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Article 2 of 4

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Construction Scheduling 101

Construction scheduling has come a long way in the last 25 years. Unfortunately, despite the widespread use of computerized scheduling on construction projects today, there still exists a large disparity in the level of understanding of those involved in construction in the proper use of this powerful tool. Some even say there is a crisis in the construction industry because they believe scheduling software is being misused to assert delay claims and there is, in their view, a predominance of poor quality schedules. Whether this is true or not, everyone who is involved in design or construction - owner, architect, engineer, contractor, subcontractor, or attorney - could use the refresher course "Construction Scheduling 101."

Practice Tips for Beginners

"Lost time is never found again.."
- Benjamin Franklin

We now have much better tools to schedule our projects - personal computers and relatively inexpensive, easy to use scheduling software. However, this technology will only help you avoid losing valuable time if it is used wisely. For this reason, the subject of "Good Scheduling Practices" is very much in the spotlight in the construction industry. Both the Project Management Institute (PMI) and the Association for the Advancement of Cost Engineering International (AACEI) are working on guidelines and training programs for doing scheduling "the right way." This article provides some basic suggestions on ways to develop and maintain a schedule that will serve the Owner and the

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Jennifer Frank is a Scheduling and Construction Claims Analyst in PinnacleOne's Middletown, CT office. She has over 25 years experience in construction management working on a wide variety of projects including offices, schools, hospitals, prisons, pharmaceutical and water treatment plants. As a scheduler for a large construction management firm, Ms. Frank had primary responsibility for the development, updating, and analysis of CPM schedules for the design and construction phases of building projects throughout the Northeast United States with construction values up to $80 million. In this

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Contractor well from the beginning to the end of the project.

Start Scheduling at the Project Start

A preliminary Master Schedule should be developed for all phases of the project when a project is in the earliest planning stages. This initial Master Schedule should detail the preliminary planning and budgeting, site selection, and other early Owner activities and include slots of time for the design phase, the purchasing phase, and the construction period.

You may ask, "Why would I need a schedule at the Design Phases of my project?" With the number of consultants involved in a substantial project and the typical phases of the design process (schematic design, design development, and construction documents), the schedule serves as a valuable communication tool for all the project participants. If schematic drawings are due on a certain date, how much sooner must the Architect finish his documents so the structural and MEP engineers can complete their work? If interim estimates and value engineering are planned, when will they be done? Is Owner input or approval needed at key points? When done properly, the preliminary Master Schedule will identify and track these activities that, if allowed to slip, can delay the completion of the project.

Other items in a design phase schedule might include the project funding process, property acquisition, and special permits (EPA, FAA, the Army Corps of Engineers) which can take six months or longer. Preliminary site examination and preparation should be tracked from the beginning of a project, especially where there may be contamination or unusual site conditions. Keeping track of all these items will give you the early warning you need to mitigate any delays to these critical activities without unnecessarily shortening the bidding or construction durations.

Anyone who has been involved with a project where the bids came in "too high" can tell you that a project can suddenly stop at this stage. Sometimes a complete re-bid is required. Other times, contracts are awarded for the earliest work stages and re-design proceeds for later packages. Bidding periods can be extended when there are too many bidder questions on the plans and addenda

capacity, she led teams of contractors, owners, and designers in the interactive development of schedules using the "card trick" process.

Since joining PinnacleOne, Ms. Frank applies this experience and her skills in CPM scheduling to analyze delay claims and she is an instructor of the PinnacleOne Institute where she conducts seminars on CPM scheduling-related topics. Ms. Frank is a registered professional engineer in Connecticut and New York.

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have to be prepared.

Do you need to schedule the "pre-construction" or buyout phase of a project? I say yes. A detailed buyout schedule with separate sets of activities for receiving bid documents, bid package preparation, bid period, bid review, owner approval, and contract award should be developed for all major bid packages. Building permits for early work stages should also be tracked at this point in a project.

There are different opinions about how much schedule information should be given to bidders and included in their contracts. At the very least, a milestone schedule showing overall start and finish dates for major bid packages should be developed and provided with the bid documents. The milestone schedule should indicate the anticipated dates for such critical items as availability of permanent power, temporary/permanent heating systems, and building enclosure. The bid documents should also identify early occupancy areas, access/availability restrictions, or other Owner requirements that could affect the construction schedule. Language should be included in the successful bidder's construction contract that requires that the successful bidder develop more detailed schedules after contract award.

Allow Enough Time for Construction

Schedules can be more aggressive depending on the type of owner and project. In a "flash track" casino project, time may be more important than money, so resources are available to support tight schedules. Municipal projects typically require longer schedule durations because there is the risk that a low bid contractor or subcontractor will not provide the resources necessary to maintain the schedule and it is often not prudent for the public owner to replace or supplement an underperforming contractor. So what is a "realistic" construction duration? Actual schedules achieved on projects of similar type and size are good guides.

Some schedules are doomed to failure. Slippage in the design and purchasing phases often "squeezes" the construction phase of a project. This seems to occur most often in educational facilities, where a one or two month slip will actually cause a six month or one year slip, because the Owner cannot move after school

starts in the fall. What do many owners do in this situation? In my experience, they typically shorten the construction duration to make up for the slippage in the pre-construction activities. Yes, the bidders accept this reduced duration by bidding on the project. However, public owners, be forewarned - an excessively short construction duration typically results in a more contentious project.

Make Sure the Construction Schedule Has Adequate Detail

To be useable, a schedule must have enough activities to accurately track the work, particularly for construction projects. Two rough rules of thumb on building projects are there should be at least 100 activities for every million dollars of work and no activity duration should exceed 20 work days. To be useful as a management and tracking tool, the schedule should include separate activities for work in different areas (i.e. each floor or each elevation) and for work by individual contractors. For example, it is not possible to monitor the work of either the mechanical, electrical, or plumbing contractor using a schedule activity titled "MEP rough in" that combines the work of these three different contractors.

The construction schedule should include activities for work that may affect the schedule, even if it is not construction work. For example, shop drawing preparation, review, and material fabrication process is frequently neglected or not developed in enough detail in many construction schedules. These activities often end up affecting when construction activities can start and, as a result, need to be monitored, particularly at the beginning of a project.

The construction schedule should identify Owner activities, especially those that run concurrently with construction work. The schedule should include the tracking of Owner-furnished equipment because information for this equipment may be needed for construction activities such as support steel or wall locations. Milestones for work in adjacent areas which could affect your project should be noted and tracked in the schedule. Time should be allocated in the schedule for cleaning, system start-up, furniture and equipment move-in, and other tasks which must be completed before Owner occupancy.

Update your Schedule Regularly

To "update a schedule" means to go through the activities at a certain point in time and check off which activities have started or finished (and when - noting the actual dates) and to "forecast" dates and durations for remaining activities. By updating the schedule, you can determine if progress prior to the update date has affected the schedule completion date and when specific work activities must be done to improve the completion date or avoid slipping the date. Generally, schedules for active construction projects should be updated monthly. Critical or short term projects may need to be updated more frequently.

Sometimes it is necessary to add missed activities, subdivide original activities into smaller components, or make improvements to the schedule logic. These changes can make it more difficult to compare different versions of the schedule, but a schedule must be "up to date" to be a useful tool in the field. The schedule should also be revised to reflect changes or delays that occur on a project.

To accurately track schedule revisions, the schedule should first be updated without making any changes. Only after this update is saved, should new activities be added and logic revised. Major logic revisions should be reviewed carefully and "tested" in the schedule before actually being incorporated. When the changes are finalized, a detailed written description of the changes should be provided to the project participants.

There are many benefits to regularly maintaining an accurately updated schedule. It allows you to monitor the progress of the work and identify slippage in a timely fashion. Shifts in the critical path can be seen and addressed or corrected. It also provides you an accurate "history" of when work got done on the project. And finally, it gives you a starting point from which to develop a plan to mitigate schedule delays. A regularly maintained schedule keeps everybody "on track." Simply put, it will help you to identify slippage, figure out its cause, and work on a cure.

We have all learned over the last 25 years that technology alone will not necessarily provide us with the right solutions to all of our challenges. This is particularly true in construction scheduling. As Mitch Ratliffe foretold in Technology Review (April 1992):

"A computer lets you make more mistakes faster than any invention in human history with the possible exceptions of handguns and tequila."

On construction projects, mistakes in your schedule can cost your project valuable time. I have found that the suggestions described above will help computers and CPM scheduling software serve you well in successfully scheduling your projects and avoiding the loss of precious time. Remember, on many projects, time lost can never be found again.

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