Risk Mitigation of Construction Projects in Hilly Areas

Nishaant Ha, Anand T, Sachin Prabhu P, Dayaanandan M

Abstract: ***In construction industry, there is no risk free project.There are various types of risk associated in a hilly construction project. Risk is identified and then risk assessment and analysis is done. Then risk management and risk mitigation process is carried out in order to reduce risk. Various types of risk associated with hilly construction projects are identified from case study, papers and field study. The identified risk factors are grouped under 9 categories. Risk factor is characterized by its occurrence and impact. The occurrence and impact score for different types of risk are collected from site and online survey from experts and weighted average mean interval score is calculated. From the score value obtained, the risk priority is given using risk heat map. Then find feasible strategy to mitigate the risk in hilly areas.***

Keywords*: Risk Management, Risk Factors, Risk Assessment, Risk Factors, Risk Priority, Feasible Strategy*

I. INTRODUCTION

Construction projects in hilly areas are complex in nature and have may inherent uncertainties. The following processes are to be followed to avoid Risk in construction projects. Risk identification: Identification and documentationof the risks that may affect the project.Risk analysis: Estimation of the probability ofoccurrence and severity of the identified risk impact. Therisk analysis process focuses on evaluation of thefeasibility of occurrence and detection of the identified risks.Risk response strategy: Exploration of risk response strategiesfor the high risk items identified in the risk analysis. Then feasible strategy is find to mitigate the risk.

Revised Version Manuscript Received on 25 November, 2018.

Nishaant Ha, Asst. professor, Department of Civil Engineering, Kumaraguru College of Technology, Coimbatore (Tamil Nadu), India.

Anand T, Asst. professor, Department of Civil Engineering, Kumaraguru College of Technology, Coimbatore (Tamil Nadu), India

Sachin Prabhu P, Asst. professor, Department of Civil Engineering, Kumaraguru College of Technology, Coimbatore (Tamil Nadu), India

Dayaanandan M, Former PG Student, Department of Civil Engineering, Coimbatore Institute of Technology, Coimbatore (Tamil Nadu), India.

II. METHODOLOGY

Plan for risk management

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Identify the various risk factors

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Grouping of risk factor

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Categorization of risk factor

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Giving priority

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Prepare a risk strategy

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Choose a feasible risk strategy

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Reduce the risk effects

Flowchart 1 Methodology

A. Risk Identification

Risks factors are identified from literature study, expert opinion and field study.

B. Grouping of Risk

Risk factors are grouped under

- Geological and Environmental risk.
- Execution risk
- Resource risk
- Financial and economical risk
- Technical risk
- Approval risk
- Political and country risk
- Health and safety risk

C. Risk Priority

Risk is characterized by its occurrence and its impact.Scale and level for risk occurrence and risk impact is given based on literature study and field study and online survey. Then risk categorization is done and priority is given. For risk analysis process the risk heat map is used in which parameter like occurrence and impact are given to find risk priority.

D. Risk Response Strategy

For various types of risk, many possiblerisk strategy are prepared .Among these, a feasible common strategy is chosen which should be at least able to reduce more than one type of risk.

III. RISK OCCURRENCE AND IMPACT SCALE

OCCURRENCE	SCORE
Very frequent	5
Frequent	4
Moderate	3
Rare	2
Very rare	1

Table 1 Risk Occurrence Scale

IMPACT	SCORE
Extremely severe impact (Near complete destruction)	5
Severe impact (Huge damage)	4
Moderate impact (Moderate destruction)	3
Less impact (Minor damage)	2
Very less impact (Very minor damage)	1

Table 2 Risk Impact Scale

A. Risk Heat Map

	RISK PRIORITY				
IMPACT	4<SCORES5	3	4	4	5	5
	3<SCORES4	2	3	4	5	5
	2<SCORES3	2	2	3	4	4
	1<SCORES2	1	1	2	3	4
	0<SCORES1	1	1	2	2	3
RISK HEAT MAP		0<SCORES1	1<SCORES2	2<SCORES3	3<SCORES4	4<SCORES5
		OCCURRENCE				

Table 3 Risk Heat Map

PRIORITY	
5	Very high risk
4	High risk
3	Moderate risk
2	Mild risk
1	Very mild risk

Table 4 Risk Priority

IV. ENVIRONMENTAL AND GEOLOGICAL RISK

- Landslides
- Erosion of soil
- Drainage problem
- Poor site condition
- Seasons and humidity
- Impact of weathering
- Settlement problem
- Disturbance of wildlife
- Structural instability
- Gradient of site
- Blocking of route due to rain and wind
- Seepage problem
- Fire risk
- Unexpected sub surface condition
- Seismic earthquake
- Heavy wind loads
- Offsite and onsite wetlands
- Ground water availability
- Rock falls

A. Execution Risk

- Construction Delay
- Poor quality maintenance
- Improper site execution
- Cost and time overruns
- Working nightshift in smog is risk
- Difficult in providing supports
- Defects in workmanship, negligence and malicious acts.
- Improper false work risk
- Difficult in construction due complexity of design
- Use of defective material in execution
- Non performance of sub contract
- Scope design & technology changes

B. Approval Risk

- Delay in approval from Geo-technical and forest office department
- AAA and HACA clearance
- Land Acquisition
- Statutory Clearance Approval
- Delay of Work Approval
- Delay of Document Preparation
- Delay or issue of certified by agricultural engineering
- Stability Certificate
- Insurance Approval
- Litigation

C. Resource Risk

- Accommodation & Storage of Resource
- Ordering and shortage delay
- Labour Productivity
- Unexpected equipment Repair & Spare parts demands
- Lack of Accessibility of procurement
- Labour Dispute
- Labour Wage Scale
- Labour Shortage
- Men, Materials and Machine Shortage

D. Economical and Financial Risk

- Fluctuation in Interest Rates
- Bank availability
- Liquidity risk
- Exchange Rate Fluctuation
- Unavailability of Fund & Finance Failure
- Inflation Rate Fluctuation
- Insurance risk

- High Market Competition

E. Technical and Design Risk

- Delay in design and regulatory approval
- Defective design , error and rework
- Work change order
- Use of advanced equipment is difficult
- Contract and condition
- Change in seismic criteria
- Violation of government standard and codes while designing
- Level of detailed design
- Improper scheduling and cost estimates
- Wrong selection of materials

F. Political and Country Risk

- Change in Country Rules & Regulations
- Public Objection
- Risk of corruption and market distortion
- Tax Changes
- Nationalization/expropriation risk
- Construction permits
- Political Interference
- Change of government

G. Health and Safety Risk

- Improper Safety Awareness
- Accidental risk
- Occupational risk
- Improper Safety Procedures
- Health care and Hospital Facility availability
- Epidemiology Health Factor
- Lack of Training & Skill to Handle Machineries

V. RISK PRIORITY

The various risk factors are identified and are grouped under eight categories. The occurrence and impact score for different types of risk factors are collected from site and collected by conducting online survey from experts and mean interval score value calculated. The weighted average mean interval score for risk occurrence and impact are calculated. Then risk priority are given using risk heat map. Risk ranking is done using risk heat index for each grouping of risk separately. With reference to the above analysis, the most sensitive risk group can be identified as environmental and geological risk, execution risk and resource risk. Priority should be given while finding feasible strategy for these risk group.

VI. CONCLUSION

This research is mainly attempted to identify all the key risks associatedwith the achievement of all objectives of the construction project.From these kind of analysis, we can identify the most sensitive risk group accurately. Factors affecting the process of that group can also identified accurately. The most influencing risk group are environmental and geological risk, execution risk and resource risk and it majorly affects hilly areas constructionprojects to a larger extent than other risk factor groups. Further studies are carried out to find the many possible risk strategy. Among these, a feasible common strategy is chosen which should be at least able to reduce more than one type of risk.

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