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A Historical Investigation of the Causes Behind Beijing's "Ring plus Radiation" Road Network Layout

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Abstract: The "Ring plus Radiation" road network layout is a typical feature of Beijing's urban spatial structure and it is necessary to conduct a specialized study on its causes. Based on a wide range of original archives and using a research methodology of urban planning history, this paper presents a systematic review of the formation process of this layout. The findings reveal that the road network layout resulted from a complex set of influencing factors, including the practical needs of the city at that time, the continuation of previous planning schemes, and Soviet Union's experiences in urban planning. The planners and designers also aimed to create an artistic urban spatial structure. Looking forward, the paper suggests that further research should be carried out with a more positive attitude to improve Beijing's road traffic system. Additionally, the study challenges the notion that Beijing's single center development is a consequence of the "Ring plus Radiation" road network layout. Through a case study comparison with Paris, which has a multi-center development approach and a similar road network layout as Beijing, the paper argues that this assertion lacks scientific rationality. DOI: 10.13813/j.cn11-5141/u.2023.0202-en

Keywords: urban planning history; urban transportation; road network layout; loop + radiation; Beijing

The study of spatial structure and urban planning history in Beijing holds particular significance. In terms of spatial structure, the distinct characteristic of the road network layout in this large city is the "Ring plus Radiation" form, which is represented by multiple concentric rings distributed in outer layers and radial lines radiating outward from the central old city. The academic community holds different views on this matter. One perspective considers the "Ring plus Radiation" structure as a significant advantage of Beijing's road network system, stating that the layout is suitable^①. On the other hand, another viewpoint argues that the "Ring plus Radiation" road network layout objectively emphasizes the existing city center, which hinders the rapid formation of new city centers and affects the renovation and transformation of the old city^[1].

There has been extensive research and discussion in the academic community regarding Beijing's "Ring plus Radiation" road network layout. Previous studies have focused on the accessibility of the urban road transportation system and its impact on the renovation of the old city and development of new areas^[1-5]. However, there is still a lack of dedicated research and discussion on how the "Ring plus Radiation" road network layout was originally formed. Based on the author's recent research on the urban planning history of Beijing and supported by the examination of a collection of primary archival materials, this paper attempts to provide an explanation on this subject.

1 Historical evolution of Beijing's urban road network

As an ancient capital, the old city of Beijing took shape primarily during the Ming and Qing dynasties, with a traditional grid-like layout of the urban road network. For a considerable period, urban construction and development in Beijing were mainly confined within the city walls. After the Lugou Bridge Incident in 1937, the Japanese occupied Beijing^[6] (which was renamed Beijing on September 27, 1949) with the intention of aggression. They formulated the "Beijing Urban Planning Outline" in 1938, with a focus on constructing two new street markets in the western and eastern suburbs outside the old city. They proposed the concept of a "Ring plus Radiation" road network layout, stating that "three circular routes are planned around the city, and green spaces are to be placed on both sides closest to the city walls to create spacious tree-lined roads" and "for the areas outside the city, radial main roads are planned from the inner city gates of Chaoyang, Dongzhimen, Anding, Desheng, Xizhimen, Fucheng, and the outer city gates of Guangqu, Zuo'an, Yongding, You'an, and Guangan, connecting various important locations"^[7]. Looking at the planning scheme formulated based on the "Beijing Urban Planning Outline" in 1939 (see Figure 1), the so-called circular and radial lines

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were more based on considerations of regional transportation functions, displaying a certain degree of arbitrariness rather than a specific urban road network form. Among them, the most remarkable road form is a rectangular ring road that surrounds the outskirts of old Beijing. This road is the widest among all roads, with a width of “140 meters, with tree-lined roads on both sides, forming green belts around the city” [7]. The western section of this road roughly corresponds to the current location of South Stadium Road and South Zhongguancun Street. During the eight years of Japanese occupation, the focus of road construction was on extending Chang'an Street west of Xidan and east of Dongdan (creating two openings in the city walls), facilitating transportation connections between the new street markets in the western and eastern suburbs. The other circular and radial roads proposed in the “Beijing Urban Planning Outline” (1938) were generally not actually constructed.

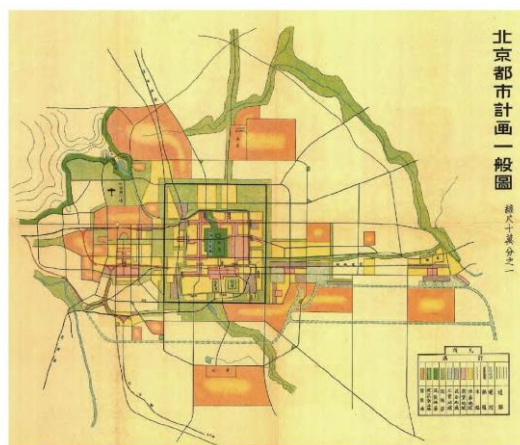


Fig.1 A general map of Beijing urban planning (1939)

Source: Reference [8].

After the victory of the War of Resistance Against Japan in 1945 and the liberation of Beiping (now Beijing), the Beiping Municipal Works Bureau revised the “Outline of Beijing Urban Planning” (1938), which was formulated by the Japanese aggressors. Some road alignments were adjusted, but in terms of road network layout, it remained relatively similar to the planning scheme formulated during the Japanese occupation of Beiping (see Figure 2). However, due to the impact of the Liberation War, the planned road transportation system in the revised Beiping Urban Planning scheme was not implemented in subsequent development efforts.

2 Formation process and reasons for the “Ring plus Radiation” road network layout

2.1 Road network planning concepts from 1949 to 1952

After the peaceful liberation of Beiping (now Beijing) on January 31, 1949, following the establishment of the People’s Republic of China and the decision to make Beijing the capital, a large-scale reconstruction and modern urban planning

development of the city began. In September 1949, the first group of Soviet municipal experts arrived in China and conducted on-site investigations, providing a series of recommendations for the future urban planning of Beijing. However, these initial planning suggestions focused on the nature, scale, and functional zoning of the city, without specific design concepts for the urban road transportation system.

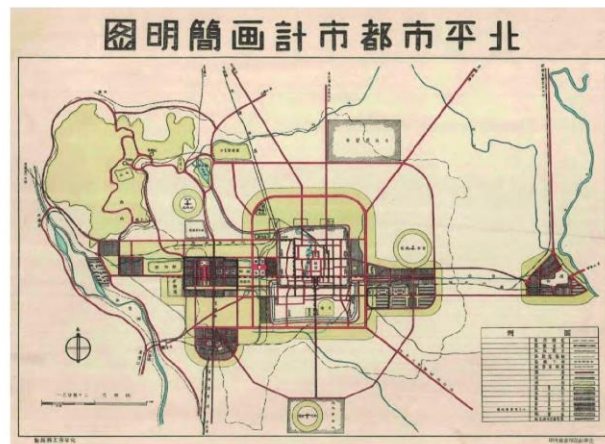


Fig.2 A sketch map of Beijing urban planning (1947)

Source: Reference [9].

On November 14, 1949, during a special report on the Beijing Municipal Construction Bureau, Qing Management Bureau, Land Administration Bureau, and urban planning issues by Soviet expert Михаил Григорьевич Баранников, Liang Sicheng and Chen Zhanxiang expressed different opinions on the location of the administrative center of the capital and the number of floors for housing construction. In February 1950, the two jointly proposed the “Proposal on the Location of the Administrative Center of the Central People’s Government,” suggesting the construction of a dedicated administrative district in the western suburbs of Beijing, known as the “Liang-Chen Plan” [10]. The Beijing Urban Planning Commission, in its illustrative documents on the “Liang-Chen Plan,” included a rough design for the main road system. Apart from the railway system, the road plans mainly consisted of one bullet-shaped ring road encompassing the old city of Beijing and the administrative district in the western suburbs (see Figure 3), with an additional irregular ring road closer to the city’s boundary.

In April 1950, in the Urban Planning Map of Beijing proposed by Zhu Zhaoxue and Zhao Dongri, several circular routes were also designed for the outer ring road network of old Beijing (see Figure 4).

From 1951 to 1952, the Beijing Urban Planning Commission proposed several overall planning schemes for the city of Beijing, which included considerations of circular and radial routes as elements of the road network design (see Figure 5). However, these circular and radial routes were relatively arbitrary and, like the “Liang-Chen Plan” and the plans proposed by Zhu Zhaoxue and Zhao Dongri, they remained at the stage of conceptual design and were not implemented.

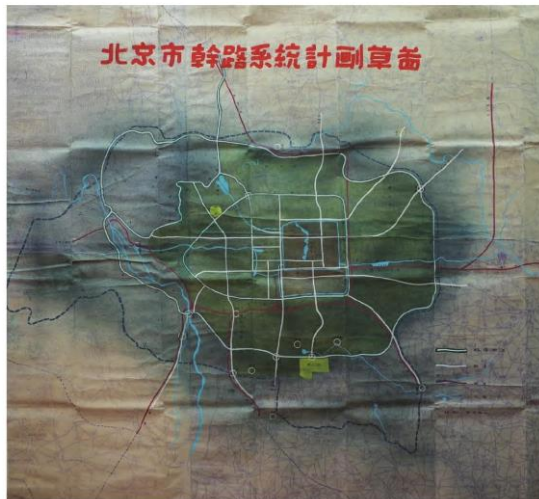


Fig.3 A diagram of the Liang Sicheng-Chen Zhanxiang Proposal: Beijing's sketch map of arterial road system planning (march 1950)

Source: Reference [11].

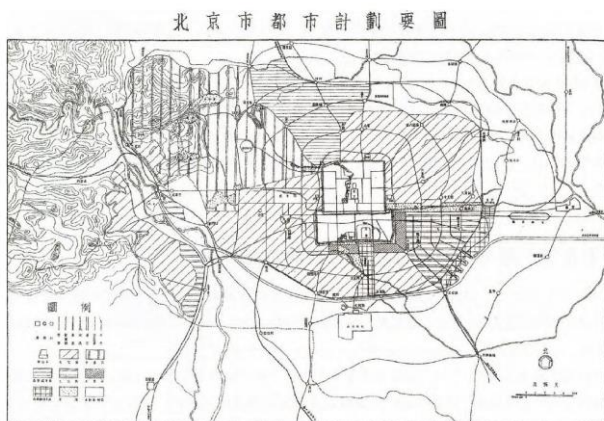


Fig.4 The proposal by Zhu Zhaoxue and Zhao Dongri: outline map of Beijing urban planning (april 1950)

Source: Reference [12].

2.2 Preliminary determination of the “Ring plus Radiation” road network layout in 1953

2.2.1 From plan A and plan B to the Changguanlou planning group plan

In 1953, China began implementing its first “Five-Year Plan,” which required large-scale urban expansion. That year, Beijing completed the initial version of its urban master plan. There were two phases of achievements: Plan A and Plan B completed in the spring of 1953 by the Beijing Urban Planning Commission, and the “Draft Plan for the Reconstruction and Expansion of Beijing” completed at the end of 1953 by the Changguanlou Planning Group of the Communist Party Beijing Municipal Committee (referred to as the “Changguanlou Planning Group”), which further integrated and modified Plans A and B. By comparing the planning maps completed in these two phases, it can be observed that the “Ring plus Radiation” road network layout of Beijing took shape during the work of the Changguanlou Planning Group.

In Plans A and B, the road network around the outskirts of old Beijing largely followed the traditional grid layout of the inner city, with the ring road characteristics not prominently featured. However, both plans included explicit radial roads. The main difference was that Plan A (led by Hua Lanhong and Chen Gan) introduced ten radial roads into the inner city in the northeast, southeast, northwest, and southwest directions, while Plan B (led by Chen Zhanxiang and Huang Shihua) only extended the radial roads to the city wall (along the moat loop), maintaining the traditional grid road system within the old city (see Figure 6).

The comprehensive plan sketch, known as the “General Plan” (see Figure 7), completed by the Changguanlou Planning Group, incorporated the characteristics of both Plans A and B in terms of radial road design. It included radial roads in four directions, while adopting Plan B’s design (no radial roads within the old city) in the northern area of the old city and Plan A’s design (radial roads extending into the old city) in the southern area. Unlike Plans A and B, the plan by the Changguanlou Planning Group included multiple ring roads around the outskirts of old Beijing.

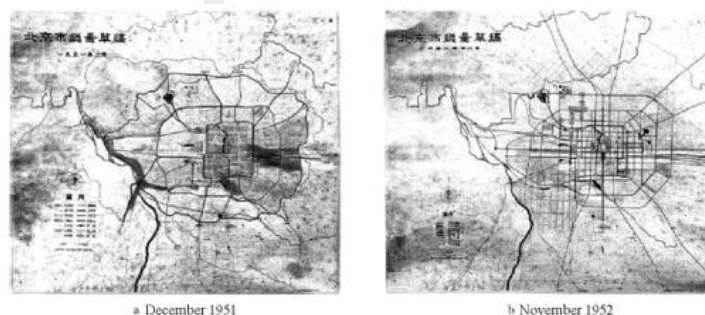


Fig.5 A preliminary draft of the master plan for Beijing urban planning in 1951–1952

Source: Reference [13].

On December 9, 1953, the Communist Party Beijing Municipal Committee submitted the planning document titled “Key Points of the Draft Plan for the Reconstruction and Expansion of Beijing” to the central government. It proposed, “Take Xijie Kou-Cai Shi Kou-Suan Shi Kou-Beixin Bridge as the first ring road (inner ring) to bear the main responsibility for ground transportation in the central area, with a width of no less than 90 meters.” It further stated, “In addition to the inner ring and the moat loop, several additional ring roads and auxiliary ring roads should be added, with widths generally ranging from 40 to 90 meters.” It also suggested, “To reduce freight transportation passing through the city, a major ring road primarily used for freight should be constructed on the outskirts of the planned area, connecting with highways from Tianjin, Baoding, Tongxian, Zhangjiakou, Chengde, and other cities coming to Beijing.” At the same time, “Four radial trunk roads should be opened from Dongzhimen, Xizhimen, Caishi Kou, and Suan Shi Kou, respectively, leading directly to the industrial zone in the northeast and the civil aviation airport and connecting to Gubeikou; to the cultural and educational district and the recuperation area; to Fengtai and Liangxiang; to the industrial zone in the southeast and connecting to Tianjin. The width of these radial roads should be no less than 70 meters”^[15] (see Figure 8). This represents the basic considerations of the planning at the time for the “Ring plus Radiation” road network, and the inner ring of Beijing’s old city, from Xijie Kou to Cai Shi Kou, Suan Shi Kou, and Beixin Bridge, became the lesser-known “First Ring Road” of Beijing.

2.2.2 The Planning incentives for the “Ring plus Radiation” road network layout

As mentioned above, the “Ring plus Radiation” road network layout of Beijing was formed during the work of the Changguanlou Planning Group in 1953. So why did the planning work adopt such a road network layout? Important clues are provided by the diary of Zheng Tianxiang, the head of the Changguanlou Planning Group and the Secretary-General of the Communist Party Beijing Municipal Committee at the time.

In the second half of 1953, with the strong assistance of Soviet expert Dmitry Dmitrievich Baragin (Дмитрий

Дмитриевич Барагин), who was part of the second group of Soviet experts sent to assist China, the planning work of the Changguanlou Planning Group commenced. According to Zheng Tianxiang’s diary, Baragin’s assistance officially began on August 14, 1953. After a period of listening to reports and understanding the situation, Baragin provided comments on the planning sketches on September 3. Regarding the urban axis and road transportation system, the following records can be found in Zheng Tianxiang’s diary:

“Main axes: Utilize an ancient one and another east-west axis. Main trunk roads: Three ring roads. Major urban traffic arteries. Add two and a half ring roads on the west side.

Fully consider the existing roads. However, the original grid-shaped roads have shortcomings in terms of traffic, so some radial roads were added. The combination of ring roads and radial roads forms the main road network, which effectively connects various regions and supplements the shortcomings of the grid-shaped roads.

Some roads require the demolition of many houses. Therefore, the use of existing roads was maximized, which imposed significant limitations on the sketches. Radial roads and ring roads are developed in open areas. The northwest area utilizes existing roads, which is economically viable and easier to implement. It is more realistic.

Railways: Originally passed through the city. As the city⁽²⁾ develops, the railways⁽²⁾ must be relocated to connect industrial areas and residential areas, now planned to run on the outskirts.”⁽³⁾

From the above summary, it can be understood that the planning proposal confirmed in the first edition of Beijing’s overall urban plan consists of the north-south central axis of Beijing and the east-west Chang’an Avenue as the city’s two main axes, with three ring roads and several radial roads as the road framework. The main reason for adopting the “Ring plus Radiation” road network layout is to compensate for the shortcomings of Beijing’s original grid-shaped road network, enhance the artistic design of urban spatial planning, and provide convenient transportation connections for various functional areas. At the same time, the relocation of the suburban railway line from the vicinity of the old city to the outer areas created the possibility for the implementation of the ring road plan.



Fig.6 Beijing master planning (in spring 1953, a redrawn edition)

Source: Reference [14].



Fig.7 A preliminary draft of Beijing urban planning—master plan (revision in 1954, a redrawn edition)

Source: Reference [14].



Fig.8 A preliminary draft of Beijing urban planning—road width (november 1953)

Source: Reference [16].

The key points of the “Plan for the Reconstruction and Expansion of Beijing City” state: “The main roads that have formed in Beijing’s history have the advantages of neatness and symmetry, but the uniform grid-like roads result in longer travel distances and more intersections, which are not suitable for the transportation needs of a modern city. In addition, the roads are narrow, with many small alleyways, and are obstructed by the ring railway and city walls, causing the majority of traffic to be concentrated on a few main arteries, severely affecting the capital’s transportation. Therefore, the existing roads must be appropriately widened, straightened, and connected, and ring roads and radial roads must be added to improve the road system.” The purpose of setting up ring roads is explicitly stated as “to organize the internal and external traffic of the city closely and allow direct connections between different parts of the city while avoiding the diversion of the highest traffic volume to the city center.”^[15]

2.3 Adjustment of road network layout in 1957–1958

After the submission of the 1953 edition of the overall

urban plan for Beijing to the central government, there were disagreements between the National Planning Commission and the Beijing municipal government on several issues regarding the capital’s planning. In order to improve the level of urban planning for Beijing, the Chinese government invited a large-scale team of Soviet urban planning experts consisting of nine members with diverse specialties to assist Beijing in formulating the overall urban plan. The third group of Soviet urban planning experts arrived in Beijing in April 1955. Under their guidance, the capital’s planning workers, after about two years of intense work, completed the Preliminary Plan for Beijing’s Urban Construction in March 1957. This became the second edition of the overall urban plan for Beijing. This edition was a further revision based on the 1953 edition and had a more mature urban road network planning.

The Preliminary Plan for Beijing’s Urban Construction proposed the expansion of the existing grid-like road network. It stated, “Extend and widen the east-west arterial road (East-West Chang’an Avenue) and the north-south arterial road (Front Gate Street-Gulou Street) that traverse the city center, forming the backbone of Beijing’s entire road system.” Additionally, it mentioned, “Based on the grid-like road system in the urban area, extend and widen some east-west and north-south arterial roads, such as Chaoyangmen-Fuchengmen, Ping’anli-Tieshizihutong, Qiansanmen Binhe Road, Caishikou-Suanmikou, Beixinqiao-Suanmikou, and Xijiekou-Caishikou, creating a network of arterial roads that crisscross east-west and north-south”^[17].

In addition to the grid-like road network, the plan proposed the idea of opening four radial roads and five ring roads. It stated, “Open four major radial roads leading to the northeast, northwest, southwest, and southeast from Dongzhimen, Xizhimen, Guang’anmen, and Zuo’anmen, respectively. In addition, open some auxiliary radial roads.” It also mentioned, “Create the first ring road in the central area along Qiansanmen Binhe Road-Zhengyi Road, Nanheyuan-Huangchenggen, and Ping’anli Street-Fuyou Street-Nanxinhua Street.” Furthermore, it stated, “Form the second ring road using the arterial road from Xijiekou to Caishikou-Suanmikou-Beixinqiao, serving as the main transportation route in the central area.” It also proposed, “Construct the third ring road along the banks of the moat, known as the Binhe Ring Road.” The plan emphasized, “Connect Beijing’s major train stations, passenger terminals, as well as Tiananmen Square, Taoranting Park, Beijing Zoo, and other large parks, serving as the main transportation routes in the outer periphery of the central area.” Lastly, it suggested, “Open the fourth and fifth ring roads, connecting the various radial roads in all directions and passing through industrial areas, warehouse districts, workers’ residential areas, major parks, large stadiums, the Chinese Academy of Sciences, and higher education institutions in the northwest. These roads would handle a huge volume of passenger and cargo transportation, avoiding excessive traffic passing through the city center”^[17] (see Figure 9).

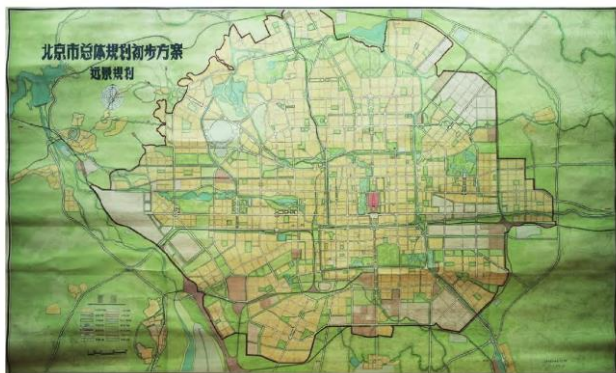


Fig.9 Preliminary proposal for Beijing urban master planning—long-range planning (march 1957)

Source: Reference [18].

Compared to the 1953 edition of the overall urban plan for Beijing, the 1957 edition of the planning proposal saw an increase in the number of ring roads in the road network. The focus was on setting up two ring roads within the old city, and the existing ring roads along the city wall and moat were transformed into the third ring road. As for the radial roads, the main change was the cancellation of the radial roads entering the old city from the southwest and southeast directions. All radial roads were unified to connect to the moat ring road (see Figure 10). This avoided the damage to the traditional urban fabric caused by the introduction of radial roads into the old city, which was an important progress in preserving the historical and cultural heritage of Beijing's old city.



Fig.10 A comparison of Beijing urban master planning—road network planning in 1953 and 1957

Source: Drawn based on the urban master plans of Beijing from 1953 and 1957, with the base map being the overall plan from 1957.

After the third group of Soviet urban planning experts returned to the Soviet Union in 1957, in the context of the “Great Leap Forward” era, the planning workers further revised the Preliminary Plan for Beijing’s Urban Construction. They emphasized the combination of “advanced Soviet experience and the specific conditions of Beijing,” resulting in the third edition of the “Overall Plan for Beijing City,” which was submitted to and received preliminary approval

from the Central Secretariat in September 1958. Regarding the planning of the road transportation system, the third edition of the “Overall Plan for Beijing City” proposed, “Based on the existing grid-like roads, undertake transformation by widening, connecting, and reducing intersections, while adding radial roads and ring roads to form a new road system.” It mentioned, “There are more than a dozen arterial roads radiating outward from the central area.” It also stated, “Within the city, the roads connecting Caishikou, Xijiekou, Beixinqiao, and Suanmiku are reconstructed as the first ring road; the city walls are demolished, and the second ring road is built along the riverbank; outside the city, the third and fourth ring roads and some auxiliary ring roads are opened. Utilize favorable terrain to arrange several expressways” [19].

Comparing the 1958 edition with the 1957 edition of the planning map, there were no significant differences in the layout of the road transportation system (see Figure 11). The key modifications in the 1958 edition focused on reducing the population and construction land in the urban area and increasing wedge-shaped green spaces in various directions (guided by the concept of “urban landscaping”). However, the terminology regarding the first ring road, second ring road, third ring road, etc., reverted to the wording used in the 1953 first edition of the overall urban plan for Beijing.

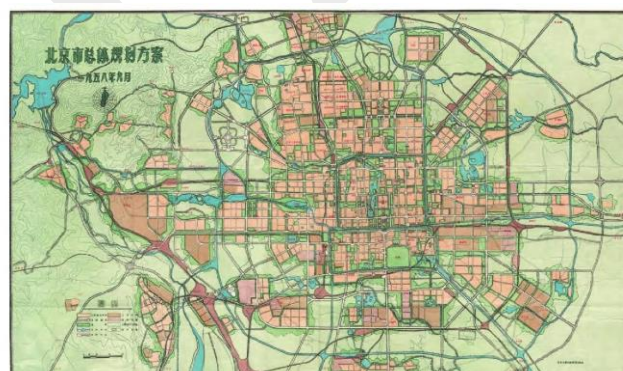


Fig.11 Beijing master plan proposal (september 1958)

Source: Reference [19].

The period from 1953 to 1958 was a time of large-scale urban construction in Beijing, and some planning content had already been implemented during the research and formulation of the various editions of the overall urban plan. In the 20 years following 1958, there were no major revisions to the overall urban plan for Beijing, and urban construction activities were primarily guided by the 1958 edition of the plan. The road transportation system in the city did not undergo significant adjustments at the design level of the overall urban plan, and the “Ring + Radial” road network layout was essentially finalized based on this.

3 Implementation of the “Ring + Radial” road network:

Ring road construction: 1) The first ring road is a road that was gradually widened and reconstructed within the old city of Beijing. It was realized during the transformation of the old city and later multiple subway lines were constructed underground along this ring road (currently part of Beijing Subway Lines 4, 5, and 7). 2) As for the second ring road, in the 1953 edition, the 1957 edition, and the 1958 edition of the urban master plan, it was originally planned as a ring road just outside the city wall, close to the direction of the moat. In 1969, during the period of wartime preparedness, the city wall began to be demolished to construct the subway (partial line operation began in 1983, and the circular line of Beijing Subway Line 2 started operating in 1987). Later, an urban expressway was built above the subway, which was completed and opened to traffic in September 1992. It is not only Beijing's first ring expressway but also China's first fully enclosed, fully interchange-based, and signal-free urban expressway. 3) The third ring road is the earliest constructed ring road in Beijing. Its east, south, and north sections started construction in 1958 and were completed in 1960. However, the originally planned route on the west side, which passes through Yuyuantan Park and poses greater construction difficulties, was unable to be completed for a long time (the south, north, and east sections are commonly referred to as the "Third Ring Road"). In the early 1980s, the route on the west side was changed to extend to the west to reach Gongzhufen and Haidianqiao. After several setbacks, the entire ring road was officially completed and opened as a fast road in 1994 (see Figure 12). 4) Construction of the fourth ring road began before the 1990 Beijing Asian Games and the entire road was opened to traffic in 2001.

Radial road construction: 1) In the northeast direction, construction of the Jingmi Highway began in 1958, leading from Dongzhimen to the direction of Gubeikou and the Beijing Capital International Airport. This road is an important national highway connecting Beijing to North China and Northeast China (now G101). Later, the Capital Airport Expressway was built based on this road. 2) In the southeast direction, it is an important passage connecting Beijing with Tianjin and the East China region. In the 1950s, road and railway construction continued to advance. In 1987, the Jingjintang Highway (now the starting section of the Beijing-Shanghai Expressway, G2) was constructed from Zuo'anmen to the southeast industrial area and Tianjin. It was the first fully completed expressway in mainland China. Subsequently, the Beijing-Shanghai Expressway and Beijing-Shanghai High-Speed Railway were also constructed, becoming one of the major north-south transportation arteries in the country. 3) In the southwest direction, the radial roads planned in the 1950s were mainly intended to connect the Fengtai District and the Liangxiang Town in Fangshan District. Due to factors such as the alteration of the railway loop line outside the old city of Beijing, the road alignment underwent significant changes. In 1986, the Jingshi Highway (now the starting section of the Beijing-Hong Kong-Macau

Expressway, G4) began construction from Guang'anmen to the southwest. This was the first expressway built in China since 1949. 4) In the northwest direction, the radial roads planned in the 1950s were primarily intended to connect the cultural and educational area with the resort area. However, due to multiple adjustments to the planning scheme for the cultural and educational area of Beijing, the radial roads in this direction were not actually constructed. However, around 1999, the western section of the Beijing Urban Light Rail Transit (predecessor of Subway Line 13) was constructed in roughly the same direction, which created a radial pattern in the northwest direction of Beijing's urban spatial structure.

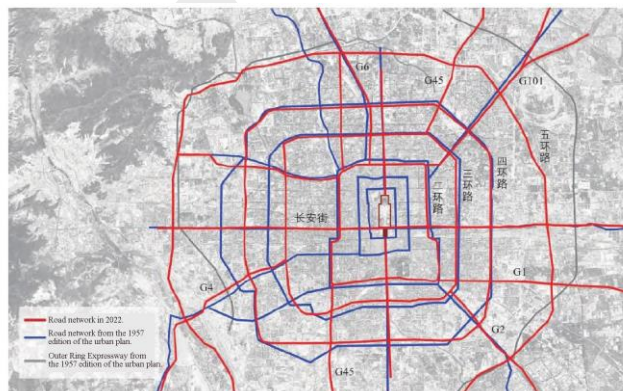


Fig.12 A comparison of Beijing urban master planning—main road network in 1957 and 2022

Source: Drawn according to the urban master plan of Beijing from 1957, with road networks and the base map based on Baidu Maps.

4 Discussion

4.1 Factors contributing to the layout of the “Ring + Radial” road network

In summary, since modern times, during the process of expanding land use and transforming into modern development within a larger regional scope, the planning and design concepts of the “Ring + Radial” road network layout in Beijing, the ancient capital, have been repeatedly proposed. The key factor that made this road network layout essentially implemented and became a dominant element in Beijing's modern urban spatial structure was the first edition of the Beijing Urban Master Plan issued in the second half of 1953. From an analysis of the planning process, it is evident that the technical assistance provided by Soviet expert Barakin played a crucial role. He evaluated the “existing roads in a grid pattern with shortcomings” and advocated the addition of ring roads and radial roads to improve Beijing's road network structure. From a causal analysis, this seems to originate from Barakin's personal preference. However, it should not be overlooked that behind Barakin's guidance was the urban planning theory of the Soviet Union, and the “Ring + Radial” road network layout was also a distinctive feature

of Moscow's urban spatial structure. Therefore, we cannot deny the potential influence of the Soviet Union's urban planning practices on Beijing's urban planning.

Furthermore, the first edition of the Beijing Urban Master Plan was based on the proposals of Plan A and Plan B, which were completed in the spring of 1953. Barakin's advocacy for the "Ring + Radial" road network layout actually absorbed and borrowed some design ideas from Plan A and Plan B, which also reflects the characteristic of continuity and development of planning proposals over different periods. Before the first edition of the Beijing Urban Master Plan and Plan A and Plan B, there were already some existing ring roads and radial roads around Beijing due to the need for transportation connections with surrounding towns and areas. However, their road grades were relatively low. It can be said that the formation of Beijing's "Ring + Radial" road network layout was influenced by various factors, including considerations of the current urban road conditions, the continuation of early planning proposals, planners drawing on Soviet planning experience, and the artistic creation of urban spatial structure. Therefore, it is the result of the complex interaction of multiple influencing factors.

It is worth noting that in the proposals of Plan A and Plan B in the spring of 1953, although there were bold considerations for the radial road design, the design of the ring road was rather conservative. However, the plan completed by the Changguanlou Planning Group in the second half of 1953 showed a significant change in the design of the ring road. What was the reason for this major shift? Studies in urban planning history indicate that the core influencing factor can be attributed to the circumferential railway outside the old city of Beijing. In the early days of the founding of the People's Republic of China, the city wall (city gates, city towers), the moat, and the circumferential railway were the three obstacles that restricted the internal and external transportation connections of Beijing's old city. In order to achieve an ideal land layout, planners had long hoped to relocate the circumferential railway outside the city, but this desire had not been fulfilled for a long time. In the working process of the Changguanlou Planning Group in the second half of 1953, with the participation and strong support of railway experts from the Ministry of Railways and the Third Design Institute of the Ministry of Railways Design General Institute, a consensus was finally reached on relocating the circumferential railway outside Beijing. In this sense, the characteristics of multi-departmental and multi-disciplinary participation by members of the Changguanlou Planning Group and the comprehensiveness of the planning work, as well as the special institutional framework and authority directly led by the Beijing Municipal Committee of the Communist Party of China, had a profound influence on the formation of the "Ring + Radial" road network layout in Beijing^[20]. As a result, the previously conceptual road network layout, which had remained on paper or had been indecisive, gained legal effectiveness and became a public

policy attribute, thus beginning its transformation into actual construction.

4.2 Evaluation of the "Ring + Radial" road network layout

When discussing the "Ring + Radial" road network layout in Beijing, an unavoidable question arises: how should we evaluate this layout? Is it scientifically reasonable? In the eyes of some experts and scholars, the "Ring + Radial" road network layout is considered a major cause of urban traffic congestion^[21]. From the perspective of land resource allocation, it leads to a homogeneous distribution of urban land, making it difficult to highlight distinctive features. It also concentrates functions in the old city center, which is not conducive to the renewal and transformation of the old city and adds to its existing burden^[1]. Through the research conducted in this paper, it can be understood that the "Ring + Radial" road network layout was formed during the early period of large-scale urban construction in Beijing after the establishment of the People's Republic of China, under specific political, economic, and social background conditions. It was also significantly influenced by Soviet experts and their urban planning experience in China, and its formation had a certain historical inevitability. Like other road network structures, the "Ring + Radial" road network layout is not flawless and inevitably has some shortcomings or deficiencies.

From another perspective, for more than 70 years since the founding of the People's Republic of China, it is precisely this "Ring + Radial" road network layout that has supported the normal operation of Beijing as a mega-city. Except for some special dates and periods, the overall traffic operation of the city remains relatively orderly. It can be said that the "Ring + Radial" road network layout has made a historic contribution to the construction and development of Beijing.

Furthermore, the "Ring + Radial" road network layout also has its advantages. For example, the ring road can prevent the city from expanding indefinitely or irregularly in all directions, while the radial roads can guide the orderly expansion of the city and facilitate traffic organization. The ring road is conducive to the formation of the central area, and the radial roads facilitate external transportation connections to the central area, which is beneficial for maintaining the prosperity of Beijing's old city^[22]. Once urban residents become familiar with some basic patterns of traffic operation in this road network layout, they can make flexible choices in their daily travel activities according to their own needs.

It should also be pointed out that in the past two to three decades, Beijing has accelerated the construction of urban rail transit, gradually forming an urban rail transit network system that can also be described as "Ring + Radial." This has played an important role in alleviating urban traffic congestion. This indicates that certain drawbacks of the "Ring + Radial" road network layout can be improved through various methods. Criticizing the established fact of

the “Ring + Radial” road network layout without justification may be of no benefit. Instead, it is advisable to promote scientific research related to it with a more positive attitude, seeking ways to optimize or improve Beijing’s road traffic system. Fundamentally, the layout of urban road networks is closely related to urban spatial structure. Simply discussing the pros and cons of road network layouts may not be appropriate. The ultimate consideration should be whether it can meet the long-term operation and sustainable development needs of urban transportation.

4.3 The “Ring + Radial” road network layout and the issue of single-center development

When discussing the “Ring + Radial” road network layout, many people tend to compare it with the issue of single-center development in Beijing. How should we understand the relationship between the two? From a historical research perspective, during the early period of urban construction in Beijing after the establishment of the People’s Republic of China, various factors such as finance and economy constrained the city’s development, and it did not have the driving force for dual-center or multi-center development. After the reform and opening up, with the advancement of land-use reforms, Beijing should have strategically adjusted its urban spatial structure at the beginning of the large-scale urban development activities. Similar to Paris, France, it should have guided modern land development activities in an orderly manner, thereby avoiding the destruction of cultural heritage within the old city of Beijing. Unfortunately, Beijing missed the most opportune time for strategic adjustment of its urban spatial structure and has maintained a pattern of single-center development for decades. Only in recent years, with the vigorous promotion of the construction of Tongzhou Sub-Center and Xiong’an New Area in Hebei Province, has it become possible to strategically adjust the urban spatial structure.

Objectively speaking, the formation of the “Ring + Radial” road network layout and the single-center development of the urban spatial structure in Beijing are both related to the historical process of urban construction and development. However, their nature and connotation are completely different and should not be confused. In this regard, Paris can still be used as an example for illustration: the road network layout in the central area of Paris is similar to Beijing, also adopting the “Ring + Radial” form. However, the city’s spatial development still allows for the construction of the La Défense new city in the west, thereby achieving the goal of strategic adjustment of the urban spatial structure. The two can coexist without contradiction. In this sense, the view that simply attributes Beijing’s single-center development of urban space to the “Ring + Radial” road network layout lacks scientific rationality. The real crux of Beijing’s long-term single-center development lies in the need for serious and in-depth historical research to summarize and reveal it.

Notes:

- ① Conversation between Mr. Qian Lianhe (former Deputy Director of the Office of the Capital Planning and Construction Commission and former Deputy Director of the Beijing Urban Rural Planning Commission) and the author on September 28, 2020.
- ② “City” and “Railway” are supplementary content for the author.
- ③ Zheng Tianxiang’s 1953 work notes were provided by his family.

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