

**Hong Kong – Zhuhai – Macao Bridge
Hong Kong Section
& North Lantau Highway Connection**

Project Profile

October 2003

Highways Department

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Annex A Drawing No. HMW6787TH-SK0073

1. BASIC INFORMATION

1.1 Project Title

Hong Kong – Zhuhai – Macao Bridge (HZMB) Hong Kong Section (HKS) and North Lantau Highway Connection (NLHC).

1.2 Purpose and Nature of the Project

The region to the west of the Pearl River estuary will be important to Hong Kong Special Administration Region's (HKSAR) future economic development. A land crossing linking HKSAR to Macao SAR and Zhuhai will drastically shorten the travelling time between HKSAR and the Pearl River West, facilitate further economic development particularly in areas of finance, logistics and tourism, and strengthen the position of HKSAR as the hub of the Pearl River Delta area.

In January 2003, the National Development and Reform Commission and the HKSAR Government jointly commissioned the Institution of Comprehensive Transportation to conduct a study on the transport linkage between HKSAR and the Pearl River West. The study completed in July 2003 concluded that the construction of a land transport link between HKSAR and the Pearl River West would contribute to the development of tourism, logistics, finance and trade in HKSAR, reinforce its status as an international shipping and aviation centre, and also promote the economic integration between HKSAR and the Pearl River West. The report confirmed the need and urgency for such a link, and recommended the construction of HZMB and the early commencement of various studies including environmental impact assessment and hydrology study. It also recommended that the form, alignment and landing points of HZMB be finalised as soon as possible.

As announced following the Sixth Plenary Session of the Hong Kong/Guangdong Co-operation Joint Conference held in HKSAR on 5 August 2003, the State Council has given approval for the governments of the HKSAR, Guangdong and Macao SAR to proceed with the preparatory work for the HZMB. A HZMB Advance Work Coordination Group (AWCG) was then established by the three governments to coordinate and take forward the detailed planning for the construction of the HZMB, including studies on economic benefits, alignment, environmental impact, and hydrology. The first AWCG meeting was held on 29 August 2003.

This project covers the part of the HZMB that falls within the boundary of HKSAR and the transport infrastructure linking it to the existing road network. The HZMB HKS extends from the HKSAR Boundary to the landing point at Northwest Lantau, and the NLHC from the landing point to the connection with the North Lantau Highway at the Airport Island and at Tai Ho as traffic builds up in the longer term. Two possible alignments of HZMB HKS and NLHC are shown in Drawing No. HMW6787TH-SK0073.

In October 2002, Highways Department engaged consultants to undertake a Preliminary Environmental Review (PER) for the possible locations of landfalls in Hong Kong. A large number of locations along the west coast of Hong Kong were

examined, including Black Point in Tuen Mun, San Shek Wan in Northwest Lantau, Yi O and Peaked Hill in Southwest Lantau etc. The landing points at Southwest Lantau would result in the shortest distance from Zhuhai and Macao SAR, but they were not acceptable and were discarded as there is a potential site for designation as a Marine Park in that area. Black point was also considered but there were concerns on ecological grounds as it is the major feeding ground for a comparatively denser population of dolphins. We propose that the landing point of the Bridge should be best at Northwest Lantau while Black Point is less favourable.

Two possible sites near San Shek Wan Headland were identified as suitable locations to provide the landing point for the Bridge, and there were two corresponding possible alignments for the connecting infrastructure to link the Bridge with the existing road network and strategic facilities. One option runs in a short tunnel underneath the south of Sha Lo Wan Village, exits at Hau Hok Wan and crosses the Airport Island at the southern air cargo area. It then crosses the waters east of the Airport Island and links with the North Lantau Highway. This is indicated as Alignment 1 in the drawing. The other option has the Bridge landing further north, which will result in reduction in the coastal area affected. The connecting link of this option will start from the landing point of the Bridge, cross the Airport Channel, run along the south coast of the Airport Island and join the local road network at the southeast tip of the Airport Island. This link will also be further extended and linked up with the North Lantau Highway at Tai Ho as traffic builds up in the longer term. The landing location and the connecting link are indicated as Alignment 2 in the drawing.

A decision on the landing point for the Bridge in HKSAR and the alignment of the connecting link will be made after necessary environmental and engineering studies are completed.

1.3 Project Proponent

Highways Department

1.4 Location and Scale of Project

The location of the project is shown on Drawing No. HMW6787TH-SK0073. The tentative study envelope for the possible alignments covers the waters north of west Lantau, part of Northwest Lantau, the southern part of the Airport Island and the waters east of the Airport Island, all within the HKSAR boundary.

The scope of the project is to provide the HKS and NLHC, a dual-3 lane highway from the boundary of HKSAR to the North Lantau Highway, which comprises the following:

- (a) the highway between the HKSAR boundary and the landing point at Northwest Lantau, about 5km in length, which is tentatively planned to be constructed as trestle bridge structures
(At the western end, the proposed highway will be connected to the HZMB Zhujiang Section (ZS) at the Mainland/HKSAR boundary); and
- (b) the highway, with link roads, between the landing point and the North Lantau

Highway, about 5km in length totally, which is tentatively planned to be constructed as bored tunnel from the landing point to the east tunnel portal near the Airport Channel (for Alignment 1), as trestle bridge structures crossing the Airport Channel and as elevated road and bridge structure on the Airport Island or along the Airport Channel (for Alignment 2).

The above proposed structural forms are all tentative at this stage and subject to review. Other structural forms will be investigated if necessary.

There will be refinement of the highway alignment within the tentative study envelope. Selection of the alignment will be dependent on a variety of factors such as environmental impacts, construction programme and cost, planning and engineering considerations, traffic implications, land resumption requirements etc.

The connection to the North Lantau Highway at the Airport Island is only an initial highway connection. In the longer term and depending on the future traffic growth, the highway will be extended across the waters east of the Airport Island and then connect to North Lantau Highway near Tai Ho.

In case railway service is to be provided on the HZMB, the rail alignment within the HKSAR may be different from the road alignment and would be dealt with in a separate EIA study if such need arises.

1.5 Number and Types of Designated Projects to be Covered by the Project Profile

The proposed HKS and NLHC involve the construction and operation of a highway and the associated link roads, and are classified as Designated Projects under Schedule 2, Categories A.1, A.7(for Alignment 1), A.8 and Q.1 of the Environmental Impact Assessment Ordinance.

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2. OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 Project Planning and Implementation

The way in which the whole HZMB will be implemented is to be discussed and agreed among the three governments. The HKSAR Government will be responsible for the road infrastructure connecting HZMB to the existing HKSAR road network, i.e. NLHC. The NLHC will be implemented as a future PWP construction item. Consultants will be appointed to undertake the investigation study for both the HKS

and NLHC projects.

2.2 Project Programme

According to the current programme, consultants would be appointed to undertake an Investigation & Preliminary Design assignment for the NLHC project and an Investigation assignment for the HKS project. Construction works are expected to commence as quickly as possible. The tentative completion date is 2007 to 2010, but this is subject to confirmation pending findings of relevant technical studies.

2.3 Interfacing with Other Projects

This project covers only the HKS portion of the HZMB and NLHC within the HKSAR waters and territory, which has to tie in with the ZS portion within the Mainland waters. Close liaison will be maintained amongst the Mainland authorities, the Macao authorities and the HKSAR Government to address interfacing problems and cumulative effects due to the construction and operation of the whole HZMB and NLHC.

Potential project interfaces with the HKS and NLHC are listed below:

- (a) Phase III and IV of North Lantau Development, including new town and tourism projects in Tung Chung;
- (b) Tung Chung Cable Car;
- (c) new contaminated mud disposal facility at Airport East;
- (d) Tonggu Channel of Shenzhen Port;
- (e) 132kV overhead pole and underground cables from Tung Chung Town Substation to Cheung Sha Substation;
- (f) future Road P1 at North Lantau; and
- (g) future development on the Airport Island.

3. POSSIBLE IMPACT ON THE ENVIRONMENT

3.1 Outline of Process Involved

Based on preliminary assessments, the HKS and NLHC would conceptually be made up of trestle bridges, a bored tunnel section (for Alignment 1) and elevated bridges. The bridges are likely to be of pre-stressed concrete construction with piled foundation whereas the bored tunnel would be constructed using tunnel boring machine/blasting. The preliminary layouts and construction methods of the bridges and tunnel will be examined under the investigation assignment of this project; and considerations would be taken in the selection of project alignment and design of the project to avoid and/or minimize the environmental impacts to the sensitive receivers.

3.2 Existing Available Data

In October 2002, Highways Department engaged consultants to undertake a PER for the possible landing points of the HZMB and the alignments of the connecting

infrastructure. A large number of areas along the west coast of Hong Kong were examined and assessed based on environment criteria such as ecology, water quality, air quality and cultural heritage.

Several studies have already been conducted within or near the tentative study envelope, including Agriculture, Fisheries & Conservation Department's study on marine benthic communities and the Port Survey. These studies provide up-to-date information on the benthic fauna and on fisheries production and fishing operation of Hong Kong, and will be very useful to the study for evaluating the possible impact on the environment.

Studies on Chinese White Dolphins (Indo-Pacific Hump-backed Dolphin) have also been carried out extensively in the North Lantau waters. Dolphin distribution patterns and recent data relating to dolphins in the waters of the tentative study envelope are available for this study.

Seagrass beds and mangroves are recognised as important coastal communities as they provide habitat for several species including fish and spawning and nursery grounds for horseshoe crabs. There is a large amount of available existing data on the mangal and seagrass habitats present in the tentative study envelope.

3.3 Construction and Operational Environmental Impacts

It is anticipated that surrounding sensitive receivers could be affected by noise, air quality, ecological, water quality, visual, waste and cultural heritage impacts during the construction and operational stages.

3.3.1 Ecology

- (a) Impacts may arise on streams from erosion of exposed earth and construction materials, with subsequent sedimentation. Poor site controls may also lead to potential impacts from chemicals, such as alkaline slurry from concrete, oil, grease and fuel spills.
- (b) Construction at the bridge-land interface and the construction of piers in west Lantau and the Airport Channel may result in increased release of sediments that could potentially affect the mangroves and seagrass communities at/near the San Tau SSSI, intertidal mudflats and horseshoe crab nursery area in Tung Chung Bay and the habitat of the Chinese White Dolphins.
- (c) During construction stage, there may be loss of vegetation and shrubland at the landing point and loss of riparian vegetation in the streams.
- (d) In order to collect updated information for ecological assessment, an ecological baseline survey is being conducted to determine the potential ecological impact.

3.3.2 Fishery

- (a) There will be potential risk of spillages to the surrounding waters during

offshore and coastal construction, and temporary disturbance to existing fishing operations.

- (b) Dredging operation, if required, may lead to localized high ambient concentration of suspended solids which may have impact on fishery resource on the coastal areas.

3.3.3 Water Quality

- (a) Mobilization of sediment and contaminated runoff spills may occur during the construction of piers.
- (b) The operational impact of the bridge would be mainly due to a reduction in flow area caused by the piers. This may reduce the flow area and hence the pollutant dispersion capability of the Airport Channel and water quality may deteriorate.

3.3.4 Air Quality

- (a) Construction will involve dust generating activities such as road pavement construction, piling works, excavation and concreting.
- (b) Local air quality impacts due to vehicular emissions during the operation stage are not significant. The effects will be further investigated by taking account of the cross-boundary aerial pollutants being transported from the Mainland under the project.

3.3.5 Noise

- (a) Construction will involve noise generating activities such as road pavement construction, piling works, excavations and concreting. Noise impact may also be caused by dredging works, if such is found to be necessary for the implementation of the project.
- (b) Noise sources in the operational stage will be associated with the traffic using the highway. A large proportion of the traffic is expected to be goods vehicles and buses.

3.3.6 Landscape and Visual

- (a) There would be potential adverse landscape and visual impact from construction activities along the coastal area, Lantau North Country Park and the proposed Lantau North (Extension) Country Park. The construction traffic (both from sea and land) would also cause potential adverse visual impact to hikers, people travelling/working on boats/shipping vessels, and local villagers.
- (b) There may be loss of visual amenity to visual sensitive receivers along North Lantau coast and visual intrusion to residents of North Lantau New Town due

to the construction of a bridge connection to the North Lantau Highway.

- (c) At operational stage, the visual appearance of the new road link crossing Airport Channel may cause visual intrusion on the open seascape. The night-time visual impact generated by street lighting and illumination on residents at Tung Chung and North Lantau New Town could also be significant if not carefully treated.

3.3.7 Cultural Heritage

- (a) Areas of archaeological interest and potential offshore marine deposits, which have not been investigated and/or adequately studied previously, may be affected. The construction activities may cause direct and/or indirect impacts on San Shek Wan, Ha Law Wan, Sha Lo Wan and Sha Lo Wan (West) archaeological sites and the items of historic interest in the villages at Sha Lo Wan and San Shek Wan. The construction activities may also cause indirect impacts on the Tung Chung Battery, a declared monument.

3.3.8 Waste Management

- (a) Activities during the construction phase may result in the generation of a variety of wastes generally comprising excavated materials, marine sediment if dredging is involved, chemical waste arising from maintenance/overhaul of mechanical equipment, construction waste and general refuse.

4. MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

4.1 Existing and Planned Sensitive Receivers

The existing and planned sensitive receivers are discussed below. Any planned sensitive receivers identified during the study will be considered. Detailed investigations and surveys will be carried out under the project to assess the impact.

4.1.1 Ecology

Potential ecological sensitive receivers in the vicinity of the alignment would be:

- (a) vegetation and coastal shrubland close to the landing point;
- (b) riparian vegetation of the stream near the landing point;
- (c) proposed Lantau North (Extension) Country Park;
- (d) mangroves and seagrass communities at/near the San Tau SSSI;
- (e) intertidal mudflats and Horseshoe Crab nursery area in Tung Chung Bay
- (f) habitat of the Chinese White Dolphins;
- (g) Sha Chau and Lung Kwu Chau Marine Park;
- (h) Scenic Hill on Airport Island which might support a remnant population of the Romer's Tree Frog.; and
- (i) seagrass communities at Tai Ho Bay.

4.1.2 Fishery

- (a) The fishing areas near Shum Wat, Sha Lo Wan, Tung Chung and Chek Lap Kok.

4.1.3 Water Quality

Potential water sensitive receivers would be:

- (a) North Western Water Control Zone;
- (b) Tung Chung water intake;
- (c) Tung Chung Bay and the Airport Channel;
- (d) ecological sensitive receivers (mangroves, seagrass, sand/mud flats, and habitats of horseshoe crabs and the Chinese White Dolphin); and
- (e) seawater/cooling water intake at Airport.

4.1.4 Air Quality

Potential air sensitive receivers are located at:

- (a) Tung Chung Airshed;
- (b) Sham Shek Tsuen;
- (c) San Shek Wan;
- (d) Sha Lo Wan Tsuen;
- (e) San Tau;
- (f) Hong Kong Business Aviation Centre within the Airport;
- (g) Asia Airfreight Terminal within the Airport;
- (h) Hong Kong Air Cargo Terminals within the Airport;
- (i) Cathay Pacific City within the Airport;
- (j) North Lantau Development in Tung Chung;
- (k) Airport Freight Forwarding Centre; and
- (l) Tradeport Logistics Centre on the Airport Island.

4.1.5 Noise

Potential noise sensitive receivers are located at:

- (a) Sham Shek Tsuen;
- (b) San Shek Wan;
- (c) Sha Lo Wan Tsuen;
- (d) San Tau; and
- (e) North Lantau Development in Tung Chung.

4.1.6 Landscape and Visual

Potential Landscape and visual sensitive receivers would be:

- (a) residents of North Lantau Development;
- (b) residents of Sha Lo Wan Valley, Tin Sum, Kau Liu and San Tau villages;

- (c) walkers on the North Lantau coastal footpath and worshippers at the Hau Wong Temple;
- (d) fishermen in Hau Hok Wan;
- (e) passengers of cable cars;
- (f) workers en route to the Airport; and
- (g) hikers at the Lantau North Country Park and proposed Lantau North (extension) Country Park as well as at the Scenic Hill on the Airport Island.

4.1.7 Cultural Heritage

Cultural and heritage resources in the vicinity of the study area would be:

- (a) potential offshore marine archaeological deposits on the seabed off North Lantau;
- (b) historical villages at San Shek Wan, Sha Lo Wan, Kau Liu, San Tau and Tin Sum;
- (c) Ha Law Wan archaeological site;
- (d) San Shek Wan archaeological site;
- (e) Sha Lo Wan archaeological site; and
- (f) Sha Lo Wan (West) archaeological site.

4.2 Major Elements of Surrounding Environment and Land Uses

San Shek Wan Headland in West Lantau is a remote and undeveloped area characterized by steep natural terrain and a number of small and traditional villages. At present, a large proportion of West Lantau has been designated as country park and area to the immediate south of the Airport Island has been identified as an extension to the existing country park. There are also a number of sites of environmental/ ecological/ historical importance located along the coastal areas, including SSSIs, archaeological sites, declared monuments and mangrove areas. Village settlements in the area include Sha Lo Wan, San Tau, San Shek Wan, Sham Shek Tsuen and Sham Wat.

5. ENVIRONMENTAL MITIGATION MEASURES

Based upon the potential impacts as a result of the construction and operation of the project, it is anticipated that mitigation measures will be required. Measures to minimise environmental effects are detailed below.

5.1 Measures to Minimize Environmental Impacts

5.1.1 Ecology

- (a) Construction impacts could be minimized through good construction planning, good working practices, and can be mitigated by reinstatement of lost habitats.
- (b) Avoidance of any identified sensitive sites through route refinement will be the preferred mitigation measure. However, in some cases compensatory habitat

on or near the site might be a feasible option.

5.1.2 Fishery

- (a) Construction impacts could be minimized through good construction planning, good working practices. The hard substrate provided by the bridge piers and any rock armour protection will provide conditions similar to those within an artificial reef with a view to enhancing the habitat and the biodiversity of the area.

5.1.3 Water Quality

- (a) Employ proper construction techniques to prevent mobilization of sediment during construction and implementation of stringent site sediment control and mitigation measure to prevent elevation of suspension solid.
- (b) There could be spills during operation of the project, potentially containing oil and other contaminants. However, the operation of the project is not expected to generate significant volumes of discharge and runoff should not be contaminated under normal conditions. Operational hard surface runoff, potentially containing oil and other contaminants can be controlled through the use of sediment traps and oil interceptors installed along the route to reduce the pollution to stormwater system.

5.1.4 Air Quality

- (a) By following the recommendations as stipulated in the Air Pollution Control (Construction Dust) Regulations, the levels of dust generation could be maintained at a minimal level.
- (b) It is expected that dust, which is predominately associated with construction, will not be an issue during the operational stage. Exhaust gaseous emissions associated with the vehicular use of the road will be major source of air pollutants. In order to reduce impacts so as to meet the Air Quality Objectives, buffer areas will be provided between the sources and the receivers.

5.1.5 Noise

- (a) To mitigate construction noise, temporary noise barriers are likely to be required along the construction site boundary such that construction equipment and noise will be screened.
- (b) Carrying out construction activities and limiting construction traffic to and from the site during daytime hours where works may affect sensitive receivers.
- (c) Noise barriers may be required along some sections of the new road for reducing traffic noise during the operational phase.

5.1.6 Landscape and Visual

- (a) Mitigation measures to minimize environmental impact during both the construction and operational stages should be comprehensively reviewed for both visual and landscape aspects. Mitigation of construction phase visual impacts should include control and minimization of the site works area together with abatement of dust generation and good site organization.
- (b) Other possible measures may include preservation of vegetation, transplanting of mature trees of high amenity value, provision of screen planting, revegetation of disturbed land, compensatory planting, provisioning of amenity areas, sensitive design of structures, provision of compatible finishes, colour and texture to structures.
- (c) As an operational stage mitigation measure, interesting and innovative design of the bridges could be adopted as means to improve the aesthetics and minimize the visual impact of the project.

5.1.7 Cultural Heritage

- (a) Conduct (i) built heritage survey and (ii) land and marine archaeological surveys, including desk-based study and field investigation, and the impact assessments on built heritage and areas with potential archaeological deposits.
- (b) Field investigation consisting of field walking, augering and test trenching for land archaeological survey, and geophysical survey and diver inspection for marine archaeological survey will be conducted where necessary based on the findings of the desk-based study and consultation with the Antiquities and Monuments Office.
- (c) Archaeological field investigation should be conducted by qualified archaeologists / marine archaeologists, who should apply for a licence issued by the Antiquities Authority under the provision of the Antiquities and Monuments Ordinance (Cap.53). The licence application will normally take at least two months' time.
- (d) Mitigation for impacts on built cultural heritage and areas of archaeological deposits in the first instance should include avoidance of the area of importance and minimisation of direct impacts. Any unavoidable impacts on cultural and heritage resources identified in the impact assessment should be addressed with appropriate mitigation measures implemented by the project proponent.

5.1.8 Waste Management

- (a) As the HKS and NLHC is a highway for use by road traffic, waste impact during the operational stage is considered as extremely small.
- (b) It is recommended that a material/waste management plan is established prior to commencement of excavation and construction work to outline the methods

that can be incorporated into the project for waste minimization, reuse, recycle, handling, storage, transport and disposal of expected waste materials.

5.2 Severity, Distribution and Duration of Environmental Effects

- (a) Ecology, water quality and landscape and visual impacts will be most severe during construction of the bridge piers.
- (b) The level of archaeological impact will need to be ascertained subject to detailed land and marine cultural heritage assessments.
- (c) Subject to investigation on noise impacts, permanent noise structures may have to be installed to keep the noise impact to acceptable level.

5.3 Further Implications

- (a) Public consultation will be arranged once sufficient information is available.
- (b) Close liaison will be maintained amongst the Mainland authorities, the Macao authorities and the HKSAR Government to address interfacing problems and cumulative effects due to the construction and operation of the whole HZMB and NLHC.

6. USE OF PREVIOUSLY APPROVED EIA REPORTS

No previously approved EIA reports exist for the proposed project. However, reference may be made to the following previously approved EIA reports within the study area:

Register No.	Title
EIA-006/BC	New Airport Master Plan – Environmental Impact Assessment
EIA-015/BC	EIA of the Proposed 6000 MW Thermal Power Station at Black Point : Initial Assessment and Key Issue Assessment
AEIAR-031/2000	Northshore Lantau Development Feasibility Study
AEIAR-036/2000	Tai O sheltered Boat Anchorage – Environmental & Drainage Impact Assessment – Environmental Impact Assessment
AEIAR-061/2002	Improvement to Tung Chung Road between Lung Tseng Tau and Cheung Sha
AEIAR-062/2002	Permanent Aviation Fuel Facility for Hong Kong International Airport
AEIAR-066/2002	Construction of Lung Kwu Chau Jetty
AEIAR-067/2002	Shenzhen Western Corridor
AEIAR-074/2003	Tung Chung – Ngong Ping Cable Car project