

# An Analysis of causes and effects of change orders on construction projects in Mumbai.

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**ABSTRACT:** Construction is one of the most important employment sectors in India with very minimal research being done to identify the causes and effects in construction industry. Large construction projects are facing problem of delays and extra costs. In all types of construction projects cost and time is an important role. The purpose of this paper to focus on various change order and cause, effects and control measures for construction projects in East region of Mumbai. A set of questions were circulated between the professionals working on the site to acquire the causes and effects of delays faced by them. The respondents are engineering professionals having minimum 5 years of experience in construction industry for handling projects. From the data collected by the questionnaire survey we first take Cronbach's Alpha test for internal consistency test by using SPSS statistics software. After analyzing and find out conclusion we used relative importance index method.

**KEYWORDS:** Construction delays, Change Management, Construction Project, Cronbach's Alpha, Causes, Change Order, Effects, Relative Importance Index.

## I. INTRODUCTION

Change orders have long been an inherent part of the construction industry. It is seldom to spot a construction project being executed without a change which normally arises as a result of some causes attributed to the different parties involved in the project execution. The management of these changes is skill; in what manner we manage that change without affecting our goal. Managing change is the greatest importance to the success of construction project. The change orders created when change occur from any reason it may owner, contractor, etc. A change is the work for addition or rework. Many of the time change causing the demolition and rework. These causes decrease the labour productivity. Change orders are easy to

manage at the initial phases of construction which reduce the rework and extra effects for particular stage. So the change orders are from any reason they collective effect on construction project which resulted in delay or cost overheads.

## II. LITERATURE REVIEW

### Change Order

A change order is order which specifies the proper changes in the contract which alters the project duration and cost of the project. It is also stated as any guidance to the contractor which changes the specification of work by the owner, consultants. (Mokbel, 2003)

### Reviews of Technical Papers

1. Khalil Ismail Wali Nazik Imad Saber (2019) One of the most important problems facing the construction management process is the occurrence of change orders, which became inevitable in every construction project and the magnitude of these variations varies considerably from project to project. Considerably causing different effects to the project like changes in cost, time, quality, and completion schedule.

2. Shabir Hussain Khahro (2017) The construction industry is considered to be one of the main sources of growth and general development. It plays an important role in the growth and economic development of any country

3. Alia Alaryan, Emadelbeltagi, Ashraf, Mahmoud (2014)

a..Changes on one project also affect other unrelated projects by tying up resources that are committed elsewhere. Negative relation between the parties and are another by product of changes on a project.

b. This study advised that the most of the changes caused by owners. The most of common effect of change orders on cost and time of the projects. The control measure checking and reviewing contract

document, review design before approval and the scope of change order must be clearly made.

c. The importance index, weighted average are used to rank causes and effects.

$$\text{Importance index} = \text{Weighted Average} \times 100/4$$

$$\text{Weighted Average} = (\sum W_i \times X_i) / N$$

Where  $W_i$  is option of cause,  $X_i$  is no. of respondent selected that cause and  $N$  is total no. of respondent.

4. According to Kaliba C., M.M. (2009), if project costs or schedules goes beyond their planned time period, client satisfaction would be trade off and the funding profile would failed to match the budget requirement and further slippage in schedule could results. Which further leads to costly disputes and shows many times adversely impact on relationships between the parties involved such as project stakeholders including owners, design professionals, construction professional, users and others.

Hence, studying is necessary and analyses causes of delay. Like the one service provided by the infrastructure projects serves input for the other sectors, the cost overrun of this project leads to an increase in capital-output ratio for the economy as a whole.

For the study, the East region of Mumbai has been selected. Being an economic hub and financial capital of India, it is important to study the problems that are faced by construction industry of Mumbai, which will further help us to understand the key factors that cause delay in the city's urban and sub urban construction projects in Mumbai Region.

### III. METHODOLOGY

- The methodology includes series of procedure followed from acquiring data to analysing it. At the very first stage defining problem statement and fix the objectives by reviewing previous literature. The outcome from the literature review would assist in finding out 28 causes of delay which were suitable for the present study
- By studying the previous literature which will helps to prepare questionnaire related to causes and effects of change orders in construction projects.
- With actual field persons helpful for preparation of questionnaire. data collection done from this questionnaire survey
- Also data collected from actual site case studies. Finding out importance index. And main causes and effects of change order.



Fig.1. Research Methodology

### IV. QUESTIONNAIRE SURVEY

To gather the data required for the study, a questionnaire survey was prepared and circulated within the professionals working on the construction site. The questionnaire consists of 28 causes are divided into four section client based, contractor based, consultants based and other related causes. The questionnaire was based on the scale of Likert's which ranged from 1-5.

### V. DATA COLLECTION AND DATA ANALYSIS

From the previous literature review prepare the questionnaire for the survey from the construction projects in East region of Mumbai The respondent are engineering professional with having minimum five years of experience in the construction industry. The causes are divided into four section client based, contractor based, consultants based and other related causes. Effect

and control sheet are prepared from the various literature papers After survey data first analyze for consistency test by finding Cronbach' alpha by

using SPSS statistics software. A commonly accepted rule of thumb for describing internal consistency is as follow

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Data were collected through a questionnaire survey collected from contractors, owners, engineers, consultants and sitestaff.

**Table No.1 Causes Of Change Order**

Sr. No	CAUSES OF CHANGE ORDER	RANK	RAN K
	<b>A) Causes due to Owner</b>		
1	Owner instructs additional works & modification to design.	70.43	1
2	Owner fails to make decisions or review document at the right time.	60.57	14
3	Unilateral decisions made by owner without proper considerations to contract.	63.20	6
4	Owner's needs during the design stage are unclear or not well-defined.	64.31	7
5	Owner's change of schedule due to financial problem.	63.92	8
6	Obstinate nature of owner.	53.16	28
7	Owner fails to maintain hold on the project schedule.	59.39	18
	<b>B) Causes due to contractor</b>		
1	The contractor misuses variations Instructions.	63.14	9
2	The scope of work for the contractor is not well defined.	51.16	27
3	The required equipment and skilled labour are not available.	60.39	17
4	Poor project management and planning by contractor.	64.49	5
5	Lack of contractor's involvement in design.	69.51	2
6	Contractor's lack of judgment and experience.	57.43	19
7	Contractor's desired profitability, cost escalation & financial problem.	60.96	12
	<b>C) Causes due to Consultants</b>		

1	Unrealistic design periods & Design errors.	66.45	3
2	Failure by consultant to perform design and supervision effectively.	53.12	26
3	Consultant's lack of judgment and experience.	53.51	25
4	Obstinate nature of consultant.	53.90	24
5	Failure by the consultant to provide adequate and clear information.	60.18	16
6	The lack of coordination between consultant and contractor or subcontractors.	65.27	4
7	Consultant fails to supervise drawing prepared by their junior team.	56.04	20
<b>D) Other Causes</b>			
1	Delay in decision making process by site engineers.	61.75	11
2	Problems on Site, Unfamiliarity with local conditions and safety consideration.	57.25	21
3	Non availability of construction manual and procedure for project construction in Mumbai	61.57	15
4	Non availability of records of similar project in Mumbai	54.12	23
5	Replacement of materials or procedures.	61.75	10
6	Demolition and re-work ,Quality improvement.	61.96	13
7	Unforeseen problems and weather conditions.	56.86	22

The actual result collected from data shown in above table no.1. The data surveyed from construction sites in Mumbai from Engineering Professionals with having minimum five years' experience in construction industry.

The data analysis done by using Relative Importance Index method.

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

where w = weighting given to each factor by the respondents and ranges from 1 to 5 where '1' is 'not significant' and '5' is 'extremely significant', A = highest weight (i.e. 5 in this case), and N = total number of respondent.

## VI. CONCLUSION

The study concluded that to minimize

the impact of delay in the construction project in East part of Mumbai certain protocols should be followed to ensure that the construction project should run without any delay. Research on causes and effects of change orders in construction projects concluded that Changes in design plan and schedule by the owner is the main cause of change order, change in the procedure and errors and design modification is the second causes. Changes in specification and scope of project mostly by clients and their consultants are the most sources of variation. The results of this study states that effects of variations are increase in project cost, additional payment for the contractor, increase in cost of the project, completion schedule delay and rework and demolition. The variation or changes increases disputes and claims in the work which will obstruct the continuousness in the work. Owner must attain

the qualified and experienced contractor to avoid changes due to contractor.

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