Towards better building and urban design in Hong Kong

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ABSTRACT

Hong Kong is the densest city in the world with an urban density of some 60,000 per square kilometer (Fig. 1). Very tall buildings closely packed together decrease the availability of the natural elements (sun and wind). The government is working to resolve the problem since 2000. This paper unfolds a story of some key events to seek for solutions. Design in the real life is as much “science” as it is “politics”. How to appropriate scientific quantities politically is perhaps more difficult than the experiments themselves. From time to time, it is necessary to work backward from the design implications and find science to moderate them. In addition, it is necessary to resolve scientific know how into prescriptions that could easily be implemented. Accuracy and simplicity have to be mutually resolved. A true test of science is how it affects life in reality. This paper hopes to share an experience.

Figure 1: A typical scene of Hong Kong.

1. INTRODUCTION

Hong Kong is the densest city in the world. Of its 1000 square kilometer of land, only around 25% is build-able. And yet it needs to house some 7.5 million inhabitants. Designing Hong Kong environmentally to provide health and comfort, as well as to optimize the use of resources and energy is an important and difficult task (Fig. 2).

Since 1999, the government has initiated a number of investigations to better design our city and to optimize the available natural agent when compacting the city. Light and Air, among others, are two of the many parameters on the table. There are fundamentally two levels of investigations: Buildings and Urban Design.

2. PROBLEMS OF BUILDINGS

Land value is very high in Hong Kong, and typically in the order of US$30,000 per square

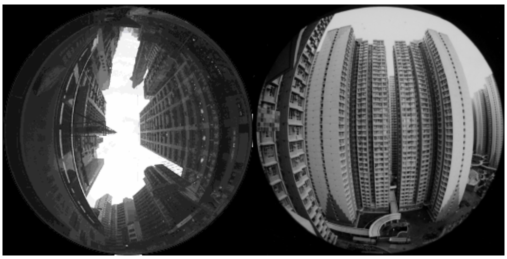

Figure 2: Tall towers and congested urban space (in terms of limited sky view) is a hallmark of Hong Kong’s cityscape.

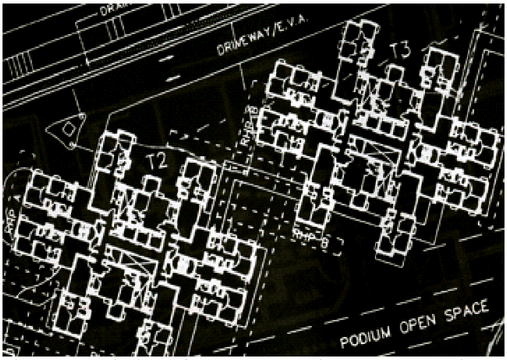

Figure 3: A design of two towers trying to come as close to each other as possible. Note how cunningly designers trying to interlock the RHP to bring the buildings closer. This results in tight space between buildings that satisfy the laws but does little to performance.


Figure 4: (Right) Legal and allowed under current building regulations. (Left) Illegal as the perpendicular distance from the window directly to the building in front is less than 1/3 of the building height.

meter. Developers would try to maximize the site by building very tall buildings very close together (Fig. 3). A site plot ratio of 5 to 10 is common. The tall towers are around 50 to 80 storey high covering around half of the site area.

The current building regulations require every window to face into a open Rectangular Horizontal Plane (RHP) of 2.3m wide and the length perpendicular to the window 1/3 that of the height of the tower. This very ancient piece of law was developed 100 years ago and was supposed to regulate a condition alien to that of contemporary Hong Kong. This results in problems as in Figure 4. Windows, especially kitchen windows, could be designed to face into a dead end and satisfy the law.

Common sense immediately tells one that the performance in terms of daylight and natural ventilation would be very poor indeed. In short, a lot of ingenuities were spent trying to satisfy the laws but at the same time result in bad design. Something is very wrong indeed.

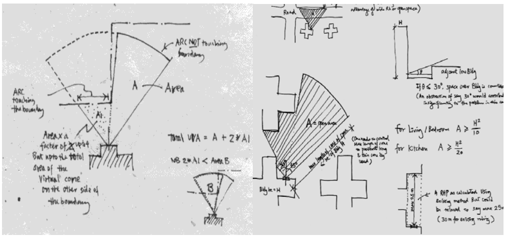
Figure 5: The pieces of napkin that the Unobstructed Vision Area Method for Building Regulations was firstly sketched.

3. THE UNOBSTRUCTED VISION AREA

A 5 year programme was commissioned by the government to find a better way. Extensive site measurements were conducted to characterise the problem. Once anomalies are noted, the next task was to have a comprehensive user survey and to establish the performance criteria acceptable to the public. Suffice to note here that the standards desired were actually quite low when compared with overseas standards. Once the performance is noted, then the key question is “so what?” This is where sciences have to end and politics takes over.

How one could find a way that the designers could understand, the government could enforce and the results are desirable? The solution, embarrassingly, was sketched on a piece of innocent napkin during a dinner session (Fig. 5). The idea actually came from a traditional Chinese saying: the more you see, the more you get”. If resolved logically, it means if the window could be designed to face into the open in such a way that a lot of the outside could be seen, then it is likely that the window will give a desirable quality.

The bottom up scientific method could be at odd with the fundamentals of science. But this is necessary as ultimately whatever science could be developed; it will have to be resolved into application. The task at hand was: how this “view out” could be quantified.

Some parametric studies using conditions of Hong Kong were conducted (Figs. 6 and 7). Eventually, it resolved that: If an open space in front of a window as defined in the UVA rules is X sq m, then there is a 75% chance that the amount of light receivable is Y% VDF.

After the unfortunate events of SARS in

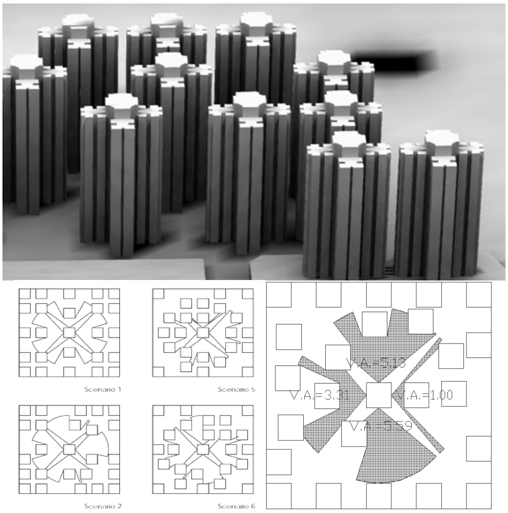

Figure 6: (Top) some tower conditions studied. (Bottom) The relationship between performance and UVA is noted for various conditions.

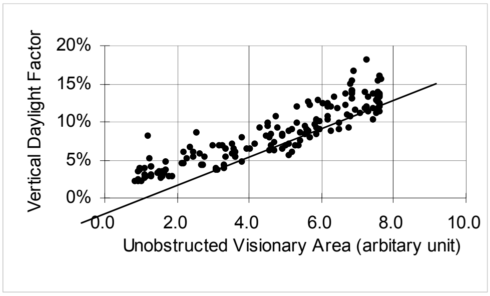

Figure 7: The relationship between performance (in this case Daylight) and UVA is plotted. A lower quantile line was drawn so that an equation could be developed for the regulations.

Hong Kong in 2003, the Hong Kong Government officially adopted the UVA laws in Dec 2003 (Fig. 8).

4. PROBLEMS OF THE CITY

Subsequent to the implementation of the UVA laws, it was future opined tat it does not matter how the buildings are designed, if the city is not designed properly, by the time the natural elements reach the façade, the battle has been lost. It was deemed necessary to embark another study to look at the problem more holistically.

The study, dubbed the "Air Ventilation Assessment Scheme (AVAS)" was launched in Oct 2003. The initial idea was to look at the city of Hong Kong and to see if it is possible to formulate guidelines for planning. And if so, what will involve and what the scheme could look like.

A problem of the city is the high density, no doubt due to the high land value. However, as the study ventured, it was noted that actually a few malpractices actually contribute more to the problem than the density. For example, in order to maximize the frontage towards the sea, developers of waterfront sites typically would build a wall like tower buildings towards the edge. This forms an "ideal" windbreak to the city behind (Fig. 9). Currently, there is no guideline preventing it from happening.

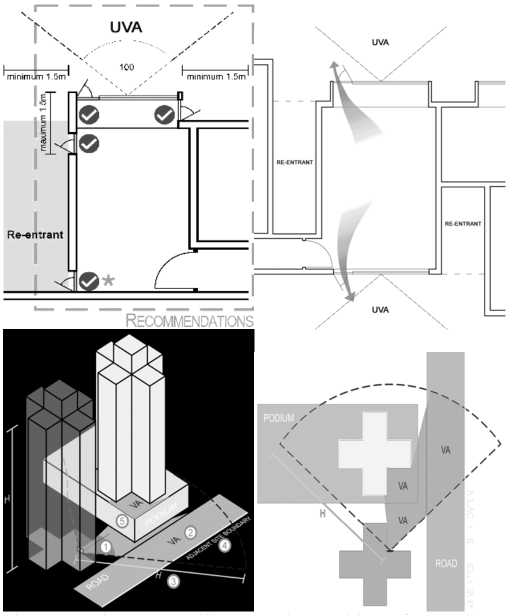

Figure 8: Diagrams to illustrate the working of UVA in the building regulations.

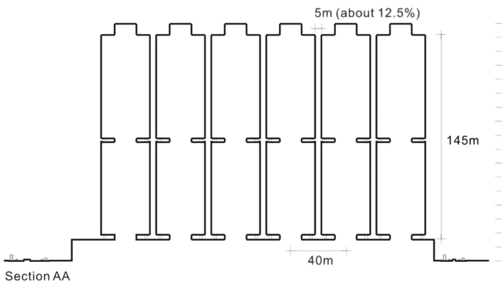

Figure 9: Tower blocks 100 to 150 metres high closely packed forming a wall like windbreak to the city behind.

The study started by identifying what is desirable of wind that urban Hong Kong should capture. Four issues were noted: Wind for indoor comfort, wind for outdoor comfort, wind gust, and wind for pollution dispersion. As the end, it was decided that wind for outdoor comfort be a criterion to head start mark 1 of the AVAS. Researches are generally lacking in Hong Kong. The team appropriates a number of studies in Thailand, Singapore and South Japan to come up with a chart. Based on this chart, it was opined that a wind speed of 1.5 to 2 m/s at ground level be conducive to thermal comfort in hot and humid Hong Kong during the summer months (Fig. 10).

With the 2 m/s "ideal" in mind, the study proceeded to see what could be done (of course if there is no ambient wind, then nothing could be done). A few important parameters was hypothesized: Density, Building Heights (or the variation of building heights), Permeability of the Fabric, Amount and Configurations of Open Spaces, and last but not least Orientation of the City Grid.

Scientific investigations went hand in hand with design studies (Figs. 11 and 12). The implications of science have to be checked against application as it goes. Typically, it is the design thinking that allows the science to be focused. For example, it was deem easy to establish a rule that buildings be setback and have gaps in them (Fig. 13). The scientific team then went on to try to define what gaps are needed (Figs. 14 and 15).

The study hit problems very quickly that data is largely not available, or not in a suitable form, to guide the investigations. A number of

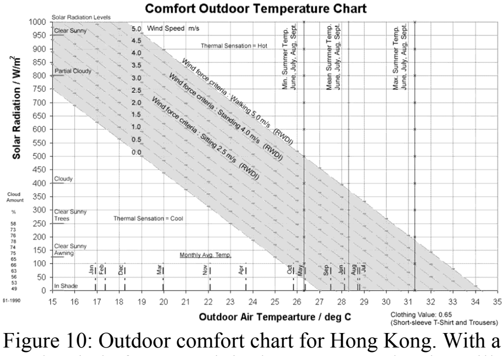

Figure 10: Outdoor comfort chart for Hong Kong. With a gentle wind of .5 to 2 m/s in the summer, pedestrian will be in comfort under shade.

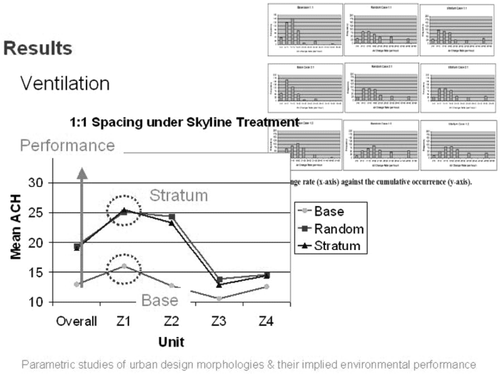

Figure 11: It was found that given the same density, varying the building heights has beneficial effects.

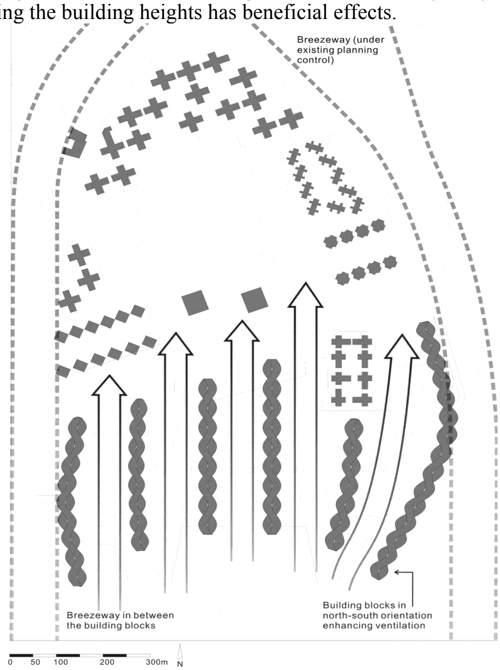

Figure 12: Apart from wind science, it is important to demonstrate how it might look like using design studies. This is a design demonstrating that wind availability could be optimized with the same density simply by orientating the buildings properly. Note the existing wall like towers towards the top.

national experts were invited to give comments. It was very quickly established that it does not really matter as the situation is so critical that as doing something is better than nothing – provide that the general feel of the critical parameter is established. For example, it does not matter if 10% gap or a 20% is needed. The fact is that gaps are important and 10% gap is better than

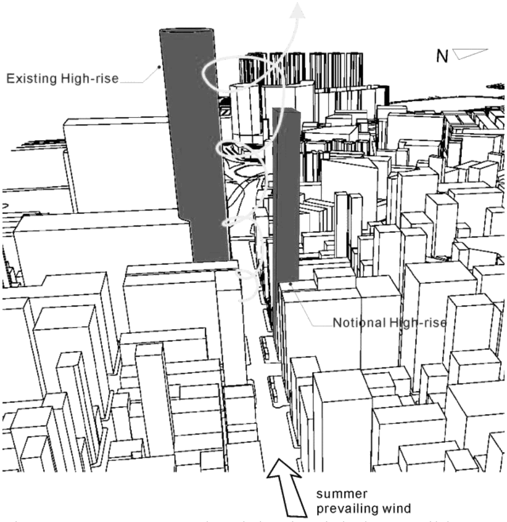

Figure 13: It was speculated that it might be possible to use the differences of building heights to promote air movement, thus allowing some tall towers to be built.

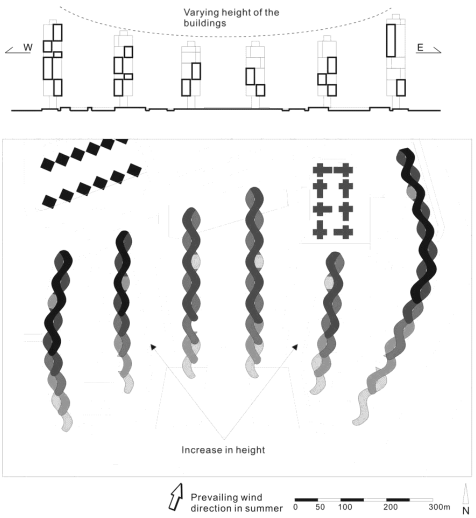

Figure 14: The top section shows some ideas of building gaps. The bottom plan shows how by weaving the building, gaps could be created within the tower itself.

no gap. Once the concept of gaps could be introduced to the thinking of the planners and the government, the % could come much later.

4. THE AIR VENTILATION METHOD

How and what the assessment should do? It was opined that wind conditions at ground level is

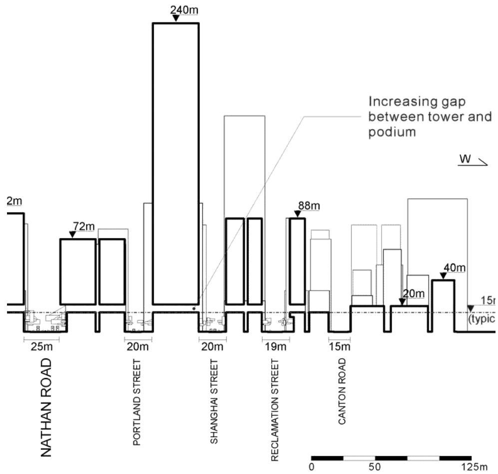

Figure 15: Forming gaps between buildings is an easy way to implement in practice.

important to assess. A number of stages for introducing the AVAS is proposed. Firstly, to “compare” designs, secondly, if some benchmarking could be done, to “evaluate” a design, thirdly, and perhaps more importantly to develop prescriptive guidelines to guide designs. The first two stages are to evaluate design; the third stage is to inform design.

For stage 1 and 2, the study team, advised by the international experts, opined that wind tunnel should be used. The metric Velocity Ratio as proposed by professor Murakami will be used. The idea is that a development will be evaluated if not more that X% of its surroundings are impacted Y% in teams of a reduction of the velocity ratio.

The proposed method is currently still under development. The initial form will be made public later. After the public consultation, the general public and the lawmakers will decide how to carry it forward.

5. CONCLUSION

The paper has little scientific details – there are too many. Instead, it tries to tell a bit of the story of wind and the design of our built environment in real life. There is no conclusion as such. The work is on-going, and our desire for a better future will never cease.

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