Performance Analysis of National Highway Public Private Partnerships (PPPS) in India

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PERFORMANCE ANALYSIS OF NATIONAL HIGHWAY
PUBLIC PRIVATE PARTNERSHIPS (PPPS) IN INDIA

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Abstract

PPP has now become the preferred mode for execution of Infrastructure projects PPPs due to its record of providing value for money by ensuring cost effective and improved quality of services without time overrun. The paper makes an attempt to assess the performance of four National Highway (NH) PPP projects in the State of Karnataka. The framework for evaluation of the projects under review includes, time overrun analysis, risk responsibility matrix, and estimation of both quantitative and qualitative accrual of value for money (VfM); i.e. the financial savings to the government and road users. The study finds that in three out of four projects under review, the positive VfM to government (financial savings) is the tune of Rs. one thousand and forty crore. VfM has also been observed to be positive to the road users in terms of average reduction in travel time, saving of fuel, constancy in reaching the destination on time, etc. Further the paper finds that average time overrun in PPPs is less as compared to non-PPP projects. The paper also provides suggestions to tone up the PPP policy of India.

Key words: Infrastructure, Public Private Partnerships (PPPs), National highways (NHs), Value for Money (VfM), Time overrun

Introduction

Economic development involves the optimal use of resources for maximizing social welfare for which not only savings, investment and capital formation but also adequate infrastructure creation and maintenance are necessary. A study by Rao (1980) points out that "The link between infrastructure and economic development is not a once and for all affair. It is a continuous process; and progress in development has to be preceded, accompanied, and followed by progress in infrastructure, if we are to fulfil our declared objectives of generating a self-accelerating process of economic development" (p.10).

Demand for the various infra services is escalating on such a scale and manner that public sector alone is seldom able to meet. Government's pro-reform policies to attract private sector investment for the creation of sound infra base in the country is therefore timely and momentous. Private sector investment in the provision of infra services through private partnerships (PPPs) is expected to reach 45- 48 percent of total infra investment of one trillion US $[1] in the current five year plan. According to GOI data, there were 600 projects with a Total Project Cost (TPC) of Rs. 3, 33,083 crore (ibid) in March 2010. The increase in investment was by about 61.33 per cent points in 2012. The total number of PPPs in 2012 was 900[2] plus, the TPC of PPP projects in the infrastructure sector being Rs. 5, 43,045 crore[2.] In that, 55-60 percent, i.e. about 900 PPP projects are in the transportation sector, of which National highways (NH) accounts for the highest share.

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This Paper is the part of broader doctoral research work

[1] GOI, 2013

[2] This includes various central and states infrastructure PPP projects in different phases (operation, construction and pipeline). Economic Survey, Ministry of finance, page250 and 251, 2012-13.

National Highways Authority of India (NHAI) has the grand vision of creating world class highways network across the country in order to achieve the multiple goals of reducing cost of fuel consumption and vehicle operation & maintenance, elimination of accidents, and ensuring faster movement of goods and passengers with least traffic congestion. Creation of such world-class highways network will ensure value for money to both the government and the users.

To empirically verify the above claims, the present paper attempts to analyse the performance of the four NH PPP projects which are in the operation phase. The rest of the paper is organized as follows: Section one analyzes the performance of PPPs with respect to time overrun, section two contains the risk matrix analysis section three estimates VfM and section and four lists out the insights gained by the study and suggestions for course corrections for streamlining future PPP frameworks.

Scope and Methodology

Private sector investment in infrastructure is considered as an important alternative to the traditional method of public investment in this sector on two counts: First, its ability to ensure efficient provision of quality infrastructure services, and secondly the creation of value for money to the governments and general public. These claims need to be empirically verified.

The present study has endeavoured to verify in the above claimed grounds of PPPs in all the four operating PPP projects (refer exhibit 01 in the annex) in the NH category falling under the Bangalore zone Project Implementation Unit (PIU). Required data was obtained from various sources: firstly, the detailed project reports & operation and maintenance reports were obtained from the respective projects; secondly data was directly collected through interviews with NH Project implementation units' officers and discussions with respective project concessionaire team. Lastly personal interviews were held for the road users' to ascertain the true benefits of the project and to assess O&M quality. Descriptive statistical tools, sensitivity analysis and present value of discounting methods were also used to estimate performance of select projects.

Results and Discussion

Time Overrun in NHs in India

An important factor that has encouraged governments across the globe to relay to PPPs as an alternative strategy is its innate potential to minimise time overruns.

In traditional/ Engineering Procurement Contracts (EPC) responsibility for time overrun of the projects rests with the government authority. In fact, time overruns yields higher revenue to private contractor (through escalated cost) as the increased costs caused by cost overruns are completely borne by the government. On the contrast, in PPP projects, time overrun risk is shared by both government and private concessionaire, based on the concession agreement. Hence, the additional financial burden of the project arising out of time overrun will be less to the government. In fact, private concessionaires in PPP project are motivated to complete project construction at the earliest because financial returns will start only after completion of the project.

General Reasons for Time Overrun

Traditionally, projects implemented by the government gets unduly delayed in construction period for several reasons. The time-overrun in public sector projects ranged between 70 per cent in 1986 and 40 per cent in 1998[3]. Vital causes for the time overrun are listed below:

1) Land acquisition issues: Time overrun of the infra projects is normally attributed to delays in acquiring private land for the purpose. Many a time, court cases, compensation issues and resettlement issues delay the construction period. Presently this is one of the major causes for delay in infra projects, irrespective of type of contract.

2) Government approvals: Infrastructure projects need to obtain much government approvals/clearness such as environmental, forestry, wild life, railway and other clearances. Obtaining such clearances constitute another major reason for the delay in project execution and time overrun.

3) Financial issues: Historically, more than 70 percent of the projects have suffered time overrun due to limited financial resources with the government. Presently this factor is not so significant due to private funding of PPPs in the infra sector. However one cannot ignore this factor totally because even some PPP projects also are now facing this problem due to lack of adequate bank funding.

4) Other issues: accessibility to raw materials and equipment's, followed by deficits in technical, managerial and professional expertise of the contractor.

Delay in the construction of the project can result in escalation of project cost as a direct impact, and indirectly it may adversely impact the growth of the economy due to inadequate infrastructure services. Mott Macdonald (2002) and National Audit office (2003) observe that 76 percent of PPPs delivered services on time compared to 30 percent in traditional projects. Further 78 percent of the PPP projects were on budget compared to 27 percent of traditional arrangements (cited by Hodge, 2010).

The magnitude of time overrun in India's NH projects can be observed from the NH database of 202 projects (refer exhibit 02 in annex). The average time overrun of non PPP 69 NH road projects was 22 months, which is over and above 7 months of the average time overrun of PPPs. In the 133 PPP BOT (annuity/toll) road projects, it is observed that 13 projects were completed on time and the remaining 120 projects were delayed by an average 15.5[4] months over the stipulated time for construction.

In the four selected cases, the average time overrun was less than the national average of 15 months i.e. 13 and 9 months respectively for projects 1 and 4, whereas for the other i.e. 2 & 3, time overrun was more than the national average. From the analysis of NHs 202 projects, one can infer the role of type of the contract (PPP/non PPP) in determining construction time overrun of the road projects.

These results reveal that although the average time overrun is less in the case of PPPs, time overrun still remains a major concern in the infrastructure irrespective of PPP or the traditional public

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[3] Morris (2003)

[4] Based on the PPP BOT roads data ; NHAI (2013) , Average time delay in construction is estimated by the author

funding. In the context of the PPP policy which is still evolving in Indian context, there is need for a careful review of the policy to rectify these problems.

Resolving Time Overrun and Some Policy Measures

In order to get the maximum advantage of the PPP in the infrastructure sector, it is very essential to resolve the time overrun problem on a priority basis. Conversations with the stakeholders in the PPP field such as PIU NHAI officers, Independent Consultants (IC) & concessionaire representatives of the respective projects under review have helped us in developing the following policy measures to eliminate time overruns in NHs construction period.

1) Bringing in more transparency in negotiations regarding- acquisition related issues.
2) Ensure speedy clearances through single window approach.
3) Adoption of innovative design and use of globally available modern technology on larger scale. For example, use of pre-fabricated structures to construct bridges, which can bring down delay in construction significantly.
4) Bringing global expertise as also big players into the infra projects through appropriate policy measures.
5) Provision of financial assurances to banks and other financial institutions by the government to solve the fund related problems of concessionaires.

Risk Analysis

In typical PPPs, the complete responsibility shared by the stakeholders i.e. the government and the private sector according with their strengths. This risk responsibility sharing feature results in the creation of surplus value/ augmenting more benefits or VfM to the government. Certain benefits accrue to the government in PPP projects because of the synergy between public and private sectors in sharing costs and as well as project risks. Teisman, E.H. (2005) argues that the Synergy from private and public sector participation in any project generates positive externalities. Optimum risk sharing is one of the merits of cooperation between public and private sectors. This can be captured in a metaphorical formula 1(public) + 1(Private)>2.

Countries like UK, South Africa and Australia view PPPs as an alternative form of public procurement due to its efficient service delivery mechanism rather than mere substitution of private investment for the government capital expenditure. Further it is argued that efficient service delivery is achieved through substantial transfer of the project risks to the private sector. According to Hodge (2010), risk transfers mainly resulted in lowering the cost of the project to the tune of 10 to 20 percent in PPPs as compared to traditional procurement. Further he cites "Australian analysis reporting perspective business cases and the industry funded Allen consulting group (2007) study, reported PPPs are cheaper by 11 percent compared to traditional projects"(p.103).

Optimum risk sharing mechanism in PPP will result in reduction in the total cost of the project and improvement in quality with respect to design, construction, financial management, etc. The key risk factors of the PPP projects under review are analysed in the following paragraphs.

In the four NHs road PPP projects under review, the project life cycle risk is being completely shared between the public and private sectors based on optimum risk managing skills. Construction, financing, operation and maintenance risks are handled by the private sector in all the projects, whereas the public sector handles land acquisition, utility shifting and obtaining all required clearances from the Ministries/departments of environment, forestry, wild life, railway, etc. In one of the projects (fourth project) the risk of traffic/ revenue is cushioned by the government while in other three projects the concessionaires take the responsibility. (Refer exhibit 03 from the annex)

Value for Money (VfM) Estimation:

It is very essential that governments that are venturing into PPP make sure that appropriate cost-benefit advantage methodologies are available and made use of. One of the methodological tools, i.e. VfM analysis enables the governments to see in advance whether PPP method of infra service provision can create any positive/ additional benefits both in terms of quantitative (financial & non-financial) or not.

Morallos and AMedkudzi (2008) argue that VfM estimation test helps guide the concerned governments to opt either the PPP or the traditional mode of contract (Public sector comparator). Countries/entities intending to adopt PPP as a method to provide infra services generally estimate VfM for the respective project during pre-feasibility studies. Arthur Andersen and Enterprise LSE (2000) identified the factors which drive the VfM through an empirical survey among government agency officers and academic professionals. Factors like optimum risk transfer, private sector's managerial and technical expertise, prevailing competition situation, performance measurement, specified output based contract factors, life time contract structure, and performance measurement and incentives are the most significant factors that drive the VfM.

Morallos and AMedkudzi (2008) in their paper reinforce the findings of Fitzerald's (2004) that the VfM is derived from factors like risk transfer, innovation, optimum asset utilization, and integrated whole life management.

The available literature of VfM estimation acknowledges that there is no unique method to estimate it, and also cautions about the difficulties in estimation. Normally VfM estimation is conducted by comparing the PPP method with a hypothetical situation of the same project with an accepted comparator (traditional mode of procurement). This method has been criticized in the literature on the grounds that hypothetical and real situations cannot be meaningfully compared. Despite such inadequacies of the methodology, the estimation provides insights into the advantages of PPP mode and ensures people VfM.

The present study uses both quantitative and qualitative methods to estimate VfM for the select four projects. For estimation of quantitative VfM, the base methodology of Pratap (2011) is employed by improving his formula and relaxing the assumptions of average toll revenue etc. by taking real time data through PIUs of NHAI. This paper employs qualitative VfM in addition to the quantitative VfM. This is explained in the following paragraph.

Quantitative Value for Money (VfM) to Government

VfM to the government refers to financial savings to the government due to implementation of the project through PPP mode.

To estimate quantitative VfM accruing to the government, the present study uses the following methodology.

1) VfM is estimated by considering construction cost and operation & maintenance costs incurred by the concessionaire.

2) Operation and maintenance cost of the project is estimated by assuming a cost of Rupees 10 lakh[5] per kilo meter per year.

3) For the toll projects, the paper considers only the toll revenue as the return.

4) In case the project is financed by government through positive Viability Gap Fund[6] (VGF), we deduct it from the total toll revenue. If the project is enjoying negative VGF, then we add that sum as additional revenue to the government.

5) Due-time differences in the construction, operation and maintenance costs and revenue to the project i.e. either toll or annuity, we estimate present value for all costs and revenues.

6) Standard discount rate at 15 percent[7] is used to estimate present value of cost/revenue.

Formulas Used to Estimate VfM to Government

General method

VFM = Present value (PV) of cost (construction cost + operation and maintenance cost) minus present value of expected toll revenue/ annuity.

1) Positive VGF PPP projects: In addition to the general method used for positive VGF projects, we deduct the amount of VGF grant given by the government to the concessionaire. Project 3, under review fits into this category.

2) Negative VGF PPP projects: In addition to the general method used for negative VGF projects, we add the amount of VGF premium given by the concessionaire to the government. Project 1 & 2 under review are negative VGF projects.

3) PPP annuity projects: Project four is an annuity project in which the concessionaire has incurred the cost of construction, operation & maintenance. Concessionaire gets revenue as annuity from NHAI (GOI). NHAI raises revenue through rising toll revenue. Project 4 under review fits into this category.

   3. A. Annuity project (without toll collection by government or government pays annuity through NHAI resources)

   VFM to government = PV of cost (estimated construction cost + O&M cost) – PV of annuity payments

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[5] Financing of National Highway Development Programme (NHDP), Planning Commission, GoI, p.23, www.infrastructure.gov.in.

[6] VGF: Viability gap funding is the capital grant . Positive VGF refers to capital grant given by the government to make the project financially viable. Negative VGF refers to payment of premium by the private concessionaire to the NHAI over the entire concession period, which normally starts from the commercial operation period.

[7] Financing of National Highway Development Programme, Planning Commission, page 24, GoI (2006).

3. B. Annuity project (NHAI rises revenue through toll)

VFM to government = PV of estimated toll revenue – PV of annuity payments to the concessionaire

The following (Table1) explains the VfM to government in the four projects under review:

Table 1: Value for Money

Name of the project	VFM (in Rupee crore)
1. **Bangalore Nelmangala stretch of NH 4**	178.93
2. **Bangalore Electronic city – Hosur section of NH 7**	-2.18
3. **Nelmangala Devihalli section of NH 48**	72.01
4. **AP border to Avathi village stretch of NH 7**	20.28* 788.75**

Note: * Method of section 3.A; ** Method of section 3.B

Source: author's compilation

VfM to the government is positive in three out of the four projects. This proves empirically that the PPP mode of service provision has resulted in financial savings to the government to the tune of Rs. 178.93, -2.18, 72.01 and 788.75 crore respectively in the projects 1, 2, 3 and 4.

Limitation of the methodology: VfM is sensitive to the discount rate; if we increase the discount rate, VfM to government increases and vice-versa. In the present study, the applied discount rate is 15 percent as per the NHAI guild lines.

Further, due to lack of actual toll revenue data for the entire concession period, we assumed that the present actual toll revenue would remain constant for the entire concession period.

Implication:

One of the important findings from the study of project four is that government gets more VfM if it takes the responsibility of toll revenue management and assures revenue through annuity to the concessionaire.

Qualitative VfM to Road Users

The ultimate beneficiary quality infrastructure is the users. Hence, the present paper has made an attempt to qualitatively assess the VfM for the road users by using the primary survey to corroborate the results obtained through quantitative methods.

Performance analysis: To analyse the performance of the relevant road project, the following indicators were used:

Qualitative assessment of VfM in the present study takes into account construction and O&M standards, quality of service delivery over the entire concession period, certainty/consistency in

reaching destination, savings in journey time, fuel efficiency, reduction in the vehicle O&M costs, reduction in accidents, road safety, etc.

Methodology for qualitative VfM: The following analysis is based on the information obtained from interviews with 50 road users for each of the projects under review i.e. a total of 200 from four projects) plus policy implementation officers and concessionaire representatives. However, this paper presents the results of the first three projects under review. The road users were selected randomly from the sample of regular travellers in the respective projects; who had travelled in both in present and old stretches. They typically represented two wheeler, own car and private taxi drivers, private and public bus and truck drivers.

Construction, Operation and Maintenance Quality Assessment

For measuring the quality aspects of construction and O&M, GOI's guidelines for monitoring road PPPs are used as benchmark. Quality assurance of the project is based on the following key performance indicators (refer exhibit 04 and 05 in the annex). The required information on the following indicators for the relevant project was obtained during the interviews with representatives of concessionaire, project implementation unit. To maintain the average speed of the vehicle and good road grip, road roughness indicator is being considered (as per the Indian Road Congress (IRC) guidelines). In all the projects under review, the road roughness index (2200 MM per Kilo Meter) has been strictly followed by the concessionaires except in project 3 (2500 MM per KM). Concessionaires adhere to specified NHAI guidelines with respect to various road furniture's installation and maintenance (further details refer exhibit 4 in the annex).

Projects Quality Appraisal from the Road Users

To assess the projects under review over the construction and O&M period, quality road users' survey[8] was conducted with respect to seven performance assessment indicators which include travel time, fuel efficiency, time consistency in reaching the destination, road safety, cost of vehicle operation and maintenance, average speed per hour, and potholes.

It is found that in all the three roads under review, travel time has reduced by 30 to 40 percent. Average fuel efficiency has increased by 30 percent. Consistency in reaching the destination and road safety has improved to a considerable extent. Further all the roads are well maintained and made pothole free. And last but not least, vehicle O&M costs are found to have declined substantially (refer exhibit 5 from the annexure).

Observation method: In order to verify the responses of Independent Consultants & road users, the author conducted an observation study by practically riding a vehicle on all the project roads under review (except project 4) and found that responses obtained in interviews with users and independent consultants were in conformity with the results obtained through the practical observation.

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[8] only for the first three projects

Positive externalities: improved transport facilities both in terms of quality and quantity, reduction in transaction cost, increased commercial activities, improvement in job opportunities, urbanization, increase in the price of land both in commercial and residential exploitation are some of the vital positive externalities observed in the field by the scholar. These benefits have accrued in almost all the four projects under review. However, the level of benefits may be not uniform in all the projects, and they are more visible in the areas/ villages adjacent to the project as compared to the other distant areas.

Conclusions

The present paper has made an attempt to examine whether PPPs are a good alternative to the traditional methods of infrastructure provisioning. The following conclusions emerge from the analysis.

The analysis reveals that governments tend to gain from the PPPs as the project risks get shared between the government and the private sector.

VfM analysis results have revealed that quantitative VfM to government is positive in three projects under review; i.e. the government saved money by executing the respective road projects through PPP.

Presence of qualitative VfM is empirically tested through road user survey by considering indicators such as substantive reduction in travel time, improved fuel efficiency, consistency in reaching the destination and reduction vehicle o & m cost. Construction of better quality roads followed by regular operation and maintenance of the same with respect to average road roughness, guaranteeing zero pothole, installation of road barricaders and all other road furniture and proper maintenance by the concessionaire, etc. are regularly monitored by an independent consultant as required in the PPP contract. These tend to enhance the quality of road infrastructure.

Policy suggestions

Notwithstanding the advantages currently observed, there is need to strengthen the PPP policy to tap the inherent PPP advantages further. Following are some policy suggestions that have emerged from the empirical study.

The study observes that there is unwillingness on the part of the concessionaire to spend adequate amounts on the O&M. In order to improve the quality of maintenance further, there is a need to create a separate fund for road maintenance through regular transfer of certain percentage of toll revenue to a corpus by the concessionaire. This should be maintained through a separate bank account and regularly supervised by NHAI. This will ensure the regular maintenance of road with specified quality, as currently this is not happening in several of the projects due to unwillingness of the concessionaire to spend on O&M adequately.

Data constraints: A systematic performance analysis of PPP projects is currently difficult due to lack of systematic data. Such analysis requires data on actual construction cost, debt-equity ratio, cost of borrowing, number of Request for Qualifications (RFQs) and Request for Proposals (RFPs) is the major

constraint in the performance analysis of the PPP projects. Measures should be taken by the PPP cell to collect and maintain all such data.

It is also observed from the field that 'O&M' reports of NHs PPP projects under review were not uniform across the four projects. In addition exhaustive information on all issues related to O&M as also data on realized toll revenue and estimated toll revenue, debt-equity ratio of the projects, costs on O&M regular and periodic up gradation costs was also not available. It is important to have data on a real time basis by regular updating of computerized time series data with respect to all the major variables, as it will help to assess the true merits of PPPs. It is therefore suggested that government should strengthen the database of all the PPPs with regular online updates, and made available to researchers and even general public.

Use of innovative methods for further reduction in construction time: Use of pre-fabricated structures for building bridges will result in further reduction in construction time.

Traffic congestion at toll plazas: Average maximum waiting/collection time as per concession agreement is 30 seconds. However, the actual time taken is often much longer, depending on traffic density. In project 1, the vehicles need to stop at toll plaza on an average 10-15 minutes during weekends, and 3-4 minutes on other days. Hence, it is recommended to install smart technologies like use of sensor based automatic reading of vehicle and deduction of toll/user fee from the respective user prepaid top-up card/bank accounts, as is practised at the global level, to reduce such jams. NHAI has recently employed electronic tolling in the select toll projects on a pilot basis to address this issue. This needs to be universalised immediately to address congestion and other related issues.

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Annexure

Exhibit 01: Profile of the PPP NH Projects

Name of the Project	Type of the PPP model used	Private Developers concessionaires	Total project cost (in Rs crore)	Concession period (years)	VGF (in Rs crore)	Average toll revenue per year Actual (2012-13) (in Rs crore)
Bangalore Nelmangala stretch of NH 4	BOT (Toll)	Navayuga Bengaluru Toll way Private Limited	445	20	20 (Negative) (4.5)	46.99
Bangalore Electronic city – Hosur section of NH 7	BOT (Toll)	Bangalore Elevated Toll ways Private Limited	450	20	16 (Negative) (3.6)	87.72
Nelmangala Devihalli section of NH 48	BOT (Toll)	Lanco Devihalli Highways limited	441	25	175.92 (positive) (39.89)	37.08
AP border to Avathi village stretch of NH 7	BOT (Annuity) 32.94 crore	Patel-KNR Infrastructure Private Limited	402.87	20	-	247.96

Note: 1) concession period includes both construction and operation and maintenance (O&M) period. 2) Annuity

refers to the semi-annual payment by government to the concessionaire.

3) Positive VGF refers to capital grant paid by government to concessionaire.

4) Negative VGF refers to premium paid by concessionaire to the government.

5) Figures in parenthesis are % to TPC

Sources: Bangalore Project Implementation Unit, NHAI

Exhibit 02: Time Overrun of National Highways

Projects	Time overrun (in months)
National average time overrun of Non PPP (EPC) NH projects in India (69 projects average)	**22**
National average time overrun of PPP NH projects in India (133 PPP projects average)	**15**
Time overrun of PPP NHs selected cases in Karnataka	
1. Bangalore Nelmangala stretch of NH 4	13
2. Bangalore Electronic city – Hosur section of NH 7	20
3. Nelmangala Devihalli section of NH 48	24
4. AP border to Avathi village stretch of NH 7	9

Source: compiled and estimated using data from the author from NHAI website & RTI response from

PIU, NHAI, Bangalore

Exhibit 03: Risk Matrix of NH PPP Road Projects

Types of Project Risks	Public Sector	Private Sector
Pre-construction risks 1) Land acquisition risk, 2) shifting of public utilities 3) Clearances: cost estimate, techno economic, pollution (water & air), forest clearances, environmental clearances, company registration, Rehabilitation & Resettlement of Displaced families.	Government ./ NHAI	
Project 1	XXX	
Project 2	XXX	
Project 3	XXX	
Project 4	XXX	
4) Construction risk 5) Financial risk 6) Operation and maintenance risk		concessionaire
Project 1		XXX
Project 2		XXX
Project 3		XXX
Project 4		XXX
7) Traffic/revenue risk		
Project 1		XXX
Project 2		XXX
Project 3		XXX
Project 4	XXX (toll operation)	

Sources: compiled from O& M reports of the projects and discussions from officers of PIU, NHAI, concessionaries and PPP INDIA Database website.

Exhibit 04: Construction, O&M Quality Assessment of the Select Cases

Indicators	Specified guidelines	Observations from O &M reports & discussions with Independent consultants
1) The average road roughness	2200 MM Per KM*	
Project 1		Around 2200 to 2500 MM per KM
Project 2		Around 2200 to 2500 MM per KM
Project 3		2500 KM
2) Road barricaders installation In case of damage, how much time is taken to get it repaired? In days_____	One week**	
Project 1		Within a week
Project 2		Within a week
Project 3		Within a week
3) Road crash guards installation In case of damage, how much time is taken to get it repaired? In days_____	One week**	
Project 1		Within a week
Project 2		Within a week
Project 3		Within a week

Note: * As per the Indian Road Congress guidelines & concession agreement; ** NHAI guidelines

Source: *Author's compilation from the interviews with independent consultants, project implementation unit officers of NHAI, and O& M reports of the respective projects*

Exhibit 05: Summary of Road User Survey Analysis

Indicators	Before	After	Elucidation
1) Travel time			
Project 1	45 to 60 minutes	20 to 30 minutes	Reduction by 40 to 50 percent of travel time
Project 2	Minimum 60 minutes	In between 30 to 45 minutes	Reduction in around 30 percent of travel time
Project 3	2.5 to 3 hours	2 hours	30 percent reduction
2) Fuel efficiency			
Project 1	No	Increased	Depends on driving style – ideal driving reduces by 30 percent
Project 2	No	Increased	
Project 3	No	increased	
3) Consistency in reaching the destination			
Project 1	No	Yes (all the 50 respondents)	Delay in 10 to 15 minutes in weekends (80 percent of the respondents)
Project 2	No	Yes	
Project 3	No	Yes	
4) Road safety (while driving)			
Project 1	No	Yes	
Project 2	No	Yes	
Project 3	No	Yes	
5) Cost of Vehicle maintenance			
Project 1			
Project 2			Reduces substantially
Project 3			
6) Average speed per hour (in KMs)			
Project 1			
Project 2		More than 80	All the respondents
Project 3			
7) Potholes			
Project 1			
Project 2	Many	Never found	All the respondents
Project 3			

Notes: project 1- Bangalore Nelmangala stretch of NH 4

Project 2 -Bangalore Electronic city – Hosur section of NH 7

Project 3 - Nelmangala Devihalli section of NH 48

Project 4 - AP border to Avathi village stretch of NH 7 (this project survey is under process)

Source: *Author's compilation from the road users schedules*

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