



---

## **Conventional Tunnelling Challenges in Jammu- Srinagar stretch: A Case Study**

***Shakher Modi***

M. Tech Scholar Galaxy Global Group of Institutions, Dinarpur(Ambala)

---

### **ABSTRACT**

The existing 3745 Km long Stretch of NH-1A (Now NH-44) is between Kanyakumari and Srinagar which Connects Jammu and Srinagar. The traffic volume between Jammu and Srinagar highway was increasing day by day and thus demanded four laning. National Highway of India (NHAI) divided the existing stretch of NH-44 into six sections and invited separate bids for each. The section-I is completed and lies between Jammu and Udhampur and is already Completed. Widening of this section was completed on June 2017 by NHAI. The length of this stretch is 65 Km. the Section-II is in progress and lies between Udhampur and Ramban. The work of this section has been awarded to M/s Gammon India on Engineering, Procurement and Construction (EPC) mode. The length of this stretch is 40.07 Km. The section-III is completed and lies between Chenani and Nashri and is already Completed. Widening of this section was completed on April 2017 by NHAI. The length of this stretch is 10.89 Km. The Section-IV is in progress and lies between Ramban and Banihal. The work of this section has been awarded to M/s Hindustan Construction Company Ltd. on Engineering, Procurement and Construction (EPC) mode. The length of this stretch is 36 Km. the Section-V is in progress and lies between Banihal and Qazigund. The work of this section has been awarded to M/s Navayuga Engineering Company Limited on Build-Operate-Transfer (BOT) Annuity Mode. The length of this stretch is 15.25 Km. the Section-VI is completed and lies between Qazigund and Srinagar and is already Completed. The length of this stretch is 68 Km. Jammu Srinagar national highway is one of the northern most segment of NH-44. It is the only highway which connects the Kashmir Valley with the rest of India. The main Feature of this Highway is that it is controlled by two control rooms one is Srinagar and other one in Jammu. The connectivity of this highway starts from Pantha Chowk in Srinagar and passes through a number of districts and ends in Jammu Narwal. The beautification of this highway is that its first 68 kms lies Upto Qazigund from Kashmir valley and then passes through a series of high altitude mountains Upto Jammu, that is the reason this highway often remains closed during Harsh Winters. As this is the only way which connects Kashmir with rest of Country hence, due to increase in Traffic Demand the two lanes did not suffice timely origin-Destination Parameters. In order to overcome this, a four lane highway was the need of hour which not only reduces Journey Time but also promises smooth and efficient traffic operations. In this study a stretch from Ramban to Banihal was taken to analyse and to observe the EIA parameters regarding Socio-Economic, employment, natural habitat, land valuation and many other factors which directly or indirectly get affected due to the construction of this Highway. As per NHAI, four Laning of Ramban to Banihal (Package-II), NH-1A (new NH-44), and section from Km 151.000 to Km 187.00 is of 36.0 km. The estimated cost of the Project is Rs. 1783.42 Crore and is being done by M/s Hindustan Construction Company Ltd. As this stretch is considered to be the deadliest highway in India due to its irregular terrain and catastrophic landslides during the harsh weathers. To overcome the difficulties and challenges posed by the harsh weathers it was found convenient to construct the Tunnels for the safe and easy passage of Traffic. A survey was conducted in this stretch among the residents, travelers and road users to get the idea about the effectiveness and efficiency of tunnel Construction. The response from those respondents were tabulated in graphical form. Few respondents were optimistic regarding the Tunnel construction as it not only saves travelers from catastrophic landsliding but it proves to be efficient from the safety, smooth and efficient travel for the road users. The study of this thesis was carried out from the excavation upto the lining of Tunnel tubes. The same has been presented in the Methodology.

The main advantage of Tunnel engineering is to overcome the catastrophic accidents as Jammu-Srinagar highway is considered to be the deadliest highway in India due to its irregular terrain and catastrophic landslides during the harsh weathers. During the execution of tunnel engineering it is quite obvious to face some hazardous and massive obstacles, but for a longer run Tunnel is considered to be safe, convenient and efficient from the structural point as well as efficiency point of view. Tunnel is considered to be all weather road. It is generally designed for 100 Years.

---

### **General**

Since the development of first Tunnel boring machine that was successfully used in the early 1950's nearly 12,000 TBM's have been inducted for the construction of Tunnels which were used to serve the function for traffic, hydropower, underground storage and mining. As technologies goes on full and continuous development large varieties of TBM are available to bore tunnels of different diameters having a variable soil and ground strata be it from hard rock to soft rock and grounds in-between. Compared this method with the conventional drilling and blasting, most developed countries of the world focus remains on the core development and infrastructural growth by adopting new tools and technique in the infrastructure industries. With the advancement of over population and globalization things are changing at a very fast rate and in current scenario only the industry will keep on surviving which drives the economy of the several nations around the globe. Drilling and blasting globally help the explosive industries to grow at a

very faster rate and to enhance the explosive technology to reach the higher levels of production through better techniques. The main point of comparison between the boring machines is that now a day we have bigger and faster drilling machines and excavators but keeping the blasting technology into consideration a significant process can be achieved because the explosives which we can use in drilling and blasting should have a safer limit and an accurate initiation that could possess overall control over blasting in terms of vibration, fragmentation, throw, fly rock and overall blast economics. Packaged explosives have been found to serve the purpose of blasting in the tunnel construction industry for the purpose of blasting and fragmentation of hard rock resulting in the minimal vibration and fragmentation in the vicinity of the hard rock.

## Methodology

In this proposed study a stretch from Banihal to Ramban has been taken as an area for the case study. Various tunnels which are in construction phase were visited and the techniques, methodologies and the feasibilities related to the tunnel engineering were studied. Each tunnel was examined related to the methodology adopted and various topographical features related to the site and other constructional features. Specified Drawings from the HCC office Banihal were taken with due permission and same will be analyzed and studied in consultation with the geologist to get an idea whether the tunnel is going as per the environmental standards and as per the design aspects. Also, soil testing reports and the safety standards were taken into consideration. Various designers, engineers, workers were consulted and a detailed discussion on table was sought and pros and cons of the tunnel engineering were discussed.

## Survey

### *Q1 Do you think that construction of tunnels will reduce the Travel time in this stretch?*

In Figure 4.1, it can be seen that there was mixed response to the question. Almost half of the people were in an Opinion, that construction of tunnels will reduce the Travel time in this stretch. Also numbers of people were in an Opinion; construction of tunnels will not reduce the Travel time in this stretch. Very people didn't have any opinion regarding the same. Out of 25 people, 12 responded in favour that construction of tunnels will reduce the Travel time in this stretch. 10 people responded that construction of tunnels will not reduce the Travel time in this stretch. In terms of percentage, it can be seen that 48 per cent responded in favour that construction of tunnels will reduce the Travel time in this stretch, while 40 per cent responded that construction of tunnels will not reduce the Travel time in this stretch, and remaining 12 per cent didn't have any opinion regarding the survey.

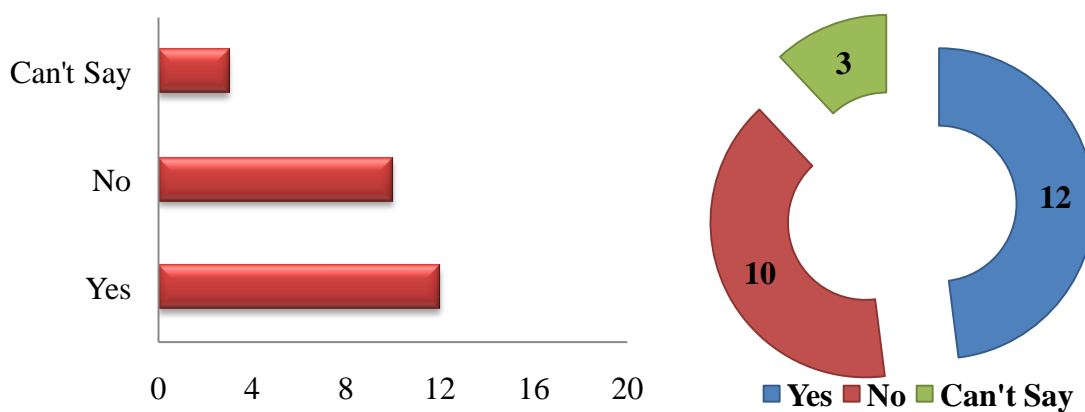


Figure 5.1 Questionnaire responses for Travel Time

### *Q2 Do you think that construction of tunnels will reduce the accidents?*

More than half of the people were in an Opinion; construction of tunnels will reduce the accidents. Also some of the people were in an Opinion, that constructions of tunnels will not reduce the accidents. Very people didn't have any opinion regarding the same. Out of 25 people, 14 responded in favour construction of tunnels will reduce the accidents. 09 people responded construction of tunnels will not reduce the accidents. In terms of percentage, it can be seen that 56 per cent responded construction of tunnels will reduce the accidents, while 36 per cent responded construction of tunnels will not reduce the accidents, and remaining 08 per cent didn't have any opinion regarding the survey.

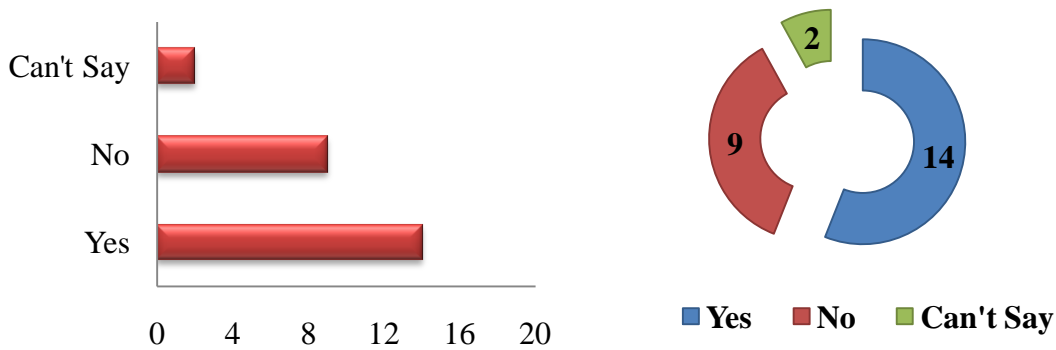


Figure 5.2 Questionnaire responses for reduction in Accidents

**Q3 Do you think that construction of Tunnel will grant greater protection in aerial warfare and bombing conditions?**

In Figure 4.4, it can be seen that construction of Tunnel will grant greater protection in aerial warfare and bombing conditions. More than half of the people were in an Opinion, that construction of Tunnel will grant greater protection in aerial warfare and bombing conditions. Also some of the people were in an Opinion; constructions of Tunnel will not grant greater protection in aerial warfare and bombing conditions. Out of 25 people, 18 responded in favour construction of Tunnel will grant greater protection in aerial warfare and bombing conditions. 05 people responded that construction of Tunnel will not grant greater protection in aerial warfare and bombing conditions. In terms of percentage, it can be seen that 72 per cent responded in favour that construction of Tunnel will grant greater protection in aerial warfare and bombing conditions, while 20 per cent responded that construction of Tunnel will not grant greater protection in aerial warfare and bombing conditions, and remaining 08 per cent didn't have any opinion regarding the survey.

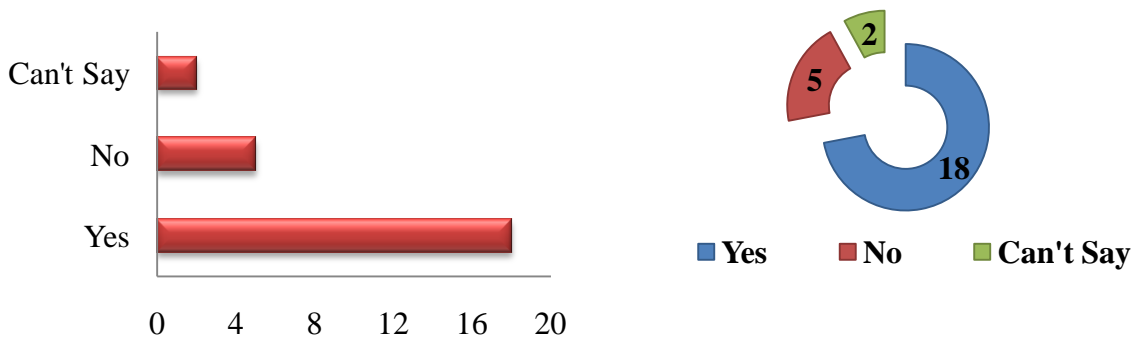


Figure 5.3 Questionnaire responses for Aerial Warfare

**Q4 Do you think that construction of Tunnel will reduce the noise Pollution?**

In Figure 4.5, it can be seen that the view of people was same. About half of the people were in an Opinion, that construction of Tunnel will reduce the noise Pollution. Also same numbers of people were in an Opinion; construction of Tunnel will not reduce the noise Pollution. Very people didn't have any opinion regarding the same. Out of 25 people, 12 responded in favour that construction of Tunnel will reduce the noise Pollution. 12 people responded that construction of Tunnel will not reduce the noise Pollution. In terms of percentage, it can be seen that 48 per cent responded in favour that construction of Tunnel will reduce the noise Pollution, while 48 per cent responded that construction of Tunnel will not reduce the noise Pollution didn't have any opinion regarding the survey.

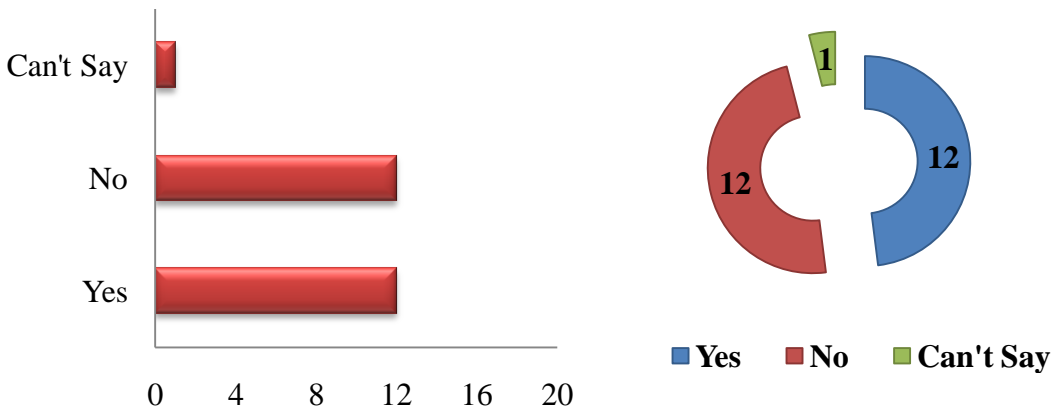


Figure 5.4 Questionnaire responses for Noise Pollution

**Q5 Do you think that construction of Tunnel will require sophisticated and specialized equipments?**

In Figure 4.6, it can be seen that majority of people were of the opinion that construction of Tunnel will require sophisticated and specialized equipments. Almost all the persons that were questioned agreed that construction of Tunnel will require sophisticated and specialized equipments. Very few people were in an Opinion that construction of Tunnel will not require sophisticated and specialized equipments. Out of 26 people, 23 responded that construction of Tunnel will require sophisticated and specialized equipments. 02 people responded that construction of Tunnel will not require sophisticated and specialized equipments. In terms of percentage, it can be seen that 88 per cent responded that construction of Tunnel will require sophisticated and specialized equipments, while 08 per cent responded that construction of Tunnel will not require sophisticated and specialized equipments, and remaining 04 per cent didn't have any opinion regarding the survey.

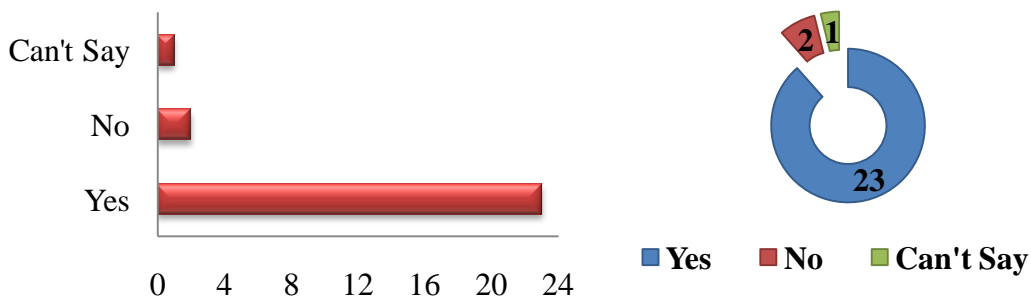


Figure 5.5 Questionnaire responses for equipments

**Q6 Is the Tunneling procedure economical in nature compared to open trench cut method?**

In Figure 4.4, it can be seen that Majority of people were of opinion that Tunnelling procedure is economical in nature compared to open trench cut method. More than half of the people were in an Opinion that Tunneling procedure is economical in nature compared to open trench cut method. Also some of the people were in an Opinion; tunnelling procedure is not economical in nature compared to open trench cut method. Out of 25 people, 18 responded in favour that tunnelling procedure is economical in nature compared to open trench cut method. 05 people responded that tunnelling procedure is not economical in nature compared to open trench cut method. In terms of percentage, it can be seen that 72 per cent responded in favour that tunnelling procedure is economical in nature compared to open trench cut method, while 20 per cent responded that tunnelling procedure is not economical in nature compared to open trench cut method, and remaining 08 per cent didn't have any opinion regarding the survey.

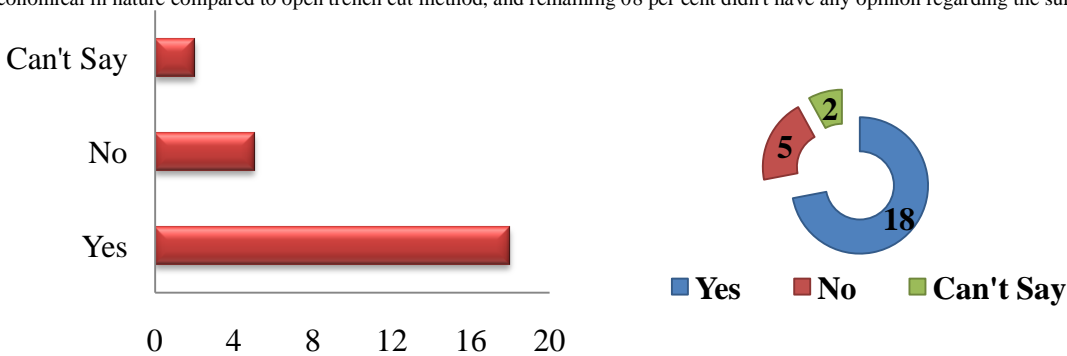


Figure 5.6 Questionnaire responses for Economy

---

## Conclusion

In this dissertation a stretch from Banihal to Ramban was analyzed. As this stretch is considered to be the deadliest highway in India due to its irregular terrain and catastrophic landslides during the harsh weathers. To overcome the difficulties and challenges posed by the harsh weathers it was found convenient to construct the Tunnels for the safe and easy passage of Traffic. A survey was conducted in this stretch among the residents, travelers and road users to get the idea about the effectiveness and efficiency of tunnel Construction. The response from those respondents were tabulated in graphical form. Few respondents were optimistic regarding the Tunnel construction as it not only saves travelers from catastrophic landsliding but it proves to be efficient from the safety, smooth and efficient travel for the road users. The study of this thesis was carried out from the excavation upto the lining of Tunnel tubes. The same has been presented in the Methodology.

The main advantage of Tunnel engineering is to overcome the catastrophic accidents as Jammu-Srinagar highway is considered to be the deadliest highway in India due to its irregular terrain and catastrophic landslides during the harsh weathers. During the execution of tunnel engineering it is quite obvious to face some hazardous and massive obstacles, but for a longer run Tunnel is considered to be safe, convenient and efficient from the structural point as well as efficiency point of view. Tunnel is considered to be all weather road. It is generally designed for 100 Years.

---

## REFERENCES

- [1] AASHTO (2017). LRFD Road Tunnel Design and Construction Guide Specifications, First Edition, American Association of State Highway and Transportation Officials, Washington.
- [2] D.C.Alostaz, Yousef (2016). "Blast Vulnerability of Underground Tunnels." Proc. Geotechnical and Structural Engineering Congress. ASCE, Reston, VA.
- [3] Bai, F., Guo, Q., Root, K., Naito, C., and Quiel, S. (2017). "Blast Vulnerability Assessment of Road Tunnels With Reinforced Concrete Liners" Proc. TRB 2018 Annual Meeting.
- [4] Choi, Sunghoon (2009). "Tunnel Stability under Explosion." PB 2003 William Barclay Parsons Fellowship, Monograph 19.
- [5] Colombo, M., Martinelli, P., Prisco, M. (2016). "On the blast resistance of high performance tunnel segments." Material and Structures, Vol. 49, 117-131.
- [6] Feldgun, V. R., Karinski, Y. S., Yankelevsky, D. Z. (2014). "The effect of an explosion in a tunnel on a neighboring buried structure." Tunnelling and Underground Space Technology, Vol.44, 42-55.