

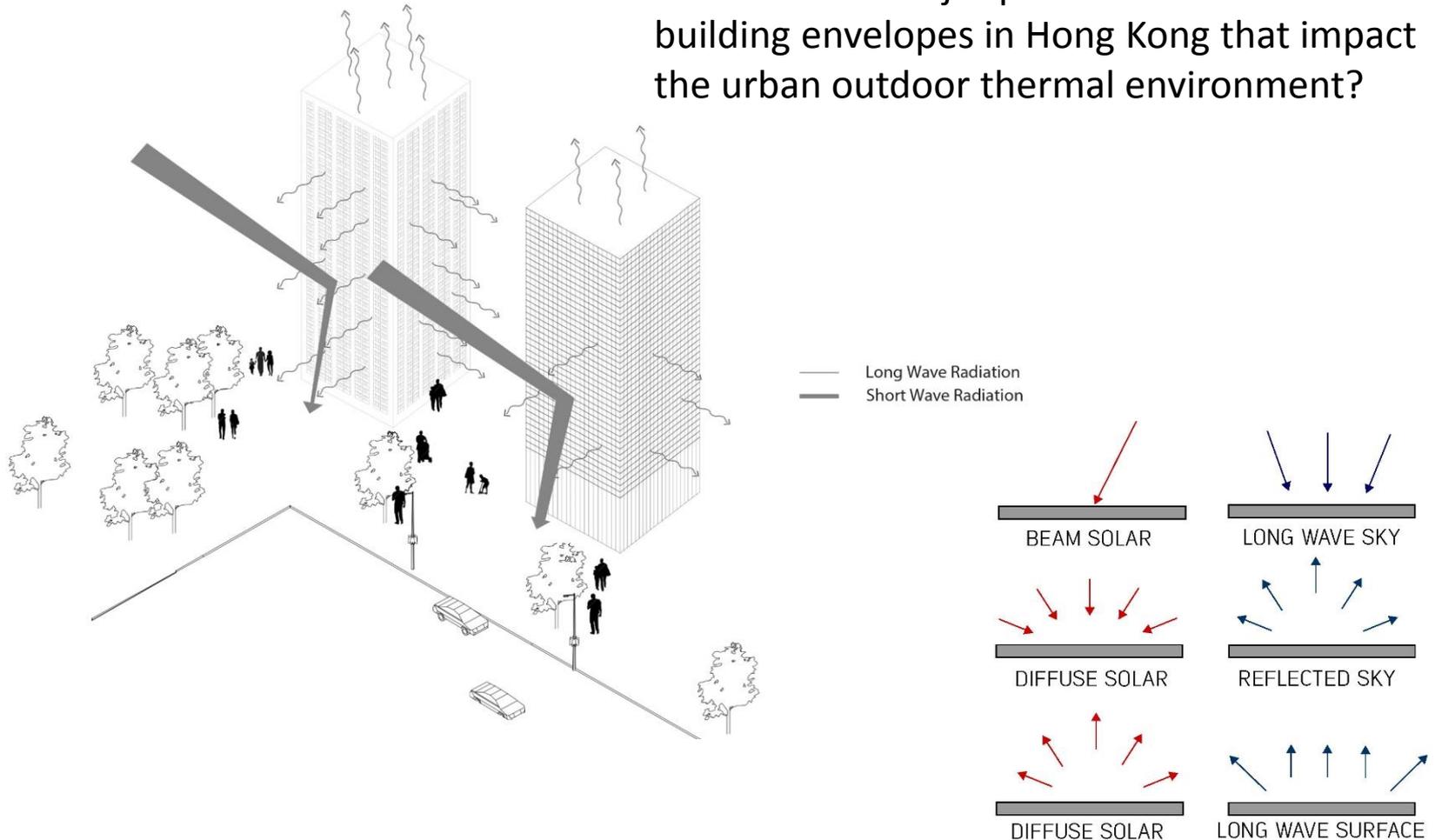
# Building Envelopes and their Impact on our Urban Environment

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How does the building envelope impact the urban outdoor thermal environment? What is its macro-level impact?

What are the major parameters of different building envelopes in Hong Kong that impact the urban outdoor thermal environment?





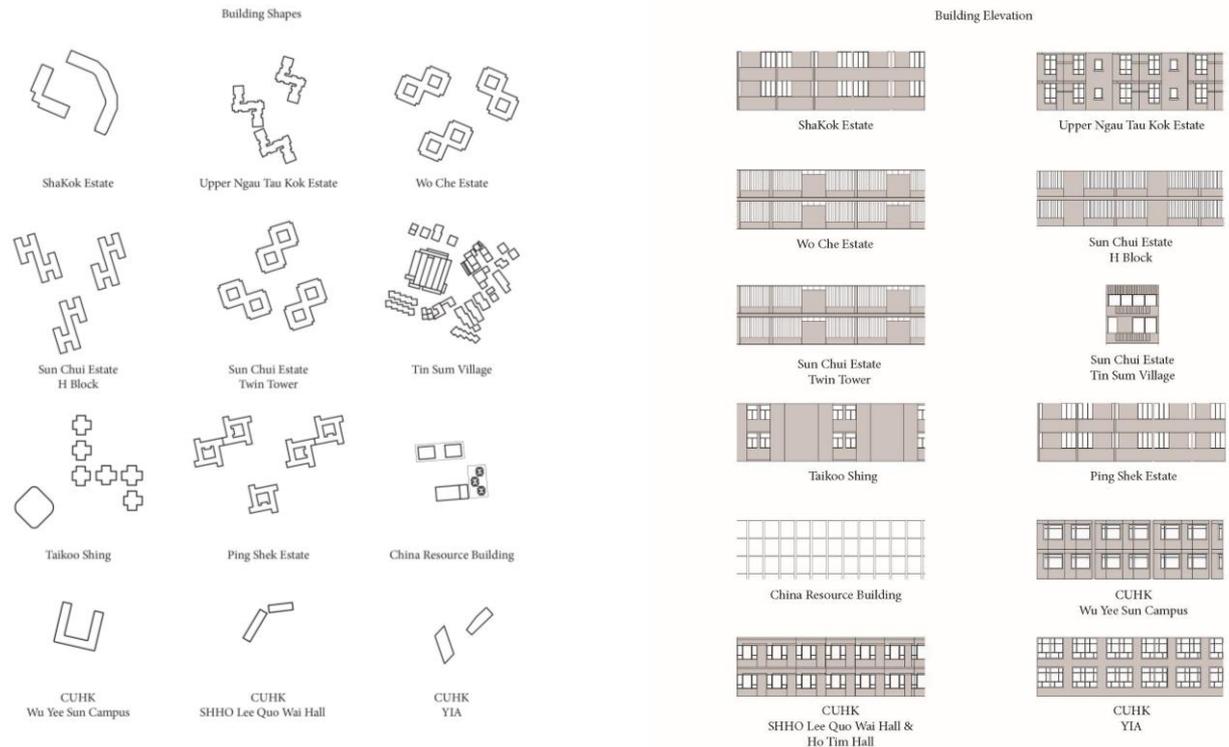
# Site Selection

## 1.

### METHODOLOGY

Site selection based on different building characteristics.

- Building Form (Shape)
- Composition of layout
- Cluster formation

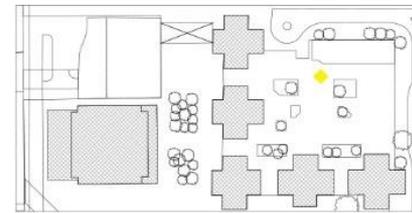
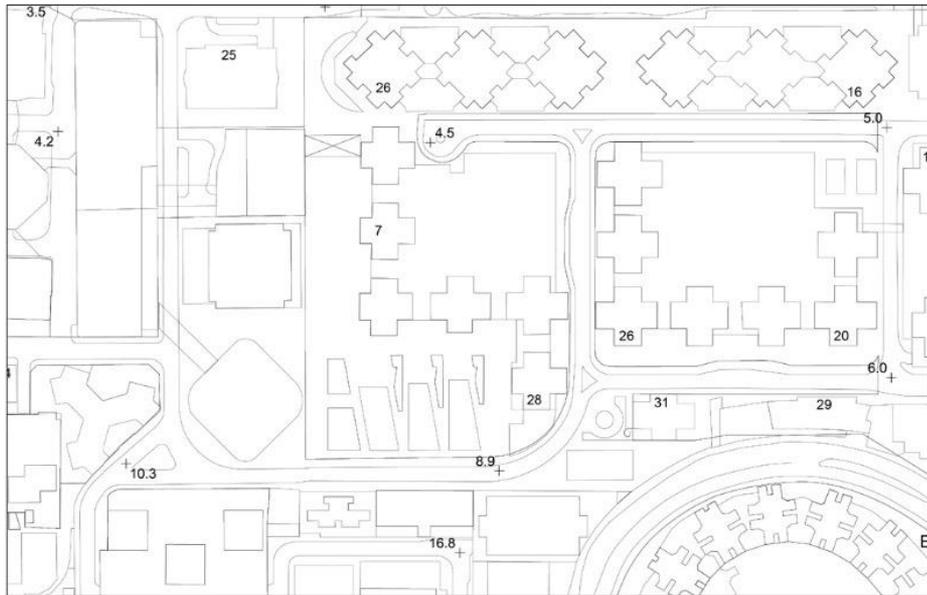


# Site Mappings

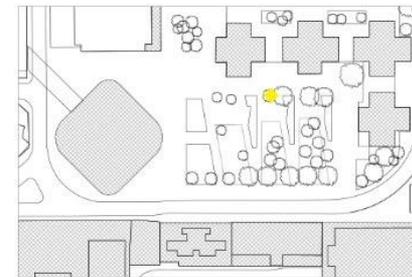
## 1.

### METHODOLOGY

### *Testing location identified – mapping studies*



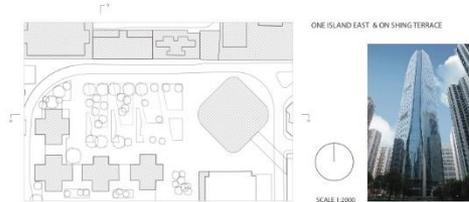
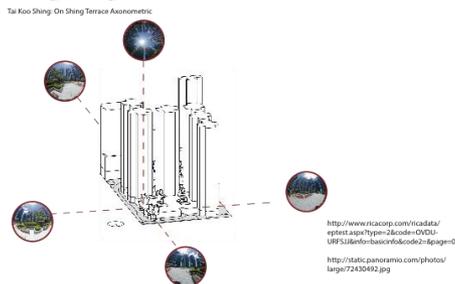
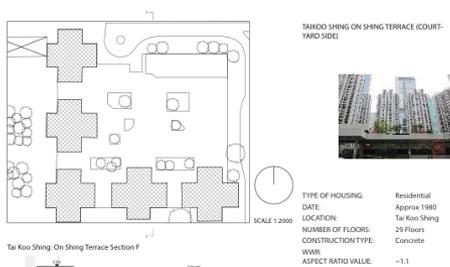
On Ching Estate



One island East

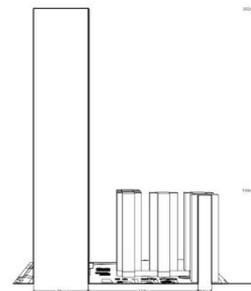
# Site Mappings

## 1. METHODOLOGY

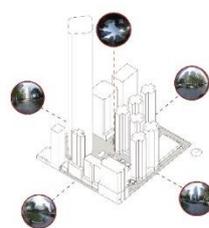


TYPE OF HOUSING: Sky Scaper  
 DATE: 2008  
 LOCATION: Quarry Bay  
 NUMBER OF FLOORS: 69 Floors  
 CONSTRUCTION TYPE: Concrete  
 WWR: -  
 ASPECT RATIO VALUE: -1.7

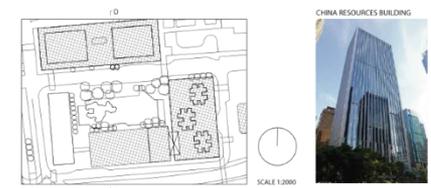
One Island East Section G



One Island East Isometric

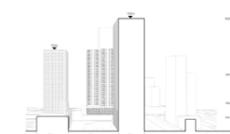


[http://www.jac.com.hk/load/image/2projectPhoto\\_2010\\_10\\_29\\_9\\_0\\_23\\_One%20Island%20East.jpg](http://www.jac.com.hk/load/image/2projectPhoto_2010_10_29_9_0_23_One%20Island%20East.jpg)

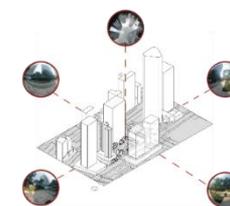


TYPE OF HOUSING: Glass Tower  
 DATE: 1993  
 LOCATION: Sun Chai Estate  
 NUMBER OF FLOORS: 48 Floors  
 CONSTRUCTION TYPE: Concrete  
 WWR: Approx 0.77  
 ASPECT RATIO VALUE: -2.2

China Resources Building Section D



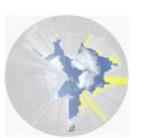
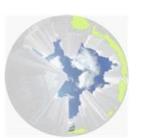
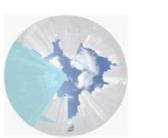
China Resources Building Isometric



China Resource Building Elevation



# Parameters

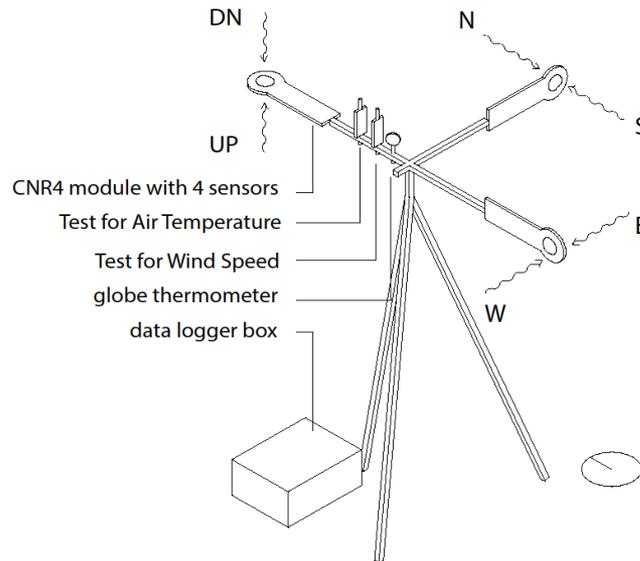
	Sky View Factor SVF	Sunlit View Factor SLVF	Green View Factor GnVF	Glass View Factor GsVF
				
				

calculate Sky View Factor (SVF)

## 1.

### METHODOLOGY

Field Measurement Setup and data collection

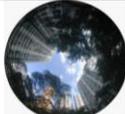
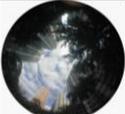


measure Short-wave and long-wave radiation

# Design of Experiment Matrix

## 1. METHODOLOGY

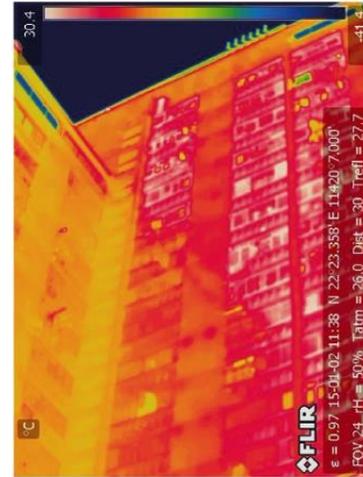
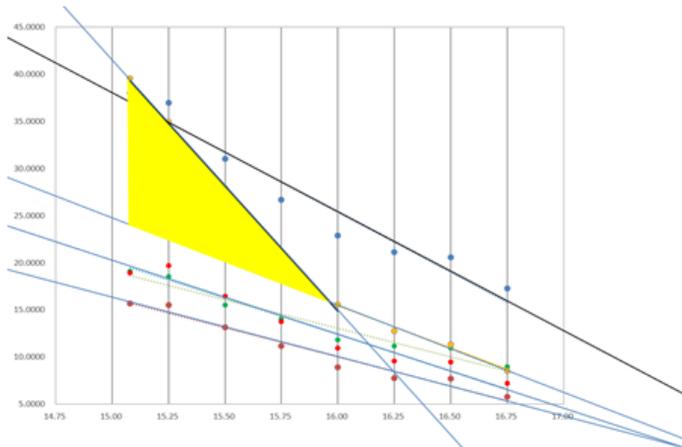
*Based on measured sites, five factors and levels, urban fabric experiment from fish eye photos towards sky (upward)*

Factors	Levels		
	-	0	+
A. Sky View Factor	 0.115	 0.192	 0.256
B. Sunlit View Factor	 0.015	 0.106	 0.181
C. Green View Factor	 0.256	 0.442	 0.674
D. Glass View Factor	 0.088	 0.174	 0.342
E. (Solar Radiation, Cloud cover)	 (High, 0-2 Oktas)	 (Med, 3-5 okta)	 (Low, 6-8 okta)

# Reflected Radiation

## 2. FINDINGS

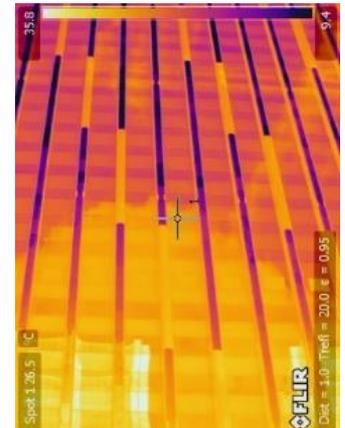
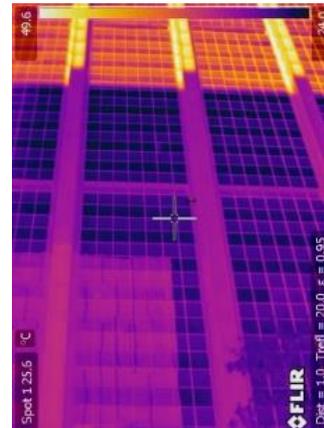
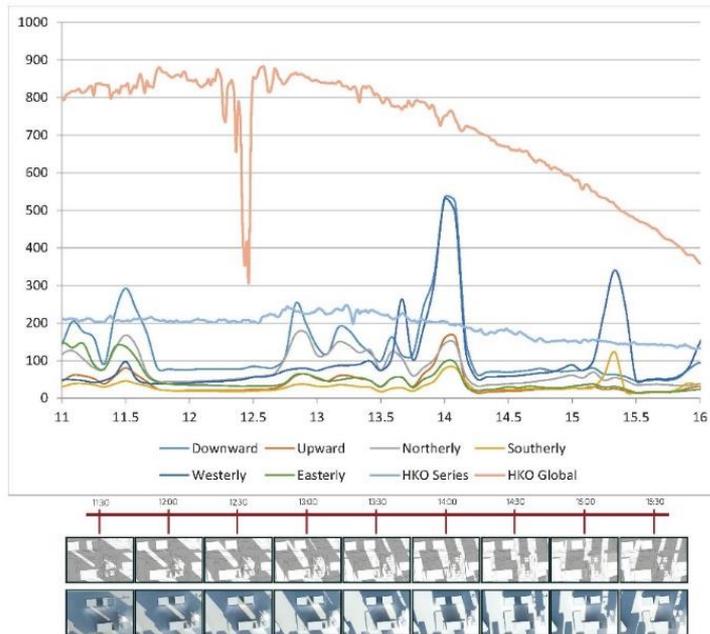
*For concrete surfaces, amount of surface radiation affects has prolonged thermal effects on outdoor environment*



# Reflected Radiation

## 2. FINDINGS

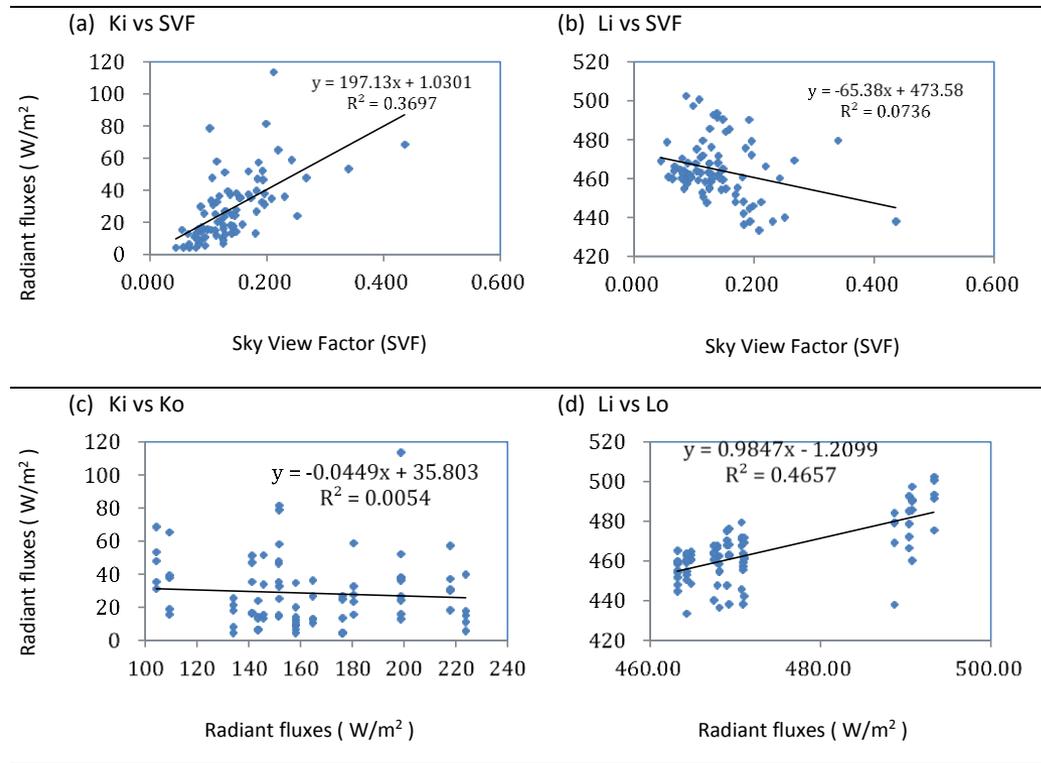
*For glass surface, amount of reflection radiation has sharp effects on outdoor environment*



# Analysis

## 2. FINDINGS

### Scatter plots for radiant fluxes using 5-min mean values against SVF



# Analysis

## 2. FINDINGS

### *Relationship Matrix (relative strength)*



SVF (+1 unit)



SLVF (+1 unit)



GnVF (+1 unit)



GsVF (+1 unit)

Shortwave radiation, K

1
1
1

0.71
------

0.14
------

0.27
------

Longwave radiation, L

-1
-1
-1

0.54
------

-0.16
-------

-0.49
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# Summary

## 3.

### Conclusions

#### Shortwave Radiation:

Significantly affected and increased by:

- More visible sky
- More concrete wall area receiving direct sunlight
- More glass wall area

Although shortwave radiation is considered a significant factor, longwave radiation results provide a better conclusion of how building envelope impacts the thermal environment.

# Summary

## 3.

### Conclusions

#### Long-wave Radiation:

To reduce longwave radiation the following could be deduced:

- More visible sky
- Reduce amount of concrete wall area receiving direct sunlight
- Increase greenery
- Increase glass wall area in shaded orientations (i.e., such as north, northeast and northwest facing walls).

THANK YOU!

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*Acknowledgements:*

*CIC funded research project “A Study of Impact of Building Envelope Design on Urban Outdoor Thermal Environment” and The Chinese University of Hong Kong for data collection and testing.*