International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 13 Issue: 05 | May 2026 www.irjet.net p-ISSN: 2395-0072

# Quantifying the Cost of Residential Construction Delays: A Study of Direct and Indirect Cost Escalation

**Ar. J. Jennifer Angelina[1], Ar. Z. Fathima Taskeen [2], Ar. V. Vidya[3]**

*[1]M. Arch (construction project management) student, [2]Additional HOD, [3]Associate Professor, Faculty of Architecture, Dr.M.G. R Educational and Research Institution, Chennai, India.*

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**Abstract -** *Construction delays are common in residential construction, adversely impacting schedules and financial performance. Although the reasons behind construction delays have been comprehensively studied in the past, there is little evidence concerning the measurement of the cost implications associated with these delays. This study will help fill this knowledge gap by formulating a methodology that would be used to assess the financial implication of delays in residential constructions. A quantitative approach combining literature review, case study analysis, and survey of construction practitioners will be utilized for this study. The cost of delay includes direct costs, which are mainly comprised of additional site overheads, additional idle equipment, reduced productivity, and rework cost, and indirect costs, which include interest, materials escalation cost, general business overheads, opportunity cost, and legal fees. Based on the results, it can be seen that there is a high positive relationship between the delay duration and the escalation of total cost of the project. The direct cost escalates in a linear way while the indirect cost escalates exponentially especially in the case where the delay duration is long. This research shows that indirect cost is underestimated most of the time.*

***Key Words***: **Delays in construction, cost overruns, residential construction, direct cost, indirect cost, delay analysis, time overruns, and budget overruns.**

## 1. INTRODUCTION

Construction projects especially those undertaken in the residential field, are very susceptible to delays owing to the complexity of the projects, number of parties involved, and reliance on external influences. Delays in construction are seen as any deviation from the intended project plan leading to delays and loss of money.

Residential construction projects in economies that are urbanizing fast like India have to be carried out within tight budget and time limits. External conditions including rise in material prices, labour shortage, licensing requirements, among others, play a big part in causing delays.

Conventionally, delay in construction studies have been conducted in such a way that their causes have been determined and ranked through the use of methods such as the Relative Importance Index (RII). Nevertheless, there is no evidence of research that quantifies the cost implications associated with delays in a numerical form. Such deficiency in research work is important since the parties concerned have a tendency of underestimating the real cost implication of delays.

### 1.1 METHODOLOGY

The methodology employed in this research utilizes a comprehensive quantitative framework that amalgamates various methods to guarantee a systematic and dependable analysis of construction delays and their corresponding cost increases. To start, a thorough review of the literature is done to build a strong theoretical base. This entails analyzing prior research studies, journals, and industry standards to ascertain the principal causes of construction delays and to categorize delay-related costs into direct and indirect components. The literature review also helps us understand the models, methods, and gaps in current research, which helps us set up the overall study framework.

Subsequently, a case study methodology is utilized to examine specific residential construction projects. These case studies show how delays happen in real life and how they affect the length and cost of a project. You can figure out how much the project was delayed and how much it cost by comparing the planned and actual timelines. This method lets you look at both direct costs (like labor, materials, and equipment) and indirect costs (like financing, overhead, and lost opportunities) in great detail.

Structured questionnaires are also used to collect primary data from contractors, consultants, and site engineers. The questionnaire is meant to get professionals' views on what causes delays, how they affect costs, and how well the project is going. We use statistical tools like ranking methods and percentage analysis to make sense of the data we collect. The combination of literature review, case study analysis, and survey data gives a complete picture of construction delays, which makes it possible to get accurate numbers and draw useful conclusions.

### 1.2 LITERATURE REVIEW

The literature review on residential construction delays underscores that time overruns substantially impact both direct and indirect cost increases, rendering delay analysis an essential domain in construction management. Numerous studies underscore that delays are not merely scheduling complications; they function as financial multipliers that escalate labor, material, equipment, and overhead expenses.

Direct costs like extended site overhead, equipment idle time, lost labor productivity, and rework can be measured and usually go up in direct proportion to how long the delay lasts. Indirect costs, on the other hand, like financing charges, rising material prices, corporate overhead, lost opportunities, and legal fees, grow faster and are often underestimated even though they have a big effect. Research consistently identifies primary causes of delays, including inadequate planning, financial limitations, design modifications, labor shortages, and ineffective resource management. Research indicates that numerous delays stem from the initial phases of a project, primarily attributed to design flaws and insufficient coordination among stakeholders.

Also, recent studies show that risk management, lean construction methods, and digital tools are all important for keeping costs down and avoiding delays. The literature shows a strong link between how long delays last and how much costs go up. This shows that we need systematic ways to measure things to make planning, cost control, and decision-making better on residential construction projects.

## 2. LIVE CASE STUDIES

2.1 Parkhouse Mews, Guindy

**Figure 1**- Parkhouse Mews, Guindy

Parkhouse Mews is a high-end residential construction project in Guindy, a highly developed urban area with a lot of demand for infrastructure and connectivity. The project was first planned to take about 24 months, which is the usual amount of time it takes to build a house, including the substructure, superstructure, finishing, and outside work. The project, on the other hand, was delayed by about three months, bringing the total actual duration to almost 27 months.

**Figure 2-** Entrance of Parkhouse Mews, Guindy

[3]Associate Professor, The main reasons for the delay were problems with repairs and maintenance during construction, workers being inefficient, delays in getting materials, and problems with coordinating the site. These delays caused costs to rise significantly, affecting both direct and indirect parts. Direct costs went up because of higher site overhead costs, longer equipment rental periods, lower worker productivity, and more rework and protection costs. Indirect costs went up because of a longer financing burden, rising material prices, corporate overhead allocation, and lost opportunities because the project took longer to finish.

The delay also had an effect on the project's cash flow and the contractor's profits. Overall, Parkhouse Mews shows how even small delays in residential projects can add a lot to the total cost of the project. This shows how important it is to plan well, keep an eye on things, and have strategies for dealing with delays.

Indirect costs escalated faster than direct costs during prolonged delay, delay duration has a compounding effect on total project cost and profitability.

**Table -1:** Identification on Parkhouse Mews, Guindy

| Parameter | Observation |
|---|---|
| Nature of Delay | Non-critical initially, later affected overall project schedule |
| Direct Cost Impact | Significant increase in site overhead, labour, equipment, and rework costs |
| Indirect Cost Impact | Higher than expected due to prolonged duration |

2.2 Parkhouse Mews, Guindy

**Figure 3**- Malkoha, Guindy

Developed as part of a premium urban housing segment, Malkoha is a high-rise residential apartment complex in Chennai. Given its structural complexity, high-rise construction constraints, and finishing standards, the project was originally scheduled to take 30 months to complete. Nevertheless, there was a significant delay of around 18

months, which increased the project's actual duration to almost 48 months. Financial limitations, labor difficulties, material procurement delays, and inadequate site coordination during crucial building phases were the main causes of the delay. The longer schedule was also caused by outside variables including changes in the cost of materials and administrative approvals.

**Figure 4-** Gym space at Malkoha, Guindy

Direct and indirect expenditures consequently increased dramatically. Increased site overhead costs, prolonged equipment use, lost labor productivity, and more rework as a result of prolonged exposure to incomplete work were all examples of direct cost escalation.

Due to corporate overhead allocation, inflation-driven material price increases, financing difficulties, and opportunity costs from postponed project turnover, indirect costs increased more dramatically. Stakeholder profit margins were lowered and project cash flow was impacted by the protracted delay. All things considered, the Malkoha project demonstrates how protracted delays can result in compounded cost escalation, with indirect costs being a major factor in raising the overall financial burden.

Indirect costs escalated more rapidly than direct costs, long-duration delays create compounding financial impact, reducing profitability significantly.

**Table -2:** Identification on Malkoha, Guindy

| Parameter | Observation |
|---|---|
| Nature of Delay | Prolonged and cumulative, affecting multiple project stages |
| Direct Cost Impact | Significant increase due to extended project duration |
| Indirect Cost Impact | Very high compared to direct costs |

2.3 Broadstone, Ramapuram

**Figure 5**- Broadstone, Ramapuram

As part of Chennai's expanding high-rise housing market, the Broadstone Appaswamy is a high-end residential apartment complex situated in Ramapuram. The project's original 36 months' timeline took into account building stages such foundation, superstructure, finishing, and services installation. Nevertheless, a 12 months, delay caused the project's real duration to increase to about 48 months. Disruptions in the supply of materials, problems with labor availability, small design modifications, and difficulties with contractor and subcontractor cooperation were the main causes of the delay. Schedule overruns were sometimes caused by outside variables like changes in market prices and delays in approval.

**Figure 6**- Mapping of Broadstone, Ramapuram

Both direct and indirect costs went up as a result. Extended site overheads, prolonged equipment use, labor productivity loss, and small rework operations all contributed to direct cost escalation. Financing costs, material price increases, corporate overhead allocation, and opportunity loss from project completion delays were the main causes of indirect cost inflation, which was more substantial.

**Figure 7-** Interior unit space of Broadstone, Ramapuram

The financial impact was significant, especially because of inflation and longer project deadlines, even though the delay duration was minor in comparison to other projects. This scenario demonstrates how even modest delays in home building can result in observable cost increases, particularly for indirect cost components.

Indirect costs escalated more rapidly than direct costs, long-duration delays create compounding financial impact, reducing profitability significantly.

**Table -3:** Identification on Broadstone, Ramapuram

| Parameter | Observation |
|---|---|
| Nature of Delay | Moderate but cumulative across project stages |
| Direct Cost Impact | Noticeable increase due to extended duration |
| Indirect Cost Impact | Significant due to time Extension |

## 3. FINDINGS

The study's findings unequivocally show that both direct and indirect cost escalation in residential projects are significantly and quantifiably impacted by construction delays. The examination of case studies showed that the total project cost increases significantly with the length of the delay, with indirect expenses rising more quickly than direct costs. Time overruns were found to result in a proportionate rise in direct cost components such labor wages, equipment utilization, extended site overheads, and rework. Among them, labor productivity loss stood out as a significant factor since longer project durations resulted in lower production, more idle time, and higher labor needs.

The results of the questionnaire analysis also showed that material shortages, labor-related problems, inadequate planning and scheduling, budgetary limitations, and delayed payments are the most important reasons for delays. Project timeframes were found to be significantly impacted by design modifications and coordination issues. Financial and management-related concerns had the greatest influence on both the occurrence of delays and cost escalation, according to a statistical assessment of these factors.

Financing charges, material price increases, and corporate overheads were found to be major indirect cost contributors to the overall delay cost. Opportunity cost was also found to be a significant impact, especially when there are protracted delays that prevent contractors from taking on new jobs. Overall, the findings show that the length of delays is a major factor in cost increases, and indirect expenses are frequently overlooked while having a significant financial influence on building projects.

## 4. CONCLUSION

According to the study's findings, building delays have a major effect on residential projects' overall cost and performance, with both direct and indirect expenses rising sharply with longer delays. According to the research, indirect costs such as financing charges, material price increases, corporate overheads, and opportunity loss grow much more quickly and are frequently underestimated, whereas direct costs such as labor, materials, equipment, and site overheads increase in a relatively proportionate manner. The results show that financial limitations, inadequate planning, labor inefficiencies, and coordination problems are the main reasons of delays, many of which may be avoided with good project management techniques.

The report also highlights how crucial early planning, precise scheduling, and proactive risk management are to reducing delays. All things considered, measuring delay-related expenses gives stakeholders insightful information that facilitates better decision-making, better cost control, and improved project performance in residential building.

## 5. RECOMMENDATIONS

1. **Boost the Effectiveness of Planning and Scheduling**
   Use cutting-edge project planning technologies, such as CPM and project management software, to guarantee precise scheduling, appropriate resource allocation, and prompt activity execution, hence reducing delays.
2. **Improve Cash Flow and Financial Management**
   To prevent job interruptions, make sure that payments are made on time and maintain appropriate financial planning. Effective cash flow management keeps costs from rising due to delays and supports ongoing project advancement.
3. **Boost Communication and Coordination**
   Clearly define routes of communication between consultants, contractors, and clients. Misunderstandings, design modifications, and

coordination problems are decreased by regular meetings and effective information flow.

4. **Improve Material and Resource Management** Implement efficient personnel management and procurement planning to prevent labor inefficiencies and material shortages, which are significant causes of project delays.
5. **Use risk management and monitoring strategies** early risk identification and ongoing project performance monitoring are made possible by techniques such as Earned Value Management (EVM). This lowers direct and indirect cost escalation and permits prompt remedial action.

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