International Journal of Innovations in Engineering and Technology (IJIET)
http://dx.doi.org/10.21172/ijiet.141.10

Analysis of BOT Model for Road Project Contract

Mayur S. Ghayal[1], Rohit R Salgude[2]
[1] *Department of Construction Engineering and Management,*
School of civil engineering, MIT-WPU, Pune, Maharashtra, India.
[2]*Assistant professor, Department of civil engineering, MIT Pune, Maharashtra, India*

Abstract- Build Operate and Transfer (BOT) was one of the most successful model from Public Private Partnership (PPP) type because of its financing strategy and risk absorption techniques. But from last couple of years BOT model is lagging behind to achieve financial closure within budget. Most of the BOT project fails due to not generating minimum revenue. Hence it is important to find out which factor is responsible for failure of BOT project. In this research paper the terms and condition related to time and cost is identified from contract document. These terms and condition further analyse by using Relative Importance Index (RII) technique to find out most influencing conditions for success and failure of BOT project. After this a formal cash flow model is generated and studied to find out the strength and weakness of limitation of this model generated. This study is important because it is important to find out the limitation of BOT model to overcome this limitation.

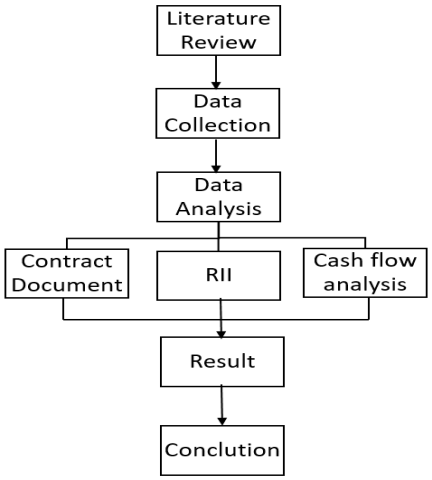
Keywords – Build Operate and Transfer (BOT), Influencing factor, RII, Cash flow model, Limitations.

I. INTRODUCTION

BOT (Toll) and BOT (Annuity) are the two PPP models used to purchase the Indian National Highways projects. The PPP model is that the private sector partner's role is to deliver the project's financing and assume accountability for building and maintaining of it. The public sector, in exchange, will allow it to gather users ' income initially whole utility have to construct by private funding i.e. by contractors money or by taking bank loans. Then the whole utility was operated and maintained by contractor at his own cost. The contractor have rights to collect revenue from users but after the concession period contractor have to hand over the property to government, which means transfer. During operation and maintenance stage contractor have to operate and maintain whole utility at his own cost and can generate profit through revenue. Hence BOT (Toll) model is mainly used for project development in elevated traffic density stretches for economic viability.

II. PROPOSED ALGORITHM

2.1 Proposed research methodology-



1 Flow chart of Research Methodology

2.1.1 Data Collection

Data collection was done for the BOT project. Model concession agreement, DPR (Detail Project Report) and contract document was collected for BOT project. And questionaire survey is conducted to find out most critical factor for suucess and failure of BOT project. The target respondent for questionaire survey is government officials of releted department and contractor.

2.1.2 Data Analysis

Identification of most influencing factor for success and failure of BOT by using RII technique. The RII is the mathematical toll which is use to analyse the qualitative data or which is use to convert qualitative data into quantitative data. The questionnaire was designed so that respondents can give the rank to the question based on their experience and knowledge. For analyse the quality of your work from RII technique you have to prepare a questionnaire which gives answer of your question on three, four, five, seven, or ten point scale. Based on response from respondent the answer is collected in form of rating and after that the RII technique is applied on that respond to find the hierarchy of factor. The analysis of these data was done by a method called as relative importance index. This method is used to determine the most influencing factor for success and failure of BOT project

Formula of Relative Important Index (RII):

$$RII = \frac{\sum W}{(A \times N)}$$

Where

W= Weightage given by the respondent to each factor

A= Highest Weightage

N= Total number of respondent

Table no 1 RII ranking 1

Sr. No.	Rating factors	Rank
1	Disagree	1
2	Cannot say	2
3	Moderately Agree	3
4	Agreed	4
5	Strongly Agree	5

Table no 1 shows the scale ranging from 1 to 5. 1 means less or no influence of factor on success or failure and 5 means most influencing factor on success or failure.

2.2 BOT Success factor-

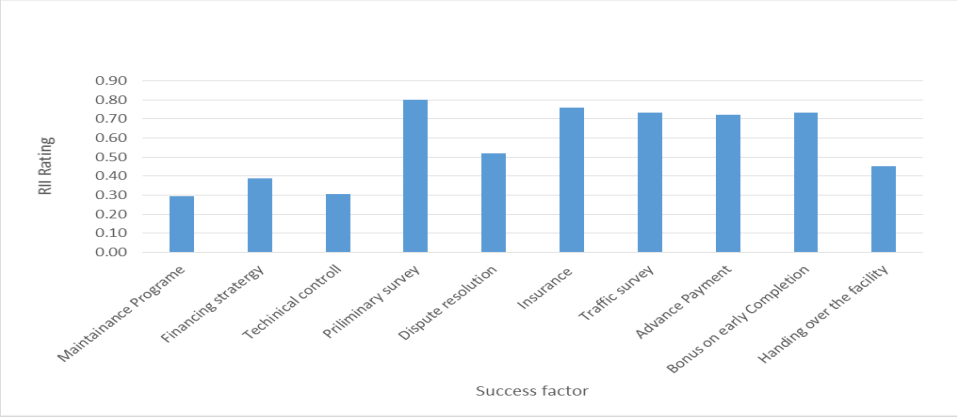
The questionnaire survey is conducted to identify most influencing factor for success of BOT. The target respondent was selected in such a way that accuracy of survey get high hence the target population are government officers from PWD or irrigation department, contractors, and persons who have the knowledge of contract and actual work on site like project manager or site engineer. The questionnaire survey was conducted in such way that the question is targeted to factor who can lead or relate to success of BOT contract to identify on what scale this factor affecting to success of BOT contract.

Table no 2 RII rating for critical success factor

Most influencing factor for success of BOT project											
		Weightage given by respondant to each factor									
Respondant No.	Success factor	Maintainance Programe	Financing strategy	Techinical controll	Priliminary survey	Dispute resolution	Insurance	Traffic survey	Advance Payment	Bonus on early Completion	Handing over the facility
1		1	2	1	4	3	3	3	1	4	3
2		1	1	2	4	2	4	4	5	4	1
3		3	2	2	5	4	4	4	4	3	3
4		1	3	1	3	4	3	1	3	3	3
5		1	3	2	3	3	3	4	3	3	3
6		2	1	1	4	2	4	4	4	4	1
7		1	2	3	5	3	5	4	5	3	2
8		1	2	3	3	3	4	4	4	3	2
9		2	1	2	4	1	4	4	5	4	1
10		1	2	1	5	2	5	5	4	4	2
11		1	4	1	3	2	4	4	4	4	2
12		2	1	1	5	2	4	4	5	4	2
13		2	1	1	4	2	4	4	5	4	2
14		2	2	1	4	3	3	3	1	4	3
15		1	2	1	4	3	3	3	1	4	4
Average Weitage		**1.5**	**1.9**	**1.5**	**4.0**	**2.6**	**3.8**	**3.7**	**3.6**	**3.7**	**2.3**
Σ of waitage		**22**	**29**	**23**	**60**	**39**	**57**	**55**	**54**	**55**	**34**
RII		**0.29**	**0.39**	**0.31**	**0.80**	**0.52**	**0.76**	**0.73**	**0.72**	**0.73**	**0.45**

Table no 2 shows the rank given by respondent to every influencing factor for success. The elements in row indicates the rank given by respondent for each factor while in column rank given by all respondent to one success factor. Each respondent give rating for each factor on five point rating scale starting from 1 to 5 one means less influencing and five manse most influencing factor for success. After getting respond from target population the RII technique were apply on above data to get the hierarchy of most influencing success factor for BOT model.

Graph no 1 Critical success factor of BOT



Above chart is made from the calculation done on RII technique. On X axis most influencing success factor are shown and on Y axis rating for that influencing factor are shown. From bar chart we can clearly identify the most and less influencing factor for success for BOT model. From above chart we can say that the most influencing factor for success of BOT is preliminary survey. We can say that the preliminary survey is directly proportional to success of BOT project. And the less influencing factor but important for success of BOT is Maintenance program and technical control (Quality control) of work.

2.3 BOT failure factor-

Table no 3 shows rating for most influencing failure factor of BOT project. The factor of failure are as follows. Effect of Initial investment on Bidding, Risk of Traffic survey, Responsibility of Force majeure event, Not getting minimum revenue, Change of Scope, Price Escalation, Suspension of work and Violation of rule of suspension of work. These are the most influencing factor for failure of BOT project. Above chart shows the rating give for each factor by respondent on five point scale. From above table we can observe higher RII is obtain by traffic forecasting followed by change of scope and price escalation. Means most critical factor for failure of BOT is traffic survey.

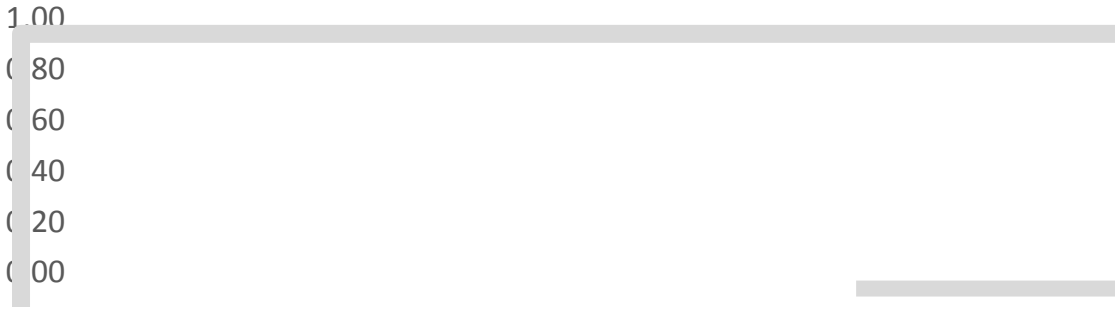
Table no 3: Rating for l failure factor of BOT

Most Influencing Factor of failure of BOT									
Respondant No.	**Success factor**	Weightage given by respondant to each factor							
		Effect of Initial investment on Bidding	Risk of Traffic survey	Responcibility of Force mejeure event	Not getting minimum revenue	Change of Scope	Price Escallation	Suspension of work	Violation of rule of suspension of work
1		1	1	2	4	5	4	4	3
2		2	5	3	4	4	5	5	3
3		2	5	4	4	3	5	4	4
4		4	5	1	3	1	1	2	3
5		2	5	4	4	5	5	4	4
6		1	5	3	4	5	4	4	4
7		2	4	4	4	5	4	4	3
8		2	5	4	4	5	4	4	3
9		1	4	3	5	4	5	5	4
10		2	5	4	4	5	4	4	3
11		3	4	3	4	5	5	3	3
12		2	5	3	4	5	5	4	3
13		2	4	3	4	4	5	5	3
14		1	5	2	4	5	4	4	3
15		1	5	3	4	5	4	4	3
Average Weitage		**1.9**	**4.5**	**3.1**	**4.0**	**4.4**	**4.3**	**4.0**	**3.3**
∑ of waitage		**28**	**67**	**46**	**60**	**66**	**64**	**60**	**49**
RII		**0.37**	**0.89**	**0.61**	**0.80**	**0.88**	**0.85**	**0.80**	**0.65**

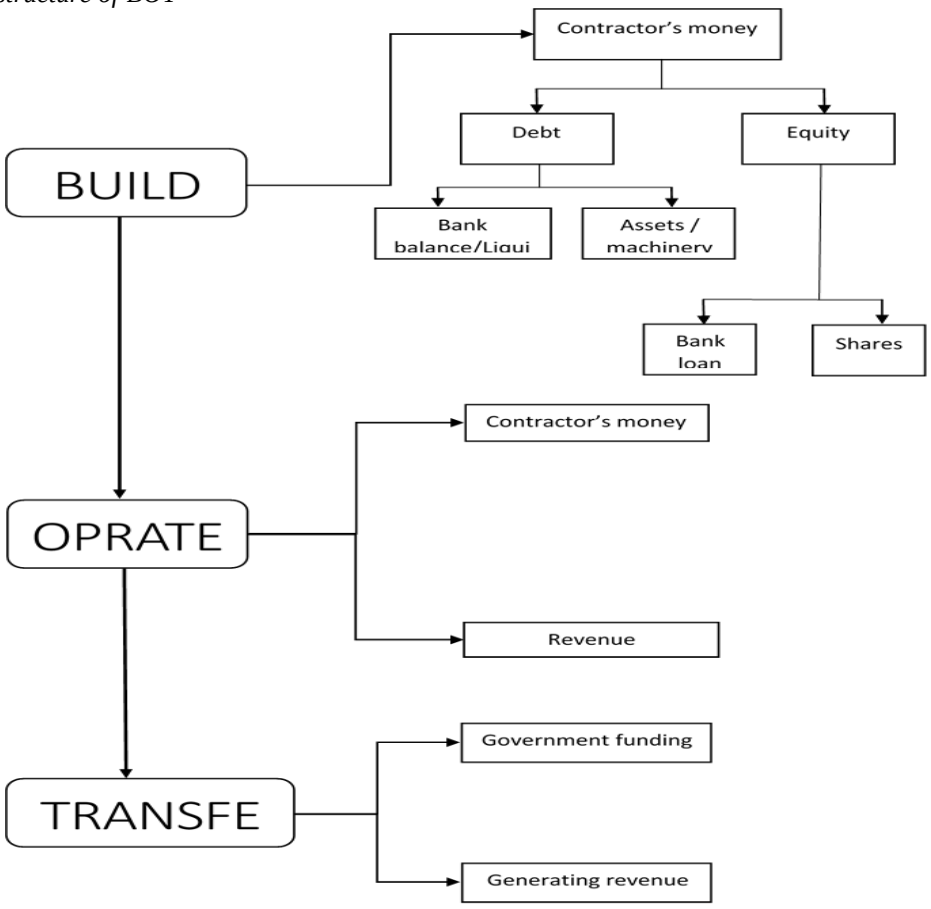
Graph no 2 shows the graphical representation of most critical factor for failure of BOT project. The graph is plotted RII vs. Influencing factor. Where on X axis most influencing factor are shown and on Y axis Rating of RII is denoted. From the above graph we can see the most and less influencing factor for failure of BOT project. From the

above graph it can be clearly seen that the most influencing factor for failure of BOT is traffic risk followed by change of scope price escalation suspension of work and not getting minimum revenue.

Graph no 2: Critical failure factor of BOT



2.4 Cash flow structure of BOT-



III. CASH FLOW STRUCTURE OF BOT MODEL

Figure no 4 shows financing structure of BOT projects at the construction stage contractor have to invest the money. The contractor's money is in form of debt or equity, contractors debt means liquidity amount, bank balance or may be assets such as plant, equipment, machinery etc. which can be used by contractor without spending money at construction stage. And another option is equity means the amount or assets taken from outsides the organization such as Bank loans, Shares. Then at the operation stage the whole utility is operated by the contractor by his own cost or by generating revenue from users. But at the same time contractor also have to generate his revenue through user by applying toll or service charge. And at the transfer stage whole utility rub by government and they may operate this structure through his own cost or they may collect revenue from users and run the project.

IV. RESULT

Most influencing factor for success of BOT project from RII techniques are

Sr. NO.	RII Rating	Success Factor of BOT
1	0.8	Preliminary survey
2	0.76	Insurance
3	0.73	Traffic survey
4	0.73	Bonus on early Completion
5	0.72	Advance Payment
6	0.52	Dispute resolution
7	0.45	Handing over the facility
8	0.39	Financing strategy
9	0.31	Technical control
10	0.29	Maintenance Programme

Most influencing factor for failure of BOT project from RII techniques are:

Sr. NO.	RII Rating	Failure Factor of BOT
1	0.89	Risk of Traffic survey
2	0.88	Change of Scope
3	0.85	Price Escalation
4	0.80	Not getting minimum revenue
5	0.80	Suspension of work
6	0.65	Violation of rule of suspension of work
7	0.61	Responsibility of Force majeure event
8	0.37	Effect of Initial investment on Bidding

V. CONCLUSION

1. BOT model is not equal risk shearing strategy contractor have to bear more risk than authority.
2. Financial issue and loan risk are major risk on BOT project because of its 100% private financing strategy
3. As per concern of financial model BOT model have their plus and minus point. Where the traffic is high BOT model should have to prefer by government. And for remote areas where traffic flow is less BOT model should not preferable.
4. Further modification is need to be done in contract condition of BOT project to make it better for major project.
5. Latest modification in Model concession agreement is Hybrid Annuity Model this model can be proper solution for failure reason in BOT.

VI. REFERENCE

[1] Ankit kumar; at_al, "Study of different Public-Private Partnership (PPP) Model for the Road Infrastructure" International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 03 | Mar -2017 [p.no. 2409 to 2412].
[2] Ganesh R Nile; Prof. P M Attarde, "Investigation of feasibility and Risk in BOT Road project" International Journal of Latest Trends in Engineering and Technology, Vol 7 issue 2 July 2016 (http://dx.doi.org/10.21172/1.72.56)
[3] Hande Aldag1 and Isik Zeynep2, "Role Of Financial Risk In Bot Megatransportation Project In Developing Countries" ASCE journals @2017, Doi 10.1061/(ASCE) ME 1943-5479.0000527.
[4] Ismail Abdul Rahman, Aftab Hameed Memon, Nora Sheda Zulkiffi, "Failure Reasons of PPP Infrastructure Projects: Case Study of Kuala Lumpur LRT Project". Life Science Journal [January 2014].
[5] John E. Schaufelberger, M.ASCE; and Isr Wipadapisut; "Alternate Financing Strategies for Build-Operate-Transfer Projects" ASCE JOURNAL OF CONSTRUCTION ENGINEERING AND MANAGEMENT © ASCE / MARCH/APRIL 2003
[6] Mahesh M. Barad, Dr. K. Ravi; "Public Private Partnership in Highway Construction in India" International Journal on Recent and Innovation Trends in Computing and Communication Volume: 4 Issue: 4 April 2016 [p.no. 174 to 176].
[7] N. Srinivasa Reddy, Sharma Pankaj, "Why PPP Modeled Infrastructure Projects Failed:A Critical Review with a Special Focus on Road Sector" International Journal of Advanced Engineering, Management and Science (IJAEMS) [Vol-3, Issue-4, Apr- 2017].
[8] Ramakrishna Nallathiga, Haris D Shaikh, Tauseef F Shaikh and Farhan A Sheik, "Factors Affecting The Success/ Failure Of Road Infrastructure Projects Under PPP In India" KICEM Journal of Construction Engineering and Project Management 2010.
[9] Surya Sudheer Meduri, M.Tech.; and Thillai Rajan Annamalai, Ph.D. "Unit Costs of Public and PPP Road Projects:Evidence from India" ASCE jurnals of construction engineering and management January 2013.
[10] Tharun Shastry L. "A Study on Public-Private Partnerships with Reference to Indian Infrastructural Projects" International Journal of Business and Management Invention Volume 3 Issue 10 October. 2014.
[11] Thillai A. Rajan1; Govind Gopinath2; and Monalisa Behera3 "PPPs and Project Overruns: Evidence from Road Projects in India" ASCE journals @2013, DOI: 10.1061/ (ASCE)CO.1943-7862.0000797.