

URBAN REPAIR MORPHOLOGY OF LANDSCAPE TRANSITION AREA IN THE URBAN CENTER: TIANMA GROUP IN CHANGSHA, CHINA

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ABSTRACT

Since the end of the 20th century, cities in China have entered a period of rapid expansion. The development not only caused the disruption of the continuity of the traditional urban form, but also eroded the natural environment in its process of integrating into the cities. The Tianma Group is located at the foot of the Yuelu Mountain, a famous scenic spot in the center of Changsha, China. Originally, it was dominated by natural villages, which demonstrated a relationship of infiltration with the natural environment. However, due to the urban development, the urban fabric became chaotic, and the area formed a rigid boundary with nature. This article takes it as the research object, through field investigation and mapping to explore the spatial evolution process and analyze its relationship with landscape space. Based on the urban morphology and landscape ecology theory, the article proposes three repair strategies from the perspectives of spatial structure of the area, connection of open landscape node, and regulation of urban fabric. Furthermore, the article wants to provide a reference for future practice of urban repair morphology in urban extension and sustainable development.

Key words: landscape transition area, repair strategy, spatial structure, spatial integration, Changsha

INTRODUCTION

Rapid urbanization has tremendously changed the urban landscape structure, which has modified urban ecological environment at all scales (Grimm et al., 2008; Xu et al., 2012). This creates new demands for a deeper understanding of the morphology of green areas in cities in their own right as ecological environments and not only as one case in urban morphology (Lars & Beta, 2015). Although such spatial morphology of natural landscapes is already a developed field and essential part of landscape ecology (Forman & Godron, 1986), there is no natural overlap between the two fields of landscape spatial morphology and urban morphology (Lars & Beta, 2015). The origins of urban landscape management are intimately connected to the nature and development of an important part of urban morphology itself (Conzen, 1966). An important basis for urban landscape management was the urban landscape units, which is linked to the social, economic and cultural forces driving the development of urban areas (Whitehand, 2005).

One type of urban landscape unit that has been recognized is the 'Landscape transition area'. While all urban landscape units are in detail unique, they have recurrent features. The transition area is no exception, and its wide significance for the understanding and management of urban landscapes makes it a good illustration of both urban morphological thinking and the potential of that thinking as a contribution to urban design. As the intermediary area between urban natural landscape and high-density built environment, the landscape transition zone in the city center is mutually responsible for the penetration and transformation of urban natural environment and artificial environment in land use, spatial form and other factors, which is also the sensitive and vulnerable area in the process of urban dynamic evolution. Compared with the fringe belt, the

landscape transition zone in city center must take both the protection of the ecological environment and the demand for space capacity of the high-density population into consideration.

This article suggests that the morphological relationship of urban natural landscape and high-density built environment cannot completely be divided with a simple line of boundary, instead, it acts as space of boundary with its special patterns, which attain the coherence of the landscape area and the urban area.

METHODOLOGY

Systematic surveying and mapping of ground plans became fundamental to the recognition of urban landscape units (Whitehand, 2005). Such recognition became, in the postwar period, a method of characterizing the various parts of towns at different scales of analysis, from the individual building to entire settlements (Conzen, 1969). The delineation of unitary areas not only distinguished historical types of development but provided an important template with which to assess future development (Conzen, 1975). Besides, the methodology employed comprised literature research and field investigation so as to research more in-depth on the theme and attempt to relate it to the urbanization process and its impacts to landscape.

Our analysis is on two main theoretical frameworks: First premise concerns the space structure observed in the study area. It regards how urban structure is shaped by the existing road system, providing the basic frame for other spatial elements and, more importantly, for landscape elements to integrate in. Through a separated layer of the road system from the context, the pattern can be judged from both accessibility and its connectivity of open space. Second premise concerns the space integration of the building cluster and landscape space. By abstracting and comparing these two spatial entities from the context, the relationship within entity itself or between these entities can be obviously distinguished and described.

EVOLUTION OF THE URBAN MORPHOLOGY IN STUDY AREA

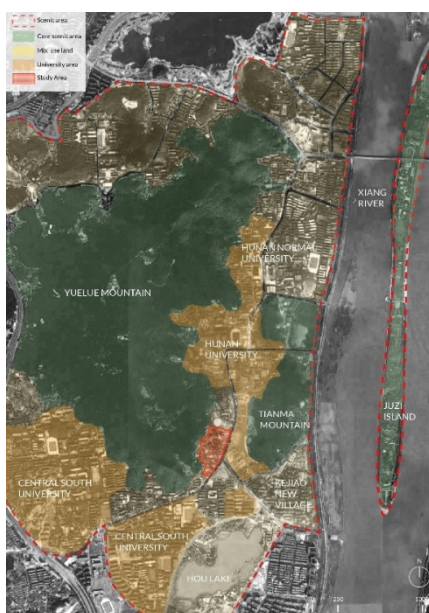


Figure 1. Overview of current landscape transition area of Yuelu Mountain and Location of study area

Changsha is a city with unique landscape layout centered on Xiang River and Yuelu mountain. Although the mountain plays an important role of urban landmark and a crucial component of urban ecological space, it is currently in a dilemma of being surrounded by intensive buildings in the landscape transition area with severe encroachment of the landscape space from the southeast side. It is worth noting that the narrow strip between Yuelu Mountain and Tianma Mountain, has formed a solid boundary infilled with a mass of artificial construction, highlighted by obvious splitting of space with the crossing of urban road-South Lushan Road. A strong opposition between landscape space and urban space has formed.

The study area Tianma Group (Red area in Fig.1), is precisely near the edge of this intense conflict. Before 1979, the area spontaneously maintained a natural settlement, with large amount of farmland and several dotted ponds shown in Fig. 2. The layout of rural house cluster also presented a natural distribution along the contour lines and the field ridges. At this

time, the spatial pattern of the transition zone was dominated by natural elements and characteristics, with construction land enclosed by natural landscape field.

The rapid expansion of the settlement of Tianma Group began after 1979, along with Changsha's overall planning for the Yuelu Mountain Scenic Area and its surrounding land and the rising population in the area. From 1979 to 1989, the land was gradually occupied by extended and illegal construction activities. Except for hills and depressions with large topographic relief, the rest of land were mostly occupied by spontaneously built houses. In terms of urban form, along Lushan South Road, the interface came into existence. Within the study area, a residential community was built at the cost of the occupation of natural mountain terrain. In this period, the building density is moderate, demonstrating the feature of the mountain landscape diverging into the farmland. The landscape space and construction space were integrated in harmony.

From 1989 to 1999, the boundary of the transition zone extended towards the nature, the former open boundary between the village and the mountain was further occupied. At the street interface, a higher density of houses formed a solid boundary with little infiltration into inner area, undermining the permeable relationship in the transition area. Within the transition zone, the disorder building construction blocked the original connectivity of the landscape space, the internal natural elements gradually becoming isolated natural patches.

Until 2009, the chaotic construction still encroached the transition area. This was reflected on both the boundary anchored into mountain edges and the inner open landscape space. The buildings with rising number and density strengthened the closure of the area; Meanwhile, isolated natural patches shrunk with the further encroachment. one example in the area is that the open depressions were fully covered by new construction works. During this period, landscape transition area basically lost its initial quality and became an obstacle between landscape and urban space.

During the recent period between 2009 and 2019, the capacity in the transition zone came near its development limit. The overall urban form has not changed significantly. But the transition zone still acted as a negative barrier, hindering the connection and penetration between urban and landscape space,

All the stages of evolution record the typical features of the subsequent terrain changing process. Compared with the initial space structure in 1979, the urban development with dense building aggregation is inevitable, but the point is how we can keep the landscape elements, such as patches, corridor and matrix, connecting in such an intersection space with future pressure from city

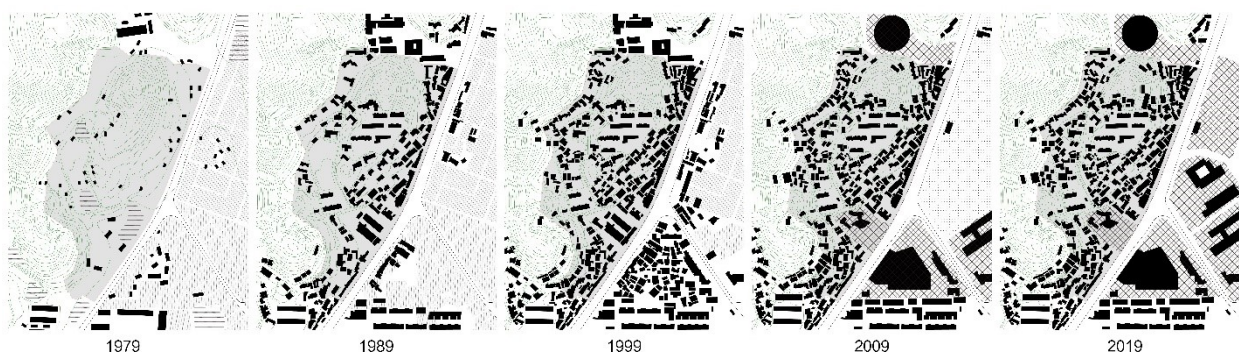


Figure 2. History evolution of study area

development, as well as nurturing the permeable boundary space between landscape and built environment.

ANALYSIS OF CURRENT URBAN FORM

The study on urban form in Tianma Group shows the characteristics of urban invasion towards landscape space between 1989 and 2009. They can be categorized into three types in terms of spatial relationship. First, replacement. Due to the insane growth of buildings in the transition zone, the landscape space was totally occupied and replaced by buildings; Second, erosion. The edge of the landscape space is encroached on by different scales of construction activities along internal roads or existing buildings adjacent to mountain boundary; Third, encirclement. Few leftover landscape space is tightly surrounded by the disorderly building patterns which form a dense network in the transition zone, leading to current isolated green 'islands'. However, behind these characteristics, the threat on transition area is deeply rooted in the lack of management of both landscape continuity and well-organized urban fabric.



Figure 3. Three types of urban invasion

Through mapping different element layers in the area, the failure of urban form can be reflected on both space structure-road system in the landscape transition area-and space integration of the open landscape space with urban fabric. From the perspective of space structure, roads, as the framework of the spatial structure, provide clues for the development of space. The current road system lacks reasonable planning, of which the paths within the area are not flexibly connected with urban interface, some parts even exist a large number of endless roads shown in Fig. 3. This is unconducive to the formation of interconnected spatial systems and frameworks on which building

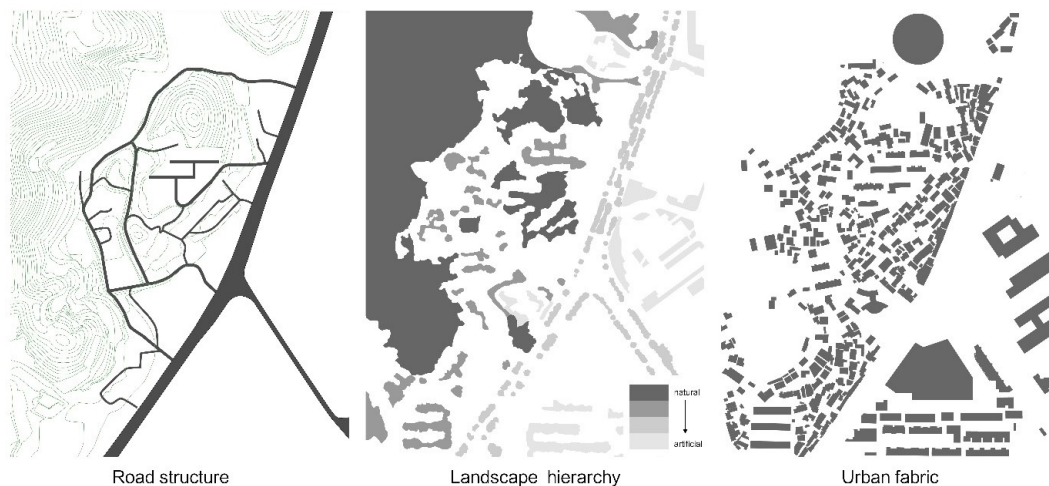


Figure 4. Urban morphological elements in the current landscape transition zone

or landscape elements can derive. From the perspective of landscape integration, fragmentation of the natural terrain are separated from each other shown in landscape hierarchy of Fig. 3. Original natural landscape is limited in certain isolated areas. And artificial landscape, like street trees, greenbelts in front of large plot and some plants in the courtyard of internal buildings, is randomly distributed without extension towards each other. Both above cannot constitute an organic landscape corridor. From the perspective of urban fabric integration, the solid boundary of building clusters on both sides set a barrier to introduce the extension into or through the transition zone. At the same time, the chaotic organization of the internal buildings with high density cannot shape a smooth space corridor to integrate landscape with the building space.

As analysis above shown, the invasion of urban construction and the deterioration of landscape space in transition area largely result from the unreasonable planning for spatial structure and lack of protective control of urban spatial and landscape elements. Therefore, to repair the urban morphology of the landscape transition area, it is necessary to start with adjustment on space structure and improvement on space integration concerning disordered urban fabric organization and low response with the natural terrain, during whose process more attention should be paid to the mainly decisive elements on both aspects, then extending to related elements to keep the space flow between the city and the landscape.

TYPICAL URBAN MORPHOLOGY IN LANDSCAPE TRANSITION AREA

This article selects three typical hilly cities with well-recognized landscape transition area to explore the organization of space structure and balanced relationship between landscape and urban environment. Rome is the capital of Italy and is known as the city of seven hills. The Villa Ada is located in the north of Rome. Its mountain landscape extends to the urban space with the form of open parks or green squares, and the roads, winding along the edge of green space, forms the organic boundary between city and natural, so that the built environment and the mountain landscape are connected in space. San Francisco is an important city on the west coast of the United States, located on a hilly peninsula. At the junction of the urban mountain and the urban space, the road forms a network of winding mountain roads that conform to the contour. The organic form retains the original mountain topography, and also provides a basic structure for building group with diverse forms of urban space. Besides, trees fill in the gap between the multi-




	ROME-Villa Ada	San Francisco-San Bruno Mountain	Canberra-Mount Ainslie
			
Characteristics of the landscape transition zone	<ul style="list-style-type: none"> The road meanders at the foot of the mountain, forming a natural boundary with urban space The green space penetrates from the mountain to the urban space 	<ul style="list-style-type: none"> Roads and houses conform to the contour layout Display the slope of the hill from the boundary 	<ul style="list-style-type: none"> The road network radiates outward following the contour of the mountain Finger-like green space connects the mountain and the city
Commonality of the landscape transition zone	<ul style="list-style-type: none"> The road structure of the transition area conforms to the natural boundary 	<ul style="list-style-type: none"> A continuous green space system connects urban spaces with landscape areas 	<ul style="list-style-type: none"> The urban texture in the transition zone is regular and orderly

Table 1. Comparison of the characteristics of the landscape transition zone in cases

story and low-rise buildings in the area, which balances the rigid form of artificial buildings. Canberra is the capital of Australia. It is located in a low hilly and gentle slope area, lying along Molonglo River. The road structure presents as a circular radial network, ingeniously combining mountain, water, land and various functions in the urban planning. At the foot of Mount Ainslie, Residential areas and public service facilities are arranged in an orderly manner, following the shape of the mountain, which harmonizes and unifies the natural features and artificial building groups, making it an idyllic modern city.

STRATEGY OF URBAN REPAIR MORPHOLOGY IN TIANMA GROUP URBAN DESIGN

Urban landscape structure is the spatial arrangement and combination of urban landscape components and elements (Wu, 2004). Urban repair morphology is aimed to coordinate the relationship between landscape elements and architectural elements with their forms. From space structure to space integration, this article suggests three specific repair strategies in landscape transition area with specific urban design tactics in the process.

First, improve the space structure to correspond with the natural boundary. The existing road system plays an important role in space structure. The principle of road arrangement in transition area should be adjusted according to the relationship with natural boundary. So it can basically conform to the contours with several curved roads around the edges introducing the green space into urban context, or with meandering roads extending to the natural slope. On the other hand, to improve the street quality with minimal interventions, roads can be designed with linear green space for pedestrians, additional walking paths would strengthen the interaction between the landscape and urban space on a micro scale.

Second, restore the original open landscape node space within the transition area. The potential node space can be identified from the evolution process first and transformed to a landscape patches with method of landscape ecology. For example, fragmented green spaces can be set up as small squares, farmland or park according to the terrain slope. Furthermore, these nodes can be linked into landscape corridor, which makes up the whole landscape system. But the construction of

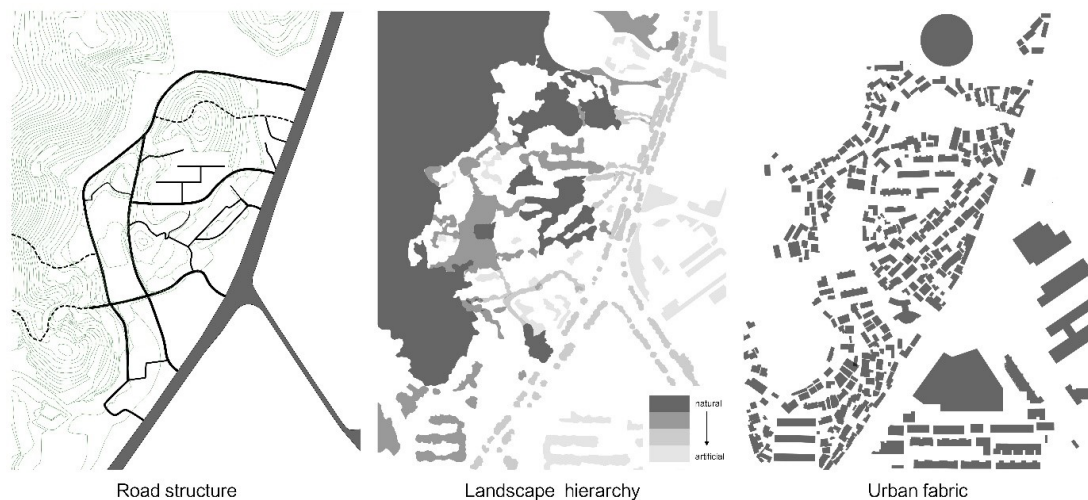


Figure 4. Urban morphological elements after repair

landscape corridors is not necessarily in the linear shape, it can be a continuous area of multiple dot-shaped green spaces. By restoring its natural form with natural or artificial green space, the landscape flow can come into existence. Third, modify the order of intensive buildings in the area. Through the demolition or reconstruction of some boundary buildings, the rigid spatial boundaries

can be broken to create a sense of penetration of space. By regulating the building layout along internal road structure, the chaotic spatial pattern can be adjusted into a more orderly spatial structure, with which the landscape elements can be integrated in to ensure the smooth flow of landscape corridors in the area.

CONCLUSIONS

The landscape transition area, as an intermediary space between urban built environment and natural landscape, simultaneously reflects the relationship between them. So in the process of restoring its urban form, it is necessary to consider from both urban aspect and landscape aspect, including the overall spatial structure based on the road system and the integration of the orderly urban fabric and connected natural landscape space. With repair strategies and more specific tactics, the landscape transition area has the potential to recover its permeability and be integrated to reconstruct a balance between built environment and landscape space. The repair strategies can also be taken into consideration during the planning stages to set a framework for future development.

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