

Risk Management in Metro Rail Construction

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ABSTRACT

This project deals with a method of measurement of project risk in metro construction. Project risk management primarily comprises cost and schedule uncertainties and risks associated with each activity of the project network. We have identified the major risk sources and quantified the risks in terms of likelihood, impact and severity in a complex infrastructure project for the construction of metro railways. A case study on Badarpur to Ballabhgarh corridor in the National capital Region MRTS phase -3 of DMRC has been considered for this project work. The methodology for this work is based on the response extracted from the experts who were associated and involved in this metro railway projects. Managing risk and safety are critical activities in the increasingly complex metro rail environment. Demonstrating that risk and safety have been managed effectively is increasingly important in many rail regulatory regimes. Developing organization's competence in these areas will allow to improve the way risk and safety is managed within organization or projects, and also helps to meet regulatory and contractual requirements in an efficient and effective way.

INTRODUCTION

Risk management is an essential and integral part of project management in major construction projects. For an infrastructure project, risk management can be carried out effectively by investigating and identifying the sources of risks associated with each activity of the project. These risks can be assessed or measured in terms of likelihood and impact. The major activities in metro construction consist of feasibility studies, design, traffic diversion, utility diversion, survey works, piling works, precast segment works, launching of girders and segments, soil and rock excavation, construction decks, steel struts, rock anchors, sub-floor drainage, other services works, waterproofing, permanent structure works, mechanical and electrical installations, backfilling and restoration works.

Pile Construction process using piling rig machine Pile cap Construction



Fig 1: Pile cap Construction





Fig 2: Pile Construction process using piling rig machine

Crane



Fig 3: Metro U-girders launching process using Tandem lifting

LITERATURE SURVEY

Risk can be defined as a measure of the probability, severity and exposure to all hazards foran activity (Jannadi and Almishari, 2003). For an infrastructure project there is always achance that things will not turn out exactly as planned. Thus project risk pertains to the probability of uncertainties of the technical, schedule and cost outcomes.



Williams, Walker and Dorofee (1997) worked on developing methods by which riskmanagement could be put into practice. Their methods were based on software intensiveprograms (SEI) along with which specific road maps were designed. These could guide andhelp identify various risk management methods which could be easily put into practice.Complex projects like the construction of an underground corridor for metro rail operationsinvolve risks in all the phases of the project starting from the feasibility phase to theoperational phase. These risks have a direct impact on the project schedule, cost andperformance. Reilly (2005), Reilly and Brown (2004), Sinfield and Einstein (1998) carried outtheir research on underground tunnel projects. Reilly and Brown (2004) state thatinfrastructure underground projects are inherently complex projects with many variablesincluding uncertain and variable ground conditions. As per Reilly (2005), for a complexinfrastructure project like underground construction, it is very important to identify the riskevents in the early phases of the project. A proper risk mitigation plan, if developed foridentified risks, would ensure better and smoother achievement of project goals within thespecified time, cost and quality parameters. Further, it would also ensure better constructionsafety throughout the execution and operational phase of the project.

Mulholand and Christan (1999) explain that due to the complexity and dynamic environments of construction projects, certain circumstances are created which result in a high degree of uncertainty and risk. Often these risks are compounded by demanding time constraints. Dey (2001) developed an Integrated Project Management Model for the Indian petroleum industry where he incorporated risk management into the conventional project management model and cited it as an integral component of project management. But Dey (2001) carried out the riskanalysis by finding out the respective likelihoods of the identified risks which were found to have a summation of 1 for the respective work packages on a local percentage (LP) basis.

The summation of the likelihoods of all the concerned work packages was found to be equal to 1 on a global percentage (GP) basis. Nehru and Vaid (2003) carried out the risk analysis with similar concepts. As per Roetzheim (1988) as quoted by Nicholas (2007), the likelihood of the identified risks can have a value ranging from 0 to 1, which indicates a 0% or a 100% chance of occurrence. But the weightage associated with all risk sources for a work package / activity is always equal to 1. The product of the likelihood and the respective weightages is equal to the cumulative likelihood factor (CLF).

Dey and Ogunlana (2002) describe that conventional project management techniques are not always sufficient to ensure time, cost and quality achievement of a large scale construction project, which may be mainly due to changes in scope and design, changes in government policies and regulations, unforeseen inflation, underestimation and improper estimation. Such projects which are exposed to such risks and uncertainties can be effectively managed with the application of risk management throughout the projects' life cycle. Dey (2002) developed a tool for risk analysis, also through the analytic hierarchy process (AHP) which is a multiple attribute decision making technique and decision tree approach. Rahman and Kumaraswamy (2002) carried out their research on joint risk management (JRM).

Moreover, they generally preferred to assign reduced risks from either one or both contrasting parties to JRM, rather than shifting more risks to the other party. This is indicative of the fact that more collaborative effort and team based work can reduce the risk component of a project. Jannadi and Almishari (2003) developed a risk assessor model (RAM) for assessing the risk associated with a particular activity and tried to find out a justification factor for the proposed remedialmeasure for risk mitigation. Ward and Chapman (2003) in their research work made anargument indicating that all current project risk management processes induce a restrictedfocus on the management of project uncertainty. Zoysa and Russel (2003) developed a knowledge based approach for risk management. According to them effective risk management is a function in the successful planning and execution of large infrastructure projects.

PROJECT BACKGROUND

Objective:

- To identify risks involved during the metro construction project.
- To identify the major RF in metro project through questionnaire survey.
- To prepare a model which will serve as guideline and explain how various risks can be entered and managed.
- To create an efficient risk management system in the metro project.





Risk Matrix





Consequence Descriptions	
(The highest category will always be u	sed)

VALUE	Result of Hazard to Personnel	Result of Hazard to Assets / Progress
5	Single or multiple Fatality	Catastrophic Damages, Critical Delay
4	Serious Injury requiring hospitalisation	Major Damages, Serious Delay
3	Lost Time Accident	Serious Damage, Moderate Delay
2	Injury requiring Medical Treatment but not Lost Time	Moderate Damage, Minor Delay
1	First Aid treatment only	Minor Damage, No Delay

FUTURE SCOPE

There is a huge scope for the construction of metro rails in India as it is a second most populous country and foremost developing country in the world. In every work there will be certain amount of risk especially in infrastructure projects there will be more number of risks and uncertainties because of its scope and cost. This study shall involve the unstructured interview method as the construction scope is large which completes the overview of the risk management analysis in the metro upcoming prokects. This study shall focus on how the construction industry is taking the care of risk management in infrastructure projects. As every coin has two sides, risk is also having two sides negative and positive. This study shall reveal how the risk management analysis has to be done and how they are affecting the project. The study of Risk management analysis is an on-going research work in order to identify the new strategies to implement effectively in the construction industry especially for the infrastructure projects as the scope and the cost overruns are huge.

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