Latest Progress of Hong Kong-Zhuhai-Macao Bridge Infrastructure Projects in Hong Kong

Supplementary Information

At the meeting of the Legislative Council (LegCo) Transport Panel on 26 October 2011, Members requested the Administration to provide supplementary information on the latest progress of Hong Kong-Zhuhai-Macao Bridge (HZMB) infrastructure projects in Hong Kong for the reference of the Public Works Subcommittee of the Finance Committee (FC) on 8 November 2011. The supplementary information is provided in ensuing paragraphs.

(I) Environmental Protection Measures for HZMB Infrastructure Projects in Hong Kong

(A) Public Consultation

2. We have commenced our public consultation and engagement activities on the HZMB Infrastructure Projects in Hong Kong as early as the project conceptual stage. We have actively engaged the public, and incorporated as far as possible the views of various sectors into the design so as to meet public expectation and minimize the impact on the environment.

3. The environmental impact assessments (EIA) of the HZMB Infrastructure Projects in Hong Kong were commenced in 2008 according to the Environmental Impact Assessment Ordinance (Cap. 499), but we have since 2005 kick-started our public consultation activities to listen to public opinions and suggestions on our projects, including concerns over the environmental impact of the alignments and site selection. During the public consultation and engagement process in the past few years, we have modified several fronts of the site location and alignments in response to public concern on the impact on the environment. We have also proposed a large number of environmental protection measures to fulfill the responsibility of the project proponent to minimize pollution as far as possible.

(B) Site Selection and Alignments

4. In April 2005, we consulted the public on the alignment options of the Hong Kong Link Road (HKLR) and the landing point of the HZMB. In response to the suggestions from public, the original eastern alignment option was not pursued. Instead, the alignment has been adjusted to the current one which is along the Airport Island to connect with the Hong Kong Boundary Crossing Facilities (HKBCF).

5. From September 2008 to October 2008, we conducted ten focus group meetings on the HKLR, HKBCF, Tuen Mun – Chek Lap Kok Link (TM-CLKL) and Tuen Mun Western Bypass (TMWB) and held two public workshops concerning the Hong Kong-Shenzhen-Zhuhai corridor[1] at Tung Chung and Tuen Mun. During these public engagement exercises, some Tung Chung residents expressed concerns over the environmental and visual impacts that might be caused by the HKBCF proposed to be located at the waters off the north-east of the Airport Island, and expressed their preference of locating the HKBCF at the west side of the Airport Island instead. In addition, some residents expressed their preference of locating the HKBCF at San Shek Wan to help boost the local development and economy as well as improve the vehicular access to Tai O and San Shek Wan. These two alternatives were not recommended after detailed assessment, primarily on grounds that they pose significant problems in hydraulics and environmental conservation, and in the case of the San Shek Wan option, noise and air quality impact on Sha Lo Wan and San Shek Wan.

6. After taking account of views collected from various sectors, we have carefully chosen the location and alignment of the HKBCF, HKLR and TM-CLKL, and gazetted the projects under the Ordinances. The present proposed HKBCF will be located approximately 2 km away from Tung Chung and the HKLR approximately 700 metres away. Impacts on air quality, noise and potential visual aspects to the residents on Tung Chung premises would be minimal. The proposed HKBCF will be located at the waters off the north-east of the Airport Island and so will avoid the relatively ecologically sensitive areas in Western Hong Kong waters.

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1 Hong Kong - Shenzhen - Zhuhai Corridor comprises: (i) HZMB HKLR and HKBCF; and (ii) TM-CLKL and TMWB.

7. The HKLR will not touch the shoreline of Lantau Island. Alignment of the HKLR will be along the Airport Island to avoid ecologically sensitive areas. The Road is approximately 700 metres away from Tung Chung. Some Tung Chung residents still showed concern over the visual impact of the HKLR sea viaduct section in front of Tung Chung. Upon review, we have replaced this section by a tunnel-cum-at-grade road scheme. We have also modified the section of the HKLR at Sha Lo Wan by increasing the span length of the viaducts to minimize the visual impact on Sha Lo Wan residents.

8. For the TM-CLKL alignment, we have combined the southern landfall of the TM-CLKL and the HKBCF instead of locating it at the Brothers. This combination will reduce the construction of approximately 1.8 km of permanent seawall and the dredging of 5 million m^3 marine sediment.

(C) EIA

9. In the preparation of the EIA reports, we have carefully analyzed the possible impacts on the environment during the construction and operation of the project, including the possible impacts on air quality, noise, water quality, ecology such as CWD, waste management, fisheries, landscape and visual and recommended appropriate mitigation measures. The EIA reports concluded that the environmental impacts due to the projects would be acceptable with the implementation of the recommended mitigation measures. The major mitigation measures recommended in the EIA reports are listed out in the paragraphs 10 to 16 below.

10. The HKBCF will be located at a distance of approximately 2 km from Tung Chung and the EIA assessment results indicated that the impacts on air quality and noise level would be minimal. Nevertheless, we will still take mitigation measures to further reduce the impacts, such as regular spraying of water on bare soil at the works areas during the construction period and regularly monitoring the air quality and noise level during construction.

11. The HKBCF will be located at a distance of approximately 2 km from Tung Chung and adjacent to the Hong Kong International Airport which is similar in appearance. The potential visual impact is therefore minimal. Through aesthetic engineering and architectural design and appropriate

greening measures, the aesthetics of the HKBCF and HKLR will be enhanced to minimize the potential visual impacts.

12. We will take various measures to reduce the impact on water quality, including the installation of silt curtains around the site perimeter to prevent sediment dispersion. We will carry out the works for the seawall before carrying out the reclamation works so as to prevent the reclamation materials from polluting the sea. At the same time, we will limit the number of barges and daily filling quantity and regularly monitor the water quality. With respect to the sub-sea tunnel of the northern connection of the TM-CLKL, we will adopt the tunnel boring machine method instead of immersed tube method to avoid large-scale dredging. This will minimize impacts on the existing seabed, water quality, benthic communities and marine ecosystems.

13. Apart from the above, in order to further minimize environmental impacts due to reclamation, the HyD together with its consultant have developed a non-dredge reclamation method to form the 150 hectares reclaimed artificial island. This new non-dredge reclamation method can almost completely avoid dredging, significantly reduce mud disposal and greatly reduce backfilling material which is thus more environmentally friendly and satisfies the principle of sustainable development.

14. For the protection of CWD, we will set up a dolphin exclusion zone of a 250m radius during the installation of the perimeter silt curtains and any re-deployment of the perimeter silt curtains. If dolphins are observed within the exclusion zone, the installation/re-deployment works will cease until they have left the area. In addition, we will perform a dolphin watching plan, including regular inspections of the silt curtains and visual inspection of the waters inside the curtains. As dolphins are acoustic sensitive, we will use the silence piling method such as vibratory or boring type instead of the noisier percussive method when carrying out marine piling. Moreover, in May and June, the peak calving season of CWD, we will suspend the formation of underwater sockets into rock for the marine bored piles. At the same time, in order to protect the safety of the dolphins, we will limit all vessels within the works areas to not travelling at a speed higher than 10 knots. In addition, we also propose to set up a marine park in the Brothers after completion of the project, which will facilitate dolphin conservation.

15. Regarding the fishing industry, although the EIA reports have shown that there will not be a significant loss of fishing area and impacts on

fisheries is acceptable, we will install new and replacement artificial reefs as mitigation and improvement measures to compensate for the impacts on the existing artificial reefs in marine restricted area.

16. According to the recommendations in the EIA reports, the contractors will engage environmental teams (ET) to undertake monitoring of water quality, air, noise, waste management, ecology (including CWD, underwater noise, mudflat ecology (San Tau and Tung Chung Bay where horseshoe crabs juveniles and seagrass beds have been sighted)), as well as landscape and visual impacts on the environment. The Highways Department (HyD) will engage environmental consultants as "Independent Environmental Checkers" to audit the environmental monitoring works carried out by the ET and check the effectiveness of the mitigation measures. The Department will also employ an environmental consultant to set up an Environmental Project Office to oversee the cumulative environmental impacts arising from the HZMB Hong Kong projects and other concurrent projects in the adjoining area (including the HZMB Main Bridge project in the Mainland waters) to ensure the compliance with the laws of Hong Kong on environment.

(D) Meeting Requirements of EIA Study

17. It can be seen from the various aforementioned measures that the HyD has introduced various improvement measures during the design stage. The EIA reports have been prepared according to the relevant legislation, Technical Memorandum and Study Brief issued by the Director of Environmental Protection and efforts have been made to reduce the environmental impacts to the minimum. The EIA reports concluded that if the proposed mitigation measures were implemented, the potential impacts of the projects on the environment would be acceptable. The HyD will construct the HZMB local projects according to the laws of Hong Kong, and implement mitigation measures, environmental monitoring and auditing plans so as to comply with the requirements of the EP conditions and requirements of other environmental protection legislation.

(II) <u>Situation of Construction Manpower</u>

18. The Government is mindful of whether the overall manpower resources of the construction industry can meet the need of its future

development. The Development Bureau (DEVB) and Construction Industry Council (CIC) have studied the demand and supply of professionals, supervisors/technicians and workers for the construction industry in the next few years. The results indicate that:

(i) no major problem is anticipated in most construction-related disciplines of professionals and supervisors/technicians and anticipated minor shortage would be manageable; and

(ii) there would be adequate construction workers in head count to meet the demand of the construction industry but individual trades might face shortage and/or ageing problems.

(A) Progress of Investment in Construction Manpower

19. In view of the increasing manpower demand in construction over the next few years, the Government needs to maintain adequate manpower supply, and enhance the skill level and competitiveness of the existing workforce. To this end, in May 2010, the DEVB sought the approval of the FC of LegCo for a one-off funding of $100 million to support the CIC to enhance the skills and competitiveness of the construction workforce through training and trade testing, and to attract more people to join the construction industry through promotion and public education. The new initiatives include the following:

(i) enhance construction manpower training for selected trades with problems of acute ageing, labour shortage or difficulties in recruiting new trainees by providing trainees with enhanced training allowance to enable them to maintain basic living expenses during the training period. This scheme will provide trainees with an average monthly training allowance of about $5,000. When the trainees complete their training and are employed by contractors participating in the scheme, they may receive a wage of no less than $10,000 a month which will be further increased to no less than $15,000 a month after six months from their employers. Up to end September 2011, about 600 trainees have participated in the scheme and among them, 60% were aged below 35 and a lot of them were new entrants, indicating that the new initiative has attracted more young people to join the construction industry.

(ii) provide advanced training course free of charge to in-service senior construction workers to equip them with necessary language and basic management skills. This will facilitate the building up of a career ladder for senior workers to advance to the frontline supervisory / management level. Upon gaining sufficient experience, they may take further supervisory level training course to acquire higher qualifications or start their own business in the trades. The first class started in May 2011 and 19 trainees were taking the course. CIC has also arranged to launch the second class in October 2011 and anticipated that about 30 trainees would join the class.

(iii) attract more young people to join CIC's Construction Supervisor / Technician Programme by offering trainees an enhanced daily training allowance of $150 (against the current amount of $105 a day). CIC also plans to enhance the programme to better meet the need of the industry and is consulting industry stakeholders about the course content, duration, entry requirements and articulation to other higher level courses. It is anticipated that the new programme will be launched in the 4th quarter of 2011.

(iv) provide a fee subsidy capped at $500 for construction workers (especially for the trades with problems of acute ageing, labour shortage or difficulties in recruiting new trainees) to attend trade tests or specified training courses (STCs). The number of trades covered under this initiative has been increased from four at the beginning to 38 now. Up to end September 2011, CIC has received 899 and 91 applications for fee subsidy to attend trade tests and STCs respectively. CIC has also launched skills enhancement courses for trades with low passing rate in trade tests, such as plumber trade. The subsidized course fees are estimated to be about $1,000 per place. Up to end September 2011, there were 112 applicants and among them 83 have completed the courses.

(v) Government has also provided seed-money to support CIC to set up a resource centre as a one-stop platform where potential new entrants and job-seekers can gain easy access to information including training opportunities, types of trades available and career development of the construction industry. The resource centre is anticipated to be commissioned in early 2012.

20. In regard to the trades facing acute shortage, CIC has launched "Contractor Cooperative Training Scheme" (CCTS), in conjunction with the "Enhanced Construction Manpower Training Scheme for Selected Trades" to train construction workers more effectively. CIC has collaborated with some bar-bending and formwork sub-contractors to launch pilot schemes to train up more skilled workers of the relevant trades. The DEVB is also arranging some public works contracts as trials to impose mandatory requirements for the contractors to join the CCTS.

(B) Construction Employment Platform

21. CIC has also developed a Construction Employment Platform (CEP), providing a one-stop on-line platform, for contractors to upload and workers to search for job vacancies, and thus enhancing the mobility of workers. In early 2012, CIC will install CEP terminals at the resource centre and Construction Workers Registration Offices.

(C) Promotion and Publicity Activities

22. In May this year, the DEVB collaborated with CIC to launch an intensive publicity and promotion campaign, "Build Up Publicity Campaign", which includes television announcement of public interests (TV API), newspaper advertorials, bus body advertisements, thematic website, giant outdoor banners to attract more people to join the construction industry. At this stage, there are signs that after the campaign, public awareness and perception on the construction industry have improved. The DEVB has also engaged the RTHK to produce a documentary on the real life success stories of construction personnel for broadcasting in early 2012. The Bureau will further design more publicity strategies targeted at young people.

(D) Promotion and Publicity Activities

23. According to our estimate, the works seeking funding approval will create about 14 250 jobs (2 360 for professional/technical staff and 11 890 for workers), the detailed breakdown is shown in the table below:

Project	Professional/ Technical Staff	Workers	Total Job Creation	Employment Man-months
HKBCF	1 410	7 880	9 290	291 020
HKLR	860	3 720	4 580	174 100
Detailed design, site investigation and advance works for TM-CLKL	90	290	380	13 400
Total	2 360	11 890	14 250	478 520

24. As explained in paragraph 18(i) above, the DEVB and CIC anticipate that in terms of supply of manpower, there will be no major problem in most construction-related disciplines in the next few years. As such, we are of the view that there should be no problem in the supply of manpower for the works of the HZMB.

(III) Cost Increase due to Judicial Review Case

25. The breakdown of the about $6.5 billion cost increase due to the judicial review case is as follows: -

	HKBCF ($ billion)	TM-CLKL Advance Works (Reclamation of Southern Landfall) ($ billion)
(I) Use of additional manpower, plant and facilities The reclamation works will be completed by phases and require the use of additional manpower (more workers and shifts) so as to compress the construction timetable. Upon completion of parts of the reclaimed land, it will be necessary to use additional manpower, increase the number of works locations, and deploy more plants and facilities to accelerate the works progress.	3.53	0.02

	HKBCF ($ billion)	TM-CLKL Advance Works (Reclamation of Southern Landfall) ($ billion)
(II) Adjustment of construction method For example, using more sand as filling material to accelerate the consolidation of marine mud for advancing the completion of the artificial island.	0.52	0.07
(IV) Increase in construction price	2.25	0.1
Sub-total cost increases	**6.3**	**0.19**
Total cost increases	**6.49 (about $6.5 billion)**	

(IV) <u>Funding Approved for Hong Kong-Zhuhai-Macao Bridge Project and Estimated Funding Required for all Related Projects</u>

(A) Funding Approved

26. For the HZMB Main Bridge and related local projects, the FC, up to now, has approved funding of about $10.2 billion (in money-of-the-day (MOD) prices) as follows:

(a) funding of $9,280 million (in MOD prices) for preliminary design, site investigation, detailed design and construction of the HZMB Main Bridge (approved by the FC in February 2009 and May 2009) (FCR(2008-09)61 and FCR(2009-10)14);

(b) funding of $621.9 million (in MOD prices) for engagement of consultants to undertake detailed design and site investigation of the HZMB HKBCF (approved by the FC in May 2009) (FCR(2009-10)14);

(c) funding of $46.6 million (in MOD prices) for the costs shouldered by the Government of the Hong Kong Special Administrative Region (HKSAR) before the commencement of the HZMB (approved by the FC in June 2008) (FCR(2008-09)19);

(d) funding of $86.9 million (in MOD prices) for engagement of consultants to undertake site investigation and preliminary design of the HKBCF (approved by the FC in June 2008) (FCR(2008-09)19);

(e) funding of $88.6 million (in MOD prices) for engagement of consultants to undertake site investigation and preliminary design of the TM-CLKL and TMWB (approved by the FC in January 2008) (FCR(2007-08)42);

(f) funding of $26.8 million (in MOD prices) for carrying out the conceptual design and advance technical studies for the HZMB (approved by FC in June 2005) (FCR(2005-06)19); and

(g) funding of $58.9 million (in MOD prices) for investigation and preliminary design of the HZMB Hong Kong Section and North Lantau Highway Connection (now called HKLR) (approved by the FC in December 2003) (FCR(2003-04)45).

(B) HZMB Main Bridge

27. For the construction cost of the HZMB Main Bridge, the three governments agreed, after detailed discussions, that the Mainland will contribute a total of RMB 7 billion, whilst the Governments of the HKSAR and Macao Special Administrative Region will contribute RMB 6.75 billion and RMB 1.98 billion respectively. The total contribution of the three sides will be RMB 15.73 billion, which is about 42% of the total project cost of the HZMB Main Bridge. The remaining 58% of the funding required will be financed by bank loans. The contribution from the Government of the HKSAR has obtained project funding approval by LegCo (Para. 26(a)). The three governments have also arranged the required funding from bank loans. Therefore, we have no plan to seek funding approval again from LegCo for the construction cost of the HZMB Main Bridge.

(C) Funding Required for HZMB Local Related Projects

28. The total amount of the current funding proposals for the HZMB local related projects is $48,533.4 million (in MOD prices), which covers the construction of the HZMB HKBCF reclamation and superstructures ($30,433.9 million (in MOD prices)), construction of the HKLR ($16,189.9 million (in MOD prices)), and the detailed design, site investigation and advance works of the TM-CLKL ($1,909.6 million (in MOD prices)). The cost does not include the remaining works of the TM-CLKL (involving

construction of about 4 km long viaducts and about 5 km long sub-sea tunnel and associated works), and the detailed design and construction of the TMWB.

29. As regards the remaining works of the TM-CLKL, as the project has not yet started the detailed design, it is difficult to estimate the cost accurately. The TM-CLKL remaining works involve a number of complicated works, including the construction of about 5 km of sub-sea tunnel and about 4 km of viaducts, as well as reclaiming land for the construction of the northern landfall of the sub-sea tunnel, etc. For the sub-sea tunnel, we propose to adopt the more environmentally friendly construction method using tunnel boring machine instead of the traditional immersed-tube method. This is a large-scale and complex construction method in view of the length of the sub-sea tunnel. At this stage, we do not have sufficient information to estimate the project cost accurately. To make a very rough estimate, based on the information we obtained in the investigation and preliminary design stage, we estimate that the TM-CLKL's remaining works may need about $21 billion in September 2011 prices, or about $28 billion in MOD prices. We plan to seek funding for the construction of the TM-CLKL remaining works next year. By that time an accurate estimate will be available. However, we must reiterate that the project details and cost estimate are yet to be finalized and they may be adjusted upon completion of the detailed design.

30. For the TMWB project, the HyD has been conducting extensive public consultations since October 2008, and has collected different views on the alignment from various sources. Based on the views collected, we have considered ten different alignment options. Through detailed discussions with the stakeholders, we have selected the current recommended alignment amongst the ten options. HyD is now proceeding with the traffic impact assessment, environmental impact assessment, site investigation and preliminary design for the TMWB project. As the project is still in the preliminary design stage, we do not intend to estimate the construction cost at this moment. We anticipate that the preliminary design will be completed by end 2012. By that time, the practical details of the project will be better known.

(V) Evaluation of Economic Benefits of HZMB

31. The traffic volume forecast for the HZMB is a key determinant in estimating the magnitude and distribution of the economic benefits arising from the project among the three governments and for the purpose of examining the economic viability of the project. The methodology for the forecast of the traffic volume adopted for the project is a four-stage modelling approach for deriving passenger and vehicle flows which is in line with international practice. It uses a systematic method to analyze the complex characteristics of population, travel characteristics, economic growth, foreign trade and transportation network development based upon various statistics and survey data. Based on the future planning data, the predicted passenger and vehicle flows on the HZMB are worked out.

32. The four stages involved in the approach are, namely,

i. **Demand Projection:** i.e. estimating the total cross-boundary passenger trips and cargo volume between Hong Kong and the Mainland, and between Hong Kong and Macao;

ii. **Distribution Pattern Analysis:** i.e. the projection of traffic flows between zones;

iii. **Mode Choice Analysis:** i.e. deciding on the share of travel demand that will choose road transportation as compared to other modes; and

iv. **Route Choice Assignment:** i.e. the prediction of travel demand to specific route, such as the HZMB.

33. Based on the results of the traffic volume forecast with the four-stage methodology, the consultant[2] has evaluated the benefits with the HZMB from savings in transport costs, value of time saved for travellers, induced traffic volume generated between the three territories, and value of time saved for goods on road, etc. The consultant has adopted conservative ranges of traffic and passenger projections in the evaluation. The HZMB will

[2] The three governments commissioned the China Highway Planning and Design Institute to conduct a feasibility study for the HZMB.

result in a significant reduction in relevant traveling time between Hong Kong and the Western PRD[3]. As illustrated by the table below, the travelling time between Zhuhai on the one hand, and the Kwai Chung Container Port and the Hong Kong International Airport on the other, will be reduced by more than 60% and 80% respectively.

Travelling Time Comparison - With and Without HZMB

Origin – Destination	Current Distance and Travelling Time	Distance and Travelling time with HZMB	Reduction in Distance and Travelling Time
Zhuhai – Kwai Chung Container Port	about 200 kilometres about 3.5 hours	about 65 kilometres about 75 minutes	more than 60%
Zhuhai – Hong Kong International Airport	over 200 kilometres about 4 hours	about 40 kilometres about 45 minutes	more than 80%

The economic benefits are then apportioned among the three places, taking into account the places of origin of the passengers, places of origin and destination of the freight vehicles. The discounted total benefits ratio for Hong Kong, Mainland and Macao will be 57.8 : 32.6 : 9.6.

34. It is estimated that the net economic benefits to the three places at discounted present value will be around RMB40 billion over a 20-year period, with RMB23 billion for Hong Kong, RMB13 billion for the Mainland and RMB4 billion for Macao. Taking into account the fact that each place has already agreed to fund the costs of connecting roads individually, sharing of the costs of the HZMB Main Bridge (excluding the capital injection form the Central Government) is so adjusted to a ratio of 50.2 (Hong Kong) : 35.1 (Mainland) :14.7 (Macao).

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[3] The Western PRD has defined as broadly covering Zhuhai, Jiangmen and Zhongshan.