



OUTSTANDING DISSERTATION  
最佳碩士論文



## Identify the Tolerance Factors of Green Housing Management: A Case Study of Hong Kong



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### Introduction

Today, people start caring about pollution which adversely affects human beings physically and mentally. Energy consumption of buildings, especially residential buildings, has been enormously increasing over the past few decades. The energy consumed in buildings has been accounted for nearly 60% of the total electricity consumption in western cities (Umberto Berardi, 2015). GHM acts as a way to reduce greenhouse gas emissions, enhance energy efficiency, save the resource and provide a better living environment. Our study focuses on human behaviors and resources management. It refers to how could individual behavior help reduce usage of all resources in managing buildings

(Kakkar, 2014) through energy management, water management and waste management. The research findings could help reduce management cost, generate tailor made energy consumption strategies and enhance productivity.

According to some studies, occupants prone to tolerate a certain level of discomfort in case they can control the personal indoor environment (Brager G, and Baker L. 2009). The tolerance factors are attempted to measuring how occupants widen their comfort zone and tolerate the drawbacks of GHM. Occupants are supposed to be more forgiving if they have a higher standard of understanding of the whole process or the benefits of GHM. By increasing those factors, occupants will have greater likelihood to widen their comfort zone.

This study is based on the theory of planned behavior (TPB) (Ajzen, 1991) to investigate the level of acceptance of GHM. The theory of reasoned action (TRA) (Ajzen and Fishbein, 1980) suggests that the behavior performed by an individual is determined by behavioral intentions.

Attitude and subjective norms are the two major motivations for one's actual behavior. TPB was developed through modifying TRA by adding another new variable of perceived behavioral control (PBC). PBC is defined as an individual's perceived ability to perform certain behavior. The higher the degree of one's PBC, the higher are their confidence to perform the behavior successfully. PBC can be divided into two parts — self-efficacy and controllability. Self-efficacy means the extent of difficulty for an individual to perform the behavior or the confidence in one's ability to perform the behavior successfully (Akhtar, 2008). According to self-efficacy theory (SET), self-efficacy has been playing a crucial role of behavioral change at the initiative stage because people are always affected by their confidence in their ability to perform specific behavior (Bandura, 1980). SET is used to explain the relationship between one's beliefs, attitudes, behavior and intentions.

Besides, Technology acceptance model (TAM) is one of the extensions of TRA and explain how people accept new technology (Davis, 1989). Davis suggested that Perceived usefulness (PU) and Perceived ease of use (PE) can help to predict user's attitude towards new technology. Positive attitude will then eventually lead to behavior intention and actual action. To a certain extent, GHM in Hong Kong is a new concept. If the occupants acquire higher PU and PE, they probably establish a better attitude.

Nevertheless, the TPB was criticized because of its ignorance of people's need to perform the behavior. For example, if an individual has a positive attitude towards hamburger, he may not order because he is already full. Ajzen (1991) said that additional variables are allowed to strengthen the explanation ability of TPB on certain behavior. According to Maslow's Hierarchy of needs, the living space shall perform the fundamental need of physiological, safety, social, esteem and self-actualization (Zhao et al., 2015). GHM is not only satisfying the physiological need, but also the need for safety because it can help to handle the environmental problems. Therefore, enhancing the social trust, consequences awareness and environmental attitude can satisfy the safety needs of individuals.

## Literature review

### Theoretical Framework

An extended TPB is developed to examine eight psychological factors on the tolerance of GHM in Hong Kong (see Fig. 1). The paths in Fig.1 represent the influence from a variable to another variable. There are nine hypotheses in the relationship between all the variables. For instance, Attitude (H1), subjective norm (H2), subjective knowledge (H3), social trust (H4), consequences awareness (H8) and environmental attitude (H9) has a positive effect on the behavioral intention to support or tolerate GHM. Social trust has a positive effect on perceived usefulness (H5). Perceived usefulness (H6) and perceived ease of use (H7) has a positive effect on the attitude towards GHM.

Fig.1 – Theoretical framework



## Hypotheses

### Attitude (AT)

AT is psychological beliefs towards behavior and a subjective evaluation with some degree of favor or disfavor towards that behavior (Fishbein and Ajzen, 1975). According to various studies, AT always has positive influence on behavior intention (Kelly et al. 2006; Davis et al. 1989; Liu et al., 2016). It supports the following hypothesis:

H1. Hong Kong residents' AT towards GHM has a positive effect on residents' intention to tolerate GHM.

### Subjective norm (SN)

SN is defined as "the perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991). An individual will comply with the expectation of other people who are important or close to (Fishbein and Ajzen, 1975). Some studies confirmed the social pressure is a crucial factor for motivating specific behavior (Sidique et al. 2010). Thus, we suggest the following hypothesis.

H2. SN towards GHM has positive effect on Hong Kong residents' intention to tolerate GHM.

### Subjective knowledge (SK)

Knowledge is one of the major factors that inhibits one to perform certain behavior (Tonglet et al. 2004). Knowledge can be divided into objective and subjective. SK is the people's perceptions of what or how much they know about an issue (Park et al., 1994) and are more suitable for predicting pro-ecological behavior (Ellen, 1994). The increase of SK can boost the self-efficacy and eventually affect behavior intention and encourage behavior change. Thus, the hypothesis is set as follows:

H3. SK of Hong Kong residents towards GHM has a positive effect on residents' intention to tolerate GHM.

**Social trust (ST)**

ST is defined as “the willingness to rely on those who have the responsibility for making decisions and taking actions related to the management of technology, the environment, medicine, or other realms of public health and safety”. Very often, when a new technology or new concept has emerged, most people do not have enough time or resources to acquire sufficient information before their decision making. The higher reliance of the information provided by specific organizations or people, the higher degree of ST is. Thus, the following hypothesis is developed:

H4. ST in organizations of Hong Kong residents has a positive effect on residents’ intention to tolerate GHM.

ST usually becomes the enhancement factor for perceived usefulness. When people are convinced by the authorities or organization responsible for GHM, they will generally agree on the usefulness of GHM. Hypothesis is assumed as follows.

H5. ST in organizations of Hong Kong residents towards GHM has a positive effect on perceived usefulness.

**Perceived usefulness (PU)**

PU the extent that something is believed to be beneficial to achieving the objective. For example, if people find something is useful in dealing with some problems or improving in some aspects, they are believed to have a more positive attitude towards those things. The hypothesis is set below.

H6. PU has a positive effect on AT of Hong Kong residents towards GHM.

**Perceived ease of use (PE)**

PE is defined as “the degree to which a person believes that using a particular system would be free from effort” (Davis 1989). If people consider GHM is convenient, they are believed to have a

better attitude towards GHM. The hypothesis is developed as follows.

H7. PE has a positive effect on AT of Hong Kong residents towards GHM.

**Consequences awareness (CA)**

CA is the extent that people are aware of the consequences of something. If the consequences are serious enough, the higher level of awareness towards the consequences, the more positive impact should be imposed on people behavior intention. It is proved that the consequences of recycling are the significant predictors of recycling behavior (Tonglet et al, 2004). Hence, a hypothesis is developed as the following.

H8. CA of Hong Kong residents has a positive effect on residents’ intention to tolerate GHM.

**Environmental attitude (EA)**

EA refers to the psychological perception in the evaluation on the degree of favor or disfavor to natural environmental (Milfont TL Duckitt J., 2004; Milfont TL Duckitt J., 2010). The increasing EA may enhance residents’ AT, SN, SK, PU and eventually influence their behavior intention in any behavior related to environmental protection. According to Value-Belief-Norm theory, (Stern, 2000), EA has a positive influence on intention and behavior.

New Ecological Paradigm (NEP) scale consists of 15 pro-NEP and anti-NEP items and is commonly used for the measurement of EA in various samples. NEP is proven by various studies there is a positive relationship between new ecological paradigm and intentions (Deuble and De Dear (2012). It supports that EA measured by NEP scale has a positive influence on behavior intention towards GHM. Therefore, the following hypothesis is submitted.

H9. EA of Hong Kong residents measured by NEP has positive effect on residents’ intention to tolerate GHM.

## Methodology

### Research design

The research project used a multiple choice questionnaire to examine the demographic information and used Likert scale to measure each factors. There were 33 statements in the questionnaire and each statement was rated by a 5-point Likert scale (see Table 1). For example, 1 refers Strongly disagree; 2 refers Disagree; 3 refers Neutral; 4 refers Agree; 5 refers Strongly agree. A pilot survey was conducted among 60 residents in Hong Kong. There were 60 valid questionnaires collected. PE1 is deleted because the standardized factor loading is below 0.50. All developed statements are as follow.

Table 1 – statements

Factors	Statements	
Attitude (AT)	AT1	I agree GHM are good
	AT2	I appreciate the benefits of GHM
	AT3	I support the development of GHM
Subjective norm (SN)	SN1	I agree that my family expect me to recycle.
	SN2	I agree that my friends expect me to recycle
	SN3	I agree that my colleagues expect me to recycle
	SN4	I agree that media influence me to recycle
Subjective knowledge (SK)	SK1	I know what green building certificate
	SK2	I know the motivation for developing GHM
	SK3	I know the advantages of GHM
Social trust (ST)	ST1	I trust the quality of assessment standards for GHM developed by the official authorities
	ST2	I trust the experts' evaluation in the GHM assessment process
	ST3	I trust the authenticity of application documents provided by the housing management companies
	ST4	I trust the Property Management Companies will implement GHM
	ST5	I trust the NGO will observe GHM
	ST6	I trust the Government will promote GHM
Perceived usefulness (PU)	PU1	I agree that GHM are useful for saving energy and resources
	PU2	I agree that GHM are useful for saving management costs
	PU4	I agree that GHM are useful for improving occupants' health physically or mentally
	PU5	I agree that GHM are useful for improving the living environment of occupants
Perceived ease of use (PE)	PE1	I agree that GHM are not difficult to implement
	PE2	I agree that the implementation of GHM needs not spending extra time
	PE3	I agree that the implementation of GHM needs not spare large space for equipment

Factors	Statements	
Consequences awareness (CA)	CA1	I agree that implementation of GHM is one of the important ways to reduce pollution
	CA2	I agree that implementation of GHM will change the way of occupants' life
Environmental attitude (EA)	NEP1	Population of human beings is reaching the limitation of the Earth can support
	NEP2	Humans are abusing the environment
	NEP3	The earth is like a spaceship with very limited room and resources
	NEP4	Despite our special abilities, humans are still subject to the laws of nature
	NEP5	If things continue on their present course, we will soon experience a major ecological catastrophe
Behavior intention (BI)	BI1	I would like to live in a place with GHM
	BI2	I would like to buy a dwelling with GHM
	BI3	I would recommend GHM to my friends

### Data collection

362 people are interviewed randomly on the street and 362 questionnaires were completed through online platform. 214 out of 724 respondents living in public housing and are screened out. 510 questionnaires are valid for the final analysis. The details demographic information of the research is shown in Table 2.

Table 2 – Sample Demographics (size = 510)

Variable	Group	Frequency	Percentage (%)
Gender	Male	240	47.1
	Female	268	52.5
	Missing	2	0.4
Age	<18	8	1.6
	18-27	38	7.5
	28-37	166	32.5
	38-47	156	30.6
	48-57	123	24.1
	>58	18	3.5
	Missing	1	0.2
No. of children	0	271	53.1
	1	126	24.7
	2	102	20
	3	8	1.6
	4	2	0.4
	5 or above	0	0
	Missing	1	0.2

Variable	Group	Frequency	Percentage (%)
Living districts	Central and Western	6	1.2
	Wan Chai	6	1.2
	Eastern	30	5.9
	Southern	8	1.6
	Hong Kong Island (Total)	50	9.9
	Yau Tsim Mong	24	4.7
	Sham Shui Po	22	4.3
	Kowloon City	20	3.9
	Wong Tai Sin	20	3.9
	Kwun Tong	0	0
	Kowloon (Total)	86	16.8
	Tsuen Wan	52	10.2
	Kwai Tsing	40	7.8
	Tuen Mun	60	11.8
	Yuen Long	78	15.3
	Islands	5	1
	New Territory West (Total)	235	46.1
	Sha Tin	54	10.6
	Tai Po	28	5.5
	North	18	3.5
	Sai Kung	36	7.1
	New Territory East (Total)	136	26.7
	Missing	3	0.6
GM or not	Yes	278	54.5
	No	228	44.7
	Missing	4	0.8
Education level	Primary school or below	10	2
	Secondary school	138	27.1
	High school, diploma or equivalent	76	14.9
	Associate degree	10	2
	Bachelor's degree	178	34.9
	Master's Degree or above	92	18
	Missing	6	1.2
Income	HKD 0-15,000	92	18
	HKD 15,001-31,000	206	40.4
	HKD 31,001-47,000	120	23.5
	HKD 47,001-53,000	16	3.1
	Over HKD53,000	70	13.7
	Missing	6	1.2



### Reliability and Validity of the data

Before the analysis of the data, the reliability and validity of the data are tested. The results are shown in Table 3. Since the standardized factor loadings of PE1 is -0.11 which is smaller than 0.5, the data of PE1 is then ignored. The scores of composite reliability are greater than 0.80 which represent good convergent validity. All average variance extracted (AVE) are greater than 0.5, validity is established on the construct level (Fornell and Larcker, 1981).

Table 3 – Measures for composite reliability and average variance extracted

Tolerance Factor	Statements	Standardized factor loading	Composite reliability	Average variance extracted
AT	AT1	0.841	0.87	0.69
	AT2	0.813		
	AT3	0.829		
SN	SN1	0.877	0.9	0.68
	SN2	0.867		
	SN3	0.851		
	SN4	0.696		
SK	SK1	0.829	0.9	0.74
	SK2	0.895		
	SK3	0.864		
ST	ST1	0.831	0.9	0.62
	ST2	0.813		
	ST3	0.853		
	ST4	0.824		
	ST5	0.662		
	ST6	0.711		
PU	PU1	0.782	0.88	0.64
	PU2	0.768		
	PU3	0.849		
	PU4	0.8		
PE	PE2	0.909	0.9	0.83
	PE3	0.909		
CA	CA1	0.909	0.9	0.83
	CA2	0.909		
EA	NEP1	0.717	0.88	0.58
	NEP2	0.806		
	NEP3	0.755		
	NEP4	0.691		
	NEP5	0.844		
BI	BI1	0.885	0.93	0.82
	BI2	0.927		
	BI3	0.898		

### Analysis

The score of each statement represents the degree of the respondents' perception in related factors towards GHM in Hong Kong. Assuming each statement is of equally weighted for each tolerance factors, the mean score of the statements are then applied for the measurement (see Fig.3).

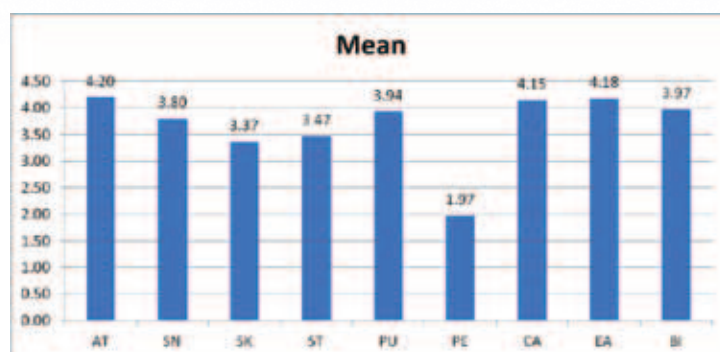
510 respondents are divided into 3 groups which are negative (score = 1 or 2), neutral (score = 3), positive (score = 4 or 5). 76.4% of respondents

are positive to BI1. BI2 and BI3 are accounted for 64.7% and 69% respectively. However, the respondents believed that the implementation of GHM need spend more time or spare large space for equipment. 51.37% and 54.12% of respondents express negatively to PE2 and PE3 respectively. And, family plays the most important role in SN. 65.88% of respondents agree their family expect them to recycle (SN1).

Fig. 2 – Mean of statements



Fig.3 – Mean of tolerance factors



The software of SPSS is used for Regression analysis. The hypotheses of H1, H2, H4, H5, H6, H8 and H9 are supported but H3 and H7 are rejected.

Table 4 – The result of hypothesis

H	Hypothesis	Coefficients	Standard error	p value	Result
H1	AT to BI	0.324	0.048	<0.001	supported
H2	SN to BI	0.185	0.035	<0.001	supported
H3	SK to BI	-0.21	0.030	0.478	rejected
H4	ST to BI	0.191	0.040	<0.001	supported
H5	ST to PU	0.499	0.036	<0.001	supported
H6	PU to AT	0.533	0.034	<0.001	supported
H7	PE to AT	-0.002	0.031	0.942	rejected
H8	CA to BI	0.235	0.039	<0.001	supported
H9	EA to BI	0.283	0.042	<0.001	supported

In order to have a deeper understanding of the respondents' perception towards BI, the supported hypotheses are tested for in different groups.

If respondents are divided by gender, the female has higher adjusted  $R^2$  and higher coefficients in SN, ST, CA and EA. It suggests that SN, ST, CA and EA are stronger predictors of BI for female at acceptable significance level.

The respondents are also reclassified into groups with and without children. Respondents with children have higher adjusted  $R^2$  and higher coefficients in SN, CA and EA. It suggests that SN, CA and EA are stronger predictors of BI for the one who have children at acceptable significance level.

If the respondents' housing unit apply GHM measures, the influence of AT and ST on intention are different. The living unit without GHM has higher adjusted  $R^2$  and has lower coefficients on AT and ST. It suggests that AT and ST are weaker predictors of BI for one's housing unit not applying at acceptable significance level.

In aims of gaining more understanding of the influence of PU and PE on AT (H6 and H7), further analysis are applied by splitting respondents by different background. Respondents with children have higher adjusted  $R^2$  and higher coefficients in PU. It suggests that PU is a stronger predictor of AT for the parents at acceptable significance level.

Moreover, since PU of respondents with children is a stronger predictor for AT, the influence of ST on PU become more important. The one without children have higher adjusted  $R^2$  and higher coefficients in ST. It suggests that ST is a stronger predictor of PU for the one without children at acceptable significance level.

## Discussion

Hypothesis H1, H2, H4, H5, H6, H8 and H9 are supported in our findings. AT is of the highest coefficient with behavior intention. It implies enhancing the image of GHM may be the most effective way to promote GHM in private housing. SN have positive influence to behavior intention of GHM, especially those are female and the one with children. It suggests that female and parents are more likely to be influence by their friends, family, collegeues or even media. In order to promote, Hong Kong government can consider promoting GHM in social media platforms with coupons or souvenirs.

According to our findings, the ST of female respondents is of higher coefficient with BI. Also, ST is of higher coefficient with PU for the one without children. Policy makers may take them into account. Relevant authorities should enhance their transparency in their findings to convince Hong Kong citizens. For example, the authorities can invite independent professionals to join and monitor the assessment. The assessment method can open to the public. It can help the public to gain deeper understanding of GHM. The information of these authorities may focus on distributing to those with higher proportion of small flats in the estate in hopes of targeting the residents without children.

Last but not least, we found the CA and EA are positively influencing BI to support GHM, especially those are female and parents. It implies the women and those with young children are more worried about the consequence of pollution such as global warming and severe climate change and more likely to support environmental protection. Numerous implementations can be introduced such as restricting the development in Country Parks, promoting eco-tourism, providing sponsorship or scholarship for environmental studies or related field because the people with environmentally based academic are suggested to have higher NEP scores (Ewert and Baker, 2001). Also, the consequence of pollution can be plugged in movie for children. Sponsorship for those production can be considered. The government can also include the consequence of pollution in the school syllabus. Essay contest or Hong Kong Diploma of Secondary Education (DSE) exam should be valuable tools for attracting students to look into the matter. Through enhancing the CA of parents and youths, Hong Kong people will eventually become more tolerate to GHM.

### Conclusion

The AT, SN, ST, CA and EA have a positive influence on BI. ST has positive influence on PU and PU has a positive influence on AT. SN, ST, CA and EA have bigger influence for female respondents on behavior intention. SN, CA and EA have bigger influence for parents on behavior intention. Also, AT and ST are relatively important for those who live in buildings with green housing measures which influences their support towards GHM. Last but not least, we found that ST has a bigger influence on PU for the respondents without children and PU has a bigger influence on AT for the respondents with children.

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## A Safe City: Crime Prevention through Environmental Design. Case Study of Wan Chai District, Hong Kong



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### Introduction

Safeness of a city will directly affect residents' living quality, a city's image and political stability. Although different disciplines have different explanations on criminal behaviors and crime prevention, layouts and forms of the environmental design have been generally agreed to have impact on criminal behaviors. Designated areas and the features of those areas in term of their overall settings and specific characteristics will also affect a crime that do (and do not) take place there. Therefore, most criminal behaviors are not a coincidence, but a pattern that may be prevented through environmental design.

Although Hong Kong is one of the worldwide recognized safest societies over the world, crime rate in certain districts are still relatively high. This research hopes to sort out the connection between crime and environmental design to prevent crime and enhance residents' quality of life.

Among all types of crime, burglary and theft are highly affected by the environment. The research mainly study residential burglary and theft to find out the relationship between such crimes and the surrounding environments and make recommendations accordingly.

### Literature Review

#### Burglary and Theft

Referring to the crime statistics and classification from Hong Kong Police Force (HKPF, 2017b), Burglary and Theft is one of the sub-categories of crime, which includes Theft (Snatching/Pickpocketing/Shop theft), Theft from construction site, Theft from vehicle, Burglary with and without breaking, Abstracting of electricity, Taking conveyance without authority, Handling stolen goods and Other miscellaneous thefts.

#### Environmental Design

Oxford (1996) suggested that environmental design is to increase the comfort and efficiency of residents or occupants through artificially

controlling the surrounding environment. The constructed environment may encourage or discourage specific behavior patterns.

## Classical Placed-based Crime Prevention Theories

### Defensible Space

Defensible Space theory was initially developed in public housing projects. It was originated in 1970s by Oscar Newman, trusting if places are built to increase residents' sense of ownership, residents would better protect those areas and properties they trust that they own and hence, it may reduce the probability of crime and disorder as a consequence (Newman, 1972). Newman suggested four key constitutions of design to facilitate social control network:

- I) Territoriality: Using the symbolic or real barriers, residential spaces may be subdivided into public and private zones, which will be more manageable for residents when they adopt the space as "their territory".
- II) Surveillance: Residents should be capable of noticing what is occurring in and around the public areas inside and outside the buildings.
- III) Building Image: Proper design and use of building materials can avoid residents from feeling stigmatized that may in turn result in feeling of isolation.
- IV) Juxtaposition of Residential Areas with Other Facilities: Domestic housing should be co-existed with social and commercial facilities to enhance security in the area.

### Crime Prevention Through Environment Design (CPTED)

When Newman's Defensible Space only focused on built environment, the CPTED's originator, C. Ray Jeffrey, proposed a broader and more systems-based approach to the correlations between crime and overall environment.

Jeffrey (1971) believed that because physical environment may provide pleasurable or painful response to people who would learn to change their behaviors to minimize pain or maximize the pleasure, changing the environment may achieve crime prevention. Four basic principles of CPTED are involved, namely, Territoriality, Natural Surveillance, Access Control and Activity Support.

- I) Territoriality: Like Newman's Defensible Space Theory, CPTED believed human would protect the space where people identify as theirs. Nonetheless, other than the building features, CPTED interventions involved more subtle measures like changing road color or narrowing entrance to make the area as private properties.
- II) Natural Surveillance: Apart from the formal surveillance like increasing security guards and CCTVs, CPTED emphasized more on the informal way such as making the kitchen facing the street and ensuring the sightline without being blocked by high walls.
- III) Access Control: Keep outsiders out by building's design through physical and symbolic barriers.
- IV) Activity Support: Creation of an area to attract authorized users to provide extra surveillance such as organizing activities in public space.

### Situational Crime Prevention Theory (SCP)

Situational Crime Prevention Theory (SCP) was developed by Ronald V. Clarke, emphasizing "opportunity" to deter crime. It explained a specific crime in specific circumstances with two concepts — Rational Choice Theory and Routine Activity Theory, and proposed to 1) raise effort to commit crime, 2) raise risk to commit crime, 3) reduce reward of crime, and 4) reduce provocation to push the offender to commit crime, in the mindset of offenders before they realize the criminal thought to actual criminal behaviors (Armitage, 2013).

### **Environmental Criminology**

While SCP stressed intervention strategies, Environmental Criminology focused on a boarder crime and victimization context. Armitage (2013) explained that neighborhood layout may affect how possible offenders to notice potential targets for committing crime. When offenders go to work, come back home and carry out daily events, the locations where offenders commute are recognized as their activity space. It helped explain why low-income districts usually have higher crime rates as offenders tend to commit crime in their activity space where they feel familiar.

### **Summary of Classical Placed-based Crime Prevention Theories**

In summary, crime may be prevented when the following four areas are achieved:—

- I. Territoriality: Differentiating the public space from private space.
- II. Surveillance: Enhancing residents' and passengers' visibility of surrounding environment.
- III. Access Control: Limiting the access right of unauthorized persons.
- IV. Buildings Image and Mixtures: Changing buildings image and mixture to alter the perception of potential offenders in search of targets

These criteria will be adopted as the analytical framework for assessing the connection between environment and crime in the case studies in Hong Kong and Wan Chai District.

### **International Practices of Crime Prevention Theories**

#### **Application of Classical Place-based Crime Prevention Theories in the U.S.**

##### ***Crime prevention design in public housings***

According to Armitage (2013), American public housing development might be classified into three design stages: the courtyard plan stage (1930s-1940s), the high-rise stage (1950s-1970s) and neighborhood connection stage (1980s – present).

In the first stage, the public housing projects were designed as low-rise, semi-enclosed courtyards. The structure of the public housings looked obviously different from the surrounding neighborhood to separate different kinds of residents.

The second stage of high-rise buildings was similar with the first stage to build public housing to look different from the neighborhood. One notorious housing project in this stage is called Pruitt-Igoe in St Louis in 1960s. Its design freed up as much as land as possible, reduced lot coverage and created super-blocks of vast self-contained communities which made the housing project become a slum area full of poverty, crime, and racial segregation. The failure of Pruitt-Igoe became a living laboratory of defensible space theory by Oscar Newman.

The third is neighborhood connection stage initiated by Oscar Newman's defensible space theory in 1970s. For example, the redevelopment of Boston's West Broadway public housing, based on defensible space theory, was constructed as the new, small-scale and neighborhood friendly environment in 1984.



## **Application of Classical Place-based Crime Prevention Theories in the U.K.**

### ***Legislation and regulations***

There are different legislation and regulations for crime prevention for housing projects in the U.K. For example, under Section 17 of Crime and Disorder Act (1998), local authorities own legal duty of care of the plaintiff. They have the responsibility for development projects within the area and hence their decisions are required to consider possible crime and disorder under this section.

On the other hand, for building regulations, “Part Q of Schedule 1 (Security) to the Building Regulations 2010” was effective on 1 October 2015 in the U.K., stipulating that all new buildings, or existing buildings that are changed into new homes are required to meet the security requirements related to the building entrances and windows (Secured by Design, 2018).

### ***Police Architectural Liaison Officers (ALO)/ Crime Prevention Design Advisors (CPDA)***

There are 43 police forces in England and Wales. Each of them has at least one officer to provide CPTED guidance to local planning officers and study the planning applications submitted to local planning department. This duty is called Police Architectural Liaison Officers (ALO) (for northern police forces) or Crime Prevention Design Advisors (CPDA) (for southern police forces).

Amid them, the practice in Manchester was the most effective. The authority established the Greater Manchester Police Design for Security Consultancy (GMP DfSC), a team involving one dedicated crime analyst and six experts in planning, design or architecture, to take up the role as ALO/CPDA. They believed that DfSC with design background may not only provide professional crime prevention advice, but also facilitate the communication process with developers and local planning authorities (Armitage, 2013).

It is compulsory for developers to consult DfSC for any residential planning application with more than ten dwellings. Although DfSC is a non-profit organization, the developers need to pay for the Crime Impact Statement (CIS) report produced by DfSC to get the consent from local planning authority for their development projects application, which provides continuous income stream to support the operation of DfSC (Armitage, 2013).

### ***Secured by Design (SBD)***

Since 1989, Secured by Design (SBD) is an award scheme to encourage the building industries to design out crime as early as the planning stage of housing projects. It is operated by ALO/CPDA to ensure the housing projects are constructed up to certain crime prevention provisions. This scheme is largely derived by Defensible Space theory and CPTED theory (Secured by Design, 2018).

According to the official statistics in 2016, SBD housing projects had 75% less burglary, 25% less vehicle crime and 25% less criminal damage compared to non-SBD estate. Besides, the Association of British Insurers estimated that introducing SBD standards in the U.K. has brought more than £3.2 billion worth of savings to the economy over 20 years, while the additional cost of adopting SBD standards at home was only £170 on average (Secured by Design, 2018).

With successful experience in the U.K., the crime prevention theories have been widely integrated into city planning and design process in other European countries. For example, the “Dutch Police Label Secure Housing” (Dutch Label) is a Dutch standard for new developments.

## Case Study of Hong Kong

### Overview of Hong Kong Crime Statistics

Comparing with other advanced cities or country, Hong Kong's crime rates in several major offenses are also relatively low, and when comparing with the past figures, Hong Kong's crime rate has significantly reduced over the years (Figure 1.1-1.2)<sup>1</sup>.

Figure 1.1: Overall crime per 100,000 populations (HKPF, 2017a)

	Year 2007	Year 2011	Year 2016
<b>Hong Kong</b>	<b>1167</b>	<b>1074</b>	<b>827</b>
Singapore	715	608	590
Tokyo	1988	1414	1074
New York	2432	2334	2036
Paris	11329	10375	11983
London	11600	10300	8932
Toronto	7059	4807	4331

Figure 1.2: Burglary per 100,000 populations (HKPF, 2017a)

	Year 2007	Year 2011	Year 2016
<b>Hong Kong</b>	<b>65.1</b>	<b>61.9</b>	<b>33.1</b>
Singapore	18.9	12.3	3.8
Tokyo	103.0	61.0	38.4
New York	254.4	221.1	140.6
Paris	652.0	561.3	620.4
London	1257.4	1225.3	801.2
Toronto	518.9	297.8	221.2

<sup>1</sup>Classifications and counting rules of crimes may be different across cities and within cities over time.

Although Hong Kong's crime rate is relatively low over the world, in the district level, crime rates in Mong Kok, Yau Ma Tai, Tsim Sha Shui (Yau Tsim Mong), Wan Chai and Central Districts are obviously higher. Looking into the burglary and theft cases, the same results is found as the overall crime rate. The burglary rate in Yau Tsim Mong, Wan Chai and Central Districts are higher than other districts (Figure 1.3).

Figure 1.3: Average crime rate/capita and average burglary and theft rate/capita in Hong Kong from year 2008 to 2017 (HKPF, 2017b)

District	Average Crime Rate/capita	Average burglary and theft rate/capita
<b>Wan Chai</b>	<b>2.44%</b>	<b>1.35%</b>
Eastern	0.64%	0.31%
<b>Central</b>	<b>2.57%</b>	<b>1.31%</b>
Western	0.63%	0.29%
Kwun Tong	0.73%	0.35%
Wong Tai Sin	0.78%	0.36%
Sau Mau Ping	0.89%	0.40%
<b>Yau Tsim</b>	<b>4.26%</b>	<b>2.12%</b>
<b>Mong Kok</b>	<b>2.90%</b>	<b>1.52%</b>
Sham Shui Po	1.28%	0.63%
Kowloon City	0.87%	0.43%
Yuen Long	0.96%	0.45%
Tai Po	0.81%	0.40%
Tuen Mun	0.81%	0.38%
Border	1.73%	0.82%
Sha Tin	0.60%	0.31%
Kwai Tsing	0.67%	0.29%
Tsuen Wan	1.00%	0.48%
Lantau	0.83%	0.42%

### Application of Classical Place-based Crime Prevention Theories

#### Territoriality

In Hong Kong, most private and public resident developments in these 40 years had been constructed with the physical or symbolic elements such as gates, fences, wall or symbolic devices to differentiate the estate and non-estate zones. It encouraged residents to protect the areas they recognized as theirs.

**Physical Surveillance**

Other than public space of residential estates, many private shops and vehicles are equipped with CCTVs or security systems which may serve as the physical surveillance to deter crime.

**Natural Surveillance**

Alongside more than 140,000 street lamps on the roads (Highway Department, 2018), most residential buildings/estates have adequate lighting facilities to enhance surveillance.

**Physical Access Control**

Apart from high wall, barbed wire and gated of the buildings/estates, high quality property management and security services are one of the crucial factors for low burglary rate in Hong Kong. There are 179 public rental estates, accommodating 30% of the population in Hong Kong. All public rental estates are either managed by Housing Department directly or by outsourced property management agents, providing comprehensive security and guarding services. About 5,353 buildings (13%) have no any management organization out of 40697 private residential buildings (Home Affairs Department, 2018). High percentage of security and guarding services are vital for access control and criminal behaviors detection.

**Buildings Image and Mixtures**

In Hong Kong, most residential flats are constructed in a high-rise single building or within an estate. Although there are different designs for different residential buildings, most of them are similar which make potential criminals harder to search targets.

**Comparison with Foreign Experiences****Hong Kong Police Force**

As one of the sectors of Hong Kong Police Force, the Crime Prevention Bureau (CPB) shares similar responsibilities with ALO/CPDA in the U.K. to offer crime prevention advices according to CPTED theory to both public and private sectors as required. Additionally, the police will conduct site visit on high burglary rate of residential or commercial buildings and give advices to property management agents for crime prevention (HKPF, 2018).

**Hong Kong Building Regulations**

Unlike the U.K. and the U.S., there is neither stipulated building regulation regarding the crime prevention standard in building design in Hong Kong, nor policy guideline by the Hong Kong Housing Authority to adopt crime prevention theories in public rental housings design. However, some crime prevention principles such as creating common area, setting physical barrier and access control are naturally integrated into environmental design of the development projects. As for private residential buildings, Home Affairs Department will also provide free consultation on security of daily operation.

**Case Study of Wan Chai District****Application of Classical Place-based Crime Prevention Theories****Housing Characteristics**

Special housing combinations may affect criminal behaviors. According to Population By-census 2016 (Census and Statistics Department, 2018), the proportion of domestic households in public housings (including subsidized flats) compared to that in private housings are particularly low in Central and Western District, Wan Chai District and Yau Tsim Mong District. Coincidentally, these three districts had the overall crime rate and burglary and theft rate.

Analyzing on the place-based crime prevention perspective, all public and subsidized housing estates, even for aged housing estates, are well-gated environment with qualified property management companies and security services. Their security level in term of territoriality, surveillance and access control are generally higher than other aged private residential buildings and villa/houses.

In contrast, lacking proper property management services and crime prevention building design will reduce risk and effort for criminal behaviors. Based on the Database of Private Buildings in Hong Kong (Home Affairs Department, 2018), there are 5,353 private residential buildings without any property management organization, in which Central and Western District, Wan Chai District and Yau Tsim Mong District, Sham Shui Po District, Kowloon City District and North District also have a higher percentage. Amid them, Central District, Wan Chai District and Yau Tsim Mong District have the highest burglary and theft rate over the territory.

### ***Territoriality***

For those residential buildings without any property management organization, they usually have less territorial elements, lower surveillance level and less access control. Such buildings are easily found In Wan Chai District.

Additionally, Wan Chai District is a central hub blending with residential and commercial buildings. Many shops are located on the ground floor or the first two floors of the residential buildings. Residents find it harder to differentiate among the shoppers, potential offenders and real residents, which may reduce the sense of ownership of their buildings. The above development pattern can be easily spotted in the areas near the railway station including Gloucester road, Victoria Park Road, Hennessy Road and Queen Road East etc.

### **Surveillance**

Apart from the large amount of aged residential buildings without CCTV system, in the mid-level area of Stubbs Road, a lot of trees and slopes reduce the visibility of residents to notice strangers in the evening. Moreover, the low living intensity will also decrease public surveillance, which reduces potential offenders' risk and effort in committing crime.

### **Access Control**

Other than the aged lower-class residential buildings, the security services and access control for some traditional upper-class areas such as the residential buildings at Shiu Fai Terrace may also be insufficient. Stranger may easily access to the private residential area.

### **Buildings Image and Mixtures**

In the upper area of Stubbs Road, most residential buildings are luxury mansion with better security services. However, because of the low living density, potential offenders may also easily spot the target.

### **Other Possible Factors Influencing the Burglary Rate in Wan Chai District**

#### ***Economics Characteristics***

Situational Crime Prevention Theory (SCP) stated that criminal behaviors are made on rational choice by five basic elements – risk, effort, reward, provocation, shame and guilt. Environmental factors such as physical barrier, access control and surveillance will increase risk and effort to commit crime, while high reward will encourage criminal behaviors.

Based on Population By-census 2016 (Census and Statistics Department, 2018), the median monthly income from employment (excluding foreign domestic helpers) in Wan Chai District as well as Central and Western District are the highest income districts among all in the territory.

Assuming similar level of risk and effort to commit crime compared to other districts, households with the higher income level may imply higher reward for the burglary and theft behaviors. It may be one of reasons why Wan Chai District and Central District have higher crime rates than other districts.

### Analysis on the Research Result

#### *“Person on the street” Questionnaire*

All questionnaires were conducted in Wan Chai District targeting the residents living in this District. A total number of 30 local people were surveyed through convenience sampling.

The questions are segregated into two categories as follows:

Category A:	Understanding whether the types and districts of residential building where the interviewees lived will affect their perception of burglary and theft rate.
Category B:	Understanding which kind of environmental design factors the interviewees think it is useful in reducing residential burglary and theft rate.

#### **Summary of Category A**

Most interviewees, including those have or never lived in other districts, believed the burglary and theft rates in Wan Chai District were relatively low.

To explain that, firstly, although the burglary and theft rate in Wan Chai District is relatively higher than other districts, Hong Kong is a relatively safe city in general. Hence, the interviewees, who have never lived or who have lived in other districts, would perceive that the crime rates in Wan Chai District were relatively low.

Secondly, while Wan Chai district is recognized as upper-class area with affluent residents, most interviewees thought that Wan Chai Districts would have a higher security level. Some interviewees believed that Yau Tsim Mong, Sham Shui Po, Yuen Long and Tuen Mun had the highest burglary and theft rates with the presence of larger communities of ethnic minorities and public rental estates. This perception may come from the fear of crime. As some media may widely report crime related to ethnic minorities, the public may be affected to link the burglary activities with ethnic minorities and lower-income districts.

#### **Summary of Category B**

All interviewees recognized the effectiveness of crime prevention by environmental design. Amid them, most interviewees believed physical environment settings were more useful in tackling criminal behaviors. Such physical facilities turn out to be easier to be observed from both residents and potential offenders. On one hand, residents may feel safe with the physical settings and have stronger sense of territoriality to protect their own area. On the other hand, the potential offenders may regard the physical settings as a hurdle and hence search for other easier prey.

### Conclusion

#### **Recommendations for Wan Chai District**

In the case study of Wan Chai District, it revealed that gathering of the high-income households, lacking proper property management services, aged residential buildings without crime prevention designs as well as quiet and isolated environment might result in higher burglary and theft rates.

Because of the unique housing and economic characteristics in this district, upgrade in the security and guard services should be the most effective tactics to deter crimes. Moreover, the Crime Prevention Bureau (CPB) from Hong Kong Police Force may also offer crime prevention advice to both public and private in term of environmental design.

### Recommendations for the Whole Territory

According to the case study of the whole tertiary, crime prevention design has rarely promoted by the authorities and private developers. There is also no restrict upon building regulation regarding crime prevention design in construction. Although such designs may be naturally integrated into the new development projects, further actions may be taken in the pre-construction stage to prevent crime.

Proactively, the government may take initiative to integrate crime prevention into urban design or public rental housing design, and promote such concepts to private developers through the CPB. Moreover, taking reference with the U.K., similar accreditation as the Secured by Design (SBD) certificate may be implemented in Hong Kong to encourage crime prevention through environmental design. Additionally, buildings with the official certification may get a discount for the home insurance to increase incentive for the scheme.

### Future Research Agenda

Other than the classical placed-based crime prevention theories, it will be interesting to examine whether other modern crime prevention theories such as Space syntax theory and New urbanism theory can also be applied to the crime condition in Hong Kong, and how new technologies such as Geographic information (mapping) system (GIS) and global positioning system (GPS) help detect crime pattern by analyzing nearby environmental characteristics.

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