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ACE Paper 10/2005
For advice

"Feasibility Study for Establishment of Air Ventilation Assessment System" – Report on Study Recommendations and Proposed Way Forward

Purpose

The purpose of this paper is to seek members' advice on the main findings and recommendations of the Feasibility Study for Establishment of Air Ventilation Assessment System (the Study) as summarized in the Gist of Study Findings (Annex A).

Background

2. The Study is to take forward one of the Team Clean's recommendations to examine the practicality of stipulating air ventilation assessment as one of the considerations for all major development or redevelopment proposals and in future plan making.

3. The primary objective of the Study is to explore the feasibility of establishing the standards, scope and mechanism for assessment of the effects of major planning and development proposals on the external macro wind environment.

4. The Study commenced in October 2003 with the Chinese University of Hong Kong as the main consultant. The Study Team was supported by a team of renowned international and local experts specialized in the relevant field. (See page 8 of Annex A for details of the Study Team.)

5. The Study has reached the final stage with the draft study findings and recommendations completed and presented in the Gist at Annex A.

Study Process

6. The Study process involves the following :

(a) to review the current urban conditions in Hong Kong to understand the key issues and problems in the urban wind environment;

(b) to explore the feasibility of establishing criteria to evaluate the performance standard of the wind environment;

(c) to explore the assessment approach and methodology; and

(d) to examine the institutional mechanism and stages for implementation of air ventilation assessment system (AVAS).

Key Study Findings and Recommendations

Existing Problems

7. One of the general common concerns about Hong Kong's wind environment is the low level of wind experienced by pedestrians, this is closely related to the low level of permeability or porosity in the urban fabric. The problem is exacerbated by compact building masses, uniform building heights, large podium structures with limited or no opening at pedestrian level, narrow spaces between buildings, streets not aligning in the directions of the prevailing wind, lack of greenery, shading and landscape, etc. Understanding the urban fabric problems would provide insights into the effective design solutions for improving the wind environment.

Feasibility of an AVAS for Hong Kong

8. The scope of the Study is on the **feasibility** of establishing an AVAS. Within this scope, the Study has recommended a broad framework of an AVAS as a starting point based on current state of knowledge and data available. It has further pointed to the direction of how a more robust and refined AVAS may be established but this would rely on build-up of more data and researches not within the time and budget allowed in this Study.

Performance Criteria

9. The Study was the first of its kind in Hong Kong. In the absence of any previous local studies on air ventilation performance in Hong Kong, a benchmark

standard on performance criterion for Hong Kong could not be established with certainty at this stage. The Study recognized that any theoretically optimum wind criterion without being tested against actual conditions may not be realistic and achievable for adoption as standard. Hence, instead of setting an absolute wind speed criterion, the Study has recommended using **velocity ratio** (see para. 13 below) in air ventilation assessment (AVA) as an indicator of wind performance.

10. Notwithstanding the above, the Study has made reference to overseas researches in hot humid environment (such as summer months in Japan, Singapore, Thailand and Philippines) which suggested that a wind speed of 1 - 2 m/s at ground level could be optimal for creating outdoor pedestrian comfort during the hot summer months. At this stage, the Study suggested 1.5m/s as an untested performance criterion for initial reference purpose as a starting point only, and **not a standard for compliance**. How realistic it could be for adoption as a benchmark standard for Hong Kong would need to be tested in later stage studies as recommended in para. 16-27 below.

Assessment Approach and Methodology

11. There are two basic approaches to AVA : performance-based approach and quantitative design guidelines approach.

Performance-Based Approach

12. Under this approach, project proponents may carry out AVA on a comparative basis to demonstrate the wind impact of individual projects case by case. At this stage, the performance-based approach could only be by comparison of performance of different design options without benchmark standards. After benchmarking studies have been carried out as recommended in Stage C (see para. 23 below), the comparison could be against an established performance standard. The assessment methodology for the performance-based approach is depicted in **Figure 1**.

13. The Study recommends the use of **velocity ratio**, which is expressed as the ratio of wind available at the pedestrian level at 2m above ground and the wind availability of the site (that is, the upper atmospheric boundary layer depending on the terrain passed by the wind). Velocity ratio indicates, as a single ratio, how much of the wind available to a location could be experienced by pedestrians on ground taking into account the proposed development on site and the surrounding buildings.

14. Wind tunnel modeling and computer simulation (computational fluid dynamics [CFD]) are tools commonly used for carrying out AVA. Based on past international researches and given the complex urban geometry of Hong Kong, the Study recommends wind tunnel as the preferred tool for AVA. However, it does not mean to preclude the use of CFD, but merely points out that it must be used with extreme caution requiring more sophisticated and refined input data and much longer computational time to reduce the magnitude of errors.

Quantitative Design Guidelines Approach

15. This approach would rely on quantitative design guidelines to guide design form and building layout. Projects designed to meet the quantitative design guidelines would be deemed satisfactory from an air ventilation perspective and would obviate the need for carrying out a project-specific performance-based AVA by wind tunnel or CFD. This approach would be further discussed in the section on Study Recommendations below.

Study Recommendations on Implementation

Plan for Implementation of AVAS

16. The implementation of AVAS would depend on how robust the AVAS is and how important AVA is considered by the decision makers amongst all factors in the consideration of development proposals. Based on the current Study findings, the Study can only recommend an advisory AVAS. If AVAS were to be introduced as mandatory, then it will have to go through a much more lengthy process of testing and validation.

17. The Study recommends that the AVAS can be implemented in stages (see page 19 of Annex A), taking into account the time needed for building up the necessary data and information and the degree of robustness expected for the AVAS. It should be noted that these stages are not sequential in the order presented and may be re-ordered or commissioned at the same time.

18. We reckon that just as other urban design factors, air ventilation is only one amongst many, rather than an over-riding factor in the design process. The approach to AVAS recommended in this Study is only a facilitating tool but not the primary decision making tool.

Near Term Implementation

Stage A – Performance-based Evaluation without Benchmark Standards

19. AVA is carried out for different design options to identify better design scenarios and potential problem areas, based on velocity ratio as an indicator. A design having a higher velocity ratio (see para. 13) would be considered as a better design than one having a lower velocity ratio. At this stage, only the better design option is known but whether the better design option meets a standard cannot be known due to the lack of benchmarking. To provide guidance on the broad assumptions and procedures and consistency in conducting AVA, a technical brief has been prepared.

20. In addition, this Study has recommended a set of **qualitative design guidelines** which could help achieve better air ventilation objectives in the urban design of our city. These guidelines are included on pages 21-22 of Annex A. It is considered appropriate that the qualitative guidelines and the need for AVA be promulgated through revision to the Hong Kong Planning Standards and Guidelines (HKPSG).

Longer Term Implementation

21. The Study recommends that should a more robust AVAS be warranted in future, the following stages would be necessary subject to further studies :

Stage B – Urban Climatic Mapping (*requires 2 years*)

22. This stage would involve the preparation of an urban climatic map for Hong Kong. It would involve collating relevant data on meteorology, topography, urban fabric, land use pattern etc. of Hong Kong. The resultant urban climatic map would identify the areas which are more in need of attention and improvements from an air ventilation perspective, e.g. highlighting locations poor in wind circulation or sensitive to wind variation, and where important breezeways and open spaces should be protected or reserved.

Stage C – Performance-based Evaluation with Benchmark Standards *(requires 2–3 years)*

23. This stage will establish the existing general wind performance condition of

Hong Kong. This would serve as a local benchmark standard that major projects should try to achieve, if possible, for optimum wind performance. This would allow direct comparison of air ventilation performance against known benchmark criteria, rather than revealing only the better or worse of design options (as in Stage A). The criteria established would provide a clear yardstick for evaluation of development projects where air ventilation is a major concern and the projects have to be justified through the existing institutional framework (such as town planning, lands and building control and/or environmental impact assessment). Technical specifications for conducting AVA would need to be prepared to ensure no dispute in the AVA requirements and vetting process.

Stage D – Quantitative Design Guidelines *(requires 2 – 4 years)*

24. This stage would develop quantitative design guidelines to facilitate early designs of development proposals. Projects are assessed against pre-set design criteria, design parameters, ratios or indices concerning developments, such as site / district openness and building mass geometry (street width to building height ratio, variation in building height within site, permeability of the building façade etc.) [see page 18 of Annex A]. These quantitative design guidelines have to be derived through iterative empirical tests by varying different design scenarios and assumed conditions to validate their magnitudes of impact on the wind environment.

25. Development schemes that are designed in accordance with the quantitative design guidelines would be deemed to satisfy air ventilation requirements, without the need to go through real AVA testing by wind tunnel or CFD. This would be less time consuming and more cost-effective, as compared to the performance based approach which the performance can only be tested after the design is generated.

Application to Government and Private Projects

Advisory and Government to take the lead

26. The Study recommends that as definitive benchmark standards are not ready without further studies to provide certainty for considering whether a development proposal's impact on the wind environment can be said to be acceptable, the AVAS should be implemented at this stage through **advisory** rather than mandatory means. Government and quasi-government organizations, such as Hong Kong Housing Authority, Hong Kong Housing Society, Urban Renewal Authority, MTRC and KCRC are recommended to take the lead in carrying out AVA for all major development

proposals, comprehensive planning for major new development and redevelopment areas and in the preparation of new or major amendments to town plans where air ventilation may be a potential concern. The aim is to move "towards a better future" rather than for precision. In fact, it has been Housing Department's practice to undertake AVA for all new public housing projects.

Private Projects - Voluntary Basis and Good Practice Guide

27. As for private projects, AVA should also be encouraged as **good practice guide** at the **initial stage**. To encourage the private project proponents to carry out AVA, incentives may be provided through performance labeling scheme. Such labeling scheme is currently given by HK-Beam. A new comprehensive performance system[*] is being recommended under Buildings Department's Study on Comprehensive Environmental Performance Assessment Scheme (CEPAS) to be administered by a CEPAS administrator. AVA can be credited in the scoring to apply for the label among other factors to be considered by the CEPAS administrator in future.

Engagement of Stakeholders

Brainstorming Workshop – Inception Stage

28. At the commencement of the Study, a brainstorming workshop with major stakeholders was held on 17 December 2003, which was attended by various professional organizations, business groups, academic institutes, citizens groups and government agencies, to provide a common platform for views and experiences sharing from stakeholders.

29. While noting that the Study was unprecedented, there was in-principle support for the Study and AVA was seen as beneficial for improving the wind environment in the city and should be introduced in Hong Kong. A brainstorming workshop report documenting the discussions and comments received was prepared and has been distributed to all invitees and uploaded to Planning Department's homepage in early 2004.

[*] A CEPAS performance label will be issued by the CEPAS administrator at the end of Design/Construction/Operation Stage after a completed building environmental performance assessment process for the relevant stage. The CEPAS performance labels are divided into 4 levels, which are 'Platinum', 'Gold', 'Silver' and 'Bronze'.

Stakeholders Engagement Forum – Pre-Conclusion Stage

30. In order to gauge the views of major stakeholders on the draft study findings as presented above and in Annex A, a stakeholders engagement forum was held on 11 May 2005. Major stakeholder groups including green groups, professional organizations, business groups, academic institutes, wind assessment consultancies, citizen groups and government agencies were invited to the forum. The Gist of Study Findings in Annex A and a technical brief outlining the suggested AVA methodology framework was presented.

31. In general, there was no fundamental objection to the draft study recommendations. However, there was common concern that AVA should not be applicable to small scale developments. While the private sector can play a role, the Government should assume the main role to carry out AVA on an area wide basis. It was suggested that AVAS should not be made mandatory and air ventilation should not become an over-riding factor in considering development proposals. There was also concern about the lack of clear benchmarking standard at present to provide certainty on the acceptability of the air ventilation performance of development proposals, thus reinforcing the need for the further studies recommended for Stages B to D.

Advice Sought

32. Members' advice is sought on the Study findings and recommendations as presented in this paper and at Annex A. The Study together with the recommended way forward will be presented to the Committee on Planning and Land Development (CPLD) on 7 June 2005 and we will brief members on the feedback of CPLD at the ACE meeting.

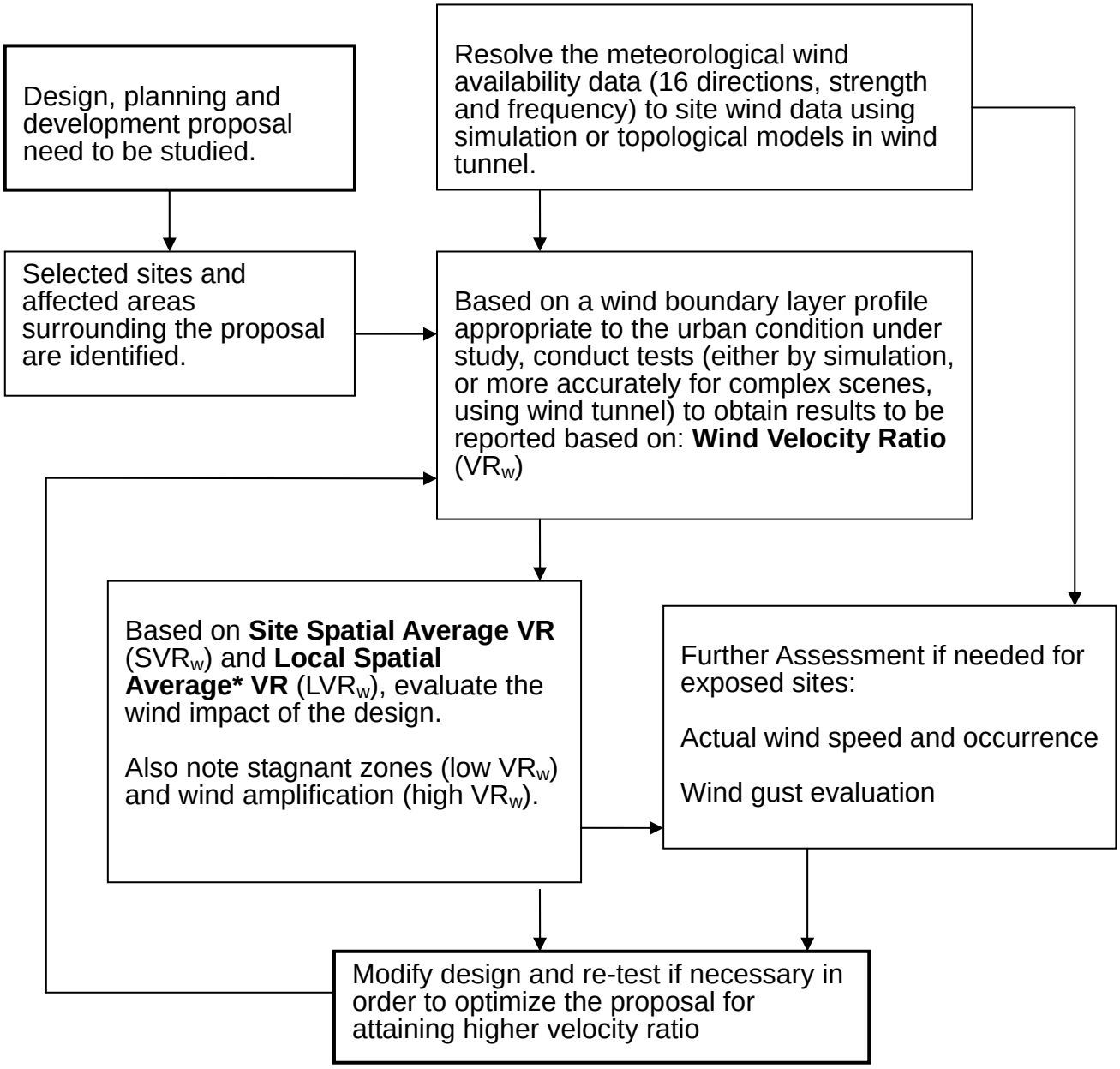
Planning Department
June 2005

ATTACHMENTS

Figure 1 – Performance-based Assessment Methodology
Annex A – Gist of Study Findings

FIGURE 1

PERFORMANCE-BASED ASSESSMENT METHODOLOGY



Notes :

* Local scale considerations should always take precedence over the site specific scale considerations.