International Journal of Advance Research in Science and Engineering
Volume No. 11, Issue No. 04, April 2022
www.ijarse.com
IJARSE
ISSN 2319 - 8354

Financial Risk Management of HAM Model Projects

Nissar A Jamadar[1] Satish Deshmukh[2], Suraj C Tandale[3]

[1,2,3]*Civil Engineering Trinity Academy of Engineering, Pune, India*

ABSTRACT

The rise in need for huge and high quality highway infrastructure projects has necessitated public authorities in India to seek the help of the private sector. Due to financial limitations and growing infrastructure sector has led to the development of various PPP models in developing countries. There are different PPP models in the highway sector such as build-operate-transfer, design-build-operate-transfer, and build-own-operate-transfer. A new variant of the PPP—hybrid annuity model (HAM) was introduced by the National Highway Authority of India in 2016.

The present paper aims to develop a financial risk model for HAM from the government's perspective in road infrastructure projects. In this study, NPV (net present value)-@-Risk Model is developed. NPV-@-Risk is the NPV at a specific confidence level. It is the decision-making tool in determining the financial feasibility of the project.

From the literature, financial risk parameters are identified and a case study of the road project is selected. Project cash flows are drawn for the project. The probability distribution is applied for risk parameters. Model is developed in @Risk software and Monte Carlo simulation is done to analyze the results. This considers uncertainties involved in project cash flow. The result shows the variation of NPV and the most influencing parameter on project cash flow. This research work provides investment decision and risk evaluation of the project for both government as well as a concessionaire.

Keywords: Financial risk, HAM, NPV-at-risk, Monte Carlo Simulation

LITERATURE REVIEW

Since the last 30 years PPP models have been vastly used to accomplish the sustainability goals. PPP is said to be a contractual arrangement between the public and private sector to fulfil the creation of infrastructure facilities and handle the distribution of risks and rewards between the parties. Different types of risks are identified in the PPP projects which include the project risk that deals with design, execution, financing and ownership. It also has market level risks for e.g. the demand and the investment risk. The allocation, transfer, management and mitigation of risk is the key that builds the trust between the public and private partner. It is observed that in comparison to the developed countries, it is the government officials from the developing nations that are unaware with the management of the PPP projects thus increasing their risks. PPP projects involve long term collaboration, in such situation if the developing government doesn't have a structured organization set up and strong technical and management ability; it shall be the private partner who will need to shoulder more risks under the projects Worldwide PPP has been used as a tool to develop the basic infrastructure. For the basics success of the PPP model it can be concluded that the steady macroeconomic

framework, firm regulatory structure, policies that are investor friendly, project revenues that are maintainable, transparent and consistent policies, effective regulation and liberalization of labor laws, and efficient corporate governance are the essential necessities. Various experiences in PPP projects and the barriers faced have been discussed in projects by the research authors. The barriers listed include no trust amongst the public and private sector, absenteeism of political willingness, the non-existence of an institutional environment, and deficiency in detailing project requirements by the public sector and badly designed and planned PPP Projects

The pace of infrastructure growth and construction of National Highways needed a boost and therefore HAM was introduced in 2016 by Government of India. Salient Features of HAM models are as follows.

1. Bid Award-Award to given to the bidder quoting lowest NPV for project life cycle cost.
2. Financial Support-The payments to the concessionaire to be done in five equal instalments according to the physical progress of the work which constitutes 40% of the bid project cost. The remaining 60% of the project cost to be borne by the concessionaire via a mix of debt and equity.
3. Escalation Formula-Proposed to include an escalation formula in the project to be affected by inflation indexed (through a Price Index Multiple) (PIM), this index in the ratio of 70:30is the weighted average of Consumer Price Index (CPI) and Wholesale Price Index (WPI).
4. Annuity Payments-The balance of the 60% of the final bid project cost to be made available to the concessionaire in the form of semi-annual annuity payments by the public authority on project completion. These payments should also include the interest in the form of reducing balance on the final cost to construction.
5. Operation and Maintenance Payments (O&M)–The authority to also release the O&M payments to the concessionaire along with annuity, this amount needs to be subjected to prime index multiple as per the inflation of the country. The concessionaire till the end of the project period is to remain responsible for the operation and maintenance.
6. Toll Collection –The money collected through toll collection is the responsibility and income of the public authority. According to CARE Ratings, (November 2017) around 48 projects with an effective length of 12,000 km and bid project cost of Rs. 49,000crores were awarded by NHAI during January 2016 to March 2017. The projects were launched to address the special purpose vehicle (SPV's) challenges during execution phase and aid liquidity of sponsors during initial period by adopting the model concession agreement (CA) of HAM.

In Live Mint (ePaper) (2017) - R. Shankar Raman, L&T's (whole time Director and Chief financial officer) has mentioned that as the government functionaries realized that the build, operate, transfer (BOT) model wasn't the key to the country's ambitious highway construction targets, the changes in the form of HAM was essential for sustainability. Though government authorities are over ambitious of this alternative, Infrastructure major L&T believes that with the existing financial stress in this sector this model may not turn out to be a sustainable solution. In the article he stated of Road and Transport Minister of India (Mr. Nitin Gadkari), who wanting to re-energize the sector, has hurriedly pushed the decision of bearing the traffic risks on the public authorities as he felt this was too intense to be borne by the developers. Thus, to

manage the risk he introduced the HAM which is half way between an annuity and a full-blown build, operate and transfer (BOT). However, this wasn't really addressing to all the issue faced in this sector and was only a solution to feel the gaps in the existing model therefore its sustainability in the near future may be doubtful. Besides he has also expressed that the major setback for HAM could be financial stress faced by the developers presently and thus raising such amount of money now could be difficult for them, then some 10 years back.

AIM OBJECTIVE AND PROBLEM STATEMENT

To Analyze and evaluate the financial risk parameter impacting the PPP – HAM model road projects in India, to identify the major causes of Financial Risk and to create a tool which can help in in determining the financial feasibility of the project

Objective of study

- To study Financial parameters of HAM model and analyze different risk factors affecting the Financial health of HAM model road projects.
- To develop financial risk assessment model software using suitable method of cost management. (Like NPV, etc.)
- To evaluate uncertainty of HAM model road projects and its effect on the financial health of the Project.
- To validate the proposed work.

Problem Statement

The contracts awarded under the HAM were steady in 2017-2018 and were half the number of contracts awarded in 2016-2017. Till June 2017, 44 projects have been awarded, out of which only 26 have achieved the financial closure. 10 projects have crossed the limit of 150 days within which project closure is required. Also, three projects were terminated due to the failure to secure the funds. As promoter's equity is only 12-15%, bankers are reluctant to provide funds to less known developers. However, developers with sound track record must not face challenges in raising fund. According to India Rating &Research, more than half of the hybrid annuity model projects awarded contract have not yet achieved financial closure. Until July 2018, only 580 billion worth contracts have achieved the financial closure out of 1.18 trillion. The rating agency further said that the number of contracts awarded in the current fiscal year may slow down because of the high order book to revenue ratio of the top players. According to Crisil, only strong developers backed by strong fundamentals bid for HAM projects as banks don't provide funding to less known developers. The bank's exposure in HAM is limited to 35%, which is much lower as compared to 70% in BOT projects. Due to large backlogs created by the players over the last two years, the competitive spirit has reduced in HAM. Also, very few players are willing to bid for the project

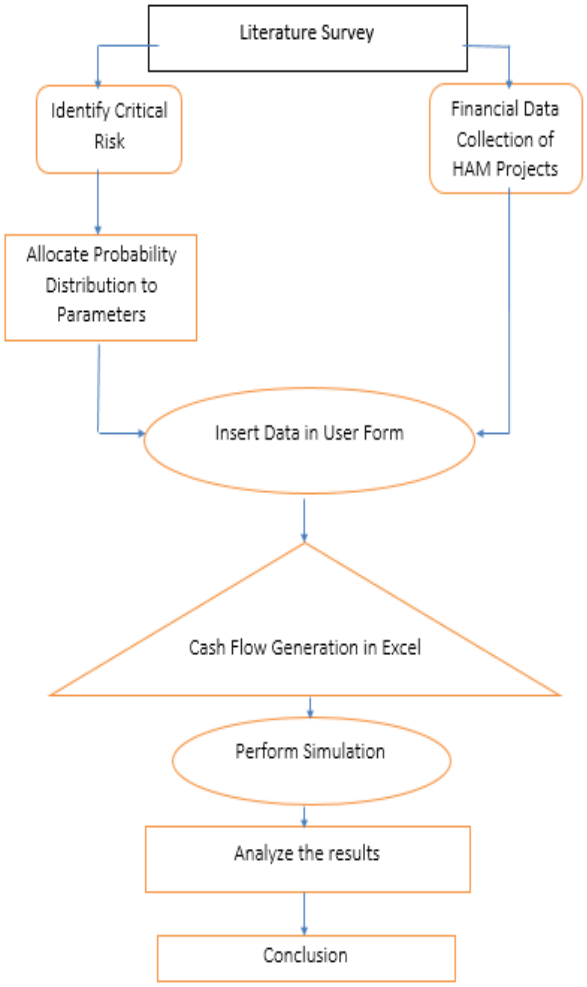
Research Methodology

The research methodology comprises of the literature survey from which the critical risk parameters will be identified followed by the project financial data collection. The critical parameters will be assigned the respective probability distributions based on the past studies.

The collected financial data for the existing projects along with the probability distribution will be fed in developed financial risk model. Further interpreting model will be developed for increasing the usability of the approach

1. Literature survey:- The literature related to financial analysis of BOT road projects will be reviewed from journal papers, articles, books and websites and standards. The literature reviewed will be summarized to give an insight of the methodologies, limitations and advantages of the work carried out by various researchers.
2. Identification of critical risk parameters:- From the previous literature the critical risk parameters are identified . Due to wide range and variation of projects in their nature, size, type, role of participants, and location considering all risks factors in project evaluation is not only impractical but also not necessary. Considering this fact risks are required to be categorized to find out the most critical risk parameters which have high impact on the financial health of the project. It is proposed to identify seven most critical parameters which may affect the financial health of the project.

FLOW CHART OF RESEARCH METHODOLGY



3.Financial Data collection: - For the accurate financial risk assessment, the reliable data is required. The government websites such as www.infrastructureindia.gov.in, tis.nhai.gov.in for the PPP BOT road projects are most authentic hence the data sets required for the proposed work will be collected from them.

4.Development of model- The financial model will be developed using a suitable tool which is an add-in to Microsoft Excel. The concept of NPV-at-risk will be used. The inbuilt Monte Carlo simulation will be used for analyzing the critical parameters for predicting the financial health of the projects. To simplify and to overcome the manual efforts of analyzing the results a software model in VBA excel will be developed.

5.Results and conclusions: -The results will be in the form of the outputs from the tool will show the most affecting risk parameter along with Net Present Valueintegrated with confidence level.

Progress of ongoing HAM projects:

- Projects equivalent to five per cent of sample 2 have achieved provisional commercial operations date (PCOD) in timely manner and some of them are also expected to qualify for early completion bonus. Additionally, projects equivalent to five per cent of sample 2 have achieved five project milestones and are expected to achieve PCOD in the near term. On an aggregate basis ten per cent of the sample BPC have either achieved PCOD or achieved five project milestones as against one per cent of sample BPC under this category one year ago.
- Projects equivalent to twenty per cent of sample 2 have achieved 3-4 project milestones and hence expected to achieve PCOD over next one year.
- NHAI has timely released construction annuity along with inflation indexation which is positive for the operators.
- Projects equivalent to twenty-four per cent of sample 2 have been delayed, with more than half of them being delayed in meeting the first milestone.

Delay in the project execution is mainly attributed to weak or modest credit profile of sponsor and non-availability of complete ROW as well as clearances. Furthermore, proportion of projects facing execution delays has increased from fifteen per cent to twenty-three per cent of BPC. The increase is attributable to persistent challenges on ground in de-scoping of unavailable land. This is despite a favorable contractual feature of issuing COD to projects where entire ROW could not be made available within 180 days from Appointed Date. Besides, some of the projects have also faced hindrances to work on the available land post Appointed Date largely owing to delay in shifting the necessary utilities. There is also a practice of de-linking of the work done from the overall scope of work to be done for achieving PCOD where ROW is handed beyond 180 days from Appointed Date. Under de-linking, PCOD may be declared upon completion of 100% work on available land, while concessionaire is required to execute the work on remaining land whenever it is handover by NHAI even post PCOD. Nevertheless, implementation of contractual terms is still awaited as most of the projects are awaiting approval of de-scoping or de-linking despite lapse of more than 180 days from Appointed Date while some projects nearing completion with project progress of around 90% due to unavailable ROW. Furthermore, CARE believes quick reassessment and approval of revised bid project cost post de-scoping of unavailable land poses another challenge from credit perspective as delay in the former can result in deferral in term debt disbursement

from lenders and in turn impede the project progress. Moreover, NHAI is required to grant extension of time (EOT) in timely manner in case the project is not delayed due to the reasons attributed to concessionaire. In case of delay in granting of EOT beyond schedule project completion date (SPCD), probability of deductions in the first annuity as well as reliance on sponsor heightens as door-to-door tenor of the project loans and their repayments are linked with SPCD. Prompt remedial action on these issues is crucial to boost lenders' confidence and reinvigorate private players interest.

4.2 Financial Data Collection

A case study of the HAM road project ―State Highway in Nagpur Maharashtra, India is selected. This considered project has a construction cost of 220 crore and a construction period of 2.5 years. The length of the project is 49 km. Input parameters of the project are given in Table below.

Input Parameters of the project

Construction period in years	2.5 Years
Construction cost in crores	220 Crores
Length of project in Km	49 Km
O&M cost in crores	1.1Crores
Traffic growth rate	7%
Discount Rate	9.5%

Cash Flows: Project amount received and amount spent are represented in the cash flow diagram

Project Amount Received: It is calculated from Toll Collection that will be collected throughout the concession period. Data required for calculating is represented in Table below. Toll rate is calculated from the base rate using the formula given by (Kumar etal, 2018)

Toll rate = Base rate*(1+0.4(WPLa-WPLb)/WPLB)

As per the Annual report of Ministry of Finance, Government of India, the wholesale price Index (WPI) for the year 2018-2019 is 3.4 and for the year 2019-2020 is 4.5

Table 5 Traffic Data of the Project

Vehicle Type	Traffic Count	PCU Conversion Factor	Base Rate (Per KM)	Toll Rate in Indian Rupees
Car Jeep, van (light Vehicles)	470	1	.65	43.56
Light Commercial Vehicle, Light Goods vehicle or Minibus	120	1.5	1.05	70.36
Bus or Truck (Two Axles)	97	3	2.2	147.42
Three Axles Commercial Vehicles	7	3	3.45	231.18
Multi Axles Commercial Vehicles	9	4.5	4.2	281.44

Project expenses: In this project the Government has contributed to 60% of the project cost. The remaining 40% construction cost which was initially invested by the contractor will be given in biannual payments by the government to the contractor. Operation and maintenance costs will be the responsibility of the contractor so

these payments will also be repaid to the contractor in form of Biannual payments. Biannual payments should be inflation indexed. As per the contract these payments should be given at a bank rate +3%. The bank rate is taken as 6.50% on the remaining payments should also be given to the contractor. The construction period is 2.5 years, in the year 2018, the 1st installment of the investment is utilized and two installments in 2019 and 2020 year. During the operation period Toll is collected. Annual traffic in terms of Passenger Cell Unit (PCU) for the year 2021 is calculated and it is multiplied by Toll Rate/PCU to get the revenue of Rs 7.25 Crore. Biannual amount Rs 2.53 Crore are returned to the contractor by the government. Interest on remaining biannual payments is also given. The total net flow for the year 2021 is Rs. -6.27 crores. NPV is calculated from net flows. Detailed cash flow is tabulated in Table below for the case study.

Table 6 Detailed Cash Flow (in crore)

Year	Project Revenue		Project Expenses				Net Flow
	Construction Cost						
	From Contractor		From Government				
2018	16.88		25.32				-8.44
2019	33.76		50.64				-16.88
2020	33.76		50.64				-16.88
	Annual Traffic	Revenue	Bi-Annual Payment	O&M annuity	Interest		
			2.53	0.4	3.89		
2021	369197.5	7.25	2.53	0.4	3.77	13.52	-6.27
			2.53	0.4	3.65		
2022	395041.33	7.99	2.53	0.4	3.53	13.04	13.04
			2.53	0.4	3.41		
2023	422694.22	8.80	2.53	0.4	3.29	12.56	-3.76
			4.22	0.6	3.09		
2024	452282.81	9.89	4.22	0.6	2.89	15.62	-5.73
			4.22	0.6	2.69		
2025	483942.61	11.11	4.22	0.6	2.49	14.82	-3.71
			4.22	0.6	2.29		
2026	517818.59	12.48	4.22	0.6	2.08	14.01	-1.53
			4.22	0.6	1.88		
2027	554065.89	14.02	4.22	0.6	1.68	13.2	0.82
			5.91	0.8	1.4		
2028	592850.51	16.05	5.91	0.8	1.12	15.94	0.11
			5.91	0.8	0.84		
2029	634350.04	18.38	5.91	0.8	0.56	14.82	3.56
			5.91	0.8	0.28		
2030	678754.55	21.04	5.91	0.8		13.7	7.34

NPV of the project is Rupees -46.07 crore. The financial risk model is developed using using @ Risk software by using probability distributions assigned to each identified financial risk parameter using 1000 iterations in @Risk Software.

International Journal of Advance Research in Science and Engineering
Volume No. 11, Issue No. 04, April 2022
www.ijarse.com
IJARSE
ISSN 2319 - 8354

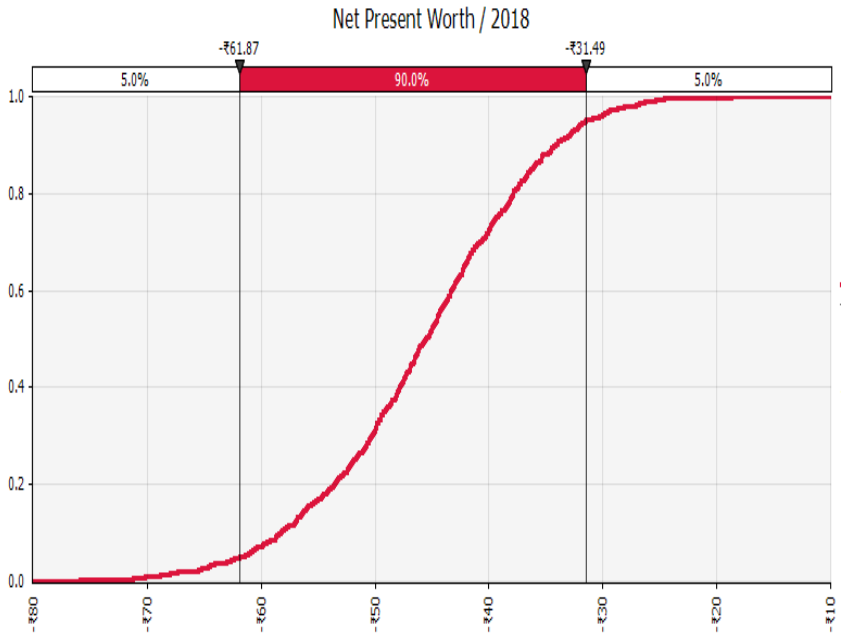


Figure 3 Showing Probability Distribution Curve of NPV

Figure 3 above shows the probability distribution curve for NPV of the Project considered in the case study. The probability distribution curve shows a maximum variation of value rupees -32.49 crores and minimum value rupees -67.87 crores. Figure above shows the tornado chart for the project considered in the case study. The tornado chart ranks input parameters according to their effect on NPV. The most significant influencing parameter of the cash flows is given by this chart. Construction cost is the critical influencing parameter of the project followed by discount rate, traffic growth rate and operation and maintenance cost.

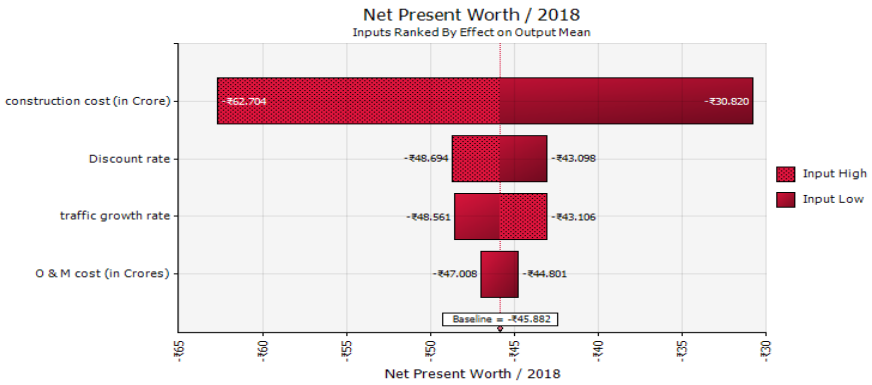


Figure 4 Showing Tornado Chart

5. RESULTS AND CONCLUSION

This research paper contributes to the development of a financial risk model for HAM projects. It incorporates NPV using @Risk Model which is supported by Monte Carlo simulation. This can be used for evaluation of financial risks on infrastructure/road projects. From this model the NPV for the project under case study is 46.07 crores. If risk parameters change within the applied probability limits. NPV will vary between Rupees -31.49 crores to Rupees -67.87 crores, this shows that incorporating uncertainties is important to get the idea about

variations associated with risk parameters. Tornado chart gives construction cost as the most influencing parameter. The risks can be mitigated by applying strategies to reduce the effect of the influencing parameter and maximize the returns. Hopefully this study can be applied to other PPP models. To improve the accuracy of the result more uncertainties can be incorporated.

REFERENCES

Dey, S., 2017. Road construction to meet 40km per day target next year: Gadkari , The Weekhttp://www.theweek.in/content/archival/news/india/road-construction-to-meet-40km-per-daytarget- next-year-gadkari.html accessed on July 26, 2017

Dixon, T., Pottinger, G., & Jordan, A. 2005. Lessons from the private finance initiative in the UK: Benefits, problems and critical success factors. Journal of Property Investment & Finance, 23(5), 412–423.

DNA, 2017. HAM road projects hit fin closure hurdle, 17 March,http://www.dnaindia.com/money/report-ham-road-projects-hit-fin-closure-hurdle-2355715

EY Ernst & Young, 2015. New Model of Indian Road PPP Projects, Asia-Pacific Forum on Public-Private Partnerships for Transport Infrastructure Development highway public-privatepartnerships: Evidence from US value for money studies, Transport Policy, accessed on July 26, 2017

Liu, J., Love, P., Davis, P., Smith, J., & Regan, M. 2015. Conceptual framework for theperformance measurement of public-private partnerships. Journal of Infrastructure Systems, 21(1),1–11.

Marschak, J., 1955. Elements for a Theory of Teams. Management Science, 1: 127-137.NDTV Correspondent, 2010. Kamal Nath's ambitious target: 20 km of road per day,http://www.ndtv.com/india-news/kamal-naths-ambitious-target-20-km-of-road-per-day-408922;accessed on July 26, 2017

OECD, 2008. Public-Private Partnerships: In Pursuit of Risk Sharing and Value for Money,OECD, Paris.

Parliament of India, 2016. Infrastructure Lending in Road Sector, Two hundred thirty sixth report, Department related Parliamentary Standing Committee on Transport, Tourism and Culture, Rajya Sabha

Pauly, M. 1968. The economics of moral hazard. American Economic Review, 58, 531–37.Pira, M.L., Ignaccolo, M., Inturri, G., Pluchino, A., & Rapisarda, A., 2016. Modelling stakeholder participation in transport planning. Case Studies on Transport Policy, 4(3).

Planning Commission, 2010. Sub-prime Highways? - An Issues Paper,http://www.gajendrahaldea.in/download/Sub-prime_Highways-An_Issues_Paper.pdf; accessed on July 26, 2017

Pratap, K. V., 2015. User Fees and Political and Regulatory Risks in Indian Public–Private Partnerships, Economic & Political Weekly, 50(36), 25.

Regan, M., Smith, J., & Love, P.E.D., 2017. Financing of public private partnerships: Transactional evidence from Australian toll roads. Case Studies on Transport Policy, 5(2), 267-278.

Rivera-Santos, M., and Rufín, C., 2010. Odd couples: Understanding the governance of firm–NGO alliances, Journal of Business Ethics, 94, 55-70

Zhang, X.Q., 2005. Critical success factors for public-private partnerships in infrastructure development. Journal of Construction Engineering and Management, 131(1), 3–14.

Zhang, S. et al., 2015. PPP application in infrastructure development in China: Institutional analysis and implications. International Journal of Project Management, 33, 497-509.

Cherkos, F. D., Jha, K. N., and Singh, A. (2020), ―Framework to Select Public-Private Partnership Modalities‖ Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 12(4).

Fredy, K., Sri, W. M., and Stephen, O. (2015), ―Best practice for financial models of PPP projects‖ Procedia Engineering, 125(124-132).

Garg, S., and Mahapatra, D. (2019), ―Hybrid annuity Model: Hamming risk allocations in Indian highway public-private partnerships‖ . J Public Affairs. 19(1).

Jeerangsuwan, T., Said, H., Kandil, A., and Ukkusuri, S. (2014), ―Financial Evaluation for Toll Road Projects Considering Traffic Volume and Serviceability Interactions‖ . Journal of Infrastructure Systems, 20(3).