

Why do projects seem to go bad right at the end?

The Hidden Risks in Earned Value Measurement

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This paper highlights some of the weaknesses in one of the most common techniques used to monitor project performance – earned value management (EVM). We then demonstrate how an alternative approach to monitoring project performance and progress – the fever chart - helps to overcome these weaknesses.

The fever chart is an integral part of the CCPM method of project management, which in turn is one of the pillars of our approach to managing capex and construction projects. Details of our approach can be found in our book *The Executive's Guide to Breakthrough Project Management* (www.BreakthroughProjectManagement.com)

This paper assumes the reader is familiar with basic idea of EVM. If you are not, there is a good summary on Wikipedia (http://en.wikipedia.org/wiki/earned_value_management).

Our book, *The Executive Guide to Breakthrough Project Management* outlines a powerful approach to improving the performance of capex and construction projects.

This approach improves the performance of projects and project portfolios, delivering the same project on-time in less time, on-budget at lower cost, and without compromising on the scope.

We first ensure that truly collaborative team is formed involving the key companies involved in the project – selected early and contracted with incentives aligned with the client's project objectives. We then exploit this collaborative team by planning and managing the execution of the project to significantly reduce risk, cost and time using the proven innovative technique of CCPM (critical chain project management).

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The hidden problems with EVM

Have you ever had the situation where a seemingly good project went off the rails right at the end? The post-mortem showed that the project started to go wrong in its early stages, but the reports all looked good until almost the end.

Earned Value (EV), is an established approach to measuring project progress. The idea is that with just three measures you can get an impression of the time and cost performance of a project. Many public sector clients, particularly in the US, make EVM reporting a contractual requirement.

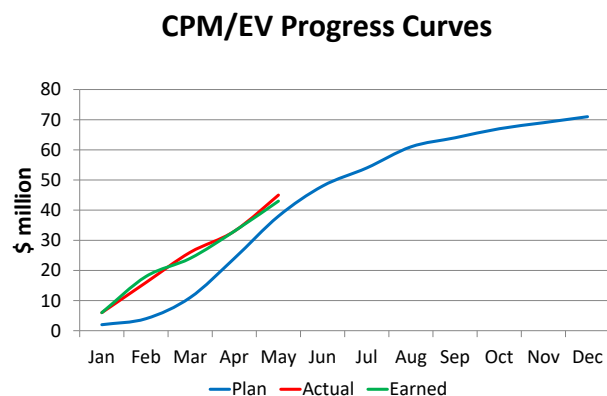
EV gives a simple graphical indication of a project's progress, and is meant to show whether things are under control or heading for disaster. The strength of EVM is it only gives credit for tasks actually completed. It does not use personal estimates that "I am 65% of the way to finishing", and so reduces the risk of optimism bias.

EVM is a neat idea, and is significantly better than not using any structured project control method. The only problem is; it has some major flaws.

Examples – EVM shows good progress

The example alongside shows an earned value graph for a project. It shows that a third of the way through, the project seems to be well ahead of schedule, and on budget.

The blue line is the plan, based on estimated costs for each work package completed, and the planned completion dates.



The green line is the "Earned Value" – the estimated cost for all the work packages actually completed. The red line is the actual cost incurred.

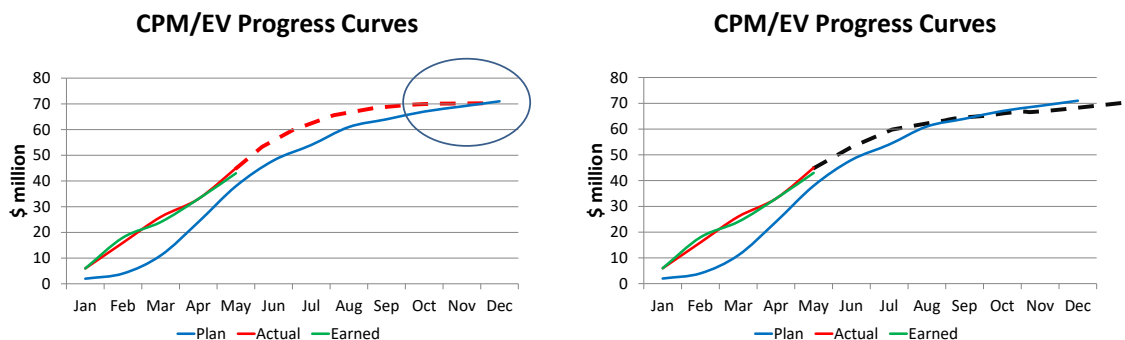
The chart shows that although you have spent more at this stage than planned (red is higher than blue), this seems to be due to better progress than planned. Spend and progress (EV) are similar (red and green), implying all is going well on this project. A senior manager could easily assume that all that was needed was to acknowledge the great efforts of the team, and just check that costs are controlled.

However, the underlying data behind this chart shows a different situation. In reality the project is destined to be late.

The problem in this case is that some non-critical tasks have been done earlier than planned, whereas critical tasks are behind schedule. In the basic application of EVM there is no mechanism to differentiate between the critical path and other tasks with float. EVM assumes that tasks are done in the planned sequence, but in reality this isn't always the case, especially when contractors and suppliers are paid based on work completed to date.

EVM is also a retrospective measure, and does not by itself provide information to extrapolate to completion. There is no easy way of knowing if the project will complete by following the red dashed line on the left (on-time and on-budget), or following the black dashed line on the right (on-budget but 2 months late).

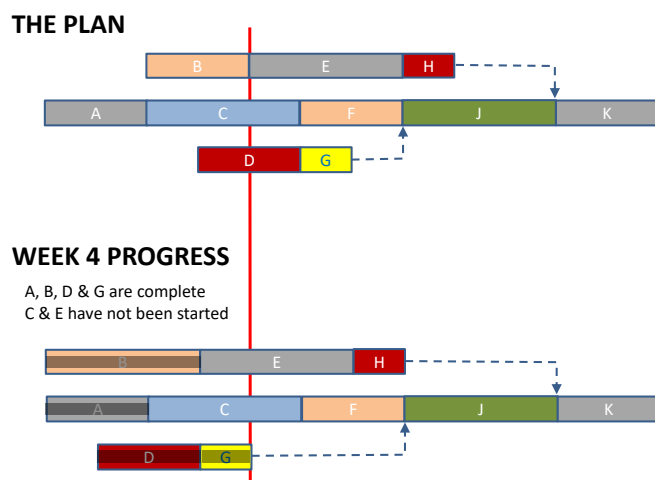
This is one significant weakness in EVM – it can provide a false sense of security, and gives no early warning under commonly occurring situations such as this.



Before demonstrating how an alternative progress measurement method would give a much better early warning, we will show what is happening behind the charts.

The top schedule alongside shows the plan, and the lower one what has happened. The critical path (A-C-F-J-K) is behind. The two feeding paths (B-E-H and D-G) were started early and are ahead of schedule.

There are often pressures to do this, for example (i) if senior managers like to see physical progress and believe that "the earlier you start the earlier you finish", and (ii) when

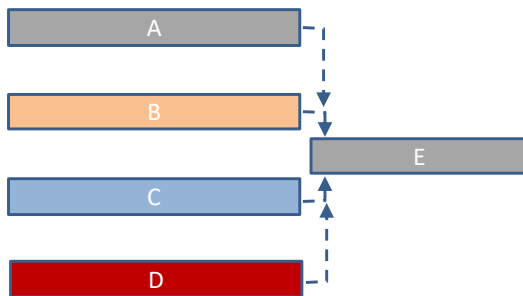


contractors are paid based on progress, and they can improve their cash flow by pulling work forwards. It could even be that there was some problem starting task C, and the project manager deliberately brought B, D and G forward to keep some progress.

This issue of working out of sequence is a known issue amongst EVM experts. Stephen Devaux in his book “Managing Projects as Investments: Earned Value to Business Value”, suggests a variation on the common EVM practice of not giving credit for work performance ahead of schedule. However, this is not part of the formal method.

The impact of Integration Points

A second common problem in using EVM comes at “integration points”. This is where several parallel project streams come together. Almost all projects have integration points, especially towards the end of a project.



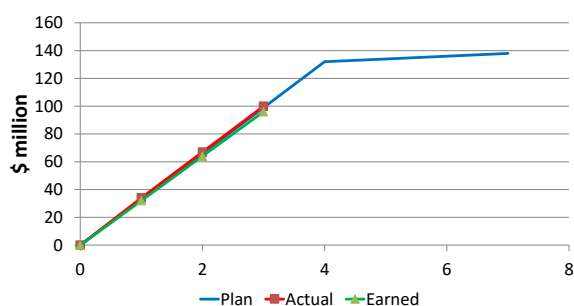
The example on the left shows a simple project with 4 parallel streams coming together at an integration point prior to starting the final task, E. E cannot be started until all 4 preceding tasks are complete.

The EV chart shows good progress at period 3. There is a slight deviation from the baseline planned line, but it is minor.

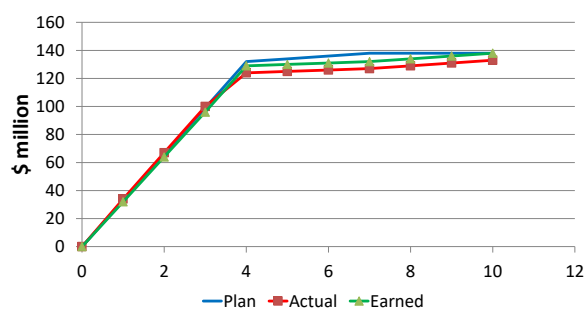
It is only in periods 4 and 5 that you see that there is something not right. The project seems to be taking forever to complete that last little bit!

By the time the project manager notices a problem using EVM the project is over 50% of the way through, and little can be done to recover this problem. The project is 3 time periods late (45%)

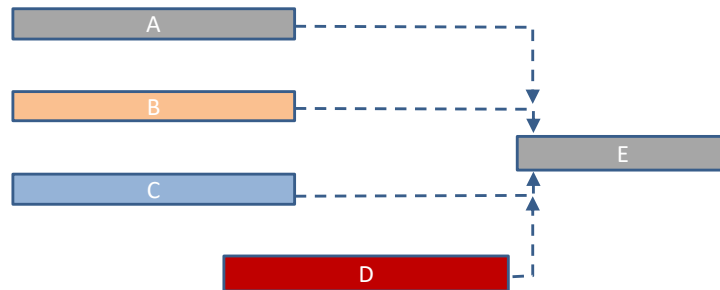
EVM Progress Curves



EVM Progress Curves



The situation underlying this situation is a simple one, as shown below. Task D is delayed. However, because tasks A, B and C use significantly more resource (and so have a higher cost/value), the underperformance is not noticed in the EV chart. Task D not only uses a small amount of resource, but this resource is limited in supply, and so cannot be simply bought-in to recover the delay.



Approaches to Reducing these Problems

There are many ways to overcome the problems, most of which make EV more complex.

A simpler approach is to use Critical Chain Project Management (CCPM). CCPM monitors progress using a graphical tool called the fever chart, which avoids many of the difficulties inherent in EVM.

The fever chart measures the % of the buffer consumed, compared to the % of progress towards completion (See the sidebar if you are not familiar with CCPM or its buffers).

The fever chart is divided into three coloured areas, which indicate the priority of actions and the need for recovery.

Green	OK
Yellow	WATCH & PREPARE
Red	ACT

CCPM's Buffer

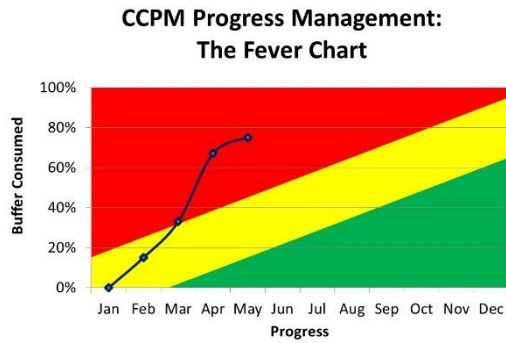
"Buffer" in CCPM is a shared time safety allowance to cover uncertainties in estimates.

CCPM does not allow individual tasks to include contingency for such uncertainty, instead the time allowed "just-in-case" is pooled and managed at the project level. This time pool is called the buffer

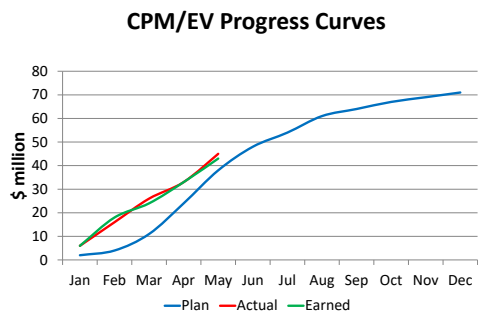
The amount time in this aggregate buffer is usually much less is needed compared to when you expect individual tasks to plan for day-day uncertainty in estimates. It uses the principles used in the insurance industry, where we all pay much less into the overall pool that we would need to put aside if we self-insured.

The following examples compare the EV charts from the above 2 examples with the fever charts based on exactly the same data. In both cases the fever charts give much better early warning or impending problems.

Example 1 – Working out of Sequence



In February and March, you can clearly see a negative trend, and the fever chart is now just “in the red”. The team would be expected to start recovery actions, though they may keep a close eye. In April when they were well and truly “in the red” they would be expected to have already started their the recovery plan.



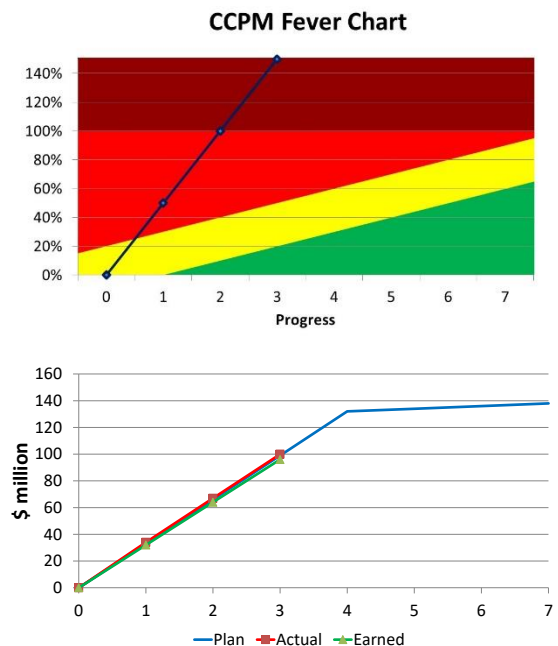
Under the EV method, in April and May, the project manager would still believe that the project was going well, and heading for an early, on-budget finish.

The underlying data is exactly the same in both these cases. Which version would you like to receive?

Example 2 – Integration Point

The fever chart gives a dramatically different view of progress in this example. Even in period 1, progress is well in the red – indicating that recovery actions should be implemented. In period 2 the fever chart shows that the delay has already used all of the buffer. In period 3, the project is expected to be significantly late.

Based on exactly the same data, as demonstrated earlier, the EV chart is



showing on-target performance up to period 3

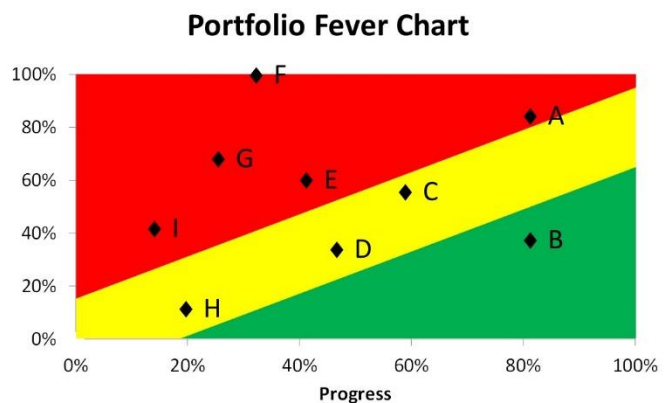
Using the Fever Chart to Manage across Multi-Projects

The fever chart is simple in concept, and easy to understand. Its green-yellow-red status indication is almost all project team members and senior managers need to know. Green = OK, Yellow = Watch/Prepare, Red = Act.

For a resource manager whose team supports many projects, they can easily see which of their team members needs support (ie those working on red activities), and which of the various projects that they could work on are the priority projects – no more “who shouts loudest”, and no more trying to make sure every project gets equal resources.

The project portfolio version of the fever chart (shown alongside) gives senior managers a single view across all their organisation’s projects.

At a glance you can see the status across the whole portfolio. Those in the green can be left alone, whilst those in the red may need help to get back on track.



Whilst the fever chart is a significant improvement over EVM for managing project execution, it is not perfect. Building on the fever chart, CCPM software company Exepron has introduced its Early Warning chart, which takes account of other significant influences on project success as well as the buffer consumption.

Keeping the three colour idea, the Exepron Early Warning uses green = OK, red = need to recover, black = big problems.

Alongside is the single project version showing the trend over the past 10 weeks. There is also a portfolio version, giving senior managers a snapshot view across their whole project portfolio, showing how many projects are in the green, red, and black.

