



MAPAN: Model for Adaptive Project Site Overheads and Preliminaries Appraisal & Norms

Yashraj Dhiraj Ingole¹

¹ Costing & Budgeting, Birla Estates Pvt. Ltd., Mumbai, India.

Corresponding Author Email: yashrajingole@gmail.com

How to Cite this Article:

Ingole, Y. D. (2026). MAPAN: Model for Adaptive Project Site Overheads and Preliminaries Appraisal & Norms. International Journal of Creative and Open Research in Engineering and Management, <i>02</i>(05).
<https://doi.org/10.55041/ijcope.v2i5.748>

License:

This article is published under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and the source are credited.

© The Author(s). Published by International Journal of Creative and Open Research in Engineering and Management.



<https://doi.org/10.55041/ijcope.v2i5.748>

Abstract—

Site Overheads and Project Preliminaries are critical enabling cost components in residential real estate construction projects, yet they are commonly budgeted during approval or design development stages as broad percentages of the Cost of Construction. This approach provides speed at the feasibility stage but does not adequately reflect actual cost behavior after site handover. These costs begin from the first day of site activation and continue throughout the project lifecycle, making them sensitive to duration, manpower deployment, built-up area, tower count, temporary infrastructure, utilities, statutory compliance, safety requirements, sales-gallery operations, market escalation and vendor rates.

This paper presents MAPAN, a Model for Adaptive Project Site Overheads and Preliminaries Appraisal and Norms, developed as a driver-based budgeting framework for residential real estate projects. The framework classifies cost heads, maps each head to measurable dependencies, applies scaling logic, normalizes historical rates through escalation factors and validates assumptions using awarded work orders, vendor quotations and internal project references. A preliminary gap validation using selected project data indicated an average observed budget gap of approximately 53.93%, confirming the limitation of percentage-based provisioning. The main contribution of the study is not the variance itself, but the

development of a structured, auditable and scalable budgeting method that improves cost accuracy, monthly cash-flow visibility, approval discipline and IRR predictability. MAPAN can serve as a practical governance tool for costing, budgeting, project operations, procurement and senior management decision-making.

Keywords - Site Overheads; Project Preliminaries; Driver-Based Budgeting; Construction Cost Management; Real Estate Projects; Cost Governance



I. INTRODUCTION

In residential real estate development, the accuracy of project budgeting has a direct influence on business feasibility, cash-flow planning, approval governance and profitability. Direct construction packages such as civil works, finishing, mechanical, electrical, plumbing, facade and external development are generally estimated with detailed quantities and package-level rates. In contrast, Site Overheads and Project Preliminaries are often considered during early approval or design development stages as broad percentage provisions over the Cost of Construction.

This practice is useful for quick feasibility, but it becomes insufficient when the same provision is used as a budget baseline for execution. Site Overheads begin from the first day of site handover, even before major construction packages reach full momentum. Security, temporary power, water, site office, technical staff, admin support, statutory requirements, housekeeping, sales-gallery support, safety arrangements and medical facilities may start incurring cost from the initial activation stage itself.

Professional cost-planning frameworks such as RICS New Rules of Measurement emphasize structured cost planning and consistent cost information for construction projects [1]. The practical challenge in real estate budgeting is to translate that principle into a project-specific internal model that captures the actual behaviour of overhead and preliminary cost heads. MAPAN addresses this need by shifting the budgeting basis from broad percentage provisioning to driver-based cost modelling.

II. LITERATURE REVIEW

Construction cost planning literature consistently recognizes that estimate reliability improves when scope definition, cost classification, assumptions and estimating methodology are clearly structured. RICS NRM provides measurement rules and guidance for order-of-cost estimating and cost planning for building works, supporting the need for consistency in cost information [1]. AACE International estimate classification guidance links estimate maturity to project definition, methodology and uncertainty, which is relevant where early-stage assumptions are later used for funding or approval decisions [2].

Project-control literature also highlights the importance of a reliable cost baseline. Earned Value Management compares planned value, earned value and actual cost to monitor cost and schedule performance [3]. However, EVM is effective only

when the planned baseline is realistic. In the context of Site Overheads and Project Preliminaries, the baseline may be weak if it is created only as a flat percentage of construction cost without cost-driver logic.

Previous research has also treated site overhead estimation as a technical problem. ElSawy, Hosny and Abdel Razek developed a neural-network model for estimating site overhead costs using actual building project cases, demonstrating that overhead estimation benefits from structured modelling rather than purely manual approximation [4]. MAPAN differs by focusing on practical driver mapping, work-order-backed rates, escalation normalization and management usability within real estate budgeting.

III. RESEARCH PROBLEM

The core research problem is that Site Overheads and Project Preliminaries are frequently estimated using broad percentage assumptions, while actual expenditure is governed by project-specific operational dependencies. This mismatch creates under-provisioning, additional approvals, cash-flow pressure and weaker visibility of true project enabling cost.

The objective of this study is to develop a dynamic, driver-based budgeting framework that improves the estimation of Site Overheads and Project Preliminaries by linking each cost head to its actual cost behaviour. The framework aims to identify dependencies, classify cost heads, apply manpower and operational scaling, normalize rates using escalation factors and validate assumptions using actual awarded work orders and project references.

IV. METHODOLOGY

The study follows an applied model-development methodology. First, a preliminary gap validation was carried out using selected residential project data to understand whether early-stage budget provisions were aligned with actual expenditure. This exercise was used only to validate the existence of the problem; the primary research contribution is the driver-based model developed after the gap was identified.

Second, Site Overheads and Project Preliminaries were classified into detailed cost heads. Third, each cost head was mapped to its logical dependency, such as duration, manpower, built-up area, tower count, utility load, compliance requirement, one-time setup, monthly recurring operation or rate escalation. Fourth, rates were validated using awarded work orders, historical project references,



vendor quotations and market-backed assumptions wherever actual work-order evidence was unavailable.

Finally, the model output was structured to support management review by showing the basis of each cost item: quantity, unit, rate source, escalation factor, scaling logic, buffer factor and final budget value. This makes the model auditable and suitable for project budgeting, cash-flow planning and cost governance.

Count-linked	Access gates, tower-wise services, fire extinguishers	Number of towers/items	Cost = count x unit rate x duration/frequency
Compliance-linked	Statutory, testing, environmental and certification costs	Regulatory requirement	Cost = event/approval requirement x applicable rate

V. MAPAN FRAMEWORK DEVELOPMENT

MAPAN stands for Model for Adaptive Project Site Overheads and Preliminaries Appraisal and Norms. The framework converts Site Overheads and Project Preliminaries from a lump-sum percentage assumption into a detailed set of driver-based cost heads. It recognizes that the budget for these heads must be built from the operating logic of the site rather than only from the construction value.

The model uses project inputs such as duration, built-up area, number of towers, site handover timeline, construction start date, sales-gallery requirement, manpower requirement, utilities and temporary infrastructure. These inputs are converted into quantities and frequencies. Rates are then selected from awarded work orders or other validated references, escalated to the current cost base and adjusted with appropriate scaling and buffer logic.

Table I summarizes the model logic used for major cost heads. The purpose is to select a calculation method according to cost behaviour instead of applying one uniform percentage to all heads.

Cost Behaviour	Typical Cost Heads	Primary Driver	Illustrative Formula Logic
Monthly recurring	Technical staff, admin, security, housekeeping, sales-gallery support	Duration and manpower count	Cost = monthly rate x duration x escalation x buffer
One-time setup	Site office setup, temporary infrastructure, safety setup	Quantity or fixed requirement	Cost = quantity x rate x escalation x buffer
Area-linked	Site office civil work, cleaning, temporary arrangements	BUA or applicable area	Cost = area x unit rate x escalation

VI. MODEL LOGIC

The technical strength of MAPAN lies in its dependency mapping. Each cost head is first assigned a cost behaviour category. Monthly recurring heads use duration as a critical driver. One-time heads are calculated using quantity and rate. Area-linked heads use built-up area or applicable service area. Count-linked heads use tower count, access points, equipment count or manpower count. Compliance-linked heads are calculated based on applicable statutory or operational requirements.

Manpower scaling is a major component of the model. Instead of assigning a fixed manpower cost to all projects, the framework links technical staff, admin staff, security, housekeeping, pantry support and sales-gallery support to project scale and operating intensity. This is essential because a single-tower project, a large multi-tower project and a luxury development with higher customer interface requirements will not have the same overhead structure.

Escalation normalization is another important component. Work-order rates taken from earlier years cannot be applied directly to current budgets. The model therefore uses category-wise escalation factors for manpower, utilities, consumables, compliance and operating expenses. This helps convert historical references into a current and comparable cost base.

VII. RESULT & DISCUSSIONS

The preliminary gap validation indicated that early-stage provisions for Site Overheads and Project Preliminaries were not fully aligned with actual expenditure. The average observed gap was approximately 53.93% for the project data considered. This does not merely indicate a variance issue; it indicates that the budgeting basis itself needs to be improved.



The analysis showed that many overhead and preliminary costs are activated from site handover and continue as time-linked cash outflows. Hence, project duration becomes one of the most important variables. If the project duration extends, recurring costs such as technical manpower, security, housekeeping, utilities, DG operation, sales-gallery operations and site office running expenses continue to accumulate.

The model also demonstrated that work-order-backed rates improve estimate credibility. When rates are traceable to actual awarded packages or vendor quotations, management can review the estimate more confidently. This reduces ambiguity, supports internal auditability and strengthens alignment between costing, budgeting, procurement and operations teams.

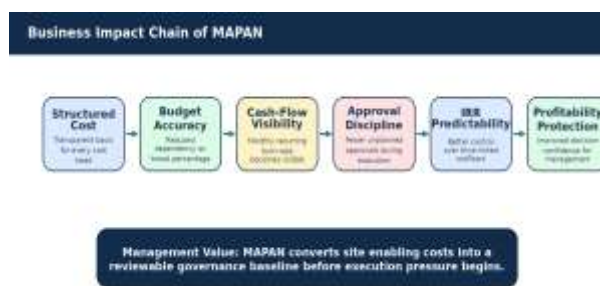


Figure 1: Business impact chain created by a driver-based overhead and preliminary budgeting model.

VIII. BUSINESS IMPACT

The business value of MAPAN is linked to cost accuracy, cash-flow visibility and profitability protection. Site Overheads and Project Preliminaries may appear as support costs, but they directly affect project cash outflow because many of them are monthly recurring. Under-provisioning these heads can make an approval budget look stronger than the actual execution requirement.

In real estate feasibility, IRR is sensitive to both timing and cash outflow. If recurring overheads are underestimated, the projected IRR may not represent the actual project outcome. If execution is delayed, overhead burn continues and further compresses realized profitability. By identifying duration-sensitive cost heads early, MAPAN improves the predictability of project cash flow and financial performance.

The framework also improves approval discipline. Instead of requesting additional approvals during execution for items that should have been planned earlier, project teams can define the requirement, driver, rate source and escalation logic at the

budgeting stage itself. This creates a more transparent and management-ready cost baseline.

IX. PRACTICAL APPLICATION

MAPAN can be applied during multiple stages of the project lifecycle. During feasibility, it can provide a more realistic provision than a flat percentage. During design development, it can be updated as project information improves. During budget finalization, it can act as a rate-backed working model. During execution, it can serve as a control baseline for monitoring actual overhead and preliminary expenditure.

The framework can also be used for future project benchmarking. Actual expenditure and awarded rates from completed projects can be fed back into the model, continuously improving the reliability of future estimates. Over time, MAPAN can become a project-cost knowledge base for Site Overheads and Project Preliminaries

X. PRACTICAL APPLICATION

The accuracy of MAPAN depends on the reliability of inputs, validity of rate references and appropriateness of escalation assumptions. Abnormal site conditions, sudden market volatility, extraordinary statutory requirements or major project delays may require manual adjustment beyond standard model logic.

Future development can include a project complexity index, location cost index, delay sensitivity simulator, IRR impact simulator, monthly cash-flow curve, cost per sq. ft. benchmark, dashboard-based management summary, automated rate library and integration with enterprise procurement or cost-control systems.

XI. REFERENCES

This paper establishes that Site Overheads and Project Preliminaries should not be treated only as fixed percentages of Cost of Construction. These costs are operational, duration-sensitive, manpower-driven and dependency-based. They begin from the first day of site handover and continue throughout the project lifecycle.

The preliminary gap validation confirmed that early-stage percentage provisions may materially differ from actual expenditure. However, the main contribution of this study is the development of MAPAN as a driver-based budgeting framework. By incorporating cost-head classification, dependency mapping, manpower scaling, escalation normalization and work-order-backed rate



validation, MAPAN provides a practical and auditable approach to budgeting Site Overheads and Project Preliminaries.

The framework supports improved budget accuracy, cash-flow planning, approval governance and IRR predictability. It can be adopted as a repeatable internal model for residential real estate construction projects and further enhanced through digital dashboards and historical rate databases.

ACKNOWLEDGMENT

The author acknowledges the learning and practical exposure gained through work in costing, budgeting and project-related functions at Birla Estates. The study is presented as an applied academic and professional exercise; project, vendor and rate details may be anonymized or restricted where required for confidentiality.

REFERENCES

- [1] Royal Institution of Chartered Surveyors, “New Rules of Measurement: Order of cost estimating and cost planning for capital building works,” RICS, 2022.
- [2] AACE international, “Professional Guidance Document No. 01: Guide to Cost Estimate Classification Systems,” AACE International, 2022.
- [3] Project Management Institute, “Earned Value Methodology,” PMI, accessed 2026.
- [4] I. El Sawy, H. Hosny, and M. Abdel Razek, “A Neural Network Model for Construction Projects Site Overhead Cost Estimating in Egypt,” arXiv:1106.1570, 2011.