

## A Study in Construction Delays of Residential Structures

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**Abstract:** Delays are one of the most common problem faced by the construction industry in India and around the world. Construction delays can be caused by several reasons which can be related to owner, design, labor or could be caused by some external factors such as bad weather. The delay in construction causes time overrun which implies that the project requires additional time for completion than originally anticipated. Time overrun in turn leads to cost overrun which causes huge monetary losses. This study focuses on finding out the most common causes of construction delays in Indian context. The study was carried out in South and Central Mumbai region. A questionnaire based survey was conducted based on 43 questions spread across 9 different categories. The findings were evaluated with Relative Importance Index technique. The aim of the study was to identify various causes of delays in construction and their importance.

**Keywords:** Time Overrun, Cost Overrun, Relative Importance Index, Construction Delays, Construction Industry.

### I. INTRODUCTION

The construction industry is the second largest industry in India after agriculture. It makes a significant contribution to the national economy and provides employment to large number of people. However, the construction industry is volatile and requires massive financial investment. Typically, the work offers low rate of returns in relation to the amount of risk involved. In construction, delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. Delays occur in every construction project and the significant of these delays varies considerably from project to project. Delays on the project are universal phenomenon.

#### 1.1 Causes of Delay:

- Owner: Owner related delay caused due to reasons such as late payment and poor communications between owner and other parties.
- Contractor: Delays caused due to difficulty in financing the project by contractor, improper site management, conflicts between contractor and other parties, poor planning and scheduling of activities.
- Consultant: Delay in performing inspection, delay in reviewing and approving design documents.
- Design: Revisions in design documents, improper design and subsequent redesigning.
- Labor: Shortage of labors, unskilled workforce.
- Equipment: Shortage of equipment, low productivity and efficiency of equipment.
- Project: Contract duration is too short, legal disputes between various parties.
- Materials: Delay in material delivery, availability of materials, changes in type and specifications of materials.
- External: Delay in obtaining permits from municipalities, accidents, bad weather, changes government rules and regulations, social and cultural factors.

#### 1.2 Effects of Delays:

- Time Overrun
- Cost Overrun
- Reduction in profits for contractor
- Losses for owner due to extended construction phase
- Distrust between owner and contractor
- Legal disputes between various parties
- Total Abandonment of project

## II. RESEARCH METHODOLOGY

The study was based on a questionnaire survey which consisted the following steps.

- Preparation of Questionnaire
- Conducting Pilot studies
- Data Collection
- Data Processing and Analysis

### 2.1 Preparation of Questionnaire:

A questionnaire was designed based on object of the study i.e. finding out causes of construction delays of residential projects, finding out opinions to minimize the construction delays. The questionnaire was prepared in such a way as to get the opinions and understandings from experienced respondents.

The questionnaires are classified into 2 categories:

#### a) Respondent Background

In this section, we try to obtain the respondents information. This questionnaire includes:

- The respondent organization
- The position of the respondent in the company
- The experience of the respondent in the construction project

#### b) Causes of Construction Delays

This section of questionnaire evaluates the factors that contribute to the cause of construction delays. The factors are divided into 9 groups namely:

- Owner
- Contractor
- Consultant
- Design
- Equipment
- Project
- Labours
- Materials
- External factors

The questionnaire is based on Likert's scale of 5 ordinal measures from 1 to 5 according to the contribution

- (5) = Very High Effective
- (4) = High Effective
- (3) = Effective
- (2) = Low Effective
- (1) = Very Low Effective

The Questionnaire Consisted of 43 questions divided into 9 categories mentioned above.

**Table 1**

NO	Group	Cause of delay	Very high effective	High effective	Effective	Low effective	Very low effective
1	Owner	Delay in progress payments by owner					
2	Owner	Late in revising and approving design documents by owner					
3	Owner	Poor communication and coordination by owner and other parties					
4	Owner	Unavailability of incentives for contractor					
5	Owner	Suspension of work by owner					
6	Contractor	Difficulties in financing project by contractor					
7	Contractor	Poor site management and supervision by contractor					
8	Contractor	Poor communication and coordination by contractor with					

		other parties.					
9	Contractor	Delay in site mobilization					
10	Contractor	Rework due to errors during construction					
11	Contractor	Conflicts b/w contractor and other parties					
12	Contractor	Ineffective planning and scheduling of project by contractor					
13	Contractor	Improper construction methods implemented by contractor					
14	Contractor	Inadequate contractor's work					
15	Consultant	Inadequate experience of consultant					
16	Consultant	Delay in performing inspection and testing by consultant					
17	Consultant	Delay in approving major changes in the scope of work by consultant					
18	Consultant	Late in reviewing and approving design documents by consultant					
19	Design	Revisions in design documents					
20	Design	Delays in producing design documents					
21	Design	Misunderstanding of owner's requirements by architect					
22	Labor	Shortage of labors					
23	Labor	Unskilled workforce					
24	Equipment	Shortage of equipment					
25	Equipment	Low level of equipment-operator's skill					
26	Equipment	Low productivity and efficiency of equipment					
27	Project	Ineffective delay penalties					
28	Project	Original planned contract duration is unrealistic					
29	Project	Disputes between various parties					
30	Materials	Changes in material types and specifications during construction					
31	Materials	Delay in material delivery					
32	Materials	Housekeeping of materials					
33	Materials	Delay in manufacturing/processing special building materials					
34	Materials	Late in selection of finishing materials due to availability of many types in market					
35	External	Delay in obtaining permissions from municipality					
36	External	Rain effect on construction activities					
37	External	Effect of social and cultural factors					
38	External	Traffic control and restriction at job site (Job layout)					
39	External	Accident during construction					
40	External	Differing site (ground) conditions					
41	External	Changes in government					

		regulations and laws					
42	External	Delay in providing services from utilities (such as water, electricity)					
43	External	Delay in performing final inspection and certification by a third party					

**2.2 Conducting Pilot studies:**

The main goal of this was to eliminate misunderstanding the questions that were mentioned in the questionnaire. Every respondent was asked about each and every question's meaning in order to ensure that there was no confusions with the questions. Further they were asked on their opinions on the questions and wordings of the question and their importance with respect to our study thereby eliminating questions which held no significance. This also allowed us to simplify the questions as it would be very important when the questionnaire would be mailed to respondents which we could not personally interview thus minimizing the confusion and getting more accurate results.

**2.3 Data Collection:**

The Data Collection for our study was done in two ways:

- a) Personal Interviews
- b) Mailing Questionnaire

a) Personal Interviews  
An appointment was taken with Project Managers, Consultants, Site Engineers & Owners (Developers). And the questionnaire was presented in order to get our data.

- b) Mailing Questionnaire

In the case of being unable to visit Respondents we mailed them soft copies of questionnaire which was filled up by them and mailed back to us.

The table below gives us the details of the respondents such as positions held by them in the organization and no of years of experience.

**Table 2**

SITE NO.	POSTION HELD	NO. OF YEARS OF EXPERIENCE
SITE 1	SITE ENGINEER	2 YEARS
SITE 2	PROJECT MANAGER	11 YEARS
SITE 3	SENIOR ENGINEER	7 YEARS
SITE 4	ASSISTANT DIRECTOR	6 YEARS
SITE 5	SITE ENGINEER	2 YEARS
SITE 6	SENIOR ENGINEER	6 YEARS
SITE 7	SITE ENGINEER	6 YEARS
SITE 8	OWNER	10 YEARS
SITE 9	SITE ENGINEER	2 YEARS
SITE 10	QUANTITY SURVEYOR	2 YEARS
SITE 11	DESIGN ENGINEER	7 YEARS
SITE 12	PROJECT ENGINEER	8 YEARS
SITE 13	SITE ENGINEER	2 YEARS
SITE 14	SENIOR ENGINEER	7 YEARS

**2.4 Data Processing and Analysis:**

The study utilized method to analyze the respondent's data to identify the critical attributes among the categories owner, contractor, consultant, design, labor, equipment, project, materials and external. The analysis and processing of the data was done using Relative Importance Index technique.

**2.4.1 Relative Importance Index**

Relative index has been widely used in construction research for measuring attributes with respect to surveyed variables. Likert's scaling was used for ranking questions that have an agreement levels. The respondents were required to rate the importance of each factor on a 5-point Likert's scale using:

- (5) = Very High Effective
- (4) = High Effective

- (3) = Effective
- (2) = Low Effective
- (1) = Very Low Effective

Then the relative importance index was computed using the following formula:

$$RII = \frac{\sum W}{A * N} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5 * N}$$

Where, “W” is the weighting given to each factor by the respondent, ranging from 1 to 5, ( $n_1$ = number of respondent for very low effective,  $n_2$ = number of respondent for low effective,  $n_3$  = number of respondent for effective,  $n_4$ = number of respondent for high effective,  $n_5$ = number of respondent for very high effective). “A” is the highest weight (i.e. 5 in the study) and “N” is the total number of samples. The relative importance index ranges from 0 to 1.

### III. CONCLUSION

From the data collected by us during the questionnaire survey we found that:

- The most important cause of construction delay of residential structures occurs due to the owner related causes. Out of all owner related causes, the respondents cited that the most important cause of delay was due to late payment by owners. The least cause of delay in this category was due to incentives for contractors.
- The second most important cause of delay was design related with misunderstanding of owner’s requirement by design engineer as the most important in the category. The other two causes that is revision in design documents and delays in producing design documents were equally important but were ranked below in the second place within the category.
- Third ranked category was of external causes with delay in obtaining permits from municipality as the highest rated cause and accidents during construction as the least important cause of delay.
- Coming in at number four was Labor category with shortage of labors as the most important cause and unskilled workforce as the least important cause of delay.
- Number fifth category was Contractor with difficulty in financing project by contractor as the most important reason and delay due to site mobilization was rated as the least cause of delay.
- Sixth and Seventh place was a tie between Consultant and Project category with late in reviewing and approving design documents by consultant as the most important cause and delay in performing inspection and testing by consultant as least important for Consultant category and in the Project category, legal disputes between various parts as the most important cause and ineffective delay penalties as the least cause of delay.
- Eight place goes to Equipment category with shortage of equipment as the most important cause. The other causes in this category received equal ratings.
- The least important category according to respondents was Material category with delay due to manufacturing of special materials as most important cause and changes in material types and specifications during construction as least important cause.

**Table 3**

Category	Relative Importance Index (Category Average)
Owner	0.677
Contractor	0.603
Consultant	0.571
Design	0.667
Labor	0.621
Equipment	0.566
Project	0.571
Materials	0.554
External	0.66

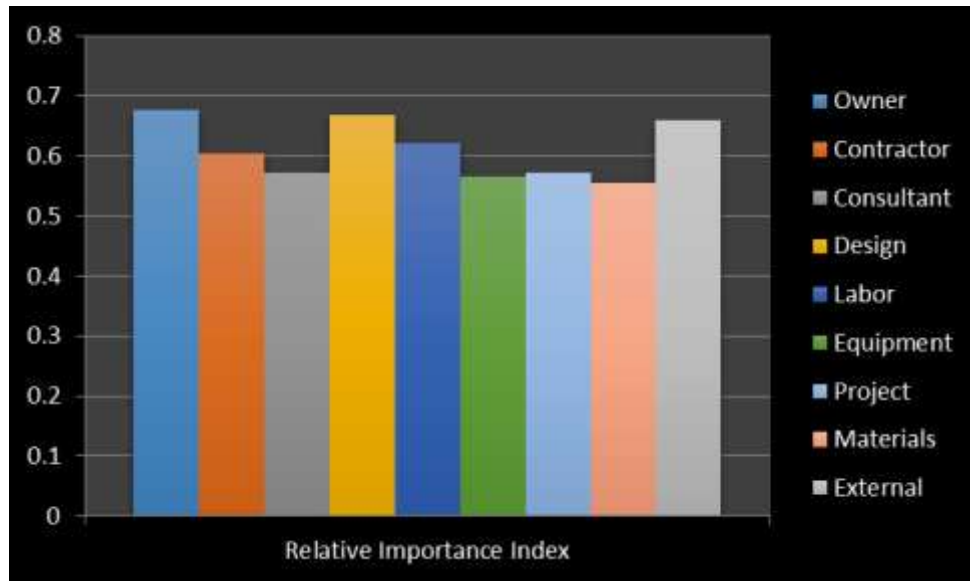


Fig. 1

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