Additional Steps Required To Perform A Delay Analysis With P6

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Bio – Glen R. Palmer, PSP, CFCC

- Owner of GR Palmer Consulting Services, LLC
- Over 30 years experience in the engineering and construction industries
- Formerly “Corporate Head Of Planning & Scheduling” with a large engineering & construction company
- Has experience on large disputes, both domestically and internationally
- Assists clients on initial / recovery project planning

Bio – J. Scott Palmer, PE, PSP

- Owner, Vice President - Alta Cascade, Inc.
- Owner - Project Controls & Forensics, LLC
- Over 17 years experience in the engineering and construction industries
- PE license in 5 states
- Has experience on large disputes, both domestically and internationally
- Assists clients on initial / recovery project planning

Bio – Greta Martin, PE, PSP

- Project Consultant - Project Controls & Forensics, LLC; Alta Cascade, Inc.
- Over 12 years experience in the engineering and construction industries
- PE license in Washington State
- Has experience on large disputes, both domestically and internationally

Introduction

This presentation is not intended to be a opportunity to criticize P6. It is solely intended to educate the industry as to why the “delay analysis” process has become more expensive when working with P6

Introduction

- P6 is not designed with forensic schedule analysis in mind

- P6 is designed to manage multiple projects for large organizations

Primavera software products are designed to support the project management needs of organizations that manage large numbers of projects at one time.

*These integrated applications use project portfolio management (PPM) to support the management needs of project teams in different locations and at varying levels of the organization.**

** Oracle P6 Reference Manual, v 7.0*

Introduction

- P6 is a powerful tool when used as was designed

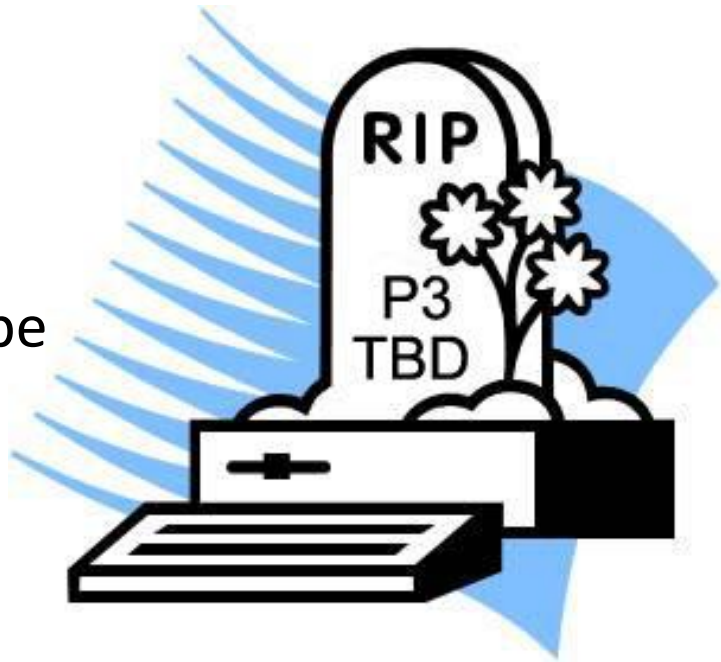
- The multiple features and global environment create additional steps to perform schedule analyses

- These features can also introduce error into a schedule analyses

Introduction

Demise of P3??

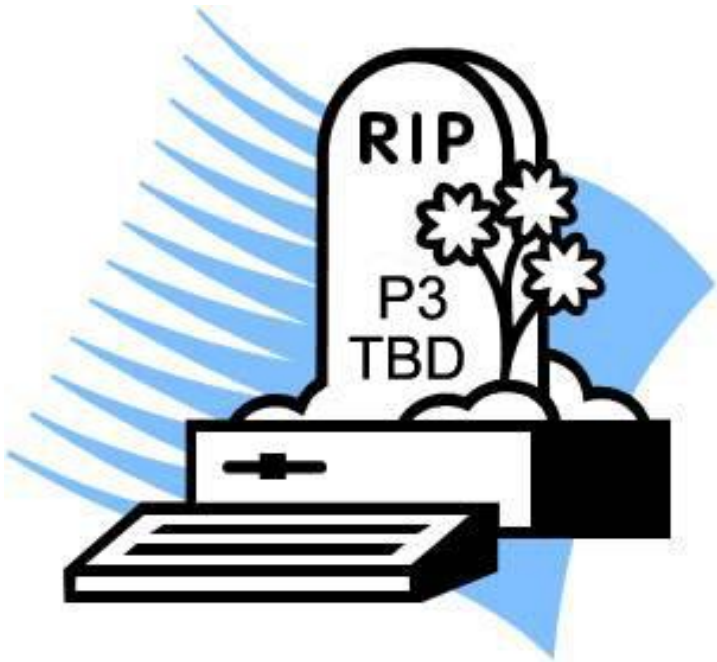
- MS Excel no longer supports .wks, .wk1 or .dbf file formats
- Windows 8 no longer supports XP mode Virtual machines
- Since P6 v 6.2, P3 (or Suretrak 3.0) has to be installed to import / export from P3
- P3 cannot be installed on 64-bit machines



Introduction

Import Problems P3 to P6

- CDI (custom data items) values do not import consistently
- Random RD do not import
- Random Actual Dates do not import
- Activity Code Values do not import if not defined in the dictionary in P3
- All Calendars are imported as Global, not Project



Introduction

Import Problems P3 to P6

- F9 Settings do not import
- Actual Dates do not import correctly
  (ex. - changes June to July)
- Change units for resources 200 vs. 25
- P3 allows the user to have actual resources without an actual date
- P3 and P6 handle expected finish constraints differently

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P6 Extra Steps

- Installation
- Databases (SQL vs. Oracle)
- Maintenance
- Import Data / Source Validation

P6 Extra Steps

Installation

- P6 Administrators Guide, v 7.0 (452 pages)

  …a step-by-step guide to installing and configuring P6 software components."

- The Guide also states:

  The talents of several different types of employees may be required to install and configure Primavera components in your organization.

1) Network Administrators
2) Database Administrators
3) Project Controls Coordinator
4) Project Managers

P6 Extra Steps

Installation

Stand-alone installations require preparation and may take as little as an hour to complete but, depending on the organization and accessibility of the system administrator rights, it may take longer.

…

*The talents of your IT staff may be required to assist you with the installation and configuration of Oracle Primavera software in your organization. An Information Technology professional or an end user with a familiar degree of computer knowledge can complete a stand-alone installation without assistance when this documentation is utilized as part of the preparation.**

* *Oracle Stand-Alone Installations and Upgrades V7.0 Instructions*

P6 Extra Steps

Databases

- Recommend creating a new database for each project
  - Not easy. Requires SQL knowledge

- Oracle Primavera supports Microsoft SQL Server Express or Oracle XE Express for stand-alone database

*A P6 Scheduler is required to know much more than just how to schedule; he or she must plan, maintain, and repair the database. The alternative is to trust that Primavera and their support staff have done this for you and knows what is best.**

** Living with P6 Databases, Ron Winter*

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P6 Extra Steps

Databases

MS SQL Server Express

- Free download from Microsoft
- Requires some SQL knowledge
- 2005 R2 4 GB size limit per database **(not data maximum)**
- 2008 R2 10 GB size limit per database **(not data maximum)**

or

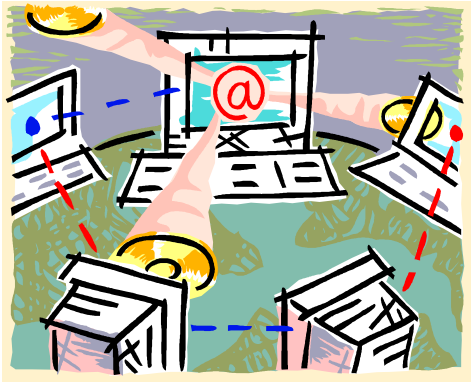
Oracle XE

- "Lite" version included with P6
- Supports up to **4GB maximum**
- Single instance only of Oracle Database XE on any server
- Only uses one processor
- Only uses up to 1GB RAM

P6 Extra Steps

Maintenance

- Network administrators



  - Ensure the hardware and software supporting P6 function reliably
  - Set up and maintain the network
  - Create and maintain accurate lists of network resources.

P6 Extra Steps

Maintenance

- Database administrators
  - Creating and implementing the databases 
  - Implementing and maintaining database security
  - Monitoring database performance (SIZE) 
  - Planning for changes and establishing and maintaining backup and recovery policies and procedures 

P6 Extra Steps

Maintenance

- Project Controls Coordinator
  - Configure and Implement P6
- Project Managers
  - Manage Projects in P6

P6 Extra Steps

Source Validation

- P6 has many features which are beneficial to project management
- There are many ways to tailor calculations in a P6 database
- These settings also impact how schedules are imported into a database
- These same functions can create problems for forensic schedule analysts

P6 Extra Steps

Source Validation

- Observational analyses use contemporaneous understanding of critical path
- To the maximum extent possible, the set-up should mirror that of the original scheduler's
- The only way to be **100% certain** that your schedule matches the contemporaneous schedule is to have a copy of the P6 database

Source Validation

Importing Schedule Files

- P6 uses XER files to transfer schedules
- The analyst imports the XER into a database
- Activities and logic typically import cleanly
- Other factors can still impact the planned dates and total float

Source Validation

Date Conversion Factor's Affect on Duration

- Schedule from a database with a global setting for 8/hrs per day
- Imported into a database with a global setting of 12 hrs/day. P6 applies date conversion factor to import
- Results in a change in activity durations.
  - A 10 work day activity at 8 hrs/day will become a 6.66 work day activity in the converted schedule.

Source Validation

Importing Calendars

- Source baseline schedule (#1) was developed with two calendars and imported into database

- The first source update (#2) has an increased number of work hrs/day for one of the calendars

  - If #2 is imported using “update existing” function, then #1 will be altered.
  - If #2 is imported using the “keep existing” function, then #2 calendar will be altered.

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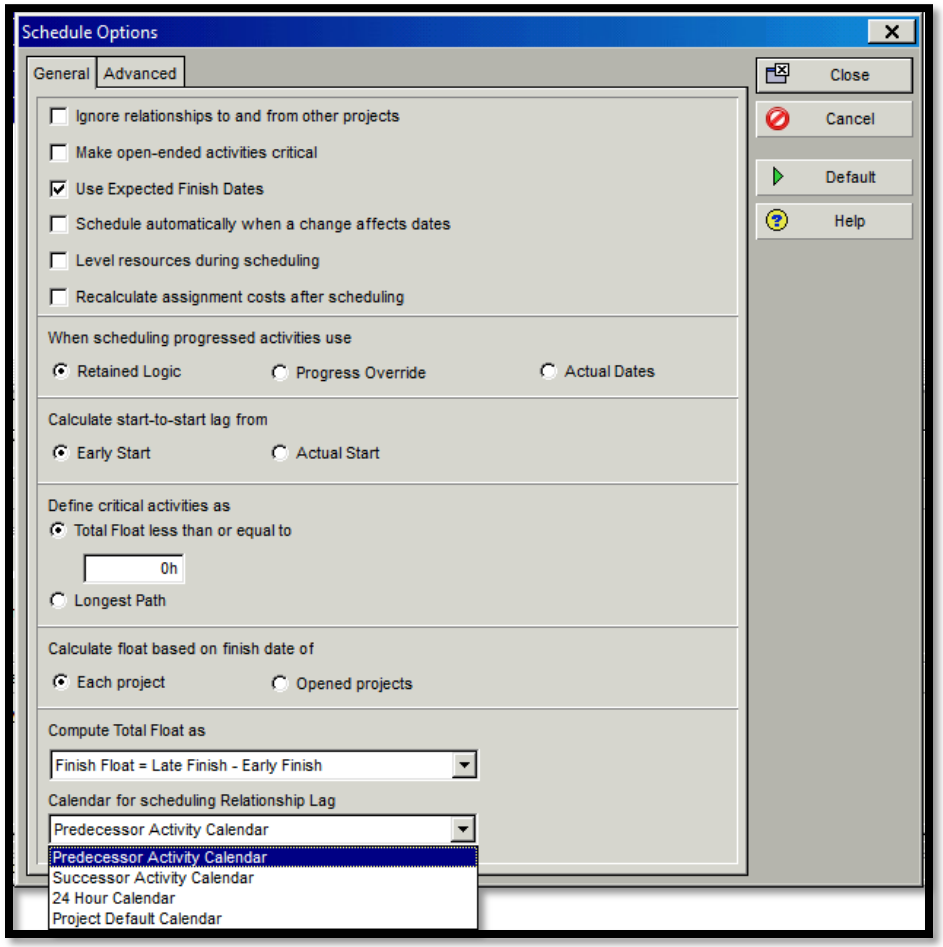
Source Validation

Calculation of Lags

- P3 uses predecessor calendar to calculate lags
- P6 has multiple settings for calculation of lags



Source Validation

Other Potential Issues

- “Keep Existing vs. Import New”
- Differences between source settings and analyst settings can alter the schedule’s completion date when recalculating the schedule.
- Expected Finish Dates
- Resources
- Resource Leveling
- Remaining Durations
- Links to External Projects

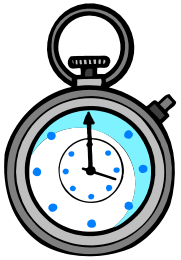
Source Validation

Methods to ensure XER import accuracy

- Installation uses a “sandbox” database with no other schedules prior to importing schedule into working database.
- Use third party software to view .xer file outside of P6 database.
- Use copy of P6 Database.

P6 Extra Steps

Previous additional steps all happen prior to beginning the analysis!!



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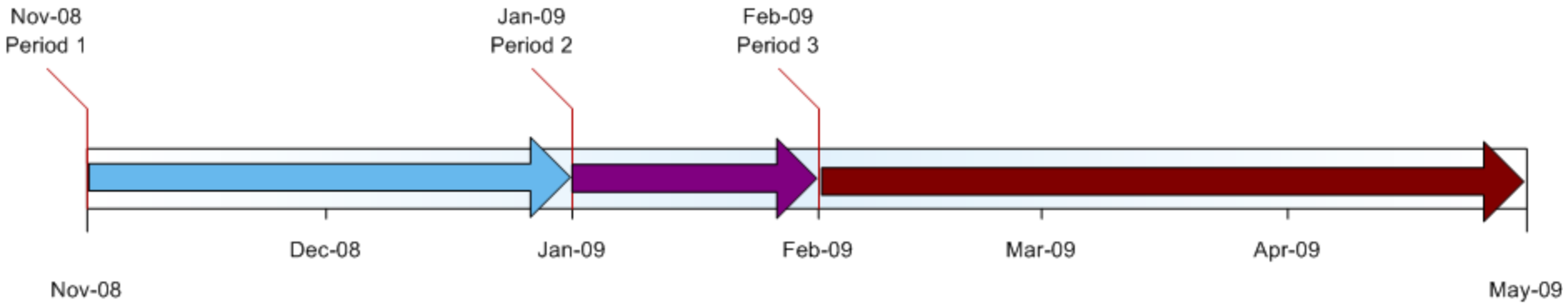
Windows Analysis

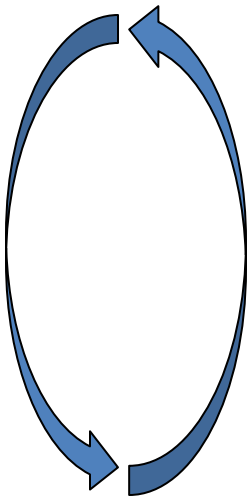
Review



- Analysis is mostly observational – changes made only to correct obvious errors in getting delay quantum to balance
- Contemporaneous – relies on schedule updates prepared during project execution
- Window periods defined by changes to the critical and near-critical paths
- Sum delay of each window used to create plan vs. actual summary

Windows Analysis

P3 Steps



1. Receive Schedules from client
2. Unzip/restore schedules
3. Compare schedules to hardcopies
4. Determine as-built schedule for actual dates (AB)
5. Target Initial Schedule 01 to Schedule AB
6. Target Initial Schedule 01 to Next update (02)
7. Create (import) layout
8. Create CDI / Activity codes as needed
9. Determine LP / NCP
10. Print Layout and perform calculations
11. Repeat steps 5-10 for each update or window period

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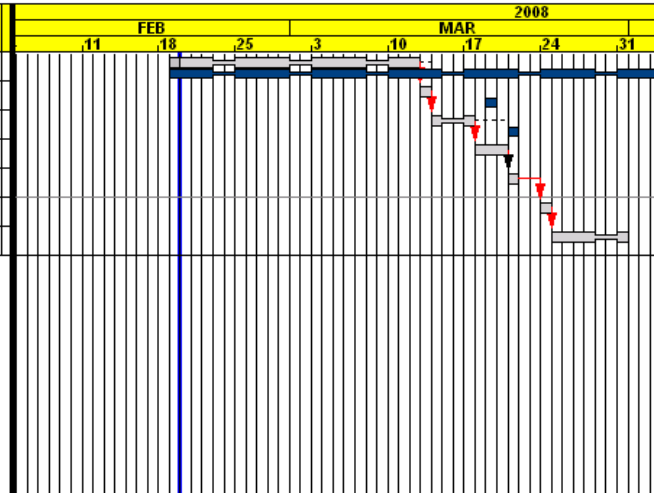
Windows Analysis

P3 Steps – Example Layout

File Edit View Insert Format Tools Data Window Help

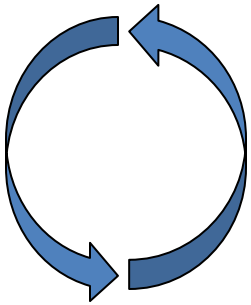
Activity ID	Activity Description	Cal ID	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float	Target 1 Early Start	Target 1 Early Finish	Target 2 Early Start	Target 2 Early Finish	ZAC1	ZAC2
5042200	Install Exterior Masonry	1	17*	16*	19FEB08A	12MAR08	0	19FEB08A	27APR08A	19FEB08A	28MAR08	100	100
5169051	Set Switchboard	1	1	1	13MAR08	13MAR08	0	19MAR08A	19MAR08A	19MAR08A	19MAR08A	100	100
5034311	Install Precast Roof Panels- Electrical	1	5	2	14MAR08	17MAR08	0	21MAR08A	21MAR08A	21MAR08A	21MAR08A	100	100
5033101	Place Topping Slab - Electrical	1	3	3	18MAR08	20MAR08	0	08APR08A	09APR08A	24MAR08	26MAR08	100	100
5072103	Install Vapor Retarder, Electrical Roof	1	2	1	21MAR08	21MAR08	0	21APR08A	21APR08A	28MAR08	28MAR08	100	100
5072104	Install Insulation, Electrical Roof	1	1	1	24MAR08	24MAR08	0	22APR08A	22APR08A	31MAR08	31MAR08	100	100
5075352	Install Membrane Roofing, Electrical Roof	1	5	5	25MAR08	31MAR08	0	23APR08A	24APR08A	02APR08	08APR08	100	100



Windows Analysis

P6 Steps

1. Create new database for project  
2. Determine settings for client database (often no access)
3. Apply settings to new database 
4. Receive schedules form client.(xer files)
5. Import .xer files 
6. Compare to hardcopy schedule
7. Modify schedule as necessary to match hardcopy 
8. Repeat steps 5-7 for each .xer file

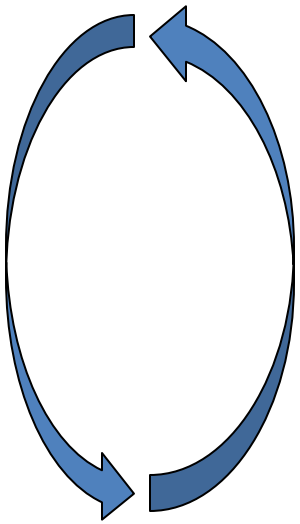


- Additional Steps in P6

Windows Analysis

P6 Steps (cont.)

9. Determine as-built schedule for actual dates (AB)*
10. Copy schedule AB and rename to B1
11. Convert schedule B1 to P6 baseline (target)
12. Assign B1 (target) to schedule 01 as P6 baseline
13. Copy schedule update 02 and rename to T2
14. Convert schedule T2 to a P6 baseline (target)
15. Assign T2 to schedule 01 as P6 baseline
16. Repeat Step 10 -16 for each update

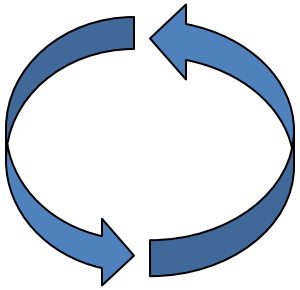


* Once a P6 baseline is created, it cannot be modified unless it is unassigned and restored.

- Additional Steps in P6

Windows Analysis

P6 Steps (cont.)



17. Create (import) layout
18. Create CDI / Activity codes as needed
19. Determine LP / NCP
20. Print Layout and perform calculations
21. Repeat steps 18-20 for each update or window period

- Additional Steps in P6

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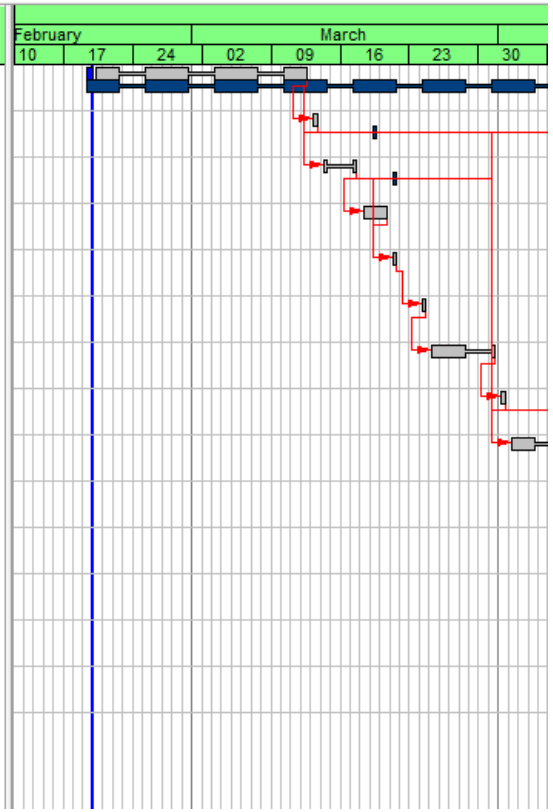
Windows Analysis

P6 Steps – Example Layout

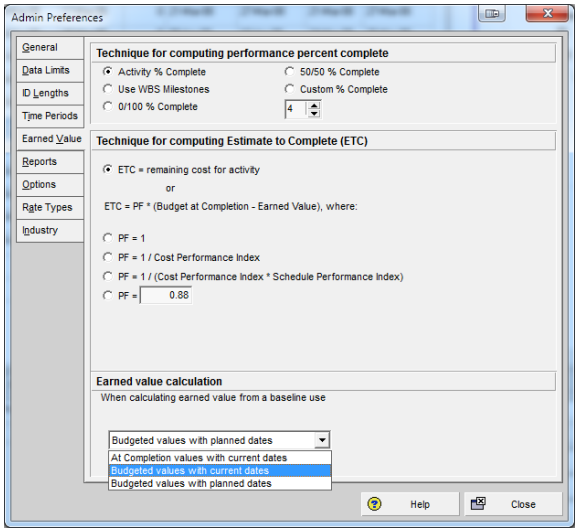
Activity ID	Activity Name	Calendar	RD	OD	Start	Finish	Total Float	BL1 Start	BL1 Finish	BL2 Start	BL2 Finish
5042200	Install Exterior Masonry	0220 - 1 - Normal	16	17	19-Feb-08 A	12-Mar-08	0	19-Feb-08	27-Apr-08	19-Feb-08	28-Mar-08
5169051	Set Switchboard	0220 - 1 - Normal	1	1	13-Mar-08	13-Mar-08	0	19-Mar-08	19-Mar-08	19-Mar-08	19-Mar-08
5034311	Install Precast Roof Panels-Electrical	0220 - 1 - Normal	2	2	14-Mar-08	17-Mar-08	0	21-Mar-08	21-Mar-08	21-Mar-08	21-Mar-08
5033101	Place Topping Slab - Electrical	0220 - 1 - Normal	3	3	18-Mar-08	20-Mar-08	0	08-Apr-08	09-Apr-08	24-Mar-08	26-Mar-08
5072103	Install Vapor Retarder, Electrical Roof	0220 - 1 - Normal	1	1	21-Mar-08	21-Mar-08	0	21-Apr-08	21-Apr-08	28-Mar-08	28-Mar-08
5072104	Install Insulation, Electrical Roof	0220 - 1 - Normal	1	1	24-Mar-08	24-Mar-08	0	22-Apr-08	22-Apr-08	31-Mar-08	31-Mar-08
5075352	Install Membrane Roofing, Electrical Roof	0220 - 1 - Normal	5	5	25-Mar-08	31-Mar-08	0	23-Apr-08	24-Apr-08	02-Apr-08	08-Apr-08
5076202	Install Flashing, Electrical Roof	0220 - 1 - Normal	1	1	01-Apr-08	01-Apr-08	0	23-Apr-08	23-Apr-08	09-Apr-08	09-Apr-08
5169052	Connect Switchboard	0220 - 1 - Normal	15	15	02-Apr-08	22-Apr-08	0	05-May-08	30-May-08	10-Apr-08	30-Apr-08
5163623	Connect Primary Power	0220 - 1 - Normal	2	2	23-Apr-08	24-Apr-08	0	07-Jul-08	11-Jul-08	01-May-08	02-May-08
6000200	Component Test Hammock	0220 - 1 - Normal	15	15	25-Apr-08	15-May-08	0	29-Sep-08	05-Dec-08	12-May-08	30-May-08
6000100	System Testing	0220 - 1 - Normal	15	15	16-May-08	05-Jun-08	0	03-Nov-08	12-Dec-08	02-Jun-08	20-Jun-08
6016617	Operational Test	0220 - 3 -	30	30	06-Jun-08	05-Jul-08	0	24-Nov-08	14-Jan-09	21-Jun-08	20-Jul-08
1010210	Actual Substantial Completion Date	0220 - 3 -	0	0		05-Jul-08	0		15-Jan-09		21-Jul-08
1010211	Final Completion Date	0220 - 3 -	0	0		19-Aug-08	0		09-Mar-09		04-Sep-08



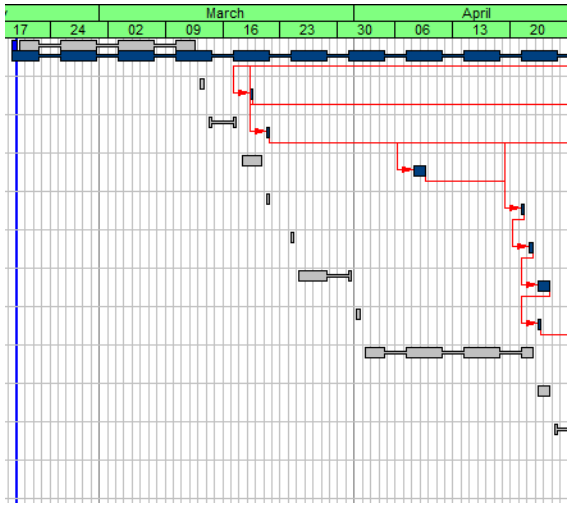
Windows Analysis

P6 Steps – Settings

- Earned Value Setting determines which values are shown for the P6 baselines



- P6 default is to show the logic on the Baseline not the current schedule



Other Delay Analyses

P6 potential Issues

- As-planned vs. As-built (Observational)
- Half Step (Observational / split)
- Impacted as-planned (Modeled)
- TIA (Modeled)
- Collapsed As-Built (Modeled)

Other Delay Analyses

Modeled Approaches

- Not Contemporaneous
- Does no need to match Project schedules since it is a modeled approach
- Opposing expert must be able to recreate analysis
- Expert should be prepared to provide database settings

Other Delay Analyses

Observational

- Observational (no changes to schedules)
- Contemporaneous
- Must match project schedules
- Must create multiple copies of each schedule 
- Opposing expert must be able to recreate analysis
- Importing Progress (Excel vs. Update Baseline)  

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Delay Analysis Using P6

Let's assume that we are performing a delay analysis on a 3000 activity schedule spanning 12 months and examine the extra hours required to do such an analysis utilizing P6 instead of P3 – this is a very small project!

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Delay Analysis Using P6

1. Create Database

   - P3 – Did not have to do this

   - P6 – Can take a couple of hours depending on how much information is available from schedule's owner – needs lots of SQL knowledge - Assume 1 hour

Delay Analysis Using P6

2. Restore / Import schedule files

   - P3 – It was possible to restore schedules in P3 in minutes

   - P6 – Can take over an hour to import a large file – Assume 1 hour

Delay Analysis Using P6

3. Compare electronic schedules to hardcopies

   - P3 – A 3000 activity schedule will take a couple of hours

   - P6 – This will take the same amount of time

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Delay Analysis Using P6

4. Modify electronic schedule to match hardcopy

   - P3 – Generally if you receive the official project file there is no modification necessary

   - P6 – This matching process can take hours and hours due to the long list of things that can be different – Assume 4 hours – Can take more

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Delay Analysis Using P6

Thru this point in time we have estimated that it will take us an additional 5 hours per update to get the P6 file to match the hardcopy file that was distributed on the project each month and 1 hour to create the database

- 5 hours per update times 12 updates =60 hours
- 60 hours + 1 hour to create database = 61 hours

We are up to 61 additional hours on a small job and we haven't even started the analysis!

Delay Analysis Using P6

5. Determine as-built schedule for actual dates

   - P3 – A 3000 activity schedule will take a couple of hours
   - P6 – This will take the same amount of time

Delay Analysis Using P6

6. Copy initial schedule used in analysis

   - P3 – It was possible to copy schedules in P3 in minutes

   - P6 – Can take over an hour to copy a large file – Assume 1 hour, could be more depending on complexity of project.

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Delay Analysis Using P6

7. Create and assign baseline (target) to initial schedule used in analysis

- P3 – It was possible to assign target schedules in P3 in minutes
- P6 – Can take over an hour to create and assign a baseline file – Assume 1 hour because you must make a copy of the schedule

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Delay Analysis Using P6

Thru this point in time we have estimated that it will take us an additional 7 hours per update to get the P6 baseline (target) files copied and assigned

- 7 hours per update times 12 updates =84 hours
- 84 hours + 1 hour to create database = 85 hours

We are up to 85 additional hours on a small job and we haven't even started analyzing delay!

Delay Analysis Using P6

8. Create (import) layout

- Using P3 creating a layout may take ½ hour
- P6 – This will take the same amount of time

Note: If the analysis has to change an actual in P6 as a result of some contemporaneous document, this will add more hours due to the re-copy and assign baseline effort – not unlikely

Delay Analysis Using P6

Additional costs

On our small project we determined that it will take an additional 85 hours to perform a delay analysis using P6.

85 hours at an average wage rate of $150/hour equates to a $12,750 cost increase on a very small project – the impact on a very large project will be substantial

Conclusions

- Forensic Analysis in P6 will take longer due to additional steps.

- The accuracy of XER imports depends on the database settings and import options.
  - The analyst may need to request the P6 database settings

- Analyst must understand the P6 import options and be able to explain why they were used.
  - Is the analysis reproducible?

- Analyst needs to be aware that imports will not always match the project schedules.

- The best way to ensure that the schedules match the project schedules is to obtain a copy of the database.

Conclusions

- Testimony issues – be prepared to have the opposing side accuse you of messing up the schedule import!

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Questions / Comments

References

Living with P6 Databases
July 16, 2012
Ron Winter, PSP

CDR.11—P6 Discovery Under the Federal Rules of Civil Procedure
2009 AACE International Transactions
Kelly Wallace & Kenji Hoshino

CDR.966-Creating Mid-Period Schedules in Window Analysis Using Primavera Version 6
2012 AACE International Transactions
Patrick M. Kelly

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Thank You

This Concludes Our Presentation

Contact Information

Name: Glen R. Palmer, PSP, CFCC
Title: Owner
Company: GR Palmer Consulting Services, LLC
Email Address: gpalmer@gpalmer.com
Phone Number: +1 (603) 591-6754

Name: J. Scott Palmer, PE, PSP
Title: Owner
Company: PCF/Alta Cascade, Inc.
Email Address: spalmer@altacascade.com
Phone Number: +1 (253) 864-6800