Discussion on Environmental Design of the Space Under the Overpass in Changchun City in Perspective of Psychological Safety

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ABSTRACT. The overpass is one product of city development and it has significant effects on relieving traffic. Though it brings many benefits to us, it triggers some problems as well. For example, it triggers regional unbalance, space blocking and commercial atmosphere, it reduces on both sides of the overpass, it affects safety of the pedestrian under the overpass. The paper summarizes the space types under the overpass in Changchun into three categories, which are point pattern, linear pattern and composite pattern. Analyses from the viewpoint of psychology, the paper put forwards some environmental design strategies for each type of spatial pattern of the overpass in Changchun city.

1. Introduction
Changchun has built many overpasses along with the rapid urbanization in recent years. It has constructed an elementary three-dimensional transport system combined with the built elevated bridges. The overpass is the product of city development and it is an effective way to relieve urban traffic. It brings many benefits to us, but it triggers some problems at the same time, such as regional unbalance, space blocking and commercial atmosphere reducing on both sides of the overpass, it affects safety of the pedestrian under the overpass. Among them, psychological safety is an important issue.

The psychological needs of people who walk through the space under the overpass mainly embody in three kinds of sense, safety, territoriality and identifiability. The environmental design of the space under the overpass in the perspective of psychological safety can improve people's safety, comfort and livability. The psychological safety factors of the space under overpass are as follows: the risk of hitting by falling objects, the risk of being victim of traffic accident, the passive behavior danger, the active behavior danger, and so on.

Based on the perspective of path form and spatial relationship, the space under the overpass in Changchun could be classified into three categories, point pattern, linear pattern and composite pattern. Aiming at three typical space patterns, it's an effective way to achieve safety environment through environmental design for the space under the overpass in the view of psychological safety.

2. The psychological safety research and environmental design strategies for the point pattern overpass
There are many examples of point pattern of the space under the overpass in Changchun such as crossing point of KaiYun street and KuanPing road, LinHe street and WeiXing road, etc. Among
them, KaiYun street and KuanPing road intersection are the typical examples. These kind of space are three-dimensional traffic patterns, they constituted a relatively complex point shape intersection space. They are places where stream of people and traffic flow overlap frequently, and thus affecting people's travel safety. (see Figure 1)

2.1 The psychological safety research of the intersection at KaiYun street and KuanPing road
(1) The influencing factors of safety
    KuanPing bridge cross through the light rail line 3 and the railway line. The pavement due to a lack of protective railings and warning signs on both sides of the road may enhance the risk of people’s falling down. On the aspect of falling objects, people who pass through below the KuanPing road have unsafe sense of being hit by the falling rainwater pipes and snow.

    (2) The influencing factors of territoriality. Because of the concentration of vendors and the intercrossing of people and traffic, the region of KuanPing bridge station has vague feeling of territoriality. Meanwhile, due to lack of planed parking lot, the pedestrians under the overpass intermingled with the vehicles pulling over and pulling out, this chaos situation affect the pedestrian’s safety.

2.2 The environmental design strategies of KaiYun street and KuanPing road intersection
In order to improve feelings of psychological safety of this kind of spaces under the overpass , we can adopt strategies as follows(see Figure 2):

    (1) The design strategies on pedestrian’s safety
The risk of falling objects lies in a relatively concentrate road edge area which is close to the rail track. It should be equipped with protective railing and set up warning signs to satisfy people's safety requirement. In order to reduce the risk of pedestrians, the measures of guiding pedestrians pass through the space under the overpass in group should be set up, meanwhile setting up the street planting shrubs to avoid the psychological safety affecting by falling objects.

(2) The design strategies on territoriality
The vendors concentrate in light rail station affect the safety of passengers. It should be managed uniformly combined with the surrounding commercial networks. It should also be suggested that setting up the necessary green belt in the vicinity of the entrance, using plant landscape to avoid traffic safety risks caused by the intercrossing. Aiming at the parking problem of under the overpass space, in order to improve the utilization rate of the space under the overpass, methods should be taken according to the complexity of urban traffic, such as using enclosing and greening to limit access to the entrance and parking. And clear signs should also be set to avoid interference of parking vehicles and urban motorized vehicles.

3. The psychological safety research and environmental design strategies for the linear pattern overpass
The linear pattern of the space under the overpass in Changchun has the southern expressway, the eastern expressway and the Light rail line four, etc. The southern expressway under the overpass space can be set up as a typical example. This part is a continuous and linear space formed by the combination of urban road, light rail line and the overpass. The problems of spatial hierarchy have no better solution to the complex traffic situation, which will not only cause regional unbalance, but also affect the psychological safety of people (see Figure 3).

![Figure 3. The psychological safety research of the southern expressway under overpass space.](image)

3.1 The psychological safety research of the southern expressway under the overpass space
(1) The influencing factors of safety
There are many factors affecting the feelings of safety. For example, the QianJin square bus station, locating in the side of city vehicle lane where pedestrians are combine with the traffic. This kind of bus station either affecting the safety of waiting passengers or the safety of motor vehicles.

(2) The influencing factors of territoriality sense
There are many factors that affect the territoriality sense such as the layout of light rail track which segregated motor vehicle lane and bicycle lane. The city’s function and connection are obstructed and the pedestrian’s activities are restricted. And then produce regional imbalance development.

(3) The influencing factors of identifiability sense
There are many factors that affect the feelings of identifiability such as WeiXing road tunnel exit which easily lead to crossover between vehicle and pedestrian, and there has visual blind area affecting people's safety.
3.2 The environmental design strategies of the southern expressway under the overpass space

To improve senses of psychological safety of this kind of under the overpass space, we can adopt following strategies (see Figure 4):

![Figure 4. The environmental design strategies of the southern expressway under overpass space.](image)

1. The design strategies on safety
   The bus station located in the area of traffic flow concentrated. The bus station should be set in the place which has certain distance to the driveway. Thus it should reduce the impact of bus stops to motor vehicles, and play a buffer role when people crossing the driveway.

2. The design strategies on territoriality
   Direct at many level crossing problems along light rail line 3. The footbridge should be set up in the reasonable position and distance, it can either conduct people to cross urban road through overbridge to increase people's safety and the contact between streets.

3. The design strategies on identifiability
   In the area close to the sinking sections of road and tunnel exit, due to the visual blind area and light interference, the passing pedestrian easy off guard vulnerable to traffic accident, low hedges or greenbelt should be set to limit people crossing through in the area where the tunnel exit access to the ground level, meanwhile add warning signs to alert pedestrians and enhance people's travel safety.

4. The psychological safety research and environmental design strategies for the composite pattern overpass

The composite pattern of the space under the overpass in Changchun such as crossing point of southern expressway and west expressway, west liberation overpass, PuYang street and JingYang road intersection, etc. But southern expressway and west expressway intersection is the typical representative. This part is a comprehensive open space which is formed by the intersection in the city road, light rail line 3 and the sinking section of the intersection of southern expressway and west expressway. It will not only affect the safety of people's travel, but also affect the overall spatial image of the city in this complex large space. (see Figure 5)
4.1 The psychological safety research of intersection of southern expressway and west expressway

(1) The influencing factors of safety
There are many factors that affect the feelings of safety such as the pedestrian over the sinking section of QianJin street lack appropriate protective measures, it affect the safety of pedestrians.

(2) The influencing factors of territoriality
There are many factors that affect the territoriality sense such as the sinking south exit section of QianJin street where the footbridge is set to crossover the QianJin street. Although the footbridge should has improve the safety issues to some extent, it position is not good enough to solve the problem effectively because it is inconvenient.

(3) The influencing factors of identifiability
There are different degrees of psychological pressure for people in different age grades when crossing through complicated composite space. As the identifiable signs are deficiency, the attractions of the space environment are reduced.

4.2 The environmental design strategies of southern expressway and west expressway intersection
In order to improve senses of psychological safety of this kind of under the overpass space, we can adopt strategies as follows (see Figure 6):

(1) The design strategies on safety
In order to protect pedestrians from hurt by falling objects or falling down from the overpass, a certain height enclosures should be added, which based on the original construction to meet people’s demand for safety and comfort. There also should have plant greening and low hedges on the sides where pedestrians are easy to fall down. Measures should be taken not only to fully utilize the space, but also beautify the environment, and keep the pedestrians from negative psychological impact.

(2) The design strategies on territoriality

With regard to the problem of the overpasses improperly located, the greening can be applied to reorganize flow distribution and set pass paths to direct the sight of pedestrians. Add street furniture and facilities within the allowable scope of space can offer people a comfortable walking experience when passing through the overpasses.

(3) The design strategies on identifiability

It is pretty important to deal with complex space environment and create a recognizable environment for people. The proper addition of colored pavement, lighting equipment and greening can effectively help people recognize and pass through complex space environment to create a better urban atmosphere to make their life more colorful.

5. Conclusion

The typical forms of the space under the overpass in Changchun are mainly classified into point pattern, linear pattern and composite pattern. There are many different factors that influence people’s psychological safety. To design the space under the overpass from the perspective of psychological safety, we should focus on the feelings of safety, territoriality and identifiability. It can effectively improve the sense of safety, identity, comfort and functionality of the space under the overpass.

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