For discussion **PWSC(2004-05)3**
on 21 April 2004

ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE

HEAD 706 – HIGHWAYS
Transport – Roads
791TH – Enhancement of bridge parapets and roadside barriers

Members are invited to recommend to Finance Committee the upgrading of **791TH** to Category A at an estimated cost of $93.7 million in money-of-the-day prices for the enhancement of bridge parapets and roadside barriers at 39 priority locations along 16 road sections in the territory.

PROBLEM

We need to enhance the containment capacities of parapets and roadside barriers as recommended in the Report on Enhancement of Highway Safety put forward by the Tuen Mun Road Independent Expert Panel.

PROPOSAL

2. The Director of Highways (D of Hy), with the support of the Secretary for the Environment, Transport and Works, proposes to upgrade **791TH** to Category A at an estimated cost of $93.7 million in money-of-the-day (MOD) prices to carry out studies on the enhancement of containment capabilities of bridge parapets and roadside barriers, and to strengthen the existing bridge parapets and roadside barriers at 39 priority locations along 16 road sections.

PROJECT SCOPE AND NATURE

3. The scope of **791TH** comprises –

(a) studies on the enhancement of bridge parapets and roadside barriers; and

/(b) …..

(b) strengthening of bridge parapets of 46 kilometres (km) in length in total and roadside barriers of 4.5 km in length in total at 39 priority locations along 16 road sections.

A plan showing the 39 locations is at Enclosure 1.

4. The proposed studies in paragraph 3(a) will include a review of the containment levels and height for bridge parapets and roadside barriers. The studies will also include the development and validation of new designs of bridge parapets and roadside barriers, and the use of parapets with multiple containment levels in Hong Kong. We will adopt the new design as standards for new roads and bridges in the future. We plan to commence the studies in June 2004 for completion in December 2005.

5. Meanwhile, we will carry out the proposed strengthening works in paragraph 3(b). We will implement the works in two phases. Phase 1 strengthening works will include the strengthening of existing bridge parapets and roadside barriers at the 39 locations by the addition of posts and rails of modified sizes and installation of thrie-beam barriers in front of the parapets. Phase 2 strengthening works entail replacement of existing bridge parapets or roadside barriers with new designs. Drawings showing the proposed strengthening works for bridge parapets and roadside barriers are at Enclosures 2 and 3 respectively. We plan to commence phase 1 in May 2004 for completion in December 2004, and phase 2 in January 2005 for completion in December 2005.We have carried out in-house designs of the strengthening works by static methods in accordance with international standards. Computer simulations have also confirmed the effectiveness of the designs.

JUSTIFICATION

6. Subsequent to the traffic incident at Tuen Mun Road on 10 July 2003, the Chief Executive appointed the Independent Expert Panel (IEP) in July 2003 to examine and make recommendations on safety measures to prevent similar catastrophes. After a four-month review, the IEP released the Report on Enhancement of Highway Safety (the Report) on 5 December 2003. The recommendations of the Report include –

(a) to expand the range of containment levels, in particular at the high end, with due regard to the extensive use of double-decked buses in Hong Kong, and the maximum vehicle weight permitted under the road system;

/(b) …..

(b) to monitor the development of multiple containment parapet in the international scene, and develop workable parapet designs suitable for Hong Kong;

(c) to develop detailed guidelines and analysis procedures on the choice of containment level and parapet height in anticipation of an expanded parapet hierarchy and the possibility of introducing greater height variations to the parapets, with particular attention to the local environment and the road network in Hong Kong;

(d) to generate more simulation results involving other impact scenarios to fully evaluate the adequacy of the standard height adopted for the normal containment bridge parapets;

(e) to carry out researches on parapet design in collaboration with local tertiary institutions; and

(f) to conduct a detailed study on the road safety enhancement measures required for 39 priority locations on 16 road sections where penetration of the vehicular parapets would result in catastrophic consequences.

Studies

7. The proposed studies in paragraph 3(a) entail a comprehensive review of the containment levels of parapets and barriers as well as the development and validation of new designs suitable for Hong Kong in response to the IEP's recommendations set out in paragraph 6. Bridge parapets and roadside barriers are protective devices that provide a passive line of defence along highways to reduce the severity of accidents. In line with international standards, parapets and barriers are generally designed for a containment level pertaining to vehicles involved in most of the accidents. A stronger parapet can withhold penetration of a heavy vehicle, but may cause severe damages to a light vehicle. It is therefore important to strike a balance between the risk of penetration by the vehicle and the containment level of the parapet.

8. In addition, there is limited knowledge worldwide about the performance of parapets or barriers during the impact of a double-decked bus. We therefore need to conduct computer simulations and full-scale impact tests for

representative types of bridge parapets and roadside barriers to assess the effect. The computer simulations and impact tests required are very specialised in nature and require sophisticated testing equipment and computer facilities. As we do not have the necessary expertise and facilities in-house, we need to engage consultants to undertake the studies.

9. We will also invite tertiary institutions to join our studies on bridge parapets and roadside barriers. They can assist in reviewing our design standards, setting detailed requirements for containment levels, designing new parapets and barriers, and exploring the use of multiple containment parapets in Hong Kong.

Strengthening works

10. We will implement the strengthening works for the 39 priority locations along the 16 road sections identified by the IEP in two phases. Phase 1 works will include the addition of posts and rails to parapets and barriers along some locations and installation of thrie-beam barriers in front of parapets where site conditions permit. Phase 2 works will include the remaining strengthening works and any further enhancement of Phase 1 works after the results of the design validation are available.

FINANCIAL IMPLICATIONS

11. We estimate the cost of the project to be $93.7 million in MOD prices (see paragraph 12 below), made up as follows –

		$ million
(a)	Studies on bridge parapets and roadside barriers	14.1
	(i) fees for consultants and tertiary institutions	9.3

/(ii) .....

	(ii) full-scale impact tests for bridge parapets and roadside barriers	4.8		
(b)	Strengthening of bridge parapets and roadside barriers at 39 priority locations		74.8	
	(i) Phase 1 works	8.6		
	(ii) Phase 2 works	66.2		
(c)	Contingencies		8.8	
		Sub-total	97.7	(in September 2003 prices)
(d)	Provision for price adjustment		(4.0)	
		Total	93.7	(in MOD prices)

A breakdown by man-months of the estimate for the consultants' fees and tertiary institutions' costs are at Enclosure 4.

12. Subject to approval, we will phase the expenditure as follows –

Year	$ million (Sep 2003)	Price Adjustment Factor	$ million (MOD)
2004 – 2005	31.3	0.97150	30.4
2005 – 2006	54.2	0.95450	51.7
2006 – 2007	12.2	0.95450	11.6
	97.7		93.7

/13. .....

13. We have derived the MOD estimate on the basis of the Government's latest forecast of trend rate of change in the prices of public sector building and construction output for the period 2004 to 2007. We plan to engage consultants and tertiary institutions for the studies on a lump-sum basis without provision for price adjustment as the duration of consultancy will not exceed 12 months.

14. Highways Department will deploy its term contractors to carry out phase 1 works to shorten the implementation period. If tenders are to be invited, the implementation programme will be lengthened by at least six months. We will invite tender for the phase 2 works under a standard re-measurement contract without provision for price adjustments as the construction period will not exceed 21 months.

15. We estimate that the annual recurrent expenditure for repair and maintenance arising from the strengthening works will be $260,000.

PUBLIC CONSULTATION

16. We briefed the Legislative Council Panel on Transport on 19 December 2003 on the Administration's responses to the IEP's recommendations, including the preliminary strengthening proposal for the bridge parapets and roadside barriers. Members supported our proposed actions.

ENVIRONMENTAL IMPLICATIONS

17. The strengthening works on bridge parapets and roadside barriers will generate about 1 000 tonnes of scrap metal which will be separated for collection by recycling contractors. We estimate that the project will generate about 200 cubic metres (m^3) of construction and demolition (C&D) materials. Of these, we will reuse 180 m^3 (90%) as fill in public filling areas[1] and dispose of 20 m^3 (10%) at landfills. The notional cost of accommodating C&D waste at

/landfill .....

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[1] A public filling area is a designated part of a development project that accepts public fill for reclamation purpose. Disposal of public fill in a public filling area requires a licence issued by the Director of Civil Engineering.

landfill sites is estimated to be $2,500 for this project (based on a notional[2] unit cost of $125/m^3).

18. The proposed studies and strengthening works on bridge parapets and roadside barriers are not designated projects under Schedule 2 of the Environmental Impact Assessment Ordinance (Cap. 499). We completed a Preliminary Environmental Review (PER) to determine the necessary mitigation measures. The Director of Environmental Protection (DEP) had no adverse comments on the PER. We will control noise, dust and site run-off nuisances to within established standards and guidelines through the implementation of control measures during construction as promulgated by DEP.

19. The proposed studies and strengthening works on bridge parapets and roadside barriers will not involve any tree removal and planting proposals.

LAND ACQUISITION

20. The proposed works do not require land acquisition.

BACKGROUND INFORMATION

21. We upgraded **791TH** to Category B in April 2004.

22. To validate the designs of P1 group parapets[3], we engaged consultants to undertake computer simulations and full-scale impact tests in August 2000 at an estimated cost of $2.2 million under **Subhead 6100TX** – "Highway works, studies and investigation for items in Category D of the Public Works Programme". Upon completion of these simulations and tests, the second generation three-rail metal P1 group parapet demonstrated a higher containment capability than those of the first generation one. We then proceeded to schedule

/replacement .....

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[2] This estimate has taken into account the cost of developing, operating and restoring the landfills after they are filled and with the aftercare required. It does not include the land opportunity cost for existing landfill sites (which is estimated at $90/m^3), nor the cost to provide new landfills (which are likely to be more expensive) when the existing ones are filled. The notional cost estimate is for reference only and does not form part of this project estimate.

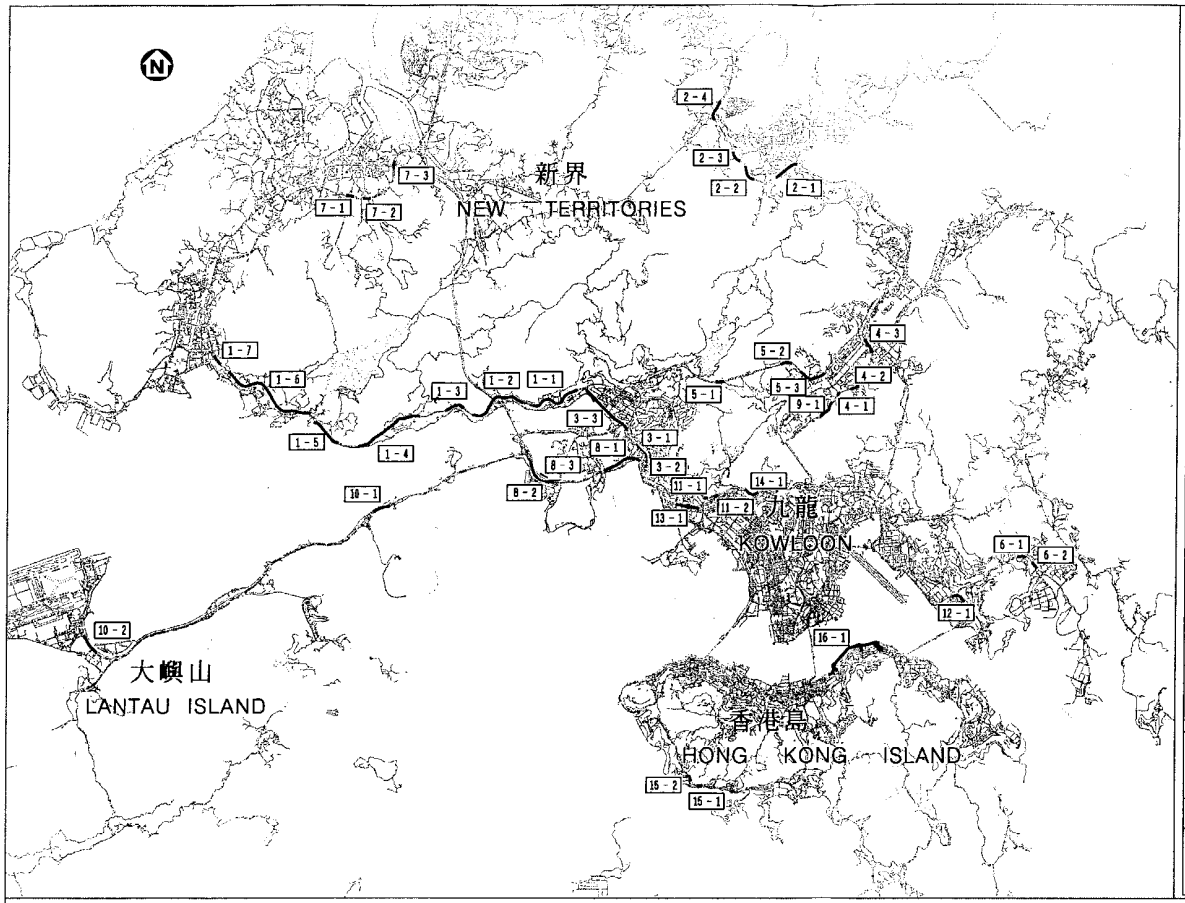
[3] P1 group parapets are designed to retain a vehicle of 1.5 tonne travelling at 113 kilometres per hour and impacting at an impact angle of 20 degrees. They are generally used on bridges and elevated sections of expressways. There are two types of P1 groups parapets, one with metal posts and three metal rails and another with a concrete base with top rails.

replacement of all first generation three-rail parapets in Hong Kong. Out of 95 kilometres of the first generation three-rail P1 parapets, about 42 kilometres have been replaced in mid 2003. In response to the IEP's recommendation, we have already speeded up the replacement programme and we aim at completing the replacement works within this year.

23. After the traffic incident at Tuen Mun Road on 10 July 2003, we engaged consultants to conduct computer simulations on the containment capacities of the P1 group parapets under the impact of a double-decked bus at an estimated cost of $2.4 million under **Subhead 6100TX**. The results showed that the P1 group parapets could retain an errant double-decked bus travelling at about 35 to 40 kilometre per hour at an impact angle of 20 degrees. The review on strengthened parapets is on-going and initial results show that an errant double-decked bus travelling at significantly higher speed can be retained.

24. We estimate that the proposed works will create about 205 jobs (165 for labourers and another 40 for professional/technical staff) providing a total employment of 2 250 man-months.

Environment, Transport and Works Bureau
April 2004



圖例 Legend :

1-1 辨識編號 Identification No.

地點 Location

加固橋樑及路側護欄一覽表

List of Bridge Parapets and Roadside Barriers to be Strengthened at 16 High-Priority Road Sections

地點 Location	辨識編號 Identification No.
1. 屯門公路 Tuen Mun Road	1 - 1 to 1 - 7
2. 吐露港公路 Tolo Highway	2 - 1 to 2 - 4
3. 荃灣路 Tsuen Wan Road	3 - 1 to 3 - 3
4. 沙田路 Sha Tin Road	4 - 1 to 4 - 3
5. 城門隧道公路 Shing Mun Tunnel Road	5 - 1 to 5 - 3
6. 將軍澳隧道公路 Tseung Kwan O Tunnel Road	6 - 1 to 6 - 2
7. 元朗公路 Yuen Long Highway	7 - 1 to 7 - 3
8. 長青公路 Cheung Tsing Highway	8 - 1 to 8 - 3
9. 獅子山隧道公路，隔田至豐盛苑段 Lion Rock Tunnel Road, section between Kak Tin and Fung Shing Court	9 - 1
10. 北大嶼山公路 North Lantau Highway	10 - 1 to 10 - 2
11. 呈祥道 Ching Cheung Road	11 - 1 to 11 - 2
12. 觀塘繞道，往鯉魚門道支路 Kwun Tong Bypass, slip road connecting Lei Yue Mun Road	12 - 1
13. 青涌道，在美孚新邨前面一段 Kwei Chung Road, section fronting Mei Foo Sun Chuen	13 - 1
14. 龍翔道近大窩坪交匯處 Lung Cheung Road near Tai Wo Ping Interchange	14 - 1
15. 石排灣道 Shek Pai Wan Road	15 - 1 to 15 - 2
16. 東區走廊，介乎維園道及健康西街一段 Island Eastern Corridor, section between Victoria Park Road and Healthy Street West	16 - 1

圖則名稱 Plan title :

工務計劃項目第 791 TH 號
改善橋樑及路側護欄 - 擬建加固工程位置圖

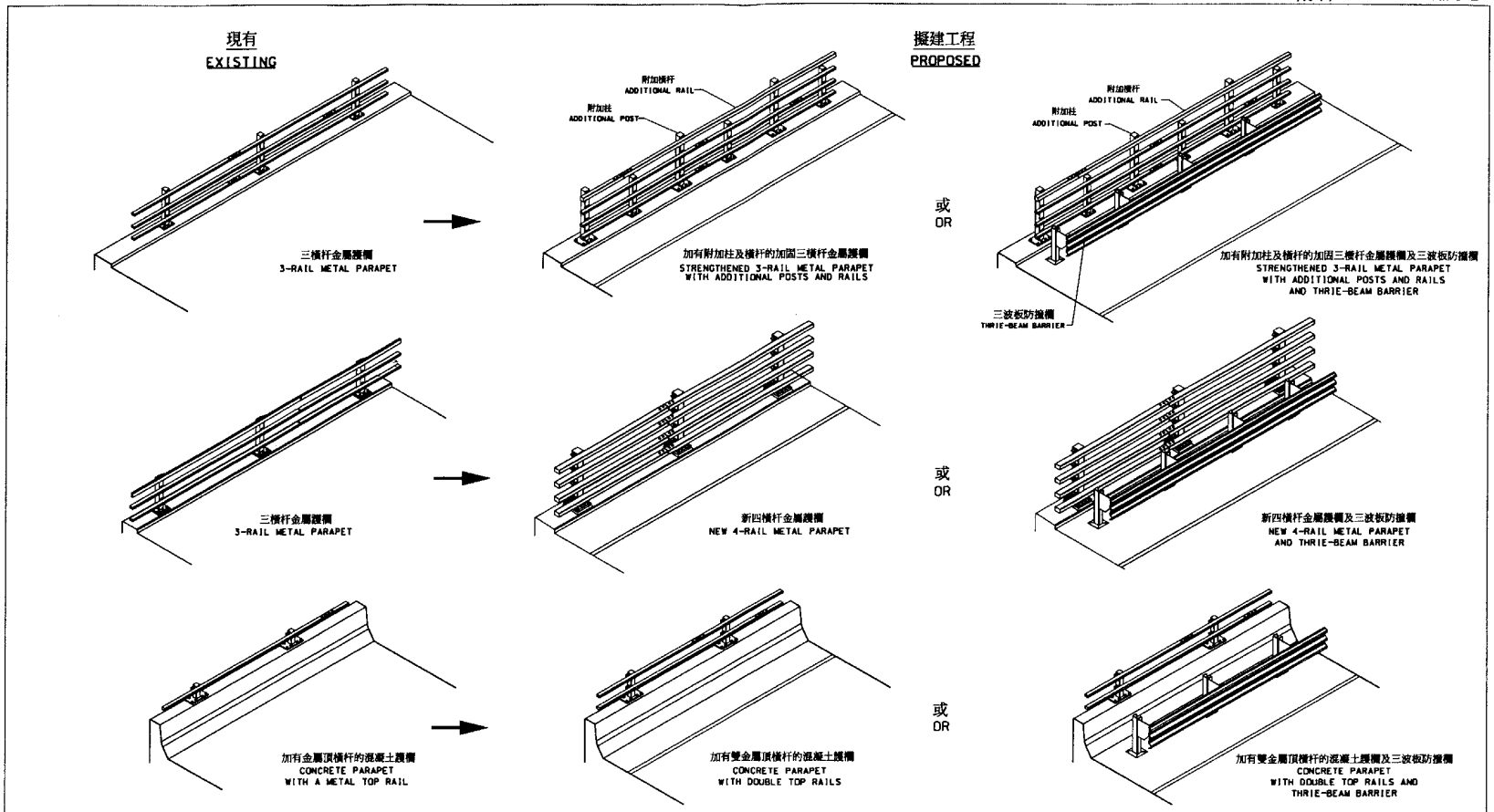
PWP ITEM NO. 791 TH
ENHANCEMENT OF BRIDGE PARAPETS AND ROADSIDE BARRIERS - LOCATION PLAN OF PROPOSED STRENGTHENING WORKS

圖則編號 Plan no :

HSTOTH013-GL0011

HIGHWAYS DEPARTMENT HONG KONG 路政署 香港

附件二 Enclosure 2



圖則名稱 Plan title :

工務計劃項目第 791 TH 號

改善橋樑及路側護欄 - 擬建橋樑護欄加固工程

PWP ITEM NO. 791 TH

ENHANCEMENT OF BRIDGE PARAPETS AND ROADSIDE BARRIERS - PROPOSED STRENGTHENING WORKS FOR BRIDGE PARAPETS

圖則編號 Plan no :

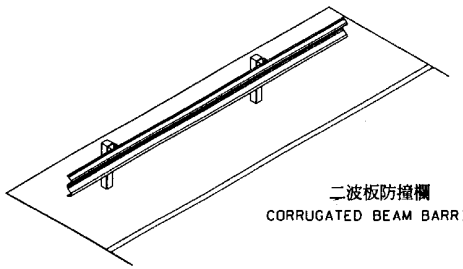
HSTOTH013-GA0011

HIGHWAYS DEPARTMENT HONG KONG 路政署 香港

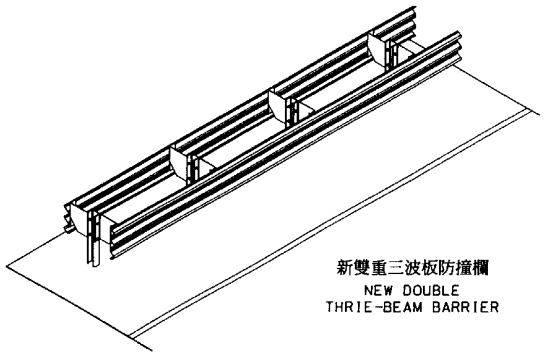
附件三 Enclosure 3

現有
EXISTING

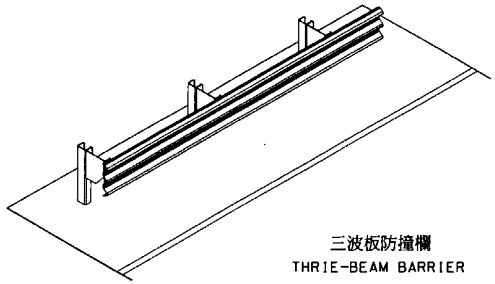
擬建工程
PROPOSED



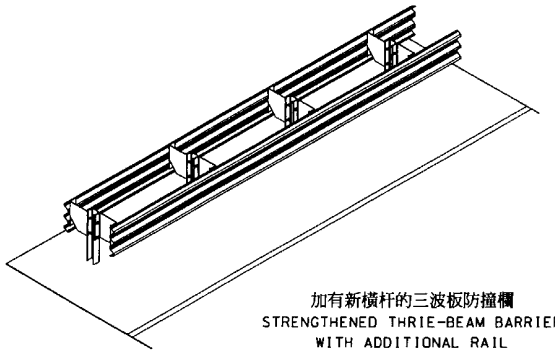
二波板防撞欄
CORRUGATED BEAM BARRIER



新雙重三波板防撞欄
NEW DOUBLE
THRIE-BEAM BARRIER



三波板防撞欄
THRIE-BEAM BARRIER



加有新橫杆的三波板防撞欄
STRENGTHENED THRIE-BEAM BARRIER
WITH ADDITIONAL RAIL

圖則名稱 Plan title :

工務計劃項目第 791 TH 號
改善橋樑及路側護欄 - 擬建路側護欄加固工程
PWP ITEM NO. 791 TH
ENHANCEMENT OF BRIDGE PARAPETS AND ROADSIDE BARRIERS - PROPOSED STRENGTHENING WORKS FOR ROADSIDE BARRIERS

圖則編號 Plan no :

HSTOTH013-GA0012

HIGHWAYS 路政署 香港
DEPARTMENT
HONG KONG

791TH – Enhancement of bridge parapets and roadside barriers

Breakdown of estimate for consultants' fees (in September 2003 prices)

Costs			Estimated man-months	Average MPS* salary point	Multiplier (Note 1)	Estimated fee ($ million)
(a)	Consultants' fee (Note 2)	Professional	50	38	2.0	5.6
		Technical	22	14	2.0	0.8
(b)	Tertiary institutions' costs (Note 3)	Professional	-	-	-	2.6
		Technical	-	-	-	0.3
					Total	9.3

* MPS = Master Pay Scale

Notes

1. A multiplier of 2.0 is applied to the average MPS point to arrive at the full staff costs, including the consultants' overheads and profit as the staff will be employed in the consultants' offices. (At 1 January 2004, MPS pt. 38 = $55,993 per month and MPS pt. 14 = $18,603 per month.)

2. The figures given above are based on estimates prepared by D of Hy. The actual man-months and fees will be known only after the consultants have been selected through the competitive lump-sum fee bid system.

3. The figures are estimates prepared by D of Hy based on the manpower and resources required by the tertiary institutions and having regard to their overheads.