SmartPM™

Setting Construction Schedules up for Success Post COVID19

Owners and Contractors involved in Large Commercial Construction projects that have already been impacted and/or will be impacted in the near future need to start keeping a more watchful eye on the schedule(s) of their medium to high-risk projects. A heightened level of attention is needed to ensure that A) these riskier projects are run optimally in a period of extreme uncertainty and B) that all impacts, delays and damages are quantifiable in a manner that is not arguable. **Reading between the lines, if there ever was a time to invest in scheduling best practices, project controls and/or schedule analytics, the time is now.**

The reality is that most stakeholders, including owners, developers and contractors, are quickly transitioning into cash conservation mode while their respective projects costs are likely increasing due to delays and impacts caused by the current pandemic. This creates a problem where prices are going up while availability of cash is going down. Therefore, and unfortunately, there will be no simple discussions regarding responsibility and entitlement for delays and overruns as a result of the Coronavirus.

But there is hope. One of the most important steps that business leaders can take right now to minimize the risk of delays, overruns and disputes is to verify that the current project schedule data accurately represents progress and that the go forward schedule is thoughtfully prepared with best practices. All parties should take scheduling seriously right now because the schedule file is the only set of logically tied data that can both manage a project effectively and explain delays and impacts accurately. Ensuring accurate schedule data and ability to identify and understand delays are the two biggest challenges we are up against right now as a result of the Coronavirus.

The following steps should be taken right now to ensure that schedules are set up for success to manage through the challenges ahead are as follows:

Checking for Accuracy of Schedule Progress Data

It is important to ensure that the project is not over- statused or under-statused because it can lead to near term confusion and disagreements down the road. Ensuring that the data in the schedule is accurate is typically a required step when requesting time and money for delays and impacts going forward. It's worth getting ahead of this now while projects are slowing down.

At the risk of sounding obvious, the first step in this process is to verify the accuracy of the percent complete data contained in the schedule on any ongoing or recently completed activities. This data is best obtained by walking the site and associating the activities in the schedule with the work in place and logging estimated progress. Since it may not be that simple going forward, photo's, daily reports and payment applications have been accepted to be a reliable source of estimated progress. Pretty straightforward stuff, right?

The second more difficult step is to make sure that the start and finish dates of all historical activities are accurate. This is important to avoid to accurately be able to assess historical performance and to reduce the risk of a delay disputes in the future. There will be impacts, there will be requests for time and money,

those requests will be likely be challenged, so the data needs to be accurate. Historical performance will likely be questioned at some point, so it's important to have accurate data here. In addition, accurate start and finish dates will help teams better understand as-built logic and durations and incorporate into the future schedules.

Assessing the Quality of the Schedule

Schedule quality, as defined in this whitepaper, is a gauge on how well a schedule has been constructed as opposed to the reasonableness of the durations and sequencing of the trades. What is being assessed is whether or not the schedule appears to have been developed and updated by an experienced scheduler that followed best practices. Schedules of high quality are evidence that the scheduling process will be managed well and decrease risk of mismanagement.

Industry guidelines exist that set the bar for best practices along with a certain set of metrics which can be utilized as indicators to assessing the overall quality of a schedule. Below is a listing of some of the more useful indicators that should be considered as schedules are reviewed in the incoming months:

1. **The number of activities with open ended or missing logic** – Rule number one of CPM scheduling is that every activity must have at least one predecessor and at least one successor, except for the first activity and the last activity (because they can't). The most valuable information that a CPM schedule provides is the criticality of activities as it relates to the overall system of construction. This enables construction managers to effectively prioritize work in a manner that keeps the project end date constant. Missing logic represents an incomplete system of construction and often results in an erroneous critical path on a schedule that can appear to be on track but, is actually not.

2. **The number of high duration activities** – High duration activities are a risk because it is a signal of a lack of detail in the schedule. High duration activities introduce risk to the schedule since longer duration activities are more difficult to accuracy progress and estimate remaining duration. This could impact the accuracy of the critical and near critical paths, which increases the risk of mismanagement. Most industry guidelines consider an activity to have a "high duration" if the duration is greater than 2 months long (or 44 workdays based on a 5-day workweek). More experienced organizations will not allow activities durations to exceed 20 working days (or one month). It is therefore recommended that the number of "high durations" activities be kept at a minimum; less than 1% of overall schedule activities, particularly amongst the actual construction work activities.

3. **The number activities containing a start constraint** – A start constraint is a setting that gives the scheduler the ability to set a future date for an activity to start on, unrelated to any logic. This presents a risk similar to that of open ended and missing logic, as it is representative of potential breakdowns in the network logic of schedule. An activity that is not driven by a predecessor does not have a mechanism to indicate whether the start date is actually on track. It is recommended that start constraints are used sparingly and that any activity that contains a start constraint also has a logic tie to a predecessor activity.

4. **The number of activities that contain a finish constraint** – A finish constraint is a setting that allows schedulers the ability to set a hard date for an activity or milestone to be completed. When finish constraints are set, scheduling programs do not actually force the activity to maintain the same completion date, allowing the activity to move along with its predecessors. Instead, the programs modify the total float calculation to indicate how delayed the activity is at the time of the update. This promotes a risk because multiple "critical paths" in the job are generated – with nothing to distinguish whether it's the project critical path or an interim milestone critical path. Because of this, finish constraints can become a source of confusion and lead to mismanagement in the field. Therefore, it is recommended that the master schedule not contain any finish constraints. There are software programs that allow milestones to be tracked in their own network without impacting the integrity of the true critical path of the project.

5. **Too many "Start to Start" and "Finish to Finish" ties -** It is recommended to limit the amount of "Start to Start" and "Finish to Finish" relationships, because they are evidence of either compression or lack of sufficient detail in schedule. "Start to Start" and "Finish to Finish" relationships typically enable a successor activity to start before the predecessor is complete. A "Finish to Start" relationship requires that any preceding work is 100% finished before the follow work is started. The former is usually how it works in the real world, so it can be counterintuitive to think that "Start to Start" relationships are considered a risk issue. However, by limiting both of these types of relationships, schedulers are forced to build a detailed schedule that is not potentially compressed from the outset. Therefore, it is recommended to maintain the number of "Start to Start" and "Finish to Finish" relationships each below 10% of the total number of relationships. In addition, it builds in room to so that compression can be achieved if necessary.

6. **Too many activities with a high total float value** – Total Float is defined as the amount of days that an activity can be delayed before impacting the project end date. Total Float is a useful metric in understanding the priority of activities. Activities with the low total float have higher priority because they have the highest risk of delaying the project if delayed. The opposite is true for activities with high total float – they can usually be pushed off. This is risky because too many activities that can be pushed off can result in a schedule that has everything happening in tandem at the end of a job. In addition, a high percentage of activities (>25%) with high total float (> 44) indicates that there are likely logical flaws in the schedule. This could be caused by the lack of "crew logic" from one area to the next, or activities with missing logic. Schedules with a high number of high float activities should be looked at closely for completeness of logic.

7. **The percentage of activities on the critical path is very low or very high** – Because of the importance of the critical path, it is important to have a guide as to the reasonableness of it. A schedule with too few activities on the critical path likely contains too many high duration activities or start constraints that put the schedule at risk. On the other hand, too many activities on the critical path represents either a schedule that is overly compressed or one that is very linear. Depending on project size and complexity, any of aforementioned issues can put the schedule at risk. The recommended sweet spot for a fairly complex non-linear project is anywhere between 5-20% of activities on the critical path.

8. **The activities in the schedule are not resource loaded** – Schedules with resource loaded activities are gold to stakeholders in a project, yet most don't require it. Having a manpower loaded

schedule offers the ability to know with some level of certainty the collective numbers of resources required, day by day, trade by trade, to keep the project on schedule. In addition, by comparing planned manpower with actual manpower, one can better understand which areas didn't meet the level of efficiency required. If there was ever a time to require this level of data, now is the time.

If all the above items are addressed, the quality of the schedule will be very high. This may not seem that important, but it is the most important thing you can do when developing or reconstructing a schedule. Without a high-quality schedule, projects can be driven into a bad direction resulting in unnecessary delays and resultant disputes.

Assessment of Schedule Feasibility

Most Baseline schedules are developed prior to the start of construction and thus can be considered a hypothetical plan. Once projects begin to progress, the real story starts to unfold. The real story being how things are actually progressing at the site, what durations are really being met, what logic between the trades really exists, what resources are really showing up. By studying this data and incorporating realistic / proven durations and logic into the schedule, the schedule becomes more realistic and thus more useful. This again seems counterintuitive, but accurate reports of progress are usually appreciated.

In a perfect world, schedules would be updated to reflect what's actually going on on-site instead of what was decided at the beginning of the project. However, and unfortunately, that is not usually the case. When delays happen in construction, the immediate knee-jerk response is to make changes to the schedule to "recover" from the delays (e.g. force the schedule to hit the original end date). This type of recovery is typically achieved by adjusting logic and shortening durations of future incomplete activities – particularly on activities that are on the critical and near critical paths and driving the project end date.

While optimism is a good thing, particularly on construction sites, sometimes over-optimism can be a silent killer of construction projects. By continuing to recover from delays, month after month, year after year, schedules can become over-compressed and unreliable. Overly compressed and extremely altered schedules generally misrepresent the true project critical path which further places the project at risk of delays, overruns, and unhappy owners.

Given the circumstances, and the likelihood of impacts, delays and overruns caused by the Coronavirus for months to come, it is highly recommended that steps are taken now to confirm that the schedule is feasible. This will pay huge dividends down the road because hidden delays from the past will rear their ugly head eventually and cloud up any discussions regarding delays and impacts caused by the Coronavirus.

VERY IMPORTANT: The feasibility of go forward schedule needs to be based on historical performance in an "unimpacted" (non-coronavirus) world. Meaning, the schedule should NOT be adjusted to reflect what is believed to be the likely impacts caused by the Coronavirus impacts in the future. The reality is that these haven't yet happened, and may never happen, so you can't really adjust the schedule to reflect them now. Impacts need to be reflected in the schedule as they occur. That being said, there should be a mechanism to estimate impacts to project completion overall, so all parties can effectively plan their business for project handover [A How to on forecasting will be covered in a future whitepaper].

The following steps can be taken to assess the feasibility and reasonableness of a go forward schedule.

1. **Study historical durations variances of trades** – Take a look at historical duration for the various trades and calculate the average duration variances across the respective (similar) work activities. Compare average durations to test whether or not variances have been incorporated in future schedule durations.

2. **Study the extent of historical critical path delays and recovery efforts** – Assuming the schedule is of sound quality, the quickest way to understand the extent of delays is by calculating the number of days later the most recently completed critical path activity is delayed as compared to its "late finish" date in the baseline schedule. In order to estimate recovery, the delay calculations obtained need to be compared to total number of days that the project end date has slipped as compared to the original baseline completion date. If the end date variance is less than the delay to date, then the schedule has been compressed. If the schedule has been compressed, it is worth the effort to review/revise historical changes to the critical and near critical activities in each schedule update.

3. **Analyzing compression** – If there is evidence that a schedule may have been compressed, then calculating the extent of compression is another important step to take. Using the most recent schedule update, calculate the overall progress achieved to date as well as the remaining duration for the project – call this duration X. Next, determine the date in which the same level of progress was supposed to be achieved in the baseline and as well as the remaining duration from that point on in the baseline – call this duration Y. The ratio if duration Y to duration X is a good gauge of compression. Any value greater than 1 indicates compression. If the value is equal to 1.2, that means that the schedule is calling for 20% more work activity in the remainder of the project as compared to the baseline. This metric can be used to assess how egregious some of the changes may have been. In addition, if compression is studied on an update by update basis once can pinpoint which schedule had the mostly highly compressive changes leading the reviewer to pinpoint the most questionable changes that may need to be reconsidered.

If the aforementioned protocols are executed upon and the necessary controls are put into place, the risk of schedule mismanagement, unnecessary delays, and resultant disputes diminishes considerably. Given the uncertain environment we may be embarking upon, it is recommended to double down on the schedule management, oversight and analytics efforts to ensure minimal exposure to risk of unnecessary costs related to delays and resultant disputes.

SmartPM™ is committed to serving and supporting the construction industry during and after the coronavirus period by simplifying schedule information and analysis to a format that all parties can understand. SmartPM™ eliminates confusion regarding the project schedule and performance, resulting in enhanced team collaboration and reduced monetary claims at the end of each project.

About SmartPM