

CONSULTANCY STUDY FOR AIR VENTILATION ASSESSMENT SERVICES

CAT. A1 – TERM CONSULTANCY FOR EXPERT EVALUATION ON AIR VENTILATION  
ASSESSMENT (PLNQ A1-4/AVA 2015)

AIR VENTILATION ASSESSMENT EXPERT  
EVALUATION REPORT

FOR

AN INSTRUCTED PROJECT AT CASTLE PEAK  
ROAD – CASTLE PEAK BAY, AREA 48,  
TUEN MUN

(PLNQ A1-4/AVA 2015)

Ref No.:RP16164

**Submitted to:**

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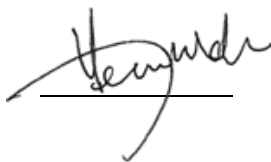
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## EXECUTIVE SUMMARY

BeeXergy Consulting Limited was commissioned by the Planning Department of Hong Kong Special Administrative Region Government to undertake an Air Ventilation Assessment (AVA) – Expert Evaluation (EE) for an instructed project at Castle Peak Road – Castle Peak Bay, Area 48, Tuen Mun (the Development). The current study aims to assess the likely air ventilation impacts of the land use proposal. The Development Site is about 1.4ha in area, covered by the approved Tuen Mun Outline Zoning Plan (OZP) No. S/TM/33. It is located at Area 48, Tuen Mun, between Tuen Mun Road and Castle Peak Road.

The annual and summer prevailing winds were studied. According to the RAMS wind data, E, ESE and SE winds are identified as the annual prevailing wind directions while ESE, SE and SSE winds are identified as the summer prevailing wind directions.

- East wind is expected to skim over existing building cluster at the north of Crossroads Foundation site and reach the Development Site. Considering the existing open nature of the Development Site, E wind could penetrate through the site and reach its downstream area to Palm Beach and existing developments at Mun Fat Lane
  - ESE wind would skim over the low-rise houses in Monte Carlo Villas and reach the Development Site. ESE wind could penetrate through the site and reach its downstream area (i.e. TMTL 423)
  - SE wind would come along Castle Peak Road, crossing the western portion of Crossroads Foundation site and reach the northeastern part of the Development Site. It is also expected that SE wind would skim over the low-rise Monte Carlo Villas to reach the Development Site and its downstream area (i.e. TMTL 423 and Harrow International School Hong Kong)
  - Part of SSE wind would skim over Monte Carlo Villas and reach the Development Site. It would also follow Golden Beach Path and reach the western part of the Development Site. Considering the open nature of the Development Site, SSE wind could penetrate through the site and reach its downstream area (i.e. TMTL 423 and Harrow International School Hong Kong)
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Based on the proposed development parameters at the Development Site, the future development may have potential impacts on Palm Beach under prevailing E wind and on areas to the north including Harrow International School Hong Kong and planned development at TMTL 423 under southerly winds. To alleviate the potential ventilation issues, the following measures are recommended for the future development at the site.

- Connectivity to planned air path at Crossroads Foundation site where possible
  - A setback of minimum 3m wide from site boundary facing Castle Peak Road at eastern part of the Development Site
  - A 15m wide air path (in form of NBA) at the eastern part of the Development in the NNE/SSW alignment
  - A 15m wide air path (in form of NBA) at the western part of the Development in the NNE-SSW alignment
  - Further good design principles (section 5.4 of the report) should be considered at the detailed design stage.
-

## 行政摘要

豐能顧問有限公司（豐能）受香港特別行政區規劃署的委託，於青山道-青山灣項目（以下簡稱“地盤”）進行了空氣流通評估-專家評估（AVA EE），根據屯門分區計劃大綱核准圖（大綱圖）編號 S/TM/33，研究潛在的地盤發展對鄰近地區風環境的影響，並提供相應的緩解措施。發展地盤面積約為 1.4 公頃，位於屯門第 48 區屯門公路與青山公路之間，由大綱圖編號 S/TM/33 所涵蓋。

本報告研究了全年及夏季盛行風環境，根據區域大氣模擬系統（RAMS）的風模擬數據，東、東南偏東及東南風向確定為全年盛行風向，而東南偏東、東南及東南偏南風被確定為夏季盛行風向。

- 東風預計將掠過現時在國際十字路基金會（Crossroads Foundation）北部的建築群，並到達地盤。考慮到發展地盤現行開放的環境，東風可穿過地盤並到達下游地區如棕月灣及現時在滿發里的周邊建築。
- 東南偏東風會掠過蒙地卡羅別墅（Monte Carlo Villas）的低層房屋上，並到達地盤。東南偏東風可以穿過地盤並到達其下游地區如 TMTL 423
- 東南風會沿青山公路，橫穿國際十字路口基金會建築群的西部，並到達地盤的東北部。此外，預期東南風會在蒙特卡羅別墅上掠過，到達地盤及其下游地區（即 TMTL 423 和香港哈羅國際學校）。
- 部份東南偏南風會在蒙特卡羅別墅上掠過到達地盤。東南偏南風亦將沿著黃金泳灘徑（Golden Beach Path），到達地盤的西部。考慮到發展地盤現行開放的環境，東南偏南風可以穿過地盤並到達其下游地區如 TMTL 423 和香港哈羅國際學校）

根據擬議發展參數，未來的發展可能在東風下對棕月灣（Palm Beach）及在南風下對地盤北面地區如香港哈羅國際學校和 TMTL 423 的計劃發展具有潛在影響。為了解決潛在的通風問題，建議以後的建築設計應考慮以下建議。

- 盡可能連接到國際十字路基金會未來的通風道
- 地盤東部的建築綫從青山道退入三米
- 在地盤東部以非建築區域的形式設十五米闊、東北偏北及西南偏南的通風道
- 在地盤西部以非建築區域的形式設十五米闊、東北偏北及西南偏南的通風道
- 在詳細設計階段應進一步考慮良好設計原則（見報告第 5.4 節）

## 1 INTRODUCTION

### 1.1 PROJECT BACKGROUND

BeeXergy Consulting Limited (BXG) was commissioned by the Planning Department (PlanD) of Hong Kong Special Administrative Region Government to undertake an Air Ventilation Assessment (AVA) – Expert Evaluation (EE) for an instructed project at Castle Peak Road – Castle Peak Bay, Area 48, Tuen Mun (the Development). The current study aims to assess the likely air ventilation impacts of the land use proposals.

In conducting the AVA EE, reference was made to previous AVA studies related to the Development site including but not limited to the followings:

- Term Consultancy For Expert Evaluation on Air Ventilation Assessment for Tuen Mun New Town Area (March 2008)
- Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment (PLNQ 37-A14/2007) Tuen Mun New Town Area (March 2009)
- Planning and Engineering Review of Potential Housing Sites in Tuen Mun East Area – Feasibility Study (November 2009)
- Term Consultancy For Expert Evaluation on Air Ventilation Assessment for Tuen Mun New Town (May 2014)

### 1.2 OBJECTIVE

The objective of this study is to evaluate the wind performance of the Development using the methodology of AVA, based on the “Housing Planning and Lands Bureau – Technical Circular No. 1/06, Environment, Transport and Works Bureau – Technical Circular No. 1/06” issued on 19th July 2006 (the Technical Circular) and “Technical Guide for Air Ventilation Assessment for Development in Hong Kong – Annex A of the Technical Circular” (the Technical Guide).

### 1.3 STUDY TASK

The major task of this study is to carry out an AVA EE on the characteristics of the site wind availability data of the development area and assessment of the wind performance under existing development situation and the proposed building design option in a qualitative manner. The AVA EE will cover the following tasks:

- Review the existing wind environment of the Development Site and its surrounding
- Assess qualitatively the potential air ventilation impacts of the proposed development on the surrounding areas
- Identify major breezeway(s), air-path(s), problematic area(s)
- Comment on the localized wind effects of the proposed development on its surrounding

- Identify if any wind stagnation and wind amplification causing uncomfortable and unsafe wind environment
- Recommend improvement and mitigation measures
- Recommend if any further study may be necessary



## 2 SITE CHARACTERISTICS

The Development Site is about 1.4ha in area, covered by the approved Tuen Mun Outline Zoning Plan (OZP) No. S/TM/33. It is located at Castle Peak Road – Castle Peak Bay, Area 48, Tuen Mun, bounded by Tuen Mun Road and Castle Peak Road as shown in Figure 1. Golden Beach is situated to the southwest of the Development Site, while Harrow International School Hong Kong is to its immediate north. The hillside further north is Tai Tam Country Park which is approximately 400m in height. Majority of areas to the east (e.g. Crossroads Foundation, Aegean Coast, Avignon), southeast (e.g. Hong Kong Gold Coast), northwest (e.g. Bayview Terrace), south (e.g. Palm Beach, Monte Carlo Villas, Spring Seaview Terrace) and southwest (e.g. Blessing Villa) are low- to medium-density residential developments and a hotel (HK Gold Coast Hotel) of less than 100mPD in height.

Also some planned developments at TMTL 423, TMTL 427, TMTL 435, various lots and Government land in D.D. 379 (to be known as TMTL 463), TMTL 475 (extension of Harrow International School Hong Kong), TMTL 500 and under approved application No. Y/TM/16 are found located to the north, east and southeast of the Development Site (Figure 2). The maximum building heights for these existing and planned developments are listed out in Table 1.

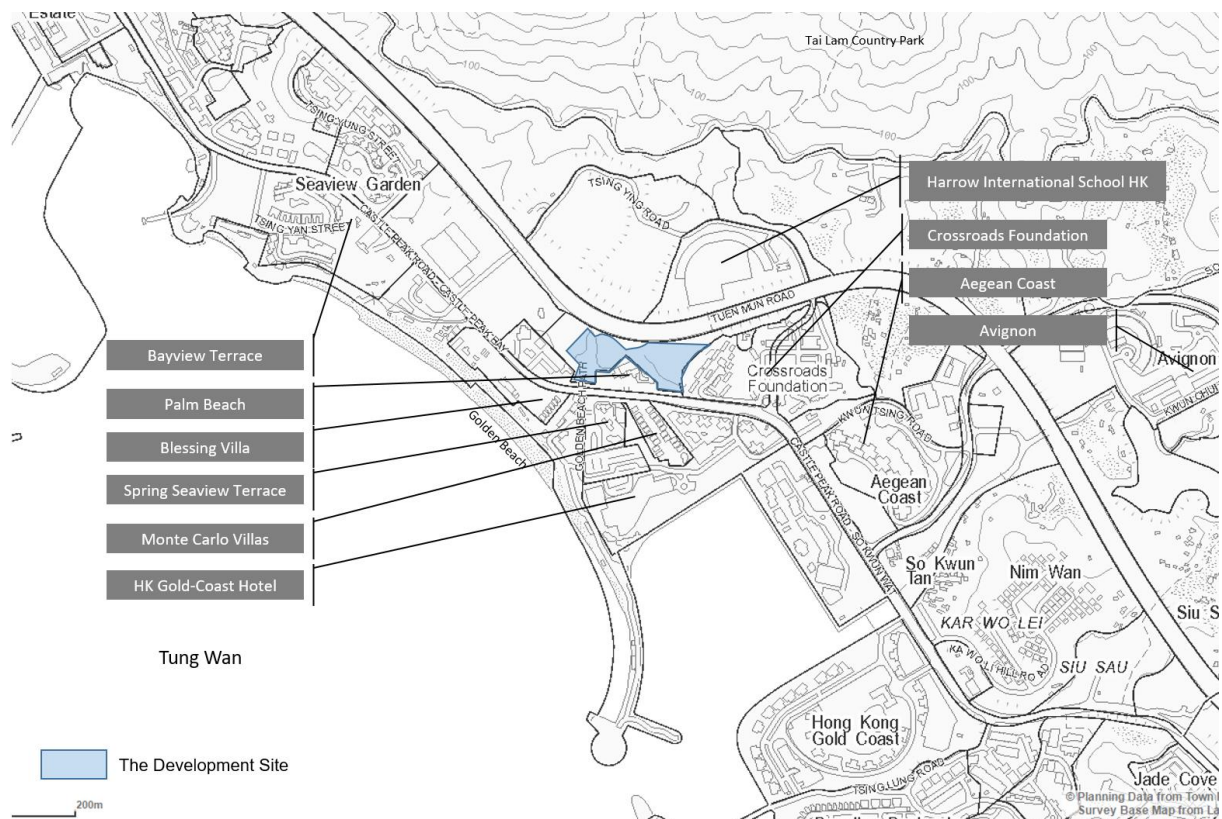


Figure 1 The Development Site and its surroundings



Figure 2 Planned Developments

Table 1 Building Height of Existing and Planned Developments

Name of Surrounding Developments	Maximum Building Height (mPD)
Harrow International School Hong Kong	70
Aegean Coast	95
Avignon	57
Hong Kong Gold Coast	76
Monte Carlo Villas	23
Palm Beach	63
Spring Seaview Terrace	60
Gold Coast Hotel	64
Blessing Villa	20
Bayview Terrace	65
Future Crossroads Foundation Site's Development	70
Planned Development at TMTL 423	90
Planned Development at TMTL 475 (extension of Harrow International School Hong Kong)	70
Planned Development under approved application No. Y/TM/16	79
Planned Development at TMTL 427	53
Planned Development at TMTL 500	80
Planned Development at TMTL 435	61
Planned Development at TMTL 463	84

### 3 SITE WIND AVAILABILITY

The characteristic of the natural wind availability of the site should be identified in order to investigate the wind performance of the Development Site. Site wind availability data could be used to assess the wind characteristics in terms of the magnitude and frequency of approaching wind from each wind direction. There are three sources of site wind data for this Development Site, including (i) the nearby Hong Kong Observatory (HKO) Station –Tuen Mun Government Offices (Station Code: TUN); (ii) experimental site wind data; and (iii) simulated RAMS wind data.

#### 3.1 HONG KONG OBSERVATORY

The prevailing wind direction for each month measured at the closest weather station – Tuen Mun Government Offices from the Hong Kong Observatory<sup>1</sup> is tabulated in Table 2. The HKO TUN weather station is located around 1km from the Development Site (Figure 3). The SE wind is the annual prevailing wind direction while the SE and SW winds are the summer prevailing wind directions, which can be found in Table 2.

Table 2 Monthly Wind Direction Recorded at Tuen Mun Government Offices Weather Station 2015  
(Source: Hong Kong Observatory)

Month	Prevailing Wind Direction (°)	
January	20	
February	160	
March	160	
April	150	
May	150	
<b>June</b>	<b>(Summer)</b>	150
<b>July</b>		220
<b>August</b>		150
September	150	
October	20	
November	20	
December	20	
<b>Annual</b>	150	

<sup>1</sup> Summary of Meteorological and Tidal Observations in Hong Kong 2015 (<http://www.hko.gov.hk/publica/smo/smo2015.pdf>)

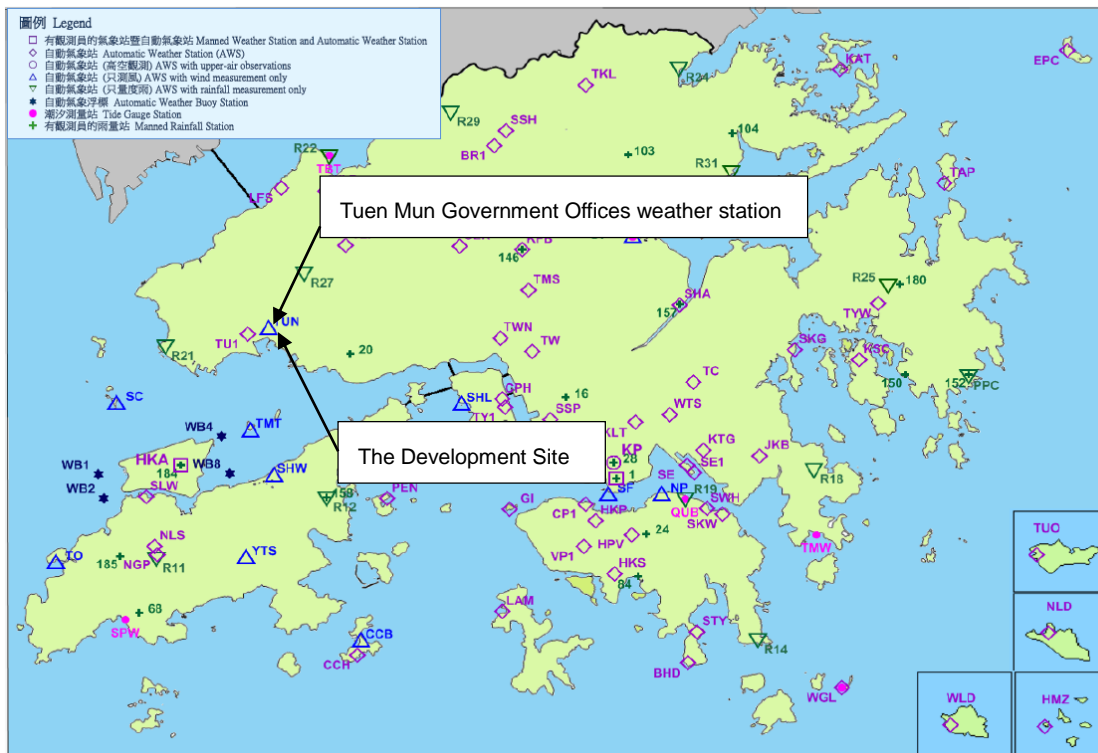


Figure 3 Location of HKO TUN Weather Station



### 3.2 EXPERIMENTAL SITE WIND DATA

“*Experimental Site Wind Availability Study for Tuen Mun East Area, Hong Kong*” conducted by the CLP Power Wind/Wave Tunnel Facility (WWTF) at The Hong Kong University of Science and Technology provides wind availability data for Tuen Mun East area from wind tunnel experiment in 2008. The measurement location is approximately at the Harrow International School Hong Kong which is around 300m away from the Development Site (Figure 4). Only the wind rose under annual wind condition is available in the captioned study (Figure 5).



Figure 4 Measurement location

According to the wind data from the wind tunnel test, N, ENE and E winds are identified as the annual prevailing wind directions.

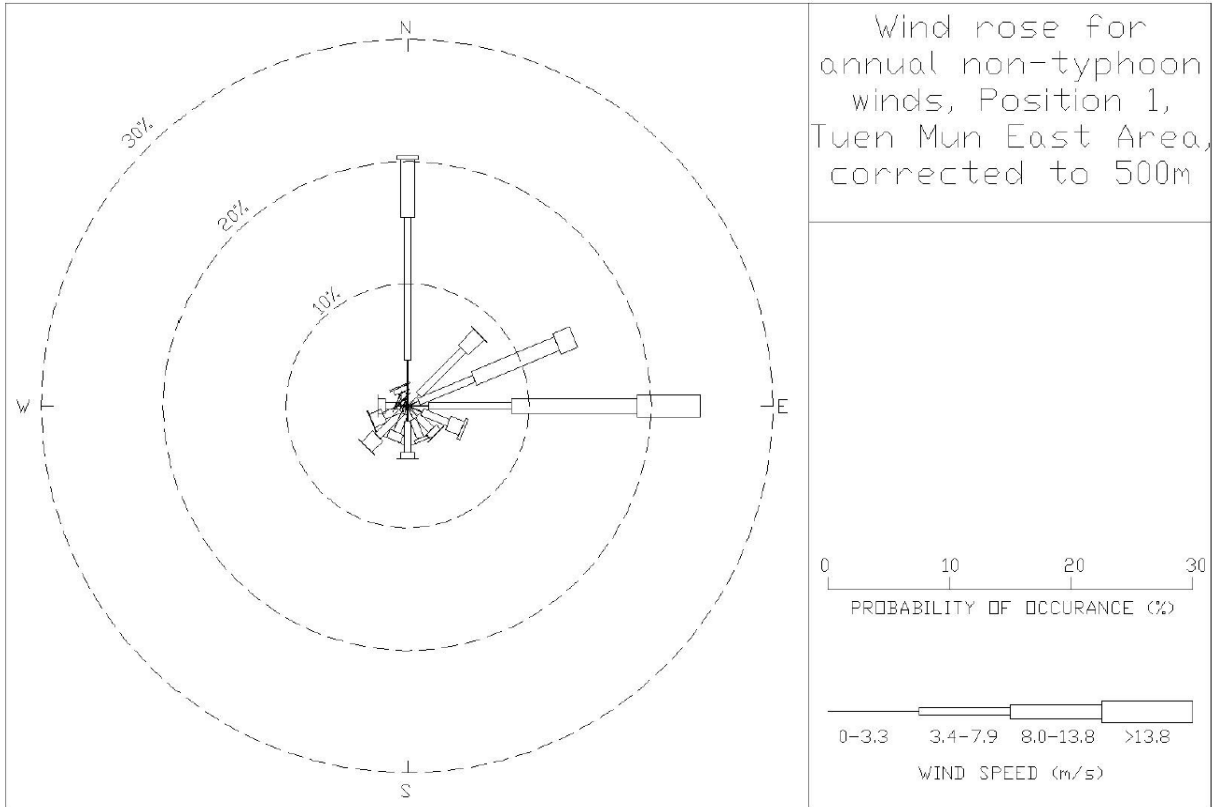


Figure 5 Annual Wind Rose

### 3.3 RAMS WIND DATA

A set of wind availability data of the Territory for AVA study is available at Planning Department’s Website<sup>2</sup>. The site wind availability would be presented by using appropriate mathematical models (e.g. RAMS simulation).

The wind availability data at 200mPD obtained from the grid of (X042, Y055) for the RAMS simulation covers the Development Site and is shown in Figure 6.

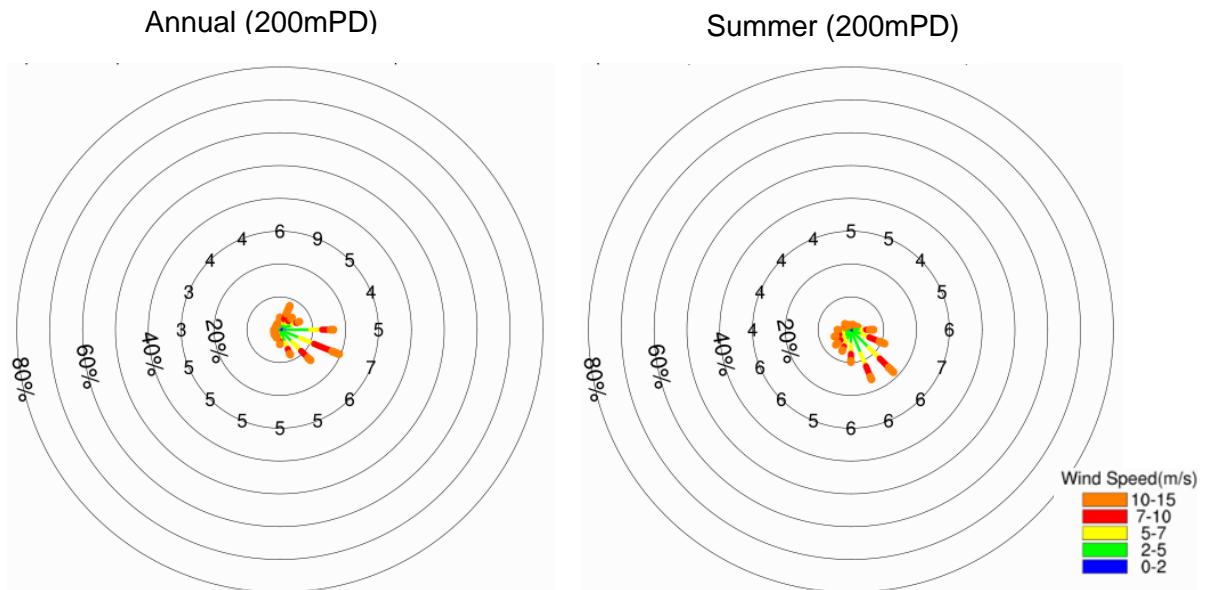


Figure 6 Wind Roses for the Development Site (X042, Y055) by RAMS Wind Data

Table 3 Prevailing Wind Frequency by RAMS Wind Data

Prevailing Wind	Annual			Summer		
	E	ESE	SE	ESE	SE	SSE
Wind Frequency	16.4%	19.6%	13.3%	11.4%	18.7%	16.5%

According to the RAMS wind data, E, ESE and SE winds contribute to 16.4%, 19.6% and 13.3% of the annual wind frequency respectively while the ESE, SE and SSE winds contribute to 11.4%, 18.7% and 16.5% of the summer wind frequency respectively. Hence, E, ESE and SE winds are identified as the annual prevailing wind directions while ESE, SE and SSE winds are identified as the summer prevailing wind directions.

<sup>2</sup> [http://www.pland.gov.hk/pland\\_en/info\\_serv/site\\_wind/site\\_wind/index.html](http://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html)

### 3.4 SITE WIND AVAILABILITY FOR CURRENT STUDY

These three sets of wind data have been studied. The wind data from the closest HKO weather station, experimental site wind data and RAMS wind data indicated prevailing winds directions are tabulated in Table 4.

While HKO weather station is relatively far from the site, only the annual wind condition is available from the experimental site wind data. On the other hand, RAMS Wind Data is obtained at the location of the Development Site. Under such consideration, RAMS Wind Data would be adopted as the basis of study, i.e. E, ESE and SE winds for annual condition and ESE, SE and SSE winds for summer condition.

Table 4 Prevailing wind directions for the Development site

<b>Prevailing Wind Direction</b>	<b>HKO</b>	<b>Experimental Site Wind Data (500m)</b>	<b>RAMS Wind Data (200m)</b>
<b>Annual</b>	SE	N, ENE, E	E, ESE, SE
<b>Summer</b>	SE, SW	-	ESE, SE, SSE



#### 4 QUALITATIVE ASSESSMENT UNDER EXISTING CONDITION OF THE DEVELOPMENT SITE

The Development Site is located within an area currently zoned “Green Belt” with no existing building. It is a sloped area bounded by Tuen Mun Road (~32mPD) to the north and Castle Peak Road (~12mPD) to the south. With consideration of the current topographical condition as well as the planned and committed developments nearby, the wind environment under both annual and summer conditions are qualitatively assessed below based on the wind data presented in Section 3. Majority of prevailing winds are coming from the East and South-eastern quarter under both annual and summer conditions. However, these areas are relatively built-up which may affect the wind availability for the site

According to the AVA report “*Term Consultancy for Expert Evaluation on Air Ventilation Assessment for Tuen Mun New Town (May 2014)*” by Chinese University of Hong Kong, an NBA, amongst others, of at least 15m wide along WSW to ENE direction is recommended as an air path across the future development at the adjacent Crossroads Foundation site, namely Sites C2 and C3 in the aforementioned report. Since there is no proposed layout available for these sites at the moment of conducting this study, the exact location of this WSW/ENE orientated NBA remains unknown.

#### 4.1 E WIND

E wind is one of the annual prevailing winds. Figure 7 shows that the incoming wind from E direction can freely reach the northern part of the Development Site through Tuen Mun Road. Since the existing Crossroads Foundation is low-rise in nature, wind is expected to skim over this building cluster and reach the Development Site (blue arrow). As mentioned, an NBA in a notional WSW/ENE alignment across the future development at the Crossroads Foundation site would allow E wind to penetrate through and reach the Development Site. Although the exact alignment and location of such notional air path is yet to be finalized, it is expected that E wind would penetrate through the Crossroads Foundation site (purple dot arrow, indicative). Some E wind would likely be diverted by the towers of Aegean Coast and reach the southern side of the Development Site via Castle Peak Road (red arrows). Considering the open nature of the Development Site, E wind could penetrate through the site and reach its downstream area to Palm Beach and existing developments at Mun Fat Lane freely.

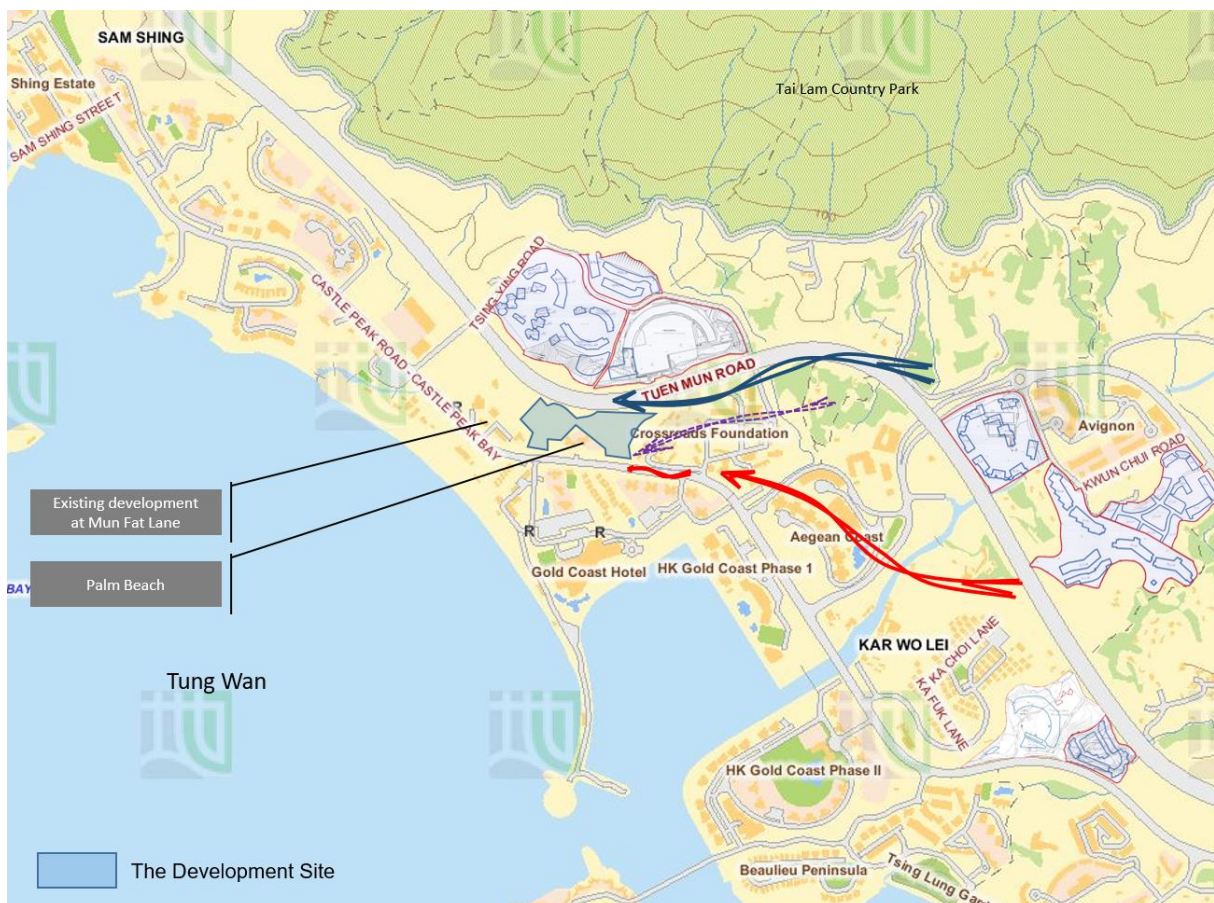


Figure 7 Major air paths under E wind

## 4.2 ESE WIND

ESE wind is the prevailing wind for both annual and summer conditions (Figure 8). ESE wind would travel along Castle Peak Road and then reach the eastern part of the Development Site (red arrow). Meanwhile, it is also expected that ESE wind would skim over the low-rise houses in Monte Carlo Villas with maximum building height of 23mPD. The air stream would then be diverted by mid-rise towers of Spring Seaview Terrace (60mPD) towards the Development Site. Moreover, Palm Beach (63mPD) may also divert incoming wind to western part of the Development Site (blue arrows). Considering the open nature of the Development Site, ESE wind could penetrate through the site and reach its downstream area (i.e. TMTL 423) freely.

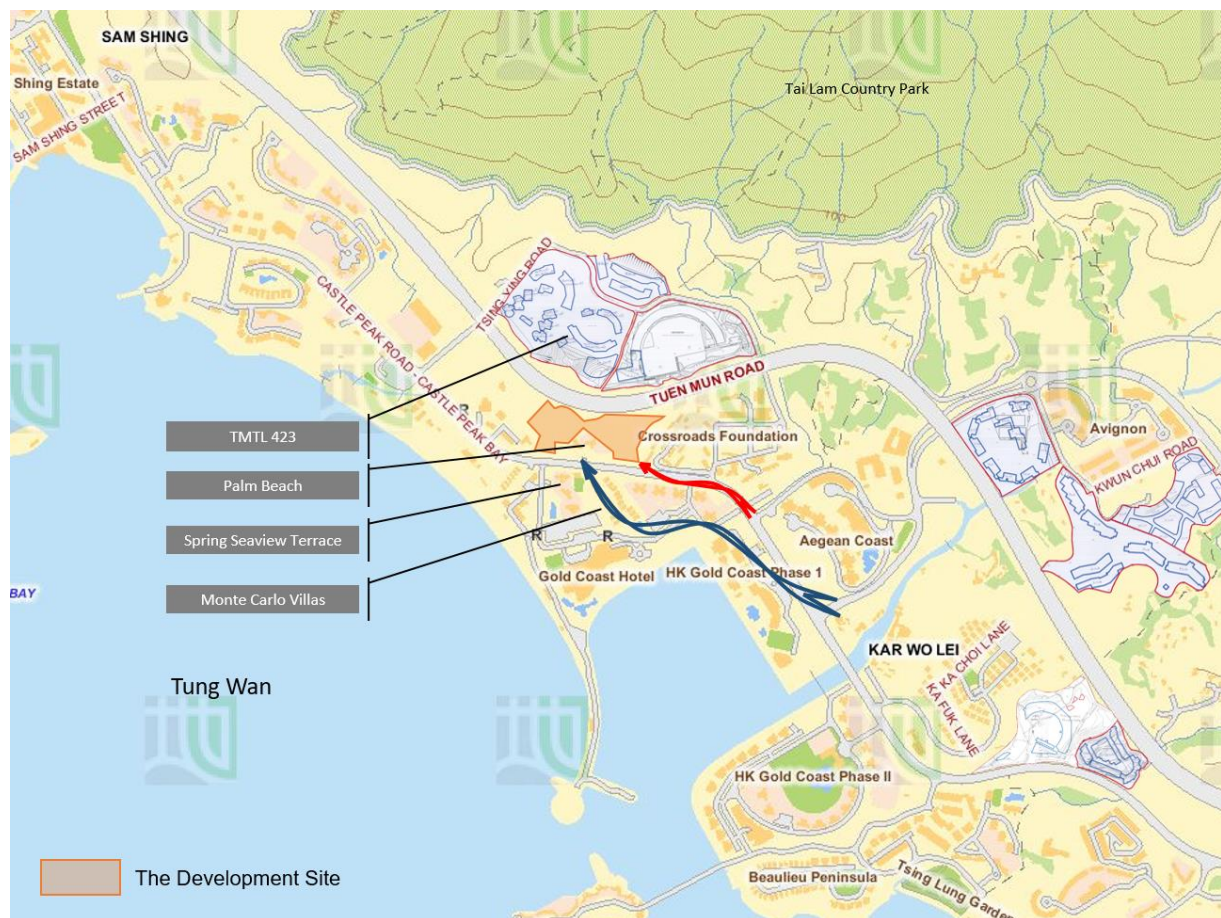


Figure 8 Major air paths under ESE wind



### 4.3 SE WIND

SE wind is the prevailing wind for both annual and summer conditions (Figure 9). SE wind would come along Castle Peak Road and may cross the western portion of Crossroads Foundation site to reach the Development Site (red arrow). SE wind would also skim over the low-rise Monte Carlo Villas and be split into two wind paths towards the eastern and western parts of the Development Site due to the presence of the mid-rise Palm Beach (blue arrows). Considering the open nature of the Development Site, SE wind could penetrate through the site and reach its downstream area (i.e. TMTL 423 and Harrow International School Hong Kong) freely.

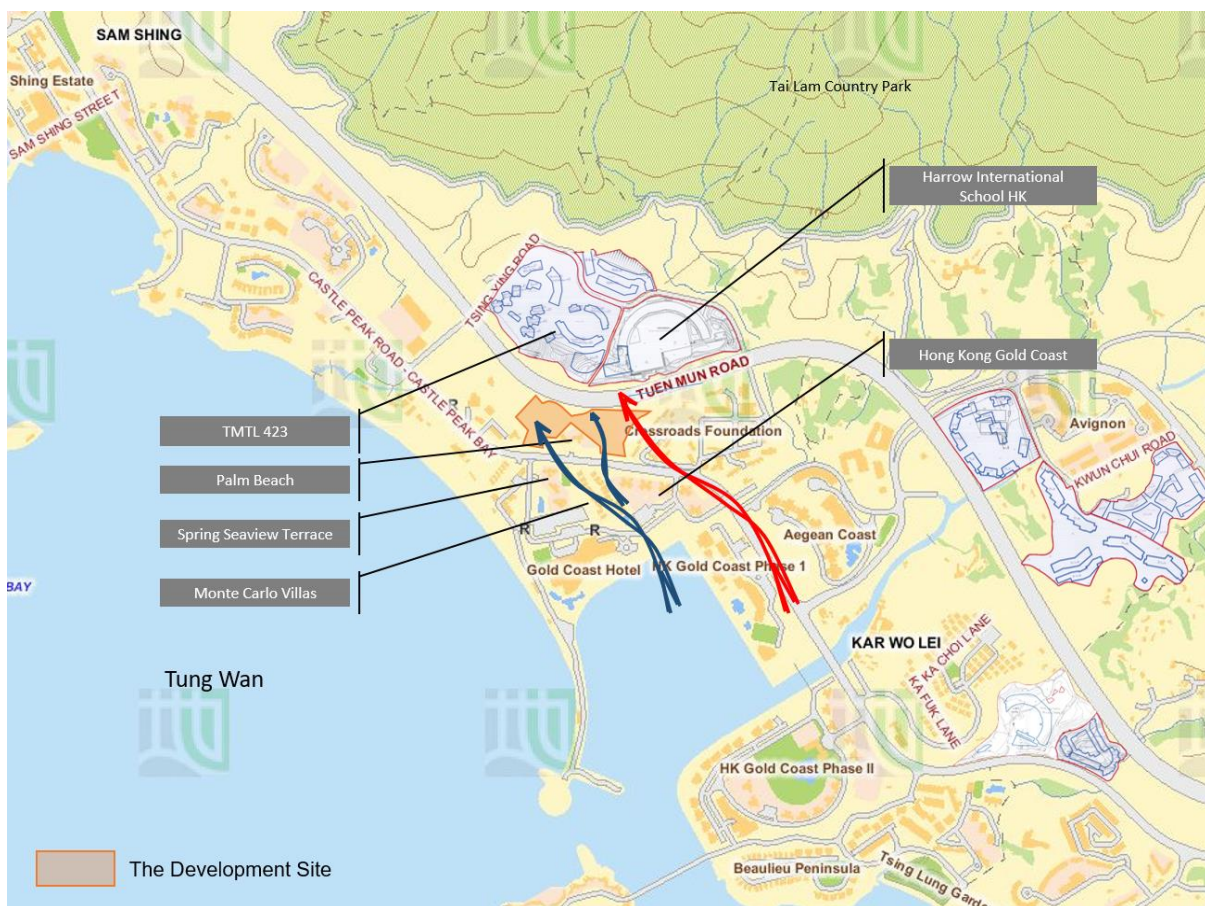


Figure 9 Major air paths under SE wind

#### 4.4 SSE WIND

SSE wind is the prevailing wind under summer condition (Figure 10). The Gold Coast Hotel (64mPD) to the south of the Development Site would slightly block the approaching wind and divert SSE wind to its two sides. Wind would then skim over Monte Carlo Villas and reach the Development Site. (blue arrows). Another air stream would be diverted to follow Golden Beach Path and reach the western part of the Development Site (red arrow). Considering the open nature of the Development Site, SSE wind could penetrate through the site and reach its downstream area (i.e. TMTL 423 and Harrow International School Hong Kong) freely.



Figure 10 Major air paths under SSE wind



## 5 RECOMMENDATIONS TO PLANNED DESIGN

### 5.1 SITE PARAMETERS

The Development Site is irregular in shape with long frontal length of about 225m and 255m facing south and north respectively. The following parameters are planned for the future development at the Development Site:

- Site area: About 1.4ha
- Domestic Plot Ratio: 4
- Maximum Building Height : 90mPD
- Site Constraints: Setback of 20m from Tuen Mun Road and 5m from Castle Peak Road

Based on the analysis in Section 4, the future development at the Development Site may have some potential air ventilation impact on its surrounding under various prevailing winds. Relevant mitigation measures should be provided, particularly related to site permeability under North-South and East-West orientation.



Figure 11 The Development Site and its surrounding

## 5.2 EAST-WEST PERMEABILITY

Under the prevailing E and ESE winds, wind reaches the site mainly through the current Crossroads Foundation site or along Castle Peak Road. As per the recommendation set out in the AVA report “*Term Consultancy for Expert Evaluation on Air Ventilation Assessment for Tuen Mun New Town (May 2014)*” by Chinese University of Hong Kong, NBA(s) including an air path of at least 15m wide along WSW to ENE direction should be provided across the adjacent Crossroads Foundation site to maintain wind penetration. While it is most desirable that this air path would be connected with one within the future development at the Development Site, the exact alignment of this WSW/ENE orientated air path through the Crossroads Foundation site is not available at this stage. In view of such limitation as well as the need to provide design flexibility for the future development at the Development Site, a minimum 3m-setback from the site boundary facing Castle Peak Road at the eastern part of the Development Site is recommended to widen the air path for E and ESE winds along Castle Peak Road to serve Palm Beach (Figure 12).



Figure 12 Connectivity to planned air path in Crossroads Foundation.



### 5.3 NORTH-SOUTH PERMEABILITY

Considering the long frontal length of the Development Site facing south (i.e. over 200m-wide), it is recommended to provide certain building separations across the future development at the site. As mentioned in previous sections, wind from the south quarter would likely skim over Monte Carlo Villas and reach the Development Site. It is recommended to provide one NBA each at the eastern and western parts of the future development. These NBAs should align in the NNE – SSW direction at a minimum width of 15m (Figure 13). It is expected that southerly winds would skim over Monte Carlo Villas and Palm Beach’s podium (21.6mPD) reach Tuen Mun Road (33mPD) and Harrow International School ground level (~45mPD) through these NBAs. It would minimize the potential impact of the future development at the Development Site on the wind environment of the surrounding area.

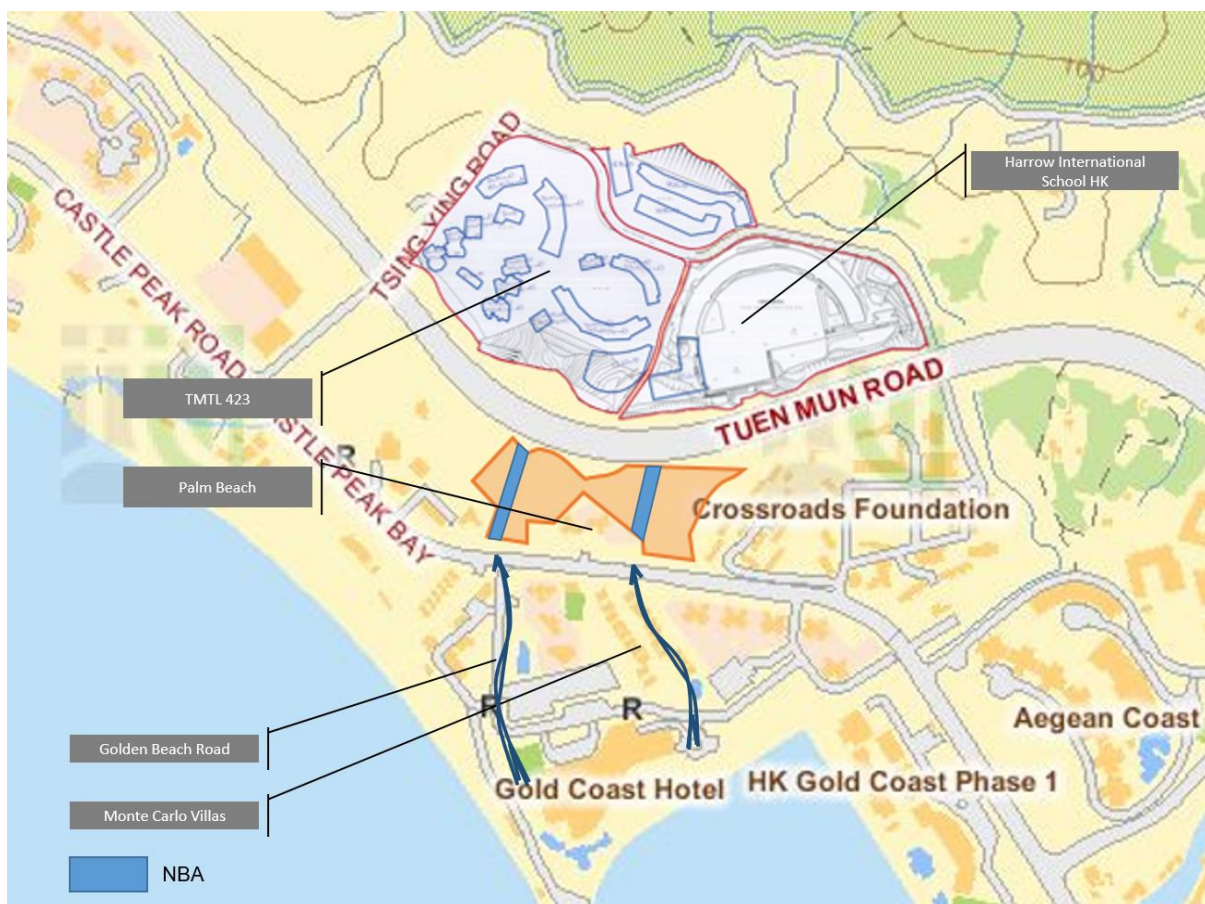


Figure 13 Recommended Non-Building Areas within the Future Development



## 5.4 FURTHER DESIGN PRINCIPLES

In addition to the above design measures, future development at the Development Site should consider adopting the following design principles at the detailed design stage as the prevailing effort for improvement in urban climate.

- ◆ Adopt building permeability equivalent to 20% to 33.3% with reference to PNAP APP-152;
- ◆ Minimize podium bulk with ground coverage of no more than 65% where feasible;
- ◆ Adopt building setback with reference to PNAP APP-152;
- ◆ Incorporate greening measures with a target of not less than 30% for sites larger than 1 ha, and not less than 20% for sites below 1 ha, preferably through tree planting at grade;
- ◆ Avoid long continuous façades; and
- ◆ Make reference to the recommendations of design measures in the Hong Kong Planning Standards and Guidelines.

## 6 FURTHER QUANTITATIVE STUDY

Given that the proposed mitigation measures (i.e. NBAs and setback) as set out in Section 5 would be fulfilled as recommended in the building design, the future development at the Development Site would have no major air ventilation issues. If the requirements of NBAs and setback cannot be provided, further quantitative assessments should be conducted to demonstrate that the performance of the proposed development would be no worse off than the scenario with these measures.

## 7 CONCLUSION

AVA EE on the wind environment of the Development for the Castle Peak Bay, Area 48, Tuen Mun was conducted. According to the analysis, the annual prevailing wind comes from E, ESE and SE directions, while the summer prevailing wind is from ESE, SE and SSE directions. Several good design features are recommended in the future design to mitigate the potential ventilation issues:

- Connectivity to planned air path in Crossroads Foundation site where possible
- A setback of minimum 3m wide from site boundary facing Castle Peak Road at eastern part of the Development Site
- A 15m wide air path (in form of NBA) at the eastern part of the Development in the NNE/SSW alignment
- A 15m wide air path (in form of NBA) at the western part of the Development in the NNE-SSW alignment
- Further good design principles listed in section 5.4 should be considered at the detailed design stage.