

2. DESCRIPTION OF THE WORKS

2.1 Introduction

This Chapter presents a description of the proposed engineering scheme, and describes the process by which the preferred engineering approach has been developed.

2.2 Scope of the Proposed Works

The overall Project includes the preliminary design and ground investigations for:

- widening of the YLH between Lam Tei and Shap Pat Heung Interchange from dual-2 lane to dual-3 lane, together with a 3.65m hard shoulder for each carriageway;
- modification of the existing roundabouts/interchanges along YLH to suit the above widening;
- modification and widening of existing highway structures, i.e. culverts, bridges, underpasses, pedestrian subways, etc. to suit the widening;
- realigning the various slip roads joining YLH to suit the above widening;
- provisioning/reprovisioning of associated civil, geotechnical, landscaping and drainage works, street lighting, traffic aids (including sign gantries), central divider/parapets, noise barriers, fire hydrants, and traffic control and surveillance (TCS) system;
- police observation platforms along the widened carriageway and interchanges; and
- assessment of existing pavement conditions.

2.3 Description of the Alignment and Proposed Engineering Works

The existing YLH is a dual-2 highway completed in 1993/94. The Highway provides a trunk route between Tuen Mun and Yuen Long, traversing terrain which encompasses some cuttings to the south in the Tuen Mun area, whilst the northern section towards Yuen Long is constructed largely on embankment over alluvial flood plain. Major interchanges are sited at Tong Yan San Tsuen connecting Long Tin Road, the eastern distributor from Tin Shui Wai New Town, and at Tin Shui Wai West interchange connecting Hung Tin Road, the western distributor for the above estate.

The existing YLH crosses a total of 10 subways, 8 underpasses and 5 nullahs. As described in Chapter 1, a major interchange is proposed in the vicinity of Lam Tei to connect with Route 10 and Deep Bay Link. These routes are being investigated under separate projects.

The highway is presently operating with a vehicle to capacity (v/c) ratio of about 0.7, but with the continuing industrial and residential development of the Yuen Long and Tuen Mun areas, and especially Tin Shui Wai New Town, saturation of the existing dual-2 highway is expected by about 2001.

The location of the alignment and extent of the proposed works and the typical section of at grade road and viaduct are shown in **Figure 2.1** and **Figure 2.3** respectively. The proposed works between Lam Tei and Shap Pat Heung cover a length of 7km and involve widening in the order of 13m, generally on either side of the existing highway. Existing bridges will be widened to the same cross-section. The length of road under consideration commences at Lam Tei south of the CLP pylons at the Castle Peak Road on- and off-ramps. The project area terminates at the bifurcation of the existing Highway just before Shap Pat Heung interchange.

Generally the widening will be carried out with a mixture of symmetrical and asymmetrical widening. Wherever possible symmetrical widening will be used to minimise traffic diversions.

Cuttings will be excavated top down and will not normally require steepening as land availability and utilities are generally not a problem in these areas. After excavating to formation level, the pavement layers will be constructed and joined with the existing pavement after drainage has been modified. Where possible, cut material will be placed direct to embankment.

Space for embankments are somewhat more constrained by service roads, land availability and utilities. It may be necessary to construct lengths of reinforced concrete toe-walls with reinforced fill slopes of 1:1.7 or full height RC walls.

Where it is necessary to realign the highway and construct the widening asymmetrically, the widening will be constructed first and traffic diverted onto the new section to avoid lane closure. Following this, any pavement under the median barriers can be reconstructed. New carrier drains will be provided in the widened section with additional gullies.

For the on and off ramps at Tai Tao Tsuen interchange it is likely that new bridges adjacent to the existing ramps will need to be constructed. Once traffic is diverted onto these new bridges, the existing ramps can be demolished to allow widening of the mainline deck.

An asphaltic overlay of 315 mm is necessary over the whole of the existing highway pavement in order to extend its life by 15 years to that of the new 465mm widening pavement. A 30mm friction course layer will also be provided to improve road safety and reduce noise emissions.

In accordance with the EIA Study Brief, the environmental effects of the above mentioned works will be addressed under this EIA. The Third Comprehensive Transport Study has recommended the availability of a dual-4 Yuen Long Highway in Year 2016 subject to a trigger point review mechanism which puts the scope and justification of the recommended widening works under constant review taking account of the latest traffic information available. In the event that this dual-4 proposal is pursued, the design and construction works will be carried out under a different project at the appropriate time and the environmental impacts associated with such works will need to be investigated under a separate EIA Study.

2.4 Construction Programme

The proposed works are due to be undertaken over a period of 28 months commencing August 2003, with completion scheduled for December 2005. The construction programme and works areas are shown in **Figure 2.2** and **2.4** respectively.

2.5 Approach to Alternative Options

2.5.1 Alternative Route Alignments

In accordance with the Brief, consideration of alternative alignments is specifically excluded from the Assignment. However, under the terms of the EIAO there is a specific requirement for the consideration of alternative options. These issues are discussed below.

It is considered that the concept of alternative alignments (i.e routing outside of the current highway reserve) is a strategic planning / environmental consideration and therefore somewhat outside the scope of a project level EIA Study. Notwithstanding this, alleviation of the projected shortfall in the existing highway capacity could theoretically be achieved through construction of a new alignment to cater for the additional demand. Whilst this approach would reduce the impacts associated with additional traffic loading on the existing Highway, widening of the existing Highway to achieve these aims is considered the most environmentally acceptable approach for the following reasons:

- the widened Highway can be confined to the existing road reserve. This is a significant positive issue as the existing reserve has already suffered disturbance through the construction of the existing Highway. A widening approach minimises environmental impacts associated with land-take of hitherto undisturbed land as well as the social impacts of land resumption which would be considerable for a new alignment.
- The planning development strategy for the NWNT has been developed based on the assumption that the anticipated shortfall in highway capacity will be overcome by a widening exercise. This approach is sanctioned at the highest level of infrastructure planning for Hong Kong as a result of the suite of studies carried out as part of the Territorial Development Strategy Review, (PELB 1998)¹. This is continued through the “Planning and Development Study on North West New Territories” (PlanD/TDD on going), which similarly recognises the option of widening, and has developed a strategy for future development including the identification of New Development Area, (NDA) taking this into account. As identified in Chapter 1, the proposed works also form part of the planned infrastructure to cater for the development proposals for the NWNT and are designed to interface with the major road networks proposed under the 'Crosslinks' study for highway links to the PRC as well as the strategic feeder network of Deep Bay Link and Route 10, both of which will connect with the widened YLH.
- Notwithstanding constraints imposed by the development plans for the area, the existing pattern of development and physical topography of the area presents a number of constraints to the addition of a new alignment. To the south, there are areas of hilly terrain with scattered rural housing. To the north of the existing alignment, Yuen Long Town is extending southward with a number of new developments currently under construction. These present considerable constraints to re-alignment.

¹ Planning Environment and Lands Bureau (1998) Territorial Development Strategy Review, A Response to Change and Challenges, Final Executive Report.

2.5.2 Alternative Options Within the Scope of the Proposed Works

For the purposes of this Study the consideration of alternative options principally relates to variations in the overall scope of the engineering options for widening of the Highway as described in the Brief. The consideration of alternative options commenced at the early stages of both the overall project and the EIA process. This has been effected through the Preliminary Project Feasibility Study (PPFS) associated Preliminary Environmental Review (PER) and the Project Profile which subsequently defined the scope of the EIA defined in the EIA Study Brief.

The alternative options for widening have been addressed in the Preliminary Environmental Review for the Study and include:

- symmetrical widening with one additional lane on each side of the existing road;
- asymmetrical widening with both additional lanes to one side or the other; or
- a combination of the above.

Existing developments surrounding the road are generally close to both sides of the current alignment so land resumption issues and the corresponding negative social issues are a key consideration for the overall project. The PPFS has identified that on the whole, symmetrical widening works can be accommodated within the existing reserve for the Highway. Given the relatively recent completion of the sections of the Highway under investigation, it is considered that this option will cause the least disturbance to the existing environment.

The proposals include for the additional lanes to be constructed in a form compatible with the existing structure, which for most of the Yuen Long Highway is upon an embankment. This approach has been adopted principally due to the low-lying nature of the surrounding land and the potential for flooding.

Derivation of the Preferred Engineering Option

The preferred option has been developed based on the fact that this is a widening scheme with alignment essentially fixed by the existing operating highway. Major changes to the alignment would cause extensive disruption due to traffic diversions and any practicable widening design must therefore aim to minimise this. The preferred scheme was therefore developed with the objective of widening the highway symmetrically as far as possible. However, due to land constraints and adjacent utilities, some lengths of the highway may require realignment in order to achieve full standard widening.

Two alternative locations were considered for the Deep Bay Link/Route 10 interchange with the YLH. These two options were rejected due to space limitations, which would affect highway safety and the need for realignment of Deep Bay Link through densely developed areas respectively.

The layout of this interchange was agreed by HyD/TD/PlanD/TDD, on 10 March 1999 following lengthy discussions and taking into consideration the Deep Bay Link/Deep Bay Coastal Link/Hung Shui Kiu NDA interchange to its north.

2.5.3 Other Potential Options

Within the fundamental approach of widening the existing highway, there are other potential options which have been considered. However, the environmental implications of these schemes have not been investigated on the basis that they are unsound from an engineering perspective and present constraints to highway safety which deem them impracticable.

Depressed Carriageways

In order to ensure adequate highway safety and facilitate the movement of vehicles between lanes, ideally the carriageways for each bound should be at a similar grade. As such, the introduction of depressed carriageways would require the construction of two additional lanes to one side of the existing highway, with works needed to reduce the elevation of the third (existing) inside lane to the same level.

The depressed carriageway would have limited visibility and additional verge would be required to ensure adequate highway safety. This approach would require significant land resumption and disruption to existing utilities, which generally run continuously along the length of the Highway to both sides.

Key utilities include the WSD local distribution water main as well as future 1000 / 1400 mm diameter trunk main, which run adjacent to the existing highway. There is also an existing 750-mm diameter trunk gas main along both sides of the alignment. The Hong Kong China Gas Company, (HKCG) have expressed difficulties in making any diversion to this trunk main as there is no alternative ring main at present and suspension of service would cause major disruptions. There are also two China Light and Power (CLP) Pylons located at the Lam Tei Interchange on either side of the existing Highway. The additional land-take necessary for a depressed alignment would require re-routing of this portion of the Highway with major resumption required and possible reconfiguration to the existing Castle Peak Road Junction.

Much of the alignment is constructed on low-lying land with a high water table and is prone to flooding hence the original construction upon embankments. Construction of a depressed road would require major engineering works to prevent flooding of the carriageways and damage to the lower layers of the highway through groundwater intrusion. In this event, additional routine road maintenance would be required, with consequential disruption to traffic flows.

The necessary works are likely to effectively dam the natural flow of groundwater and result in permanent lowering of the water table. In turn this could result in ground settlement affecting nearby properties. In the hilly areas, the necessary excavations would result in significant cuttings. In the event that these drainage constraints could be overcome, the depressed carriageway would still require a pumping system to ensure that any floodwater could be raised to a sufficient head for gravitational dispersal to the main drainage channels.

As described above, there are a number of sub-ways, underpasses and nullahs that are bridged by the existing Highway as well as slip roads along the toe of the embankment which provide access to adjacent villages. Significant engineering works would be necessary to reroute or modify these features to facilitate the depressed carriageways.

Tunnel

The engineering constraints for a tunnel option would be similar to those for a depressed road, although the underlying geology would pose additional constraints. The geology of the alignment is unusual for Hong Kong in that there is widespread soft, saturated and compressible alluvium along the route as well as cavities in the underlying Yuen Long Formation Marble. Any tunnel would need to be constructed below the saturated alluvium, traversing the cavity bearing marble bed-rock. This would introduce an inherent risk of cavities collapsing to the surface.

Additional E&M systems would be required for a tunnel such as ventilation systems to avoid adverse operational air quality impacts, and a Traffic Control and Surveillance System (TCSS). These additional safety requirements mean that tunnels require a dedicated operational and maintenance staff.

Tunnels generally present a lower incidence of accidents, although given their enclosed nature, the consequences of accidents and fires can be more serious than for open roadways. There is a restriction on traffic within tunnels, such that a suitable alternative route would be necessary for Dangerous Goods Vehicles (Categories 1,2 and 5). Further traffic capacity studies would also be required as tunnel speeds tend to be restricted to below 80km/h due to the reduced marginal strip, whereas the current Highway now operates at 80km/h with wider marginal strips.

Elevated Road

Provision of staggered (double-decking) or elevated roads would generally avoid the need for resumption along the main line, however in order to maintain safety standards for interchanges the provision of off-ramps and on ramps would require significant land resumption. This is particularly the case at the Lam Tei interchange where there is unlikely to be adequate clearance of the CLP Pylons that lie either side of the existing Highway. In this area, complete remodification of the junction layout and re-routing of the existing roads would be likely.

As described above, the underlying geology includes cavity bearing marble bedrock which presents constraints upon the short term stability as well as the degree of settlement likely to occur over time. The implications of these effects would be exacerbated by the introduction of a relatively complex engineering structure such as a double decked highway. The work required to ensure a suitable factor of safety would be significant including deep piling and major ground stabilisation works.

Summary

The proposed widening scheme presents the most practicable engineering option to achieve the intended aim of providing increased capacity for vehicular traffic between Lam Tei and Shap Pat Heung. Whilst it is a requirement under the terms of the EIAO to consider the environmental considerations associated with alternative options in conjunction with the relative engineering issues, it is considered that the engineering constraints imposed upon alternative options are of a severity such that they cannot be considered feasible. As such, no further investigation of the environmental implications of alternative options has been carried out.