



Baseline Schedule Metrics...

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PROJECT MANAGEMENT SOLUTIONS THAT *SIMPLY WORK* SINCE 1989.

www.drmcnatty.com

Thank you for joining today's technical webinar

- Mute – all call in phones are automatically muted in order to preserve the quality of the audio for all attendees.
- Questions – during the session, questions can be submitted through the Questions Box on the right side of the screen . We will try to address your questions at the end of the presentation, time permitting.
- Follow up – all registrants will receive an Excel file listing all questions and responses along with a link to the recorded webinar.

Safe Harbor

- The statements made in this technical presentation are based on our current knowledge of the tools.
- Our statements should not be construed to be an official “Vendor perspective”, but are intended to be the sharing of technical and user knowledge gained as we explore new paths and technologies, often in advance of our clients.
- You need to make your own judgments as to the application of our shared ideas in your own, unique environment.

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- Custom Integration, Analytics, Dashboards, Risk and Role-based User Access.
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- Cloud based P6 and Asta Hosting Services.
- **Project Status**, Java-free Risk and Collaboration Using P6 Web Services.
- Contract Management Interface (**CMI**) – Extend Your PCM Deployment.

Tool Matrix

Business Process		 Asta Powerproject®	
Portfolio Management	P6, Unifier		Portfolios
Planning & Budgeting	Unifier	Powerproject	Planning
Estimating		BidCon	Estimating
CPM Scheduling	P6	Powerproject	Scheduling
Cost Management & Reporting	P6, Unifier	Powerproject	Cost Management
Document Management	Unifier		Doc. Management
Change Management	Unifier		Workflows
BIM/Engineering Forms	Unifier	Asta BIM	Engineering Forms
Risk Analysis	Risk Analysis	Asta Risk	Risk Register
Facility Management/Work Orders	Unifier		Facility Management
Claims Support & Analysis	P6	Powerproject	Scheduling Doc. Management

Abstract

BASELINE SCHEDULE METRICS AND WHAT THEY MIGHT BE TELLING YOU ABOUT THE BASELINE SCHEDULE AND THE SCHEDULER WHO PREPARED IT

There are many documents and presentations on the subject of Baseline Schedules and some excellent "Recommended Practices" available from AACE. So, the knowledge is out there for schedulers to gain a clear understanding of what a Baseline Schedule should be and how to review Baseline Schedules to identify where they could use some improvement. We have observed many cases where schedulers with varying levels of experience will produce baseline schedules that fail to meet minimum standards of professional practice. In this technical webinar Don McNatty will review and explain various metrics and tools for evaluating the quality of baseline schedules.

Agenda

BASELINE SCHEDULE METRICS AND WHAT THEY TELL US...

- What a Good Project Schedule Should Provide
- Definition of an Original Baseline CPM Schedule
- Recommended Practices for Analysis
- Baseline Schedule Metrics
- Tools for Analyzing Baselines
- Summary
- Upcoming Events
- Questions

Baseline Schedule Metrics

WHAT A GOOD PROJECT SCHEDULE SHOULD PROVIDE

- What has to be done? **Activity Description**
- Where does it have to happen? **Activity Code**
- Who is responsible for doing it? **Activity Code**
- When does it have to happen? **Activity Dates**

WW4

When a project manager has the answers to these questions, they have the core information needed to control the project...

Baseline Schedule Metrics

DEFINITION OF A BASELINE CPM SCHEDULE

- This presentation refers to “Original Baseline Schedule”
 - The schedule should represent how the contractor plans to execute the project in alignment with their bid and the plans & specifications.
 - Presentation does not apply to revised baselines or schedule updates.
 - “Baseline” as used here, does not refer to what some software vendors call a copy of a schedule that can be compared to...
- The baseline schedule should:
 - Include 100% of the scope of the work as defined by the contract.
 - Include any significant work activity that needs to be performed by any other project stakeholder that could impact the contractors schedule.
 - Clearly delineate singular responsibility for each activity.
 - Comply with the contract and specifications for submittal.
 - Clearly delineate the “Longest (Critical) Path” to project completion.

Baseline Schedule Metrics

RECOMMENDED PRACTICE FOR ANALYSIS

- Baseline Schedule Submittal
 - A written narrative describing the general workplan and any issues.
 - A complete electronic file that has been properly built and calculated.
 - Printed reports that can be compared to the data in the file.
 - Printed Graphics that can be compared to the output from the file.
- Reviewer Process
 - A thorough understanding of the contract documents.
 - Verify calculation (make a copy, calculate, and compare to original).
 - Review Narrative and make note of any issues or concerns.
 - Check and verify software options or administrative settings.
 - Verify Calendars and calculation settings.
 - **Develop, check and document Baseline Schedule Metrics.**

Reference: (AACE® International Recommended Practice No. 78R-13)

<http://www.aacei.org/resources/rp/>

Baseline Schedule Metrics

ANALYSIS METRICS

- Project
- Activity
- Codes/WBS
- Relationships
- Constraints



Baseline Schedule Metrics

TOTAL NUMBER OF ACTIVITIES

- How many are the right number of activities?
- How many activities are “enough” per month to provide control and manage risk?
 - How long is the project and how often will it be updated?
 - How complex is the work and how risk do you have?
 - Too many short duration activities statused in one month can be overwhelming to the scheduler.
 - Too few (long durations) may not provide enough “points of reference” to measure progress.
 - Money, time, complexity and risk should determine level of detail.
- Some tools such as Deltek Acumen provide benchmark reports comparing your project to industry averages.

Baseline Schedule Metrics

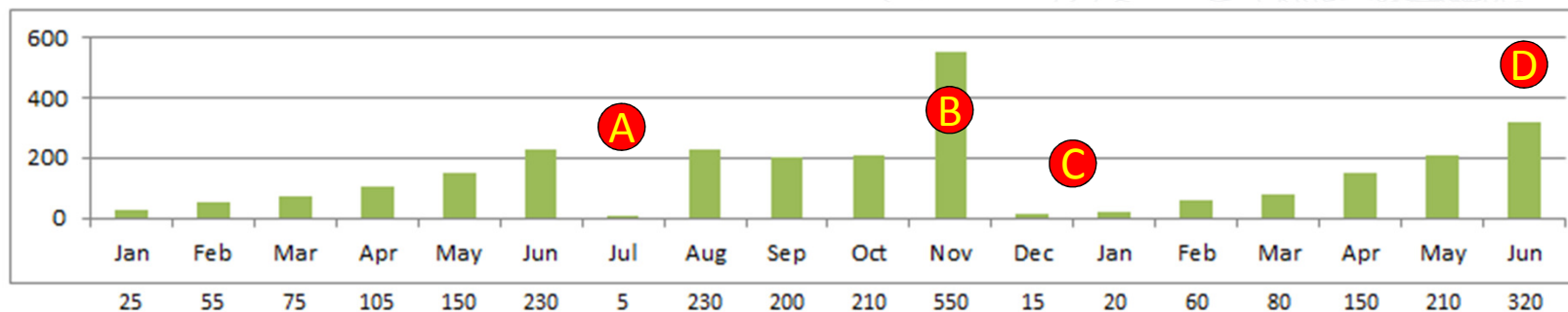
PERCENTAGE OF CRITICAL AND NEAR CRITICAL ACTIVITIES

- If most of the activities (over 50%) in a schedule are critical or near critical, then you need to understand why.
 - Is the project a fairly simple, linear project like a road or pipeline?
 - Many concurrent “crew chases” merge frequently along the timeline.
 - If not, are there excessive logic ties (see Relationships) that limit movement?
 - Are there mid-project milestone requirements that force multiple critical paths?
- Generally, we look to see less than 15 to 20% critical.
- A high percentage (more than 20%) of additional near critical (within 20 days of critical) may indicate a very “tight” schedule.
 - A 20 day activity can go from 20 days TF to zero in one month!

Baseline Schedule Metrics

ACTIVITY DISTRIBUTION

- The number of activities that are active each month.
 - If the distribution per month decreases over time it could indicate that only the early work has been adequately thought out and the later work may not be detailed enough.
 - Any month that spikes or drops should be explained in the narrative.



A – Why is there a gap when the project just got going?

B – A big spike in one month, is it feasible? In a “holiday month”? Can resources support this “surge”

C – Is this “winter shut-down”?

D – 12% of the activity occurs in the last 5% of the project time?

Baseline Schedule Metrics

CONTRACTUAL MILESTONES

- Every project should have at least 2 milestones.
 - Start (Notice to Proceed)
 - Finish (Substantial or Final Completion)
- Other milestones may be defined by the contract documents.
 - Multiple mid-project milestones with contractual finish dates can create multiple critical paths to each milestones.
- Non-contract milestones could define key handoffs.
- Notice to Proceed
 - Project time commences with this milestone
 - Data Date should be set to equal the NTP
 - While there might be actual dates before NTP (pre-contract work) there would not be any Actual Dates on or after the NTP.

Baseline Schedule Metrics

PROJECT COMPLETION DATE

- The Contract Completion Date should be put on the Completion Milestone activity and not the Project Level “Must Finish By Date” field.
 - Many projects have close-out work after Substantial Completion that should not be on the critical path.
 - If not defined in the specifications then it should be resolved as part of the Baseline submittal process.
 - Putting the Finish Date at the project level forces all project activities to set late dates equal to the Project Level Must Finish By date field.
 - Using a milestone for completion gives the scheduler specific control of how and when float is calculated.

Baseline Schedule Metrics

ACTIVITY ANALYSIS METRICS

- Mechanically Incorrect Dates
- Actual Dates
- Activity Types
- Duration Types
- Percent Complete Types
- Calendars
- Negative Float
- Activity ID Structure
- Activity Durations



Baseline Schedule Metrics

MECHANICALLY INCORRECT DATES

- Blank or missing start or finish dates on non-milestone activities.
- Finish dates earlier than start dates (an indicator of negative float).

ACTUAL DATES

- Actual starts or finishes on or after the NTP/Data Date
- Could be OK to document pre-NTP activities.
- This applies even though the actual dates are already known. Actual dates should be part of the first update, not the Original Baseline.
- Double check activities that start on the Data Date
 - Activities with no predecessors will start on the Data Date.

Baseline Schedule Metrics

ACTIVITY TYPE

- Most scheduling tools allow different activity “types”
 - The “activity type” can affect how dates and durations are calculated.
 - Use “Task Dependent”(P6) to allow the scheduler to define durations, constraints and calendars.
 - Using the “Resource Dependent” type may allow the resource and the resources calendar to drive the activity (do you really want this?)
 - The schedule has to be resource loaded for this to impact.
 - Level of Effort or Hammock activities get their durations based on relationships to other activities.

DURATION TYPE

- “Fixed Duration and Units” provides direct entry of duration and Units (Resources). Anything else may recalculate.

Baseline Schedule Metrics

PERCENT COMPLETE TYPES

- Physical
 - Can be entered directly or calculated based on Steps (good for EVM).
- Units
 - Driven by what percentage of Resources expended vs budget.
- Duration
 - Driven by time units expended vs budgeted
- If these vary across the schedule you need to understand why, how does the contractor plan to status these activities.

Baseline Schedule Metrics

CALENDARS

- Calendars are one of the biggest causes of problems and confusion in schedules.
 - Usually caused by a lack of understanding on how Calendars work.
 - Just because some activities work 10 hrs and others 8 hrs, does not necessarily mean you need to change the hours on the calendar.
 - When an 8hr/day activity hands off to a 10hr/day activity you end up with a “fractional duration” for the successor.
- Display decimals in “User Preferences” to uncover fractured durations in your Baseline!

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
City Center Office Building Addition					
	681.11d	01-Nov-10 08:00 AM A	03-Jul-13 08:53 AM	0.00d	
Design and Engineering					
EC1000	Design Building Addition	107.08d	01-Nov-10 08:00 AM A	06-Apr-11 09:36 AM A	
EC1010	Start Office Building Addition Project	55.33d	01-Nov-10 08:00 AM A	19-Jan-11 09:36 AM A	
EC1030	Review and Approve Designs	0.00d	01-Nov-10 08:00 AM A		
EC1050	Assemble Technical Data for Heat Pump	21.60d	7-Jan-11 09:36 AM A	17-Feb-11 03:24 PM A	
EC1160	Review Technical Data on Heat Pumps	7.20d	16-Feb-11 08:00 AM A	25-Feb-11 09:36 AM A	
	26.88d	24-Feb-11 09:36 AM A	06-Apr-11 09:36 AM A		
Foundation					
EC1100	Site Preparation	149.55d	23-Feb-11 08:00 AM A	23-Sep-11 01:24 PM	171.16d
	43.08d	23-Feb-11 08:00 AM A	18-Apr-11 09:36 AM A		
11.345-4	Cost for Foundation	149.55d	23-Feb-11 08:00 AM A	23-Sep-11 01:24 PM	164.16d
EC1090	Begin Building Construction	0.00d	28-Feb-11 08:00 AM A		
EC1230	Excavation	24.13d	02-May-11 08:00 AM	06-Jun-11 09:00 AM	126.91d
EC1320	Install Underground Water Lines	12.13d	03-Jun-11 08:00 AM	21-Jun-11 09:00 AM	126.91d
EC1330	Install Underground Electric Conduit	12.13d	03-Jun-11 08:00 AM	21-Jun-11 09:00 AM	126.91d
EC1340	Form/Pour Concrete Footings	24.13d	21-Jun-11 08:00 AM	26-Jul-11 09:00 AM	126.91d
EC1350	Concrete Foundation Walls	24.13d	25-Jul-11 08:00 AM	26-Aug-11 09:00 AM	126.91d
EC1360	Form and Pour Slab	12.13d	26-Aug-11 08:00 AM	14-Sep-11 09:00 AM	126.91d
EC1370	Backfill and Compact Walls	4.93d	03-Sep-11 08:00 AM	19-Sep-11 04:24 PM	126.91d
EC1380	Foundation Phase Complete	0.00d		19-Sep-11 03:24 PM	177.91d

Baseline Schedule Metrics

NEGATIVE FLOAT

- Negative float in a baseline submittal indicates that a milestone or project completion date is not going to be met.
- You usually want to identify, understand and eliminate negative float from an initial baseline.

ACTIVITY ID STRUCTURE

- An “intelligent” Activity ID structure can make it easier to find and sort similar activities.
 - The structure should be consistent across the entire schedule.
 - Get the Activity ID structure finalized in the baseline.
 - When activities are renumbered later, the **baseline is useless!**
 - When updates add and delete activities, the **baseline is useless!**

Baseline Schedule Metrics

ACTIVITY DURATIONS

- Organize by duration to identify long and short duration activities
 - A high percentage of short duration activities could be too much detail.
 - Physical work activities that exceed 2 months (44 work days) may be difficult to measure progress and performance.
 - Some specifications limit the duration of physical work activities.
 - A lot of activities with 5 day durations (P6 default) may indicate a lack of in-depth thought on durations.
 - Zero duration activities that are not milestones could be a concern.
 - Long durations in odd numbers (323 days...) may indicate a need for further investigation on how the number was determined. The same is true for many activities with similar, rounded durations (100 days). The durations may not have been completely defined.
 - Be aware of the “rolling wave” of detail – early activities more detailed than those occurring later in the project.

Baseline Schedule Metrics

MISSING ACTIVITY DESCRIPTIONS

- Blank descriptions must be resolved (unless it's a top secret project...).

DUPLICATE ACTIVITY DESCRIPTIONS

- All Descriptions should be unique. Duplicates can be confusing. There may be a generic description (Formwork) but with a location added (Formwork, wall A100) it becomes unique and more clearly defines “what” and “where”.

SUBSTANTIAL COMPLETION ACTIVITY

- Always look for a “Substantial Completion” or similar milestone that denotes the end of a contract time period.

Baseline Schedule Metrics

ACTIVITY ANALYSIS METRICS

- Activity Codes
- WBS Codes
- Relationships
- Leads/Lags
- Constraints



Baseline Schedule Metrics

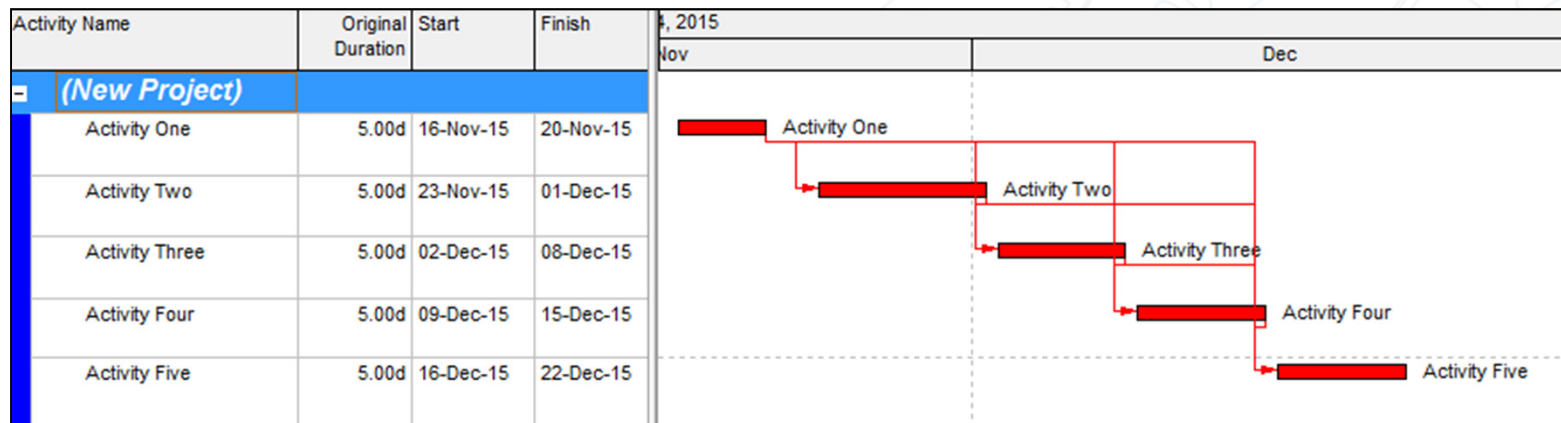
ACTIVITY & WBS CODE METRICS

- Missing Codes – Not all codes apply to all activities but a blank value should be verified before accepting the Baseline.
- Missing Code Descriptions – All Codes need descriptions or the Baseline is incomplete.
- Duplicate Code Descriptions – Duplicate Code Descriptions, like duplicate Activity Descriptions can be confusing. The description should be unique.

Baseline Schedule Metrics

RELATIONSHIP METRICS

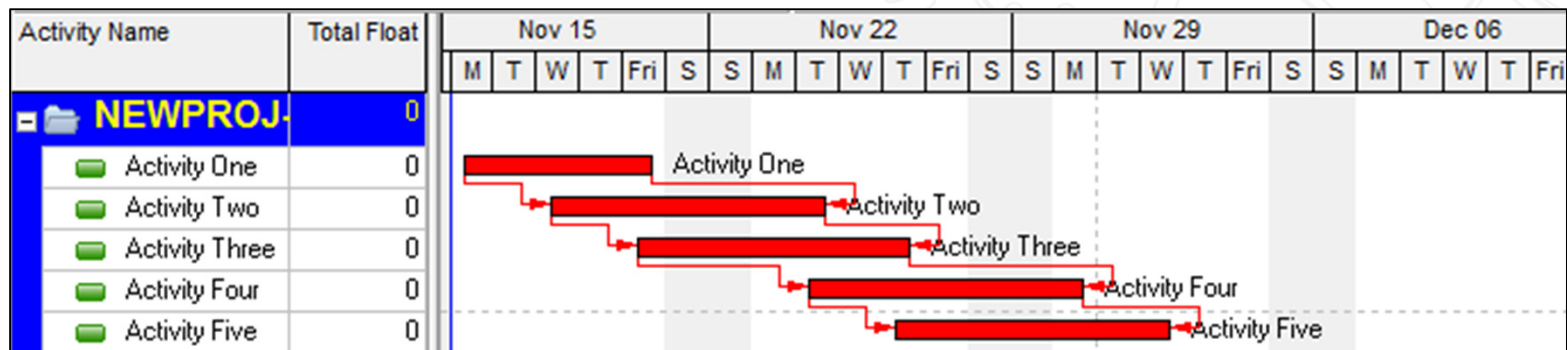
- Summary Activities – Check total # of LOE/hammock and WBS Summary activities. Should review for how they are being used. Usually less than 5% of total activities. Look for at least one SS and one FF relationship to ensure the summary covers the entire period.
- Redundant Relationships – when all predecessors are linked to all successors – this can be overkill.



Baseline Schedule Metrics

RELATIONSHIP METRICS

- Multiple Relationships – Two relationships of different type between two activities. SS combined with FF is common. Any other types should be investigated.

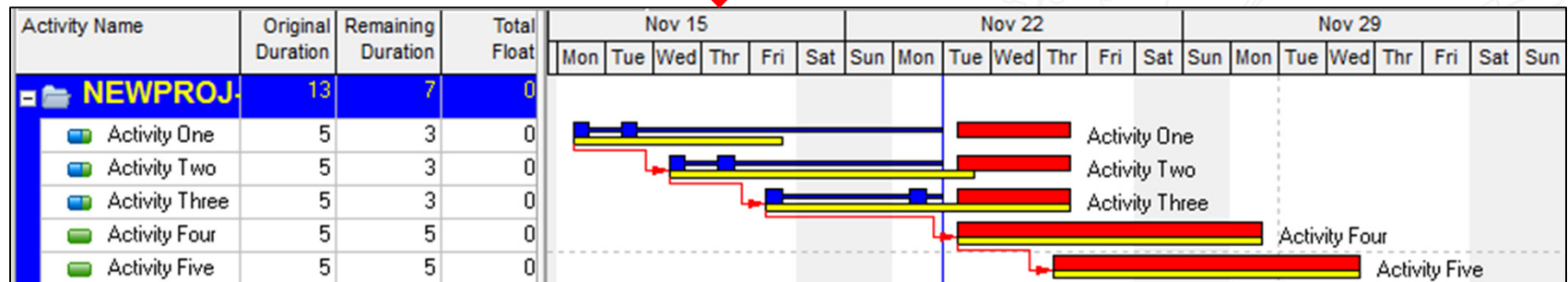
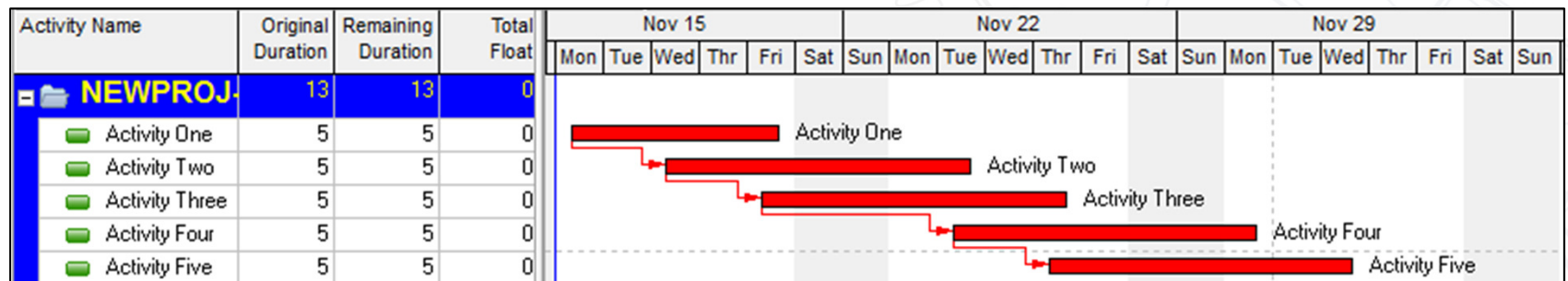


- This could be a classic “crew chase” where once framing is in place the rough electric starts, followed by drywall one-side, followed by...
- But if any crew gets delayed on one activity, it in turn will delay the start of the following activity.

Baseline Schedule Metrics

RELATIONSHIP METRICS

- Missing Finish Relationships on FS/SS Activities – a common mistake in some construction schedules is using only SS relationships and not locking down the finish.



Baseline Schedule Metrics

RELATIONSHIP METRICS

- Illogical Relationships – sometimes a scheduler may link an activity to a successor just because the activity starts at a time the scheduler would like to see the predecessor finish.
 - Example 1: A concrete mix submittal that is linked to ordering paint.
 - Example 2: A concrete installation in Area A precedes a concrete installation in Area B.
 - Example 2 would likely be a “preferential relationship” used to position resources (the same crew will do Area A, then Area B...). Preferential relationships should be justified in the narrative because they often change once the actual work starts and the contractor starts moving crews around on the job (common cause of out-of-sequence progress).

Baseline Schedule Metrics

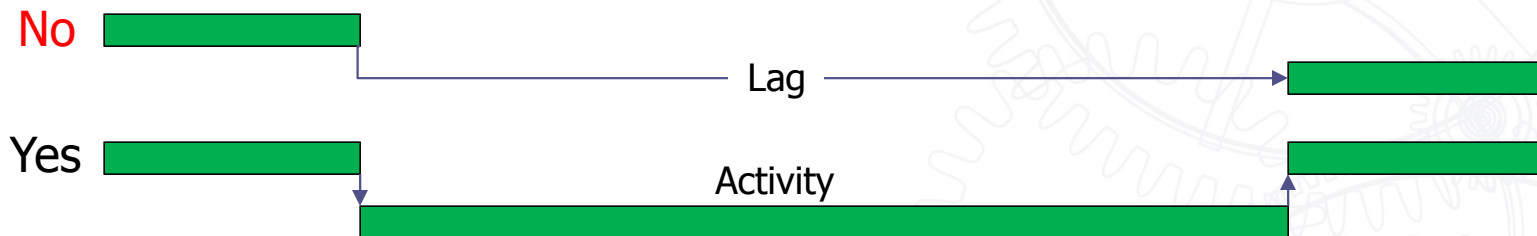
LEAD/LAG METRICS

- Purpose or Justification of the Lead/Lag – Lead or Lag is used to control the start of an activity after a predecessor event for some reason – the reason should be justified in the narrative.
- Lead/Lag Values that Exceed Pred/Succ Durations – when the Lead/Lag value exceeds the value of the Pred/Succ durations, serious justification is required.
 - Lead/Lags function like activities (they have a start and finish and can even have a different calendar than the activities).
 - But, they are “activities” without descriptions. Long Lead/Lags communicate better as activities rather than as a Lead/Lag.
 - If you intend to run a Risk Analysis calculation on a schedule Lead/Lag should be kept to a minimum because they can not be impacted.

Baseline Schedule Metrics

LEAD/LAG METRICS

- Long Duration Lead/Lags – these are sometimes used as “placeholders” for future activity detail. They would communicate much better as activities rather than Lead/Lag.



- Number of Lead/Lags Compared to Number of Activities – because Leads/Lags are functionally “hidden activities”, they should be kept to a minimum for a baseline that communicates well. Compare the number of Lead/Lags to total number of activities. In excess of 5% should be closely looked at.

Baseline Schedule Metrics

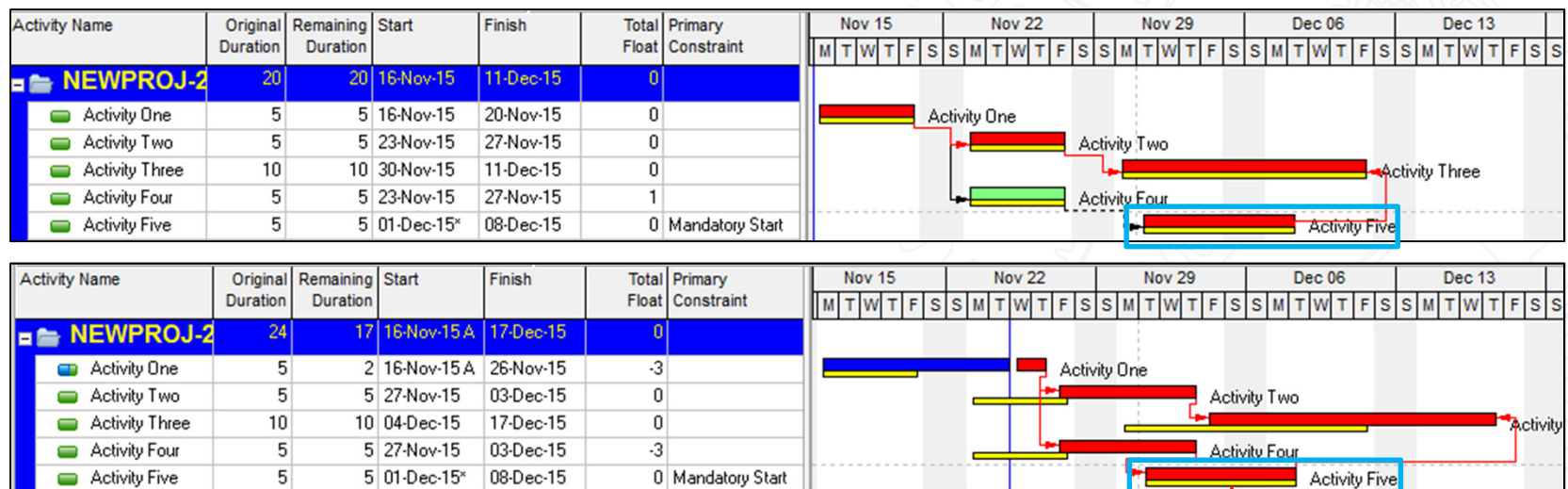
CONSTRAINT METRICS

- Zero Free Float – allows an activity to finish just before it will impact the early start of its successor. Could be thought of as “As Late as Convenient”.
 - However, if the Successor is on the Critical Path, the ZFF constrained activity will also display as Critical!
- Zero Total Float – does impact Total Float. Forces an activity and its successors to be critical. Definitely requires justification in the narrative. These constraints over-ride the critical path and need to be justified.
- Expected Finish – convenient for long duration activities. May be based on “best available information” or a commitment. Allows the activity to “self status” as the data date moves forward. Needs justification in the narrative.

Baseline Schedule Metrics

CONSTRAINT METRICS

- Mandatory Dates – Forces Early/Late dates to only that date!
Requires justification for why that date and only that date!
 - A predecessor cannot push it out but will force negative float on the predecessors but not itself. Will allow predecessors to pass it...

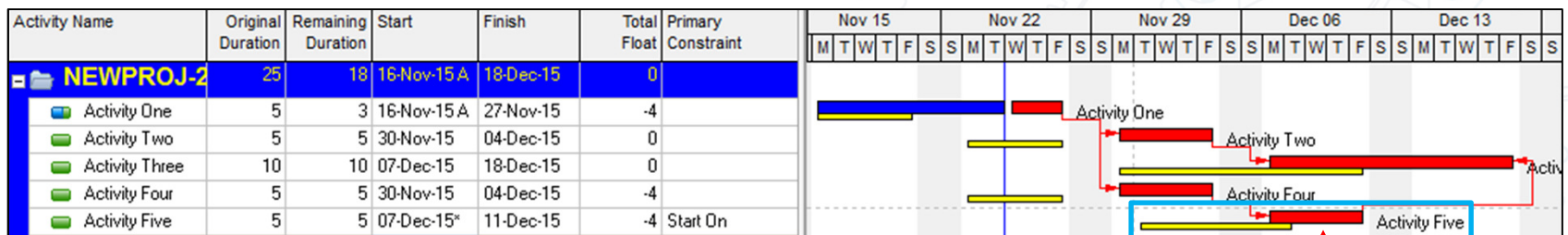
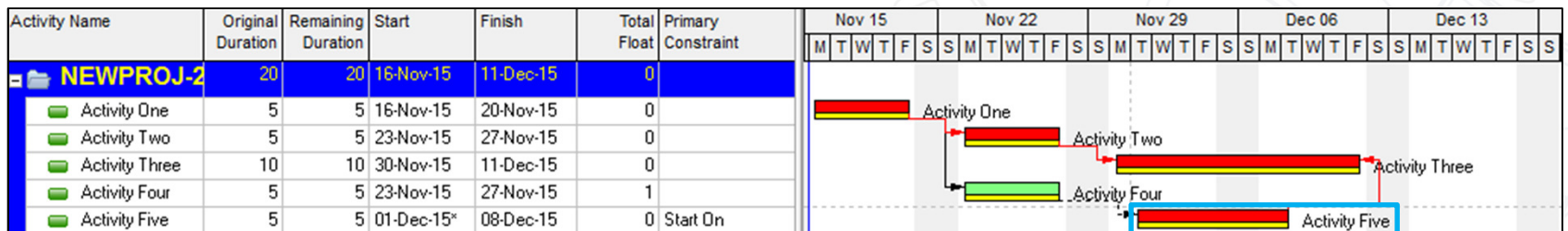


Activity Five (Mandatory Start) remains in place while all predecessors pass it by!

Baseline Schedule Metrics

CONSTRAINT METRICS

- Start Constraints
 - Start On – Early and Late Starts set to this date, BUT a predecessor can push out the Early Start forcing Negative float on itself & predecessors.

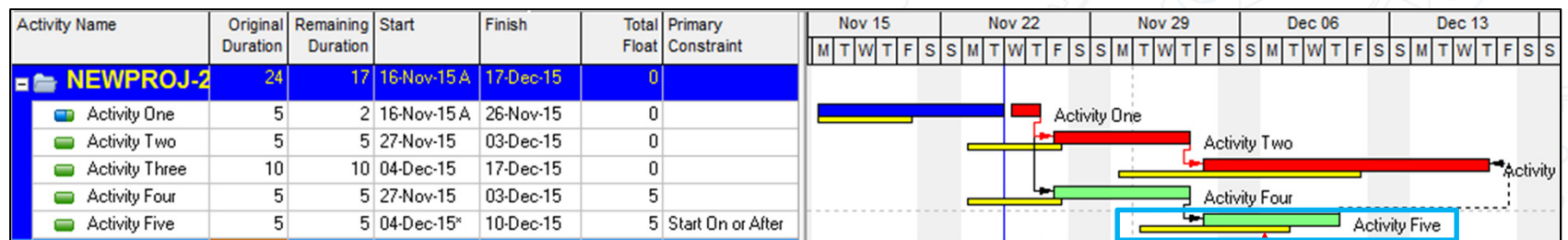
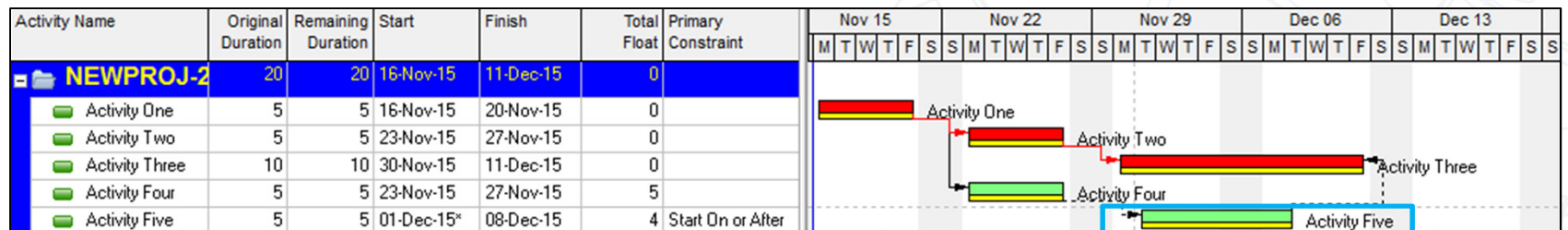


Activity Five (Start On) is pushed out by its predecessor but forces negative float...

Baseline Schedule Metrics

CONSTRAINT METRICS

- Start Constraints
 - Start On or After – sets Early Start date but allows predecessor to push it out without forcing negative float.

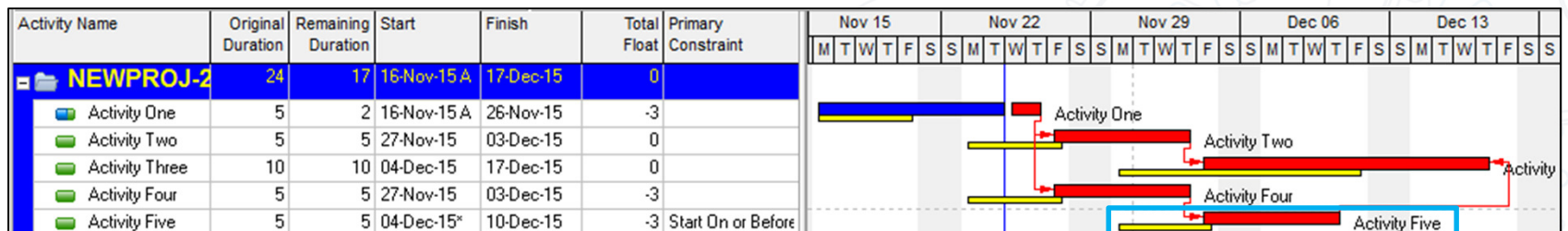
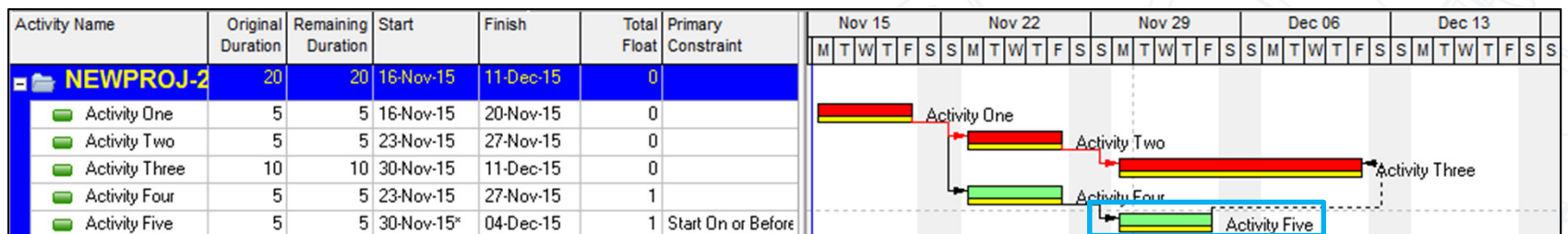


Activity Five (Start On or After) can be pushed out by its predecessors...

Baseline Schedule Metrics

CONSTRAINT METRICS

- Start Constraints
 - Start On or Before – allows the Early Start to move forward but forces the Late Start Date to remain in place forcing negative float on delay.



Activity Five (Start on or Before) can move forward but when pushed out forces negative float...

Baseline Schedule Metrics

CONSTRAINT METRICS

- Finish Constraints (same characteristics as Start constraints but applies to the Finish of the activity)
 - Finish On – Early and Late dates set to the constraint date BUT a predecessor can push out the Early Finish forcing negative float from the Late Finish.
 - Finish On or After – Sets the Early Finish date but allows predecessors to push the Late Finish without creating negative float.
 - Finish On or Before – this is a “Finish No Later Than” constraint. Allows the activity to finish earlier if predecessors allow but forces negative float when finish date is pushed beyond this date. **This constraint is commonly used for Finish Milestones allowing the milestone to finish early but not late.**
- Lastly, use Activity Notebooks to document your justification.

Baseline Schedule Metrics

TOOLS FOR ANALYZING BASELINES

- Primavera P6
 - Claim Digger (P6 Professional)
 - Check Schedule (P6 EPPM)
- Schedule Analyzer Enterprise
 - Baseline Checker
- Acumen Fuse
 - Diagnostics



Baseline Schedule Metrics

ORIGINAL BASELINE METRICS

- Has everything to do with the quality of the schedule – not changes.
- Whatever “quality” you allow into the Original Baseline you will live with through your updates and as-built schedules.
- Use the metrics and standard best practices to create a solid foundation for your Original Baseline.
- Understanding these “metrics” and how to use them to create a foundation for your baseline schedule is critical to achieving control and minimizing conflict and confusion down the line.

Baseline Schedule Metrics

QUESTIONS AND COMMENTS

- All questions are gathered into a master sheet, answered and distributed to all registrants as well as posted on our website.
- Answers are based on our own experiences using the various software products covered in this webinar.
- For additional information you may also reference the following document provided by Ron Winter.

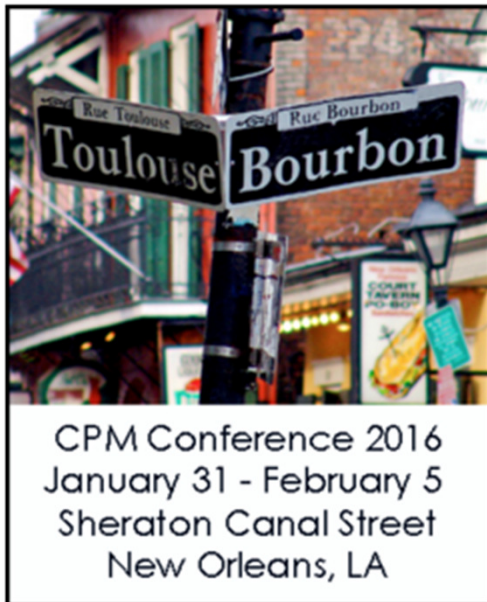
http://www.ronwinterconsulting.com/Reviewing_a_Baseline_Schedule.pdf

Thank you for participating

Contact - contact@drmcnatty.com

Upcoming Events

We highly recommend the following technical education and relationship events



<http://www.constructioncpm.com/>



<http://www.westernwinterworkshop.com/>



aace-northeast-total-cost-management-symposium/



Free Asta Powerproject Seminar

<http://www.astapowerproject.com/usa-posts/asta-powerproject-seminar/>

Friday December 11, 8:30am – 11:00am
Holiday Inn, Santa Ana – Orange County Airport
2726 South Grand Ave.
Santa Ana, CA 92705

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