

# **Defining the environmental performance of neighbourhoods in high-density cities**

## **Abstract (a limit of 200 words)**

The regenerative design framework aims to “engage a broader range of possibilities by moving beyond the immediate building and site boundaries”. It implies that the environmental performance of buildings requires a revised definition so that it considers not only the building itself, but also its contribution beyond its own boundary, i.e. neighbourhoods. In high-density cities, outdoor spaces are culturally considered as the extension of one’s living spaces. The environmental performance of neighbourhoods is particularly important to the health and well-being of urban inhabitants. This paper aims to define the environmental performance of neighbourhoods in high-density urban context based on the experience acquired in previous studies in Hong Kong over the last 15 years. These studies cover a wide range of environmental issues including urban climate, outdoor thermal comfort, and daylighting design in high-density cities. Subsequent development of the assessment tools for environmental performance of neighbourhoods in Hong Kong is also presented. The framework of stakeholder engagement, as an integral part of the neighbourhood assessment tool, is discussed. This paper highlights the distinctive features of the environmental performance of neighbourhoods in high-density urban context and how it influences the professional practices in Hong Kong.

Keywords: environmental performance, neighbourhoods, performance-based regulations, passive design, high-density cities

## **Introduction**

The regenerative design framework aims to “engage a broader range of possibilities by moving beyond the immediate building and site boundaries” (Cole *et al.*, 2012). The environmental performance of buildings should therefore consider its contribution to the surrounding environment. As building surroundings generally serve as the living places, the environmental performance of outdoor spaces is of utmost importance for the health and well-being of urban inhabitants.

In rapidly developing Asian cities, the compact and high-density urban form results in increasing air temperature and reduced air ventilation in the city. It causes a wide range of impacts on urban living such as thermal discomfort (Cheng and Ng, 2006; Ng and Cheng, 2012; Niu *et al.*, 2015), air pollution (Ai *et al.*, 2016; Shi *et al.*, 2016), and health risks (Goggins *et al.*, 2012; Ho *et al.*, 2017) due to the deteriorating urban climatic conditions (Arnfield, 2003). In such a high-density context, the environmental performance of neighbourhoods is particularly important to the living quality of the urban environment. However, such understandings are generally lacking, resulting in the decline in urban living quality and health and well-being of urban inhabitants (Lung *et al.*, 2014; Sansom *et al.*, 2017).

In high-density cities, building façades do not only serve as the envelope of building interiors, but also constitute the surface of surrounding neighbourhoods. The interactions between buildings and neighbourhoods, particularly the spaces between buildings, are important to the environmental conditions which urban inhabitants are exposed to. In addition, outdoor spaces are culturally considered as the extension of one’s living spaces in high-density urban living (Ahmed, 2003). The inclusion of a wider range of considerations in the environmental performance of buildings echoes the objective of the regenerative design framework (du Plessis and Cole, 2011; Cole, 2012; du Plessis, 2012).

The present paper aims to define the environmental performance of neighbourhoods in high-density cities based on the experience acquired in a wide range of scientific and planning studies in Hong Kong over the last 15 years. In particular, the translation of scientific knowledge of these studies into planning-oriented guidelines demonstrates how such experience improved urban planning and design practices in Hong Kong. It also discusses the participatory approach to engage stakeholders, particularly building inhabitants, in the development process of the assessment tool for the environmental performance of neighbourhoods. The effort of resolving scientific questions and developing a system thinking together with professionals and policy-makers is also introduced. This paper highlights the distinctive features of the environmental performance of neighbourhoods in high-density urban context and how it influences the professional practices in Hong Kong.

### **Urban context of high-density cities**

In high-density cities, closely packed buildings generally limit the availability of natural light and ventilation, as well as high urban temperature resulted from urban heat island (UHI) phenomenon (Givoni, 1998). Optimizing design for natural light and air ventilation becomes an important issue for architects, engineers, and industry stakeholders (Ng, 2010). Planning and design of buildings and neighbourhoods without considering the environmental and microclimatic conditions would result in mechanical cooling and hence increase the energy consumption in buildings (Hui, 2001). Due to the extremely high building density, extrapolating conventional design tools in Hong Kong was found to be insufficient to take into account the distinctive urban morphology and associated daylighting and ventilation conditions (Chung and Burnett, 1999; Ng, 2001). More importantly, human adaptation is rarely considered in conventional design tools

(Keyvanfar et al., 2014). It implies that new tools are required to ensure the living quality of urban dwellings and the environmental quality of neighbourhoods.

In order to improve the daylighting design for high-density urban environment, Ng (2001) developed a new design tool, namely unobstructed vision area (UVA) for regulating the daylighting performance of buildings in Hong Kong. Due to the high-rise buildings in Hong Kong, the sky component is virtually impossible to be captured above the top of buildings. Instead, Ng (2001) argued that it is more useful to provide daylight from gaps between buildings, which is a distinctive method offering a contextual solution to the issues. The socio-cultural factors concerning the usage of habitable spaces have considerable effects on the availability of daylight (Lau et al., 2006) and solar access (Lau et al., 2011). For example, the need for natural light in kitchen was found to be far less important compared to western countries since kitchens are generally not the dining place in Hong Kong (Lau et al., 2011). For high-density cities, it is of utmost importance to accommodate users' need as a result of cultural and behavioural factors. Therefore, a contextual approach provides place-based solutions and contextually appropriate rules and regulations, which can be practically applied to enhance the health and sustainability of the built environment. This method was subsequently incorporated into Buildings Department's Practice Note for Lighting and Ventilation Requirements – Performance-based Approach (APP-130; Buildings Department, 2004).

Urban ventilation in high-density cities did not receive much attention until the outbreak of severe acute respiratory syndrome in Hong Kong in 2003. According to the Team Clean Final Report (Team Clean, 2003), it was proposed to investigate the feasibility of establishing an air ventilation assessment (AVA) system as “one of the considerations for all major development or redevelopment proposals and in future planning” (Ng, 2009). However, the effect of strong winds on human comfort is traditionally the focus of studies

of the pedestrian wind environment in urban areas (Hunt *et al.*, 1976; Murakami, 1982; Blocken and Carmeliet, 2004). There is a lack of studies on weak wind conditions and the high-rise urban morphology, which are common in high-density cities. The then-existing urban fabric in Hong Kong is the major reason for such a poor ventilation, for example, lack of breezeways and air paths, closely packed high-rise buildings, uniform building height, tight and narrow streets not aligning with the prevailing wind, lack of urban permeability, projections from buildings, and lack of greenery in urban areas (Ng and Wong, 2005; 2006). Major development in recent years took into account air ventilation. Figure 1 shows how one of the largest development in Hong Kong incorporates the guidelines for ventilation into the design of site layout. According to the requirements stated in the AVA system, potential ventilation corridors have to be considered to provide a designated level of wind speed (1 m/s), which is specified according to the understandings of outdoor thermal comfort in sub-tropical cities (Cheng and Ng, 2006). Major air paths and breezeways were identified based on the results of wind tunnel test, which were then considered in the subsequent design by providing building setbacks in order to ensure sufficient ventilation in the area.

***Figure 1. Air ventilation assessment of Kai Tak Development and the strategy of building setback based on the results of wind tunnel test. Kai Tak Development is situated at the harbourfront and located in the former international airport of Hong Kong.***

The central idea of the AVA methodology is to improve outdoor thermal comfort through enhancing urban ventilation. It moves beyond a “sustainable” approach which aims to reduce the impacts but increases the regenerative capacity of the urban environment. Mang and Reed (2012) argued that regenerative design and development facilitate

positive changes and generate positive environmental and social outcomes as enhancing life in all its manifestations is the collective focus of the buildings, development projects, stakeholders and inhabitation. Cole *et al.* (2013) also suggested that the continually evolving inter-relationship between socio-cultural (built environment) and ecological (inhabitants and their well-being) systems should be acknowledged under different spatial contexts. The AVA system in Hong Kong reiterates the concept of the built environment as a socio-ecological system with a practical application in human comfort and well-being in high-density cities. Through the understanding of the relationship between urban morphology and human thermal comfort, the AVA system can enhance the social capital by providing a sustainable and climate-sensitive built environment and build the natural capital through improving the human comfort and well-being. It therefore “provides a catalyst for positive change” within the place (i.e. the neighbourhood) it is situated (Mang and Reed, 2012).

### **Development of BEAM Plus Neighbourhood**

As the quest for the environmental assessment for development projects increased in the last decade, the Building Environmental Assessment Method (BEAM) Society launched BEAM Plus Neighbourhood (BEAM-ND) in order to “assess the performance of a development project and help project owners to incorporate a broader framework of urban sustainability principles at the early planning stage for subsequent project implementation” (Hong Kong Green Building Council, 2016, p.1). Hong Kong is one of the most densely populated cities in the world with a population of 7.3 million residing in a land area of 1,106 km<sup>2</sup>. The built-up area in Hong Kong accounts for only 24% of land, resulting in an average population density of built-up areas of 27,330 person/km<sup>2</sup> (Planning Department, 2016). In order to accommodate such a large population, the

urban morphology of Hong Kong is characterized by its high-rise and compact nature. Given the distinctive contextual characteristics in Hong Kong, there are large variations in the physical context of neighbourhoods. As such, the objective of BEAM-ND is to accommodate a wide range of typologies and spatial scales in the assessment framework. The compact urban form resulted in deteriorated quality of life such as air pollution, high urban air temperature, the lack of green and open spaces, and hence hampered sustainable and healthy living. In the BEAM-ND, there are seven aspects which contribute to neighbourhood sustainability. One of the key assessment aspects is Outdoor Environmental Quality (OEQ) which requires attention on outdoor thermal comfort, intra-urban temperature and urban heat island effect, neighbourhood daylight access, visual quality and air quality of open spaces (Figure 2). To attain the credits for each of these criteria, it is required to demonstrate that certain level of environmental quality is achieved. The standard for outdoor thermal comfort was developed according to previous studies commissioned by the government and academic studies conducted in similar climatic regions (Lin and Matzarakis, 2008; Lin et al., 2011; Ng and Cheng, 2012). For example, the AVA study completed in 2006 defined the methodology and established the system for improving the air ventilation in urban areas (Ng, 2009). The subsequent study on the feasibility of developing the urban climatic map (UCMap), commissioned by the Planning Department in 2006, defined the standard for the wind environment in Hong Kong and, more importantly, employed physiological equivalent temperature (PET; Höppe, 1999) as the indicator to outdoor thermal comfort so that the understandings of how urban morphology affects urban climate are relevant to the standard of outdoor thermal comfort in Hong Kong. PET is employed as the synergetic indicator of human thermal comfort and collates the effect of the urban morphological parameters in the UCMap

because outdoor thermal comfort affects the usage of open spaces (Lin et al, 2011) and hence associated issues of health and well-being of urban inhabitants (Lee et al., 2015).

***Figure 2. The seven aspects in the assessment framework of BEAM Plus Neighbourhood***

Urban heat island (UHI) phenomenon is another important aspect since the higher temperature in urban areas than that of the rural surroundings is a function of materials with high absorptivity, insufficient greenery, and low sky view factor (Arnfield, 2003). Such high temperature is caused by the compact built environment and heavily affects the quality of outdoor spaces (Taha, 2017). It has also been associated with impacts on social, environmental and economic aspects of urban areas (Akbari et al., 2016; Aflaki et al., 2017). The Hong Kong Observatory examined the spatial and temporal characteristics of UHI in Hong Kong and found that the urban-rural difference is approximately 3°C (Mok et al., 2010) or up to 4°C during night-time (Siu and Hart, 2013). This understanding is embedded in the benchmarking process of both daytime and night-time UHI in the assessment framework for the UHI aspect in BEAM-ND. In the assessment framework of BEAM-ND, it is required to demonstrate that the maximum intra-urban heat index in summer is within 3.0°C. It aims to prevent further increase in daytime UHI and reduce the night-time UHI while prepare for the effect of future climate change which may exacerbate the UHI intensity. Reference environmental conditions for calculating the intra-urban heat index are defined for relevant heat island studies (Table 1). Such a performance-based approach facilitates the flexibility of design without compromising the environmental performance of the development.

**Table 1. Reference environmental conditions for intra-urban heat index calculation (Hong Kong Green Building Council, 2016). These reference conditions are used in the assessment of outdoor environmental quality in BEAM-ND tool.**

The assessment of environmental aspects in neighbourhood sustainability assessment tools such as LEED-ND, BREEAM and CASBEE-UD, BEAM-ND focuses on energy, water and greenery (Sharifi and Murayama, 2014). There are no explicit considerations of the environmental quality of outdoor spaces which are frequently used by urban inhabitants in high-density cities. Among these common neighbourhood sustainability assessment (NSA) tools, only CASBEE-UD incorporates microclimatic considerations into the assessment of environmental quality (Komeily and Srinivasan, 2015). Compared to other NSA tools, BEAM-ND shares similar assessment criteria but emphasizes the environmental quality of outdoor environment. This is particularly important in high-density cities due to the frequent use of outdoor spaces for different purposes. Increasing usage of outdoor environment is associated with the health and well-being of urban inhabitants, especially for elderly population.

#### **Stakeholder engagement in the BEAM-ND assessment framework**

Engaging stakeholders, particularly urban and building inhabitants, provides “values and aspirations” to inform the planning, design, development and occupation processes (Cole *et al.*, 2012). Regenerative design, which creates the regenerative capacity of designed systems, therefore allows building inhabitants to “design, create, operate and evolve regenerative socio-ecological systems in their place” (Mang and Reed, 2012). As such, the behaviour, health and well-being of building and urban inhabitants can be enhanced, given the regenerative capacity and potential development occurred within. The

development of the NSA tools requires stakeholders' participation in developing the indicators of neighbourhood sustainability to ensure that the indicators do not conflict the values, priorities, needs and positions of different parties in the neighbourhood (Roseland, 1999). In the development of BEAM-ND, different types of stakeholders were involved in order to acquire the views and aspirations from the industry and the community (Table 2). They were also invited to share their expectations and the acceptability of the proposed assessment and rating scheme. In the development stage of the BEAM-ND tool, participation from the community or inhabitants is rather limited since it mostly affects the practices of urban planners and designers and various government departments in a manner that existing policies and regulations may need to be reviewed to be in line with the tool itself. Nonetheless, in the framework of the BEAM-ND tool, community engagement forms an integral part in the Community Aspect which accounts for 20% of the credit points.

***Table 2. Five types of stakeholders involved in the process of stakeholder engagement for the development of BEAM-ND.***

In the BEAM-ND assessment framework, community engagement plan is required for attaining the credit for the Community Aspect. This important element of community engagement involves existing and/or intended occupants, key members or stakeholders of community within 500m beyond the site boundary. The community engagement plan is required to state the "objectives and scopes of community engagement in order to manage participants' expectation" (Hong Kong Green Building Council, 2016, p.37). The baseline conditions of the neighbourhood, development constraints and controls, development parameters, and proposed design are included in the community

engagement plan. It also provides the timing of the engagement activities and includes a feedback mechanism to demonstrate the developer's intention to respond to different views from stakeholders. Engaging the community in the planning and design stages of development projects allows communities to build on a common ground and interest such that positive changes can be provided by the development (The Royal Town Planning Institute, 2005).

Comments received during the community engagement activities are to be evaluated and feedback is provided to the participants. For example, it should be shown how comments received from the community are considered in the review of the masterplan and corresponding justifications have to be made for adopting (or not adopting) recommendations from the community. It should also address the concerns from the community with support of technical assessment where appropriate. Subsequent review of the masterplan design is expected to include evidence on establishing the visions of the development with the community and the inclusion of opinions of the community gathered in the revision of the masterplan. The BEAM-ND tool therefore provides an opportunity for public engagement in future developments within the community and delineates a methodological framework of community engagement programme.

In previous studies, surveys were conducted to obtain information about users' opinion, requirement and preference. Such information is particularly useful for researchers and policy-makers to develop more user-oriented design guidelines so that building and urban inhabitants can be relieved from the impacts of reduced daylight and ventilation. It also encourages people to better use the indoor and outdoor places and hence improve the living quality of urban inhabitants. Ng (2003) conducted a territory-wide survey to determine the minimum acceptable daylight performance which provides the basis for standard of daylighting performance in high-rise, high-density buildings. The study

recommended that an 80% satisfaction rate is suitable for establishing the standard threshold, which was found to be reasonable as confirmed by simulation results (Ng, 2003). This process empowers building inhabitants since the user-defined standard guided the development of subsequent building regulations. It implies that designers require to holistically consider both subjective and objective information in their practices. In the newly developed BEAM-ND tool, the involvement of building occupants and community inhabitants is enhanced through the Community Aspect, an element that was not implemented in previous assessment tools.

### **Policy implications: the assessment of environmental performance at different spatial levels**

The final stage of the development of the UVA method was to translate it into Buildings Department's Practice Notes APP-130 so that architects and building designers can implement the method without any ambiguity. The use of performance criteria, which are defined by users' survey, was found to be a reasonable approach to formulate the design guidelines. A series of sensitivity tests were also conducted to investigate the impacts of the UVA method to actual design. It is worth to note that the UVA method was developed based on reasonable assumptions of different circumstances. In practice, because of the variety of situations and case-specific issues, simple prescriptive rules are necessary for resolving complicated sciences so that designers can make correct decisions or prevent (Ng, 2005).

The performance-based approach allows the flexibility of the methods used to prove the compliance of the performance requirements. As such, the technical aspects of the design guidelines can be updated with technological advances in computational methods in the future. The UVA method was implemented by the Buildings Department of the Hong Kong

Government in late 2003 for regulatory control of daylight performance of buildings in Hong Kong. The Practice Note (APP-130) was therefore issued in response to public concern of the built environment after the outbreak of SARS in Hong Kong. It was generally recognized that actions had to be taken and the study was in a timely manner to address the increasing public concern.

Apart from daylighting performance, the AVA system was introduced in 2006 as an advisory approach to encourage better design in terms of urban ventilation. In the initial stage of implementation, qualitative design guidelines were formulated to encourage good design practices to “move towards a better future rather than for precision” (Ng, 2009). Therefore, the AVA did not serve as a primary decision-making tool in this stage. Nonetheless, the qualitative design guidelines were incorporated into Chapter 11 of the Hong Kong Planning Standard and Guidelines to reinforce or complement the existing guidelines (Planning Department, 2016). As shown in Figure 1, these qualitative guidelines were considered in the initial design stage of one of the largest developments, Kai Tak Development, in Hong Kong. It provides guidance for sustainable building design at site and building levels (Figure 3 and 4). In the subsequent study of urban climatic map (UCMap), the standard for wind environment and quantitative requirements would be defined for the revision of existing policies in order to promote the consideration of such guidelines.

***Figure 3. Qualitative guidelines in the Hong Kong Planning Standard and Guidelines for safeguarding air ventilation and microclimate at site level.***

***Figure 4. Qualitative guidelines for enhancing air ventilation and microclimate at building level.***

Traditionally, the consideration of urban climate had limited impacts on urban planning and design because of the different language between scientists and urban planners (Eliasson, 2000). There is a need for an information platform to bridge the gaps between urban climatology and urban planning and design and transfer the climatic knowledge into planning language (Ren *et al.*, 2011). UCMMap is “an information and evaluation tool to integrate urban climatic factors and town planning considerations by presenting climatic phenomena and problems into two-dimensional spatial maps (Baumüller *et al.*, 1992; VDI, 1997; Scherer *et al.*, 1999; Ren *et al.*, 2011). It was first developed in Germany and has been widely used to provide urban climatic information for climate-sensitive urban planning. The UCMMap of Hong Kong uses human thermal comfort as the indicator to define the classification of different layers such that the magnitude of urban morphological parameters determines the thermal comfort conditions of local urban areas. These layers, including building height and coverage, greenery, topography and proximity to openness, are used to represent the built environment and quantify their effect on urban climatic conditions and human thermal comfort (Ren *et al.*, 2011).

The urban climatic understandings provided by the UCMMap of Hong Kong help to identify the problematic areas which require attention on the local ventilation conditions. Such understandings allow urban planners and designers to take appropriate measures that improve the urban climate of the city. They supplement the existing qualitative guidelines with quantitative information that to what extent planning and design measures should be taken. For example, as suggested by Ng *et al.* (2012), a greenery coverage of 30% would reduce daytime air temperature by approximately 1°C. As such, in the subsequent Buildings Department’s Practice Note on Sustainable Building Design Guidelines (APP-152; Buildings Department, 2016), a site coverage of greenery of 30% is recommended.

Detailed quantitative guidelines on air ventilation at site level were also included in this Practice Note to guide design practices. At this stage, these guidelines were not mandatory to private developments but incentives were offered by new policies, in the way of gross floor area concession, to attract developers to implement them in new building developments. Evidence of its applications was found in recent development.

***Figure 5. Recent development incorporating sustainable building design guidelines which originated from AVA system.***

## **Conclusions**

This paper presents the development of the assessment of environmental performance of neighbourhoods in high-density urban environment of Hong Kong. Contextual problems in high-density cities require a revision to conventional methods in order to address the constraints encountered in high-density cities. Design tools for daylighting and ventilation were specifically developed for high-density compact environment to improve the environmental quality at building and site levels. Place-specific solutions are necessary for more appropriate regulatory tools for better environmental design. Environmental performance of buildings should not be limited to building interior because the interactions beyond building façades are important in the environmental assessment of neighbourhoods. The development of BEAM-ND provides an assessment tool specifically designed for neighbourhood-level assessment, which aims to incorporate the principles of urban sustainability at the early planning and design stages of development projects.

Participatory approach is also important to provide appropriate solutions for the environmental problems that are oriented to the inhabitants of the community. Engaging

stakeholders in the planning and design stages of new development ensures that inhabitants' need is addressed through the community engagement plan of the BEAM-ND tool. More importantly, the boundary of buildings has to be re-defined in high-density urban context that the surrounding environment of buildings is an integral part of inhabitants' living space. Environmental performance of neighbourhoods needs to be holistically considered in high-density cities for the health and well-being of the inhabitants. The experience of our studies provides a useful reference to designers and policy-makers trying to tackle the issue of rapid urban development. Environmental performance of neighbourhoods in high-density cities is highly relevant to developing countries which have considerable pressure on population density and limited land resources.

### **Epilogue**

Professor Ray Cole was involved in the development of Comprehensive Environmental Performance Assessment Scheme (CEPAS) for Buildings. He was leading the consultant team to devise a label system for "green buildings" and the resultant CEPAS is a holistic assessment tool for different building types in Hong Kong (Buildings Department, 2006). It also laid out the roadmap and led to the development of subsequent BEAM Accreditation System which has become the principal building assessment system in Hong Kong since then (Hong Kong Green Building Council, 2016).

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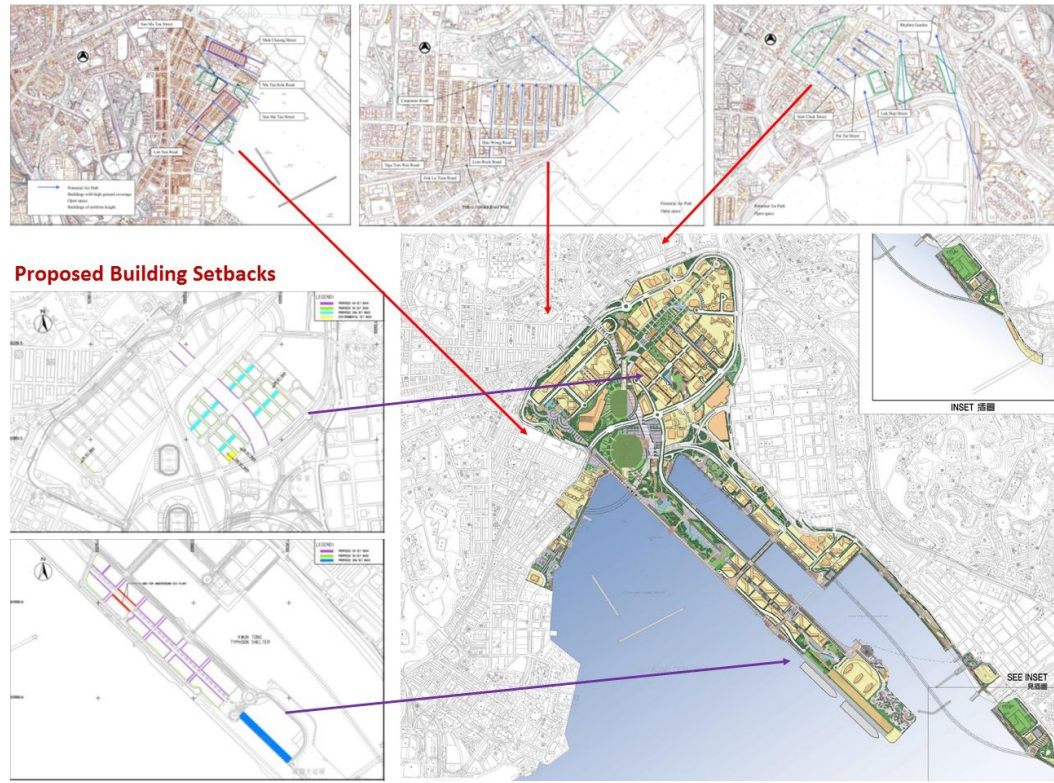
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**Table 1. Reference environmental conditions for intra-urban heat index calculation (Hong Kong Green Building Council, 2016). These reference conditions are used in the assessment of outdoor environmental quality in BEAM-ND tool.**

Hour	T <sub>a</sub> (°C)	RH (%)	GHI (W/m <sup>2</sup> )	DHI (W/m <sup>2</sup> )	WS (m/s)
1	28.5	83	0	0	0.5
2	28.3	84	0	0	0.4
3	28.1	85	0	0	0.4
4	28.0	85	0	0	0.4
5	27.8	86	0	0	0.4
6	27.7	87	0	0	0.4
7	27.8	86	0	0	0.4
8	28.1	84	154	93	0.4
9	28.5	82	298	161	0.6
10	29.0	79	449	216	0.7
11	29.8	76	573	259	0.8
12	30.3	74	622	272	0.8
13	30.7	73	638	285	0.9
14	30.9	72	602	287	0.9
15	31.0	72	525	254	0.9
16	31.0	72	429	210	0.8
17	30.5	73	290	154	0.7
18	29.9	75	141	89	0.7
19	29.5	77	0	0	0.6
20	29.3	78	0	0	0.6
21	29.1	80	0	0	0.5
22	29.0	80	0	0	0.5
23	28.9	81	0	0	0.5
24	28.7	82	0	0	0.5

**Table 2. Five types of stakeholders involved in the process of stakeholder engagement for the development of BEAM-ND.**

<b>Potential Stakeholders</b>	<b>Specific Objectives</b>
<b>Government Sector</b> <ul style="list-style-type: none"> <li>• Relevant Govt. Bureau and Departments</li> </ul>	<ul style="list-style-type: none"> <li>• To understand the practicality and relevant concerns in adopting sustainable design and practices in the proposed rating scheme in the context of Hong Kong</li> <li>• To exchange views on how the rating scheme could help the Government sector to adopt sustainable design and practices in their projects</li> <li>• To explore ways to collaborate with the Government sector to encourage the use of the rating scheme to promote sustainable design and practices</li> </ul>
<b>Quasi-public Organization</b> <ul style="list-style-type: none"> <li>• Urban Renewal Authority</li> <li>• Hong Kong Housing Society</li> <li>• Mass Transport Railway</li> </ul>	<ul style="list-style-type: none"> <li>• To exchange views on how the rating scheme could help them to adopt sustainable design and practices in their project</li> <li>• To understand their views and concerns on using the rating scheme to assess their projects</li> </ul>
<b>Professional association and Academics</b> <ul style="list-style-type: none"> <li>• Professionals Institutes (such as HKIA, HKIP, HKIUD, HKIE, HKIS, BEAM Society etc.)</li> <li>• Academics on green buildings, technology, sustainability, architecture, planning, urban design, engineering, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• To understand the practicality and relevant concerns in adopting sustainable design and practices in the proposed rating scheme in the context of Hong Kong</li> <li>• To explore ways to encourage the adoption of sustainable design and practices in practice, with a view to facilitate acceptance by the industry</li> </ul>
<b>Development Industry</b> <ul style="list-style-type: none"> <li>• Private Developers</li> <li>• REDA</li> </ul>	<ul style="list-style-type: none"> <li>• To exchange views on how the rating scheme could help them to adopt sustainable design and practices in their project</li> <li>• To understand their views and concerns on using the rating scheme to assess their projects</li> </ul>
<b>Green and Environmental Concern Groups</b>	<ul style="list-style-type: none"> <li>• To understand the practicality and relevant concerns in adopting sustainable design and practices in the proposed rating scheme in the context of Hong Kong</li> <li>• To explore ways to encourage the adoption of sustainable design and practices in practice</li> </ul>



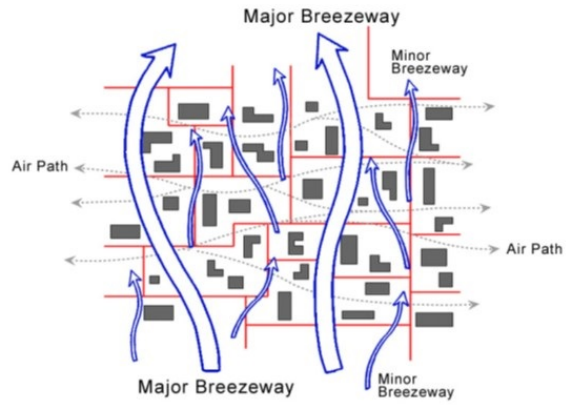
**Figure 1. Air ventilation assessment of Kai Tak Development and the strategy of building setback based on the results of wind tunnel test. Kai Tak Development is situated at the harbourfront and located in the former international airport of Hong Kong.**



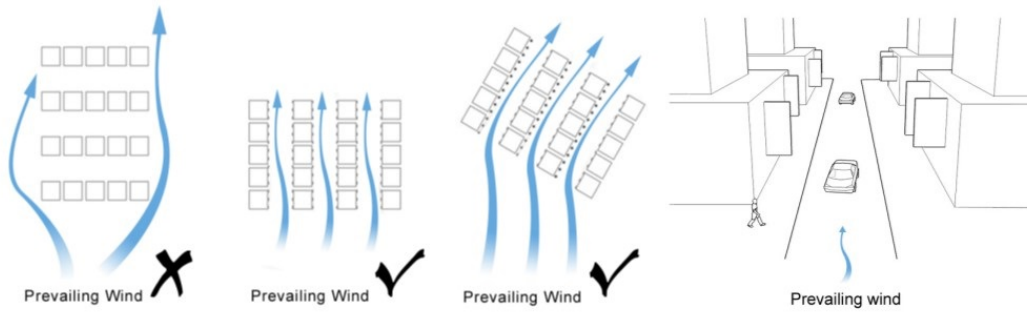
**Figure 2. The seven aspects in the assessment framework of BEAM Plus Neighbourhood**



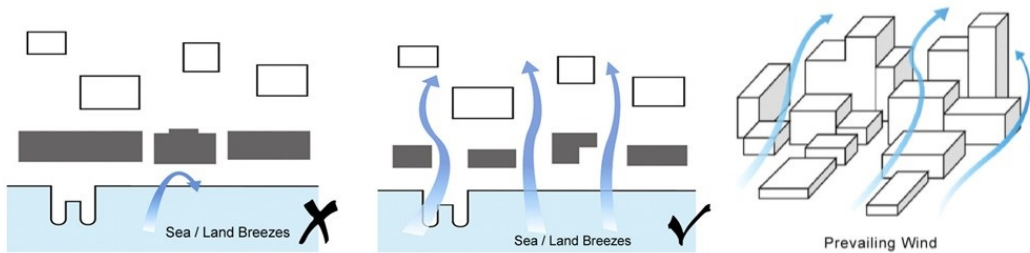
**1. Site disposition to provide air paths**



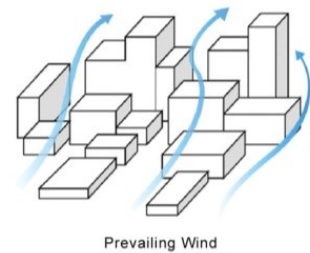
**2. Breezeway and air paths**



**3. Street Orientation, Pattern and Widening**



**4. Waterfront sites**



**5. Height Profile**

**Figure 3. Qualitative guidelines in the Hong Kong Planning Standard and Guidelines for safeguarding air ventilation and microclimate at site level.**

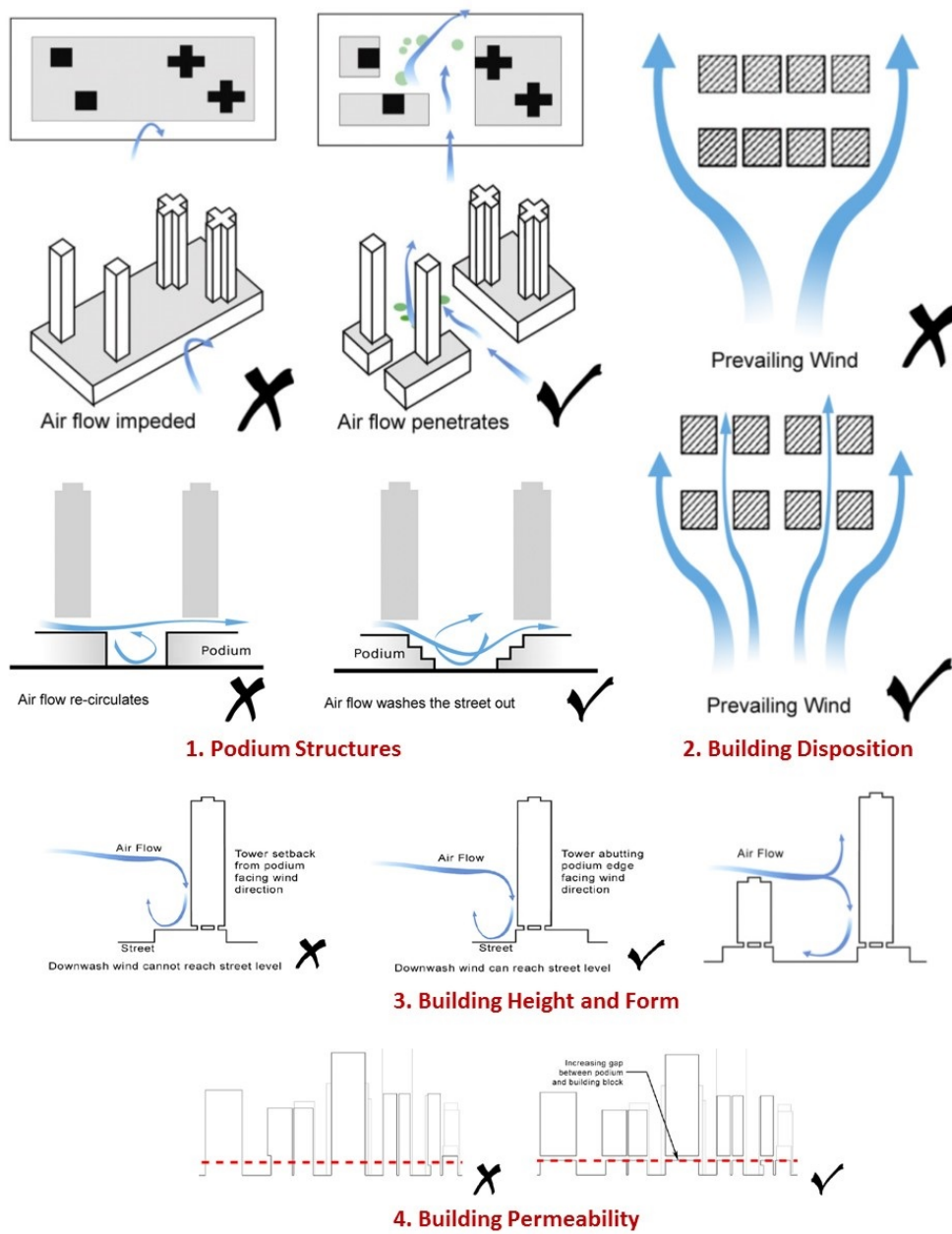


Figure 4. Qualitative guidelines for enhancing air ventilation and microclimate at building level.



**1. Building Setback**



**2. Reduced Ground Coverage**



**3. Building Permeability**



**4. Vertical Greening**

**Figure 5. Recent development incorporating sustainable building design guidelines which originated from AVA system.**