



TenStep Supplemental Paper

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Combine the Basics Metrics to Unleash the Power of Earned Value

Earned value is a way to measure the progress of a project with greater precision and accuracy than is typically available. The primary units of measure are the Budgeted Cost of Work Performed (BCWP) (which is also called the “Earned Value”), the Actual Cost of Work Performed (ACWP) and the Budgeted Cost of Work Scheduled (BCWS). Now let’s put these fundamental metrics together.

Today’s Date: March 31

Completed Activity	A	B	C	D	Remaining Work
Target Date	March 10	March 15	March 31	April 5	July 31
Budgeted Cost	20	10	15	5	500
Actual Cost	20	5	20	10	?

Schedule Variance (SV)

The Schedule Variance (SV) tells you whether you are ahead of schedule or behind schedule, and is calculated as $BCWP - BCWS$. In our example above, the BCWP is 50 ($20 + 10 + 15 + 5$) and the BCWS is 45 ($20 + 10 + 15$). Note that the difference is activity D. Since work has been completed on this activity, it is included in the BCWP. However, since it was not scheduled to be completed by March 31, it is not included in the BCWS.

The Schedule Variance is 5 ($50 - 45$). If the result is positive, it means that you have performed more work than what was initially scheduled at this point. You are probably ahead of schedule. Likewise, if the SV is negative, the project is probably behind schedule.

Cost Variance (CV)

The Cost Variance gives you a sense for how you are doing against the budget, and is calculated as $BCWP - ACWP$. If the Cost Variance is positive, it means that the budgeted cost to perform the work was more than what was actually spent for the same amount of work. This means that you are fine from a budget perspective. If the CV is negative, you may be overbudget at this point. In our example above, the BCWP is 50. The ACWP is 55. Therefore, the Cost Variance is -5 ($50 - 55$), which implies we are overbudget.

Schedule Performance Index (SPI)

This is a ratio calculated by taking the $BCWP / BCWS$. This shows the relationship between the budgeted cost of the work that was actually performed and the cost of the work that was scheduled to be completed at this same time. It gives the run rate for the project. If the calculation is greater than 1.0, the project is ahead of schedule. In the example above, the SPI is equal to ($50 / 45$) or 1.11. This implies that your team has completed approximately 11% more work than what was scheduled. If that trend



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continues, you will end up taking 11% less time to complete the project than what was scheduled.

Cost Performance Index (CPI)

This is the ratio of taking the BCWP / ACWP. This shows the relationship between the budgeted cost of work performed and the actual cost of the work that was performed. It gives the burn rate for the project. If the calculation is less than 1.0, the project is over budget. In our example, the CPI is $(50 / 55)$ or .91. A CPI of .91 means that for every \$91 of budgeted expenses, your project is spending \$100 to get the same work done. If that trend continues, you will end up over budget when the project is completed.

Budget at Completion (BAC)

This calculation can be in terms of dollars or hours. It is the Actual Cost of Work Performed (ACWP) plus the budgeted cost of the remaining work. This should make sense and it does if you are spending your budget at roughly the same rate as your plan. However, if the Cost Performance Index (CPI) is not 1.0, it means that you are spending at a different rate than your plan, and this needs to be factored in as well. So, the better formula for the Budget at Completion (BAC) is the $ACWP + (\text{Budgeted Cost of Work Remaining} / CPI)$. In other words, if you are running 10% overbudget to get your work done so far, there is no reason to believe the remaining work will not also take 10% more to complete, and your final budget at completion would be 10% over as well.

In our example above, the ACWP is 55 and the Budgeted Cost of Work Remaining is 500. The estimated budget at completion would be $55 + (500 / .91)$ or approximately 604.5. Since our total budget is 550, this shows that we will be approx 10% over budget.

Summary

Math is the crux of earned value. Although there are many other formulas as well, these are the basics behind this concept.

The question then, is how is our sample project doing? The good news is that our Schedule Variance (SV) shows that we are ahead of schedule, and our Schedule Performance Index (SPI) quantifies that at 11% ahead of schedule. If we take earned value calculations on an ongoing basis, we can see what the trend is. If this trend holds true, then we should finish the project 11% ahead of schedule.

Likewise, the Cost Variance (CV) shows we are overbudget, and the Cost Performance Index (CPI) quantifies the overbudget situation to be close to 10%. (We are spending an extra \$9 for every \$91 budgeted.)

So, is this good or bad? Earned Value calculations give you the numbers you need to ask the right questions. In our sample project we are trending ahead of schedule and overbudget. This may mean that the cost of resources is higher, but they are being more productive. It could mean that the project manager is using more resources than planned, which is allowing the project to be completed faster, but at a higher cost. It could mean that the team members are working overtime. If it were important, it may be possible for



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the project team to slow down a little and save costs, thereby completing the project closer to schedule and budget targets.

There are many possibilities and many questions to raise – all brought to light by the Earned Value calculations.