

## White Paper –

# Using S-Curves to improve Project Performance

Ever increasing pressure on businesses to deliver projects on time and to budget means that accurate monitoring of progress, resources and costs are even more important than ever before.

Creating a schedule of activities and a critical path using Project Management software tells us when our project will finish. Adding progress and actuals and then rescheduling the remaining work will give us a revised completion date.

However, it can be very difficult to visualise how the project is performing and as importantly, how likely to perform from a Gantt chart, particularly when the schedule contains hundreds or thousands of activities.

Creating S-Curves from the project data can give us much more information about our project depending on the shape of the curves. Often a client or sponsor will ask for an S-Curve as part of the regular progress report, however, even if this isn't requested, it is recommended that they are used alongside traditional project management software to improve project performance and monitoring.

Creating S-Curves can seem a daunting task, especially as they are not a standard feature of most project management software application. Project Tracker provides a one click method of importing data from Primavera P6, Microsoft Project or Asta Powerproject.



Andrew Willard. Director

Willmer Limited

## What is an S-Curve?

An S-Curve allows the status of a project to be monitored graphically as it progresses, and displays an historical record of actuals to date. By analysing the S-Curves, project managers can quickly identify project growth, slippage, and potential issues that may impact the successful outcome of the project should nothing be done.

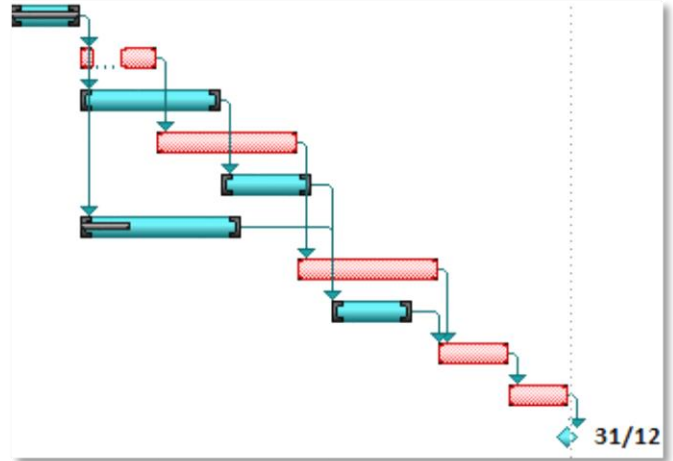
Projects generally start slowly and then accelerate in the middle before slowing down again at the end. This produces a curve which resembles an S, flatter at the start and then rising quickly before flattening out at the end.



## Prerequisites for S-Curves

To create an S-Curve it is important to create the following;

1. A project plan with activities linked together to form a critical path
2. If required the activities are cost and resource loaded
3. A baseline of the activities before the project starts.
4. Actual progress is assigned at regular intervals and optionally, actual costs and actual resource usage is applied
5. A project is rescheduled to determine a new finish date.



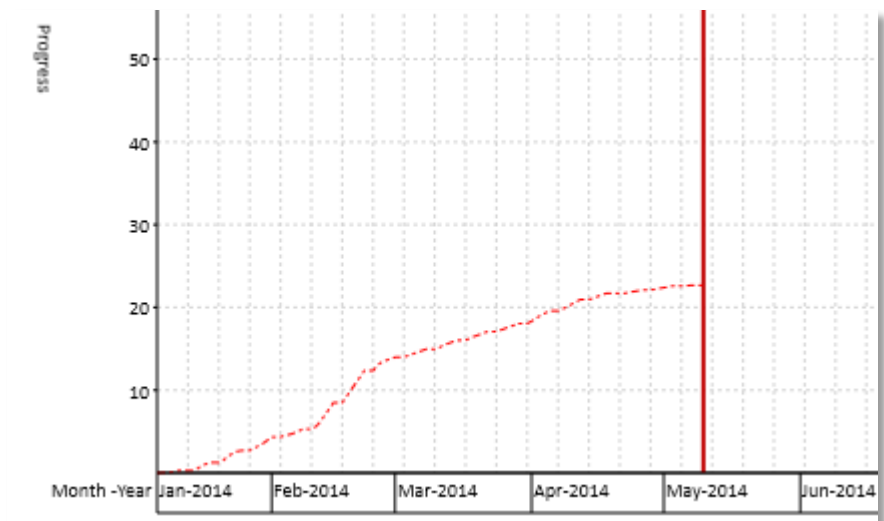
## Understanding the lines in a S-Curve

An S-Curve report can be made up of a number of different curves.

### Actual Line

This line displays the actual progress to date and dependant on the measure used, will show duration, cost or resource units completed. The actual curve is always drawn to the report or data date.

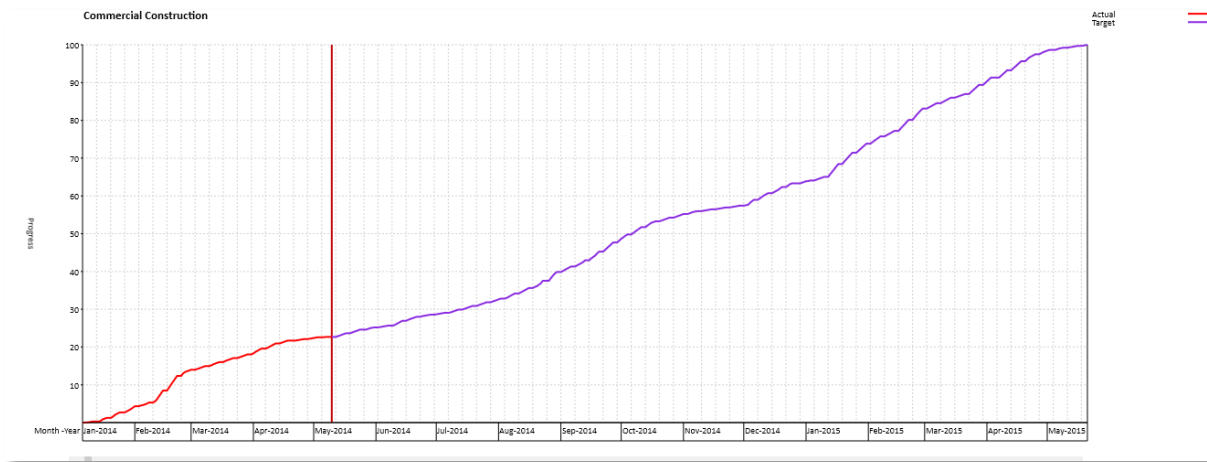
From the example we can see the project is currently 23% complete.





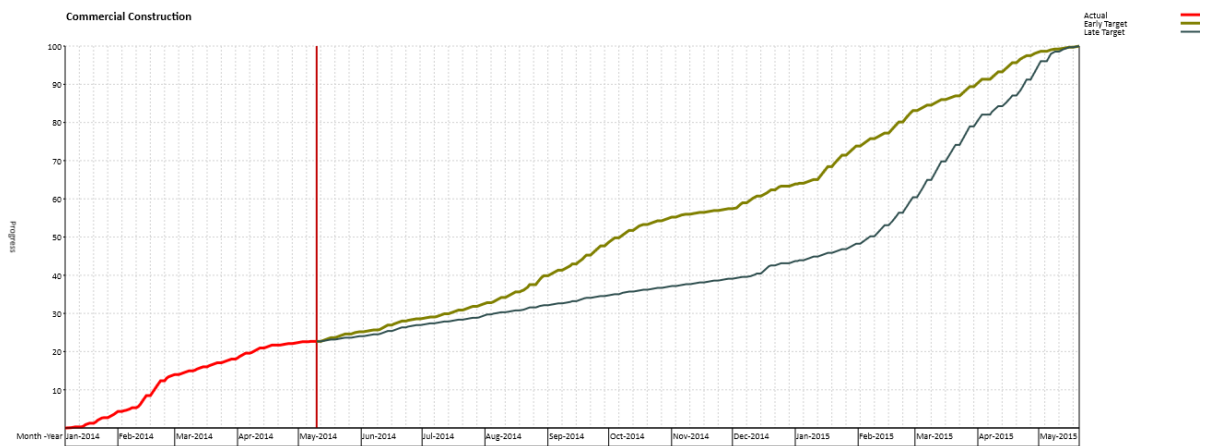
## Target Line

The target line always runs from the report date to the end of the project and reflects the current position of the remaining activities should they be completed as scheduled.



## Early and Late Target Lines

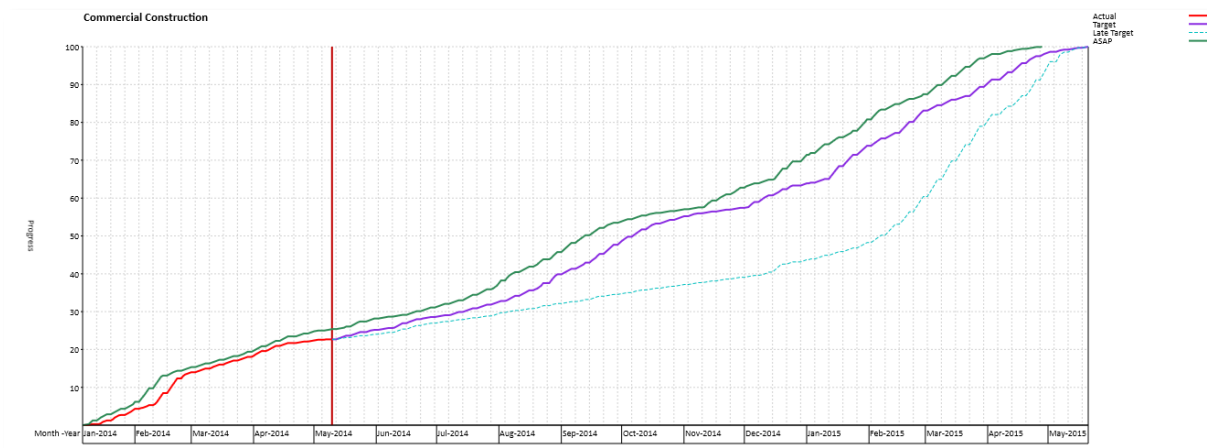
Two additional target lines are useful that display the scheduled position of activities, but in their earliest finish and latest finish date position. Again, these are drawn from the report date and will meet the normal target line.



## Baseline Line

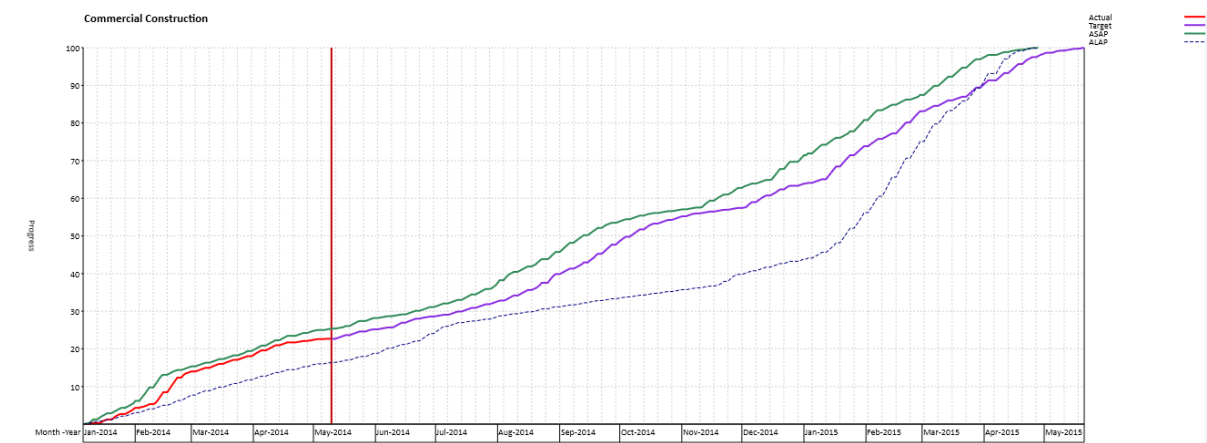
This line plots the position of the activities contained in the baseline. An in schedule plan will mean the baseline curve finishes at the same point as the target line.

Ideally, the Target line will meet the Baseline line at the end of the project (On Time, On Budget) or finish below and to the left of the Baseline S-Curve (Early, Under Budget). In reality, it is not uncommon for the Target S-Curve to finish above and to the right of the Baseline S-Curve (Late, Over Budget). In the example below the target line finishes to the right of the baseline which shows the project is late.



It can be useful to show 2 baseline lines. These could be the original baseline and a revised baseline. It is common practise to show one baseline line as the early dates and one for the late dates in the project.

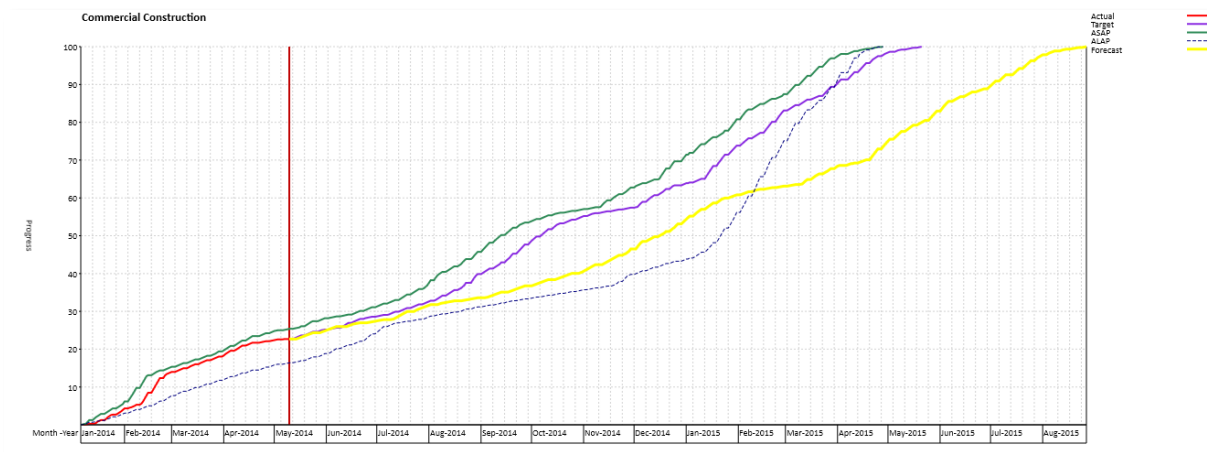
This creates an envelope in which the target line will ideally fit between. In the example below we can see the projects tracks within the envelope until the latter stages of the project.



## Forecast Line

Project Tracker affords us an additional line. This line is drawn from the report date and looks at the progress to date and applies the delay or acceleration in the project so far and applies this ratio to the target. For example if the project was 2 weeks late after 10 weeks of the plan and there is 100 weeks left, the target line will be increased proportionally to give us a projected finish date should we continue at the current rate.

In the example below were we to carry on at the current rate of progress the project will may complete in August 2015.



## Benefits of using S-Curves

Due to the graphical nature of S-Curves, we are able to visualise divergences from the baseline. For team members unfamiliar with Gantt charts they are an exceptional visual aid. The greater the divergence from the baseline indicates worse (or better) performance.

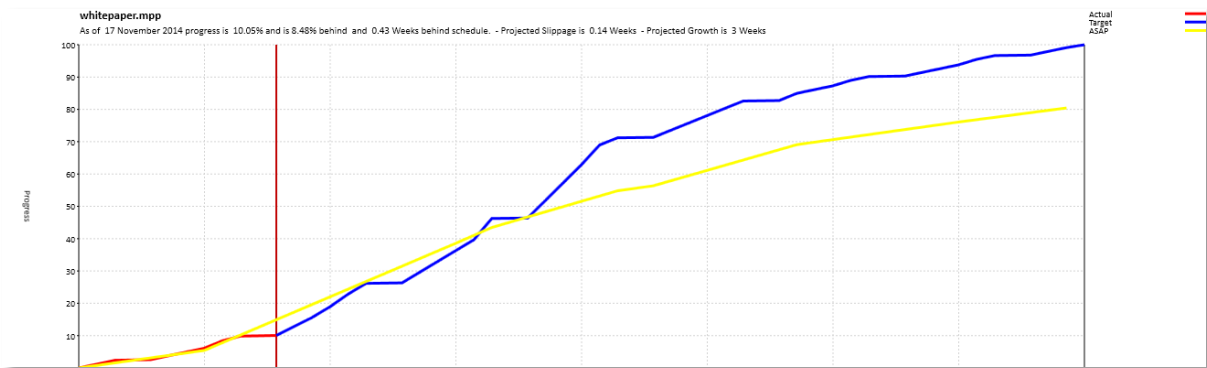
From the S-Curve we can determine 4 key indicators;

- ◇ Project growth
- ◇ Project slippage
- ◇ Actual percentage complete against Target percentage complete to date
- ◇ Actual percentage complete against Baseline percentage complete to date

## Project Growth

If the target curve finishes above the baseline curve the project has grown in scope. Depending on the criteria this will mean there is either more activities in the project or that the duration, cost or resource has increased and contract variations may need to be raised.

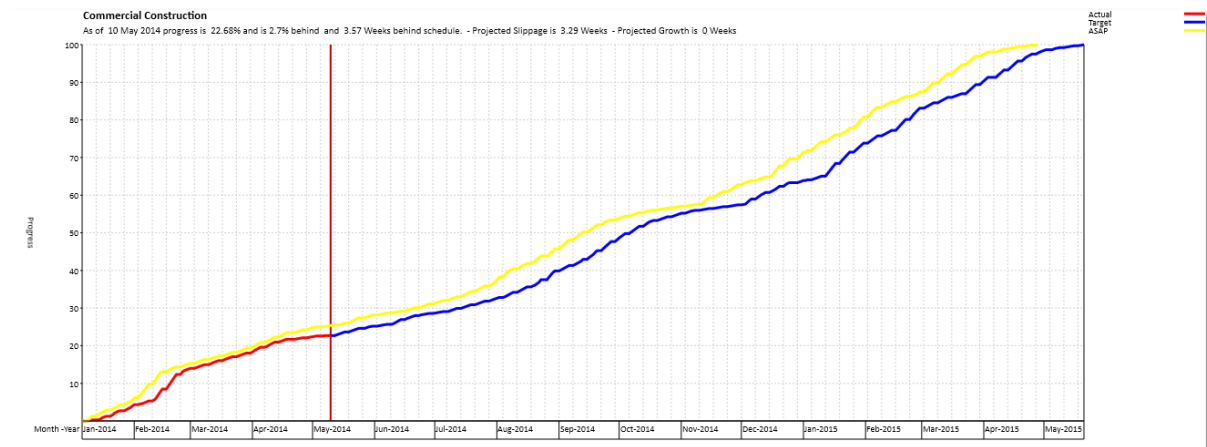
In this example we can see the target line finishes above the target line and that project has grown in scope by 3 weeks.



## Project Slippage

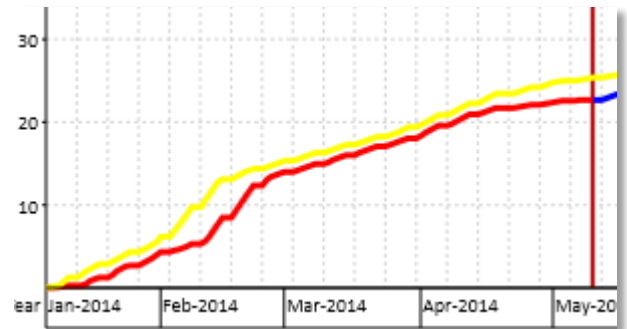
If the target line finishes to the right of the baseline curve, the project has slipped. This means the finish date is compromised and remedial action should be taken or an extension of time requested. Ideally, the target line meets the baseline and indicates an on schedule project or finishes to the left indicating we are ahead of schedule.

In this example the project has slipped by some 3 weeks.



### Actual Percent Complete against target

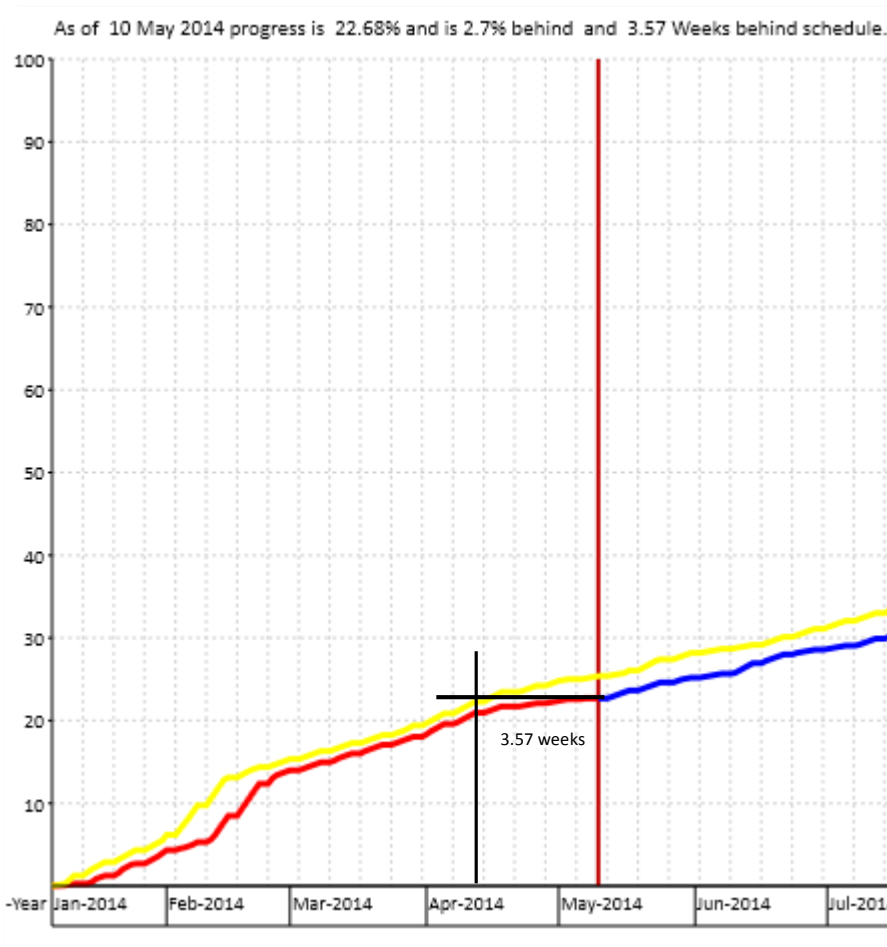
The Actual line will finish at the report date and will be drawn to the current percent complete. In this example the project is 22.68% complete.



### Actual Percent Complete against baseline

By comparing the actual percent against target and calculating where in the baseline this amount of progress should have been achieved.

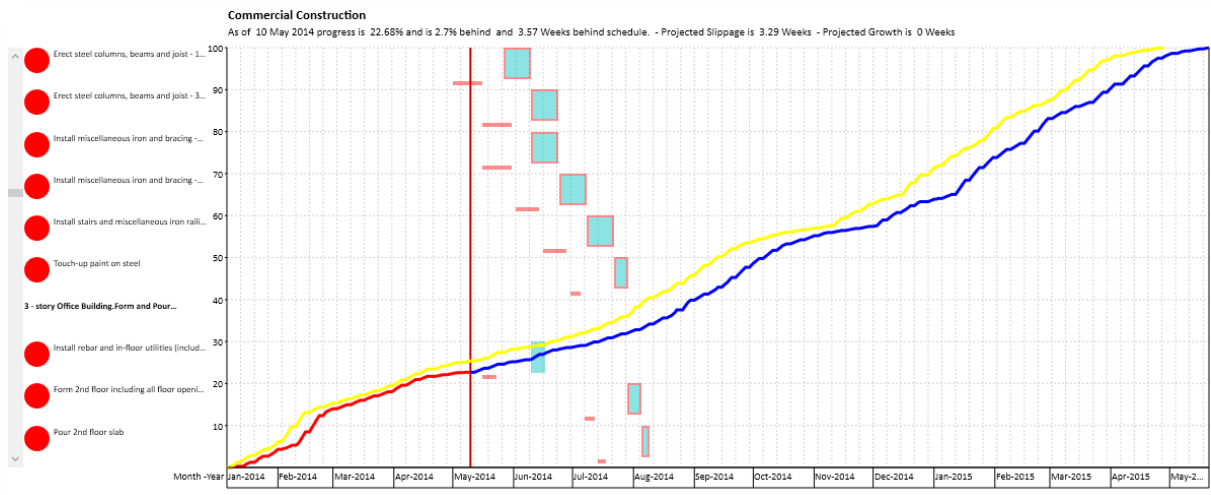
In this example we should have achieved 25.38% of the project at the report date. Therefore, it is 2.7% behind progress and as we should have completed 22.68% of the baseline in mid-April, the project is 3.57 weeks behind schedule.





## Overlaying the S-Curves over the Gantt chart

Project Tracker uniquely has the option of overlaying the S-Curve over the Gantt chart. This clearly shows which activities may have affected the performance of the project and how adjustments to the schedule may improve it.



## Types of S Curve

### ◇ Activity Duration

The simplest type of S-Curve is created from the durations of the activities in the project. This type of curve is suitable when resources and costs haven't been assigned to a project. Often overlooked as an important method of measuring progress, it is however, the simplest to be created. As it is often very time consuming to fully cost or resource load a project and to apply actuals, the duration curve is simply derived from the activities in the project and the percentage progress applied.

Creating a duration curve using project management software normally involves adding a dummy cost or resource which can be time consuming. Project Tracker negates the need for this as it analyses the activities and produces a curve.

One of the downsides of a duration curve is that all activities are treated the same. For example a 5 day activity such as concrete curing will be treated the same as a 5 day activity for an important item, such as erecting a steel frame. One way of circumnavigating this is to apply weightings in the project.





◇ Cost

This type of S-Curve shows the cumulative project costs expended over time for the duration of the project, and can be used to assist in the calculation of the project's cash flow, and cost to complete.

◇ Labor

The Labor S-Curve is a good measure for projects that are labor intensive. It shows cumulative man hours and resource units (e.g. m3 concrete) expended or used for the duration of the project. Projects may require additional resources to complete on time due to low productivity, unavailability, delays and disruptions, rework, variations, etc.



## **The Author**

Andrew Willard spent 18 years working for Asta Development plc in a range of roles from Trainer/Consultant to Professional Services Director and ultimately International Business Director, with responsibility for all distribution and reseller relationships outside the UK. He was been responsible for the successful delivery of high profile project management implementations in a wide range of sectors.

Clients included Lockheed Martin (US), Unocal (US), Taylor Wimpey (UK), Mace (UK), Balfour Beatty (UK), Hansen Yuncken (Aus), Abigroup (Aus) and Christchurch Rebuild (NZ).

One of Andrew's key roles was product development and he has used this experience to identify a gap in the market and develop Project Tracker.

## **Project Tracker**

Project Tracker is a Windows based application that imports project information from Primavera P6, Microsoft Project and Asta Powerproject\* to create S-Curves which are used to analyze the progress of the project.

Most project management software does not provide in built S-Curve capability; therefore users must export data to spreadsheet software such as Microsoft Excel to plot the curves.

This method requires a number of steps and a certain level of knowledge including how to add resources or costs to the plan, how to create time phased exports from the PM tool, how to open the data in the spreadsheet and how to create graphs from the data. Project Tracker eliminates all of these steps.

Aside from the number of steps required to export data from PM software to a spreadsheet; this method can be acceptable as a reporting medium but the problem with this method is that the analytical possibilities are not available as the data is now disconnected from the actual plan.

Therefore rather than just importing the data required to plot a curve, Project Tracker imports the activity data and is able to optionally plot a Gantt Chart under the S-Curve allowing the Project Manager to assess which activities may be causing issues and what action can be taken.

One of the key benefits of Project Tracker is that it will create an S-Curve using the durations of activities. To produce S-Curves using the spreadsheet method it has been necessary to add resources and/or costs to all the activities in a project.

Project Tracker will of course plot resource and cost curves but can the ability to use duration data is unique.



### **Willmer Limited**

Willmer Limited is a UK based company that offers planning and training services for any company involved in projects. The founders have many years' experience of implementing, training and delivering planning and scheduling services to the construction, rail and engineering industries. Additionally we have worked with Finance, IT and Pharmaceutical companies. The founders both worked at senior level for one of the leading project management software companies in professional services.

For more information on this white paper, Project Tracker or Willmer Limited, visit [www.willmer.co.uk](http://www.willmer.co.uk)