《香港風力效應作業守則》

屋宇署於2019年9月公布《香港風力效應作業守則2019年》(《2019守則》)。《2019守則》為一部全面的香港風力效應作業守則,內容已顧及風力工程和科技的最新發展,以及國際作業守則就風荷載的規定。《香港風力效應作業守則2019年說明資料》(《說明資料》)載有《2019守則》的理論背景、假定、參考資料來源和說明舉例,為使用《2019守則》提供進一步的指引。《說明資料》不應視為《2019守則》的一部分。

《2019 守則》的實施

2. 《2019守則》於2019年9月30日發出通告函件後開始生效。在通告函件發出日期起計算的寬限期內,屋宇署會接納按照《香港風力效應作業守則2004年》設計有關基礎工程或結構工程呈交的圖則。在延至2021年3月31日的寬限期屆滿後,屋宇署只接納按照《2019守則》設計有關基礎工程或結構工程呈交圖則。然而,如有關基礎工程或結構工程的圖則[1],於寬限期屆滿之前呈交並獲建築事務監督批准,則隨後呈交的基礎工程或結構工程圖則仍可繼續採用在原有設計中所使用的風力效應作業守則。

3. 對於在寬限期後呈交的改建及加建工程圖則,其新建結構構件的設計及/或現有結構承載力的檢查工作應遵從《認可人士、註冊結構工程師及註冊岩土工程師作業備考》(《作業備考》)APP-117的指引。

4. 儘管有上述的安排,根據《建築物條例》第16(3)(d)條的規定,如該等建築工程的訂明圖則自獲批准的日期起計相隔超逾2年,建築事務監督可拒絕就任何建築工程給予展開工程同意書。

[1] 包括於圖則內列明預留未來建築物荷載的基礎工程或結構工程。

5. 屋宇署已成立技術委員會，工作範疇包括收集及考慮建築業界就使用《2019 守則》和《說明資料》所得出的意見。屋宇署現因應技術委員會的建議，公布以下修訂內容並已上載屋宇署網頁 www.bd.gov.hk：

(a) 《2019 守則》的修訂內容載於附錄 A[2] — 2023 年 12 月；以及

(b) 《說明資料》的修訂內容載於附錄 B[2] — 2023 年 12 月

風洞測試

6. 《2019 守則》第 6 部分指明風洞測試的要求。如風洞測試未能按照該要求進行，註冊結構工程師須在測試前呈交風洞測試建議書供屋宇署接納。署方一般會在收到風洞測試建議書後的 45 天內作出決定。註冊結構工程師在正式提交風洞測試建議書前，可按照《作業備考》ADM-19 的要求提交一份初步測試建議書作呈交圖則前的諮詢，以確定設計原理。署方或會與註冊結構工程師和風洞實驗室代表舉行呈交圖則前的會議，討論並審研風洞測試所牽涉的原理和方法。附錄 C 載列風洞測試建議書所需涵蓋的主要資料。

7. 風洞測試建議書應包含品質保證計劃，內容可參考相關的國際標準／手冊，例如美國土木工程師學會發布的《美國土木工程師學會實務手冊第 67 號：建築物及構築物風洞研究》(ASCE Manuals and Reports on Engineering Practice No. 67 - Wind Tunnel Studies of Buildings and Structures) 或澳洲風力工程協會發布的《品質保證手冊：建築物的風力工程研究》(Quality Assurance Manual: Wind Engineering Studies of Buildings)。附錄 D 載列品質保證計劃所需涵蓋的主要資料。

8. 風洞測試應由註冊結構工程師或一名獨立的工程師進行見證。作為前者的代表，該獨立工程師應為香港工程師學會的法定會員或持有同等專業資格，並具備合共最少五年相關工作經驗，惟不可由進行風洞測試的實驗室職員或僱員擔任。見證測試的註冊結構工程師或獨立工程師應確保品質保證程序得到妥善遵從。

[2] 暫只提供英文版本。

9. 風洞測試報告應包含測試程序、整套測試讀數，以及計算建築結構的風荷載時所採用的結構和動力特性，並連同一份由註冊結構工程師簽署的聲明，確認在進行風洞測試期間，已作出適當的督導安排，且風洞測試的原始數據和結果亦完全符合《2019 守則》內為釐定風荷載而設的要求，適合納入當前項目所需呈交的結構圖則。

建築事務監督　余寶美

檔號：BD GR/1-50/59/0

本作業備考前稱《認可人士及註冊結構工程師作業備考》291
初版：1985年2月
上次修訂版：2004年12月
本修訂版：2023年12月（助理署長／拓展(2)）
（一般修訂）

Appendix A
(PNAP APP-139)

Amendments to the Code of Practice on Wind Effects in Hong Kong 2019

(December 2023)

Legends:

Amended

Deleted

(12/2023)

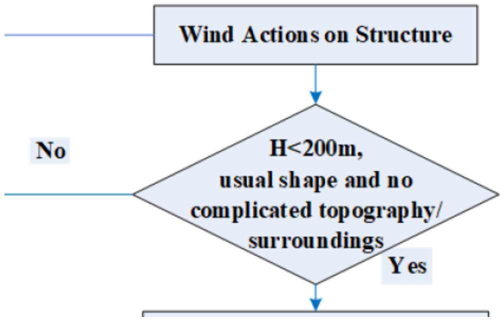
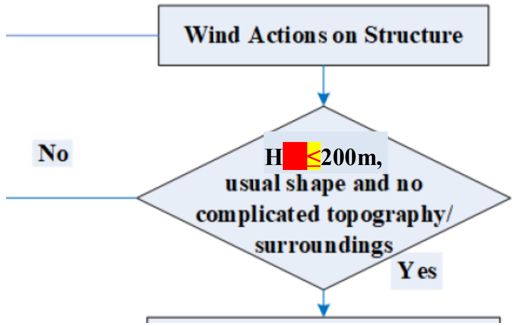
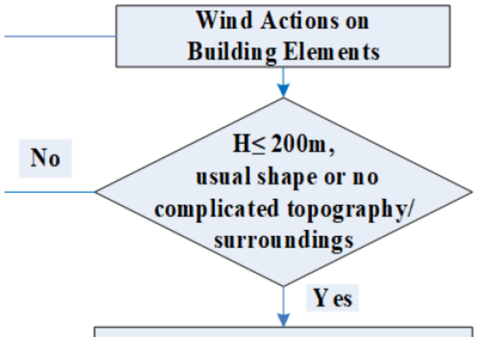
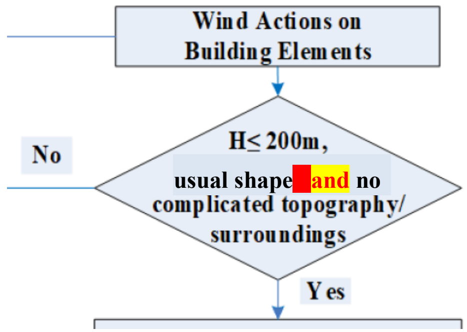
Amendments to the Code of Practice on Wind Effects in Hong Kong 2019 in December 2023 included:

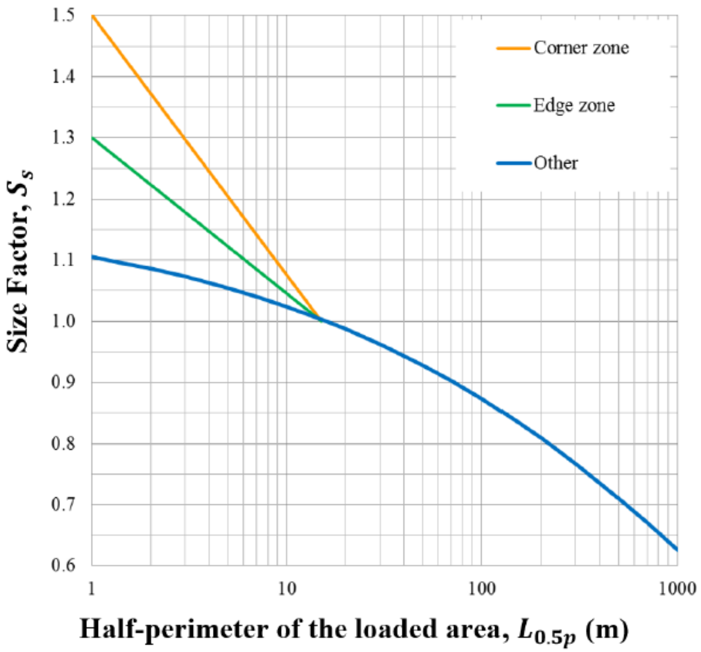
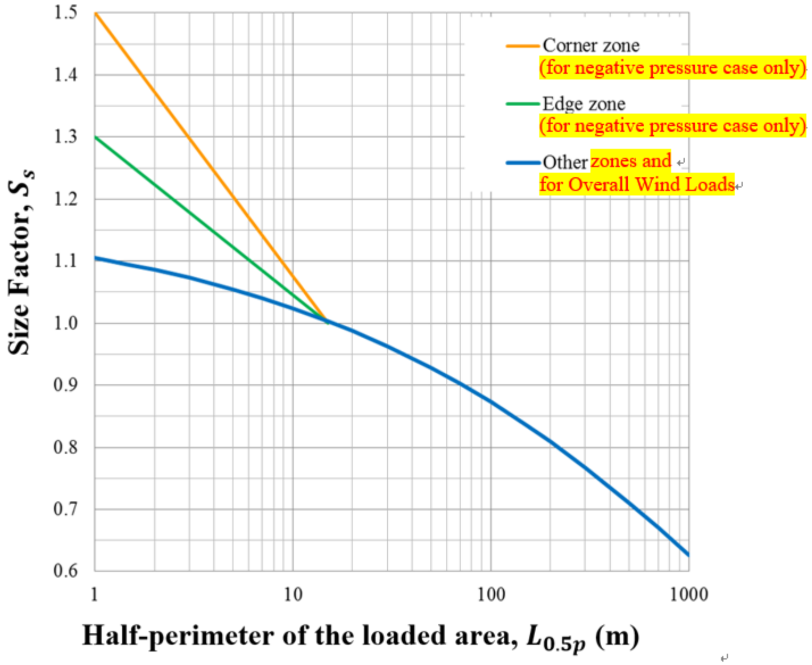
(a) Figures 2-1 and 2-2 – Revision on the condition required to carry out wind tunnel test;

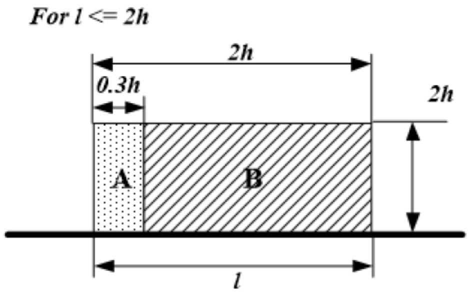
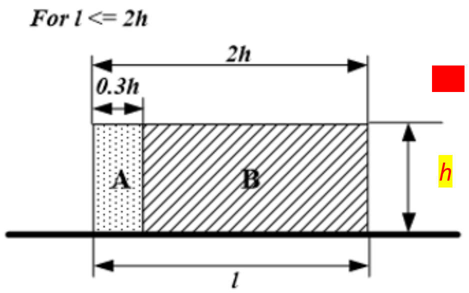
(b) Table 4-1, Appendix A2 and Figure B3-1 – Textual refinement; and

(c) Figure 5-2 and Appendix C1 – Elaboration on calculation of size factor.

Amendments to the Code of Practice on Wind Effects in Hong Kong 2019

<table>
<tr><th>Item</th><th>Current version</th><th>Amendments</th></tr>
<tr><td>1. Figure 2-1</td><td>
</td><td>
</td></tr>
<tr><td>2. Figure 2-2</td><td>
</td><td>
</td></tr>
<tr><td>3. Table 4-1</td><td>(d) Where there are significant steps in building form, i.e. podiums, the height rules for tower and podium in Figure 4.6(a) and Figure 4.6(b) should be followed.</td><td>(d) Where there are significant steps in building form, i.e. podiums, the height rules for tower and podium in Figure 4.5(a) and Figure 4.5(b) should be followed.</td></tr>
</table>

Item	Current version	Amendments
4. Figure 5-2	 **Figure 5-2 Size factor, S_s**	 **Figure 5-2 Size factor, S_s**
5. Appendix A2	Figure A2-3 can be used to determine the most and the second most obstructing buildings. The largest and the second largest H_d. Z_e are taken as the following:	Figure A2-3 can be used to determine the most and the second most obstructing buildings (i.e. the largest and the second largest H_d). Z_e are taken as the following:

Item	Current version	Amendments
6. Figure B3-1		
7. Appendix C1	**C1 Equations for Calculation of Size Factor** The size factor, S_s, depends on the loaded area and is defined by the half-perimeter of the area, $L_{0.5p}$ as shown in Figure 5-2. Alternatively, S_s, may be calculated using the formulas below: **Other zones and for Overall Wind Loads** $S_{s=L_{0.5p}} = Exp(0.17 - 0.07\ L_{0.5p}{}^{0.32})$ - Equation C1-1a **Edge** zones if $L_{0.5p} < 15\text{m}$ $S_{s=L_{0.5p}} = 1.3 - \log_n(L_{0.5p})\ /9.0 > 1.0$ - Equation C1-1b **Corner** zones if $L_{0.5p} < 15\text{m}$ $S_{s=L_{0.5p}} = 1.5 - \log_n(L_{0.5p})\ /5.4 > 1.0$ - Equation C1-1c	**C1 Equations for Calculation of Size Factor** The size factor, S_s, depends on the loaded area and is defined by the half-perimeter of the area, $L_{0.5p}$ as shown in Figure 5-2. Alternatively, S_s, may be calculated using the formulas below: **Edge** zones if $L_{0.5p} \geq 15\text{m}$, **Corner** zones if $L_{0.5p} \geq 15\text{m}$, **Other zones and for Overall Wind Loads** $S_{s=L_{0.5p}} = Exp(0.17 - 0.07\ L_{0.5p}{}^{0.32})$ - Equation C1-1a **Edge** zones if $L_{0.5p} < 15\text{m}$ $S_{s=L_{0.5p}} = 1.3 - \log_n(L_{0.5p})\ /9.0 > 1.0$ - Equation C1-1b **Corner** zones if $L_{0.5p} < 15\text{m}$ $S_{s=L_{0.5p}} = 1.5 - \log_n(L_{0.5p})\ /5.4 > 1.0$ - Equation C1-1c

Appendix B
(PNAP APP-139)

Amendments to the Explanatory Notes to the Code of Practice on Wind Effects in Hong Kong 2019 (December 2023)

Legends:

Amended

Deleted

(12/2023)

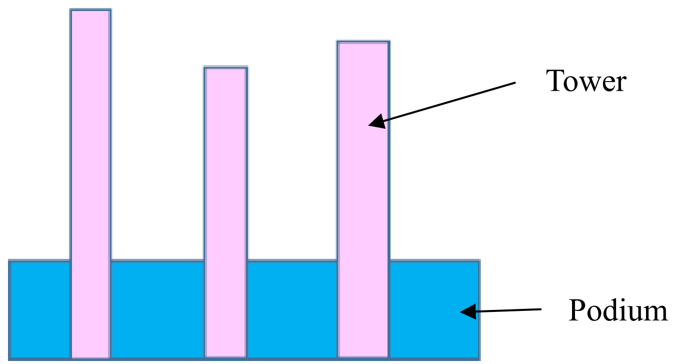
Amendments to the Explanatory Notes to the Code of Practice on Wind Effects in Hong Kong 2019 in December 2023 included:

(a) Clause 2.2.3 – Addition of guidelines for determination of fundamental frequency for assessing across wind effects;

(b) Clause 2.5 – Addition of design net pressure for hoarding and covered walkway associated with construction site; and

(c) Clause 4.3.1, Clause 6.4, Figure B-1, Appendices C2 and E3.1 – Textual refinement.

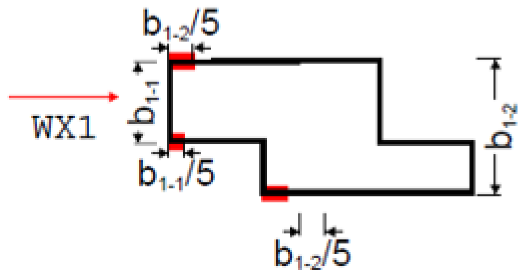
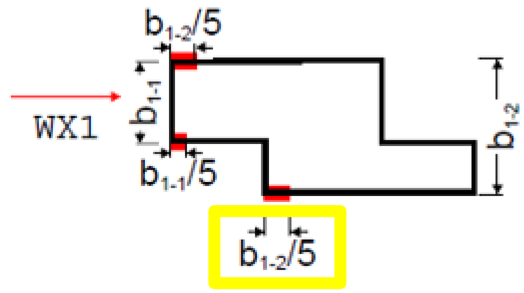
Amendments to the Explanatory Notes to the Code of Practice on Wind Effects in Hong Kong 2019

Item	Current version	Amendments
1. Clause 2.2.3	Last paragraph – According to a parametric study with selected parameters, assuming natural periods of $H/46$ in both directions, for buildings which satisfy $H/min(B,D)$<5, H<100m and N>0.5Hz, the along-wind base moment is always larger than the across-wind base moment in the same direction, even with consideration of some level of uncertainty on the period estimation. Therefore checking of the across-wind base moment is not required when these conditions are met.	Last paragraph – According to a parametric study with selected parameters, assuming natural periods of $H/46$ in both directions, for buildings which satisfy $H/min(B,D)$<5, H<100m and N>0.5Hz, the along-wind base moment is always larger than the across-wind base moment in the same direction, even with consideration of some level of uncertainty on the period estimation. Therefore checking of the across-wind base moment is not required when these conditions are met. For multiple towers over a common podium, the fundamental frequency for estimation of across wind effects could be assessed by <u>either one</u> of the following assumptions: (a) assuming individual tower standing alone and extended to the building base without connecting to the podium; 

Item	Current version	Amendments
		(b) assuming individual tower integrated with the portion of the podium measured from structural wall/column edge of the modelled tower by not exceeding the minimum of 20m, three bays of the podium structure, and the middle line between the modelled tower and its nearby tower, subject to no substantial openings in floor slabs of the integrated portion of the podium. The effect of those floor openings might be considered separately; or (c) assuming individual tower integrated with the portion of the podium in conformity with the recognised engineering principles and engineering practices. Alternatively, if an integrated computer model of the towers and podium was set up, the dominant fundamental frequency of the mode of vibration mainly aligned with the across-wind direction of the respective towers obtained from the computer analysis could be adopted based on engineering justification. For cases where the tributary extent could not be clearly defined based on the above-mentioned criteria (b), an integrated computer model with all the towers and podium might be used to obtain the dominant fundamental frequency of the respective towers.

<table>
<tr><th>Item</th><th>Current version</th><th>Amendments</th></tr>
<tr><td>2. Clause 2.5</td><td>End of 2nd paragraph –
For designing hoarding and covered walkway associated with construction site, contractor shed, bamboo shed, tent or marquee that are not for residential use, wind pressures of not less than 37 per cent of the pressures given in the Code should be used.</td><td>End of 2nd paragraph –
For designing hoarding and covered walkway associated with construction site, contractor shed, bamboo shed, tent or marquee that are not for residential use, wind pressures of not less than 37 per cent of the pressures given in the Code should be used. In particular for hoarding and covered walkway associated with construction site, the design net pressure in Table 2-1 may be used.

Table 2-1 Design net pressure for hoarding and covered walkway associated with construction site
<table>
<tr><th>Height above ground level, Z(m)</th><th>Design Net Pressure (kPa) (all-inclusive value)</th></tr>
<tr><td>≤ 2.5</td><td>0.63</td></tr>
<tr><td>5</td><td>0.70</td></tr>
<tr><td>10</td><td>0.77</td></tr>
</table>
Notes:
(a) For intermediate values of height, linear interpolation is permitted.
(b) Cp and Ss have been included.
(c) Beneficial effect due to self-weight of steel members may be considered.
(d) Topography factor should be considered in location where local topography may adversely affect wind effect.</td></tr>
<tr><td>3. Clause 4.3.1</td><td>Last paragraph –
However, the accidental dominant open scenario is out of scope of this Code, as discussed in Appendix B1.3.</td><td>Last paragraph –
However, the accidental dominant open scenario is not a compulsory requirement of this Code, as discussed in Appendix B1.3.</td></tr>
<tr><td>4. Clause 6.4</td><td>Last sentence of 2nd paragraph –
If a building removal investigation is not carried out, then the shelter benefit is limited to 80% of the along-wind value in accordance with the Code.</td><td>Last sentence of 2nd paragraph –
If a building removal investigation is not carried out, then the shelter benefit is limited to 80% of the loads of the Standard Method. The comparison should be in the form of total base moments.</td></tr>
</table>

Item	Current version	Amendments
5. Figure B-1	Top left figure –  	Top left figure – 
6. Appendix C2	2nd paragraph – Outlying high damping value was recorded for a 200m building which was cubic.	2nd paragraph – Outlying high damping value was recorded for a 250m building which was cubic.
7. Appendix E3.1	The critical torsional load cases can be obtained by the following procedures: 1. For each tower, the loads on individual towers are calculated following the Code as shown in Figure E-7(a), (b) and (c). 2. Obtain the eight translational governed loads according to Section E2. In each subzones defined in Figure E-5, the resultant force ($F_{lateral-i}$) can be calculated by vector summation. For example, $F_{lateral-1}$ is the resultant force by F_{1-1}, F_{2-1} and F_{3-1}, as shown in Figure E-7(d). 3. For each $F_{lateral-i}$, the maximum projecting diagonal breadth B_i can be identified as shown in Figure E-7(e).	The critical torsional load cases can be obtained by the following procedures: 1. For each tower, the loads on individual towers are calculated following the Code as shown in Figure E-7(a), (b), (c) and (d). 2. Obtain the eight translational governed loads according to Section E2. In each subzones defined in Figure E-5, the resultant force ($F_{lateral-i}$) can be calculated by vector summation. For example, $F_{lateral-1}$ is the resultant force by F_{1-1}, F_{2-1}, F_{3-1} and F_{4-1}, as shown in Figure E-7(e). 3. For each $F_{lateral-i}$, the maximum projecting diagonal breadth B_i can be identified as shown in Figure E-7(f).

附錄 C

（認可人士、註冊結構工程師及註冊岩土工程師作業備考 APP-139）

風洞測試建議書所需涵蓋的主要資料

常見項目		主要資料
一般		(a) 風洞實驗室的名稱和地點。
風場模擬與使用儀器	一般 (參考第 6.1.1 及 6.1.2 節)	(a) 地盤位置； (b) 建築圖則，包括建築物的幾何形狀尺寸、立面和樓層高度； (c) 建築物的 H/B 和 H/D 數值和需考慮的頻率模式；以及 (d) 風洞測試的範疇，例如風荷載、加速度、覆蓋層／幕牆／建築構件的風壓等。
	地形模型 (參考第 6.1.3、6.1.5 及 6.1.6 節)	(a) 模型比例、範圍及物料； (b) 阻塞比率； (c) 來流風剖面包括平均風速及湍流強度剖面；以及 (d) 風向角度的數量及其間距。
	周邊景物模型 (參考第 6.1.3、6.1.4、6.1.5 及 6.1.6 節)	(a) 模型比例及範圍； (b) 周邊建築物的資料來源； (c) 模型物料（包括擬建及周邊建築物）； (d) 雷諾數及阻塞比率； (e) 風向角度的數量及其間距； (f) 峰值陣風風壓的匹配高度； (g) 地形放大因數；以及 (h) 根據《2019 守則》計算的匹配峰值陣風風壓。
	使用儀器 (參考第 6.1.1 及 6.3 節)	(a) 測量方法； (b) 數據採樣頻率和長度，及按實際比例的等效時間長度； (c) 測壓點的數量和密度（如適用）；以及 (d) 附加要求（如有）。
風氣候	風向特性 (參考第 6.5.2 節)	(a) 風氣候數據的來源和風向因數；以及 (b) 分析技術，即“Sector Method”、“Up-crossing Method”、“Storm Passage Method” 或其他方法。

<table>
<tr><th colspan="2">常見項目</th><th>主要資料</th></tr>
<tr><td>測試情況</td><td>測試情況
(參考第 6.4 節)</td><td>(a) 現存情況；以及
(b) 移除遮護物情況與移除原則，及需移除的建築物／建築物群的總數。</td></tr>
<tr><td rowspan="3">後期數據處理</td><td>理論背景</td><td>(a) 理論背景，例如動態模態分析／隨機振動理論、壓力積分法、設計峰值覆蓋層風壓的釐定及建築物最大加速度評估。</td></tr>
<tr><td>荷載組合
(參考第 6.6 節)</td><td>(a) 釐定荷載組合因數的背景與提議荷載情況的數目；以及
(b) 附加要求（如有）。</td></tr>
<tr><td>荷載分佈
(參考第 6.6 節)</td><td>(a) 計算樓層風荷載垂直分佈的背景。</td></tr>
<tr><td>品質保證</td><td>品質保證計劃</td><td>(a) 詳情參閱附錄 D。</td></tr>
</table>

註：括號內標示香港風力效應作業守則 2019 年的參考章節。

（2023 年 12 月初版）

風洞測試品質保證計劃所需涵蓋的主要資料

常見項目		主要資料
1.	風洞模型	(a) 說明製造及檢查模型的程序； (b) 說明模擬、測試及分析技術的限制及容差；以及 (c) 提供流程表並說明程序，包括由註冊結構工程師作出的檢驗及批註。
2.	風洞測試儀器	(a) 說明測試裝置／儀器的校正細節及相隔時間；以及 (b) 檢查並確保在測試前及測試過程中裝置／儀器能正常運作，包括模擬所得的風剖面。
3.	數據分析／匯報	(a) 以抽樣計算方式，檢查電腦軟件輸入及輸出的數據是否準確一致； (b) 說明驗證測試結果的程序，以及減少測試結果出現誤差／異常情況的措施； (c) 說明匯報系統的特點及跟進工作，例如就異常情況重新進行測試； (d) 設立系統妥善記錄所有測試內容，包括進行風洞測試的設置、模型及測試儀器的照片記錄；以及 (e) 說明擬備、檢查及批註測試報告的程序。
4.	監督	(a) 提供每階段督導人員的主管的詳細資料，包括姓名及職位； (b) 提供有關在測試、分析及匯報過程中進行監察及檢查次數的資料；以及 (c) 提供擔任註冊結構工程師代表的獨立工程師的姓名。