

# Analysis of Change Order in Road Construction Projects

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**Abstract** - Construction contracts are complex because they involve many human and nonhuman factors and uncertain conditions. Hence changes in plans, contract terms, designs or specifications are very common and likely to occur at any stage of the project. These changes have to be effectively analyzed to reduce their unfavorable effects on the completion of the project which would require a comprehensive understanding of the root causes. This project is aimed to identify the vital causes of change orders and their effects in road construction projects in Kerala and further to identify the measures to mitigate their impacts in project execution. Global causes and effects were obtained from literature study and personal interviews were conducted to ascertain the factors influencing in the local scenario. Using this questionnaire was prepared and survey was conducted among government officials, contractors, project managers and consultants of road projects. The most influential causes and effects is analyzed using IBM SPSS and they are ranked through Relative Importance Index (RII) using weighted mean. Relevant suggestions are proposed to improve the level of project performance and to assist professionals to take proactive measures for reducing change orders.

**Key Words:** Change, Weighted average, Questionnaire, Reliability, Chronbach's Alpha, Likert scale

## 1. INTRODUCTION

Change of planned design, construction procedure and contract terms during execution of work leads to the change order. A change order is a written order to the contractor, signed by the owner, and issued after execution of the contract, authorizing a change in the work or an adjustment in the contract sum or the contract time. Decisions are made every day in construction processes based on incomplete information, assumptions and the personal experience of the construction professionals that might lead to change or rework. Both change and rework are done in the form of either 'adding', 'deleting' or 'replacement'. A degree of change should be expected since it is difficult for the clients to visualize the end product they requested. These changes are commonly referred to as change orders

Critical change may cause consecutive delays in project schedule, re-estimation of the work statement, and extra demands of equipment, materials, labor, and overtime. Changes, if not resolved through a formalized change management process, can lead to big number of claims and disputes.

## 1.1 Need For The Study

In Kerala, road construction projects undergo extensive changes which often lead to deviation from the preplanned construction methods. They are mostly unforeseen; hence it is a serious issue and does not receive sufficient attention from researchers. These changes have to be efficiently managed through a formalized method for the successful completion of project. This project is trying to open up the area by identifying the major causes and effects and suggesting certain remedies to minimize the impact of change orders.

## 1.2 Scope

The aim of the study is to investigate the causes of change orders on road construction projects, as well as to identify the effects of change orders on road construction projects in Kerala. Evaluating and suggesting remedial measures to overcome such problems.

## 1.3 Objective

This Study has the following four main objectives:

- To understand and evaluate various changes in road construction projects.
- To identify causes of changes in construction projects.
- To determine effect of changes in construction projects.
- To suggest remedial control measures towards the identified causes.

## 2. METHODOLOGY

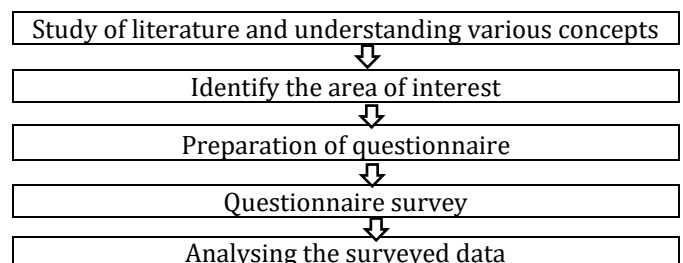


Fig -1: Methodology chart

In the developing countries, there have been a lot of adverse effects on ongoing projects as a result of constant changes in the course of carrying out such projects. Questionnaire

survey is adopted as a methodology in accordance with the fulfillment of the objective of the study. Detailed study on the causes and effects of road projects were done through literature study. A draft was prepared with 111 Global causes and 27 effects of changes orders. Draft was revised according to prevailing conditions in Kerala through 6 Personal Interview, Case study of a delayed project. The draft was finalized to 21 causes and 11 Effects. The main causes of change orders were divided mainly into four sections: consultant and authority related causes, contractor related causes, unforeseen causes and government related causes. The questionnaire was structured in three sections (A, B and C). The first section of questionnaire (A) provides data regarding the personal information of the surveyed respondents. The second section (B) consists of 21 causes for change order. The section (C) consists of 11 major effects of change orders. A seven point Likert scale was adopted to mark the responses, the responses are 1. Strongly disagree 2. Moderately disagree 3. Disagree 4. Neither agree nor disagree 5. Agree 6. Moderately agree 7. Strongly agree

To check the reliability of questionnaire, pilot survey was conducted among 15 respondents. The reliability check was done using SPSS software. The reliability coefficient Chronbach's alpha was found to be 0.883 which is more than the minimum value. Hence the questionnaire was found to be reliable.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.883	.881	31

Fig -2: Reliability test output

To achieve the research objectives, survey was conducted on a selected sample of construction experts. The respondents are divided into three groups: contractors, consultants and clients. The response from the three groups are shown in pie chart. Forty responses were collected in total which includes 16 contractors, 9 consultants and 15 clients. It was noticed that most of the respondents had either experience between 10 and 20 years or more than 20 years which strengthens the result obtained as their responses were based on sufficient years of experience that allowed them to digest the question well and give a precise answer.

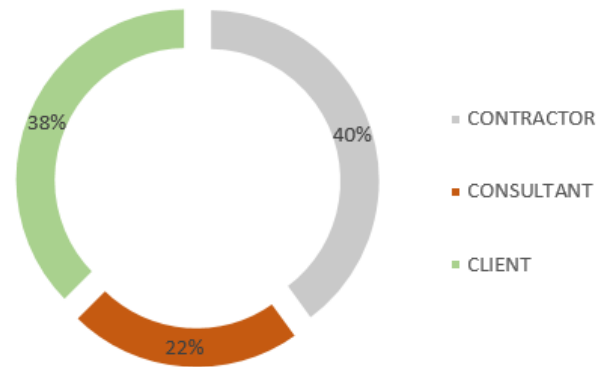


Fig -3: Response Distribution

The questionnaire was statically analyzed using Statistical Package for Social Science (SPSS). The most important causes and effects of change orders on construction projects was ranked according to the weighted arithmetic mean.

### 3. RESULTS

From the obtained responses of all the category of respondents, the causes and effects were ranked based on the weighted average as shown in table A and table B.

Table -1: Causes ranked using weighted average

SL.NO.	CAUSES
1	Difficulties faced in land acquisition by the client/Delay in handover of site to contractor.
2	Misuse of democratic privileges (Increased intervention by public, if any issue affects them).
3	Delay in stage payments.
4	Restrictions regarding environmental clearance, certain statutory requirements etc.
5	Unforeseen changes in grade of work, Deviation from original scope of work during extension.
6	Changes in government regulations and policies
7	Troublesome procedures for safety especially due to work in midst of traffic through existing roads.
8	Unexpected ground conditions and terrain.
9	Prevailing political situations.
10	Insufficient coordination between various departments in utility shifting and placing.
11	Delay made by authorities in making firm decision.
12	Poor project management practices in

	Departments.
13	Difficulties in financing project.
14	Delay in obtaining permits from local authorities
15	Inefficient site study/ lack of clarity in scope of work and incomplete bill of quantities (BOQ).
16	Prevailing economic condition.
17	Incompetency of officials due to lack of updation of technical knowhow, secured job and other benefits received by them.
18	Lack of quality assurance of (low grade) materials
19	Technical incompetency of contractor and his team
20	Poor construction methods of contractor, lack of sufficient machinery.

**Table -2:** Effects ranked using weighted average

SL.NO.	EFFECTS
1	Cost overrun
2	Delay in completion schedule
3	Delays/ obstructs work in other areas or in other projects
4	Delay in payment to contractor
5	Public discomfort & Traffic congestion
6	Increase in contractors overhead
7	Failure to meet utility
8	Legal dispute between owner and contractor
9	Decrease in quality of work
10	Contract termination
11	Demolition and rework

The data analysis showed that each category of respondents opined different causes of change order. From the perspective of the contractor the major causes for the generation of change orders are misuse of democratic privileges, difficulties faced in land acquisition by the client, delay in handover of site to the contractor, changes in government regulations and policies.

According to consultant, the major causes for change orders are difficulties faced in land acquisition by the client and delay in handover of site to the contractor, unforeseen changes in grade of work, deviation from original scope of work during extension, unexpected ground conditions and terrain.

The client of the project regarded insufficient coordination between various departments in utility shifting and troublesome procedures for safety especially due to work in midst of traffic through existing roads as the major causes for change orders.

#### 4. CONCLUSIONS AND RECOMMENDATIONS

This research investigated the causes and effects of change orders in road construction projects in Kerala. Through the survey it is concluded that the most influencing causes for the generation of change orders are difficulties faced in land acquisition by the client and delay in handover of site to the contractor and misuse of democratic privileges by the public. The significant effects of change orders are cost overrun, delay in completion schedule.

Based on the study, the following points are suggested to minimize change orders.

1. Land acquisition and related procedures should be completed prior to the commencement of project
2. Intervention by people other than department should be minimized.
3. Proper investigation for study of site and terrain conditions for DPR preparation
4. Detailed BOQ considering practical work has to be made before tendering
5. Utility shifting should be made as part of the project and executed by same contractor
6. EPC projects to be promoted
7. Fund allocation as per DPR requirement proper management in execution.

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