

“Analysis of Factors Influencing Time Overrun in Build Operate Transfer Infrastructure Projects: A Case Study on BOT Road Project in Maharashtra”

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Abstract - The construction industry in India is expected to be worth Rs 120 billion per year; the sector caters to the requirements of billions of people and contributes 5.5% to the country's GDP. However construction industry continues to face challenges around skill deficiency, escalation in material and labour expenses, and socioeconomic changes. The main intent of this research study is to focus on the India construction transportation sector with an emphasis on multiple project risk factors. The progress of the construction sector in India has been comparatively slow compared with the industrial and manufacturing sectors.

The Build-Operate-Transfer (BOT) scheme is now becoming one of the usual ways for construction development in India to meet the needs of India's forthcoming economic growth and development. There are great opportunities for overseas investors to finance in India. However, undertaking construction venture in India, involves many risks and difficulties that are due primarily to variances in legal systems, market situation and culture. It is vital for overseas investors to recognize and manage the critical risks linked with investments in India's BOT schemes.

Based on the review, the following critical risks are recognized: delay in approval, change in law, cost overrun, dispatch constraint, Land acquisition and compensation, enforceability of contracts, construction schedule, financial closing, tariff adjustment, and Environmental risk. The influencing factors which are responsible for time overruns for BOT projects are identified through a literature. The relative importance and significance of these factors are calculated by conducting a survey. This project mainly aims at finding the factors influencing the Time Overrun in BOT infrastructure projects and give recommendations to Client, Consultant and Contractors to avoid these factors causing delays and minimizing the Time overruns and additional cost associated with the same from the analysis of case study.

Key Words: Build Operate Transfer (BOT), Risks, Infrastructure Construction Industry, Time Overrun

1. Introduction

Civil infrastructure is vital to the country's financial growth. Infrastructure may be considered to be the skeleton on which the society is built. It includes 1) highways, 2) railways, 3) ports, 4) bridges, 5) hydraulic structures, 5) power plants, 6) tunnels, 7) municipal facilities like sanitation and water supply, and 8) other facilities serving public needs. Sufficient funding is required to construct and maintain the requisite infrastructure. The instant need for such projects coupled with budget shortages experienced by public agencies has encouraged the use of innovative financing. Conventionally public infrastructure has been carried out by the public sector using the DBB procurement system. With the increased demand for innovative developments and for maintaining existing projects, public funding resources were unable to keep pace with the demand.

Public-private partnerships (PPPs) were sought as alternative delivery systems to address some of the funding problems. PPP arrangements are utilized extensively and have found considerable acceptance in several parts of the world. India has seen a rapid increase in private investment in infrastructure since 2003.

PPP program has grown rapidly in the past 5 to 6 years; in 2002-06 more than 150 PPP deals closed, compared with 66 in the last 7 years. Several arrangements of PPPs have been utilized including the common build-operate transfer (BOT). Based on the original BOT concept, diverse variations have evolved in many countries.

2. Objectives

Despite the importance and the significance of the construction sector in India, it is noted that the owners, consultants and contractors don't give importance to evaluate the additional costs incurred due to Time Overrun of construction projects. It is therefore essential to identify actual factors causing Time overrun and steps should be taken to avoid unnecessary delays and additional costs associated with delays in any construction project. The objectives of this study are as follows:

1. To Identify the Risks associated in Build Operate Transfer (BOT) Infrastructure Projects.
2. To Identify the Various Risks associated in different stages of Project life cycle of Build Operate Transfer (BOT) Infrastructure Projects.
3. To conduct survey by postal questionnaire and personal interviews of the experts to identify principal causes of delay for BOT projects, and to obtain the perceptions of three main participants: owner, consultant and contractor to the factors influencing Time overrun of BOT project.
4. To analyze the data obtained through survey and calculate their Relative Importance Index (RII).
5. To assess the effects of Time Overrun on BOT Project by studying a specific case of a BOT Road Project in the state of Maharashtra.

3. Problem Statement

Out of every 10 BOT projects, 9 projects are suffering from Time Overrun due to various delays, which means around 90% projects are affected due to various delays causing Time overruns and additional costs associated with it.

Due to which stake holders are suffering from major losses. Rate of Overruns are increasing day by day; hence there is need to think on the potential causes of such delays causing overruns.

This project mainly aims at finding the factors influencing the Time Overrun in BOT infrastructure projects and give recommendations to Client, Consultant and Contractors to avoid these factors causing delays and minimizing the Time overruns and additional cost associated with the same from the analysis of case study.

4. Scope and Limitation of Study

In recent days, BOT projects are suffering from various significant factors which may cause delays resulting in Time overruns and additional costs associated with the same; hence there is need for assessment of the impacts of such factors on BOT projects in order to achieve overall objectives of the project. For this study, data collection and analysis was limited to the data received through Questionnaire survey from Clients, Contractors and Consultants in the field of construction industry. Recommendations are suggested for the Top five factors affecting Time Overrun which are derived through Relative Importance Index (RII).

5. Literature review

Albinu and Jagboro (2002), identified contractor's financial difficulties, the project owner's cash flow problems, Incomplete drawings, subcontractor's incompetency, equipment breakdown, late delivery of materials, planning problems, price escalation and Sub-Contractor's financial problems, in that order as leading causes of project time overruns.

Ali and Kamaruzzaman (2010) through questionnaire survey in different projects at Klang Valley in Malaysia, found that main factors that contribute to cost overruns include inaccurate/poor estimation of original cost, construction cost

underestimation, land acquisition, Improper planning, poor project management, lack of experience, poor contract management, Inflation of project costs, high cost of machineries, fluctuation in price of raw materials, unforeseen site conditions, Insufficient fund, obsolete/unsuitable construction equipments and methods and Mistake in design.

Doloi et al. (2012) identified the key factors impacting delay in Indian Construction Industry and then established the relationship between the critical attributes for developing predictions models for assessing the impacts of these factors on delay. Regression modeling and Factor analysis were used to examine the significance of the delay factors. The most critical factors of construction delay were identified as lack of commitment, insufficient site management, poor co-ordination on site, improper planning, lack of clarity in scope of project, lack of communication, poor labour productivity, rework due to mistakes in construction are the reasons that affect the overall delay of the project.

Kikwasi (2012), identified causes of delays and disruptions and their effects put construction projects at great risk that have an effect on their performance. These causes are: design changes, delays in payments to contractors, information delays, funding problems, poor project management, compensation issues and disagreement on the valuation of work done. Similarly the effects of these delays are: time overruns cost overrun, negative social impact, idling resources and disputes. Recommendations were adequate construction budget, timely issuing of information, finalization of design and project management skills should be the main focus of the parties in project procurement process.

Olawale and Sun (2010), identified 21 major factors causing overruns are changes in design, risk and uncertainty associated with projects, inaccurate evaluation of projects time and cost, non-performance of subcontractors, complexity of works, conflict between project parties, disagreements in contract documentation, contract and specification interpretation disagreement, inflation of prices, financing and payment, lack of proper training and experience of project manager, low skilled manpower, unpredictable weather condition, dependency on imported materials, lack of appropriate software, unstable Interest rate, fluctuation of currency/exchange rate, weak regulation and control, projects fraud and corruption and unstable government policies.

There are two types of delay one is non-excusable delays and other is excusable (Saleh Al Hadi Tumi, 2009). A non-excusable delay is delay caused by the contractor or its suppliers, through no fault of the owner. The contractor is generally not entitled to relief and must either make up the lost time through acceleration or compensate the owner. Therefore non-excusable delays usually result in no additional money and no additional time being granted to the contractor.

Schaufelberger (2005) reports the results of a study of seven Asian BOT projects undertaken to determine the

primary risks the project sponsor faced, the risk management strategies that were selected, and the results obtained. Two major categories of risk were identified, general risks and project-specific risks. From this analysis, a risk management framework was developed for each category of risk. The results of this study indicate that the private sector cannot be the only participant in risk management, but that the host government's active support is essential to have a viable BOT project in Asia.

Hyun-Soo Lee et al. (2012) suggested an assessment system considering risk influence factors on construction sites, examined the factors through literature reviews and surveys, and builds a weighting system for their classification. The risks for each type of work are estimated based on their frequency and severity. With the understanding that perceiving a specific type of risk on a construction site increases the effectiveness of safety management, the study suggests an assessment system, integrating associated risks and risk influence factors. A risk assessment system has been proposed that considers influence factors and addresses the characteristics of construction sites. The system is intended for use with regard to the safety of construction workers.

6. Methodology

The research methodology for present study has adopted is Questionnaire survey to identify significant factors influencing Time Overruns in BOT Infrastructure projects and a Case Study analysis. To identify the factors causing Time overrun, literature reviews, books, conference proceedings and discussion with practitioners of all parties involved in BOT infrastructure projects were carried out. Questionnaire for the survey was developed based on 44 factors of Time Overrun and grouped into 9 Major groups. For each factor the Respondents were requested to give a rating using five point scale of 1 to 5 (Likerts scale). It is categorized as follows 5 = very high; 4 = High; 3 = medium; 2 = low and 1 = very low.

1. DATA ANALYSIS

To identify the factors causing time overruns, literature reviews, books, Conference proceedings and discussion with practitioners of all parties involved in construction industry were carried out.

Questionnaire for the survey was developed based on 44 factors of time overruns and grouped in to 9 major groups.

Followings are the 9 Major Areas of life cycle:

- 1)Pre-Bid Factors
- 2) Design
- 3) Environment
- 4) Legal Approval
- 5) Tender & Contract
- 6) Planning
- 7) Execution
- 8) Monitoring & Control
- 9) Other Factors

For each factor the respondents were requested to rate using five point scale of 1 to 5 is adopted. It is categorized as follows 5=very high; 4=high; 3=medium; 2=low; and 1=very low.

2. DATA ANALYSIS: Relative Importance Index (RII)

The Relative Importance Index (RII) ranking method had been applied to determine the ranks of the different delay causes. From the ranking assigned to each cause of delays, it is able to identify the most critical delay factors in the

construction industry. The RII has been used in many domains to evaluate the comparative importance of a single item to others. The equation stated below was used to compute the relative importance index for all the causes.

The five-point scale ranging from 1 (very low) to 5 (Very high) was adopted and transformed to relative importance indices (RII) for each factor as follows:

$$RII = \frac{\sum W}{A * N}$$

Where:

W = Weightage given to each factor (ranging from 1 to 5)
 A is 5 (the highest weight) and
 N is the Total number of Respondents

The RII value had a range from 0 to 1 (0 not inclusive), the higher the value of RII indicates that the more important was the delay factor to the Construction industry.

Result of Relative Importance Index (RII) of Top Five Factors Affecting Time Overrun

Sr. No	Causes	RII	Ranking
1	Land Acquisition	0.880	1
2	Poor Financial Management	0.853	2
3	Improper Planning of project	0.833	3
4	Weak regulation and control of Project	0.833	3
5	Delay in Decision	0.807	4
	Design Changes	0.807	4
6	Approval & Sanction for Project	0.793	5
7	Insufficient number of Equipment's	0.793	5
8	Sanctioned Drawings	0.793	5
9	Unavailability of required data at Initial Stage	0.793	5

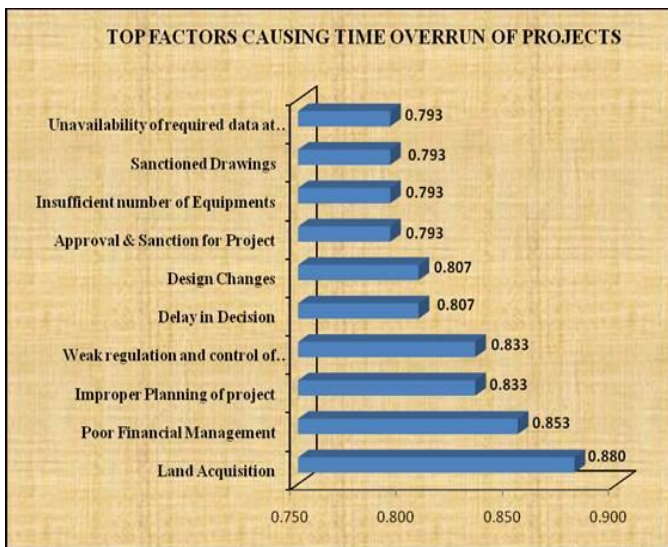


Figure 6.1 shows Top Factors Causing Time Overrun of Projects

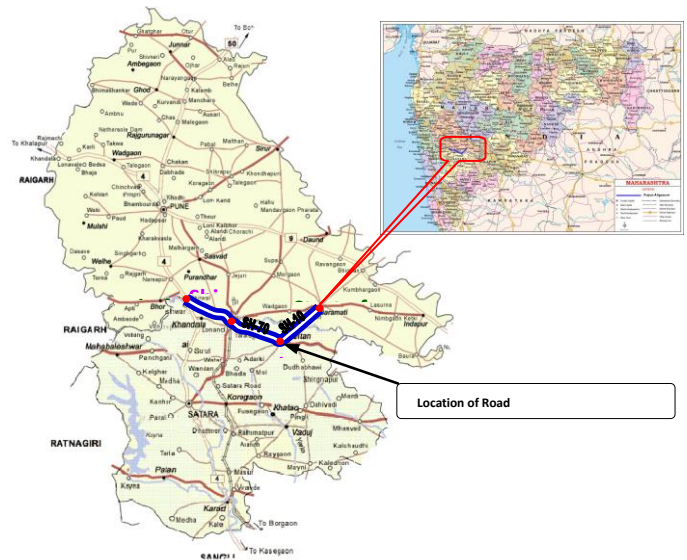


Figure 7.1 Location Map of Projects

7) CASE STUDY

PROJECT BACKGROUND

The Secretary, Public Works Department, Government of Maharashtra, Mantralaya Mumbai is engaged in the development of State Highways and, as part of this endeavor, the Government has decided to undertake development of Four Lanning of Baramati to Phaltan Road SH10 (Km. 42/400 to Km. 64/300) and, Phaltan - Lonand to Shirwal Road SH 70 (136/000 to 80/000) Dist- Pune & Satara District of Maharashtra State through Public-Private-Partnership model on Design, Build, Finance, Operate and Transfer (DBFOT) basis.

The Detailed Engineering Report (Feasibility) was prepared by PWD, Pune. PWD has awarded the work to the Concessionaire M/s SPB Infrastructure Pvt. Ltd., Pune and the Concession Agreement for the work was signed on 03rd October 2009. The Concessionaire has mobilized its own wing M/s IVRCL Infrastructure & Projects Ltd as EPC Contractor to execute the works.

The PWD has appointed M/s. Consulting Engineering Services (India) Private Limited, joint venture with Astute Infrastructure Private Limited, Pune to act as Independent Engineer (IE) for this project on 22nd October 2010.

The project was divided into 3 Sections for convenience of execution & monitoring as per the details mentioned below:

- Section I Km 80/000 to Km 108/000 28.0 Km
- Section II Km 108/000 to Km 136/000 28.0 Km
- Section III Km 42/400 to Km 64/300 21.9 Km

The concession period is of 25 Years from the date of Appointment.

SAILENT FEATURES OF PROJECT

Sr. No	Items	Details
Contract Details:		
1	Name of the Project	Four Lanning of Baramati Phaltan road S.H10 CH 42/400 to 64/300 and Phaltan Lonand to Shirwal Road S.H 70 CH 136/000 to 80/000
2	Contract Package Name (From -To)	Shirwal to Baramati
3	Chainage	42/400 to 64/300 and 136/000 to 80/000
4	State	Maharashtra
5	Name of the client	Public Works Department (Pune)
6	Name of Independent Engineer	Consulting Engineering Services (India) Pvt Ltd joint venture with ASTUTE Infrastructure Pvt. Ltd.
7	Name of Concessionaire	M/s SPB Developers Pvt. Ltd. IVRCL House ,35 Suyojana H.S., Koregaon Park, Pune 411001 India Ph: +91-020 26137741, 26111224, 26050104 Email: ivrclpune@ivrinfra.com
8	Total Cost of the Project	355.65 Crores
9	VGF	122.09 Crores
10	Grant Received	87.53 Crores
11	Already Spent Up to Date	298.49 Crores
12	Variations	Submitted 1. (Ref : IVRCL/Shirwal-Baramati/352/10-11) Dated : 21 st July'10 2. (Ref: IVRCL/Shirwal-Baramati/1959/11-12) Dated: 04 th Nov'11
13	Utility Shifting	Status Enclosed (Annexure - I)
14	Amount of performance	17.61 Crores (Submitted on 29 th April'10)

	security	Vide letter Ref: IVRCL/Shirwal/98/08-10
15	Appointed Date	06 th Mar'2010
16	Commercial Operating Date	05 th Mar'2013
17	Construction period	1095 Days
18	Date of letter of acceptance	27 th Aug'2009
19	Date of Agreement	3 rd Nov'2009

PROJECT MILESTONE

The Concessionaire has determined the commencement of work from 6th March 2010. Considering Appointed Date as on 6th March 2010, the Concessionaire had set project completion schedule as follows.

Sr. No.	Completion Schedule	Occurrence Date	Activities to be Completed
1.	Project Milestone I	05.09.2010	Commenced construction and expended 10% cost of TPC*
2.	Project Milestone II	05.03.2011	Commenced construction of all bridges and expended 35% cost of TPC*
3.	Project Milestone III	05.09.2011	Commenced construction of project facilities and expended 70% cost of TPC*
4.	Scheduled 4-laning date (COD)	05.03.2013	Completion of 4-lane

Note:- (*) TPC - Total Project Cost as defined in the Concession Agreement.

FINANCIAL PROGRESS OF PROJECT

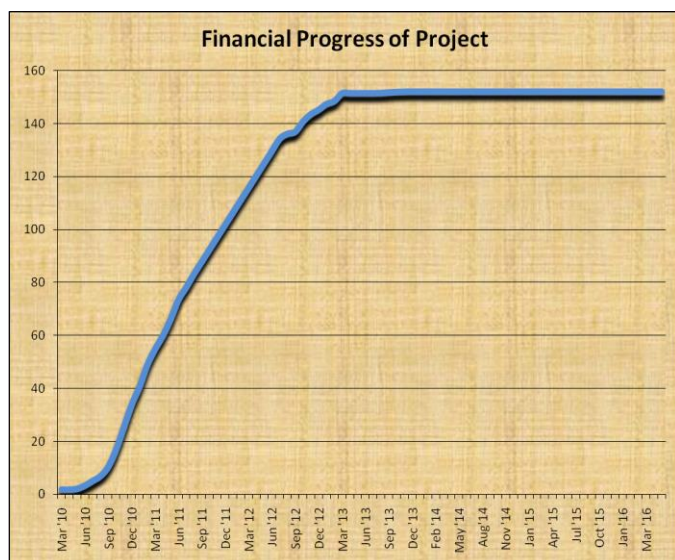


Figure No: 7.2 shows Financial Progress of Project

PHYSICAL PROGRESS OF PROJECT

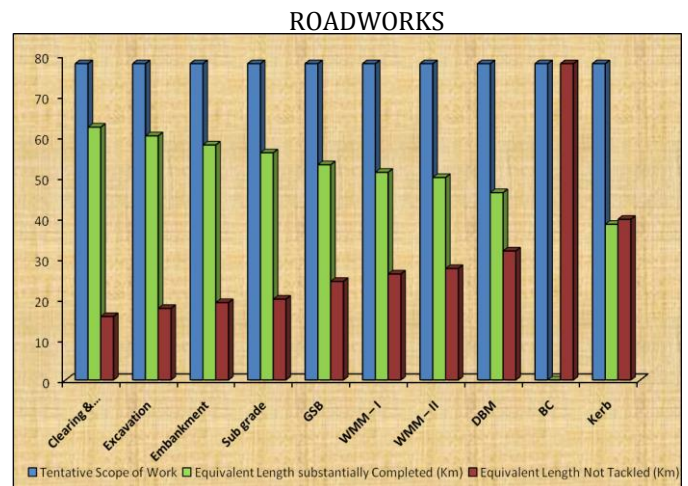


Figure no: 7.3 shows Completed and Balance Lengths for Road Works

STRUCTURE WORKS

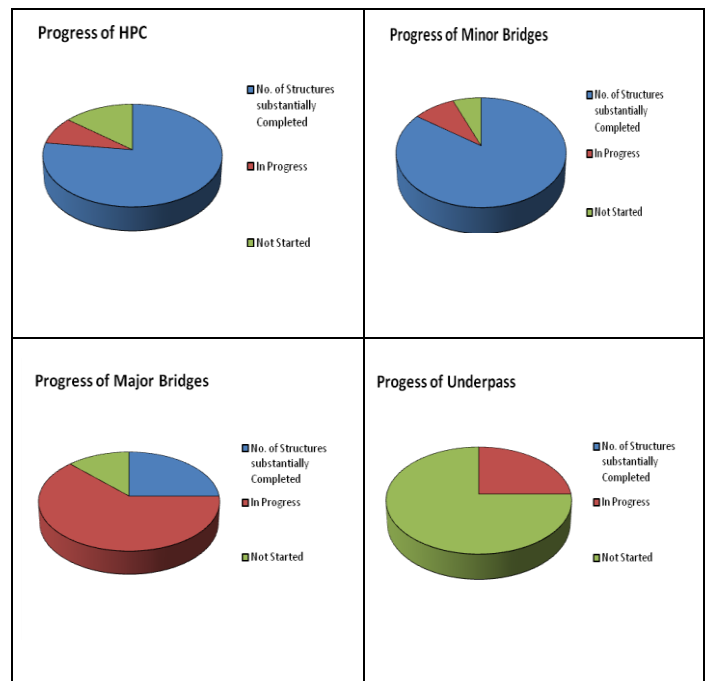


Figure No: 7.4 shows Completed and Balance for Structure Works

HINDRANCES TO THE PROJECT

LAND ACQUISITION

Land Acquisition for proposed Four-Laning is long pending and is still in progress. The Project is passing through rough weather due to Land Acquisition issues and ROW. Proposed 40m Row for Four-Laning has been acquired in approximately 30 Km. length as understood from PWD. The existing ROW in the remaining length varies from 16m to 35m. PWD has started the process for Compulsory Land acquisition for balance land since 1st April 2013 and PWD expects to acquire the balance land by end of May 2016. Forest Land in Section-I (320m) and Section-II (885m one side) are yet to be acquired.

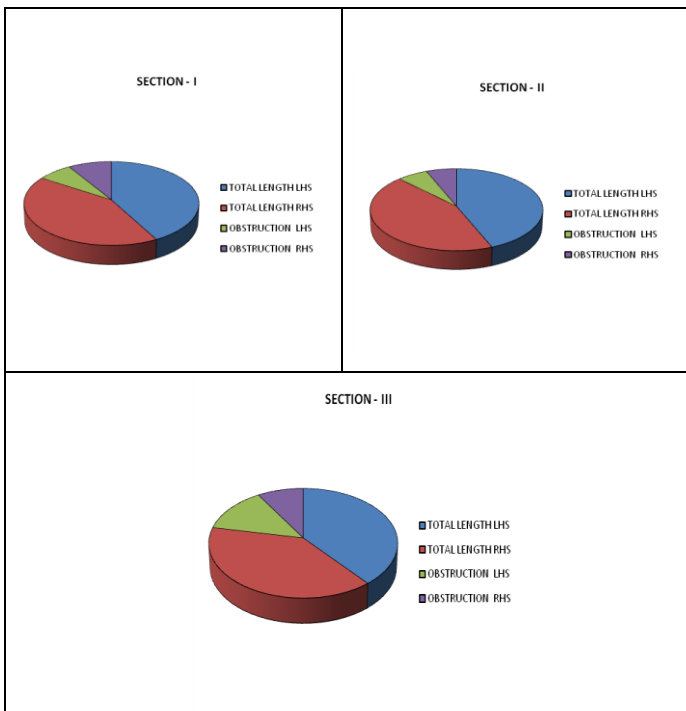


Figure No: 7.5 shows Land Availability in all 3 sections of Project

PROJECT BALANCE QUANTITIES

ROAD WORKS

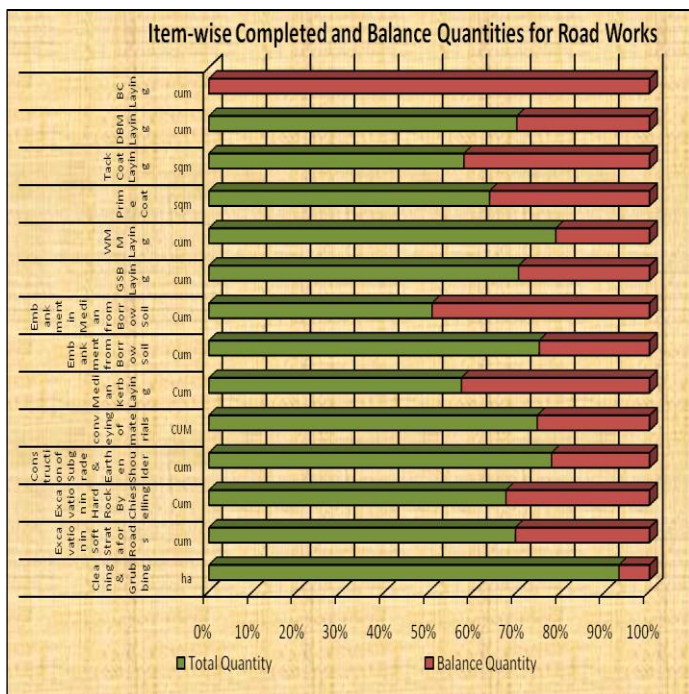


Figure No: 7.6 shows Item wise Completed vs Balance Quantities for Road

STRUCTURE WORKS

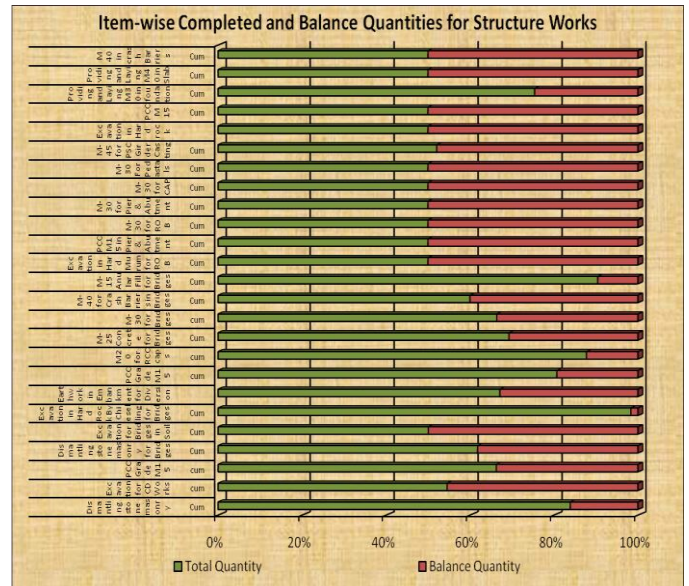


Figure No: 7.7 shows Item wise Completed vs Balance Quantities for Structure works

PROJECT BALANCE AMOUNTS

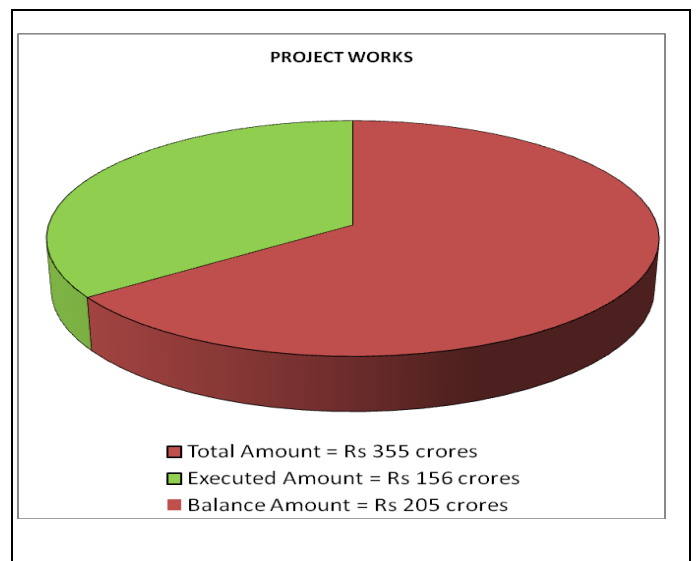


Figure No: 7.8 shows Total Amount Vs Balance Amount

8) CONCLUSION

Delays are inevitable; however, they can be avoided or minimized when their causes are effectively identified and analyzed. The aim of this study was to assess the effect of delays on BOT infrastructure projects in India, using Shirwal-Lonand-Phaltan-Baramati road project as the case study. Five objectives were investigated using a detailed literature review and interviews with stakeholders in the construction industry in India.

Through extensive literature review the various types of Risks associated with BOT infrastructure project were identified as follows: Market and Revenue Risks, Design Risks, Construction Risks, Operating Risks, Financial Risks,

Political Risks, Legal Risks, Environmental Risks and Force Majeure Risks.

Once the risks associated with BOT projects were identified through literature survey these risks at different stages of project life cycle of a BOT project were studied. The different stages of a BOT project are as follows: The Gestation Stage, The Development Stage, The Construction and Start -up Stage, The Operational and Maintenance Stage, Termination and Transfer Stage.

Through extensive literature review a total of 44 attributes were identified and categorized into nine groups. The Likert scale which is most commonly used for questionnaire surveys was used for this survey. The scale for this survey is categorized as follows 5=very high; 4=high; 3=medium; 2=low; and 1=very low. The respondents were requested to give Weightage to each of the attributes in a scale of 1 to 5. These Weightage were useful in computing the RII for each attribute. The computed RIIs provided a benchmark for ranking all the attributes of delays so as to form the basis for determining the most significant and insignificant factors.

The results of data analysis of responses by RII method for Time Overrun, the respondents had ranked "Land Acquisition", "Poor Financial Management", "Improper Planning of project", "Weak regulation and control of Project", "Delay in Decision", "Design Changes", "Approval & Sanction for Project", "Insufficient number of Equipment's", "Sanctioned Drawings" and "Unavailability of required data at Initial Stage" as the Top 5 factors contributing to Time Overrun of construction projects.

For validation of Questionnaire results, a case study analysis is done. Purpose of case study was to check the correlation of Questionnaire survey with the Actual case study of a BOT project in Maharashtra. The project considered in Case Study was planned to be completed in 1095 days from the commencement date of 6th March 2010 and accordingly the Commercial opening date was 5th March 2013, but due to various Land Acquisition problems PWD has still not handed over 25.500 kms of Project land on LHS and 24.290 kms of Project land on RHS to Concessionaire for construction. Till date more than 1185 days have been delayed by PWD, but yet full Project land has not been handed over to Concessionaire for construction. This shows till date there is 108.21% Time Overrun in the Project with to planned duration for completion.

Case Study shows that, due to the Land Acquisition problems project has been severely affected and out of the Estimated Cost of Project i.e. Rs 355 crores, till date Project works amounting to Rs 156 crores have been completed by the Concessionaire i.e. only 43.94% of Project have been completed. The Balance Project works amounting to Rs 200 crores is still pending i.e. 56.06% of Project works are yet to be completed.

The case study also reveals the fact that, it was the Clients (i.e. PWD's) responsibility to hand over obstruction free land to the Concessionaire for timely completion of project, but the Client (i.e. PWD) has failed to do so, which has resulted in heavy Financial problems to the Concessionaire as no Toll

collection could be done by them for past 1185 days and they have to bear the burden of Paying the Interest amount to Lender Banks without any Capital gains. Also the end users (i.e. The Common People) using this road face difficulties of travelling through incomplete stretches of road left abandoned by the Concessionaire.

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