

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

Risk Assessment and Safety Management in the Construction Industry

Dr. Prof. Ajit Patil, Kiran Phad, Pravin Wajirgave, Subhash Kumar, Nikita Ahirrao

Department of Civil engineering, MIT college of Engineering, Pune, 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 and a questionnaire survey. 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 buildings.

KEYWORDS: High-rise residential buildings, Safety management, Risk analysis.

I. INTRODUCTION

The statistics from Indian Government says that the area of the country is about 3,287,590 sq.km and the population about 1,250,193,422. This makes land resource very precious to the India. A high-rise structure can provide space and work for people in such a case. A high-rise is just a tall structure. They first became possible due to the invention of the elevator and a cheap building material. Reinforced concrete and steel are used for their structural system. Steel Frames are used for most American style skyscrapers and concrete for residential tower blocks. Construction projects are always unique and risks raises from a number of different sources. Risk is defined as any action or occurrence which will affect the achievement of project objectives. 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.

1. *Inconsistent and late instructions from the client*
2. *Incomplete design*
3. *Lack of meticulous planning at the design stage*
4. *Lack of co-ordination of specialist design work*

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

5. 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. Furthermore changes may occur due to the clients desire to incorporate the latest technology into the project which will led to deviations of time.

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.

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

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. In this system each risk item is qualified on two scales likelihood and impact. Each scale is divided into two categories of "low" (or) "high" and risks are rated according to each scale.

Risks and other uncertainties can cause losses, which lead to increased costs and time delays, during the currency of projects and at their end. The need to prevent failures in the construction process and other losses relating to projects has been highlighted many times over the years and figures strongly in a recent major report.

II. OBJECTIVES

To determine the most suitable technique for high rise development by studying various techniques, comparing them, analyzing them and determining best way to manage the project along with cost efficiency. 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.

III. NEED OF THE STUDY

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 favor this are:

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

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

IV. REVIEW OF LITERATURE

Roozbeh kangari (1995) discussed the attitude of large U.S construction firms toward risk and determined how the contractors conduct construction risk management through a survey of the top 100 contractors. The study showed that in the recent years contractors are more willing to assume risks that accompany contractual and legal problem in the form of risk sharing with the owner. The survey also found that contractors assume the risk associated with actual quantities toward the practice of defensive engineering is determined.

Akintola S Akintoye and Malcolm J MacLeod (1997) studied the construction industry's perception of risk associated with its activities and the extent to which the industry uses risk analysis and management techniques with the help of a questionnaire survey of general contractors and project managers. The authors concluded 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, judgment 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.

Shen L Y (1997) identified the most serious project delay risks and the effective actions for managing these risks. Practitioners' risk management actions and their effectiveness have been investigated through a questionnaire survey. It revealed that methods where practitioners' experience and subjective judgment are used are the most effective and important risk management action, and that methods using quantitative analytical techniques have been rarely used due to limited understanding and experience. The findings also suggest a need to promote the application and awareness of various analytical techniques for risk management in a proper context in the Hong Kong construction industry.

Thomas E Uher and A Ray Toakley (1999) studied the use of risk management in the conceptual phase of the construction project development cycle in the Australian construction industry through a survey. It was found that while most respondents were familiar with risk management; its application in the conceptual phase was relatively low, even though individuals were willing to embrace change.

Li Bing and Robert L. K. Tiong (1999) based on their study categorized the risk factors and their mitigating measures, the most effective risk mitigating measures were categorized into eight groups. Those are partner selection, agreement, employment, control, subcontracting, engineering contract, good relationship, and renegotiation. They proposed a risk management model incorporating measures. Three cases of international construction JVs were analyzed from the perspectives of the execution of these measures.

Li Bing et al (1999) identified the risk factors associated with international construction joint ventures (JVs) from an "integrated" perspective. The risk factors were grouped into three main groups: (1) Internal; (2) Project-specific; and (3) External. The study examined the most effective mitigating measures adopted by construction professionals in managing these risks for their construction projects in East Asia. Based on an international survey of contractors, it was found that the most critical risk factors exist in the financial aspects of JVs, government policies, economic conditions, and project relationship. When entering a foreign construction market in the form of a JV, a foreign construction company could reduce its risks if it would carefully select its local partner, ensure that a good JV agreement is drafted, choose the right staff and subcontractors, establish good project relationships, and secure a fair construction contract with its client.

Mulholland and Christian (1999) made a model in a systematic way to consider and quantify uncertainty in construction schedules. The study focused on lessons learned from past projects and describes a risk assessment process involving typical inputs and expected outputs. The model incorporates knowledge and experience acquired from many experts, project-specific information, decision analysis techniques, and a

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

mathematical model to estimate the amount of risk in a construction schedule at the initiation of a project. The model provides the means for sensitivity analyses for different outcomes wherein the effect of critical and significant risk factors can be evaluated.

Shou Qing Wang (1999) conducted an international survey on risk management of BOT projects in China. The overall objectives of the survey are (1) to identify the unique or critical risks associated with China's BOT projects; (2) to evaluate the effectiveness of measures for mitigating these risks; (3) to examine the key contract clauses used in Laibin B's concession agreement; and (4) to provide a risk management framework for investing in future BOT projects in China. The study discussed the adequacy of key contract clauses in Laibin B's concession agreement related to the political and force majeure risks in China, from the perspective of foreign developers, lawyers, and lenders. The contract clauses discussed include changes in law, corruption, delay in approval, expropriation, and force majeure.

Sudong Ye and Robert L. K. Tiong (2000) formed a systematic classification of existing evaluation methods developed a new method—the net-present-value-at-risk (NPV-at-risk) method—by combining the weighted average cost of capital and dual risk-return methods. The evaluation of two hypothetical power projects showed that the NPV-at-risk method can provide a better decision for risk evaluation of, and investment in, privately financed infrastructure projects.

Shou Qing Wang (2000) based on their survey on risk management of build-operate-transfer (BOT) projects in developing countries, with emphasis on infrastructure projects in China, discussed specifically the criticality of the political and force majeure risks. Based on the survey, critical risks, in descending order of criticality, were identified: Chinese Parties' reliability and credit worthiness, change in law, force majeure, delay in approval, expropriation, and corruption. The measures for mitigating each of these risks are also discussed.

Makarand Hastak and Aury Shake (2000) developed a risk assessment model for international construction projects named ICRAM-1. The paper discusses some of the existing models for country risk assessment, presents potential risk indicators at the macro, market, and project levels, and explains the ICRAM-1 methodology through an applied example. Four main results are obtained from the ICRAM-1 analysis: (1) High-risk indicators; (2) impact of country environment on a specific project; (3) impact of market environment on a specific project; and (4) overall project risk.

Hastak and Shaked (2000) in their study classified all risks specific to whole construction scenario into three broad levels, i.e. country, market and project levels. Macroeconomic stability is partly linked to the stance of fiscal and monetary policy, and to a country's vulnerability to economic shocks. Construction market level risks, for a foreign firm, include technological advantage over local competitors, availability of construction resources, complexity of regulatory processes, and attitude of local and foreign governments towards the construction industry while project level risks are specific to construction sites and include logistic constraints, improper design, site safety, improper quality control and environmental protection, etc.

Artem Aleshin (2001) studied the problem of risk management of international and joint venture projects with foreign co-operation in Russia. The author identified classified and assessed risks inherent to joint venture projects in Russia and practical recommendation for risk management.

Shen et al (2001) based on their survey, established a risk significance index to show the relative significance among the risks associated with the joint ventures in the Chinese construction procurement practice. Real cases were examined to show the risk environment faced by joint ventures.

Nabil A.Kartam and SaiedA.Kartam (2001) based of a questionnaire survey found that contractors show more willingness to accept risks that are contractual and legal related rather than other types of risks. Their

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

research also indicated that the application of formal risk analysis techniques is limited in the Kuwaiti construction industry.

Prashant Kapila¹ and Chris Hendrickson (2001) they identified the financial risk factors associated with international construction ventures from an integrated perspective. They examined the most effective mitigation measures adopted by construction professionals in managing these risks for their construction projects and suggests other means of risk aversion.

Tarek M. Zayed (2002) made a BOT risk prototype evaluation model that provides a logical, reliable, and consistent procedure for assessing the BOT project risk. The proposed model introduced the BOT risk index (F), which relied on the actual performance of eight main BOT risk areas. Two different modeling approaches were used in constructing this index: a new developed and an adapted Dias and Ioannou model.

Darrin and Mervyn K Lewis (2002) analysed the principles involved, on practical experience of evaluating projects to form a framework for assessing the risk, with a help of waste water treatment facility in Scotland as a case study which is a typical PPP project.

Motiar rahman.M and Mohan.M.Kumaraswamy (2002) developed a basic model which conceptualized for improved project delivery through Joint risk management through a survey conducted in Hong Kong and with a case study in mainland China.

V. PROPOSED WORK

Development of new technology occurs based upon necessity, and the technology evolves towards enhanced efficiency. The development of braced frame structures to produce more rentable spaces in dense urban lands by constructing tall buildings in the past and their evolutionary paths up to the present towards even taller and more efficient structures to maximize land uses more economically are within this track. Tall buildings, which began from with 10-story office towers in the late nineteenth century, have evolved to mega structures like the Burj Dubai, which is over 150 stories and will be the tallest building in the world at the time of its completion in 2009.

There continues to be a need for building upward. Populations worldwide have grown rapidly, and migration of populations from rural areas to urban, has resulted in high-density mega cities. Denser cities with mega structures are more efficient in terms of energy consumption and land use. By making a city smaller and denser, the power grid becomes smaller, making the transfer of electrical energy more efficient. The need for automobile transportation declines as well as the need for personal transportation, which is a large contributor to the problems of efficient energy consumption and pollution. By creating denser cities with tall buildings, more natural green areas can be saved globally. However, compactness will result in crowding and hence a balance must be struck.

VI. METHODOLOGY

1. RISK IDENTIFICATION TECHNIQUES

Risk Identification can be done by the following methods:

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.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

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 .

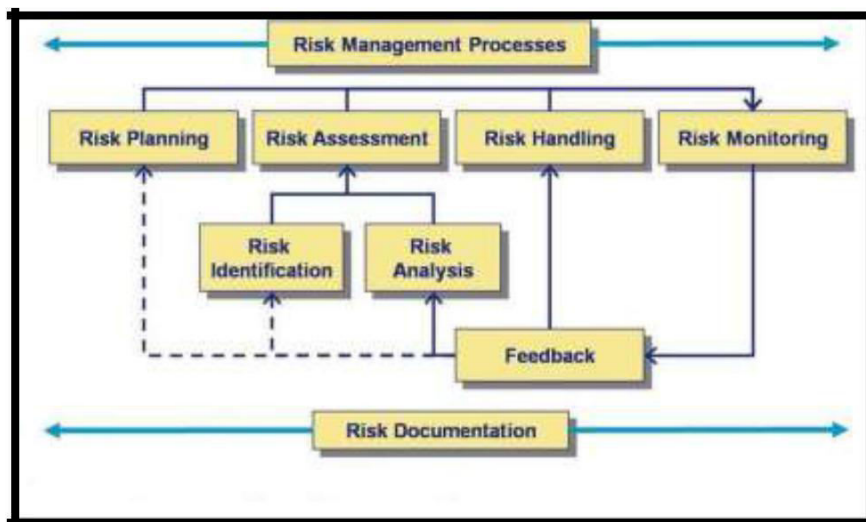


Fig.1 Risk Management Process

2. Safety in design and construction – Necessity or luxury?

In many countries, concept of safety is still not part of the professionals' imperative. There is also the deeply ingrained feeling myth that safety concerns will lead to greater cost and reduced productivity.

Over the last few decades, it has been proved that safety evaluation and control save money provided, professionals place worker injury and death at the top of their list. Otherwise, it may become (and remain) a legal necessity and an industry statistic. The truth however is that investment in safety is like planting a tree close to the compound wall: The fruit will be slow in coming, not immediate; and the branches will grow beyond the property, not just one-on-one. Which should be quite acceptable for the industry and the nation.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

2.1 When design intervention is effective

Current philosophy is to integrate all the activities over the life span of a structure: Planning, design (and drafting), construction, use and maintenance, and decommissioning. It can be shown that over the life cycle of a structure, implementation of safety is easiest and least expensive at the concept stage, and most difficult and expensive after the construction stage. (Fig. 2.) Thus the designer is an early player, and must be an integral part of the life cycle!

2.2 Barriers to designing for safety

Incorporation of safety into design will not be easy however. Many obstacles will slow down the process or wipe it out. Some of the barriers, apart from the cost at front end are:

- Fear of liability
- Designers' lack of safety expertise
- Designers' lack of understanding of construction processes
- Increase in professional fees
- Rigid contract terms (– Presently forbidding designer intervention, in some codes!)
- All barriers would of course have to be overcome, if people are to have a safe high-rise building.

3. REALISTIC MODELING

(a) Centre-line modeling:

Modelling of eccentricity, step, and haunch in structures with large-size members is often done in ad-hoc manner, taking the easy way out by neglecting what is perceived to be insignificant variations along the Centre lines. Consequences, while generally minor, may become cumulatively adverse. (Fig. 3.)

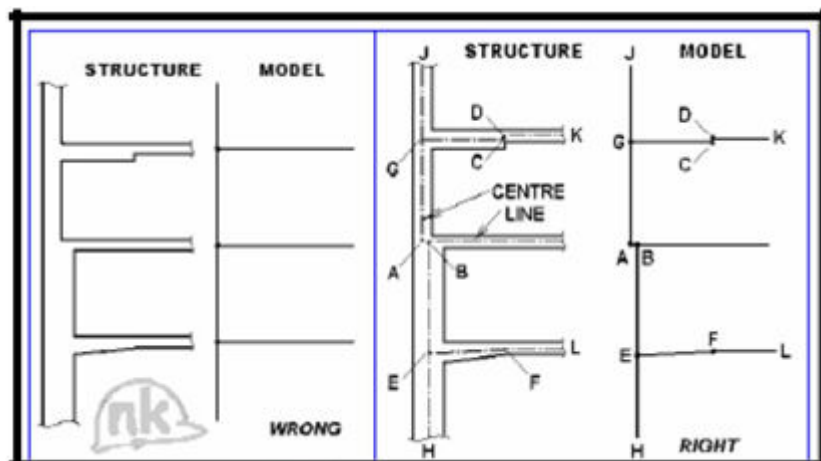


Fig.2 Realistic modeling

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

(b) Rigid joint zones:

Another common practice is (knowingly or unknowingly) to ignore the effect of modeling wide regions (such as RC beams and columns) by straight lines. (Fig. 4.) These may be generally conservative, but apart from decrease in economy, there may be loading combinations which may actually have an adverse impact.

4. Analysis Of Survey Results

The survey result has to be analyzed using SPSS software (Statistical Package of Social Studies). This software is one of the management tool helps to analyse the 5-scale like factor analysis. The various formulas were used to calculate the factor analysis is listed below. To assess the relative significance among risks, previous literatures study suggests establishing a risk significance index by calculating the significance score for each risk. For calculating the significance score is to multiply the probability of occurrence by the degree of impact Thus, the significance score of each risk assessed by each respondent can be obtained through the model

$$S_p^i = \sigma_j^i \beta_j^i$$

Where S_i = significance score assessed by respondent j for risk i ; a_i = probability of occurrence of risk i , assessed by respondent j ; and p_i = degree of impact of risk i , assessed by respondent j . By averaging scores from all responses, it is possible to get an average significance score for each risk, and this average score is called the risk index score and is used to rank among all risks. The model for the calculation of risk index score can be written

$$RS^i = \frac{\sum_{j=1}^T S_j^i}{T}$$

Where RS^i = index score for risk i ; and S_j^i = significance score assessed by respondent j for risk i and T =Total number of responses. To calculate S_j^i , the five scales for 0 and (3, this will be converted into numerical (Likert scale) scales.

5. Pilot Survey

A pilot questionnaire survey and follow-up interviews with local contractors was conducted. The purpose was to identify the factors out of the 68 factors that applied overseas could also apply to the construction industry. The small number interviews and the structure of the questionnaire in die pilot study does not allow for statistical analysis.

Responses to the interviews have been used to identify consistent themes, common practices, and insight provided by active and influential project participants that would provide additional guidance and assistance to the research team.

The survey results formed the basis of modifying the questionnaire for the subsequent full-scale survey. The pilot study attempts to short-list locally relevant factors. The criteria for a shortlisting are that the chosen factors are relevant in the local construction industry. As a result, only important and relevant factors can be chosen for inclusion in the full-scale survey in the second phase research.

VII. ANALYSIS AND DISCUSSION

Respondents are 21-30 Projects, 32 % of respondents are 31-40 Projects, 12 % of respondents are 40 above labours so the Projects, 12 % of respondents are 40 above labours so the majority of the respondents are Project in hand are 31-40.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

| SI No | Experience | No of Resonance | % |
|-------|-------------------------|-----------------|-----|
| 1 | Less than 1 year | 4 | 16 |
| 2 | From 1 to 3 years | 7 | 28 |
| 3 | More than 3 to 5 years | 5 | 20 |
| 4 | More than 5 to 10 years | 4 | 16 |
| 5 | Over 10 years | 5 | 20 |
| | Total | 25 | 100 |

The table reveals that 16 % of respondents are below 1 year of experience, 28 % of respondents are 1-3 year of experience, 20 % of respondents are 3-5 year of Experience, 16 % of respondents are 5-10 years of Experience, 20 % of respondents are above 10 years of Experience so the majority of the respondents are 3-5 years of Experience in the projects.

1. Demographical Analysis & Results of Survey

Table 1. Age of the Respondent

| SI No | Age | No Of Resonance | % |
|-------|----------------|-----------------|-----|
| 1 | 30 to 35 years | 7 | 28 |
| 2 | 35 to 40 years | 12 | 48 |
| 3 | Above 40 years | 6 | 24 |
| | Total | 25 | 100 |

The table reveals that 28 % of respondents are 30 to 35 years, 48 % of respondents are 35 to 40 years, 24 % of respondents are above 40 years, so the majority of the respondents are 35-40 years of age, the majority of the respondents are 35 to 40 years.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

Table 2. Position of the Respondent

| Sl No | Position | No of Resonance | % |
|-------|----------------------|-----------------|-----|
| 1 | Director | 2 | 8 |
| 2 | Vice director | 12 | 48 |
| 3 | Project manager | 3 | 12 |
| 4 | Site/Office engineer | 8 | 32 |
| | Total | 25 | 100 |

The table reveals that 8 % of respondents are Directors, 48 % of respondents are Vice Directors, 12 % of respondents are Project managers, 32 % of respondents are Site Engineers so the majority of the respondents are Site Engineers.

Table 3. No of labours in the project

| Sl No | No. of labours | No of Resonance | % |
|-------|----------------|-----------------|-----|
| 1 | 50-60 | 2 | 8 |
| 2 | 60-70 | 6 | 24 |
| 3 | 70-80 | 8 | 32 |
| 4 | 80-90 | 6 | 24 |
| 5 | 90 above | 2 | 8 |
| | Total | 25 | 100 |

The table reveals that 8 % of respondents are 50-60 labours, 24 % of respondents are 60-70 labours, 32 % of respondents are 70-80 labours, 24 % of respondents are 80-90 labours, 8 % of respondents are 90 above.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

Table 4. No of projects in hand

| Sl No | No. of labours | No of Resonance | % |
|-------|----------------|-----------------|-----|
| 1 | Below 10 | 3 | 12 |
| 2 | 11-20 | 6 | 24 |
| 3 | 21-30 | 5 | 20 |
| 4 | 31-40 | 8 | 32 |
| 5 | 40 above | 3 | 12 |
| | Total | 25 | 100 |

The table reveals that 12 % of respondents are below 10 Projects, 24 % of respondents are 11-20 Projects, 20 % of respondents are 21-30 Projects, 32 % of respondents are 31-40 Projects, 12 % of respondents are 40 above labours so the majority of the respondents are Project in hand are 31-40.

Table 5. Experience of the Respondent

| Sl No | Experience | No of Resonance | % |
|-------|-------------------------|-----------------|-----|
| 1 | Less than 1 year | 4 | 16 |
| 2 | From 1 to 3 years | 7 | 28 |
| 3 | More than 3 to 5 years | 5 | 20 |
| 4 | More than 5 to 10 years | 4 | 16 |
| 5 | Over 10 years | 5 | 20 |
| | Total | 25 | 100 |

The table reveals that 16 % of respondents are below 1 year of experience, 28 % of respondents are 1-3 year of experience, 20 % of respondents are 3-5 year of Experience, 16% of respondents are 5-10 years of Experience, 20 % of

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

pendants Are above 10 years of Experience so the majority of the respondents are 3-5 years of Experience in the projects.

2. Descriptive Analysis & Results of Survey

Sub-contractor related problems, time constraint, and increase in inflation were the major problems concerned with the construction companies. The full results were shown in the table 6. As far as the contractor is concerned shortage of skillful workers has the maximum risk rating and other risks which have maximum risk rating are time constraint, sub-contractor related problems, project delay, improper verification of contract documents, and competition from other companies. For the construction companies, time constraint has the maximum risk rating and other risks which have maximum risk rating shortage of skillful workers, project delay, errors in design drawings, improper project planning and budgeting, and loss due to fluctuation of inflation rate. The least risk rating is environmental risk, social risk, relation with government departments, local protectionism and industrial disputes and problem from near project.

Table 6. Overall ranking of risk

| | | | | |
|---|--|------|-------|------|
| 1 | There are no regular tests for materials | 3.44 | 1.261 | 2.42 |
| 2 | Absence of basic materials in the project | 2.68 | 1.600 | 1.29 |
| 3 | Scarcity of resources, especially basic resources | 1.96 | 0.841 | 1.89 |
| 4 | Some materials do not arrive at the assigned site | 2.84 | 0.898 | 3.42 |
| 5 | Agreed-upon technical specification are not realized | 3.28 | 1.696 | 2.14 |
| 6 | The contractor takes into account the resource of lowest price | 3.32 | 1.464 | 3.42 |
| 7 | Heavy equipment are not | 3.04 | 0.978 | 4.14 |

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

| | | | | |
|----|---|------|-------|------|
| | maintained periodically | | | |
| 8 | Fluctuating prices of materials | 2.64 | 1.254 | 3.42 |
| 9 | There are no guarantees on imported materials | 2.56 | 1.685 | 4.92 |
| 10 | Absence of trained local manpower | 3.56 | 1.758 | 3.21 |
| 11 | Wages of local manpower are high | 3.08 | 1.498 | 4.15 |
| 12 | Law of employing foreign manpower are rigid | 2.44 | 1.158 | 2.82 |
| 13 | Absence of training centers for local manpower | 3.32 | 1.600 | 2.74 |
| 14 | The worker does not abide by regular work-hours | 3.48 | 1.159 | 3.21 |
| 15 | Necessary technical skills are not available | 2.64 | 1.254 | 2.49 |
| 16 | Public safety rules are not abided by | 2.32 | 0.802 | 2.64 |
| 17 | Absence of health insurance | 2.56 | 0.917 | 2.52 |
| 18 | Low productive efficiency of the worker | 2.52 | 1.358 | 2.62 |
| 19 | There is no care for | 3.00 | 1.443 | 3.42 |

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

| | | | | |
|----|--|------|-------|------|
| | e workmanshi p | | | |
| 20 | Instabilit y of Cadre in the compani es | 2.92 | 1.382 | 3.16 |
| 21 | Desig n bureaus are no monitore d | 2.24 | 1.165 | 1.85 |
| 22 | There are many design bureaus | 2.44 | 1.261 | 3.14 |
| 23 | Providing special Cadre is not abided by | 3.24 | 1.615 | 1.72 |
| 24 | The designer does not follow up designs and changes made on them | 2.92 | 1.187 | 2.42 |
| 25 | The owner's meddling with the desig n | 3.48 | 1.229 | 3.60 |
| 26 | Recurring design errors | 3.20 | 1.443 | 2.72 |
| 27 | Error inventor s in the y of quantitie s | 2.96 | 1.767 | 2.64 |
| 28 | Supervising project the is not abided by | 3.12 | 1.563 | 4.42 |
| 29 | Plan desig s of n are incompatible with execution | 2.40 | 1.581 | 2.82 |

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

| | | | | |
|----|----------------------------------|------|-------|------|
| 30 | Survey processes are not precise | 2.72 | 1.173 | 2.42 |
|----|----------------------------------|------|-------|------|

Table 7. Showing the One-way ANOVA for time management on the basis of their Age

| S. | Age | Number | Mean | SD | F-value | P-value |
|----|----------------|--------|--------|-------|---------|----------|
| 1. | 30 to 35 years | 7 | 95.86 | 31.17 | 4.182 | 0.01 (S) |
| 2 | 35 to 40 years | 12 | 104.92 | 30.95 | | |
| 3. | Above 40 | 6 | 104.83 | 41.21 | | |
| | Total | 25 | 102.36 | 32.45 | | |

S – Significant

The above table clearly shown that below 40 years of age group scored higher mean value (104.92) than the other groups. The calculated F-ratio (4.182) to confirmed the mean difference between the groups, which is significant. Therefore irrespective of the age group all the respondents have same opinion about the time management.

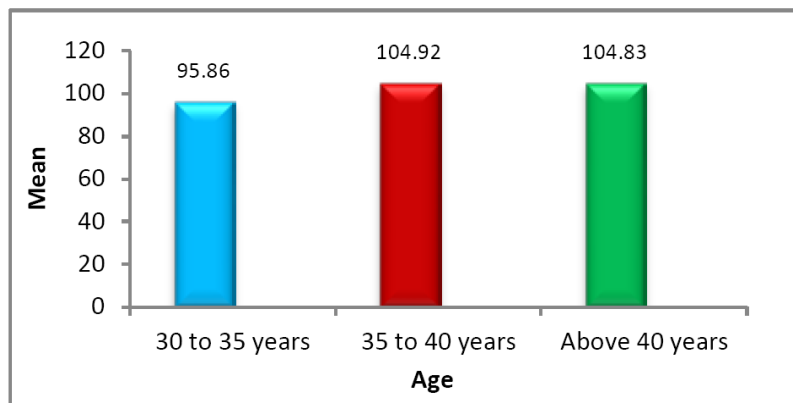


Fig 3. Time management on the basis of their Age

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

Table 8. Showing the One-way ANOVA for time management on the basis of their position

| S. No. | Position | Number | Mean | SD | F-value | P Value |
|--------|----------------------|--------|--------|--------|---------|----------|
| 1. | Director | 2 | 109.50 | 28.991 | 4.146 | 0.01 (S) |
| 2. | Vice director | 12 | 108.83 | 35.396 | | |
| 3. | Project manager | 3 | 117.00 | 25.981 | | |
| 4. | Site/Office engineer | 8 | 85.38 | 28.645 | | |
| | Total | 25 | 102.36 | 32.450 | | |

S -Significant

The above table clearly has shown that Project manager group scored higher mean value (117.00) than the other groups. The calculated F-ratio (4.146) to confirm the mean difference between the groups, which is significant. Therefore irrespective of the position group all the respondents have same opinion about the time management.

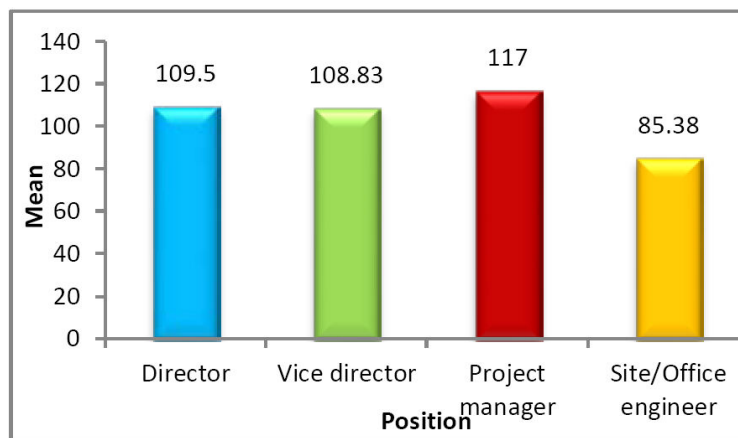


Fig 4. Time management on the basis of their position

Table. 9 Showing the One-way ANOVA for time management of the basis of their experience

| S. No. | Experience | Number | Mean | SD | F value | P Value |
|--------|-------------------------|--------|--------|--------|---------|----------|
| 1. | Less than 1 year | 4 | 96.50 | 27.086 | 4.109 | 0.01 (S) |
| 2. | From 1 to 3 years | 7 | 96.86 | 35.396 | | |
| 3. | More than 3 to 5 years | 5 | 120.40 | 29.492 | | |
| 4. | More than 5 to 10 years | 4 | 80.50 | 24.839 | | |
| 5. | Over 10 years | 5 | 114.20 | 38.271 | | |
| | Total | 25 | 102.36 | 32.450 | | |

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

S - Significant

The above table clearly shown that more than 3 to 5 years of experience group scored higher mean value (120.40) than the other groups. The calculated F-ratio (4.109) to confirmed the mean difference between the groups, which is significant. Therefore irrespective of the experience group all the respondents have same opinion about the time management.

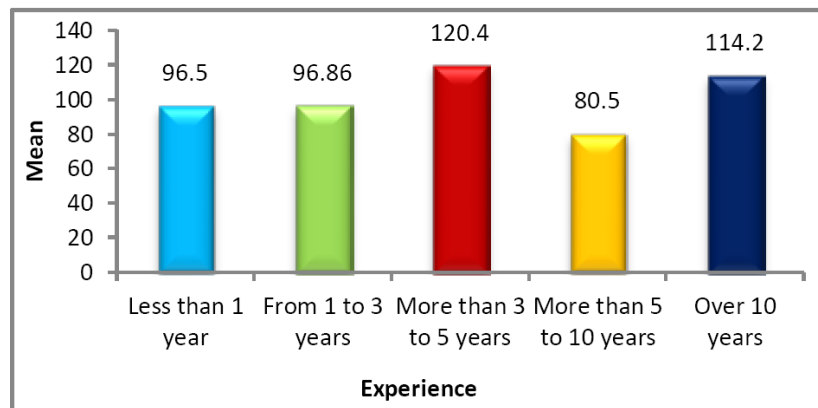


Fig 5. Time management on the basis of their Experience

Table .10 Showing the One-way ANOVA for financial management on the basis of their Age

S - Significant

The above table clearly shown that below 40 years of age group scored higher mean value (53.83) than the other groups. The calculated F-ratio (3.04S) to confirmed the mean difference between the groups, which is significant. Therefore irrespective of the age group all the respondents have same opinion about the financial management.

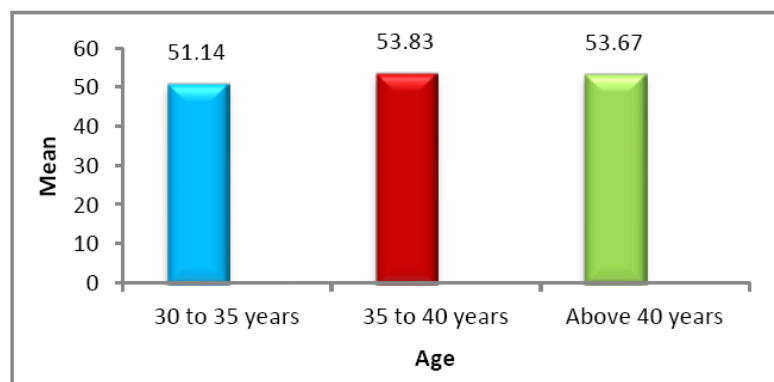


Fig 6. Financial management on the basis of their Age

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

Table 11. Showing the One-way ANOVA for financial management on the basis of their position

| S. No. | Position | Number | Mean | SD | F-value | P Value |
|--------|----------------------|--------|-------|--------|---------|----------|
| 1. | Director | 2 | 52.50 | 19.092 | 3.677 | 0.01 (S) |
| 2. | Vice director | 12 | 55.42 | 20.987 | | |
| 3. | Project manager | 3 | 62.33 | 14.434 | | |
| 4. | Site/Office engineer | 8 | 46.12 | 15.652 | | |
| | Total | 25 | 53.04 | 18.315 | | |

S - Significant

The above table clearly has shown that Project manager group scored higher mean value (62.33) than the other groups. The calculated F-ratio (3.677) to confirm the mean difference between the groups, which is significant. Therefore irrespective of the position group all the respondents have same opinion about the financial management

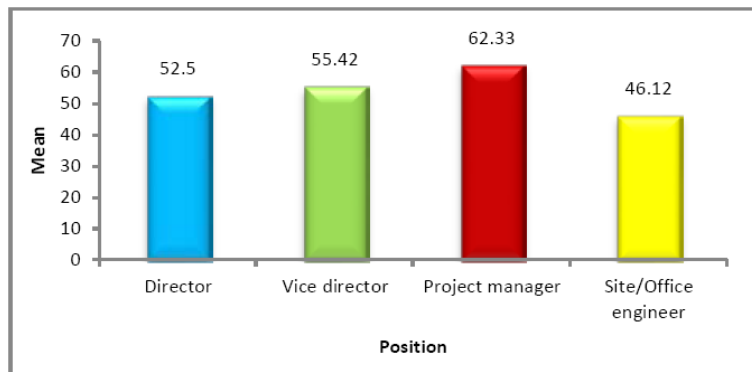


Fig 7. Financial management on the basis of their position

Table 12. Showing the One-way ANOVA for Financial management on the basis of their Experience

| S. NO. | Experience | Number | Mean | SD | F-value | P Value |
|--------|-------------------------|--------|-------|--------|---------|----------|
| 1. | Less than 1 year | 4 | 46.25 | 17.443 | 3.685 | 0.01 (S) |
| 2. | From 1 to 3 years | 7 | 51.43 | 19.060 | | |
| 3. | More than 3 to 5 years | 5 | 62.00 | 18.358 | | |
| 4. | More than 5 to 10 years | 4 | 45.25 | 10.751 | | |
| 5. | Over 10 years | 5 | 58.00 | 23.948 | | |
| | Total | 25 | 53.04 | 18.315 | | |

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

S -Significant

The above table clearly shown that more than 3 to 5 years of experience group scored higher mean value (62.00) than the other groups. The calculated F-ratio (3.685) to confirm the mean difference between the groups, which is significant. Therefore irrespective of the experience group all the respondents have same opinion about the financial management.

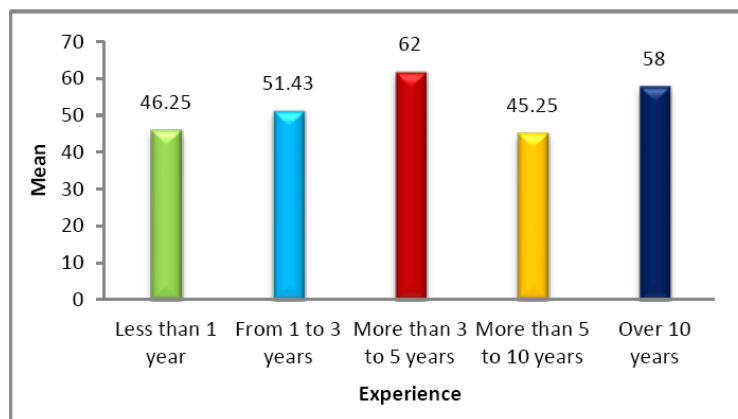


Fig 8. Financial management on the basis of their Experience

Inflation rate is very high in India and increasing proportionately with time, this causes the increase in prices of materials like cement, steel which interns causes financial risk to the land developers and construction firms. Banks have also raised their interest rates for the loan given by them, this have affected the residential construction market hugely. Thus the financial part of risk is very is very high than any other risk. Ranking of time management risks are given in the table

VIII. CONCLUSION

According to the methodology, The risks factors are identification based on the literature collected and by consulting the experts, based on this the questionnaires were prepared. Totally for ten companies the questionnaires were given, out of which three had an effective reply. Thus the response rate is 60% which is considered a good response in this type of survey. According to them the major part of risks in high-rise buildings are caused due to technical, financial, physical and constructional problems. This paper has presented a general review of structural systems for tall buildings. Unlike the height-based classifications in the past, a system-based broad classification (i.e., exterior versus interior structures) has been proposed. Various structural systems within each category of the new classification have been described with emphasis on innovations. As far as the engineers concerned Lack of knowledge of arbitration has the maximum risk rating and other risks are material shortage, shortage in supply of electricity, poor quality of procured materials, loss due to fluctuation of interest rate, accident in site sub-contractor related problems, error in drawings, improper verification of contract documents, and competition from other companies. The least risk rating given by project engineer is environmental risk, relation with government departments, local protectionism and industrial disputes.

REFERENCES

1. A Guide to the Project Management Body of Knowledge, (1996), PMI, Project Management Institute.
2. Akintola S Akintoye and Malcolm J MacLeod "Risk analysis and management in construction" International Journal of Project Management Vol. 15, No. 1, pp. 31-38, 1997
3. Alfredo del Can, and M. Pilar de la Cruz, "Integrated Methodology for Project Risk Management" , Journal of Construction Engineering and Management, ASCE, December 2002, 473-485

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

4. Artem Aleshin "Risk management of international projects in Russia", International Journal of Project Management Vol. 19, 2001, PP. 207-222
5. Bing, L., Tiong, R. L. K., Wong, W. F., and Chow, D, "Risk management of international construction joint ventures." Journal of Construction Engineering and Management, 1999, ASCE, 125(4), 277-284.
6. Darrin and Mervyn K Lewis "Evaluating the risks of public private partnerships for infrastructure projects", International Journal of Project Management 2002 , 107-118
7. Daud Nasir, Brenda McCabe and Loesie Hartono "Evaluating Risk in Construction-Schedule Model (ERIC-S) Construction Schedule Risk Model" Journal of Construction Engineering and Management, ASCE, Vol. 129, No. 5, October, 2003, 518-527
8. El-Diraby.T. A and Gill S. M. "A taxonomy for construction terms in privatized infrastructure finance: supporting semantic exchange of project risk information" Construction Management and Economics, March 2006, 271-285
9. Eric Verzuh, "The Fast Forward MBA in Project Management", Wiley - 2nd Ed - 2005, 105-109
10. Garg.A.K.,(2005) "Risk management in construction contracts", Construction Materials Purchase, February 2005, 14-16.
11. Hyun-Ho Choi Hyo-Nam Cho and J. W. Seo "Risk Assessment Methodology for Underground Construction Projects" Journal of Construction Engineering and Management, ASCE, April 2004, 258-272
12. Joe Wong and Eddie C. M. Hui, "Construction project risks: further considerations for constructors pricing in Hong Kong", Construction Management and Economics, April 2006, 425-438
13. John Walewski and Edward Gibson.G, Jr., "International Project Risk Assessment", A Report of the Centre Construction Industry Studies, University of Texas, Austin, 2003, 11-15
14. Li Bing and Robert L. K. Tiong, "Risk management model for international construction joint ventures" Journal of Construction Engineering and Management, ASCE, Vol. 125, No.5, September/October, 1999, 377-384
15. Li Bing, A. Akintoye, P.J. Edwards, C. Hardcastle "The allocation of risk in PPP/PFI construction projects in the UK" International Journal of Project Management 23, 2005, 25-35
16. Likert R. "A Technique for the Measurement of Attitudes" Archives of Psychology 140, 1932, 55.
17. Makarand Hastak and Aury Shaked "ICRAM-1:Model for international construction risk assessment" Journal of Management in Engineering, Vol. 16, No. 1,January/February, 2000, ASCE, 59-69
18. Ming-Teh Wang and Hui-Yu Chou "Risk Allocation and Risk Handling of Highway Projects in Taiwan" Journal of management in engineering, ASCE, April 2003, 60-68
19. Motiar rahman.M and Mohan.M. Kumaraswamy "Joint risk management through transactional efficient relational contracting" Construction Management and Economics ,2002, 20, 45-54
20. Mulholland.B and Christian.J "Risk assessment in construction schedules" Journal of Construction Engineering and Management, Vol. 125, No. 1, January/ February, 1999, 8-15