TUEN MUN - CHEK LAP KOK LINK

Executive Summary

1. The Tuen Mun - Chek Lap Kok Link (TM-CLKL) provides a strategic link connecting the North West New Territories to North Lantau, the Hong Kong International Airport and the Hong Kong-Zhuhai-Macao Bridge (HZMB). According to the Government, the commissioning of TM-CLKL provides better and more reliable transport infrastructure to Lantau, the aviation and land transport "double gateway" connecting Hong Kong to other parts of the world and Mainland cities of the Guangdong-Hong Kong-Macao Greater Bay Area, thereby reinforcing Hong Kong as an international and regional hub.

2. The Transport and Logistics Bureau is responsible for the formulation of policies on matters relating to Hong Kong's transportation and logistics, including planning for and implementing the construction and improvement of transport infrastructure. In November 2011 and June 2013, the Finance Committee of the Legislative Council approved a total funding of $46,708.0 million for the construction of TM-CLKL (the Project). The Highways Department (HyD) was the works agent responsible for implementing the Project. A consultancy agreement was awarded to a consultant (Consultant X) in November 2011 for the design and construction supervision work, and 8 works contracts (Contracts A to H) were awarded between June 2013 and June 2022 for the implementation of the Project. For the 8 works contracts awarded, the works under 7 contracts (Contracts A to F and H) were completed between June 2019 and August 2024, and Contract G was in progress as of August 2024. As of August 2024, $42,186.2 million (90% of the approved project estimate of $46,708.0 million) had been incurred for the Project.

3. TM-CLKL, which includes the Southern Connection (mainly a sea viaduct between North Lantau and the Hong Kong Port (HKP), which is a reclaimed artificial island) and the Northern Connection (mainly a sub-sea tunnel (Tuen Mun-Chek Lap Kok Tunnel (TM-CLK Tunnel)) between Tuen Mun and HKP), was fully commissioned in December 2020. The annual average daily traffic volume of TM-CLKL increased from 17,548 vehicles in 2021 to 29,967 vehicles in 2023. The Transport Department (TD) is responsible for monitoring the traffic conditions of various major tunnels and roads (including TM-CLKL). In September 2020, TD

awarded the first management, operation and maintenance (MOM) agreement for TM-CLK Tunnel through open tender to an operator (Operator A) at a fixed lump sum management fee of $298.6 million for four years from 27 December 2020 to 26 December 2024. The total management fee since commencement of the MOM agreement and up to December 2023 was about $221 million. The Audit Commission (Audit) has recently conducted a review of the implementation of the Project and traffic management of TM-CLKL.

Administration of Contracts A and B

4. Contracts A and B were lump sum design-and-build contracts, covering the design and construction of the Southern Connection of TM-CLKL and the Northern Connection sub-sea tunnel section of TM-CLKL respectively. Contracts A and B were awarded to Contractors A and B respectively and Consultant X was the Supervising Officer responsible for supervising the contract works. Contracts A and B were substantially completed 26.7 months (813 days) and 19.3 months (586 days) later than their respective original completion dates respectively. The final contract sum of Contract A was $9,272.7 million and the latest contract expenditure of Contract B as of August 2024 was $21,368.8 million (paras. 2.2 and 2.5).

5. ***Scope for improvement in managing interfacing works.*** The Northern Connection sub-sea tunnel section of TM-CLKL (i.e. TM-CLK Tunnel constructed under Contract B) and the Southern Connection of TM-CLKL (constructed under Contract A) are both connected with HKP (reclaimed under HZMB project). As such, the reclamation works of HKP under another HyD works contract (HKP Reclamation Contract) had extensive interfaces with the works of Contracts A and B. According to HyD, the progress of the reclamation works under HKP Reclamation Contract had been unsatisfactory since the commencement of works (resulting in knock-on delays in the handover of works sites to Contractors A and B), and lateral movements of seawall of HKP were observed since October 2014. As a result, Contractors A and B were unable to carry out subsequent works under Contracts A and B as planned, causing substantial works variations (valued at a total of $7,937.0 million), prolongation costs and disruption costs (of a total of $1,006.4 million), and extensions of time (EOTs) granted under Contracts A and B (of 779 and 475 days respectively). In Audit's view, there is scope for improvement in managing interfacing works by HyD (paras. 2.6 to 2.9).

6. ***Need to better ascertain site conditions for watermain diversion works.*** Under Contract A, Contractor A was required to divert a section of an existing fresh watermain due to the realignment of sections of Cheung Tung Road in North Lantau. Before the tendering of Contract A, based on the as-built records, HyD anticipated that the length of the watermain to be diverted was about 270 metres (m). After the commencement of Contract A, taking into account the actual site conditions, the actual length of the watermain to be diverted was measured to be about 422 m (or 56% longer). In July 2018, Consultant X issued a variation order (VO) to Contractor A to extend the diversion of watermain. In Audit's view, in implementing works contracts involving watermain diversion works, HyD needs to take measures to better ascertain the site conditions at the planning stage (paras. 2.12, 2.13 and 2.15).

7. ***Substantial increase in quantity of rock fill material required for reclamation works.*** Under Contract B, Contractor B was required to carry out reclamation works to form extra land of approximately 16.5 hectares at Tuen Mun for the northern landfall of TM-CLK Tunnel. The quantity of rock fill material for the reclamation works specified in Contract B was 441,400 cubic metres (m^3). After the commencement of Contract B, Contractor B carried out further pre-construction ground investigation and estimated that the required quantity of rock fill material was about 850,000 m^3 (i.e. about 90% higher than the quantity specified in Contract B). In the event, the final quantity of rock fill material was about 832,552 m^3. In November 2017, Consultant X certified a sum of $115.8 million for the claim submitted by Contractor B for additional payment attributable to the substantial increase in quantity of rock fill material required for the reclamation works. In Audit's view, in implementing works projects involving reclamation works, HyD needs to take measures to estimate the quantity of fill material required for the reclamation works as accurately as practicable (paras. 2.25 and 2.26).

8. ***Change of type of passive fire protection system inside TM-CLK Tunnel after contract commencement.*** Under Contract B, Contractor B was required to supply and install non-combustible thermal barrier inside TM-CLK Tunnel as the passive fire protection system, and the thermal barrier was specified to be spray type. After the commencement of Contract B, the maintenance party for the civil works of TM-CLK Tunnel had been expressing concerns about the spray type thermal barrier. Considering the concerns of using spray type thermal barrier and the long-term operation and maintenance benefits of using board type thermal barrier, 2 VOs (valued at a total of $328.7 million) were issued under Contract B in connection with the change of thermal barrier from spray type to board type. In this connection, Audit noted that HyD had promulgated guidelines in 2018 which stipulated that thermal

barrier inside tunnels should be board type. In Audit's view, in implementing tunnel works projects, HyD needs to regularly remind its staff and consultants to follow the related guidelines in specifying the passive fire protection system inside tunnels (paras. 2.27 to 2.29 and 2.31).

9. ***Need to continue to enhance the design of road drainage system in response to climate change.*** Under Contract B, Contractor B was required to design and construct the south approach ramp leading to the south portal of TM-CLK Tunnel, including the road drainage system for collecting surface runoff. On 28 June and 29 July 2021, significant flooding incidents occurred at the south portal of TM-CLK Tunnel, which caused disruption to tunnel traffic. In order to eliminate any risk of undesirable performance of the gully grating under extreme weather and ensure safe operation of TM-CLK Tunnel, Consultant X issued a VO (valued at $6.4 million) in January 2022 to instruct Contractor B to enhance the performance of the as-constructed gullies by constructing additional U-channels for the gullies. In Audit's view, in implementing tunnel works projects, HyD needs to continue to enhance the design of road drainage system in response to climate change (paras. 2.32 to 2.35).

10. ***Need to draw lessons from construction of emergency access hatches in TM-CLK Tunnel.*** In March 2014, Contractor B proposed to construct a service gallery underneath the tunnel carriageway and provide 45 emergency access hatches as supplementary evacuation/rescue routes. Both the service gallery and emergency access hatches were new designs adopted for the first time for tunnels in Hong Kong. After the commissioning of TM-CLK Tunnel in December 2020, an access hatch cover accidentally opened in the same month (which created safety hazards to road users), and defect rectification works were carried out by Contractor B. However, there were repeated malfunctioning of the emergency access hatches (i.e. accidental opening of an access hatch cover in July 2022 and repeated damages or dislocations of small parts of access hatch covers). Although Contractor B had carried out further defect rectification works to the emergency access hatches, accidental opening of an access hatch cover happened again in August 2023. In October 2023, having considered the balance among the availability of other supplementary evacuation routes, the possible risks to road safety, and the operation and maintenance efforts needed to upkeep the emergency access hatches, it was decided to seal off all emergency access hatches. In Audit's view, in implementing tunnel works projects, HyD needs to draw lessons from the experience gained in constructing emergency access hatches in carriageway along TM-CLK Tunnel (paras. 2.36 and 2.38 to 2.41).

Other contract management issues

11. ***Scope for improvement in ascertaining underground conditions for constructing slope and retaining wall.*** Under Contract C, Contractor C was required to carry out site formation works for the toll plaza, including construction works for a cut slope of about 285 m in length and a reinforced concrete retaining wall of about 180 m in length. After the commencement of Contract C, unforeseeable adverse ground conditions were encountered for a particular section of the slope and a layer of soft materials was unexpectedly found underneath the base of the retaining wall. In the event, Consultant X issued: (a) a VO (valued at $176.9 million) instructing Contractor C to carry out: (i) additional ground investigation; (ii) construction of the slope based on revised design by making reference to the additional ground information obtained; and (iii) delay recovery measures to minimise the potential delay and prolongation cost due to the change of design for the slope; and (b) another VO (valued at $21.1 million) instructing Contractor C to replace the existing fill below the base of the retaining wall with concrete, resulting in an EOT of 273 days and additional payment for prolongation cost of $31.5 million granted to Contractor C. In Audit's view, there is scope for improvement in ascertaining underground conditions for constructing slope and retaining wall by HyD (paras. 3.4 and 3.5).

12. ***Dislocation of manhole and drain covers.*** Under Contract C, Contractor C was required to modify and construct sewerage manholes at Lung Mun Road and construct cut-off drains near the portals of the vehicular underpass near Lung Fu Road Roundabout. Dislocation of covers of these sewerage manholes and cut-off drains occurred between May 2021 and February 2023. According to HyD: (a) after investigations, it was noted that the dislocation of covers was due to frequent traffic with high wheel loads; (b) as Contract C was already substantially completed in September 2019, Consultant X issued 3 VOs (valued at a total of $3 million) under Contract H (which covered road improvement works) instructing Contractor H to carry out modification works (e.g. change of design and upgrading works of covers which could resist higher wheel loads); and (c) subsequent to the completion of the modification works, dislocation of covers at the locations concerned did not occur. In Audit's view, HyD needs to draw lessons from the dislocation of manhole and drain covers constructed under Contract C with a view to improving the design of such works in future works projects (paras. 3.6 to 3.9).

13. ***Need to critically vet tender documents.*** Audit noted that: (a) according to Contract D, Contractor D was required to construct a vehicular access for future tunnel area operation vehicles. The vehicular access would also serve as an emergency vehicular access in future. However, the concrete paving, drainage and associated emergency vehicular access signage for the vehicular access had not been specified in the contract drawing nor included in the contract scope. In the event, a VO (valued at $5.5 million) was issued to instruct Contractor D to carry out the related works; and (b) there were discrepancies among contract documents (e.g. among contract drawings, or between Particular Specification and contract drawings) under Contract D. In the event, 10 instructions were issued by Consultant X under Contract D to clarify the details of works, resulting in a total additional cost of $92.6 million. In Audit's view, there was scope for improvement in vetting tender documents of Contract D (para. 3.13).

14. ***Scope for enhancing construction site safety.*** According to HyD, from the contract commencement dates of the respective contracts to August 2024, 2 fatal accidents happened at the construction sites of Contracts A and B, and 173 non-fatal reportable accidents happened at the construction sites of Contracts A to F and H. Audit noted that, according to HyD, Consultant X did not compile management information on whether the contractors had timely reported the reportable accidents and submitted the related reports to Consultant X in accordance with the Construction Site Safety Manual issued by the Development Bureau. In September 2024, HyD informed Audit that according to Consultant X, there were 2 and 7 cases of late submission of the preliminary accident report by Contractors A and B respectively, with delays ranging from 8 to 98 days (paras. 3.22 to 3.24).

15. ***Need to ensure that contractors submit reports relating to site safety monitoring procedure in accordance with contract requirements.*** Audit noted that, during the contract period for Contract B (83 months), the conditions for triggering the site safety monitoring procedure were met in 16 months and reports should be submitted by Contractor B outlining the problem areas in relation to site safety, actions taken/to be taken to improve the safety performance and the way the site safety improvement measures to be monitored. However, for 3 out of the 16 months, Contractor B did not submit the required reports (para. 3.27).

Operation and traffic management

16. ***Staff manning level requirements not met.*** Audit noted that, since the commissioning of TM-CLK Tunnel in December 2020 and up to June 2024 (i.e. 43 months): (a) the number of actual working hours of the designated ranks of Operator A's staff was less than that specified in the MOM agreement in all the 43 months (an average shortfall of 4%), resulting in the payment of liquidated damages totalling $6.2 million by Operator A to TD; and (b) the actual number of the designated ranks of Operator A's staff employed was less than that specified in the MOM agreement in all the 43 months. The monthly shortfall ranged from 8 to 30 staff (averaged 15 staff), representing 6% to 21% (averaged 11%) shortfall of the manning level of 140 staff (para. 4.5).

17. ***Scope for improvement in assessing the performance of the operator of TM-CLK Tunnel.*** TD prepares an overall quarterly performance assessment report on Operator A. According to TD, there are 20 items for assessing the performance of Operator A. An overall performance rating for the quarter will be formed based on the ratings of these 20 assessment items. There was a total of 15 quarters since the commissioning of TM-CLK Tunnel in December 2020 and up to July 2024 (paras. 4.9 and 4.10). Audit examination revealed that:

(a) ***No timeframe set for completion of overall quarterly performance assessment report on Operator A.*** TD did not set timeframe for the completion of the overall quarterly performance assessment report. As of September 2024, TD had not completed 1 overall quarterly performance assessment report covering the period from May to July 2024 (para. 4.10(a));

(b) ***Need to review assessment basis.*** For an assessment item on "arrival time for vehicle recovery within tunnel area", instead of arrival time, clearance time was adopted by TD as the assessment basis (para. 4.10(b)(ii)); and

(c) ***Need to document justification for performance rating.*** Of the 14 overall quarterly performance assessment reports completed by TD, performance ratings of "good" or "satisfactory" were given to the assessment item on "corporate governance" in 13 reports. However, TD did not document the justification for these ratings (para. 4.10(c)).

18. ***Scope for improvement in vehicle recovery operations.*** In accordance with the MOM agreement, TD provided 2 heavy recovery vehicles (HRVs) to Operator A solely and exclusively for discharging the obligations and duties under the MOM agreement. Audit noted that: (a) according to Operator A, it encountered problems in using HRV for two vehicle recovery operations in May and June 2021 respectively, and it had reported the problems encountered to TD and the Electrical and Mechanical Services Department (EMSD); and (b) from June 2021 and up to May 2024, 5 more vehicle recovery operations encountered similar problems, and as of May 2024 (i.e. about 3 years after the first vehicle recovery operation encountering problems in May 2021), the issue relating to the 2 HRVs had yet to be resolved or rectified. According to TD, it had ongoing discussions with EMSD since the issue was reported by Operator A. In September 2024, TD, EMSD and the manufacturer of the HRVs had ascertained the underlying reasons for the issue relating to the HRVs and were exploring feasible improvement measures. In Audit's view, TD needs to, in collaboration with EMSD, expedite follow-up actions to resolve the problems in using the HRVs with a view to ensuring timely and safe vehicle recovery operations in TM-CLK Tunnel (paras. 4.14 to 4.16).

19. ***Need to keep under review the traffic at TM-CLKL and relevant road sections in Tuen Mun.*** Audit noted that: (a) from 2021 to 2024, the Tuen Mun District Council Members had expressed concerns about the persistent traffic congestion in Tuen Mun (e.g. on Wong Chu Road) since the commissioning of the Northern Connection of TM-CLKL in December 2020; (b) a traffic survey conducted by Consultant X under the Project in 2021 showed that the traffic flows at the relevant major road sections in Tuen Mun (including Wong Chu Road) had increased; and (c) the volume-to-capacity ratios of Wong Chu Road (i.e. one of the relevant major road sections in Tuen Mun) had exceeded 1.0 (i.e. indicating the onset of traffic congestion) since 2022 and increased to 1.17 in 2023. In Audit's view, TD needs to keep under review the traffic at TM-CLKL and relevant road sections in Tuen Mun, and take traffic management measures where appropriate (paras. 4.26 and 4.27).

Audit recommendations

20. **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 Director of Highways should:**

Administration of Contracts A and B

(a) **in implementing works projects involving interfacing works contracts, take measures to improve the management of interfacing works with a view to mitigating the risks arising from interfacing issues, including:**

(i) **ensuring timely handover of works sites among interfacing works contracts (para. 2.10(a));**

(ii) **better coordinating with all related parties on interfacing works (para. 2.10(b)); and**

(iii) **enhancing project management planning (para. 2.10(c));**

(b) **in implementing works contracts involving watermain diversion works, take measures to better ascertain the site conditions at the planning stage (para. 2.23(a));**

(c) **in implementing works projects involving reclamation works, take measures to estimate the quantity of fill material required for the reclamation works as accurately as practicable (para. 2.42(a));**

(d) **in implementing tunnel works projects:**

(i) **regularly remind HyD staff and consultants to follow the related guidelines in specifying the passive fire protection system inside tunnels (para. 2.42(b)(i));**

(ii) **continue to enhance the design of road drainage system in response to climate change (para. 2.42(b)(iii)); and**

(iii) **draw lessons from the experience gained in constructing emergency access hatches in carriageway along TM-CLK Tunnel (para. 2.42(b)(iv));**

Other contract management issues

(e) **in implementing works projects involving construction of slope and retaining wall, remind HyD staff and consultants to conduct thorough pre-tender site investigation as far as practicable in accordance with the related guidelines (para. 3.18(a)(i));**

(f) **draw lessons from the dislocation of manhole and drain covers constructed under Contract C with a view to improving the design of such works in future works projects (para. 3.18(b));**

(g) **in preparing documents for works contracts, take additional measures to critically vet tender documents to ensure their completeness, accuracy and consistency with one another before tenders are invited (para. 3.18(d)(i));**

(h) **make continued efforts to enhance site safety with a view to safeguarding safety of all operations and all persons on sites (para. 3.29(a));**

(i) **take additional measures to ensure that HyD contractors timely report accidents at construction sites in accordance with related requirements (para. 3.29(b)); and**

(j) **enhance the monitoring to ensure that HyD contractors submit the reports relating to site safety monitoring procedure in accordance with the contract requirements (para. 3.29(c)).**

21. **Audit has *recommended* that the Commissioner for Transport should:**

Operation and traffic management

(a) **require the operator of TM-CLK Tunnel to take further measures with a view to complying with the staff manning level requirements stipulated in the MOM agreement (para. 4.19(c));**

(b) **take measures to improve the assessment of performance of the operator of TM-CLK Tunnel (para. 4.19(d));**

(c) **in collaboration with the Director of Electrical and Mechanical Services, expedite follow-up actions to resolve the problems in using the HRVs (para. 4.19(e)); and**

(d) **keep under review the traffic at TM-CLKL and relevant road sections in Tuen Mun, and take traffic management measures where appropriate (para. 4.28).**

Response from the Government

22. The Director of Highways, the Commissioner for Transport and the Director of Electrical and Mechanical Services agree with the audit recommendations.