Improved Project Control Through Scheduling

January 24, 2014
The Survey Says!
Source: The Project Manager, Pinnell-Bush, Inc.

- Owner’s say 31% of contractors do not submit monthly updates.
- 41% don’t submit recovery schedules if delayed.
- 28% of projects don’t finish on time.
- Owner’s report that 64% of contractor’s schedules are “fair to poor”.

The Survey Says!
Source: The Project Manager, Pinnell-Bush, Inc.

- 76% Of subcontractors say seldom to sometimes have input into schedules.
- 81% of subcontractors say GC seldom to sometimes keep them informed.
- 72% subcontractor say delays are hidden and then they are accelerated.
- 64 % of GC’s schedulers are fair to poor according to subcontractors.
The Survey Says!
Source: The Project Manager, Pinnell-Bush, Inc.

- GC’s say that 51% of Owner’s reps seldom to sometimes meet to review schedules.
- Only 35% of time do they enforce scheduling specs.
- Only 22% of time do they keep detailed scheduling records.
Reality of Most Projects
(Focus is on Design/Bid/Build)

- Contractor’s PM is typically responsible for the schedule development.
- Contractor’s PM not identified until after bid opening.
  - This is also often true for Superintendents.
- Contractor’s PM has little or no input into bid estimate.
- Contractor’s PM is typically closing out one project or projects while starting the new project.
- Contractor’s often assign multiple projects to a single PM.
- Contractor’s PM may or may not have a good grounding in CPM fundamentals.
- Contractor’s PM typically don’t know the scheduling requirements until they start developing the baseline schedule.
Contractor’s bid typically does not include a budget for schedule development or maintenance.

Schedule level of detail dependent upon:
- Contractor’s PM’s background and appreciation for value of good schedule.
- Contractor’s PM’s available time at the beginning of the project.

Quality of the bid:
- How much money did they leave on the table?
Achieving Goals

- Planning for success and doing it right the first time.
- Have realistic controls in place to assure adequate planning.
- Having a dynamic tool to deal with change.
- Having a tool to manage resources and project stakeholders
  - Tool to report to project stakeholders
Basic Functions of the Schedule

- Schedule needs to be of sufficient detail to:
  - Manage and monitor progress.
  - Minimize secondary effects of construction on operations.
  - Document as built conditions.
  - Demonstrate need for time extensions and work around options.
  - Tool to resolve disputes.
Cost Loading vs. Schedule Of Values
  Earned Value vs. Percent Complete

Identify critical and near critical activities; Plus.
  Document Changes, FI’s and RFI’s.
  Manage submittals and procurement.
  Track overall progress.
  Document delays.
Plan of contractor’s means and methods
- Develop the plan of work and phasing
- Allocate resources and equipment
- Define and assign responsibilities
  - Determine subcontractor’s manpower requirements
  - Incorporate subcontractor’s schedules
How To Get Performance
The Owner Wants

- In The Low-bid World
  - Specifications
  - Pre-bid Meeting
  - Pre-schedule Meeting
- Options
  - LD's
  - Unrecoverable Deductions
  - Dedicated Contractor’s Scheduler
  - Termination For Cause
Specifications

"You can’t enforce it if it’s not in the contract."

- The specifications need to be at a strength level that match the needs of the project.
  - Too stringent on small projects.
  - Not stringent enough on large or complex projects.
Too often the specifications are drafted by individuals that do not have a strong background in scheduling.

Adequate specifications are the only way to have good project control and minimize abuses in the schedule.

In the low bid environment many contractors will fight you on specification enforcement!

Do not allow “Compounded” work activities such as “MEP”. 
Specify software for CPM

Define Planning Unit
- Calendar Days, Work Days Or Both?

Define how to handle normal weather days.
- Last activity at end of schedule as predecessor to project completion and all other activities must flow into this activity
- Include Normal Weather in calendar.
- Document weather days outside the schedule
Submittals

- Require that all submittals required by specifications are included.
- Make sure there is realistic time for submittal development and procurement.
- Make sure the allowed review time is included.
- Make sure time for any deferred approvals is included.
Confirm the submittal timing is staggered and realistic.

Contractor’s will often show all submittals on the data date of the baseline. This is not realistic.

Confirm all submittals are logically tied from submittal to review to procurement and to physical work activity.

You can often identify “Orphaned” submittal logic chains by high total float values.
Specifications Continued

- Establish max level of near critical activities.
  - “Not more than 20% of activities in the schedule can be critical or near critical, with near critical being defined as having a float value of ten (10) working days or less.”

- The above percentage would apply to buildings but would be higher on more linear civil work.
- Define maximum activity duration.
  - With the exception of long lead items typically the activity duration should not exceed update requirements.
- Don’t allow sequestering of float.
  - Extending activity duration estimates to consume float.
    - Are the durations realistic?
  - Including preferential logic.
    - Abuse of lags in logic.
- Excessive use of constraints.
- Define schedule submittal timing for initial schedule, baseline schedule and updates.
- Require cost loading at a minimum.
  - Require initial schedule of values to be basis for cost loading baseline.
  - Make submittal of update a condition precedent to processing the contractor’s payment application
- Define procedure for payment from the schedule.
- Require Coordination Drawings as a submittal.
For large civil project require equipment loading.

- Confirm production rates for equipment with the Civil Engineer.

- Require manpower loading on large complex or multiple shift projects, or if there are shortages of craft labor.

- Demand “Retained Logic” in schedule updates, not “Progress Override”.
Require statused but unmodified update schedule for record purposes.

Rule: Require statused update schedule with proposed changes to logic and/or as planned durations.

Rule: Require “Look Ahead” schedules to be generated from the last update, not a time scaled bar chart.

Rule: Look Ahead schedules based on Superintendent’s plan can diverge from Project Schedule.
- Require data disk be submitted with monthly update.
- Define narrative submittal requirements.
- Require cash flow reporting.
- Define and require recovery plan.
  - If schedule update reflects that the project is more than “X” days behind schedule.
- Define and require time impact analysis (TIA) for all time extension requests.
  - It should be “Window” based and cotemporaneous with the alleged delay.
Commissioning

- More and more projects are being designed and built to a "Leeds" standard.
- A result is that Commissioning is becoming a larger part of project acceptance and closeout.
  - It is no longer just an HVAC function.
- Not enough time is being included in the schedule for Commissioning.
The Commissioning Program must be developed prior to bid and the requirements included in the bid documents.

- The scheduling specification needs to address these commissioning requirements.

Commissioning activities should logically flow to Punch List as deficiencies can become part of the Punch List.

- Otherwise deficiencies will become warranty work.
Any item of physical work that is critical to the quality assurance of a project can be included in the Commissioning Program:

- HVAC System
- Fire Life Safety Systems
- Sustainability Features
- Special Systems
  - Floor Levelness for an Electron Microscopy Lab
  - Sensitive Compartmented Information Facility (SCIF).
Specifications should require contractor to coordinate with the CM and the “Commissioning Agent” in developing this component of the schedule.

All “Pre-Functional Testing” needs to be identified in the schedule.

Commissioning durations need to be of sufficient length to support the Commissioning Program.
Relationship Flaws

- Look for inappropriate or “Odd Lag” usage (Sometimes also referred to as Leads).
  - Positive Lag on Finish to Start logic.
  - Negative Lag on Start to Start logic.
  - Non-Overlapping Lag usage.
- Can create gaps in the logic chain.
- Can create unrealistic sequences.
Lag = An offset or delay from an activity to its successor.
Lag can be positive or negative.
It is measured in the planning units for the project.
Total float calculation is based on the calendar of the predecessor activity.
Inappropriate Logic

SS w/ - Lag

Activity A

Activity B

FS w/+Lag

Activity A

Activity B
Float vs. Lag

- A logic tie lag is not float
  - Lags can be used to sequester float

- Who owns the float?
  - Normally the Project owns the float.
  - You can allow for owner to retain float for their time savings, but this must be in the contract.
    - We have seen this in contracts but never enforced.
Unconventional and Unbalanced, or Uncoordinated Logic

- Many schedulers refer to finish to start as conventional logic and all other logic types as unconventional.
- There is noting wrong with start to start and finish to finish logic but it does have some fundamental implications that can cause problems.
- Minimize use of non-conventional logic
  - Aim for majority of logic to be finish to start.
Reverse Critical Path

- With unconventional logic, even if the logic is properly coordinated its use can have drastic effects when original durations are revised.
Install Drywall – 30 days

Tape & Float – 10 days

Prime Walls – 10 days
Install Drywall – 30 days

Tape & Float – 5 days

Prime Walls – 10 days
Install Drywall – 30 days

Tape & Float – 30 days

Prime Walls – 10 days
Resource Constraints

- A resource constraint is a logic tie not a float or date constraint.
  - The relationships between like activities in different project areas
- These relationships are resource driven.
  - Typically it is a logic tie reflecting number of crews.
  - Can be applied to any resource.
Resource Constraints – Their Role in the Schedule

- Install Drywall – Bldg 1
- Install Drywall – Bldg 2
- Install Drywall – Bldg 3
Resource Constraints – Their role in the schedule

Install Drywall – Bldg 1

Install Drywall – Bldg 2

Install Drywall – Bldg 3

Install Drywall – Bldg 1

Install Drywall – Bldg 2

Install Drywall – Bldg 3
Constraints

- In general the baseline schedule should only contain two (2) constraints; the notice to proceed and the project completion date.

- Use of constraints other than these requires careful consideration.
  - Internal milestones with LD’s
Sample Constraint Window

- Start constraint
  - Early
  - Late

- Finish constraint
  - Early
  - Late

- Start on

- Expected finish

- Mandatory
  - Start
  - Finish

- Float constraint
  - Zero total float
  - As late as possible
Zero Float Constraints

- Float constraints force criticality without reference to start and finish dates.
- Contractors often want to use Zero Free Float constraints on procurements.
  - Delays procurements to their latest date without delaying the project.
  - Can make the schedule hyper critical or near critical.
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Out of Sequence Progress

- Every project will experience "out of sequence progress" at some time during the project.
- With finish to start logic and out of sequence progress you can have artificial push out on logic chains.
- If out of sequence progress becomes excessive the contractor is not working to his plan.
If out-of-sequence progress becomes excessive the value of the schedule as a proper management and monitoring tool is diminished.

The contractor should review the successor logic of the out of sequence activities and propose logic revisions that will indicate a realistic "new work plan".
Retained Logic

- Retained logic schedules an activity with out of sequence progress according to the network logic. It allows an activity to begin out of sequence, but the remaining duration for the activity cannot be completed until it’s logical predecessors complete.
  - This is what artificially pushes out the successor activities.
- Accounts for all logic and follows CPM fundamentals.
Progress Override

- Progress override ignores network logic and treats "out of sequence activities" as though they have no predecessors and can progress without delay.
  - It can hide delays to the project.
  - It can give you an artificial critical path.
  - As it ignores logic it violates CPM fundamentals.
Questions
And
Discussion