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TVD FOR ENHANCED VALUE: A CASE STUDY OF PRECONSTRUCTION COST OPTIMIZATION IN RESIDENTIAL BUILDINGS

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ABSTRACT

Target Value Delivery (TVD) offers a promising approach to optimizing cost and maximizing value in construction projects, yet its practical implementation in complex residential developments remains relatively unexplored. This case study demonstrates the successful application of TVD in a 35-story mixed-use residential building in Florida, achieving significant cost savings and aligning design with evolving owner value criteria. The project employed a three-phase TVD framework, incorporating early stakeholder collaboration, a Common Data Environment (CDE), and continuous cost tracking. Data was collected through project documentation, cost reports, and observations. The project realized demonstrable cost savings while successfully aligning the design with the owner's evolving value criteria. Challenges related to cost-tracking standardization (transitioning from MasterFormat to Uniformat II) and CDE adoption were effectively addressed through targeted training and process adjustments. This case study contributes empirical evidence to the growing body of knowledge supporting the effectiveness of TVD. It highlights areas for future research, such as developing best practices for CDE implementation, refining cost-tracking methodologies, and exploring the impact of TVD on other project outcomes. This study provides empirical evidence supporting the efficacy of TVD in controlling costs and enhancing value in complex residential projects. The findings underscore the importance of early collaboration, rigorous cost management, and proactive strategies for CDE implementation in maximizing the benefits of TVD.

KEYWORDS

Target Value Delivery, Team integration, preconstruction, cost optimization, BIM, lean construction, CDE, and Integrated project delivery.

INTRODUCTION

This research investigates how the application of Target Value Delivery (TVD) aided project management by facilitating value identification and enabling early collaboration among the construction manager, designers, subcontractors, and owner representatives. This collaborative approach aligned the project's design development and fostered efficient decision-making.

This paper aims to demonstrate the positive contribution of TVD during the building's preconstruction phase. TVD supported cost optimization and promoted a focus on predefined value criteria. Key challenges included integrating designers within a shared data environment for real-time access to design and modeling information, standardizing project costs to facilitate

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cost tracking during design development, and ensuring design adherence to pre-established design criteria. This paper further contributes to Florida's construction stakeholders by presenting a new, more collaborative, transparent, and integrated project delivery approach.

BACKGROUND

TEAM INTEGRATION

Early contractor engagement and target costing are critical for successful collaborative building delivery. A Norwegian case study (Narum et al., 2022). demonstrated the importance of an early definition of project scope, allowable costs, and procurement strategy. Furthermore, early contractor involvement enhanced constructability, fostered commitment, improved cost estimation accuracy, and facilitated effective team formation during the design phase. A balanced allocation of risk within the target cost framework, coupled with continuous client and senior management participation, promoted collaboration throughout the construction phase.

Team integration has been recognized as an effective strategy for enhancing efficiency and client satisfaction in Architecture, Engineering, and Construction (AEC) projects AEC (Alhava et al., 2015; Choi et al., 2019; Gutierrez Lazarte, 2020; Majava et al., 2019). This approach facilitates value co-creation by fostering communication, coordination, collaboration, and innovation among project stakeholders (Demirkesen & Ozorhon, 2017; Gaur & Tawalare, 2024).

TARGET VALUE DELIVERY

Target Value Delivery (TVD), initially conceptualized as Target Value Design due to its broader focus encompassing the entire design and construction lifecycle, represents an adaptation of the Target Costing approach for the Architecture, Engineering, and Construction (AEC) industry. TVD is a management methodology that seeks to optimize value creation within the constraints of a predetermined cost target. It recognizes the complexity inherent in AEC projects and fundamentally restructures conventional design practices (Miron et al., 2015).

Target costing

While the application of target costing, which prioritizes cost and value considerations in the design process, has been explored in various contexts, its utilization within high-performance building projects remains relatively under-researched. As highlighted by Do et al. (2014), existing evidence suggests that Target Value Design (TVD), a methodology incorporating target costing principles, demonstrates efficacy in controlling construction costs. Specifically, their findings indicate that TVD projects exhibit a reduced likelihood of budget overruns, even when operating with lower contingency reserves.

Furthermore, the work of Kron & Von Der Haar (2016). underscores the importance of clearly defined owner expectations in the initial stages of a project. They posit that this upfront clarity is essential for maintaining owner engagement and fostering trust in the provided cost estimations. Moreover, these authors contend that the typical pattern of escalating expected costs during the design phase, followed by subsequent cost reduction efforts, can negatively affect team morale and overall project performance. This aligns with our findings, as the clear establishment of a target cost and the owner’s active participation in value engineering were critical to maintaining team focus and achieving cost savings.

Value in Construction

Within the Architecture, Engineering, and Construction (AEC) industry, the concept of value is multifaceted, encompassing the perspectives of various stakeholders, including owners, end-users, builders, designers, and others (Haddadi et al., 2017; Kineber et al., 2022; Le Pennec &

Raufflet, 2018) For the purposes of this paper, "value" will be defined as the fulfillment of the owner's conditions of satisfaction, representing the key characteristics of the product intended for the ultimate client.

Although Target Value Design (TVD) cultivates a project environment conducive to value creation by emphasizing design, client integration, and collaborative practices, its principal focus remains cost attainment. While the target cost is theoretically linked to client value, this emphasis on cost may eclipse a more holistic consideration of value generation. Thus, TVD establishes a foundation for value creation but does not consistently prioritize or explicitly measure value beyond cost containment (Miron et al., 2015).

METHODOLOGY

PROJECT DESCRIPTION

The project comprises a new 35-story mixed-use building encompassing a condominium/hotel with 579 residential units, covered parking for 155 vehicles, and a total gross floor area of 42,835 m² (461,077 ft²).

FRAMEWORK TVD

The preconstruction phase employed three-phase Target Value Delivery (TVD) practices. This approach aimed to capture the owner's understanding of the desired product and their conditions of satisfaction while aligning key stakeholders towards a design that reflected the target cost and project requirements.

Phase 1- Business Case Planning

The project owner, a Peruvian real estate development firm, presented the project conceptualization for their recently acquired land parcel. They outlined the business model and key financial considerations used in the feasibility analysis, including:

- Project Schedule: The anticipated design, permitting, and construction timeframe.
- Allowable Cost: The maximum construction cost permissible for project viability.
- Financial Target: The approved internal rate of return (IRR) required by project investors.
- Financial Constraints: Financial restrictions related to capital contributions, equity financing, loans, and other funding sources.

During the conceptual phase, several design iterations were explored, evaluating variations in the number of floors, residential units, parking spaces, and associated construction costs for each scenario. These iterations aimed to optimize project efficiency and align with the financial targets and constraints. Table 1 below provides an example of the scenario analysis conducted during the conceptual design stage.

By systematically evaluating different design options and their associated costs, the project team sought to identify the most efficient approach that met the owner's requirements and financial objectives. This iterative process facilitated informed decision-making and laid the groundwork for subsequent project phases.

Table 1: Conceptual Design Scenario Analysis

Design	GSF	# Floors	Construction Cost	# Units	# Parkings	Parking Ratio
Scenario 1	452,838	35 Floors + Green Area	$153,960,589	598	161	26.92%
Scenario 2	440,401	34 Floors + Green Area	$149,743,670	579	161	27.81%
Scenario 3	428,951	33 Floors + Green Area	$145,526,751	560	161	28.75%
Scenario 4	417,501	32 Floors + Green Area	$140,589,831	541	155	28.65%
Scenario 5	428,951	32 Floors + Mixed Floor	$147,226,751	562	173	30.78%

A Virtual Design and Construction (VDC) framework was developed, aligning with the owner's and project's primary objectives. This framework served as a roadmap for project execution, guiding decision-making and ensuring alignment between project goals and stakeholder interests. Figure 1 illustrates the VDC framework and its role in defining owner and project objectives.

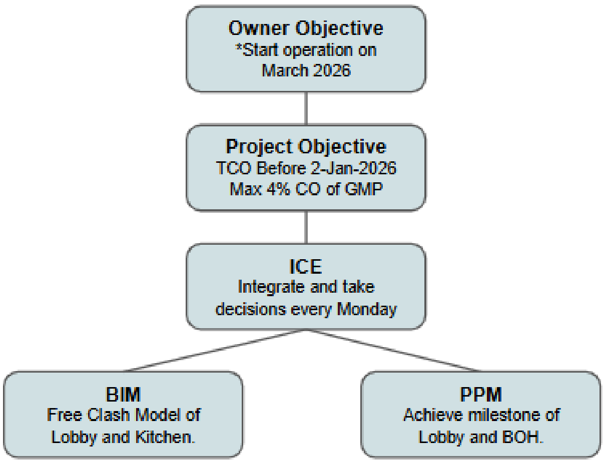

Figure 1: Using the VDC Framework to Identify the Owner Objectives and Project Objectives

Fase 2- Validation

The project team was assembled through a careful selection process. Invitations to participate were extended to various companies, accompanied by a Request for Proposal (RFP) outlining the project scope. The RFP emphasized collaborative principles, including early involvement, utilization of a Common Data Environment (CDE), transparent information sharing, continuous cost estimation, integrated scheduling, constructability analysis, BIM-based design and drawing generation, trade-specific cost control, and evaluation of design alternatives.

Key stakeholders engaged during this phase included:

- General Contractors/Subcontractors: General Contractor, Structural Subcontractor, Mechanical Subcontractor, Electrical Subcontractor, Plumbing Subcontractor, and Fire Protection Subcontractor.
- Design Consultants: Architect, Structural Engineer, MEP Engineers, and Interior Designer.
- Peer Reviewers: Structural and MEP peer reviewers were engaged to ensure technical compliance with the design basis.
- Owner Representatives: Development Director and President.

- Integrated Project Practices Facilitators: Facilitators were present to guide the collaborative process, facilitating the collaborative model to the team. Produktiva (PDK) was the company that led the process.

This phase focused on developing the Basis of Design (BOD), which was the foundation for defining project value and key product characteristics. To capture these characteristics, structured value questionnaires, and interviews were organized by discipline and cost structure. This information facilitated project cost modeling and established a value baseline aligned with the owner's requirements.

Target cost negotiations commenced with the owner's established allowable cost of USD 150.9 million. Potential cost optimization strategies, including value engineering, were quantified. Furthermore, historical data on change orders due to design incompatibilities informed a reduction in the anticipated change order percentage.

Finally, a target for future cost savings, incentivizing innovation throughout the design process, was established. Through this process, a negotiated target cost of USD 140.5 million was agreed upon, representing a 6.9% reduction from the allowable cost. While literature addressing the percentage difference between allowable and target costs for building projects is limited, research by Johansen et al. (2021) on large infrastructure projects suggests setting the target cost 12-20% below the allowable cost. This difference may reflect the distinct nature and scale of infrastructure projects compared to building construction.

Phase 3- Value Delivery

With the project team established, the Basis of Design (BOD), overall target cost, and trade-specific cost targets were communicated to all stakeholders. Collaborative design work was conducted within a common data environment (CDE), Autodesk Construction Cloud, enabling real-time design modifications and review by the entire project team. Weekly design review sessions were implemented to assess adherence to the BOD, current design cost versus the target cost, and key risks and opportunities related to target cost attainment.

Furthermore, specialist peer reviews were conducted to ensure technical compliance with the BOD. For instance, the structural peer review involved re-analyzing the structural design to identify potential efficiencies, while the MEP peer review evaluated the proposed equipment and systems for optimal performance. In both cases, formal reports documenting key findings and recommendations were generated.

Integrated project teams, or clusters, evaluated design alternatives through Integrated Concurrent Engineering (ICE) sessions. These sessions facilitated collaborative assessment of design options by the owner, designers, subcontractors, and peer reviewers. Each alternative was analyzed regarding its technical implications, alignment with the BOD, and cost-effectiveness.

This rigorous process yielded a high-quality technical design package, vetted by the project's future construction team, with cost commitments secured and value criteria validated by the owner. The project delivery method employed was Construction Manager at Risk (CMAR) under a cost-reimbursable plus fee contract with a Guaranteed Maximum Price (GMP). Contract negotiations were ongoing at the time of writing.

RESULTS

COLLABORATIVE MODELING AND COMMON DATA ENVIRONMENT.

The primary results achieved are presented below, categorized by cost implications. A key aspect of the project's success involved collaborative modeling and the implementation of a Common Data Environment (CDE).

A BIM Execution Plan (BEP) was developed to guide the implementation, configuration, and training of key design personnel in utilizing BIM models throughout the project lifecycle. This BEP established standardized BIM workflows, facilitating efficient stakeholder collaboration, enabling clash detection and resolution, streamlining quantity takeoffs, and automating drawing generation. These standardized processes contributed to cost efficiencies by reducing rework, improving coordination, and enhancing design quality.

The project employed a CDE, a centralized digital repository for all project information. This structured approach ensured data integrity by enabling single-source data creation and controlled updates. The CDE facilitated information access and visualization for all project participants, while role-based access controls maintained data security and managed information flow. The platform supported key functionalities such as information sharing, version control, efficient search capabilities, and integrated workflows. A three-phase workflow was implemented within the CDE:

- Work in Progress (WIP): Each design team utilized a private WIP workspace within the CDE to develop and refine their respective models before sharing them with the broader project team. This allowed for iterative design development and internal quality control.
- Shared: Information was transitioned to the "Shared" phase using a formal transmittal process upon verification and internal approval. This provided a controlled mechanism for disseminating design information to other project teams as a reference point for collaborative review and coordination.
- Published: The approved design information was subsequently "Published" using a dedicated review tool within the CDE. This released the approved design information to the owner, ensuring transparency and facilitating informed decision-making. This structured release process minimized the risk of errors and inconsistencies and ensured the owner had access to the most up-to-date and validated design information.

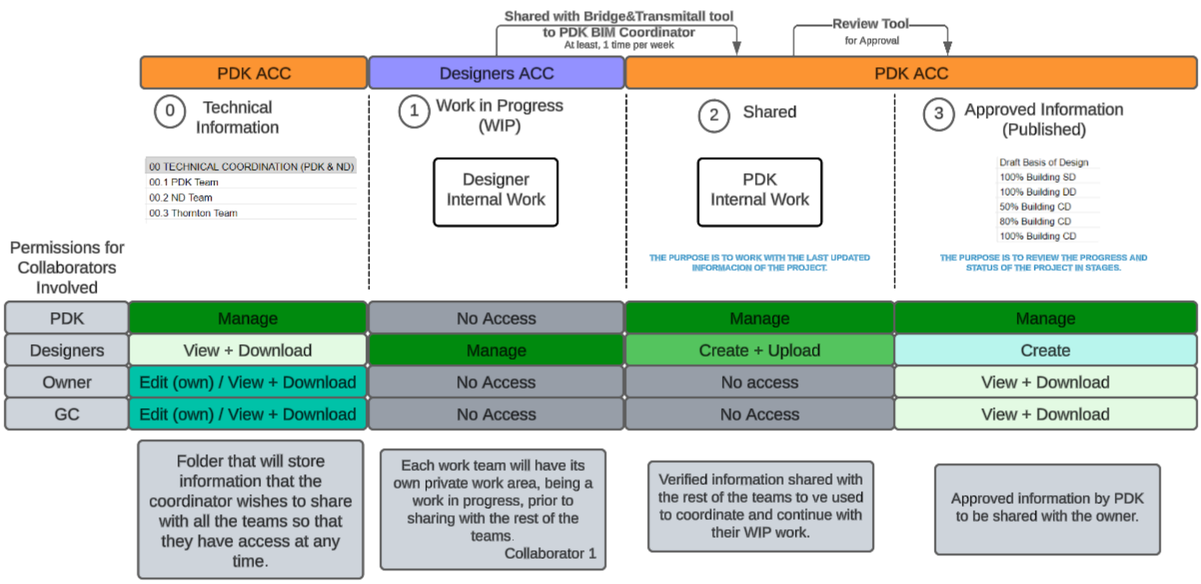

Figure 2: Common Data Environment Work Flowchart

COST OPTIMIZATION RESULTS

Figure 3 illustrates the design cost tracking from May to December, representing the design evolution from conceptualization to 90% completion of Construction Documents (CDs). Initially, the owner's allowable cost was USD 150.9 million, while the estimated design cost was USD 152.1 million. Following the formation of the preconstruction team and the implementation of Target Value Design (TVD), a negotiated target cost of USD 140.5 million was established.

Subsequently, integrated project teams, or clusters, collaborated to develop value-engineered design alternatives aligned with the predefined value criteria outlined in the Basis of Design (BoD) while maximizing cost efficiency. This iterative process, spanning several months, generated proposed savings totaling USD 12.6 million. Of these proposed savings, USD 7.5 million were approved, USD 3.4 million were rejected, and USD 1.7 million remains under consideration.

Concurrently, the owner gained a deeper understanding of market demands, leading to modifications in the value criteria to enhance the project's offerings. These adjustments, incorporated into the original BoD, resulted in a revised target cost of USD 145.07 million. These enhancements included upgrades to finishes in closets, kitchens, doors, and other areas.

In the end, the current cost at 90% CDs reached USD 145.64 million, closely aligning with the revised target and significantly below the initial estimated cost of USD 152.1 million. This current cost reflects all approved value engineering savings and incorporates the cost of the aforementioned product enhancements driven by the owner's evolving market analysis.

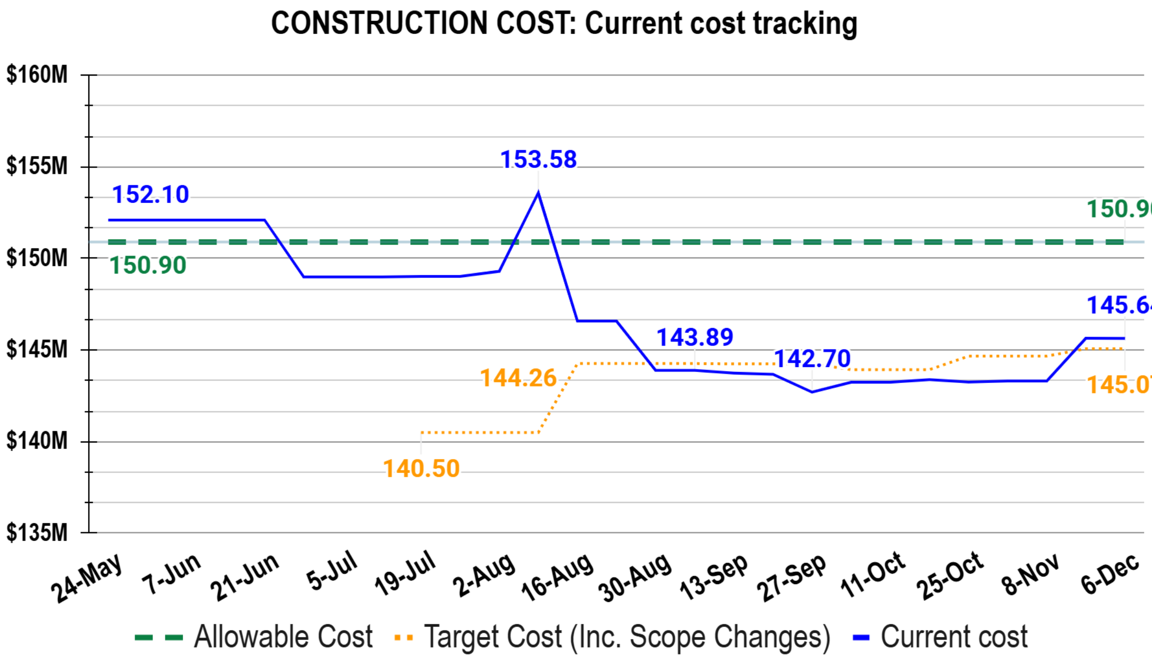

Figure 3: Cost Tracking of the Project

ENHANCE VALUE

The project's adherence to the approved Basis of Design (BOD) was measured to assess value realization. The following nomenclature was employed: "Completed" indicated full compliance with the BOD description; "In progress" signified partial compliance requiring clarification; and "Incomplete" denoted either a lack of definition in design documents or deviation from the BOD.

Figure 4 illustrates the adoption of BOD across four design disciplines. For instance, the "BOD vs 80% CD ARQ" comparison reveals an 80% completion rate for architectural design elements, with 10.9% in progress and 6.3% incomplete. Architecture and structural design (92.9% complete) demonstrated high BOD adherence.

On the other hand, MEP disciplines exhibited lower compliance. Mechanical design, for example, reached only 57.8% completion, with 26.7% in progress and 15.6% incomplete. This discrepancy suggests further efforts are required to align the MEP designs with the established Basis of Design. This analysis provides a quantitative measure of how effectively the design embodies the intended value parameters defined by the owner.

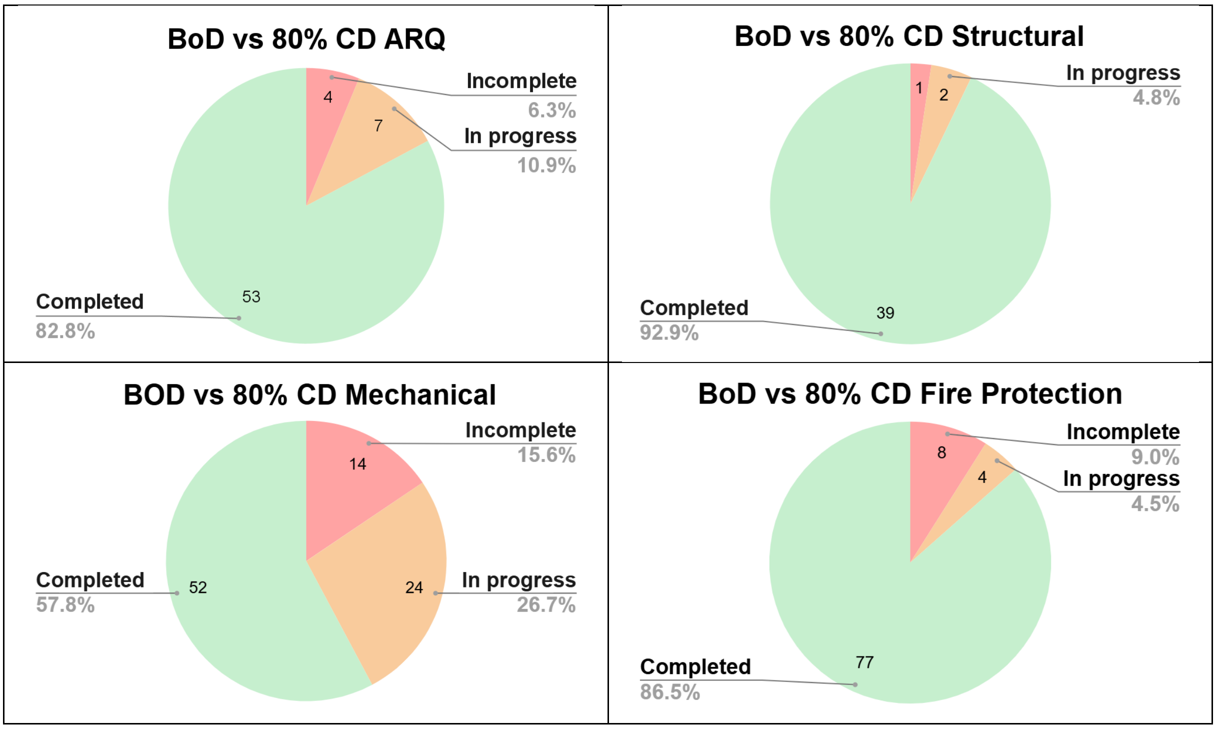

Figure 4: Example of BoD Adoption

SCHEDULE

Regarding project schedule performance, the provided Gantt chart (Figure 5) illustrates the schedule status as of the first week of January 2025. The baseline schedule is represented by Gantt bars labeled "BL" in the "Baseline vs. Actual" column, while actual durations and projections are depicted by bars labeled "AC." A schedule variance is evident, indicating a delay in the design phase compared to the original plan.

This design delay stemmed primarily from significant modifications to the real estate product based on evolving market insights. Although the client valued these changes and approved a revised construction start date of August 2025, the original baseline schedule was not updated to reflect these revisions. This lack of baseline revision makes accurate schedule performance analysis challenging, as the current schedule variance reflects legitimate delays and approved scope changes. A revised baseline incorporating the approved modifications would better represent project progress against the adjusted plan.

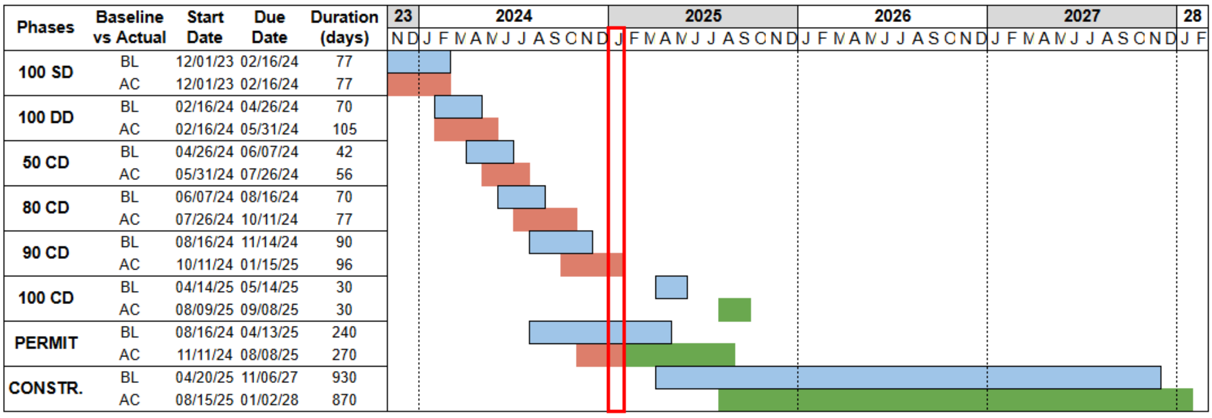

Figure 5: Tracking Schedule

DISCUSSION

Target Value Delivery (TVD) is a potent methodology for aligning project stakeholders' interests toward shared value criteria within a defined budget. This finding aligns with previous research highlighting the benefits of early contractor involvement and collaborative project delivery(Choi et al., 2019; Narum et al., 2022). Furthermore, it fosters innovation and continuous improvement by establishing a tangible target, echoing the principles of target costing as demonstrated by Do et al. (2014) in reducing budget overruns. Deconstructing the overarching project goal into smaller, manageable objectives promotes team commitment and shared accountability for project success, a concept supported by Demirkesen & Ozorhon (2017), who found a positive correlation between integration management and project performance.

Four key factors contributed to the successful implementation of TVD in this case. First, the owner's consistent involvement in decision-making proved crucial. Second, integrating project information within a Common Data Environment (CDE) facilitated collaborative design and stakeholder contributions. Third, continuous cost tracking enabled informed cost-based decisions, ensuring adherence to the budget and driving design efficiency. Finally, the early engagement of the general contractor and subcontractors fostered a strong commitment to cost and design quality, recognizing their future involvement in the project's construction phase.

The implementation process, however, presented several challenges. One notable hurdle was the cost-tracking structure. Utilizing the international Uniformat II standard, unfamiliar to an industry accustomed to MasterFormat, necessitated significant effort to harmonize cost concepts, structures, units, quantities, estimation bases, and unit prices. While this process was initially complex, it improved with each iteration.

Another significant challenge arose from working within a CDE. Although the design team routinely used Building Information Modeling (BIM), collaborating in a shared environment with continuous peer and contractor review was a novel experience. Initial concerns regarding liability for design modifications were addressed by clarifying that access permissions were limited to viewing and commenting on design issues. Initial training and ongoing support from a BIM coordinator mitigated this challenge.

CONCLUSIONS

This case study demonstrates the efficacy of Target Value Delivery (TVD) in achieving substantial cost optimization and enhanced value during the preconstruction phase of a high-rise residential project. By fostering early collaboration among key stakeholders, integrating project information within a Common Data Environment (CDE), and implementing rigorous cost-tracking procedures, the project team successfully reduced the initial estimated cost while simultaneously aligning the design with the owner's evolving value criteria. This successful outcome underscores the potential of TVD to improve project outcomes in similar high-value, complex building projects.

However, the implementation process also illuminated key challenges associated with TVD adoption. The project highlighted the critical importance of carefully selecting and adapting cost-tracking systems, particularly when transitioning between established industry standards like MasterFormat and internationally recognized standards like Uniformat II. Furthermore, addressing the initial apprehension and training needs associated with CDE adoption proved essential for maximizing the collaborative benefits of this technology. These experiences underscore the need for proactive training and ongoing support to facilitate effective CDE integration within project teams.

This study provides concrete evidence of TVD's capacity to deliver cost savings and enhance value in a complex residential project, reinforcing existing anecdotal evidence and contributing to a growing body of empirical research supporting TVD implementation. Furthermore, this study provides valuable insights and lessons learned that can inform and guide other practitioners seeking to implement TVD, contributing to best practices and increasing the likelihood of successful outcomes. In addition, it contributes to the body of knowledge surrounding TVD implementation by offering both practical guidance and empirical validation of its effectiveness while highlighting key challenges and suggesting strategies for successful adoption within the construction industry.

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