Analysis on Defense Safety Design of Building’s Outside Environment in Rural-Urban Fringe Zones Dominated by Industrial Lands in Changchun in the perspective of Criminal Pattern Theory

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Abstract. The Rural-urban fringe zones dominated by industrial lands are important regions for the defense safety design. After the field survey of a typical area of this kind of fringe zones in Changchun, the author proposes the four types of key locations and thinking framework of the defense safety design of building’s outside environmental in the view of crime patterns theory (CPT), namely nodes, paths, edges and areas. Meanwhile, combining the crime pattern theory, the author analyzes the defense safety problems of these key locations in the research area and then puts forward the feasible defense safety design strategies.

1. Introduction
The rural-urban fringe zones are special regions that have the attributes of both urban and rural. They are the concentration areas of many contradictions between cities and villages and their population composition is diversity. The mobility of people is high and the spatial developments are imbalance. Moreover, the social structures are not stable, and the social prevention and control system are not sound. These places are the weakest zones of the defense safety. They are not only the “hot spots” of development and transformation of society and economy, but also the difficult areas of urban administration and crime prevention and control[1].

If there are significant defects in building’s outside environment, they may provide opportunities and conditions for crime. The reasons for rural-urban fringe zones becoming the “hot spots” areas of crime, to a great extent, are the ambiguous, dynamic, complex and farraginous characteristics of their spatial environments. The opportunities and conditions of crime are overlapping and interweaving together. Meanwhile, the infrastructures, roads, and service facilities are relatively incomplete. Liu Daqian and other scholars proposed crime distribution maps of crime of Changchun[2], which verify the rural-urban fringe zones are high incidence areas of two types of crimes related to defense safety. As it is shown in the Figure 1.

2. Crime template of CPT
About the causing factors of Crime, there are three major crime prevention theories, the Routine activity theory, the Rational choice theory and the Crime pattern theory ( abbr. CPT ).The CPT
was proposed by Brantingham and J. l. Brantingham in 1993\cite{3} and they believed that the potential offenders choose their crime targets and sites of crime relying on their life experience.

CPT explains how the awareness spaces of potential offenders affect their decision-making during the target selection process. The Brantinghams thought that crime associated with the physical distribution of people and things, routine activity patterns, the way people perceiving and using of environmental information. They emphasized that crime focused on the personal attractors such as home, known shopping center, work or school, well-known sports areas, park or recreation center, or along major routes of connecting these nodes\cite{3}.

According to CPT, spatial cognition of potential offenders forms the mind-set that crime behavior. The mindset is also called the “crime template”. If affect the crime template corresponds to the city environment, it is the inducing factor of crime. Crime templates include: 1) whether the spaces are convenient for potential offenders to commit, namely, the “access ability”; 2) whether the spaces are convenient for potential offenders to hide after committing crimes, namely, the “conceal ability”; 3) whether the spaces are convenient for potential offenders to access or escape, i.e. the “traffic ability” or “permeability”; 4) whether there is lack of natural surveillance or not, namely, the “surveillance ability” \cite{4}. In people’s daily activities, the formation of the “crime templates” have several important restraining factors, includes the awareness spaces, pathways and the ranges of activities. These factors affect the decision-making of potential offenders whether to commit or not.

![Figure 1 Main crime distribution in Changchun\cite{2}.](image)

3. Defense safety design of building’s outside environment in rural-urban fringe zone base on CPT
In modern cities, the construction of environmental qualities which seriously lag behind the paces of urbanization, plus the disadvantages of built environment and the problems of social environment. These issues give rise to a lot of unfavorable factors that crime in the building’s outside environment. Defense safety design means to restrict and eliminate the conditions that induce the crime, reduce the opportunities and motive potential offenders to commit the crime by
changing or improving the unreasonable factors of environments, and finally achieve the goal of crime prevention.

3.1. The key locations of defense safety design in rural-urban fringe zone

The Brantinghams proposed in their early study that four elements formed people’s awareness space in the built environment, nodes, paths, areas and edges\(^3\). In the rural-urban fringe zones, the nodes, paths, areas and edges are key locations for crime prevention and control. If there are existing factors that crime, they will directly sway the defense safety. As a result, these locations are the key locations of the defense safety design in rural-urban fringe zones.

(1) Nodes. In the building’s outside environment, spatial nodes are the high utilizing rate and long occupying time places. They are places that people are familiar with and the anchor points of daily activities. There is high crime rate in spatial nodes, partly because they are people’s awareness space\(^5\).

(2) Paths. The paths are the passageways that link one spatial node to another, based on network of roads and traffic modes, which is said on the holistic level. The paths shape the patterns how people aggregate or move in the built environment. In the view of defense safety, the problems of paths in the rural-urban fringe zones of Changchun mainly include the road form, the road facilities and the road net structure problems.

(3) Edges. The edges are boundaries among different attributes areas. Sometimes edges are as obvious as those parts of the built environment. Sometimes edges are social boundaries constructed by people’s perception. The reason why the edges are important lies on these regions where the strangers are more easily accepted because of the presence with great frequency and legitimacy, and the edge effect of crowds and high activity areas\(^3\).

(4) Area. Spatial areas refer to the concentration regions with certain characteristics in the rural-urban fringe zones. They are the locations for people’s daily activities. They are “surface” elements of built environment. Potential offender are more easy to commit crimes, so the areas are also the key location of defense safety design of building’s outside environment in the rural-urban fringe zones.

3.2. The framework of defense safety design in rural-urban fringe zones

Each kind of trigger mechanism of crime has a reverse mechanism, or it is called purposefully resist, interference. It weakens or transfers mechanism of crime. Therefore, restraining the resources, conditions, opportunities of crimes are the important starting points for crime prevention. A series of thoughts of the defense safety design for rural-urban fringe zones can be summarized as follows: The author analyze the defense safety problems about nodes, paths, edges and areas through the investigation and the study of the research site, combined with CPT, to establish crime templates, and then eliminate the crime templates by reducing the access abilities, weakening the conceal abilities, holding up the traffic abilities of potential offenders, and increasing the capabilities of surveillance. Finally, put forward a serial of feasible methods on defense safety design.

3.3. Analysis on defense safety problems in rural-urban fringe zones dominated by industrial lands in the viewpoint of CPT

The research site adjoins to Changshen road toward northwest, Nansihuan road to the northeast, and it abuts Guigu street to southeast, and it is next to Belt expressway. As it is shown in the Figure 2. There are a large number of automobile industry ancillary enterprises. It is a typical rural-urban fringe zone dominated by industrial lands. The defense safety problem are as follows: 1) Problems about the Nodes. The environment images of small factories are poor. The spatial identifications are bad. The concave and convex structures of buildings may become the concealed sites of potential offenders. At the same time, the public spatial environment qualities are poor. There are lack of rest spaces, terrible landscapes and lack of sense of depths; 2)
Problems about the Paths: the paths in the areas are lack of identification. The buildings around the roads are homogeneity. There are too many road intersections. The trafficability are too high; 3) Problems about the Edges: There are too many access roads to Nansihuan road. The accessibility and trafficability along Nansihuan road are excessively high; 4) Problems about the Areas: There are a large number of vacant land inside the zone. The surveillance abilities are feeble.

4. The defense safety design strategies in the perspective of CPT in rural-urban fringe zones dominated by industrial lands

4.1. Defense safety design strategies aim at problems about spatial nodes

4.1.1. Design strategies relate to nodes of composition of building form. To strengthen the gateway design and boost up the sense of territory, marks with clear identification should be set up to strengthen the territoriality. In addition, different materials should be used to pave the entrance around areas to distinguish the inside area from the outside. According to CPT, eliminate the crime template “Easy crime = Spatial environment enhance the ‘accessibility’ of potential offenders”, achieve the goal of crime prevention.

To improve the qualities of environment and boost the natural surveillance. To ensure the environment of small factories neat and tidy, good environment qualities may hint potential offenders psychologically and the places are “administration orderly”. In addition, people can set the guarding facilities such as gate sentry to consolidate the level of management and maintenance and enhance surveillance abilities to potential offenders. Eliminate the “Easy to crime = Spatial environment is lack of ‘surveillance ability’ to potential offenders” crime template. These measures can prevent the occurrences of crimes.

4.1.2. Design strategies in view of nodes of public spaces. To set up the rest spaces and boost the natural surveillance. Rest facilities should be set up on both sides of the sidewalks. The recommend distance interval is 500 meters; At the same time, the spare areas between buildings should be used as leisure spaces, because they can attract people and enhance the natural surveillance of public spaces. In the view of CPT, they can eliminate the “Easy to crime = Spatial environment is lack of ‘surveillance ability’ to potential offenders” crime template.

To promote the environmental public spatial qualities, first of all, attentions should be paid to strengthen the management of public spatial environments. Industrial wastes should be removed in time; Second, the poor quality of spatial environments should be renovated. Rest spaces and the landscape spaces should be set up so as to attract people be involved. These ways can decrease the criminal stimulation for potential offenders and boost the necessary social interactions among people, at the same time. According to CPT, enhancing the natural surveillance to potential offenders can eliminate the “Easy to crime = Spatial environment is lack of ‘surveillance ability’ to potential offenders” crime template.
4.1.3. Design strategies aim at nodes of landscapes. To select the appropriate landscape plants varieties. According to the climate characteristics of Changchun city, selecting the appropriate plant species can ensure the continuity of landscape greening in different seasons and sustainable attracting to people, for example, the hedge. We can choose northeast forsythia, privet, etc, the arbors, we can choose fir, chinese junipers, picea koraiensis, cedar, etc. Therefore, we can eliminate the “Easy to crime = Spatial environment is lack of ‘surveillance ability’ to potential offenders” crime template.

To divide the large scale of spaces into small ones to create surveillance groups, Directing at the problems that the landscape spaces are lacking of subdivisions, and attraction are insufficient to people, the large area of landscape spaces should be divided into some small scale semi-public spaces that are convenient to entertain and relaxing for people and boost up their attractions, so as to eliminate the “Easy to crime = Spatial environment is lack of ‘surveillance ability’ to potential offenders” crime template.

4.2. Defense safety design strategies direct at problems about the paths
The network of roads affects the accessibility of roads, i.e. trafficability or permeability, and also affects criminal decision-making of potential offenders. Complex roads layouts are more likely to give rise to crime than the succinct ones. Former study pointed out that road networks influenced the location of some potential targets and the aggregate size of agglomerated awareness spaces[6]. Bevis and Nutter proposed that the accessibility of cul-de-sac was minimum (Beta indices is 0.5), followed by L-type layout (Beta indices is 1.0), again for T-type layout (Beta indices is 1.5), the highest accessibility for through block layout (i.e. grid type, Beta indices is 2.0)[7]. In the view of the problems that there are too many road intersections and high accessibility in research areas, people can apply the crime template reversely and try to change the through block layouts to T-type layouts which have lower accessibility and more difficulty for potential offenders to escape after committing crimes. Meanwhile, the lower level roads, such as branches, can be changed into cul-de-sacs. The above measures can minimize the road accessibility. According to CPT, reducing the accessibility of roads can eliminate the “Easy to crime = Spatial environment enhance the ‘accessibility’ of potential offenders” crime template.

In the view of the problem of high trafficability in research sites, we should try to change the grid type layouts into T-type networks with lower trafficability to boost the difficulties of potential offenders escaping after committing the crimes. Meanwhile, we should change the lower level road, such as branches, into cul-de-sacs, or change grid type roads layout into T-type and supplemented by cul-de-sacs. All these methods can minimize the road accessibility. As it is shown in the Figure 3. According to CPT, reducing the accessibility of roads can eliminate the “Easy to crime = Spatial environment enhance the ‘traffic capacity’ of potential offenders” crime template.

4.3. Defense safety design strategies in view of problems about the edges
To control the number of intersections reasonably along the transition edges and integrate the forms of the road intersections. In the view of the problem of too much road intersection, on the
basis of meeting the normal needs of pedestrians, we should try to lop the count of the intersections along the inboard edges of Nansihuan road, to guarantee the configurations of intersections to keep simple as far as possible, for instance, using two-way intersection or three-way intersection, trying to avoid four-way intersection even more way intersection. As is is shown in the Figure 4. According to CPT, controlling the number and form of intersections is to control the accessibility of roads, restrain the access abilities of potential offenders committing, and make sure that the potential offenders not be easy to access to criminal targets. Meanwhile, the planners can boost the difficulties of escaping after committing crimes, thus eliminate the “Easy to crime = Spatial environment enhance the ‘traffic capacity’ of potential offenders” crime template. Therefore, the environmental conditions of crime prevention can be improved.

4.4. Defense safety design strategies relate to problems about the areas
To the problems of vacant lands and natural surveillance in the research areas, we should optimize the environmental qualities of vacant lands, attract people to reside, enhance the surveillance abilities to potential offenders. To eliminate the “Easy to crime = Spatial environment is lack of ‘surveillance ability’ to potential offenders” crime template, we should offer different defense safety design strategies according to the scale of the vacant lands.

(1) Transform the smaller vacant lands into mini squares. Square space’s abilities of attractions are strong, but attention should be paid to refine the scale of squares according to the requirements of people. The large squares can be divided into small scale sub-regions such as children’s activity areas, old people’s activity areas. Such small sub-regions are conducive to the natural surveillance.

(2) Set greening along the periphery of larger vacant lands. For larger scale of vacant lands, they should not be transformed into squares, because of the lack of territoriality. Those large scale of squares are tended to be bad for defense safety requirements. Green belts can be set up around the perimeters of the vacant lands and the abilities of attracting people of the refined green spaces are strong. They provide people to have a rest. Meanwhile, they can enhance the surveillance abilities to potential offenders. At the same time, improve the quality of environment and ease crime stimulus to potential offenders.
5. Conclusion
The rural-urban fringe zones are the important areas of the defense safety design. The Nodes, Paths, Edges and Areas are the four key locations of defense safety. CPT explains how the awareness spaces of potential offenders affect their decision-making of targets selection process. Using CPT combined with the field investigations and analyzing the defense safety problems of the four types of key locations in the rural-urban fringe zones dominated by industrial lands, the author sums up the crime templates in the viewpoint of CPT, and then applies the crime template reversely to putting forward defense safety design strategies. All these measures can effectively improve the environmental qualities of the rural-urban fringe zones, to reduce the potential opportunities and conditions of potential offenders to commit crimes.

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