

# STUDY OF FACTORS CAUSING COST OVERRUN IN CONSTRUCTION INDUSTRY USING AHP TECHNIQUE

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*Abstract- For a construction parties, cost performance is most important. Cost overrun are a serious issue in several Indian construction parties. Most construction projects experiences cost overrun and it place financial burden on the consumer and owner. Therefore, this work is carried out to find the major factors that were responsible for cost overrun within construction industry in Gwalior region of Madhya Pradesh(INDIA). A questionnaire for the survey has been prepared by authors based on 32 common factors that were taken from previous work on cost overrun in different regions from literature reviews, articles, journals etc. The survey is taken from the members who involved in construction industries mainly contractor, site engineer, project manager, architects and various other respondent related to construction projects/industry. The result came from survey revealed that the top most critical factors that causes cost overruns during construction projects are Lack of Involving Contractor during Design, Poor Site Management and Supervision, Theft on Site, Frequent Design Changes, Incomplete design and Change in Material Specification.*

**Keywords-** AHP technique, Cost Overruns, Construction Industry, construction cost.

## I. INTRODUCTION

Construction business is a vital business that plays an important role within the socio-economic growth of the country, particularly developed countries. Gwalior city is located in the state of Madhya Pradesh in India, experience in large amount of work related to construction in last few years. Due to the Large and complex projects, that were constructed in Gwalior attracts the construction companies from all over the India. This industry contributes to the GDP and employment rate of the many nations and for this reason it's considered important for the economic development of nation. Cost overruns in construction projects result in a rise within the capital- output-ratio for the whole economy. The cost overruns have become hallmark of infrastructure projects in India. Despite of the project management, there has been a need arisen to research out the top most factors that causes cost overrun for company's future that could help the construction companies to complete their project on or before estimated time which could increase the profit values of companies and also reduce the losses that were occurred due to overrun of project which exceeded the estimated time. To find the factors affecting cost overrun in Gwalior region of construction projects, a questionnaire has been prepared. The feedback is taken from respondents and calculated by using AHP Technique. It is important to determine the reasons behind every factors that causes cost overruns in construction industry by knowing the opinions from the member which are concerned in construction industry. This study is carried out to understand and dig out the major factors resulting in cost overruns in construction industry which helps in improving the performance of the construction industry.

## II. ANALYTICAL HIERARCHY PROCESS

The AHP is a multi-criteria decision making tool that was introduced by Saaty. It has been used in decision making related applications. It uses multi-level hierarchy structure of criteria, sub-criteria (factors and sub-factors) and alternatives. A pair wise comparison is made between factors with the help of received data. These comparisons are used to make the matrices to obtain the priorities ranking of factors for making decision. If the comparisons are not consistent, then the result and comparison will be revised. The AHP converts these analytical values to numerical values that can be processed and compared over the entire range of problem. In the final stage, numerical priorities/weight are calculated for making decision alternatives.

The Analytic Hierarchy Process for Decisions making is developed by Dr. Thomas Saaty breaks the AHP into five steps, as follows –

- Step 1 - Build a hierarchy
- Step 2 - Make comparisons
- Step 3 - Calculate weights
- Step 4 - Check consistency
- Step 5 - Produce result

## COST OVERRUN FACTORS

S NO.	FACTORS	SUB-FACTORS	ABBR.
1	CONTRACTOR'S SITE MANAGEMENT	Poor site management and supervision	PSMS
2		Lack of experience of contractor	LEC
3		Mistake during construction	MDC
4		Relationship between management and labour	RBML
5		Shortage of labour	SL
6		Late delivery of material/equipment	LDME
7		Shortage of material/equipment	SME
8		Problem with sub-contractor	PSC
9		Dispute between parties	DBP
10	DESIGN AND DOCUMENTATION	Frequent design changes	FDC
11		Mistake in design	MD
12		Late in revising and approving of design document by consultant and client	LRADDCC
13		Incomplete design	ID
14		Lack of involving contractor during design	LICDD
15	FINANCIAL MANAGEMENT	Delay in progress payment by owner	DPPO
16		Insufficient fund	IF
17		Delay in payment to contractor	DPC
18		Change or fluctuation in foreign exchange rate	CFFER
19		Financial management on site	FMS
20		Bankruptcy	BR
21	COST ESTIMATING	Inflation	INF
22		Fluctuation in price of raw material	FPRM
23		Transportation cost	TC
24		High maintenance and cost of machinery	HMCM
25		Change in material specification	CMS
26		Change in orders	CO
27		Inaccurate or poor estimating of original cost	IPEOC
28	EXTERNAL	Bad weather condition	BWC
29		Labour strike	LS
30		Theft on site	TS
31		Unexpected ground condition	UGC
32		Act of god	AG

### III. RESEARCH METHODOLOGY

The methodology for present study has chosen a survey, made with the help of questionnaire form to find critical factors influencing cost overruns in construction projects. A questionnaire survey has been prepared with the help of a literature review of past works of various factors that causes cost overrun. Factors were taken from reviews from journals, articles, papers and websites which were based on construction's cost overrun. A survey was given to employees from different trades involved with the construction project. 32 common factors were taken through a detailed literature reviews of cost overrun. The similar factors were grouped under one main group.

These sub-factors were taken under into five main groups of factors:

**Group 1:** Contractor's site management factors (9 factors)

**Group 2:** Design and documentation factors (5 factors)

**Group 3:** Financial management factors (6 factors)

**Group 4:** Cost estimating factors (7 factors)

**Group 5:** External factors (5 factors)

The questionnaire was designed in such a way so that it is easy to read and response and are easy to fill in. The questionnaire was separated into two parts. The first included the information about the respondents and their roles, experience, and the types of construction they are involved in. Part second includes the comparison between factors that were identified through literature reviews.

The forms were distributed to engineering staff who involve in the process of construction (engineers, Contractors, project manager etc).

### IV. DATA ANALYSIS

As discussed earlier survey was carried out to collect the data. Scale was adopted according to SAATY(1980) AHP Technique. Ranking were given from 1 to 9 according to importance of one factor over other factor given by respondents. Ranking is given for 1=equal importance, 3=weak importance of one over other, 5=much more important, 7=very much more important, 9=absolute important and 2,4,6,8=intermediate values between the two adjacent judgements.

Total 80 sets of questionnaire were distributed, 48 responses were received. The ranking of factors causes cost overrun for construction project has been done on the basis of weight calculated through AHP Technique. Highest weight of factor should come at top followed by others as the weight decreases.

Table 1 shows the top most significant factors of cost overrun ranked by overall respondents

SRNO	FACTORS OF COST OVERRUN	OVERALL	
		AHP WEIGHT	RANK
1	Lack of involving contractor during design	0.280	1
2	Poor site management and supervision	0.268	2
3	Theft on site	0.246	3
4	Frequent design change	0.229	4
5	Incomplete design	0.229	4
6	Change in material specification	0.222	5
7	Act of God	0.215	6
8	Mistake in design	0.212	7
9	Financial management on site	0.206	8
10	Bad weather condition	0.206	8
11	Delay in progress payment by owner	0.202	9
12	Fluctuation in price of raw material	0.201	10

From the analysis of results, it is found that lack of involving contractor and poor site management and supervision are ranked high by respondents. These factors are elaborated in more details as follows -

**Lack of involving contractor during design-**Lack of involving contractor is ranked 1<sup>st</sup> by overall respondents shown in table 1. Construction companies was highly depends on contractors work than other. If contractor participate earlier during design to understand all the plan then many problems should be avoided during construction regarding drawing understandings.

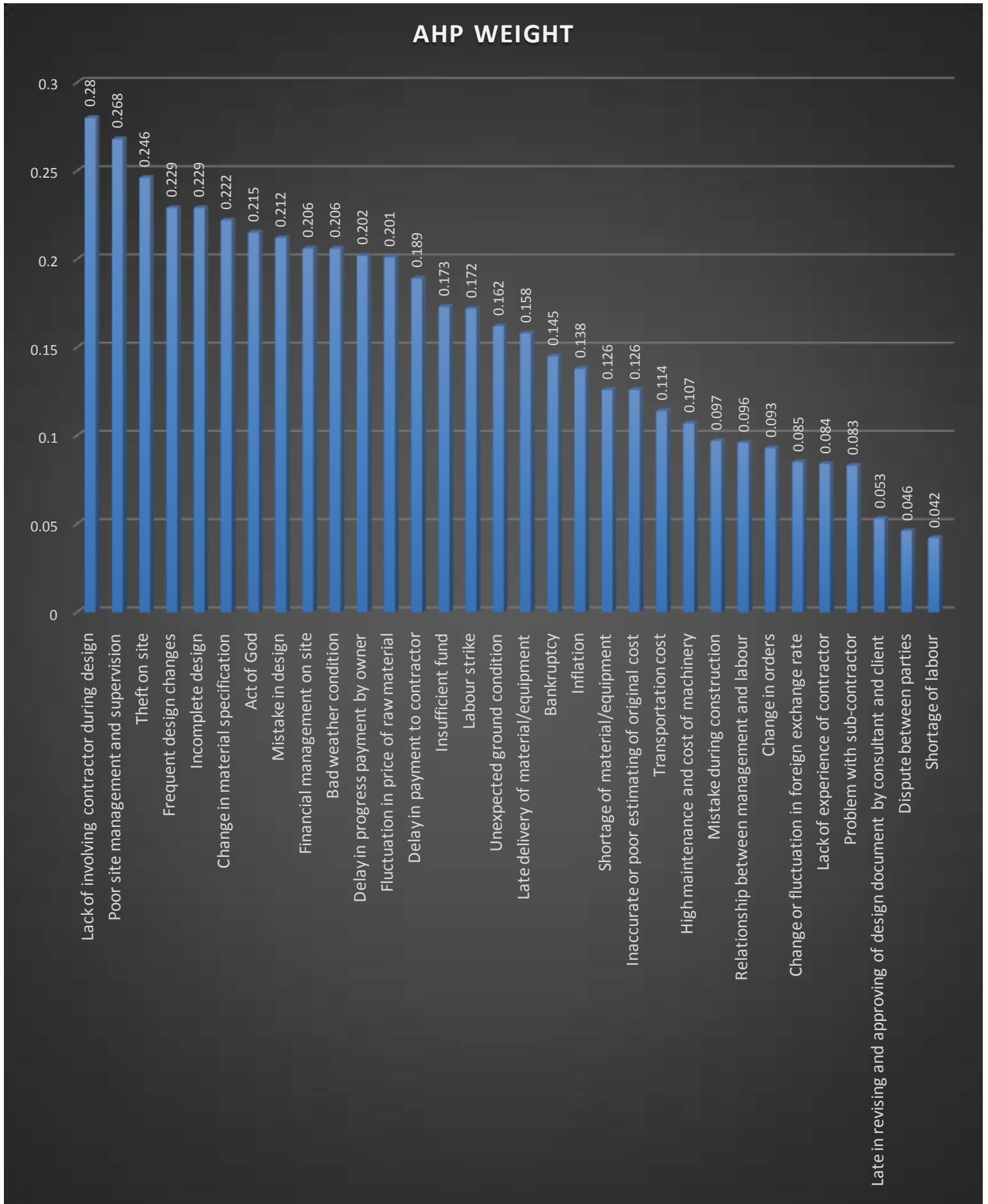
**Poor site management and supervision-** Ranked 2<sup>nd</sup> in overall ranking. Effective management on site by contractors is very important to ensure that project should complete on time (Choon 2008) and poor site management contributes to delay the project which increases the cost. Poor site management may occur when contractors do not have enough experience and suffer from a lack of knowledge in managing the project team (Kadiret *et al.*, 2005). However poor site management from the construction project manager's side will affect the whole team and also the progress of works, resulting in the odd outcome of project experiencing construction cost overrun as time increases. This view is supported by studies conducted by Augustine and Mangvwat (2001), Arshi and Sameh (2006), Aibinu and Odenyika (2006) and Ahmed *et*

*al.* (2003) who concluded that poor site management is one of the factors that contribute to delay in construction projects, which eventually result in cost overrun.

Table 2 RANKING DONE THROUGH AHP

S no.	RANKING OF CRITERIA	WEIGHT	RANK
	SUB –CRITERIA		
1	Lack of involving contractor during design	0.280	1
2	Poor site management and supervision	0.268	2
3	Theft on site	0.246	3
4	Frequent design changes	0.229	4
5	Incomplete design	0.229	4
6	Change in material specification	0.222	5
7	Act of God	0.215	6
8	Mistake in design	0.212	7
9	Financial management on site	0.206	8
10	Bad weather condition	0.206	8
11	Delay in progress payment by owner	0.202	9
12	Fluctuation in price of raw material	0.201	10
13	Delay in payment to contractor	0.189	11
14	Insufficient fund	0.173	12
15	Labour strike	0.172	13
16	Unexpected ground condition	0.162	14
17	Late delivery of material/equipment	0.158	15
18	Bankruptcy	0.145	16
19	Inflation	0.138	17
20	Shortage of material/equipment	0.126	18
21	Inaccurate or poor estimating of original cost	0.126	18
22	Transportation cost	0.114	19
23	High maintenance and cost of machinery	0.107	20
24	Mistake during construction	0.097	21
25	Relationship between management and labour	0.096	22
26	Change in orders	0.093	23
27	Change or fluctuation in foreign exchange rate	0.085	24
28	Lack of experience of contractor	0.084	25
29	Problem with sub-contractor	0.083	26
30	Late in revising and approving Of design document by consultant and client	0.053	27
31	Dispute between parties	0.046	28
32	Shortage of labour	0.042	29

Chart 1 GRAPH BETWEEN OVERALL FACTORS AND ITS AHP WEIGHT



## V. CONCLUSION-

The present study identified and analyzed the factors that causes cost overrun in construction industry/projects in Gwalior region. It is observed that top most factors that causes cost overrun are the Lack of involving contractor during design, Poor site management and supervision, Theft on site, Frequent design change, Incomplete design, Change in material specification, Act of God, Mistake in design and Financial management on site. If these factors are controlled, then the overall project cost should be reduced and project should complete before estimated time at given cost. The knowledge gained about cost overruns causes and the way it is affecting construction industry might prove to be beneficial to the members that involve in the construction project like investors .

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