

# Kai Tak Development – Infrastructure at Former Runway and Remaining Areas of North Apron and Improvement of Adjacent Waterways – Design and Construction

**Expert Evaluation for Air Ventilation on Kai Tak Development  
North Apron Grid Neighbourhood and Area 2 (Ref. 086-01)**

March 2011



(REF. 086-01)

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## **1 INTRODUCTION**

### **1.1 Purpose**

- 1.1.1 Under this assignment, a Conceptual Design Plan on the townscape of the North Apron shall be prepared with the objectives of enhancing the overall built environment and fulfilling the vision of developing the Kai Tak City Centre into a world-class integrated lively town centre. Changes/ enhancement proposals have been particularly made in the Grid Neighbourhood zone.
- 1.1.2 As instructed by CEDD, a brief expert evaluation on air ventilation, with reference to the previous findings in the detailed air ventilation assessment (AVA) for Kai Tak Development (KTD), is required to confirm whether the proposed changes/ enhancement proposals are acceptable in air ventilation terms.

### **1.2 Background**

- 1.2.1 A district-level detailed AVA study was conducted in 2009 and completed in early 2010 for KTD under Agreement No. CE 35/2006 (CE) Kai Tak Development Engineering Study cum Design and Construction of Advance Works – Investigation, Design and Construction. The study was conducted in accordance with the recommendations of Planning Department's Feasibility Study for Establishment of Air Ventilation Assessment System – Final Report (2005) and Technical Guide for Air Ventilation Assessment for Developments in Hong Kong (2006).
- 1.2.2 Under the AVA study, two 1:800 scale wind tunnel models which subdivided KTD into Study Areas A and B were fabricated in 2009 with reference to the Recommended Outline Development Plan (RODP) prepared at that stage.
- 1.2.3 In accordance with the findings of this detailed air ventilation study, the measured overall wind velocity ratios within KTD are in general relatively higher than those measured in the surroundings hinterland area. The wind performance in the hinterland area is likely to be governed by the existing configuration of streets and buildings. Thus, the KTD is not expected to have significant overall (i.e. district level) adverse effects on air ventilation conditions inside KTD and the surrounding hinterland area.



## 2 SITE WIND ENVIRONMENT

### 2.1 General

- 2.1.1 In the previous detailed AVA Study, a 1:2000 scale topography study was undertaken to determine the effect of topography on local wind conditions for Study Areas A and B. The topography study results were combined with statistical models of the annual and summer non-typhoon wind climate at Kai Tak, that are based on measurements of non-typhoon wind climate taken by the Hong Kong Observatory above the roof of the former Kai Tak Airport Fire Station during the period of 1998 – 2009 inclusive, to determine the wind availability during annual and summer (June to August) periods at the two study areas.
- 2.1.2 In accordance with the findings of this site wind availability study, the annual prevailing non-typhoon winds at the North Apron area (known as Study Area B in the Study) are mainly from the east and south-east. During the summer months, the prevailing non-typhoon winds are mainly from the south-east and south-west quadrants.
- 2.1.3 Significant reductions in wind speed were observed at elevations below 150mPD for winds coming from north and northeast caused by the surrounding mountains. Existing buildings surrounding the study areas including those in the hinterland areas at Mong Kok, Kowloon Bay, Hung Hom, Kwun Tong, To Kwa Wan, Ngau Tau Kok and Ho Man Tin also have some effects on the wind speeds in the study areas. The mountains located on Hong Kong Island reduced wind speeds from the south and southwesterly directions. Winds approaching from the southeast are the least affected due to the relatively open water of Victoria Harbour and Lei Yue Mun.
- 2.1.4 Grid Neighbourhood medium-density residential area in North Apron is located in Study Area B of the model, the annual and summer wind roses as extracted from the “Investigation Report on Experimental Site Wind Availability Study” is appended in **Appendix A**.

### **3 CHARACTERISTICS OF THE CONCERNED AREA IN KAI TAK NORTH APRON AND ITS AIR VENTILATION PERFORMANCE**

#### **3.1 Introduction**

3.1.1 The approved Kai Tak Outline Zoning Plan (OZP) No. S/K22/2 has already built in design and measures to maximize penetration of the prevailing winds from the south-east and south-west quadrants during the summer time. The major air paths aligned in such directions are in the form of interconnected major open spaces or open areas covering Kwun Tong Typhoon Shelter, Kai Tak Approach Channel, To Kwa Wan Typhoon Shelter, Kai Tak River, Metro Park and the Sung Wong Toi Park and open space adjoining the Stadium. These unobstructed air paths allow the prevailing winds to penetrate into the built environment of the Kai Tak City Centre as well as into Kowloon City and San Po Kong.

3.1.2 To allow the prevailing wind to further penetrate to individual development lots in the North Apron, development parcels are also aligned in south-east to north-west direction and podium-free design is adopted to improve wind penetration at the pedestrian street level.

#### **3.2 Grid Neighbourhood**

3.2.1 Under the approved Kai Tak OZP No. S/K22/2, the Grid Neighbourhood is intended for medium-density residential development based on grid pedestrian street pattern. The Grid Neighbourhood design concept is to facilitate a tight character distinguished by a mix of low-rise residential storeys with adjacent of medium-rise residential blocks, which is shown in **Figure 1** and is elaborated as follows:

- A distinctive residential neighbourhood with combination of three-storey residential buildings and medium-rise residential towers up to 100 to 110mPD;
- A network of 10m wide pedestrian streets lined with trees and street furniture are proposed to provide breezeways capturing the southeast prevailing winds;
- Two 20m-wide corridors in NE-SW direction to serve as visual corridors as well as additional breezeways for the penetration of winds laterally;
- Three-storey residential buildings lined along these pedestrian streets to encourage interaction in the neighbourhood and to achieve integrated community; and
- Behind the three storey low-rise residential buildings, the medium-rise residential towers are located in the inner part of these sites with carpark facilities to be provided on basement level to enable podium free development to enhance interaction in the community.

##### *Pedestrian Level Ventilation Performance*

3.2.2 A physical model incorporating the above mentioned air penetration enhancement features were prepared for the wind tunnel test. Based on the findings of the detailed wind tunnel tests, the annual and summer Spatial Average Velocity Ratios (SAVRs) for the northeast portion of the Grid Neighbourhood are both 0.15. On the other hand, the annual and summer SAVRs for the southwest portion of the Grid Neighbourhood are 0.16 and 0.17 respectively. The wind condition at pedestrian level is considered moderate to low as the building mass in the surrounding hinterland areas and within each individual lot caused some obstruction to the wind flow towards and across the area.

- 3.2.3 To further enhance the wind penetration into the Grid Neighbourhood, 3m setback is proposed in each site from the boundary abutting pedestrian streets. The additional 3m setback would increase the width of the southeast/ northwest wind corridors across the Grid Neighbourhood effectively and hence enhance the penetration of pedestrian winds into the Grid Neighbourhood as a whole. With this additional 3m setback, the SAVRs in the area shall compare well with the overall annual and summer SAVRs of 0.17 and 0.18 respectively for all zones in Kai Tak which is moderate condition.

## 4 URBAN DESIGN ENHANCEMENT PROPOSALS IN NORTH APRON TOWNSCAPE

### 4.1 Grid Neighbourhood

4.1.1 To manifest the planning intention and to enhance community interactions within the neighbourhood and the pedestrian streets, it is proposed to enhance visual permeability by refining the massing and disposition of medium-rise and low building blocks within the development sites as well as incorporating a courtyard design approach to project a well-proportioned neighbourhood environment for a comfortable urban intimacy. (**Figures 2 to 3**) The urban enhancement proposal involves the following design considerations:

- Provision of more domestic low blocks to reduce the GFA assigned to towers and hence the overall massing of towers;
- Reduced tower overlooking and to avoid creating wall effect by reducing the number of residential towers;
- Residential blocks to create well-defined public and private domain and streetscape; and
- Courtyard configuration to create a sense of neighbourhood and to foster community spirit, to provide a transition from public open space to semi-public space and then to private space.

4.1.2 This will provide a more integrated urban fabric and smoother transition of scale from Kowloon City to cater for the townscape as outlined above. Under this enhanced design option, courtyards will have wide openings facing pedestrian streets at regular interval. To achieve this objective, the following enforcement mechanisms are proposed to the Grid Neighbourhood to control the design development:

- Residential low blocks
  - The low residential blocks shall be three storeys to six storeys abutting on building lines with maximum building height of 25 mPD;
  - Depending on site configuration, allocate 10%-13% of the total domestic GFA for low block development to guarantee provision; and
  - Depending on site configuration, low blocks shall abut on at least, 30%-40% of the building lines of the sites.
- Residential towers
  - The total site coverage of the residential towers shall not exceed 17% to reduce the massing of tower blocks;
  - At least one façade of each residential tower shall abut on a building line. The cumulative projected façade length of the residential towers against the nearest building line in the same direction shall not exceed 65m to enhance townscape and reduce overlooking; and
  - The continuous projected façade length of any residential tower or any group of residential towers shall not exceed 40m to enhance visual permeability.
- For the low zone (below 25mPD) of residential towers and low blocks
  - Openings with the minimum area of 185m<sup>2</sup> in total shall be provided in façade surface area of the lowest 6 floors for a continuous block length exceeding 60m to enhance visual permeability.

Possible Effect on Ventilation Performance

- 4.1.3 The enhancement proposal maintained the width and orientation of the pedestrian streets and the two 20m-wide northeast/ southwest visual corridors which serve as wind corridors for the Grid Neighbourhood. There are no change in building height limit, site coverage, development intensity and building setback along the pedestrian streets. Overall, there is no alteration of major proposals and as such the air ventilation condition inside KTD and the surrounding hinterland areas at the district level should be similar to the design concept under the PLUD Study.
- 4.1.4 Under the original Grid Neighbourhood design concept, there is a possibility that 3 storeys low blocks will locate continuously along the pedestrian streets if developer intends to maximize the provision of houses in the development.
- 4.1.5 The current enhancement proposal has defined a number of building design requirements as stated in paragraph 4.1.2 to achieve better overall townscape design. In order to allocate more GFA to the low block and to reduce the overall massing of the towers and to allow flexibility in meeting these building design requirements, the low block has been relaxed to no more than 6 storeys or 25mPD. Under the current enhancement proposal, the location of the low blocks instead of limiting at pedestrian street side can abut the visual corridors as well as all sides of the sites. This makes it possible to have courtyards with wide openings facing pedestrian streets at certain interval and openings of 185 m<sup>2</sup> at low zone are also required for a continuous block length exceeding 60m along the pedestrian streets. These design features are important to ensure that the wind flow along the pedestrian streets can penetrate through each individual lot and achieve better air ventilation within each individual lot and for the Grid Neighbourhood as a whole.
- 4.1.6 Moreover, the building design guidelines suggested in the enhancement proposal will impose more stringent requirements than those stipulating in the latest PNAP No. 152 on sustainable design guidelines in terms of building separation, intervening space, building setbacks for improving air ventilation and enhancing the environmental quality at pedestrian level. It is expected that the building and air permeability of the Grid Neighbourhood would therefore be better with these building design guidelines in place.



## **5 CONCLUSION**

### **5.1 Summary**

- 5.1.1 The enhancement proposals for the townscape of the Grid Neighbourhood maintained the width and orientation of the pedestrian streets and visual corridors which serve as local breezeways for the Grid Neighbourhood. There are no change in building height limit, site coverage, development intensity and building setback along pedestrian streets. At the district level, the Grid Neighbourhood proposal under the PLUD Study and the current Townscape Study proposal will result in similar wind conditions in Kai Tak City Centre and hinterland areas.
- 5.1.2 At the Grid Neighbourhood pedestrian level, the enhancement proposals have defined a number of building design requirements to achieve better overall building permeability for each individual lot. This is important to ensure that the wind flow along the pedestrian streets and the 20m-wide visual corridors can penetrate through each individual lot and achieve better air ventilation within each individual lot and for the Grid Neighbourhood as a whole.
- 5.1.3 With the enhancement proposals, together with the set of design guidelines on building disposition, façade length, openings requirement at low zone, it is believed that the overall local air ventilation performance and building permeability of individual lots in the Grid Neighbourhood is comparable to the original proposal under the approved Kai Tak OZP.

***Appendix A***

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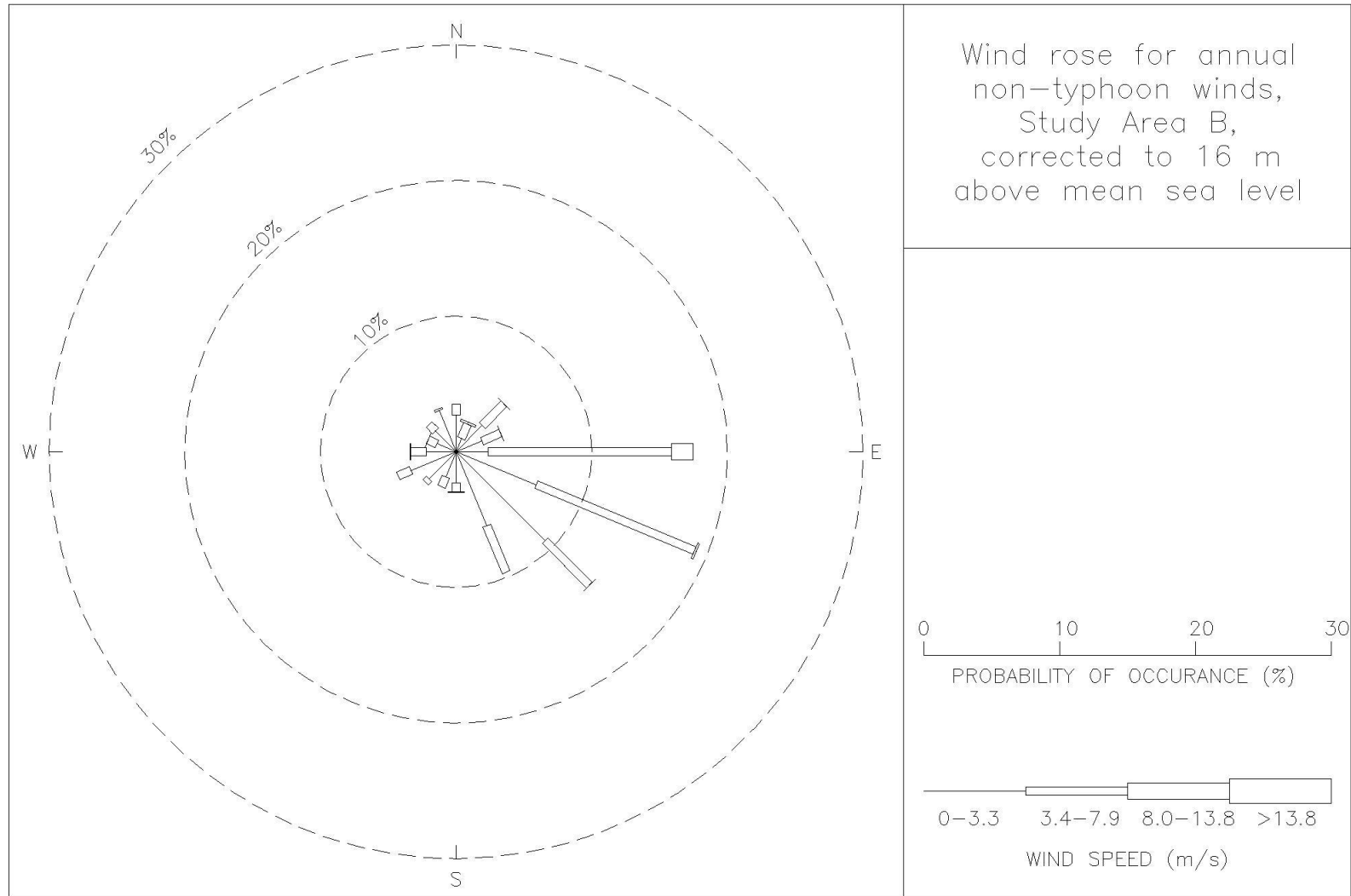


Figure 41: Wind rose for annual, non-typhoon winds for Kai Tak, corrected to 16 m above mean sea level at Study Area B, 1998 - 2009

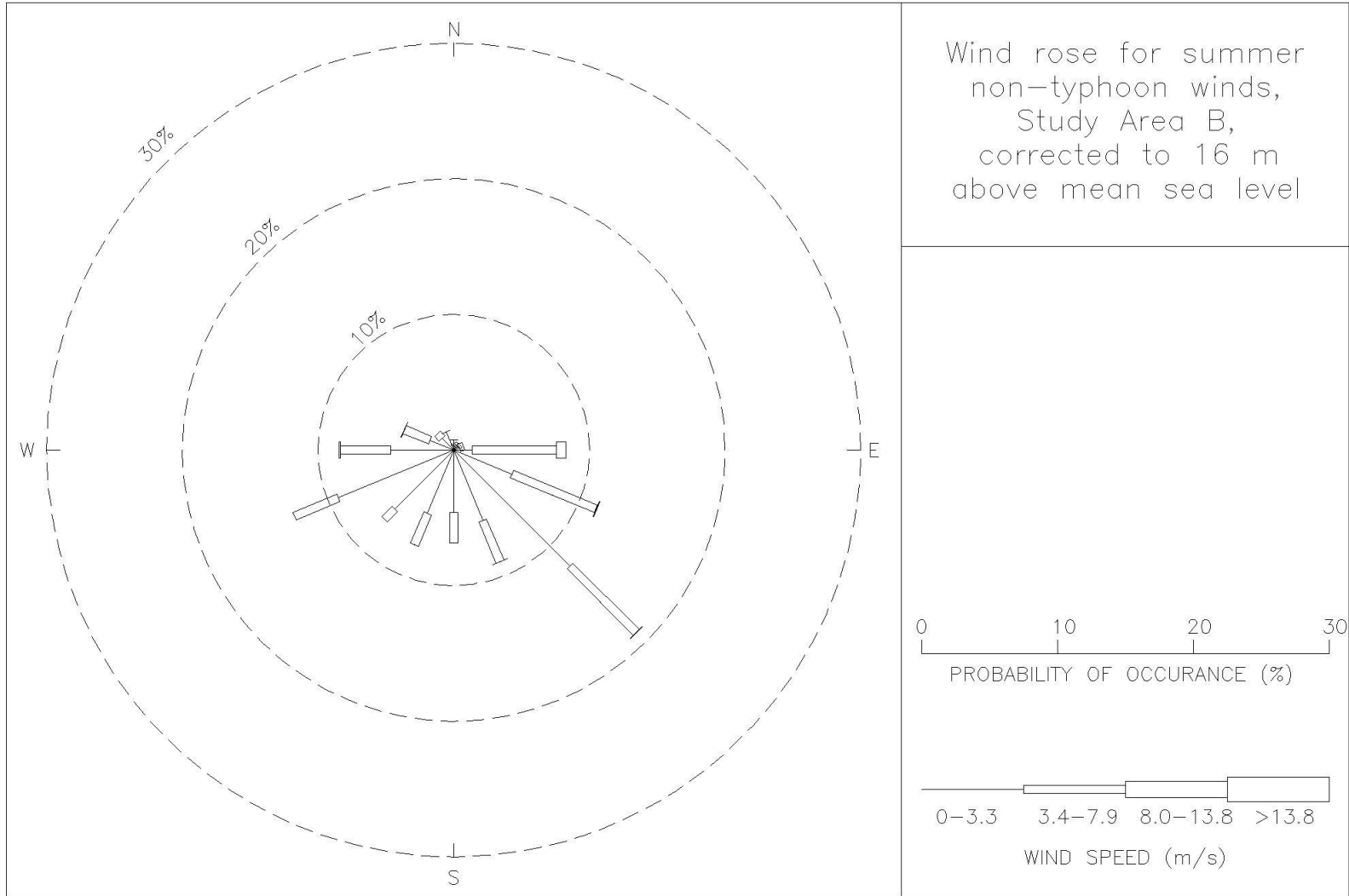


Figure 42: Wind rose for summer, non-typhoon winds for Kai Tak, corrected to 16 m above mean sea level at Study Area B, 1998 - 2009

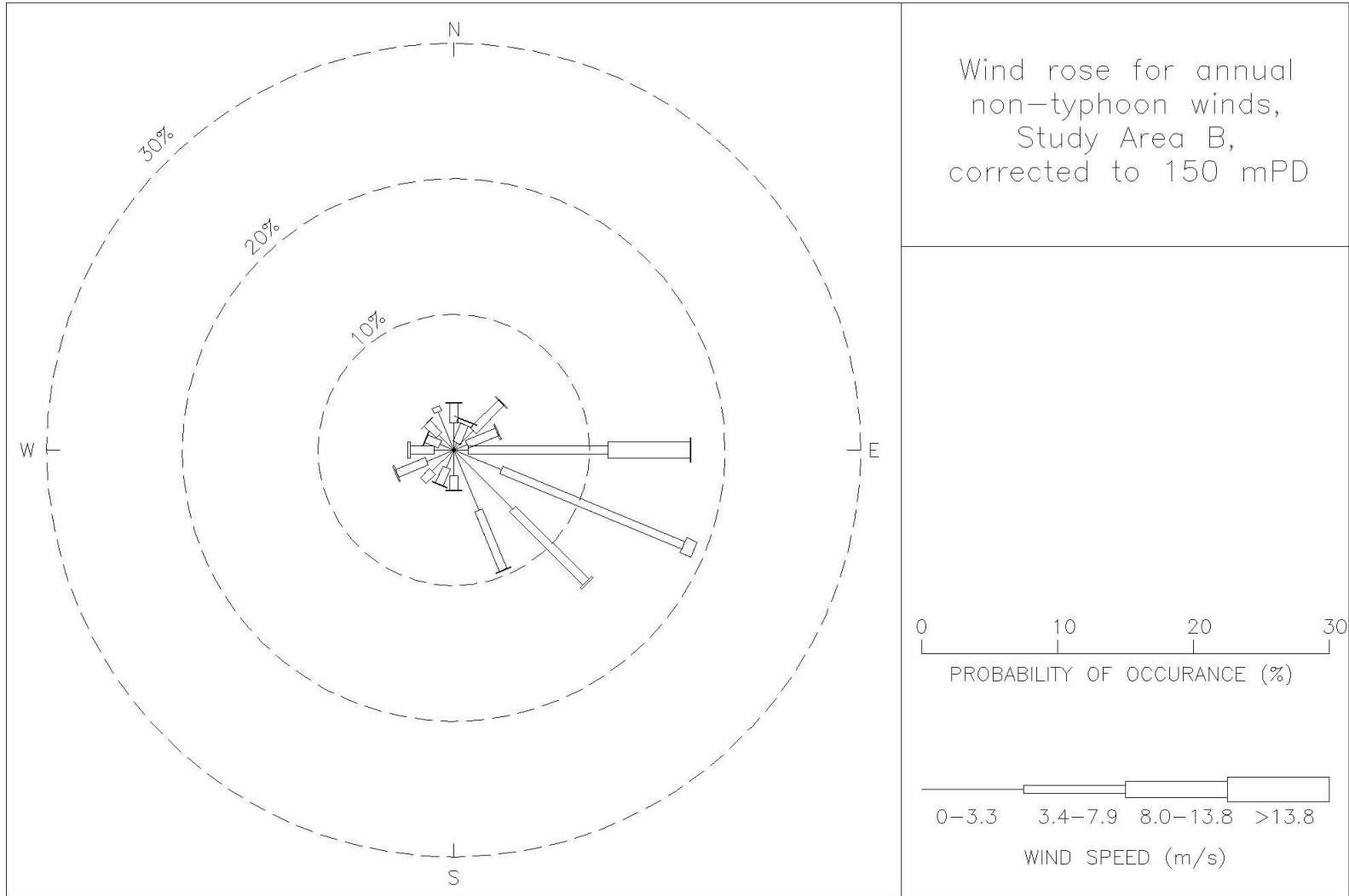


Figure 45: Wind rose for annual, non-typhoon winds for Kai Tak, corrected to 150 mPD at Study Area B, 1998 - 2009



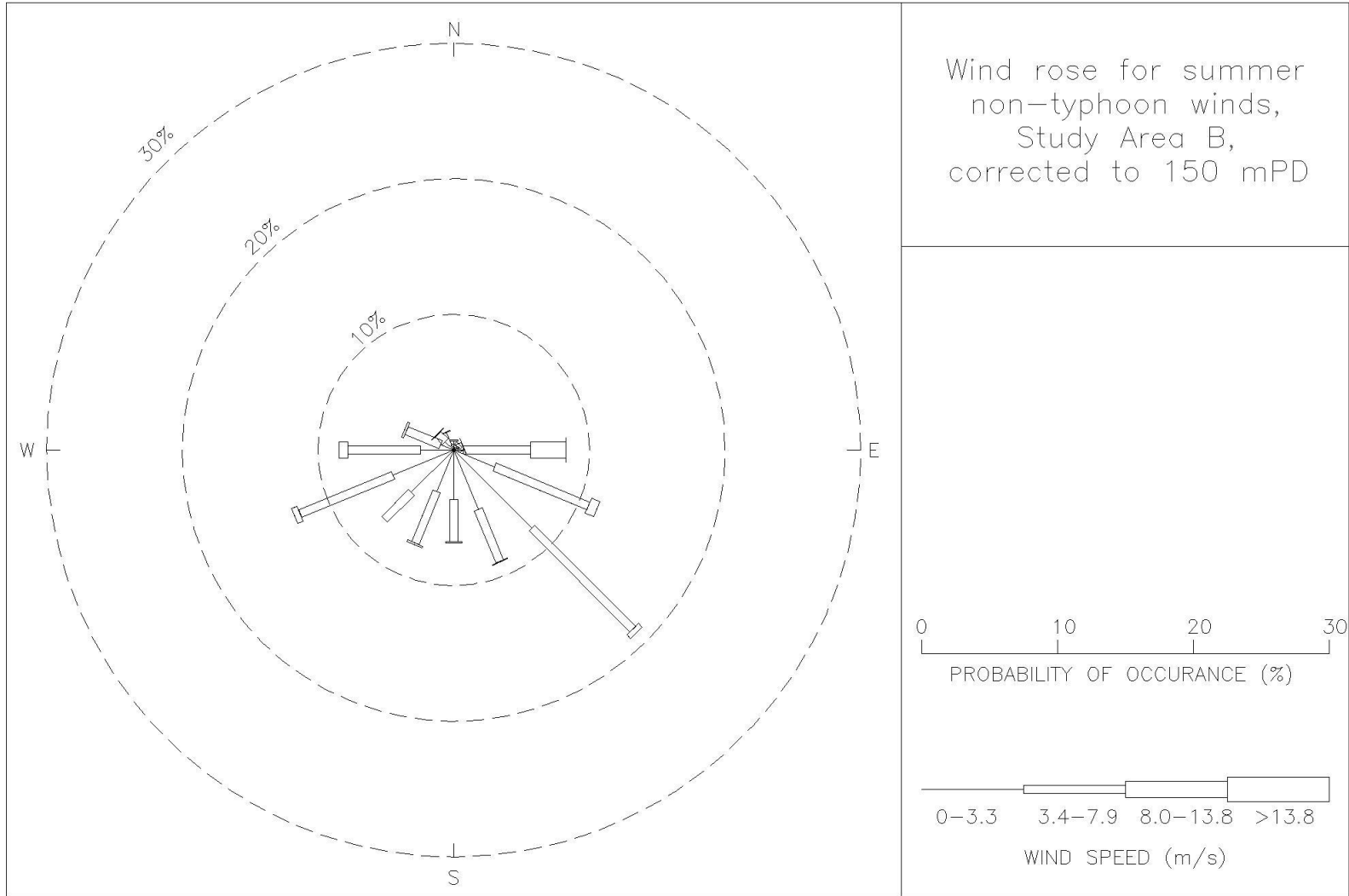
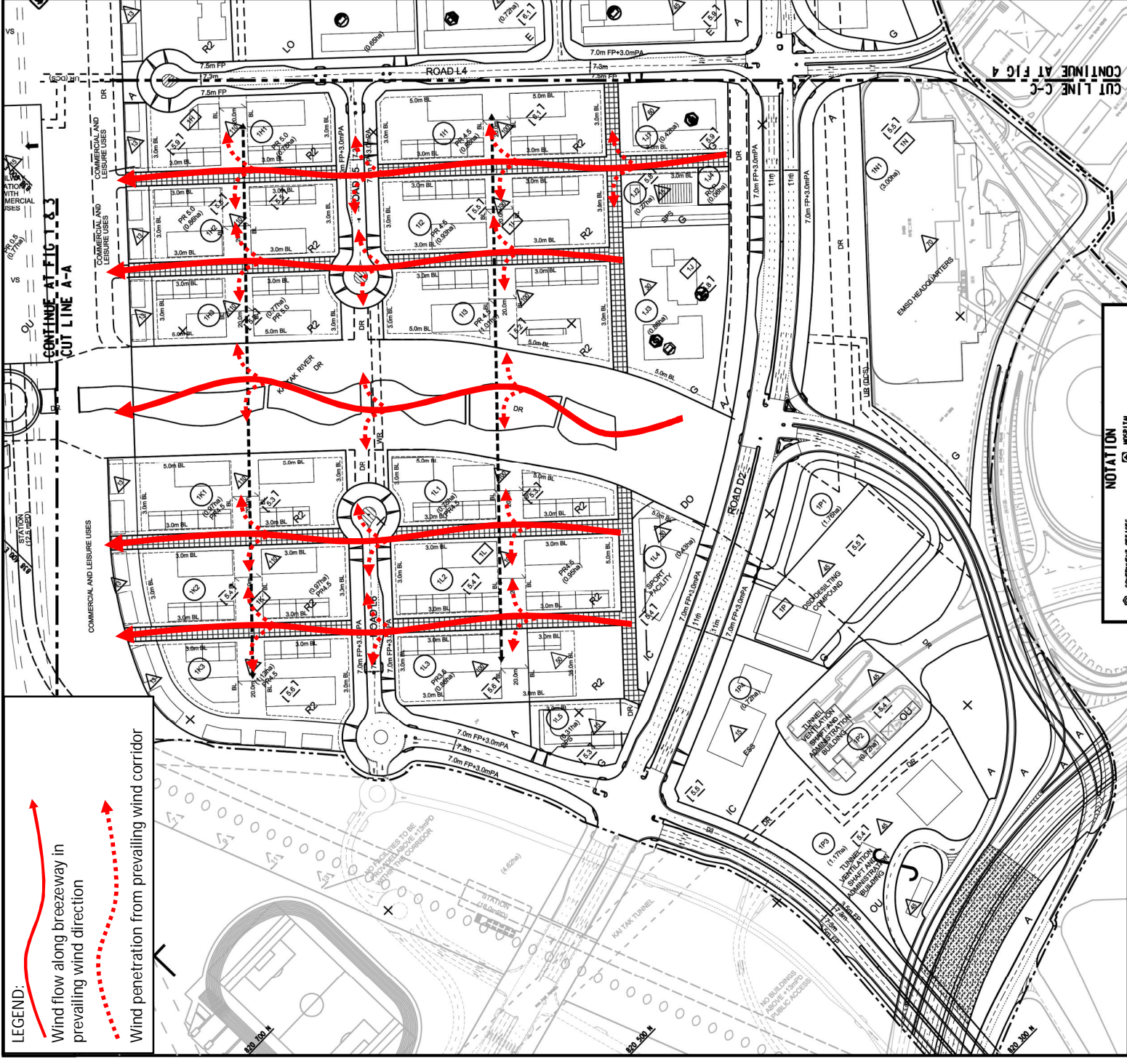


Figure 46: Wind rose for summer, non-typhoon winds for Kai Tak, corrected to 150 mPD at Study Area B, 1998 - 2009

***Figures***

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**LEGEND:**

Wind flow along breezeway in prevailing wind direction

Wind penetration from prevailing wind direction

| USES                               | NET SITE AREA & % EXCLUDES |
|------------------------------------|----------------------------|
| C COMMERCIAL                       | 6.10 4.85                  |
| RS SPECIAL RESIDENTIAL             | 9.17 7.29                  |
| RT1 RESIDENTIAL - ZONE 1           | -                          |
| RT2 RESIDENTIAL - ZONE 2           | 19.78 15.73                |
| RT3 RESIDENTIAL - ZONE 3           | -                          |
| G GOVERNMENT                       | 11.93 9.48                 |
| IC INSTITUTION OR COMMUNITY        | 2.28 1.81                  |
| E EDUCATION                        | 4.07 3.23                  |
| RD REGIONAL OPEN SPACE             | 9.70 7.71                  |
| DD DISTRICT OPEN SPACE             | 7.70 6.12                  |
| LD LOCAL OPEN SPACE                | 5.89 4.68                  |
| A AMENITY                          | 3.81 3.11                  |
| OU OTHER SPECIFIED USES            | 6.77 5.38                  |
| CD COMPREHENSIVE DEVELOPMENT AREA  | 3.75 2.98                  |
| ROADS, JUNCTIONS, ETC.             | 34.76 27.63                |
| <b>TOTAL AREA OF PLANNING AREA</b> | <b>125.81</b>              |
|                                    | 100                        |

| SCHEDULE OF USES AND AREAS                  |                                     |
|---|-------------------------------------|
| GOVERNMENT OFFICES                          | GO HOSPITAL                         |
| POLICE HEADQUARTERS                         | GC POLYCLINIC / SPECIALIST CLINIC   |
| DIVISIONAL POLICE STATION                   | GC GENERAL CLINIC                   |
| SUB-DIVISIONAL FIRE STATION                 | GC REGIONAL PARK                    |
| AMBULANCE DEPOT                             | GC TOWN PARK                        |
| LIBRARY                                     | GC CAR PARK                         |
| COMMUNITY HALL                              | GC BIG TENNIS                       |
| SOCIAL WELFARE FACILITY                     | GC SPORTS HALL / STADIUM            |
| SECONDARY SCHOOL                            | GC PETROL FILLING STATION           |
| PRIMARY SCHOOL                              | GC LIGHTED PETROLZUM                |
| KINDERGARTEN                                | GC GAS FILLING STATION              |
| PLANNING BOUNDARY                           | GC STADIUM / MULTIPURPOSE STADIUM   |
| SUB-AREA BOUNDARY                           | GC RESERVE FOR OTHER INTEREST       |
| ELEVATED ROAD                               | GC SUBJECT TO FURTHER INVESTIGATION |
| ELEVATED WALKWAY                            | GC MARINE VESSEL TRACING SYSTEM     |
| DEPRESSION ROAD                             | GC NON-BUILDING AREA                |
| TUNNEL                                      | GC SENS PUMPING STATION             |
| PERESTRIAN CROSSING                         | GC PETS                             |
| VIEW CORRIDOR                               | GC PTTI PUBLIC FILLING STATION      |
| BRICKLAYER                                  | GC RCP REFUSE COLLECTION POINT      |
| AVIATION MANAGEMENT CENTRE                  | GC PR PLOT RATIO                    |
| ELECTRICITY SUBSTATION                      | GC VENTILATION SHANT                |
| LPG LIQUEFIED PETROLEUM GAS FILLING STATION | GC PLANTING AREA                    |
|   | GC FOOTPATH AREA                    |
|   | GC SERVICE                          |

| NOTATION                                       |                                     |
|--|-------------------------------------|
| GC GOVERNMENT OFFICES                          | GC HOSPITAL                         |
| GC POLICE HEADQUARTERS                         | GC POLYCLINIC / SPECIALIST CLINIC   |
| GC DIVISIONAL POLICE STATION                   | GC GENERAL CLINIC                   |
| GC SUB-DIVISIONAL FIRE STATION                 | GC REGIONAL PARK                    |
| GC AMBULANCE DEPOT                             | GC TOWN PARK                        |
| GC LIBRARY                                     | GC CAR PARK                         |
| GC COMMUNITY HALL                              | GC BIG TENNIS                       |
| GC SOCIAL WELFARE FACILITY                     | GC SPORTS HALL / STADIUM            |
| GC SECONDARY SCHOOL                            | GC PETROL FILLING STATION           |
| GC PRIMARY SCHOOL                              | GC LIGHTED PETROLZUM                |
| GC KINDERGARTEN                                | GC GAS FILLING STATION              |
| GC PLANNING BOUNDARY                           | GC STADIUM / MULTIPURPOSE STADIUM   |
| GC SUB-AREA BOUNDARY                           | GC RESERVE FOR OTHER INTEREST       |
| GC ELEVATED ROAD                               | GC SUBJECT TO FURTHER INVESTIGATION |
| GC ELEVATED WALKWAY                            | GC MARINE VESSEL TRACING SYSTEM     |
| GC DEPRESSION ROAD                             | GC NON-BUILDING AREA                |
| GC TUNNEL                                      | GC SENS PUMPING STATION             |
| GC PERESTRIAN CROSSING                         | GC PETS                             |
| GC VIEW CORRIDOR                               | GC PTTI PUBLIC FILLING STATION      |
| GC BRICKLAYER                                  | GC RCP REFUSE COLLECTION POINT      |
| GC AVIATION MANAGEMENT CENTRE                  | GC PR PLOT RATIO                    |
| GC ELECTRICITY SUBSTATION                      | GC VENTILATION SHANT                |
| GC LPG LIQUEFIED PETROLEUM GAS FILLING STATION | GC PLANTING AREA                    |
|  | GC FOOTPATH AREA                    |
|  | GC SERVICE                          |

| NOTATION                                       |                                     |
|--|-------------------------------------|
| GC GOVERNMENT OFFICES                          | GC HOSPITAL                         |
| GC POLICE HEADQUARTERS                         | GC POLYCLINIC / SPECIALIST CLINIC   |
| GC DIVISIONAL POLICE STATION                   | GC GENERAL CLINIC                   |
| GC SUB-DIVISIONAL FIRE STATION                 | GC REGIONAL PARK                    |
| GC AMBULANCE DEPOT                             | GC TOWN PARK                        |
| GC LIBRARY                                     | GC CAR PARK                         |
| GC COMMUNITY HALL                              | GC BIG TENNIS                       |
| GC SOCIAL WELFARE FACILITY                     | GC SPORTS HALL / STADIUM            |
| GC SECONDARY SCHOOL                            | GC PETROL FILLING STATION           |
| GC PRIMARY SCHOOL                              | GC LIGHTED PETROLZUM                |
| GC KINDERGARTEN                                | GC GAS FILLING STATION              |
| GC PLANNING BOUNDARY                           | GC STADIUM / MULTIPURPOSE STADIUM   |
| GC SUB-AREA BOUNDARY                           | GC RESERVE FOR OTHER INTEREST       |
| GC ELEVATED ROAD                               | GC SUBJECT TO FURTHER INVESTIGATION |
| GC ELEVATED WALKWAY                            | GC MARINE VESSEL TRACING SYSTEM     |
| GC DEPRESSION ROAD                             | GC NON-BUILDING AREA                |
| GC TUNNEL                                      | GC SENS PUMPING STATION             |
| GC PERESTRIAN CROSSING                         | GC PETS                             |
| GC VIEW CORRIDOR                               | GC PTTI PUBLIC FILLING STATION      |
| GC BRICKLAYER                                  | GC RCP REFUSE COLLECTION POINT      |
| GC AVIATION MANAGEMENT CENTRE                  | GC PR PLOT RATIO                    |
| GC ELECTRICITY SUBSTATION                      | GC VENTILATION SHANT                |
| GC LPG LIQUEFIED PETROLEUM GAS FILLING STATION | GC PLANTING AREA                    |
|  | GC FOOTPATH AREA                    |
|  | GC SERVICE                          |

AGREEMENT NO. CE 35/2006 (CE)

KAI TAK DEVELOPMENT ENGINEERING STUDY CUM DESIGN AND CONSTRUCTION OF ADVANCE WORKS-INVESTIGATION, DESIGN AND CONSTRUCTION

Original Layout of Grid Neighbourhood

SCALE AO 1 : 1000

CHECK CHECK CHECK

JOB No. 60022408

DRAWING No. FIG 1

REV -

DATE JANUARY 2010

DRAWN ZJ





**LEGEND:**



Wind flow along breezeway in prevailing wind direction



Wind penetration from prevailing wind corridor



Courtyard

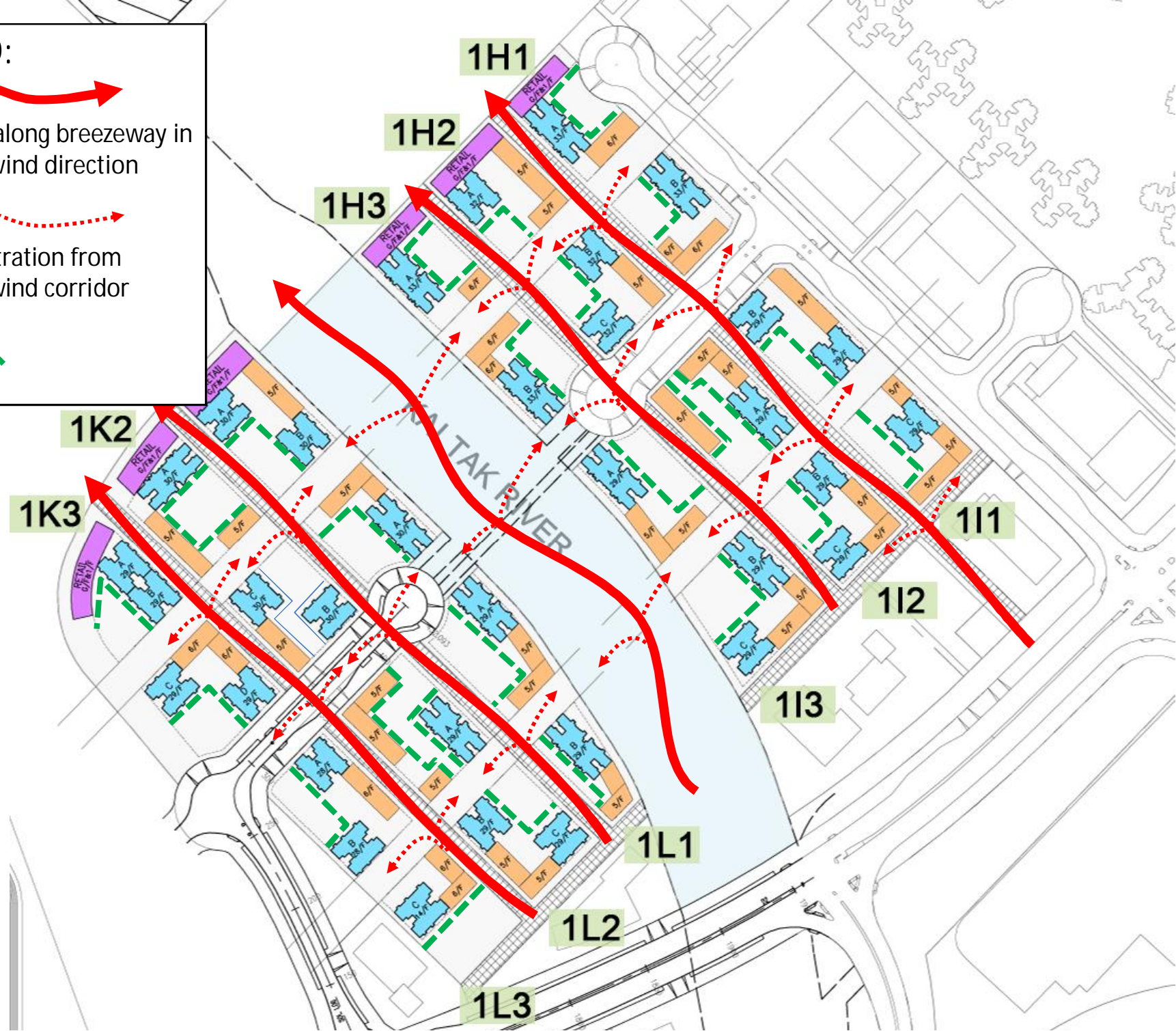


FIG 2

Proposed Layout of Grid Neighbourhood



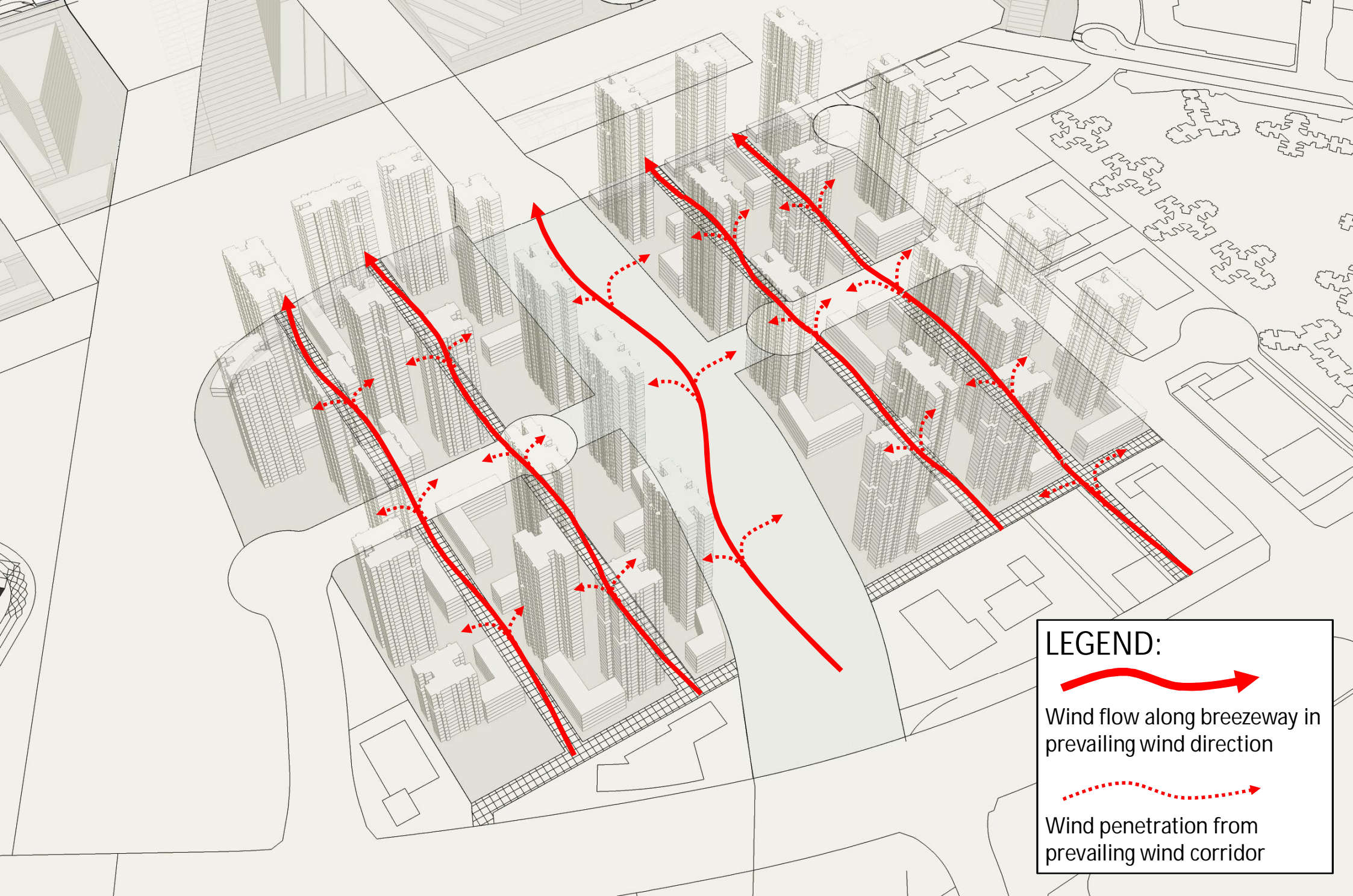


FIG 3

Perspective of Proposed Layout of Grid Neighbourhood