

CHAPTER 3

Highways Department

<p>Construction works under Castle Peak Road Improvement Project</p>

**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. 53 of the Director of Audit contains 11 Chapters which are available on our website at <http://www.aud.gov.hk>.

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CONSTRUCTION WORKS UNDER CASTLE PEAK ROAD IMPROVEMENT PROJECT

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PART 1: INTRODUCTION

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

Background

Role of the Highways Department

1.2 One of the functions of the Highways Department (HyD) is to implement highways projects to meet the growth in traffic demand and serve new development areas. This involves the planning, design and supervision of the construction of roads, bridges and noise barriers. In 2008, the HyD incurred \$3.8 billion in implementing road infrastructure projects.

Castle Peak Road Improvement Project

1.3 In 1994, the Transport Department noted that, after the completion of planned residential developments in Tsuen Wan West and Tuen Mun, the peak-hour traffic flow of Castle Peak Road (CPR) between Hoi On Road, Tsuen Wan and Siu Lam would exceed the road design capacity. In order to cope with the increase in traffic demand in future, it was necessary to upgrade the CPR to a dual two-lane carriageway. The HyD planned to improve the CPR under a project (hereinafter referred to as the **CPR Project**). The works were to be implemented under two road sections (see Figure 1 in para. 1.6):

- (a) **Road Section A:** a carriageway of 8.3 kilometres (km) between Hoi On Road and Ka Loon Tsuen; and
- (b) **Road Section B:** a carriageway of 2.3 km between Ka Loon Tsuen and Siu Lam.

Planning and funding for CPR Project

1.4 Between October 1994 and February 2004, the HyD carried out feasibility studies, investigations and designs, and sought funding for the works under the CPR Project. Details are shown in Table 1.

Table 1
Feasibility studies, designs and funding approvals
(October 1994 to February 2004)

Date	Event
Road Section A	
October 1994	The HyD appointed a consultant (Consultant A) to conduct a feasibility study of the works.
June 1997	The Finance Committee (FC) of the Legislative Council approved funding of \$57.2 million for the investigation and design. The HyD appointed a consultant (Consultant B) to carry out the design and supervision of the works.
March 2001	The FC approved funding of \$3,761 million for the works, which were targeted for completion by June 2005.
Road Section B	
March 1997	The HyD carried out a feasibility study using in-house resources.
October 1999	The HyD appointed a consultant (Consultant C) to carry out the investigation and preliminary design of the works.
May 2003	The HyD appointed a consultant (Consultant D) to prepare tender documents (for a design-and-build contract) and to supervise the works.
February 2004	The FC approved funding of \$686 million for the works, which were targeted for completion by May 2007.

Source: HyD records

1.5 The scope of works of Road Sections A and B, as stated in the papers submitted to the Public Works Subcommittee (PWSC) of the FC seeking funding for the works, is shown in Table 2.

Table 2
Scope of works

<p>Road Section A</p> <ul style="list-style-type: none">• widening and realignment of Road Section A from a single two-lane to a dual two-lane carriageway, with a footpath of three-metre (m) wide on both sides, including the construction of elevated highway structures• associated works on road reconstruction, road-junction modifications, slope stabilisation, landscape, lighting and drainage• reclamation of 2.8 hectares of land• construction of two seawalls of 310 m and 970 m in length• installation of noise barriers• construction of a 300-m long two-lane flyover in Ting Kau and eleven covered footbridges• provision of recreational facilities at five beaches in the area to compensate for alienation of beach space <p>Road Section B</p> <ul style="list-style-type: none">• widening of the section between Ka Loon Tsuen and Tai Lam Kok from a three-lane carriageway to a dual two-lane carriageway with a 3-m wide footpath on both sides• construction of a new section between Tai Lam Kok and Siu Lam, including a dual two-lane viaduct• reclamation of 0.8 hectare of land• construction of a seawall of 1.1 km in length• provision of a roundabout at Tai Lam Kok• reconstruction of the section between Tai Lam Kok and Siu Lam
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Source: HyD records

Award of works contracts

1.6 Between August 2001 and December 2005, the HyD awarded five contracts for implementing the works under the CPR Project, as follows:

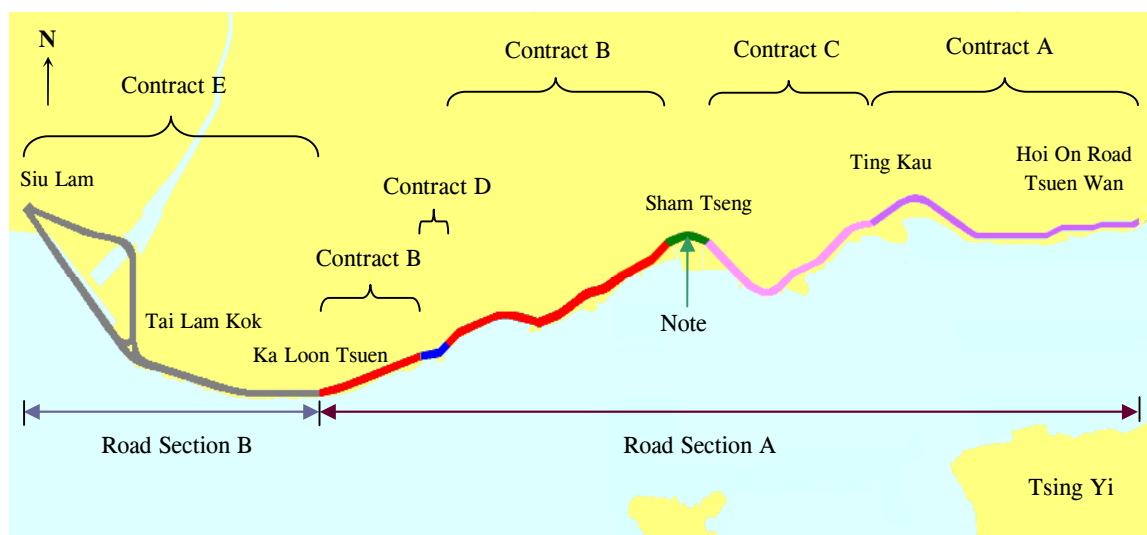
- (a) for Road Section A, the HyD awarded four remeasurement contracts (**Contracts A, B, C and D** — Note 1) to **Contractors A, B, C and D** between August 2001 and December 2005. Consultant B was appointed the Engineer of the four contracts; and
- (b) for Road Section B, the HyD awarded a design-and-build contract (**Contract E** — Note 2) to **Contractor E** in February 2004. Consultant D was appointed the Supervising Officer of Contract E.

The road sections of the five contracts are shown in Figure 1.

Note 1: *Under a remeasurement contract, payments are made to the contractor based on the quantities of works performed.*

Note 2: *Under a design-and-build contract, payments are made to the contractor for different types of works based on fixed amounts prescribed in the contract.*

Figure 1
Road sections of five works contracts



Source: HyD records

Note: As required under the land grant conditions of a site in Sham Tseng, a developer had carried out road improvement works for a section of CPR in Sham Tseng (the green road section) before 2001. Therefore, improvement works for this section were not required under the CPR Project.

Completion of works

1.7 Between March 2005 and June 2007, the works under Contracts A to E were substantially completed. The whole dual two-lane carriageway was open to traffic in phases from March 2005 to July 2007. Details of the five contracts are shown in Table 3.

Table 3
Five works contracts

Contract	Original contract sum (\$ million)	Contract commencement date	Substantial completion date
Contract A — a road section between Hoi On Road and Ting Kau	843.0	17.8.2001	17.3.2005
Contract B — a road section between Sham Tseng and Ka Loon Tsuen (excluding the road section under Contract D — see Figure 1)	764.0	23.11.2001	25.5.2006 (Note)
Contract C — a road section between Ting Kau and Sham Tseng	963.0	21.5.2002	31.7.2006
Contract D — a road section at west of Tsing Lung Tau (not covered under Contract B — see Figure 1)	92.8	21.12.2005	30.6.2007
Contract E — a road section between Ka Loon Tsuen and Siu Lam	608.1	8.3.2004	24.2.2007

Source: HyD records

Note: According to the HyD, the Contract B works were substantially completed on 25 May 2006. Up to August 2009, the Engineer (Consultant B) had not certified the substantial completion of Contract B due to outstanding disputes between the HyD and Contractor B (see Note 6 to para. 2.7).

*Director of Audit's Report on administration
of consultancies under CPR Improvement Project*

1.8 In 2008, the Audit Commission (Audit) conducted a review of the administration of consultancies under the CPR Project and the results were included in Chapter 1 of the Director of Audit's Report No. 51 of October 2008. Audit made a number of recommendations for improvement. The HyD accepted the audit recommendations and subsequently implemented them.

Audit review

1.9 The 2008 audit review focused on issues relating to the administration of consultancies under the CPR Project (Note 3). With a view to identifying room for improvement in works-contract administration, Audit has recently conducted a review to examine the HyD's administration of the construction works carried out under Contracts A to E. The review focused on the following areas:

- (a) management of omitted items under Contracts A to D (PART 2);
- (b) noise mitigation measures under Contract A (PART 3);
- (c) noise mitigation measures under Contract E (PART 4); and
- (d) rainwater drainage system under Contract C (PART 5).

Audit has found that there are areas where improvements can be made by the HyD in the planning, monitoring and administration of works for road projects. Audit has made a number of recommendations to address the issues.

Acknowledgement

1.10 Audit would like to acknowledge with gratitude the full cooperation of the staff of the HyD during the course of the audit review.

Note 3: *The review focused on the feasibility, design and construction consultancies for Road Section A.*

PART 2: MANAGEMENT OF OMITTED ITEMS UNDER CONTRACTS A TO D

2.1 This PART examines the HyD's management of works items relating to works or services provided in Contracts A to D but not included in the Bills of Quantities (BQ) of the respective contracts (Note 4).

Bills of Quantities

2.2 As mentioned in the Project Administration Handbook for Civil Engineering Works (**Project Administration Handbook**), the BQ of a remeasurement contract:

- (a) allow a comparison of tender prices; and
- (b) provide a means of valuing the works.

Compilation of BQ

2.3 For a remeasurement works contract, BQ are prepared after completing the works design. The nature and extent of works to be performed are based on the drawings, specifications and conditions of the works contracts, with reference to the Standard Method of Measurement for Civil Engineering Works (Note 5). Related works items are grouped into BQ sections. For each BQ item, an estimated quantity of works to be performed is included in the BQ. During the tendering of the contract, tenderers are required to indicate in the BQ:

- (a) a rate for each BQ item;
- (b) the amount of each BQ item (i.e. estimated quantity × BQ rate); and
- (c) the sum of the amounts for the BQ items.

Note 4: *This PART does not cover Contract E as it is a design-and-build contract without the BQ.*

Note 5: *The booklet lays down the methods and criteria for measuring civil engineering works undertaken for the Government.*

2.4 After the award of the contract, the BQ form part of the contract. Upon completion of the BQ item works, payments are made to the contractor based on the actual quantity of works carried out and the BQ rate of the item.

Omitted items

2.5 An omitted item refers to the omission of an appropriate item in the BQ for the works or services which are shown/provided in the contract drawings or specifications. As laid down in the General Conditions of Contract for Civil Engineering Works (GCC), for an omitted item:

- (a) the contractor is required to carry out the works of the omitted item;
- (b) the Engineer shall correct any such omission, and ascertain and certify the value of the works actually carried out;
- (c) if there is a similar item in the BQ, the omitted item should be valued at the rate of the similar BQ item; and
- (d) if there is no similar item in the BQ, the omitted item should be valued at a rate:
 - (i) based on the rates in the contract so far as may be reasonable and failing which, at a rate agreed between the Engineer and the contractor; and
 - (ii) fixed by the Engineer in the event that the Engineer and the contractor fail to reach an agreement on a rate.

Bills of Quantities for Contracts A to D

2.6 Contracts A to D are remeasurement contracts. As part of his work, Consultant B prepared the BQ for each of the four contracts for inclusion in the tender documents. Between August 2001 and December 2005, after completing the tender exercises, Contracts A to D were awarded to Contractors A to D respectively.

Audit observations and recommendations

Value of omitted items

2.7 Audit examination revealed that, as at 31 March 2009, there were 1,466 omitted items with a total value of \$120.4 million executed under Contracts A and C (Note 6). Details are shown in Table 4.

Table 4
Omitted items under Contracts A and C
(31 March 2009)

Contract	Original contract sum	Omitted items		Percentage of value of omitted items to original contract sum
		Number	Value	
	(a) (\$ million)		(b) (\$ million)	(c) = $\frac{(b)}{(a)} \times 100\%$ (%)
A	843	609	72.8	9%
C	963	857	47.6	5%
Overall	1,806	1,466	120.4	7%

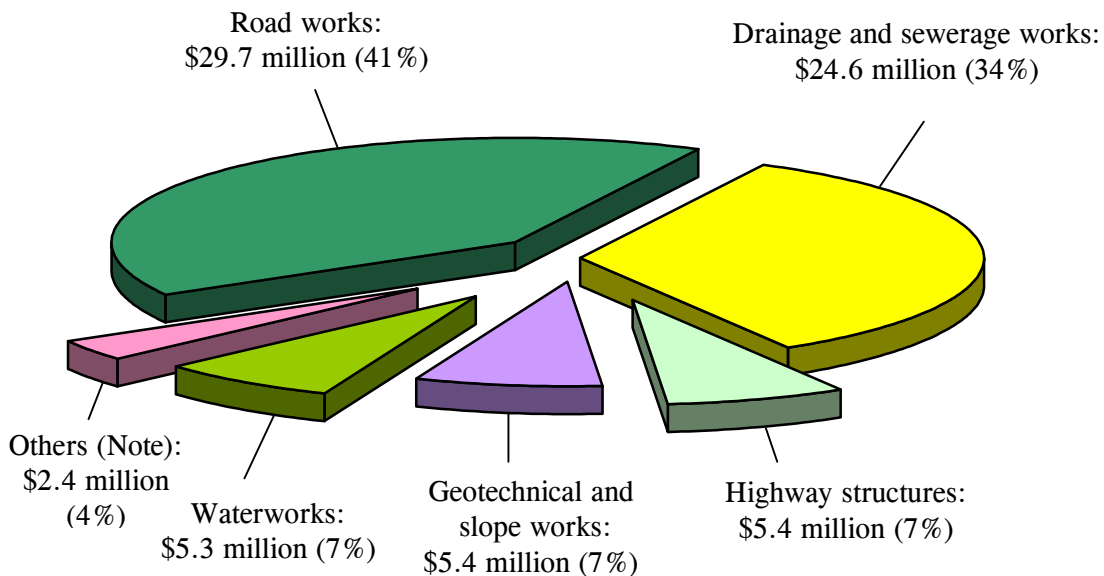
Source: HyD records

2.8 For Contract A, there were 609 omitted items, with a value of \$72.8 million, representing 9% of the original contract sum. A breakdown of the omitted items by nature of works is shown in Figure 2.

Note 6: *The audit analysis in Table 4 did not cover Contracts B and D as there were outstanding disputes under the two contracts.*

Figure 2

**Omitted items under Contract A
(31 March 2009)**



Source: HyD records

Note: Other omitted items included items relating to site clearance and landscaping works.

2.9 Audit examination revealed that the omitted items were mainly attributable to:

- (a) the omission of some works items in the BQ; and
- (b) the inclusion of incorrect works items in the BQ.

Need to take measures to minimise omitted items

2.10 According to the Project Administration Handbook (see para. 2.2), before the BQ are issued to tenderers, the BQ should undergo a checking process to ensure the accuracy of the BQ and the elimination of major errors. Audit considers that all works items should be included in BQ as far as practicable because:

- (a) accurate and complete BQ would facilitate competitive tendering;
- (b) omitted items require additional resources for valuation; and
- (c) omitted items may give rise to contract disputes if there are disagreements on their valuation.

In view of the amount of omitted items in Contracts A and C (see Table 4 in para. 2.7), Audit considers that the HyD needs to take measures to ensure the completeness and accuracy of BQ.

2.11 With reference to Environment, Transport and Works Bureau Technical Circular (Works) No. 26/2003 on “Post-completion review on major consultancy agreements and major works contracts under public works programme” of September 2003, a post-completion review of a works project may be conducted upon substantial completion of the project to review the overall effectiveness of the procedures with a view to identifying areas for improvement. **Audit considers that the HyD needs to conduct reviews of works contracts with a significant amount of omitted items upon the substantial completion of the contracts. The HyD also needs to evaluate the consultants’ performance in preparing BQ in their overall performance assessment.**

Need to document justifications for omitted items

2.12 Audit noted that there were different procedures for handling omitted items among Contracts A to D, as follows:

- (a) for Contracts A and C, the Engineer and Contractors A and C had informal discussions on omitted items. Audit could not find records showing the contractors’ applications for payment of omitted items and their subsequent acceptance by the Engineer. The valuation of omitted items was shown on the interim payment certificates of works;
- (b) for Contract B, the Engineer and Contractor B exchanged views in writing on omitted items. The Engineer’s acceptance or rejection of omitted items was confirmed in writing with justifications; and
- (c) for Contract D, in finalising the account of the contract, Contractor D submitted applications for payment of omitted items in writing and the Engineer exchanged views with him in writing.

- 2.13 In April 2009, in response to Audit's enquiry, the HyD informed Audit that:
- (a) an omitted item might be identified by the Engineer or a contractor; and
 - (b) there was no contract provision specifying:
 - (i) that notification of an omitted item should be made in writing; and
 - (ii) the notification period within which the contractor should notify the Engineer of the omitted item.

2.14 **With a view to enhancing the control over omitted items, Audit considers that there are merits for the HyD, in consultation with the Development Bureau, to specify in consultancy agreements the requirement for the Engineer to document the justifications for accepting an omitted item, and the basis for valuing the item.**

Need to improve monitoring over omitted items

2.15 Under the consultancy agreement, Consultant B was not required to provide monthly reports on omitted items accepted for payment. Audit's analysis of the omitted items under Contract A is shown in Table 5.

Table 5
Omitted items under Contract A

Value	Number of omitted items
\$150,000 and below	543
\$150,001 to \$300,000	32
\$300,001 to \$1,000,000	24
\$1,000,001 to \$3,000,000	7
More than \$3,000,000	3 (Note)
Total	609

Source: HyD records

Note: The values of the three omitted items ranged from \$5 million to \$18 million.

- 2.16 In August 2009, in response to Audit's enquiry, the HyD informed Audit that:
- (a) omitted items were within the original scope of the works to which the HyD had already committed; and
 - (b) omitted items were different from variation orders which were instructions to vary (add, modify and/or delete) any part of the works during the course of the contract (i.e. varying the original scope of the works).

2.17 **With a view to improving the monitoring of omitted items, the HyD needs to consider specifying in consultancy agreements the requirement for the consultants to provide regular updates on omitted items accepted for payment.**

2.18 **Audit considers that the audit observations in paragraphs 2.10 to 2.17 are useful to works departments.** There are merits for the Development Bureau to take measures to draw the attention of works departments to the audit observations and recommendations, with a view to making improvements on the management of omitted items.

Audit recommendations

- 2.19 **Audit has recommended that, for administering remeasurement works contracts in future, the Director of Highways should:**
- (a) **remind HyD staff and consultants to ensure the completeness and accuracy of BQ (see para. 2.10);**
 - (b) **conduct reviews of works contracts with a significant amount of omitted items upon substantial completion of the contracts (see para. 2.11);**
 - (c) **evaluate the consultants' performance in preparing BQ in their overall performance assessment (see para. 2.11); and**
 - (d) **in consultation with the Secretary for Development, consider specifying in consultancy agreements the requirement for the consultants:**
 - (i) **to document the justifications for accepting an omitted item, and the basis for valuing the item (see para. 2.14); and**

- (ii) to provide regular updates on omitted items accepted for payment (see para. 2.17).

2.20 Audit has *recommended* that the Secretary for Development should take measures to draw the attention of works departments to the audit observations and recommendations on the management of omitted items (see para. 2.18).

Response from the Administration

2.21 The **Director of Highways** accepts the audit recommendations in paragraph 2.19.

2.22 The **Secretary for Development** agrees with the audit recommendations in paragraphs 2.19(d) and 2.20.

PART 3: NOISE MITIGATION MEASURES UNDER CONTRACT A

3.1 This PART examines the HyD's administration of the implementation of noise mitigation measures under Contract A.

Measures to control traffic noise

3.2 Excessive levels of traffic noise interfere with verbal communication, disturb concentration, disrupt sleep and contribute to stress. In 1990, in the Hong Kong Planning Standards and Guidelines (HKPSG — Note 7), the Planning Department set out standards for controlling road traffic noise (see Table 6).

Table 6

Standards for controlling traffic noise

Facilities	Noise limit Decibel (dB — Note)
Domestic premises including temporary housing accommodation	70
Hotels, hostels and offices	70
Educational institutions including kindergartens, child care centres and others where unaided voice communication is required	65
Hospitals, clinics, convalescence and residential care homes for the elderly	55

Source: HKPSG

Note: "dB" is the unit for measuring the loudness of a sound.

Note 7: *The HKPSG issued by the Planning Department set out the criteria for determining the scale, location and site requirements of various land uses and facilities.*

Guidelines on using low noise road surfacing materials

3.3 Overseas research has found that low noise road surfacing (LNRS) materials could reduce traffic noise from high-speed traffic. In 1987, the HyD carried out a trial on a section of Island Eastern Corridor using LNRS materials. The trial confirmed the overseas research finding. Since then, the HyD has laid LNRS materials on some high-speed road sections (with traffic running at 70 km per hour (km/hr) or above) as a noise mitigation measure.

3.4 In December 1994, the HyD issued “Guidance Notes on Noise Reducing Highway Surfacing” (hereinafter referred to as **1994 Guidance Notes**). According to the 1994 Guidance Notes:

- (a) the effectiveness of using LNRS materials as a traffic noise reduction measure depended on the road geometry, surface regularity and vehicle characteristics; and
- (b) the adoption of LNRS materials should be limited to straight roads with a gradient of about 1% and with free flow traffic running at 70 km/hr or above.

3.5 Between 1995 and 1998, with the assistance of the Environmental Protection Department (EPD), the HyD tested the laying of LNRS materials on low-speed roads as a noise mitigation measure. According to the study report issued in December 1998, the laying of LNRS materials should not be regarded as a normal noise mitigation measure for low-speed roads.

3.6 In July 2001, the HyD issued “Guidance Notes on Noise Reducing Road Surfacing” (hereinafter referred to as **2001 Guidance Notes**), which superseded the 1994 Guidance Notes. According to the 2001 Guidance Notes:

For high-speed roads (with free flow traffic running at 70 km/hr or above)

- (a) **since 1987, a number of high-speed roads with free flow traffic had been laid with LNRS materials as a noise mitigation measure;**

- (b) in recent years, LNRS materials had become the standard surfacing materials for all new high-speed roads as their use was generally recommended in the Transport Planning and Design Manual (Note 8) for:
 - (i) minimising road spray from vehicles during wet weather;
 - (ii) increasing the texture depth of roads;
 - (iii) reducing the risk of vehicle skidding; and
 - (iv) improving skid resistance of vehicles at high speeds;
- (c) LNRS materials should be applied with different compositions according to the type of road surface of high-speed roads;

For low-speed roads (with traffic running below 70 km/hr)

- (d) under the existing policy, LNRS materials should be used under exceptional circumstances where noise reduction was an absolute necessity but could not be achieved by other means; and
- (e) LNRS materials could be applied to low-speed roads subject to certain conditions.

Requirements under Environmental Impact Assessment Ordinance

3.7 In April 1998, the Environmental Impact Assessment Ordinance (EIAO — Cap. 499), enacted in February 1997, came into effect. Under the EIAO:

- (a) a person carrying out a designated project (i.e. a project that may have an adverse environmental impact — Note 9) is required to conduct an Environmental Impact Assessment (EIA);

Note 8: *The Transport Planning and Design Manual published by the Transport Department provides information and guidance on planning and design of transport infrastructure in Hong Kong.*

Note 9: *Under the EIAO, there are two types of designated projects, namely Schedule 2 projects and Schedule 3 projects. Schedule 2 projects include road improvement, reclamation and dredging works, and Schedule 3 projects mainly comprise works relating to engineering feasibility studies.*

- (b) for a designated project involving a road, the EIA should include an assessment of the traffic noise impact; and
- (c) the person should apply for an environmental permit from the EPD for the project.

The EPD may issue an environmental permit for a designated project if it is satisfied that the environmental impact of the project is unlikely to be adverse, and that there are acceptable mitigation measures for the project.

Noise reduction

3.8 In planning a road project, if the estimated traffic noise is found to exceed the noise standards, the department concerned should adopt all practicable mitigation measures, including using LNRS materials and erecting noise barriers or enclosures, to reduce the impact on users of nearby buildings. The noise reduction levels of noise mitigation measures are shown in Table 7.

Table 7

Noise reduction of noise mitigation measures

Measure	Noise reduction
LNRS material	Up to 5 dB on a high-speed road Up to 3 dB on a low-speed road
Noise barrier	Up to 5 dB
Noise semi-enclosure	Up to 15 dB
Noise enclosure	Up to 25 dB

Source: Environment Bureau records

Noise mitigation measures for Road Section A

1996 EIA Report

3.9 In October 1994, the HyD appointed Consultant A to conduct a feasibility study, including an EIA, on the improvement works for Road Section A. The design speed limit of the improved Road Section A was 70 km/hr. In July 1995, after examining a draft EIA report, the EPD said that:

- (a) the noise reduction ability of LNRS materials had been well established, and that a 2.5 dB noise reduction would generally be achieved. Therefore, LNRS materials would be an effective noise mitigation measure; and
- (b) the HyD and the EPD were conducting a test of LNRS materials (see para. 3.5) and it was hoped that a more durable and effective LNRS material could be found in the future. The results of the test might be established before the commencement of the project. The new LNRS material should overcome the maintenance problem and might be suitable for the road project. **Therefore, the LNRS materials should be assessed as one of the noise mitigation measures for the project.**

3.10 In July 1995, in response to the EPD's views, Consultant A said that:

- (a) it was agreed that LNRS would be an effective noise mitigation measure, and guidance from the HyD would be sought on this matter; and
- (b) it would not be prudent to base the EIA study on the possible outcome of tests that were underway. **If a more durable LNRS material was found in the future, its use might be incorporated in the subsequent EIAs of the project.**

3.11 **In November 1995, the HyD and the EPD agreed that, if a suitable LNRS material was found before works commencement, its use might be considered.** In December 1996, Consultant A submitted an EIA report (**1996 EIA Report**) to the EPD. As stated in the 1996 EIA Report:

- (a) improvement works to Road Section A would increase the level of traffic noise, resulting in more flats being exposed to traffic noise that exceeded the HKPSG standards;

- (b) the laying of LNRS materials on Road Section A as a noise mitigation measure was not suitable, because the frequent stopping and braking of vehicles along the section, resulting from the presence of junctions, would lead to rapid deterioration of the LNRS materials. This would lead to high maintenance costs and frequent maintenance works that would disrupt traffic and cause a nuisance to local residents. **At that time, there were no durable LNRS materials available in the market suitable for the CPR Project;**
- (c) **if a durable LNRS material was proven for use, it might be considered at future stages of the project as an effective mitigation measure; and**
- (d) some noise mitigation measures were recommended, including the construction of a 7-m high retaining wall along a 300-m road section adjacent to a residential area at Yau Kom Tau (hereinafter referred to as Location A — see Figure 3).

In February 1997, the EPD endorsed the findings and recommendations of the 1996 EIA Report.

Figure 3

Location A



Source: HyD records

1998 and 2000 EIA Reports

3.12 In June 1997, the HyD appointed Consultant B to carry out the design and supervision of the works for Road Section A. Consultant B conducted a review of the 1996 EIA Report. In May 1998, Consultant B submitted an EIA report (**1998 EIA Report**) to the HyD and the EPD. The use of LNRS materials as a noise mitigation measure was not mentioned in the report.

3.13 In January 2000, based on the 1998 EIA Report and the subsequent design changes for Road Section A, Consultant B submitted another EIA report (**2000 EIA Report**) to the HyD and the EPD. Among others, the 2000 EIA Report stated that:

- (a) as mentioned in the 1996 EIA Report (see para. 3.11(b)), due to frequent stopping and braking of vehicles along Road Section A because of the presence of road junctions, the use of LNRS materials would not be feasible. There were no modifications to the design which would change this conclusion; and
- (b) as the retaining wall originally recommended for Location A (see para. 3.11(d)) had been deleted during the detailed design of the project, it was necessary to construct a noise barrier at Location A.

Subsequently, a noise barrier at Location A was included in the works design.

Noise-barrier works under Contract A

3.14 After inviting tenders for the works in April 2001, the HyD awarded Contract A to Contractor A in August 2001. The road works under the contract were not a designated project under the EIAO (see para. 3.7). The works under Contract A included the erection of noise barriers and enclosures at three locations, including the erection of a noise barrier (5 m in height and 300 m in length) at Location A. The estimated cost of constructing the noise barrier at Location A was \$19.7 million. The noise-barrier works commenced in May 2002 and were scheduled for completion in August 2004.

3.15 In April 2003, the EPD compiled draft guidance notes on the practicability of constructing noise barriers for designated projects under the EIAO (Note 10). In May 2003, the then Environment, Transport and Works Bureau (ETWB — Note 11) requested the HyD to provide comments on the draft guidance notes. Subsequently, the HyD conducted a review of the cost-effectiveness of constructing noise barriers under Road Section A. In July 2003, Consultant B informed Contractor A that:

- (a) the HyD was reviewing the possibility of replacing the noise barrier at Location A with alternative noise mitigation measures; and
- (b) the noise-barrier works at Location A should be suspended.

In July 2003, the noise-barrier works were suspended. At that time, Contractor A had commenced foundation works (such as piling works) for the noise barrier at Location A and incurred a cost of \$8.7 million.

3.16 In August 2003, Consultant B completed a review of the laying of LNRS materials at Location A and submitted a review report to the HyD. In the same month, the HyD informed the ETWB that:

- (a) it would be more cost-effective to replace the construction of the 300-m long noise barrier at Location A with the laying of LNRS materials along 250 m of the road section; and
- (b) the number of dwellings protected (noise mitigated to a level not exceeding 70 dB) would increase from 28 to 78 after laying LNRS materials at Location A.

3.17 Between August and September 2003, the ETWB, the EPD and the HyD exchanged views on the provision of noise mitigation measures at Location A. In September 2003, the HyD informed the ETWB that LNRS materials had become more durable and were considered appropriate at Location A.

Note 10: *The draft guidance notes consolidated existing practices with a view to assisting works departments in dealing with issues relating to noise barriers. Up to September 2009, the guidance notes had not been promulgated.*

Note 11: *In July 2007, the Development Bureau, the Environment Bureau, and the Transport and Housing Bureau were formed to take over the works, environment and transport policy portfolios respectively from the then ETWB.*

3.18 In September 2003, both the ETWB and the EPD said that, as long as the predicted noise benefit of the mitigation measures recommended in the EIA studies could be achieved, they had no objection to the laying of LNRS materials at Location A as an alternative measure to noise barrier if this was practicable and acceptable to the “noise sensitive receivers” (Note 12) concerned. In November 2003, the HyD, through Consultant B, instructed Contractor A to cease carrying out the noise-barrier works at Location A. In December 2003, the HyD issued a variation order for surfacing the road section at Location A with LNRS materials at a cost of \$0.2 million. In March 2005, the works under Contract A, including the road surfacing works, were substantially completed. Photograph 1 shows part of CPR at Location A laid with LNRS materials.

Photograph 1

CPR at Location A



Source: Photograph taken by Audit in August 2009

Remarks: LNRS materials were laid at the road section as a noise mitigation measure.

Note 12: Noise sensitive receivers include domestic premises, hospitals, medical clinics, hotels, hostels and educational institutions.

Audit observations and recommendation

Need for adopting more cost-effective methodology

3.19 The speed limit of the road section at Location A is 70 km/hr. The 1994 Guidance Notes stated that LNRS materials could be adopted for roads with free flow traffic running at 70 km/hr or above (see para. 3.4(b)). The 2001 Guidance Notes issued in July 2001 also stated that LNRS materials had become the standard surfacing materials for all new high-speed roads (see para. 3.6(b)).

3.20 **In July 1995, Consultant A said that the use of LNRS materials might be incorporated in the EIAs of the CPR Project, if a more durable material was found in the future. In November 1995, the HyD and the EPD agreed that the use of LNRS materials might be considered before works commencement (see para. 3.11). Subsequently:**

- (a) the 1996 EIA Report recommended the construction of a retaining wall at Location A as a noise mitigation measure, because there were no durable LNRS materials suitable for the CPR Project at that time (see para. 3.11(b));
- (b) the 1998 EIA Report did not mention the use of LNRS materials (see para. 3.12); and
- (c) according to the 2000 EIA Report, the use of LNRS materials as a noise mitigation measure was considered not feasible. This was based on the findings of the 1996 EIA Report (see para. 3.13(a)).

3.21 The 2000 EIA Report stated that a noise barrier should be constructed instead of the proposed retaining wall. In August 2001, Contract A was awarded, which included the construction of a noise barrier at Location A at a cost of \$19.7 million. **There was no mention in the 1998 and 2000 EIA Reports (see para. 3.20(b) and (c)) that reviews had been carried out to ascertain the availability of more durable LNRS materials for Location A.**

3.22 In May 2002, the noise-barrier works at Location A commenced. However, the HyD decided to suspend the noise-barrier works in July 2003 after noting the EPD's draft guidance notes. At that time, Contractor A had incurred \$8.7 million for the foundation works of the noise barrier (see para. 3.15).

3.23 In August 2003, after conducting a review, the HyD informed the ETWB that the proposed noise barrier at Location A was less cost-effective than LNRS materials, which had become more durable and were considered appropriate at the location. In September 2003, both the ETWB and the EPD said that they had no objection to deleting the noise barrier at Location A and to the laying of LNRS materials. Subsequently, the noise barrier at Location A was deleted from Contract A and was replaced by the laying of LNRS materials at a cost of \$0.2 million. As a result, the foundation works for the noise barrier costing \$8.7 million became abortive.

3.24 In August and September 2009, in response to Audit's enquiry, the HyD informed Audit that:

- (a) the HyD considered that both the 1994 and 2001 Guidance Notes recommended the use of LNRS materials for high-speed roads only under free flow traffic conditions. For the CPR Project, there were frequent stopping and braking of vehicles along Road Section A because of the presence of road junctions. Although the speed limit of this road section was 70 km/hr, the traffic was not free flow;
- (b) before awarding Contract A in August 2001, the use of LNRS materials at Location A was considered but not recommended in both the 1998 and 2000 EIA Reports based on the Guidance Notes. Noise reduction could be achieved by other means such as construction of a noise barrier;
- (c) while the foundation works for the noise barrier costing \$8.7 million had been carried out before the review mentioned in paragraph 3.23, there was a saving of \$10.8 million in the noise mitigation works as a result of the adoption of LNRS materials at Location A;
- (d) in the EIA reports completed for the CPR Project, LNRS materials were critically considered and found to be unsuitable for use along CPR with non-free flow traffic. The frequent stopping and braking of vehicles would lead to rapid deterioration of the LNRS materials then available. The resultant repeated maintenance would lead to a high recurrent cost, persistent traffic disruption and nuisances to local residents; and
- (e) with the advent of better LNRS materials, the performance of LNRS materials improved. After conducting the review in August 2003 in the light of the EPD's draft guidance notes (see para. 3.15), the HyD considered that the proposed noise barrier at Location A was no longer cost-effective. As such, the proposal was made to delete the noise barrier at Location A and lay LNRS materials as a noise mitigation measure.

Audit recommendation

3.25 **Audit has recommended that, in administering a road project in future, the Director of Highways should take measures to remind HyD staff of the need to critically examine the feasibility of adopting a more cost-effective methodology during the course of the project.**

Response from the Administration

3.26 The **Director of Highways** accepts the audit recommendation. He has said that the HyD will remind its Works Offices of the need to critically examine the feasibility of adopting a more cost-effective methodology during the course of a road project.

3.27 The **Director of Environmental Protection** agrees with the audit recommendation.

PART 4: NOISE MITIGATION MEASURES UNDER CONTRACT E

4.1 This PART examines the HyD's administration of the implementation of noise mitigation measures under Contract E.

Noise mitigation measures for Road Section B

2001 Environmental Impact Assessment

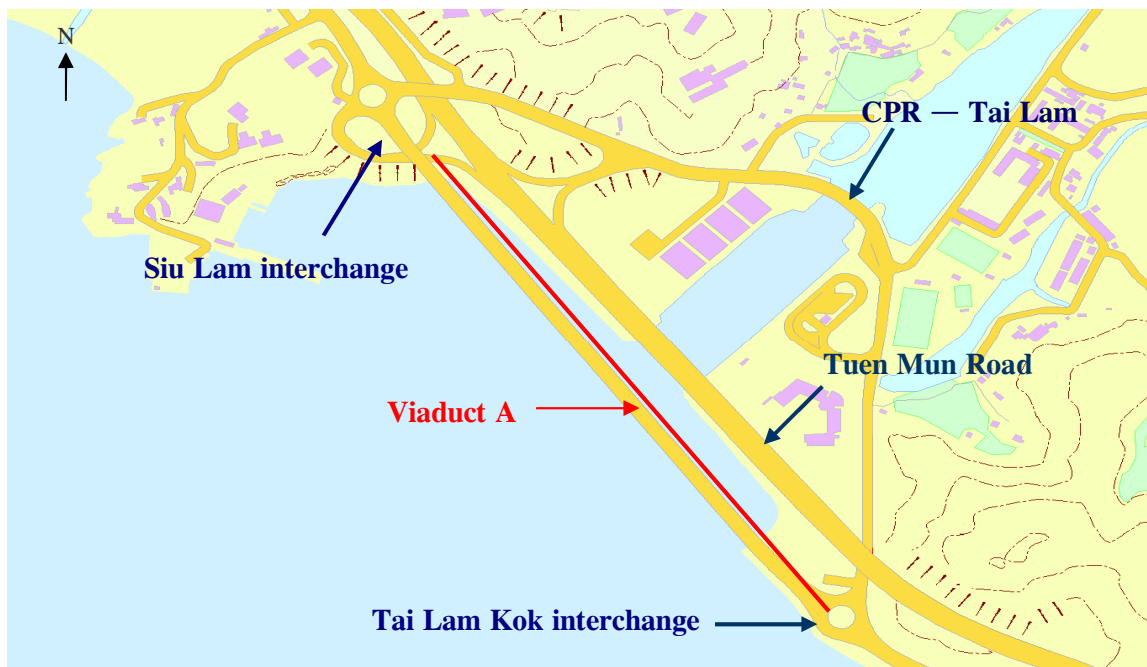
4.2 The road works for Road Section B were classified as a designated project under the EIAO (see para. 3.7). The EIAO has laid down traffic noise standards which are the same as those specified in the HKPSG (see Table 6 of para. 3.2).

4.3 In October 1999, the HyD appointed Consultant C to carry out the investigation and preliminary design of Road Section B. Upon completion of the preliminary design, the HyD decided to construct a new 800-m long dual two-lane viaduct (Note 13) connecting Tai Lam Kok and Siu Lam (Viaduct A — see Figure 4).

Note 13: *A viaduct is a long and high bridge that carries a road or a railway.*

Figure 4

Viaduct A under Road Section B



Source: HyD records

4.4 As part of the consultancy work, Consultant C carried out an EIA in accordance with the requirements of the EIAO. In August 2001, the HyD submitted an EIA report (**2001 EIA Report**) to the EPD.

4.5 According to the 2001 EIA Report:

- (a) the developments near Road Section B included low-rise residential buildings, scattered village houses, educational institutions and hospitals;
- (b) the noise in the area was dominated by that generated from the CPR – Tai Lam and Tuen Mun Road traffic; and
- (c) for abating the traffic noise arising from Viaduct A, the following works were proposed:

- (i) a 5.5-m high and 604-m long noise barrier along part of the land side of Viaduct A (see Photograph 2); and
- (ii) a 175-m long noise enclosure on part of Viaduct A.

In December 2001, the EPD approved the 2001 EIA Report.

Photograph 2

Viaduct A



Source: HyD records

4.6 In May 2003, the HyD appointed Consultant D to prepare tender documents and to supervise the works of Road Section B. In July 2003, the EPD issued an environmental permit for Road Section B, which specified the implementation of the noise mitigation measures on Viaduct A as mentioned in paragraph 4.5(c).

2003 environmental review

4.7 In June 2003, after noting from a traffic study that the latest forecast traffic flow would be lower than that adopted in the 2001 EIA Report, the HyD requested Consultant D to conduct an environmental review for Road Section B. In October 2003, the HyD submitted an environmental review report (hereinafter referred to as the **2003 ER Report**) to the EPD. According to the 2003 ER Report:

- (a) the noise impacts from Viaduct A would exceed the noise standards after the laying of LNRS materials on the viaduct;
- (b) to meet the noise standards, a 3.5-m high and 780-m long noise barrier on Viaduct A might be required instead of the originally proposed noise barrier and enclosure (see para. 4.5(c)); and
- (c) the effectiveness of the proposed noise barrier was very minimal (i.e. the noise level could only be reduced by less than 1dB) as the noise level in the vicinity was dominated by traffic noise generated from existing roads rather than Viaduct A. Installing the noise barrier on the viaduct was therefore not recommended.

4.8 In October 2003, after receiving the 2003 ER Report, the EPD informed the HyD that:

- (a) it was agreeable that the provision of a noise barrier on Viaduct A was not a practicable noise mitigation measure as traffic noise would be dominated by the prevailing noise generated from Tuen Mun Road; and
- (b) **the EPD had no objection to the deletion of the noise barrier on Viaduct A, and it could not see any rationale for providing such measures later.**

Environmental permit

4.9 In December 2003, the EPD issued a revised environmental permit for Road Section B. According to the environmental permit:

- (a) the noise barrier and enclosure on Viaduct A specified in the environmental permit of July 2003 (see para. 4.6) were deleted; and
- (b) LNRS materials would be laid on Viaduct A.

Funding approval

4.10 In February 2004, in the paper submitted to the PWSC seeking funding for the works of Road Section B, the Administration said that:

- (a) the 2003 ER Report showed that the overall noise level near Tuen Mun Road was dominated by traffic noise generated from the existing roads;
- (b) the provision of a 3.5-m high and 780-m long noise barrier on Viaduct A could only reduce traffic noise from 64.9 dB – 70.1 dB to 64.6 dB – 69.9 dB. Such reductions in noise level were considered ineffective;
- (c) LNRS to be provided on Viaduct A would reduce traffic noise by 2 to 3 dB; and
- (d) by providing LNRS instead of a noise barrier, there would be a saving of \$21 million in capital cost.

4.11 At the PWSC meeting in February 2004, in examining the funding application for Road Section B, a question was raised about whether land had been reserved for erecting noise barriers on Viaduct A for future property development in the vicinity. In response, the HyD said that:

- (a) there was no planned property development near Viaduct A at that time; and
- (b) the viaduct had been designed to cater for the installation of noise barriers, if they were required in future.

In the same month, on the recommendation of the PWSC, the FC approved the funding for the works.

Award of Contract E

4.12 In February 2004, the HyD awarded Contract E (a design-and-build contract) to Contractor E for the design and construction of Road Section B. Consultant D was the Supervising Officer of the contract (see para. 1.6(b)). According to Contract E:

- (a) the scope of works included the design and construction of the noise barrier and enclosure specified in the 2001 EIA Report; and

- (b) the design of the noise barrier and enclosure should be carried out according to the contract terms and conditions, and the construction works were subject to excision (Note 14).

Implementation of noise mitigation works

Noise mitigation measures for Viaduct A

4.13 Between May and December 2004, the HyD, through Consultant D, informed Contractor E that he:

- (a) should not carry out the construction works for the noise barrier and enclosure on Viaduct A as specified in the 2001 EIA Report. Such construction works were subject to excision under the contract; and
- (b) should include in the works design a 3.5-m high and 780-m long noise barrier on the land side of Viaduct A, and construct the foundation works (i.e. provision of pre-installed bolts and nuts) for erecting a noise barrier in future.

4.14 In July 2006, Contractor E commenced the foundation works for the noise barrier. In September 2006, Consultant D issued a variation order of \$2 million for the foundation works for erecting the noise barrier on Viaduct A in future. In November 2006, the foundation works were completed.

Noise mitigation measures for Tuen Mun Road

4.15 In April 2008, the FC approved funding for reconstructing and improving Tuen Mun Road (from Tsuen Wan to Sam Shing Hui) covering a section of Tuen Mun Road parallel to Viaduct A (see Photograph 2 in para. 4.5). The works would include provision of noise mitigation measures, such as noise barriers and enclosures, and LNRS. For the Tuen Mun Road section parallel to Viaduct A, noise barriers and enclosures would not be constructed. The works commenced in October 2008 and were scheduled for completion by April 2014.

Note 14: *The noise barrier and enclosure construction works were included in a section “Works subject to excision” of Contract E. The works under this section were those where: (a) details of the works had not been decided by the HyD when the tender documents were issued; and (b) the works should only be implemented upon a subsequent decision of the HyD and a written instruction from the Supervising Officer.*

Audit observations and recommendation

Need for providing noise mitigation measures

4.16 According to the EPD's comments on the 2003 ER Report in October 2003, the provision of a noise barrier on Viaduct A was not a practicable noise mitigation measure as traffic noise would be dominated by the prevailing noise generated from Tuen Mun Road. The EPD could not see any rationale in providing such measures later (see para. 4.8). In February 2004, the Administration informed the PWSC that the reductions in noise level by providing a 3.5-m high and 780-m long noise barrier were considered ineffective, as they would only reduce traffic noise by less than 1 dB (see para. 4.10(b)). Instead, LNRS would be provided on Viaduct A, which would reduce traffic noise by 2 to 3 dB. At the PWSC meeting of February 2004, the HyD said that there was no planned property development near Viaduct A at that time (see para. 4.11(a)).

4.17 Despite the decision to use LNRS materials to mitigate the noise impact, in December 2004, the HyD informed Contractor E to construct the noise-barrier foundation works. The HyD considered that if a noise barrier was to be installed on Viaduct A in future, demolition of part of the viaduct would not be necessary, and disruption to traffic would be minimised. In September 2006, the HyD issued a variation order for the foundation works.

- 4.18 In August 2009, in response to Audit's enquiry, the HyD informed Audit that:
- (a) while there were no planned developments near Viaduct A when funding application for Road Section B was sought in 2004, the Administration noted that the structure and foundation of Viaduct A had already been designed for the provision of a noise barrier, in case there were subsequent changes to the planning parameter and land use. As the noise-barrier foundation works would require demolishing part of the viaduct and entail large-scale and prolonged traffic diversion, the HyD considered it prudent to complete such works under Contract E to minimise future works and disruption to the public; and
 - (b) it was the Administration's commitment made at the PWSC meeting in February 2004 to cater for the installation of noise barriers along Viaduct A if required in future.

4.19 **Audit noted that the construction of a noise barrier on Viaduct A was considered ineffective, and that there was no planned property development near Viaduct A. In Audit's view, it may not be justifiable to carry out the noise-barrier foundation works on the viaduct at a cost of \$2 million.** In this connection, it is noteworthy that in the Tuen Mun Road improvement project, which is currently in progress, noise barriers and enclosures will not be provided on the road section parallel to Viaduct A (see para. 4.15).

Audit recommendation

4.20 **Audit has recommended that, in administering a road project in future, the Director of Highways should remind HyD staff to critically examine the need for, and cost-effectiveness of, providing noise mitigation measures (see para. 4.19).**

Response from the Administration

4.21 The **Director of Highways** accepts the audit recommendation. He has said that:

- (a) the Tuen Mun Road improvement project is not a designated project under the EIAO. The noise mitigation measures under the project are provided in line with the policy to address the noise impact of existing roads on neighbouring residents; and
- (b) the HyD will remind its Works Offices to critically examine the need for, and cost-effectiveness of, providing noise mitigation measures.

4.22 The **Director of Environmental Protection** agrees with the audit recommendation.

PART 5: RAINWATER DRAINAGE SYSTEM UNDER CONTRACT C

5.1 This PART examines the HyD's administration of works for the rainwater drainage system at Ting Kau (see Figure 5 in para. 5.4) under Contract C with a view to identifying room for improvement.

Rainwater drainage system

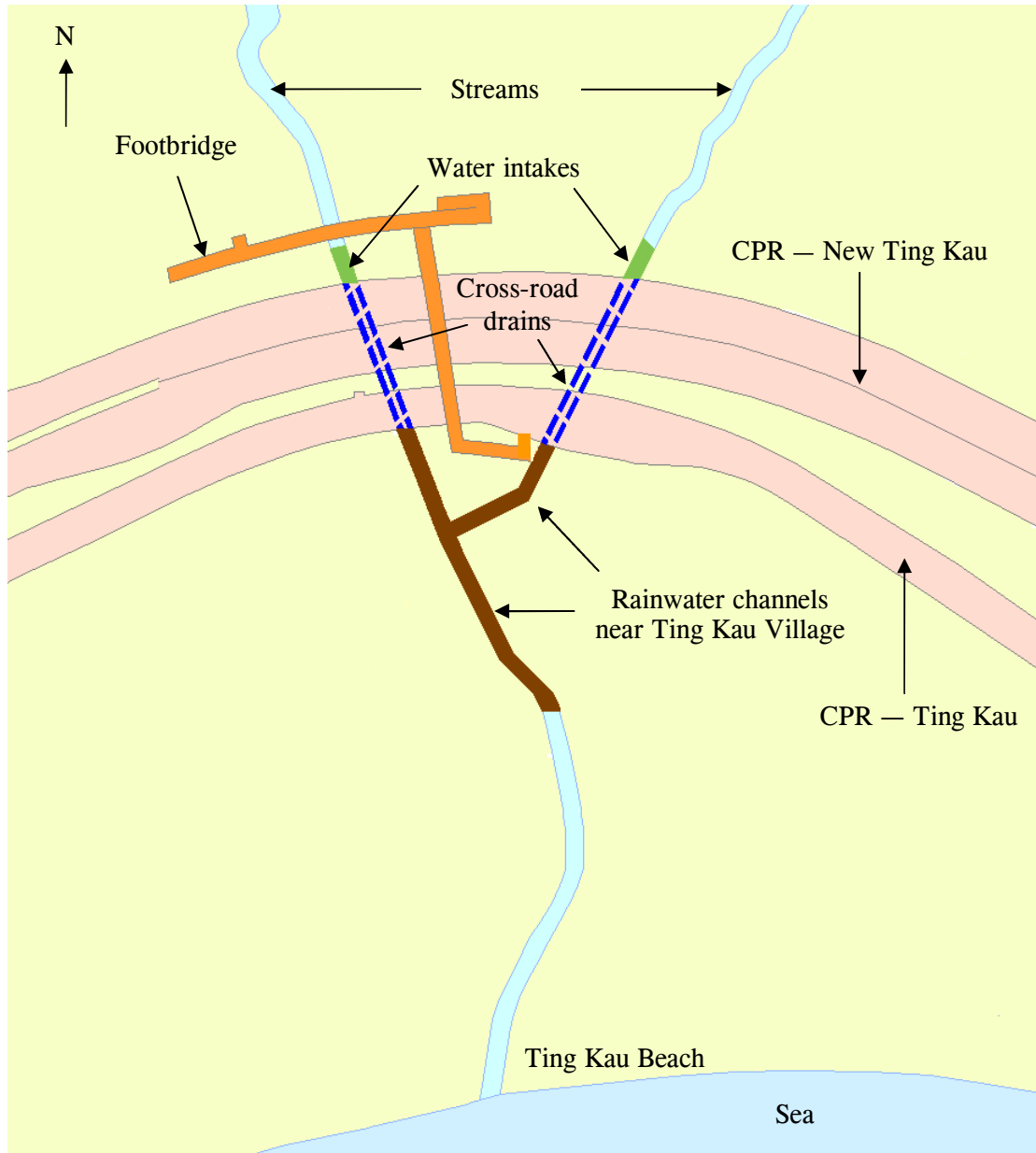
5.2 Road Section A runs largely parallel with the coastline between Hoi On Road and Ka Loon Tsuen (see Figure 1 in para. 1.6). As part of Road Section A, CPR — Ting Kau lies between the coastline and the north upland at Ting Kau. Ting Kau Village is situated between the southern side of the road section and Ting Kau Beach. There are two streams in the north upland areas. Before the CPR improvement works, there were two cross-road drains underneath CPR — Ting Kau, directing rainwater from the two upland streams to rainwater channels running towards Ting Kau Beach for discharge into the sea.

5.3 In the upland areas of Ting Kau, the Water Supplies Department (WSD) has developed a water-catchment system for collecting and directing rainwater to Tai Lam Chung Reservoir. During rainstorms, rainwater exceeding the capacity of the water-catchment system and rainwater collected in the Ting Kau Village area would be discharged into the sea through the rainwater drainage system at Ting Kau.

5.4 As part of the CPR improvement works, a new dual two-lane carriageway (known as CPR — New Ting Kau) was constructed parallel to CPR — Ting Kau. In order to direct rainwater from the streams in the upland areas to the sea, two cross-road drains were constructed underneath CPR — New Ting Kau and CPR — Ting Kau (hereinafter referred to as cross-road drain improvement works). Details are shown in Figure 5.

Figure 5

Rainwater drainage system at Ting Kau



Source: Audit's sketch based on HyD records

Design and improvement works

5.5 In June 1997, the HyD appointed Consultant B to carry out the design and construction supervision of the improvement works for Road Section A. According to the consultancy agreement:

- (a) Consultant B should carry out a Drainage Impact Assessment (DIA) study in accordance with:
 - (i) the Stormwater Drainage Manual issued by the Drainage Services Department (DSD) in October 1994 (Note 15);
 - (ii) Works Branch Technical Circular No. 18/95 “DIA Process for Public Sector Projects” issued in August 1995 (see para. 5.6); and
 - (iii) other requirements of the relevant government departments;
- (b) a study working group chaired by the HyD’s representative should be set up to provide guidance to Consultant B, and to review the work and output of the DIA study; and
- (c) Consultant B should design appropriate measures to mitigate the drainage impact as recommended in the DIA study.

Drainage impact assessment

5.6 According to Works Branch Technical Circular No. 18/95 of August 1995 (Note 16):

- (a) public works projects might have an impact on drainage and flooding. The impact should be considered at the early stages of the project planning and design to minimise drainage and flooding problems and to avoid costly remedial measures;

Note 15: *The Manual, subsequently superseded by a revised edition in December 2000, provided guidance and standards for the planning and management of rainwater drainage systems and facilities.*

Note 16: *The circular was superseded by Environment, Transport and Works Bureau Technical Circular (Works) No. 2/2006 of February 2006. The two circulars contained similar requirements for carrying out a DIA study.*

- (b) **if a project was likely to have an impact on drainage and flooding, the works department responsible for the project should notify the DSD by submitting a project profile at an early stage of the project planning and development;**
- (c) based on the information in the project profile, the DSD would decide whether a DIA study would be required;
- (d) if a DIA study was required, the study should be carried out in accordance with Works Branch Technical Circular No. 18/95 and the Stormwater Drainage Manual;
- (e) the works department and the DSD should agree on the findings, anticipated drainage impact, the necessary mitigation measures and the monitoring requirements stated in the DIA study report;
- (f) **the works department should be responsible for incorporating the agreed drainage impact mitigation measures into the design of the project to ensure that the expected drainage performance was achieved;**
- (g) after completing the detailed design, the works department should send the relevant drawings, specifications and contract conditions to the DSD for agreement, and should certify that the agreed mitigation measures had been incorporated into the submitted documents; and
- (h) the works department should be responsible for implementing the agreed drainage impact mitigation measures and monitoring the construction programme.

1998 DIA Report

5.7 In March 1998, Consultant B completed the DIA study and submitted a study report (**1998 DIA Report**) to the HyD and other relevant departments, including the DSD, the EPD and the WSD. The Report included a proposed preliminary drainage design. According to the 1998 DIA Report:

- (a) no assessment of natural stream capacities had been made due to their irregular shapes; and

- (b) the preliminary design of the cross-road drains and rainwater channels (see Figure 5 in para. 5.4) took into account the need for collecting part of the road-surface runoff on CPR. For the rainwater drainage system at Ting Kau, drainage impact mitigation measures were proposed for:
 - (i) the cross-road drains; and
 - (ii) a section of a rainwater channel running through Ting Kau Village.

5.8 In May 1998, in view of the EPD's concerns over diverting road-surface runoff near Ting Kau to a gazetted beach, Consultant B submitted a revised design to the HyD and the DSD, in which the road-surface runoff was diverted to an adjacent rainwater drainage system instead of the system at Ting Kau.

5.9 In June 1999, in reviewing the revised design of the rainwater drainage system at Ting Kau, the DSD informed Consultant B that:

- (a) as the rainwater channels collecting rainwater from the cross-road drains ran through local villages, the channels should have sufficient capacity to handle the water flow; and
- (b) if improvement works to the rainwater channels were required, the works should be included in the CPR Project.

In July 1999, Consultant B informed the DSD that, based on the 1998 DIA Report, the rainwater channels had sufficient capacity to handle the water flow.

5.10 In September 2001, Consultant B completed a detailed design of the rainwater drainage system at Ting Kau, taking account of the DSD's comments, and submitted the final tender drawings to the DSD. In the detailed design, the drainage impact mitigation measures proposed in the 1998 DIA Report were revised, as follows:

- (a) the size of the cross-road drains (see para. 5.7(b)(i)) was changed; and
- (b) the proposed mitigation measures for the rainwater channel section (see para. 5.7(b)(ii)) were deleted.

5.11 In May 2002, the HyD awarded Contract C to Contractor C. Consultant B was the Engineer of the contract. The Contract C works included the cross-road drain improvement works at Ting Kau, which were completed in November 2005.

Further improvement works

Causes for flooding

5.12 On 2 June 2006, there was a heavy rainstorm causing flooding in the vicinity of Ting Kau Village and resulting in damages to the properties of some residents. At the request of the HyD, Consultant B carried out an investigation into the incident. In July 2006, Consultant B submitted an investigation report to the HyD. In the same month, the HyD issued an incident report to the DSD and the WSD. In September 2006, after exchange of views among the related parties, another incident report was issued to the Tsuen Wan District Office of the Home Affairs Department.

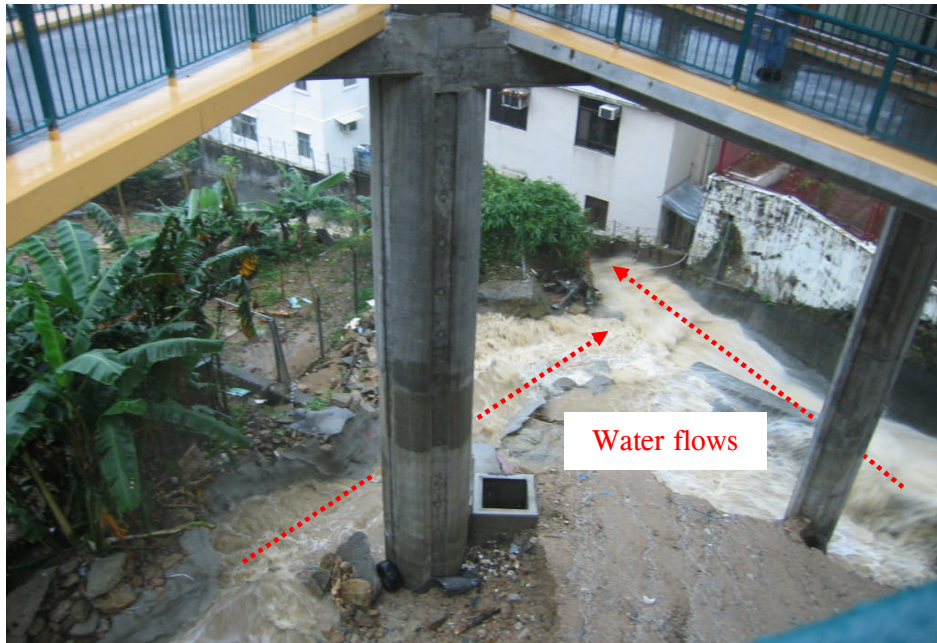
5.13 According to the investigation report and the two incident reports, the possible causes for the flooding included:

- (a) there was an exceptional heavy rainstorm in Tsuen Wan on the day of flooding. Over 200 millimetres of rainfall was recorded from early morning to noon on 2 June 2006;
- (b) boulders and rocks were deposited in the water intakes of the rainwater drainage system at Ting Kau. They obstructed the water flow from the upland areas and caused splashing of water at the water intakes; and
- (c) the rainwater channels were disturbed during the course of foundation works for a footbridge (Note 17). During the works, the original channel bed was removed and replaced by a temporary concrete channel bed. The rainstorm damaged and washed away the temporary channel bed, causing splashing of water into village houses adjacent to the channels (see Photograph 3).

Note 17: *The works under Contract C included the construction of a footbridge across Road Section A near Ting Kau Village (see Figure 5 in para. 5.4).*

Photograph 3

Damaged rainwater channels near Ting Kau Village



Source: Photograph taken by the HyD after the rainstorm of 2 June 2006

5.14 In July 2006, Consultant B proposed that further improvement works should be carried out on the water intakes of the cross-road drains and on the rainwater channels.

DSD's comments

5.15 In July 2006, the DSD said that there were discrepancies between the proposed design in the 1998 DIA Report and the completed improvement works for the rainwater drainage system at Ting Kau. In the same month, in response to the DSD's views, Consultant B said that:

- (a) the size of a cross-road drain was reduced as the road-surface runoff on the road section was diverted to an adjacent rainwater drainage system (see para. 5.8); and
- (b) the improvement works for the rainwater channel section proposed in the DIA study were considered as drainage improvement works and therefore excluded from the CPR Project.

5.16 In July 2006, after conducting a review of the rainwater drainage system, Consultant B said that:

- (a) based on the updated water flow discharge figures provided by the WSD in July 2006, it was found that the design of the water intakes of the cross-road drains could not cope with the peak water flow from the WSD's water-catchment system; and
- (b) the capacity of the rainwater channels was marginally adequate to cope with the water flow of a local rainwater drainage system within a village.

5.17 In September 2006, the HyD, the DSD and the WSD agreed to the need for carrying out improvement works on the water intakes of the cross-road drains and on the rainwater channels. Between December 2006 and May 2007, Consultant B issued variation orders to Contractor C for carrying out the works, which were completed in August 2007 at a cost of \$7.1 million. For rainwater channels not included in the CPR Project, the enhancement works were carried out by the DSD. Photograph 4 shows the rainwater channel near Ting Kau Village after the improvement works.

Photograph 4

**Rainwater channel near Ting Kau Village after improvement works
(August 2007)**



Source: HyD records

Audit observations and recommendations

Need to ensure sufficient capacity of rainwater drainage systems

5.18 According to the 1998 DIA Report, improvement works were proposed for the cross-road drains and the rainwater channel section near Ting Kau Village (see para. 5.7(b)). In June 1999, the DSD said that, as the rainwater channels ran through local villages, the channels should have sufficient capacity to handle the water flow (see para. 5.9(a)). However, upon the completion of the rainwater drainage system works in November 2005, improvement works were only carried out on the cross-road drains, but not on the rainwater channels.

5.19 During the rainstorm on 2 June 2006, there was splashing of water at the water intakes of the cross-road drains and at the rainwater channels (see para. 5.13(b) and (c)), resulting in flooding in the vicinity of Ting Kau Village. According to Consultant B, the water intakes of the cross-road drains could not cope with the peak runoff, and the capacity of the rainwater channels was marginally adequate to cope with the water flow (see para. 5.16). As a result, between December 2006 and August 2007, the HyD carried out further improvement works on the water intakes of the cross-road drains and on the rainwater channels at a cost of \$7.1 million. **Audit considers that, in carrying out road works in future, the HyD needs to take measures to ensure that different parts of the related rainwater drainage system have sufficient capacity to cope with the peak water flow. The HyD needs to enhance coordination with the DSD on the design of the rainwater drainage system.**

Need to inform the DSD of drainage improvement works

5.20 In June 1999, the DSD said that, if improvement works for the rainwater channels were required, the works should be included in the CPR Project (see para. 5.9(b)). However, in July 2006, Consultant B said that the improvement works for the rainwater channels were considered as drainage improvement works and therefore excluded from the CPR Project (see para. 5.15(b)).

5.21 **Audit considers that the HyD needs to inform the DSD of drainage improvement works identified during the course of a road project with a view to working out arrangements for implementing the works in a timely manner.**

Need to establish a DIA study working group

5.22 According to the consultancy agreement of June 1997, a study working group should be set up to provide guidance to Consultant B, and to review the work and output of the DIA study (see para. 5.5(b)). **However, such a working group was not established. Audit considers that the HyD needs to make improvement in this area.**

Need to certify drainage impact mitigation measures

5.23 In September 2001, the detailed design was completed, in which the drainage impact mitigation measures at Ting Kau proposed in the 1998 DIA Report were revised, including the deletion of the improvement measures for the rainwater channels (see para. 5.10). According to Works Branch Technical Circular No. 18/95 (see Note 16 to para. 5.6), the responsible works department should certify to the DSD that the agreed drainage impact mitigation measures have been incorporated into the documents forwarded to the DSD (see para. 5.6(g)). However, there was no record indicating that the HyD had complied with the certification requirement. **Audit considers that the HyD needs to comply with this requirement and draw the DSD's attention to significant revisions to the mitigation measures.**

Need to take flood prevention measures for works affecting drainage systems

5.24 The rainwater channels near Ting Kau Village were disturbed during the course of foundation works for a footbridge (see para. 5.13(c)). This partly led to the flooding in the area on 2 June 2006. **Audit considers that, in carrying out road works in future, if nearby rainwater channels are adversely affected, the HyD needs to take necessary flood prevention measures.**

Audit recommendations

5.25 **Audit has recommended that, in carrying out a road project in future, the Director of Highways should remind HyD staff of the need to:**

- (a) **take measures to ensure that different parts of the related rainwater drainage system have sufficient capacity to cope with the peak water flow (see para. 5.19);**
- (b) **enhance coordination with the DSD on designing the capacity of rainwater drainage systems (see para. 5.19);**

- (c) **inform the DSD of drainage improvement works identified during the course of the road project with a view to working out arrangements for implementing the works in a timely manner (see para. 5.21);**
- (d) **establish a DIA study working group to monitor the related rainwater drainage improvement works (see para. 5.22);**
- (e) **certify to the DSD that the agreed drainage impact mitigation measures have been incorporated into the documents forwarded to the DSD in accordance with Environment, Transport and Works Bureau Technical Circular (Works) No. 2/2006 (see para. 5.23);**
- (f) **draw the DSD's attention to significant revisions to the agreed drainage impact mitigation measures (see para. 5.23); and**
- (g) **for road works which may adversely affect nearby rainwater channels, take necessary flood prevention measures for the affected areas (see para. 5.24).**

Response from the Administration

5.26 The **Director of Highways** accepts the audit recommendations. He has said that the HyD will remind its Works Offices in respect of the recommendations.

Acronyms and abbreviations

Audit	Audit Commission
BQ	Bills of Quantities
CPR	Castle Peak Road
dB	Decibel(s)
DIA	Drainage Impact Assessment
DSD	Drainage Services Department
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance
EPD	Environmental Protection Department
ER	Environmental review
ETWB	Environment, Transport and Works Bureau
FC	Finance Committee
GCC	General Conditions of Contract for Civil Engineering Works
HKPSG	Hong Kong Planning Standards and Guidelines
HyD	Highways Department
km	Kilometres
km/hr	Kilometres per hour
LNRS	Low noise road surfacing
m	Metre(s)
PWSC	Public Works Subcommittee
WSD	Water Supplies Department