

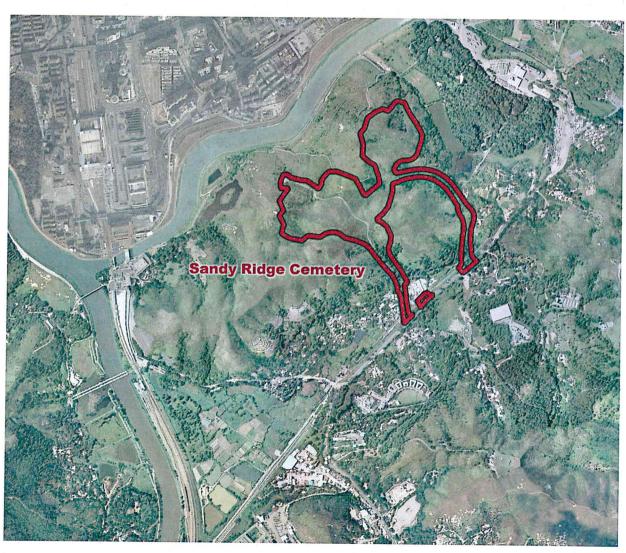
土木工程處

**Civil Engineering Office** 

Agreement No. CE 1/2013 (CE)
Site Formation and Associated Infrastructural Works for
Development of Columbarium, Crematorium and Related
Facilities at Sandy Ridge Cemetery

- Design and Construction

Final Traffic Impact Assessment Report (Rev. 5) (Ref: REP-024-08)



**ARUP** 

# Civil Engineering and Development Department

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Infrastructural Works for
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Crematorium and Related
Facilities at Sandy Ridge Cemetery
- Design and Construction

Final Traffic Impact Assessment Report (Rev.5)

REP-024-08

Final (Rev. 5)

This report takes into account the particular instructions and requirements of our client.

This report may be provided to third parties solely to inform any such person that our report has been prepared and to make them aware of its substance but not for the purposes of reliance. No third party is entitled to rely on this report unless and until they and we sign a reliance letter in the form attached to our appointment. We do not in any circumstances accept any responsibility or liability to retail investors whether via bond issue or otherwise and no such party is entitled to relay on this report.

In preparing this report we have relied on information provided by others and we do not accept responsibility for the accuracy of such information.

We emphasise that the forward-looking projections, forecasts, or estimates are based upon interpretations or assessments of available information at the time of writing. The realisation of the prospective financial information is dependent upon the continued validity of the assumptions on which it is based. Actual events frequently do not occur as expected, and the differences may be material. For this reason, we accept no responsibility for the realisation of any projection, forecast, opinion or estimate.

Findings are time-sensitive and relevant only to current conditions at the time of writing. We will not be under any obligation to update the report to address changes in facts or circumstances that occur after the date of our report that might materially affect the contents of the report or any of the conclusions set forth therein.

In preparing this report we have relied on information supplied by others. We have relied in particular on the accuracy and completeness of such information and accept no liability for any error or omission in this report to extent the same results from errors or omissions in the information supplied by others

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 231448

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### 1 Introduction

### 1.1 General

1.1.1 On 28 June 2013, Civil Engineering and Development Department (CEDD) commissioned Ove Arup & Partners Hong Kong Limited (Arup) as the Consultant to undertake the design and construction on site formation and infrastructural works for development of columbarium, crematorium and related facilities at the Sandy Ridge Cemetery.

## 1.2 Project Background

- With a growing and aging population in Hong Kong, the number of 1.2.1 deaths and the corresponding number of cremations have been rising gradually every year, resulting in an increasing public demand for columbarium facilities. Based on past data, the average annual numbers of deaths and cremations in the next 20 years (i.e. from 2013 to 2032) are estimated to be about 53,000 and 49,900 respectively. Upon completion of the latest re-provisioning projects of Wo Hop Shek and Cape Collinson Crematoria by late 2015, the total annual capacity of all public cremators will be increased from 38,000 sessions to 53,000 sessions. This will sufficiently meet the cremation demand up to around 2025. There is genuine need to construct new crematoria at Sandy Ridge Cemetery to address the demand beyond 2024. As for columbarium, the supply of public niches is uncertain after the completion of the Diamond Hill Columbarium extension and the new public columbarium at Kiu Tau Road in the Wo Hop Shek Cemetery in April and July 2012 providing about 1,500 and 43,700 new niches respectively, and with the completion of 1,000 niches in Cheung Chau Cemetery extension in late 2013. Hence, there is a need to construct new columbarium facilities at the Sandy Ridge Cemetery to meet public demand.
- The Sandy Ridge Cemetery is one of the 24 potential sites for 1.2.2 columbarium development in 18 districts announced in three batches in July 2010, December 2010 and April 2011 respectively. Furthermore, it is planned to provide synergistic one-stop services at the Sandy Ridge Cemetery by including at least a funeral parlour and a visitor service centre so as to maximise the convenience to the public. The proposed public C&C facilities development project at the Sandy Ridge Cemetery will be by far of the largest scale of similar public facilities in Hong Kong. It is hoped that this project will set a new benchmark for the public C&C facilities and services in terms of its functional onestop services, state-of-the art design incorporating artistic elements of aesthetic appeal where appropriate, greening and landscaping, userfriendly access for grave sweepers and serene surrounding environment. It will be a place where those lost loved ones can rest in eternal peace in a dignified manner, and where family members, relatives and friends can part with and mourn for their loved ones in reasonable privacy, and

where grave sweepers will find it pleasant to stay to admire the landscape and the greenery.

1.2.3 The proposed development for Columbarium and Crematorium (C&C) facilities at Sandy Ridge Cemetery is required to form at least 9 ha of land to accommodate at least 200,000 niches with the target operation year to be at year 2023 for phase 1 of columbarium. The layout plan prepared under the Feasibility Study (FS) is shown in Figure 1.1.

## 1.3 Description of the Site

- 1.3.1 Sandy Ridge Cemetery is located between Lo Wu Boundary Control Point (BCP) and Man Kam To BCP. It falls within the study area of the "Land Use Planning for the Closed Area-Feasibility Study" ("the Closed Area Study") commissioned by the Planning Department (PlanD). According to the Recommended Development Plan (RDP) of the Closed Area Study, the Sandy Ridge Cemetery is considered suitable for accommodating the C&C facilities.
- 1.3.2 The Study Area covers the whole of Sandy Ridge Cemetery, which occupies about 91 ha of land located between Lo Wu and Man Kam To BCPs. To the North across Shenzhen River are the residential and commercial areas of Shenzhen. To the East are the Man Kam To BCP and San Uk Ling (Indigenous Village). To the South are the rural settlements of Sha Ling and existing Government, Institution or Community (G/IC) facilities including the Border District Police Headquarters. To the West are MTR Lo Wu Station, Lo Wu BCP and the hilly terrain of Tai Shek Mo West of the Ng Tung River.
- 1.3.3 Sandy Ridge Cemetery is currently under the control of Food and Environmental Hygiene Department (FEHD).

## 1.4 Latest Development after the FS

1.4.1 Under the FS, the grave sweepers are recommended to use MTR Lo Wu Station (by walking mode via the proposed grave sweepers walkway), MTR Sheung Shui Station (by special buses) as well as MTR Yuen Long Station / MTR Kam Sheung Road Station (by special buses) to go the proposed development at Sandy Ridge Cemetery.

1.4.2

An alternative to carry the grave sweepers to the Sandy Ridge Cemetery should be explored to achieve the 200,000 niches required.

1.4.3

1.4.4 The project layout at Sandy Ridge Cemetery after deleting the proposed pedestrian walkway connecting to MTR Lo Wu Station is shown in **Figure 1.2**. However, to minimise the land form and substantially reduce the visual impact due to the project, ArchSD proposed to adopt a more environmental friendly site formation layout, for which cut and fill materials would be substantially reduced, and less woodland and grassland would be affected. The revised project layout plan is attached at **Figure 1.3**.

## 1.5 Purpose of the Report

1.5.1 This Traffic Impact Assessment report assesses and evaluates the nature and extent of the potential traffic impacts arising from the revised layout of the PTI and road network in Sandy Ridge C&C.

## 1.6 Objectives

- 1.6.1 The TIA will provide information on the nature and extent of the potential traffic impacts arising from the project and propose mitigation measures to meet the requirements of the Transport Department and relevant governmental departments. The specific objectives are summarised as below:
  - To identify and describe the elements of the community and the existing traffic characteristics likely to be affected by the Project, and/or likely to cause adverse impacts upon the Project, including both the existing and proposed road network during the construction of the Project, the Ching Ming and Chung Yeung festive periods and also during the operation/maintenance of the proposed C&C facilities;
  - To propose and agree with the Transport Department and the Hong Kong Police Force the Area of Influence (AOI) for the assessment;
  - To assess the traffic impacts include resumption of clearance service of passengers at the Man Kam To BCP in the TIA;
  - To determine any adverse traffic impacts on roads and junctions within AOI during construction, the Ching Ming and Chung Yeung festive periods and also during the operation/maintenance of the proposed C&C facilities;
  - To determine the local road network, layout and alignment for the Project and introduce a structured and systematic approach to identifying, assessing and mitigating potential adverse traffic impacts which might arise from the Project during construction, the Ching Ming and Chung Yeung festive periods and also during the operation/maintenance of the C&C facilities;
  - To propose and agree with the Transport Department and Hong Kong Police Force on the approach, assumptions, methodologies, area of traffic models and design years prior to carrying out the TIA; the TIA should include sensitivity tests of under-estimate of

proposed trip rates and background traffic of road network, increase of proposed number of niches;

- To work out the proposed trip rates and estimate the daily and peak hour grave sweepers and traffic forecast for the road network within the Study Area resulting from the implementation of the Project. The Consultants shall determine the grave sweepers circulation, crowd control plans and traffic management schemes for the Project during construction, the Ching Ming and Chung Yeung festive periods and also during the operation/maintenance of the C&C facilities, the Consultant should also proposed enough loading/unloading areas for pick-up/drop-off of grave sweepers and carry out the associated vehicle and grave sweepers queue length analysis;
- To obtain traffic data and carry out traffic survey and traffic count, if necessary, to verify the existing traffic condition and for the process of carrying out the TIA;
- To collect the necessary information on traffic flow data, street furniture and carriageway configuration for the planning of traffic diversion proposals within the AOI;
- To examine the adequacy and inadequacy of the existing and planned road system during the Ching Ming and Chung Yeung festive periods and normal days, liaise with public transport operators to propose public transport services including detailed assessment on special bus services and MTR services; liaise with MTRCL, TD, HKPF to propose public transport services including MTR services and remedial measures required if deficiencies are identified; and
- To explore possible alternative routes to the C&C facilities at Sandy Ridge Cemetery.

## 1.7 Structure of the Report

- 1.7.1 The Report shall consist the following:
  - existing traffic condition and the latest road layout;
  - planning data, socio-economic assumptions and other assumptions adopted in the assessment;
  - assessment and evaluation of the traffic impacts in the AOI during the Ching Ming and Chung Yeung festive periods and also during the operation/maintenance of the C&C facilities;
  - pick-up/drop-off arrangement during festive periods and associated provisions of transport services including special bus services, bus frequency, MTR services, queue analyses, etc;
  - identification of interface problems with existing/planned transportation, utilities and new development projects; and
  - assessment findings, conclusions, recommendation and mechanisms for implementation of the various temporary management schemes.

## 2 Existing Traffic Conditions

## 2.1 Locality and Accessibility

2.1.1 The development site at Sandy Ridge Cemetery is only accessible from Sha Ling Road and Man Kam To Road. Traffic generated by the site can only access Kowloon and NENT area via Man Kam To Road, Jockey Club Road, Po Shek Wu Road and Fanling Highway.

## 2.2 Existing Traffic Conditions

2.2.1 To appreciate the existing traffic conditions, comprehensive classified traffic counts have been conducted at the following junctions. **Figure 2.1** which illustrates the Proposed Area of Influence (AOI) indicates the locations of these junctions.

J1	Man Kam To Road/ Sha Ling Road	(Priority)
J2	Man Kam To Road/ Lo Wu Station	(Priority)
J3	Man Kam To Road/ New Proposed Road	(Priority)
J4	Jockey Club Road/ Po Shek Wu Road	(Roundabout)
J5	Po Wan Road/ Po Shek Wu Road	(Signal)
J6	Choi Yuen Road/ Po Shek Wu Road	(Signal)
J7	Po Shek Wu Interchange	(Roundabout)
J8	San Wan Road/ Sha Tau Kok Road	(Roundabout)
J9	San Wan Road/ Fanling Station Road	(Signal)
J10	Au Tau Interchange	(Roundabout)
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho Road	(Roundabout)
J12	Po Wan Road/San Fung Avenue	(Signal)
J13	Po Wan Road/Jockey Club Road	(Signal)
J14	Man Kam To Road/Fu Tei Au Road	(Signal)
J15	Man Kam To Road/ Kong Nga Po Road	(Priority)
J16	Man Kam To Road/Lin Ma Hang Road	(Priority)

## 2.3 Traffic surveys

- 2.3.1 Traffic count surveys were undertaken on Chung Yeung Festival on 13 October 2013 (Sunday) and June 2014 at the identified critical junctions, which are listed below. The assessment will mainly focus on the busiest hour of festive period, which identified to be from 11 am to noon. The observed peak hour flows during this peak hour are shown in Figure 2.2.
- Junction capacity analyses based on the Transport Planning and Design Manual (TPDM) and link flow analyses were carried out at key junctions using the peak hour surveyed flows. The results of the analyses are shown in **Table 2.1a** and **Table 2.1b**. A signal-controlled junction with a reserve capacity (RC) of 0% implies that it is operating at capacity while a negative RC% suggests that it is overloaded. For roundabout and priority junction, the performance indicator is the DFC (Design Flow to Capacity) ratio. A DFC ratio of 1.00 indicates that capacity has been reached; a DFC over 1.00 indicates overloaded conditions. The key junctions fall within the AOI are listed in **Table 2.1a**.

Table 2.1a Existing Junction Performance

	Junction June 1987	Junction Type	R.C. / DFC (weekend) (1)	
J1	Man Kam To Road/ Sha Ling Road	Priority	0.02	
J2	Man Kam To Road/ Lo Wu Station Road	Priority	0.08	
J3	Man Kam To Road/Proposed New Road	Priority	N/A	
J4	Jockey Club Road/ Po Shek Wu Road	Roundabout	0.18	
J5	Po Wan Road/ Po Shek Wu Road	Signal	>50%	
J6	Choi Yuen Road/ Po Shek Wu Road	Signal	>50%	
J7	Po Shek Wu Interchange	Roundabout	0.30	
J8	San Wan Road/ Sha Tau Kok Road	Roundabout	0.19	
J9	San Wan Road/ Fanling Station Road	Signal	>50%	
J10	Au Tau Interchange	Roundabout	0.41	
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho Road	Roundabout	0.17	
J12	Po Wan Road/San Fung Avenue	Signal	>50%	
J13	Po Wan Road/Jockey Club Road	Signal	>50%	
J14	Man Kam To Road/Fu Tei Au Road	Signal	>50%	
J15	Man Kam To Road/Kong Nga Po Road	Priority	0.08	
J16	Man Kam To Road/Lin Ma Hang Road	Priority	0.26	

#### Notes:

- Figures shown represent "Reserve Capacity" (RC) for the signal controlled junctions and "Design Flow to Capacity" (DFC) ratio for the roundabout.
- 2) N/A = not applicable

Table 2.1b Existing Road Link Flow Performance

	Name of Road Link	V/C Ratio (weekend)
L1	Lin Ma Hang Road (NB/SB)	0.18/0.14
L2	Man Kam To Road (NB/SB)	0.39/0.39
L3	Jockey Club Road (NB/SB)	0.18/0.15
L4	Po Shek Wu Road (NB/SB)	0.15/0.18

Note: NB = Northbound, SB=Southbound

As shown in **Table 2.1a**, all existing junctions have ample capacity; in **Table 2.1b**, the existing road capacity of Man Kam To Road was assessed, and the V/C ratio is 0.39 for both directions, which is considered acceptable. As for the future scenario, the road capacity of Man Kam To Road has been assessed and will be discussed in later chapter of this report. For Jockey Club Road, both directions have V/C ratio of 0.18 and 0.15 respectively. Similarly to Po Shek Wu Road, the V/C ratios are 0.15 and 0.18 for NB and SB during the weekend peak.

## 2.4 Public Transport Facilities

2.4.1 Public transport services currently operating along Sha Tau Kok Road (Lung Yeuk Tau) and Man Kam To Road and in vicinity to the Site are summarised in **Table 2.2** below.

Table 2.2 Existing Franchised Bus and GMB Services

Route No.	Origin	Destination	Peak Headway (Min.)
Franchi	ised Bus Service		
73K	Sheung Shui Bus Terminus	Man Kam To	30
78K	Sheung Shui Bus Terminus	Sha Tau Kok Bus Terminus	20
79K	Sheung Shui Bus Terminus	Ta Kwu Ling Bus Terminus	30
GMB S	ervices	trace to the P.P. Shielder Land 10.	TREAT PL
52K	Fanling Station	Ping Che	10
55K	Sheung Shui Station (Landmark North)	Sha Tau Kok	10
56B	Fanling Station	Tan Chuk Hang	30
56K	Fanling Station	Luk Keng	30
59K	Sheung Shui Station (Landmark North)	Lin Ma Hang	15-60

## 3 Approach of the Traffic Impact Assessment

### 3.1 Introduction

- 3.1.1 The Sandy Ridge Cemetery is one of the 24 potential sites for columbarium development in 18 districts announced in three batches in July 2010, December 2010 and April 2011 respectively. It is planned to provide synergistic one-stop services at the Sandy Ridge Cemetery by providing columbarium facilities of 200,000 niches, a crematorium, a funeral parlour as well as a visitor service centre so as to maximise the convenience to the public.
- 3.1.2 Under the Feasibility Study, it is anticipated that enormous grave sweepers will mainly rely on railway system to reach the rail stations nearby and access the Site by special buses (from MTR stations on both East and West Rail lines).
- 3.1.3 The capacity of the existing transportation system is limited by the availability of spare spaces for introduction a temporary Pick-up/Dropoff Areas (PDAs) for special bus services during the festive periods. Therefore, the handling capacities of the proposed PDAs, grave sweepers access and road network are the controlling factors to determine the allocation programme of the proposed 200,000 niches to be implemented in phases.
- 3.1.4 While the arrival trip rate for cemeteries and columbaria (C&C) facilities may vary by a numbers of factors including the location factor and accessibility, there is also flexibility in proposing niches number to be provided each year for public as such to ensure the proposed transport provision could smoothly accommodate grave sweepers demand.

## 3.2 Niches Allocation by Phases

- 3.2.1 The first batch of niches allocation of proposed Sandy Ridge C&C facilities is planned to be commenced in year 2023 for phase 1 of columbarium. The niches allocation rate would be adjusted to ensure sufficient support of transport facility could be maintained.
- In consultation with FEHD, the niches allocation in the whole territory would be about 18,000 niches per year. The niches allocation rate at Sandy Ridge might vary depending on supply from other columbarium projects. As a conservative approach, it is assumed that all the niches allocation could be supplied in proposed Sandy Ridge C&C while the supply from the other columbarium will be on hold. Hence, niches allocation rate of 18,000 niches/year will be adopted for the first few years until the visitor demand has reached the capacity of the proposed transport provision. After that, the implementation of the remaining niches allocation would be provided at a slower rate by offsetting the old aged niches and complete the total 200,000 niches.
- 3.2.3 Nonetheless, FEHD would carry out monitoring on the amount of grave sweepers after commissioning of the Sandy Ridge C&C facilities.

Regular review on the visitor demand (or trip rate) to the newly Sandy Ridge C&C facilities should be carried out upon its operation. It would facilitate the refinement on the provision of the transport facility and adjustment on the rate of niches allocation to suit the traffic conditions.

## 3.3 Trip Rate Review for New Columbarium

- 3.3.1 For the assessment of supporting transport infrastructures required for the proposed C&C facilities, the visitor numbers derived from the trip rate will be a key assumption of the traffic forecasts to be used in the Traffic Impact Assessment. The results of surveys show a decreasing trend of trip rate over columbarium's operation year. Based on the above trip rates analysis (including the trip rates derived from the survey carried out in 2014 Ching Ming Festival), the trip rates for the cemeteries and columbarium with operation history of around 1st-20th year are varying from 0.171 to 0.421 visitor/niche/hr (two-way). The results show that trip rates may vary by location and time. There is no fixed pattern on the trip rate except a general observation of decrease in trip rates as time lapses.
- 3.3.2 It is considered appropriate to establish a set of trip rates that vary with operating years. The results of surveys show a decreasing trend of trip rate over columbarium's operation year. Reference is therefore made to the trip rates derived from 9 existing columbaria/ cemeteries which could provide suitable information for derivation of the time factor based on the observed trip rate for application to the proposed C&C development at Sandy Ridge Cemetery.
- 3.3.3 By plotting the trip rates for various columbaria against the years of operation, the adopted visitor's trip rate for newly commissioned columbarium facilities is 0.345 visitor/niche/hr (two-way). However, throughout surveys from other columbarium project experiences, it is understood that trip rate does have a wide range as the arrival pattern vary by location and time. Therefore, the trip rate should be regularly reviewed upon the operation of the Sandy Ridge C&C to facilitate the refinement on the provision of the transport facility and adjustment on the rate of niches allocation to suit the traffic conditions.
- 3.3.4 The detail on Trip Rate Review is shown in **Appendix A**.

## 3.4 Modal Split of Arrival Grave sweepers

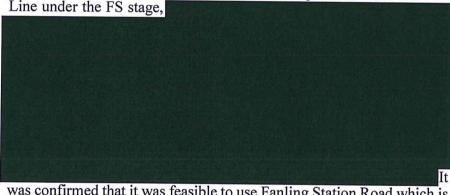
- 3.4.1 The distribution of the graves sweepers could be estimated based on the population distribution over the territory. Based on the latest Territory population planning data, the percentage of population distribution among eastern and western sides was about 70% vs 30% by year 2036.
- 3.4.2 In view of the population distribution, the majority of grave-sweeper's split is anticipated to be distributed to the nearest MTR stations (i.e: MTR Fanling Station / MTR Sheung Shui Station / future planned MTR Kwu Tung Station) then via the special bus services or by walking (MTR Lo Wu Station) to access the site.

For the MTR Lo Wu Station, it can only be connected to the proposed Sandy Ridge C&C by walking of about 2 km (via Lo Wu Station Road, Man Kam To Road and Sha Ling Road) with level difference of 30m which is not considered easy especially most grave sweepers groups with elderly and children with items for paying respect to their ancestors.

the

demand of grave sweepers accessing the proposed Sandy Ridge C&C via MTR Lo Wu Station is foreseen to be minimal. Hence, MTR Lo Wu Station will not be proposed as the main MTR Station for receiving the grave sweepers.

- Nevertheless, the demand of grave sweepers accessing the proposed Sandy Ridge C&C via MTR Lo Wu Station will be monitored after its commencement. The option for provision of mini-concourse at Lo Wu Station and an elevated walkway could be further investigated if the usage of this station to access Sandy Ridge C&C was found to be increasing in the future.
- 3.4.5 For the MTR Sheung Shui Station, which was recommended as the main MTR Station for receiving the grave sweepers from the East Rail



was confirmed that it was feasible to use Fanling Station Road which is next to MTR Fanling Station as PDA for special bus services to transport the visitor coming from the Eastern side.

- 3.4.6 Similar to the crowd management measures for other existing columbarium facilities, the traffic related information could be disseminated to the general public via Announcement of Public Interest (API) on TV, radio, newspaper or posted at the transport hub for information of the general public to channelize the grave sweepers to the major PDA at Fanling Station.
- 3.4.7 To share the traffic burden for MTR Fanling Station, it is anticipated enhancement of existing bus services to the proposed Bus-Bus-Interchange (BBI) which is near Pak Wo Road (also nearby Wah Ming Estate Bus Terminus) and provision of special bus services from BBI to the Sandy Ridge C&C would be proposed.
- 3.4.8 It is anticipated that small proportion of grave sweepers like those residents in Sheung Shui area are likely to use the existing bus route 73K running between Sheung Shui Landmark North and Man Kam To

Road as well as other kinds of transport mode, such as taxi, GMB, or by walking via MTR Lo Wu Station to access the C&C facilities at Sandy Ridge Cemetery.

- Originally, MTR Kam Sheung Road Station was planned for receiving the grave sweepers from the western side via West Rail Line. Following the recent publishing of the 2014 Railway Development Strategy in November 2014, the MTR Kwu Tung Station is planned to be opened by year 2026. Hence it is proposed to using MTR Kwu Tung Station to replace MTR Kam Sheung Road Station as the PDA under Stage 2 special bus arrangement
- 3.4.10 For the grave sweepers from the western side, it is proposed to use the PTI outside the future MTR Kwu Tung Station as the main pick-up and drop-off point for special buses for transporting the grave sweepers from the western side.
- 3.4.11 Based on the above, the anticipated modal choice of grave sweepers is shown in **Table 3.1** below.

Table 3.1 Anticipated Transport modal choice of Grave sweepers

Mode	e de la Companya de l
MTR Fanling Station + Special Bus (1)	Agir his Rigidar
MTR Kwu Tung Station + Special Bus	
MTR Sheung Shui Station + Special Bus <sup>(2)</sup>	
Taxi (3) / GMB (4)	
Existing Bus and Special Bus Route(1)	
MTR Lo Wu Station by walking	

Note: (1) Fanling, special bus will run through Liantang Connection Road.

- (2) Sheung Shui special bus will run through Jockey Club Road.
- (3) Taxi mode is anticipated to be originated from all regions of HKSAR
- (4) GMB mode is to be originated from Sheung Shui Station
- In the early stage, existing bus route nos. 277X from Lam Tin and 278X from Tsuen Wan will be enhanced to connect MTR Fanling Station PDA while existing bus route nos. 261 & 276 from Tuen Mun & Tin Shui Wai respectively will be enhanced to connect to MTR Sheung Shui Station. When Fanling PDA and Sheung Shui PDA have reached their capacities, special bus service from MTR Kwu Tung Station PDA will be introduced.
- 3.4.13 The detail of each pick-up/drop-off location for the mentioned modal choice will be discussed in later chapter.

# 4 Provision of Traffic and Transport Facilities at Sandy Ridge Cemetery

### 4.1 Introduction

- 4.1.1 It is planned to provide synergistic one-stop services at the Sandy Ridge Cemetery by providing columbarium facilities of 200,000 niches, crematorium, funeral parlour as well as a visitor service centre so as to maximise the convenience to the public.
- 4.1.2 Currently, Sha Ling Road as well as Man Kam To Road are the only existing roads connecting to Sandy Ridge Cemetery. To facilitate the development of the proposed C&C facilities at Sandy Ridge Cemetery, a new road network connecting C&C facilities and Man Kam To Road should be proposed to enhance the vehicular connectivity.
- Under the Feasibility Study (FS) stage, a road layout has been prepared to support the proposed development at Sandy Ridge Cemetery. However, in this Design and Construction (D&C) stage, some refinement to the road layout developed in the FS is required and a new road layout is then formulated.

# 4.2 Proposed New Road Layout in Sandy Ridge Cemetery

- 4.2.1 **Figure 4.1** shows the new road layout and some description for the new road layout is as follows:
  - Sha Ling Road is widened to single two-lane carriageway with 7.3m in width and 3m footpath on both sides as the main access to the Columbarium site. Vehicular traffic will then split to one-way traffic entering the pick-up/drop-off area (PDA) via the internal road to form a circuit. The one-way traffic will then merged to Sha Ling Road for departing from the PDA and extend to "MacIntosh Fort" with a roundabout at the end.
  - A new road junction at Man Kam To Road will be formed to allow the vehicular access to the Crematorium site via the new Viaduct A, which will link to the internal loop surrounding Crematorium and Funeral Parlour. The new junction is illustrated in Figure 4.10. This new road is designed as single two-lane carriageway with 7.3m in width and 2m footpath on both sides.
  - A new at-grade road with 7.3m in width and with 2m footpath on both sides will be formed to provide connection between Columbarium and Crematorium sites.
  - A PDA at uphill side will be provided to facilitate the pick-up and drop-off arrangement for the special buses, which will be operated during the festive periods.
  - A Pick-up and Drop-off Point for the mini-buses, taxis and private cars is proposed at the junction between Sha Ling Road and Man

Kam To Road as these vehicles are not allowed to go uphill during the festive periods.

- Two EVAs, as per ArchSD's request for evacuation from the proposed columbarium buildings in case of emergency, will be provided, one is located on the west side of the PDA, which is branched off from the carriageway heading towards the roundabout adjacent to the MacIntosh Fort, the EVA lies along the downhill runs to the bottom of the slope. The other EVA is located on the northeast side of the PDA, which is branched off from the connection road between Sha Ling Road and the roundabout at the Crematorium.
- An area of sufficient size at PDA will be reserved for the parking of the private vehicles during normal days.

## 4.3 Gradient of the Proposed Road Network

- 4.3.1 Under the FS, the gradient of Sha Ling Road was improved to 8% to meet the requirement for emergency access. However, under the latest proposal, road widening works would be required at Sha Ling Road and its gradient has been reviewed and lowered to 7.5% max.
- 4.3.2 To facilitate future operation of the C&C facilities at Sandy Ridge Cemetery, Sha Ling Road shall be designed to allow the usage of double decker buses during festive periods. Under the refined road layout, Sha Ling Road would be improved to a single two-lane carriageway with a gradient between 2.5% and 7.5%, which are all below the absolute maximum value of 8% as specified in the TPDM, whilst the gradient of other access roads proposed for the development would be between 0% to 6%. The layout plan of road gradient and sections of roads are shown in Figure 4.2 and the longitudinal profile is illustrated in Figures 4.3 to 4.4a.
- 4.3.3 The constraints why part of Sha Ling Road would need to be constructed to a gradient of 7.5% are discussed as follows with a plan illustrated in **Figure 4.4b**:
  - The columbarium site is composed of platforms at various levels which have been carefully designed based on the constraints of natural topography, locations of graves and woodland. There is a constraint that the PDA at +50mPD would require an access directly from Sha Ling Road at the same level. Therefore, at this area, Sha Ling Road would need to attain a level of +50mPD.
  - On the other hand, since there are private lots in the existing Sha Ling Village near Man Kam To Road, the existing run-in has to be maintained as access to these lots and thus the road profile of this section of Sha Ling Road from +12.3mPD to +20mPD has to be kept unchanged.
  - After attaining the level of +20mPD, Sha Ling Road has to be rise to a level of +50mPD for an elevation difference of 30m within a horizontal distance of about 450m in order to access the platform of PDA. This means this section of Sha Ling Road could only be

constructed to a gradient of about 7.5% (with consideration of the transition curve), which is below the absolute maximum road gradient for double-decker buses, as specified in TPDM.

- An alternative route from Man Kam To Road to our proposed PDA has also been explored. Nevertheless, since the road level along Man Kam To Road is only slightly varying from +11.5 to +13.5mPD, there would not be substantial difference if we propose the junction for the alternative route at another location.
- Besides, the presence of existing Sha Ling Village, the private lot next to Sha Ling Road and graves scattered around the Sandy Ridge Cemetery are also another constraint for an alternative route. There are also existing large diameter exposed Dongjiang watermains running along Man Kam To Road with top level at most portions above the road level.
- Coupled with the hilly topography at the southern side facing Hong Kong varying from +12mPD to around +90mPD, the alternative route is considered technically infeasible with these constraints.
- 4.3.4 Due to the similar constraints in Section 4.3.3 above, the new road/viaduct at the eastern end of the site would need to cross over the existing exposed Dongjiang watermains and some minor re-profiling of Man Kam To Road would be required. Moreover, the road/viaduct could only be constructed to a gradient of maximum 6% in order to access the platform of +40mPD and +37mPD from the road level of +13mPD at Man Kam To Road. The road alignment and profile have been designed to avoid conflict with the existing graves and connect to the existing Sha Ling Road, which is running perpendicular to our proposed new road at-grade.
- 4.3.5 Despite the above constraints, during festive periods, a gyratory traffic system would be enforced that special buses would reach the Pick-up and Drop-off Area uphill via Sha Ling Road and leave the columbarium site via the new viaduct at the eastern side of Sandy Ridge Cemetery downhill. It is anticipated that such arrangement could effectively uphold road safety at Sha Ling Road during festive periods. In addition, during normal days, the traffic flow at Sha Ling Road would be very low and the road is mainly used by small vehicles.
- In short, it is considered that Sha Ling Road could be widened but only be constructed to 7.5% max. gradient while the new road at eastern end could only be constructed to 6% max. due to various technical constraints. Nevertheless, this is still considered acceptable as per TPDM. In addition, special traffic arrangement (i.e. traffic gyratory system) will also be implemented during festive periods to maintain road safety. In case any portion of the minor road which has substandard road gradient, traffic signage "1:10" could be installed to alert the motorist to enhance safety.
- 4.3.7 Comparison of the gradient of the Sha Ling Road before and after will be shown in **Table 4.1a**.

Table 4.1a Summary Table for Existing and Future Gradient of Sha Ling Road

Chainage (CH)	Existing Gradient	Future Gradient	Length
0+000 to 0+070 (Near Man Kam To Road)	3.50%	3.29%	70m
0+70 to 0+108	5.50%	Transition	38m
0+108 to 0+422	7.5% to 16.4%	7.50%	314m
0+422 to 0+472	4.6% to 13.6%	Transition	50m
0+472 to 0+488	4.60%	2.50%	16m
0+488 to 0+533	-9.0% to -6.6%	Transition	45m
0+533 to 0+579	-6.8% to -8.2%	7.50%	46m
0+579 to 0+621	-6.50% to -2.3%	Transition	42m
0+621 to 0+659	-2.31% to -4.60%	1.01%	38m
0+659 to 0+679	-4.60% to -1.10%	Transition	20m
0+679 to 0+725	-1.10% to 2.60%	-1.01%	46m
0+725 to 0+751	-1.50% to 1.20%	Transition	26m
0+751 to 0+797	-1.50% to 1.20%	-5.00%	46m
0+797 to 0+851	-2.20% to -3.90%	Transition	54m
0+851 to 0+858	-4.60%	-1.00%	51m

Associating with the gradient of the road, the vertical curves should be 4.3.8 provided at the changes of the gradient. Under the proposed speed limit of 50km/h in all proposed roads (M001, M003, M004, M005. M006 and M007), the desirable minimum K-value (i.e. Crest curve – 10, Sag curve – 13 as stated in Table 3.3.7.1 and 3.3.7.2 respectively in TPDM Vol. 2) is widely used for design of the road. However, to cater for the difficult terrace and the existing site constraints such as connection to the existing Man Kam To Road, some of the K-values are of absolute minimum (i.e. Crest curve – 6.5, Sag curve – 9 as stated in Table 3.3.7.1 and 3.3.7.2 respectively in TPDM Vol. 2). These road sections with absolute minimum K-values are at the locations near the road junctions, roundabout, turnaround or exit to the existing road at where the vehicles should slow down its speed well below the design speed limit. In this connection, it is believed that the use of minimum K-values at aforesaid locations will not impose safety issue of the road users and is acceptable due to the site constraints.

## 4.4 Traffic Operation of the New Road Layout

### **During Normal Days**

Under the road layout of this Project, during normal days, Sha Ling Road as well as the proposed new roads will be remained as two way traffic. Vehicles (including taxis and private cars) are anticipated to use the Sha Ling Road to the columbarium as well as the proposed new road to the Crematorium and Funeral Parlour, as indicated in the scheme for Normal Day in Figure 4.5.

### **During Festive Periods**

- During Festive Periods, Sha Ling Road, the proposed new road and the internal ring road surrounding Crematorium and Funeral Parlour will be restricted for private vehicles except permitted vehicles (e.g. special bus service, emergency vehicles, hearses and private vehicles with permits from crematorium/funeral parlour).
- 4.4.3 Sha Ling Road and the proposed new road will be implemented as one-way traffic for ingress and egress. The ingress route will be along Man Kam To Road (both directions) then turn onto Sha Ling Road, while travelling uphill, the vehicle will head straight into the outer ring road surrounding the Pick-up and Drop-off area (PDA). The special buses would drop off the grave-sweepers along the outer ring road. Upon the grave-sweepers had enlightened special buses, the buses will loop to the inner ring road for passengers boarding.
- 4.4.4 The egress route will be from the pick-up point, heading to Sha Ling Road via the outer ring road. The buses will be turning left via the roundabout, back to the proposed new road. The vehicular traffic arrangement scheme for Festive Periods is illustrated in Figure 4.6.
- 4.4.5 For grave sweepers by mini-buses, taxi, or private cars, they will be dropped off at the proposed pick-up and drop-off point at Man Kam To Road and Sha Ling Road, and using the walking path along Sha Ling Road to the Project site.

## 4.5 Parking Facilities

- 4.5.1 Parking facilities will be provided for proposed columbarium site during non-festive period and its location will be in the PDA area. Since there is no requirement for parking provision at columbarium development, and there is no data collected from existing columbaria to reflect the actual parking demand during the normal non-festival days, the parking standard would be made reference to "Industrial/Office" use in HKPSG as provisional design basis. The numbers of parking spaces would be reviewed upon the operation of Phase 1 of Sandy Ridge Columbarium, and Sandy Ridge Crematorium facilities. Refinement on the provision of the parking facilities would be made to suit the actual demand.
- 4.5.2 The total GFA for columbarium buildings is 44,550m<sup>2</sup>, by reference with the parking requirement of HKPSG "Industrial/Office", there should be maximum of 1 parking space per each 600m<sup>2</sup>. Thus, the min. no of private car parking space is 75.
- 4.5.3 In terms of disable parking, according to HKPSG, if the total private parking spaces are between 51 and 150, then there should be 2 disabled parking spaces being provided.
- According to the Schedule of Accommodation Form provide by ArchSD on 21 June 2016, it was noted that 2 nos. parking spaces for light buses and two emergency vehicles lay-bys are needed due to operation.

- 4.5.5 The indicative location of the open car park is shown in **Figure 4.7**
- 4.5.6 The parking facilities are mainly provided for normal days only, for festive periods, all the private cars, taxis and coaches will be prohibited to arrive to C&C area.
- 4.5.7 Parking facility will also be provided for the funeral parlour and crematorium. the estimated total GFA for crematorium, funeral parlour and visitor centre was about 30,000m². By taking reference with the parking requirement of HKPSG "Industrial/Office" of 1 parking space per each 600m² GFA, the number of private car parking space will be 50 and the breakdown for funeral parlour and crematorium will be 8 and 42 respectively including 1 disabled parking space in each facility.
- 4.5.8 For the loading/ unloading bays recommended in HKPSG, the requirement of 1 goods vehicle bay per 1,200 m<sup>2</sup> of 50% of the GFA and 1 goods vehicle bay per 3,000 m<sup>2</sup> of the remaining 50% of the GFA is taken as the reference. Therefore, 18 loading/ unloading bays will be provided and the breakdown or the funeral parlour and crematorium will be 10 and 8 respectively.
- 4.5.9 In addition, two emergency lay-bys and two parking spaces for shuttle buses are proposed in the site of funeral parlour and crematorium based on operational needs.
- 4.5.10 The provision of parking facilities are summarised in **Table 4.1** below:

Table 4.1 Provision of Parking Facilities

Location		Remarks	
Columbarium Compound	Open Parking Area	Private car parking spaces x 73 Disabled car parking spaces x 2 Light Bus parking space x 2 Emergency vehicle lay-bys x 2	
Crematorium/ Funeral Parlour	Crematorium	Private car Parking spaces x 7 Disabled car parking space x 1 Loading/Unloading x 8 Emergency vehicle lay-bys x 2	
us peterring su Maria dramiti Maria ding radi	Funeral Parlour	Private car parking spaces x 39 Disabled car parking space x 1 Light bus parking spaces x 2 Loading/ Unloading x 10 Emergency vehicle lay-bys x 2	

## 4.6 Pick-up and Drop-off Area (PDA)

- 4.6.1 For public transport facility, it is proposed to provide a Pick-up and Drop-off Area (PDA) in C&C platform shown as an indicative layout in **Figure 4.8**. The proposed PDA will be in saw-tooth shape, and will provide the total of 43 nos. of bus bays when the operation of special bus service are running during festive periods, the number of 43 nos. of bus bays remain unchanged from the last approved version of Final TIA.
- 4.6.2 All public transport services (solely special buses) could reach the PDA via Sha Ling Road, while taxi and private cars could also access the PDA via Sha Ling Road during normal days only.
- 4.6.3 It is proposed to have about 1.27 ha of platform within the proposed development of C&C facilities and use as PDAs for specials bus services during festive periods and used as open car park during normal days respectively.

## 4.7 Pick-up and Drop-off Point at Man Kam To Road

- 4.7.1 As shown in **Figure 4.9**, there is a proposed pick-up/drop-off point located at junction of Man Kam To Road & Sha Ling Road, for taxi, minibus and for private cars, which could serve as a boarding/alighting point of the proposed columbarium site during festive periods as these vehicles are prohibited from going uphill to the C&C facilities. During normal days, this facility will be used as general layby.
- 4.7.2 The area of the proposed pick-up/drop-off point is approximately 0.08 ha. Nevertheless, the actual size and provision details of the pick-up & drop-off point will be further reviewed during the detailed design stage.
- 4.7.3 The junction at Man Kam To Road and the proposed new road is shown in **Figure 4.10.**
- 4.7.4 The proposed PDA at Man Kam To Road has approximately 110m of drop-off layby, and it is anticipated that such PDA is able to handle the arrivals of taxi/private car trips. The PDA also has a turn-around function to let the private cars/taxi to turn-around to the westbound of Man Kam To Road.
- 4.7.5 As shown in **Figure 4.9**, the drop-off bay on the footpath side, has approximately 40m, which is able to handle 8 spaces of taxis/private cars. Assuming the drop-off servicing time is 2 mins, and each vehicle has occupancy of 4 people. The servicing handling capacity is 8 spaces x 4 people x 30 cars/hour = 960 ppl/hour. With the other 70m of layby, the handling capacity of this PDA can definitely handle more than 850 ppl/hour.

4.7.6

During the Stage 1 (for the first 4 years) of the commissioning of the C&C facilities, if the percentage of visitors using private car/taxi/GMB is higher than the anticipated one, the capacity of the proposed laybys (1,560ppl/hr or 390 car/hour) could actually handle up to approximately 13% (1560/12,200) of grave-sweepers [whereas 12,200 is the total

arrival visitors to Sandy Ridge at 4th year, please refer in **Table 5.19a** and **5.19b**] during the peak hour, which is considered a very high percentage. At Stage 1, the anticipated grave-sweepers by taxi/GMB (3%) will be anticipated to be only 366 ppl/hour.

- 4.7.7 In addition, similar to other cemeteries/columbarium sites, it is believed that TTM would be implemented in order to cater for the worse case during the peak hours or any unforeseen case.
- 4.7.8 As discussed in several meetings, FEHD would regularly monitor on the amount of visitors, including the modal spilt, after commissioning of the C&C facilities. Hence, there would be enough time to refine the transport facilities in order to cater for the ultimate case in the future.

## 4.8 Crowd Control Plans for Grave Sweepers during Festive Periods

- 4.8.1 Further to previous section regarding vehicular traffic arrangement during festive periods, crowd control plan for grave sweepers will also be implemented to cater the substantial amount of grave sweepers.
- 4.8.2 During festive periods, the whole section of Sha Ling Road will be controlled and only special buses are allowed, all vehicular traffic is prohibited, except for emergency vehicles, hearses and vehicles with permits issued under special situation.
- 4.8.3 For grave sweepers arriving by bus / special bus, they will be dropped-off at the outer ring at ground level where the saw-tooth bus bays are located.
- 4.8.4 The proposed directional traffic signs will guide the grave sweepers walking from PDA towards the proposed building blocks. The width of the outer ring of PDA is designated to have at least 6m of clear width, which is sufficient for the pedestrian traffic. During festival periods, the outer ring at ground level will only be allowed for arrival visitors.
- 4.8.5 For grave sweepers departing from columbarium building areas, they will be guided to area in the inner PDA, by having directional signs at elevated walkway which connects to various buildings. The elevated walkway will also have a minimum of 6m clear width. The elevated walkway is only allowed for departure visitors.
- 4.8.6 With adopting the separation of arriving grave-sweepers and departing grave-sweepers, pedestrian traffic flow within the PDA is anticipated to be effective by avoiding grave sweepers conflicts.
- 4.8.7 For grave sweepers travelling by taxi, private cars, and minibus, they are anticipated to be walking from/to pick-up and drop-off point along Man Kam To Road, which the walking path is illustrated in **Figure 4.11**.
- 4.8.8 The proposed grave sweepers arrangement on festive periods is illustrated in **Figure 4.11**. The details of crowd control plan (arrival and departure) are illustrated in **Figure 4.12 and 4.13**.

## 5 Crowd Control Plans and Grave Sweepers Impact Assessment for the Pick-up and Drop-off Points during Festive Periods

### 5.1 Introduction

- 5.1.1 Under the FS, it is anticipated that enormous grave sweepers will mainly rely on railway system to reach the stations in the vicinity of the Project site and commute either by bus (from MTR stations on both East and West lines) or on foot from MTR Lo Wu Station.
- Nevertheless, Figure 5.1 illustrates the general idea of the routing of each proposed pick-up/drop-off point. The location is chosen based on the future population split of HKSAR as well as the anticipated handling capacities of the proposed two main pick-up/drop-off points, which are identified to be nearby of MTR Fanling Station and the future MTR Kwu Tung Station.
- 5.1.3 For more efficient use of bus resources, the future provision of special bus service would be implemented in three stages as follows to match with the niches allocation programme:

### Stage 1 (1st – 4th year; i.e. year 2023 - 2026):

5.1.4 To introduce special bus service at Fanling Station Road PDA and enhance existing bus service at Sheung Shui Landmark PDA.

### Stage 2 (5th – 6th year; i.e. year 2027 - 2028):

5.1.5 At this stage, special bus service from MTR Kwu Tung PDA will be introduced. Stage 2 is anticipated to be last from 5th year and 6th year.

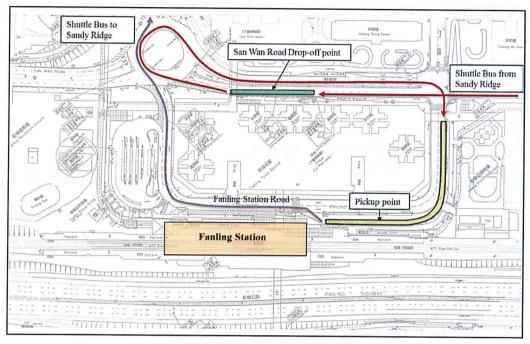
### Stage 3 (7th - 29th year; i.e. year 2029 - 2052):

- Stage 3 will be started at 7th year. The bus service between MTR Kwu Tung PDA will continue to handle new demand at Stage 3. At 9th year (i.e.: Year 2031), a potential Bus-bus Interchange (BBI) will be introduced by providing special bus services at Pak Wo Road, which is nearby Wah Ming Estate Bus Terminus (note: this location of BBI is still subjected to TD's approval). At this stage, the grave sweepers will be using the existing bus services and be interchanged to the proposed special bus services at potential location Pak Wo Road, and then to access the proposed Sandy Ridge C&C. These special buses with BBI will be started to be operated from 9th year to the end of the programme (duration of 29th year).
- 5.1.7 The implementation of the above proposed scheme will depend largely on the availability of bus resource at the time of introduction of the service and cannot be confirmed at this stage. The bus fleet requirement laid down in the report is for illustration purpose only. The actual provision of special bus services will depend on the availability of bus resource and actual passenger demand at the time when the niches are commenced, and will be subject to on-site situation and actual operation arrangement of bus companies.

- 5.1.8 FEHD will carry out a substantial traffic and public transport review 5 years after the commissioning of the proposed Sandy Ridge C&C facilities to ascertain the number of grave sweepers and review the niche allocation rate, i.e. during Stage 2.
- 5.1.9 The routings of the special buses and proposed existing bus and special buses are indicated in **Figure 5.1**.
- As indicated in **Figure 5.1**. the special buses from/to pick-up/drop-off areas at MTR Fanling Station and special buses from/to Sandy Ridge C&C, are proposed to take the future Liantang/Heung Yuen Wai Connection Road, which via the Boundary Control Point, and leading to Man Kam To Road towards the project site. This routing is anticipated to provide the fastest link. Such traffic will be from the east side of the project site.
- 5.1.11 On the other hand, the buses from/to pick-up/drop-off areas at MTR Kwu Tung Station and from/to MTR Sheung Shui Station will be leading to Man Kam To Road and to the project site. Such traffic will be from the west of the project site.
- 5.2 Pick-up/Drop-off Arrangement at MTR Fanling Station
- 5.2.1 There are two main proposed pick-up/drop-off points, which are nearby of MTR Fanling Station and MTR Kwu Tung Station. This section will discuss on the handling capacity of the pick-up/ drop-off point which controls the grave sweepers demand in festive periods.

Due to the limited area provision in the vicinity of MTR Fanling Station, the maximum provision of pick-up/drop-off area would be provided by temporarily relocating the existing bus/GMB stop on San Wan Road and Fanling Station Road. The proposed pick-up point and drop-off point near MTR Fanling Station are shown in **Diagram 5.1**.

Diagram 5.1 Proposed Pick-up/Drop-off point near MTR Fanling Station during Festive Periods



5.2.3 Existing bus and GMB stops are proposed to be relocated in order to provide ample boarding area for special bus services, as shown in **Diagram 5.2**, the bus and GMB stops would be relocated to the existing loading/unloading lay-by on Fanling Station Road, the associated affected bus/GMB routes are listed in **Table 5.1**.

Diagram 5.2 Proposed Location of temporary bus stop at pick-up point at MTR Fanling Station

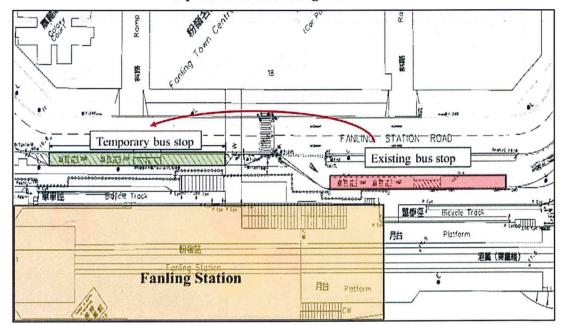


Table 5.1 Associated affected Bus/GMB routes at pick-up point at Fanling Station Road

Service Type	Route	From	To
	78K	Sha Tau Kok B/T	Sheung Shui B/T
Bus	79K	Ta Kwu Ling	Sheung Shui B/T
Company	278K	Luen Wo Hui B/T	Fanling Railway Station (CIRCULAR)
GMB	52A/54A/56A	MTR Fanling station	Luen Wo Hui

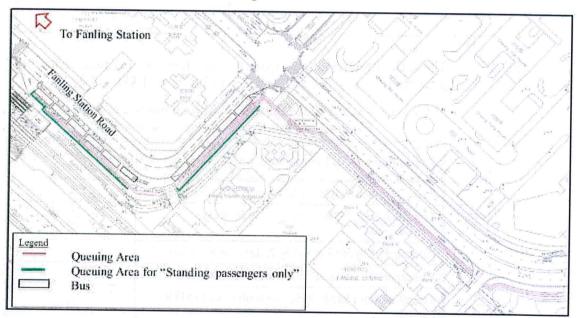
Table 5.2 The affected bus/GMB routes at drop-off point at San Wan Road

Service Type	Route	From	То
Bus Company	70K	Wah Ming B/T	Ching Ho
	277X	Luen Wo Hui B/T	Lam Tin Railway Station B/T
	279X	Luen Wo Hui B/T	Tsing Yi Railway Station Bus Terminus
	373	Sheung Shui B/T	Sheung Wan
	A43	Luen Wo Hui B/T	Airport (Ground Transportation Centre)
	N42A	Luen Wo Hui B/T	Tung Chung Railway Station

### Proposed Pick-up point at Fanling Station Road

5.2.4 As shown in Diagram 5.3, the existing bus stop lay-bys and GMB bus lay-bys at Fanling Station Road are capable to provide pick-up/drop-off area as well as grave sweepers queuing, the existing bus stop and GMB stop are proposed to be temporarily relocated on festive periods in order to provide special bus service to Sandy Ridge Cemetery. Meanwhile, the road marking on Fanling Station Road would be revised permanently to provide bus stacking lay-by of 3.2m in width. Such road marking revision should be implemented in 2nd year. The lane marking would be re-provided for two existing lanes of 6.75m in width. The revision of road marking on Fanling Station Road is shown in Diagram 5.4. In order to allow the queuing and boarding of passengers at Fanling Station Road near the playground, it is proposed to widen the footpath by removal of existing planter area as such 1,100 m<sup>2</sup> of queuing area on western footpath of Fanling Station Road and San Wan Road would become available. Though a walkway reservation of minimum 1.5m in width would be maintained along the queuing area for grave sweepers circulation purpose, the existing cycle track will be maintained.

Diagram 5.3 Provisions of Boarding Facilities on Fanling Station Road during Festive Periods



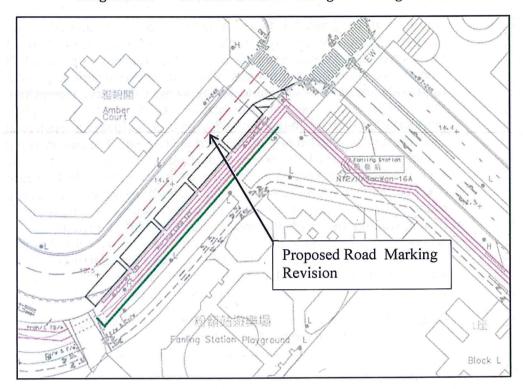


Diagram 5.4 Revision of road marking on Fanling Station Road

5.2.5 The anticipated handling capacity in this location, is calculated to be 9 platoons of buses /hour x120 pax x 11 buses = 11,880 ppl/hr.

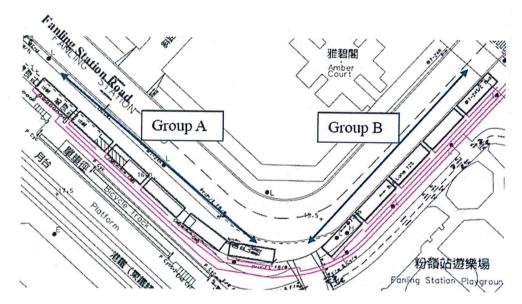
Table 5.3 Cycle Time of the Special Special bus Route from MTR Fanling Station to Sandy Ridge Columbarium

Events of a Special bus to Sandy Ridge columbarium	Time Required (min)
Passengers Boarding at MTR Fanling Boarding Point	5
Travelling from MTR Fanling to Sandy Ridge Columbarium	21
Passengers Alighting at Sandy Ridge Columbarium	3
Passengers Boarding at Sandy Ridge Columbarium	5
Travelling from Sandy Ridge Columbarium to MTR Fanling	21
Passengers Alighting at MTR Fanling Alighting Point	3
Stacking Movements	2
Total Time for 1 round trip	60

The cycle time is shown in **Table 5.3**, with the assumed headway of 7min between every 11 buses, the special special bus route with a fleet size of (11 lay-by x 60min/7min) /(60min /60 cycle time) = 95, can achieve 9 platoons of buses /hour x 11 buses = 99 trips/hr, which can accommodate the grave sweepers at MTR Fanling Station.

- The bus boarding lay-bys would be separated into 2 groups, as illustrated in **Diagram 5.5**. In view of practical operation, maximum no. of 6 buses would departure in a group at the same time. Therefore, there would be group A with 6 buses departure followed by group B with 5 buses in every 7 minutes interval. The time interval between the departure of group A and B is 3mins which is the passengers alighting time at drop-off point, which illustrated in **Diagram 5.6**.
- 5.2.8 It is understood that Highways Department is planning to install lift adjacent to the elevated walkway closed to the proposed San Wan Road Drop-off point. The exact location of the drop-off bus bay will be adjusted according to the final location of the lift.

Diagram 5.5 Proposed bus boarding lay-bys on Fanling Station Road



San Wan Road Drop-off point

San Wan Road Drop-off point

San Wan Road

San Wan Road

San Wan Road

San Wan Road

MTR Fanling Towns Centre

San Wan Road

MTR Fanling Station

Diagram 5.6 Proposed Location of drop-off point on San Wan Road at Fanling

### Queuing in MTR Fanling Station

5.2.9 The available area of queuing on western footpath of Fanling Station Road and San Wan Road is 1,100 m<sup>2</sup>. By adopting the average occupancy space of 0.4m<sup>2</sup>/person, the maximum number of people in the queuing area would be 1,100/0.4=2,750 ppl.

5.2.10 The number of queuing passengers was assessed by the relationship between passenger arrival rate and departure rate according to the proposed pick-up/ drop-off schedule of the 2 groups of buses which is illustrated in Diagram 5.7. The arrival rate refers to the passenger arrive to the PDA to take the special bus. The departure rate refers to the handling rate of the special bus to carry the passenger to Sandy Ridge C&C.

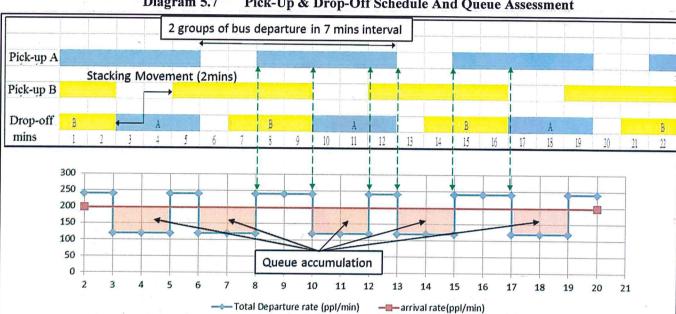


Diagram 5.7 Pick-Up & Drop-Off Schedule And Queue Assessment

5.2.11 During the peak hour, the maximum nos. of queuing passengers would be about 140 ppl. By the anticipated daily profile of visitor arrival rate, the maximum nos. of queuing passengers would be around 55 and 58 in the hour before peak and after peak respectively. **Diagram 5.8** shows the variation of queue length in peak hour as well as one hour before and after peak.

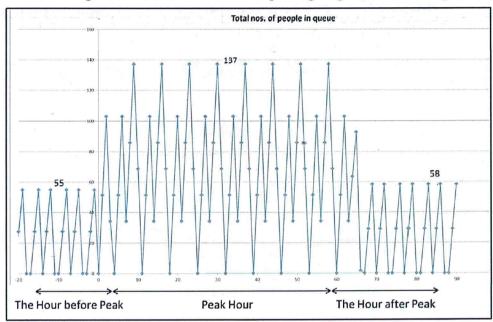


Diagram 5.8 The variation of queuing length (MTR Fanling Station)

- 5.2.12 Thus, the available area of 1,100 m<sup>2</sup> can allow 2,750 ppl for queuing which is adequate for the anticipated queuing passengers of maximum 140 ppl.
- 5.2.13 The special buses would be separated into first group of 6 buses and second group of 5 buses with 3 mins interval on departure times between groups. Hence, 6 bus lay-bys are adequate to provide alighting service on San Wan Road.

### Grave Sweepers Walking Path within MTR Fanling Station

MTR Fanling Station is also a pick-up/drop off point for Wo Hop Shek Columbarium. During festive periods, both Wo Hop Shek and Sandy Ridge grave sweepers would reach the pick-up point from MTR Fanling Station. There would be no conflicts between the grave sweepers flows going to these two columbaria. Grave sweepers going to Wo Hop Shek would use Entrance B, whilst the ones going to Sandy Ridge would use Entrance A2. An insight of the grave sweeper walk path inside MTR Fanling Station is illustrated in **Diagram 5.9** below. This management plan is known as "crowd control plan - Stage 1". Nevertheless, the surveyed grave sweepers flows in Ching Ming Festival of 2014 indicated that there were 5,765 ppl/hr and 1,760 ppl/hr in Entrance A1 and Entrance A2 respectively.

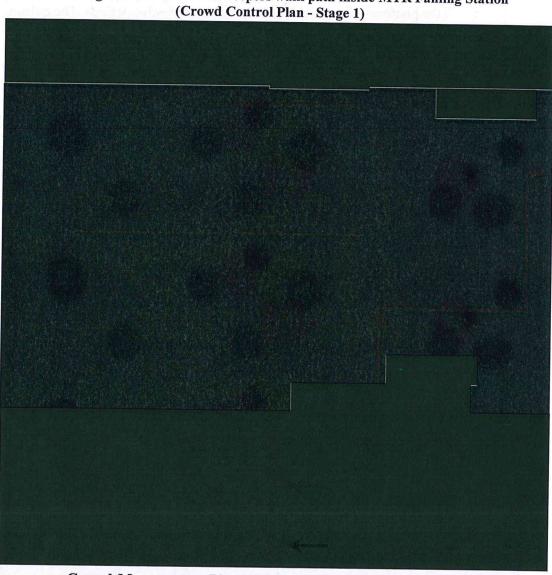


Diagram 5.9 Grave sweepers walk path inside MTR Fanling Station

Crowd Management Plan - Stage 2 within Fanling Station during the Peak Period

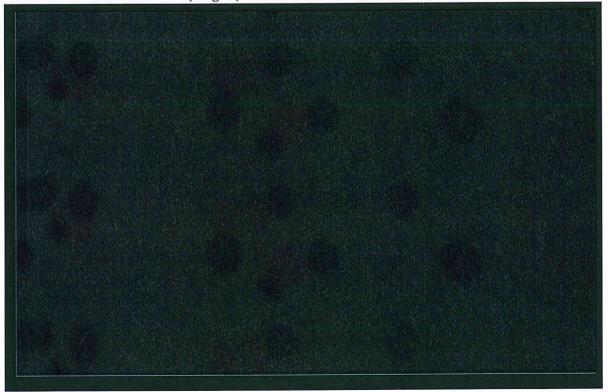
5.2.15 A "crowd control plan - Stage 2", to separate the grave sweepers routing of future Sandy Ridge Columbarium grave sweepers from that of Wo Hop Shek Cemetery grave sweepers is formulated.

5.2.16

5.2.17 It is suggested a temporary staircase to be located at the east side near the cycle track during the peak hour in festive periods. With the modification work of gate opening on the platform of Hung Hom Bound, it can serve as a new station exit on Fanling Station Road connecting the platform (Hung Hom bound) during the festive periods. The existing 1 escalator & 1 staircase connecting eastern end of concourse and platform (Hung Hom Bound) will become one-way passageway going down to the proposed temporary staircase to Fanling Station Road, while the remaining 1 escalator would be serving downward to platform.

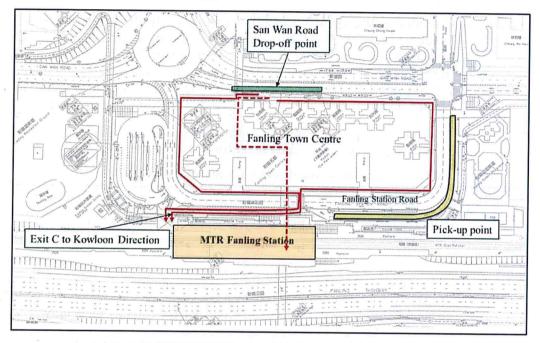
- 5.2.18 By introduction of temporary physical barrier and slightly relocation of Automatic Fare Collection (AFC) gates, the associated section of platform will temporarily become exclusive passageway for the Sandy Ridge visitors in festive periods. HKPF would be required to guide the visitors to the advisory routing. The alternative routing of AFC gates would be in use in case there is queuing problem of the main routes.
- On the platforms, crowd control and advisory signage will be required to direct the Wo Hop Shek grave sweepers and Sandy Ridge grave sweepers. Sandy Ridge grave sweepers and Wo Hop Shek grave sweepers will be guided to the escalators/staircase at eastern end and western end of platform respectively. Under the crowd control plan, the conflict in grave sweeper flow of those visitors can be minimized. Once again, further liaison with MTRC is required.
- 5.2.20 For the first few years after the first intake year of columbarium (Year 2023), it is not anticipated that the "Crowd management plan Stage 2" would need to be implemented.
- 5.2.21 The illustration of the "Crowd management plan Stage 2" inside MTR Fanling Station is shown in **Diagram 5.10**.

Diagram 5.10 Grave sweepers walk path inside MTR Fanling Station (Stage 2)



- 5.2.22 Some of the existing payphones adjacent to Exit A2 of MTR Fanling Station may be relocated so as to provide more spaces for the proposed grave sweepers.
- 5.2.23 The major grave sweepers flow return to Hung Hom direction of MTR East Rail Line is proposed to use the footbridge to go to MTR Exit C within 5 minutes walking or reaching MTR Fanling Station via Fanling Town Centre, which has been illustrated in **Diagram 5.11** below.

Diagram 5.11 Grave sweepers walk path after drop-off at San Wan Road



### Level of Service for grave sweepers walkway (Existing)

- 5.2.24 Grave sweepers traffic surveys were conducted on 2014 Ching Ming Festival (Sunday) in the exits and the vicinity of MTR Fanling Station. The peak hour was found to be from 1200 noon to 1300.
- 5.2.25 MTR Fanling Station Exit A2 is found to be the critical point where the heavy visitor demand would pass by to reach the special bus boarding point. Currently, there are one staircase walkway and one escalator in upward-motion. The survey reveals the numbers of grave sweepers were 1,100 ppl/hr and 670 ppl/hr, entering and exiting the Exit A2 during the peak hour, respectively.
- Regarding the people going up to the station from Exit A2. It was observed that all of the passengers were using escalator; by using the observed data, it gives a result of 19 ppl/min, which is less than 100 ppl/min (Maximum Practical Capacity; with 0.5m/s operational speed),

Regarding the people going down from the station. For staircase which grave sweepers exiting from Exit A2, it gives a result of 7.5 ppl/min/m (by walkway width of 1.6m), which is less than 70 ppl/min/m (unidirectional-down)

Level of Service for grave sweepers walkway (With Columbarium Development)

- 5.2.28 for Maximum Practical capacity (MPC), the capacity of escalator is 150ped/min 1 and staircase is 63ped/min/width (m) 2.
- Considering the visitors leaving MTR station in the design case, the handling capacity (for Sandy Ridge visitors) of staircase at Exit A2 would be 1.6m x 70 ppl/min/m (unidirectional-down) background flow 670 ppl/hr = 6,050 ppl/hr. Thus, in case the induced visitor number approaching 6,050 ppl/hr in the future. The "Crowd management plan Stage 2" mentioned in Items 5.2.15 to 5.2.20 would be required.
- 5.2.30 The vertical transportation capacity of the exclusive passageway for Sandy Ridge Visitors is listed in **Table 5.4 & 5.5** below.

Table 5.4 Exclusive passageway for Sandy Ridge Visitor

	Nos. of Escalator	Capacity per hour	Nos. of Staircase	Capacity per hour	Total Capacity per hour
Fanling Station (for single bound)	1	9,000	1 (1.6 meter wide)	6,720	15,720

Table 5.5 Volume to Capacity of Exclusive passageway for Sandy Ridge Visitor at Design Scenario

1 2 3 3 5 6 7 1	Volume	Capacity	V/C
Fanling Station (for single bound)	11,880	15,720	0.76

5.2.31 Assuming all grave sweepers are arriving at Lo Wu Bound, the vertical transportation capacity of the passageway coming up from Lo Wu bound platform is listed in **Table 5.6 & 5.7** below.

Table 5.6 Passageway coming up from Lo Wu bound platfrom

	Nos. of Escalator	Capacity per hour	Nos. of Staircase	Capacity per hour	Total Capacity per hour
Fanling Station (for single bound)	3	27,000	3 (1.6 meter wide)	14,400 <sup>3</sup>	41,400

<sup>&</sup>lt;sup>1</sup>Taking MPC and speed of escalator = 0.75m/s

<sup>&</sup>lt;sup>2</sup>Taking the uni-direction capacity: Up (63 ppl/min) and Down (70 ppl/min) of staircase

<sup>&</sup>lt;sup>3</sup> Taking MPC and Bi-direction capacity: Up (50 ppl/min) and Down (56 ppl/min) of staircase

Table 5.7 Volume to Capacity of passageway coming up from Lo Wu bound platform at Design Scenario

	Volume	Capacity	V/C
Fanling Station (for single bound)	24,196	41,400	0.58

Assuming all grave sweepers are leaving to Hung Hom Bound, the vertical transportation capacity of the passageway going down to Hung Hom bound platform is listed in **Table 5.8 & 5.9** below.

Table 5.8 Passageway commuting to Hung Hom bound platform

	Nos. of Escalator	Capacity per hour	Nos. of Staircase	Capacity per hour	Total Capacity per hour
Fanling Station (for single bound)	3	27,000	2 (1.6 meter wide)	10,7524	37,752

Table 5.9 Volume to Capacity of passageway going to Hung Hom bound platform at Design Scenario

	Volume	Capacity	V/C
Fanling Station (for single bound)	26,512	37,752	0.70

Apart from the vertical transportation between the station and platforms, the handling capacity of AFC gates was also assessed. Despite the AFC gates are proposed to be shifted slightly forward for aisle enhancement, the total nos. of AFC gate is remained unchanged as current layout. The handling capacity of the AFC gate is tabulated in **Table 5.10** below.

Table 5.10 Passageway coming up from Lo Wu bound platform

Mac 18	Nos. of AFC gate	Capacity per hour	Total V		
Fanling Station (for single bound)	235	55,200	26,512 +24,196 = 50,708	0.92	

5.2.34 The above results indicate that MTR Fanling Station is anticipated to operate within its handling capacity in both reference and design scenarios. Nonetheless, appropriate implementation of crowd control measures is subject to review every year after the commencement of the Sandy Ridge C&C at year 2023.

<sup>5</sup> Taking MPC and scissors gates/flap gates (40 ppl/min)

<sup>&</sup>lt;sup>4</sup> Taking MPC and Bi-direction capacity: Up (50 ppl/min) and Down (56 ppl/min) of staircase

5.2.35 In case the escalators are not functioning, all the escalators will become staircases with uni-direction up/down. With the measured width of escalators, the handling capacities as well as the operating performance (V/C) are tabulated in **Table 5.11** to **Table 5.16**.

Table 5.11 Exclusive passageway for Sandy Ridge Visitor (Scenario – All escalators not functioning)

	Nos. of Escalator	Capacity per hour	Nos. of Staircase	Capacity per hour	Total Capacity per hour
Fanling Station Scenario — all escalators not functioning	1 (not functioning) = 1 meter wide staircase (uni-direction down)	4,200	1 (1.6 meter wide) (Bi-direction)	6,720	10,920

Table 5.12 Volume to Capacity of Exclusive passageway for Sandy Ridge Visitor at Design Year (Scenario – All escalators not functioning)

The second second second	Volume	Capacity	V/C
Fanling Station Scenario – all escalators not functioning	11,880	10,920	1.09

5.2.36 Assuming all grave sweepers are arriving at Lo Wu Bound, the vertical transportation capacity of the passageway coming up from Lo Wu bound platform with the scenario that all escalators are not functioning is listed in **Table 5.13 & 5.14** below.

Table 5.13 Passageway coming up from Lo Wu bound platform (Scenario – All escalators not functioning)

THE COURT	Nos. of Escalator	Capacity per hour	Nos. of Staircase	Capacity per hour	Total Capacity per hour
Fanling Station Scenario – all escalators not functioning	3 (not functioning) = 3 x 1 meter wide staircase (uni-direction up)	11,340	3 (1.6 meter wide) (Bi-direction)	14,400 <sup>6</sup>	25,740

Table 5.14 Volume to Capacity of passageway coming up from Lo Wu bound platform at Design Year (Scenario – All escalators not functioning)

	Volume	Capacity	V/C
Fanling Station Scenario – all escalators not functioning	24,196	25,740	0.94

<sup>&</sup>lt;sup>6</sup> Taking MPC and Bi-direction capacity: Up (50 ppl/min) and Down (56 ppl/min) of staircase

Assuming all grave sweepers are leaving to Hung Hom Bound, the vertical transportation capacity of the passageway going down to Hung Hom bound platform with the scenarios that all and partial escalators are not functioning are listed in **Table 5.15 & 5.16** below.

Table 5.15 Passageway commuting to Hung Hom bound platform

	Nos. of Escalator	Capacity per hour	Nos. of Staircase	Capacity per hour	Total Capacity per hour
Fanling Station Scenario – all escalators not functioning	3 (not functioning) = 3 x 1m wide staircase (uni-direction down)	12,600	2(1.6 meter wide) (Bi- direction)	10,752 <sup>7</sup>	- 23,352
Fanling Station Scenario – If only 2 escalators are not functioning	1 + 2 (not functioning)	17,400	2(1.6 meter wide) (Bi- direction)	10,752	28,152

Table 5.16 Volume to Capacity of passageway going to Hung Hom bound platform at Design Scenario

	Volume	Capacity	V/C
Fanling Station Scenario – all escalators not functioning	26,512	23,352	1.14
Scenario – If only 2 escalators are not functioning	26,512	28,152	0.94

The associated escalators for grave sweepers leaving to Hung Hom Bound will be operating over-capacity if all the 3 escalators do not function simultaneously at the peak hour. If 2 escalators do not function at the same time, the only 1 working escalator and 2 malfunctioned escalators serving as staircases will still be operating within capacity during the peak hour of festive periods.

#### **Proposed Road Improvement Work**

- In order to provide adequate bus lay-bys for pick-up and drop-off, road improvement work is required. As shown in **Diagram 5.12** and **Diagram 5.13**, some of the planters on Fanling Station Road and San Wan Road are proposed to be removed for providing ample special bus boarding /alighting area.
- 5.2.40 Diagram 5.14 shows the modification work of the barrier at the Fanling Station Road pickup point. In order to avoid blockage of lane due to any broken down bus, the physical barrier will be demolished to provide ample room for bypassing and would be replaced by crash gate. Although the removal of the physical barrier would be permanent, it is not required in the first two years when the passenger flow is not high at the early stage of the columbarium intake. It is estimated that the

<sup>&</sup>lt;sup>7</sup> Taking MPC and Bi-direction capacity: Up (50 ppl/min) and Down (56 ppl/min) of staircase

removal of the physical barrier be required in the third/fourth year when the number of special bus starting to be increased.

Diagram 5.12 Planter removal on Fanling Station Road for Special bus boarding

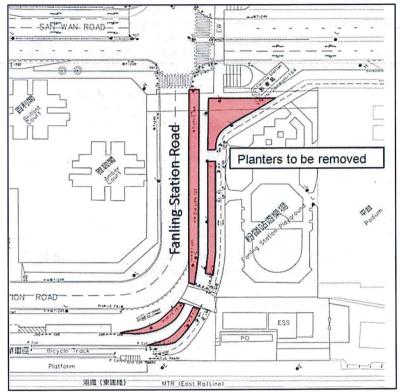
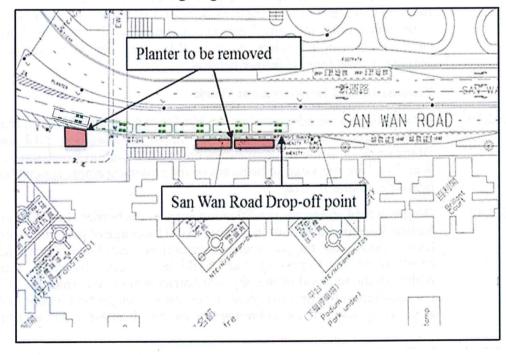


Diagram 5.13 Planter removal on San Wan Road for special bus alighting



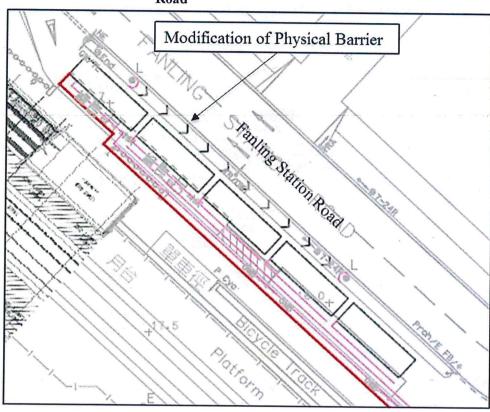
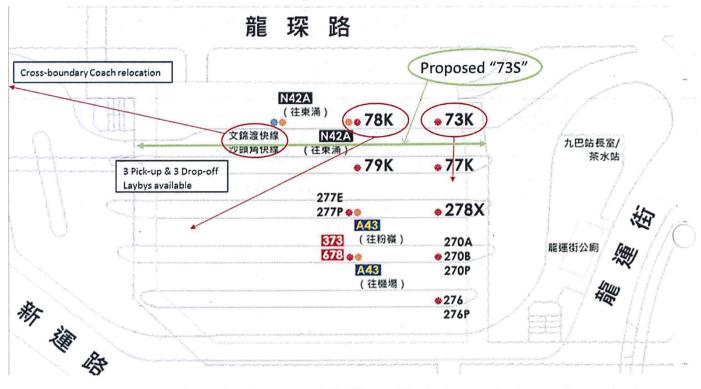


Diagram 5.14 Modification of Physical Barrier along Fanling Station Road

- 5.3 Pick-up/Drop-off Arrangement at MTR Sheung Shui Station
- 5.3.1 In the Feasibility Study, Choi Yuen Road near MTR Sheung Shui Station was proposed as a pick-up/drop-off point for Sandy Ridge C&C development.
- 5.3.2 It is noted that there is an existing bus route 73K serving grave sweepers between Sheung Shui and existing Sandy Ridge Cemetery. However, the special bus services still need to be explored. In festive periods, existing bus routes 73K, 78K and Cross Boundary Coach are proposed to be relocated to the other bays to spare out the whole lay-by for the special bus service. i.e. 73S.

#### 5.3.3 The indicative scheme is shown in **Diagram 5.15**.

Diagram 5.15 Arrangements in Sheung Shui



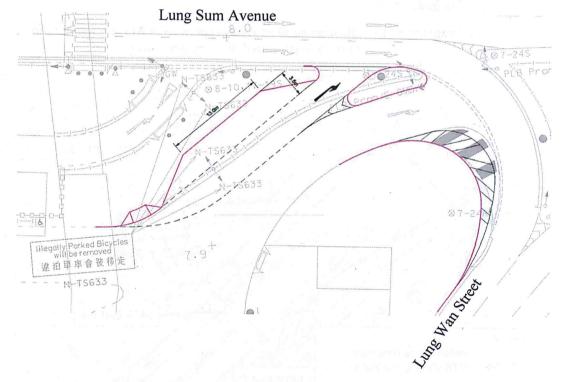
Bus Survey on bus route 73K



5.3.4 Bus survey on route 73K was conducted on 2014 Ching Ming Festival. The bus service was already with 5-7mins headway in the observed peak hour 11am-12noon.

- 5.3.5 The survey reveals the existing passenger using 73K on Ching Ming Festival was 1,790 pax/hr.
- 5.3.7 It is proposed to provide a vehicular opening connecting the Sheung Shui Landmark North PTI and Lung Sum Avenue to avoid the detour of bus heading towards Man Kam To Road direction. In addition, there will be Cross boundary coach bus layby along the proposed opening.
- The proposed vehicular opening could allow direct access for the Man Kam To Road bound bus services and avoid the current congested junction Lung Sum Avenue / San Fung Avenue. There will be 73K and proposed special bus service "73S", using this new vehicular opening, the junction performance was assessed and the DFC (Design Flow to Capacity) ratio of 0.25 in design case. And the adjacent junction of San Hong Street/Chi Cheong Road/ Lung Sum Avenue would perform in a DFC over 50% in design case.
- 5.3.9 The proposed layout of the vehicular opening is shown in **Diagram 5.16**.

Diagram 5.16 Modification of Physical Barrier at Lung Sum Avenue



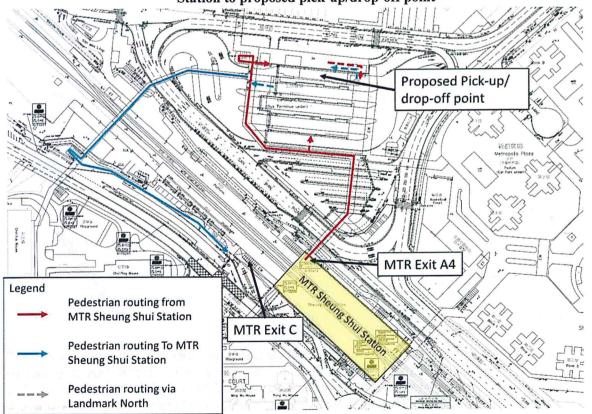
Feasibility of maximizing the handling capacity of proposed route "73S" was also explored. It is proposed the existing 73K bus stop can be relocated to the bay for 77K (second bay) during festive periods. The whole length of the bay (adequate for stacking 6 buses) for 73K can be spared for the proposed special route "73S" to Sandy Ridge C&C.

- 5.3.11 The existing 73K bus services will maintain its current services at 15 mins headway running along Man Kam To Road without stopping at Sandy Ridge C&C PDA uphill.
- 5.3.12 With the relocation of 73K, three pick-up lay-bys and three drop-off bays could be provided for the proposed bus service "73S" which will stop at Sandy Ridge C&C PDA uphill during the festive periods.
- 5.3.13 The number of passengers taking bus service 73K is: 4 trip/hr (15-min. headway) X 120 pax/bus = 480 ppl/hr. On the other hand the number of passengers taking proposed 73S (with 7 mins headway) would be 9 trips/hr X 3 buses X 120 pax/bus = 3,240 ppl/hr. Therefore, the remaining handling capacity for Sandy Ridge grave sweepers is: 480+3,240-1,790=1,930 ppl/hr.

#### **Proposed Road Improvement Works**

- 5.3.14 As mentioned in Section 5.3.7, a vehicular opening connecting the Sheung Shui Landmark North PTI and Lung Sum Avenue is required to facilitate the bus circulation in Sheung Shui during the Festive Periods. As shown in **Diagram 5.16**, modification of the existing paved area at Sheung Shui Landmark North PTI is required.
- 5.3.15 Nevertheless, the illustration of grave sweepers from MTR Sheung Shui Station to the proposed pick-up/drop-off point is shown below of **Diagram 5.16a**.

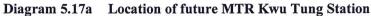
Diagram 5.16a Illustration of grave sweepers from MTR Sheung Shui Station to proposed pick-up/drop-off point

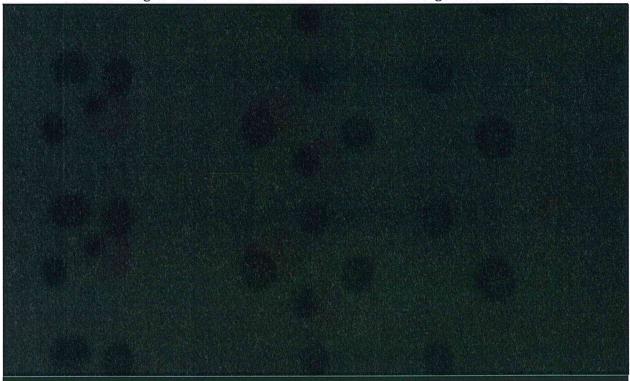


# 5.4 Pick-up/Drop-off Arrangement at future MTR Kwu Tung Station

- Other than the pick-up/drop-off location at MTR Fanling Station as mentioned previously, there is a proposed pick-up/drop-off facility to cater the grave-sweepers from the west side: MTR Kwu Tung Station.
- According to the "Railway Development Strategy 2014" announced by Transport and Housing Bureau in 17 September 2014, the plan of construction of Northern Link (NOL) was firm. Thus, the PDA at MTR Kwu Tung Station would likely replace that at Kam Sheung Road Station at Stage 2. [Note: The NOL would connect MTR Kam Sheung Road station to MTR Lok Ma Chau Station, and the future MTR Kwu Tung Station would be one of the stations along the NOL.]
- The advantage of setting the pick-up/drop-off location in Kwu Tung is due to the fact that the conceptual alignment of the future NOL will link up the East Rail Line and West Rail Line and form as a loop. It is considered very convenient for grave-sweepers from two different railway lines. In terms of geographically, Kwu Tung is actually the nearest point from Sandy Ridge C&C.
- Moreover, the traffic model projected that, during the peak hour on the festive days, there would be a maximum flow of about 28,030 people per hour and that over 80% of them would use the PDAs at Fanling Station and Kwu Tung Station for taking the special buses. Noting the fact that the population along the East Rail Line (ERL) was higher than that along the West Rail Line (WRL), it was projected that certain percentage of grave sweepers from the ERL would choose to take the special buses at Kwu Tung Station of the proposed Northern Link of the WRL, via the existing Lok Ma Chau Spur Line of the ERL. The overall travelling time from Kwu Tung Station would be similar to that from Fanling Station since the proposed bus route from the former to the proposed C&C facilities would be shorter than that from the latter.

5.4.5 The location of the future Kwu Tung Station is illustrated in **Diagram** 5.17a below.





5.4.6 The anticipated handling capacity in this location, is calculated to be 9 platoons of buses /hour x 120 pax x 11 buses = 11,880 ppl/hr.

Table 5.17 Cycle Time of the Special Special bus Route from MTR Kwu Tung Station to Sandy Ridge Columbarium

Events of a Special bus to Sandy Ridge columbarium	Time Required (min)
Passengers Boarding at MTR Kwu Tung Boarding Point	5
Travelling from MTR Kwu Tung to Sandy Ridge Columbarium	10
Passengers Alighting at Sandy Ridge Columbarium	3
Passengers Boarding at Sandy Ridge Columbarium	5
Travelling from Sandy Ridge Columbarium to MTR Kwu Tung	10
Passengers Alighting at MTR Kwu Tung Alighting Point	3
Stacking Movements	2
Total Time for 1 round trip	38

- The cycle time is shown in **Table 5.17**, with the assumed headway of 7min between every 11 buses, the special special bus route with a fleet size of (11 lay-by x 60min/7min) /(60min /38 cycle time) = 60 buses, can achieve 9 platoons of buses /hour x 11 buses = 99 trips/hr, which can accommodate the grave sweepers at MTR Kwu Tung Station PTI.
- 5.4.8 The bus boarding lay-bys would be separated into 2 groups. In view of practical operation, maximum no. of 6 buses would departure in a group at the same time. Therefore, there would be group A with 6 buses departure followed by group B with 5 buses in every 7 minutes interval.

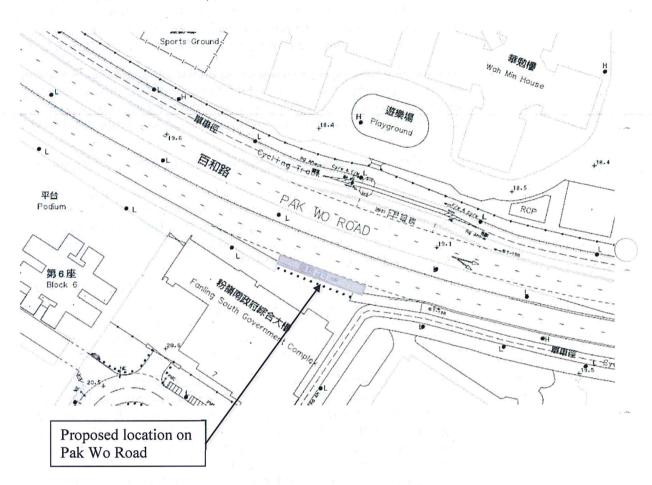
# 5.5 Existing Bus and Special Bus Services at Stage 3

- When the special bus service from Fanling and Sheung Shui, and Kwu Tung, have reached their design capacities (in Year 9 in Table 5.19a), then existing bus services to the potential Bus-Bus Interchange (BBI) as well as special bus service from BBI to Sandy Ridge C&C would be introduced (subject to future bus availability) at Stage 3.
- 5.5.2 In order to share the traffic burden on Fanling and Sheung Shui PDA, enhancement of existing bus services to the proposed BBI and provision of special bus services from BBI to the Sandy Ridge C&C would be proposed in the later stage of development when Fanling and Sheung Shui PDAs have reached their capacities.
- Existing bus routes like nos. 277X from Lam Tin and 278X from Tsuen Wan will be enhanced to connect MTR Fanling Station PDA while existing bus routes nos. 261 & 276 from Tuen Mun & Tin Shui Wai respectively will be enhanced to connect to MTR Sheung Shui Station. When Fanling PDA and Sheung Shui PDA have reached their capacity, special bus service from future MTR Kwu Tung PDA will be introduced. When future MTR Kwu Tung PDA have reached their capacities, existing buses and special bus service to Sandy Ridge C&C (via the possible Bus-Bus Interchange (BBI) at Fanling) will be introduced.
- According to the meeting with the bus company, the implementation of Stage 3 will be subject to review, as mentioned in **Para 5.1.7**.

#### Possible Bus-to-Bus Interchange (BBI)

- 5.5.5 The existing bus and special bus arrangement is proposed to be operated with the use of Bus-Bus-Interchange (BBI) concept. The general concept of such arrangement is to make use of the existing bus and special bus routes from urban areas, boarding and alighting at a location somewhere nearby the development, and to provide special bus service between the proposed development and the BBI.
- Nevertheless, further agreement from relevant government departments and parties should be obtained and bus trial run has to be conducted.
- 5.5.7 The location of the existing bus stop at Pak Wo Road (near Wah Ming Estate) is illustrated in **Diagram 5.17b** below.

Diagram 5.17b Location of drop-off point of special bus service on Pak Wo Road



- 5.5.8 The feasibility of adopting BBI arrangement into Sandy Ridge project is considered as positive. By adopting the BBI arrangement, the bus fleet in general (i.e.: from Kowloon East Region) could be reduced, yet having almost the same outcome of bringing substantial amount people from urban area to the project site.
- In view of the fact that, bus companies has limited bus fleet resources, by having BBI, the resources of buses can be used more effectively.
- 5.5.10 Eventually, a trial run of 12.8m bus for the proposed pick-up point at nearby Pak Wo Road would need to be performed.
- There are 4 out of 6 bus routes originating outside North District (i.e. Route no. 270A, 278X, 373A and 277X) that are terminating/passing through Wah Ming Estate Bus Terminus, which would need to be strengthened in services to facilitate the grave sweeper to interchange to the proposed special bus services to Sandy Ridge C&C during the festive periods.
- 5.5.12 The impact due to special buses on Strategic road networks have been analysed. The V/C ratio of the three Strategic Road sections nearby the project site at Year 2052 are shown in **Table 5.18**.

Table 5.18 V/C ratio of Strategic Road Sections in 2052

Regional Link in NTE	Direction	Capacity ( pcu/hr)	Total	V/C Ratio
Fanling Hwy.	EB/WB	8,000	4,268/5,199	0.53/ 0.65
San Tin Hwy.	EB/EB	8,000	3,363/3,582	0.42/0.45
Tolo Hwy.	NB/SB	8,000	5,427/6,162	0.68/0.77

5.5.13 It shows that even with the introduction of special buses, all the strategic roads nearby the proposed site in Year 2052 has V/C ratio less than 0.85, which is considered acceptable in traffic terms.

# 5.6 Grave Sweepers Access between MTR Lo Wu Station and the C&C facilities

5.6.1 For the MTR Lo Wu Station, it can only be connected to the proposed Sandy Ridge C&C by walking of about 2 km with level difference of 30m which is not considered easy especially with items for paying respect to their ancestors.

the demand of grave sweepers accessing the proposed Sandy Ridge C&C via MTR Lo Wu Station is foreseen to be low. Hence, MTR Lo Wu Station will not be proposed as the main MTR Station for receiving the grave sweepers

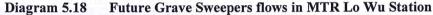
- Nevertheless, the demand of grave sweepers accessing the proposed Sandy Ridge C&C via MTR Lo Wu Station will be monitored after its commencement. The option for provision of mini-concourse at Lo Wu Station and an elevated walkway could be further investigated if the usage of this station to access Sandy Ridge C&C was found to be increasing in the future.
- In our preliminary assessment,

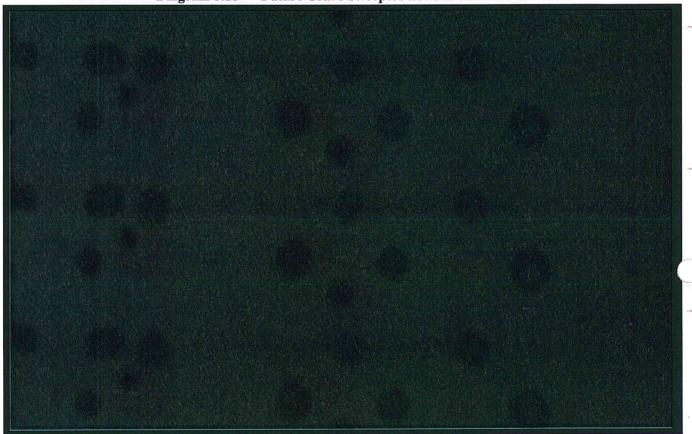
walking for 2km (i.e. via Lo Wu Station Road, Man Kam To Road and Sha Ling Road) will become a major consideration to them for selecting the walk mode at MTR Lo Wu Station, especially most grave sweepers groups with elderly and children with items for paying respect to their ancestors. It is anticipated that approximately 1% of the total grave sweepers would be walking from MTR Lo Wu Station

The anticipated 1% of total arrival grave sweepers is anticipated to be 280 ppl/hr.

The adequacy of the stairway/walkway inside MTR Lo Wu Station has been checked to ensure the additional grave sweepers flow generated/attracted by the Sandy Ridge C&C facilities would not create adverse impact to Lo Wu Station.

- 5.6.5 the critical locations (exit/entrance) have capacity of 50 ppl/min/m (Design Factor 0.8, unidirection up) and 56 ppl/min/m (Design Factor 0.8, uni-direction down).
- As mentioned, the forecast grave sweepers flow to Sandy Ridge C&C facilities and the background flow (surveyed on Ching Ming Festival 2014) at the critical section are:
  - A. Up: 280 ped/hr (one-way) and 1,470 ped/hr (one-way) = 29 ped/min/m < 50 ped/min/m
  - B. Down: 280 ped/hr (one-way) and 1,510 ped/hr (one-way) = 19 ped/min/m < 56 ped/min/m
- 5.6.7 Therefore, the existing staircases are capable to accommodate the additional grave sweepers from Sandy Ridge C&C.
- 5.6.8 The anticipated grave sweeper's flows in MTR Lo Wu Station are illustrated in **Diagram 5.18**.

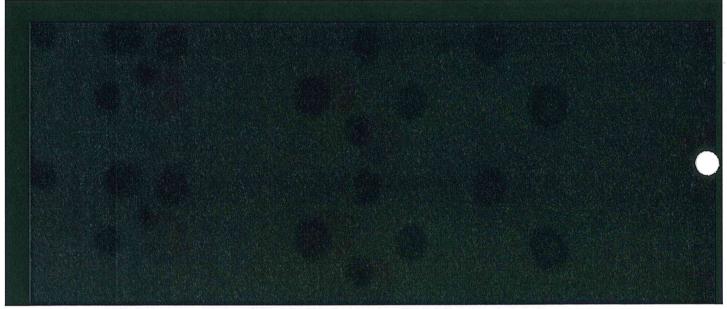




- As mentioned in Section 5.5.2, the anticipated 1% of total arrival grave sweepers is 280 ppl/hr. However, Lo Wu Station Road might need temporary traffic management plan to ensure the pedestrian flow is smooth and safe. Such temporary traffic management plan will be imposed by HKPF when it is necessary during the festival period.
- 5.6.10 The grave sweepers from Lo Wu Station can go via the existing Lo Wu Station Road.
- 5.6.11 Similar to the crowd management measures for other existing columbarium facilities, the traffic related information could be disseminated to the general public via Announcement of Public Interest (API) on TV, radio, newspaper or posted at the transport hub for information of the general public to channelize the grave sweepers to the major PDA at Fanling Station and Kwu Tung Station.
- 5.6.12 In case of over-crowdedness in Lo Wu Station temporary traffic management plan by directing the grave sweepers going to Fanling Station and Kwu Tung Station, when there are too many people at Lo Wu Station. These grave sweepers will be guided back to the Kowloon bound inside MTR Lo Wu Station.
- The existing footpath along Lo Wu Station Road is 1.5m in width. During the festive period, the carriageway assumed to be reserved for EVA, all pedestrians will be using the existing footpath. The effective width of the footpath could be taken as 0.9m (=1.5m-0.3m-0.3m). The ped flow in future would be: 1,470+1,510 (background) +280 (one-way ped flow to Sandy Ridge) = 3,260 ped/hr. The Level of Service would be:3,260ped/hr/60min/0.9m=61ppl/min/m. This equivalent to Level of Service (LOS) E which is considered as acceptable for festive period in traffic engineering terms.
- To further enhance and elaborate the temporary traffic management plan, during festive periods, there will be public announcement provided by MTRCL to inform the grave sweepers and would advise them to use MTR Fanling Station and Kwu Tung Station if MTR Lo Wu Station is anticipated to be over-crowded. This would be announced before the MTR Lo Wu Station is about to reach its capacity.

As mentioned before, in addition of the public announcement, there is an operation plan, which is for the case where the grave sweepers need to "turn back" to the Kowloon bound and use MTR Fanling Station and Kwu Tung Station when the Lo Wu Station is over-crowded. Such plan in general form is illustrated in **Diagram 5.19** below.

Diagram 5.19 Operation Plan in MTR Lo Wu Station



- As shown, the routing of the passenger 'turn back' to the Kowloon bound is clearly stated. There is an access inside MTR Lo Wu Station which could be accessed in case of any emergency that need the grave-sweepers to 'turn back' to Kowloon-bound because of anticipated overcrowded.
- 5.6.17 For instance, if a grave-sweeper heard the announcement that the station is anticipated to be crowded, and passengers are required to 'turn back 'to Kowloon-bound, it is possible that they can still come out to platforms, and then following the proposed signages (i.e. hang onto the ceiling ) and following the instructions from the on-site crowd management officers to access the pathway and head back to Kowloon-bound.
- This traffic management measure will be acted as the first measures, it provides a 'turn back' access before the grave-sweepers actually approaching the concourse level. The second traffic management measure will be having on-site crowd management officers stand-by the concourse level before the grave-sweepers actually exit thru toll-gate.
- 5.6.19 With these two traffic management measures, it is anticipated that the likelihood of grave-sweepers exit out of Lo Wu Station in over-crowded situation is very minimal. However, agreement on the "Operation Plan" will be obtained from both Transport Department and Hong Kong Police at later stage.

## 5.7 Summary

- As mentioned before, the proposed location for pick-up/drop-off from the Eastern side and Western side (at future MTR Kwu Tung Station) as the Base Case scenario is developed.
- 5.7.2 Such grave sweepers split in view of handling capacities of transport modes for Base Case, is illustrated in **Table 5.19** below and associated program is also listed.

Table 5.19 Handling Capacities and Modal Split of Arrival Grave Sweepers (Base Case)

Mode	Handling (	Split	
MTR Fanling Station + Special Bus Services:	11,880	ppl/hr	42%
MTR Kwu Tung Station + Special Bus Services:	11,880	ppl/hr	42%
MTR Sheung Shui Station + Special Bus Services:	1,900	ppl/hr	7%
Taxi / GMB	850	ppl/hr	3%
Existing bus and Special bus:	1,240	ppl/hr	5%
MTR Lo Wu Station by walking:	280	ppl/hr	1%
Total:	28,030	ppl/hr	100%

- 5.7.3 A sensitivity analysis has been conducted to ascertain the possible modal choices in the situation that more grave sweepers than the original forecast chose to use the PDA at Fanling Station in the 8<sup>th</sup> and 10<sup>th</sup> year.
- In the sensitivity analysis, it was by comparing choices between (a) Taking special buses at Sheung Shui Station PDA, (b) Taking special buses at Kwu Tung Station PDA and (c) Walking from Lo Wu Station. In conclusion, it was logical to assume that most of the grave sweepers would prefer choice (b), Kwu Tung Station PDA, to the other two choices. The detail of the sensitivity analysis and an illustration of such modal choice sensitivity test is in **Appendix E**.

Table 5.19a Niche Allocation Programme (Base Case):

T.					Passe	enger S	plit (o	ne way a	rrival)		Bus service	provision	1
	Niches	Total Niches	Year	Total visitor (one- way arrival)	кт	FL	SS	Existing bus and special bus (BBI)	Other Modes (Taxi, GMB, walking, etc.)	KT (bus per 7 mins headway)	FL (bus per 7 mins headway)	SS (73S) (bus per 7 mins headway	Existing bus and special bus at BBI (bus per 7 mins headway) (bus per 7 mins headway
	18,000	18,000	1	3,100	1	2,800	200		100		3	2	
stage 1	18,000	36,000	2	6,200		5,500	400	-	200	-	6	2	_
stage 1	18,000	54,000	3	9,200	1	8,200	600	-	400		8	2	
	18,000	72,000	4	12,200	1	10,900	700	-	500		11	2	
Store 2	18,000	90,000	5	15,200	820	11,880	1,900		600	1	11	3	
Stage 2	18,000	108,000	6	18,200	3,720	11,880	1,900		700	4	11	3	-
stage 3	18,000	126,000	7	21,100	6,520	11,880	1,900	-	800	7	11	3	-
	18,000	144,000	8	24,100	9,320	11,880	1,900	1	1,000	9	11	3	-
	18,000	162,000	9	26,900	11,880	11,880	1,900	140	1,100	11	11	3	1
	7,000	169,000	10	28,000	11,880	11,880	1,900	1,240	1,100	11	11	3	2
	2,000	171,000	11	28,000	11,880	11,880	1,900	1,240	1,100	11	11	3	2
								·		and the Har-			
	1,000	200,000	29	27,800	11,880	11,880	1,900	1,040	1,100	11	11	3	2

Table 5.19b Niche Allocation Programme (bus fleet estimation) Base Case:

					g.all.	T 4.1			
	Niches	Total Niches	Year	Total visitor (one-way arrival)	кт	FL	ss	Existing Bus and Special Bus at BBI	Total
	18,000	18,000	1	3,100	-	26	11		37
	18,000	36,000	2	6,200	-	52	11		63
stage 1	18,000	54,000	3	9,200	-	69	11		80
	_18,000	72,000	4	12,200	-	95	11	WHEN THE PARTY	106
0. 0	18,000	90,000	5	15,200	6	95	16		117
Stage 2	18,000	108,000	6	18,200	22	95	16		133
	18,000	126,000	7	21,100	38	95	16	e e	149
	18,000	144,000	8	24,100	49	95	16		160
	18,000	162,000	9	26,900	60	95	16	9	180
Stage 3	7,000	169,000	10	28,000	60	95	16	18	189
	2,000	171,000	11	28,000	60	95	16	18	189
	1,000	200,000	29	27,800	60	95	16	18	189

- 5.7.5 According to the **Table 5.19a** and **Table 5.19b**, Stage 1 will be from 1<sup>st</sup> year to 4<sup>th</sup> year, as the result shows that the MTR Fanling Station will reach the handling capacity in 4<sup>th</sup> year. During Stage 1, existing bus route no. 261 & 276 from Tuen Mun & Tin Shui Wai and 277X & 278X from Lam Tin & Tsuen Wan will be enhanced to connect FL pick-up point.
- 5.7.6 When Sheung Shui PDAs reach their maximum handling capacities in the 5<sup>th</sup> year. The Stage 2 starts to kick-in. At this stage, special bus service from MTR Kwu Tung PDA will be introduced. Stage 2 is anticipated to be last from 5<sup>th</sup> year and 6<sup>th</sup> year.
- 5.7.7 Stage 3 will be started at 7<sup>th</sup> year, which is anticipated that PDAs at Fanling Station Road, Sheung Shui Landmark bus terminus as well as PTI near MTR Kwu Tung Station have reached their capacities. During Stage 3, Bus-bus Interchange (BBI) will be introduced by providing special bus services at Pak Wo Road. The grave sweepers using the existing bus services can be interchanged to the proposed special bus services at Pak Wo Road to access the proposed Sandy Ridge C&C. These existing bus and special buses with BBI will be started to be operated in Stage 3 from 7<sup>th</sup> year to the end of the programme (29<sup>th</sup> year).
- Nevertheless, it is worthwhile to mention at the 9<sup>th</sup> year, it is still able to provide 18,000 niches but in its next year, the intake rate has to be decreased to 7,000 niches as all the planned PDAs has reached their operational capacities. It is shown that 162,000 niches (81% of the target total number of niches) can be achieved in 9<sup>th</sup> year. Ultimately, the 200,000 number of niches could be provided at the 29th year for this Base Case.
- 5.7.9 The bus company agreed that the proposed PDAs at MTR Fanling, Sheung Shui as well as Kwu Tung Stations would be suitable locations for provision of special bus services.

## Liantang/Heung Yuen Wai Connection Road

- As indicated in **Table 3.1**, buses from MTR Fanling Station as well as the special buses from Pak Wo Road BBI are proposed to be running along the future Liantang/Heung Yuen Wai Connection Road. For the special buses travelling on Liantang/Heung Yuen Wai Connection Road, the journey time is anticipated to be reduced. Please refer to the routing of buses running along Liantang/Heung Yuen Wai Connection Road is illustrated in **Figure 5.1**.
- 5.7.11 By running along Liantang/Heung Yuen Wai Connection Road, the newly introduced special buses would not interfere with the urban Sheung Shui area.
- 5.7.12 The buses from MTR Kwu Tung Station and MTR Sheung Shui Station are proposed to be running on Jockey Club Road, leading to Man Kam To Road. Please refer to the illustrative routing is shown in **Figure 5.1**.

## 6 Possible Alternative Routes

### 6.1 Introduction

- 6.1.1 According to the Study Brief, the consultant shall explore the possible alternative routes of hearse vehicles to the C&C facilities at Sandy Ridge Cemetery. The three alternative route choices are:
  - 1) via future slip road from Fanling Highway to Liantang/Heung Yuen Wai BCP and the existing Lin Ma Hang Road
  - 2) via potential Fanling Bypass under other projects and existing Man Kam To Road; and
  - 3) a proposed viaduct from Fan Kam Road directly to the C&C facilities.
- A working paper has been prepared under this Design and Construction assignment and was circulated to the relevant government departments for comments on 19<sup>th</sup> September 2013.
- 6.1.3 Evaluation of these three routes has been undertaken and the findings of the evaluation are summarised in **Section 6.2**. For more details, please refer to **Appendix B** and **Appendix C**.

Improvement of Lin Ma Hang Road

- As mentioned, for the anticipated increased traffic flows (especially special buses and existing bus and special buses) to the project site via Lin Ma Hang Road, there is a section (from Man Kam To Road to Ping Yuen River) which is considered necessary to be improved, in order to cater for the future buses running east-west direction.
- In general, the goal of the improvement is to bring up the existing carriageway width to 7.3m with 2 m footpath on both sides (subject to the detail design) with 2.5% gradient maximum. Such improvement will enhance the carriageway to a safer route for 2-way buses running simultaneously. The total length of the improvement works is about 1.4 km. The improvement is illustrated in **Figure 6.1**.
- 6.1.6 The construction of Lin Ma Hang Road improvement works is anticipated to be completed prior the first intake of the Columbarium (year 2023) for cater the buses and the future traffic flows.

# 6.2 Summary of Findings

6.2.1 By comparing the engineering, traffic, environmental, land issues, cost and implementation issues for hearses travelling directly to the C&C facilities at Sandy Ridge Cemetery during normal days, the Route 1 (i.e. via future slip road from Fanling Highway to Liantang/Heung Yuen Wai BCP and the existing Lin Ma Hang Road) would offer a better overall solution than the other two routes. As such, Route 1 is recommended to be used by hearses to minimise the psychological impact to the residents in Sheung Shui. However, discussion and liaison

- with FEHD and funeral parlour operators is necessary regarding the operational arrangement of hearses by making use of this route.
- To provide a safe and effective road network for the vehicles travelling to Sandy Ridge Cemetery, a minimal improvement works is proposed to widen a section of LMHR (between Ping Yuen River and Man Kam To Road), which is not covered under the scope of CE 5/2013 (HY), from 6m to 7.3m.
- 6.2.3 To further alleviate the public concern on potential overloading of the transport networks in Sheung Shui New Town (especially Man Kam To Road), Route 1 should also need to be considered for usage by special buses during festive periods (these special buses would be using future slip road from Fanling Highway to Liantang/Heung Yuen Wai BCP and the existing Lin Ma Hang Road). In this TIA Report, an investigation has been carried out to further ascertain the feasibility of this route for special buses during the festive periods.

## 7 Traffic Forecast and Traffic Impact Assessment

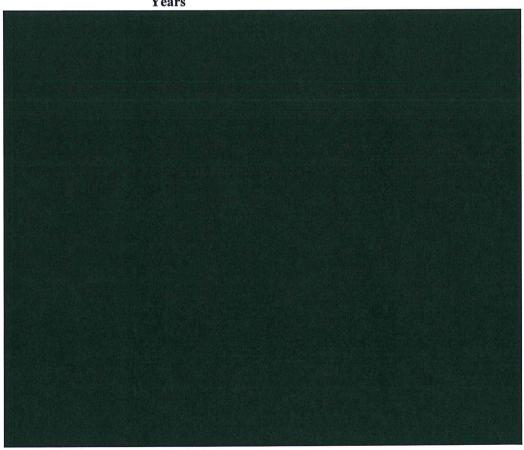
# 7.1 Planning Data and Network Assumptions Overview

7.1.1 The proposed approach of traffic forecast is presented in this section. The model input data including population and employment assumptions, highway and rail infrastructure assumptions, fleet size and economic assumptions, airport and port assumptions, etc., has been reported in the Technical Note on Model Assumption and TIA Approach circulated previously. They will be listed in the subsequent sub-sections.

## 7.2 Territorial Planning Assumptions

7.2.1 The population and employment assumptions have adopted the latest version of 2011-based Territorial Population and Employment Data Matrices (TPEDM) released in June 2013. Summaries of the population and employment data by district for the Base Year 2011 and Design Years 2021 and 2026, 2031 and 2036 are presented in **Tables 7.1** and 7.2 respectively.

Table 7.1 Summary of Population 1 Data for Base Year and Design Years



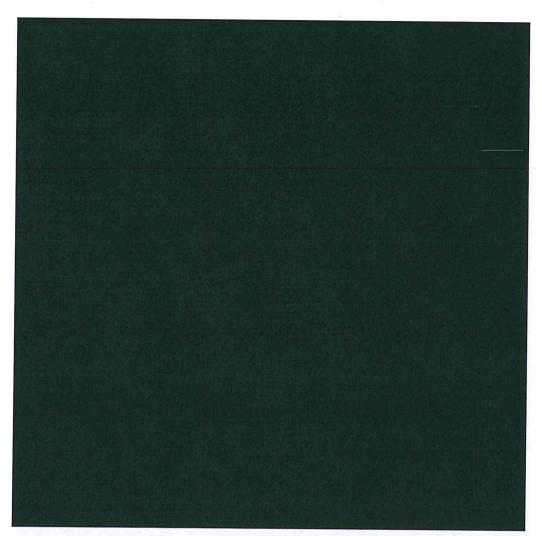
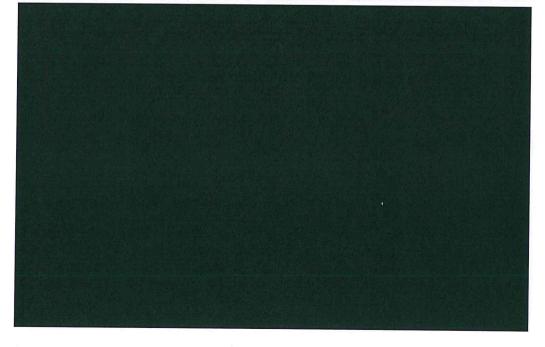
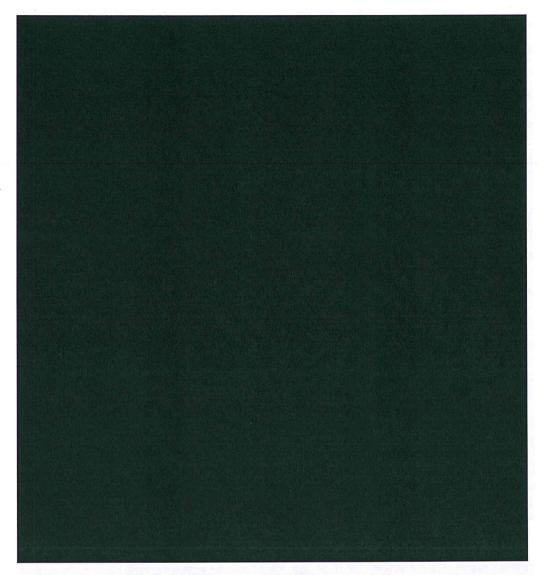


Table 7.2 Summary of Employment Data for Base Year and Design Years





# 7.3 Highway Infrastructure Assumptions

7.3.1 The adopted highway infrastructure assumptions are presented in **Table** 7.3.

Table 7.3 Highway Infrastructure Assumptions for Design Years 2021, 2026 and Beyond

Year 2021 (In addition to 2011 Road Network)	Configuration	
Hong Kong		
Road P2 and Realigned Hung Hing Road on Wan Chai Development phase II	Dual 2	
Road P1, P2 and Distributor Roads on Central Reclamation Phase III	Dual 2	
Central – Wan Chai Bypass and Island Eastern Corridor Link	Dual 3	
Kowloon		
Kai Tak Development	District & Local Road Network	
Route 6 (formerly Route 11) – Central Kowloon Route	Dual 3	

Year 2021 (In addition to 2011 Road Network)	Configuration
Route 6 (formerly Route 11) - Trunk Road T2 (Kai Tak - Cha Kwo Ling Link)	Dual 2
New Territories	
Widening of Tolo Highway/Fanling Highway between Island House Interchange and Fanling (Stage 1 – Section between Island House Interchange and Tai Hang)	Dual 4
Hong Kong – Zhuhai – Macao Bridge Hong Kong Link Road	Dual 3
Traffic Improvement to Tuen Mun Road (Town Centre Section)	Dual 3
Southern Connection of Tuen Mun-Chek Lap Kok Link	Dual 2
Tsuen Wan Bypass, Widening of Tsuen Wan Road between Tsuen Tsing Interchange and Kwai Tsing Interchange, and Associated Junction Improvement Works	Add 2 lanes per direction
Dualling of Hiram's Highway between Clear Water Bay Road and Sai Kung Town	Dual 2
Widening of Tolo Highway/Fanling Highway between Island House Interchange and Fanling (Stage 2 – Section between Tai Hang and Wo Hop Shek Interchange)	Dual 4
Route 6 (formerly Route 11) - Tseung Kwan O - Lam Tin Tunnel	Dual 2
Cross Bay Link at Tseung Kwan O	Dual 2
Connecting Road between Liantang/Heung Yuen Wai BCP and Fanling Highway	Dual 2
Widening of Castle Peak Road (Castle Peak Bay Section)	Dual 2
Northern Connection of Tuen Mun-Chek Lap Kok Link	Dual 2
Tuen Mun Western Bypass	Dual 2
Kwu Tung Development	District & Local Road Network
Cross Boundary	the state of the s
Hong Kong – Zhuhai – Macao Bridge	Dual 3
Link Road to Liantang/ Heung Yuen Wai Cross-Boundary Control Point	Dual 2

Year 2026 (In addition to 2021 Road Network)	Configuration
Hong Kong	,
Island Eastern Corridor Improvement between Causeway Bay and North Point	Dual 4/5*
Kowloon	7
Widening of Gascoigne Road Flyover	Dual 2
New Territories	
Sha Tin Trunk Road T4	Dual 2
Lantau Road P1 between Tung Chung and Sunny Bay	Dual 2
Hung Shui Kiu Development	District & Local Road Network
Year 2031 (In addition to 2026 Road Network) and beyond	Configuration
No New Projects	

#### Note:

- 1. Only these major highway projects have been listed in the above tables. District or local improvement projects have not been included in the above lists.
- 2. \* The configuration of the highway varies at different sections of the road.

## 7.4 Railway Projects Assumptions

7.4.1 The adopted railway projects assumption is presented in **Table 7.4**. As the implementation programme of South Island Lind (West) (SIL(W)) and North Island Line (NIL) is yet to be determined, they will not be included in the assumption.

Table 7.4 Railway Project Assumptions for Design Years 2021, 2026 and beyond

By Year 2021 (In addition to 2011 Existing Railway Network)		
Kwun Tong Line Extension		
West Island Line	- 1	1 6
South Island Line (East)	- 1 11 2	2.00
Guangzhou - Shenzhen - Hong Kong Express Rail Link (Hong Kong S	Section)	
Shatin to Central Link (East-West Line)		
Shatin to Central Link (North-South Line)		
By Year 2026 and beyond (In addition to 2021 Railway Network)		
Northern Link (NOL)		

7.4.2 Based on Arup's information in other recent studies, there is a concern on the opening year of some rail projects including Northern Link (NOL), South Island Line (West) (SIL(W)) and North Island Line (NIL). The schedule of these railway projects has been reviewed and updated based on Government website information and consultation with relevant project offices in the course of other Arup's studies. After review, it is proposed to assume NOL to be in place in around year 2026, while SIL(W) and NIL will not be included in the assumptions. Since SIL (W) and NIL are far from the Study Area, it is considered that the

operation of these rail projects would have insignificant traffic impact in the Study area.

# 7.5 Economic Growth Assumptions

7.5.1 According to the C&SD's information released, the year-on-year growth in Gross Domestic Product (GDP) in real terms for base year 2011 was 9%. The year-on-year growth in for year 2012 was 5.5%. For the further design years, the adopted growth rate is summarised in. **Table 7.5**.

Table 7.5 Assumed GDP Growth Rates for the Design Years

Year	Annual GDP Growth Rate (in Real Terms)
2011	9.0%
2012	5.5%
2013 – 2017	4.0%
2018 - 2021	3.0%
2022 - 2031	2.5%
2032 - 2036	2.0%

#### Note

# 7.6 Vehicle Fleet Size Assumptions

7.6.1 The adopted fleet size assumption of Private Vehicles and Goods Vehicles is presented in **Table 7.6**.

Table 7.6 Projections of Vehicle Fleet Sizes for the Design Years

	Private V	Vehicles	Goods Vehicles			
Year	Mid-year fleet size	Average annual growth rate	Mid-year fleet size	Average annual growth rate		
2011	424,800		110,300			
2013	505,200	5%	114,400	0.50%		
2021	630,000	1.50%	119,000	0.50%		
2026	678,700	1.50%	122,000	0.50%		
2031	731,200	1.50%	125,100	0.50%		
2036	787,700		128,300			

#### Note

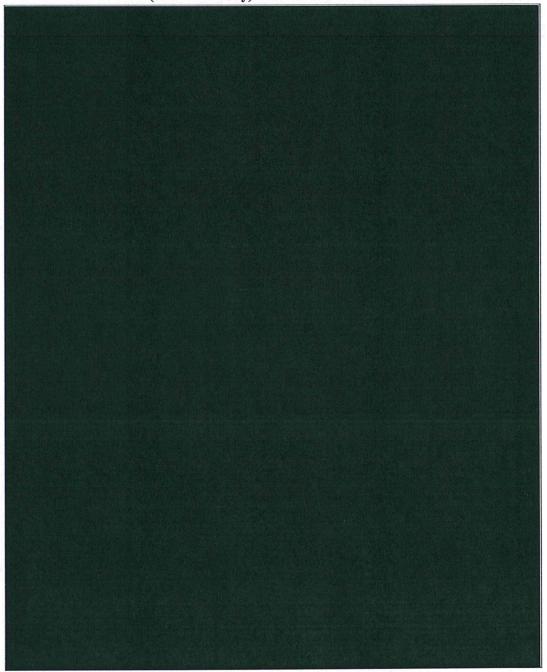
- 1. The vehicle fleet sizes of private vehicles and goods vehicles in year 2011 are further updated according to the data available from Monthly Traffic and Transport Digest.
- 7.6.2 It is noted that the number of licensed taxis has remained relatively unchanged at around 18,000 vehicles with a mere increase by less than 200 vehicles over the 10-year period from 1996 to 2011. Assuming this trend is to continue, the taxi fleet is assumed to remain stagnant at 18,000 vehicles for the entire forecasting period.

<sup>1.</sup> The GDP Growth for Year 2011 and 2012 are based on the data available from Census and Statistics Department (C&SD).

# 7.7 Cross Boundary Traffic Forecasts

7.7.1 The adopted cross boundary traffic assumptions are summarised in **Table 7.7**.

Table 7.7 Forecasts of Cross Boundary Two-way Vehicular Traffic (in Vehicles/Day)



# 7.8 Port Related Land Use Assumptions

7.8.1 The adopted port related land use assumptions are presented in **Table** 7.8.

Table 7.8 Estimated Productivity of Container Terminals (in thousand Twenty-foot Equivalent Unit (TEU) per Year)

Year
2011
2021
2026
2031
2036



7.9.1 The adopted airport passenger and cargo forecast are summarised in **Table 7.9**.

Table 7.9 Airport Usage Assumptions

Parameter	2021	2026	2031	2031	
Daily Air Passengers	134,900	162,500	192,300	221,100	
Daily Air Cargo (Tonnes)	13,000	16,600	20,000	23,000	

# 7.10 Toll Assumptions

7.10.1 Future tolls were assumed to remain constant in real terms. For government tunnels with an existing flat toll structure, the same flat toll structure will be maintained for future design years. Toll assumptions in 2013 dollars are shown in **Table 7.10**.

Table 7.10 Toll Assumptions – 2013 Dollars

Toll Facility	Motor cycle	Car	Taxi	Private/ Public Light Bus	Goods Van	Light Goods Vehicle	Medium Goods Vehicle	Goods	Tractor Unit
Lion Rock Tunnel	8	8	8	8	8	8	8	8	8
Tate's Cairn Tunnel	13	17	17	23	24	24	28	28	49
Tseung Kwan O Tunnel	3	3	3	3	3	3	3	3	3
Shing Mun Tunnel	5	5	5	5	5	5	5	5	5
Cross Harbour Tunnel	8	20	10	10	15	15	20	30	40
Western Harbour Crossing <sup>1</sup>	25	55	50	65	65	65	90	120	150
Eastern Harbour Crossing	13	25	25	38	-38	38	50	75	100
Aberdeen Tunnel	5	5	5	5	5	5	5	5	. 5
Lantau Link <sup>2</sup>	20	30	30	40	40	40	50	80	80
Tai Lam Tunnel (R3-CPS) <sup>1</sup>	20	36	36	100	38	38	43	48	48
Route 8 Eagle Nest Tunnel	8	8	8	8	8	8	8	8	8

Source: Toll charges of all vehicle classes except motorcycle are provided by TD.

The toll charge of motorcycle is referred to webpage information available in TD's website.

#### Note:

- 1. Concessionary Tolls in effect
- 2. Toll booths of Lantau Link are located in the eastbound direction only. The figures presented are 2-way tolls collected only in the eastbound direction
- 5. New tolls for Tai Lam Tunnel effective on 1 January 2013, new tolls for Tate's Cairn Tunnel effective on 1 August 2013 and new tolls for Western Harbour Tunnel effective on 1 January 2013. Route 8 (Shatin to Cheung Sha Wan section) opens in March 2008.

# 7.11 Vehicular Modelling Approach and Methodology

### Study Area and Traffic Impact Assessment Scenarios

7.11.1 In order to investigate the traffic impact due to the Sandy Ridge Development, transport model should be developed for a reference case without the development and a design case with the introduction of the

development. Hence, there would be altogether four modelling scenarios as summarised in Table 7.11.

7.11.2 The first intake of Sandy Ridge C&C facilities is planned to be commence at year 2023. It is proposed to undertake the traffic impact assessment for the three assessment years: 2023(1st year), 2052 (full operation) and 2055 (3 years after full operation).

Table 7.11 Traffic Impact Assessment Scenarios

Scenario	1	2	3	- 4
Model period	Normal Weekday		Sunday/ Festival	
Sandy Ridge Development	o ton Hij	<b>/</b>		1

#### **Model Development**

7.11.3 A 2-tier transport model has been developed under Agreement No. 32/2010 (CE) Site Formation and Associated Infrastructural Works for Proposed Development of Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery - Feasibility Study. This transport model will be applied as a basis for reviewing the traffic forecast under this Study. Since there has been update in the planning assumptions, the model will be updated accordingly to reflect the change in the planning assumptions.

Base Year Model Development

- 7.11.4 It is proposed to adopt 2011 as the Base Year for transport model validation. The 2-tier model mechanism will be employed. Arup's inhouse Strategic Transport Model (STM), which is compatible with Government's CTS Model, will be applied to develop the Base Year STM for normal weekday. The base year for validation of the STM will depend on the base year of the available planning data to be collected from the Planning Department. The STM will be validated to major screenlines defined in Annual Traffic Census (ATC) published by the Transport Department.
- 7.11.5 The required trip matrices will be extracted from the STM in accordance with the AOI. The trip matrices will be fed into the Local Area Traffic Model (LATM) for more detailed analysis and assessment.
- 7.11.6 However, as the STM is calibrated based on travel characteristics for a weekday situation, it is considered inappropriate to be applied for developing the Sunday model. Suitable conversion factor between normal weekday and Sunday will be applied to weekday LATM for appropriate conversion.
- 7.11.7 The Base Year LATM for normal weekday will be validated to year 2013 using matrix estimation at the cordon points and identified key junctions. The key count locations should achieve GEH 6 or less on 70% of links, GEH 7 or less on 80% of links and GEH 10 or less on 100% of links.

7.11.8 For Base Year LATM for normal Sunday, conversion factors between weekday and Sunday can be derived using traffic profile from Annual Traffic Census (ATC) data and/or traffic survey counts. The factors are to be applied to the validated 2013 Base Year LATM for weekday for an initial conversion of a weekday LATM to a Sunday LATM. The trip matrices will be refined by means of matrix estimation process at the cordon points and the identified key junctions based on the traffic counts undertaken on Sunday. The validated LATM will form the Base Year 2013 Sunday model for Sandy Ridge.

## Design Year Model Development

- 7.11.9 The Design Year LATM will be developed for years 2021 and 2036. The model development for a normal weekday will still be based on the 2-tier modelling approach. Similar to the Base Year Sunday model, however, the 2-tier model mechanism is considered inappropriate to be applied for developing the Design Year Sunday model. In this case, the projection of Sunday traffic data to the Design Years will be carried out by applying suitable growth factors to the Base Year Sunday LATM.
- 7.11.10 The development of Design Year model under Scenarios 1-4 as outlined below:

#### Scenario 1

- Design Year STM will be developed based on the latest available TPEDM for years 2021, 2026, 2031 and 2036, and the agreed model assumptions and inputs.
- The developed Design Year STM will be cordoned to the LATM coverage to provide the required cordoned trip matrices.
- Growth factors in cordoned trip matrices between Base Year and the respective Design Year will form a vital element in predicting the future growth in traffic pattern and volume due to changes in future year population/ employment work places. The changes in traffic distribution due to the opening of new strategic highway projects and the impacts of the commencement of new railway projects will also be reflected in the STM cordoned matrices.
- The derived STM matrix growth factors for respective Design Year will be applied to the Base Year weekday LATM matrices to develop the Design Year LATM matrices.
- The Design Year model network will be updated based on the available highway and public transport assumptions accordingly. Origin-destination path checks will be undertaken within the LATM network to ensure that sensible paths are being modelled. Travel speeds and queues under congested conditions will also be checked to ensure that the network is operating correctly.
- This will form the Design Year weekday LATM without Sandy Ridge Development.

#### Scenario 2

- The weekday development traffic will be calculated based on the trip rates for the Columbarium, Funeral Parlour and Crematorium, and the proposed scale of the Sandy Ridge Development.
- Based on the Design Year LATM developed under Scenario 1, the weekday development traffic from Sandy Ridge will be incorporated to form the Design Year LATM for Scenario 2. The Design Year LATM matrices will be refined via the matrix furnishing process.
- The proposed internal roads for the Sandy Ridge Development will be incorporated into the LATM network.
- This will form the Design Year weekday LATM with Sandy Ridge Development.

#### Scenario 3

- Appropriate growth factors for respective Design Year will be derived according to the population and employment data from TPEDM. As this is a Sunday model, only the employment data for Retail, Restaurants, Community, Social and Personal Services, etc. will be considered in deriving the growth factors.
- The derived growth factors will be applied to the Base Year Sunday LATM matrices. The trip matrices will be refined through matrix furnishing.
- The Design Year model network will be updated based on the available highway and public transport assumptions accordingly.
- This will form the Design Year Sunday LATM without Sandy Ridge Development.

#### Scenario 4

- The Festival development traffic will be calculated based on the trip rates for the Columbarium, Funeral Parlour and Crematorium and the proposed scale of the Sandy Ridge Development.
- Based on the Design Year LATM developed under Scenario 3, the Festival development traffic from Sandy Ridge will be incorporated to form the Design Year LATM for Scenario 4. The Design Year LATM matrices will be refined via the matrix furnishing process.
- The proposed internal roads for the Sandy Ridge Development will be incorporated into the LATM network.
- This will form the Design Year Festival LATM with Sandy Ridge Development.
- 7.11.11 For traffic forecast for assessment construction year 2019, it will be interpolated of years 2011 to 2021. Whilst year 2022, 2023 will be

interpolated between 2021 to 2026. Lastly, assessment year 2052 and 2055 will be extrapolated after year 2036.

7.11.12 The Design Model Flow steps are illustrated in **Figure 7.1**.

### **Traffic Impact Assessment Years**

- 7.11.13 With the aids of the developed LATM, the traffic impact assessment for the following assessment years have been carried:
  - 1. Reference Case 2022 (with opening of Sha Ling Road)
  - 2. Reference Case 2023: (with the opening of Closed Area + without C&C)
  - 3. Reference Case 2052: (with the opening of Closed Area + without C&C)
  - 4. Reference Case 2055: (with the opening of Closed Area + without C&C)
  - 5. Design Case 2023: (with the opening of Closed Area + with C&C)
  - 6. Design Case 2052: (with the opening of Closed Area + with C&C)
  - 7. Design Case 2055: (with the opening of Closed Area + with C&C)

## 7.12 Validation Results of STM and LATM

#### **Base Year STM Validation**

- 7.12.1 As the Strategic Transport Model (STM) is developed based on year 2011 of TPEDM, the model has validated to year 2011 traffic conditions. To replicate this, the model was validated to the observed data obtained from 2011 Annual Traffic Census (ATC) traffic count data for Daily, AM and PM peak hour traffic in pcu/hour (by direction at the following screenlines:
  - ATC Screenlines at Harbour Crossing;
  - ATC Kowloon External Cordon (Kowloon Urban Area Boundary);
  - ATC Screenline R-R (North end of Tsuen Wan and Sha Tin);
  - ATC Screenline T-T (North end of Tai Po & Yuen Long).
- 7.12.2 Apart from ATC screenlines, two local screenlines were selected within the Study area which could further enhance the model validation by providing a powerful tool for checking the overall performance of the model. The local screenlines are located at
  - Tolo Highway Screenline; and
  - Fanling Highway Screenline.
- 7.12.3 The two-tier modelling approach is adopted in this Study to develop a 2nd tier LATM for traffic impact assessment, in which the strategic sector-to-sector traffic demand is fed from the 1st tier STM. The

validation of STM is therefore to ensure a reliable platform of cordoning the district traffic demand matrix for the development of LATM. The validation criteria of the STM would follow the similar guidelines as for LATM as shown in **Table 7.16**. The validation target is 10% for screenline and 20% for major road links.

As ATC traffic data is presented in number of vehicles, it is converted to pcu for comparison with the model result. The adopted pcu factor is shown in **Table 7.12**. Since the vehicle classification in ATC is different from the STM, they are grouped into private vehicles, goods vehicles and public transport services for easier comparison, which is the vehicle classification adopted for LATM. The vehicle classification for ATC, STM and LATM is also shown in **Table 7.12** below.

Table 7.12 Vehicle Types and PCU Factors Summary

ATC	STM	LATM	PCU Factor for ATC user class		
Motorcycle	Car		0.75		
Private Car	Car		1		
Taxi	Taxi	PV	1		
Private Light Bus	Special Purpose		1.5		
Non Franchised Bus	Bus		2		
	Light Vehicle				
Light Goods Vehicle	Light Goods Vehicle		1.4		
Medium Goods Vehicle/	Medium Goods Vehicle	GV			
Heavy Goods Vehicle	Heavy Goods Vehicle		2.25		
	Tractor Unit				
Public Light Bus	Public Light Bus		1.5		
Franchised Bus Single Deck		PT			
Franchised Bus Double Deck	Bus	1 - 1	2.5		

7.12.5 **Figure 7.2** shows the location of proposed screenlines for validation. A summary of the daily and peak hour validation results in total pcus is presented in **Table 7.13** for the selected screenlines. The results indicate that the differences of the modelled and observed ATC screenline total are all within 10%. The modelled result at local screenlines show a discrepancy of less than 15% with the observed data. The STM is therefore considered capable of replicating the existing traffic condition in daily traffic basis.

Table 7.13 Highway Screenline Total Validation Summary

			Private Vehicle + Goods Vehicle + PT in PCU											
Screenline	Bound	Daily			A	M Peak H	lour	P	M Peak H	Iour				
		Obs	Mod	Mod/Obs	Obs	Mod	Mod/Obs	Obs	Mod	Mod/Obs				
807.0		37 11	47 - 10.	ATC	Screenlin	ies	11							
Cross Harbour	N	156,556	157,296	1.00	8,187	8,022	0.98	10,241	9,887	0.97				
Tunnels	S	151,902	156,420	1.03	10,620	10,184	0.96	8,469	8,014	0.95				
Kowloon External	N	438,248	469,211	1.07	24,205	25,130	1.04	28,484	29,677	1.04				
Cordon	S	441,742	465,178	1.05	35,305	34,192	0.97	25,221	25,826	1.02				

		Private Vehicle + Goods Vehicle + PT in PCU										
Screenline	Bound		Daily			M Peak H	lour	P	M Peak H	lour		
		Obs	Mod	Mod/Obs	Obs	Mod	Mod/Obs	Obs	Mod	Mod/Obs		
D D	N	226,279	238,909	1.06	11,430	11,342	0.99	15,897	15,242	0.96		
R-R	S	211,973	233,801	1.10	18,181	17,325	0.95	11,905	12,003	1.01		
T-T	N	169,344	163,660	0.97	10,273	10,131	0.99	10,608	10,139	0.96		
1-1	S	160,981	165,681	1.03	11,181	10,747	0.96	9,716	9,763	1.00		
				Loca	l Screenli	nes	. با جابات وحداد					
Tolo	N	86,196	91,621	1.06	4,672	4,611	0.99	5,780	5,258	0.91		
Highway	S	82,869	91,539	1.10	6,699	6,281	0.94	4,709	5,008	1.06		
Fanling	N	46,077	51,793	1.12	2,748	2,983	1.09	3,043	3,129	1.03		
Highway	S	46,412	51,439	1.11	3,165	2,906	0.92	2,753	2,816	1.02		

Note: The modelled public transport vehicles are calculated from the service headway of each public transport service. Since there is discrepancy between observed public transport volume and the modelled public transport vehicles, the observed count also adopts the modelled public transport vehicles in the total volume.

The cordoned trip matrices from the developed STM will be fed into the LATM for traffic impact assessment. The matrices will be grouped into private vehicle (PV) and goods vehicle (GV) for AM and PM peaks. In order to enhance the accuracy of the cordoned matrices to LATM during the AM and PM peaks, the validation of STM has also separately reviewed the modelled flow against the observed data by PV and GV for peak hours. The result is presented in Table 7.14 - 7.15 respectively. The results indicate that the differences of the modelled and observed ATC screenline total are all within 10%. The modelled result at local screenlines show a discrepancy of less than 15% with the observed data. The STM is therefore considered capable of replicating the existing traffic condition in peak hour basis for PV and GV.

Table 7.14 Highway Screenline Validation Summary for Private Vehicles

			Private Vehicle in PCU									
Screenline	Bound		M Peak l	Hour	flan i de I	PM Peak F	Iour					
	14 ft 16	Obs	Mod	Mod/Obs	Obs	Mod	Mod/Obs					
		TRUE LA LA	ATC S	creenlines								
Cross	N	5,398	5,233	0.97	6,810	6,452	0.95					
Harbour Tunnels	S	6,296	5,860	0.93	6,237	5,735	0.92					
Kowloon	N	12,453	13,235	1.06	15,870	17,443	1.10					
External Cordon	S	19,388	18,724	0.97	14,978	15,297	1.02					
D. D.	N	5,007	5,085	1.02	7,931	7,804	0.98					
R-R	S	8,442	8,252	0.98	6,295	6,601	1.05					
	N	4,678	4,798	1.03	5,491	5,335	0.97					
T-T	S	5,107	4,834	0.95	5,081	5,210	1.03					

		Private Vehicle in PCU								
Screenline	Bound	A	M Peak I	Hour	F	M Peak I	Iour			
		Obs	Mod	Mod/Obs	Obs	Mod	Mod/Obs			
			Local S	Screenlines	Al Cont	87				
Tolo	N	2,508	2,688	1.07	3,193	2,888	0.90			
Highway	S	3,330	3,159	0.95	2,860	3,176	1.11			
Fanling Highway	N	1,392	1,571	1.13	1,385	1,475	1.06			
	S	1,408	1,306	0.93	1,615	1,752	1.08			

Note: The modelled public transport vehicles are calculated from the service headway of each public transport service. Since there is discrepancy between observed public transport volume and the modelled public transport vehicles, the observed count also adopts the modelled public transport vehicles in the total volume.

Table 7.15 Highway Screenline Validation Summary for Goods Vehicles

			Goods Vehicle in PCU									
Screenline	Bound		AM Peak I	Iour	PM Peak Hour							
	September 1	Obs	Mod	Mod/Obs	Obs	Mod	Mod/Obs					
a fair fa.	- 47 Temp	n filaru s	ATC Sc	reenlines	31 2 <sup>5</sup> 1							
Cross	N	1,555	1,555	1.00	2,134	2,138	1.00					
Harbour Tunnels	S	2,863	2,863	1.00	1,090	1,137	1.04					
Kowloon	N	8,734	8,878	1.02	9,758	9,379	0.96					
External Cordon	S	12,530	12,082	0.96	7,673	7,959	1.04					
. 17 7 7	N	4,874	4,708	0.97	6,373	5,845	0.92					
R-R	S	7,970	7,303	0.92	4,275	4,066	0.95					
e spilo en	N	4,839	4,577	0.95	4,333	4,020	0.93					
T-T	S	5,259	5,098	0.97	3,867	3,783	0.98					
te affilie	. 1, 61 1,	g di cui	Local Sc	reenlines		35	ž.					
Tolo	N	1,863	1,621	0.87	2,384	2,166	0.91					
Highway	S	3,042	2,795	0.92	1,597	1,581	0.99					
Fanling	N	1,334	1,390	1.04	1,628	1,625	1.00					
Highway	S	1,734	1,577	0.91	1,116	1,042	0.93					

Note: The modelled public transport vehicles are calculated from the service headway of each public transport service. Since there is discrepancy between observed public transport volume and the modelled public transport vehicles, the observed count also adopts the modelled public transport vehicles in the total volume.

### **Base Year LTM Validation**

7.12.7 The guidelines for validation for this study are presented in **Table 7.16** below.

Table 7.16 Validation Guidelines

	Validation Criteria	Validation Target
1.	Total Screenline Flows	100% within ± 10%
2.	Major Road Links	85% within $\pm$ 10% 100% within $\pm$ 20%
3.	Key Junctions (Entry / Exit arm)	GEH 6 or less on 70% of links GEH 7 or less on 80% of links GEH 10 or less on 100% of links

7.12.8 The GEH statistic is a modified chi-square test of the form:

$$\sqrt{\frac{(v2-v1)^2}{0.5*(v1+v2)}}$$

V1 and V2 are the observed and modelled flows on a specific link. This is used in order to reflect importance of a difference based on the total volume on a link. If percentages alone are examined then there is a risk of very large percentage differences in small flow volumes appearing important when they are not. Use of the GEH statistic is designed to remove this risk by reducing the significance of relatively large (percentage) differences between two small numbers. (For example an absolute difference of 100 pcu/hr gives a big percentage difference if the flows are of the order of 100 pcu/hr but would be unimportant for 1,000 pcu/hr). In general a GEH statistic of less than 6.0 or 7.0 is considered adequate and less than 3.0 is very good.

7.12.9 The LATM is validated to 2013 traffic conditions. The observed traffic data was collected by on-site survey count. The validation results at each cordon point are summarised in **Table 7.17** and the statistic is shown in **Table 7.18**. The results indicate that the differences at each cordon point and major road links are all within 10%.

Table 7.17 External Cordon Points Validation Summary

			Total Vehicles (PV+GV+PT) in PCU									
The second secon	Bound	AM Peak Hour			PM Peak Hour			WE Peak Hour				
Link		Obs	Mod	(D)((A)	Obs	Mod	(D)/(A)	Obs	Mod	(D)/(A)		
		(A)	(B)	(B)/(A)	(A)	(B)	(B)/(A)	(A)	(B)	(B)/(A)		
External Cordon 1 - Inbound												
Sha Tau Kok Road	Inbound	258	258	100%	378	343	91%	372	372	100%		
	Total	258	258	100%	378	343	91%	372	372	100%		
External Cordon 1 - Outbo	ound		~					2				
Sha Tau Kok Road	Outbound	568	536	94%	337	355	106%	407	444	109%		
	Total	258	258	100%	378	343	91%	407	444	109%		
External Cordon 2 - Inbou	nd .											
Fanling Highway (Southern Section)	Inbound	4,259	4,471	105%	4,802	4,785	100%	3,163	3,269	103%		
	Total	4,259	4,471	105%	4,802	4,785	100%	3,163	3,269	103%		

				Total	Vehicles	(PV+G	V+PT) in	PCU		
Link	Bound	AN	I Peak H	The state of the s	Santa A. Carlotte	I Peak H			E Peak H	lour
	Bound	Obs	Mod	(D)((A)	Obs	Mod	(D)((A)	Obs	Mod	THE THE
		(A)	(B)	(B)/(A)	(A)	(B)	(B)/(A)	(A)	(B)	(B)/(A)
External Cordon 2 - Out	bound	Jan 10			and the same			_		
Fanling Highway (Southern Section)	Outbound	5,398	5,118	95%	4,893	4,817	98%	2,391	2,345	98%
	Total	5,398	5,118	95%	4,893	4,817	98%	2,391	2,345	98%
External Cordon 3 - Inbo	ound		FILE					-,0 > 1	_,0 10	2070
Tai Wo Service Road West	Inbound	281	272	97%	320	330	103%	201	211	105%
	Total	281	272	97%	320	330	103%	201	211	105%
External Cordon 3 - Out	bound						10.7			10070
Tai Wo Service Road West	Outbound	174	169	97%	106	105	100%	126	127	101%
	Total	174	169	97%	106	105	100%	126	127	101%
External Cordon 4 - Inbo	ound					51.765	14			
Fanling Highway (Western Section)	Inbound	3,712	3,923	106%	3,869	3,975	103%	1,959	1,865	95%
	Total	3,712	3,923	106%	3,869	3,975	103%	1,959	1,865	95%
External Cordon 4 - Outl	bound					,		,	-,000	2070
Fanling Highway (Western Section)	Outbound	4,106	3,857	94%	3,863	3,858	100%	2,241	2,153	96%
	Total	4,106	3,857	94%	3,863	3,858	100%	2,241	2,153	96%
External Cordon 5 - Inbo	und			,				_,,	_,100	7070
Castle Peak Road (Kwu Tung)	Inbound	793	729	92%	535	499	93%	458	458	100%
	Total	793	729	92%	535	499	93%	458	458	100%
External Cordon 5 - Outh	ound					100	,,,,	.55	150	10070
Castle Peak Road (Kwu Tung)	Outbound	574	571	99%	664	668	101%	463	463	100%
	Total	574	571	99%	664	668	101%	463	463	100%

Table 7.18 Statistics of Cordon Points and Major Road Links Validation Summary

	Percentage of Major Road Links Flows							
Validation Target	AM Peak Total (PV + GV + PT)	PM Peak Total (PV + GV + PT)	WE Peak Total (PV + GV + PT)					
85% within ± 10%	100%	100%	100%					
100% within ± 20%	100%	100%	100%					

7.12.10 As mentioned, this TIA is focused on weekend (festive periods). Therefore, the validation of key junctions (for weekend peak) was undertaken for entry/exit flows on each arm separately. **Table 7.19** summarised the results of validation for weekend peak. The statistic of these key junctions validation summary is presented in **Table 7.20**.

Table 7.19 Key Junction Validation Summary for Weekend Peak

	Total Vehicl	es (PV+GV+P7	) in PCU
Junction	Wee	kend Peak Hou	ır
	Observed	Modelled	GEH
Junction 1 - Man Kam To Road/ Sha	Ling Road		
ENTRY ARM			
Sha Ling Road S/B	10		
Man Kam To Road W/B	455	449	
Man Kam To Road E/B	426	430	
Sub-Total	890	879	
EXIT ARM		3.4	1
Sha Ling Road N/B	426	430	
Man Kam To Road E/B	455	449	
Man Kam To Road W/B	10		
Sub-Total	890	879	1
Junction 2 - Man Kam To Road/ Lo	Wu Station R	oad	
ENTRY ARM			
Man Kam To Road S/B	462	457	
Man Kam To Road N/B	483	482	III
Lo Wu Station Road E/B	43	42	
Sub-Total	988	980	L
EXIT ARM			
Man Kam To Road N/B	438	437	
Man Kam To Road S/B	489	483	
Lo Wu Station Road W/B	61	61	1 [
Sub-Total	988	980	
Junction 4 - Jockey Club Road/ Po	Shek Wu Road		
ENTRY ARM	in many order		-
Jockey Club Road S/B	482	480	
Jockey Club Road W/B	472	517	
Po Shek Wu Road E/B	370	351	
Sub-Total	1,323	1,348	
EXIT ARM		a, the problem	2-17
Jockey Club Road N/B	492	554	
Jockey Club Road E/B	385	353	
Po Shek Wu Road W/B	446	441	2
Sub-Total	1,323	1,348	
Junction 5 - Po Wan Road/ Po Shek	Wu Road		_
ENTRY ARM		-	
Po Shek Wu Road S/B	445	441	
Po Wan Road W/B	357	320	
Po Shek Wu Road N/B	757	744	
Po Wan Road E/B	146	117	
Sub-Total	1,705	1,622	

	Total Vehic	les (PV+GV+P7	(in PCU
Junction	Wee	kend Peak Hou	ır
	Observed	Modelled	GEH
EXIT ARM	ومطور انتظاره	1.1346.	
Po Shek Wu Road N/B	371	351	1
Po Wan Road E/B	419	365	3
Po Wan Road S/B	798	808	0
Po Wan Road W/B	118	97	2
Sub-Total	1,705	1,622	2
Junction 6 - Choi Yuen Road/ Po Sh		114 51	_
ENTRY ARM	872	of green dig. T	
Po Shek Wu Road S/B	799	808	0
Choi Yuen Road W/B	370	368	0
Po Shek Wu Road N/B	1,050	1,025	1
Choi Yuen Road E/B	56	41	2
Sub-Total	2,274	2,242	1
EXIT ARM	,	-,	
Po Shek Wu Road N/B	754	737	1
Choi Yuen Road E/B	432	415	1
Po Shek Wu Road S/B	1,015	1,026	0
Choi Yuen Road W/B	74	64	1
Sub-Total	2,274	2,242	1
Junction 7 - Po Shek Wu Interchang		2,2 12	1
ENTRY ARM		The second second	
Po Shek Wu Road S/B	1,017	1,026	0
Fanling Highway Slip Road W/B	686	606	- 3
Fan Kam Road N/B	758	781	1
Fanling Highway Slip Road E/B	551	545	0
Sub-Total	3,011	2,958	1
EXIT ARM	2,011	2,550	1
Po Shek Wu Road N/B	1,006	1,025	1
Fanling Highway Slip Road E/B	667	705	1
Fan Kam Road S/B	885	814	2
Fanling Highway Slip Road W/B	454	414	2
Sub-Total	3,011	2,958	1
Junction 8 - San Wan Road/ Sha Tau		2,730	1
ENTRY ARM	A A A A A A A A A A A A A A A A A A A	AND A GLI APRIL	
Sha Tau Kok Road S/B	598	611	1
San Wan Road W/B	249	248	0
Fanling Station Road N/B	397	374	1
San Wan Road E/B	280	273	0
Sub-Total	1,522	1,506	0
EXIT ARM	1,000	1,500	-
Fanling Station Road N/B	601	585	1
San Wan Road E/B	656	647	0
San Wan Road W/B	266	274	0
Sub-Total	1,522	1,506	0

	Total Vehicles (PV+GV+PT) in PCU		
Junction	Weekend Peak Hour		
(1) 1 (1) (1) (1) (1) (1) (1) (1) (1) (1	Observed	Modelled	GEH
Junction 9 - Fanling Station Road/S	an Wan Road	in Atributa	-
ENTRY ARM		Laborator,	6
Fanling Station Road S/B	137	95	•
San Wan Road W/B	502	497	
San Wan Road E/B	656	647	1
Sub-Total	1,295	1,239	
EXIT ARM	<u> </u>	- 47.4	
Fanling Station Road N/B	158	160	1
San Wan Road E/B	309	265	
Fanling Station Road S/B	581	567	
San Wan Road W/B	248	248	-1
Sub-Total	1,295	1,239	
Junction 12 - Ma Sik Road/ Jockey (	Club Road		
ENTRY ARM			
Ma Sik Road S/B	253	255	
Jockey Club Road W/B	360	319	-
So Kwun Po Road N/B	325	331	1
Jockey Club Road E/B	482	471	1 2
Sub-Total	1,419	1,377	
EXIT ARM	Contract to Market	Land Clarence	
Ma Sik Road N/B	433	356	_
Jockey Club Road E/B	398	464	
So Kwun Po Road S/B	166	148	
Jockey Club Road W/B	423	408	
Sub-Total	1,419	1,377	
Junction 13 - Sha Tau Kok Road/ Jo	ckey Club Roa	ad Interchange	
ENTRY ARM		19925511	
Sha Tau Kok Road S/B	584	661	
Jockey Club Road W/B	436	407	
Sha Tau Kok Road N/B	604	585	
Jockey Club Road E/B	414	449	
Sub-Total	2,036	2,102	
EXIT ARM	part and the same		1
Sha Tau Kok Road N/B	885	916	
Jockey Club Road E/B	243	263	
Sha Tau Kok Road S/B	598	611	<u> </u>
Jockey Club Road W/B	312	312	i i
Sub-Total	2,036	2,102	
Junction 14 - San Wan Road/ Jockey	Club Road/ l	Lok Yip Road	
ENTRY ARM		milene i sette	
Lok Yip Road S/B	694	681	-
Jockey Club Road W/B	1,113	1,135	
San Wan Road N/B	259	230	
Jockey Club Road E/B	244	263	
Sub-Total	2,309	2,309	

ed to boothiff dissert on the Light	Total Vehicles (PV+GV+PT) in Po		
Junction	Weekend Peak Hour		
Legistrative out out here is the legis	Observed	Modelled	GEH
EXIT ARM	THE PERSON	DECEMBER 1985	
Lok Yip Road N/B	454	469	1
Jockey Club Road E/B	1,002	1,057	2
San Wan Road S/B	417	376	2
Jockey Club Road W/B	437	407	1
Sub-Total	2,309	2,309	0
Junction 15a - San Wan Road/ So K	wun Po Road (		
ENTRY ARM		7	
So Kwun Po Slip Road S/B	601	590	0
San Wan Road W/B	253	230	1
San Wan Road E/B	684	684	0
Sub-Total	1,538	1,505	1
EXIT ARM	paistings (	1.00 1.00	
San Wan Road E/B	912	902	0
San Wan Road W/B	626	603	1
Sub-Total	1,538	1,505	, 1
Junction 15b - San Wan Road/ So K			
ENTRY ARM	n will be in	r allif an Lie	
San Wan Road W/B	368	352	1
San Wan Road E/B	911	902	0
Sub-Total	1,279	1,254	- 1
EXIT ARM	String Harris	anda a New	
So Kwun Po Slip Road N/B	751	763	0
San Wan Road E/B	275	261	1
San Wan Road W/B	253	230	1
Sub-Total	1,279	1,254	1
Junction 16 - Fanling Highway/ So K	wun Po Road		
ENTRY ARM			
So Kwun Po Road S/B	799	795	0
Fanling Highway Slip Road W/B	190	197	1
So Kwun Po Road N/B	519	519	0
Fanling Highway Slip Road E/B	551	595	2
Sub-Total	2,059	2,107	1
EXIT ARM			
So Kwun Po Road N/B	812	805	0
Fanling Highway Slip Road E/B	327	321	0
So Kwun Po Road S/B	420	486	3
Fanling Highway Slip Road W/B	501	495	0
Sub-Total	2,059	2,107	1

Table 7.20 Key Junction Validation Summary

	Percentage	of Key Junction Ent	ry/Exit Flows
Validation Target	AM Peak Total (PV + GV + PT)	PM Peak Total (PV + GV + PT)	WE Peak Total (PV + GV + PT)
70% Witan GEH 6	93%	100%	100%
80% Witan GEH 7	100%	100%	-100%
100% Witan GEH 10	100%	100%	100%

7.12.11 The results show that key junctions are well validated as the validation criteria for GEH 6, 7 and 10 are all met both weekday peaks and weekend peak period. As demonstrated in the screenline, major road link and junction validation summaries, the LATM was developed satisfactorily in replicating the existing traffic flow pattern and show high degree of agreement between the modelled flows and observed traffic data.

# 7.13 Estimation of Grave Sweepers flows (for normal days)

7.13.1 Estimation of traffic/ grave sweepers flow to/from Sandy Ridge Cemetery during weekday has been carried out (for Columbarium and Crematorium), although in this TIA study, the focus will be the traffic/grave sweepers flows during festive periods for anticipated peak flows during Ching Ming / Chung Yeung festivals.

### Columbarium

7.13.2 For grave sweepers during normal days, the trip rate at the peak hour was calculated as 0.05 pcu/hr/1,000 niches. In the full operation year of having 200,000 niches, the peak hour 1-way traffic will be 10 pcu/hr. Thus, assuming peak hour factor of 8% which is a normal practice in traffic engineering, the total daily traffic flows (pcu) at Columbarium will be 250 pcu (2-way) and total daily grave sweepers flows (2-way) will be about 50 ppl, which is considered minimal.

#### Crematorium

- 7.13.3 During normal days, the visitor demand to the funeral parlour and crematorium, it is likely to be designed as a one-stop service for both the funeral and cremation events. It is therefore proposed to make the following assumptions:
  - No. of cremator: 10
  - No. of cremation sessions per standard cremator per day: 6
  - No. of cremation sessions per large cremator per day: 4
  - Total No. of cremation sessions: 56 (30 sessions associated with funeral event at the funeral parlour)
  - No. of service halls of funeral parlour: 30
  - No. of attendees in each funeral & cremation event: 80
  - No. of attendees in each of the remaining cremation session: 30
  - No. of supporting staff and workers: 138 (17 staff for crematorium + 5 management staff + 30 MC + 22 funeral workers + 22 general workers for the funeral parlour with 30 service halls + 42 staff working in the visitor service centre's restaurant, grocery shop, etc.)

- 7.13.4 The daily visitor demand for all funeral & cremation events will be 30  $\times$  80 + (56-30)  $\times$  30 = 3,180 ppl.
- 7.13.5 Regarding the working staff, it is assumed about 96 people is required for the daily management and maintenance of the funeral parlour & crematorium facility as well as the funeral/ cremation affairs.
- 7.13.6 Hence, a total of 3,318 daily person trips of Crematorium are expected.
- 7.13.7 According to FS Study, similar calculation has been conducted and total daily vehicles (in pcu) at Crematorium 2-way are: 780 pcu.
- 7.13.8 The total daily vehicle traffic for Columbarium and Crematorium (2-way) is 250+780 = 1,030 pcu.
- 7.13.9 The link assessment of Man Kam To Road and Lin Ma Hang Road for normal weekday in Year 2055 were conducted and tabulated at below table:

Link	Year 2055 weekday  AM peak  reference case	Year 2055 weekday AM peak design case
Man Kam To Road NB	0.54	0.55
Man Kam To Road SB	1.03	1.07
Lin Ma Hang Road EB	0.48	0.48
Lin Ma Hang Road WB	0.45	0.46

- 7.13.10 Without any road widening nor addition of traffic lane, Man Kam To Road will be operating over-capacity at year 2055 at the reference case. In view of the heavy background traffic flow at year 2055 reference case, this project will impose insignificant impact to the over-loaded road link.
- 7.14 Junction Capacity Assessment (for festive periods)
- 7.14.1 As mentioned, the critical peak is considered in festive periods. Therefore the TIA report will be focused on such periods. Junction assessment was undertaken based on the methodology presented in the TPDM.
- 7.14.2 By adopting the previous-mentioned Base Case scenario, and also considering that the operation of the proposed development would occur by phase, the year 2022 (when the Sha Ling Road opens), 2023 (day 1 operation of C&C) and 2052 (full operation with target 200,000 niches) as well as 2055 (in which three years after full operation) are adopted as the design years.
- 7.14.3 The results for the 2022, 2023, 2052, and 2055 reference and design cases are shown in later sections.
- 7.14.4 The assessment scenarios are summarised as below:
  - 2022 Festive Periods Reference Case (with the opening of Sha Ling Road)

- 2023 Festive Periods Reference Case (with the opening of Closed Area + without C&C)
- 2052 Festive Periods Reference Case (with the opening of Closed Area + without C&C)
- 2055 Festive Periods Reference Case (with the opening of Closed Area + without C&C)
- 2023 Festive Periods Design Case (with the opening of Closed Area + with C&C)
- 2052 Festive Periods Design Case (with the opening of Closed Area + with C&C)
- 2055 Festive Periods Design Case (with the opening of Closed Area + with C&C)

## 7.15 2022 Reference Case Assessment

- 7.15.1 Junction assessment was undertaken based on the methodology presented in the Transport Planning and Design Manual (TPDM).
- 7.15.2 The Sha Lang Road will be opened in Year 2022, the result for the 2022 Reference cases are shown in **Table 7.21a**; and the link flows performance are in **Table 7.21b** and **Table 7.21c**. The corresponding traffic flow are for 2022 Reference Case are shown in **Figures 7.3**. It is important to note that the peak operation period the proposed C&C facility will be during festive period. Therefore, the assessments will mainly focus on the festive periods (weekend).

Table 7.21a Junction Capacity to be assessed for Year 2022

	Junction (1)	Junction Type	Year 2022 Reference
J1	Man Kam To Road/ Sha Ling Road	Priority	0.01
J2	Man Kam To Road/ Lo Wu Station Road	Priority	0.07
J3	Man Kam To Road/Proposed New Road	Priority	N/A
J4	Jockey Club Road/ Po Shek Wu Road	Roundabout	0.18
J5	Po Wan Road/ Po Shek Wu Road	Signal	>50%
J6	Choi Yuen Road/ Po Shek Wu Road	Signal	>50%
J7	Po Shek Wu Interchange	Roundabout	0.42
J8	San Wan Road/ Sha Tau Kok Road	Roundabout	0.23
J9	San Wan Road/ Fanling Station Road	Signal	>50%
J10	Au Tau Interchange	Roundabout	0.53
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho road	Roundabout	0.21
J12	Po Wan Road/San Fung Avenue	Signal	>50%
J13	Po Wan Road/Jockey Club Road	Signal	>50%
J14	Man Kam To Road/Fu Tei Au Road	Signal	>50%
J15	Man Kam To Road/Kong Nga Po Road	Priority	0.24
J16	Man Kam To Road/Lin Ma Hang Road	Priority	0.18

Table 7.21b Road Link Flow Performance at Year 2022

814	Name of Road Link	Year 2022 Reference
L1	Lin Ma Hang Road (NB/SB)	0.13/0.10
L2	Man Kam To Road (NB/SB)	0.31/0.27
L3	Jockey Club Road (NB/SB)	0.17/0.13
L4	Po Shek Wu Road (NB/SB)	0.13/0.20

Table 7.21c Road Link Flow Performance for Liantang/Heung Yuen Wai Connection Road at Year 2022

Name of Road Link	Year 2022 Reference
Liantang/Heung Yuen Wai Connection Road (NB/SB)	0.18/0.13

# 7.16 2023 Design Case Assessment

7.16.1 The proposed C&C will have the first intake in Year 2023. The associated junction capacity and link flows are listed in **Table 7.21d** below. The traffic flows of 2023 is in **Figures 7.4** and **Figures 7.5**. **Tables 7.21d** and **7.21f** also reveal the link flow performances on two specific links (L1 and L2 by referring to **Figure 2.1**) and also on Liantang/Heung Yuen Wai Connection Road.

Table 7.21d Junction Capacity to be assessed for Year 2023

	Junction (1)	Junction Type	Year 2023 Reference	Year 2023 Design
J1	Man Kam To Road/ Sha Ling Road	Priority	0.01	0.20
J2	Man Kam To Road/ Lo Wu Station Road	Priority	0.08	0.09
J3	Man Kam To Road/Proposed New Road	Priority	N/A	0.09
J4	Jockey Club Road/ Po Shek Wu Road	Roundabout	0.17	0.19
J5	Po Wan Road/ Po Shek Wu Road	Signal	>50%	>50%
J6	Choi Yuen Road/ Po Shek Wu Road	Signal	>50%	>50%
J7	Po Shek Wu Interchange	Roundabout	0.37	0.41
Ј8	San Wan Road/ Sha Tau Kok Road	Roundabout	0.13	0.22
J9	San Wan Road/ Fanling Station Road	Signal	>50%	>50%
J10	Au Tau Interchange	Roundabout	0.53	0.54
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho Road	Roundabout	0.21	0.21
J12	Po Wan Road/San Fung Avenue	Signal	>50%	>50%
J13	Po Wan Road/Jockey Club Road	Signal	>50%	>50%
J14	Man Kam To Road/Fu Tei Au Road	Signal	>50%	>50%
J15	Man Kam To Road/Kong Nga Po Road	Priority	0.23	0.23
J16	Man Kam To Road/Lin Ma Hang Road	Priority	0.18	0.30

#### Notes

- 1. Figures shown represent "Reserve Capacity" (RC) for the signal controlled junctions and "Design Flow to Capacity" (DFC) ratio for the roundabout.
- 2. Changes compare to the latest version of TIA:
  - J3: change in Junction design layout in term of share lane and sight-line
  - J9: Change of pedestrian walking speed from 0.9m/s to 1.2m/s according to TPDM
  - J10: Assessment was reviewed in term of the traffic flow on dedicated traffic lane.
  - J12: Assessment was reviewed in term of the lane sharing.
  - J14: Assessment was reviewed in term of the turning pocket and opposing traffic The changes were adopted in all assessment scenarios

Table 7.21e Road Link Flow Performance at Year 2023

110	Name of Road Link	Year 2023 Reference	Year 2023 Design
L1	Lin Ma Hang Road (NB/SB)	0.13/0.07	0.19/0.18
L2	Man Kam To Road (NB/SB)	0.31/0.27	0.35/0.32
L3	Jockey Club Road (NB/SB)	0.17/0.13	0.19/0.16
L4	Po Shek Wu Road (NB/SB)	0.13/0.20	0.11/0.20

Table 7.21f Road Link Flow Performance for Liantang/Heung Yuen
Wai Connection Road at Year 2023

Name of Road Link	Year 2023 Reference	Year 2023 Design
Liantang/Heung Yuen Wai Connection Road (NB/SB)	0.18/0.13	0.21/0.16

7.16.2 In conclusion, all the results revealed that junction capacity of all concerned junctions, and all the link flow performances at Year 2023 are considered acceptable in terms of traffic engineering.

## 7.17 2052 Design Case Assessment

7.17.1 Since the total timespan of the whole allocation program will be last for 29 years, therefore Year 2052 is considered crucial as well. Such junction assessment for festive periods for the 2052 Reference case and Design cases are shown in **Table 7.22a** below and the corresponding traffic flow are for 2052 Reference and Design Cases are shown in **Figures 7.6** and **7.7** respectively. **Tables 7.22b** and **7.22c** reveal the link flow performances on two specific links (L1 and L2 refer to **Figure 2.1**) and Liantang/Heung Yuen Wai Connection Road.

Table 7.22a Junction Capacity to be assessed for Year 2052

	Junction (1)	Junction Type	Year 2052 Reference	Year 2052 Design
J1	Man Kam To Road/ Sha Ling Road	Priority	0.01	0.52
J2	Man Kam To Road/ Lo Wu Station Road	Priority	0.16	0.28
J3	Man Kam To Road/Proposed New Road	Priority	N/A	0.49
J4	Jockey Club Road/ Po Shek Wu Road	Roundabout	0.27	0.34
J5	Po Wan Road/ Po Shek Wu Road	Signal	>50%	>50%
J6	Choi Yuen Road/ Po Shek Wu Road	Signal	>50%	>50%
J7	Po Shek Wu Interchange	Roundabout	0.48	0.48
J8	San Wan Road/ Sha Tau Kok Road	Roundabout	0.26	0.30
J9	San Wan Road/ Fanling Station Road	Signal	>50%	>50%
J10	Au Tau Interchange	Roundabout	0.41	0.51
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho Road	Roundabout	0.43	0.47
J12	Po Wan Road/San Fung Avenue	Signal	>50%	>50%
J13	Po Wan Road/Jockey Club Road	Signal	>50%	>50%
J14	Man Kam To Road/Fu Tei Au Road (2)	Signal	>50%	>50%
J15	Man Kam To Road/Kong Nga Po Road	Priority	0.26	0.17
J16	Man Kam To Road/Lin Ma Hang Road	Priority	0.28	0.68

#### Notes:

- 1. Figures shown represent "Reserve Capacity" (RC) for the signal controlled junctions and "Design Flow to Capacity" (DFC) ratio for the roundabout.
- 2. J14 Man Kam To Road/Fu Tei Au Road will be operating under amended cycle time in the design case.

Table 7.22b Road Link Flow Performance at Year 2052

	Name of Road Link	Year 2052 Reference	Year 2052 Design
L1	Lin Ma Hang Road (NB/SB)	0.18/0.15	0.38/0.38
L2	Man Kam To Road (NB/SB)	0.39/0.31	0.82/0.83
L3	Jockey Club Road (NB/SB)	0.16/0.15	0.18/0.18
L4	Po Shek Wu Road (NB/SB)	0.22/0.33	0.28/0.39

Table 7.22c Road Link Flow Performance for Liantang/Heung Yuen Wai Connection Road at Year 2052

Name of Road Link	Year 2052 Reference	Year 2052 Design	
Liantang/Heung Yuen Wai Connection Road (NB/SB)	0.23/0.17	0.31/0.28	

7.17.2 In conclusion, from Table 7.22a to 7.22c, all the results revealed that junction capacity of all concerned junctions, provided that J14 will be needed to have cycle time amended in Design case; all the link flow performances at Year 2052 are considered acceptable in terms of traffic engineering.

## 7.18 2055 Design Case Assessment

7.18.1 Three years after the completion of allocation (Year 2055) is considered as necessary to perform in TIA according to TD standards. Such junction assessment for festive periods for the 2055 Reference cases and Design cases are shown in **Table 7.23a** below and the corresponding traffic flow are for 2055 Reference and Design Cases are shown in **Figure 7.8** and **7.9** respectively. **Table 7.23b** and **7.23c** reveal the link flow performances on two specific links and Liantang/Heung Yuen Wai Connection Road.

Table 7.23a Junction Capacity to be assessed for Year 2055

	Junction (1)	Junction Type	Year 2055 Reference	Year 2055 Design
J1	Man Kam To Road/ Sha Ling Road	Priority	0.01	0.52
J2	Man Kam To Road/ Lo Wu Station Road	Priority	0.16	0.28
J3	Man Kam To Road/Proposed New Road	Priority	N/A	0.49
J4	Jockey Club Road/ Po Shek Wu Road	Roundabout	0.27	0.34
J5	Po Wan Road/ Po Shek Wu Road	Signal	>50%	>50%
J6	Choi Yuen Road/ Po Shek Wu Road	Signal	>50%	>50%
J7	Po Shek Wu Interchange	Roundabout	0.48	0.48
J8	San Wan Road/ Sha Tau Kok Road	Roundabout	0.26	0.30
Ј9	San Wan Road/ Fanling Station Road	Signal	>50%	>50%
J10	Au Tau Interchange	Roundabout	0.41	0.51
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho Road	Roundabout	0.44	0.48
J12	Po Wan Road/San Fung Avenue	Signal	>50%	>50%
J13	Po Wan Road/Jockey Club Road	Signal	>50%	>50%
J14	Man Kam To Road/Fu Tei Au Road (2)	Signal	>50%	>50%
J15	Man Kam To Road/Kong Nga Po Road	Priority	0.26	0.17
J16	Man Kam To Road/Lin Ma Hang Road	Priority	0.29	0.68

#### Notes:

- 1. Figures shown represent "Reserve Capacity" (RC) for the signal controlled junctions and "Design Flow to Capacity" (DFC) ratio for the roundabout.
- J14 Man Kam To Road/Fu Tei Au Road will be operating under amended cycle time in the design case.

Table 7.23b Road Link Flow Performance at Year 2055

Name of Road Link		Year 2055 Reference	Year 2055 Design
L1	Lin Ma Hang Road (NB/SB)	0.18/0.15	0.38/0.38
L2	Man Kam To Road (NB/SB)	0.39/0.31	0.83/0.83
L3	Jockey Club Road (NB/SB)	0.16/0.15	0.18/0.18
L4	Po Shek Wu Road (NB/SB)	0.22/0.33	0.28/0.39

Table 7.23c Road Link Flow Performance for Liantang/Heung Yuen
Wai Connection Road at Year 2055

Name of Road Link	Year 2055 Reference	Year 2055 Design
Liantang/Heung Yuen Wai Connection Road (NB/SB)	0.23/0.17	0.31/0.28

- In conclusion, from Table 7.23a to 7.23c, all the results revealed that junction capacity of all concerned junctions, provided that J14 will be needed to have cycle time amended in Design case, and at J16 the junction will need to be manually controlled by HKPF; all the link flow performances at Year 2055 are considered acceptable in terms of traffic engineering. To alleviate the traffic condition at J16, it is proposed to manually control the operation of the junction by HKPF. With the manual control of the junction, the performance of J16 is assessed in form of signalised junction. The result shows that the junction could be operated within capacity by allocating appropriate green time for each arm under manual control. It is recommended that around 90s for Man Kam To Road Eastbound with around 75s for Lin Ma Hang Road left turn for 1st phase, then provide around 25s for Man Kam To Road Westbound, to obtain the optimal result.
- 7.18.3 The difference between each reference flows and design flows for each year is shown in **Figures 7.12 to Figure 7.14**.

Final Traffic Impact Assessment Report

# 8 Sensitivity Cases

# 8.1 Possible Pick-up/Drop-off near MTR Mei Foo Station

- 8.1.1 Mei Foo is also another location which could be viewed as urban transport hub; however, the residents from its neighbourhood districts like Kwai Chung, Tsuen Wan, Lai Chi Kok will mostly fall within the catchment from the Western side (MTR Nam Cheong Station, MTR Mei Foo Station, and MTR Tsuen Wan West Station) and so it shares the split of the catchment of Western side without helping to increase the percentage split from the Eastern side.
- 8.1.2 On the other hand, preliminary site search around MTR Mei Foo Station has revealed that it is not likely to identify a suitable pick-up/ drop-off point in the vicinity of the station (see photos below).



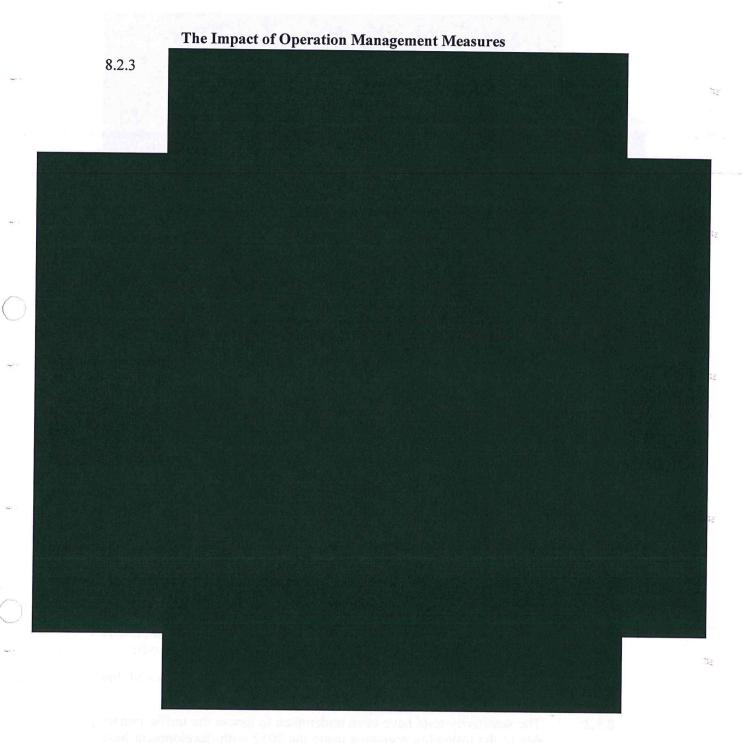
8.1.3 As such, MTR Mei Foo Station is not recommended as a transport hub.

# 8.2 - Suppressing Trip Rate by Operation Management Measures

8.2.1 In view of the limited provision of transport facilities and further increasing the handling capacity is not possible, operation management measures are recommended to minimize the peak visitor demand.



The details of such Operation Management Measures had been submitted as Working Paper, which is attached as **Appendix D** in this report for reference.





# 8.3 Sensitivity Tests on Background Traffic, Trip Rate and Niches Numbers

- 8.3.1 The sensitivity tests have been undertaken to assess the traffic impact due to the following scenarios using the 2055 with development base case scenario:
  - Sensitivity Test 1 (ST1) background traffic on the road network within the study area is under-estimated by 20%.
  - Sensitivity Test 2 (ST2) vehicle generation and attraction rate is under-estimated by 20% for the Ching Ming Festive Periods;
  - Sensitivity Test 3 (ST3) proposed number of niches at the proposed site is increased by 20%, and;
- 8.3.2 The sensitivity tests have been undertaken to assess the traffic impact due to the following scenarios using the 2052 with development base case scenario:

### Under-estimation of Background Traffic by 20%

- 8.3.3 Sensitivity Test 1 (ST1) background traffic on the road network within the study area is under-estimated by 20%.
- Junction assessment for festive periods for the 2052 Reference case and Design cases are shown in **Table 8.3** and **8.4** below.

Table 8.3 Junction Capacity to be Assessed for Year 2055 – Sensitivity Test 1

	Junction	Junction Type	Year 2055 Reference (ST1)	Year 2055 Design (ST1)
J1	Man Kam To Road/ Sha Ling Road	Priority	0.01	0.54
J2	Man Kam To Road/ Lo Wu Station Road	Priority	0.22	0.41
J3	Man Kam To Road/Proposed New Road	Priority	N/A	0.49
J4	Jockey Club Road/ Po Shek Wu Road	Roundabout	0.34	0.40
J5	Po Wan Road/ Po Shek Wu Road	Signal	>50%	31%
J6	Choi Yuen Road/ Po Shek Wu Road	Signal	>50%	>50%
J7	Po Shek Wu Interchange	Roundabout	0.63	0.63
Ј8	San Wan Road/ Sha Tau Kok Road	Roundabout	0.33	0.37
Ј9	San Wan Road/ Fanling Station Road	Signal	>50%	42%
J10	Au Tau Interchange	Roundabout	0.51	- 0.61
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho road	Roundabout	0.58	0.63
J12	Po Wan Road/San Fung Avenue	Signal	>50%	>50%
J13	Po Wan Road/Jockey Club Road	Signal	>50%	>50%
J14	Man Kam To Road/Fu Tei Au Road (1)	Signal	49%	30%
J15	Man Kam To Road/Kong Nga Po Road	Priority	0.34	0.22
J16	Man Kam To Road/Lin Ma Hang Road	Priority	0.37	(44% after manually controlled by HKPF)

#### Note:

Table 8.4 Road Link Flow Performance at Year 2055 – Sensitivity test 1

Name of Road Link		Year 2055 reference	Year 2055 Design
L1	Lin Ma Hang Road (NB/SB)	0.31/0.18	0.22/0.57
L2	Man Kam To Road (NB/SB)	0.49/0.39	0.93/0.93
L3	Jockey Club Road (NB/SB)	0.20/0.19	0.22/0.22
L4	Po Shek Wu Road (NB/SB)	0.27/0.41	0.32/0.46

8.3.5 Sensitivity Test 1 was carried out to assess the traffic impact due to the background traffic at the road network within the study area being under-estimated by 20%. With the increase in background traffic, the junction J16 would be operating in excess of its capacity in design year

<sup>1.</sup> J14 - Man Kam To Road/Fu Tei Au Road will be operating under amended cycle time in the design case.

2052. To alleviate the traffic condition at J16, it is proposed to manually control the operation of the junction by HKPF. With the manually controlled of the junction operation, the junction performance of J16 is assessed in form of signalised junction. The result shows that the junction could be operated within capacity by allocating appropriate green time for each arm under manually controlled. It is recommended that around 90s for Man Kam To Road Eastbound with around 75s for Lin Ma Hang Road left turn for 1st phase, then provide around 25s for Man Kam To Road Westbound, to obtain the optimal result.

### Under-estimation of Trip Rates by 20%

- 8.3.6 Sensitivity Test 2 (ST2) vehicle generation and attraction rate is underestimated by 20% for the Ching Ming Festive Periods;
- Junction assessment for festive periods for the 2052 Reference case and Design cases are shown in **Table 8.5a** and **8.5b**.

Table 8.5a Junction Capacity to be Assessed for Year 2055 – Sensitivity Test 2

Junction		Junction Type	Year 2055 Reference (ST2)	Year 2055 Design (ST2)
J1	Man Kam To Road/ Sha Ling Road	Priority	0.01	(10% after manually controlled by HKPF)
J2	Man Kam To Road/ Lo Wu Station Road	Priority	0.16	0.63
J3	Man Kam To Road/Proposed New Road	Priority	N/A	0.16
J4	Jockey Club Road/ Po Shek Wu Road	Roundabout	0.27	0.42
J5	Po Wan Road/ Po Shek Wu Road	Signal	>50%	27%
J6	Choi Yuen Road/ Po Shek Wu Road	Signal	>50%	>50%
J7	Po Shek Wu Interchange	Roundabout	0.48	0.67
J8	San Wan Road/ Sha Tau Kok Road	Roundabout	0.26	0.49
Ј9	San Wan Road/ Fanling Station Road	Signal	>50%	18%
J10	Au Tau Interchange	Roundabout	0.41	0.63
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho Road	Roundabout	0.44	0.64
J12	Po Wan Road/San Fung Avenue (1)	Signal	>50%	25%
J13	Po Wan Road/Jockey Club Road	Signal	>50%	>50%
J14	Man Kam To Road/Fu Tei Au Road (1)	Signal	>50%	23%
J15	Man Kam To Road/Kong Nga Po Road	Priority	0.26	0.23
J16	Man Kam To Road/Lin Ma Hang Road	Priority	0.29	(49% after manually controlled by HKPF)

#### Notes:

<sup>1.</sup> J12 - Po Wan Road/San Fung Avenue and J14 - Man Kam To Road/Fu Tei Au Road will be operating under amended cycle time in the design case.

Table 8.5b Road Link Flow Performance at Year 2055 – Sensitivity Test 2

Name of Road Link		Year 2055 reference	Year 2055 Design
L1	Lin Ma Hang Road (NB/SB)	0.26/0.15	0.18/ 0.57
L2	Man Kam To Road (NB/SB)	0.39/0.31	0.99/1.00
L3	Jockey Club Road (NB/SB)	0.16/0.15	0.21/0.21
L4	Po Shek Wu Road (NB/SB)	0.22/0.33	0.36/0.51

8.3.8 In Sensitivity Test 2, junctions are anticipated to exceed or reach its capacity when vehicle generation and attraction rate is under-estimated by 20% for the Ching Ming Festive Periods. Therefore, in addition to proposed improvement measure, temporary traffic management measures such as restricting traffic other than special bus from using the routing should be developed to alleviate the traffic congestion at the junctions during the Festive Periods. Additional bus stacking spaces should be identified at PDA to transport the additional grave sweepers to the development. To alleviate the traffic condition at J1 and J16, it is proposed to manually control the operation of the junction by HKPF. With the manual control of the junction operation, the junction performance of J1 and J16 are assessed in form of signalised junction. The result shows that the junction could be operated within its capacity by allocating appropriate green time for each arm under manual control. It is recommended that around 95s for Man Kam To Road Eastbound with around 80s for Lin Ma Hang Road left turn for 1st phase, then provide around 20s for Man Kam To Road Westbound, to obtain the optimal result.

## Under-estimation of Number of Niches.by 20%

- 8.3.9 In case there is any under-estimation of number of niches, the only effect would be the extent of the niche implementation programme. In view of the unchanged handling capacity of the transport facilities, the associated traffic at year 2055 would be equal to those from base case.
- Junction assessment for festive periods for the 2055 Reference case and Design cases are shown in **Table 8.6a** and **8.6b** below.

Table 8.6a Junction Capacity to be Assessed for Year 2055 – Sensitivity Test 3

	Junction	Junction Type	Year 2055 Reference	Year 2055 Design
J1	Man Kam To Road/ Sha Ling Road	Priority	0.01	0.52
J2	Man Kam To Road/ Lo Wu Station Road	Priority	0.16	0.28
J3	Man Kam To Road/Proposed New Road	Priority	N/A	0.49
J4	Jockey Club Road/ Po Shek Wu Road	Roundabout	0.27	0.34
J5	Po Wan Road/ Po Shek Wu Road	Signal	>50%	>50%

Junction		Junction Type	Year 2055 Reference	Year 2055 Design
J6	Choi Yuen Road/ Po Shek Wu Road	Signal	>50%	>50%
J7	Po Shek Wu Interchange	Roundabout	0.48	0.48
J8	San Wan Road/ Sha Tau Kok Road	Roundabout	0.26	0.30
J9	San Wan Road/ Fanling Station Road	Signal	>50%	>50%
J10	Au Tau Interchange	Roundabout	0.41	0.51
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho Road	Roundabout	0.44	0.48
J12	Po Wan Road/San Fung Avenue	Signal	>50%	>50%
J13	Po Wan Road/Jockey Club Road	Signal	>50%	>50%
J14	Man Kam To Road/Fu Tei Au Road (1)	Signal	>50%	>50%
J15	Man Kam To Road/Kong Nga Po Road	Priority	0.26	0.17
J16	Man Kam To Road/Lin Ma Hang Road	Priority	0.29	>50% (after manually controlled by HKPF)

### Notes:

Table 8.6b Road Link Flow Performance at Year 2055 – Sensitivity Test 3

Name of Road Link		Year 2055 reference	Year 2055 Design
L1	Lin Ma Hang Road (NB/SB)	0.26/0.15	0.53/0.53
L2	Man Kam To Road (NB/SB)	0.39/0.31	0.82/0.83
L3	Jockey Club Road (NB/SB)	0.16/0.15	0.18/0.18
L4	Po Shek Wu Road (NB/SB)	0.22/0.33	0.28/0.39

8.3.11 In Sensitivity Test 3, J16 junction is anticipated to be operated close to its capacity when proposed number of niches at the proposed site is increased by 20%. It will generate /attract additional trips to/from the development during festive periods. It is assumed that the special bus fleet size is fixed in order not to impose burden to the road networks. If no substantial improvement was made to the junction, the new niches could only be added in a slow rate corresponding to the natural reduction in grave sweeper for the old niches.

<sup>1.</sup> J14 - Man Kam To Road/Fu Tei Au Road will be operating under amended cycle time in the design case.

# 9 Construction Traffic Assessment

## 9.1 Overview

- 9.1.1 The volume of construction traffic is based on the preliminary estimates on the excavation and construction materials.
- 9.1.2 Quantities for the various construction tasks have been identified to calculate the number of trips that can be expected for the duration of the project. Estimates of the number of site employees have also been made from which employee movements have been calculated to derive the total number of trips expected from the site both throughout the day and during the peak period.

## 9.2 Construction Programme

At this stage of the project, the construction works for the site formation and the associated infrastructural works are assumed to be between early 2016 and mid-2020. After that, the formed platforms will be handed over to ArchSD to carry out the building works in late 2018 the latest. The proposed operation year for the C&C facilities is assumed in Year 2023 for phase 1 of columbarium. Based on our preliminary estimation, the peak construction traffic volume will be in Year 2019.

# 9.3 Construction Material Transport Assumptions

- 9.3.1 Assumptions to estimate the number of vehicle trips generated from the transport of construction materials on the road network have been estimated based on the nature and size of the works. Construction traffic is principally generated by spoil disposal and concrete delivery trucks.
- 9.3.2 To facilitate assessment of the capacity of the key junctions and road links, the construction traffic generated was converted into terms of passenger car units (pcu), using a common multiplication factor of 2.5 for both spoil and concrete lorries. The maximum number of trucks generated hourly during the peak periods was estimated based on the design assumptions as shown in **Tables 9.1 & 9.2**.

Table 9.1 Truck Type and Capacity Assumptions

Truck Type	Transport Materials	Truck Capacity	PCU Factor	
g alldjaghg	Spoil/Fill /Bulk deliveries	5.0 m <sup>3</sup>	2.5	
2	2 Steel 10 or 20 ton		2.5	
3	Concrete	5.0 m <sup>3</sup>	2.5	
4	Formwork	50 m <sup>2</sup>	2.5	

# 9.4 Construction Material Trip Estimates

9.4.1 Estimates of the number of trips likely to be made from each construction activity were calculated according to the above stated assumptions. For each activity the expected timing and duration from

the construction programme were used to calculate the daily and peak hour estimates of construction trips.

Table 9.2 Work Rate Assumptions

Criteria	Value
Working hours per day (i.e. $1000 - 1600$ hours) (for truck movement)	6
Peak hour factor (PHF)	1.25

## 9.5 Construction Material Trip Generation

- 9.5.1 To determine the total traffic movements for the site, the cumulative effect of concurrent activities has been derived and the busiest period during the entire construction period identified. The peak period of construction related traffic activity is expected to be in Year 2018/2019 (between in Year 2016 to Year 2020) when the maximum nos. of 180 truck per day or 94 pcus/hr (180 trucks per day ÷ 6 working hours x 2.5 PCU factor x 1.25 PHF) will be expected to be generated and attracted in the peak hour.
- 9.5.2 A summary of trips generated and attracted by the construction is listed in **Table 9.3**.

Table 9.3 Estimated Construction Traffic Generation & Attraction

Work Site	Estimation of Peak Construction Traffic (pcus/hr each way)		
C&C	94		

# 9.6 Trips by Construction Workers and Staff

9.6.1 In addition to the journeys made by vehicles transporting construction material, trips will also be made by construction workers and staff travelling to and from the site. The site is quite remote from public transport hub and is only served by 1 franchised bus route. The majority of site employees will therefore likely use existing public transport services and will not generate additional trips on the road network.

## 9.7 Construction Traffic Routing

9.7.1 As mentioned earlier, construction traffic is principally generated by spoil disposal and concrete delivery trucks. At this stage of the assessment, it is assumed that the construction traffic will lead to the nearest trunk road i.e. Fanling Highway. The main access route is summarised in **Table 9.4**, which shown in below:

**Table 9.4** Tentative Construction Traffic Route

Construction Route
Sha Ling Road <-> Man Kam To Road <-> Jockey Club Road <-> Po Shek Wu
Road <-> Fanling Highway

## 9.8 Construction Traffic Forecasts

- 9.8.1 Construction works is planned to commence in Year 2017 for completion in before Year 2020. Peak traffic levels generated from construction site are expected to occur in Year 2018/2019; therefore Year 2019 has been adopted as the design year for capacity assessment.
- 9.8.2 The future year traffic forecasting was developed with the same methodology as discussed previously.
- 9.8.3 In view of the sewerage proposal scheme, a maximum of 18 nos. and 11 nos. of desludging vehicles per day are required for disposal of sewage during festive periods and normal periods respectively. However, no desludging to be carried out for the festive day and the following weekend. Hence, with the insignificant nos. of trips, the desludging vehicles are not anticipated to have any traffic impact.

## 9.9 Assessment Scenarios

- 9.9.1 To evaluate the associated traffic impact likely to be induced by construction worksites two scenarios have been developed and analysed. The first scenario, named "Reference Scenario", assumed that there will be no construction taking place. The second scenario, named "Design Scenario", assumed that there will be construction traffic as well as the Temporary Traffic Management Scheme (TTMS) and the associated traffic diversion in place. The traffic forecast scenarios are summarised as follows:
  - Year 2019 Reference Scenario Year 2019 background traffic forecast obtained by the growth rate method + traffic generated / attracted by concurrent large-scale constructions sites in the vicinity;
  - Year 2019 Design Scenario Year 2019 Reference scenario + traffic generated / attracted
- 9.9.2 In view of the subject site that, all the construction vehicles are simply hauling materials to its remote area of construction site at the top of the hill, it is not anticipated that any TTMS along existing carriageway would be needed.

## 9.10 Traffic from Adjacent Construction Sites

- 9.10.1 Other planned projects that may affect the C&C project include:
  - Closed Area Development
  - MTR Lo Wu Station Grave Sweepers Link Works
- 9.10.2 The investigation and preliminary design of the above mentioned are still in progress and there is limited information related to the actual construction methodology and programme available. This project, at the stage, is assumed not to induce traffic impact to the vicinity of the subject works site since its construction traffic is mainly routed within Man Kam To Road, Jockey Club Road and Po Shek Wu Road.

Therefore, for these projects, the relevant construction traffic is not added to the traffic forecasts.

## 9.11 Traffic Impact Assessment

9.11.1 Assessments for the peak construction stage have been prepared for all critical junctions. The junction assessment was undertaken based on the methodology presented in the Transport Planning and Design Manual (TPDM). The results for the 2019 Reference and Design cases (non-peak hour) are shown in **Table 9.5** below. It is anticipated traffic measures will be implemented. (such as: construction vehicles are prohibited to arrive the site in peak hours during weekdays.) Therefore, this assessment is focused on non-peak hours only. The traffic flow diagrams are illustrated in **Figure 7.10 and 7.11** 

Table 9.5 Junction Performances during peak construction year in non-peak hour during weekdays

	Junction (1)	Junction Type	Year 2019 Reference	Year 2019 Design
J1	Man Kam To Road/ Sha Ling Road	Priority	0.03	0.32
J2	Man Kam To Road/ Lo Wu Station Road	Priority	0.36	0.39
J3	Man Kam To Road/Proposed New Road	Priority	N/A	N/A
J4	Jockey Club Road/ Po Shek Wu Road	Roundabout	0.48	0.52
J5	Po Wan Road/ Po Shek Wu Road	Signal	31%	25%
J6	Choi Yuen Road/ Po Shek Wu Road	Signal	>50%	>50%
J7	Po Shek Wu Interchange	Roundabout	0.97	0.97
J8	San Wan Road/ Sha Tau Kok Road	Roundabout	0.39	0.39
J9	San Wan Road/ Fanling Station Road	Signal	>50%	>50%
J10	Au Tau Interchange	Roundabout	0.46	0.46
J11	Kam Tin Road / Kam Tin Bypass / Kam Ho road	Roundabout	0.19	0.19
J12	Po Wan Road/San Fung Avenue	Signal	>50%	>50%
J13	Po Wan Road/Jockey Club Road	Signal	23%	16%
J14	Man Kam To Road/Fu Tei Au Road	Signal	35%	25%
J15	Man Kam To Road/Kong Nga Po Road	Priority	0.16	0.16
J16	Man Kam To Road/Lin Ma Hang Road	Priority	0.69	0.69

# 10 Summary and Conclusion

## 10.1 Summary

- 10.1.1 The Sandy Ridge Cemetery is one of the 24 potential sites for columbarium development in 18 districts announced in three batches in July 2010, December 2010 and April 2011 respectively. Furthermore, it is planned to provide synergistic one-stop services at the Sandy Ridge Cemetery by including at least a columbarium with 200,000 niches, 1 crematorium, a funeral parlour and a visitor service centre so as to maximise the convenience to the public. The proposed development for Columbarium and Crematorium (C&C) facilities at Sandy Ridge Cemetery is required to accommodate at least 200,000 niches and crematorium with the target operation year to be started at year 2023 for phase 1 of columbarium.
- The TIA aims to provide information on the nature and assess the extent of the potential traffic impacts arising from the project and propose mitigation measures to meet the requirements of the Transport Department and relevant government departments.
- By considering the availability of spare spaces for introduction of a temporary Pick-up/Drop-off Areas (PDAs) for special bus services during the festive periods and the coverage of population, it is recommended MTR Fanling Station and MTR Kwu Tung Station will be the major PDAs for receiving the grave sweepers from the Eastern side and the Western side respectively.
- For more efficient use of bus resources, the future provision of special bus service would be implemented in three stages as follows to match with the niches allocation programme:

Stage 1 (1st – 4th year; i.e. year 2023 - 2026):

To introduce special bus service at Fanling Station Road PDA and enhance existing bus service at Sheung Shui Landmark PDA.

Stage 2 (5th – 6th year; i.e. year 2027 - 2028):

- 10.1.6 At this stage, special bus service from MTR Kwu Tung PDA will be introduced. Stage 2 is anticipated to be last from 5th year and 6th year.

  Stage 3 (7th 29th year; i.e. year 2029 2052):
- Stage 3 will be started at 7th year. During Stage 3, the bus service between MTR Kwu Tung PDA will be continuous to operate. At 9th year (i.e.: Year 2031), a potential Bus-bus Interchange (BBI) will be introduced by providing special bus services at Pak Wo Road, which is nearby Wah Ming Estate Bus Terminus (note: this location of BBI is still subjected to TD's approval). At this stage, the grave sweepers will be using the existing bus services and be interchanged to the proposed special bus services at potential location Pak Wo Road, and then to access the proposed Sandy Ridge C&C. These special buses with BBI

- will be started to be operated from 9th year to the end of the programme (duration of 29th year).
- 10.1.8 The special bus services to Sandy Ridge C&C would be provided, the implementation of the above mentioned scheme will depend largely on the availability of bus resource at the time of introduction of the service and cannot be confirmed at this stage.
- 10.1.9 The bus fleet requirement laid down in this report is for illustration purpose only. The actual provision of special bus services will depend on the availability of bus resource and actual passenger demand at the time when the niches are commenced, and will be subject to on-site situation and actual operation arrangement of bus companies. FEHD will carry out a substantial traffic and public transport review 5 years after the commissioning of the proposed Sandy Ridge C&C facilities to ascertain the number of grave sweepers and review the niche allocation rate, i.e. during Stage 2.
- 10.1.10 Similar to the crowd management measures for other existing columbarium facilities, the traffic related information could be disseminated to the general public via Announcement of Public Interest (API) on TV, radio, newspaper or posted at the transport hub for information of the general public to channelize the grave sweepers to the major PDAs at Fanling Station Road and MTR Kwu Tung Station PTI.
- 10.1.11 A small proportion of grave sweepers like those residents in Sheung Shui area are likely to take the bus route at Sheung Shui Landmark as well as other kinds of transport mode, such as taxi, GMB or by walking via MTR Lo Wu Station to access the C&C facilities at Sandy Ridge Cemetery.
- 10.1.12 The maximum total passenger handling capacity of proposed transport facilities will be 28,030 grave sweepers/hr (one-way). The modal split of the grave sweepers and the corresponding handling capacities is shown in **Table 10.1** below:

Table 10.1 Handling Capacities and Modal Split of Arrival Grave Sweepers

Mode	Handling Capacity		Split
Fanling Station + Special Bus Services:	11,880	ppl/hr	42%
Kwu Tung Station + Special Bus Services:	11,880	ppl/hr	42%
Sheung Shui Station + Special Bus Services:	1,900	ppl/hr	7%
Taxi / GMB:	850	ppl/hr	3%
Existing bus and special bus at BBI	1,240	ppl/hr	5%
Lo Wu Station by walking:	280	ppl/hr	1%
Total:	28,030	ppl/hr	100%

10.1.13 To facilitate the pick-up/drop-off activities at various MTR stations, only minor improvement works such as planter demolition at Fanling Station Road and San Wan Road, modification of physical barrier at

Fanling Station Road, and revision of road marking on Fanling Station Road is required.

- It is proposed to provide a vehicular opening connecting the Sheung Shui Landmark North PTI and Lung Sum Avenue to avoid the detour of bus heading towards Man Kam To Road direction. The proposed vehicular opening could allow direct access for the Man Kam To Road bound bus services and avoid the current congested junction at Lung Sum Avenue / San Fung Avenue.
- Based on the limited capacities of the transport provision, a total of 162,000 niches (about 81% of the 200,000 target niches) could be achieved by the 9<sup>th</sup> year (i.e. year 2031) at the rate of 18,000 per year. After that, the implementation of the remaining niches would only be provided at a slower rate by offsetting the old aged niches and will take 29 years to allocate the total 200,000 niches.
- 10.1.16 For the assessment of supporting transport infrastructures required for the proposed C&C facilities, the visitor numbers derived from the trip rate will be a key assumption of the traffic forecasts. However, trip rate does have a wide range as the arrival pattern vary by location and time. Therefore, the trip rate should be regularly reviewed upon the operation of the Sandy Ridge C&C to facilitate the refinement on the provision of the transport facility and adjustment on the rate of niches allocation to suit the traffic conditions.
- In order to minimise the traffic impacts on Sheung Shui Area and Man Kam To Road, it is proposed to permanently widen the existing Lin Ma Hang Road (section from Man Kam To Road to Ping Yuen River) to a 7.3m wide 2-lane carriageway with 2m footpath at both sides such that the special bus services from Fanling Station PDA and special bus service from nearby Pak Wo Road BBI as well as the hearse vehicles could access the site via the future Liantang/Heung Yuen Wai BCP Connecting Road and Lin Ma Hang Road.
- 10.1.18 To assess the traffic impacts caused by the proposed Sandy Ridge C&C facilities, various scenarios for with and without the proposed C&C facilities are assessed. By considering that the allocation of the niches would be implemented by phases, the year 2023 (year 1 occupation of 18,000 niches) and year 2052 (full occupation of 200,000 niches after 29 years) as well as 2055 (3 years after full occupation) are adopted as the design years.
- 10.1.19 The assessment scenarios are summarised as below:
  - 2022 Festive Periods Reference Case (with opening of Sha Ling Road)
  - 2023 Festive Periods Reference Case (with the opening of Closed Area + without C&C)
  - 2052 Festive Periods Reference Case (with the opening of Closed Area + without C&C)
  - 2055 Festive Periods Reference Case (with the opening of Closed Area + without C&C)

- 2023 Festive Periods Design Case (with the opening of Closed Area + with C&C)
- 2052 Festive Periods Design Case (with the opening of Closed Area + with C&C)
- 2055 Festive Periods Design Case (with the opening of Closed Area + with C&C)
- Junction assessment was undertaken for the 2022 Reference case; and 2023, 2052, and 2055 Reference Cases and Design Cases. It is important to note that the peak operation period of the proposed C&C facility will be during festive periods. Therefore, the assessments will mainly focus on the festive periods. All junctions will perform within acceptable levels in all design years after improvements recommended in the main text of this report. Therefore, it is expected that the existing road network, with proposed special bus services implemented during the festive days, could accommodate the traffic impacts arising from the development.
- 10.1.21 Sensitivity Test 1 was carried out to assess the traffic impact due to the background traffic at the road network within the study area being under-estimated by 20%. With the increase in background traffic, the junction J16 would be operating in excess of its capacity in design year 2055. To alleviate the traffic condition at J16, it is proposed to manually control the operation of the junction by HKPF. With the manually controlled of the junction operation, the junction performance of J16 is assessed in form of signalised junction. The result shows that the junction could be operated within capacity by allocating appropriate green time for each arm under manually controlled.
- In Sensitivity Test 2, junctions are anticipated to exceed or reach its capacity when vehicle generation and attraction rate is under-estimated by 20% for the Ching Ming Festive Periods. Therefore, in addition to proposed improvement measure, temporary traffic management measures such as restricting traffic other than special bus from using the routing should be developed to alleviate the traffic congestion at the junctions during the Festive Periods. Additional bus stacking spaces should be identified at PDA to transport the additional grave sweepers to the development. To alleviate the traffic condition at J1 and J16, it is proposed to manually control the operation of the junction by HKPF. With the manual control of the junction operation, the junction performance of J1 and J16 are assessed in form of signalised junction. The result shows that the junction could be operated within its capacity by allocating appropriate green time for each arm under manual control.
- In Sensitivity Test 3, J16 junction is anticipated to be operated close to its capacity when proposed number of niches at the proposed site is increased by 20%. It will generate /attract additional trips to/from the development during festive periods. It is assumed that the special bus fleet size is fixed in order not to impose burden to the road networks. If no substantial improvement was made to the junction, the new niches could only be added in a slow rate corresponding to the natural reduction in grave sweeper for the old niches.

# 10.2 Conclusions & Recommendations

Based on the traffic analysis, the proposed C&C facilities at Sandy Ridge Cemetery will have manageable traffic impact on the nearby road links, junctions and grave sweepers facilities while appropriate improvement measures and suitable crowd management plan during festive periods have been proposed as necessary. The conclusion therefore is that the proposed development is acceptable from the traffic point of view.

# Appendix A

Trip Rate Review

# Civil Engineering and Development Department

Agreement No. CE1/2013 (CE)
Site Formation and Associated
Infrastructural Works for
Development of Columbarium,
Crematorium and Related
Facilities at Sandy Ridge Cemetery
– Design and Construction

Working Paper on Trip Rate Review (Rev 4)

231448-REP-003-03 Rev 4 | July 2015

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Job number 231448



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### Introduction

## 1.1 Background

- 1.1.1 Ove Arup and Partners Hong Kong Limited (Arup) was commissioned by Civil Engineering and Development Department (CEDD) of the Hong Kong Special Administrative Region (HKSAR) Government on 28 June 2013 to provide consultancy services for the design and construction of the site formation and associated infrastructural works for development of columbarium, crematorium and related facilities (C&C facilities) at Sandy Ridge Cemetery (the Project).
- Preliminary assessment has been carried out to determine the potential scale of columbarium at Sandy Ridge with due consideration on estimation of trip rate of visitors to/from the proposed development and the capacity of external public transport system, i.e. shuttle bus services between nearby railway station and the proposed development to cope with the estimated patronage demands. Reference has been made to the trip rate derived from surveys conducted during the Ching Ming Festival in year 2011 at Sandy Ridge Cemetery and Diamond Hill Columbarium conducted under the "Agreement No. CE32/2010 (CE) Site Formation and Associated Infrastructural Works for Proposed Development of Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery Feasibility Study".

## 1.2 Purpose of this Working Paper

- 1.2.1 A Working Paper for discussion on trip rates of existing columbarium during festive periods was circulated in August 2013. There was in lack of reference data for the trip rate of columbarium with operation history of around 1<sup>st</sup> 20<sup>th</sup> year. In order to further verify the decreasing trend and to achieve a precise estimation of trip rate, columbaria satisfying this criterion were chosen and surveys were undertaken. The trip rates were reviewed and thus a revision of the Working Paper has been circulated in November 2013.
- However, due to programme constraints, 3 columbaria surveys were conducted during 2013 Chung Yeung Festival and the results were projected by seasonal factor. The projected 2013 Chung Yeung Festival trip rate surveys are as follows:
  - Chung Yeung Festival 2013 Surveys at Tsui Yuan Hall, Block 6 of Cape Collinson Columbarium;
  - Chung Yeung Festival 2013 Surveys at Wo Hop Shek Columbarium Phase III;
  - Chung Yeung Festival 2013 Surveys at Kiu Tau Road Columbarium.

- 1.2.3 In order to update the projected trip rate of the above-mentioned 3 columbaria, surveys were conducted during 2014 Ching Ming festive days to verify the projected survey count.
- This Working Paper was prepared as a supplementary document for summarizing all findings on the visitor trip rates of the existing columbarium facilities during the festive periods. For the assessment of supporting transport infrastructures required for the proposed C&C facilities, the visitor numbers derived from the trip rate will be a key assumption of the traffic forecasts to be used in the detailed Traffic and Transport Impact Assessment. As such, agreement on this assumption with relevant parties at the outset of this assignment would be instructive and constructive for subsequent work to proceed.
- 1.2.5 This Working Paper will also summarise the survey results and findings at some existing cemeteries and columbaria carried out under the following studies for completeness:
  - "Agreement No. CE 54/2011(CE) Potential Sites for Columbarium Developments Group A Feasibility Study";
  - "Agreement No. CE 55/2011(CE) Potential Sites for Columbarium Developments - Group B - Feasibility Study";
  - "Contract No. CPM301\_12/10 Traffic Impact Assessment Study for Niche Development at Wo Hop Shek Cemetery (Programme No. 118ZX)"; and
  - "Contract No. CPM301\_13/10 Traffic Impact Assessment Study for Columbarium Development at Kwai Chung (Programme No. 126ZX)".

### 2 Data Collection

## 2.1 Pedestrian Count Survey

- 2.1.1 Throughout the years from 2011 to 2014, there were 11 cemeteries of pedestrian data has been collected at the grave sweeper festivals (Ching Ming Festival and Chung Yeung Festival).
- 2.1.2 These 11 cemeteries which has been surveyed are listed as below:
  - 1) Kiu Tau Road Columbarium
  - 2) Tsui Yuan Hall of Cape Collinson Columbarium
  - 3) Wo Hop Shek Columbarium Phase III
  - 4) Yuen Yuen Institute
  - 5) Tsing Chung Sin Yuen
  - 6) Chinese Christian Cemetery
  - 7) Roman Catholic Cemetery
  - 8) Sandy Ridge Cemetery
  - 9) Wo Hop Shek Cemetery
  - 10) Kwai Chung Columbarium
  - 11) Diamond Hill Columbarium
- 2.1.3 The reason of choosing these 11 cemeteries are because they are considered as remarkable size cemeteries in Hong Kong. These cemeteries were also located in different parts of Hong Kong.
- 2.1.4 Out of these 11 cemeteries, 7 of them are located in New Territories, 2 of them are located in Hong Kong Island, and lastly 2 of them are located in Kowloon side. The choice of these locations of cemeteries are well-balanced.
- Each of the cemeteries has the pedestrian counts conducted throughout most of the day to obtain the grave sweepers arrival profile; the results show each of the cemeteries has different pattern. In view of the result of all these profiles, it is anticipated the peak flow are occurred from 11 a.m. to noon time. This peak hour will form the basis of choosing the peak hour in future analysis in traffic impact assessments.
- 2.1.6 Moreover, the result has revealed that the peak arrival flows (between 11 a.m. to noon time) are approximately 20% of the daily total grave sweepers.
- 2.1.7 The summary of the arrival profile of these 11 surveyed cemeteries (in graph format) is illustrated in **Appendix A**.

## Trip Rates Review for Columbarium Operating for about 1st -20th years

#### 3.1 Introduction

- 3.1.1 It is noted that the database derived from previous surveys was in lack of reference of columbarium with operation history in around 1<sup>st</sup> -20<sup>th</sup> year. In order to further verify the decreasing trend for a more precise estimation of trip rate, 6 columbaria satisfying this criterion were chosen.
- On 2013 Chung Yeung festive days, visitors count surveys were carried out at the following locations:
  - Tsui Yuan Hall, Block 6 of Cape Collinson Columbarium;
  - Wo Hop Shek Columbarium Phase III:
  - Kwai Chung Columbarium;
  - Yeung Nim Hall, Diamond Hill Columbarium;
  - Sze Chen Hall, Diamond Hill Columbarium; and
  - Kiu Tau Road Columbarium.
- 3.1.3 However, it is subsequently revealed that some survey data is not suitable for replicating the visitor trip rates for the development at Sandy Ridge. The data collected at i) Diamond Hill Columbarium and ii) Kwai Chung Columbarium are considered inappropriate for projection of visitor trip rate in this study due to their uniqueness in nature with site-specific conditions for the following rationales:
  - Diamond Hill Columbarium: It is located in close vicinity to a densely populated urban settlement, which is therefore considered inappropriate for replicating the rural settlement at Sandy Ridge;
  - ii) Kwai Chung Columbarium: The collected information, is from mixed young-age and old-age niches in the same building, would not be able to reflect trip rate for any representable age of operation and thus should be extracted from the trip rate vs time profile;

## 3.2 Supplementary Surveys in 2014 Ching Ming

#### Surveys at Tsui Yuan Hall, Block 6 of Cape Collinson Columbarium

- 3.2.1 Tsui Yuan Hall, Block 6 of Cape Collinson Columbarium started operation in late 1994 and the niches allocation programme completed in early 2005 providing 19,509 nos. of niches.
- 3.2.2 As shown in **Table 3.1** below, grave sweepers count surveys were undertaken on the Ching Ming Festival as well as one day just after it, that is, 5-6 April 2014.

Table 3.1 Visitor Count Surveys during 2014 Ching Ming Period at Tsui Yuan Hall

Common Data	2014 Ching Ming			
Survey Date	Peak Hour Two-way Visitor Flow (visitor/hr)			
5/4/2014 (Sat)	<ul> <li>Very Life in Shell, Circler chinch.</li> </ul>			
Ching Ming Festival	3,344			
6/4/2014 (Sun)	1.00			
Public holiday	1,607			

- 3.2.3 The peak visitor flow (3,344 visitors/hr) was found to be recorded on Ching Ming Festival.
- Tsui Yuan Hall has a total of 19,509 niches currently. Based on the recorded number of visitors (3,344 visitor/hr) in the peak hour of Ching Ming Festival, the peak hour two-way visitor trip rate for the grave sweepers flow is 0.171 visitor/niche/hr (two-way), as shown in Table 3.2 below.

Table 3.2 Peak Hour Trip Rate at Tsui Yuan Hall, Block 6 of Cape Collinson Columbarium

e eksternik om de Eksterniks often	No. of niches	Peak Hour Visitors	Trip Rate (Two-way) Visitor/niches/hr
Tsui Yuan Hall, Block 6 of Cape Collinson Columbarium	19,509	3,344	0.171

#### Surveys at Wo Hop Shek Columbarium Phase III

- 3.2.5 Wo Hop Shek Columbarium Phase III started operation in late 1990 and the niches allocation programme completed in mid 2001 providing 16,044 nos. of niches.
- As shown in **Table 3.3** below, grave sweepers count surveys were undertaken on the Ching Ming Festival as well as one day just after it, that is, 5-6 April 2014.

Table 3.3 Visitor Count Surveys during 2014 Ching Ming Period at Wo Hop Shek Columbarium Phase III

Survey Data	2014 Ching Ming	
Survey Date	Peak Hour Two-way Visitor Flow (visitor/hr)	
5/4/2014 (Sat) Ching Ming Festival	7,679	
6/4/2013(Sun) Public Holiday	2,446	

3.2.7 Wo Hop Shek Columbarium Phase III has a total of 16,044 niches currently allocated before the survey taken place. Based on the recorded number of visitors (7,679 visitor/hr) in the peak hour of Ching Ming Festival, the peak hour two-way visitor trip rate for the grave sweepers flow is 0.479 visitor/niche/hr (two-way), as shown in Table 3.4 below.

Table 3.4 Peak Hour Trip Rate at Wo Hop Shek Columbarium Phase III

Tariby British to	No. of niches	Peak Hour Visitors	Trip Rate (Two-way)  Visitor/niches/hr
Wo Hop Shek Columbarium Phase III	16,044	7,679	0.479

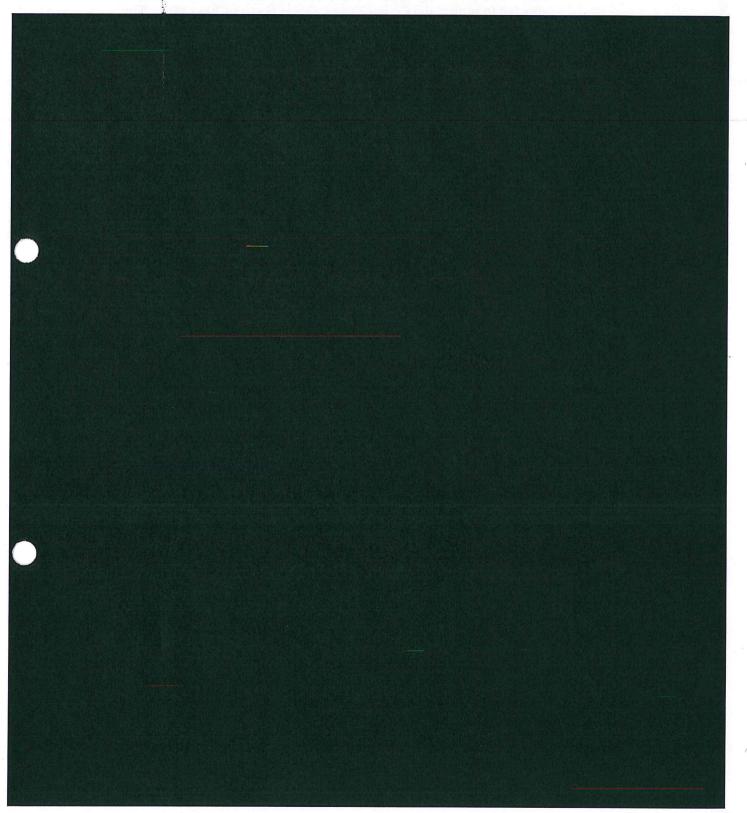
#### Surveys at Kiu Tau Road Columbarium

- In accordance with FEHD's niche implementation record, the total nos. of niches in Kiu Tau Road Columbarium was increased from 8,334 to 13,605 at its phase II development after 2013 Chung Yeung Festival. However, the newly-added niches should not be considered in the trip rate derivation due to the abnormal visiting pattern regarding the Chinese Tradition.
- 3.2.9 Regarding the Chinese Tradition (習俗-「新山不過社」), new niches should be visited before Spring Sacrifice (春社) in the first year. In 2014, Spring Sacrifice (春社) was on 18 March 2014, which was before Ching Ming Festival (5 April 2014).
- 3.2.10 It is anticipated that some visitors may follow the tradition. Therefore, the new niches (5,271 nos.) implemented after 2013 Chung Yeung Festival may not induce the normal additional trip rate. These newly-added niches are considered not effective in reflecting the actual trip generation at their first Ching Ming Festival.
- 3.2.11 Due to uncertainty in the reliability of the derived trip rates from Kiu Tau Road Columbarium, the 2014 Ching Ming survey finding is suggested to be ignored. Thus, the trip rate projected from 2013 Chung Yeung survey will be adopted in the derivation.

#### Seasonal Factor for Kiu Tau Road Columbarium

- 3.2.12 It is noticed that the visitor counts on Ching Ming Festival are much higher than those on Chung Yeung Festival. Therefore, seasonal factors (Ching Ming/ Chung Yeung) established from other published on-going/recently completed survey studies are adopted to project the visitors flow from Chung Yeung to Ching Ming Festival for comparison.
- 3.2.13 By the provision of data from FEHD, the seasonal factor (Ching Ming/ Chung Yeung) over 2006 2013 were found and tabulated in the **Table 3.5** below. Some abrupt surges in seasonal factor are found at Wo Hop Shek Cemetery & Columbarium in 2006 & 2009 Ching Ming Festival. Similar irregularities are also found at Diamond Hill Urn Cemetery/Columbarium in 2009 Ching Ming Festival. This is probably due to the provision of new columbarium facilities in the identified periods and locations. As such, it is considered appropriate to exclude these 3 seasonal factors in establishing the average seasonal factor.

3.2.14 The results in **Table 3.5** indicated that an average seasonal factor of +2.34 is derived.



- Based on the result of the Kiu Tau Road Columbarium surveyed on 2013 Chung Yeung festive days, the seasonal factor of +2.34 is adopted to project the Chung Yeung visitor flow to Ching Ming flow.
- 3.2.16 As shown in **Table 3.6** below, grave sweepers count surveys were undertaken on the Chung Yeung Festival as well as one day just before and after it, that is, 12-14 October 2013.

Table 3.6 Visitor Count Surveys during 2013 Chung Yeung Period at Kiu Tau Road Columbarium

Common Data	2013 Chung Yeung Peak Hour Two-way Visitor Flow (visitor/hr)		
Survey Date			
12/10/2013 (Sat)	334		
13/10/2013 (Sun)	1,501		
Chung Yeung Festival			
14/10/2013(Mon)	840		
Public holiday			

3.2.17 The projected number of visitors (3,512 visitor/hr) is derived for the peak hour of Ching Ming Festival as shown in **Table 3.7** below.

Table 3.7 Projected Peak Hour Visitor Flow for Ching Ming Festival

Seasonal	Chung Yeung	Projected Ching Ming
Factor	Peak Hour Two-way Visitor Flow (visitor/hr)	Peak Hour Two-way Visitor Flow (visitor/hr)
2.34	1,501	3,512

3.2.18 Kiu Tau Road Columbarium has a total of 8,334 niches allocated before the survey taken place. Based on the projected number of visitors (3,512 visitor/hr) derived for the peak hour of Ching Ming Festival, the peak hour two-way visitor trip rate for the grave sweepers flow is 0.421 visitor/niche/hr (two-way), as shown in **Table 3.8** below.

Table 3.8 Peak Hour Trip Rate at Kiu Tau Road Columbarium

	No Carlobor	Peak Hour	Trip Rate (Two-way)	
	No. of niches	Visitors	Visitor/niches/hr	
Kiu Tau Road Columbarium	8,334	3,512	0.421	

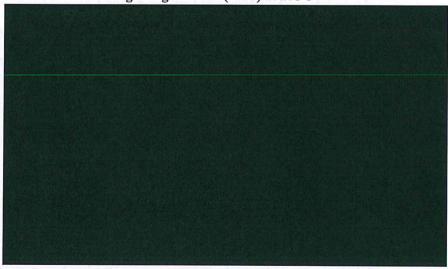
## 4 Trip Rates Adopted for Group A & B Columbarium Studies

- 4.1.1 Under the Group A & B Columbarium Studies, surveys were conducted at the following locations. The survey results were discussed in the following sections.
  - Junk Bay Chinese Permanent Cemetery (JBCPC);
  - Roman Catholic Cemetery (RCC); and
  - Chinese Christian Cemetery (CCC).
- 4.1.2 However, the data collected at JBCPC are considered inappropriate for projection of visitor trip rate in this study due to their uniqueness in nature with site-specific conditions.
- 4.1.3 In JBCPC, special temporary traffic arrangements are implemented on the festive days such that there would be nil provision of any public nor private transport. This purely walk mode nature on festive days, which have resulted in distortion of arrival pattern, are therefore considered inappropriate for replicating the traffic arrangement at Sandy Ridge.

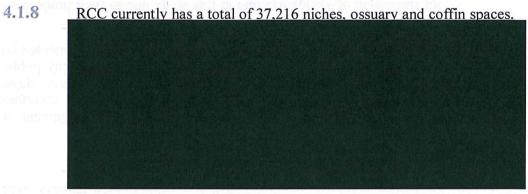
#### Surveys at Roman Catholic Cemetery (RCC)

As shown in **Table 4.1** below, grave sweepers count surveys were undertaken at the key grave sweepers routes at Wing Ming Street, Castle Peak Road, Ku Chau West Street and the main entrance of RCC on 21<sup>st</sup>(Sun), 23<sup>rd</sup>(Tue)(Chung Yeung Festival) and 27<sup>th</sup>(Sat) October 2012 for the Chung Yeung festive period and 31<sup>st</sup> (Sun) March, 4<sup>th</sup> (Thu) (Ching Ming Festival) and 6<sup>th</sup> (Sat)April as well as a normal day on 20<sup>th</sup> (Wednesday) January 2013.

Table 4.1 Visitor Count Surveys during Chung Yeung (2012) and Ching Ming Festival (2013) at RCC

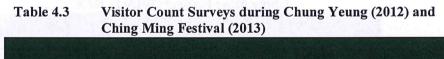


- 4.1.5 It is noticed that the first highest peak visitor flow was recorded on the Ching Ming Festival (4 April 2013). The amount of visitors was found to drop significantly on the first holidays immediate before and after the Ching Ming Festival.
- 4.1.6 The total number of visitors reduced by 83% for the first Saturday before Ching Ming Festival (31 March 2013) and reduced by 95% for the first Sunday after Ching Ming Festival (6 April 2013) when compared against the visitor flow recorded on the first peak on Ching Ming Festival (4 April 2013).
- 4.1.7 According to the results of survey on normal weekday, the number of visitors (14 visitor/hr) is negligible on a normal day and therefore is unlikely to create any significant traffic impact.



#### Surveys at Chinese Christian Cemetery (CCC)

As shown in **Table 4.3** below, grave sweepers count surveys were undertaken at the key grave sweepers routes and cemetery entrances at Victoria Road on 21<sup>st</sup> (Sun), 23<sup>rd</sup> (Tue) (Chung Yeung Festival) and 27<sup>th</sup> (Sat) October 2012 for the Chung Yeung Festival period and 31<sup>st</sup> (Sun) March, 4<sup>th</sup> (Thu) (Ching Ming Festival) and 7<sup>th</sup> (Sun) April as well as a normal day on 7<sup>th</sup> (Thursday) March 2013.



- 4.1.10 It is noticed that the first highest peak visitor flow was recorded on the Ching Ming Festival (4<sup>th</sup> April 2013) and the second peak was recorded on the Chung Yeung Festival (23<sup>rd</sup> October 2012). The amount of visitors was found to drop significantly on the first holidays immediate before and after the Chung Yeung and Ching Ming Festivals.
- 4.1.11 However, the total number of visitors reduced by 80% for the first Sunday before Ching Ming Festival (31 March 2013) and reduced by 89% for the first Sunday after Ching Ming Festival (7 April 2013) when compared against the visitor flow recorded on the second peak on Ching Ming Festival (4 April 2013).
- 4.1.12 According to the results of survey on normal weekday, the number of visitors (29 visitor/hr) is negligible on a normal day and therefore is unlikely to create any significant traffic impact.
- 4.1.13 CCC currently has a total of 52,917 niches, ossuary, urn and coffin spaces.

## 5 Trip Rates Adopted for Other Columbarium Studies

Recently, there was a study completed for the proposed columbarium development at Wo Hop Shek Cemetery (WHSC);

#### Surveys at Wo Hop Shek Cemetery (WHSC)

5.1.2 As shown in **Table 5.1** below, grave sweepers count surveys were undertaken on a weekday, Saturday, Sunday and the festival day during festive period.

Table 5.1 Visitor Count Surveys during Chung Yeung (2010) and projected demand during Ching Ming Festival



5.1.3 WHSC had a total of 110 940 niches, urn and coffin spaces in the year of survey. I

## 6 Summary and Recommendation

## 6.1 Summary

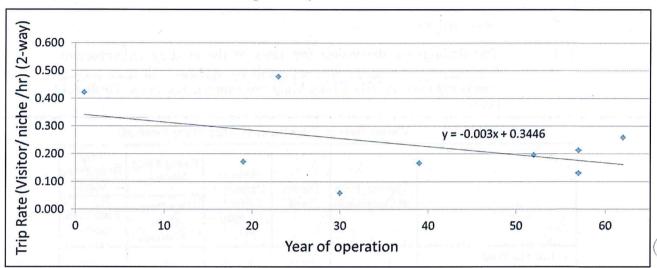
6.1.1 The findings on the visitor trip rates of the existing columbarium developments during the festive periods are updated with latest survey results obtained in 2014 Ching Ming and summarized in the **Table 6.1** below.

Table 6.1 Visitor Survey Trip Rates (Ching Ming Festival)

	Approx. Year	Survey	Niches + Ossuary +	Ching Ming Festival	Trip Rate(Two- way)	
	of Operation Year		Urn + Coffin	Day Peak Hour Visitors	Visitor/nic he/hr	
1. Kiu Tau Road Columbarium	1 years	2013	8,334	3,512	0.421	
2. Tsui Yuan Hall of Cape Collinson Columbarium	19 years	2014	19,509	3,344	0.171	
3. Wo Hop Shek Columbarium phase III	23 years	2014	16,044	7,679	0.479	
4. Yuen Yuen Institute	>30 years	2009	59,700	3,522	0.059	
5. Tsing Chung Sin Yuen	>30 years	2009	95,000	15,865	0.167	
6. Chinese Christian Cemetery	>50 years	2013	52,917			
7. Roman Catholic Cemetery	>50 years	2013	37,216			
8. Sandy Ridge Cemetery	>50 years	2011	35,014	4,552	0.130	
9. Wo Hop Shek Cemetery	>50 years	2010	110,940		A VARIA	

Note: For items 1-5, only niches are provided.

- 6.1.2 The trip rates for the existing cemeteries and columbaria are varying from 0.059 to 0.479. The results show that trip rate may vary by a numbers of factors including the location factors and accessibility. Moreover, there is a general observation that newly completed C&C facility would yield higher trip rates and thus it is expected that trip rates would reduce as time lapsed.
- All the existing cemeteries and columbaria have been operated for certain years. In the summary of the survey results shown in **Graph 1**, the survey result indicates that the trip rate of the columbaria could likely decrease with time, despite that the trip rate may vary by location and their size. The trip rates for various columbaria were plotted against the years of operation as shown in **Graph 1** below.



Graph 1: Trip rates for existing cemeteries and columbaria against their operation year

- The trip rates for all operating years are derived by a linear trend-line (y=-0.003x+0.3446) where y=trip rate and x=years of operation) of the trip rates for the 9 existing columbaria/cemeteries survey results. The trend line is found to be intersected at y-axis (i.e. for those newly commissioned niches) at 0.345 visitor/niche/hr (two-way). Therefore the time factor for the newly commissioned niches has been defined by the above time-line equation (y=-0.003x+0.345).
- The functionality of TIA-adopted trip rate equation, which involves visitor count projections, has been verified by 2014 Ching Ming Festival Survey with insignificant difference.
- 6.1.6 It is assumed that the one-way IN flow rate will be the same as one-way OUT flow rate. Then the trip rates from year 0 to 25 are derived from the linear trend line (y = -0.003x + 0.345 where y = trip rate and x = years of operation) and the results are shown in **Table 6.2**.

el year espa	Table 6.2 Change of Peak Hour Trip Rate by Year							
Years of Operation	Trip Rate (visitor/niche/hr)		Years of Operation	Trip Rate (visitor/niche/hr)		Years of Operation	Trip Rate (visitor/niche/ hr)	
	In	Out		In .	Out		In	Out
0	0.172	0.172	9	0.159	0.159	18	0.145	0.145
1	0.171	0.171	10	0.157	0.157	19	0.144	0.144
2	0.169	0.169	11	0.156	0.156	20	0.142	0.142
3	0.168	0.168	12	0.154	0.154	21	0.141	0.141
4	0.166	0.166	13	0.153	0.153	22	0.139	0.139
5	0.165	0.165	14	0.151	0.151	23	0.138	0.138
6	0.163	0.163	15	0.150	0.150	24	0.136	0.136
7	0.162	0.162	16	0.148	0.148	25	0.135	0.135
								-

Table 6.2 Change of Peak Hour Trip Rate by Year

#### 6.2 Recommendation

0.160

17

0.160

6.2.1 It is recommended to adopt the set of trip rates as shown in **Table 6.2** for calculation of the visitor numbers attracted/generated by the development during the design years. Niche allocation schedule will then be derived based on this set of trip rates.

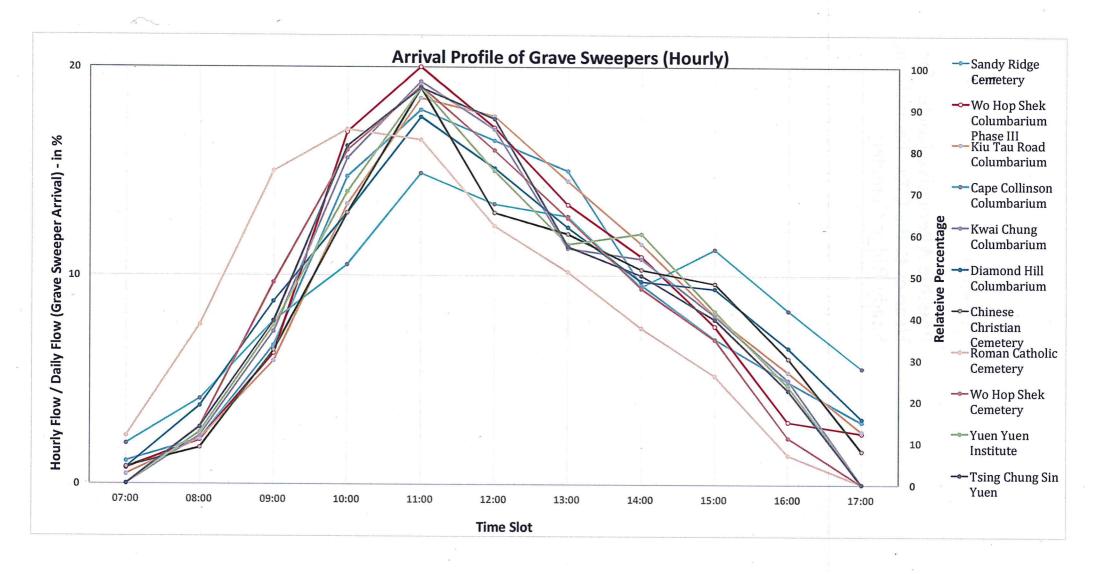
0.147

0.147

#### 6.3 Conclusion

- Based on the above trip rates analysis, the trip rates for the existing cemeteries and columbaria are varying from 0.059 to 0.479 visitor/niche/hr (two-way). The results show that trip rates may vary by location and time. There is no fixed pattern on the trip rate except a general observation of decrease in trip rates as time lapses.
- 6.3.2 It is considered appropriate to establish a set of trip rates that vary with operating years. The results of surveys show a decreasing trend of trip rate over columbarium's operation year. Reference is therefore made to the trip rates derived from 9 existing columbaria/ cemeteries which could provide suitable information for derivation of the time factor (y= -0.003x+0.345 where y = trip rate and x = years of operation) based on the observed trip rate for application to the proposed C&C development at Sandy Ridge Cemetery.
- 6.3.3 The functionality of TIA-adopted trip rate equation, which involves visitor count projections, has been verified by 2014 Ching Ming Festival Survey with insignificant changes.

6.3.4	Therefore, it is considered the set of trip rate adopted in the TIA is
	valid for calculation of the visitor numbers attracted/generated by the
	development for the design years.



Appendix A

## Appendix B

Possible Alternative Routes for Hearses to the C&C Facilities at Sandy Ridge Cemetery

## Appendix B

Possible Alternative Routes for Hearses to the C&C Facilities at Sandy Ridge Cemetery

#### 1.1 Overview

- In the North District Council and Rural Committee meetings during the Feasibility Study (FS) stage, there are concerns that large amount of hearses travel in the North district would affect residents psychologically and cause potential traffic congestions at Man Kam To, on top of the re-opening of Man Kam To Boundary Control Point, opening of the Frontier Closed Area and the future Liantang/ Heung Yuen Wai Boundary Control Point (LT/HYW BCP).
- 1.1.2 In view of this, the following possible alternative routes for hearses (see **Figure A**) are explored to alleviate the public concern on potential overloading in Man Kam To areas and minimise the psychological impact of hearses to residents:
  - Route 1: Via the Fanling Highway to LT/HYW Connection Road and the existing Lin Ma Hang Road (LMHR)
  - Route 2: Via the potential Fanling Bypass under North East New Territories New Development Areas (NENT NDAs)
  - Route 3: Via the proposed viaduct from Fan Kam Road directly to the C&C Facilities

## 1.2 Methodology

1.2.1 The alignments of the alternative routings to C&C facilities are formulated based on the key issues and constraints identified through the desktop study and site inspection. The alignments are designed to avoid and minimise these constraints as far as practicable. In addition to the site constraints, a wide range of factors including land issues, traffic, ecology, air quality, noise, water quality, waste, land contamination, cultural heritage, landscape and visual, cost and implementation are also taken in consideration.

2 Route 1 - Via the Fanling Highway to LT/HYW Conection Road and the existing LMHR

## 2.1 Description of Routing

This alternative route (Refers to as Route 1 hereafter) will make use of the Fanling Highway, LT/HYW Connection Road, existing LMHR and Man Kam To Road (see Figure B). The vehicles will not go through the busy LT/HYW BCP. Instead, they will be going onto slip road from the LT/HYW Connection Road, then connected to roundabout that links back to LMHR. Table 1 below shows the list of projects in the vicinity of Route 1.

Table 1 List of projects in the vicinity of Route 1

Road	Scope of Works	Target Completion Year	Managing Department/ Suggested Managing Department
Works to be carried	out under separate projects	i maiganono-	
LT/HYW Connection Road	To be constructed under Liantang/Heung Yuen Wai Boundary Control Point and Associated Works – Design and Construction (Agreement No: CE 38/2010 (CE))	2018	CEDD
LMHR western section (Ping Che Road to Ping Yuen River section)	Proposed to be widened to 7.3m under Widening of 2 Sections of Lin Ma Hang Road – Investigation (Agreement No: CE51/2013(HY)))	Mid 2018	HyD
Works proposed und LMHR (Ping Yuen		Not later	חיים
River to Man Kam To Road section)	Proposed to be widened from 6m to 7.3m – 2 lane carriageway (also with 2m wide footpath on both sides of the carriageway) under this project	than 2019	HyD

#### **Existing Condition of LMHR**

2.1.2 The existing LMHR connects to Ping Che Road in the south and Man Kam To Road in the west. Majority of the LMHR is of single two-lane configuration (6m wide) (see Appendix C Photos 1 and 2), except for the section near Ping Yuen River which adopts a single track arrangement (3.5m wide) (see Appendix C Photos 3 and 4).

#### Works proposed under CE51/2013(HY)

2.1.3 Widening of LMHR western section (Ping Che Road to Ping Yuen River section) to a 7.3m wide single two-lane carriageway (including a bridge crossing at Ping Yuen River) is proposed under CE 51/2013(HY). The widening works are targeted to complete in end Mid 2018.

#### Works proposed under this project

- As mentioned, for the anticipated increased traffic flows (especially shuttle buses and long haul buses) to the project site via Lin Ma Hang Road, there is a section (from Man Kam To Road to Ping Yuen River) which is considered necessary to be improved, in order to cater the future buses running east-west direction.
- The goal of the improvement is to bring up the existing carriageway width to 7.3m with 2 m footpath on both sides with 2.5% gradient maximum. Such improvement will enhance the carriageway to a safer route for 2-way buses running simultaneously. The total length of the improvement works is about 1.4 km.
- The construction of Lin Ma Hang Road improvement works is anticipated to complete prior to the first intake of the Columbarium (year 2023) to cater for the buses and the future traffic flows.

#### **Key Issues and Constraints**

- Through the desktop study and our site inspection, some constraints such as private lots, indigenous villages (San Uk Ling (新屋嶺), Muk Wu (木湖) and Nga Yiu (瓦窰)), graves, urns, burial ground and Sam Wo Public School are identified along the section of LMHR between Ping Yuen River and Man Kam To Road
- 2.2.2 The Sam Wo Public School is a major premises in Lin Ma Hang. It is located next to registered slope feature no. 3NW-C/C470 along existing LMHR. The extent of slope works will be minimised to avoid affecting the operation of the school.
- 2.2.3 The section of LMHR between Ping Yuen River and Man Kam To Road are surrounded by hilly terrain. Over 10 numbers of registered slope features are identified along this section of LMHR. From the preliminary desktop study, eight cut slopes maintained by Highway Department (Slope no.: 3NW-C/C223, 3NW-C/C224, 3NW-C/C225, 3NW-C/C229, 3NW-C/C230, 3NW-C/C455, 3NW-C/CR456 and 3NW-C/C470) are close to the existing LMHR and might need to be partly modified.

## 2.3 Impact Evaluation

#### Traffic

As mentioned, this route connects the Fanling Highway to the proposed columbarium site via LT/HYW connection road, LMHR and Man Kam To Road. This route is preferred for the people currently within the eastern catchment of the New Territories around the LT/HYW connection road.

- Assuming the hearses will depart at Hung Hom area (where most of the funeral parlours and undertakers of burials located), the estimated total length of this route would be approximately 44 km and its journey time is estimated to be 45 minutes under the ideal 'free flow' condition. On the other hand, the estimated total length of route from Hung Hom area via Sheung Shui District to Man Kam To Road is approximately 36 km and its journey time is estimated to be 36 minutes.
- 2.3.3 The traffic forecasts for 2031 have been investigated. Traffic flows along LMHR (during weekday scenario) would be approximately 230 veh/hr and 225 veh/hr (2-way) for AM and PM peak respectively. The Volume/Capacity ratio (V/C ratio) is estimated to be 0.14 and 0.13, which represent a free flow condition. From our preliminary desktop study, the number of hearses to the development site is estimated to be 23 veh/hr, which is considered minimal. In view of such small amount of vehicular trips, major traffic impact is not expected. However, some part of LMHR is currently substandard. In order to promote safety, a standardized 7.3m (considered as standard width of a two-lane carriageway) is recommended.

#### **Ecology**

2.3.4 The alignment is located along the existing highway corridors and has limited ecological impacts.

#### Air Quality

- 2.3.5 There are scattered air sensitive receivers (ASRs) such as village houses along LMHR between Ping Yuen River and Man Kam To Road, San Uk Ling, Muk Wu and Nga Yiu. The separation distance between the road and the ASRs would be less than 10m. In general, the surrounding area of Route 1 is less developed and the number of ASRs that may be affected by the induced traffic and construction dust would be fewer than options surrounded by more developed areas.
- 2.3.6 This alignment would involve widening of an at-grade road along LMHR which there are a number of existing receivers and the air quality impacts during both construction and operational phases would be relatively larger.

#### **Noise**

2.3.7 There are scattered noise sensitive receivers (NSRs) such as village houses along LMHR between Ping Yuen River and Man Kam To Road, San Uk Ling, Muk Wu and Nga Yiu. As mentioned above, Route 1 is surrounded by less developed area and will affect fewer structures than options surrounded by more developed areas. It follows that Route 1 has comparatively fewer NSRs than the options surrounded by more developed areas.

- 2.3.8 The construction activities for road widening work consist of ground improvement, earthwork and paving while for viaduct construction, more construction activities are involved such as piling and mobile crane. The Sound Power Levels for road widening and viaduct construction are 105 dB(A) and 107 dB(A) respectively accordingly to the recently approved EIA "Development of Lok Ma Chau Loop EIA-212/2013". Therefore, the noise impact during construction phase would be slightly lowered for Route 1.
- 2.3.9 This route will be an at-grade road at which there are a number of existing 3 storeys high NSRs. The noise impact during operational phase is expected to be greater than viaduct options. Nevertheless, the impact can be mitigated by adoption of noise barrier or low noise surfacing, which will be subject to further liaison with the Highways Department on the feasibility of adopting low noise surfacing.

#### **Water Quality**

- 2.3.10 Only landbased construction would be required for the widening works at LMHR and so good site practices can ensure that the impacts are controlled properly.
- 2.3.11 Surface runoff during construction and operational phases would eventually be discharged to Shenzhen River. Good practices could be implemented to remove pollution loading and avoid adverse water quality impacts.

#### Waste

2.3.12 This route only involves minimal improvement works of existing LMHR and the Construction and Demolishing (C&D) waste is expected to relatively less than new road construction. Limited waste production is also expected during operational phase.

#### **Land Contamination**

2.3.13 No potential contamination sites are observed as the road improvement works are carried out along the LMHR.

#### Landscape and Visual

- 2.3.14 Landscape and visual impact is one of the prime concerns in the selection of routings. Existing land on both sides of LMHR between Ping Yuen River and Man Kam To Road are mostly covered with shrubland, woodland and inactive/active farmland. The widening of this section of LMHR will directly affect the roadside trees. Approximately 680 numbers of existing trees will be affected.
- 2.3.15 Open storage yards, existing villages and scattered structures are found along the roadsides. Most of them have direct connection to the road. Three villages along the alignment, namely, San Uk Ling Muk Wu and Nga Yiu, are identified as key Visually Sensitive

Receivers (VSRs). These VSRs will suffer slight to moderate adverse visual impact due to the permanent loss of greening.

2.3.16 This route has no significant visual impact to the surroundings as this route does not involve mega vertical structure, and have only a few key VSRs.

#### **Cultural Heritage**

- 2.3.17 There are no proposed or declared monuments in the vicinity of the section of LMHR between Ping Yuen River and Man Kam To Road.
- 2.3.18 The following graded historic buildings are in the vicinity of the widened LMHR: The Entrance Gate at Muk Wu Wai (Grade 3), Tin Hau Temple (Ta Kwu Ling) (Grade 3) and Nga Yiu MacIntosh Fort (Grade 2). The proposed alignment would not encroach onto these buildings, and therefore impacts are not anticipated.

#### **Land Matter**

A number of private lots are in close proximity to the road edge of the existing LMHR (Ping Yuen River to Man Kam To Road section). Residential housing, temporary structures, open storage yards, graves and burial urms are identified in these private lots (see Appendix C Photos 5 and 6). In particular, three indigenous villages, namely, San Uk Ling, Muk Wu and Nga Yiu are located along the LMHR where improvement works are proposed (see Appendix C Photos 7 and 8). Although the proposed improvement works are endeavoured to avoid substantial land resumption and clearance of existing structures, the works will inevitably affect the village entrance of San Uk Ling and Nga Yiu, and some temporary structures along the alignment. Sufficient time shall be allowed for the land acquisition and land resumption process.

#### Cost

- 2.3.20 The preliminary cost estimate includes the construction cost of the major elements of works and the contingency sums. The base estimate is at the price level of September 2013.
- 2.3.21 The major element of works for this route includes the widening of a section of LMHR (between Ping Yuen River and Man Kam To Road) from 6m to 7.3m, provision of 2m wide footpath on both sides, associated slope works and landscaping works along this section of LMHR, preliminaries and site safety. The total cost is estimated to be HK\$37 million, which is the lowest among the three routings.

#### **Implementation**

2.3.22 This route will make use of the LT/HYW Connection Road and connect to the widened LMHR (Ping Yuen River to Man Kam To Road section) in the west. The construction period of the LT/HYW

BCP and associated works including the LT/HYW Connection Road is 2013 to 2018, whereas the tentative completion year of LMHR widening (Ping Yuen River to Man Kam To Road section) is mid 2018, both of which coincide with our tentative construction programme from 2016 to 2019.

2.3.23 Coordination with LMHR widening project team will be required on the interfacing issues, to avoid any repetitive works and minimise the disturbance to the public.

| Final|

## 3 Route 2 - Via the potential Fanling Bypass under NENT NDAs

## 3.1 Description of Routing

3.1.1 This alternative route (Refers to as Route 2 hereafter), with single 2lane configuration, will connect with the proposed Fanling Bypass Western Section under NENT NDAs (Agreement No: CE 61/2007 (CE)) (see Figure C). Fanling Bypass is proposed as a regional highway linking Fanling North and Fanling Highway to alleviate the anticipated traffic congestion in Fanling and Sheung Shui districts. Its western section will have a single 2-lane arrangement, and will start from a proposed at-grade roundabout with Man Kam To Road near Hung Kiu San Tsuen (紅橋新村). Route 2 is proposed to branch off from the main line of Fanling Bypass which is a viaduct section before the proposed roundabout at Man Kam To Road. It will climb uphill and run adjacent to Man Kam To Road as a viaduct. The proposed route will then go straight to the development site near Shaling Police Post. It will arrive at the proposed platform in the development site via a 400m long road tunnel.

## 3.2 Key Issues and Constraints

- 3.2.1 Through desktop study and site inspection, major constraints including Dongjiang watermains, WSD Western Aqueduct Supply Tunnel, 400kV overhead power transmission line, open storage, police facilities, existing graves, hilly terrain and villages are identified along the proposed Route 2 (see Figure C).
- 3.2.2 The alignment has been carefully selected near Fu Tei Au to avoid impacting Hung Kiu San Tsuen at the east, while minimising the impact to the open storage and hilly terrain at the west as far as practicable. Near the Sandy Ridge Cemetery, the proposed viaduct will go across a piece of agriculture land adjacent to Shaling Village to avoid clearance of the small houses within Shaling Village.
- 3.2.3 The Border District Headquarters and Police Dog Unit And Force Search Unit Training School are located along Man Kam To Road near Shaling Village. These facilities are in operation and shall be maintained. The alignment of this route is designed such that there will be no impact to these structures.
- 3.2.4 The existing 400kV overhead power transmission line runs east-west across Route 2 near Hung Kiu San Tsuen (Refer to Appendix C Photo 10). According to the record map provided by CLP on 27 November 2013, there is approximately 22m vertical clearance between the overhead transmission lines and the existing ground level. Considering the structural depth of the viaduct (assumed to be 2.5m), the minimum vertical ground clearance for electrical safety consideration listed out in HKPSG (7.6m) and the minimum

headroom requirement listed out in SDM (5.1m), the proposed viaduct will cross underneath the overhead power lines without impacting these power lines or avoid being extremely close to the pylons.

- 3.2.5 There are four existing Dongjiang Watermains supplying water from Shenzhen to Hong Kong with diameter 1.2m running along Man Kam To Road (Refer to Appendix C Photo 11). Route 2 will have an intersection point with the existing watermains running on ground level near the Shaling Police Post. These watermains are important water supply trunk mains and diversion is not recommended. Hence, the alignment will span across them to avoid infringing the existing watermains and to maintain its accessibility for maintenance.
- In addition, there exists a WSD Western Aqueduct Supply Tunnel (WAST) in the Sandy Ridge Cemetery which runs across mid-way in the Study Area from North-East to South-West at a range of invert levels at +3.618mPD to +8.596mPD with an outer diameter of 2.935m to 3.6m. The proposed tunnel within the Sandy Ridge has been formulated to minimise the impact to the WAST and its 120m wide tunnel reserve zone by going at least 50m above the WAST (similar to the invert level of the proposed Tunnel A in the feasibility study). Nevertheless, the excavation works for the proposed tunnel within the reserve zone will be further liaised with WSD and their agreement has to be sought before commencement of works.
- 3.2.7 Preliminary desktop study has also identified a number of Pre-1950s and Post-1950s graves within the Sandy Ridge Cemetery. As there will be difficulties in clearing the existing graves, the alignment of Route 2 is designed to avoid such conflict as far as practicable. However, two Pre-1950s graves in close proximity to the proposed alignment might be affected during the construction of the proposed tunnel section. In this regard, detailed designs and assessments shall be carried out with appropriate monitoring measures to be proposed during the construction, should this route be developed eventually.

## 3.3 Impact Evaluation

#### **Traffic**

- 3.3.1 This route connects the existing Fanling Highway, via the proposed Fanling Bypass and proposed viaduct, to the proposed columbarium development. By using the same approach as Route 1, the estimated total length from Hung Hom area to proposed development site using Route 2 is approximately 35 km and the estimated journey time is 38 minutes under 'free flow' condition.
- 3.3.2 Route 2 is the most direct connection for vehicles to access the C&C facilities.
- 3.3.3 The traffic forecasts for Year 2031 along Man Kam To Road (during weekday scenario) is approximately 1,140 veh/hr and 1,200 veh/hr (2-way) for AM and PM peak respectively, and its V/C ratio is

estimated to be 0.38 and 0.4, which reflects an easy flow condition. For Fanling Bypass, the traffic forecasts for Year 2031 is approximately 2,650 pcu/hr and 2,630 pcu/hr (2-way) for AM and PM peak respectively, and its V/C ratio is estimated to be 0.39 for both AM and PM peak, which reflects an easy flow condition.

3.3.4 The additional vehicular trips brought by the hearses, or even the shuttle buses and other vehicles using this route to the proposed columbarium development is not expected to create major traffic impact.

#### **Ecology**

- 3.3.5 The alignment is already highly disturbed near the proposed Fanling Bypass. Therefore, limited ecological impacts are expected for the part of the proposed alignment adjacent to the existing Man Kam To Road.
- 3.3.6 However, the part of the proposed alignment near Sandy Ridge will pass through ecological important areas such as agricultural land south of Lo Wu which is important for water birds. During construction phase, it will affect water birds and Eurasian Otter using this agricultural land. During operational phase, habitat will lost directly under the alignment and areas of ecologically important habitat (primarily agricultural land) disturbed along the alignment would require areas of permanent mitigation. This would require a ratio of 1:1 for habitats under the viaduct and at 0.5:1 for all areas within 100m of the alignment (based on current practices). Besides, there may be residual impacts on fragmentation of habitats used by Eurasian Otter. It is anticipated that the public and the green groups would challenge the suitability of this option.

#### **Air Quality**

- 3.3.7 The proposed viaduct branching out from Fanling Bypass would run close to a number of planned ASRs, including the proposed Police Driving and Traffic Training Division and proposed Weapons Training Division recommended under the NENT NDAs. The separation distance would be less than 5m. Other than the planned ASRs, some existing ASRs such as the village houses at Hung Kiu San Tsuen, village houses along Man Kam To Road would also be potentially affected. The separation distance would be approximately 15m. In general, the number of ASRs in the vicinity of the alignment is more than Route 1.
- 3.3.8 The viaduct construction would generate less fugitive dust as compared to the excavation for Route 1, and therefore the impacts during construction phase would be less than Route 1. Furthermore, the viaduct structure would increase the vertical separation distance for most of the ASRs and the impacts during operational phase would also be less than that of Route 1 which is an at-grade road.

#### **Noise**

- As mentioned above, the proposed viaduct branching out from Fanling Bypass would run close to a number of planned and existing NSRs, with a separation distance of less than 5m and up to 15m. The proposed Route 2 will affect more premises than Route 1 and hence has comparatively more NSRs than Route 1.
- 3.3.10 The construction of viaduct will generate more construction noise as compared to road widening work. The noise impacts during construction phase would be more adverse than Route 1.
- 3.3.11 On the other hand, the viaduct structure would increase the vertical separation distance for most of the NSRs and the impacts during operational phase would be less than that of Route 1 which is an atgrade road.

#### Water Quality

- 3.3.12 Since only landbased construction would be required, good site practices can ensure that the impacts are controlled properly.
- 3.3.13 Surface runoff during construction and operation would be directly discharged to Ng Tung River before arriving Shenzhen River. Potential impact will be from the construction surface run-off. However, with proper site management practices, pollution loading can be removed and significant water quality impact is not anticipated.

#### Waste

3.3.14 Waste production during new viaduct construction is anticipated to be relatively more than road widening work. On the other hand, limited waste production is expected during operational phase.

#### **Land Contamination**

3.3.15 Industrial activities are observed alongside of Route 2 and it is possible to have potential land contamination and detailed investigation is required.

#### Landscape and Visual

- 3.3.16 Some village houses in Hung Kiu San Tsuen and Shaling Village, which are key VSRs, are located adjacent to this alternative route. They will suffer moderate to substantial adverse impact due to the proposed viaduct structure.
- 3.3.17 The rural landscape resource in Cheung Po Tau and the hillside woodland of Sandy Ridge will be affected by the proposed viaduct. Existing roadside tree planting along Man Kam To Road will suffer indirect impact or permanently lost. Approximately 570 numbers of existing trees will be affected.

#### **Cultural Heritage**

- 3.3.18 There are no proposed/declared monuments or proposed/graded historic buildings in the vicinity of the proposed alignment.
- 3.3.19 Limited impacts may occur on potential archaeological deposits as the excavation work areas are limited to the viaduct piers.

#### **Land Matter**

3.3.20 The road alignment is designed to minimise the number of affected private lots as far as practicable by running adjacent to Man Kam To Road. However, the alignment will inevitably affect a number of open storages within private lots along Man Kam To Road and a piece of private agriculture land adjacent to Shaling Village. Sufficient time shall be allowed for the land acquisition and land resumption process.

#### Cost

- 3.3.21 The preliminary cost estimate includes the construction cost of the major elements of works and the contingency sums. The base estimate is at the price level of September 2013.
- 3.3.22 The major element of works for this route includes 1.4km long viaduct, 400m long tunnel, landscaping works, preliminaries and site safety. The total cost is estimated to be HK \$0.7 billion, which is higher than Route 1.

#### **Implementation**

- This route is connected to Fanling Bypass Western Section in the east and is highly dependent on the implementation of the proposed Fanling Bypass. The tentative opening year for Fanling Bypass Eastern and Western Section is 2023 and 2029 respectively, which is later than the tentative first intake of niches. This route is thus not considered feasible in view of the programme mismatch.
- 3.3.24 In addition, this route consists of a viaduct more than 100 m in length between abutments, which is a designated project (DP) under Part I, Schedule 2 of the EIAO and requires EPs prior to its construction and operation. Extra time shall be allowed for assessing the nature and extent of environmental impacts arising from the construction and operation of the viaduct.
- 3.3.25 Besides, the proposed viaduct will pass through the agriculture land south of Lo Wu which is important for water birds and Eurasian Otter. It may attract public concern from environmental points of view. Serious objections from Green Group are anticipated which may cause severe delay to the programme.

| Final|

# 4 Route 3 - Via the proposed viaduct from Fan Kam Road directly to the C&C Facilities

## 4.1 Description of Routing

This alternative route (Refers to as Route 3 hereafter) will connect to 4.1.1 Fan Kam Road using mainly viaduct (see Figure D). The route consists of approximately 3.5km long viaduct, 100m at-grade road and 500m tunnel. Two addition lanes will be branched off from the main line of Fan Kam Road near Fanling Pumping Station and go over the edge of Hong Kong Golf Course. The viaduct will climb uphill and cross over the proposed elevated slip road under NENT NDAs at a level of approximately +26mPD. The road will then cross a piece of private agricultural land between the two indigenous villages, Tsung Pak Long (松柏塱) and Tai Tau Leng (大頭嶺), and go north along Ng Tung River. The road will go down gradually after crossing the Sheung Yue River and become an at-grade road near the Lo Wu Correctional Institution to avoid conflict with the 400kV power line. The road will climb uphill again, turn eastwards to cross Ng Tung River and go straight into the development site. The road will finally arrive the proposed platform at the development site via a 500m long road tunnel.

## 4.2 Key Issues and Constraints

- 4.2.1 Route 3, which is situated in more urbanised area, is the most constrained among the three routings. Site constraints such as Shek Wu Hui Sewage Treatment Works, Sheung Shui Slaughter House, Sheung Shui Water Treatment Works, East Rail, 400kV overhead power transmission line, WSD Western Aqueduct Supply Tunnel, Ng Tung River, golf course, existing graves, some indigenous villages and existing housing development in Sheung Shui are identified along its alignment (see Figure D).
- 4.2.2 A majority of premises to the east of Fan Kam Road is high-rise buildings. North District Hospital and existing housing development such as Tai Ping Estate, Choi Po Court and Choi Yuen Estate are located along Fan Kam Road and Fanling Highway. These physical constraints largely limit the proposed viaduct from going east into the Sheung Shui New Town.
- 4.2.3 The alignment is also constrained by the Hong Kong Golf Course and its associated facilities such as car park and golf club along Fan Kam Road. The golf course is currently a private land under New Grant Lot. Although the alignment of Route 3 is endeavoured to avoid the golf course as far as practicable, the alignment will inevitably affect the edge of golf course near Castle Peak Road and overpass the car park located to the east of Fan Kam Road.

- 4.2.4 The presence of the aboveground MTR East Rail (Lo Wu to Sheung Shui Section) and the associated structures along the east bank of Ng Tung River also pose large constraint to the alignment. There is an intersection point with the East Rail near MTR Lo Wu Station. Approximately 100m of proposed viaduct section falls within the MTR railway protection boundary. MTRCL's agreement will have to be sought in order for this alignment to be feasible.
- There are a number of existing premises along the riverbank of Ng Tung River. The Shek Wu Hui Sewage Treatment Works and Sheung Shui Slaughter House are located to the south of Ng Tung River whereas the Sheung Shui Water Treatment Works are situated at the north of the river. These facilities are currently in operation and their lots are currently under permanent Government Land Allocation. An indigenous village, Sheung Shui Heung (上水鄉), is also located at the east bank of Ng Tung River. The alignment of this route is designed such that there will be no impact to these structures. The Ng Tung River, a main drainage watercourse and a highly ecologically sensitive receiver, is a site constraint itself. The alignment is therefore carefully selected to minimise the disturbance to the river.
- 4.2.6 Indigenous villages such as Tsung Pak Long and Tai Tau Leng are situated north of the Fanling Highway. To avoid affecting the village houses in these two villages, Route 3 will go across a piece of private agricultural land between the two villages.
- 4.2.7 The proposed single-lane elevated slip road branching out from the Fanling Highway to bypass the existing Po Shek Wu Interchange under NENT NDAs is also considered when formulating the alignment. The proposed viaduct will likely cross over the slip road due to the physical constraints on site. The alignment of Route 3 is designed to avoid crossing the slip road at its highest road level of approximately +25mPD to reduce the visual impact as far as practicable.
- 4.2.8 There is a 400kV overhead power transmission line running eastwest across Route 3 near Lo Wu Correctional Institution. Diversion to the 400kV overhead power line and its associated pylons is not recommended in terms of power supply security. According to the record map provided by CLP on 27 November 2013, the vertical clearance between the power lines and the existing ground level is only 5.6m. Considering the structural depth of the viaduct (assumed to be 2.5m), the minimum vertical ground clearance for electrical safety consideration listed out in HKPSG (7.6m) and the minimum headroom requirement listed out in SDM (5.1m), there will not be enough clearance if viaduct is to be proposed in this section. Therefore, approximately 100m at-grade vehicular access is proposed for this section of Route 3.
- 4.2.9 In addition, there exists a WSD Western Aqueduct Supply Tunnel

(WAST) in the Sandy Ridge Cemetery which runs across mid-way in the Study Area from North-East to South-West at a range of invert levels at +3.618mPD to +8.596mPD with an outer diameter of 2.935m to 3.6m. The proposed tunnel within the Sandy Ridge has been formulated to minimise the impact to the WAST and its 120m wide tunnel reserve zone by going at least 50m above the WAST (similar to the invert level of the proposed Tunnel A in the feasibility study). Nevertheless, the excavation works for the proposed tunnel within the reserve zone will be further liaised with WSD and their agreement has to be sought before commencement of works.

4.2.10 Preliminary desktop study has also identified a number of Pre-1950s and Post-1950s graves within the Sandy Ridge Cemetery. As there will be difficulties in clearing the existing graves, the alignment of Route 2 is designed to avoid such conflict as far as practicable. However, two Pre-1950s graves in close proximity to the proposed alignment might be affected during the construction of proposed tunnel section. In this regard, detailed designs and assessments shall be carried out with appropriate monitoring measures to be proposed during the construction, should this route be developed eventually.

## 4.3 Impact Evaluation

#### **Traffic**

- 4.3.1 By using the same approach as Routes 1 and 2, the estimated total length from Hung Hom area to proposed development site using this route will be approximately 40 km and its journey time is estimated to be 42 minutes under 'free flow' condition.
- 4.3.2 As this route has no direct connection with MTR Fanling or Yuen Long Station, the route is not expected to be used by shuttle buses operated between these MTR Stations and Sandy Ridge Columbarium during festive periods. It is anticipated that this route would be mainly used by hearses or private vehicles to the columbarium.
- 4.3.3 The traffic forecasts for 2031 along Fan Kam Road (during weekday scenario) is approximately 1,020 veh/hr and 800 veh/hr (2-way) for AM and PM peak, and its V/C ratio would be 1.3 and 1.0, representing a manageable to severe degree of congestion. Currently, Fan Kam Road is approximately 5.5m in width (kerb-to-kerb) and is considered to be substandard. Fan Kam Road widening work will be required but its implementation is still uns at this moment.

#### **Ecology**

4.3.4 This alignment has significant ecological impacts to a number of highly sensitive receivers including Long Valley, Ho Sheung Heung egretry, Ng Tung River, and agricultural land near Tsung Pak Long and south of Lo Wu. These impacts would be highly controversial requiring challenging mitigations.

- 4.3.5 Long Valley, located extremely close to the proposed viaduct along Ng Tung River, is a unique habitat in Hong Kong and is highly important for a suite of wetland dependent birds. The area is subject to government funded Management Agreements which aim to promote wildlife friendly agriculture. During construction phase, the water birds using Long Valley will be affected.
- 4.3.6 Ho Sheung Heung egretry near the proposed alignment is a very important egretry supporting a substantial proportion of Chinese Pond Herons which breed in Hong Kong. There is a high potential that the breeding egrets will suffer from direct impacts during construction phase.
- 4.3.7 The alignment will cross over a piece of agricultural land east of Tsung Pak Long which are important habitat for water birds. It will also affect the large water birds using Ng Tung River. Besides, the agriculture land to the south of Lo Wu, which is affected by land resumption, is important for water birds and also a known location for Eurasian Otter. It also has a strong connectivity to Long Valley.
- 4.3.8 During operational phase, similar compensation (i.e. Route 2) of agricultural land may be required and the land take for this would be significant. In addition, there may be residual impacts on disruption of flightlines for egret breeding in the Ho Sheung Heung egretry. Similar to Route 2, it is anticipated that the public and the green groups would challenge the suitability of this option.

#### **Air Quality**

- 4.3.9 There are a number of ASRs such as village houses in Tsung Pak Long, Tai Tau Leng and scattered houses along Ng Tung River. The number of ASRs in the vicinity of the alignment is more than that for Route 1. The separation distance between ASRs and the proposed alignment is 8 50m.
- 4.3.10 The viaduct construction would generate less fugitive dust as compared to the excavation for Route 1, and therefore the impacts during construction phase would be less than Route 1. Moreover, the viaduct structure would increase the vertical separation distance for most of the ASRs and the impacts during operational phase would also be less than that of Route 1 which is an at-grade road.

#### Noise

- 4.3.11 There are a number of NSRs such as village houses in Tsung Pak Long, Tai Tau Leng and scattered houses along Ng Tung River. The number of NSRs in the vicinity of the alignment is more than that for Route 1.
- 4.3.12 Similar to Route 2, the viaduct construction in Route 3 will generate more construction noise as compared to road widening work. The noise impacts during construction phase would be more than Route 1.

4.3.13 Since the viaduct structure would increase the vertical separation distance for most of the NSRs, the impacts during operational phase would also be less than that of Route 1 which is an at-grade road.

#### **Water Quality**

- 4.3.14 Since only landbased construction would be required, good site practices can ensure that the impacts are controlled properly.
- 4.3.15 Surface runoff would be directly discharged to Ng Tung River and Sheung Yue River before arriving Shenzhen River. Potential impact will be from the construction surface run-off. However, with proper site management practices, pollution loading can be removed and significant water quality impact is not anticipated.

#### Waste

4.3.16 Waste production during construction phase is anticipated to be most significant among the three alignments due to its longest viaduct alignment. On the other hand, limited waste production is expected during operational phase.

#### **Land Contamination**

4.3.17 No potential contamination sites are observed as Route 3 connects to Sandy Ridge through viaduct over abandoned area.

#### Landscape and Visual

- 4.3.18 The long and massive viaduct structure will create substantial adverse visual impact to the surrounding key Visually Sensitive Receivers (VSRs), such as Tsung Pak Long, Tai Tau Leng, Choi Yuen Estate, and some residential structures along Long Valley.
- 4.3.19 The construction of the proposed viaduct will affect the existing landscape resources found in Long Valley, which are considered to have medium to high value. As the proposed route goes adjacent to most part of the Long Valley and several rivers, including Shek Sheung River and Sheung Yue River, the viaduct will be an obstacle to the existing continuous rural landscape resources, and the existing trees along Shek Sheung River will suffer indirect impact or permanently lost. Approximately 1330 numbers of existing trees will be affected.
- 4.3.20 The extensive viaduct structure will cause substantial adverse landscape and visual impact to those rural residential areas. The impact is considered as the highest when compared with the other alternative routes.

#### **Cultural Heritage**

4.3.21 Minimal archaeological potential along most of the proposed alignment is expected as the routing is in close proximity to large river.

There are no proposed/declared monuments in the vicinity of the proposed alignment. The following graded historic buildings are located in the vicinity of the proposed alignment in the historical village of Tsung Pak Long: Hakka Wai (Residential Houses, Study Hall, Watchtower, Enclosing Walls together with Entrance Gate and Wong Shek Chung Ancestral Hall) (all Grade 1), Bok Man School (Main Block and School Building) (both Grade 3), the Chan Ancestral Hall (Grade 3), Chan Study Hall (Entrance Gate and Main Building) (both Grade 3), Dun Hau Tong (Grade 3), Lau Ancestral Hall (Grade 3) and Suen Shing Tong (Grade 3). However, the proposed alignment would not encroach onto these buildings, so impacts are not anticipated.

#### Land Matter

4.3.23 The road alignment is designed to minimise the number of affected private lots as far as practicable by running along the west bank of Shek Sheung River and Ng Tung River. However, a large piece of private agricultural land between Tsung Pak Long and Tai Tau Leng, and some open storage between Castle Peak Road and Fanling Highway will be inevitably affected. Land resumption of partial areas of golf course near Castle Peak Road will also be required. Sufficient time shall be allowed for the land acquisition and land resumption process.

#### Cost

- 4.3.24 The preliminary cost estimate includes the construction cost of the major elements of works and the contingency sums. The base estimate is at the price level of September 2013.
- 4.3.25 The major element of works for this route includes 3.9km long viaduct, 100m at-grade road, 500m long tunnel, landscaping works, preliminaries and site safety. The total cost estimated is HK \$1.5 billion, the highest among the three options. Besides, the widening works of Fan Kam Road from 5.5m to 7.3m is estimated to be HK\$39 million. This route, serving mainly hearses, would be under-utilised and is not favourable from cost-effective point of view.

#### **Implementation**

- 4.3.26 There will be an intersection point with the NENT NDAs along the Fanling Highway near Po Shek Wu Interchange. This route will go over the proposed elevated slip road branching out from the Fanling Highway. According to the latest implementation programme of NENT NDA study, the tentative completion year of the proposed slip road is 2029.
- 4.3.27 The interface increases the complexity of the construction as the column foundation of the proposed viaduct under this project might have to cater for the loading of the proposed slip road from the Fanling Highway under NENT NDAs. Close liaison with the NENT NDAs project team on the interfacing issues will be required.

- 4.3.28 The branching of the proposed viaduct from Fan Kam Road will require Fan Kam Road widening works, as mentioned before. The implementation programme has to consider the programme of Fan Kam Road widening works which implementation is still unforeseen at this moment.
- 4.3.29 This route, consisting of a viaduct of more than 100 m in length between abutments, is a designated project (DP) under Part I, Schedule 2 of the EIAO and requires EPs prior to its construction and operations. Extra time shall be allowed for assessing the nature and extent of environmental impacts arising from the construction and operation of the viaduct.
- 4.3.30 In addition, the proposed viaduct is extremely close to a number of ecological sensitive receivers including Long Valley, Ho Sheung Heung egretry, Ng Tung River, and agricultural land near Tsung Pak Long and south of Lo Wu. It may attract public concern from environmental points of view. Serious objections from Green Group are anticipated which may cause severe delay to the programme.

#### 5 Implementation Strategy

#### **5.1** Route 1

- 5.1.1 The proposed road widening works in Route 1 is not a DP under the EIAO and is expected to have limited ecological impact. However, the road widening works of Route 1 will change the scope of the Project and may need to revise the EIA Study Brief (ESB-257/2013).
- 5.1.2 The revised EIA project profile was issued by EPD in April 2014 by incorporating the proposed improvement works at LMHR.

#### **5.2** Route 2

As mentioned, Route 2 is a DP under the EIAO and requires EPs prior to its construction and operations. Extra time shall be allowed for revising the EIA Study Brief and assessing the nature and extent of environmental impacts arising from the construction and operation of the viaduct. As the project is under a tight schedule, it is suggested to conduct the construction works of Route 2 under a separate study to avoid severe delay to the programme.

#### 5.3 Route 3

5.3.1 Similar to Route 2, Route 3 is a DP under the EIAO and requires EPs prior to its construction and operations. As the project is under a tight schedule, it is suggested to conduct the construction works of Route 2 under a separate study to avoid severe delay to the programme.

| Final|

## 6 Comparison of the three alternative routes for Hearses

Based on the above discussion, the merits and demerits of the three alternative routings for hearses to C&C facilities are summarised in the table below:

 Table 2
 Comparison of the three alternative routes

		Route 1	Route 2	Route 3
Scope of Work	,	- Widening of 1.4km long existing LMH Road, footpath and associated slope works	- Construction of 1.4 km viaduct - Construction of 400 m tunnel	<ul> <li>Construction of 3.9 km viaduct,</li> <li>Construction of 100 m at-grade road</li> <li>Construction of 500 m tunnel</li> </ul>
Key Issues and Constraints		- The surrounding area of Route 1 is less developed and have the least site constraints	- The surrounding area of Route 2 is more developed and have more site constraints	- The surrounding area of Route 3 is mostly urbanised and have the most site constraints
Traffic	Pros	- Vehicles will experience faster speed along Liantang/Heung Yuen Wai Connection Road	- Slightly shortest journey time (38 mins) from popular area of funeral parlour (Hung Hom) compared to other options Most direct road connection to the C&C facilities which may be used by shuttle buses or other vehicles	N/A
	Cons	- Slightly longer journey time of 45 mins from popular area of funeral parlour (Hung Hom)	N/A	<ul> <li>Slightly longer journey time (42 mins) from popular area of funeral parlour (Hung Hom)</li> <li>Fan Kam Road will be under manageable to severe degree of congestion in 2031 and road widening work will be required</li> <li>No direct connection between MTR Fanling or Yuen Long Station and so is not expected to be used by shuttle buses operated between these MTR stations and Sandy Ridge</li> </ul>
Ecology	Pros	- Limited ecological Impact	N/A	N/A
	Cons	N/A	- Ecological impacts to the agriculture land south of Lo Wu for which is important for water birds	- Significant ecological impacts to a number of highly sensitive receivers including Long Valley, Ng Tung River, Ho Sheung Heung egretry, agricultural land near Tsung Pak Long and south of Lo Wu for which impacts would be highly controversial requiring challenging mitigations

Air Quality	Pros	- Fewer numbers of ASRs than Route 2 and 3	- The viaduct option will has less air impact during construction and operational phase	- The viaduct option will has less air impact during construction and operational phase
	Cons	The widening of an at-grade road will have more air impact during construction and operational phase	- More numbers of ASRs	- More numbers of ASRs
Noise	Pros	<ul> <li>Fewer number of NSRs than Route 2 and 3</li> <li>Less noise impact during construction phase</li> </ul>	- Less noise impact during operational phase	- Less noise impact during operational phase
e - il,is;	Cons	<ul> <li>At-grade road have more noise impact than viaduct during operational phase</li> <li>Noise mitigation measures, e.g. noise barriers and low noise surfacing may be required</li> </ul>	<ul> <li>More number of NSRs</li> <li>New road construction lead to more noise impact during construction phase than road widening work</li> </ul>	<ul> <li>More number of NSRs</li> <li>New road construction lead to more noise impact during construction phase than road widening work</li> </ul>
Water Quality	Pros	<ul> <li>Since only landbased construction would be required, good site practices can ensure that the impacts are controlled properly.</li> </ul>	- Since only landbased construction would be required, good site practices can ensure that the impacts are controlled properly.	- Since only landbased construction would be required, good site practices can ensure that the impacts are controlled properly.
	Cons	<ul> <li>Surface runoff during construction and operation would eventually be discharged to Shenzhen River.</li> </ul>	<ul> <li>Surface runoff during construction and operation would be directly discharged to Ng Tung River before arriving Shenzhen River.</li> </ul>	- Surface runoff during construction and operation would be directly discharged to Ng Tung River before arriving Shenzhen River.
Waste	Pros	<ul> <li>Relatively less waste for the proposed widening as compared to the new road construction for Route 2 &amp; 3.</li> <li>Limited waste production during operational phase.</li> </ul>	- Limited waste production during operational phase	- Limited waste production during operational phase
i	Cons	N/A  Alternation of the content of t	- Relatively more waste production than Route 1 but less significant than Route 3.	- Most significant waste production among 3 routes as it is the longest alignment.
Land Contamination	Pros	<ul> <li>No potential contamination sites are observed as Route 1 is proposed along existing LMHR.</li> </ul>	N/A	- No potential contamination sites are observed as Route 3 connects to Sandy Ridge through viaduct over abandoned area.

	Cons	N/A	- Industrial activities are observed alongside Route 2 and so there may be some potential land contamination.	N/A
Landscape and Visual	Pros	- Least impact compared with the other two alternative routes.	- Least number of existing trees (570 nos.) will be affected	N/A
	Cons	- More existing trees (680 nos.) will be affected when compared with Route 2	- More impact when compared with Route 1	<ul> <li>Most number of existing trees (1330 nos.) will be affected</li> <li>Substantial adverse landscape and visual impact to those rural residential areas.</li> <li>Highest impact compared with the other two alternative routes.</li> </ul>
Cultural Heritage	Pros	<ul> <li>No proposed/declared monuments in the vicinity of the proposed road widening.</li> <li>Some graded historic buildings are in the vicinity of the widened LMHR. However, the widened LMHR would not encroach onto these buildings and impacts are not anticipated.</li> </ul>	<ul> <li>Limited impacts may occur on potential archaeological deposits due to excavation work areas for viaduct piers.</li> <li>No proposed/declared monuments or proposed/graded historic buildings in the vicinity of the proposed alignment.</li> </ul>	<ul> <li>Minimal archaeological potential along most of the proposed alignment due to close proximity of large river</li> <li>No proposed/declared monuments in the vicinity of the proposed alignment.</li> <li>Some graded historic buildings are located in the vicinity of the proposed alignment. However, the proposed alignment would not encroach onto these buildings and impacts are not anticipated.</li> </ul>
	Cons	N/A	N/A	N/A
Land Matter	Pros	Substantial land resumption and clearance of existing structure is not required	Substantial land resumption and clearance of existing structure is not required	- Substantial land resumption and clearance of existing structure is not required
	Cons	N/A	- The alignment will inevitably affect a number of open storages within private lots along Man Kam To Road and a piece of private agriculture land adjacent to Shaling Village. Sufficient time shall be allowed for the land acquisition and land resumption process.	- Partial area of the Hong Kong Golf Course would require land resumption

Cost	Pros	Lowest cost estimate of \$37 million     Route 1 strikes a balance between cost and the volume of anticipated traffic	- This Route is considered cost-effective as it has the possibility to be used by shuttle buses and other vehicles as well	N/A
	Cons	N/A	- Higher cost estimate (\$ 0.7 billion) than Route 1	<ul> <li>Highest cost estimate of \$ 1.5 billion (excluding the road widening cost of Fan Kam Road which is estimated to be HK\$39million)</li> <li>The route is mainly for hearses and is not considered to be cost effective.</li> </ul>
Implementation	Pros	The programme date of LT/HYW BCP and LMH widening will be ready by the time of the first intake of niches.	N/A	N/A
	Cons	N/A	<ul> <li>The programme date of Fanling Bypass is 8 years later than the first intake of niches. The route is not considered to be feasible due to programme mismatch.</li> <li>Serious objections from environmental point of view are anticipated which may cause severe programme delays.</li> <li>The route involves a DP and extra time shall be allowed for revising the EIA Study Brief and carrying out the EIA.</li> </ul>	<ul> <li>Interfacing issue with the proposed slip road in Fanling Highway under the NENT NDAs</li> <li>Fan Kam Road is substandard and road widening is necessary, but its implementation is uncertain</li> <li>Serious objections from environmental point of view are anticipated which may cause severe programme delays.</li> <li>The route involves a DP and extra time shall be allowed for revising the EIA Study Brief and carrying out the EIA.</li> </ul>

#### 7 Conclusions

## 7.1 Route 1 – Via the Fanling Highway to LT/HYW Connection Road and the existing LMHR

- 7.1.1 Route 1 will make use of the Fanling Highway to LT/HYW Connection Road and the existing LMHR and Man Kam To Road to the columbarium development. The major scope of works includes minimal improvement works of a section of LMHR (between Ping Yuen River and Man Kam To Road) which is not covered by CE51/2013(HY), 2m wide footpath on both sides of the carriageway and its associated slope works.
- 7.1.2 In general, Route 1 has minor impact on traffic, ecology, air, noise, water, waste, land contamination, landscape and visual and cultural heritage. Its impact to the environment and local community can be minimised after adoption of good site practice and proper implementation of mitigation measures.
- 7.1.3 This route does not require substantial land resumption or clearance of existing structures. However, some temporary structures and open storage on private lots will be inevitably affected.
- 7.1.4 Route 1 has the lowest cost estimate of HK\$37 million among the three options. The implementation programme of the interfacing projects (LT/HYW Connection Road and LMHR widening works) coincide with our tentative construction programme from 2015 to 2019.

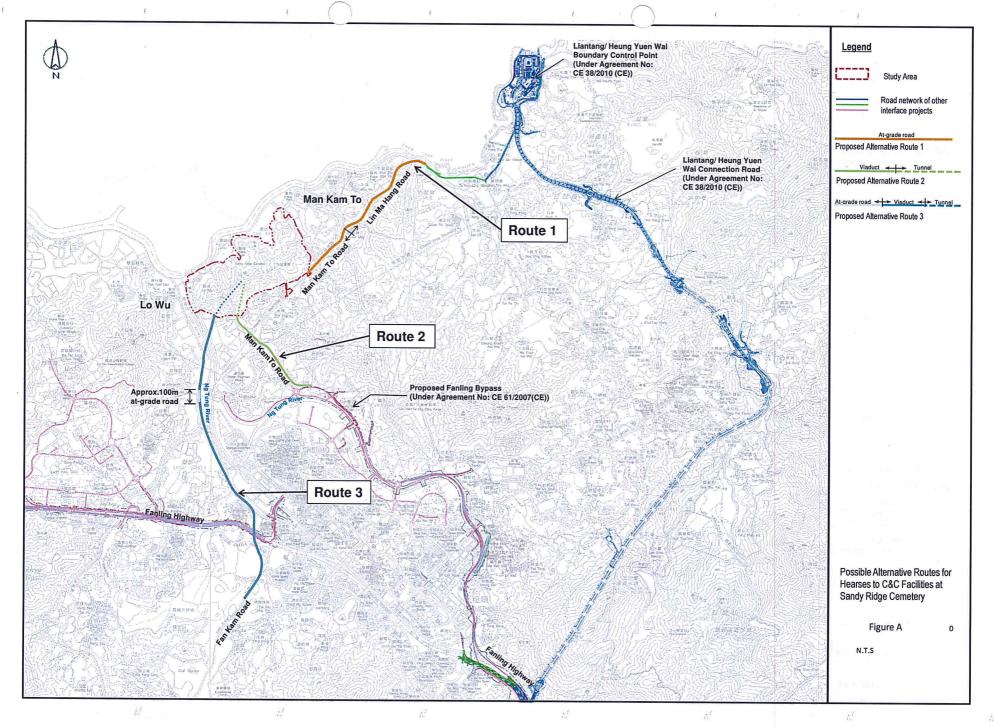
## 7.2 Route 2 – Via the potential Fanling Bypass under NENT NDAs

- 7.2.1 Route 2 will make use of the potential Fanling Bypass under NENT NDAs to the columbarium development. The major scope of works includes constructing a1.4 km viaduct and a 400 m tunnel.
- 7.2.2 In general, Route 2 has minor impact on traffic, air, noise, water, waste, land contamination, landscape and visual and cultural heritage but would have great impact on ecology. In particular, the agriculture land south of Lo Wu will be affected.
- 7.2.3 Similar to Route 1, Route 2 does not require substantial land resumption or clearance of existing structures. However, some agriculture land and open storage on private lots will be inevitably affected.
- 7.2.4 The cost estimate (HK\$0.7 billion) of Route 2 is higher than Route 1 but lower than Route 3. In terms of implementation, Route 2 is highly dependent on the implementation of the proposed Fanling Bypass, which will not be fully open until 2029. The tentative opening year of Fanling Bypass is later than the tentative first intake of niches. Therefore, this route is not considered feasible in view of the programme mismatch. Moreover, Route 2 involves a DP and extra time shall be allowed for revising the EIA study brief and carrying out the EIA.

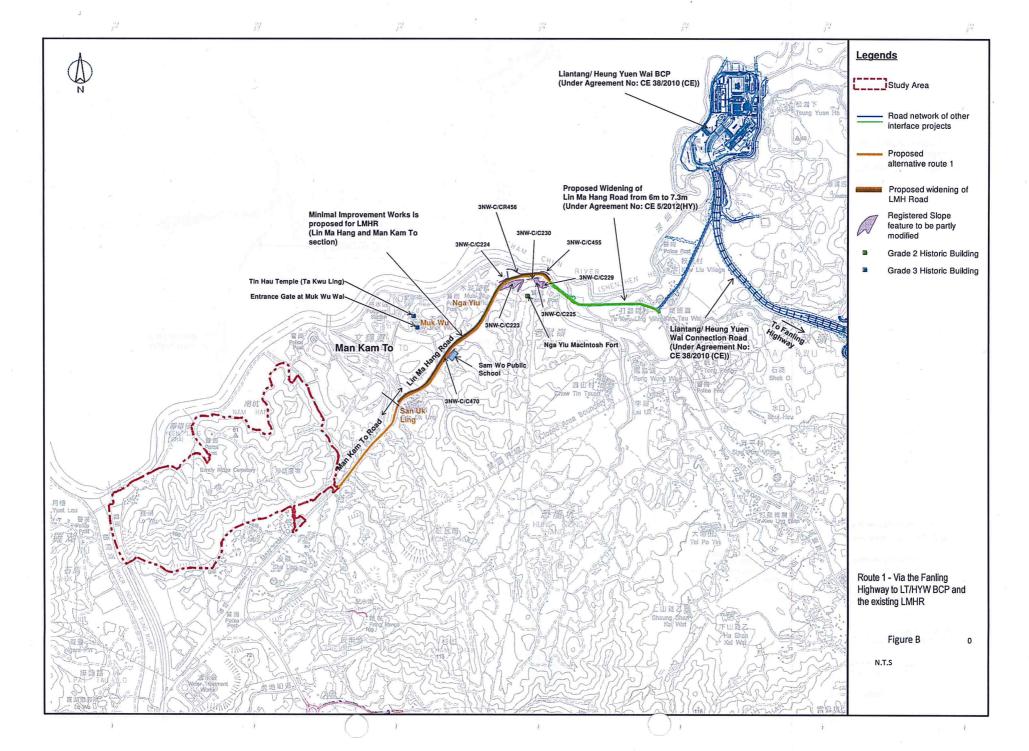
- 7.3 Route 3 Via the proposed viaduct from Fan Kam Road directly to the C&C facilities
- 7.3.1 Route 3 will make use of the existing Fan Kam Road to the columbarium development. The major scope of works includes constructing a 3.9 km viaduct, 100m at-grade road and a 500 m tunnel.
- 7.3.2 In general, Route 3 has minor impact on air quality, noise, water quality, waste, land contamination and cultural heritage but would cause great impact on ecology, landscape and visual, and traffic. In particular, Route 3 would have significant ecological impact to a number of highly sensitive receivers such as Long Valley, Ng Tung River and Ho Sheung Heung egretry. These impacts would be highly controversial requiring challenging mitigations.
- 7.3.3 Similar to Routes 1 and 2, Route 3 does not require substantial land resumption or clearance of existing structures. However, some agriculture land on private lot and partial area of Hong Kong Golf Course will be inevitably affected.
- Route 3 has the highest cost estimation of HK\$ 1.5 billion (excluding the road widening cost of Fan Kam Road which is estimated to be HK\$39million) and is considered not cost-effective in view of its low utilisation. In terms of implementation, the implementation programme has to consider the programme of Fan Kam Road widening works which implementation is still unforeseen at this moment. Strong objection is anticipated from environmental points of view which may cause severe programme delay. Furthermore, this route involves a DP and extra time shall be allowed for revising the EIA study brief and carrying the EIA.

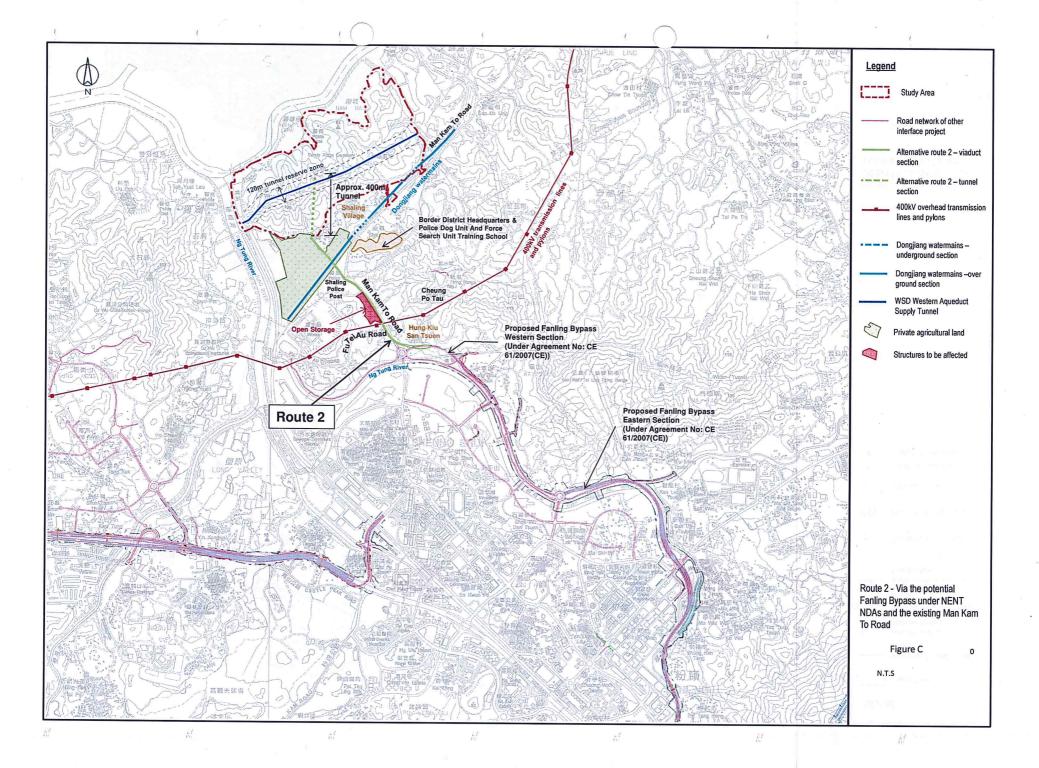
#### 8 Summary

Based on the aforesaid pros and cons of the three alternative routes for hearses, Route 1 would offer a better overall solution than the other two routes in terms of engineering, traffic, environmental, land issues, cost and implementation for hearses travelling directly to the C&C facilities at Sandy Ridge during normal days. Nevertheless, further discussion and liaison with FEHD and funeral parlour trade operators is also necessary regarding the operational arrangement of hearses by making use of this route.

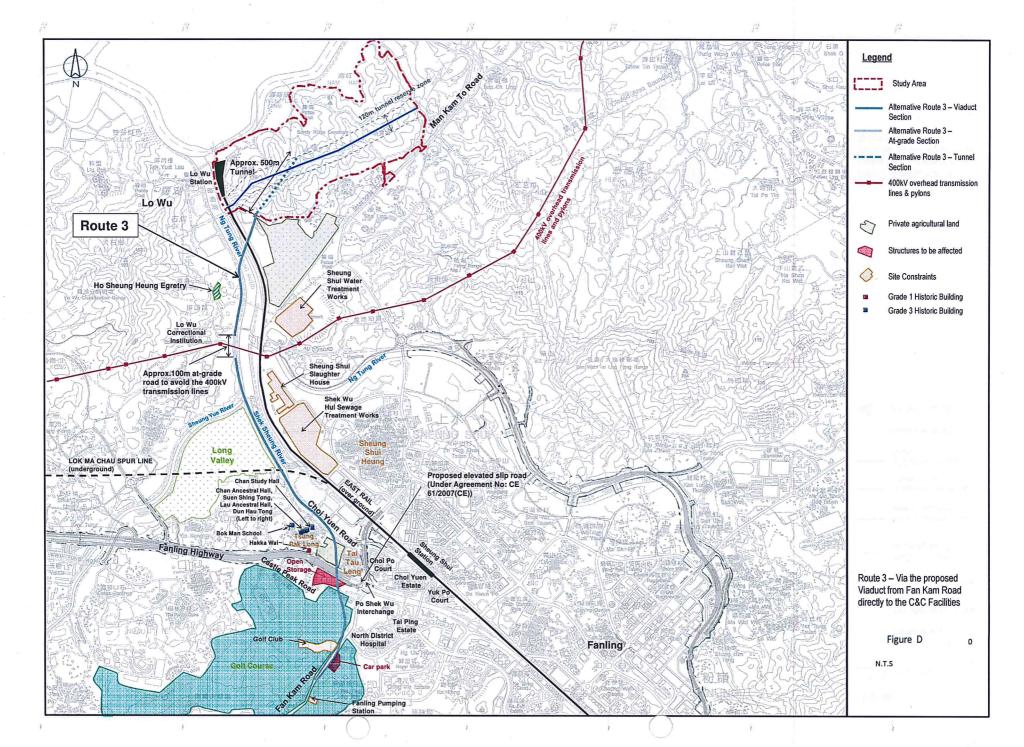


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## Appendix C

Site Photos



Photo 1 Existing Lin Ma Hang Road (Near Nga Yiu Village)



Photo 3 Existing vehicular bridge across Ping Yuen River



Photo 2 Existing Lin Ma Hang Road (Near San Uk Ling)



Photo 4 Existing Lin Ma Hang Road (Near Ping Yuen River)



Photo 5 Existing Structure along Lin Ma Hang Road



Photo 7 Nga Yiu Village



Photo 6 Existing Structure along Lin Ma Hang Road



Photo 8 San Uk Ling



Photo 9 Existing residential housing along Lin Ma Hang Road



Photo 11 Existing Dongjiang Watermains along Man Kam To Road



Photo 10 400kV transmission lines and pylons across Man Kam To Road

#### Appendix E

Working Paper on Sensitivity analysis - the possible modal choices of more grave sweepers than the original forecast chose to use the PDA at Fanling Station

# Sensitivity analysis - the possible modal choices of more grave sweepers than the original forecast chose to use the PDA at Fanling Station

- Using the projected numbers of grave sweepers arriving from the ERL and WRL, that were based on the population distribution along these two railway lines and the handling capacities of the PDAs, it was estimated that about 2,000 to 3,000 grave sweepers would overflow to other PDAs in case of overcrowding at the Fanling Station PDA. Assuming that half of these grave sweepers chose to remain at the Fanling Station PDA, the analysis indicated that they would need to wait for extra 15 minutes for the special buses. Instead of waiting for the special buses there, the grave sweepers would have three choices, namely (i) going to the Sheung Shui Station PDA to take the special buses; or (ii) going to the Kwu Tung Station PDA to take the special buses instead; or (iii) going to Lo Wu Station and walking to the proposed C&C facilities.
- Taking special buses at Sheung Shui Station PDA since this PDA was very small and there was no space for expansion, the grave sweepers would need to queue up for more than 200 m and wait for about one hour for the special buses.
- Taking special buses at Kwu Tung Station PDA as this PDA would be designed with sufficient space and the bus travelling time to the proposed C&C facilities would be about 10 minutes, 11 and 5 minutes shorter than from Fanling Station PDA and Sheung Shui Station PDA respectively.
- Walking from Lo Wu Station the train fare to Lo Wu Station was higher (\$10 vs \$37.5 to Lo Wu Station from Hung Hom Station). Also, the grave sweepers would need to walk for more than 50 minutes via Lo Wu Station Road and Sha Ling Road uphill.
- 1.5 The detail illustration concept is being shown in the figure below.

## Fanling Station Rd PDA (11,800ppl/hr)

MTR Fare \$10.0, Special bus fare

No need to wait for the bus, Journey time 21mins

In case half visitors remain



(i.e. 2,090/2 = +1,045 ppl/hr) at yr 2029 (i.e. 3,480/2 = +1,740 ppl/hr) at yr 2031

- Waiting Time  $\sim 14$  mins at Yr 2029
- Waiting Time ~ 16 mins at Yr 2031

MTR Travel time ~ 10 mins







#### Lo Wu Station By walk

- MTR fare: \$37.5
- Need > 50mins Walking (about 2km with level diff 30m)
- Lo Wu Station Road already congested

#### Kwu Tung PDA (11,800ppl/hr)

- Special bus fare:
- Bus Journey Time: 10 mins (less 11mins than Fanling Station Rd Special bus)
- Similar MTR fare as Fanling Station
- Sufficient passenger queuing area

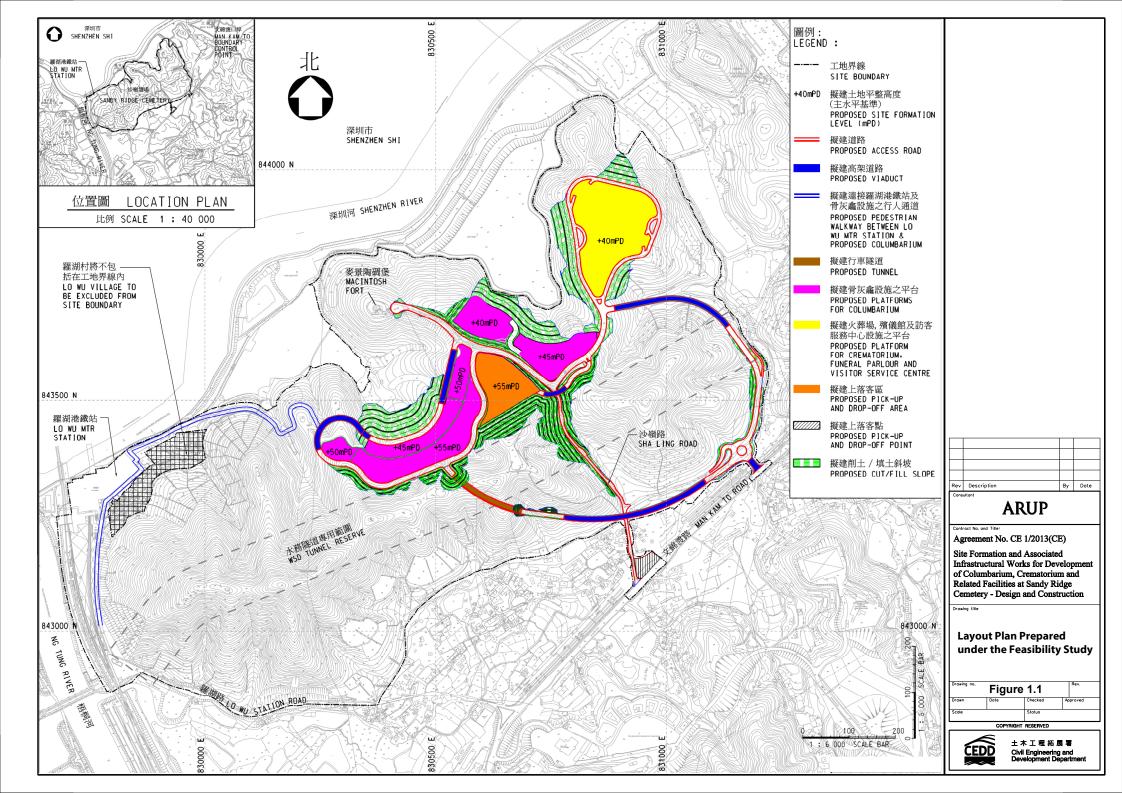
#### Sheung Shui PDA (1,900ppl/hr)

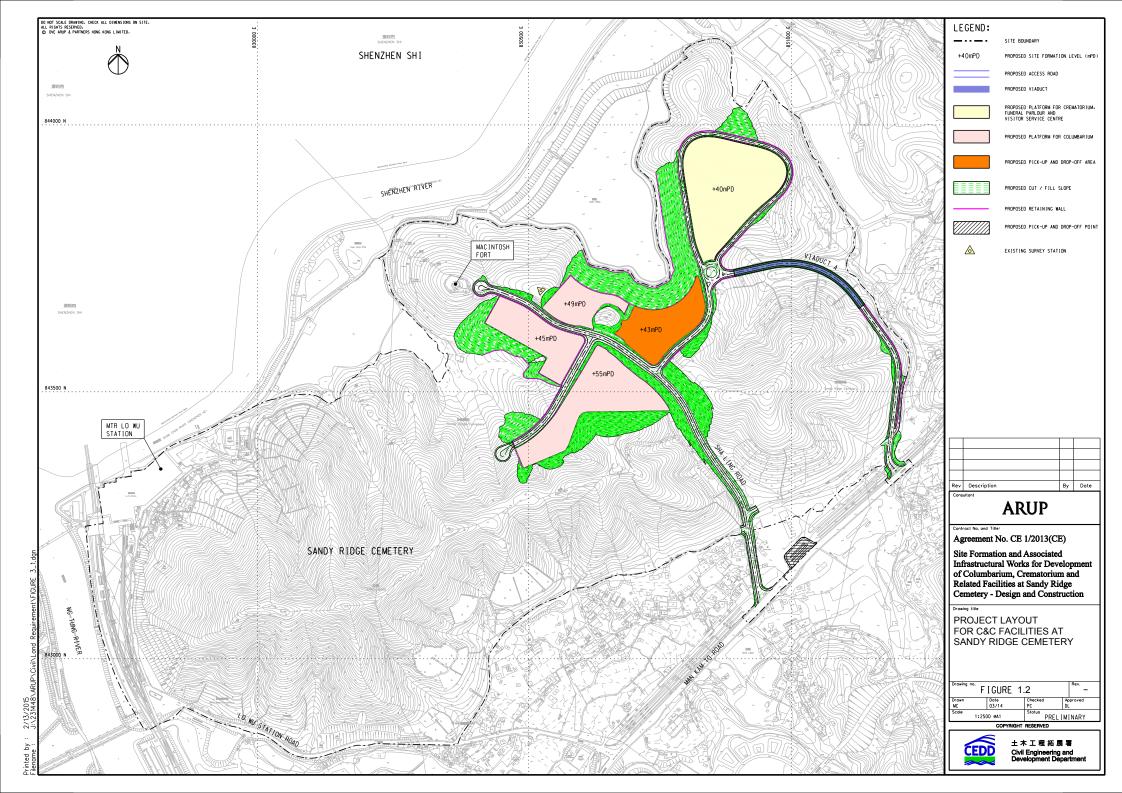
- Special bus fare:
  - Bus Journey Time: 15 mins
  - In case overflow:
- <u>210m</u> queue & wait 1hr at 2029
- <u>1km</u> queue & wait 2hr at 2031 (worsen quickly due to low handling capacity of SS)

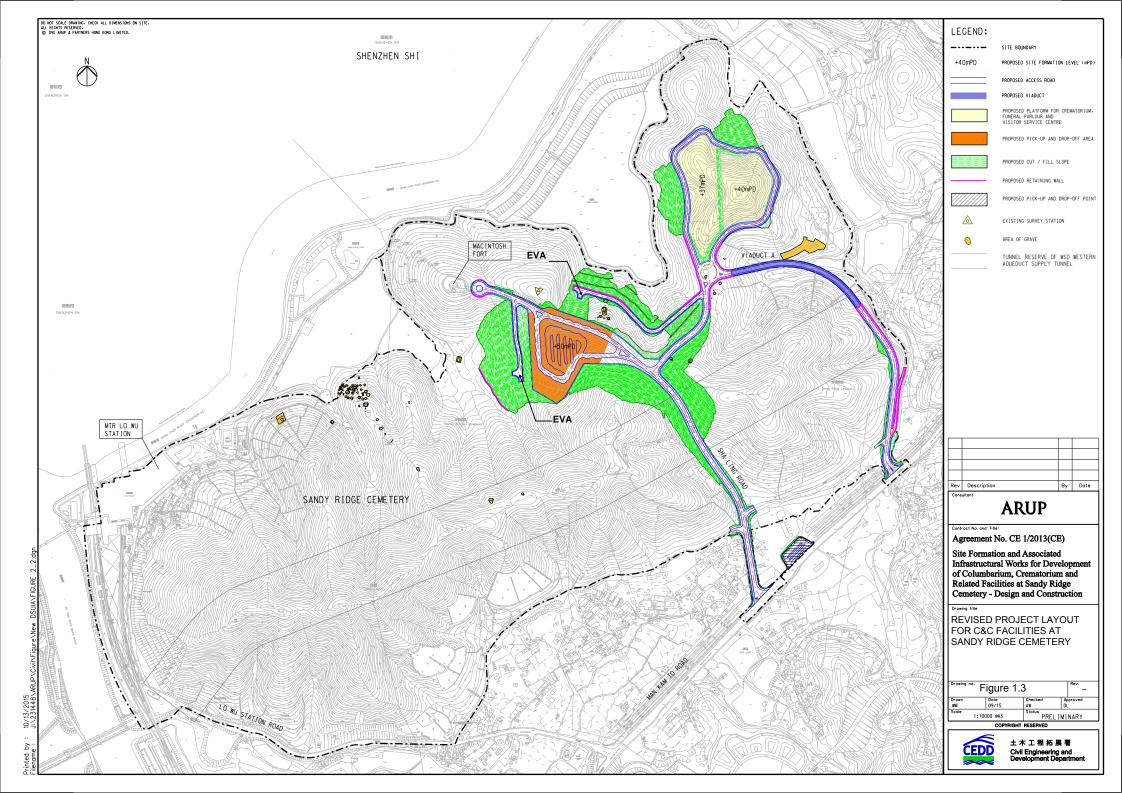
Sensitivity Test

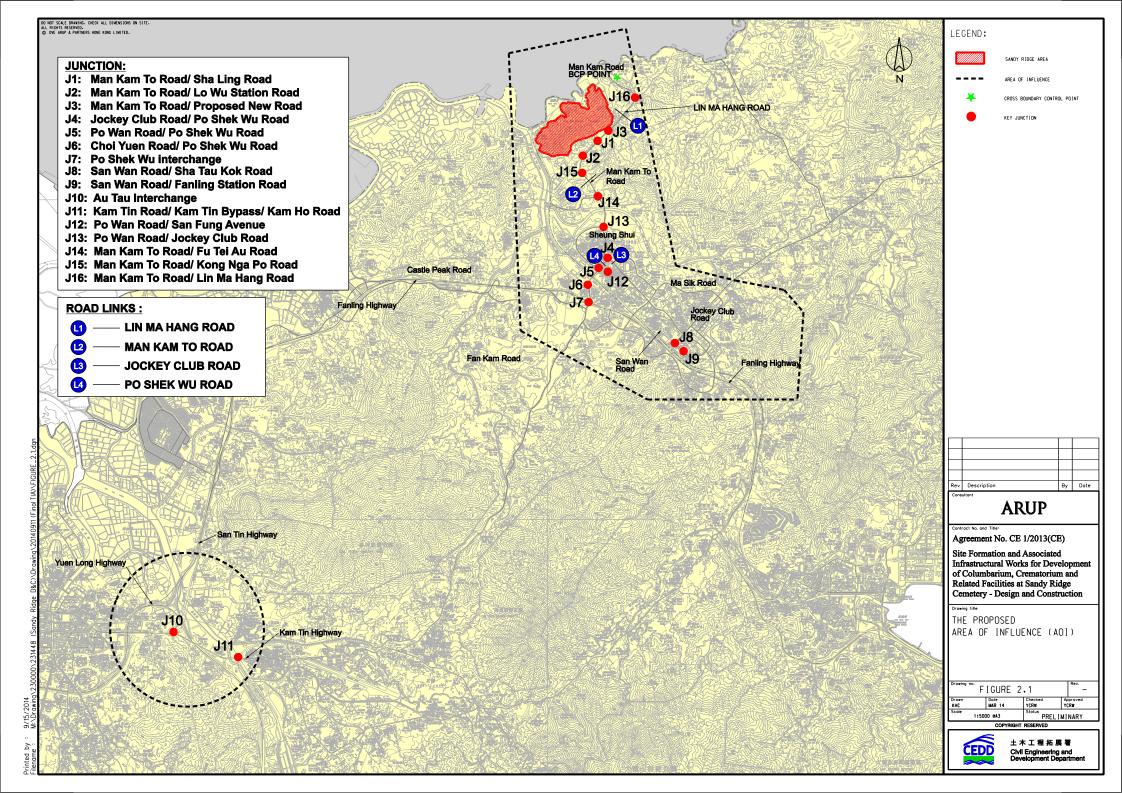
ARUP

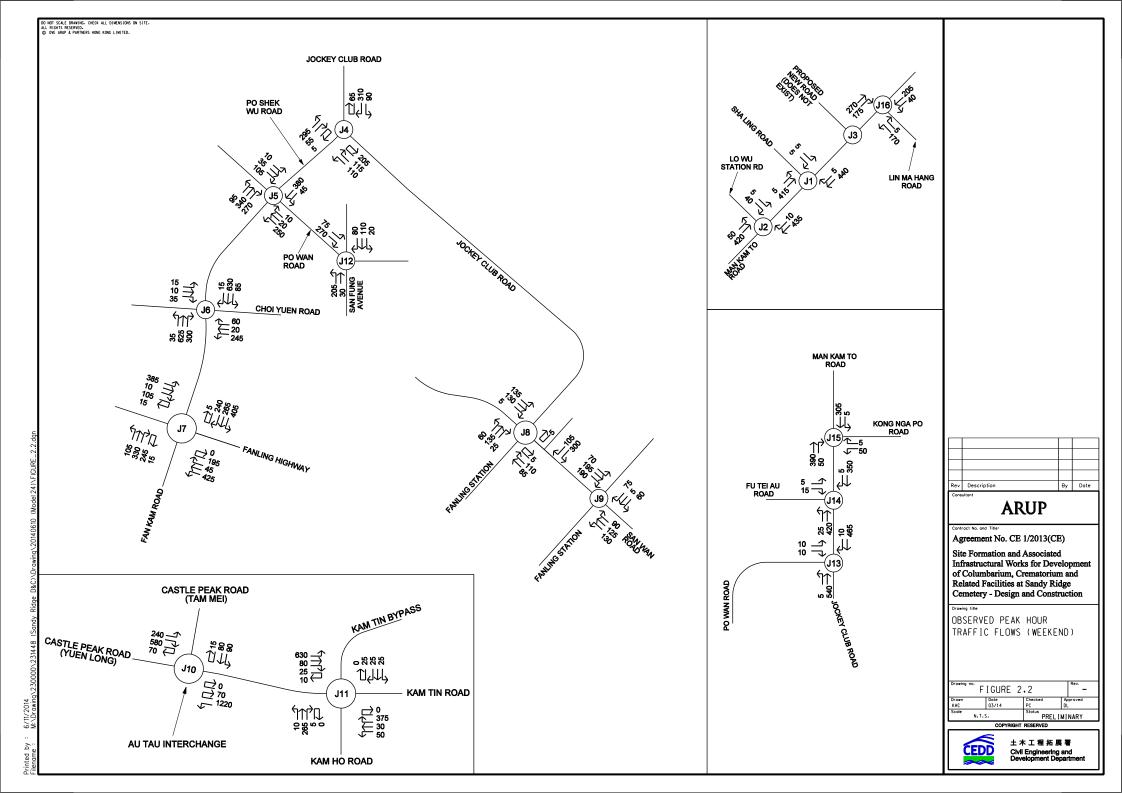
### Figures

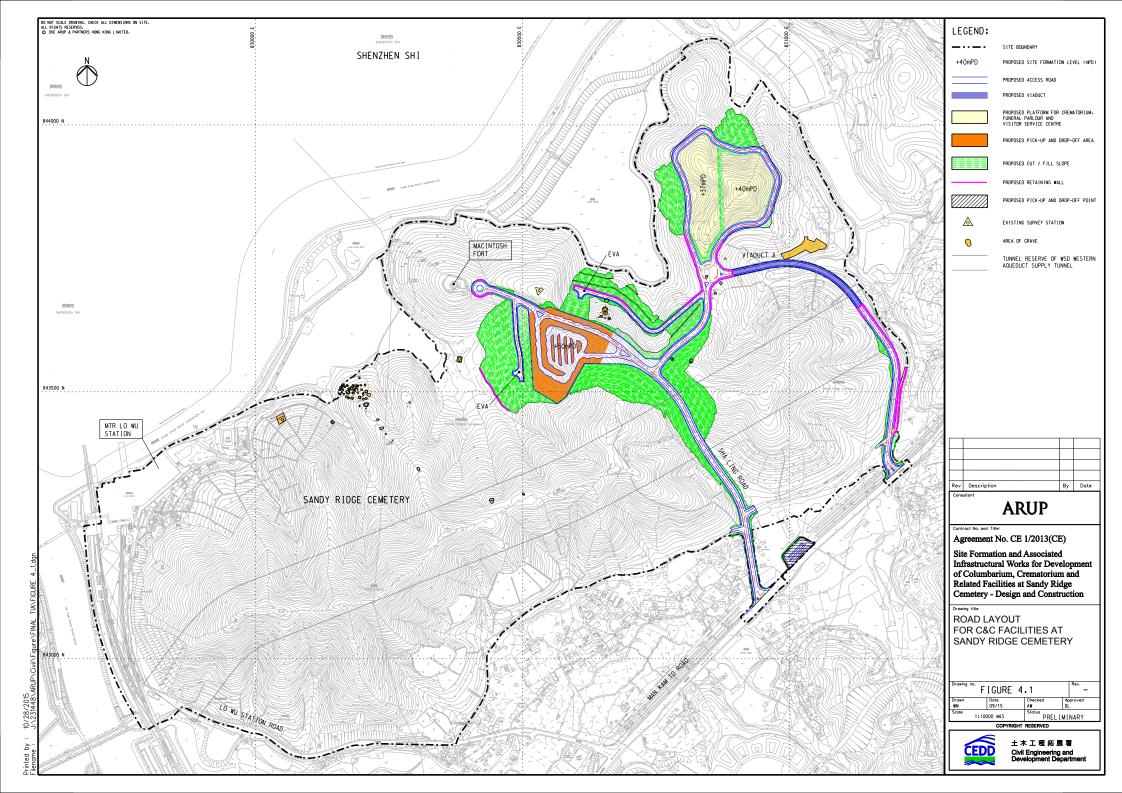


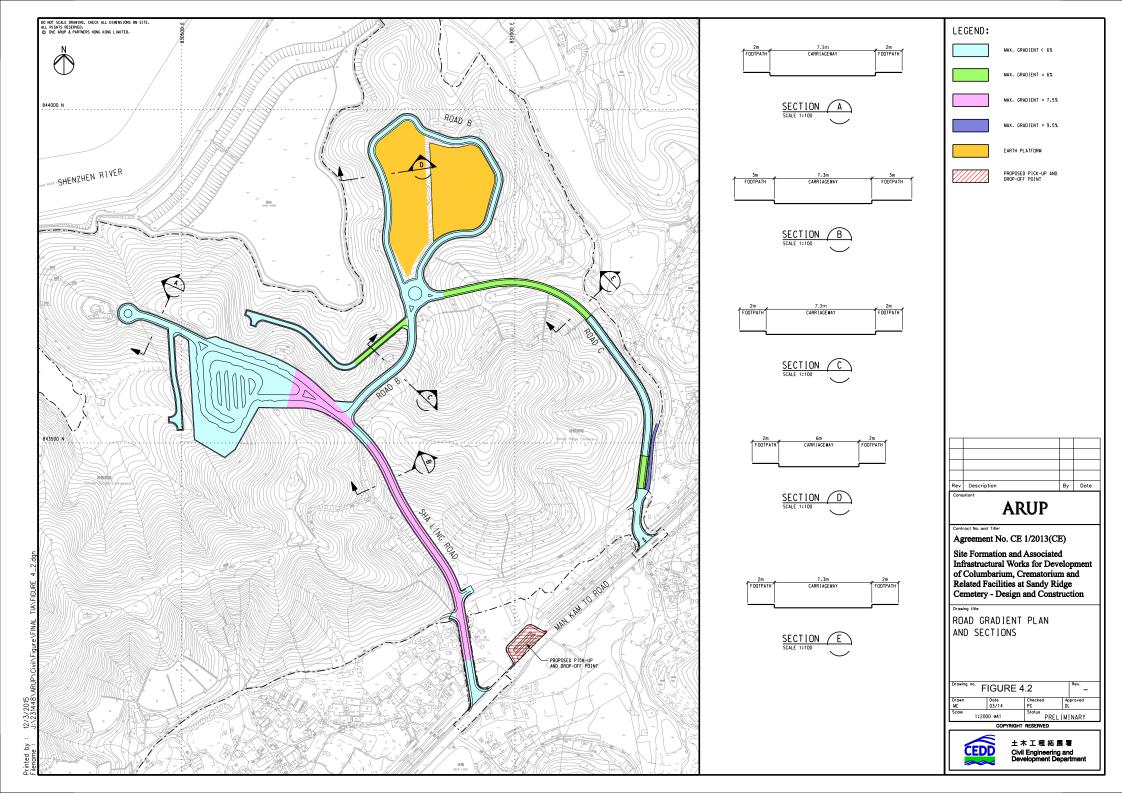


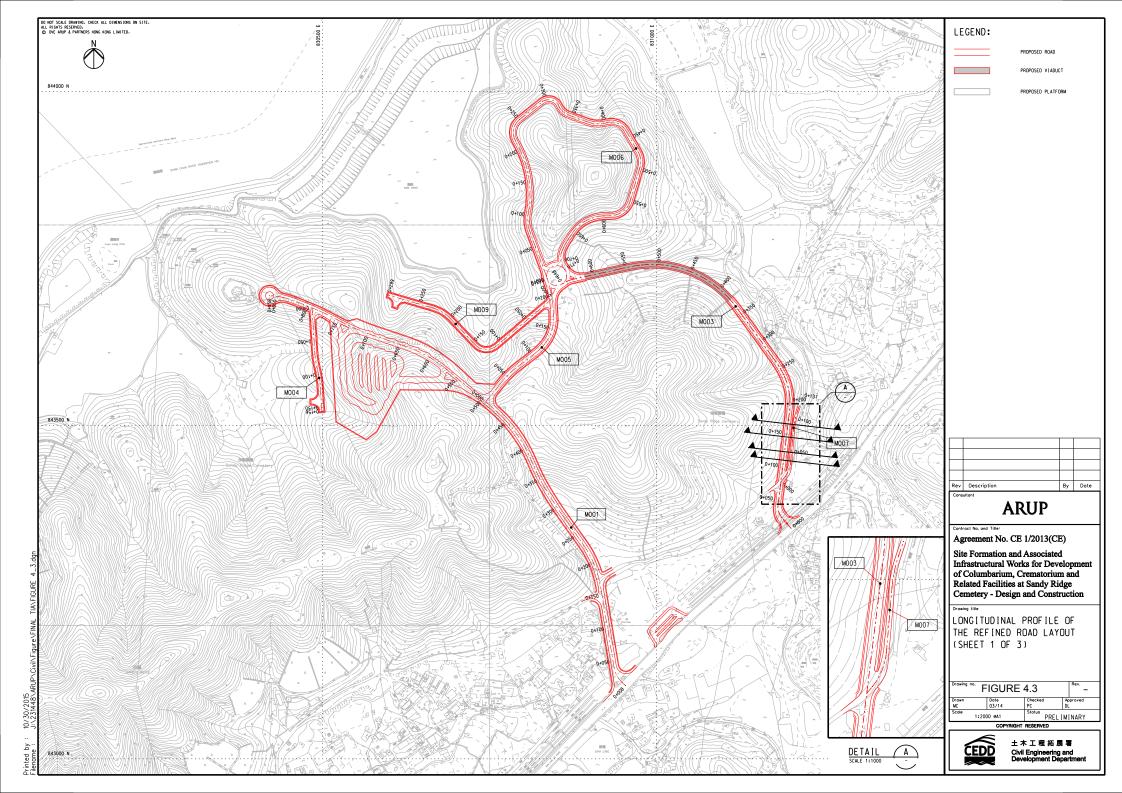


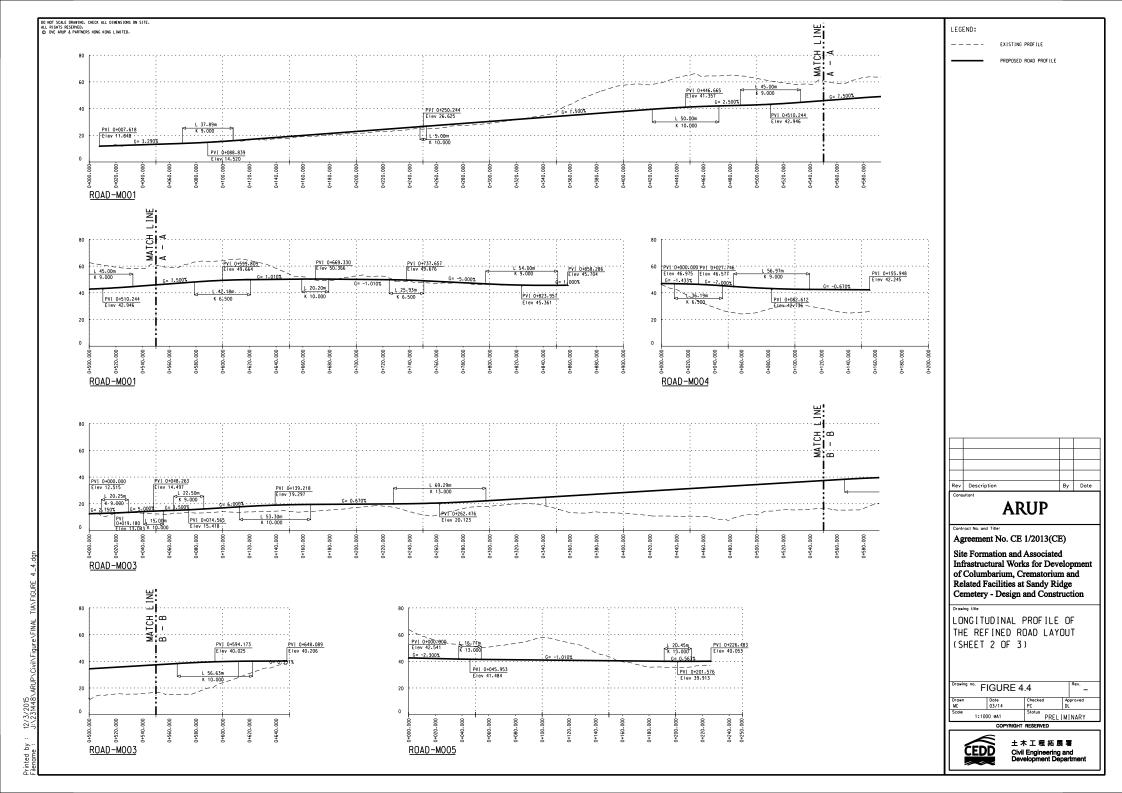


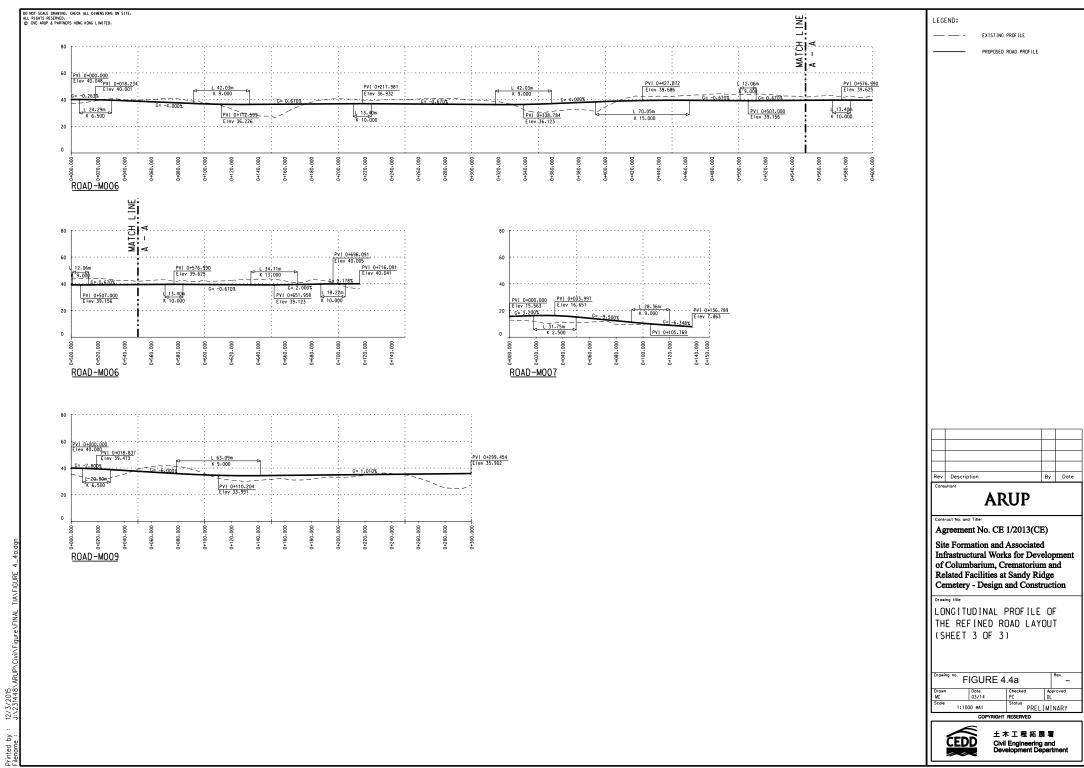




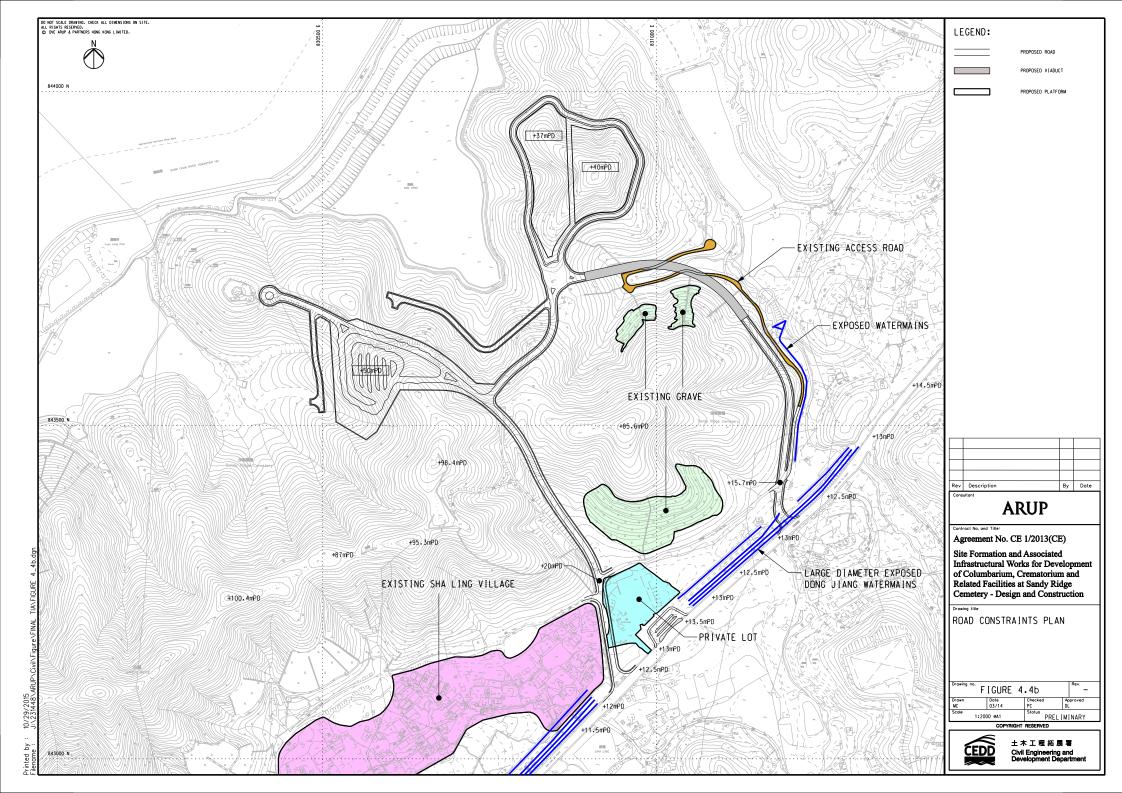


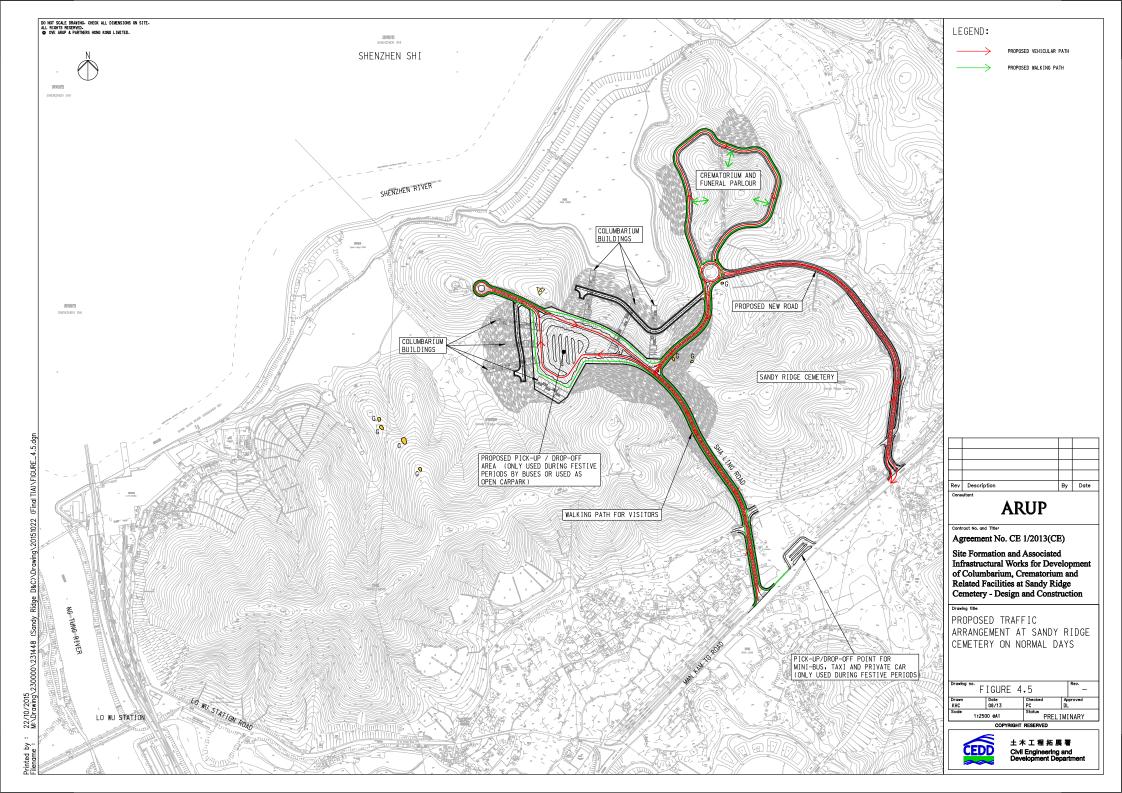


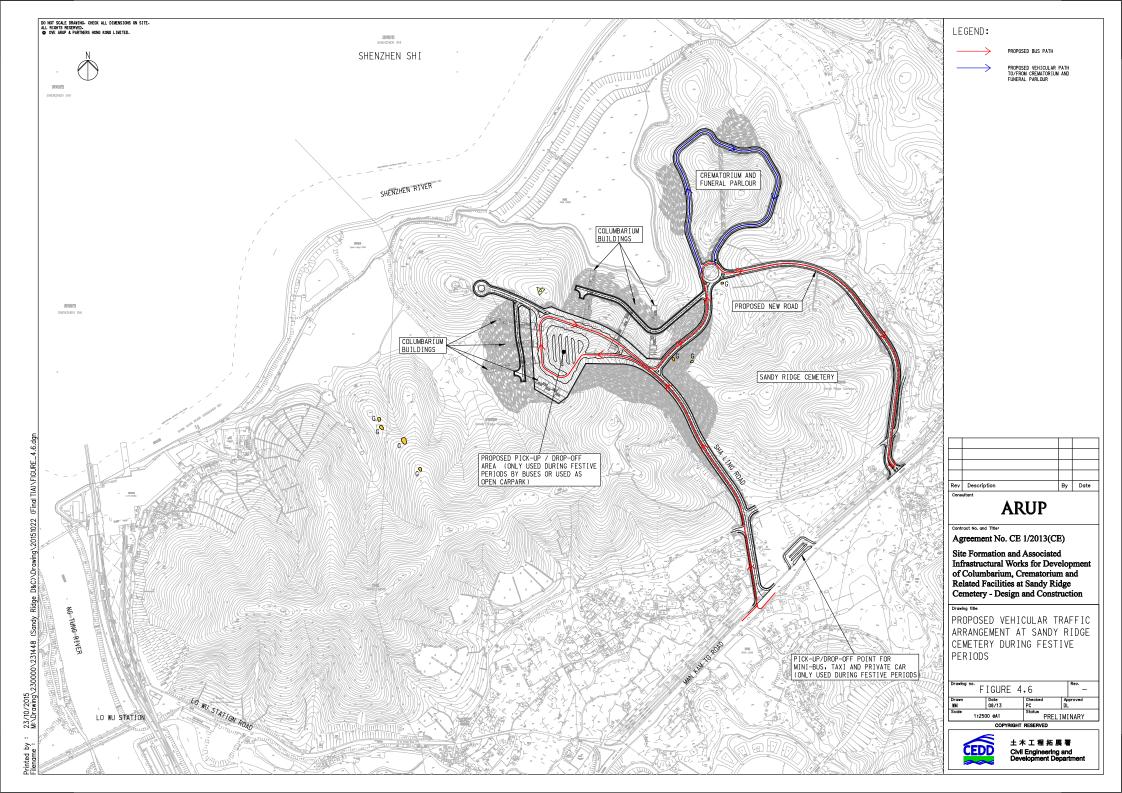


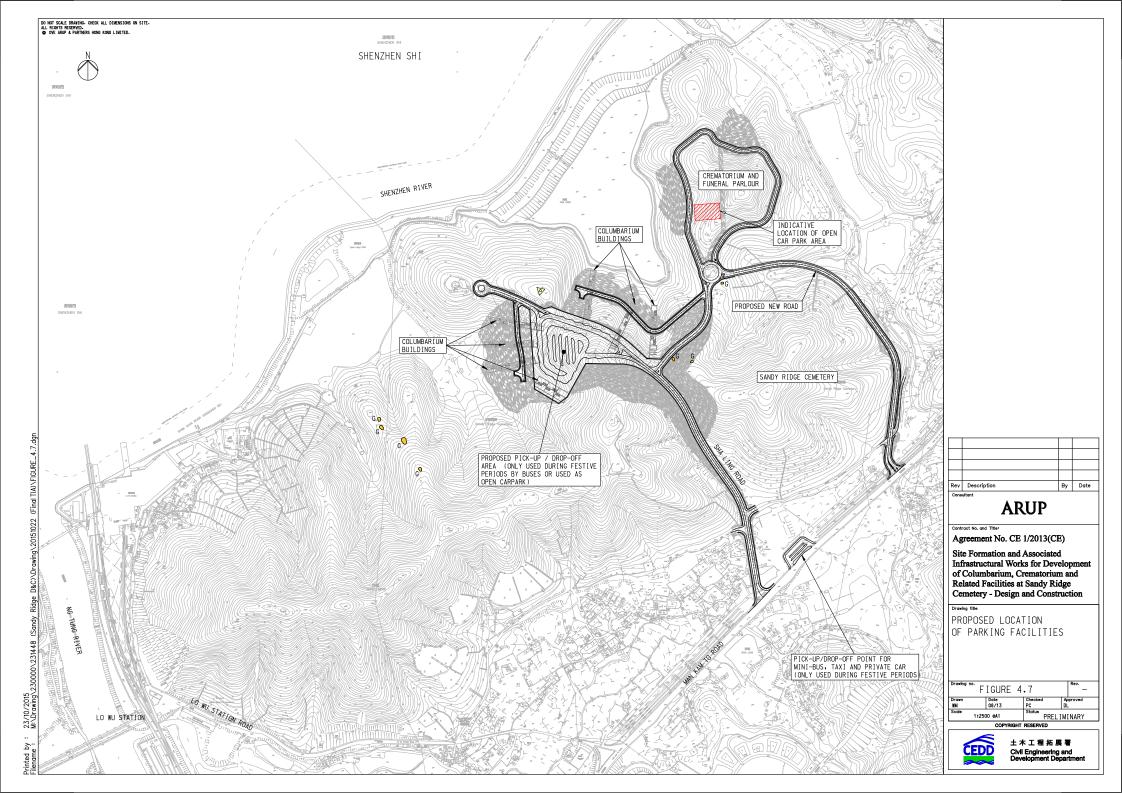


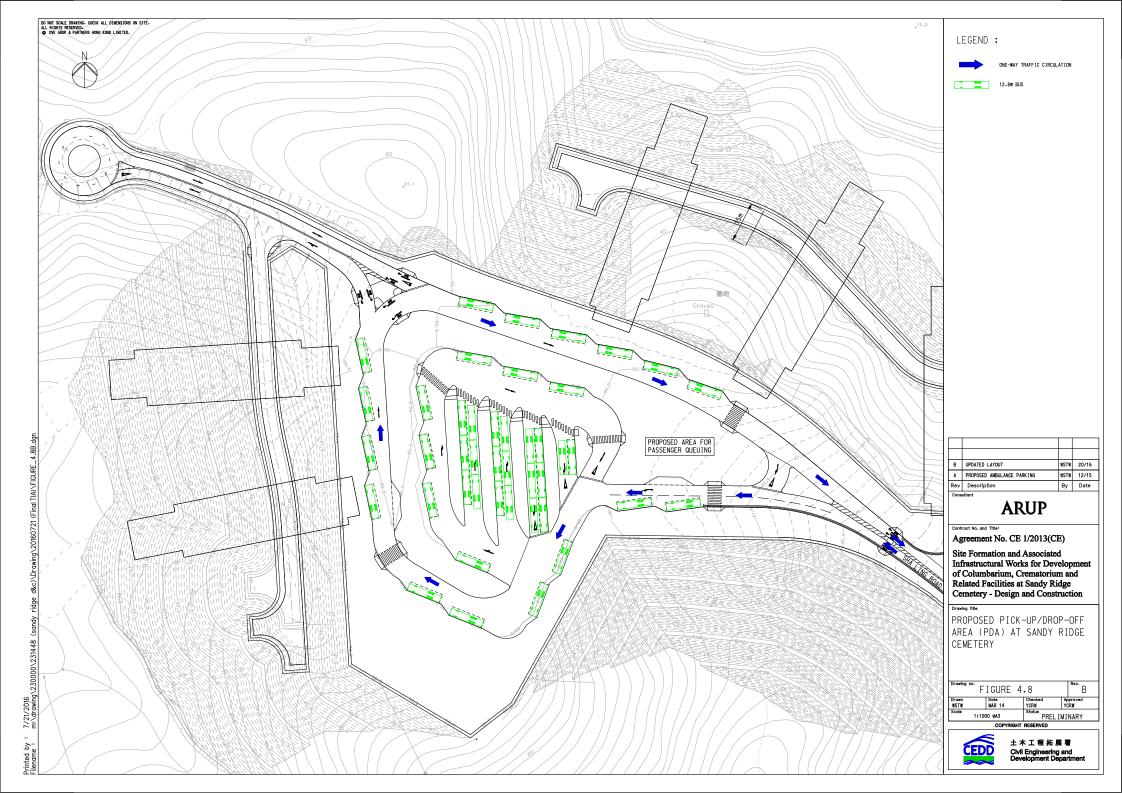
Civil Engineering and Development Department

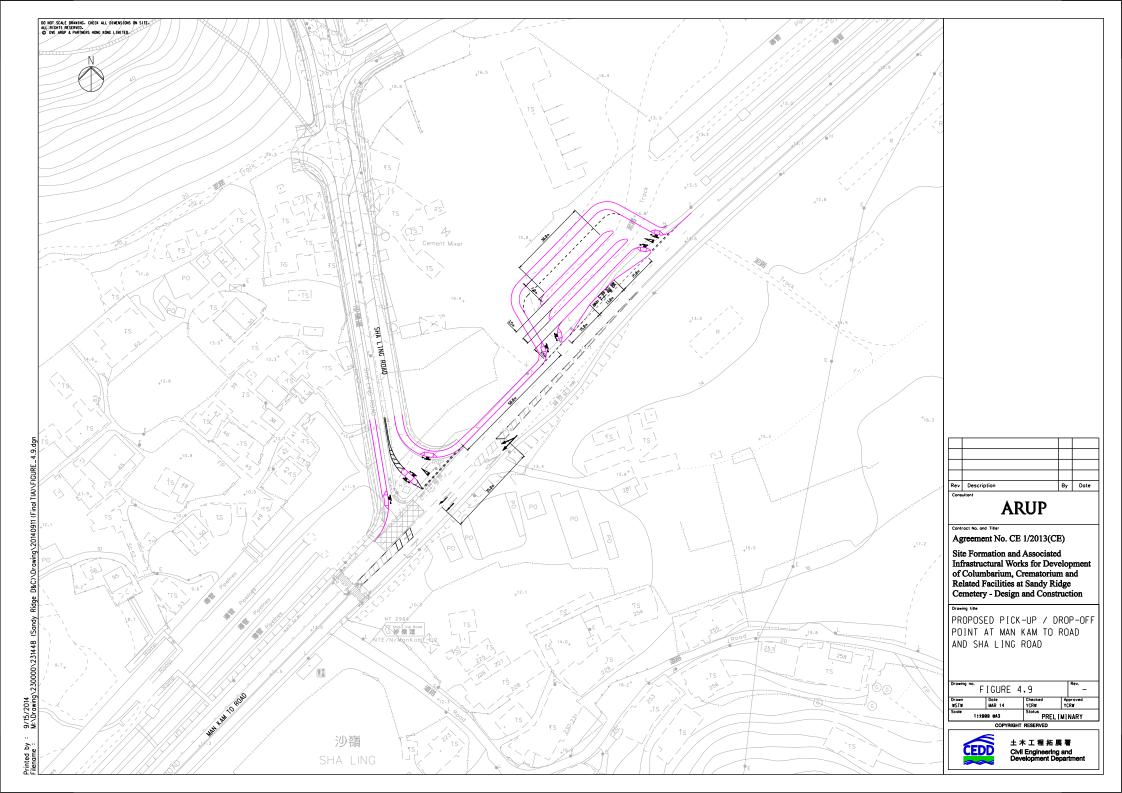


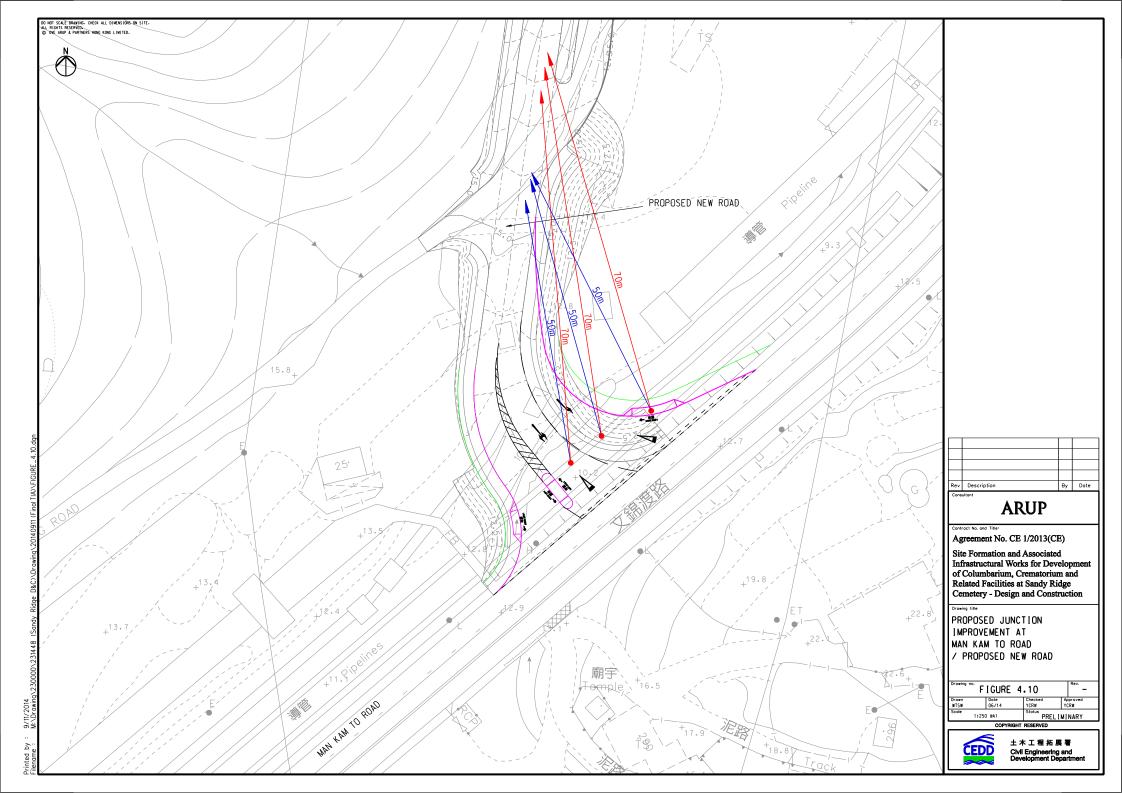


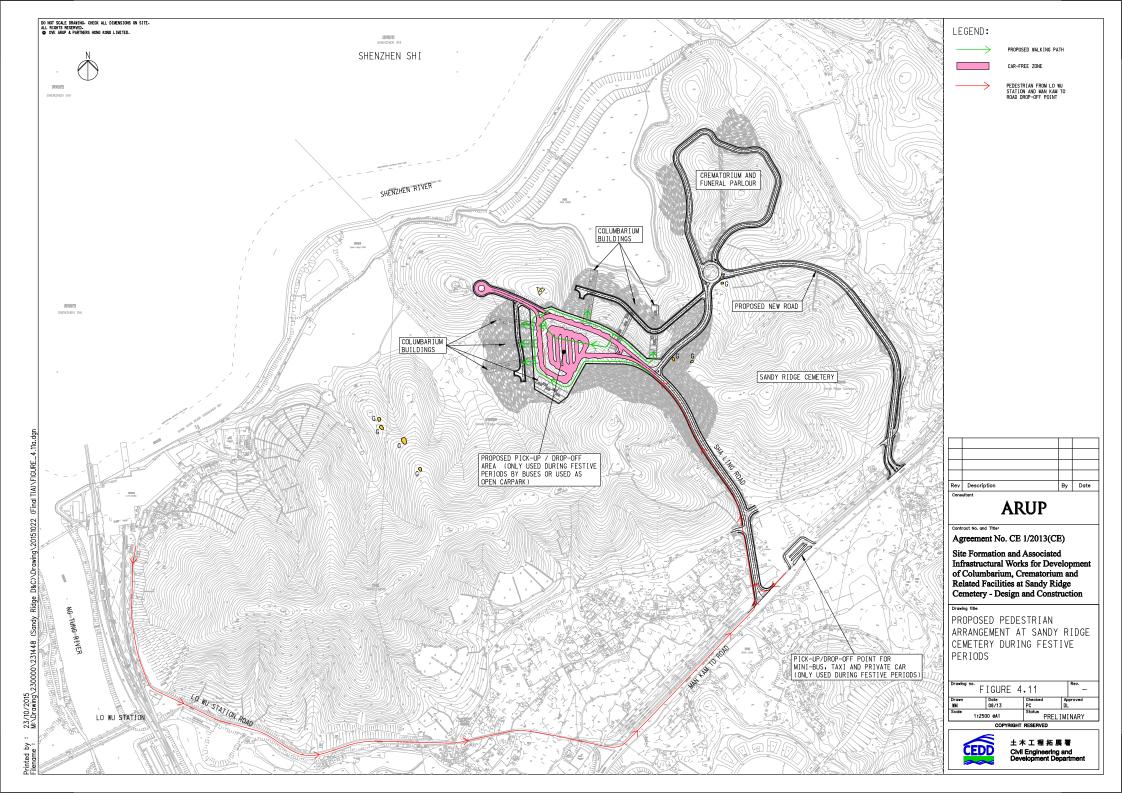


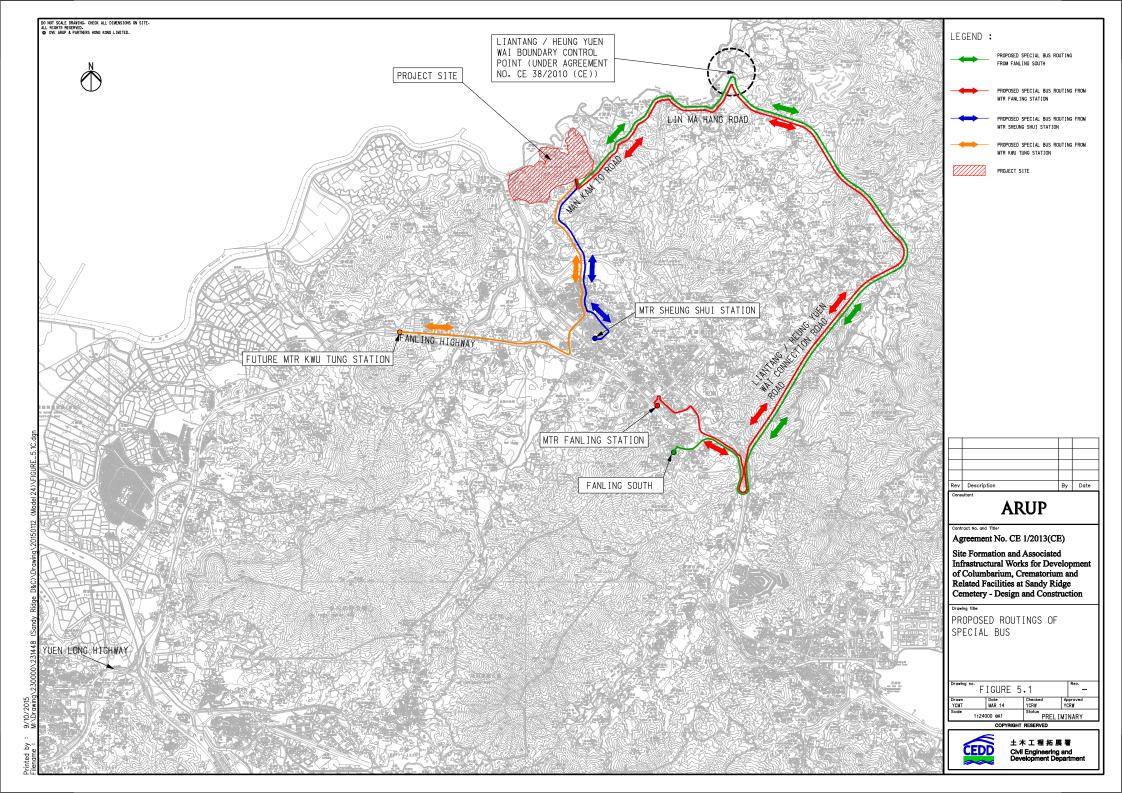


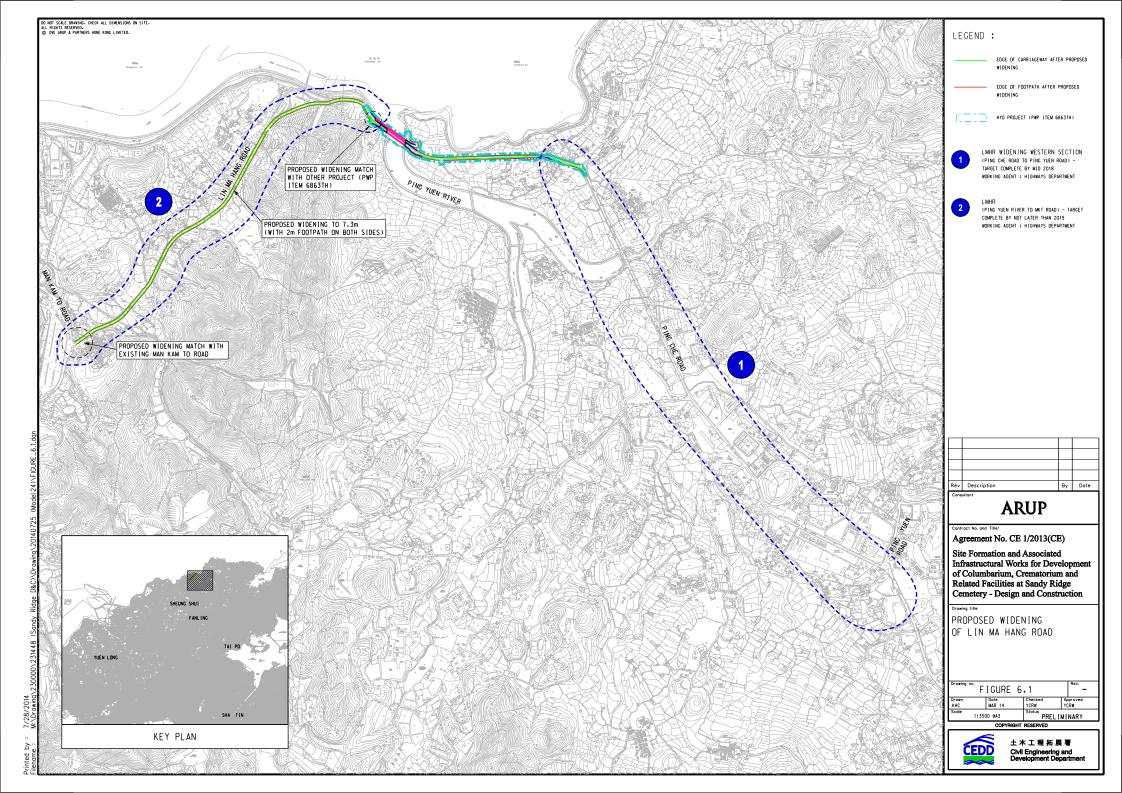














**ARUP** 

Contract No. and Title:

Agreement No. CE 1/2013(CE)

Site Formation and Associated Infrastructural Works for Development of Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery - Design and Construction

rawing title

MODEL FLOW DIAGRAM

| Rev. - | Rev. - | | Rev. - | | Proving no. | Rev. - | | Proving no. | Rev. - | | Proving no. | Pro

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