

# Oracle Primavera P6 Delay Analysis Techniques

## 1 Introduction

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 demonstrate and calculate the delay.

Delays are often assigned categories such as:

- Inexcusable, an extension of time is NOT granted.
- Excusable, an extension of time would be granted.
- Compensable is an Excusable delay and costs would be paid.
- Non Compensable is an Excusable delay and costs would NOT be paid.

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.

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 is often useful in the evaluation of delays.

## 2 Aim

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

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appropriate to your project and activities. I also outlined the advantages and disadvantages of each technique.

## 3 Prerequisites

### 3.1 Prereading

It is suggested that before you read this paper you should have a good understanding of delay analysis by reading some of the following types of papers:

- AACE International Recommended Practice 29R-03 Forensic Analysis
- Society of Construction Delay and Disruption Protocol

### 3.2 Planning your project

Many contracts are silent on how delay claim values should be calculated and this is the first step in the process is working out how delays are evaluated.

I recommend that the client and contractor agree the method that they are going to use to evaluate delays when the contract is signed and ensure the process is written into the contract, some of the issues you need to agree upon:

- What program will be used to evaluate delays, a couple of options are:
  - The contract program, or
  - The last updated program.
- It is delays only to the critical path, or all delays ,or delays to activities that have high costs that are considered?
- If you are a contractor then will you record and calculate both the Client and Contractor delays or just Client delay?
- Contractors should ensure that they have planned the process of collecting delay information is such a way that it is simple to update the program.
  - Ensure site progress reports have Activity IDs against all items in the report.
  - Ensure they delay claim numbers are used in the daily reports and the updated schedule.
  - Ensure there is a written procedure for the project team to follow.

## 4 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.

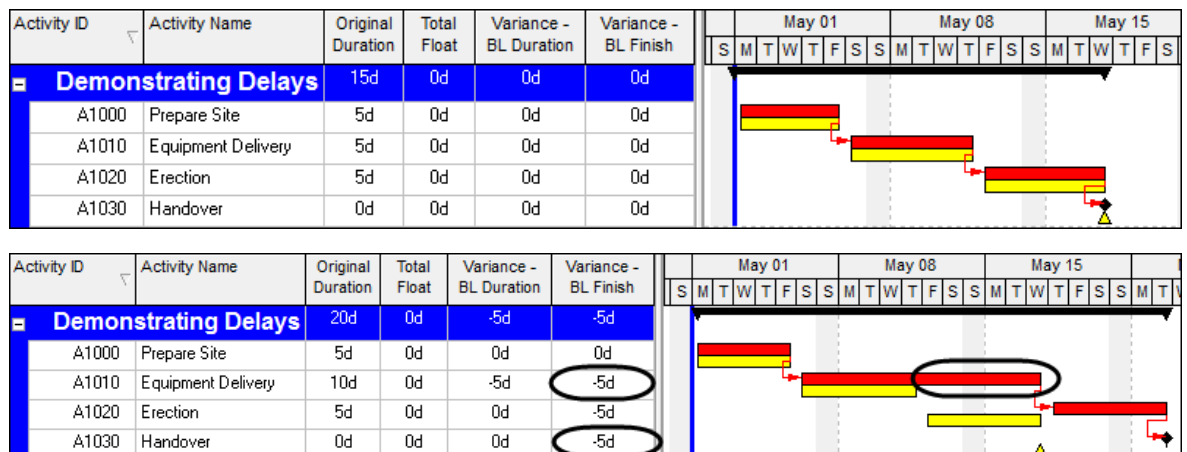
### 4.1 Adding delays to represent a delay before the activity starts

#### 4.1.1 Extending the Duration of the Delayed Activity

The simplest method of adding a delay to an activity is just extending the duration.

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The pictures below show the before and after increasing the duration of the **Equipment Delivery** activity to demonstrate a delay to the delivery of the equipment:



## Advantages

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

## Disadvantages

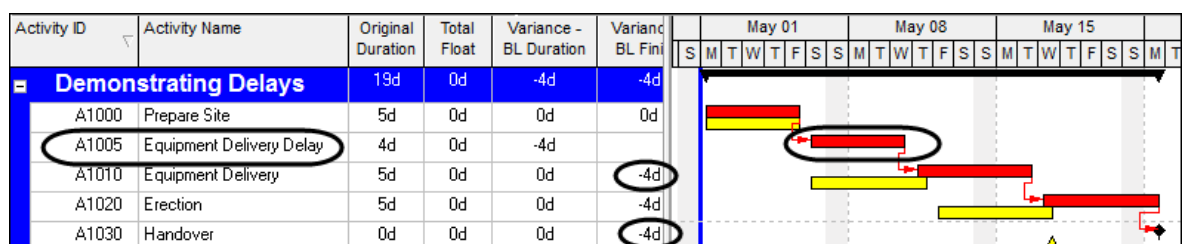
- It does not show if the delay is at the beginning of the task or in the middle of the task.
- It does not show you the value of the delay.
- If the activity is a resourced activity, then the cost will be increased which is undesirable if the resource is were not working during this period.
- It is not possible to simply zero out the duration of the task in order to bring the project schedule back to its original status.
- Not simple to identify client or contractor delays.

## Recommendations

- I suggest you do not use this method.

### 4.1.2 Adding a delay activity before the start of the delayed activity

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



## Advantages

- This is a good method to demonstrate a delay to the start of an activity.
- It could be used to demonstrate a delay in the middle of an activity, as long as there is sufficient evidence in the activity description
- 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.

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- 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 customer or the contractors delays.

## Disadvantages

- I cannot identify any real disadvantages with this method.

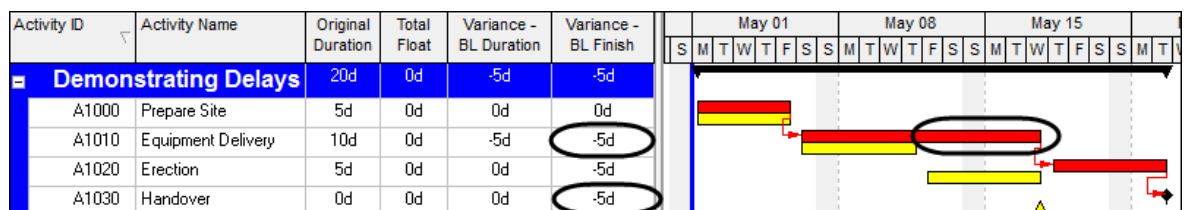
## Recommendations

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

### 4.2 Modelling a delay after an activity starts

#### 4.2.1 Extending the Duration of the Delayed Activity

This is exactly the same method as demonstrated in para 4.11 and I do not recommend you use this.

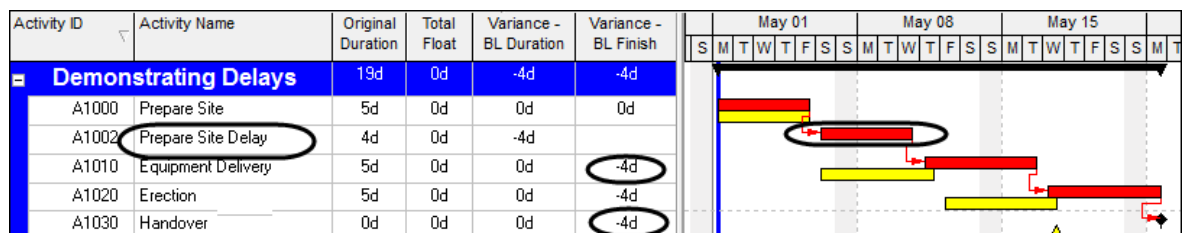


#### 4.2.2 Adding a delay activity before the start of the delayed activity

See the paragraph 4.1.2 above.

#### 4.2.3 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.



## Disadvantages

- The delay activity does not clearly demonstrate when the delay happened.
- The delay does not impact the end date of the delayed activity.

## Advantages

- This is quick and simple.
- This allows the assignment of the delay activities to the contractor or client and filtering against client or contractor delays.
- May provide a collapsed program by zeroing of activity durations

## Recommendations

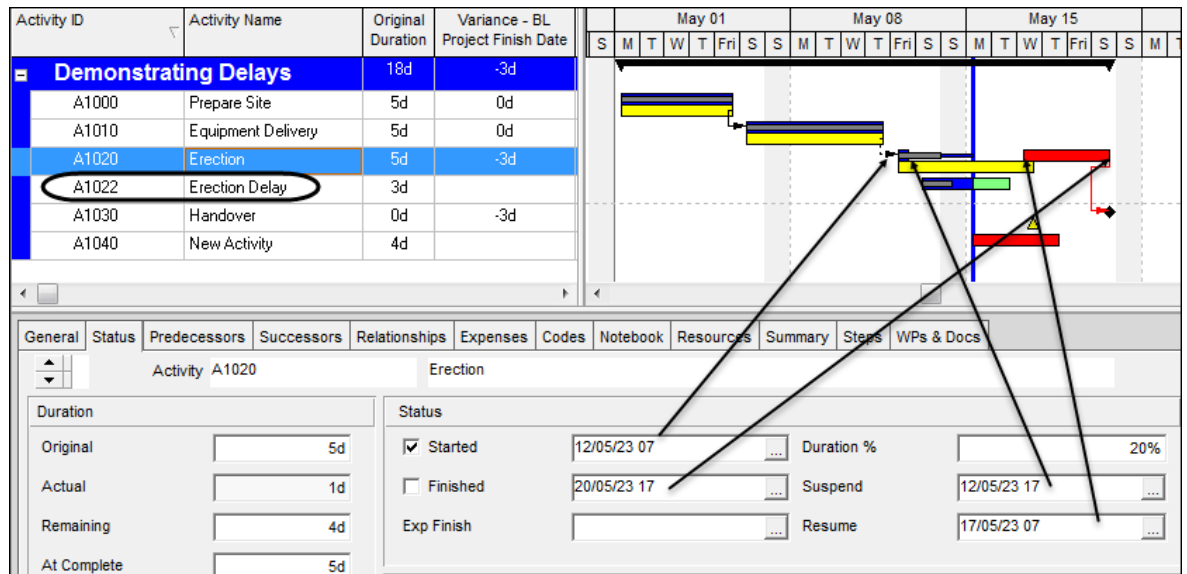
- This method is suitable when the customer is in agreement to allowing delays during an activity execution to be added at the end of a delayed activity.



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### 4.2.4 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 plus add an additional activity added below to represent the value of the delay.



#### 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.

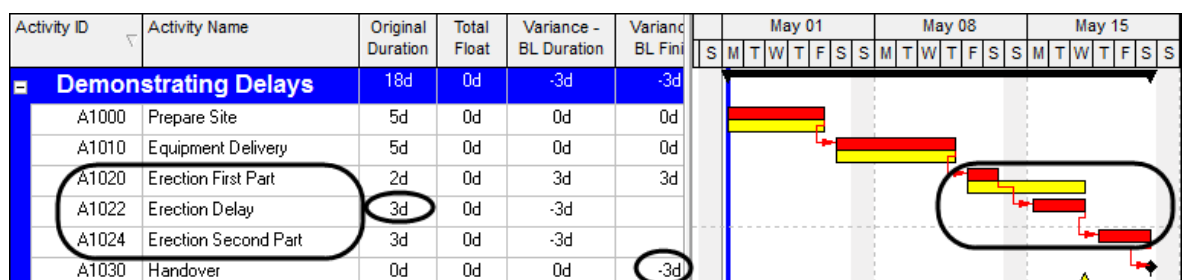
#### Disadvantages

- 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.

### 4.3 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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## Advantages

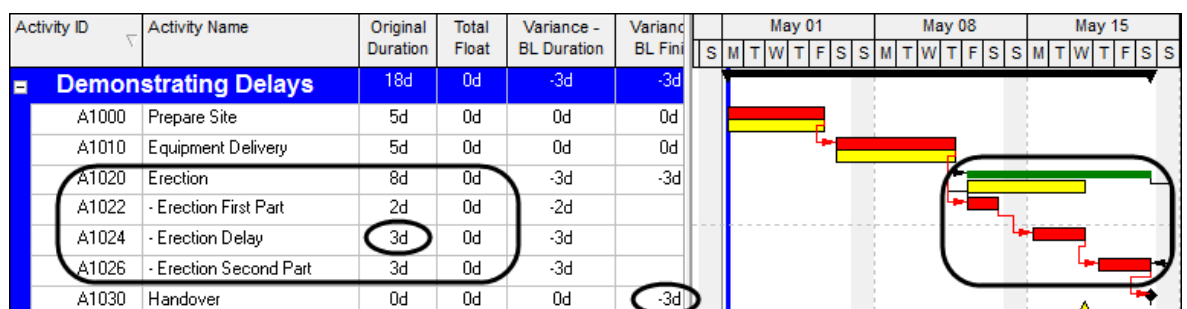
- It may be used for a collapse as built by changing the delay activity durations to zero.
- It is possible to assign codes and filter out delays and zero out either the client or the contractor delay to evaluate the total delay by the contractor all the client on a project schedule that has not been 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 now the task titled **Erection First Part** is also relevant for **Erection Second Part** as well but is obviously not associated with that new activity.
- The original baseline bar does not represent just the one activity as the second part of the activity is below.

### 4.3.1 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.



## Advantages

- 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.
- It clearly identifies when the work started and finished and when the delay happened.
- And unlike the method above now the baseline for the erection activity is now directly related to the level of effort duration.

## Disadvantages

- This technique requires more work to create but gives a very accurate model of the delays against the activity.

## Recommendations

- This is the recommended method in Primavera P6 if you have the time to do it.

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## 4.4 Modeling delays using a calendar

### 4.4.1 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 task 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.

Project Calendar: Activity A1000 Delay Calendar

☐ Total work hours/day ☒ Detailed work hours/day

May 2023

Mon Tue Wed Thr Fri Sat Sun

1 2 3 4 5 6 7

8 9 10 11 12 13 14

15 16 17 18 19 20 21

22 23 24 25 26 27 28

29 30 31

Work hours

:00-:30 :30-:60

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

OK Cancel Help

Work Nonwork Standard

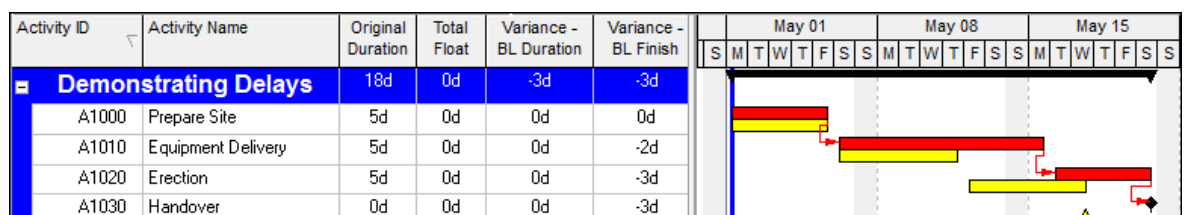
Workweek... Time Periods

Inherit holidays and exceptions from Global Calendar:

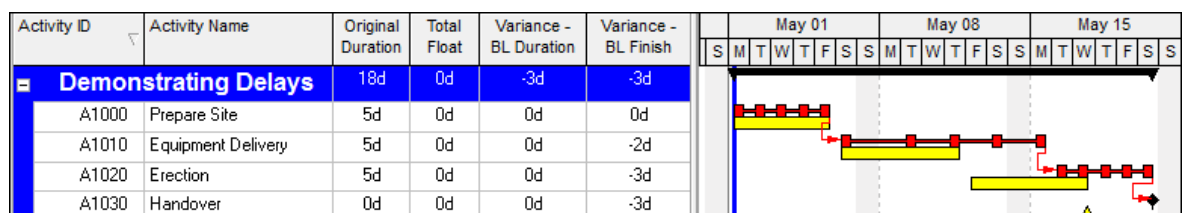
B 10h/d 6d/w Inc PH Resources and...

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 in the **Bars** form, 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 calendar with non-work periods but this will affect every project in the database and is not a recommended method.

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## Advantages

- The duration of the task 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.

### 4.4.2 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.

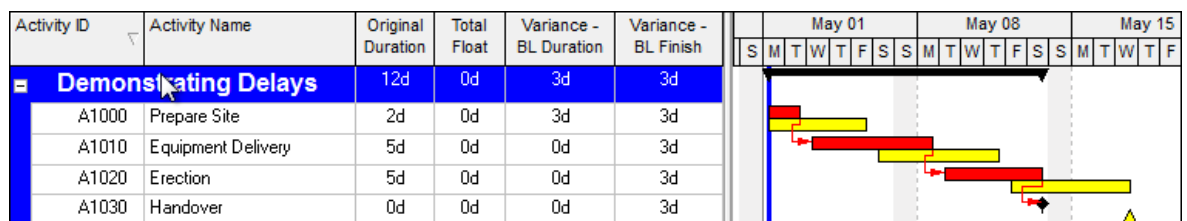
For example, all crane activities could be assigned a windy weather calendar and when the crane may not be used non work periods are assigned to the windy weather calendar.

## 5 Acceleration

There are several methods of demonstrating acceleration:

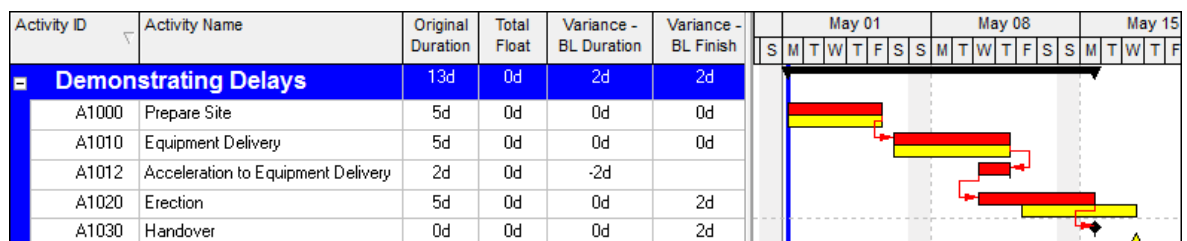
### 5.1 Reducing the activity duration

The first one is to reduce the duration of the activity which I do not recommend as the delay is not visible in the program.



### 5.2 Adding an acceleration activity

The second one 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.



## Advantages

- The delay activity may be zeroed out to remove the acceleration.



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- The delay activity may have codes and be filtered to isolate acceleration activities.

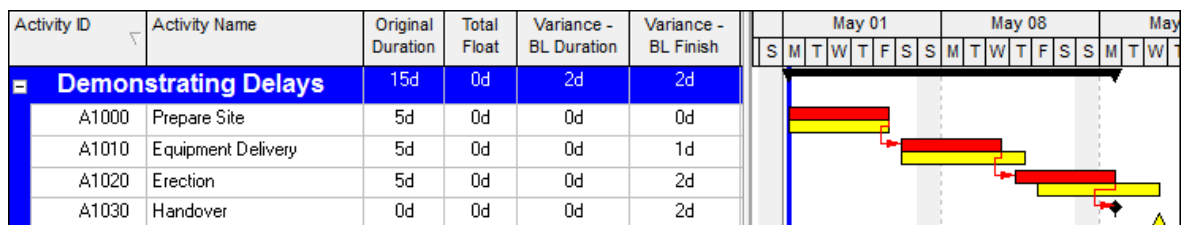
### Disadvantages

- 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 an activity in this unusual manner.
- This method also does not reduce the costs against the activity if it is a resource activity. P6 does not allow negative values against resource but you could put a negative cost against an expense item to reflect the reduced cost if the overheads were shortened

### 5.3 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.

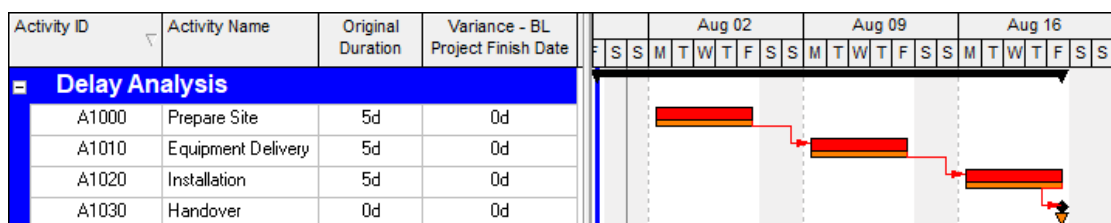


## 6 Removing Scope

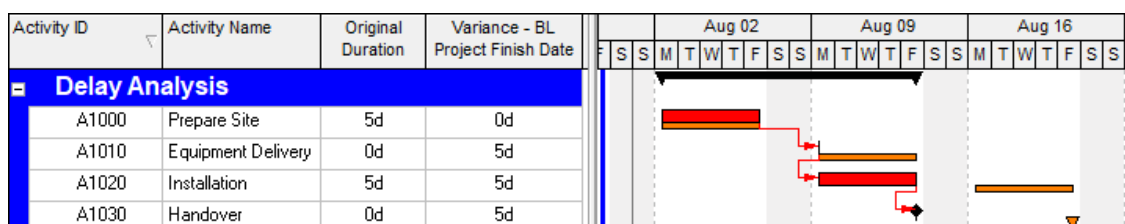
If you wish to remove scope is best to maintain a history and as opposed to deleting the task you should reduce the duration to zero and make a comment in the **Activity Name** or **Notes**.

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:



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## 7 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 two 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 client and contractor delays I'll transfer to a spreadsheet to calculate the total delay value for each party at the end of the project.

Another option that some companies adopt is not to actualize their schedule and keep what I term 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. 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](http://eastwoodharris.com/DL/TP/PS-2768_Rev2018-04-16.pdf)

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