The Project for Rehabilitation of Railway Facilities in Mongolia

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1. Introduction

The Mongolian Railway, having a length of 1,110 km and crossing the country from north to south, was rapidly constructed between 1949 and 1953 following the Second World War in co-operation with the former Soviet Union that had assisted Mongolia as its ally. The Railway is linked with the Siberian Railway via Irkutsk in the north and Beijing in the south across the Chinese border while running through the arid region of Gobi.

The above rail transport is operated as an important lifeline of this landlocked country of Mongolia. However, securing the safety and sure rail transport becomes a problem due to frequent natural disasters and the visibly outdated facilities.

This paper is prepared to describe the matters related to the Project under implementation with the grant aid assistance of the Government of Japan, namely THE PROJECT FOR REHABILITATION OF RAILWAY FACILITIES and THE PROJECT FOR REHABILITATION OF RAILWAY FACILITIES (PHASE II), in order to secure the safe and sure railway transport in Mongolia.

2. Project outline

The project is to be implemented over 4 years and, as of March 2004, it goes into the 2nd stage of its implementation.

The project area covers a distance of 450 km from Bayan station (with the maximum altitude of about 1,410 m) to the south of the capital city of Ulaanbaatar up to the Russian border (with an altitude of about 600 m) with 100 improvement sections scattered all over the area.

- * Client: Mongolian Railways
- * Design & Execution Control: Pacific Consultants International/Tonichi Engineering Consultants, Inc.
- * Main works:
 - Erosion protection of railway basement from river flood
 River bank protection work: 9 locations (Rubble mound revetment)
 - 2) Falling rock prevention from cut-off slopeSlope stabilization work: 20 locations
 - Improvement of the outdated bridge structures
 Bridge rehabilitation work: 11 locations
 - Protection of railway embankment from destruction by small and medium inland river flood Track-crossing water drainage through installation of pre-cast box-culvert:

59 locations

 Protection of Sukhbaatar station against flood water Construction of U-shape cast in-situ RC channels with the size of 3.0m x 2.0m and 1.5m x 1.5m:

2,100m in total

Keyword : Natural Disasters, Seasonal Frost, Melt Water, Flash Flood, Pre-Cast Box Culvert, Wind Time Contact : KONOIKE CONSTRUCTION CO., LTD. Tel (+81)-3-3296-7634 Fax (+81)-3-3296-7628 tsukuda_ms@konoike.co.jp

3. The feature of climate and natural disasters

Mongolia is located in high latitudes. It has a continental climate with an annual average precipitation of 250 mm and the temperature varying from (+) 43°C in summer up to (-) 48°C in winter. The period with the temperature of (+) 5°C and above continues for about 4 months, with the cooling temperature of 0 °C \sim 5 °C for 3 months and with the freezing temperature of 0 °C \sim (-) 35 °C for 5 months. Due to the above reasons, Mongolia could be counted as a country with the worst natural environmental conditions in terms of execution of construction works as well. The railway route could be largely divided into a dry steppe section on the Chinese-side section and a dry steppe-to-taiga section on the Russian-side section. Under the influence of the climatic conditions, most sections of the route go through the areas with permafrost and seasonal frost and where the track is laid over a several meter-thick embankment. Consequently, the track basement is a structure that can easily be destroyed by water flow during melting water in spring and flash flood in summer because the bold hilly landscape almost without trees is not able to suck in water.

Average annual rainfall: $250 \text{ mm} \sim 300 \text{ mm}$ Average annual temperature:(-) $3^{\circ}C \sim (+) 1^{\circ}C$

4. Track crossing drain (Pre-cast box culvert)

From the climatic conditions mentioned above, the period when it is impossible for the earthworks continues from December till April. From the end of September, the temperature also falls below freezing point, which makes outdoor concrete works difficult. With due consideration of the above, the construction plan was basically designed to concentrate the efforts during the six months starting from May to September. Besides, the construction of box-culverts across the track should be executed in a short time since it requires the temporary suspension of the railway operation. For this reason, pre-cast box culverts as ready-made products were selected and designed, taking into account their weight for transportation and installation, to have a RC structure with a relatively high strength of 400 kg/cm². It was designed to join together about 10 box-culverts with a length of 1.0 m each for the installation, basically, on the single-track sections. The whole work was to be completed during the allocated wind time of 10 hours (railway operation suspension hours) and, therefore, the accuracy of the installation of box-culverts was kept under the permanent control since it could affect the whole construction work schedule.

5. Conclusion

Mongolia, as a former member of COMECON with the social basis formed by the assistance of the former Soviet Union during the cold war, still faces the situation where the infrastructure has been left almost unfurnished after 12 years of shifting to the market-oriented economy and the stopping of the assistance from the Soviet Union. Securing of a safe and certain transport system by the Mongolian Railway that fulfills more than 90% of the transportation of the country, is an absolutely indispensable condition for the sustainable and stable social and economic development of Mongolia.

Since the works should be constructed now closely to the railroad track accompanied by the suspension of the track business operation and the construction period will be featured by frequent natural disasters during the warm seasons, it is required to prepare a carefully thought-out plan and secure the quality with sufficient safety margins during the short schedule time.

At the present time, the project for rehabilitation of railway facilities under the implementation with the assistance of Japan is now coming to the final stage. In the circumstances when the existing facilities are progressively deteriorating and the frequency of transport operations are increasing, the securing of the safety of the rail transport and protection from natural disasters as well as taking into account the transfer of technology and training of personnel throughout the period of the execution of works are required. As for the future, expectations should be put on the efforts of Mongolia itself in regard to the maintenance of the facilities.