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8 June 2018

Clerk to Public Accounts Committee
Legislative Council,
Legislative Council Complex
1 Legislative Council Road
Central, Hong Kong

(Attn.: Mr Anthony CHU)

Dear Sirs,

Public Accounts Committee

Consideration of Chapter 8 of the Director of Audit's Report No. 70

Sha Tin Section of Route 8

Thanks for your letter of 31 May 2018. The requested response and information set out in your letter are enclosed at the **Annex**.

Yours faithfully,

(Kelvin K W LO)
for Director of Highways

c.c.	STH	(Attn.: Ms CHUNG Sui-kei, Judy)
	SDEV	(Attn.: Mr CHAN Fuk-yiu, Victor)
	DCED	(Attn.: Mr LAM Tat-ming, Terence)
	SFST	(Attn.: Ms HSIA Mai-chi, Margaret)
	Director of Audit	(Attn.: Mr TEO Wing-on)

Public Accounts Committee

Consideration of Chapter 8 of the Director of Audit's Report No. 70

Sha Tin Section of Route 8

- (a) *reasons for splitting the construction of Sha Tin Section of Route 8 into three works contracts and awarding them to two different consultants;*

The implementation of mega projects is very complicated. Mega projects will normally be implemented under several contracts having regard to the programme and interface requirements of different parts of the project concerned. This will also increase the competitiveness and reduce the overall project risk. If a mega project is implemented under one single contract, the number of eligible tenderers may be reduced thereby reducing the competitiveness and increasing the project cost. Therefore, this split-contract arrangement will give more opportunity to potential tenderers and invite competitive tenders. In addition, from a project risk management perspective, it is appropriate to implement a mega project under several contracts so as to minimize the reliance on the performance of a single contractor and hence reduce the project risk.

Due to the scale of a mega project, some parts of it are required to be completed at an earlier stage so that they can match with other interfacing parts. As such, the construction of Sha Tin Section of Route 8 was implemented under three civil engineering contracts, namely Contracts A, B and C (i.e. Route 8 - Lai Chi Kok Viaduct, Route 8 - Eagle's Nest Tunnel and Associated Works and Route 8 - Sha Tin Heights Tunnel and Approaches) and one traffic control and surveillance system contract, namely Contract D (Route 8 – Traffic Control and Surveillance System).

For consultancies, they usually involve planning, design and construction supervision, especially for mega projects, the consultants should consider the project as a whole in planning and design. Therefore, it is usual to appoint one consultant for one project. Except under special circumstances, for example in this case, as Civil Engineering and Development Department (“CEDD”) had other on-going or planned projects interfacing with this project in Sha Tin area at that time, Contract C was entrusted to CEDD under their existing consultancy for implementation of the design and construction supervision work for Contract C.

(b) regarding the design and construction supervision work of Sha Tin Section of Route 8, please advise:

- (i) the tendering procedures to award the consultancy contract(s) for Contracts A and B;***
- (ii) the number of consultants which have been invited to submit tender proposals and number of tender proposals received;***
- (iii) the reasons for awarding the contract(s) to Consultant X;***

- (i) An Assessment Panel (“AP”) for the consultant selection exercise of the Consultancy for the project - Route 8 between Cheung Sha Wan and Sha Tin was set up in January 1999 in order to determine the longlist criteria for inviting Expression of Interest (“EOI”), the longlist of consultants and the marking scheme for the shortlist, to establish the marking scheme for technical proposals, and to conduct the assessments etc. The AP comprised representatives from HyD, Transport Department, the then Civil Engineering Department (CED) and Water Supplies Department, and was chaired by an officer at D2 rank of HyD. With reference to the Consultants Services Directory maintained by the then CED and nature of the project works, HyD prepared a longlist of consultants and proposed a marking scheme for shortlisting the consultants for the consideration of the AP. With the AP’s agreement sought on the longlist of consultants and the proposed marking scheme for shortlisting, letters of invitation for EOI in undertaking the Consultancy were sent to the longlisted consultants on 27.1.1999.

Interested consultants submitted EOI proposals for the Consultancy. The AP marked the submitted proposals based on the agreed marking scheme and shortlisted four consultants with proposals having scored the highest marks for the next stage of selection. HyD then sought approval from the Engineering and Associated Consultants Selection Board (“EACSB”) on 18.3.1999 on the four shortlisted consultants, the proposed marking scheme for the Technical Proposals, the proposed parameters for evaluation of Fee Proposals, the proposed payment schedule and a set of proposed additional special conditions of employment for the Consultancy. In seeking approval from the EACSB, the draft Consultancy brief, the AP meeting minutes and assessment results etc. were also submitted.

Upon obtaining the approval of the EACSB, HyD sent letters to the four

shortlisted consultants to invite submission of Technical Proposals to HyD and Fee Proposals to EACSB.

The AP first assessed and gave technical marks to the submitted Technical Proposals according to the approved marking scheme. Upon completion of that assessment, the AP then obtained from the EACSB the Fee Proposals for fee assessment. The consultants' technical marks and fee marks were then combined for assessment, with technical weighting and fee weighting being 80% and 20% for this project respectively. HyD then sought approval from the EACSB on the appointment of the consultant with the highest combined technical and fee score on 2.7.1999. Upon obtaining the approval of the EACSB on 9.7.1999, HyD appointed the consultant for the Consultancy on 13.7.1999.

- (ii) For the Sha Tin Section of Route 8, a longlist of 16 consultants was agreed by the AP. Letters of invitation for EOI in undertaking the Consultancy were sent to these consultants on 27.1.1999. By the deadline for submission on 24.2.1999, seven consultants/joint venture expressed interests in undertaking the Consultancy. Four were shortlisted and subsequently, four Technical and Fee Proposals were received from them.
- (iii) Consultant X had the highest technical marks and the lowest total fee, and hence the highest combined score. Therefore, HyD sought approval from the EACSB for the appointment of Consultant X for the consultancy. Upon obtaining approval of the EACSB on 9.7.1999, HyD awarded the Consultancy to Consultant X on 13.7.1999.

- (c) *with reference to paragraph 2.5 of the Audit Report, the total amount with a breakdown of the claims submitted by Contractor A in respect of Contract A and the sum certified by Consultant X;*

According to the terms of the Contract A, the sum of claims certified by Consultant X under Contract A is \$85.7 million.

The total amount and breakdown of the claims unresolved under Contract A and therefore disputed by Contractor A in the Arbitration A is tabulated as follows:

	Claimed Amount
Varied and additional works	\$587,975,385
Measurement	\$50,711,983
Prolongation Cost	\$122,626,544
Further financial entitlement	\$255,431,900
Total	\$1,016,745,812

This dispute was finally settled through the extra-contractual settlement sum of \$273 million.

(d) according to paragraph 2.5 and 2.6 of the Audit Report, Contractor A submitted a request for mediation in February 2008, but the mediation was unsuccessful. Eventually, Contractor A served a Notice of Arbitration in June 2009 to refer the claims to arbitration (“Arbitration A”) and the Government engaged a quantum expert and an engineering expert in April and May 2010 to prepare for the arbitration. In this connection, please advise:

(i) whether HyD had, before accepting the mediation request, sought legal opinion from the Department of Justice or LAD of the Development Bureau about the feasibility of settling the claim by mediation. If yes, dates the legal opinion sought and details of the legal opinion; if not, why not;

(ii) the reasons for not engaging the quantum expert and the engineering expert immediately after the Notice of Arbitration was served in June 2009;

(iii) the number of mediators and arbitrators engaged by the Government for the mediation and arbitration with Contractor A, the number of mediation sessions and arbitration sessions held and the expenditure incurred;

(iv) whether there are any criteria and procedural guidelines on engaging and selecting mediators and arbitrators to handle contract disputes involving government projects;

(v) whether HyD had been informed of the cost incurred for the mediation/arbitration exercise. If yes, when? Has HyD considered in consultation with other departments on whether it should proceed with the mediation/arbitration exercise taking into account the cost incurred;

- (i) Before accepting Contractor A's request on 5.2.2008 for mediation, HyD obtained legal opinion from Legal Advisory Division (Works) of Development Bureau ("LAD(W)") on 18.2.2008 about the feasibility of settling the claim by mediation. In accordance with the Government's policy of resolving constructions disputes as far as possible by mediation (only resorting to arbitration where the disputes cannot be resolved by way of mediation) and given that mediation was a viable and from time to time successful way of settling construction disputes, LAD(W) supported the proposal of mediation.
- (ii) Consideration was given by LAD(W) as to the engagement of the quantum expert and the engineering expert immediately after the Notice of Arbitration was served on the Government in June 2009. Given the high stake involved, it was imperative that care be taken to select the most suitable candidates. Steps were accordingly taken by LAD(W) for short listing eligible candidates, inviting EOI, considering the proposals submitted by the candidates, conducting interviews with the candidates, internally discussing the choice of appointees, and seeking approval for appointments and financial provisions. The appointments were then confirmed as soon as possible.
- (iii) There were one mediator and one arbitrator in the mediation and arbitration with Contractor A respectively. Four mediation sessions were held in November 2008, January 2009, February 2009 and March 2009 respectively. One arbitration session was held in November and December 2009. According to legal advice, the expenditure incurred in the mediation and the arbitration with Contractor A is confidential and sensitive information, and it is inappropriate to discuss legal costs incurred as it touches on the Government's negotiation and settlement strategy and such discussion would be prejudicial to the handling of future cases.
- (iv) There are guidelines on the engagement and selection of mediators and arbitrators which were followed at the time of conducting the mediation and arbitration with Contractor A.

Generally speaking, selection criteria include expertise and relevant experience in the field, whether there is any potential conflict of interest, performance, availability and whether there are any other current

appointments, proposed fees and/or estimate for the work to be carried out, views of the parties involved including agreement by the contractor bearing in mind that the mediator / arbitrator is to be jointly appointed by the parties in most of the cases.

- (v) HyD had been kept informed of the cost incurred for the mediation and arbitration throughout the proceedings. HyD had consulted with LAD(W) on whether it should proceed with the mediation/arbitration exercise taking into account the cost incurred.

- (e) *according to paragraph 2.7 of the Audit Report, the disputes between HyD and Contractor A on the claims in Arbitration A mainly consisted of two key issues, namely adequacy of the design for viaduct structure and erection, and measurements and valuations of additional or varied works. Please elaborate on the definitions of “additional or varied works” with examples, and provide details of the additional or varied works involved in Arbitration and the relevant costs;*

In accordance with the General Conditions of the Contract, the Engineer shall order any variation to any part of the Works that is necessary for the completion of the Works and have the power to order any variation that for any other reason shall in his opinion be desirable for or to achieve the satisfactory completion and functioning of the Works. Such variations may include:

- (a) additions, omissions, substitutions, alterations, changes in quality, form, character, kind, position, dimension, level or line;
- (b) changes to any sequence, method or timing of construction specified in the Contract; and
- (c) changes to the Site or entrance to and exit from the Site.

In this connection, the Engineer shall issue variation orders (VOs) for additional or varied works which are considered to be necessarily executed by the Contractor for the satisfactory completion of the Works. In other words, the Engineer will instruct the Contractor to carry out the additional works and varied works in the same manner through VOs.

An example in Contract A was a variation order due to additional works issued to Contractor A for construction of an additional concrete buttress below Lai Wan Road Overpass abutment as the actual ground conditions were found different from that assessed in the design stage. Another example was a variation order due to varied works for the enhancement of bridge parapet to comply with HyD's latest requirement on road safety.

The details of additional or varied works involved in Arbitration A are tabulated with the cost incurred as follows:

Types of Varied and Additional Works	Claimed Amount in Arbitration A
1. Viaduct Structure Design and Erection	\$128,477,801
2. Project Design Additional Resources	\$20,819,995
3. Variation Orders	\$438,677,589
Total	\$587,975,385

(f) with reference to paragraphs 2.9 and 2.18(a) of the Audit Report, please advise:

- (i) the breakdown of the extra-contractual settlement sum of \$273 million, including the amount of interest;*
- (ii) the basis to support HyD's views that not all the disputes with Contractor A settled under the \$273 million could be attributed to Consultant X;*
- (iii) the basis for HyD's view that the proposed settlement would cost appreciably less and be beneficial to the Government;*

(i) The settlement sum was a global figure and there was no breakdown including interest.

(ii) According to the legal advice, some of the settlement sum paid in settlement of the Contractor A's claims were related to additional or varied works but not the viaduct structure design and erection caused by the performance of Consultant X. Therefore, not all the disputes with Contractor A settled under the \$273 million could be attributed to Consultant X.

(iii) The Government had carried out a detailed assessment of the total risk exposure of the Government regarding the disputes and, based on that, formulated the negotiation strategy. HyD considered that the proposed settlement would cost less and be beneficial to the Government having regard to the assessed total risk exposure mentioned above and the costs in continuing the arbitration proceedings.

(g) *according to Note 13 of paragraph 2.21 of the Audit Report, HyD amended the Structures Design Manual for Highways and Railways in August 2006 setting out guidelines for carrying out appropriate level of independent checking on the design of different categories of new highway structures and the associated modification of existing highway structures by consultants or contractors employed by the Government. In this connection, please advise:*

- (i) *a copy of the extracts of the amended part(s) of the Manual;*
- (ii) *how to define the “appropriate level of independent checking on the design of highway structures” with examples;*
- (iii) *the number of cases in which the independent checking had revealed irregularities;*

(i) A copy of the extracts of the amended part of the Manual is attached at **Appendix A**.

(ii) The independent checking would be conducted by a Checking Engineer appropriate to its Category. There are 3 categories of highway structures requiring checking by Checking Engineers. For Category I, the Checking Engineer shall be a qualified professional in the same organization who may be from the same design team. For Category II, the Checking Engineer shall be a qualified professional or checking team in the same organization but shall be independent of the design team. For Category III, the Checking Engineer shall be a checking team from a separate independent organization. The Classification of Highway Structures for checking is tabulated as follows:

Structure Category	Description
I	<p>Simple Structures</p> <p>Structures which contain no departures from or aspects not covered by current standards adopted by Highways Department, and which are either :</p> <ul style="list-style-type: none"> a) Single simply supported span of less than 20m and having less than 25° skew; b) Buried concrete box type structures with less than 8m span;

	<p>c) Retaining walls with a retained height of less than 7m; or</p> <p>d) Noise barrier with a maximum height of 3m.</p>
II	<p>Intermediate Structures</p> <p>Structures not within the parameters of Structure Categories I and III.</p>
III	<p>Complex Structures</p> <p>Structures requiring sophisticated analysis or with any one of the following features:</p> <p>a) High structural redundancy;</p> <p>b) Unconventional design aspects;</p> <p>c) Any span exceeding 80m;</p> <p>d) Skew exceeding 45°;</p> <p>e) Continuous structure with spans exceeding 65m;</p> <p>f) Difficult foundation problems; or</p> <p>g) Difficult construction techniques/ problems.</p>

(iii) No irregularity has been identified in the independent checking in HyD since the promulgation of the requirement in 2006.

(h) with reference to paragraphs 2.25 and 2.27 of the Audit Report, please advise the improvement measures taken/to be taken with the implementation timeline for the followings:

- (i) vetting of consultants' designs and handling of responses to tender queries;***
- (ii) the Administration's "check the checker" role in monitoring the implementation of government projects by consultants and contractors, such as the design and drawings produced by consultants and contractors;***

- (i) HyD had already reminded its staff and consultants in May 2018 to continue to strictly follow the guidelines stipulated in the Structures Design Manual for Highways and Railways ("SDM").

For responses to tender queries, HyD would review and update, if necessary, the document entitled "HQ/GN/02 Guidelines for Checking Submissions of Consultants" ("HQ/GN/02") to incorporate principles for checking the responses to tender queries prepared by the consultants. HyD will also continue to ask its staff and consultants to strictly comply with the requirements for handling tender queries including those to be enhanced in the Project Administration Handbook for Civil Engineering Works.

- (ii) The project office shall arrange with the designer the checking of a highway structure by a Checking Engineer appropriate to the category as defined in SDM.

When the Checking Engineer has completed the design checking including the design calculations, specifications, drawings etc., the designer and the Checking Engineer shall sign the Highway Structures Design and Check Certificate as per the standard form appended in SDM or as per other form as agreed with the Chief Highway Engineer/Bridges and Structures (CHE/B&S). Notwithstanding the design checking in accordance with SDM, CHE/B&S will spot check the proposed structural form aspects of the design and drawings in accordance with HQ/GN/02.

- (i) ***with reference to paragraphs 2.31 and 2.32 of the Audit Report, please advise the reasons for HyD not seeking prior agreement from the Financial Services and the Treasury Bureau (“FSTB”) to the strategy or bottom line for negotiation before discussing and reaching a consensus with Contractor A;***

In December 2010, HyD had sought and obtained the FSTB’s prior agreement to a strategy and bottom line for proceedings in Arbitration A.

While pending the FSTB’s agreement to a revised strategy and bottom line for proceedings in Arbitration A submitted by HyD in June 2012, Contractor A approached HyD in July 2012 to explore the possibility of settling the disputes without continuing the arbitration proceedings on a without prejudice basis. In considering that by early settling the disputes, both parties including the Government would be benefited by saving the huge costs in continuing with the arbitration, HyD thus agreed to discuss with Contractor A with an attempt to settle the disputes on a without prejudice basis as early as possible.

After several meetings, both parties in end July 2012 reached a non-committal consensus (which was subject to the Government’s internal approval and the execution of a formal settlement agreement) to settle all the disputes under Contract A at a settlement sum of \$273 million on a “no admission of liability” basis.

Upon obtaining Government’s internal approval on 11.10.2012, HyD and Contractor A executed the settlement agreement on 24.10.2012.

- (j) except the extra-contractual settlement sum of \$133.1 million, any other actions taken against the unsatisfactory performance of Consultant X and whether any sanction system is in place for banning the relevant consultant from bidding consultancy contracts under HyD or other government departments for a limited period of time. If yes, the details; if not, why not.*

HyD manages the consultants according to Handbook on Selection, Appointment and Administration of Engineering and Associated Consultants and Works Technical Circular of Development Bureau Nos. 3/2016 - Management of Consultants' Performance. HyD will report consultants' performance regularly and take regulating actions (such as suspension from bidding for new consultancies) against poor performers.

As Contract A involved complicated technical and legal issues and the arbitration with Consultant X was in progress, the performance of Consultant X in the relevant design and response to tender queries issues could only be considered based on the result of the arbitration. Subsequently, the disputes with Consultant X were settled on a "without admission of liability" basis, avoiding further proceeding of arbitration.

In light of the recovery, through the ex-contractual settlement, of the amount from the Consultant X to settle the disputes being on a "without admission of liability" basis, the disputes on the performance of Consultant X in the relevant design and response to tender queries issues could not be ascertained.

STRUCTURES DESIGN MANUAL

for Highways and Railways

Third Edition



HIGHWAYS DEPARTMENT

*The Government of the Hong Kong
Special Administrative Region*



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FOREWORD

The Structures Design Manual for Highways and Railways sets out standards and provides guidance for the design of highway and railway structures in Hong Kong. The Manual was first published in August 1993 with its second edition released in November 1997. It has been widely used as a reference for highway and railway structural works by practitioners.

The third edition incorporates a new Chapter 19 on Design Checking. It also includes revisions to Wind Loading Design in Chapter 2, Parapet Design in Chapter 15 and Aesthetics in Chapter 17 which are based on recent studies, as well as minor amendments as a result of new research information, refinements in design methods and feedbacks on the previous editions.

The Bridges and Structures Division of Highways Department will regularly review and improve on the content of this Manual so that all design standards and guidance will be in line with the most up-to-date practice. We welcome any comments on this Manual for further improvements.



(MAK Chai-kwong)
Director of Highways

CHAPTER 19. DESIGN CHECKING

19.1 GENERAL

This chapter sets out the guidelines for carrying out independent checking on the design of new highway structures and the associated modification of existing highway structures by consultants or contractors employed by the government. The design checking stipulated below shall also apply to public highway structures which are designed by public organizations (other than the government), private organizations or their agents. These guidelines do not modify the contractual or legal responsibilities of any party for the work carried out including without limitation the Designer and Checking Engineers as defined in Clause 19.2.

19.2 TERMINOLOGY

The terms adopted in this chapter are defined as follows :

Project Office	The office in charge of the project or the developer in the case of a private development.
Designer	The professional, the team of professionals, the company or the organization being responsible for the design.
Checking Engineer	The professional, the team of professionals, the company or the organization separate from the Designer being responsible for the independent check of the design.

19.3 OBJECTIVE

The objective of the independent checking is to ensure :

- (a) compliance of the design with the Project Office's requirements, relevant design standards and statutory requirements;
- (b) validity of design concepts, methods and assumptions;
- (c) applicability, accuracy and validity of the computer programs and models used in the design;
- (d) accurate translation of the design into drawings and specifications; and
- (e) practicality and adequacy of key details.

19.4 CLASSIFICATION OF HIGHWAY STRUCTURES

For design checking purpose, all highway structures shall be classified into Categories I, II and III as shown in Table 41. This classification is not rigid and each case shall be decided on its merits having regard to the cost, complexity, safety, durability and consequences of failure. The Designer shall determine and agree with the Project Office the proposed Category for the highway structures being designed. If necessary, the Project Office or the Designer may approach the Chief Highway Engineer/Bridges and Structures for advice and/or decision on any matters relating to this classification.

The Project Office shall arrange with the Designer the checking of a highway structure by a Checking Engineer appropriate to its Category. The Category shall be identified early. As the design evolves, the Designer shall ensure the structure is appropriately classified and seek the agreement of the Project Office to amend its Category and checking arrangements when necessary.

19.5 CHECKING ENGINEER

The requirements of the Checking Engineer in each category of highway structures are outlined below :

- (a) For Category I structures, an independent check shall be carried out by a qualified professional in the same organization as the Designer who may be from the same design team.
- (b) For Category II structures, an independent check shall be carried out by a checking team in the same organization as the Designer but shall be independent of the design team.
- (c) For Category III structures, an independent check shall be carried out by a checking team from a separate independent organization.

For Categories II and III structures, the Checking Engineer shall be strictly excluded from having direct involvement in the design of the concerned project. In all cases, the Checking Engineer must have sufficient knowledge and experience relating to the type of structures to be checked. The Checking Engineer proposed or appointed by the Designer shall be approved by the Project Office in advance. The Checking Engineer shall exercise reasonable and professional skill, care and diligence at all times in the design checking and that the safety and integrity of the structures shall not be compromised in any way.

Should the Project Office be dissatisfied with the Checking Engineer at any time, the Project Office may, having given reasonable notice of dissatisfaction, order the dismissal and replacement of the Checking Engineer.

19.6 COMMENT BY THE CHIEF HIGHWAY ENGINEER / BRIDGES AND STRUCTURES

For Category III structures, the Designer shall at the commencement of the design

forward his design approach statement including design concept, design philosophy and outline of mathematical modelling of the structure to the Chief Highway Engineer/Bridges and Structures for comments and make a presentation if required. The Designer shall take account of the Chief Highway Engineer/Bridges and Structures' comments in his design.

The comment by the Chief Highway Engineer/Bridges and Structures will be provided from the viewpoint of design standards and for public interest. It will not relieve the responsibility of the Designer or the Checking Engineer in any way.

19.7 CHECKING PROCESS

Irrespective of the Category of structures, all design calculations, drawings and specifications shall first be self-checked by the Designer prior to the checking by the Checking Engineer. Also, any computer programs including those developed in-house and spreadsheet applications used in the structural analysis shall be verified and validated by an appropriate method, and the Designer shall be responsible for such verification and validation.

It is a good practice to start the design checking as early as possible so that the design and checking can proceed together. Also, any disagreements or points of differences can be resolved earlier as the design progresses.

Table 42 gives details of the design checking required for each Category of highway structures.

The independent design checking for Category III structures shall be carried out without reference to the design calculations. It is incumbent upon the Checking Engineer to establish the validity of the design assumptions independently. The Checking Engineer would require documents including the design memorandum/manual, drawings, specifications, ground investigation results and other relevant design information for him to carry out the checking. The design memorandum shall contain sufficient information detailing the assumptions made in the design to enable the Checking Engineer to carry out his own independent analysis and assessment and to make direct comparison between his own results and the Designer's design. Major difference in design assumptions should be brought to the attention of the Designer. Although the methods of analysis need not be the same, the Designer and the Checking Engineer should consult with each other to ensure that their calculated results are comparable.

In the event that the design checking reveals errors, omissions or ambiguities in the design, the Checking Engineer shall inform the Designer who shall in turn seek agreement with the Checking Engineer on the course of action required to rectify the design deficiency. The Designer shall make all necessary changes to the design and associated documents, and re-submit them to the Checking Engineer for further review and agreement.

Should the Designer disagree with the Checking Engineer's view, he shall promptly refer the case to the Project Office. Where necessary, advice from an independent expert or the Chief Highway Engineer/Bridges and Structures may be sought.

It must be emphasized that an independent check shall not in any way absolve the Designer from his responsibility and liability for the proper design of highway structures. The

independent checking procedures stipulated herein are additional to any in-house design checking by the Designer.

19.8 HIGHWAY STRUCTURES DESIGN AND CHECK CERTIFICATE

When the design checking has been completed and all necessary amendments to the design calculations, specifications and drawings have been made and checked by the Checking Engineer, the Designer and the Checking Engineer shall sign the Highway Structures Design and Check Certificate as per the standard form appended in Table 43 or as per other form as agreed with the Chief Highway Engineer/Bridges and Structures. Unless there are justifiable reasons acceptable to the Project Office, the Designer shall exercise every effort to ensure that no drawings shall be issued for tendering or construction until the Highway Structures Design and Check Certificate has been accepted by the Project Office.

For Category III structures, a full set of the design submissions and the Highway Structures Design and Check Certificate shall be submitted to the Chief Highway Engineer/Bridges and Structures for audit and record purpose before construction commences. Should the Designer or the Project Office have any difficulties to comply with this requirement under exceptional circumstances, they should seek the special agreement from the Chief Highway Engineer/Bridges and Structures.

For all categories of structures, any amendments to the design deemed necessary which have structural implications following the issue of the Highway Structures Design and Check Certificate shall be checked and certified by an appropriate Checking Engineer. The Designer shall notify the Chief Highway Engineer/Bridges and Structures in case such amendments deviate significantly from the original design intent.

An alternative design by a contractor shall also be subject to design checking if it is to be implemented.

Table 41 - Classification of Highway Structures

Category	Description
I	<p style="text-align: center;"><u>Simple Structures</u></p> <p>Structures which contain no departures from or aspects not covered by current standards adopted by Highways Department, and which are either</p> <ul style="list-style-type: none"> a) Single simply supported span of less than 20m and having less than 25° skew b) Buried concrete box type structures with less than 8 m span c) Retaining walls with a retained height of less than 7 m, or d) Noise barrier with a maximum height of 3 m.
II	<p style="text-align: center;"><u>Intermediate Structures</u></p> <p>Structures not within the parameters of Categories I and III.</p>
III	<p style="text-align: center;"><u>Complex Structures</u></p> <p>Structures requiring sophisticated analysis or with any one of the following features :</p> <ul style="list-style-type: none"> a) High structural redundancy, b) Unconventional design aspects, c) Any span exceeding 80 m, d) Skew exceeding 45 °, e) Continuous structure with spans exceeding 65 m, f) Difficult foundation problems, or g) Difficult construction techniques/ problems.

Table 42 - Scope of Design Checking

Category	Scope of Design Checking
I	<ul style="list-style-type: none"> a) Check compliance with design codes and standards. b) Carry out arithmetic check on the design calculations. c) Carry out spot checks on critical structural elements. Repetition of numerical calculations is not required if the Checking Engineer can validate the structural adequacy by alternative method or comparison with other similar completed structures. d) Ensure that the design is correctly translated into the drawings and specifications.
II	<ul style="list-style-type: none"> a) Carry out comprehensive check on drawings with reference to the design calculations. The check will include but not be limited to the design concept, the compliance with design code and standards, the derivation of loadings, method of analysis and design assumptions, the structural adequacy of individual structural elements, stability of the structures and sequence of construction. b) Check/Confirm the applicability, accuracy and validity of all computer programs used by the Designer. c) Check the numerical model, its applicability, input parameters and boundary conditions. d) Carry out separate analytical check on critical structural elements without reference to the design calculations. e) Ensure that the design is correctly translated into the drawings and specifications.
III	<ul style="list-style-type: none"> a) Derive all loading, design concept, criteria, assumptions and parameters, and sequence of construction from the design document i.e. drawings, design memorandum, specifications, site investigation records, etc. b) Check the compliance with design codes and standards, and limitations if any. c) Check the applicability, accuracy and validity of all computer programs used in design checking. d) Construct computer models, input boundary conditions and parameters and carry out independent structural analysis. e) Prepare an independent set of design check calculations. f) Ensure that the design is correctly translated into the drawings and specifications.

Table 43 - Highway Structures Design and Check Certificate

HIGHWAY STRUCTURES DESIGN AND CHECK CERTIFICATE

Agreement No. : _____ **(if appropriate)**

Project Title : _____

Project Office : _____

1. This Design and Check Certificate refers to submission No. _____ which comprises

(a) Highway structures covered by this Certificate
(*nature and description of the submission*)

in respect of :
(*description of the highways structures to which the submission refers*)

(b) Contents of this submission are listed in Schedule A below.

2. Designer's certification

I / We certify that

(a) the design of the highway structures, as illustrated and described in the documents listed in Schedule A below, complies with the standards set out in the Agreement or _____ (any form of agreement as appropriate) and with amendments agreed to by the Director's Representative or _____ (any relevant authorities as appropriate);

(b) all reasonable and professional skill, care and diligence have been exercised in designing the highway structures, as illustrated and described in the documents listed in Schedule A below; and

(c) a self-check has been undertaken and completed to confirm the completeness, adequacy and validity of the design of the highway structures as illustrated and described in documents listed in Schedule A below.

Signed : _____

_____ (Name)

_____ (Position)

_____ (Organization)

_____ (Date)

