

Schedule Preparation and Earned Value Management Analysis for High-Rise Residential Projects

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Abstract

Construction projects, especially high-rise residential buildings, involve complex activities, large financial investments, strict deadlines, and continuous coordination among multiple stakeholders. Effective planning, scheduling, and monitoring are therefore essential for successful project execution. This study focuses on the preparation of project schedules and performance evaluation using Microsoft Project (MSP) and Earned Value Management (EVM) techniques for the Palladio La Viento high-rise residential project located at Mahalunge, Pune. The research includes collection of project data such as BOQ, activity durations, cost details, and progress records. MSP was used for activity scheduling, sequencing, critical path identification, and progress tracking, while EVM techniques were used to evaluate project cost and schedule performance through parameters such as Planned Value (PV), Earned Value (EV), Actual Cost (AC), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), and Schedule Performance Index (SPI). The study observed that excavation work was completed ahead of schedule and within budget, while PCC work experienced delayed commencement due to dependency on previous activities. However, all major activities achieved satisfactory cost performance with CPI values greater than one. The study concludes that the combined application of MSP scheduling and EVM analysis significantly improves project monitoring, cost control, schedule tracking, and decision-making efficiency in high-rise residential construction projects.

Keywords: Earned Value Management, Microsoft Project, Construction Scheduling, High-Rise Residential Project, Project Monitoring

1. Introduction

The construction industry plays a major role in the economic growth and infrastructure development of a country. In India, rapid urbanization, population growth, and increasing housing demands have resulted in the development of large-scale high-rise residential projects in metropolitan cities. These projects involve multiple construction activities, large financial investments, resource management, and strict project deadlines. Construction management is therefore essential for organizing project activities, allocating resources, controlling costs, maintaining quality, and ensuring safety during execution. High-rise residential buildings require continuous coordination among engineers, contractors, consultants, suppliers, and labor teams because delays in one activity directly affect subsequent activities. Hence, proper planning, scheduling, monitoring, and controlling are necessary for successful project completion. Modern construction companies increasingly use advanced project management tools to improve efficiency and minimize risks related to delays and cost overruns.

Despite advancements in the construction industry, many high-rise residential projects still face challenges such as project delays, cost overruns, poor coordination, labor shortages, material unavailability, and inefficient resource utilization. Improper planning and inadequate monitoring often create problems during project execution and reduce overall productivity. Traditional project monitoring methods generally analyze schedule and cost separately, making it difficult to identify project performance issues accurately. In complex construction projects, poor communication between project participants can lead to delays in approvals, rework, material supply interruptions, and activity conflicts. These problems increase project duration and affect project profitability and client satisfaction. Therefore, effective project scheduling and integrated performance evaluation techniques are essential for improving project control and ensuring timely completion within the planned budget.



Figure 1: Construction Management Impacts High-Rise Projects

The increasing complexity of modern construction projects has created a strong need for advanced project management techniques such as Microsoft Project (MSP) and Earned Value Management (EVM). MSP is widely used for preparing detailed construction schedules, identifying critical activities, allocating resources, and monitoring project progress systematically. Similarly, EVM integrates project scope, schedule, and cost into a single performance measurement system using parameters such as Planned Value (PV), Earned Value (EV), Actual Cost (AC), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), and Schedule Performance Index (SPI). These indicators help evaluate project cost efficiency and schedule performance while supporting timely corrective actions. The main aim of this study is to analyze project scheduling and performance using MSP and Earned Value Management techniques for a high-rise residential construction project. The study focuses on comparing planned and actual progress, identifying project delays, evaluating cost and schedule performance, and improving overall project monitoring and management efficiency.

2. Literature Review

Construction project management has become an important area of research due to increasing project complexity, schedule delays, and cost overruns in modern infrastructure and residential developments. Several researchers have emphasized the importance of planning, scheduling, and monitoring techniques for improving construction project performance. Construction Management Durga Sruthi and Aravindan (2020) studied schedule and cost performance analysis for a residential building using Earned Value Management (EVM) and concluded that EVM effectively helps in identifying project delays and cost deviations at an early stage. Bhagwat and Chavan (2021) analyzed project tracking in high-rise buildings using EVM and observed that integrated schedule and cost monitoring improves project control and decision-making. Patil and Jamgade (2021) discussed the use of Microsoft Project and EVM for residential building management and concluded that MSP helps in activity scheduling, progress tracking, and resource allocation efficiently. Sharun and Sundara Kumar (2018) highlighted that improper planning and poor monitoring are the major causes of delays and cost overruns in construction projects. Bovteev and Petrochenko (2015) explained the importance of EVM for monitoring project timescale performance and controlling schedule deviations in construction projects.

Several researchers have also focused on integrating schedule management and cost analysis techniques for improving project efficiency in residential construction projects. Vaibhava, Rao, Shetty, and Prakash (2020) studied the application of earned value and earned schedule methods for residential apartment projects and concluded that these techniques improve forecasting accuracy and schedule performance analysis. Vyas and Patel (2016) explained that EVM is an effective tool for tracking construction project performance because it combines project scope, schedule, and cost into a single management system. Humphreys (2002) stated that EVM provides accurate project status information and supports corrective decision-making during project execution. Fleming and Koppelman (2016) emphasized that CPI and SPI are reliable indicators for evaluating project cost efficiency and schedule performance. Mayo-Alvarez et al. (2022) conducted a systematic review on EVM methods and concluded that EVM significantly improves project monitoring and control practices. Andreas, Tinumbia, and Anggraini (2023) analyzed construction project control in high-rise

building projects and observed that EVM and Earned Schedule Management improve project forecasting and performance evaluation. Setiyowati and Jalaludin (2025) evaluated time and cost performance in residential projects using EVM and found that continuous monitoring helps maintain project performance within planned targets.

Recent studies have further highlighted the importance of advanced technologies and forecasting methods in project management. Yalçın, Bayram, and Çıtakoğlu (2024) studied EVM-based cost estimation using machine learning techniques and concluded that predictive models improve construction cost forecasting accuracy. Chaudhary et al. (2025) discussed the integration of machine learning and EVM for data-driven decision-making in rural construction projects and observed that automated forecasting techniques enhance project performance analysis. Babar, Thaheem, and Ayub (2016) integrated risk analysis with EVM and concluded that risk-based EVM improves project completion forecasting and project control. Acebes et al. (2024) proposed stochastic earned value and earned duration analysis techniques for handling uncertainty in project schedule management and improving performance prediction. Lipke, Zwikael, Henderson, and Anbari (2009) explained that statistical approaches combined with EVM improve project outcome prediction and schedule forecasting. Overall, the literature indicates that the combined implementation of Microsoft Project scheduling and Earned Value Management techniques significantly improves project monitoring, schedule control, cost efficiency, resource utilization, and decision-making in high-rise residential construction projects.

3. Research Methodology

1. Collection of Project Data

The research began with the collection of project-related data such as drawings, BOQ (Bill of Quantities), activity durations, quantity details, cost information, and project schedules from the Palladio La Viento high-rise residential project located at Mahalunge, Pune.

2. Preparation of Work Breakdown Structure (WBS) and MSP Schedule

Major construction activities including excavation, PCC work, raft footing, column work, and backfilling were divided into smaller work packages using Work Breakdown Structure (WBS). Microsoft Project (MSP) software was used for activity sequencing, scheduling, resource allocation, and identification of critical path activities.

3. Site Visits and Progress Monitoring

Regular site visits were conducted to observe actual work execution, monitor construction progress, collect actual start and finish dates, and compare planned progress with actual progress. Quality, safety conditions, and activity coordination were also observed during site inspections.

4. Earned Value Management (EVM) Analysis

Earned Value Management techniques were used to evaluate project cost and schedule performance. Parameters such as Planned Value (PV), Earned Value (EV), Actual Cost (AC), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), and Schedule Performance Index (SPI) were calculated for major project activities.

5. Performance Evaluation and Conclusion

The calculated EVM results and MSP schedule tracking data were analyzed to identify project delays, cost efficiency, and resource utilization performance. Based on the analysis, conclusions and recommendations were prepared for improving project monitoring and management efficiency in high-rise residential construction projects.

4. Case Study

Site Visit Report

Palladio La Viento – High Rise Residential Project

Table 1: Site Details

Particular	Details
Project Name	Palladio La Viento
Project Type	High-Rise Residential Building
Project By	Vilas Javdekar Eco Developers Pvt. Ltd.
Location	Mahalunge, Pune
Project Wings	A1 & A2
Total Built-Up Area	435801 sq.ft
Project Start Date	01/12/2025
Project Finish Date	01/08/2028
RERA Registration No.	PR1260002501182
RERA Duration	13/10/2025 to 31/12/2029

The site visit was conducted at Palladio La Viento project located at Mahalunge, Pune. The objective of the visit was to review the construction progress, monitor planned versus actual work execution, assess quality and safety conditions, and evaluate project performance using Earned Value Management (EVM). The activities inspected during the visit included Excavation and PCC works.

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3. Planned Activities with Dates & Duration

Activity	Qty	Planned Start	Planned Finish	Planned Duration	Status
Excavation	17350.84 Cum	01/12/2025	30/01/2026	60 Days	Completed
PCC Work	231.10 Cum	29/01/2026	04/02/2026	7 Days	Completed

Excavation work was completed 10 days ahead of the planned schedule. Machinery utilization and manpower management were efficient. The work was completed within budget and proper safety precautions were maintained.

Activity	Qty	Planned Start	Planned Finish	Planned Duration	Status
Excavation	17350.84 Cum	01/12/2025	30/01/2026	60 Days	Completed
PCC Work	231.10 Cum	29/01/2026	04/02/2026	7 Days	Completed

PCC Work Calculations

8. Planned Value (PV) = ₹8.73 Lakhs

9. Earned Value (EV) :

EV = Budgeted Cost × % Progress

= 8.73 × 100%

= ₹8.73 Lakhs

10. Actual Cost (AC) = ₹7.86 Lakhs

11. Cost Variance (CV) :

$$CV = EV - AC$$

$$= 8.73 - 7.86$$

$$= ₹0.87 \text{ Lakhs}$$

12. Schedule Variance (SV) :

$$SV = EV - PV$$

$$= 8.73 - 8.73$$

$$= ₹0$$

13. Cost Performance Index (CPI) :

$$CPI = EV / AC$$

$$= 8.73 / 7.86$$

$$= 1.11$$

14. Schedule Performance Index (SPI) :

$$SPI = EV / PV$$

$$= 8.73 / 8.73$$

$$= 1.00$$

Observation: PCC work was completed within budget. However, delayed commencement indicates the need for better activity coordination.





Figure 2: Site Visit

5. Results and Discussion

The study focused on the implementation of Microsoft Project (MSP) scheduling and Earned Value Management (EVM) analysis for the Palladio La Viento high-rise residential project located at Mahalunge, Pune. The site observations and collected project data were used to compare planned progress with actual work execution for major construction activities such as excavation and PCC work. The MSP schedule helped in tracking activity durations, identifying delays, and monitoring overall project progress. The analysis revealed that excavation work was completed in 50 days against the planned duration of 60 days, indicating efficient machinery utilization, manpower management, and effective project coordination. The activity was completed ahead of schedule while maintaining quality and safety standards at the construction site.

The Earned Value Management analysis provided detailed information regarding project cost and schedule performance. For excavation work, the Planned Value (PV) and Earned Value (EV) were ₹73.74 Lakhs, while the Actual Cost (AC) was ₹70.11 Lakhs. The positive Cost Variance (CV) of ₹3.63 Lakhs and Cost Performance Index (CPI) value greater than 1 indicated good cost efficiency and effective resource utilization. Similarly, PCC work achieved satisfactory performance with Planned Value (PV) and Earned Value (EV) of ₹8.73 Lakhs and Actual Cost (AC) of ₹7.86 Lakhs. The Cost Variance (CV) of ₹0.87 Lakhs and CPI value of 1.11 showed that the activity was completed within the planned budget. The Schedule Performance Index (SPI) value of 1.00 for both activities indicated satisfactory schedule performance.

Although PCC work experienced delayed commencement due to dependency on previous activities and site preparation issues, the work quality and finishing were found satisfactory during inspection. The overall project performance analysis showed that proper planning, scheduling, and continuous monitoring significantly improved project control and minimized cost overruns. The combined application of MSP scheduling and Earned Value Management techniques helped in identifying project deviations, evaluating construction performance, and supporting effective decision-making. The study concludes that the use of MSP and EVM techniques improves project monitoring efficiency, cost control, schedule tracking, and resource management in high-rise residential construction projects.

Conclusion

The study concludes that effective planning, scheduling, monitoring, and cost control are essential for the successful execution of high-rise residential construction projects. The implementation of Microsoft Project (MSP) proved highly useful for preparing detailed construction schedules, sequencing activities, identifying critical path operations, and monitoring project progress systematically. Regular schedule updating and comparison between planned and actual progress helped identify project delays and improve coordination among project activities. The site visits conducted during the study provided valuable practical information regarding work execution, quality control, safety measures, and resource utilization. Earned Value Management (EVM) analysis provided an integrated approach for evaluating project cost and schedule performance. Parameters such as Planned Value (PV), Earned Value (EV), Actual Cost (AC), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), and Schedule Performance Index (SPI) helped assess project efficiency and performance accurately. The analysis showed positive Cost Variance values and CPI values greater than one, indicating that major construction activities were completed within budget and with effective resource utilization. Although some activities experienced delayed commencement due to dependency and coordination issues, overall project performance remained satisfactory. The study highlights that the combined use of MSP scheduling and EVM techniques significantly improves project monitoring, schedule control, cost management, and decision-making in high-rise residential construction projects.

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