



**HIGHWAYS DEPARTMENT  
MAJOR WORKS PROJECT MANAGEMENT OFFICE**

3 & 6/F, HO MAN TIN GOVERNMENT OFFICES  
88 CHUNG HAU STREET, HOMANTIN, KOWLOON, HONG KONG  
Web site: <http://www.hyd.gov.hk>

路政署  
主要工程管理處  
香港九龍何文田忠孝街八十八號  
何文田政府合署三及六樓  
網址: <http://www.hyd.gov.hk>

本署檔案 Our Ref. : ( ) in HyD MWO 11/1/694TH/1/9/2 (C)  
來函檔號 Your Ref. : CB4/PAC/R70  
電 話 Tel. : 2762 3600  
圖文傳真 Fax : 2714 5224

香港中區  
立法會道 1 號  
立法會綜合大樓  
政府帳目委員會秘書  
朱漢儒先生

朱先生：

政府帳目委員會

審議《審計署署長第七十號報告書》第8章

八號幹線沙田段

謝謝秘書處 2018 年 5 月 31 日的來信。信中要求提供的回應和資料現載於附件。

路政署署長

(盧國華 代行)

2018年6月8日

副本送： 運輸及房屋局局長 (經辦人：鍾瑞琦女士)  
發展局局長 (經辦人：陳福耀先生)  
土木工程拓展署署長 (經辦人：林達明先生)  
財經事務及庫務局局長 (經辦人：夏鎂琪女士)  
審計署署長 (經辦人：張永安先生)



ISO 9001 : 2008  
Certificate No.: CC 1881



ISO 14001 : 2004  
Certificate No.: CC 263

政府帳目委員會  
審議《審計署署長第七十號報告書》第8章

八號幹線沙田段

**(a) 把八號幹線沙田段的建築工程分拆為三份工程合約及將顧問合約批給兩間顧問公司的原因；**

大型工程項目的推展非常複雜，考慮到工程項目中不同部分的時間表和銜接要求，通常都會將項目分拆為數份合約去建造，這樣亦可以加強競爭，並減低工程的整體風險。如果大型工程是以單一合約去推展，有資格投標的承建商數目便會減少，因而減低競爭和增加工程成本。所以，分拆合約安排會提供更多機會給有意投標的承建商，並可吸引競爭性投標。此外，從工程風險管理角度來看，把一個大型工程項目分拆為數份合約去推展，可以儘量減少對單一承建商的倚賴，從而減低工程項目的風險。

鑑於大型工程項目的規模，工程項目部分的工序必須較早完成，才可銜接其它部分工序。因此，八號幹線沙田段的建築工程透過三份土木工程合約去推展，分別為合約 A、B 和 C（即八號幹線—荔枝角高架道路、八號幹線—尖山隧道及相關工程和八號幹線—沙田嶺隧道和引道），以及一份交通管制及監察系統合約，即合約 D（八號幹線—交通管制及監察系統）。

就顧問合約而言，這類合約通常涉及規劃、設計和工程監督，特別是在大型工程項目中，顧問公司應在規劃和設計時把工程項目作為一個整體來考慮。因此，為每一個工程項目委聘一間顧問公司是常見的做法。除非在特殊情況下，如以此個案為例，由於土木工程拓展署當時有其它正在進行或計劃中的工程項目與這項目在沙田區的工程銜接，路政署因此將合約 C 交由土木工程拓展署透過其顧問公司推展，以進行合約 C 的設計及工程監督工作。

(b) 關於八號幹線沙田段的設計及工程監督工作，請提供以下事項的資料：

(i) 為合約 A 和 B 所批出的顧問合約的招標程序；

(ii) 曾獲邀提交標書的顧問公司數目和收到的標書數目；

(iii) 批出顧問合約給顧問 X 的原因；

(i) 為工程項目《八號幹線—長沙灣至沙田段》的顧問合約進行招標工作，於 1999 年 1 月成立顧問公司評審委員會，以制定邀請意向書的準則及顧問公司名單、篩選顧問公司意向書草擬的評分方案、技術建議的評分方案、以及進行評審等工作。評審委員會的成員包括來自路政署、運輸署、當時的土木工程署和水務署的代表，並由路政署一名首長級第二級的人員擔任主席。在參考過當時土木工程署的《顧問服務目錄》及工程項目的性質後，路政署草擬了一份顧問公司名單及顧問公司遴選評分方案，並徵求評審委員會同意。在徵得評審委員會同意後，路政署於 1999 年 1 月 27 日發出邀請信，邀請名單上的顧問公司對進行有關顧問合約表達意向。

有興趣的顧問公司就有關顧問合約提交了意向書。評審委員會根據已同意的評分方案對收到的建議書進行評分，初步選出四間取得最高分數的顧問公司進行下一階段的遴選。路政署就所選出的四間顧問公司、技術建議書的擬議評分方案、費用建議書的擬議評估準則、擬議付款表及一套聘用顧問公司的擬議額外特別條款，於 1999 年 3 月 18 日向「工程及有關事務顧問公司遴選委員會」徵求批准。在徵求有關批准的同時，路政署亦向「工程及有關事務顧問公司遴選委員會」提交了顧問工作簡介、評審委員會會議紀錄及評審結果等。

在得到有關批准後，路政署發信邀請該四間顧問公司，向路政署提交技術建議書及向「工程及有關事務顧問公司遴選委員會」提交費用建議書。

評審委員會首先根據獲「工程及有關事務顧問公司遴選委員會」批准的評分方案，對收到的技術建議作出評審和給予技術評分。接着「工程及有關事務顧問公司遴選委員會」將顧問公司提交的費用建議書交給評審委員會作評估。顧問公司的技術

評分和費用評分會按技術比重和費用比重（就此工程項目，分別為 80%和 20%）合併計算。其後，路政署於 1999 年 7 月 2 日，就聘用取得最高合計技術及費用評分的顧問公司向「工程及有關事務顧問公司遴選委員會」徵求批准。路政署於 1999 年 7 月 9 日獲得有關批准，並於 1999 年 7 月 13 日委聘該顧問公司進行有關顧問合約。

- (ii) 就八號幹線沙田段來說，評審委員會同意納入 16 間顧問公司於邀請名單內。評審委員會在 1999 年 1 月 27 日發出邀請信，邀請名單上的顧問公司對進行有關顧問合約表達意向。在提交意向書的期限（即 1999 年 2 月 24 日）前，共收到七間顧問公司/聯營公司的意向書。其中四間顧問公司在初步遴選中入圍，路政署其後收到這四間顧問公司提交的技術及費用建議書。
- (iii) 由於顧問 X 的建議書的技術評分最高，而其總標價又是最底，因此顧問 X 取得最高的合計評分。路政署就聘用顧問 X 向「工程及有關事務顧問公司遴選委員會」徵求批准，並於 1999 年 7 月 9 日獲得批准後，於 1999 年 7 月 13 日將有關的顧問合約批予顧問 X。

(c) 參照審計報告書第2.5段，請列出承建商A就合約A所提出的申索總額連同分類細帳，以及顧問X所核證的總額；

就承建商 A 所提出的申索，顧問 X 根據合約 A 的條款核證了總共 8,570 萬元。

承建商 A 在仲裁 A 所提出，就合約 A 中未解決的申索總額（即有爭議的申索總額）連同分類細帳如下：

	索償額
變更及新增工程	\$587,975,385
計量	\$50,711,983
延期完工費用	\$122,626,544
其它應得款項	\$255,431,900
總計	\$1,016,745,812

最後，此爭議以一筆金額為2.73億元的款項解決。

(d) 參照審計報告書第2.5及2.6段，承建商A於2008年2月要求進行調解，但最終調解失敗。其後，承建商A於2009年6月送達仲裁通知書，就申索進行仲裁（仲裁A），政府並為準備與承建商A展開仲裁，分別於2010年4月和5月委聘一名定量專家和一名工程專家。就此，請提供以下事項的資料：

(i) 路政署在接受調解要求前，有否就透過調解解決爭議的可行性，尋求律政司或發展局轄下法律諮詢部（工務）的法律意見。如有，請提供取得法律意見的日期及法律意見的詳情；如否，請解釋原因；

(ii) 政府沒有即時在2009年6月收到仲裁通知書後委聘定量專家和工程專家的原因；

(iii) 政府就與承建商A進行調解和仲裁委聘的調解員人數和仲裁員人數、進行調解和仲裁的節數，以及當中的開支；

(iv) 政府有否就遴選及委聘為政府處理有關工程項目糾紛的調解員和仲裁員，定立任何準則及程序指引；

(v) 路政署是否知悉進行調解或仲裁的開支。如是，路政署是在何時獲悉？路政署在考慮到相關開支後，有沒有考慮就應否繼續進行調解或仲裁，諮詢其它政府部門；

(i) 在接受承建商A於2008年2月5日所提出的調解要求之前，路政署已於2008年2月18日，就透過調解解決爭議的可行性，徵得發展局轄下法律諮詢部（工務）（下稱「法律諮詢部（工務）」）的法律意見。法律諮詢部（工務）根據政府的政策，即是儘可能透過調解解決工程爭議（只有在調解無法解決爭議的情況下，才會訴諸仲裁），及因調解是切實可行和不時能夠成功解決爭議的前提下，贊成進行調解。

(ii) 政府於2009年6月收到仲裁通知書後，法律諮詢部（工務）已即時考慮是否需要委聘定量專家和工程專家。由於涉及風險甚高，因此法律諮詢部（工務）有迫切需要遴選出最合適的候選專家、邀請他們表達意向、考慮他們的建議書、與他們進行面試、內部討論人選和徵求委任和財政撥款批准，並隨後儘快進行委聘。

(iii) 政府分別為與承建商 A 進行調解和仲裁，委聘了一名調解員和一名仲裁員。於 2008 年 11 月、2009 年 1 月、2009 年 2 月和 2009 年 3 月，分別進行了四節調解，而於 2009 年 11 月至 12 月則進行了一節仲裁。根據法律意見，政府與承建商 A 的調解和仲裁開支是機密和敏感資料，而且由於這些資料會對將來政府處理其它協商和解決爭議的策略不利，因此，並不適宜討論有關法律開支。

(iv) 政府有指引，規定遴選及委聘調解員和仲裁員的程序。政府在與承建商 A 進行調解和仲裁時，法律諮詢部（工務）有遵從該指引。

一般而言，遴選的準則包括專長和在相關範疇的經驗、是否有潛在利益衝突、過往表現、工作時間安排上是否許可（例如同時有其它工作）、擬議和/或估計工作費用和調解/仲裁對方的意見（由於在大多數情況下，調解員和仲裁員是由雙方共同委聘的）等。

(v) 路政署在過程中一直知悉調解和仲裁的開支。路政署有考慮到相關開支，並就應否繼續進行調解或仲裁，徵詢法律諮詢部（工務）。

- (e) 參照審計報告書第2.7段，仲裁 A 涉及路政署與承建商 A 對申索的爭議，主要包括以下兩大事宜，分別為：高架道路結構和架設工程的設計是否有不足之處；及新增或變更工程的計量和估價。請闡述「新增或變更工程」的定義和例子，並提供仲裁A牽涉的新增或變更工程及其相關金額；

根據《土木工程合約一般條件》，工程師須就任何對完成工程有必要的工程變更發出指示，並有權就他認為對達至令人滿意的工程完工及工程功能有利的其它變更發出指示。這些變更可包括：

- (a) 新增、刪除、替代、更改、有關質量、形式、特徵、種類、位置、尺寸、高度或路線的改變；
- (b) 有關任何合約訂定的工序、施工方法或建造時間的更改；及
- (c) 有關工地或工地出入口的更改。

就此，工程師須發出變更工程訂單，要求承建商進行必要的新增或變更工程，使工程可良好完工。換句話說，工程師會經相同程序，就新增或變更工程向承建商發出變更工程訂單。

以合約A為例，其中一個因新增工程而向承建商A發出的變更工程訂單，是因應實際土地狀況與用作設計的岩土評估結果不同，額外於荔灣道橋墩下建造一幅混凝土支撐牆。另一個因變更工程而發出的變更工程訂單，是因應在施工期間，路政署對道路安全的最新要求，而需要加強橋面護欄。

仲裁A涉及的新增或變更工程之詳情如下：

變更及新增工程類別	仲裁A中的索償額
1. 高架道路結構的設計和架設	\$128,477,801
2. 工程設計的額外資源	\$20,819,995
3. 工程變更訂單	\$438,677,589
總計	\$587,975,385



(f) 參照審計報告書第2.9及2.18(a)段，請提供以下事項的資料：

(i) 該筆以解決合約 A 所有爭議，金額為 2.73 億元的合約未有訂明的款項之分類細帳，包括利息；

(ii) 路政署認為與承建商 A 以 2.73 億元解決的爭議事項並不能全部歸咎於顧問 X 的理據；

(iii) 路政署認為擬議解決爭議的金額是較低及對政府有利的理據；

(i) 解決合約 A 所有爭議的款項為整體金額，並沒有分類細帳，包括利息。

(ii) 根據法律意見，解決合約 A 所有爭議的款項中，部分金額是與新增或變更工程有關，並不是關於顧問 X 在高架道路結構的設計和架設的工作表現。因此，路政署與承建商 A 以 2.73 億元解決的爭議事項並不能全部歸咎於顧問 X。

(iii) 政府有就所須承擔的整體風險進行詳盡評估，並由此制定協商策略。路政署考慮上述的政府整體風險承擔估算，以及繼續仲裁程序的費用後，認為擬議所須支付的金額較低，而且對政府較為有利。

(g) 參照審計報告書第2.21段註13，路政署於2006年8月修訂了《道路及鐵路結構設計手冊》，訂明應對受聘於政府的顧問公司或承建商所負責的各類新道路結構的設計和所作出的現有道路結構相關修訂，進行適當程度的獨立查核，並提供這方面的指引。就此，請提供以下事項的資料：

(i) 摘錄該手冊修訂部分的複本；

(ii) 如何定義「對道路結構的設計進行適當程度的獨立查核」，請以例子作解釋；

(iii) 獨立查核發現了多少個不符合規定的個案；

(i) 摘錄該手冊修訂部分的複本載於附件 A。

(ii) 獨立查核會根據不同類別由相應合適的審核工程師負責進行。需要進行獨立查核的道路結構分為三個類別。類別 I，審核工程師是一名與設計者屬同一機構，亦可以是屬同一設計組別的專業人士。類別 II，審核工程師是與設計者屬同一機構，但獨立於設計者所屬組別的專業人士或審核小組。類別 III，審核工程師必須是獨立於設計者所屬機構的審核小組。查核道路結構設計的分類如下：

結構類別	描述
I	<p><u>簡單結構</u></p> <p>沒有偏離路政署現行標準或超出該標準所涵蓋範疇的結構，並且符合以下其中一項：</p> <p>a) 跨度少於 20 米及斜交角少於 25 度的單跨簡支結構；</p> <p>b) 跨度少於 8 米並埋入地底下的箱形混凝土結構；</p> <p>c) 護土高度少於 7 米的護土牆；或</p> <p>d) 不高於 3 米的隔音屏障。</p>
II	<p><u>中度複雜結構</u></p> <p>不屬於結構類別 I 和 III 的結構。</p>
III	<p><u>複雜結構</u></p>

	<p>需要複雜分析或具有以下其中一項特徵的結構：</p> <ul style="list-style-type: none"><li>a) 高結構冗餘度；</li><li>b) 非傳統設計範疇；</li><li>c) 任何跨度超過 80 米；</li><li>d) 斜交角超過 45 度；</li><li>e) 跨度超過 65 米的連續結構；</li><li>f) 困難的地基問題；或</li><li>g) 困難的建築技術或問題。</li></ul>
--	---

(iii) 自 2006 年頒布有關要求後，獨立查核並沒有發現不符合規定的個案。

(h) 參照審計報告書第2.25及2.27段，請提供就以下事宜已採取或將會採取的改善措施，以及時間表：

(i) 審核顧問公司的設計及處理標書查詢的回覆；

(ii) 「對查核員進行查核」在監察為政府推展工程項目的顧問公司及承建商的角色，例如：查核由顧問公司及承建商擬備的設計和圖則；

(i) 路政署已於 2018 年 5 月，提醒員工及受委聘的顧問公司，必須嚴格遵從《道路及鐵路結構設計手冊》訂明的指引。

就標書查詢的回覆，路政署會檢討「HQ/GN/02 檢查顧問公司提交的文件指引」（下稱「HQ/GN/02」），如有需要會作出更新，加入審核由顧問公司擬備的標書查詢回覆的準則。路政署亦會繼續要求員工及受委聘的顧問公司，嚴格遵從處理標書查詢回覆的規定，包括《土木工程管理手冊》內將強化的規定。

(ii) 項目管理處與設計者須根據《道路及鐵路結構設計手冊》中的分類，安排符合相應類別要求的審核工程師，對道路結構設計進行獨立查核。

當審核工程師完成獨立查核，包括設計計算、規格及圖則等，設計者及審核工程師須按照《道路及鐵路結構設計手冊》附加的標準表格，或其它得到路政署總工程師（橋樑及結構）同意的格式，簽發道路結構設計及檢查證書。而儘管設計查核已經根據《道路及鐵路結構設計手冊》進行，路政署總工程師（橋樑及結構）亦會根據 HQ/GN/02 對顧問公司擬備的設計和合約圖則的擬議結構形態方面進行抽樣查核。

- (i) 參照審計報告書第2.31及2.32段，請解釋為何路政署沒有在與承建商A商討和達成共識前，事先就談判的策略或底線徵求財經事務及庫務局的同意；

於2010年12月，路政署已就進行仲裁A的策略和底線，徵求並獲得財經事務及庫務局的事先同意。

路政署其後於2012年6月，就仲裁A向財經事務及庫務局提交經修訂的策略和底線。在等待財經事務及庫務局給予同意期間，承建商A於2012年7月主動聯絡路政署，有意就有關糾紛進行不構成任何承諾的討論，探討可否在毋需繼續仲裁程序的情況下，解決有關糾紛。考慮到儘快解決有關糾紛能讓雙方（包括政府）有效節省仲裁程序所需的法律費用，路政署因此同意和承建商A就有關糾紛進行不構成任何承諾的討論，試圖儘早解決有關糾紛。

於2012年7月底，路政署與承建商A經過多次會議後達成沒有任何承諾的共識（該共識須得到政府內部批准，雙方並須簽立正式協議後，方為有約束力的），在建基於「不承認任何法律責任」的前提下，以一筆金額為數2.73億元的款項解決合約A的所有爭議。

路政署於2012年10月11日獲得政府內部批核後，與承建商於2012年10月24日正式簽訂和解協議。

- (j) 除金額為1.331億元的合約未有訂明的款項外，路政署有否就顧問X的工作表現欠佳而採取其它行動，以及有沒有任何懲處機制，在期限內暫停有關顧問公司競投路政署或其它政府部門的顧問合約。如有，請提供詳情；如沒有，請解釋原因。

路政署一向按照《工程及有關顧問公司遴選委員會手冊》及發展局發出的《工務技術通告第3/2016號—管理顧問公司工作表現》，管理顧問公司。路政署會定期對顧問公司的工作表現進行評核，並會對表現欠佳的顧問公司採取規管行動，其中包括暫停其競投工務工程顧問合約的資格。

由於合約A涉及複雜的技術及法律問題，而且政府當時已經與顧問X展開仲裁程序，所以，顧問公司在有關設計和回覆標書查詢的工作表現是否有不足，需要視乎仲裁完結後的結果才作考慮。其後，路政署與顧問X是在建基於「不承認任何法律責任」的前提下解決爭議，避免繼續進行仲裁程序。

考慮到顧問X是在建基於「不承認任何法律責任」的前提下，支付了一筆金額解決爭議。因此，有關設計和回覆標書查詢的責任爭議，仍未能確定。

# STRUCTURES DESIGN MANUAL

*for Highways and Railways*

Third Edition



**HIGHWAYS DEPARTMENT**

*The Government of the Hong Kong  
Special Administrative Region*

\* 委員會秘書附註：本文件只備英文本。



© The Government of the Hong Kong Special Administrative Region  
First edition, August 1993.  
Second edition, November 1997.  
Third edition, August 2006.

Prepared by :

Bridges and Structures Division,  
Highways Department,  
Room 1502, Skyline Tower,  
39 Wang Kwong Road,  
Kowloon Bay, Kowloon,  
Hong Kong.

This publication is obtainable from:

Publications Sales Unit,  
Information Services Department,  
Room 402, 4/F., Murray Building,  
Garden Road, Central,  
Hong Kong.

Price in Hong Kong : HK\$54.00

Cheques, bank drafts or money orders must be made payable to  
**The Government of the Hong Kong Special Administrative Region**



## 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"> <li>a) Single simply supported span of less than 20m and having less than 25° skew</li> <li>b) Buried concrete box type structures with less than 8 m span</li> <li>c) Retaining walls with a retained height of less than 7 m, or</li> <li>d) Noise barrier with a maximum height of 3 m.</li> </ul>
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"> <li>a) High structural redundancy,</li> <li>b) Unconventional design aspects,</li> <li>c) Any span exceeding 80 m,</li> <li>d) Skew exceeding 45 °,</li> <li>e) Continuous structure with spans exceeding 65 m,</li> <li>f) Difficult foundation problems, or</li> <li>g) Difficult construction techniques/ problems.</li> </ul>

Table 42 - Scope of Design Checking

Category	Scope of Design Checking
I	<ul style="list-style-type: none"> <li>a) Check compliance with design codes and standards.</li> <li>b) Carry out arithmetic check on the design calculations.</li> <li>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.</li> <li>d) Ensure that the design is correctly translated into the drawings and specifications.</li> </ul>
II	<ul style="list-style-type: none"> <li>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.</li> <li>b) Check/Confirm the applicability, accuracy and validity of all computer programs used by the Designer.</li> <li>c) Check the numerical model, its applicability, input parameters and boundary conditions.</li> <li>d) Carry out separate analytical check on critical structural elements without reference to the design calculations.</li> <li>e) Ensure that the design is correctly translated into the drawings and specifications.</li> </ul>
III	<ul style="list-style-type: none"> <li>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.</li> <li>b) Check the compliance with design codes and standards, and limitations if any.</li> <li>c) Check the applicability, accuracy and validity of all computer programs used in design checking.</li> <li>d) Construct computer models, input boundary conditions and parameters and carry out independent structural analysis.</li> <li>e) Prepare an independent set of design check calculations.</li> <li>f) Ensure that the design is correctly translated into the drawings and specifications.</li> </ul>

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)



Table 43 - Highway Structures Design and Check Certificate (Cont'd)

3. Checking Engineer's certification

(a) I / We certify that the design has been independently checked in accordance with the Structures Design Manual for Highways and Railways using all reasonable skill and care and that I/we am/are satisfied that the design checked complies in all respects with the agreed design criteria.

(b) I / We further certify that I am/are satisfied that the checking of the above design is completed.

Signed : \_\_\_\_\_  
 \_\_\_\_\_ (Name)  
 \_\_\_\_\_ (Position)  
 \_\_\_\_\_ (Organization)  
 \_\_\_\_\_ (Date)

**Schedule A**

Submission No. \_\_\_\_\_ comprises the followings :

Documents : *(Title, reference number and revision)*

---

---

---

---

---

---

---

---

---

---

Drawings : *(Title, drawing number and revision)*

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

Others : *(Please Specify)*

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---