

Statistical Analysis of Delays in Construction Projects

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Abstract - With sophisticated techniques being adopted for construction, and an increasing number of individuals getting involved in projects, the process has gotten increasingly complex. The new standards that have been identified have made completing projects within budget and necessary time frame. This has led to increase in the costs of the materials and labor involved, also leading to the process of delay which causes distress to both the owners and builders. The aim of this thesis is to determine the factors which lead to delays in completion of projects, understand them after identification and analyze the impact of them. With the help of our various observations we will suggest measures that can reduce the delays caused.

Key Words: Techniques, Construction, Delay, Project.

1. Introduction

Construction industry is reason behind the development of the rural and urban areas. Many construction projects suffer from delay. Disruption of work caused due to delays leads to loss of productivity, the consequent result of which is escalation in costs and changing the owner- builder dynamic, often leading to bitter and difficult termination of contract which are not hassle free. Thus, it is necessary for the management to keep a track of the progress of the project on a regular basis. However it has become increasingly difficult to achieve economy and avoid delays at the same time because of the sophistication of the construction processes and the involvement of large number of parties i.e. clients, designers, contractors, consultants, suppliers etc.

Thus, it is of prime importance to tackle possible delaying factors at the earliest stage to minimize collateral damage, whether physical or relationship and image that can possibly be tarnished in the industry.

The study undertakes a holistic approach to understand the root causes of project delays, understand them and analyze the cause and effects, and overall impact on the viability of the project and negative effects experienced.

2. Aim and Objective:

Following are the main objectives of the thesis:

- To discover major causes and sources for delay of residential construction in Pune city.
- To analyze data collected of the on-going projects and create a factor for delays of various items of work.
- Discuss and suggest possible solutions for minimization of delays for construction projects.

3. List of factors that cause delay:

This thesis is based on the delays that occur during the execution of various items of work during completion of construction projects like:

1) Delay factors during excavation:

- Type of soil
- Depth of hard strata
- Occurrence of unplanned drainage lines
- Dewatering during rainfall
- Dewatering due to presence of underground water
- Difficult architecture requirements
- Late submission of drawings by RCC consultants
- Late supply of materials by vendors
- Labor issues

2) Delay factors during brickwork:

- Type of bricks to be used
- The availability of suitable bricks
- Inappropriate purchase orders
- Design specifications
- Quality of bricks
- Labor issues
- Insufficient storage place

3) Delay factors during fixing of doors and windows:

- Transportation of doors, windows
- Architect's decisions and demands
- Change in the design specifications
- Availability of suitable materials

- High costing materials
- Availability of various fixtures and fasteners

4) Delay factors during plastering:

- Unavailability of material
- High cost of riversand
- Continuous rainfall
- Change in proportions due to rainfall
- Type of plaster (exterior)
- Difficult elevations
- Unavailability of labor

5) Delay factors due to government clearances:

- Sanctioning of plans
- Late allotment of additional FSI
- Unavailability of government officers
- Lack of personnel for clearance purposes

4. Methodology and Analysis:

The methodology selected for this research paper is questionnaire survey. The form consists of five important items of work which were investigated for delays. After the form was generated, the data was to be collected of various sites located in different regions in Pune. These questionnaires have been collected after meeting professionals i.e. project engineers, site engineers etc of three different projects. In these forms they fill the columns consisting of the labors/machines employed, time taken, time expected and their average. Also a factor is generated for every item of work individually.

Fig No. 1: The scheduled form submitted to the professionals.

Items	Total	Labors/ Machines employed	Time Expected	Time Taken	Aver age

Here,

Items = items of work like excavation, brickwork, plastering etc.

Total = total work done

Labor/machines employed = the no. of machines or labors employed to finish the particular job.

Time Expected = It is the time frame in days in which the item of work was supposed to be completed

Time Taken = It is the time taken in days in which the item of work was actually completed.

Average = Time Taken / Time Expected

Factor was calculated by the adding the average of the particular item of work of all three sites and dividing it by three.

Results and Discussions:

The major causes and sources for delay of residential construction in Pune city are:

1) Delay factors during excavation:

- Type of soil
- Depth of hard strata
- Occurrence of unplanned drainage lines
- Dewatering during rainfall
- Dewatering due to presence of underground water
- Difficult architecture requirements
- Late submission of drawings by RCC consultants
- Late supply of materials by vendors
- Labor issues

2) Delay factors during brickwork:

- Type of bricks to be used
- The availability of suitable bricks
- Inappropriate purchase orders
- Design specifications
- Quality of bricks
- Labor issues
- Insufficient storage place

3) Delay factors during fixing of doors and windows:

- Transportation of doors, windows
- Architect's decisions and demands
- Change in the design specifications
- Availability of suitable materials
- High costing materials
- Availability of various fixtures and fasteners

4) Delay factors during plastering:

- i. Unavailability of material
- ii. High cost of riversand
- iii. Continuous rainfall
- iv. Change in proportions due to rainfall
- v. Type of plaster (exterior)
- vi. Difficult elevations
- vii. Unavailability of labor

5) Delay factors due to government clearances:

- i. Sanctioning of plans
- ii. Late allotment of additional FSI
- iii. Unavailability of government officers
- iv. Lack of personnel for clearance purposes

• Discussion for objective No. 2

- i. Therefore we can conclude that the most amount of delay which takes place is due to the late allowances and permissions given by the government with a factor of 1.60
- ii. Thereafter the most delay takes place for brickwork with a factor of 1.44.
- iii. Third in the list of delay is fixing of windows with a factor of 1.30 and after that is delay during internal plastering with a delay factor of 1.28.
- iv. After that in list is delay during excavation with a factor of 1.23 and lastly the least delay occurs is during fixing of doors with a factor of 1.14.

• Discussion for objective No.3

The suggestions and solutions to avoid the delays in the future are:

1) Solution for delay factors during excavation:

- i. Conduct a thorough survey of the soil type and conditions present before starting with the excavation.
- ii. Also know various drainage lines present in and around the property to be excavated to avoid any damage to the pipelines.
- iii. Dewater the entire area and make sure the soil is dry during excavation and avoid excavating soil with much underground water presence.
- iv. The site engineer should be in constant contact with the architecture and RCC consultants during the

execution of the project to avoid any incorrect construction.

- v. The delivery of the needed materials should be properly co-ordinated with the on-site engineer and delivered on time with any damage to the materials.

2) Solution for delay factors during brickwork:

- i. Appropriate bricks should be ordered in suitable quantity as suggested by the consultants and the engineer.
- ii. The bricks should be available locally and easily or else the transportation charges for the bricks are very high and economy cannot be achieved.
- iii. Enough storage space should be available on site to store the buffer materials required in case of emergency.
- iv. Skilled and unskilled labours should be available to do the required job and that to in time.

3) Solutions to avoid delay factors during fixing of doors and windows:

- i. Appropriate doors and windows should be ordered in suitable quantity as suggested by the consultants and the engineer.
- ii. There should be no change in design and specifications of doors and windows by the architect or interior designer once the order has been placed.
- iii. The required materials should be available in the market locally in order to avoid buying expensive materials.
- iv. Enough storage space should be available on site to store the buffer materials required in case of emergency.

4) Solutions to avoid delay factors during plastering:

- i. Plastering should be done non-rainy seasons to avoid the damage done by moisture.
- ii. Alternative to riversand i.e. crush sand should be used in order to achieve economy.
- iii. The proportions should be carefully designed and mixtures should be made on site during plastering.
- iv. Difficult elevations and designs should be avoided during at initial stages only as very skilled labours are required to plaster such elevations.
- v. Sufficient labour and equipments should be available to carry out the plastering in the time specified.

5) Solutions to avoid delay factors due to government clearances:

- i. The plans should be submitted on time by the company to get the approval on time.
- ii. The allotment of additional FSI should be done in time by the government officials so that time is not wasted and construction of the building is continued.
- iii. A systematic approach should be followed by the government officers and avoid any type of delay from their side to verify the submitted documents.
- iv. Highly qualified and competent engineers and officers should be hired by the municipality to carry out the major works.

The average of the various items of work was calculated for all sites which later are used to calculate the factor. Below are the tables:

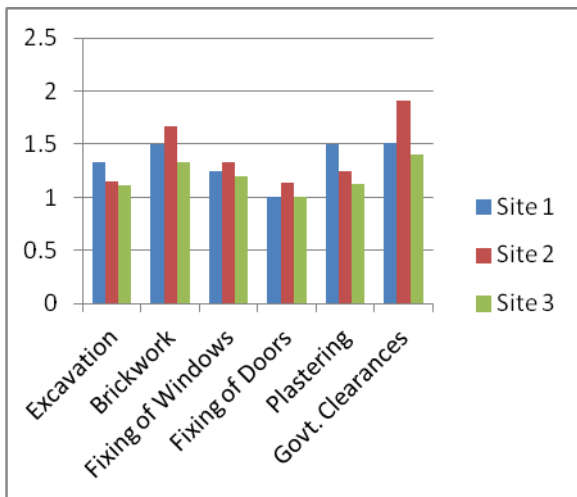


Fig No. 2: The above bar graph shows the comparison of average factor for various items of work.

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