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Original Paper

Bangladesh Railway EPC Track Engineering Investigation and Summary

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Abstract

Bangladesh's railway infrastructure is outdated and inadequate, and the lack of transportation capacity seriously hinders the country's economic development. In the track engineering practice of EPC projects such as the second line project of a railway Meter-Gauge addition project and the new Board-Gauge railway project in Bangladesh, according to the operation characteristics and maintenance status of the existing cable of the Bangladesh railway, the design and construction characteristics of the railway track, and the procurement of track materials, combined with the characteristics of the EPC project management in the country, suggestions on the general contracting and construction of track engineering were put forward. He also analyzed and summarized the risk factors in the design and construction of Bangladesh railway track engineering, and made some useful thoughts and explorations on how to do a good job in the general contracting of track engineering of EPC projects according to local conditions.

Keyword

Bangladesh, EPC, railway track engineering, risk

1. Introduction

For railway construction enterprises, the market competition is extremely hot; entering the international engineering market has been the short and medium term development strategy and market positioning that many enterprises have already formulated. After years of construction and investigation, combined with some understanding and experience of the construction market in Bangladesh, the author believes that the railway construction market in Bangladesh has a broad space, but also faces many risks.

2. Characteristics of Bangladesh Railway General Contract Track Project

2.1 Current Situation of Bangladesh

Bangladesh is located in South Asia, bordered by the Indian Ocean and the Bay of Bengal. It is adjacent to Myanmar in the southeast and shares borders with India to the east, west, and north, while the south faces the Bay of Bengal. It has a tropical monsoon climate and does not experience the severe cold of China. In Bangladesh, there is a dry winter and spring season from November to March, which is considered the prime construction season, while roadbed construction during the rainy season can be largely halted. The country has a large population of around 170 million, with 85% practicing Islam. Bangladesh celebrates numerous holidays, and the impact of holidays on construction schedules must be taken into account.

The people of Bangladesh primarily speak South Asian English and Bengali, but the English accent here is unique, with some pronounced phonetic differences from British and American accents.

2.1.1 Situation of Construction Laborers

The wages of construction workers in Bangladesh are relatively low, typically ranging from 8000TK to 15000TK, which is equivalent to less than 1000RMB. There are regional differences in wages. However, compared to textile workers or workers in other industries, construction labor wages are considered relatively high. In Bangladesh, manual laborers often carry heavy loads on their heads or use two-person teams to carry them by hand, with the frequent use of baskets. They are not skilled in utilizing simple equipment such as hand carts.

The overall work efficiency in Bangladesh is low. Considering the wage rates, labor discipline, self-consciousness, and work efficiency, the intrinsic wages are not considered low. The low wages and lack of motivation among workers result in a large number of people who pass time without actively engaging in work. The fundamental reason for this is the lack of an incentive system.

The infrastructure in Bangladesh is generally poor, with few highways. For example, the route between Dhaka and Chittagong, two important cities in Bangladesh, is still only a two-lane road, and traffic congestion is normal. The average travel speed on these routes is around 30-40 km/h. However, rural roads in Bangladesh are relatively well-developed, connecting villages, but they are difficult to use as construction access roads.

Most of Bangladesh's railways are dual gauge or meter gauge, and their operational efficiency is generally low. Apart from a few passenger trains, there are hardly any freight trains running in a day. The 38 kg/m rails and sleepers are old and worn, with severe rail wear, inadequate sleeper ballast, incomplete rail fasteners, incomplete fishplate bolts, uneven rail joints, and numerous track deformities. The track conditions are poor, with mud and mudflats, and various rail defects. Therefore, the train speeds are limited to within 45 km/h. During holidays, the train compartments and locomotives are overcrowded with people, posing great danger. Sitting on the roof of the train is free in Bangladesh. Train tickets in Bangladesh are not expensive, but many poor people cannot afford them and are forced to travel on the

train roof. Another reason is the severe shortage of transport capacity, resulting in overcrowded compartments and an inability to address the issue of excess demand.

2.1.2 Situation of Construction Materials

Bangladesh relies entirely on imports for steel, with a customs tariff of 40%. As a result, the price of steel in Bangladesh is higher than in China, and the availability of steel in the market is not sufficient. Generally, it needs to be pre-ordered for supply.

Crushed stone for construction in the southern region of capital Dhaka, is very expensive. The price at the quarry is around 130RMB per cubic meter, and with an additional 200-300 kilometers of transportation by truck, the price of crushed stone at the construction site can exceed 300RMB per cubic meter. The main reason is the lack of resources in Bangladesh. There are no mountains for quarrying, so a large amount of crushed stone needs to be imported from India or transported over long distances from the northern region of Dhaka, with transportation costs exceeding 200RMB per cubic meter. Bangladesh has many rivers and produces sand, but most of it is fine sand or silt, priced at around 20-30RMB per cubic meter. However, if medium-coarse sand is used, the price is higher, ranging from 70 to 80RMB per cubic meter due to the scarcity of sand production sites.

The cement in Bangladesh is primarily self-supplied, but the raw materials rely on water transportation. Cement factory are generally built along major rivers, with self-built docks and wharves, making material loading and unloading more convenient.

Taking into account the aforementioned supply situation, the cost of concrete with a grade above C30 in Bangladesh exceeds 1000 RMB.

There are many brick factories in Bangladesh, and the quality of bricks is relatively stable. The factory price is approximately 0.1RMB. Brick chips (either manually or by using a crusher to break bricks into 20-40mm sizes) have a wide range of applications. They are used as aggregates in highway subgrades, base layers, and are indispensable for lower-grade concrete such as C15 and C20. They are also commonly used for repairing road pavements and laying bottom layers.

In recent years, investment and construction in Bangladesh have been increasing, and material prices have shown a rising trend. If not considered in advance, it can lead to losses. For example, in the road expansion project from Dhaka to Chittagong, the large quantity of coarse aggregates needed for the subgrade and base layers resulted in significant losses for local companies due to the price increase of crushed stones and gravel over the past two years.

Bangladesh suffers from a severe power shortage, and in Dhaka, electricity is rationed during peak hours on a rotational basis, with scheduled power cuts. Therefore, households, businesses, and shopping malls with slightly better economic conditions are equipped with generators with automatic switching. As a result, most construction sites rely on generators for electricity, resulting in higher electricity costs. However, fuel prices here are 10% to 20% cheaper compared to China.

2.1.3 Construction Machinery Equipment

The economic situation in Bangladesh is poor, so they generally purchase old machinery and equipment from around the world because it is cheaper. There is a wide variety of machinery available, but the utilization rate is extremely low mainly due to the low-level of maintenance personnel and the unavailability of spare parts. Since the old equipment comes from various parts of the world, some of it is already obsolete, making it extremely difficult to find spare parts in Bangladesh. The spare parts market in major cities like Dhaka and Chittagong is also very limited. As a result, many parts need to be imported from abroad, which not only delays the time but also incurs high costs.

2.1.4 Project Investment and Its Risk

When Bangladesh gained independence in the 1970s, many countries were concerned that the Bangladesh government would be unable to feed its large population. However, through the efforts of Bangladesh government and its people, the issue of food security was resolved. However, there has been slow progress in infrastructure development, mainly due to a lack of funds. Therefore, it is difficult to increase the cost of projects in Bangladesh, and if the estimated budget exceeds the limit, consideration can be given to reducing related ancillary projects. Many projects in Bangladesh rely on loans from other countries or financial institutions such as the Asian Development Bank and the World Bank. The budget allocation for these projects is limited, with only 10% allocated as contingency funds. Once this portion of the funding is exhausted, it becomes increasingly challenging to raise additional funds.

Bangladesh construction period requirements are not strict, basically not many projects are completed on time, often because the employer has no money to let the construction company stop for a few months, wait for money to do it again. The government's ability to promote land acquisition and demolition is weak. Land requisition and resettlement is also a complicated problem in road construction in Bangladesh. Bangladesh's supervision system is similar to China's, both of which are derived from the FIDIC provisions, but it also has Bangladeshi characteristics, and the quality of supervisors varies.

China Export and Credit Insurance Corporation describes Bangladesh's investment environment in its Country Risk Report as follows: The investment circumstance in Bangladesh is characterized by a lack of resources, poor infrastructure, severe energy shortages, inadequate supply of water, electricity and natural gas, chaotic and crowded transportation, inadequate cargo handling capacity at ports, heavy bureaucracy, corruption, inadequate legal system, and frequent strikes.

3. Risk Analysis of EPC

3.1 Design Risk

The following content is included in the bidding documents: The contractor shall submit detailed drawings (including required design calculations and samples) and specifications for all materials and track components (such as rails, sleepers, fasteners, turnouts, ballast, etc.) to be supplied and used for the track works of this project. They shall also submit detailed product data, drawings, and performance specifications for all materials and equipment (e.g., ballast laying, compacting, and surface finishing;

sleeper laying, compacting, lining, and leveling equipment; including special equipment for alignment and leveling control, such as ALC and lasers; flash welding, aluminum thermite welding, other track laying and construction equipment) planned for the track works of the project. A complete list of equipment and component manufacturers, dates of transportation to the site, operation procedures, and instructions should be included as well. The contractor should also submit construction manuals that cover the handling, transportation, and storage procedures for all materials, as well as inspection and testing plans developed to ensure compliance with the prescribed procedures. Based on the plans included in the bidding documents and the surveys conducted personally (as specified in this specification), the contractor shall submit detailed construction drawings related to alignment and profiles, including tangent and curve coordinates, turnout positions, station layout, and other track arrangements, as well as complete construction details for all track works, including phased plans.

The railway design in Bangladesh generally follows European standards (EN), UIC standards, as well as Indian and Bangladeshi national standards. It is necessary to be familiar with these relevant standards and make additional improvements accordingly. The design drawings for station ancillary facilities and level crossing layouts are based on the basic standard drawings of Bangladesh Railway (BR). It is important to collect and familiarize oneself with local standard designs and practices.

3.2 Construction Risk

Improper storage, handling, and transportation of track materials can result in accidents, injuries to personnel, and damage or scrapping of the track materials. The main reasons for such incidents are as follows: Non-compliance with relevant specifications in the storage of track materials, such as uneven or unstable stacking areas, improper placement of the center of gravity, or excessive stacking height. Non-compliance with requirements for wire rope splicing during lifting operations. Construction personnel standing or sitting on the railcars or end plates during the loading or unloading of ballast. Non-compliance with specified procedures for the loading and unloading of turnouts. Improper operation of mechanical equipment and facilities.

Incidents of casualties and damage to mechanical equipment during ballast track-bed construction: Temporary storage of ballast encroaching on clearance limits. Imbalanced unloading of ballast from railcars. Over-speeding of ballast transport vehicles. Ballast falling from the track-bed onto the bridge during construction. Insufficient anti-sliding measures in the area where large maintenance machinery is stationed. Operating on track with excessive temperature. Exceeding the loading limit when the power on the bridge is stable.

4. Result

The construction of railways in China generally adopts mechanized track laying, with a high degree of mechanization and automation, resulting in faster construction progress. However, in Bangladesh, track construction is currently entirely reliant on manual labor, with limited use of machinery and a lack of large-scale equipment.

China's railway has fully transitioned to using long welded rails (100m) and employ factory or base welding for long rails. They also utilize mobile flash butt welding for seamless track laying across different sections. In contrast, Bangladesh Railway generally uses short welded rails (12.8m) produced on-site and relies on mobile flash butt welding for all joint connections in track laying.

Overall, considering the current state of Bangladesh's underdeveloped national economy, there is a tremendous demand for investment in infrastructure sectors such as water, electricity, gas, transportation, and telecommunications. The country urgently requires large-scale foreign investment and offers favorable policies and incentives for foreign investors. With a population of 140 million, a vast labor force, and low labor costs, Bangladesh provides an attractive market for international investment capital and serves as a suitable market for China's industrial restructuring. However, challenges such as weak infrastructure, corruption, bureaucratic governance, confrontational politics, frequent strikes, and concerning social security pose difficulties for foreign investors in Bangladesh.

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