Importance of Project Risk Management in Construction of Multi-Story Building

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Abstract— The construction project are one of the most important projects which plays an important role in the development of the country. It is generally found that multi storey (or high rise) building are the most important part of the construction industry for the greater development. The major part of the construction industry leads to the multi storey building. Hence risk involved in this part also rates higher in the construction industry. Risk in the construction project is considered as one of the most common problem causing multitude of negative effect on the construction project. The purpose of the study is to identify the construction execution risk of the particular selected sites of multi-storey building and with the help of relationship among them by a questionnaire survey and interdependency can be found. Diagraphs can be generated from the data analysis using the appropriate methods. Which gives clear idea about high to low risk in the construction activity and it is helpful to minimize the risk easily.

Key words: Risk Management, Construction Project Management

I. INTRODUCTION

Risk is the probability that an unfavorable outcome will occur. Risk management is the process of measuring risk and then developing the strategies to manage the risk. 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), 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, its application is promoted in all projects in order to avoid negative consequences. There are four stages to risk management.

- Risk Identification
- Risks Quantification
- Risk Response
- Risk Monitoring and Control

Risk management is not a complex task. If you follow the four steps, you can put together a risk management plan for a project in a short space of time. In addition, there needs to be an overall management strategy such that this four-step process is implemented in a co-ordinate fashion. This strategy should include how risk management will be integrated into the project management process on a project.

The construction industry operates in a very uncertain environment where conditions can change due to the complexity of each project. The aim of each organization is to be successful and RM can facilitate it. However it should be underlined that risk management is not a tool which ensures success but rather a tool which helps to increase the probability of achieving success. Risk management is therefore a proactive rather than a reactive concept. Risks are viewed as either manageable or unmanageable. A manageable risk is one you can live with, such as a minor requirement change. An unmanageable risk is impossible to accommodate, such as a huge turnover of core team members.

Risk factors can be classified into eight categories namely.

- Construction risk
- Design risk
- Environmental risk
- Financial risk
- Management risk
- Political risk
- Procurement risk
- Sub-Contractors risk
- Technology risk

II. OBJECTIVE

To identify & evaluate project risks involved in and associated with multi-storey building

III. LITERATURE REVIEW

By the review of some past research paper related to the risk management related to construction industry especially multi storey building, it is observed that this method is used to minimize risk in many industry other than construction industry. These research is done to apply ISM method to the project management of multi-storey building to minimize the construction execution risk. For this purpose the Iyer and Sagheer (2010) ISM uses experts' practical experience and knowledge to decompose a complicated system into several subsystems and construct a multilevel structural model. The fundamental concepts of the process are an "element set" and a "contextual relation." The element set is identified within some situational context, and the contextual relation is selected as a possible statement of relationship among the elements in a manner that is contextually significant for the purposes of the inquiry.

Martin Schieg studied that adopting risk management, savings potentials can be realized in construction projects. For this reason, for project managers as well as real estate developers, a consideration of the risk management process is worthwhile. The risk management process comprises 6 process steps, which will be discussed in greater detail below. The integration of a risk management system in construction projects must be oriented to the progress of the project and permeate all areas, functions and

processes of the project. In this, particular importance is attached to the risks in the personnel area, for, particularly for enterprises providing highly qualified services, specialized employees are essential for market success. Effective risk management must permeate all areas, functions and processes of the project. The goal therefore must be to negotiate risks, assess these or even make these marketable and reduce the memphatically. In this, a decisive factor in its success is in the end the interaction of all elements represented. [12]

Interpretive Structural Modeling was first proposed by Warfield (1973). Iyer and Sagheer (2010) ISM uses experts' practical experience and knowledge to decompose a complicated system into several subsystems and construct a multilevel structural model. The fundamental concepts of the process are an "element set" and a "contextual relation." The element set is identified within some situational context, and the contextual relation is selected as a possible statement of relationship among the elements in a manner that is contextually significant for the purposes of the inquiry. [3]

Pejman Rezakhani studied that Risk management is an important step in project success. It is the process of identifying, classifying, analysing and assessing of inherent risks in a project. Due to the nature of the construction projects which consists of many related and none-related operations, many risk factors will contribute in a project. To have an effective risk management plan, at first step the key risk factors which have the most effect on project objectives should be identified and classified. This paper is an investigation of different risks which may be involved in construction projects. Project management functions which have the most effect on risk management plan are categorized and an analysis of key risk factors in every category is described. Finally a hierarchical risk classification to cover all the effective key risk factors in construction projects is suggested. Case studies have shown that this classification covers the most key risks that should be taken into consideration in a risk management plan in this paper, the most effective key risk factors which have a significant effect on construction projects scope are identified and classified through a comprehensive literature survey and professional experiments of experts in construction management field. In proposed classification, effort is to cover the most effective risk factors. Case studies have shown that by utilizing proposed hierarchical risk breakdown, most of the risks in regular and complex projects are covered and as a result an effective risk management plan can be conducted. [4]

Arati Chougule, Ashish Waghmare Risk is an integral part of any project. Risk is present in all projects irrespective of their size or sector. No project is totally free from risks. If risks are not properly analysed and strategies are not developed to deal with them, the project is likely to lead to failures.[1]

IV. DATA COLLECTION

The development of the high-rise building has followed the growth of the city closely. The process of urbanization that started with the age of industrialization is still in progress in developing countries like India. Industrialization causes migration of people to urban centers where job opportunities are significant. The land available for buildings to accommodate this migration is becoming scarce, resulting in rapid increase in the cost of land. Thus, developers have looked to the sky to make their profits. The result is multistoried buildings, as they provide a large floor area in a relatively small area of land in urban centers. The construction procedure of multistoried building is very complex task. There are no of activities and agencies are involved in the construction process of the multi storied building. Due to presence of no of people and activities there is certain amount of risk is involved in completion of the project. There are various types of activities included in each and every construction project from start to end of the project. To complete any construction project as per desired level of satisfaction and as per design it is necessary to complete all activities of project successfully and without errors within estimated time, cost and desired quality.

The data collection work for this research work is done by identifying the construction execution activities by consulting an expert. From the identified activities, the questionnaire format is prepared to quantify the likelihood and the impact of the risk on the project. The questionnaire survey is done by distributing the questionnaire format to engineers and contractors by mail and personally meeting and getting their review about their experience about the predefined construction activities. In this questionnaire survey total 12 construction activities are been identified and their sub activities are also been identified. They are as follow.

a) Excavation
b) Foundation
c) Sub-structure column
d) Plinth beam construction
e) RCC work for super structure
f) Masonry work
g) Plumbing and electric work installation
h) Plaster work
i) Tiles work
j) Paint and finishing
k) Firefighting system
l) Glass work and another miscellaneous fixture

V. DATA ANALYSIS

The analysis was done by taking into consideration first the expected value method. In this process the likelihood rating and the impact rating were given to various risks present in construction of Multi-storey building. With the help of a questionnaire survey the following risks were found to exist in construction activities of Multi-storey building. These risks were marked on a scale of 0-1 both on likelihood rating as well as impact rating. Further these individual likelihood factors were multiplied by weights assigned to each factor. Thus we found out CLF or Cumulative Likelihood Factor.

Similarly we also found out the Cumulative impact factor by multiplying impact rating with the weights assigned to each factor. Finally the severity rating was found by multiplying Cumulative likelihood factor with the Cumulative impact factor. The severity rating thus obtained was then sorted in an increasing order to find the risks which caused maximum threat for the respondents. These were further divided into categories based on the severity ratings.

This process is termed as risk categorization. The scale followed for risk categorization is shown below:

Scale	Range
Low risk	0.00000-0.00050
Medium risk	0.00050-0.0010
High risk	0.0010-0.0020
Very High risk	0.00200-0.0050
Critical risk	0.0050-0.08000

Table 1: Risk Scale

S.No	Operations	Severity	Categorization according to scale
		S= CLF*CIF	
1	Site Clearance	0.00006	Low Risk
2	Finishing	0.00029	
3	Marking level of beam on column	0.00031	
4	Vibration and compaction	0.00036	
5	Concreting	0.00047	
6	PCC	0.00048	
7	Side skirting	0.00050	
8	Reinforcement for stair case	0.00058	Medium Risk
9	Concreting od column	0.00061	
10	Vibration and compaction	0.00062	
11	Fixing tiles for stair case	0.00077	
12	Marking level of lintel	0.00078	
13	Placing reinforcement for slab	0.00078	
14	Making grooves for electric line and board	0.00081	
15	Making groove for water pipeline	0.00083	
16	Concreting	0.00085	
17	Fixing floor tiles	0.00088	
18	Marking of doors and windows	0.00088	
19	Cleaning of surface	0.00089	
20	Placing reinforcement of beam	0.00089	
21	Plastering of interior wall	0.00096	
22	Installation of handrail, water tap, etc.	0.00097	
23	Plastering of celling	0.001	
24	Placing reinforcement of column	0.00101	
25	Form work for stair case	0.00103	
26	Cleaning of surface	0.00107	
27	Fixing of wall tiles	0.001076	
28	Masonry wall above lintel	0.001079	
29	Curing	0.00117	High Risk
30	Installation of door and windows	0.00121	
31	Marking of switch board	0.00123	
32	Construction of masonry wall up to lintel level	0.001235	
33	Vibration and compaction	0.001237	
34	Covering of switch board and cables	0.001255	
35	Placing of reinforcement	0.001260	
36	Construction of form work for column	0.001337	
37	Concreting	0.001338	
38	Marking of partition wall	0.00136	
39	Concreting	0.00137	
40	Dressing of soil	0.00138	
41	Vibration and compaction	0.001412	
42	Placing of cover	0.001439	
43	Construction of form work for slab	0.001623	
44	Marking of cut-off level	0.001655	
45	Concreting	0.001755	
46	Fixing cables and switch board	0.001763	
47	Curing	0.001815	
48	Plastering of exterior wall	0.001819	
49	Marking of electric line	0.001994	
50	Placing of cover	0.002332	Very High Risk
51	Setting out corner bench mark	0.002332	

52	Provision of cover	0.002449	
53	Form work for lintel bend	0.002542	
54	Marking the level of exterior plaster	0.002564	
55	Construction of side support	0.002671	
56	Marking the level of flooring	0.002691	
57	Leveling the sub base for flooring	0.002802	
58	Back filling of soil	0.002802	
59	Excavation up to the approved depth	0.002896	
60	Application of paint	0.003034	
61	Construction of form work for beam	0.003044	
62	Marking the boundary of building	0.003149	
63	Survey of ground level	0.003251	
64	Marking the level for interior plaster	0.003339	
65	Fixing the water pipe	0.003628	
66	Marking the layout of pipeline	0.00373	
67	Curing	0.00376	
68	Placing of reinforcement	0.00432	
69	Marking of exterior wall	0.00439	
70	Marking the level of casting	0.00444	
71	Curing	0.004469	
72	Marking of footing center	0.004652	
73	Application of final coat	0.004655	
74	Soil backfilling and compaction	0.004716	Critical Risk
75	Construction of form work	0.005108	
76	Construction of dewatering well	0.005127	
77	Filling of crack	0.005335	
78	Erection of reinforcement	0.005361	
79	Curing	0.006376	
80	Waterproofing work	0.006878	
81	Curing	0.007121	
82	Scaffolding or lowering and lifting equipment	0.007242	
83	Construction of form work	0.007242	
84	Erection of scaffolding for exterior plaster	0.007525	
85	Erection of reinforcement	0.008268	
86	Installation of glass work	0.008409	
87	Construction of form work0.084	0.009678	
88	Checking of firefighting system	0.012880	
89	Installation of elevators	0.05593	
90	Installation of firefighting system	0.08480	

Table 2: Categorization of Risk

These results were then put on a graph to see which risks wanted maximum attention and immediate measures to be taken. The analysis is shown below.

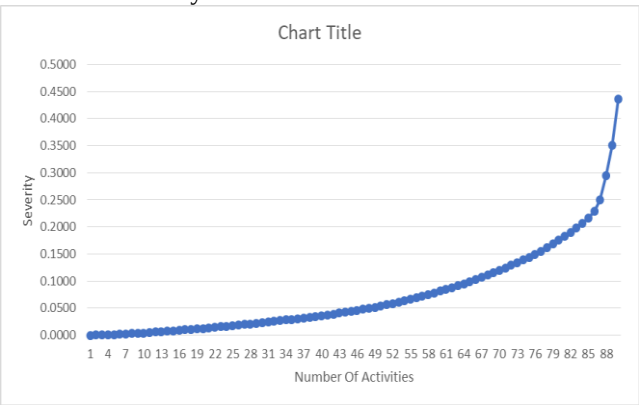

Fig. 5.1: Severity Graph

VI. CONCLUSION

To avoid failure of construction projects, we can apply an Expected value method to better understand critical factors. This paper identified 12 construction execution risks and the relationships between them. It is also highlighted the level of importance of activities. The findings of proposed theoretical framework serve as a guideline for decision makers to concentrate on influential factors. After analysis we have found that 1 out of 11 risks identified is critical risk (Firefighting system), 2 out of 12 is high risk, 5 activities are under medium risk, and other four activities are under low risk.

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