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ACE Paper 3/2012

For discussion on 7 February 2012

Urban Climatic Map and Standards for Wind Environment Feasibility Study – Stakeholders Engagement

PURPOSE

This paper is to brief Members on the findings and recommendations of the Urban Climatic Map and Standards for Wind Environment – Feasibility Study (the UCM Study) which are also summarized in the attached Stakeholders Engagement Digest (**Annex 1**) and leaflet (**Annex 2**); and to seek Members' views on the study recommendations.

BACKGROUND

2. Hong Kong is a high-density city situated in the sub-tropical climate region with hot and humid summers. Owing to the dense concentration of buildings and urban activities, urban emissions, congested public spaces, insufficient greenery, etc., Hong Kong is suffering from the Urban Heat Island (UHI) effects. The urban temperature has been increasing while the wind speed has been decreasing in the past few decades. There is a need to better plan and design our city to improve the quality of urban living through reducing thermal load and promoting air ventilation in the built environment.

3. The air ventilation assessment (AVA) system was introduced in 2006 to guide public projects through the promulgation of Technical Circular No. 1/06

on Air Ventilation Assessments jointly issued by the then Housing, Planning and Lands Bureau and Environment, Transport and Works Bureau. In parallel, the Government commissioned the UCM Study to examine Hong Kong's urban climatic conditions and identify appropriate planning and design measures to achieve long-term improvement of the urban climate and urban living environment.

4. In the Report on the Public Engagement Process on Building Design to Foster a Quality and Sustainable Built Environment promulgated in June 2010, the Council for Sustainable Development recommends, amongst others, the Government to consider incorporating more scientific considerations in the planning process for a quality and sustainable built environment. The Urban Climatic Maps serve this purpose.

FINDINGS AND RECOMMENDATIONS OF UCM STUDY

5. The technical investigations of the UCM Study have been completed. Major recommendations of the Study including (i) Urban Climatic Planning Recommendation Map (UC-ReMap), (ii) wind performance criterion for AVAs, and (iii) refinements to the AVA system are summarized below :

Urban Climatic Planning Recommendation Map

6. The UC-ReMap is formulated based on :

- (i) an Urban Climatic Analysis Map which maps out the urban climatic characteristics in different parts of the territory based on an analysis and evaluation of the urban climatic factors and their effects on the thermal load¹ and the dynamic potential² as well as

¹ Thermal load measures the stored or emitted heat intensity of particular localities of urban areas. It has an effect on intra-urban air temperature increase depending on (a) the building volume (which has an impact on heat storage, and blocking the sky view slowing the city's cooling at night), (b) the topography and (c) the availability of green space.

² Dynamic Potential of an area depends mainly on its ground roughness which influences the air ventilation and air exchange of the areas. It is evaluated mainly based on (a) site coverage of buildings, (b) natural landscape and (c) proximity to surrounding openness.

impact on human thermal comfort³; and

- (ii) a wind information layer to complement the Urban Climatic Analysis Map.

There are altogether five urban climatic planning zones (UCPZs) delineated on the UC-ReMap. The planning recommendations for each UCPZ are set out below.

7. **UCPZ1** are mostly the natural areas at higher altitude, providing sources of cool air to their adjoining areas. These urban climatically valuable areas need to be preserved as far as practicable. Currently, the majority of this zone has already been subject to different statutory controls such as country parks and conservation related and non-development zones on statutory town plans. Essential small scale development is however possible.

8. **UCPZ2** are currently urban climatically “neutral” in terms of urban thermal comfort. They are mostly urban fringe or rural lowland. New low-density individual developments and comprehensive developments are possible subject to prudent planning and building design to avoid adverse impact on the urban climatic condition.

9. **UCPZ3** are currently subject to urban climatically “moderate” impact in terms of urban thermal comfort. They are mostly in the urban fringe or less dense development areas. Some mitigation actions are encouraged where possible.

10. **UCPZ4** and **UCPZ5** are the densely built areas, including most of the new town areas, the metro areas at the northern part of the Hong Kong Island, at the Kowloon Peninsula and at Tsuen Wan. The existing developments have already had a strong to very strong impact on thermal comfort. Mitigation actions are essential and recommended. Intensification of use/additional

³ Human thermal comfort is indicated by Physiologically Equivalent Temperature (PET), the temperature of a reference environment based on a heat balance model that combines climatic and physiological variables including air temperature, relative humidity, solar radiation, air movement, clothing and metabolic rate. Based on the Users’ Thermal Comfort Survey, under Hong Kong’s summer conditions, the neutral PET is 28°C.

development is not recommended unless with adequate mitigation measures.

11. The UC-ReMap is a strategic and comprehensive urban climatic planning framework and information platform. At the strategic level, it helps identify areas in need of improvement, select suitable locations for new development areas as well as evaluates urban climatic effects of major planning and development proposals. For UCPZ1, preservation of the climatically valuable areas is the focus. For UCPZ3, 4 and 5, opportunities should be maximized to avoid intensification of the existing problems of high thermal load and poor air ventilation, and to provide mitigation measures. If new additional development areas are contemplated, UCPZ2, in particular, formed sites and spoiled rural areas, would be a more acceptable choice, subject to comprehensive planning and development to maintain the existing urban climatic characteristics and avoid adverse impacts on human thermal comfort.

12. At the district level, the UC-ReMap helps understand the local urban climatic conditions, and hence identify appropriate planning measures such as designation of air path, designation of non-building area, regulation of development intensity, preservation of greenery and open space, etc. for addressing urban climatic concerns during forward planning. Planning and design measures to improve the urban climate through enhancing urban permeability and reducing thermal load are investigated and proposed in the Study.

Wind Performance Criterion

13. The AVA system has been in force since 2006. AVAs have been incorporated in the planning and development process for Government projects and relevant private sector projects requiring planning approval from the Town Planning Board or Government approval. As there is no benchmark for AVA performance, it has been based on an option comparison and improvement approach. Based on the Users' Thermal Comfort Survey⁴

⁴ Users' Thermal Comfort Survey was conducted as part of the UCM Study to understand the outdoor thermal comfort requirements of the Hong Kong people and to find out the range of comfortable wind environment from a human physiological point of view. A total of 2,702 interviews were completed. The survey results suggest that providing light air in the order of 0.9 – 1.3 m/s in summer is important and beneficial for the hot summer months of Hong Kong.

(the optimum wind requirement) and the Wind Tunnel Benchmarking Studies⁵ (the practical considerations of the existing built environment), a wind performance criterion for AVAs comprising the following two components is proposed for development sites requiring AVAs.

(a) Wind Performance Requirement

80% of all test points inside the assessment area as defined in the AVA Technical Circular have:

**Annual median hourly mean wind speed \geq 1 metre/second
(m/s)**

AND

Summer median hourly mean wind speed \geq 1 m/s

And

95% of all test points inside the assessment area as defined in the AVA Technical Circular have:

Annual median hourly mean wind speed \geq 0.6 m/s

AND

Summer median hourly mean wind speed \geq 0.6 m/s

The requirement for 80% of all test points to achieve the wind speed of 1m/s is in recognition of some unavoidable isolated wake areas behind buildings. The requirement of 95% of all test points to achieve a minimum wind speed of 0.6m/s is to safeguard against a stagnant wind environment.

(b) Alternative (Prescriptive) Approach

Taking into account the practical constraints of some existing dense built environment to achieve the wind performance requirement, the studies on various parameters and their effectiveness to mitigate UHI

⁵ The UCM Study has conducted wind tunnel benchmarking tests for 10 pairs of 20 areas with a view to investigating the existing wind environment of our city and comparing against the desirable urban air ventilation performance. It is revealed that given the high urban density, narrow streets, tall and bulky buildings with large podium, the need for urban human thermal comfort as indicated in the Survey would be practically difficult to achieve, except in unobstructed areas nearer to the waterfront and exposed areas.

effect, and the newly promulgated Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP) APP-152 on Sustainable Building Design (SBD) Guidelines, the following mitigating design measures are required as an alternative to comply with the above wind performance requirement :

- ground coverage of no more than 65%;
- building (tower block) permeability as per PNAP APP-152;
- setback requirement as per PNAP APP-152; and
- greenery (preferably tree planting) of no less than 30% for sites larger than 1 ha and 20% for sites between 1,000m² and 1 ha, at lower levels and preferably at grade.

Exemption

14. Developments with demonstrated functional requirements in terms of building length and/or ground coverage, such as infrastructural facilities, transport terminus, sports and civic facilities, may be exempted from the prescriptive design requirements, provided that all practical design improvement measures are incorporated in the development.

Refinements to the Air Ventilation Assessment System (AVA System)

15. The AVA System has been in force since 2006. Based on the Study findings and a review of all the completed AVAs on the AVA register⁶, refinements to the AVA system are proposed. The major refinements include incorporating the proposed wind performance criterion as a quantitative yardstick to confirm acceptance of development proposal from the air ventilation view point, extending the scope of application of AVA requirements to cover both public and private sector projects, and including non-waterfront sites with lot frontage of >140 m as a requirement for AVA. Some technical refinements to the AVA System are also proposed.

⁶ AVA register keeps AVAs completed by Government departments/bureaux to facilitate public inspection and review of the AVA process. Subject to the agreement of the private or quasi-government project proponents, non-public AVA projects may also be deposited in the AVA register.

WAY FORWARD AND IMPLEMENTATION

16. To carry forward the Study recommendations and improve the urban climate, concerted efforts of the public and the private sectors are required in the following areas :

By Government

- incorporate the UC-ReMap, the wind performance requirement and the planning and design measures to improve the urban climate into the Hong Kong Planning Standards and Guidelines to guide both public and private development projects;
- suitably amend the joint Technical Circular No. 1/06 on AVA to reflect the refined methodology and wind performance criterion for AVA; and
- at district level, co-ordinate suitable planning measures to increase building permeability and reduce thermal load by regulating building density, building height and ground coverage, introducing breezeway/air path, and connecting green and open space. PlanD, in this respect, has already been stipulating appropriate planning and building measures on statutory town plans where appropriate and during planning of new development areas such as Kai Tak development;

By Private Sector

- incorporate appropriate building design to ensure no adverse impact on the urban climatic environment; and
- demonstrate air ventilation acceptability when required in application for planning permission and lease modification or demonstration of compliance with the relevant requirement under the SBD Guidelines for applying for GFA concession.

17. Notwithstanding the above, it must be stressed that sustainable development is a matter of balancing environmental, social and economic

needs. Urban climatic issue is one of the important considerations in the planning and design process.

STAKEHOLDERS ENGAGEMENT

18. The Planning Department has commenced a stakeholders engagement to consult the trade, professional institutes, development and environment related statutory/advisory bodies, technical experts, academia as well as members of the public on the study findings and recommendations since 8 December 2011. The stakeholders engagement will last for 2 months until 15 February 2012.

ADVICE SOUGHT

19. Members are invited to offer views on the findings and recommendations of the UCM Study.

Planning Department
January 2012