

THE CASE FOR CONSTRUCTION SCHEDULE VALIDATIONS AND PERIODIC AUDITS

Earl Glenwright, PE, MBA, PSP

Aldo Dórea Mattos, MSc, PMP

ABSTRACT

Construction projects represent investments at risk for Owners and Contractors, who invest massive amounts of money and resources. Although some investors resort to evaluations (e.g., appraisals by mortgage investors), to gain a level of confidence in the outcome, validation processes are not a common practice in construction. There are many advantages in engaging Owners and Contractors in performing a reasonable, rational, and feasible independent Validation of the work plan and planned schedule, as well as periodic Audits of the performance achieved. Planning and scheduling practices have become more complex as they have matured and can produce a greater degree of management and control, but they are vulnerable to incorrect procedures, illogical logic, abuse, misuse, and outright manipulation. Schedule Validation and Audit can be used to minimize the impact of conflicts by detecting issues and anticipating problems. Reasons for implementing Schedule Validation and Audits, benefits, methodology, deliverables, and steps towards a standard practice and procedure are presented herein.

Key works: construction, schedule, validation, audit.

WHY ARE SCHEDULE VALIDATION AND AUDITING NEEDED?

It is undeniable that construction projects represent substantial investments at risk both for Owners and Contractors. The Owners, a category which includes but is not limited to private companies, government agencies, real estate developers and funding agents, invest massive amounts of money to get a final product of acceptable quality, whereas the Contractors invest huge amounts of resources in their efforts to deliver a profitable product.

Today's construction operations rely on each contributor performing to the agreed upon Work Plan and Schedule. And the Work Plan and Schedule must be valid, reasonable, rational, and achievable if the Project is to be successfully and profitably completed.

In construction projects, scheduling has become progressively more common in the past 20+ years as more and more tools have been put at the reach of planners and schedulers. More affordable hardware and software, broader access to information and better understanding of principles have made scheduling a highly rewarded engineering specialty. In this evolution over the last two decades or so, old practices have been

replaced by very sophisticated and complex practices and techniques. Nowadays it is not uncommon to find schedules with thousands of activities which generate a wide range of reports and graphs.

All these factors contribute to create today's delicate situation in which construction schedule practices contain many misuses, or omissions of basic principles, processes, and tools. For instance:

- Illogical activity logic and relationships are common;
- Resources [the basis of all schedules] are either not considered or, if they are, then are either not scheduled 'forward' to reduce usage peaks and valleys, or 'backwards' to prevent end of project buildups (only 1 in 8 Contractors even consider resources to develop their schedules);
- Earned Value concepts are infrequently used to monitor performance and progress;
- Date constraints are overused;
- Work calendars are inappropriately used;
- Linear scheduling for specific trades is not considered; and
- Outright abuses so as to set the stage and conditions for future claims.

This means all of the underlying aspects of the scheduling technique need to be checked and validated for the sake of transparency and contractual balance between the parties involved.

In a world of increasing complexity of construction projects, progressively tighter deadlines and shortage of available resources, Validation and Auditing are important tools to ensure the proper management of the schedule, and in increasing its transparency.

If today's construction schedules are properly prepared, Construction Managers, Owners, Suppliers, and Subcontractors have an efficient and effective management tool to control complex construction projects accomplished by a diverse array of designers, engineers, suppliers, and specialty subcontractors.

Planning, coordination, and communication of the Work Plan, Schedule, performance, and control are then greatly facilitated in the efforts to achieve projects successfully and profitably.

However, the *if* needs to become *when*. And this means all of the underlying aspects need to be checked by an independent, qualified and experienced Master Construction Scheduler and the Validation-Auditing team.

Before you begin on your construction journey, it is better to know where you are going, rather than later learning where you were.

WHAT IS SCHEDULE VALIDATION?

Schedule validation is a process by means of which Owner and Contractor resort to the expertise of a third party to validate the schedule of a certain project in all its features and components.

The validation is thus an external evaluation to ensure that a foremost contract instrument — the schedule — is correct in scope and assumptions, as well as free from all sorts of *pitfalls* and *booby traps*. The validated schedule should represent the model of how the Contractor intends to carry out the work plan's activities, and how the Owner is supposed to get the project delivered.

It is routine to find investors resorting to second and third evaluations, e.g. appraisals by mortgage investors, to gain a level of confidence in the outcome and the return on their investment. This typical validation process, however, is not a common practice in the construction area, but Owners and Contractors can have solid benefits by adopting scheduling validation procedures and periodic audits.

Validation occurs when the original work plan and, as an extension, the project schedule developed by the Contractor and their sub-contractors and suppliers is submitted to the Owner and is then evaluated by an external expert (or a team of experts) and approved as valid, reasonable, rational, and achievable — **valid**, to be accepted and recognized as an official instrument of communication and commitment; **reasonable**, because based on assumptions that do not go beyond the limits of the common sense; **rational**, because it incorporates proper construction methods, production rates, calendars and resource availability compatible with the environment and location of the project; and **achievable**, because its goal is meeting the construction of the project's requirements in terms of scope, time and resources.

Once the baseline schedule developed by the Contractor is submitted to its client, the “validators” run a general sanity check, assessing the reasonableness of the schedule in terms of observance of the milestones and completion date[s], productivity rates and resource allocations, and the contract’s logical work sequence. The validating team then checks if the entire scope of work is contemplated in the schedule, the means and methods proposed, requests adjustment of some assumptions, raises questions to the Contractor and points out problems regarding the form and/or the content of the schedule to both the Contractor and Owner.

Construction planning and scheduling practices have become more complex as they have matured and can produce a greater degree of management and control, but they also are vulnerable to incorrect procedures, illogical logic, misuse, abuse, and outright manipulation.

Even if supporting explanations and data are provided there can be still many hidden tricks and techniques that were used to develop the schedule.

In the Validation process the electronic database used to prepare the proposed schedule is broken down to reveal all of the constraints, restraints, components, tools, processes, and techniques applied to the work organization, scheduled activities and logic. All of this information is analyzed given the Contractor’s means and methods.

Standard practices and experienced judgment are then used to validate the correct application of schedule preparation and development principles and then determine the reasonableness, realism, and risk of the proposed work plan and schedules.

The final product, or deliverable, of the validation process is the *validated baseline*, a schedule that can efficiently serve as a reference for monitoring and controlling the progress of the project. The contract management and issues such as schedule performance index, project delays and claims resolution can then be carried out based on the validated schedule.

WHAT IS SCHEDULE AUDITING?

As progress proceeds, checks for performance in relation to the planned schedule (baseline) must be done. Typically a construction schedule shall be statused on a weekly, biweekly, or monthly basis at the most. It is the Contractor’s responsibility to assess the

status of the project, enter the status into the current schedule and analyze its outcome. In each one of these reviews deviations from the original plan invariably occur, due to, fluctuations of labor/equipment productivity, unforeseen site conditions, differing site conditions, labor shortages, external interferences, design defects, change orders, owner-directed or contractor-initiated accelerations, and other reasons.

The schedule database should be audited for the correct entry of actual dates, resource utilization, and performance as to both productivity and in relation to the planned schedule.

A comparison of Actual Start and Finish dates to the Planned Start and Finish dates is made and actual versus planned resource histograms are charted.

In addition, the Earned Value charts for all significant resources (earnings, man-days, pacing resources, and/or material placement) are statused with the progress and performance as of the audit date.

As a result, the baseline schedule may need to be adjusted, or changed. In this new schedule, the activity's new planned start/finish dates (as well as project completion date[s]) may be different from the baseline schedule previously validated. Also, individual duration and sequencing of activities may be different and some activities may need to be added to or removed from the Work plan and activity network.

This is why the initial validation alone is not enough. The validation process calls for a schedule auditing procedure that complements it and keeps transparency in the schedule. By means of the auditing, the schedule continues as a **valid, reasonable, rational, and achievable plan** of work, still able to yield a high level of confidence in the outcome of the project.

Whereas the focus of the initial schedule validation was on *quality* — completeness, adequacy of form, abidance to specifications —, herein the focus shifts to *changes*. Statusing a schedule is all about monitoring how much modification it has undergone since the previous review. The changes can be in scope, logic, durations and project completion date.

The main questions to be made by the schedule auditors are, among others:

- Has the project proceeded according to plan?

- Have the change orders approved by the Owner been incorporated into the work plan and schedule? Is their scope of work reasonably described in terms of new activities (or adjusted old ones)?
- Has the progress in the period impacted the project completion date?
- Are all changes and impacts documented and addressed to the Owner?

WHEN SHOULD VALIDATION AND AUDITS BE DONE?

Validation occurs when the initial or revised baseline schedule is submitted prior to the start of any construction field-site work, with the possible exception of mobilization, site preparation, ordering of long-lead time equipment or materials, permits, excavation, and installation of in-ground site utilities.

Validation is an extensive process and can be time consuming both initially and after each re-submittal of the proposed baseline 'planned' construction schedule until a valid baseline schedule is accepted by all significant stakeholders: Owner, Contractor, Subcontractors, Suppliers, Financing entities, and Permitting agencies.

Auditing must occur several times during the execution phase of the Project's life cycle. The first such audit should be done between the 15 and 20 percent completion points to recheck the initial duration, resource, and productivity estimates. This audit may coincide with the completion or near completion of the excavation and installation of the in-ground utilities. At that point the major 'unknown unknowns' and risks are resolved. In consideration of the actual results, a revised Work Plan and development of a new Baseline Schedule in accordance with the known conditions and better estimates can be made.

A second time for auditing and reappraisal is when the erection of structures are 'complete' and the finishing work done by multiple specialty trades can begin. At this point a new 'estimate to complete' and 'estimate at completion' can be made.

The final time when an Audit is desirable and/or required is at the completion of the Project to document the 'as-built' schedule and of course whenever a claim needs to be analyzed.

THE COMPONENTS OF SCHEDULE VALIDATION AND AUDITING

There are many facets and procedures used to conduct schedule Validations and Audits. Basically, the electronic database used to develop the proposed schedule is dissected to reveal all of the parameters used. In addition, a 100% cross-check is made between the Work Package activity logic diagrams and the data in the electronic database, as they must be in absolute agreement. All visible data, constraints, etc., must be the same as that used by the electronic program that produces the schedules, resource histograms, and Earned Value charts.

Typically, some of the Validation efforts are:

- Review, evaluate and critic the Work Breakdown Structure;
- Evaluate estimates of resources, schedule activity durations, and earnings;
- Check the logic: mandatory and preferential;
- Analyze the work plan strategy, means, methods, and assumptions;
- Review date constraints: milestones, external, and performance duration;
- Review resource, earnings, production, and space restraints;
- Review resource calendars;
- Check on-site long-lead item requirements: selection/approval, manufacturing, shipping & delivery to site, Inspection, acceptance, and storage;
- Perform database validity / cross-check;
- Review linear schedules of trades and materials;
- Review the submittal register and schedule: completeness and the submittal review loading histogram;
- Review the use of contingencies for activities, work-packages, and milestones;
- Review time and earning-funding reserves – buffers;
- Review earned value graphs: earnings-funding, man-days, material placements, trade performance/productivity;
- Analyze schedule and earnings performance indexes;
- Evaluate historic performance and estimated forecast at completion

WHO CAN BENEFIT FROM SCHEDULE VALIDATION AND AUDITS?

Owners and Contractors will both benefit from Schedule Validations and Audits.

From the Owners point of view, it is necessary to know that the Contractor's plan and schedules are realistic and achievable as these documents also indicate what actions the Owner must accomplish when in order not to delay the Contractor's progress while avoiding submittal review and approval or overload.

A valid, reasonable, and rational Work Plan and Schedule minimizes the inherent risks of budget overruns and late delivery of the Project's product.

For Owners, some of the benefits are:

- Schedule validation and auditing can be used to minimize the impact of construction conflicts because it can detect the issues at the beginning or in due time to allow corrections and negotiations.
- Guarantee of a valid, reasonable, rational and feasible schedule;
- Guarantee of constructability of the project's schedule;
- Guarantee of adequate timing and phasing of the project ;
- Minimization of schedule manipulation by claim-oriented Contractors;
- Guarantee of proper project schedule status and reviews;
- Guarantee of proper documentation and traceability;
- Better information for contemporaneous project analysis;
- Immediate detection of delays, deviations, trends;
- Issues raised in due time to allow for corrective and preventive measures, analysis of alternatives, scope adjustments, etc.;
- Less susceptibility to late claims by Contractors;
- Less need of arbitration as a last resource to solve disputes.

Contractors also need to know that their subcontractors and suppliers can perform as needed and promised, and also that the Contractor's own forces can function effectively and efficiently.

The bottom line objective of work planning, scheduling, and project controls is profitably completing a project at or above the desired quality while adhering to budget and schedule constraints.

For Contractors, subcontractors and suppliers, some of the major benefits are:

- Detection of errors in scope definition, relationships between activities, milestones, resource allocations, etc;
- Upon being validated and audited, the schedule becomes more reliable and technically stronger to reserve the Contractor's rights when preparing claims and requesting compensation;
- The experience of the validators/auditors in similar projects serves as a support for the Contractor in technical issues such as construction methodology, production rates, problem solving, etc.;
- The presence of validators/auditors induces the Contractors to better plan and control the job.

SCHEDULE VALIDATION AND AUDITING: CONCLUSION

Construction work scheduling has become a complex process as it attempts to model the real world of building a project of high quality and reasonable profitability in today's environment of limited resources, both material and skilled workers, on time and within budget.

Consequently a schedule becomes vulnerable to inappropriate practices, misuse, abuse, and gamesmanship.

Hence to attain a **reasonable, rational, realistic**, and **valid** work plan and schedule for both the owner and contractor, an experienced external person or team should validate the baseline schedule and periodically audit the project's progress and performance.

Contractors and Owners have too much invested to ignore the benefits of an independent Validation and periodic Audits. The expense is nominal: the ROI is large.