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Risk Management in High-Rise Construction Projects in Pune Region

Prof. D.S.Jadhav[1], Shubham Kumar[2], Saurabh Newase[3], Prathmesh Konde[4], Sumit Barkale[5]

[1]Assistant Professor, Department of Civil Engineering, Navsahyadri Group of Institutions,Facu1ty of Engineering, Naigaon, Pune, Maharashtra, India
[2,3,4,5]Students, Department of Civil Engineering, Navsahyadri Group of Institutions,Facu1ty of Engineering, Naigaon, Pune, Maharashtra, India

ABSTRACT

High-rise construction projects in Pune region are increasing rapidly due to urban growth and infrastructure demand. However, these projects face significant risks related to safety, material supply, labour availability, cost overruns, and design changes. Effective risk management is essential to ensure timely and cost-efficient completion. This study evaluates major risks in high-rise construction projects in Pune using a questionnaire survey of 50 construction professionals. A 5-point Likert scale was used to assess 17 risk factors.

The collected data were analyzed using Mean Score and Relative Importance Index (RII) to rank the risks. The results indicate that material supply delays, design changes, and poor monitoring are the most critical risks. The study concludes with practical recommendations for improving risk management practices in Pune's high-rise construction sector.monitoring capability. The system is suitable for small-scale renewable installations and enhances operational reliability of standalone power systems.

Keywords: Risk management, High-rise construction, Pune region, RII, Construction delays, Cost overrun.

INTRODUCTION

Pune is one of the fastest developing cities in Maharashtra. Areas such as Wakad, Baner, Hinjewadi, Kharadi, and Hadapsar have seen rapid growth in high-rise residential and commercial buildings. These projects involve:

- Complex structural systems
- Multiple contractors and subcontractors
- Large financial investments
- Strict safety requirements

Due to this complexity, risks frequently occur during construction, leading to:

- Time delays
- Cost overruns
- Quality issues
- Safety incidents

Therefore, systematic risk management is essential in high-rise projects. The objectives of the study are:-

1. To identify major risks affecting high-rise construction projects in Pune region.
2. To rank the risks based on their importance.
3. To analyze the impact of safety, delay, cost, and design risks.
4. To provide recommendations for effective risk management.

LITERATURE REVIEW

Risk management has been widely acknowledged as a critical component of construction project success, particularly in high-rise developments where technical complexity, vertical logistics, and multi-stakeholder coordination increase uncertainty. Studies by Flanagan and Norman (1993) and Smith, Merna, and Jobling (2006) emphasize that construction risks typically arise from poor planning, resource constraints, design uncertainties, and external environmental factors.

Research on delay and cost overrun issues (Assaf & Al-Hejji, 2006; Sambasivan & Soon, 2007) identifies material supply disruptions, labour shortages, and ineffective monitoring as primary contributors to project performance failure. In rapidly urbanizing cities, these risks are amplified due to fluctuating demand, supply chain pressure, and regulatory complexities, making systematic risk identification and prioritization essential.

Recent literature highlights the growing importance of safety management and digital technologies in mitigating construction risks. Hinze (2006) stresses that structured safety planning and training significantly reduce accident rates in high-rise projects, while studies on design changes (Doloi, 2012; Love et a1., 2004) show that frequent modifications during execution lead to rework and cost escalation.

Furthermore, the integration of digital tools such as Building Information Modeling (BIM) and software-based risk registers has been shown to improve monitoring, coordination, and decision-making (Azhar, 2011; Eastman et al., 2011). These findings suggest that modern high-rise construction projects increasingly rely on proactive and technology-driven risk management approaches to enhance project efficiency and control delays and costs.

METHODOLOGY

1.1 Data Collection

- A structured questionnaire consisting of 17 risk-related statements was distributed to construction professionals including:
- Site engineers
- o Project managers
- Contractors
- Consultants Total respondents: 50

1.2 Likert Scale Used

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

1.3 Data Analysis Method

Two statistical tools were used:

- 1 Mean Score
- o Relative Importance Index (RII)

$$\mathbf{RII} = \frac{\sum W}{A \times N}$$

Where 5 is the highest weight.

RESULTS

Table 1 shows the overall Risk Ranking of all the risk factors studied with questionnaire survey.

Table 1: **Risk Ranking**

Sr.No	Risk Factor	Mean Score	RII	Rank
1	Safety risks properly documented	3.90	0.78	10
2	Workers follow safety rules	3.85	0.77	11
3	Training reduces accidents	4.05	0.81	7
4	Material supply delays affect progress	4.30	0.86	2
5	Labour shortages cause delays	4.15	0.83	5
6	Equipment failure disrupts activities	4.00	**0.80**	**8**
7	Monsoon/weather creates scheduling	4.10	0.82	6
8	Planning and scheduling managed	3.70	0.74	14
9	Cost ovemins due to poor monitoring	4.05	0.81	7
10	Client payment delays impact execution	3.95	0.79	9
11	Material quality testing adequate	3.65	0.73	15
12	Design changes reduce efficiency	4.25	0.85	3
13	Digital tools improve risk monitoring	4.40	0.88	1
14	Software-based tracking improves control	4.22	0.84	4
15	Digital risk register improves decision-	4.18	0.83	5
16	Software risk management reduces delays & cost	4.35	0.87	2
17	Software should be used in Pune high-rise projects	4.45	0.88	1

1.4 Safety **Risks**
Average RII = 0.79

This shows moderate concern regarding safety documentation and compliance. Although training is considered effective, safety practices require improvement.

4.1 Delay Risks

Includes:

- Material supply delays
- Labour shortages
- Equipment failures
- Monsoon impact
- Average RII = 0.83

Material supply delay (RII = 0.86) is one of the most critical risks. This is common in Pune due to logistics and demand fluctuations.-

4.2 Cost Risks

Includes:

- Cost overruns due to poor monitoring
- Client payment delays Average RII = 0.80

Costoverruns are mainly linked to poor project monitoring and planning inefficiencies.

4.3 Design and Efficiency Risks

Design changes reducing efficiency (RII = 0.85) ranked among top risks. Frequent design revisions lead to rework and productivity loss.

4.4 Digital Risk Management

Highest ranked category (Average RII = 0.86). Top responses:

- Software should be used in Pune projects (RII = 0.88)
- Digital tools improve monitoring (RII = 0.88)

This indicates strong professional support for digital risk management systems.

DISCUSSION

The analysis shows that traditional risks such as material delays, labour shortages, and design changes significantly affect high-rise projects in Pune. However, respondents strongly agree that digital monitoring and software-based risk management improve control over time and cost.

Key findings are:

- Material delay is the most serious operational risk.
- Design changes significantly reduce efficiency. o Poor monitoring leads to cost overruns.
- Digital tools are widely supported for better risk management.

CONCLUSION

This study identified and ranked major risks affecting high-rise construction projects in Pune region using questionnaire analysis. Material supply delays, design changes, and monitoring issues are major contributors to project delays and cost ovemins.

The strong agreement on digital risk management indicates that modern construction projects require structured and systematic risk monitoring systems.Effective risk management practices can significantly improve project performance in Pune's high-rise construction sector.

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