

A STUDY ON CRITICAL RISK ASSESSMENT AND SAFETY MANAGEMENT FOR A HIGH RISE BUILDING

Ms. S. JANANI¹, A. BALKIS²

¹Assistant Professor, Department of Civil Engineering, RVS Technical Campus, Coimbatore-600025, India.

²PG student, Department of Civil Engineering, RVS Technical Campus, Coimbatore-600025, India.

Abstract - High-rise structures are also called “vertical cities”, having the potential to decongest urban sprawl. Indian cities are witnessing immense demographic expansion due to migration from surrounding villages, leading to urban sprawl, housing demand, rise in cost of land. Housing has developed into an economy generating industry. The construction projects are one of the most important one which plays a vital role in development of the country. It is estimated that the High-rise (or) multi storey buildings are the most important part of the construction for the greater development. Given this demand, while high-rise residential structures have become a solution in the metropolitan cities, they remain eluded in tier II cities in India. Low-rise or mid-rise high-density dwelling types have developed in these cities. . Construction risks can be minimized only when their cause are identified. The objective of this study was to study the risk assessment in the construction of high rise buildings. This study was carried out based on literature review. Most of the high-rise projects remain as proposals. An investigation in this case study reveal that high rise structures are not preferred due to user perception of insecurity in case of fire and high cost of the building. The paper aims at studying the availability and use of fly ash in various proportions, which can be used in Indian high-rise residential.

- ✓ Lack of meticulous planning at the design stage
- ✓ Lack of co-ordination of specialist design work
- ✓ Late clarification of complex details

Additionally on civil engineering works there are many cases where changes and new rates are necessary because of the nature of the ground. Further more changes may occur due to the client’s desire to incorporate the latest technology into the project which will led to deviations of time.

1.1 Aim

The aim of this study is

- To analyze the risk assessment and safety management in the construction of high rise buildings
- Comparing the various techniques of risk assessment and identifying better solution.
- Reducing both the Cost of Project and safety measures.

1.2 Objectives

The main objectives of this study are:

- To identify the different types of Constructions risks occurring during the Construction of high rise buildings.
- To provide a better provision for safety management.

1.3 Need Of This Project

The normal storied buildings and high rise buildings are very different. So, the activities involved starting from the planning stage will impact the completion of the project. It will require planning of urban infrastructure around the structure. A detailed planning will be required for the building services and utilities in all the stages of construction. The safety requirements, the management requirement all increases drastically. Other factors that favour this are:

1. Rapidly growing urban population that increased demand for tall buildings

1. INTRODUCTION

Risk management is a technique which is used in many other industries from, IT related to business, automobile, pharmaceutical industry, to the construction sector. Risks and uncertainties inherent in the construction industry are more than any other industries. Many industries have become more proactive about using risk management techniques in project. However, with respect to the construction industry, the same is not used commonly. Risk is an integral component of any project. If risks are not properly analyzed and strategies are not trained to deal with them, the project is likely to lead to failures. In practice, these new rates would often be valued after the work was executed based on the actual costs. There are number of reason for the introduction of changes on construction works including:

- ✓ Inadequate briefing from the client
- ✓ Inconsistent and late instructions from the client
- ✓ Incomplete design

2. At the expense of quality of life, the human factors being neglected.
3. To establish priorities for new research in this particular field.
4. The professionals must have the new information on high-rise buildings.

Above points justify considering high rise building construction management different than the normal.

2. RISK MANAGEMENT

Risk is defined as an exposure to the consequences of uncertainty. Risk is usually considered as an unwanted event that can be identified and quantified through its impact and probability of occurrence. The classical definition of risk states that

Risk = Probability x Impact

- A probability of occurrence of that event.
- Impact of the event occurring (Magnitude of amount loss/gain).

A project risk uncertain event (or) condition that, if it occurs, has a positive or a negative effect on at least one project objective. A risk may have one or more causes and, if it occurs, one or more impacts which are inevitable in projects and because of this uncertainty influence project performance. In which the chance of something happening that will have an impact upon project objectives. Traditional methods of coping with project risks and uncertainties mainly consist of establishing a contingency budget which is estimated as a percentage of the various project components. This method of calculating contingencies for risk has a low level of confidence and reliability. Probabilistic risk assessment techniques can provide an analytical basis for establishing contingency budgets by modeling the impact of risk factors using data ranges. The goal of risk assessment and risk management is to minimize cost overruns and scheduling problems. It has been shown that cost overruns are positively related to project size, engineering uncertainty, inflation, project scope increase, the length of time between planning and completion of a project, delays, and the inexperience of administrative personnel. Many systems exist for categorizing risks into different categories but the one presented here is fairly simple.

2.1 Risk Management Cycle

Risk management (RM) is a concept which is used in all industries, from IT related business, automobile or pharmaceutical industry, to the construction sector. Each industry has developed their own RM standards, but the general ideas of the concept usually remain the same regardless of the sector. According to the Project Management Institute (PMI) (2004), project risk

management is one of the nine most critical parts of project commissioning. This indicates a strong relationship between managing risks and a project success. While RM is described as the most difficult area within construction management (Winch, 2002; Potts 2008) its application is promoted in all projects in order to avoid negative consequences (Potts, 2008).

One concept which is widely used within the field of RM is called the risk management process (RMP) and consists of four main steps: identification, assessment, taking action and monitoring the risks (Cooper et al., 2005). In each of these steps, there are a number of methods and techniques which facilitate handling the risks.

Each activity or process, regardless of the area of business domain, has a beginning and an end. Similar concepts are used in the engineering world to systemize projects over time. The term project life cycle is used as a management tool to improve a project's performance. The scope of life cycles differs among industries and diverse terminology with a various number of phases is used depending on the sectors. However, several terms are often used within one particular sector even though a number of phases can vary (Smith et al., 2006). Therefore, it is difficult to systemize and provide one common scope and definition of a project life cycle.

Smith et al. (2006) concluded that various forms of PLC frameworks described in the literature are a result of variety of project types. For construction projects, for instance, the PLC model can consist of eight succeeding phases including pre-feasibility, feasibility, design, contract/procurement, implementation, commissioning, handover and operation (Smith et al., 2006). In contrast, Pinto and Prescott (1988) present a four stage PLC developed by Adams and Brandt, and King and Cleland as the most widely used framework, where conceptualization, planning, execution and termination are the main phases.

A similar model is used by Westland (2006) who identifies initiation, planning, execution and closure as principal project steps.

3. LITERATURE REVIEW

- Hanish Verma, Neha Verma, "A Study on Risk Assessment and Safety Management in the Construction of High-Rise Buildings(2017)" in International Journal of Engineering Development and Research States that

Brain storming:

This is one of the most popular techniques. Generally, it is used for idea generation; it is also very

useful for risk identification. All relevant persons associated with project gather at one place. There is one facilitator who is briefing about various aspects with the participants and then after note down the factors. Before closing it the facilitator review the factors eliminate the unnecessary ones.

Delphi technique:

This technique is similar to brainstorming but the participants in this do not know each other and they are not at the same place. They will identify the factors without consulting other participants. The facilitator like in brain storming sums up the identified factors.

Interview /expert opinion:

Experts or personnel with sufficient experience in a project can be a great help in avoiding/solving similar problems over and over again. All the participants or the relevant persons in the project can be interviewed for the identification of factors affecting risk.

Past experience:

Past experience from the same kind of project, the analogy can be formed for identification of the factors. When comparing the characteristics of projects will provide insight about the common factors.

Check lists:

These are simple but very useful predetermined lists of factors that are possible for the project. The check list which contains a list of the risks identified in projects undertaken in the past and the responses to those risks provides a head start in risk identification.

Influence diagram:

It is a graphical representation containing nodes representing the decision variables of a problem. A traditional influence diagram is formed by three types of nodes: utility, decision and informational. The causal relationship occurs between utility

- **Syed Hossein Abedian Kalkhoran, Gholamali Liravi, Fereshte Rezagholi Risk Management in Construction Projects(2014)** in **International Journal of Engineering Trends and Technology** states Risk is involved in every business and construction industry is no exception. Risk in terms of safety, economy and timely completion are more crucial for a project to be a successful one. Indian construction industry is worth about \$100 billion and this could grow considerably driven by major projects across the country. The demand for infrastructure is going to be in great volume in the coming future. Use of modern construction

equipments and techniques has accelerated the growth. As the industry grows the associated risk also grows. Risk management in construction is one important area that needs attention for successful completion of the project. A risk free project is one that results in a zero dispute situation so that there is a reasonable profit for the parties involved in a project. A well-drafted, balanced contract with a proper administration can mitigate exposure to risk and keep the project on track. Construction Managers need to know how to balance the contingencies of risk with their specific contractual, financial and organizational requirements. In order to achieve this balance, proper Risk identification and Risk analysis is required.

The objective of the paper is to study the aspects that are more vital for the success of the project and highlight those pitfalls that increase the risk of the project. It is also attempted to arrive at some suggestions by referring to various cases and their judgments delivered in the past.

- In **Anandhababu S., Vinoth M., Visagavel.K Understanding the A Study On Risk Assessment In Construction Project Of An Educational Institution (2014)** **International Journal of Research in Engineering and Technology** states The risk involved in the construction works is relatively higher than the other works. The biggest challenge is to reduce the risks involved. Risk assessments include identifying risks, analyzing risk and controlling risk qualitatively by various methods. In this study, the Questionnaire checklist method is used to identifying the risk in the construction work, at an educational institution. Based on this, risk assessment is made to control the risks. Checklist analysis is the methodology used for this study. Detailed checklist has been prepared as per the construction work at the educational institution. Checklist analysis has been found to be simple and cost effective analysis, which can provide reasonable results. The checklist is prepared by dividing the whole work into 10 categories. It helps in detailed examination and analysis of the hazard and there by risk identification and risk assessment. The checklist is divided into Excavations and Trenches, Scaffolding, Electricity and Lighting, Machinery and Equipment, Fire safety, Physical Hazards, Chemical Hazards, Psychosocial stress factors, First Aid and Emergency preparedness and Personal Protective Equipment (PPE). Data is collected by direct survey by using the prepared checklist, which provided a better picture of the hazards and risks.
- **Kinnaresh Patel, A Study on Risk Assessment and Its Management in India(2013)** states all of the most challenging construction projects worldwide

involve a variety of complex processes working simultaneously. Managing these processes can be quite a challenge for the management. A big part of meeting these challenges is mitigating the RISKS involved. Risk management includes identifying risks, assessing risks either quantitatively or qualitatively, choosing the appropriate method for handling risks, and then monitoring and documenting risks. This study identifies the procedures for risk identification, management and its perception from the Indian construction industry players. Time and cost management need to be fully integrated with the identification process. Time constraints and project managers with sufficient experience are critical when identifying the level of risk for large and/or complex projects. The aim of this study is to advocate for a method of risk mitigation which includes a well-documented procedure which serves as a one stop-solution to all the risks that would emanate in the future.

- **S. M. Renuka, C. Umarani, S. Kamal A Review on Critical Risk Factors in the Life Cycle of Construction Projects(2014)** In any country, infrastructure development will increase the growth of countries economy and generates the large amount of job opportunities. Hence those projects involve a large amount of investment to carry out. In view of that, if any sort of wastage (either time, resources etc) occurs that would lead to the huge monetary losses. These losses occur due to various risks associated with such mega projects. Consequently, these risks play a crucial role for the completion of project within the time schedule and planned budget. In this connection, this study mainly discusses the critical risk factors and its assessment techniques through comparative study of various international construction projects. About 50 relevant articles published over the last 25 years have been reviewed. The review resulted that a simple analytical tool will be developed for each project task to assess the risk easily and quickly, which will encourage the practitioners to do the risk analysis in their project. This review concluded that the earlier risk identification in the project and assessment during the bidding stage of the construction project will lead to the better estimation of the escalation on cost and time overrun. Such risk assessments help to include in the budget and scheduling for the successful completion of the project.
- In **Mr. Satish K. Kamane, Mr. Sandip A. Mahadik Risk Management in Construction Industry** states Construction projects are characterized as very complex projects, where uncertainty comes from various sources. Construction projects gather together hundreds of stakeholders, which makes it difficult to study a network as a whole. But at the

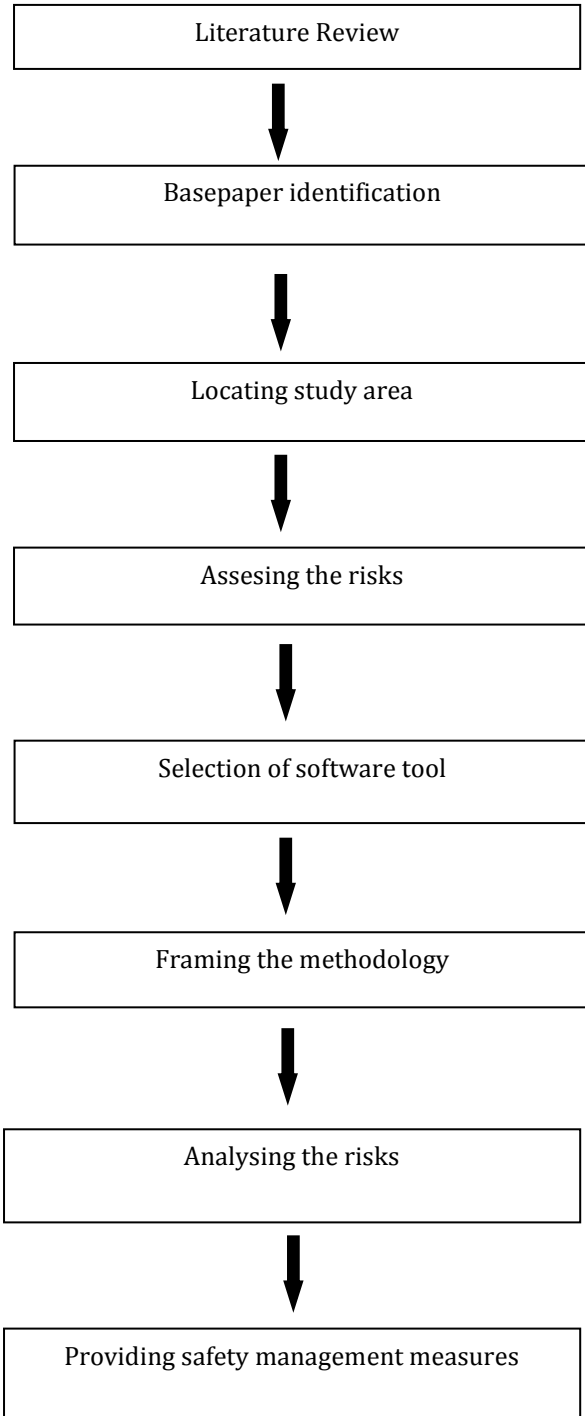
same time, these projects offer an ideal environment for network and risk management research. Additionally, construction projects are frequently used in management research, and several different tools and techniques have already been developed and especially for this type of project. However, there is a gap between risk management techniques and their practical application by construction contractor. This paper deals with the identification of risk by different methods, types of risks associated with construction project and different risk mitigation techniques.

- In **K. Jayasudha Dr. B.Vidivelli E.R. Gokul Surjith Risk Assessment and Management in Construction Projects** states that Construction of bridge projects are initiated in complex and dynamic problems resulting in circumstances of high uncertainty and risk, which are compounded by demanding time and cost constrains. The general methodology is to study relies largely on the survey questionnaire which will be collect from the various bridge project construction contractors and project manager of different sizes by mail or personnel meeting. The questionnaire prepared for the survey was formulated by seeing the relevant literatures in the area of construction management. This research seeks to identify the risk factors that affect the performance of bridge projects as a whole and analyze by using appropriate tools and technique and to develop a risk management framework. The responses were analyzed like bar charts were subjected to using the software of SPSS. This questionnaire has been divided in to two factors namely time and finance management. The 25 number of companies related to bridge projects industries. For these factors analysis of t-test and ANOVA were calculated, tabulated and the result are given according to the suitable suggestions.
- **Akintola S Akintoye, Malcolm J MacLeod Risk analysis and management in construction** states that The paper describes, on the basis of a questionnaire survey of general contractors and project management practices, the construction industry's perception of risk associated with its activities and the extent to which the industry uses risk analysis and management techniques. It concludes that risk management is essential to construction activities in minimizing losses and enhancing profitability. Construction risk is generally perceived as events that influence project objectives of cost, time and quality. Risk analysis and management in construction depend mainly on intuition, judgement and experience. Formal risk analysis and management techniques are rarely used due to a lack of knowledge and to doubts on the

suitability of these techniques for construction industry activities.

4. METHODOLOGY

4.1 Flow Chart



5. CONCLUSION

The Risk factors has been assesed from the above literature study and then the risk factors are grouped into different categories and then the probability of the risk factors has been calculated by the Risky project Pro. The reliability of the risk factors has been calculated by the Risky project Pro. Then the Safety measures for that risk factors has been determined and the results and discussions are determined among the above process.

- Assesing The Risks
- Selection Of Software Tool
- Analysing The Risks
- Providing Safety Management Measures

The above literature study denotes the risks occurred in the construction industry thus the risks causes the different impacts on completion of the project. In Phase-I the literatures are collected and the detailed study has been completed. The further process in the project are carried out in the future. The future study is based among the tool named "Risky Project Pro". The schedule has been done in the MS-Project, then the tool has been used for the further process.

REFERENCES

1. kansal,r.k (2012) "risk assessment methods and application in construction projects" international journal of modern engineering research .
2. Kolhatkar, M. J, Dutta, Er. A.B, (2013) "Study of Risk in Construction Projects", international journal of modern engineering research.
3. Kinnaresh Patel, M.E. (C.E.M.), (2013) "A study on risk assessment and its management in India",
4. Ling ,F. Y. Y. and Hoi ,L. , 2006. "Risks faced by Singapore firms when taking construction projects in India".
5. Mehmood Alam, Dr. Nadeem Ehsan, Ebtisam Mirza, Azam Ishaque, (2010) „Risk Management in construction industry“,
6. Pardhi. Dilesh, Patil AnandKumar, Thesis (2008) „Risk Management in BOT Projects“.