



Study on the Spatial Planning of the Secondary Station –Located Areas along Chinese Eastern Railway

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During the Chinese Eastern Railway construction (1897-1903), a large amount of areas attached to railway station-located areas had been constructed and developed constantly, which therefore facilitates the emergence of new type morphology of cluster arising from the railway in northeast China. And the towns' morphology of this period had had the profound influence on the subsequent the towns' development in northeast China. In this research, the author himself went to St. Petersburg in Russia and to check and collect files in Russian National History Archives, from which a large amount of basic files about city construction during the period of the construction of Chinese Eastern Railway have been generated; then, based on the above materials (ages and number), the research period (construction of Chinese Eastern Railway 1897-1903), objects (railway stations along the main lines of Chinese Eastern Railway:) and sample (Station Hailar and Suifenhe)are determined; Thirdly, the historic planning drawings and towns' construction for two stations are translated to extract the planning information ,earlier city construction, social economy development , location features, land layout, texture of street profile, street transport, buildings' texture, landscape greening and other basic elements of towns' morphology. Two towns are compared to conclude the typical structural pattern and morphology. Ultimately, Russian style station in Suifenhe City is taken to conduct field research and empirical analysis and explicit the conservation content of historic features as well as propose the conservation ideas depending on the principles of completeness and authenticity. After hundreds of years, the Russian style stations during the Chinese Eastern Railway have developed into to the commercial centers, which dominate in the modern city. Although the features of earlier Russian style stations have been broken, these centers still demonstrate strong sense of environment and landscape as Russian style colonial city. This research intends to explore the planning content of earlier stations to restores the planning elements of earlier cities with the ultimate aim to reveal the historical landscape of the towns, which is greatly significant to the conservation of urban historical features.

Keywords: urban morphology, urban planning history, Chinese Eastern Railway, secondary railway station.

Introduction

At the end of 19th century, to expand the influence in the Far East and consolidate the strategic position in the Yellow Sea region of China, Russian Tsar constructed a T-shaped railway (hereinafter referred to as Chinese Eastern Railway) through northeast Chinese, which starts from Manchuria in the west, ended in Suifenhe in the east and reached to Lushun in the north (Shixuan Jin 1986,chap 1). During the construction process of Chinese Eastern Railway, the stations along the railway were divided into five types based on the railway transport service and its derived requirements. Among them, the secondary station, as the crucial node of the railway service, functioned as the collection and distribution of the materials, locomotive maintenance and railway administration management, etc(Jianhong Dong 1989, chap 3). meanwhile, the spatial planning and construction of the station-located areas were increasingly developed, which then drove the secondary station-located villages and towns to gradually become the important administrative and border trade along the railway.

Table 1 Geographical statistics of secondary stations

Station	Construction	Original	Distance from	Distance from	Location
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		name	Station Harbin	Station Manchuria	
Manzhouli	1901	Mengjiuliya	935km	—	Manzhouli City, Inner Mongolia Autonomous Region
Hailar	1901	Hulun	748km	187km	Hailar District, Hulunbuir City Inner Mongolia Autonomous Region
Boketu	1901	Buhaduo	539km	396km	Boketu Town, Yakeshi City, Inner Mongolia Autonomous Region
Qiqihar	1903	Xitun	270km	665km	Anangxi District, Qiqihar City, Heilongjiang Province
Hengdaohezi	1901	—	271km	1206km	Hengdaohezi Town, Hailin City, Heilongjiang Province
Suifenhe	1903	Pogulanqiana	548km	1418km	Suifenhe City, Heilongjiang Province

I layout of land use

Station-located areas, as the spatial node for the service of railway operation, involves many aspects of railway-related economy, culture, education and administration and others in its types of land use. The specific types include the commercial land for the service of railway transport and trade, the residential land for the living and daily life of railway staff and residents, the recreational land for leisure, medical land for rehabilitation and care and specific land for professionals (including monks, judges, translators, teachers, etc.). Different types of land use are set up to initially form the towns' function of the station-located areas, such as administration, border trade and locomotive maintenance.

As shown in Figure 1 and Figure 2, the layout of land use for two secondary station-location areas takes the railway station as the origin with the distribution along the railway lines, while constantly extending to both sides of the railway. The railway station is located in the center with the elliptical square to the south; closely to the railway station, the residential land is distributed on the west and east side of the square in front of the station, which includes staff dormitory and residential houses; the commercial land and medical land are adjacent to the residential land use, locating in the western part of the town, which include shop, hotels; the special land is scattered in the northwestern part of the town, which includes education land (schools for Russian students), houses for translators and teachers; the entertainment land is between the special land in the western part of the town, which includes clubs and parks. The newly added land for citizen's life, closely to the residential land, is distributed to the northern edge of the town.

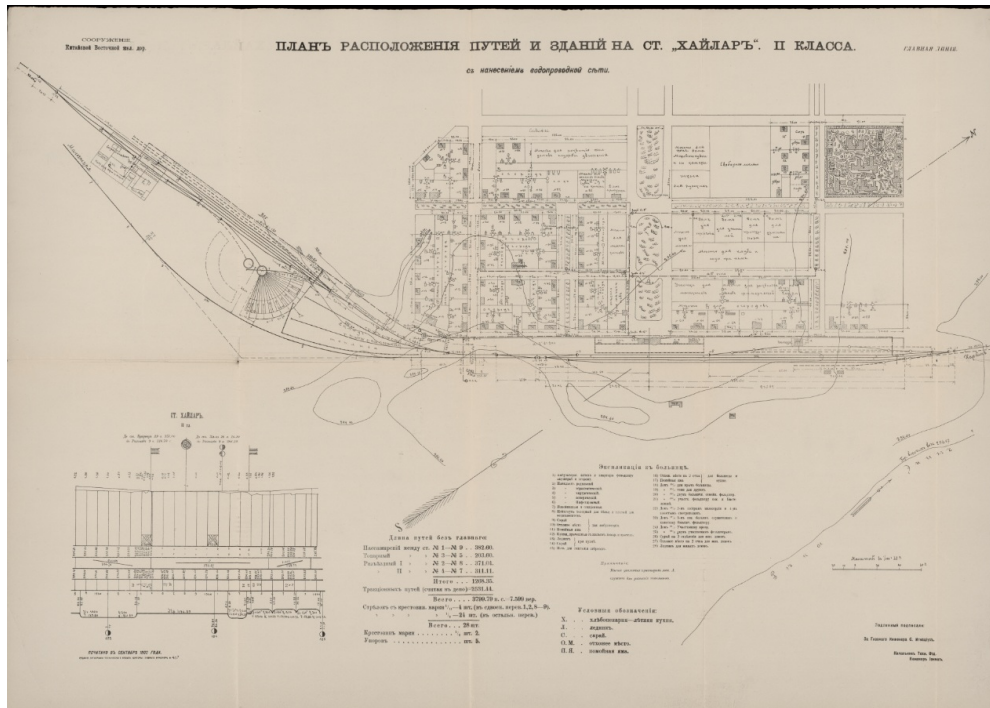


Figure 1: Ignagus . Hailar planning drawing . [Hailar,1902]

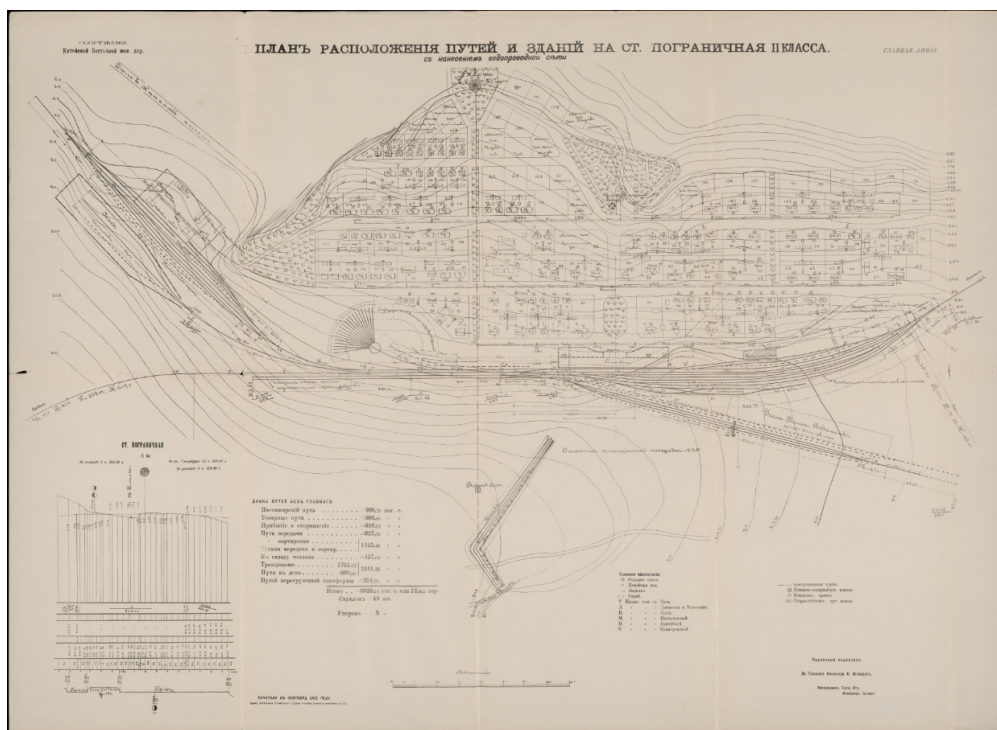


Figure 2: Ignagus . Suifenhe planning drawing . [Suifenhe,1902]

Through the comparison of each land scales and the distance away from the railway station (seen in Table 2), it's concluded that the scale of the residential land is the largest and then the commercial land; for the distance away from the railway station, the nearest is the residential land and then the commercial land. The station-location area is generally planned to service the railway operation and its required derivative services. In the plan, a large amount of residential land, squares and commercial land are set around the railway station. Additionally, the medical land is set up closely to the railway station, which is convenient to the life of railway staff and their



families; in the plan, the commercial, special and entertainment land are scattered to improve activity space and towns' vitality; on the other side, in the plan, there are also the hotels specially for Chinese, which are set at the northeastern edge of the town along with the houses for translators. A large amount of idle land is reserved for the future construction and development of the towns. As the crucial transport nodes of prosperous trades, the proportion of commercial land in station-located area is larger. In sight of the land demand from the population growth, the land for life is reserved to accommodate newly increased citizens. Large scale parks are constructed in the towns to further mitigate the environmental issues brought by the surging population(Sun Hui, 2006).

Table 2 Statistics of land use in station-located areas (sagene¹)

Land use	Station Suifenhe			Station Hailar		
	Planning area (m ²)	percentage	Distance from Station Harbin (m)	Planning area (m ²)	Percentage	Distance from Station Harbin (m)
Residential land	45000	67.37%	< 10	22500	48.70%	< 10
Commercial land	3500	5.24%	< 75	5000	10.82%	< 25
Special land	3200	4.79%	< 125	2700	5.84%	< 75
Medical land	2000	2.99%	< 150	—	—	—
Entertainment land	1100	1.65%	< 200	2500	5.41%	< 100
Idled land	12000	17.96%	—	—	—	—
Total	66800	100%	—	46200	100%	—
Remarks	Idled land is set up around the towns.			The land for life is reserved to accommodate new newly increased citizens at the north end of the towns.		

The plan of secondary station-located not only serves the railway operation, but also satisfies the derivative requirements from the operation, which include staff residence, commercial trade, entertainment, education, religion and military, etc. For the types of land use, according to the different functional demands, the land use of station-located area include commercial land, residential land, entertainment land, special land, medical land and idled land (reserved land for newly increased residents), etc. The structure layout depends on the proportion of land use and the distance from the railway station. The railway station is located at the center of the town with the square to the north; the commercial land, closely to the railway station, is distributed along both sides of the square in front of the station; the residential land, closely to commercial land, is distributed on both sides of railway station; entertainment land, distributed in the west of the town, is closely adjacent to commercial land and residential land; the special land, distributed in the west of the town, is closely adjacent to the commercial land and entertainment land; distributed at the northwestern edge of the town, medical land is closely to the residential land; the idled land (reserved land for newly increased residents) is scattered on the edges of the town.

II Road network structure and street design

Since these two secondary station-located areas were constructed on newly built area, their road networks therefore demonstrate the characteristics of overall planning. The road structure is the compact small-scale grid with straight roads. The towns with grid road network are more resilient in growth scale and direction. Meanwhile the frontage proportion could be increased to ensure the standard land subdivision, fair land purchase and lease, accessible trade flows and unified planning and management. For Station-Hailar-located areas, the distance between the roads is commonly within 125 sagene, the width of the main road is 9 sagene and 7.5 sagene for minor roads. For Station-Suifenhe-located areas, the distance between the roads is commonly within 100 sagene, the width for main roads is 10 sagene and 4 sagene for minor roads.

Through the comparison between the structures of the road network and street design for these two stations (see Table 3), it's concluded that the structure of road network , which is applied in the planning patterns of the secondary-station-located areas, the width of main roads is approximately 10 sagene and 5 sagene for the minor roads. This kind of structure could easily generate the street profile, parallel to the roads, which avoids the sharp corners at road crossings, benefits to deal with the building orientation and land lease as well as the land

¹ 1 sagene=2.134 meter



development and commercial operation. In general, the grid structure unifies the orderly layout of the towns, which is conducive to the towns' development of construction. In addition, the street design is featured as wide, flat and straight with dense road network. The distance between the roads is commonly within 100 sagene. For straight streets, nodes are connected with straight lines to further facilitates traffic and eliminate the secrets among irregular neighborhood; with the straight street, the colonists could more effectively control the city.

Table 3 Comparison of road network structure and street design for two stations (Sagene)

Station	Structure of road network	Street width		Street design
		Main street	Minor street	
Suifenhe	grid	10	4	wide, straight and flat
Hailar	grid	9	7.5	wide, straight and flat

III Town texture and landscape greening

The street profiles for two secondary station-located areas are mostly short squares with the ratio of length and width between 1:2 and 1:3. The street profile, however, for residential land ranges from short and squares to narrow and long and the ratio of length and width even reaches to 1:4. The scale of the street profile is relatively small. The planning structure has demonstrated strict geometric features, small scale of street profile and dense urban fabric. The depth of typical street profile for Station Hailar-located areas and Station Suifenhe-located areas are respectively 120 sagene and 110 sagene. The typical depth of commercial land and residential land is 50 sagene; the standard grid dominates in land division. The scale are 50 sagene ×132 sagene and 45 sagene ×115 sagene in respective. For architectural texture, the buildings are set up in double rows within the street profile and the buildings at the edge are set up closely to the four corners of the land, of which the public toilets, garbage, ice pits and sheds exist in the middle (see Figure 3). The greening in front of the station is the oval green land with the respective scale of 20 sagene×50 sagene×3 sagene and 18 sagene×38 sagene (see Figure 4); setting up in the middle of the roads, the width are respective are 5 sagene and 6 sagene; the park greening concentrates in the north of the towns, which is square and trapezoidal, with the scale of 5,041 square sagene and 4,750 square sagene (see Figure 5).

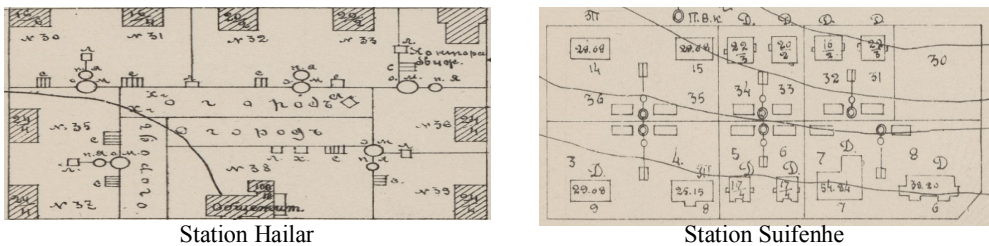


Figure 3: Ignagius . Buildings' texture. [Hailar、 Suifenhe, 1902]

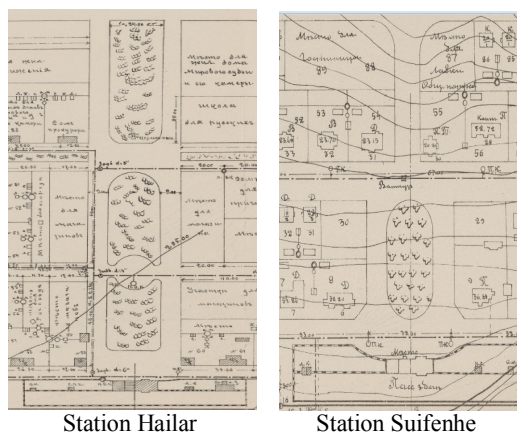


Figure 4: Ignagius . Greening in front of the station. [Hailar、 Suifenhe, 1902]

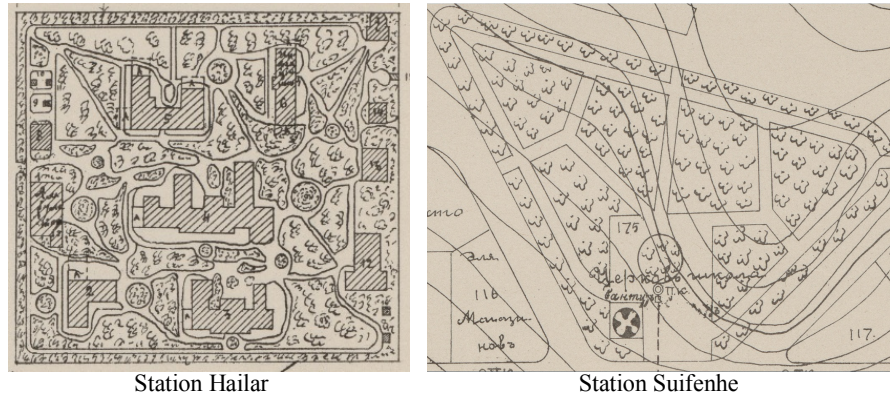


Figure 5: Ignagus . *Parks' greening*. [Hailar、 Suifenhe, 1902]

Based on the comparison of towns' texture and landscape greening (see Table 1), the depth of street profile for the secondary station-located areas is 100 sagene. And it's 50 sagene for commercial land and residential land. The standard grid dominates in land division. The land scale is 50 sagene×100 sagene, which unified the shape, orientation and scale of the land. For architectural texture, the buildings are set up in double rows within the street profile and the buildings at the edge are set up closely to the four corners of the land, of which the public toilets, garbage, ice pits and sheds exist in the middle. With this kind of layout, it's possible to obtain large inner courtyard between the dwellings to further form an ideal public space of communication, which is more concentric and conducive to the neighborhood communication as well as cold resistance and wind protection; in additional, one characteristic of this layout is to stress the street-facing interface with the vegetable garden in the inner courtyard, which endows the courtyard with the function of agricultural production. The landscape greening include greening in front of the station (oval), road greening and park greening; the road greening is set up in the middle of the roads, 5 sagene; the parks greening concentrates at the north end of the towns.

Table 4 Comparison of towns' texture for each station (Sagene)

Station	depth of street profile		plot		Building's texture	
	Typical street profile	commercial and residential land	division	scale	buildings' layout	remarks
Suifenhe	110	40	grid	45×115	double row, closely to the four corners of the land; public toilets, garbage, ice pits and sheds exist in the middle	—
Hailar	125	50	grid	50×132	set up along the edge, closely to the four corners of the land; public toilets, garbage, ice pits and sheds exist in the middle	vegetable garden in the inner courtyard

Table 5 comparison of landscape greening for each station (Sagene)

Station	Greening in front of the station	Scale	Road greening	Greening width	Parks greening	Greening area	shape
Suifenhe	oval	18×38	In the middle of the roads	6	northwest part of the town	4750	trapezoidal
Hailar	oval	20×50×2	In the middle of the roads	5	northeast of the town	5041	square

IV Summary of planning models for secondary station-located areas

Influenced by the idea of functional zoning of the secondary station-located area, the layout considers the railway station as the center and set up a large amount of oval squares and greening at the center of the towns. Public buildings, such as commerce and entertainment, are also set around the squares. The railway station,



additionally, is taken as the base to develop along the railway lines from the south to the north, in which residential land, commercial land, entertainment land, special land, medical land and military land. The land scale is dominated by the residential and commercial land. It's therefore generated that the plan focuses on the railway operation and the basic function of the station-located area is to satisfy the requirements of residence, life and business from the railway staff. The typical grid is applied by the road network of the towns. The spatial form of the square is the simple and wide station in front of the station. The street is wide, straight and flat. The depth of the typical street profile is 100 sagene and 50 for the typical depth of commercial land and residential land. The buildings are set up in double rows within the street profile and the buildings at the edge are set up closely to the four corners of the land, of which the public toilets, garbage, ice pits and sheds exist in the middle. The road greening is set up in the middle of the roads and the parks greening concentrates at the north end of the towns.

V The application in conservation of historical features-taking Suifenhe City as an example

After hundreds of years of city development and construction, the earlier station-located areas have already been submerged in the continuous expansion and reconstruction of city map. Through the comparison of original planning drawings and remote sensing of status quo, the historical boundaries of earlier Suifenhe Station-located areas is determined (see Figure 6), which is composed by Xinghong Road, Zhanqian Road, Changan Street and Jvyuan Street. Within historical boundaries, it's still clear to find out the planning characteristics of earlier secondary station-located areas, which conclude the grid road network, flat and straight street and orderly land division. However, the typical greening in front of the station and road greening is hardly reserved and the enclosed structure of the building is additionally changed. Generally speaking, the Russian style station-located areas in Suifenhe City have retained the earlier planning framework.



Figure 6 illustration of historical boundaries for Suifenhe Station-located areas

Historic buildings, as the most recognizable characteristic elements, are significantly crucial to the construction of historical features. The field research of historic building is conducted to clarify the current information of the remains within historical boundaries (see Table 6). According to the statistics, within Russian style station-located areas, there are total 26 historic buildings, among which the number of building is 2 for Japanese occupation period(1935-1945) and 24 for Russian occupation(1896-1917); most of the buildings are well preserved with less influence on authenticity. For buildings' base, more than 60% have mildew problems and some have others such as weathering, settlement, fragmentation, cracks and burial issues. 70% of the walls more or less have crack issues and less have weathering, mildew and efflorescence; the users are complex and 16 buildings is individually owned and 9 buildings is state owned. The rest one is collective ownership. In



conclusion, the number of historic building remains is less, well preserved and, however, is faced with damage such as mildew and cracks as well as lost risk; additionally since the remains is largely individual owned, the utilization and conservation of the buildings themselves are hardly regulated and consistent with the counterpart of the surrounding environment, which has caused huge damage to the historical features (see Figure 7).

Table 6 Statistics of status quo of historic buildings

Name	The former site of the Russian Consulate in Suifenhe	Current function	commerce
Address	No.111,Guanghua Road Guanghua Community, Suifenhe Town, Suifenhe City, Heilongjiang Province		
Age	1931	Façade material	Plastering
Altitude elevation(M)	456	Building's structure	Brick and mortar
Level of cultural relics	National Key Cultural Relic Conservation Unit	Heritage type	Administrative office
Ground floor	2	Underground floor	1
Floor area(m²)	679	Construction area(m²)	1358
Ownership	Country	Using agency	Suifenhe Museum of Russian Painting Art
Damage	Base	Mildew	
	Wall	Peeling	
	Layout	Complete and authenticity	



Figure 7 Environment of historic buildings

Suifenhe City has completely preserved the earlier planning framework and part of historical buildings in Russian style station-located areas. Two historical featured areas are mainly constituted within historical boundaries: areas of single historic building and clusters of historic buildings (see Figure 8). Under preserving the earlier planning framework completely and following the principles of building authenticity and completed features(Long Shao 2016,chap 2), the existing problems from the field research are combined to put forward the following conservation ideas of historic features. In general, the earlier planning layout, the authenticity of historic buildings and consistency of surrounding environment are in full conservation while continuing their earlier function and moderately increasing new functions without destroying historic features (Jun Zhang 2017,chap 2). Another is to formulate the conservation principles and measures for conservation of historic



buildings, environmental remediation, management and exhibition, etc. On the other side, two distinct strategies are deployed for two types of historic featured areas. Since the historic features of single historic buildings area have been broken, therefore, in this area, the conservation of the buildings themselves is stressed to implement overall conservation. The conservation scope is rationally divided according to the specific circumstances, where the development and utilization should be forbidden and the proper development is permitted(Wan Yong,2011). As developing, the coordination of the overall style is also paid attention. The design of new elements should be coordinated with historic features to avoid using strange decoration materials and excessive large mass and scale; the new is coordinated with the old and the traditional buildings are coordinated with the modern buildings to form mutually coordinated features. The cultural relic conservation units and excellent historic buildings are not only in respect; new modern buildings are also arranged reasonably. New buildings obey not breaking the overall atmosphere of historic and cultural featured areas.



Figure 8 illustration of spatial distribution of historic buildings

Conclusion

After hundred years of vicissitudes and drastic changes of social and economic system, Russian style station-located areas, along Chinese Eastern Railway, still demonstrate strong adaptability with obvious location advantages. The land layout of parcel development is conducive to consolidation and expansion for goods, people and commercial trade. The spatial texture of street profile is condensed and fine and the road traffic is smooth and orderly. Although the earlier planning framework of station-located areas is reserved, a large amount of historic buildings have already been damaged more or less, and even most of them have disappeared. The historical features require urgent conservation within the station-located areas. In this research, the author strives to restore planning histories to further achieve the conservation of historic features of earlier station-located areas. However, this research is only limited to the quantitative analysis, including the collection of historical materials and the existing problems, which is insufficient in the consideration of the recognition of historical features from different groups as well as the eyes' perception on historical features and other factors.



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Disclosure Statement

No potential conflict of interest was reported by the author.

Notes on contributor(s)

Bocheng Zhang, from the School of Architecture of Harbin Institute of Technology, Heilongjiang Key Lab on Urban-Rural Human Settlement Science in Winter Cities, PhD student. Research fields: conservation and planning of cultural heritages. During August to December, 2016, I visited St. Petersburg State University to make joint research on cultural heritage conservation along Chinese Eastern Railway. The published papers include Study on the Conservation of Historical Cultural Heritage in St Petersburg City and Research Situation and Hot Issues Analysis of Chinese Eastern Railway from the Perspective of Urban Heritage. The papers pending on include the Spatial Characteristics of Station Area Planning for the Secondary Stations along Chinese Eastern Railway, Research on the construction of Chinese Eastern Railway (main line) and Urban Planning in Northeast China and etc.

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Image sources

Figure1:Russian National History Archives, Digital Collections [ф350оп16д700л1], [http://www.fgurgia.ru/search/SIMPLE/10523?sPs\[0\].tV=%D0%9A%D0%92%D0%96%D0%94&lc=ru#!page:1/o:27608476/p:1/o:27821861/p:35/o:1167965283/p:1](http://www.fgurgia.ru/search/SIMPLE/10523?sPs[0].tV=%D0%9A%D0%92%D0%96%D0%94&lc=ru#!page:1/o:27608476/p:1/o:27821861/p:35/o:1167965283/p:1)

Figure2:Russian National History Archives, Digital Collections [ф350оп16д678л1], [http://www.fgurgia.ru/search/SIMPLE/10523?sPs\[0\].tV=%D0%9A%D0%92%D0%96%D0%94&lc=ru#!page:1/o:27608476/p:1/o:27821861/p:34/o:1167964489/p:1](http://www.fgurgia.ru/search/SIMPLE/10523?sPs[0].tV=%D0%9A%D0%92%D0%96%D0%94&lc=ru#!page:1/o:27608476/p:1/o:27821861/p:34/o:1167964489/p:1)

Figure 4、 5、 : The same as Figure 1 and Figure 2

Figure 6: Google Remote Sensing Satellite Gallery

Figure 7: Taken by author

Figure 8: Google Remote Sensing Satellite Gallery