As contract glazing firms navigate this tumultuous market, there is a heightened need to closely monitor project schedules. Building and maintaining an accurate schedule is one of the best ways to efficiently allocate resources that might already be stretched thin.

A schedule is only as good as the information it contains, and it relies on the expertise of those creating, implementing and analyzing it. Management must determine what personnel and software resources it is willing to dedicate to scheduling. For simple projects, a project manager can effectively coordinate the basic activities—submittals, shop drawings, fabrication and installation—with a spreadsheet and milestone dates.

A large project with a complicated scope of work lends itself to a scheduling method known as Critical Path Management. CPM scheduling has been around since the mid-1950s and is commonly used by construction managers and general contractors to manage thousands of activities that must be completed in a specific order to facilitate on-time completion of a project. CPM scheduling identifies the specific sequence of activities that will dictate the project completion date; this sequence is the critical path.

The main benefits of a CPM schedule are:

• A CPM schedule will identify the activities on the critical path. In most situations, resources are limited; therefore, focusing resources on critical-path activities allows for maximum efficiency.
• By updating the CPM schedule during the project, a contractor can identify the overall impact to the project when a specific activity is delayed, and react accordingly.
• In addition to scheduling dates and durations, many of the scheduling software programs allow for cost and resource loading, which can provide important decision-making information at the touch of a button. Contractors can accurately forecast both revenue and cost projections at any time.
• Upon completion of the project, a properly maintained schedule serves as a detailed record of events that determined the project completion date. The CPM schedule can provide an "as-planned to as-built" comparison that is often necessary in claims and dispute situations.

In a trade-specific CPM schedule, it is important to understand how the contractor's scope of work integrates into the overall project schedule. Think about how many times you have had to pay to store material because the project was not ready to receive it. How often have you had other scopes or projects where material was in critical need but delayed by submittals, or a long lead time?

At the commencement of a project, the glazing contractor and the GC/CM must work closely to identify the scope items that are on the critical path of the overall project. Building dry-in is almost always going to be a critical path item, but there are often small items that can be easily overlooked that have a major impact to the overall project as well. On a large project, a small bay of louvers might not seem like a high priority to the glazing contractor, but it could enclose a critical HVAC component for the project. Or perhaps, a few small windows are needed for stair pressurization. Understanding the needs of the overall project up front will help to prevent fire drills as the project progresses. Once there is an understanding of the overall project...
critical path and how the glazing package integrates with it, a trade-specific CPM schedule can be developed.

Creating a CPM schedule
When creating a CPM schedule, there are a few overall parameters that are typically established first—such as work hours and holidays—and then accounted for during the duration of the project. Listing all necessary activities by phase is an important first step in building the CPM schedule. Typically, on a large project, the main glazing system is broken into several phases, and scope items such as doors, louvers, etc., are scheduled as separate phases. Accurate durations must be entered for each activity to ensure a satisfactory schedule is constructed.

After listing the activities by phase, relationships between the activities need to be established. The most commonly used scheduling relationship is "Finish to Start," where the second activity starts when the first completes. For example, anchor installation completes and window installation starts. There are many other types of relationships that can link activities, depending on the complexity of the project.

Many activities will probably have multiple links. For example, shop production of a unitized curtain-wall panel cannot start until all procurement activities are complete: extrusion, glass, gaskets, PVC, caulk, etc. It is very important that every activity listed is linked with the proper relationships, as these links will dictate the schedule dates and critical path. As the project progresses, updating the schedule provides a snapshot of the progress of each activity, as well as a projection of overall completion. See Figure 1.

Additional useful functions
Once relationships have been established, the base schedule is a functioning document, and the critical path is identified. The CPM schedule can now effectively be used as a tool for the glazing contractor to track progress and identify critical activities that need to be completed to maintain the project end date.

With the input of additional information, a CPM schedule has several other functions that are extremely useful:

- **Resource loading.** A list of available resources can be established; for instance, draftsman #1 and draftsman #2, or field crew A and field crew B. This allows for resource allocation. The resources can be linked as constraints, which is an extremely important function. In a non-loaded schedule, a given activity might be able to start based on all preceding activities being complete, but the assigned resource might not be available. By using available resources as a constraint, resource shortages can be identified, allowing managers to make informed decisions to add resources, re-sequence activities or adjust finish dates.

- **Cost loading.** Individual activities can be assigned a lump sum cost. For instance, phase one glass costs $20,000. Resources also can be assigned a cost, such as field crew A costs $300 per hour. Once these costs are assigned, the schedule will apply the costs as they are incurred on the project.

CPM scheduling is a powerful tool available to glazing contractors. Many different products are available with varying costs, benefits and drawbacks. Implementing and maintaining a proper CPM schedule requires an upfront investment in scheduling software. Building and maintaining a CPM schedule requires a time investment on behalf of internal management, or a commitment to hire an outside scheduling firm or consultant. It is also necessary to collaborate with the GC/CM and the various people and firms that play a role in completing the work: suppliers, fabricators, field crews, design team, etc. Management should also evaluate the cost and benefits of allocating resources to scheduling based on the needs of their projects.

There are many clichés about planning, and most of them are true. Generally speaking, the time and cost invested in proper scheduling is significantly less than the time and cost of undertaking a project without an adequate plan.

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