

# Categories of Building Violations and Environmental Externalities - Empirical Observation in Taiwan

Pong-Kuang Tseng<sup>1</sup> Che-Ming Chiang<sup>2</sup> Hsueh-Yen Hu<sup>3</sup> Chau-Yau Chen<sup>4</sup>

## Abstract

Despite of the efforts of law regulations in relating to urban planning and building management, building violations is still one of the most important issues in Taiwan. While building violations are resulted from the fall between the “Legal Building Usage” of buildings having obtained legal permits constructed according to the Urban Planning Act, the Building Act, the Building Code and Regulations as well as other relevant laws and regulations and the “Reasonable Building Usage” according to the characteristics of personal demands of users based on their own viewpoints. This study hopes to analyze the fall between the “Legal Building Usage” from the aspect of regulatory normalization and the “Reasonable Building Usage” from the aspect of the users through the theories of externality so as to discuss how to consider the demands of the users from the aspect of laws and regulations and to propose appropriate strategies for building management.

We select Tainan City, the fourth largest city in Taiwan, as empirical case to classify the investigation data of building violations in past years by time (building violations of early years and new building violations) and space (areas of early development and newly developed areas) for comparison and analysis on the features and impacts of different building violations, to analyze and review the rationality of the normalization of current laws and regulations on building management for building space through questionnaire investigation on the demands of the residents for usage space, to propose appropriate and reasonable suggestions on strategies of building management through the integration of the concept of reasonably building usage and the concept of legal building usage, and finally, to build the Hedonic Price Model with the Hedonic Price Method to compare and analyze actual effects resulted from different building management strategies taken by governmental agencies so as to propose appropriate and reasonable solutions for the future.

**Keywords:** Building violations, Environmental Externality, Hedonic Price, Taiwan

<sup>1</sup> Ph.D. Candidate, Dept. of Architecture, National Cheng Kung University, Taiwan

<sup>2</sup> Professor, Dept. of Architecture, National Cheng Kung University, Taiwan

<sup>3</sup> Associate Professor, Dept. of Real Estate Management, Kun Shan University, Taiwan

<sup>4</sup> Assistant Professor, Dept. of Real Estate Management, Kun Shan University, Taiwan

## **I. Introduction**

Possible problems about building management in urban areas mainly include building violations and usage violations, which is also one of the key subjects for the building authorities on building management. The so-called building violations mean all buildings constructed within areas carrying out urban planning, urban regional planning or areas applicable to the Construction Act designated by the Ministry of the Interior without receiving examination carried out by and the building permit issued by the building authorities. Said usage violations mean all applications in legal buildings violating the urban planning or non-urban land use control regulations in terms of natures or categories of usage.

However, as for the situation that building violations still generally exist though there have been urban planning and building management codes in Taiwan at present, the cause may be the fall between “Legal Building Usage” and “Reasonable Building Usage”. Said “legal building usage” means buildings are legally constructed according to the Urban Planning Act, the Construction Act and the Building Code and Regulations, etc. and have obtained legal permits. While said “reasonable building usage” means the space of usage of buildings are provided according to the personal demands and the natures of the buildings based on the viewpoints of the users. Should there be a consistent reorganization on both concepts, theoretically, there should be no building violations. However, the actual existence of building violations shows that the fall of a certain degree does lie between the both.

Therefore, the purpose of this study is to, through the analysis of externality, discuss how to propose appropriate management strategies according to the demands of the users from the aspect of laws and regulations according to the fall between the “legal usage of buildings” stipulated by laws and regulations and the “reasonable usage of buildings” from the aspect of the users. This study also tries to take Tainan City as the object to find out the fall between the legal usage of buildings and the reasonable usage of buildings through the data of building violations reports and the questionnaires on the characteristics of the demands of the residents for the usage of building spaces so as to educe proper and reasonable building management strategies and to explain the expected benefits of relevant strategies from the analysis on the externality.

Part I of the article is the Introduction; Part II probes into externality theories and documents relating to building violations; Part III analyzes features of urban building violations in Taiwan and their externality according to materials on the investigation of building violations in Tainan City during 1984~2007; Part IV analyzes the features and demands of the building spaces of urban residents in Taiwan through data of interviews with building violators; Part V discusses the building violation externality by integrating the features of existing building violations with the demands of users and proposes relevant strategies; and the conclusions of the article and relevant suggestions are made in the end.

## **II. Externality theories and documents relating to building violations**

Most documents on building violations adopt the legal and administrative aspects while few of them take the externality for the generation of building violations for discussion. Now let's discuss the externality and relevant documents:

## 2.1. Externality theories:

According to Rosen's definition (1998), "externality" means the effect generated when the behaviors of a unit (enterprise or individual) directly influence the benefits of another unit (enterprise or individual) by means of non-market price delivery, which has the following features: 1) Externality can be generated by consumers or manufacturers. 2) Externality has a symmetrical feature in nature. 3) Externality can be positive or negative.

Theoretically, building violations will inevitably produce some externality to the environment, said externality means that people cannot enjoy part of the benefits from their building (economic) behaviors or need not to assume part of the costs. However, as for the External Costs of building violations, e.g., infringement of the safety of neighboring buildings or rights and interests of public and private land or damage of urban landscape, etc.

Causes of the eternal costs of building violations are shown in Fig. 1; we can see that for external costs, PMC represents the marginal costs borne by building violators, SMC represents the marginal social costs resulted in building violations, which are seldom counted as social costs, so the social marginal costs are higher than private marginal costs, as for private profit, the max. building capacity should be  $Q_1$ , when this is not considered, the social welfare  $\triangle abc$  will be lost. As the max development capacity of social welfare should be  $Q^*$ , if the developer fails to consider the social costs for the development, the developer's excessive development may result in negative externality, which may cause the social welfare  $\triangle abc$  produced by the whole society be lost.

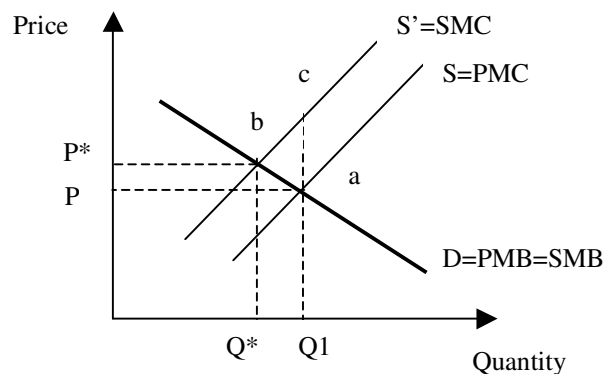


Fig. 1 External costs of building violations

Measures for solving the externality generally include: (1) "Definition of property rights", i.e., reducing the transaction costs due to property rights during transactions and the uncertainty of human interactions so as to achieve more efficient utilization of resources. (2) "Internalization of external costs", i.e., levying tax on developers with behaviors resulting in external costs, subsidizing those providing external benefits and making the developers bear the effects of the externality due to building violations; this tax is also called the "Pigouvian Tax". (3) "Direct involvement of government", i.e., regulating the social responsibilities on building violations through direct involvement of the government in the planning of regulation of the market as well as the establishment of relevant laws and regulations so as to make social resources fairer and more efficient.

## 2.2. Types of building violations of relevant documents

In the discussion of Kuen-Tsing Shieh (2006) on building violations in Kaohsiung City, Taiwan, he proposed his viewpoints on the causes of building

violations from aspect of law, society, economy and administration. Targeting at the treatment modes of building violations in Taiwan, Ting-Yi Lin (2005) pointed out in his study that, there are 6 main causes why building violations cannot be eradicated, including: Insufficient awareness of laws and regulations on construction of the people; Most people still have the mind of fluke or illegal lobby of elected representatives; Inability of existing laws and regulations to thoroughly and effectively punish building violations; The lack of outlays and manpower, failure of implementation of bans; Most citizens of Taipei believe that the existence of building violations will influence the rights of citizens and the overall residential environments; There's still flexible space left by authorities of Taipei City Government for the treatment of building violations. Hung, Tsun-Shan (2002) pointed out 5 points in his study including the treatment modes of building violations that the influence of building violations on residential quality and safety includes, he also provided 8 recommended modes for treatment of building violations including bidding for compulsory dismantlement, etc. Chiu, Hung-Che (2001) has proposed policies for treatment of building violations and divided them into two types of "Instructive" and "Banning".

### **III. Analysis on features of urban building violations in Taiwan and their externality**

Taiwan's building violations are mainly resulted from two aspects: first, the laws and regulations on construction may be too strict to allow users to get sufficient building area while complying with the existing laws and regulations; Second, there're problems in the mentality of users, because the government failed to carry out dismantlement or punishment on building violations, which provided the people with the mentality of speculation and building violations more generalized and aggravated.

In order to find out the features and possible environmental externality of urban building violations in Taiwan at present, this article is to analyze the features of building violations through data on the investigation of urban building violations in Taiwan and tries to discuss the externality relevance of building violations through the analysis on the locations and types of building violations.

#### **3.1. Existing laws and regulations on building violations in Taiwan**

Existing laws and regulations on building violations in Taiwan include relevant central laws and local regulations or banning measures against building violations taken by local governments according to local characteristics and related demands.

"Building violations" should mean buildings constructed or used within the area for implementation of urban plans or the Construction Act without obtaining building permits or use permits issued by authorities of corresponding municipalities, counties (cities) (bureaus), whether public or private, construction, alteration or dismantlement, part of or the entire project.

Classification by type of building violations: 1) All building violations; 2) Building violations of interlayer; 3) Building violations of legal clearance; 4) Building violations of terraces; 5) Building violations of terraces; 6) Building violations of fire barriers or fire passages; 7) Building violations of attic platforms; 8) Building violations of bouncing walls; 9) Building violations of dooryards; 10) Building

violations of arcades or sidewalks without penthouses; 11) Illegal light absorbing shades; 12) Illegal sunshades; 13) Illegal booths; 14) Illegal advertising; 15) Illegal pigeonries.

### 3.2. Analysis on basic data of urban building violations in Taiwan

This article adopts Tainan City, Taiwan as the object for case study and is based on statistical analysis on data of building violations investigated and reviewed during 1984~2007 provided by Construction Management Section of Tainan City Public Works Department, in this study, essential statistics analysis is carried out by the distribution characteristics of time and space and discussion on the locations and types of building violations is also carried out.

#### (1) Analysis on quantity of building violations investigated and reviewed in Tainan City reported during 1984~2007:

From the data shown in Table 1, during 1984~2007, there were altogether 19970 building violations investigated in Tainan City. From the annual statistics of building violations in Tainan City, there was a peak in 1989 and another peak after 1998, according to analysis, 1989 was just a peak period of the real estate industry in Taiwan, while when Taiwan announced to carry out full-scale capacity control in 1997, the area of structural flooring before and after the implementation of the capacity control, which further aggravated the phenomenon of building violation.

Table 1 Analysis on the quantity of building violations in Tainan City reported during 1984~2007

| Year | Number of building violations (A) | %    | Number of use permits issued (B) | (A) / (B) |
|------|-----------------------------------|------|----------------------------------|-----------|
| 1984 | 654                               | 3.3  | 6138                             | 0.107     |
| 1985 | 735                               | 3.7  | 6520                             | 0.113     |
| 1986 | 595                               | 3.0  | 5984                             | 0.099     |
| 1987 | 564                               | 2.8  | 5765                             | 0.098     |
| 1988 | 489                               | 2.4  | 5931                             | 0.082     |
| 1989 | 818                               | 4.1  | 5394                             | 0.152     |
| 1990 | 659                               | 3.3  | 7134                             | 0.092     |
| 1991 | 492                               | 2.5  | 7158                             | 0.069     |
| 1992 | 476                               | 2.4  | 7479                             | 0.064     |
| 1993 | 651                               | 3.3  | 6899                             | 0.094     |
| 1994 | 627                               | 3.1  | 14083                            | 0.045     |
| 1995 | 654                               | 3.3  | 13823                            | 0.047     |
| 1996 | 553                               | 2.8  | 7955                             | 0.070     |
| 1997 | 602                               | 3.0  | 5995                             | 0.100     |
| 1998 | 949                               | 4.8  | 6908                             | 0.137     |
| 1999 | 1141                              | 5.7  | 8835                             | 0.129     |
| 2000 | 1210                              | 6.1  | 6028                             | 0.201     |
| 2001 | 839                               | 4.2  | 2237                             | 0.375     |
| 2002 | 925                               | 4.6  | 4407                             | 0.210     |
| 2003 | 1225                              | 6.1  | 3493                             | 0.351     |
| 2004 | 2081                              | 10.4 | 4811                             | 0.433     |
| 2005 | 1435                              | 7.2  | 4156                             | 0.345     |
| 2006 | 877                               | 4.4  | 5491                             | 0.160     |

|      |     |     |      |       |
|------|-----|-----|------|-------|
| 2007 | 719 | 3.6 | 5393 | 0.133 |
|------|-----|-----|------|-------|

Note: (A) / (B) is called the building violation index, i.e., the ratio of the number of use permits issued to that of building violations.

(2) Analysis on the features of building violations investigated and reviewed in different districts in Tainan City reported during 1984~2007:

From the data in Table 2, “Private land” takes up the highest percentage of locations of building violations in Tainan City reported during 1984~2007, while that of “Public land”, “Occupied roads” and “Arcade Land” have little difference. This indicates that building violations have comparatively small impact on public rights and interests.

Additionally, in all types of building violations in Tainan City reported during 1984~2007, “building violations of legal clearance” takes the highest percentage, “Illegal advertising”, “All building violations” and “Building violations of roofing” follow. Where, “Illegal advertising” takes up a high percentage, the cause is that Tainan City government took the measure to ban bamboo and wood scaffolding stand advertisements in 2004.

Table 2 Statistical analysis on building violations in Tainan City reported during 1984~2007 by location and type

| Item             | Location |      | Item                               | Type  |      |
|------------------|----------|------|------------------------------------|-------|------|
|                  | Qty      | %    |                                    | Qty   | %    |
| Public land      | 497      | 2.5  | Building violations of legal space | 11215 | 56.2 |
| Occupied roads   | 591      | 3.0  | All building violations            | 2109  | 10.6 |
| Private land     | 16833    | 84.3 | Building violations of roofing     | 1853  | 9.3  |
| Land for arcades | 807      | 4.0  | Illegal advertising                | 3063  | 15.3 |
| Other            | 1242     | 6.2  | Other                              | 1730  | 8.7  |

### 3.3. Analysis on the externality factors of the forming of building violations

Impacts of the externality of building violations may include aspects like safety (life and property), urban landscape, public and private rights infringement, etc. However, possible impacts will be relevant to the “locations” and “types” of building violations.

(1) Classification of building violations by “location”

In term of “position”, the externality of building violations includes:

- a. Public land: Public land being occupied by building violations without treatment, which results in insufficient public power, stimulated illegal behaviors of people and influence the public trust of law enforcement of government. This should be solved by legal means in the future.
- b. Occupied roads: basically infringe public right of passage, influence the

safety of pedestrians and vehicles, causing traffic accidents and results in direct external costs.

- c. Private land: for land of the others, it will influence the land use right of the others, which should be solved by legal means. For self-owned land, the possible externality should be discussed according to the types of building violations.
- d. Arcade land: basically, arcade land is for public passage, which is similar to the function of roads, the externality impact of building violations occupying arcade land is the same like to that of building violations of roads.

Violation of self-owned land or land belonging to others should be treated according to law. Different impacts of externality due to different “locations” of building violations and externality are listed in Table 3, whether the impact on public safety is the most serious. Besides, urban physical environment, which has received increasing attention, is also listed in considerations of externality.

Table 3 Analysis on locations of building violations and externality

| Location       | Impact of externality | Impact on public safety | Impact on urban landscape | Infringement of rights of others | Urban physical environment |
|----------------|-----------------------|-------------------------|---------------------------|----------------------------------|----------------------------|
| Public land    |                       | ●                       | ○                         | ●                                | ○                          |
| Occupied roads |                       | ●                       | ○                         | ●                                | ○                          |
| Private land   |                       | ●                       | ●                         | ○                                | ●                          |
| Arcade land    |                       | ●                       | ○                         | ●                                | ○                          |

Note: ●—Serious; ○—Average

## (2) Classified by “type” of building violations

Discussing the externality of building violations in term of “type”, there’s distinct relationship with locations of building violations. However, for further discuss on the impacts of externality, we should consider “locations” and “types” of building violations comprehensively as shown in Table 4. Different “locations” and “types” of building violations have different impacts of externality, therefore, different countermeasures against building violations externality should be considered in the future.

Table 4 Analysis on the relationship between “locations” and “types” of building violations and the impacts of externality

| Type                               | Location | Public land | Occupied roads | Private land | Arcade land |
|------------------------------------|----------|-------------|----------------|--------------|-------------|
| Building violations of legal space |          |             |                | ●★■          | ●★◆         |
| All building violations            |          | ●★◆         | ●★◆            | ●★■          | ●★◆         |

|                                |     |     |     |    |
|--------------------------------|-----|-----|-----|----|
| Building violations of roofing |     |     | ●★■ |    |
| Illegal advertising            | ●★◆ | ●★◆ | ●★◆ | ★◆ |

Note: ●: Impact on public safety, ★: Impact on urban landscape, ◆: Impact on rights and interests of others, ■: Impact on urban physical environment.

#### IV. Analysis on the features of the usage of building space by urban residents in Taiwan

In order to the features of the usage of building space by urban residents so as to explore the opinion of the users for “reasonable usage of buildings” and probe into possible causes for different types of building violations, this article analyzes the demands of users by collecting data on building violators surveyed by means of questionnaires on data of building violations investigated and reviewed. Moreover, in order to find out the externality of building violations, questionnaires have also been handed out to neighbors of building violators so as to collect data on the impact on physical environment of buildings.

##### 4.1. Questionnaire

In order to fully compare the differences in the demands of building violators before and after full implementation of the capacity control, this study adopts the 8,304 building violators investigated in Tainan City in the 5 years (1992~2002) before and after the implementation of the capacity control (1997) as the targets and carry out sampling with the cooperation of registered households in different administrative districts, with the sampling rate of 3%, it has been estimated that 250 building violators would be sampled. However, due to the sensitive content of the questionnaire and the particularity of respondents, a high reject rate has occurred during our door to door survey, after repeated sampling continuously, altogether 2,716 replied have been received, which is less than 1/3 of all targets, including only 172 households as valid samples.

As for the questionnaire survey for impact of building environment on neighbors of building violators, one household was randomly sampled in the neighborhood of each building violator willing to receive the survey, therefore, respondents of the survey on neighbors of building violators were also 172. The questionnaire survey was carried out in the door-to-door mode during Jul and Sep of 2008.

##### 4.2. Results analysis

###### (1) Analysis on results of the questionnaire survey on building violators

Altogether 172 building violators were surveyed and the results are as follows.

###### a. Basic data of respondents

Basic data of building violators surveyed are shown in Table 5. The respondents are during the age span of 41~60, mainly with the education background of junior or senior high school, most of them are commercial



operators with the monthly income of below NT\$ 40,000, families with 3~5 members take up a high proportion.

Table 5 Basic data of building violators surveyed

| Basic Data of Building Violators Surveyed |   |
|---|---|
| Age                                       | Below 30 (15, 8.7%); 31~40 (37, 21.5%); 41~50 (65, 37.8%); 51~60 (40, 23.3%); Above 60 (16, 8.7%)   |
| Education                                 | Elementary School (16, 9.3%); Junior High School (43, 25%); (Vocational) High School (62, 36%); College (28, 16.5%); University (22, 12.8%); Master & doctor's degree (2, 1.2%)   |
| Occupation                                | Servicemen, civil servants, teachers (5, 2.9%); Industry (19, 11.04%); Commerce (82, 47.67%); Agriculture, forestry, fishing, stock raising (2, 1.2%); Freelance (25, 14.5%); Housewife (30, 17.4%); Retired (13, 7.6%); Unemployed (3, 1.7%) |
| Monthly Income                            | Below NT\$ 20,000 (55, 32%); NT\$ 20,000~40,000(69, 40.01%); NT\$ 40,000~60,000 (34, 19.8%); NT\$ 60,000~80,000 (7, 4.1%); NT\$ 80,000~100,000 (3, 1.74%); Above NT\$ 100,000 (3, 1.74%)  |
| Number of family members                  | 1(2, 1.2%); 2(12, 7%); 3(30, 17.4%); 4(41, 23.8%); 5(56, 32.6%); 6(17, 9.9%); 7(6, 3.5%); 8(1, 0.6%); 9(2, 1.2%); 10(3, 1.7%); 11(1, 0.6%)  |

Note 1: The first value in the bracket indicates the times of samples and the second value indicates the percentage.

Source: Investigation data of this study

#### b. General survey of real properties of respondents

Most of all building violators surveyed have land and buildings under their own ownership (about 70%, see Table 6), with the land of building of about 36~99m<sup>2</sup>, most of them have the structural area of 69-198 m<sup>2</sup>, etc.. In term of building structure, most of their buildings are 1-store~4-store buildings, most are with 3~4 bedrooms, 2 halls, 2~3 bathrooms, 0~1 terrace and 0~1 parking space (See Table 7).

Table 6 Land and building title and area of building violators surveyed

| Land title                              | Times | %      | Building title                          | Times | %      |
|---|-------|--------|---|-------|--------|
| Privately-owned                         | 123   | 71.51  | Privately-owned                         | 120   | 69.77  |
| Tenanted                                | 49    | 28.49  | Tenanted                                | 52    | 30.23  |
| Total                                   | 172   | 100.00 | Total                                   | 172   | 100.00 |
| Land acreage (unit: 3.3m <sup>2</sup> ) | Times | %      | Land acreage (unit: 3.3m <sup>2</sup> ) | Times | %      |
| Below 10                                | 7     | 4.07   | Below 20                                | 1     | 0.58   |
| 11~20                                   | 19    | 11.05  | 21~40                                   | 22    | 12.79  |
| 21~30                                   | 51    | 29.65  | 41~60                                   | 16    | 9.30   |
| 31~40                                   | 12    | 6.98   | 61~80                                   | 10    | 5.81   |
| 41~50                                   | 8     | 4.65   | 81~100                                  | 11    | 6.40   |
| Over 50                                 | 5     | 2.91   | Over 101                                | 17    | 8.14   |
| Subtotal                                | 102   | 59.30  | Subtotal                                | 77    | 44.77  |
| Missing value                           | 70    | 40.70  | Missing value                           | 95    | 55.23  |
| Total                                   | 172   | 100.00 | Total                                   | 172   | 100.00 |

Source: Investigation data of this study

Table 7 Overview of building spaces of building violators surveyed

| Item<br>Number | Stories |        | Bedrooms |       | Halls |        |
|----------------|---------|--------|----------|-------|-------|--------|
|                | Times   | %      | Times    | %     | Times | %      |
| 0              | 0       | 0      | 17       | 9.88  | 24    | 13.95  |
| 1              | 31      | 18.02  | 7        | 4.07  | 38    | 22.09  |
| 2              | 32      | 18.60  | 19       | 11.05 | 103   | 59.88  |
| 3              | 40      | 23.26  | 40       | 23.26 | 5     | 2.91   |
| 4              | 43      | 25.00  | 47       | 27.33 | 1     | 0.58   |
| 5              | 16      | 9.30   | 19       | 11.05 | 0     | 0      |
| 6~12           | 6       | 3.48   | 22       | 12.78 | 0     | 0      |
| Missing Value  | 4       | 2.33   | 1        | 0.58  | 1     | 0.58   |
| Total          | 172     | 100.00 | 172      | 100   | 172   | 100.00 |

| Item<br>Number | Bathroom |        | Terrace |       | Parking space |        |
|----------------|----------|--------|---------|-------|---------------|--------|
|                | Times    | %      | Times   | %     | Times         | %      |
| 0              | 10       | 5.81   | 86      | 50    | 108           | 62.79  |
| 1              | 32       | 18.60  | 49      | 28.49 | 53            | 30.81  |
| 2              | 55       | 31.98  | 16      | 9.30  | 9             | 5.23   |
| 3              | 42       | 24.42  | 12      | 6.98  | 1             | 0.58   |
| 4              | 19       | 11.05  | 5       | 2.91  | 0             | 0      |
| 5              | 7        | 4.07   | 2       | 1.16  | 0             | 0      |
| 6~12           | 6        | 3.48   | 1       | 0.58  | 0             | 0      |
| Missing Value  | 1        | 0.58   | 1       | 0.58  | 1             | 0.58   |
| Total          | 172      | 100.00 | 172     | 100   | 172           | 100.00 |

Source: Investigation data of this study

In term of parking problem in urban area, over 60% of building violators surveyed have no parking spaces, 30% have only one parking space each, according to our investigation, the car ownership rate in Tainan City as of the end of 2007 was about 245 cars/1000 persons, or about 0.73 car/household, therefore, the parking spaces of most building violators are highly insufficient, which may cause building violations or traffic problems like occupation of roads or parking violations, etc.

c. Analysis on the places of building violation of building violators surveyed

The locations and places of building violators surveyed are respectively shown in Table 8 and Table 9. In term of location, most of building violations are of privately-owned land (about 90%), in term of places, legal space (about 50%) and roofing (about 34%) are leading.

Causes for building violations of building violators surveyed are shown in Table 10. The cause checked the most by respondents is “Insufficient Space” (about 40%), “Unawareness of laws and regulations” follows (about 25%), near 25% have checked “others”, which, in detail, mainly include “existing building violations due to former owners” and “existing building violations in houses tenanted”, etc.. From the fact that about 40% building violators surveyed have reflected “Insufficient Space” as the main cause, we can see that the building spaces of existing design of buildings are obviously incapable of meeting the demands of users. The weighted average on the basis of the statistical data of land acreage for buildings of

building violators surveyed (See Table 6) is about 86m<sup>2</sup>/household, according to the members per household shown in Table 5, it is estimated that in average, there're about 4.5 members in each household, if we calculate by the average capacity rate of 200%, the average living space for each person is about 38 m<sup>2</sup>, which was slightly lower than the living space standard of 50 m<sup>2</sup> of urban planning. This may be one of the main causes of building violations due to insufficient spaces of building violators.

Table 8 Locations of building violation

| Location       | Times | %      |
|----------------|-------|--------|
| Private land   | 155   | 90.12  |
| Public land    | 3     | 1.74   |
| Arcade land    | 6     | 3.49   |
| Occupied roads | 6     | 3.49   |
| Other          | 2     | 1.16   |
| Total          | 172   | 100.00 |

Source: Investigation data of this study

Table 9 Places of building violation

| Place                  | Times | %      |
|------------------------|-------|--------|
| Legal space            | 87    | 50.58  |
| Roofing                | 59    | 34.30  |
| Dooryard               | 2     | 1.16   |
| Light adsorbing shades | 1     | 0.58   |
| Bounding walls         | 10    | 5.81   |
| Sunshades              | 3     | 1.74   |
| All violations         | 3     | 1.74   |
| Stand advertisements   | 7     | 4.07   |
| Interlayer             | 1     | 0.58   |
| Terraces               | 9     | 5.23   |
| Pigeonries             | 1     | 0.58   |
| Total                  | 183   | 100.00 |

Source: Investigation data of this study

Table 10 Causes of building violations

| Cause                               | Times | %      |
|-------------------------------------|-------|--------|
| Too strict laws and regulations     | 22    | 12.79  |
| Insufficient space                  | 68    | 39.53  |
| Unawareness of laws and regulations | 44    | 25.58  |
| Expensive land                      | 32    | 18.60  |
| Not dismantled by the government    | 8     | 4.65   |
| Others                              | 42    | 24.42  |
| Total                               | 216   | 100.00 |

Source: Investigation data of this study

#### d. Analysis on the satisfaction for building spaces

Results of the survey on the satisfaction of respondents for the building spaces are shown in Table 11. In term of the usage and acreage of the overall building, about 1/4 (slightly lower) of all building violators surveyed have been unsatisfied. In term of specific building spaces, including the usage, acreage and quantity of rooms, parking spaces and kitchens, over 1/4 of all building violators surveyed have been unsatisfied, which shows a general trend of dissatisfaction of building violators surveyed for those spaces, which then resulted in building violations, such as building violation of the roofing, extension of rooms in quantity and acreage, violation of the legal spaces as well as extension of parking

spaces and kitchen in acreage, etc..

The weighted average of the number of bedrooms per building violator is 3.4 according to the number of bedrooms shown in Table 7, and according to the average number of family members of 4.5 in the family of each building violator as mentioned above, each person holds only about 0.75 bedroom in average, which may easily result in building violations.

In term of satisfaction for parking spaces, each household in Tainan city owns 0.73 car in average, about 1 car per household, from the cross analysis of the quantity of parking spaces and the satisfaction for parking spaces in Table 12 we can see that 48 building violators surveyed are unsatisfied, near 65% (31) are families without cars, the other 35% (17) have 1 parking space each. This shows that in term of the economic capacity of residents in Tainan City, it is general that each household owns 1 car, however, due to the expensive land price, the land acreage of each building unit is too small, it is hard to design sufficient parking spaces, which therefore leads to the problem of utilizing legal spaces as parking spaces.

Table 11 Satisfaction of building violators surveyed for spaces

| Item                  | Satisfied |       | Average |       | Unsatisfied |       |
|-----------------------|-----------|-------|---------|-------|-------------|-------|
|                       | Times     | %     | Times   | %     | Times       | %     |
| Overall Usage         | 50        | 29.07 | 84      | 48.84 | 39          | 22.64 |
| Overall Acreage       | 45        | 26.16 | 85      | 49.42 | 41          | 23.84 |
| Room Usage            | 49        | 28.49 | 79      | 45.93 | 44          | 25.58 |
| Room Acreage          | 45        | 26.16 | 85      | 49.42 | 45          | 26.16 |
| No. of Rooms          | 45        | 26.16 | 81      | 47.09 | 47          | 27.33 |
| Bathroom Usage        | 42        | 24.42 | 96      | 55.81 | 33          | 19.19 |
| Bathroom Acreage      | 39        | 22.67 | 96      | 55.81 | 35          | 20.35 |
| No. of Bathrooms      | 43        | 25    | 92      | 53.49 | 37          | 21.51 |
| Parking Space Usage   | 20        | 11.63 | 86      | 50    | 44          | 25.58 |
| Parking Space Acreage | 20        | 11.63 | 85      | 49.42 | 45          | 26.16 |
| No. of Parking Spaces | 20        | 11.63 | 83      | 48.26 | 48          | 27.91 |
| Parlor Usage          | 34        | 19.77 | 118     | 68.64 | 19          | 11.05 |
| Parlor Acreage        | 33        | 19.19 | 116     | 67.44 | 22          | 12.79 |
| No. of Parlor s       | 32        | 18.6  | 123     | 71.51 | 16          | 9.3   |
| Kitchen Usage         | 30        | 17.44 | 95      | 55.23 | 46          | 27.74 |
| Kitchen Acreage       | 30        | 17.44 | 92      | 53.49 | 49          | 28.49 |
| Dining Hall Usage     | 24        | 13.95 | 124     | 72.09 | 16          | 9.3   |
| Dining Hall Acreage   | 22        | 12.79 | 128     | 74.41 | 14          | 8.14  |
| No. of Dining Halls   | 21        | 12.21 | 127     | 73.83 | 16          | 9.3   |

Source: Investigation data of this study

Table 12 Cross analysis for number of parking spaces and satisfaction for parking spaces

| Number | Satisfaction for Parking Spaces |         |             |
|--------|---------------------------------|---------|-------------|
|        | Satisfied                       | Average | Unsatisfied |
| 0      | 4                               | 53      | 31          |
| 1      | 9                               | 27      | 17          |

|   |   |   |   |
|---|---|---|---|
| 2 | 6 | 3 | 0 |
| 3 | 1 | 0 | 0 |

Note: values in the table above indicate Times

e. Comparison of building violations before and after capacity control

The full implementation of capacity control of Taiwan in 1997 has restricted the floorage of landowners, has this policy impacted the behaviors of space usage and building violations of people? It is a topic worth discussing. To find out the difference between the status of space usage and building violations of people before and after capacity control, this article has divided samples of building violators into those whose building violations are investigated before the implementation of capacity control (before 1996) and those whose building violations are investigated after the implementation of capacity control (after 1997) so as to probe into the difference between the causes and places of their building violations.

Table 13 is a comparison between the causes and places of building violations before and after the capacity control. It is known by  $\chi^2$  determination that at the significance level  $\alpha = 0.1$ , indistinctive null hypothesis cannot be refused, therefore, in term of places of violations of building violators surveyed, there's no distinct difference before and after the capacity control. In term of causes of violations, It is also known by  $\chi^2$  determination that at the significance level  $\alpha = 0.1$ , indistinctive null hypothesis can be refused, which indicates that there may be difference in the distribution of times and causes of building violations before and after the capacity control. After determination, it is found that the main differences between the both are "Unawareness of laws and regulations" and "Others", after the implementation of capacity control, the proportions of both causes have increased distinctively, however, it is not in accordance with the expected causes of "Insufficient space" or "Expensive land" due to reduction of the building floorage after the implementation of capacity control.

Table 13 Comparison between the causes and places of building violations before and after the capacity control

| Item                 | Before | After | Item                                | Before | After |
|----------------------|--------|-------|-------------------------------------|--------|-------|
| Legal space          | 32     | 43    | Too strict laws and regulations     | 30     | 32    |
| Roofing              | 22     | 30    | Insufficient space                  | 9      | 12    |
| All violations       | 2      | 1     | Unawareness of laws and regulations | 15     | 28    |
| Stand advertisements | 0      | 7     | Expensive land                      | 15     | 16    |
| Other                | 9      | 19    | Not dismantled by the government    | 5      | 3     |
| Totals               | 65     | 93    | Others                              | 8      | 25    |
| $\chi^2$             | 7.3459 |       | Total                               | 82     | 93    |

|  |          |          |
|--|----------|----------|
|  | $\chi^2$ | 10.2617* |
|--|----------|----------|

Note: values in the table indicate the times checked; "\*\*\*" indicates that at the significance level  $\alpha = 0.1$ , indistinctive null hypothesis is refused

(2) Analysis on the results of the questionnaire survey on neighbors of building violators

Altogether 172 neighbors of building violators have been surveyed in this study, the purpose is mainly to learn their opinions on the impact of building violators on physical environments of buildings, the results are shown below.

a. Basic data of respondents

Basic data of neighbors of building violators surveyed are shown in Table 14. The respondents are during the age span of 41~60, mainly with the education background of junior or senior high school, most of them are commercial operators with the monthly income of below NT\$ 40,000, families with 4~5 members take up a high proportion.

b. Analysis on the impact of building violators on physical environments of buildings

The survey is carried out on neighbors of building violators to learn their opinions on the impact of building violators on physical environments of building (See Table 15) including: public safety, urban landscape, rights and interests of the others, sound environment, light environment, thermal environment, air environment, water environment, green environment, vibration environment and electromagnetic environment, etc.. When asked on the impact of building violators on various environments, many respondents considered that the impact is great on "public safety", "urban landscape" and "rights and interests of the others", with over 40% having checked "Impacted"; in term of physical environments of relevant buildings, it is possible that some people are not so sensitive to the change in physical environments of relevant buildings, the proportion of respondents checking "Not Impacted" is higher than that of those checking "Impacted".

Table 14 Basic data of neighbors of building violators surveyed

| Basic Data of Neighbors of Building Violators Surveyed |  |
|--|--|
| Age  | Below 30 (23, 13.37%); 31~40 (34, 19.76%); 41~50 (73, 42.44%); 51~60 (36, 20.96%); Above 60 (6, 3.48%)   |
| Education  | Elementary School (10, 5.81%); Junior High School (44, 25.58%); (Vocational) High School (70, 40.69%); College (24, 13.95%); University (22, 12.79%); Master & doctor's degree (2, 1.16%)  |
| Occupation   | Servicemen, civil servants, teachers (8, 4.65%); Industry (19, 11.04%); Commerce (82, 47.67%); Agriculture, forestry, fishing, stock raising (0, 0%); Freelance (20, 11.62%); Housewife (26, 15.11%); Retired (10, 5.81%); Unemployed (6, 3.48%) |
| Monthly Income   | Below NT\$ 20,000(52, 30.23%); NT\$ 20,000~40,000 (87, 50.28%); NT\$ 40,000~60,000 (23, 23.37%); NT\$ 60,000~80,000 (5, 2.9%);   |

NT\$ 80,000~100,000 (3, 1.74%); Above NT\$ 100,000 (2, 1.16%)

Number of family members 1(1, 0.58%); 2(8, 4.65%); 3(21, 12.21%); 4(59, 34.3%); 5(55, 31.98%); 6(22, 12.79%); 7(2, 1.16%); 8(2, 1.16%); 9(1, 0.58%); Above 10 (1, 0.58%)

Note 1: the first value in the bracket indicates the times of samples and the second value indicates the percentage.

Table 15 Analysis on the severity of the impact of building violations on relevant environments

| Item                               | Impacted |       | No comment |       | Not Impacted |       |
|------------------------------------|----------|-------|------------|-------|--------------|-------|
|                                    | Times    | %     | Times      | %     | Times        | %     |
| Public safety                      | 84       | 48.84 | 47         | 27.33 | 41           | 23.84 |
| Urban landscape                    | 76       | 44.19 | 47         | 27.33 | 49           | 28.49 |
| Rights and interests of the others | 69       | 40.12 | 60         | 34.88 | 41           | 23.84 |
| Sound Environment                  | 42       | 24.42 | 69         | 40.12 | 61           | 35.47 |
| Light Environment                  | 47       | 27.33 | 61         | 35.47 | 64           | 37.21 |
| Thermal Environment                | 53       | 30.81 | 53         | 30.81 | 66           | 38.37 |
| Air Environment                    | 54       | 31.40 | 54         | 31.40 | 64           | 37.21 |
| Water Environment                  | 44       | 25.58 | 62         | 36.05 | 66           | 38.37 |
| Green Environment                  | 42       | 24.42 | 69         | 40.12 | 61           | 35.47 |
| Vibration Environment              | 32       | 18.60 | 64         | 35.47 | 80           | 46.51 |
| Electromagnetic Environment        | 34       | 19.77 | 64         | 37.21 | 77           | 44.77 |

Source: Investigation data of this study

## V. Analysis on Strategies of the management of building violations externality

### 5.1. Strategies of the management of building violations externality

As for solutions of externality problems, different measures should be taken according to different subject factors of externality, comparison of objects to levy on, objective of levy and standard of levy from different aspects is shown in Table 16. Basic concepts include “paid by users”, “paid by beneficiaries”, “growth payment”, “return of added value” and “special common levies”, etc. Objectives of levy adopted include internalization of external costs, recycling of facility costs, reducing development impacts and levying on gains from alteration without pains. Those should also be applied to the actual strategies on land development, including Burden of redeemed land in urban land readjustment, Impact fee for non-urban land development and air pollution prevention fees, etc.

Table 16 Comparison of concepts on the treatment of relevant fees and taxes of externality

| Basic concept | Objects to levy on        | Objective of levy  | Standard of levy           | Application cases                                  |
|---------------|---------------------------|--|----------------------------|--|
| Paid by users | Direct user of facilities | Internalization of external costs<br>Recycling of facility costs | User behavior as the index | Burden of redeemed land in urban land readjustment |

| Paid by beneficiaries | Beneficiaries of facilities                                    | Internalization of external costs<br>Recycling of facility costs  | Based on the degree of benefit   | Project benefited-user charge             |
|-----------------------|--|---|--|---|
| Growth payment        | Developer or modifier  | Internalization of external costs, reducing impact of development | Based on the degree of impact of development or alteration   | Impact fee for non-urban land development |
| Return of added value | Owner of altered land  | Levying on gains from alteration without pain                     | Certain proportion after deducting necessary costs for alteration and development from the added value | Land value increment tax                  |
| Special common levies | Personnel whose specific behavior causing negative externality | Internalization of negative externality                           | Based on the degree of negative externality impact   | Air pollution prevention fee              |

Source: Data from researchers of Lai, Tsung-Yu (2000) and this study.

However, for the externality relationship resulting from building violations as well as the differences in their impacts, different management strategies should be taken for the treatment of externality. There are two causes of building violations, one is that the laws and regulations on construction may be too strict to allow users to get sufficient building area while complying with the existing laws and regulations; the other is the people's insufficient awareness or indifference to relevant laws and regulations. Results of the questionnaire survey on building violators also show that among all causes of building violators, "Insufficient space" is the main cause of most building violators surveyed, however, "Insufficient space" is mainly caused by expensive land price in urban areas and the reduction of floorage due to the implementation of capacity control, making it hard to realize the per capita living space specified in existing urban plans, the result is that users can only extend their living spaces by building violations. In this case, if the externality derived from the building violations of building violators is not so serious, it may be feasible and reasonable to levy compulsory impact fees on building violators for building violations. In the future, by amendment of urban plans and relevant laws and regulations on building management, the capacity control in urban areas may be relieved as proper so as to improve the living quality of people, and by reviewing relevant standards on parking spaces, problems like building violations and violations of traffic rules may be avoided or reduced.

For suggestions on treatment of building violations externality, the study mainly focuses on the impacts of externality, i.e., impacts on public safety, urban landscape, rights and interests of the others and urban physical environment, and then, considering legal factors and factors of users, researches to propose corresponding management countermeasures. According to the questionnaire survey on neighbors of building violators, most neighbors of building violators consider "public safety", "urban landscape" and "rights and interests of the others", etc. as main externality impacts of building violations, and that the impact on other urban physical environments are slight. Therefore, for management strategies, existing laws and regulations on the treatment of building violations should be taken as the basic spirits, corresponding management countermeasures include: 1) Compulsory dismantlement; 2) Improvement within limited period; 3) Levying of impact fee. Please see Table 17



for management strategies and suggestions for treatment of externality impacts.

Table 17 Suggested measures for the management of building violations externality

| Management strategies             | Impact of externality | Impact on public safety | Impact on urban landscape | Infringement of rights of others | Urban physical environment |
|-----------------------------------|-----------------------|-------------------------|---------------------------|----------------------------------|----------------------------|
| Compulsory dismantlement          |                       | ●                       |                           | ●                                |                            |
| Improvement within limited period |                       |                         | ●                         |                                  | ●                          |
| Compulsory impact fee             |                       |                         | ●                         | ●                                | ●                          |

## 5.2. Compulsory impact fee

From the strategies of the management of building violations externality mentioned above we can see that levying compulsory impact fees on building violators for building violations can internalize the external costs created by building violations and is an effective method to improve urban environments. However, if the impact fee is to be levied, what about the levy standard?

To provide reference for establishing a mechanism for levy standard, referring to the basic data of building violators surveyed as well as the location and place of the building violation of each building violator surveyed as independent variables, and in accordance with the stipulations in Articles 25 and 86 of the Construction Act on penalties for building violations as well as the construction costs standard of Tainan City promulgated in 2001, this study has established the secular equation of maximum of willingness to pay in the Hedonic Price method after estimating the fine to be paid according to the nature, structure and acreage of every building violator case and making this amount of fine the maximum of willingness to pay of building violators surveyed (the dependent variable). As for the function types of the equation, this study has considered different function types like the Linear, Exponential and Logarithmic, etc. and finally adopted the Logarithmic function, which has the best effect, to establish the Hedonic Price Equation. And the Hedonic Price Equation model is as follows:

$$P = e^{\beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_4 x_{ji} + \dots + \beta_5 x_{ki}}$$

Where, P is the maximum of willingness to pay,  $x_j$  is the relevant attribute influencing the maximum of willingness to pay. The regression module can be built by acquiring the natural logarithm of both sides of equal mark, results of parameter estimation are shown in Table 18.

Table 18 Regression model of Hedonic Price of building violations

| Variable                               | Parameter Value | Standard Deviation | t-Value | Significance Level |
|--|-----------------|--------------------|---------|--------------------|
| Constant                               | 8.881**         | 0.487              | 18.238  | 0.000              |
| Number of Family Members               | 0.155*          | 0.084              | 1.841   | 0.069              |
| Building violations of legal clearance | -0.946**        | 0.354              | -2.673  | 0.009              |

|  |          |       |        |       |
|--|----------|-------|--------|-------|
| Building violations of roofing platforms | -0.627*  | 0.358 | -1.750 | 0.083 |
| Illegal light absorbing shades           | -2.948** | 1.401 | -2.104 | 0.038 |
| Building violations of bounding walls    | -1.298*  | 0.694 | -1.869 | 0.065 |

Note 1: “\*” indicates that at the significance level  $\alpha = 0.05$ , null hypothesis of 0 can be refused; “\*\*” indicates that at the significance level  $\alpha = 0.01$ , null hypothesis of 0 can be refused

According to the results of parameter estimation, the overall correct of the model R2 is 0.079, although the percentage of the explained variance of regression model established by data of cross sections of space is generally low, the correction R2 of this model is smaller than 0.1, which indicates that there're still a lot of factors impacting the maximum of wiliness to pay not included in the model. In the existing Hedonic Price Model, factors impacting the maximum of wiliness of building violators to pay are: number of family members, whether or not building violation of legal spaces, whether or not building violation of roofing platforms, whether or not building violation of light absorbing shades and whether or not building violation of bounding walls, etc..

In the parameter estimation results shown in Table 18, only values of “Number of Family Members” are positive, indicating that the maximum of wiliness of building violators to pay grows with the number of family members. Since the characteristic

function is an exponential function, the elasticity is  $\frac{\partial P}{\partial x_j} \cdot \frac{x_j}{P} = \beta_j \cdot x_j$ , which means that besides the estimation coefficient  $\beta_j$ , the elasticity is also relevant to the independent variable  $x_j$ , therefore, it can be used to calculate the elasticity of family members, for example, in Tainan City, the average number of family members is about 4, then the elasticity is about 0.62, and if the number of family members is increased by 1 (i.e., 5 family members), the elasticity is about 0.775, taking the 16,479.87 (standard variation of 27,242.51), the average of dependent variables of all samples, for the calculation, the opportunity cost of building violation (exempted from immediate dismantlement by paying fines) for a 5-member family compared with a 4-member family is about 2,554.37, i.e., the opportunity cost of building violation for a family to increase one member is about NT\$ 2,554.37.

Since all parameter values of all other variables of building violations are negative, the greater the value is, the higher the maximum willingness to pay, the maximum willingness to pay for building violation of roofing platforms is the highest, building violation of legal space follows and building violation of bounding walls is ranked the 3rd. Based on the estimated coefficient, the opportunity cost of building violation for building violation of roofing platforms compared to that of legal space is increased by about NT\$ 2,404.43, the opportunity cost of building violation for building violation of legal space compared to that of bounding walls is increased by about NT\$ 3,636.00, while that of bounding walls is increased by about NT\$ 1,898.71 compared to that of light absorbing shades. Therefore, when levying the impact fee for different building violations, the results of analysis above may be provided to governmental agencies as a reference for defining the standard.

## VI. Conclusions and Suggestions

It is found through the analysis of the study on the features of existing building violations in cities of Taiwan that under existing laws and regulations, during 1984~2007, the quantity of building violations reported in Tainan City has been increasing year after year, especially 1996, when Taiwan announced the full-scale capacity control, which shows that the capacity control did impact users of buildings. However, in term of “type” of building violations, building violations of legal clearance is still the main type of building violations in Tainan City, the reservation of legal clearance is an important regulation for maintaining urban environment, especially “urban light environment”, “urban thermal environment”, “urban air environment”, “urban water environment” and “urban green environment”, however the people generally lack in this consciousness. It can also be found through the questionnaire survey on building violators that the main cause for the building violations of ordinary people is insufficient spaces, at present, under the capacity control, the actual living space standard has not yet reach the standard specified in the urban plan, which makes people to extend their space of usage through building violations of legal spaces or roofing platforms. Therefore, further discussion is required to decide whether to relieve the capacity control when complete supporting facilities are provided in the future.

As for externality problems due to building violations, following the principles of social equity and efficiency, responsibilities of the externality should be borne by producers of the externality, therefore, it is necessary to discuss the externality of building violations by classification, different externality should be subject to different treatment. The article holds the viewpoint that building violations may cause externality impacts on public safety, urban landscape, rights and interests of the others and urban physical environment, etc., and has discussed the relationships and impacts and proposed recommended management strategies, including Improvement within limited period or compulsory impact fees, etc. When discussion the possibility of the levy of impact fees, this article established the Hedonic Price function of the maximum willingness of building violators to pay for fines of building violations, the results show that the opportunity cost of building violation increases along with the increase in family members, as for the opportunity cost of different types of building violations, that of building violation of roofing platforms is the highest and that of legal space goes next. This result may be provided to public sectors as reference for establishing relevant standards on levying impact fees to internalize the external costs of building violations.

## References

- Kuen-Tsing Shieh (2006) Research on Problem of Illegal Constructions in a City - Take Kaohsiung City for Example, magisterial thesis, Institute of Interdisciplinary Studies for Social Sciences, National Sun Yat-sen University.
- Tsun-Shan Hung (2000) A Probe into Treatment Modes of Building Violations - The Case of Taipei County, magisterial thesis, Architecture and Urban Planning Graduate Institute, Chung-Hua University.
- Ting-Yi Lin(2001)The Study on Handling Model of Squatter in Cities around Taiwan - Taipei as an Example, magisterial thesis, Department of Architecture, National

Taiwan University of Science and Technology.

Chin-Tang Huang (2001) The Study on Legal Treatment of Building Violations in Taipei City, Taipei City Government.

Yu-Wen Lan (1997) Practices on Dismantlement and Reservation of Building Violations, Perennial Press.

Hung-Che Chiu (2001) The research on evolution and development of illegal structures in Taiwan, magisterial thesis, Architecture and Urban Planning Graduate Institute, Chung-Hua University.

Shih-Chung Ho (2006) A Systematic Discussion on the Treatment of Building Violations by Local Governments - The Case of Taipei County, magisterial thesis, Department of Civil Engineering & Engineering Informatics, Chung-Hua University.

Tsung-Yu Lai (2000) The Research on the Limit and Proportion of Impact Fees, research report, Construction and Planning Agency, Ministry of the Interior.

Xiu-Fang Wang (1999) The Study on the Factors of Physical Environment in Sustainable City and Buildings - A Case Study of Taiwan in the Subtropical Climate Zone, magisterial thesis, Department of Architecture, National Cheng Kung University.

Chi-Ming Lai (2000) A Study on the DSR Indicators of Building Physical-Environment, doctoral thesis, Department of Architecture, National Cheng Kung University.

Lai, L.W.C. and Ho, D.C.W. (2001) Unauthorized structures in structures in high-rise high-density environment, Property Management, 19(2) : 112-123

Yiu, C.Y. (2005) Institutional arrangement and unauthorized building works in Hong Kong, Structural Surver, 23(1) : 22-29

Yiu, C.Y., Kitipornchai, S. and Sing, C.P. (2004) Review of the status of unauthorized building works in Hong Kong, Journal of Building Surveying, 4(1) : 28-34

Yiu, C.Y. and Yau, Y. (2005) Exemption and illegality-the dividing line for building works in Hong Kong, CI-OB(HK) Quarterly Journal, October : 16-19