RNTPC Paper No. 2/20

For Consideration by the
Rural and New Town Planning Committee on 29.5.2020

PROPOSED AMENDMENTS TO
THE APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN NO. S/TKO/26

## PROPOSED AMENDMENTS TO

THE APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN NO. S/TKO/26

## 1. Introduction

This paper is to seek Members' agreement that:
(a) the proposed amendments to the approved Tseung Kwan O (TKO) Outline Zoning Plan (OZP) No. S/TKO/26 (Attachment I) as shown on the draft OZP No. S/TKO/26A (Attachment II) and its Notes (Attachment III) are suitable for exhibition for public inspection under section 5 of the Town Planning Ordinance (the Ordinance); and
(b) the revised Explanatory Statement (ES) of the OZP (Attachment IV) should be adopted as an expression of the planning intentions and objectives of the Town Planning Board (the Board) for the various land use zonings of the OZP, and is suitable for exhibition together with the draft OZP and its Notes.

## 2. Status of the Current OZP

2.1 On 16.10.2018, the Chief Executive in Council (CE in C) under section 9(1)(a) of the Ordinance, approved the draft TKO OZP, which was subsequently renumbered as $\mathrm{S} / \mathrm{TKO} / 26$.
2.2 On 17.12.2019, the CE in C referred the approved TKO OZP No. S/TKO/26 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. On 27.12.2019, the reference back of the OZP was notified in the Gazette under section 12(2) of the Ordinance.

## 3. Background

3.1 The initiative to explore the development potential of railway stations and their related sites along existing and future rail lines, with the objective to increase housing supply was announced in the 2015 Policy Address. The MTR Corporation Limited (MTRCL), which is the current occupier and operator of the Pak Shing Kok Ventilation Building (PSKVB) site, has commissioned technical studies to explore the feasibility of residential development atop the PSKVB, taken into consideration the planning context and various development constraints.
3.2 The current proposed amendments to the OZP mainly involves the rezoning of the site currently occupied by the PSKVB (about $2,532 \mathrm{~m}^{2}$ ) and its adjoining government land (about $1,986 \mathrm{~m}^{2}$ ) (the Site) from an area shown as
'MTR Pak Shing Kok Ventilation Building' and "Green Belt" ("GB") to "Residential (Group A)8" ("R(A)8") (Amendment Item A). The "R(A)8" zone will be subject to a maximum plot ratio (PR) of 6 and a maximum building height of 130 mPD .
3.3 It is also proposed to rezone a strip of land along Chiu Shun Road (about $105 \mathrm{~m}^{2}$ ) from an area shown as 'MTR Pak Shing Kok Ventilation Building' to 'Road' (Amendment Item B) to form part of the future footpath.

## 4. The Amendment Sites

Item A - Rezoning of a Site at Chiu Shun Road from an area shown as 'MTR Pak Shing Kok Ventilation Building' (about 3,227m²) and "GB" (about 1,291m²) to "R(A)8"

The Site and its Surroundings (Plans 1, 3 to 5b)
4.1 The Site (about 0.45ha) is located at Chiu Shun Road, and about 400m away from the MTR Hang Hau Station. The major part of the Site is currently used for the PSKVB by MTRCL under a Running Line Lease, and the rest are man-made slopes on government land. The Site falls within an area mainly shown as 'MTR Pak Shing Kok Ventilation Building' and partly zoned "GB".
4.2 The PSKVB provides air ventilation for the tunnels of the railway line. It measures about 29.72 mPD up to the top of the vent shaft. It is served by a vehicular ingress/egress via Chiu Shun Road to allow access of large vehicles for maintenance. The PSKVB is vital to the operation of the MTR line and will be maintained uninterrupted at all times during the construction of the residential towers.
4.3 To the immediate north-east adjoining the Site is a planned public housing development zoned "Residential (Group A)7" with a maximum building height ( BH ) of 130 mPD . To the south and south-east are vegetated slope areas. To the further north-east are Fat Tau Chau Village and Tin Ha Wan Village. To the north and north-west across Chiu Shun Road are high-rise residential developments of Hang Hau, including La Cite Noble (about 146 mPD ), Yuk Ming Court (about 115 mPD ), Maritime Bay (about 147 mPD ), Wo Ming Court (about 101mPD) and Hin Ming Court (about 114mPD).
4.4 Within the 500 m walking distance from the Site, there are Hang Hau MTR station, bus/GMB stops, shopping malls (East Point City, TKO Gateway, Ming Tak Shopping Mall) and open space (Hang Hau Man Kuk Lane Park). There is a footbridge across Chiu Shun Road about 250 m to the north-east of the Site. The Civil Engineering and Development Department is also planning to construct an at-grade crossing at the junction of Chiu Shun Road and Ngan O Road to enhance pedestrian connectivity to Hang Hau MTR station.
4.5 The Site is proposed to be rezoned from an area shown as 'MTR Pak Shing Kok Ventilation Building' (about $3,227 \mathrm{~m}^{2}$ ) and "GB" (about $1,291 \mathrm{~m}^{2}$ ) to " $R(A) 8$ " with a maximum PR of 6 and maximum BH of 130 mPD .
4.6 According to MTRCL's conceptual scheme, the PSKVB will retain in-situ and two domestic towers could be developed over a transfer plate on top of the PSKVB with about 432 flats and a total domestic gross floor area (GFA) of $26,748 \mathrm{~m}^{2}$. According to MTRCL, the development is anticipated to be completed by 2029. The conceptual scheme is shown at Attachments Va and $\mathbf{V b}$ and the major development parameters are summarized below:

| Site Area | About $4,458 \mathrm{~m}^{2}$ |
| :--- | :--- |
| $-\quad$ MTRCL Lot | $-\quad$ About $2,571 \mathrm{~m}^{2}$ |
| $-\quad$ Government Land | $-\quad$ About $1,887 \mathrm{~m}^{2}$ |
| Domestic PR | 6 |
| Domestic GFA | About $26,748 \mathrm{~m}^{2}$ |
| No. of Flats | About 432 |
| No. of Towers | 2 |
| No. of Domestic Storeys | 27 storeys per tower |
| Building Height | 130 mPD |

Note: It is assumed that GFA of non-domestic uses such as railway facilities and above-ground ancillary carpark may be disregarded.
4.7 Technical studies (Attachment VII) have been conducted by MTRCL for the proposed residential development atop the PSKVB on visual, air ventilation, traffic, environmental, landscape and other aspects. The assessments have been circulated to relevant government bureaux/departments and no insurmountable technical problem has been identified.

## Land Use Compatibility

4.8 The Site is in a neighborhood comprising mainly high-rise high-density residential developments, open space and vegetated slope areas. The proposed BH restriction of 130 mPD and PR of 6 are considered compatible with the existing high-rise high-density residential developments with BHs ranging from 101 mPD to 175 mPD and PR ranging from about 4 to 8 .

## Visual Aspect

4.9 The proposed " $\mathrm{R}(\mathrm{A}) 8$ " zone is subject to a maximum BH restriction of 130 mPD and the proposed development is located at the fringe of groups of high-rise towers in Hang Hau. Based on the Visual Impact Assessment (VIA) conducted by MTRCL (Appendix C of Attachment VII), the proposed development would not cause any major visual obstruction to its surrounding visual context. While visual impact to long and medium-range viewpoints are considered negligible, slight to moderate adverse visual impact would be caused to viewers from short-ranges viewpoints (Attachment VIa to VIg). Mitigation measures such as multi-levelled greenery and voids at podium
levels and building façade treatment to introduce visual amenity and improve visual permeability will be further explored at the detailed design stage to further reduce the visual impact arising from the proposed residential development. The Chief Town Planner/Urban Design and Landscape, Planning Department (CTP/UD\&L, PlanD) has no adverse comment from visual perspective.

## Air Ventilation Aspect

4.10 The Site is located at the foothill of Pak Shing Kok abutting Chiu Shun Road. To the immediate south-west is vegetated slope and further south-west is the major intersections of Chiu Shun Road/Wan Po Road/Po Yap Road beyond which is an existing district open space. Under the annual and summer wind conditions, Chiu Shun Road running in NE-SW direction which aligns with the prevailing wind and is more than 15 m wide serves as an effective wind corridor for wind penetration through the area. As the Site is elongated and parallel to the major wind flow direction, the proposed development is not expected to have significant impact on the overall wind environment of the district.
4.11 Air Ventilation Assessment (AVA) Initial Study (AVA (IS)) (Appendix A of Attachment VII) has been conducted by MTRCL to assess the wind performance of the proposed residential development. Two scenarios, i.e. the Baseline Scheme (existing condition of the site) and the Conceptual Scheme, have been studied. According to the AVA IS report, the overall performance of the Conceptual Scheme on pedestrian wind environment is slightly lower than that of the Baseline Scheme under both annual and summer conditions. Slight improvement in wind performance at Chiu Shun Road, and slight stagnation in wind performance in Hang Hau Man Kuk Lane Park and Assembly of God Leung Sing Tak Primary School are observed. To alleviate the potential air ventilation impact to the surrounding pedestrian wind environment due to the proposed development, some mitigation measures including: (i) 5 m setback at podium level and 10 m setback of residential towers from Chiu Shun Road; (ii) permeable elements underneath the podium and above the PSKVB; and (iii) 15 m building separation between the two residential blocks have been incorporated in the Conceptual Scheme. No significant adverse impact is anticipated to the surrounding wind environment with the provision of these mitigation measures. In finalising future development scheme at detailed design stage, the future developer should take into account these proposed mitigation measures in the AVA to alleviate the potential impact of the development. CTP/UD\&L, PlanD has no adverse comment from air ventilation perspective.

## Traffic Aspect

4.12 The site is well served by public transport network. According to the Traffic Impact Assessment (TIA) conducted by the MTRCL (Appendix D of Attachment VII), most junctions will operate with spare capacity with the proposed residential development, except for the junction at Po Ning Road/Po Shun Road/Po Lam Road North (J7) and Ying Yip Road southbound. The traffic generated by the proposed residential development would not induce significant traffic impact to the adjacent junctions.
4.13 In order to improve the accessibility of the Site to the surrounding areas, a footpath of minimum 3m-wide along the frontage of the Site at Chiu Shun Road and an at-grade pedestrian crossing across Chiu Shun Road to Ngan O Road are proposed. The Commissioner for Transport ( C for T ) has no adverse comment on the TIA and has no objection to the rezoning proposal from traffic perspective.
4.14 The site is located about 400 m from the MTR Hang Hau station. Finding shows that the estimated number of MTR passengers generated from the proposed development is insignificant when compared with the critical link flows in the railway network. The railway network has sufficient capacity to accommodate the additional demand. The Railway Development Office of Highways Department also has no adverse comment from railway point of view.

## Environmental Aspect

4.15 An Environmental Assessment (EA) has been conducted to assess the environmental impacts arising from the PSKVB and proposed residential development on air quality and noise (Appendix B of Attachment VII). The PSKVB including its vent shafts and air-conditioning units will be located under the transfer plate. With mitigation measures such as the installation of acoustic louvres/silencers at the ventilation openings of the PSKVB and at least 5 m exhaust air zone buffer distance from the ventilation openings of the PSKVB, no adverse air quality and noise impacts from the PSKVB to the proposed residential development are anticipated. Regarding the proposed residential development, mitigation measures such as building setback from Chiu Shun Road and installation of fixed/maintenance/acoustic windows are proposed such that no insurmountable air quality and noise impacts from Chiu Shun Road are envisaged. The EA concludes that the proposed development is environmentally acceptable and feasible. The Director of Environmental Protection (DEP) has no objection to the rezoning proposal.

## Landscape Aspect

4.16 According to the Indicative Landscape Master Plan and Tree Survey Report (LMP) (Appendix H of Attachment VII), the proposed development will replace the existing utility character of the Site to residential landscape character. A total number of 31 trees with low to medium amenity value are identified within the site, without any registered or potential Old and Valuable Tree, rare or protected tree species, or Champion Tree. All these trees will be fell and fully compensated with additional 8 trees (replanting ratio $1: 1.26$ ) on the podium garden and ground floor. Taking into account the surrounding areas of the Site with landscape resources including wooldland, shrubland, plantation, roadside plantation and open space, landscape mitigation measures including multi-level greening framework at car park level and slope area, compensation of existing trees loss with native and ornamental tree species and introduction of residential landscape to improve amenity and shading would be implemented. The change of existing utility character of the Site to residential landscape character is considered
compatible to the high-rise residential, urban fringe and recreational landscape character of Hang Hau. CTP/UD\&L, PlanD has no adverse comment on the LMP.

## Infrastructural and Other Aspects

4.17 MTRCL has also submitted Sewerage Impact Assessment, Drainage Impact Assessment and Geotechnical Planning Review Report (Appendices E to G of Attachment VII) to demonstrate the technical feasibility of the proposed development. Relevant departments have no adverse comments on these technical aspects.

## Item B - Rezoning of a strip of land along Chiu Shun Road from an area shown as 'MTR Pak Shing Kok Ventilation Building' (about $\mathbf{1 0 5 m}{ }^{2}$ ) to 'Road'

4.18 The site comprises a strip of land along Chiu Shun Road currently occupied by roadside planting (Photo 4 on Plan 5b). It is proposed to rezone the site from an area shown as 'MTR Pak Shing Kok Ventilation Building' to 'Road', to form part of the future footpath.

## 5. G/IC Facilities and Open Space Provisions

5.1 Taking into account the proposed residential development, the planned population of the Planning Scheme Area as estimated by PlanD would be about 470,800 persons.

GIC Facilities
5.2 Based on the requirements in Hong Kong Planning Standards and Guidelines (HKPSG) and the planned population, as shown in Attachment VIII, the planned provision for GIC facilities in the area is generally adequate to meet the demand of the overall planned population (including the increase in population from the proposed residential development) except mainly for elderly facilities and child care centres. As the Site is occupied by the PSKVB and associated facilities, provision of elderly facility and child care centre within the future development is not feasible as these facilities should not be located more than 24 m above ground according to HKPSG. Moreover, the provision of GIC facilities are long-term target and the actual provision would be subject to the consideration of the relevant departments during the planning and development process. PlanD and concerned departments will work closely together to ensure that additional GIC facilities will be included in new and redevelopment proposals from both public and private sectors.

Open Space
5.3 There will be a surplus of 9.23ha of district open space and 26.12ha of local open space provision.

## 6. Proposed Amendments to Matters shown on the OZP

The proposed amendments as shown on the draft Tseung Kwan O OZP No. S/TKO/26A at Attachment II are as follows:

Item A (about 0.45ha)
Rezoning of a Site at Chiu Shun Road from an area shown as 'MTR Pak Shing Kok Ventilation Building' and "GB" to "R(A)8" with a maximum PR of 6 and BH of 130 mPD .

Item B (about 0.01ha)
Rezoning of a strip of land along Chiu Shun Road from an area shown as 'MTR Pak Shing Kok Ventilation Building' to 'Road' to form part of the future footpath.

## 7. Proposed Amendment to the Notes of the OZP

7.1 The proposed amendments to the Notes of the OZP (with additions in bold and italics and deletions in 'erossed out') are at Attachment III for Members' consideration. The proposed amendments are summarised as follows:
" $R(A)$ " zone
7.2 In relation to Item $\mathbf{A}$ mentioned in paragraph 7 above, the Notes of the " $R(A)$ " zone are revised to include 'Mass Transit Railway Vent Shaft and/or Other Structure above Ground Level other than Entrances (on land designated "R(A)8" only)' in Column 1 of the User Schedule, and 'Mass Transit Railway Vent Shaft and/or Other Structure above Ground Level other than Entrances (except on land designated " $R(A) 8$ ")' in Column 2 of the User Schedule. The Remarks of the Notes for " $R(A)$ " zone are also revised to specify the development restrictions and that railway facilities may be disregarded in determining the maximum plot ratio for the " $\mathrm{R}(\mathrm{A}) 8$ " sub-area.

## Technical amendments

7.3 In accordance with the latest amendments to the MSN in relation to the subsuming of 'Market' use under 'Shop and Services' use endorsed by the Board on 28.12.2018, the following amendments to the Notes will be made:
(a) deletion of 'Market' from Column 1 use in "Commercial / Residential" and "Other Specified Uses" annotated "Commercial/Residential Development with Public Transport Interchange" zones;
(b) deletion of 'Market' from Column 2 use in "Comprehensive Development Area", "Residential (Group B)", Schedule I of "Residential (Group E)" and "Village Type Development" zones; and
(c) revising 'Shop and Services' to 'Shop and Services (not elsewhere specified)' in Column 2 of "R(A)" and "Government, Institution or Community" zones respectively.

## 8．Revision to the Explanatory Statement of the OZP

The ES of the TKO OZP has been revised to take into account the proposed amendments as mentioned in the above paragraphs．Opportunity has also been taken to update the general information for the various land use zones to reflect the latest status and planning circumstances of the OZP．The proposed amendments to the ES of the OZP（with additions in bold and italics and deletions in＇erossed out＇） area at Attachment IV for Members＇consideration．

## 9．Plan Number

Upon exhibition for public inspection，the OZP will be renumbered as $\mathrm{S} / \mathrm{TKO} / 27$ ．

## 10．Consultation

Consultation with Sai Kung District Council
10．1 On 5 May 2020，the Sai Kung District Council（SKDC）was consulted on the proposed amendment．The SKDC members mainly raised concerns on the potential adverse traffic impact，inadequate road and railway capacity， adverse air ventilation，inadequate GIC and retail facilities，and lack of comprehensive planning for Tseung Kwan O area．Some members opined that Tseung Kwan O Area 137 should be given priority for development． Some members also queried MTRCL＇s development right over the Site．The SKDC passed a motion ${ }^{(1)}$ at the meeting objecting to residential development at the Site．

10．2 In response，PlanD explained at the SKDC meeting that the Government has adopted a multi－pronged strategy to increase housing land supply，including new development areas，rezoning of＂Green Belt＂sites，as well as exploring development potential of railway stations and their related sites along existing and future rail lines．Relevant technical assessments（including TIA，EA and AVA etc．）have been conducted by MTRCL for the proposed development atop the existing PSKVB and no insurmountable problems have been identified by bureaux／departments．The GIC provision in Tseung Kwan O have been planned in a holistic manner and PlanD would continue to take opportunities to identify suitable land／premises for the provision of various GIC facilities taking into consideration the HKPSG＇s requirements and requirements of relevant government departments．The＂Planning and Engineering Study for Re－planning of Tseung Kwan O Area 137＂is in progress and technical assessments on the preliminary land use options are being carried out．Public consultation would be conducted in a timely manner．

[^0]
## Departmental Consultation

10.3 The rezoning proposal has been circulated to the following bureaux/departments for comment. No objection or adverse comments have been received and their comments have been incorporated into the proposed amendments to the OZP as appropriate.
(a) Secretary for Development;
(b) Secretary for Food and Health;
(c) Secretary for Education;
(d) Secretary for Financial Services and the Treasury;
(e) Secretary for Transport and Housing;
(f) District Lands Officer/Sai Kung, Lands Department;
(g) Chief Estate Surveyor/Railway Development, Lands Department;
(h) Project Manager (East), Civil Engineering and Development Department;
(i) Head of Geotechnical Engineering Office, Civil Engineering and Development Department;
(j) Project Team Leader/Housing, Civil Engineering and Development Department;
(k) Chief Architect/Central Management Division 2, Architectural Services Department;
(1) Director of Environmental Protection;
(m) Director of Housing;
(n) District Officer (Sai Kung), Home Affairs Department;
(o) Government Economist, Financial Secretary's Office;
(p) Commissioner for Transport;
(q) Chief Highway Engineer/New Territories East, Highway Department;
(r) Chief Engineer/Railway Development 2-2, Railway Development Office, Highways Department;
(s) Chief Engineer/Construction, Water Supplies Department;
(t) Chief Engineer/Mainland South, Drainage Services Department;
(u) Chief Building Surveyor/New Territories East (2) and Rail, Buildings Department;
(v) Director of Agriculture, Fisheries and Conservation;
(w) Director of Food and Environmental Hygiene;
(x) Director of Fire Services;
(y) Director of Leisure and Cultural Services;
(z) Executive Secretary (Antiquities \& Monuments), Antiquities and Monuments Office;
(aa) Director of Electrical and Mechanical Services;
(bb)Director of Social Welfare; and
(cc) Chief Town Planner/Urban Design and Landscape, Planning Department.

## Public Consultation

10.4 If the proposed amendments are agreed by the Committee, the draft OZP (to be renumbered to S/TKO/27 upon exhibition) and its Notes will be exhibited under section 5 of the Ordinance for public inspection. Members of the public can submit representations on the OZP to the Board during the two-month statutory public inspection period.

## 11. Decision Sought

Members are invited to:
(a) agree to the proposed amendments to the approved Tseung Kwan O OZP No. S/TKO/26 and that the draft Tseung Kwan O OZP No. S/TKO/26A at Attachment II (to be renumbered as S/TKO/27 upon exhibition) and its Notes at Attachment III are suitable for public exhibition under section 5 of the Ordinance; and
(b) adopt the revised ES at Attachment IV for the draft Tseung Kwan O OZP No. S/TKO/26A (to be renumbered as $\mathrm{S} / \mathrm{TKO} / 27$ ) as an expression of the planning intention and objectives of the Board for various land use zonings of the OZP and the revised ES will be published together with the OZP.
12. Attachments

| Attachment I | Approved Tseung Kwan O OZP No. S/TKO/26 <br> (reduced scale) |
| :--- | :--- |
| Attachment II | Draft Tseung Kwan O OZP No. S/TKO/26A <br> Revised Notes of Draft Tseung Kwan O OZP No. <br> S/TKO/26A |
| Attachment III | Revised Explanatory Statement of Draft Tseung Kwan O <br> OZP No. S/TKO/26A |
| Attachment IV | Conceptual Scheme Drawings of the Proposed Residential <br> Development at PSKVB |
| Attachment Va to Vb |  |
| Attachment VIa to VIg | Photomontages of the Proposed Residential Development at <br> PSKVB |
| Attachment VII | Rezoning Report submitted by MTRCL for the Proposed <br> Residential Development at PSKVB <br> Provision of Major Community Facilities and Open Space in <br> Tseung Kwan O |
| Attachment VIII | Location Plan of the Proposed Amendment Items <br> Proposed Amendments to the Approved TKO OZP No. |
| Plan 2 | S/TKO/26 <br> Site Plan |
| Plan 3 | Aerial Photo <br> Plan 4 |
| Plans 5a to 5b | Site Photos |




## APPROVED DRAFT TSEUNG KWAN O OUTLINE ZONING PLAN NO. S/TKO/26A

(Being an Approved Plan $\boldsymbol{a}$ Draft Plan for the Purposes of the Town Planning Ordinance)

## NOTES

(N.B. These form part of the Plan)

These Notes show the uses or developments on land falling within the boundaries of the Plan which are always permitted and which may be permitted by the Town Planning Board, with or without conditions, on application. Where permission from the Town Planning Board for a use or development is required, the application for such permission should be made in a prescribed form. The application shall be addressed to the Secretary of the Town Planning Board, from whom the prescribed application form may be obtained.
2) Any use or development which is always permitted or may be permitted in accordance with these Notes must also conform to any other relevant legislation, the conditions of the Government lease concerned, and any other Government requirements, as may be applicable.
(a) No action is required to make the existing use of any land or building conform to this Plan until there is a material change of use or the building is redeveloped.
(b) Any material change of use or any other development (except minor alteration and/or modification to the development of the land or building in respect of the existing use which is always permitted) or redevelopment must be always permitted in terms of the Plan or, if permission is required, in accordance with the permission granted by the Town Planning Board.
(c) For the purposes of subparagraph (a) above, "existing use of any land or building" means -
(i) before the publication in the Gazette of the notice of the first statutory plan covering the land or building (hereafter referred as 'the first plan'),

- a use in existence before the publication of the first plan which has continued since it came into existence; or
- a use or a change of use approved under the Buildings Ordinance which relates to an existing building; and
(ii) after the publication of the first plan,
- a use permitted under a plan which was effected during the effective period of that plan and has continued since it was effected; or
- a use or a change of use approved under the Buildings Ordinance which relates to an existing building and permitted under a plan prevailing at the time when the use or change of use was approved.

Except as otherwise specified by the Town Planning Board, when a use or material change of use is effected or a development or redevelopment is undertaken, as always permitted in terms of the Plan or in accordance with a permission granted by the Town Planning Board, all permissions granted by the Town Planning Board in respect of the site of the use or material change of use or development or redevelopment shall lapse.

Road junctions, alignments of roads and railway tracks, and boundaries between zones may be subject to minor adjustments as detailed planning proceeds.

Temporary uses (expected to be 5 years or less) of any land or building are always permitted as long as they comply with any other relevant legislation, the conditions of the Government lease concerned, and any other Government requirements, and there is no need for these to conform to the zoned use or these Notes. For temporary uses expected to be over 5 years, the uses must conform to the zoned use or these Notes.

The following uses or developments are always permitted on land falling within the boundaries of the Plan except where the uses or developments are specified in Column 2 of the Notes of individual zones:
(a) provision, maintenance or repair of plant nursery, amenity planting, open space, rain shelter, refreshment kiosk, road, bus/public light bus stop or lay-by, cycle track, taxi rank, nullah, public utility pipeline, electricity mast, lamp pole, telephone booth, telecommunications radio base station, automatic teller machine and shrine;
(b) geotechnical works, local public works, road works, sewerage works, drainage works, environmental improvement works, marine related facilities, waterworks (excluding works on service reservoir) and such other public works co-ordinated or implemented by Government; and
(c) maintenance or repair of watercourse and grave.

In any area shown as 'Road', all uses or developments except those specified in paragraph (7) above and those specified below require permission from the Town Planning Board:
toll plaza, on-street vehicle park and railway track.
Unless otherwise specified, all building, engineering and other operations incidental to and all uses directly related and ancillary to the permitted uses and developments within the same zone are always permitted and no separate planning permission is required.

In these Notes,
"existing building" means a building, including a structure, which is physically existing and is in compliance with any relevant legislation and the conditions of the Government lease concerned.
"New Territories Exempted House" means a domestic building other than a guesthouse or a hotel; or a building primarily used for habitation, other than a guesthouse or a hotel, the ground floor of which may be used as 'Shop and Services' or 'Eating Place', the building works in respect of which are exempted by a certificate of exemption under Part III of the Buildings Ordinance (Application to the New Territories) Ordinance (Cap. 121).

## Schedule of Uses

Page
Comprehensive Development Area ..... 1
Commercial/Residential ..... 4
Residential (Group A) ..... 5
Residential (Group B) ..... 89
Residential (Group C) ..... 910
Residential (Group E) ..... 412
Village Type Development ..... 1617
Government, Institution or Community ..... 1819
Open Space ..... 2021
Recreation ..... 2223
Other Specified Uses ..... 2324
Green Belt ..... 3132

Column 2
Column 1
Uses always permitted

Uses that may be permitted with or without conditions on application to the Town Planning Board

Ambulance Depot<br>Commercial Bathhouse/Massage Establishment<br>Eating Place<br>Educational Institution<br>Exhibition or Convention Hall<br>Flat<br>Government Refuse Collection Point<br>Government Use (not elsewhere specified)<br>Hospital<br>Hotel<br>House<br>Information Technology and Telecommunications Industries<br>Institutional Use (not elsewhere specified)<br>Library<br>Market<br>Off-course Betting Centre<br>Office<br>Petrol Filling Station<br>Pier<br>Place of Entertainment<br>Place of Recreation, Sports or Culture<br>Private Club<br>Public Clinic<br>Public Convenience<br>Public Transport Terminus or Station<br>Public Utility Installation<br>Public Vehicle Park (excluding container vehicle)<br>Recyclable Collection Centre<br>Religious Institution<br>Research, Design and Development Centre<br>Residential Institution<br>School<br>Shop and Services<br>Social Welfare Facility<br>Training Centre<br>Utility Installation for Private Project

## COMPREHENSIVE DEVELOPMENT AREA (cont'd)

## Planning Intention

This zone is intended for comprehensive development/redevelopment of the area for residential and/or commercial uses with the provision of open space and other supporting facilities. The zoning is to facilitate appropriate planning control over the development mix, scale, design and layout of development, taking account of various environmental, traffic, infrastructure and other constraints.

## Remarks

(a) Pursuant to section 4A(2) of the Town Planning Ordinance, and except as otherwise expressly provided that it is not required by the Town Planning Board, an applicant for permission for development on land designated "Comprehensive Development Area" shall prepare a Master Layout Plan for the approval of the Town Planning Board and include therein the following information:
(i) the area of the proposed land uses, the nature, position, dimensions, and heights of all buildings to be erected in the area;
(ii) the proposed total site area and gross floor area for various uses, total number of flats and flat size, where applicable;
(iii) the details and extent of Government, institution or community (GIC) and recreational facilities, public transport and parking facilities, and open space to be provided within the area;
(iv) the alignment, widths and levels of any roads proposed to be constructed within the area;
(v) the landscape and urban design proposals within the area;
(vi) programmes of development in detail;
(vii) an environmental assessment report to examine any possible environmental problems that may be caused to or by the proposed development during and after construction and the proposed mitigation measures to tackle them;
(viii) a drainage and sewerage impact assessment report to examine any possible drainage and sewerage problems that may be caused by the proposed development and the proposed mitigation measures to tackle them;
(ix) a traffic impact assessment report to examine any possible traffic problems that may be caused by the proposed development and the proposed mitigation measures to tackle them; and
(x) such other information as may be required by the Town Planning Board.

## COMPREHENSIVE DEVELOPMENT AREA (cont'd)

## Remarks (cont'd)

(b) The Master Layout Plan should be supported by an explanatory statement which contains an adequate explanation of the development proposal, including such information as land tenure, relevant lease conditions, existing conditions of the site, the character of the site in relation to the surrounding areas, principles of layout design, major development parameters, design population, types of GIC facilities, and recreational and open space facilities.
(c) On land designated "Comprehensive Development Area" in Area 86, no new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of a maximum domestic gross floor area of $1,612,800 \mathrm{~m}^{2}$ and a maximum non-domestic gross floor area of $40,000 \mathrm{~m}^{2}$.
(d) On land designated "Comprehensive Development Area" in Area 92, no new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of a maximum gross floor area of $15,700 \mathrm{~m}^{2}$ and a maximum building height of 6 storeys over one level of carport.
(e) In determining the maximum gross floor area for the purposes of paragraph (c) above, any floor space that is constructed or intended for use solely as car park, loading/unloading bay, plant room and caretaker's office, or caretaker's quarters and recreational facilities for the use and benefit of all the owners or occupiers of the domestic building or domestic part of the building, provided such uses and facilities are ancillary and directly related to the development or redevelopment, may be disregarded. Any floor space that is constructed or intended for use solely as public transport facilities or GIC facilities, as required by the Government, may also be disregarded.
(f) In determining the maximum gross floor area for the purposes of paragraph (d) above, any floor space that is constructed or intended for use solely as car park, loading/unloading bay, plant room and caretaker's office, or caretaker's quarters and recreational facilities for the use and benefit of all the owners or occupiers of the domestic building or domestic part of the building, provided such uses and facilities are ancillary and directly related to the development or redevelopment, may be disregarded.
(g) Based on the individual merits of a development or redevelopment proposal, minor relaxation of the gross floor area restrictions stated in paragraph (c) above and the gross floor area/building height restrictions stated in paragraph (d) above may be considered by the Town Planning Board on application under section 16 of the Town Planning Ordinance.

Column 2
Column 1
Uses always permitted

Uses that may be permitted with or without conditions on application to the Town Planning Board

Ambulance Depot
Eating Place
Educational Institution
(in a commercial building or in the
purpose-designed non-residential portion ${ }^{@}$
of an existing building only)
Exhibition or Convention Hall
Flat
Government Use (not elsewhere specified)
Hotel
House
Information Technology and
Telecommunications Industries
Library
Market
Off-course Betting Centre
Office
Place of Entertainment
Place of Recreation, Sports or Culture
Private Club
Public Clinic
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Residential Institution
School (in free-standing purpose-designed school
building, in a commercial building or in the
purpose-designed non-residential portion ${ }^{@}$
of an existing building only)
Shop and Services (not elsewhere specified)
Social Welfare Facility
Training Centre
Utility Installation for Private Project
Wholesale Trade
@ Excluding floors containing wholly or mainly car parking, loading/unloading bay and/or plant room

## Planning Intention

This zone is intended primarily for commercial and/or residential development. Commercial, residential and mixed commercial/residential uses are always permitted.

## RESIDENTIAL (GROUP A)

Column 1
Uses always permitted

## Column 2

Uses that may be permitted with or without conditions on application to the Town Planning Board

Ambulance Depot
Flat
Government Use (not elsewhere specified)
House
Library
Market
Mass Transit Railway Vent Shaft and/or Other Structure above Ground Level other than Entrances (on land designated " $R(A) 8$ " only)
Place of Recreation, Sports or Culture
Public Clinic
Public Transport Terminus or Station (excluding open-air terminus or station)
Residential Institution
School (in free-standing purpose-designed building only)
Social Welfare Facility
Utility Installation for Private Project

Commercial Bathhouse/Massage Establishment
Eating Place
Educational Institution
Exhibition or Convention Hall
Government Refuse Collection Point
Hospital
Hotel
Institutional Use (not elsewhere specified)
Mass Transit Railway Vent Shaft and/or Other Structure above Ground Level other than Entrances (except on land designated " $R(A) 8$ ")
Office
Petrol Filling Station
Place of Entertainment
Private Club
Public Convenience
Public Transport Terminus or Station (not elsewhere specified)
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Religious Institution
School (not elsewhere specified)
Shop and Services (not elsewhere specified)
Training Centre

## RESIDENTIAL (GROUP A) (cont'd)

## Column 2

Uses that may be permitted with or without conditions on application to the Town Planning Board

In addition, the following uses are always permitted (a) on the lowest three floors of a building, taken to include basements; or (b) in the purpose-designed non-residential portion of an existing building, both excluding floors containing wholly or mainly car parking, loading/unloading bays and/or plant room:

Eating Place<br>Educational Institution<br>Institutional Use (not elsewhere specified)<br>Off-course Betting Centre<br>Office<br>Place of Entertainment<br>Private Club<br>Public Convenience<br>Recyclable Collection Centre<br>School<br>Shop and Services<br>Training Centre

## RESIDENTIAL (GROUP A) (cont'd)

## Planning Intention

This zone is intended primarily for high-density residential developments. Commercial uses are always permitted on the lowest three floors of a building or in the purpose-designed nonresidential portion of an existing building.

## Remarks

(a) No new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of the maximum plot ratio, site coverage and building height specified below, or the plot ratio, site coverage and height of the existing building, whichever is the greater:

| Sub-area |  | Maximum Domestic Plot Ratio | Maximum Non- Domestic Plot Ratio | Maximum Site Coverage (excluding basement(s)) | Maximum Building Height (metres above Principal Datum) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{R}(\mathrm{A}) 1$ |  | 5.5 | 0.5 | - | 138 |
| $\mathrm{R}(\mathrm{A}) 2$ |  | 5 | 0.5 | 50\% | 100 |
| $\mathrm{R}(\mathrm{A}) 3$ |  | 4 | 0.5 | 50\% | 100 |
| R(A)4 | Area (a) | 3 | 0.5 | 50\% | 65 |
|  | Area (b) | 3 | 0.5 | 50\% | 35 |
| $\mathrm{R}(\mathrm{A}) 5$ |  | 3 | 0.5 | 50\% | 65 |
| R(A)6 | Area (a) | 2 | 0.5 | 50\% | 50 |
|  | Area (b) | 2 | 0.5 | 50\% | 35 |
|  | Area (c) | 2 | 0.5 | 50\% | 60 |

(b) On land designated " $\mathrm{R}(\mathrm{A}) 7$ ", no new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of a maximum plot ratio of 6.5 and a maximum building height in terms of metres above Principal Datum as stipulated on the Plan, or the plot ratio and height of the existing building, whichever is the greater.
(c) On land designated " $R(A) 8$ ", no new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of a maximum plot ratio of 6 and a maximum building height in terms of metres above Principal Datum as stipulated on the Plan, or the plot ratio and height of the existing building, whichever is the greater.

# RESIDENTIAL (GROUP A) (cont'd) 

Remarks (cont'd)
(e)(d) On land designated " $R(A) 3$ " in Area 65 , a public open space of not less than $4,600 \mathrm{~m}^{2}$ shall be provided in the southern portion and at the street level.
(d)(e) In determining the maximum plot ratio for the purposes of paragraphs (a) and (b) to (c) above, any floor space that is constructed or intended for use solely as car park, loading/unloading bay, plant room and caretaker's office, or caretaker's quarters and recreational facilities for the use and benefit of all the owners or occupiers of the domestic building or domestic part of the building, provided such uses and facilities are ancillary and directly related to the development or redevelopment, may be disregarded.
(f) In determining the maximum plot ratio for the purpose of paragraph (c) above, any floor space that is constructed or intended for use solely as railway facilities, as required by the Government, may be disregarded.
(e)(g) In determining the maximum site coverage for the purposes of paragraph (a) above, any floor space that is constructed or intended for use solely as car park, loading/unloading bay, plant room and caretaker's office, or caretaker's quarters and recreational facilities for the use and benefit of all the owners or occupiers of the domestic building or domestic part of the building, shall be included for calculation.
$(\ddagger)(\boldsymbol{h})$ Based on the individual merits of a development or redevelopment proposal, minor relaxation of the plot ratio/site coverage/building height restrictions stated in paragraphs (a) and (b) to (c) above and minor adjustment to the boundaries of Areas (a)/(b) of "R(A)4" and/or Areas (a)/(b)/(c) of "R(A)6" as shown on the Plan may be considered by the Town Planning Board on application under section 16 of the Town Planning Ordinance.

## RESIDENTIAL (GROUP B)

## Column 1

Uses always permitted

Column 2
Uses that may be permitted with or without conditions on application to the Town Planning Board

Flat
Government Use (Police Reporting Centre, Post Office only)
House
Library
Residential Institution
School (in free-standing purposedesigned building only)
Utility Installation for Private Project

Ambulance Depot
Eating Place
Educational Institution
Government Refuse Collection Point
Government Use (not elsewhere specified)
Hospital
Hotel
Institutional Use (not elsewhere specified)
Market
Off-course Betting Centre
Office
Petrol Filling Station
Place of Entertainment
Place of Recreation, Sports or Culture
Private Club
Public Clinic
Public Convenience
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Recyclable Collection Centre
Religious Institution
School (not elsewhere specified)
Shop and Services
Social Welfare Facility
Training Centre

Planning Intention
This zone is intended primarily for medium-density residential developments where commercial uses serving the residential neighbourhood may be permitted on application to the Town Planning Board.

## RESIDENTIAL (GROUP C)

Column 2
Column 1
Uses always permitted

Uses that may be permitted with or without conditions on application to the Town Planning Board

Flat
Government Use (Police Reporting Centre, Post Office only)
House
Utility Installation for Private Project

Ambulance Depot<br>Eating Place<br>Educational Institution<br>Government Refuse Collection Point<br>Government Use (not elsewhere specified)<br>Hospital<br>Hotel<br>Institutional Use (not elsewhere specified)<br>Library<br>Petrol Filling Station<br>Place of Recreation, Sports or Culture<br>Private Club<br>Public Clinic<br>Public Convenience<br>Public Transport Terminus or Station<br>Public Utility Installation<br>Public Vehicle Park (excluding container vehicle)<br>Recyclable Collection Centre<br>Religious Institution<br>Residential Institution<br>School<br>Shop and Services<br>Social Welfare Facility<br>Training Centre

## Planning Intention

This zone is intended primarily for low-rise, low-density residential developments where commercial uses serving the residential neighbourhood may be permitted on application to the Town Planning Board.

## RESIDENTIAL (GROUP C) (cont'd)

## Remarks

(a) No new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of the maximum plot ratio, site coverage and building height specified below, or the plot ratio, site coverage and height of the existing building, whichever is the greater:

| Sub-area | Maximum <br> Plot Ratio | Maximum <br> Site Coverage | Maximum <br> Building Height |
| :---: | :---: | :---: | :---: | :---: |
| R(C)1 | 0.6 | $30 \%$ | 2 storeys over one <br> level of carport |

(b) In determining the maximum plot ratio and site coverage for the purposes of paragraph (a) above, any floor space that is constructed or intended for use solely as car park, loading/unloading bay, plant room and caretaker's office, or caretaker's quarters and recreational facilities for the use and benefit of all the owners or occupiers of the domestic building or domestic part of the building, provided such uses and facilities are ancillary and directly related to the development or redevelopment, may be disregarded.
(c) Based on the individual merits of a development or redevelopment proposal, minor relaxation of the plot ratio/site coverage/building height restrictions stated in paragraph (a) above may be considered by the Town Planning Board on application under section 16 of the Town Planning Ordinance.

## RESIDENTIAL (GROUP E)

## Column 2

Column 1
Uses always permitted

Uses that may be permitted with or without conditions on application to the Town Planning Board

## Schedule I : for open-air development or for building other than industrial or industrial-office building ${ }^{@}$

Ambulance Depot
Government Use (not elsewhere specified)
Public Transport Terminus or Station
(excluding open-air terminus or station)
Utility Installation for Private Project

Commercial Bathhouse/Massage Establishment
Eating Place
Educational Institution
Exhibition or Convention Hall
Flat
Government Refuse Collection Point
Hospital
Hotel
House
Institutional Use (not elsewhere specified)
Library
Market
Office
Petrol Filling Station
Place of Entertainment
Place of Recreation, Sports or Culture
Private Club
Public Clinic
Public Convenience
Public Transport Terminus or Station (not elsewhere specified)
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Religious Institution
Residential Institution
School
Shop and Services
Social Welfare Facility
Training Centre
(Please see next page)

## RESIDENTIAL (GROUP E) (cont'd)

## Column 2

Uses that may be permitted with or without conditions on application to the Town Planning Board

In addition, the following uses are always permitted (a) on the lowest three floors of a building, taken to include basements; or (b) in the purpose-designed non-residential portion of an existing building, both excluding floors containing wholly or mainly car parking, loading/unloading bays and/or plant room:

## Eating Place

Educational Institution
Institutional Use (not elsewhere specified)
Library
Off-course Betting Centre
Office
Place of Entertainment
Place of Recreation, Sports or Culture
Private Club
Public Clinic
Public Convenience
Recyclable Collection Centre
School
Shop and Services
Social Welfare Facility
Training Centre

## Column 1

Uses always permitted

## Column 2

Uses that may be permitted with or without conditions on application to the Town Planning Board

Schedule II : for existing industrial or industrial-office building ${ }^{\text {@ }}$

Ambulance Depot
Art Studio (excluding those involving direct provision of services or goods)
Cargo Handling and Forwarding Facility (not elsewhere specified)
Eating Place (Canteen only)
Government Refuse Collection Point
Government Use (not elsewhere specified)
Information Technology and Telecommunications Industries
Non-polluting Industrial Use (excluding industrial undertakings involving the use/storage of Dangerous Goods ${ }^{\Delta}$ )
Office (Audio-visual Recording Studio, Design and Media Production, Office Related to Industrial Use only)
Public Convenience
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Radar, Telecommunications Electronic Microwave Repeater, Television and/or Radio Transmitter Installation
Recyclable Collection Centre
Research, Design and Development Centre
Shop and Services (Motor Vehicle Showroom on ground floor, Service Trades only)
Utility Installation for Private Project
Warehouse (excluding Dangerous Goods Godown)

Cargo Handling and Forwarding Facility
(Container Freight Station, free-standing
purpose-designed Logistics Centre only)
Industrial Use (not elsewhere specified)
Off-course Betting Centre
Office (not elsewhere specified)
Petrol Filling Station
Place of Recreation, Sports or Culture (not elsewhere specified)
Private Club
Shop and Services (not elsewhere specified)
(ground floor only except Ancillary
Showroom ${ }^{\#}$ which may be permitted on any floor)
Vehicle Repair Workshop
Wholesale Trade

## Column 1

Uses always permitted

## Column 2

Uses that may be permitted with or without conditions on application to the Town Planning Board

In addition, the following uses are always permitted in the purpose-designed nonindustrial portion on the lower floors (except basements and floors containing wholly or mainly car parking, loading/unloading bays and/or plant room) of an existing building, provided that the uses are separated from the industrial uses located above by a buffer floor or floors and no industrial uses are located within the non-industrial portion:

In addition, the following use may be permitted with or without conditions on application to the Town Planning Board in the purpose-designed non-industrial portion on the lower floors (except basements and floors containing wholly or mainly car parking, loading/unloading bays and/or plant room) of an existing building, provided that the use is separated from the industrial uses located above by a buffer floor or floors and no industrial uses are located within the non-industrial portion:

Eating Place
Educational Institution
Exhibition or Convention Hall
Institutional Use (not elsewhere specified)
Library
Off-course Betting Centre
Office
Place of Entertainment
Place of Recreation, Sports or Culture
Private Club
Public Clinic
Religious Institution
School (excluding kindergarten)
Shop and Services
Training Centre

Social Welfare Facility (excluding those
involving residential care)
${ }^{@}$ An industrial or industrial-office building means a building which is constructed for or intended to be used by industrial or industrial-office purpose respectively as approved by the Building Authority.
${ }^{\triangle}$ Dangerous Goods refer to substances classified as Dangerous Goods and requiring a licence for their use/storage under the Dangerous Goods Ordinance (Cap. 295).
\# Ancillary Showroom requiring planning permission refers to showroom use of greater than $20 \%$ of the total usable floor area of an industrial firm in the same premises or building.

## RESIDENTIAL (GROUP E) (cont'd)

## Planning Intention

This zone is intended primarily for phasing out of existing industrial uses through redevelopment (or conversion) for residential use on application to the Town Planning Board. Whilst existing industrial uses will be tolerated, new industrial developments are not permitted in order to avoid perpetuation of industrial/residential interface problem.

## Remarks

(a) No new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of a maximum plot ratio of 5.0 and a maximum building height of 130 m .
(b) In determining the maximum plot ratio for the purposes of paragraph (a) above, any floor space that is constructed or intended for use solely as car park, loading/unloading bay, plant room and caretaker's office, or caretaker's quarters and recreational facilities for the use and benefit of all the owners or occupiers of the domestic building or domestic part of the building, provided such uses and facilities are ancillary and directly related to the development or redevelopment, may be disregarded. Any floor space that is constructed or intended for use solely as public vehicle park and public transport facilities, as required by the Government, may also be disregarded.
(c) Based on the individual merits of a development or redevelopment proposal, minor relaxation of the building height restriction stated in paragraph (a) above may be considered by Town Planning Board on application under section 16 of the Town Planning Ordinance.

## VILLAGE TYPE DEVELOPMENT

Column 2
Uses that may be permitted with or without conditions on application to the Town Planning Board

Agricultural Use
Government Use (Police Reporting Centre, Post Office only)
House (New Territories Exempted House only)
On-Farm Domestic Structure
Religious Institution (Ancestral Hall only)
Rural Committee/Village Office

Eating Place<br>Government Refuse Collection Point<br>Government Use (not elsewhere specified)\#<br>House (not elsewhere specified)<br>Institutional Use (not elsewhere specified)\#<br>Market<br>Petrol Filling Station<br>Place of Recreation, Sports or Culture<br>Public Clinic<br>Public Convenience<br>Public Transport Terminus or Station<br>Public Utility Installation\#<br>Public Vehicle Park (excluding container<br>vehicle)<br>Religious Institution (not elsewhere specified)\#<br>Residential Institution\#<br>School\#<br>Shop and Services<br>Social Welfare Facility\#<br>Utility Installation for Private Project

In addition, the following uses are always permitted on the ground floor of a New Territories Exempted House:

Eating Place
Library
School
Shop and Services

## VILLAGE TYPE DEVELOPMENT (cont'd)

## Planning Intention

The planning intention of this zone is to reflect existing recognized and other villages, and to provide land considered suitable for village expansion and reprovisioning of village houses affected by Government projects. Land within this zone is primarily intended for development of Small Houses by indigenous villagers. It is also intended to concentrate village type development within this zone for a more orderly development pattern, efficient use of land and provision of infrastructures and services. Selected commercial and community uses serving the needs of the villagers and in support of the village development are always permitted on the ground floor of a New Territories Exempted House. Other commercial, community and recreational uses may be permitted on application to the Town Planning Board.

## Remarks

(a) No new development, or addition, alteration and/or modification to or redevelopment of an existing building (except development or redevelopment to those annotated with \#) shall result in a total development and/or redevelopment in excess of a maximum building height of 3 storeys $(8.23 \mathrm{~m})$ or the height of the existing building, whichever is the greater.
(b) Based on the individual merits of a development or redevelopment proposal, minor relaxation of the building height restriction stated in paragraph (a) above may be considered by the Town Planning Board on application under section 16 of the Town Planning Ordinance.

Column 2
Uses that may be permitted with or without conditions on application to the Town Planning Board

Ambulance Depot
Animal Quarantine Centre (in Government building only)
Broadcasting, Television and/or Film Studio
Cable Car Route and Terminal Building
Eating Place (Canteen,
Cooked Food Centre only)
Educational Institution
Exhibition or Convention Hall
Field Study/Education/Visitor Centre
Government Refuse Collection Point
Government Use (not elsewhere specified)
Hospital
Information Technology and
Telecommunications Industries (within "G/IC(9)" only)
Institutional Use (not elsewhere specified)
Library
Market
Pier
Place of Recreation, Sports or Culture
Public Clinic
Public Convenience
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Recyclable Collection Centre
Religious Institution
Research, Design and Development Centre
Rural Committee/Village Office
School
Service Reservoir
Social Welfare Facility
Training Centre
Wholesale Trade

Animal Boarding Establishment
Animal Quarantine Centre (not elsewhere specified)
Columbarium
Correctional Institution
Crematorium
Driving School
Eating Place (not elsewhere specified)
Flat
Funeral Facility
Holiday Camp
Hotel
House
Marine Fuelling Station
Off-course Betting Centre
Office
Petrol Filling Station
Place of Entertainment
Private Club
Radar, Telecommunications Electronic
Microwave Repeater, Television
and/or Radio Transmitter Installation
Refuse Disposal Installation (Refuse Transfer Station only)
Residential Institution
Sewage Treatment/Screening Plant
Shop and Services (not elsewhere specified)
Utility Installation for Private Project
Zoo

## GOVERNMENT, INSTITUTION OR COMMUNITY (cont'd)

## Planning Intention

This zone is intended primarily for the provision of Government, institution or community facilities serving the needs of the local residents and/or a wider district, region or the territory. It is also intended to provide land for uses directly related to or in support of the work of the Government, organizations providing social services to meet community needs, and other institutional establishments.

## Remarks

(a) No new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of the maximum building height specified below, or the height of the existing building, whichever is the greater:

| Sub-area |  | Maximum Building Height |
| :---: | :---: | :---: |
| G/IC(1) |  | 75 m |
| G/IC(2) |  | 55 m |
| G/IC(3) |  | 45m |
| G/IC(4) |  | 40m |
| G/IC(5) |  | 10 m |
| G/IC(6) |  | 5 m |
| G/IC(7) | Area (a) | 100 mPD , except a fire services rescue training tower up to 114 mPD |
|  | Area (b) | 120 mPD |
| G/IC(8) |  | 106 mPD |
| G/IC(9) |  | 60 mPD , except a communications tower up to 76 mPD |

(b) Based on the individual merits of a development or redevelopment proposal, minor relaxation of the building height restriction stated in paragraph (a) above may be considered by the Town Planning Board on application under section 16 of the Town Planning Ordinance.

Column 2
Column 1
Uses always permitted

Uses that may be permitted with or
without conditions on application to the Town Planning Board

Aviary
Barbecue Spot
Field Study/Education/Visitor Centre
Library (within "O(1)" only)
Park and Garden
Pavilion
Pedestrian Area
Place of Recreation, Sports or Culture (within " $O(1)$ " only)
Picnic Area
Playground/Playing Field
Promenade
Public Convenience
Sitting Out Area
Zoo

Cable Car Route and Terminal Building Eating Place
Government Refuse Collection Point
Government Use (not elsewhere specified)
Holiday Camp
Pier
Place of Entertainment
Place of Recreation, Sports or Culture (not elsewhere specified)
Private Club
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Religious Institution
Service Reservoir
Shop and Services
Tent Camping Ground
Utility Installation for Private Project

## Planning Intention

This zone is intended primarily for the provision of outdoor open-air public space for active and/or passive recreational uses serving the needs of local residents as well as the general public.

## OPEN SPACE (2)

Column 2
Column 1
Uses always permitted

Uses that may be permitted with or without conditions on application to the Town Planning Board

Aviary
Barbecue Spot
Field Study/Education/Visitor Centre
Landfill
Park and Garden
Pavilion
Pedestrian Area
Picnic Area
Playground/Playing Field
Promenade
Public Convenience
Sitting Out Area
Zoo

Cable Car Route and Terminal Building
Eating Place
Government Refuse Collection Point
Government Use (not elsewhere specified)
Holiday Camp
Place of Entertainment
Place of Recreation, Sports or Culture
Private Club
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Religious Institution
Service Reservoir
Shop and Services
Tent Camping Ground
Utility Installation for Private Project

## Planning Intention

This zone is intended primarily for the provision of outdoor open-air public space for active and/or passive recreational uses serving the needs of local residents as well as the general public after the decommissioning and restoration of the landfill site, while permitting landfill use in the interim.

## RECREATION

Column 1<br>Uses always permitted

Column 2
Uses that may be permitted with or without conditions on application to the Town Planning Board

Agricultural Use
Field Study/Education/Visitor Centre
Government Use (Police Reporting Centre only)
Holiday Camp
Picnic Area
Place of Recreation, Sports or Culture
Public Convenience
Tent Camping Ground

Animal Boarding Establishment<br>Broadcasting, Television and/or Film Studio<br>Eating Place<br>Golf Course<br>Government Refuse Collection Point<br>Government Use (not elsewhere specified)<br>Marina<br>Pier<br>Place of Entertainment<br>Private Club<br>Public Utility Installation<br>Public Vehicle Park (excluding container vehicle)<br>Residential Institution<br>Shop and Services<br>Theme Park<br>Utility Installation for Private Project<br>Zoo

## Planning Intention

This zone is intended primarily for recreational developments for the use of the general public. It encourages the development of active and/or passive recreation and tourism/eco-tourism. Uses in support of the recreational developments may be permitted on application to the Town Planning Board.

## Remarks

(a) No new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of a maximum plot ratio of 0.1 and a maximum building height of 1 storey, or the plot ratio and height of the existing building, whichever is the greater.
(b) Based on the individual merits of a development or redevelopment proposal, minor relaxation of the plot ratio/building height restrictions stated in paragraph (a) above may be considered by the Town Planning Board on application under section 16 of the Town Planning Ordinance.

## OTHER SPECIFIED USES

## Column 2

## Column 1

Uses always permitted

Uses that may be permitted with or without conditions on application to the Town Planning Board

## For "Commercial Development with Public Transport Interchange" Only

Ambulance Depot
Commercial Bathhouse/Massage
Establishment
Eating Place
Educational Institution
Exhibition or Convention Hall
Government Use (not elsewhere specified)
Hotel
Information Technology and
Telecommunications Industries
Institutional Use (not elsewhere specified)
Library
Off-course Betting Centre
Office
Place of Entertainment
Place of Recreation, Sports or Culture
Private Club
Public Clinic
Public Convenience
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Recyclable Collection Centre
Religious Institution
School
Shop and Services
Social Welfare Facility
Training Centre
Utility Installation for Private Project
Wholesale Trade

Broadcasting, Television and/or Film Studio Flat
Government Refuse Collection Point Hospital
Petrol Filling Station
Residential Institution

## Planning Intention

This zone is intended primarily for commercial developments, which may include uses such as office, shop and services, place of entertainment, eating place and hotel, with public transport interchange facilities serving as a major employment node and a commercial, retail and entertainment centre for the New Town as well as for Sai Kung hinterland.

## Column 1

Uses always permitted

Column 2
Uses that may be permitted with or without conditions on application to the Town Planning Board

## For "Commercial/Residential Development with Public Transport Interchange" Only

Ambulance Depot
Eating Place
Educational Institution
(in a commercial building or in the
purpose-designed non-residential portion ${ }^{\circledR}$
of an existing building only)
Exhibition or Convention Hall
Flat
Government Use (not elsewhere specified)
Hotel
House
Information Technology and
Telecommunications Industries
Library
Market
Off-course Betting Centre
Office
Place of Entertainment
Place of Recreation, Sports or Culture
Private Club
Public Clinic
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Residential Institution
School (in free-standing purpose-designed school building, in a commercial building or in the purpose-designed non-residential portion ${ }^{@}$ of an existing building only)
Shop and Services (not elsewhere specified)
Social Welfare Facility
Training Centre
Utility Installation for Private Project
Wholesale Trade

Broadcasting, Television and/or Film Studio
Commercial Bathhouse/Massage Establishment
Educational Institution (not elsewhere specified)
Government Refuse Collection Point
Hospital
Institutional Use (not elsewhere specified)
Petrol Filling Station
Public Convenience
Recyclable Collection Centre
Religious Institution
School (not elsewhere specified)
Shop and Services (Motor Vehicle Showroom only)
@ Excluding floors containing wholly or mainly car parking, loading/unloading bay and/or plant room

## OTHER SPECIFIED USES (cont'd)

$\underline{\text { For "Commercial/Residential Development with Public Transport Interchange" Only (cont'd) }}$

## Planning Intention

This zone is intended primarily for commercial and/or residential development with public transport interchange facilities. Commercial, residential and mixed commercial/residential uses are always permitted.

## OTHER SPECIFIED USES (cont'd)

## Column 1

Uses always permitted

Column 2
Uses that may be permitted with or without conditions on application to the Town Planning Board

## For "Sports and Recreation Club" Only

Place of Recreation, Sports or Culture Private Club

Eating Place<br>Government Refuse Collection Point<br>Government Use (not elsewhere specified)<br>Public Vehicle Park (excluding container vehicle)<br>Shop and Services<br>Social Welfare Facility<br>Utility Installation for Private Project

## Planning Intention

This zone is intended primarily to reserve land for water sports and recreation facilities.

## Remarks

(a) No new development, or addition, alteration and/or modification to or redevelopment of an existing building shall result in a total development and/or redevelopment in excess of a maximum plot ratio of 0.5 , a maximum site coverage of $50 \%$ and a maximum building height of 1 storey, or the plot ratio, site coverage and height of the existing building, whichever is the greater.
(b) Based on the individual merits of a development or redevelopment proposal, minor relaxation of the plot ratio/site coverage/building height restrictions stated in paragraph (a) above may be considered by the Town Planning Board on application under section 16 of the Town Planning Ordinance.

> (Please see next page)

Column 2
Column 1
Uses always permitted

Uses that may be permitted with or without conditions on application to the Town Planning Board

## For "Industrial Estate" Only

Ambulance Depot
Broadcasting, Television and/or Film Studio
Cargo Handling and Forwarding Facility
Dangerous Goods Godown
Eating Place
Gas Works
Government Refuse Collection Point
Government Use (not elsewhere specified)
Industrial Use
Information Technology and
Telecommunications Industries
Marine Fuelling Station
Office
Petrol Filling Station
Pier
Private Club
Public Convenience
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Radar, Telecommunications Electronic
Microwave Repeater, Television and/or Radio
Transmitter Installation
Refuse Disposal Installation
Research, Design and Development Centre
Shop and Services
Social Welfare Facility (excluding those
involving residential care)
Training Centre
Utility Installation for Private Project
Warehouse (excluding Dangerous Goods
Godown)
Wholesale Trade

Electric Power Station
Off-course Betting Centre
Offensive Trades
Oil Depot, Oil Refinery and Petro-chemical Plant
Place of Recreation, Sports or Culture
Service Industries (not elsewhere specified)

## Planning Intention

This zone is intended primarily to provide/reserve land for the development of an industrial estate for industries to be admitted by the Hong Kong Science and Technology Parks Corporation according to the criteria set by the Corporation. Industries to be included would normally not be accommodated in conventional industrial buildings because of their specific requirements.

Column 2

## Column 1

Uses always permitted

Uses that may be permitted with or without conditions on application to the Town Planning Board

## For "Deep Waterfront Industry" Only

Ambulance Depot
Cargo Handling and Forwarding Facility
Eating Place (Canteen, Cooked Food Centre only)
Government Refuse Collection Point
Government Use (not elsewhere specified)
Industrial Use (Motor-vehicle Assembly Plant, Paint Manufacturing, Service Trades, Steel Works only)
Information Technology and
Telecommunications Industries
Marine Fuelling Station
Open Storage of Construction Materials
Open Storage of Cement/Sand
Petrol Filling Station
Pier
Public Convenience
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Recyclable Collection Centre
Research, Design and Development Centre
Refuse Disposal Installation
Ship-building, Ship-breaking and Ship-repairing Yard
Utility Installation for Private Project
Warehouse (excluding Dangerous Goods
Godown)

Asphalt Plant/Concrete Batching Plant
Container Storage/Repair Yard
Container Vehicle Park/Container Vehicle Repair Yard
Dangerous Goods Godown
Eating Place (not elsewhere specified)
Electric Power Station
Gas Works
Industrial Use (not elsewhere specified)
Off-course Betting Centre
Office
Oil Depot, Oil Refinery and Petro-chemical Plant
Place of Recreation, Sports or Culture
Private Club
Shop and Services
Social Welfare Facility
Training Centre
Wholesale Trade

## Planning Intention

This zone is intended primarily for special industries which require marine access, access to deep water berths or water frontage. Industries to be accommodated within this zone are usually capital intensive, land-intensive and cannot be accommodated in conventional industrial buildings.

## Column 1

Uses always permitted

Column 2
Uses that may be permitted with or without conditions on application to the Town Planning Board

## For "Desalination Plant" Only

Desalination Plant
Government Use
Pier
Utility Installation not ancillary to the Specified Use

## Planning Intention

This zone is intended primarily for the development of a desalination plant to provide fresh water serving the needs of the community.

> For "Cemetery" Only

Columbarium
Crematorium
Funeral Facility
Government Use (not elsewhere specified)
Grave
Public Convenience

Place of Recreation, Sports or Culture
Public Transport Terminus or Station
Public Utility Installation
Religious Institution
Shop and Services (Retail Shop only)
Utility Installation for Private Project

## Planning Intention

This zone is intended primarily for the provision of land for cemetery use serving the needs of the community.

|  | For "Petrol Filling Station" Only |
| :--- | :--- |
| Petrol Filling Station | Government Use |
|  | Public Utility Installation |
| Workshop (Vehicle Repair Workshop only) |  |

## Planning Intention

This zone is intended primarily for the provision of petrol filling station serving the needs of the community.

## OTHER SPECIFIED USES

Column 2

## Column 1

Uses always permitted

Uses that may be permitted with or without conditions on application to the Town Planning Board

> For "Pier" Only

Government Use
Pier

Eating Place
Marine Fuelling Station
Shop and Services
Utility Installation for Private Project

## Planning Intention

This zone is primarily intended for the provision of pier for recreation and pleasure vessels and tourism to serve the needs of the community and to enhance the recreation and tourism potential of the area.

## Remarks

Kiosks not greater than $10 \mathrm{~m}^{2}$ each in area and not more than 10 in number for uses as shop and services are considered as ancillary to "pier" use.

## For "Ventilation Building" only

Ventilation Building

Government Use
Utility Installation not ancillary to the Specified Use

## Planning Intention

This zone is intended primarily for the development of ventilation building.

For All Other Sites (Not Listed Above)
As Specified on the Plan
Government Use
Utility Installation not ancillary to the Specified Use

## Planning Intention

These zones are intended primarily to provide land for the specified use serving the specific needs of the community.

## GREEN BELT

## Column 2

Uses that may be permitted with or without conditions on application to the Town Planning Board

Agricultural Use
Barbecue Spot
Government Use (Police Reporting Centre only)
Nature Reserve
Nature Trail
On-Farm Domestic Structure
Picnic Area
Public Convenience
Tent Camping Ground
Wild Animals Protection Area

Animal Boarding Establishment
Broadcasting, Television and/or Film Studio
Cable Car Route and Terminal Building
Columbarium (within a Religious Institution or extension of existing Columbarium only)
Crematorium (within a Religious Institution or extension of existing Crematorium only)
Field Study/Education/Visitor Centre
Flat
Government Refuse Collection Point
Government Use (not elsewhere specified)
Helicopter Landing Pad
Holiday Camp
House
Marine Fuelling Station
Petrol Filling Station
Pier
Place of Recreation, Sports or Culture
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Radar, Telecommunications Electronic
Microwave Repeater, Television
and/or Radio Transmitter Installation
Religious Institution
Residential Institution
Rural Committee/Village Office
School
Service Reservoir
Social Welfare Facility
Utility Installation for Private Project
Zoo

## Planning Intention

The planning intention of this zone is primarily for defining the limits of urban and sub-urban development areas by natural features and to contain urban sprawl as well as to provide passive recreational outlets. There is a general presumption against development within this zone.

## EXPLANATORY STATEMENT

## APPROVED DRAFT TSEUNG KWAN O OUTLINE ZONING PLAN NO. S/TKO/26A

CONTENTS ..... Page

1. INTRODUCTION ..... 1
2. AUTHORITY FOR THE PLAN AND PROCEDURE ..... 1
3. OBJECT OF THE PLAN ..... 4
4. NOTES OF THE PLAN ..... 4
5. THE PLANNING SCHEME AREA ..... 45
6. POPULATION ..... 5
7 URBAN DESIGN FRAMEWORK ..... 5
7. LAND USE ZONINGS
8.1 Comprehensive Development Area ..... 7
8.2 Commercial/Residential ..... 78
8.3 Residential (Group A) ..... 8
8.4 Residential (Group B) ..... 412
8.5 Residential (Group C) ..... 12
8.6 Residential (Group E) ..... 1213
8.7 Village Type Development ..... 1314
8.8 Government, Institution or Community ..... 1415
8.9 Open Space ..... 1718
8.10 Recreation ..... 1819
8.11 Other Specified Uses ..... 1920
8.12 Green Belt ..... 2021
8. COMMUNICATIONS ..... 2021
9. UTILITY SERVICES ..... 2223
10. CULTURAL HERITAGE ..... 2324
11. IMPLEMENTATION ..... 24
(Being an Approved a Draft Plan for the Purposes of the Town Planning Ordinance)

## EXPLANATORY STATEMENT

Note: For the purposes of the Town Planning Ordinance, this Statement shall not be deemed to constitute a part of the Plan.

## 1. INTRODUCTION

This Explanatory Statement is intended to assist an understanding of the approved draft Tseung Kwan O Outline Zoning Plan (OZP) No. S/TKO/26A. It reflects the planning intention and objectives of the Town Planning Board (the Board) for various land-use zonings of the Plan.

## 2. AUTHORITY FOR THE PLAN AND PROCEDURE

2.1 On 11 December 1992, the draft Tseung Kwan O OZP No. S/TKO/1, the first statutory plan covering the Tseung Kwan O area, was gazetted under section 5 of the Town Planning Ordinance (the Ordinance). The OZP was subsequently amended twice.
2.2 On 16 July 1996, the then Governor in Council, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as S/TKO/4. On 4 November 1997, the Chief Executive in Council (CE in C) referred the approved OZP No. S/TKO/4 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. The OZP was subsequently amended and exhibited for public inspection under section 5 of the Ordinance.
2.3 On 9 February 1999, the CE in C, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as S/TKO/6. On 20 July 1999, the CE in C referred the approved OZP No. S/TKO/6 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. The OZP was subsequently amended three times and exhibited for public inspection under section 7 or 12(3) of the Ordinance.
2.4 On 15 May 2001, the CE in C, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as S/TKO/10. On 25 September 2001, the CE in C referred the approved OZP No. S/TKO/10 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. The OZP was subsequently amended twice and exhibited for public inspection under section 5 or 7 of the Ordinance.
2.5 On 17 December 2002, the CE in C, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as $\mathrm{S} / \mathrm{TKO} / 13$. On 8 July 2003, the CE in C referred the approved OZP No. S/TKO/13 to the Board for amendment under section 12(1)(b)(ii) of the

Ordinance. The OZP was subsequently amended and exhibited for public inspection under section 5 of the Ordinance.
2.6 On 2 November 2004, the CE in C, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as $\mathrm{S} / \mathrm{TKO} / 15$. On 30 May 2006, the CE in C referred the approved OZP No. S/TKO/15 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. The OZP was subsequently amended and exhibited for public inspection under section 5 of the Ordinance to reflect the relevant recommendations of the Feasibility Study for Further Development of Tseung Kwan O (the Study).
2.7 On 2 June 2009, the CE in C, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as S/TKO/17. On 1 December 2009, the Secretary for Development (SDEV), under the delegated authority of the Chief Executive (CE), directed the Board under section 3(1)(a) of the Ordinance to extend the planning scheme boundary of the Tseung Kwan O OZP to cover a piece of land proposed to be excised from the Clear Water Bay Country Park (CWBCP) for the proposed South East New Territories Landfill Extension. On 2 February 2010, the CE in C referred the approved OZP No. S/TKO/17 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. The OZP was subsequently amended twice, including the exclusion of about 5 ha of CWBCP land from the planning scheme boundary of the Tseung Kwan O OZP, and was exhibited for public inspection under section 5 or 7 of the Ordinance.
2.8 On 17 April 2012, the CE in C, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as $\mathrm{S} / \mathrm{TKO} / 20$. On 29 April 2014, the CE in C referred the approved Tseung Kwan O OZP No. S/TKO/20 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. On 16 May 2014, the reference was notified in the Gazette under section 12(2) of the Ordinance.
2.9 On 27 February 2015, the draft Tseung Kwan O OZP No. S/TKO/21 incorporating amendments mainly to rezone a site in Area 85 from "Other Specified Uses" annotated "Sewage Treatment Works" to "Government, Institution or Community (9)" to facilitate a proposed data centre development was exhibited for public inspection under section 5 of the Ordinance. In addition, the road schemes of the Tseung Kwan O - Lam Tin Tunnel and the Cross Bay Link, Tseung Kwan O authorized by the CE in C under the Roads (Works, Use and Compensation) Ordinance are shown on the Plan for information.-During the exhibition period, a total of 385 representations were received. On 29 May 2015, the representations were published for three weeks for public comments and 9 comments were received. On 11 September 2015, the Board decided not to propose any amendment to the draft OZP to meet the representations under section $6(B) 8$ of the Ordinance.
2.10 On 1 December 2015, the CE in C, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as $\mathrm{S} / \mathrm{TKO} / 22$. On 11 December 2015, the approved Tseung Kwan O OZP No. S/TKO/22 was exhibited for public inspection under section $9(5)$ of the

Ordinance. On 5 April 2016, the CE in C referred the approved Tseung Kwan O OZP No. S/TKO/22 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. The reference was notified in the Gazette on 15 April 2016 under section 12(2) of the Ordinance.
2.11 On 24 June 2016, the draft Tseung Kwan O OZP No. S/TKO/23, incorporating an amendment to rezone a site in the south-eastern part of Tseung Kwan O Area 137 for desalination plant use, was exhibited for public inspection under section 5 of the Ordinance. In addition, the footbridge as described in the road scheme of the Tseung Kwan O further development infrastructure works for Tseung Kwan O Stage 1 Landfill Site as authorized by the CE in C under the Roads (Works, Use and Compensation) Ordinance is shown on the Plan for information. During the two month exhibition period, one valid representation was received. On 9 September 2016, the representation was published for three weeks for public comments and one comment was received. After giving consideration to the representation and comment on 16 December 2016, the Board decided not to propose any amendment to the draft OZP to meet the representation under section $6 \mathrm{~B}(8)$ of the Ordinance.
2.12 On 14 March 2017, the CE in C, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as S/TKO/24. On 24 March 2017, the approved Tseung Kwan O OZP No. S/TKO/24 was exhibited for public inspection under section 9(5) of the Ordinance. On 27 June 2017, the CE in C referred the approved Tseung Kwan O OZP No. S/TKO/24 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. The reference was notified in the Gazette on 7 July 2017 under section 12(2) of the Ordinance.
2.13 On 11 August 2017, the draft Tseung Kwan O OZP No. S/TKO/25, incorporating amendments to rezone five sites from "Green Belt" ("GB") to "Residential (Group A)7" ("R(A)7") to facilitate public housing development, including one in Area 114 to the north of Tseung Kwan O Village, one in Area 111 to the northwest of Ying Yip Road, one in Areas 35 and 108 to the south of Chiu Shun Road, one in Area 113 to the west of Yau Yue Wan Village and one in Area 106 to the east of Hong Kong Movie City, was exhibited for public inspection under section 5 of the Ordinance. During the exhibition period, a total of 1,020 valid representations were received. On 17 November 2017, the representations were published for three weeks for public comments and 9 valid comments were received.
2.14 After consideration of the representations and comments under section $6 \mathrm{~B}(1)$ of the Ordinance on 10 May and 21 June 2018, the Board decided to propose amendment to the draft Tseung Kwan O OZP No. S/TKO/25 by rezoning the site north of Tseung Kwan O Village from "R(A)7" to "GB". On 13 July 2018, the proposed amendment to the draft OZP was exhibited for public inspection under section $6 \mathrm{C}(2)$ of the Ordinance.-During the three-week exhibition period, a total of 365 valid further representations were received. After consideration of the further representations under section $6 \mathrm{~F}(1)$ of the Ordinance on 14 September 2018, the Board decided to amend the draft OZP by the proposed amendment under section $6 F(9)$ of the Ordinance.
2.15 On 16 October 2018, the CE in C, under section 9(1)(a) of the Ordinance, approved the draft Tseung Kwan O OZP, which was subsequently renumbered as S/TKO/26 (the Plan). On 26 October 2018, the approved Tseung Kwan O OZP No. S/TKO/26 was exhibited for public inspection under section 9(5) of the Ordinance. On 17 December 2019, the CE in C referred the approved Tseung Kwan O OZP No. S/TKO/26 to the Board for amendment under section 12(1)(b)(ii) of the Ordinance. The reference was notified in the Gazette on 27 December 2019 under section 12(2) of the Ordinance.
2.16 On XX XXX 2020, the draft Tseung Kwan O OZP No. S/TKO/27, incorporating amendments including mainly the rezoning of Pak Shing Kok Ventilation Building and its adjoining land from an area shown as 'MTR Pak Shing Kok Ventilation Building' and "GB" to "Residential (Group A)8", was exhibited for public inspection under section 5 of the Ordinance.

## 3. OBJECT OF THE PLAN

3.1 The object of the Plan is to indicate the broad land use zones and major transport networks for the Tseung Kwan O area so that development and redevelopment in the area can be subject to statutory planning control. Such control is necessary to develop Tseung Kwan O New Town into a balanced community.
3.2 The Plan is to illustrate the broad principles of development within the Planning Scheme Area. As it is a small-scale plan, the alignment of roads and the Mass Transit Railway (MTR) line as well as boundaries between the land use zones may be subject to minor alterations as detailed planning and development proceed.
3.3 Since the Plan is to show broad land use zonings, there would be situations in which small strips of land not intended for building development purposes and carry no development right under the lease, such as the areas restricted as nonbuilding area or for garden, slope maintenance and access road purposes, are included in the zones. The general principle is that such areas should not be taken into account in plot ratio (PR) and site coverage (SC) calculation. Development within zones should be restricted to building lots carrying development right in order to maintain the character and amenity of the Tseung Kwan O area and not to overload the road network in this area.

## 4. NOTES OF THE PLAN

4.1 Attached to the Plan is a set of Notes which shows the types of uses or developments which are always permitted within the Planning Scheme Area and in particular zones and which may be permitted by the Board, with or without conditions, on application. The provision for application for planning permission under section 16 of the Ordinance allows greater flexibility in land use planning and control of development to meet changing needs.
4.2 For the guidance of the general public, a set of definitions that explains some of
the terms used in the Notes may be obtained from the Technical Services Division of the Planning Department and can be downloaded from the Board's website at http://www.info.gov.hk/tpb.

## 5. THE PLANNING SCHEME AREA

5.1 The Planning Scheme Area (the Area), which covers an area of about 1,718 hectares (ha), is located at the southern part of Sai Kung District in the South East New Territories. It is bounded by Clear Water Bay Peninsula to the east, Junk Bay to the south, Lam Tin and Sau Mau Ping areas to the west, and Tseng Lan Shue and the Hong Kong University of Science and Technology to the north. The Area is surrounded by steep sloping hills in the north, east and west, and is physically segregated from East Kowloon and Clear Water Bay Peninsula.
5.2 The boundary of the Area is shown in a heavy broken line on the Plan. For planning and reference purposes, the Area has been divided into a number of smaller planning areas as shown on the Plan.

## 6. POPULATION

Based on the 2016 Population By-census, the population of the Area was estimated by the Planning Department as about 398,000 persons. It is estimated that the planned population of the Area would be about 472,000 470,800 persons.

## 7. URBAN DESIGN FRAMEWORK

7.1 Tseung Kwan O is a third generation new town. Capitalizing on the enhanced accessibility brought about by Tseung Kwan O MTR Line, high-density developments are located close to MTR stations at Po Lam, Hang Hau, Tseung Kwan O, Tiu Keng Leng and Tseung Kwan O South, each forming a district centre with its own retail and supporting facilities. The southeastern part of the New Town is reserved for specific uses to meet territorial needs, such as Tseung Kwan O Industrial Estate in Area 87, deep waterfront industries and a desalination plant in Area 137, landfills and proposed landfill extension in Areas $77,101,105$ and 137.
7.2 As recommended under the Study completed in 2005, an urban design framework has been formulated mainly for the new development areas in Town Centre South, Tiu Keng Leng and Pak Shing Kok areas to direct the development of a coherent and legible structure of land uses, urban form and open spaces that is appropriate to the unique development context of a waterfront and valley setting of the New Town.
7.3 The framework seeks to optimize opportunities afforded by the new development areas in Town Centre South to create a new and distinctive waterfront district that capitalizes on the dramatic visual and physical relationship of the natural landscape of the surrounding country parks and Junk Bay, with the objective of fostering a unique district identity. It also seeks to
maximize the development potential of the existing Eastern Channel and Junk Bay by promoting water sports and recreation. The primary objective is to provide a high quality vibrant leisure and recreational area for the enjoyment of the Tseung Kwan O residents and visitors. The new development areas in the Town Centre South, Tiu Keng Leng and Pak Shing Kok areas are intended to be highly integrated with the hinterland through the provision of a comprehensive pedestrian circulation and open space framework and to incorporate architectural designs and landscape treatments that promote a positive public image of the New Town.
7.4 The key features of the new development areas proposed under the urban design framework include the following:
(a) reduction in the population density within Town Centre South and Tiu Keng Leng from that formerly proposed for the area;
(b) diminution in building height towards the waterfront with modulation in building height at the waterfront to enhance variety in the height and massing of new development;
(c) elimination of waterfront roads to promote a more pedestrian friendly and attractive waterfront district;
(d) provision of a "Central Avenue" which is a landscaped pedestrian retail corridor in the form of open space that links the commercial and entertainment node adjacent to MTR Tseung Kwan O Station with the waterfront;
(e) provision of a high quality waterfront park and promenade with related leisure and commercial uses;
(f) provision of a new riverine park along a landscaped corridor adjacent to the Eastern Channel that provides connections to the waterfront and opportunities for active and passive recreation;
(g) provision for water sports activity and recreation in the Eastern Channel and Junk Bay;
(h) continual provision of a comprehensive breezeway system by suitably aligned open space, low-rise Government, institution or community (GIC) facilities and major road corridors to promote better ventilation within the New Town;
(i) provision of a signature Civic Node and GIC cluster at the western gateway to the New Town at the intersection of Po Yap Road and Road P2;
(j) provision of 'breathing spaces' for the more densely populated areas such as Tiu Keng Leng, by the introduction of district parks and local open spaces;
(k) provision of low-rise developments at Pak Shing Kok to maintain the existing ridgeline when viewed from Sai Kung;
$(1)(k)$ promotion of lively streetscapes and activities and avoidance of podium developments which may create 'dead' development edges; and
$(\mathrm{m})(\boldsymbol{l})$ development of Cross Bay Link in the form of a landmark feature bridge.

## 8. LAND USE ZONINGS

8.1 "Comprehensive Development Area" ("CDA") : Total Area 38.72 ha
8.1.1 This zone is intended for comprehensive development/redevelopment of the area for residential and/or commercial uses with the provision of open space and other supporting facilities. It is to facilitate appropriate planning control over the development mix, scale, design and layout of development, taking into account of various environmental, traffic, infrastructure and other constraints. It is also intended for developing or redeveloping relatively large sites in a comprehensive manner and maintaining planning control within the zone through the submission of a Master Layout Plan (MLP). Developments within this zone are subject to gross floor area (GFA) and/or building height restrictions. To provide flexibility for innovative design adapted to the characteristics of particular sites, minor relaxation of these restrictions may be considered by the Board through the planning permission system. Each proposal will be considered on its individual planning merits.
8.1.2 The "CDA" site in Area 86 is intended to facilitate comprehensive development including a MTR depot, a MTR station, associated property development and supporting community facilities. Development/redevelopment within this "CDA" site is restricted to a maximum domestic GFA of $1,612,800 \mathrm{~m}^{2}$ and a maximum non-domestic GFA of $40,000 \mathrm{~m}^{2}$ (mainly for retail purpose).
8.1.3 The existing film studio site in Area 92 is within this zoning and is intended for comprehensive redevelopment for low-density residential use. Development or redevelopment within this "CDA" site is restricted to a maximum GFA of $15,700 \mathrm{~m}^{2}$ and a maximum building height of 6 storeys over one level of carport.
8.1.4 Pursuant to section $4 \mathrm{~A}(1)$ of the Ordinance, any development proposal under this zoning will require the approval of the Board by way of a planning application under section 16 of the Ordinance. Unless otherwise specified, a MLP should be submitted together with environmental, traffic and other relevant assessment reports as well as other materials as specified in the Notes of the Plan for the approval of the Board under section $4 \mathrm{~A}(2)$ of the Ordinance. A copy of the approved MLP will be made available for public inspection pursuant to section 4A(3) of the Ordinance.
8.2 "Commercial/Residential" ("C/R") : Total Area 20.07 ha
8.2.1 This zone is intended primarily for commercial and/or residential development. Commercial, residential and mixed commercial/ residential uses are always permitted.
8.2.2 The areas within this zoning are primarily planned and concentrated in the town centre and district centres where accessibility is enhanced by MTR Tseung Kwan O ExtensionLine.
8.3 "Residential (Group A)" ("R(A)") : Total Area 152.23152.68 ha
8.3.1 This zone is intended primarily for high-density residential developments. Commercial uses are always permitted on the lowest three floors of a building or in the purpose-designed non-residential portion of an existing building.
8.3.2 This zoning constitutes the major type of residential land uses in the Area. It covers public rental housing estates (PRH), Home Ownership Schemes (HOS), Private Sector Participation Schemes (PSPS), Sandwich Class Housing (SCH) and, Flat for Sale Schemes (FFSS), Subsidized Sales Flats (SSF) as well as private residential developments. Commercial uses such as eating places, offices, shops and services are permitted as of right on the lowest three floors of the buildings, including basement(s), and in the purpose-designed nonresidential portion of the existing buildings.
8.3.3 Existing PRH estates include Tsui Lam Estate in Area 5, Po Lam Estate in Area 14, King Lam Estate in Area 23, Ming Tak Estate in Area 34, Hau Tak Estate in Areas 39 \& 41, Sheung Tak Estate in Area 59, Yee Ming Estate in Area 65, Kin Ming Estate in Area 73 and part of Choi Ming Court in Area 74. In addition, thirteen HOS developments namely King Ming Court in Area 6, Ying Ming Court in Area 14, Yan Ming Court in Area 21, Ho Ming Court in Area 23, Hin Ming Court and Yuk Ming Court in Area 34, Yu Ming Court in Area 39, Chung Ming Court in Area 41, Wo Ming Court in Area 34/44, Tong Ming Court in Area 57, Kwong Ming Court and Po Ming Court in Area 59, and part of Choi Ming Court in Area 74, as well as four PSPS developments namely Fu Ning Garden in Area 30, On Ning Garden in Area 40, Beverly Garden in Area 55 and Bauhinia Garden in Area 65 have also been completed.
8.3.4 Existing SCH developments comprise Serenity Place in Area 13, Radiant Towers in Area 18 and The Pinnacle in Area 24. Verbena Heights in Area 19 is an existing mixed public rental and FFSS development developed by the Hong Kong Housing Society. Mount Verdant in Area 73 is an existing SSF development.
8.3.5 The ex-Tiu Keng Leng cottage area in Areas 73 and 74 has been cleared and planneddeveloped primarily for the development of PRH estates,
subsidised sale flatsSSF and private residential developments. Most of the residential developments within the area have been completed.
8.3.6 There are seveneight sub-areas within this zone, each with its own specific development restrictions:
(a) "Residential (Group A)1" ("R(A)1") : 1.49 ha

A site to the southwest of Kin Ming Estate in Area 73 is zoned "R(A)1". Development within this sub-area is restricted to maximum domestic and non-domestic PRs of 5.5 and 0.5 respectively and a maximum building height of 138 m above Principal Datum (mPD). A stepped building height profile should be adopted for developments within the site thereby reducing its visual impact on the surrounding low-rise GIC developments.
(b) "Residential (Group A)2" ("R(A)2") : 6.60 ha

Two sites in Area 66 to the south of Po Yap Road are zoned "R(A)2". Development within this sub-area is subject to maximum domestic and non-domestic PRs of 5 and 0.5 respectively, a maximum SC of $50 \%$ and a maximum building height of 100 mPD . Podium development within these sites should be avoided as far as possible, but may be used within these sites to act as noise mitigation measure against Po Yap Road. Besides, built form and heights should be articulated to create a varied and interesting built form and activity/development edge. Retail and commercial facilities should be promoted along the boundaries fronting directly onto the pedestrianized Central Avenue. The Wings II, The Wings IIIA, the Wings IIIB, The Parkside and Twin Peaks fall within this sub-area.
(c) "Residential (Group A)3" ("R(A)3") : 3.04 ha

A site in Area 65 to the east of Bauhinia Garden is zoned "R(A)3". Development within this sub-area is restricted to maximum domestic and non-domestic PRs of 4 and 0.5 respectively, a maximum SC of $50 \%$ and a maximum building height of 100 mPD . A public open space with a site area of $4,600 \mathrm{~m}^{2}$ at the southern portion of this sub-area has been provided at street level to serve as a transitional buffer with the adjacent non-residential developments as well as serving the needs of the surrounding neighbourhoods. To be compatible with the overall urban design concept of the Town Centre South area, the use of podium and wall-like development within this sub-area is avoided. Yee Ming Estate, a PRH estate, falls within this sub-area.
(d) "Residential (Group A)4" ("R(A)4") : 3.54 ha

A site in Area 65 to the west of the Eastern Channel is zoned " $R(A) 4$ ". Development within this sub-area is restricted to maximum domestic and non-domestic PRs of 3 and 0.5 respectively, and a maximum SC of $50 \%$. To achieve a gradation in height towards the waterfront, this sub-area has different building height restrictions, i.e. 65 mPD for Area (a) and 35 mPD for Area (b). To create a varied and interesting activity edge along the waterfront promenade, publicly accessible outdoor spaces in the form of 'urban courtyards' are encouraged to be provided adjoining the promenade within the site. It is proposed that recreational and entertainment uses such as alfresco dining, sitting out areas, gardens could be provided within these outdoor spaces. Apart from $\mathfrak{a} \boldsymbol{A}$ private residential development, Savanah, and a subsidised sale flats project HOS development, Yung Ming Court, to be developed by Housing Authority is ineluded fall within this sub-area.
(e) "Residential (Group A)5" ("R(A)5") : 3.67 ha

Two sites in Area 66 abutting the town plaza and the waterfront park along Tong Chun Street and along Tong Yin Street respectively are zoned " $R(A) 5$ ". They are subject to maximum domestic and non-domestic PRs of 3 and 0.5 respectively, a maximum SC of $50 \%$ and a maximum building height of 65 mPD . Retail and commercial activities should be developed along the edge that fronts onto the town plaza and the waterfront park. Corinthia By The Sea and Ocean Wings fall within this sub-area.
(f) "Residential (Group A)6" ("R(A)6") : 9.36 ha

Two sites in Area 68, one along Tong Chun Street to the west of the Eastern Channel and one along Tong Yin Street to the south of the Civic Node are zoned "R(A)6". They are subject to maximum domestic and non-domestic PRs of 2 and 0.5 respectively, and a maximum SC of $50 \%$. To achieve a gradation in height towards the waterfront, this sub-area also has different building height restrictions, i.e. 50 mPD for Area (a), 35 mPD for Area (b) and 60 mPD for Area (c). The building height restriction for Area (c) of both sites is intended to allow the development of a feature tower to provide height variation at the waterfront. Similar to the "R(A)4" site, 'urban courtyards' are encouraged to be provided along the promenade. Capri, Alto Residences, The Papillons and Monterey fall within this sub-area.
(g) "Residential (Group A)7" ("R(A)7"): 7.26 ha

Four sites, including one in Area 111 to the northwest of Ying Yip Road, one in Areas 35 and 108 to the south of Chiu Shun Road, one in Area 113 to the west of Yau Yue Wan Village and one in Area 106 to the east of Hong Kong Movie City, are zoned "R(A)7". Development within this sub-area is subject to a maximum PR of 6.5 and maximum building heights in metres above Prineipal DatummPD as stipulated on the Plan.
(h) "Residential (Group A)8" ("R(A)8"): 0.45 ha

A site in Area 108 to the south of Chiu Shun Road is zoned " $R(A) 8$ ". It is intended for residential development on top of the existing Pak Shing Kok Ventilation Building. Development within this sub-area is subject to a maximum PR of 6 and a maximum building height of 130 mPD . Any floor space that is constructed or intended for use solely as railway facilities, as required by the Government, may be disregarded in the PR calculation.
8.3.7 The five sites in the " $R(A) 4$ ", " $R(A) 5$ " and " $R(A) 6$ " sub-areas are intended for the development of waterfront-related commercial and residential uses. These sites will provide a mix of high quality residential development with the provision of retail and other commercial, leisure and entertainment activities to enhance activity and to create a unique, interesting and vibrant waterfront for use by local residents and visitors. The different building height restrictions within these sub-areas are intended to introduce a height variation for each site.
8.3.8 Land has been reserved inSeveral 24 hour-dedicated pedestrian passageways have been provided within the " $\mathrm{R}(\mathrm{A}) 5$ " sitesub-area at Tong Yin Street and Tong Chun Street. "R(A)6" sites adjacent to the waterfront promenade for the provision of 24 hour-dedicated pedestrianThese passageways. These are generally non-building areas which-will follow the major pedestrian desire lines and guide pedestrians to the Central Avenue and waterfront promenade The passageways would be landseaped to high quality and are planned to be consistent with the waterfront landseape treatments.
8.3.9 The use of podium and wall-like development within the " $R(A) 2$ ", "R(A)3", "R(A)4", "R(A)5" and "R(A)6" sub-areas are avoided to ensure compatibility with the overall urban design concept of the Town Centre South area, particularly the promotion of lively streetscapes and activities. This objective is attained by ensuring the inclusion of car parking facilities, loading/unloading facilities, plant room, caretaker's office and quarters and recreational facilities in SC calculation, if provided above ground. The developments are encouraged to adopt suitable design measures to minimize any possible adverse air ventilation impacts. These include lower podium height, greater
permeability of podium, wider gap between buildings, non-building area to create air path for better ventilation and minimize the blocking of air flow through positioning of building towers and podiums to align with the prevailing wind directions, as appropriate.
8.3.10 To provide flexibility for innovative design adapted to the characteristics of particular sites, minor relaxation of PR/SC/building height restrictions of the sub-areas and/or minor adjustment to the boundaries of Areas (a)/(b) of "R(A)4" and/or Areas (a)/(b)/(c) of " $\mathrm{R}(\mathrm{A}) 6$ " may be considered by the Board through the planning permission system. Each proposal will be considered on its individual planning merits.
8.3.11 An Air Ventilation Assessment Expert Evaluation (AVA EE) (2017) has been carried out for the sites within "R(A)7" sub-area. For all the sites excluding the one in Areas 35 and 108 to the south of Chiu Shun Road, it is found that design measures including building separations and open space at designated areas would alleviate the potential air ventilation impacts on the surrounding wind environment. Quantitative AVAs should be carried out at the detailed design stage. Requirements of the design measures and quantitative AVAs will be incorporated in the planning brief for implementation.
8.3.13 A quantitative AVA has been carried out in 2019 for the site within " $\boldsymbol{R}(A) 8$ " sub-area and several mitigation measures have been proposed in the assessment, including setback at podium level and setback of tower blocks from Chiu Shun Road; permeable elements underneath the podium and above the Pak Shing Kok Ventilation Building; and $15 m$-wide building separation between the two residential blocks. In finalizing future development scheme at detailed design stage, the future developer should take into account these proposed mitigation measures in the AVA to alleviate the potential impact of the development.
8.4 "Residential (Group B)" ("R(B)") : Total Area 4.49 ha
8.4.1 This zone is intended primarily for medium-density residential developments where commercial uses serving the residential neighbourhood may be permitted on application to the Board.
8.4.2 Two sites are under this zoning, one is Hong Sing Garden in Area 4 and the other is Oscar by the Sea (the ex-Hong Kong Oxygen site) in Area 51.
8.5 "Residential (Group C)" ("R(C)") : Total Area 0.66 ha
8.5.1 This zone is intended primarily for high quality, low-rise residential developments where commercial uses serving the residential neighbourhood may be permitted on application to the Board.
8.5.2 Developments within this zone are subject to PR, SC and building height controls.
"Residential (Group C)1" ("R(C)1") : 0.66 ha
Development within this sub-area is restricted to a maximum PR of 0.6 , a maximum SC of $30 \%$, and a maximum building height of 2 storeys over one level of carport, or the PR, SC and height of the existing building(s), whichever is the greater. These restrictions are to ensure that any development or redevelopment of this sub-area will be in line with the general character of the adjoining environment. Two sites in Areas 36 and 92 fall within this sub-area.
8.5.3 Application for minor relaxation of the $\mathrm{PR} / \mathrm{SC} /$ building height restrictions may be considered by the Board under section 16 of the Ordinance. The purpose of this provision is to allow the Board to consider building layout and design proposals which, whilst not strictly complying with the stated restrictions, will meet the planning objectives for the area and provide some additional benefits, such as the conservation of environmentally important natural features or mature vegetation. Each application will be considered on its own merits.
8.6 "Residential (Group E)" ("R(E)") : Total Area 4.00 ha
8.6.1 This zone is intended primarily for phasing out of existing industrial uses through redevelopment (or conversion) for residential use on application to the Board.
8.6.2 Two sites abutting Shek Kok Road in Area 85 are under this zoning. Development within the zone is subject to a maximum PR of 5 and a maximum building height of 130 m . To provide flexibility for innovative design adapted to the characteristics of particular sites, minor relaxation of the building height restriction may be considered by the Board through the planning permission system. Each proposal will be considered on its individual planning merits. The Beaumount and The Beaumount II fall within this zone.
8.6.3 The developers will be required to submit adequate information to demonstrate that new residential developments will be environmentally acceptable, and suitable mitigation measures, if required, will be implemented to address the potential industrial/residential interface problems, the potential land contamination issue, and the noise impact of the MTR open track section nearby. One of the sites will alse accommodate a public vehicle park comprising 21 private car and 26 lorry parking spaces for reprovisioning of a public vehicle park eriginally located at the nerthern end of Shek Kok Road. One footbridge across Wan Po Road and one across Shek Kok Road to link up the sites with the "CDA" in Area 86 are required in the new residential developments.
8.6.4 Under this zoning, existing industrial uses will be tolerated but new industrial development will not be permitted upon redevelopment in order to avoid the perpetuation or aggravation of the industrial/ residential interface problems with the new residential development during the redevelopment process. In existing industrial buildings, new developments involving offensive trades will not be permitted. Any modification of use from non-industrial to industrial uses (other than non-polluting industrial uses) within existing industrial buildings will require the permission of the Board. In addition, commercial uses, other than those permitted in the purpose-designed non-industrial portion of the existing industrial buildings, would require the permission of the Board. Upon redevelopment of the industrial buildings to non-industrial buildings, commercial uses will be permitted as of right on the lowest three floors, including basement(s), and in the purpose-designed nonresidential portion of the existing buildings.

## 8.7 "Village Type Development" ("V") : Total Area 22.03 ha

8.7.1 The planning intention of this zone is to reflect existing recognized and other villages, and to provide land considered suitable for village expansion and reprovisioning of village houses affected by government projects. Land within this zone is primarily intended for development of Small Houses by indigenous villagers. It is also intended to concentrate village type development within this zone for a more orderly development pattern, efficient use of land and provision of infrastructures and services. Selected commercial and community uses serving the needs of the villagers and in support of the village development are always permitted on the ground floor of a New Territories Exempted House. Other commercial, community and recreational uses may be permitted on application to the Board.
8.7.2 In order to retain the village character, any future development or redevelopment within this zone, except otherwise specified, is subject to a maximum building height of 3 storeys $(8.23 \mathrm{~m})$ or the height of the existing building(s), whichever is the greater. To provide flexibility for innovative design adapted to the characteristics of particular sites, minor relaxation of the building height restriction may be considered by the Board through the planning permission system. Each proposal will be considered on its individual planning merits.
8.7.3 This zoning covers the existing villages including Tseung Kwan O Village in Area 7, Mau Wu Tsai Village in Area 123 and Boon Kin Village in Area 109. It also includes the Yau Yue Wan Village resite area in Area 22, the Hang Hau Village resite area in Area 31, the Fat Tau Chau and Tin Ha Wan Village resite areas in Area 35. Besides, a site in Area 8 is reserved for the future expansion of Tseung Kwan O Village.
8.8.1 This zone is intended primarily for the provision of GIC facilities serving the needs of the local residents and/or a wider district, region or the territory. It is also intended to provide land for uses directly related to or in support of the work of the Government, organizations providing social services to meet community needs, and other institutional establishments.
8.8.2 There are a number of sub-areas under this zone, each with its own specific building height restriction to ensure that developments within these sub-areas are in line with the overall urban design concept of the New Town:
(a) "Government, Institution or Community (1)" ("G/IC(1)") : 5.16 ha

Development within this sub-area is restricted to a maximum building height of 75 m . A piece of land in Area 67 which is reserved for the development of a Civic Node falls within this sub-area. The Civic Node will comprise a cultural complex/town hall, government offices, lorry park and public car parking facilities. Landmark buildings should be developed within this site to create a symbolic 'gateway' at this prominent location. This site, together with the proposed GIC cluster to the west of Road P2 in Area 72, will form the western gateway of the New Town.
(b) "Government, Institution or Community (2)" ("G/IC(2)") : 2.42 ha

Development within this sub-area is restricted to a maximum building height of 55 m . The campus of Hong Kong Design Institute and Hong Kong Institute of Vocational Education (Lee Wai Lee) of the Vocational Training Council to the south of Choi Ming Court in Area 74 fall within this sub-area.
(c) "Government, Institution or Community (3)" ("G/IC(3)") : 2.50 ha

Development within this sub-area is restricted to a maximum building height of 45 m . Two sites are within this sub-area. A site located immediately to the northwest of MTR Tiu Keng Leng Station in Area 73 consists of two post-secondary colleges operated by Caritas Bianchi College of Careers and Caritas Institute of Higher Education. Another site in Area 65 is reserved for the development of a government complex, possibly for recreational and other uses.
(d) "Government, Institution or Community (4)" ("G/IC(4)") : 8.08 ha

Development within this sub-area is restricted to a maximum building height of 40 m . There are four sites within this sub-area. One of them is located to the west of Road P2 in

Area 72, which is reserved for the development of a GIC cluster comprising a social welfare complex, a police station, a fire station cum ambulance depot and a refuse collection point. The architecture of buildings within this GIC cluster should be distinctive and compatible with the Civic Node in Area 67 to create a landmark gateway at this location. Another site, which is located in Area 106 and to the east of " $\mathrm{G} / \mathrm{IC}(8)$ " sub-area in Area 78, is for the development of departmental quarters for Fire Services Department. The remaining two sites are located at Town Centre South comprising an existing primary school and a through-train primary cum secondary school in Area 65; the French International School and a planned secondary school in Area 67.
(e) "Government, Institution or Community (5)" ("G/IC(5)") : 0.33 ha

Development within this sub-area is restricted to a maximum building height of 10 m . A piece of land in Area 68, which is reserved for the development of a telephone exchange, is within this sub-area. Another site at the south-eastern portion of Area 77 is within this sub-area. It accommodates an existing gas and leachate management compound which serves to extract the gas and leachate in the Tseung Kwan O Stage I Landfill thereby keeping these substances down to acceptable levels.
(f) "Government, Institution or Community (6)" ("G/IC(6)") : 0.05 ha

Development within this sub-area is restricted to a maximum building height of 5 m . A site in Area 77, which is reserved for the development of a sewage pumping station, is within this sub-area. This pumping station serves to convey the collected sewage from the Tseung Kwan O Stage I Landfill to the existing trunk sewer under Wan Po Road.
(g) "Government, Institution or Community (7)" ("G/IC(7)") : 16.11 ha

A site in Pak Shing Kok (Area 78) occupied by the Fire and Ambulance Services Academy is within this sub-area. Development in Area (a) of this sub-area is restricted to a maximum building height of 100 mPD , except a fire services rescue training tower up to 114 mPD . Development in Area (b) of this sub-area is restricted to a maximum building height of 120 mPD .
(h) "Government, Institution or Community (8)" ("G/IC(8)") : 6.05 ha

Development within this sub-area is restricted to a maximum building height of 106 mPD . A site in Pak Shing Kok (Area 78) reservedplanned for a Chinese Medicine Hospital and fattre

GIC uses a Government Chinese Medicines Testing Institute is within this sub-area. "Government, Institution or Community (9)" ("G/IC(9)") : 6.87 ha

Development within this sub-area is restricted to a maximum building height of 60 mPD , except a communications tower up to 76 mPD . A site in Area 85 reserved for a new Radio Television Hong Kong broadcasting house and future GIC uses is within this sub-area. To create a clustering effect of this sub-area with areas for broadcasting, innovation and technology industries in Tseung Kwan O , information technology and telecommunications related uses are permitted in this sub-area.
8.8.3 Specific building height restrictions for the "G/IC" sub-areas in terms of m or mPD , which mainly reflect the planned building heights of developments, have been incorporated into the Plan to provide visual and spatial relief to the Area.
8.8.4 To provide flexibility for innovative design adapted to the characteristics of particular sites, minor relaxation of the building height restriction of the sub-areas may be considered by the Board through the planning permission system. Each proposal will be considered on its individual planning merits.
8.8.5 Apart from the above, other major GIC facilities provided or planned in the Area include:
(a) existing and proposed primary and secondary schools distributed in various areas;
(b) a wide range of community facilities such as town hall, libraries, indoor recreation centres, community centres, care and attention homes and religious institutions in various areas;
(c) hospitals in Areas 27 and 32;
(d) clinics in Areas 22, 44, 56 and 67;
(e) police stations in Areas 21 and 72;
(f) fire stations and/or ambulance depots in Areas 10, 72 and 87;
(g) government staff quarters in Areas 22, 106 and 123;
(h) YMCA youth camp in Area 122;
(i) electricity substations in Areas 11, 24, 39, 56, 72 and 115;
(j) telephone exchanges in Areas 26 and 68;
(k) water pumping stations in Areas 5 and 120;
(l) service reservoirs in various areas; and
(m) film studio for pre-production and post-production of films in Area 106.
8.9 "Open Space" ("O") : Total Area 190.80 ha
8.9.1 This zone is intended primarily for the provision of outdoor public open-air space for active and/or passive recreational uses serving the needs of local residents as well as the general public.
8.9.2 Two sites in Areas 72 along Road P2 are proposed for the development of Tiu Keng Leng Park which includes landscaped pedestrian decks spanning across the depressed Road P2. This open space will provide some visual relief to the adjacent high density developments and will link up with the waterfront park in Area 68 via a waterfront promenade.
8.9.3 The central part of Area 68 fronting Junk Bay is proposed for a waterfront park which will link up with a town plaza proposed to its north in Area 66. The proposed waterfront park is intended predominantly for passive recreation with a high quality landscaping design to promote a unique identity for the New Town. The proposed town plaza is to serve primarily as an urban civic space with provision for public gatherings and other activities.
8.9.4 A semi-circular area in Area 66 south of Po Yap Road and MTR Tseung Kwan O Station is proposed to be developed as an open/green plaza serving as a recreational space for nearby residents and visitors and a buffer between MTR Tseung Kwan O Station and the future residential developments in Area 66.
8.9.5 A Central Avenue at Area 66 is proposed between the open/green plaza south of Po Yap Road and the town plaza which will form a major linkage between Town Centre North and the waterfront area. The proposed Central Avenue is intended primarily for the provision of a landscaped corridor in the form of open space, which would be flanked by retail development edges on both sides of the adjacent $\mathrm{R}(\mathrm{A})$ zones and landscaped to a high quality. Shops and services, and eating places including alfresco dining may be considered by the Board through the planning permission system.
8.9.6 A riverine park is proposed along the Eastern Channel in Area 65 and a waterfront promenade is provided along Junk Bay in Area 68. The sites will provide a range of passive recreational facilities and opportunities. Alfresco dining may be considered by the Board through the planning permission system.
8.9.7 The landfill site in Area 105 has been decommissioned and restored. The landfill sites in Areas 101 and 137 will be developed into major
open spaces upon completion of the landfill. However, any development proposals within the 250 m Consultation Zone of these landfills will need to include a Landfill Gas Hazard Assessment to the satisfaction of the Environmental Protection Department (EPD).
8.9.8 Other open spaces are also provided in Areas 12, 24, 25, 37, 40, 73 and 74 and another site in Area 51 is reserved to provide recreational outlets for the nearby residential neighbourhood.
"Open Space (1)" ("O(1)") : 16.79 ha
8.9.9 In " $\mathrm{O}(1)$ ", 'Place of Recreation, Sports or Culture' and 'Library' uses are always permitted. A town park in Area 45 provides a variety of active and passive recreational facilities, a sports ground and an indoor velodrome cum sports centre (IVSC). A sports centre together with a library (SCL) is provided in the open space in Area 74. The zoning of this sub-area allows locational and design flexibility for the provision of IVSC in Area 45 and SCL in Area 74. The building height of IVSC in Area 45 and SCL in Area 74 have not exceeded 30m above ground.
"Open Space (2)" ("O(2)") : 100.54 ha
8.9.10 The landfill sites in Areas 101 and 137 fall within the " $\mathrm{O}(2)$ " sub-area. The " $\mathrm{O}(2)$ " zoning is to reflect the long-term planning intention of open space use of the landfill sites after the decommissioning and restoration of the landfill, while permitting landfill use in the interim.
8.9.11 Upon detailed planning, additional local open spaces will be provided in the residential zones. These open spaces are however not shown on this Plan.
8.10 "Recreation" ("REC") : Total Area 65.85 ha
8.10.1 The planning intention of this zone is primarily for recreational developments for the use of the general public. It encourages the development of active and/or passive recreation and tourism/ eco-tourism. Uses in support of the recreational developments may be permitted subject to planning permission. Part of the Tseung Kwan O Stage I Landfill in Area 77 within this zone has been developed for recreational uses including the Wan Po Road Pet Garden and Jockey Club HKFA Football Training Centre.
8.10.2 Given the development constraints associated with landfill sites, development within this zone is restricted to a maximum PR of 0.1 and a maximum building height of 1 storey. To provide design flexibility, minor relaxation of the PR/building height restrictions may be considered by the Board through the planning permission system. Each proposal will be considered on its individual planning merits. Moreover, similar to other landfill sites, any development proposals within the 250 m Consultation Zone of the landfill will need to include a Landfill Gas Hazard Assessment to the satisfaction of EPD.
8.11 "Other Specified Uses" ("OU") : Total Area 225.69 ha

This zone denotes land allocated or reserved for specific uses, including the following:
(a) a waterfront site at the toe of the Tseung Kwan O Stage I Landfill in Area 77 is reserved for water sports and recreational facilities. Given the prominent location of this site and the constraints associated with landfill sites, development within this zone is restricted to a maximum PR of 0.5 , a maximum SC of $50 \%$ and a maximum building height of 1 storey. To provide design flexibility, minor relaxation of the PR/SC/building height restrictions may be considered by the Board through the planning permission system;
(b) a pair of finger piers at the waterfront of Area 68 is proposed to cater for the berthing of recreational/pleasure vessels and kaidos thereby serving the needs of the community and to enhance the water-borne recreation and tourism potential of Junk Bay as well as the New Town. Structures to be accommodated are intended for low-intensity low-rise developments generally of one storey high, depending on the design. Dining, including alfresco dining, and recreation and tourism related commercial facilities may be considered by the Board through the planning permission system. Each proposal will be considered on its individual planning merits. In addition, special and/or atypical design of these piers is encouraged to allow the creation of a place of attraction, resting and recreation and/or focal and vantage point for visitors;
(c) a commercial development with public transport interchange in Area 56. This site is intended for an entertainment node within the New Town and comprises a range of entertainment, leisure and commercial uses. Some residential elements within the site has been allowed through planning permission from the Board and the development is known as The Wings;
(d) commercial/residential developments with public transport interchange on sites in Areas 17, 38 and 73;
(e) Tseung Kwan O Industrial Estate in Area 87, which enjoys the advantage of marine frontage as well as proximity to the Hong Kong University of Science and Technology;
(f) the deep-waterfront industry in Area 137 for industries which require marine access;
(g) the proposed desalination plant in the southeastern part of Area 137 which is intended to provide fresh water serving the needs of the community;
(h) a bus depot in Area 26;
(i) an explosive store in Area 124;
(j) petrol filling stations in Areas 10 and 16 which may include vehicle repair workshops subject to planning permission from the Board;
(k) the landing steps in Area 68;
(1) the sewage treatment works in Area 85;
(m) a cemetery in Area 130 with access from Ko Chiu Road in East Kowloon;
(n) an underground desilting compound in Area 68; and
(o) the proposed ventilation building for Tseung Kwan O - Lam Tin Tunnel in Area 128.

### 8.12 "Green Belt" ("GB") : Total Area 753.06752.93 ha

The planning intention of this zone is primarily for defining the limits of urban and sub-urban development areas by natural features and to contain urban sprawl as well as to provide passive recreational outlets. There is a general presumption against development within this zone. Development within this zone will be strictly controlled and development proposals will be considered on individual merits taking into account the relevant Town Planning Board Guidelines.

## 9. COMMUNICATIONS

9.1 Roads
9.1.1 Only major road networks, which comprise trunk roads, primary and district distributors, are shown on the Plan. As the Plan is drawn at a small scale, design details of major road junctions and local access roads are not indicated.
9.1.2 The road schemes of Tseung Kwan O - Lam Tin Tunnel and Cross Bay Link, Tseung Kwan O were authorized by the CE in C on 29 April 2014 and 2 September 2014 respectively. The footbridge as described in the road scheme of the Tseung Kwan O further development infrastructure works for Tseung Kwan O Stage 1 Landfill Site was authorized by the CE in C on 21 July 2015. Pursuant to section 13A of the Ordinance, the road schemes authorized by the CE in C under the Roads (Works, Use and Compensation) Ordinance (Cap. 370) shall deem to be approved under the Ordinance and the road schemes are shown on the Plan for information only.
9.1.3 External access to and from the Area will be mainly via Tseung Kwan O Tunnel and Tseung Kwan O-Lam Tin Tunnel, supplemented by Po Lam Road as well as Ying Yip Road and Hang Hau Road connecting to Clear Water Bay Road.
9.1.4 Within the Area, a number of primary and district distributors and local roads have been planned to provide access between the various planning areas as well as access to each locality. In particular, two new major distributor roads, namely Cross Bay Link and Road P2 are proposed. Cross Bay Link will be designed as a feature bridge and will provide direct access from Tseung Kwan O - Lam Tin Tunnel to Area 86, Tseung Kwan O Industrial Estate in Area 87 and the special industrial area in Area 137. Road P2 will provide a link from Tseung Kwan OLam Tin Tunnel directly into the town centre. A section of Road P2 will be depressed to reduce its environmental impact as well as to allow the provision of an at-grade pedestrian crossing in the form of landscaped decks above the depressed Road P2, which facilitates pedestrian movement from the waterfront park to the proposed Tiu Keng Leng Park.

### 9.2 Mass Transit Railway

Apart from Tseung Kwan O Tunnel and Tseung Kwan O - Lam Tin Tunnel, external access is supported by an extension of the MTR line from Lam Tin to Tseung Kwan O. Phase I of MTR Tseung Kwan O Extension project comprising four stations in Tseung Kwan O, namely Tiu Keng Leng, Tseung Kwan O, Hang Hau and Po Lam, commenced operation in August 2002. The MTR tracks are primarily underground, except for the section between Ho Ming Court and Po Shun Road, which are at grade and enclosed by structures with a landscaped bund on top to eliminate any noise impact caused by the MTR operation on the adjacent residential areas. Phase II of the project includes a spur line to Tseung Kwan O South with a depot and LOHAS Park Station in Area 86. The depot has been completed and the station commenced operation in July 2009. The railway scheme and its amendments have been authorized by the CE in C on 20 October 1998 and 14 September 1999 respectively and amended on 9 May 2005 by the then Secretary for Environment, Transport and Works.

### 9.3 Public Transport

Franchised buses, taxis, green mini-buses and ferries will be the main modes of public transport in addition to MTR. Public transport interchange facilities are/will be provided at strategic locations.

### 9.4 Pedestrian and Cycle Networks

The cycle track and pedestrian walkway networks will be designed to facilitate convenient cycle and pedestrian movements within the Area. Grade-separated pedestrian and cycle crossings will be provided at major pedestrian and cycle crossing points. A cycle track with associated facilities along the waterfront at Town Centre South has been completed.

## 10. UTILITY SERVICES

### 10.1 Water Supply

10.1.1 A water supply and distribution system has been implemented to meet the demand arising from the development in Tseung Kwan O.
10.1.2 Apart from the existing fresh water service reservoirs in Areas 1, 2, 3, 106, 113 and 125, an extension of fresh water service reservoir is proposed in Area 113 to cater for further development of the Area. Moreover, there is an existing fresh water pumping station in Area 120.
10.1.3 Apart from the existing salt water service reservoirs in Areas 1 and 5 and the existing salt water pumping stations in Areas 5 and 86, additional salt water service reservoir and pumping station will be reserved to cater for supply of flushing water.

### 10.2 Drainage and Sewage Collection

Surface water will be channeled into two main culverts for discharge into the sea. An overland drainage and flood path system will cater for very heavy rain and possible blockage of culverts. Sewage will be conveyed via a network of sewers and a sewer tunnel through Areas 108 and 78 to the sewage treatment works in Area 85 for treatment before being discharged into the Harbour Area Treatment Scheme Stage I deep tunnel conveyance system. There will be sufficient capacity to serve the currently planned developments.

### 10.3 Electricity

10.3.1 Electricity will be supplied to the Area through a new distribution network. Sites in Areas 11, 24, 39, 56, 72, 86, 87 and 115 have been developed into electricity substations. Adequate sites have been reserved in Area 137 for future electricity substations to meet the demand in short and long terms.
10.3.2 The facility at the site in Area 115 is a 400 kV electricity substation. Stringent pollution control measures have been imposed in order to ensure that the adjacent residential neighbourhood will not be adversely affected.

### 10.4 Town Gas

The network for supplying town gas to the developments in the Area has been extended from Kowloon via Po Lam Road North, Tseung Kwan O Tunnel and Clear Water Bay Road.

### 10.5 Telephone

Telephone service is available through the telephone exchanges in Areas 26 and 87. An additional telephone exchange is reserved in Area 68 to cater for future demand.

## 11. CULTURAL HERITAGE

11.1 Several buildings/structures/sites which are of historical significance and archaeological interest are located within the Area. They include Site of the Chinese Customs Station on Fat Tau Chau (Junk Island) (Fat Tau Chau is now known as Fat Tong Chau) in Area 135, which is a Declared Monument under the Antiquities and Monuments Ordinance, Fat Tau Chau Site of Archaeological Interest, Fat Tau Chau Qing Dynasty Grave Stone and Fat Tau Chau House Ruin also in Area 135, Yau Yue Wan Kiln in Area 22, Tin Hau Temple at Hang Hau in Area 35 which is a Grade 3 historic building, Observation Post at Mau Wu Shan in Area 125 which is a Grade 1 historic structure as well as Fortifications at Devil's Peak in Area 132 which is a Grade 2 historic structure.
11.2 On 19 March 2009, the Antiquities Advisory Board (AAB) released the list of 1,444 historic buildings, in which some buildings/structures within the Area have been accorded gradings. AAB also released a number of new items in addition to the list of 1,444 historic buildings. These items are subject to the grading assessment by AAB. Details of the list of 1,444 historic buildings and its new items have been uploaded onto the official website of AAB at http://www.aab.gov.hk.
11.3 Prior consultation with the Antiquities and Monuments Office (AMO) of the Leistre and Cultural Services Department-should be made if any development, redevelopment or rezoning proposals that might affect the above sites of archaeological interest, graded/proposed graded historic buildings/structures, declared monuments, new items pending grading assessment and their immediate environs. If disturbance of the site of archaeological interest or other areas of archaeological potential is unavoidable, a detailed Archaeological Impact Assessment (AIA) conducted by a qualified archaeologist is required. The archaeologist shall apply for a licence to conduct AIA under the Antiquities and Monuments Ordinance (Cap. 53). A proposal for AIA shall be submitted to AMO for agreement prior to applying for a licence.

## 12. IMPLEMENTATION

12.1 Although existing uses non-conforming to the statutory zonings are tolerated, any material change of use and any other development/redevelopment must be always permitted in terms of the Plan or, if permission is required, in accordance with the permission granted by the Board. The Board has published a set of guidelines for the interpretation of existing use in the urban and new town areas. Any person who intends to claim an "existing use right" should refer to the guidelines and will need to provide sufficient evidence to support his claim. The enforcement of the zonings mainly rests with the Buildings Department, the Lands Department and the various licensing authorities.
12.2 The Plan provides a broad land use framework within which more detailed nonstatutory plans for the Area are prepared by the Planning Department. These
detailed plans are used as the basis for public works planning and site reservation within the Government. Disposal of sites is undertaken by the Lands Department. Public works projects are co-ordinated by the Civil Engineering and Development Department in conjunction with the client departments and the works departments, such as the Highways Department and the Architectural Services Department. Implementation of these public works projects will be subject to the availability of resources. In the course of implementation of the Plan, the Sai Kung District Council will also be consulted as appropriate.
12.3 Planning applications to the Board will be assessed on individual merits. In general, the Board, in considering planning applications, will take into account all relevant planning considerations which may include the departmental outline development plans/layout plans and the Guidelines published by the Board. The outline development plans and the layout plans are available for public inspection at the Planning Department. Guidelines published by the Board are available from the Board's website, the Secretariat of the Board and the Planning Department. Application forms and Guidance Notes for planning applications can be downloaded from the Board's website and are available from the Secretariat of the Board, and the Technical Services Division and the relevant District Planning Office of the Planning Department. Applications should be supported by such materials as the Board thinks appropriate to enable it to consider the applications.

## TOWN PLANNING BOARD

OCTOBER 2018-XXX 2020


Figure 3.1 Conceptual Scheme


Figure 3.8 Indicative Section A-A



KEY PLAN

Viewpoint A
Viewpoint A Elevation: +152 mPD at Duckling Hill Viewing Distance: 1190 m
Proposed Building Height in the Site: +130 mPD

Existing View


| SCALE | N.t.s. | DATE | MAR 2018 | ADI | ADI LIMITED LANDSCAPE ARCHITECTURE, URBAN DESIGN AND MASTER PLANNING 10/F BANGKOK BANK BUILDING, 18 BONHAM STRAND WEST, HONG KONG <br> TELEPHONE 21318630 FACSIMLE 21318609 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | drawn | TEAM |  |  |
| figure no. | V3.1 |  | REV |  |  |
|  |  |  | A |  | - |




Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use
Photomontage of Proposed Development - Viewpoint C: View Northeast from Hang Hau Man Kuk Lane Park

| SCALE | N.ts. | DATE | $\frac{\text { JAN } 2019}{\text { TEAM }}$ | ADI | ADI LIMITEDLANDSCAPE ARCHITECTURE, URBAN DESIGN AND MASTER PLANNING10/F BANGKOK BANK BUILDING, 18 BONHAM STRAND WEST, HONG KONGTELEPHONE 21318630 FACSIMIE 2131 8609 TELEPHONE 21830 FACSIMILE 2131860 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | drawn |  |  |  |
| FIGURE No. | V3.3 |  | REV |  |  |
|  |  |  | в |  | (1) |



Viewpoint D
Viewpoint Elevation: +6mPD in Hong Kong Velodrome Park
Viewing Distance: 520 m
Proposed Building Height in the Site: +130 mPD

## Existing View





Photomontage (Artist's impression. For illustrative purpose only, subject to detailed design)
Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use
Photomontage of Proposed Podium Treatments - Viewpoint E: View East from Chiu Shun Road

| SCALE | N.T.S. | DATE | JAN 2019 |  |
| :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | DRAWN | TEAM |  |
| FIGURE NO. | V3.5 |  |  | REV |
|  |  |  |  | - |
|  |  |  |  |  |

ADI

Attachment VIg


KEY PLAN

Viewpoint F
Viewpoint Elevation: +6.7 mPD at Chiu Shun Road
Viewing Distance: 12 m
Proposed Building Height in the Site: +130 mPD

Photomontage (Artist's impression. For illustrative purpose only, subject to detailed design)
Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use Photomontage of Proposed Podium Treatments - Viewpoint F: View South from Chiu Shun Road

| SCALE | N.t.s. | DATE | JAN 2019 |  |
| :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | DRAWN | TEAM |  |
| FIGURE NO. | V3.6 |  |  | REV |
|  |  |  | - |  |
|  |  |  |  |  |

[^1]Director of Planning
c／o Sai Kung \＆Islands District Planning Office
Planning Department
15／F，Sha Tin Government Offices， 1 Sheung Wo Che Road， Sha Tin，N．T．

Attn：Ms．Donna Tam，District Planning Officer／Sai Kung \＆Islands
Dear Madam，

## Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use

## Rezoning Report（For Submission to the Town Planning Board）

The captioned rezoning proposal refers．As requested，we provide herewith 16 copies of Rezoning Report and 45 CD－roms containing soft copy of the Rezoning Report for submission to the Town Planning Board．

Should you have any query，please feel free to contact the undersigned．

Yours faithfully，


Sharon Liu
Chief Town Planning Manager
Encl． 16 copies of Rezoning Report and 45 CD－Roms containing soft copy of Rezoning Report

## PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE

Final Report
May 2020

## EXECUTIVE SUMMARY

1. INTRODUCTION
1.1. Purpose of the Study

## 2. BASELINE REVIEW

2.1. The Subject Site and its Surrounding Context
2.2. Pak Shing Kok Ventilation Building
2.3. Statutory Planning Context
2.4. Site Analysis
3. THE PROPOSED DEVELOPMENT
3.1. Conceptual Scheme
3.2. Proposed Development Parameters
3.3. Indicative Landscape Master Plan
3.4. Local Open Space
3.5. The Rezoning Proposal
4. TECHNICAL ASSESSMENTS
4.1. Air Ventilation
4.2. Environment
4.3. Visual
4.4. Traffic
4.5. Sewerage
4.6. Drainage
4.7. Geotechnical

## 5. PLANNING GAINS AND JUSTIFICATIONS

5.1. Making Good Use of an Already Developed Site
5.2. Compatible with Planning and Development Contexts
5.3. Acceptable in Infrastructure, Engineering, Environment, Visual and Landscape Aspects
6. CONCLUSION

## LIST OF FIGURES

2.1 Location and Site Conditions
2.2 Statutory Planning Context (Extracted from approved Tseung Kwan O OZP No. S/TKO/26)
2.3 Development Constraints
3.1 Conceptual Scheme
3.2 Indicative Ground Floor Plan
3.3 Indicative Plan at Level +13mPD
3.4 Indicative Plan at Level + 19mPD
3.5 Indicative Plan at Level +25 mPD
3.6 Indicative Plan at Level + 32 mPD
3.7 Indicative Plan at Level +38.95 mPD
3.8 Indicative Section A-A
3.9 Indicative Section B-B
3.10 Indicative Landscape Master Plan - Ground Level
3.11 Indicative Landscape Master Plan - Podium Level
3.12 Indicative Local Open Space

## LIST OF TABLE

3.1 Proposed Development Parameters

## LIST OF APPENDICES

A. Quantitative Air Ventilation Assessment Initial Study
B. Environmental Assessment
C. Visual Impact Assessment
D. Traffic Impact Assessment
E. Sewerage Impact Assessment
F. Drainage Impact Assessment
G. Geotechnical Planning Review Report
H. Indicative Landscape Master Plan and Tree Survey Report

## EXECUTIVE SUMMARY

## Introduction

A rezoning study is conducted to examine the feasibility of property development at the existing Pak Shing Kok Ventilation Building Site and adjacent area, taking into consideration the site context, statutory planning context and various development constraints.

The proposed rezoning of the Subject Site is located at Chiu Shun Road, Hang Hau. The Site is covered by the current approved Tseung Kwan O Outline Zoning Plan (OZP) No. S/TKO/26.

## The Conceptual Scheme

The proposed development comprises two residential towers at the Subject Site with a domestic plot ratio of 6 , which will be compatible with the surrounding high density residential developments. The residential towers will each have 27 storeys and provide 432 flats in total. The proposed Development Parameters are tabulated as follows:

| Site Area | 4,458 sq. m. |
| :--- | :--- |
| Domestic Plot Ratio | 6 |
| Domestic Gross Floor Area* | 26,748 sq. m. |
| No. of Flats | 432 |
| No. of Residential Storeys | 27 |
| No. of Towers | 2 |
| Building Height | 130 mPD |
| Note | *The aboveground car park, existing railway facilities and other public facilities, if any, are accountable for |
| gross floor area (GFA) under the Buildings Ordinance (Cap. 123) (BO), unless exempted. |  |
| *The Buildings Authority may consider application for GFA concession on a case-by-case basis upon |  |
| formal submission of general building plans under the BO. Attention should be drawn to Practice Notes |  |
| for Authorised Person, Registered Structural Engineer and Registered Geotechnical Engineer (PNAP) |  |
| APP-2 issued by the Buildings Department. |  |

## Rezoning Proposa

Based on the Conceptual Scheme, it is proposed to amend the approved Tseung Kwan O OZP No. S/TKO/26 as follows:

- To rezone the Subject Site to "Residential (Group A) 8" from "Green Belt" and an area shown as 'MTR Pak Shing Kok Ventilation Building', with a maximum domestic plot ratio of 6 whilst any floor space that is constructed or intended for use solely as railway facilities required by the Government may be disregarded for GFA calculation. A maximum building height restriction of 130 mPD is applicable to the Subject Site.


## Planning Justification

The proposed development will optimise utilisation of valuable land resources and make a positive contribution to housing land supply. A series of technical assessments conclude that the proposed development is technically feasible.

## Development Programme

According to the current development programme, the proposed OZP amendment is expected to be approved in 2021 and the development at the Subject Site would commence in 2021.

## 1. Introduction

### 1.1. Purpose of the Study

1.1.1.The report presents the findings of a rezoning study in support of the proposed residential development at the existing Pak Shing Kok Ventilation Building Site and its adjacent area. Technical assessments, based on the proposed Conceptual Scheme, have been undertaken to demonstrate its technical feasibility.

## 2. BASELINE REVIEW

### 2.1. The Subject Site and its Surrounding Context

2.1.1. The Subject Site is located at Chiu Shun Road. The Subject Site is currently occupied by the existing Pak Shing Kok Ventilation Building for the MTR Tseung Kwan O Line and man-made slopes.
2.1.2. Figure 2.1 illustrates the location of the Subject Site and its existing conditions.
2.1.3. With regards to its surrounding context, the area north of the Subject Site is largely dominated by high density residential developments. Supporting Government, institution or community (GIC) and recreational facilities such as school, park and sports ground are located close to the Subject Site.

### 2.2. Pak Shing Kok Ventilation Building

2.2.1. The existing Pak Shing Kok Ventilation Building forms part of the MTR Tseung Kwan O Line. The Ventilation Building provides air ventilation for the tunnels of the MTR line.
2.2.2. At present, main roof of the Ventilation Building is measured about 24.17 mPD and top of the vent shaft is measured about 29.72 mPD . It is served by a vehicular ingress/egress via Chiu Shun Road which allows the access by large vehicles to a delivery platform. The vehicular ingress/egress and delivery platform are critical for the delivery of large equipment/machines in case replacement of parts of the ventilation facilities is required.

### 2.3. Statutory Planning Context

2.3.1.The Subject Site is covered by the approved Tseung Kwan O OZP No. S/TKO/26.
2.3.2. According to the current OZP, the Subject Site comprises "Green Belt" zone and an area shown as 'MTR Pak Shing Kok Ventilation Building'. Figure 2.2 provides the location of Subject Site on the approved Tseung Kwan O OZP No. S/TKO/26.

### 2.4. Site Analysis

## Development Constraints

2.4.1.Developing over Operating Railway Facilities - The functioning of the existing Pak Shing Kok Ventilation Building (PVB) is paramount to the operation of the MTR Tseung Kwan O Line. The construction of residential development atop the PVB therefore will need to take into account existing condition of the Ventilation Building, underground ventilation tunnel, technical requirements and the associated operational and construction risks.
2.4.2.Ensuring Compatibility between Railway Facilities and Residential Development - In terms of the operation of the PVB, under normal circumstances, the dampers at the vent shafts are in open position for air ventilation. The extracted air is not polluting in nature. Modifications to the Ventilation Building will be implemented to ensure compatibility with the residential development. Please refer to Figure 2.3 for details.
2.4.3.Maintaining Vehicular Access for Operations and Maintenance of Railway Facilities - The maintenance access and parking for regular and urgent maintenance of the PVB are still necessary to be provided at the ground level with the development atop, where lifting facilities will be provided for heavy maintenance. The same functions of the existing open parking area at the PVB still need to be maintained after the development. This is achieved by site re-planning for more compact and integrated uses of various facilities.
2.4.4.Vehicular Traffic and Fixed Plant Noise - Traffic noise generated by Chiu Shun Road abutting to the northwest of the Subject Site and fixed plant noise from PVB may cause potential impact on the residential units. Sufficient setback and other suitable noise mitigation measures will be required to ameliorate the potential impact to the future residents and to comply with relevant criteria as stipulated in the Hong Kong Planning Standards and Guidelines (HKPSG) and the Noise Control Ordinance respectively.
2.4.5.Prevailing Wind - With reference to the annual wind rose, the dominated annual prevailing winds of the area come from east and east-northeast directions and summer prevailing winds are dominated from southwest and south-southwest directions (please refer to Appendix A). The proposed development will have to be positioned and orientated in a sensitive manner in order to minimise its potential impact to the local wind environment and to enhance the air permeability.
2.4.6.Air Pollution from Vehicular Traffic - The air pollution generated by the vehicular traffic along Chiu Shun Road may have an impact to the air sensitive receivers. As shown in Figure 2.3, sufficient setback has been allowed to ameliorate the potential impact to the future residents of the Subject Site.
2.4.7.Man-made Slopes - A number of registered slopes are located within and at the periphery of the Subject Site. According to the record from the Slope Information System of Geotechnical Engineering Office, there are man-made slopes located within the Subject Site. Appropriate slope
improvement works may need to be carried out to maintain existing slope stability. Please refer to Appendix G for details.

## 3. THE PROPOSED DEVELOPMENT

### 3.1. Conceptual Scheme

3.1.1. A Conceptual Scheme has been prepared in support of the proposed residential development within the Subject Site. The Conceptual Scheme is presented in Figure 3.1, Indicative Ground Floor Plan and Indicative Plans at Level $13 \mathrm{mPD}, 19 \mathrm{mPD}, 25 \mathrm{mPD}, 32 \mathrm{mPD}$ and 38.95 mPD are presented in Figures 3.2 to 3.7 respectively. Indicative Sections are also presented in Figures 3.8 and 3.9.
3.1.2. As shown in Figure 3.1, two residential towers are located within the Subject Site with site area of 4,458 square metres. The residential towers will be developed atop a transfer plate decking over the existing PVB.
3.1.3. As the operating PVB will remain in-situ, portion of the Subject Site will therefore be jointly used by the proposed residential development and existing PVB. Vehicular entrance for the Site will be shared by the proposed residential development and the existing PVB.
3.1.4.As PVB and related underground ventilation tunnel are paramount to deliver the safe operation of the railway, construction of underground car park will lead to high risk to the integrity of the ventilation tunnel, which is required to address railway congestion or emergency situations such as fire. Therefore, aboveground car park is proposed to be provided for the residential development and full GFA concession for aboveground car park is expected to be granted by the Building Authority.
3.1.5. The two proposed residential towers are carefully situated taking into account the geotechnical and topographic conditions. Also, the residential towers have setback from Chiu Shun Road to mitigate the potential air pollution and road traffic noise. In addition, the residential towers are designed with consideration of the potential impact to the air ventilation of the area.
3.1.6. Taking into account the building heights of the neighbouring developments and the existing site conditions of the Subject Site, it is proposed that the residential towers will each have 27 storeys and with a height of 130 mPD . The proposed building height of residential towers will be compatible with the building height of nearby property developments.

### 3.2. Proposed Development Parameters

3.2.1.Table 3.1 below summarises the major development parameters of the proposed conceptual scheme.

Table 3.1 Proposed Development Parameters

| Site Area | 4,458 sq. m. |
| :--- | :--- |
| Domestic Plot Ratio | 6 |
| Domestic Gross Floor Area* | 26,748 sq. m. |
| No. of Flats | 432 |
| No. of Residential Storeys | 27 |
| No. of Towers | 2 |
| Building Height | 130 mPD |
| Note |  |
| *The aboveground car park, existing railway facilities and other public facilities, if any, are |  |
| accountable for gross floor area (GFA) under the Buildings Ordinance (Cap. 123) (BO), unless |  |
| exempted. |  |
| *The Buildings Authority may consider application for GFA concession on a case-by-case basis upon |  |
| formal submission of general building plans under the BO. Attention should be drawn to Practice |  |
| Notes for Authorised Person, Registered Structural Engineer and Registered Geotechnical Engineer |  |
| (PNAP) APP-2 issued by the Buildings Department. |  |

### 3.3. Indicative Landscape Master Plan

3.3.1. An Indicative Landscape Master Plan has been prepared with the following design objectives:

- To provide a quality and sustainable environment with adequate landscape area for the enjoyment of the residents of the proposed development.
- To incorporate new trees and shrubs to enhance the greenery.
- To create a landscape vista for future residents through provision of proper vegetated slope area to provide meaningful and tangible benefits to the residents.
3.3.2. An Indicative Landscape Master Plan has been prepared to achieve the above and comply with the greenery requirements that are stipulated in the Sustainable Building Design Guidelines. Not less than $20 \%$ of site area of greenery (i.e. 892 square metres) will be provided within the Subject Site.
3.3.3. Figures 3.10 and 3.11 respectively illustrate the Indicative Landscape Master Plan at ground leve and podium level. Appendix H further illustrates the Indicative Landscape Master Plan and Tree Survey Report.


### 3.4. Local Open Space

3.4.1. As per the HKPSG, the standard of provision for local open space is 10 hectares per 100,000 persons. This equates to the requirement of providing 1 square metre of local open space per person. The estimated population of the Subject Site is 1,210 persons. Therefore, 1,210 square metres of local open space should be provided within the Subject Site per the HKPSG.
3.4.2 As shown in Figure 3.12, a total of 1,210 square metres of local open space is provided at podium within the Subject Site. Given the estimated population of 1,210 persons, the proposed local open space provision within the Subject Site is sufficient and meets the standard of provision for local open space.

### 3.5. The Rezoning Proposal

3.5.1. Based on the proposed Conceptual Scheme outlined above, it is proposed to amend the current approved Tseung Kwan O OZP No. S/TKO/26 as follows:

- To rezone the Subject Site to "Residential (Group A) 8" from "Green Belt" and an area shown as 'MTR Pak Shing Kok Ventilation Building', with a maximum domestic plot ratio of 6 whilst any floor space that is constructed or intended for use solely as railway facilities required by the Government may be disregarded for GFA calculation. A maximum building height restriction of 130 mPD is applicable to the Subject Site.


## 4. TECHNICAL ASSESSMENTS

### 4.1. Air Ventilation

4.1.1. A Quantitative Air Ventilation Assessment Initial Study has been conducted and is attached in Appendix A. The air ventilation performance under the Existing Condition and the Conceptual Scheme was compared.
4.1.2. Dominated annual prevailing winds are from east and east-northeast directions. Chiu Shun Road is a major wind corridor to facilitate wind penetration. Therefore, 5 to 10 m setback distance from Chiu Shun Road is provided in the Conceptual Scheme with an aim to facilitating the wind movement and would not cause any substantial blockage to the approaching annual prevailing winds.
4.1.3. Summer prevailing winds are dominated from southwest and south-southwest directions and Chiu Shun Road serves as a major wind corridor. With the provision of 5 to 10 m setback distance from Chiu Shun Road in the Conceptual Scheme, it would not impose major obstruction to the summer prevailing winds.
4.1.4. Furthermore, the proposed residential towers are orientated to align with the NE-SW direction to reduce impediment to the annual and summer prevailing winds. Void areas are provided at the lower zone of the proposed development to enhance building permeability.
4.1.5. According to the CFD modelling result, it is concluded that the air ventilation performance in terms of LVRw and SVRw are slightly decreased as compared to the Existing Condition. Improvement in velocity ratio at local breezeway Chiu Shun Road and potential impact on Hang Hau Man Kuk Lane Park is observed. The Conceptual Scheme has incorporated some wind enhancement features in order to reduce the potential impact to the surrounding pedestrian wind environment, which include: (1) setback at podium level and setback of tower blocks from Chiu Shun Road;
(2) permeable elements underneath the podium and above the PVB; and (3) building separation between the two residential blocks. Another quantitative air ventilation assessment (AVA) will be conducted at detailed design stage to demonstrate that the wind performance of the Proposed Scheme is comparable with that of the Baseline Scheme, i.e. the Conceptual Scheme presented in the Rezoning Report.
4.1.6. The Baseline Scheme adopted for quantitative AVA will incorporate all wind enhancement features proposed in the Rezoning Report for comparison of wind performance with the Proposed Scheme. More wind enhancement features in the future development will be explored during the detailed design stage to further alleviate the potential impact on pedestrian wind environment.

### 4.2. Environment

4.2.1. An Environmental Assessment has been conducted and is attached in Appendix B. Potentia impacts, such as vehicular emission, road traffic noise and fixed plant noise have been studied.
4.2.2. Given the interface of the existing PVB and the proposed development, the potential impacts of the PVB on the residential development were also appraised. The PVB provides natural ventilation within the sections of Tseung Kwan O Line tunnels in its normal operation via the ventilation shafts. Only under congestion or emergency situations such as fire, the tunnel ventilation fan will be turned on for air intake/exhaust as necessary. The extracted air is not polluting in nature. 5m exhaust air zone buffer distance from the existing tunnel ventilation louvres has been allowed to the future residential development where openable windows for natural ventilation are required to fulfil both fire services and smoke exhaust requirements by Fire Services Department. Hence, there will not be any potential air quality impact to the proposed development over the Ventilation Building.
4.2.3. To alleviate the potential fixed plant noise impact to the residential development, mitigation measures such as installing appropriate acoustic louvres/silencers at the ventilation openings will be provided. As such, no unacceptable noise impact is envisaged upon occupation of the proposed development due to the operation of PVB.
4.2.4. No significant fugitive dust impact is anticipated during construction phase with implementation of relevant mitigation measures recommended in the Air Pollution Control (Construction Dust) Regulation. No adverse air quality impact due to industrial emission of chimney would be experienced by the proposed development due to the absence of chimney within 200 m of the Subject Site.
4.2.5. With respect to the potential issues arising from vehicular emissions, a minimum horizontal buffer separation of 10 m , as per Table 3.1 of Chapter 9 of HKPSG, is also proposed between the kerb side of Chiu Shun Road (a district distributor) and the proposed residential towers. To this extent, no unacceptable air quality impact due to vehicular emission is anticipated. A road traffic noise impact assessment based on forecasted traffic data has also been prepared and it is confirmed that the road traffic noise impact is considered acceptable with the implementation of appropriate mitigation measures.
4.2.6. In short, it is concluded that the extent of these environmental impacts would be acceptable with the recommended mitigation measures implemented.
4.3. Visual
4.3.1. A Visual Impact Assessment has been conducted and is attached in Appendix C. The assessment was conducted with the preparation of a series of photomontages from key local viewpoints. Given Hang Hau is a densely developed urban area, together with careful consideration of the building form, building height and tower disposition, it is concluded that the proposed residential development would not cause any major visual obstruction to its surrounding visual context. Taking into account the sensitivity of the key public viewers, visual resources and visual amenities, the proposed development would not generate unacceptable visual impact on various selected key local viewpoints.
4.3.2. Regarding the potential visual impact of the podium, various mitigation measures including multilevelled greenery, voids and building façade treatment are proposed and illustrated in Figures V3.5 and V3.6 in Appendix C, aiming to soften the development edges and improve the visual permeability.

### 4.4. Traffic

4.4.1. A Traffic Impact Assessment has been conducted and is attached in Appendix D. The findings of the traffic impact assessment indicated that the traffic generated by the proposed residential development is not anticipated to induce significant traffic impact onto the adjacent junctions. The road network in the vicinity of the Subject Site would be able to cope with the proposed residential development. Also, the findings showed that the railway network has sufficient capacity to accommodate the additional demand for the proposed PVB Site.
4.4.2. In addition, given there is currently no footpath at the eastern kerbside of Chiu Shun Road along the frontage of the Subject Site, it is proposed to modify the existing planter to provide a minimum 3 m wide footpath. A schematic layout is shown in Figure 7 in Appendix D.
4.4.3. Furthermore, to enhance the accessibility of the Subject Site to the nearby public transport services provided on Ngan O Road and the public transport interchange at MTR Hang Hau Station, an atgrade pedestrian crossing across Chiu Shun Road is proposed to be provided as shown in Figure 7 in Appendix $D$.

### 4.5. Sewerage

4.5.1. A Sewerage Impact Assessment has been conducted and is attached in Appendix E. The report has reviewed the existing sewerage system of the Subject Site, evaluated the potential sewerage impact induced from the proposed development and recommended feasible option for sewer connection. It is proposed that a 250 mm diameter sewerage pipeline, comprising three new manholes at Chiu Shun Road, be constructed and connected with an existing 300mm public sewerage pipe from Hang Hau Man Kuk Lane Park to a manhole of an existing 1,650mm diameter public trunk sewer pipeline along Chiu Shun Road. Compared with the hydraulic capacity of existing 1650 mm diameter trunk sewer pipeline along Chiu Shun Road ( $2.472 \mathrm{~m}^{3} / \mathrm{sec}$ ), the quantity of sewage flow from the proposed development is considered to be relatively small ( $0.0292 \mathrm{~m}^{3} / \mathrm{sec}$ ). Therefore, it is anticipated that there would not be any adverse sewerage impact due to the proposed development.

### 4.6. Drainage

4.6.1. A Drainage Impact Assessment has been conducted and is attached in Appendix F. The report has reviewed the existing drainage arrangement and evaluated potential impacts from the proposed development to the existing drainage system. There is a 4-cell box culvert located along Chiu Shun Road. Under the existing condition, the stormwater runoffs from the Subject Site are discharged to the existing box culvert through existing sand traps within the Subject Site. With the proposed development in place, it is recommended that the stormwater runoffs of the proposed development be separately drained to the existing box culvert via a new terminal manhole. The increase in stormwater runoff from the Subject Site with the proposed development is estimated to be $0.006 \mathrm{~m}^{3} / \mathrm{sec}$, which is comparatively small to the hydraulic capacity of the existing box culvert of $27.33 \mathrm{~m}^{3} / \mathrm{sec}$. Hence, it is anticipated that the proposed development will not cause any adverse drainage impact on the existing drainage system.

### 4.7. Geotechnical

4.7.1. A Geotechnical Planning Review Report has been conducted and is attached in Appendix G Existing site geology, man-made slopes, natural terrain and possible foundation types were appraised. Based on the available information and through implementation of the recommended slope improvement works and natural terrain mitigation measures, the proposed development is considered to be geotechnically feasible. In the detailed design stage, slope improvement works, natural terrain hazard study, and related mitigation measures will be further studied.

## 5. PLANNING GAINS AND JUSTIFICATIONS

5.1. Making Good Use of an Already Developed Site
5.1.1. Developable land is a scarce resource in Hong Kong. The proposal of developing housing atop the existing Ventilation Building represents an innovative means to increase housing supply and optimise existing land resource. The proposed development will be served by existing roads, infrastructure and railway network.

### 5.2. Compatible with Planning and Development Contexts

5.2.1. Given the Subject Site is located within an area that is dominated by high density residential developments, the proposed residential development will not cause any issue on land use interface. The proposed development is also unlikely to cause any adverse impact on the provision of GIC facilities and open spaces given its scale.
5.3. Acceptable in Infrastructure, Engineering, Environment, Visual and Landscape Aspects
5.3.1. The technical assessments have confirmed that no significant adverse impact will result from the proposed development from air ventilation, environmental, traffic, sewerage, drainage, geotechnical, landscape and visual aspects.
6. CONCLUSION
6.1.1. A rezoning study is conducted to examine the feasibility of property development at the existing Pak Shing Kok Ventilation Building Site and adjacent area, taking into consideration the local context, statutory planning context and various development constraints of the Subject Site. A series of technical assessments conclude that the proposed development has no significant adverse impact on its surroundings.


Figure 2.1 Location and Site Conditions


Figure 2.2 Statutory Planning Context (Extracted from approved Tseung Kwan O OZP No. S/TKO/26)


Figure 2.3 Development Constraints


Figure 3.1 Conceptual Scheme


Figure 3.2 Indicative Ground Floor Plan


Figure 3.3 Indicative Plan at Level +13mPD


Figure 3.4 Indicative Plan at Level +19mPD


Figure 3.5 Indicative Plan at Level +25mPD


Figure 3.6 Indicative Plan at Level +32mPD


Figure 3.7 Indicative Plan at Level +38.95mPD


Figure 3.8 Indicative Section A-A


Figure 3.9 Indicative Section B-B


Figure 3.10 Indicative Landscape Master Plan - Ground Level


Figure 3.11 Indicative Landscape Master Plan - Podium Level


Figure 3.12 Indicative Local Open Space

Appendix A
Quantitative Air Ventilation Assessment Initial Study

| ISSUE No. | $: 4$ |
| :--- | :--- |
| ISSUE DATE | $:$ SEP 2019 |
| Project No. | $: 1395$ |

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential USE

## Air Ventilation Assessment REPORT

## COMMERCIAL-IN-CONFIDENCE

Prepared By:
Allied Environmental Consultants Limited
For:
DLN Architects Limited

$\frac{\text { Allied Environmental Consultants Limited }}{\text { Acousticians \& Environmental Engineers }}$<br>19/F, Kwan Chart Tower, 6 Tonnochy Road, Wan Chal, Hong Kong Te: (852) 28157028 Fox (852) 28155399 Email: infoebochk.com

Proposed rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential USE

Air Ventilation Assessment REPORT

COMMERCIAL-IN-CONFIDENCE
 MIMeche, REA, MHKIQEP, BEAM Pro, BREEAM AP,

Approved


This report has been prepared by Allied Environmental Consultants Limited with all reasonable skill, care and diligence within the terms of the Agreement with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

## List of Figures

1. INTRODUCTION....................................................................................................... 4

## Table of Contents

2. PROJECT INFORMATION ..................................................................................... 4 2.1 Background ..................................................................................................... 4 2.2 Objectives. ... 4
3. SITE LOCATION AND SURROUNDING ENVIRONMENTAL CONTEXT ..... 5 3.1 Existing Condition...................................................................................................... 5
3.2 Proposed Development .................................................................................... 7
4. SITE WIND ENVIRONMENT (WIND AVAILABILITY)........................................ 9
4.1 General ............................................................................................................ 9

5. EXPERT EVALUATION......................................................................................... 13


5.3 Annual Prevailing Wind Condition................................................................. 16
5.4 Summer Prevailing Wind Condition............................................................... 16
5.5 Air Ventilation Improvement Features ...................................................................... 16
5.6 Focus Areas ..................................................................................................... 16
5.7 Conclusion on Expert Evaluation.................................................................................................................................. 17

6.1 Assessment Approach and Methodolo.................................................................................................................................... 18
6.2 Assessment Scenarios ........................................................................................................ 18
6.3 Geometry and Domain Setting ........................................................................ 18
6.4 Meshing Setting........................................................................................................................ 25
6.5 Numeric Scheme Setting................................................................................. 27
6.6 Wind Profile ..................................................................................................... 28
6.7 Site Boundary, Assessment Area and Surrounding Area................................. 29
6.8 Test Points. 30
6.9 Wind Velocity Ratio........................................................................................................................................ 34
6. FINDINGS ................................................................................................................. 36
7.1 Air Ventilation Results............................................................................................................................................................ 36
7.2 Site Air Ventilation Assessment Results.............................................................. 40
7.3 Local Air Ventilation Assessment Results ...................................................... 40
7.4 Focus Areas ..................................................................................................... 42
7. DISCUSSION \& DIRECTIONAL ANALYSIS ..................................................... 45
8.1 Overall Ventilation Performance under Annual Condition.............................. 45
8.2 Overall Ventilation Performance under Summer Condition
8.3 Directional Analysis .............................................................................................. 49
8. CONCLUSION

Figure 3.1 Location of Subject Site
Figure 3.2 Immediate Site Surroundings of the Subject Site............................................... 6
Figure 3.3 Conceptual Scheme ........................................................................................... 8
Figure 3.4 Conceptual Scheme, Section ............................................................................. 9


Figure 5.1 OZP showing Vicinity of the Subject Site....................................................... 13
Figure 5.2 Building Heights in the Vicinity of the Subject Site ........................................ 14
Figure 5.3 Air Path under Annual Prevailing Northeasterly Wind.................................... 15
Figure 5.4 Air Path under Summer South-westerly Wind ................................................. 15
Figure 6.1 CFD Geometry Set-up (Top View) $\quad 19$
Figure 6.2 CFD Geometry Set-up (Side View)................................................................. 19
Figure 6.3 Overall CFD Model........................................................................................ 20
Figure 6.4 CFD Model 3-D View (East) under Existing Condition .................................................................................................
Figure 6.5 CFD Model 3-D View (South) under Existing Condition.............................................. 21
Figure 6.6 CFD Model 3-D View (West) under Existing Condition................................. 22
Figure 6.7 CFD Model 3-D View (North) under Existing Condition............................... 22
Figure 6.8 CFD Model 3-D View (East) under Conceptual Scheme................................. 23
Figure 6.9 CFD Model 3-D View (South) under Conceptual Scheme .............................. 23
Figure 6.10 CFD Model 3-D View (West) under Conceptual Scheme ............... 24
Figure 6.11 CFD Model 3-D View (North) under Conceptual Scheme .............................. 24
Figure 6.12 Zoom in 3D model under Conceptual Scheme.............................................................. 25
Figure 6.13 CFD Mesh Model ....................................................................................................................... 26
Figure 6.14 CFD Prism Layers .......................................................................................... 27
Figure 6.15 Wind Profile at Grid $(099,041)$...................................................................... 29
Figure 6.16 Subject Site, Assessment Area and Surrounding Area.................................... 30
Figure 6.17 Positions of Perimeter Test Points (23 perimeter test points) .......................... 32
Figure 6.18 Positions of Overall Test Points ( 112 overall test points) ............................... 33
Figure 6.19 Positions of Special Test Points ( 20 special test points) . 34
Figure 7.1 Wind Velocity Ratio of Perimeter Test Points (Annual).................................. 36
Figure 7.2 Wind Velocity Ratio of Overall Test Points (Annual OP001 - OP112)........................ 37
Figure 7.3 Wind Velocity Ratio of Perimeter Test Points (Summer)................................ 38
Figure 7.4 Wind Velocity Ratio of Overall Test Points (Summer OP001 - OP112) ........ 39
Figure 7.5 Identified Focus Areas.
... 42
Figure 8.1 Annual frequency weighted VR contour plot under Existing Condition ......... 45
Figure 8.2 Annual frequency weighted VR contour plot under Conceptual Scheme........ 45
Figure 8.3 Summer frequency weighted VR contour plot under Existing Condition ....... 47
Figure 8.4 Summer frequency weighted VR contour plot under Conceptual Scheme...... 47
Figure 8.5 VR Contour Plot under ENE wind of Existing Condition................................ 50
Figure 8.6 VR Contour Plot under ENE wind of Conceptual Scheme ................................................ 50
Figure 8.7 VR Contour Plot under E wind of Existing Condition.................................................. 52
Figure 8.8 VR Contour Plot under E wind of Conceptual Scheme ................................... 52
Figure 8.9 VR Contour Plot under NE wind of Existing Condition.................................. 54
Figure 8.10 VR Contour Plot under NE wind of Conceptual Scheme ................................ 54
Figure 8.11 VR Contour Plot under NNE wind of Existing Condition ............................... 55
Figure 8.12 VR Contour Plot under NNE wind of Conceptual Scheme.............................. 55
Figure 8.13 VR Contour Plot under ESE wind of Existing Condition ................................ 57
Figure 8.14 VR Contour Plot under ESE wind of Conceptual Scheme.................................... 57

## Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use

 air Ventilation Assessment ReportFigure 8.15 VR Contour Plot under SSW wind of Existing Condition
Figure 8.16 VR Contour Plot under SSW wind of Conceptual Scheme
$\qquad$ .
Figure 8.17 VR Contour Plot under SE wind of Existing Condition
Figure 8.17 VR Contour Plot under SE wind of Existing Condition.................................. 61
Figure 8.18 VR Contour Plot under SE wind of Conceptual Scheme . .61
Figure 8.19 VR Contour Plot under SW wind of Existing Condition ................................. 63
Figure 8.20 VR Contour Plot under SW wind of Conceptual Scheme................................ 63
Figure 8.21 VR Contour Plot under SSE wind of Existing Condition ................................ 65
Figure 8.22 VR Contour Plot under SSE wind of Conceptual Scheme............................... 65
Figure 8.23 VR Contour Plot under S wind of Existing Condition..
Figure 8 VR Contour Plot under S wind or Existing Condition..................................... 67
Figure 8.25 Velocity Streamline under S wind of Existing Condition 67

Figure 8.26 Velocity Streamline under S wind of Conceptual Scheme. .....  68
Figure 8.27 VR Contour Plot under WSW wind of Existing Condition. .....  70
Figure 8.28 VR Contour Plot under WSW wind of Conceptual Scheme ..... 70

## List of Tables

Table 4.1 Summary of Wind Contribution at Subject Site $\qquad$ .. 10
Table 6.1 Boundary Condition Setting for CFD Modelling . 28

Table 6.2 Weighted Occurrence Frequency (Fi) of Annual Prevailing Wind Directions... 35
Table 7.1 Summary of Weighted Site Velocity Ratios (SVRw).
Table 7.2 Summary of Weighted Local Velocity Ratios (LVRw) 41

Table 7.3 Focus Area Weighted Average Velocity Ratio .

## List of Appendices

## Appendix A Detailed Wind Profile

Appendix B Location of Overall and Perimeter Test Points
Appendix C Detailed Velocity Ratio (VR) Results for All Test Points
Appendix D Contour and Vector Plots of CFD Simulation Result of Velocity Ratio

## 1. INTRODUCTION

1.1.1 Allied Environmental Consultants Limited (AEC) was commissioned by the DLN Architects Limited (DLN) to undertake the Consultancy Service for Rezoning Study of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use.

## 2. PROJECT INFORMATION

### 2.1 Background

2.1.1 The Subject Site is at the MTR Pak Shing Kok Ventilation Building (PVB) Site and adjacent "Green Belt" Site to the south of PVB. Site area is about $4,458 \mathrm{~m}^{2}$. The site is immediately fronting to Chiu Shun Road at north-west, and Wan Po Road at southwest.
2.1.2 The Conceptual Scheme involves a podium and two 27 -storey residential towers. The proposed project is planned to be completed in Year 2029.

### 2.2 Objectives

2.2.1 This Air Ventilation Assessment (AVA) is divided into two parts. The first part is to carry out Expert Evaluation (EE), which is a qualitative assessment to evaluate the wind characteristic to the surrounding environment, with respect to the proposed development scheme, taking into account surrounding buildings and topography (including the planned public housing development). The second part is to carry out Initial Study (IS), is a quantitative assessment to substantiate the preliminary findings suggested in the EE.
2.2.2 Relevant information on the Tseung Kwan O Area Air Ventilation Assessment Expert Evaluation Report (2011) made available by the Authority, and wind rose data available from Planning Department (PlanD) ${ }^{1}$ have been taken into consideration in this EE, with reference to the recommendations suggested on the "Technical Guide of HPLB and ETWB Technical Circular (TC) on AVA No. 1/06" and Chapter 11 of the Hong Kong Planning Standard and Guidelines (HKPSG).

## Expert Evaluation (EE)

2.2.3 The main objectives of this EE are:-

- To conduct desk-top review for the wind performance at the vicinity of the proposed development based on available information in PlanD portal;
- To compare the Existing Condition \& Conceptual Scheme for evaluating qualitatively the wind performance of the proposed development; and
- To identify problematic areas and recommend mitigation measures on the Conceptual Scheme to optimize local and regional air ventilation performance; if necessary


## Initial Study

2.2.4 Further to the EE, quantitative AVA Initial Study (IS) has been carried out to refine and substantiate the preliminary findings suggested in the EE. This AVA IS presents the cumulative air ventilation performance of the site, taking into account also the planned public housing development to its north-east.
3. SITE LOCATION AND SURROUNDING ENVIRONMENTAL CONTEXT

### 3.1 Existing Condition

3.1.1 Site location of the proposed residential development is shown in Figure 3.1


Figure 3.1 Location of Subject Site
3.1.2 As shown in Figure 3.1, Pak Shing Kok Ventilation Building with a maximum height of 29.72 mPD is located at the northeastern portion of the Subject Site. North to the Subject Site is dominated with residential developments with maximum building height of 175 mPD . To the immediate north and north-east of the Site across Chiu Chun Road is residential developments La Cite Noble and Yuk Ming Court at around

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use Air Ventilation Assessment Report

146 mPD and 115 mPD respectively; and a planned public housing development with a maximum building height of 130 mPD
3.1.3 Towards the southern part of the Subject Site is a vegetated slope and about 1 km south-east of the Subject Site is Sheung Yeung Shan with an elevation of about 250 mPD . Open areas Hang Hau Man Kuk Lane Park across Chiu Chun Road is located west of the site, where Tseung Kwan O Sports Ground located further west of the Site
3.1.4 Photos of immediate surroundings are shown in Figure 3.2.



Figure 3.2 Immediate Site Surroundings of the Subject Site (continued)
3.2 Proposed Development
3.2.1 The proposed development involves construction of two 27-storey residential towers, combined with a podium including carpark and resident clubhouse. Building height at main roof is 130 mPD
3.2.2 Building height of the existing developments surrounding the Subject Site such as La Cite Noble and Yuk Ming Court is at around 146 mPD and 115 mPD . A planned public housing development is located adjacent north-east of the site with a building height of 130 mPD .
3.2.3 For this air ventilation assessment, the Conceptual Scheme has been developed to compare the ventilation performance of the existing wind environment. Conceptua Drawings of the Conceptual Scheme are shown in below Figure 3.3 to Figure 3.4
3.2.4 The Conceptual Scheme tries to maximize the setback distance from Chiu Shun Road with around 5 m at podium level and 10 m from tower block to Chiu Shun Road.


Figure 3.3 Conceptual Scheme


Figure 3.4 Conceptual Scheme, Section

### 4.2 Site Wind Availability Data

4.2.1 The simulated set of meso-scale model Regional Atmospheric Modeling System (RAMS) wind data at different level $(200 \mathrm{~m}, 300 \mathrm{~m}$ and 500 m above terrain) are available at the website of the Planning Department (PlanD) and captured in Figure 4.1 .
4.2.2 Referring to PlanD website, the Subject Site is located at Grid (x:099, y:041). Table 4.1 summarises wind contribution under 16 wind directions at 500 m during annual, winter and summer
4.2.3 As shown in Figure 4.1 and Table 4.1, the dominated annual prevailing winds are from E and ENE where winter prevailing wind dominates from ENE and NE, and summer prevailing wind dominates from SW and SSW. The seasonal prevailing wind condition reaching the subject site is summarized Figure 4.2

| Prevailing Condition | Annual | Summer | Winter |
| :---: | :---: | :---: | :---: |
| N | $3.3 \%$ | $1.1 \%$ | $4.4 \%$ |
| NNE | $7.2 \%$ | $1.5 \%$ | $11.9 \%$ |
| NE | $10.7 \%$ | $2.1 \%$ | $19.3 \%$ |
| ENE | $16.7 \%$ | $3.9 \%$ | $27.1 \%$ |
| E | $18.0 \%$ | $9.3 \%$ | $19.2 \%$ |
| ESE | $7.6 \%$ | $7.8 \%$ | $6.4 \%$ |
| SE | $5.1 \%$ | $6.2 \%$ | $3.6 \%$ |
| SSE | $4.4 \%$ | $7.6 \%$ | $2.1 \%$ |
| S | $4.5 \%$ | $9.9 \%$ | $1.5 \%$ |
| SSW | $6.1 \%$ | $14.2 \%$ | $1.1 \%$ |
| SW | $6.7 \%$ | $16.0 \%$ | $1.0 \%$ |
| WSW | $4.1 \%$ | $9.7 \%$ | $0.4 \%$ |
| W | $2.3 \%$ | $5.0 \%$ | $0.5 \%$ |
| WNW | $1.0 \%$ | $2.1 \%$ | $0.3 \%$ |
| NW | $1.0 \%$ | $2.1 \%$ | $0.3 \%$ |
| NNW | $1.1 \%$ | $1.3 \%$ | $0.8 \%$ |

Table 4.1 Summary of Wind Contribution at Subject Site
4. SITE WIND ENVIRONMENT (WIND AVAILABILITY)
4.1 General
4.1.1 Hong Kong as a whole is characterised with northeast prevailing wind throughout the year. During summer time, southwest wind is also predominant
4.1.2 In order to analyse the wind characteristics in the vicinity of the proposed development at Subject Site and its surrounding area, a meso-scale model Regiona Atmospheric Modeling System (RAMS) simulated site wind availability data at the grid of the subject sites were reviewed.

| 䦎 | 䦎 | 䦎 |
| :---: | :---: | :---: |
| C | B | e |
| Hin | 湤 | fin |
| c） | （8） | （3） |
| fin | biin | min |
| － | 8 | e |

Figure 4．1 RAMS Wind Roses at Grid（x：099，y：041）
Issue 4 AEC


## 5. EXPERT EVALUATION

### 5.1 Land Use and Existing Urban Morphology

 $\underline{\text { Land Use }}$5.1.1 According to the approved Tseung Kwan O Outline Zoning Plan (OZP No. S/TKO/26) in Figure 5.1, the Subject Site is currently situated in between a Residential (Group A) zone (R(A)) and Green Belt zone (GB) with a local access road. Village Houses ar located north-east of the Subject Site and open areas are situated west of the subject site together with a heavily traffic Wan Po Road. The maximum building height in immediately surrounding the Site is about 150 mPD .


Figure 5.1 OZP showing Vicinity of the Subject Site

## Existing Urban Morphology and Topography

5.1.2 The Site is bounded by Chiu Shun Road to the northwest. Pak Shing Kok Ventilation Building ( $\sim 30 \mathrm{mPD}$ ) situates at the northeast portion of the Site; north of the Site is existing developments which are mainly high-rise ( $\sim 150 \mathrm{mPD}$ ) residential buildings and schools ( $\sim 40 \mathrm{mPD}$ ) and village houses ( $\sim 20 \mathrm{mPD}$ ); a planned public housing site is
located north-east of the Subject Site (130mPD). In addition, the Hang Hau Man Kuk Lane Park and Tseung Kwan O Sports Ground situate at the west of the site. Sheung Yeung Shan and Pak Shing Kok Hillslope with elevation up to 250 mPD are at the south-east of the Subject Site.
5.1.3 Approximate building height of the surrounding existing building developments are indicated in Figure 5.2.


Figure 5.2 Building Heights in the Vicinity of the Subject Site

### 5.2 Wind Corridor and Air Path

5.2.1 As discussed in Section 4, annual prevailing winds at the Subject Site shall mainly come from northerly east, while summer prevailing winds come from southerly west In other words, Chiu Shun Road would serve as one of the air paths surrounding the Subject Site under both annual prevailing wind and summer wind scenarios. The potential air paths / breezeways are identified and illustrated in Figure 5.3 to Figure 5.4 under dominated annual easterly and summer westerly wind directions.


Figure 5.3 Air Path under Annual Prevailing Northeasterly Wind


Figure 5.4 Air Path under Summer South-westerly Wind

### 5.3 Annual Prevailing Wind Condition

5.3.1 Under annual prevailing east and north-easterly wind, the site topology is anticipated to divert the upcoming east wind towards to north-easterly direction and the upcoming wind reaching the Subject Site is anticipated to be north-easterly in most probable situations.
5.3.2 Under the north-easterly wind direction, Chiu Shun Road acts as an air path to facilitate wind penetration through the upstream area towards the downstream Tseung Kwan O Sports Ground and Wan Po Road.
5.3.3 The setback distance from Chiu Shun Road aims to facilitate such wind movement without causing any substantial blockage and impediment to the approaching north easterly wind.

### 5.4 Summer Prevailing Wind Condition

5.4.1 South-westerly wind is the prevailing winds under summer period. Similar to annual prevailing easterly wind, Chiu Shun Road serves as an air path along the SW-NE direction.
5.4.2 The open area such as Tseung Kwan O Sports Ground and Po Yap Road located south-west of the Subject Site is anticipated to allow prevailing south-westerly wind to flow through towards the subject site and through to the downstream Hang Hau area.
5.4.3 With the proposed setback distance and alignment with the south-westerly orientation, the proposed building aims to minimize any major obstruction or impediment to the prevailing south-westerly wind
5.5 Air Ventilation Improvement Features
5.5.1 As shown in Figure 3.3 and Figure 3.4, the Conceptual Scheme has allowed air ventilation improvement features to enhance air ventilation and permeability in the immediately vicinity of the Subject Site such as

- $\quad 5-10 \mathrm{~m}$ set back from Chiu Shun Road to improve the width of annual prevailing wind and summer wind breezeway
- Orientated tower blocks aligning with the NE-SW direction to reduce impediment to the annual and summer prevailing wind
- Provided void areas to enhance building permeability at the lower (pedestrian) zone of the proposed development
- Alignment of building height at a maximum of 130 mPD respecting to the immediate surrounding (ie., La Cite Noble in 146 mPD ) and planned public housing development in 130 mPD


## Focus Area

5.6.1 The height of the residential towers may cause screening effect to the approaching SW prevailing winds through towards downstream village houses of Fat Tau Chau Village and other downstream areas within the assessment boundary
Issue 4

## Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use AIR VENTILATION ASSESSMENT REPORT

5.6.2 Also, open areas such as Tseung Kwan O Sports Ground located south-west of the Subject Site may also be affected by the proposed building under prevailing easterly wind directions.
5.6.3 It is important to take into consideration of the above mentioned issues as far as practicable and enhance the permeability of the proposed development to prevailing wind.

### 5.7 Conclusion on Expert Evaluation

5.7.1 The Conceptual Scheme introduced range of features and design considerations to maintain a good wind penetrations and wind permeability.
5.7.2 As the Site is located within the breezeway along Chiu Shun Road, therefore A Computational Fluid Dynamic shall be carried out to determine velocity ratios (VR) a different concerned locations in order to quantitatively assess the air ventilation performance at pedestrian level to demonstrate whether the proposed private housing development would have any adverse air ventilation impact on the surrounding areas.

## 6. INITIAL STUDY

### 6.1 Assessment Approach and Methodology

6.1.1 ANSYS FLUENT version 15, as a computational fluid dynamics (CFD) simulation model, has been used for the natural ventilation study. It is a sophisticated modelling method, which takes into account the usual fluid dispersion calculation method under both laminar and turbulence flow stimulation. The equations that the CFD mode solves are algebraic equations which result from applying the conservation laws of physics to finite volumes of space and time.
6.1.2 The geometry and simulation options for subject development and surrounding environment have been set up to calculate the wind speed at the development and surrounding ambient. Related wind speeds around the development were assessed by setting up a scaled model of the development with surrounding building structures and topographical features.

### 6.2 Assessment Scenarios

6.2.1 To compare the wind environment of the assessment area, CFD analysis has been carried out for two Schemes:

1) Existing Condition. This considers the ventilation performance of the assessmen area without the proposed residential development in place
2) Conceptual Scheme. This considers the ventilation performance of the assessment area with the proposed residential development in place.

### 6.3 Geometry and Domain Setting

6.3.1 Geometry including roads and buildings was imported to the CFD modelling for an area of approximately 500 m radius around the development. The CFD setup of different perspectives are shown in Figure 6.1 to Figure 6.11. The zoom in 3D model view under Conceptual Scheme is shown in Figure 6.12


Figure 6.1 CFD Geometry Set-up (Top View)


## Figure 6.2 CFD Geometry Set-up (Side View)



Figure 6.4 CFD Model 3-D View (East) under Existing Condition


Figure 6.5 CFD Model 3-D View (South) under Existing Condition


Figure 6.6 CFD Model 3-D View (West) under Existing Condition


Figure 6.7 CFD Model 3-D View (North) under Existing Condition

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use Air Ventilation Assessment Report


Figure 6.8 CFD Model 3-D View (East) under Conceptual Scheme


Figure 6.9 CFD Model 3-D View (South) under Conceptual Scheme


Figure 6.10 CFD Model 3-D View (West) under Conceptual Scheme


Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use Air Ventilation Assessment Report


Figure 6.12 Zoom in 3D model under Conceptual Scheme
6.3.2 The size of the computational domain of the 3D model is illustrated below:

$$
\begin{aligned}
& \mathrm{x} \text {-direction }(\mathrm{L})=3,850 \mathrm{~m} ; \\
& \mathrm{y} \text {-direction }(\mathrm{W})=3,850 \mathrm{~m} ; \text { anc } \\
& \mathrm{z} \text {-direction }(\mathrm{H})=1,100 \mathrm{~m}
\end{aligned}
$$

6.3.3 It is calculated that the blockage ratio of the model is less than $3.0 \%$.
6.4 Meshing Setting
6.4.1 Unstructured grid is constructed by ANSYS FLUENT version 15 and the grid size can be manually adjusted in the aforesaid meshing tools. Within the assessment area, cells located across the $x$-axis and $y$-axis are positioned with smaller intervals than those ocated further from the site location in order to produce a more precise result at higher resolution where it is required.
6.4.2 The CFD model is developed with the combination of tetrahedral and prism cells. Approximately 5 million cells are constructed for the study. The grid arrangement within the assessment height of 2 m above ground has been refined to facilitate the pedestrian wind environment study. In order to improve accuracy, smaller gird has been adopted in order to achieve a higher resolution at low levels of $z$-axis and thus capable of resolving small scale height structures and changes in topography at pedestrian level. The expansion ratio between two consecutive cells is less than 1.3 Four prism layers are created at 2 m above ground to increase modelling accuracy a pedestrian level. Figure 6.13 and Figure 6.14 show the meshing details of the geometries.



Figure 6.14 CFD Prism Layers

### 6.5 Numeric Scheme Setting

6.5.1 ANSYS FLUENT offers an unparalleled breadth of turbulence models such as realizable k-epsilon turbulence model and the Reynolds stress model (RSM). In this study, the realizable k -epsilon model and a second order discretization scheme are adopted for simulation.
6.5.2 FLUENT uses iterative methods to solve the algebraic system of equations. The termination criterion is usually based on the residuals of the corresponding equations The termination criterion of 0.001 has been used in this study.
6.5.3 The boundary conditions under various winds are tabulated in Table 6.1.

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use
air Ventilation Assessment Report

|  | Wind Directions | East | North | South | West | Top | Terrain |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Annual <br> Prevailing Winds <br> Wind | E | Velocity inlet | Symmetry | Symmetry | Pressure outlet | Symmetry | Wall |
|  | ENE | Velocity inlet | Velocity inlet | Pressure outlet | Pressure outlet | Symmetry | Wall |
|  | NE | Velocity inlet | Velocity inlet | Pressure outlet | Pressure outlet | Symmetry | Wall |
|  | NNE | Velocity inlet | Velocity inlet | Pressure outlet | Pressure outlet | Symmetry | Wall |
|  | ESE | Velocity inlet | Pressure outlet | Velocity inlet | Pressure outlet | Symmetry | Wall |
|  | SSW | Pressure outlet | Pressure outlet | Velocity inlet | Velocity inlet | Symmetry | Wall |
|  | SW | Pressure outlet | Pressure outlet | Velocity inlet | Velocity inlet | Symmetry | Wall |
| Summer Prevailing Winds | SW | Pressure outlet | Pressure outlet | Velocity inlet | Velocity inlet | Symmetry | Wall |
|  | SSW | Pressure outlet | Pressure outlet | Velocity inlet | Velocity inlet | Symmetry | Wall |
|  | E | Velocity inlet | Symmetry | Symmetry | Pressure outlet | Symmetry | Wall |
|  | SE | $\begin{gathered} \hline \text { Velocity } \\ \text { inlet } \\ \hline \end{gathered}$ | Pressure outlet | Velocity inlet | Pressure outlet | Symmetry | Wall |
|  | SSE | Velocity inlet | Pressure outlet | Velocity inlet | Pressure outlet | Symmetry | Wall |
|  | S | Symmetry | Pressure outlet | Velocity inlet | Symmetry | Symmetry | Wall |
|  | WSW | Pressure outlet | Pressure outlet | Velocity inlet | Velocity inlet | Symmetry | Wall |
|  | ESE | Velocity inlet | Pressure outlet | Velocity inlet | Pressure outlet | Symmetry | Wall |

Table 6.1 Boundary Condition Setting for CFD Modelling

### 6.6 Wind Profile

6.6.1 Wind data used in CFD simulation should be referred to the latest simulated data published by Planning Department. The wind profiles from the simulated data are demonstrated in Figure 6.15.


## Figure 6.15 Wind Profile at Grid $(099,041)$

6.6.2 Detailed wind profiles are provided in Appendix $A$.
6.7 Site Boundary, Assessment Area and Surrounding Area
6.7.1 It is recommended in the Technical Guide that the Assessment Area and Surrounding Area of the Project should include the Project's surrounding of up to a perpendicular distance H and 2 H respectively from the Project boundary, while H being the height of the tallest building of the proposed development

Surrounding Buildings and Structures
6.7.2 All existing buildings and elevated structures have been included. Besides, a planned public housing development to the north-east of the subject site have also been included. Noise barriers, elevated structures and planned development indicated in the CFD model as shown in Figure 6.3

## Assessment Area

6.7.3 The assessment area covers the surrounding environment of the project, which is up to a perpendicular distance H (where H is the height of the tallest building within the site i.e. 123 m ). However, it is necessary to enlarge the area to distance of 2 H up to approximately 260 m in order to define a representable assessment area as shown in Figure 6.16.

## Surrounding Area

6.7.4 The surrounding area should normally up to a perpendicular distance of 2 H from the project area boundary, which is approximately 260 m for this study. In practice of a conservative approach, a surrounding area 500 m measured from the Subject Site boundary has been adopted in the model. Figure 6.16 illustrates respectively the Subject Site, assessment area and surrounding area for the project development.


Figure 6.16 Subject Site, Assessment Area and Surrounding Area

## Test Points

1 Test points are the locations where Wind VRs are determined and reported. Based on the VR of the test points, the resultant wind environment of the project can be assessed
6.8.2 Both perimeter test points and overall test points were positioned within the assessment area in order to assess the immediate impact of the Proposed Development to the surrounding area (i.e. Site Air Ventilation Assessment) and local areas (i.e. Local Air Ventilation Assessment) respectively.
6.8.3 Perimeter Test Points are distributed along the site boundary of the proposed development which are accessible. Test Points in this group are named with prefix "PP" (i.e. PP001, PP002...). There are a total of 23 Perimeter Test Points located at around 10 m centre to centre.
6.8.4 Overall Test Points are evenly distributed at a distance of around 40 m centre to centre on the open streets, open space and places of the project and Assessment Areas where pedestrians frequently access. Test points in this group are named with prefix "OP" (i.e. OP001, OP002...). There are a total of 112 overall test points in this study
6.8.5 Special Test Points are evenly distributed at a distance of around 40 m centre to centre on the podium of the surrounding residential developments (e.g. La Cite Noble and Maritime Bay) in order to evaluate the potential impact by the proposed development Test points in this group are named with prefix "SP" (i.e. SP001, SP002...). There are a total of 20 special test points in this study
6.8.6 All test points are the locations where Wind Velocity Ratio (VR) at pedestrian leve ( 2 m above ground) is reported.
6.8.7 Locations of the perimeter test points, overall test points and special test points are shown in Figure 6.17, Figure 6.18 and Figure 6.19 respectively. Detailed locations of perimeter test points, overall test points and special test points are shown in Appendix B.


Figure 6.17 Positions of Perimeter Test Points (23 perimeter test points)


Figure 6.18 Positions of Overall Test Points (112 overall test points)

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use AIR VENTLLATION ASSESSMENT REPORT


Figure 6.19 Positions of Special Test Points (20 special test points)

### 6.9 Wind Velocity Ratio

6.9.1 Wind Velocity Ratio (VR) should be used as an indicator of wind performance for the AVA. Wind velocity is assessed at 2 m above ground level. It indicates how much of the wind availability of a location could be experienced and enjoyed by pedestrians on ground taking into account the surrounding buildings. The higher the wind velocity ratio, the less likely would be the impact of the proposed developments on the wind availability.
6.9.2 The assessment on the overall wind performance of the current situation and the proposed developments are analysed by comparing the weighted-mean wind velocity ratio $\left(\mathrm{VR}_{\mathrm{w}}\right)$ to account for wind coming from the wind directions for which the sum of occurrence frequency is $>75 \% . \mathrm{VR}_{\mathrm{w}}$ is the sum of the Wind Velocity Ratio of wind from direction $\left(\mathrm{VR}_{\mathrm{i}}\right)$ multiplied by the probability ( Fi ) of wind coming from that direction.
$V R i=\frac{V_{p i}}{V_{\infty i}}$
$V R_{w}=\sum_{i=1}^{n} F_{i} \times V R_{i}$
where ${V R_{i}}$ is the velocity ratio of the location when wind comes from direction $i$;
$\mathrm{V}_{\mathrm{pi}}$ is the wind velocity at the pedestrian level ( 2 m above ground) when wind comes from direction i;
$\mathrm{V}_{\infty i}$ is the wind availability of the site when wind comes from direction i , i.e. wind velocity at the top of the wind boundary layer;
$F_{i}$ is the frequency occurrence of wind from direction $i$
n is the number of wind from 16 wind directions with sum of occurrence frequency $>75 \%$
6.9.3 The normalized weighting ( $\mathrm{F}_{\mathrm{i}}$ ) for each wind direction under annual and summer prevailing conditions is in Table 6.2.

| Annual Prevailing Wind condition |  |  | Summer Prevailing Wind condition |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Wind <br> Direction | Occurrence <br> (requency of the <br> wind direction | Normalized <br> weighting (Fi) | Wind <br> Direction | Occurrence <br> frequency of the <br> wind direction | Normalized <br> weighting (Fi) |
| E | $18.0 \%$ | $23.0 \%$ | SW | $16.0 \%$ | $19.8 \%$ |
| ENE | $16.7 \%$ | $21.4 \%$ | SSW | $14.2 \%$ | $17.6 \%$ |
| NE | $10.7 \%$ | $13.7 \%$ | S | $9.9 \%$ | $12.3 \%$ |
| ESE | $7.6 \%$ | $9.7 \%$ | WSW | $9.7 \%$ | $12.0 \%$ |
| NNE | $7.2 \%$ | $9.2 \%$ | E | $9.3 \%$ | $11.5 \%$ |
| SW | $6.7 \%$ | $8.6 \%$ | ESE | $7.8 \%$ | $9.7 \%$ |
| SSW | $6.1 \%$ | $7.8 \%$ | SSE | $7.6 \%$ | $9.4 \%$ |
| SE | $5.1 \%$ | $6.5 \%$ | SE | $6.2 \%$ | $7.7 \%$ |
| Total | $\mathbf{7 8 . 1 \%}$ | $\mathbf{1 0 0 \%}$ | Total | $\mathbf{8 0 . 7 \%}$ | $\mathbf{1 0 0 \%}$ |

Table 6.2 Weighted Occurrence Frequency (Fi) of Annual Prevailing Wind Directions
6.9.4 For the Site Air Ventilation Assessment, the Site spatial average Velocity Ratio (SVR) is reported, which takes into account the perimeter test points evenly positioned on the existing site boundary as shown in Figure 6.17.
6.9.5 For the Local Air Ventilation Assessment, the Local spatial average Velocity Ratio (LVR) is reported, which takes into account perimeter test points, the overall test

## Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use

 air Ventilation Assessment Reportpoints and the special test points evenly distributed and positioned in the open spaces, on the streets within the assessment area as shown in Figure 6.17 to Figure 6.19.

## 7. FINDINGS

### 7.1 Air Ventilation Results

7.1.1 The simulation results of VR at all test points are provided in Appendix C. VR demonstrated in terms of contour and vector plots for all prevailing wind directions are provided in Appendix $\boldsymbol{D}$
7.1.2 For air ventilation assessment of the Existing Condition and Conceptual Scheme, perimeter test points and overall test points are assigned at the pedestrian level. The performance under annual and summer prevailing wind conditions are discussed below.

Annual Wind Ventilation Performance
7.1.3 The differences of VRw at each perimeter test point between Existing Condition and Conceptual Scheme under annual condition are presented in Figure 7.1, while differences of VRw at each overall test point are presented in Figure 7.2.

## Wind Velocity Ratio of Perimeter Test Points (Annual)



Figure 7.1 Wind Velocity Ratio of Perimeter Test Points (Annual)

Project No.: 1395
Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use Air Ventilation Assessment Report

## Summer Wind Ventilation Performance

7.1.4 The differences of VRw at each perimeter test point between Existing Condition and Conceptual Scheme under summer condition are presented in Figure 7.3 while differences of VRw at each overall test point are presented in Figure 7.4

Wind Velocity Ratio of Perimeter Test Points (Summer)


Figure 7.3 Wind Velocity Ratio of Perimeter Test Points (Summer)

Project No.: 1395
Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent area for Residential Use Air Ventilation Assessment Report

### 7.2 Site Air Ventilation Assessment Results

7.2.1 Site Velocity Ratios (SVR) under annual and summer prevailing winds are evaluated by considering the average Velocity Ratio of all Perimeter Test Points ( 23 points) along the project site boundary. Weighted Site Velocity Ratios (SVRw) are determined by taking into account the wind probability of the assessed annual and summer prevailing wind directions. The SVRw results for the Existing Condition and Conceptual Scheme are summarized in Table 7.1 below.

| Annual <br> Wind <br> Condition | VRaverage $^{\text {(Existing) }}$ | VR $_{\text {average }}$ <br> (Conceptual) | $\mathbf{V R}_{\text {average }}$ <br> Change | Summer <br> Wind <br> Condition | $\mathbf{V R}_{\text {average }}$ <br> (Existing) | $\mathbf{V R}_{\text {average }}$ <br> (Conceptual) | VR $_{\text {average }}$ <br> Change |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E | 0.350 | 0.261 | -0.089 | SW | 0.144 | 0.209 | 0.065 |
| ENE | 0.313 | 0.296 | -0.017 | SSW | 0.134 | 0.160 | 0.026 |
| NE | 0.148 | 0.163 | 0.015 | S | 0.146 | 0.153 | 0.007 |
| ESE | 0.274 | 0.200 | -0.074 | WSW | 0.184 | 0.170 | -0.014 |
| NNE | 0.242 | 0.199 | -0.043 | E | 0.350 | 0.261 | -0.089 |
| SW | 0.144 | 0.209 | 0.065 | ESE | 0.274 | 0.200 | -0.074 |
| SSW | 0.134 | 0.160 | 0.026 | SSE | 0.214 | 0.170 | -0.044 |
| SE | 0.111 | 0.163 | 0.052 | SE | 0.111 | 0.163 | 0.052 |
| SVRW | $\mathbf{0 . 2 4 0}$ | $\mathbf{0 . 2 1 4}$ | $-\mathbf{0 . 0 2 6}$ | SVRW | $\mathbf{0 . 1 8 8}$ | $\mathbf{0 . 1 8 7}$ | $-\mathbf{0 . 0 0 1}$ |

Table 7.1 Summary of Weighted Site Velocity Ratios (SVRw)
7.2.2 As shown in Table 7.1, the SVRw show changes in the range of -0.089 to 0.065 under annual prevailing wind conditions. The weighted average SVR is found to be 0.240 and 0.214 in the Existing Condition and Conceptual Scheme respectively, reflecting an overall reduction of 0.026 in SVRw.
7.2.3 The predicted SVRw values for summer prevailing wind condition also show changes in the range of -0.089 to 0.065 . The weighted average SVR is found to be 0.188 and 0.187 in the Existing Condition and Conceptual Scheme respectively, reflecting an minor overall negative change of 0.001 in SVRw.
7.2.4 The findings indicated that Conceptual Scheme introduces slightly different wind ventilation performance in its immediate vicinity under both annual and summer wind conditions. As annual wind mostly comes from the easterly direction where frontal area at east facing elevation is larger as compared to south facing elevation, the SVRw is slightly reduced under annual and summer wind condition.
7.3 Local Air Ventilation Assessment Results
7.3.1 Local Velocity Ratios (LVR) under annual and summer prevailing winds are evaluated by considering the average Velocity Ratio of at all Perimeter Test Points (23 points) and Overall Test Points (112 test points). Weighted Local Velocity Ratios (LVRw) are determined by taking into account the wind probability of the assessed annual and summer prevailing wind directions. The LVRw results for the Existing Condition and Conceptual Scheme are summarized in Table 7.2 below.

Project No.: 1395
Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use

| AIR VENTILATION ASSESSMENT REPORT |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Annual <br> Wind <br> Condition | $\mathbf{V R}_{\text {average }}$ <br> (Existing) | VR $_{\text {average }}$ <br> (Conceptual) | VR $_{\text {average }}$ <br> Change | Summer <br> Wind <br> Condition | $\mathbf{V R}_{\text {average }}$ <br> $($ Existing) | $\mathbf{V R}_{\text {average }}$ <br> (Conceptual) $)$ | VR $_{\text {average }}$ <br> Change |
| E | 0.285 | 0.258 | -0.027 | SW | 0.270 | 0.292 | 0.022 |
| ENE | 0.244 | 0.245 | 0.001 | SSW | 0.170 | 0.183 | 0.013 |
| NE | 0.199 | 0.199 | 0.000 | S | 0.138 | 0.140 | 0.002 |
| ESE | 0.184 | 0.166 | -0.018 | WSW | 0.203 | 0.203 | 0.000 |
| NNE | 0.165 | 0.151 | -0.014 | E | 0.285 | 0.258 | -0.027 |
| SW | 0.270 | 0.292 | 0.022 | ESE | 0.184 | 0.166 | -0.018 |
| SSW | 0.170 | 0.183 | 0.013 | SSE | 0.181 | 0.157 | -0.024 |
| SE | 0.192 | 0.196 | 0.004 | SE | 0.192 | 0.196 | 0.004 |
| LVRW | $\mathbf{0 . 2 2 7}$ | $\mathbf{0 . 2 2 1}$ | $\mathbf{- 0 . 0 0 6}$ | LVRw | $\mathbf{0 . 2 0 7}$ | $\mathbf{0 . 2 0 7}$ | $\mathbf{0 . 0 0 0}$ |

Table 7.2 Summary of Weighted Local Velocity Ratios (LVRw)
7.3.2 As shown in Table 7.2, the LVRw show changes in the range of -0.027 to 0.022 under annual prevailing wind condition. The weighted average LVRw is found to be 0.227 and 0.221 under Existing Condition and Conceptual Scheme respectively, reflecting an overall change of -0.006 in LVRw. The predicted LVR for summer prevailing wind condition also show change in the range of -0.027 to 0.024 . The weighted average LVRw is found to be 0.207 under both Existing Condition and Conceptual Scheme.
7.3.3 In terms of annual prevailing wind condition, although there is a separation distance of about 15 m between the two tower blocks, the frontal area of the development in east facing elevation would impose some wind impediment on the approaching easterly wind and therefore the LVRw is slightly decreased. In summer condition, the Conceptual Scheme is designed to align with the NE-SW direction with setback distance to nearby Chiu Shun Road in order to maintain the ventilation performance of the air path and the wind environment of the surrounding.
7.3.4 With the proposed features of the Conceptual Scheme, both SVRw and LVRw under annual and summer prevailing wind conditions indicate slight or no reduction on ai ventilation performance within the assessment area. Detailed VR for each individual test points are shown in Appendix $C$.

### 7.4 Focus Area

7.4.1 Within the assessment area, different areas that potentially raise concern after the development of the proposed building or within major activity zones are labelled as focus areas for further wind environment analysis. The areas are listed below and labelled in Figure 7.5. The VRw of the focus areas under annual and summer prevailing wind conditions are tabulated in Table 7.3


Figure 7.5 Identified Focus Areas

Project No.: 139
Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use
Air Ventilation Assessment Report

| Focus Area | Location | Test Points | Annual Prevailing Wind Condition |  | Summer Prevailing Wind Condition |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | VR w | VR w | $\mathrm{VR}_{\mathrm{w}}$ | VR ${ }_{\text {w }}$ |
|  |  |  | (Existing) | (Conceptual) | (Existing) | (Conceptual) |
| 1 | Tsueng Kwan O Sports Ground | OP072, OP073, OP080 - OP082, OP088- OP091, OP096 - OP099, OP104, OP 105 | 0.204 | 0.210 | 0.203 | 0.202 |
| 2 | Po Yap Road | OP0100, OP106, OP107, OP110 | 0.250 | 0.266 | 0.243 | 0.264 |
| 3 | Wan Po Road | OP054, OP064, OP065, OP074, OP075, OP083, OP084, OP092 OP094, OP101- OP103, OP108, OP109, OP111, OP112 | 0.223 | 0.217 | 0.261 | 0.257 |
| 4 | Assembly of God Leung Sing Tak Primary School | OP025, OP034, OP044 | 0.165 | 0.141 | 0.189 | 0.182 |
| 5 | Hang Hau Man Kuk Lane Park | $\begin{gathered} \text { OP035, OP045 - OP047, OP055 - } \\ \text { OP060, OP066 - OP070, OP076 - } \\ \text { OP078, OP085 } \end{gathered}$ | 0.189 | 0.160 | 0.208 | 0.186 |
| 6 | Man Kuk Lane | OP026, OP036 | 0.134 | 0.129 | 0.179 | 0.193 |
| 7 | Pui Shing Road | OP006, OP016 | 0.206 | 0.210 | 0.199 | 0.200 |
| 8 | Chiu Shun Road | OP015, OP022, OP030, OP039, OP048, OP049, OP061, OP063, OP071, OP079, OP086, OP087, OP095 | ${ }^{0.301}$ | 0.319 | 0.210 | 0.241 |
| 9 | Ngan O Road | OP007, OP008, OP017, OP018, OP027, OP028, OP037, OP038 | 0.229 | 0.237 | 0.224 | 0.227 |
| 10 | Wo Ming Court | OP001, OP002, OP009 | 0.192 | 0.203 | 0.160 | 0.158 |
| 11 | Yuk Ming Court | OP010, OP019 - OP021, OP029 | 0.226 | 0.219 | 0.152 | 0.161 |
| 12 | Yan Chai Hospital Chan Iu Seng Primary School | OP003, OP011, OP012 | 0.159 | 0.164 | 0.132 | 0.120 |
| 13 | Park at the NE of Yuk Ming Court | OP004, OP005, OP013, OP014 | 0.300 | 0.305 | 0.262 | 0.270 |
| 14 | Hang Hau Garden | OP023, OP024, OP033 | 0.201 | 0.200 | 0.188 | 0.187 |
| 15 | Fat Tau Chau Village | $\begin{gathered} \hline \text { OP031, OP032, OP041 - OP043, } \\ \text { OP052, OP053 } \\ \hline \end{gathered}$ | 0.199 | 0.201 | 0.183 | 0.181 |
| 16 | Planned Public Housing Development | OP040, OP050, OP051 | 0.280 | 0.273 | 0.209 | 0.206 |
| 17 | Maritime Bay | SP001- SP007 | 0.093 | 0.081 | 0.090 | 0.080 |
| 18 | La Cite Noble | SP008-SP020 | 0.113 | 0.120 | 0.146 | 0.138 |

Table 7.3 Focus Area Weighted Average Velocity Ratio
7.4.2 During the annual prevailing wind condition, most of the focused areas are generally maintained to level comparable. A slightly increase of 0.018 VR is observed for the local breezeway of Chiu Shun Road. The increase in building frontage of the Conceptual Scheme diverts more wind towards the NE-SW direction, while at the same time less wind penetration towards the leeward area under the south-easterly direction. This lead to a minor reduction of 0.024 VR and 0.029 VR at Assembly of God Leung Sing Tak Primary School and Hang Hau Man Kuk Lane Park respectively
7.4.3 During the summer prevailing wind conditions, wind environment of the most focus areas generally maintain a comparable VR result under Existing Condition and Conceptual Scheme. Slight increase in VR of 0.021 VR and 0.031 VR is observed in local air path of Po Yap Road and Chiu Shun Road respectively.
7.4.4 Since the major prevailing wind under summer is $\mathrm{SW}, \mathrm{SSW}$ and S , the orientation and alignment and the proposed development creates a "funnel shape" entrance would
$\qquad$ AEC

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use air Ventilation Assessment Report
direct more wind towards Chiu Shun Road, while less wind is diverted to Hang Hau Man Kuk Lane Park, which results in a minor reduction of 0.022 VR for Hang Hau Man Kuk Lane Park.
7.4.5 In terms of the podium of the neighbouring residential developments Maritime Bay and La Cite Noble, a slight increase in VR is observed in La Cite Noble under annual prevailing wind condition due to the slight increase in VR in Chiu Shun Road. A slight reduction in VR is observed of 0.012 VR and 0.01 VR for Maritime Bay under annual and summer prevailing wind conditions, and a reduction of 0.008 VR for La Cite Noble under summer prevailing wind condition.

## 8. DISCUSSION \& DIRECTIONAL ANALYSIS

8.1 Overall Ventilation Performance under Annual Condition


Figure 8.1 Annual frequency weighted VR contour plot under Existing Condition


Figure 8.2 Annual frequency weighted VR contour plot under Conceptual Scheme

Project No.: 1395
Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use air Ventilation Assessment Report
8.1.1 The frequency weighted VR contour shown in Figure 8.1 and Figure 8.2 demonstrated the integrated effect of the winds under annual condition. It is shown that:
8.1.2 The overall ventilation performances of the Existing Condition and the Conceptual Scheme are comparable.
8.1.3 The dominant annual prevailing wind are E (18.0\%) and ENE (16.7\%) directions. The winds enter the Subject Site through Chiu Shun Road, which is the local breezeway.
8.1.4 Chiu Shun Road has a higher VR under the Conceptual Scheme (pink circle in Figure 8.2). It is because the building frontage of the Conceptual Scheme will divert the annual prevailing wind along Chiu Shun Road.
8.1.5 Under Existing Condition, annual prevailing winds will divert to Hang Hau Man Kuk Lane Park and flow towards the Assembly of God Leung Sing Tak Primary School and Man Kuk Lane especially under south and south-easterly wind directions, resulting a better ventilation performance under Existing Condition (black rectangle in Figure 8.1)
8.1.6 The site surrounding under the Conceptual Scheme has a slightly higher VR while comparing with the Existing Condition. The proposed development captures the high level annual prevailing wind downwash towards the street level. Since the overall VR results under annual condition of leeward surrounding areas are comparable, it is anticipated that the ventilation impact to its surroundings is minimal.

## 8.2



Figure 8.3 Summer frequency weighted VR contour plot under Existing Condition


Figure 8.4 Summer frequency weighted VR contour plot under Conceptual Scheme

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent area for Residential Use Air Ventilation Assessment Report
8.2.1 The frequency weighted VR contour shown in Figure 8.3 and Figure 8.4 demonstrated the integrated effect of the winds under summer condition during June to August. It is shown that:
8.2.2 The overall ventilation performances of the Existing Condition and the Conceptual Scheme are comparable.
8.2.3 The dominant summer prevailing wind are SW (16.0\%) and SSW (14.2\%) directions. The winds enter the Subject Site through Chiu Shun Road, which is the local air path.
8.2.4 Similar to the annual condition, Chiu Shun Road has a slightly higher VR under the Conceptual Scheme. (pink circle in Figure 8.4). It is due to the building frontage of the proposed development and the noise barrier along Chiu Shun Road create a "funnel shape" entrance and divert the wind to the Chiu Shun Road, and thus enhance the ventilation performance of the park at the NE of Yuk Ming Court (orange circle in Figure 8.4). Meanwhile less wind divert from Chiu Shun Road to Ngan O Road and Yuk Ming Court, result in a slightly reduced VR at the aforementioned area.
8.2.5 Since the majority of SW and SSW winds are diverted to Chiu Shun Road, the VR for Man Kuk Lane and the Assembly of God Leung Sing Tak Primary School have slightly worse ventilation performance (black rectangle in Figure 8.4).
8.2.6 The wind penetration towards Ngan O Road and the downstream Yuk Ming Court are mainly come from Pui Shing Road and Chiu Shun Road. Since the wind diverts more evenly towards Ngan O Road under the Existing Condition (black circle in Figure 8.3), the VR in the aforementioned area is slightly better
8.2.7 Since the overall VR results under summer condition of leeward surrounding focus areas are comparable in most of the cases. Hence, it is anticipated that the ventilation impact to its surroundings is minimal.
8.3 Directional Analysis

## ENE Wind

8.3.1 ENE is the $2^{\text {nd }}$ most dominant annual prevailing wind direction with an annual occurrence frequency of $16.7 \%$. With the Subject Site located west of Sheung Yeung Shan at a lower elevation where annual prevailing easterly wind is anticipated to be diverted by the mountain at low level; north-easterly wind is regard as an importan wind direction and was considered significant when designing the project.
8.3.2 The proposed building design was designed to be aligned with the NE/SW direction in order to minimise any adverse impact to the north-easterly prevailing wind and summer wind directions (black dotted line in Figure 8.6).
8.3.3 Better ventilation performance in the Chiu Shun Road is observed (blue circle in Figure 8.6). The building height of the Conceptual Scheme is desirable to capture the high level wind and downwash towards the local breezeway. In result the VR at downstream Tseung Kwan O Sports Ground is maintained under the Existing Condition and Conceptual Scheme although the increase in frontal area of the proposed development.
8.3.4 The stagnant zone at Hang Hau Man Kuk Lane Park is reduced under the Conceptual Scheme. It is anticipated that more winds would divert to the Hang Hau Man Kuk Lane Park from Chiu Shun Road, which slightly improved the ventilation performance at the Hang Hau Man Kuk Lane Park (black arrow in Figure 8.5 and Figure 8.6).
8.3.5 The building frontage of the proposed development induced a larger wake zone at the SW portion of the project building under the Conceptual Scheme (pink circle in Figure 8.6). Since the leeward region is a large open space, it is anticipated that the impact to the surrounding is minimal.


Figure 8.5 VR Contour Plot under ENE wind of Existing Condition


Figure 8.6 VR Contour Plot under ENE wind of Conceptual Scheme

## E Wind

8.3.6 Although E wind is being the most dominant annual prevailing wind, the Subject Site is located at the downslope area west of Sheung Yeung Shan. The prevailing wind will be diverted by Sheung Yeung Shan and the anticipated wind availability at pedestrian level is relatively lower compared to ENE wind. The major breezeway under E wind is Chiu Shun Road
8.3.7 As shown on the vector plots in Appendix $\boldsymbol{D}$, the approaching easterly wind at pedestrian level is diverted by Sheung Yeung Shan upwards as anabatic wind while some easterly approaching wind and downwash is diverted to Chiu Shun Road.
8.3.8 Under the Conceptual Scheme, the project development directs the downwash wind at Chiu Shun Road towards the south-west Wan Po Road (pink arrow in Figure 8.8) while under Existing Condition the wind flow more towards Hang Hau Man Kuk Lane Park (black arrow in Figure 8.7). In result, a slight improved ventilation performance is observed at the Tseung Kwan O Sports Ground under the Conceptual Scheme and a wake zone is observed at northern part of Hang Hau Man Kuk Lane Park and Assembly of God Leung Sing Tak Primary School as shown in Figure 8.8


Figure 8.7 VR Contour Plot under E wind of Existing Condition


Figure 8.8 VR Contour Plot under E wind of Conceptual Scheme
8.3.9 NE and NNE wind is the $3^{\text {rd }}$ and $5^{\text {th }}$ dominant prevailing wind accounts for $10.7 \%$ and $7.2 \%$ probability during annual condition. Since Chiu Shun Road is in the same alignment with the prevailing wind, it is the major breezeway under these wind directions (black dotted line in Figure 8.10).
8.3.10 Under NE/NNE wind, the high-rise residential buildings at Hang Hau such as Yuk Ming Court, Wo Ming Court, La Cite Noble, Maritime Bay create a large frontal area to the approaching north-easterly wind (black arrow in Figure 8.9) which lead to a
 Park, the Assembly of God Leung Sing Tak Primary School and the Tseung Kwan O Sports Ground.
8.3.11 Chiu Shun Road is the major breeze way to facilitate air movements towards the downstream open areas. Maximum set back from Chiu Shun Road, as well as enhancing building permeable elements at the lower (pedestrian) zone of the proposed development have been introduced to minimize the impact to Chiu Shun Road.
8.3.12 As read on Figure 8.9 and Figure 8.10, some stagnant areas such as Hang Hau Man Kuk Lane Park and Tseung Kwan O Sports Ground are found under Existing Condition at the downstream areas. With the proposed development in place, taking into account the above air ventilation enhancement designs, it is noted that no significant impact to the downstream areas is further introduced.
8.3.13 In terms of NNE wind in particular as shown in Figure 8.11 and Figure 8.12, slightly more approaching winds are being diverted towards Sheung Yeung Shan by the proposed development and adjacent planned public housing development, thus a larger wake zone at the leeward region of the proposed development and Wan Po Road is observed (pink circle in Figure 8.12).



Figure 8.11 VR Contour Plot under NNE wind of Existing Condition


Figure 8.12 VR Contour Plot under NNE wind of Conceptual Scheme

## ESE Wind

8.3.14 ESE wind contribute $7.6 \%$ and $7.8 \%$ during annual and summer condition respectively. The prevailing wind will penetrate from Wan Po Road to the Hang Hau region. Some wind diverted by the Sheung Yeung Shan will flow towards Chiu Shun Road, and allows Chiu Shun Road to act as the local breezeway under ESE wind.
8.3.15 Under the Conceptual Scheme, the proposed development is perpendicular to the prevailing wind direction. The building separation between the neighbouring planned public housing development and the proposed development allows wind to penetrate through from the Sheung Yeung Shan to Chiu Shun Road in a higher speed as compared to the Existing Condition. The incoming high level wind will then capture by the La Cite Noble and downwash to the street level of Chiu Shun Road, resulting in a better local ventilation performance (pink arrow in Figure 8.14).
8.3.16 In contrast, the building frontage of existing Ventilation Building is smaller, which allows more wind to penetrate towards the leeward region at the Assembly of God Leung Sing Tak Primary School and Man Kuk Lane. Thus, a slightly higher VR at aforementioned area is observed under Existing Condition (black arrow in Figure 8.13).
8.3.17 Under ESE wind, the proposed development is located at the windward region of Hang Hau. The increased building frontage is anticipated to divert wind as compared to Existing Condition where some wind energy would be dissipated by the proposed building and wind availability in leeward area is anticipated to be reduced, such as Tsuen Kwan O Sports Ground and along Wan Po Road where a reduction in VR is observed. Nonetheless, the overall LVR under ESE wind is reduced marginally by -0.018 VR as compared to Existing Condition under both annual and summer condition.
8.3.18 The wind performance of downstream Ngan O Road as an air path under ESE wind is maintained as compared to the Existing Condition. Thus, the proposed development does not induce a significant impact to the downstream areas


Figure 8.13 VR Contour Plot under ESE wind of Existing Condition


[^2]
## SSW Wind

8.3.19 SSW wind is the second most dominant summer prevailing wind with an occurrence frequency of $14.2 \%$ during summer. Similar to the NE/NNE directions, the SSW/SW direction was also considered in design point of view that the alignment of majo façade should be along the NE/SW direction to facilitate wind penetrations (black dotted line in Figure 8.16). Chiu Shun Road with the same alignment with SSW direction are the major breezeway. Some wind penetration will be diverted by the La Cite Noble to the Tseung Kwan O Sports Ground (black arrow in Figure 8.15).
8.3.20 The wind performance at Chiu Shun Road is locally enhanced by the proposed development (orange circle in Figure 8.16) due to a venturi effect as the proposed podium and towers together with the structure of La Cite Noble across Chiu Shun Road created a relatively constricted section as compared to the open area upstream near the roundabout at Wan Po Road. The effect slightly increases wind speed at Chiu Shun Road in Conceptual Scheme and the project development also act as a "funne shape" to favour more wind to drive towards inner Hang Hau area. In result, the LVR of Conceptual Scheme is slightly improved.
8.3.21 However, two residential blocks are introduced in Conceptual Scheme as compared to Existing Condition and therefore a larger shadow zone (pink circle in Figure 8.16) is anticipated immediate downstream of the development as shown in Figure 8.16.


Figure 8.15 VR Contour Plot under SSW wind of Existing Condition


Figure 8.16 VR Contour Plot under SSW wind of Conceptual Scheme

## SE Wind

8.3.22 SE wind is the $8^{\text {th }}$ dominant wind under annual and summer condition. The major air path under SE wind is Wan Po Road and Ngan O Road, as they aligned with the wind direction (black dotted line in Figure 8.18).
8.3.23 Similar to ESE, the proposed development is perpendicular to the prevailing wind direction. The building separation between the neighbouring planned public housing development and the proposed development creates a "funnel shape" entrance which allows wind penetration from the Sheung Yeung Shan to Chiu Shun Road in a higher velocity under the Conceptual Scheme. The incoming high level wind will then capture by the La Cite Noble and downwash to the street level of Chiu Shun Road, resulting in a better ventilation performance (pink arrow in Figure 8.18).
8.3.24 On the other hand, the longer building façade divert the approaching wind to the SW portion of the development and reduced the wind penetration towards Hang Hau Man Kuk Lane Park (blue arrow in Figure 8.18). However, since Wan Po Road is the major air path under SE wind, wind can penetrate towards the aforementioned area and result in a comparable ventilation performance under both schemes (black arrow in Figure 8.17 and Figure 8.18).


[^3]
## SW Wind

8.3.25 SW wind is the most probable summer prevailing wind, similar to the discussion above, the Conceptual Scheme is intended to be aligned with the SW/NE direction where blockage to the adjacent wind corridor Chiu Shun Road is minimized as far as practicable by setback and permeable elements (black dotted line in Figure 8.20).
8.3.26 The approaching wind is slightly diverted by the upstream elevated ground towards the south-south-westerly direction, in result, a shadow zone is observed at the immediate downstream of the project under Conceptual Scheme within Chiu Shun Road and the effective width of Chiu Shun Road air path is slightly reduced (pink circle in Figure 8.20). In contrast, the existing scheme allows more incoming wind to penetrate from Chiu Shun Road towards downstream area, resulting in a higher VR in Ngan O Road and the road between Wo Ming Court and Yuk Ming Court (black arrow in Figure 8.19). On the other hand, the reduction in effective width of Chiu Shun Road air path has led to a slight decrease in VR in Fat Tau Chau Village and along Chiu Shun Road (orange circle in Figure 8.20)


Figure 8.19 VR Contour Plot under SW wind of Existing Condition


Figure 8.20 VR Contour Plot under SW wind of Conceptual Scheme

## SSE Wind

8.3.27 SSE wind occupies $7.6 \%$ of the summer prevailing wind probability. Under the south south-easterly wind condition, the approaching wind from the open area south of the Subject Site are split into two waves, one flowing north-east direction of the Subject Site through Chiu Shun Road and other flowing north-west of the Subject Site towards Wan Po Road and downward open areas (black arrow in Figure 8.21).
8.3.28 The building width of the proposed development creates a slightly narrow entrance at Chiu Shun Road, and accelerate the local wind at the entrance of Chiu Shun Road (black circle in Figure 8.22). The narrower entrance leads to an increase in energy dissipation of the incoming wind where a reduction in VR is observed towards the downstream Chiu Shun Road (orange circle in Figure 8.22).
8.3.29 The building height of the Conceptual Scheme capture the high level wind and downwash to the windward open space of the proposed development, result in a local ventilation improvement. Meanwhile, it reduces the high level wind penetration towards the leeward Ngan O Road (pink circle in Figure 8.22), result in a slightly worse ventilation performance as compared to the Existing Condition.


Figure 8.21 VR Contour Plot under SSE wind of Existing Condition


Figure 8.22 VR Contour Plot under SSE wind of Conceptual Scheme

Project No.: 1395
Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use Air Ventilation Assessment Report

## S Wind

8.3.30 S is the $3^{\text {rd }}$ dominant wind during the summer condition. The prevailing wind will be diverted by the La Cite Noble and split into 2 streams, one flowing through Chiu Shun Road towards Ngan O Road and other stream towards Hang Hau Man Kuk Lane Park and La Cite Noble (black arrow in Figure 8.23)
8.3.31 Under the Existing Condition, the approach wind flow directly towards La Cite Noble and separate into two portions, one towards the western side of La Cite Noble and downwash towards Hang Hau Man Kuk Lane Park and other over the Ventilation Building towards Chiu Shun Road and Ngan O Road (orange circle in Figure 8.23 and Figure 8.25). Whereas Conceptual Scheme allows more wind to flow around the proposed building towards Chiu Shun Road resulting in an increase in VR in Chiu Shun Road (black circle in Figure 8.24 and Figure 8.26) and also the downstream Fat Tau Chau Village (pink circle in Figure 8.24).
8.3.32 Under Conceptual Scheme, as more wind is flowing towards Chiu Shun Road, less wind is flowing towards the western side of La Cite Noble podium and less downwash towards Hang Hau Man Kuk Lane Park is observed resulting in a reduction in VR in Hang Hau Man Kuk Lane Park (orange circle in Figure 8.24).


Figure 8.24 VR Contour Plot under S wind of Conceptual Scheme


Figure 8.25 Velocity Streamline under $S$ wind of Existing Condition


Figure 8.26 Velocity Streamline under S wind of Conceptual Scheme
8.3.33 WSW prevailing wind accounts for $9.7 \%$ probability during summer condition. WSW wind diverts by the upstream development into 2 streams approaching the study area through Po Yap Road and from the NW portion of Wan Po Road towards Chiu Shun Road. The major air path under WSW wind direction is Chiu Shun Road (black arrow in Figure 8.27).
8.3.34 The proposed development captures more wind towards Chiu Shun Road. Also, the proposed development can effectively capture high level wind and downwash towards the local air path, lead to a higher VR in Chiu Shun Road (pink arrow in Figure 8.28)


Figure 8.27 VR Contour Plot under WSW wind of Existing Condition


Figure 8.28 VR Contour Plot under WSW wind of Conceptual Scheme

## 9. CONCLUSION

9.1.1 In this Initial AVA Study, two scenarios, Existing Condition and Conceptual Scheme for the Subject Site being assessed by CFD modelling are investigated.
9.1.2 Based on the result of the wind rose analysis, the wind directions for the Subject Site and the surrounding area representative of the prevailing situations are determined to be mainly E, ENE, NNE, NE, ESE, SSW, SW and SE for annual condition and SW, SSW, S, E, WSW, SSE, ESE and SE for summer condition. These wind directions out of the 16 wind directions which occur for respective about $78.1 \%$ and $80.7 \%$ of time in a year and during summer time are adopted in the Initial Study.
9.1.3 According to the CFD modelling result, it concludes that LVRw and SVRw are generally maintained with the level comparable to the Existing Condition. With the proposed development, slight improvement in velocity ratio at local breezy way Chiu Shun Road is observed and slight decrease in velocity ratio is observed in Hang Hau Man Kuk Lane Park and Assembly of God Leung Sing Tak Primary School. No other major stagnation is observed due to the proposed development under annual and summer prevailing wind conditions.
9.1.4 The Conceptual Scheme maintains a desirable wind environment by increasing its air permeability at low zone, orientation and alignment with NE-SW prevailing wind direction as well as maximising building setback of the two residential blocks from nearby breezeway (Chiu Shun Road). No significant adverse impact is therefore anticipated in the surrounding wind environment with the addition of proposed development.

Project No.: 1395
PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE
AIR VENTILATION ASSESSMENT REPORT

Appendix A Detailed Wind Profile

|  | $\sum_{Z}^{3}$ | $\underset{0}{0}$ | $\stackrel{\rightharpoonup}{\circ}$ | $\left\|\begin{array}{c} \underset{O}{O} \\ \vdots \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{c} \mathrm{O} \\ \hline \mathrm{O} \end{array}\right\|$ | $\begin{array}{\|l\|l\|l\|l\|l\|} \hline O \\ \hline \end{array}$ | $\stackrel{\rightharpoonup}{\circ}_{\dot{O}}$ | $\left\|\begin{array}{l} \delta_{0}^{0} \\ 0 \end{array}\right\|$ | － | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | － | － | $\bigcirc$ |  |  |  |  |  |  |  | 0 | － | － | － |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 令 | $\stackrel{\square}{\circ}$ | $\left\|\begin{array}{l} \overrightarrow{0} \\ \dot{O} \end{array}\right\|$ | $\left\|\begin{array}{c} \mathrm{O} \\ \hline \mathrm{O} \end{array}\right\|$ | $\left\|\begin{array}{c} \mathrm{O} \\ \vdots \\ 0 \end{array}\right\|$ | $\stackrel{\rightharpoonup}{\circ}$ | $\begin{aligned} & ⿹_{0} \\ & 0 \\ & \hline \end{aligned}$ | $\underset{\substack{\circ \\ O \\ 0 \\ \hline}}{ }$ | $\stackrel{\rightharpoonup}{\circ}$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \end{array}\right\|$ | － | $\bigcirc$ | － | － | $\bigcirc$ |  |  |  |  |  |  |  | － | － | $\bigcirc$ | － |
|  | $\sum_{3}^{3}$ | $\stackrel{\rightharpoonup}{\circ}$ | $\left\|\begin{array}{l} \overrightarrow{0} \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & \stackrel{\rightharpoonup}{\mathrm{O}} \\ & \hline \end{aligned}\right.$ | $\left\|\begin{array}{c} \mathrm{O} \\ \hline \mathrm{O} \end{array}\right\|$ | $\begin{array}{\|} 0 \\ 0 \\ 0 \end{array}$ | $\begin{aligned} & \underset{O}{0} \\ & \hline \end{aligned}$ | $\begin{array}{\|c\|} \hline \stackrel{\rightharpoonup}{0} \\ 0 \\ \hline \end{array}$ | $\left\|\begin{array}{l} \stackrel{\rightharpoonup}{0} \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & \stackrel{\rightharpoonup}{0}_{0} \\ & 0 \end{aligned}\right.$ | $\bigcirc$ | － | $\bigcirc$ | － | $\bigcirc$ | － |  |  |  |  |  |  |  | － | $\bigcirc$ | － |
|  | 3 | İ⿱⿵人一口口内 | $$ | $\left\lvert\, \begin{gathered} o \\ o \\ 0 \\ \hline \end{gathered}\right.$ | $\left\|\begin{array}{c} \circ \\ \vdots \\ 0 \end{array}\right\|$ | $\begin{aligned} & 0 \\ & \hline 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \infty \\ & \vdots \\ & 0 \\ & \hline \end{aligned}$ | $\left.\begin{array}{\|c} 0 \\ 0 \\ 0 \end{array} \right\rvert\,$ | $\left\|\begin{array}{c} \text { ơ } \\ 0 \end{array}\right\|$ | $\left.\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned} \right\rvert\,$ | $\begin{aligned} & \text { O} \\ & \hline \end{aligned}$ | $\begin{aligned} & \bar{O} \\ & \dot{O} \end{aligned}$ | $\bigcirc$ | － | $\bigcirc$ | － | $\bigcirc$ | $\bigcirc$ |  | － | － |  |  | － | － | $\bigcirc$ |
|  | $\begin{gathered} 3 \\ 3 \\ 3 \end{gathered}$ | $\underset{\substack{\mathrm{O}}}{\text { On }}$ | $\left\|\begin{array}{l} \stackrel{\rightharpoonup}{0} \\ \hline 0 \end{array}\right\|$ | $\left\lvert\, \begin{gathered} \mathrm{O} \\ \underset{O}{0} \end{gathered}\right.$ | $\left\lvert\, \begin{gathered} \mathrm{t} \\ \hline \mathrm{O} \\ \hline \end{gathered}\right.$ | O | $\begin{aligned} & 2 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & n \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\left\|\begin{array}{l} n \\ 0 \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{gathered} \text { to } \\ 0 \\ 0 \end{gathered}\right.$ | O | $\begin{aligned} & \mathrm{O} \\ & \vdots \\ & 0 \end{aligned}$ | $\begin{aligned} & \bar{\circ} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\rightharpoonup}{\mathrm{O}}$ | $\stackrel{\rightharpoonup}{\circ}$ |  | $\bigcirc$ |  | － | － |  | － | － | － | － |
|  | 3 | $\stackrel{\substack{0 \\ \hline \\ \hline}}{ }$ | $\left\|\begin{array}{l} \stackrel{\rightharpoonup}{0} \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{gathered} \mathrm{g} \\ \underset{O}{0} \end{gathered}\right.$ | $\left\lvert\, \begin{gathered} \mathrm{O} \\ \hline \mathrm{O} \\ \hline \end{gathered}\right.$ | O | $\begin{aligned} & \hat{8} \\ & \hline 0 \\ & \hline \end{aligned}$ | $\begin{array}{\|c\|} \hat{0} \\ 0 \\ \hline \end{array}$ | $\left.\begin{array}{\|l\|} \hline \\ 0 \\ 0 \\ 0 \end{array} \right\rvert\,$ | $\left\|\begin{array}{l\|} \infty \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & 28 \\ & \hline 0.0 \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & \text { to } \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & \hline 8 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { İ } \\ & 0 \\ & \hline \end{aligned}$ | $\underset{O}{\circ}$ |  | O- |  | 0 | － |  |  | － | － | 0 |
|  | $\frac{3}{5}$ | $\stackrel{\rightharpoonup}{\circ}$ | $\left\|\begin{array}{l} \stackrel{\rightharpoonup}{0} \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{c} \mathrm{O} \\ \mathrm{O} \\ \hline \end{array}\right\|$ | $\left\|\begin{array}{c} \mathrm{O} \\ \mathrm{O} \end{array}\right\|$ | $\left\|\begin{array}{c} \mathbf{O} \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\hat{O}$ | $\hat{o}$ | $\hat{O}$ | $\begin{aligned} & \hat{O} \\ & 0 \\ & 0 \end{aligned}$ | $\left\|\begin{array}{l} n \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & t \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{gathered} \text { Ơ } \\ \hline \end{gathered}$ | $\begin{aligned} & \circ \\ & \hline 0 \\ & \hline \end{aligned}$ | $\underset{\substack{s \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline}}{ }$ |  |  |  | － |  |  | － | － | － |
|  | a | ぎ | $\left\lvert\, \begin{aligned} & \stackrel{\rightharpoonup}{0} \\ & \hline 0 \end{aligned}\right.$ | $\left\|\begin{array}{l} \mathrm{O} \\ \mathrm{O} \\ \mathrm{O} \end{array}\right\|$ | $\left\|\begin{array}{l} \text { t } \\ 0 \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{c} n \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\underset{o}{0}$ | $0$ | $\left\|\begin{array}{l} n \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & \mathrm{O} \\ & \hline 0 \end{aligned}\right.$ | $\begin{aligned} & \mathrm{O} \\ & \mathrm{O} \\ & \hline \end{aligned}$ | $\begin{aligned} & -\quad . \\ & \hline \end{aligned}$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \end{array}\right\|$ | － | － | $\bigcirc$ |  |  |  |  |  |  | － | － | － |
|  | $\stackrel{山}{0}$ | 志 | $\left\|\begin{array}{l} \overrightarrow{0} \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\left\|\begin{array}{l} n \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\stackrel{\rightharpoonup}{\mathrm{O}_{\mathrm{O}}^{\mathrm{O}}}$ | $\begin{aligned} & \hat{0} \\ & 0 \\ & 0 \end{aligned}$ | $0$ | $\left\lvert\, \begin{aligned} & n \\ & 0 \\ & 0 \end{aligned}\right.$ | $0$ | $\begin{aligned} & \mathrm{O} \\ & \mathrm{O} \\ & \mathrm{O} \end{aligned}$ | $\stackrel{\rightharpoonup}{\circ}$ | $\left\lvert\, \begin{aligned} & \ddot{O}_{0} \\ & 0 \end{aligned}\right.$ | $\begin{aligned} & { }_{8}^{0} \\ & 0 \\ & \hline \end{aligned}$ | － | － | $\bigcirc$ |  |  |  | － |  |  | － | － | － |
|  | 卧 | $\stackrel{\stackrel{\rightharpoonup}{0}}{0}$ | $\left\|\begin{array}{l} \stackrel{\rightharpoonup}{0} \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & \circ \\ & \hline 0 \\ & 0 \\ & \hline \end{aligned}\right.$ | $\left.\begin{array}{\|l\|} \hline 0 \\ 0 \\ 0 \\ \hline \end{array} \right\rvert\,$ | $\left.\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned} \right\rvert\,$ | $\hat{O}$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & \text { O } \\ & 0 \\ & 0 \end{aligned}\right.$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \vdots \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{g} \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & 0 \end{aligned}$ | $\stackrel{\rightharpoonup}{8}$ | － | $\bigcirc$ | $\bigcirc$ |  |  | － |  |  | － | － | － |
|  | 窰 | 哭 | $\left\|\begin{array}{l} \overrightarrow{0} \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\left\lvert\, \begin{aligned} & \circ \\ & \hline 0 \\ & 0 \\ & \hline \end{aligned}\right.$ | $\left\|\begin{array}{l} \stackrel{\rightharpoonup}{0} \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & 0_{0}^{0} \end{aligned}$ | $\underset{0}{\rightharpoonup_{0}}$ | $\overrightarrow{\vec{D}_{0}}$ | $\left\lvert\, \begin{aligned} & \infty \\ & 0 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\left\lvert\, \begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\begin{aligned} & \mathrm{t} \\ & \mathrm{O} \\ & \mathbf{0} \end{aligned}$ | $\begin{aligned} & \text { İ } \\ & \text { on } \end{aligned}$ | $\underset{o}{\circ}$ | $\stackrel{\rightharpoonup}{\circ}$ | $\stackrel{\rightharpoonup}{\mathrm{O}}$ | $\bigcirc$ | $\bigcirc$ |  |  | － |  |  | － | － | － |
|  | $\pm$ | $\stackrel{\infty}{\bigcirc}$ | $\left\lvert\, \begin{aligned} & 0.0 \\ & \hline 0 \\ & \hline \end{aligned}\right.$ | $\left\|\begin{array}{l} \circ \\ \hline 0 \\ 0 \\ \hline \end{array}\right\|$ | $\left\|\begin{array}{l} \hat{0} \\ 0 \\ 0 \end{array}\right\|$ | $\dot{0}_{0}^{0}$ | $\stackrel{n}{n} \underset{0}{0} \mid$ | $\underset{O}{O}$ | $\left\lvert\, \begin{gathered} \pm \\ O \\ 0 \end{gathered}\right.$ | $\mathfrak{y}$ | $\underset{O}{0}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \hat{0} \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { d } \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{gathered} 8 \\ \hline 8.0 . ~ \\ \hline \end{gathered}$ |  |  |  | － |  |  | － | － | － |
|  | 䍜 | $\stackrel{6}{0}$ | $\begin{aligned} & \stackrel{\rightharpoonup}{8} \\ & 0 . \\ & \hline \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\left\|\begin{array}{l} n \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{array}{\|l\|} \hline 0 \\ 0 \\ 0 \\ \hline \end{array}$ | $\begin{gathered} I \\ 0 \\ 0 \\ 0 \end{gathered}$ | $\begin{aligned} & \hat{0} \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { I } \\ & \hline 0 \\ & \hline 0 \end{aligned}$ | $\left\lvert\, \begin{aligned} & \text { and } \\ & 0 \\ & 0 \end{aligned}\right.$ | $\begin{array}{\|l\|l} \text { İ } \\ \hline \end{array}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & n \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { t } \\ & \hline 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \hline \mathrm{O} \\ & \hline \end{aligned}$ | $\begin{gathered} \substack{3 \\ \hdashline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline} \\ \hline \end{gathered}$ |  |  |  |  |  |  | － | － | － |
|  | 罠 | $\stackrel{\rightharpoonup}{0}$ | $\begin{array}{\|l\|} \hline \\ \hline . \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{gathered} 0 \\ 0 \\ 0 \\ 0 . \\ \hline \end{gathered}$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $0$ | $0$ | $\left\lvert\, \begin{aligned} & 7 \\ & 0 \\ & 0 \end{aligned}\right.$ | $0 .$ | $\begin{aligned} & \hat{0} \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & n \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { O} \\ & \hline \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{O}_{\mathrm{O}} \\ & \hline \end{aligned}$ |  | ${ }_{P}^{\circ}$ |  |  | 0 |  |  | 0 | － | 0 |
|  | $\sum_{Z}^{\text {罠 }}$ | 苟 | $\begin{array}{\|l\|} \hline 0 \\ \hline 0 \\ \hline \end{array}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\left\|\begin{array}{l} \mathrm{t} \\ \mathrm{O} \\ \mathbf{O} \end{array}\right\|$ | $\begin{array}{\|c} \stackrel{\rightharpoonup}{0} \\ 0 \\ \hline \end{array}$ | $\begin{gathered} 0 \\ 0 \\ 0 \\ 0 \end{gathered}$ | $\hat{0}$ | $\hat{0}$ | $\hat{0}$ | $\left\lvert\, \begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}\right.$ | $\left\lvert\, \begin{aligned} & n \\ & 0 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\begin{aligned} & \text { I } \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { to } \\ & \hline 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline 0 \end{aligned}$ | O |  | $8.0$ |  | $5$ |  |  |  | － | － | － |
| $\underset{\approx}{\approx}$ | z | $\stackrel{\stackrel{\circ}{\circ}}{\circ}$ | $\begin{aligned} & \stackrel{\rightharpoonup}{0} \\ & 0 \\ & \hline \end{aligned}$ | $\left\lvert\, \begin{aligned} & \mathrm{I} \\ & \mathrm{O} \\ & 0 \\ & 0 \end{aligned}\right.$ | $\left\|\begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & 0 \\ & 0 \end{aligned}$ | $\left\lvert\, \begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\left\lvert\, \begin{gathered} \mathrm{O} \\ 0 \\ 0 \end{gathered}\right.$ | $\begin{aligned} & \text { İ } \\ & \hline 0 . \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \hline \mathrm{O} \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \text { O} \\ & \hline \end{aligned}$ | $\begin{aligned} & O_{0} \\ & 0 \\ & \hline \end{aligned}$ | $\stackrel{\rightharpoonup}{8}$ | $\stackrel{\rightharpoonup}{\mathrm{O}}$ |  | $8 .$ |  | O | － |  | － | － | － | 0 |
|  |  | $\begin{aligned} & x \\ & =1 \\ & \gg \end{aligned}$ | $\left[\begin{array}{l} \sigma_{1}^{\prime} \\ a_{1} \\ 8 \\ 8 \end{array}\right.$ | $\left\|\begin{array}{c} 1 \\ c_{1} \\ e_{1} \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{c} x_{1} \\ e_{1} \\ \sigma_{1} \end{array}\right\|$ |  | $\left\{\begin{array}{c} n_{1} \\ 1 \\ \vdots \\ 1 \\ 1 \\ 0 \\ 0 \end{array}\right.$ |  |  | $\begin{gathered} \infty \\ e_{1}^{\infty} \\ 0_{1} \\ 0_{1} \end{gathered}$ | $\left(\begin{array}{c} g_{1} \\ e_{1} \\ x_{1} \end{array}\right.$ | $\left(\begin{array}{c} o_{1} \\ g_{1} \\ g_{1} \end{array}\right.$ | $\left\{\begin{array}{l} 7 \\ x_{1} \\ 0 \\ 0 \end{array}\right.$ | $1 \begin{gathered} I_{1} \\ e_{1} \\ = \end{gathered}$ |  |  |  |  |  |  |  |  |  | a <br> d <br> N | 1 <br>  | d ¢ d̀ |


|  | $\sum_{Z}^{3}$ | $\stackrel{0}{0}$ | $\stackrel{\rightharpoonup}{\circ}$ | $\left\|\begin{array}{c} \mathrm{O} \\ \vdots \\ 0 \end{array}\right\|$ |  | $\begin{aligned} & \mathrm{O} \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \vdots \\ & 0 \end{aligned}$ | $\left.\begin{array}{\|c\|} \hline \\ \vdots \\ 0 \end{array} \right\rvert\,$ | $\hat{b}_{\dot{O}}$ | $\left\|\begin{array}{l} \bar{O} \\ 0 . \end{array}\right\|$ | $\begin{aligned} & \circ \\ & \hline 0 \\ & \hline 0 \end{aligned}$ | － | － | 0 | － |  | $\bigcirc$ | － | $\bigcirc$ | － | － | － | － | － | $\bigcirc$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | z | 등 | $\left\|\begin{array}{c} \stackrel{\rightharpoonup}{\theta}_{\dot{O}} \end{array}\right\|$ | $\left\|\begin{array}{c} \mathrm{O} \\ \underset{O}{0} \end{array}\right\|$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{gathered} 0 \\ 0 \\ 0 \\ 0 \end{gathered}$ | O | $\left.\begin{gathered} \underset{O}{\mathrm{O}} \\ \mathbf{O} \end{gathered} \right\rvert\,$ | $\begin{aligned} & \mathrm{O} \\ & \hline \mathrm{O} \\ & \hline \end{aligned}$ | $\left\|\begin{array}{c} \mathrm{O} \\ \underset{O}{0} \end{array}\right\|$ | $\stackrel{\rightharpoonup}{\partial}$ | $\stackrel{\rightharpoonup}{\partial}$ | $\stackrel{\rightharpoonup}{\circ}$ | － | $\bigcirc$ |  | $\bigcirc$ | － | $\bigcirc$ | $\bigcirc$ | － | － | － | － | $\bigcirc$ |  |
|  | $\sum_{3}^{3}$ | $\stackrel{\rightharpoonup}{\mathrm{o}}$ | $\left\|\begin{array}{c} 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & \mathrm{O} \\ & \underset{O}{\mathrm{O}} \end{aligned}\right.$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { O} \\ & \hline 0 \\ & \hline \end{aligned}$ | $\left.\begin{array}{\|c\|} \hline \\ \hline \\ 0 \\ 0 \end{array} \right\rvert\,$ | $\begin{array}{\|c\|} \hline 0 \\ 0 \\ 0 \\ 0 \end{array}$ | $\begin{array}{\|c} \hline \mathrm{O} \\ \hline \mathrm{O} \\ \hline \end{array}$ | $\left\|\begin{array}{l} \stackrel{\rightharpoonup}{O} \\ \hline 0 \end{array}\right\|$ | $\stackrel{\rightharpoonup}{8}$ | $\begin{aligned} & 0 \\ & \hline 0 \\ & \hline \end{aligned}$ | $\left\lvert\, \begin{aligned} & \stackrel{\rightharpoonup}{0} \\ & \hline \end{aligned}\right.$ | $\bigcirc$ | $\bigcirc$ | 0 | $\bigcirc$ | － | 0 |  | $\bigcirc$ | － | － | － | － |  |
|  | 3 | $\stackrel{c}{0}_{0}^{0}$ | $\left.\begin{gathered} 0 \\ \hline 6 \\ 0 \end{gathered} \right\rvert\,$ | $\left\|\begin{array}{l} n \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{l} n \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{array}{r} 0 \\ \vdots \\ 0 \\ \hline \end{array}$ | $\left\|\begin{array}{l} \hat{8} \\ 0 \\ 0 \end{array}\right\|$ | $\left.\begin{array}{\|c\|} \hline 0 \\ 0 \\ 0 \end{array} \right\rvert\,$ | $\dot{c}$ | $\left\lvert\, \begin{aligned} & 0 \\ & 0.8 \\ & 0 \\ & \hline \end{aligned}\right.$ | $\begin{aligned} & \mathrm{O} \\ & \hline 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \bar{O} \\ & 0 \end{aligned}$ | $\left\lvert\, \begin{gathered} \text { Ö } \\ \vdots \\ \hline \end{gathered}\right.$ | $\left.\begin{aligned} & \bar{\circ} \\ & \hline 0 \end{aligned} \right\rvert\,$ | $\left\|\begin{array}{l} \vec{\circ} \\ 0 \\ 0 \end{array}\right\|$ | － | $\bigcirc$ | － | － |  | 0 | － | － | － | $\bigcirc$ | － |
|  | $\begin{aligned} & 3 \\ & 3 \\ & 3 \end{aligned}$ | $\stackrel{\rightharpoonup}{\mathrm{O}}$ | $\stackrel{\rightharpoonup}{\circ}$ | $$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\cong}{0}$ | $\begin{array}{\|c} \stackrel{~}{0} \\ 0 \\ \hline \end{array}$ | $\begin{array}{\|l\|} \hline 0 \\ 0 \\ 0 \\ \hline \end{array}$ | $\begin{array}{\|c\|} \hline \\ \vdots \\ 0 \\ \hline \end{array}$ | $\left\|\begin{array}{l} 0_{0} \end{array}\right\|$ | $\begin{aligned} & \mathrm{o} \\ & \hline \mathrm{O} \\ & \hline \end{aligned}$ | $\begin{aligned} & 20 \\ & 0 \\ & 0 \end{aligned}$ |  | $\begin{array}{\|c\|} \hline 0.6 \\ \hline . \\ \hline \end{array}$ | $\begin{array}{\|c\|} \hline \underset{O}{\circ} \\ \hline \mathrm{O} \end{array}$ | $\begin{array}{\|l\|} \hline \mathrm{O} \\ \hline \mathrm{O} \\ \hline \end{array}$ | $\stackrel{\rightharpoonup}{\mathrm{O}}$ | $\stackrel{\rightharpoonup}{\partial}$ | 0 | － | 0 | － | － | － | － | $\bigcirc$ |
|  | 䂞 | $\because$ | $\begin{aligned} & \text { İ } \\ & \text { ob } \end{aligned}$ | $\begin{array}{\|l\|l\|} \hline \mathrm{O} \\ \hline \mathrm{O} \\ \hline \end{array}$ | $\begin{gathered} o \\ 0 \\ 0 \\ \hline \end{gathered}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{array}{\|l\|} \hline n \\ 0 \\ 0 \\ \hline \end{array}$ | $\begin{array}{\|l\|} \hline \infty \\ \stackrel{\infty}{0} \\ \hline \end{array}$ | $\begin{aligned} & \mathrm{O} \\ & 0 \end{aligned}$ | $\left\|\begin{array}{c} \mathrm{O} \\ 0 \end{array}\right\|$ | $\begin{aligned} & \mathrm{m} \\ & \stackrel{\rightharpoonup}{0} \\ & \hline \end{aligned}$ | $0$ | $\left\lvert\, \begin{aligned} & \infty \\ & 0 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\begin{array}{\|c\|} \hline 0 \\ \hline . \\ \hline . \end{array}$ | $\left.\begin{array}{\|c\|} \hline 0 \\ 0 \\ 0 \end{array} \right\rvert\,$ | $\left\lvert\, \begin{gathered} \text { to } \\ 0 \end{gathered}\right.$ | Oig | $\begin{aligned} & \mathrm{O} \\ & \hline \mathrm{O} \\ & \hline \end{aligned}$ | O | $\stackrel{\circ}{\circ}$ | ． | － | － | － | － | － |
|  | $\frac{3}{5}$ | $\frac{\tilde{Z}}{0}$ | $\begin{aligned} & \mathrm{O} \\ & \hline \mathrm{o} \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { n } \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \infty \\ & 0.6 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 . \\ & 0 . \end{aligned}$ | $\begin{array}{\|l\|} \hline \stackrel{\rightharpoonup}{0} \\ 0 \end{array}$ | $\begin{array}{\|l\|} \hline \\ \hline \\ 0 \\ 0 \end{array}$ | $\begin{array}{\|l\|} \hline 0 \\ 0 \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \infty \\ & \hline 0 \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & n \\ & \hline 0 \\ & \hline 0 \end{aligned}$ | $\stackrel{\rightharpoonup}{0}$ | $\begin{array}{\|l\|} \hline 0 \\ \hline 0 . \\ \hline . \end{array}$ | $\begin{array}{\|c\|} \hline \mathrm{O} \\ \hline \mathrm{O} \end{array}$ | $\begin{array}{\|c\|} \hline \mathrm{O} \\ \hline \mathrm{O} \\ \hline \end{array}$ | İ | $\begin{aligned} & \mathrm{o} \\ & \hline \mathrm{O} \\ & \hline \end{aligned}$ | $\stackrel{\rightharpoonup}{\circ}$ | $\stackrel{\circ}{\circ}$ | O | － | － | － | $\bigcirc$ | － |
|  | is |  | $\underset{O}{\circ}$ | $\left.\begin{gathered} \text { t } \\ 0 \\ 0 \end{gathered} \right\rvert\,$ | $\begin{aligned} & \stackrel{\rightharpoonup}{0} \\ & 0 . \\ & \hline \end{aligned}$ | $\stackrel{\substack{\mathrm{o} \\ \hline \mathrm{O}}}{ }$ | $\begin{aligned} & 9 \\ & \\ & \\ & 0 \\ & 0 \end{aligned}$ | $\left\|\begin{array}{l} 7 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left.\begin{aligned} & 9 \\ & 0 \\ & 0 \end{aligned} \right\rvert\,$ | $\left\lvert\, \begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\underset{0}{0}$ | $\begin{array}{\|l\|l\|l\|l\|l\|l\|} \hline 0 \\ \hline 0 \end{array}$ | $\left\lvert\, \begin{aligned} & \circ \\ & O \\ & 0 \\ & \hline \end{aligned}\right.$ | $\left\|\begin{array}{c} \circ \\ \hline 0 \\ \hline 0 \end{array}\right\|$ | $\left\|\begin{array}{l} \stackrel{\rightharpoonup}{O} \\ \underset{O}{2} \end{array}\right\|$ | $\left\|\begin{array}{l} \partial_{0} \\ 0 \end{array}\right\|$ | $\bigcirc$ | $\stackrel{\rightharpoonup}{\mathrm{O}}$ | $\stackrel{\rightharpoonup}{\mathrm{O}}$ | $\stackrel{\circ}{\circ}$ | ． | － | － | － | － | － |
|  | $\stackrel{山}{\sim}$ | $\begin{aligned} & 0 \\ & \stackrel{0}{0} \\ & \hline 0 \end{aligned}$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{array}{\|c} \mathbf{y} \\ 0 \\ 0 \end{array}$ | $\begin{array}{\|c} \hline 0 \\ 0 \\ 0 \\ \hline \end{array}$ | $\begin{gathered} \overrightarrow{0} \\ 0 \end{gathered}$ | $\begin{aligned} & \stackrel{\rightharpoonup}{0} \\ & 0 \end{aligned}$ | $\left\|\begin{array}{c} \infty \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{l} 0 \\ 0.0 \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & n \\ & 0 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\begin{aligned} & 0 \\ & \hline 0 \\ & 0 \end{aligned}$ | $\left\lvert\, \begin{gathered} \text { to } \\ \text { O} \end{gathered}\right.$ | $\left\lvert\, \begin{aligned} & 0 \\ & 8 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\left\|\begin{array}{r} {\underset{O}{0}}^{0} \end{array}\right\|$ | $\begin{aligned} & -0 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\rightharpoonup}{\circ}_{6}$ | － | － | － | 0 | － | － | － | － | 0 |
|  | ${ }_{5}$ | $\underset{\substack{\text { O} \\ \hline \\ \hline}}{ }$ | $\begin{aligned} & \underset{O}{O} \\ & \underset{O}{2} \end{aligned}$ | $\left\|\begin{array}{c} \mathbf{t} \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{array}{\|c} \hat{8} \\ 0 \\ 0 \end{array}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\left\|\begin{array}{c} \hat{0} \\ 0 \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & n \\ & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}\right.$ | $\left\lvert\, \begin{aligned} & \text { to } \\ & \hline 0 \\ & \hline \end{aligned}\right.$ | $\left\|\begin{array}{l} t \\ 0 \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & \mathrm{O} \\ & \mathrm{O} \\ & \mathrm{O} \end{aligned}\right.$ | $\left\|\begin{array}{l} \mathrm{O} \\ \mathrm{O} \\ \mathrm{O} \end{array}\right\|$ | $\left\|\begin{array}{l} \mathrm{O} \\ 0 \\ 0 \\ \hline \end{array}\right\|$ | $\begin{aligned} & \stackrel{\rightharpoonup}{0} \\ & 0 \end{aligned}$ | O | － | $\stackrel{\rightharpoonup}{\circ}$ | 0 | － | － | － | － | － | 0 |
|  | 濁 | $\stackrel{\infty}{\stackrel{\infty}{6}}$ | $\underset{O}{\substack{\mathrm{O} \\ \underset{O}{2} \\ \hline}}$ | $\begin{gathered} \text { t } \\ 0 \\ 0 \\ 0 \end{gathered}$ | $\begin{array}{\|c} 0 \\ 0 \\ 0 \\ 0 \\ \hline \end{array}$ | $\left.\begin{aligned} & \stackrel{\rightharpoonup}{0} \\ & 0 \\ & 0 \end{aligned} \right\rvert\,$ | $\begin{aligned} & 0_{0} \\ & 0 \end{aligned}$ | $\begin{aligned} & \overrightarrow{0}_{0} \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \overrightarrow{0} \\ & 0 \\ & 0 \end{aligned}$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & n \\ & 0 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\underset{O}{\mathrm{O}}$ | $\left\lvert\, \begin{aligned} & \mathrm{O} \\ & \mathrm{O} \\ & \mathrm{O} \end{aligned}\right.$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\left\|\begin{array}{l} \mathrm{O} \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & D_{0} \\ & 0 \\ & \hline \end{aligned}$ | $\stackrel{\stackrel{\rightharpoonup}{\mathrm{O}}}{\mathrm{O}}$ | － | － | － | $\bigcirc$ | － | － | － | － | － |
|  | $\pm$ | ${ }_{\mathrm{O}}^{\mathrm{O}}$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \\ \hline \end{array}\right\|$ | $\begin{array}{\|c} \mathbf{t} \\ 0 \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & n \\ & 0.0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{array}{\|l} \hline 0 \\ 0 \\ 0 \\ \hline \end{array}$ | $\left\|\begin{array}{l} o \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{array}{\|l\|} \hline \overrightarrow{0}_{0} \\ \hline \end{array}$ | $\left.\begin{array}{\|c} 9 \\ 0 \\ 0 \\ 0 \end{array} \right\rvert\,$ | $\begin{aligned} & \mathrm{O} \\ & \stackrel{0}{0} \\ & \hline \end{aligned}$ | $\begin{array}{\|l\|} \hline \\ \hline 0 \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & \hat{0} \\ & 0 \\ & 0 \end{aligned}$ | $\begin{array}{\|c} \circ \\ \hline 0 \\ \hline \end{array}$ | $$ | $\left\|\begin{array}{l} \mathrm{O} \\ \mathrm{O} \\ \hline \mathrm{O} \end{array}\right\|$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\stackrel{\circ}{8}$ | $\begin{aligned} & { }_{0}^{\circ} \\ & \hline 0 . \end{aligned}$ | － | － | － | － | － | － | － |  |
|  | 罳 | 俞 | $\left\|\begin{array}{l} \overline{0} \\ 0 \end{array}\right\|$ | $\begin{gathered} 0 \\ 0 \\ 0 \\ \hline \end{gathered}$ | $\begin{array}{\|c\|} \hline 0 \\ 0 \\ 0 \\ \hline \end{array}$ | $\begin{array}{\|c\|} \hline 0 \\ 0 \\ 0 \\ \hline \end{array}$ |  | $\begin{array}{\|c\|} \hline 0 \\ 0 \\ 0 \\ \hline \end{array}$ | $$ | $\begin{aligned} & 0 \\ & \hline 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{t} \\ & \hline 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \stackrel{\rightharpoonup}{\mathrm{O}} \\ & \hline \mathbf{~} \end{aligned}$ | $\begin{aligned} & \stackrel{\rightharpoonup}{\mathrm{O}} \\ & \hline \mathbf{~} \\ & \hline \end{aligned}$ | $\begin{array}{\|l\|} \hline \\ \hline \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & b_{8}^{\circ} \\ & \hline \end{aligned}$ | ${ }_{0}$ | $\bigcirc$ | $\bigcirc$ | 0 | 0 | － | － | $\stackrel{\circ}{\circ}$ | $\bigcirc$ |
|  | 岸 | 등 | $\left\|\begin{array}{l} \overline{0} \\ 0 \end{array}\right\|$ | Bos | $\begin{array}{\|c} \mathrm{O}_{0} \\ 0 \\ \hline \end{array}$ | $\left.\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned} \right\rvert\,$ | $\left\|\begin{array}{c} \mathrm{O} \\ 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{array}{\|c\|} \hline 0 \\ 0 \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & 0_{0}^{0} \\ & 0 . \end{aligned}$ | $\begin{array}{\|l\|} \hline \\ \hline 0 \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & 0 \\ & \hline 0 \\ & \hline \end{aligned}$ | － | － | － | $\begin{array}{\|l\|} \hline \stackrel{\rightharpoonup}{\circ} \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & 0_{8} \\ & 0 \\ & \hline \end{aligned}$ | $\bigcirc$ | $\stackrel{0}{0}$ | － | 0 | 0 | － | － | － | $\bigcirc$ |  |
|  | $\frac{\mathrm{M}}{\mathrm{Z}}$ | $\stackrel{n}{0}$ | $\begin{array}{\|c} 0 \\ 0 \\ 0 \end{array}$ | Box | $\begin{aligned} & \mathrm{O} \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{gathered} \text { O} \\ 0 \\ 0 \\ \hline \end{gathered}$ | $\left\|\begin{array}{l} { }_{8}^{0} \\ 0 \\ 0 \end{array}\right\|$ | $\begin{array}{\|c\|} \hline \\ \hline \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & \delta_{0} \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{O}_{0} \\ & 0 . \end{aligned}$ | － | － | $\begin{aligned} & \overline{\mathrm{O}} \\ & \hline \mathrm{O} \end{aligned}$ | 0 | $\bigcirc$ | － | － | － | － | － | 0 | － | － | － | － |  |
| $\mathbb{a}$ | z | $\stackrel{\rightharpoonup}{0}$ | $\begin{gathered} 0 \\ \hline \end{gathered}$ | $\left\lvert\, \begin{gathered} \mathrm{O} \\ \hline \mathrm{O} \\ \hline \end{gathered}\right.$ | $\begin{array}{\|c} \mathrm{O}_{0} \\ 0 \\ \hline \end{array}$ | $\begin{aligned} & \stackrel{\rightharpoonup}{0} \\ & 0 \\ & \hline \end{aligned}$ | $\left.\begin{array}{\|c} 0_{0} \\ 0 \end{array} \right\rvert\,$ | $\left.\begin{array}{\|l\|} \hline 0 \\ 0 \\ 0 \end{array} \right\rvert\,$ | $\bigcirc$ | － | － | $\begin{aligned} & \mathrm{o} \\ & \hline 0 \end{aligned}$ | － | $\bigcirc$ | $\bigcirc$ | － | － | $\bigcirc$ | － | － | 0 | － | － | － | － | － |
|  | 坒荷 | $\varepsilon_{1}$ |  |  |  | $\left\|\begin{array}{c} O_{1} \\ s_{1} \\ o_{1} \end{array}\right\|$ | $\left\|\begin{array}{l} n_{1} \\ 0_{1} \\ d_{1} \end{array}\right\|$ | $\left\|\begin{array}{c} 8_{1} \\ 0_{1} \\ n_{1} \end{array}\right\|$ | $\left\|\begin{array}{c} 0_{1} \\ 0_{1} \\ 0_{1} \end{array}\right\|$ | $\left\|\begin{array}{c} \infty \\ 0 \\ c_{1} \\ 1 \\ 1 \end{array}\right\|$ | $\left\|\begin{array}{c} o_{1} \\ e_{1} \\ o_{1} \end{array}\right\|$ | $\left\lvert\, \begin{gathered} a_{1} \\ a_{1} \\ g_{1} \end{gathered}\right.$ | $\left\lvert\, \begin{gathered} = \\ z_{1}^{\prime} \\ e_{1}^{\prime} \end{gathered}\right.$ | $\left\|\begin{array}{c} 9_{1}^{\prime} \\ g_{1}^{\prime} \\ \exists_{1} \end{array}\right\|$ | $\left\lvert\, \begin{gathered} n_{1} \\ a_{1} \\ \Omega_{1} \end{gathered}\right.$ | $\mathfrak{c} \begin{gathered} J_{1}^{\prime} \\ s_{1} \\ 2 \end{gathered}$ |  | $\begin{gathered} 0 \\ n_{1} \\ n_{1} \end{gathered}$ | $\begin{aligned} & 2 \\ & 5 \end{aligned}$ |  | $\begin{array}{c\|c} \infty & 9 \\ s_{1} & 9 \\ =1 & \infty \end{array}$ | $\begin{gathered} i_{1} \\ o_{1}^{\prime} \\ \sigma_{1} \end{gathered}$ | $\begin{aligned} & \bar{N}_{1} \\ & 0_{1} \\ & d_{1} \end{aligned}$ | $\begin{aligned} & {\underset{N}{1}}^{\prime} \\ & \varrho_{1} \end{aligned}$ | N ¢ d |  |

Prevailing Wind Profile


Project No.: 1395
PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE
AIR VENTILATION ASSESSMENT REPORT

## Appendix B Location of Overall and Perimeter Test Points


<br>AEC_SERVER_2\Project Server_2\1351-1400\1395\05 Modelling\CFD_PVB\PVB_Drawings\works\Basemap_PVB_drafted_20180301(focus area).dwg

<br>AEC_SERVER_2\Project Server_2\1351-1400\1395\05 Modeling\CFD_PVB\PVB_Drawings\works\Basemap_PVB_drafted_20180301(focus area).dwg

<br>AEC_SERVER_2\Project Server_2\1351-1400\1395\05 Modelling\CFD_PVB\PVB_DrawingS\workS\Basemap_PVB_drafted_20180706(focus area).dwg

## Appendix C Detailed Velocity Ratio (VR) Results for All Test Points


$\mathscr{y}$


щ 쓴，気



$\stackrel{\circ}{\circ}$

$\stackrel{y}{2} \stackrel{\text { 可 }}{5}$ O


$\underset{\sim}{\underset{\sim}{4}} \stackrel{\infty}{8}$我品
$\qquad$
 000000000000000000000员


$\underset{\sim}{w}$
os










$\stackrel{3}{3} \stackrel{\sim}{3}$気尝







殅 $\div$













$\sum_{z}$
ц




















| 高 |  | \％ | \％ | $\bigcirc$ | \％ | \％ |  |  | สั์ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Uum | \％ |  |  | 刃ix did |  |  | \％ |  | 亳哀家。 |
|  |  | on ox |  | gex y y | \％ | $\pm$ |  |  | \％힝 |
|  | \％ |  |  | 品 艮 |  | 迢 | 8 |  | \％ |
|  |  | $0$ | 응융 둥 | Rix |  | 名: |  |  |  |
|  |  | $8$ |  | $\%$ | \％ | 管 | No |  | $!$ |
|  |  | 잉 | 웅ㅇㅇㅇ웅 |  | \％ |  |  |  |  |
|  |  | ส |  | 영 | I | N～0 |  |  |  |
|  |  |  |  | O |  |  |  |  |  |
|  |  |  | ส | ส | \％융융 | 为 | 哏 |  |  |
| S |  |  |  | สั |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |


| $\begin{aligned} & 3 \\ & 6 \\ & 3 \end{aligned}$ |  | $\stackrel{\infty}{\circ}$ | $\div$ | $\underset{O}{\mathrm{O}}$ |  |  | $\underset{0}{\sigma}$ | $\stackrel{\circ}{0}$ | $\dot{c}$ | N | $\underset{o}{\stackrel{N}{\circ}}$ |  |  | O | O | 앙 | - | O |  |  |  |  | - |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\left\|\begin{array}{l} \boldsymbol{\omega} \\ \boldsymbol{\omega} \end{array}\right\|$ |  | $\underset{0}{\circ}$ | ${ }^{8}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \end{aligned}$ | $\infty$ |  | $\begin{gathered} \overline{0} \\ \dot{0} \end{gathered}$ | $\underset{0}{\delta}$ | $\begin{aligned} & \text { O } \\ & 0 \end{aligned}$ |  | O. |  |  |  |  |  | , | $$ | N | - | N | - | N |
| の |  | $\stackrel{O}{0}$ | $\underset{\circ}{\stackrel{\rightharpoonup}{\circ}}$ | $\begin{aligned} & \mathrm{N} \\ & \mathrm{O} \end{aligned}$ | $0$ |  | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & \hline 0 \end{aligned}$ | $\stackrel{\leftarrow}{\stackrel{\circ}{\circ}}$ | $\stackrel{\sim}{\square}$ | $\underset{\vdots}{\overleftarrow{\sigma}}$ | $8$ |  |  |  |  | N |  |  | $O_{0}$ | - | N | N- |
| $\boldsymbol{\omega}$ |  | $\stackrel{0}{0}$ | $\div$ | $\underset{\square}{\overleftarrow{0}}$ |  |  | $\stackrel{N}{0}$ | O | $\underset{0}{\square}$ | $\stackrel{\bar{m}}{0}$ | $\underset{i}{N}$ | $0$ |  | $\cdots$ | - | - | \% | \# | O | N | O | - | - |
| $3$ |  | $8$ | $\begin{aligned} & \mathrm{O} \\ & \hline 0 \\ & \hline \end{aligned}$ |  | $0$ |  | $\stackrel{N}{\mathrm{~N}}$ | O. | $\begin{aligned} & \text { I } \\ & 0 \end{aligned}$ | $\stackrel{\mathbf{N}}{\mathbf{o}}$ | $\mathfrak{c}$ | $0$ |  | 5 | - | N | - | N | - | N | O | O | N0 |
| $\begin{aligned} & \mathbf{3} \\ & \mathbf{y y} \\ & \boldsymbol{0} \end{aligned}$ |  | $\stackrel{\sim}{\circ}$ | $\stackrel{\sim}{\circ}$ |  | $0$ |  | $\stackrel{\rightharpoonup}{0}$ | $8$ | $\underset{\substack{\mathrm{N}}}{\substack{2}}$ | $\stackrel{\sim}{\sim}$ | $\underset{\substack{\text { N } \\ \text { N }}}{ }$ | $0$ | $\begin{aligned} & \text { No } \\ & \hline \end{aligned}$ | $\bigcirc$ | - | ${ }^{\circ}$ | - | - | - | $\stackrel{\circ}{\circ}$ | \% | - | $\stackrel{\infty}{\square}$ |
| $\begin{array}{\|l\|} \hline \boldsymbol{\sim} \\ \underset{\sim}{w} \end{array}$ |  | O- | $\underset{\sim}{\dot{\sigma}}$ | $\stackrel{9}{\dot{\circ}}$ | $0$ |  | $\stackrel{m}{0}$ | $\begin{aligned} & 1 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ |  | O | $\underset{i}{\circ}$ | $0$ | $\frac{N}{0}$ | 0 | 앙 | $\div$ | - | O | - | - | - | - | $\stackrel{\text { N}}{0}$ |
| $\underset{\mathbf{Z}}{\mathbf{Z}}$ |  | O. | $\stackrel{n}{\Gamma}$ | No | $0$ |  | $\begin{gathered} \mathrm{N} \\ \mathrm{O} \\ \hline \end{gathered}$ | ${ }^{\circ}$ | $\begin{gathered} \infty \\ \\ \hline \end{gathered}$ | $\begin{aligned} & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\underset{i}{\underset{O}{0}}$ |  |  | 0 | O | $0$ | $\bigcirc$ | $\bigcirc$ |  | - | O | O | $\stackrel{N}{\circ}$ |
| $\underset{\mathbf{Z}}{\mathbf{m}}$ |  | $\stackrel{\circ}{\circ}$ | $0$ | $\underset{O}{\mathrm{O}}$ | $0$ |  | $\begin{aligned} & 10 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{o} \\ & \hline 0 \end{aligned}$ | $0_{0}^{2}$ | $\frac{N}{O}$ | $\frac{\underset{j}{j}}{\underset{O}{2}}$ | $0$ | $\begin{aligned} & 4 \\ & \hline \end{aligned}$ | O | O | $0_{0}$ | - | 0 |  | $\bigcirc$ | - | O | O |
| $\underset{\sim}{\underset{\sim}{2}}$ |  | ${ }_{0}^{\infty}$ | ${ }^{\mathrm{O}} \mathrm{O}$ | $\underset{\substack{0 \\ \\ \hline}}{ }$ | $0$ |  | $\underset{0}{\dot{O}}$ | $\stackrel{1}{0}$ | $\underset{o}{\infty}$ | $\begin{aligned} & \mathbf{O} \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { O } \\ & 0 \\ & 0 \end{aligned}$ | $c$ | $\frac{0}{3}$ | $\bigcirc$ | O | $\bigcirc$ |  | $\bigcirc$ | - | $\bigcirc$ | $\bigcirc$ |  | $\stackrel{\infty}{\sim}$ |
| ш |  | $\stackrel{\circ}{0}$ | O | $\stackrel{8}{\circ}$ |  |  | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\mathbf{\Sigma}_{0}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \end{aligned}$ | No | $j \div$ |  |  | $\bigcirc$ | - | O | O | O | 0 |  | O. | N | - |
|  |  | $\bar{o}$ 0 0 | $\begin{aligned} & \text { N } \\ & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{gathered} 0 \\ 0 \\ 0 \\ 0 \end{gathered}$ |  |  | $\begin{aligned} & \circ \\ & \hline 0 \\ & 0 \\ & 0 \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ |  | $\begin{gathered} \infty \\ 0 \\ 0 \\ \infty \end{gathered}$ | 8 <br> 0 <br> 0 | $j \sqrt{6}$ |  |  | O | - |  |  |  |  |  |  | ㅁ |


| $\begin{aligned} & 3 \\ & 3 \\ & 3 \end{aligned}$ |  | $\underset{\substack{\mathrm{N}}}{ }$ | $\frac{\pi}{0}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\circ}{\div}$ |  | $\begin{aligned} & 4 \\ & \hline \end{aligned}$ | No | $\begin{aligned} & \hat{O} \\ & 0 \end{aligned}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\sim}{\stackrel{n}{0}}$ |  | $\stackrel{m}{0}$ | $\stackrel{\infty}{0}$ | $\begin{aligned} & \mathrm{N} \\ & \mathrm{O} \\ & \hline \end{aligned}$ | $0$ |  | ָ |  | $\begin{gathered} \mathrm{N} \\ \mathbf{0} \end{gathered}$ | $\begin{aligned} & 8 \\ & \hline 0 \\ & \hline \end{aligned}$ | $\stackrel{m}{\dot{c}}$ | O | $\underset{O}{\mathrm{O}}$ | $\stackrel{\text { N }}{\substack{0}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\underset{\sim}{\boldsymbol{\omega}}$ |  | $\stackrel{\infty}{\circ}$ | $\begin{aligned} & 0 \\ & 0.0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \overline{0} \\ & 0 \end{aligned}$ | $\stackrel{\vdots}{\circ}$ | $\begin{array}{lll} 5 \\ 0 \\ 0 \end{array}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{m}{0}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathbf{O} \\ & 0 \end{aligned}$ | $\underset{\sim}{\dot{O}}$ |  | $\underset{O}{\mathrm{O}}$ | $\begin{aligned} & \dot{0} \\ & \hline \end{aligned}$ | $\stackrel{\infty}{\infty}$ | $\begin{gathered} \infty \\ 0 \\ 0 \end{gathered}$ |  |  |  | $\stackrel{\sim}{\circ}$ | $\stackrel{\underset{0}{\circ}}{ }$ | $0$ |  | $\begin{gathered} \text { M } \\ 0 \\ \hline \end{gathered}$ | ${ }_{\circ}^{\circ}$ |
| $\omega$ |  | N | $\stackrel{m}{\stackrel{m}{0}}$ | $\overline{0}$ | $\begin{aligned} & 0 \\ & 0 \\ & \hline \end{aligned}$ |  | $\begin{aligned} & \text { O} \\ & \hline \end{aligned}$ |  | $\hat{O}_{0}$ | $\stackrel{0}{\dot{0}} \underset{\dot{0}}{ }$ | $\stackrel{\circ}{0}$ |  | $\underset{O}{\mathrm{O}}$ | $\hat{O}_{0}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { O } \\ & 0 \\ & 0 \end{aligned}$ | $\bigcirc$ |  |  | $\stackrel{\infty}{\dot{\circ}}$ | $\stackrel{\stackrel{\rightharpoonup}{\mathrm{o}}}{\dot{\circ}}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | O | $\stackrel{\circ}{\div}$ | $\stackrel{m}{5}$ |
| い |  | $\stackrel{\odot}{\circ}$ | $\frac{\pi}{i}$ | $\begin{aligned} & \text { m } \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\underset{o}{\circ}}{ }$ |  | $\stackrel{\sim}{0} \mathbf{0}$ | $\stackrel{m}{0}$ | $\stackrel{\rightharpoonup}{\circ}$ | $\begin{gathered} \mathbf{~} \\ \substack{2} \end{gathered}$ | $\stackrel{\underset{\sigma}{\circ}}{ }$ |  | $\begin{gathered} 0 \\ 0 \\ 0 \end{gathered}$ | N̦ | $\underset{\sim}{\circ}$ | $\begin{aligned} & \infty \\ & \mathbf{m} \\ & 0 \\ & 0 \end{aligned}$ | $\bar{\sigma}$ |  |  | $\begin{gathered} 0 \\ \hline \\ 0 \end{gathered}$ | $\stackrel{\substack{\mathrm{N}}}{\substack{ \\\hline}}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | O | $\stackrel{\circ}{\circ}$ | - |
| $\underset{\sim}{3}$ |  | $\stackrel{10}{\vdots}$ | $\frac{10}{0}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\circ}{\circ}$ |  | $\mathfrak{R}$ | $\underset{o}{\circ}$ | $\stackrel{\stackrel{\rightharpoonup}{\mathbf{m}}}{\substack{2}}$ | $\left\|\begin{array}{c} \infty \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & 0 \\ & N \\ & 0 \\ & 0 \end{aligned}$ |  | $\underset{o}{\overleftarrow{o}}$ | $\stackrel{0}{\dot{O}}$ | $\stackrel{\underset{ }{\circ}}{\dot{o}}$ | $\begin{gathered} \mathrm{N} \\ \mathbf{N} \\ 0 \end{gathered}$ | N |  |  | $\underset{\sim}{N}$ | $\begin{aligned} & \ddagger \\ & j \\ & 0 \end{aligned}$ | $\begin{gathered} \mathbb{N} \\ 0 \\ 0 \end{gathered}$ |  | $\underset{\substack{\text { N } \\ \hline}}{ }$ | $\stackrel{m}{\square}$ |
| $\underset{\sim}{3}$ |  | $\underset{O}{\mathrm{O}}$ | $\frac{\pi}{0}$ | $\begin{aligned} & \mathbf{9} \\ & 0 \\ & 0 \end{aligned}$ |  |  |  | $$ | N | $\begin{gathered} \tilde{m} \\ 0 \\ 0 \end{gathered}$ | $\stackrel{\sim}{\stackrel{\circ}{\circ}}$ |  | $\begin{array}{lll} 1 \\ 0 & 1 \\ \hline \end{array}$ | $\hat{O}_{0}$ | $\underset{\sim}{\underset{O}{0}}$ | $\begin{gathered} \text { M } \\ \mathbf{m} \\ 0 \end{gathered}$ | o |  |  | $\begin{gathered} \underset{\sim}{2} \\ \mathbf{O} \end{gathered}$ | $\begin{gathered} \text { M } \\ \text { en } \end{gathered}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \end{aligned}$ |  | $\mathrm{O}_{\mathrm{O}}^{\infty}$ | - |
| $\underset{\sim}{\boldsymbol{u}}$ |  | $\stackrel{\substack{0 \\ \hline}}{ }$ | $\left\|\begin{array}{l} 0 \\ 0 \\ 0 \end{array}\right\|$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\sim}{\circ}$ |  | $\underset{\sim}{\tilde{f}}$ | $\begin{gathered} \text { Nu} \\ \text { N } \end{gathered}$ | $\stackrel{\sim}{0}$ | $\stackrel{\rightharpoonup}{\dot{0}}$ | $\frac{m}{\circ}$ |  | $\underset{\sim}{\stackrel{\rightharpoonup}{\circ}}$ | $\stackrel{\infty}{\stackrel{\infty}{\circ}}$ | $\stackrel{\circ}{\circ}$ | $\begin{gathered} 9 \\ 0 \\ 0 \end{gathered}$ |  | o |  | $\begin{gathered} \underset{\sim}{2} \\ \hline 0 \end{gathered}$ | $\begin{gathered} \infty \\ \underset{\sim}{N} \\ \hline \end{gathered}$ | $\stackrel{m}{\dot{0}}$ |  | $\stackrel{10}{\stackrel{1}{0}}$ | ${ }^{\circ}$ |
| $\underset{\text { Z }}{\underset{Z}{2}}$ |  | $\stackrel{0}{\dot{o}}$ | $\underset{\substack{\grave{N} \\ \vdots}}{ }$ | $\frac{\infty}{\dot{o}}$ |  | $\underset{\sim}{\underset{\sim}{c}} \underset{\sim}{\alpha}$ | $\begin{aligned} & \infty \\ & \mathbf{m} \\ & 0 \end{aligned}$ | $\frac{\infty}{\circ}$ | $\underset{\substack{\text { N } \\ \hline}}{ }$ | $\begin{gathered} \underset{N}{N} \\ 0 \end{gathered}$ | $\underset{\sim}{\underset{O}{0}}$ |  | 웅 | $0$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\frac{\infty}{\stackrel{\infty}{0}}$ |  |  |  | $\begin{gathered} 0 \\ \\ \hline \end{gathered}$ | $\begin{aligned} & \bar{m} \\ & 0 \end{aligned}$ | $\begin{aligned} & \underset{\sim}{N} \\ & 0 \end{aligned}$ | N | $\begin{aligned} & \hat{0} \\ & 0 \end{aligned}$ | O- |
| $\underset{\mathbf{Z}}{\mathbf{w}}$ |  | $\begin{aligned} & \mathrm{N} \\ & \mathrm{O} \\ & \mathbf{O} \end{aligned}$ | $\underset{0}{\infty}$ | $\begin{aligned} & m \\ & 0 \\ & 0 \end{aligned}$ |  |  | $\stackrel{m}{\dot{\circ}} \underset{\sim}{\mid}$ | $\stackrel{\infty}{\circ}$ | $\underset{\substack{\text { N }}}{ }$ | $\underset{c}{\underset{0}{0}}$ | $\begin{aligned} & 8 \\ & \hline 0 \\ & \hline 0 \end{aligned}$ |  | $\underset{\sim}{\infty} \underset{\sim}{c}$ | $\stackrel{0}{\dot{\circ}}$ | $\stackrel{m}{\square}$ | $\begin{gathered} \text { N } \\ \underset{O}{2} \end{gathered}$ |  | $0$ |  | $\stackrel{n}{\square}$ | $\begin{gathered} \infty \\ \underset{\sim}{\infty} \\ 0 \end{gathered}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | O. | $\underset{\vdots}{ \pm}$ | N |
| $\underset{\text { \| }}{\underset{\sim}{\mid}}$ |  | $\begin{aligned} & \circ \\ & \dot{0} \end{aligned}$ | $\stackrel{N}{N}$ | $\begin{gathered} \underset{\sim}{2} \\ 0 \end{gathered}$ |  | $\underset{\substack{N}}{\substack{2}}$ | $8$ | $\stackrel{ \pm}{\dot{\sigma}}$ | $\stackrel{\circ}{\circ}$ | $\stackrel{ㅇ}{3}$ | $\begin{aligned} & \text { M } \\ & \\ & \hline \end{aligned}$ |  | $\underset{\sim}{\mathrm{N}}$ | $\underset{\sim}{N}$ | $\stackrel{\stackrel{1}{5}}{0}$ | $\begin{gathered} \hat{m} \\ 0 \\ 0 \end{gathered}$ | $\bar{\sigma}$ |  |  | $\begin{gathered} \underset{\sim}{m} \\ 0 \end{gathered}$ | $\frac{0}{\dot{o}}$ | $\begin{gathered} n \\ N \\ 0 \end{gathered}$ | o | $\stackrel{\leftarrow}{\stackrel{\circ}{\circ}}$ | N |
| ш |  | ò | $\begin{gathered} 1 \\ \\ 0 \end{gathered}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ |  |  | Ban | $\stackrel{m}{\circ}$ | $\underset{\square}{\square}$ | $\begin{aligned} & \overline{0} \\ & 0 \end{aligned}$ | $\begin{aligned} & \underset{N}{N} \\ & 0 \\ & \hline \end{aligned}$ |  | $\underset{\sim}{\mathbf{m}}$ | $$ | $\begin{gathered} \text { O} \\ \text { N } \end{gathered}$ | $\left\lvert\, \begin{gathered} 0 \\ 0 \\ 0 \\ 0 \end{gathered}\right.$ |  | - |  | $\underset{\sim}{\mathrm{N}}$ | $\stackrel{\bar{N}}{\substack{0}}$ | $\stackrel{\bar{m}}{0}$ | $\stackrel{\square}{\circ}$ | $\stackrel{N}{\mathbf{N}}$ | $\stackrel{\bigcirc}{\text { N}}$ |
|  |  | $\begin{aligned} & \overline{0} \\ & 00 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \mathbf{0} \\ & \mathbf{0} \\ & \mathbf{O} \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ |  |  |  | $\begin{array}{ll} 0 \\ \hline \end{array}$ | N 0 0 0 | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { O} \\ & \text { O} \\ & 0 \end{aligned}$ |  | $\begin{aligned} & \text { 웅 } \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \overline{0} \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { N } \\ & \text { O} \\ & \text { O } \end{aligned}$ | $\begin{aligned} & \text { m } \\ & \stackrel{n}{0} \\ & \hline \end{aligned}$ | 0 | 0 | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & \hline 1 \end{aligned}$ | Bo | $\begin{aligned} & \mathrm{N} \\ & \mathbf{0} \\ & \mathbf{0} \end{aligned}$ | $\begin{aligned} & \infty \\ & \stackrel{\infty}{n} \\ & 0 \end{aligned}$ | 0 | 믕 | - |

3
3
3


荡

ש




$\sum_{\Sigma}$

w
ш



w

ש





 00000000000000000000000




$\underset{\sim}{\boldsymbol{\sim}} \boldsymbol{\sim}$










ш $\stackrel{\propto}{>}$

















| $\begin{aligned} & 3 \\ & 3 \\ & 3 \end{aligned}$ |  | $\begin{aligned} & \mathrm{O} \\ & \hline \mathrm{O} \end{aligned}$ | $\begin{aligned} & \text { I } \\ & 0 \\ & \hline \end{aligned}$ | $\left.\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned} \right\rvert\,$ | $\left\|\begin{array}{l} 8 \\ 0 \\ 0 \end{array}\right\|$ | $\frac{\pi}{0}$ | $\frac{0}{0}$ | $\stackrel{8}{0}$ | $\begin{gathered} 8 \\ \hline \end{gathered}$ | $\stackrel{\rightharpoonup}{N}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & \mathrm{O} \end{aligned}$ | $\left\lvert\, \begin{gathered} \hat{N} \\ \mathbf{o} \end{gathered}\right.$ | $\begin{gathered} \underset{\sim}{*} \\ \underset{O}{2} \end{gathered}$ | $\underset{\square}{\square}$ | $\stackrel{m}{\square}$ |  |  | $\frac{\pi}{i}$ | $\stackrel{9}{\stackrel{9}{0}}$ | $\begin{gathered} N \\ \mathrm{~N} \\ \mathbf{O} \end{gathered}$ | $\left\lvert\, \begin{gathered} \mathbb{N} \\ \mathbf{N} \\ \hline \end{gathered}\right.$ | $\begin{gathered} n \\ \\ \hline \end{gathered}$ | $\stackrel{\text { N }}{\substack{\text { ® }}}$ | $\stackrel{N}{N}$ | ¢ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\underset{\sim}{\boldsymbol{\omega}}$ |  | $\underset{\sim}{\mathrm{N}}$ | $\begin{gathered} \stackrel{\infty}{0} \\ 0 \\ 0 \end{gathered}$ | $\begin{gathered} \dot{W} \\ 0 \\ 0 \end{gathered}$ | $\left\lvert\, \begin{gathered} \mathbf{D} \\ \mathbf{N} \\ \mathbf{O} \end{gathered}\right.$ | $\begin{aligned} & \underset{\sim}{2} \\ & \mathbf{N} \end{aligned}$ | $\begin{aligned} & 0 \\ & \underset{O}{0} \end{aligned}$ | $\begin{aligned} & \mathbf{D} \\ & \mathbf{N} \\ & \hline \end{aligned}$ | $\begin{gathered} \substack{1 \\ \hline \\ \hline} \\ \hline \end{gathered}$ | $$ | $\underset{\substack{\mathrm{N}}}{ }$ | $\underset{\sim}{\stackrel{N}{\circ}}$ | $\stackrel{m}{\stackrel{m}{0}}$ | $\begin{gathered} n \\ N \\ 0 \end{gathered}$ | $\stackrel{\sim}{\mathrm{N}}$ | No |  | $\stackrel{m}{0} \underset{c}{c}$ | $\begin{aligned} & \dot{0} \\ & \hline \end{aligned}$ | $\begin{aligned} & \overline{0} \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { O } \\ & 0 \\ & 0 \end{aligned}$ | $0$ | O | $\begin{aligned} & \text { O } \\ & 0 \\ & \hline \end{aligned}$ | $\bigcirc$ | ¢ |
| の |  | $\stackrel{\sim}{N}$ | $\left\lvert\, \begin{gathered} 2 \\ \mathbf{N} \\ 0 \end{gathered}\right.$ | $\left\|\begin{array}{c} 2 \\ N \\ 0 \end{array}\right\|$ | $\left\|\begin{array}{c} \text { din } \\ \text { O} \end{array}\right\|$ | $\begin{gathered} \underset{\sim}{N} \\ \underset{O}{2} \end{gathered}$ | $\underset{\substack{n \\ N \\ \hline}}{ }$ | $\stackrel{n}{N}$ | $\begin{gathered} \underset{\sim}{2} \\ \underset{\sim}{2} \\ \hline \end{gathered}$ | $\underset{\substack{- \\ \hline \\ \hline}}{\substack{2}}$ | $\frac{\pi}{0}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\underset{0}{\underset{o}{0}}$ | $\frac{0}{\grave{0}}$ | $\underset{\substack{4 \\ \hline \\ \hline}}{ }$ | $\stackrel{\rightharpoonup}{0}$ | $\stackrel{N}{\div}$ |  | $\begin{aligned} & 10 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & O_{0} \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 20 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & 10 \\ & 0 \\ & 0 \end{aligned}$ | O | $\bigcirc$ |
| $\boldsymbol{\omega}$ |  | $\stackrel{\substack{\mathrm{m} \\ 0}}{ }$ | $\begin{aligned} & \underset{\sim}{N} \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\left\|\begin{array}{c} \underset{N}{N} \\ 0 \end{array}\right\|$ | $\stackrel{N}{N}$ | $\begin{aligned} & \text { No} \\ & 0 \end{aligned}$ | $\underset{0}{\stackrel{N}{0}}$ | $=10$ |  | $\begin{aligned} & \mathrm{O} \\ & \mathrm{O} \end{aligned}$ | $\frac{\pi}{i}$ | $\stackrel{\underset{N}{N}}{\substack{0}}$ | $\begin{gathered} \underset{N}{N} \\ 0 \end{gathered}$ | $\begin{aligned} & \text { LN} \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\square}{\circ}$ | $\stackrel{\circ}{\circ}$ | $\delta_{0}^{\circ}$ | $\stackrel{\rightharpoonup}{\dot{\circ}}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \circ \\ & \hline 0 \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & \mathbf{O} \\ & \hline \end{aligned}$ | O | O. | O. | $\stackrel{\square}{\circ}$ |
| $\underset{\infty}{3}$ |  | N | $\left\lvert\, \begin{gathered} \text { d } \\ \text { N } \end{gathered}\right.$ | $\frac{\infty}{\dot{o}}$ | $\stackrel{0}{0}$ | $\hat{O}$ | $\underset{\sim}{\underset{O}{O}}$ | O | $\underset{i}{ \pm} \underset{i}{\infty}$ |  | $\underset{\substack{\text { ̇ } \\ \text { N }}}{ }$ | $\begin{gathered} \mathrm{N} \\ \mathrm{~S} \\ 0 \end{gathered}$ | $\stackrel{0}{\dot{0}}$ | $\underset{\dot{O}}{\underset{\sigma}{2}}$ | O | $\begin{gathered} \pm \\ \dot{O} \end{gathered}$ | $\stackrel{\infty}{\vdots}$ |  | $\begin{gathered} 0 \\ 0 \\ 0 \end{gathered}$ | $\frac{\infty}{\vdots}$ | $\left.\begin{gathered} 10 \\ 0 \\ 0 \end{gathered} \right\rvert\,$ | $\begin{aligned} & 0 \\ & N \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & m \\ & 0 \\ & 0 \end{aligned}$ | $\begin{gathered} \mathrm{N} \\ \hline 0 \end{gathered}$ | $\bigcirc$ | － |
| $\underset{\sim}{3}$ |  | $\begin{aligned} & \hat{m} \\ & 0 \end{aligned}$ | $\begin{gathered} \mathrm{n} \\ \mathrm{~m} \\ 0 \end{gathered}$ | $\begin{gathered} \bar{m} \\ 0 \end{gathered}$ | $\begin{gathered} n \\ \\ \hline \end{gathered}$ | $\begin{aligned} & \stackrel{O}{N} \\ & 0 \end{aligned}$ | $\underset{o}{\circ}$ | $\stackrel{0}{\dot{o}}$ | $\frac{0}{0} 0$ |  | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\frac{\infty}{\dot{o}}$ | $\stackrel{\underset{N}{N}}{\substack{0}}$ | $\left\|\begin{array}{c} \mathbf{o} \\ \underset{0}{2} \end{array}\right\|$ | $\begin{aligned} & \mathrm{m} \\ & 0 \\ & \hline \end{aligned}$ | $\stackrel{\rightharpoonup}{\dot{~}}$ | O. |  | $\stackrel{\infty}{\stackrel{\infty}{\circ}}$ | $\begin{aligned} & O_{0} \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \hat{O} \\ & 0 \end{aligned}$ | $\begin{aligned} & \hat{O} \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | ${ }_{0}^{\mathrm{O}}$ | $\begin{aligned} & 0 \\ & 0 \\ & \hline \end{aligned}$ | O |
| $\left\lvert\, \begin{aligned} & \boldsymbol{\sim} \\ & \boldsymbol{\sim} \end{aligned}\right.$ |  | $\begin{gathered} \infty \\ \substack{\infty \\ 0 \\ \hline} \end{gathered}$ | 苞 | $\begin{gathered} 0 \\ 0 \\ 0 \\ 0 \end{gathered}$ | $\begin{array}{\|c} \underset{\sim}{N} \\ \underset{O}{2} \end{array}$ | $\begin{gathered} \underset{N}{N} \\ 0 \end{gathered}$ | $\underset{\sim}{\sim}$ | $\stackrel{\infty}{\dot{\circ}}$ | $\frac{n}{0} \underset{i}{5}$ | $\underset{0}{\sigma}$ | $\underset{\sim}{\underset{O}{0}}$ | $\stackrel{N}{\sigma}$ | $\left\lvert\, \begin{aligned} & \infty \\ & 0 \\ & 0 \\ & 0 \end{aligned}\right.$ | $\begin{aligned} & \text { O} \\ & 0 \\ & 0 \end{aligned}$ | $\underset{\substack{\infty \\ \underset{0}{2} \\ \hline}}{ }$ |  | N |  | $\stackrel{\substack{0}}{\substack{0}}$ | $\stackrel{\bar{N}}{\substack{0}}$ | $\begin{gathered} \mathrm{O} \\ \mathbf{o} \end{gathered}$ | $\stackrel{\circ}{0}$ | $\underset{\sim}{\sigma}$ | O. | $0$ | $\stackrel{\square}{\square}$ |
| $\underset{\mathbf{Z}}{\mathbf{Z}}$ |  | $\begin{aligned} & n \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { g } \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\left.\begin{aligned} & 0 \\ & N \\ & 0 \end{aligned} \right\rvert\,$ | $\begin{gathered} 0 \\ \mathbf{N} \\ 0 \end{gathered}$ | $\frac{\pi}{\dot{O}}$ | $\stackrel{0}{\dot{o}}$ | $\begin{array}{ll} 0 \\ \hline & \overleftarrow{0} \\ \hline \end{array}$ | $\bar{\sigma}_{0}^{0}$ | $\begin{aligned} & \infty \\ & \hline 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 9 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{\widetilde{N}}{\stackrel{\sim}{0}}$ |  | $\begin{gathered} \text { No } \\ \text { O} \end{gathered}$ |  |  | $\left\lvert\, \begin{gathered} 0 \\ \underset{N}{0} \\ 0 \end{gathered}\right.$ |  | $\stackrel{0}{\stackrel{0}{0}}$ | $\frac{0}{\dot{o}}$ | $\frac{1}{c}$ | $\stackrel{m}{\square}$ | $\stackrel{\rightharpoonup}{\circ}$ |
| $\underset{\mathbf{Z}}{\mathbf{w}}$ |  | $\stackrel{N}{\dot{O}}$ | $\stackrel{m}{\stackrel{0}{0}}$ | $\stackrel{m}{\dot{\circ}}$ | $\stackrel{m}{\stackrel{m}{0}}$ | $\frac{\sim}{\vdots}$ | $10$ | $\stackrel{\infty}{\circ}$ | $\stackrel{0}{0} \underset{\sim}{\circ}$ | $\underset{\sim}{\stackrel{\rightharpoonup}{0}}$ | $\frac{9}{5}$ | $\begin{aligned} & \text { \# } \\ & 0 \\ & \hline \end{aligned}$ | $\underset{i}{\underset{0}{0}}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\underset{0}{\infty}$ | $\stackrel{\circ}{\circ}$ |  | $\stackrel{m}{0} \underset{\sim}{c}$ | $\stackrel{ }{\substack{0 \\ \hline}}$ | $\begin{gathered} \text { O} \\ \text { O} \end{gathered}$ | $\begin{gathered} \infty \\ \underset{o}{0} \\ \hline \end{gathered}$ | $\begin{array}{\|c} \hat{N} \\ \mathbf{N} \end{array}$ | $\begin{array}{\|c} 0 \\ N \\ 0 \\ \hline \end{array}$ | N | $\begin{aligned} & 10 \\ & 0 \\ & 0 \end{aligned}$ | － |
| $\underset{\boldsymbol{\sim}}{\boldsymbol{\sim}}$ |  | $\underset{\substack{\text { N }}}{\substack{2 \\ \hline}}$ | $\begin{gathered} \infty \\ 0 \\ 0 \end{gathered}$ | $\begin{gathered} 0 \\ 0 \\ 0 \end{gathered}$ | $\begin{array}{\|c} 0 \\ \\ \hline \end{array}$ | $\begin{gathered} N \\ \mathbf{N} \\ 0 \end{gathered}$ | $\underset{\sim}{O}$ | $\underset{\substack{N \\ \hline}}{ }$ | $\begin{gathered} \underset{\sim}{2} \\ \hline \end{gathered}$ | $\stackrel{\sim}{n}$ | N | $\underset{\sim}{N}$ | $\stackrel{m}{\stackrel{m}{0}}$ | $\left\lvert\, \begin{aligned} & \infty \\ & 0 \\ & 0 \end{aligned}\right.$ | $\begin{aligned} & 8 \\ & \hline 0 \end{aligned}$ |  |  |  | $\begin{gathered} \stackrel{9}{\dot{0}} \\ 0 \end{gathered}$ | $\begin{gathered} n \\ 0 \\ 0 \\ 0 \end{gathered}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 8 \\ & \hline 0 \\ & \hline 0 \end{aligned}$ | No | $\begin{gathered} \mathrm{N} \\ 0 \end{gathered}$ | $\bigcirc$ |
| ш |  | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\underset{O}{\dot{f}}$ | $\left.\begin{gathered} 0 \\ 0 \\ 0 \end{gathered} \right\rvert\,$ | $\begin{aligned} & \mathbf{~} \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\underset{\sim}{\underset{O}{N}}$ | $\begin{aligned} & 0 \\ & \stackrel{O}{N} \\ & \hline 0 \end{aligned}$ | $\stackrel{\substack{1 \\ \hline}}{\substack{0}}$ | $$ | $\stackrel{\vdots}{\mathrm{N}}$ | $\begin{gathered} \hat{m} \\ 0 \end{gathered}$ | $\begin{gathered} \substack{N \\ 0 \\ 0} \end{gathered}$ | $\frac{10}{\vdots}$ | $\stackrel{0}{0}$ | $\stackrel{\sim}{\mathrm{N}}$ |  |  | $\begin{gathered} \text { N } \\ \text { - } \end{gathered}$ | $\underset{\sim}{\underset{O}{2}}$ | $\begin{gathered} \mathbf{m} \\ 0 \\ 0 \end{gathered}$ | $\begin{array}{\|c} \underset{N}{N} \\ 0 \end{array}$ | $\left\lvert\, \begin{gathered} 0 \\ N \\ 0 \\ \hline \end{gathered}\right.$ | $\underset{\sim}{N}$ | $\stackrel{m}{c}$ | \％ |
|  |  | $\begin{aligned} & \overline{8} \\ & \mathbf{n} \\ & \mathbf{n} \end{aligned}$ | $\begin{aligned} & \text { N } \\ & \text { 잉 } \\ & \mathbf{0} \end{aligned}$ | $\begin{aligned} & \text { m } \\ & 0 \\ & 0 \mathrm{n} \\ & \mathbf{0} \end{aligned}$ | $\begin{aligned} & \text { 寸 } \\ & \text { O} \\ & \text { n} \end{aligned}$ | $\begin{aligned} & \text { 닝 } \\ & \text { 문 } \end{aligned}$ | $\begin{aligned} & \circ \\ & 0.0 \\ & \text { na } \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { 응 } \\ & \text { na } \end{aligned}$ |  |  | $\begin{aligned} & \text { O} \\ & \text { 움 } \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { 응 } \\ & \frac{0}{0} \end{aligned}$ | $\begin{aligned} & \stackrel{r}{\bar{n}} \\ & \mathbf{a} \end{aligned}$ | $\begin{aligned} & \mathbf{N} \\ & \stackrel{0}{\mathbf{n}} \\ & \mathbf{n} \end{aligned}$ | $\stackrel{m}{0}$ | $\begin{aligned} & \stackrel{\rightharpoonup}{2} \\ & \stackrel{0}{2} \end{aligned}$ | $\stackrel{10}{\vdots}$ |  | $\begin{aligned} & 0 \\ & \frac{0}{2} \\ & \frac{0}{2} \end{aligned}$ | $\begin{aligned} & \text { N } \\ & \text { in } \end{aligned}$ | $\begin{aligned} & \infty \\ & \stackrel{\infty}{\mathbf{n}} \\ & \mathbf{0} \end{aligned}$ | $\begin{aligned} & \text { o } \\ & \stackrel{0}{2} \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { N } \\ & \text { O} \\ & \mathbf{2} \end{aligned}$ | N্ত্ㅇ | N | － |


| $\begin{aligned} & 3 \\ & 00 \\ & 3 \end{aligned}$ |  | $\begin{aligned} & \infty \\ & \hline \\ & \hline \end{aligned}$ | $\stackrel{0}{\dot{0}}$ | $\begin{aligned} & 1 \\ & 0 \\ & 0 \end{aligned}$ | 亏 | $\underset{\dot{0}}{\underset{\sigma}{2}}$ | $\begin{aligned} & \hat{0} \\ & 0 \\ & 0 \end{aligned}$ | $\frac{10}{\stackrel{1}{0}}$ | $\begin{gathered} \text { d } \\ \text { N } \end{gathered}$ | $\frac{m}{\grave{0}}$ | $\underset{\sim}{\underset{O}{0}}$ | $\stackrel{0}{\dot{0}}$ | $\begin{aligned} & \mathrm{N} \\ & \mathbf{O} \end{aligned}$ |  |  | $\stackrel{\rightharpoonup}{\dot{\circ}}$ | ${ }_{0}^{\infty}$ | $\begin{aligned} & \text { I } \\ & 0 \end{aligned}$ | $\stackrel{n}{0}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\hat{O}$ | $\stackrel{\Gamma}{\square}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\underset{\sim}{\boldsymbol{\omega}}$ |  | $\begin{aligned} & \mathrm{M} \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \hat{O} \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \hat{O} \\ & 0 \end{aligned}$ | $\stackrel{O}{\mathrm{O}}$ | $\stackrel{\mathrm{O}}{\mathrm{O}}$ | $\begin{aligned} & \overline{0} \\ & 0 \end{aligned}$ | $\frac{\infty}{\dot{c}}$ | O | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{gathered} \underset{N}{N} \\ 0 \end{gathered}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \end{aligned}$ | O. |  | $\hat{0}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\stackrel{t}{\dot{O}}$ | $\underset{0}{\stackrel{\rightharpoonup}{0}}$ | $\begin{aligned} & 8 \\ & \hline 0 \\ & \hline 0 \end{aligned}$ | $\underset{\sim}{\underset{O}{0}}$ | － |
| の |  | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{m}{\square}$ | $0$ | $\stackrel{\circ}{\circ}$ | $\frac{0}{0}$ | $\stackrel{n}{0}$ | $\stackrel{N}{\stackrel{N}{0}}$ | $\stackrel{\infty}{\stackrel{\infty}{0}}$ | $\div$ | $0$ | $\underset{0}{0}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \end{aligned}$ |  |  | $\stackrel{n}{\square}$ | $\stackrel{0}{3}$ | $\underset{\dot{O}}{\underset{\sigma}{2}}$ | $\begin{aligned} & \text { O } \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & 0 \end{aligned}$ | $\stackrel{N}{\grave{o}}$ | O |
| $\boldsymbol{\omega}$ |  | $\begin{aligned} & \hat{0} \\ & 0 \\ & \hline \end{aligned}$ | $0$ | $\frac{m}{\square}$ | $\underset{\sim}{\sigma}$ | $\begin{aligned} & \hat{0} \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \mathrm{O} \end{aligned}$ | $\begin{aligned} & H \\ & 0 \\ & 0 \end{aligned}$ | $\underset{\sim}{\underset{O}{0}}$ | $\frac{0}{i}$ | $\begin{gathered} \substack{m \\ 0 \\ 0} \end{gathered}$ | $\begin{aligned} & \hat{0} \\ & 0 \\ & 0 \end{aligned}$ |  |  | $\stackrel{\infty}{\infty}$ | $\begin{aligned} & 10 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \mathbf{N} \end{aligned}$ | $\begin{array}{\|c} \underset{N}{N} \\ \text { O} \end{array}$ | $\stackrel{n}{\stackrel{n}{\circ}}$ | $\stackrel{\varphi}{\dot{\circ}}$ | $\stackrel{10}{0}$ |
| $3$ |  | $\begin{aligned} & \mathrm{N} \\ & \mathrm{O} \\ & \hline \end{aligned}$ | $\overline{0}$ | $0$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\underset{\sim}{\underset{O}{0}}$ | $\mathrm{N}$ | $\begin{aligned} & \mathrm{O} \\ & \mathrm{O} \end{aligned}$ | $\begin{gathered} n \\ N \\ 0 \end{gathered}$ | $\stackrel{\rightharpoonup}{\dot{o}}$ | $\frac{\pi}{0}$ | $\begin{gathered} \stackrel{1}{N} \\ \underset{0}{2} \end{gathered}$ | $\stackrel{m}{\grave{0}}$ | $\stackrel{\circ}{\square}$ |  | $\underset{\sim}{\underset{O}{2}}$ | $\stackrel{\stackrel{\rightharpoonup}{0}}{\dot{o}}$ | $\begin{gathered} \mathrm{N} \\ \mathbf{N} \end{gathered}$ | $\underset{o}{\stackrel{F}{0}}$ | $\frac{m}{\square}$ | $\stackrel{m}{\square}$ |  |
| $\underset{\sim}{3}$ |  | $\stackrel{\underset{c}{\circ}}{\square}$ | $\underset{\sim}{\underset{O}{0}}$ | $\frac{\pi}{0}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \end{aligned}$ | O. | $\stackrel{0}{\square}$ | $\begin{gathered} 0 \\ N \\ 0 \end{gathered}$ | $\stackrel{\underset{r}{0}}{\dot{0}}$ | $\frac{\pi}{i}$ | $\stackrel{\pi}{\dot{O}}$ | $\stackrel{0}{\dot{0}}$ | $\underset{\sigma}{\sigma}$ |  | $\underset{\substack{0}}{\substack{2}}$ | $\underset{\sim}{\underset{O}{\circ}}$ | $\stackrel{m}{\dot{0}}$ | $\begin{gathered} 0 \\ \\ \hline \end{gathered}$ | $\stackrel{O}{\circ}$ | $\stackrel{N}{\overleftarrow{O}}$ | $\stackrel{\sim}{0}$ |
| $\begin{array}{\|c} \underset{\sim}{w} \\ \hline \end{array}$ |  | O. | $\frac{\infty}{\dot{o}}$ | $\underset{\substack{\Gamma \\ 0}}{ }$ | $\begin{aligned} & \hline 0 \\ & 0 \\ & \hline \end{aligned}$ | $\underset{o}{\underset{O}{0}}$ | $\stackrel{\infty}{\infty}$ | $\frac{\pi}{i}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{10}{\stackrel{1}{0}}$ | $\underset{o}{\sigma}$ | $\frac{\pi}{\square}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ |  |  | $\begin{aligned} & 8 \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & \text { O} \\ & 0 \\ & 0 \end{aligned}$ | $\left\lvert\, \begin{aligned} & \infty \\ & 0 \\ & 0 \\ & \hline \end{aligned}\right.$ | $\underset{\dot{O}}{\underset{\sigma}{2}}$ | $\stackrel{\infty}{\circ}$ | O. | $\stackrel{10}{\square}$ |
| $\underset{\text { Z }}{\underset{Z}{2}}$ |  | $\begin{aligned} & \infty \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{N}{0}$ | $\frac{0}{5}$ | $\underset{0}{\infty}$ | $\frac{9}{0}$ | $\begin{aligned} & 9 \\ & \hline 0 \\ & \hline 0 \end{aligned}$ | $\begin{gathered} \circ \\ \\ \hline \end{gathered}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \hat{0} \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & \hline 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \hat{0} \\ & 0 \end{aligned}$ | $0$ |  | $\stackrel{ }{\dot{0}}$ | $\begin{aligned} & \text { O } \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \mathrm{N} \\ & \mathrm{O} \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \mathrm{O} \end{aligned}$ | $\stackrel{N}{\square}$ |
| $\underset{\mathbf{Z}}{\mathbf{w}}$ |  | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\bar{O}$ | $\begin{aligned} & \text { n } \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\left\|\begin{array}{l} 10 \\ 0 \\ 0 \end{array}\right\|$ | $8$ | $\begin{aligned} & \overline{0} \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & \overline{0} \\ & 0 \end{aligned}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { O } \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \infty \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $0$ |  | $\begin{aligned} & \mathrm{O} \\ & 0 \end{aligned}$ | $\frac{9}{0}$ | $\stackrel{m}{\grave{0}}$ | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{n}{\stackrel{n}{0}}$ | $\stackrel{\circ}{\div}$ | $\bigcirc$ |
| $\underset{\underset{\sim}{u}}{\underset{\sim}{u}}$ |  | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \hat{O} \\ & 0 \end{aligned}$ | $\frac{\pi}{\square}$ | $\stackrel{\pi}{\dot{O}}$ | $\stackrel{\rightharpoonup}{\dot{o}}$ | $0$ | $\underset{\square}{i}$ | $0$ | $\begin{aligned} & \mathrm{N} \\ & \mathbf{O} \\ & \mathbf{o} \end{aligned}$ | $\underset{\sim}{\stackrel{N}{0}}$ | $\begin{aligned} & \text { O } \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $0$ |  | O. | $\begin{aligned} & 8 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{0}{0}$ | $\begin{aligned} & \bar{o} \\ & \dot{0} \end{aligned}$ | $$ | $\underset{\substack{\text { y } \\ \text { O}}}{ }$ | $\stackrel{\sim}{N}$ |
| ш |  | ${ }_{0}^{\circ}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\frac{0}{0}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & 0 \\ & 0 \end{aligned}$ | $0$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\stackrel{N}{\underset{0}{\circ}}$ | $0$ | $\underset{\sim}{\stackrel{n}{\circ}}$ | $\stackrel{0}{i}$ |  |  | $\begin{gathered} \hat{O} \\ 0 \end{gathered}$ | $\begin{gathered} \mathbf{g} \\ \text { y } \\ \hline \end{gathered}$ | $\begin{gathered} m \\ 0 \\ 0 \end{gathered}$ | $\stackrel{0}{0}$ | $\begin{aligned} & \infty \\ & \underset{\sim}{0} \\ & \hline \end{aligned}$ | $$ | $\xrightarrow{\sim}$ |
|  |  | $\begin{aligned} & \overline{8} \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { N } \\ & 0 \\ & 0 \\ & 0 \\ & \infty \end{aligned}$ | $\begin{aligned} & \text { n } \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { I } \\ & \text { O } \\ & \text { in } \end{aligned}$ | $; \begin{aligned} & \text { n } \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{array}{\|l\|} \hline 8 \\ 0.8 \\ 00 \\ 心 \end{array}$ | $\begin{aligned} & \hat{O} \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \infty \\ & 00 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \hline 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & \vdots \\ & 0 \\ & \infty \\ & \infty \end{aligned}$ | $\begin{aligned} & \bar{r} \\ & \dot{0} \\ & \dot{\omega} \end{aligned}$ | $\begin{aligned} & \mathbf{v} \\ & \dot{0} \\ & \dot{\omega} \end{aligned}$ | 0 |  |  | $\begin{aligned} & 10 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & \stackrel{0}{0} \\ & \dot{0} \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & \mathrm{N} \\ & \stackrel{N}{n} \\ & \stackrel{n}{n} \end{aligned}$ | $\begin{aligned} & \infty \\ & \stackrel{\infty}{\circ} \\ & \stackrel{n}{\infty} \end{aligned}$ | － | N |

Local Spatial Average Velocity Ratio（LVR）

|  | Nom | Mo | \|o | $8$ | $\underbrace{\infty}_{i}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\mathfrak{m}$ | $\underset{\substack{\circ \\ 0 \\ 0 \\ 0 \\ \hline 10}}{ }$ | Con on el ed |  | $\stackrel{5}{c}$ |  |
|  |  | Ron | $\stackrel{m}{c}(\underset{y}{c}$ |  | ${ }_{0}^{6}$ |  |  |
|  | $\mathfrak{y y y}$ | $s_{0}^{3}$ | $\cos \frac{3}{3}$ | $\underset{3}{3}$ | لـ | $\underset{\sim}{\omega}$ |  |
|  | AO | Bo: | $0$ | \|o | ${ }_{0}^{2}$ | $x_{0}^{m}$ |  |
|  |  | 告告會 | $\stackrel{8}{\circ} \stackrel{\circ}{\circ}$ | $8$ | ${ }_{0}^{6}$ |  |  |
|  | b |  |  |  | $B_{0}^{8}$ |  | No |
|  | $\mid \boldsymbol{w}$ | $\underset{\sim}{\underset{\sim}{\underset{2}{2}}}$ | \|ưّ |  | $\sum_{n}^{n} z_{n}^{3}$ | $\underset{e}{3}$ | ${ }_{2}$ |

Site Spatial Average Velocity Ratio（SVR）

| 100＊0－ | L81．0 | 881．0 | My／s | 970＊0－ | ャレで0 | Oちで0 | My＾S |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 290＇0 | ع91．0 | レレ＊0 | $\exists \mathrm{S}$ | 290＇0 | ع91．0 | レレ＊0 | ヨS |
| カャ0＇0－ | 0＜L＇0 | ャレで0 | ヨSS | 920＇0 | 091．0 | 七\＆${ }^{\circ} 0$ | MSS |
| ャ $20{ }^{\circ}{ }^{-}$ | 00で0 | カくで0 | ヨSヨ | S9000 | 60で0 | カカレ゚O | MS |
| 680 ${ }^{-}$ | 19Z＊0 | 098\％0 | $\exists$ | \＆ャ0 ${ }^{-}$ | 661．0 | でで0 | ヨNN |
| ナ100－ | 0＜10 | †81．0 | MSM | ヤ $200^{-}$ | 00で0 | カくで0 | ヨSヨ |
| L00＇0 | ESL＇0 | 9ャレ＇0 | S | S10＇0 | ع91\％ | 8ャレ＇0 | ヨN |
| 970 0 | 091．0 | 七\＆${ }^{\circ} 0$ | MSS | L10 ${ }^{-}$ | 96で0 | $\varepsilon 1 \varepsilon^{\circ} 0$ | ヨNヨ |
| S900 | $60 \chi^{\circ} 0$ | カヤレ＇0 | MS | $680{ }^{\circ}{ }^{-}$ | 19で0 | OS\＆＇0 | $\exists$ |
| әбиечว <br> әбеәлеу』 | （ןenłdəouoう） әбедәлеуへ | （6u！ $1 \times 1 \times$ ） <br> әбยләлеуへ | uo！！！puos <br> pu！M лəmuns | әбиечว <br> әбеләлеу』 |  әбенәлу」 | $\begin{aligned} & \text { (6u!ps!xヨ) } \\ & \text { абенәля } \end{aligned}$ | uo！！！puos pu！M Ienuu＊ |

## Appendix D Contour and Vector Plots of CFD Simulation Result of Velocity Ratio















Existing Condition Annual Overall Weighted Velocity Ratio


Existing Condition Summer Overall Weighted Velocity Ratio



Appendix B
Environmental Assessment

| ISSUE No. | $: 7$ |
| :--- | :--- |
| ISSUE DATE | $:$ MAY 2020 |
| PROJECT NO. | $: 1395$ |

PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE
Environmental Assessment

REPORT - PVB

## COMMERCIAL-IN-CONFIDENCE

## Prepared By:

Allied Environmental Consultants Limited
For:

DLN Architects Limited

## Allied Environmental Consultants Limited <br> Acousticians \& Environmental Engineers 9/E. Kwan Chant Tower, 6 Tonnochy Road, Wan Chat, Hong Kong Tel: (852) 28157028 fox ( 852 ) 28155390 Email: infolanghkcom

| Issue No. | $: 7$ |
| :--- | :--- |
| IsSUE DATE | $:$ MAy 2020 |
| Project No. | $: 1395$ |

CONSULTANCY
Agreement

## Q047403

PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE

ENVIRONMENTAL
Assessment
REPORT - PVB

COMMERCIAL-IN-CONFIDENCE


Checked:

Approved:


BEng(Hons), MHKIEIA,
MISWA, BEAM Pro, LEED AP,
BREEAM AP, CAP, FFHKI@EP


This report has been prepared by Allied Environmental Consultants Limited with all reasonable skill, care and diligence within the terms of the greement with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by

This report is confidential to the client and we accept no responsibility
is made known. Any such party relies upon the report at their own risk.

## PROPOSED REZON

 ESIDENTIAL USEEnvironmental Assessment Report - PVB

## Table of Contents

1. INTRODUCTION..................................................................................................... 1
2. PROJECT INFORMATION...................................................................................... 1
$\qquad$

2.2 Site Location and Surrounding Environmental Context ....................................
2.3 Proposed Development .................................................................................... 1
2.4 Major Noise and Air Quality Issues ................................................................... 2
3. AIR QUALITY IMPACT ASSESSMENT .............................................................. 3
3.1 Introduction ....................................................................................................... 3
3.2 Air Quality Objectives....................................................................................... 3
3.3 Potential Air Quality Impact during Construction Phase ................................... 5
3.4 Potential Air Quality Impact - Vehicular Emission........................................................... 6
3.5 Potential Air Quality Impact - Exhaust from PVB ................................................................. 6
3.6 Potential Air Quality Impact - Industrial Emission of Chimney ....................... 7
3.7 Conclusions ....................................................................................................... 7
4. NOISE IMPACT ASSESSMENT .............................................................................. 8
$\qquad$
4.1 Introduction ............................................................................... 8
4.2 Road Traffic Noise Impact Assessment ........................................................... 8
4.3 Fixed Plant Noise Impact Assessment ............................................................ 10
4.4 Conclusions ..................................................................................................... 10
5. CONCLUSION.......................................................................................................... 11
5.2 Air Quality....................................................................................................... 11
5.3 Noise
5.4 Summary ........................................................................................................................................................... 12

RESIDENTIAL USE
Environmental Assessment Report - PVB

## List of Figures

Figure 2.1 Location of Subject Site
Figure 2.2 Proposed Residential Development at Subject Site
Figure 2.3 Slope at South East Bounding the Subject Site
Figure 2.4 Residential Developments Opposite to the Site, Separated by Chiu Shun Road
Figure 3.1 Location of Air Quality Buffer Zone
Figure 3.2 Tunnel Ventilation Shafts / Louvers at PVB (view from Chiu Shun Road)
Figure 3.3 Tunnel Ventilation Shafts / Louvers at PVB (view from PVB Existing Open Car Park)
Figure 4.1 Locations of Representative Noise Assessment Points on Typical Floor Plan
Figure 4.2 Typical Configurations of Acoustic Windows
Figure 4.3 Locations of Road Traffic Noise Mitigation Measures

## List of Tables

Table 3.1 Hong Kong Air Quality Objectives
Table 3.2 Guidelines of Buffer Distance between Road Kerb and Permitted Uses

## List of Appendices

Appendix 2.1 Conceptual Scheme of Proposed Development
Appendix 4.1 Traffic Forecast Data of Year 2044
Appendix 4.2 Predicted Traffic Noise at Proposed Development, Unmitigated Scenario
Appendix 4.3 Schedule of Road Traffic Noise Mitigation Measures
Appendix 4.4 Information of Existing Noise Mitigation Measures adopted around Site (Obtained from Highways Department)

## 1. INTRODUCTION

1.1.1 Allied Environmental Consultants Limited (AEC) was commissioned by DLN Architects Limited (DLN) to undertake the Consultancy Service for Rezoning Study of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use.

## 2. PROJECT INFORMATION

### 2.1 Background

2.1.1 The Subject Site is at the MTR Pak Shing Kok Ventilation Building (PVB) Site and adjacent "Green Belt" Site to the south of PVB. Site area is about $4,458 \mathrm{~m}^{2}$. The Site is immediately fronting to Chiu Shun Road at north west. Wan Po Road is located about 110 m away from the Site at south west. The proposed scheme involves a podium and two 27 -storey residential towers decking over the existing Pak Shing Kok Ventilation Building. The proposed project is planned to be completed in Year 2029.
2.1.2 This is not a designated project under the Environmental Impact Assessment (EIA) Ordinance (Cap. 499). Environmental Assessment (EA) has been carried out for the project.
2.1.3 This EA has been undertaken with reference to the guidance for environmental considerations provided in Chapter 9 "Environment" of the Hong Kong Planning Standards and Guidelines (HKPSG). This EA presents a study of the potential environmental impacts, including air quality and noise. Drainage and sewerage impact assessments shall be presented separately from this EA report.

### 2.2 Site Location and Surrounding Environmental Contex

2.2.1 The Subject Site locates at Tseung Kwan O (TKO) near Hang Hau Station, as shown in Figure 2.1. Residential development is proposed to be constructed at the Pak Shing Kok Ventilation Building Site and adjacent "Green Belt" Site to the south of PVB (see Figure 2.2).
2.2.2 Slope covered by vegetation is at the south east bounding the Site (see Figure 2.3). Residential developments La Cite Noble and Yuk Ming Court situate opposite to the Subject Site, separated by Chiu Shun Road (see Figure 2.4).

### 2.3 Proposed Development

2.3.1 The proposed development involves construction of two 27-storey residential towers combined with podium including carpark and resident clubhouse, providing a total number of 432 flats. Building height at main roof level is 130 mPD .

PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE
Environmental Assessment Report - PVB $\qquad$
2.3.2 As shown in Figure 2.1, about 110 m separation between the Subject Site boundary to Wan Po Road (road type of District Distributor) has been allowed, which provides more than sufficient 10 m buffer distance as recommended under the HKPSG, Table 3.1 in Chapter 9, in order to minimise potential air quality impact due to on-road vehicular emission. Meanwhile, at least 10 m set back from Chiu Shun Road immediate fronting the Subject Site (road type of District Distributor) has been also allowed for the residential tower and associated active amenity spaces, in order to fulfi vehicular air emission buffer distance recommended under the HKPSG
2.3.3 Design drawings of the proposed scheme, including conceptual scheme, indicative floor plans and section drawings are presented in Appendix 2.1
2.3.4 It should be noted that the conceptual scheme represents a conceptual design of proposed residential development, to demonstrate suitability of the Subject Site being re-zoned for proposed residential use only. Further optimisation of floor layouts would be studied in later development stage. The flat layout as shown in Figure 4.1 represents typical floors of development as indicative illustration for this rezoning study only. There will be variation in demarcation of flats at upper floor levels which would be studied in the detailed design stage.
2.4 Major Noise and Air Quality Issues
2.4.1 Major noise and air quality issues associated with the proposed development at the Subject Site have been initially discussed with governmental departments, as identified below:

## Air Quality

- Any potential air quality impact during construction phase
- Potential vehicle emissions from nearby roads including Chiu Shun Road and Wan Po Road
- Any potential emissions from nearby Pak Shing Kok Ventilation Building / shafts


## Noise

- Potential road traffic and fixed plant noise impact to the proposed development due to Chiu Shun Road, Wan Po Road and Pak Shing Kok Ventilation Building


## 3. AIR QUALITY IMPACT ASSESSMENT

### 3.1 Introduction

3.1.1 This section addresses the potential air quality impacts associated with the proposed residential development. Following considerations are included:

- Vehicular emissions
- Exhaust from Pak Shing Kok Ventilation Building (PVB)


### 3.2 Air Quality Objectives

## Hong Kong Air Quality Objectives

3.2.1 Air quality in Hong Kong is governed under the Air Pollution Control Ordinance (APCO) (Cap. 311) and its subsidiary Regulations. Under this legislation, the Government has designated Air Control Zones (ACZ) for the whole territory, along with the new Air Quality Objectives (AQOs) which takes effect in 2014. The AQOs stipulate the statutory limits for 7 pollutants and dictate the maximum number of allowable exceedances over specified time periods. For details, please refer to below Table 3.1

PROPOSED REZON
RESIDENTIAL USE
Environmental Assessment Report - pVB

## Table 3.1 Hong Kong Air Quality Objectives

| Pollutant | Concentration Limit, $\mu \mathrm{g} / \mathrm{m}^{3}{ }^{[1]}$(Number of Exceedances per Calendar Year Allowed in Brackets) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 10-minute | 1-hour | 8-hour | 24-hour | Annual |
| Sulphur dioxide ( $\mathrm{SO}_{2}$ ) | 500 (3) |  |  | 125 (3) |  |
| Respirable suspended particulates $\left(\mathrm{PM}_{10}\right){ }^{[2]}$ |  |  |  | 100 (9) | $\begin{gathered} 50 \\ (\mathrm{~N} / \mathrm{A}) \\ \hline \end{gathered}$ |
| $\begin{array}{lc} \hline \text { Fine } & \text { suspended } \\ \text { particulates }\left(\mathrm{PM}_{2.5}\right)^{[3]} \end{array}$ |  |  |  | 75 (9) | $\begin{gathered} 35 \\ (\mathrm{~N} / \mathrm{A}) \\ \hline \end{gathered}$ |
| Nitrogen dioxide $\left(\mathrm{NO}_{2}\right)$ |  | 200 (18) |  |  | $\begin{gathered} 40 \\ (\mathrm{~N} / \mathrm{A}) \end{gathered}$ |
| Ozone ( $\mathrm{O}_{3}$ ) |  |  | 160 (9) |  |  |
| Carbon monoxide (CO) |  | 30,000 (0) | 10,000 (0) |  |  |
| Lead (Pb) |  |  |  |  | $\begin{gathered} \hline 0.5 \\ (\mathrm{~N} / \mathrm{A}) \end{gathered}$ |

Notes:
[1] All measurements of the concentration of gaseous air pollutants, i.e., $\mathrm{SO}_{2}, \mathrm{NO}_{2}, \mathrm{O}_{3}$ and CO , are to be adjusted to a reference temperature of $293 \mathrm{~K}\left(20^{\circ} \mathrm{C}\right)$ and a reference pressure of 101.325 kPa (one atmosphere). Meanwhile, "N/A" represents not applicable since there is no AQO for such parameter. [2] $\mathrm{PM}_{10}$ means the suspended particulates in air with a nominal aerodynamic diameter of $10 \mu \mathrm{~m}$ or smaller
[3] $\mathrm{PM}_{2.5}$ means the suspended particulates in air with a nominal aerodynamic diameter of $2.5 \mu \mathrm{~m}$ or smaller.

## Hong Kong Planning Standards and Guidelines

3.2.2 The Hong Kong Planning Standards and Guidelines (HKPSG) also provides guidance for including environmental considerations in the planning application of both private and public sectors. A summary of environmental design guidelines extracted from the HKPSG is provided below.

Table 3.2 Guidelines of Buffer Distance between Road Kerb and Permitted Uses (Table 3.1 of HKPSG Ch.9)

| Pollution Source | Parameter (Type of Road) | Buffer Distance | Permitted Uses |
| :---: | :---: | :---: | :---: |
| Road and Highways | Trunk Road and Primary Distributor (UT/ PD) | $>20 \mathrm{~m}$ | Active and passive recreational uses |
|  |  | 3-20m | Passive recreational uses |
|  |  | $<3 \mathrm{~m}$ | Amenity areas |
|  | District Distributor (DD) | $>10 \mathrm{~m}$ | Active and passive recreational uses |
|  |  | $<10 \mathrm{~m}$ | Passive recreational uses |
|  | Local Distributor (LD) | $>5 \mathrm{~m}$ | Active and passive recreational uses |
|  |  | $<5 \mathrm{~m}$ | Passive recreational uses |
|  | Under Flyovers | - | Passive recreational uses |

3.2.3 The buffer distance stated in the HKPSG requirement refers to the site nature and the road types of adjacent roads. Since there is no specific buffer distance requirement for "domestic premises" indicating on the HKPSG, buffer distance for this Site has been referred to "Open Space Site". In accordance with the HKPSG, the buffer distance between roads kerb and permitted uses is given in Table 3.2.

### 3.3 Potential Air Quality Impact during Construction Phase

The proposed development will involve the following activities during construction:

- Site hoarding, site clearance and tree removal;
- Superstructure works - Modification of existing Ventilation Building;
- Site preparation works and slope stabilization;
- Foundation and piling; and
- Superstructure.
3.3.2 Construction dust will be generated from the construction activities including open site erosion, excavation, material handling and truck movement. It is anticipated that no significant fugitive dust impact which the implementation of relevant mitigation measures stipulated in the Air Pollution Control (Construction Dust) Regulation:
- Use of regular watering to reduce dust emissions from exposed site surfaces unpaved roads, dusty construction areas;
- Adoption of side enclosure and covering of any aggregate or dusty material storage piles to reduce emissions. Where this is not practicable owing to frequent usage, watering shall be used to aggregate fines;
- Open stockpiles shall be avoided or covered. Prevent placing dusty materia storage piles near ASRs;
- All dusty vehicle loads transported to, from and between site locations shall be covered by tarpaulin;
- Vehicle wheel and body washing facilities shall be established at exit points of the site;
- Loading, unloading, transfer, handling or storage of bulk cement or dry pulverised fuel ash shall be carried out in a totally enclosed system or facility, and any vent or exhaust shall be fitted with an effective fabric filter or equivalent air pollution control system; and
- Travelling speeds should be controlled to reduce traffic induced dust dispersion and re-suspension within the site from the operating dump trucks.
3.3.3 The contractor will be required to follow the relevant mitigation measures stipulated in the Air Pollution Control (Construction Dust) Regulation under contract provisions.


### 3.4 Potential Air Quality Impact - Vehicular Emission

3.4.1 In general, the assessment area for an air quality impact assessment (AQIA) is defined by a distance of 500 m from the site boundary.
3.4.2 According to the "Guidelines for Potentially Polluting Uses" as stated in Section 3.3 of the HKPSG, the potentially polluting uses surrounding the Site were investigated by performing site survey on 8 August 2016 and reviewing the specified licence records on 18 August 2016. From the results, it was concluded that no industrial building is located within 200 m radius of the Project whilst slaughterhouses, sewage treatment works facilities, village incinerators, odour sources and duty uses are not found within 500 m radius of the Project. Thus, no adverse air quality impact is anticipated and no further assessment is necessary.
3.4.3 Therefore, the dominant potential sources of impacts include the vehicular emissions mainly from the Wan Po Road and Chiu Shun Road.
3.4.4 With reference to the Annual Traffic Census 2016 issued by Transport Department (TD), the section of Wan Po Road locates the nearest to the Subject Site is classified as District Distributor. About 110 m from Wan Po Road to the Subject Site boundary has been provided, as indicated in Figure 2.1, which has fully satisfied the recommended 10 m horizontal buffer distance as recommended in the HKPSG.
3.4.5 Meanwhile, with reference to the Annual Traffic Census 2016, the sections of Chiu Shun Road immediate fronting the Subject Site is classified as District Distributor. A minimum of 10 m horizontal separation from the proposed residential development towers with openable windows and all active amenities on podium garden to the edge of road kerb would be required in accordance with the HKPSG. Such a setback requirement has been allowed in the proposed scheme, as shown in Figure 3.1
3.4.6 In this connection, it is anticipated no adverse air quality impact due to on-road vehicular emissions would be imposed to the Subject Site.

### 3.5 Potential Air Quality Impact - Exhaust from PVB

3.5.1 Two tunnel ventilation shafts (TVS), each consists of two ventilation louvers, are currently constructed at Pak Shing Kok Ventilation Building (PVB), as shown in Figures 3.2 and 3.3. Each of the TVS is connected to one tunnel ventilation fan (TVF), serving MTR Tseung Kwan O (TKO) Line respectively. Under normal condition, the ventilation fans are providing natural ventilation to the railway tunnel and not necessarily turned on except congestion or emergency situations of fire etc. These shafts only provide fresh air intake / exhaust serving TKO Line via the underground
ventilation tunnel. No undesirable emissions, pollutants and / or odorous gas are emitted from the tunnel ventilation building / shafts under normal operations.
3.5.2 The tunnel ventilation fans can operate as smoke extraction during tunnel firing emergency condition. The ventilation shafts will be decked-over by transfer plate of the proposed development, and at least 5 m exhaust air zone buffer distance from the tunnel ventilation louvers has been allowed to the future residential development where openable windows for natural ventilation are required, fulfilling fire services and smoke exhaust requirements by Fire Services Department (FSD), and to avoid flow and smoke disturbance to the future tenants during emergency smoke extraction.

### 3.6 Potential Air Quality Impact - Industrial Emission of Chimney

3.6.1 Site visit has been carried out in August 2016. It is confirmed that no chimney is located within 200m of the Subject Site. The nearest chimney is located at Tseung Kwan O Hospital that is more than 500 m to the northeast of the Subject Site.
3.6.2 Therefore, it is anticipated no adverse air quality impact due to industrial emission of chimney would be imposed to the proposed development.

### 3.7 Conclusions

3.7.1 With implementation of relevant mitigation measures stipulated in the Air Pollution Control (Construction Dust) Regulation, no significant fugitive dust impact is anticipated.
3.7.2 The vehicular emission horizontal buffer distance between Wan Po Road and Chiu Shun Road to the Subject Site is sufficient as stipulated in Chapter 9 - Environment of HKPSG. No adverse air quality impact due to vehicular emission is anticipated at the Subject Site.
3.7.3 No undesirable emissions, pollutions, and / or odorous gas emission from the tunnel ventilation building / shafts is anticipated, which would not bring to any adverse air quality impact to the proposed development.
3.7.4 With no identification of chimney within 200 m of the Subject site, no adverse air quality impact due to industrial emission of chimney is anticipated at the Subject Site.
proposed rezoning of pak shing kok ventilation building and adjacent area for RESIDENTIAL USE
Environmental Assessment Report - PVB

## 4. NOISE IMPACT ASSESSMENT

### 4.1 Introduction

4.1.1 This section addresses the potential noise impacts associated with the proposed residential development. Following considerations are included:

- On-road traffic noise emanated from the adjacent road network, particularly from Chiu Shun Road immediately fronting the Site
- Fixed plant noise from Pak Shing Kok Ventilation Building (PVB)


### 4.2 Road Traffic Noise Impact Assessment

## Assessment Criteria

4.2.1 According to the Hong Kong Planning Standards and Guidelines (HKPSG), road traffic noise impact has been assessed against the noise limit of $\mathrm{L}_{10}(1-\mathrm{hr}) 70 \mathrm{~dB}(\mathrm{~A})$ for domestic premises/hostels/offices. The standard applies to the uses which rely on openable windows for ventilation.

## Assessment Methodology

4.2.2 According to the HKPSG, predictions can be readily based on the procedures given in the UK Department of Transport "Calculation of Road Traffic Noise" 1988 (CRTN). For application in Hong Kong, the road traffic noise is represented in terms of $\mathrm{L}_{10}$ (1$\mathrm{hr}) \mathrm{dB}(\mathrm{A})$. The predicted noise levels at the building facades include $2.5 \mathrm{~dB}(\mathrm{~A})$ facade reflection and correction factors for effects due to gradient, distance, view angle, road surface and barriers.
4.2.3 In accordance with the requirements of the CRTN, road traffic noise should be predicted based on the maximum traffic forecast within 15 years upon the occupation of the proposed development. In this connection, the assessment is conducted based on the peak hour traffic flow predictions for year 2044, as the operation of the proposed residential development shall be commenced in year 2029 tentatively. Traffic flows and heavy vehicle percentages are given in Appendix 4.1, provided by the project traffic consultant.
4.2.4 Traffic noise prediction has been conducted by employing the RoadNoise 2000 computer software.

## Impact Assessment

 Level +19.0 mPD and Level +25.0 mPD are mainly reserved for lift lobby, car lifts and plant room for MTR Ventilation Building. Level +32.0 mPD is carpark and clubhouse. Podium garden is provided at Level +38.95 mPD above transfer plate. Two 27 -storey residential towers will be above the podium garden. A total of 432 flats are proposed for residential uses.4.2.6 Locations of representative Noise Assessment Points (NAPs) for typical floor are shown in Figure 4.1. The noise assessment locations indicated on Figure 4.1 can be applied for all 27 storeys residential tower for noise sensitive determination.
4.2.7 Project construction is tentatively completed by year 2029. Traffic forecast data up to 15 years after project commencement, i.e. year 2044, has been taken into consideration in the road traffic noise impact assessment.
4.2.8 By year 2044, Chiu Shun Road with hourly vehicle flow over 2,190 during peak hours is the major source contributing to traffic noise impact to the proposed residential development. Wan Po Road with hourly vehicle flow of 2,100 during peak hours also contributes to certain traffic noise impact. Referring to the modelling result, the maximum value of predicted road traffic noise level on the proposed scheme is 75 $\mathrm{dB}(\mathrm{A})$. Traffic noise mitigation measures such as road-side noise barriers and low noise paving materials have been adopted in the traffic noise evaluation, based on the information provided by Highways Department (HyD) as shown in Appendix 4.4
4.2.9 The predicted traffic noise impact compliance rate is $34 \%$. 283 out of 432 flats would exceed road traffic noise limit $\mathrm{L}_{10}(1-\mathrm{hr}) 70 \mathrm{~dB}(\mathrm{~A})$ under the HKPSG requirements. Details of the predicted traffic noise levels are presented in Appendix 4.2.

## Mitigation Measures

4.2.10 In order to alleviate traffic noise impact, the following noise design features have been already adopted in developing the proposed development scheme, which results in traffic noise impact compliance rate is $34 \%$ as abovementioned.

- Building setback - increasing separation between the noise sources (Chiu Shun Road and Wan Po Road) and residential development
- Building block disposition - arranging the building block layout in T-shape such that direct view angle to Chiu Shun Road from some of the noise sensitive facades at the back row could be minimised.
- Internal layout design - arranging noise tolerant portions of building, such as kitchens and toilets at end falls facing Chiu Shun Road as far as practicable.
- Building on elevated ground - arranging residential portion of the development elevated at some 20 m above Chiu Shun Road, in order to increase separation between noise source and the residential dwellings.
4.2.11 In order to further improve the predicted traffic noise level compliance at the affected flats of the proposed development, fixed window / maintenance windows, as well as appropriate type(s) of acoustic window, will be provided as mitigation measures with respect to required noise reduction at the sensitive facades
4.2.12 Fixed windows / maintenance windows are designated for particular façade locations with predicted traffic noise exceedance. They will not be relied on openable windows

PROPOSED REZONI
RESIDENTIAL USE
Environmental Assessment Report - PVB
for ventilation. The maintenance window shall only be opened occasionally for cleansing / maintenance purpose. Glass pane of minimum 6 mm thickness can provide transmission loss (TL) of 28 dB or above in 250 Hz octave-band and Sound Transmission Class (STC) 31 or above, which will be adopted for the fixed windows maintenance windows for securing quiet indoor environment.
4.2.13 Selection of acoustic window type and associated noise reduction achievable is subjected to parameters such as room dimensions, size of ventilation opening required under the Building Regulations and façade design. Acoustic window (top-hung type or baffle type) can be adopted for the proposed development. Typical configurations of the acoustic window are provided in Figure 4.2. It is considered that the required noise reduction ranged from 1 to $5 \mathrm{~dB}(\mathrm{~A})$ would be achievable by selection of proper acoustic windows in detailed design stage.
4.2.14 Locations for the use of fixed window / maintenance window, as well as acoustic window, with respect to conceptual layout are presented in Appendix 4.3 and Figure 4.3 respectively. With the abovementioned additional traffic noise mitigation measures adopted, compliance rate extends to $100 \%$ to all flats.

### 4.3 Fixed Plant Noise Impact Assessment

## Impact Assessment and Mitigation Measures

4.3.1 All ventilation shafts, roof-top AC units of Ventilation Building will be located under the transfer plate of the proposed development, as shown in indicative section diagrams in Appendix 2.1.
4.3.2 The roof-top AC units will be relocated into concrete enclosed plant rooms. Typical plant room noise control treatments such as acoustic louvres and acoustic lining will be provided in the plant rooms as necessary in detailed design stage, such that cumulative impact from noise sources will comply with Acceptable Noise Levels (ANLs) stipulated under Noise Control Ordinance.
4.3.3 Existing ventilation louvres of the two ventilation shafts will be equipped with additional air plenums with louvres located underneath building line of transfer plate, so as to comply with the smoke extraction requirement stipulated by Fire Services Department. Necessary acoustic louvres / silencers would also be provided to ensure there will be no adverse fixed plant noise impact to the proposed development and nearby noise sensitive receivers.

### 4.4 Conclusions

4.4.1 In order to alleviate traffic noise impact to the proposed residential development, use of fixed glazing / maintenance window and acoustic window at affected NSRs have been recommended. Compliance rate of $100 \%$ can be achieved and fully comply with the traffic noise criterion recommended in the HKPSG.
4.4.2 Fixed plant noise mitigation measures have been recommended to alleviate potential fixed plant noise impact. No residual fixed plant noise impact is anticipated with fully compliance with the fixed plant noise criterion stipulated under the Noise Control Ordinance.

## 5. CONCLUSION

5.1.1 In order to evaluate the acceptability of the proposed residential development in respect of environmental aspects, an Environmental Assessment has been carried out to examine the impacts during the construction and operation phases. Potential environmental impacts in air quality and noise impacts have been presented in this report. Key findings of this assessment are summarised in the following sections.

### 5.2 Air Quality

5.2.1 The proposed scheme has provided about 110 m separation and 10 m setback from Wan Po Road (district distributor) and Chiu Shun Road (district distributor) respectively. Corresponding HKPSG's buffer separation requirements on minimising vehicular emission can be fulfilled.
5.2.2 No undesirable emissions, pollutants, and / or odorous gas shall be emitted from Pak Shing Kok Ventilation Building / shaft. Existing Pak Shing Kok Ventilation Building / shaft will be decked-over under transfer plate of the proposed development. At least 5 m exhaust air zone buffer distance from the existing tunnel ventilation louvers has been allowed to the future residential development where openable windows for natural ventilation are required, fulfilling both fire services and smoke exhaust requirements by Fire Services Department (FSD).
5.2.3 With no identification of chimney within 200 m of the Subject site, no adverse air quality impact due to industrial emission of chimney is anticipated at the Subject Site.
5.2.4 It is expected that no adverse air quality impact would be imposed on the proposed residential development during operation phase.
5.2.5 With implementation of relevant mitigation measures stipulated in the Air Pollution Control (Construction Dust) Regulation, no significant fugitive dust impact is anticipated during construction phase.

### 5.3 Noise

5.3.1 In order to alleviate traffic noise impact to the proposed residential development, the use of fixed window / maintenance window as well as acoustic window have been recommended. Compliance rate of $100 \%$ can be achieved and fully comply with the traffic noise criterion recommended in the HKPSG.
5.3.2 Fixed plant noise mitigation measures have been recommended to alleviate potential fixed plant noise impact. No residual fixed plant noise impact is anticipated with fully compliance with the fixed plant noise criterion stipulated under the Noise Control Ordinance.

### 5.4 Summary

5.4.1 Overall, with proper implementation of mitigation measures and good site practice, no insurmountable impacts on air quality and noise is anticipated. The proposed residential development is therefore considered environmentally acceptable and feasible.

## Figures



Figure 2.1 Location of Subject Site


Pak Shing Kok Ventilation Building

Figure 2.2 Proposed Residential Development at Subject Site


Figure 2.3 Slope at Southeast Bounding the Subject Site


Figure 2.4 Residential Developments Opposite to the Site, separated by Chiu Shun Road


Figure 3.1 Location of Air Quality Buffer Zone


Figure 3.2 Tunnel Ventilation Shafts / Louvers at PVB (view from $\quad$ Figure 3.3 Tunnel Ventilation Shafts / Louvers at PVB Chiu Shun Road) (view from PVB Existing Open Car Park)


Figure 4.1 Locations of Representative Noise Assessment Points on Typical Floor Plan

## Acoustic Window (Top-Hung Type)



## Acoustic Window (Baffle Type)



Figure 4.2 Typical Configurations of Acoustic Windows


Figure 4.3 Locations of Road Traffic Noise Mitigation Measures

## Appendix 2.1 -

Conceptual Scheme of Proposed Development



## Appendix 4.1 -

Traffic Forecast Data of Year 2044


## Appendix 4.2 -

Predicted Traffic Noise at Proposed Development, Unmitigated Scenario


## Appendix 4.3 -

Schedule of Road Traffic Noise Mitigation Measures

## Road Traffic Noise Impact Assessment



Information of Existing Noise Mitigation Measures adopted around Site (Obtained from Highways Department)









Appendix C
Visual Impact Assessment

# Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use 

Technical Assessment

Visual Impact Assessment

January 2019

Prepared By: ADI Limited

## ADI

| Project Title | Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for <br> Residential Use |
| :--- | :--- |
| Report Title | Visual Impact Assessment |
| Date of Issue | $23^{\text {rd }}$ January 2019 |



## Visual Impact Assessment

## Table of Contents

1.0 Introduction
2.0 The Proposed Development
3.0 Baseline Condition
4.0 Visual Appraisa
5.0 Evaluation of Overall Visual Impact

## Figures

V1.0 Visual Context
V2.0 Assessment Area and Location of Public Viewing Points
V3.1 Photomontage of Proposed Development - Viewpoint A: View South from the Peak of Duckling Hill

V3.2 Photomontage of Proposed Development - Viewpoint B: View Southwest from Footbridge across Chiu Shun Road
V3.3 Photomontage of Proposed Development - Viewpoint C: View Northeast from Hang Hau Man Kuk Lane Park
V3.4 Photomontage of Proposed Development - Viewpoint D: View East from Hong Kong Velodrome Park

V3.5 Photomontage of Proposed Podium Treatment - Viewpoint E: View East from Chiu Shun Road
V3.6 Photomontage of Proposed Podium Treatment - Viewpoint F: View South from Chiu Shun Road

### 1.0 Introduction

1.1 This report sets out to assess the potential visual impacts of the proposed development at the existing Pak Shing Kok ventilation building (PVB) site and adjacent "Green Belt" site to the south of PVB (hereafter "the Site") in support of the proposed amendments to OZP. This visual impact assessment appraises the effect of the proposed development on the overall visual composition, visual changes to the public viewers and on the visual resources in the surroundings. Photomontages of the proposed development from key public viewing points will be used to facilitate the evaluation, and photomontages at pedestrian level at Chiu Shun Road will be used to illustrate the proposed visual mitigation measures. The report is prepared in accordance with TPB PG-No. 41 'Guidelines on Submission of Visual Impact Assessment for Planning Applications to the Town Planning Board'.
1.2 This report should be read in conjunction with the Indicative Landscape Master Plan (LMP) in a separate appendix of this Study Report.

### 2.0 The Proposed Development

2.1 The Site, with an area of $4,458 \mathrm{~m}^{2}$, is located at the southern edge of Hang Hau and foothill of the Pak Shing Kok hillslope. It is currently occupied by an operating ventilation building at the north-eastern portion, and a car parking and vehicular circulation area at the south-western part. The man-made slope surrounding the Site is largely hard surfaced with little greenery whilst the upper portion of the Pak Shing Kok hillslope at the backdrop is covered by vegetation.
2.2 The proposed development comprises two 27 -storey ( +130 mPD ) residential towers sitting on podium and built over the ventilation building. A landscaped garden is set at +38.95 mPD on podium providing recreation facilities for the enjoyment of future residents. The existing ventilation building $(+24.17 \mathrm{mPD}$ at main roof) will remain in-situ and will be covered by the podium. Greenery treatment will be applied on existing slopes within the Site. The conceptual scheme, indicative section and development schedule are provided in separate appendix of this Study Report.
2.3 The design and disposition of the proposed residential towers is guided by the need for continuing operation of the ventilation building, environmental concerns, development needs and various site constraints. To ameliorate the potential visual impact and to better integrate the proposed development with the existing and planned context at this planning stage, the following design measures are incorporated in the conceptual scheme:

- Responsive building height of the proposed development is similar and compatible with the surrounding residential high-rises in Hang Hau;
- Setting the two residential towers with a separation of 15 m apart to maintain visual access from the surrounding developments to the Pak Shing Kok hillslope, refers to indicative elevation in Appendix 8 of the Indicative LMP;
- Voids incorporated at low level of the development to provide permeable openings to the development and visual access to the green backdrop at Pak Shing Kok hillslope, refers to indicative elevation in Appendix 8 of the Indicative LMP;
- The disposition of two residential towers are able to reduce the building mass and presents a slender profile particularly in views looking from the south and the north along Chiu Shun Road (along the north-south visual axis); and
- Application of multi-levelled greenery at ground floor, carpark floor edge planting, podium garden and on slope of the proposed residential towers to soften the development edge and provide visual relief, refers to Figures V3.5 and V3.6, and indicative elevation in Appendix 8 of the Indicative LMP.
2.4 Regarding the potential visual impact of the proposed podium, various mitigation measures including multi-levelled greenery, voids and building façade treatment are proposed aiming to soften the development edges and enhance visual permeability. The landscape mitigation measures will be in the form of multi-levelled greenery that compose of the following:
- Roadside tree and shrub planting along Chiu Shun Road;
- Edge planting at carpark floor and podium floor;
- Tree and shrub planting at podium garden; and
- Greenery treatment on slope within site.


### 3.0 Baseline Condition

## Assessment Area

3.1 Considering the dense urban context of Hang Hau to the northwest, the cluster of open spaces to the southwest and the hilly topography of Pak Shing Kok to the southeast of the Site, the assessment area (visual envelope) extends to Po Ning Road to the northeast, the Pak Shing Kok hillslope to the east, the Wan Po Road/ Chiu Shun Road Roundabout to the south and Hong Kong Velodrome Park to the west. While the northern boundary is generally defined by high-rises along Chiu Shun Road and Wan Po Road beyond which direct sightline to the proposed development will largely be blocked, it will extend locally to the peak of Duckling Hill, a popular lookout point commanding panoramic view towards Hang Hau Area and mountain ranges of Clearwater Bay

Peninsula. Visual context of the Site is shown in Figure V1.0. The extent of the assessment area is presented in Figure V2.0.

## Existing Visual Context and Visual Elements

3.2 Hang Hau where the proposed development situates is a densely developed urban area with residential high-rises surrounding MTR Hang Hau Station. The highest building group of Residence Oasis is located at the MTR Hang Hau Station and building height of surrounding developments gradually descends to the edge of Hang Hau. Several lowrise free-standing retail, carpark and GIC buildings mingled in between to provide visual relief from the high-rises.
3.3 Opposite of Ming Tak Estate to the northeast of the Site is characterised by the low-rise developments of Tin Ha Wan Village ( +16 mPD ). A public housing development is planned to the immediate northeast of the Site. To the southeast of the Site is the hillslope of Pak Shing Kok that provides a mountain backdrop to the proposed development. Roadside planters along Chiu Shun Road provide visual relief from the surrounding high-rises.
3.4 To the further south and southwest of the Site feature a relatively vast visual openness attributed to the Pak Shing Kok hillslope, the Wan Po Road/ Chiu Shun Road Roundabout, as well as the public open space of Hang Hau Man Kuk Lane Park, Tseung Kwan O Sports Ground and Hong Kong Velodrome Park. To the further northeast of the Site is characterised by the lower ridge north of Hang Hau Road. All of them provide visual amenity to the surrounding neighbourhood of the Site.
3.5 In sum, the high-rises of Hang Hau are key urbanised visual elements in the visual context. The roadside trees along Chiu Shun Road, the Pak Shing Kok hillslope and public open spaces in Hang Hau including Hang Hau Man Kuk Lane Park, Tseung Kwan O Sports Ground and Hong Kong Velodrome Park are key visual resources providing visual amenity in the visual context of the Site. Major roads surrounding Hang Hau including Chiu Shun Road, Wan Po Road and Po Ning Road are key infrastructure edges that serve as visual corridor and breezeway in the dense urbanised context.

## Key Public Viewing Points

3.6 Taking into account the siting and the scale of the proposed development and its surrounding visual context, a total of 6 viewpoints, which are publicly accessible, are identified within the assessment area with direct sightlines to the proposed development:
(1) Viewpoint A: View south from the peak of Duckling Hill;
(2) Viewpoint B: View southwest from footbridge across Chiu Shun Road;
(3) Viewpoint C: View northeast from Hang Hau Man Kuk Lane Park;
(4) Viewpoint D: View east from Hong Kong Velodrome Park;
(5) Viewpoint E: View east from Chiu Shun Road at pedestrian level; and
(6) Viewpoint F: View south from Chiu Shun Road at pedestrian level.
3.7 The location of the viewpoints is shown in Figure V2.0.

Viewpoint A - View South from the Peak of Duckling Hill (Figure V3.1)
3.8 The peak of Duckling Hill is located at a distance of approximately $1,190 \mathrm{~m}$ to the north of the Site. The viewing point from the pavilion at the peak of the Hill ( +152 mPD ) is selected, representing mainly long-range transient views of the hikers to Duckling Hill. This viewpoint provides panoramic view over the high-rise developments in Hang Hau and the ridgeline of mountain ranges at Clearwater Bay Peninsula setting as the backdrop. Alternative view towards Silverstrand is also available to the east. The visual sensitivity of the public viewers at this viewpoint is low.

Viewpoint B - View Southwest from Footbridge across Chiu Shun Road (Figure V3.2)
3.9 The footbridge across Chiu Shun Road is located at a distance of approximately 235 m to the northeast of the Site, at an elevated level on the footbridge ( +12 mPD ), mainly representing short-range transient views of the pedestrians crossing Chiu Shun Road. The general view of this viewpoint is composed of high-rise residential developments in Hang Hau to the west, the hillslope of Pak Shing Kok to the east, as well as roadside planters. High-rises in Tseung Kwan O Town Centre can also be seen at the background. Considering the quality of view being fair and the transient nature of the viewpoint, the visual sensitivity of the public viewers from this viewpoint is low.

## Viewpoint C - View Northeast from Hang Hau Man Kuk Lane Park (Figure V3.3)

3.10 Hang Hau Man Kuk Lane Park is a popular open space among locals of Hang Hau. It is located at a distance of approximately 150 m to the west of the Site at street level ( +7 mPD ), mainly representing short-range views of visitors to the Park engaging in passive recreational activities. The selected viewpoint is at the Chinese Garden, which is the focal point of the Park. The general view of this viewpoint is dominated by La Cite Noble and other residential developments, open sky view as the background, with the landscape feature and trees of the park at the foreground serving as visual relief. Considering the location and nature (passive recreation/open space), the location of the visitors in the eastern portion of the Park is close to the proposed development, the sensitivity of viewers at this viewpoint is high.

## Viewpoint D - View East from Hong Kong Velodrome Park (Figure V3.4)

3.11 Hong Kong Velodrome Park is a town park that provides important recreational outlet for the densely developed Tseung Kwan O. It is located at a distance of approximately

520 m to the west of the Site at street level (+6mPD), mainly representing medium-range views of visitors to the Park and the Tseung Kwan O Sports Ground. The selected viewpoint is near to the central lawn of the Park where visitors will congregate for passive recreational activities. The general view of the viewpoint is characterised by landscape features in the Park and the low-rise Hong Kong Velodrome at the foreground, residential high-rises to the east and open sky view to the south at the background. As the quality of existing view is fair and viewers there are occasional in nature, the visual sensitivity of the public viewers from this viewpoint is medium.

## Viewpoint E - View East from Chiu Shun Road at Pedestrian Level

3.12 This viewpoint locates at the northwest side of Chiu Shun Road pedestrian footpath near a taxi stand and minibus stop at a distance of approximately 25 m to the west of the Site at street level (+7.0mPD). It represents transient views of pedestrians along Chiu Shun Road. The view is composed of row of trees at central median in the front, ventilation building with a hard-paved area in the middle, and vegetated hill slope as the background. Considering the transient nature and small number of viewers, with the view characterised by vegetation of road corridor of Chiu Shun Road, the visual sensitivity of the public viewers at this viewpoint is low. This viewpoint at close distance to the Site is selected to illustrate the proposed treatments on podium, and their relation with the existing landscape context.

## Viewpoint F - View South from Chiu Shun Road at Pedestrian Level

3.13 This viewpoint represents the views of vehicular travellers along Chiu Shun Road. It is viewing from the north of the Site at close distance of about 12 m at street level (+6.7mPD). Framed by roadside vegetation and residential developments along Chiu Shun Road, general view is confined along road corridor and quality is fair. Together with the occasional nature of view by the vehicular travellers, the visual sensitivity of the viewers is low. This viewpoint with direct view to the Site could demonstrate the overall visual impact of the podium at pedestrian level, and allows illustration of proposed treatments on podium, which the existing view comprises the ventilation building and roadside shrub planting with self-seeded weedy young trees in front.

### 4.0 Visual Appraisal

4.1 The effects of visual changes on the assessment area and sensitive public viewers as a result of the proposed development is assessed, taking into account the visual composition, its effect on visual obstruction, visual changes to public viewers and visual resources. Photomontages showing the proposed development vis-à-vis the visual context of the viewing points are presented in Figures V3.1 to 3.4. Photomontages
showing the proposed podium treatment viewing from pedestrian level at Chiu Shun Road are presented in Figures V3.5 and V3.6.

## Viewpoint A - View South from the Peak of Duckling Hill (Figure V3.1)

4.2 Visual Composition - The visual composition of this viewpoint comprises dense vegetation around Duckling Hill and the high-rises at Hang Hau at the foreground, as well as the mountain ranges of Clearwater Bay Peninsula at the background. As demonstrated in Figure V3.1, the proposed development is entirely screened off by La Cite Noble and East Point City at the front. Visual composition of the viewing point remains unchanged.
4.3 Visual Obstruction - The proposed development does not affect the existing skyline of developments at Tseung Kwan O Centre. No additional open sky view and ridgeline will be blocked by the proposed development.
4.4 Effect on Visual Resources - The proposed development will integrate with the highrises at Hang Hau and is screened entirely. Moreover, no additional obstruction to existing visual resources of this viewpoint, such as the mountain ranges and the open sky view, will be caused by the proposed development. The visual character will remain the same.
4.5 Effect on Public Viewers - View to the proposed development will be entirely screened off by the existing high-rises at Hang Hau at this viewpoint. There is no change to this viewpoint and thus no impact caused.
4.6 Based on the above, there will be no visual impact brought by the proposed development to public viewers at the peak of Duckling Hill.

Viewpoint B - View Southwest from Footbridge across Chiu Shun Road (Figure V3.2)
4.7 Visual Composition - The visual composition of this viewpoint consists of high-rise blocks of Yuk Ming Court, the roadside planters along Chiu Shun Road and the dense vegetation of the Pak Shing Kok hillslope at the foreground, as well as the high-rises at Tseung Kwan O Town Centre and the open sky view at the background. With the implementation of the proposed development, the high-rise urban character currently dominant to the northwest of Chiu Shun Road will extend to the southeast across the road. With responsive building mass and disposition of proposed residential towers, nevertheless, the scale of the proposed development will be in keeping with the existing high-rise context. A public housing development is planned to the immediate northeast of the Site along Chiu Shun Road. The proposed development is therefore considered compatible with the visual composition.
4.8 Visual Obstruction - By virtue of its close proximity, the proposed development would inevitably obstruct some sky view at the background. With due considerations given to the building mass and disposition, the proposed development presents a slender profile towards the northeast that minimises its visual obstruction.
4.9 Effect on Visual Resources - With its scale and height in keeping with adjacent developments, the proposed development and the planned public housing development to its northeast can be seen as an extension of the high-rises group at Hang Hau. Although the proposed development will result in visual obstruction to some sky view at the background, distant view and visual opening towards the south and southwest is stil available. The dense vegetation on the hillslope of Pak Shing Kok and the roadside planters along Chiu Shun Road which serve as visual relief will not be affected.
4.10 Effect on Public Viewers - Visual experience at the viewpoint is already dominated by existing high-rises to the northwest of Chiu Shun Road. The proposed development will not significantly change such experience. With a slender profile of the proposed residential towers facing the viewpoint, obstruction to sky view has already been minimised. Alternative sky view is still available towards the south. Existing roadside planters providing visual amenity to viewers at street level will not be affected. The magnitude of change to this viewpoint is small.
4.11 Considering the small magnitude of change and low sensitivity of the public viewers, visual impact brought by the proposed development to public viewers at footbridge across Chiu Shun Road would be slightly adverse.

## Viewpoint C - View Northeast from Hang Hau Man Kuk Lane Park (Figure V3.3)

4.12 Visual Composition - The visual composition of this viewpoint is composed of tree, vegetation and other landscape features of the Hang Hau Man Kuk Lane Park at the foreground, as well as the high-rises at Hang Hau and open sky view at the background. By virtue of low elevation and close proximity of this viewpoint, the proposed development will inevitably reduce visual openness towards the east. With due consideration to building mass and height, however, the scale and proportion of the proposed residential towers will be in keeping with the adjacent La Cite Noble at the background. The proposed development is therefore considered compatible with the visual composition.
4.13 Visual Obstruction - Due to low elevation and close proximity of this viewpoint, the proposed development would inevitably obstruct some sky view at the background. By incorporation of separation between towers, obstruction brought by the proposed development will be minimised.
4.14 Effect on Visual Resource - The proposed development will result in visual blockage to some sky view and hillside at the background. However, such obstruction is minimised through the incorporation of 15 m building separation between the two residential towers. The visual amenity as provided by the water feature and landscape trees of the Park will not be affected. With its scale and height in keeping with adjacent developments, the proposed development can be seen as an extension of the high-rises group at Hang Hau.
4.15 Effect on Public Viewers - The imposing high-rises at Hang Hau has already formed an important part of existing viewers' visual experience. The proposed development will be seen as an extension of the high-rises group and will not significantly alter such perception. Whilst the proposed development will diminish visual openness towards the east, access to open view is preserved between proposed towers. Meanwhile, there is alternative sky view towards the south. View looking towards portion of hillslope and sky view will be replaced by residential towers and podium garden. The visual amenity as provided by the water feature and landscape of the Park will not be affected. Since views from other portion of the Park are largely confined by trees and built structures, only visitors in the eastern portion closed to the development would be affected. The magnitude of change to this viewpoint is intermediate.
4.16 Considering the intermediate magnitude of change and high sensitivity of the public viewers at the eastern portion of Park, visual impact brought by the proposed development to public viewers at the Hang Hau Man Kuk Lane Park would be moderately adverse.

Viewpoint D - View East from Hong Kong Velodrome Park (Figure V3.4)
4.17 Visual Composition - The visual composition of this viewpoint comprises the Hong Kong Velodrome and its adjoining landscape features at the foreground, as well as Nan Fung Plaza and open sky view at the background. The proposed development, by virtue of its farther distance, is perceived as smaller in scale than the existing high-rises at Hang Hau, and seen as being part of the existing high-rises group. The visual composition will not be significantly changed by virtue of the proposed development.
4.18 Visual Obstruction - When viewed from this viewpoint, the proposed development will only slightly obstruct the sky view at the background. The visual openness currently available will be largely maintained while the 15 m building separation between towers will further increase visual permeability to the sky view.
4.19 Effect on Visual Resources - The height and mass of the proposed development is in keeping with adjacent high-rises group at Hang Hau. It will only cause minor blockage to the sky view. Visual openness and distant view will be largely maintained. The landscape features of the Hong Kong Velodrome Park that provide visual amenity to public viewers will not be affected.
4.20 Effect on Public Viewers - With its scale and height in keeping with adjacent developments, the proposed development will be perceived as part of the existing group of high-rises at Hang Hau. Visual obstruction is insignificant in that majority of open sky view and visual opening currently enjoyed by viewers will be maintained. The magnitude of change to this viewpoint is small.
4.21 Considering the small magnitude of change and medium sensitivity of the public viewers, visual impact brought by the proposed development to public viewers at the Hong Kong Velodrome Park would be slightly adverse.

## Viewpoint E - View East from Chiu Shun Road at Pedestrian Level (Figure V3.5)

4.22 Visual Composition - The visual composition of this viewpoint comprises row of existing roadside tree planted at central median along Chiu Shun Road in front of the proposed development. Due to close proximity to the Site, the view is largely occupied by the proposed development.
4.23 Visual Obstruction - By virtue of its very close proximity and low elevation, the proposed development would inevitably obstruct the green slope and sky view at the background. The existing ventilation building and surrounding area are covered and replaced by the proposed podium. Voids on different levels of podium would increase visual permeability and allow visual access to the green slope behind, which also create more building articulation to the podium, minimising the obstruction of view by the podium.
4.24 Effect on Visual Resources - The proposed development will introduce high quality multi-levelled greenery particularly facing Chiu Shun Road to replace existing planting of fair to poor condition with the growth of weedy tree species. Multi-levelled greenery composed of roadside tree and shrub planting at ground level, edge planting at carpark floor and podium floor, will soften the development edge of the podium and enrich the landscape context along Chiu Shun Road for public enjoyment. The existing roadside tree planting at central median of Chiu Shun Road will be respected. Visual resources will thus be optimised with the proposed development.
4.25 Effect on Public Viewers - Apart from maintaining access to green slope through voids on podium and introduction of multi-levelled greenery, façade treatment on podium helps to create a less prominent building structure. As a result, though the podium may bring visual obstruction, the enriched roadside landscape, with consideration on visual permeability, building articulation and façade treatment will result in a pleasant landscape context respecting existing resources for the pedestrians of Chiu Shun Road. The magnitude of change to this viewpoint is intermediate.
4.26 Considering the intermediate magnitude of change and low sensitivity of the public viewers, visual impact brought by the proposed development to public viewers at Chiu Shun Road would be slightly adverse.

Viewpoint F - View South from Chiu Shun Road at Pedestrian Level (Figure V3.6)
4.27 Visual Composition - The visual composition of this viewpoint mainly consists of the proposed development with proposed footpath on Chiu Shun Road in front. Due to close proximity to the Site, the view is largely occupied by the proposed development.
4.28 Visual Obstruction - Due to very close proximity and low elevation of this view, the proposed development would inevitably obstruct the sky view behind the ventilation building. Podium design incorporating voids above ventilation building and at other levels of podium improves visual permeability and allows visual access to the sky view and the green slope at the background. The voids create articulation and minimise wall structure of the podium, reducing the visual impact by the podium.
4.29 Effect on Visual Resources - Proposed roadside planters with tree and shrub planting at ground floor will help screening the proposed development. Meanwhile, with the selection of high quality tree and shrub to replace existing weedy trees of fair to poor condition, landscape context along Chiu Shun Road could be improved for public enjoyment. Also, edge planting at carpark floor and podium floor softens development edge. Visual resources could be optimised.
4.30 Effect on Public Viewers - With the voids at lower levels of the podium allowing visual access to the sky view and green slope at the background, tree and shrub planting at ground level, edge planting at carpark floor and podium floor, the development edges will be softened and visual permeability will be improved. Visual amenity is introduced to reduce the potential impact of the podium. The magnitude of change to this viewpoint is intermediate.
4.31 Considering the intermediate magnitude of change and low sensitivity of the public viewers, visual impact brought by the proposed development to public viewers at Chiu Shun Road would be slightly adverse.

### 5.0 Evaluation of Overall Visual Impact

5.1 The proposed development is located at the periphery of the high-rises group at Hang Hau. With the proposed building height and mass in keeping with the existing and planned high-rises in the surroundings, the proposed residential towers will be perceived as part of the high-rises group when viewed from the long and medium-range viewpoints. It will cause little change to the visual amenity currently enjoyed by public viewers at these viewpoints. Visual impact to these viewpoints will in general be considered as negligible.
5.2 By virtue of the close proximity, the proposed development will inevitably cause visual changes to viewers from the short-range viewpoints. Efforts have been made to minimise the potential visual impact, including the application of responsive building height, mass and disposition, and tower separation, such that visual obstruction to the viewpoints will be minimised and visual permeability of the proposed development will be improved. Besides, the provision of multi-levelled greenery and voids at lower level of proposed development will also soften the development edges, contribute to the permeability of the proposed residential development, and introduce visual amenity to these viewpoints.
5.3 In overall terms, the proposed development is compatible with the existing urban highrise context. Its effect on visual resources and key public viewers is not significant. Whilst some degree of visual obstruction to short-ranged viewers will occur, the proposed development will make a positive contribution to the supply of housing unit and optimise land utilisation. The resultant overall impact is therefore concluded as slightly to moderately adverse.

Figures









KEY PLAN

# Viewpoint F <br> Viewpoint Elevation: +6.7 mPD at Chiu Shun Road <br> Viewing Distance: 12 m <br> Proposed Building Height in the Site: +130 mPD 

Photomontage (Artist's impression. For illustrative purpose only, subject to detailed design)
Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use
Photomontage of Proposed Podium Treatments - Viewpoint F: View South from Chiu Shun Road

| SCALE | N.T.S. | DATE | JAN 2019 |
| :---: | :---: | :---: | :---: |
| CHECKED | ELK | DRAWN | TEAM |
| FIGURE NO. | V3.6 |  |  |
|  |  |  | REV |
|  |  |  |  |

[^4]Appendix D
Traffic Impact Assessment

## DOCUMENT STATUS CONTROL RECORD

## Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area

## for Residential Use

Traffic Impact Assessment Repor

| Originating Organisation : | Prepared by: GWL | Ging | Date: 6 May 2020 |
| :---: | :---: | :---: | :---: |
| LLA Consultancy Limited Unit 610, 6/F, Island Place Tower, | Approved by: SLN | iy | Date: 6 May 2020 |
| North Point, Hong Kong | Revision No.: F |  | Date of Issue: 6 May 2020 |

## Table of Conten

1 INTRODUCTIONPage$\begin{array}{ll}\text { 1.1 } & \text { Background } \\ 1.2 & \text { Objectives }\end{array}$ ..... $\ldots . . . . .1$ 1
2 THE PROPOSED DEVELOPMENT .....  .1
2.1 The Site ..... $\begin{array}{r}. . . . . . ~ \\ \hline\end{array}$
2.2 Proposed Development Schedule. .....  1
3 EXISTING TRAFFIC SITUATION .....  1
3.1 Existing Traffic Conditions .....  1
3.2 Traffic Count Survey.. ..... $-\ldots . .1$
2
3.3 Existing Junction Capacity Assessmen ..... $\begin{array}{r}. . . . . \\ . . . \\ . . \\ \hline\end{array}$
4 FUTURE TRAFFIC SITUATION. .....  3
4.1 Design Year ..... $\ldots$ ..... $\ldots$
4.2 Future Road Network
4.2 Future Road Network
4.3 Traffic Forecast 3
$4.4 \quad$ Planned/Committed Developments$\begin{array}{ll}\text { 4.5 } & \text { Traffic Generation of the Proposed Development. } \\ \text { 4.6 } & \text { Reference and Design Flows......................... } \\ \text { 4. } & \text { Junction/Link Capacity Assessment }\end{array}$

5 PUBUN| .... |
| ---: |
| .4 |
| 4 |

5 PUBLIC TRANSPORT ASSESSMENT .....  5
5.2 Impact Assessment on Public Transport Services .....  56 PROPOSED PEDESTRIAN FACILIATES 6
6.1 Proposed Improvement along Chiu Shun Road and at J/O of Chiu Shun Road/Ngan O Road .....  6
7 PROPOSED TRANSPORT FACILITIES PROVISIONS .....  .7
7.1 Access Arrangement .....  7
7.2 Car Parking and Loading/Unloading Provision .....  7
8 SUMMARY AND CONCLUSION .....  8
8.1 Summary .....  .8

## List of Tables

Table 2.1 Table 3.1 Table 3.2 Table 3.3 Table 4.1 Table 4.2 Table 4.3 Table 4.4
Table 4.5
Table 4.6
Table 4.7
Table 5.1
Table 5.2
Table 5.3
Table 6.1
Table 7.1

List of Figures
Figure 1 Location Plan
Figure 2 Surveyed Junctions
Figure 3 Observed Traffic Flows
Figure 4 Development Traffic Flows
Figure $5 \quad 2032$ Reference Traffic Flows
Figure 62032 Design Traffic Flows
Figure $7 \quad$ Proposed Pedestrian Connections Across Chiu Shun Road

## List of Appendices

Appendix 1 Junction Capacity Assessment - Existing Scenario
Appendix 2 Schematic Junction Layout of J/O Po Ning Road/ Sheung Ning Road/ Ying Yip Road Appendix 3 Junction Capacity Assessment - Reference \& Design Scenarios
Appendix 4 Schematic Junction Layout of J/O Po Ning Road/ Po Shun Road/ Po Lam Road North Appendix 5 Junction Capacity Assessment - Design Scenario (With Proposed Layout)
Appendix 6 Car Lift Assessmen

## 1 INTRODUCTION

### 1.1 Background

1.1.1 The MTR Pak Shing Kok Ventilation Building (PVB) and adjacent "Green Belt" site to the south of PVB are located on Chiu Shun Road (hereinafter referred to as "the Site"). A location plan of the Site is shown in Figure 1.
1.1.2 LLA Consultancy Limited was commissioned to carry out a traffic impact assessment study to assess the potential traffic impact due to the proposed residential development scheme at the Site. This report presents the findings of the study.

### 1.2 Objectives

1.2.1 The objectives of the traffic impact assessment study are as follows:

- to review the existing traffic conditions in the surrounding road network;
- to estimate the potential traffic generation due to the proposed development;
- to assess the future traffic situation in the surrounding road network
- to appraise the potential traffic impact of the proposed development
- to recommend the transport facilities provisions for the proposed development; and
- to consider road improvement proposals, if required.


## 2 THE PROPOSED DEVELOPMENT

### 2.1 The Site

2.1.1 As shown in Figure 1, the Site is located at Chiu Shun Road near its junction with Ngan O Road, Tseung Kwan O.

### 2.2 Proposed Development Schedule

2.2.1 The key parameters of the proposed development are summarized in Table 2.1:

## Table 2.1 Proposed Development Schedule

| Components | The Site |
| :---: | :---: |
| Development Site Area | $4,458 \mathrm{~m}^{2}$ |
| Domestic Plot Ratio | 6 |
| Domestic GFA | $26,748 \mathrm{~m}^{2}$ |
| No. of Flats | 432 |
| Average Flat Size (GFA) | About $62 \mathrm{~m}^{2}$ |

## 3 EXISTING TRAFFIC SITUATION

### 3.1 Existing Traffic Conditions

3.1.1 Chiu Shun Road is a dual two-lane district distributor road which connects Po Ning Road and Wan Po Road and the slip roads to/from the Tseung Kwan O Tunnel. The section of Chiu Shun Road along the frontage of the Site between Ngan O Road and Wan Po Road roundabout carried an AADT of 19,850 vehicles in 2015

### 3.2 Traffic Count Survey

3.2.1 In order to assess the existing traffic conditions, traffic count surveys were carried out at the following locations in the vicinity of the Site on 6 June 2017 (Tuesday) (for Junctions J1 to J3); on 27 February 2018 (Tuesday) (for Junctions J4 to J7) and on 14 March 2018 (Wednesday) (for Junction J8) during the peak hour period from 07:30 to 09:30 and 17:00 to 19:00. Supplementary traffic count surveys are carried out on 28 May 2019 (Tuesday). The locations of the surveyed junctions/road links and the Area of Influence (AOI) are presented in Figure 2

## Junctions

J1 - Chiu Shun Road/Po Ning Road Roundabout
J2 - Chiu Shun Road/Ngan O Road
J3 - Chiu Shun Road/Wan Po Road Roundabout
J4 - Po Yap Road/ Po Hong Road/ Chi Shin Street
J5 - Po Yap Road/ Tong Chun Street
J6 - Po Ning Road/ Sheung Ning Road/ Ying Yip Road
J7 - Po Ning Road/ Po Shun Road/ Po Lam Road North
J8 - Clear Water Bay Road/Ying Yip Road/Hang Hau Road
Road Links
L1 - Po Shun Road
L2 - Wan Po Road
L3 - Po Yap Road
L4 - Hang Hau Road
L5 - Po Lam Road North
L6 - Ying Yip Road
L7 - Clear Water Bay Road
3.2.2 The identified AM and PM peak hours are 07:45-08:45 and 17:45-18:45, respectively. The peak hour traffic flows are presented in Figure 3

### 3.3 Existing Junction Capacity Assessment

3.3.1 Based on the existing traffic flows, the performance of the key junctions during the AM and PM peak hours were assessed. The results are summarized and presented in Table 3.1 and detailed junction capacity calculation sheets are presented in Appendix 1.

Table 3.1 Existing Junction Performance - Junction Capacity Assessment

| No. | Junction Location | Type/Capacity <br> Index | AM Peak <br> Hour | PM Peak <br> Hour |
| :---: | :--- | :---: | :---: | :---: |
| J1 | Chiu Shun Road/Po Ning Road Roundabout | Roundabout/DFC | 0.43 | 0.34 |
| J2 | Chiu Shun Road/Ngan O Road | Signalized/RC | $46 \%$ | $104 \%$ |
| J3 | Chiu Shun Road/Wan Po Road Roundabout | Roundabout/DFC | 0.55 | 0.59 |
| J4 | Po Yap Road/ Po Hong Road/ Chi Shin Street | Roundabout/DFC | 0.23 | 0.33 |
| J5 | Po Yap Road/ Tong Chun Street | Signalized/RC | $76 \%$ | $69 \%$ |
| J6 | Po Ning Road/ Sheung Ning Road/ Ying Yip Road | Roundabout/DFC | 0.81 | 0.83 |
| J7 | Po Ning Road/ Po Shun Road/ Po Lam Road North | Roundabout/DFC | 0.72 | 0.58 |
| J8 | Clear Water Bay Road/Ying Yip Road/Hang Hau Road | Roundabout/DFC | 0.68 | 0.61 |

Note: (1) $\quad \mathrm{RC}=$ Reserve Capacity for signalized junction
DFC $=$ Design Flow to Capacity ratio for priority junction and roundabout.
3.3.2 As shown in Table 3.1, it is noted that all junctions are operating satisfactorily under the existing scenario.
3.3.3 At the same time, link capacity assessments have been conducted and the results are presented in Table 3.2. The results showed that the concerned road links are operating with spare capacity.

Table 3.2 Existing Junction Performance - Link Capacity Assessment

| No. | Link | Bound | Capacity (pcu/hr) | Flows (pcu/hour) [V/C Ratio] |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | AM Peak Hour | PM Peak Hour |
| L1 | Po Shun Road | S/B | 3,600 | 815 [0.23] | 206 [0.06] |
|  |  | N/B | 3,600 | 1,095 [0.30] | 1,381 [0.38] |
| L2 | Wan Po Road | S/B | 3,600 | 1,382 [0.38] | 1,591 [0.44] |
|  |  | N/B | 3,600 | 1,904 [0.53] | 2,086 [0.58] |
| L3 | Po Yap Road | E/B | 3,600 | 1,079 [0.30] | 1,278 [0.36] |
|  |  | W/B | 3,600 | 645 [0.18] | 878 [0.24] |
| L4 | Hang Hau Road | S/B | 1,140 | 395 [0.35] | 459 [0.40] |
|  |  | N/B | 1,140 | 303 [0.27] | 403 [0.35] |
| L5 | Po Lam Road North | S/B | 3,600 | 766 [0.21] | 758 [0.21] |
|  |  | N/B | 3,600 | 898 [0.25] | 815 [0.23] |
| L6 | Ying Yip Road | S/B | 1,140 | 802 [0.70] | 774 [0.68] |
|  |  | N/B | 1,140 | 484 [0.42] | 788 [0.69] |
| L7 | Clear Water Bay Road | S/B | 1,320 | 929 [0.70] | 823 [0.62] |
|  |  | N/B | 2,640 | 1,110 [0.42] | 1,059 [0.40] |

### 3.4 Existing Public Transport Services

3.4.1 At present, there are a few bus routes and minibus route travelling along Chiu Shun Road and Ngan O Road and the MTR Hang Hau Station is within 500 m radius of the Site. The details of the bus/minibus routes are shown in Table 3.3

Table 3.3 Existing Public Transport Routes

| Mode | Route No. | Terminating Points | Frequency (min) |
| :---: | :---: | :---: | :---: |
| Bus | 91M | Po Lam - Diamond Hill Station | 12-20 |
|  | 98A | Hang Hau (North) - Ngau Tau Kok Station | 8-15 |
|  | 98C | Hang Hau (North) - Mei Foo | 8-20 |
|  | 98D | Hang Hau (North) - Tsim Sha Tsui East | 8-15 |
|  | 98P | Hong Sing Garden - Tsim Sha Tsui East | 3 per day |
|  | 98 S | LOHAS Park Station - Mei Foo | 4 per day |
|  | 290 | Choi Ming - Tsuen Wan West Station | 10-20 |
|  | 296M | Hang Hau Station - Hong Sing Garden | 15-25 |
|  | 290A | Choi Ming - Tsuen Wan West Station | 10-25 |
|  | 297 | Hang Hau (North) - Hung Hom (Hung Luen Road) | 12-25 |
|  | 297P | Hang Hau (North) -Hung Hom (Hung Luen Road) | 07:55, 08:05 |
|  | 298E | Hang Hau Railway Station - Tseung Kwan O Industrial Estate | 10-20 |
|  | 694 | Tiu Keng Leng Station - Siu Sai Wan Estate | 15-25 |
|  | 798 | Tiu Keng Leng Station - Fo Tan | 10-20 |
|  | 798B | LOHAS Park - Shatin Station | 07:05, 18:30 |
|  | A29 | Po Lam - Airport | 15-30 |
|  | E22A | Hong Sing Garden - AsiaWorld Expo | 25-30 |
|  | E22C | Tiu Keng Leng Station - Aircraft Maintenance Area | 4 per day |
|  | E22S | Po Lam - Tung Chung | 07:13, 07:28 |
|  | N293 | Sheung Tak - Mong Kok East Station | 15-20 |
|  | N691 | Tiu Keng Leng - Central (Macau Ferry) | 20-30 |
|  | N29 | Hong Sing Garden - Tung Chung Station | 7 per day |
|  | NA29 | Tseung Kwan O (Po Lam) - Airport /HZMB Hong Kong Port | 6 per day |
| GMB | 15 | Hang Hau - Hong Sing | 5-15 |
|  | 15A | Hang Hau (North) - Verbena Heights | 12-14 |
|  | 16 | Po Lam - Po Toi O | 10-30 |
|  | 19S | Hau Hau (North) - Causeway Bay | 15 |
|  | 113 | Hang Hau - The Beaumount | 20-30 |
|  | 102 | Hau Hau Station - San Po Kong | 2-15 |
|  | 102B | Yuk Ming Court - Choi Hung | 12-20 |
|  | 102 S | Hang Hau Station - San Po Kong | 6-20 |
|  | 103M | Tseung Kwan O Station PTI - Clear Water Bay | 7-20 |
|  | 108A | Hang Hau (North) - Choi Ming PTI | 6-15 |
|  | 109M | Hang Hau Station - Oscar By The Sea | 3-25 |

## 4 FUTURE TRAFFIC SITUATION

### 4.1 Design Year

4.1.1 The proposed development will be completed in 2029. Therefore, the design year for the subsequent traffic impact assessment will be 2032, i.e. 3 years after the completion of the proposed development.

### 4.2 Future Road Network

4.2.1 According to the latest information, the Tseung Kwan O-Lam Tin Tunnel (TKO-LTT) and the Cross Bay Link (CBL) will be completed by 2021 and 2022, respectively. Slip roads and branch tunnels will be constructed to connect Po Shun Road of Tseung Kwan O in the east with Eastern Harbour Crossing and Cha Kwo Ling Road of Kwun Tong in the west. TKO-LTT, together with the proposed Trunk Road T2 and Central Kowloon Route, will form the Route 6 providing an east-west express link between West Kowloon and TKO areas. In association with the TKO-LTT and CBL, the future traffic following assessments.

## J6 - Po Ning Road/ Sheung Ning Road/ Ying Yip Road

4.2.2 Under the Final Report of Agreement No. CE 61/2014 (CE) Site Formation and Infrastructure Works for nine Housing Sites in Tseung Kwan O - Feasibility Study Final Report (Five TKO Sites) issued in April 2017, CEDD has committed to implement the junction improvement works before the population intake of the housing sites in Tseung Kwan O in design year 2024. The schematic layout of the proposed junction improvement extracted from Transport Department's Report on the Progress of the Stage II Improvement Works of the Roundabout at Ying Yip Road (Amendment 1) (Document No. 185/14) of the Sai Kung District Council Traffic \& Transport Committee held on 18 September 2014 is shown in Appendix 2.
4.2.3 J/O Po Ning Road/ Sheung Ning Road/ Ying Yip Road will be converted from the existing roundabout to a signalized junction. It is anticipated that the junction improvement scheme will be completed before the completion of the proposed development at Pak Shing Kok Ventilation Building (PVB) site in 2029. It should also be noted that Ying Yip Road northbound will be widened from 1 lane to 2 lanes This proposed layout will be taken into consideration in the following assessments.
4.3 Traffic Forecast
4.3.1 Reference was made to the 2012 to 2016 Annual Traffic Census Reports on the historical traffic data. The traffic data recorded at counting stations in the vicinity of the Development Site are shown in Table 4.1.

Table 4.1 Annual Traffic Census Data

| Station <br> No. | Road Section |  |  |  | Road | From | To | $\mathbf{2 0 1 2}$ | $\mathbf{2 0 1 3}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 2014 | 2015 | $\mathbf{2 0 1 6}$ | Average |  |  |  |  |  |
| Growth\% |  |  |  |  |  |  |  |  |  |$|$

Note: (1) Figures in bracket indicated the $\%$ increase between two years.
4.3.2 From Table 4.1, the recorded average traffic growth rate was $+3.0 \%$ between the years 2012 to 2016 for the above counting stations.
4.3.3 Apart from the historical traffic data, reference was also made to 2014-based Territorial Population and Employment Data Matrix (TPEDM) published by the Planning Department. The population and employment data of year 2021 and 2026 are summarized in Table 4.2.

Table 4.2 Growth Rate Derived from TPEDM

| Year | Population | Employment | Total |
| :---: | :---: | :---: | :---: |
| 2021 | 434,850 | 96,450 | 531,300 |
| 2026 | 484,850 | 91,700 | 576,550 |
| Average Annual Growth Rate | $\mathbf{+ 2 . 3} \%$ | $\mathbf{- 1 . 1} \%$ | $\mathbf{+ 1 . 7 \%}$ |

4.3.4 As shown in Table 4.2, the average annual growth rate for both population and employment is $+1.7 \%$. Given design year is 2032 which is 15 years from the existing year, the long term growth rate of $+1.7 \%$ which is derived from the future forecast based on the TPEDM is adopted in the following traffic forecast.

### 4.4 Planned/Committed Developments

4.4.1 To estimate the future traffic flows, updated information has been obtained from available information regarding the planned and approved developments in the vicinity of the study area. Details of these developments are given in Table 4.3.

## Table 4.3 Planned and Approved Developments

| No. | Location/Area | Proposed Use / Content |
| :---: | :--- | :---: |
| S1 $^{(1)}$ | North of Tseung Kwan O (TKO) Village | Residential/3,700 units ${ }^{(2)}$ |
| S2 $^{(1)}$ | Northwest of Ying Yip Road | Residential/1,600 units |
| S3 ${ }^{(1)}$ | South of Chiu Shun Road | Residential/560 units |
| S4 ${ }^{(1)}$ | West of Yau Yue Wan (YYW) Village | Residential/2,500 units |
| S5 ${ }^{(1)}$ | East of Hong Kong (HK) Movie City | Residential/2,900 units |

 According to the $1171^{\text {s }}$ meeting of Town Planning Board held on 21 June 2018, it was agreed that Site S 1 should not be rezoned to Resideniial (Group)7 for he proposed public housing developmen. Therefore, Site S1 excluded from the following assessment
4.4.2 Reference was also made to the latest set of traffic generation and attraction rates published by Transport Department (TD) for the estimation of the traffic generated by these developments. Also, per comments from Housing Department, a $10 \%$ design flexibility is incorporated in the following assessment to estimate the traffic generation and attraction of the planned housing developments. The total traffic generation and attraction by these adjacent developments are summarized in Table 4.4

## Table 4.4 Traffic Generations by the Planned and Approved Developments

|  | Use / Content | AM Peak Hour |  |  | PM Peak Hour |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Gen. | Att. | Total | Gen. | Att. | Total |
| Trip Rates |  |  |  |  |  |  |  |
| Subsidised Sale Flat ${ }^{(1)}$ | pcu/hr/flat | 0.0622 | 0.0426 | - | 0.0297 | 0.0401 | - |
| Traffic Generation/Attraction ${ }^{(2)}$ |  |  |  |  |  |  |  |
| S2 - NW of Ying Yip Road | Residential/1,760 units | 110 | 75 | 185 | 53 | 71 | 124 |
| S3-S of Chiu Shun Road | Residentia//616 units | 39 | 27 | 66 | 19 | 25 | 44 |
| S4 - W of YYW Village | Residential/2,750 units | 172 | 118 | 290 | 82 | 111 | 193 |
| S5-E of HK Movie City | Residential/3,190 units | 199 | 136 | 335 | 95 | 128 | 223 |

Note: (1) Mean trip rate of Subsidised Housing: HOS / PSPS with average flat size of $50 \mathrm{~m}^{2}$ is adopted.
(2) A A developments per comments from Housing Department received on 11 December 2019
4.5 Traffic Generation of the Proposed Development
4.5.1 The traffic generation and attraction of the proposed residential development are summarised in Table 4.5.

## Table 4.5 Development Traffic Generation

|  | Use / Content | AM Peak Hour |  |  | PM Peak Hour |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Gen. | Att. | Total | Gen. | Att. | Total |
| Trip Rates | Residential $\left(60 \mathrm{~m}^{2}\right) /$ <br> pcu/hr/flat | 0.0718 | 0.0425 | - | 0.0286 | 0.0370 | - |
| Traffic Generation | 432 flats@ $62 \mathrm{~m}^{2}$ | 32 | 19 | 51 | 13 | 16 | 29 |

Notes: (1) Mean trip rates for private housing (average flat size of $60 \mathrm{~m}^{2}$ ) is adopted to represent the worst case scenario.
4.5.2 The proposed development is expected to generate a two-way traffic of 51 pcu/hour and 29 pcu/hour in the AM and PM peak hours respectively. The estimated traffic volumes of the proposed development are presented in Figure 4

### 4.6 Reference and Design Flows

4.6.1 With the introduction of TKO-LTT and CBL, significant changes in traffic volumes of Tseung Kwan O area are expected. Therefore, reference traffic flows were obtained from the latest available 2008based Base District Traffic Model (BDTM) output for year 2021, which has already taken into account the effect of TKO-LTT and CBL.
4.6.2 The 2032 Reference Flows, i.e. the traffic flows in the local road network without the proposed development, are estimated based on the following equations.

2032 Reference Flows $=2021$ BDTM Traffic Flows $\times(1+1.7 \%)^{11}+$ Traffic Generated by Planned Developments in the Vicinity
4.6.3 The 2032 Design Flows, i.e. the traffic flows in the local road network with the additional traffic generated by the proposed conversion, were estimated based on the following equation:

2032 Design Flows $=2032$ Reference Flows + Development Traffic Flows
4.6.4 The 2032 Reference and Design Flows are shown in Figure 5 and Figure 6, respectively.

### 4.7 Junction/Link Capacity Assessment

4.7.1 Assessments of the junction and link performances were based on the reference and design flows for the year 2032. Two scenarios were assessed they are scenario with the existing junction layout and scenario with junction modification. The results are summarized and presented in Table 4.6 and 4.7 The detailed junction capacity calculation sheets are presented in Appendix 3.

Table 4.6 Junction Capacity Assessment for Design Year 2032

| Jun. No. | Junction | Type/ Capacity Index ${ }^{(1)}$ | 2032 Reference |  | 2032 Design |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | AM Peak | PM Peak | AM Peak | PM Peak |
| Without Junction Modification (Existing Layout) |  |  |  |  |  |  |
| J1 | Chiu Shun Road/Po Ning Road Roundabout | Roundabout/DFC | 0.63 | 0.59 | 0.64 | 0.60 |
| J2 | Chiu Shun Road/Ngan O Road | Signalized/RC | 57\% | 69\% | 55\% | 68\% |
| J3 | Chiu Shun Road/Wan Po Road Roundabout | Roundabout/DFC | 0.71 | 0.51 | 0.72 | 0.52 |
| J4 | Po Yap Road/ Po Hong Road/ Chi Shin Street | Roundabout/DFC | 0.42 | 0.40 | 0.42 | 0.41 |
| J5 | Po Yap Road/ Tong Chun Street | Signalized/RC | 6\% | 71\% | 5\% | 68\% |
| J6 | Po Ning Road/ Sheung Ning Road/ Ying Yip Road | Roundabout/DFC | 1.36 | 1.27 | 1.36 | 1.27 |
| J7 | Po Ning Road/ Po Shun Road/ Po Lam Road North ${ }^{(2)}$ | Roundabout/DFC | 1.91 | 1.77 | 1.91 | 1.77 |
| J8 | Clear Water Bay Road/Ying Yip Road/Hang Hau Road | Roundabout/DFC | 0.96 | 0.86 | 0.96 | 0.86 |
| With Junction Modification |  |  |  |  |  |  |
| J6 | Po Ning Road/ Sheung Ning Road/ Ying Yip Road | Signalized/RC | 12\% | 5\% | 12\% | 5\% |
| J7 | Po Ning Road/ Po Shun Road/ Po Lam Road North ${ }^{(2)}$ | Roundabout/DFC | 0.90 | 0.94 | 0.90 | 0.94 |

Note: $\quad$ (1) $\quad \mathrm{RC}=$ Reserve Capacity for signalized junction
$\mathrm{DFC}=$ Design Flow to Capacity ratio for priority
(2) Based on the modified rad marking as shown in Road westbound. The layout will be subjected to further review if deemed necessary.
4.7.2 As shown in Table 4.6, all concerned junctions will operate with spare capacity in future scenarios, except for J/O Po Ning Road/Po Shun Road/Po Lam Road North (Junction J7). Junction modification is proposed as shown in Appendix 4 for J/O Po Ning Road/Po Shun Road/Po Lam Road North (Junction J7). By providing a segregated left turning lane for Po Ning Road westbound, the left turn traffic does no. have to give way to others using the roundabout which Ran whe to improve the DFC of the junction. Moreover, by comparing the assessment results in the Reference and the Design Scenarios, the numbers are almost identical for Junction J7. As a result, the traffic generated by the proposed residential development is not anticipated to induce significant traffic impact onto the adjacent junctions.

## Table 4.7 Link Capacity Assessment for Design Year 2032

| No. | Link | Bound | Capacity (pcu/hr) | Flows (pcu/hour) [V/C Ratio] |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | AM Peak Hour | PM Peak Hour |
| 2032 Reference |  |  |  |  |  |
| L1 | Po Shun Road | S/B | 3,600 | 1,156 [0.32] | 1,095 [0.30] |
|  |  | N/B | 3,600 | 1,769 [0.49] | 1,676 [0.47] |
| L2 | Wan Po Road | S/B | 3,600 | 1,742 [0.48] | 1,691 [0.47] |
|  |  | N/B | 3,600 | 1,286 [0.36] | 1,032 [0.29] |
| L3 | Po Yap Road | E/B | 3,600 | 1,465 [0.41] | 1,069 [0.30] |
|  |  | W/B | 3,600 | 1,305 [0.36] | 1,237 [0.34] |
| L4 | Hang Hau Road | S/B | 1,140 | 886 [0.78] | 802 [0.70] |
|  |  | N/B | 1,140 | 512 [0.45] | 702 [0.62] |
| L5 | Po Lam Road North | S/B | 3,600 | 1,156 [0.32] | 1,080 [0.30] |
|  |  | N/B | 3,600 | 1,114 [0.31] | 1,318 [0.37] |
| L6 | Ying Yip Road | S/B | 1,140 | 1,109 [0.97] | 884 [0.78] |
|  |  | N/B | 2,280 ${ }^{(1)}$ | 1,514 [0.66] | 853 [0.37] |
| L7 | Clear Water Bay Road | S/B | 1,320 | 1,240 [0.94] | 1,102 [0.83] |
|  |  | N/B | 2,640 | 1,477 [0.56] | 1,375 [0.52] |
| 2032 Design |  |  |  |  |  |
| L1 | Po Shun Road | S/B | 3,600 | 1,156 [0.32] | 1,095 [0.30] |
|  |  | N/B | 3,600 | 1,777 [0.49] | 1,682 [0.47] |
| L2 | Wan Po Road | S/B | 3,600 | 1,742 [0.48] | 1,691 [0.47] |
|  |  | N/B | 3,600 | 1,325 [0.37] | 1,051 [0.29] |
| L3 | Po Yap Road | E/B | 3,600 | 1,475 [0.41] | 1,077 [0.30] |
|  |  | W/B | 3,600 | 1,337 [0.37] | 1,250 [0.35] |
| L4 | Hang Hau Road | S/B | 1,140 | 894 [0.78] | 808 [0.71] |
|  |  | N/B | 1,140 | 533 [0.47] | 717 [0.63] |
| L5 | Po Lam Road North | S/B | 3,600 | 1,156 [0.32] | 1,080 [0.30] |
|  |  | N/B | 3,600 | 1,122 [0.31] | 1,324 [0.37] |
| L6 | Ying Yip Road | S/B | 1,140 | 1,109 [0.97] | 884 [0.78] |
|  |  | N/B | 2,280 ${ }^{(1)}$ | 1,514 [0.66] | 853 [0.37] |
| L7 | Clear Water Bay Road | S/B | 1,320 | 1,241 [0.94] | 1,104 [0.84] |
|  |  | N/B | 2,640 | 1,477 [0.56] | 1,375 [0.52] |

Note: (1) Ying Yip Road northbound will be widened to 2 lanes in association with the planned housing sites in Tseung Ying Yip
Kwan O.
4.7.3 As shown in Table 4.7, all concerned road links will operate with spare capacity in future scenarios, except for Ying Yip Road southbound. Again, by comparing the assessment results in the Reference and the Design Scenarios, the numbers are almost identical. As a result, the traffic generated by the proposed residential development is not anticipated to induce significant traffic impact onto Ying Yip Road

## 5 PUBLIC TRANSPORT ASSESSMENT

### 5.1 Future Public Transport Services

5.1.1 Since the Site is located within 500 m radius of the MTR Hang Hau Station, it is expected that the residents will make use of MTR and the PTI for public transport services.

### 5.2 Impact Assessment on Public Transport Services

5.2.1 In order to assess the impact on the public transport services, the pedestrian generation/attraction of the Site during peak hour are estimated in Table 5.1.

Table 5.1 Pedestrian Generation of the Site

| Type | Unit/ Content | AM Peak |  | PM Peak |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
|  |  | Att. | Gen. | Att. | Gen. |
| Pedestrian Trip Rates | ped/hrflat | 0.2200 | 0.8000 | 0.5000 | 0.1700 |
| Pedestrian Generation | 432 flats | 96 | 346 | 216 | 74 |

5.2.2 Table 5.1 shows that the Site will generate a two-way pedestrian flow of 442 and 290 pedestrian/hour during AM and PM peak, respectively.
5.2.3 In order to estimate the public transport demand of the proposed development, reference was made to the recorded number of boardings for different transport mode as documented in the Final Report of the Travel Characteristics Survey 2011. The adopted modal split for local guests is shown in Table 5.2 .

Table 5.2 Modal Split from Travel Characteristics Survey 2011

| Mode | Public |  |  | Private |  | Total |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  | MTR | PLB | Franchised <br> Bus | Taxi | Private <br> Vehicle |  |
| Total Boardings ('000) | 4,047 | 1,972 | 3,987 | 950 | 1,735 | 12,691 |
| $\%$ of Total | $31.9 \%$ | $15.5 \%$ | $31.4 \%$ | $7.5 \%$ | $13.7 \%$ | $100.0 \%$ |
| $\%$ of Total | $78.8 \%$ |  |  | $21.2 \%$ |  | $100.0 \%$ |

5.2.4 Based on the estimated pedestrian generation/attraction in Table 5.1, the number of visitors using each of the transport mode are summarized in Table 5.3

## Table 5.3 Estimated Number of Visitors using Public Transport Services



Note
(1) Capacity adopted from
5.2.5 As shown in Table 5.3, it is anticipated that the proposed development will not generate significant amount of pedestrian demand on the public transport facilities.

## 6 PROPOSED PEDESTRIAN FACILIATES

### 6.1 Proposed Improvement along Chiu Shun Road and at J/O of Chiu Shun Road/Ngan O Road

6.1.1 Currently, there is no pedestrian footpath at the eastern kerbside of Chiu Shun Road along the frontage of the Site. With the proposed development, it is proposed to modify the existing planter to provide a minimum 3-meter wide footpath.
6.1.2 In order to improve the accessibility of the Site to the public transport services provided on Ngan O Road and the public transport interchange at MTR Hang Hau Station, a schematic layout of the pedestrian connection is proposed as shown in Figure 7 to introduce an at-grade pedestrian crossing across Chiu Shun Road as well as to modify the existing planter to provide a minimum 3-meter wide footpath. Based on the proposed layout, the junction is re-assessed and the results are shown in Table 6.1. The detailed calculation sheets are shown in Appendix 5

## Table 6.1 Junction Capacity Assessment for Design Year 2032

| Jun. <br> No. | Junction | Type/ Capacity <br> Index |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 2032 Design <br> (With Existing <br> Layout) |  | 2032 Design <br> (With Proposed <br> Layout) |  |
|  |  |  | AM Peak | PM Peak | AM Peak | PM Peak |
| J2 | Chiu Shun Road/Ngan O Road | Signalized/RC | $55 \%$ | $68 \%$ | $25 \%$ | $42 \%$ |

Note: (1) $\quad \mathrm{RC}=$ Reserve Capacity for signalized junction.
6.1.3 As shown in Table 6.1, the provision of pedestrian crossing across Chiu Shun Road will not induce significant adverse traffic impact on the junction. However, it should be noted that the proposed layout is schematic and indicative only. It may be subject to modifications under the detailed design stage.

## $7 \quad$ PROPOSED TRANSPORT FACILITIES PROVISIONS

### 7.1 Access Arrangement

7.1.1 At present, the ingress/egress of the existing Ventilation Building is provided at Chiu Shun Road. The existing vehicular access will be maintained. The overall traffic layout will be subjected to detail design under the GBP stage.

### 7.2 Car Parking and Loading/Unloading Provision

7.2.1 The car parking and loading/unloading provision of the proposed private residential development has been estimated in accordance with the latest Hong Kong Planning Standards and Guidelines (HKPSG).
7.2.2 The proposed car parking provision for the Site is calculated as shown in Table 7.1.

Table 7.1 Parking and Loading/Unloading Provision

| Residential (432 flats) | HKPSG Standards | Required Provision | Proposed Provision |
| :---: | :---: | :---: | :---: |
| Car Parking | Parking Requirement $=G P S \times R 1 \times R 2 \times R 3$ <br> Where <br> GPS = 1 car space per 6-9 flats <br> R1 $=0.7$ for average flat size $40-70 m^{2}$ GFA <br> $R 2=0.75$ for developments within a 500 m -radius of rail station <br> R3 $=0.90$ for domestic plot ratios $5.00-8.00$ | 23-35 | $35{ }^{(1)}$ |
|  | $1-5$ visitor parking spaces for private residential developments with more than 75 units per block or as determined by the Authority | 2-10 | $10^{(2)}$ |
| Total |  | 25-45 | $45^{(3)}$ |
| Motorcycle Parking | 1 motorcycle parking space per $100-150$ flats | 3-5 | $10^{(4)}$ |
| Loading/Unloading | 1 loading / unloading bay for goods vehicles per block | 2 | 2 |
| Bicycle Parking | Within a $0.5-2 \mathrm{~km}$ radius of a rail station, 1 bicycle parking space for every 15 flats with flat size smaller than $70 \mathrm{~m}^{2}$ | 29 | $44^{(5)}$ |

Note: (1) 1 no. of car parking space to be allocated for disable use.
(2) 1 no. of visitor car parking space to be allocated for disable use
(3) A total of 2 car parking spaces to be allocated for disable use.
(4) A higher provision standard to be adopted as per comments from Transport Department received on 29 May
(5) A higher provision standard to be adopted at a rate of $10 \%$ of the number of flats as per comments from
7.2.3 Based on Table 7.1, a total of 45 car parking spaces (including 2 no. of parking space for disable use) 10 motorcycle parking spaces, 2 MGV/HGV loading/unloading spaces and 44 bicycle parking spaces will be provided in accordance with HKPSG standards.
7.2.4 Two car lifts will be provided to serve the car parking spaces on the upper floor. More details will be discussed in Section 7.3.

### 7.3 Car Lift Assessment

7.3.1 To assess the performance of the car lift system, it is necessary to adopt an appropriate arrival rate (attraction rate) in the assessment. With reference to the trip rates as documented in the latest Transport Planning and Design Manual, Volume 1, Chapter 3 prepared by the Transport Department, the peak traffic attraction rate of the proposed development is $0.0425 \mathrm{pcu} / \mathrm{hr} / \mathrm{unit}$ occurred during the AM peak period.
7.3.2 The servicing rate of the car lift system is estimated based on the operation data provided by the car lift supplier.
7.3.3 A $M / M / N$ queuing model is adopted to assess the probability of nos. of vehicle queuing in the car lift system. The adopted model is based on the following assumptions:

- In $\mathbf{M} / \mathrm{M} / \mathrm{N}$, the first " M " denotes the average arrival rates of vehicles is exponentially (i.e. randomly) distributed;
- In $M / M / N$, the second " $M$ " denotes the average arrival rates of the lift is exponentially (i.e. randomly) distributed; and
- In $M / M / \mathbf{N}$, the last " $N$ " denotes multiple service channels (i.e. lifts) are provided.
7.3.4 Given the assumption that the arrival rates of vehicles and lifts are random, the worst case scenario , when the $1^{\text {st }}, 2^{\text {nd }}$ and $3^{\text {rd }}$ cars arrive when both lifts have just left ground floor, has already been taken into account in the Car Lift Assessment. From the assessment result, the probability of queuing onto the public road is only $0.6 \%$. In other words, there is $99.4 \%$ confidence level that no traffic queue will occur in the public road and the system performance is found to be satisfactory. The details of the car lift assessment calculation are shown in Appendix 6.
7.3.5 At the same time, the future car park operator will ensure that the vehicles waiting for car lifts will not obstruct the loading/unloading and RCV bays.


## 8 SUMMARY AND CONCLUSION

### 8.1 Summary

8.1.1 LLA Consultancy Limited was commissioned to carry out a traffic impact assessment study to assess the potential traffic impact due to the proposed residential development scheme at the Site.
8.1.2 The proposed development will consist of 432 flats with an average flat size of about $62 \mathrm{~m}^{2}$. The proposed development is expected to generate two-way traffic volumes of $51 \mathrm{pcu} / \mathrm{hour}$ and 29 pcu/hour, in the AM and PM peak hours, respectively. The increase in traffic was assigned onto the existing road network based on the observed traffic pattern.
8.1.3 Junction/Link capacity assessments were carried out for the key junctions/road links for both the Reference and Design scenarios in 2032 based on both the existing junction layout and the layout after modification. The assessment results reveal that all concerned junctions will operate with spare capacity in the future scenario, except for J/O Po Ning Road/Po Shun Road/Po Lam Road North (Junction J7) and Ying Yip Road southbound. However, by comparing the assessment results in the Reference and the Design Scenarios, the numbers are almost identical for both Junction J7 and Ying Yip Road southbound. As a result, the traffic generated by the proposed residential development is not anticipated to induce significant traffic impact onto the adjacent junctions
8.1.4 In order to improve the accessibility of the Site to the public transport services provided on Ngan O Road and the public transport interchange at MTR Hang Hau Station, a schematic layout of the pedestrian connection is proposed at J/O Chiu Shun Road/Ngan O Road to introduce an at-grade pedestrian crossing across Chiu Shun Road.
8.1.5 The existing vehicular access on Chiu Shun Road will be maintained
8.1.6 The proposed residential development will provide the following internal transport facilities:

- 45 private car parking spaces (including 2 nos. for disable use)
- motorcycle parking spaces
- 2 MGV/HGV loading/unloading spaces
- 44 bicycle parking spaces


### 8.2 Conclusion

8.2.1 The findings of the traffic impact assessment indicated that the traffic generated by the proposed residential development is not anticipated to induce significant traffic impact onto the adjacent junctions and railway network. As a result, the proposed residential development is acceptable in traffic point of view








## Appendix 1

Junction Capacity Assessment

- Existing Scenario








## LLA CONSULTANCY LIMITED




ARM
A B C D
INPUT PARAMETERS

| v | = | Approach half width (m) | 7.40 | 7.30 | 7.80 | 7.70 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E | $=$ | Entry width (m) | 12.50 | 13.50 | 15.60 | 15.00 |
| L | = | Effective length of flare (m) | 30.00 | 19.00 | 17.00 | 19.00 |
| R | = | Entry radius (m) | 23.00 | 145.00 | 53.00 | 55.00 |
| D | $=$ | Inscribed circle diameter (m) | 80.00 | 80.00 | 80.00 | 80.00 |
| A | $=$ | Entry angle (degree) | 60.00 | 60.00 | 55.00 | 55.00 |
| Q | = | Entry flow (pcu/h) | 378 | 459 | 278 | 630 |
| Qc | $=$ | Circulating flow across entry (pcu/h) | 540 | 184 | 327 | 540 |
| OUTPUT PARAMETERS: |  |  |  |  |  |  |
| s | = | Sharpness of flare $=1.6(\mathrm{E}-\mathrm{V}) / \mathrm{L}$ | 0.27 | 0.52 | 0.73 | 0.61 |
| K | = | 1-0.00347(A-30)-0.978(1/R-0.05) | 0.90 | 0.94 | 0.94 | 0.94 |
| X2 | = | $\mathrm{V}+((\mathrm{E}-\mathrm{V}) /(1+2 \mathrm{~S})$ ) | 10.70 | 10.33 | 10.96 | 10.97 |
| M | $=$ | $\operatorname{EXP}((\mathrm{D}-60) / 10)$ | 7.39 | 7.39 | 7.39 | 7.39 |
| F | $=$ | 303*×2 | 3243 | 3131 | 3321 | 3325 |
| Td | = | 1+(0.5/(1+M)) | 1.06 | 1.06 | 1.06 | 1.06 |
| Fc | $=$ | $0.21 *$ Td( $1+0.2 *$ X2) | 0.70 | 0.68 | 0.71 | 0.71 |
| Qe | $=$ | K(F-Fc*Qc) | 2586 | 2819 | 2915 | 2778 |
| DFC | $=$ | Design flow/Capacity = Q/Qe | 0.15 | 0.16 | 0.10 | 0.23 |

FFC of Critical Approach =

DFC = Design flow/Capacity $=$ Q/Qe
$\begin{array}{llll}0.15 & 0.16 & 0.10 & 0.23\end{array}$
DFC of Critical Approach =

## LLA CONSULTANCY LIMITED

| ROUNDABOUT CALCULATION |  |  | intials | date |
| :---: | :---: | :---: | :---: | :---: |
|  | PRoJECT No: 40370 | PrEPARED BY: | vWI | Dec |
| Existing PM |  | CHECKED BY: | GWL | Dec-19 |
|  |  |  |  |  |



ARM
A B C D
INPUT PARAMETERS

| v |  | Approach half width (m) | 7.40 | 7.30 | 7.80 | 7.70 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E | = | Entry width (m) | 12.50 | 13.50 | 15.60 | 15.00 |
| L | = | Effective length of flare (m) | 30.00 | 19.00 | 17.00 | 19.00 |
| R | = | Entry radius (m) | 23.00 | 145.00 | 53.00 | 55.00 |
| D | = | Inscribed circle diameter (m) | 80.00 | 80.00 | 80.00 | 80.00 |
| A | = | Entry angle (degree) | 60.00 | 60.00 | 55.00 | 55.00 |
| Q | = | Entry flow (pcu/h) | 346 | 938 | 320 | 552 |
| Qc | = | Circulating flow across entry (pcu/h) | 482 | 210 | 379 | 482 |
| OUTPUT PARAMETERS: |  |  |  |  |  |  |
| S | $=$ | Sharpness of flare $=1.6(\mathrm{E}-\mathrm{V}) / \mathrm{L}$ | 0.27 | 0.52 | 0.73 | 0.61 |
| K | = | 1-0.00347(A-30)-0.978(1/R-0.05) | 0.90 | 0.94 | 0.94 | 0.94 |
| X2 | = | $\mathrm{V}+((\mathrm{E}-\mathrm{V}) /(1+2 \mathrm{~S})$ ) | 10.70 | 10.33 | 10.96 | 10.97 |
| M | = | $\operatorname{EXP}((\mathrm{D}-60) / 10)$ | 7.39 | 7.39 | 7.39 | 7.39 |
| F | = | 303*X2 | 3243 | 3131 | 3321 | 3325 |
| Td | = | 1+(0.5/(1+M)) | 1.06 | 1.06 | 1.06 | 1.06 |
| Fc | = | $0.21 * T d(1+0.2 * X 2)$ | 0.70 | 0.68 | 0.71 | 0.71 |
| Qe | = | $\mathrm{K}(\mathrm{F}-\mathrm{Fc} * \mathrm{Qc})$ | 2622 | 2803 | 2880 | 2817 |
| DFC | = | Design flow/Capacity = Q/Qe | 0.13 | 0.33 | 0.11 | 0.20 |










## Appendix 2

Schematic Junction Layout of
J/O Po Ning Road/ Sheung Ning Road/ Ying Yip Road


## Appendix 3

Junction Capacity Assessment

- Reference \& Design Scenarios














## LLA CONSULTANCY LIMITED

| ROUNDABOU | CALCULATION |  | INITIALS | E |
| :---: | :---: | :---: | :---: | :---: |
|  | PRoJECT No.: 40370 | EDBY: | vWI | 析 |
| Reference AM |  | CHECKED BY: | 6 WL | Dec |



ARM
A B C D
NPUT PARAMETERS

| $\checkmark$ | = | Approach half width (m) | 7.40 | 7.30 | 7.80 | 7.70 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E | = | Entry width (m) | 12.50 | 13.50 | 15.60 | 15.00 |
| L | = | Effective length of flare (m) | 30.00 | 19.00 | 17.00 | 19.00 |
| R | = | Entry radius (m) | 23.00 | 145.00 | 53.00 | 55.00 |
| D | = | Inscribed circle diameter (m) | 80.00 | 80.00 | 80.00 | 80.00 |
| A | = | Entry angle (degree) | 60.00 | 60.00 | 55.00 | 55.00 |
| Q | = | Entry flow (pcu/h) | 386 | 1188 | 543 | 834 |
| Qc | = | Circulating flow across entry (pcu/h) | 1223 | 152 | 1002 | 1223 |
| OUTPUT PARAMETERS: |  |  |  |  |  |  |
| S | = | Sharpness of flare $=1.6(\mathrm{E}-\mathrm{V}) / \mathrm{L}$ | 0.27 | 0.52 | 0.73 | 0.61 |
| K | = | 1-0.00347(A-30)-0.978(1/R-0.05) | 0.90 | 0.94 | 0.94 | 0.94 |
| x2 | = | $\mathrm{V}+((\mathrm{E}-\mathrm{V}) /(1+2 \mathrm{~S})$ ) | 10.70 | 10.33 | 10.96 | 10.97 |
| M | = | $\operatorname{EXP}((\mathrm{D}-60) / 10)$ | 7.39 | 7.39 | 7.39 | 7.39 |
| F | = | 303*X2 | 3243 | 3131 | 3321 | 3325 |
| Td | = | 1+(0.5/(1+M)) | 1.06 | 1.06 | 1.06 | 1.06 |
| Fc | = | 0.21*Td(1+0.2*X2) | 0.70 | 0.68 | 0.71 | 0.71 |
| Qe | = | K(F-Fc*Qc) | 2155 | 2840 | 2462 | 2319 |
| DFC | = | Design flow/Capacity = Q/Qe | 0.18 | 0.42 | 0.22 | 0.36 |

2951
PCU
DFC of Critical Approach $=$
0.42

## LLA CONSULTANCY LIMITED

| ROUNDABOUT CALCULATION |  |  | Intials | dAtE |
| :---: | :---: | :---: | :---: | :---: |
|  | PRoJECT No.: 40370 | ED Br: | uwi | 19 |
| Reference PM | FILENAMI J4. PYR P PrR.x[sx] | CHECKED BY: | 6WL | Dec |

(ARM D)


INPUT PARAMETERS

| V | $=$ | Approach half width $(\mathrm{m})$ | 7.40 | 7.30 | 7.80 |
| :--- | :--- | ---: | ---: | ---: | ---: |
| E | $=$ | Entry width $(\mathrm{m})$ | 12.50 | 13.50 | 15.60 |

## LLA CONSULTANCY LIMITED

| ROUNDABOUT CALCULATION |  |  | Intials | DATE |
| :---: | :---: | :---: | :---: | :---: |
|  | PROJECT No.: 40370 | br: | uwi | 析 |
| 32 Design AM | FILENAMI J4. PYR P PrR.x[sx] | CHECKED BY: | GWL | Dec |



| ARM |  | A | B | C | D |
| :---: | :---: | :---: | :---: | :---: | :---: |
| INPUT PARAMETERS: |  |  |  |  |  |
| v | $=$ Approach half width (m) | 7.40 | 7.30 | 7.80 | 7.70 |
|  | $=$ Entry width (m) | 12.50 | 13.50 | 15.60 | 15.00 |
| L | $=$ Effective length of flare (m) | 30.00 | 19.00 | 17.00 | 19.00 |
| R | $=$ Entry radius (m) | 23.00 | 145.00 | 53.00 | 55.00 |
| D | $=\quad$ Inscribed circle diameter ( m ) | 80.00 | 80.00 | 80.00 | 80.00 |
| A | $=$ Entry angle (degree) | 60.00 | 60.00 | 55.00 | 55.00 |
| Q | $=$ Entry flow (pcu/h) | 386 | 1204 | 543 | 847 |
| Qc | $=$ Circulating flow across entry (pcu/h) | 1236 | 152 | 1018 | 1236 |
| OUTPUT PARAMETERS: |  |  |  |  |  |
| S | $=$ Sharpness of flare $=1.6(\mathrm{E}-\mathrm{V}) / \mathrm{L}$ | 0.27 | 0.52 | 0.73 | 0.61 |
|  | $=1-0.00347(A-30)-0.978(1 / R-0.05)$ | 0.90 | 0.94 | 0.94 | 0.94 |
| X2 | $=\quad \mathrm{V}+((\mathrm{E}-\mathrm{V}) /(1+2 \mathrm{~S})$ ) | 10.70 | 10.33 | 10.96 | 10.97 |
|  | $=\operatorname{EXP}((\mathrm{D}-60) / 10)$ | 7.39 | 7.39 | 7.39 | 7.39 |
| F | $=303 * \times 2$ | 3243 | 3131 | 3321 | 3325 |
| Td | $=1+(0.5 /(1+\mathrm{M})$ ) | 1.06 | 1.06 | 1.06 | 1.06 |
| Fc | $=0.21 * \mathrm{Td}(1+0.2 * \times 2)$ | 0.70 | 0.68 | 0.71 | 0.71 |
|  | $=\mathrm{K}(\mathrm{F}-\mathrm{FC} * \mathrm{Qc})$ | 2147 | 2840 | 2452 | 2310 |
| DFC | $=$ Design flow/Capacity $=$ Q/Qe | 0.18 | 0.42 | 0.22 | 0.37 |

## LLA CONSULTANCY LIMITED



ARM
A B C D
NPUT PARAMETERS

| V | = | Approach half width (m) | 7.40 | 7.30 | 7.80 | 7.70 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E | = | Entry width (m) | 12.50 | 13.50 | 15.60 | 15.00 |
| L | = | Effective length of flare (m) | 30.00 | 19.00 | 17.00 | 19.00 |
| R | = | Entry radius (m) | 23.00 | 145.00 | 53.00 | 55.00 |
| D | = | Inscribed circle diameter (m) | 80.00 | 80.00 | 80.00 | 80.00 |
| A | = | Entry angle (degree) | 60.00 | 60.00 | 55.00 | 55.00 |
| Q | = | Entry flow (pcu/h) | 558 | 1137 | 504 | 383 |
| Qc | = | Circulating flow across entry (pcu/h) | 731 | 220 | 761 | 731 |
| OUTPUT PARAMETERS: |  |  |  |  |  |  |
| S | = | Sharpness of flare $=1.6(\mathrm{E}-\mathrm{V}) / \mathrm{L}$ | 0.27 | 0.52 | 0.73 | 0.61 |
| K | = | 1-0.00347(A-30)-0.978(1/R-0.05) | 0.90 | 0.94 | 0.94 | 0.94 |
| X2 | = | $\mathrm{V}+((\mathrm{E}-\mathrm{V}) /(1+2 \mathrm{~S})$ ) | 10.70 | 10.33 | 10.96 | 10.97 |
| M | = | $\operatorname{EXP}((\mathrm{D}-60) / 10)$ | 7.39 | 7.39 | 7.39 | 7.39 |
| F | = | 303*X2 | 3243 | 3131 | 3321 | 3325 |
| Td | = | 1+(0.5/(1+M)) | 1.06 | 1.06 | 1.06 | 1.06 |
| Fc | = | $0.21 * T d(1+0.2 * \mathrm{X} 2)$ | 0.70 | 0.68 | 0.71 | 0.71 |
| Qe | = | $\mathrm{K}(\mathrm{F}-\mathrm{Fc} * \mathrm{Qc})$ | 2465 | 2796 | 2624 | 2649 |
| DFC | = | Design flow/Capacity = Q/Qe | 0.23 | 0.41 | 0.19 | 0.14 |






















## LLA CONSULTANCY LIMITED

| N | INITIALS | DATE |  |  |  |  |  |  |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 40370 | PREPARED BY: | VWI | Dec-19 |  |  |  |  |  |
| G:IProject1403701D. CHECKED BY: | SLN | Dec-19 |  |  |  |  |  |  |
|  |  |  |  |  |  | REVIEWED BY: | SLN | Dec-19 |

[4]
(ARM B)
Po Ning Road
[5] 1769
Sheung Ning Road
(ARM C)


A B
C
INPUT PARAMETERS:
$\mathrm{V} \quad=\quad$ Approach half width ( m )
$=\quad$ Effective length of flare $(\mathrm{m})$
$=$ Entry radius ( m )
$=$ Inscribed circle diameter ( m )
$=$ Entry angle (degree)
$=\quad$ Entry flow (pcu/h)
$=$ Circulating flow across entry (pcu/h)
$=\quad$ Sharpness of flare $=1.6(\mathrm{E}-\mathrm{V}) / \mathrm{L}$
$1-0.00347(\mathrm{~A}-30)-0.978(1 / \mathrm{R}-0.05)$
$=\operatorname{EXP}((\mathrm{D}-60) / 10)$
$=303 * \times 2$
$=0.21^{*} \mathrm{Td}\left(1+0.2^{*} \mathrm{X} 2\right)$
$\mathrm{K}\left(\mathrm{F}-\mathrm{Fc}{ }^{\star} \mathrm{Qc}\right)$ *
Design flow/Capacity = Q/Qe
$\begin{array}{lll}7.00 & 3.80 & 7.90 \\ 1130 & 7.30 & 10.00\end{array}$

| $11.30-7.30$ | 10.00 |
| :--- | :--- | :--- |

$\begin{array}{lll}15.00 & 15.00 & 10.00\end{array}$
$\begin{array}{lll}60.00 & 55.00 & 70.00\end{array}$
$\begin{array}{lll}55.00 & 55.00 & 55.00\end{array}$
$40.00 \quad 45.00 \quad 25.00$
$\begin{array}{lll}1156 & 870 & 1769\end{array}$
1564821896
$\begin{array}{lll}0.46 & 0.37 & 0.34\end{array}$
$1.00 \quad 0.98 \quad 1.05$
$\begin{array}{lll}9.24 & 5.80 & 9.16\end{array}$
$\begin{array}{lll}0.61 & 0.61 & 0.61\end{array}$
$2801 \quad 1759 \quad 2774$
$\begin{array}{lll}1.31 & 1.31 & 1.31\end{array}$
$0.78 \quad 0.59 \quad 1.31$
$\begin{array}{lll}1413 & 1119 & 1966\end{array}$
Total In Sum =
3795
PCU
$0.82 \quad 0.78 \quad 0.90$
DFC of Critical Approach =

## LLA CONSULTANCY LIMITED

| N | INITIALS | DATE |  |  |  |  |  |  |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 40370 | PREPARED BY: | VWI | Dec-19 |  |  |  |  |  |
| G:IProject1403701D. CHECKED BY: | SLN | Dec-19 |  |  |  |  |  |  |
|  |  |  |  |  |  | REVIEWED BY: | SLN | Dec-19 |

```
    = Approach half width (m)
```

    \(=\) Entry width (m)
    \(=\) Effective length of flare ( m )
    \(=\quad\) Entry radius ( m )
    \(=\quad\) Inscribed circle diameter ( m )
    \(=\) Inscribed circle diame
    $=\quad$ Entry angle (degree)
$\begin{array}{ll}= & \text { Entry angle (degree) } \\ = & \text { Entry flow (pcu/h) }\end{array}$
= Circulating flow across entry (pcu/h)
OUTPUT PARAMETERS:
$\mathrm{S}=\quad$ Sharpness of flare $=1.6(\mathrm{E}-\mathrm{V}) / \mathrm{L}$
$\begin{array}{ll}\mathrm{K} & =1-0.00347(\mathrm{~A}-30)-0.978(1 / \mathrm{R}-0.05) \\ \mathrm{X} 2 & =\mathrm{V}+((\mathrm{E}-\mathrm{V})(1+2 \mathrm{~S}))\end{array}$
$\mathrm{x} 2=\mathrm{V}+((\mathrm{E}-\mathrm{V}) /(1+2 \mathrm{~S}))$
$\mathrm{M}=\operatorname{EXP}((\mathrm{D}-60) / 10)$
$=303^{*} \times 2$
$=\quad 1+(0.5 /(1+\mathrm{M}))$
$=1+(0.5 /(1+\mathrm{M}))$
$=0.21^{*} \mathrm{Td}\left(1+0.2^{*} \mathrm{X} 2\right)$
$=K\left(F-F c^{*} \mathrm{Qc}\right)$ *
DFC = Design flow/Capacity = Q/Qe

| 7.00 | 3.80 | 7.90 |
| ---: | ---: | ---: |
| 11.30 | 7.30 | 10.00 |


| 11.30 | 7.30 | 10.00 |
| :--- | :--- | :--- |

                                \(\begin{array}{lll}15.00 & 15.00 & 10.00\end{array}\)
                                \(\begin{array}{llll}60.00 & 55.00 & 70.00\end{array}\)
                                \(\begin{array}{lll}55.00 & 55.00 & 70.00\end{array}\)
                                \(55.00 \quad 55.00 \quad 55.00\)
                                \(\begin{array}{rrr}40.00 & 45.00 & 25.00 \\ 1080 & 1073 & 1676\end{array}\)
    $1459 \quad 783 \quad 1095$
$\begin{array}{lll}0.46 & 0.37 & 0.34 \\ 1.00 & 0.08 & 1.05\end{array}$
$\begin{array}{lll}1.00 & 0.98 & 1.05\end{array}$
$9.24 \quad 5.80-9.16$
$\begin{array}{lll}0.61 & 0.61 & 0.61\end{array}$
$\begin{array}{llll}2801 & 1759 & 2774\end{array}$
$\begin{array}{llll}1.31 & 131 & 1.31\end{array}$
$\begin{array}{lll}1.31 & 1.31 & 1.31 \\ 0.78 & 0.59 & 0.78\end{array}$
$\begin{array}{lll}0.78 & 0.59 & 0.78 \\ 1487 & 1139 & 1819\end{array}$
$\begin{array}{lll}1487 & 1139 & 1819\end{array}$
Total In Sum =

DFC of Critical Approach =



Appendix 4

# Schematic Junction Layout of 

 J/O Po Ning Road/ Po Shun Road/ Po Lam Road North

Appendix 5
Junction Capacity Assessment - Design Scenario (With Proposed Layout)




## Appendix E

Sewerage Impact Assessment

PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE

Sewerage Impact Assessment


## PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND <br> ADJACENT AREA FOR RESIDENTIAL USE

Sewerage Impact Assessment

Author

Reviewer

Approver

Report No
EB001753/PVB/SIA/R07
Date
May 2020

## CONTENTS

1 INTRODUCTION

$\qquad$ .....  .1
1.1 Background .....  1
1.2 Objectives .....  1
1.3 Information Available for the Study$\ldots .$.
2 PROJECT OUTLINE ..... 2
2.1 Project Background and Project Site .....  2
2.2 Planning and Implementation .....  2
3 EXISTING PUBLIC SEWERAGE INFRASTRUCTURE AND EXISTING BUILDINGSEWERAGE
$\qquad$ 2
3.1 Existing Public Sewerage .....  2
3.2 Existing Building Sewerage. .....  2
4 METHOD OF ANALYSIS .....  3
4.1 Estimation of Sewage Flow Rates .....  3
4.2 Assumptions .....  4
5 ASSESSMENT ..... 6
5.1 Planned Sewage Flow - Proposed Development Scenario. .....  6
5.2 Proposed Sewerage Works .....  7
6 CONCLUSIONS AND RECOMMENDATIONS .....  8

## LIST OF DRAWINGS

3001-EB001753-06 Existing Public Sewerage System in the Vicinity of the Site and Recommended Building Sewer Connection to Existing Public Sewerage Infrastructure

## 3002-EB001753-02 Cross Section of Proposed Sewerage Works

3003-EB001753-01 Recommended Building Sewer Connection to Existing Public Sewerage Infrastructure

## LIST OF APPENDICES

APPENDIX A
Assessment of Sewage Flows for the New Development

## 1 INTRODUCTION

### 1.1 Background

1.1.1 Arcadis Design \& Engineering Limited was commissioned by DLN Architects Limited to undertake a sewerage impact assessment (SIA) for the proposed residential development at MTR Pak Shing Kok Ventilation Building (PVB) Site, and adjacent "Green Belt" Site to the south of PVB in Tseung Kwan O, New Territories (hereafter referred to as "the Site").
$1.2 \quad$ Objectives
1.2.1 This SIA report outlines the existing sewerage system in the vicinity of the Site and investigates the potential sewerage impacts arising from the proposed residential development. It also proposes appropriate mitigation measures if necessary.
1.2.2 The objectives of this SIA are as follows:

- Identify any potential sewerage impact arising from the Site;
- Identify design requirements of the sewerage system of the proposed residential development; and
- Substantiate the technical feasibility of connecting the proposed sewerage system of the proposed development with the nearby public sewerage system.
1.3 Information Available for the Study
1.3.1 The following information was reviewed for the Study:
a. Conceptual Scheme of the Proposed Residential Development, February 2018;
b. The Drainage Services Department Drainage Record Sheet of existing public sewerage infrastructure in the vicinity of the Site, April 2016;
c. DSD Sewerage Manual (Part 1) - Key Planning Issues and Gravity Collection System (Third Edition, May 2013);
d. EPD Technical Paper EPD/TP 1/05, Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (March 2005) (GESF);
e. PlanD Technical Document - HK Planning Standards \& Guidelines, February 2014;
f. PlanD Study Document - Commercial and Industrial Floor Space Utilization Survey;
g. Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/26;
h. BS EN 12056-2:2000 - Gravity Drainage Systems Inside Buildings - Part 2: Sanitary Pipework, Layout and Calculation (British Standard).


## 2 PROJECT OUTLINE

### 2.1 Project Background and Project Site

2.1.1 A new residential development was proposed to be constructed at the MTR PVB Site, and adjacent "Green Belt" Site to the south of PVB. The Site is bounded by Chiu Shun Road to the northwest and is surrounded by vegetated manmade slopes.
2.1.2 The proposed development comprises two residential towers with 27 floors each on a podium with clubhouse and car park.
2.2 Planning and Implementation
2.2.1 The proposed development would be constructed in one single phase. The tentative programme of the proposed private housing development population intake was scheduled in 2029.

3 EXISTING PUBLIC SEWERAGE INFRASTRUCTURE AND EXISTING BUILDING SEWERAGE
3.1 Existing Public Sewerage
3.1.1 As shown in drawing no. 3001-EB001753-06, an existing 1650 mm diameter public sewer pipeline along the northeast bound carriageway of Chiu Shun Road serves the adjacent land lots. A 300 mm diameter sewerage connection pipe conveys the sewage flows from the Hang Hau Man Kuk Lane Park to DSD manhole FMH4035351 at Chiu Shun Road.
3.1.2 The existing public sewerage infrastructure in the vicinity of the Site and the lot boundaries of the proposed development Site are shown in drawing no. 3001-EB001753-06.
3.1.3 The estimated sewage flow from the proposed development was assessed based on the preliminary conceptual scheme drawings and development parameters of the proposed development.
3.2 Existing Building Sewerage
3.2.1 The information about the existing PVB building sewerage system is shown in drawing no. 3001-EB001753-06. The proposed residential development sewerage system will be separated from the existing PVB building sewerage system.

## 4 METHOD OF ANALYSIS

### 4.1 Estimation of Sewage Flow Rates

4.1.1 The design sewage flow rates were estimated in accordance with EPD Technical Paper EPD/TP 1/05, Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (March 2005) (GESF). The sewage flow rates estimation is contained in Appendix A of this report.
4.1.2 According to section 2.2 of the EPD GESF the equation for average flow is as follows:
$Q_{\text {AVERAGE }}=\left(Q_{\text {Domestic }}+Q_{\text {commercial }}+Q_{\text {INSTITUTIonal }}+Q_{\text {INDUSTRIAL }}\right) \times P_{\text {CIF }}$ Where,
Qdommestic
Is the average dry weather domestic flow;
Qcommercial
Is the average dry weather commercial flow;
Qinstitutional
Is the average dry weather institutional flow;
Qindustrial
Is the average dry weather industrial flow;
PCIF
Is the catchment inflow factor;
4.1.3 The catchment inflow factor takes into account the excessive inflow quantities that occurs in some catchments. They are catchment-dependent and applicable to major sewerage facilities of a catchment. The values are given in Table T-4 of the EPD GESF
4.1.4 The average dry weather flows are calculated with the unit flow factor as follows: Average Dry Weather Flow (ADWF) ( $\mathrm{m}^{3} /$ day ) $=$
$\Sigma$ [Population (head) x unit flow factor ( $\mathrm{m}^{3} /$ head $/$ day $)$ ]
4.1.5 In the case of Commercial and Industrial Flows, the total unit flow generated from an employee in a particular trade is the sum of the unit flow factor of employee and the unit flow factor of a particular trade under consideration.
4.1.6 The peak flow is calculated with an appropriate peaking factor as follows:

Peak Flow ( $\mathrm{m}^{3} / \mathrm{day}$ ) = ADWF ( $\mathrm{m}^{3} /$ day) $\times$ Peaking Factor
The peaking factors are given in Table T-5 of section 11.5 of the EPD GESF as a function of the contributing population. According to the information presented in this section:

- Peaking factors excluding storm water allowance should be used to sewerage facilities receiving flow from new upstream sewerage systems which essentially have no misconnections and defects for infiltration.
- Peaking factors including storm water allowance should be used to sewerage facilities where there is doubt about the service conditions of the upstream sewerage systems for the planning horizons under consideration.

PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING
AND ADJACENT AREA FOR RESIDENTIAL USE
4.1.7 For the purpose of determining the appropriate peaking factor, the contributing population is calculated using the expression presented in section 12.1 of EPD population is calc

## Contributing Population $=$

Calculated total average flow ( $\mathrm{m}^{3} /$ day) / 0.27 ( $\mathrm{m}^{3} /$ person/day)
4.2 Assumptions
4.2.1 Sewage flow rates were principally estimated with the use of the global unit flow factors given in Table T-1 and Table T-2, and the relevant peaking factors given in Table T-5 of the EPD GESF.
4.2.2 The total unit flow factors adopted in this assessment are summarised in Table 4.1 below.

| Type of Population | Total Unit Flow Factor <br> $(\mathrm{m} 3 / \mathrm{head} / \mathrm{day})$ |
| :---: | :---: |
| Domestic (R2) | 0.27 |
| Community, Social \& Personal Services | $0.08+0.20=0.28$ |

## Table 4.1 - Total Unit Flow Factors

4.2.3 The average domestic household size of 2.8 people/unit was adopted for estimation of the residential population associated with the proposed estimation of

For the estimation of population associated with the commercial activities in the clubhouse, the values presented in Figure 9 of the "PlanD Study Document Commercial and Industrial Floor Space Utilization Survey" were used.
A sewage flow was also considered for the car park on level +32.00 mPD of the proposed development. The estimated average daily volume of sewage generated by cleaning the car park was estimated based on the number of tap points. Detailed calculation of the average volume of sewage generated during the cleaning of the car park is contained in Appendix A.
4.2.6 The peaking factor adopted to estimate the peak flow was selected taking into account the contributing population of the sewage catchment area under consideration.
4.2.9 The detailed calculations of the total population figures for the Proposed Development Scenario are shown in the tables contained in Appendix A.
4.2.10 The peak sewage flow from existing public toilets and changing room at Hang Hau Man Kuk Lane Park were estimated in accordance with the criteria presented on BS EN 12056-2:2000 - Gravity drainage systems inside buildings - Part 2: Sanitary pipework, layout and calculation. The exact numbers of existing sanitary fitments were surveyed on site. The detailed calculation of estimated peak sewage flow from existing public toilet and changing room at Hang Hau Man Kuk Lane Park toilet is contained in Appendix A.

## PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE

## ASSESSMENT

5.1 Planned Sewage Flow - Proposed Development Scenario
5.1.1 For calculation of sewage flow from the Site (Catchment SC-01), the residential population and employee population associated with the clubhouse, were estimated based on the preliminary building plans and development parameters of the proposed residential development.
5.1.2 The estimated Average Dry Weather Sewage Flow generated by the estimated population for the Proposed Development Scenario is summarized in Table 5.2. Detailed calculations are contained in Appendix A.

| Proposed Development Parameters and Estimation of Average Dry Weather Sewage Flows |  |
| :--- | :---: |
| MTR Lot Area <br> (including the maintenance slope area and vehicular/pedestrian right of way) | 4,458 sq.m. |
| No. of Towers | 2 |
| No. of Flats | 432 |
| Average domestic household size | 2.8 |
| Estimated Population | 1,210 |
| Clubhouse Area (m²) | 1,203 |
| Average Worker Density for Community, Social \& Personal Services (workers per |  |
| 100m of GFA - PlanD Commercial and Industrial Floor Space Utilization Survey) | 3.3 |
| Estimated Workers for Community Social \& Personal Services (Clubhouse) | 40 |
| Estimated taps for pavement cleansing of Car Park | 4 |
| Estimated Average Dry Weather Domestic Sewage Flow (m³/day) | 326.70 |
| Estimated Average Dry Weather Commercial Sewage Flow - Clubhouse (m³/day) | 11.20 |
| Estimated Average Dry Weather Sewage Flow - Car Park (m³/day) | 4.32 |
| Catchment inflow factor (PclF - as defined in Section 10.1 of EPD/TP1/05) | 1.2 |
| Estimated Average Dry Weather Sewage Flow (m³/day) (with PclF applied) | 410.66 |
| Contributing population (as defined in Section 12.1 of EPD/TP1/05) | 1,521 |
| Peaking factor for Sewers (as defined in Section 11.5 of EPD/TP1/05) | 6 |
| Estimated Sewage Peak Flow from development (m³/s) | 0.0285 |

Table 5.2 - Proposed Development Scenario - Average Dry Weather Sewage Flows based on Population
5.1.3 With reference to MTRC Contract 601 Pak Shing Kok Ventilation Building as-built drawings, there is a staff toilet at the ground floor of existing Pak Shing Kok Ventilation Building.
5.1.4 The estimated peak flow for the toilet at the existing Pak Shing Kok Ventilation Building is $0.0007 \mathrm{~m}^{3} / \mathrm{s}$. Detailed calculations are contained in Appendix A.
5.1.5 The estimated peak sewage flow from existing public toilets and changing room at Hang Hau Man Kuk Lane Park (Catchment SC-02) is $0.00495 \mathrm{~m}^{3} / \mathrm{s}$. Detailed calculations are contained in Appendix A.
5.2 Proposed Sewerage Works
5.2.1 With reference to DSD record sheet 12-NW-16C-4, existing 1650 mm diameter sewerage pipeline at Chiu Shun Road is a deep sewer with manholes depths greater than 10 meters. Therefore, connection of the terminal manhole of the proposed development to this existing pipeline would require deep excavation at Chiu Shun Road.
5.2.2 From DSD record sheet 12-NW-16C-4, it is also noted that there is a 300 mm diameter sewerage pipe conveying the sewage flows from the Hang Hau Man Kuk Lane Park to DSD manhole FMH4035351 at Chiu Shun Road. This pipe connects to DSD manhole FMH4035351 at a depth of 4.89 m .
5.2.3 In order to avoid deep excavation at Chiu Shun Road, it is proposed that a 250 mm diameter sewerage pipeline comprising three new sewer manholes at Chiu Shun Road is constructed for the connection of the proposed residential development foul terminal manhole with the existing 300mm public sewerage pipe from Hang Hau Man Kuk Lane Park to DSD manhole FMH4035351.
5.2.4 With reference to the hydraulic calculations contained in Appendix A, the existing 300 mm diameter pipe should have adequate hydraulic capacity to convey the design flows from the proposed development and Hang Hau Man Kuk Lane Park.
5.2.5 The proposed 250 mm diameter sewerage pipeline at Chiu Shun Road is to be handed over to DSD.
5.2.6 The preliminary hydraulic design of proposed sewerage work is contained in Appendix A.
5.2.7 The layout of the proposed sewerage works at Chiu Shun Road is shown in Drawing No. 3001-EB001753-06.
6.1.1 The proposed development comprises two residential towers with 27 floors each on a podium with clubhouse and car park.
6.1.2 Existing 1650 mm diameter sewerage pipeline at Chiu Shun Road adjacent to the Site is a deep sewer with manholes depths greater than 10 meters.
In order to avoid deep excavation at Chiu Shun Road, it is proposed that a 250 mm diameter sewerage pipeline comprising three new sewer manholes at Chiu Shun Road is constructed for the connection of the proposed residential development foul terminal manhole with the existing 300mm public sewerage pipe from Hang Hau Man Kuk Lane Park to DSD manhole FMH4035351.
6.1.4 With reference to the hydraulic calculations contained in Appendix A, the existing 300 mm diameter pipe should have adequate hydraulic capacity to convey the design flows from the proposed development and existing Hang Hau Man Kuk Lane Park.
6.1.5 The layout of the proposed 250 mm diameter sewerage pipeline and sewer terminal manhole of the proposed development is shown in drawing 3001-EB001753-06.
6.1.6 Since the quantity of sewage flow from the existing Pak Shing Kok Ventilation Building and the proposed development is relatively small $\left(0.0292 \mathrm{~m}^{3} / \mathrm{s}\right)$ when compared to the hydraulic capacity of existing 1650 mm diameter trunk sewer pipeline along Chiu Shun Road ( $2.472 \mathrm{~m}^{3} / \mathrm{s}$ ). It is anticipated that there would not be any adverse sewage impact due to the proposed residential development.





## APPENDIX A

Assessment of Sewage Flows for the New Development

| (A) A | Project No.: EB001753 Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use |  |
| :---: | :---: | :---: |
|  | Date: February 2018 |  |
|  | Design By: Reden Armand Mallare | Signature: P.P. F._へ |
|  | Check By: Fernando Coutinho | Signature: $\Gamma_{1}{ }_{\text {c }}$ |
|  | Reviewed By: Luke Leung | Signature: Luce Len |
|  | Sewage Flow Estimation for Car Park | $\bigcirc$ |


| Car Park | 4 |  |
| :--- | ---: | ---: |
| Number of taps for cleaning | 0.3 | $\mathrm{I} / \mathrm{s}$ |
| Flow rate of each tap | 1 | h |
| Duration of cleaning | 4.32 | m 3 |
| Volume of sewage per day for cleaning |  |  |


Table A) Average dry weather flows based on Population

|  |  |  | Commercial and Institutional Flow |  |  |  |  | Domestic Flow |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Catchment ID | Location | Building Type | Commercial Activity | Total Gross Floor Area (m) | Worker <br> Density <br> (person <br> $/ 100 \mathrm{~m}^{2}$ ) | Number of Employee | Global Unit flow factor ( $\mathrm{m}^{3} /$ day/person) | $\begin{array}{\|c\|} \hline \text { No. of } \\ \text { Residential } \\ \text { Flat } \end{array}$ | Population (head) | Global Unit flow factor ( $\mathrm{m}^{3} /$ day $/$ person $)$ | $\begin{array}{\|c\|} \text { Average Dry } \\ \text { Weather } \\ \text { Commercial Flow } \\ \left(\mathrm{m}^{3} / \mathrm{d}\right) \end{array}$ | Average Dry Weather Residential Flow $\left(\mathrm{m}^{3} / \mathrm{d}\right)$ | $\begin{aligned} & \text { Average Dry } \\ & \text { Weather } \\ & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{d}\right) \end{aligned}$ | $\begin{gathered} \text { Average Dry } \\ \text { Weather Flow } \\ \times \text { PCIF } \\ \left(\mathrm{m}^{3} / \mathrm{d}\right) \end{gathered}$ | Discharge to Manhole No. |
| MTR Pak Shing Kok Ventilation Building Site (SK-06A) | Chiu Shun Road |  <br> Commercial | Community, Social \& Personal Services Car Park | 1203 | 3.3 | 40 | 0.28 | 432 | 1210 | 0.27 | 11.20 4.32 | 326.700 | 342.220 | 410.664 | Proposed Sewer Manhole |

*EPD/TP $1 / 05$ Table T-4 Catchment Inflow Factor in Tseung Kwan $\mathrm{O}=1.20$

## -ARCADIS <br> roject No.: EB001753 Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use Design By: Marco Kan <br> heck By: Fernando <br> Reviewed By: Luke Leung <br> Peak Flow Estimation of the Public Toilet and Changing Room at Hang Hau Man Kuk Lane Park <br> 

Reference:
BS EN 12056 -2000-Gravity Drainaze Syster
Sewage Flow Rate (L/s) =

$$
K \sqrt{\Sigma D U}
$$

where: $\quad K=\quad$ Frequency factor
$\Sigma D U=\quad$ Sum of discharge units

| Table 1-Discharge units (DU) |  |
| :---: | :---: |
| Appliance | System II DU |
|  | (//s) |
| Wash lasin, bidet | 0.3 |
| Single runal with cistern | 0.4 |
| WC with 6.0L cistern | 1.5 |
| Shower without plug | 0.4 |


| Table 2 - Typical frequency factor ( K ) |  |
| :---: | :---: |
| Usage of Appliances | K |
| Congested use | 1.0 |


|  | No. of WC |  |  |  |  |  | No. of Single Urinal |  |  |  | No. of Wash Basin |  |  |  |  |  | No. of Shower |  |  |  |  |  | EDU (1/s) | $a_{w w}(1 / s)$ | $\begin{gathered} \mathrm{a}_{w w} \\ \left(\mathrm{~m}^{3} / \mathrm{s}\right) \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Public Toilet | Male | Female | Disabled, Accessible, \& Universal | Total | $\begin{gathered} \text { DU factor } \\ (1 / 5) \end{gathered}$ | DU (1/s) | Male | Total | $\begin{gathered} \text { DU factor } \\ (1 / s) \end{gathered}$ | DU (1/s) | Male | Female | Disabled, <br> Accessible, <br> \& Universal | Total | $\begin{gathered} \text { DU factor } \\ (1 / s) \end{gathered}$ | DU (1/s) | Male | Female | Disabled, Accessible, \& Universal | Total | $\begin{aligned} & \text { DU } \\ & \text { factor } \\ & (1 / s) \end{aligned}$ | DU (1/s) |  |  |  |
| Hang Hau Man Kuk Lane Park | 3 | 8 | 1 | 12 | 1.5 | 18.0 | 3 | 3 | 0.4 | 1.2 | 5 | 5 | 1 | 11 | 0.3 | 3.3 | 4 | 0 | 1 | 5 | 0.4 | 2.0 | 24.5 | 4.95 | 0.0049 |


| GARCADIS | Project No.: EB001753 Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use |  |
| :---: | :---: | :---: |
|  |  |  |
|  | Design By: Marco Kan | Signature: Hant |
|  | Check By: Fernando Coutinho | Signature: |
|  | Reviewed By: Luke Leung | Signature: ( |
|  | Planning Sewage flows - Peak Flow Estimation according to Technical Paper EPD/TP 1/05 |  |

Table B.1) Adopted peaking factors

| Peaking Factors, P |  |
| :---: | :---: |
| Population Range | Peaking Factor <br> including <br> stormwater <br> allowance |
| $<1000$ | 8 |
| $1000-5000$ | 6 |
| $5000-10000$ | 5 |
| $10000-50000$ | 4 |

For the propose of determining the appropriate peaking factor the contributing population is calculated using the expression presented in section 12.1 of EPD GESF as follows:
Contributing Population $=$ Calculated total average flow $\left(\mathrm{m}^{3} /\right.$ day $) / 0.27\left(\mathrm{~m}^{3} /\right.$ person $/$ day
Colebrook-White Equation for circular pipes is applied to calculate the full bore velocity
Colebrook-White equation for circular pipes

$$
\bar{V}=-\sqrt{(8 g D s} \log \left(\frac{k_{s}}{3.7 D}+\frac{2.51 v}{D \sqrt{(2 g D s)}}\right)
$$

where: $V=$ mean velocity $(\mathrm{m} / \mathrm{s})$
$\mathrm{g}=$ gravitational acceleration $\left(\mathrm{m} / \mathrm{s}^{2}\right)$ $\mathrm{R}=\quad$ hydraulic radius $(\mathrm{m})$
$\begin{array}{lll}\mathrm{D} & = & \text { pipe diameter }(\mathrm{m}) \\ \mathrm{k}_{\mathrm{s}} & = & \text { equivalent sand roughness }(\mathrm{m})\end{array}$
$\begin{array}{lll}\mathrm{k}_{\mathrm{s}} & = & \text { equivalent sand roughness }(\mathrm{m}) \\ \mathrm{v} & = & \text { kinematic viscosity of fluid }\left(\mathrm{m}^{2} / \mathrm{s}\right)\end{array}$
$\begin{array}{lll}\mathrm{v} & = & \text { kinematic viscosity of fluid }\left(\mathrm{m}^{2} / \mathrm{s}\right) \\ \mathrm{s} & = & \text { frictional slope (energy gradient due to frictional loss }\end{array}$
A $10 \%$ reduction in pipe flow capacity is applied in the calculation to account for sedimentation

| Pipeline location | Links |  | Average Flows |  |  |  | Peak Flows |  |  | Pipe capacity check |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Street | Upstream Node | Downstream Node | From buildings ( $\mathrm{m}^{3} /$ day) | $\begin{aligned} & \text { From US } \\ & \text { pipe } \\ & \left(\mathrm{m}^{3} / \text { day }\right) \end{aligned}$ | Total average flow ( $\mathrm{m}^{3} /$ day $)$ | Contributing Population | Peaking Factor | Peak flow from buildings (m ${ }^{3} / \mathrm{s}$ ) | Peak design flow $\left(\mathrm{m}^{3} / \mathrm{s}\right)$ | $\begin{aligned} & \mathrm{USIL} \\ & (\mathrm{mPD}) \end{aligned}$ | $\begin{aligned} & \mathrm{DSIL} \\ & (\mathrm{mPD}) \end{aligned}$ | Length (m) | $\begin{gathered} \text { Gradient } \\ (\mathrm{m} / \mathrm{m}) \end{gathered}$ | Diameter (mm) | Full Bore Velocity, Vc ( $\mathrm{m} / \mathrm{s}$ ) | $\begin{aligned} & \text { Pipe Full } \\ & \text { Capacity, Qc } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Pipe Capaity Check |
| Chiu Shun Road | Terminal Manhole | SM1 | 410.664 | 0.000 | 410.664 | 1521 | 6 | 0.02852 | 0.0285 | 4.84 | 4.59 | 25.0 | 100 | 250 | 1.10 | 0.0486 | OK |
|  | SM1 | SM2 | 0.000 | 410.664 | 410.664 | 1521 | 6 | 0.00000 | 0.0285 | 4.59 | 4.43 | 16.0 | 100 | 250 | 1.10 | 0.0486 | OK |
|  | SM2 | SM3 | 0.000 | 410.664 | 410.664 | 1521 | 6 | 0.00000 | 0.0285 | 4.10 | 4.06 | 4.0 | 100 | 250 | 1.10 | 0.0486 | OK |
|  | SM3 | FMH4035351 | N/A | 410.664 | 410.664 | 1521 | 6 | 0.00495* | 0.0335 | 3.56 | 3.45 | 10.1 | 92 | 300 | 1.30 | 0.082 | OK |
|  | FMH4035351 | FMH4035349 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | -2.03 | -2.11 | 65.0 | 812 | 1650 | 1.32 | 2.537 | N/A |

Peak sewage flow for toilet and changing room was estimated using BS EN 12056-2:2000 therefore the Peaking Factor from EPD GESF doesn't apply,
Colebrook-White Pipe Roughness $\mathrm{k}_{\mathrm{s}}=3 \mathrm{~mm}$
Kinematic Viscosity of Fluid $\mathrm{v}=0.000001 \mathrm{~m}^{2} / \mathrm{s}$

## Appendix F

Drainage Impact Assessment

PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE

Drainage Impact Assessment

## MAY 2020



PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE

Drainage Impact Assessment

Author

Reviewer

Approver

Report No
Date
Wei Ming Khoo
Wiolloy
Fernando Coutinho

Luke Leung $\qquad$
EB001753/PVB/DIA/R06
May 2020

## CONTENTS

1 INTRODUCTION

$\qquad$ .....  .1
1.1 Background .....  1
1.2 Objective .....  1
1.3 Information Available for the Study .....  1
2 PROJECT OUTLINE

$\qquad$ 1
2.1 Project Background and Project Site .....  1
2.2 Planning and Implementation .....  2
Area of Project Site .....  2
3 EXISTING PUBLIC DRAINAGE INFRASTRUCTURE .....  .2
Existing Box Culvert .....  2
Existing PVB Drainage System. .....  2
Existing Vegetated Man-made Slopes .....  2
3.4 Existing Connections with Public Drainage Infrastructure .....  2
METHOD OF ANALYSIS
4.1 Assessment Criteria .....  3
4.2 Drainage Impact Assessment .....  4
4.3 Recommendations .....  5
5 CONCLUSIONS .....  .5

PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE

## LIST OF DRAWINGS

4001-EB001753-02 Existing Stormwater Catchment Area, Surface Types and Existing Connections to Public Stormwater System
4002-EB001753-04 Proposed Connections to Public Drainage System
4003-EB001753-04 Proposed Stormwater Catchment Area and Surface Types
4004-EB001753-02 Proposed Slope Drainage System
4005-EB001753-02 Cross Section of Proposed Stormwater Works

## LIST OF APPENDICES

## APPENDIX A

As-built Drawings of Main Box Culvert at Chiu Shun Road

## APPENDIX B

Information Extracted from GEO's GINFO System

## APPENDIX C

Hydraulic Assessment

## 1 INTRODUCTION

### 1.1 Background

1.1.1 Arcadis Design \& Engineering Limited was commissioned by DLN Architects Limited to undertake a drainage impact assessment (DIA) for the proposed residential development at MTR Pak Shing Kok Ventilation Building (PVB) Site and adjacent "Green Belt" Site to the south of PVB in Tseung Kwan O, New Territories (hereafter referred to as "the Site").

### 1.2 Objective

1.2.1 This DIA report outlines the existing drainage system in the vicinity of the Site, studies the potential drainage impacts that may arise from the proposed residential development and proposes appropriate mitigation measures where necessary
1.2.2 The objectives of this DIA are as follows:

- Identify any potential drainage impact arising from the Site;
- Identify design requirements of the drainage system of the proposed residential development; and
- Substantiate the technical feasibility of connecting the proposed drainage system of the proposed development with the nearby public drainage system.


### 1.3 Information Available for the Study

1.3.1 The following information was reviewed for the Study:
a. Drainage Services Department Drainage Record Sheet of existing public drainage infrastructure in the vicinity of the Site, April 2016;
b. Relevant as-built information on the existing box culvert completed by TDD Contract No. JB25/86 Box Culvert Details in Hang Hau, Stage 2 - Engineering Work;
c. DSD Stormwater Drainage Manual (SDM) Fifth Edition (January 2018 Edition).
2.1 Project Background and Project Site
2.1.1 A new residential development was proposed to be constructed at the MTR Pak Shing Kok Ventilation Building (PVB) Site and adjacent "Green Belt" Site to the south of PVB. The Site is bounded by Chiu Shun Road to the northwest and is surrounded by vegetated man-made slopes.
2.1.2 The proposed development comprises two separate towers with 27 floors for residential use, on a podium with clubhouse and carpark.

### 2.2 Planning and Implementation

2.2.1 The proposed development would be constructed in one single phase. The tentative programme of the proposed private housing development population intake was scheduled in 2029.
2.3 Area of Project Site
2.3.1 The Site has an area of approximately $4,458 \mathrm{~m}^{2}$.

3
EXISTING PUBLIC DRAINAGE INFRASTRUCTURE
3.1 Existing Box Culvert
3.1.1 There is a 4-cell box culvert constructed under TDD Contract No. JB 25 / 86. The box culvert is located along Chiu Shun Road and abutting on the northwest side of the Site.
3.1.2 The box culvert drains stormwater from the catchments along Chiu Shun Road including that of the Site.
3.1.3 Relevant as-built drawings of the Main Box Culvert completed under TDD's Contract No. JB 25 / 86 are included in Appendix A of this report.
3.1.4 The existing public drainage infrastructure in the vicinity of the Site is shown in drawing no. 4001-EB001753-02.
3.2 Existing PVB Drainage System
3.2.1 There are two existing drainage systems within PVB site, the Pak Shing Kok Ventilation Building and perimeter drainage system incorporating existing slope drainage system.
3.3 Existing Vegetated Man-made Slopes
3.3.1 There are existing vegetated man-made slopes abutting on the Site. The stormwater runoff of the vegetated man-made slopes drains to existing sand traps at the west corner and north corner of the Site (ST1 and ST2 respectively).
3.4 Existing Connections with Public Drainage Infrastructure
3.4.1 Existing connections to the public stormwater infrastructure are shown in drawing no. 4001-EB001753-02.

## 4 METHOD OF ANALYSIS

### 4.1 Assessment Criteria

4.1.1 With reference to the DSD SDM, underground drainage pipes with a diameter smaller than 1.8 m (or equivalent diameter in case of a box culvert) conveying stormwater to a trunk drain, river or sea are normally classified as "Urban Drainage Branch System". An "Urban Drainage Trunk System" collects stormwater from branch drains and conveys the flow to outfalls in river or sea. Pipes with size or box culverts with equivalent diameter equal to or larger than 1.8 m are normally considered as trunk drains. Recommended Design Return Periods from DSD SDM are shown in the table below:

| Drainage Type | Design Return Period |
| :--- | :---: |
| Urban Drainage Branch Systems | 50 Years |
| Urban Drainage Trunk Systems | 200 Years |
| Slope Drainage Systems | 200 Years |
| Table 1 - Recommended Design Return Periods |  |

4.1.2 The catchment run-off was calculated using the "Rational Method", as outlined in the DSD SDM.

$$
\mathrm{Q}=0.278 \mathrm{C} i \mathrm{~A}
$$

Where: $\quad$ Q $=$ peak run-off in $\mathrm{m}^{3} / \mathrm{s}$
$\mathrm{C}=$ run-off coefficient (dimensionless)
$i=$ rainfall intensity in $\mathrm{mm} / \mathrm{hr}$
$\mathrm{A}=\quad$ catchment area in $\mathrm{km}^{2}$
The runoff coefficient $C$ adopted for roof/asphalt/concrete/man-made slope, vegetated slope/vegetated area with underlying structure and vegetated land are $0.9,0.6$ and 0.20 respectively.
4.1.4 The rainfall intensity parameter " $i$ " is dependent on the return period, rainfall duration and the time of concentration of the catchment under consideration.
4.1.5 The times of concentration (tc) for the different types of catchments are summarized in Table 2.

| Type of Catchment | Time of Concentration |
| :--- | :--- |
| Residential Development | a minimum of 3 minutes |
| Vegetated Slope | a minimum of 1 minute |
| Table 2 - Times of concentration for Different Types of Catchment |  |

Table 2 - Times of concentration for Different Types of Catchment
4.1.6 The inlet times, or times of concentration of catchments considered in this DIA Report were estimated using the Brandsby William's Equation as shown below:

$$
t_{0}=\frac{0.14465 L}{H^{0.2} A^{0.1}}
$$

Where: $\quad \mathrm{t}_{0}=\quad$ time of concentration of the catchment (min)
$L=\quad$ distance (on plan) measured on the line of natural flow between the summit and the point under consideration ( m )
$A=\quad$ Catchment area $\left(\mathrm{m}^{2}\right)$
$H=\quad$ Average slope ( $m$ per 100 m ), measured along the line of natural flow, from the summit of the catchment to the point under consideration

PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING AND ADJACENT AREA FOR RESIDENTIAL USE

### 4.2 Drainage Impact Assessment

4.2.1 Presently, the stormwater runoff from the Site is discharged to an existing 4-cell box culvert along Chiu Shun Road through existing sand traps ST1 and ST2 at the west corner and north corner of the Site respectively.
4.2.2 It is proposed that two new terminal manholes connecting to the existing public drainage infrastructure are constructed to drain the stormwater runoff from the proposed residential development and existing Pak Shing Kok Ventilation Building respectively.
4.2.3 It is also proposed that a new manhole is constructed outside the site near its boundary. This manhole would receive the connection pipes from the proposed terminal manholes for discharge of the flows to the existing 4-cell box culvert along Chiu Shun Road. The location of the proposed manhole is shown on drawing 4002-EB001753-04.
4.2.4 The drainage system of the proposed development would intercept the stormwater runoff within the footprint of the proposed development building and convey it to existing 4-cell box culvert along Chiu Shun Road through the proposed manhole adjacent to the site boundary. As a result, the stormwater flow drained to the existing sand traps ST1 and ST2 will be reduced.
4.2.5 The podium of the proposed development covers part of the man-made slopes no. 12NW-C/C 520 and therefore the surface runoff on that part of the slope would be intercepted by the podium structure and drained by the building drainage system. As a result, the surface runoff on the slope drainage system will be reduced.
4.2.6 The columns and associated foundations supporting the podium of the proposed development will not affect the existing slope drainage system.
4.2.7 A maintenance area to serve the existing PVB building is proposed on existing A maintenance area to serve the existing PVB building is proposed on existing
slope $12 N W-C / C 519$. This platform would require modification of the existing slope drainage system. are shown in drawings no. 4001-EB001753-02 and 4003-EB001753-04 respectively.
The estimated 1 in 200 years baseline and new-development stormwater runoff from the building drainage system and slope drainage system are summarized below:

| Scenario | Building Drainage <br> System Stormwater <br> Runoff $\left(\mathrm{m}^{3} / \mathrm{s}\right)$ | Slope Drainage System <br> Stormwater Runoff <br> $\left(\mathrm{m}^{3} / \mathrm{s}\right)$ | Total Stormwater <br> Runoff $\left(\mathrm{m}^{3} / \mathrm{s}\right)$ |
| :---: | :---: | :---: | :---: |
| Baseline | 0.168 | 0.831 | 0.999 |
| Proposed Development | 0.207 | 0.798 | 1.005 |

Table 3 Estimated Stormwater Runoff
4.2.10 Detailed calculations of the stormwater runoff from the building drainage system and slope drainage system are contained in Appendix C. The rainfall intensity adopted in the detailed calculations is increased by $10.4 \%$ to account for effects of climate change up to the mid $21^{\text {st }}$ century.
4.2.11 Based on the hydraulic assessment result the proposed development would increase the total stormwater flows discharged to the existing 4-cell box culvert along Chiu Shun Road by $0.006 \mathrm{~m}^{3} / \mathrm{s}$.
4.2.12 Since the increase in stormwater runoff due to the proposed residential development is small $\left(0.006 \mathrm{~m}^{3} / \mathrm{s}\right)$ comparatively to the hydraulic capacity of existing 4 -cell box culvert along Chiu Shun Road ( $27.33 \mathrm{~m}^{3} / \mathrm{s}$ ), it anticipated that there would not be any adverse drainage impact due to the proposed residential development.

### 4.3 Recommendations

4.3.1 There will be a need for modification of the existing drainage system of the MTR Pak Shing Kok Ventilation Building for the new development. The existing terminal manhole of the Ventilation Building will need to be reconstructed to connect with a new terminal manhole situated at the proposed vehicular access area of the proposed development.
4.3.2 It is recommended that the stormwater runoff of the new development of the Site be separately drained via a new terminal manhole located at the run-in/out of the proposed development.
4.3.3 A new stormwater manhole would be constructed outside the site, near its boundary, to convey the flows from the proposed terminal manholes to the existing 4-cell box culvert along Chiu Shun Road. The new stormwater manhole and associated outlet pipe are to be handed over to DSD.
4.3.4 The proposed new building drainage system will be separated from the existing MTR Pak Shing Kok Ventilation Building drainage systems.
4.3.5 The location of the proposed new stormwater terminal manholes and the proposed building drain pipe connections to the existing box culvert are shown in drawing no. 4002-EB001753-04. The hydraulic calculations of the proposed building drain pipes are contained in Appendix $C$.
4.3.6 The proposed maintenance platform at slope 12NW-C/C 519 will require modification of the existing slope drainage system. Proposed slope drainage works are shown in drawing no. 4004-EB001753-02.
5.1.1 A new residential development with two towers was proposed to be constructed at the MTR Pak Shing Kok Ventilation Building (PVB) Site and adjacent "Green Belt" Site to the south of PVB.
5.1.2 The proposed development would change the surface characteristics of the Site as summarized in Table 3
5.1.3 The drainage system of the proposed development would intercept the stormwater runoff within the proposed building footprint and therefore the stormwater flow drained to the existing sand traps ST1 and ST2 will be reduced.
5.1.4 The total stormwater runoff from the building drainage system and slope drainage system for the 1 in 200 years baseline scenario and the proposed development scenario were estimated to be $0.999 \mathrm{~m}^{3} / \mathrm{s}$ and $1.005 \mathrm{~m}^{3} / \mathrm{s}$ respectively.

## PROPOSED REZONING OF PAK SHING KOK VENTILATION BUILDING <br> AND ADJACENT AREA FOR RESIDENTIAL USE

5.1.5 The proposed residential development would increase the stormwater flow discharged to the existing 4 -cell box culvert along Chiu Shun Road by $0.006 \mathrm{~m}^{3} / \mathrm{s}$.
5.1.6 Since the increase in stormwater runoff from the Site is small $\left(0.006 \mathrm{~m}^{3} / \mathrm{s}\right)$ comparatively to the hydraulic capacity of existing 4-cell box culvert along Chiu Shun Road ( $27.33 \mathrm{~m}^{3} / \mathrm{s}$ ), it anticipated that there would not be any adverse drainage impact due to the proposed residential development.
5.1.7 Hence, the development should not cause an adverse drainage impact on the existing public infrastructure and surrounding areas.

Drawings







## APPENDIX A

As-built Drawings of Main Box Culvert at Chiu Shun Road



## APPENDIX B

Information Extracted from GEO's GINFO System


## APPENDIX C

Hydraulic Assessment

## DRAINAGE DESIGN



```
Minimum Time of Concentration (roof rea)
    CW Kinemaic Viscosity, v:
    Pipe rougness coeficient, k
```

    ox Culvert, ,
    | Drain run reference / Manhole Number | $\frac{\text { Conduit Shape }}{\text { pipe }}$ | b | d | Length | Gradient | $k_{5}$ or n | Full Bore | Full Bore | Time of inlet from catchment to | Time of conc tf | $\begin{aligned} & \text { Total Time } \\ & \text { of conc tc } \end{aligned}$ | $\text { Rainfall intensity } \begin{gathered} \text { Rainfal intensity i } \\ \text { (w/ climate change } \\ \text { increase) } \end{gathered}$ |  | Vegetated areas | Vegetated areas w/ underlying structure | Paved Drained areas | Total Drained areas | Flow Rate | Capacity used |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | U-ch | mm | mm | m | 1 in | - | m/s | $\mathrm{m}^{3} / \mathrm{s}$ | min | min | min | mm/r | mm/h | $\mathrm{m}^{2}$ | $\mathrm{m}^{2}$ | $\mathrm{m}^{2}$ | $\mathrm{m}^{2}$ | $\mathrm{m}^{3} \mathrm{~s}$ | \% |
| $\begin{aligned} & \text { Proposed Residential } \\ & \text { Building's Terminal } \\ & \text { Manhole - Proposed } \\ & \text { Stormwater Manhole } \end{aligned}$ | pipe | 450 | 450 | 7.0 | 50 | 3.000 | 2.303 | 0.366 | 3.00 | 0.00 | 3.00 | 254.7 | 281.2 | 43 | 446 | 2479 | 2968 | 0.196 | 53.46\% |
| Proposed Pak Shing Kok Ventilation Building's Terminal Manhole Proposed Stormwater Manhole | pipe | 225 | 225 | 20.0 | 50 | 3.000 | 1.449 | 0.058 | 3.00 | 0.00 | 3.00 | 254.7 | 281.2 | 136 | 0 | 0 | 136 | 0.002 | 3.69\% |
| Proposed Manhole Existing Box Culvert | pipe | 450 | 450 | 2.0 | 11 | 3.000 | 4.914 | 0.781 | 3.23 | 0.00 | 3.23 | 251.2 | 277.3 | 179 | 446 | 2479 | 3104 | 0.195 | 24.98\% |
| Existing rectangular 4 x $3500 \times 3200$ Box Culvert | rectangular | 3500 | 3200 | - | 800 | 1.5 | 0.610 | 27.328 | - | - | - | - |  | - | - | - | - | - | - |


| GARCADIS | Project No.: EB001753 |
| :---: | :---: |
|  | Date: 27/11/2018 |
|  | Designed By: Fernando Coutinho / - |
|  | Checked By: Luke Leung |
|  | Subject: MTRCL'S Private Housing Proposal at MTR Ventilation Building in Pak Shing Kok |

## Reference

DSD Stormwater Drainage Manual, Fifth Edition, Jan 2018
CEDD Geotechnical Manual for Slopes, January 2011

## A.) Desian Criteria

Runoff Coefficient

| Surface Material | Coefficient |
| :---: | :---: |
| Paved | 0.90 |
| Vegetated w/ underlying Structure | 0.60 |
| Vegetated | 0.20 |
| Man-made Slope | 0.90 |
| Natural Vegetated Slope | 0.60 |


| Increase in Rainfall Intensity due to climate change |
| :--- |
| Mid 21st century (2041- <br> 2060) |
| Rainfall Increase |


| Storm Constants |  |  |
| :---: | :---: | :---: |
| 50 Years | A | 451.300 |
| Return | B | 2.460 |
| Period | C | 0.337 |
| 200 Years | A | 429.500 |
| Return | B | 2.050 |
| Period | c | 0.295 |

B.) Estimation of Peak Runoff for Each Catchment

| Catchment ID | Discharge to Manhole / Catch Pit | Catchment Area ( $\mathrm{m}^{2}$ ) | Paved Area $\left(\mathrm{m}^{2}\right)$ | Natural Vegetated Slope Area (m) | Man-made slope Area $\left(m^{2}\right)$ | Vegetated w/ Underlying Structure Area $\left(\mathrm{m}^{2}\right)$ | Vegetated Area (m) | Flow Length (m) | Average Slope (m/m) | Time of Concentratio $n\left(\right.$ min), $t_{c}$ | Intensity of <br> Precipitation (mm/hr) (1 in 50 years) | Intensity of Precipitation w/ climate change increase (mm/hr) (1 in 50 years) | Stormwater Runoff w/ climate change increase $\left(\mathrm{m}^{3} / \mathrm{s}\right)(1$ in 50 years) | Intensity of Precipitation (mm/hr) (1 in 200 years) | Intensity of <br> Precipitation w/ climate change increase (mm/hr) (1 in 200 years) | Stormwater <br> Runoff w/ climate change increase $\left(\mathrm{m}^{3} / \mathrm{s}\right)$ (1 in 200 years) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Baseline Scenario - Building Drainage System Stormwater Surface Runoff |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SC-01 | ST1 | 2617 | 2186 | 0 | 0 | 0 | 431 | 38 | 0.010 | 3.0 | 254.7 | 281.2 | 0.1604 | 266.4 | 294.1 | 0.1678 |
| Baseline Scenario - Slope Drainage System Stormwater Surface Runoff |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SC-02 | ST1 | 1080 | 0 | 0 | 1080 | 0 | 0 | 33 | 0.455 | 1.1 | 294.0 | 324.6 | 0.0876 | 306.0 | 337.8 | 0.0912 |
| SC-03 | ST1 | 9604 | 0 | 9604 | 0 | 0 | 0 | 160 | 0.335 | 4.6 | 233.8 | 258.1 | 0.4131 | 245.8 | 271.3 | 0.4343 |
| SC-04 | ST2 | 1896 | 0 | 0 | 1896 | 0 | 0 | 35 | 0.429 | 1.1 | 293.6 | 324.1 | 0.1536 | 305.5 | 337.3 | 0.1599 |
| SC-05 | ST2 | 2852 | 0 | 2852 | 0 | 0 | 0 | 70 | 0.300 | 2.3 | 266.5 | 294.2 | 0.1398 | 278.1 | 307.0 | 0.1459 |

1 in 50 years total surface runoff from building drainage system $=0.160(\mathrm{~m} 3 / \mathrm{s})$
200 years total surface runof from bullaing drainage system $=0.168$ ( $\mathrm{m3} / \mathrm{s}$ )
1 in 200 years total Surface runof from slope drainage system $=0.831(\mathrm{m3} / \mathrm{s})$
1 in 200 years total Surface runoff from building drainage system + slope drainage system= $0.999(\mathrm{~m} 3 / \mathrm{s})$

## Reference

DSD Stormwater Drainage Manual, Fifth Edition, Jan 2018
CEDD Geotechnical Manual for Slopes, January 2011

## A.) Desian Criteria

Runoff Coefficient

| Surface Material | Coefficient |
| :---: | :---: |
| Paved | 0.90 |
| Vegetated w/ underlying Structure | 0.60 |
| Vegetated | 0.20 |
| Man-made Slope | 0.90 |
| Natural Vegetated Slope | 0.60 |


| Increase in Rainfall Intensity due to climate change |
| :--- |
| Mid 21st century (2041- <br> 2060) |

Storm Constants

| 50 <br> Years Return <br> Period | A | 451.300 |
| :---: | :--- | :---: |
|  | B | 2.460 |
| 200 Years Return <br> Period | A | 0.337 |
|  | B | 429.500 |

B.) Estimation of Peak Runoff for Each Catchment

| Catchment ID | Discharge to Manhole / Catch Pit | Catchment <br> Area ( $\mathrm{m}^{2}$ ) | Paved Area $\left(\mathrm{m}^{2}\right)$ | Natural Vegetated Slope Area ( $\mathrm{m}^{2}$ ) | Man-made slope Area (m) | Vegetated <br> w/ <br> Underlying <br> Structure <br> Area ( $\mathrm{m}^{2}$ ) | Vegetated Area ( $\mathrm{m}^{2}$ ) | Flow Length (m) | Average Slope (m/m) | Time of Concentratio $n($ min $), t_{c}$ | Intensity of <br> Precipitation <br> ( $\mathrm{mm} / \mathrm{hr}$ ) (1 <br> in 50 years) | Intensity of Precipitation w/ climate change increase $(\mathrm{mm} / \mathrm{hr})(1$ in 50 years) | Stormwater <br> Runoff w/ <br> climate <br> change <br> increase <br> $\left(\mathrm{m}^{3} / \mathrm{s}\right)$ (1 in <br> 50 years) | Intensity of <br> Precipitation <br> ( $\mathrm{mm} / \mathrm{hr}$ ) (1 <br> in 200 years) | Intensity of Precipitation w/ climate change increase ( $\mathrm{mm} / \mathrm{hr}$ ) $(1$ in 200 years) | Stormwater <br> Runoff w/ <br> climate <br> change <br> increase <br> $\left(\mathrm{m}^{3} / \mathrm{s}\right)(1$ in <br> 200 years) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Proposed Development Scenario - Building Drainage System Stormwater Surface Runoff |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SC-01a | Proposed Termina Manhole For The Proposed Development | 2968 | 2479 | 0 | 0 | 446 | 43 | 38 | 0.010 | 3.0 | 254.7 | 281.2 | 0.1958 | 266.4 | 294.1 | 0.2048 |
| SC-01b | Proposed Terminal <br> Manhole For Existing Pvb <br> Building | 136 | 0 | 0 | 0 | 0 | 136 | 4 | 0.010 | 3.0 | 254.7 | 281.2 | 0.0021 | 266.4 | 294.1 | 0.0022 |
| Proposed Development Scenario - Slope Drainage System Stormwater Surface Runoff |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SC-02 | ST1 | 1292 | 67 | 0 | 1225 | 0 | 0 | 33 | 0.455 | 1.1 | 294.6 | 325.2 | 0.1050 | 306.5 | 338.4 | 0.1093 |
| SC-03 | ST1 | 9392 | 0 | 9392 | 0 | 0 | 0 | 160 | 0.335 | 4.6 | 233.6 | 257.9 | 0.4038 | 245.7 | 271.2 | 0.4246 |
| SC-04 | ST2 | 1410 | 0 | 0 | 1410 | 0 | 0 | 35 | 0.429 | 1.2 | 292.6 | 323.1 | 0.1139 | 304.6 | 336.2 | 0.1185 |
| SC-05 | ST2 | 2852 | 0 | 2852 | 0 | 0 | 0 | 70 | 0.300 | 2.3 | 266.5 | 294.2 | 0.1398 | 278.1 | 307.0 | 0.1459 |

in 50 total surface runoff from building drainage system $=0.198(\mathrm{~m} 3 / \mathrm{s})$
in 200 years total Surface runoff from building drainage system $=0.207(\mathrm{~m} 3 / \mathrm{s})$
in 200 years total Surface runoff from slope drainage system $=0.798(\mathrm{m3} / \mathrm{s})$
in 200 years total Surface runoff from building drainage system + slope drainage system $=1.005(\mathrm{~m} 3 / \mathrm{s})$

Appendix G
Geotechnical Planning Review Report

D）DLN Architects Limited劉榮廣伍振民建築師有限公司

## 9ARCADIS

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use GEOTECHNICAL PLANNING REVIEW REPORT

SEP 2019

## CONTACTS

DR．PETER ONUSELOGU
Associate Director
$T+85229112108$
$G+85229112233$
E peter．onuselogu＠arcadis．com

G＋ 85229112233
E peter．onuselogu＠arcadis．com
Arcadis Design \＆
ngineering Ltd
20／F，AXA Tower，
andmark East
100 How Ming Street，
Kwun Tong，Kowloon
Hong Kong

DR．ROBIN ZHOU

T＋ 85229112583<br>G＋ 85229112233<br>E robin．zhou＠arcadis．com

Senior Engineer

DLN Architects Limited
劉榮廣伍振民建築師有限公司

## －ARCADIS ：

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use

GEOTECHNICAL PLANNING REVIEW REPORT


## CONTENTS

1．INTRODUCTION ..... 1
1．1．Background． .....
Purpos1
1．3．Site Topography
．． 3
2．DESK STUDIES
．．．． 3
2．1 Sources of Data
2.2 Man－made Features ..... 3
2．4 Existing Ground Investigation ..... ．．．． 4
3．PROPOSED DEVELOPMENT ..... ．． 6
4．GEOTECHNICAL APPRAISAL ..... ．． 6
4．1 Site Geology．．．．．． 6
4．2 Man－made Features．．． 7
4．3 Natural Terrain ..... ．．． 7
ndation Types． ..... ．．． 8
5．CONCLUSION AND RECOMMENDATIONS ..... 9

## APPENDICES

APPENDIX A
Slope Stability Analyses for the Adjacent Man－made Features 12NW－C／C520（1）\＆（2）and 12NW－ C／C519（1）\＆（2）

## 1．INTRODUCTION

1．1．Background
Arcadis Design \＆Engineering Limited was commissioned by DLN Architects Limited to undertake geotechnical planning review report for the MTR Pak Shing Kok Ventilation Building （PVB）Site and adjacent＂Green Belt＂Site to the south of PVB，in support for the rezoning of the site with a proposed residential development

1．2．Purpose
This Report presents the Geotechnical Planning Review Report（GPRR）for PVB Site and adjacent＂Green Belt＂Site to the south of PVB．It is based on extensive information search in all relevant Government databases．Some site－specific information as well as previous wide－area study report have been consulted

## 1．3．Site Topography

The Site overlooks Chiu Shun Road which has moderate traffic density．It is currently an open car park within the premises of Pak Shing Kok Ventilation Building（PVB），see Figure 1．1．

The site was formed in 1999 during the site formation works at the toe of the western portion of Sheung Yeung Shan，which is a natural hillside with dense vegetation cover measuring about 260m high

The site is divided into two parts．The first part includes the existing Ventilation Building，while the second part includes the man－made slopes to the south of Ventilation Building．

Standing at a general elevation of +8.8 mPD ，the concrete paved PVB site area is about $3,000 \mathrm{~m}^{2}$ ， including the existing Ventilation Building whose roof slab level is at +29.7 mPD ．

Shotcreted man－made slopes notably Cut Slope No．12NW－C／C 519（1）\＆（2）border the south－ western portion around the Ventilation Building．Fill Slope No．12NW－C／F 194 borders the south－ eastern portion and Cut Slope No．12NW－C／C 520（1）\＆（2）borders the south－eastern and north－ eastern portions（see Figure 2．1）．The section of Chiu Shun Road immediately adjacent to the proposed site is approximate +7 mPD


Figure 1．1 Location Plan of the Subject Site


Photo 1．1 Aerial view of the Subject Site area showing densely vegetated overlooking natural hillside

DLN Architects Limited
劉榮廣伍振民建築師有限公司

The overlooking natural hillside has a general angle of 26 degree and faces northwest direction to the site．Drainage channel and flexible debris fence were observed along edge of the slope berm．


Photo 1．2 View of the concrete surfaced Subject Site facing PVB Ventilation Building


Photo 1．3 View of the concrete surfaced Subject Site backing PVB Ventilation Building and looking at Slope No．12NW－C／C 519（2）


Photo 1．4 View of the concrete surfaced Subject Site backing PVB Ventilation Building and looking at Site Entrance Gate and Chiu Shun Road

2．DESK STUDIES

## 2．1 Sources of Data

Information search on the geotechnical features within and the vicinity of the PVB site has been carried out in the following government departments：
－Civil Engineering and Development Department（CEDD）
＞Geotechnical Information Infrastructure（GII）for records of previous ground investigations，man－made features，ENTLI，boulder，historical landslide catchment， MTR protection zone，etc
－Lands Department（LD）
＞Slope Maintenance Responsibility Information System（SMRIS
－Geotechnical Engineering Office（GEO）
＞Slope Safety Division for Slope Information System（SIS）
＞Hong Kong Geological Survey Geological Map（Sheet 12）
＞Hong Kong Geological Survey Memoir No． 4
2．2 Man－made Features
The existing registered man－made features in the vicinity of the proposed site area are shown in Figure 2．1．Their maintenance responsibility and technical information are summarised in Table 2.1 below．


Figure 2．1 Registered Man－made Features around the Site

| Table 2．1 A Summary of Registered Man－made Features around the Site |  |  |  |  |  |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: |
| Feature No． | Maintenance <br> Responsibility | Slope <br> Height（m） | Slope <br> Length（m） | Slope <br> Angle（deg） | Ref． |
| 12NW－C／F194 | HyD | 6 | 15 | 25 | SIS／SMRIS |
| 12NW－C／C519（1） | HyD | 18 | 52 | 67 | SIS／SMRIS |
| 12NW－C／C519（2） | MTRL3 |  |  |  |  |
| 12NW－C／C520（1） | HyD | 24.5 | 115 | 45 | SIS／SMRIS |
| 12NW－C／C520（2） | MTRL3 |  |  |  |  |

## 2．3 Natural Terrain

There is natural terrain（Sheung Yeung Shan）at the location of this site．Based on guidelines given in GEO Report No． 138 （Second Edition），the natural terrain located to the southwest of the Site meets the＂Alert Criteria＂and hence，natural terrain hazard study（NTHS）is required．A preliminary natural terrain hazard study（NTHS）has been carried out for this project．The findings are presented in Section 4 in this report．The study area for the natural terrain hazard study is shown in Figure 2．2．The boundary of catchment area is formed by the bounded adjacent ridge lines and the boundary of the existing slopes on a 1：2000 scale topographic map．


Figure 2．2 Study Area for the Natural Terrain Hazard Study

According to the Historical Landslide Catchment Inventory（HLCI），there is no historical landslide records within the study area．In addition，according to the Enhanced Natural Terrain Landslide Inventory（ENTLI），there is no recent or relict landslide records（Figure 2．3）within the study area．Moreover，in this study area，no boulder record is found according to the SIS


Figure 2．3 ENTLI Record in the Study Area
2．4 Existing Ground Investigation
Records of previous site investigations of the project area were obtained from Geotechnical Information Infrastructure of the Civil Engineering and Development Department（CEDD）．The as－built locations of the existing Gl works are presented in Figure 2．4．The relevant GI stations are highlighted within a 200 m radius around the proposed site．

The retrieved relevant existing ground investigation records are summarized in Table 2．2．


Figure 2．4 Locations of Existing Ground Investigation Stations in the Vicinity of the Site

Table 2．2 A Summary of Available Ground Investigation Information

| GI Station | GIU <br> Reference | Agreement／ Contract No． | Project Title | Year |
| :---: | :---: | :---: | :---: | :---: |
| 660／TKE／D222， <br> 660／TKE／D303 to 309，S001 to 2 | $\begin{aligned} & 33999, \\ & 34000 \end{aligned}$ | 660 | Ground Investigation Term Contract Works Order No， 19 PH．IVC－Ancillary Buildings（Pak Shing Kok Ventilation Building） | 1998 |
| JBS1 to 2，JBS11 | 5350 | NTDD 18／ST／82 | Site Investigation for the Tunnel | 1983 |


| GI Station | GIU <br> Reference | Agreement／ Contract No． | Project Title | Year |
| :---: | :---: | :---: | :---: | :---: |
| to 12 |  |  | Sewer in Junk Bay |  |
| JBS14，17 to 18 | 5392 | NTDD 18／ST／82 | Site Investigation for the Tunnel Sewer in Junk Bay | 1983 |
| JBS19 to 20 | 5757 | EDD10／GCO／83 | Junk Bay Sewage Disposal | 1984 |
| 660／TKE／D210， | $\begin{aligned} & 34083,34060 \\ & , 34061 \end{aligned}$ | 660 | Ground Investigation for TKE Cut \＆Cover Tunnel | 1998 |
| $\begin{aligned} & \text { 660/TKE/D134, } \\ & 136 \end{aligned}$ | 33954 | 660 | Ground Investigation for Tseung Kwan O Extension（Pak Shing Kok Tunnel） | 1997 |
| 660／TKE／D029， | $\begin{array}{ll} 33904 \\ 33907 \end{array} \quad \text { to }$ | 660 | Ground Investigation for Tseung Kwan O Extension（Hang Hau \＆ Po Lam Station） | 1998 |
| B11 to 16, D12 to 14 | 15722，16820 | HKHA 122／90， HKHA 143／88 | Site Investigation for Tseung Kwan O Area 34 －Phase II | 1991 |
| T1 to T4 | 18114 | TK37／93 | Site Investigation for Tseung Kwan O Development | 1993 |
| B4 | 27340 | CEDD GE／95／03 | Ground Investigation for Tseung Kwan O Development | 1997 |
| J25／L1 to 5 | 10361 | EDD GC／85／08 | Site Investigation for Junk Bay Development | 1987 |
| J25／M9 to 11， 13 | 10495 | CESD GC／85／04 | Marine Site Investigation：Hang Hau，Junk Bay，Stage 2 | 1987 |

These existing ground investigation information indicate that the natural terrain catchment area with typical strata of Debris Flow Deposit（about 1m），overlying completely decomposed tuff and bedrock．Localised areas of fill are found near the slope toes and are likely due to the backfilling of platforms for construction works of the former site formation works．

The interpreted tentative rockhead contour is presented in Figure 2．5．The tentative rockhead level is relatively high with range of about 0 to 4 m below the existing ground level．

Groundwater monitoring records from the drillholes in the vicinity of the proposed site are retrieved for understanding the groundwater conditions in the site area．The groundwater monitoring records are summarised in Table 2.3 below．The monitored groundwater indicate that the groundwater level is about 2 to 5 m below the original ground level before site formation for the Ventilation Building and very close to the existing ground level．


Figure 2．5 Interpreted Rockhead Contour


DLN Architects Limited
劉榮廣伍振民建築師有限公司

3．PROPOSED DEVELOPMENT
Figure 3.1 is the indicative conceptual scheme of the proposed development．Two 27 －storey residential blocks sit on a podium at the Subject Site．


Figure 3．1 Proposed Development

4．GEOTECHNICAL APPRAISAL

## 4．1 Site Geology

In accordance with the 1：20，000 scale Hong Kong Geological Survey（HKGS）Map published by the Geotechnical Engineering Office and entitled＂Clear Water Bay：Solid and Superficial Geology，Sheet 12，Map HGM20＂，Hong Kong Geological Survey Memoir No． 4 －Geology of Sa Kung and Clear Water Bay，The Quaternary Geology of Hong Kong，The Pre－Quaternary Geology of Hong Kong，geological settings of this site are presented below．

Solid Geology
As shown in extracted geological map in Figure 4．1，the solid geology predominantly comprises mainly fine ash TUFF．It belongs to Ap Lei Chau Formation of Repulse Bay Volcanic Group in the Upper Jurassic－Lower Cretaceous of Mesozoic Age．The Ap Lei Chau Formation is considered the oldest tuff division within the Repulse Bay Volcanic Group of this district．This Volcanic Rock is typically described as brownish grey and dark grey Lapilli bearing fine ash Tuff．

Superficial Geology
The superficial geology at the site comprises Fill placed in 1999 during the construction for the existing Pak Shing Kok Ventilation Building．Based on the above publications，the superficial geology at the adjacent natural terrain comprises debris flow deposits（or Colluvium）which are defined as accumulations of mass－transported material formed by water－mobilised gravitationa processes．They are typically described as soft，light brown，sandy clayey Silt with some subangular medium to coarse gravel sized moderately strong tuff fragments．

## Structural Geology

According to the Geological Map in Figure 4．1，there is no major fault around the site Nevertheless，a photogeological lineament trending in the northwest－southeast direction is observed on the east side of the site．The distance between this lineament and the site is ove 110m．


Figure 4．1 Geological Map（extracted from Sheet 12，Map HGM20）
4．2 Man－made Features
The proposed development means that（a）the facilities at the toe of the man－made features 12NW－C／F194 will change from＂open area＂to＂residential buildings＂，（b）the proposed bore pile foundation for Tower 2 will encroach into the existing man－made feature，Slope Nos．12NW－ C／C520（1）\＆（2）and clash with some of its existing permanent soil nails at Slope No．12NW－ C／C520（1）and（c）the proposed platform for uplifting／unloading E\＆M plants will encroach into the existing man－made features 12NW－C／C519（1）\＆（2）and clash with some of their existing permanent soil nails

The implication of the changes is，on one hand，that consequence－to－life category of Slope No． 12NW－C／F194 will be upgraded from Category 2 to Category 1．Based on Table 1 of Works Bureau Technical Circular No．13／99，the categories of the slopes and their required minimum factor of safety（FOS）are presented in Table 4．1．
Table 4．1 Status of the affected Slopes with respect to Category and FOS

| Slope No． | Status of the Slopes in <br> 1999 | Status of the Slopes as a result of <br> Proposed Re－development |  |  |  |
| :--- | :---: | :---: | :---: | :--- | :--- |
|  | Category | Required <br> minimum <br> FOS | Category | Impact | Required <br> minimum <br> FOS |
| 12NW－C／F194 | 2 | 1.2 | 1 | Not modified | 1.4 |
| 12NW－C／C519（1） | 2 | 1.2 | 1 | Modified | 1.4 |
| 12NW－C／C519（2） | 2 | 1.2 | 1 | Modified | 1.4 |
| 12NW－C／C520（1） | 1 | 1.4 | 1 | Modified | 1.4 |
| 12NW－C／C520（2） | 1 | 1.4 | 1 | Modified | 1.4 |

The implication of the changes is，on the other hand，that the man－made features，Slope Nos 12NW－C／C519（1）\＆（2）and 12NW－C／C520（1）\＆（2）will be modified．

Before installing the proposed 4 nos．of bore piles with diameter of 3 m each，the existing 16 nos of soil nails（J10，A10，A11，J15，A15，A16，J19，A19，A20，J24，J25，A24，A25，A26，T1 \＆T2 will be cut，which results in inadequate factors of safety for the Slope No．12NW－C／C520（2）．To maintain the required factor of safety of 1.4 for modified Category 1 slope，one additional row of soil nails（12 nos．of soil nails）are proposed．

During excavation of Slope Nos．12NW－C／C519（1）\＆（2）for the proposed platform for uplifting／unloading E\＆M plants， 14 nos．of soil nails（AA5，AA6，BB4，CC3，A33 to A41 \＆T3）will be cut／removed and one or two additional row of soil nails（about 18 nos．）are needed．

For details of the modification of the Slope Nos．12NW－C／C519（1）\＆（2）and 12NW－C／C520（1）\＆ （2）the calculations for reaching the required factors of safety，please refer to Appendix $\mathbf{A}$ ．

## 4．3 Natural Terrain

As mentioned in Section 2 above，the natural terrain study area is typically covered by 1 m of Debris Flow Deposit overlying completely decomposed tuff and bedrock and there is no recen and relict landslide records and no boulder records．It is expected that the study area shall not be subject to natural terrain hazards：open hillslope landslide，Channelised Debris Flow（CDF）， deep－seated slide，rockfall and boulder fall．Nevertheless，potential topographic depressions（TD） are possible．

The major terrain features－drainage lines around the site are presented in Figure 4．2．By virtue of its location，the drainage DL1 shelters the site from any direct impact because of failures occurring on its east potential side．Similarly，drainage lines DL2，DL3 and DL4 have potential to conduct landsliding debris originating outside the indicated catchment boundary away from the proposed site．The proposed site is susceptible to TD hazards mostly originating at locations within the indicated catchment boundary north of DL2 and DL3．

The potential topographic depressions（TD1 to TD4）in Figure 4.2 are capable of conducting landslide debris towards the proposed site


Figure 4．2 Major Terrain Features－Drainage Lines \＆Topographic Depression
As one of mitigation measures，flexible debris fence as a barrier outside the site boundary

Figure 4．3）is suggested to address these potential TD hazards shown in Figure 4.2


Figure 4．3 Natural Terrain Hazard Mitigation Measures－Typical Flexible Debris Fence
4．4 Possible Foundation Types
According to the existing ground investigation data from Geotechnical Information Infrastructure of CEDD，the rockhead level in the proposed site area is almost the existing ground level at the
southern portion and approximate 4 m below the existing ground level at the west－northern portion．With respect to the proposed high－rise residential buildings，it is expected that pile foundation with adequate socketed length（to be determined in the detailed design stage）shall be used for the proposed development．

## 4．5 Possible ELS Works

There is no underground basement for the proposed development．Therefore，major ELS works is not expected for the proposed development．Nevertheless，as mentioned in Section 4．2，the adjacent man－made feature nos．12NW－C／C519（1）\＆（2）and 12NW－C／C520（1）\＆（2）will be modified．Some minor ELS works such as open cut excavation for installation of pile cap，trial pit \＆additional soil nails（about 27 nos．）and modification of existing soil nails（about 23 nos．）can be foreseen．

In accordance with Building（Planning）Regulations 27，the minimum 2.5 m and $1 / 4$ of the height of the cutting shall be maintained during the cutting works．

5．CONCLUSION AND RECOMMENDATIONS
This Geotechnical Planning Review Report has been based on desk study information．
Based on the available information，and through implementation of the recommended slope mprovement works on affected man－made feature，Slope Nos．12NW－C／C519（1）\＆（2），12NW－ ／C520（1）\＆（2）and natural terrain mitigation measures，the proposed development is considered to be geotechnically feasible．

Detailed design of modified man－made features 12NW－C／C519（1）\＆（2），12NW－C／C520（1）\＆（2） and natural terrain hazard study and mitigations shall be submitted to the Buildings Department for approval in the detailed design stage

## APPENDIX A

Slope Stability Analyses for the Adjacent Man-made Features 12NWC/C520(1)\&(2) and 12NW-C/C519(1)\&(2)

1. Introduction

Four sections (A, B, C, D) are chosen for the slope stability analyses of the modified man-made features $12 \mathrm{NW}-\mathrm{C} / \mathrm{C} 520(1) \&(2)$ and $12 \mathrm{NW}-\mathrm{C} / \mathrm{C} 519(1) \&(2)$. Their layout plan and sections are presented in Drawing No. GEO-SK07-EB001753-01 and Drawing No. GEO-SK08-EB001753-01, respectively.
2. Assumptions

Soil/rock Parameters in Slope/W

| Soil Type | Bulk Density, <br> $\mathbf{k N} / \mathbf{m}^{\mathbf{3}}$ | Cohesion c, kPa | Friction Angle, <br> $\boldsymbol{\varphi}, \mathbf{d e g}$ |
| :--- | :--- | :--- | :--- |
| In-situ Fill ${ }^{\mathbf{1}}$ | 19 | 2 | 33 |
| In-situ CDT ${ }^{2}$ | 19 | 5 | 33 |
| No Fine <br> Concrete $^{3}$ | 24 | 10,000 | 0 |
| Rock $^{4}$ | Bedrock (impenetrable) |  |  |

Notes.

1. In-situ Fill parameters refer to Table 8 of Geoguide 1 for in-situ soil - Colluvium.
2. CDT parameters refer to Table 8 of Geoguide 1 for in-situ soil - Completely decomposed tuffs.
3. Assume Grade 20D for No fine concrete for conservative
4. Default bedrock model for rock material.

Soil Nail
Working load $=100 \mathrm{kN} / \mathrm{m}$ (same as the as-built drawing no. 611/Z/04/MGS/C22/022)

## Groundwater level

1 m above rockhead level
3. Results

A Summary of Calculated Factors of Safety for the Modified Man-made Features 12NW-C/C520, 12NW-C/C519 (After Excavation)

| Section | Affected Man-Made <br> Features | Without Improvement <br> Works | With Additional Soil Nails |
| :--- | :--- | :--- | :--- |
| A | 12NW-C/C520(1) \& (2) | $1.025<1.4$, NOT OK | $1.541>1.4$, OK |
| B | 12NW-C/C520(1) \& (2) | $1.275<1.4$, NOT OK | $1.409>1.4$, OK |
| C | $12 N W-C / C 520(1) \&(2)$ | $1.345<1.4$, NOT OK | $1.549>1.4$, OK |
| D | $12 N W-C / C 519(1) \&(2)$ | $1.133<1.4$, NOT OK | $1.633>1.4$, OK |




Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use

Modified Feature no. 12NW-C/C520(1)/(2)
Section A - A
(After Excavation without Additional Soil Nails)

Name: Rock
Model: Bedrock (Impenetrable)
Name: CDT
Model: Mohr-Coulomb
Unit Weight: $19 \mathrm{kN} / \mathrm{m}^{3}$ Cohesion: 5 kPa
Phi: $33^{\circ}$
Name: Fill
Model: Mohr-Coulomb
Unit Weight: $19 \mathrm{kN} / \mathrm{m}^{3}$
Cohesion: 2 kPa
Phi: $33^{\circ}$


Proposed Rezoning of Pak Shing Kok
Ventilation Building and Adjacent Area for Residential Use

Modified Feature no. 12NW-C/C520(1)/(2)
Section A - A
(After Excavation with Additional Soil Nails)
Name: Rock
Model: Bedrock (Impenetrable)
$\because \cdot{ }^{\bullet}$
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: $33^{\circ}$
Name: Fill
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³ Cohesion: 2 kPa
Phi: $33^{\circ}$

Name: Rock
Model: Bedrock (Impenetrable)
Name: CDT
Model: Mohr-Coulomb
Unit Weight: $19 \mathrm{kN} / \mathrm{m}^{3}$
Cohesion: 5 kPa
Phi: $33^{\circ}$
Name: No fines concrete
Model: Mohr-Coulomb
Unit Weight: 24 kN/m³ Cohesion: 10000 kPa
Phi: $0^{\circ}$
Name: Fill
Model: Mohr-Coulomb
Unit Weight: $19 \mathrm{kN} / \mathrm{m}^{3}$
Cohesion: 2 kPa
Phi: 33

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use

Modified Feature no. 12NW-C/C520(1)/(2) Section B - B (After Excavtion without Additional Soil Nails)


Proposed Rezoning of Pak Shing Kok
Ventilation Building and Adjacent Area for
Residential Use
Modified Feature no. 12NW-C/C520(1)/(2) •
Section B - B
(After Excavation with Additionad Soil.Nails)


Proposed Rezoning of Pak Shing Kok
Ventilation Building and Adjacent Area for

Residential Use
Name: Rock
Model: Bedrock (Impenetrable)
Modified Feature no. 12NW-C/C520(1)/(2)
Section C - C
(After Excavation without Additional Soil Nails)


Proposed Rezoning of Pak Shing Kok
Ventilation Building and Adjacent Area for Residential Use

Name: Rock
Model: Bedrock (Impenetrable)
Modified Feature no. 12NW-C/C520(1)/(2)
Section C-C
(After Excavation with Additional Soil Nails)


Name: CDT
Model: Mohr-Coulomb
Unit Weight: $19 \mathrm{kN} / \mathrm{m}^{3}$
Cohesion: 5 kPa
Phi: $33^{\circ}$
Name: Fill
Model: Mohr-Coulomb
Unit Weight: $19 \mathrm{kN} / \mathrm{m}^{3}$
Cohesion: 2 kPa
Phi: $33{ }^{\circ}$



Appendix H
Indicative Landscape Master Plan and Tree Survey Report

# Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use 

Technical Assessment

Indicative Landscape Master Plan \& Tree Survey Report

May 2020

Prepared By:
ADI Limited

ADI

## ADI

| Project Title | Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area <br> for Residential Use |
| :--- | :--- |
| Report Title | Indicative Landscape Master Plan \& Tree Survey Report |
| Date of Issue | $5^{\text {th }}$ May 2020 |


|  | Name | Signature | Date |
| :---: | :---: | :---: | :---: |
| Compiled by | Trazy Kong |  | $5^{\text {th }}$ May 2020 |
| Checked by | Elsa Kwong |  | $5^{\text {th }}$ May 2020 |
| Approved by | Alison Lee |  | $5^{\text {th }}$ May 2020 |

## Table of Contents

1. Introduction
2. Existing Site Conditions
3. Proposed Development
4. Landscape Assessment \& Assessment of the Potential Impacts on Existing Trees
4.1 Landscape Assessment
4.2 Tree Survey Findings
4.3 Tree Recommendation and Compensatory Tree Planting Proposal
5. Indicative Landscape Master Plan
5.1 Landscape Design Objectives
5.2 Landscape Areas on Ground Floor
5.3 Landscape Areas on Podium Floor and Car Park Floor
5.4 Hard Landscape Materials Proposal
5.5 Planting Proposal
5.6 Provision of Soft Landscape Areas
5.7 Open Space Proposal
5.8 Irrigation and Drainage
5.9 Lighting
5.10 Barrier Free Access
5.11 Future Landscape Management and Maintenance

## Tables

4.1 Summary of Tree Survey Findings and Recommendation
4.2 Summary of Compensatory Tree Planting Proposal
5.1 Indicative Hard Landscape Materials Schedule
5.2 Proposed Planting Mix
5.3 Minimum Soil Depth of Planting Area (Indicative Only)
5.4 Summary of Soft Landscape Area Provision
5.5 Soft Landscape Maintenance Schedule

## Appendices

Appendix 1 Photos of Existing Site
Appendix 2 Tree Location Plan
Appendix 3 Tree Survey Schedule
Appendix 4 Photographic Record of Tree Survey
Appendix 5 Tree Recommendation Plan
Appendix 6 Compensatory Tree Plan
Appendix 7 Indicative Landscape Master Plan
Appendix 8 Indicative Elevation
Appendix 9 Green Coverage
Appendix 10 Indicative Local Open Space
Appendix 11 Existing Landscape Resources and Landscape Character Areas

## 1. Introduction

The report presents the Indicative Landscape Master Plan and Tree Survey Report for the proposed rezoning of MTR Pak Shing Kok Ventilation Building (PVB) Site and adjacent "Green Belt" Site to the south of PVB for residential use. The report intends to demonstrate the conceptual landscape design for the residential use for the Subject Site based on the architectural design and development layout. The Indicative Landscape Master Plan is attached in Appendix 7.

The proposed residential development will built over the existing Ventilation Building, which will remain operation in future. Replacing existing infrastructure character of the Subject Site with quality residential building and its associated landscape proposal is considered compatible with existing and planned residential character of Hang Hau. The landscape quality of the development would be enhanced by provision of quality planting at ground and upper levels of the residential development portion. Development edge at street level facing Chiu Shun Road will be softened through the use of greenery treatment on slope, tree and shrub planting. The greening proposal extended from street level to the existing slopes surrounding the Subject Site forms a continuous landscape framework to ensure a harmonious relationship between the proposed development and its surroundings.

## 2. Existing Site Conditions

The Subject Site is located at Hang Hau with site area of $4,458 \mathrm{~m}^{2}$. It is bounded by Chiu Shun Road to the northwest, planned public housing development to the northeast and man-made slopes to the southeast and southwest. The Subject Site is occupied by MTR Pak Shing Kok Ventilation Building, hard-paved surfaces for car parking, vehicular circulation for railway facilities, and existing man-made slopes. Planting area with trees and/or shrubs is found at the slope toe and periphery of the Subject Site. Photos showing the existing site conditions are attached in Appendix 1.

## 3. Proposed Development

The Subject Site is proposed to be rezoned to allow for the proposed residential development. The proposed development includes two towers of 27 storeys. The proposed building height s +130mPD.
4. Landscape Assessment \& Assessment of the Potential Impacts on Existing Trees

## 41 Landscape Assessment

## Assessment Area and Baseline Conditions

A study area of 500 m from the site boundary is identified for the landscape assessment. The existing landscape resources (LRs) and landscape character areas (LCAs) within the study area are mapped on plan in Appendix 11.

The study area composed of a combination of landscape resources (LRs) including woodland, shrubland/grassland, plantation, roadside plantation, and open space. The Subject Site is currently composed of LRs as shown in Appendices 1 and 11 including developed area and plantation.

## LRs Sensitivity to Change

LR1 Woodland - It covers the undisturbed area at higher elevation of Pak Shing Kok hillslope with tree and shrub naturally grown over it. Given it is locally important as a green backdrop to Tseung Kwan O New Town landscape context, it is relatively mature, hence its sensitivity to change is high.

LR2 Shrubland/Grassland - It covers the area of mid-slope and hill top of Pak Shing Kok with relatively less amount of trees interspersed with large extents of shrub, groundcover and grass. Trees are relative small in size. The vegetation is naturally grown extending from the wooded area above. It is another major component on Pak Shing Kok hillslope. Considered its less importance to landscape context, its sensitivity to change is medium.

LR3 Plantation - It covers most of man-made slopes at the lower slope of Pak Shing Kok hill slope. It originally formed to accommodate roads and developments or village settlements. Some of these slopes are planted densely with trees and less groundcover whilst some steeper slopes are only grassed and some shotcrete surface are covered by climbing plants. Trees form a green backdrop to roadside amenity. A combination of both exotic and native species is observed. Considered its importance, its maturity and common treatment on man-made slope, its sensitivity to change is medium.

LR4 Roadside Plantation - Common street trees and/shrub are planted in central median and in planter along Wan Po Road and Chiu Shun Road. They are largely exotic species. They are relatively mature and have contribution to the amenity of road corridor. Considered its importance, maturity and rarity, its sensitivity to change is medium.

LR5 Open Space - Hong Kong Velodrome Park/ Tseung Kwan O Sports Ground, Hang Hau Man Kuk Lane Park and Pui Shing Garden are major recreational spaces for general public in Tseung Kwan O New Town. There is another smaller garden, Hang Hau Garden, located at Tin Ha Wan Village. These LR is largely covered by trees and plantation. Considered their importance to the district and its amenity, its sensitivity to change is medium.

## LCAs Sensitivity to Change

The landscape character areas covered the study area is categorised into LCA1 Hang Hau high-rise residential, LCA2 Hang Hau urban fringe and LCA3 Hang Hau recreational landscape character areas. The boundary of these LCAs is shown in Appendix 11. The LCA1 Hang Hau high-rise residential landscape character area is located to the north of Chiu Shun Road that is dominated by high density built-up areas of residential developments with high-rise towers. Also, there are auxiliary community and commercial facilities including schools, shopping centres, gardens, public transport interchange and terminals forming a highly urbanised area. The sensitivity to change of this LCA1 is low.

The LCA2 Hang Hau urban fringe landscape character area is located to the south-east of Chiu Shun Road. This LCA is dominated by Pak Shing Kok vegetated hillslope interspersed with village settlement. The Subject Site is located in this LCA abutting to Chiu Shun Road. This LCA is an urban fringe landscape character with combination of built-up areas, plantation and woodland, its sensitivity to change is medium.

The LCA3 Hang Hau recreational landscape character area is located to the west of Chiu Shun Road and Wan Po Road that is dominated by parks and sports ground with extensive amenity planting scattered with low-rise facility buildings. It is a partially urbanized area with lots of landscape area and planted trees. Its sensitivity to change is medium.

## LRs Magnitude of Change

Considering the proposed development is confined within the site boundary, there is no change and impact on the LRs outside the Subject Site, particularly no change to highly sensitive LR woodland.

Potential landscape impacts would arise from the site formation works and introduction of the proposed residential development. Among the five LRs, the proposed development will only affect those within the Subject Site, which only LR3 plantation is affected

LR3 Plantation - narrow strip planting area at the periphery of the Ventilation Building will be affected. 31 trees and shrubs are inevitable to be removed to accommodate the development. Shrub species are common such as Loropetalum chinense and Hibiscus rosa-sinensis etc. Trees are common amenity species (details of existing trees refer to Appendix 3). A small portion of grass and groundcover on slope within the Site will be affected by columns supporting the residential podium and towers. The magnitude of change on LR3 Plantation within the Study Area is relatively small. Considering with its medium sensitivity, impact on this LR is moderate.

## CAs Magnitude of Change

For the three LCAs, LCA2 Hang Hau urban fringe will be affected by the proposed development as a result of introduction of residential development, as it is where the Subject Site located; while LCA1 and LCA3 will not be affected. The introduction of a small-scale residential development at the edge of LCA2, adjacent to high-rises and a planned housing development, is being a small component in this LCA. The development is also matched with the character of adjacent LCA1 Hang Hau high-rise residential. The vegetated hill in the urban fringe largely remains unchanged. Hence the magnitude of change to the LCA2 is small; impact is considered to be slight.

## Proposed Landscape Mitigation Measures

Landscape mitigation measures (LMMs) are recommended to address and alleviate the landscape impacts mentioned above. LMMs include the followings:

- Establish a multi-level greening framework through the use of tree and shrub planting, edge planting at car park level and greenery treatment on slope to enhance the landscape context and streetscape amenity.
- Compensate the loss of existing trees with a combination of both native and ornamental tree species.
- Introduction of residential landscape to improve amenity and shading in the locality

Details of the landscape and tree planting proposal refer to Paragraph 4.3 and Section 5 below.

## Residual Landscape Impacts and Compatibility

With the implementation of LMMs, the slight to moderate impact on LR3 plantation and LCA2 Hang Hau urban fringe will be alleviated. Considered the small scale of development, the surrounding urban character, the change of utilities character of the Site to residential landscape character, and implementation of new planting proposal and green treatment on slope, the development is compatible to Hang Hau high-rise residential, urban fringe and recreational landscape characters.

### 4.2 Tree Survey Findings

A Tree Location Plan showing the location of existing trees recorded within the Subject Site is attached in the Appendix 2. Condition of existing trees is listed in the Tree Survey Schedule and Photographic Record of Tree Survey in Appendices 3 and 4 respectively.

A total number of 31 trees were found within the Subject Site. The condition of the trees is generally fair with low to medium amenity value. Trees area was originally planted at the periphery of the Ventilation Building or at the slope toe for screening the railway facilities Among 31 trees, 7 trees are found on slopes at the periphery of the Subject Site. These trees are self-seeded species and their condition is generally fair with low amenity value. There are no registered or potential Old and Valuable Tree, rare or protected tree species, or Champion Tree within the Subject Site.

### 4.3 Tree Recommendation and Compensatory Tree Planting Proposal

The proposed development includes two residential towers built on a podium covering the existing Ventilation Building, ground level landscaping and podium garden, as well as at-grade and above-ground car parking spaces

31 existing trees are affected by the proposed residential development and recommended tree felling. Majority of these trees generally have defects such as unbalance crown and leaning form due to their growing condition. Majority of them are exotic species and common to Hong Kong. A few self-seeded trees found on slope are native species to Hong Kong. The form and condition of the affected trees are not good specimens for tree retention and will no fit into the future residential character. They are growing and confined in narrow planting area or interfered by adjacent concrete structures and/or the shotcrete slope behind, hence preparing of a viable rootball for tree transplanting is not technically feasible as such implied a relatively low survival rate and stability after tree transplanting, hence no tree is suitable for tree transplanting

To compensate for the loss of 31 trees, 39 new trees will be planted in the podium garden and ground level of proposed residential development. Due to spatial constraints at ground floor level imposed by continuing the operation of existing railway facilities, as well as to provide vehicular entrance to the Subject Site, necessary car parking and facilities for future residents and the Ventilation Building, tree retention within the Subject Site is not technically feasible. Tree planting opportunities have also been maximised regarding to the constraints mentioned above. Standard size tree stock will be utilised considering its planting location. About 1:1.26 replanting ratio could be achieved to compensate the tree loss and there is a net gain of 8 trees on site. In addition to tree planting, other greenery features have been accommodated in the development such as greenery treatment on slopes and planters along building edge will urther enhance the landscape context.

Table 4.1 provides a summary of the tree survey findings and recommendation. Table 4.2 gives a summary of the Compensatory Tree Planting Proposal.

A Tree Recommendation Plan is shown in Appendix 5. Compensatory Tree Plan indicating the potential locations of the compensatory trees is shown in Appendix 6. Enhanced planting proposals are illustrated in the Indicative Landscape Master Plan in Appendix 7 and Indicative Elevation in Appendix 8.

Table 4.1 Summary of Tree Survey Findings and Recommendation

|  | Subject Site |
| :--- | :--- |
| Existing Trees | 31 nos. |
| Trees affected by the proposed residential development |  |
| Retain | 0 |
| Transplant | 0 |
| Fell | 31 nos. |

Table 4.2 Summary of Compensatory Tree Planting Proposal

|  | Subject Site |
| :--- | :--- |
| Fell | 31 nos. |
| Compensatory Tree for residential <br> development <br> (to be planted in the podium garden and <br> ground level) | 39 nos. |
| Replanting Ratio in Quantity | About 1:1.26 |

## 5. Indicative Landscape Master Plan

This study report has been prepared to support the proposed residential development at the Subject Site. It provides an overview of the proposed landscape design together with a description of the design concept, the level of landscape area provision and a summary of the hard and soft landscape materials.

### 5.1 Landscape Design Objectives

The design objectives for the proposed Indicative Landscape Master Plan of the Subject Site are as follows:

- To provide a quality and sustainable environment with adequate landscape area for the enjoyment of the residents of the proposed development
- To create a landscape character setting which is distinctive for the residential development and establishes a clear design theme which is in tune with Hang Hau residential characters;
- To maximise greening opportunities with the proposed development;
- The proposed landscape design provides an overall sense of coherence while also responding to the various architectural components of the proposed development;
- To enhance the development edge with greenery features such as greenery treatment on slopes and planters along building edge at car park level; and
- To utilise a combination of native and ornamental and/or flowering tree and shrub species with an interesting form, colour and foliage texture to enrich the landscape experiences and provide architectural highlights.


### 5.2 Landscape Areas on Ground Floor

Landscape areas on the ground floor comprise of planting areas with shrubs and trees along the pedestrian pathway of Chiu Shun Road. Besides, greenery treatment will be added on existing slopes within the Subject Site to provide green backdrop for the development and to blend into the local urban fringe landscape. The greenery treatment on slope within the development site boundary will be maintained by the Proposed Development. The greenery features mentioned above can be seen in views at pedestrian level as well as through the voids at the lower levels of proposed development. The hard landscape surfaces have integrated paving patterns and design highlights for the entrance threshold to the residentia lobby and demarcate the shared vehicular entrance to the residential building and the Ventilation Building

Landscaping provisions on the ground floor are illustrated in Figure 7.1 in Appendix 7 Figures 8.1 and 8.2 in Appendix 8.

### 5.3 Landscape Areas on Podium Floor and Car Park Floor

Landscape areas on the podium floor are designed in form of courtyard gardens framed by trees, shrubs and/or hedges to create a tranquil and shaded environment. These gardens will accommodate passive recreation facilities and sitting out areas for the enjoyment of future residents. Decorative paving highlights the pathway through the gardens and to the residential lobby on podium. Planting along the building edge at the car park floor will also soften the development edge. Planting in the covered area will utilise shade tolerant shrub species to maximise area of visible greenery.

Landscaping provisions on the car park floor and podium floor are illustrated in Figures 7.2 and 7.3 in Appendix 7.

The materials and finishes for the key exterior landscape areas to complement the quality of the architectural finishes are described in the following table．The proposal is indicative and subject to detailed design．Non－slip paving materials will be selected to suit the various uses within the Subject Site

Table 5．1 Indicative Hard Landscape Materials Schedule

| Table 5.1 Indicative Hard Landscape Materials Schedule |
| :--- |
| Location Material \＆Colour <br> Vehicular Entrance and <br> Car Parking Areas Recycled pavers <br> with a combination of neutral／grey colour palette <br> Pedestrian Entrance to <br> Residential Lobby Natural stone or artificial granite tile <br> with a combination of earth colour palette／beige <br> colour <br>  $\bullet \quad$Natural stone and／or artificial granite tile with a <br> combination of grey and beige colour palette <br> Courtyard Gardens －$\quad$Natural coloured recycled wood panel <br> on Podium <br> －Proprietary seating bench of natural coloured <br> recycled wood and stainless steel  |

## 5．5 Planting Proposal

Species proposed for the Subject Site are chosen for their attractive foliage，lush colours and varies shapes in order to create an attractive visual appearance．Use of a combination of evergreen，broadleaf and／or ornamental trees and／or flowering shrubs enhances the quality． Shade tolerant species will be used underneath the building block or area with relative less sun light．Trees within the landscape areas will be specified at standard size．

A summary of proposed plant materials is provided as follows：

## Table 5．2 Proposed Planting Mix

| Botanical Name | Chinese Name | Size（DBH） | Spacing（mm） |
| :---: | :---: | :---: | :---: |
| Tree |  |  |  |
| Bischofia javanica | 秋楓 | Standard | $\begin{gathered} \text { Minimum } \\ 3500-5000 \mathrm{~mm} \end{gathered}$ |
| Cinnamomum burmanii | 陰香 |  |  |
| Elaeocarpus hainanensis | 水石榕 |  |  |
| Garcinia subelliptica | 菲島福木 |  |  |
| llex rotunda | 鐵冬青 |  |  |
| Magnolia grandiflora | 荷花玉蘭 |  |  |
| Plumeria rubra | 雞蛋花 |  |  |
| Senna surattensis | 黃槐 |  |  |
| Terminalia mantaly | 小葉欖仁 |  |  |
|  |  |  |  |
| Botanical Name | Chinese Name | Size（Height x <br> Spread）（mm） | Spacing（mm） |
| Shrub |  |  |  |
| Alpinia speciosa ＇Variegata＇ | 花葉豓山薑 | $400 \times 300$ | 450 |
| Brunfelsia acuminata | 鴛鶽茉莉 | $250 \times 250$ | 300 |
| Bougainvillea spectabilis | 簕杜鵑 | $700 \times 600$ | 500 |
| Cordyline fruticosa | 朱蕉 | $700 \times 500$ | 400 |
| Dracaena sanderiana Virescens＇ | 富貴竹 | $500 \times 300$ | 400 |
| Duranta erecta＇Golden Leave＇ | 金葉假邊堯 | $300 \times 300$ | 200 |
| Ixora chinensis | 龍船花 | $450 \times 300$ | 250 |
| Phyllanthus myrtifolius | 錫蘭葉下珠 | $200 \times 200$ | 150 |
| Plumbago auriculata | 藍雪花 | $300 \times 250$ | 250 |
| Rhapis humilis | 棕竹 | $800 \times 600$ | 400 |
| Sansevieria trifasciata ＇Laurentii＇ | 金邊虎尾蘭 | $450 \times 150$ | 300 |
| Schefflera arboricola ＇Variegata＇ | 花葉鴨腳木 | $400 \times 300$ | 300 |
| Groundcover |  |  |  |
| Nephrolepis exaltata | 波士頓堅蕨 | $300 \times 300$ | 200 |
| Tradescantia zebrina | 吊竹草 | $200 \times 250$ | 300 |
| Hedge Planting |  |  |  |
| Ficus microcarpa cv． Golden Leaves | 黄金榕 | $1500 \times 1000$ Columnar | 800 |


| Botanical Name | Chinese Name | Size（Height x Spread）（mm） | Spacing（mm） |
| :---: | :---: | :---: | :---: |
| Planting on Slope |  |  |  |
| Cynodon dactylon | 狗牙根 | Part of hydroseeding mix |  |
| Lolium perenne | 黑麥草 |  |  |
| Eragrostis curvula | 彎葉畫眉草 |  |  |
| Paspalum notatum | 百喜草 |  |  |
| Zoysia matrella | 溝葉結縷草 |  |  |
| Ficus pumila | 薜荔 |  |  |

The following minimum soil depth should be incorporated into all planting areas／planters for the health of plant establishment．Structural and drainage layers shall be excluded from the minimum depth of planter required．
Table 5.3 Minimum Soil Depth of Planting Area（Indicative Only）

| Plant Category | Minimum Soil Depth | Location |
| :--- | :--- | :--- |
| Trees | 1200 mm | Ground and Podium Floor |
| Shrubs／Hedges and <br> Climber Plants | 600 mm | Ground and Podium Floor |
| Hydroseeding on Green <br> Slope Feature with <br> Geofibre or other Geomat <br> products | 150 to 300 mm thick <br> growing media | On Slope |

## 5．6 Provision of Soft Landscape Area

To fulfil the Practice Note for Authorized Persons（PNAP）PNAP－APP－152 Sustainable Building Design Guidelines，not less than $20 \%$ of green coverage within the Subject Site is required．Not less than $10 \%$ of the greenery shall be provided at the Primary Zone within the 15 m vertical zone of the site along the abutting mean street level．The provision of soft landscape areas in terms of total planting area is summarised as follows：
Table 5．4 Summary of Soft Landscape Area Provision

| Location | Area $\left(\mathrm{m}^{2}\right)$ | Reduction <br> Factor | Greenery Area in <br> Primary Zone $\left(\mathrm{m}^{2}\right)$ | Total Greenery <br> Area $\left(\mathrm{m}^{2}\right)$ |
| :--- | :--- | :--- | :--- | :--- |
| Ground Floor Planting Areas <br> （uncovered） | $164 \mathrm{~m}^{2}$ | N／A | $164 \mathrm{~m}^{2}$ | $164 \mathrm{~m}^{2}$ |
| Greenery Treatment／ <br> Hydroseeding on Slopes <br> （uncovered） | $282 \mathrm{~m}^{2}$ | NIL | $282 \mathrm{~m}^{2}$ | $282 \mathrm{~m}^{2}$ |
| Podium Floor Planting Areas <br> （uncovered） | $446 \mathrm{~m}^{2}$ | N／A | - | $446 \mathrm{~m}^{2}$ |
|  |  |  | $446 \mathrm{~m}^{2}$ <br> $(=10 \%$ of site area）$)$ | $892 \mathrm{~m}^{2}$ <br> $(=20 \%$ of site area $)$ |

As shown above，not less than $20 \%$ of total green coverage is provided for the residentia development，in which not less than 10\％of green coverage is provided at Primary Zone Areas with green coverage are illustrated in Appendix 9.

5．7 Open Space Proposal
According to the Hong Kong Planning Standards and Guidelines（HKPSG），the standard of provision of local open space is $1 \mathrm{~m}^{2}$ per person for residential development．The estimated population for the proposed residential development is 1,210 persons．Therefore，not less than $1,210 \mathrm{~m}^{2}$ of local open space will be provided for the residential development in accordance to the HKPSG．The indicative local open space is shown in Appendix 10

## 5．8 Irrigation and Drainage

Drainage will be adequate and in compliance with relevant regulations．The proposed irrigation system will be via manual water point operation and covers the entire planting area within the Subject Site．Sub－soil drainage shall be provided for all planting areas．

## 5．9 Lighting

The objective of landscape lighting is to provide a safe and secured environment，while maintaining themed lighting effect to the landscape．All the accessible points and open space areas will be provided with sufficient illumination to meet the required lighting standards．

## 5．10 Barrier Free Access

Design of all landscape areas would comply with the latest Design Manual－Barrier Free Access issued by the Buildings Department

5．11 Future Landscape Management and Maintenance

The management office of the Proposed Development will employ maintenance staff to take care of all landscape areas including hard and soft landscape works as described below：

Hard Landscape Elements

## I－Routine Maintenance（Daily－Weekly）

a．Rubbish and litter removal；
b．Sweeping and cleaning
c．Water feature cleaning；and
d．Damage inspection and repair for site furniture and light bulb replacement．

## II - Annual / Long Term Maintenance

a. Repainting;
b. Resurfacing of worn pavements;
c. Replacing worn parts site furniture, lighting fixture and other facilities; and
d. Replacement of worn landscape furniture.

## Soft Landscape Elements

The softworks contractor will be responsible for a 12-month establishment period of plants after practical completion of the planting works. It allows a period of time for proper establishment of the plants.

Upon the end of the 12-month establishment period, the management office of the Proposed Development will employ maintenance staff to take care of all landscape areas within the development.

Tree Management and Maintenance
The management office of the Proposed Development will employ a certified arborist/tree assessor or competent person to carry out a tree risk assessment during operation stage of the development. The assessment shall be following the procedures and requirements stipulated in the Guidelines for Tree Risk Assessment and Management Arrangement by Greening, Landscape and Tree Management Section of Development Bureau. The assessment shall cover all trees within the site and shall be conducted at least once a year before wet season.

The soft landscape maintenance schedule including tree risk assessment and management arrangement is presented in Table 5.5

Table 5.5 Soft Landscape Maintenance Schedule

| Item | Maintenance <br> Operation | Frequency | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Replacement <br> planting | As required |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | Checking after <br> exceptional <br> weather | As required |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | Irrigation | As required |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | Litter <br> collection | As required |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 | Weed control | Once/month |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | Fertiliser <br> application | Twice/year |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | Pruning | Thrice/year |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | Top-up soil <br> and mulch | Once/year |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 | Pest control | As required |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | Tree Risk <br> Assessment | Once/year <br> or as required |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | Maintenance <br> inspection | Four <br> times/year |  |  |  |  |  |  |  |  |  |  |  |  |

$\square$ Feasible maintenance month/period
Note: Irrigation (item 3) will be on a twice daily basis when necessary. The other maintenance operations outlined in the schedule above will be performed as part of the monthly maintenance visit when necessary. The frequency of the pruning operation (item 7) will be determined by the individual species. The maintenance operation will include the periodic replacement of the plants where required ( 5 to 10 years depending on the species and the maintenance objectives). The condition of the plants will be assessed during the maintenance inspection and following up the replacement strategy adjusted accordingly.

APPENDIX 1


APPENDIX 2


APPENDIX 3

Proposed Rezoning of Pak Shing Kok Ventilation Building and Adjacent Area for Residential Use
Tree Survey Schedule
to be read in conjunction with drawing numbers：DLNA20C－PVB－TL01 and DLNA20C－PVB－TR01．

| Tree ID | Botanical Name | Chinese Name | Survey Size（M） |  |  | Soil <br> Level at <br> Base of <br> Tree | Amenity Value |  |  | Form |  |  | Health Condition |  |  | Structural Condition |  |  | Transplant Survival Rate |  |  | Location |  | ConservationStatus | Recommendation |  |  | Justification | $\begin{gathered} \text { Current } \\ \text { Maintenance } \\ \text { Responsible Party } \end{gathered}$ | Remarks |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | DBH | Height | Crown |  | High | Med | Low | Good | Fair | Poor | Good | Fair | Poor | Good | Fair | Poor | High | Med | Low | Flat | Slope |  | Retain | Transplant | Fell |  |  |  |
| T1 | Aleurites moluccana | 䃌 | 0.13 | 5 | 3 | 8.47 |  | 1 |  |  |  | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not isted |  |  | 1 | B，E | MTR Railway | Unbalanced tree crown，broken branch，confined by narrow planter |
| T2 | Ficus virens | 大葉榕 | 0.26 | 7 | 6 | 8.20 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B，E | MTR Railway | Climbers，watersprouts，confined by narrow planter |
| T3 | Ficus virens | 大葉穃 | 0.18 | 4 | 3 | 7.99 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B，E | MTR Railway | confined by narrow planter |
| T4 | Casuarina equisetifolia | 木厥黄 | 0.22 | 10 | 3 | 7.91 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B，E | MTR Railway | confined by narrow planter |
| T5 | Casuarina equisetifolia | 木麻黄 | 0.25 | 12 | 3 | 7.87 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B，E | MTR Railway | confined by narrow planter |
| T6 | Casuarina equisetifolia | 木麻黄 | 0.26 | 11 | 3 | 8.00 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B，E | MTR Railway | confined by narrow planter |
| T7 | Ficus virens | 大葉榕 | 0.13 | 4 | 3 | 7.93 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B，E | MTR Railway | Climbers，confined by narrow planter |
| T8 | Ficus virens | 大葉积 | 0.17 | 6 | 5 | 7.98 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B，E | MTR Railway | Dead stub，confined by narrow planter |
| T9 | Melaleuca cajuputi subsp． cumingiana | 白千層 | 0.27 | 8 | 4 | 7.69 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | в | MTR Railway |  |
| T10 | Bauhinia x blakeana | 洋紫荆 | 0.25 | 4 | 3 | 7.59 |  |  | 1 |  |  | 1 |  | 1 |  |  |  | 1 |  |  | 1 | 1 |  | Not listed |  |  | 1 | B，${ }^{\text {E }}$ | MTR Railway | Leaning，unbalanced tree crown，support by staking， cavity at trunk |
| T11 | Bauhinia x blakeana | 洋紫荊 | 0.13 | 3 | 5 | 7.69 |  |  | 1 |  |  | 1 |  | 1 |  |  |  | 1 |  |  | 1 | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Borer，crooked branches |
| T12 | Delonix regia | 鳳凰木 | 0.38 | 6 | 5 | 7.50 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Included bark，multiple stems，codominant stems |
| T13 | Bauhinia x blakeana | 洋紫蜊 | 0.20 | 5 | 5 | 7.24 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Bark crack |
| T14 | Aleurites moluccana | 石票 | 0.20 | 5 | 4 | 7.17 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Support by staking，corrected lean，bending trunk |
| T15 | Melaleuca cajuputi subsp． cumingiana | 白千層 | 0.27 | 8 | 4 | 7.32 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  | 1 |  | Not listed |  |  | 1 | в | MTR Railway |  |
| T16 | Melaleuca cajuputi subsp． cumingiana | 白千層 | 0.21 | 6 | 3 | 8.77 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  | 1 |  | Not listed |  |  | 1 | B | MTR Railway |  |
| T17 | Melaleuca cajuputi subsp． cumingiana | 白千層 | 0.27 | 7 | 3 | 8.94 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  | 1 |  | Not listed |  |  | 1 | в | MTR Railway |  |
| T18 | Albizia lebbeck | 大葉合歡 | 0.15 | 5 | 3 | 8.95 |  |  | 1 |  |  | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Unbalanced tree crown，dieback，dead branch |
| T19 | Delonix regia | 鳳凰木 | 0.37 | 8 | 7 | 8.77 |  | 1 |  |  | 1 |  |  | 1 |  |  |  |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Dead stub |
| T20 | Albizia lebbeck | 大葉合歡 | 0.11 | 4 | 3 | 8.79 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Dead stub |
| T21 | Cinnamomum camphora | 弾 | 0.25 | 7 | 5 | 8.86 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Leaning，twigs |
| T22 | Ficus virens | 大葉榕 | 0.28 | 8 | 6 | 8.84 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Crossed branches，unbalanced tree crown |
| T23 | Ficus virens | 大葉榕 | 0.34 | 11 | 8 | 8.52 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | в | MTR Railway | Crossed branches，twigs，watersprouts．Co－dominant trunk |
| T24 | Celtis sinensis | 朴榯 | 0.17 | 8 | 3 | 8.79 |  |  | 1 |  |  | 1 |  | 1 |  |  | 1 |  |  |  | 1 | 1 |  | Not listed |  |  | 1 | B | MTR Railway | Swelling trunk，unbalanced tree crown，leaning， climbers |
| T25 | Macaranga tanarius var．tomentosa | 血桐 | 0.26 | 5 | 6 | 9.43 |  |  | 1 |  |  | 1 |  | 1 |  |  |  | 1 |  |  | 1 |  | 1 | Not listed |  |  | 1 | в | HyD | Co－dominant trunks，outside existing fencing，on slope，root restricted by u－channel |
| T26 | Macaranga tanarius var．tomentosa | 血桐 | 0.25 | 4 | 5 | 10.14 |  |  | 1 |  |  | 1 |  | 1 |  |  |  | 1 |  |  | 1 |  | 1 | Not listed |  |  | 1 | B | HyD | on slope，root restricted by u－channel |
| T32 | Sapium sebiferum | 鳥柏 | 0.28 | 7 | 6 | 18.73 |  | 1 |  |  | 1 |  |  | － |  |  | 1 |  |  |  | 1 |  | 1 | Not listed |  |  | 1 | B | HyD | Co－dominant trunk |
| T33 | Cinnamomum cassia | 肉桂 | 0.10 | 3 | 2 | 18.19 |  | 1 |  |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 |  | 1 | Not listed |  |  | 1 | B | HyD | Multi－trunk |
| T34 | Macaranga tanarius var．tomentosa | 血桐 | 0.22 | 5 | 5 | 16.55 |  |  | 1 |  | 1 |  |  | 1 |  |  | 1 |  |  |  | 1 |  | 1 | Not listed |  |  | 1 | B | HyD |  |
| T49 | Mallotus paniculatus | 白森 | 0.16 | 6 | 4 | 18.69 |  |  | 1 |  |  | 1 |  | 1 |  |  | 1 |  |  |  | 1 |  | ＋ | Not listed |  |  | 1 | B | HyD | crooked trunk，restricted rooting area |
| T50 | Mallotus paniculatus | 白森 | 0.12 | 6 | 4 | 18.72 |  |  | 1 |  |  | 1 |  | 1 |  |  | 1 |  |  |  | 1 |  | 1 | Not listed |  |  | 1 | B | HyD | restricted rooting area |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Legend

Soil Level at the base of the Tree
The diameter of the trunk of the plant measured at a height of 1300 mm above ground level．
It should be noted that this figure provides the existing soil level and that where these trees are to be retained in－situ the soil level will be maintained at the base of the tree and not cover the root collar

## Amenity Value

High With cultural significance or high functional and visual signficance，or mature and good to medium form and health condition－ $\begin{array}{ll}\text { Medium } & \text { With cultural significance but poor form and health co } \\ \text { Low } & \text { Common species and poor form and health condition }\end{array}$

## Tree Form／Health Condition／Structural Conditio

G Good
Fair
Poor
Transplant Survival Rate
High Very likely to survive after transplantation．
Low Unlikely to survive due to poor health／form；or tree species has very little tolerance to the effects of transplanting；or difficult to transplant．

## Uustification for Tree Recommendatio

$\begin{array}{ll}\text { A } \text { Tree retention recommended } \\ \text { B } & \text { Felling recommended as tree is directly in conflict with the residential development／site formation work }\end{array}$
C Tree transplanting recommended
D Dead tree to be removed

Remarks
Special characteristics of tree form and health condition，any evidence of broken trunk
－Special characteristics of tree form and heath condtion，any evidence of broken trunk
leaning trunk trunk decay or water sprouts will berecorded in the remarks of the Tree Survey
－Trees with high conservation values such has reare or protected species or of Old and
Valuable tree values or will be recorded in the remarks of the Tree Survey Schedule．

APPENDIX 4






T8（OVERALL）


T9（OVERALL）


T8（BASE）


T9（BASE）


T8（TRUNK）


T9（CROWN）


T8（CROWN）

| SCALE | As Shown | DATE | JUL 2017 | ADI | ADI LIMITED LANDSCAPE ARCHITECTURE，URBAN DESIGN AND MASTER PLANNING 10／F BANGKOK BANK BUILDING， 18 BONHAM STRAND WEST，HONG KONG 10／F BANGKOK BANK BUILDING， 18 <br> 雅博奥頓圆際狡計有限 $\qquad$ $\qquad$ $\qquad$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | drawn | TEAM |  |  |
| FIGURE No． | DLNA20C－TS－T5 |  | REV |  |  |
|  |  |  |  |  |  |



T11（OVERALL）


T10（BASE）


T11（DETAILS）


T10（TRUNK）


T11（TRUNK）


T10（CROWN）


T11（CROWN）
R－Retain T－Transplant F－Fell D－Dead Tree

| Scale | As Shown | DATE | JUL 2017 | ADI | ADI LIMITED 10／F BANGKOK BANK BUILDING， 18 BONHAM STRAND WEST，HONG KON雅博自頓國際故㐖有限公司$\qquad$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | drawn | теAM |  |  |
| Figure no． | DLNA20C－TS－T6 |  | Rev |  |  |
|  |  |  | － |  |  |




T13(OVERALL)


T14(OVERALL)


T13(BASE)


T14(BASE)


T13(CROWN)


T14(TRUNK)


T13(DETAILS)


T14(CROWN)
R-Retain T-Transplant F-Fell D-Dead Tree

| SCALE | As Shown | DATE | JUL 2017 | ADI | AORIMITED |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | drawn | TEAM |  | mom nem |
| FIGURE No. | DLNA20C-TS-T8 |  | REV |  |  |
|  |  |  | - |  |  |





T19(OVERALL)


T19(CROWN)


T19(OVERALL)


T19(CROWN)


T19(BASE)


T19(DETAILS)


T19(TRUNK)

| SCALE | As Shown | DATE | JUL 2017 | ADI |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | drawn | тEAM |  |  |
| Figure no. | DLNA20C-TS-T11 |  | REV |  |  |
|  |  |  |  |  |  |



T20(OVERALL)


T21(OVERALL)


T21(BASE)


T20(TRUNK)


T21(TRUNK)


T20(CROWN)


T21(CROWN)

R-Retain T-Transplant F-Fell D-Dead Tree

| SCALE | As Shown | DATE | JUL 2017 | ADI |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | drawn | TEAM |  | (eate |
| Figure no. | DLNA20C-TS-T12 |  | REV |  |  |
|  |  |  |  |  |  |





T24(OVERALL)


T24(CROWN)


T24(BASE)


T24(DETAILS)


T24(BASE)


T24(TRUNK)



T25(OVERALL)


T25(TRUNK)

T25(BASE)



T25(TRUNK)


T25(CROWN)



T26（OVERALL）

T26（CROWN）


T26（CROWN）


T26（BASE）


T26（TRUNK）

| SCALE | As Shown | DATE | JUL 2017 | ADI | ADI LIMITED LANDSCAPE ARCHITECTURE，URBAN DESIGN AND MASTER PLANNING 10／F BANGKOK BANK BUILDING， 18 BONHAM STRAND WEST，HONG KONG 10／F BANGKOK BANK BUILDING， 18 TELEPHONE 21318630 FACSIMLE 21318609 <br> 雄博奥頓圆際敬計有限 $\qquad$ <br> 秀㟟上 $\square$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | drawn | теAM |  |  |
| Figure no． | DLNA20C－TS－T17 |  | REV |  |  |
|  |  |  | － |  |  |





T34（CROWN）

T34（CROWN）


| Scale | As Shown | date | JUL 2017 | ADI | ADI LIMITED LANDSCAPE ARCHITECTURE，URBAN DESIGN AND MASTER PLANNING 10／F BANGKOK BANK BUILDING， 18 TELEPHONE 21318630 FACSIMLE 21318609 <br> 雅博奥頓图際烚竍有限公 <br>  <br>  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHECKED | ELK | drawn | TEAM |  |  |
| FIGURE No． | DLNA20C－TS－T19 |  | REV |  |  |
|  |  |  | － |  |  |



APPENDIX 5


APPENDIX 6


APPENDIX 7




APPENDIX 8



APPENDIX 9


APPENDIX 10


APPENDIX 11


Provision of Major Community Facilities and Open Space in Tseung Kwan O

| Type of Facilities | Hong Kong Planning Standards and Guidelines (HKPSG) | HKPSG <br> Requirement (based on planned population: about 470,800 ${ }^{1,2}$ ) | Provision |  | Surplus / Shortfall (against planned provision) |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Existing Provision | Planned (existing + proposed) Provision |  |
| District Open Space | $\begin{array}{c\|} \hline 10 \text { ha per } \\ 100,000 \text { persons } \end{array}$ | 45.66 ha | 22.40 ha | 54.89 ha | +9.23ha |
| Local Open Space | $\begin{array}{c\|} \hline 10 \text { ha per } \\ 100,000 \text { persons } \end{array}$ | 45.66 ha | 62.98ha | 71.78 ha | +26.12 ha |
| Secondary School | 1 whole day classroom for 40 persons aged $12-17^{*}$ | $\begin{gathered} 521 \\ \text { classrooms } \end{gathered}$ | 684 classrooms | 774 classrooms | $+253$ <br> classrooms |
| Primary School | 1 whole day classroom for 25.5 persons aged 6-11* | $678$ <br> classrooms | 693 classrooms | 783 classrooms | $+105$ <br> classrooms |
| Kindergarten/ Nursery | 34 classrooms for 1,000 persons aged 3 to under $6^{*}$ | $256$ <br> classrooms | 322 classrooms | 360 <br> classrooms | $+104$ <br> classrooms |
| District Police Station | $\begin{aligned} & 1 \text { per } 200,000 \text { to } \\ & 500,000 \text { persons } \end{aligned}$ | 0 | 1 | 1 | 1 |
| Divisional Police Station | $\begin{aligned} & 1 \text { per } 100,000 \text { to } \\ & 200,000 \text { persons } \end{aligned}$ | 2 | 0 | 1 | -1 |
| Hospital | 5.5 beds per 1,000 persons | $\begin{gathered} \hline \text { 2,589 } \\ \text { beds } \end{gathered}$ | $\begin{gathered} 1,228 \\ \text { beds } \end{gathered}$ | $\begin{gathered} 2,828 \\ \text { beds } \end{gathered}$ | $\begin{gathered} +239 \\ \text { beds } \end{gathered}$ |
| Clinic/Health Centre | $\begin{gathered} 1 \text { per } 100,000 \\ \text { persons } \end{gathered}$ | 4 | 2 | 4 | 0 |
| Magistracy (with <br> 8 Courtrooms) | $\begin{gathered} 1 \text { per } 660,000 \\ \text { persons } \end{gathered}$ | 0 | 0 | 0 | 0 |
| District Elderly Community Centres | 1 in each new development area with a population of around 170,000 or above ${ }^{\#}$ | N/A | 2 | 2 | N/A ${ }^{3}$ |


| Type of Facilities | Hong Kong Planning Standards and Guidelines (HKPSG) | HKPSG <br> Requirement <br> (based on <br> planned <br> population: <br> about 470,800 ${ }^{1,2}$ ) | Provision |  | Surplus / Shortfall (against planned provision) |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Existing Provision | Planned (existing + proposed) Provision |  |
| Neighbourhood Elderly Centres | 1 in a cluster of new and redeveloped housing areas with a population of 15,000 to 20,000 persons, including both public and private housing | N/A | 4 | 7 | N/A ${ }^{4}$ |
| Community Care Services Facilities | 17.2 subsidised places per 1,000 elderly persons aged 65 or above ${ }^{\#}$ | $2,034^{5}$ <br> places | 774 places | $\begin{gathered} 894 \\ \text { places } \end{gathered}$ | $\begin{gathered} -1,140^{6} \\ \text { places } \end{gathered}$ |
| Residential Care Homes for the Elderly | 21.3 subsidised beds per 1,000 elderly persons aged 65 or above ${ }^{\#}$ | $\begin{gathered} \text { 2,518 } \\ \text { beds } \end{gathered}$ | $\begin{aligned} & 1,022 \\ & \text { beds } \end{aligned}$ | $\begin{aligned} & 1,202 \\ & \text { beds } \end{aligned}$ | $\begin{gathered} -1,316^{6} \\ \text { beds } \end{gathered}$ |
| Child Care Centre | 100 aided places per 25,000 persons | $\begin{gathered} 1,826 \\ \text { places } \end{gathered}$ | $\begin{gathered} 726 \\ \text { places } \end{gathered}$ | $\begin{gathered} 926 \\ \text { places } \end{gathered}$ | $\begin{gathered} -900^{7} \\ \text { places } \end{gathered}$ |
| Integrated Children and Youth Services Centre | 1 for 12,000 persons aged 6-24 ${ }^{\text {\# }}$ | 6 | 7 | 7 | +1 |
| Integrated Family Services Centre | $\begin{array}{\|c\|} \hline 1 \text { for } 100,000 \text { to } \\ 150,000 \text { persons } \end{array}$ | 3 | 3 | 4 | +1 |
| Library | $\begin{gathered} 1 \text { district library } \\ \text { for } 200,000 \\ \text { persons } \end{gathered}$ | 2 | 2 | 2 | 0 |
| Sports Centre | $\begin{aligned} & 1 \text { per } 50,000 \text { to } \\ & 65,000 \text { persons } \end{aligned}$ | 7 | 6 | 8 | +1 |


| Type of Facilities | $\begin{array}{l}\text { Hong Kong } \\ \text { Planning } \\ \text { Standards and } \\ \text { Guidelines } \\ \text { (HKPSG) }\end{array}$ | $\begin{array}{l}\text { HKPSG } \\ \text { Requirement } \\ \text { (based on } \\ \text { planned } \\ \text { population: } \\ \text { about 470,800 }\end{array}$ | Provision |  |
| :--- | :--- | :--- | :---: | :---: | :---: |$)$

## Remarks:

1. "Planned Population" is estimated based on the existing population and future population generated from known and planned residential developments under 2016-based TPEDM (i.e. including the estimated population of 4 downhill sites and MTR Pak Shing Kok Ventilation Building).
2. Depending on the nature of the community facilities, different population categories will be used for estimating GIC requirements ("Planned Population" may include Usual Residents and/or Mobile Residents and/or Transients).
3. Provision of District Elderly Community Centres is only applicable for new development areas. The OZP area is not a new development area.
4. Provision of Neighbourhood Elderly Centres is only applicable for clusters of new and redeveloped housing areas with 15,000 to 20,000 persons. There is no such cluster in the OZP area.
5. The planning standard of the Community Care Services (CCS) Facilities (including both centre-based and home-based) is population-based. There is no rigid distribution between centre-based CCS and home-based CCS stated in the Elderly Services Programme Plan. Nonetheless, in general, $60 \%$ of CCS demand will be provided by home-based CCS and the remaining $40 \%$ will be provided by centre-based CCS.
6. As the revised standards reflect the long-term target towards which the provision of elderly services and facilities would be adjusted progressively subject to the consideration of the SWD in the planning and development process, it may not be appropriate to compare the standards with the provision of elderly services and facilities for the existing population. PlanD and SWD will work closely together to ensure that additional GIC facilities will be included in new and redevelopment proposals from both public and private sectors.
7. This is a long-term target and the actual provision would be subject to the consideration of the SWD in the planning and development process as appropriate. PlanD and SWD will work closely together to ensure that additional GIC facilities will be included in new and redevelopment proposals from both public and private sectors.
\# The requirements exclude transients.

* The requirements exclude mobile residents and transients (i.e. usual residents only).



將軍澳分區計劃大綱核准圖編號 S／TKO／26
APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN No．S／TKO／26


將軍澳分區計劃大綱核准圖編號 S／TKO／26 的擬嶬修訂 PROPOSED AMENDMENTS TO THE
APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN No．S／TKO／26

## 位置圖 LOCATION PLAN

將軍澳分區計劃大綱核准圖編號 S／TKO／26 的擬議修訂 PROPOSED AMENDMENTS TO THE APPROVED

| 規劃署 <br> PLANNING <br> DEPARTMENT |  |
| :---: | :---: |
| 參考編號 REFERENCE No． | 圖 PLAN |
| M／TKO／20／14 | 2 |




（3）

（4）


地點界線只作識別用
SITE BOUNDARY FOR IDENTIFICATION PURPOSE ONLY

## 實地照片 SITE PHOTO

將軍澳分區計劃大綱核准圖編號 S／TKO／26 的擬議修訂 PROPOSED AMENDMENTS TO THE APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN No．S／TKO／26

## 規劃署

PLANNING
DEPARTMENT


## 參考編號

REFERENCE No
M／TKO／20／14


[^0]:    ${ }^{(1)}$ The SKDC passed a motion titled＂反對昭信路公屋規劃及百勝角通風大樓的私人住宅發展規劃＂at the meeting held on 5 May 2020.

[^1]:    Aition
    
    ADI
    

[^2]:    Figure 8.14

[^3]:    Figure 8.18 VR Contour Plot under SE wind of Conceptual Scheme

[^4]:    
    
    ADI
    

