

COMPARING DESIGN-BUILD AND DESIGN-BID-BUILD PROJECT- CASE OF RESIDENTIAL PROJECTS

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Abstract—Every construction project is unique in nature; it needs certain resources, viz. man, material, machinery, money, methodology, time etc. in addition to conducive environment required for its successful execution. To complete any construction project vis-a-vis planned objectives within the allotted budget and stipulated time is always a difficult task for the management. With the continuous decline in profit margins and greater competition in construction projects, construction contractors are finding ways of eliminating waste and increasing profit. Although numerous approaches have been developed to improve efficiency and effectiveness of construction processes, there still seems lack of proper research to predict the performance of a particular parameter based on other factors affecting the project. Here, an attempt has been made to correlate the resource utilization for both traditional as well as fast-track construction, which would ultimately help project stakeholders, decide the optimum use of available resources. The objectives of this paper is to conduct a questionnaire survey on construction projects executed with both traditional and fast-track approach and determine Karl-Pearson's correlation co-efficient between two independent projects (one traditional and one fast-track) w.r.t optimum resource utilization. In essence, this crux of this exercise is to help project stakeholders predict the approach to be adopted for a particular project.

Index Terms—Resources, Construction Project, Fast-track Construction, Correlation.

I. INTRODUCTION

To complete the project prior to normal duration is always a challenge to the management of any project, as it often demands many pattern shifts. Opportunities of globalization, competition from multinational firms force the management of the organizations in the Indian Housing Infrastructure sector to take various aggressive strategies to maintain their profitability. Constructing infrastructure for housing is one of such problems. Moreover, these projects are required to be completed in quick duration compared to normal time to remain competitive, to get faster return on investment, and to give longer project life. However, using Design-Bid-Build approach of project management, it is impossible to handle the problem of minimizing the project duration from a normal period. To overcome such difficulties, managements are looking for new approaches and one such approach is the use of concurrent engineering. In this approach the phases of the project are accomplished concurrently instead in series. The complexities that arise in managing projects are tackled through proper restructuring of project organization; upgrade management commitment, proper planning of

activities, safeguard project quality, managing project risk equitably.

II. ROLE OF TIME & COST IN CONSTRUCTION

Timely completion of a construction project is frequently seen as a major criterion of project success by clients, contractors and consultants alike. Newcombe [1990] note that there has been universal criticism of the failure of the construction industry to deliver projects in a timely way. NEDO [1983] states that a disciplined management effort is needed to complete a construction projection time, and that this concerted management effort will help to control both costs and quality. It is predominant saying that the client's objectives can be achieved through a complete management effort that recognizes the interdependence of time, cost and quality. Clients have been constantly concerned with the overall profitability of projects and the accountability of projects generally. Cost overruns, in association with project delays, are frequently identified as one of the principal factors leading to the high cost of construction Charles and Andrew, [1990]. Research to date has tended to focus on the technical aspects of managing costs on construction projects in the attainment of client objectives. There is little evidence of a concern for the organizational, social and political problems that are inherent in the management of construction costs and the ability of the project team to meet the client's needs in terms of cost.

III. LITERATURE REVIEW

Prasanta Kumar Dey [2000] in his work explains that Conventional ways of managing projects are no longer valid for managing projects of this dimension. Fazio in their work explains Accelerating a project through fast tracking is a major decision, and construction professionals should be aware of its implications. Analysis of fast-track construction projects indicated that despite the apparent advantages, not all projects lend themselves to a successful application of the fast-track approach. Kasim [2005] in their work presented a brief overview of materials management practices on fast track construction projects. The traditional construction methods apply more paper-based work during the construction process. The emergence of ICT systems could transform conventional to modern methods in managing construction activities. Abhijeet Deshpande [2012] in their work emphasis on increased importance in fast-track projects because design and construction are executed almost simultaneously with very little or no lag between them and

the compressed schedule interferes with the inherently iterative nature of design, sometimes resulting in suboptimal design. Alhomadi [2011] in their work investigated the relationship between fast-tracking and predictability through an extensive literature review. It revealed that schedule compression, accelerating or overlapping has an impact on projects in terms of achieving the original objectives and sometimes may lead to unexpected outcomes. It can be concluded from the findings in the literature review that using fast-track the duration of the projects can be reduced and even the cost for construction will be more when compared with traditional approach. But still there has been not enough evident regarding correlation between various resources utilized in both traditional and fast-track Approach of managing construction projects. Hence an attempt has been made in this paper to evaluate correlation between various parameters like time and cost of the major activities of construction and conducted a questionnaire survey for the projects applying either of the approaches and draw conclusions for the same.

IV. DATA COLLECTION

The study is based on questionnaire survey wherein the questionnaire prepared is used to collect data from various developers, contractors, project managers etc. regarding the important aspects necessary for comparing design-build and design-bid-build projects relating to the construction of residential projects. The questionnaire was prepared with the help of expert opinions and was survey was followed on two construction sites one Traditional site and one being fast-track project and observations were noted. While comparing Design-build and Design-bid-build project following points were given utmost importance which are:

- Time
- Cost
- Quality
- Type of Contract
- Role of Entity
- Schedule Compression
- Mobilization
- Productivity and Maintenance
- Alterations
- Risk Associated
- Unique Problems
- Technical Advisors
- Safety
- Lack of Competition
- Shortage of materials.

V. OBSERVATIONS AND FINDINGS

Following Observation were found on site as per questionnaire prepared:

1. Time: Time is the most important criteria for judging the success of the project. It was find in the survey that traditional project required about **709 days** for completing and handing over the project whereas fast-track projects required only about **573 days** which is

- about **20%** faster as compared to traditional project.
2. Cost: Cost is a time dependent parameter; more the time required for completion more will be the cost of completion. In was found from the study that traditional project required about **11.6 crores** and for fast-track project it was about **13.53 crores** which is about **16.62%** more than required for the traditional approach.
3. Quality: Quality of construction is an important aspect and it may differ from firm to firm. It was observed Fast-track projects have more control on quality as compared to traditional approach.
4. Type of Contract: In the study it was observed that traditional project followed Item Rate Contract which might have resulted to pay more money that what was estimated whereas fast-track project used Cost plus fixed amount type of contract.
5. Role of Entity: It was seen from the study that for traditional project the execution work was carried out by more than one entity and that for fast-track project the entire execution was carried out by single entity.
6. Scheduled Compression: It was observed that compression for traditional project is only possible unless all activities of construction are treated as critical and fast-track project Compression can be done with the help of advanced technologies.
7. Mobilization: It was studied from both projects that mobilization amount for traditional project is much less as compared to fast-track project.
8. Productivity and Maintenance: It was observed that fast-track project yield higher productivity and lesser maintenance cost as compared to traditional project.
9. Alterations: If there is some changes in the design after starting the construction work those alterations cannot be easily dealt with in fast-track projects. In this study it was observed that the work in fast-track project was delayed for **30 days** because of certain changes in design.
10. Risk Associated: From the study undertaken it was observed that fast-track project has inherent litigation risk and for traditional project is due to cost overruns.
11. Unique Problems: From the study it was observed that fast-track project possess more unique problems due to multiple contract conditions as compared to traditional project.
12. Technical Advisors: Since concept of fast-track is very new in Indian market hence the firms opting for fast-track approach need to rope in technical advisors for the proper implementation of work.
13. Safety: It was observed from study that no common safety culture is practiced by contractors in case of traditional projects whereas fast-track projects are more concerned to safety policies followed on their site.
14. Lack of Competition: From the study it was observed that fast-track projects have very less bidders for work as the fast-track approach is not used extensively in the Indian market.
15. Storage of Materials: As materials count for 50-60% of total project cost, hence storage of critical materials and

equipment are ordered early in case of fast-track projects.

CALCULATIONS

During the study some major activities time and cost were determined from the concerning firms with the help of which we performed correlation and regression for the time and cost and results so obtained were used for finding the feasible project of the two taken for the study.

| Sr. No | Activities | Overall Time (days) | Overall Cost (Lakhs) |
|--------|---|---------------------|----------------------|
| 1 | Excavation and Footing | 60 | 174 |
| 2 | All Floor Slab including Terrace slab | 142 | 580 |
| 3 | Lift Machine Room | 25 | 58 |
| 4 | O.H Tank | 32 | 58 |
| 5 | Finishing Works including waterproofing | 385 | 288 |
| 6 | Compound Development | 35 | 2 |

Table 1: Time and Cost for Traditional Project.

| Sr. No | Activities | Overall Time (days) | Overall Cost (Lakhs) |
|--------|---------------------------------------|---------------------|----------------------|
| 1 | Excavation and Footing | 50 | 183.8 |
| 2 | All Floor Slab including Terrace slab | 98 | 750 |
| 3 | Lift Machine Room | 20 | 58 |
| 4 | O.H Tank | 25 | 58 |

| | | | |
|---|---|-----|-----|
| 5 | Finishing Works including waterproofing | 350 | 301 |
| 6 | Compound Development | 30 | 2 |

Table 2: Time and Cost for Fast-track Project

RESULTS

For traditional Project

X Values

| PARAMETER | VALUES |
|--------------------|-----------|
| Σ | 679 |
| Mean | 113.167 |
| $\Sigma(X - Mx)^2$ | 98022.833 |

Y Values

| PARAMETER | VALUES |
|--------------------|------------|
| Σ | 1160 |
| Mean | 193 |
| $\Sigma(Y - My)^2$ | 232085.333 |

Combined X and Y

N = 6

$\Sigma(X-Mx)(Y-My) = 75782.657$

Hence by using Karl Pearson's Coefficient of correlation

$$r = \frac{\Sigma(X - \bar{X})(Y - \bar{Y})}{\sqrt{\Sigma(X - \bar{X})^2 \Sigma(Y - \bar{Y})^2}}$$

We have, $r = 0.5024$

For fast-track Project

X Values

| PARAMETER | VALUES |
|--------------------|---------|
| Σ | 573 |
| Mean | 95.5 |
| $\Sigma(X - Mx)^2$ | 81807.5 |

Y Values

| PARAMETER | VALUES |
|--------------------|------------|
| Σ | 1352.8 |
| Mean | 225.467 |
| $\Sigma(Y - My)^2$ | 388604.133 |

Combined X and Y

N = 6

$\sum (X-Mx) (Y-My) = 61517.6$

Hence by using Karl Pearson's Coefficient of correlation

$$r = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum(X - \bar{X})^2 \sum(Y - \bar{Y})^2}}$$

We have, $r = 0.345$

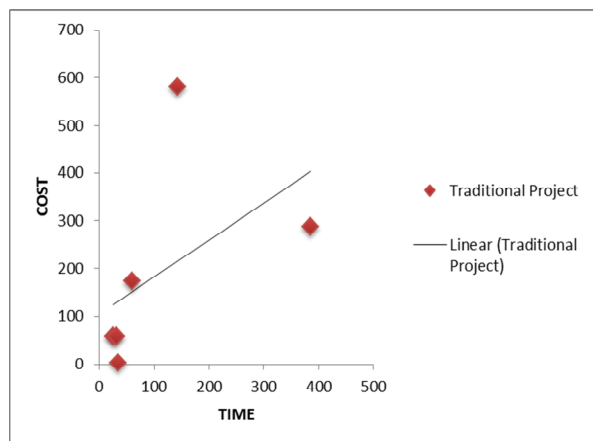


Fig 1: Scatter Plot for Traditional Project

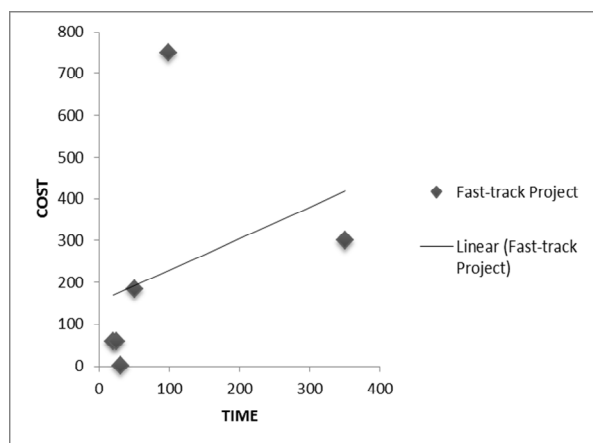


Fig 2: Scatter Plot for Fat-track Project

From the results it can be concluded that traditional project utilized resources better than the fast-track project

VI. CONCLUSION

From the study it is evident that traditional project although not able to yield results in time perform better than fast-track

projects from economy standpoint of view. Also most of the project developers in India opt for Traditional approach of construction because of certain reasons like large no. of Unskilled labours available in plenty, Lack of Technical Expertise, Seasons like Monsoon where most of the construction activities are stopped, Lack of buyers of the commodity in the market. Another reason of why fast-track approach not being followed because of some advanced tools and equipment used in this approach requires additional infrastructure on site for its smooth working and if work stops for certain reason than developers have to bear great losses. From the past study many conclusion were drawn that fast-track is only suitable if the project is repetitive or if there is mass housing project. The study lack some limitation as well first of them is project size and complexity, unforeseen difficulties data missing, no detail about the delay in traditional approach, changes in government policies and regulations caused certain changes in the design, absence of Holiday calendar from the site. Though there are certain more parameters like mentioned above this needs more focus before concluding a best technique for construction. The more detail we get from both approaches a broader picture we get to comment on adoption of technique. Also it is very important to note that most of the traditional Project use fast-track logic for Planning and execution for the certain activities of project.

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