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CONSTRUCTION AND
ENGINEERING

Lean and Critical Path Scheduling: Bridging the Great Divide for Exceptional Outcomes

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Introduction

As the construction sector continues its strong rebound, expanded opportunities bring new challenges and business considerations. Project owners demand faster builds; skilled trade resources become increasingly scarce; cash flow requirements intensify; and costs—both real and reputational—mount for delays. These factors—and many more—exert considerable pressure on already narrow margins.

Firms seek solutions to help them more consistently deliver projects on-time and within (or under) budget to optimize customer satisfaction and margin potential. Lean methodologies increasingly factor into the mix, and for good reason. Leveraging Lean practices and principles—which focus on optimizing value with fewer resources—can save an average of 10% on total project cost, according to the Lean Construction Institute. Simply embracing Lean does not guarantee these impressive results, though. Instead, firms must effectively implement the approach. Tools have been scarce, however, and those that exist often require considerable manual effort and support only portions of the Lean methodology.

With the rise of Lean in construction, we've also seen many in the industry adopt an either/or approach to construction management methodologies—aligning with either the Critical Path Method (CPM) camp or the Lean Construction contingent. Both approaches have strong and proven merits. Limiting adoption to one or the other, however, inherently means that organizations are leaving important opportunities for improving performance on the table. Firms that can successfully harness the power of both approaches stand to gain a significant competitive and operational advantage.

It's time to bridge the divide between Lean Construction and CPM. The key is digitizing and simplifying Lean to optimize its impact while providing a unified platform where Lean and CPM can coexist, thrive, complement each other—and deliver compounded benefits.

Opportunities Abound; Risk Remains

Construction is a large and complex market—and one that is expanding exponentially. According to “Global Construction 2030,” a 2016 report by Global Construction Perspectives and Oxford Economics, the global market “is forecast to grow 85% to \$17.5 trillion, accounting for almost 15% of world output by 2030.”

There is tremendous opportunity, but challenges remain; and success is not assured at any level—from project owners to sub-contractors. Today, [70% of projects](#) come in over budget and are delivered late. In addition, cash flow complexity continues to intensify, especially at the vital subcontractor level—threatening stability of this critical sector of the construction ecosystem.

To ensure successful project and business outcomes today, stakeholders at every level—from the C-suite to the job site—require unprecedented levels of coordination, control, consistency, and compliance. The combined power of Lean and CPM empowers organizations to deliver on each of these requirements.

Stronger Together

CPM and Lean both have strong track records.

CPM uses a project network diagram to identify and map relationships between activities that have a direct impact on the project completion date. The approach is well suited for any project with a network of interdependent activities—hence, its popularity in construction and engineering. CPM modeling techniques have a storied history and ties to corporate stalwarts DuPont and Remington Rand Corporation. The methodology's precursor, developed by DuPont in the early 1940s, was even applied to and associated with the success of the Manhattan Project.

Lean Construction brings a similar pedigree. It applies the concepts of Lean Manufacturing to the end-to-end design and construction process—focusing on the task level and the precise coordination and communication required to meet commitments.

Coordination, commitment, and community are the bedrock for Lean Construction. “Lean methods seek to develop and manage a project through relationships, shared knowledge, and common goals,” according to the [Lean Construction Institute](#). “Traditional silos of knowledge, work, and effort are broken down and reorganized for the betterment of the project rather than of individual participants.”

Lean strives to continuously improve quality and efficiency in the construction process. To achieve this goal, it focuses on maximizing utilization of materials and labor and eliminating waste and non-value adding activities.

How Lean construction methodologies differ from other forms of project management:



- Control is redefined from “monitoring results” to “making things happen,” with a measured and improved planning process to assure reliable workflow and predictable project outcomes
- Maximizing value and minimizing waste at the project level is the goal, versus attempting to optimize each individual activity
- Value to the customer is defined, created, and delivered throughout the life of the project, while traditional practice calls for defining requirements at the outset for delivery at the end
- Action is coordinated through pulling and continuous flow, as opposed to schedule-driven push
- Decision-making is decentralized

Source: Lean Construction Institute <https://www.leanconstruction.org/about-us/what-is-lean-design-construction/>

A recent Dodge Data & Analytics Owner Satisfaction & Project Performance study found that “High Lean intensity projects were three times more likely to complete ahead of schedule and two times more likely to complete under budget.”

That’s a powerful testament. However, too often Lean values don’t align with CPM priorities. As a result, we’ve seen tension arise between “scheduling camps,” as traditional CPM advocates hold firmly to the opinion that its means

and methods were the “right way” to build and maintain a proper schedule. At the same time, Lean advocates firmly assert that CPM networks were never intended to manage the level of detail that a Lean schedule targets to properly execute the field production work.

We argue that, with the right technology and tools, these approaches are not only compatible, but when skillfully integrated can deliver exponential benefits.

Organizations using Lean practices report:



Source: Lean Smart Market Report 2013: Dodge Data & Analytics

Getting on the Same Page

Organizations seeking to unite both approaches have faced challenges on three fronts:

Coordination

Engineering and construction projects are continually challenged with coordination complexities. At the top of the list is the need to assemble owners, contractors, subcontractors, suppliers, and specialty service firms around shared knowledge and common goals to create an environment of mutual benefit. Optimal coordination of planning and execution teams requires a blended approach of CPM and Lean methods because they target different personas and levels of detail.

Commitment

The scheduling discipline has always worked to reflect the closest image of reality it could, with logical ties between activities. Yet, even the best-laid plans can fail to capture the commitments that must be made between field disciplines at the physical work site. Firms continue to grapple with creating master schedules that outline the “big picture” planning and activity sequences of physical work, while allowing flexible sequences of work to be committed between field disciplines at the physical work site in shorter intervals.

Community

Engineering and construction projects will always have multiple stakeholders, and this makes the industry historically litigious and complex. Building a sense of community around what is to be built can be difficult given the agendas, legal ramifications, and potential monetary losses that accompany project failure. Building community is all about incentivizing shared knowledge and common goal behaviors across stakeholders. To bridge the divide, project teams seek flexible but commitment-based planning and performance tools, while the enterprise seeks the benefits of multi-project roll ups and the predictability of overall performance.

Firms focused on integrating Lean and CPM have struggled to bridge the coordination, commitment, and community gap between project teams and the enterprise. Traditionally, Lean methodologies have largely relied on manual tools. Consider the planning board, complete with Post-it® Notes. While very effective for managing at the job site, these manual processes and tools prohibit intuitive integration and coordination with the enterprise and remote stakeholders. For example, they limit enterprise visibility into important schedule variables, such as overdue tasks, which can have a considerable impact on the master schedule.

In recent years, vendors have begun to offer standalone point systems designed to automate parts of the commitment and task management processes. While these systems bring new levels of efficiency to site-based Lean processes, they lack integration to enterprise CPM platforms. As a result, firms continue to struggle with communicating accurate task status information to the enterprise project management system in a timely manner.

Wanted: A Unified Platform

To effectively blend Lean and CPM methodologies and realize the benefits of both, organizations need a single, unified platform for engineering and construction projects, programs, and enterprises.

We illustrate the process flow of an integrated platform below:



Work Breakdown Structure (WBS): Create a big-picture schedule by organizing a project into manageable phases using WBS

Activities, Durations, Relationships: Map logical relationships between activities in the CPM network

Activity Plans: Last Planners® break down activities and identify task durations, sequences, and due dates in facilitated production meetings

Commitment: Last Planners® commit to due dates on planning board, indicate when done, and recommit if not completed

Monitor Performance: Monitor Planned Percent Complete (PPC) and assign reasons for missed commitments per Lean Construction Institute best practices. Task alerts notify the CPM network of incompatible dates or status

The cycle begins anew with real-time information sharing.

An integrated platform for CPM and Lean scheduling as defined above would resolve lingering coordination, commitment, and community challenges. Specifically, it would:

- » Reduce the need for larger, complex master schedules that were never intended to micro-manage the level of detail required for field execution teams
- » Place the right coordination tool in the hands of the right stakeholder to eliminate costly re-work, drive accountability, and reduce risk
- » Drive performance down to the worksite based on commitments of field disciplines

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- » Align stakeholder incentives with shared knowledge and common goals to drive community engagement and successful business outcomes
 - » Allow the field to work the way they want while providing the enterprise visibility that the home office requires

Make the Distinction

Lean and CPM are not the same for all industries, and construction and engineering projects bring unique requirements. The solution, therefore, must be purpose-built for the industry to accommodate these distinctions and optimize value.

Additional key requirements for an integrated solution should include the ability to:

- » Support and facilitate high-frequency collaboration—at and between the back office, front office, and job site
- » Incorporate scope, cost, and schedule solutions
- » Accommodate extreme scale—one project or entire portfolio
- » Provide visibility from sub-task through enterprise view
- » Automate and digitize Last Planner® process and ensure institutional knowledge capture
- » Deliver standardized and centralized data and views while facilitating personalization that avoids information overload
- » Enable mobile access to project status online or offline to support remote users
- » Include advanced analytics and extensive reporting to drive real-time insight as well as continuous improvement across the enterprise—from the job site to the c-suite
- » Ensure rapid adoption with an easy-to-use interface and simple deployment—saving time, money, and reducing risk of change resistance

Power of the Cloud

As modern enterprises look to the cloud, it is important to consider this option, as well, for schedule and task management solutions. The cloud model enables low cost of entry—eliminating the need to purchase additional hardware—and assures a lower management burden moving forward. Further, it assures high reliability, rapid access to the latest versions and updates, and ease of scalability.

Oracle's Approach

Oracle Lean Scheduling Solution is the first and only offering that unites Lean Construction and CPM approaches to achieve exceptional project and business outcomes. The cloud-based, mobile-enabled solution automates and simplifies Lean to optimize its impact—facilitating the precise coordination, commitment, and community required for success. It also harnesses the power of Oracle's industry-leading Primavera P6 Enterprise Project Portfolio Management solution to deliver the enterprise-level visibility and control essential for CPM.

The easy-to-use system gives team members in the field the flexibility to apply their preferred task management best practices while providing the enterprise insight that the home office requires. It also captures the combined knowledge of all stakeholders to enable continuous improvement and greater efficiency moving forward—all while supporting accountability at every step of the construction management process.

The bottom line: Oracle Lean Scheduling Solution delivers complete coordination and project command for more successful and profitable projects and business ventures.



Conclusion

CPM and Lean have strong track records, but many in the construction and engineering sectors view these methodologies as disparate approaches. It's time to rethink this equation to harness the exponential power and benefits of a blended approach that automates Lean while aligning stakeholder incentives with shared knowledge across the enterprise. An integrated CPM scheduling and Lean scheduling platform positions firms to move ahead of the curve to drive more successful projects and business outcomes.

Learn more

To learn more about the Oracle Lean Scheduling Solution, visit <https://www.oracle.com/applications/primavera/solutions/lean-scheduling/index.html>.



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