



Department of Veterans Affairs – Office of Construction & Facilities Management
CONSULTING SUPPORT SERVICE (003C5)
Technical Topics

Keeping the Project on Schedule

April 5, 2013

The management of a construction project requires a multitude of abilities, duties, and responsibilities of the Resident Engineer (R/E). Some of these responsibilities consist of, to name a few, contract administration; analyzing and issuing change orders; inspection; and coordination between the VAMC and contractor. Contract administration includes the oversight of the project through the eyes of a cost and manpower loaded CPM which is of particular importance and the focus of this article.

Manpower and cash flow are two of the key elements of the schedule, both of which must be regularly monitored to give the resident engineer and contractor early warning signs on how the project is progressing and raise a red flag when the project is starting to "head south." By monitoring these two elements in the project schedule as well as the accuracy of the schedule's construction logic, the R/E maximizes the opportunity to keep the project on schedule.

Even in a closely monitored project, however, there are many reasons for a project falling behind schedule. The following are major causes of project schedule slippage:

- Changed work
- Faulty logic
- Insufficient manpower
- Contractor's failure to work on critical path activities
- Unrealistic activity durations

Delays due to changed work

Assuming that the contractor is reasonably following the approved schedule and working on the critical path activities, the project may fall behind schedule from month-to-month. One

reason for the slippage may be change order work affecting the critical path; this slippage would show up on the monthly analysis of the parallel runs implementing the change orders into the logic and analyzing the schedule to determine potential reasons for slippages. If change orders are causing the project slippage, a time extension is warranted and should be issued adjusting the contract completion date to reflect the affect of the change on the contractor's schedule.

Faulty Schedule Logic

After each monthly update it is imperative to re-evaluate the schedule logic and adjust the logic if necessary as part of the update process. All too often the update is performed mechanically with no consideration given to re-evaluating the plan for the balance of the project. To update a CPM schedule whose foundation (logic and/or estimated durations) is outdated will typically result in a misleading forecast and erroneous reports.

Insufficient manpower

Based upon manpower data initially obtained from the contractor in the Day-1 CPM, the project scheduling software, Primavera (P3), can give the resident engineer and contractor the ability to generate reports identifying manpower requirements for individual trades. These reports could include a two-month projection (window) of manpower requirement by trade/work area or a projection of manpower by trade for the upcoming month. (See Appendix)

Project slippage can often be attributed to a lack of manpower or insufficient manpower on critical path activities. The easiest way to verify the adequacy of the contractor's projected manpower is to compare the actual manpower indicated on the daily logs with the manpower report generated from the previously updated schedule. If the project is continuously slipping from month-to-month, the cause may be a lack of manpower. An example of insufficient manpower is as follows: The critical path generated from the updated information indicates the critical path going through Rough-In Power Conduit Area 1 - 15 days, Rough-in Power Conduit Area 2 - 15 days, Pull Power Wire Area 2 - 10 Days, etc. Reviewing either the approved CPM diagram or a manpower report indicates that the contractor planned on performing the conduit Rough-In work with 4 electricians and the estimated duration in the schedule is 15 workdays.

Based upon the resident engineer's experience, the contractor's projection of 15 workdays utilizing 4 electricians is a reasonable duration based on the amount of power conduit in Area 1. A review of the daily logs indicate that over the past 15 work days the contractor only achieved the estimated manpower of 4 electricians in Area 1 on 3 days. The average number of electricians for the 15-day period was 2, well below the projected 4-man crew. Barring any disruptions due to VA changes, which may have precluded the contractor from achieving the projected planned manpower, it is obvious from the above scenario that the project slippage is attributed to insufficient manpower. Similarly, the progress schedule can reveal portions of the work where performance is ahead of schedule. In these areas, it is possible that manpower can be reduced, without delaying the project completion date, and the surplus manpower may be used in more critical areas of the project.

VA also requires the contractor to submit activity cost data for each activity in the CPM schedule. A "cost-loaded" CPM provides a method to determine a cash flow forecast for the project on a month-by-month base. Comparing the actual project percent complete to the planned percent complete for the same period will give the resident engineer and contractor an indication as to how the project is progressing. If the actual cash flow is lagging behind the planned or projected cash flow, chances are the project is heading for potential problems if it is not having problems already. Usually, unless there is unrealistic cash flow data in the schedule, the actual percent complete compared to the as-planned cash flow is a good barometer of how the project is progressing and whether the project is on schedule.

Contractor's failure to work on critical path activities

What is critical today may not be critical tomorrow. The critical path identified in the original or Day-1 schedule, will only remain the critical path if everything goes according to plan.

Experienced resident engineers and contractors know that this is almost never the case.

Although CPM is a well accepted and powerful tool for managing the day-to-day events on a project, the accuracy of the calculated milestones or project completion date is directly dependent on the completion of every critical task taking no longer than originally estimate. If the contractor fails to work on the critical path or works on it part time, the project schedule will slip a day for a day that the contractor did not work on the critical path. The project

slippage will be reflected in the next month's update. A report that can assist the resident engineer and contractor is the Hot List Report, which reflects the activities the contractor must be working on during the reporting period to maintain the projected project completion date. It is a good practice to review the Hot List Report at the weekly progress meetings and discuss the status of the work effort on the critical path and near critical activities. The resident engineer and contractor must monitor the near critical activities as closely as the critical activities to prevent them from becoming the next month's critical path. A near critical activity is defined as an activity whose early start and late start dates fall between the current as-of date and the next scheduled update date. Doing so will keep both the contractor and the resident engineer focused on the status of the project and the progress on the critical path.

Unrealistic activity durations

For any given activity in a construction schedule, a delay may occur i.e., late delivery of material or equipment, which is truly unforeseeable, and the Day-1 duration for the activity may have been entirely appropriate. This is not always the case; all too often the duration of activities in a CPM network are guesses that may be unrealistically short, calculated by how much time the contractor has to complete the project rather than how long the activity will actually take to complete. Another explanation is that the planned duration is based on an unrealistic crew size which will never be achieved. Conversely, durations can be longer than necessary based on a planned smaller crew size where in actuality the crew size is much larger than originally planned. Comparing a similar area of work and evaluating its durations, and adjusting the durations for the next portion of work according to the historical as-built information, can easily correct this situation and give the resident engineer and contractor a more realistic schedule.

Conclusion

Updating the schedule monthly is not sufficient to keep the project on schedule and prevent the project completion date from slipping. The updating process must include a systematic review of the schedule's logic, durations, manpower, cash flow and change orders, as well as an analysis of the actual progress of the work to date.

The above represents an explanation of the various major causes of schedule slippage. Remember, the CPM schedule is only as good as the information which is used in its preparation and maintenance, and the ability of the resident engineer and contractor to identify the necessary activities, determine their interrelationships, accurately estimate the time necessary to complete these activities, and translate the information generated by the updating process into realistic solutions to problems arising on the project.

For more information, contact the Consulting Support Service (003C5), Bill Goodman at 202-632-5051, Mo Ghorbanpour at 202-632-5027, or Sekhar Datta at 202-632-4831.

EXHIBIT

AUTOMATED CONSTRUCTION TECHNOLOGY, INC.

REPORT DATE 25FEB03
09:24

Psychiatric Patient Privacy

START DATE 28SEP01 FIN DATE 20APR04

60-day Manpower Report, by Trade/Late Start

Project Version: P.R.#16, 31JAN03

DATA DATE 03FEB03 PAGE NO. 1

ACTIVITY ID	DESCRIPTION	REM DUR	MANP	EARLY START	EARLY FINISH	LATE START	LATE FINISH	TOTAL FLOAT
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GENERAL CONSTRUCTION

17062	REPLACE SLATE@CHUTE CHASES B7	2	2	03FEB03	04FEB03	12MAR03	13MAR03	27
12590	FINAL CLEAN-UP ATTIC B7	2	3	04FEB03	05FEB03	27MAR03	28MAR03	37
15180	PATCH&LEVEL FLOORS GFL B7	4	2	03FEB03	06FEB03	05FEB03	10FEB03	2
15210	FIRE EXT.CABINETS GFL B7	1	1	07FEB03	07FEB03	11FEB03	11FEB03	2
15310	WINDOW SILLS GFL B7	1	2	10FEB03	10FEB03	12FEB03	12FEB03	2

GENERAL CONSTRUCTION

16590	FINAL CLEAN-UP BSM B7	5	3	13FEB03	19FEB03	24MAR03	28MAR03	27
11590	FINAL CLEAN-UP ADDS B7	2	2	26FEB03	27FEB03	27MAR03	28MAR03	21
13590	FINAL CLEAN-UP 2FL B7	5	3	27FEB03	05MAR03	24MAR03	28MAR03	17
13592	INTERIOR SIGNAGE 2FL B7	4	2	28FEB03	05MAR03	25MAR03	28MAR03	17
14590	FINAL CLEAN-UP 1FL B7	5	3	03MAR03	07MAR03	24MAR03	28MAR03	15
14592	INTERIOR SIGNAGE 1FL B7	4	2	04MAR03	07MAR03	25MAR03	28MAR03	15
15492	MISC.SPECIALTIES GFL B7	1	1	11MAR03	11MAR03	20MAR03	20MAR03	7
15540	HANG DOORS GFL B7	2	3	11MAR03	12MAR03	11MAR03	12MAR03	0
15494	INSTALL SPECIALTIES GFL B7	4	3	12MAR03	17MAR03	21MAR03	26MAR03	7
15543	BUILDERS HARDWARE GFL B7	4	3	19MAR03	24MAR03	19MAR03	24MAR03	0
15474	WALL&CORNER GUARDS GFL B7	3	3	24MAR03	26MAR03	24MAR03	26MAR03	0
15544	LOUVERS&WALL VENTS GFL B7	2	2	25MAR03	26MAR03	25MAR03	26MAR03	0
15590	FINAL CLEAN-UP GFL B7	2	3	27MAR03	28MAR03	27MAR03	28MAR03	0
15592	INTERIOR SIGNAGE GFL B7	2	2	27MAR03	28MAR03	27MAR03	28MAR03	0

SITework

11310	LANDSCAPING ADDS B7	6	3	18FEB03	25FEB03	19MAR03	26MAR03	21
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STRUCTURAL STEEL

11260	MODIFY&INSTALL CANOPY ADDS B7	6	3	03FEB03	10FEB03	04MAR03	11MAR03	21
11262	HANDRAILS ADDS B7	4	3	11FEB03	14FEB03	12MAR03	17MAR03	21

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ACTIVITY ID	DESCRIPTION		REM DUR	EARLY MANP	EARLY START	EARLY FINISH	LATE START	LATE FINISH	TOTAL FLOAT
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ACOUSTICAL CEILING

15412	ACOUS.CLG TILE	GFL B7	3	2	28FEB03	04MAR03	28FEB03	04MAR03	0
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FLOORING

15500	VCT FLOORING&BASE	GFL B7	4	3	05MAR03	10MAR03	05MAR03	10MAR03	0
15504	CARPET & BASE	GFL B7	4	2	20MAR03	25MAR03	21MAR03	26MAR03	1

PAINTING

17230	FINISH PAINT	CHASES B7	6	2	05FEB03	12FEB03	14MAR03	21MAR03	27
15340	PRIME PAINT	GFL B7	3	3	11FEB03	13FEB03	13FEB03	17FEB03	2
15470	FINISH PAINT	GFL B7	4	3	05MAR03	10MAR03	05MAR03	10MAR03	0
15472	VINYL WALL COVERING	GFL B7	4	3	18MAR03	21MAR03	18MAR03	21MAR03	0

CAULKING & SEALANTS

15410	INT.CAULK&SEALANTS	GFL B7	4	2	14FEB03	19FEB03	24FEB03	27FEB03	6
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STOREFRONT & GLAZING

15542	INT GLAZING	GFL B7	2	2	13MAR03	14MAR03	25MAR03	26MAR03	8
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FIRE PROTECTION

15360	SPRINKLER TRIM&TEST	GFL B7	6	2	14FEB03	21FEB03	20FEB03	27FEB03	4
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DATA DATE 03FEB03 PAGE NO. 3

ACTIVITY ID DESCRIPTION REM DUR EARLY START EARLY FINISH LATE START LATE FINISH TOTAL FLOAT

MECH PIPING

19010	FINAL TEST PIPE	P1 B7	5	2	10FEB03	14FEB03	10MAR03	14MAR03	20
19018	START-UP STM COND PUMPS	P1 B7	1	1	17FEB03	17FEB03	21MAR03	21MAR03	24
19060	MEC PUNCH LIST	P1 B7	5	1	03MAR03	07MAR03	31MAR03	04APR03	20

TEMPERATURE CONTROLS

10054	T/C MOBILIZATION 89-100%		0	1	03FEB03	31JAN03	05MAR03	04MAR03	22
18050	R/I T.CNTRL 0- 50%	B.107	10	2	03FEB03	14FEB03	05MAR03	18MAR03	22
19020	T/C FINAL TEST/BALANCE	P1 B7	5	2	17FEB03	21FEB03	17MAR03	21MAR03	20
10056	T/C GRAPHIC GENERATION		20	2	03FEB03	28FEB03	19FEB03	18MAR03	12
18052	R/I T.CNTRL 50-100%	B.107	10	2	17FEB03	28FEB03	19MAR03	01APR03	22
19028	T/C ADJUSTING&TESTING	P1 B7	5	1	24FEB03	28FEB03	24MAR03	28MAR03	20
18054	REVISE ECC	B.107	10	2	03MAR03	14MAR03	19MAR03	01APR03	12
18110	TRIM&TERM CONTROLS	B.107	10	2	17MAR03	28MAR03	02APR03	15APR03	12

INSULATION

18070	O/H PIPE INSULATION	B.107	20	2	03FEB03	28FEB03	27MAR03	23APR03	38
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ELECTRICAL

11258	TEST ELE GENERATOR&EQ ADDS	B7	1	1	03FEB03	03FEB03	24MAR03	24MAR03	35
19040	TEST N.C. SYSTEM FINAL	P1 B7	2	2	03FEB03	04FEB03	27MAR03	28MAR03	38
19050	TEST COMM SYSTEM FINAL	P1 B7	2	2	03FEB03	04FEB03	27MAR03	28MAR03	38
15253	WIRE FOR POWER	GFL B7	4	2	03FEB03	06FEB03	17FEB03	20FEB03	10
18080	CONDUIT FOR HVAC EQ	B.107	10	3	03FEB03	14FEB03	25FEB03	10MAR03	16
18090	ELE PNL EQ&HOOK-UP	B.107	6	3	17FEB03	24FEB03	11MAR03	18MAR03	16
19030	TEST F.A. SYSTEM FINAL	P1 B7	2	2	24FEB03	25FEB03	27MAR03	28MAR03	23

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ACTIVITY ID DESCRIPTION REM DUR **MANP** EARLY START EARLY FINISH LATE START LATE FINISH TOTAL FLOAT

ELECTRICAL

18100 WIRE FOR MECH EQ B.107 10 3 25FEB03 10MAR03 19MAR03 01APR03 16

VETERANS ADMINISTRATION

19600 VA INSPECTION P1 B7 5 31MAR03 04APR03 31MAR03 04APR03 0

PROCUREMENT ACTICITIES

00122 F/D LANDSCAPING 02480 5 03FEB03 07FEB03 12MAR03 18MAR03 27
00557 F/D PROTECTIVE COVERS 10530 5 03FEB03 07FEB03 17MAR03 21MAR03 30