



Figure 3i Views of Wang Tai Road (a key breezeway) Looking Northward (Image source: CO₂nnsulting Ltd.)



Figure 3j Views of Wang Chiu Road (a key breezeway) Looking Northward Showing Enterprise Square V (left) and Enterprise Square III (right) (Obstruction to breeze) (Image source: CO₂nnsulting Ltd.)





Figure 3k Views of Lam Wah Street Playground (ventilation pocket) on Wang Kwong Road

(Image source: CO₂nnsulting Ltd.)



Figure 3I Views of Kowloon Bay Sports Ground

(Image source: CO2nnsulting Ltd.)

3. WIND ENVIRONMENT

The wind data at various heights refers to the experimental data conducted by the CLP Power Wind / Wave Tunnel Facility (WWTF) at The Hong Kong University of Science and Technology for the Ngau Tau Kok and Kowloon Bay Study Area. The annual and Summer wind roses at 60m, 120m and 450m are shown in Figure 4. The wind roses show that the wind data at the lowest levels of 60m and 120m are subject to more urban roughness, compared to the data at 450m, which is closer to the edge of the atmospheric boundary layer. Nonetheless, the annual prevailing wind directions for the Project Area are: north-easterlies, easterlies and south-easterlies. The summer prevailing winds are: easterlies, south-easterlies, south-easterlies and south-westerlies.

Height	Annual	Summer
60m	Height: 60m, Angle: 16 intervals	Height: 60m, Angle: 16 intervals
120m	Height: 120m, Angle: 16 intervals	Height: 120m, Angle: 16 intervals
450m	Height: 450m, Angle: 16 intervals	Height: 450m. Angle: 16 intervals

Figure 4 Annual and Summer Wind Roses for Ngau Tau Kok and Kowloon Bay

(Source: CLP Power Wind / Wave Tunnel Facility (WWTF) at The Hong Kong University of Science and Technology)

4. EXISTING SCENARIO

4.1 Topography

The following observations of the characteristics of the project area are noted:

- The Project Area is surrounded by Hammer Hill, Fei Ngo Shan and Tan Shan. It includes hilly Ngau Tau Kok and Jordan Valley. The Project Area is relatively flat north-west of Ngau Tau Kok and reclaimed Kowloon Bay. Kwun Tong (South) with development of up to 170 mPD is found at the south-east of the Project Area. It is adjacent to the Kai Tak Planning Area where the existing low-rise developments are to be redeveloped. The Project Area is dissected into two regions according to the topography for the purpose of the expert evaluation.
- Region 1, adjacent to the Kwun Tong Typhoon Shelter in the southwest, is relatively flat (4.6 mPD to 5.8 mPD), with low-rise developments at the waterfront. Region 1 consists of KBBA with maximum building height restriction of 170 mPD, and large-scale residential developments with maximum height up to 100mPD and OU sites up to 140 mPD. Region 1 also includes some open space areas in the form of open space and G/IC sites, such as Kowloon Bay Park, Kowloon Bay Sports Ground, Kowloon Bay Playground, Lam Wah Street Playground and CICTA Sheung Numerous sites in form of Residential (R(C)), Yuet Road Training Ground. Commercial, G/IC and OU are planned to be developed in Kai Tak which is just southwest of Region 1, outside the Project Area. The majority of the buildings are up in the range of 15 mPD to 65mPD, as shown in Figure 5. Care should be exercised in the arrangement of building blocks in the Kai Tak area to minimise the adverse impact of air ventilation to the Kowloon Bay area. A handful of sites are up to 100 mPD. These sites are surrounded by low-rise developments (up to 65mPD), the impact to air ventilation in Kowloon Bay would be minimal.
- Region 2 is hilly (8.5 mPD to 175.2 mPD), and consists of Ngau Tau Kok Valley east of Kowloon Bay and Jordan Valley with vast open space areas and green belts. Region 2 is adjacent to Fei Ngo Shan and Tan Shan in the respective north and east, and should enjoy the downhill winds. The centre of Region 2 is the natural green

belt of Jordan Valley, areas of larger-scale medium-rise residential developments are located along the eastern and western boundaries of Region 2, with existing building heights from 80mPD to 250mPD.

The wind flow in the Project Area is impacted not only by the disposition, massing, site coverage and height of buildings, but also the Victoria Harbour nearby and the surrounding hills, Fei Ngo Shan and Tan Shan. The proximity of water mass will bring cooler breeze. The land heats up more rapidly than the water, causing the air over the land to rise and be replaced by the cool air from over the water. Existing open areas in the form of green belt, open space and low-rise G/IC developments such as Kowloon Bay Park, Kowloon Bay Sports Ground, Kowloon Bay Playground, Lam Wah Street Playground and CICTA Sheung Yuet Road Training Ground, Jordan Valley, Jordan Valley Playground, Jordan Valley Leisure Pool Complex, Ping Shek Recreational Ground, Former Jordan Valley Landfill Site, Service Reservoir and Shun Lee Tsuen Park are essential ventilation pockets to the Project Area. These regions are recommended to be maintained to allow penetration of wind inland.

The Project Area benefits from Jordan Valley and the proximity of Hammer Hill, Fei Ngo Shan and Tan Shan. Even on a calm day, upward air movement can be created as the sun warms the hills slopes, and creates a thermal gradient between the top of the hill and its base. The air movement cycle reverses when the air cools in the evening; it descends the hills and brings cooler wind to the base of the hills. Winds descend the faces of these green slopes of Hammer Hill and Jordan Valley and bring coolth to the base of the hill.



Figure 5 Kai Tak Outline Zoning



Figure 6a Existing Scenario showing Breezeways



Figure 6b Existing Scenario with Major Breezeways

4.2 Existing Summer and Annual Scenarios

Section 3 has identified the annual prevailing wind directions are north-easterlies, easterlies and south-easterlies, whilst the summer prevailing wind directions are easterlies, south-easterlies, southerlies and south-westerlies. The information on the existing scenario, as provided by the Planning Department, presents the existing building profile including the approved and committed developments. It is used as a basis for appreciating the existing wind environment and understanding the effects of development restrictions. Figure 6 shows the prevailing winds for the existing scenario with breezeways marked by arrows. Table 2 summarises the major breezeways throughout the Project Area. It can be seen that these wind corridors are essential for air ventilation all year round.

Breezeways			
Northeasterlies (annual)	Easterlies (summer and	Southeasterlies	Southerlies
Southwesterlies (summer)	annual)	(summer and	(summer)
		annual)	
Jordan Valley	New Clear Water Bay Road	Shun On Road	Ngau Tau Kok Road
Ngau Tau Kok Road	Sau Mau Ping Road	Choi Ha Road	Kwun Tong Road
Lee On Road (adjacent to	Wang Tai Road and Lam	Ngau Tau Kok Road	Wai Yip Street
Shun Lee Discipline Services	Wah Street		Wang Hoi Road
Quarters)	Sheung Yuet Road		Wang Tai Road
Shun Chi Street	Kai Cheung Road		Wang Chiu Road
Shun Lee Tsuen Road	Choi Hing Road		Wang Kwong Road
Open Space (O) on Kai Fuk			
Road and CITIA Sheung			
Yuet Road Training Ground			

Table 2 Major Breezeways in Ngau Tau Kok and Kowloon Bay



J9008-07 Ngau Tau Kok and Kowloon Bay

Region 1 of the Project Area is located at the east of Kai Tak Planning Area (former airport), and adjacent to the Kwun Tong Typhoon Shelter. Region 1 includes KBBA with building height restrictions up to 170 mPD, and large-scale public housing estates and substantial private residential developments. See Figure 7.

Region 1 enjoys abundant sea breeze due to its proximity to the harbour. The majority of streets in Region 1 run north-south and east-west, channeling cooler sea breeze to the redevelopment area. As Region 1 is the gateway to sea breeze, it is essential that the OU and G/IC sites at the waterfront are maintained at 40mPD or below to allow permeability of sea breeze to Kowloon Bay. This strategy has already been adopted in the committed plan.

The KBBA is densely packed with medium to high-rise commercial and industrial buildings (120 mPD to 170 mPD). Narrow roads are found in the KBBA. Given the maximum building height and the width of the blocks, the negative impact on air ventilation cannot be mitigated unless the effective road spacing (measured from building face-to-building face) is increased from 10m - 25m to 30m or beyond. See Figure 8. Since this mitigation measure is not practical, it is recommended to introduce and maintain several urban linear parks and open space within KBBA, as well as practical setbacks from the roads. These ventilation pockets include the CICTA Sheung Yuet Road Training Ground, Lam Wah Street Playground, Kowloon Bay Park, Kowloon Bay Sports Ground, Kowloon Bay Playground, a series of "linear open space" as shown in Figure 9, as well as numerous low-rise G/IC sites with building height restriction of 40mPD, help to improve air ventilation in the Kowloon Bay Area, and should be maintained.



Figure 8 Planned Maximum Building Height with Recommended Road Spacing for Streets in KBBA

Enterprise Square III, Enterprise Square V, One Kowloon and Manhattan Place up to 170mPD stand tall amidst the committed 120mPD business developments should introduce

some downwash onto the pedestrian level with the sea breeze, and thus ventilate the Wang Tai Road, Wang Mau Street, Wang Chiu Road and Sheung Yee Road, however the podia are sizable and would cancel out the air ventilation benefits; the same buildings also create a stagnant area at its immediate north, along Wang Yuen Street; and CITIA Sheung Yuet Road Training Ground. The negative impact on AVA caused by this existing development is inevitable. The overall negative impact is minimised by the maintenance of the linear open space along Wang Mau Street, as well as the open space along Kai Fuk Road, as shown in Figure 9. Furthermore, the committed linear open spaces from Kai Cheung Road to Wang Yuen Street would better serve the business area if the further redeveloped building(s) are set back from Wang Mau Street by 5m. A building gap of around 15m is recommended along Sheung Yee Road and Lam Hing Street to extend the breezeway for better permeability in KBBA, as shown in Figure 10. Widening breezeways, Wang Kwong Road and Wang Chiu Road, by setting back three meters of each side of the road, will lead to road widths of 31m, and improve the effectiveness of the major breezeways. The KBBA area lacks breezeways to funnel easterlies and sea breeze. The introduction of a non-building area of 15m at the proposed International Mail Centre to connect to the breezeway provided by Wang Tai Road and Lam Wah Street would improve the air ventilation in the KBBA.

The site of Enterprise Square V is sizable with unfavourable slab-type towers. As Enterprise Square V sits on the waterfront, it presents an obstacle to permeability to KBBA. A slanting alignment of the 15m building gap is recommended at the 22mPD podium level of Enterprise Square V to introduce a wind corridor for the oncoming sea breeze. See Figure 11b. The lot in front (i.e. the "G/IC(1)" site) will have some impact on the air ventilation, but the impact is reduced by the height restriction of 40mPD. The wind can flow over the low-rise development of 40mPD and reach the Enterprise Square V. It is therefore essential to open up the Enterprise Square V to allow the wind to permeate to other areas in Kowloon Bay. It is recommended to arrange the buildings of the Enterprise Square V in the manner as shown in Figure 11b for air ventilation improvement. A permeable podium is recommended for the Enterprise Square V. See Figure 12. Figure 13 shows the committed plan of KBBA in Region 1 with recommendations.

Linear open space



Figure 9 The Vicinity of One Kowloon

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Figure 10 Recommendations of Building Gaps to connect to Sheung Yee Road and Lam Hing Street



(a) Existing Layout Plan Figure 11 Enterprise Square V (b) Recommended Layout Plan



Figure 12 Recommendations for the site of Enterprise Square V



Figure 13 Committed Plan of KBBA in Region 1 with Recommendations

Outside of the KBBA, the majority of the land consists of large-scale housing estates and residential developments, such as the Kai Yip Estate, the committed Lower Ngau Tau Kok Estate Redevelopment Project, Richland Gardens and Telford Gardens. The building disposition and arrangement of Kai Yip Estate are slab-type and are not favourable to air ventilation as it impedes southerlies and northerlies. This existing arrangement will result in a large area with little wind movement at the site as well as up to a radius of 600m from the site. Figures 14 a and b show the existing building arrangement and the recommended principle for Kai Yip Estate. The principle shown in Figure 14b eliminates the slab-type

buildings and replace with smaller blocks with sufficient building spacing of 35m and a wide A series of 15 to 20m wide linear parks are courtyard to improve ventilation. recommended with the Telford site to allow permeability of southerlies. The committed Lower Ngau Tau Kok Estate Redevelopment Project includes a proposed G/IC development of the Cross District Community Cultural Centre (CDCCC) at 40mPD, a District Open Space and a road connecting Ngau Tau Kok Road and Kwun Tong Road. See Figure 15a. The maximum building heights of 100mPD to 140mPD is acceptable, but wider building-to-building gaps are recommended to improve permeability, as shown in Figure 15b. Further air ventilation assessment is recommended for the proposed built form and massing of the committed Lower Ngau Tau Kok Estate Redevelopment Project.



(b) Recommended Airpaths with Maximum Open Space

Figure 14 Kai Yip Estate





Figure 15 Committed Redevelopment of Lower Ngau Tau Kok Estate

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4.2.2 Region 2

Region 2 of the Project Area is hilly, with the majority of open space in the form of G/IC sites, green belts and open space areas, such as Jordan Valley Playground, Jordan Valley Leisure Pool Complex, Ping Shek Recreational Ground, Former Jordan Valley Landfill Site, Service Reservoir, Shun Lee Tsuen Park, which provide pleasant air ventilation to the region, should be maintained. See Figure 16.

Region 2 enjoys pleasant air ventilation throughout the year, and benefits from any transpiration cooling effect from the vegetated hill sides. The large-scale public housing estates and the private residential developments are mainly located around the boundary of Region 2. Table 3 summarises the characteristics of the developments. The positive and negative impacts are highlighted in the following paragraphs with recommendations to improve air ventilation.





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Developments	Housing	Existing/	Impacts
	Туре	Committed	
		Heights	
Committed Choi Tak	Public	137-174 mPD,	Some negative impacts. Recommendations provide to
Estate		medium-rise	improve site 3A. See Figure 17b.
Committed Choi	Public	166-174 mPD,	No major negative impact.
Fook Estate		medium-rise	
Choi Ha Estate	Public	138 mPD,	Some negative impacts, but not severe due to abundant
		medium-rise	surrounding open space which acts as alternative
			breezeways. Recommendations provided in Figure 18.
Ping Shek Estate	Public	32-85 mPD, low	No major negative impact due to availability of sizable
		to medium-rise	courtyards within the site and low building height.
			Recommendations provided in Figure 19.
Tak Bo Garden	Private	105-125 mPD,	No major negative impact due to availability of low-rise
		medium-rise	development within site and open space in Choi Wan Road.
Amoy Garden	Private	100-119 mPD,	Some negative impacts, but not severe due to availability of
		medium-rise	low-rise development within site and adjacent open space
			and G/IC site in Chun Wah Road. See Figure 20 for
			recommendations.
Shun Lee Estate	Public	160-175 mPD,	Some negative impacts due to slab type buildings, but not
		medium-rise	significant due to low building height. Recommendations
			are provided in Figure 21.
Shun Chi Court	Public	168 mPD,	Some negative impacts due to slab type buildings, but not
		medium-rise	significant due to low building height. Recommendations
			are provided in Figure 21.
Shun Tin Estate	Public	155-173 mPD,	Some negative impacts, but not significant due to low
		low to	building height. Recommendations are provided in Figure
		medium-rise	21.
Shun Lee Discipline	Staff	Over 180 mPD,	Some negative impacts, but not significant due to abundant
Services Quarters	Quarters of	high- rise	surrounding open space which act as alternative
	Government		breezeways. Recommendations are provided in Figure 21.

*Table 3 Summary of Negative Impacts due to Existing / Committed*¹ *Residential Developments in Region 2*

¹ Existing developments are developments that have already existed on site whereas committed developments are those approved by relevant authority for impending development.

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(a) Committed Choi Tak Estate

Figure 17a shows the disposition of the committed Choi Tak Estate with 40 storeys. The current disposition forms a wind fence and blocks the north-easterlies, easterlies and downhill wind to permeate to Region 1. It is recommended to arrange the buildings in the manner as shown in Figure 17b. This principle shown reduces the resistance to coming wind and provides better permeability. Further air ventilation assessment is recommended for the proposed built form and massing.



(a) Existing Layout Plan

(b) Recommended Layout Plan



(b) Choi Ha Estate and Committed Choi Fook Estate

These two public housing estates with around 40 storeys are located closely to each other and the current dispositions impede the north-easterlies and downhill wind as shown in Figure 18a. Figure 18b shows the recommended principle to improve air ventilation.



Figure 18 Choi Ha Estate and Committed Choi Fook Estate

(c) Ping Shek Estate

The current slab-type building disposition of Ping Shek Estate forms an obstacle to the winds. Figure 19 shows the existing scenario and the recommended disposition. Further air ventilation assessment is recommended for the proposed built form and massing.



- (a) Existing Layout Plan Figure 19 Ping Shek Estate
- (d) Amoy Garden

It is recommended to rearrange the building blocks in order to maximise the open space within Amoy Garden as shown in Figure 20b. The courtyard shown in Figure 20b will help to improve the air ventilation within the estate.

(b) Recommended Layout Plan



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(e) Shun Lee Estate, Shun Chi Court, Shun Tin Estate and Shun Lee Discipline Services Quarters

Since the developments are aligned along the boundary of Region 2 and can impede downhill winds from Fei Ngo Shan and Tan Shan outside the Project Area, it is recommended that the redevelopment should follow the arrangement as demonstrated in Figure 21b.



Figure 21 Recommended Disposition for Shun Lee Estate, Shun Chi Court, Shun Tin Estate and Shun Lee Discipline Services Quarters



Figure 22a Building Blocks and Layout of Future Developments (Indicative)





Figure 22b Proposed Plan with Major Breezeways

5.2 Areas of Concern

Figure 22a shows the proposed maximum building height restrictions on the OZP. The design, disposition and height of new development shown in this figure are hypothetical.

5.2.1 General

Where podia are allowed, it is recommended to provide set-back from the site boundary, or to recess the lower floors from these key wind corridors, or to align the podia edge with the building edge, to make the podia more permeable, by delineating non-building areas wherever possible, as shown in Figure 23.



Figure 23 Recommendations for Podia

5.2.2 Region 1

Figure 24 shows the proposed plan for Region 1.



There are no changes in the proposed outline plan in the KBBA between the committed and the proposed plans. The recommendations to the committed plan have been provided in Section 4.2.1.

Outside of the KBBA, the maximum proposed building height of Telford Gardens remain unchanged (60mPD and 100mPD). The proposed plan indicates that two corridors have been proposed to be introduced on the podium (22mPD) as shown in Figure 25. This strategy will help to provide a wind corridor connecting Wang Tai Road and Sheung Yuet Road. It is also recommended that a 15m to 20m building gap at 22mPD to be provided as shown in Figure 25, to connect to Kwun Tong Road Tai Yip Street, to improve air ventilation.



Figure 25 Recommended Building Gap for Telford Gardens

The maximum proposed building height of Kai Yip Estate increased from 60mPD to 100mPD. The increased maximum height is acceptable, however it is recommended that the building disposition should adopt a similar arrangement shown in Figure 14 in section 4.2.1.

The existing building height of Richland Gardens is about 100mPD. The current disposition includes sizable building gaps in the range of 60m to 85 m, maintenance of this space

together with the existing building height will give a positive impact on air ventilation, as shown in Figure 26.



Figure 26 Richland Gardens

5.2.3 Region 2

There are no significant changes in Region 2. The proposed maximum building height of Shun Chi Court and Shun Tin Estate are kept at 170mPD and 160mPD/170mPD respectively. When the building disposition adopts a similar arrangement shown in Figure 21, discussed in section 4.2.2, the air ventilation effectiveness will be improved. The other recommendations have already been provided in Section 4.2.2.

Two non-building areas are proposed in Ping Shek Estate and Shun Chi Court, see Figure 27. It is recommended to maintain these two non-building areas for better air ventilation.



Figure 27 Proposed Non-building areas in Region 2

Notwithstanding the above, there is an area of concern in the future redevelopment of Kai Tak Mansion and the assessment is detailed in section 5.3.

5.3 Kai Tak Mansion

5.3.1 Background

The Kai Tak Mansion is located at the foothill of the slope adjoining the Hong Kong Baptist University Academy of Visual Arts to the south-east of Ping Shek Estate. The site consists of seven storeys with a building height of approximately 25.6mPD. The nearby spot height is approximately 4.6mPD. The "R(A)" site is surrounded by a number of historic buildings, G/IC facilities, open spaces and medium-rise public housing estates. Figure 29 shows the view of the Site and its surrounding. To its immediate north are two Grade I historic buildings of Ex-Royal Air Force (RAF) Officers' Quarters Compound (which include the two-storey RAF Officers Mess and an Annex Block) zoned "G/IC(2)", which are now being re-used as the Hong Kong Baptist University's (HKBU) Academy of Visual Arts, and to its immediate southwest is another two-storey Grade I historic building Ex-RAF Headquarters Building, which is currently zoned "O" and occupied by Caritas Family Crisis Support Centre. A one-storey Sam Shan Kwok Wong Temple (Grade III) and 8-storey St. Joseph Anglo-Chinese Primary School are located to its northwest and southeast respectively.



Figure 28 Project Site for Option Study

The building height of subject "R(A)" site, which could be built up to 110mPD, may have adverse impact on the air ventilation of the HKBU site at its rear and thus affecting students' activity. In order to minimise the potential adverse air ventilation impacts on the neighbours, development restrictions (NBAs and/or building gap) are proposed for future redevelopment of the "R(A)" site and tested in different options. Two development options: the baseline option (PR 9, BH 105mPD with no NBAs and building gap and alternative option (PR 9, BH 105mPD with NBAs and building gap restrictions), are compared qualitatively in terms of the impacts on air ventilation in the surrounding developments in particular HKBU with the existing scenario (i.e. 7-storey building).

Figure 29 shows the view of the site and its surrounding.

Figure 29 Views of Kai Tak Mansion Site and its Surrounding Developments

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5.3.2 Existing Scenarios of Kai Tak Mansion Site

Figure 30 shows the prevailing winds, identified in Section 3, for the existing scenario with breezeways.



Figure 30 Existing Scenario at Kai Tai Mansion Site (highlighted in cross-hatched pattern) and its Surrounding Developments showing Major Breezeways

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Figure 31 shows the building disposition of the existing Kai Tai Mansion. Some downdraft will also ventilate the area. The site includes four similar blocks with a 5m spacing. These narrow building gaps are insufficient to funnel the south-westerlies to the HKBU Academy of Visual Arts. However, this negative impact is not significant due to two reasons: the availability of the adjacent green belt and the large open space, Kwun Tong Road Children's Playground and Ping Shek Recreational Ground; as well as the limited building height of seven storeys (25.6mPD). It can therefore be said that the surrounding buildings have access to breeze.



Figure 31 Existing Kai Tak Mansion

5.3.3 Options study of Kai Tak Mansion Site

(A) Baseline Option

Figure 32 shows the baseline option with a proposed building height of 105 mPD. Observations of the baseline option are described in the following paragraphs.



The large-scale podium would reduce the downdraft attributed by the subject towers with the south-westerlies and southerlies, and therefore minimise the ventilation on Kwun Tong Road.

The non-building area of 3m next to St. Joseph's Anglo-Chinese Primary School (approximately 37mpD), as shown in Figure 32, is insufficient to allow the south-westerlies to reach Hong Kong Baptist University Academy of Visual Arts, but will help to receive downdraft to ventilate the area with easterlies.

With the elevated height of 105 mPD (compared to approximately 25.6mPD of the existing scenario), the building gap of 5 m is not effective in ventilating the area.

The alignment of a building gap is directed too much towards the west to harvest the south-westerlies and southerlies.

The HKBU lies in the wake (area with no or little air movement) of the Kai Tak Mansion with diminished air ventilation. Part of the Kwun Tong Road Playground and St. Joseph Anglo-Chinese Primary School also lie in the area with little air movement. See Figure 32.

In general, the baseline scenario causes significant negative impact on air ventilation compared to the existing scenario.

(B) Alternative Option

Figure 33 shows alternative option for Kai Tak Mansion site. The proposed building height is at 105 mPD, similar to that in the baseline scenario.



Figure 33 Alternative Option for Kai Tak Mansion with Recommendations

Two non-building areas of 10m each are introduced as shown in Figure 33. The non-building area of 10m adjacent to St. Joseph's Anglo-Chinese Primary School is insufficient to ventilate the area with south-westerlies, but will encourage downdraft to reach the ground level and ventilate the area with easterlies.

The introduction of a 20m building gap between the four towers of 105mPD encourages the south-westerlies and north-easterlies to permeate. Nevertheless, it is recommended to widen the building gap to ideally 24m to further improve ventilation. See Figure 33.

The alignment of this 20m building gap also encourages south-westerlies and southerlies to permeate.

In general, alternative option provides better air ventilation to the vicinity than the baseline option.

5.4 Further Study

Given the consideration of development right which will lead to high-rise buildings, control of building height in itself is not an effective means for better air ventilation. This study has also included measures on set-backs, podia design, non-building areas to supplement with the height restriction. This study provides an overview of the existing wind environment and recommends broad measures to minimise negative impacts and where appropriate, improvement to the existing conditions.

The Project Area benefits from green belts, open spaces and low-rise G/IC sites, the sites should be maintained for better air ventilation. Building gaps and non-building areas have been recommended throughout the Project Area to improve permeability.

For specific sites where large-scale development or redevelopment may be possible, as shown in Figure 34, detailed AVAs on a site-by-site basis should be undertaken.



Figure 34 Recommended Sites for Detailed AVAs during Development / Redevelopment

6 CONCLUSIONS

As Region 1 is the gateway to sea breeze, it is essential that the OU and G/IC sites at the waterfront are maintained at 40mPD or below to allow permeability of sea breeze to Kowloon Bay. This strategy has already been adopted in the committed plan. Numerous sites in form of Residential, Commercial, G/IC and OU are planned to be developed in Kai Tak which is just southwest of Region 1, outside the Project Area. The majority of the buildings are up to in the range of 15mPD to 65mPD. Care should be exercised in the arrangement of building blocks in the Kai Tak area to minimise the adverse impact of air ventilation to the Kowloon Bay area.

The KBBA is densely packed with medium to high-rise commercial and industrial buildings (120 mPD to 170 mPD). Narrow roads are found in the KBBA. Given the maximum building height and the width of the blocks, the negative impact on air ventilation cannot be mitigated unless the effective road spacing (measured from building face-to-building face) is increased from 10m - 25m to 30m or beyond. Since this mitigation measure is not practical, it is recommended to introduce and maintain several urban linear parks and open space within KBBA, as well as practical setbacks from the roads. These ventilation pockets include the CICTA Sheung Yuet Road Training Ground, Lam Wah Street Playground, Kowloon Bay Park, Kowloon Bay Sports Ground, Kowloon Bay Playground, a series of "linear open space", as well as numerous low-rise G/IC sites with building height restriction of 40mPD, help to improve air ventilation in the Kowloon Bay Area, and should be maintained.

The committed linear open spaces from Kai Cheung Road to Wang Yuen Street would better serve the business area if the future redeveloped building(s) are set back from Wang Mau Street by 5m. A building gap of around 15m is recommended along Sheung Yee Road and Lam Hing Street to extend the breezeway for better permeability in KBBA. Widening breezeways, Wang Kwong Road and Wang Chiu Road, by setting back three meters of each side of the road will improve the effectiveness of the major breezeways. The KBBA area lacks breezeways to funnel easterlies and sea breeze. The introduction of a non-building area at the proposed International Mail Centre to connect to the breezeway provided by Wang Tai Road and Lam Wah Street would improve the air ventilation in the KBBA. The site of Enterprise Square V is sizable with unfavourable slab-type towers. As Enterprise Square V sits on the waterfront, it presents an obstacle to permeability to KBBA. A slanting alignment of the 15m building gap is recommended at the 22mPD podium level of Enterprise Square V to introduce a wind corridor for the oncoming sea breeze. A permeable podium is recommended for the Enterprise Square V. It is also recommended that the building

disposition should adopt a similar arrangement shown in the study report for air ventilation improvement.

Outside the KBBA, the majority of the land consists of large-scale housing estates and residential developments, such as Kai Yip Estate, the committed Lower Ngau Tau Kok Estate Redevelopment Project, and Richland Gardens. In general, building disposition should not form a wind wall to improve permeability. Furthermore, low-rise facilities should be located in the centre of these developments to maximise the size of the open courtyard to improve local ventilation. Recommendations for such sites have been provided in the study report.

Region 2 of the Project Area is hilly, with the majority of open space in the form of G/IC sites, green belts and open space areas, such as Jordan Valley Playground, Jordan Valley Leisure Pool Complex, Ping Shek Recreational Ground, Former Jordan Valley Landfill Site, Service Reservoir, Shun Lee Tsuen Park, which provide pleasant air ventilation to the region, and should be maintained. Areas of larger-scale medium-rise residential developments are located along the eastern and western boundaries of Region 2, with maximum height from 80mPD to 250mPD. In general, there are no significant negative air ventilation impacts due to these estates because of the abundant surrounding open space, green belt and/or low-rise G/IC developments. These areas shall be maintained for better air ventilation. However, better arrangements in terms of air ventilation have been proposed in the study report for future redevelopments.

In the proposed plan, the proposed maximum building height of Telford Gardens remain unchanged (60mPD and 100mPD). The proposed plan also indicates that two corridors have been proposed to be introduced on the podium (22mPD). This strategy will help to provide a wind corridor connecting Wang Tai Road and Sheung Yuet Road. A 15m to 20m building gap is also recommended to connect Kwun Tong Road to Tai Yip Street to improve air ventilation.

The proposed maximum building height of Kai Yip Estate increased from 60mPD to 80mPD and 100mPD. The increased maximum height is acceptable, however it is recommended that the building disposition should adopt a similar arrangement shown in the study report for air ventilation improvement.

The maximum building height of 100mPD is retained for the site of Richland Gardens. The current disposition includes sizable building gaps in the range of 60m to 85 m, maintenance

of this space together with the unchanged building height will give a positive impact on air ventilation.

The proposed maximum building heights of Shun Chi Court and Shun Tin Estate are kept at 170mPD and 160mPD/170mPD respectively. When the building disposition adopts a similar arrangement shown in the study report, the air ventilation effectiveness will be improved.

For specific sites where large-scale development or redevelopment may be possible, detailed AVAs on a site-by-site basis should be undertaken.

The summary of recommendations to minimise the impact of the overall Project Area are listed below and illustrated in Figure 35.

General:

 Provide set-back from the site boundary, or recess the lower floors from these key wind corridors, or align the podia edge with the building edge, to make the podia more permeable, by delineating non-building areas wherever possible

Region 1:

- Maintain the linear open spaces from Kai Cheung Road to Wang Yuen Street;
- Introduce a building gap of around 15m wide along Sheung Yee Road and Lam Hing Street to extend the breezeway for better permeability in KBBA;
- Introduce set-back of 5m to the building(s) on Wang Mau Street;
- Introduce a 15m building gap and a permeable podium for Enterprise Square V;
- Avoid slab-type building disposition in the Enterprise Square V. Buildings should be arranged in the manner as recommended in the report to allow wind corridor;
- Introduce a set-back of 3m on each side of Wang Kwong Road and Wang Chiu Road;
- Introduce a 15m non-building area at the proposed International Mail Centre;
- Widen the building-to-building gaps in the committed Lower Ngau Tau Kok Estate Redevelopment Project;
- Avoid slab-type building disposition in the Kai Yip Estate. Air paths should be introduced;
- Maximise the open space within the Amoy Garden;
- Introduce a building gap of 15 to 20m wide in Telford Gardens to connect Kwun Tong Road to Tai Yip Street;

- Maintain the sizable building gaps in range of 60m to 85m in the Richland Gardens;
- Maintain the open space and G/C sites in the future development;

Region 2:

- Avoid slab-type building disposition in the Ping Shek Estate. Air paths should be introduced;
- Maintain the non-building areas in the Ping Shek Estate and Shun Chi Court;
- Avoid wind wall building disposition in the committed Choi Tak Estate Site 3A. Air paths should be introduced;
- Introduce air paths in the Choi Ha Estate, the Shun Lee Estate, the Shun Chi Court, the Shun Tin Estate and the Shun Lee Discipline Services Quarters; and
- The baseline scenario and alternative option of Kai Tak Mansion site have been compared. It is concluded that the alternative option with building gap of 20m to 24m wide at 13.6mPD and non-building areas of 10m provides better air ventilation compared to the baseline option.

