

Challenges and Accomplishments of Chenab Railway Bridge: The Backbone of Udhampur-Srinagar-Baramulla-Rail-Link (Usbrl) Project

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ABSTRACT

The Kashmir valley of Jammu & Kashmir state is largely mountainous where accessibility and connectivity poses a challenge all along. The Northern Indian Railway has embarked the USBRL project in the construction of a mountain railway on the mission to minimize distances and create connectivity with the geographically isolated Kashmir Valley. The present study systematically defines and elaborates the Northern Indian Railways, brief profile of USBRL project and categorizes the work executions. The paper focuses on the challenges and accomplishments of mega sub project Chenab Railway Bridge. Further the paper highlights the scope of Udhampur-Srinagar-Baramulla-Rail-Link (USBRL) project for Socio economic development of the J&K state.

1. Introduction

After all, what other experiences do we have to compare with travel as opportunities to expand our horizons (geographically, culturally, emotionally, intellectually) to come across with people, cultures and places so different from ourselves" (Smith and Duffy, 2003).

Northern Indian Railway, the Jewel Set in the Crown of Indian Railways, has embarked on the mission to vanquish distances and create its own metaphor of existence. It serves eight states - Jammu & Kashmir, Delhi, Haryana, Himachal Pradesh, Punjab, Uttaranchal, Uttar Pradesh and the Union Territory of Chandigarh. Kashmir valley, a well-known tourist destination as paradise on the earth also tagged as the crown of India's geographical map too. Due to the lack of suitable transport routes, Kashmir has long been cut-off from the rest of India. The Kashmir valley is largely mountainous where accessibility poses a challenge all along. The Indian railway has put forward the project to construct the railway route from Jammu to Baramulla known as Udhampur-Srinagar-Baramulla Rail Link project (USBRL). Currently, the project is functioning in the last stages. The USBRL Project is being developed to provide an alternative and reliable transportation system to the Kashmir valley. USBRL Project is the only railway line in mountainous ranges in India that is being constructed in broad gauge. It connects Jammu and Kashmir's winter capital Jammu to its summer capital Srinagar. The project covers 235 km of access roads, 922 bridges. Chenab Rail Bridge, a 1,315 m in long and 359 m high, is under construction on the route assuming to be the Asia's largest arch structured bridge.

The core business of the Indian Railways (to transport passengers and freight) is completely in line with the objectives and actions of green transport (Ali & Fazili, 2017).

Indian Railways must maintain the Social Service Obligation in order to sustain the social aspect of sustainable development (Ali & Mir, 2018).

2. Observation Details:

For the ease of execution, the work has been sub-divided into the following three Legs:

2.1 LEG -1: Udhampur- Katra (25 Km)

The Executing Agency for Udhampur-Katra section was Northern Railway for the 25 kms (km 0 – km 25). The construction work is complete and the railway track is operational since July 2014. This section is 25 km long and the cost incurred for this section was around Rs. 928 cr. The longest tunnel is 3.15 km long and the tallest bridge in this section is 85m high (Br. No. 20).

2.2 LEG -2: Katra-Qazigund (129 km)

The Executing Agencies for Katra-Qazigund section are Northern Railway for the first 5 kms (km 25 – km 30) within Katra, KRCL (Konkan Railway Corporation Limited) for the next 67 kms (km 30 – km 97) from Katra to Dharam (also known for Leg-2A) and IRCON (Indian Railway Construction Company Limited) for the last 57 kms (km 97 – km 154) from Dharam to Qazigund (also known for Leg-2B). The construction work started in Nov. 2002 is still in progress expecting to be completed in December 2019. Katra-Qazigund section is the most difficult stretch of this project. Construction of tunnels and bridges in Katra-Qazigund section pose a greater challenge than other sections of the project. In 2014, PAC (Public Accounts Committee) report submitted in Parliament recommended that effective measures should be taken in cost estimation of similar challenging projects in future. The pioneering Railway Bridge come under the Katra-Qazigund section.

2.2.1 Chenab Railway Bridge

Indian Railways has undertaken the mega-project of construction of a new railway line in the State of Jammu and Kashmir. The project includes a large number of tunnels and bridges which are to be implemented in highly rugged and mountainous terrain. The alignment crosses a deep gorge of the Chenab River, which necessitates construction of a long-span Chenab railway bridge (Pulkkinen et al., 2012).

Chenab Railway Bridge's work has been divided in four parts from the construction point of view, these are discussed as follows:

A. Construction and Progress on Arch Portion (S10 to S70):

1. **Design:** Design of this portion of the bridge has been completed and proof checked by Proof Consultant except the pier cap/abutment cap of S-70, S-10, SEJs & BEJs
2. **Progress:**
 - I. RCC work: Concreting of S10 (Except 234cum), S20, S30, S40, S50 and S60 has been completed in all respect. Concreting work of S70 is in progress.
 - II. Workshop: Pier Fabrication workshop at Surundi, Arch fabrication workshop at S-180 and at Wheels India Ltd., Wardha, Main span fabrication at S-180 and Bakkal and Trestle fabrication at AIML, Rajpura are functional.

B. Construction and Progress on Viaduct Portion (S-70 to S-180):

1. **Design:** Design of all parts in this portion is approved and the drawings have been issued except the pier cap of S-70.
2. **Progress:**
 - i. RCC Work: All completed except the pier cap of S-70.
 - ii. Superstructure work: Deck of Viaduct consists of steel structures of 65 segments which involves approx. 4200 MT steel fabrication. Fabrication and welding of segments from AS07 to AS65 and segment to segment connections from AS07#AS65 have been completed.

C. Slope stabilization Kauri end: Work in progress.

D. Slope stabilization Bakkal end: Work in progress.

Table 1: Salient features of Chenab Railway Bridge

1.	Total length of the Bridge	1315 meters
2.	Contract amount	Rs.5120 millions
3.	Design life of the bridge	120 years
4.	Design speed	100 kmph
5.	Height of Bridge (river bed to formation)	359m
6.	Main Arch Span	467 meters
7.	Total No of Spans	17 Nos.
8.	Deck Width	NA
	Viaduct Portion	13.50 meters
	Arch Portion	17.00 meters

9.	Max. Ht. of Steel Pier	133.734 meters
10.	Max. Ht. of Concrete Pier	49.343 meters
11.	Max. Size of Foundation	NA
	Viaduct Portion	18 x 15 x 4.15 meters
	Arch Portion	50 x 30 meters
12.	Total Steel Fabrication	25,000 MT
13.	Seismic zone	Zone V
14.	Design Wind Velocity	266 kmph (at deck level)
15.	Geology of terrain	NA
16.	Slope along	NA
	Katra side bank (South)	+35 to 50 degrees
	Qazigund side bank	vertical to sub-vertical

Source: Northern Indian Railways

Chenab Railway Bridge is a mega railway bridge over river Chenab near Salal village. The construction of the 1315 m long bridge is still in progress and is expected to be completed in 2019. The bridge is 14m wide dual carriageway and 1.2m wide central verge expecting lifespan of 120 years and will have 17 spans including the main arch span of steel and a viaduct with steel girders on concrete piers. The construction of this bridge would involve structural steel work of about 25000 MT and reinforcement steel of about 4000 MT. The construction will involve about 43000 cum of concrete and about 6 lac cum of excavation in rocks. Also, the bridge is 35 m tall than the Eiffel tower and will connect Baikal in Katra town of Reasi district in Jammu region with kauri in Kashmir region. Since the bridge is over a very deep gorge, wind will have very significant effect on the stability of bridge and therefore, the modern wind tunnel tests were performed in Denmark for finalizing the design. A comprehensive scheme of instrumentation for monitoring the health of the bridge has been conceptualized and information will be fully online so as to take necessary action in case of any emergency/contingency to safeguard the passengers/trains. The Sensors would detect the speed of the wind and trains wouldn't be allowed to pass over the bridge if the speed of the wind will be above 90 km/h. Construction and executing agency, AFCONS are building the World's largest arch type railway bridge, Chenab Railway Bridge.

2.3 LEG -3: Qazigund-Baramulla (119 km)

The Executing Agency for Qazigund-Baramulla section was IRCON (Indian Railway Construction Company Limited) for the 119 kms (km 154 – km 273). Also, 898 hectares of land involved was acquired. The whole section falls in the Kashmir Valley, though there is no tunnel, construction of heavy bridging is vital across rivers, canals and roads. The construction work is complete and the railway track is fully operational since October 2009.

3. Socio-Economic Impact of the Project

The socio-economic development of a country stresses on its crucial role in sustaining the social, environmental and

economic values of a state. As Eco-efficiency emphasizes on ecological and economic efficiency and focuses a little on social value of a society, still there is a scope of close association between economic, ecological and social sustainability (Dyllick and Hockerts 2002; Ehrenfeld 2005; Hukkinen 2001; Welford 1997). It implies that eco-efficiency alone is not enough for sustainability leading to the association of all three vital factors namely economic, ecological and social values for socio-economic development.

The Northern Indian Railways acts as a central promoter of the economic growth but on the other side it fails to the safety and security of the environment owing to the emissions, harmful effects on ecosystems, energy consumption, etc. and the social order due to congestions. Further, health effects have adverse relation with the energy intensity of the land transport (Woodcock et al. 2007). The Northern Indian Railways need to promote a change from the current transport system to eco-friendly transport that enthalls economic, environmental and social sustainable development (OECD 2011).

The USBRL project boosts the morale of society, environment and economy of the state as:

- a) The USBRL project will provide an all-weather and consistent connectivity of the J&K State with the rest of the country. The railway network also provides connectivity by rail to far flung areas of J&K as most of the villages lacks proper connectivity through roads. A state achieves development only when the main factor connectivity is there. This gap is minimized by the objectives of Railways enriching the J&K state to contribute to the economic development of both the state and the country.
- b) The construction of Access Roads (about 235 kms of approach roads) to work sites are to be constructed. Out of which, 192.05 kms already constructed. Completion of Approach Road connecting large number of villages will provide road connectivity to thousands of people boosting the trade and commerce of the J&K state.

- c) The vital element of development, Employment generation (direct employment) to the local people (about 7000) and indirect employment to thousands for day to day requirement of the project personnel. Further, permanent job in Railways has been provided to one of the family members whose more than 75 per cent of land has been acquired.

4. Conclusion and the Way Forward

The vision of Northern Indian Railways is to provide reliable and alternative transportation system to Jammu & Kashmir despite of the young Himalayas, tectonic thrusts and faults. In 2002, the Project was declared as "Project of National Importance". The length of the Rail link is around 273 km from Udhampur to Baramulla and has been divided into three sections. The section from Udhampur to Katra is complete; the section from Katra to Qazigund is in progress and the section from Qazigund to Baramulla is complete. The two mega sub-projects Pir-Panjal Tunnel, T-80 is complete and the construction of the Chenab Railway Bridge is still in progress and is expected to be completed in 2019. The USBRL project boosts the morale of society, environment and economy of the state. The USBRL Project is progressing at par despite of the harsh difficulties. The collective efforts of the Management, Engineering and Technology teams are making USBRL project a possible reality. In future, the project will demand huge investments in terms of Infrastructure, Rolling stock, Access roads, Expansion to Ladakh division and other districts of Kashmir. But, on the other side, the contribution to the General Logistics, Military Logistics, Tourism Mobility and Socio-economic development will prove a more beneficial than a lesser loss.

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