International Comparative Analysis of Transport Modes in China and the United States

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Abstract. Transportation is becoming increasingly important for economic development. In recent years, China has made some achievements in the field of transportation. However, compared with the U.S., there are still certain shortcomings. The purpose of this article is to explore the similarities and differences between China and the U.S. in terms of integrating transportation systems through comparative analysis and statistical analysis. The differences between China and the U.S. in terms of transportation service, infrastructure, and management indicators is compared and analyzed their strengths and weaknesses by this article. Faced with global environmental challenges, China and the U.S. need to work together to promote the coordinated development of transportation and economic and social development. On this basis, this article puts forward the prospect and suggestions for the future development of the transportation system, in order to provide reference for the sustainable and healthy development of Chinese transportation industry.

Keywords: China and the United States.; transportation system; comparative analysis; service indicators; infrastructure; management metrics

1 Introduction

With the acceleration of globalization, transportation, as an important link connecting the world, is of great significance for promoting national economic development and strengthening international exchanges. As important economies in the world, the development status and characteristics of the transportation system of China and the U.S. have an important impact on the development of the world's transportation industry. Therefore, conducting in-depth research and comparative analysis on transportation systems not only helps us better understand the current development status of transportation systems in various countries, but also provides useful references for the development of Chinese transportation industry.

The purpose of this article is to clearly define the specific objectives of the study and to define the scope of the analysis more clearly through a comprehensive comparative analysis of the transport systems. Specifically, we will conduct research from the following aspects: Firstly, by comparing the transportation service indicators of China and

G. Zhao et al. (eds.), *Proceedings of the 2024 7th International Symposium on Traffic Transportation and Civil Architecture (ISTTCA 2024)*, Advances in Engineering Research 241,
https://doi.org/10.2991/978-94-6463-514-0_52

the U.S. to reveal the differences, advantages and disadvantages of transportation services between the two countries; Secondly, the construction of transportation infrastructure in China and the U.S. is analyzed, including the construction of infrastructure networks and equipment allocation. Thirdly, transportation management are compared to discuss the experiences and lessons learned in transportation management in China and the U.S.

Through this series of comparative analysis, we hope to deeply understand the advantages and characteristics of different countries in the development of transportation systems, identify our shortcomings, and provide useful reference and inspiration for the future development of Chinese transportation industry.

2 Comprehensive Transportation Development in the U.S.

The economic development of the U.S. is inseparable from the transportation industry to a certain extent. The transportation industry in the U.S. has a short history, but it has a pattern of competing in many ways[1]. In addition, the U.S. has a well-developed transportation infrastructure. Today, the U.S. has one of the most developed integrated transportation systems in the world[2].

2.1 The Development of Railways Has Gone from Glory to Decline

Regional railroads in the U.S. are mainly divided into Amtrak and class I for passenger and freight transportation, respectively.

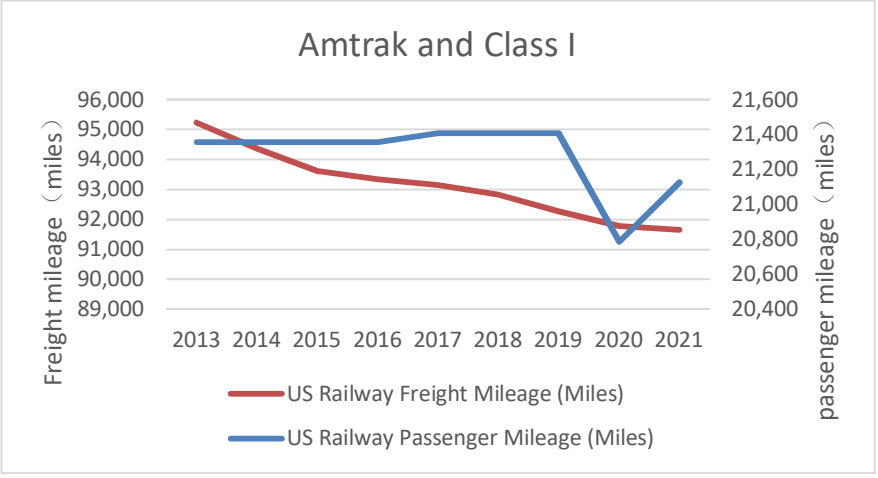

Fig. 1. The tendency of Amtrak and Class I

Source: Transportation Statistics Bureau Transportation Yearbook, U.S.

From Figure 1, it can be seen that from 2013 to 2021, the freight mileage in the U.S. gradually decreased by 3.76%. From 2013 to 2019, passenger mileage in the U.S.

showed an overall slight (0.24%) upward trend. After being as low as 20,787 miles during the pandemic in 2020, it rebounded in 2021, but it is still less than in 2013. This is due to excessive U.S. government intervention, rigid railroad management, and even the need for slowdowns to reduce maintenance and safety costs.

2.2 The Construction of the Highway Network is Relatively Perfect

In the U.S., the overall trend of public road, street mileage and total lane mileage by functional type is relatively stable. From Figure 2, the total number of bridges has shown a relatively stable upward trend every year, increasing by 1.96% from 2013 to 2021. Vehicle mileage generally trended upward, but fell back to its lowest point in 2020 and rebounded to 3140088 million miles in 2021.

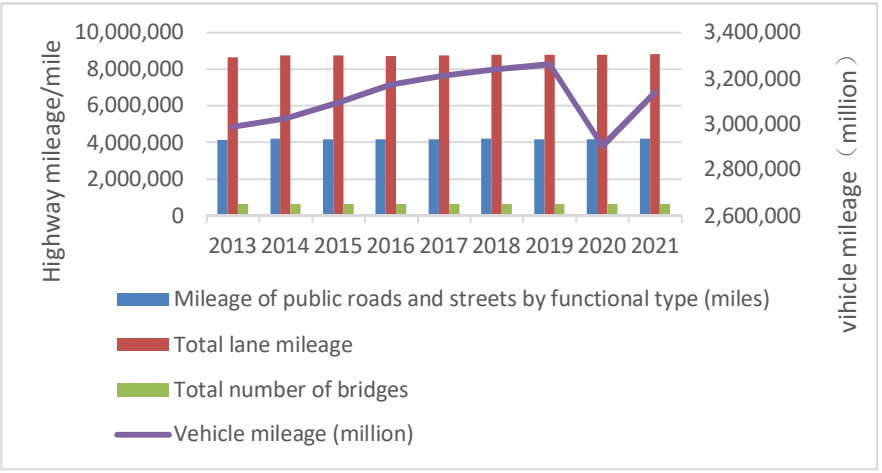

Fig. 2. U.S. highway related data statistics from 2013 to 2021

Source: Transportation Statistics Bureau Transportation Yearbook, U.S.

2.3 Waterway Transportation is Relatively Developed

The U.S. waterway transportation system is well developed, thanks to its many rivers, lakes, and coastlines. From Table 1, the U.S. water transport plays an important role in international trade, with 2,347 million tons as of 2021. Moreover, the U.S. has complete waterway facilities and a stable quantity, reaching 8276 as of 2021. Meanwhile, as of 2021, there were a total of 208 ports of all sizes in the U.S. The U.S. port system is one of the most developed and busiest port systems in the world.

Table 1. Statistics on variables related to water transport in the U.S.

Year	Waterway facilities (including cargo handling docks)	Port (250,000 tons of handling)	Total Maritime Trade (million tons)
2016	8,227	181	2,292

2017	8,239	186	2,387
2018	8,238	181	2,438
2019	8,250	185	2,363
2020	8,334	192	2,226
2021	8,276	208	2,347

Source: Transportation Statistics Bureau Transportation Yearbook, U.S.

2.4 Aviation HAS Made Remarkable Achievements

The number of airports in the U.S. is numerous, reaching 20,061 as of 2021. In 2022, the world's top 50 airports accounted for 83% of U.S. airport passenger traffic. From Figure 3, the total number of aircraft in the U.S. has also reached 215012, and the total load factor is high, except for the impact of the epidemic, it is basically maintained at about 80, which is a veritable aviation power.

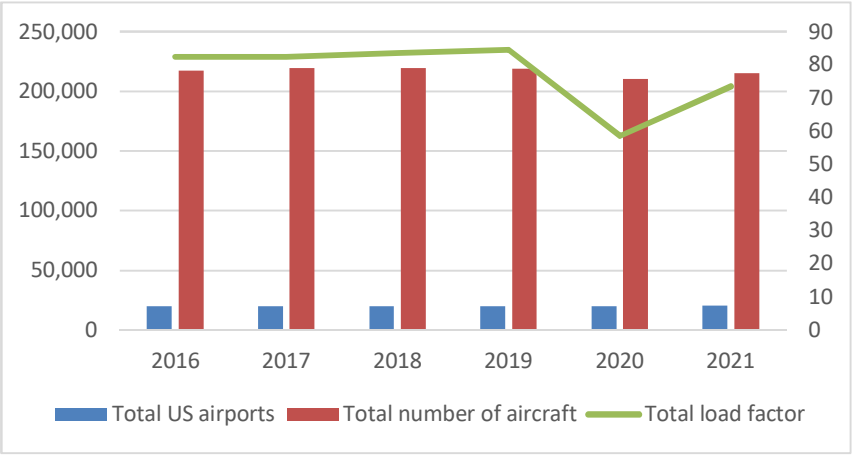

Fig. 3. U.S. airports, number of aircraft, and total load factor statistics

Source: Transportation Statistics Bureau Transportation Yearbook, U.S.

3 Comparative Analysis of Comprehensive Transportation Systems between China and the U.S.

This chapter collects data in the course of comparative analysis: the yearbook of the Ministry of Transport of China, the yearbook of the Bureau of Statistics of the U.S. and the International Union of Railways, etc. It is to ensure the accuracy and authority of the data, so as to better compare the advantages and disadvantages of transportation between China and the U.S. At the same time, various data tables were made, and the changes in 2010 and 2018 were selected to conduct a dynamic and intuitive analysis of the two countries.

3.1 Comparison of Transportation Service Indicators between China and the U.S.

For the transportation services in China and the U.S., the passenger and freight volume and passenger and freight turnover of different transportation in 2010 and 2018 were selected for comparative analysis.

Table 2. U.S.-China Transportation Services Indicators

serial number	The name of the metric	2018		2010	
		China	U.S.	China	U.S.
1	Railway passenger traffic (10,000 people)	337495	31700	167609	28700
2	Railway passenger turnover/100 million person-km	14146.6	102.37	8762.2	103.32
3	Railway freight turnover/100 million tons km	28821	27847.17	27644.1	27225.16
4	Highway passenger turnover (100 million person-kilometers)	9279.68	6244.77	15020.81	4697.9
5	Road freight turnover/100 million tons km	71249.2	32876	43389.7	29475.25
6	Air passenger traffic (10,000 people)	61173.77	88902.2	26769.14	72049.7
7	Air passenger turnover (100 million person-kilometers)	10712.32	11755.07	4039	9087.88
8	Air cargo turnover / 100 million tons km	262.5	257.1	178.9	201.9
9	Waterway freight turnover / 100 million tons km	99052.8	9800.97	68427.5	9751.22

Source: Transportation Statistics Bureau Transportation Yearbook, U.S. Department of Transportation, International Union of Railways

As can be seen from Table 2, there is a large gap between China and the U.S. in terms of rail passenger traffic and rail passenger turnover, and Chinese rail passenger traffic in 2010 was more than five times different from that of the U.S. In 2018, Chinese railway passenger traffic continued to rise, increasing by 101.36% compared with the original, and the gap with the U.S. has been as much as ten times; In addition, with the decline of railway development in the U.S. year by year, China has achieved rapid growth in recent years with vigorous development in the railway sector.

Next is a comparison of road passenger and freight turnover. Chinese road passenger turnover in 2010 was 3.2 times that of the U.S., and in 2018 it was 1.49 times that of the U.S. In terms of road freight turnover, China has more than twice that of the U.S. in 2010 to more than twice that of the U.S. in 2018, reflecting the rapid development of road freight turnover.

There are also big differences between the two countries in terms of waterway freight turnover: In 2010, China reached 5.65 times more than the U.S., and in 2018, Chinese own growth was 9.11 times more than that of the U.S. Chinese waterways are able to cover a wide range of areas, connecting inland and overseas destinations. The U.S. has a strong water transportation capacity and vast waters.

In terms of air transportation: in 2010, the U.S. air passenger turnover was more than twice that of China, and in 2018, the gap between the two was not large, and the U.S. air cargo turnover in 2010 was about 1.13 times that of China, but in 2018, China itself

grew by 46.7% and surpassed the U.S. by 540 million ton-kilometers. The American air transportation industry has a longer history and a larger scale[3].So it's highly influential; There are also differences in the technical and management level of air transport between the two countries; In addition, the competition landscape and policy environment of the air transport market between the two countries are also different. American airlines strive to gain market share by offering diversified services. The Chinese government, on the other hand, promotes the healthy development of the air transportation industry through policy regulation and market access.

3.2 Comparison of Transportation Infrastructure between China and the U.S.

Table 3. U.S.-China transportation infrastructure and transportation equipment indicators

The name of the metric	2018		2010	
	U.S.	China	U.S.	China
Comprehensive density of the road network（km/100 km2）	73.48	50.48	71.55	41.75
Comprehensive density of expressway network (km/100 km2).	0.85	1.49	0.82	0.77
Comprehensive density of railway network (km/100 km2).	1.55	1.36	1.6	0.95
High-speed railway mileage (1000km).	0	29	0	8.358
Electrified railway (1000km).	0	92	0	42
Navigable inland waterway (1000km).	40	127.1	19.3	124.2
Number of the world's top 50 ports by cargo throughput by weight	5	14	3	10
The number of airports with an annual passenger throughput of more than 10 million passengers	28	37	23	16

Source: United Nations Economic Commission for Europe, Federal Highway Administration, Statistical Bulletin on the Development of the Transportation Industry

From the perspective of highways, although the comprehensive density of the highway network in the U.S. is still growing slowly, it is not difficult to see that the comprehensive highway network in the U.S. has developed relatively well[4]. On the other hand, Chinese highway development lags behind that of the U.S., but it has grown at a faster pace, increasing by 20 percent in eight years.

From the perspective of rail development, Chinese high-speed rail and electrified railways have nearly quadrupled their operating mileage, while the U.S. has not developed high-speed rail in the past eight years. From Table 3, the slow pace of electrification may be due to the fact that the U.S. rail freight double-decker containers are not being built, while the lack of high-speed rail may be due to the low economic efficiency of high-speed rail construction due to the well-developed aviation industry in the U.S.

For water transport, Chinese navigable inland waterways far exceed those of the U.S., but in fact, according to the Ministry of Transport, only about 10 percent of Chinese waterways are classified or higher. Moreover, the number of Chinese top 50 ports in global cargo throughput is much greater than that of the U.S., which reflects the high dependence of the Chinese economy on foreign trade.

In addition, for the air transportation industry, there has been a significant increase in the number of airports in China with an annual passenger throughput of over 1 million people. The number of airports with an annual passenger throughput of over 10 million has surpassed that of the U.S. Based on the huge travel demand of Chinese passengers, this growth may continue for some time.

3.3 Comparison of Transportation Management Indicators between China and the U.S.

Table 4. U.S.-China Transportation Management

serial number	The name of the metric	2018		2010	
		U.S.	China	U.S.	China
1	Electrification rate of railways (%)	Less than1%	73.3%	Less than1%	70.0%
2	Road traffic fatalities	36560	63194	30000	62218
3	CO2 emissions from the transport sector (tons/person)	5.9	0.7	5.86	0.7
4	Proportion of energy consumption in transportation as a percentage of total energy consumption of all industries (%)	36%	8.4%	33%	9.2%

Source: U.S. Federal Highway Administration, Transportation Industry Development Statistical Bulletin, www.bts.gov (U.S. Department of Transportation)

From the perspective of road traffic fatalities, an upward trend is shown by the number of fatalities in both countries, but if the statistics are calculated by the statistical indicator of people/vehicles, a downward trend is shown by a mortality rate in both countries[5].

In terms of CO_2 emissions from the transportation sector, the per capita CO_2 emissions from the transportation sector in the U.S. are much higher than those in China. From a perspective of proportion, the transportation industry in the U.S. accounts for a high proportion of the total energy consumption of all industries. From the perspective of development laws, a decrease in the proportion of energy consumption in both the living and industrial sectors will inevitably lead to an increase in the proportion of transportation industry, reflecting that the U.S. is relatively ahead of China in terms of industrial development structure.

Overall, China leads the way in rail electrification, while the U.S. has higher energy consumption and CO_2 emissions from transportation. From Table 4, these data reflect the different development paths and challenges of the two countries in terms of transport infrastructure and equipment. In the future, both countries will need to make efforts to improve safety, reduce emissions, and improve efficiency.

4 Conclusion

China and the U.S. have their own unique transportation systems. The U.S. civil aviation industry is more developed, the highway network is more dense, the transportation equipment is more perfect, and Chinese railway and water transportation are more

perfect; China performs better in passenger and freight traffic, while the U.S. has better economic returns and higher labor productivity. Transportation in China is less energy-intensive, and the U.S. roads are safer.

China should learn from the experience of the U.S., strengthen the planning and construction of transportation infrastructure, improve the road network, and optimize civil aviation policies. At the same time, inland waterways and ports should be continuously developed to improve transport efficiency. In terms of transportation equipment, research and innovation should be increased to improve the quality and efficiency of equipment. In addition, we should pay attention to environmental protection and sustainable development, and promote the green transformation of transportation. Through these measures, China will further optimize its transportation system and promote sustainable and healthy economic and social development.

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