

# ANALYSIS ON FACTORS CAUSING TIME AND FINANCIAL OVERRUN IN ROADS AND HIGHWAY CONSTRUCTION

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## ABSTRACT

*Delays and cost overrun is most common in infrastructure projects mainly in road construction projects. The impact of such factors is very high in India. The 80% of projects where suffered by schedule delays and cost overrun in developing countries like India. The comparison between actual cost, actual duration during construction phase and estimated cost, scheduled duration before construction is known as cost escalation and schedule delays.*

*Main objective of the study is to identify the factors causing delays and cost overrun in road construction project, to rank them based on their impact and to find critical factor among them. And finally to provide the recommendations to overcome such factors. The factors are listed out from the literature survey and such factors are considered for questionnaire survey. The respondents selected for questionnaire survey are (contractors, project managers, site engineers, clients of companies, highway department authorities). The ranking of factors can be formed from the collected questionnaire. The recommendations and conclusions are made from based on the analysis of questionnaire result to overcome critical factors in future projects.*

**KEYWORDS:** schedule delay, cost overrun, road construction

## INTRODUCTION:

India is the country which has the largest road network in the world. The government has taken various steps to increase and improve the transportation facilities and increasing the funds for growth and development of it. Construction industry is playing the major role in economic growth of India. The project management is to achieve the projected objective on time and specified cost, quality and its performance. The cost and time are considered as first and second criteria whereas quality, health and safety as fourth, fifth criteria in project management. In case of cost, time or quality factors are not properly planned or utilized the project will not attain it's goal and leads to failure. There are many reasons for delay and cost overrun in construction projects such as lack of planning, monitoring, and execution of work. More efficient planning of cost and duration achieves the project task with high precision.

It is common that all researchers have divided the main obstacles in large construction and infrastructure projects into main categories of time and cost overruns and tried to study the problems from different points of view including contractor side, consultant side and owner's side.

Many road and highway construction fail in time oriented problems, others fail in financial wise and others fail in other performance wise.

## OBJECTIVE:

- To identify the various factors responsible for cost overrun and schedule delays in construction phase of road projects.
- To rank the factors based on their impact
- To find critical factor among the listed factors dominating delays and cost overrun
- To make recommendations to overcome those critical factor in future construction of roads.

## METHODOLOGY:

- The factors causing cost overrun and schedule delays where collected from literature study and sorted out based on their category
- The questionnaire was prepared and a survey with 20 factors causing delays and cost overruns.

- Each factor was given a scale of 0 to 3 so that person could express the severity i.e., 0 being lowest and 3 being the highest.
- Questionnaire was conducted among various highway authorities, contractors, sub-contractors, site engineers, and supervisors.
- The scale value obtained for each factor where found out and ranked based on of the response.
- Findings of the study based on the statistical analysis
- Finally suggestions and recommendations are given to prevent from scheduled delays and cost overrun in future road construction

**QUESTIONNAIRE SURVEY:**

The factors responsible for delays and cost overrun where collected from literature study. Based on the factors the opinion where collected from highway authorities, contractors, sub-contractors, site engineers and project managers. Where listed based on their category. Finally the factors were selected and considered for questionnaire survey. The various factors are listed below.

**Factors related to consultant:**

- Incomplete drawing given by the consultant
- Late Issuance of instructions by the consultant
- Mistakes and errors in design documentation
- Unclear and inadequate details in drawings
- Delay in quality assurance / control
- Late in approving and receiving of complete work details

**Factors related to contractor and site condition:**

- Delay due to the effects of subsurface conditions
- Unavailability of utilities in site
- Delay in shifting of long distance to borrow pits
- Delay due to sub surface condition
- Quantity increase over contract during Construction
- Material related problem (Transportation, Cost, Handling etc.)
- Lack of efficiency of contractor to achieve time goal of project

**Cost influencing parameters:**

- Land acquisition
- Payment related problem from owner side
- Poor communication between construction parties
- Climatic condition
- Lack of experience & knowledge of construction parties
- Conflict among project participants
- Rework
- Unreliable sources of materials on the local market

**Responsibility and category of the major causes of schedule delays and cost overrun**

S.NO	FACTORS	Responsibility	Type of delay
1.	Incomplete drawing given by the consultant	Owner/Highways department	Controllable
2.	Late Issuance of instructions by the consultant	Owner/Highways department	Controllable
3.	Mistakes and errors in design documentation	Owner/Highways department	Controllable
4.	Unclear and inadequate details in drawings	Owner/Highways department	Controllable

5.	Delay in quality assurance / control	Contractor , highways department	Controllable
6.	Late in approving and receiving of complete work details	Highways department	Controllable
7.	Delay due to the effects of subsurface conditions	-	Un Controllable
8.	Unavailability of utilities in site	Contractor, Sub-Contractor	Controllable
9.	Land acquisition	Contractor	Un Controllable
10.	Delay in shifting of long distance to borrow pits	Contractor	Controllable
11.	Quantity increase over contract during Construction	Contractor, Sub-Contractor	Controllable
12.	Material related problem (Transportation, Cost, Handling etc.)	Contractor, Sub-Contractor	Controllable
13.	Lack of efficiency of contractor to achieve time goal of project	Contractor	Controllable
14.	Land acquisition	Highways department	Un controllable
15.	Payment related problem from owner side	Highways department	Un Controllable
16.	Poor communication between construction parties	Contractor and Sub-Contractor	Controllable
17.	Conflict among project participants	Contractor and Sub-Contractor	Controllable
18.	Lack of experience & knowledge of construction parties	Contractor and Sub-Contractor	Controllable
19.	Rework	Contractor and Sub-Contractor	Controllable
20.	Unreliable sources of materials on the local market	-	Controllable

**RESPONDENTS RECEIVED**

Organization/respondents	Number of questionnaires sent	Number of questionnaires received
Highway department	5	4
Contractors	4	4
Project managers	3	2
Engineers and supervisors	10	10
Total	22	20

**FACTOR ANALYSIS**

Factor Analysis (FA) is associate degree preliminary technique applied to a group of discovered variables that seeks to seek out underlying factors (subsets of variables) from that the discovered variables were generated. as an example, associate degree individual's response to the queries on a school entrance exam is influenced by underlying variables like intelligence, years at school, age, spirit on the day of the check, quantity of apply taking tests, and so on.

**Table 1** Factor Analysis

<b>FACTORS</b>	<b>Initial</b>	<b>Extraction</b>
Payment related problem from owner side	1.000	.837
Late in approving and receiving of complete work ?	1.000	.882
Unavailability of utilities in site?	1.000	.844
Quantity increase over contract during Construction ?	1.000	.752
Incomplete drawing given by the consultant	1.000	.764
Late Issuance of instructions by the consultant	1.000	.746
Mistakes and discrepancies in design documentation?	1.000	.731
Unclear and inadequate details in drawings?	1.000	.877
Delay due to the effects of subsurface conditions?	1.000	.929
Land acquisition	1.000	.791
Problem with neighbours in the project location ?	1.000	.807
Limited space of construction Area?	1.000	.846
Delay in shifting of long distance to borrow pits?	1.000	.887
Terrain condition affect the cost overrun ?	1.000	.853
Soil & rock suitability / drillability ?	1.000	.792
Material related problem	1.000	.909
Delay in quality assurance / control?	1.000	.822
Poor communication between construction parties	1.000	.892
Climatic condition	1.000	.842
Lack of experience & knowledge of construction parties	1.000	.857
Involvement of more no. Of parties (contractor) in single project	1.000	.883
Lack of efficiency of contractor to achieve time goal of project ?	1.000	.789
Conflict among project participants	1.000	.913

**Table 2** Reliability statistics

<b>Item Statistics</b>			
	<b>Mean</b>	<b>Std. Deviation</b>	<b>N</b>
Incomplete drawing given by the consultant	2.70	1.380	20
Late Issuance of instructions by the consultant	3.35	1.348	20

Mistakes and discrepancies in design documentation?	3.00	1.124	20
Unclear and inadequate details in drawings?	2.35	.671	20
Payment related problem from owner side	2.80	1.281	20
Late in approving and receiving of complete work?	2.65	1.387	20
Unavailability of utilities in site?	3.00	1.487	20
Land acquisition	2.55	1.276	20
Problem with neighbors in the project location ?	2.25	1.372	20
Limited space of construction Area?	3.50	1.318	20
Delay in shifting of long distance to borrow pits?	2.85	1.694	20
Quantity increase over contract during Construction?	2.30	1.218	20
Terrain conditions affect the cost overrun?	2.65	1.137	20

**FREQUENCY ANALYSIS**

A diagram consisting of rectangles whose area is proportional to the frequency of a variable and whose width is equal to the class interval. A histogram is an accurate representation of the distribution of numerical data. It is an estimate of the probability distribution of a continuous variable (quantitative variable) and was first introduced by Karl Pearson. It is a kind of bar graph. To construct a histogram, the first step is to "bin" the range of values that is, divide the entire range of values into a series of intervals and then count how many values fall into each interval. The bins are usually specified as consecutive, non-overlapping intervals of a variable. The bins (intervals) must be adjacent, and are often (but are not required to be) of equal size.

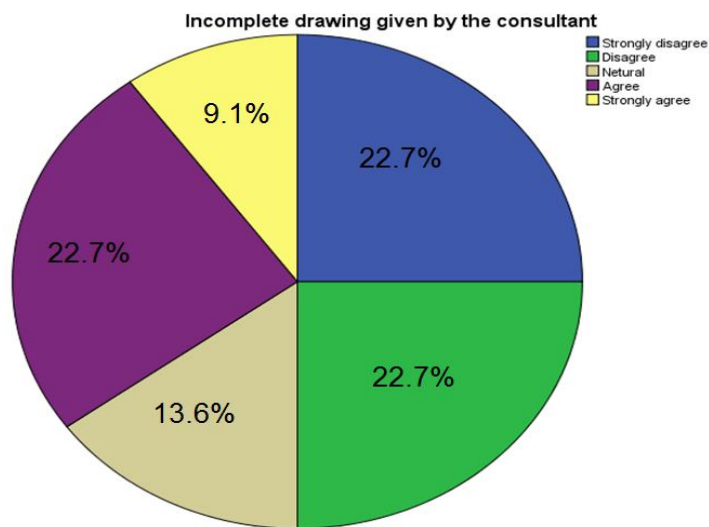
**Table 3** Statistics

		Incomplete drawing given by the consultant	Mistakes and discrepancies in design documentation ?	Payment related problem from owner side	Unavailability of utilities in site?	Land acquisition
N	Valid	20	20	20	20	20
	Missing	2	2	2	2	2
Mean		2.70	3.00	2.80	3.00	2.55
Median		2.50	3.00	3.00	3.00	3.00
Mode		1 <sup>a</sup>	3	3	1 <sup>a</sup>	3
Std. Deviation		1.380	1.124	1.281	1.487	1.276

**Table 4** Frequency analysis for Incomplete drawing given by the consultant

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	22.7	25.0	25.0
	Disagree	5	22.7	25.0	50.0
	Netural	3	13.6	15.0	65.0
	Agree	5	22.7	25.0	90.0
	Strongly agree	2	9.1	10.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

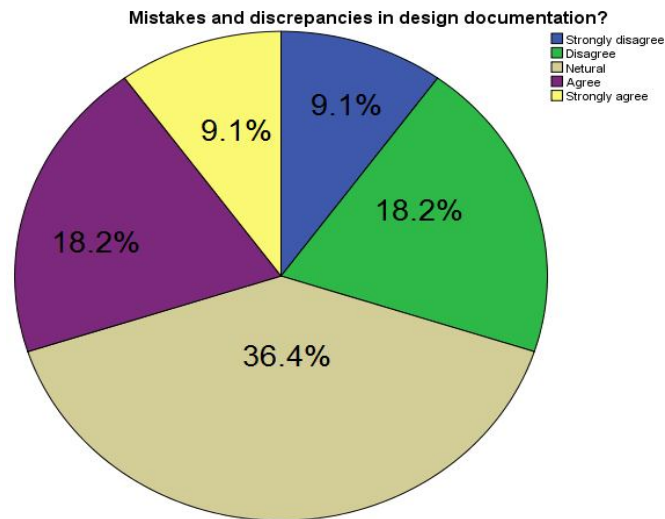
**Fig 1** Graph shows the Incomplete drawing given by the Consultant



**Table 5** Frequency analysis for Mistakes in Design documentation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	9.1	10.0	10.0
	Disagree	4	18.2	20.0	30.0
	Netural	8	36.4	40.0	70.0
	Agree	4	18.2	20.0	90.0
	Strongly agree	2	9.1	10.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

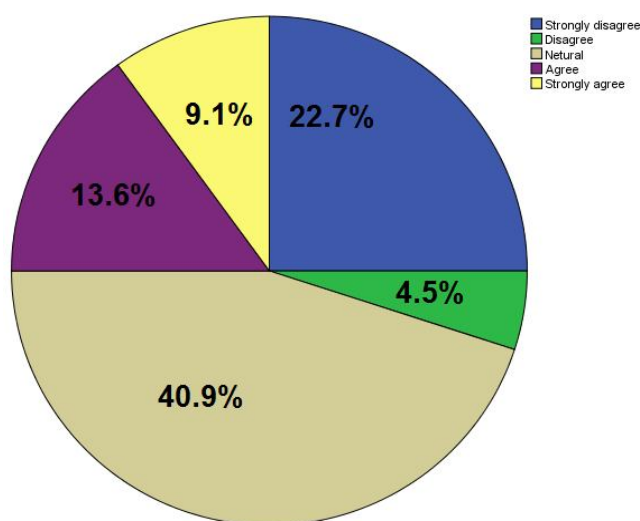
**Fig 2** Graph shows the Mistakes in Design documentation



**Table 6** Frequency analysis for Payment related problem from owner side

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	22.7	25.0	25.0
	Disagree	1	4.5	5.0	30.0
	Netural	9	40.9	45.0	75.0
	Agree	3	13.6	15.0	90.0
	Strongly agree	2	9.1	10.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

**Fig 3** Graph shows the Delay due to Payment related problem from owner side

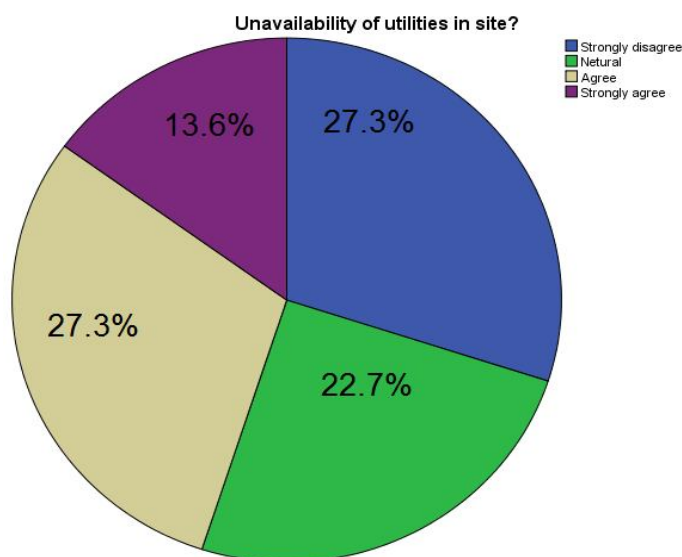


**Table 7** Frequency analysis for Unavailability of Utilities in site



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	27.3	30.0	30.0
	Netural	5	22.7	25.0	55.0
	Agree	6	27.3	30.0	85.0
	Strongly agree	3	13.6	15.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

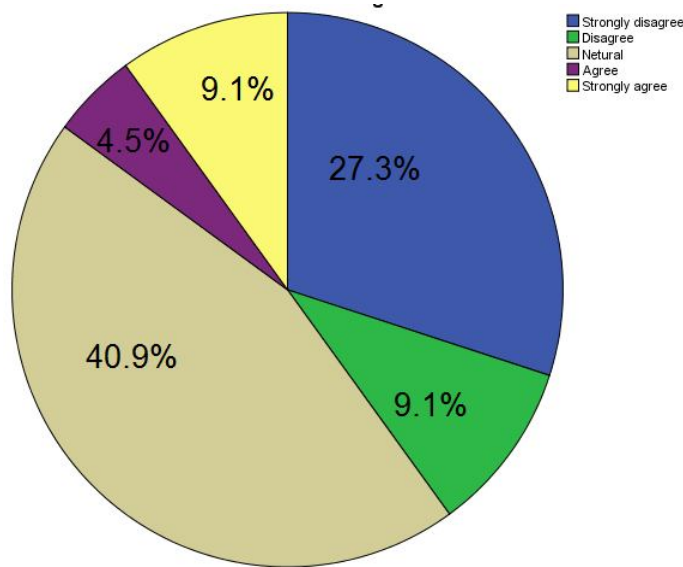
**Fig 4** Graph shows the Unavailability of Utilities in site



**Table 8** Frequency analysis for Land acquisition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	27.3	30.0	30.0
	Disagree	2	9.1	10.0	40.0
	Netural	9	40.9	45.0	85.0
	Agree	1	4.5	5.0	90.0
	Strongly agree	2	9.1	10.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

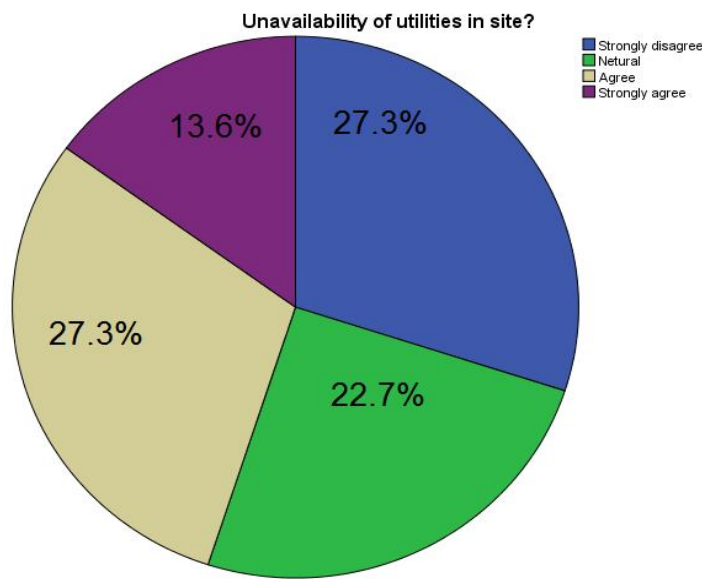
**Fig 5** Graph shows the delay due to Land acquisition



**Table 9** Frequency analysis for Delay in shifting of long distance to borrow pits

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	27.3	30.0	30.0
	Disagree	5	22.7	25.0	55.0
	Netural	1	4.5	5.0	60.0
	Agree	2	9.1	10.0	70.0
	Strongly agree	6	27.3	30.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

**Fig 6** Graph shows the Delay in shifting of long distance to borrow pits



**CONCLUSION AND RECOMMENDATIONS**

**Conclusion**

Schedule delays and cost overrun are the most common factors in road construction projects in India. From the study most influencing factors were listed out based on their ranking. So as the questionnaire survey was conducted across various contractors, project managers, government authorities and site engineers. From the survey most of the respondents mainly focused on completing the project within the scheduled duration and estimated budget. To find out the final result from the questionnaire survey the mean value method is used.

**Recommendations:**

To avoid design error and issues based on drawings the new software tools must be used. As now the building information modeling is applicable for road and highway construction projects. By utilizing the BIM workflow in road and highway projects starts with 3d model of the highway in which the components are linked to each other. This means a set of information about the project together in a single file..

BIM must not be use just as a three dimensional representation tool, four dimensional and five dimensional models can be prepared. In fourth dimension schedule data is attached to the model and in fifth dimension financial data is also attached. The Operation and Maintenance schedule also be introduced in the model which gives a brief information of

maintenance schedule of the road constructed. BIM must be used in designing, as some advanced software provides a better designing approach; such software must be exploited more like Infracore 360 and Mx Road suite.

To avoid the funding and payment delay, the time period should be mentioned in the contract, and indicating about the parties involved in the project to prepare the detailed budget. Financial plan should be made and date should be fixed for amount to be settled

The earlier identification of required land is the solution to avoid such problems. The 80% of the land are acquired before the work started. And remaining 20% of land is acquired periodically after starting the work. Forming the new team under project managers for identifying the required lands.

The unavailability of utilities needed for construction issue can be reduced by preplanning purchase methods. It includes that the unique and rarely available materials stored and before the activity starts. And it is one of the root issue for the financial overrun issue

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