In search of the Interchange King in Urban Rail Lines in China

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With the rapid development of the urban rail system in China, the scale of urban line network continues to expand. Passengers only need to transfer several times to reach all corners of the city by train. In the process of forming the network with lines, the line nodes become the transfer stations, and some lines are also taking on more and more transfer functions in the network. Based on the data in “China Urban Rail Transit Yearbook 2019” (as of the end of 2018), the Shanghai Rail Transit Industry Information Center is looking for the “Interchange King” among the 154 urban rail lines in China according to the Yearbook.

1. Viewing from the number of interchange stations

Viewing from the number of interchange stations, as shown in figure 1, the top 8 lines are located in Beijing, Shanghai, and Guangzhou, which are in the ultra-large-scale urban rail transit network, and this result is expected. Beijing Metro Line 10 has 16 interchange stations, ranking first, and Shanghai Metro Line 4 has 15 interchange stations, ranking second, both of which are ring lines. The 3rd to 8th are all routes that pass through the city center, with more than 30 stations. Therefore, there are more interchange stations.

As demonstrated in figure 2, according to the statistics in “China Urban Rail Transit Yearbook 2019” (as of the end of 2018), 11 urban rail lines in China has no interchange stations, while 45 lines have only one interchange station, accounting for 36.4% of all lines. Most lines have 2 to 8 interchange stations (accounting for 50%). Only 13.6% of the lines has more than 9 interchange stations.
Due to the large difference in the operating length of the lines, it is unfair to compare the number of interchange stations only. Therefore, the following sorting is done based on the proportion of the number of interchange stations in all stations, as displayed in figure 3.

2. Viewing from the proportion of interchange stations

In this statistic, the contestants in the Top list have changed, but the top 10 are still dominated by Beijing, Shanghai, and Guangzhou (6 lines in Beijing, 2 lines in Shanghai and Guangzhou respectively). Shanghai Metro Line 4 ranks first with 57.69% of interchange stations, followed by Beijing Metro Line 2, 9, 13 and Airport Metro Line. It is worth noting that, among the lines in the “Ranking number of interchange stations” in Fig. 3, only Shanghai Metro Line 12 and Line 4 are still on the list, which are the only two lines on the list with more than 25 stations in total.
3. Viewing from the distribution density of interchange stations

In order to perform the evaluation more comprehensively, the factor of line length was introduced to calculate and rank the number of interchange stations per 10km on average. This time, as exhibited in figure 4, Guangzhou APM Line ranks first with 5.1 ones per 10 km. However, because its total length is only 3.9km with 2 interchange stations, it is regarded as a special case. Shanghai Metro Line 4 appears in the runner-up position once again. Beijing Metro Line 2, also a ring line, ranks third with a gap of 0.1, while Shenzhen Metro Line 7 ranks the 8th, breaking the monopoly of Beijing, Shanghai, and Guangzhou.

After competitions in three indicators, the result has been released: Shanghai Metro Line 4 with one champion and two runner-ups, winning the title of “Interchange King” in urban rail transit lines in China! Finally, the number of interchange stations per 10km in Beijing, Shanghai, Guangzhou, and Shenzhen (TOP5) was calculated, as depicted in figure 5.

As new lines in various cities continue to be put into operation, the scale of the network continues to expand, and more and more interchange stations are bound to appear. According to the national line network plan approved in the end of 2018, interchange stations accounted for approximately 26.8% of all planned stations. It is foreseeable that the competition for the “Interchange King” will be more intense. However, this is only the prelude to China’s urban rail transit entering the networked era. How to deal with the huge challenges posed to the operation organization and risk control after the multi-line network is formed is the problem that contemporary Chinese urban rail workers need to work hard to think, deal with, and solve.
Fig. 4. Ranking of the average number of interchange stations per 10km in urban rail lines in China (Top 11)

Fig. 5. Average number of interchange stations per 10km in urban rail lines in Beijing, Shanghai, Guangzhou, and Shenzhen (Top 5)