

# Analysis of Critical Risk Parameters of Highway Projects under Public Private Partnership

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## ABSTRACT

*There is no standard method of Public Private Partnership (PPP) implementation as each country adapts the process as appropriate for its own culture, economy, political climate and legal system. This study deals with analyzing the critical risk factors in highway projects done under PPP and suggesting measures to overcome such risk for improvements in urbanization. Successful PPP projects like the Golden Quadrilateral project were studied. Traffic survey has been done at two places (Paranur, Nalur) to find out the traffic risks and from that the revenue collected is calculated based on toll rates. From expert judgement the probability of occurrence of various risk events in different phases of project were identified and the critical factors were outlined. The risk intensity is considered based on which impact of risk is calculated at various phases of the project. It is found out that in the pre operative phase, financial risk acts as a key impact of about 52%. This financial risk has greater impact in operation phase but not as significant as in pre operative phase. The critical success factors include economic viability, appropriate risk allocation via reliable contractual arrangements, sound financial package, reliable concessionaire consortium with strong technical strength, favorable investment environment.*

**Keywords:** Risk factors –highway –Golden quadrilateral –risk probability- success factors.

### **Aim of the study:**

This study aims at identifying and analyzing the various risks involved in highway projects which comes under the category of Public Private Partnership.

### **Scope of the study:**

This study is concentrated on identifying the critical risks involved in Highway projects under Public Private Partnership in India. The scope of the project is limited to the study of risk sharing and analysis under BOT projects.

***Review of literature:***

The effect of debt service options on the cash flow situation and the intricacies of debt service relationships is necessary for completing the project successfully. The inferences derived are likely to be valuable to prospective concessionaires in preparing for successful negotiations for financial closure. The debt: equity ratio should preferably be around 70:30, and definitely below 80:20 to avoid cash flow (liquidity) problems in the early part of the operation period (Malini 2007).

Mahalingam (2010) used a set of secondary data sources, a set of five case studies of urban PPP projects experiencing varying degrees of success were documented and data and insights that arose from a roundtable discussion on India's PPP infrastructure barriers at the state and urban levels which was attended by 40 senior Indian and international representatives from the government of India, leading academic institutions, consulting firms, financiers, project sponsors, and infrastructure construction companies. Strategies which provide a partial, actionable list of interventions that governments can use to overcome barriers to PPPs were proposed and mentioned that successful project structuring and risk mitigation are necessary but not sufficient conditions for PPP success.

Performance management and measurement, in which Key Performance Indicators are the core elements, viewed as effective methods to help PPPs deliver value for money. These KPIs can be used to identify strengths and weaknesses of PPP projects and improve effective performance management and measurement in PPPs (Yuan *et al.* 2012).

BOT has been one of the recent innovations in project finance. The Build-Operate-Transfer (BOT) scheme is a limited recourse financing technique.. It examines the type of capital and debt in project financing. Due to lack of fund availability, government had taken decision to implement many projects through BOT. The risk of financing in operation period due to fluctuation in prime lending rate plays a major role in PPP projects ( Rinaj Pathan & S. S. Pimplikar 2013).

***Risk allocation:***

- When the risk allocation is considered, only the risk of delay in land acquisition, external linkages, change in law and concessionaire risk are taken care by the public sector.
- Rest of the major risk like financing risk, planning, approval, payment risk and handover risk are taken care by private sector only.
- The risk due to force majeure causes is shared between the public and private sectors.

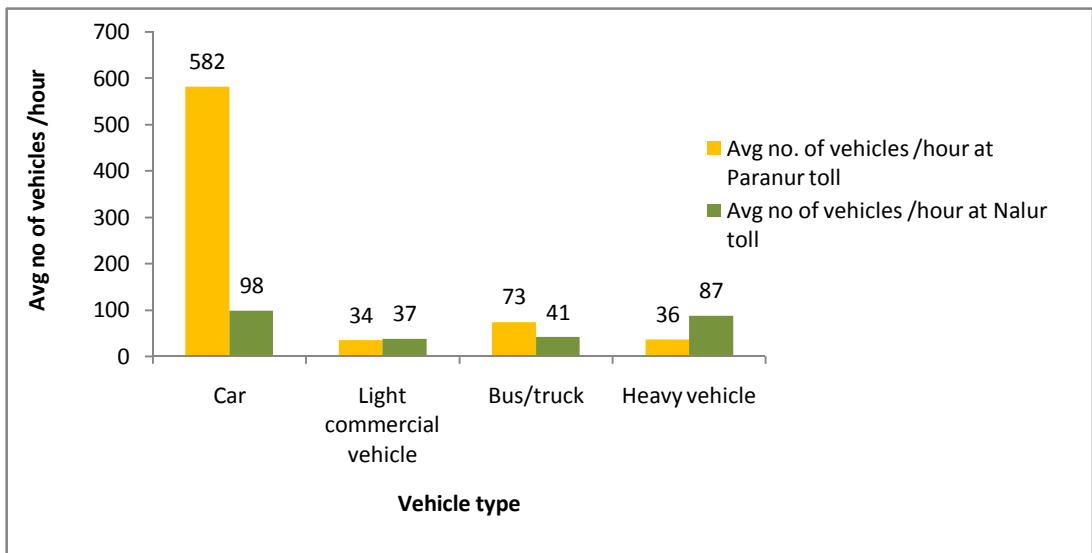
***Risk analysis:***

- Risk analysis has been done by expert judgement from three experts.

- The most critical risk have been identified from previous NHAI projects and the experts were asked to give their opinion on the probability of occurrence of such risk and also on the intensity of such risk.
- The identified critical risk are grouped into various stages of project as pre operative risk, construction phase risk, operation phase risk, handover phase risk and the other risks.
- Intensity of risk was based on optimistic, most likely and pessimistic time.
- Then the total impact of each risk was identified by multiplying the probability of occurrence of such risks with its intensity value.

**Traffic And Revenue Risk :**

- To find the traffic and revenue risk, traffic survey has been taken at Paranur toll (BOT toll and Nalur toll (BOT annuity) for twelve hours on two representative days (weekday and weekend). The survey was taken based on the assumption that all vehicles passing through the toll are getting ticket for single trip. The inference drawn from the survey are as follows:
- When Paranur toll is considered, the number of cars observed was very large when compared to other types of vehicles.



**Figure- Vehicle type versus average number of vehicles per hour**

From the following traffic data, we can conclude that the total number of cars observed in paranur toll was more when compared with other types of vehicles. 15% of the total revenue is deducted for the assumption of multiple trip and monthly pass vehicle.

But, on the contrary in Nalur toll the no of heavy vehicles were more when compared with that of Paranur.

## 5. REVENUE CALCULATION

From the toll rates it is calculated that annual collection from Paranur toll is Rs.51, 65, 03, 520 but the as per the forecast based on details obtained from NHAI, the revenue collection is Rs.31, 64, 85, 782. Therefore more risk have to be encountered in BOT annuity projects .But multiplying the forecasted revenue with a *factor of 1.6* the actual revenue collected in BOT annuity projects can be calculated. It is also observed that the growth in vehicular movement is increasing tremendously day by day.

When calculating the revenue for BOT toll project (Chennai-Tada Highway at Nalur) it was observed that the *total annual revenue and the forecasted revenue was almost the same* accounting around Rupees 49 crores.

## 6. DETAILS ON GOLDEN QUADRILATERAL PROJECT

Golden quadrilateral is a network of highways connecting the four metropolitan cities of India-Delhi, Mumbai, Chennai and Kolkata. This project was launched as a part of National Highway Development Programme (NHDP).The overall length of the quadrilateral was 5, 846km. The cost of the project was estimated around Rs.60, 000/- crore but was completed at a cost of Rs.30, 800/-crore. The roads were open to operation in January 2012.

This project has four sections. The first section is 1454 km stretch of National Highway 2 from Delhi to Kolkata. It runs through Delhi, Haryana, Uttar Pradesh, Bihar, Jharkhand and West Bengal.Section two is 1, 684 km from Kolkata to Chennai. It consists of NH6 (Kolkata toKharagpur), NH 60 (Kharagpur to Balasore) and NH 5 (Balasore to Chennai). Section III is a 1, 290km stretch from Chennai to Mumbai. It constitutes parts of NH4 (Mumbai to Bangalore), NH7 (Bangalore to Krishnagiri, Tamil Nadu) and NH46 (Krishnagiri to nearby Chennai). It passes through Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu.Section IV is a 1, 419km stretch between Mumbai and Chennai. It constitutes parts of NH 8 (Delhi to Kishangarh), NH 79A (Ajmer bypass), NH 79 (Nasirabad to Chittaurgarh) and NH 76 (Chittaurgarh to Udaipur). It passes through the states of Maharashtra, Gujarat, Rajasthan, Haryana and New Delhi.

Major contractors involved in the project are Larsen & Toubro, LG Engg. & Construction, Nagarjuna Construction, Consortium of GVK International and BSCPL, IRCON International, Punj Lloyd, Progressive Construction, ECSB-JSRC, B. Seenaiiah & Co., Madhucon Projects, Sadbhav Engg., KMC Construction, Gujarat Public Works Department, SKEC - Dodsai, MSRDC, Mumbai, Skanska Cementation India, Hindustan Construction Company, RBM - PATI, Unitech, CIDBI Malaysia and PATI - BEL.

The financing for the project is obtained from the taxes on petrol and diesel, which accounts to Rs.20, 000/- crore, Rs.20, 000/- crore through external assistance, Rs.10, 000/- crore from market borrowings and Rs.4, 000/- crore from private sector participation.



Route of Golden Quadrilateral

### *Risk impact calculation*

From the expert judgement, the probability of risks and intensity of risk is found out. By multiplying these values we get the intensity of risk events.

**Table- impact of risk**

<i>Risk category</i>	<i>Risk event</i>	<i>Likely occurrence</i>	<i>Intensity</i>	<i>Impact of risk = likely occurrence * intensity</i>
Pre operative risk	Delays in Land Acquisition	0.49	19.5	9.5
	External Linkages	0.43	29.56	12.71
	Financing Risks	0.67	34.95	23.41
	Planning	0.54	14.44	7.8
Construction phase risk.	Design Risk	0.56	20.28	11.36
	Construction Risk	0.59	28.67	16.91
	Approvals	0.42	26.83	11.27
Operation phase risk	Operations & Maintenance Risk	0.42	14.06	5.91
	Volume Risk	0.58	20.72	12.01
	Payment Risk	0.74	23.61	17.47
	Financial Risk	0.69	25.44	17.55
Hand over phase risk	Handover Risk	0.47	15.11	7.1
	Terminal Value Risk	0.49	23.72	11.62
Other risks	Change in Law	0.41	11.17	4.58
	Force Majeure	0.47	11.61	5.45
	Concessionaire Risk	0.43	14.94	6.42
	Sponsor Risk	0.5	16.17	8.08

## 7. CONCLUSION

- The traffic and revenue risk has been calculated by taking traffic survey at two places (Paranur and Nalur ) and comparing these data with those obtained from NHAI.

- It has been found out that more risk have to be encountered in BOT annuity projects .By multiplying the forecasted revenue with a factor of 1.6 the actual revenue collected in BOT annuity projects can be calculated. It is also observed that the growth in vehicular movement is increasing tremendously day by day.
- When calculating the revenue for BOT toll project (Chennai-Tada Highway at Nalur) it was observed that the total annual revenue and the forecasted revenue was almost the same accounting around Rupees 49 crores.
- Based on the expert judgement the total impact of the risk is distributed among the various phases of the project as below:
  - Pre operative risk =53.42
  - Construction phase risk =39.54
  - Operation phase risk =52.94
  - Handover phase risk =18.72
  - Other risks =24.53.
- The success factors are
  - Economic viability
  - Appropriate risk allocation via reliable contractual arrangements
  - Sound financial package
  - Reliable concessionaire consortium with strong technical strength
  - Favourable investment environment.

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