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WHITE PAPER / **ADVANCED WORK PACKAGING**

OPTIMIZING CONSTRUCTION WITH THE RIGHT MIX OF TECHNOLOGY AND PLANNING

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Large-scale construction projects require detailed planning and considerable collaboration. Planning and execution have historically relied on tens of thousands of documents to orchestrate the details. Risks can be reduced through technology to enhance construction planning and facilitate collaboration.

Construction projects have a productivity problem. While global construction project spending has reached 13% of global GDP, productivity in the sector has stagnated in recent decades, according to *The Economist*. At a site level, the Construction Industry Institute (CII) has found that direct work typically amounts to no more than 35% to 45% of a worker's time on the job.

How can large-scale construction projects simplify planning and execution documents and coordinate workers to achieve performance improvements and safely deliver high-quality results for clients? All roads lead to integrating the right technologies and processes to help communicate and streamline complicated efforts.

PLANNING AND PRODUCTIVITY

Regardless of project size, better results derive from a strategic, comprehensive approach to planning. Gathering project teams and input from all team members, project planning provides the framework to explore the scope, define technical requirements, determine cost and schedule milestones, discuss procurement strategy, and begin defining Construction Work Areas (CWA), which can help drive and inform engineering sequence and release plans.

Historically, construction project planning was a manual process of assembled information in the form of drawings, schedules, specifications, lists and manuals. These were interpreted by procurement and construction professionals to identify which materials to buy, when to have them delivered, and then to determine the path of construction. Risks to this approach include outdated data inputs, incorrect interpretations, longer lag time, misinformed just-in-time decisions and inadequate team collaboration.

Today, the potential for increased productivity and optimized efficiency doesn't necessarily come from changing the planning process. Instead, gains come from digitally integrating all disciplines and implementing planning technologies that improve overall collaboration.

TECHNOLOGY IN CONSTRUCTION

The digitization of construction and commissioning processes and the integration of data — coupled with easier-to-deploy cloud-based software — are technology drivers with significant potential to enhance efficiency for planning and executing large construction projects.

Software was developed for the creation of electronic documents and drawings, and online programs exist for scheduling, purchasing and tracking progress. And while engineering and procurement became connected digitally, the construction discipline was less involved in the transformation.

Using 3D models in construction project planning facilitates more creative designs, sharing ideas and improved collaboration among workers who understand and are involved with the work. Now project schedule, material and engineering information is brought into a single platform along with Advanced Work Packaging (AWP) processes to enhance the ability to perform Workface Planning.

A CONSTRUCTION PROJECT BEST PRACTICE

The Construction Industry Institute (CII) promotes AWP as a best practice. It has undertaken research to validate the benefits of increased project performance, compared against traditional planning and execution processes:

- **Up to 25% increase in field productivity.**
- **Up to 10% decrease in total installed cost (TIC), with increased savings for owners and increased profitability for contractors.**
- **Improved schedule performance.**
- **Improved safety performance, with zero lost-time accident records.**
- **Increased quality, with reduced construction rework.**
- **Increased predictability in terms of cost and schedule estimates.**

THE AWP ROAD MAP

While the concepts of Advanced Work Packaging (AWP) are straightforward, an understanding of the terminology can demystify the process and demonstrate how elements interconnect.

***Path of construction*: A systematic project planning exercise results in a course the project will follow. Covering the entire project scope, the project is broken into Construction Work Areas (CWA) that are defined based on input from project management, design, procurement and construction professionals, and sequenced to optimize resources and equipment.**

***Engineering work package (EWP)*: Containing all engineering data, drawings and technical specifications, the EWP details the scope of work for the construction team.**

***Construction work package (CWP)*: Using data and documents of the EWP as a foundation, the CWP defines the specific construction planning requirements to complete the EWP scope. Benchmarks vary, but a CWP typically consists of about 40,000 hours of project work, which is divided into smaller work packages.**

***Procurement work package (PWP)*: Using the EWP information as the basis, the PWP outlines all the equipment and materials that require sourcing. The PWP becomes a tracking and logistics tool to provide visibility on purchase orders, shipments, receiving and progress.**

***Installation work package (IWP)*: The smallest work package on a project (sometimes referred to as a micropackage), the IWP details the exact scope in easy-to-understand terms and includes all relevant tools, drawings, materials and scaffold plans for a defined job. IWP work periods are flexible but of limited duration and include enough work for one construction crew to perform over one to three weeks, typically.**

WHAT IS AWP?

AWP is a CII best practice that leverages technology with existing planning standards to create process improvement for construction projects. The CII defines AWP as:

> *The overall process flow of all the detailed work packages (construction, engineering and installation work packages). AWP is a planned, executable process that encompasses the work on an EPC project, beginning with initial planning and continuing through detailed design and construction execution. AWP provides the framework for productive and progressive construction and presumes the existence of a construction execution plan.*

Using the 3D model as a representation of a plant, the planning process and technology provide a systematic way to aggregate and integrate all project data and documents between engineering, procurement and construction in a single place for the AWP process.

AWP provides a view of a project at a point in time in the form of a 3D construction model connected to:

- Engineering specifications
- Manpower requirements
- Material requirements
- Procurement status and location
- Project schedule
- Timeline and sequencing
- Tool requirements

The AWP data provides real-time interaction between all components and visualization of progress, potential challenges, schedule risks and possible deviations in outcomes. Users can go into the 3D model to package work requirements, providing an actionable level of detail for workers over a defined period.

Because the 3D model provides visualization from the first day of a project, an integrated project team immediately understands the goal, with a unified vision helping the team optimize the schedule.

The goal of AWP is to remove constraints and provide people with the right equipment, materials, tools and instruction to get a specified job done. The result is

reduced idle time in the field, increased productivity, greater efficiency and more reliable outcomes.

OPTIMIZING THE CONSTRUCTION PROCESS

By embracing best practices for planning, incorporating the AWP process, and leveraging the power of 3D models, complex projects can achieve more predictable outcomes through a range of benefits.

PRODUCTIVITY

CII estimates a reduction in project labor costs of up to 25% using the AWP execution program and by minimizing lost and idle time on the job. Achieving clarity of each job assignment and knowing the real-time availability of materials and dependent tasks allows proactive planning to make the most out of labor.

VISIBILITY

Combining the AWP process with appropriate technologies, all project stakeholders — whether involved in engineering, procurement or construction — have real-time insight into project progress. Understanding the status of tasks and materials provides the transparency needed to assign labor efficiently and route priorities according to the sequencing of work packages.

COMMUNICATION

With upfront multidisciplinary planning as well as data and document integration, AWP delivers needed project insights, allowing collaboration and trust among team members and across work silos. Communication at the planning level and in the field enables information to be aggregated upfront. Using structured work packages makes sure there are no islands or unforeseen delays, creating adaptive workflows.

READINESS

Complexity can slow processes when change is required. With detailed planning coupled with real-time access to schedules, resources, materials, procurement and fabrication, AWP processes integrate with material receiving to create dynamic assignments and optimize availability and sequencing. Teams gain confidence that packages are logical and that the necessary materials are available to get jobs completed.

SAFETY

Using AWP and 3D modeling, hazards and potential risks can be identified from initial planning through execution. Before tasks are undertaken, teams can determine how many people will be on-site, in which areas, and what equipment will be used. This allows high-risk activities to be flagged. Work sequences can be modified and methods deployed to reduce risk and keep sites safe.

CONCLUSION

AWP uses readily available technologies and a collaborative approach to consolidate and integrate the numerous documents and plentiful data involved in a project. This depends upon balancing new technologies with traditional, experience-based planning efforts to make smart decisions early enough to improve the outcome of the project.

Building on a comprehensive planning exercise and a thorough project execution plan, detailed work packages are developed early in a project that clarify the construction road map and support the team integration that results in greater project efficiency.

BIOGRAPHIES

JOSH HAUSER is a construction project manager at Burns & McDonnell. He has spent the last decade in the energy sector, focusing on scheduling, estimating, subcontract administration and contract management. His focus began in the air quality control system market and has shifted toward new generation and project planning.

SCOTT HENDRICKSON is a technology manager for Burns & McDonnell, focusing on the integration of technology in the delivery of all types of power generation projects. He combines his experience with IT systems, network architecture, security and governance with his knowledge of heavy industrial design and delivery to align business objectives and drive accountability for successful technology implementations.

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