

RECONSTRUCTION AND IMPROVEMENT OF TUEN MUN ROAD

Executive Summary

1. Tuen Mun Road (TMR) is a 21.4-kilometre long high speed road connecting Tsuen Wan and Tuen Mun. As TMR was designed and built in the 1970s, as of 1990s, most at-grade sections reached the end of their service life and were in a state beyond economical repair, and some sections were dual two-lane carriageways and heavily used. To upgrade the sections of TMR to the then prevailing expressway standards, turn the entire strategic TMR to a dual three-lane carriageway, bring about an overall improvement to highway and serve the traffic needs of the Northwest New Territories (NWNT) better, the Transport and Logistics Bureau proposed 3 projects (Projects I to III) to the Legislative Council to reconstruct and improve TMR. The Highways Department (HyD) was the works agent responsible for implementing these 3 projects.

2. Between June 2001 and January 2013, the Finance Committee of the Legislative Council approved a total funding of \$8,942.2 million for Projects I to III. For Projects I to III: (a) between April 2002 and November 2005, 3 consultancies were awarded to the same consultant (Consultant X); and (b) between May 2008 and March 2012, 6 works contracts (Contracts A to F) were awarded to 4 contractors (Contracts A and B to Contractors A and B respectively, Contracts C, E and F to Contractor C, and Contract D to Contractor D). In the event, Projects I to III were completed between January 2010 and December 2014. As of June 2022, the Government had incurred \$8,629.3 million (97% of \$8,942.2 million) for Projects I to III.

3. HyD is responsible for the maintenance of public roads (including TMR), highway structures and ancillary facilities within its ambit. The Transport Department (TD) is responsible for monitoring the traffic conditions of various major roads (including TMR). In 2021, the annual average daily traffic volume of TMR was 127,800 vehicles. The Audit Commission (Audit) has recently conducted a review of HyD's work in implementing the projects for reconstruction and

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improvement of TMR and the work of HyD and TD in maintenance and traffic management of TMR.

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4. Contracts A to F were completed between January 2010 and December 2014. Except Contract D which was completed on time, the other 5 contracts were completed 2.1 to 13.2 months later than their respective original completion dates, but within the extended contract completion dates with extensions of time (EOTs) granted. Except Contract E which was an in-house managed contract, for the other 5 contracts, Consultant X was the Engineer or Supervising Officer responsible for supervising the contract works. The total final contract sum of all 6 contracts was \$7,919.0 million (para. 2.3).

5. *Need to draw lessons from the events causing potential delays to Contracts A and C.* Under Contracts A and C, Contractors A and C were required to modify over 140 and 70 slopes in association with the road improvement along both sides of TMR respectively. According to Consultant X's assessment, due to the additional works to slopes under Contracts A and C and 3 other major delaying events under Contract C, Contracts A and C might suffer a potential delay of 3 years and 2.5 years respectively if no mitigation measures were implemented. Between July and August 2016, Consultant X issued 3 variation orders (VOs) (valued at \$140.5 million) under Contract A and 1 VO (valued at \$145.4 million) under Contract C to carry out measures to recover potential delays caused by the additional works to slopes and the 3 other delaying events. In the event, according to HyD, all potential delays were recovered and the related works under Contracts A and C were completed by the scheduled completion dates under the Contracts (paras. 2.4, 2.8 to 2.11). Audit noted that the following issues merit HyD's attention and drawing lessons therefrom in administering future reconstruction and improvement of road works projects:

- (a) *Significant additional works to slopes along TMR after award of Contracts A and C.* According to HyD, during the design stage of Contracts A and C: (i) ground investigations had been carried out to obtain subsoil information; and (ii) for cases due to existing site constraints, detailed design of geotechnical works was carried out based on the best available information such as the subsoil data at the nearby accessible locations. In the event, the actual ground conditions at some slopes were

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found different from those assumed during planning and design stage, and about 500 VOs (valued at \$174.0 million) and 160 VOs (valued at \$43.0 million) were issued under Contracts A and C respectively to carry out additional works for the slopes. Audit noted that there were guidelines related to site investigation (including ground conditions of slopes) before award of Contracts A and C, and further guidelines on good site investigation practice and geotechnical works of public works projects were subsequently promulgated after the award of Contracts A and C. In Audit's view, in implementing road works projects involving slope works in future, HyD needs to remind its staff and consultants to follow the related guidelines on site investigation (paras. 2.6 and 2.12);

- (b) ***Scope for improvement in local consultation.*** Under Contract C, Contractor C was responsible for the design and construction of a reinforced earth wall at a slope next to a residential development near Castle Peak Bay. According to HyD, notwithstanding previous consultations, after the commencement of site clearance works, residents of the residential development nearby expressed concern that the proposed reinforced earth wall was in close proximity to the residential development, and requested to shift the proposed wall further away from the premises. In the event, Consultant X issued a VO (valued at \$3.4 million) to shift the alignment of the earth retaining structure and change the proposed reinforced earth wall to a reinforced concrete wall. In Audit's view, there is scope for improvement in local consultation (para. 2.14); and
 - (c) ***Scope for enhancing ground investigation for bridge works.*** Under Contract C, Contractor C was responsible for the widening of bridge structure of So Kwun Tan Bridge (i.e. Bridge A). According to HyD, ground investigations had been carried out during the design stage. However, an unexpected layer of marine mud was encountered during the piling works of Bridge A. In the event, Consultant X issued 2 VOs to change: (i) the foundation of Bridge A (valued at \$1.5 million); and (ii) the alignment of a section of reinforced earth wall (valued at \$3.6 million). In Audit's view, there is scope for enhancing ground investigation for bridge works (para. 2.15).
6. ***Some necessary slope works not included in contracts.*** Under Contracts A to C, Contractors A to C were required to carry out slope modification and/or stabilisation works along the TMR covered by the respective contracts. According to

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HyD, 23 slopes had been upgraded under 2 previous contracts and no upgrading or modification works would be required for these slopes based on the preliminary assessment results during design stage. In the event, after 2 rock fall incidents happened in March 2009, comprehensive site inspection, desktop study and additional investigation were conducted for these 23 slopes and upgrading and stabilisation works were carried out for 10 of the 23 slopes under Contracts A to C. In Audit's view, in implementing road works projects involving slope works in future, HyD needs to critically assess the conditions of slopes (including those previously upgraded) and include the related slope works in contracts (paras. 2.17, 2.18 and 2.20).

7. ***Construction works of some facilities not clearly specified in contract clauses.*** Project III involved permanent relocation or reprovision of facilities within the then existing boundary of On Ting Estate. However, the contract clauses of Contract F (a design-and-build lump sum contract) only required Contractor C to submit the design and construction programme for these facilities. According to Consultant X, the construction works of these facilities were not specified under the contract clauses of Contract F and they were deemed to be additional works and shall be separately measured. In the event, Consultant X issued a VO (valued at \$3.9 million) to instruct Contractor C to carry out the construction works of these facilities (paras. 2.27 and 2.28).

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8. ***Need to draw lessons from the installation of vertical greening panels along various sections of TMR.*** According to HyD: (a) vertical greening panels were installed at the noise barriers along TMR as trial with a view to maximising greening opportunities at highways structures; and (b) the vertical greening panels on noise barriers along TMR were constructed under Projects I and III with a total construction cost of \$75.6 million. HyD and the Leisure and Cultural Services Department are responsible for maintenance of vegetation on the vertical greening panels along sections of TMR under their purview. However, the growing conditions of vegetation on these panels were not satisfactory. HyD and the Leisure and Cultural Services Department concluded that the maintenance works of vegetation were difficult and the vertical greening panels were not sustainable in the long run. In the event, all the vertical greening panels on noise barriers along various sections of TMR were replaced with acoustic panels or under planning for replacement/removal. In Audit's view, HyD needs to draw lessons from the installation of vertical greening panels on noise barriers along TMR (paras. 3.2 to 3.4 and 3.13).

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9. ***Scope for enhancing construction site safety.*** According to HyD, from 2008 to 2016, there were 2 fatal accidents at construction sites of Contracts A and C (1 under each contract) and 43 non-fatal reportable accidents (i.e. accident resulting in an injury with incapacity for more than three days) at construction sites of Contracts A to C, E and F. Audit noted that there were late reporting of reportable accidents by Contractor C under Contracts C and F on 4 occasions, ranging from about 3 months to about 11 months late. In Audit's view, there is scope for enhancing construction site safety (paras. 3.19 to 3.21).

10. ***Scope for improvement in cost apportionment among project votes.*** Upon commencement of 4 TMR contracts (Contracts A to C and F) at various sections of TMR, HyD, together with Consultant X, had reviewed and identified the need to strengthen their communication with the general public through the establishment of a community liaison centre in Tuen Mun Town Centre. The total cost for provision and operation of the centre amounted to \$4.3 million. Based on the agreed cost apportionment arrangement, \$0.4 million and \$3.9 million should be charged under two project votes respectively. However, Audit noted that \$4.3 million were all charged under one of the two project votes. In Audit's view, HyD needs to take measures to ensure proper cost apportionment among project votes (paras. 3.24 to 3.26).

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11. ***Management of works orders.*** The maintenance works for TMR are covered under two term contracts (Contract G covering the period from 1 April 2016 to 31 March 2022 and Contract H covering the period from 1 April 2022 to 31 March 2028) let out by HyD in recent years. Of 635 works orders for non-routine maintenance and rehabilitation works relating to TMR issued by HyD to Contractor G from 2017-18 to 2021-22 and completed as of July 2022, 29 (5%) were completed later than their target completion dates (paras. 4.2, 4.3 and 4.7). Of the 29 works orders, Audit noted that:

- (a) ***Delays in completion of works orders.*** For 5 (17%) works orders, there were delays in completion of works orders by Contractor G, ranging from 10 to 144 days (or 4.7 months), averaging 2.2 months. According to HyD, such delays were mainly due to slow progress of contractor's works and it had notified Contractor G for the imposition of liquidated damages for the 5 overdue works orders (para. 4.7);

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- (b) ***Late notifications of EOT claims.*** For 13 (45%) works orders which were completed between November 2019 and September 2021, there were late notifications of EOT claims by Contractor G (notifications served on 30 September 2022, ranging from 370 to 1,060 days (or 2.9 years), averaging 2.5 years after completion of works orders) (para. 4.7); and
- (c) ***Delays in provision of information for claim assessments.*** For 11 (38%) works orders, Contractor G served notifications of EOT claims for 4 works orders in October 2018 and 7 works orders in February 2022. However, as of September 2022, assessments of EOT claims for these works orders were still in progress. According to HyD, this was mainly due to delays in provision of information by Contractor G for claim assessments (para. 4.7).
12. ***Need to improve the monitoring of defect rectification works.*** For 67 notification forms (NFs) relating to TMR issued during the period from April 2021 to March 2022 to instruct Contractor G to rectify defects, Audit noted that: (a) for 24 (36%) NFs, there were delays in completion of defect rectification works by Contractor G, ranging from 1 to 207 days (or 6.8 months), averaging 2.0 months; and (b) for 24 (36%) NFs, there were delays in submission of completion reports by Contractor G after the completion of defect rectification works, ranging from 1 to 356 days (or 11.7 months), averaging 5.0 months (paras. 4.9 and 4.10).
13. ***Scope for making better use of information technology for contract administration.*** According to HyD, inspection and maintenance records for roads and associated structures under its purview were stored in a computer system. Audit noted that HyD had not regularly compiled management information (e.g. based on the inspection and maintenance records in the computer system) for monitoring the conditions of high speed roads (including TMR) and associated structures, and determining their maintenance strategy (para. 4.17).
14. ***Need to keep under review the traffic conditions of TMR and the traffic demand arising from the development of NWNT.*** Audit noted that: (a) from 2015 to 2021, the volume-to-capacity ratios (an indicator of the traffic condition of a road) of TMR during the evening peak hour (Tuen Mun bound) had exceeded 1.0 since 2016 and generally increased to 1.12 in 2020 and 2021. This indicated that TMR had been at the onset of traffic congestion since 2016; (b) the Government planned to complete

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a series of road infrastructure projects in stages so as to enhance the internal and external connectivity of NWNT. Upon completion of these projects, the projected volume-to-capacity ratios of major roads (including TMR) connecting NWNT and the urban areas during the morning peak hour in 2036 would generally be lower to not more than 1.0 (i.e. has sufficient capacity to cope with the anticipated volume of vehicular traffic); and (c) the continuous growth in population and economic development of NWNT would generate additional traffic demand and put further pressure on TMR. Audit considers that there is a need to keep under review the traffic conditions of TMR and the traffic demand arising from the development of NWNT by TD, and the implementation progress of the road infrastructure projects in NWNT by HyD (the works agent for implementing these projects) (paras. 4.22, 4.23, 4.25 and 4.26).

15. ***Scope for further enhancing road safety of TMR.*** TMR was upgraded to the then prevailing expressway standards as far as practicable in order to improve the traffic flow and further enhance road safety. Audit noted that: (a) while the number of traffic accidents on TMR generally decreased from 231 in 2012 to 163 in 2015 (i.e. the first year after the substantial completion of reconstruction and improvement works of TMR in December 2014), it increased to 263 in 2019 and then decreased to 246 in 2021; and (b) while the accident rate per million vehicle-kilometre for TMR generally decreased from 0.38 in 2012 to 0.25 in 2016, it increased to 0.36 in 2018 and then decreased to 0.34 in 2021. In addition, from 2012 to 2021, the accident rates for TMR for each year (except for 2016) were higher than those of all major roads selected by TD. In Audit's view, TD needs to keep under review the safety performance of TMR and implement appropriate improvement measures with a view to further enhancing road safety of TMR (paras. 4.23, 4.27 and 4.28).

Audit recommendations

16. **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:**

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- (a) **in implementing road works projects involving slope works or bridge works in future, remind HyD staff and consultants to follow the related guidelines on site investigation, and critically assess the conditions of**

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slopes (including those previously upgraded) and include the related slope works in contracts (para. 2.25(a));

- (b) in implementing road works projects involving structures nearby property development in future, improve local consultation process and better address the concerns of relevant stakeholders (para. 2.25(b));
- (c) in preparing documents for a design-and-build lump sum works contract in future, take measures to critically vet contract documents to ensure completeness and accuracy (para. 2.38(a));

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- (d) draw lessons from the installation of vertical greening panels on noise barriers along TMR (para. 3.14);
- (e) in implementing works projects in future:
 - (i) make continued efforts to enhance construction site safety and take measures to ensure that HyD contractors timely report accidents at construction sites (para. 3.22(a) and (b)); and
 - (ii) take measures to ensure proper cost apportionment among project votes (para. 3.32(a));

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- (f) continue to closely monitor the implementation progress of works orders to ensure their timely completion by the contractors of high speed road maintenance term contracts (para. 4.19(a));
- (g) expedite the assessments of EOT claims and timely notify the contractors for the imposition of liquidated damages for overdue works orders under high speed road maintenance term contracts (para. 4.19(b));

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- (h) take measures to improve the monitoring of defect rectification works carried out by the contractors of high speed road maintenance term contracts (para. 4.19(c));
 - (i) compile regular management information for monitoring the conditions of high speed roads (including TMR) and associated structures, and determining their maintenance strategy (para. 4.19(g)); and
 - (j) keep under review the implementation progress of the road infrastructure projects in NWNT (para. 4.30).
17. Audit has *recommended* that the Commissioner for Transport should keep under review:

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- (a) the traffic conditions of TMR and the traffic demand arising from the development of NWNT, and take appropriate traffic management measures (para. 4.29(a)); and
- (b) the safety performance of TMR and implement appropriate improvement measures (para. 4.29(b)).

Response from the Government

18. The Director of Highways and the Commissioner for Transport agree with the audit recommendations.