

CHAPTER 6

Highways Department

Tung Chung Road Improvement Project

**Audit Commission
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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. 60 of the Director of Audit contains 8 Chapters which are available on our website at <http://www.aud.gov.hk>

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TUNG CHUNG ROAD IMPROVEMENT PROJECT

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TUNG CHUNG ROAD IMPROVEMENT PROJECT

Executive Summary

1. Tung Chung Road (TCR) is the only vehicular access connecting North and South Lantau between Tung Chung and Cheung Sha. Before 2002, TCR was a single-lane road for two-way traffic with sharp bends and steep gradients. This traffic arrangement posed high safety risks and caused inconvenience to road users. From 2002 to 2009, the Government implemented the TCR Improvement Project to progressively upgrade TCR to a single two-lane road for two-way traffic with lower gradients. The Project was carried out under two works projects by two Government departments respectively, namely Project A (from Pa Mei to Lung Tseng Tau) by the Civil Engineering and Development Department and Project B (from Lung Tseng Tau to Cheung Sha Sheung Tsuen) by the Highways Department (HyD).

2. Contract A under Project A commenced in May 2002 was substantially completed in December 2003 at a cost of \$22.6 million, which was on schedule and within budget. Contract B under Project B commenced in June 2004 was substantially completed in June 2009 at a cost of \$743.5 million. There was a 36-month delay and a 32% cost increase in completing Contract B. Single two-lane TCR was open to traffic in February 2009.

Project planning and environmental impact assessment

3. In 1997, the HyD found in a feasibility study that upgrading TCR along the existing alignment was not acceptable because of excessive gradients of some sections of the road. The HyD subsequently identified a new road option between Tai Ho Wan and Mui Wo (Tai Ho Wan Option) which would be shorter and have lower gradients than the TCR on-line option. From 1998 to 2000, the HyD carried out environmental impact assessments (EIAs) for proposed works under the Tai Ho Wan Option. However, the Environmental Protection Department (EPD) did not

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issue environmental permits for the works on the grounds that the EIA reports submitted by the HyD did not meet the EPD's requirements. In 2001, the HyD re-examined the feasibility of widening TCR along the existing alignment and decided to adopt a new scheme of widening a road section of TCR from Lung Tseng Tau to Pak Kung Au and constructing a new road section from Pak Kung Au to Cheung Sha Sheung Tsuen (Adopted Option). This scheme was implemented under Project B (paras. 1.6 to 1.8 and 2.3).

4. ***Road options not thoroughly explored during feasibility study in 1997.*** In January 2001, the HyD informed the Legislative Council Panel on Transport that the Adopted Option was the most promising solution. However, Audit is concerned that the HyD had not identified the Adopted Option during its feasibility study in 1997. This resulted in incurring additional cost of \$9 million and taking more than three years in conducting the design and investigation of the Tai Ho Wan Option, which was eventually abandoned (para. 2.24).

5. ***Inadequate consideration of challenges for carrying out works in areas of ecological significance.*** According to the EPD, the Tai Ho Wan Option would lead to a substantial habitat loss of woodland, adverse impacts on areas of ecological significance including Tai Ho Stream, disturbance and a loss of habitat of protected or rare species, and encroachment on the Lantau Country Park. From 1997 to 2000, the Agriculture, Fisheries and Conservation Department, the Planning Department, the Country and Marine Parks Board and the Advisory Council on the Environment had raised reservations over the Tai Ho Wan Option. However, the HyD had not adequately considered their views and the challenges in investigating the Tai Ho Wan Option (paras. 2.26 and 2.27).

6. ***Project feasibility not critically re-examined after significant changes in circumstances.*** Tai Ho Stream was designated as a Site of Special Scientific Interest in May 1999. As a result, the proposed reclamation in Tai Ho Wan area was shelved. However, the HyD had not critically re-examined the viability of the Tai Ho Wan Option in the light of the significant changes in circumstances, but took another 19 months from May 1999 to December 2000 to further pursue the Option before abandoning it (para. 2.28).

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Project implementation

7. Contract B comprised works for two road sections, namely Road Section A running from Lung Tseng Tau to Pak Kung Au and Road Section B from Pak Kung Au to Cheung Sha Sheung Tsuen. Road Sections A and B had taken additional 1,098 and 953 days respectively for completion. After examining the reasons for the delays, the HyD granted extensions of time (EOTs) of 794 days for Road Section A and 757 days for Road Section B, and imposed liquidated damages totalling \$26.2 million for contract delays of 304 days and 196 days for the two road sections (paras. 3.5 to 3.8).

8. *Insufficient road permits to meet excavation programme.* During the contract period from June 2004 to June 2009, TCR was largely a closed road and a prohibited zone where vehicle users were required to apply from the Transport Department for road permits for using the road. Audit examination revealed that, from November 2004 to March 2005, the actual number of road permits issued to the contractor (Contractor B) was less than that specified in Contract B. Furthermore, according to an Independent Quantity Surveyor employed by the HyD, the number of road permits actually required for the excavation programme was more than that specified in Contract B. As a result, the HyD granted EOTs of 209 days and 143 days for Road Sections A and B respectively, and incurred a related prolongation cost of \$25.8 million for Contract B (paras. 3.14 to 3.18 and 3.20).

9. *Limited site investigation before contract award.* Owing to restrictions on carrying out pre-contract site investigation in country-park areas, only limited site investigation had been carried out before Contract B was awarded. In the event, after commencement of works, the actual site conditions were found significantly different from those ascertained in the site investigation. This led to significant increases in boulder and rock quantities for excavation. As a result, the HyD had to grant EOTs of 134 days and incur a related prolongation cost of \$10.5 million for Contract B (paras. 3.21 and 3.22).

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Adoption of alternative designs

10. In September 2004, Contractor B submitted alternative designs for certain works items to the HyD for approval. In October 2004, Contractor B informed the HyD that there would be a cost saving of \$12 million for adopting the alternative designs and he agreed to share the saving equally with the Government. Works for the alternative designs commenced in June 2006 and were completed in June 2009. In December 2009, the HyD and Contractor B entered into a supplementary agreement under which the HyD would pay a sum of \$150.42 million for the alternative-design works, which was the same cost as the works for the original conforming designs. As a result, there was no cost saving to the Government (paras. 4.8, 4.10 and 4.15).

11. *Tenderers not invited to propose alternative designs.* Notwithstanding that Works Bureau Technical Circular No. 2/2001 had stipulated that works departments might invite tenderers to submit alternative designs during tendering, the HyD did not invite tenderers to propose alternative designs during the tendering of Contract B. In the event, the HyD accepted alternative designs proposed by Contractor B after the award of contract. The HyD's arrangement was not conducive to enhancing competitive tendering (para. 4.11).

12. *Delay in entering into supplementary agreement.* The HyD had not entered into a supplementary agreement with Contractor B before commencing the alternative-design works in June 2006. In the event, when the HyD entered into the supplementary agreement in December 2009, it had already paid \$150.36 million (99.96% of the total cost of the related works) to Contractor B. Under the circumstances, the HyD did not have alternative options, but to accept the completed works (paras. 4.8, 4.14 and 4.15).

Utilisation of TCR

13. *Lower-than-forecast traffic demand.* The objectives of the TCR Improvement Project were to improve road safety and meet future traffic demand. In 2003, it was estimated that the peak volume-to-capacity ratio of improved TCR would be 0.84 in 2011 and increase to 0.99 in 2016. Audit noted that the actual

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utilisation of TCR after the improvement works was 69% less than the forecast utilisation. According to the Transport Department, the significant volume-to-capacity ratio variation was mainly due to the lower-than-forecast population on Lantau Island (paras. 5.3 and 5.5).

Audit recommendations

14. **Audit recommendations are provided in the respective sections of this Audit Report. Only the key ones are highlighted in this Executive Summary. Audit has *recommended* that, in planning for and implementing a road project in future, the Director of Highways should:**

Project planning and environmental impact assessment

- (a) **conduct thorough examination with a view to identifying all feasible options for comparison and choosing the most practicable and cost-effective one for implementation (para. 2.29(a));**
- (b) **heighten vigilance in planning works that will affect areas of ecological significance (para. 2.29(b));**
- (c) **re-examine the viability of a chosen project option when there are significant changes in circumstances (para. 2.29(c));**

Project implementation

- (d) **take measures to ensure that sufficient number of road permits are specified in the works contract and issued to the contractor, where applicable (para. 3.29(b));**
- (e) **if works are to be carried out within country-park areas, closely liaise with the Director of Agriculture, Fisheries and Conservation with a view to exploring arrangements for acquiring more thorough site information before contract award (para. 3.29(c));**

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Adoption of alternative designs

- (f) **critically consider inviting tenderers to submit alternative designs at the tender stage where there is a potential for better value for money (para. 4.18(a)(i));**
- (g) **in accepting alternative designs after contract award, agree with the contractor over the terms of implementing the alternative-design works before the works commence (para. 4.18(a)(ii)); and**

Utilisation of TCR

- (h) **enhance vigilance in conducting and presenting traffic forecasts with a view to making traffic-flow estimations as accurately as possible (para. 5.10).**

Response from the Administration

15. The Administration agrees with the audit recommendations.

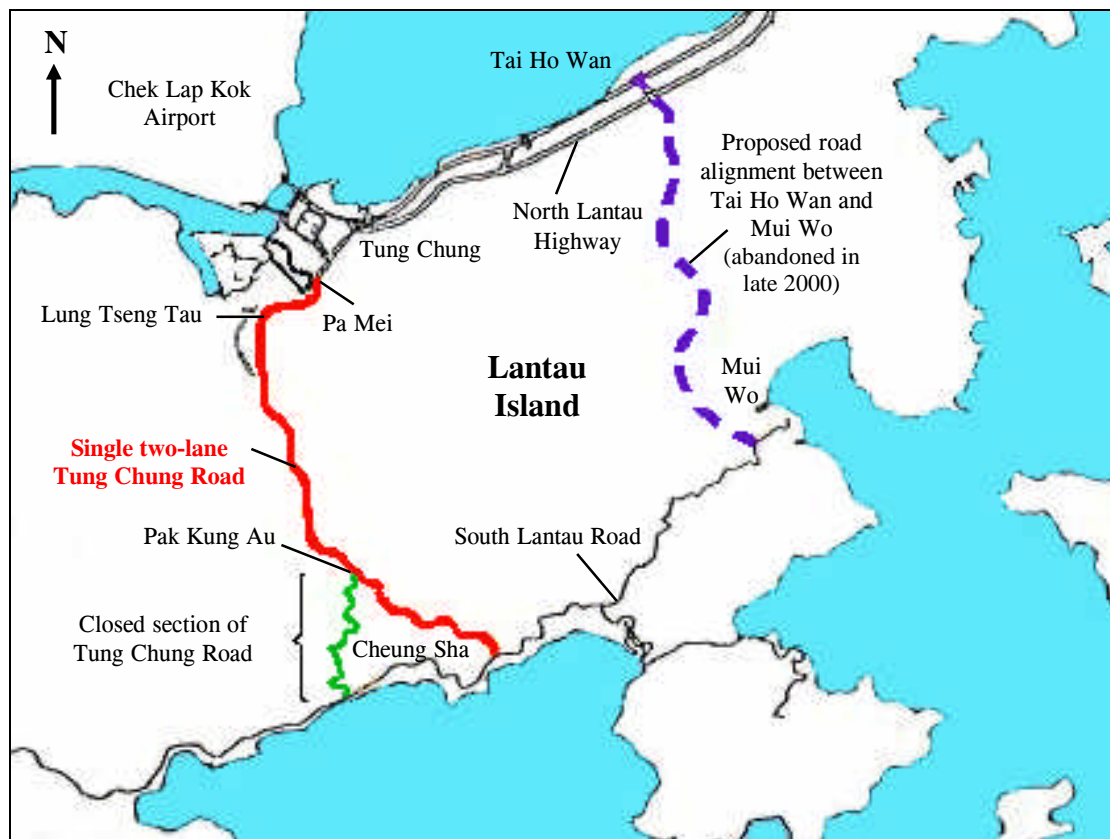
PART 1: INTRODUCTION

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

1.2 Tung Chung Road (TCR) of about seven kilometres (km) is the only vehicular access connecting North and South Lantau between Tung Chung and Cheung Sha (see Figure 1). The original TCR, running from Pa Mei in Tung Chung to Cheung Sha Beach on South Lantau, was a substandard road with sharp bends and steep gradients (the gradients of about 4 km of road sections were 10% to 20%) exceeding the Transport Department (TD)'s normal standard allowed for safe operation of buses and other vehicles (Note 1). Between 2002 and 2009, improvement works were carried out to progressively upgrade TCR from a single-lane road to a single two-lane road for two-way traffic (see Figure 2). Single two-lane TCR was open to traffic in February 2009.

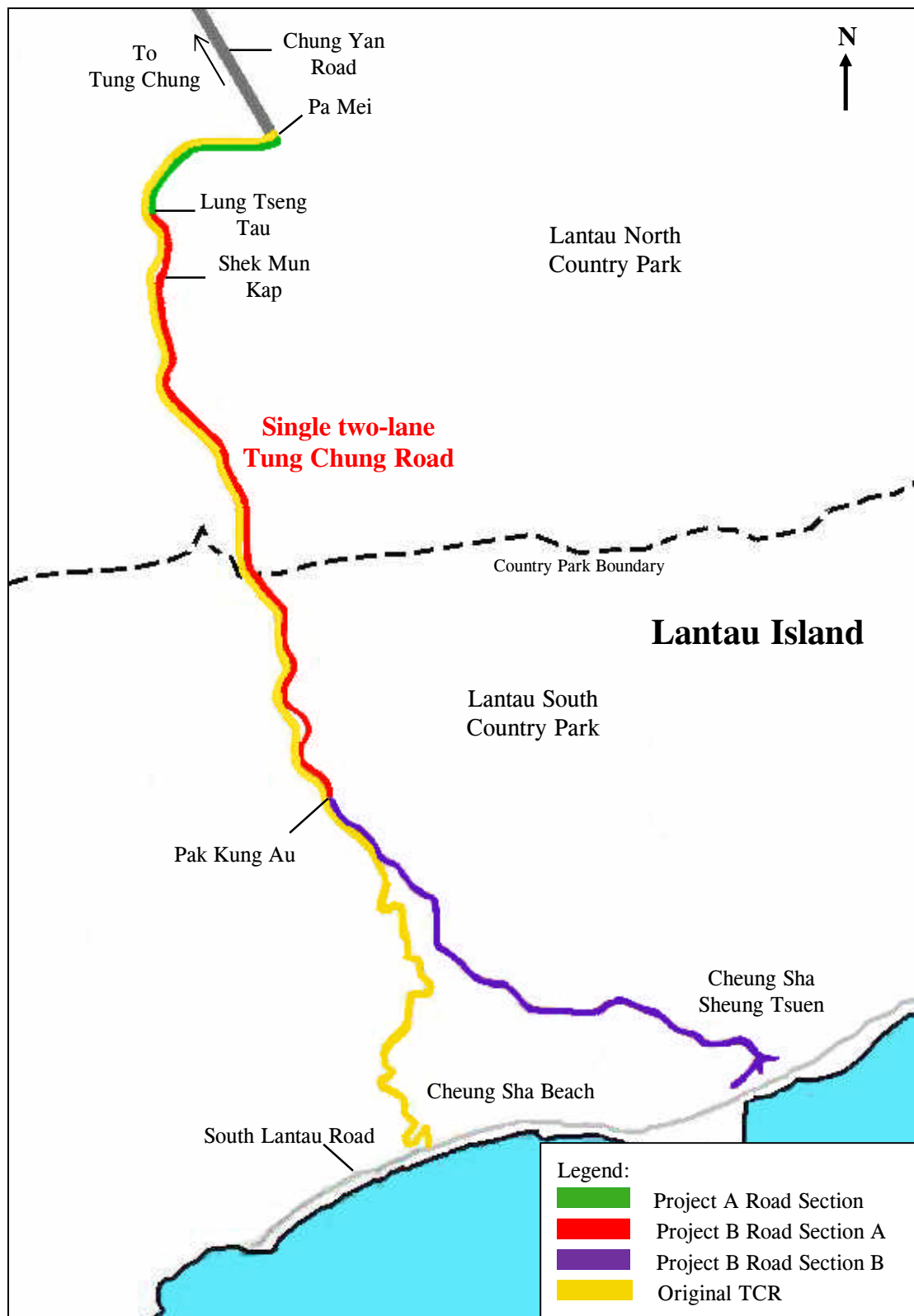
Note 1: *According to the Transport Planning and Design Manual of the TD, the maximum gradient of a road for safe operation of buses is 8% and that for other vehicles is 10%.*

Figure 1
Tung Chung Road



Source: Highways Department records

Figure 2
TCR Improvement Project



Source: Highways Department records

Justification for improving TCR

1.3 TCR is a largely restricted road (Note 2) which is only for use by vehicles having permits issued by the TD. These vehicles mainly comprise franchised buses, government vehicles and vehicles used by residents in the vicinity along TCR. TCR before upgrading (see para. 1.2) was a single-lane road for two-way traffic with some 40 passing bays for a vehicle to give way to another when coming head-to-head. This traffic arrangement posed high safety risks and caused inconvenience to road users.

1.4 In 1990s, Lantau residents expressed concerns over the road safety of TCR and urged the Government to upgrade TCR to meet the increasing traffic demand subsequent to the opening of the North Lantau Highway in 1997. In March 1996, the Highways Department (HyD) informed the Islands District Council that a feasibility study would be conducted on widening TCR. The Council strongly urged the HyD to implement the widening works at an early time to meet the anticipated increase in traffic demand.

Feasibility and investigation studies on identifying the Adopted Option

1.5 The HyD awarded three consultancies over a period of five years for carrying out a feasibility study, namely Consultancy A in 1996 on identifying feasible road widening options, Consultancy B in 1998 on exploring an alternative option between Tai Ho Wan and Mui Wo and Consultancy C in 2001 on re-examining the widening of TCR (see Appendix A).

1.6 In 1996, the HyD employed a consultant (Consultant X) at a cost of \$4.3 million to carry out Consultancy A, a feasibility study on widening TCR from a single-lane to a single two-lane road. The study found that upgrading the road along the existing alignment was not acceptable because of excessive gradients of some sections of the road. In August 1997, the HyD extended the scope of Consultancy A at a cost of \$1.5 million to explore other road options. Consultant X later recommended a new road option between Tai Ho Wan and Mui Wo, which was shorter and with lower gradients (see Figure 1 in para. 1.2). According to Consultant X:

Note 2: *TCR from Shek Mun Kap to Cheung Sha is a restricted road.*

- (a) the maximum gradient of the new road would be 6%;
- (b) the new road would be shorter than the TCR on-line option (see para. 2.3(a)); and
- (c) the new road would provide direct connections near main population centres.

In July 1998, the HyD commissioned Consultancy B (Note 3) at a cost of \$7.5 million to carry out investigation and the preliminary design of a new road linking Tai Ho Wan and Mui Wo. After examining different proposed options (with different alignments), the HyD selected a road alignment between Tai Ho Wan and Mui Wo (the Tai Ho Wan Option) as the preferred option for further investigation.

1.7 From 1998 to 2000, the HyD carried out environmental impact assessments (EIAs — Note 4) for proposed works under the Tai Ho Wan Option and submitted EIA reports (indicating the proposed works and environmental mitigation measures) to the Environmental Protection Department (EPD) for approval and for the issue of the required environmental permits. However, after examining the EIA reports, the EPD informed the HyD that the reports did not meet the requirements for the issue of environmental permits under the Environmental Impact Assessment Ordinance (Cap. 499 — EIAO).

1.8 In early 2001, the HyD re-examined the feasibility of widening TCR along the existing alignment. With the assistance of Consultant X, the HyD identified a new scheme of widening the road section of TCR from Lung Tseng Tau to Pak Kung Au and constructing a new road section from Pak Kung Au to Cheung Sha Sheung Tsuen on South Lantau (the Adopted Option — see Figure 2). After

Note 3: *Consultancy A and Consultancy B were both awarded to the same consultant (Consultant X) through two separate tender exercises.*

Note 4: *Under the Environmental Impact Assessment Ordinance (Cap. 499), which was enacted in February 1997 and came into effect in April 1998, a person carrying out a designated project needs to apply for an environmental permit from the Environmental Protection Department after conducting an EIA. The Tai Ho Wan Option was a designated project under the Ordinance.*

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conducting an investigation study and an EIA under Consultancy C at a cost of \$6.9 million (Note 5), the Adopted Option was found to be technically feasible and environmentally acceptable. In late 2001, the HyD decided to choose the Adopted Option for improving TCR under the TCR Improvement Project (see para. 1.11).

Key stages of project implementation

1.9 The planning and implementation of the TCR Improvement Project under the Public Works Programme involve three key stages, namely preliminary stage, design and investigation stage, and implementation stage (see Appendix B).

1.10 According to the Technical Manual on the Project Management (Note 6) for the Public Works Programme, a project manager should ensure that a project is completed on time, within budget and to the specified quality standards. Furthermore, the Project Administration Handbook for Civil Engineering Works (Note 7) also specifies that a project engineer should from time to time monitor the approved project estimate (APE) and expenditure of a project. Moreover, Financial Circular No. 3/2012 issued in July 2012 provides that, if a project with an APE exceeding \$30 million requires an increase in APE by more than \$15 million (Note 8), the project department should seek additional funding approval from the Finance Committee (FC) of the Legislative Council (LegCo).

Note 5: *Through direct appointment, the HyD awarded Consultancy C to Consultant X.*

Note 6: *The Technical Manual issued by the Development Bureau specifies requirements on the Public Works Programme delivery processes, with a view to enhancing the project management capabilities and culture of works departments.*

Note 7: *This Handbook issued by the Civil Engineering and Development Department provides guidance on matters commonly encountered by works departments in administering works projects.*

Note 8: *According to Financial Circular No. 3/2012, the Secretary for Financial Services and the Treasury may approve under delegated authority from the Finance Committee of the Legislative Council an increase in APE of a project by \$15 million or less.*

Project implementation

1.11 The TCR Improvement Project was implemented under two works projects, namely Project A and Project B. Audit has found that the implementation of Project A is generally satisfactory but there are areas for improvement in implementing Project B.

Project A

1. Project A involved the widening of a road section of 0.95 km from a single-lane road to a single two-lane road between Pa Mei and Lung Tseng Tau by the Civil Engineering and Development Department (CEDD — Note 1). In March 2002, the FC approved funding of \$32 million for the works under Project A.

2. Project A was not a designated project under the EIAO and hence an application for environmental permits for carrying out the works was not required. The CEDD appointed a consultant (Consultant Y) under Consultancy D at a cost of about \$0.6 million to design and supervise the work for implementation of Project A.

3. In May 2002, the CEDD awarded a works contract (Contract A) under Project A to a contractor (Contractor A), targeting for completion in November 2003 at an estimated cost of \$25.8 million.

4. Contract A was substantially completed in December 2003 at a cost of \$22.6 million (Note 2). The single two-lane road section under Project A was open for public use in early 2004.

Note 1: The TCR section between Pa Mei and Lung Tseng Tau is located in Tung Chung. As the CEDD was responsible for implementing infrastructure works for Tung Chung New Town, it took up the responsibility for implementing Project A.

Note 2: The account of Contract A was finalised in March 2005.

Project B

1. Project B involved the widening of a road section of 3.6 km from a single-lane road to a single two-lane road between Lung Tseng Tau and Pak Kung Au (Project B Road Section A), and the construction of a new single two-lane road of 2.6 km between Pak Kung Au and Cheung Sha Sheung Tsuen (Project B Road Section B) by the HyD (see Figure 2 in para. 1.2). The works of Road Section B included constructing elevated highway structures of a total length of 750 metres (m).
2. In July 2002, the HyD appointed a consultant (Consultant Y — Note) under Consultancy E at a cost of \$16.8 million for carrying out the detailed design, investigation and supervision of the implementation of Project B.
3. In July 2003, the FC approved funding of \$629.8 million for the works under Project B. In June 2004, the HyD awarded a works contract (Contract B) under Project B to a contractor (Contractor B), targeting for completion in June 2006 at an estimated cost of \$561.6 million.
4. Contract B was substantially completed in June 2009 at a cost of \$743.5 million. Consultant Y was the Engineer for Contract B. The single two-lane road section under Project B was open for public use in February 2009.

Note: Consultancy D and Consultancy E were both awarded to the same consultant (Consultant Y) through two separate tender exercises.

1.12 At a LegCo Panel on Transport meeting in January 2002, Members in general expressed dissatisfaction that Project B would only be completed in 2006 and called on the Administration to take all possible measures to expedite the project so that there would be early improvement to TCR to address the transport needs of Lantau residents. In response, the Transport and Housing Bureau (THB — Note 9) indicated that it would take all possible steps to advance the project programme.

1.13 The Director of Highways held monthly progress meetings to discuss key issues of all major projects (including Project B), with a view to ensuring that all major projects were well planned and progressed according to their latest programmes.

Cost overrun and delay of Project B

1.14 ***Cost increases of Contract B.*** In July 2003, the FC approved \$629.8 million for the works under Project B. In November 2003, after inviting tenders for works under Project B, the HyD received 12 tenders. However, the lowest tender sum was higher than the HyD's original estimated cost. The HyD applied and the FC approved in June 2004 additional funding of \$58.7 million (Note 10) for Project B, increasing the APE to \$688.5 million. The HyD later awarded Contract B to Contractor B in June 2004 at a sum of \$561.6 million. In February 2007 and November 2008, the FC further approved additional funding for Project B on two occasions, namely:

- (a) in February 2007, additional funding of \$143.5 million; and
- (b) in November 2008, further additional funding of \$33.1 million.

Note 9: *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 Transport and Housing Bureau 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.*

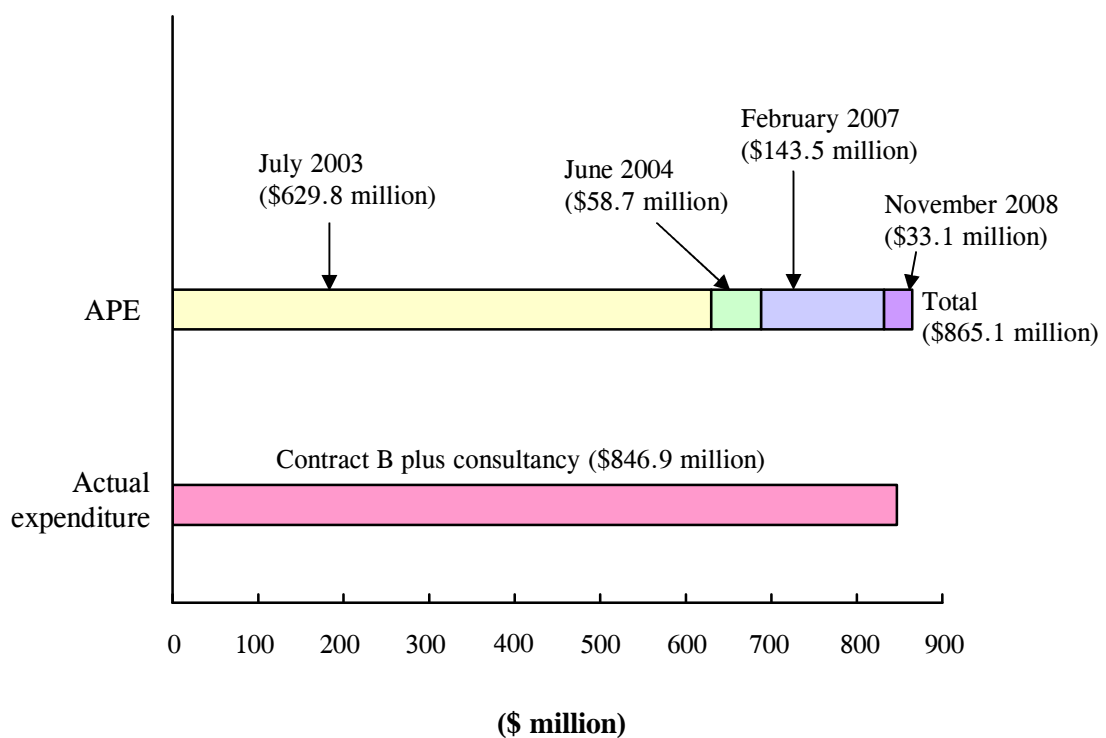
Note 10: *This sum included funding for implementing additional safety measures for the project.*

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1.15 As a result, the APE of Project B was increased by \$176.6 million (\$143.5 million + \$33.1 million) to \$865.1 million. Figure 3 shows the increases in APE and actual expenditure of Project B. Figure 4 shows a breakdown of the actual expenditure of Project B.

Figure 3

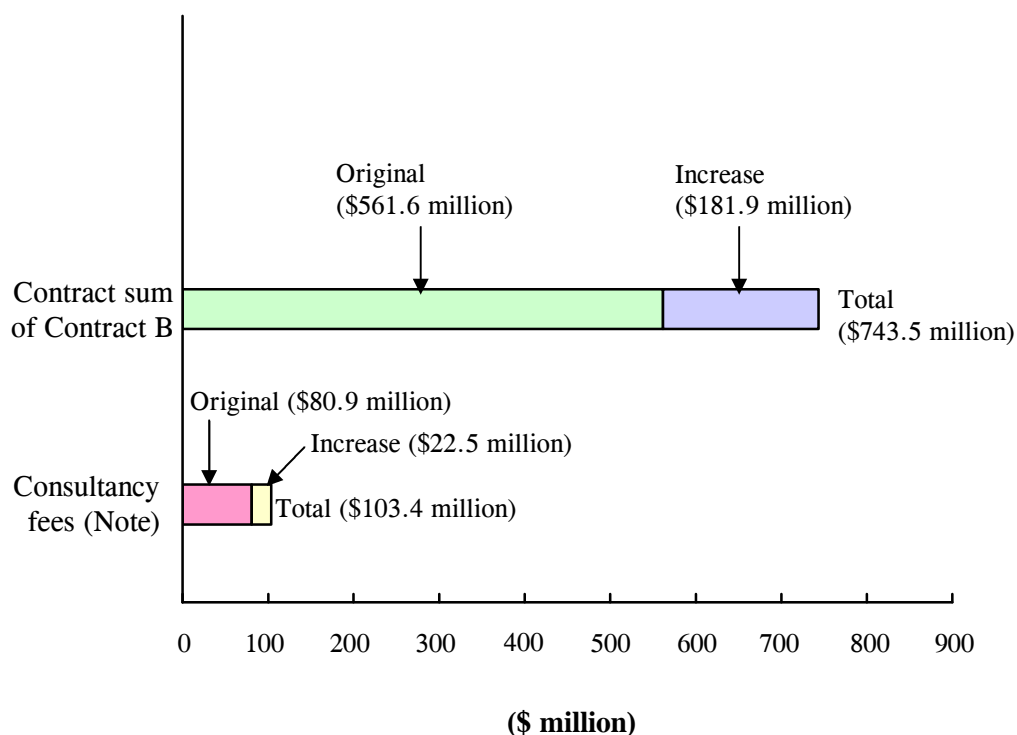
Approved project estimate and actual expenditure of Project B



Source: Audit analysis of HyD records

Figure 4

Actual expenditure of Project B



Source: Audit analysis of HyD records

Note: Consultancy fees included fees for construction supervision and contract administration, and resident site staff costs.

1.16 **Delay in completing Contract B.** Contract B comprised works for two road sections (see Figure 2 in para. 1.2), namely:

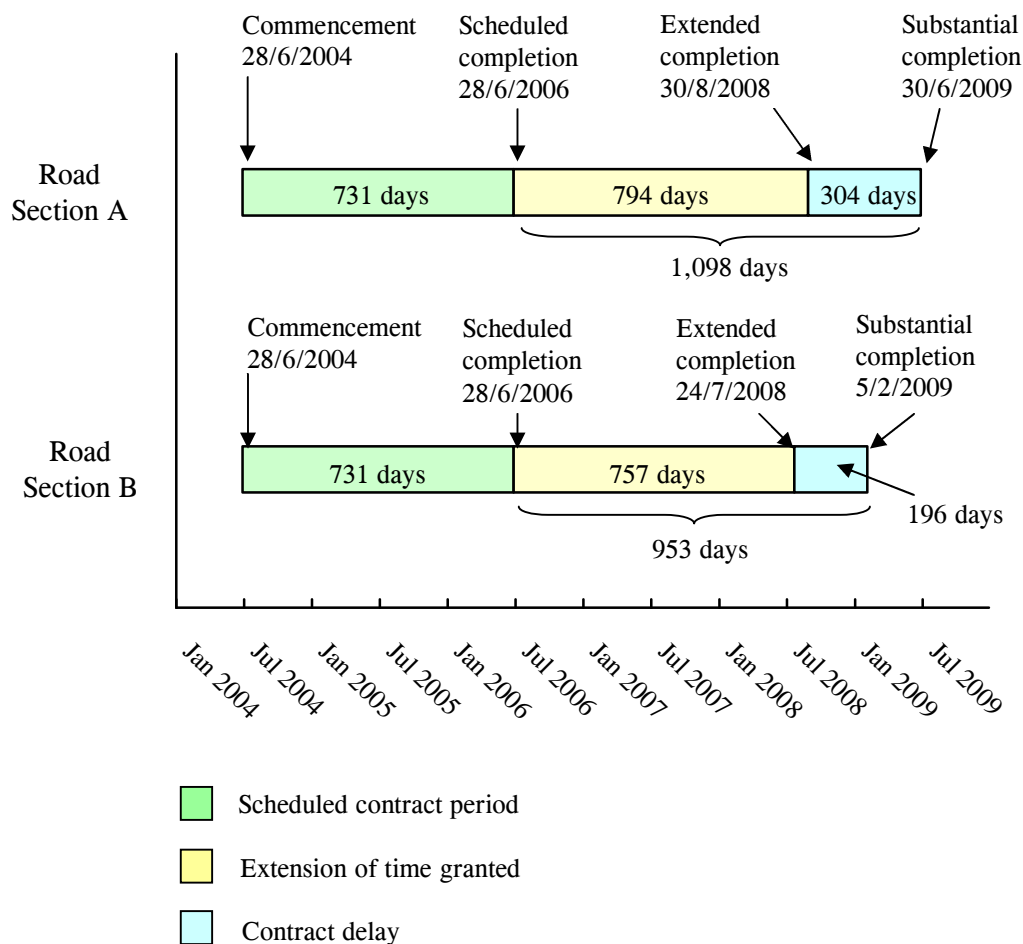
- (a) **Road Section A** running from Lung Tseng Tau to Pak Kung Au; and
- (b) **Road Section B** running from Pak Kung Au to Cheung Sha Sheung Tsuen.

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1.17 According to Contract B, the scheduled completion date of both Road Sections A and B was June 2006, 731 days from commencement of works in June 2004. As it transpired, Road Section A was substantially completed in June 2009 and Road Section B in February 2009, which were 1,098 and 953 days (i.e. about 36 and 32 months) respectively later than the scheduled completion date. Figure 5 shows the time for completing Contract B.

Figure 5

Time for completing Contract B



Source: Audit analysis of HyD records

Audit review

1.18 The TCR Improvement Project was one of the major road projects (costing over \$500 million) implemented by the Major Works Project Management Office of the HyD, with objectives of increasing the traffic capacity and improving the road safety of TCR. It was a high risk project with significant uncertainties and challenges (Note 11). In January 2001, the Administration informed the LegCo Panel on Transport that the widening of TCR was not an easy task in view of the difficult terrain, the potential impact on a country park and other environmentally sensitive areas such as Tung Chung Stream. It is the HyD's target to complete projects on time, within budget and to a high quality standard. In the event, the TCR Improvement Project could not be completed on schedule, with a substantial increase in cost (see paras. 1.14 to 1.17).

1.19 The Audit Commission (Audit) has recently conducted a review of the HyD's planning and implementation of the TCR Improvement Project, focusing on:

- (a) project planning and environmental impact assessment (PART 2);
- (b) project implementation (PART 3);
- (c) adoption of alternative designs (PART 4);
- (d) utilisation of TCR (PART 5); and
- (e) way forward (PART 6).

Audit has found that there are areas where improvements can be made by the HyD in implementing similar road projects in future, and has made a number of recommendations to address the issues.

Note 11: *For example, the works traversed two country parks requiring the successful application of environmental permits and were carried out on hilly terrain, and the road was kept open for two-way traffic during the construction period.*

Acknowledgement

1.20 Audit would like to acknowledge with gratitude the full cooperation of the staff of the HyD, the Agriculture, Fisheries and Conservation Department (AFCD), the CEDD, the EPD, the Planning Department (Plan D) and the TD during the course of the audit review.

PART 2: PROJECT PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT

2.1 This PART examines the HyD's planning of the TCR Improvement Project, focusing on the selection of road alignment.

Decision in 1997 of not adopting on-line widening arrangement

2.2 In March 1997, during the conduct of the feasibility study, with the assistance of Consultant X under Consultancy A (see para. 1.6), the HyD consulted the Country and Marine Parks Board (Note 12) about the proposed works. The Board expressed concerns over the proposed works as they would have adverse impacts on the Lantau South Country Park, and the Board requested the HyD to explore other road options.

2.3 In April 1997, Consultant X submitted an alignment-assessment report to the HyD covering an on-line widening option (a road alignment along existing TCR) and two off-line widening options (meandering road alignments near existing TCR). The report revealed that:

- (a) if the widening of TCR was to be carried out by adopting the on-line widening arrangement, the road would still be substandard with about 500 m of the road having a gradient of 20%. This works arrangement would affect 10 hectares (ha) of the Lantau South Country Park; and
- (b) if the road gradients were to be reduced to acceptable standards (see Note 1 to para. 1.2), an off-line widening arrangement with sharp bends across the Tung Chung Valley would have to be adopted, which would affect 20 ha of the Lantau South Country Park.

Note 12: *The Board is a consultative body to provide advice to the Country and Marine Parks Authority (i.e. the Director of Agriculture, Fisheries and Conservation). The Board is chaired by an academic with members comprising academics, businessmen, professionals and representatives from major environmental groups, trade and industrial associations, and relevant government departments.*

2.4 In May 1997, in view of the Country and Marine Parks Board's concerns and Consultant X's findings (see paras. 2.2 and 2.3), the THB requested the HyD to explore other road options. In August 1997, Consultant X recommended adopting the Tai Ho Wan Option (see para. 1.6) of constructing a new 6-km single two-lane carriageway, which was accepted by the HyD for consultation.

Consultation on Tai Ho Wan Option from 1997 to 2000

Concerns over Tai Ho Wan Option

2.5 In June 1997, the HyD proposed carrying out a consultancy (Consultancy B — see para. 1.6) on the Tai Ho Wan Option and sought Government bureaux and departments (B/Ds)' comments. In the same month, the then Planning, Environment and Lands Branch of the Government Secretariat (now the Development Bureau and the Environment Bureau) and the AFCD raised the following concerns:

Planning, Environment and Lands Branch

- The proposed new route would cut across the Lantau North Country Park, which might receive objection from the Country and Marine Parks Board (see para. 2.2).
- There might be strong objection from green groups if the road link cut across the stream courses in Tai Ho which had been identified to have many species of freshwater fish.

AFCD

- The proposed new route would have considerable environmental, visual and landscape impacts on the country park areas.
- As the proposed route would pass through Tai Ho Wan, it might affect salmonoid fishes (Ayu — Note 13) found in Tai Ho Stream.
- The proposed Tai Ho Wan Option should be discouraged.

Note 13: *Ayu is a migratory fish. According to the International Union for Conservation of Nature, Ayu has a decreasing population trend.*

2.6 In November and December 1997, in response to the HyD's proposed adoption of the Tai Ho Wan Option, the AFCD and the EPD expressed reservations on the grounds that the new road would encroach on the Lantau North Country Park. The EPD also requested the HyD to consider another road alignment in order to reduce the environmental impact.

Conduct of EIA in 1998

2.7 The proposed construction of a new road under the Tai Ho Wan Option was a designated project under the EIAO, which required the HyD to conduct an EIA (see Appendix C for procedures of conducting an EIA). In March 1998, the EPD issued an EIA study brief for the Tai Ho Wan Option setting out the following main requirements for conducting an EIA:

- (a) carrying out necessary environmental surveys, site investigations and background studies to identify, collect and analyse information relevant to the EIA study; and
- (b) proposing practicable, effective and enforceable methods, measures and standards to effectively mitigate significant environmental impacts in the short and long terms.

Concerns of Country and Marine Parks Board in October 1998

2.8 In July 1998, the HyD commissioned Consultancy B at a cost of \$7.5 million (see para. 1.6) to explore possible road alignments from Tai Ho Wan to Mui Wo, recommend a preferred alignment, and carry out a preliminary design and an EIA on the recommended alignment. The EIA report under Consultancy B included 17 alignments for Tai Ho Wan Option and one improved on-line TCR option. In October 1998, the Country and Marine Parks Board expressed concerns over the possible adverse impacts of the proposed Tai Ho Wan Option on the environment.

Concerns of Advisory Council on the Environment in mid-1999

2.9 Between May and July 1999, the Advisory Council on the Environment (ACE — Note 14) expressed reservations on the justifications, the assessment criteria and the environmental impact of adopting the Tai Ho Wan Option. The Council requested the HyD to:

- (a) provide full information from the environmental perspective on the comparison of various options, including widening existing TCR and constructing a tunnel underneath existing TCR, and other route alignments;
- (b) address the concerns over the potential impacts on Tai Ho Stream in Tai Ho Wan and consider all possible mitigation measures; and
- (c) take into account the cumulative impacts that would be caused by the project and the proposed Tai Ho development on Lantau.

Note 14: *The ACE is the Government's principal advisory body on matters relating to pollution control, environmental protection and nature conservation. The ACE is chaired by an academic with members comprising academics, businessmen, professionals and representatives from major environmental groups, and trade and industrial associations.*

Tai Ho Stream designated as a Site of Special Scientific Interest in May 1999

2.10 In January 1999, the AFCD proposed designating Tai Ho Stream as a Site of Special Scientific Interest (SSSI — Note 15) and in February 1999, the Plan D supported the SSSI proposal. In May 1999, the Committee on Planning and Land Development (Note 16) endorsed the AFCD's proposal to designate Tai Ho Stream as an SSSI on the grounds that the stream had a high diversity of fish species including Ayu (see Note 13 to para. 2.5). At a meeting in September 1999, the Committee agreed that a minimal development without reclamation should be planned for Tai Ho South. As a result, the proposed Tai Ho Wan reclamation recommended in the "Remaining Development in Tung Chung and Tai Ho Comprehensive Feasibility Study" (Note 17) was shelved.

Concerns of Plan D and AFCD over EIA report in November 1999

2.11 In October 1999, the Plan D informed the HyD that there might be no reclamation in Tai Ho Wan, and the final scale of development and road pattern in Tai Ho South was subject to further investigation. In November 1999, the HyD submitted an EIA report for the Tai Ho Wan Option for the EPD's approval. The EIA report included:

- (a) mitigation measures to reduce potential impacts on Tai Ho Stream, including measures to minimise disturbance of the seabed, and control discharges of muddy water into Tai Ho Wan; and

Note 15: *The designation of an area as an SSSI is an administrative measure and government B/Ds are required to give due consideration to the scientific and conservation importance of an SSSI in planning developments in or near the area.*

Note 16: *The Committee was chaired by the then Secretary for Planning, Environment and Lands. Its terms of reference include overseeing formulation and review of development strategies, considering the adequacy of development plans and programmes, and approving outline development and layout plans.*

Note 17: *The CEDD carried out the Study from September 1997 to March 1999. The objective of the Study was to investigate the feasibility of intensifying the Tung Chung New Town development for achieving a target population of 320,000 by 2011.*

Project planning and environmental impact assessment

- (b) a comparison of the key environmental implications of 17 alignment options and an upgraded on-line TCR option.

2.12 In November 1999, the Plan D and the AFCD expressed the following concerns over the information in the EIA report:

Plan D

- As there would not be any reclamation or development in Tai Ho Wan (see para. 2.10), the EIA report had to be revised accordingly.
- Considerable significant adverse landscape and visual impacts would be created along the route. Full justifications should be given for not choosing other alignments or construction methods which would have less landscape and visual impacts.

AFCD

- Not all habitats to be affected had been fully described in the EIA report and the impact of the works on them had not been fully evaluated.
- No survey had been conducted on three drainage outfalls which would lead to direct road-surface discharge into Tai Ho Wan.
- It had not been demonstrated that the mitigation measures proposed were feasible and effective.

EIA report not approved by EPD in December 1999

2.13 In December 1999, the EPD informed the HyD that the EIA report did not meet the requirements under the EIAO on the following grounds:

- The proposed road alignment would lead to a substantial habitat loss of woodland and cause adverse ecological impacts in the Tai Ho Wan area and along Tai Ho Stream. The alignment would affect certain areas of ecological significance including Tai Ho Stream which was recognised as one of the most ecologically valuable fresh water streams in Hong Kong. The EIA report had not demonstrated that the adverse environmental effects would be avoided to the maximum practicable extent.
- There was insufficient information in the EIA report to conclude whether the cumulative landscape impact, in particular at Tai Ho Wan, was acceptable or not.
- The report had not provided forecast future traffic demand to address the ACE's concern (see para. 2.9).

2.14 In January 2000, the EPD requested the HyD to carry out further work to address the above concerns, and to consider road options other than the Tai Ho Wan Option. In June 2000, the HyD informed the ACE that:

- (a) the on-line widening of TCR would give rise to a transport safety problem. On the other hand, an off-line widening option would lead to serious encroachment on the Lantau Country Park; and
- (b) the construction of a single-tube tunnel for the Tai Ho Wan Option was accident-prone. Although a twin-tube tunnel would increase traffic capacity substantially, it would incur a much higher construction cost (estimated at \$4.6 billion), which was about three times of that of the Tai Ho Wan Option (estimated at \$1.4 billion), and would lead to local pressure to develop South Lantau.

Submission of revised EIA report in September 2000

2.15 In September 2000, the HyD submitted a revised EIA report for the EPD's approval. In the revised EIA report, the HyD provided further information on alignment comparisons, and proposed further mitigation and enhancement measures to minimise the ecological impact, as follows:

- controlling site runoff to protect the ecology of nearby water courses, including Tai Ho Stream and Lung Mei Hang Stream;
- minimising works areas during construction to reduce habitat damage;
- surveying and translocating Romer's Tree Frogs, Chinese Bull Frogs, Orchids, Pitcher Plants and Chinese New Year Flowers along the route alignment; and
- planting a minimum of 15 ha of woodland to mitigate and provide enhancement for habitat loss.

Concerns of Plan D and AFCD over revised EIA report in late 2000

2.16 The revised EIA report was circulated to the relevant departments, including the Plan D and the AFCD, for comments. In October 2000, the AFCD said that the EIA report had failed to meet the requirements set out in the study brief (see para. 2.7). In October and November 2000, the Plan D also expressed concerns over the revised EIA report. Their main concerns are appended below.

Plan D

- A number of alignment options had been put forward for comparison of their environmental impacts. However, all the options shared the same starting point at Tai Ho and finishing point at Mui Wo, where both areas had some habitats of high ecological significance, particularly the SSSI at Tai Ho Stream.
- Constructing an elevated highway structure against a natural backdrop might cause visual and landscape impacts, and this should be addressed in the EIA study.

AFCD

- A number of habitats affected by the proposed road alignment were found to support rare species. Not all potential impacts had been assessed.
- The effectiveness of many mitigation measures recommended in the EIA report would be subject to assumptions. If any of these mitigation measures was not fully implemented or did not perform as expected, there would be detrimental effects on some important species and habitats.
- The quality and diversity of habitat loss associated with the various alignment options were not fully presented.
- The information provided had not demonstrated that the Tai Ho Wan Option was ecologically better than some other schemes.

Revised EIA report not approved by EPD in November 2000

2.17 In November 2000, the EPD informed the HyD that the revised EIA report did not meet the requirements under the EIAO for reasons appended below.

- The proposed road alignment would cause adverse environmental impacts. It would lead to a substantial habitat loss of woodland and cause adverse ecological impacts in the Tai Ho Wan area and along Tai Ho Stream.
- The proposed mitigation measures were inadequate and ineffective to reduce the environmental impacts to an acceptable level.
- More environmentally preferable alternative in the form of a tunnel was not addressed in the EIA report.

Decision to proceed with the Adopted Option in 2001

2.18 In January 2001, the HyD re-examined the feasibility of widening TCR along the existing alignment. Subsequently, it identified the Adopted Option involving widening the road section of TCR from Lung Tseng Tau to Pak Kung Au and constructing a new road section from Pak Kung Au to Cheung Sha Sheung Tsuen (see para. 1.8).

2.19 The works under the Adopted Option were a designated project under the EIAO (see Note 4 to para. 1.7). In February 2001, the EPD issued an EIA study brief for the proposed works. In April 2001, the HyD appointed Consultant X under Consultancy C at a cost of \$6.9 million to carry out an investigation study, an EIA study and a preliminary design of the project. In November 2001, the HyD consulted the Country and Marine Parks Board on the Adopted Option, which would reduce the affected country park area from 20 ha (for the Tai Ho Wan Option) to 15 ha (for the Adopted Option). The Board did not object to the Adopted Option.

2.20 In April 2002, the HyD submitted an EIA report for the EPD's approval. In June 2002, the ACE endorsed the EIA report. In July 2002, the EPD approved the EIA report. In June 2003, the HyD substantially completed the detailed design for the TCR Improvement Project. Tendering of the works contract subsequently took place and the works were substantially completed in June 2009.

Areas for improvement

2.21 Audit examination of the planning of the TCR Improvement Project revealed the following three areas for improvement:

- (a) road options not thoroughly explored during feasibility study in 1997 (see paras. 2.22 to 2.25);
- (b) inadequate consideration of challenges for carrying out works in areas of ecological significance (see paras. 2.26 and 2.27); and
- (c) project feasibility not critically re-examined after significant changes in circumstances (see para. 2.28).

Road options not thoroughly explored during feasibility study in 1997

2.22 The HyD noted from the 1997 consultancy study that adopting the on-line widening arrangement (see para. 2.3) would affect 10 ha of the Lantau South Country Park, and result in a road section of about 500 m having a gradient of 20%, which did not meet the TD's guidelines for safe operation of buses and other vehicles. On the other hand, an off-line widening arrangement would affect 20 ha of the country park, although the road gradients would be reduced to acceptable standards (see para. 2.3(b)). As a result, from 1997 to 2000, the HyD engaged two consultancies (Consultancy A and Consultancy B) at a total cost of \$9 million (\$1.5 million + \$7.5 million — see para. 1.6) to identify and carry out the preliminary design of the Tai Ho Wan Option, and conduct an EIA and consultations. However, owing to the failure to meet the requirements under the EIAO, in 2001, the HyD needed to re-examine the feasibility of widening TCR along the existing alignment and identified the Adopted Option (see para. 2.18).

2.23 In January and March 2013, the HyD and the TD informed Audit that:

HyD

- (a) it had conducted a thorough examination and a comprehensive assessment of alternative options in order to arrive at the best practical engineering solution for the Project. The Adopted Option was less desirable than the Tai Ho Wan Option in terms of road-design standards and engineering difficulties, but it was a compromised option to meet the public transport demand for early implementation of the project;
- (b) to identify a north-south link traversing Lantau North Country Park and Lantau South Country Park was a very complicated and time consuming task as there was a need to balance various constraints and requirements, including requirements introduced under the EIAO in April 1998, designation of Tai Ho Stream as an SSSI in May 1999, and changes in development planning during the period. As the HyD needed to thoroughly examine alternative alignments, it took time before reaching consensus. The Adopted Option was evolved after examining other possible alternative alignment options;
- (c) there were projects which had been successfully implemented in areas of ecological significance. The designation of Tai Ho Stream as an SSSI was made at a very late stage of the investigation study of the project. During the preparation of the revised EIA report, the HyD had diligently proposed mitigation measures for the Tai Ho Wan Option with a view to satisfactorily addressing the concerns raised by various parties. The HyD promptly reverted to the Adopted Option after the Tai Ho Wan Option had been confirmed to be not viable following the disapproval of the revised EIA report;

TD

- (d) the new single two-lane road for two-way traffic all the way had greatly improved the TCR by removing sharp bends, improving visibility, and reducing the gradient to acceptable standards where it was feasible to do so. The new road with much improved geometry was acceptable to the TD. An old road section of about 2.5 km long with gradients of 15% to 20% had been replaced. Due to difficult terrains, the road gradients could only be reduced to within 15% and additional management facilities

(such as arrester beds on downhill sections, road barriers and larger traffic signs) had been installed; and

- (e) the Transport Planning and Design Manual provided information and guidance for the planning and design of transport infrastructures in Hong Kong. The standards promulgated in the Manual should not be followed rigidly but rather should be treated as a framework within which professional judgement should be exercised to reach an optimum solution.

2.24 Audit noted that the estimated construction cost of the Tai Ho Wan Option (\$1.4 billion) was 61% higher than that of the Adopted Option (\$0.87 billion). In January 2001, the Administration informed the LegCo Panel on Transport that the Adopted Option was the most promising solution which was practicable, quick for implementation and cost-effective. However, Audit could not find records showing that the Adopted Option had been identified and examined during the feasibility study in 1997. In Audit's view, had the Adopted Option been identified and compared with other options during the feasibility study in 1997, this road option might have been chosen at that time without the need for the HyD to:

- (a) incur a total additional expenditure of \$9 million in undertaking Consultancy A and Consultancy B for the design and investigation of the Tai Ho Wan Option;
- (b) spend more than three years from mid-1997 to late 2000 to examine the Tai Ho Wan Option which was eventually abandoned. This has caused a significant delay to completion of the TCR Improvement Project and provision of a better road facility for use by members of the public; and
- (c) carry out the works under Project B under time pressure to complete the road works as early as possible as three years had already lapsed before re-examining the widening of TCR along the existing alignment.

2.25 Audit considers that, in planning a similar road project in future, the HyD needs to conduct a more thorough examination at the planning stage with a view to identifying all feasible options for comparison and choosing the most practicable and cost-effective one.

Inadequate consideration of challenges for carrying out works in areas of ecological significance

2.26 According to the EPD, the potential adverse environmental impacts of the Tai Ho Wan Option included a substantial habitat loss of woodland, adverse impacts on areas of ecological significance including Tai Ho Stream (which was designated as an SSSI), disturbance and a loss of habitat of protected or rare species, and encroachment on the Lantau Country Park. Other government departments and advisory bodies including the Planning Department, the AFCD, the Country and Marine Parks Board and the ACE had also raised reservations over the Tai Ho Wan Option during consultations and the EIA studies from 1997 to 2000.

2.27 Audit notes that one of the major concerns of the parties raising reservations over the Tai Ho Wan Option was that this Option would affect certain areas of ecological significance including Tai Ho Stream. In this connection, Works Bureau Technical Circular No. 18/98 of October 1998 has stipulated that a works department needs to take into account the views of the ACE in conducting an EIA. Given that there is a high risk in planning works that will affect areas of ecological significance, the HyD needs to heighten vigilance in planning a road project that will potentially affect areas of ecological significance in future.

Project feasibility not critically re-examined after significant changes in circumstances

2.28 In June 1997, both the then Planning, Environment and Lands Branch and the AFCD indicated that the Tai Ho Wan was an ecologically sensitive area and did not support the Tai Ho Wan Option (see para. 2.5). In May 1999, Tai Ho Stream was designated as an SSSI on the grounds that the stream had a high diversity of fish species. As a result, the proposed reclamation in the Tai Ho Wan area was shelved (see para. 2.10). In Audit's view, the designation of Tai Ho Stream as an SSSI and the shelving of the reclamation proposal in the Tai Ho Wan area in mid-1999 had constituted significant changes in circumstances in the pertinent area which would affect the viability of the Tai Ho Wan Option. However, the HyD took another 19 months (from May 1999 to December 2000) to further pursue the Option before abandoning it.

Audit recommendations

2.29 **Audit has *recommended* that, in planning a road project in future, the Director of Highways should:**

- (a) **conduct thorough examination with a view to identifying all feasible options for comparison and choosing the most practicable and cost-effective one for implementation;**
- (b) **heighten vigilance in planning works that will affect areas of ecological significance; and**
- (c) **re-examine the viability of a chosen project option when there are significant changes in circumstances.**

Response from the Administration

2.30 The Director of Highways agrees with the audit recommendations. He has said that the HyD has taken action and will continue to:

- (a) conduct thorough examination of feasible options for road projects, and pay particular attention to projects involving areas of ecological significance; and
- (b) critically review the feasibility of project options when there are significant changes in circumstances.

PART 3: PROJECT IMPLEMENTATION

3.1 This PART examines the HyD's implementation of the TCR Improvement Project, focusing on the significant delay in completing Project B and the increase in project cost.

Project cost and completion time

3.2 Project A was completed within the original budget and largely on schedule (see para. 1.11). For Project B, Contract B was awarded in June 2004, targeting for completion in June 2006 at an estimated cost of \$561.6 million. As it transpired, Contract B was substantially completed in June 2009 and the final contract cost was \$743.5 million. There was however a 36-month delay and a 32% cost increase in completing Contract B works.

Cost increases of Contract B

3.3 As mentioned in paragraph 1.15, total additional funding sought after commencement of works was \$176.6 million. Table 1 shows the justifications provided by the HyD to the FC in applying for the additional funding.

Table 1
Justifications for increasing the APE of Project B

Justifications	Amount (\$ million)
(a) Contract price fluctuation (Note)	122.9
(b) Works variations to suit actual site conditions	30.1
(c) Increase in consultancy fee	23.6
Total	176.6

Source: Audit analysis of HyD records

Note: Contract B adopted a contract-price fluctuation adjustment system, under which payments to the contractor would be adjusted according to the “Index Numbers of the Costs of Labour and Materials used in Public Sector Construction Projects” published by the Census and Statistics Department.

3.4 According to the contract account finalised in November 2012, the expenditure under Contract B amounted to \$743.5 million, which was 32% higher than the original contract sum of \$561.6 million. The contract cost increase was mainly due to reasons shown in Table 1.

Delay in completing Contract B

3.5 Contract B comprised works for two road sections, namely:

- (a) **Road Section A** running from Lung Tseng Tau to Pak Kung Au; and
- (b) **Road Section B** running from Pak Kung Au to Cheung Sha Sheung Tsuen (see Figure 2 in para. 1.2).

3.6 As mentioned in paragraph 1.17, Road Sections A and B under Contract B had taken additional 1,098 and 953 days respectively for completion. Extension of time (EOT) had been granted and liquidated damages had been imposed (see paras. 3.7 and 3.8).

3.7 **EOT granted.** After examining the justifications provided by Contractor B, the HyD granted 794 days and 757 days of EOT for works under Road Section A and Road Section B respectively. According to the Project Administration Handbook for Civil Engineering Works (see Note 7 to para. 1.10), an EOT granted (Note 18) for completion of a works contract in effect will deprive the Government of the right to impose liquidated damages on the contractor for a delay in completing the works (for the period of the EOT) and therefore has a financial implication. Table 2 shows an analysis of the EOT granted.

Note 18: *An EOT is normally granted for inclement weather or works variations instructed by the Engineer (Consultant Y in Contract B).*

Table 2
EOT granted to Contractor B

Reason	EOT granted (days)	
	Road Section A	Road Section B
(a) Inclement weather and related repair works (Note 1)	337	240
(b) Design changes and works variations		
(i) Constraints on construction owing to insufficient vehicle permits	209	143
(ii) Substantial increases in piling obstruction	N/A	134
(iii) Changes in bridge alignments to avoid existing streams	94	115
(iv) Others (Note 2)	154	125
Total	794	757

Source: Audit analysis of HyD records

Note 1: In April and June 2008, heavy rainstorms took place on some parts of Lantau Island, causing damage to newly-completed TCR under Contract B. As a result, Contractor B took time to carry out repair works for the damage.

Note 2: These included design changes in slope works, retaining walls and road furniture.

Project implementation

3.8 **Liquidated damages.** For the remaining 304 days (1,098 days less 794 days) and 196 days (953 days less 757 days) of contract delays for Road Sections A and B respectively, the HyD imposed liquidated damages totalling \$26.2 million according to the provisions in Contract B. Figure 5 in paragraph 1.17 shows an analysis of the time for completion of the two road sections. In February 2009, the whole road section under Project B was open for public use (Note 19). In June 2009, the works under Contract B were substantially completed at a cost of \$743.5 million (Note 20).

Areas for improvement

3.9 As shown in Table 2 in paragraph 3.7, additional 337 days and 240 days were required for completing Road Sections A and B respectively owing to inclement weather and the related repair works, which were outside the control of the HyD. However, Audit has identified the following issues:

- (a) as shown in Figure 5 in paragraph 1.17, there were contract delays of 304 days and 196 days in completing Road Sections A and B respectively. According to the HyD, Contractor B's slow progress of work during the initial stage of works was accountable for these delays (see paras. 3.10 to 3.13);
- (b) there were insufficient road permits to meet the excavation programme (see paras. 3.14 to 3.20); and
- (c) there was limited site investigation before award of Contract B (see paras. 3.21 to 3.28).

The latter two factors led to the granting of substantial EOTs and consequential prolongation costs to the contractor.

Note 19: *According to the HyD, Contract B works relating to road traffic were completed in February 2009, and the remaining works in June 2009.*

Note 20: *The account of Contract B was finalised in November 2012.*

*Contractor's slow progress of work
during the initial stage of works*

3.10 According to the HyD, it had closely monitored Contractor B's performance and taken regulatory action against him. For instance, from June 2004 to August 2006, mainly attributable to slow work progress and insufficient resource deployment, the HyD had issued seven unsatisfactory performance reports on Contractor B, including two consecutive reports in 2005 and 2006, which led to enhanced monitoring of Contractor B's performance on a six-weekly basis. The HyD and Consultant Y had also held regular meetings, issued warning letters and conducted top-level interviews with Contractor B.

3.11 The slow work progress and insufficient resource deployment from June 2004 to August 2006 had a knock-on effect on subsequent works progress, resulting in a substantial delay in opening the improved Road Sections A and B for public use. In addition, the prolonged road works during the period had caused inconvenience and nuisance to users of TCR. As a result, liquidated damages totalling \$26.2 million were imposed on the contractor for the contract delays.

3.12 At a LegCo Panel on Transport meeting in December 2006, a Member said that the delay of the project was mainly due to lax supervision in the initial years of works. He requested the HyD to ensure that the project would be completed on schedule. In response, the HyD said that:

- (a) Contractor B was required to submit a plan for management of the sub-contractors; and
- (b) with the change of management staff of Contractor B in early 2006, there was marked improvement in the supervision of the project.

3.13 In Audit's view, the HyD needs to strengthen its monitoring of a contractor's performance and explore measures to minimise any contract delays caused by a contractor's slow progress in carrying out works.

Insufficient road permits to meet excavation programme

3.14 During the contract period June 2004 to June 2009, TCR covered by Contract B was largely a closed road and a prohibited zone where vehicle users were required to apply from the TD for:

- (a) a closed-road permit for using the road section during any time of a day; and
- (b) a prohibited-zone permit for using the road section from 8 am to 6 pm every day.

3.15 During the planning for Project B, the HyD had estimated the number of closed-road permits and prohibited-zone permits required for construction and delivery vehicles of Contract B. After seeking the views of the TD on the Traffic Management Schemes for the construction work and taking into account the estimated number of permits required, the HyD specified in Contract B the number of closed-road permits and prohibited-zone permits that could be made available at the initial project stage. With a view to preventing traffic accidents and minimising nuisance caused to the public during the construction period, the Traffic Management Liaison Group for Contract B (comprising representatives from the TD, the Hong Kong Police Force and the HyD) would examine, among other things, Contractor B's applications for road permits. In October 2004, Contractor B commenced applying for the road permits. After examining the traffic conditions, the TD had progressively increased the number of road permits issued to Contractor B (the number of closed-road permits and that of prohibited-zone permits issued during a particular period were the same). However, the actual number of road permits issued to Contractor B during the first five months of construction (November 2004 to March 2005) was less than that specified in Contract B (see para. 3.16). Details are shown in Table 3.

Table 3

Road permits from Monday to Friday excluding public holidays (Note)
(June 2004 to November 2005)

Hour	Estimated number specified in Contract B	Actual number granted per day							
		Jun to Oct 04	Nov 04	Dec 04	Jan to Feb 05	Mar 05	Apr to Jul 05	Aug to Oct 05	Nov 05
8:00 to 8:59 am	—	—	—	—	—	—	—	—	26
9:00 to 10:59 am	16	—	3	16	16	16	16	16	26
11:00 am to 1:59 pm	26	—	3	16	16	17	21	26	36
2:00 to 3:59 pm	16	—	3	16	16	16	16	16	26
4:00 to 4:59 pm	—	—	3	16	16	16	16	16	26
5:00 to 5:59 pm	—	—	—	—	—	—	—	—	26

Source: Audit analysis of HyD records

Note: A road permit in this Table comprises a closed-road permit and a prohibited-zone permit. Contract B also specified the number of road permits for Saturdays, Sundays and public holidays, and road permits for such days were also granted during the construction period. For simplicity, such information is not shown in this Table.

Project implementation

3.16 Based on the number of permits and hours of permit shown in Table 3, the estimated permit-hours specified in Contract B and the actual permit-hours (from Monday to Friday excluding public holidays) are appended as follows:

Estimated permit-hours per day according to Contract B	Actual permit-hours per day							
	Jun to Oct 04	Nov 04	Dec 04	Jan to Feb 05	Mar 05	Apr to Jul 05	Aug to Oct 05	Nov 05
142	0	24	128	128	131	143	158	290

Source: Audit analysis of HyD records

3.17 It can be seen that the minimum of 142 permit-hours per day according to Contract B had only been provided from April 2005 onwards. In May 2006, Contractor B claimed EOTs due to insufficient number of road permits issued to him during the initial stage of the contract and for the resulting delay to the progress of excavation works for roads and drains. In October 2007, the HyD employed an Independent Quantity Surveyor to assess Contractor B's claim. Based on the Surveyor's assessment, the HyD granted EOTs of 209 days and 143 days for Road Sections A and B respectively for the claim (see Table 2 in para. 3.7).

3.18 Although Contract B stated that Contractor B was required to obtain the necessary road permits at its expense to meet the works programme, the insufficient number of road permits issued to Contractor B from November 2004 (24 permit-hours per day) to October 2005 (158 permit-hours per day) had adversely affected the work progress, causing delays of 209 days and 143 days in completing Road Sections A and B respectively, and leading to prolongation cost of \$25.8 million (Note 21). Sufficient number of road permits had not been issued until November 2005, after which 290 or more permit-hours per day had been issued to Contractor B to meet the need of the excavation programme.

Note 21: *According to the HyD, the daily overhead costs of Road Sections A and B were \$70,000 and \$78,000 respectively. Therefore, the total prolongation cost was \$25.8 million (209 days × \$70,000 + 143 days × \$78,000).*

3.19 In January and March 2013, the HyD and the TD informed Audit that:

HyD

- (a) the slippage in approving road permits was partly due to Contractor B's delay in mobilising equipment to site, late submissions of permit applications (first permit application made in October 2004) and a permit management plan with updated survey data;
- (b) more road permits were actually required than that specified in Contract B because of increases in quantities of boulders and rocks requiring disposal, and the need for Contractor B to accelerate works to catch up the works slippage (see para. 3.10);

TD

- (c) in accordance with the provision of Contract B, Contractor B was required to work out and submit a permit management plan with updated traffic survey data. The Traffic Management Liaison Group (see para. 3.15) considered on a case-by-case basis the number of road permits to be issued, having regard to the justifications in the permit management plan submitted by Contractor B; and
- (d) all applications for road permits submitted by Contractor B from October 2004 to November 2005 had been granted, and there was no discrepancy between the number of road permits applied for and the number of road permits issued. The TD issued road permits in a timely manner, and there had not been any delay in issuing the road permits required upon receiving the full sets of supporting documents (e.g. valid vehicle registration documents) for road permit applications. The TD, as the permit issuing authority, had to take a number of factors into consideration when issuing the permits, such as the prevailing traffic situation, spare road capacity, road safety concern, nuisance caused to the public, and construction details proposed by the works agent. The TD believed that this was necessary to protect the public interest.

Project implementation

3.20 According to the HyD's Independent Quantity Surveyor, the number of road permits actually required for the excavation programme should be more than that specified in Contract B, and Contractor B had a reasonable expectation that it would have a sufficient number of road permits for carrying out the works in order to meet the excavation programme (see para. 3.17). As a result of the insufficient number of road permits issued to Contractor B from November 2004 to October 2005, the HyD granted EOTs of 209 days and 143 days for Road Sections A and B respectively. In Audit's view, in implementing a road project in future, the HyD needs to take measures, in consultation with the TD, to ensure that sufficient number of road permits are specified in a contract and issued to the contractor.

Limited site investigation before contract award

3.21 In December 2002, the HyD awarded a contract for carrying out site investigation for Project B at a cost of \$11 million (Note 22). Based on the ground investigation results, Consultant Y carried out the works design and cost estimation, and prepared the tender documents for Contract B. The works design later formed part of Contract B. After commencement of works, the actual site conditions were however found significantly different from those identified in the site investigation. The following are some examples:

- (a) the actual quantity of boulders for excavation was 5,800 cubic metres (m^3), which was 863% greater than the estimated quantity of 602 m^3 ; and
- (b) the actual quantity of rocks for excavation was 52,800 m^3 , which was 41% greater than the estimated quantity of 37,412 m^3 .

3.22 The significant increases in the quantities of boulders and rocks for excavation led to an increase in contract cost of \$30.1 million and affected the piling works. These resulted in the grant of 134 days of EOT (see Table 2 in para. 3.7) and payment of \$10.5 million ($\$78,000 \times 134$ days) of prolongation cost for works under Road Section B. In January 2007, in seeking additional funding of \$143.5 million for Project B (see para. 1.14(a)), the Administration informed the FC that:

Note 22: *The actual expenditure was \$9.9 million.*

- (a) the progress of works had not kept pace with the original programme due to difficult site conditions and difficulties in dealing with unforeseen situations. Unexpected difficulties in various site areas were encountered because of limited pre-contract site investigation and topographical surveys, which were carried out under very restrictive conditions in the site areas; and
- (b) the very narrow access roads within the country parks did not permit the use of large-size investigation equipment. The actual site conditions were not known until the commencement of the construction contract and after clearance of the trees and undergrowth.

3.23 In January 2013, the HyD informed Audit that:

- (a) for Contract B, \$9.9 million (or 1.76% of the estimated contract sum of \$561.6 million) was spent on pre-contract site investigation, which had covered all accessible points in the country parks. The amount spent on the pre-contract site investigation was considered reasonable and adequate for the road project; and
- (b) when seeking funding approval for implementing Project B in June 2003, the Administration had informed the FC that the quantities of foundation and earthworks were subject to variations according to actual ground conditions, and works under Contract B were tendered under a re-measurement contract. The increase in the actual quantities of boulders and rocks was mainly due to difficulties of carrying out site investigation in areas of highly vegetated valleys. No tree or shrub cutting was allowed within the country parks before the land was allocated to the project.

3.24 Audit noted that although \$9.9 million had been spent on site investigation, the actual ground condition had not been adequately examined because felling of trees in the country-park areas was not permitted before occupation of works site. In the event, ground conditions were found significantly different during construction. According to FC paper of January 2007, the pre-contract site investigation and topographical survey had been carried out under restrictive conditions (see para. 3.22(a)).

Project implementation

3.25 In Audit's view, if similar constraints are encountered in future in carrying out site investigation for a road project, the HyD needs to closely liaise with the AFCD with a view to exploring arrangements for acquiring more thorough site information before contract award.

3.26 Furthermore, according to Environment, Transport and Works Bureau (ETWB) Technical Circular (Works) No. 17/2004 on "Impossibility/Unforeseen Ground Conditions/Utility Interference" of June 2004, works departments should observe the following guidelines on risk management with reference to unforeseen ground conditions:

- (a) project officers should arrange to carry out all necessary site investigations and satisfy themselves that sufficient ground information has been made available prior to commencement of the detailed design. The extent of ground investigation and/or geotechnical analysis should be adequate for estimating construction cost and duration to an acceptable degree of accuracy; and
- (b) for practical reason such as works site not yet cleared or not available during the design stage, it may be desirable for the project officers to have more site investigation data or utility search after the occupation of the works site with a view to verifying the ground condition and hence confirming the design (confirmatory site investigation) prior to tender. Following contract commencement, such investigation works should be kept to a minimum, preferably confined to those needed to confirm a design.

3.27 The limited site investigation had not revealed the significant quantity of boulders and rocks to be excavated, resulting in a substantial cost increase and longer time required for completing works for TCR, and causing a delay in providing an improved road facility and inconvenience and nuisance to road users. Contract B was awarded in the same month of the issuing of ETWB Circular No. 17/2004. Owing to the restrictions in the country-park areas, only limited pre-contract site investigation and topographical surveys had been carried out. Based on the principles outlined in the Circular, if the works site under Contract B was not made available during the design stage, the HyD should conduct additional site investigation after the occupation of the works site and prior to tender. However, Audit noted that such investigation had not been carried out in the case of Contract B.

3.28 In March 2013, the HyD informed Audit that:

- (a) ETWB Technical Circular (Works) No. 17/2004 was not applicable to Contract B which had been tendered before the promulgation of the Technical Circular. It was not a normal practice to have site possession for a road project before contract award (although temporary land allocation subject to site availability or constraints could be obtained to carry out site investigation as far as practicable). Quite often, additional site investigation could not be carried out due to inaccessibility problems (such as the TCR Improvement Project). Under such circumstances, the HyD would conduct further site investigation after the contract commenced; and
- (b) for projects similar to the TCR Improvement Project, the HyD would conduct pre-contract site investigation as far as practicable where site conditions permitted. The HyD would also conduct risk assessments to analyse the probable variations that might be encountered during construction and would make adequate provision in the tender and budget.

Audit considers that, if a works site is not available for conducting adequate site investigation during the design stage, the HyD needs to conduct additional site investigation before contract award as far as practicable.

Audit recommendations

3.29 **Audit has *recommended* that the Director of Highways should, in implementing a road project in future where project delays will lead to significant adverse impacts:**

- (a) **strengthen the monitoring of the contractor's performance and explore measures to minimise any contract delays caused by the contractor's slow progress in carrying out works;**
- (b) **in consultation with the Commissioner for Transport, take measures to ensure that sufficient number of road permits are specified in the works contract and issued to the contractor, where applicable;**

Project implementation

- (c) **if works are to be carried out within country-park areas, closely liaise with the Director of Agriculture, Fisheries and Conservation with a view to exploring arrangements for acquiring more thorough site information before contract award; and**
- (d) **if a works site is not available for conducting adequate site investigation during the design stage, conduct additional site investigation before contract award as far as practicable.**

Response from the Administration

3.30 The Director of Highways agrees with the audit recommendations. He has said that the HyD has taken action to implement the audit recommendations.

3.31 The Commissioner for Transport has said that the TD will continue to work closely with works departments when the TD's assistance is needed, and will not unnecessarily withhold issuing road permits required for their works.

3.32 The Director of Agriculture, Fisheries and Conservation agrees with the audit recommendation in paragraph 3.29(c).

PART 4: ADOPTION OF ALTERNATIVE DESIGNS

4.1 This PART examines issues relating to the adoption of alternative designs after the award of Contract B.

Contractor's alternative design

4.2 According to the HyD:

- (a) contract works are normally carried out in accordance with the Engineer's design (conforming design). A contractor may offer an alternative design if he considers that he can provide the Government with a more cost-effective works design; and
- (b) most alternative designs were related to changes in the piling method for the purpose of suiting a contractor's available resources. The contractor's reasons for adopting an alternative design may include increasing his profit, facilitating construction and saving construction time. The contractor may propose an alternative design during the tender stage, or during construction.

In 2001 and 2004, the Government issued two circulars for accepting alternative designs at the tender stage and during construction (see paras. 4.3 and 4.4).

2001 Technical Circular

4.3 Works Bureau Technical Circular No. 2/2001 on Designs and Alternative Designs by Tenderers (2001 Technical Circular) issued in February 2001 stipulated that, among other things:

- (a) where there was potential for better value for money, departments might invite tenderers to submit tenders incorporating their own alternative designs for a certain part of the works notwithstanding that a design of the works had been provided; and

Adoption of alternative designs

- (b) an alternative design might be accepted provided that it was cost effective on a whole-life basis.

2004 Technical Circular

4.4 ETWB Technical Circular (Works) No. 25/2004 issued in August 2004 on Contractors' Designs and Alternative Designs (2004 Technical Circular) embodied and replaced 2001 Technical Circular. In addition to guidelines on accepting alternative designs at the tender stage (see para. 4.3), 2004 Technical Circular also stipulates the following guidelines on accepting alternative designs after contract award:

- (a) the alternative designs should have no additional cost implications;
- (b) works departments are encouraged to consider the option of inviting tenderers of works contracts to submit alternative designs during tendering, where there is potential for better value for money;
- (c) as the Government will only get 50% of the resulting cost saving, it is always preferred that all alternative designs are duly considered during the design and tender stages;
- (d) reasons as to why the designer did not propose such alternative designs during the design stage should be noted;
- (e) justifications for accepting alternative designs should be properly documented for future reference and auditing purposes; and
- (f) Special Conditions of Contract should be included in the tender document, which allow the Government to accept alternative designs submitted by a contractor after contract award, including:
 - (i) an accepted alternative design shall have a lump sum cost supported by a schedule of rates. The resulting saving in cost, if any, shall be shared between the Government and the contractor; and

- (ii) the acceptance of the alternative designs shall not entitle the contractor to claim additional costs or EOT.

In January 2009, the Development Bureau issued a Circular Memorandum (2009 Development Bureau Circular Memorandum) which promulgates a requirement that all works departments need to properly document the justifications for not inviting tenderers to submit alternative designs for future reference and auditing purposes.

Negotiation over alternative designs from 2004 to 2009

4.5 Contract B mainly comprised works for constructing roads, drainage systems, bridges, piling foundations, and landslide-prevention structures. Detailed designs of works prepared by Consultant Y (see para. 1.11) had been incorporated into the tender documents for Contract B, which subsequently formed part of Contract B. There was no provision in the tender documents inviting tenderers to submit alternative designs for any works item. In June 2004, the HyD awarded Contract B to Contractor B.

4.6 In July 2004, Contractor B proposed to the HyD for adopting alternative designs mainly for the following works items:

- (a) construction of 15 of the 21 bridges (Note 23) and the associated foundations works; and
- (b) piling foundation works for landslide-prevention structures.

Note 23: *Under Contract B, a bridge is a road section above ground level which is supported by an abutment at both ends.*

Adoption of alternative designs

4.7 The main differences between the original designs (conforming designs) included in Contract B and the alternative designs are shown in Table 4.

Table 4
Differences between original designs and alternative designs

Works item	Original design	Alternative design
Bridge foundation structures	Using piles of 1.5-m diameter (10 m to 25 m underground)	Using piles of 0.6-m diameter (10 m to 40 m underground)
Bridge structures	Using precast beams (Note)	Casting beams on site

Source: HyD records

Note: A beam is a long thick concrete bar used to support a bridge deck.

4.8 In September 2004, Contractor B submitted nine packages of conceptual alternative designs to the HyD for approval, comprising four for slope structures, four for 15 bridges and one for 6 landslide-prevention structures. Subsequently, the HyD informed Contractor B that the four packages of alternative designs for slope structures could not be accepted for implementation. Regarding the remaining five packages of alternative designs, after negotiations from October 2004 to November 2009, the HyD and Contractor B entered into a supplementary agreement in December 2009 for the alternative-design works. However, during the negotiation period, the HyD had granted four approvals in principle to Contractor B from June to November 2005 for carrying out the alternative-design works (see Table 5). In the event, Contractor B commenced the alternative-design works in June 2006 before the finalisation of the supplementary agreement.

Table 5

**Five packages of alternative-design works
(June to November 2005)**

Works Package	Works	Approval sought by Contractor B on	Approval in principle granted by HyD on
A	1 bridge	4.5.2005	3.6.2005
B	4 bridges	30.5.2005	17.6.2005
C	5 bridges	8.7.2005	8.8.2005
D	5 bridges	10.8.2005	(Note)
E	6 landslide-prevention structures	23.9.2005	14.11.2005

Source: HyD records

Note: On 2 September 2005, the HyD informed Contractor B that approval in principle could not be given for Works Package D because the submitted information was not adequate. Nevertheless, the two parties entered into a supplementary agreement in December 2009 which settled all the related issues.

Adoption of alternative designs

4.9 According to the HyD, the granting of approvals in principle to Contractor B indicated that the alternative designs were technically feasible, and the approvals would serve as consents to allow the contractor to proceed with the alternative-design works pending finalisation of a supplementary agreement. The approvals in principle included the following conditions:

- (a) any works in relation to the alternative designs before acceptance by the HyD should be carried out at Contractor B's own risk and cost, and any claim for abortive designs should not be entertained by the HyD; and
- (b) Contractor B should provide a confirmation of a guaranteed minimum cost saving to the HyD.

4.10 During the negotiation over the terms of adopting the alternative designs, Contractor B informed the HyD in October 2004 that there would be a cost saving of \$12 million, but no time saving, from adopting the alternative designs, and Contractor B agreed to share the cost saving equally with the Government. Contractor B and the HyD continued the negotiation and finally entered into a supplementary agreement in December 2009 under which the HyD would eventually pay a sum of \$150.42 million for the alternative-design works (the same cost as the original-design works) plus a sum of \$31 million for price-fluctuation adjustments.

Areas for improvement

Tenderers not invited to propose alternative designs

4.11 According to 2001 Technical Circular (which was in force at the time of inviting tenders for Contract B in October 2003), where there was potential for better value for money, departments might invite tenderers to submit tenders incorporating their own alternative designs for certain parts of the works (see para. 4.3(a)). As it transpired, although tenderers had not been invited to submit alternative designs during the tender stage, the HyD accepted alternative designs proposed by Contractor B after awarding the contract. In Audit's view, in

administering a works project in future, the HyD should invite tenderers to submit alternative designs during the tender stage as far as possible, because this arrangement will:

- (a) enhance competitive tendering as all tenderers will be given equal opportunities to submit their alternative designs for consideration; and
- (b) the Government will only be entitled to 50% of the cost saving arising from adopting alternative designs proposed by a contractor after contract award.

4.12 Audit could not find records showing the justifications for not inviting tenderers to submit alternative designs during the tender stage of Contract B. In January 2013, the HyD informed Audit that:

- (a) Project B was under a very tight schedule and timely completion of the tender assessment was critical. Inviting alternative designs at that time would involve additional time and cost. Therefore, it was not appropriate to invite alternative designs under Contract B at the tender stage;
- (b) since the expertise for bored piling was commonly available in the market, it did not warrant inviting alternative designs. Such designs were normally applicable to part of works in specialist or developing field according to 2001 Technical Circular, which was in force during the tendering of Contract B in 2003; and
- (c) the prevailing practice in 2003 (during the tendering of Contract B) was for a works department to provide justifications if alternative designs were invited (which required approval from an officer of D2 or above), and not vice versa.

4.13 The 2004 Technical Circular required a works department to critically consider the option of inviting tenderers to submit alternative designs at the tender stage where there is potential for better value for money (see para. 4.4(b)). Additionally, the 2009 Development Bureau Circular Memorandum further required works department to document the justifications for not doing so (see para. 4.4). Although the requirements stipulated in 2004 Technical Circular and 2009

Adoption of alternative designs

Development Bureau Circular Memorandum are good practices in contract administration, they had not been issued at the time of inviting tenders for Contract B in 2003. In Audit's view, had the HyD applied the good practice of inviting alternative designs at the tender stage, it would have enhanced competitive tendering under Contract B.

Delay in entering into supplementary agreement

4.14 Audit noted that there were no provisions in the 2001 Technical Circular for the acceptance of alternative designs proposed by a contractor after contract award. In the circumstance, if alternative designs proposed by a contractor were to be adopted after contract award, the Government and the contractor needed to enter into a supplementary agreement for the purpose. Audit noted that the supplementary agreement under Contract B for carrying out the alternative-design works was only entered into in December 2009, four years and six months after the first approval in principle given in June 2005, and six months after the substantial completion of the works in June 2009.

4.15 In Audit's view, it is unsatisfactory that the HyD had not entered into a supplementary agreement with Contractor B before commencing the alternative-design works in June 2006 for the following reasons (Note 24):

- (a) *the HyD did not have alternative options other than accepting the alternative designs.* Before entering into the supplementary agreement in December 2009, the HyD had already paid \$150.36 million (99.96% of the total cost of \$150.42 million) to Contractor B for the alternative-design works, and the related works had already been substantially completed in June 2009. Under the circumstances, the HyD was not in a favourable position to negotiate for better terms of agreement and it did not have alternative options, but to enter into an agreement with Contractor B to accept the completed works;

Note 24: *As 2004 Technical Circular was issued as early as in August 2004, Audit considers that the HyD should have taken into account the relevant provisions in the Circular in considering the alternative designs proposed by Contractor B, and before it granted the first approval in principle in June 2005.*

- (b) ***no cost saving achieved.*** Audit noted that Contractor B had indicated in October 2004 that there would be a cost saving of \$12 million arising from adopting the alternative designs which would be shared equally between the Government and himself (see para. 4.10). Furthermore, it was also clearly stated in the approvals in principle for the alternative-design works that Contractor B would confirm a guaranteed minimum cost saving to the HyD (see para. 4.9(b)). The supplementary agreement was not finalised until after the completion of works and it did not specify any amount of cost saving. In the event, the Government achieved no cost saving. In this connection, Audit considers it unsatisfactory that the “guaranteed minimum cost saving” condition included in the approvals in principle did not specify an amount of cost saving, rendering the condition not enforceable; and

- (c) ***EOTs and additional cost of alternative designs.*** According to 2004 Technical Circular, the acceptance of alternative designs shall not entitle the contractor to claim additional costs or EOT (see para. 4.4(f)(ii)). In this connection, Audit noted that a “no cost or EOT claim” condition had been included in the supplementary agreement of December 2009. However, EOTs totalling four months were granted and a related prolongation cost of \$10.5 million was paid to Contractor B for bridge-structure piling works relating to the alternative designs, contrary to the “no-claim” condition specified in the supplementary agreement. The HyD needs to conduct a review to ascertain why the “no-claim” condition was not complied with.

4.16 In January and March 2013, the HyD informed Audit that:

- (a) Contractor B had provided preliminary and rough cost estimates for the alternative designs which would be subject to further assessment by Consultant Y. Negotiation continued and agreement on costs and time could not be made during the works period due to Contractor B’s disputes over variations of actual site conditions;

Adoption of alternative designs

- (b) in order to minimise delays to the works, the HyD issued approvals in principle, advising Contractor B that any alternative-design works carried out before the HyD's acceptance would be at his own risk and cost. The HyD wished to ensure the early completion of the works. During the progress of the works, Contractor B lodged many claims for other works items not related to the alternative designs. The HyD decided to negotiate and settle the claims before signing the supplementary agreement; and
- (c) the "no-claim" condition specified in the supplementary agreement was intended to include an equitable term in the contract so that the contractor should not be entitled to any additional payment or compensation based on or arising from the contractor's alternative design. The HyD had employed an Independent Quantity Surveyor in 2007 (see para. 3.17) to review and ascertain the reasons for granting EOTs and prolongation cost on various claims under Contract B. Given that there was more rock in the piling works than anticipated, the HyD considered that Contractor B was fairly entitled to a reasonable EOT.

4.17 As revealed in paragraph 4.15, the failure to agree with Contractor B over the cost of the alternative designs before works commencement had resulted in no cost saving to the Government. Audit noted that, since the issue of 2004 Technical Circular in August 2004, works departments had been required to include relevant Special Conditions of Contract (see para. 4.4(f)) in works contracts for accepting alternative designs after contract award. This has obviated the need to execute a supplementary agreement for the purpose. Nevertheless, Audit considers that, in accepting alternative designs after contract award in future, the HyD needs to agree in writing with the contractor on the terms of implementing the alternative-design works before the works commence.

Audit recommendations

4.18 **Audit has *recommended* that the Director of Highways should, in administering a works contract in future:**

- (a) comply with the requirements stipulated in 2004 Technical Circular to:**
 - (i) critically consider inviting tenderers to submit alternative designs at the tender stage where there is a potential for better value for money; and**
 - (ii) in accepting alternative designs after contract award, agree with the contractor over the terms of implementing the alternative-design works before the works commence;**
- (b) in granting approvals to the contractor for carrying out works, avoid imposing a condition that the contractor would provide a guaranteed minimum cost saving to the Government without specifying the amount; and**
- (c) comply with the requirement stipulated in the 2009 Development Bureau Circular Memorandum to document the justifications if tenderers are not invited to submit alternative designs at the tender stage.**

Response from the Administration

4.19 The Director of Highways agrees with the audit recommendations. He has said that the HyD has complied with the requirements of the relevant technical circulars on adoption of alternative designs, and will ensure compliance with the requirements in future.

PART 5: UTILISATION OF TCR

5.1 This PART examines the low utilisation of TCR.

Low utilisation of improved TCR

5.2 As mentioned in paragraph 1.4, an objective of the TCR Improvement Project was to meet the traffic demand of Lantau residents. According to the traffic impact assessment (TIA) carried out by Consultant X in 2002, the population on Lantau Island was projected to increase significantly from 2002 to 2016, as follows:

Table 6
Population projection of Lantau Island

	Population projection			
	2002	2006	2011	2016
South Lantau	13,800	15,200	27,200	39,100
North Lantau	17,300	202,000	271,000	330,000
Total	31,100	217,200	298,200	369,100

Source: HyD records

5.3 At the LegCo Panel on Transport meetings in January 2001 and January 2002, Members expressed concern over the serious safety risks caused by the substandard conditions of TCR and considered that the TCR Improvement Project should be implemented expeditiously. In June 2003, in a paper seeking funding approval for implementing Project B (see para. 1.14), the Administration informed the FC that:

- (a) the existing TCR was the only vehicular access connecting North and South Lantau. The opening of the North Lantau Highway in 1997 and the Hong Kong International Airport in Chek Lap Kok in 1998 had significantly increased traffic demand between the North and South Lantau and exacerbated the traffic situation on TCR;
- (b) the road was then operating beyond its capacity of 100 vehicles per hour with a traffic volume-to-capacity ratio (v/c ratio — Note 25) of 1.4 during peak hours;
- (c) in order to meet traffic demand up to 2016 and improve road safety, TCR had to be upgraded to a single two-lane road of 7.3 m in width for two-way traffic, with footpaths alongside;
- (d) the v/c ratio of improved TCR would be 0.84 in 2011, and further increase to 0.99 in 2016; and
- (e) between January 1998 and December 2002, there were 163 traffic accidents leading to 123 injuries on TCR, the majority of which occurred between Lung Tseng Tau and Cheung Sha.

5.4 Single two-lane TCR was fully open for public use in February 2009. According to the HyD, the capacity of improved TCR is 1,100 vehicles per hour. In April 2010, the TD informed the LegCo Panel on Transport that, as of January 2010, the peak v/c ratio of TCR was 0.26. Since June 2010, TCR has no longer been a prohibited zone, but TCR and all roads on South Lantau are still closed roads and vehicle drivers need to obtain closed-road permits from the TD for using the roads. According to the 2011 Population Census conducted by the Census and Statistics Department, the population in 2011 on Lantau Island was 105,526, which was 65% less than that estimated in the TIA Report (298,200 in 2011 — see para. 5.2).

Note 25: *According to the Transport Planning and Design Manual, a road with a v/c ratio equals to or less than 1.0 implies that it has sufficient capacity to cope with the volume of vehicular traffic, whereas a road with a v/c ratio above 1.0 indicates the onset of traffic congestion.*

Areas for improvement

Lower-than-forecast traffic demand

5.5 In seeking funding approval in June 2003 and May 2004 (see para. 1.14) for the TCR Improvement Project, the Administration informed the FC that the objectives of the project were to improve road safety and meet the future traffic demand. As it transpired, the number of serious accidents per year had reduced after improvement of TCR (from 3 to 6 per year before improvement works to 2 to 4 per year after works completion). The number of serious injuries had also decreased (from 3 to 10 per year to 2 to 6 per year). On the other hand, the actual utilisation of TCR in 2010 after the improvement works (with a peak v/c ratio of only 0.26 in 2010) was 69% less than the forecast utilisation (with an estimated v/c ratio of 0.84 in 2011 — see para. 5.3(d)) stated in the FC paper of June 2003. According to the TD, the significant v/c ratio variation was mainly due to the lower-than-forecast population on Lantau Island (see para. 5.4), and South Lantau was a conservation area and the existing land transport arrangements would be maintained. There was no proposed relaxation on public transport arrangements in the area.

5.6 During the audit, the HyD informed Audit that:

- (a) the primary justification for the TCR Improvement Project was on road safety. The provision of a single two-lane carriageway was essential from road safety point of view, which was the bare minimum for normal two-way traffic operation. Catering for increased traffic demand arising from future population growth was in fact a secondary justification in the TCR Improvement Project; and
- (b) the traffic forecasts for TCR were based on the relevant TIA studies which adopted the planning data available at the time. The traffic forecasts in the TIA Report (see para. 5.2) had taken into account an increase in the number of senior airport workers and pilots living in Mui Wo which would lead to high usage of private cars, an increase in the number of tourists visiting Mui Wo and proposed developments on South Lantau, and an allowance for additional traffic during the suspension of the cable-car service to Ngong Ping. However, there had been changes in the development parameters after 2003. Despite the

present lower-than-forecast population and road utilisation, the improved TCR would sustain the future Lantau development with population increase in future.

5.7 Audit noted that the traffic-flow projection for TCR was largely based on the population projection on Lantau Island that the population would increase from 31,100 in 2002 to 298,200 in 2011, and further to 369,100 in 2016 (10.9 times increase). As it transpired, the population on Lantau Island was only 105,526 in 2011, 65% less than the forecast of 298,200. In Audit's view, as the traffic demand for TCR was largely based on a forecast that the population of Lantau would increase by more than ten times in 14 years, the HyD should have assessed more comprehensively scenarios of lower population growth by examining the risks of the underlying assumptions (see para. 5.6(b)). The HyD needs to be more vigilant in conducting and presenting traffic forecasts for road projects in future.

5.8 Audit noted that the actual traffic flow (with an actual v/c ratio of 0.26 in 2010) of TCR was significantly lower than the estimated flow (with an estimated v/c ratio of 0.84 in 2011) included in funding applications for the TCR Improvement Project submitted to the FC. In Audit's view, after implementing a road project in future, if there is a significant variation between the actual traffic flow and the estimated traffic flow, where the latter has been used as one of the justifications for the project in applying for funding approval from the FC, it may be desirable for the Administration to inform LegCo of the variation and the underlying reasons. This will help enhance public accountability.

5.9 In response to Audit's observation in paragraph 5.8, in March 2013, the HyD, the TD, the THB and the Financial Services and the Treasury Bureau informed Audit that:

HyD and TD

- (a) the inclusion of the estimated v/c ratios in the funding paper of the TCR Improvement Project was partly to meet a standard requirement, and partly to illustrate that a minimum configuration of a single two-lane two-way configuration was sufficient and necessary. The Adopted Option was the minimum road design required to achieve one of the objectives to improve the safety condition of the then substandard TCR;

TD

- (b) for a road project in general, a discrepancy between the actual traffic flow and the traffic flow estimated at the time of the funding application could only be known some time after the completion of the project, and a reduction of the scale of the project was not possible at that time. Reporting to LegCo about discrepancies between estimated traffic flow and actual traffic flow should not be done indiscriminately in all cases whenever there was a discrepancy. Each case should be considered on its own merits, taking into account the significance of the estimated traffic flow in the funding application and other considerations, such as whether LegCo's attention had already been drawn to the reasons for such discrepancies in another context;

THB

- (c) the Audit observation in paragraph 5.8 could have significant implications, as this might also apply to other government works, housing projects and community facilities that involved the adoption of planning parameters or assumptions and use of statistical forecasts. As it usually took years to implement a works project, varying degrees of deviation between the actual outcome and the estimated figures at the design stage were natural. As an established practice, a project proponent could only make his best endeavours to plan and design a project with the latest data available at the time of funding application; and

Financial Services and the Treasury Bureau

- (d) the Administration would continue to ensure that adequate information was provided when seeking funding approval for a project from the Public Works Subcommittee and the FC, and would report to LegCo any substantial developments of the project as necessary.

Audit recommendation

5.10 Audit has *recommended* that, in implementing a road project in future, the Director of Highways should, in collaboration with the Commissioner for Transport, enhance vigilance in conducting and presenting traffic forecasts with a view to making traffic-flow estimations as accurately as possible.

Response from the Administration

5.11 The Director of Highways agrees with the audit recommendation.

5.12 The Commissioner for Transport has said that the TD will review the forecast method adopted in TIAs to explore ways for addressing possible variations in traffic-flow estimations.

PART 6: WAY FORWARD

6.1 This PART summarises the areas for improvement and examines the way forward.

Post-completion review

6.2 In September 2003, ETWB Technical Circular (Works) No. 26/2003 on Post-completion Review of Major Works Contracts under Public Works Programme was promulgated. According to the Circular, the purposes of a post-completion review are to:

- (a) measure the success of a project in achieving its planned objectives on time, within budget and at the specified quality;
- (b) bring up the lessons learned, both good and bad, for the benefit of future projects; and
- (c) provide an opportunity to review the overall effectiveness of the procurement strategy and procedures so as to identify any necessary improvement areas.

6.3 According to ETWB Technical Circular (Works) No. 26/2003:

- (a) a post-completion review needs not be conducted for a project with a total cost of less than \$500 million, or for a project which does not involve complicated issues; and
- (b) a project involving a variation item or a claim costing a substantial amount, say over \$1 million, or a project involving incidents that attract public attention, can be classified as a project involving complicated issues.

6.4 Before upgrading, TCR was a substandard road connecting Tung Chung and South Lantau. The TCR Improvement Project implemented between 2004 and 2009 aimed to improve the road safety and the traffic capacity of TCR. In this review, Audit has identified some areas that call for improvement:

Project planning and environmental impact assessment (PART 2)

- (a) the following anomalies have caused abortive time and cost in planning the Project:
 - (i) road options not having been thoroughly explored during feasibility study in 1997 (paras. 2.22 to 2.25);
 - (ii) inadequate consideration being given to the challenges in carrying out works in areas of ecological significance (paras. 2.26 and 2.27); and
 - (iii) project feasibility of the Tai Ho Wan Option not having been critically re-examined after significant changes in circumstances (para. 2.28);

Project implementation (PART 3)

- (b) the following inefficiencies have resulted in a substantial delay and prolongation cost in completing Contract B:
 - (i) Contractor B's slow progress of work at the initial stage of the contract (paras. 3.10 to 3.13);
 - (ii) insufficient road permits having been issued to the contractor in the early contract stage to meet excavation programme (paras. 3.14 to 3.20); and
 - (iii) limited site investigation before awarding the contract (paras. 3.21 to 3.28);

Adoption of alternative designs (PART 4)

- (c) tenderers not having been invited to propose alternative designs during the tender stage (paras. 4.11 to 4.13);
- (d) entering into a supplementary agreement only after making full payment and substantial completion of works (paras. 4.14 to 4.17); and

Utilisation of TCR (PART 5)

- (e) the utilisation of the improved TCR is significantly lower than the forecast utilisation (paras. 5.5 to 5.9).

6.5 With a view to improving the implementation of road projects in future, Audit considers that there are merits for the HyD to conduct a post-completion review of the TCR Improvement Project, taking into account the audit observations in this Audit Report (see para. 6.4).

Audit recommendation

6.6 Audit has *recommended* that the Director of Highways should, in collaboration with the Commissioner for Transport, conduct a post-completion review of the TCR Improvement Project, taking into account the audit observations in this Audit Report.

Response from the Administration

6.7 The Director of Highways agrees with the audit recommendation. He has said that the HyD will commence a post-completion review in the first quarter of 2013.

6.8 The Commissioner for Transport also agrees with the audit recommendation. She has said that, as part of the review, the TD will review the traffic forecast method adopted in TIAs.

Appendix A
(para. 1.5 refers)

Consultancies and works contracts for the Project

Consultancy/ Contract	Scope	Cost (\$ million)
<i>Feasibility study, investigation and preliminary design</i>		
Consultancy A (Consultant X)	➤ Feasibility Study on widening of TCR	4.3
	➤ Feasibility Study for Lantau North-South Road Link between Tai Ho Wan and Mui Wo (extended scope of consultancy under a Supplementary Agreement)	1.5
Consultancy B (Consultant X)	➤ Investigation and preliminary design for Lantau North-South Road Link between Tai Ho Wan and Mui Wo	7.5
Consultancy C (Consultant X)	➤ Investigation and preliminary design for Improvement to TCR between Lung Tseng Tau and Cheung Sha	6.9
<i>Detailed design and construction supervision</i>		
Consultancy D (Consultant Y)	➤ Design and construction supervision for Improvement to TCR between Pa Mei and Lung Tseng Tau (Project A)	0.6
Consultancy E (Consultant Y)	➤ Design and construction supervision for Improvement to TCR between Lung Tseng Tau and Cheung Sha (Project B)	16.8
<i>Construction</i>		
Contract A (Contractor A)	➤ Widening of TCR between Pa Mei and Lung Tseng Tau	22.6
Contract B (Contractor B)	➤ Construction for Improvement to TCR between Lung Tseng Tau and Cheung Sha	743.5

Source: CEDD and HyD records

Remarks: Consultancies A, B, D and E were awarded through separate tender exercises while Consultancy C was awarded by direct appointment.

Key stages of the Project

Preliminary stage	<ul style="list-style-type: none"> • Need for the project • Preliminary project appraisal <ul style="list-style-type: none"> ➤ Project definition statement ➤ Technical feasibility statement • Feasibility study
Design and investigation stage	<ul style="list-style-type: none"> • Resource allocation exercise • Apply for EIA study brief • EPD's approval of EIA study report • Detailed design and ground investigation • Cost estimation • Preparation of tender documents • Funding approval
Implementation stage	<ul style="list-style-type: none"> • Tendering (inviting alternative designs where there is value for money) • Contract award • Construction <ul style="list-style-type: none"> ➤ mainly based on Engineer's design ➤ contractor's alternative design may be accepted if better value for money can be achieved

Source: HyD records and Project Administration Handbook for Civil Engineering Works

**Procedures of conducting
an environmental impact assessment**

Under the EIAO:

- (a) a person (the applicant) planning to conduct a designated project should submit a project profile to the EPD in accordance with the technical memorandum (Note) of the EIAO;
- (b) after submitting the project profile to the EPD, the applicant should advertise in two local newspapers stating a place where members of the public can have access to the project profile, and that they may give their comments to the EPD;
- (c) the EPD should forward a copy of the project profile to the ACE;
- (d) after taking into account the comments of the ACE and the public, the EPD would either:
 - (i) issue to the applicant an EIA study brief with details for an EIA to be carried out; or
 - (ii) give permission for the applicant to directly apply for environmental permits;
- (e) after conducting an EIA in accordance with the requirements under the EIA study brief, the applicant should submit an EIA report to the EPD;
- (f) after examining the EIA report, the EPD may advise the applicant to make the report available at specified locations for public inspection and comments during a 30-day period;
- (g) after taking into account any comments from the ACE and the public on the EIA report, the EPD may approve the report and place a copy of it on a register (EIA Register) established under the EIAO for public inspection; and
- (h) thereafter, the applicant may apply for environmental permits and the EPD may grant the permits if it is satisfied that the environmental impact of the designated project is unlikely to be adverse, and that there are acceptable mitigation measures for the project.

Source: EPD records

Note: The technical memorandum sets out the principles, procedures and guidelines for compiling a project profile, an EIA study brief and an EIA report.

Acronyms and abbreviations

ACE	Advisory Council on the Environment
AFCD	Agriculture, Fisheries and Conservation Department
APE	Approved project estimate
Audit	Audit Commission
B/Ds	Bureaux and departments
CEDD	Civil Engineering and Development Department
EIAs	Environmental impact assessments
EIAO	Environmental Impact Assessment Ordinance
EOT	Extension of time
EPD	Environmental Protection Department
ETWB	Environment, Transport and Works Bureau
FC	Finance Committee
ha	Hectares
HyD	Highways Department
km	Kilometres
LegCo	Legislative Council
m	Metres
m ³	Cubic metres
Plan D	Planning Department
SSSI	Site of Special Scientific Interest
TCR	Tung Chung Road
TD	Transport Department
THB	Transport and Housing Bureau
TIA	Traffic impact assessment
v/c ratio	Volume-to-capacity ratio