



A Guide to Instantaneous Project Controls

Case Studies



Implementation Resource 316-2



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Research Team 316, Instantaneous Project Controls Systems

Construction Industry Institute

Implementation Resource 316-2

Volume II

April 2016

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The University of Texas at Austin

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Printed in the United States of America.

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Introduction

To document current industry practices for instantaneous project controls, Research Team (RT) 316, Instantaneous Project Controls, conducted multiple case studies, with a holistic line of inquiry that incorporated a variety of perspectives. In total, the team investigated and documented the implementation and use of instantaneous controls practices in 10 organizations, among which were both CII members and non-CII members. (See Figure 1.)

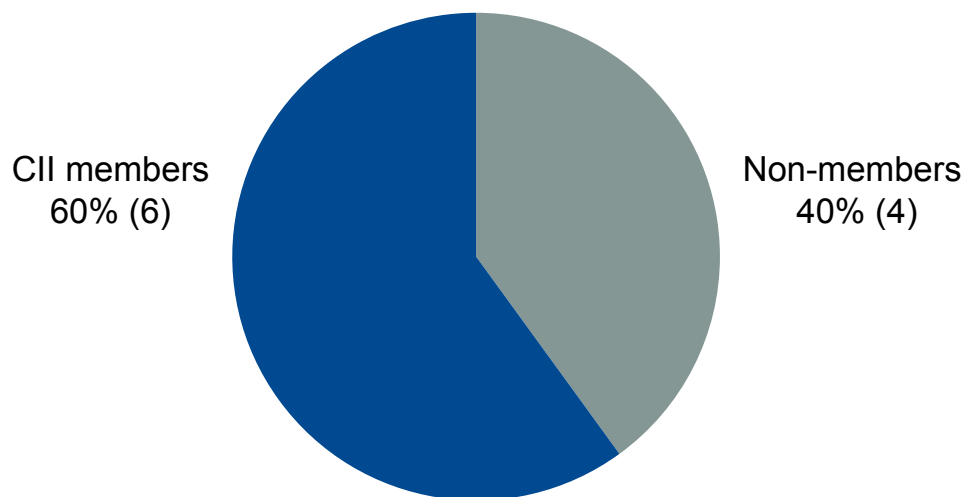


Figure 1. Case Study Sample Population

This sample also included organizations sectors other than construction, such as technology, manufacturing, and aerospace. Indeed, the team carefully selected these cases, to ensure that they would present a variety of trends, patterns, and clusters of data on instantaneous communication of information. (See Table 1.) The unit of analysis was the organization, except in Case Study 2, which focused on a single project. To obtain a holistic perspective on implementing instantaneous controls, the team designed its interview protocol with 16 open-ended interview questions that addressed issues related to business rationale, data collection/reporting, technologies, benefits and barriers, implementation cost and schedule, or maintenance, among others. (The appendix to this resource presents the protocol in its entirety.)

Table 1. Summary of Case Studies

Case No.	Sector	Organization Role	Unit of Analysis	Function(s)	Reporting Frequency	Median Industry Reporting Frequency to Owner/Client
1	General Construction	Construction Manager	Organization	Reporting: Project Cost, Procurement, and Change Management	Daily	Monthly
1	General Construction	Construction Manager	Organization	Reporting: Portfolio Financials	Daily	Multiple Months
2	Oil and gas	Owner	Project	Reporting: Project Cost and Schedule Progress	Daily	Monthly
3	General Construction	Software Provider	Organization	Automation: Payment Transactions	Instantaneous	Up to Several Months
4	General Construction	Software Provider	Organization	Information Integration: Project Information	Instantaneous	N/A
5	Automobile	Automotive Manufacturer	Organization	Monitoring: Production and Quality	Instantaneous	(*)
6	Building Facilities	Contractor	Organization	Reporting: Craft Labor Productivity	Daily	Monthly
7	General Energy	Engineering & Contractor	Organization	Reporting: Cost and Schedule for Pipeline Infrastructure Projects	Daily	Monthly (cost)/ Bi-weekly (schedule)
8	Aerospace	Owner	Organization	Information Integration: Project Information	Instantaneous	N/A
9	Technology Manufacturing	Owner	Organization	Reporting: Planning, Budgeting, and Scheduling for Capacity Planning Decisions	Monthly	Five months (**)
10 (i)	Engineering Design	Software Provider	Organization	Reporting: Craft Labor Productivity	Daily	Monthly
10 (ii)	Engineering Design	Software Provider	Organization	Reporting: Design Engineering Progress	Instantaneous	Bi-weekly

N/A – Not available

(*) Company reported as a manufacturing organization, so no construction industry comparison is assessed

(**) Reported from the same organization -no industry data was available

The team sent the interview protocol to interviewees in advance, to acquaint them with CII, briefly describe the research scope and purpose, and alert them to the likely open-ended nature of the discussions. A total of 90 minutes was allotted for each interview. It is important to note that, in all but one case, the participating organizations were represented by at least two individuals; and the interviewees were always upper managers (except in Case Study 2). This upper management perspective accounts for the organizational focus on the implementation of instantaneous project controls (as opposed to a project-based perspective) in nine of the 10 case studies. Since the interviewees in Case Study 2 were project managers and controllers, it stands alone in its project-centered focus on implementing instantaneous controls.

The open-ended design of the questions allowed the RT 316 interviewers to pursue specific threads of discussion or expand the scope of a conversation, as warranted by the discussion. As Table 1 illustrates, because the organizational roles, business sectors, and instantaneous control functions discussed in the interviews differed widely, the scope and details of the discussions varied from interview to interview. For instance, only 30 percent of the organizations were specialized in engineering design, construction, and construction management, while 60 percent were affiliated with CII at the time of the interview. Nonetheless, the common interview protocol enabled a general comparison of the multiple perspectives expressed across the 10 case studies. Chapter 2 of this volume discusses the general insights gleaned from the interviews, while the following chapters discuss each case in detail.

2

Insights

The analysis of the case studies provided important research insights, particularly with respect to how the implementation of instantaneous reporting relates to lean construction, how it is often implemented for monitoring (rather than for controls), and how the scope of instantaneous reporting/controls can substantially vary, depending on the monitored metric or function. These insights are discussed in this chapter.

A Lean Perspective

According to lean principles, as developed and implemented in the manufacturing sector, reducing variability should be a critical goal for any production process. As explained in Case Study 5, manufacturing organizations work primarily to establish instantaneous controls on the assembly line, specifically to reduce variability in productivity and quality. While the production process is monitored in real time, business-related information is still reported in a batch mode. Indeed, business metrics such as number of manufactured products or work hours per unit of product are reported at weekly, bi-weekly, or monthly frequencies, depending on the metric or function.

So, the “control” on the manufacturing line is actually a real-time monitoring effort, quickly detecting and instantly correcting. The reader should note that, in this way, manufacturing lines are only *monitored*, and that no actual reporting of information occurs. That is, assembly line data are captured and transmitted in real time, but not analyzed. To enable such corrective real-time monitoring of production, the ultimate decision-maker must frequently be the worker, who, in certain situations, is instructed to halt production at the workstation to correct any issue. Any event that interrupts a steady workflow or degrades the quality of the final product is an absolute priority until it is solved on the spot. Conversely, the business functions are reported on in batch mode at pre-determined frequencies, to support strategic decision-making. Management is instantaneously notified of events on the production line, and workers are ultimately responsible for addressing them in real time. Thus, responding to a production event at the moment it happens, right at the source, eliminates the need to address its multiple ripple effects later. So, again, while the vehicle production process is monitored in real time, the business-related reporting functions are set at specific frequencies (not necessarily in an immediate manner). The underlying concept is that both monitoring and reporting functions are set to support timely and informed decision-making, and to prevent the negative impacts of making late or uninformed decisions.

Monitoring Construction versus Controlling Projects

RT 316 observed that the control and monitoring model as implemented in manufacturing industries is slowly but steadily being adopted by construction industry organizations, whether deliberately or in an ad hoc manner. Indeed, the industry has already begun the shift toward having prioritized controls and instant monitoring to achieve the efficiency required to compete globally. Capital project delivery is actually a highly variable process that often sustains significantly compounding negative impacts if issues are not proactively addressed.

Based on its investigation of the evolution and status of instantaneous monitoring and reporting in other industries, RT 316 concludes that the *construction industry must rapidly shift toward implementing timely, if not on-demand, project/operations status monitoring*. Indeed, through the case studies, the research team observed that functions with a near or real-time reporting capability are, for the most part, being implemented to monitor different field functions, rather than report on project performance measures. For instance, the team repeatedly observed a focus on real-time or near-real-time tracking of project quality, craft labor productivity, or progress. The underlying benefit is that such instantaneous functions enable organizations to monitor aspects critical to project success. For instance, because quality defects often determine the success of energy and health care projects, the team observed consistent quality monitoring in those sectors, typically with 24 hours reporting intervals. In fact, a large amount of rework is a primary consequence of the late disclosure of quality issues, with craft labor demotivation (at the prospect of rework) being a knock-on effect. Similarly, the team documented certain organizations' use of real-time or near-real-time monitoring of craft labor productivity and progress. This sort of tracking is evidence not only that the industry is focusing its real-time monitoring efforts on field construction issues that are equivalent to the assembly line issues typically monitored in manufacturing; it also shows that both industries tend to monitor similar metrics, such as quality and workflow, with the aim of reducing variability.

Scope and Implementation Effort

The case studies also revealed that distinct instantaneous control functions have different scopes. While many of these functions ultimately aim at providing a frequent, near real-time assessment of a project's current and forecasted cost and schedule, other instantaneous functions have a more limited scope. For example, the research team found evidence of specific near real-time functions tracking payments, change management, craft labor productivity, and quality, among others. The relationship

between the scope of a real-time function and the ease of implementing it is also important. In general, the team found that the broader the scope of the function, the larger the amount of time and resources required for its implementation. Comprehensive real-time assessment of cost and schedule performances requires either project-wide or enterprise-wide implementation of relational databases, or the development of communication interfaces between existing software packages and tools. Such information integration efforts require a solid business case to justify all that is needed for successful implementation: the long-term commitment of a multi-disciplinary team (e.g., personnel from accounting, project controls, project management, engineering design, information technologies, and human resources, among others); the inevitable technology nuisances during the integration process; the training efforts; the capital investment in expensive software solutions; and the future maintenance and service efforts. At the project level, this integration should be complemented with the feed and read functions across organizational boundaries. So, on the one hand, the project organizations collecting data (e.g., subcontractors) should be able to feed structured raw data and, on the other hand, key stakeholders (e.g., clients) should be able to access the report functions and data they need. As detailed in the maturity matrix strategies, all data collection, communication, and reporting commitments must be contractually enforced to ensure that the data communication chain is established and maintained.

While more comprehensive efforts require an extensive investments of time, effort, and money, real-time functions with very specific scopes can be implemented with a modest amount of resources and within very short periods of time. For instance, the deployment of an automated payment function such as the one discussed in Case Study 3 typically requires less than a month, with minimal in-house resources, and with an almost immediate payoff. Thus, even though most of the interviewees and experts contacted by RT 316 expressed an interest in the instantaneous control of project cost and schedule functions, the team noted that organizations can implement less comprehensive control functions that have a narrower scope, require fewer resources, and can provide immediate payoffs. These smaller-scale, complementary efforts may actually constitute the way to go for industry organizations with less maturity or limited resources.

Case Study 1

Daily Reporting of Project Cost, Procurement, and Change Management/Updated Portfolio Financials

1. Industry Context

- Construction consulting and management services to owner organizations throughout the project life cycle, from pre-construction to maintenance and operations.
- Type of projects: school districts, commercial, infrastructure, and mining.

2. Business Driver

- Informed and timely decision making.
- Full compliance with laws and regulations needed; audits are very frequent.
- Transparency increases owner satisfaction and, thereby, improves marketability, providing a competitive advantage during the prequalification process.

3. Instantaneous Controls Functions

A web-based enterprise project portfolio management solution enables seamless sharing of documents and information among key stakeholders.

- **Continuous feed of project cost and procurement data.** Project cost and procurement data are continually and instantaneously fed into the web-based enterprise project portfolio management solution, with daily reports available to the owner.
- **Immediate update of owner's financials through customized integration interface.** For school district investment programs, project cost and procurement data are interconnected with the owner's portfolio financials through a customized interface that uses XML or comma delimited types of files. Such school district programs have durations as long as, perhaps eight, 10, or 15 years, and account for hundreds of different projects.
- **Implementation of document sharing.** These programs implement direct-feed and seamless sharing of most project-related documents and transactions, such as contract approvals, task orders, notices to proceed, change orders, design submittals, and RFIs, among others.
- **Regular progress updates.** The contractor updates progress on a monthly or, at best, bi-weekly basis, with monthly earned value reports.

- **Full integration of vendor data.** The projects in such programs enable full integration of data from vendor to owner, e.g., procurement requests sent to the owner for approval, invoices sent by vendors, invoices approved by the program manager, check numbers received, and transactions consolidated through the owner financial and accounting system.
- **Streamlined RFI processes.** Processes for RFIs (submittals and transmittals) and change orders are streamlined through the project management solution. The web-based system enforces the workflow of both processes, and decisions are enabled at the lowest possible level. Information is immediately updated and available to team members. Also, warning and escalation rules are embedded in the system; so, for instance if an RFI is not replied to within a given timeline, the system sends out reminders and escalates the issue.
- **Availability of key metrics through dashboard.** Reporting through pre-defined queries is available, but the construction management company has made a customized dashboard of key metrics available to the owner, to ensure full transparency, problem identification, and rapid and informed decision-making.
- **Automated warnings** (e.g., about late completion) are communicated to key stakeholders and/or shown on the dashboard.

4. Benefits

- **Full regulatory compliance.** With minimal training, project teams can use built-in business intelligence and compliance rules to comply fully with laws and regulations.
- **Improved accountability and transparency.** Accountability and transparency are driven by upper management access to data. Each team member has access to the data required for his or her role. Moreover, everyone has access to the documentation of decisions and their impacts. Also, reporting of delayed data/information submissions exposes accountable individuals or vendors.
- **Increased competitive advantage and more marketability.** Transparency increases owner satisfaction and, thereby, improves marketability, providing a competitive advantage during the prequalification process.
- **Timely and informed decision-making.** Owners use a customized dashboard of instant and reliable information to identify and understand problems on their own, as opposed to waiting for over-the-phone details from the construction management firm. This immediate access to information supports timely and informed decision-making
- **Informed and rapid decision-making.** Decisions are enabled at the lowest possible level and are made rapidly. For instance, a small change order (under a certain cost threshold) requires approval in the field, a relatively large change order requires approval by project management, and a large change order (above a certain threshold of cost) requires approval by upper management.