Planning Department

Term Consultancies for Air Ventilation Assessment Services for Potential Commercial Site at Cheung Shun Street near Lai Chi Kok Road, Cheung Sha Wan

Executive Summary of Final Report

Issue | March 2016

Job number 246224-00

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Executive Summary

Ove Arup & Partners Hong Kong Ltd. (Arup) was commissioned by Planning Department (PlanD) to carry out an Air Ventilation Assessment (AVA) for Potential Commercial Site at Cheung Shun Street near Lai Chi Kok Road, Cheung Sha Wan.

The site is situated at the southwestern fringe of the Cheung Sha Wan Industrial/ Business Area. A cluster of medium-rise business/ industrial buildings are located to the east and north of the project site. In addition, high-rise residential developments of Banyan Garden, Liberte, The Pacifica and One West Kowloon are located to the immediate south of the site, whereas an elevated Tsing Sha Highway is located west of the site.

The site of about 0.423 ha at Cheung Shun Street near Lai Chi Kok Road, Cheung Sha Wan is zoned "Government, Institution or Community" ("G/IC") on the approved Cheung Sha Wan Outline Zoning Plan (OZP) No. S/K5/35, subject to a building height restriction of 13 storeys. To optimize the development opportunity and to allow for more design flexibility, it has been identified as a potential site to be rezoned for commercial use.

A qualitative assessment of the existing wind condition as well as a site-specific quantitative assessment on the possible air ventilation impacts have been conducted to support the rezoning proposal to be submitted for the Town Planning Board (TPB)'s consideration.

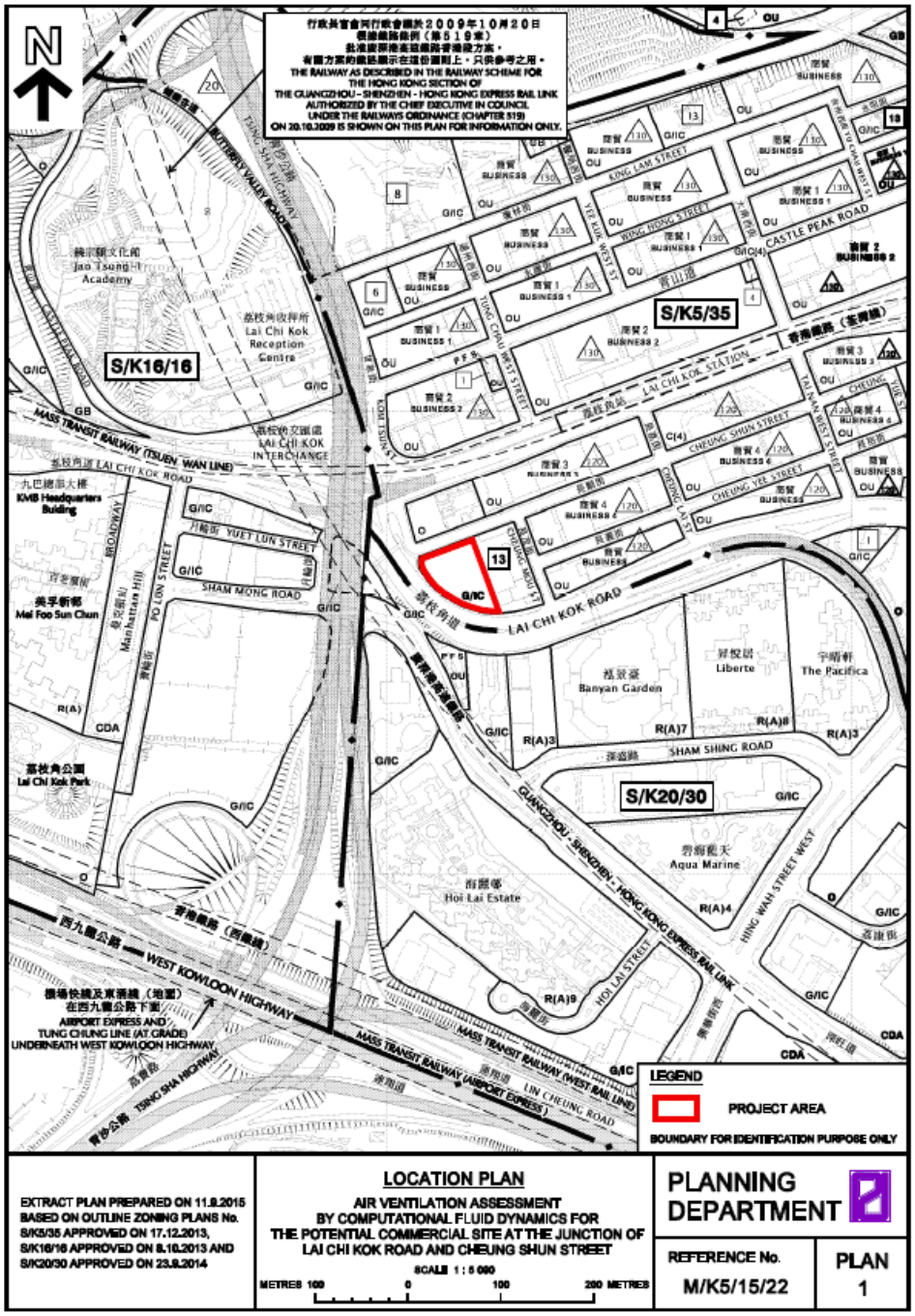


Figure 1 Project Site boundary with OZP zoning (Image Source: Planning Department)

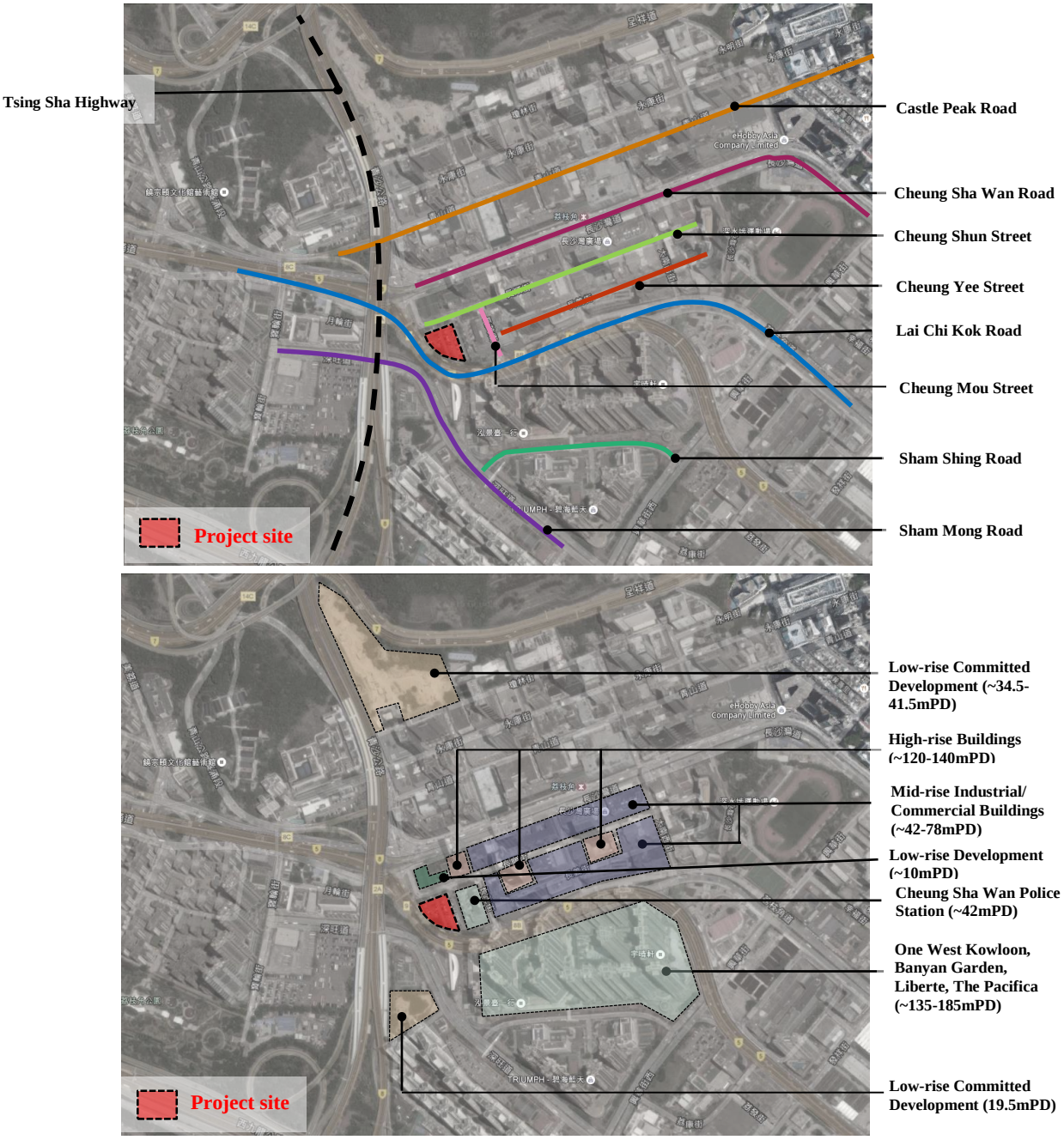


Figure 2 Project Site and its Surrounding Areas (Image Source: Google Earth)

Previous AVA(s) Conducted near the Project Site

The following listed out the previous air ventilation assessment(s) conducted for the Project Area and its surrounding.

- Term Consultancy for AVA Services – Expert Evaluation on Air Ventilation Assessment of Cheung Sha Wan Area- Expert Evaluation and Advisory Report for Proposed Amendments to Cheung Sha Wan Outline Zoning Plan
- Cheung Sha Wan Wholesale Food Market (CSWWFM) Phase 2 Site and Fat Tseung Street West (FTSW) Developments
- Proposed Public Rental Housing (PRH) Development at Lai Chi Kok Road/ Tonkin Street

Site Wind Availability

A study of wind availability and characteristics for Hong Kong was conducted by the City University of Hong Kong. In the study, a meso-scale model Regional Atmospheric Modelling System (RAMS)[1] was used to reproduce the site wind data including wind rose and wind profile. Based on the site wind availability data, the Project Site is located within grid X: 074 Y: 046.

Wind Data for Qualitative Assessment

Wind rose at 200m height is selected to investigate prevailing wind condition, as it can better represent the incoming wind to the site which include the influence from the surrounding morphology. The wind availability data shows that NE and E winds dominate under the annual wind condition while E, ESE, SW and SSW dominate under the summer wind condition.

Wind Data for Quantitative Assessment – Initial Study

Wind rose at 500m height is selected to investigate prevailing wind condition in the Initial Study, as the wind is unaffected by the urban roughness value.

Eight prevailing wind directions are considered in this AVA Study which covers 78.9% of the total annual wind frequency. They are north-easterly (7.6%), east-north-easterly (11.9%), easterly (21.8%), east-south-easterly (12.4%), south-easterly (6.5%), south-south-easterly (4.8%), south-south-westerly (7.3%) and south-westerly (6.6%) winds.

In addition, eight prevailing wind directions are considered in the AVA Study which covers 81.8% of the total summer wind frequency. They are easterly (8.1%), east-south-easterly (9.7%), south-easterly (7.9%), south-south-easterly (7.9%), southerly (9.3%), south-south-westerly (15.7%), south-westerly (16.4%) and west-south-westerly (6.8%) winds.

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

Qualitative Assessment of the Existing Wind Condition

Under Annual Wind Condition – NE and E Wind

Under annual wind condition, the prevailing winds are mainly coming from Northeast (NE) and East (E) directions.

Under NE wind condition, upwind mid-rise and high-rise building clusters would block the incoming wind and induces wake zone within the site. The wind environment at the project site is expected to be relatively low.

Under E wind condition, Cheung Sha Wan Temporary Wholesale Poultry Market and Sham Shui Po Sports Ground act as wind entrance for Lai Chi Kok Road and facilitates E wind to flow along and further towards Sham Mong Road.

Under Summer Wind Condition – E, ESE, SSW and SW Wind

Under summer condition, the prevailing winds are mainly coming from East (E), East-Southeast (ESE), Southwest (SW) and South-South-West (SSW) directions.

Under SW and SSW wind condition, the large building gap between Hoi Lai Estate and Mei Foo Sun Chuen allow wind penetrate into western portion of Lai Chi Kok Area. A portion of incoming winds from Tsing Sha Highway could also penetrate across Sham Mong Road into the Project Site resulting a good wind environment.

Under ESE wind condition, the high-rise residential building clusters at the southern side would block the ESE prevailing wind significantly from low level to mid-level, resulting the diversion of wind to Lai Chi Kok Road and Sham Mong Road and approach to the site.

Studied Scenarios

In this study, there are three scenarios – namely Baseline Scenario, Scenario A, and Scenario B.

- **Baseline Scenario** - The Baseline Scenario represents a GIC development with building height not exceeding 13 storeys, which is an OZP-conforming scheme. The building tower is setback from south boundary with a podium of ~26.5mPD and there is an around 6.5m building setback from the east boundary.

- **Scenario A** – Scenario A presents a commercial development with a Plot Ratio (PR) of 12 and a building height restriction of 120mPD. The design intent is to adopt a conventional podium design with full site coverage at a height of 15m. And a ~10m tower setback design is also adopted from east boundary in Scenario A. A maximum 23m building tower setback is adopted from the south site boundary.

- **Scenario B** - Scenario B presents a commercial development with a PR of 12 and a maximum building height restriction of 120mPD. The design intent is to adopt a commercial development with incorporation of mitigation measures to improve air ventilation such as 15m Non-building Area(s) and setback from the lot boundaries. There is also a ~4m setback from the north

site boundary. At high level, a part of the tower (~25m) at upper level has been trimmed to enlarge the opening for wind penetration.

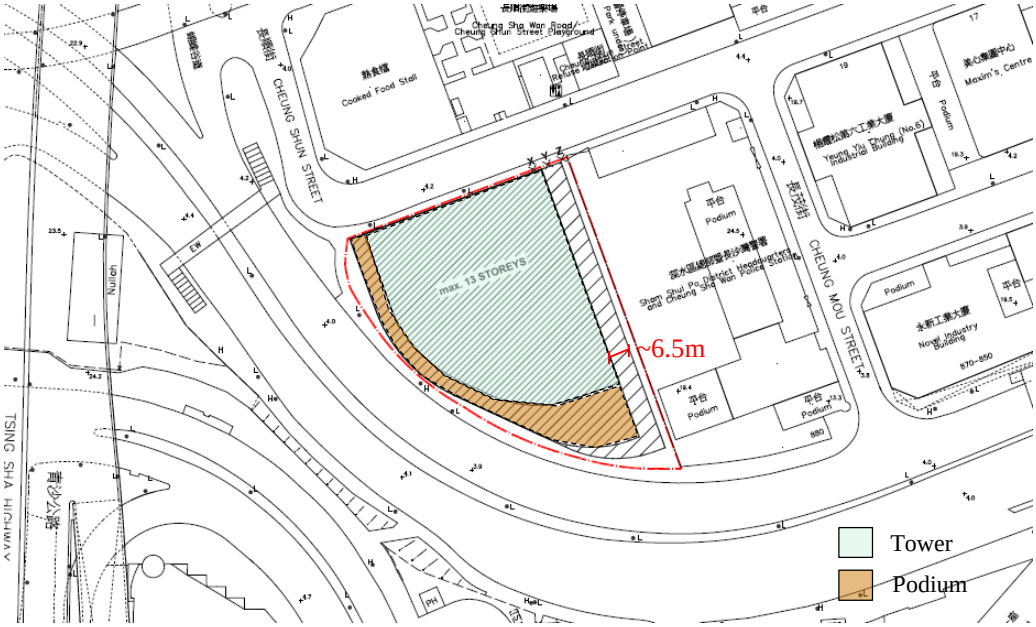


Figure 3 Building layout of Baseline Scenario

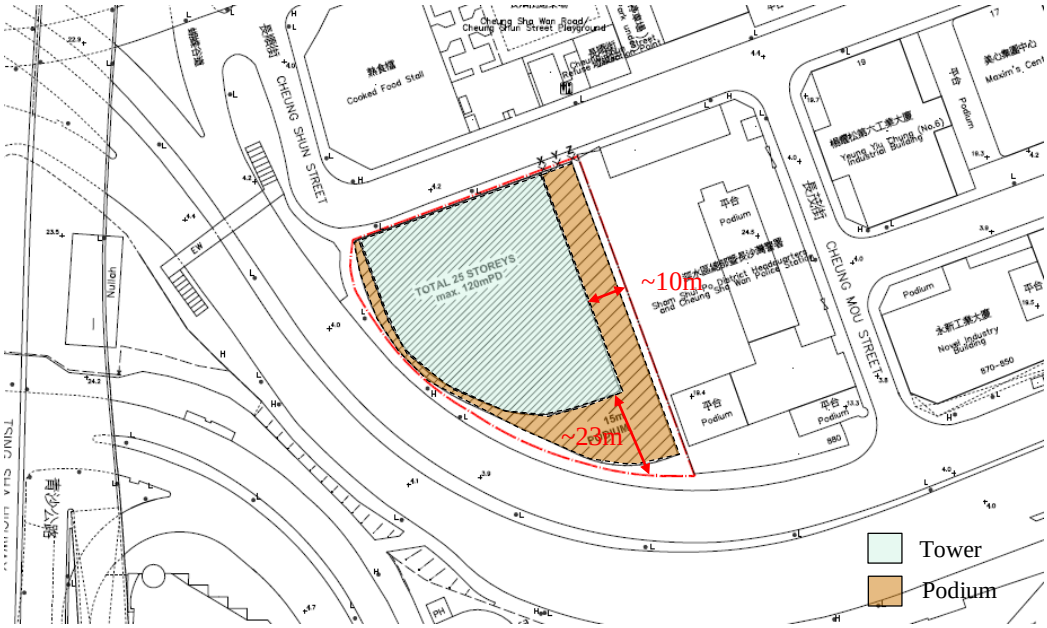


Figure 4 Building layout of Scenario A

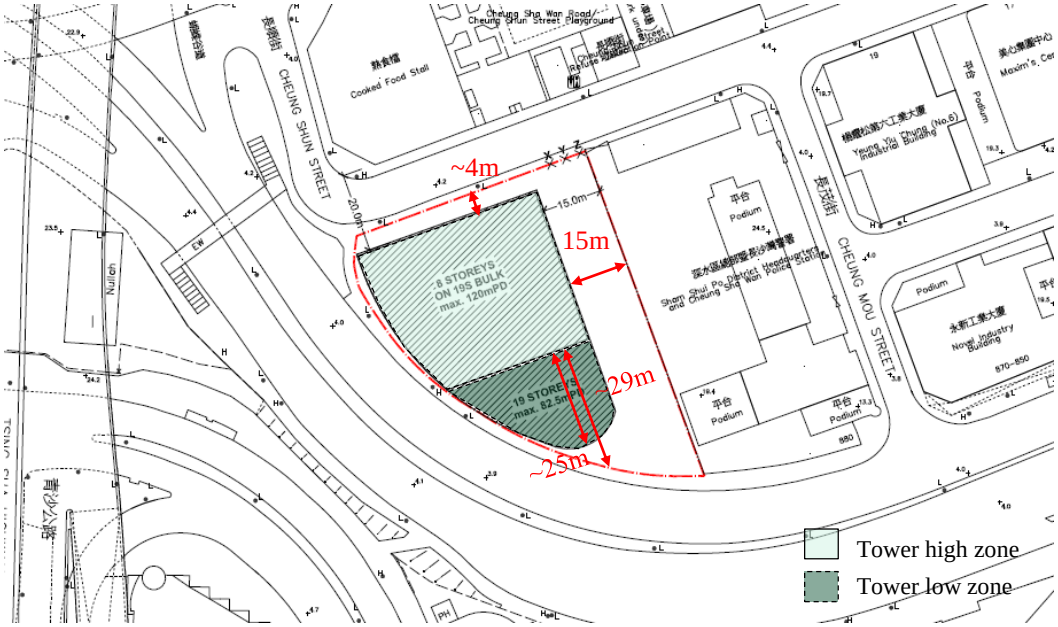


Figure 5 Building layout of Scenario B

Test Point Location

Test points are evenly placed along the site boundary and within the assessment area of the Proposed Development to determine the ventilation performance. There will be two types of test points in the study:

Perimeter Test Points

Perimeter test points are the points positioned at the boundary of the Project Site. In accordance with the Technical Circular for AVA, 30 perimeter points (purple spots) are positioned at interval of 10 – 50m alongside the site boundary as shown in Figure 6.

Overall Test Points

Overall test points are those points evenly positioned in the open space, on the streets and places where pedestrian frequently access within the assessment area. 100 overall test points (blue spots) are selected and shown in Figure 7.

Special Test Points

Special test points are the points evenly positioned in the open area that pedestrians can access within the site boundary. 8 special test points (orange spots marked with "SBS") are selected for Scenario B and the location of points are shown in Figure 8.

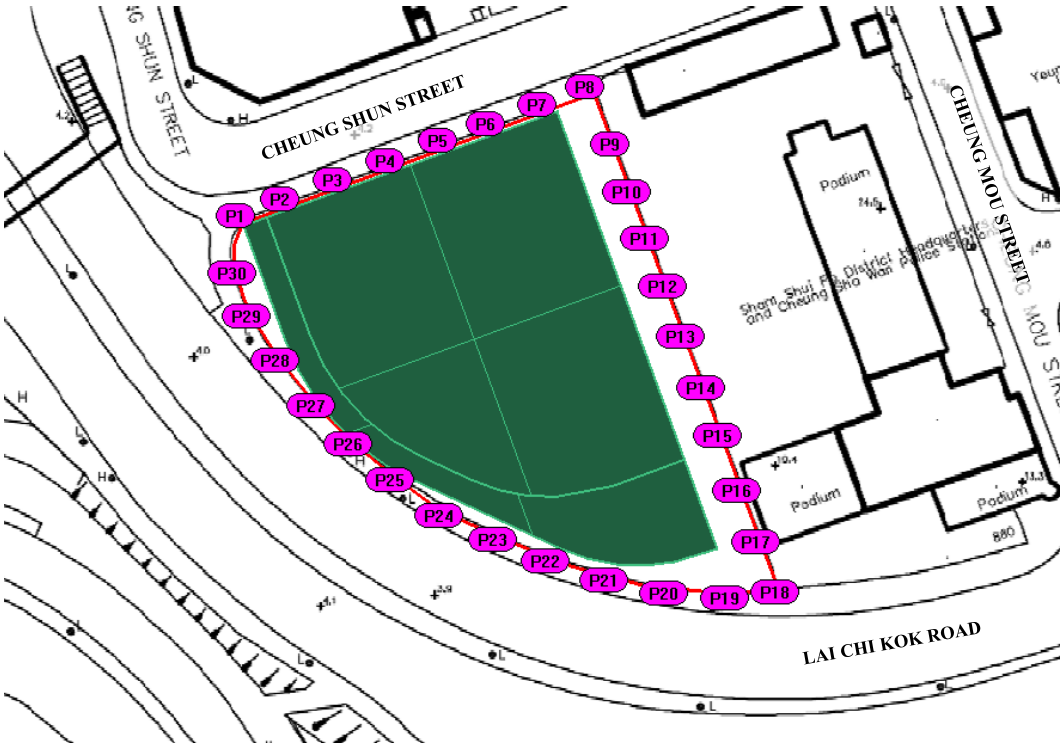


Figure 6 Location of perimeter test points (Image Source: Google Map)

Site Boundary
Assessment Area

Figure 7 Location of overall test points (Image Source: Google Map)

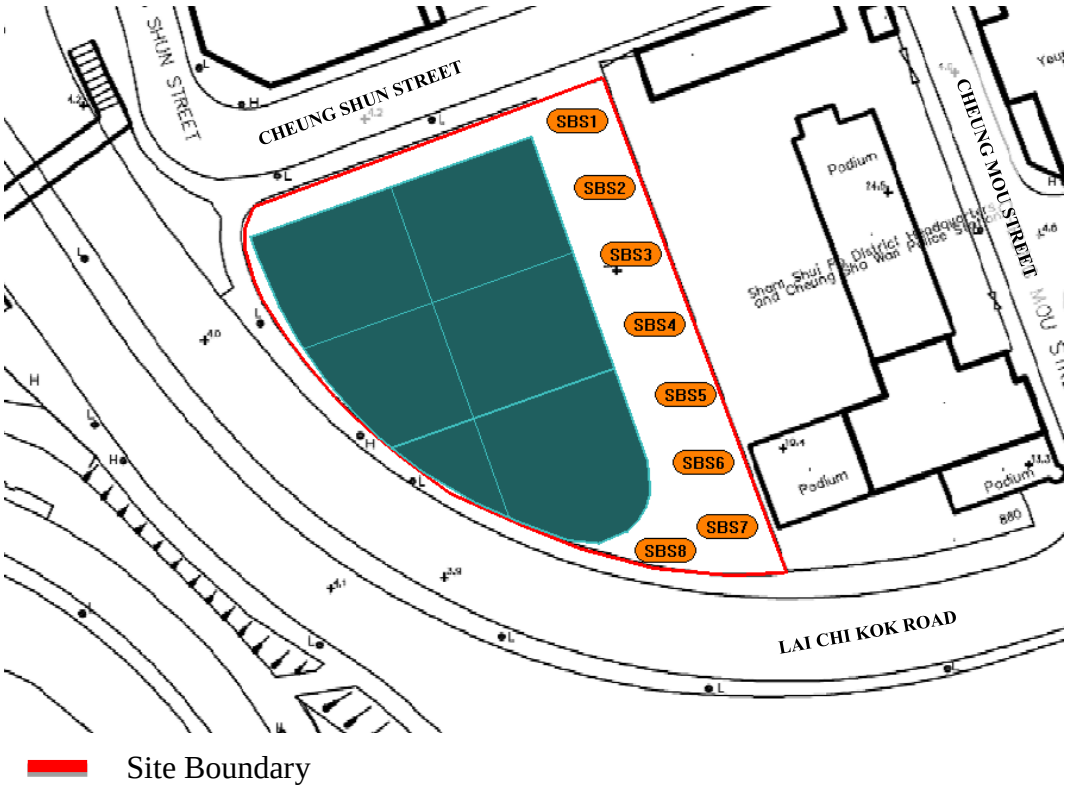


Figure 8 Location of special test points under Scenario B (Image Source: Google Map)

Results and Discussion

The Wind Velocity Ratio (VR) as proposed by the Technical Circular was employed to assess the ventilation performances of the Proposed Development and surrounding environment. VR is defined as the ratio of the wind velocity at the pedestrian level (2m above ground) to the wind velocity at the top of the wind boundary layer. Higher VR implies better ventilation.

The Site spatial average velocity ratio (SVR) represents the average VR of all perimeter test points at the site boundary. The Local spatial average velocity ratio (LVR) represents the average VR of all perimeter and overall test points. The SVR and LVR under annual and summer conditions were calculated respectively.

Annual Condition

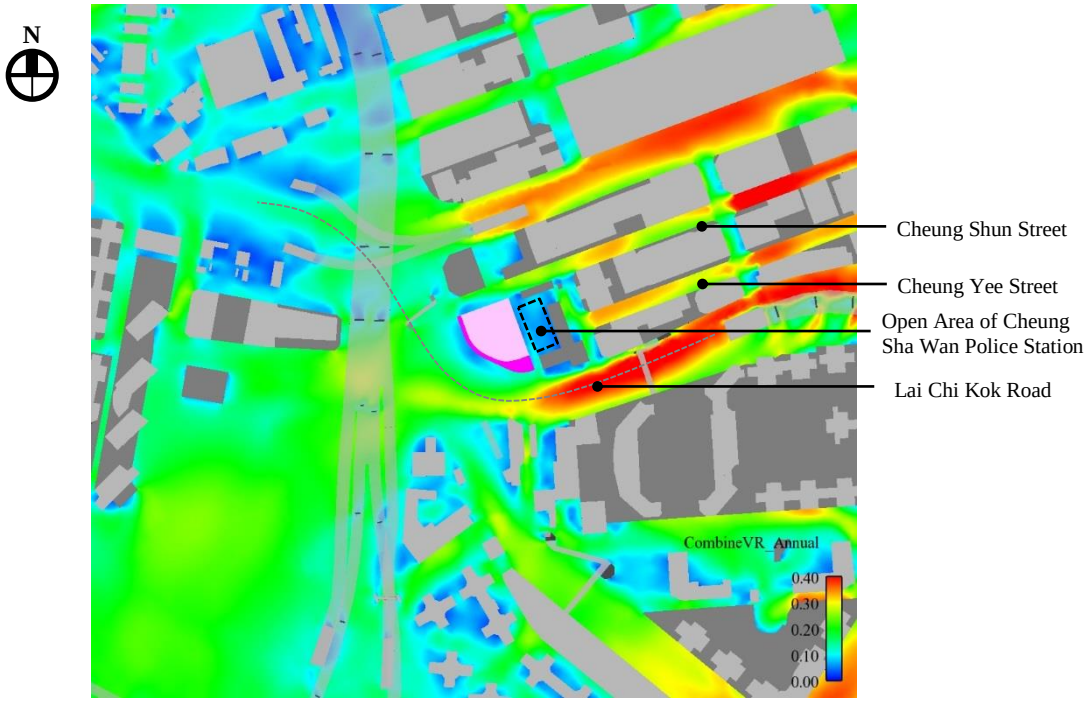


Figure 9 Contour plot of annual weighted VR of Baseline Scenario

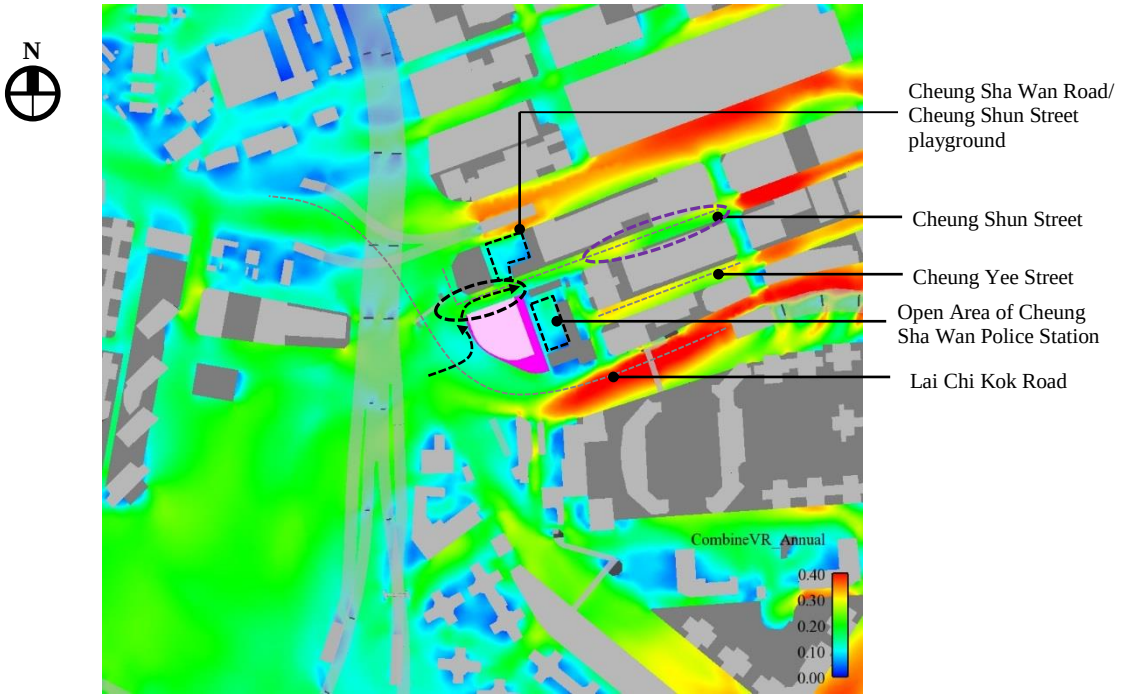


Figure 10 Contour plot of annual weighted VR of Scenario A

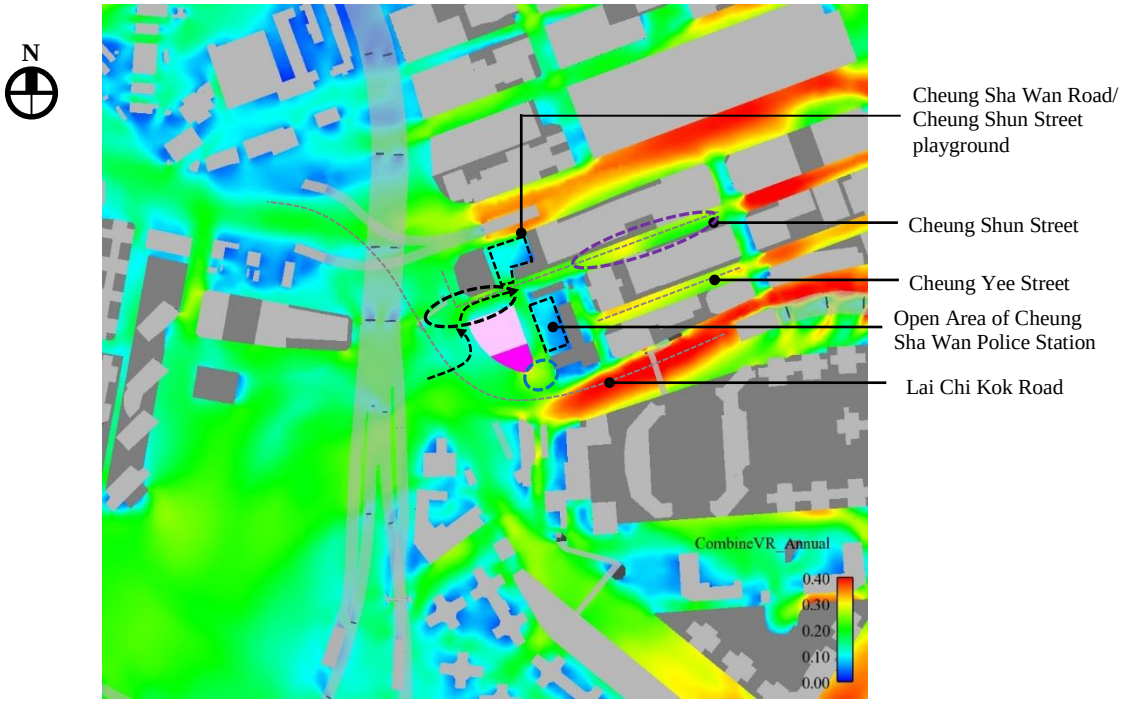


Figure 11 Contour plot of annual weighted VR of Scenario B

Table 1 Annual SVR and LVR for Baseline Scenario, Scenario A and Scenario B

	Comparison between Baseline Scenario, Scenarios A, and B		
	Baseline Scenario	**Scenario A**	**Scenario B**
SVR	0.10	0.14	0.17
LVR	0.18	0.19	0.20

Under annual condition, the SVR and LVR of both Scenarios A and B is higher than Baseline Scenario, indicating that ventilation performance at the immediate area and local area are both better. Among the three scenarios, Scenario B achieves the best wind performance with SVR of 0.17 and LVR of 0.20 respectively.

The overall ventilation performances among Baseline Scenario, Scenario A and Scenario B are quite similar under annual condition. In addition, the main Road such as Lai Chi Kok Road also has similar wind performances among the three scenarios.

The taller building towers under Scenarios A and B would divert and downwash the SW quarterly wind to the pedestrian level resulting better wind performance at west part of Cheung Shun Street (black arrow in Figure 10 and Figure 11). At the same time, the building would block the SW quarterly wind resulting a slightly lower VR at the eastern side of the site along Cheung Shun Street (purple circle in Figure 10 to Figure 11).

Open area of Cheung Sha Wan Police Station achieves a slightly better VR under Scenarios A and B due to the downwash effect of the taller building height under E quarter wind.

Southern site boundary achieve a slightly higher VR under Scenario B as compared with Scenario A (blue circle in Figure 11) due to the straight building frontage at east facade of Scenario B facilitate downwash wind to the pedestrian level.

Summer Condition

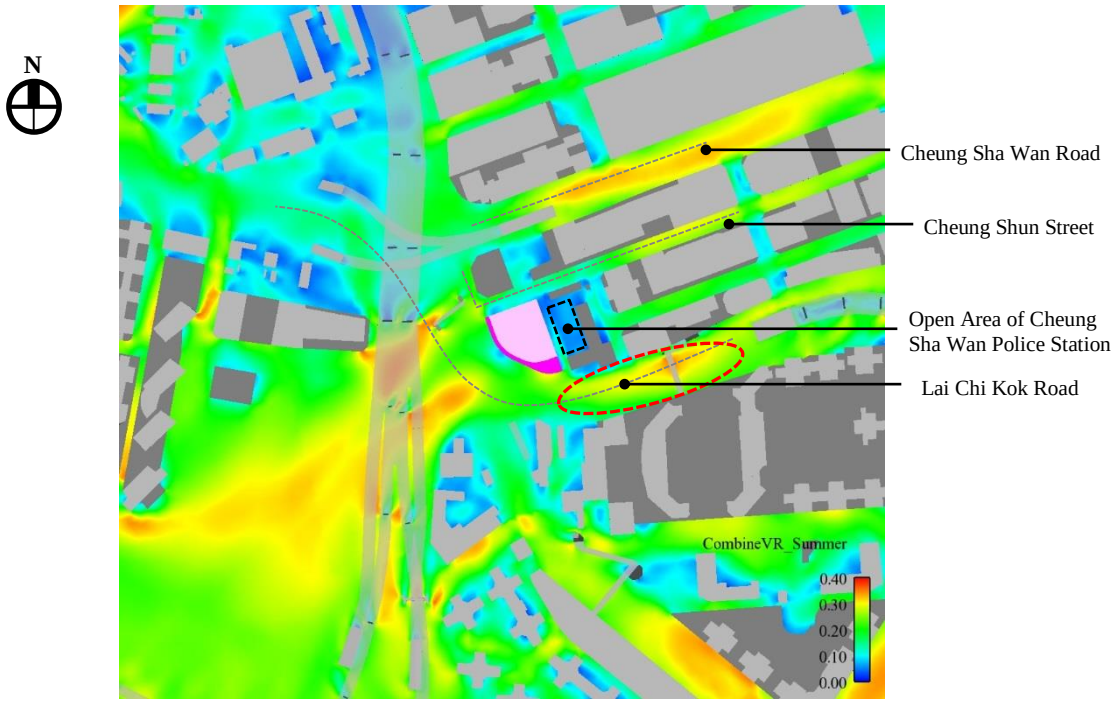


Figure 12 Contour plot of summer weighted VR of Baseline Scenario

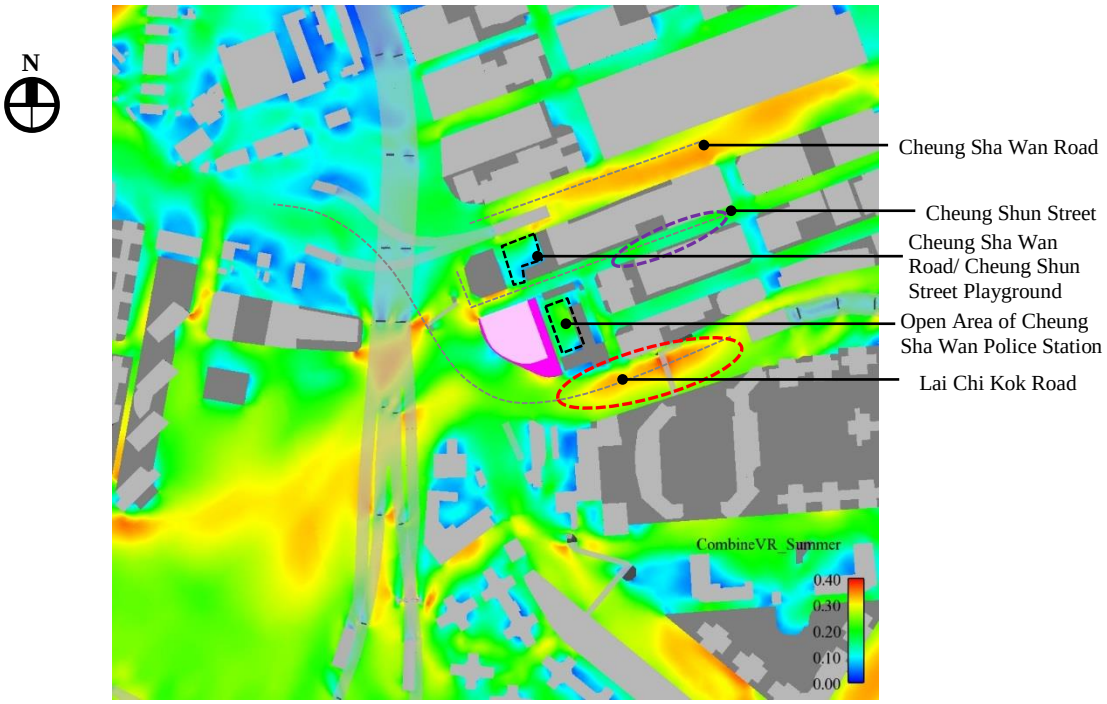


Figure 13 Contour plot of summer weighted VR of Scenario A

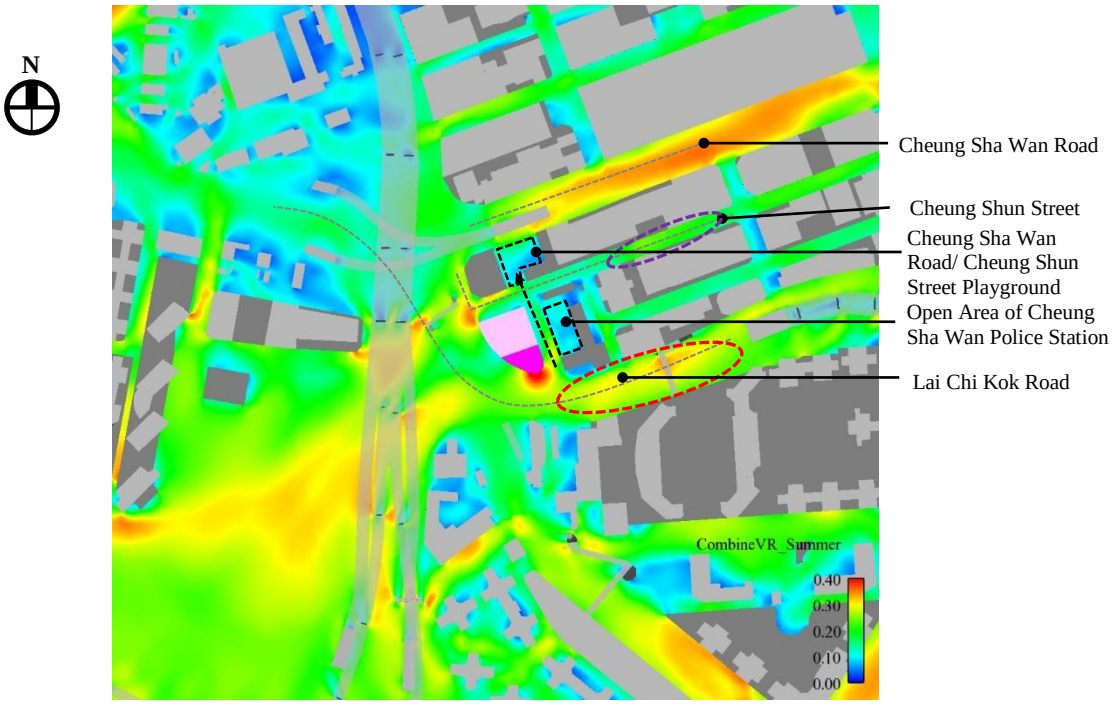


Figure 14 Contour plot of summer weighted VR of Scenario B

Table 2 Summer SVR and LVR for Baseline Scenario, Scenario A and Scenario B

	Comparison between Baseline Scenario, Scenarios A, and B		
	Baseline Scenario	**Scenario A**	**Scenario B**
SVR	0.15	0.18	0.21
LVR	0.18	0.20	0.20

Scenarios A and B also have better SVR and LVR than Baseline Scenario, achieving a better wind environment at the immediate surroundings and local area. Furthermore, for the LVR, both Scenarios A and B achieves a similar value, reflecting that their local ventilation performance is similar.

The overall ventilation performances among Baseline Scenario, Scenario A and Scenario B are quite similar under summer condition.

The taller building towers in Scenarios A and B blocks prevailing wind from SW quarter resulting a lower VR around the east part of the Cheung Shun Street (purple circle in Figure 13 and Figure 14). At the same time, higher building towers under Scenarios A and B diverts the south-westerly quarter wind to Cheung Sha Wan Road resulting better wind performance.

The downwash effect along Lai Chi Kok Road near the Project Site is also strengthened due to the taller and larger building bulk under Scenarios A and B (red circle in Figure 13). This effect has localized impact and enhances the wind environment of Lai Chi Kok Road.

Compared between Scenarios A and B, better ventilation performance is observed under Scenario A at Lai Chi Kok Road. The 15m NBA under Scenario B allows a portion of wind along Lai Chi Kok Road would flow across the NBA and less wind would flow along Lai Chi Kok Road to the east. In contrast, the podium bulk of Scenario A would direct the wind towards Lai Chi Kok Road.

Focus Area

Various Focus Areas with frequent pedestrian access and within major activity zones were defined, as shown in Figure 15.

Figure 15 Highlights of the Focus Areas for the study (image Source: Lands Department)

Annual Condition

Table 3 VR Results for Focus Areas under Annual Wind Condition under Baseline Scenario, Scenario A and Scenario B

	Focus Areas	Test Points	Baseline Scenario	Scenario A	Scenario B
1	Castle Peak Road	O1 – O12	0.19	0.20	0.20
2	Kom Tsun Street and Bus Terminus	O4, O13 – O15	0.17	0.19	0.19
3	Butterfly Valley Road	O3, O16 – O20	0.16	0.17	0.18
4	Tung Chau West Street	O21 – O24	0.15	0.15	0.15
5	Cheung Sha Wan Road	O25 – O32	0.33	0.33	0.33
6	Cheung Shun Street	O33 – O42	0.24	0.23	0.23
7	Cheung Yee Street	O43 – O47	0.32	0.29	0.29
8	Cheung Mou Street	O48 – O51	0.13	0.14	0.13
9	Lai Chi Kok Road	O52 – O65	0.21	0.22	0.22
10	Yuet Lun Street	O66 – O70	0.14	0.17	0.16
11	Cheung Sha Wan Road/ Cheung Shun Street Playground	O71 – O74	0.11	0.11	0.12
12	Open Area of Cheung Sha Wan Police Station	O75 – O77	0.07	0.11	0.08
13	Sham Mong Road	O78 – O88	0.22	0.21	0.20
14	Sham Shing Road	O89 – O95	0.18	0.18	0.18
15	Open Area of Proposed Special School	O96 – O97	0.09	0.10	0.09
16	KMB Temporary Bus Depot	O98 – O100	0.20	0.18	0.18
17	Non-building Area	SBS1 – SBS8	NA	NA	0.20

Under annual condition, most of the focus areas achieved a similar VR values indicating their ventilation performance is quite similar among the scenarios, except Lai Chi Kok Road, Cheung Yee Street, open area of Cheung Sha Wan Police Station, Yuet Lun Street and KMB Temporary Bus Depot.

- For Lai Chi Kok Road, localized area near the site is better under Scenario B. This is due to the 15m NBA and 4m setback would facilitate the wind flow around the site under SE quarter wind.
- Cheung Yee Street has a better ventilation performance under Baseline Scenario. It is because Baseline Scenario has higher wind permeability and allows more wind penetration across the site toward Cheung Yee Street.
- Comparing Scenario B to Scenario A, the provision of tower setback in Scenario A allows larger separation between the building and the adjacent Police Station. This would facilitates the SW quarterly wind penetrate into the open area of Cheung Sha Wan Police Station.
- For the Yuet Lun Street, the downwash wind from NE quarter strengthen the air flow along Cheung Shun Street and further enhance the ventilation performance at Yuet Lun Street under Scenarios A and B.

- For the KMB Temporary Bus Depot, the downwash wind of the project site under annual wind condition would disturb the air stream along Lai Chi Kok Road under Scenarios A and B, resulting a slightly lower VR under Scenarios A & B.
- Under Scenario B, the NBA has a VR of 0.20 higher than the SVR and similar to the LVR, which indicates the 15m NBA is quite effective.

Summer Condition

Table 4 VR Results for Focus Areas under Summer Wind Condition under Baseline Scenario, Scenario A and Scenario B

	Focus Areas	Test Points	Baseline Scenario	Scenario A	Scenario B
1	Castle Peak Road	O1 – O12	0.18	0.19	0.19
2	Kom Tsun Street and Bus Terminus	O4, O13 – O15	0.19	0.18	0.19
3	Butterfly Valley Road	O3, O16 – O20	0.15	0.16	0.16
4	Tung Chau West Street	O21 – O24	0.13	0.14	0.13
5	Cheung Sha Wan Road	O25 – O32	0.27	0.29	0.30
6	Cheung Shun Street	O33 – O42	0.20	0.20	0.21
7	Cheung Yee Street	O43 – O47	0.20	0.15	0.16
8	Cheung Mou Street	O48 – O51	0.12	0.18	0.15
9	Lai Chi Kok Road	O52 – O65	0.20	0.21	0.21
10	Yuet Lun Street	O66 – O70	0.16	0.18	0.17
11	Cheung Sha Wan Road/ Cheung Shun Street Playground	O71 – O74	0.10	0.13	0.12
12	Open Area of Cheung Sha Wan Police Station	O75 – O77	0.06	0.14	0.08
13	Sham Mong Road	O78 – O88	0.25	0.24	0.24
14	Sham Shing Road	O89 – O95	0.23	0.23	0.23
15	Open Area of Proposed Special School	O96 – O97	0.08	0.08	0.08
16	KMB Temporary Bus Depot	O98 – O100	0.27	0.26	0.25
17	Non-building Area	SBS1 – SBS8	NA	NA	0.22

Similar to the annual condition, the VR at most of the focus areas is generally similar among the three scenarios under summer condition, except Cheung Mou Street, open area of Cheung Sha Wan Police Station, Cheung Yee Street, KMB Temporary Bus Depot and Cheung Sha Wan Road/ Cheung Shun Street Playground.

- The wind performance at Cheung Mou Street and open area of Cheung Sha Wan Police Station are better under Scenarios A and B. Among all the scenarios, Scenario A achieves the best wind performance at these focus areas.
- For the Cheung Mou Street, under Scenario B, the 15m NBA design facilitates the wind penetrate from Lai Chi Kok Road to Cheung Shun Street

while under Scenario A, the separation between Scenario A building and Police Station is reduced and the wind cannot pass the Site.

- For the open area of Cheung Sha Wan Police Station, the tower setback of Scenario A allows more SW quarterly wind penetrate the Site to the open area of Cheung Sha Wan Police Station.
- The wind environment at Cheung Yee Street is better under Baseline Scenario, as the wind from SW can flow over the low-rise building tower (~40mPD) and reach to Cheung Yee Street.
- The KMB Temporary Bus Depot has a slightly lower VR under Scenarios A and B. This is due to the downwash wind induced by the taller building of Scenarios A and B disturbs the air stream from Lai Chi Kok Road leading to less wind reach to that area.
- Cheung Sha Wan Road/ Cheung Shun Street Playground has a higher VR results under Scenarios A and B. This is due to the downwashed wind under SW quarter allow more wind flow along Cheung Shun Street with a portion of wind would divert to the Playground.
- Under Scenario B, the 15m NBA within Site has a VR of 0.22 higher than the SVR and LVR, which indicates the 15m NBA is effective.

Recommendation

Under Scenario B, the provision of 15m NBA and 4m setback create larger wind entrance thus further enhance wind penetration using 15m NBA towards Cheung Shun Street, Open Space of Cheung Sha Wan Police Station and Cheung Sha Wan Road/ Cheung Shun Street Playground.

The development would also consider to further chamfer the southern portion building edge and create a larger separation between the building block and adjacent Cheung Sha Wan Police Station in order to facilitate the summer wind penetration.

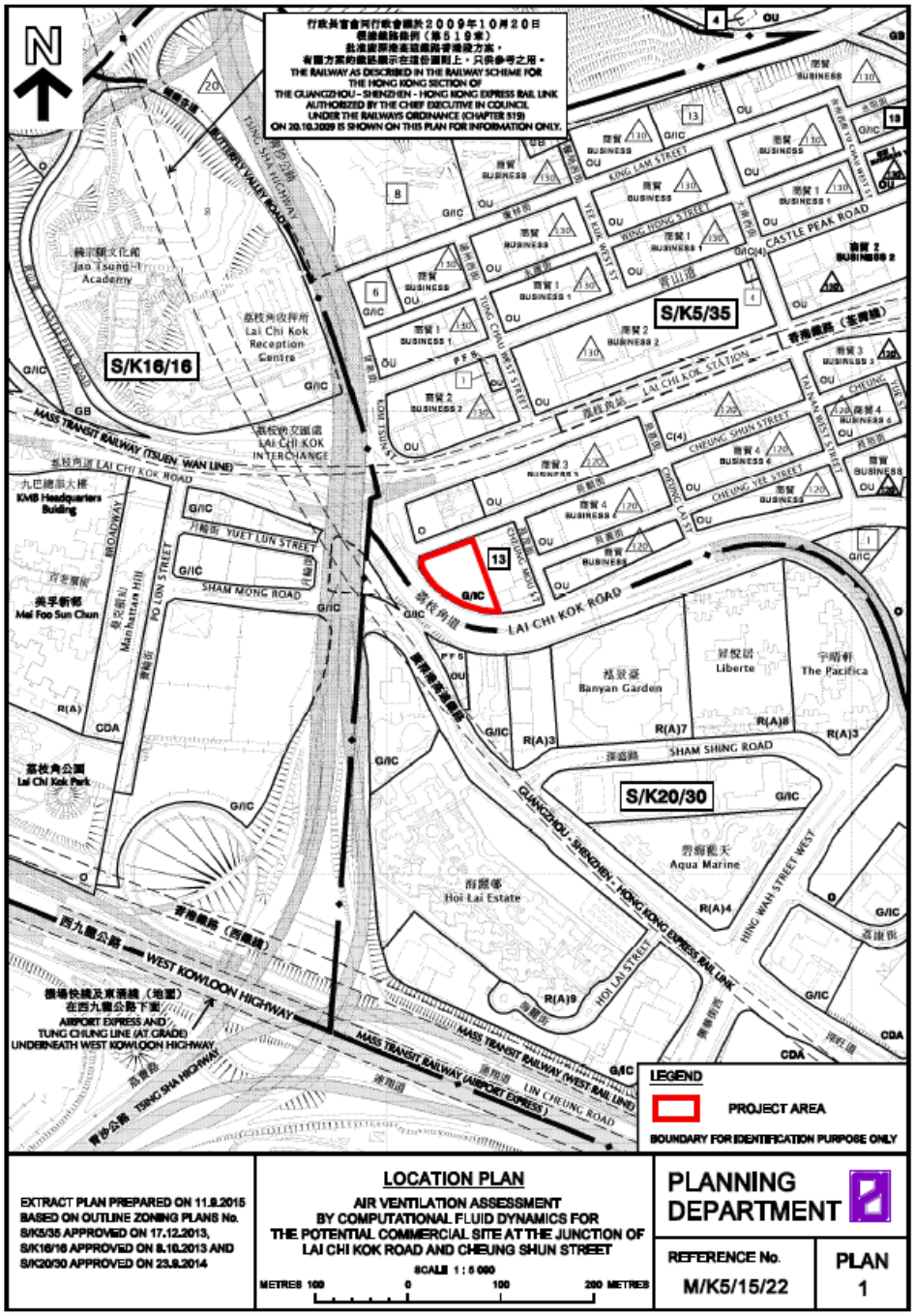
If the future development cannot fulfil the 15m NBA and 4m setback requirement, a quantitative analysis should be carried out to demonstrate that no adverse ventilation impact would be imposed to the surrounding wind environment.

行政摘要

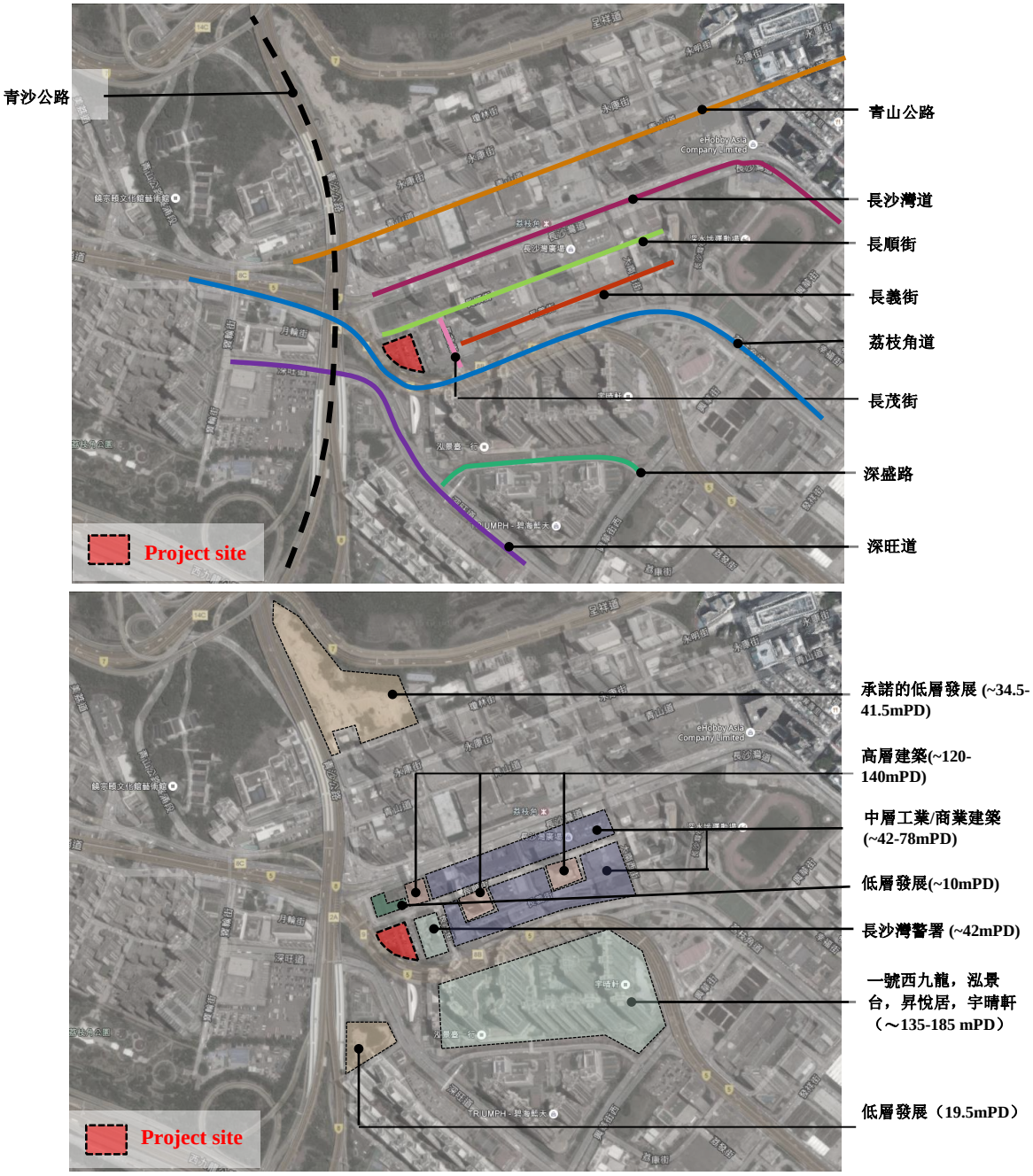
奧雅納工程顧問香港有限公司（奧雅納）受規劃署的委託，於長沙灣長順街近荔枝角道潛在的商業用地進行了空氣流通評估(AVA)。

該選址位於長沙灣的工業/商業區的西南邊緣。中等高度的企業/工業建築群分別位於項目選址的東面和北面。此外，泓景台，昇悅居，宇晴軒和一號西九龍高層住宅發展位於選址的南面，而青沙公路位於選址的西面。

根據長沙灣分區計劃大綱圖（大綱圖）編號 S / K5 / 35，選址項目約 0.423 公頃劃為「政府，機構或社區“（”G / IC“）用途」，並受樓高 13 層的建築高度限制。為了優化發展機會，並提供更多的設計靈活性，它已被確定為待重新規劃用於商業用途的潛在選址。



圖表 1 與分區計劃大綱圖的分區項目邊界（圖片來源：規劃署）



圖表 2 項目現場及周邊地區（圖片來源：谷歌地球）

項目選址附近進行過的 AVA

下面列出項目區及其周邊土地發展已在進行的空氣流通評估。

- 合約 AVA 顧問服務 -長沙灣區域 - 專家評審和諮詢報告-空氣流通評估擬議修訂長沙灣分區計劃大綱圖的專家評估
- 長沙灣副食品批發市場（CSWWFM）二期工地和發祥街西（FTSW）發展項目
- 荔枝角道/ 東京街的公共房屋（公屋）發展項目 -

項目選址的總體風環境資料

香港城市大學進行了香港的總體風環境資料的研究。在這項研究中，採用了 RAMS 來重現現場風力數據，當中包括風玫瑰，風剖面等。該項目地點位於網格 X：074 Y：046。

風數據的定性評估

是項定性評估採用了 200m 高度的風玫瑰作為對該地盤的風環境特性進行研究。因為它考慮了周邊地形對風環境的影響。根據風環境資料顯示，地盤的主要盛行風為東北風和東風，夏季盛行風為東風，東南偏風，西南風和西南偏南風。

對風數據進行定量評估 - 初始研究

定量評估採用了 500m 高度的風玫瑰作為這次研究的基礎。

初始研究中考慮了八個盛行風的方向，覆蓋了全年總風頻率的 78.9%。該風向為東北（7.6%），東北偏東（11.9%），東（21.8%），東南偏東（12.4%），東南（6.5%），東南偏南（ 4.8%），西南偏南（7.3%）及西南（6.6%）風。

此外，初始研究中也考慮了八個盛行風的方向，覆蓋了夏季總風頻率的 81.8%。它們分別為東風（8.1%），東南偏東（9.7%），東南（7.9%）， 東南偏南（7.9%），南風（9.3%），西南偏南（15.7% ）西南（16.4%）及西南偏西（6.8%）風。

地盤現階段風環境的定性評估

全年盛行風 – 東北和東風

全年盛行風主要的風向為東北風和東風。

在東北風下，地盤東北面的中層和高層建築群阻礙了部分盛行風來源，對地盤形成低風速區域。在選址現場的風環境預計將相對較平靜。

在東風下，地盤東北面的長沙灣臨時家禽批發市場及深水埗運動場充當荔枝角道通風走廊的入口，促進了東風沿深旺道穿行。

夏季盛行風 – 東，東南偏東，西南偏南和西南風

夏季盛行風主要的風向為東，東南偏東，西南以及西南偏南風。

在西南和西南偏西風下，海麗邨及美孚新邨之間的建築間距允許大部分的夏季盛行風穿行到荔枝角區的西面。一部分的盛行風可從青沙公路橫跨深旺道滲透到項目選址，從而產生了良好的風環境。

在東南偏東風下，在南面的高層住宅建築群會阻礙盛行風來源，盛行風主要經過荔枝角道及深旺道到達選址。

定量評估-初始部分

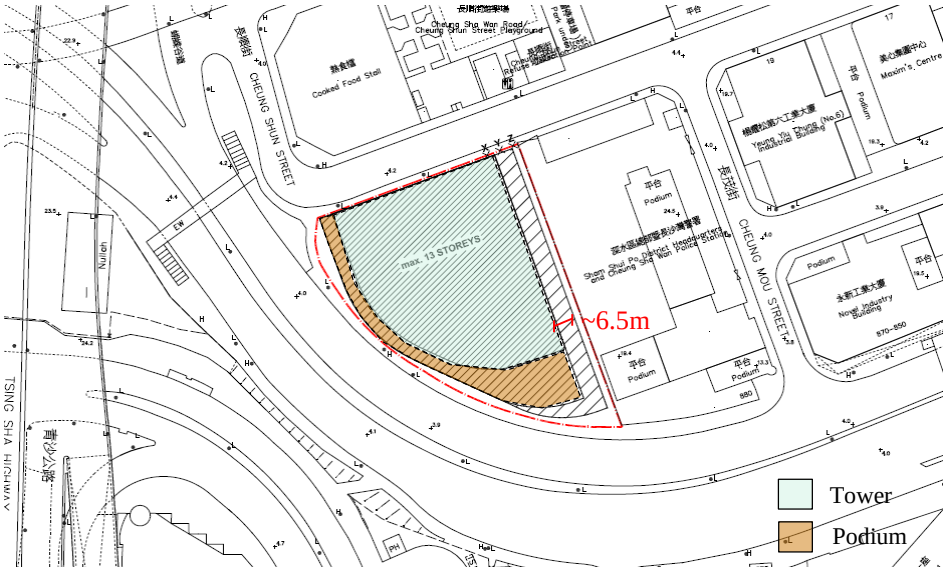
研究的設計方案

這項目檢視了合共三個設計方案 - 即基準方案，方案 A 和方案 B

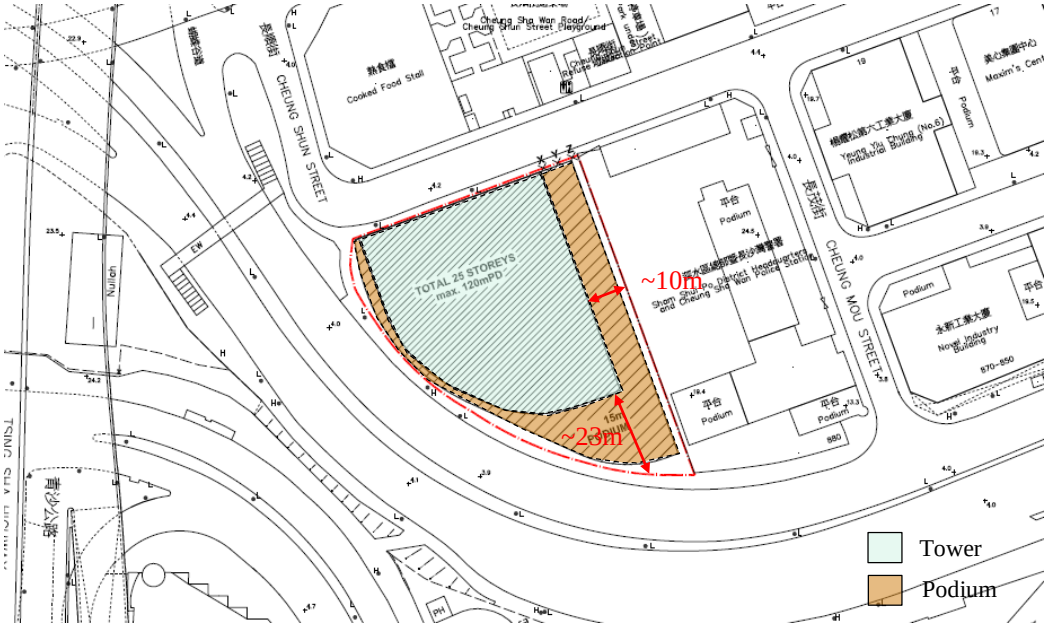
- **基準方案** - 基準方案是一個不超過 13 層的政府機構或社區發展項目。該建築高度符合現有的分區計劃大綱草圖。該建築在南邊有一個約 26.5mPD 的平台，並從東部邊界的周圍後退了 6.5 米。

- **方案 A** - 方案 A 是一個有 12 倍地積比率（PR）和主水平基準上 120 米建築高度限制的商業開發項目。設計意念是採用傳統 15 米高度的平台設計。該建築項目從東部邊界後退了約 10 米，而大樓建築也從南部邊界後退了最大 23 米。

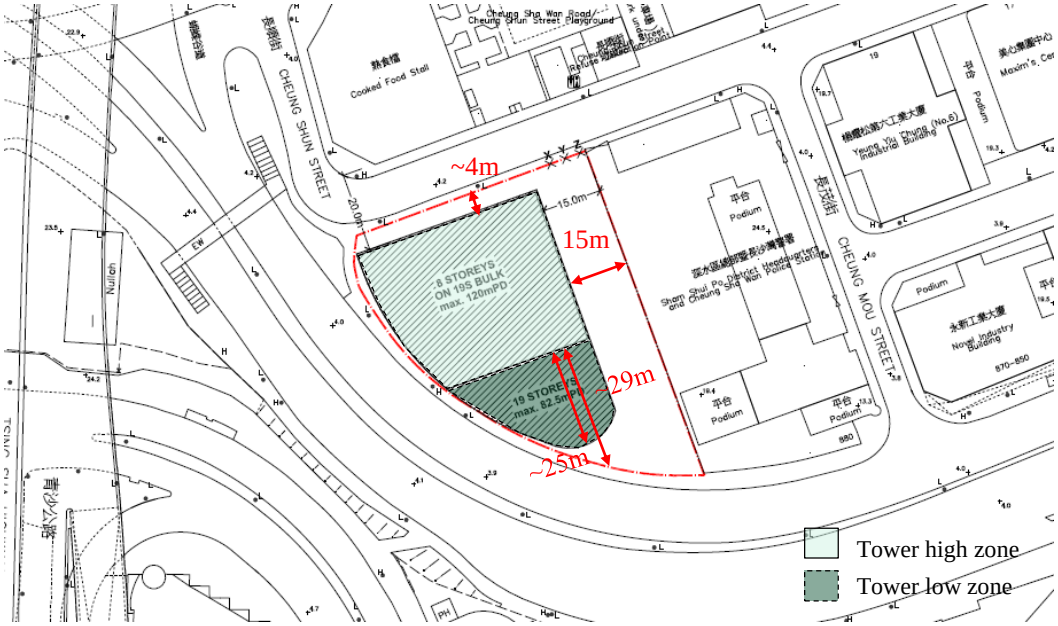
- **方案 B** - 方案 B 是一個有 12 倍地積比率（PR）和 120mPD 建築高度限制的商業開發項目。設計意念是一個純商業的發展並採用了一些緩解措施以改善空氣流通，例如 15 米非建築用地(NBA)及建築物從邊界後退等。在北面也有約 4 米的後退。在高層位置有約 25 米的裁減，以擴大風滲透能力。



圖表 3 基準方案的建築佈局



圖表 4 方案 A 的建築佈局



圖表 5 方案 B 的建築佈局

測試點位置

測試點沿項目界線和發展評估區域內均勻擺放以評估通風性能。在研究中會有三種類型的測試點：

周邊測試點

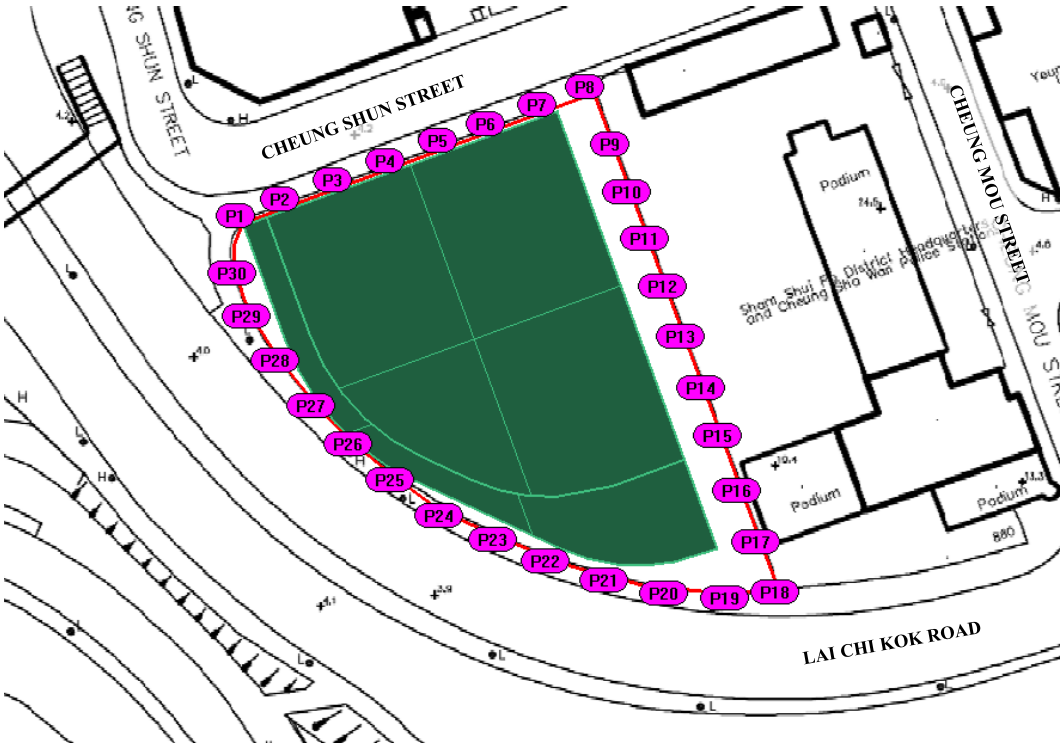
周邊測試點定位在項目現場的邊界點。根據 AVA 技術通告，在地盤邊界平均分佈了總共 30 個測試點（紫色斑點）。各測試點之間約 10 - 50 米間隔，如圖 6。

整體測試點

整體測試點均勻放置在空地上，在街道和行人頻繁地經過的評估範圍內。本研究總共選定了 100 個測試點（藍點）並在圖 7 中所示。

特殊測試點

特殊的測試點均勻放置在項目範圍內行人能夠經過的公共開放空間。定位了 8 個特殊測試點（標有“SBS”橙色點）並在圖 8 中所示。

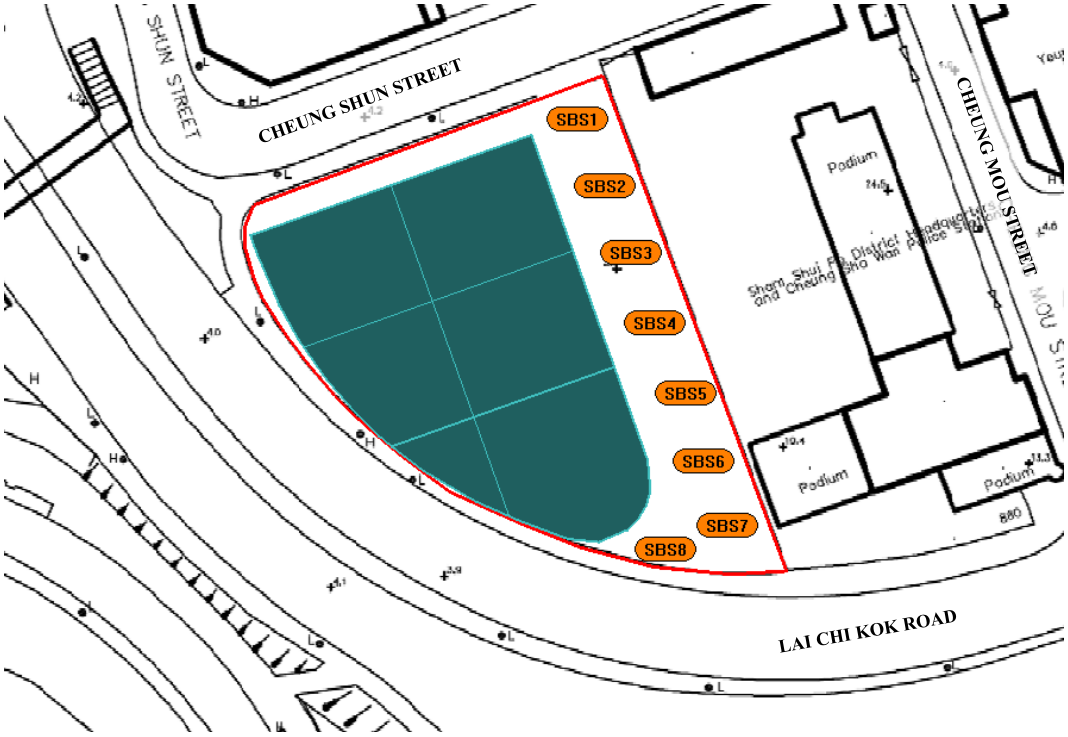


項目邊界

圖表 6 周邊測試點位置（圖片來源：谷歌地圖）

項目邊界
評估區

圖表 7 整體測試點位置（圖片來源：谷歌地圖）



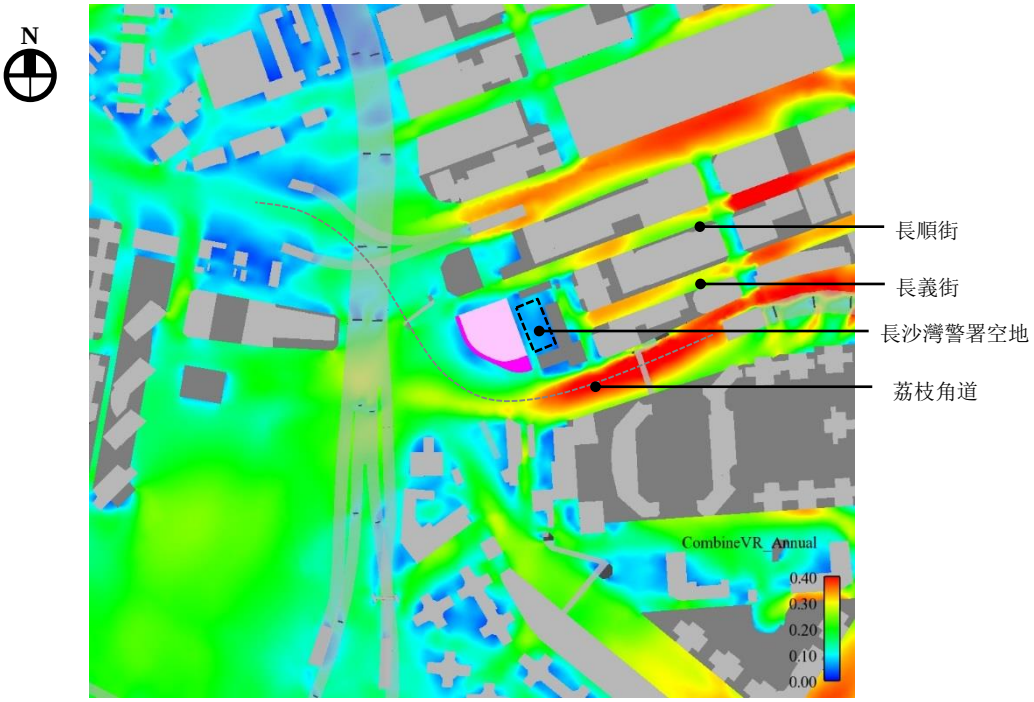
圖表 8 方案 B 在特殊測試點位置（圖片來源：谷歌地圖）

結果與討論

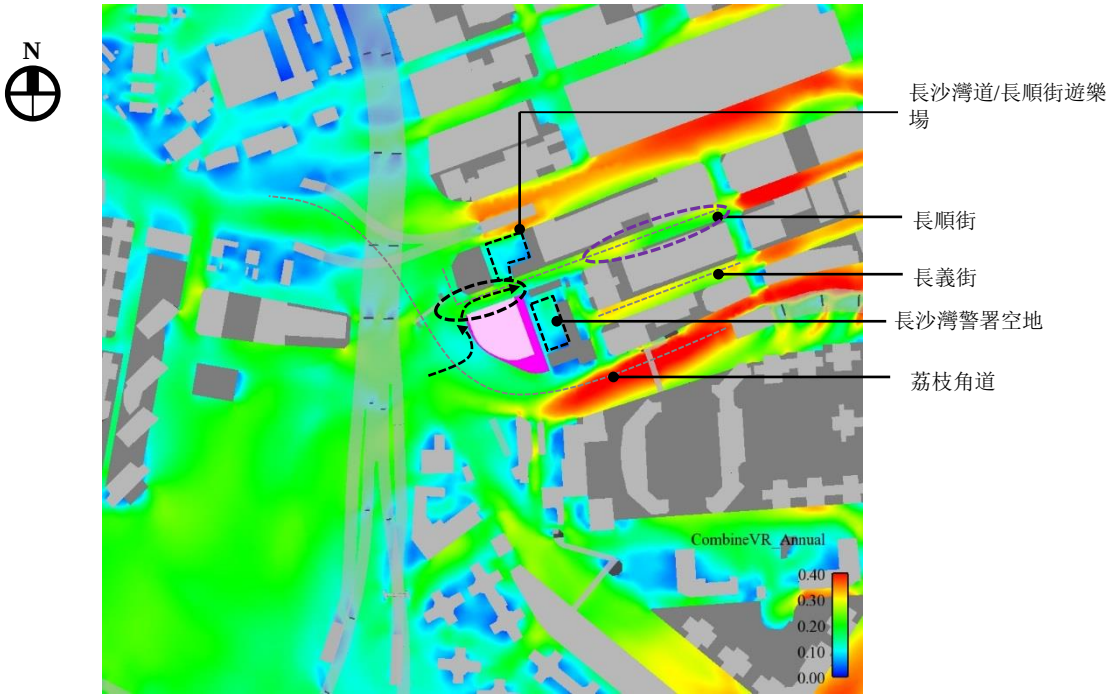
由 AVA”技術通告”提出的風速比（VR）作為用來評估周邊環境的通風性能。 VR 被定義為在行人路離地 2 米的風速，及在風力邊界層頂部的風速值的比。VR 數值愈高代表通風表現愈好。

地盤空間平均風速比（SVR）代表所有周邊測試點在現場邊界的平均 VR 值。地區性空間平均風速比（LVR）代表所有周邊和整體測試點的平均 VR 值。全年及夏季條件下的 SVR 和 LVR 將分別計算。

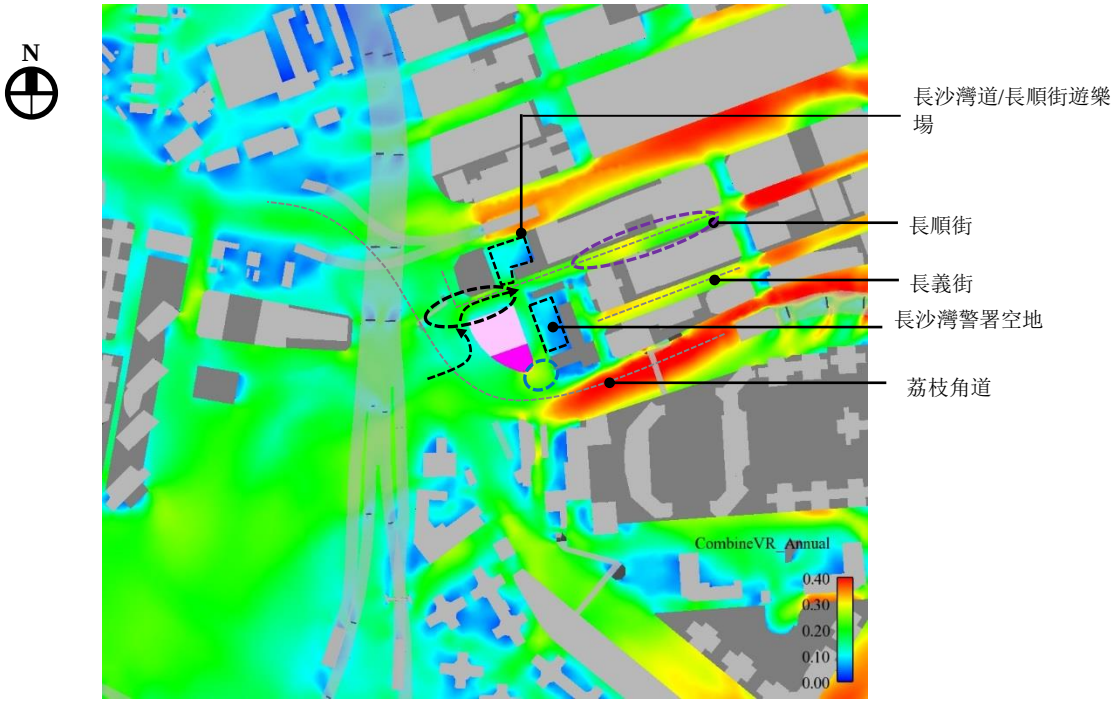
全年風環境



圖表 9 基準方案的全年加權 VR 的等值線圖



圖表 10 方案 A 的全年加權 VR 的等值線圖



圖表 11 方案 B 的全年加權 VR 的等值線圖

表格 1 基準方案，方案 A 和方案 B 的全年 SVR 和 LVR

	基準方案，方案 A，和方案 B 的比較		
	基準方案	方案 A	方案 B
SVR	0.10	0.14	0.17
LVR	0.18	0.19	0.20

在全年盛行風下，方案 A 和方案 B 的 SVR 及 LVR 比基準方案為高，結果指出方案 A 和 B 在地盤空間及地區性空間都有較好的通風表現。當中方案 B 的通風表現較其他為佳， 方案 B 的 SVR 和 LVR 分別為 0.17 和 0.20。

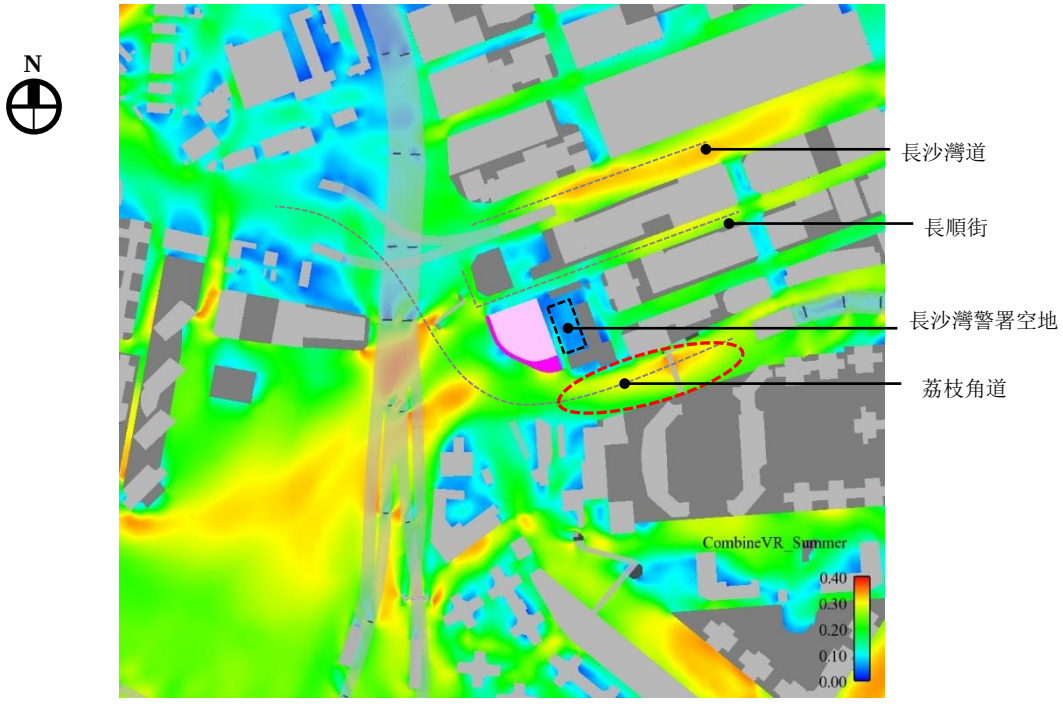
在全年盛行風下，基準方案，方案 A 和方案 B 之間的整體通風表現頗為相似。此外，三個方案在主要道路如荔枝角道也有相似的通風表現。

相比基準方案，方案 A 和 B 的建築物設計能夠將風引導向下吹至路面，使長順街以西部分有更好的通風表現（圖 10 和圖 11 中黑色箭頭）。另一方面，方案 A 和 B 的大樓也將阻擋部分的西南風，導致沿長順街以東的風環境表現較差（圖 10 和圖 11 的紫色圓形）。

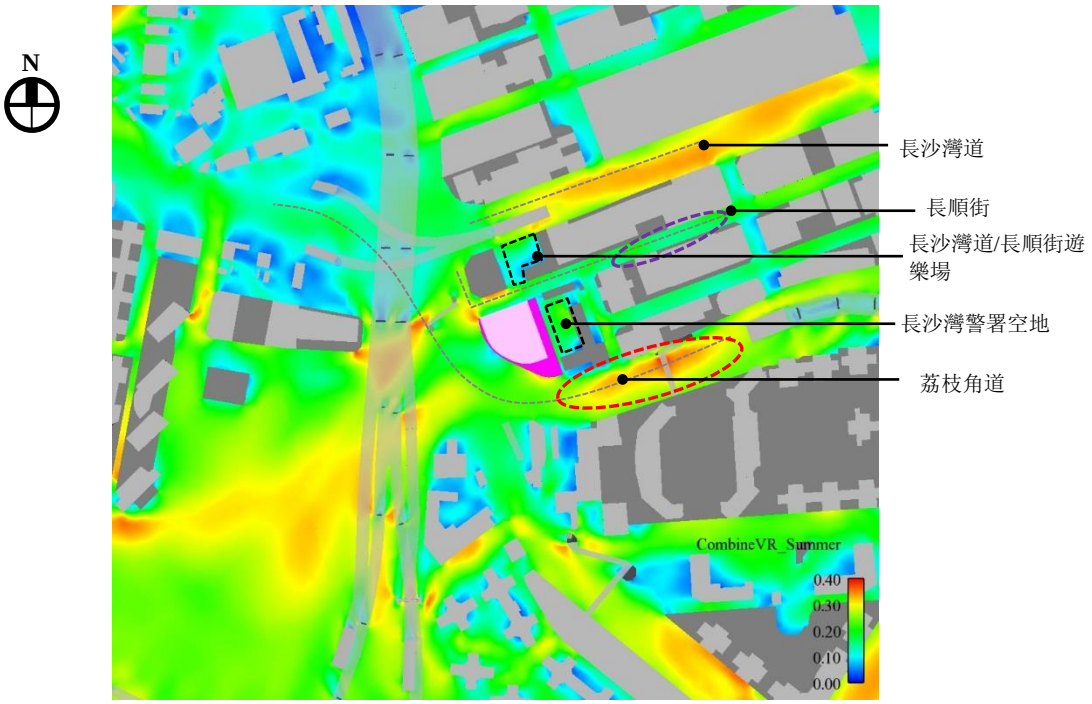
方案 A 和 B 也在長沙灣警署空地有一個較高的 VR 值，這是由於在東風下較高的建築有助將風引導向下吹至路面。

與方案 A 相比（圖 11 中的藍色圓圈），方案 B 在南面項目邊界有較高的 VR，這是因為面向與風向成直角的一方，垂直的大廈牆身設計有助引導風向下至路面。

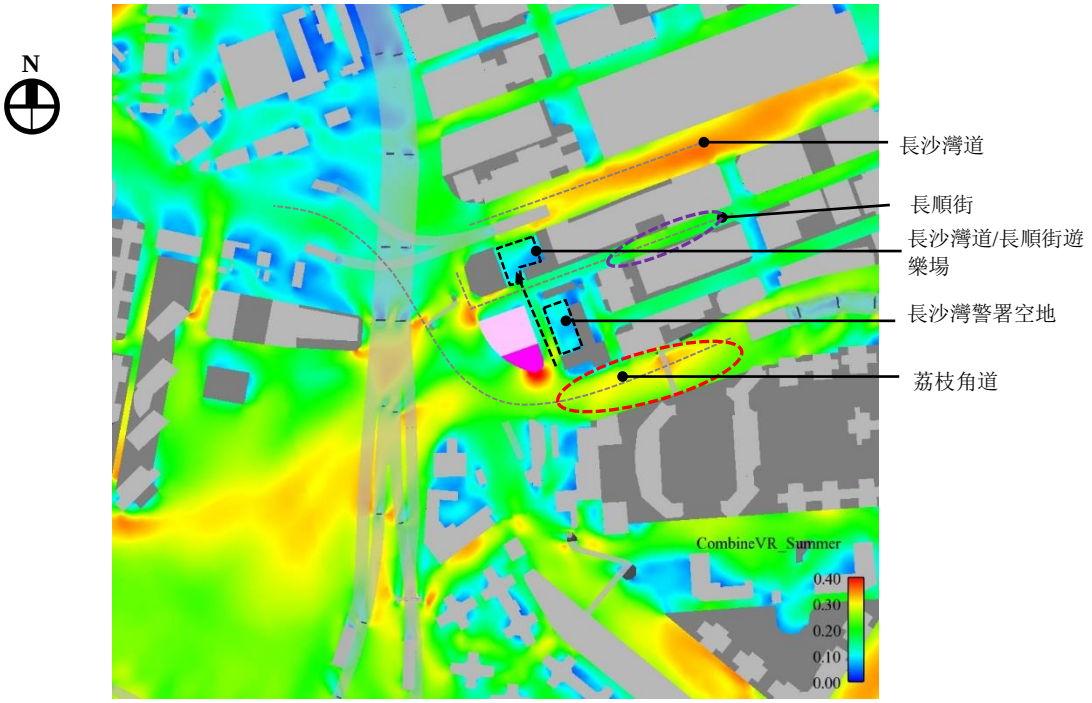
<u>夏季風環境</u>



圖表 12 基準方案的夏季加權 VR 的等值線圖



圖表 13 方案 A 的夏季加權 VR 的等值線圖



圖表 14 方案 B 的夏季加權 VR 的等值線圖

表格 2 基準方案，方案 A 和方案 B 的夏季 SVR 和 LVR

	基準方案，方案 A，和方案 B 的比較		
	基準方案	方案 A	方案 B
SVR	0.15	0.18	0.21
LVR	0.18	0.20	0.20

與基準方案比較，方案 A 和 B 有更好的 SVR 及 LVR，結果指出方案 A 和 B 在地盤空間及地區性有較好的風環境。此外，方案 A 和 B 有相似的 LVR 值，反映了當地的通風性能是相似的。

在夏季風下，基準方案，方案 A 和方案 B 之間的整體通風表現頗為相似。

方案 A 和 B 的高層建築阻止了部分西南盛行風，導致長順街以東有較低的 VR（圖 13 圖 14 紫色圓圈）。與此同時，方案 A 和 B 的建築把部分西南風分流到長沙灣道，從而使長沙灣道有較好的通風表現。

方案 A 和 B 的建築物設計有助將風引導向下至路面，使荔枝角道的局部性的地方的通風性較佳。（圖 13 紅色圓圈）。

比較方案 A 和 B，方案 A 在荔枝角道有更好的通風表現。方案 B 有 15 米 NBA，導致風從荔枝角道分流到 NBA，而相對少風沿荔枝角道吹向東面。相比之下，方案 A 的平台設計使大部分的風吹向荔枝角道。

重點區域

圖 15 定義了頻繁的人行通道和主要活動區域內的各個重點領域。

圖表 15 研究的重點區域（圖片來源：地政總署）

全年風環境

表格 3 基準方案，方案 A 和方案 B 的重點區域在全年風環境下的 VR 結果

	重點區域	測試點	基準方案	方案 A	方案 B
1	青山公路	O1 – O12	0.19	0.20	0.20
2	甘泉街巴士總站	O4, O13 – O15	0.17	0.19	0.19
3	蝴蝶谷道	O3, O16 – O20	0.16	0.17	0.18
4	通州西街	O21 – O24	0.15	0.15	0.15
5	長沙灣道	O25 – O32	0.33	0.33	0.33
6	長順街	O33 – O42	0.24	0.23	0.23
7	長義街	O43 – O47	0.32	0.29	0.29
8	長茂街	O48 – O51	0.13	0.14	0.13
9	荔枝角道	O52 – O65	0.21	0.22	0.22
10	月輪街	O66 – O70	0.14	0.17	0.16
11	長沙灣道/長順街遊樂場	O71 – O74	0.11	0.11	0.12
12	長沙灣警署空地	O75 – O77	0.07	0.11	0.08
13	深旺道	O78 – O88	0.22	0.21	0.20
14	深盛路	O89 – O95	0.18	0.18	0.18
15	建議特別學校的空地	O96 – O97	0.09	0.10	0.09
16	九巴臨時巴士車廠	O98 – O100	0.20	0.18	0.18
17	非建築區域	SBS1 – SBS8	NA	NA	0.20

在全年風環境下，大部分的重點區域取得了相似的 VR 值，表明其通風表現頗為相似，當中荔枝角道，長義街，長沙灣警署空地，月輪街及九巴臨時巴士車廠除外。

- 對於荔枝角道，方案 B 在項目附近的局部區域有輕微較高的 VR。這是由於 15 米非建築用地區域(NBA)和建築物後退 4 米有助於項目附近在東南盛行風下的流動。
- 長義街在基準方案下有更好的通風性能表現，這是因為基準方案具有較高的風滲透性並允許更多的風滲透到長義街。
- 比較方案 A 和方案 B，方案 A 的建築後退設計使建築和警署之間有較大的空間。這有利於西南季度風滲透到長沙灣警署空地。
- 方案 A 和 B 的建築物設計有助將風引導向下吹至長順街，並進一步加強了月輪街的空氣流動。
- 對於九巴臨時巴士車廠，在全年盛行風環境下方案 A 和 B 建築物設計會引導風向下吹至路面，並干擾沿荔枝角道的氣流，導致方案 A 和 B 中車廠位置有一個較低的 VR。
- 方案 B 的 NBA 的 VR 值是 0.2，比較 SVR 值高及與 LVR 值相近，這顯示 15 米 NBA 是有效的。

夏季風環境

表格 4 基準方案，方案 A 和方案 B 的重點區域在夏季風環境下的 VR 結果

	重點區域	測試點	基準方案	方案 A	方案 B
1	青山公路	O1 – O12	0.18	0.19	0.19
2	甘泉街巴士總站	O4, O13 – O15	0.19	0.18	0.19
3	蝴蝶谷道	O3, O16 – O20	0.15	0.16	0.16
4	通州西街	O21 – O24	0.13	0.14	0.13
5	長沙灣道	O25 – O32	0.27	0.29	0.30
6	長順街	O33 – O42	0.20	0.20	0.21
7	長義街	O43 – O47	0.20	0.15	0.16
8	長茂街	O48 – O51	0.12	0.18	0.15
9	荔枝角道	O52 – O65	0.20	0.21	0.21
10	月輪街	O66 – O70	0.16	0.18	0.17
11	長沙灣道/長順街遊樂場	O71 – O74	0.10	0.13	0.12
12	長沙灣警署空地	O75 – O77	0.06	0.14	0.08
13	深旺道	O78 – O88	0.25	0.24	0.24
14	深盛路	O89 – O95	0.23	0.23	0.23
15	建議特別學校的空地	O96 – O97	0.08	0.08	0.08
16	九巴臨時巴士車廠	O98 – O100	0.27	0.26	0.25
17	非建築區域	SBS1 – SBS8	NA	NA	0.22

和全年風的情況類似，在夏季風環境下，三個方案在多數重點區域有相似的 VR，當中長茂街，長沙灣警署空地，長義街，九巴臨時巴士車廠及長沙灣道/長順街遊樂場除外。

- 方案 A 和 B 在長茂街及長沙灣警署空地有較好的通風表現。在所有方案下，方案 A 在這些重點區域有最好的通風表現。
- 對於長茂街，方案 B 的 15 米 NBA 設計有助風從荔枝角道穿行到長順街。而方案 A，項目建築和警署之間的距離相對較小，令風較難通過。
- 對於長沙灣警署空地，方案 A 的大樓後退設計讓更多的西南風穿透到長沙灣警署空地。
- 基準方案在長義街有較好的風環境，因為西南風可以流過低層建築（～40mPD），並到達長義街。
- 方案 A 和 B 在九巴臨時巴士車廠有較低的 VR，這是因為方案 A 和 B 的建築會引導風向下吹至路面並干擾了荔枝角道的風，從而減少到達該區的風量。
- 方案 A 和 B 在長沙灣道/長順街遊樂場有較高的 VR。這是由於方案 A 和 B 的大樓設計有助引導風吹向路面並使更多的風流向長順街，而當中的一部分將流向遊樂場區。

- 方案 B 的 15 米 NBA 的 VR 是 0.22，這都比 SVR 值和 LVR 值高，這意味著 15 米 NBA 是有效的。

建議

方案 B 的 15 米 NBA 和建築物 4 米後退造成更大的入風口，並增加風滲透到長順街，長沙灣警署空地及長沙灣道/長順街遊樂場。

該發展項目可以考慮在南面的部分建築物邊緣進一步減少，設計有助增加項目建築物與長沙灣警署之間的距離，增強夏季風的風滲透能力。

如果將來的發展不能提供 15 米 NBA 和 4 米建築後退的要求，將需要進行定量分析以證明對周圍的風環境無不良通風影響。