

Risk Planning in Construction of Highway Project: Case Study

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ABSTRACT : Risk management is an activity which integrates recognition of risk, risk assessment, developing strategies to manage it, and mitigation of risk using managerial resources. Risks can come from various sources: e.g., uncertainty in financial markets, threats from project failures (at any phase in design, development, production, or sustainment life-cycles), legal liabilities, credit risk, accidents, natural causes and disasters as well as deliberate attack from an adversary, or events of uncertain or unpredictable root-cause. This study describes the different steps for effective risk management planning in construction of highway project.

KEYWORDS – Mitigation, Planning, Risk Assessment, Risk Management.

1. INTRODUCTION

Widely used vocabulary for risk management is defined by ISO Guide 73, "Risk management. Vocabulary". In ideal risk management, a prioritization process is followed whereby the risks with the greatest loss (or impact) and the greatest probability of occurring are handled first, and risks with lower probability of occurrence and lower loss are handled in descending order. But where as in construction industry let risk be high or low it cannot be prioritized as it has to be minimized as it occurs during highway construction process. Effective risk management planning provides:-An increased awareness of the consequences of risks, A focus for a more structured approach to risk management, Better risk information transfer between those concerned with and those responsible for such matters and Reduced long term loss expenditure and hence corresponding increased profits.

Risk management also faces difficulties in allocating resources. This is the idea of opportunity cost. Resources spent on risk management could have been spent on more profitable activities. Again, ideal risk management minimizes spending (or manpower or other resources) and also minimizes the negative effects of risks. As risks are present from start to end of the project i.e. from development phase to operational phase so it becomes very important to analyze risks and mitigate them by proper means of planning and management. [1]

2. RESEARCH OBJECTIVES AND IMPORTANCE

Objectives:- Studying, identifying and implementing effective risk management for construction projects success. Identifying the key risk factors could stand in front of construction processes. Management planning of risks and their remedial measures.

Importance:- This research mainly focuses on the importance of risk management. The risk management has been identified as one of the most important tools in determining any project success. This research will drive the attention to the occurrence of unpredictable risks during the construction project. In addition, studying the relation between risk management and project's success is important because most of the projects take place in unpredictable environmental conditions and uncertain factors affecting the firm. It is important to identify project's strengths, weaknesses, opportunities and threats.

3. METHODOLOGY

Risk Management model:- A Management Model is simply the set of choices made by executives about how the work of management gets done-about how they define objectives, motivate effort, coordinate activities, and allocate resources.

Level 1:- Planning

Level 2:- Risk identification and its impact on construction project

Level 3:- Mitigation [3]

Planning:-Planning is the first step of any project which includes planning, organizing and controlling and execution of the project. Project planning is the function in which project and construction managers and their key staff members prepares the master plan. Then this master plan is put into time schedule by scheduling people which is called project scheduling. As Project planning and project scheduling is two separate and distinct function of the project management. A project planning is mostly responsible for the success or failure of the project. So planning of the project should be done very carefully and under expert advice. Following questions should be asked before planning a project:-

- Will the planning meet the target date?
- Are sufficient resources available with the company to complete the project?
- Is the original contracting plan still valid?
- Are the designs and concepts ready to start the construction?
- Are the resources available in case of overload and where we will get it?
- Is the original contracting plan still valid?
- Are there long delivery equipment or materials involved?

All the above questions are answered while planning a project for its smooth execution and completion till the targeted date.

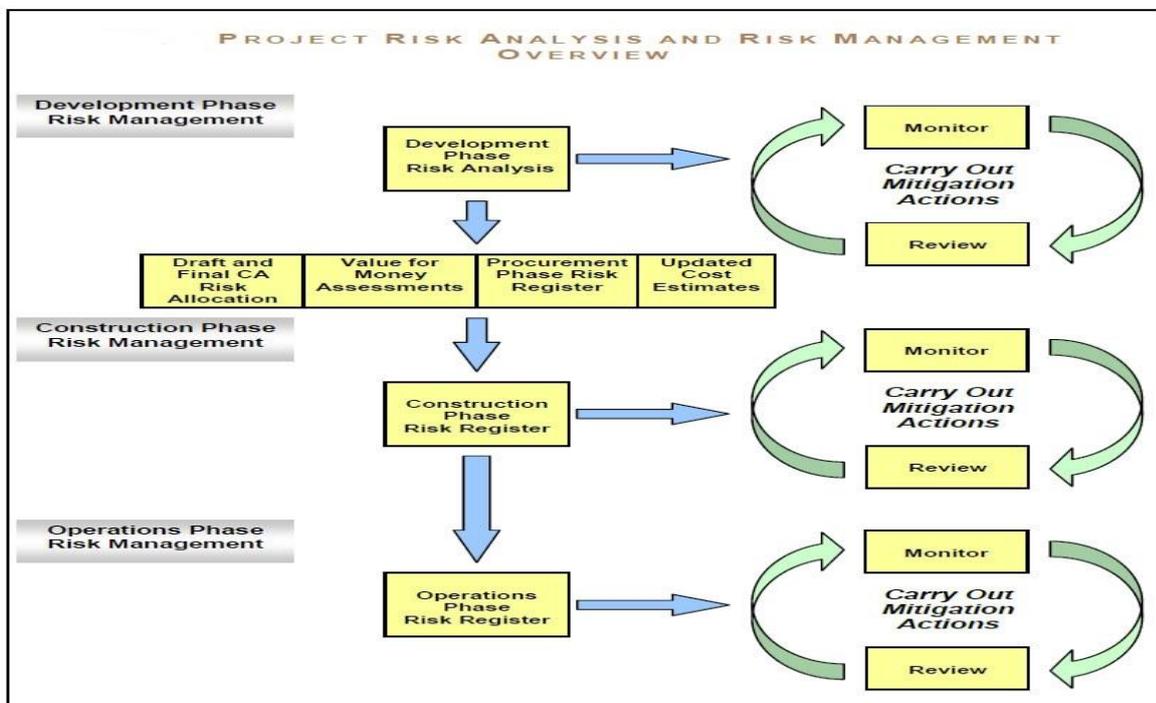


Figure 1: Project Risk Analysis And Risk Management Overview.

[Source:www.google.com]

Risk Identification and Impact:-The construction industry is fully exposed to the risks because of its very nature of activities still we find different techniques to tackle these risks (legal liabilities, credit risk, accidents, natural causes and disasters) for successful completion of the project.

Over the decades to tackle the risks, organizations and researchers have defined or cited several risk management models as mentioned above. It plays a very important role in a construction industry for completion of the project within targeted date. So the risks should be identified and analyzed very carefully and the impacts of these risks should be studied before execution.

Remedial measures:-Remedial measures is the effort to reduce loss of life and property by lessening the impact of disasters. In order for mitigation to be effective we need to take action now before the next disaster to reduce human and financial consequences later (analyzing risk, reducing risk, and insuring against risk). As construction industry is full of risks it is important to know that disasters can happen anytime and anywhere if

not prepared and consequence may be fatal so efforts should be made to mitigate these risks. Without mitigation we will jeopardize our safety, financial safety and self-reliance.

4. CASE STUDY

4.1. Introduction:-

The Government of Maharashtra represented by Secretary, Public Works Department and having its principal offices at Mumbai. The Secretary, Public Works Department has, vide notification No. 1/BOT/2008-09 invited proposal dated 21/04/2008, ("The tender Notice") for widening of 2 lanes BT Road to 4 lane BT road from Km 42/100 to 64/300 of Baramati Phaltan Road SH and Km.136/00 to 80/00 of Phaltan-Lonand-Shirwal Road SH through Build Operate and Transfer "BOT" Basis [Project]

The Secretary, PWD had after evaluation of the bids received, have accepted the bid of IVRCL Infrastructures & Projects Ltd (Bidder) and issued its Letter Of Award No.5639 dated 27/08/2009 i.e. LOA to the Bidder(IVRCL) requiring the execution of the Concession Agreement within 45 days of the issue thereof.

Consequent to their selection by GoM(Government of Maharashtra), IVRCL issued the Letter of Acceptance on dated 08/09/2009. A special purpose company viz., SPB Developers Private Limited (SPBDPL) was incorporated by IVRCL in September 2nd, 2009 to implement the Project.

The principal components of the project are widening of 2 lanes BT Road to 4 lanes BT road from Km 42/100 to 64/300 of Baramati Phaltan Road SH and Km.136/00 to 80/00 of Phaltan-Lonand-Shirwal Road SH and collection of toll from the tollable traffic at three toll plazas.

PWD, GoM as Concessioneing Authority had entered into a Concession Agreement (CA) with SPBDPL the concessionaire on 3rd October, 2009.

The Project is estimated to cost Rs 382.12 crores and is proposed to be funded by way of Rs 69.00 crores of equity, Rs 191.03 crores of Debt and Rs 122.09 crores grant from GoM.

4.2. Project Details:-

Project Description

As per the concession agreement, the scope of the Project would include the following

Core Construction Requirements: Design, Build, Finance, Operate and Transfer [DBFOT] basis and maintenance during construction period and functions associated with the construction of the Project Highway and roadside facilities. The Project Highway is to be widened to have a 4 lane divided carriageway facility.

Project Facilities:

Toll Plaza(s): There are three toll plaza(s) to be erected 1st Km 43/600 on SH10, 2nd Km 125/000 on SH70 3rd in Km 80/200 on SH70 of the project highway for the purpose of regulating the entry and exit of vehicles.

Road side Furniture: To be provided for the entire length of the project highway. Viz., sign board, overhead portal with sign boards etc.

Pedestrian facilities: Facilities of safe and unhindered movement of pedestrian and cyclist shall be provided on the project highway

Landscaping and Tree plantation: All along the road, tree shall be planted as per standards; tree shall be planted in rows and on either side of project highway as per standards. The plantations in the median shall comprise of shrubs and flowering plants. Tree plantation shall also be taken to environmental balance and loss due to cutting of trees for road widening.

The scheme for landscaping shall be part of overall environmental mitigation plan (EMP). The area around toll plaza and check post shall be properly landscaped. All depressed/scraped area shall be properly landscaped all along project road.

Bus-bays and passenger shelter: These shall be provided in accordance with CA and places mentioned therein.

Cattle crossing: Facilities for crossing highway at busy intersection is proposed through vehicular underpass at Lonand Bypass, Taradgaon, Jitni Naka and Phaltan.

Highway Lighting: The lighting shall comply with the provisions of standards and specifications, the project Highway shall also be provided with adequate lighting system in Urban /built up areas, Under Passes/ Cattle Passes, at grade intersections, Toll plaza, Bus Stop etc.

Administrative: Operation and Maintenance Base Camp: A minimum of 300 Sqm of covered area for functional base camp shall be provided. The base camp shall be located near the plazas location.

The proposed facilities available at base camp are described here under:-

Toll plaza /collection centre, Main collection centre administrative block, Equipment and machinery required for operation and maintenance and storage space for them, Storage space for equipment and material for traffic signs and marking, Workshop, General Garage and repair shop, Testing laboratory and First Aid Box.

Bridges & Other Structures: The Project includes construction of 8 major bridges widened for four lane, widening of 20 minor bridges, one Road over bridge near Lonand.

ProjectMap-

The following map in Figure 2 shows the Shirwal-Baramati highway (BOT Project). It shows the road chainage A,B,C and D. 'A' is Shirwal, 'B' is Lonand, 'C' Phaltan and 'D' is Baramati.

The toll plaza locations are located by numerals 1,2 and 3 in red colour.

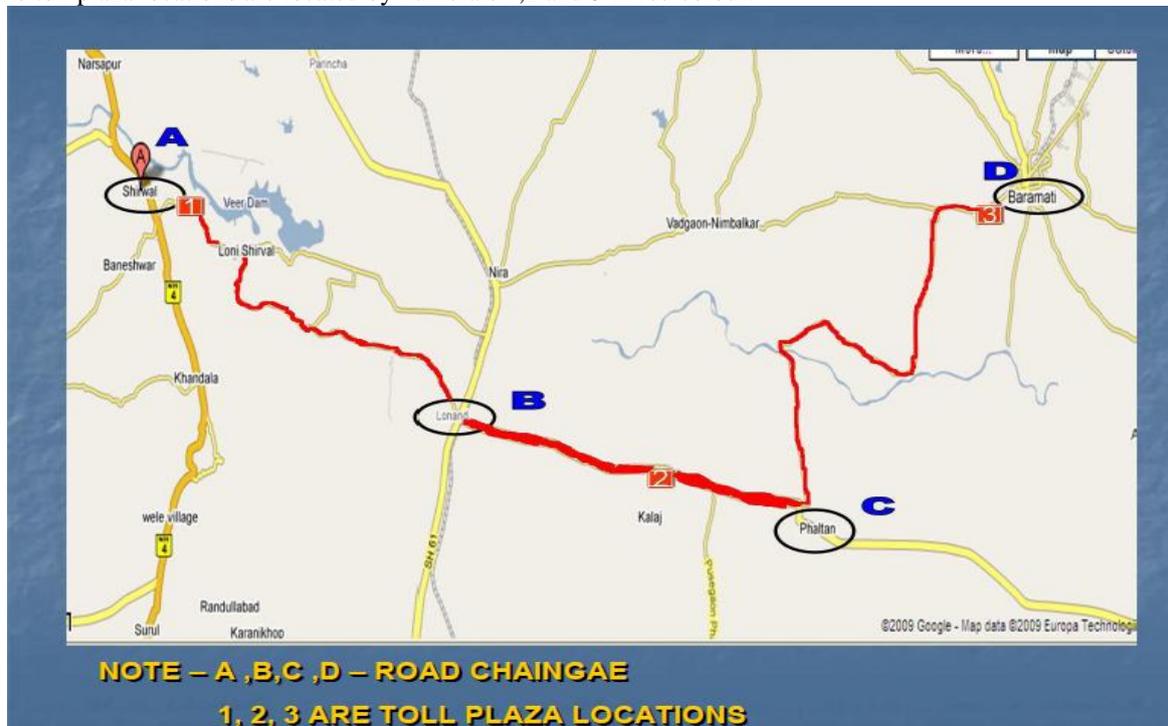


Figure 2: Map of Shirwal-Baramati Highway.
[Source:www.google.com]

4.3 Key Risks Identification of Highway Construction Project:-

Major Risks:

Traffic Risk-Traffic during the construction process. Inconvenience for the commuters to travel.

Toll Risk-Due to the lower traffic density, the collection of toll reduced. Toll risk lead to the failure in recovery of construction cost. Total construction cost increased.

Constructional Risk-The project is implemented by the way of fixed price and time. So the risk in the increase of material cost increased

Operational and Maintenance Risk-Due to the delay of the project, the Operational and Maintenance cost increased which affected the commencement of operation to cover the estimated maintenance expenditure.

Land Acquisition-Delay in the project due to land acquisition leading to increase in the estimated construction cost.

Minor Risks:

Utilities- Non availability of fuel, electricity and utilities not relocated at time delays the work of the day.

Noise- Repetitive, excessive noise causes long term hearing problems in labour and can be a dangerous distraction.

Material & Manual Handling- Materials and equipment is being constantly lifted and moved around on a construction site, whether manually or by the use of lifting equipment. Different trades will involve greater demands, but all may involve some degree of risk.

4.4 Remedial Measures:-

Traffic Risk- The base Tollable Traffic had been considered based on the Independent Traffic report given by Executive Engineer Public Works Department, GoM, Pune. However, considering a fall in the base traffic number by 5 % in the process of working out sensitivity analysis, the Min DSCR and Avg DSCR are at acceptable levels.

Toll Risk- Financial indicators of the project are highly sensitive to tariff growth assumptions. In the model it is considered with an average traffic growth of 5%, though there is enough potential due to anticipated industrial growth.

Also we have checked on the sensitivity we have reduced the traffic growth to 4% and found that the DSCRs are at acceptable levels.

There is no risk perceived on the WPI factor, since the toll fee given by GoM(Government of Maharashtra) if for the total concession period and the revised toll fee numbers are also mentioned.

Constructional Risk- The Project is implemented by way of a fixed price fixed time EPC contract. Hence the risk on account of price increase in material cost is mitigated.

Operational and Maintenance Risk- O&M contract for periodic maintenance is likely to be awarded to IVRCL. IVRCL has substantial experience in implementing road contracts. It is also proposed to have a major Maintenance Reserve (MMR) to be built up through internal accruals from commencement of operation to cover the estimated major maintenance expenditure.

Utilities- There should be adequate amount of fuel in backup in case of emergency, electricity backup should be there in case of power cuts for completion of project on time without any delay.

Noise- Using simple ear plugs does not necessarily offer total protection against hearing damage – employers are required to carry out and document a comprehensive noise risk assessment.

Material & Manual Handling- Where employee's duties involve manual handling, then adequate training must be carried out. Where lifting equipment is used, then adequate training must also be carried out, but may involve some form of test, to confirm competency. Records of training must be maintained for verification.

4.5 Result:-

- Initial base traffic reduced by 5%.
- Traffic growth rate reduced from 5% to 4%.
- Interest rate increased by 1%, both during construction and operation period.
- Increase in O & M expenses by 10% during operation period.

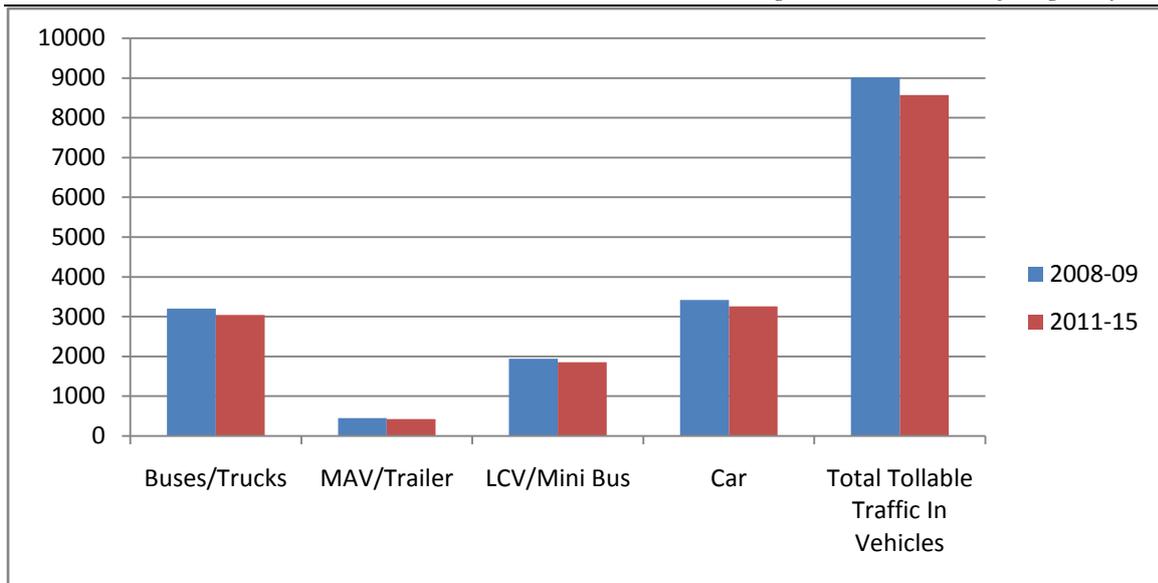
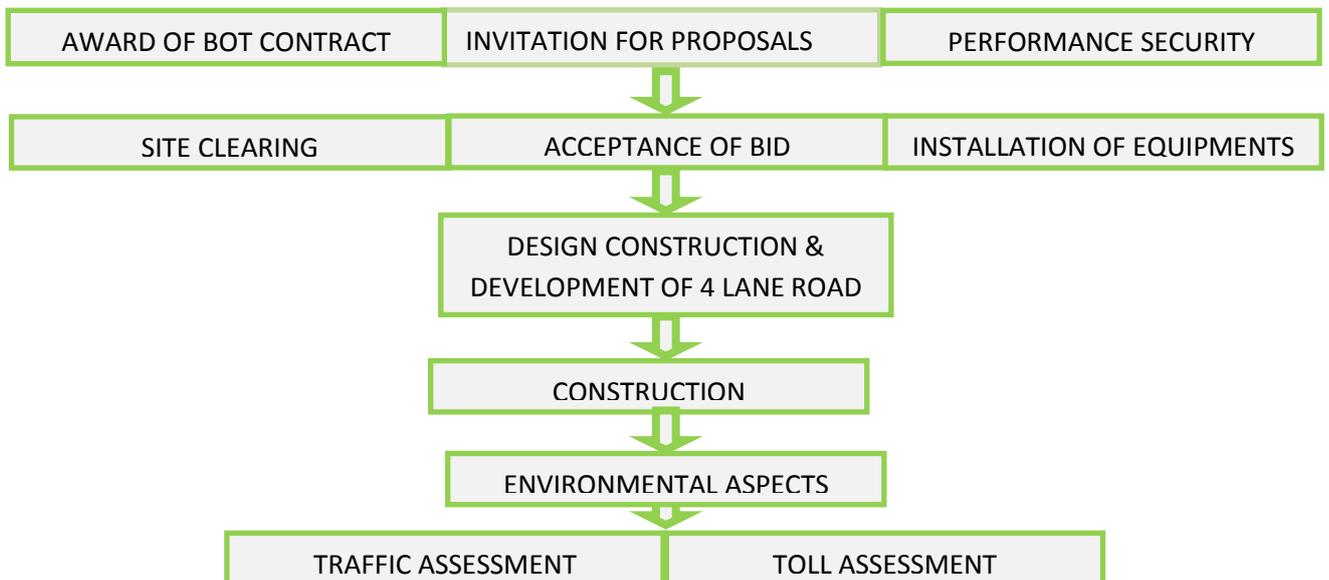


Figure 3: Bar Chart Analysis of Average Annual Daily Traffic.

- The project manager should collect the information to choose between feasible responses to each risk identified during qualitative analysis. There are two types of response to a risk immediate and contingency.
 - Immediate response*-An alteration to the project plan such that the identified risk is mitigated or eliminated.
 - Contingency response*-A provision in the project plan for a course of action that will only be implemented should the adverse consequences of the identified risk materialize.
- Responses to risk can do one or combination of five things:
 - Remove*-Risk that can be eliminated from the project and therefore no longer propose a threat.
 - Reduce*- Risks that can be decreased by taking certain actions immediately.
 - Avoid*- Risks that can be mitigated by taking contingency actions.
 - Transfer*-Risks can be passed onto other parties.
 - Acceptance*-The benefits that can be gained from taking the risk should be balanced against the penalties.
- Risk models should be often calculated using Monte Carlo methods, a technique involving random sampling, so that risk identification will be effective and respective measures can be taken. Risk management should be introduced at institutional levels and organisations should be investing in training engineering and construction staff on risk assessment implement, so that uncertain risk factors will reduced.
 - The responsible managers must understand the risk faces by the organization. The following flow chart shown in Figure 4 shows the necessary activities for risk planning.



The risk planning activities includes Invitation for proposals following by the award of BOT contract and the acceptance of bid with a performance security. After the acceptance of bid and other paper work the design construction takes place. Where design of each and every component of road is done. After the designing site clearance takes place and construction of road is started. During the construction activity environmental aspects is taken into consideration. Finally the traffic and toll assessment of the vehicles is done to record the traffic and funds raised.

5. CONCLUSION

It was found from the case study that the flow chart of the different activity for better planning of risk management is necessary. Effective risk management process encourages the construction companies to identify and mitigate the risks and later if those risks managed effectively they can efficiently enjoy financial savings, and greater productivity, improved success rates of new projects and better decision making. The risk management in any construction project is very essential. It identifies the factors that cause uncertain risks in a construction project and a possible process of mitigating them. The research shows that the IVRCL construction company differs from other construction companies in adoption of risk management practices.

REFERENCES

- [1]. Dr.Haitham H.Al-Shibly, Dr.Basem M.Louzi, Mohammad A.Hiassat, The impact of risk management on construction projects success from the employees perspective, *Interdisciplinary Journal of Contemporary Research in Business*,5(4), 2013,13-14.
- [2]. Leslie Edwards, Practical risk management in the construction industry (*Thomas Telford Publications, Thomas Telford Services Ltd, 1 Heron Quay, London E14 4JD*, 1995).
- [3]. Nicholas Chileshe, Awotunde, Gabriel Babajide, An evaluation of risk impacting highway and road construction projects in Nigeria, *Research gate*, 2010, 7-8.
- [4]. Shuaibu Saminu, Raj Prasad, V.Thamiasaru, A study of various factors affecting risk management techniques in construction project:A case study of India, *International Journal of Research in Engineering and Technology*,04(03),2015,591.
- [5]. www.wikipedia.com
- [6]. www.google.com
- [7]. Project information memorandum, *IVRCL Infrastructures and Projects Ltd*.