

Workshop on Earth Observation for Urban Planning and Management

**Quest for a better tool to understand
the urban heat island and plan a
better environment in Hong Kong**

Planning Department (HKSAR)



Hong Kong Planning Department

Vision: We plan to make Hong Kong an international city of world prominence

Mission: We make Hong Kong a better place to live and work in

Hong Kong's Unique Environment

Population: Around 7 millions

Land Area: About 1.1 thousand square kilometers

Density: More than 6,000 persons/km²

The background of the slide features several faint, concentric circular ripples that resemble water droplets, scattered across the lower half of the blue background.

Land-use Characters

Green area: more than 70%

Built-up area: less than 30%

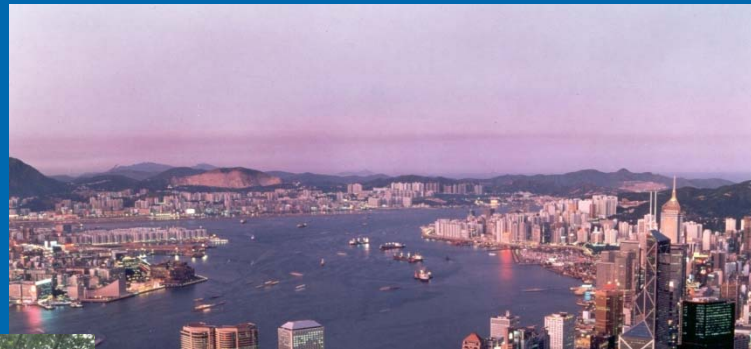
Highest population density: more than 50,000 persons/km² in Kwun Tong

Major Consideration Factors in Planning for Hong Kong

- **high population**
 - **small land area**
 - **hilly terrain**
 - **high GDP**
 - **complex economic activities**
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Planning Challenges

- **balance between different land-uses, in particular between natural green areas and built-up areas**



Planning Challenges

- **concentrate development with high development density vs wider spread of development areas with comparatively reduced density**



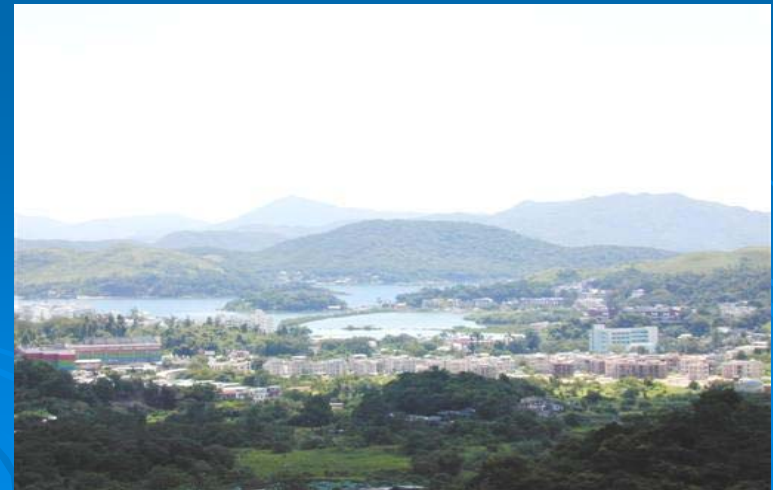
Planning Challenges

- **high-rise development with larger building gaps and more provision of ground floor open space vs medium-rise development with narrower building gaps and less provision of ground floor open space**



Planning Challenges


- **public's increased aspiration for a better and more sustainable environment**



Major means to shape the built environment:

- **Outline Zoning Plans (Planning Department)**
- **Building Regulations (Buildings Department)**
- **Land Leases (Lands Department)**
- **Others (Environmental Protection Department, Fire Services Department etc)**

Major controlling factors used in OZP:

- maximum plot ratio
 - maximum site coverage
 - maximum gross floor area
 - maximum building height
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Plot Ratio :

the ratio between the gross floor area built on a site and its site area



Site Coverage : the area of the site covered by building(s) erected on it

Different site coverage but fixed plot ratio

(PR = 6.5, SC = 25%)



(PR = 6.5, SC = 19%)



Fixed site coverage but different plot ratio

(PR = 6.5, SC = 19%)



(PR = 8.5, SC = 19%)



Gross Floor Area :

- **the total floor area erected on the site**
- **the effect of imposing restriction on maximum gross floor area is similar to that on maximum plot ratio**

Building Height :

- the maximum height of building(s) on a site
- in mPD or in number of storeys



Building height controlled by former airport height restriction

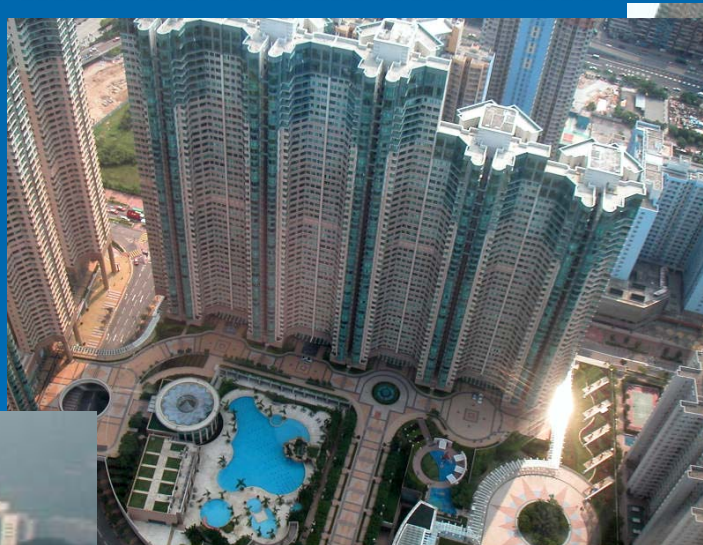
Building Height :

Building height without restriction



For a fixed plot ratio to restrict the development density, the development can take various forms.

- **high rise building(s) with large building gaps in between and with larger ground floor space**
- **relatively low rise with narrow building gaps or even no gaps that results in what we commonly call “wall building(s)”**



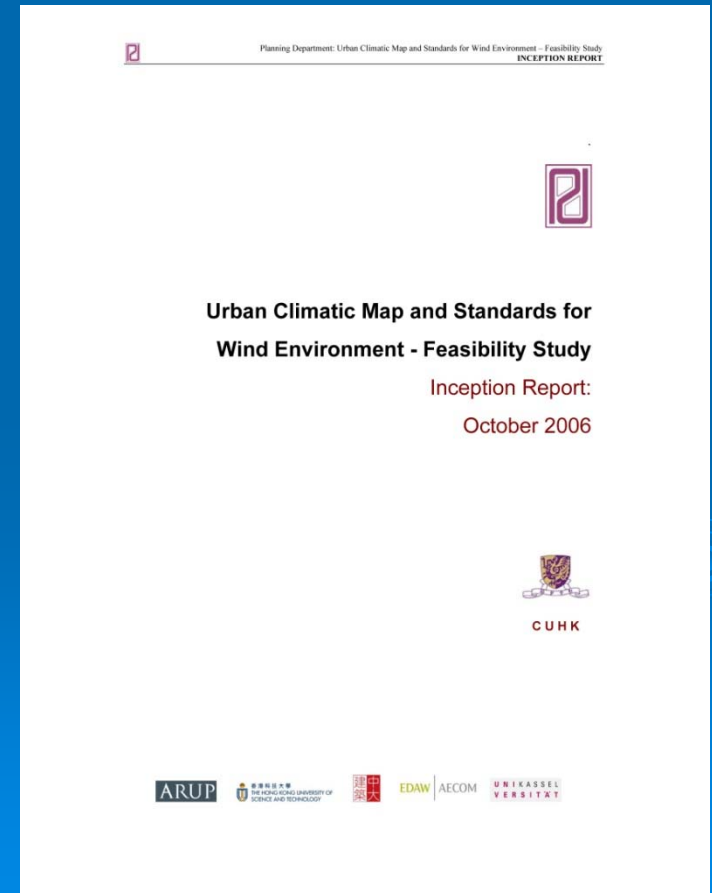
Is there a quantitative indicator or parameter to determine what sort of building layout and form is more able to achieve better environment?

There are many aspects of consideration for achieving a better environment with respect to building layout and form:

- **air ventilation**
 - **solar access**
 - **visual**
 - **economics**
 - **ground floor open space provision**
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Urban Climatic Map

To provide a more scientific and objective basis for identifying climatically sensitive areas and assessing the impacts of major developments and planning proposals on the local wind environment



In-house preliminary study by PlanD to investigate relevant parameters contributed to UHI for Hong Kong

Area: Kowloon

Parameters:

- **building density**
- **altitude**
- **amount of green area**
- **distance to shore**

Methodology: multiple linear regression

Result:

Parameter	Building Density	Altitude	Amount of Green Area	Distance to Shore	All
Adjusted R	0.000218	0.406789	0.435842	0.171744	0.531170
Conclusion	Statistically insignificant	Statistically significant	Statistically significant	Statistically insignificant	Statistically significant

Surprisingly, building density is statistically not a significant factor in the study.

It may be possible that building density has not been represented properly, SVF may be an appropriate parameter to represent building density in the study.

Sky View Factor (SVF)

SVF is, a geometric ratio that expresses the fraction of the visible sky at the observer's location. It is a dimensionless number between zero and one (one represents unity)(Oke, 1987)

Mathematically, SVF (Ψ) is the ratio of the solid angle (Ω) of the portion of sky visible from the observer point (origin or O) to the solid angle the hemisphere centred at the same observer point (Ω_0 , equals to 2π), or

$$\Psi = \Omega / \Omega_0 = \Omega / 2\pi$$



SVF has been studied extensively in relation with:

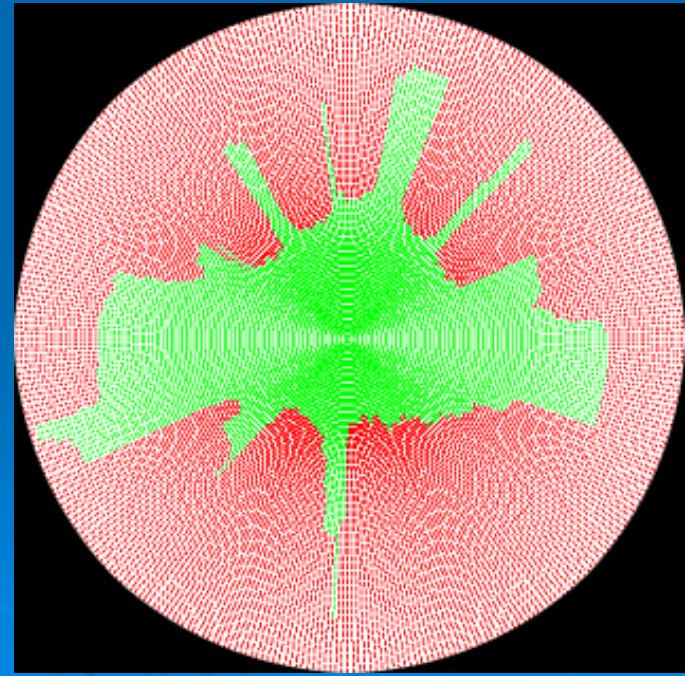
- **urban heat island (UHI) effect**
- **thermal comfort**
- **energy conservation**

But little has been done to explore the applicability of SVF to planning and urban design, though SVF is basically a parameter defined by the local scale urban geometry, which to certain extent is shaped by the planning mechanism.



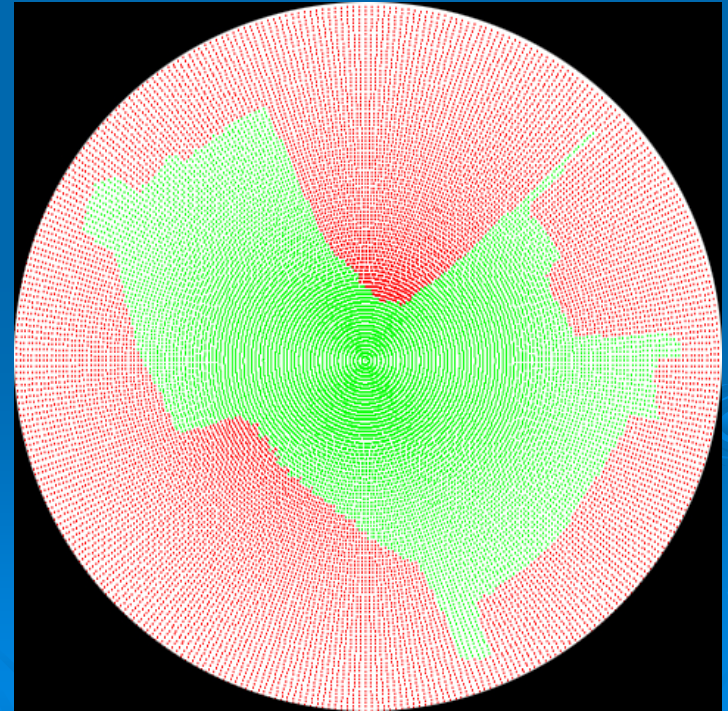
High density private development in Lai Chi Kok

Sky view factor : 0.30



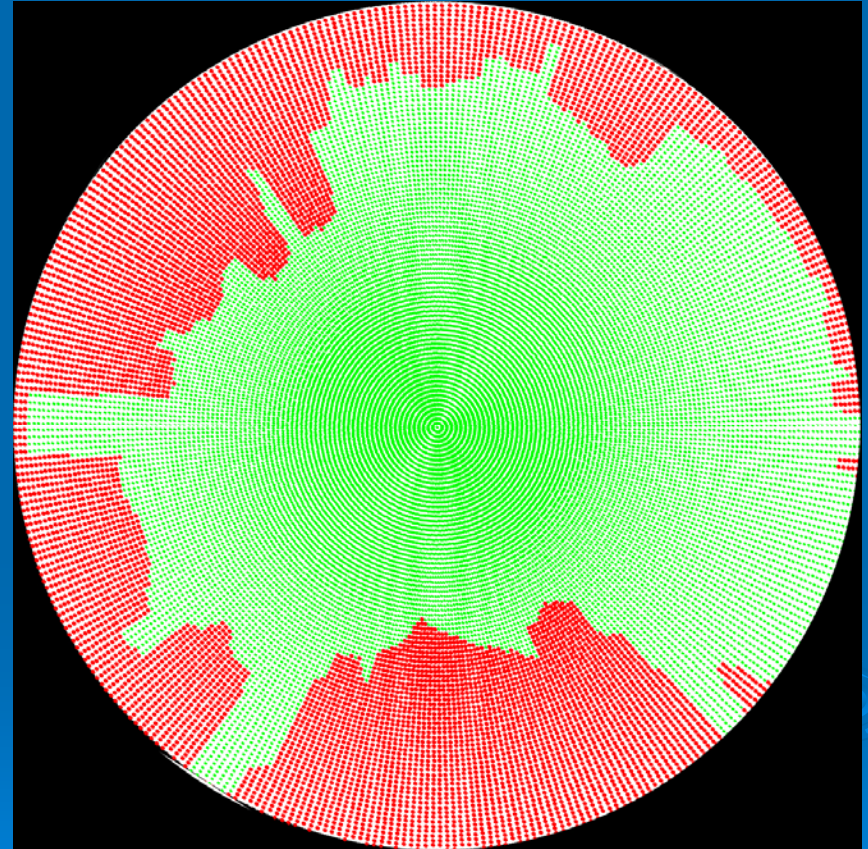
Public housing development in Shatin

Sky view factor : 0.41



Tsing Yi Town Park

Sky view factor : 0.65

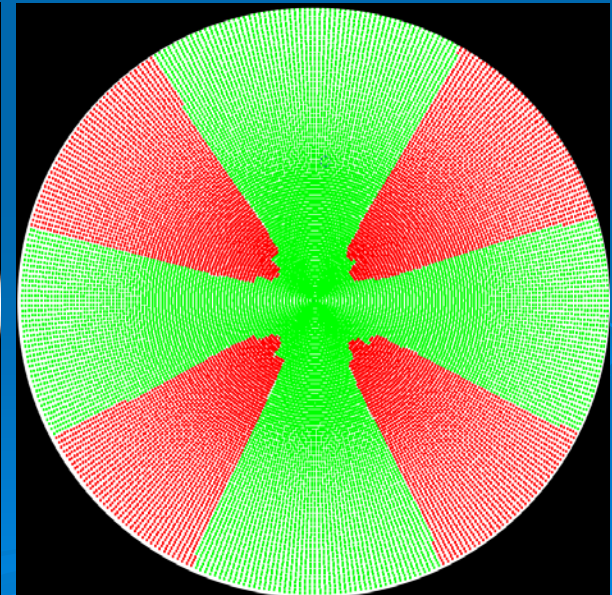
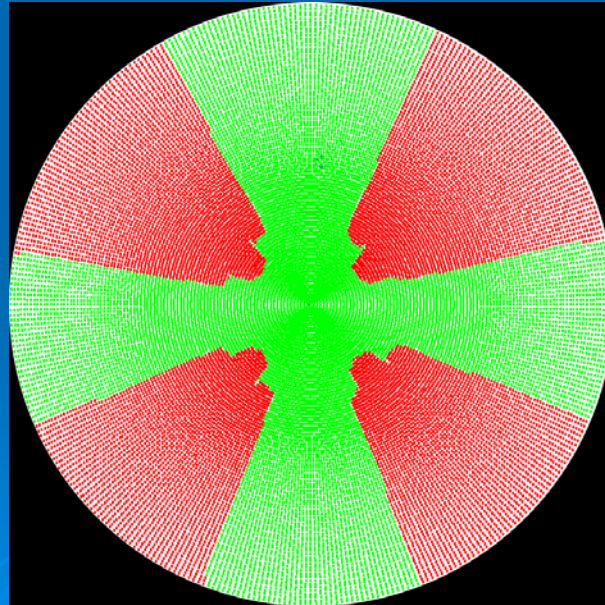
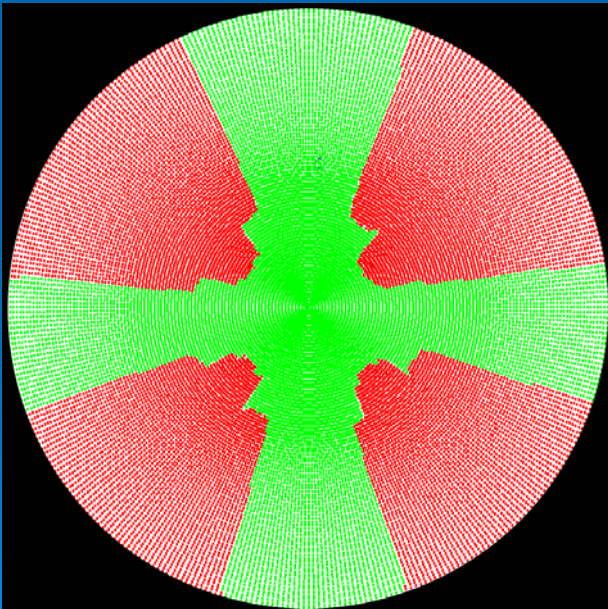


For a fixed development density, i.e., fixed gross floor area, different building height and footprint area may result in different SVF.

footprint area = 1000 sq m,
No. of towers = 4
No. of storeys = 20
SVF = 0.462

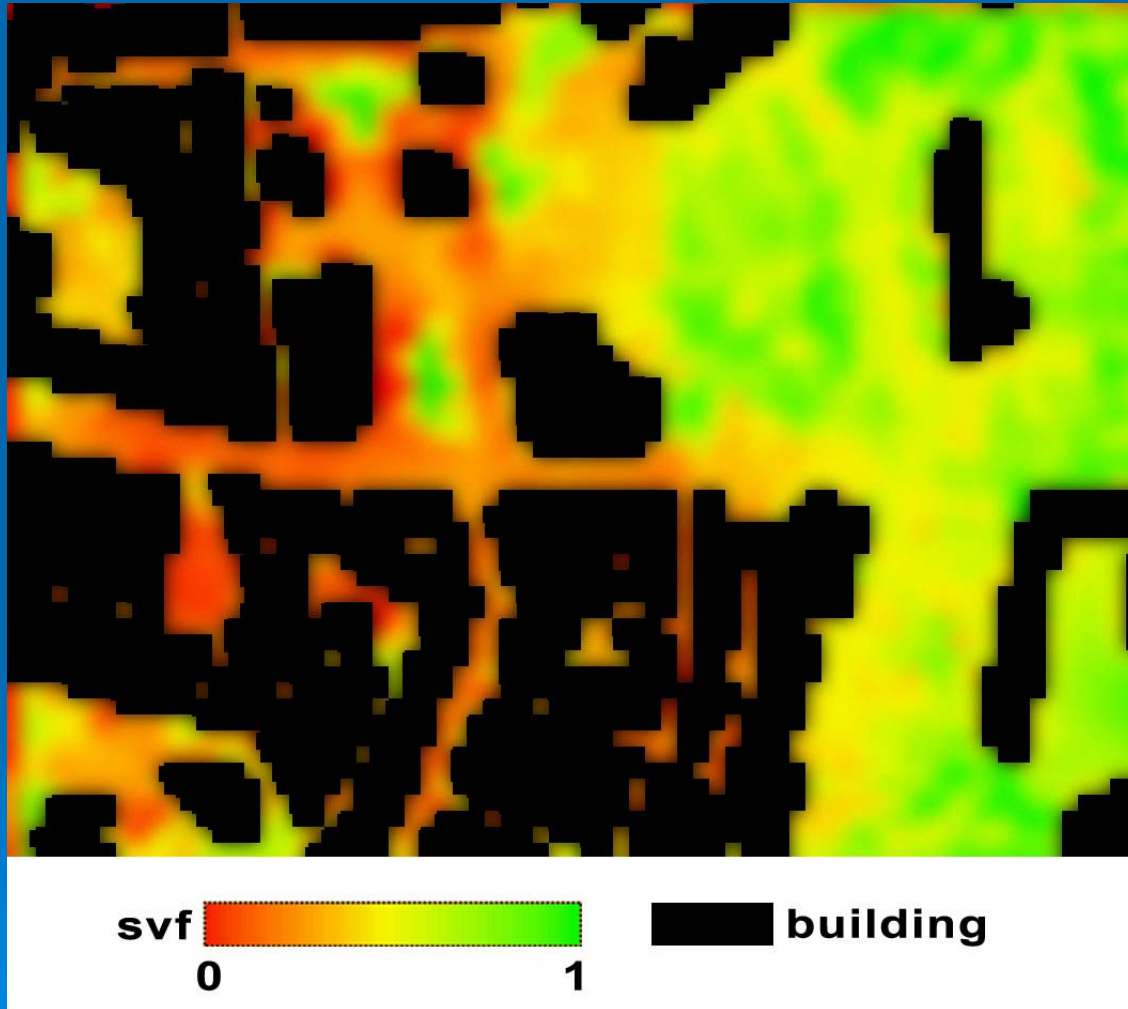
footprint area = 750 sq m,
No. of towers = 4
No. of storeys = 27
SVF = 0.514

footprint area = 500 sq m,
No. of towers = 4
No. of storeys = 40
SVF = 0.588



Wan Chai Area

Sky view factor distribution



Conclusion:

Need more research, in particular in the local, to strength the applicability of SVF, or any other parameter, as a better tool or indicator to help the Government and planners to better shape the environment.

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Thank you

