

**Planning Department**

**The Government of the Hong Kong  
Special Administrative Region**

**TERM CONSULTANCIES FOR  
AIR VENTILATION ASSESSMENT SERVICES  
(Agreement No. PLN AVA 2024)**

**Category A - Term Consultancy for Expert Evaluation and  
Advisory Services on Air Ventilation Assessments**

**Category B - Term Consultancy for Air Ventilation Assessments  
by Computational Fluid Dynamics**

**ASSIGNMENT BRIEF**

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## 1. INTRODUCTION

- 1.1 This Brief forms part of and is to be read in conjunction with the Articles of Agreement and Conditions of Contract (the Agreement), the Scope of Services, Letter(s) of Acceptance and all other related instructions for the concerned instructed project(s) which the Consultant may be awarded to undertake during the Term of the Agreement.

## 2. BACKGROUND

- 2.1 To ensure that air ventilation impacts are duly considered as one of the main criteria in the planning and design process, a Technical Circular (TC) on Air Ventilation Assessments was promulgated in July 2006 by the then Housing, Planning and Lands Bureau and Environment, Transport and Works Bureau (HPLB TC No. 1/06 and ETWB TC No. 1/06). The Technical Circular sets out the guidance and need to apply air ventilation assessment (AVA) to all major government projects which may have major impacts on the macro wind environment. The private and quasi-government sectors are also encouraged to apply AVA to their projects on voluntary and need basis.
- 2.2 Since then, Planning Department (PlanD) has undertaken to apply AVA as one of the considerations in formulating planning proposals such as planning studies for new development areas and comprehensive redevelopment areas, preparation of new town plans and planning briefs, and major amendment of town plans. Private and quasi-government sectors have also shown initiatives to incorporate AVA in some of their planning submissions to PlanD/Town Planning Board (TPB).
- 2.3 The methodology for undertaking AVA is set out in the Technical Guide for AVA for Developments in Hong Kong in HPLB TC No. 1/06 and ETWB TC No. 1/06 (Appendix). In 2012, the Planning Department completed the “*Urban Climatic Map and Standards for Wind Environment - Feasibility Study*” (UCM Study), the findings of which will form a basis for future refinement of the AVA system. Should the TC and Technical Guide on AVA be updated, the updated version of these documents should be referred to and adopted when they are issued.
- 2.4 In 2013, the Planning Department completed the “*Consultancy Study on Establishment of Simulated Site Wind Availability Assessment in Hong Kong*” and produced a set of comprehensive site wind availability data in supporting qualitative and quantitative AVAs. The

new set of site wind availability data has been uploaded onto the Planning Department's website for public use.

### **3. OBJECTIVES OF THE ASSIGNMENT**

- 3.1 The Assignment Brief covers two different categories of standing services, namely: (i) Category A services to undertake expert evaluation on AVA projects (Category A1 services), or provide professional comments/advice on AVA submissions or associated matters (Category A2 services), and (ii) Category B services to undertake AVA projects by Computational Fluid Dynamics (CFD) which may be instructed by the Director's Representative (DR), i.e. instructed projects, during the Term of the Agreement. The Consultant shall refer to the appropriate sections in this Assignment Brief under the respective category of services applicable to the instructed project(s) awarded to them for fulfillment of the Assignment.
- 3.2 The main objectives of the services are to facilitate objective assessment, formulation and improvement of development schemes so that air ventilation impacts are duly considered as one of the main criteria in the planning and design process for better air ventilation.
- 3.3 The services provided by the Consultant shall meet the programme and budget objectives which may be specified by the DR for each instructed project.

### **4. DESCRIPTION OF THE ASSIGNMENT**

- 4.1 To achieve the objectives of the Assignment, the Consultant shall undertake and be responsible for the tasks under the respective category of services as described in this Assignment Brief, and as supplemented by the Scope of Services, Letter of Acceptance and all other related instructions issued for the concerned instructed project.
- 4.2 For each instructed project under this Assignment except for Category A2 services, the DR may instruct the Consultant to assess a number of options of development scheme, normally not more than 3, with a view to identifying the most preferred option and the necessary mitigation/improvement measures from air ventilation perspective. The exact number and details of the options for assessment shall be specified by the DR for each instructed project. The details of the options of development scheme may not be all available concurrently and may be subject to revision or refinement during the study period. The assessment may be staggered in stages pending instructions from

the DR regarding the option(s) to be finalized in the planning, design or consultation process.

- 4.3 In addition, the Consultant shall provide comments and advices related to AVA matters of the instructed project as may be requested by DR, prepare relevant documents such as report on expert advice or expert witness statements and attend relevant TPB meeting(s) (including representation hearing(s) in the case where amendments of statutory plan are involved) and Town Planning Appeal Board meeting(s), if so requested. Depending on the circumstances, such service may be required after the acceptance of all Deliverables required under the Scope of Services specified for each instructed project.
- 4.4 The Consultant should note that the requirements specified in this Assignment Brief are general and may vary for each instructed project according to their nature, location and scale. The Consultant shall also refer to the Scope of Services and Letter of Acceptance issued by the DR for the concerned instructed project forming part of the Agreement.

**Category A Services - Expert Evaluation and Advisory Services on AVA** (applicable only to Category A Consultant)

***Category A1 Services – Expert Evaluation Services on AVA***

- 4.5 For each site or area specific instructed project requiring expert evaluation services on AVA, the Consultant shall provide professional qualitative assessments covering but not be limited to the following major aspects:
  - (a) A desktop analysis on the existing annual and summer wind environment of the project area;
  - (b) A qualitative evaluation of the air ventilation impacts of the different options of development scheme in the project area and recommendations on improvement and mitigation measures and any further study as may be necessary.
- 4.6 The desktop analysis of the existing wind environment shall include the following tasks:
  - (a) Conduct site inspection of the project area, review any previous available AVAs if applicable, analyze relevant existing wind data of both annual and summer conditions and any available wind data as may be provided by the DR, and assess the applicability of the wind data and how they may be interpreted for assessment of wind

environment at pedestrian level within the project area and its surroundings;

- (b) Based on the wind data, previous available AVA(s), if applicable, and examination of all the existing, committed and planned developments and the surrounding topographic characteristics, assess qualitatively the likely prevailing wind patterns and directions at the pedestrian level of the project area and its surroundings;
- (c) Identify any major features (natural or man-made) which may have positive or negative effects on air ventilation of the project area and which should be preserved, created or mitigated; and
- (d) Identify any major wind potential, sensitive or problematic areas which warrants attention in formulating the development scheme.

4.7 The expert evaluation shall include the following tasks:

- (a) Evaluate and compare qualitatively the prima facie impact, merits or demerits of the different options of development scheme as provided by the DR on the pedestrian wind environment, focusing on public areas frequented by pedestrians in the existing/committed/planned condition, and advise whether the pedestrian wind environment could likely be better, similar or worsened under each option under both annual and summer conditions;
- (b) Identify the rough order of the magnitude of any possible wind potential and problem areas due to the different development schemes;
- (c) Recommend any improvements that could be made in refining the development schemes;
- (d) Advise the effectiveness of the improvements in Clause 4.6(c) above in enhancing or addressing the possible wind potential or problems identified;
- (e) The recommended improvement and mitigation measures should pay regard to the development potential in the relevant statutory plans and Building (Planning) Regulations, and any relevant planning briefs, Sustainable Building Design Guidelines and the Hong Kong Planning Standards and Guidelines, also taking into account existing constraints, effectiveness, feasibility and practicability;

- (f) Based on qualitative comparison of the overall options, recommend the most preferred option from air ventilation perspective, with any necessary mitigation measures for incorporation as development restrictions/requirements, as the case may be; and
- (g) Advise any need for further study and if so, recommend the scope, focuses, levels of details and boundaries of the assessment area and whether CFD or wind tunnel should be used for the further study.

4.8 During the course of each instructed project, site specific development schemes other than those covered in the Scope of Services specified for each instructed project may be worked out for sites within the project area. If requested by the DR, the consultants shall provide comments and advices related to AVA matters on such development schemes as additional services. Such services shall be paid as per the rate specified in the Fee Proposal. For any additional services that may be instructed by the DR after expiry of the 18-month post-project period (the “18-month post-project period” means the 18-month period after the acceptance of all Deliverables required under the Scope of Services specified for each instructed project and such date shall be confirmed in writing to the Consultant by the DR), there shall be adjustment to the Average All-Inclusive Time Charge Rate as specified in the Fee Proposal. Details of the rate adjustment are set out in Clause 7.3 below.

***Category A2 Services – Professional Comments/Advices on AVA Submissions or Associated Matters***

- 4.9 For instructed projects under this category of services, the Consultant shall be required to perform as an independent advisor and review AVA submissions prepared by third party project proponents not in conflict with the role of the Term Consultant. The Consultant shall provide neutral professional comments on the AVA submissions. The comments, supported with literatures, data and reasoning, should cover but not be limited to the following aspects:
- (a) Whether the AVA submission is properly done with reference to the prevailing Technical Guide;
  - (b) The appropriateness of the coverage of the assessment and model areas;
  - (c) The appropriateness of the input data with respect to wind rose, in particular the percentage of wind covered annually and in summer

in the assessment, mean wind speed profiles, turbulence intensity profiles, and boundary conditions;

- (d) The appropriateness of the numbers, locations and distribution of test points;
- (e) If CFD is used for the AVA submission, the appropriateness of the modeling software as well as setting and configuration of the CFD model used, including turbulence model, model geometry, meshing setup and quality, domain setup, simulation methodologies and techniques, convergence criteria, order of discretization and calculation method of velocity ratios;
- (f) If wind tunnel is used for the AVA submission, the appropriateness of the scale of the model, testing methodology and techniques;
- (g) The appropriateness of the presentation and analysis of the assessment results;
- (h) Whether the assessment results and recommendations are reasonable;
- (i) Any particular issues which may affect the reliability of the assessment and if so, need for re-assessment;
- (j) Any suggestion for improvements with respect to air ventilation that could be made in the design for the development schemes as presented in the AVA submission;
- (k) Any major problem areas which have not been properly addressed in the AVA submission;
- (l) Whether and what further studies are required; and
- (m) Any other comments which need to be highlighted for attention of the DR.

4.10 The Consultant shall, if necessary, seek clarification and/or request further information regarding the AVA submissions from the project proponents for the AVA submissions via the DR. The Consultant shall respond to the feedback from the project proponents for the AVA submissions and advise the DR on any further clarification/information necessary from the project proponents.



**Category B Services – AVA by CFD** (applicable only to Category B Consultant)

- 4.11 For Category B Services, the Consultant shall be required to carry out AVA Initial study by CFD testing for each instructed project with reference to the prevailing Technical Guide, unless otherwise specified in the Scope of Services for the concerned instructed project or as instructed by the DR.
- 4.12 For each instructed project, the tasks shall include but not be limited to the following:

Analysis of Existing Wind Environment

- (a) Conduct site inspection, review any previous expert evaluation conducted for the project area, and analyze relevant existing wind data of both annual and summer conditions and any available wind data as may be provided by the DR for initial reference;
- (b) Conduct quick and broad-brush qualitative assessment of the existing annual and summer wind conditions, as a basis for defining the focus of the CFD testing;

Methodology and Assumptions

- (c) Advise and agree with the DR on the modeling software as well as the setting and configuration of the CFD model used including turbulence model, model geometry, mesh setup and quality, domain setup, convergence criteria and order of discretization, simulation methodologies and techniques, input wind profiles (including but not limiting to the exponent/roughness lengths used in the Power Law or Log Law), calculation method of the velocity ratios and to explain the appropriateness of all the above settings or methodologies;
- (d) Advise and agree with the DR on the boundary conditions for the simulations, the set of site wind availability data to be adopted and the number of wind directions to be simulated. Unless otherwise as agreed by the DR, not less than 75% of 16 directions each of the annual and summer wind roses should be adopted respectively;
- (e) Advise and agree with the DR on the boundaries of the project area, Assessment Area, Surrounding Area and model area, and the numbers, locations and distribution of perimeter, overall and special test points for construction of model and CFD testing;

- (f) Advise and agree with the DR on any necessary grouping of test points into different focus areas (including major streets) for analysis and comparison of the ventilation performance of the different options of development scheme;
- (g) Set up the model to cover all the major topographical features, existing, committed and planned buildings and structures (including major elevated structures and noise barriers) within the model area;
- (h) The model and mesh topology shall be checked and agreed by the DR before commencement of the AVA study by CFD;

#### Testing of Development Schemes and Recommendations

- (i) Based on the available site wind data agreed by the DR, carry out testing of different options of development scheme by CFD;
- (j) Unless otherwise as agreed by the DR, annual and summer Wind Velocity Ratios (VRs) for all simulated directions of all the test points at 2m above pedestrian level shall be individually reported, and based on which, their Site Spatial Average VR, Local Spatial Average VR and respective Spatial Average VRs for all the focus areas mentioned in clause 4.12(f) shall be derived and reported. VR plots should be produced for all the tested wind directions;
- (k) Analyze, interpret and compare the assessment results on the air ventilation impacts of each option of development scheme on the pedestrian wind environment, focusing on the public areas frequented by pedestrians. The analysis and interpretation should make reference to the annual and summer air ventilation performance of the Assessment Area as well as the individual focus areas as agreed with DR under Clause 4.12(f);
- (l) Quantify any betterment or worsening of the pedestrian wind environment in whole or in part by order of percentages due to the different options of development scheme with explanation and present the major wind effects and characteristics within the Assessment Area by appropriate flow diagrams or vector plots in all the simulated wind directions for checking by the DR;
- (m) Recommend and test any improvement and mitigation measures that could be made in refining the development scheme;
- (n) The recommended improvement and mitigation measures should be specific and quantitative (e.g. in form of development parameters) having regard to the development potential in the

relevant statutory plans and Building (Planning) Regulations, and any relevant planning briefs, Sustainable Building Design Guidelines and the Hong Kong Planning Standards and Guidelines, also taking into account existing constraints, effectiveness, feasibility and practicability;

- (o) Compare the overall assessment results of the different options and recommend the most preferred option from air ventilation perspective, with any necessary mitigation measures, for incorporation as development restrictions/requirements, as the case may be; and
- (p) Advise any need for further study and if so, recommend the scope, focuses, levels of details and boundaries of the assessment area, and whether the further study should be by CFD or wind tunnel.

## 5. DELIVERABLES

5.1 The Consultant shall work in collaboration with any sub-consultants and any other consultants as necessary in the preparation, coordination, production of the deliverables as detailed in this Brief and the Scope of Services for relevant instructed projects for the completion of the Assignment. These shall include but not be limited to reports, graphs, charts and tables, illustration, photographs, 3D drawings and other necessary presentation materials as may be specified by the DR for any meetings related to the Assignment.

5.2 For each instructed project, the Consultant shall prepare and submit the following deliverables:

### **Category A Services** (applicable only to Category A Consultant)

- (a) A draft final report and final report to cover the relevant tasks in Clauses 4.5 to 4.8 for Category A1 services, and to cover Clauses 4.9 to 4.10 for Category A2 services; and
- (b) A Draft Executive Summary and Final Executive Summary to summarize the gist of the Final Report.

### **Category B Services** (applicable only to Category B Consultant)

- (c) Working Paper 1 on analysis of existing wind environment, and methodology and assumptions to cover the tasks in Clauses 4.12(a) to (b) and Clauses 4.12(c) to (h) respectively;

- (d) Working Paper 2 on testing of development schemes and recommendations to cover the tasks in Clauses 4.12(i) to (p). The working paper shall be divided and submitted in parts for the different options tested (e.g. for 3 options tested, parts A, B and C for options A, B and C respectively);
  - (e) A Draft Final Report and Final Report to consolidate Working Papers 1 and 2;
  - (f) A Draft Executive Summary and Final Executive Summary to summarize the gist of the Final Report;
  - (g) All the CFD geometry files, mesh setup, raw result data, simulation input/setup files, calculations and wind data conversion, VR plots, vector plots should be submitted to the DR in soft copy and a format to be agreed with the DR for checking and retention;
- 5.3 All reports should be in English, except for the Executive Summary which should be in both English and Chinese and unless as otherwise specified in the Scope of Services for the concerned instructed project. Use of technical jargons should be avoided in the reports.
- 5.4 The Consultant shall submit 6 copies each of the above deliverables in draft version and 30 copies each of the deliverables in final version to the DR, unless as otherwise specified in the Scope of Services for the concerned instructed project or as agreed with the DR. For the deliverables requiring coloured illustrative materials, coloured copies shall be provided.
- 5.5 The Consultant shall provide both hard and soft copies of all the deliverables.

## **6. PROGRAMME**

- 6.1 This Term Consultancy agreement is valid for a period of **two** years commencing tentatively from late October/early November with an option for the DR to extend the appointment for another year. During this period, the Consultant may be invited to bid for instructed projects. Once commissioned, the instructed project will be binding and if the time taken to complete the project or respond to any query arising from it or any related additional services extends beyond the Term of this Agreement, the Consultant shall be bound to continue the service until its satisfactory completion.
- 6.2 The submission of deliverables should meet the deadlines in accordance with and as specified in the Scope of Services and the

Letter of Acceptance of Fee Proposal for the concerned instructed project, or at such other time as may be agreed in writing with the DR.

## **7. SCHEDULE FOR PAYMENT OF FEES**

- 7.1 Payment breakdown for each instructed project shall be specified in the Scope of Services for the instructed project.
- 7.2 For instructed projects related to AVAs on the amendment of statutory plans, representations or comments related to the amendments may be lodged with TPB subsequent to the acceptance of all Deliverables. In response to the representations or comments, the DR may seek documentary input from the consultants for submission to TPB. The complexity of some of the representations and comments may not be accurately anticipated at the time of appointment. These may include for instance alternative proposals which would warrant further expert evaluation not within the Scope of Services specified for the instructed projects. The Consultants' input, if they are agreed by the DR to be beyond the Scope of the Services for the concerned instructed projects, shall be considered as additional services and paid on a time charge basis subject to a fee cap set by the DR in accordance with the Fee Proposal. The fee cap should not be exceeded without his approval.
- 7.3 For additional services that may be instructed by the DR after expiry of the 18-month post-project period, the Average All-Inclusive Time Charge Rate as specified in the Fee Proposal shall be adjusted based on the percentage difference between the monthly CPI(C) at the date of the quotation closing date of the instructed project and the latest monthly CPI(C) when the additional services is requested. "Consumer Price Index (C)" in this assignment brief shall mean the Consumer Price Index (C) (October 2022 - September 2023 = 100)<sup>1</sup> compiled by the Census and Statistic Department, and published monthly in the Hong Kong Monthly Digest of Statistics. An example showing the calculation of rate adjustment of an instructed project after the 18-month post-project period is at Appendix 3 of Attachment D. The acceptance of the adjusted rate for the concerned additional services shall be agreed in writing by the DR. There shall be no further rate adjustment until completion of the additional services.
- 7.4 Any additional services should be instructed by the DR before commencement by the Consultant. Additional services should not

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<sup>1</sup> The Consultant should adopt the 2022/2023 based index series for calculating the price adjustment when it is released.

include responses to queries as specified in Section 13 of the Assignment Brief.

- 7.5 Any additional services that may be instructed by the DR would be paid upon completion of the additional services within the time specified by the DR and production of time sheets to validate the man-hour inputs.

## **8. INFORMATION PROVIDED BY THE GOVERNMENT**

- 8.1 The following information relevant to the Assignment will be provided to the Consultant by the DR:
- (a) Simulated and/or experimental site wind data, if available;
  - (b) Geographical information (including natural topographical features, location, form and height of major existing, committed and planned developments) of the surrounding area of the project area;
  - (c) The development parameters (e.g. plot ratio, site coverage, building height, setback, non-building area, etc.) of each option of development scheme for the project area to be assessed; and
  - (d) Relevant statutory plans, planning briefs and planning documents.

## **9. WORKING SESSIONS AND EXTERNAL MEETINGS**

- 9.1 The Consultant may be required to attend working sessions and meetings with the DR, other relevant bureaux/departments and parties related to the instructed projects to discuss and explain the deliverables and to address/resolve issues arising from the assessment and related matters.
- 9.2 In addition, the Consultant may be required to attend external meetings (such as meetings of TPB including representation hearings in the case where amendments of statutory plan are involved, Town Planning Appeal Board, Legislative Council and District Councils as well as public consultation activities) to present and explain the assessment and answer queries. The number of these external meetings shall not normally exceed 3<sup>2</sup>, the exact number of which is to be specified in the

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<sup>2</sup> The duration of each meeting is normally taken as not exceeding eight hours per day. Meeting that lasts beyond eight hours will be taken as a separate meeting.

Scope of Services for the concerned instructed project. Attendance of additional meetings may be required and shall be paid as per the rate specified in the Fee Proposal. The Consultant shall prepare in both English and Chinese suitable concise illustrative and presentation materials in plain language with minimum technical jargons for presentation or public consultation purpose as may be required by the DR for these external meetings. The Consultant's representatives attending the meetings should be of appropriate rank and experience as agreed by the DR.

## **10. REFERENCES, STANDARDS AND SPECIFICATIONS**

10.1 The Consultant shall make reference to and adopt but not be limited to the following documents:

- (a) Study on Feasibility Study for Establishment of Air Ventilation Assessment System;
- (b) Technical Guide for Air Ventilation Assessment for Developments in Hong Kong in the Housing, Planning and Lands Bureau TC No. 1/06 and Environment, Transport and Works Bureau TC No. 1/06 on Air Ventilation Assessments or any subsequent updating of the Technical Guide and guidelines in the prevailing TC;
- (c) Hong Kong Observatory Wind Data;
- (d) Wind data provided by the DR;
- (e) Working papers and reports of the "Urban Climatic Map and Standards for Wind Environment – Feasibility Study";
- (f) Relevant Air Ventilation Assessment Reports available on PlanD's Air Ventilation Assessment Register;
- (g) Relevant statutory plans, planning briefs, and planning documents provided by the DR;
- (h) Hong Kong Planning Standards and Guidelines;
- (i) Building (Planning) Regulations;
- (j) PNAP APP-152 Sustainable Building Design Guidelines;
- (k) Code of Practice on Wind Effects in Hong Kong 2004;

- (l) Manuals and Reports on Engineering Practice No. 67: Wind Tunnel Studies of Buildings and Structures, Virginia 1999 issued by the American Society of Civil Engineers;
- (m) Wind Engineering Studies of Buildings, Quality Assurance Manual on Environment Wind Studies AWES-QAM-1-2001 issued by the Australasian Wind Engineering Society;
- (n) COST Action C14 (May 2004) “Impact of Wind and Storms on City Life and Built Environment” Working Group 2 – CFD techniques – “Recommendations on the use of CFD in predicting pedestrian level wind environment”;
- (o) COST Action 732 (May 2007) “Quality Assurance and Improvement of Microscale Meteorological Models” – “Best Practice Guidelines for the CFD Simulation of Flows in the Urban Environment”; and
- (p) A. Mochida, Y. Tominaga and R. Yoshie (2006), Paper on AIJ guideline for practical applications of CFD to wind environment around buildings.

## **11. CONSULTANT’S OFFICE AND STAFFING**

- 11.1 For Category A Term Consultant, the Consultant must be present in Hong Kong for the entire duration from commencement to satisfactory completion of the instructed projects.
- 11.2 For Category B Term Consultants, the Consultant shall maintain for the duration of the Agreement and for the time beyond if required for the completion of an instructed project an office in Hong Kong under the control of a principal of the Consultant who shall be responsible for the Assignment. The principal shall have adequate authority and sufficient professional and technical support to ensure progress to the satisfaction of the DR.

## **12. DIRECTOR’S REPRESENTATIVE**

- 12.1 The DR shall be the Chief Town Planner/Urban Design and Landscape or Chief Town Planner(s) responsible for the concerned instructed project of Planning Department or such other person as may be authorized by the Government in writing and notified to the Consultant. The DR may delegate any of the powers and functions vested in him/her to other officers. If the Consultant is dissatisfied with a



decision or instruction of any such officer pertaining to the Assignment, the matter shall be referred to the Director for a ruling.

- 12.2 During the course of the Agreement, the Consultant shall report direct to the DR.

### **13. RESPONSE TO QUERIES**

- 13.1 The Consultant shall respond to any written or verbal queries raised by the DR in writing within 1 week or within the time as specified by the DR.
- 13.2 The Consultant shall respond to queries on the Consultancy Services (including those arising from representations and comments on the representations made during the plan making process in the case where amendments of statutory plan are involved) on the technical assumptions, findings and conclusions or related matters of the Deliverables specified in this Brief and in the Scope of Services for the concerned instructed projects, raised prior to expiry of the 18-month post-project period.
- 13.3 Save as the circumstances provided in Clause 7.2, responses to queries should not be considered as additional services.

**Technical Guide for Air Ventilation Assessment  
for Developments in Hong Kong  
in the Housing, Planning and Lands Bureau  
Technical Circular No. 1/06 and  
Environment, Transport and Works Bureau  
Technical Circular No. 1/06 on Air Ventilation Assessments**

1. This Technical Guide assists project proponent to undertake Air Ventilation Assessment (AVA) to assess the impacts of the proposal on the pedestrian wind environment. The assessment should follow this Technical Guide as far as possible and a report should be submitted to the proponent departments / bureaux or authorities on the assessment findings.
2. Every site is different. The assessor is strongly advised to approach the assessment intellectually and discretionally taking into account different site conditions. Working with experienced practising wind engineers throughout the assessment process is strongly recommended.

**Indicator**

3. Wind Velocity Ratio (VR) should be used as an indicator of wind performance for the AVA. It indicates how much of the wind availability of a location could be experienced and enjoyed by pedestrians on ground taking into account the surrounding buildings and topography and the proposed development. Given the general weak wind conditions in Hong Kong, the higher the wind velocity ratio, the less likely would be the impact of the proposed development on the wind availability.
4. Wind VR is defined as  $V_p/V_\infty$  ( $V$  pedestrian/ $V$  infinity).  $V_\infty$  captures the wind velocity at the top of the wind boundary layer (typically assumed to be around 400 m to 600 m above city centre, or at a height wind is unaffected by the urban roughness below).  $V_\infty$  is taken as the wind availability of the site.  $V_p$  captures the wind velocity at the pedestrian level (2 m above ground) after taking into account the effects of buildings and urban features.

**Expert Evaluation / Initial Study / Detailed Study**

5. It is always useful and cost effective for the assessor to conduct an early round of **Expert Evaluation**. This provides a qualitative assessment to the design and/or design options and facilitates the identification of

problems and issues. The Expert Evaluation is particularly useful for large sites and/or sites with specific and unique wind features, issues, concerns and problems. The following tasks may be achieved with Expert Evaluation:

- (a) Identifies good design features.
- (b) Identifies obvious problem areas and propose some mitigation measures.
- (c) Defines “focuses” and methodologies of the Initial and/or Detailed studies.
- (d) Determines if further study should be staged into Initial Study and Detailed Study, or Detailed Study alone.

6. In exercising expert knowledge and experience, the assessor should refer to the “Urban Design Guidelines”, Chapter 11 of the Hong Kong Planning Standards and Guidelines downloadable from the Planning Department’s (PlanD) website at <http://www.pland.gov.hk>.

7. The Expert Evaluation could lead to an Initial Study or directly to a Detailed Study depending on the nature of the development. The **Initial Study** will refine and substantiate the Expert Evaluation. The following tasks may be achieved with the Initial Study:

- (a) Initially assesses the characteristics of the wind availability ( $V_{\infty}$ ) of the site.
- (b) Gives a general pattern and a rough quantitative estimate of wind performance at the pedestrian level reported using Wind VR.
- (c) Further refines the understanding (good design features and problem areas) of the Expert Evaluation.
- (d) Further defines the “focuses”, methodologies and scope of work of the Detailed Study.

8. It is sometimes necessary to reiterate the Initial Study so as to refine the design and/or design options.

9. With or without the Initial Study, the **Detailed Study** concludes the AVA. With the Detailed Study, the assessor could accurately and “quantitatively” compare designs so that a better one could be selected. Detailed Study is essential for more complex sites and developments, and where key air ventilation concerns have been reviewed and identified in the Expert Evaluation / Initial Study. The following tasks may be achieved with the Detailed Study:

- (a) To assess the characteristics of the wind availability ( $V_{\infty}$ ) of the site in detail.
- (b) To report all VR of test points. To report Site VR (SVR) and Local VR (LVR) when appropriate (as outlined in paras 27 to 30). To report, if any, wind gust problems.
- (c) To provide a summary of how the identified problems, if any, have been resolved.

### **Site Wind Availability Data**

10. It is necessary to account for the characteristics of the natural wind availability of the site. As far as possible, the design should utilize and optimize the natural wind.

11. For the Expert Evaluation, it is advisable to make reference to the Hong Kong Observatory Waglan Island wind data, as well as reasonable wind data of nearby weather stations. Expertly interpreted, it is possible to qualitatively estimate the prevailing wind directions and magnitudes of the site necessary for the evaluation.

12. For the Initial Study, it is necessary to be more precise. Either “simulated” site wind data, or “experimental” site wind data, as described in paras. 13 and 15 below, respectively, could be used.

13. Using appropriate mathematical models (e.g. MM5 and CALMET), it is possible to simulate and estimate the site wind availability data ( $V_{\infty}$ ). For the Expert Evaluation and Initial Study, project proponent may refer to the preliminary set of simulated “Site Wind Availability Data” ( $V_{\infty}$ ) available at PlanD’s website.

14. For the Detailed Study, it is necessary to be even more precise. “Experimental” site wind data, as described in para 15 below, should be used.

15. Using large scale topographical model (typically 1:2000 to 1:4000) tested in a boundary layer wind tunnel, more precise wind availability and characteristics information in terms of wind rose, wind profile(s) and wind turbulence intensity profile(s) of the site could be obtained. Hong Kong Observatory Waglan Island wind data should be referenced to for the experimental study.

## **Tools**

16. Wind tunnel is recommended for both the Initial and the Detailed Studies, and most particularly for the Detailed Study. The conduct of the wind tunnel test should comply, as far as practicable, with established international best practices, such as, but not be limited to:

- (a) Manuals and Reports on Engineering Practice No. 67 : Wind Tunnel Studies of Buildings and Structures, Virginia 1999 issued by American Society of Civil Engineers.
- (b) Wind Engineering Studies of Buildings, Quality Assurance Manual on Environment Wind Studies AWES-QAM-1-2001 issued by Australasian Wind Engineering Society.

17. Computational Fluid Dynamics (CFD) may be used with caution, it is more likely admissible for the Initial Studies. There is no internationally recognized guideline or standard for using CFD in outdoor urban scale studies. The onus is on the assessor to demonstrate that the tool used is “fit for the purpose”.

18. Should the assessor wish to use other forms of tool for the assessment not described above, the onus is on the proponent to demonstrate that the tool to be employed is “fit for the purpose”. The scientific suitability, as well as the practical merits of the tool to be used must be demonstrated.

## **Simplification of Wind Data for the Initial Study**

19. In general, the characteristics of the site wind availability data should be reported in 16 directions. This is necessary to work out the Wind Velocity Ratio.

20. For the Initial Study, if using CFD, it may be appropriate and cost effective, to reduce the number of directions in the study. This is reasonable especially for sites with only a few incoming prevailing wind directions. The assessor must demonstrate that the probability of wind coming from the reduced set of directions should exceed 75% of the time in a typical reference year. Wind profile(s) for the site could also be appropriated from the  $V_{\infty}$  data developed from simulation models (e.g. MM5 and CALMET) and with reference to the Power Law or Log Law using coefficients appropriate to the site conditions.

21. For the Detailed Study, no simplification is allowed. Wind from all 16 directions and their probability of occurrences must be accounted for, and wind profiles(s) obtained from wind tunnel experiments should be used to conduct the study, and when calculating the Wind Velocity Ratio.

## **Project, Assessment and Surrounding Areas**

22. The testing model for the Initial and the Detailed Studies should cover the Project, the Assessment and the Surrounding Areas.

23. The Project Area is defined by the project site boundaries and includes all open areas within the project that pedestrians are likely to access.

24. A key aim of AVA is to assess a design's impact and effects on its surroundings. The Assessment Area of the project should include the project's surrounding up to a perpendicular distance H from the project boundary, H being the height of the tallest building on site. Occasionally, it may be necessary to include an assessment area larger than that defined above so that special surrounding features and open spaces are not omitted.

25. For the model, it is necessary to include areas surrounding the site. The Surrounding Area is important as it gives a reasonable and representative context to the Assessment Area. It "conditions" the approaching wind profiles appropriately. If the Surrounding Area is not

correctly included and modeled, the wind performance of the Assessment Area will likely to be wrongly estimated. The Surrounding Area of up to a perpendicular distance of 2H from the project boundary must be included. Sometimes it may be necessary to enlarge the Surrounding Area if there are prominent features (e.g. tall buildings or large and bulky obstructions) immediately outside the 2H zone. Other than the method recommended, wind engineers can advise alternative extent of the surroundings to be included on a case-by-case basis, especially when there are nearby prominent topographical features.

## **Test Points**

26. Test points are the locations where Wind VRs are reported. Based on the VR of the test points, the resultant wind environment of the project can be assessed. As each site is unique, it is impossible to be specific about the number and distribution of the required test points; but they must be carefully and strategically located. Three types of test points may be specified for assessment: Perimeter, Overall and Special.

27. Perimeter test points are positioned on the project site boundary. They are useful to assess the “immediate” effect of the project to the Assessment Area. Test points at around 10 m to 50 m center to center (or more if larger test site is evaluated) may be located around the perimeters of the project site boundary. Test points are normally not necessary at perimeter(s) where there is no major air ventilation issues e.g. waterfront area with ample sea breeze, inaccessible land such as green belt. Tests points must be located at the junctions of all roads leading to the project site, at main entrances to the project, and at corners of the project site. This group of perimeter test points will provide data for the **Site Air Ventilation Assessment**. Typically about 30 to 50 perimeter test points well spaced out and located will suffice.

28. Overall test points are evenly distributed and positioned in the open spaces, on the streets and places of the project and Assessment Areas where pedestrians frequently access. This group of overall test points, together with the perimeter test points, will provide data for the **Local Air Ventilation Assessment**. For practical reasons, around 50 to 80 test points may be adequate for typical development sites.

29. Special test points may be positioned in areas that special localized

problems are likely to appear (e.g. wind gust problem for exposed sites). These special test points should not be included in the Site and Local Air Ventilation Assessments, as they may distort the average VRs. They independently may provide additional information to assessors.

## Reporting

30. For the purpose of the AVA, Wind Velocity Ratios of all test points should be individually reported. They help to identify problem areas. Two ratios may also be reported, they give a simple quantity to summarise the overall impact on the wind environment for easy comparison:

- (a) For the **Site Air Ventilation Assessment**, the Site spatial average Velocity Ratio (SVR) of all perimeter test points (para 27 refers) may be reported. This gives a hint of how the development proposal impacts the wind environment of its immediate vicinity.
- (b) For the **Local Air Ventilation Assessment**, the Local spatial average velocity ratio (LVR) of all perimeter and overall test points (paras 27 and 28, respectively refer) may be reported. This gives a hint of how the development proposal impacts the wind environment of the local area.

The local air ventilation considerations should always take precedence over the site specific air ventilation considerations. For exposed sites, concerns of wind gust should be reported.

31. The AVA report should contain the following key sections. The technical merit, as well as the results of the AVA of the project must be demonstrated:

- (a) An introductory section of the details of **the project**.
- (b) A section on results of the **Expert Evaluation**. Concerns and potential problems should be identified. Focuses and methodologies of further studies should be defined.
- (c) A section on the characteristics of the **Site Wind Availability** to be used for Initial Studies and Detail Studies. Methodologies used to obtain the information must be explained in detail.



- (d) A section on the **Methodology of the Initial Study**. The tool used for the studies must be explained in detail. It is important for the assessor to demonstrate and to justify that the tool and work process used is technically “fit for the purpose”.
  - (e) A section on results and **key findings of the Initial Study**.
  - (f) A section on **Methodology of the Detailed Study**. The tool used for the studies must be explained in detail. It is important for the assessor to demonstrate and to justify that the tool and work process used is technically “fit for the purpose”.
  - (g) A section on results and **key findings of the Detailed Study**.
  - (h) A section on Evaluation and **Assessment**. Summarise findings, highlight problems and outline mitigation measures, if any.
32. Based on the reported VR, the assessor would compare the merits and demerits of different design options. The following considerations on the reporting of SVR and LVR may be useful to note:
- (a) In the general weak wind conditions in Hong Kong, for the AVA, the higher the values of the spatial average VR, the better the design. Comparing performances of design options using the spatial average VR (both SVR and LVR) is recommended (para 30 refers).
  - (b) The **Site Air Ventilation Assessment** (SVR) gives an idea of how the lower portion of the buildings on the project site may affect the immediate surroundings. When problems are detected, it is likely that design changes may be needed for the lower portion of the development (e.g. the coverage of the podium) (para 30(a) refers).
  - (c) The **Local Air Ventilation Assessment** (LVR) gives an idea of how the upper portion of the buildings on the project site may affect the surroundings. When problems are detected, it is likely that design changes may be needed for the upper portion of the development (e.g. re-orientation of blocks and adjustment to the extent of the towers) (para 30(b) refers).
  - (d) For very large sites, or for sites with elongated or odd geometry, it may be necessary to work out the SVR and LVR to suit the size or

geometry. For example, say for an elongated site, it might be useful to sub-divide the site into smaller sub-sections to work out the spatial averages. It is possible that the development may have a high VR at one end and a low VR at the other end.

- (e) It is necessary to examine VR of the individual test points of SVR and/or LVR to ensure that none is way below the spatial average. When this happens, it indicates possible stagnant zones to be avoided.
- (f) On the other hand, no individual VR should be obviously above the spatial average SVR and/or LVR. When this happens, it indicates wind amplification, and the possibility of wind gust and pedestrian safety concerns. Further assessments and mitigation measures may be required.
- (g) Where large differentials in individual VRs are reported, the spatial average SVR and/or LVR should be interpreted more carefully to avoid overlooking problem areas due to averaging of the individual VRs.
- (h) In addition to SVR and LVR, and beyond the key focus of AVA in this Technical Guide, VR of special test points, if positioned, may be analysed. The results from these additional test points will identify potential wind problems in areas of special concerns.