



**Reprovisioning of FEHD Sai Yee Street
Environmental Hygiene Offices-cum-vehicle Depot
at Yen Ming Road, West Kowloon Reclamation Area**

**Air Ventilation Assessment
EXPERT EVALUATION**

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**Food and Environmental Hygiene Department
The Government of the
Hong Kong Special Administrative Region**



**Architectural Services Department
The Government of the
Hong Kong Special Administrative Region**



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1. INTRODUCTION

1.1 BACKGROUND – PROPOSED DEVELOPMENT

- 1.1.1 P&T Architect and Engineers Limited was awarded, as the lead consultant, by Architectural Services Department (ArchSD) for the design and construction supervision for Consultancy Agreement No. 9AX 034 “Reprovisioning of FEHD Sai Yee Street Environmental Hygiene Offices-cum-vehicle Depot at Yen Ming Road, West Kowloon Reclamation Area” (hereinafter referred as the Project). URS/Scott Wilson Limited was commissioned as an environmental sub-consultant to provide an air ventilation assessment for the proposed depot site. This consultancy study is based on the methodology of Air Ventilation Assessment as set out in *Technical Circular No. 1/06 issued jointly by Housing, Planning and Lands Bureau and Environment, Transport and Works Bureau*.
- 1.1.2 The Project is to develop and construct a new office-cum-vehicle depot (hereinafter referred as the Development) to house the existing facilities in Sai Yee Street Vehicle Depot. Upon the completion of the new office-cum-vehicle depot building, the new building will be handed over to the Food and Environmental Hygiene Department (FEHD) for operation.
- 1.1.3 The Project is located at Yen Ming Road, West Kowloon Reclamation Area (hereinafter referred as the Site), with a total site area of about 8,278 m² and site frontage of 100.5 m at waterfront. The Site falls within an area zoned as “Government, Institution or Community” on the draft South West Kowloon Outline Zoning Plan (OZP) No. S/K20/27 and is designated as “Government” and “Cable / Drainage / WSD / MTRC Reserve” on the draft South West Kowloon (Central Section) Outline Development Plan (ODP) No. D/K20B/D. According to “*Planning Study on the Harbour and Its Waterfront Areas*” conducted by Planning Department in 2003, the Site was regarded as planned Waterfront Functional Zone.
- 1.1.4 The Site is now being occupied as 3 site offices and associated storage areas for the Civil Engineering and Development Department’s (CEDD) Landslip Prevention and Mitigation works contracts (Contract Nos. GE/2009/02, GE/2010/04 and GE/2009/21), since around 2010. The location of the Site is shown in **Figure 1-1**.
- 1.1.5 The Development is a five-storey composite building consisting of a depot, carparks and offices. Height of the tallest part is 35.4 mPD.



Figure 1-1 Project Location

1.2 OBJECTIVES

1.2.1 The objective of Air Ventilation Assessment is to evaluate the likely impact of the proposed building and planning of the development site on the pedestrian wind environment and identify any problem area as compared to the existing condition, as well as proposing any mitigation measures if necessary.

1.3 GENERAL APPROACH

1.3.1 This study is an Expert Evaluation on the site wind characteristics and the wind environment under the proposed development situation. The outline of tasks involved is as follow:

- Identification of any major air corridor in the vicinity;
- Identification of impact to wind environment arising from the Site;
- Identification of problem areas arising from the development;
- Identification of good design features and mitigation measures; and
- Determination of stages and methodologies for further study, if required.

2. SURROUNDING BUILT ENVIRONMENT

2.1 SURROUNDING TOPOGRAPHY

2.1.1 The Site is situated at the waterfront of West Kowloon Reclamation Area. The reclaimed area is flat and low-elevated near seashore while at far Northern direction are hilly region including Eagle's Nest and Piper's Hills, with ridge extending from East to West as shown in **Figure 2-1**.



Figure 2-1 Surrounding Topography of the Site

2.2 ADJACENT FEATURES

2.2.1 Surrounding the Site, to the North is Lin Cheung Road while to the immediate South-east is Tai Kok Tsui Substation. The South-west of the Site is Yuen Fat Building for commercial purpose while across Yen Chow Street West is low-rise Cheung Sha Wan Wholesales Fish Market. Nam Cheong Station which is being proposed with high-rise comprehensive residential and commercial development as well as high-rise Fu Cheong Estate are located at the North.

2.2.2 Apart from the proximate built features, the Tai Kok Tsiu region at the East and Sham Shui Po region at the North of the Site are distributed with densely but regularly aligned tenement buildings. Between the tenements and the Site, there are open spaces formed by Tung Chau Street Park and Nam Cheong Park.

2.2.3 The major built features including a number of mid-rise and high-rise residential developments in the vicinity are shown in **Figure 2-2**.

ID	Surrounding Built Environment
1.	Hampton Place
2.	The Long Beach
3.	West Kowloon Disciplined Services Quarter
4.	Nam Cheong Estate
5.	Fu Cheong Estate
6.	Harbour Green
7.	Planned residential development above Nam Cheong Station
8.	Sir Ellis Kadoorie Secondary School
9.	Tai Kok Tsui Catholic Primary School
10.	Cheung Sha Wan Wholesales Fish Market
11.	Cheung Sha Wan Wholesales Food Market
12.	Office of Yuen Fat Building
13.	Nam Cheong Park
14.	Tung Chau Street Park



Figure 2-2 Built Environment Surrounding the Site

3. WIND AVAILABILITY

3.1 WIND ENVIRONMENT

3.1.1 In order to investigate existing wind environment and availability, natural wind characteristics of the Site are considered. As recommended by the Technical Circular, wind data collected from the meteorological station of Hong Kong Observatory (HKO) and the Site Wind Availability Data simulated using Fifth-Generation NCAR/ Penn State Mesoscale (MM5) from the Planning Department were reviewed in this Expert Evaluation.

3.2 WIND DATA FROM HONG KONG OBSERVATORY

3.2.1 The nearest weather station from the Site was Cheung Sha Wan Weather Station which was closed in 2010. The annual and summer wind rose generated from the average wind data collected near ground level in past 20-year, as shown in **Figure 3-1**, was reviewed. The wind data was considered valid in view of the long period of 20 years. The prevailing wind direction and summer wind direction were Easterly wind and South-western wind respectively.

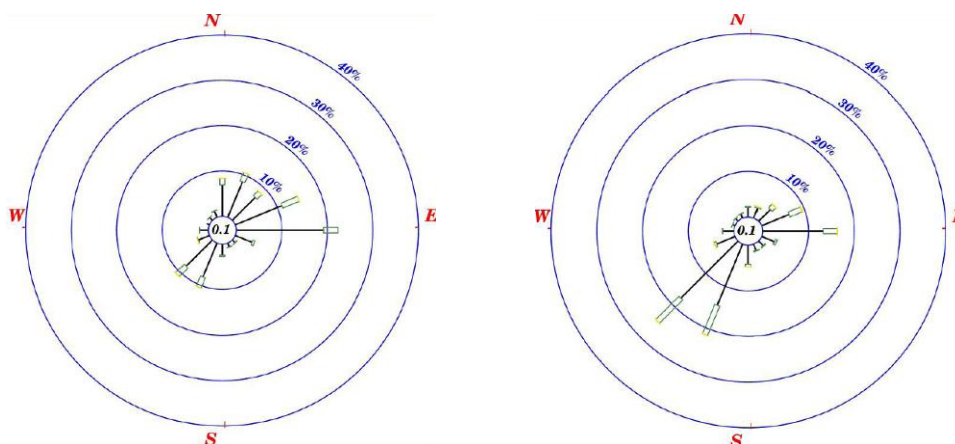


Figure 3-1 Wind Rose for Near-ground Cheung Sha Wan Station (1989-2009) from HKO
(Left: Annual, Right: Summer)

3.3 WIND DATA FROM MM5

3.3.1 The MM5 model predicts the wind velocity ranging from 0 to 22 m/s from 16 directions at a height of 596 m above the terrain level, which is considered as undisturbed wind flow. The nearest grid (27,27) with grid size of 1.5 km x 1.5 km were obtained for this study and the mean speed was simulated at this grid. The mean wind speed is around 8.92 m/s at 596 m above ground. The most possible wind direction is from east-north-east as shown in the wind rose in **Figure 3-2**.

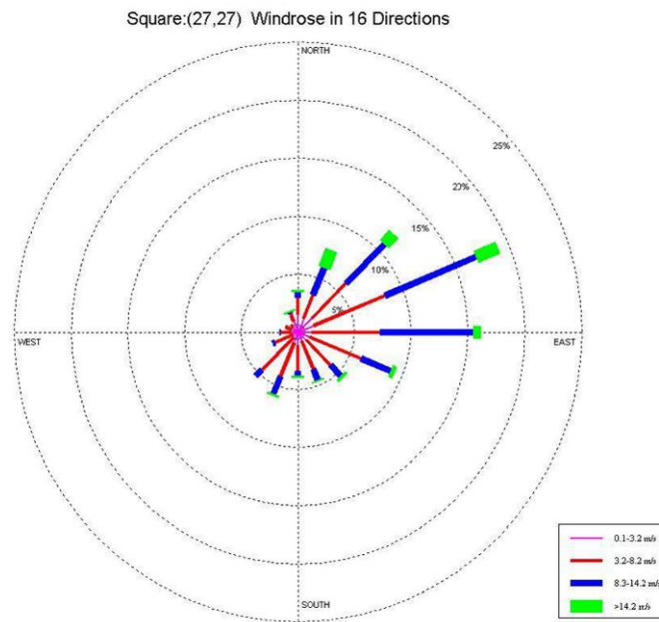


Figure 3-2 Wind Rose from MM5 Database at Grid (27,27) at 596 m

3.4 WIND AVAILABILITY AT THE SITE

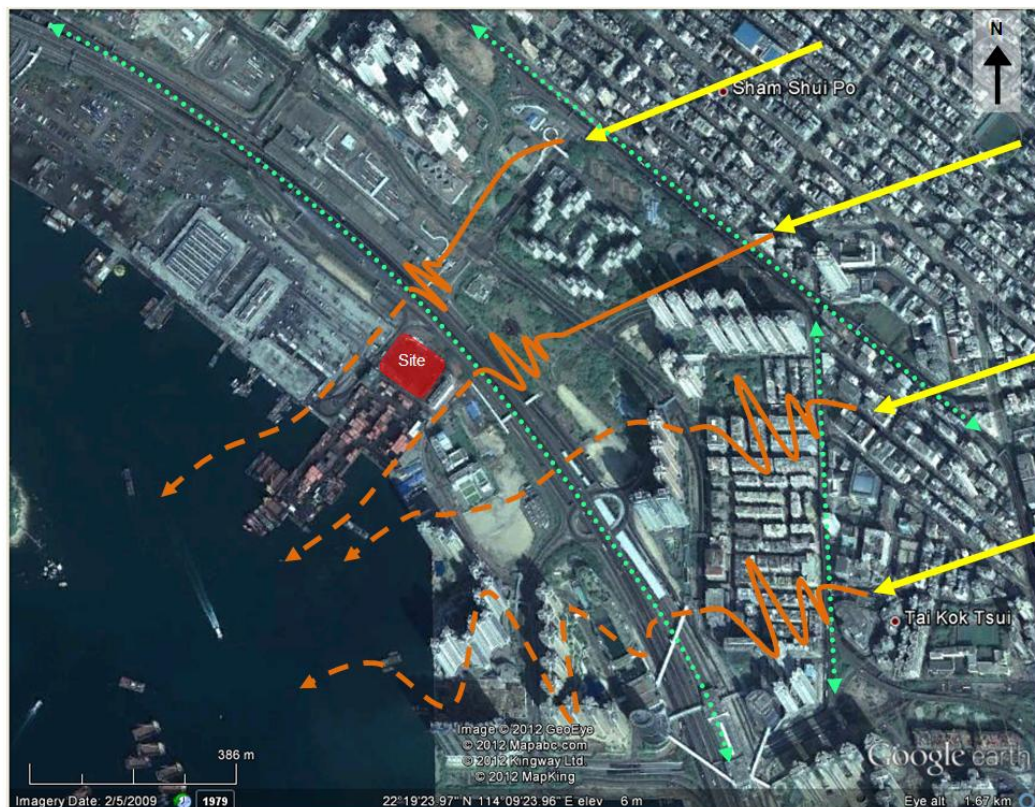
- 3.4.1 With reference to the wind data from HKO and MM5 which are representing wind characteristic at near ground and undisturbed height respectively, the annual prevailing wind directions are East-north-east (ENE) and East (E). In summer periods as shown in **Figure 3-1**, the prevailing wind comes from South-west (SW) which is the sea breeze being regarded as major wind source to the inland in summer.
- 3.4.2 The height of buildings in close proximity is generally low with limited wind blockage and the streets at the perimeter of the Site are relatively wide. The open area provided by the parks and the frontal of the wholesale markets could facilitate wind reattachment while the waterfront pier allows onshore or offshore wind flow. The Site would be benefited by these open spaces and wide roads, envisaging wind available at the Site.
- 3.4.3 Nevertheless, in regard of the potential planning of high-rise residential development (in which the rezoning is still under consideration) at the open areas at current wholesale markets, the wind availability at the Site may be reduced significantly, depending on the layout of future development.

4. EXPERT EVALUATION

4.1 WIND PERFORMANCE IMPACT BY THE SURROUNDING ENVIRONMENT

Annual Prevailing Wind – East-north-east Wind

- 4.1.1 The approaching ENE wind affected by densely developed Sham Shui Po region at the pedestrian level could flow toward the seafront via regularly arranged streets which are served as wind path. By considering the low-rise tenement buildings, the wind could be reattached at the open spaces at the South-west such as Nam Cheong Park and Yen Chow Street West between Fu Cheong Estate and Nam Cheong Estate.
- 4.1.2 As illustrated in **Figure 4-1**, the high-rise buildings such as Harbour Green at the east induces a wake at the South-eastern Nam Cheong Park and potentially decrease the wind availability at the Site.







- | | | | |
|---|---------------------------------|--|--------------------|
|  | Prevailing East-north-east Wind |  | Downwashing Wind |
|  | Potential Local Breeze |  | Potential Air Path |

Figure 4-1 Existing Wind Environment in Non-summer Period – East-north-east Wind

Annual Prevailing Wind – East Wind

- 4.1.3 To the East of the Site, the disposition of buildings are less regular than inland Sham Shui Po at the North. The East wind approaching to the Site could be blocked by Harbour Green and West Kowloon Disciplined Services Quarter.

4.1.4 The open spaces at this area serves as major breezeway for inland wind to sweep across the coastal buildings to the sea as shown in **Figure 4-2**.



- | | | | |
|--|---------------------------------|--|--------------------|
| | Prevailing East-north-east Wind | | Downwashing Wind |
| | Potential Local Breeze | | Potential Air Path |

Figure 4-2 Existing Wind Environment in Non-summer Period – East Wind

Summer Prevailing Wind – South-west Wind

4.1.5 Summer sea breeze approaches the Site from South-west as indicated in **Figure 4-3**. The Southern residential buildings especially Hampton Place and the Long Beach would divert approaching sea breeze to the North where the open spaces at the coast facilitates sea breeze to flow into the inland region. The major breezeway includes Yen Chow Street West, Nam Cheong Park and Tung Chau Street Park.

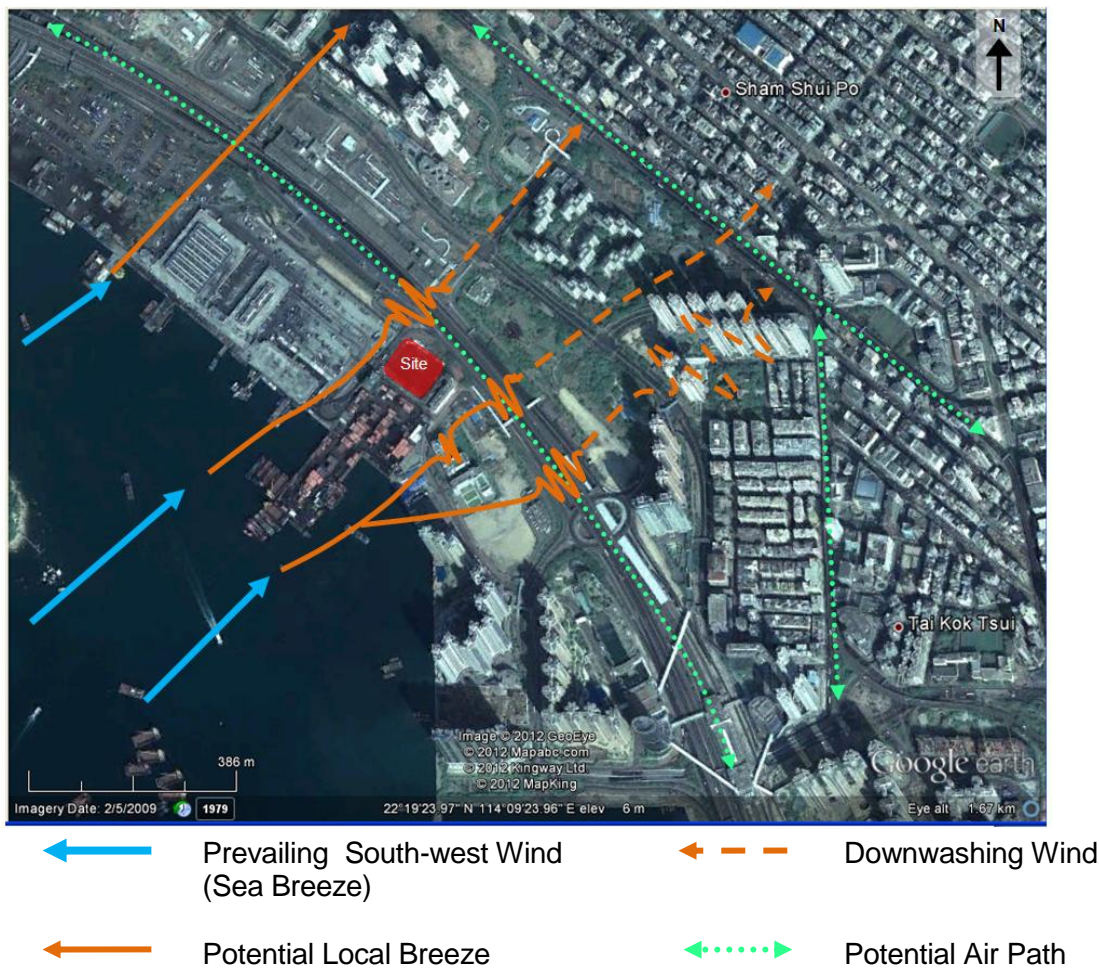


Figure 4-3 Existing Wind Environment in Summer Period – South-west Sea Breeze

4.2 EXISTING SITE WIND CONDITION

Annual Prevailing Wind

- 4.2.1 The prevailing wind coming from ENE and East direction flows from the open spaces at Tung Chau Street Park and reaches the coast via Nam Cheong Park. The elevated West Kowloon Highway and the bund wall between Nam Cheong Park and Lin Cheong Road as shown in **Figure 4-4**, as well as the Tai Kok Tsui Substation, could reduce the pedestrian wind. It is possible that the off-shore wind slips over the Highway and downwashes to the Site, leaving the seafront via Yen Chow Street West. At the same time, the open ground at low-rise Wholesales Market, Hoi Fan Road and the Schools provide a wind corridor for off-shore wind which were illustrated in **Figure 4-5**.



Figure 4-4 View from the Site to Lin Cheung Road and Nam Cheong Park

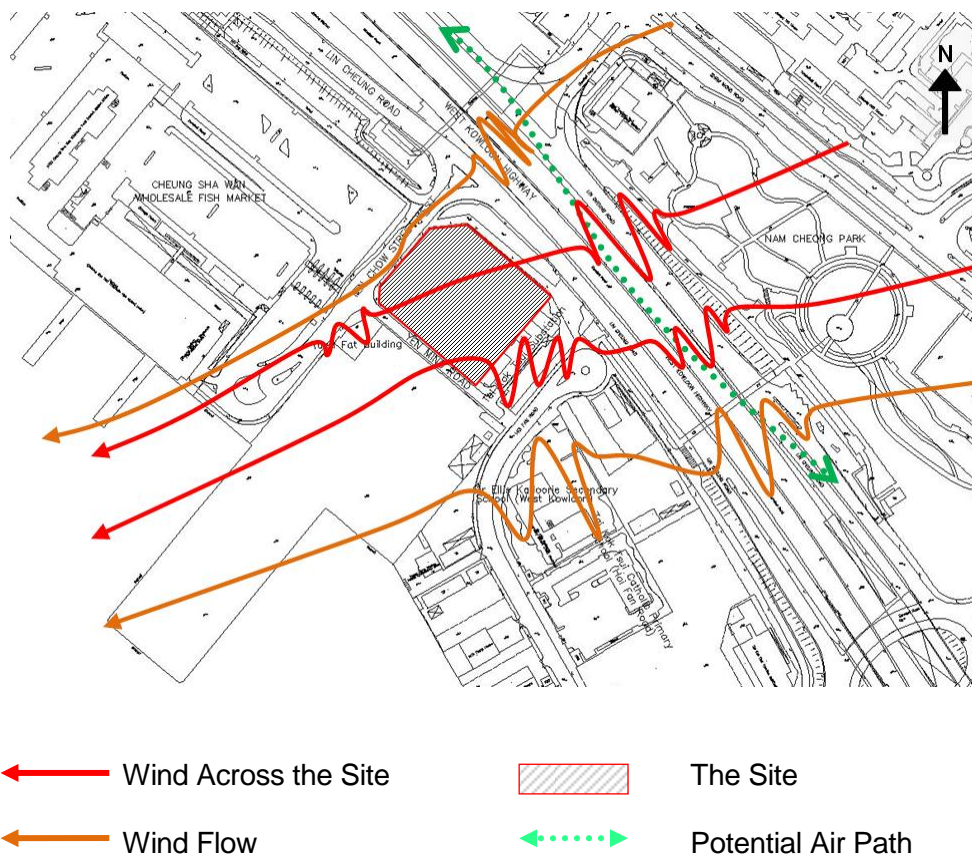


Figure 4-5 Site Wind Condition under Annual Prevailing Wind

Summer Prevailing Wind

4.2.2 The majority of on-shore sea breeze coming from South-west flows along Yen Chow Street West and dissipated at Lin Cheung Road and inland region. Similar to the annual prevailing wind, the Highway and bund wall would limit the pedestrian wind availability. The wind could pass over the Highway and the bund wall before reattachment at the Nam Cheong Park. Major wind corridor under this scenario is shown in **Figure 4-6**.

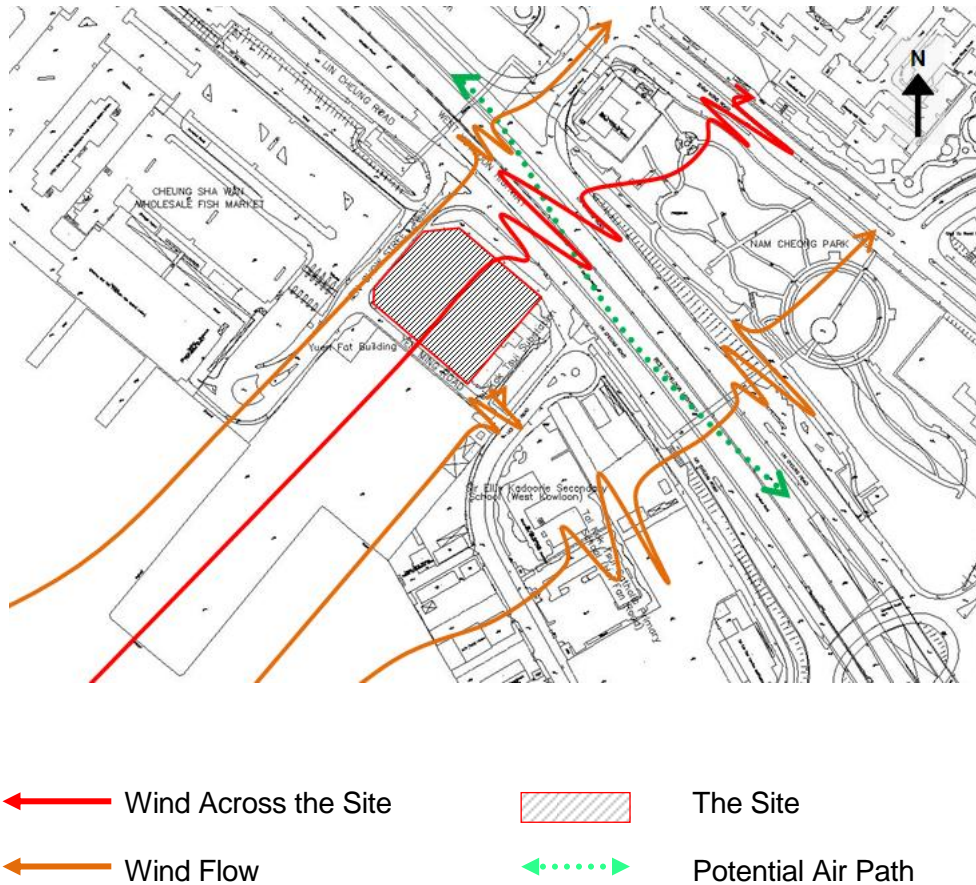


Figure 4-6 Site Wind Condition under Summer Prevailing Wind

5. MITIGATION DESIGN TO WIND ENVIRONMENT

5.1 DEVELOPMENT AT WATERFRONT SITE

5.1.1 As recommended by studies and guidelines including *Hong Kong Planning Standards and Guidelines*, for development located at the site regarded as waterfront, sustainable design concepts to be taken into consideration include, but not limited to, the followings:-

- Wind permeability e.g. natural ventilation, disposition
- Cascade down along prevailing wind direction in order to facilitate air wash to pedestrian level
- Low blocking ratio allowing sea breeze penetrating into the inland area
- Street widening/ building setback

5.2 PROPOSED DESIGN ON LOCAL AIR VENTILATION

5.2.1 The Site is located at the waterfront where on-shore and off-shore prevailing wind would flow over the Site. Although the impact to wind environment arising from this Project would be minimal due to existing surrounding building bulk such as Harbour Green, Nam Cheong Station residential development and the bund wall along Lin Cheung Road, in order to maximise wind penetration toward either inland region or the sea, enhancement design for wind flow has been duly proposed for the Development.

Optimisation of Building Disposition for Wind Penetration

- 5.2.2 Roof garden would be provided at 3/F of the Development with two design options showing in **Figure 5-1** for facilitate wind penetration. Option 1 provides a corridor across from the East to Yen Chau Street West while Option 2 is perpendicular to Option 1 with corridor aligning from South to North.
- 5.2.3 During prevailing wind condition, before off-shore, approaching wind from the East flowing over the Site is already weaken by the inland built structures and adjacent substation. On the other hand, sea breeze from the South-West in summer could flow through the roof garden which is slightly higher than the West Kowloon Highway and allow sea breeze reaching the inland area, such as Nam Cheong Park and Tung Chau Street Park. Hence, Option 2 is adopted in final design. As shown in **Figure 5-2**, by adopting Option 2, the roof garden at 3/F provides an unobstructed wind path for the sea breeze, allowing wind penetration to the inland region.



Figure 5-1 Wind Flow (Orange Line) over Rooftop – (Left: Option 1; Right: Option 2)



Figure 5-2 Adopted Wind Corridor at Rooftop (Option 2) with Wind Flow (Orange Line)

Natural Ventilation

5.2.4 The Development is a low-rise complex housing depot and offices. The ground level and two floors above ground are intended to be mainly open depot and carparks allowing wind penetration to further inland region under annual prevailing wind. In order to facilitate cross ventilation for both onshore and offshore wind, apart from the four-side opening at 1/F, openings at Yen Ming Road are also provided at G/F and 2/F to increase permeability. The permeable area at these three floors are indicated in **Figure 5-3** to **Figure 5-5**.



Figure 5-3 Permeable Design at G/F (at 5.1 mPD) Workshop with Wind Flow (Orange Line)

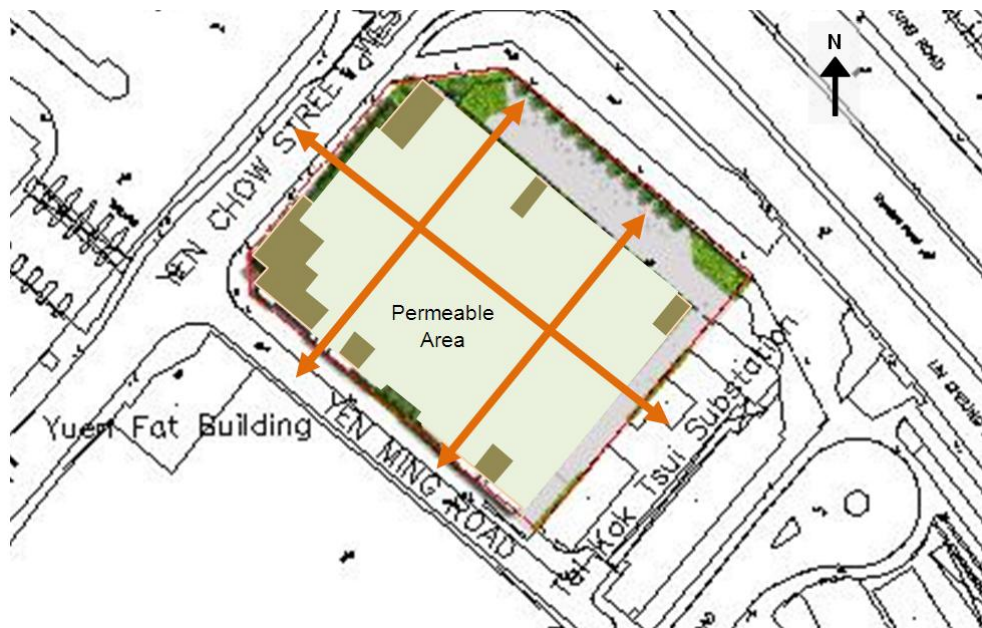


Figure 5-4 Permeable Design at 1/F (at 13.8 mPD) Carpark with Wind Flow (Orange Line)



Figure 5-5 Permeable Design at 2/F (at 20.0 mPD) Carpark with Wind Flow (Orange Line)

Building Set-back

5.2.5 The Site will be set-back from the CLP Substation, at Yen Ming Road and at Yen Chow Street West while non-building area will be provided at the North-west as indicated in **Figure 5-6**. Both measures provide an air path and reduce wind blockage, potentially increasing pedestrian wind availability.

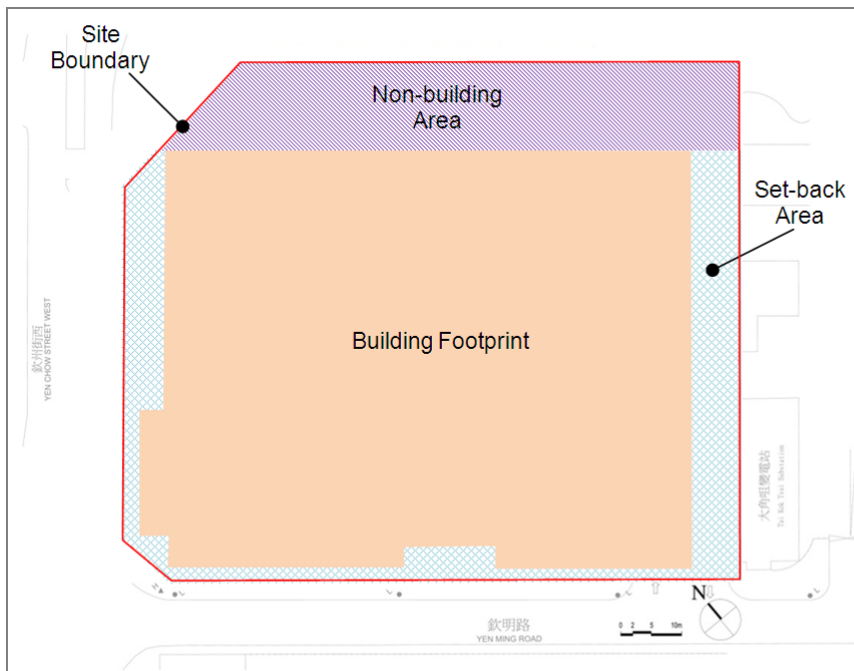
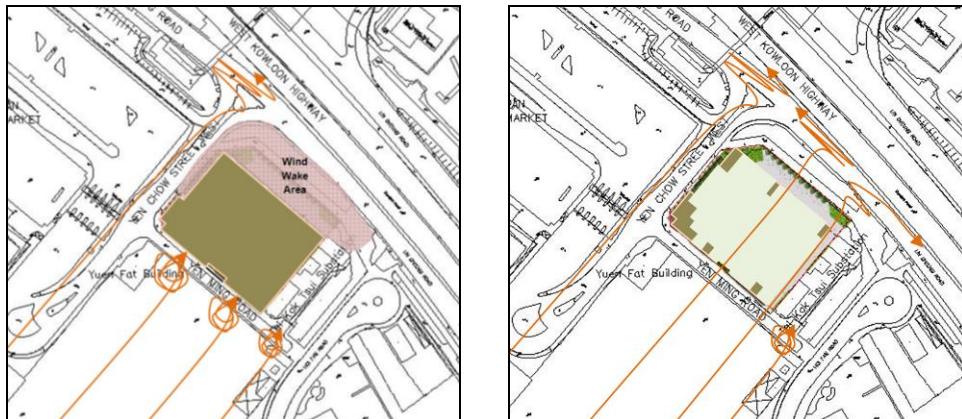


Figure 5-6 Set-back and Non-building Area of the Development

5.3 MITIGATED SITE WIND CONDITION

5.3.1 With the implementation of the wind enhancement designs, the expected Site Wind Condition at pedestrian level under unmitigated and mitigated scenario were compared in **Figure 5-7**. The massive development without permeable design restricts sea breeze approaching to Lin Cheung Road, producing a large wind wake. Despite both scenario encounters blockage of further flow to inland due to the bund wall and the Highway as mentioned in **Section 4.2.1.**, the mitigated scenario maximise the permeability to minimise the impact to the pedestrian.



**Figure 5-7 Near-ground Site Wind Condition with Wind Flow (Orange Line)
(Left: Unmitigated Scenario; Right: Mitigated Scenario)**

5.3.2 At higher level, the corridor at rooftop provides a wind passage for connection at Nam Cheung Park and to the inland region, passing over the ground structures as shown in **Figure 5-1** and **Figure 5-2**.

6. CONCLUSION

- 6.1.1 An Expert Evaluation on site wind characteristics and wind environment under the proposed development situation regarding qualitative air ventilation assessment was conducted.
- 6.1.2 The result of the evaluation on the annual and summer prevailing wind obtained from HKO and MM5 and the surrounding topography revealed that the prevailing wind of ENE and E in non-summer period and SW in summer period would flow through the Site and the open spaces at the seafront.
- 6.1.3 The existing bulky structures at the surroundings would reduce the site wind availability. Although the Project is in small scale and has minimal impact to the ventilation of the region relative to adjacent bulks, the design optimisation and consideration of wind enhancement features including permeable floors, wind corridor at the roof and building set-back have been incorporated into the design of this compacted building in order to maximise the permeability and wind enhancement. It is expected within the allowable height of 35.4 m under land allocation, and air ventilation impacts arising from the proposed Development will be little and localised.
- 6.1.4 As the proposed Development would have insignificant adverse wind penetration effects to its surrounding area and major breezeway, in view of the adopted mitigation designs, further air ventilation assessment for Initial Study is considered not necessary.