ORACLE PRIMAVERA P6 DELAY ANALYSIS TECHNIQUES

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Abstract

- Many construction contracts specify that a delay must be calculated on the critical path of the contract program,

- Often project programs are completed in Oracle Primavera P6 and therefore to demonstrate a delay the scheduler needs to add delays to the program to calculate the delay value,

- This paper outlines the various techniques for demonstrating delays using Oracle Primavera P6 .

What is a Delay?

Delay may be defined in contracts in many ways including:

- An event that impacts the timing of projects activities and may impact on:

  - The contract end date,

  - Stage end date, or

  - The date for Practical Completion,

- It may also be defined as:

  - An impact to the Critical Path, or

  - An event that consumes Float,

  - An event that causes work to start or finish later than planned,

- It is important that you check that what you intend to claim as a delay is claimable under the contract,

- Also make sure you know any time bars for submitting claims.

How to perform a Delay Analysis

The process of performing a Delay Analysis should be based on evidence derived from project records:

- Identify the delays and the time periods that they impacted on the project,
- Select the appropriate "Delay Analysis" process based on the available evidence,
- Impact the schedule(s) with the evidence objectively,
- Calculate the impact to the schedule for each delay,
- Assign the responsibility for each delay,
- Calculate the delay impact by each party,
- Apply contract terms and conditions to the impacts,
- Evaluate damages.

Delay Categories

Delays are often assigned categories such as:

- **Inexcusable -** an extension of time is NOT granted.

- **Excusable -** an extension of time would be granted.

- **Compensable -** an Excusable delay and costs would be paid.

- **Non-Compensable -** an Excusable delay and costs would NOT be paid.

Understanding Delays

Before a delay may be assigned a category it must have a value calculated and delays may occur in different ways for example:

- They may occur at the start of the activity,
- They may occur during the activity and therefore splitting the work and the activity is no longer contiguous, and the crew are not gainfully engaged in work,
- There may be a reason for low productivity and resulting in the work taking longer,
- The delay may affect one activity, or it may affect multiple activities, for example:
  - A delay affecting one activity could be a delay in delivering some equipment,
  - A delay affecting multiple activities might be a delay where there is adverse weather affecting the whole site.
- It may be on the critical path, or it may be off the critical path,
- Some delays may initially not be on the critical path and have float but then may result in the activity being moving on to the critical path. In this case the full delay of the activity is not equal to the critical path delay.
- Finally, how you demonstrate acceleration in a program? I'll cover this issue as well.

Assigning Delays and Software Functionality

- This process of adding delays to a program is often not obvious and there are several techniques that I will document in this paper that show you methods that you can use to demonstrate delays and calculate delay values,

- One issue with P6 is that it does not allow the splitting of activities into multiple splits like many other software packages, except for the **Suspend and Resume** function allowing one split in an activity,

- This option available in other software is often useful in the evaluation of delays.

Aim and Methodology

- The aim of this paper is to demonstrate various techniques of assigning delays to activities in an Oracle Primavera P6 program, which will in turn allow you to select the method that is appropriate to your project and activities,

- I will also outline the advantages and disadvantages of each technique.

Methodology

- I will use a very simple program with a few activities, a finish milestone and a baseline to represent the Contract Program demonstrate the various methods of assigning delays against a single activity,

- In all the pictures the Contract Program is the lower bar in the picture,

- We will look at:

  - Adding an activity to represent a delay before the activity starts,

  - Adding an activity to modelling a delay after activity starts,

  - Breaking the original activity into multiple activities to model multiple delays,

  - Modeling delays using a calendar,

Adding delays to represent a delay before the activity starts Extending the Duration of the Delayed Activity

- The simplest method of adding a delay to an activity is just extending the duration.
- The pictures below show the before increasing the duration of the **Equipment Delivery**:
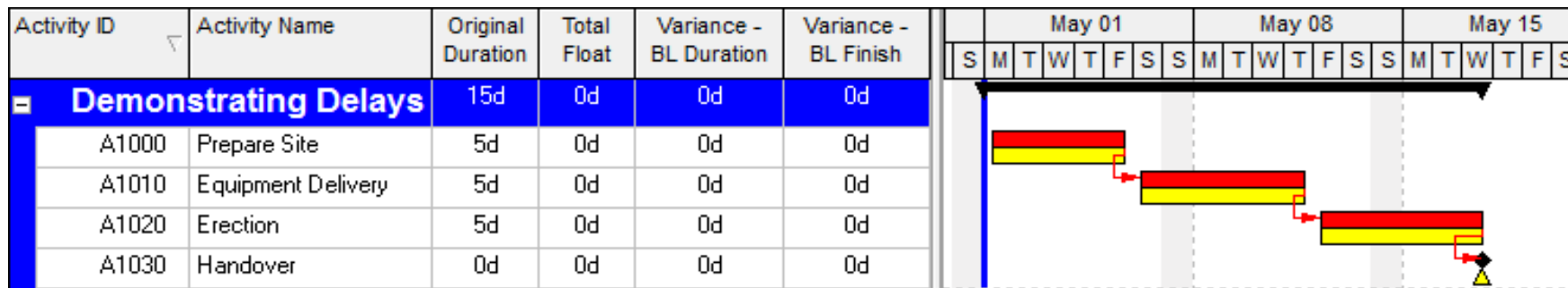
- And after increasing the duration of the **Equipment Delivery** activity to demonstrate a delay to the delivery of the equipment:
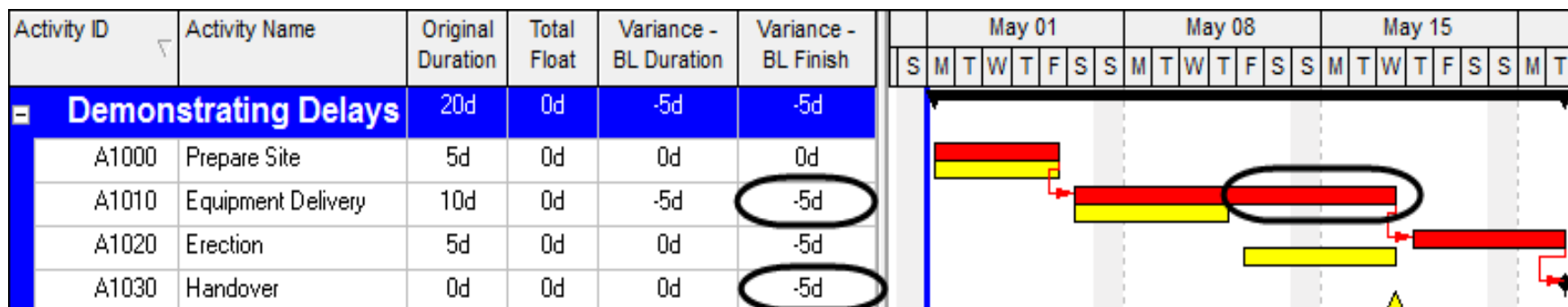
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Adding delays to represent a delay before the activity starts Extending the Duration of the Delayed Activity

Advantages

- It is very simple and easy to increase the duration of activity and demonstrate the delay to the project end date.

Disadvantages

- It does not show if the delay is at the beginning of the activity or in the middle of the activity,

- It does not show you the value of the delay,

- If the activity is a resourced activity, then the cost will be increased which is undesirable if the resource is were not working during this period,

- It is not possible to simply zero out the duration of the activity in order to bring the project schedule back to its original status,

- It is not simple to identify client or contractor delays.

Recommendation

- I suggest you do not use this method.

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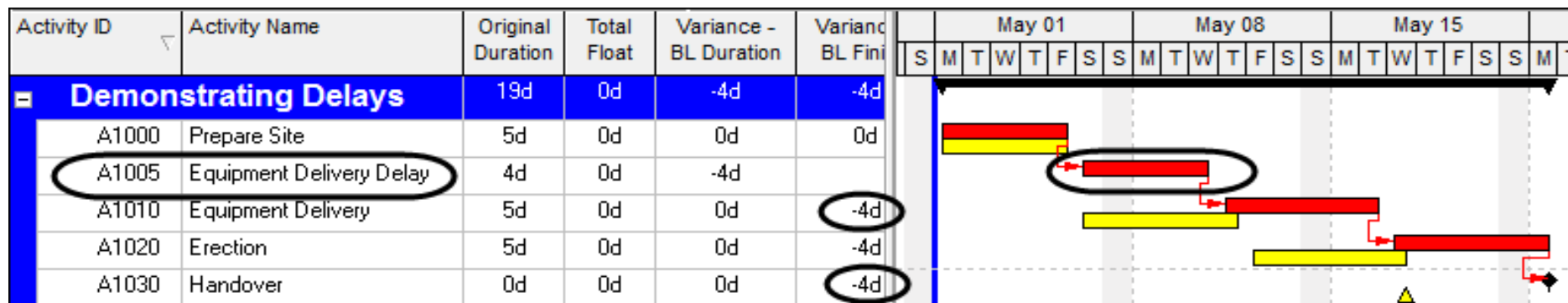**Project Controls EXPO**
Melbourne, Australia

Adding delays to represent a delay before the activity starts
Adding a delay activity before the start of the delayed activity

- This method inserts an activity to represent the delay before the activity starts.

- Before adding a delay activity:
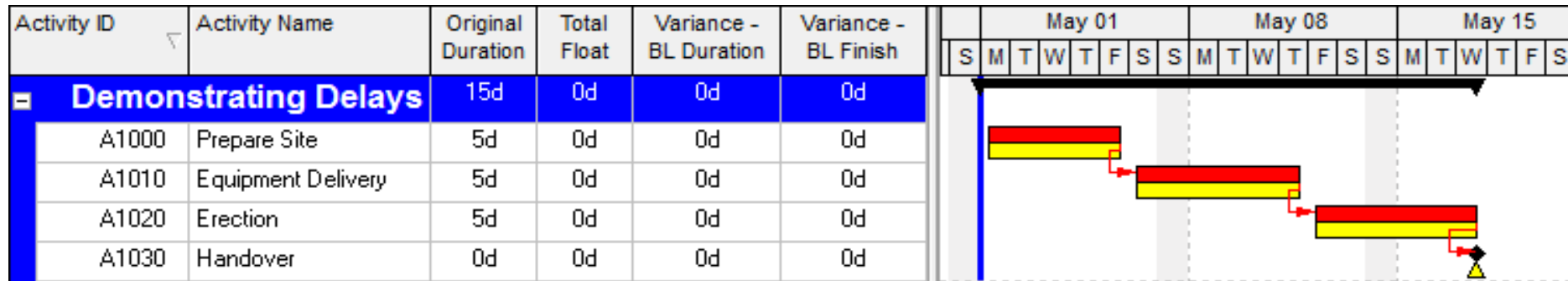
- After adding a delay activity:

Adding delays to represent a delay before the activity starts
Adding a delay activity before the start of the delayed activity

Advantages

- This is a good method to demonstrate a delay to the start of an activity.

- The cost of the delay could be modeled by assigning resources to the delay activity.

- It is also simple to change the duration to zero to remove the delay and create a collapsed schedule.

- Multiple delay activities may be used to identify customer and contractor delays.

- It is also possible to code up activities and then be able to filter them out by client or contractor delays and zero out either the contractor or the client delays to calculate the impact of either the client or the contractor's delays.
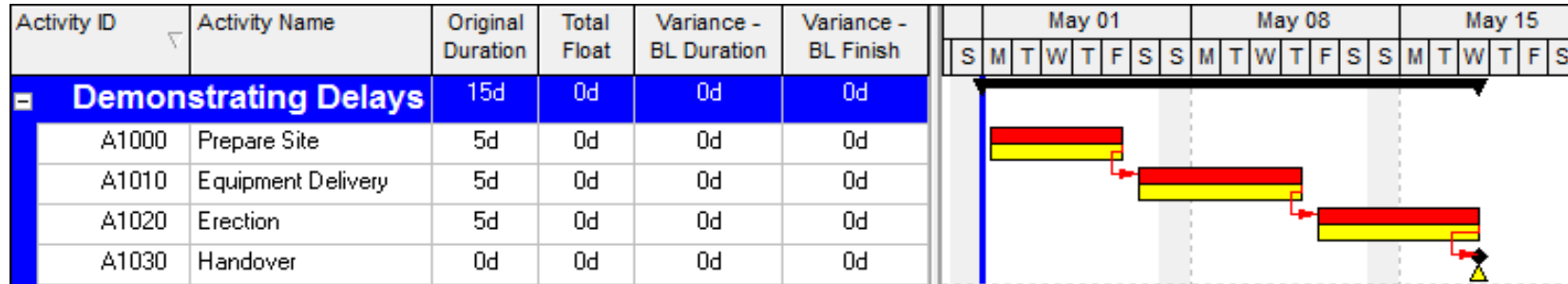
Disadvantages

- I cannot identify any real disadvantages with this method.
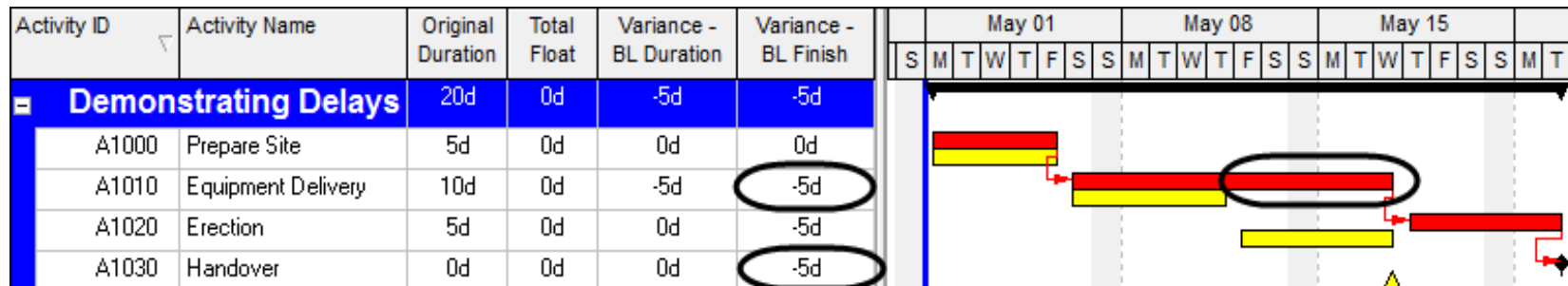
Recommendation

- This is the method I recommend for all activities when there are delays before the work starts.

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Modelling a delay after an activity starts
Extending the Duration of the Delayed Activity

- This is exactly the same method as demonstrated earlier and I do not recommend you use this for the same reasons.
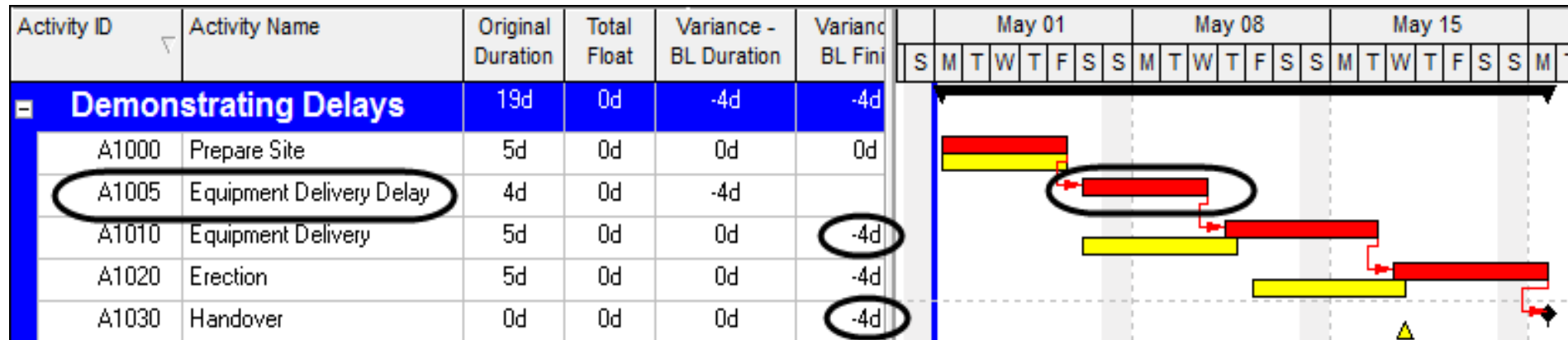
- Before adding a delay activity:

Activity ID	Activity Name	Original Duration	Total Float	Variance - BL Duration	Variance - BL Finish
Demonstrating Delays		15d	0d	0d	0d
A1000	Prepare Site	5d	0d	0d	0d
A1010	Equipment Delivery	5d	0d	0d	0d
A1020	Erection	5d	0d	0d	0d
A1030	Handover	0d	0d	0d	0d

- After adding a delay activity:

Activity ID	Activity Name	Original Duration	Total Float	Variance - BL Duration	Variance - BL Finish
Demonstrating Delays		20d	0d	-5d	-5d
A1000	Prepare Site	5d	0d	0d	0d
A1010	Equipment Delivery	10d	0d	-5d	-5d
A1020	Erection	5d	0d	0d	-5d
A1030	Handover	0d	0d	0d	-5d

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Modelling a delay after an activity starts
Adding a delay activity before the start of the delayed activity

- If the delay occurs after the activity starts then it is best not to put the delay at the start as one would want to set the actual start of the original activity when the activity started.
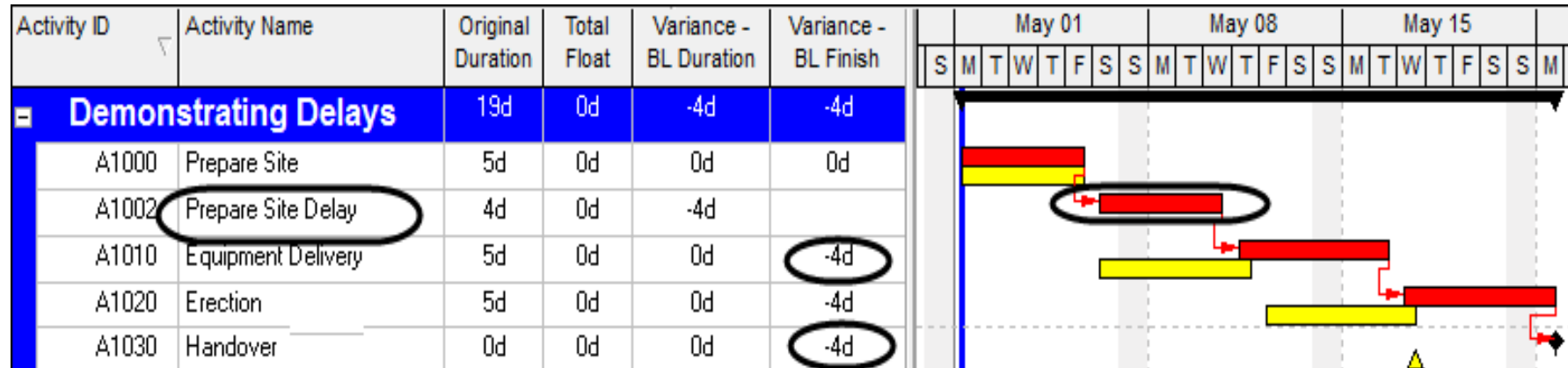

- This method does not identify when the delay occurred.

- On the other hand if there is sufficient description in the activity name then this method could be suitable, but not ideal.

Modelling a delay after an activity starts
Adding a delay activity after the delayed activity

- The picture below shows a delay activity A1002 Prepare Site Delay has been added after the original activity duration.

- Again, this has the issue as before and this method does not identify when the delay occurred.

- On the other hand if there is sufficient description in the activity name then this method could be suitable, but not ideal.

Modelling a delay after an activity starts
Using Oracle Primavera P6 Suspend and Resume

- It is unfortunate that the P6 Suspend and Resume requires the activity to have started but the picture below demonstrates how you can use the Suspend and Resume.

- You may also add an additional activity added below to represent the value of the delay.

Modelling a delay after an activity starts Using Oracle Primavera P6 Suspend and Resume

Advantages

- It keeps the activity at completion duration equal to the working time of the activity.

- It is simple to demonstrate the delay value by the addition of a second activity below as indicated in the picture above by the addition of the Erection Delay activity that has been added with a Start On constraint.

- The cost of the delay could be modeled by assigning resources to the delay activity.

Disadvantages

- Because the Oracle Primavera P6 Suspend and Resume function requires the activity to have an actual start then this process may not simply used in a Collapsed As Built scenario, one has to remove the suspend and resume dates.

- This only allows for one delay to be assigned to an activity.

- The delay activity is not linked in logically.

Recommendation

- This method is suitable if you do not wish to collapse a schedule.

Modelling a delay after an activity start
Breaking the original activity into multiple activities

- The way this method works is it you shorten the first part of the activity then you added delay activity and then you add a new activity for the remaining work.

- You will see in the picture below that I have changed the name of the Erection activity to Erection First Part and reduced the duration; I have added an Erection Delay activity an Erection Second Part activity and linked them together.
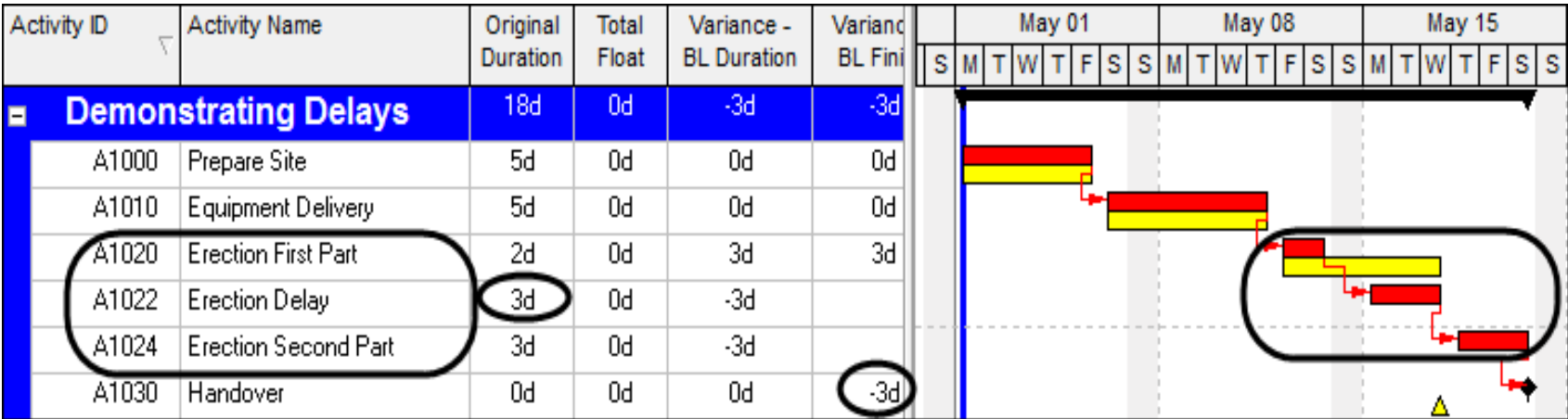
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Modelling a delay after an activity start
Breaking the original activity into multiple activities

Advantages

- It may be used for a collapse as built by changing the delay activity durations to zero.

- It is possible to assign codes and filter out delays and zero out either the client or the contractor delay to evaluate the total delay by the contractor all the client on a project schedule that has not been updated with actuals.

- This method allows multiple delays that the Suspend and Resume function does not allow.

- The cost of the delay could be modeled by assigning resources to the delay activity.

- It clearly identifies when the work started and finished and when the delay happened.

Disadvantages

- The disadvantage of this technique is that the baseline for the activity titled **Erection First Part** is also relevant for the activity **Erection Second Part**, but is not associated with that new activity.

Recommendation

- Again, this is not Ideal for demonstrating a delay in the middle of a task.

Making the original activity an LOE and adding detailed activities underneath

- This method is a variation on the method above but in this case the original activity is made into an LOE activity and then detailed activities are added below.
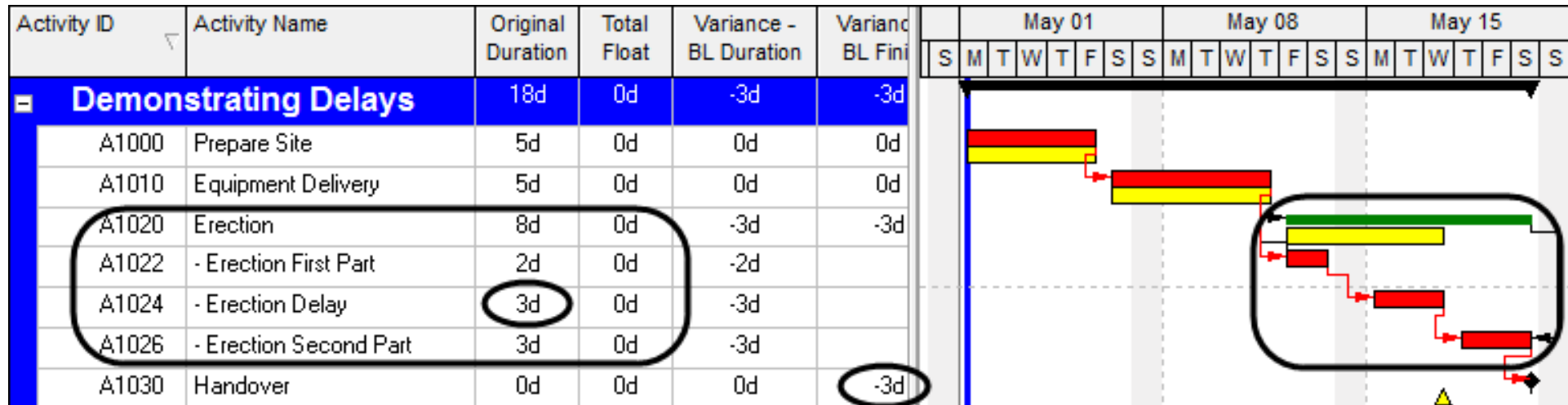
Making the original activity an LOE and adding detailed activities underneath

Advantages

- It clearly identifies when the work started and finished and when the delay happened.

- The advantages of this method is it that can be used for a collapse as built by changing the delay activity durations to zero.

- It is possible to assign codes and filter out delays and zero out either the client or the contractor delay to evaluate the total delay by the contractor all the client on a project schedule that has not been updated with actuals.

- This method allows multiple delays that the Suspend and Resume function does not allow.

- And unlike the method above, the baseline for the erection activity is now directly related to the level of effort duration.

Disadvantages

- This technique requires significantly more work to demonstrate the delay.

Recommendations

- This is the recommended method in Primavera P6 to demonstrate a delay in the middle of an activity if you have the time to do it.

Modeling delays using a calendar
Modeling a delay against a single activity

- If you wish to model a delay against a single activity using a calendar, then you will need to create a new calendar just for that activity and assign that calendar to the single activity.

- In this example I have created a new calendar called **Activity A000 Delay Calendar**, assigned three non-work days to it and assigned the calendar to the activity.

Modeling delays using a calendar against a single activity

- You can see the impact of the delay on the Equipment Delivery activity in the picture below.
- In the picture below you are unable to see which days are not working.
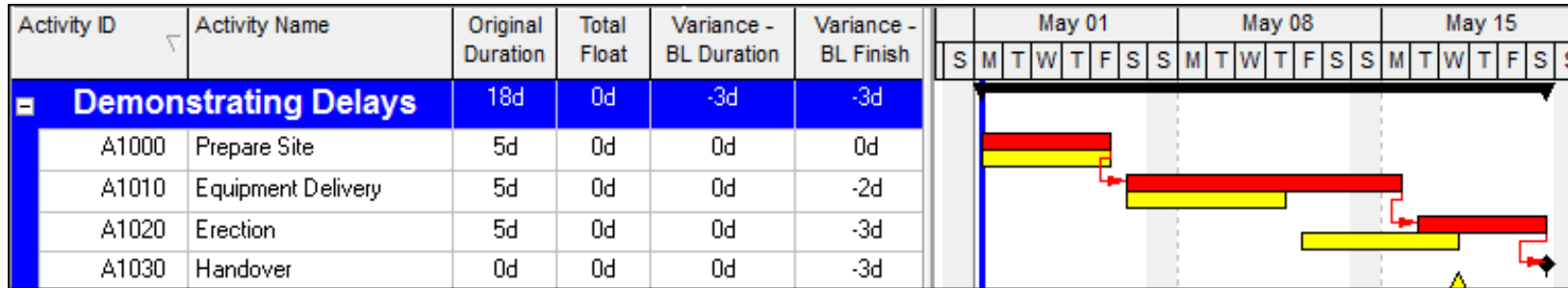
- In the picture below I have switched on bar necking for the Calendar Nonwork Intervals option and you may now see the days that the activity is not working:
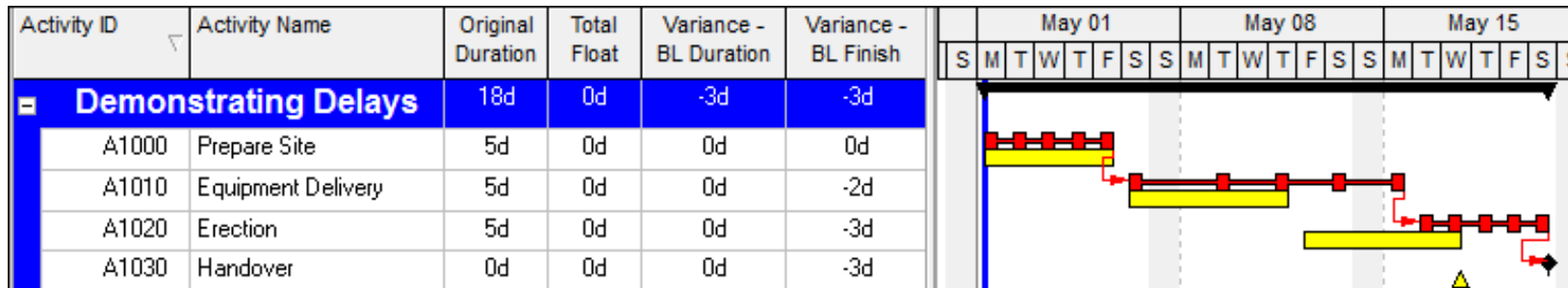
- Another option in P6 would be to change the Global Default Calendar to show the delay calendar with non-work periods but this will affect every project in the database and is not a recommended method.
- Or finally a curtain could be added to demonstrate non work periods.

Modeling delays using a calendar against a single activity

Advantages

- The duration of the activity that has been delayed remains the correct worked duration.
- By switching on bar necking it is possible to see the days that the activity is not working but this affects every activity in the program.
- The delay may be removed to create a collapsed as built by changing the calendar.

Disadvantages

- The delay value may not be calculated as an activity and only available by inspection over calendar.
- Unlike other products like Microsoft Project notes are not available against calendar non work days in P6 calendars.
- This does not show the value of the delay as an activity.

Recommendation

- This is a suitable method to demonstrate delays.

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Modeling a delay against multiple activities using a calendar

- This method is exactly the same as modeling a delay on a single activity with the calendar but you assign a calendar to multiple activities,

- This method is ideal when a whole site is being shut down due to bad weather or large number of activities can be assigned a calendar to represent inclement weather,

- For example, all crane activities could be assigned a windy weather calendar and when the crane may not be used non work periods are assigned to the windy weather calendar.

Acceleration
Reducing the activity duration

- The first method is to reduce the duration of the activity:

- I do not recommend as the delay is not visible in the program as an activity.

Acceleration
Adding an acceleration activity

- The second method is to put an acceleration activity in and as you increase the acceleration it reduces the end date of the project as per the picture below.

Acceleration
Adding an acceleration activity

Advantages

- The delay activity may be zeroed out to remove the acceleration.
- The delay activity may have codes and be filtered to isolate acceleration activities.

Disadvantages

- The disadvantage of this method is that if you accelerate the last activity in a project then the last activity will be scheduled beyond the end of the project.
- Some people would object to the use of and activity in this unusual manner.
- This method also does not reduce the costs against the delay activity when it is a resourced activity. P6 does not allow negative values against resource but you could assign a negative cost against an expense item to reflect the reduced cost.

Recommendation

- As long as the delay activity does not finish after the project end date I would use it.

Acceleration
Making changes to the calendar

- If the acceleration has been achieved by working on non-work days, such as Saturdays or Sundays, or by increasing them the number of hours per day worked against activities then it may be appropriate to make changes to the calendar.

- The picture below shows the calendar against all the activities has now allowed for Sunday workdays.

| Activity ID	Activity Name	Original Duration	Total Float	Variance - BL Duration	Variance - BL Finish
Demonstrating Delays		15d	0d	2d	2d
A1000	Prepare Site	5d	0d	0d	0d
A1010	Equipment Delivery	5d	0d	0d	1d
A1020	Erection	5d	0d	0d	2d
A1030	Handover	0d	0d	0d	2d

- Again, there are the usual issues not of being able to display the additional work time on the Gantt chart without affecting every other user.

Removing Scope

- If you wish to remove scope is best to maintain a history and as opposed to deleting the activity you should reduce the duration to zero and make a comment in the Activity Name or Notes.

- In the example below we're assuming that there is no equipment to be delivered or is being delivered by the customer and we need to show acceleration due to the equipment delivery activity being removed.

- Before zeroing out the Equipment Delivery activity:
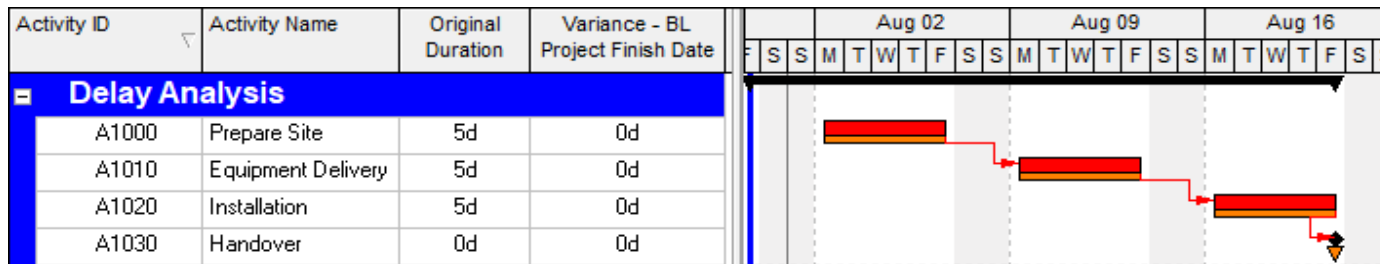
- After zeroing out the Equipment Delivery and the Finish Date has come in by 5 days:
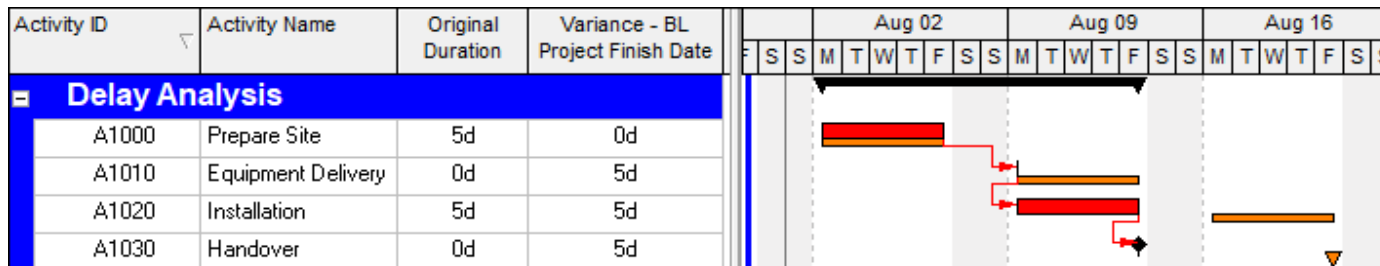
Updating the program after delays have been assigned

- Delays are normally added to activities at each update and it is normal to actualize the program by applying actual starts and actual finishes to activities that are all complete and actual start and remaining durations to those that are in progress, and then the program rescheduled to calculate a new project end date.

- Normally at this point in time the client and contractor delays are transferred to a spreadsheet to calculate the total delay value for each party at the end of the project.

- Another option some companies adopt is not to actualize their schedule and keep the schedule as a live as built program, but this is quite difficult and very rare.

- Then all the delays may be zeroed and a collapsed As Built program is available.

- This process also the gives provides an As Built Critical Path.

- I have written a paper on the three methods of updating a program and you may wish to read this next. You will find the paper here: http://eastwoodharris.com/DL/TP/PS-2768_Rev2018-04-16.pdf

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THANK YOU
ANY QUESTIONS?