



# Development and Challenges of Iran's Railway Transportation Infrastructure Based on The Perspective of “The Belt and Road” Initiative

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**Abstract.** With a significant position of energy and transportation, Iran is an important corridor connecting Eastern and Western civilizations. Iran is also an important trade partner to China in promoting the “the Belt and Road” initiative in the Middle East. Infrastructure is a priority area for the construction of the “the Belt and Road” initiative. On the basis of sorting out the current situation of railway transportation in Iran, this article analyzes the basic capacity, international cooperation strategy of Transport in Iran in the field of transportation infrastructure, and the compatibility between Iran's transportation development strategy and the “the Belt and Road” initiative, evaluates Iran's strategic value, investment potential and Development prospects.

**Keywords:** The Belt and Road Initiative; Iran; railway; development and challenges

## 1 Introduction

Iran is located in the core area of the Persian Gulf. And adjacent to Pakistan, Afghanistan, Turkey and Iraq. It has a prominent position as an energy and transportation hub. It is an important corridor connecting Eastern and Western civilizations, spanning the two major oil and gas producing regions of the Caspian Sea and the Persian Gulf.<sup>[1]</sup> In 2022, Iran's Gross Domestic Product ranks 17th in the World. And its Comprehensive National Power has exceeded that of Saudi Arabia in the Middle East countries. In January 2016, the United States and Europe lifted sanctions against Iran. Iran is considered to have entered a golden era, and its confidence as a regional leading power has significantly increased<sup>[2]</sup>.

Iran established diplomatic relations with China in 1971, and since then, the two countries have had frequent political and economic exchanges. Iran is an important trading partner of China. In January 2016, China and Iran established a comprehensive strategic partnership, and the potential for cooperation between the two countries is expected to further enhance. The “the Belt and Road” initiative is an important practice

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and embodiment of China's building a new type of international relations with win-win cooperation at the core. Iran is the intersection of the "Silk Road Economic Belt" and the "Maritime Silk Road", and plays a pivotal role in the "the Belt and Road" initiative.

The interconnection of transportation infrastructure is an important carrier and platform for deep exchanges in international political, economic, and cultural. The construction of international transportation channels is not only affected by the progress and effectiveness of node construction between countries, but also by the development level and service efficiency of domestic transportation systems. The development level of Transport in Iran's transportation infrastructure is relatively lagging behind. There are many problems in transportation network, technical status, operational efficiency and other aspects. There is an urgent need to improve the development level of transportation infrastructure. Therefore, improving the development level of transportation infrastructure is not only an important part of the "The Belt and Road" initiative, but also a strategic measure to work with Iran to achieve economic and social development goals.

## **2 Development status of transportation infrastructure in Iran**

### **2.1 Current Situation of Highway Infrastructure in Iran**

Iran is rich in oil and gas resources and has relatively low transportation costs. It has a total of 180 thousand kilometers of various roads, including a total of 100 thousand kilometers of rural roads. Although an average of 1200-1300 kilometers of new roads are built every year, the increasing number of cars continues to make Iran's roads congested and the development level of road construction still lags behind. The poor technical condition of the road network and the widespread uncivilized driving phenomenon have made Iran one of the countries with a high incidence of traffic accidents<sup>[3]</sup>.

The density of Iran's road is about 12 kilometers per 100 square kilometers, and the development level of road is lower than that of neighboring countries. The latest statistical data released by the Ministry of Road and Urban Development of Iran shows that the total mileage of roads which are being maintained and managed is about 79 thousand kilometers, of which only 2053 kilometers are expressways, accounting for 2.6% of the total mileage. The vast majority of roads under management are second-class highway, accounting for 54.2%. There are approximately 45 thousand main roads and 10 thousand rural roads in Iran that lack funds for maintenance. In recent years, the decline in international oil prices has brought huge challenges to Iran's road infrastructure development goals. It can be seen that there is a long way to go for Iran's road infrastructure, and it also faces financial pressure for construction.

### **2.2 Current Development Status of Railway Infrastructure in Iran**

The construction of the Iranian railway system began in 1872, and in 1887, the railway from Tehran to the suburbs was opened to traffic, with a total length of only 8.7 kilometers. In 1927, Iran began to reconstruct the national railway network according to the

international standard gauge. Since then, Iran's new railway systems have basically adopted the standard gauge. Most of the existing railway systems are built, maintained and operated according to the UIC (International Union of Railway) standard. After World War II, the development of Iranian railways was relatively slow. After the Islamic Revolution in 1979, the government formulated a 2000 kilometers railway development plan, and the total length of Iran's national railways exceeded 9 thousand kilometers in 2000. The China Ministry of Commerce's Guidelines for Foreign Investment and Cooperation Countries (Regions) (2021) shows that Iran currently has a total railway mileage of 13954 kilometers, transporting 29 million passengers and 50 million tons of goods throughout the year.

Overall, Iran's railway infrastructure and capabilities are still lacking. The railway lines are mainly distributed in Tehran, and most of them are Monorail line, and there has been no electrification engineering transformation (electrification rate is only 2%), and most railways are designed with low speeds (50-80km/h). Due to aging railway lines and outdated locomotives, the overall operating speed of railways is slower than that of highways, and the price of goods transportation is higher<sup>[4]</sup>. There is also a lack of passenger transportation capacity. Therefore, most freight owners and passengers still tend to choose transportation tools such as cars or airplanes.

### 2.3 Shipping and Port Layout of Iran

Oil is the main export products in Iran. In 2022, Iran's oil exports amounted to 160 billion US dollars, accounting for 35% of the total exports. Oil reserves in Iran is mainly exported to China, India, Japan and other countries. The transportation mainly relies on shipping, and about 93% of crude oil exports are by sea. In addition, more than 95% of non-crude oil export are transported by sea.

Iran has a coastline of 2440 kilometers, and there are nearly 200 ports, including 11 important commercial ports. Most of the seaports are concentrated in the southern Persian Gulf, such as Abadan Port, Bandar Abbas and Bushehr Port. There are four important ports along the Caspian Sea in the north of the country, namely, Anzali Port, Nowshahr Port, Amiabad Port and Neckar Port. Iran's important oil producing areas and refineries are connected to ports along the Persian Gulf coast through oil pipelines, and oil is transported to oil consuming countries through large oil tankers.

In 2016, China and Iran signed a new energy construction project to cooperate in the construction of the "Qeshm Oil Terminal" near Bandar Abbas in the south of the Persian Gulf, which will make the "Qeshm Island" an important hub in the field of oil production in the Gulf region. The joint construction of the Qashm oil terminal by the Iranian government and the Chinese government has important strategic value for both sides. The construction of this oil terminal has important strategic meaning in driving the development of southern Iran. At the same time, the construction of this project objectively improves the guarantee ability of China Petroleum's overseas supply, and also provided opportunities for Chinese shipping companies in Iran Trade and transportation have provided convenience, creating benefits for Chinese enterprises to expand Iran's oil market.

## 2.4 Current Situation of Gas Pipeline Construction in Iran

Iran's natural gas reserves reach 34 trillion cubic meters, accounting for 16.6% of the world's total reserves, surpassing Russia's reserves which is 32.6 trillion cubic meters and ranking first in the world. South Pars Gas Field is located in Arusha, Bushehr province, it extends about 300 kilometers along the Persian Gulf coast, covering an area of 10000 hectares. It is one of the largest oil and gas fields in the world at present. The explored reserves of natural gas are  $10.2 \times 10^{12}$  standard cubic meters. As an important clean energy, natural gas is increasingly favored by the global energy consumption market. According to the forecast, the annual growth rate of the global market's demand for natural gas is 2.4%. In order to meet this growing trend of energy demand, Iran is planning to transport the natural gas from South Pars, the country's largest Natural gas field, to the energy consuming countries through pipelines. Iran has nearly 20000 kilometers of gas pipelines, mainly distributed in the southwest and northwest parts of the country.

Although Iran has huge natural gas reserves, most Natural gas field haven't yet to be developed. Iran began to export natural gas after achieving self-sufficiency. At present, Turkey and Iraq are Iran's main natural gas exporters. Due to the political influence between Iran with Turkey, the gas transmission pipeline between Ta Britz in northwest Iran and Ankara in Turkey, which has been planned for many years, was completed and opened at the end of 2001. Some of the pipelines pass through the regions frequently attacked by the Kurdistan Workers' Party in eastern Turkey, and gas transmission is often interrupted as a result. In April 2014 Iran reached an agreement with Iraq to supply gas to its power plants. The gas supply to Iraq increase to 25 million cubic meters per day through gas pipelines during the agreement period.

Pakistan has been plagued by energy shortage for a long time<sup>[5]</sup>. In 2009, Iran and Pakistan signed a natural gas export agreement worth 1.3 billion dollars. The Iran Pakistan natural gas transmission pipeline in Iran section was started as early as 2010, and the project was completed in March 2016. The project in Pakistan was put on hold because Pakistan failed to build Oil pipeline due to financial difficulties.

## 3 Evaluation of Iran's transportation infrastructure development prospect

### 3.1 Development and Investment Plan of Iran's Highway Network

The infrastructure of Iran's road transportation is underdeveloped. In recent years, the Iranian government has made more efforts in road construction. The development of Iran's road infrastructure is focused on upgrading and renovating the existing road network. Since 2013, the Iranian government has built 700 kilometers of highways. In June 2015, the Iranian government announced that it would expand to 10000 kilometers on top of the existing 2000 kilometers of highways, which means the Iranian government needs to invest at least \$3 billion in road infrastructure.

In terms of road construction, Iran has not only formulated a domestic development plan, but also developed international connectivity and cooperation in transportation<sup>[6]</sup>.

Iran has not only planned the Iran- Turkey- Europe road corridor, but also launched the Iran's new cross-border transport corridor plan to connect Central Asia and Europe with a total investment of about 1.5 billion US dollars. This agreement involves six countries, including Avaya, Azerbaijan, Georgia, Turkey, Bulgaria and Greece. It is planned to realize that the total length is about 550 kilometers from Central Asian to Black Sea ports. The project is planned to be built according to the highest international standard, starting from the border of Georgia in the north and Iran in the south, and then leading to the international market. The project has a loan of 500 million dollars from the Asian Development Bank, 150 million yuan from the Eurasian Development Bank, and 60 million euros from the European Investment Bank. The whole project is completed in 2019.

### **3.2 Renovation of Iran's Railway Transportation System**

Since the Islamic Revolution, Iran's railway transportation has developed to a certain extent, the scale of the road network has doubled. However, there has no significant progress in the level of railway technology, operating speed, and operational efficiency, and low double track rates and low electrification rates still exist. The low efficiency of the railway system has affected the efficiency of economic operation. Since President Ruhani took office in 2013, the development of the national railway has become a key focus of the government's work. In 2014, the Iran Economic Commission approved the Development Plan for Iranian Railways, which plans to carry out large-scale reconstruction of the existing railway system in the next ten years. By 2025, the existing railway lines will be electrified and double tracked, enhance the capacity of railway passenger transport and freight transport, and build 12000 kilometers of new railway lines, ultimately doubling the total mileage. The implementation period of this plan is 10 years, and the planned investment exceeds 7.5 billion US dollars. The plan also proposes that the freight volume and passenger volume will increase from 21.7 billion ton kilometers and 17.4 billion person kilometers in 2013 to 75.8 billion ton kilometers and 34.2 billion person kilometers in 2023, respectively. The plan also includes the construction of 26 new stations.

The long-term planning of Iran's railway system is ambitious. The seven directional railway lines not only enrich and improve the domestic railway system, but also form a huge international railway transportation channel, with the intention of occupying an important position in the international transit trade and international transportation. It connects with the railways of Turkmenistan and Kazakhstan, and finally leads to Xinjiang, China. It connects Turkey railway and southern Europe. This route is an important part of Iran's "New Silk Road" plan. Iran plans to electrify the domestic section of this line, increase the freight capacity from 3 million tons to 10 million tons. This line is an ideal route for China Europe international railway transportation corridor, which can not only connect China and Europe directly, but also save about 30 days of transportation time compared with water transportation. "The Belt and Road" initiative advocates joint construction, and emphasizes the common interests. China should give priority to the electrification reconstruction project of this line through in-depth coop-

eration with Iran, so as to improve the transport capacity and operation efficiency of this channel.

### 3.3 Exploration of Iran's Gas Pipeline Planning and International Cooperation

Iran is currently negotiating with Pakistan, India and other countries on the construction of oil and natural gas transmission pipelines<sup>[7]</sup>. The natural gas pipeline from Iran's South Pars gas field to Pakistan and India has a complicated negotiation process, which involves the respective interests and contradictions among Iran, Pakistan and India. Although the construction plan for Iran Pakistan and India natural gas pipeline was proposed as early as the late 1980s, India is unable to import natural gas from Iran through the pipeline, and to this day, this pipeline has not made substantial progress until now.

China's natural gas demand has continued to grow rapidly Since 1980s, while China's domestic natural gas resources are not sufficient, Iran is undoubtedly a promising partner<sup>[8]</sup>. Regarding the cooperation between Iran and China's oil and gas pipeline, there are three main directions to consider<sup>[9]</sup>. Firstly, China- Central Asia natural gas pipeline (Turkmenistan- Uzbekistan- Kazakhstan- China) has been connected. Iran can connect with the Turkmenistan oil and gas pipeline through the planned northeast oil and gas pipeline and join China- Central Asia natural gas pipeline network. Secondly, Iran can enter the Chinese market through Afghanistan. Thirdly, extending the Iran Pakistan gas pipeline northward to connect with the Kashgar gas pipeline in China. From a geopolitical perspective, options one and options three are more operable. Despite the enormous potential for energy cooperation between China and Iran, there are also challenges. The internationalization of energy cooperation is Iran's current national strategy. When Western economies return to the Iranian market, China is likely to face challenges in Iran's energy and many other fields<sup>[10]</sup>.

## 4 Conclusion

In order to improving the level of economic and social development, Iran is making great efforts on strengthening investment and construction in the field of infrastructure. The Iranian government has a clear development idea and construction plan in the construction of railways, roads, ports and transnational gas pipelines. Financing is an important constraint to the construction of transportation infrastructure in Iran. Iran is in the position of a "transit station" in the Eurasian Unicom. The improvement of the carrying capacity and service level of Iran's domestic transport infrastructure has a positive effect on the operational efficiency of the "land Silk Road" and the "maritime Silk Road". Iran's transport infrastructure development plan is highly compatible with the "Belt and Road" initiative.

Chinese engineering construction enterprises have technological and cost advantages in the fields of high-speed railway and highway construction, port development and gas transmission engineering construction, and also have a lot of overseas

engineering experience. For Chinese construction enterprises, in addition to seeing market opportunities, they should also objectively look at the problems existing in the Iranian construction market in terms of project bidding, project approval, contract dispute settlement, etc. Therefore, before undertaking local transportation construction projects, Chinese construction enterprises need to have a thorough understanding of the business environment such as local policies and culture. Identify the risks that may exist in the process of project implementation, strengthen risk management and control, and establish various emergency plans to ensure the smooth implementation of the project.

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## References

1. Najibi H, Rezaei R, Javanmardi J, et al. (2009) Economic evaluation of natural gas transportation from Iran's South-Pars gas field to market. *Applied Thermal Engineering*, 29(10):2009-2015. <https://doi.org/10.1016/j.applthermaleng.2008.10.008>
2. Uysal O. (2016) Kazakhstan-Turkmenistan-Iran railway to open today. <https://railturkey.org/2014/12/03/kazakhstan-turkmenistan-iran-railway>
3. Fereshteh F, Mahshad F, Alireza R, Pedram B (2022) A Framework to Assess the Correlation between Transportation Infrastructure Access and Economics: Evidence from Iran. *Mathematical Problems in Engineering*. DOI: 10.1155/2022/8781686
4. Wang L, Ma J, Jiang Z, et al. (2021) Highway Freight Transportation Diversity of Cities Based on Radiation Models. *Entropy*. 23:637-637. DOI: 10.3390/E23050637
5. Qasim M, Kotani. (2014) An empirical analysis of energy shortage in Pakistan. *Asia-Pacific journal of rural development*, 21(1):137-166. DOI:10.18356/e84bd5d1-en
6. Mousavi M, Ghavidel S (2019) Structural time series model for energy demand in Iran's transportation sector. *Case Studies on Transport Policy*. 7:423-432. DOI: 10.1016/j.cstp.2019.02.004
7. Destradi S. (2014) India: A Reluctant Partner for Afghanistan. *The Washington quarterly*. 37(2):103-117. DOI:10.1080/0163660X.2014.926212.
8. RMT0. (2016) Total Road Length under protection of Ministry of roads and Urban Development. <http://www.rmto.ir/en/SiteAssets/Roads%20Network.pdf>.
9. SH M. Oil price plunges hitting infrastructure hard. (2016). <https://en.mehrnews.com/news/105613/Oil-price-plunges-hitting-infrastructure-hard>.
10. Nathan H S K, Kulkarni S S, Ahuja D R. (2013) Pipeline politics—A study of India's proposed cross border gas projects. *Energy Policy*. 62:145-156. DOI: 10.1016/j.enpol.2013.06.073

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