2 PROJECT DESCRIPTION

2.1 NEED OF THE PROJECT

2.1.1 As described in **Sections 1.1 & 1.2**, the Project is designed to provide: -

- Lung Fu Road Slip Road: a direct connection between existing Lung Fu Road (LFR) viaduct and Tsing Wun Road (TWR) for both traffic directions. This slip road acts as a parallel route of Tuen Mun Road (TMR), which can increase the attractiveness of the current alternative route along Lung Mun Road (via Tsing Tin Road, Ming Kum Road, TWR) to reach Tuen Mun Area 40 & Tuen Mun – Chek Lap Kok Tunnel (TM-CLKT);
- Hoi Wing Road Slip Road: a direct connection between Tuen Mun Road (Sam Shing Section) (TMR(SSS)) northbound to Castle Peak Road (Castle Peak Bay Section) (CPR(CPBS)) westbound near Hoi Wing Road (HWR); and,
- Widening of existing Wong Chu Road Slip Road: provision of a 200m additional traffic lane at the downstream section of the existing slip road from TMR southbound to Wong Chu Road (WCR) westbound to allow dedicated traffic lane for traffic heading to Tuen Mun West and Tuen Mun South; thus, minimizing weaving movement at downstream section of the heavily trafficked slip road.

2.1.2 The implementation of the above slip roads is to divert existing traffic flow away from WCR and its associated connecting slip roads. These are identified as a medium-term mitigation measures to alleviate the traffic situation on WCR before the completion of Tuen Mun Bypass (TMB).

Existing Traffic Condition

2.1.3 After the commissioning of TM-CLKT, an alternative route for North Lantau Highway (i.e. Route 8) is provided for connecting Tuen Mun and Hong Kong International Airport & Hong Kong Boundary Crossing Facilities. This alternative route is particularly attractive to through traffic from the northwest part of the New Territories, including Tuen Mun and Yuen Long, as well as Kong Sham Western Highway. Currently, through traffic between the northwest part of the New Territories and TM-CLKT is mainly via TMR and WCR. It is anticipated that the above-mentioned road links will become over-capacity beyond 2026. It is planned that TM-CLKT will be connected with TMB so that in the long-term the main access for TM-CLKT traffic coming from or accessing to the northwest part of New Territories will be via TMB, relieving the capacity problem of TMR and WCR. However, since the investigation studies of TMB are currently being carried out, it is envisaged that TMR and WCR will remain as the main traffic corridors in Tuen Mun for a considerable future till the commissioning of TMB. Therefore, there is an imminent need to carry out local improvement works to enhance the traffic conditions on the major roads in Tuen Mun.

Provision of Lung Fu Road Slip Road (LFRSR)

2.1.4 An alternative route for traffic travelling between northwest part of New Territories and TM-CLKT is via Tsing Tin Road, Ming Kum Road, TWR, and Lung Mun Road which with closely spaced signalized junctions. As currently there is no direct connection between LFR viaduct and TWR, the closely spaced signalized junctions along this alternative route makes it less preferred by the motorists and low usage in result. After completion of LFRSR, traffic travelling between TM-CLKT and TWR can make use of existing LFR viaduct to bypass the closely spaced signalised junctions along Lung Mun Road. With TWR being more accessible to TM-CLKT, the attractiveness of this alternative route will be increased. Thus, alleviating the traffic congestion situation on TMR and WCR during peak hours.

Provision of Hoi Wing Road Slip Road (HWRSR)

2.1.5 Currently, there is no direct connection between TMR (SSS) northbound and the southern part of Tuen Mun near CPR(CPBS) or HWR. Traffic coming from Kowloon towards the southern part of Tuen Mun has to travel via WCR. The proposed HWRSR running from TMR (SSS) northbound to CPR(CPBS) westbound near HWR provides a direct connection for these traffic. Upon completion of HWRSR under this Project, a portion of traffic from southeast heading to southern part of Tuen Mun originally travelling along WCR would be diverted to this new route. The accessibility of the southern part of Tuen Mun from TMR northbound (NB) would be enhanced.

Widening of Wong Chu Road Slip Road (WCRSR) (not to be proceeded under this Project)

2.1.6 The existing slip road connecting TMR (Town Center Section) southbound and WCR westbound is the main route for traffic from the northwest part of the New Territories, including Yuen Long and Tuen Mun, to the southern part of Tuen Mun and TM-CLKT.

2.1.7 In view of the fact that there are relatively less constraints at the downstream of this existing slip road, the feasibility of providing an additional traffic lane at this section only was established on a prima facie basis during the preliminary feasibility study. Based on this preliminary proposal, further impacts assessments and preliminary design were carried out under the investigation stage of this Project to ascertain the feasibility, to determine the extent of works, and to examine its overall traffic benefits to Tuen Mun.

2.1.8 According to the independent Road Safety Auditor's assessment, the potential safety risks for the widened WCRSR would not be able to overcome without implementing substantial temporary road works (e.g. construction of a temporary bridge on Siu Lun Street) and extensive reconstruction of existing roads and noise barriers. Also, based on the preliminary assessment during the course of the Environmental Impact Assessment Study under the Project, it is noted that noise enclosure may be required as a noise abatement measure along the widened road section.

2.1.9 It is foreseeable that the substantial temporary bridgeworks, reconstruction of existing roads and noise barriers, and construction of noise enclosure would increase the overall project cost and require a relatively long construction period. All these works would likely defer the commissioning of WCRSR to mid 2032; thus, further lowering what was originally an already marginal traffic benefit[1] to the public.

2.1.10 The Government considered it necessary to balance the overall cost-effectiveness of the Project with a view to reduce the nuisances caused to nearby sensitive receivers. Hence, it is concluded to only proceed the construction of LFRSR and HWRSR, which would already improve the traffic conditions on major roads in Tuen Mun District. Therefore, the assessments for WCRSR will not be covered by the rest of this EIA report.

[1] : The original target commissioning year of TMB was in 2036. Subsequently, the Government stated in the LegCo meeting that they would strive to commission TMB in an earlier year (likely 2033).

2.2 SCENARIO "WITH" AND "WITHOUT" PROJECT

Scenario "without" Project

2.2.1 The traffic loading on TMR and WCR is expected to increase continuously with the commissioning of TM-CLKT and aggravate the congestion level during the peak hours. It is anticipated that the major road links and road junctions in Tuen Mun area would experience capacity problem by 2026. The traffic congestion levels of some major roads in Tuen Mun would become unacceptable with volume-to-capacity (V/C) ratio over 1.2 by 2031.

2.2.2 The traffic conditions will not be improved until the completion of TMB or other large scale traffic measures are implemented. Longer traffic queues along TMR and longer travelling time during peak hours are anticipated. The higher traffic flow and longer traffic queues will result in greater degree of air quality and noise impacts to the area.

2.2.3 Without the Project, the road traffic congestion could not be relieved in the medium-term and missed an opportunity to alleviate the associated air and noise pollution within the area.

Scenario "with" Project

2.2.4 With the completion of LFRSR and HWRSR, it will offer alternative route choices to road users from Tuen Mun East and Tuen Mun West, and also an alternative route between northwest of the New Territories and southern of Tuen Mun/ TM-CLKT. The V/C ratio on TMR (Town Center Section), WCR and its associated slip roads will be reduced during the peak hours, which in turns reducing the vehicular emission and road traffic noise due to the reduced road traffic in the traffic congestion areas.

2.2.5 Nevertheless, the Project will induce short-term environmental impacts during construction such as construction noise, dusts, site surface runoff etc. It is envisaged that with the implementation of quieter construction method(s), low noise machinery and good site practices, the construction environmental impacts could be limited to acceptable levels. It should also be noted that the works under the Project are designed to avoid impacting the Shing Miu (also commonly known as Sam Shing Temple) along TMR as far as possible.

2.2.6 A summary of the environmental benefits and disbenefits with and without the Project is provided is **Table 2.1**.

Table 2.1 Summary of Environmental Benefits and Disbenefits With and Without the Project

Scenarios	Environmental Benefits	Environmental Disbenefits
With Project	• Provide alternative route accessing LFR to/from TWR, and TMR heading to HWR, thereby relieving congestion and decreasing the impacts to air quality and noise along the existing WCR and TMR	• C&D materials will be generated due to the excavation and lateral support works along TMR (potential for re-use and at other projects) • Construction phase environmental impacts such as construction noise, dust, site surface runoff etc. (implement good site practices) • The air quality and noise impact imposed on the Air Sensitive

Scenarios	Environmental Benefits	Environmental Disbenefits
		Receivers/ Noise Sensitive Receivers (ASRs/NSRs) close to the new slip roads may be increased.
Without Project	• No construction-related environmental impacts to TMR, LFR and TWR • No wastes generated	• Many of the existing road links are already operating close to or above capacity. Congestion, and therefore impacts to air quality and noise, of not only TMR, WCR, LFR and TWR, but also large areas in Tuen Mun and beyond will continue to worsen.

2.3 CONSTRUCTION PROGRAMME

2.3.1 Construction of the Project is anticipated to commence tentatively in Q3 2024 for completion by 2031. Details of the preliminary construction programme and the measures recommended to be taken during construction are presented in **Appendix 2.1**.

2.3.2 In order to minimize the adverse impacts to the sensitive receivers during construction of the proposed works, the construction programme and sequence of works will be carefully planned such that the environmental impacts would be kept to minimum and within acceptable limits. The followings are the measures recommended to be taken during construction:

- Avoid noisy construction activities during school examination period and schedule the construction works in the vicinity of schools and kindergartens during summer recess as much as possible if programme allows; and
- Close liaison with the contractors of other concurrent projects in order to avoid overlapping of construction activities and allow sufficient buffer for works at project interface due to potential delays in the programme so that the cumulative effects of environmental impacts could be minimized.

2.4 CONSIDERATIONS AND DEVELOPMENT OF SCHEME OPTIONS

2.4.1 This Project consists of providing three (3) new road links as a medium-term measure to mitigate the traffic congestion issue on the major roads in Tuen Mun District before commissioning of TMB.

2.4.2 The assessment year of the EIA would be determined based on the critical traffic flow during the 15 years after the completion of the proposed new road links (i.e. year 2031 + 15 years = year 2046). The Project serves as a medium term measures to improve the traffic conditions in Tuen Mun before the commissioning of TMB. It is anticipated that the traffic loading of some roads in Tuen Mun will ultimately be relieved by the commissioning of TMB.

2.4.3 Traffic flows in year 2031, 2033, 2036, and 2046 have been estimated, based on Transport Department approved methodology [2], to determine the worst case scenario for impact assessment of each environmental aspect. Detailed explanation to determine the worst case assessment year will be discussed in Section 3 to 10 respectively.

2.4.4 The alignment of the new road links has a number of pre-determined items that cannot be changed in order to maintain the connectivity to the existing road network. For example, connection points of the new road links are fixed in order to improve the traffic conditions on certain major roads.

2.4.5 To select the best road alignment option for the Project, the following factors have been thoroughly considered: (i) environmental considerations during construction and operations stages; (ii) engineering factors such as traffic, land requirement, engineering feasibility; (iii) public perception; and (iv) required construction time and cost etc.. The considerations factors and constrained for option selection as illustrated in **Figure 2.4** are summarized and presented in **Table 2.2**.

Table 2.2 Considerations and Constraints for Option Selection

Considerations	Description
Engineering Factors	
Interface with Existing / Planned Facilities	Different options of the alignment would have different interface issues with the existing / planned facilities, such as Christian Service Jockey Club Lodge of Rising Sun, Lung Yat Estate, Nam Fung Industrial Centre (i.e. Land Lot No. TMTL 233) and the Kau Hui public housing site. An option with the least interfacing issues relating to these facilities should be considered as far as practicable to avoid potential programme implication, land acquisition and disturbances to the environment.
Nature of the traffic/ Road Safety	A number of factors determining traffic safety in both the design and construction of flyovers and associated road links include: - provision of sufficient diverging distance; - minimization of cross weaving issues; - achievement of a maximum vertical gradient of 8% - achievement of desirable minimum sightline
Land issue	Minimization/avoidance of land resumption and/or land clearance
Slope Works	Minimization of slope excavation works

[2] : Traffic flows in 2031 are extracted from traffic model. Traffic flows in 2033 and 2036 before the commissioning of TMB are estimated by using the growth rate method approved by the Transport Department. Traffic flows between 2031 and 2036 are obtained by applying corresponding growth rate (with an agreed annual growth rate of 0.5%) to the modelled traffic flow in year 2031. Traffic flows in 2036 and 2046 with TMB are extracted from traffic model. between 2031 and 2036 are obtained by applying corresponding growth rate (with an agreed annual growth rate of 0.5%) to the modelled traffic flow in year 2031. Traffic flows in 2036 and 2046 with TMB are extracted from traffic model.

Considerations	Description
Construction Programme	Minimisation of construction period. Shorter construction period is preferred to minimise the disturbance to the community.
Constructability	- Practicality in constructing the viaduct and abutment structures, and carrying out slope works in the well-developed area; and, - Difficulty in undertaking utilities diversion and Temporary Traffic Management Scheme
Environmental Factors	
Construction Dust	Minimisation of construction dust impact
Noise	Minimisation of construction plant noise impacts
Terrestrial Ecology	Avoid direct impact and minimise disturbance to sensitive ecological area
Water Quality	Minimisation of construction activities which would affect water quality
Cultural Heritage	Minimisation of construction impacts and disturbance to the identified cultural heritage resources and built heritages
Other Factors	
Community Disruption	The construction works arising from the Project should be minimised as far as practicable to minimise the disturbance to the community.

2.4.6 Several options were developed for each slip road to explore an option which works the best for the Project in terms of engineering and environment. The detailed comparison between options for each slip road are summarized in **Table 2.3** to **Table 2.5**. Detailed environmental impact assessments on each preferred alignment are presented in Sections 3 to 10.

Hoi Wing Road Slip Road (HWRSR)

2.4.7 The following alignment options were developed for HWRSR:

- Option H1: to provide a slip road from TMR(SSS) northbound to CPR(CPBS) westbound near HWR with an exclusive left turn lane from HWRSR to junction of CPR(CPBS)/ HWR (see **Figure 2.1a**) ;
- Option H2: to provide a slip road from TMR(SSS) northbound to CPR(CPBS) westbound near HWR with an exclusive left turn lane from HWRSR to junction of CPR(CPBS)/ HWR and an underpass to divert traffic from CPR(CPBS) southbound (see **Figure 2.1b**); and
- Option H3: to provide a slip road from TMR(SSS) northbound to CPR(CPBS) westbound near HWR with signalized junction at CPR(CPBS) (see **Figure 2.1**).

Table 2.3 Comparison of HWRSR Alignment Options

Considerations	Option H1	Option H2	Option H3 (Preferred Option)
Engineering Factors	• Exclusive left turn lane from TMR(SSS) northbound such that traffic will be in free flow condition with no delay time • Intense cross weaving between traffic coming from CPR(CPBS) westbound and HWRSR causes potential road safety hazard • Lengthy construction period	• Exclusive left turn lane from TMR(SSS) northbound such that traffic will be in free flow condition with no delay time • An underpass to divert existing CPR(CPBS) westbound traffic to avoid weaving issue with traffic from HWRSR • Require E&M maintenance due to the provision of barrier-free access (i.e. elevator) for pedestrian • No weaving issue concern • Longest construction period	• Form a signalized junction at the intersection of HWRSR and CPR(CPBS) westbound which brings delay time to the traffic • Road gradient is slightly over the design requirements; however, it can be made good by providing addition traffic aids to notify drivers • No weaving issue concern • Shortest construction period
Environmental Factors	• Longer in length and relatively larger footprint • Generate relatively more C&D materials • Traffic queues induce air quality and noise impact • Higher air quality, noise, and landscape	• Relatively the largest footprint • Generate the most C&D materials due to the construction of extra underpass • Similar air quality, noise, landscape and visual impacts as Option H1	• Relatively the smaller footprint • Generate relatively the least C&D materials • Relatively less landscape and visual impact as it is farther away from Sam Shing Temple

Considerations	Option H1	Option H2	Option H3 (Preferred Option)
	and visual impacts due to its proximity to residential buildings (e.g. Siu Lun Court and Hanford Garden), Sam Shing Temple and educational institutions • Less vehicle emission as no mandatory waiting time at signalized junction and gentler road gradient • Similar construction noise and dust issues • Affect the existing Arch to Sam Shing Temple • Affect a portion of the existing staircase to Sam Shing Temple • Relatively high cultural heritage impact due to the proximity to Sam Shing Temple which is sensitive to construction vibration, settlement and tilting • Affect the existing car park at the junction	• Less vehicle emission as no mandatory waiting time at signalized junction and gentler road gradient • Similar construction noise and dust issues • Affect the existing Arch to Sam Shing Temple • Affect the entire existing staircase to Sam Shing Temple • Relatively high cultural heritage impact due to the proximity to Sam Shing Temple which is sensitive to construction vibration, settlement and tilting • Relatively the biggest impact to CEDD's proposed cycle track	• Relatively more vehicle emission during operation phase due to steeper road gradient and stopping at signalized junction • Similar construction noise and dust issues • Existing Arch to Sam Shing Temple can be retained • Only affect a small portion of existing staircase to Sam Shing Temple • The least cultural heritage impact as this alignment situates farthest away from Sam Shing Temple • The least impact to the existing car park

Considerations	Option H1	Option H2	Option H3 (Preferred Option)
	of CPR (CPBS)/ HWR		
Other Factors	• Relatively shorter disruption to general public	• Relatively longer disruption to general public	• Relatively shorter disruption to general public

2.4.8 Both Option H1 and H2 provide a slip road directly from TMR(SSS) northbound to the junction of CPR (CPBS)/HWR without traffic signal. No stopping is required in general and less vehicles emission is anticipated during the operation phase. However, Option H1 and H2 alignment is closer to the existing Sam Shing Temple which may induce certain degrees of impact to this landmark during the construction and operation stage (e.g. the existing Arch of Sam Shing Temple is affected).

2.4.9 Option H3 provides a slip road with signalized junction perpendicularly to CPR(CPBS) westbound. The alignment of Option H3 is the farthest away from the boundary of Sam Shing Temple. This obviates the need of demolishing any of the existing iconic structures or features and the existing Arch beside CPR(CPBS) can be retained.

2.4.10 To resolve the potential cross weaving problem between traffic from CPR(CPBS) westbound and HWRSR, the underpass proposed under Option H2 and the signalized junction proposed under Option H3 can both improve road safety. However, the proposal of underpass gives the largest footprint and generates the most C&D materials amongst the three options which is considered not environmentally friendly.

2.4.11 Although the road gradient under Option H3 is slightly steeper than the design requirement, this can be made good by implementing appropriate traffic aids such as “Steep Hill Downward Ahead” and “Use of Low Gear Now”.

2.4.12 After evaluating the pros and cons of the alignment options, Alignment Option H3 was selected as the preferred option for HWRSR. Exact alignment of Option H3 is shown on **Figure 2.1**.

Lung Fu Road Slip Roads (LFRSR)

2.4.13 The proposed LFRSR are bounded by existing residential area, such as Lung Mun Oasis and Lung Yat Estate, on the east and MTRCL light rail on the west. Also, the existing Lung Fu Road viaduct structure, headroom availability for overpassing existing viaducts, and compacted underground utilities limited the flexibility of LFRSR vertical and horizontal alignment and its structure form.

2.4.14 The road alignment design was optimized by considering the environmental benefits, engineering feasibility, and site conditions.

<u>Lung Fu Road Slip Road Southbound (LFRSR – SB)</u>

2.4.15 The following alignment options were developed for the proposed LFRSR – SB:

- Option LS1: to provide a new viaduct connecting TWR southbound to existing LFR viaduct southbound, and to shift the existing junction of TWR/ Yip Wong Road northward (see **Figure 2.2a**);

- Option LS2: to provide a new viaduct connecting TWR southbound to existing LFR viaduct southbound without any junction modification (see **Figure 2.2**).

Table 2.4 Comparison of LFRSR – SB Alignment Options

Considerations	Option LS1	Option LS2 (Preferred Option)
Engineering Factors	• Shifting of TWR/ Yip Wong Road (YWR) junction is required • Complicated traffic lane arrangement between LFRSR – SB and the existing road network • Do not require realigning existing slip road from TWR southbound to WCR eastbound • Meet merging distance design requirements • Steep road gradient with potential safety concern • Similar construction period • Clearance of existing dwellings/ squatter area near YWR is required • Require land resumption • Encroach into the boundary of Lung Yat Estate • Public objection is anticipated	• Do not require to shift TWR/ YWR junction • Simpler traffic lane arrangement between LFRSR – SB and the existing road network • Require realignment of existing slip road from TWR southbound to WCR eastbound • Meet road gradient design requirement • Similar construction period • Do not require clearance of existing squatter area • No land resumption • Encroach relatively less into the boundary of Lung Yat Estate
Environmental Factors	• Generate the most C&D materials due to the modification of road junction and existing slope at YWR • Relatively higher construction noise and dust issues • Moderate landscape and visual impacts • Existing trees at the existing slope of YWR are affected	• Generate relatively less C&D materials • Moderate construction noise and dust issues • Moderate landscape and visual impacts • No existing tree at the existing slope of YWR is affected • Less vehicular emission due to gentler road gradient

Considerations	Option LS1	Option LS2 (Preferred Option)
	• Higher vehicular emission due to steep road gradient • Similar air quality, noise, and landscape and visual impacts during operation	• Similar air quality, noise, and landscape and visual impacts during operation
Other Factors	• Similar disruption period to general public	• Similar disruption period to general public

2.4.16 Although the existing slip road from TWR southbound to WCR eastbound is required under Option LS2, the existing junction of TWR/ YWR can be retained. This results in shifting existing junction and clearing of nearby existing dwellings/ squatter arear no longer required. This can also greatly reduce the amount of C&D materials generation and tree felling.

2.4.17 For both Options, part of the proposed viaduct will be higher than the existing elevated LFR and cause certain degree of visual obstruction and loss of views or visual openness from key public viewing points.

2.4.18 However, under the Option LS2, the vertical alignment of the proposed viaduct ascends at maximum allowable gradient after crossing WCR and LFR such that the height of the bridge structures would be reduced as much as possible. The slight reduction in height of the bridge structures across WCR and LFR would reduce the visual impact to the environment and the nearby visual sensitive receivers.

2.4.19 Although there are impacts to the residents and recreational users nearby during the construction and operation stages of the Project, the impacts are considered not insurmountable and would be further limited to the acceptable levels by means of suitable noise mitigation measures in place.

2.4.20 After evaluating the pros and cons of the refined alignment options, Alignment Option LS2 was selected as the preferred option for LFRSR - SB. Exact alignment of Option LS2 is shown on **Figure 2.2**.

Lung Fu Road Slip Road Northbound (LFRSR – NB)

2.4.21 The following options were developed for the selection of LFRSR – NB:

- Option LN1: to provide a new viaduct connecting existing LFR viaduct northbound to TWR northbound, which the new viaduct will be connected to at-grade TWR near Light Rail (see **Figure 2.3a**);
- Option LN2: to provide a new viaduct connecting existing LFR viaduct northbound to TWR northbound, which the new viaduct will be connected to a higher point of TWR(see **Figure 2.3**).

Table 2.5 Comparison of LFRSR – NB Alignment Options

Considerations	Option LN1	Option LN2 (Preferred Option)
Engineering Factors	• Steeper road gradient • Longer extent of viaduct in proximity to the existing MTRCL Light Rail • Long construction period due to the extensive slopeworks near MTRCL Light Rail and complicated MTRCL advance protective works • Similar proximity to historic building (e.g. No. 3 San Shek Wan North Road) which are sensitive to construction vibration, settlement, and tilting	• Meet road gradient design requirement • Relatively shorter extent and farther away from existing MTRCL Light Rail • Moderate construction period • Similar proximity to historic building (e.g. No. 3 San Shek Wan North Road) which are sensitive to construction vibration, settlement, and tilting
Environmental Factors	• High C&D materials generation • Similar construction noise and dust issues • Higher vehicular emission due to steep road gradient • Similar air quality, noise, and landscape and visual impacts	• Relatively less C&D materials generation • Similar construction noise and dust issues • Less vehicular emission due to gentler road gradient • Similar air quality, noise, and landscape and visual impacts
Other Factors	• Relatively more disruption to general public due to proximity to Light Rail	• Relatively less disruption to general public due to slightly away from Light Rail

2.4.22 The options to further refine on the alignment or profile of LFRSR – NB are very limited given the site constraints, including existing MTRCL Light Rail on the west, existing LFR viaduct and existing Lung Mun Road on the east, and headroom availability for overpassing the existing roads etc.

2.4.23 Under Alignment Option LN2, the northern merging point of LFRSR – NB is relocated to a higher point of TWR to minimize the road level difference between the new viaduct and the existing road, which leads to a reduction in earthworks and hence dust emission. This allows a slightly better road gradient as well as more clearance with the Light Rail.

2.4.24 Moreover, the height of the overall bridge structures is slightly reduced. Thus, lightly improved the visual impact to the environment and the nearby sensitive receivers.

2.4.25 Therefore, Alignment Option LN2 was selected as the preferred option for LFRSR – NB. Exact alignment of Option LN2 is shown on **Figure 2.3**.

2.5 Key Design Elements

2.5.1 For the compliance of noise level requirements to the nearby Noise Sensitive Receivers (NSRs) of residential buildings in Tuen Mun Central including Lung Yat Estate, Lung Mun Oasis, Kau Hui Public Housing Site, extensive noise barrier/enclosure on the bridge structures of the LFRSR-NB fronting the adjacent residential blocks would be anticipated.

Road Section at LFRSR

2.5.2 The road section of LFRSR will be mainly in the form of bridge structure. This is because the LFRSR will branch out from the existing elevated LFR to at-grade TWR. Such connection will enhance the connectivity of Tuen Mun Central by further diversion of traffic flow to/from the existing WCR connection roads.

2.5.3 The proposed viaducts will ascend from the existing LFR at approximately +19mPD to +26mPD, going above another existing slip road to WCR eastbound, and descend at maximum allowable gradient to the existing road level of TWR at +11mPD.

2.5.4 The bridge deck structures will be supported by intermediate piers located along the new alignment. To minimize the extent of diversion/ disruption of variety of features or utilities both above and below ground, streamlined shape of the bridge piers will be adopted in the design to reduce as much modification/ diversion of underground utilities as possible.

2.5.5 To construct a new deck adjacent and parallel to the existing LFR bridge deck, the gap between the new and existing decks will be closed by a cast-in-situ concrete stitch. To minimize the detrimental effect from the traffic vibration on the strength development and the structural integrity of the concrete stitch, concreting of the stitch will be carried out while one traffic lane of LFR will be temporarily closed for the works. The structural articulation of the new deck will be compatible with the existing deck.

2.5.6 The new deck will be supported on reinforced concrete piers and portal frames spanning across TD's New Motorcycle Parking, GREEN@TM and drainage reverse zone underneath. DSD Western Interceptor Sewer Sewage Pumping Station is also in vicinity of the proposed bridge works. The design has taken its access and egress into account and no encroachment to the sewage pumping station is anticipated.

Road Section at HWRSR

2.5.7 Construction of a new depressed slip road in the form of a U-trough structure along the existing TMR requires modifying the road-side slope feature nos. 6SW-A/C94, 6SW-A/C8 and 6SW-C/C212. If necessary, soil nails will be installed to ensure the slope stability meets the current safety standards. Some existing u-channels will need to be extended and modified to accommodate the modified slope extents and profiles.

2.5.8 Typical work fronts of maximum 50m in length would be implemented at regular separations simultaneously along TMR with occupation of the existing hard shoulder of the TMR northbound in stages. Conventional construction method using excavation and lateral support (ELS) System should be adopted on the proposed slip road works extending TMR directly to CPR(CPBS).

2.5.9 Although adopting conventional construction method as mentioned above would require overall longer construction period, using conventional construction method would involve less complicated traffic diversion scheme and induce less disturbance to the existing roadside developments. It is anticipated that such arrangement would bring the least changes to the

existing traffic patterns and the least impact to the road users. In addition, the extent of the existing slopes, number of trees to be affected and temporary land required facilitating the temporary traffic diversion could be minimized. In conclusion, the above proposed construction method and sequence of works are considered to be the most cost effective and causing least adverse impact to the traffic and public.

2.5.10 For the section of works along TMR northbound, the existing slope would be modified near the slope toe for the construction of the proposed depressed slip road and its U-trough structure will also serves as protection to road users against any potential natural terrain hazards.

2.6 Considerations of Construction Methods

2.6.1 The major construction works under the Project will include:

- Construction of bridge structure for LFRSR;
- Construction of a reinforced concrete “U-shaped“ trough and at-grade road for HWRSR.

Hoi Wing Road Slip Road (HWRSR)

2.6.2 The comparison of different construction methods for HWRSR is summarised in **Table 2.6**.

Table 2.6 Engineering and Environmental considerations for various construction methods for HWRSR

Considerations	Traditional Open Cut Excavation Method	Excavation and Lateral Support (ELS) Method	
		Sheet Piled Wall	Pipe Piled Wall
Engineering Factors	• Require extensive working space • Require extensive road closure • Bring the most traffic impact • Best ability to overcome underground obstructions • Require the least capacity of plants & equipment • Longest construction period	• Moderate ability to overcome underground obstructions • Require moderate capacity of plants & equipment • Require moderate working space for plants & equipment • Require moderate temporary traffic arrangement • Relatively poor in ground settlement and seepage control	• Good ability to overcome underground obstructions • Require moderate capacity of plants & equipment • Require moderate working space for plants & equipment • Good in ground settlement and seepage control • Moderate construction period

Considerations	Traditional Open Cut Excavation Method	Excavation and Lateral Support (ELS) Method	
		Sheet Piled Wall	Pipe Piled Wall
		• Moderate construction period	
Environmental Factors	• Extensive felling of trees • Excessive generation of C&D materials • Moderate impacts on noise, vibration and air quality • High impacts on water quality and landscape & visual • Brings the most environmental impact due to longest duration of works and largest works extent.	• Moderate felling of trees • Moderate generation of C&D materials • Relatively high impact on noise • Low impacts on air quality, water quality, and landscape & visual • Brings moderate environmental impact	• Moderate felling of trees • Moderate generation of C&D materials • Relatively less noise and vibration impact due to the available non-percussive piling method • Low impacts on air quality, water quality, and landscape & visual • Brings moderate environmental impact

2.6.3 In view of the areas of steep topography/ hillslopes along TMR, avoidance of such geographical features is suggested to limit the amount of slope cutting required and to limit the risk of boulder falls or landslides affecting the existing TMR. In view that an extensive extent of the existing slopes along TMR would be cut back, the open-cut method will generate a larger amount of C&D materials and require a larger extent and number of felling trees and vegetation removed for slope cutting and stabilisation. Thus, larger environmental impacts would be created as compared to either type of ELS. Therefore, traditional open-cut method is not recommended.

2.6.4 Selection of the ELS for the construction of U-trough structure needs to be based upon the depth and extent for slip road construction, site-specific geology, groundwater conditions, adjacent existing and proposed structures which are sensitive to settlement, the available working area, environmental impact to the surroundings, cost and time.

2.6.5 Comparing with the open cut excavation method, adopting ELS method with sheet-piled wall or pipe pile wall would reduce the amount of C&D materials generated. Although installing piles would induce noise and vibration, using silent press-in techniques would significantly reduce the noise and vibration impacts. Considering pipe-piled wall gives a better control in ground settlement and groundwater, ELS method with pipe pile wall is recommended for the construction of HWRSR.

Lung Fu Road Slip Roads (LFRSR)

2.6.6 The comparison of different construction methods for LFRSR is summarised in **Table 2.7**.

Table 2.7 Engineering and Environmental considerations for various construction methods for LFRSR

Considerations	Precast Method (E.g.: Launching girder/ Balanced Cantilever)	Cast-in-Situ Method	
		Suspended Travelling Formworks	**Ground-supported Falseworks**
Engineering Factors	• Road closure required for each lifting operation due to road safety concern and in close proximity of Light Rail • Repositioning of plants & equipment involve temporary road closure which would only be allowed during restricted hours • Require the heaviest plants & equipment • Require the longest time to set up heavy plants & equipment • The longest construction period due to limited working space for plants & equipment	• Works could be carried out during non-restricted hours as proposed work would not take up carriageway space • Require moderate capacity of plants & equipment • Require the least working space for plants & equipment • Road closure only required for repositioning of suspended travelling formworks • Moderate construction period	• Falseworks could be erected/ dismantled during non-restricted hours • The most serious impact to existing traffic as road closure required for all works over carriageway • Require moderate working space • Require the least capacity of plants & equipment • Require the least setting up time for plants & equipment • Shortest construction period as multiple works front could be set up concurrently
Environmental Factors	• The worst night-time construction noise impact amongst all methods due to heavy lifting operations during restricted hours • The least amount of construction site activities & traffic flow induced due to precast segmental construction • Brings the most serious environmental	• Night-time construction noise impact due to repositioning the suspended travelling formworks above existing carriageways not as serious as precast method • The largest amount of construction site activities & traffic flow induced due to small scale	• Night-time construction noise impact due to erection of temporary cross beams above existing carriageways not as serious as precast method • Moderate amount of construction site activities & traffic flow induced due to synergy of larger

Considerations	Precast Method (E.g.: Launching girder/ Balanced Cantilever)	Cast-in-Situ Method	
		Suspended Travelling Formworks	**Ground-supported Falseworks**
	impact in terms of the longest duration of works	cast-in-situ works for segmental construction • Brings moderate environmental impact in terms of the moderate duration of works	scale of cast-in-situ works • Brings the least environmental impact in terms of the shortest duration of works

2.6.7 Considering LFRSR is located closed to the Light Rail, available working space is very limited, and the relatively small scale of works, even though precast method allows pre-fabrication of segments at off-site yard and only give moderate environmental impact, the precast method is considered not cost effective and does not help in the construction programme. Moreover, the construction programme will be lengthened due to the safety concerns for working and lifting close to the Light Rail.

2.6.8 Taking a balance between the engineering and environmental considerations above, cast-in-situ method with ground-supported falseworks will be favourable in expediting the construction programme. Expediting the works is the most effective means of minimizing the environmental and traffic impacts during the construction phase. Therefore, it is recommended for the construction of the elevated LFRSR as it allows the shortest construction programme, which in turns brings the least environmental impacts during the construction period.

2.7 CONCURRENT PROJECTS

2.7.1 Concurrent projects in the vicinity of the Project site are identified. The status of these concurrent projects is based on the available information obtained during the course of the EIA Study. It should be noted that the implementation of individual project would be subject to further development and subsequent actions of the respective project proponent.

2.7.2 The associated mitigation measures were also recommended where necessary to minimize the potential cumulative environmental impacts to the sensitive receivers. The concurrent project would include:

- Site Formation and Infrastructure Works for Public Housing Developments at Tuen Mun Central – Phase 1;
- Construction of Public Housing Development (PHD) at Yip Wong Road Phase 1 and Phase 2;
- Cycle track between Tsuen Wan and Tuen Mun (Tuen Mun to So Kwun Wat Section);
- Tuen Mun South Extension;
- Tuen Mun Bypass;
- Reprovision of Tuen Mun Swimming Pool, Tuen Mun Golf Centre Practice Green, Pet Garden and Community Green Station; and,
- Sports Ground and Open Space in Area 16, Tuen Mun.

2.7.3 The key details of these identified planned/committed projects are summarized in **Table 2.8**. The locations of these projects from which potential cumulative impact may arise are shown in **Figure 2.5**. Cumulative impacts from the concurrent projects have been assessed in the individual sections of this EIA Report.

Table 2.8 Summary of Concurrent Projects

Project [Project Proponent]	Construction Programme		Potential Cumulative Impact	
	Start	Complete	Construction Phase	Operation Phase
Site Formation and Infrastructure Works for Public Housing Developments at Tuen Mun Central – Phase 1 [CEDD] [1]	2021	Q3/2024	Cumulative construction dust is not anticipated as heavy construction works of this concurrent project would be completed before commencement of the Project. Cumulative noise impact was evaluated in Section 4 of this EIA Report.	Not anticipated in view of the nature of the concurrent project.
Construction of Public Housing Development (PHD) at Yip Wong Road Phase 1 and Phase 2 [HD] [2]	2020	2024-2025	Cumulative dust and noise impacts were evaluated in Section 3 and 4 of this EIA Report respectively.	Not anticipated in view of the nature of the concurrent project.
Cycle track between Tsuen Wan and Tuen Mun [CEDD] [3]	2023	2026	Cumulative dust and noise impacts were evaluated in Section 3 and 4 of this EIA Report respectively.	Not anticipated in view of the nature of the concurrent project.
Tuen Mun South Extension [MTRCL] [4]	2023	2030	Cumulative dust and noise impacts were evaluated in Section 3 and 4 of this EIA Report respectively.	Not anticipated in view of the nature of the concurrent project.
Tuen Mun Bypass Project [HyD]	2026	2033	Cumulative dust and noise impacts were evaluated in Section 3 and 4 of this EIA Report respectively.	Cumulative air quality and noise impacts were evaluated in Section 3 and Section 4 of this EIA Report respectively. Due to considerable separation distance between the Project and this concurrent project, the cumulative impact is anticipated to be insignificant.
Reprovision of Tuen Mun Swimming Pool, Tuen Mun Golf Centre Practice Green, Pet Garden and Community Green Station [MTRCL] [4]	2023	2030	Cumulative dust and noise impacts were evaluated in Section 3 and 4 of this EIA Report respectively.	Not anticipated in view of the nature of the concurrent project.
Sports Ground and Open Space in Area 16, Tuen Mun [ArchSD] [5]	2023-2024	2027-2028	Not Anticipated due to considerable separation distance between the Project and this concurrent project.	Not anticipated in view of the nature of the concurrent project.

Note:

[1] Source: PWSC Paper at https://www.legco.gov.hk/yr20-21/english/fc/pwsc/papers/p20-18e.pdf

[2] Source: LegCo Paper at https://www.legco.gov.hk/yr2022/english/panels/hg/papers/hg20220207cb1-33-1-e.pdf

[3] Source: EIA report at https://www.epd.gov.hk/eia/register/report/eiareport/eia_2802022/CONTENT%20PAGE.htm

[4] Source: EPD's website at https://www.epd.gov.hk/eia/register/profile/latest/esb332/esb332.pdf

[5] Source: ArchSD's webpage at https://www.archsd.gov.hk/en/projects/capital-projects-under-detail/278RS.html

2.8 PUBLIC CONCERNS

2.8.1 The Project Profile was submitted to the Environmental Protection Department (EPD) on 3 May 2021 and was exhibited for public inspection between 4 May 2021 and 17 May 2021.

2.8.2 The received comments mainly focused on observations on the existing traffic conditions and suggestions on additional traffic aids or modification to alleviate the situation, nuisance of noise, construction impacts to the Shing Miu and the surrounding environments, extent of tree felling, and preservation of the habitat. This EIA study has addressed the aforesaid potential impacts in **Sections 3 to 10**.

2.8.3 The Project was presented in the Traffic and Transport Committee (T&TC) Meeting of Tuen Mun District Council (TMDC) on 8 February 2021. During the briefing session, district council members raised the following concerns / issues about the implementation of the Project and the follow-up actions to be taken are summarized in **Table 2.9**.

Table 2.9 Summary of Concerns Raised by TMDC T&TC Members and Follow Up Actions

Concerns / Issues	Follow Up Actions to be Taken
• Concerns of future logistics centres in Tuen Mun Areas 38, 40 and 46 would make WCR and HWR much busier	• This EIA report is to address the environmental impacts. Details of the mitigation measures to be adopted during the construction and operational phases are discussed in the relevant chapters of this EIA report.
• The commissioning of TM-CLKT will increase the traffic loading of Tuen Mun Road (Town Center Section), WCR and LMR	
• More congested traffic on TWR causing noise problem	