



**HIGHWAYS DEPARTMENT
MAJOR WORKS PROJECT MANAGEMENT OFFICE**

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10 August 2018

Clerk to Public Accounts Committee
Legislative Council,
Legislative Council Complex
1 Legislative Council Road
Central, Hong Kong

(Attn.: Mr Anthony CHU)

Dear Sirs,

Public Accounts Committee

Consideration of Chapter 8 of the Director of Audit's Report No. 70

Sha Tin Section of Route 8

Thanks for your letter of 24 July 2018. The requested response and information set out in your letter are enclosed at the **Annex**.

Please note that Appendices C, D and E of the Annex should be restricted to Public Accounts Committee's reference only and not be disclosed to the public.

Yours faithfully,

(Kelvin K W LO)
for Director of Highways

c.c. STH (Attn.: Ms CHUNG Sui-kei, Judy)
SDEV (Attn.: Mr CHAN Fuk-yiu, Victor)
DCED (Attn.: Mr LAM Tat-ming, Terence)
SFST (Attn.: Ms HSIA Mai-chi, Margaret)
Director of Audit (Attn.: Mr TEO Wing-on)



**Public Accounts Committee
Consideration of Chapter 8 of the Director of Audit's Report No. 70**

Sha Tin Section of Route 8

Contract B

- (a) how many tender proposals had been received for the tender for Contract B? whether Contractor B submitted the lowest bid price? If yes, what was the second lowest bid price? If no, what was the lowest bid price?*

In accordance with the tendering procedure stipulated in the Stores and Procurement Regulations ("SPR") 370(c), normally, the tender which attains the highest overall score (technical and price) under the marking scheme should be recommended for Central Tender Board ("CTB")'s approval of the contract award. In the tender for Contract B, seven tender proposals had been received. The bid price submitted by Contractor B was the second lowest one, whereas the lowest bid price was \$1,782.2 million. Nevertheless, the tender proposal submitted by Contractor B attained the highest overall mark and hence was recommended to the CTB in accordance with the SPR 370(c). The CTB approved the award of Contract B to Contractor B on 19 September 2003.

(b) according to paragraph 3.9 of the Audit Report, the Audit Commission noted that there was a discrepancy in the thickness of smoothing shotcrete requirement between the contract clause (i.e. 100 mm at maximum) and the contract drawing (i.e. 170 mm), and the 170 mm smoothing shotcrete was omitted in the Bills of Quantity ("BQ"). Eventually, the Highways Department ("HyD") paid \$43.7 million to Contractor B for the works item omitted in BQ. Please provide/advise:

(i) an extract of the relevant part of the tender documents in relating to the thickness of the smoothing shotcrete requirements;

(ii) whether HyD had examined all documents, designs and drawings prepared by Consultant X under Contract B in accordance with HyD's "Guidelines for Checking Submissions of Consultants". Whether spot check or full check had been adopted for the tender documents and the contract drawings? If spot check was conducted, the basis for choosing which part of the tender documents/contract drawing for checking. The reasons for unable to detect the above discrepancy and whether HyD considered it necessary to review the above Guidelines. If no, why not;

(iii) according to the evidence given by Project Manager/Major Works Project Management Office, HyD at the public hearing, the thickness of smoothing shotcrete could vary depending on the rock conditions. Would this justify the 100 mm thickness requirement in the Particular Specification instead of using 170 mm;

(iv) an extract of the relevant part of the tender documents/contract relating to how omitted works items in BQ were to be handled and explain how the cost for the 170 mm shotcrete was to be determined;

(v) copy of communication records with Consultant X to clarify/investigate into the matter. Whether any sanction has been imposed on Consultant X in this regard. If yes, details of the sanction. If no, why not;

(vi) a breakdown of the \$43.7 million paid to Contractor B, and how had HyD verified the accuracy of Consultant X's cost estimation;

- (i) Relevant parts of the tender documents in relating to the thickness of the smoothing shotcrete requirements including the Particular Specification (PS) clause 27.74(5) (i.e. 100 mm at maximum) and the contract drawing No. 94099/ENT/4203 (i.e. 170 mm) are enclosed in **Appendix A**.

- (ii) HyD had spot checked the documents, designs and drawings prepared by Consultant X under Contract B in accordance with HyD's document "HQ/GN/02 Guidelines for Checking Submissions of Consultants" ("HQ/GN/02"). In accordance with the Guidelines, HyD selected specific areas or items to carry out detailed check on the PSs, drawings and BQ. Based on records, HyD had checked PS Section 27 and drawing and provided comments to Consultant X. Notwithstanding the checking and approval by HyD, according to the consultancy agreement, it shall not affect the responsibilities of the Consultant X to provide and complete the professional services including the preparation of tender documents. In view of the size of the tender documents, the checking of the tender documents including PSs, drawings and BQ was divided and assigned amongst different officers at that time in order to complete the checking within a short period. This might be a reason for not detecting the discrepancy amongst the documents. HyD would review and update the HQ/GN/02 to enhance the checking system and has reminded individual project team to assign the checking of concerned or related sections amongst different parts of tender documents to the same officer.

- (iii) According to the PS of Contract B, the thickness of the smoothing shotcrete should be between 30 mm and 100 mm outside the extrados of the permanent concrete lining of the tunnel. According to the contract drawing, the thickness of the temporary support layer was shown as 170 mm from the permanent concrete lining, and this temporary support layer also included the smoothing shotcrete layer. As the contract drawing did not show a demarcation for the smoothing shotcrete layer and the temporary support layer, there was a discrepancy in the thickness of smoothing shotcrete required between the contract drawing (i.e. 170 mm) and the PS clause (i.e. 100 mm at maximum). If the smoothing shotcrete was to be applied to bare rock surfaces, the thickness should have to be 170 mm. In other words, if temporary support layer was required depending on the rock conditions and the smoothing shotcrete was to be applied following the application of temporary support layer, the thickness of the smoothing

shotcrete might be 100 mm as specified in the PS.

- (iv) Pursuant to General Conditions of Contract (“GCC”) Clauses 59 and 61 (**Appendix B**), the omitted works item was valued at a rate as determined based on the rate of a similar item in the BQ of Contract B.
- (v) Copy of communication record from Consultant X to clarify/investigate into the matter with the relevant attachments is enclosed in **Appendix C**.

According to GCC Clause 59, any items omitted from the BQ shall be corrected by the Engineer (i.e. Consultant X) and the value of the works shall be ascertained in accordance with Clause 61. Consultant X had handled this omitted item in accordance with the contract.

According to the guidelines stipulated at that time in Works Technical Circular of Development Bureau (“DEVB TC(W)”) No. 2/2009 on management of consultants’ performance, the performance score of a consultant on individual consultancy is based on an overall assessment of individual aspects concerned. These performance scores will be consolidated into the consultant’s performance rating to be considered in the bidding of future consultancies. Regulating actions, such as suspension from bidding, will be taken against a consultant by the project department concerned under serious circumstances e.g. court conviction, violation of laws, bankruptcy, the consultant having received two consecutive adverse performance reports, etc. HyD had been conducting assessments on the Consultant X’s overall performance regularly in accordance with the guidelines stipulated in DEVB TC(W) No. 2/2009. Colleagues concerned at that time evaluated Consultant X’s performance in various aspects, including the matters arising from the omitted items, and reflected the overall performance in its performance report. Based on the above guidelines given in DEVB TC(W) No. 2/2009, colleagues concerned at that time considered that the overall performance of Consultant X was acceptable, with no regulating action taken.

- (vi) A breakdown of \$43.7 million paid to Contractor B for the 170mm thick smoothing shotcrete is enclosed in **Appendix D**. Colleagues concerned had checked the Consultant X’s cost estimation for this omitted item and certified payment to Contractor B.

***Note by Clerk, PAC:** *Please see Appendix 26 of this Report for Appendix B, and Appendices C and D not attached.*

(c) *according to paragraph 3.11 of the Audit Report, Contractor B made a claim for the costs of performing controlled blasting for the formation of the tunnel perimeter which was omitted in BQ. Please advise/provide:*

(i) *whether the formation of the tunnel perimeter could be accomplished by techniques other than controlled blasting. If yes, whether it was assumed in the contract that this alternative technique was to be used. If no, why is controlled blasting not included in BQ;*

(ii) *copy of communication records with Consultant X to clarify/investigate into the matter. Whether any sanction has been imposed on Consultant X in this regard. If yes, details of the sanction. If no, why not;*

(i) According to the PS of Contract B, controlled blasting technique is specified for the formation of the tunnel perimeter. Controlled blasting was omitted in the BQ possibly because it was not recognized at that time that the original extent of works covered by tunnel excavation in Standard Method of Measurement Section 18 did not include controlled blasting.

(ii) Copy of communication record from Consultant X to clarify/investigate into the matter is enclosed in **Appendix E**.

According to GCC Clause 59, any items omitted from the BQ shall be corrected by the Engineer (i.e. Consultant X) and the value of the works shall be ascertained in accordance with Clause 61. Consultant X had handled this omitted item in accordance with the contract.

According to the guidelines stipulated at that time in DEVB TC(W) No. 2/2009 on management of consultants' performance, the performance score of a consultant on individual consultancy is based on an overall assessment of individual aspects concerned. These performance scores will be consolidated into the consultant's performance rating to be considered in the bidding of future consultancies. Regulating actions, such as suspension from bidding, will be taken against a consultant by the project department concerned under serious circumstances e.g. court conviction, violation of laws, bankruptcy, the consultant having received two consecutive adverse performance reports, etc. HyD had been conducting assessments on the Consultant X's overall performance regularly in accordance with the

***Note by Clerk, PAC: Appendix E not attached.**

guidelines stipulated in DEVB TC(W) No. 2/2009. Colleagues concerned at that time evaluated Consultant X's performance in various aspects, including the matters arising from the omitted item, and reflected the overall performance in its performance report. Based on the guidelines given in DEVB TC(W) No. 2/2009, colleagues concerned at that time considered that the overall performance of Consultant X was acceptable with no regulating action taken.

(d) with reference to Table 10 of paragraph 3.20 of the Audit Report, please elaborate/advise:

(i) the formula for calculating the prolongation cost;

(ii) whether Consultant X's assessment of the extension of time and prolongation costs for the works in Butterfly Valley and Eagle's Nest Tunnel ("EN Tunnel") was justified. Details of the mechanism for HyD to check the consultant's assessment of extension of time and hence the prolongation costs;

(iii) whether any extension of time was granted to Contractor B due to its own faults. If yes, details of the faults and number of extension days and the Administration's handling of the prolongation cost incurred;

(i) Prolongation cost is generally the time related cost (e.g. the costs of a contractor's site establishment, site overheads and general plant) that is typically affected by a delay to the critical path of construction works. The Engineer for the contract would assess the prolongation cost associated with the granted extension of times ("EOTs") on a case by case basis, according to the actual situation and the relevant clauses of the contract. In principle, the prolongation cost is calculated as the time related cost additionally incurred for the relevant delay duration.

(ii) Consultant X's assessment of the EOT and prolongation costs for the works in Butterfly Valley and EN Tunnel was justified as the EOTs were due to additional works at the three slopes arising from actual site conditions undetected at the design stage. According to the terms of the consultancy, consultants shall report to HyD all claims for additional payment and EOT made by the contractor, and submit the details and justifications of the preliminary assessments to enable HyD to provide his views. The consultants shall take into account HyD's views before making their final assessments and informing the contractors the extent of EOTs and any payment to be granted according to relevant clauses of the contract.

(iii) No EOT was granted to Contractor B for delay due to its own faults.

(e) with reference to paragraphs 3.22(a) and (b) of the Audit Report, please advise:

- (i) the reasons for conducting additional slope stabilization works at Slope A;*
- (ii) reasons for unable to include the additional slope stabilization works to and installation of watermains on Slope A in the tender documents;*
- (iii) whether HyD considered the scale of site investigations conducted by Consultant X for the works in Butterfly Valley sufficient before the award of contract;*

- (i) Additional slope stabilization works at Slope A were conducted to cope with actual site conditions undetected in earlier site investigations (“SI”).
- (ii) As the actual site conditions were undetected in earlier SI, the additional slope stabilization works to Slope A were unable to be included in the tender documents.

Owing to the additional slope stabilization works to Slope A, the installation of watermains on Slope A was required to be realigned to cope with the actual topographical conditions, and had to be carried out on a steeper slope. As the actual site conditions and the additional slope stabilization works were not anticipated at the design stage, the realignment of watermains on Slope A was also unable to be included in the tender documents.

- (iii) Consultant X had conducted site or ground investigations for Contract B according to Geoguide 2 – Guide to Site Investigation (“Geoguide 2”) published by Geotechnical Engineering Office (“GEO”) and sought GEO’s comments according to Works Lands and Works Branch Technical Circular (“LWBTC”) No. 3/88. On 28 September 1999, GEO had no adverse comments on The Ground Investigation Plan and Proposal for Route 8 Sha Tin Section prepared by Consultant X. Taking into account GEO’s views on the Ground Investigation Plan, colleagues concerned at that time considered the scale of SI sufficient before the award of contract.

HyD agrees to continue to conduct thorough SI as far as practicable with a view to incorporating comprehensive and adequate information for design

and tender purposes. However, as advised in section 10.2 of Geoguide 2, whilst the uncertainties can be reduced but, except by complete excavation, can never be wholly eliminated by a more intensive investigation.

(f) according to paragraph 3.23 of the Audit Report, Contractor B contended that it was beyond his reasonable contemplation at the time of tender that additional ground investigation and stabilization works to another two slopes located in the vicinity affected by the blasting works of EN Tunnel had to be carried out before obtaining a blasting permit. At the public hearing, Project Manager/Major Works Project Management Office, HyD said that additional ground investigation and stabilization works had to be carried out as squatter huts erected on the above two slopes might be affected by the blasting works. Please advise:

- (i) a chronology of events leading to the decision to undertake additional ground investigation and stabilization works to the two slopes;*
- (ii) whether Consultant X had, before preparing the tender documents, assessed the possible impact of the blasting works on the relevant squatter huts. If yes, the results of the assessment and why did Consultant X or HyD not notice that the blasting works might affect the relevant squatter huts. If no, why not;*
- (iii) whether HyD agreed that it was unnecessary to conduct the additional ground investigation and stabilization works to the above two slopes at the very beginning, and eventually changed its mind. Has the Administration received any complaints from residents of the relevant squatter huts on the blasting works? If yes, details of these complaints;*
- (iv) are there any guidelines for HyD to follow on assessing the impact of public works projects on the nearby residents in the vicinity of works sites, in particular the structure of their houses. If yes, a copy of these guidelines. If no, how would HyD handle these cases;*
- (v) measures taken/to be taken to enhance the accuracy of site condition information to be obtained from preliminary site investigations for major public works projects in the future. Whether extensive horizontal directional coring will be used for all tunneling works in future to obtain more accurate information;*

(i) Chronology of events is shown below -

Date	Event
29 October 2001	According to LWBTC No. 3/88, Consultant X submitted a Blasting Assessment Report (“BAR”) to GEO and other relevant government departments for comment and approval. The assessment confirmed that the two existing Water Supplies Department (“WSD”) ‘s slopes could withstand the blasting vibration induced from the proposed blasting operation in accordance with the standards stipulated in WBTC No. 13/99 and GEO Report No. 15.
23 & 29 November 2001	WSD and GEO replied that they had no further comment on the blasting assessment for the slopes.
9 January 2004	The occupant of a squatter hut located in between the two WSD’s slopes complained that some wall tiles had fallen from the top of kitchen door frame due to the construction works carried out under Route 8 project. During the joint site inspection between the Contractor and the Resident Site Staff of the Advance Works Contract of Route 8, cracks were found on the structure elements (floor slab, wall and beam) of the squatter hut.
15 March 2004	GEO inspected the site with the Resident Site Staff of the Contract B. The slope directly below the squatter hut was considered in good condition in terms of slope maintenance. The cause of the above cracks was not

	clear.
13 May 2004	WSD advised HyD that regular inspections and maintenance works according to the requirements laid down in Geoguide 5 had been carried out to the slope features. Tension cracks found in 2000 at the crest of slope directly below the squatter hut were repaired. The slopes were also shotcreted in April 2002 to protect the slope surfaces from erosion during rainy seasons.
19 July 2004	In order to reaffirm the stability issue of the slopes under blasting vibration, Consultant X proposed ground investigation works to collect more data to verify the design assumptions made in the slope stability study. As reported by Consultant X, GEO had mentioned to it that without knowing the cause of the cracks, slope upgrading works were still required even if the Factor of Safety ("FOS") of the concerned slopes were found greater than the required FOS, as this would become more conservative to facilitate the proposed blasting operation.
13 September 2004 to 8 November 2004	Ground investigation works were carried out for the slope features.
18 & 25 November 2004	Based on the ground data from the investigation, Consultant X submitted the slope stability assessment and upgrading work design report to GEO.
1 December 2004	GEO had no comments on the assessment and the report.

- (ii) Before preparing the tender documents, Consultant X had assessed and proposed an allowable blasting vibration induced i.e. in terms of peak particle velocity (PPV) for the village houses including the squatter huts in the vicinity of the proposed tunnel blasting works with reference to international standards so as to avoid possible blasting impact on the houses. Consultant X prepared and submitted the BAR to GEO and WSD according to LWBTC No. 3/88. GEO and WSD had reviewed the BAR and had no comments on the blasting assessment results. During construction stage of the project, GEO reconfirmed that they had no adverse comments on the allowable PPV proposed for the village houses including the squatter huts in line with the recommendation given in the BAR prepared by Consultant X during the design stage.
- (iii) The BAR prepared in design stage had assessed the possible impact of the blasting works on the relevant squatter huts and the two slopes, confirming that they would not be affected. GEO had no adverse comments on this. It was considered that additional ground investigation and stabilization works to the above two slopes were not necessary. A complaint about some wall tiles having fallen from the top of kitchen door frame, which was received from the occupant of the concerned squatter hut in early 2004 before the commencement of the blasting works of EN Tunnel. Nevertheless, as mentioned in paragraph (i) and (ii) above, the additional ground investigation and subsequent slope stabilization works were required by GEO to make the slope stability more conservative.
- (iv) For public works involving blasting operations, the project proponent should have obtained GEO's agreement to the pre-contract BAR. The purpose of the pre-contract BAR is to identify all sensitive receivers, assess any adverse effects and risks arising from the transport, storage and use of explosives for blasting, and to demonstrate the feasibility of carrying out the blasting works in a practical, safe and acceptable manner. The "Guidance Note on How to Apply for a Blasting Permit" published by Mines Division of the Civil Engineering and Development Department ("CEDD") provides guidelines for the project proponent to follow in preparing the BAR. A copy of the guidance notes is enclosed in **Appendix F**.
- (v) Development Bureau ("DEVB") has been enhancing the guidance and control on geotechnical works from time to time when required. In

accordance with Technical Circular (Works) No. 29/2002, the Project Department should agree with the GEO the scope and extent of all necessary geotechnical investigation and studies to be carried out as part of the project. In 2005 via ETWB TC(W) No. 15/2005, DEVB requires that for tunnel works, departments should consult GEO on geotechnical appraisals which should also cover the possible scope and extent of SI and geotechnical studies required to reduce uncertainties and risks, and take into account GEO's response in finalizing these documents. The departments or its consultants should also submit the geotechnical design to the GEO for audit, where such works would pose a significant risk to public life or property. This submission should also identify the requirements for any investigation. In 2018, to further enhance the control in major geotechnical works, DEVB requires, via DEVB TC(W) No. 3/2018, departments to submit to GEO, and copy to the Project Cost Management Office ("PCMO") of DEVB, the schematic design proposal with relevant information, such as ground investigation data, for review and comment.

In addition, GEO promulgated in 2004 the "GEO Technical Guidance Note No. 24 Site Investigation for Tunnel Works", advising on the SI techniques for tunnels, including horizontal directional coring ("HDC") which can be very useful for investigating deep tunnels. As this technique can provide continuous information along the tunnel alignment to minimize uncertainty of the tunnel works and enhance the management of risks for the project, where feasible and appropriate, HyD would use this technique more for tunneling works in future. Notwithstanding this, the use of HDC is subject to limitations, such as the driven depths and lengths, the type of core samples that can be taken and the type of geotechnical tests that can be performed etc., and therefore may not be applicable to all tunneling works.

- (g) whether any mechanism was in place to examine the pecuniary interest between Consultant X and Contractor B. If yes, details of the mechanism and the Administration's findings about the relationship between Consultant X and Contractor B, if any;***

According to the General Conditions of Employment of Engineering and Associated Consultants for a Design and Construction Assignment, Consultants must declare any interest if it is considered to be in real or apparent conflict with their services under the consultancy agreement. In any case the Consultants shall not undertake any services for a contractor in respect of a contract between that contractor and the Employer (i.e. the Government) for which the Consultants are providing a service to the Employer. In fact, Consultant X had declared during the tender assessment that their staff involved in the preparation of the tender report for Contract B had no conflict of interest in connection with the tender assessment, whether actual or perceived, arising between their duties and private interests.

(h) *having regard to the above administration issues of Contract B, please advise:*

- (i) *whether HyD considered the performance of Consultant X unsatisfactory and led to cost overruns and delay of Contract B. If yes, has any sanction been imposed on Consultant X. If no, why not;***
- (ii) *measures taken/to be taken to strengthen the checking of accuracy of tender documents, contract clauses, drawings and BQs prepared by consultants for major public works contracts in future;***

- (i) Under contracts, the Government has the obligations to pay for the works done and other associated costs which the contractors are entitled to, including omitted items and prolongation costs. Contracts also include provisions for granting EOT for completion due to events covered by the contract provisions, such as additional works, inclement weather etc. The Consultant X had made the relevant decisions in administering the Contract B in accordance with the above contract provisions.

According to the guidelines stipulated at that time in DEVB TC(W) No. 2/2009 on management of consultants' performance, the performance score of a consultant on individual consultancy is based on an overall assessment of individual aspects concerned. These performance scores will be consolidated into the consultant's performance rating to be considered in the bidding of future consultancies. Regulating actions, such as suspension from bidding, will be taken against a consultant by the project department concerned under serious circumstances e.g. court conviction, violation of laws, bankruptcy, the consultant having received two consecutive adverse performance reports etc. HyD had been conducting assessments on the Consultant X's overall performance regularly in accordance with the guidelines stipulated in DEVB TC(W) No. 2/2009. For the items omitted, Consultant X had, in accordance with the GCC, measured and valued the items at a rate as determined based on the rate of similar item in the BQ. For the delays leading to EOTs, they were due to additional works required to be carried out to cope with actual site conditions not anticipated at the design stage. Colleagues concerned at that time evaluated Consultant X's performance in various aspects, including the matters arising from the omitted items and programme delays, and reflected the overall performance in its performance report. Based on the guidelines given in DEVB TC(W)

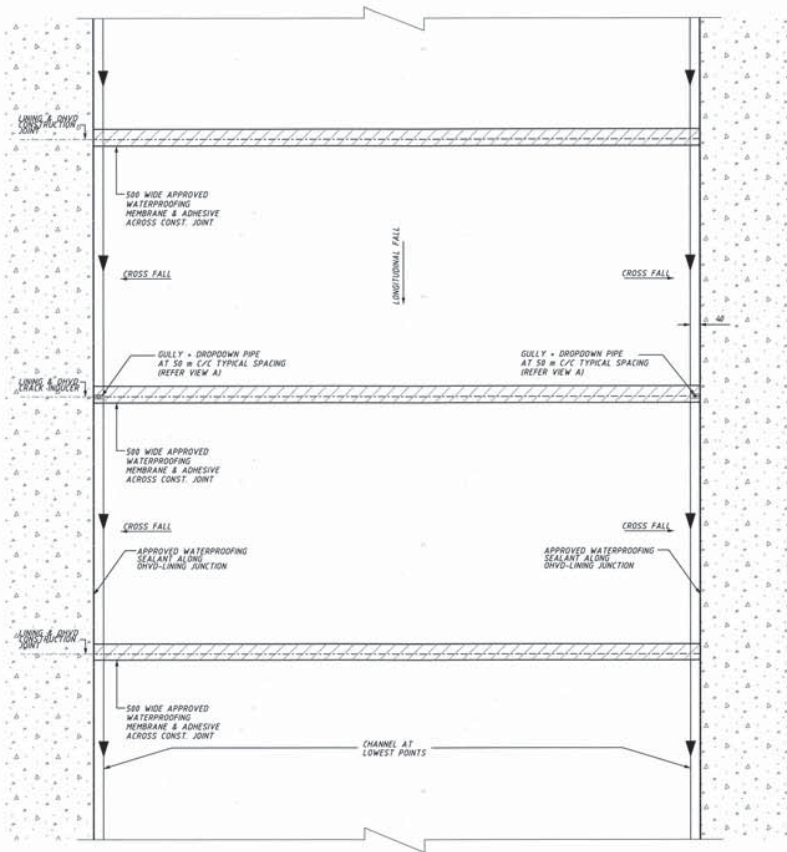
No. 2/2009, colleagues concerned at that time considered that the overall performance of Consultant X was acceptable with no regulating action taken.

- (ii) HyD would continue to conduct checking on tender documents, contract clauses, drawings and BQs prepared by consultants in accordance with the requirements stipulated in the Project Administration Handbook (“PAH”) and the established guidelines. HyD would review and update the HQ/GN/02 to enhance the checking system and has reminded individual project team to assign the checking of concerned or related sections amongst different parts of tender documents to the same officer. Indeed, CEDD issued in October 2010 the revised PAH, requiring omitted items should be minimized as far as practicable and the BQs should undergo a checking process. To enhance the accuracy of the BQs prepared by the consultants, HyD would request the consultants to conduct independent checks and consider adopting computer tools e.g. Building Information Modeling in carrying out the checking.

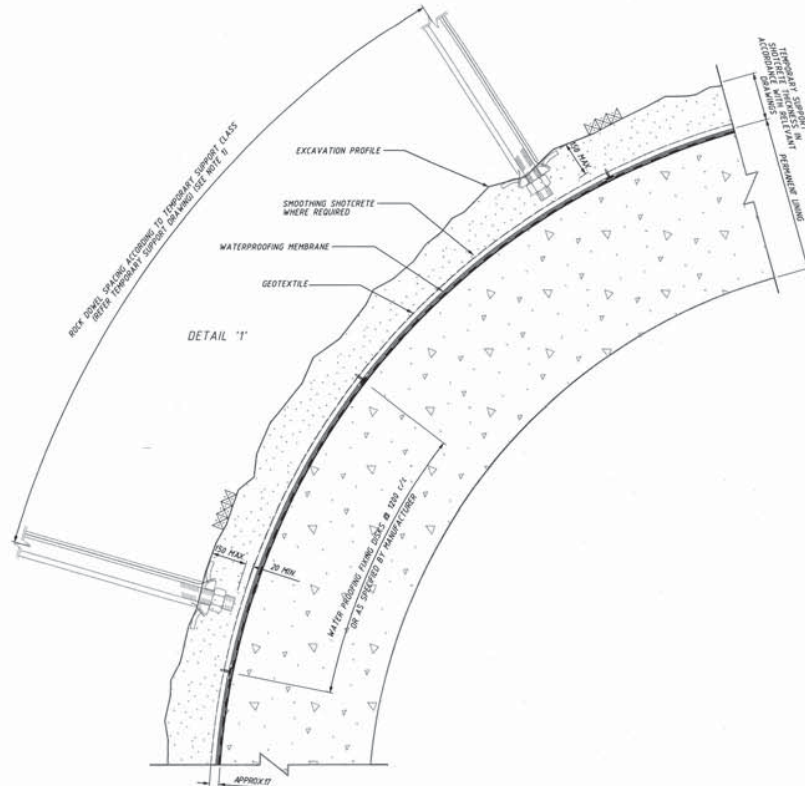
Contract C

- (i) *with reference to paragraphs 3.40 and 3.41 of the Audit Report, details of measures to be implemented to ensure the consistency of time programmes for interface works in all major public works contracts in future.*

HyD would remind its staff and consultants, in preparing tender documents in future, to continue to carefully check and update that the prevailing time programmes and associated contractual provisions for interface works in all contracts involving interfaces with other contracts are still consistent.



OHVD SLAB WATERPROOFING MEMBRANE DETAIL
N.T.S.



WATERPROOFING MEMBRANE FIXING DETAILS
N.T.S.

NOTES ON SHOTCRETING:

1. TEMPORARY SUPPORT SHOTCRETE SHALL EITHER BE PLAIN SHOTCRETE OR FIBRE REINFORCED AND SHALL FOLLOW THE MINIMUM THICKNESS SPECIFIED IN THE TEMPORARY TUNNEL EXCAVATION DRAWINGS REF. DRG. NO. 94099/ENT/4210-4229.
2. SMOOTHING SHOTCRETE PRIOR TO THE INSTALLATION OF THE WATERPROOFING MEMBRANE SHALL ONLY BE PLAIN SHOTCRETE.
3. WEEPHOLES SHALL BE PROVIDED AT 1.2m C/C (TRIANGULAR GRID OVER AREAS OF PERSISTENT SEepage) MEASURES TO CONTROL SURFACE PRIOR TO MEMBRANE INSTALLATION AND LINING CONSTRUCTION SHALL ALSO BE SUBMITTED TO THE ENGINEER FOR HIS APPROVAL.
4. WATERPROOFING MEMBRANE SHALL BE HEAT-WELDED TO FORM A PLAT DOUBLE WELD SEAM. SPACING BETWEEN THE TWO WELDS SHALL NOT EXCEED 20mm. EACH WELD SHALL BE AT LEAST 6mm WIDE.
5. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRG. NO. 94099/ENT/4000

TENDER DRAWING		CAJ	CW	APR.03
Highways Department 路政署 Major Works Project Management Office				
ROUTE 9 - EAGLE'S NEST TUNNEL AND ASSOCIATED WORKS				
TUNNEL SUPPORT & LINING WATERPROOFING MEMBRANE FIXING DETAILS				
MAUNSELL HYDER JOINT VENTURE				
Maunsell THE CONSULTANTS				
DRG. NO. 圖號: 94099/ENT/4203				
DRAWN BY WKT	CHECKED BY H1/2003/02			
SCALE 1:100	DATE 11/1/2003			
TENDERS DRAWING				
COPYRIGHT RESERVED				

PATN : p:\1582FP1\tender\ent\420014202.dwg

- Watertightness Standards - General* 27.72 The permanent works shall be watertight with no identifiable flow of water penetrating the lining. Leakage which, in the opinion of the Engineer, is concentrated or significant or affects the use of the works shall be sealed by the Contractor using approved methods and materials.
- Watertightness of Tunnels and Adits* 27.73 (1) The completed tunnels and cross passages shall be substantially watertight with no evidence signs of the following:
- a) leaks or any indication of water movement through the primary linings and construction joints
 - b) dampness or efflorescence at the exposed concrete surfaces
 - c) drips through the overhead duct slab
 - d) dampness or leaks which result in staining of the tunnels cladding or internal finishing
- (2) There shall be no discernible flow of water through the tunnel lining.
- Tunnel drainage* 27.74 (1) A drainage system comprising geotextile fleece, drainage pipe sleeves, drainage pipes, graded granular drainage material and manhole pits as shown on the drawings shall be provided in the tunnels. The drainage system shall drain all water collected inside the tunnel to the invert drainage system and eventually to the portal collection points. The invert drainage system shall comply with the relevant provisions of Section 5 of the General Specifications. Waterproofing of the tunnels shall be in accordance with the requirements of PS Clauses 27.103 to 27.107.
- (2) All grouting associated with the tunnel lining shall be completed to the satisfaction of the Engineer prior to the laying of pipe bedding materials and the granular drainage layer.
- (3) Initial and permanent drainage works shall be installed in the tunnels to ensure that all concrete is placed in as dry as conditions as practical and that no accumulations of water occur which could affect the quality of the insitu concrete.
- (4) Water pressure relief holes shall be drilled into the rock or shotcrete to intercept and channel water to the invert drainage system prior to the casting of the concrete lining. The Contractor shall submit for approval of the Engineer, the number, location, size, spacing, length and orientation of the water pressure relief holes to suit the actual conditions encountered.
- (5) A layer of Grade 25 smoothing shotcrete at least 30 mm thick shall be applied to bare rock surfaces, fibre reinforced shotcrete surfaces and any surface which, in the opinion of the Engineer, may cause puncturing of the drainage geotextile or waterproof membrane. The surface of the smoothing shotcrete shall be between 30 mm and 100 mm outside the extrados of the permanent concrete lining shown on the Drawings.

Guidance Note On How to Apply for a Blasting Permit



**Mines Division
Civil Engineering and Development Department**

1. Introduction

- 1.1 Under Regulation 46 of the Dangerous Goods (General) Regulations, no person shall carry out any blasting without the permission of the Commissioner of Mines. This note provides guidance to Contractors on making application for a Blasting Permit to carry out blasting. For private projects, a pre-contract Blasting Assessment Report (BAR) submitted by the Registered Geotechnical Engineer should have been agreed by the Buildings Department as part of the site formation plans approval. For public projects, the project proponent should have obtained GEO's agreement to the pre-contract BAR at the planning and design stages.
- 1.2 The purpose of the pre-contract BAR is to identify all sensitive receivers, assess any adverse effects and risks arising from the transport, storage and use of explosives for blasting; and to demonstrate the feasibility of carrying out the blasting works in a practical, safe and acceptable manner. As it is essentially a feasibility study at the project planning and design stage before award of contract, the assumptions adopted in the BAR are not binding on the Contractor, who can propose alternatives. However, it needs to be appreciated that for private projects, this may require resubmission to the Buildings Department to obtain approval of amendments to the site formation plans, and time needs to be allowed for this statutory process. Buildings Department will consult the Mines Division on the proposed amendments within the statutory period. For public projects, the proposed amendments should be discussed directly with the Mines Division.

2. Application for a 'Licence to Possess Category 1 Dangerous Goods' and a 'Permit to Use Category 1 Dangerous Goods'

- 2.1 When the contract is awarded, the Contractor shall apply for a 'Licence to Possess Category 1 Dangerous Goods' for the possession of explosives for immediate use at a blast site, and a 'Permit to Use Category 1 Dangerous Goods' for preparing, loading and firing of explosive charges. The 'Licence to Possess Category 1 Dangerous Goods' and 'Permit to Use Category 1 Dangerous Goods' are together referred to as a Blasting Permit.
- 2.2 Submission of Applications
To apply for a Blasting Permit, the Contractor should submit an application to the Commissioner of Mines with the following documents:
 - (a) a covering letter enclosing a duly completed application form No. MIN/EXP/F.1CR which can be downloaded from <http://www.cedd.gov.hk/eng/forms/index.html>;
 - (b) an updated BAR (known as the Contractor's BAR) to re-visit and confirm or amend the assumptions and recommendations in the pre-contract BAR. The contents of the

Contractor's BAR could be the same as the pre-contract BAR if the site conditions, assumptions and recommendations are confirmed unchanged, or may be amended if required. Please refer to Annex 1 for the contents of a BAR;

- (c) a Method Statement (MS) checked by the Site Supervisory Staff. Annex 2 provides typical contents of a MS;
- (d) six copies of the following site plan of scale 1:500 or 1:1000 showing :
 - i. the intended boundary for the Licence to Possess Category 1 Dangerous Goods, which should normally cover all areas, including all possible accesses to blasting areas within the site boundary;
 - ii. the intended boundary of blasting areas for the Permit to Use Category 1 Dangerous Goods, marked with coordinates together with notes on any restrictions and conditions regarding the blasting proposal;
 - iii. all sensitive receivers, including streets, structures, foundations, railways, public utilities, water mains, drains, sewers, gas mains and other services, geotechnical features such as slopes, retaining walls, boulders, tunnels, caverns, etc. within a plan radius of 150m for tunnel/shaft blasting or 300m for open-cast;
 - iv. the intended boundary of blasting areas shall be confined to such areas requiring blasting and exclude any Dangerous Goods stores, site offices, etc.
- (e) one set of relevant specifications and parts of contract drawings (for government projects) or relevant plans approved by Buildings Department (for private projects) showing any restrictions and conditions on blasting.

2.3 Processing of Application

Mines Division will respond normally within 28 days upon the receipt of a submission from the Contractor or within 25 days upon the receipt of the subsequent submission of any missing/supplementary information. Upon the acceptance of the MS and site check to verify that the information and documents submitted are correct and acceptable, Mines Division will provide the pre-licensing requirements to the Contractor for follow-up action. The agreed MS will form part of the conditions for the issue of the Blasting Permit. General pre-licensing requirements will include, but will not be limited to, items listed in Annex 3.

2.4 Issue of Permit

Upon satisfactory completion of the works and compliance with Mines Division's pre-licensing requirements, a Blasting Permit (normally valid for one year) will be issued to the Contractor within 3 working days upon payment of the prescribed licence and permit fees.

2.5 Renewal of Permit

Any application for renewal of a Blasting Permit shall reach the Mines Division not less than 28 days before the expiry date. The Contractor shall provide an updated MS to review the site conditions, the manner of working, precautionary and protective measures to protect the existing sensitive receivers and also new sensitive receivers, if any, during blasting.

**Mines Division
November 2007**

General guidance is provided in this Note. Site-specific requirements may be imposed by the Commissioner of Mines according to the site conditions and characteristics. Feedback or enquiries on this document can be directed to the Chief Geotechnical Engineer/Mines of the Geotechnical Engineering Office, Civil Engineering and Development Department at 25/F, 410 Kwun Tong Road, Kwun Tong, Kowloon, Hong Kong.

Telephone: (852) 2716 8666 Facsimile: (852) 2714 0193 E-mail: mines@cedd.gov.hk

Contents of a Blasting Assessment

- (a) Site plans clearly indicating the proposed areas of blasting and locations of all sensitive receivers including streets, structures, foundations, railways, public utilities, water mains, drains, sewers, gas mains and other services, geotechnical features such as slopes, retaining walls, boulders, tunnels, caverns, etc. that may be damaged or destabilised by the proposed blasting works.
- (b) A report containing the results of a study, including the site topography, geology, ground, groundwater and surface water conditions, and the physical site constraints, sensitive receivers and site history.
- (c) A report containing examination of the conditions of the sensitive receivers on and adjacent to the site.
- (d) A report containing an assessment of the effects of blasting works to demonstrate that the proposed blasting would not cause any injury to persons or damage to property and sensitive receivers.
- (e) Proposals of preventive measures to be carried out for sensitive receivers, if considered necessary.
- (f) A list of the alert and cease works limits to be specified for the implementation of blasting works, including blasting vibration limits and air-overpressure limits, etc. to ensure that the blasting works to be carried out would not cause any injury to persons, damage to sensitive receivers, significant disruption to traffic or undue nuisance to the public. The limits proposed shall take into account the existing conditions of all sensitive receivers. The source of the limits and documentary evidence of consultation and agreement, where appropriate, with the key stakeholders (e.g. owners or maintenance agents) of the sensitive receivers shall be provided.
- (g) An outline of the blast design to demonstrate that the blasting works could be safely carried out and the proposed limits and any other constraints could be satisfied.
- (h) A document setting out methods to be employed, working procedures and sequences for all blasting works, and the safety management system.
- (i) Particulars of the site inspections, surveys and monitoring to be carried out to check and measure the effects of blasting, including plans showing the locations of the monitoring stations, the performance criteria and the alert and cease works limits.
- (j) Proposals of protective and precautionary measures to be taken, including any evacuation and closure of public areas (such as roads and other facilities) and warnings needed to protect the sensitive receivers and the safety of the public and workers.
- (k) Proposals of the arrangement for delivery of explosives to the site to demonstrate the practicability of completing the blasting works and the rock excavation needed within the construction period.
- (l) If an on-site explosive store is considered necessary, a report containing an assessment of its feasibility and proposed arrangement.

Contents of a Method Statement

1. Brief description of the project (including blasting period, amount of rock excavation, works programme, no. of blast per day/week, time of blast, etc.).
2. Outline Design of Blasting Works
 - a. Open-cast blasting
 - i. Table showing General Blasting Parameters (ranges of values, where applicable) in Production Blasting and Pre-split Blasting, which include:

1. Bench Height	2. Hole Diameter	3. Stemming
4. Sub-drill	5. Drill Hole Depth	6. Burden x Spacing
7. Inclination	8. No. of rows	9. Cartridged/Bulk Explosive Charge per Hole
10. Use of Detonating Cord	11. Excavation Volume per Shot	12. Powder Factor
13. Others (e.g. Secondary blasting ¹)		

- ii. Cross-sections showing the charging details of blast holes for production and pre-split blasting.
- b. Tunnel blasting
 - i. Table showing combination of General Blasting Parameters (ranges of values, where applicable) in tunnel blasting (shafts, caverns and subsurface etc.), includes:

1. Face Area	2. Hole Diameter	3. Stemming
4. Drillhole Spacing	5. Drill Hole Depth	6. Drill Hole Inclination
7. Cartridged/Bulk Explosive Charge per Hole	8. Expected Pull	9. Excavation Volume per Shot
10. Powder Factor	11. Use of Detonating Cord	12. Others

3. Typical Daily Blast Design
4. Estimation of Blast Effects
 - a. Blasting induced vibration. A charge weight per delay table based on the allowable PPVs proposed for the nearby sensitive receivers.
 - b. Blasting induced air overpressure. An air overpressure target of 120dBL should be adopted initially for blasting adjacent to sensitive receivers with inhabitants (e.g. residential building, school, hospital, church, etc.) to avoid causing any human discomfort, alarm or damage to hearing. This may subsequently be adjusted upwards or downwards in response to outcome and human reaction.
 - c. Evacuation zone. The zone to be evacuated to protect people against the possible ejection of flyrock, taking into account of the difference in elevation between the blast area and sensitive receivers.
5. Anticipated Maximum Daily Consumption of Explosives types and Quantities

¹ Secondary blasting should be carried out with extreme caution and tailor-made blast design and particular protective and precautionary measures should be provided.

6. Sequence of blasting works
7. Non-Blast zone
Defining the Non-Blast Zone to avoid causing any unacceptable adverse effects on the stability of adjoining temporary/permanent slopes and/or sensitive receivers as a result of blasting.
8. Protective Measures
 - a. Drawings showing typical details of protective measures² against flyrock. Example:
 - (i) Vertical screens;
 - (ii) Blasting cages;
 - (iii) Blast door³, etc.
 - b. Arrangement and layout of protective measures to demonstrate the blasting proposal is safe and feasible.
9. Precautionary Measures
 - a. A plan showing the evacuation zone⁴ and sentry points.
 - b. For any evacuation zone encroaching onto any public road/area outside the site boundary, temporary closure/evacuation shall only be carried out with the prior agreement from HKP and other government departments concerned. It is the Permittee's responsibility to obtain such agreement in a timely manner before carrying out the blast. If no prior agreement could be obtained, Permittee is required to provide suitable protective measures (e.g. vertical screens, blasting cages, etc. at the blast locations) to protect the affected public area/road located outside the site boundary.
 - c. Evacuation procedures for the Contractor, Sub-contractors and the Site Supervisory Staff.
10. Safe Handling of Explosives
 - a. Cordon-off line to prevent unauthorised entry to the blasting areas during handling of explosives.
 - b. Maximum. no. of personnel permitted at blasting areas.
 - c. Location of handing over the explosives to shotfirer.
 - d. Contractor's own transport of explosives within the site.
11. Inspection and Monitoring plan
 - a. Locations and details of vibration and air overpressure monitoring stations.
 - b. Monitoring Action Levels.
 - c. Requirements for inspection of sensitive receivers before and after each blast.
12. Contractor Organization and Responsibility
 - a. Contractor's drilling and blasting crew organization chart.
A flow chart details the various steps, working procedures, cross-checking and responsible persons for all blasting related activities.
 - b. The roles, duties and responsibilities of all these Contractor personnel mentioned in the above flow chart.

² Blasting cages and vertical screens may need to be provided at blast locations when appropriate to protect against flyrock affecting adjacent sensitive receivers and members of the public.

³ A blast door should be provided at each tunnel entrance to protect against ejection of flyrock and to reduce air overpressure during blasting. Sufficient air vents should be formed at areas between the frame and arch ribs to release air pressure effectively, and the door should be covered with some acoustic materials to mitigate air overpressure.

⁴ A mobile robust blast shelter for the shotfirer should be provided if he chooses to remain in the evacuation zone during the blast.

- c. Channels of communication between the Contractor and the Site Supervisory Staff.
 - d. An emergency contact list.
13. Contingency plan for the following scenarios, but not limited to :
- a. Loaded blastholes not being able to discharge within the same day.
 - b. Thunderstorm or lightning.
 - c. Rainstorm.
 - d. Typhoon.
 - e. Misfire.

Typical Pre-licensing Requirements

1. General Requirements
 - a. Establishment of vibration monitoring stations on site.
 - b. Erection of warning signboards at major accesses to prevent unauthorised vehicles or personnel entering the evacuation zone after the commencement of warning signals prior to the blasting.
 - c. Provision of sufficient numbers of wooden boxes for storing electric detonators on the journey to the blasting area(s). The wooden boxes shall be painted in red with words “Danger-Detonators” “危險-雷管” painted in white letters/characters of not less than 40mm in height on four sides and the top.
 - d. Completion and return to Mines Division the ‘Authorised signature for placing and ordering for an explosives delivery’ form.
 - e. A visit by the Contractor to the Mines Division office together with the proposed shotfirer(s) for an interview to discuss the delay firing techniques and other safety conditions required for the site, during which the Contractor should bring to Mines Division office for test and registration the firing equipment and circuit testing equipment to be used for initiation of blast.
 - f. Arrangement with the appointed explosives supplier(s) to give briefing(s) to the blasting crew to enhance their awareness on the method of safe handling and use of explosives (i.e. cartridges, bulk emulsion explosives, detonating cords and initiation system) to be used for blasting, and submission of the training attendance records.

2. Open-cast Blasting
 - a. Erection of boundary markers at all control points to identify the blasting area requiring different protective measures, design blasthole diameter, etc. These markers shall be made of steel poles of not less than 60mm in diameter anchored in concrete and projected not less than 1.5m above ground.
 - b. Vegetation and overburden has to be stripped to form a level platform so that the height and other details of rock face to be blasted and the distances from any sensitive receivers (i.e. adjacent properties, structures, utilities and installations) to be protected can be measured and shown on plan. Prior stripping of overburden may be waived if protective measures are not required for the blast.
 - c. Sufficient protective measures (eg. roof-over meshes, vertical screens and protective cages, etc.) and quantities of gunny sacks, mesh covers and filled sandbags, if proposed, required for the daily blasts are available on site.
 - d. Provision of a specially constructed mobile robust blast shelter for the shotfirer if he chooses to remain in the evacuation zone during the blast.
 - e. Provision of a portable lightning detector to monitor the approach of thunderstorms.

3. Tunnel Blasting
 - a. Construction of a blast door and/or blast screen¹.
 - b. Provision of a stray current detector.

¹ A typical blast screen normally consists of wire mesh and conveyor belt, or equivalent.