CHAPTER 8

Highways Department
Civil Engineering and Development Department
Transport Department

Sha Tin Section of Route 8

Audit Commission
Hong Kong
3 April 2018

This audit review was carried out under a set of guidelines tabled in the Provisional Legislative Council by the Chairman of the Public Accounts Committee on 11 February 1998. The guidelines were agreed between the Public Accounts Committee and the Director of Audit and accepted by the Government of the Hong Kong Special Administrative Region.

Report No. 70 of the Director of Audit contains 8 Chapters which are available on our website at http://www.aud.gov.hk

Audit Commission
26th floor, Immigration Tower
7 Gloucester Road
Wan Chai
Hong Kong

Tel : (852) 2829 4210
Fax : (852) 2824 2087
E-mail : enquiry@aud.gov.hk

SHA TIN SECTION OF ROUTE 8

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SHA TIN SECTION OF ROUTE 8

Executive Summary

1. Route 8 links Sha Tin with North Lantau via Cheung Sha Wan and Tsing Yi. In order to alleviate traffic congestion at the then existing road links between Kowloon and Sha Tin, and meet the future traffic demand, the Government commenced the construction of Sha Tin Section (between Sha Tin and Cheung Sha Wan) of Route 8 in 2002. The construction was implemented through awarding three works contracts, namely Contracts A, B and C, and a traffic control and surveillance system (TCS System) contract (Contract D). The project works under Contracts A, B and D were implemented by the Highways Department (HyD) while those works under Contract C were entrusted to the Civil Engineering and Development Department (CEDD) for implementation. The design and construction supervision work of Sha Tin Section were conducted under Consultancy X (for Contracts A and B by Consultant X) and Consultancy Y (for Contract C by Consultant Y).

2. Between March 1997 and June 2002, the Finance Committee of the Legislative Council (LegCo) approved funding of $7,083.9 million in total for the investigation, detailed design and construction of Sha Tin Section. After the substantial completion of the main works, Sha Tin Section was commissioned in March 2008. As of December 2017, the Government had incurred $6,179.1 million for the Sha Tin Section project, $904.8 million (13%) below approved funding.

3. Sha Tin Section (a 5.6 kilometre (km) dual three-lane expressway), together with Tsing Yi Section (a 7.6 km dual three-lane expressway between Cheung Sha Wan and Tsing Yi) of Route 8, form the Tsing Sha Control Area (TSCA). The management, operation and maintenance (MOM) of the TSCA has been outsourced to an operator through open tender since commissioning of Sha Tin Section. The Transport Department (TD) is responsible for handling the tendering of management contract, and for overseeing and monitoring the performance of the contractor for the TSCA. The Audit Commission (Audit) has recently conducted a review of Sha Tin Section of Route 8, covering mainly Contracts A to C (Contract D involved the implementation of the TCS System for both Sha Tin Section and Tsing Yi Section, and an audit review of Tsing Yi Section in 2014 had covered this contract).

Administration of Contract A

4. Contract A mainly involved the construction of Lai Chi Kok (LCK) Viaduct. In September 2003, the HyD awarded Contract A to Contractor A at a contract sum of $1,066.2 million. The contract works were completed in November 2009 (about 24 months later than the original completion date of November 2007) and the total contract expenditure was $1,445 million (an increase of $378.8 million (36%) over the original contract sum of $1,066.2 million). In the construction of LCK Viaduct, there were disputes under Contract A and disputes under Consultancy X. The disputes under Contract A mainly consisted of two key issues, namely adequacy of the design for viaduct structure and erection, and measurements and valuations of additional or varied works (a majority of which were related to the viaduct design). In October 2012, the HyD and Contractor A agreed to settle all the disputes under Contract A at an extra-contractual settlement sum of $273 million on a "without admission of liability" basis. The disputes under Consultancy X were mainly in respect of the viaduct design issues. In November 2016, Consultant X, also on a "without admission of liability" basis, agreed to pay an extra-contractual settlement sum of $133.1 million to settle all the disputes under Consultancy X (paras. 2.2 to 2.4, 2.7, 2.9 and 2.11 to 2.14).

5. ***Need to strengthen vetting of consultant's design.*** One of the key issues in the disputes between the HyD and Contractor A related to the design for viaduct structure and erection. According to the HyD, this issue concerned, for example, whether the design for the permanent structure of the viaduct envisaged to be built by the balanced cantilever method should have taken into account the temporary loadings during construction. In the course of disputes resolution, having considered legal opinion and views of an engineering expert on the design for the permanent structure of LCK Viaduct, the HyD noted that: (a) the construction and erection loadings did not appear to have been properly considered in the design; (b) the contract drawings only showed the use of balanced cantilever method of construction but did not indicate the need for certain requisite construction systems; and (c) Consultant X's response to a tender query requesting clarification of the temporary loads used in Consultant X's design could lead to confusion that construction and erection loadings had been considered in Consultant X's design. In implementing a works project in future, there is a need for the HyD to take measures to strengthen vetting of a consultant's design, including carrying out appropriate level of independent checking on the design of highway structures (paras. 2.15, 2.16 and 2.21).

6. ***Need to strengthen measures in handling responses to tender queries.*** Audit noted that Consultant X's response to the tender query could lead to confusion (see para. 5(c)) and could give rise to grounds for claims on the design for viaduct structure and erection. In view of the possible significant implications of responses to tender queries, there is a need for the HyD to strengthen measures in handling responses to tender queries (paras. 2.22 and 2.24).

7. ***Need to consult Financial Services and the Treasury Bureau (FSTB) earlier regarding extra-contractual settlement of claims.*** The Stores and Procurement Regulations set out requirements for contract negotiation. In July 2012, the HyD discussed with Contractor A and reached a non-committal consensus (which was subject to the Government's internal approval and the execution of a formal settlement agreement) to settle all the disputes under Contract A at an extra-contractual settlement sum of $273 million. Audit noted that the HyD had not sought the FSTB's prior agreement before discussing with Contractor A and reaching such consensus (paras. 2.30 and 2.31).

Administration of Contract B and Contract C

8. Contract B mainly involved the construction of Eagle's Nest (EN) Tunnel. In September 2003, the HyD awarded Contract B to Contractor B at a contract sum of $1,836 million. In the event, the contract works were completed in February 2009 (about 15 months later than the original completion date of November 2007). The total contract expenditure was $2,317.1 million (an increase of $481.1 million (26%) over the original contract sum of $1,836 million). Contract C mainly involved the construction of Sha Tin Heights (STH) Tunnel and Approaches. The HyD entrusted the works to the CEDD which awarded Contract C to Contractor C in November 2002 at a contract sum of $1,073.8 million. The contract works were completed in September 2008 (about three months later than the extended completion date). The total contract expenditure was $1,199.6 million (an increase of $125.8 million (12%) over the original contract sum of $1,073.8 million) (paras. 3.2 to 3.4, 3.27 and 3.28).

9. ***Discrepancy between contract clause and contract drawing in Contract B.*** Contract B was a remeasurement contract under which the costs of works are based on the actual quantities of works done to be remeasured and the prices of different works items as priced by the contractor in the Bills of Quantities (BQ) according to the contract. Under Contract B, a contract clause on tunnelling works required that

a layer of smoothing shotcrete should be applied outside the extrados of the permanent concrete lining of EN Tunnel. However, the thickness of smoothing shotcrete was stated at a maximum of 100 millimetres (mm) in the contract clause and 170 mm in the contract drawing. According to Consultant X's assessment, the thickness of the smoothing shotcrete should have been 170 mm. The 170 mm smoothing shotcrete was omitted in the BQ. In the event, the thickness of smoothing shotcrete measured 170 mm and the HyD paid $43.7 million to Contractor B for the works item omitted in the BQ (paras. 2.2, 3.2, 3.6 and 3.8).

10. ***Unclear contract clauses for measurement of tunnelling works.*** A contract clause on tunnelling works of Contract B required the adoption of controlled blasting techniques for the formation of the tunnel perimeter. Contractor B contended that such a works item was omitted in the BQ for excavation in tunnel. Consultant X agreed that the BQ for excavation in tunnel had not included controlled blasting as a works item and it was desirable to expand the BQ for excavation in tunnel to cover controlled blasting. In the event, the HyD paid $54.6 million to Contractor B for its claims (paras. 3.10 to 3.12).

11. ***Scope for conducting more thorough preliminary site investigations.*** At the tender stage of Contract B, drawings showing the ground investigation information obtained at the design stage would be provided to tenderers for reference upon request. Audit noted that total prolongation costs of $34.5 million were awarded under Contract B due to extensions of time for additional works at three slopes at which actual site conditions were undetected in earlier site investigations. There is merit for the HyD and its consultants to conduct more thorough preliminary site investigations for works at critical locations with a view to incorporating more accurate information on site conditions for design and tender purposes as far as practicable (paras. 3.22 and 3.24).

12. ***Shortened facilitation period arising from an error in drafting of Contract C.*** The scope of works entrusted to the CEDD (implemented under Contract C) did not include electrical and mechanical (E&M) works and TCS System works which had to be performed by the HyD contractors under Contracts B and D respectively. After the substantial completion of certain sections of works in Contract C, the HyD contractors' follow-on works would commence. Under Contract C, Contractor C would provide the necessary facilitation works (e.g. temporary ventilation and lighting) to enable the HyD contractors to carry out

follow-on works at the site areas of such sections for a period of nine months (facilitation period). However, due to a processing error during the drafting of Contract C, the facilitation period was defined to be about 7.5 months instead of the agreed duration of 9 months. Audit considers that the processing error could have been avoided with more diligence and care (paras. 3.29, 3.31 and 3.32).

Usage and management of Sha Tin Section

13. Since commissioning of Sha Tin Section in March 2008, the MOM of the TSCA has been outsourced to an operator through open tender. The TD awarded the current MOM contract in June 2013 to an operator at a fixed lump-sum management fee of $964.4 million for six years from 19 September 2013 to 18 September 2019. The operator is responsible for the proper MOM of the TSCA. According to the current TSCA MOM contract: (a) a Government Monitoring Team (GMT), comprising officers from the TD, the HyD, the Electrical and Mechanical Services Department (EMSD) and the Architectural Services Department, is responsible for monitoring the TSCA operator's performance; (b) the operator shall at all times provide and maintain sufficient number of competent personnel at all levels for safe, effective and efficient MOM of the TSCA in accordance with the staff plan specified in the contract; and (c) if the operator fails to employ the required number of staff at certain ranks, the operator shall pay the Government, as liquidated damages (LD), the sum for shortfall of staff at each rank (paras. 4.10 to 4.12).

14. ***Need to make better use of spare capacity of Sha Tin Section.*** In 2002, the Transport and Housing Bureau informed LegCo that the construction of Sha Tin Section of Route 8 was needed to alleviate the traffic congestion at the then existing road links between Kowloon and Sha Tin, in particular Lion Rock Tunnel and Tate's Cairn Tunnel. However, Audit noted that as of April 2017, during weekday peak hours, EN Tunnel and STH Tunnel of Sha Tin Section still had spare capacity while Lion Rock Tunnel and Tate's Cairn Tunnel had exceeded their respective design capacities. For example, in the AM peak hours, EN Tunnel and STH Tunnel were at 79% of their tunnel design capacity with no observable traffic queue, while Lion Rock Tunnel and Tate's Cairn Tunnel reached 135% and 138% of their respective tunnel design capacities and with traffic queues of 1.8 km and 1.9 km respectively (para. 4.4).

15. ***Responsibilities of GMT members not clearly set out.*** According to the TD, the GMT members monitor the performance of the operator under their respective purview. However, Audit noted that the respective responsibilities among the GMT members were not specified in the TSCA MOM contract or documented in other records (paras. 4.13 and 4.14).

16. ***Manning level requirements for some types of staff not monitored.*** According to the TD, for different types of staff specified in the TSCA MOM contract, the GMT members are responsible for monitoring the staff manning level and imposing LD for any staff shortfall. Audit noted that, as of December 2017, the manning level of administrative and supporting staff and that of building maintenance staff had not been monitored since the commencement of the TSCA MOM contract in September 2013 (paras. 4.15 and 4.16).

17. ***Staff manning level requirement not met.*** According to the TD, the TSCA operator is required to deploy a total of 403 staff, of which 343 staff are subject to LD for any shortfall. However, the operator was not able to continuously maintain the required staff manning level since the commencement of the contract in September 2013 and, as a mitigation measure, had arranged its staff to work overtime to fill the vacancies as far as possible. Audit found that, for the period from January to September 2017, out of the required manning level of 343 staff subject to LD for any shortfall, there was a shortfall of about 25 staff on average (around 7% of the required manning level of 343 staff), mostly attributed to the shortfall of about 24 E&M staff (around 20% of the required manning level of 122 E&M staff) (paras. 4.25 to 4.27).

18. ***Delay in imposing LD.*** The TD initiated action to impose LD for staff shortfall on the TSCA operator in October 2014. However, due to unclear methodology set out in the MOM contract, it took 27 months (from November 2014 to January 2017) for discussing and agreeing with the operator the methodology for calculating the amount of LD. Audit noted that, as of December 2017: (a) for E&M staff, in respect of the operator's staff shortfall for about 51.5 months from 19 September 2013 to 31 December 2017, the TD had only imposed LD of about $5.7 million for about 14.5 months, and the TD and the EMSD had not yet ascertained the amount of LD for the remaining 37 months; and (b) for building maintenance staff, as the manning level of such staff had not been monitored since the commencement of the TSCA MOM contract, information on staff shortfall remained

to be checked and hence no LD had been imposed up to December 2017 (paras. 4.32 and 4.33).

Audit recommendations

19. **Audit recommendations are made in the respective sections of this Audit Report. Only the key ones are highlighted in this Executive Summary. Audit has *recommended* that the Government should:**

Administration of Contract A

(a) **in implementing a works project in future, take measures to strengthen vetting of a consultant's design, and strengthen measures in handling responses to tender queries (para. 2.25(a) and (b));**

(b) **strictly follow the Stores and Procurement Regulation requirements for contract negotiation and seek the relevant authority's prior agreement to the strategy or bottom line for the contract negotiation before entering into negotiation with contractors or consultants in future (para. 2.40(a));**

Administration of Contract B and Contract C

(c) **in preparing documents for a works contract in future, take measures to strengthen the checking of consistency between contract clauses and contract drawings, and strengthen the vetting of tender documents regarding contract clauses for the measurement of works (para. 3.18(a) and (b));**

(d) **consider conducting more thorough preliminary site investigations for works at critical locations with a view to incorporating more accurate information on site conditions for design and tender purposes as far as practicable (para. 3.25);**

(e) **in preparing documents for a works contract in future, take measures to ensure that contract clauses for time programmes are carefully checked to ensure their accuracy and consistency (para. 3.38(a));**

Usage and management of Sha Tin Section

(f) **explore measures to make better use of the spare capacity of EN Tunnel and STH Tunnel of Sha Tin Section to alleviate the traffic congestion at the existing road links between Kowloon and Sha Tin (para. 4.8(a));**

(g) **set out clearly the responsibilities of each member of the GMT in monitoring the TSCA operator's performance (para. 4.36(a));**

(h) **take measures to ensure that the TSCA operator complies with the manning level requirement in the MOM contract for all staff, and take timely actions to monitor the staff manning level of the TSCA operator (para. 4.36(b), (c) and (f)); and**

(i) **take timely actions in calculating and imposing LD for the TSCA operator's shortfall of E&M staff and building maintenance staff (para. 4.36(g)).**

Response from the Government

20. The Government agrees with the audit recommendations.

PART 1: INTRODUCTION

1.1 This PART describes the background to the audit and outlines the audit objectives and scope.

Background

Route 8

1.2 Route 8 is a 27.7-kilometre (km) expressway linking Sha Tin and North Lantau via Cheung Sha Wan and Tsing Yi. It comprises three road sections, namely North Lantau Section, Tsing Yi Section and Sha Tin Section (see Figure 1). The Highways Department (HyD) was responsible for the implementation of Route 8.

Figure 1

Route 8

Source: *HyD records*

Note 1: *North Lantau Section of Route 8 includes Lantau Link (comprising Tsing Ma Bridge, Ma Wan Viaduct and Kap Shui Mun Bridge) and North Lantau Highway.*

Note 2: *Tsing Yi Section of Route 8 comprises Ngong Shuen Chau Viaduct, Stonecutters Bridge, East Tsing Yi Viaduct, Nam Wan Tunnel and West Tsing Yi Viaduct.*

1.3 North Lantau Section of Route 8 (comprising Tsing Ma Bridge, Ma Wan Viaduct, Kap Shui Mun Bridge and North Lantau Highway) is of 14.5 km long linking Tsing Yi and the Hong Kong International Airport on North Lantau. Its construction works commenced in May 1992 and were completed in April 1997. To cope with the increasing traffic demand, the construction of Sha Tin Section and Tsing Yi Section commenced in 2002. After the substantial completion of the main works, Sha Tin Section and Tsing Yi Section were commissioned in March 2008 and December 2009 respectively. The remaining works (including the establishment works — Note 1) for the two sections were completed in November 2009 and January 2010 respectively (see Table 1).

Table 1

Sha Tin Section and Tsing Yi Section of Route 8

Road section	Road length (km)	Major part	Works commenced in	Works completed in	Commissioned in (Note)
Sha Tin Section (between Sha Tin and Cheung Sha Wan — see Figure 2 in para. 1.4)	5.6	Lai Chi Kok (LCK) Viaduct Eagle's Nest (EN) Tunnel Sha Tin Heights (STH) Tunnel and Approaches	November 2002	November 2009	March 2008
Tsing Yi Section (between Cheung Sha Wan and Tsing Yi)	7.6	Ngong Shuen Chau Viaduct Stonecutters Bridge East Tsing Yi Viaduct Nam Wan Tunnel West Tsing Yi Viaduct	April 2002	January 2010	December 2009

Source: *HyD records*

Note: *The two sections were commissioned after the substantial completion of the main works.*

Note 1: *According to the HyD, establishment works include regular inspections, cultivations and other operations as specified to be performed during the period of establishment following completion of the landscape softworks.*

Justifications for constructing Sha Tin Section

1.4 In 2002, in seeking funding approval from the Finance Committee of the Legislative Council (LegCo) for the construction of Sha Tin Section of Route 8 (see Figure 2), the Transport and Housing Bureau (THB — Note 2) informed LegCo that:

(a) there was traffic congestion at the then existing road links between Kowloon and Sha Tin, in particular Lion Rock Tunnel and Tate's Cairn Tunnel, during morning peak hours. To alleviate traffic congestion, the construction of Sha Tin Section of Route 8 was needed in order to provide an additional road link between Kowloon and Sha Tin; and

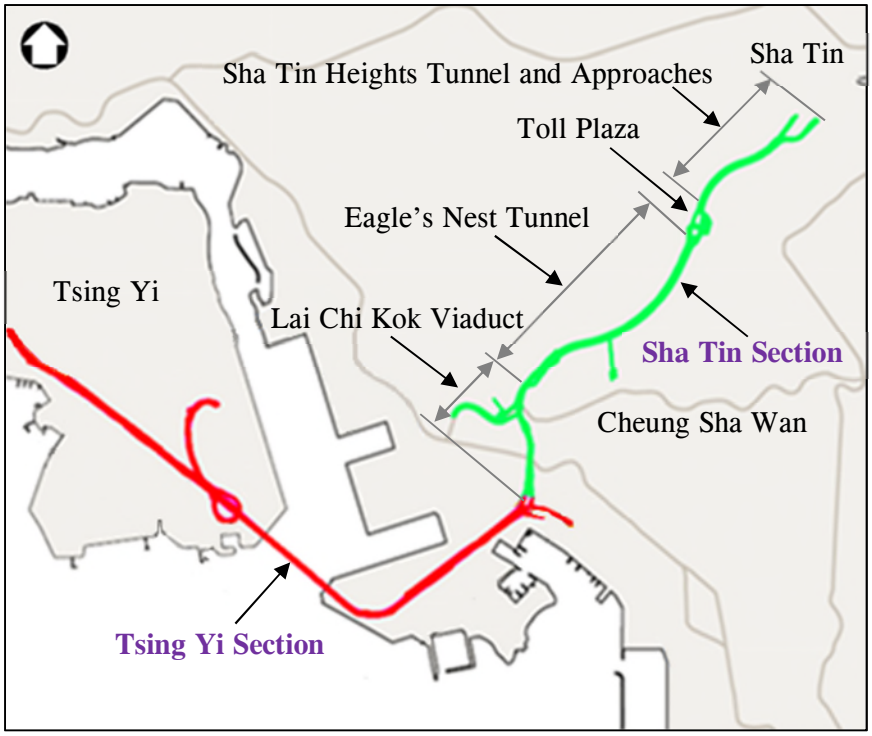
(b) the Strategic Highway Project Review (Note 3) carried out by the Transport Department (TD) in 2001-02 found that Sha Tin Section of Route 8 would be required by 2007, and a dual three-lane configuration of the project was appropriate for meeting the future traffic demand and relieving traffic pressure on the then existing external road corridors from Sha Tin to the urban areas and the container ports in Kwai Chung or Tsing Yi.

Note 2: *Before July 2002, the then Transport Bureau was responsible for the policy portfolio of transport matters. In July 2002, the then Environment, Transport and Works Bureau was formed to take over the policy portfolio. In July 2007, the THB was formed to take over the transport policy portfolio. For simplicity, the then Transport Bureau and the then Environment, Transport and Works Bureau are referred to as the THB in this Audit Report.*

Note 3: *A Strategic Highway Project Review is conducted regularly to examine the need, timing, scope and configuration of strategic highway projects to ensure that they are planned and implemented in an effective and timely manner to meet future transport demands.*

Figure 2

Sha Tin Section of Route 8



Source: *HyD records*

1.5 Between March 1997 and June 2002, the Finance Committee of LegCo approved funding of $7,083.9 million in total for the investigation, detailed design and construction of Sha Tin Section (see Table 2).

Table 2

Funding approvals for Sha Tin Section (March 1997 to June 2002)

Date	Particulars	Approved amount ($ million)
Investigation and detailed design		
March 1997	Investigation	15.5
February 1998	Detailed design	263.0
Construction works		
November 2001	Enabling works (Note 1)	45.7
June 2002	Implementing LCK Viaduct, EN Tunnel, STH Tunnel and Approaches, and associated traffic control and surveillance system (TCS System)	6,759.7 (Note 2)
	Total	7,083.9

Source: *HyD records*

Note 1: *The enabling works refer to the entrustment of the construction of ten piers of a section of slip roads in Tai Wai to the Kowloon-Canton Railway Corporation.*

Note 2: *The Financial Services and the Treasury Bureau (FSTB) has put in place measures to ensure proper control and use of funding under the approved project estimate. If the outturn tender price is lower than the approved estimate, the FSTB would administratively adjust downward the capital resources allocated to the project. The lower spending limit would become an administrative cap on the project expenditure. Works departments should not expend beyond the administrative cap unless with full justifications and approval by the FSTB. In 2003, the FSTB imposed an administrative cap of $5,339.8 million on the works project for Sha Tin Section in view of its lower outturn tender prices (see Table 5 in para. 1.10). The FSTB subsequently approved the revisions of the administrative cap several times to $6,136 million in 2015.*

1.6 The project works for LCK Viaduct, EN Tunnel and the TCS System were implemented by the HyD while those works for STH Tunnel and Approaches were entrusted to the Civil Engineering and Development Department (CEDD — Note 4) for implementation (Note 5).

1.7 The design and construction supervision work of Sha Tin Section were conducted under two consultancies (see Table 3).

Note 4: *In July 2004, the CEDD was formed upon the merging of the then Civil Engineering Department and the then Territory Development Department. For simplicity, the then Territory Development Department is referred to as the CEDD in this Audit Report.*

Note 5: *According to a paper submitted by the HyD in May 1998 to the Engineering and Associated Consultants Selection Board (which approves the selection and appointment of engineering and associated consultants for government projects, and is chaired by the Director of Civil Engineering and Development and comprises members from the FSTB and the Development Bureau), since the consultancy work for all strategic infrastructure within Sha Tin New Town (including STH Tunnel and Approaches) was covered by a consultancy agreement of the CEDD, the project works for STH Tunnel and Approaches were proposed to be entrusted to the CEDD for implementation. The Board approved the proposed entrustment of works in June 1998.*

Table 3

Consultancies and contracts for Sha Tin Section

Consultancy	Consultant	Cost ($ million)	Responsible for design and construction supervision work
X (Awarded by the HyD in July 1999)	X	83.5	LCK Viaduct (Contract A) EN Tunnel (Contract B)
Y (Note)	Y	57.6	STH Tunnel and Approaches (Contract C)
	Total	141.1	

Source: *HyD and CEDD records*

Note: *In 1998, the CEDD appointed Consultant Y to conduct the design and construction supervision work of STH Tunnel and Approaches under Consultancy Y.*

1.8 Between November 2002 and October 2004, three works contracts and a TCS System contract (Contract D) were awarded to four contractors (Contracts A, B and D by the HyD and Contract C by the CEDD).

Completion of Sha Tin Section

1.9 Contracts A, B and C were completed in November 2009, February 2009 and September 2008 respectively, and the TCS System under Contract D was completed in January 2010 (Note 6), which were later than the respective original contract completion dates (see Table 4).

Note 6: *The TCS System under Contract D for Sha Tin Section was completed in March 2008 and that for Tsing Yi Section was completed in December 2009 (Tsing Yi Section of Route 8 was opened to traffic in the same month). The system operability test for Sha Tin Section was completed in April 2008, while that for Tsing Yi Section was completed in January 2010, upon which the contract was completed.*

Table 4

Contracts A to D for Sha Tin Section

Contract	Works	Commencement date	Original contract completion date	Actual completion date	No. of months later than original contract completion date
Works contracts					
A	LCK Viaduct (1.9 km)	23.9.2003	4.11.2007	12.11.2009	24
B	EN Tunnel (2.1 km)	20.10.2003	24.11.2007	27.2.2009	15
C	STH Tunnel and Approaches (1.6 km)	18.11.2002	17.5.2007	22.9.2008	16
TCS System contract					
D	TCS System (Note)	12.10.2004	8.8.2008	19.1.2010	17

Source: *HyD and CEDD records*

Note: *Under Contract D, the TCS System was implemented for both Sha Tin Section and Tsing Yi Section and the system cost was to be shared between the two road projects.*

Costs of Sha Tin Section

1.10 The accounts of Contracts A to D (see Table 5) were finalised between October 2010 and December 2012. Consultancy X was completed in January 2017 (following settlement of all the disputes under Consultancy X in November 2016 — see para. 2.14) and the consultancy work relating to Sha Tin Section under Consultancy Y was completed in February 2011. As of December 2017, $6,179.1 million (87%) of the approved project estimate totalling $7,083.9 million (see Table 2 in para. 1.5) for Sha Tin Section had been incurred. Of the $6,179.1 million, $5,119.6 million (83%) were related to expenditures for Sha Tin Section under Contracts A to D (see Note 6 to Table 5). The remaining $1,059.5 million (17%) mainly included resident site staff costs, consultancy fees and works carried out by other government departments (see Table 6).

Table 5

Total contract expenditure of Contracts A to D
(December 2017)

Contract	Original contract sum (a) ($ million)	Total contract expenditure (Note 1) (b) ($ million)	Increase (c) = (b) − (a) ($ million)	Increase due to price fluctuation adjustment (Note 2) (d) ($ million)	Increase after price fluctuation adjustment (e) = (c) − (d) ($ million)
A	1,066.2	1,445.0	378.8 (36%)	83.6 (8%)	295.2
B	1,836.0	2,317.1 (Note 3)	481.1 (26%)	172.6 (9%)	308.5
C	1,073.8	1,199.6 (Note 4)	125.8 (12%)	123.6 (12%)	2.2
D (Note 5)	255.0	309.2	54.2 (21%)	—	54.2
Overall	4,231.0	5,270.9 (Note 6)	1,039.9 (25%)	379.8 (9%)	660.1

Source: *HyD and CEDD records*

Note 1: *The accounts of Contracts A to D were finalised in November 2012, November 2012, October 2010 and December 2012 respectively.*

Note 2: *The original contract sums of Contracts A to C already included provisions for price fluctuation adjustments. These are additional sums to cover excessive price fluctuation adjustments.*

Note 3: *For Contract B, $2.7 million of the total contract expenditure of $2,317.1 million was regional laboratory expenditure reimbursed by the CEDD and not funded under the works project for Sha Tin Section.*

Note 4: *For Contract C, out of the total contract expenditure of $1,199.6 million, $12.2 million was funded under the works project of the CEDD for the construction of Road T3 (an elevated roadway connecting the existing Tai Po Road (Sha Tin Heights Section) and Route 8 (Sha Tin Section) to the existing Tai Po Road (Sha Tin Section)), and $0.2 million was regional laboratory expenditure reimbursed by the CEDD and not funded under the works project for Sha Tin Section.*

Note 5: *Contract D did not include a provision for price fluctuation adjustments. Furthermore, $136.2 million of the total contract expenditure of $309.2 million was funded under the works project for Tsing Yi Section and the remaining $173 million was funded under the works project for Sha Tin Section.*

Note 6: *Of the $5,270.9 million, $5,119.6 million related to Sha Tin Section, $2.7 million (see Note 3) and $0.2 million (see Note 4) were reimbursed by the CEDD, $12.2 million related to the construction of Road T3 (see Note 4) and $136.2 million related to Tsing Yi Section (see Note 5).*

Table 6

Other expenditures for Sha Tin Section
(December 2017)

Item	Amount ($ million)
Resident site staff costs (Note 1) paid to Consultants X and Y	601.2
Consultancy fees paid to Consultants X and Y	141.1
Project insurance premium	50.3
Works carried out by other government departments (Note 2)	166.1
Miscellaneous costs (Note 3)	100.8
Total	1,059.5

Source: *HyD and CEDD records*

Note 1: *Consultants are required to employ resident site staff in different grades (e.g. professional grade and technical grade) for supervising contractors' works. The Government reimburses consultants the personal emoluments of resident site staff and pays an on-cost to consultants to cover their costs in managing the resident site staff.*

Note 2: *Works carried out by other government departments mainly included public works regional laboratory services provided by the CEDD, and electrical and mechanical (E&M) services provided by the Electrical and Mechanical Services Department (EMSD).*

Note 3: *Miscellaneous costs mainly included expenditures on advance works, reprovisioning of waterworks and dispute resolution, and were netted off by an amount received for settlement of claims (see para. 2.14).*

Usage and management of Sha Tin Section

1.11 Apart from Lion Rock Tunnel and Tate's Cairn Tunnel, EN Tunnel and STH Tunnel constructed under Sha Tin Section provide additional land tunnels connecting Kowloon and Sha Tin (Note 7). The alleviation of traffic congestion of Lion Rock Tunnel and Tate's Cairn Tunnel was one of the reasons for the construction of Sha Tin Section (see para. 1.4(a)). However, as of April 2017, during weekday peak hours, EN Tunnel and STH Tunnel (commissioned in March 2008) still had spare capacity while the other two tunnels had exceeded their respective design capacities.

1.12 Sha Tin Section, together with Tsing Yi Section, form the Tsing Sha Highway. The Government enacted the Tsing Sha Control Area Ordinance (Cap. 594) in June 2007 (which came into operation in March 2008) for the management, operation and maintenance (MOM) of the Tsing Sha Control Area (TSCA), which comprises Tsing Sha Highway. The MOM of the TSCA has been outsourced to an operator through open tender (annual fee for 2016-17 amounted to $159 million) since commissioning of Sha Tin Section in March 2008 (Note 8). According to the TD's Controlling Officer's Report, the TD is responsible for handling the tendering of management contracts for a number of government transport infrastructure and services (including the TSCA), and for overseeing and monitoring the performance of the contractors that operate and maintain these transport infrastructure and services.

Note 7: *As of December 2017: (a) EN Tunnel and STH Tunnel of Sha Tin Section were tolled at a flat rate of $8 for all vehicle types; (b) the toll for Lion Rock Tunnel was at a flat rate of $8 for all vehicle types; and (c) the tolls for Tate's Cairn Tunnel varied between $15 and $35 according to vehicle types.*

Note 8: *The arrangement is similar to that for the Tsing Ma Control Area which comprises North Lantau Section of Route 8 (see para. 1.3). The Government enacted the Tsing Ma Control Area Ordinance (Cap. 498) in January 1997 (which came into operation in May 1997). The MOM of the Control Area has been outsourced to an operator through open tender.*

Audit review

1.13 In 2014, the Audit Commission (Audit) completed a review of Tsing Yi Section of Route 8 and the results of which were included in Chapter 4 of the Director of Audit's Report No. 62 of April 2014.

1.14 Against the above background and with the recent completion of Consultancy X in January 2017 (see para. 1.10), Audit commenced a review of Sha Tin Section of Route 8 in October 2017. This review mainly covered Contracts A to C (Note 9), focusing on the following areas:

(a) administration of Contract A (PART 2);

(b) administration of Contract B and Contract C (PART 3); and

(c) usage and management of Sha Tin Section (PART 4).

Audit has found room for improvement in the above areas, and has made a number of recommendations to address the issues.

Acknowledgement

1.15 Audit would like to acknowledge with gratitude the full cooperation of the staff of the HyD, the CEDD, the TD, the EMSD and the Architectural Services Department (ArchSD) during the course of the audit review.

Note 9: *Contract D involved works for both Sha Tin Section and Tsing Yi Section (see Note to Table 4 in para. 1.9 and Note 5 to Table 5 in para. 1.10). The 2014 audit review of Tsing Yi Section (see para. 1.13) had covered this contract and the audit findings were mentioned in paragraphs 4.2 to 4.24 of the 2014 Audit Report.*

PART 2: ADMINISTRATION OF CONTRACT A

2.1 This PART examines the administration of Contract A by the HyD, focusing on:

(a) design for viaduct structure and erection (paras. 2.15 to 2.28); and

(b) general contract management issues (paras. 2.29 to 2.41).

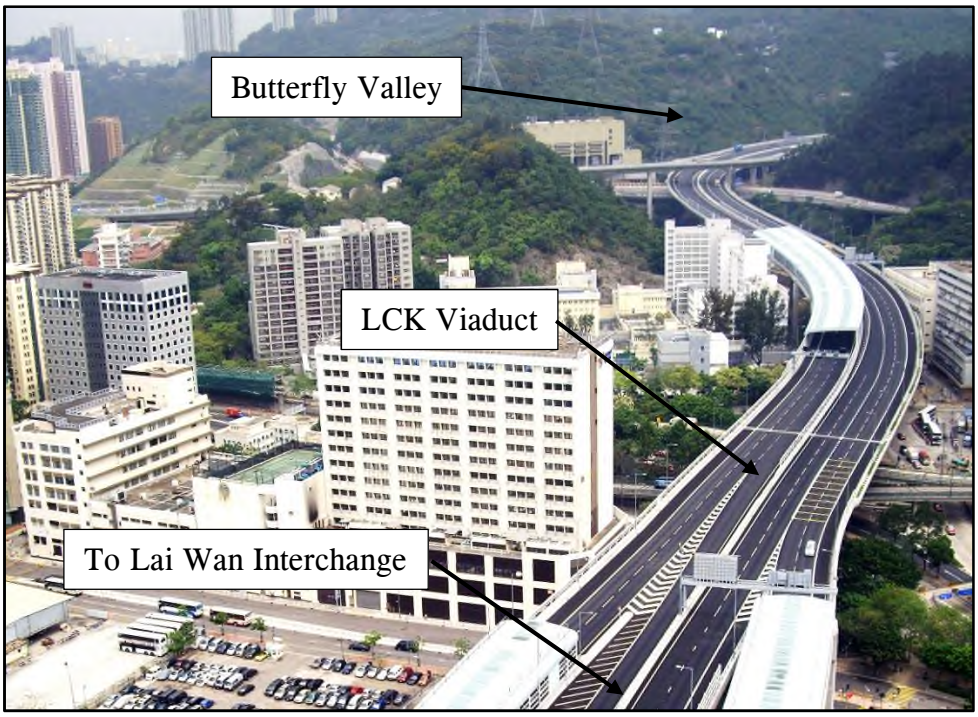
Contract A

2.2 Contract A was a remeasurement contract (Note 10) covering the construction of a 1.4 km long dual three-lane LCK Viaduct from Lai Wan Interchange to Butterfly Valley (see Photograph 1) and its slip roads, a 0.5 km long dual three-lane carriageway within Butterfly Valley, and noise barriers and noise enclosures on the viaduct and its slip roads.

Note 10: *Under a remeasurement contract, the costs of works are based on the actual quantities of works done to be remeasured and the prices of different works items as priced by the contractor in the Bills of Quantities according to the contract. Bills of Quantities, which form part of the tender documents and subsequently the contract documents after the award of a contract, contain estimated quantities of various works items. A tenderer needs to provide a tender price for the relevant Bills of Quantities items. For the successful tenderer, the Bills of Quantities prices would be used for valuing the actual works performed as remeasured.*

Photograph 1

LCK Viaduct



Source: *HyD records*

2.3 The HyD awarded Contract A to Contractor A in September 2003 at a contract sum of $1,066.2 million. The works commenced in September 2003 with a contract period of about 49 months. Consultant X was the Engineer responsible for supervising the contract works. In the event, the contract works were completed in November 2009 (including the establishment works — see Note 1 to para. 1.3), about 24 months (739 days) later than the original completion date of November 2007. Of the 739 days, extensions of time (EOTs) of 276 days were granted to Contractor A (of which 33 days were owing to inclement weather) in accordance with the terms of Contract A, and the remaining 463 days were delays resulting in liquidated damages (LD) settled under a Settlement Agreement with Contractor A in 2012 (see para. 2.11). The account of Contract A was finalised in November 2012 and the total contract expenditure was $1,445 million (see Table 7).

Table 7

Total contract expenditure of Contract A
(November 2012)

Particulars	Amount ($ million)	Amount ($ million)
1. Contract works completed	926.8	
2. Payment for contract price fluctuation (Note 1)	88.6	
3. Alternative-design works completed under Supplementary Agreement (SA) 1 (Note 2)	2.1	
4. Alternative-design works completed under SA2, SA3 and SA4 (Note 3)	23.6	
5. Alternative-design works completed under SA5 (Note 4)	45.2	
Total works completed		1,086.3
Payments for settling contract claims		
6. Claims certified by Consultant X	85.7	
7. Full and final settlement of all claims (see para. 2.11)	273.0	
Total claims		358.7
Total contract expenditure		1,445.0

Source: *Audit analysis of HyD records*

Note 1: *Of the $88.6 million payment for contract price fluctuation, $5 million was provision for price fluctuation adjustments included in the original contract sum.*

Note 2: *In September 2005, the HyD and Contractor A entered into SA1, under which Contractor A's alternative design and construction of the foundations of two piers at a fixed cost of $2.1 million would replace the corresponding contract works of $2.6 million, with a saving of $0.5 million.*

Note 3: *Between May and July 2006, the HyD and Contractor A entered into SA2, SA3 and SA4, under which Contractor A's alternative designs and construction of three retaining walls at a fixed cost of $23.6 million in total would replace the corresponding contract works of $26.6 million in total, with a saving of $3 million in total.*

Note 4: *In September 2007, the HyD and Contractor A entered into SA5, under which Contractor A's alternative design and construction of the structural steel frame for noise barriers and noise enclosures at a fixed cost of $45.2 million would replace the corresponding contract works of $51.2 million, with a saving of $6 million.*

Contract disputes

2.4 In the construction of LCK Viaduct, there were disputes under Contract A (see paras. 2.5 to 2.11) and disputes under Consultancy X (see paras. 2.12 to 2.14).

Disputes under Contract A

2.5 ***Mediation with Contractor A.*** Contractor A submitted claims under Contract A, of which Consultant X certified a much lower sum. In February 2008, Contractor A disputed Consultant X's decisions on the claims and submitted a request for mediation. The HyD accepted the request in the same month. The mediation was conducted in March 2009. However, after extensive exchanges of information and analysis, the HyD and Contractor A were unable to make further progress towards settlement of the disputes and agreed that the mediation was concluded without settlement.

2.6 ***Arbitration with Contractor A.*** Following the unsuccessful mediation, Contractor A then served a Notice of Arbitration in June 2009 to refer the claims to arbitration (Arbitration A). To prepare for the arbitration with Contractor A, the Government engaged a quantum expert (to assess the claims and assist in the arbitration) and an engineering expert (to review Consultant X's design for the viaduct) in April and May 2010 respectively.

2.7 ***Key dispute issues.*** According to the HyD, the disputes between the HyD and Contractor A on the claims in Arbitration A mainly consisted of the following two key issues:

(a) adequacy of the design for viaduct structure and erection; and

(b) measurements and valuations of additional or varied works (a majority of the disputes were related to item (a)).

2.8 After obtaining legal opinion of the Legal Advisory Division (Works) (LAD) of the Development Bureau (which had taken into account the assessments of experts), the HyD considered that the Government would have a rather heavy exposure on viaduct design issues, and a majority of the Government's assessed gross

potential financial exposure was related to viaduct design issues, which affected a number of claims in Arbitration A between the Government and Contractor A.

2.9 ***Extra-contractual settlement.*** In the course of arbitration proceedings, in July 2012, after a number of meetings, the HyD and Contractor A reached a consensus (which was non-committal and subject to the Government's internal approval and the execution of a formal settlement agreement) to settle all the disputes under Contract A at an extra-contractual settlement sum of $273 million (inclusive of interest and costs) on a "without admission of liability" basis (proposed settlement). According to the HyD, the justifications for the proposed settlement were as follows:

(a) before reaching the non-committal consensus with Contractor A, the HyD had sought the advice from the LAD in the course including the assessment, strategy and considerations mentioned in (b) and (c) below;

(b) the Government had carried out a detailed assessment of the total risk exposure of the Government regarding the disputes and, based on that, formulated the negotiation strategy; and

(c) the HyD considered that the proposed settlement would cost appreciably less and be beneficial to the Government having regard to the assessed total risk exposure mentioned in (b) above and the costs in continuing the arbitration proceedings.

2.10 In August 2012, the HyD:

(a) informed the FSTB of the non-committal consensus reached in July 2012 and the justifications for the proposed settlement as mentioned in paragraph 2.9; and

(b) sought the FSTB's approval to settle with Contractor A for full and final settlement of all the disputes under Contract A at the proposed extra-contractual settlement sum of $273 million on a "without admission of liability" basis.

2.11 The arbitration proceedings were then suspended. In October 2012, the FSTB approved the proposed settlement. Accordingly, the HyD entered into a Settlement Agreement with Contractor A for full and final settlement of all the disputes under Contract A at a sum of $273 million in the same month. According to the HyD, the settlement sum was a lump sum figure which was less than the assessed total risk exposure of the Government (including the exposure on cost) as advised by the LAD.

Disputes under Consultancy X

2.12 ***Arbitration with Consultant X.*** After settling the disputes under Contract A and taking into account legal advice, the Government served a Notice of Arbitration on Consultant X mainly in respect of the viaduct design issues in April 2013 (Arbitration B).

2.13 ***Extra-contractual settlement.*** In the course of proceedings in Arbitration B, in August 2016, Consultant X made an offer, on a "without admission of liability" basis, to pay the Government an extra-contractual settlement sum of $133.1 million (inclusive of interest and costs) for full and final settlement of the Government's claims in Arbitration B. According to the HyD, based on legal advice and after thorough analysis of the likely range of recovery by the Government in Arbitration B (including the costs to be incurred in continuing the proceedings), it was considered desirable for the Government to accept Consultant X's offer of settlement.

2.14 In September 2016, the HyD sought the FSTB's approval to accept the offer and the FSTB approved the acceptance in the same month. In November 2016, the HyD entered into a Settlement Deed with Consultant X at a sum of $133.1 million (the sum was received in the same month) for full and final settlement of all the disputes under Consultancy X. Consultancy X was then completed in January 2017.

Design for viaduct structure and erection

2.15 As mentioned in paragraph 2.7(a), one of the two key issues in the disputes between the HyD and Contractor A related to the design for viaduct structure and erection. According to the HyD, this issue concerned, for example, whether the design for the permanent structure of the viaduct envisaged to be built by the balanced

cantilever method (Note 11) should have taken into account the temporary loadings during construction.

2.16 In the course of disputes resolution, having considered legal opinion and views of the engineering expert (see para. 2.6) on the design for the permanent structure of LCK Viaduct, the HyD noted the following:

(a) the construction and erection loadings did not appear to have been properly considered in the design;

(b) the contract drawings only showed the use of balanced cantilever method of construction but did not indicate the need for certain requisite construction systems (e.g. substantial propping systems and cranes); and

(c) Consultant X's response to a tender query requesting clarification of the temporary loads used in the design (which was circulated to all tenderers, including Contractor A) could lead to confusion that construction and erection loadings had been considered in Consultant X's design.

2.17 As mentioned in paragraph 2.7(b), measurements and valuations of additional or varied works were another key issue in the disputes between the HyD and Contractor A. According to the HyD, this issue concerned whether measurements and valuations of additional or varied works were carried out in accordance with the rules prescribed in the Standard Method of Measurement (SMM) for Civil Engineering Works (Note 12) and valued at applicable rates set out in the Bills of Quantities (BQ — see Note 10 to para. 2.2) in Contract A or at rates agreed with Contractor A. The HyD considered that a majority of the disputes were related to the viaduct design.

Note 11: *According to the HyD, the balanced cantilever method is the form of construction of concrete bridge decks where precast concrete segments are erected in sequence and in balance on either side of a pier such that the concrete deck extends as a cantilever away from the pier evenly and in balance such that the overturning moment on the pier is minimised at all times.*

Note 12: *The SMM for Civil Engineering Works lays down the method and criteria for the measurement of civil engineering works undertaken for the Government.*

2.18 In the event, the claims relating to the two key issues (i.e. design for viaduct structure and erection, and measurements and valuations of additional or varied works) were settled together with other claims under Arbitration A at an extra-contractual settlement sum of $273 million (see para. 2.11). Subsequently, the Government succeeded in recovering $133.1 million (see para. 2.14) from Consultant X. According to the HyD:

(a) this took into account legal opinion that not all of the disputes with Contractor A settled under the $273 million could be attributed to Consultant X; and

(b) the Government would have to bear part of the additional costs claimed by Contractor A by way of increased tender sum of Contract A if Consultant X had, in the design, allowed for the temporary loadings during construction and the additional or varied works.

Need to strengthen vetting of consultant's design

2.19 According to the Project Administration Handbook for Civil Engineering Works issued by the CEDD, in preparing contract documents:

(a) it is essential that the contract documents for each contract are prepared with great care and by an experienced professional who has thorough knowledge of the works to be constructed;

(b) the documents forming a contract must be scrutinised for comprehensive coverage, accuracy and consistency with one another before tenders are invited; and

(c) the responsibility for ensuring that tender documents are properly prepared rests with the professional officers handling the project.

2.20 The HyD advised Audit in February 2018 that:

(a) according to the consultancy agreement between the Government and Consultant X, it was Consultant X's contractual duties to carry out detailed design (including specifications, drawings, dimensions, sections, design

data and calculations, checking and other information) of all aspects of the works following the requirements of the Project Administration Handbook for Civil Engineering Works, including those requirements mentioned in paragraph 2.19; and

(b) the HyD, as the employer of Consultant X, also needed to follow such requirements in its consultancy management work.

2.21 Audit noted that the Government would have a rather heavy exposure on viaduct design issues, and a majority of the Government's assessed gross potential financial exposure was related to viaduct design issues, which affected a number of claims in Arbitration A between the Government and Contractor A (see para. 2.8). According to the handbook issued by the Engineering and Associated Consultants Selection Board (see Note 5 to para. 1.6), in monitoring and administering a consultancy agreement, a government department should monitor the consultant's compliance with the agreement and also, to the extent authorised therein, with government regulations and procedures. In Audit's view, in implementing a works project in future, the HyD needs to take measures to strengthen vetting of a consultant's design, including carrying out appropriate level of independent checking on the design (Note 13) of highway structures (e.g. construction and erection loadings of structures).

Need to strengthen measures in handling responses to tender queries

2.22 Audit noted that Consultant X's response to the tender query could lead to confusion (see para. 2.16(c)) and could give rise to grounds for claims on the design for viaduct structure and erection from Contractor A. In response to Audit's enquiry, the HyD advised Audit that:

(a) it was Consultant X's contractual duties under Consultancy X to answer queries on the tender documents;

Note 13: *In August 2006 (after the awards of Consultancy X and Contract A in July 1999 and September 2003 respectively), the HyD amended the Structures Design Manual for Highways and Railways setting out guidelines for carrying out appropriate level of independent checking on the design of different categories of new highway structures and the associated modification of existing highway structures by consultants or contractors employed by the Government.*

(b) based on HyD records, Consultant X had forwarded the tender query to the HyD for information and copied the response to the tender query to the HyD when issued; and

(c) there was no record indicating that Consultant X had sought the HyD's comments on the response to the tender query before issue.

2.23 In this connection, Audit notes that the Project Administration Handbook for Civil Engineering Works issued by the CEDD only specifies the timeframe for responding to queries from tenderers, and the requirement for providing the same information to all tenderers for fairness and transparency. As far as could be ascertained, there is no further guidance for handling tender queries, including the need to provide a clear and accurate response and the need for a consultant to seek the responsible project department's comments on the response before issue.

2.24 In view of the possible significant implications of responses to tender queries, Audit considers that, in implementing a works project in future, the HyD needs to strengthen measures in handling responses to tender queries, including reminding its consultants to provide a clear and accurate response and, where warranted, seek the HyD's comments on its response before issue. In addition, the CEDD needs to consider providing further guidelines for handling tender queries.

Audit recommendations

2.25 **Audit has *recommended* that, in implementing a works project in future, the Director of Highways should:**

(a) **take measures to strengthen vetting of a consultant's design, including carrying out appropriate level of independent checking on the design of highway structures (e.g. construction and erection loadings of structures); and**

(b) **strengthen measures in handling responses to tender queries, including reminding HyD consultants to provide a clear and accurate response and, where warranted, seek the HyD's comments on its response before issue.**

2.26 **Audit has *recommended* that the Director of Civil Engineering and Development should consider providing further guidelines for handling tender queries, including the need to provide a clear and accurate response and the need for a consultant to seek the responsible project department's comments on the response before issue.**

Response from the Government

2.27 The Director of Highways agrees with the audit recommendations in paragraph 2.25. He has said that the HyD will:

(a) remind its staff and consultants to continue to strictly follow the guidelines stipulated in the Structures Design Manual for Highways and Railways; and

(b) in handling tender queries, remind its consultants to provide a clear and accurate response and, where warranted, seek the HyD's comments on its responses before issue. The HyD will also continue to remind its staff to take action to this end.

2.28 The Director of Civil Engineering and Development agrees with the audit recommendation in paragraph 2.26.

General contract management issues

2.29 In the administration of Contract A and Consultancy X, the HyD is required to follow the requirements under various government regulations and circulars, including the Stores and Procurement Regulations (SPRs) and Works Technical Circulars. Audit notes that there is room for improvement in ensuring compliance with such requirements (see paras. 2.30 to 2.40).

Need to consult FSTB earlier regarding extra-contractual settlement of claims

2.30 According to the SPRs, if a department proposes to vary the terms of a contract (including extra-contractual settlement of claims), it shall seek agreement of the relevant authority (as specified in the SPRs) on the proposed variation and seek

its prior agreement to the strategy or bottom line for the contract negotiation (Note 14).

2.31 Regarding the extra-contractual settlement of claims with Contractor A involving a settlement sum of $273 million, the approving authority as specified in the SPRs is the Permanent Secretary for Financial Services and the Treasury (Treasury). In December 2010, the HyD had obtained the FSTB's prior agreement to a strategy and bottom line for proceedings in Arbitration A. While pending the FSTB's agreement to a revised strategy and bottom line for proceedings in Arbitration A submitted by the HyD in June 2012, the HyD discussed with Contractor A and reached a non-committal consensus (which was subject to the Government's internal approval and the execution of a formal settlement agreement) to settle all the disputes under Contract A at an extra-contractual settlement sum of $273 million in July 2012. Audit noted that the HyD had not sought the FSTB's prior agreement to the strategy or bottom line for negotiation before discussing with Contractor A and reaching such consensus.

2.32 In giving its approval for the settlement of the disputes under Contract A in October 2012 (see para. 2.11), the FSTB said that:

(a) the HyD's arrangement for seeking the FSTB's approval (i.e. entered into negotiation with Contractor A in the course of the arbitration proceedings and agreed on a settlement sum without alerting the FSTB in advance) was not entirely satisfactory. It would have been better had the HyD alerted or consulted the FSTB earlier. This could help avoid a potentially embarrassing situation where the FSTB did not support the settlement or the proposed settlement figure agreed between the HyD and Contractor A; and

(b) for similar situation in future, the HyD should alert or consult the FSTB in advance.

Note 14: *This SPR requirement prevailing at the time of processing the extra-contractual settlement of disputes under Contract A in 2012 (2010 version of SPRs) remained unchanged as of February 2018.*

2.33 In Audit's view, the HyD needs to strictly follow the SPR requirements for contract negotiation and seek the relevant authority's prior agreement to the strategy or bottom line for the contract negotiation before entering into negotiation with contractors or consultants in future.

Need to timely conduct post-completion review

2.34 According to Environment, Transport and Works Bureau Technical Circular (Works) No. 26/2003 on "Post-completion Review on Major Consultancy Agreements and Major Works Contracts under Public Works Programme":

(a) a post-completion review is a useful project management tool and shall be conducted upon the substantial completion of a major consultancy agreement or a major works contract on projects under the Public Works Programme;

(b) as a broad guideline, post-completion reviews are generally not warranted for consultancy agreements and works contracts of a project which has a total cost less than $500 million or of a project which does not involve complicated technical and management issues; and

(c) upon the completion of a post-completion review, the department shall prepare a report documenting all concerned issues, findings, conclusions and recommendations for future reference by the department.

2.35 Furthermore, according to the guidance notes promulgated in the Technical Circular:

(a) indicators that a project involves complicated issues may include, among others, project involving a claim of a substantial sum, say over $1 million;

(b) a post-completion review should be carried out within a reasonable period, say six months, after the substantial completion of a consultancy agreement or a works contract; and

(c) in case there are on-going disputes with the service providers, it may be more appropriate to defer the review until the disputes are settled.

2.36 The disputes with Contractor A and Consultant X were settled in October 2012 and November 2016 respectively, and subsequently Consultancy X was completed in January 2017. However, as of November 2017, more than six months after the completion of Consultancy X, the HyD had not conducted post-completion reviews for Contract A and Consultancy X.

2.37 Upon Audit's enquiry, in December 2017, the HyD said that:

(a) as there were disputes of claims with Contractor A and Consultant X, the post-completion reviews for the consultancy agreement and the major works contracts under the project were deferred; and

(b) a single holistic post-completion review for Contract A and Consultancy X would be carried out soon and targeted to be completed in early 2018.

2.38 In the event, the post-completion review was completed in January 2018 (Note 15), one year after the completion of Consultancy X. According to the HyD:

(a) by the time all disputes under the project had been settled in November 2016 to enable the conduct of post-completion review, the project had been commissioned for about eight years; and

(b) as most of the personnel involved in the project had already left, a longer period of time had been taken to retrieve the necessary information for conducting a proper post-completion review.

2.39 As a post-completion review is a useful project management tool, the HyD needs to take measures to ensure the timely conduct of post-completion reviews on major consultancy agreements and major works contracts in future.

Note 15: *According to the post-completion review, in general, the Sha Tin Section was a successful infrastructure project which had been properly controlled.*

Audit recommendations

2.40 **Audit has *recommended* that the Director of Highways should:**

(a) **strictly follow the SPR requirements for contract negotiation and seek the relevant authority's prior agreement to the strategy or bottom line for the contract negotiation before entering into negotiation with contractors or consultants in future; and**

(b) **take measures to ensure the timely conduct of post-completion reviews on major consultancy agreements and major works contracts in future.**

Response from the Government

2.41 The Director of Highways agrees with the audit recommendations. He has said that the HyD will:

(a) continue to strictly follow the SPR requirements for contract negotiation and seek the relevant authority's prior agreement to the strategy or bottom line for the contract negotiation before entering into negotiation with contractors or consultants in future; and

(b) remind its staff to continue to arrange with consultants and contractors to timely conduct post-completion reviews on major consultancy agreements and major works contracts in future.

PART 3: ADMINISTRATION OF CONTRACT B AND CONTRACT C

3.1 This PART examines the administration of Contract B by the HyD and Contract C by the CEDD, focusing on:

(a) cost increase of tunnelling works under Contract B (paras. 3.5 to 3.19);

(b) prolongation costs under Contract B (paras. 3.20 to 3.26); and

(c) provision of facilitation works under Contract C (paras. 3.29 to 3.41).

Contract B

3.2 Contract B was a remeasurement contract covering the construction of a 2.1 km long dual three-lane EN Tunnel (see Photograph 2) and associated works, including the construction of:

(a) four associated tunnel buildings including the North and South Portal Buildings of EN Tunnel, the Ventilation Building at Tai Po Road and the Administration Building at the Toll Plaza; and

(b) a footbridge and associated canopy, a toll collector passageway, and all other roadworks and finishing works at the Toll Plaza.

Photograph 2

EN Tunnel

Source: *HyD records*

3.3 The HyD awarded Contract B to Contractor B in September 2003 at a contract sum of $1,836 million. The works commenced in October 2003 with a contract period of about 49 months. Consultant X was the Engineer responsible for supervising the contract works. In the event, the contract works were completed in February 2009 (including the establishment works — see Note 1 to para. 1.3), about 15 months (461 days) later than the original completion date of November 2007. Of the 461 days, EOTs of 186 days in total owing to inclement weather were granted to Contractor B according to the terms of Contract B for completing various sections of works under Contract B. The account of Contract B was finalised in November 2012 and the total contract expenditure was $2,317.1 million (see Table 8).

Table 8

Total contract expenditure of Contract B
(November 2012)

Particulars	Amount ($ million)	Amount ($ million)
1. Contract works completed	1,954.5	
2. Payment for contract price fluctuation (Note 1)	182.1	
3. Alternative-design works completed under SA6 (Note 2)	19.4	
4. Alternative-design works completed under SA7 (Note 3)	13.6	
Total works completed		2,169.6
Payments for settling contract claims		
5. Claims for prolongation costs (see paras. 3.20 to 3.24)	137.5	
6. Other claims (Note 4)	10.0	
Total claims		147.5
Total contract expenditure		2,317.1

Source: *Audit analysis of HyD records*

Note 1: *Of the $182.1 million payment for contract price fluctuation, $9.5 million was provision for price fluctuation adjustments included in the original contract sum.*

Note 2: *In October 2007, the HyD and Contractor B entered into SA6, under which Contractor B's alternative design and construction of a retaining wall and box culvert at a fixed cost of $19.4 million would replace the corresponding contract works of $22.7 million, with a saving of $3.3 million.*

Note 3: *In October 2007, the HyD and Contractor B entered into SA7, under which Contractor B's alternative design and construction of noise barrier foundations at a fixed cost of $13.6 million would replace the corresponding contract works of $17.4 million, with a saving of $3.8 million.*

Note 4: *Other claims mainly included costs relating to E&M procurement and engineering works ($3.7 million), and disposal of rock ($3.5 million).*

Cost increase under Contract B

3.4 As shown in Table 8, the total contract expenditure of Contract B was $2,317.1 million, representing an increase of $481.1 million (26%) over the original contract sum of $1,836 million (see para. 3.3). Audit noted that $431.3 million (90%) of the increase was attributed to three items (see Table 9). In particular, tunnelling works ($121.2 million) and prolongation costs ($137.5 million) accounted for $258.7 million (54%) of the increase.

Table 9

Cost increase under Contract B
(November 2012)

Item	Amount			
	Under Contract B (a) ($ million)	**After remeasurement (b) ($ million)**	**Increase (% of total increase) (c) = (b) − (a) ($ million)**	
(a) Tunnelling works	611.8	733.0	121.2 (25%)	
(b) Prolongation costs	—	137.5	137.5 (29%)	431.3 (90%)
(c) Contract price fluctuation	9.5	182.1	172.6 (36%)	
(d) Others	1,214.7 (Note 1)	1,264.5	49.8 (10%) (Note 2)	
Total	1,836.0	2,317.1	481.1 (100%)	

Source: *Audit analysis of HyD records*

Note 1: *Others comprised the following items: (a) construction of buildings ($348.5 million); (b) preliminaries ($217.2 million — including, for example, temporary site office accommodation, provision of land transport and computer facilities, and general site clearance); (c) earthworks, slopeworks, noise barriers, retaining structures, landscape and finishing works and other roadworks ($189.4 million); (d) site safety and staff-related items ($82.0 million — including, for example, employees' compensations); (e) E&M works ($76.2 million); (f) toll related works and computer system ($64.0 million); (g) drainage, sewerage and waterworks ($35.1 million); (h) miscellaneous ($13.4 million); and (i) contingency ($188.9 million).*

Note 2: *It is the net amount of cost increases and savings on various items, including payment for Employees' Compensation Insurance Premium, site clearance, and construction of portal buildings and toll booths, after remeasurement of their actual quantities.*

Cost increase of tunnelling works under Contract B

3.5 Based on Consultant X's assessment, the cost of tunnelling works under Contract B had increased by $121.2 million (see Table 9 in para. 3.4). Audit notes that there is room for improvement in contract management work on this area (see paras. 3.6 to 3.18).

Discrepancy between contract clause and contract drawing in Contract B

3.6 Under Contract B:

(a) a Particular Specification (PS — Note 16) clause on tunnelling works required that a layer of smoothing shotcrete (Note 17) should be applied to bare rock surfaces, fibre reinforced shotcrete surfaces and any surface which, in the opinion of the Engineer, might cause puncturing of the geotextile or waterproof membrane, and that the surface of the smoothing shotcrete should be between 30 millimetres (mm) and 100 mm outside the extrados of the permanent concrete lining of EN Tunnel (i.e. the thickness of the smoothing shotcrete should be between 30 mm and a maximum of 100 mm); and

(b) in a contract drawing showing the details of permanent concrete lining and temporary support layer (Note 18), the thickness of the temporary support layer was shown as 170 mm from the permanent concrete lining, and this

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Note 16: *Each contract will require a different set of PS clauses (which amplify and modify the General Specification for Civil Engineering Works) to suit its own circumstances. The General Specification for Civil Engineering Works lays down the quality of materials, the standards of workmanship, the testing methods and the acceptance criteria for civil engineering works undertaken for the Government.*

Note 17: *The smoothing shotcrete refers to the application of a separate treatment on top of a surface in order to ensure that the geotextile or waterproof membrane is not damaged.*

Note 18: *According to a PS clause on tunnelling works of Contract B, prior to the installation of the permanent geotextile membranes and concrete lining, any remaining bars, nuts, faceplates and grout pipes protruding from the rock should be embedded in temporary sprayed concrete or smoothing shotcrete (temporary support layer).*

temporary support layer also included the smoothing shotcrete layer specified in the PS clause mentioned in (a) above.

3.7 Before commencing the works on application of smoothing shotcrete layer, Contractor B clarified with Consultant X the minimum thickness of smoothing shotcrete. In response, Consultant X requested Contractor B to refer to the contract drawing (see para. 3.6(b)) showing the details. Contractor B contended that the thickness of the smoothing shotcrete to be measured was 170 mm as shown on the contract drawing and made a claim for the costs of performing the smoothing shotcrete.

3.8 According to Consultant X's assessment on Contractor B's contention:

(a) 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. It was agreed that the 170 mm smoothing shotcrete was an omitted BQ item and a correction to the BQ was needed to ascertain the value of works actually carried out according to Contract B; and

(b) in the excavation of EN Tunnel, the perimeter drill holes were set out 170 mm from the permanent concrete lining in order to comply with the contract drawing. It was therefore considered that the thickness of the smoothing shotcrete should have been 170 mm in order to comply with the details shown on the contract drawing.

In the event, according to the HyD, the thickness of smoothing shotcrete measured 170 mm and it paid $43.7 million to Contractor B for the works item omitted in the BQ and subsequently measured according to the terms of Contract B.

3.9 According to the Project Administration Handbook for Civil Engineering Works issued by the CEDD, the documents forming a contract must be scrutinised for comprehensive coverage, accuracy and consistency with one another before tenders are invited. Audit 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). In Audit's view, in preparing documents for a works contract in future, the HyD needs to take measures to strengthen the checking of consistency between contract clauses and contract drawings.

Unclear contract clauses for measurement of tunnelling works

3.10 A PS clause on tunnelling works of Contract B required the adoption of controlled blasting techniques (which include presplitting (Note 19) or smooth blasting (Note 20)) for the formation of the tunnel perimeter. BQ items for excavation in tunnel were included in Contract B and measured in accordance with the SMM for Civil Engineering Works (Part V Section 18: Tunnelling — hereinafter referred to as SMM Section 18) as amended by the Particular Preambles (Note 21) under Contract B.

3.11 Contractor B contended that:

(a) presplitting and smooth blasting were items required to be measured separately by reference to a section of SMM for Civil Engineering Works

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Note 19: *According to a report issued by the Geotechnical Engineering Office of the CEDD, presplitting is a blasting method under which a single line of lightly charged drillholes along line of final face simultaneously detonated before the main bulk blast.*

Note 20: *According to a report issued by the Geotechnical Engineering Office of the CEDD, smooth blasting is a blasting method under which a single line of lightly charged drillholes along line of final face simultaneously detonated after the main bulk blast.*

Note 21: *The SMM for Civil Engineering Works lays down the method and criteria for the measurement of civil engineering works undertaken for the Government. Any methods of measurement which are not in accordance with or included in the SMM for Civil Engineering Works shall be stated in a Particular Preamble to the BQ.*

(Part V Section 7: Earthworks — hereinafter referred to as SMM Section 7); and

(b) since the item coverage for excavation in tunnel as set out in SMM Section 18 as amended by the Particular Preambles did not specifically identify or describe presplitting or smooth blasting, there was an omission of a BQ item for presplitting or smooth blasting in the BQ for excavation in tunnel.

Hence, Contractor B made a claim for the costs of performing controlled blasting for the formation of the tunnel perimeter which had not been specified as a BQ item.

3.12 According to Consultant X's assessment on Contractor B's contention:

(a) the original extent of work covered by the tunnel excavation item in SMM Section 18 did not include controlled blasting;

(b) the item coverage of excavation in SMM Section 7 should apply to that of excavation in tunnel in SMM Section 18 (Note 22). Nevertheless, the item coverage of excavation in SMM Section 7 did not include controlled blasting and, accordingly, the item coverage of excavation in tunnel in SMM Section 18 could be construed as not including controlled blasting;

(c) for the avoidance of doubt, it would be desirable to introduce Particular Preambles to expand the item coverage for excavation in tunnel in SMM Section 18 to cover the works (i.e. controlled blasting); and

(d) it was considered that controlled blasting of presplitting or smooth blasting was an item of works omitted to be measured in the BQ and the value of works actually carried out should be ascertained according to Contract B.

Note 22: *According to the SMM for Civil Engineering Works, if any item coverage includes reference to work which is the subject of item coverages elsewhere in the SMM for Civil Engineering Works, then the combined item coverages shall apply.*

In the event, according to the HyD, the HyD paid $54.6 million to Contractor B for its claims for the works item omitted in the BQ and subsequently measured according to the terms of Contract B.

3.13 Regarding the PS clause on tunnelling works, Audit noted that, in vetting the draft tender documents of Contract B, the HyD had raised comments on such PS section as follows:

(a) the PS on earthworks and tunnelling works were not well organised, for example, the requirements on blasting had been scattered in different PS clauses and sections of the tender document; and

(b) there might be ambiguity in demarcation in the tender document between excavation under PS on earthworks and excavation under PS on tunnelling works.

3.14 In response, Consultant X advised that:

(a) the blasting requirements had been consolidated wherever possible. It should be noted that distinct requirements had to be laid out in several sections; and

(b) the demarcation between the PS on earthworks and the PS on tunnelling works was evident from the contract drawings.

3.15 According to the HyD:

(a) it had provided comments on the tender documents prepared by Consultant X relating to presplitting or smooth blasting for the tunnelling works; and

(b) Consultant X had subsequently included the relevant controlled blasting requirements in the PS on tunnelling works.

3.16 In the event, in assessing Contractor B's claim, the HyD considered that there were uncertainties in determining the scope of coverage for excavation in tunnel for the presplitting or smooth blasting which had not been expressly specified in the Particular Preambles. Audit considers that, in preparing documents for a works contract in future, the HyD needs to strengthen the vetting of tender documents regarding contract clauses for the measurement of works (e.g. for tunnelling works).

3.17 Audit noted that, in February 2010 (after the awards of Consultancy X and Contract B in July 1999 and September 2003 respectively), the CEDD amended the Project Administration Handbook for Civil Engineering Works concerning preparation of BQ as follows:

(a) all works items should be included in the BQ and omitted items should be minimised as far as practicable;

(b) the BQ should undergo a checking process to ensure the completeness and accuracy of the BQ and elimination of major errors; and

(c) the above measures would facilitate competitive tendering, reduce resources for valuation of omitted items and minimise the disputes arising from the valuation of omitted items.

Audit considers that the HyD needs to take measures to ensure compliance with these requirements.

Audit recommendations

3.18 **Audit has *recommended* that the Director of Highways should, in preparing documents for a works contract in future:**

(a) **take measures to strengthen the checking of consistency between contract clauses and contract drawings;**

(b) **strengthen the vetting of tender documents regarding contract clauses for the measurement of works (e.g. for tunnelling works); and**

(c) **take measures to ensure compliance with the requirements for preparation of BQ as stated in the Project Administration Handbook for Civil Engineering Works.**

Response from the Government

3.19 The Director of Highways agrees with the audit recommendations. He has said that the HyD will remind its staff and consultants to continue to strictly follow the requirements as stated in the Project Administration Handbook for Civil Engineering Works for BQ preparation work in future.

Prolongation costs under Contract B

3.20 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 only take into account those EOTs relevant to the claim concerned in the assessment of prolongation cost according to the terms of the contract. Based on Consultant X's assessment, the HyD paid $137.5 million to Contractor B for settling claims for prolongation costs (see Table 10).

Table 10

Prolongation costs under Contract B

Section of works	EOT awarded (Day)	Prolongation cost ($ million)
(a) All works (excluding E&M) in Butterfly Valley	331	19.6
(b) All works (excluding E&M) in EN Tunnel	114	14.9
(c) All works (excluding E&M) in ventilation adit and site	116	3.1
(d) All works (excluding E&M) in Toll Plaza	46	3.5
(e) All works (excluding E&M) in Sha Tin Heights Portal Buildings	277	7.8
(f) E&M works to whole site (Note 1)	347	44.1
(g) Core — staff (Note 2)	347	44.5
	Total	137.5

Source: *Audit analysis of HyD records*

Note 1: *Prolongation cost relating to "E&M works to whole site" mainly included staff costs, site expenses, head office overheads and sub-contractors' costs incurred for EOTs of 347 days awarded.*

Note 2: *Prolongation cost relating to "Core — staff" included staff costs for overall supervision and general administration incurred for EOTs of 347 days awarded.*

3.21 As shown in Table 10:

(a) sections (a) to (e) were works excluding E&M works, whereas section (f) was E&M works at the whole site (divided into different portions of works areas). For each portion of works area, as the E&M works (i.e. section (f)) were carried out after the substantial completion of sections (a) to (e), any delay in completing sections (a) to (e) would have a direct impact on the progress of section (f). In addition, section (g) would be affected by the

overall delay of the works in sections (a) to (f) as it was related to staff costs for the overall supervision and general administration; and

(b) as a result, the delay in sections (a) to (e), particularly sections (a) and (b) which involved main works, had a direct impact on sections (f) and (g).

Audit noted that the EOTs of 331 days awarded for the section of works in Butterfly Valley (section (a)) were due to additional works to cope with actual site conditions, and the EOTs of 114 days awarded for the section of works in EN Tunnel (section (b)) were due to additional ground investigation works. Audit notes that there is room for improvement in conducting more thorough preliminary site investigations with a view to incorporating more accurate information on site conditions for design and tender purposes (see paras. 3.22 to 3.25).

Scope for conducting more thorough preliminary site investigations

3.22 At the tender stage of Contract B, drawings showing the ground investigation information obtained at the design stage would be provided to tenderers for reference upon request. During the construction stage, Contractor B found that:

(a) the design of works at a slope (Slope A) at Butterfly Valley (see section (a) in Table 10 in para. 3.20) had to be revised to include additional slope stabilisation works in order to cope with actual site conditions;

(b) owing to the additional slope stabilisation 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. Contractor B asserted that this made the works more difficult, which was not anticipated by him at the time of tender;

(c) the additional slope stabilisation works to Slope A and the realignment of watermains on Slope A delayed the commencement of watermain installation; and

(d) the additional slope stabilisation works to Slope A also had a knock-on effect on subsequent works, including the construction of box culvert, a retaining wall and roadworks.

In the event, Consultant X assessed that Contractor B was entitled to the award of a prolongation cost of $19.6 million for the EOTs of 331 days.

3.23 In addition, Contractor B contended that it was beyond his reasonable contemplation at the time of tender that additional ground investigation and stabilisation works to another two slopes located in the vicinity affected by the blasting works of EN Tunnel (see section (b) in Table 10 in para. 3.20) had to be carried out before obtaining a blasting permit from the Geotechnical Engineering Office of the CEDD. In the event, Consultant X assessed that Contractor B was entitled to the award of a prolongation cost of $14.9 million for the EOTs of 114 days.

3.24 Audit noted that total prolongation costs of $34.5 million ($19.6 million + $14.9 million) were awarded under Contract B due to EOTs (331 and 114 days for two sections of works respectively) for additional works at the three slopes arising from actual site conditions undetected in earlier site investigations (see paras. 3.22 and 3.23). In Audit's view, there is merit for the HyD and its consultants to conduct more thorough preliminary site investigations for works at critical locations with a view to incorporating more accurate information on site conditions for design and tender purposes as far as practicable.

Audit recommendation

3.25 **Audit has *recommended* that the Director of Highways should consider conducting more thorough preliminary site investigations for works at critical locations with a view to incorporating more accurate information on site conditions for design and tender purposes as far as practicable.**

Response from the Government

3.26 The Director of Highways agrees with the audit recommendation. He has said that:

(a) the HyD will continue to conduct thorough site investigations as far as practicable with a view to incorporating comprehensive and adequate information for design and tender purposes;

(b) there is, however, practical limit on the extent of site investigation works that can be done at the design stage for a particular project due to many constraints, particularly when the concerned site areas have not been possessed at that stage;

(c) for example, ground investigations at the design stage could only practically be carried out at isolated locations in civil engineering projects where the land is government land and accessible. The area covered would usually be very small when comparing with the size of the site. The ground conditions could only be predicted by interpolation or extrapolation based on the information obtained in the site investigation as well as adjacent existing boreholes. The accuracy of the predicted outcome would depend a lot on the uniformity of the ground which can often be quite variable. Where there is an abrupt change in the ground conditions between the boreholes, the accuracy of the prediction would inevitably be affected; and

(d) indeed, in the Central Kowloon Route (connecting the West Kowloon reclamation and the proposed Kai Tak Development) project, the HyD will carry out extensive horizontal directional coring to obtain more accurate information in advance of the tunnel construction works.

Contract C

3.27 Contract C was a remeasurement contract covering the construction of a 1 km long dual three-lane STH Tunnel (see Photograph 3), a 0.6 km long dual two-lane tunnel approach road in Tai Wai and its slip roads, and noise barriers and noise enclosures on the approach road and its slip roads. The HyD entrusted such works to the CEDD for implementation.

Photograph 3

STH Tunnel

Source: *HyD records*

3.28 The CEDD awarded Contract C to Contractor C in November 2002 at a contract sum of $1,073.8 million. The works commenced in November 2002 with a contract period of about 54 months. The original contract completion date was May 2007, which was extended to June 2008 under an SA (see Note 26 to para. 3.35(b)). Consultant Y was the Engineer responsible for supervising the contract works. In the event, the contract works were completed in September 2008 (including the establishment works — see Note 1 to para. 1.3), about three months (84 days) later than the extended completion date. EOTs of 84 days were granted to Contractor C mainly due to the extended facilitation works provided to the HyD contractors. The account of Contract C was finalised in October 2010 and the total contract expenditure was $1,199.6 million (see Table 11).

Table 11

Total contract expenditure of Contract C
(October 2010)

Particulars	Amount ($ million)	Amount ($ million)
1. Contract works completed	818.0	
2. Payment for contract price fluctuation (Note 1)	128.6	
3. Alternative-design works completed under SA8 to SA11 (Note 2)	234.5	
4. Deletion of a section of works and re-sequence of certain works under SA12 and SA13 (Note 3)	(2.6)	
5. Extended facilitation works provided under SA14 (see paras. 3.33 to 3.37)	15.1	
Total works completed		1,193.6
Payment for settling contract claim		
6. Claim related to extended maintenance of a temporary access road		6.0
Total contract expenditure		1,199.6

Source: *Audit analysis of CEDD records*

Note 1: *Of the $128.6 million payment for contract price fluctuation, $5 million was provision for price fluctuation adjustments included in the original contract sum.*

Note 2: *Between September 2003 and March 2005, the CEDD and Contractor C entered into SA8 to SA11, under which Contractor C's alternative designs and construction of works items (i.e. a temporary access road, slip road bridges, site formation, and noise mitigation measures) at a fixed cost of $234.5 million in total would replace the corresponding contract works of $250 million in total, with a saving of $15.5 million in total.*

Note 3: *Contractor C proposed to delete a section of works and re-sequence certain works under Contract C to optimise the operations and save costs. The CEDD accepted Contractor C's proposal and entered into SA12 and SA13 with Contractor C in March and September 2005 respectively, under which a section of works would be deleted and certain works would be re-sequenced, and Contractor C would pay the Government a lump sum amount of $2.6 million in total.*

Provision of facilitation works under Contract C

3.29 The scope of works entrusted to the CEDD included civil engineering works (implemented under Contract C) but not E&M works and TCS System works as these works had to be performed by the HyD contractors under Contracts B and D respectively. After the substantial completion of certain sections of works in Contract C, the HyD contractors' follow-on works (including the E&M works under Contract B and the TCS System works under Contract D) would commence in the respective site areas. Contractor C would provide the necessary facilitation works (e.g. temporary ventilation and lighting) to enable the HyD contractors to carry out follow-on works at the site areas of such sections for a period of nine months (facilitation period). Contractor C would continue to complete the remaining works of Contract C at the same time.

Shortened facilitation period arising from an error in drafting of Contract C

3.30 According to the CEDD, three sections of works (namely Sections 1, 2 and 3) in Contract C for which the HyD contractors' follow-on works and Contractor C's facilitation works were most critically required (hereinafter referred to as critical sections of works). Sections 1, 2 and 3 comprised works relating to northbound tube of STH Tunnel, southbound tube of STH Tunnel and cross passages, and noise enclosure of approaches respectively. The facilitation period was governed by two separate clauses of Contract C, as follows:

(a) ***Clause A.*** Facilitation works should be provided for a period of nine months after the three critical sections of works had been substantially completed; and

(b) ***Clause B.*** Facilitation works would only be required up to the completion of a specific section of works (namely Section 4, which was the last section of works for Contract C before the start of establishment works — see Note 1 to para. 1.3) or such earlier date as instructed.

3.31 Audit noted that:

(a) based on Clause A, the 9-month facilitation period for the three critical sections of works would commence on 2 October 2005 (i.e. the original substantial completion date of the three sections under Contract C) and end on 2 July 2006 (Note 23);

(b) based on Clause B, the facilitation period would end on 17 May 2006, which was the original completion date of Section 4 under Contract C;

(c) in July 2006, in discussing the time programmes for facilitation periods under Contracts B, C and D, the CEDD informed the HyD that due to a processing error during the drafting of Contract C, Clauses A and B did not match one another, and Clause B took precedence over Clause A in case of discrepancies; and

(d) the original facilitation period end dates for the three critical sections of works would be 17 May 2006, resulting in a shorter facilitation period of about 7.5 months (from 2 October 2005 to 17 May 2006) instead of the agreed duration of 9 months.

3.32 According to the Project Administration Handbook for Civil Engineering Works, the documents forming a contract must be scrutinised for comprehensive coverage, accuracy and consistency with one another before tenders are invited. Audit considers that the processing error could have been avoided with more diligence and care. In Audit's view, in preparing documents for a works contract in future, the CEDD needs to take measures to ensure that contract clauses for time programmes (e.g. for facilitation works) are carefully checked to ensure their accuracy and consistency.

Note 23: *After contract commencement, the commencement date and end date of the facilitation period would be revised if the original completion date of the section concerned is extended.*

Scheduled periods for facilitation works in Contracts B, C and D deviated from agreed period

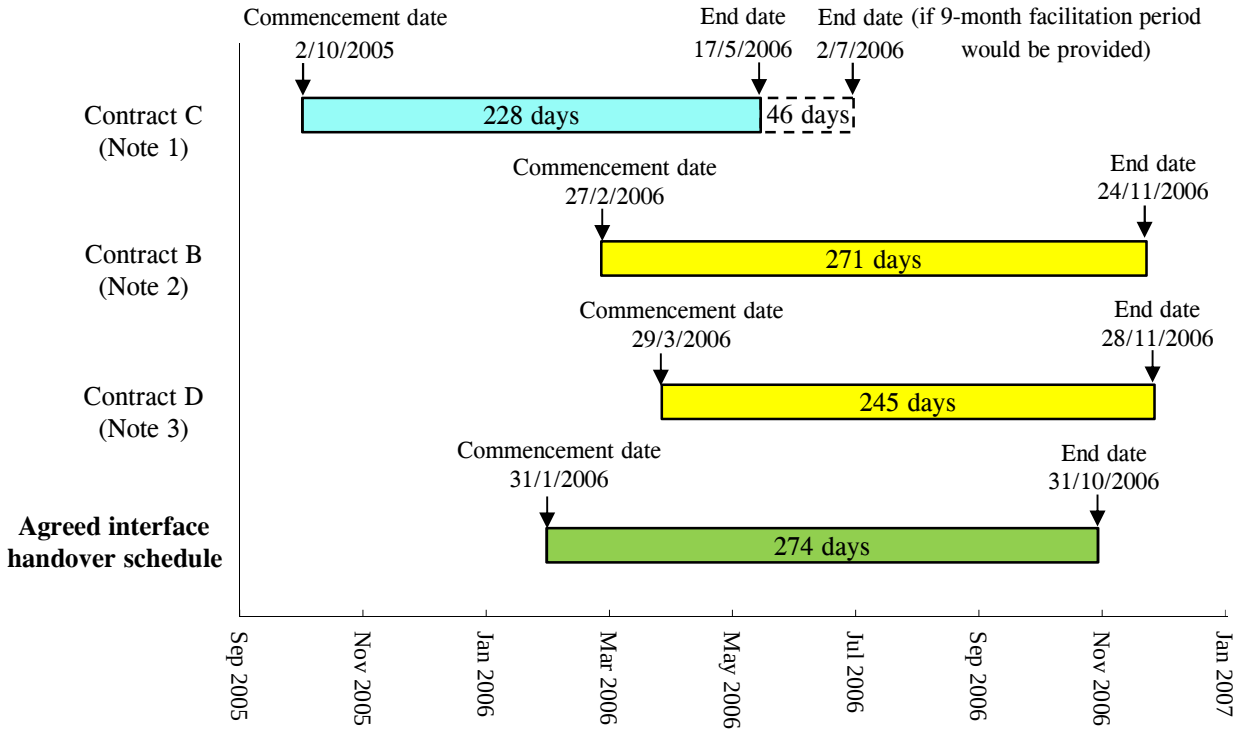
3.33 During the detailed design stage, the CEDD and the HyD discussed the construction interface between the civil engineering works under Contract C and the HyD contractors' follow-on works under Contracts B and D, and agreed an interface handover schedule for different sections of works under Contract C in late 2001. The CEDD and the HyD then proceeded to finalise the design and tender of the respective contracts.

3.34 According to the interface handover schedule agreed between the CEDD and the HyD in late 2001, the facilitation periods for the three critical sections of works were the same (i.e. from 31 January 2006 to 31 October 2006). However, Audit noted that:

(a) for the three critical sections of works under Contract C, the scheduled facilitation periods in Contract C and the scheduled site access periods in Contracts B and D (which specified the time of the facilitation works provided under Contract C for the access to Contract C's site areas by Contractors B and D to carry out follow-on works) deviated from the agreed schedule. The scheduled periods for facilitation works in each contract for Section 1 are summarised in Figure 3;

Figure 3

Scheduled periods for facilitation works in Contracts B, C and D for Section 1



Legend:

- Shortened facilitation period due to CEDD's processing error in drafting contract clauses of Contract C (see para. 3.31)
- Facilitation period not scheduled in Contract C
- Access to Contract C's site areas to carry out follow-on works as scheduled in Contracts B and D
- Agreed interface handover schedule

Source: *Audit analysis of CEDD and HyD records*

Note 1: *Under Contract C, Sections 1 to 3 had the same facilitation period from 2 October 2005 to 17 May 2006 (see para. 3.31(d)).*

Note 2: *Under Contract B, the site access periods for Sections 2 and 3 were from 27 February to 24 November 2006, and from 29 March to 24 November 2006 respectively.*

Note 3: *Under Contract D, the site access periods for Sections 2 and 3 were from 30 March to 28 November 2006, and from 11 December 2005 to 12 August 2006 respectively.*

(b) for Contract C (awarded in November 2002):

(i) according to the CEDD, in order to meet the agreed interface handover dates, it had included floats in various sections of works of Contract C to allow for possible delays that might arise from unforeseen poor ground conditions in the tunnel works. Therefore, the scheduled facilitation period commencement dates for Sections 1 to 3 were about four months earlier than the agreed interface handover date of 31 January 2006; and

(ii) Audit noted that the reason for the scheduled facilitation period for Sections 1 to 3 ending before the agreed end date of 31 October 2006, resulting in a shorter facilitation period of about 7.5 months instead of the agreed duration of 9 months, was due to the CEDD's processing error in drafting contract clauses (see paras. 3.30 and 3.31); and

(c) for Contracts B and D (awarded in September 2003 and October 2004 respectively), according to the HyD's advice in February 2018:

(i) it had included floats between the agreed interface handover date and the scheduled site access period commencement dates in Contracts B and D to cater for the potential delays in Contract C. Therefore, the scheduled site access period commencement dates for Sections 1 to 3 were later than the agreed interface handover date of 31 January 2006; and

(ii) counting from the contractual access dates to Contract C's site areas under Contracts B and D, the site access periods under these two contracts were less than nine months in order to tally with the agreed 9-month facilitation period as provided for under Clause A of Contract C (see para. 3.30(a)). Since most of the site access dates scheduled in Contracts B and D commenced later than the agreed date (i.e. 31 January 2006), the scheduled site access periods would end on 24 and 28 November 2006 in Contracts B and D respectively, about one month later than the agreed end date (i.e. 31 October 2006) of provision of facilitation works by Contractor C.

3.35 In the event, Contractor C provided facilitation works for Sections 1 to 3 to the HyD contractors for a 21-month period from 3 December 2005 to 31 August 2007 (Note 24) due to various reasons (e.g. inclement weather and delay of works of the HyD contractors, and re-sequencing of certain works in Contract C (see Note 3 to Table 11 in para. 3.28)). Of the 21-month facilitation period provided by Contractor C:

(a) about 9 months (from 3 December 2005 to 4 September 2006 — Note 25) were for facilitation works under Contract C;

(b) about 10 months (from 5 September 2006 to 30 June 2007 — Note 26) were related to a supplementary agreement (SA14) entered into between the CEDD and Contractor C to extend the provision of facilitation works to the HyD contractors at an amount of $15.1 million; and

(c) 2 months (from 1 July to 31 August 2007) were related to a variation order issued by the CEDD (pursuant to the option available under SA14) for a further extension of the duration of facilitation works at an amount of $2.6 million.

3.36 The specification of consistent periods in providing and requiring facilitation works in Contracts B, C and D is important as it would enable Contractors B, C and D to plan their works programmes and the time needed, and would help minimise the risk of claims from the contractors. Audit noted that the CEDD and the HyD had included floats in the three contracts to allow buffers between interfacing dates to cater for the potential delays in Contract C. However, after taking into account the floats, the scheduled periods for facilitation works in Contracts B, C and D deviated from the agreed interface handover schedule (see para. 3.34). As far as could be ascertained, there was no documentation showing that the CEDD and

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Note 24: *The facilitation period commencement dates for Sections 1 to 3 were 18 January 2006, 20 January 2006 and 3 December 2005 respectively, while the end dates were the same on 31 August 2007.*

Note 25: *Under Contract C, the facilitation periods for Sections 1 to 3 were from 18 January to 4 September 2006, from 20 January to 4 September 2006, and from 3 December 2005 to 2 September 2006 respectively.*

Note 26: *The completion date of Contract C was extended to June 2008 under SA14 after taking into account the 1-year establishment period starting from July 2007.*

the HyD had made subsequent revision to the agreed schedule. Audit considers that, in preparing documents for a works contract involving interface with other contracts (e.g. facilitation works) in future, the CEDD and the HyD need to take measures to ensure that the time programmes for interface works in all contracts concerned are carefully checked to ensure consistency.

3.37 In this connection, Audit notes that according to the Project Administration Handbook for Civil Engineering Works issued by the CEDD, for multi-contract projects, those parts of tender documents delineating the split of the works, particularly the drawings and BQ, should be carefully checked to ensure consistency and that there is no omission or duplication of works at the interface. In Audit's view, there is merit for the CEDD to consider including a requirement in the Handbook that, for multi-contract projects, the time programmes for interface works in all contracts concerned should be carefully checked to ensure consistency.

Audit recommendations

3.38 **Audit has *recommended* that the Director of Civil Engineering and Development should:**

(a) **in preparing documents for a works contract in future, take measures to ensure that contract clauses for time programmes (e.g. for facilitation works) are carefully checked to ensure their accuracy and consistency; and**

(b) **consider including a requirement in the Project Administration Handbook for Civil Engineering Works that, for multi-contract projects, the time programmes for interface works in all contracts concerned should be carefully checked to ensure consistency.**

3.39 **Audit has *recommended* that, in preparing documents for a works contract involving interface with other contracts (e.g. facilitation works) in future, the Director of Civil Engineering and Development and the Director of Highways should take measures to ensure that the time programmes for interface works in all contracts concerned are carefully checked to ensure consistency.**

Response from the Government

3.40 The Director of Civil Engineering and Development agrees with the audit recommendations in paragraphs 3.38 and 3.39.

3.41 The Director of Highways agrees with the audit recommendation in paragraph 3.39. He has said that the HyD will remind its staff and consultants, in preparing tender documents, to continue to carefully check that the time programmes for interface works in all contracts involving interfaces with other contracts are consistent in future.

PART 4: USAGE AND MANAGEMENT OF SHA TIN SECTION

4.1 This PART examines the usage and management of Sha Tin Section, focusing on:

(a) usage of Sha Tin Section (paras. 4.2 to 4.9); and

(b) management of performance of operator for Tsing Sha Control Area (paras. 4.10 to 4.41).

Usage of Sha Tin Section

Study relating to Sha Tin Section

4.2 In January 2017, the TD commenced a consultancy study (toll rationalisation study) on the rationalisation of traffic distribution of the three road harbour crossings (i.e. Cross Harbour Tunnel, Eastern Harbour Crossing and Western Harbour Crossing) and the three land tunnels between Kowloon and Sha Tin (i.e. Lion Rock Tunnel, Tate's Cairn Tunnel, as well as EN Tunnel and STH Tunnel of Sha Tin Section — Note 27) in a holistic manner (Note 28). The aim of the study is to formulate various proposals to influence the choice of motorists through raising and lowering the tolls of different tunnels in order to rationalise traffic distribution among the six tunnels. According to the TD, it has been supporting the THB on the toll rationalisation study and the target is to finalise the proposals for briefing LegCo Panel on Transport by mid-2018.

Note 27: *As EN Tunnel and STH Tunnel are connected by a toll plaza between them and cannot be used separately, they are counted as one land tunnel in the study.*

Note 28: *According to the TD, owing to the geographical locations of the tunnels, there is a natural "pairing effect" on the use of the three road harbour crossings and the three land tunnels. For example, the majority of the cross-harbour road traffic coming through Lion Rock Tunnel prefers Cross Harbour Tunnel. Similar tendencies are also observed in the eastern areas (pairing Tate's Cairn Tunnel and Eastern Harbour Crossing), and in the western areas (pairing EN Tunnel and STH Tunnel of Sha Tin Section and Western Harbour Crossing). Noting this pairing effect, the TD commenced the toll rationalisation study of these six tunnels in a holistic manner.*

4.3 In November 2017, the THB and the TD informed LegCo Panel on Transport of the preliminary findings of the toll rationalisation study, including traffic conditions of the three land tunnels between Kowloon and Sha Tin (see para. 4.2). According to a traffic survey conducted in March and April 2017 under the study, the weekday peak-hour traffic demands for Lion Rock Tunnel and Tate's Cairn Tunnel exceeded their respective design capacities, resulting in long traffic queues on their connecting roads, while EN Tunnel and STH Tunnel of Sha Tin Section was not congested during weekday peak hours (see Table 12).

Table 12

Weekday peak-hour traffic conditions at tunnels between Kowloon and Sha Tin (March and April 2017)

Particulars	Lion Rock Tunnel	Tate's Cairn Tunnel	EN Tunnel and STH Tunnel of Sha Tin Section
Tunnel length	1.4 km	4 km	EN Tunnel: 2.1 km STH Tunnel: 1 km
Tunnel design capacity per hour for one-way	2,600 vehicles	2,600 vehicles	4,700 vehicles
Average weekday traffic demand per hour			
AM peak hours (southbound)	3,500 vehicles	3,600 vehicles	3,700 vehicles
(% of tunnel design capacity)	(135%)	(138%)	(79%)
PM peak hours (northbound)	3,800 vehicles	3,200 vehicles	3,000 vehicles
(% of tunnel design capacity)	(146%)	(123%)	(64%)
Average length of traffic queue			
AM peak hours (southbound)	1.8 km	1.9 km	No observable queue
PM peak hours (northbound)	1.5 km	1.2 km	No observable queue
Time for crossing the tunnel (Note)			
AM peak hours (southbound)	17 minutes	26 minutes	5 minutes
PM peak hours (northbound)	13 minutes	14 minutes	5 minutes

Source: *TD records*

Note: *It represented the time required to travel from the end of traffic queue to the exit portal of the tunnel.*

Need to make better use of spare capacity of Sha Tin Section

4.4 In 2002, the THB informed LegCo that the construction of Sha Tin Section of Route 8 was needed to alleviate the traffic congestion at the then existing road links between Kowloon and Sha Tin, in particular Lion Rock Tunnel and Tate's Cairn Tunnel (see para. 1.4(a)). However, Audit noted that as of April 2017, during weekday peak hours, EN Tunnel and STH Tunnel of Sha Tin Section still had spare capacity while Lion Rock Tunnel and Tate's Cairn Tunnel had exceeded their respective design capacities. As shown in Table 12 in paragraph 4.3, in the AM peak hours, EN Tunnel and STH Tunnel were at 79% of their tunnel design capacity with no observable traffic queue, while Lion Rock Tunnel and Tate's Cairn Tunnel reached 135% and 138% of their respective tunnel design capacities and with traffic queues of 1.8 km and 1.9 km respectively. Audit also noted that since commissioning of Sha Tin Section in March 2008, the TD had not conducted any specific study or review on its road usage until January 2017 when it commenced the toll rationalisation study (see para. 4.2). According to the TD, although no specific study on the road usage of Sha Tin Section had been conducted, it had been monitoring the traffic condition thereat.

4.5 In Audit's view, the TD needs to explore measures to make better use of the spare capacity of EN Tunnel and STH Tunnel of Sha Tin Section (e.g. whether enhancement of the connecting roads to the two tunnels is needed) to alleviate the traffic congestion at the existing road links between Kowloon and Sha Tin, in particular Lion Rock Tunnel and Tate's Cairn Tunnel. The TD also needs to keep under review the progress of the toll rationalisation study with a view to meeting the target of finalising the proposals for the rationalisation of traffic distribution among the six tunnels, including the three land tunnels between Kowloon and Sha Tin, for briefing LegCo Panel on Transport by mid-2018 (see para. 4.2).

Need to keep under review bus and minibus services passing through Sha Tin Section

4.6 As of December 2017, there were 23 franchised bus routes and no public light bus (i.e. minibus) route passing through Sha Tin Section (i.e. EN Tunnel and STH Tunnel) of Tsing Sha Highway. In this connection, Audit noted that:

(a) as reflected by the analysis of franchised bus and public minibus routes passing through the three tunnels between Kowloon and Sha Tin as of December 2017 (see Table 13), only 5 franchised bus routes passing through EN Tunnel and STH Tunnel provided whole-day services, whereas there were 21 and 23 franchised bus routes with whole-day services passing through Lion Rock Tunnel and Tate's Cairn Tunnel respectively; and

Table 13

Franchised bus and public minibus routes passing through tunnels between Kowloon and Sha Tin (December 2017)

Particulars	Lion Rock Tunnel	Tate's Cairn Tunnel	EN Tunnel and STH Tunnel
(a) Number of franchised bus routes			
(i) whole-day services	21	23	5
(ii) peak-hour services	10	28	15
(iii) mid-night services	6	1	2
(iv) special-day services (Note)	6	1	1
Total	43	53	23
(b) Number of public minibus routes			
(i) peak-hour services	1	—	—
(ii) mid-night services	7	—	—
Total	8	—	—

Source: *Audit analysis of TD records*

Note: *The bus routes passing through Lion Rock Tunnel and Tate's Cairn Tunnel provided services only on horse-racing days, while the bus route passing through EN Tunnel and STH Tunnel provided services only on the occasions of Ching Ming Festival and Chung Yeung Festival.*

(b) from time to time, Members of the Sha Tin District Council had requested the TD to better utilise Tsing Sha Highway and introduce new bus routes passing through Sha Tin Section. As an example, at the meeting of the Traffic and Transport Committee of the Sha Tin District Council held in

July 2017, District Council Members requested improvement of bus services (e.g. extending the peak-hour services of certain bus routes to whole-day services, and increasing the bus frequency of certain bus routes) for better utilising Tsing Sha Highway to alleviate the traffic congestion at Lion Rock Tunnel and Tate's Cairn Tunnel. In addition, a trade association had requested the TD to open up EN Tunnel to red minibuses (Note 29).

4.7 According to the TD, when considering the introduction of a new bus or green minibus route, it will take into account a basket of factors, including the existing public transport network, service levels of existing public transports, passenger demands and the expected financial viability of the proposed new route. In view of the spare capacity of Sha Tin Section (i.e. EN Tunnel and STH Tunnel) of Tsing Sha Highway (see Table 12 in para. 4.3), and District Council Members' and the trade association's requests for bus and minibus services passing through Tsing Sha Highway (see para. 4.6(b)), Audit considers that the TD needs to keep under review the bus and minibus services passing through Sha Tin Section and the factors for introduction of new services with a view to enhancing the services for better utilisation of this road section.

Audit recommendations

4.8 **Audit has *recommended* that the Commissioner for Transport should:**

(a) **explore measures to make better use of the spare capacity of EN Tunnel and STH Tunnel of Sha Tin Section (e.g. whether enhancement of the connecting roads to the two tunnels is needed) to alleviate the traffic congestion at the existing road links between Kowloon and Sha Tin, in particular Lion Rock Tunnel and Tate's Cairn Tunnel;**

(b) **keep under review the progress of the toll rationalisation study with a view to meeting the target of finalising the proposals for the rationalisation of traffic distribution among the six tunnels, including the three land tunnels between Kowloon and Sha Tin, for briefing LegCo Panel on Transport by mid-2018; and**

Note 29: *As of December 2017, red minibuses were not allowed to pass through EN Tunnel and STH Tunnel.*

(c) **keep under review the bus and minibus services passing through Sha Tin Section and the factors for introduction of new services as stated in paragraph 4.7, with a view to enhancing the services for better utilisation of this road section.**

Response from the Government

4.9 The Commissioner for Transport agrees with the audit recommendations. She has said that the TD will balance the factors for introduction of new services as stated in paragraph 4.7. In 2018-19 Bus Route Planning Programmes, the TD has proposed seven improvement items for bus routes passing through Sha Tin Section, which are now undergoing consultation of District Councils.

Management of performance of operator for Tsing Sha Control Area

MOM of TSCA

4.10 According to the THB, for effective and efficient traffic control and incident management, Sha Tin Section and Tsing Yi Section form one single control area (i.e. TSCA). The Government enacted the Tsing Sha Control Area Ordinance for the MOM of the TSCA in June 2007 (which came into operation in March 2008). Since commissioning of Sha Tin Section in March 2008, the MOM of the TSCA has been outsourced to an operator through open tender. The TD awarded the current MOM contract in June 2013 to an operator at a fixed lump-sum management fee of $964.4 million (Note 30) for six years from 19 September 2013 to 18 September 2019. The operator is responsible for the proper MOM of the TSCA, including ensuring safe and efficient traffic movement, collecting tolls and fees, regulating and controlling vehicular and pedestrian traffic, managing and patrolling the area, and removing any vehicle or thing causing obstruction.

Note 30: *Out of the total management fee of $964.4 million, $704.4 million (73%) relating to operation and maintenance works (including E&M works but excluding highway facilities maintenance works) is funded under TD departmental vote, and $260 million (27%) relating to highway facilities maintenance works is funded under HyD departmental vote.*

4.11 ***Monitoring operation of TSCA.*** The government departments responsible for monitoring the operation of the TSCA are as follows:

(a) according to the Tsing Sha Control Area Ordinance, in relation to a breach of a management agreement for the MOM of the TSCA, the Commissioner for Transport is the relevant authority where the breach relates to the management or operation of the TSCA, and the Director of Highways is the relevant authority where the breach relates to the maintenance of the TSCA;

(b) according to the TD's Controlling Officer's Report, the TD is responsible for handling the tendering of management contracts for a number of government transport infrastructure and services (including the TSCA), and for overseeing and monitoring the performance of the contractors that operate and maintain these transport infrastructure and services; and

(c) according to the current MOM contract for the TSCA, a Government Monitoring Team (GMT — Note 31), comprising officers from the TD, the HyD, the EMSD and the ArchSD, is responsible for monitoring the TSCA operator's performance.

4.12 ***Staff manning level requirement.*** According to the current MOM contract for the TSCA:

(a) the operator shall at all times during the term of the contract provide and maintain sufficient number of competent personnel at all levels for safe, effective and efficient MOM of the TSCA in accordance with the staff plan specified in the contract;

Note 31: *According to the current MOM contract for the TSCA, the Government may from time to time appoint a GMT to be responsible for monitoring the operator's performance.*

(b) if the operator fails to employ the required number of staff at certain ranks, the operator shall pay the Government, as LD (Note 32), the sum for shortfall of staff at each rank to be calculated on the basis of the number of man-days or working hours of shortfall and the amount of monthly basic salary or hourly rate at each rank specified in the contract (Note 33); and

(c) the operator is required to maintain a total manning level of 483 staff working in different areas, including operations, highway maintenance, E&M services, building maintenance, and administration and support services.

Responsibilities of GMT members not clearly set out

4.13 The maintenance responsibilities of the operator are set out in the TSCA MOM contract (Note 34). According to the TD, the GMT members (see para. 4.11(c)) monitor the performance of the operator under their respective purview, and their respective responsibilities are as follows:

Note 32: *According to the TD: (a) in order to ensure efficient and safe operation of the TSCA, the TSCA operator needs to deploy sufficient frontline staff who are critical in carrying out the routine operations and maintenance duty in the TSCA (e.g. incident handling and maintenance of E&M systems); and (b) therefore, LD are imposed in the current MOM contract for any staff shortfall in the ranks of frontline operational and maintenance staff.*

Note 33: *In May 2013, after selection of the successful tenderer for the MOM contract of the TSCA as recommended by the Tender Assessment Panel (comprising officers from the TD, the HyD, the EMSD and the ArchSD), the Central Tender Board informed the TD that sanctions should be imposed if the operator failed to comply with its committed minimum manpower level, with a view to conveying a clear message that the operator had to fully comply with the contract requirements and address its inadequacies as soon as possible. The TD, after obtaining the agreement of the selected tenderer, included sanction clauses relating to LD for staff shortfall in the MOM contract for the TSCA.*

Note 34: *According to the TD, the maintenance responsibilities of the operator are set out in Schedules I and III of the TSCA MOM contract, as follows: (a) Schedule I provides clear descriptions of major buildings, structures, facilities and equipment to be managed, operated and maintained by the operator; and (b) Schedule III defines clearly the requirements of scheduled maintenance works to be performed by the operator for buildings, structures, facilities and equipment.*

(a) the TD oversees daily operation, traffic and incident management;

(b) the HyD oversees the maintenance of bridges, viaducts and tunnel structures;

(c) the EMSD oversees the maintenance of all E&M systems and equipment (Note 35); and

(d) the ArchSD oversees the maintenance of building structures.

4.14 However, Audit noted that the respective responsibilities among the GMT members were not specified in the TSCA MOM contract or documented in other records. In Audit's view, the TD, in collaboration with other GMT members, needs to set out clearly the responsibilities of each member in monitoring the TSCA operator's performance.

Manning level requirements for some types of staff not monitored

4.15 According to the TD, for different types of staff specified in the TSCA MOM contract (see para. 4.25), the GMT members are responsible for monitoring the staff manning level and imposing LD for any staff shortfall (see Table 14).

Note 35: *According to the EMSD, its responsibilities in monitoring the TSCA operator's performance are explicitly stated in the service level agreement between the TD and the EMSD, which includes provision of monitoring services in relation to the E&M systems.*

Table 14

Monitoring of staff manning level for TSCA

Type of staff	Department responsible for	
	monitoring staff manning level	imposing LD for any staff shortfall
(a) Operations staff	TD	TD
(b) E&M staff	EMSD	TD
(c) Highway maintenance staff	HyD	HyD
(d) Administrative and supporting staff	TD	Not subject to LD
(e) Building maintenance staff	ArchSD	TD

Source: *TD records*

4.16 Audit noted that, as of December 2017:

(a) the EMSD and the HyD had taken measures to monitor the manning level of E&M staff and highway maintenance staff under their respective purview;

(b) while the TD had monitored the manning level of operations staff, it had not monitored that of administrative and supporting staff since the commencement of the MOM contract for the TSCA in September 2013; and

(c) the manning level of building maintenance staff had not been monitored since the commencement of the MOM contract for the TSCA in September 2013 as there was no established monitoring mechanism.

4.17 Regarding administrative and supporting staff, in response to Audit's enquiry in January 2018, the TD advised Audit in February and March 2018 that:

(a) for contract management, the TD had all along adopted a two-pronged approach in monitoring performance of the contractor/operator, namely input-oriented approach and performance-oriented approach, depending on the nature of the work, as follows:

(i) under the input-oriented approach, the TD set the minimum manning level requirement for frontline staff who were critical to the safe and efficient operation of the TSCA, and had been taking various measures (e.g. surprise check and record checking) to ensure that the TSCA operator complied with the relevant requirement; and

(ii) under the performance-oriented approach, the TD measured the level and standard of core services, such as rescue/recovery operations (e.g. time to respond to an incident and remove a breakdown vehicle) and environmental control standards for tunnels (e.g. air quality and visibility). As for other non-core services, such as catering and accounting services, the operator was allowed to use its expertise and resources as necessary to enhance operation efficiency and effectiveness;

(b) the TD regularly checked the services provided by administrative and supporting staff, including cleansing services and catering provisions to staff;

(c) submission of human resources/financial information as prepared by the administrative and supporting staff of the operator was found to be in order; and

(d) the operator was not required to submit the manning level of these staff to the TD as the TD was satisfied with the performance/services provided.

4.18 Regarding building maintenance staff, in response to Audit's enquiry in January 2018, the TD and the ArchSD advised Audit in February 2018 that:

(a) as the respective responsibilities among the GMT members were not specified in the TSCA MOM contract or documented in other records, nor was there any documentation showing that the TD (being the contract

administrator) had requested the ArchSD to provide any input in this area, the operator's manning level of building maintenance staff during the current contract period had yet to be fully checked upon Audit's enquiry in January 2018; and

(b) after Audit's enquiry, the TD and the ArchSD had worked together, and the ArchSD had carried out checking on the operator's shortfall of building maintenance staff subject to LD and informed the TD of the findings. The information on staff shortfall for those staff not subject to LD was not yet available as submission of staff manning level was pending from the operator.

4.19 The MOM contract for the TSCA specified the staff manning level requirement which included administrative and supporting staff under the TD's purview. Although the TD had monitored the service level of the TSCA operator on provision of administrative support (see para. 4.17), it had not monitored the manning level of administrative and supporting staff. In Audit's view, given that the manning level of administrative and supporting staff is a contract requirement, the TD needs to take measures to ensure that the TSCA operator complies with the manning level requirement in the MOM contract for all staff under its purview, including the administrative and supporting staff. Audit also considers that the TD, in collaboration with the ArchSD, needs to take timely actions to monitor the building maintenance staff manning level of the TSCA operator.

Performance reports on TSCA operator not prepared by all GMT members

4.20 The GMT, comprising officers from the TD, the HyD, the EMSD and the ArchSD, is responsible for monitoring the TSCA operator's performance. Audit noted that, as of December 2017:

(a) the TD and the EMSD had prepared quarterly performance reports to assess the performance of the operator. The EMSD had also submitted its reports to the TD for information; and

(b) there was no documentation showing that the HyD and the ArchSD had prepared performance reports on the operator's performance under their

respective purview (see para. 4.13), and that the TD had required them to provide such reports.

4.21 In February and March 2018, the HyD, the ArchSD and the TD informed Audit that:

HyD

(a) under the current TSCA MOM contract arrangement, the HyD was not required to carry out independent performance assessment on the operator;

ArchSD

(b) the ArchSD would provide technical advice to the TD (being the contract administrator) as and when requested, and would not assess the performance of the operator directly;

TD

(c) the HyD held monthly highway maintenance meetings with the TSCA operator and would alert/discuss with the TD any special maintenance issues (such as security enhancement) when necessary;

(d) the operator submitted monthly maintenance reports for the ArchSD's review and the ArchSD would discuss with the TD any critical building maintenance issues (such as replacement of building facilities) when necessary;

(e) the HyD and the ArchSD were members of the tender assessment board for MOM contracts and had provided technical inputs for aspects under their respective purview in the tender assessment; and

(f) therefore, the HyD and the ArchSD had been monitoring the performance of the TSCA operator while the TD was well aware of such arrangement as well as the key maintenance issues under the respective purview of the HyD and the ArchSD even though the TD had not required them to provide the performance reports.

4.22 According to the SPRs, departments shall evaluate the performance of their contractors at least once every six months until completion of the contract for contracts lasting more than one year. Audit considers that the HyD and the ArchSD, being the GMT members, need to evaluate the performance of the TSCA operator in the area of work under their respective purview at least once every six months, and inform the TD of the assessment results. Audit also considers that the TD, being the contract administrator, needs to keep under review the TSCA operator's performance as assessed by other GMT members for overseeing the overall performance of the operator and providing reference for evaluating its future bids of government MOM contracts.

Need to clearly define staff manning level requirement in tender documents and MOM contracts

4.23 Out of the total manning level of 483 staff under the TSCA MOM contract (see para. 4.12(c)), 80 staff are "leave relief" staff (Note 36). According to the TD, provided that the TSCA operator could deploy sufficient and competent manpower to each of the required duty shifts, the manning level requirement for "leave relief" staff is included in the contract for reference purpose only. In substance, the operator is required to deploy a total of 403 staff (483 staff – 80 staff), of which 343 staff are subject to LD for any shortfall (Note 37). The staff manning level requirement for the TSCA is shown in Table 15.

Note 36: *According to the TD, the manning level for "leave relief" staff represents the number of staff desirable to be employed for the purpose of replacement of staff working on a shift in rest/sudden leave.*

Note 37: *Under the TSCA MOM contract, for staff working on shifts, the manning level requirement includes the number of staff for "AM shift", "PM shift", "night shift" and "leave relief". According to the TD: (a) LD are only applicable to staff subject to LD for any shortfall and deployed in the required duty shifts (i.e. "AM shift", "PM shift" and "night shift") but not the "leave relief" staff; (b) whenever there is a staff shortfall in a required duty shift, the TSCA operator will suitably deploy replacement staff through offering overtime or "leave relief" staff to fill the vacancy; (c) in case the vacancy in the required duty shift cannot be filled, LD will be imposed if the staff is subject to LD for any shortfall; and (d) LD are imposed in the current MOM contract for any staff shortfall in the ranks of frontline operational and maintenance staff (see Note 32 to para. 4.12(b)).*

Table 15

Staff manning level requirement for TSCA
(September 2013 to September 2019)

Particulars	Staff		Total
	subject to LD for any shortfall (a) (No.)	not subject to LD for any shortfall (b) (No.)	(c) = (a) + (b) (No.)
Manning level requirement per MOM contract			
Manning level per contract	420	63	483
"Leave relief" staff	77	3	80
Manning level per TD requirement			
Required manning level	343	60	403

Source: *Audit analysis of TD records*

Remarks: *According to the TD, the manning level requirement for "leave relief" staff is for reference purpose only. Therefore, in substance, the operator is required to deploy a total of 403 staff, which is equal to the manning level requirement per contract minus the number of "leave relief" staff.*

4.24 Audit notes that the TD considers that the manning level requirement for "leave relief" staff in the MOM contract is for reference purpose only (see para. 4.23). However, there was no specification in the tender documents or the MOM contract stating that the manning level requirement for "leave relief" staff was for reference purpose only. In Audit's view, the TD needs to clearly specify whether the staff manning level requirement is for mandatory compliance by operators or for reference purpose in future tender documents and MOM contracts.

Staff manning level requirement not met

4.25 According to the TD, the operator is required to deploy a total of 403 staff, of which 343 staff are subject to LD for any shortfall (see para. 4.23). The staff manning level requirement for the TSCA by types of staff is shown in Table 16.

Table 16

Staff manning level requirement for TSCA by types of staff
(September 2013 to September 2019)

Type of staff	Manning level per MOM contract (a) (No.)	"Leave relief" staff per MOM contract (b) (No.)	Required manning level per TD (c) = (a) − (b) (No.)	Staff		Required manning level per TD (f) = (d) + (e) (No.)
				Subject to LD for any shortfall (d) (No.)	not subject to LD for any shortfall (e) (No.)	
Operations staff	263	67	196	186	10	196
E&M staff	140	13	127	122	5	127
Highway maintenance staff	44	—	44	34	10	44
Administrative and supporting staff	31	—	31	—	31	31
Building maintenance staff	5	—	5	1	4	5
Total	483	80	403	343	60	403

Source: *Audit analysis of TD records*

4.26 According to the TD, the TSCA operator was not able to continuously maintain the required staff manning level since the commencement of the contract in September 2013 and, as a mitigation measure, had arranged its staff to work overtime to fill the vacancies as far as possible. According to the HyD, for highway maintenance staff, the staff shortfall problem mainly occurred in the first contract year when the operator had difficulties in recruiting new staff, and the shortfall problem had been significantly improved thereafter. Based on the GMT members' records as of December 2017, Audit findings on the staff shortfall problem of the operator for

the period from January to September 2017 (Note 38) are shown in Table 17 and the details are given in paragraph 4.27.

Table 17

Staff shortfall of TSCA operator from January to September 2017 (December 2017)

Type of staff	Staff subject to LD		Staff not subject to LD	
	Manning level per TD requirement (No.)	Actual staff shortfall on average (No.)	Manning level per TD requirement (No.)	Actual staff shortfall on average (No.)
Operations staff	186	—	10	—
E&M staff	122	24	5	—
Highway maintenance staff	34	1	10	—
Administrative and supporting staff	—	—	31	(Note)
Building maintenance staff	1	(Note)	4	(Note)
Total	343		60	

Source: *Audit analysis of records of TD, EMSD, HyD and ArchSD*

Note: *As of December 2017, information on the operator's compliance with the manning level requirement for administrative and supporting staff (see para. 4.16(b)) and building maintenance staff (see para. 4.16(c)) was not available. In February 2018, the TD and the ArchSD informed Audit that: (a) for building maintenance staff subject to LD and administrative and supporting staff, there was no staff shortfall from January to September 2017 (see para. 4.28); and (b) for building maintenance staff not subject to LD, the information on staff shortfall was not available as submission of staff manning level was pending from the operator (see para. 4.18(b)).*

Note 38: *As of December 2017, the TD and the EMSD had ascertained and the TD had imposed LD on the operator for the periods from September 2013 to February 2014, and from January to September 2017, while the HyD had ascertained and imposed LD for the period from September 2013 to November 2017. In order to ascertain the latest position, Audit examined the staff shortfall problem for the period from January to September 2017.*

4.27 Audit found that, as of December 2017, the staff shortfall problem of the TSCA operator for the period from January to September 2017 was as follows:

(a) ***Staff shortfall subject to LD.*** Out of the required manning level of 343 staff subject to LD for any shortfall (see Table 17 in para. 4.26), on average, there was a shortfall of about 25 staff (around 7% of the required level, ranging from 23 to 26 staff), with details as follows:

(i) for E&M staff, out of the required manning level of 122 E&M staff, on average, there was a shortfall of about 24 staff (around 20% of the required level, ranging from 22 to 26 staff). In particular, for the rank of "E&M technicians" with the required manning level of 46 staff, on average, there was a shortfall of about 16 staff (around 35% of the required level, ranging from 14 to 18 staff);

(ii) for highway maintenance staff, out of the required manning level of 34 staff, on average, there was a shortfall of about 1 staff (around 3% of the required level, ranging from 0 to 1 staff);

(iii) for building maintenance staff with the required manning level of 1 staff, information on shortfall was not available as of December 2017 (see para. 4.16(c)); and

(iv) according to the TD, there was no shortfall for operations staff with the required manning level of 186 staff as the operator had arranged overtime work and acting arrangements of its staff to fill the vacancies; and

(b) ***Staff shortfall not subject to LD.*** Out of the required manning level of 60 staff not subject to LD for any shortfall (see Table 17 in para. 4.26):

(i) regarding the administrative and supporting staff with the required manning level of 31 staff, the TD had not ascertained the manning level of these staff as of December 2017 (see para. 4.16(b));

(ii) in general, there was no shortfall for operations staff, highway maintenance staff and E&M staff with the required manning level of 10 staff, 10 staff and 5 staff respectively; and

(iii) for building maintenance staff with the required manning level of 4 staff, information on shortfall was not available as of December 2017 (see para. 4.16(c)).

4.28 In February 2018, the TD and the ArchSD advised Audit that for building maintenance staff subject to LD (required manning level of 1 staff — see para. 4.27(a)(iii)), there was no staff shortfall from January to September 2017. The TD also said that for administrative and supporting staff not subject to LD (required manning level of 31 staff — see para. 4.27(b)(i)), there was no staff shortfall during the same period.

4.29 Audit noted that the staff shortfall problem for E&M staff (about 20% of the required manning level subject to LD) was more significant (see para. 4.27(a)(i)). In February 2018, the TD and the EMSD informed Audit that:

(a) the TD and the EMSD had taken various follow-up actions on the staff shortfall problem of the TSCA operator, including imposing LD for staff shortfall (see para. 4.33(a)), requesting the operator to rectify the staff shortfall problem and reminding the operator to comply with the staff manning level requirement through regular contact with the operator (e.g. during meetings or through letters), and reflecting the staff shortfall problem in the quarterly performance reports for the operator;

(b) the TSCA operator had, upon request of the TD and the EMSD, organised various recruitment exercises to comply with the contract requirement, and increased the basic salary and improved fringe benefit of existing staff. The operator had also attempted to relieve the staff shortfall problem through arranging overtime work to fill the vacancies and through outsourcing of works such as preventive maintenance works; and

(c) the TD and the EMSD were well aware of the potential consequence of the staff shortfall problem and, hence, had closely monitored the service level and performance of the TSCA operator and found that the normal operation of the control area had been maintained throughout the contract period.

4.30 While actions had been taken by the TD and the EMSD in addressing the staff shortfall problem (see para. 4.29), the problem remained unsolved (shortfall of 27 E&M staff as of December 2017). In Audit's view, the TD, in collaboration with the EMSD, needs to strengthen monitoring actions to ensure that the TSCA operator fully complies with the E&M staff manning level requirement in the MOM contract.

Delay in imposing LD

4.31 According to the current MOM contract for the TSCA, the operator shall pay LD to the Government if he fails to employ the required number of staff at certain ranks (see para. 4.12(b)). LD for the shortfall of highway maintenance staff are imposed by the HyD while those of all other staff are imposed by the TD (see Table 14 in para. 4.15).

4.32 ***Methodology for calculating LD not clearly set out.*** The TD initiated action to impose LD for staff shortfall on the TSCA operator in October 2014. However, due to unclear methodology set out in the MOM contract, it took 27 months (from November 2014 to January 2017) for discussing and agreeing with the operator the methodology for calculating the amount of LD (e.g. how sick leave or annual leave would be taken into account, and whether a staff could take up the duties of two posts at the same time). According to the TD:

(a) the MOM contract for the TSCA was the first contract imposing LD clauses against the operator;

(b) the disagreement between the TD, the EMSD and the operator on the methodology for calculating LD took a long time to settle; and

(c) the TD started collecting LD on E&M staff after reaching an agreement on the calculation methodology.

In the event, the HyD and the TD could only issue the first letter to the operator for imposing LD in February and May 2017 respectively.

4.33 ***Delay in imposing LD.*** Audit noted that, as of December 2017:

(a) for E&M staff, the TD had only imposed LD of about $5.7 million in respect of the operator's staff shortfall for about 14.5 months (from 19 September 2013 to 28 February 2014, and from 1 January to 30 September 2017). However, the TD and the EMSD had not yet ascertained the amount of LD for the remaining 37 months (from 1 March 2014 to 31 December 2016, and 1 October to 31 December 2017);

(b) for highway maintenance staff, the HyD had imposed LD of about $1.4 million in respect of the operator's staff shortfall from 19 September 2013 to 30 November 2017;

(c) for building maintenance staff, the manning level of such staff had not been monitored since the commencement of the TSCA MOM contract on 19 September 2013 as there was no established monitoring mechanism (see para. 4.16(c)). As a result, information on staff shortfall remained to be checked and hence no LD had been imposed up to December 2017; and

(d) for operations staff, the TD considered that no LD were required to be imposed after checking the records submitted by the operator as the operator had arranged overtime work and acting arrangements of its staff to fill the vacancies.

4.34 In February 2018, the TD informed Audit that:

(a) in June 2017, the TD and the EMSD had already planned to collect the outstanding LD (for over 40 months) by March 2018; and

(b) as of February 2018:

(i) for E&M staff, in respect of the operator's staff shortfall for about 50.5 months from 19 September 2013 to 30 November 2017, the TD had imposed and collected LD of about $13.3 million for about 36.5 months (from 19 September 2013 to 31 October 2015, and from 1 January to 30 November 2017). The TD and the EMSD had also ascertained the amount of LD for the remaining 14 months

(from 1 November 2015 to 31 December 2016) for which LD would be collected in March 2018; and

(ii) for building maintenance staff, the ArchSD had ascertained that there was staff shortfall for about 6.5 months (from 1 March to 14 September 2014) and LD of about $0.12 million would be collected by the TD in March 2018.

4.35 In Audit's view, the TD, in collaboration with the EMSD and the ArchSD, needs to take timely actions in calculating and imposing LD for the TSCA operator's shortfall of E&M staff and building maintenance staff. The TD also needs to set out clearly the methodology for calculating LD for an operator's staff shortfall in future MOM contracts.

Audit recommendations

4.36 **Audit has *recommended* that the Commissioner for Transport should:**

(a) **in collaboration with the Director of Highways, the Director of Electrical and Mechanical Services and the Director of Architectural Services, set out clearly the responsibilities of each member of the GMT in monitoring the TSCA operator's performance;**

(b) **take measures to ensure that the TSCA operator complies with the manning level requirement in the MOM contract for all staff under the TD's purview, including the administrative and supporting staff;**

(c) **in collaboration with the Director of Architectural Services, take timely actions to monitor the building maintenance staff manning level of the TSCA operator;**

(d) **keep under review the TSCA operator's performance as assessed by other GMT members for overseeing the overall performance of the operator and providing reference for evaluating its future bids of government MOM contracts;**

(e) **clearly specify whether the staff manning level requirement is for mandatory compliance by operators or for reference purpose in future tender documents and MOM contracts;**

(f) **in collaboration with the Director of Electrical and Mechanical Services, strengthen monitoring actions to ensure that the TSCA operator fully complies with the E&M staff manning level requirement in the MOM contract;**

(g) **in collaboration with the Director of Electrical and Mechanical Services and the Director of Architectural Services, take timely actions in calculating and imposing LD for the TSCA operator's shortfall of E&M staff and building maintenance staff; and**

(h) **set out clearly the methodology for calculating LD for an operator's staff shortfall in future MOM contracts.**

4.37 **Audit has *recommended* that the Director of Highways and the Director of Architectural Services should evaluate the performance of the TSCA operator in the area of work under their departments' respective purview at least once every six months, and inform the TD of the assessment results.**

Response from the Government

4.38 The Commissioner for Transport agrees with the audit recommendations in paragraph 4.36. She has said that:

(a) the TD, in collaboration with other GMT members, has consolidated a list of "GMT Members Monitoring Responsibility for TSCA", which has been attached to the current TSCA MOM contract and will also be incorporated in the next contract to be renewed in 2019;

(b) while there were no minimum manning level requirements for administrative and supporting staff in the tender documents, the TD has started monitoring the operator's compliance with the manning level requirement for administrative and supporting staff as specified in the TSCA MOM contract;

(c) for building maintenance staff, the ArchSD has taken follow-up actions for the manning level requirement since the commencement of the TSCA MOM contract and will continue to monitor the manning level in this regard;

(d) the HyD and the ArchSD will provide quarterly assessment of the TSCA operator's performance (from December 2017 onwards) on aspects under their respective purview, and provide assessment results to the TD for compilation of the overall quarterly assessment report on performance;

(e) the TD will review whether and how to specify the manning level of "leave relief" staff and administrative and supporting staff in future MOM contracts;

(f) during the current contract term, the TD and the EMSD will continue to monitor the manning level of E&M staff and take necessary actions timely. The TD, with the support of the EMSD, has implemented a number of measures in new MOM contracts since 2017, including introducing a rank of technical apprentice to bring new blood to the industry as well as reviewing the work experience requirement of E&M staff to suitably reflect entry requirement. The TD will also consider strengthening new contractual measures to ensure compliance with the staff manning level requirement, such as imposing additional costs on the operator for failing to meet the required manning level;

(g) after the methodology and the calculation of LD had been settled, the TD, the EMSD and the TSCA operator have taken vigorous follow-up actions in calculating and imposing LD for the operator's shortfall of E&M staff. For building maintenance staff, the ArchSD has also taken similar follow-up actions since January 2018; and

(h) the TSCA MOM contract was the first contract imposing LD clauses against the operator. With the experiences gained in handling LD, the TD has incorporated the refined LD calculation methodology into new tender documents and MOM contracts since 2016.

4.39 The Director of Electrical and Mechanical Services agrees with the audit recommendations in paragraph 4.36 relating to E&M monitoring of the TSCA MOM contract.

4.40 The Director of Highways agrees with the audit recommendation in paragraph 4.37. He has said that the HyD will carry out performance assessment on the TSCA operator relating to highway maintenance on a quarterly basis, and provide assessment results to the TD for overall compilation.

4.41 The Director of Architectural Services agrees with the audit recommendation in paragraph 4.37. She has said that the ArchSD will work closely with the TD to evaluate the TSCA operator's performance on aspects under the ArchSD's purview on a quarterly basis, and to provide input to the TD for coordination and compilation of the overall quarterly performance report.

Acronyms and abbreviations

ArchSD	Architectural Services Department
Audit	Audit Commission
BQ	Bills of Quantities
CEDD	Civil Engineering and Development Department
E&M	Electrical and mechanical
EMSD	Electrical and Mechanical Services Department
EN Tunnel	Eagle's Nest Tunnel
EOT	Extension of time
FSTB	Financial Services and the Treasury Bureau
GMT	Government Monitoring Team
HyD	Highways Department
km	Kilometre
LAD	Legal Advisory Division (Works)
LCK Viaduct	Lai Chi Kok Viaduct
LD	Liquidated damages
LegCo	Legislative Council
mm	Millimetre
MOM	Management, operation and maintenance
PS	Particular Specification
SA	Supplementary Agreement
SMM	Standard Method of Measurement
SPRs	Stores and Procurement Regulations
STH Tunnel	Sha Tin Heights Tunnel
TCS System	Traffic control and surveillance system
TD	Transport Department
THB	Transport and Housing Bureau
TSCA	Tsing Sha Control Area