

# *The Feasibility of TOD Mode in Transportation Planning of Nantong City*

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**Abstract:** The study examines the feasibility of the Transit-Oriented Development (TOD) model in the transportation planning of Nantong City. In the context of the "14th Five Year Plan for the Comprehensive Transportation System Development of Nantong City", it investigates the viability of the TOD mode within Nantong's rail transit system. This article will examine the successful TOD development cases in Shanghai, a first-tier city, and Suzhou, a new-tier city, both located in the Yangtze River Delta region. It will also compare the rail transit systems of Shanghai, Suzhou, and Nantong. Based on the current development status of rail transit in Nantong City, SWOT model is used to position the development of rail transit in Nantong City. Through this analysis, this paper identified the advantages and disadvantages that Nantong City may face in advancing the TOD mode, as well as the potential opportunities and threats. Measures such as creating TOD channels, formulating ride discounts, expanding regional connectivity, flexible commuting time, and optimizing station facilities are proposed. These strategies aim to promote the sustainable development of Nantong rail transit system, improve the convenience and efficiency of urban transportation, and then provide strong support for the economic and social development of Nantong city and the improvement of residents' quality of life.

**Keywords:** Nantong City, rail transit, TOD mode

## **1. Introduction**

In accordance with the "14th Five-Year Plan" for the comprehensive transportation system development in Nantong City, Nantong is dedicated to constructing a multi-tiered rail transit network. At present, Nantong Rail Transit Line 1 and Line 2 are officially in operation, seamlessly connecting the four core urban districts of Tongzhou District, Gangzha District, Chongchuan District, and the Development Zone in Nantong. This facilitates the expansion of urban development space and enhances the interconnectedness of urban clusters.

As the saying goes, "If you want to be rich, first build a road.". The establishment of a public transportation system primarily focused on rail transit is also one of the planning objectives of Nantong City. Moreover, the TOD mode is a crucial component of both rail transit and sustainable urban development. For example, the success of TOD modes in cities such as Shanghai and Suzhou has injected new impetus into urban development. So, is it feasible to apply the TOD mode to Nantong, which is in the embryonic stage of rail transit development? The article will analyze the current

situation and characteristics of Nantong's rail transit planning, and analyze the development needs of the city's rail transit. And combining the development concept of TOD mode, explore the feasibility of TOD mode in the transportation planning of Nantong City.

The TOD mode is an urban development model guided by public transportation. The TOD mode mainly uses rail transit as a means to effectively integrate land use and transportation facilities, improve the utilization efficiency of transportation facilities, increase the proportion of residents choosing public transportation modes, and promote the development of public transportation. It is an important means to optimize urban spatial structure by effectively avoiding the adverse effects of excessive land use concentration and curbing the excessive diffusion of cities centered around cars [1].

The advantages of TOD mode in urban transportation development include the following points:

(1) Promoting sustainable urban development: The TOD mode concentrates buildings and facilities in core areas, reduces land development pressure, and improves land use efficiency. In addition, it also encourages the construction of high-density, multifunctional buildings to better meet the needs of different communities. This helps to reduce land consumption, lower energy consumption, and minimize adverse impacts on the environment.

(2) Alleviating Peak Traffic Congestion: The TOD mode encourages the establishment of efficient and convenient public transportation networks in core areas, making it easier for residents to use public transportation and reducing their dependence on private cars, thereby alleviating road congestion during rush hours of morning and evening work. And the TOD mode closely connects residential areas, commercial areas, and work areas, greatly reducing people's commuting time and travel costs.

(3) Reasonable optimization of urban spatial layout: The TOD mode optimizes urban spatial layout through compact development, high-density construction, mixed-use, pedestrian friendliness, and open space, which helps to improve land use efficiency, improve the quality of life of residents, and construct a more livable urban environment through sustainable development.

## 2. Analysis of Successful Cases in TOD Mode

According to the "Multi-level Rail Transit Plan for the Yangtze River Delta Region", the Yangtze River Delta region aims to build a "Yangtze River Delta on rail" by 2025, becoming a demonstration and leading area for the deep integration and development of multi-level rail transit. Since Nantong is located in the Yangtze River Delta region, Shanghai and Suzhou, which are also part of the Yangtze River Delta region, were selected as case studies for this part.

### 2.1. Shanghai

Shanghai, as a socialist modernized international metropolis with global influence, in the past 20 years, Shanghai has continuously explored and developed land resource development models along the rail transit line with local characteristics, and has carried out many TOD comprehensive development practices. For example, the construction of Wanxiang City on Wuzhong Road parking lot, Xingmao Square on Hanzhong Road hub, and LaLaLaStation (Lotus Life Square) for Lianhua Road renovation have a total development area of approximately 3.77 million square meters [2].

Shanghai's rail transit traffic volume is large and the subway station efficiency is high. The stations are basically located in key locations, such as Lujiazui Underground Public Street, which connects Shanghai Center, Guojin Center and Metro Line 2, so that people can avoid the danger of road traffic, pass through the underground without obstacles and shorten commuting time.

## 2.2. Suzhou

As a typical multi-center and cluster development city, Suzhou adopts the TOD development model of multi-network integrated rail transit, which not only improves the convenience and accessibility of intercity travel services but also promotes regional and urban integration development [3]. For example, a "wind and rain free" space crossing passage called the "Cha Le TOD Passage" has been created between the Chayuan Station on Suzhou Metro Line 4 and the Leqiao Station on Line 1. It is also the first TOD exhibition center in Suzhou, with a total length of about 300 meters. The opening of this passage allows people to walk 5 minutes to the core cultural and commercial circle of Guanqian Street, effectively utilizing underground space and shortening travel distance.

In addition, in June 2023, Suzhou Metro Line S1 was officially put into operation and achieved seamless transfer with Shanghai Metro Line 11. The opening of this channel will become a convenient and popular interchange between Shanghai, Kunshan, and Suzhou, promoting the integration of urban and rural areas within their respective regions; On the other hand, it is to promote the integration of Shanghai and Suzhou [4]. The interconnection and integration of Suzhou and Shanghai rail transit have accelerated the deep urbanization of core cities in the Yangtze River Delta.

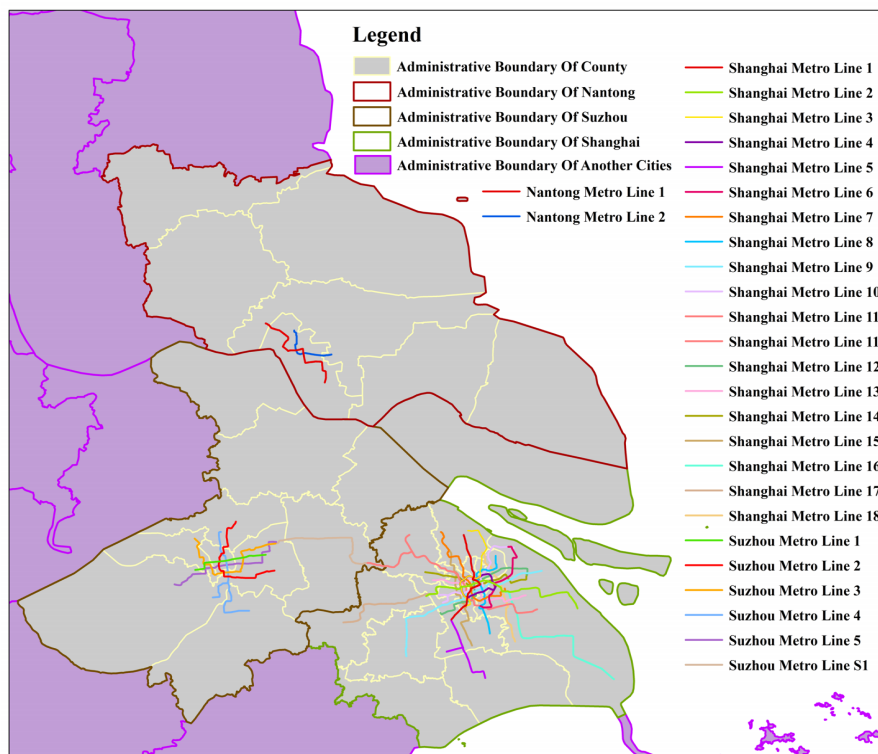


Figure 1: Macro distribution map of rail transit in Shanghai, Suzhou, and Nantong.

As shown in figure 1, Shanghai has a total of 16 municipal districts, with a total of 18 rail transit lines covering 14 districts. The rail transit network is quite dense, and it can be said that it is well-connected. Multiple underground transfer channels also greatly accelerate the speed of passenger flow.

Except for the S1 line, which is seamlessly connected to Shanghai Metro Line 11, there are a total of 5 Suzhou Metro lines, less than one-third of Shanghai Metro lines, but they also cover 5 districts in Suzhou, including Wuzhong District, Wujiang District, Xiangcheng District, Gusu District, and Huqiu District. However, Nantong only has two rail transit lines, mainly in Chongchuan District.

### 3. Current Situation of Transportation Planning in Nantong City

Based on the current development status of urban transportation in China, the goal of rail transit construction is not only to improve the urban transportation system, increase the proportion of green travel, and reduce pollution, but also to build station area integration around rail transit stations, optimize the urban spatial pattern, and drive urban renewal [5].

#### 3.1. Basic Status Quo

At present, there are two rail transit lines in Nantong City, with a construction scale of about 59.55 kilometers and 43 stations, connecting important external transportation hubs such as Nantong West Station and Nantong Automobile East Station. It gathers various transportation modes such as high-speed rail, intercity rail, conventional rail, and automobile transportation, forming a passenger transportation hub cluster and strengthening the interconnection between Nantong and surrounding cities [6].

##### 3.1.1. Current Situation of Nantong Rail Transit

The first line of Nantong Rail Transit Line 1 was opened for operation on November 10, 2022. With the opening of Line 1, Nantong has become the 43rd city in the Chinese Mainland and the 6th city in Jiangsu Province to open the subway. Then the Nantong Rail Transit Line 2 was put into operation on December 27, 2023, forming a "cross shaped" backbone line with Line 1, promoting Nantong's entry into the "double line transfer era". On February 10th of this year (the first day of the Lunar New Year), the passenger flow of Nantong Rail Transit exceeded 300000, setting a new historical high.

##### 3.1.2. Cultural Characteristics of Nantong Rail Transit

(1) The river breeze and sea charm bloom the clear "lotus" flower.

The Nantong Metro Line 1 is divided into 2 key stations and 7 characteristic stations. In addition, it is particularly prominent that there is a clean culture station, which selects "lotus" as the internal element and uses "river breeze and sea charm" as the theme to express the blooming of the flower of integrity. And the entire line uses red and white tones, showcasing Nantong's enthusiasm, vitality, and agility.

(2) Porpoise playing in water showcases unique culture

The Nantong Rail Transit Line 2 presents an "L" shape, with an overall selection of blue and white tones and the theme of "finless porpoises playing in the water". The design incorporates Nantong's intangible cultural heritage blue printed fabric, showcasing the unique Jianghai culture.

(3) "Haohao and Tongtong" Nantong rail mascot

Chinese people often say "good things come in pairs". The mascot of the Nantong subway is a man and a woman, which means "Tongtong" and "Haohao". When they are connected, they are "Hao Tong", symbolizing the smooth and smooth operation of the Nantong urban rail transit. The main body of "Good" is red, while the main body of "Tongtong" is blue. Wearing a mecha, it exudes a sense of future, reflecting the intelligence and cutting-edge of Nantong's urban rail transit. Nantong uses "good" and "smooth" to establish an IP and promote the dissemination of Nantong's brand and culture.



### 3.2. SOWT Model

Table 1: SWOT model of rail transit in Nantong City.

Internal factor External factor	Strength	Weakness
Opportunity	By leveraging unique geographical advantages, enhance regional transportation connectivity.	Economic pressure hinders transportation construction, creating a distinctive urban image to attract development opportunities.
Threat	Accelerate cooperation with surrounding cities in construction and promote urbanization in the Yangtze River Delta.	Improve accessible and convenient facilities, and enhance the happiness index of people in need of care.

According to the table 1, Nantong is adjacent to Shanghai and Suzhou. Although Nantong can leverage its unique geographical location and leverage the economic radiation of Shanghai and Suzhou to promote economic development, as a second tier city, it still cannot compete with first tier cities. Therefore, Nantong should strengthen regional transportation connectivity, accelerate the construction of surrounding cities, and create a distinctive urban image to attract development opportunities. Internally improve basic transportation facilities, add accessible and convenient facilities, and enhance people's well-being.

## 4. Current Situation of Transportation Planning in Nantong City

Based on the analysis in the third part, feasible measures for the TOD mode in the transportation planning of Nantong City are identified, and the problems to be improved and their solutions are pointed out.

### 4.1. Creating TOD Channels between Sites

According to Figure 3, Wenfeng Station is located at the intersection of Metro Line 1 and Line 2 and is also the gathering point of Nantong Grand Hotel and Yuanrong Shopping Center. Line 1 of the rail transit can reach Youyi Bridge or South Street to the north, and Wenfeng City Square and Government Center Line 2 to the south. Multiple universities are located on Line 2 of the rail transit system. For example, Nantong University (Qixiu Campus), Nantong Normal College, and Yijiaqiao Center next to Yijiaqiao Station, as well as Jiangsu Engineering Vocational School, Nantong Vocational University, and Nantong Vocational College of Science and Technology next to Wuyi Road Station.

On the east side of the Charity Museum Station is the Tongqi Road Elevated Road, which belongs to a transportation artery. The Wenfeng Station and the Charity Museum Station are located on the north-south axis of Nantong's Gongnong Road, with a large volume of pedestrian and vehicular traffic.

On Line 1 of Nantong Rail Transit, a "Wen Ci TOD Passage" will be built between Wenfeng Station and Charity Museum Station. Wenfeng Station is a transfer station between Line 1 and Line 2 of Rail Transit. This situation is similar to the background of the "Cha Le TOD Passage" in Suzhou, like the figure 2. Planning the "Wen Ci TOD Passage" can promote interconnectivity between commercial centers and shorten commuting time. But the distance between Wenfeng Station and

Charity Museum Station is about 920 meters, and the length of the "Wenci TOD Passage" will be almost three times that of the "Chale TOD Passage" in Suzhou. To address the distance issue, an intermittent automatic pedestrian walkway is installed, which avoids the manpower and material resources required for the use of shuttle vehicles and can relatively reduce operating costs.

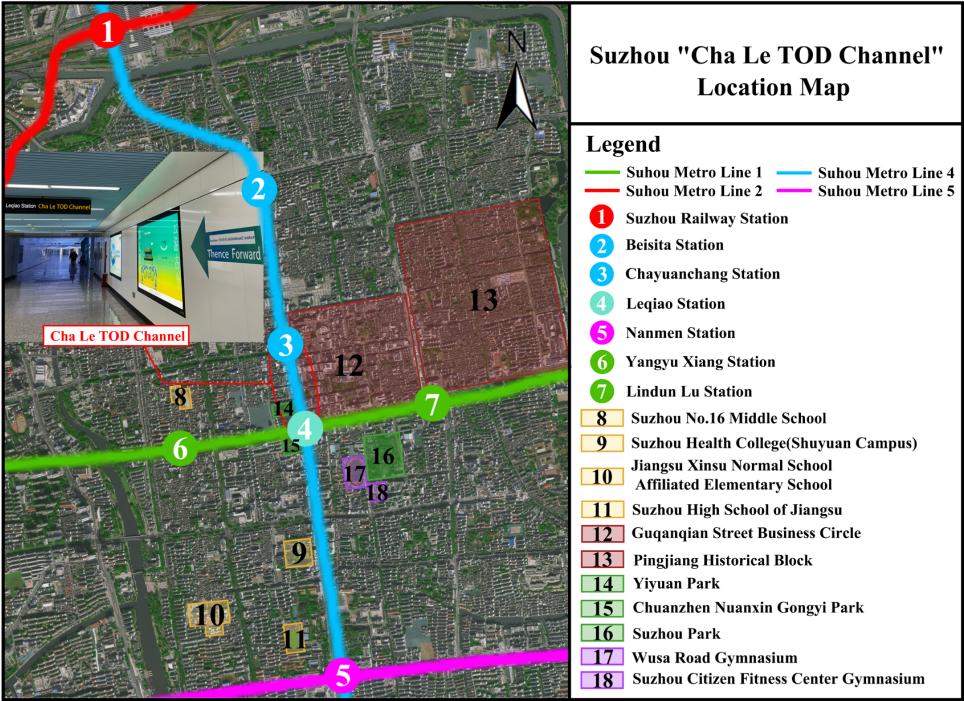


Figure 2: Suzhou "Chale TOD Channel" Location map.

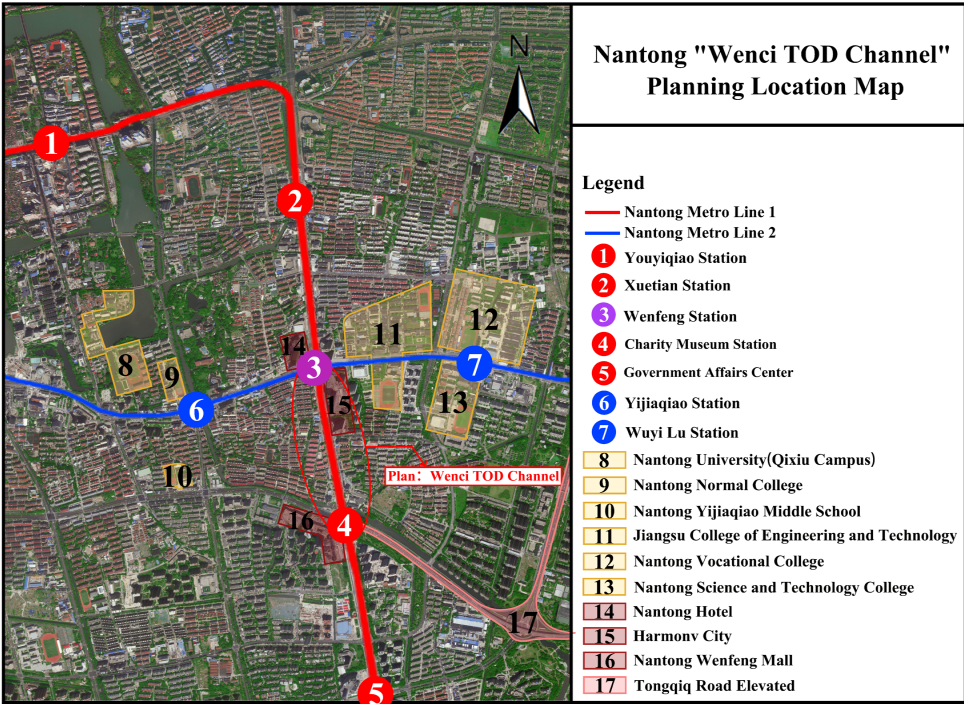


Figure 3: Nantong "Wenci TOD Channel" planning location map.

#### 4.2. Develop Preferential Policies for Urban Rail Transit

The current fare discounts for rail transit in Nantong involve free rides for children under 1.3 meters in height and elderly people aged 65 and above, while primary and secondary school students or those holding citizen cards enjoy different discounts, except for college students who do not have any preferential policies. Based on this, the "Nantong Metro" APP can be improved to offer student authentication services and enjoy certain discounts.

#### 4.3. Improve Inter-regional Transportation Connectivity

As shown in table 1, By leveraging unique geographical advantages, enhance regional transportation connectivity. Accelerate the construction of the Nantong Suzhou high-speed railway line. Currently, only long-distance passenger buses can directly connect Nantong and Suzhou, while the high-speed railway line can only transfer through Shanghai.

According to the "Multi level Rail Transit Plan for the Yangtze River Delta Region", In terms of trunk railways, Shanghai, Nanjing, Hangzhou, Hefei, and Ningbo are identified as the four major hub nodes, and "three vertical and three horizontal" main backbone of the trunk line is constructed. Relying on a radial railway network in three directions: north, west, and southwest, a 3-hour inter-regional transportation circle is formed between the Yangtze River Delta and adjacent city clusters and provincial capitals [7]. The Tongsu Jiayong high-speed railway is also included in the plan. Nantong passes through Suzhou and Jiaxing to Ningbo Railway (Tongsu Jiayong Railway), with a length of 369 kilometers. It runs from Nantong, Jiangsu, through Zhangjiagang, Changshu, Suzhou, and Jiaxing in Zhejiang to Ningbo [8]. Strengthen the connectivity between Nantong and Suzhou as well as promote urbanization in the Yangtze River Delta.

#### 4.4. Strengthen the Image of "Haotong"

By leveraging "good" and "connectivity" to create distinctive IPs in Nantong, we aim to attract investment from first tier cities in the Yangtze River Delta region. Developing IP peripherals, designing cultural and creative products, and setting up cultural and creative product vending machines or self-service retail stores in subway stations to facilitate visitors and urban residents to understand and purchase, and the profits obtained are used for the maintenance of rail transit. Making good use of the "star effect" of the "Haotong" IP ambassador to enhance the city's reputation is not only a feasible measure to promote economic development but also to advance urban tourism development.

#### 4.5. Flexible Commuting Time

The operating hours of the rail transit in Nantong City are all from 6:00 to 22:00. However, some train services at Nantong West Station and Nantong Station arrive after 22:00. For residents living in the city, it is not convenient to take the subway home, and there is a serious phenomenon of taxi overcharging and refusal to take short distance passengers, there is also a safety risk of getting a black train. To address this issue, it is possible to coordinate train schedules at the train station and set up a special evening "Safe Home" subway service. By combining one subway with multiple bus services, Nantong provides multiple options for people returning late.

#### 4.6. Optimize Station Facilities

For the provision of accessible facilities inside and outside subway stations, the signage at accessible entrances and exits must be visible, accessible passages must reflect convenience and accessible protective equipment must prioritize safety. Secondly, a completely inclined barrier-free lifting



platform should be installed on the transfer building staircase within the station, and a dedicated person should be arranged to operate it when needed. With the continuous development of AI technology, digital technology is gradually integrating into urban development. So that improve accessible and convenient facilities, and enhance the happiness index of people in need of care. Moreover digital intelligence can be applied to accessible devices, and artificial intelligence can replace specialized operators to reduce labor consumption and labor costs.

## 5. Conclusion

With the continuous deepening of urbanization, traffic congestion, and transportation planning have become difficult problems that many cities must face. Introducing the TOD mode in Nantong's transportation planning can be seen as an innovative solution.

By analyzing the existing transportation situation in Nantong, it can be concluded that the rail transit system in Nantong is in its early stages of development, with a certain foundation and great potential for development. This provides favorable conditions for the implementation of the TOD mode. Secondly, the population distribution in Nantong City is relatively concentrated, with a high level of urbanization, which also provides development space for the implementation of the TOD mode.

In the TOD mode, Nantong can better utilize public transportation resources, improve the operational efficiency and convenience of the transportation system, and cluster population and economic activities around transportation nodes, achieving the exchange of urban functions. Through reasonable planning and design, a more livable, business friendly, and tourist friendly urban environment can be created. This can not only alleviate traffic congestion and reduce exhaust emissions, but also promote sustainable development of residents' lives and urban prosperity. In summary, the TOD mode has certain feasibility and potential in the transportation planning of Nantong City. By introducing the TOD mode, Nantong City can achieve an effective combination of transportation and urban development, promoting sustainable development of the city.

## References

- [1] He, J.S., Hu, Q.S. (2014) *TOD Based Rail Transit Guided Urban Development Strategy*. *Urban Rapid Rail Transit*, (01), 49-54.
- [2] Liu, H.J. (2023) *Exploration of Shanghai Rail Transit Overcover Development in the New Era*. *Urban rail transit* (11), 28-30.
- [3] Wang, C., Cai, R.L., Geng, J, Xiao, L. (2022) *The TOD Development Model of Rail Transit Under the Guidance of Multi Network Integration: Connotation, Focus, and System - Taking Suzhou as an Example*. *Urban Planning Forum*, (S2), 135-141.
- [4] Sun, Z. (2023) *The Connection Between Shanghai and Suzhou Rail Transit Promotes the Urbanization of the Yangtze River Delta Region*. *Research on Urban Rail Transit*, (03), 3+266.
- [5] Peng, D., Hui, F., et al. (2023) *Exploring the Urban Renewal Strategy Based on Transit-oriented Development Concept--a Case Study of Japan and Hong Kong*. *Frontiers in Materials*.
- [6] Yan, L., Chen, M. (2022) *Entering the Era of Subway, Nantong's Future Will Be More "Convenient"*. *Xinhua Daily*, 021.
- [7] *The Multi-level Rail Transit Plan for the Yangtze River Delta Region Has Been Released, and by 2025, the "Yangtze River Delta on Rail" Will Be Basically Completed*. (2021) *Shanghai Quality*, (07), 28-29.
- [8] Xu, P., Chen, H. (2021) *10 Rail Transit Projects in Our City Have Been Included in National Level Planning*. *Jiaxing Daily*, 001.