Abstract

In the past boundary space in the condominium complexes was closed space however, recently it is changing that the space is recognized like physical and social perception of the open public space or partly open space. According to this point of view, the boundary space in condominium complexes have significant meanings for interaction between housing dwellers and local community on the other hand, there is weakness part that it is highly vulnerable to crime.

Therefore, this study attempted to identify CPTED planning factors about the boundary space to prevent crime and analyze the importance of them which is reflected openness in the apartment housing complexes. In addition the main purpose of the research is suggesting the right direction of planning open boundary space that it is able to interact with the local people and safe for residents so, this research examined the importance of planning factors thought AHP analysis.

To eliciting the urban design factors, it was selected the planning principles of CPTED as a superordinate concept. There are some principles such as natural surveillance, access control, territory reinforcement, revitalization of community activities and maintenance management. However, it excluded the maintenance control in fact that it was the principle after the city plan set up and it is an unsuitable planning factor for this research. The fallowing step, it considered literature review, CPTED guideline and it classified a comprehensive list of elements. Finally it deduced them using literature review, brain storming, FG(Focus Group Interview).

The quantitative research method was used to investigating the importance. The questionnaire started during 4th to 14th October 2016 and it targeted over postgraduate students, research institute and the other expert at the related engineering company. The research method carried out an individual interview and online survey and it distributed 100 questionnaire papers and 83 % of them returned. But, only 67 surveys presented that consistency index(C.R) was below 0.1 and which means the research standard is over 90.

The result of analysis showed that it has to presenting natural surveillance and revitalization of community activities, cooperation and interaction among the residents rather than promoting closeness and creating private spatialization within the boundary space like access control and territoriality reinforcement.

Therefore, the boundary area in the condominium complex should be established as an open space for local revitalization and communication between residents and their neighborhood. Moreover, it ought to prevent crime or accident through the interaction and social activities with local people and residents for a safe city.

This study bears great significance that it has investigated and developed the importance of CPTED planning factors about boundary space in the apartment housing complex based on openness of the area and it may be use for the basic data for designing crime prevention regarding to boundary space in the condominium complex.

Keywords: Condominium Complex, Boundary Space, CPTED, Safety, Planning Factors
1. Introduction

In the past, boundary area in the apartment housing complex construct closed fence, high sound proof wall and hedge and it interrupted the flow of interaction between inside and outside of the condominium complex. It has created sense of fear and otherness with surrounding environment beside, it has occurred social problem internally and externally.

However, current boundary space in housing complex becomes mainstream medium for connecting to the inside of complex and surrounding area and physical and social awareness is changing as an open public space and partly public area.

According to the same point of urban planning, advantage of boundary space within apartment complex is useful for interaction but it has high risk of being exposed to crime.

Therefore, the main purpose of this research is examining CPTED planning factors to prevent crime and accident around the boundary space, analyzing the importance of the element and advocating the scheme on urban plan of safe boundary space.

The following is the gist of this study in detail.

The first, it considers literature review associated with the boundary space of housing complex and CPTED and contrives the outcome of the research.

The second, it sums up and categorizes the planning factors which are presented within boundary space, apartment complex and CPTED.

The third, it changes and improves the planning elements of urban design through brain storming and FGI (Focus Group Interview).

The forth, it identifies final planning factors by the expert survey method and carries out AHP analysis after then it examines the importance of planning factors.

Finally it suggests the implication of CPTED plan in relation to the safe boundary area in condominium complex.

In this research, the boundary space is reflected openness of the apartment complex defines the border construct with opened fence and outdoor wall and connects to the pedestrian pathway and the road.

Thus it is not simply construct with partition wall and it means the space is able to communicate between residents and local people such as a rest facility, pedestrian pavement and opened main entrance.

2. Literature Review and the Aspect of the Study

To considering the literature review in terms of boundary space and condominium complex,

Lee(2014)[1], Choi(2004)[2] figured out the problem of boundary space and produced the way of improvement also, Ha(2012)[3], Han(2010)[4] and Jo(2009)[5], advocated the solution to improve the boundary area through feature analysis, comparative analysis and environmental analysis. In addition Yoo(2007)[6] and Kim (2005)[7] looked into the plan content using the case study.

After reviewed the advanced research linked with the housing complex and CPTED, Kim(2015)[8] resolved the satisfaction to applying CPTED in the apartment area and. Lee(2016)[9] investigated the scheme to avoid accidents as the security of personal privacy in one person household. Yoon(2015)[10] insisted the high quality of guideline for planning crime prevention.

According to examine the literature review, recently many city plan focused on open space but there are lack of expertise to study crime safety for the boundary space in the apartment complex. Moreover, most of thesis evaluates just about the CPTED and housing complex so, it is required to investigating the application of CPTED to the boundary space in the apartment area. Hence, this research attempt to
explore planning factors to make crime-free environment while it design the boundary space after then it analyzes the importance of the factors and it suggests future plan.

3. Plan Factors and Derivation of the Element

Above all, it will examine the CPTED plan factors and related elements as the following stages.

Table 1. Basic principle of CPTED and contents[11].

<table>
<thead>
<tr>
<th>Basic principle</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural surveillance</td>
<td>The principle to protecting the victim of crime or accident and easily expose criminal behavior.</td>
</tr>
<tr>
<td>Access control</td>
<td>The principle to derive people to the certain space like road, landscape and main entrance also controlling strangers to do not access the complex.</td>
</tr>
<tr>
<td>Territory reinforcement</td>
<td>The principle to indentify the certain area is the public space or private space clearly and definite the responsibility of management in the area.</td>
</tr>
<tr>
<td>Revitalization of community activities</td>
<td>The principle to promote the residents and local people communicate in the public area and make themselves get urban tribe and a sense of security.</td>
</tr>
<tr>
<td>Maintenance</td>
<td>The principle to conform that the space and facilities are utilized and upkeep properly as it designed at the first time.</td>
</tr>
</tbody>
</table>

The first, it set up a design principle of CPTED as a superordinate concept and there were some plan principles such as natural surveillance, access control, territory securement and revitalization of community activities and upkeeping. However, maintenance is the concept after the plan carries on and it is not appropriate factors so it was decided to exclude it.

The second, it evaluated CPTED guideline and literature review to sum up and classify the planning factors. But the advanced research related with CPTED planning elements of boundary space does not exist so this research reviewed the building design guideline for crime prevention published by the Ministry of land, infrastructure and transport(2013)[12], the design principle to crime prevention by the National police agency(2007)[13], the environmental design guideline for crime safety and housing environmental management system in Seoul(2013)[14], and then it summarized and classified the planning factors based on them. As a generic concept, planning factors were selected like natural surveillance, access control, territory securement and revitalization of community activities after then it expressed the correctly related elements as a subordinate concepts at the first stage.

The third, it made complementary measure about the planning factors through brain storming and FGI which were selected at the first step. It was hard to get some information link with CPTED planning factors in terms of boundary space in apartment housing due to lacks of resource. It advocated part of data in detail from the guideline and collected various opinions from the professionals.

The final planning factors selected via planning principle, guideline review, brain storming and FGI are below.
Table 2. Final planning factors and criteria derivation.

<table>
<thead>
<tr>
<th>Basic principle</th>
<th>Planning factors</th>
</tr>
</thead>
</table>
| Natural surveillance | - Natural monitoring about pedestrian road.  
- Pockets and dark corner clearance (maintenance of interspaces of trees, maintenance of interspaces of facilities).  
- Crime prevention and installation of lighting system and CCTV for security.  
- Set up landscape and perspective walls in private area except the opened main entrance. |
| Access control | - Easy to find main entrance and access control for strangers.  
- Build up a outer wall to stop trespass.  
- Equip lighting and access control system between the space of buildings.  
- Set up fence in private space. |
| Territory securement | - Definite division between public and private spaces.  
- Clarity of main entrance and outer boundary.  
- Certainty regarding to location information and use of space.  
- Considering color and lighting for territory securement. |
| Revitalization of community activities | - Connection with diverse facilities for activation of outer space.  
- Space arrangement to promote the implication of community strengthening.  
- Minimization for the influence of dangerous place due to harmful materials.  
- Diversification of space structure and recuperating shopping stores (Invigoration of community activities). |

4. Examination of the Importance through AHP Analysis

Analytic Hierarchy Process (AHP) was founded by Thomas. L. Saaty in 1970. It is especially effective and efficient to discover complicated phenomenon and it is widely apply to analyze the importance in order of priority. Therefore, this study tried to evaluate the importance of criteria and CPTED planning factors of boundary space within the apartment complex using AHP.

Table 3. Sample of the survey toward the importance comparison using AHP analysis.

| Importance comparison of planning factors in the cluster called ‘natural surveillance’ |  |
| 1. Do you think how much important is ‘the natural surveillance about pedestrian pathway (A1)’ than ‘the establishment of lighting system and CCTV to prevent crime and security(A2)’? |  |
| | A1 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 A2 |

It was considered to enhance quantitative research method to investigate the importance of planning factors and elements focused on expertise and professionals.

It surveyed from October 4th 2016 to October 14th and the members of academic community (over postgraduate course), research institute and related engineering company answered. The research method was individual interview and online research via internet.

It circulated 100 questionnaires and 83 out of 100 the respondents filled in also it represented only 67 surveys carried out consistency Index or CR under 01 and the standard level over 90.
Table 4. Result of the survey collection.

<table>
<thead>
<tr>
<th>Division</th>
<th>No. of distributed questionnaires papers</th>
<th>No. of returned questionnaires papers</th>
<th>Collection rate(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researchers</td>
<td>30</td>
<td>26</td>
<td>86.67</td>
</tr>
<tr>
<td>Academic community</td>
<td>30</td>
<td>22</td>
<td>73.33</td>
</tr>
<tr>
<td>Others</td>
<td>40</td>
<td>35</td>
<td>87.5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>83</td>
<td>83.0</td>
</tr>
</tbody>
</table>

The outcome of importance via AHP analysis is follows,

According to the result of importance linked with CPTED planning factors, the natural surveillance is the most essential factor (importance: 0.351). Subsequently the following factors were occurred; revitalization of community activities(0.312), territory reinforcement(0.225) and access control (0.112). It can be explained that the natural surveillance has to concern as a major key factor to design crime safety environment at the boundary space in the housing complex.

Table 5. The result of importance of planning factors through AHP analysis.

<table>
<thead>
<tr>
<th>Planning factors</th>
<th>Importance</th>
<th>Planning criteria</th>
<th>Detail priority</th>
<th>Importance in total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural surveillance</td>
<td>0.351</td>
<td>The natural surveillance about pedestrian pathway</td>
<td>0.321</td>
<td>0.113</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pockets and dark corner clearance (maintenance of interspaces of trees, maintenance of interspaces of facilities)</td>
<td>0.423</td>
<td>0.148</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crime prevention and installation of lighting system and CCTV for security</td>
<td>0.135</td>
<td>0.047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set up landscape and perspective walls in private area except the opened main entrance</td>
<td>0.121</td>
<td>0.042</td>
</tr>
<tr>
<td>Access control</td>
<td>0.112</td>
<td>Easy to find main entrance and access control for strangers</td>
<td>0.333</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Build up a outer wall to stop trespass</td>
<td>0.210</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equip lighting and access control system between the space of buildings</td>
<td>0.245</td>
<td>0.027</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set up fence in private space</td>
<td>0.212</td>
<td>0.024</td>
</tr>
<tr>
<td>Territory securement</td>
<td>0.225</td>
<td>Definite division between public and private spaces</td>
<td>0.375</td>
<td>0.084</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity of main entrance and outer boundary</td>
<td>0.305</td>
<td>0.069</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Certainty regarding to location information and use of space(signboard etc.)</td>
<td>0.098</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Considering color and lighting for territory securement</td>
<td>0.222</td>
<td>0.050</td>
</tr>
<tr>
<td>Revitalization of community activities</td>
<td>0.312</td>
<td>Connection with diverse facilities for activation of outer space</td>
<td>0.333</td>
<td>0.104</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Space arrangement to promote the implication of community strengthening</td>
<td>0.413</td>
<td>0.129</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimization for the influence of dangerous</td>
<td>0.098</td>
<td>0.031</td>
</tr>
</tbody>
</table>
After analyzing the overall importance about CPTED planning factors, it resolved that pockets and dark corner clearance (maintenance of interspaces of trees, maintenance of interspaces of facilities) is the most important planning criteria to design safe boundary space in housing complex (total importance: 0.148). The next, it illustrated that space arrangement to promote the implication of community strengthening (0.129) and natural monitoring about pedestrian pathway (0.113).

So, it founded further urban plan has to promote social activities in the community, cooperation and interaction between the residents and local people rather than closed design plan like access control at the boundary space in apartment housing.

5. Conclusion

To summarize this article, it examined CPTED planning factors and criteria for crime prevention. After then, it analyzed the importance of each factors and presented the scheme of the boundary area because many borderline space in the condominium complex has changed to the public space and partly public space.

According to the result of the analysis, it can be considered that the design scheme of boundary space has to promote social activities in the community and naturally cooperation and interaction between residents and local people for crime prevention rather than emphasizing closeness and private spatialization such as access control and territory securing.

Therefore, the boundary space in the apartment housing should be systemically planned for the open space to encourage the revitalization of local community and communication between the residents and local people for safe city. Consequently they have to protect their residential area from accidents and crime through bilateral collaboration among them.

This research has significant meaningful to investigating the CPTED planning factors and criteria in terms of the boundary area in the condominium complex and identify the importance of each elements. Moreover it may be use for the basic data for making crime prevention scheme regarding to boundary space in the apartment housing.

6. References

6.1. Thesis degree

[1] Lee YK. Improvement of Apartment Complex Boundaries by Street Design: Focused on 4, 5, 7 Complexes in Bora District Yongin City. Sungkyunkwan University, Master’s Thesis (2014).


6.2. Additional reference


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