

The Overheating Cities and Adaptions

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香港大學

THE UNIVERSITY OF HONG KONG

Residents in Hong Kong's poorest neighbourhoods **struggle to keep cool** as city endures record long heatwave (PUBLISHED : Saturday, 07 July, 2018, 3:42pm)

Heatwave brings tears and depression

Survey reveals emotional cost of record hot spell on some of city's poorest

Christy Leung
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"My 6½-year-old daughter only wears underwear at home as it is too hot. She can't sleep and often has fever," Lin said. "She has to shower three times at night. We have dinner at the park after making food at home."

organisation, Sze Lai-shan. The group measured the temperature at 27 subdivided units in June and the first week of July, and found that places in Yuen Long reached up to 42 degrees. The temperature inside 81 per cent of these units was higher than outside, in some cases by as much as 5 degrees.

"[The families] would rather stay outside and come home late. The hot weather also brought more bugs to their places," Sze said.

The blazing heat prompted a

42°C

Temperature recorded inside flats in Yuen Long during last month and the first week of this month, according to the Society for Community Organisation

very hot weather warning from the Observatory, which ran for 348 hours. It was the longest period for the warning to remain in place since the system was launched in 2000. It was also the hottest May since records began.

Sze urged the government to resume offering a living subsidy to "have-nots", and build more transitional housing.

The wait for public housing in Hong Kong is at its longest in almost two decades, with families waiting for more than five years to be allocated a flat, according to official statistics released in May.

Families spend an average of five years and one month waiting for a public housing flat, according to the Housing Authority. Elderly applicants wait for an average of two years and nine months. The last time there was such a long wait for public flats was in 2000, when low-income families had to wait five years and three months.

Out of 272,300 applicants, 5 per cent were families and single elderly people, and the rest were single, non-elderly applicants.



A satellite-style aerial photograph of Hong Kong, showing its rugged terrain, green hills, and urban areas. The island is surrounded by dark blue water. The text 'Hong Kong' is overlaid in the top right corner.

Hong Kong

Climate: sub-Tropical (hot and humid summer, mild winter)

Land area: 1000 sq.km

Urban area: 220 sq.km (23% of total land)

Population: 7.5 million



香港屬世界最具競爭力营商环境
香港政府致力提升营商环境，吸引国际人才，促进经济持续发展。香港政府一直致力提升营商环境，吸引国际人才，促进经济持续发展。香港政府一直致力提升营商环境，吸引国际人才，促进经济持续发展。

50% population lives in public housing

2017 The Thematic Household Survey Report No. 60, published by The Census & Statistics Dept. of HK Gov.,



0.2 Million people live in subdivided units

2017 The Thematic Household Survey Report No. 60, published by The Census & Statistics Dept. of HK Gov.



A photograph of a man sitting in a cage home. The man is shirtless and wearing white shorts, sitting on the edge of a metal cage. The cage is made of wire mesh and is cluttered with various items, including clothes and a calendar. In the background, another person is sitting on the floor, reading a newspaper. The floor is checkered, and there is a red plastic stool. The overall environment is cramped and appears to be a typical cage home in Hong Kong.

0.1 Million cage home dwellers

2017 The Thematic Household Survey Report No. 60, published by The Census & Statistics Dept. of HK Gov.

Ageing Society & Poverty

老齡与贫困

本港去年長者貧窮人口在政策介入後，回升至30.85萬，較前年增加1.47萬人，創2009年以來新高；貧窮率升至30.1%，即每三個長者就有一個要捱窮。(苹果日报，要闻港闻，16/10/2016)

香港的人口將急速高齡化，由2015年至2064年，65歲或以上的長者人數預期會由約112萬上升2.3倍至258萬，長者安老服務的需求更見殷切。

<http://www.rthk.hk/tv/dtt31/programme/hkcc/episode/444380>



14/08/2017

Time & Dept.	Government Projects	Technical Note, Practice Note and Guidelines	Design Levels
2003-2005 Planning Dept.	Air Ventilation Assessment	2005: Development Bureau published the Technical Note on Air Ventilation Assessment	<ul style="list-style-type: none"> District Planning Building Site Plan Building Design
		Aug 2006: Hong Kong Planning & Standard Guideline- Chap.11	<ul style="list-style-type: none"> Urban Design
2006-2009 Building Dept.	Building Design that Supports Sustainable Urban Living Space in Hong Kong	June 2009, the Council for Sustainable Development launched a public engagement process entitled 'Building design to foster a quality and sustainable built environment'	<ul style="list-style-type: none"> Building Design
		2011: Practice note: APP 518 & 52 - Sustainable Building Design	<ul style="list-style-type: none"> Building Design Building Site Plan
2006-2012 Planning Dept.	Urban Climatic Map and Standards for Wind Environment - Feasibility Study	From 2007: Update & renew the 109 urban zoning plans of Hong Kong	<ul style="list-style-type: none"> District Planning Building Site Plan Urban Planning
		From 2007 to now: new town development and urban renewal projects	<ul style="list-style-type: none"> Urban Planning and Design
2010-2013 Planning Dept.	Consultancy study on establishment of simulated site wind availability data for air ventilation assessment in Hong Kong	Since 2013, the site wind availability data for Hong Kong have been available online	<ul style="list-style-type: none"> District Planning Building Site Plan Building Design
2004-Now Housing Authority	「Micro-climate」 Study	Public Housing Estate Projects: master plan, design: air ventilation and heat island assessment, daylight design, shading and thermal comfort study.	<ul style="list-style-type: none"> District Planning Building Site Plan Building Design
2016-2018 HKGBC	Microclimate Guidebook	HKGBC Guidebook on Urban Micro-climate study	<ul style="list-style-type: none"> Building Design Building Site Plan

HK governmental consultancy projects related to urban climate since 2003
 2003年后香港政府主导的有关城市气候与环境的研究项目

香港都市气候图的绘制流程

Hong Kong UCMAP Development Process

都市气候分析图

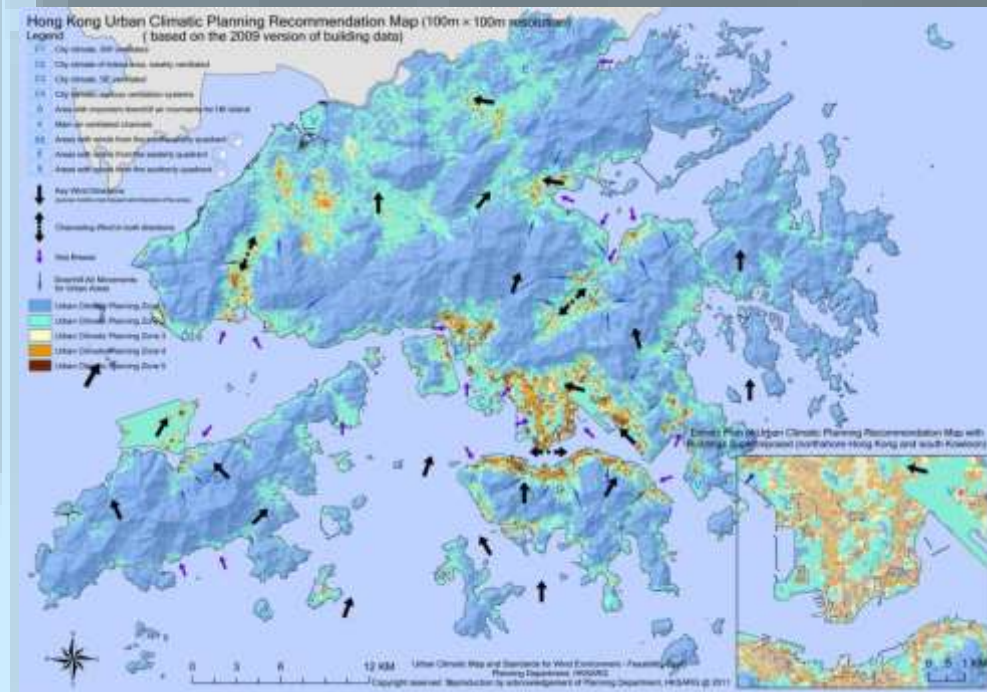
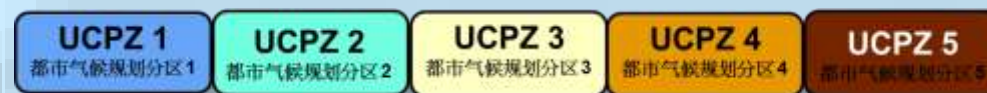


UC-AnMap 都市气候分析图 8 Urban Climatic Classes 八个都市气候规划特性分类

No	Urban Climatic Analysis Class	Impact on Thermal Comfort	Urban Climatic Planning Zone (UCPZ)
1	Moderate negative Thermal Load and Good Dynamics Potentials	Moderate	UCPZ 1 Urban climatically valuable area
2	Some negative Thermal Load and Good Dynamics Potentials	Slight	UCPZ 2 Neutral urban climatically sensitive area
3	Low Thermal Load and Good Dynamics Potentials	Neutral	
4	Some Thermal Load and Some Dynamics Potentials	Slight	UCPZ 3 Moderate urban climatically sensitive area
5	Moderate Thermal Load and Some Dynamics Potentials	Moderate	
6	Moderately High Thermal Load and Low Dynamics Potentials	Moderately strong	UCPZ 4 Highly urban climatically sensitive area
7	High Thermal Load and Low Dynamics Potentials	Strong	
8	Very High Thermal Load and Low Dynamics Potentials	Very strong	UCPZ 5 Very highly urban climatically sensitive area

UC-ReMap 都市气候规划建议图 5 Urban Climatic Planning Zones 五个都市气候规划分区

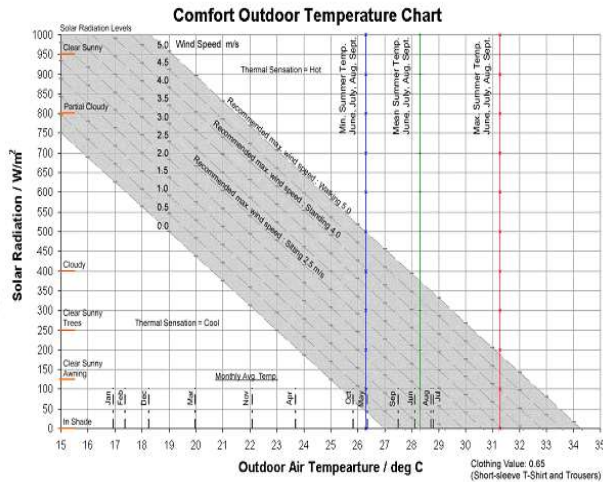
UC-ReMap 都市气候规划建议图 5 Urban Climatic Classes 五个都市气候规划分区



风环境信息图



INFORMATION

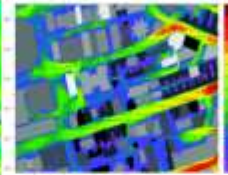
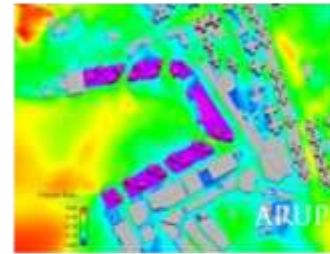


References:
 Baruch Givoni et al. "Outdoor comfort research issues". Energy and Buildings, vol. 35, pp. 77-86, 2003.
 Baruch Givoni and M Noguchi. "Issues and problems in outdoor comfort research". Proc. PLEA 2000 Conference, Cambridge, UK, July 2000.
 Baruch Givoni and M Noguchi. "Outdoor Comfort Responses of Japanese Person". Proc. Solar 2004 Conference, Portland, US, July 2004.
 Hong Kong Observatory. Monthly Meteorological Normals and Extremes for Hong Kong 1961-1990.
 RWGI. M. Saito et al. "A comprehensive assessment of pedestrian comfort including thermal effects". Journal of Wind Engineering and Industrial Aerodynamics, vol. 77/78, pp. 753-766, 1998.



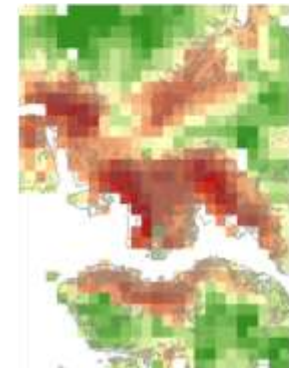
User survey

Bio-meteorological modelling



CFD

Wind Tunnel tests



Model simulations



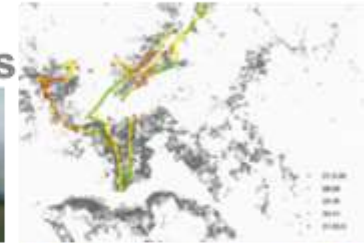
Meso-scale modelling



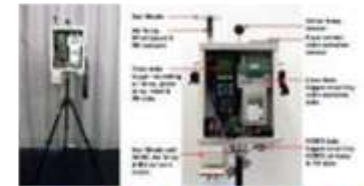
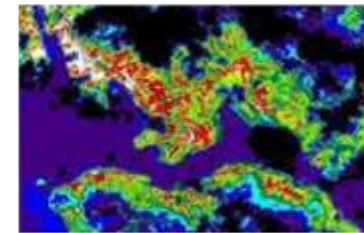
Field studies



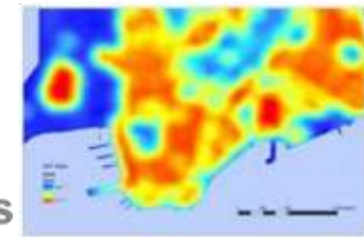
Traverse measurements



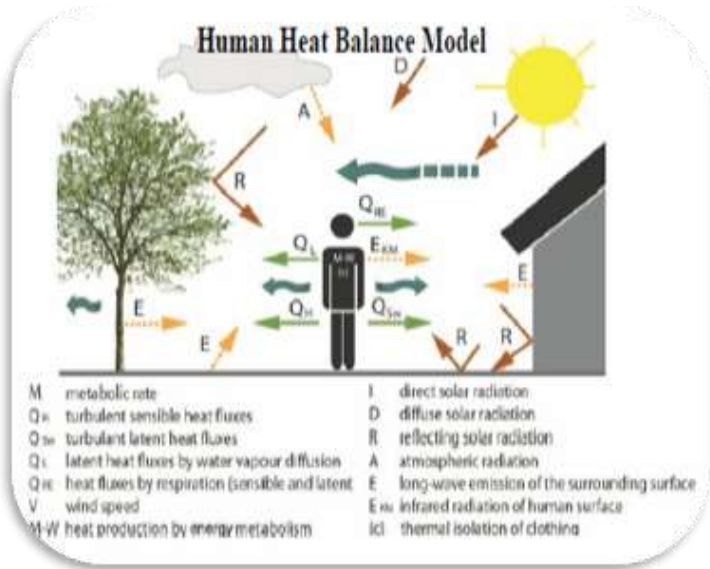
Remote sensing



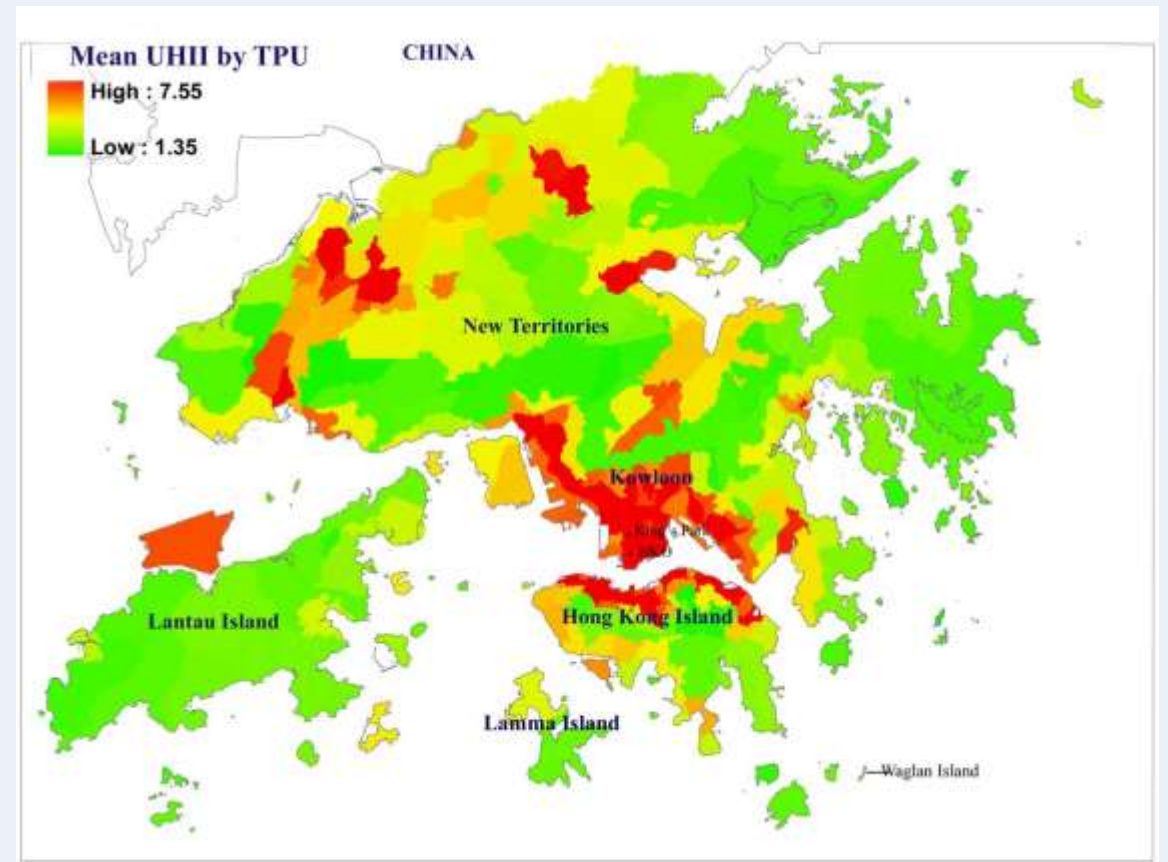
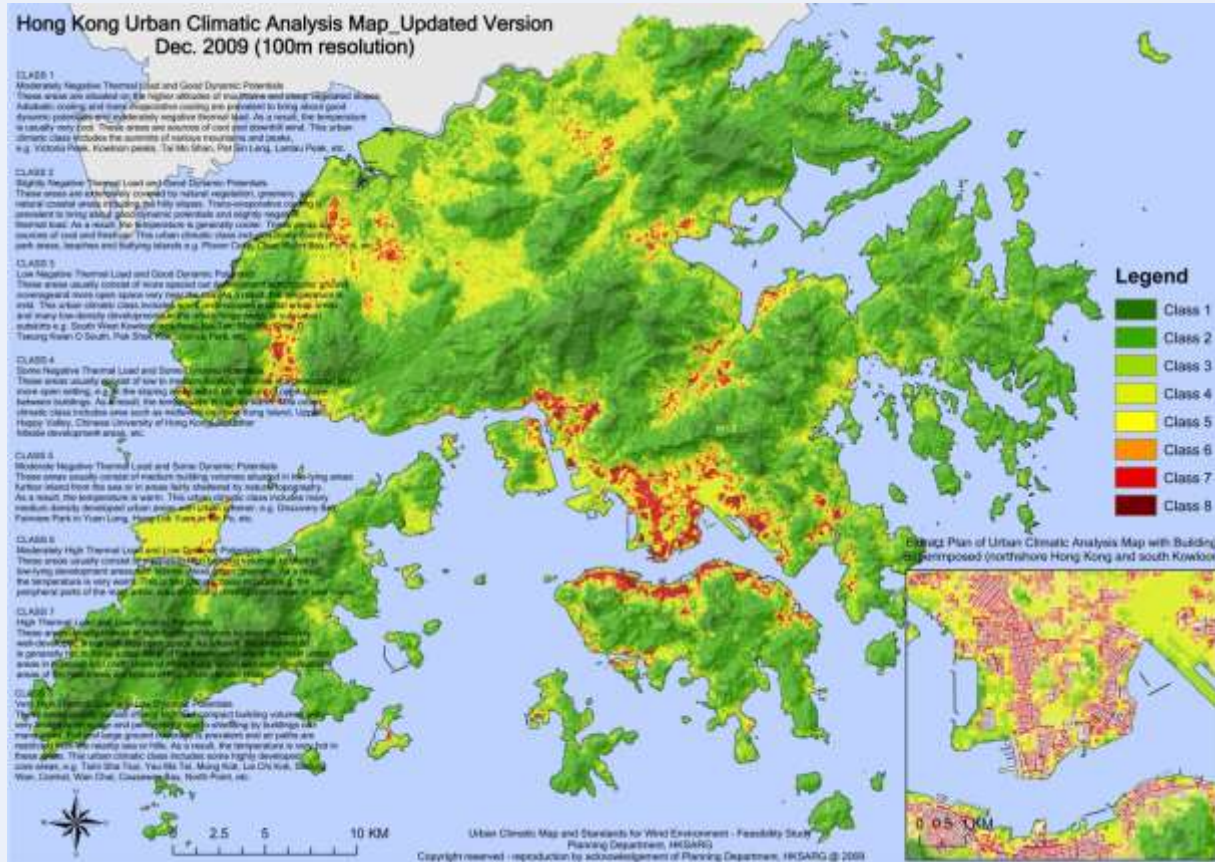
Micro-climatic monitoring



Theoretical calculations



Extract UHI Intensity Information from UCMMap



PlanD. (2012). Urban Climatic Map and Standards for Wind Environment – Feasibility Study. Technical Report, Commissioned by the Planning Dept. Of Hong Kong Government. Hong Kong.
https://www.pland.gov.hk/pland_en/p_study/prog_s/ucmapweb/ucmap_project/content/reports/final_report.pdf

Mortality Risk

Table 2. Excess mortality of prolonged heat (lag 0 – 3). The results indicate the percentage increase in mortality in 1°C increase in daily minimum air temperature at lag 0 – 3 and the corresponding 95th confidence intervals of each model. Significant results are marked with asterisks.

Model	All-cause mortality	Cardiovascular mortality	Respiratory mortality
Baseline ($T_{max} \geq 33^{\circ}\text{C}$)	3.67% [3.53%, 3.81%]*	3.87% [3.55%, 4.18%]*	3.55% [3.24%, 3.86%]*
Three consecutive VHDs	7.97% [7.14%, 8.80%]*	8.42% [6.59%, 10.25%]*	7.06% [5.32%, 8.80%]*
Three consecutive HNs	7.37% [7.14%, 7.61%]*	7.41% [6.88%, 7.93%]*	7.26% [6.77%, 7.75%]*
Five consecutive VHDs	4.90% [3.59%, 6.21%]*	9.68% [6.79%, 12.6%]*	0.63% [-2.16%, 3.42%]
Five consecutive HNs	7.99% [7.64%, 8.35%]*	7.74% [6.93%, 8.55%]*	8.14% [7.39%, 8.89%]*
At least three VHDs and three HNs within a 7-day period	1.46% [1.22%, 1.71%]*	1.83% [1.29%, 2.36%]*	1.81% [1.28%, 2.33%]*
At least five VHDs and five HNs within a 7-day period	5.31% [4.59%, 6.04%]*	5.73% [4.18%, 7.29%]*	6.23% [4.62%, 7.85%]*

Higher risk under night-time prolonged heat

Reduced risk if they are not continuous

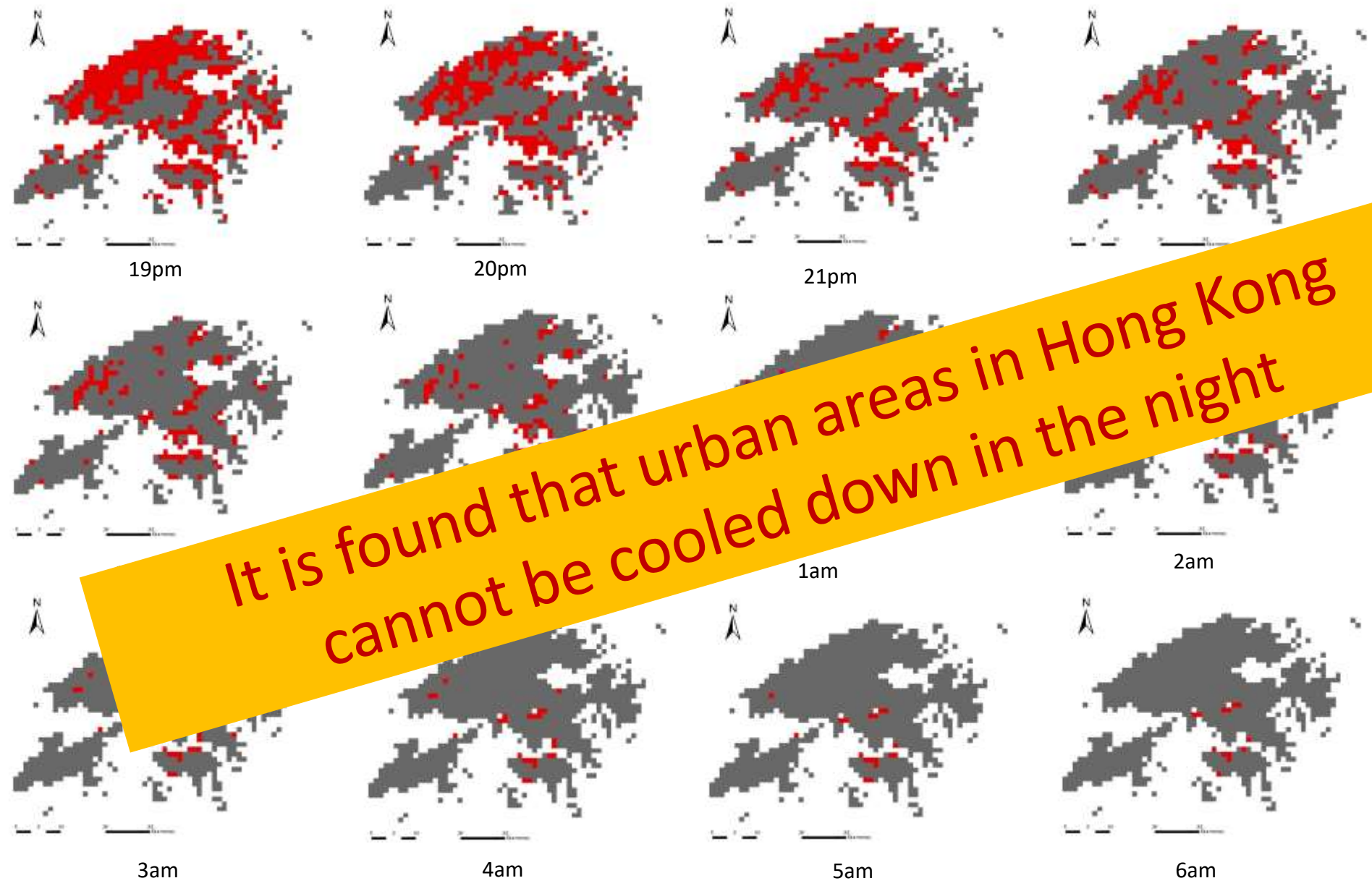
Table 3. Excess mortality of prolonged heat (lag 0 – 1 and lag 2 – 3). The results indicated the percentage increase in mortality in 1°C increase in daily minimum air temperature at lag 0 – 1 and lag 2 – 3, and the corresponding 95th confidence intervals of each model. Significant results are marked with asterisks.

Model	All-cause mortality (lag 0 – 1)	All-cause mortality (lag 2 – 3)
Baseline ($T_{max} \geq 33^{\circ}\text{C}$)	5.91% [5.72%, 6.10%]*	1.09% [0.88%, 1.30%]*
Three consecutive VHDs	10.24% [9.02%, 11.45%]*	6.60% [5.68%, 7.53%]*
Five consecutive HNs	10.95% [10.48%, 11.42%]*	5.24% [4.72%, 5.76%]*
At least five VHDs and five HNs within a 7-day period	15.61% [14.52%, 16.70%]*	-2.00% [-2.83%, -1.17%]*

Significant short-term effect of prolonged heat events

Hotspot Areas Detection in Summer Nighttime

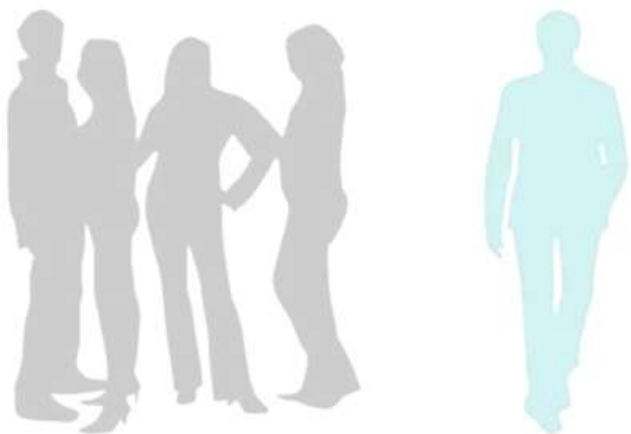
(red colour: $T \geq 28$ deg C)



It is found that urban areas in Hong Kong cannot be cooled down in the night

Potential Heat-related Health Impact

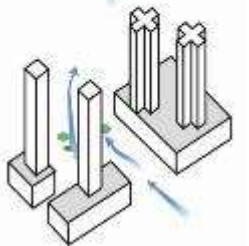
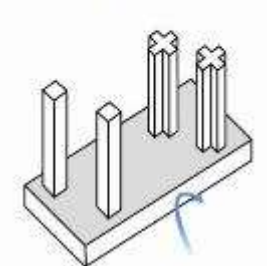
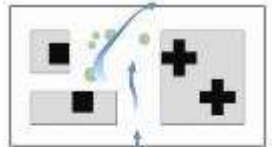
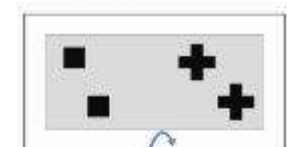
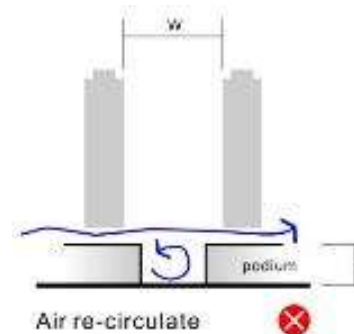
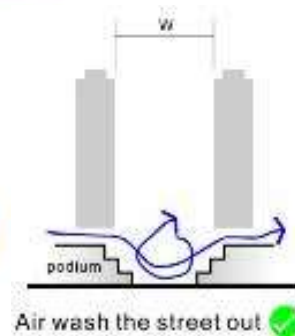
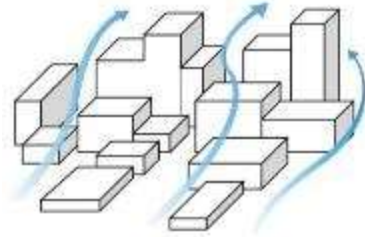
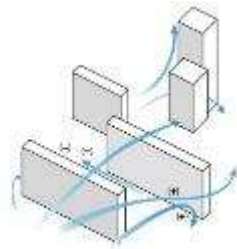
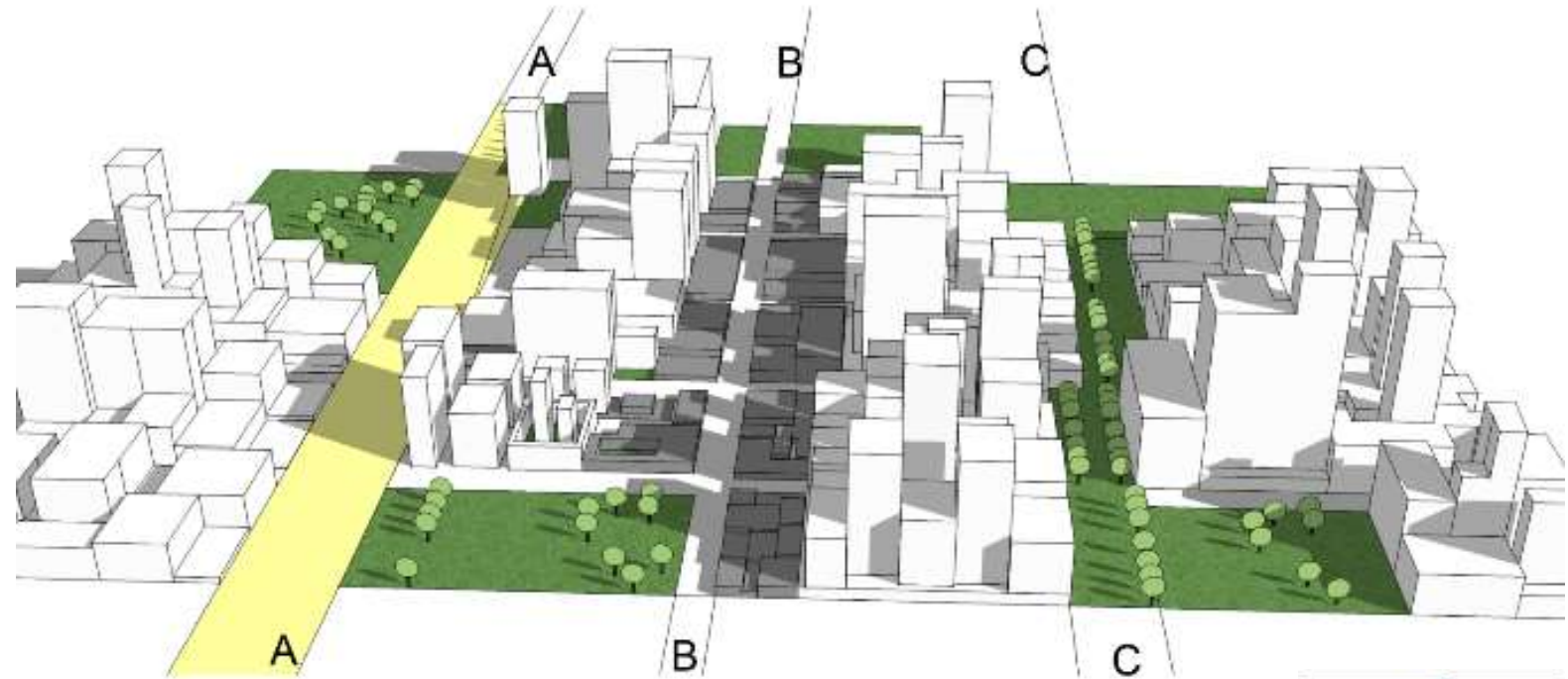
Sensitive Population & People cannot access or afford air conditioning in Summer





HONG KONG PLANNING STANDARDS AND GUIDELINES

Breezeway / Air path
Orientation of Street Grids
Linkage of Open Spaces
Non-building Area
Waterfront Sites
Building Heights
Building Disposition
Shading and greenery

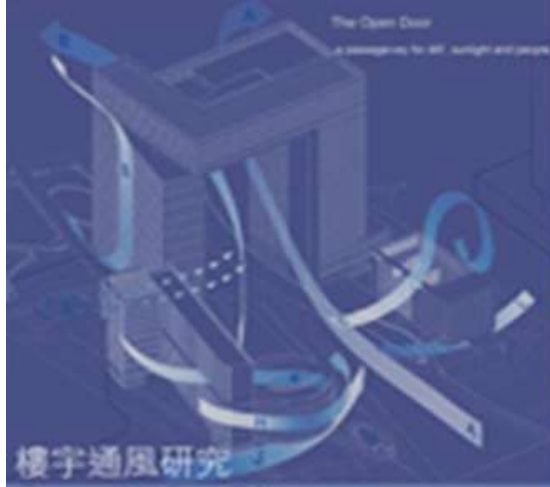


Different Levels of Urban Climatic Planning Actions

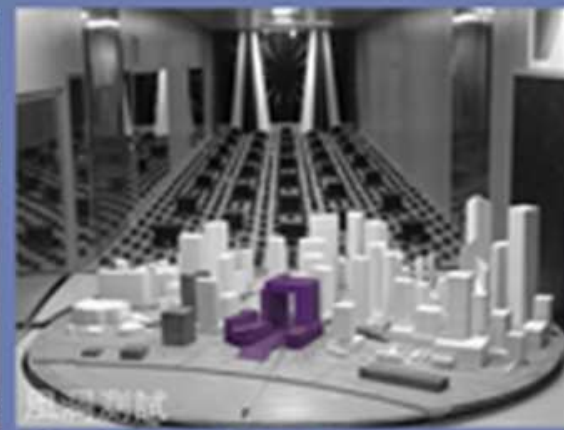




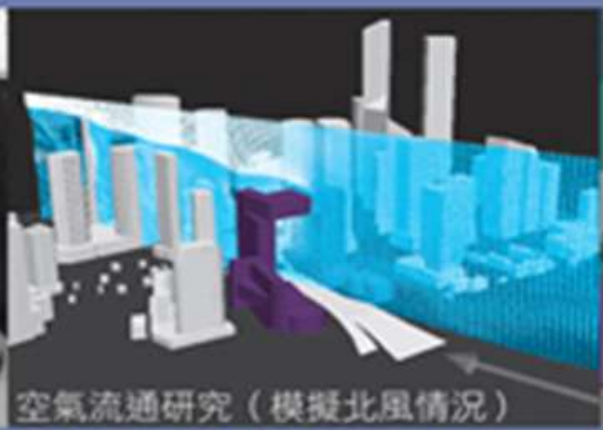
Township Government Buildings
 Mountain Park



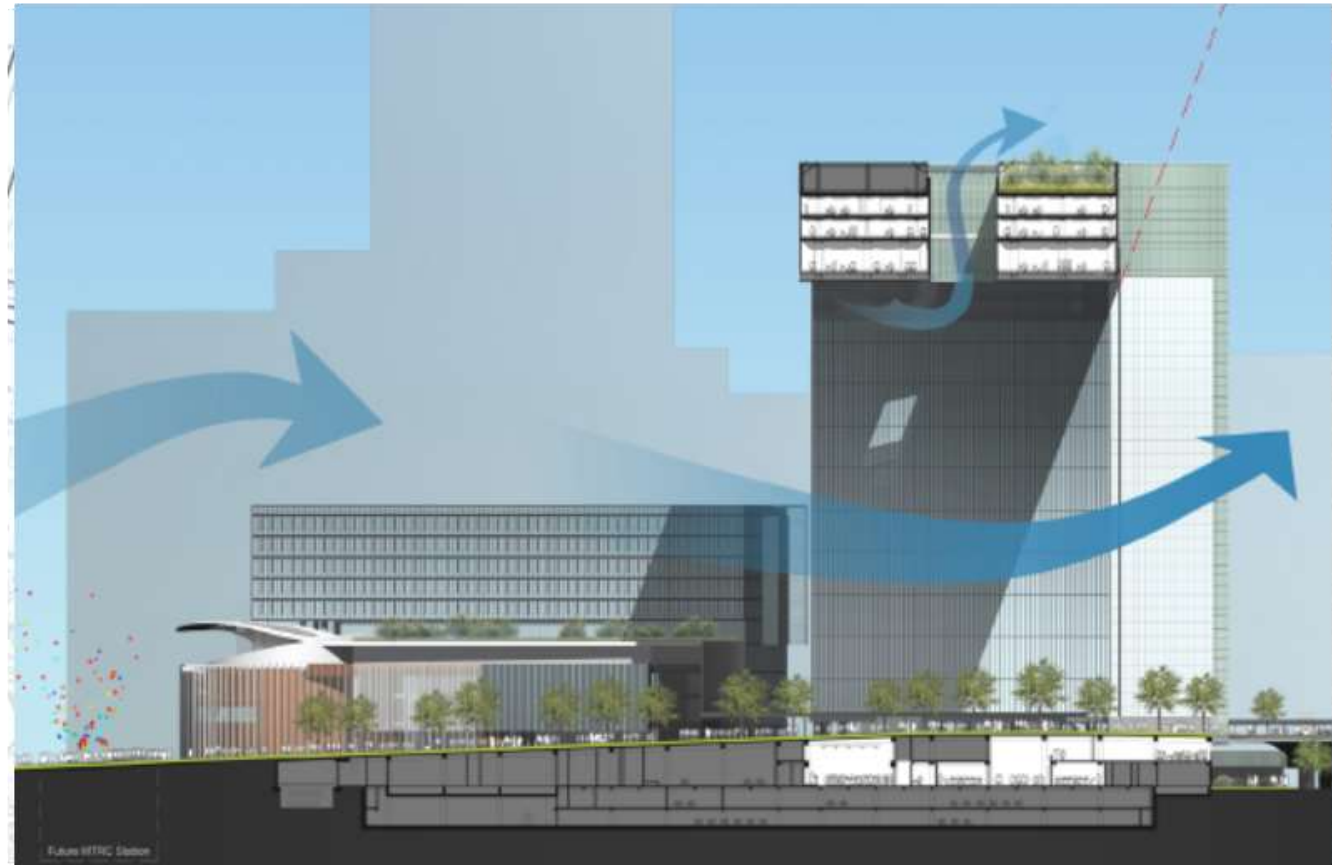
樓宇通風研究
Overall Wind Diagram



Wind Tunnel Test



Air Ventilation Assessment
(Prevailing North Wind)





Building Block 1
 Planning for a Liveable High-density City
 A Healthy City

The city is our main activity area and is a conducive environment for promoting health and well-being. A healthy city will bring tangible benefits such as improving health, relieving stress, encouraging active ageing, and alleviating the burden on public health services.

We propose to incorporate "active design"¹⁷ considerations in shaping the built environment to promote physical activities and health through responsive urban design and building design by promoting walking, cycling, exercising and a healthy lifestyle. We propose to rekindle our connection with

nature in the city. We propose to strengthen our continued commitment to enhancing biodiversity, promoting environmentally-friendly initiatives, and creating a clean and healthy built environment. To alleviate the urban heat island effect, to improve the urban climate and to respond to climate change, we seek to further incorporate urban climatic and air ventilation considerations in planning and urban design.

¹⁷Active design¹⁷ is both an approach to and an ethos of promoting physical activity and health through responsive urban design and building design by promoting walking, exercising and recreational pursuits.

Key Strategic Directions	Key Actions
Improving the urban climate by incorporating urban climatic and air ventilation considerations	<ul style="list-style-type: none"> To strengthen urban climatic and air ventilation considerations in the planning and design of new development areas and to retrofit the densely developed urban areas having due regard to proposals in the Hong Kong Urban Climatic Planning Recommendation Map To update the current Technical Circular on Air Ventilation Assessment and the relevant Hong Kong Planning Standards and Guidelines (HKPSG)

Key Strategic Directions	Key Actions
Promoting active design	<ul style="list-style-type: none"> To embrace active design in promoting physical activities and health through urban design and building design To appropriately increase open space provision To promote accessibility to recreational facilities (e.g. country parks and sports facilities) To provide a comfortable walking and cycling environment

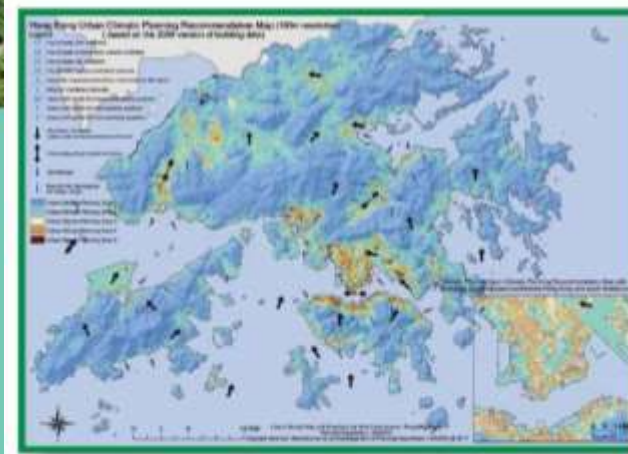


Fig.17 Hong Kong Urban Climatic Planning Recommendation Map

“ We need a physical city environment that is conducive to healthy and active lives.”



HONG KONG
 香港 2030+
 Towards a Planning Vision and Strategy Transcending 2030

PUBLIC ENGAGEMENT

HONG KONG CLIMATE CHANGE REPORT 2015



Environment Bureau in collaboration with
Development Bureau | Transport & Housing Bureau
Commerce & Economic Development Bureau | Food & Health Bureau | Security Bureau

TEMPERATURE RISE

Hong Kong will be hotter (cont.)

- Hong Kong Planning Standards and Guidelines (HKPSG)** – Practising good urban design at the local level can contribute to a livable high-density environment. HKPSG provides design guidelines on aspects such as massing, height profile, street orientation, breezeways, etc. to promote better urban air ventilation, and thereby help tackle Urban Heat Island effect and improve the micro-climate of urban environment. The Government follows these qualitative guidelines on urban design and air ventilation that are promulgated in the HKPSG in the planning of NDAs. For existing built-up areas, project proponents are encouraged to take on board these design principles in planning and designing their development/redevelopment projects so as to pursue incremental improvement of the urban wind environment.
- Air ventilation assessment** – Since 2006, the Government requires air ventilation assessments to be done for all major government projects so that the result can improve the design to facilitate wind penetration to their surrounding area²⁸ and the private sector is encouraged to follow this practice. In new strategic planning studies, such as the Investigation of North East New Territories New Development Areas Planning and Engineering Study and the Feasibility Study of Planning and Engineering Study on the Remaining Development in Tung Chung, air ventilation considerations are reflected in the conscious planning decision to create breezeways and air ventilation corridors.

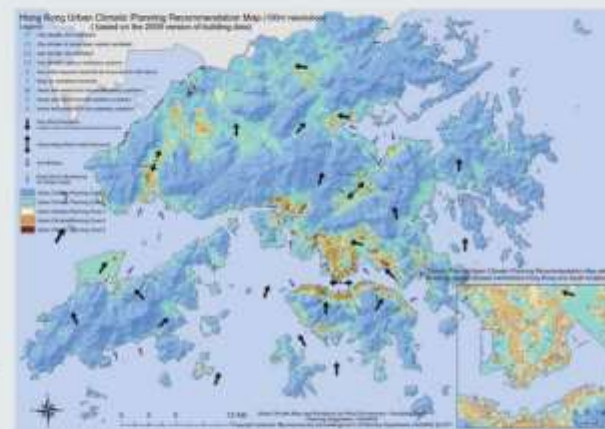
Wind Corridor of Kwu Tung North NDA



TEMPERATURE RISE

Hong Kong will be hotter (cont.)

- Urban Climatic Planning Recommendation Map** – PlanD formulated an Urban Climatic Planning Recommendation Map in a consultancy study completed in 2012, which provides a scientific basis for assessing urban climatic and air ventilation impacts of major developments, and helps tackle the heat island challenge.²⁹
- Greening Master Plans (GMPs)** – The Government, led by the Civil Engineering and Development Department (CEDD), has developed district-based Greening Master Plans to define comprehensively the greening framework of an area by studying its characteristics and particular needs, as well as providing a guide to the planning, design and implementation of works. The plans identified planting locations, established greening ‘themes’ and proposed appropriate planting species. GMPs for the urban areas were



completed between 2007 and 2011; and further plans are being implemented in the remaining districts (also see Chapter 5).

- Sustainable Building Design Guidelines** – Since 2011, the Government promulgated a set of Sustainable Building Design Guidelines on building separation, building set

back and site coverage of landscape through the Building Department’s (BD) Gross Floor Area concession policy, as well as including these guidelines in lease conditions of new land sale sites or lease modifications/land exchanges of 1,000 square metre or more so as to achieve better air ventilation, provide more greenery and mitigate the heat island effect.

- BEAM Plus** – BEAM Plus is a comprehensive environmental assessment scheme for buildings in Hong Kong. It is a standard for green buildings to emphasize the in-door health and environmental quality and amenities as key performance indicators, with proper consideration of the local, regional and global environment impacts.



Tai Yiu Lane, Kowloon Bay



ICS 07.060.1
A 47.1

GB

中华人民共和国国家标准

GB/T XXXXX—XXXX

Technology for Climatic Feasibility Demonstration in Urban Master Plan

城市总体规划气候可行性论证技术

Technonology for climatic feasibility demonstration in urban master plan

(征求意见稿)



XXXX-XX-XX 发布

XXXX-XX-XX 实施

中国人名共和国国家质量监督检验检疫总局
中国国家标准化管理委员会

National Standard Of Urban Climatic Application



Master Layout Plan and Urban Ventilation

- Wind Corridor, Open Space, City Parks, Linear Green Belt and Wetland Parks



Greenery Master Layout and Thermal Environment

- Waterbodies, agriculture Land, Wood Land as fresh air resources



Allocation of Industry Area and Intensive Factories Areas

- New industry area, intensive factories areas vs air pollution dispersion ability



Integrate Renewable Energy and Energy Structure

- Energy Balance, Energy supplies and important facilities



Rainfall and Sponge City Development, urban flooding management

- Annual rainfall, sponge city development, drainage system design,



Extreme Weather and Risk Management

- Extreme weather events, urban flooding caused by heavy rainfall, sand storm, lightening, etc



Integrated Meteorological Evaluation for livable cities

- Human Thermal Comfort, Tourism and Relaxation Areas

Under Review!

Data Science in Time, Data Science in Space

Data Science and Informatics Technology

Applications & Implementations

Policy Change

People's Urban Living Quality Improvement



Prof Edward Ng (Leader)
Yue Ling Sun Professor of Architecture

Prof Ren Cheo
Associate Professor

Prof Kevin Lau
Research Assistant Professor

Dr Wan Li
Postdoctoral Fellow

Dr Tobi Eniola Merakinyo
Postdoctoral Fellow

Dr Shi Yuan
Postdoctoral Fellow

Dr Tanya Tan
Postdoctoral Fellow

Miss Gong Fangying
PhD Student

Mr Chi Xinan
PhD Student

Miss Li Kehan
PhD Student

Mr Sheo Chengzhuan
PhD Student

Miss Wang Ran
PhD Student

Miss Xiang Luyao
PhD Student

Dr Yuan Cheo
Associate

Miss Cai Meng
PhD Student

Miss Kwok Yu Ting
PhD Student

Thanks! Any question?

Miss Duyang Wan Lu
PhD Student

Miss Li Xiawei
Research Assistant

Miss Mona Chung
Research Assistant

Miss Zhang Xuyi
Research Assistant

Dr Xu Yong
Associate

Miss Ade Lee
Research Assistant

Miss Wong See Wai
Research Assistant

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