

## Scheduling in Construction for the Pre and Post-Award Environment - Lessons Learned and Best Practices

by Jerome Schoffler, PMP, LEED® AP, Construction Executive for Kirlin Builders

Scheduling is one of the most central aspects of effective Project Management. Often the art and science of formulating a schedule comes down to experience – nothing will replace the lessons learned of building a schedule project after project, keeping those experiences with you, and applying them later. Through my own experiences as a Project Management and Controls professional building construction schedules, I know what I am trying to accomplish is to provide the most efficient schedule as possible but keep it realistic in terms of expectations. This is especially important in the procurement stage to not only be competitive to win the job, but also be sufficient enough in planning to effectively complete the project. Building the schedule before construction and managing it after construction starts are almost two entirely different tasks revolving around the same project paradigm.

### Scheduling in the Procurement Stage

When creating the schedule in procurement, efficiency is the key thing to accomplish. Efficiency can be determined in my experience by defining all the constraints in the sequence of the project, and performing as much parallel tasks as possible without jeopardizing trade work from conflicting with each other and preventing unnecessary multiple mobilizations and demobilizations of trades.

Historical data can show how long a definable feature of work can take, and that is scaled given the project size, with some contingency to allow for any potential delays based on experience.

It's impossible to anticipate every delay, but you have to assume some or you're setting yourself up for failure and are certain to disappoint your clients. If you don't have historical data, lean on your subcontractors for theirs. You have to pool all the resources available to come up with the best estimation on how long each feature of work or contract task will take.

The estimated schedule has to then be cross-checked with the trades performing each feature of work to ensure that the proposed schedule is as accurate as can be reasonably defined at this stage through assumptions communicated to the customer. As much as you can, communicate scheduling expectations with the customer. You do all your stakeholders a strong service by being upfront with an accurate schedule and communicating current status of the schedule often with the customer.

### Build for Contingencies

Every schedule in the earliest of stages needs to have contingencies built-in. Contingencies in the schedule are built by categorizing each task in terms of risk and defaulting those tasks with constraints to their most conservative values. Even though task durations are derived from historical experience to perform based on manpower, material & equipment availability, each task is also evaluated for risks in terms of difficulty to perform, unknown existing conditions, or logistics concerns.

Difficult work can include tasks that have multiple constraints to allow performance, or critical technical work with exhaustive quality control tests & inspections and/or coordinated outages that can impact a schedule if not accounted for. If there are unknown existing conditions, build that task duration with assumptions in mind about those unknown conditions to take into account performance in a more conservative scenario.

Logistical concerns can sometimes include the work space not being available, manpower shortages experienced with trades, work dependent on another contract, or customer operations needing to be considered (sub-phasing, hours of operations, haul routes, laydown restrictions, etc.). This is more art than science, but you have to weigh all of those risks identified for those tasks and add days to those durations to serve as contingency. I also will make assumptions based on the longest submittal review periods anticipated possible by contract, and assume lead times are the longest time that has been experienced.

Recently, I bid a clinic renewal project with required design submittal review periods of 21 days with risks including: phased construction to keep the clinic in operation, and liquidated damages for any delays incurred. The project schedule was built accordingly for both efficiency and project constraints with conservative values to meet customer requirements. However, following award during the kickoff meeting with the customer we identified that if we shortened the review period to 14 days it would push the start of substantial demolition up to be performed over the end-of-year holiday period when the building would be vacant while everyone was on vacation – an ideal period for the customer to minimize impact to building operations during phased construction, and to gain additional time by my project team to utilize later if an unforeseen delay cropped up during construction. It was a “win-win” that aligned the schedule to best suit my customer’s needs and was advantageous to the project team for accelerated construction. Later during construction, we encountered equipment and outfitting delays from the vendor which were outside of our control. By taking advantage of the opportunity for a shortened review period earlier in the schedule, it afforded me the opportunity to handle the risk of the

additional time from the equipment lead time delays without impacting my overall contracted schedule period of performance. No liquidated damages were incurred as a result.

Taking into account risks with conservative assumptions to build each task duration will naturally provide for contingencies in the overall schedule. During performance, those items with contingencies built in will be identified to mitigate those risks and resolve assumptions in advance to allow those schedule contingencies to be reserved for any other unknowns that crop up during construction, thereby improving the probability that the original completion date can still be met for a complex project with significant risks involved.

Depending on the task’s constraints, successors or predecessors, or lead/lag time defined during schedule development, it may not be on the critical path affecting overall project duration and can be allowed to float. Once a schedule is built, it is important to define the critical path and identify those tasks that have the potential to impact the overall schedule.

The amount of float (or slack) in your schedule is defined as indication of how long tasks can be delayed before other tasks or the project finish date are affected. If you know where slack occurs in your schedule, you can move tasks when certain phases of the schedule have no slack and other phases have too much. By default and by definition, a task with no slack is considered a critical task – And if a critical task is delayed, the project finish date is also delayed.

Those items with float should also be identified in case of delay and the Project Manager should understand that A) taking advantage of that float is sometimes advisable based on allocating the limited available resources at that time to more critical tasks, and B) knowing when a floated task can impact your overall project schedule and become a critical item affecting

your overall schedule.

### **Avoid the Problem Areas with Diligence**

Sufficient preparatory work and contract required items are commonly overlooked when building a schedule. Preparatory work can include all the effort necessary to mobilize, apply for proper permitting and allow for appropriate submittal review times. Preparatory work will almost always be required prior to starting work, and should be anticipated. Understanding the requisite contract requirements is a necessity, otherwise if missed they can hold up actual work being performed and cause you to incur unnecessary delay. Have a thorough understanding of what is in your contract and how it pertains to performance of your work. A missed contract or regulatory requirement that needs to be performed can result in an unanticipated delay, and they are not always accounted for in your project scope.

Early in my healthcare construction career, I built a schedule for a lab renewal in Oklahoma without taking into account proper contract requirements – specifically, understanding the impact of liquidated damages. When I proposed the schedule, I accelerated as many tasks as I was able to based on the most idyllic durations and no delays with constraints to the critical tasks. We won the project over the competition based on an unseasoned accelerated schedule as it provided the customer with the most expeditious project delivery date at a lower overall project cost due to lower overheads from a shorter project duration. As I wound down to complete this complex lab renewal project, it was clear that based on my current progress for each definable feature of work that I would not complete the job on time due to cumulative minor delays incurred from each task. Contract oversight by both my customer and senior management oversight noted the contract requirement for liquidated damages if the contracted period of performance was

not met. Once aware of the cost implications of the overall delayed project, I doubled up resources to compress task deliveries in order to shorten up my critical path duration to meet the contracted project delivery date. The outcome of this project without understanding contract implications of liquidated damages resulted in scrambling effort to offset cumulative delays with increased costs to compress the unrealistic schedule – ultimately causing both increase stress to the project team to accommodate the increased workload, as well as decreased profit because of the schedule compression due to more manpower being needed.

In addition to preparatory work and contract required items being missed, completion of actual work can sometimes take longer than anticipated if contract requirements and time to complete punch lists and turnover to customer is not accounted for. Testing and quality control reporting methods should be identified to track with the project schedule to show all critical path and testing milestones. Derive these by the requirements delineated in the specifications. In addition to tests and inspections, take into account independent third party tests and inspections required by the design specifications, and contract closeout activities.

Experience and keen attention to contract detail can often overcome many of the missed items overlooked with building an accurate schedule. If these specific items aren't identified, they should at least be accounted for in the milestone durations when compiling the overall schedule.

### **Chutes and Ladders, the Post Award Schedule**

Once a project is awarded, expectations for an accurately developed schedule remain the same until slippage occurs or opportunities to expedite or compress tasks become available. These chutes and ladders will present themselves and the Project Manager must always be aware of

and take advantages of opportunities to improve the schedule as they present themselves throughout the project. Chances are it will even itself out somewhere else.

Each project should be operated as an individual project. In other words, backlog or other projects won't get much sympathy from your client unless communicated to a customer of shared resources among projects. Even then, tread lightly and build projects in a vacuum. Manpower, material, and equipment resources are already defined for the project following project award and should be validated with trade subcontractors in terms of manpower availability, lead times, and any additional considerations.

As new risks or unforeseen issues come up, the expectations for the schedule can change, and should be regularly communicated to all the project stakeholders so that everyone can properly plan for schedule adjustments with new or revised projected completion dates. Eventually as the project unfolds many of the risks will have been mitigated with a resolution, previous unknowns identified, and constraints defined to where a reasonable projection for project completion can be defined.

### **Snuff Out Early Warning Signs**

An unknown trade subcontractor can be an early warning sign that should be closely managed in terms of them meeting the contracted quality and schedule expectations communicated to the customer. Management of an unfamiliar or unproven contractor should be actively performed throughout the project by the Project Manager and Superintendent, with the goal to ensure quality and progress are maintained per the design standards and contracted schedule.

Regular reviews of the Plan of Work should be conducted between the Design Team, the Construction Team and the Subcontractors at regular intervals during the project design

phase for constructability, evaluation of quality control requirements, and schedule. The built schedule should be accurate and feasible for the loaded costs, labor and material, and submittals should be in conformance with task order contract performance specifications.

Deviations in initial expectations of the subcontractor can be indicative of low-performance during construction and should immediately be addressed and resolved during preconstruction. Have actions in place to get that subcontractor back on track or, in some scenarios, seek the replacement of a low-performing subcontractor with an approved and qualified replacement contractor prior to construction. It can be considered a hardline approach, but you have to put your client and the project first.

Slippage of a scheduled task duration during continuous schedule monitoring is another early warning sign that can be an issue if it lands on the critical path of a project. Overcome this by taking advantage of float built in the overall schedule, or through schedule compression techniques if it's a really critical task.

### **Schedule Compression**

Problems will inevitably occur with any project, but it is up to the Project Manager or Superintendent to be continually diligent to identify any problem that could derail the project. One way is to visually track and document the actual start and stop times against the schedule baseline. Once a deviation is encountered during performance or anticipated, there are a number of ways to resolve to get back on schedule.

It is important to identify items with float to decide whether corrective or preventive action is required, otherwise if the task is not on the critical path it is sometimes advantageous to take advantage of the float because it will not affect the schedule outcome of the project. While

you push a task with float, you can re-allocate those resources to more critical tasks on your critical path that will affect the overall schedule performance.

If an item affects the critical path of the project, the Project Manager or Superintendent can look to compress the schedule through careful analysis for crashing or fast tracking opportunities. Crashing is done to provide the greatest amount of compression for the least incremental cost by utilizing approved overtime, bringing in additional resources, or expediting delivery of material/equipment. Fast tracking means to perform work in parallel, such as starting limited construction work as the design is being finished; however, it can result in rework or increased work.

On a recent gut & remodel construction project for a clinic renewal in Texas requiring transition for the occupants to maintain operations during construction, our project team found that fast-tracking construction of the transition while the building construction design was being completed resulted in additional time gained in the overall project schedule through efficiency. Concurrent tasks were evaluated based on impact versus schedule gain, and fast-tracking features such as segmented design development were incorporated as a best value feature to the project. To shorten project duration, we proposed and issued the Transition Plans for review/approval in advance of the Renewal Plans. This approach allowed the transition delivery and construction to occur prior to the renewal design being finalized, so that we could immediately commence into the renewal following the building construction design approval.

As a last resort, a schedule extension may be in order due to circumstances that are beyond your control and extend beyond the contract obligations. If this is the case, it is important to set expectations with the customer that

the problems encountered are not able to be overcome within the contract period and will push the completion. If realistic expectations are not set, and you try to correct beyond the resources available to you within the project constraints it can and often result in a poor customer experience due to the strains it puts on the overall project team.

### **Adopt Best Practices**

My recommendation for Construction Managers when building the initial schedule is to have a planned methodology with schedule development. Draft up all the tasks required by the scope of work to perform to ensure the scope of work is completely covered. Backfill the preliminary schedule with all anticipated preparatory and contract tasks that are may be required. Walk through the sequence and organize a milestone schedule to document when each task is to be performed within an overall project schedule.

Further define each task with all definable features of work by trade for each task, then utilize experience and resources anticipated available to make assumptions on each task duration. Look for opportunities to be efficient with mobilizing trades at a minimum and performing tasks in parallel by understanding the constraints of each task and knowing the risks associated with each.

Validate your estimated schedule with trade subcontractors to ensure it is accurate. Before finalizing a proposed schedule during procurement, ensure that you have taken all of your customer's constraints and expectations into consideration to ensure that you're not impacting their operations with phasing but still efficiently completing work as fast as possible.

At the project kickoff, look for feedback from all stakeholders not just your customer (including subcontractors, authorities having jurisdiction,

or even your project management team) for additional constraints, risks or other items to consider during execution of the project. If due diligence is performed during the preparation of the schedule and feedback is provided to make that schedule as accurate as possible at the start of the project it will provide as realistic projection as possible for customer expectations on completion.

Even though all the due diligence in the world can be used to develop as accurate a schedule as possible, the schedule is a living breathing document that needs to be continually updated based on current and projected progress of each task. No one can predict problems and there are potential unknowns with each project, but due diligence in the preparation and aggressive oversight and control to maintain the schedule and overcome problems is key in successful project completion on-time, within budget and to meet customer expectations with quality and safety.

#### **About the Author:**

**Jerome Schoffler, PMP, LEED® AP, is Kirlin Builders' Construction Executive overseeing our site staff throughout Texas, Kansas, Oklahoma, Louisiana and Missouri. Based at Kirlin Builders' Austin, Texas location, Jerome is a seasoned and energetic program and project management professional. He oversees a regional project portfolio from procurement through closeout, managing all aspects of the bidding process, pricing, scope development, design, constructibility of the design, scheduling, budgeting, and construction management.**

**A former United States Navy service member, Jerome has over 17 years' experience in advanced industrial operations and delivering healthcare construction projects – ensuring ambitious design meets beautiful end results within scope, budget and schedule. He is a LEED® Accredited Professional and Project Management Professional whose cross-functional capabilities and experience allow him to seamlessly operate in any project management capacity and meet the most rigorous of client standards.**

**Jerome can be reached at [JSchoffler@jklc.com](mailto:JSchoffler@jklc.com).**