



KEY FACTORS IN CONSTRUCTION

This article introduces the many control points contractors need to consider in their mission to be more profitable.

PROJECT CONTROLS: INTEGRATING COST AND SCHEDULE

TONY OLLMANN

Construction companies can often be driven by a “get it done” mentality. Contractors who can get it done and get it done right are on owners’ short lists of firms to work with; however, this same delivery methodology that ensures on-time delivery can be at odds with an accounting department’s need to preserve profit, bill in a timely fashion, and minimize project surprises. Therefore, it becomes the chief financial officer’s task to seamlessly integrate good project controls, financial monitoring, and risk prevention without eroding delivery capabilities and overburdening superintendents with paperwork. Every construction project presents an opportunity to improve delivery and owner satisfaction and achieve greater profitability.

Today’s successful construction projects are an integrated team effort of

owner, architect, and contractor. Understanding the development team’s role and their associated project risks enables the contractor to implement controls that minimize overall project risk, improve profitability, and increase customer retention.

These projects are often complex and involve taxpayers, public agencies, investors, and community stakeholders, which in turn creates high visibility. Consequently, the integrated project delivery team of architect, contractor, and owner takes on significant additional risks and administrative burden when embarking on a construction project.

Project risk is inherent in construction and is magnified by communication gaps between the owner, contractor, and architect. A contractor’s first project control program is a good contract that can bridge communication gaps with the

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owner, set expectations, and monitor performance metrics that can help mitigate profit fade.

Construction contracts

Most contractors use some form of the American Institute of Architects' contract templates; however, the best firms have committed resources to customizing these templates in order to minimize ambiguity and set owner expectations. A good contract should include clear terms for the following.

- *Change order control.* These are well-defined procedures that promote quick responses from the owner, minimize field delays, and ensure fair compensation for the work performed. Not only should the control environment document change order scope and cost, but it should also track change order performance. How long does it take to deliver the change order and get the owner to approve it?
- *Cost of work definition.* Contracts include these terms and are often framed with broad and general statements. Be specific about general conditions, general requirements, fees, preconstruction costs, insurance, bonds, and other project costs that you feel should be included. Do not leave this open to interpretation.
- *Liquidated damages.* As these clauses are becoming popular again, the contractor needs to define under what circumstances damages will be assessed, the computation methodologies, and how the contractor can get relief from liquidated damages.

This only highlights some of the most commonly customized contract terms. All contract terms should be evaluated regularly to ensure they continue to mitigate risk. Even seemingly insignificant terms (like communication frequency or progress report content) can become a significant project risk if not well-defined. Of course, no discussion of contract controls would be complete without these actions items:

- Use legal counsel with construction experience. Not all contract attorneys fully understand construction risk.
- Get the contract signed and, if terms are in negotiation, get a notice to proceed with terms to retroactively compensate the contractor for costs and fees incurred subsequent to the notice to proceed.
- Read the contract. Too often, assumptions are made that this contract looks like the last, and costs are incurred that result in project write-offs instead of reimbursements. The contract needs to be read by the superintendent, project manager, billing administrator, and project administrator because these people will be working in the environment set by the contract terms.

Basic project controls

The project control environment should have policies, procedures, and measurable tasks to communicate with the owner, administer the project documentation, manage the estimate cost, and schedule control aspects of the project. Furthermore, it is the purpose of this article to define certain estimating, cost, and schedule requirements, with which owners expect to accomplish a reasonable amount of control over the activities of the contractor in its performance of the work.

What is the contractor responsible for? All activities relating to project control and document control that are to be executed as part of project scope (also referred to as "work"). Project control environments should encompass the following project functions:

- estimating;
- cost control;
- variation/change control;
- planning and progress management;
- risk analysis;
- cost accounting/invoicing; and
- project reporting.

Cost control plan

The cost control plan (CCP) should describe the systems and procedures



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proposed for estimating, controlling, analyzing, and reporting on the costs of the project, including representative illustrations, flowcharts, examples of standard reports, and reports for proposed deliverables. The CCP serves multiple purposes.

1. It is an assessment of current controls that can lead to the planning for what one's controls should look like and the function they will perform.
2. Upon implementation, it documents the existing control environment, mirroring the contractor's construction manual.
3. It is a ready-made owner communication tool, providing additional assurance that the project will be managed well.

A typical CCP will cover each of these topics, and the level of detail should be appropriate for the project scope. Contractors documenting their control procedures should have, at a minimum, the following topics in their plans:

- cost control organizations;
- duties of specific individuals;
- overview of cost reporting system with sample reports;
- quality control procedures to ensure accuracy and integrity in the cost control system;
- process for collecting data (e.g., man-hours, costs, quantities, etc.);
- process for reporting cost performance versus the approved control budget, including a description of proposed reports and proposed timing/frequency and distribution of such reports;
- process for forecasting future costs, estimates to complete, and cash flow requirements;
- change control procedures; and
- process for providing final "actual" cost data.

Cost control

The contractor is responsible for all cost control activities for the owned scope of work as well as the reporting of suppliers and subcontractors. At a minimum, the cost control system should be

able to capture the original or baseline project budget, capture all costs to the job, and produce project performance reports against the baseline budget and estimate to complete.

In general, it is expected that the contractor will monitor and analyze its cost performance on a daily and weekly basis. The analysis should include an overall complete and comprehensive quantitative and narrative summary of the period in question. This is typically performed monthly but should be done as needed at the discretion of management depending on the project manager's performance.

The objective is to raise potential cost performance problems as early as possible so that informed management decisions can be made or actions to mitigate such problems can be implemented cost-effectively.

Cost control monitoring and analysis shall include, at a minimum, the following types of activities:

- retention of all relevant history and actuals for reimbursable estimates;
- trend analysis and notification;
- change control and analysis of the impact of approved or pending changes;
- maintenance of an accurate cost expenditure database; and
- forecast of future costs, identifying any variances.

Change management system

Similar to a CCP, contractors need a well-documented change management system (CMS). The contract terms will establish the basic change order control requirements and owner authorization. In addition, the contractor needs to have a tracking mechanism that will highlight change orders and requests for information that are outdated, unapproved, and funded as well as those that may result in backcharges that need to be charged against subcontractors and suppliers.

Several key principles should drive an organization's CMS. They include:

- early identification of any potential deviation from the established base-

- line schedule or budget;
- quick review, resolution, authorization, and close-out of all changes; and
- documented and approved changes prior to implementation.

CMS procedures should be documented in a formal change management plan and contain procedures for each of the following topics:

- criteria for determining what is or is not a “change”;
- initiation of change requests;
- forms to be used for change requests;
- preparation of change order pricing and schedule impacts;
- timeliness requirements for change order pricing and schedule impact analyses;
- review and approval of change orders by owner;
- formalization and issuance of change orders;
- forms to be used for change orders;
- logs to be maintained by the contractor and owner to track change requests, change order proposals, and change orders;
- classifications of changes by root cause (e.g., types such as design change (DC), scope change (SC), engineering error (EE), construction error (CE), etc., and/or reason or justification);
- incorporation of approved changes into the budget;
- supporting documentation and justification requirements including pricing assumptions and any qualifications to pricing or impact estimates;
- incorporation of approved or pending changes into cost reporting requirements;
- implementation of actions and work related to approved or pending change orders; and
- funding source (e.g., budget transfer, contractor’s contingency, owner’s contingency, GMP change, backcharge, etc.).

The CMP is intended to provide the final vehicle (document) reflecting agreed-upon changes to the contract

documents that affect work scope and/or schedule.

Schedule control

A schedule control plan (SCP) describes the systems and procedures proposed for planning, sequencing, scheduling, controlling, and reporting on the schedule including representative illustrations, flowcharts, examples of standard reports, and reports for proposed deliverables.

The SCP should be integrated with the previously described CCP and cover, at a minimum, the following topics:

- organization chart with authorization matrix documenting team members responsible for modifying and authorized to modify the schedule;
- inventory of scheduling tools with minimum data and interface capabilities (sophisticated owners are using Primavera Enterprise tools and other enterprise capital management tools with expectations of contractors to interface with the owner’s enterprise systems);
- flow of information through planning and schedule cost control systems;
- quality control procedures to ensure accuracy and integrity in schedules;
- process for collecting data (e.g., schedule progress, remaining duration for schedule activities, quantities designed, procured, or installed, etc.);
- process for analyzing schedule data;
- process for reporting schedule performance versus the approved control schedule, including a description of proposed reports, timing/frequency, and distribution;
- process for forecasting future schedule milestones/completion dates and plans for execution of the remaining work;
- schedule milestones (targets) change or adjustment procedures;
- process for providing final “as-built” schedule data;
- process of including and distinguishing services rendered so single



A SCHEDULE CONTROL PLAN (SCP) DESCRIBES THE SYSTEMS AND PROCEDURES PROPOSED FOR PLANNING, SEQUENCING, SCHEDULING, CONTROLLING, AND REPORTING ON THE SCHEDULE.



THE OBJECTIVE OF CONTINUOUS MONITORING IS TO DETECT PERFORMANCE PROBLEMS AS EARLY AS POSSIBLE SO MANAGEMENT CAN TAKE CORRECTIVE ACTION IF NECESSARY.

- source responsibility is assigned (this includes different craft discipline under direct hire — suppliers, fabricators, consultants, and subcontractors under contractor’s direct control and supervision — from contractor’s own workforces, reimbursable only);
- develop a project-specific schedule activity breakdown; and
- develop a data map linking work breakdown structure, job cost activity coding, and general ledger expense coding.

Schedule content

A good project schedule is more than a forecast. It is a significant control mechanism when used with historical cost data as well as resource availability and productivity data. More than reporting just days ahead of schedule, the schedule report should document the following baseline attributes:

- schedule basis, including items such as early contracting requirements and ordering of long lead items;
- production/productivity considerations or factors;
- unit rates for frequently occurring commodities;
- quantities to be used for scope definition;
- earned value analysis;
- plans for activity coding;
- allowance considerations;
- any exclusions from the schedules;
- resultant schedule contingency development and management such as wet weather, wind days, or other periods of suspended or intermittent work;
- critical sequences;
- any internal or external constraints; and
- activities and logic relationships, including construction completion and commissioning.

The objective of continuous monitoring is to detect performance problems as early as possible so management can take corrective action if necessary. Considerations that should go into schedule analysis are:

- schedule performance to date and to-date rate of progress;
- potential increases or decreases in quantities;
- potential increases or decreases in resources;
- production rates, progress rates, and productivity trends;
- evolving project issues and constraints on performance;
- status of procurement of long lead-time items;
- effects of remaining areas of risk for changes;
- approved and pending changes;
- allowances and contingencies used to date and any proposed adjustments;
- integration of engineering, procurement, and construction activities as they progress;
- cost/benefit of any proposed schedule recovery alternatives and any new or revised external or internal constraints;
- evaluation of float consumption and changes to observe negative trends;
- impact on punch listing, pre-commissioning, startup, or commissioning types of activities;
- significant changes in execution strategy; and
- significant changes in relationships between critical/near critical activities.

Physical progress measurement

Integrating costs incurred, schedule data, and physical progress enables measurement of productivity and improves the accuracy of estimates to complete. Additionally, frequent monitoring of physical progress will notify project management of pending overbilling and underbilling scenarios. Many controls and measurement programs require project management and superintendents to monitor:

1. physical progress based on actual physical work completed without regard to the actual number of labor and costs expended;
2. physical progress measured and reported separately for:
 - engineering and design activities;

- procurement activities (including fabrication); and
 - field activities, including construction, testing, startup, and commissioning;
3. progress determined based on physical progress for discrete and identifiable pieces of work (earned value) using weighted steps of progress milestones (weight factors are applied to the progress milestones based on the work content of each activity); and
 4. productivity reports and analysis based on the cost performance index (CPI) as calculated through the use of the earned value calculation for the CPI.

Typically, a productivity of 1.0 is the normal base index. Productivity in this reference is calculated per the following:

- $\text{earned hours/actual hours} = \text{productivity}$;
- less than one = bad or abnormal; and
- greater than one = good or normal.

Progress reporting, when used as a control tool, is more than an owner's requirement to be satisfied. It is a profit opportunity indicator. Identification of efficient operations should be analyzed to determine why they are more efficient

than planned and whether that experience can be replicated on future projects. Additionally, can those lessons learned be applied to underperforming tasks preventing further margin erosion?

Best in class contractors are using project controls, statistical reporting, and data mining to know how projects are performing, identify strengths and weaknesses, and invest in developing delivery systems that enable them to harvest consistent profits and improve market competitiveness. This article only introduces the many control points contractors need to consider in their mission to be more profitable. Of course, each project brings its own unique factors that must be successfully managed on top of the established controls environment to avoid an unsatisfactory outcome.

In today's environment, successful projects are those with a management team that achieves a truly integrated approach to mitigating risk and clear communication. While this article outlines key considerations, owners, architects, and contractors should understand their roles within each unique project and strive for process ownership, open communication, and effectively integrated controls from notice to proceed and contracting through final punch list and delivery. ■