# 3A. 深港西部通道(深圳灣公路大橋)—環境影響報告書(一九九八年三月)

**3A.1** This Study was completed in 1998 by the China Greening Environment Development Centre, affiliated to the State Environmental Protection Administration. Potential environmental impacts from the construction and operation of the proposed bridge were evaluated. The following sections highlight findings from this Mainland EIA report.

***Water Quality Impacts***

**3A.2** A mathematical model was used to predict impacts on hydrodynamic and water quality conditions in Deep Bay (Shenzhen Bay).

**3A.3** The navigation span of the recommended bridge option was 340m in length and the spacing of typical span was 50m. The total length of the bridge was 4,880m. Diameters of the piles for navigation span and typical span were 2.2m and 1.8m respectively.

**3A.4** Increases in suspended solids levels within the affected areas were predicted. Also, the impacts may migrate towards the Hong Kong side, depending on the sediment discharge locations. The water quality conditions of the affected areas would be able to recover several days after the discharge of sediment at the reclamation site.

**3A.5** The reduction in tidal flow across Deep Bay was predicted to be about 4% after the completion of the bridge. Tidal currents would be mostly below 0.6 m/s near Dongjiaotou and the highest speeds would be at the navigation channel. The influence to the dilution of pollutants in the bay was identified to be small.

**3A.6** Water quality monitoring was specified in the Report. The working practices for bridge construction would include the treatment of dredged materials. Release of the dredged materials would be controlled during the bridge pier construction. Personnel responsible for environmental protection and control would be deployed to monitor the operation of treatment facilities for sediment removal. Illegal disposal of wastes into Deep Bay would be prohibited.

**3A.7** Monitoring of suspended solids levels would be carried out during flood and neap tide periods at the beginning of the construction works, and on a quarterly basis throughout the construction period. The monitoring locations were specified to be respectively at 500 m and 2,000 m upstream, and at 500 m downstream from the bridge alignment. At the 500 m upstream monitoring location, the suspended solids level should not exceed that at the 500 m downstream location by more than 100 mg/L. At the 2,000 m upstream location, the suspended solids level should not exceed that at the 500 m downstream location by more than 10 mg/L.

**3A.8** From the water quality impact assessment performed, it was concluded that the proposed project would be environmentally feasible.

***Air Quality Impacts***

**3A.9** Construction phase impacts from dust and construction vehicles emissions were found to be minor, particularly that no sensitive receivers are located near the work site.

**3A.10** Results from the assessment of operation phase traffic emissions showed that air quality impact on receivers east of the bridge alignment would be small, for scenarios up to the year 2020. At the crossing service area and the surrounding vicinity, concentrations of air pollutants would be relatively high. The assessment also predicted moderate increase in concentrations at Si Hai Park and the Shekou School.

**3A.11** Regarding the crossing service area, the Study concluded that a suitable buffer zone would be necessary. Based on the modelling results, it was recommended that sensitive receivers should not be placed within a distance of 400 m from the western boundary of the crossing service area.

**3A.12** For mitigating impacts from the construction phase, the following measures were recommended:

- Materials that may generate fugitive dust should be stored in a temporary warehouse if feasible. Where storage at the construction site is necessary, such materials should be covered. When a gale is forecast, these stockpiles should be inspected, and their covers strengthened.
- Dust and smoke from concrete batching and production should be minimized through the use of proper facilities.
- The main transport road should be determined by the Mainland Environmental Protection Bureau (EPB). Water should be sprayed on the road once a day to reduce dust generation. Vehicles should be washed after rain. Also, vehicles transporting powdery materials should be covered with canvas.
- Transportation of construction materials via waterways would be preferable, in order that deliveries by road could be reduced.
- Water should be sprayed at the construction site on sunny days to reduce dust generation.
- The loading or unloading of powdery materials such as cement should cease when the prevailing wind speed is greater than 5 m/s.
- All construction vehicles should meet exhaust emission standards.
- Construction workers should be provided with training on proper construction techniques and environmental protection.

**3A.13** For mitigating traffic emission impacts from the operational phase, the following measures were recommended:

- Vehicle staying time in the inspection area should be reduced.
- The design of the inspection building and other buildings in the Crossing Area should allow free flow of air around these structures. Particularly for the goods vehicle waiting and inspection areas, no tall buildings should be located around these areas.
- The link road should be able to divert vehicles from the Crossing Area rapidly, in order to reduce vehicle waiting time in the Crossing Area.
- Vehicles should be equipped with exhaust treatment device.
- An area within 400 m west of the Crossing Area boundary should be classified as Grade 3 standard control area.
- Comprehensive monitoring should be conducted to determine the distribution and level of exhaust emission in the Crossing Area.
- Accelerating the pace of adopting natural gas as fuel for vehicles would help in reducing air pollution from the vehicle exhaust.

***Noise Impacts***

**3A.14** The Report noted that pile driver, stick vibrator and concrete mixing machine would generate substantial levels of noise during the construction phase.

**3A.15** During the construction preparation period and when bank protection activities are carried out, daytime noise levels 50 m from the source would comply with the standards of GB12523 Noise Limits for Construction Site. Also, nighttime noise level at a distance of 250 m from the noise source would comply with the standards.

**3A.16** During the bridge and Crossing Area construction periods, daytime noise levels at a distance 100 m from the source would comply with the standards, whereas nighttime noise level at a distance of 500 m from the noise source would comply with the standards.

**3A.17** Piling activities were predicted to pose no impact to the Futian mangrove natural conservation area, which is located about 9,000 m from the construction site.

**3A.18** Regarding the operational phase, noise impacts from the ring roads in the vicinity of the bridge were assessed. In year 2010, noise level at 200 m from the noise source would comply with GB3096-93 Class IV requirements for daytime/nighttime periods. In year 2020, noise level at 200 m from the noise source would only comply with GB3096-93 Class IV requirements for daytime period. The assessment predicted that Class IV peak hour requirement would be exceeded by 1-3 dB(A) in year 2010, and similar exceedance against nighttime/peak hour requirements would occur in year 2020. All predicted traffic noise levels exceed Class II requirements in the same standards.

**3A.19** Noise from operational phase traffic at the truck inspection area was predicted to comply with GB3096-93 Class IV requirements. In year 2010, noise level at 200 m from the noise source would comply with Class II requirements for nighttime period. The assessment predicted that Class II daytime and peak hour requirements would be exceeded by 1-9 dB(A) in year 2010, and similar exceedance against daytime/nighttime and peak hour requirements would occur in year 2020.

**3A.20** Noise from operational phase traffic at the bus inspection area was predicted to comply with GB3096-93 Class IV requirements. In year 2010, noise levels would comply with Class II requirements for daytime/nighttime and peak periods. In year 2020, noise levels would only comply with Class II requirements for daytime period. The assessment predicted that Class II nighttime and peak hour requirements would be exceeded by about 1 dB(A) in year 2020.

**3A.21** The following measures were recommended to mitigate noise impacts during the construction phase:

- The construction site should be carefully planned, and low noise construction equipment should be used.
- Construction schedule should also be planned carefully. The works must strictly comply with the regulation for prohibiting piling activities during nighttime, as stipulated in GB12523 Noise Limits for Construction Site.
- Although piling noise from the project would not affect the Futian mangrove natural conservation area located about 9,000 m away, piling at nighttime, noon and sleeping time should be avoided.

**3A.22** The following measures were recommended to mitigate noise impacts during the operational phase:

- The layout of the Crossing Area should be carefully determined. The surrounding vicinity should be planned for commercial uses, which have lower requirements regarding noise mitigation. Residential buildings or noise sensitive facilities should not be established within 200 m of ring roads linked to the bridge.

- Mitigation measures for the inspection house would be required to protect the health of personnel working within the building. The details of these mitigation measures should be considered during the design of the project. With appropriate measures, noise levels in the building could be reduced to below 60 dB(A).

***Ecology***

*Construction stage*

**3A.23** Direct impacts include:

(1) Aquaculture zone: There are currently 700 oyster rafts occupying 150 ha in Deep Bay within the Mainland waters. During construction, the area covering 500 m from either side of the bridge alignment would not be available for aquaculture. About 15 ha of existing oyster farming area would be affected, accounting for 10% of the total farming area in Deep Bay. However, on the Hong Kong side of the project, only 50 m from either edge of the bridge would be cleared; thus, the affected area on the Hong Kong side would be much less than 10%. Marine traffic during construction phase would also disturb the growth of oysters.

(2) Within the works area of the bridge, i.e. 100 m from either side of the bridge, dredging and the construction of temporary working platforms would disturb benthic habitats. Marine organisms on the seabed, except mobile organisms like fishes, would be affected or killed. According to the information provided in the Mainland EIA, the temporary loss of benthic habitats would be 50 ha along the 4880-m bridge alignment.

(3) The landing point of the bridge together with the associate facilities would occupy 130 ha of reclaimed land. Impacts on aquaculture and marine benthic habitats, however, would occur before the commencement of the construction of those facilities. This reclamation area had been designated as a traffic usage zone in the planning of Shenzhen Special Economic Zone (SSEZ).

**3A.24** Indirect impacts include:

(1) Suspended solids

- Water quality modeling predicts that during the construction phase the SS level would increase by 20 mg/L within a 1000 m belt centered on the works area, and by 5 mg/L within an area extending 2 km upstream and 3 km downstream from the bridge.
- The production of oysters was reported to decline when the SS levels exceeded 40 mg/L, while the growth rate of oysters would decline when SS levels exceeded 20 mg/l.
- During the construction stage, the existing oyster farming zone within 500 m downstream from the sediment sources would cause increases in SS levels to exceed 40 mg/L, and the growth of oysters would be affected. The affected time period, however, would be less than 90 days.
- Within 1 km downstream form the sediment sources, the SS level would exceed 20 mg/L and would disturb the growth of oysters. The disturbance period would be less than 90 days.
- For the sea areas over 1 km from the bridge, aquaculture practices would not be affected.

(2) Re-suspension

- Since the level of organic materials and $H_2S$ in the seabed sediment within the works area is relatively low, release of nutrients and the resulting eutrophication would have a minimal effect.
- No major eutrophication or change of mudflat biomass would be expected within a 2-km zone covering the bridge alignment. The proposed SWC would not further contribute to the change of marine community structure in Shenzhen Bay.

(3) Sedimentation

- A reduction of organic material content and an increase of mean particle size would be expected near the works area after construction. These changes would affect the species composition and the biomass of benthos. For the seabed further away, there would be an increase of less than 0.068 mm sedimentation caused by the construction works. The survival of marine benthos would not be threatened.

(4) Neelingding Futian National Nature Reserve

- The bridge alignment would be 5 km away from the boundary of the Nature Reserve. No direct impacts would be caused by the proposed project. In the sea area 7 km away from the mangroves, the increase in SS levels would be less than 5 mg/L. This change would not cause impacts on the marine and coastal ecosystems. Being outside the impacted area, the water quality within and near the Nature Reserve would also not be affected by the project.
- Air quality and noise impact assessment showed that Neelingding Futian National Nature Reserve and Mai Po Marshes both lie outside the area affected by the proposed project.
- There would be no direct nor indirect impacts on the mangrove ecosystems within Shenzhen Bay from the present project.

*Operation stage*

**3A.25** Water quality : According to the prediction resulting from hydrodynamic modeling, the hydrodynamics and exchange capacity of Shenzhen Bay during the operation stage would be similar with the existing conditions. After the implementation of sewage collection by the urban sewer network, sewage from Shenzhen would be discharged to the estuary of Pearl River rather than to Shenzhen Bay. No impacts on marine ecology would be expected from the operation of Shenzhen Western Corridor.

**3A.26** Noise and Air pollution : According to the prediction of air and noise impacts, the extent of the affected area for both air and noise would be the same, i.e. covering 500m from either side of the bridge alignment. No impact would be posed on the habitats of avifauna within Shenzhen Bay.

*Mitigation Measures and Recommendation*

**3A.27** The impacts from the project include:

(1) 15 ha of Deep Bay currently used for oyster farming would not be available during the construction phase.

(2) 50 ha marine benthic habitat would be affected.

(3) 15 ha of oyster farming zone would be subject to a high level of suspended solid level for 90 days, and oyster growth would be affected.

(4) 30 ha of oyster farming zone would be subject to a level of suspended solid higher than the baseline level for 90 days, and the oyster would be disturbed.

**3A.28** Most of these impacts would be temporary, and self-correction would occur after the sources of impacts disappear.

**3A.29** Water quality would be restored to baseline levels in a short period and the biological resources in the water column would recover to baseline conditions very quickly. Aquaculture could be performed in sea areas 100 m distant from the bridge. Benthic habitats would be affected by fill materials. This would affect the colonization by marine benthos and elongate the recovering period. Measures to prevent the dispersal of construction materials and dredged materials should be implemented.

*Conclusion*

**3A.30** There would be no direct impacts on terrestrial habitats from the project. Impacts on marine habitats include: destruction of benthic habitat within the works area, suspension from operation for 10% of existing oyster farming zone in Shenzhen Bay, and impacts on oyster growth and biodiversity from the increase of suspended solid. No direct or indirect impacts on mangroves inside the Neilinding Futian National Nature Reserve. These construction phase impacts would be naturally recovered to baseline levels after the completion of construction works. There would be only very limited impacts caused by the operation of the bridge.

**3A.31** The project is thus feasible **and acceptable from the ecological point of view.**

***Environmental Management and Audit***

**3A.32** An Environmental Management and Audit Plan for the project was prescribed in the Report.

**3A.33** For the construction phase, the following recommendations were outlined in the Report:

- The main tasks should include the implementation of the structure and duties of the environmental management organization, and the setting up of supervisory system and procedures for pollution control. Compliance with relevant regulations and prevention of environmental incidents should be the key objectives of the Environmental Management and Audit programme.
- The environmental management supervision team should include an environmental observer, a supervising engineer and environmental staff from the contractor. It should be the contractor's responsibility to execute relevant control measures, and a supervising firm should be responsible for checking and examining such measures. The results should be verified by the Mainland Environmental Protection Bureau and other relevant safety supervision departments.
- The client would determine contractual environmental requirements based on current laws and regulations. The tender should include details of pollution control specifications. The contract between the client and contractor should include pollution control requirements and punitive measures for cases of non-compliance. The relevant costs of environmental requirements should also be described in the contract.
- It would also be the contractor's responsibility to train employee on environmental protection and control measures. Work activities that may cause environmental impacts should be carried out only by personnel qualified through an examination process.
- Monitoring of air quality, noise and water quality parameters should adhere to the requirements specified in the Environmental Management and Audit Plan.

**3A.34** For the operational phase, the Report recommended the establishment of an environmental protection management unit as part of the bridge and crossing management authority. Also, programs for monitoring air quality, noise and water quality parameters were prescribed.