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Project Status using Earned Value Management

Lunch and Learn



Certification Training



Knowledge Sharing



Continuous Learning



Mission Assistance

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Learning Objectives

- Calculate Earned Value Management Metrics using earned value data
- Interpret and analyze trend charts



Contractor Data Analysis (bottoms-up)

Analysis by the Contractor is accomplished at the control account level by the CAM:

- Status is determined at the control account level for completed work packages and actual costs to accomplish that work
- Analysis needs to include:
 - Updated schedule
 - Variance analysis
 - Impact analysis
 - Updated EAC
 - Actual Costs to date
 - Overhead and Inflation rates
 - Performance to date
 - Future performance on work
 - Cost and schedule variances
 - Changes to requirements
 - Reliability and relevance of data
 - Organizational culture



Government Data Analysis (top-down)

Government Analysis occurs at a higher level (reporting levels):

- Although status is determined at the control account level it is rolled up to reporting levels (specified in the CDRL) where the government analysis is done
- Analysis needs to include:
 - Updated schedule
 - Variance analysis
 - Impact analysis
 - Updated EAC



EARNED VALUE MANAGEMENT TERMINOLOGY

Acronym	Term	Meaning
BCWS	Budgeted Cost for Work Scheduled	Plan – Baseline - PMB
BCWP	Budgeted Cost for Work Performed	Earned Value
ACWP	Actual Cost of Work Performed	Actuals
BAC	Budget ^{Cost} At Completion	Planned Cost
EAC LRE	Estimate ^{Cost} At Completion Latest Revised Estimate – Contractor's	Forecasted Cost Forecasted Cost
SV	Schedule Variance	Accomplishment Variance
CV	Cost Variance	Earned Value vs Actual Cost
VAC	Variance At Completion	Forecasted Overrun / Under-run



Schedule Variance (SV)

- Leading / Predictor metric
- Positive SV is Favorable 😊
- Negative SV is Unfavorable 😞
- SV equals 0.0 when all the work is completed
- More valuable early in contract life.

$$SV = BCWP - BCWS$$

Plain Language Definition – Difference between the budget of the work that was completed (BCWP) and the budget of the work that was planned to be completed (BCWS).



Cost Variance (CV)

- Positive CV is Favorable 
- Negative CV is Unfavorable 
- CV at completion will not normally be less than the cost variance to date.
(Overruns don't get better with time)

$$CV = BCWP - ACWP$$

Plain Language Definition – Difference between the budget of the work that was completed (BCWP) and the cost of the work that was completed (ACWP).



Percent Spent & Percent Complete

- These metrics are normally compared to each other. (what % of the budget have you spent compared to how much work you have completed)

$$\% \text{ Spent} = \text{ACWP}/\text{BAC}$$

$$\% \text{ Complete} = \text{BCWP}/\text{BAC}$$

Plain Language Definition:

% Spent – Percent of the total budget that has been spent.

% Complete – Percent of the total work (in terms of budget) that has been completed.



Percent Scheduled & Percent Complete

- These metrics are normally compared to each other. (what % of the budget has been scheduled to be complete compared to how much work you have completed)

$$\% \text{ Scheduled} = \text{BCWS}/\text{BAC}$$

$$\% \text{ Complete} = \text{BCWP}/\text{BAC}$$

Plain Language Definition:

% Scheduled – Percent of the total budget that has been scheduled to be complete.

% Complete – Percent of the total work (in terms of budget) that has been completed.



Schedule Performance Index (SPI)

- Leading / Predictor metric
- SPI greater than 1.0 are Favorable 😊
- SPI less than 1.0 are Unfavorable 😞
- SPI always equals 1.0 when all the work is completed
- More valuable early in contract life.

$$\text{SPI} = \frac{\text{Budget for the work completed}}{\text{Budget for work scheduled for completion}}$$

$$\text{SPI} = \frac{\text{BCWP}}{\text{BCWS}}$$

Plain Language Definition - Given a SPI of 0.95, for every dollar of work scheduled for completion only 95 cents worth of work was completed.



Cost Performance Index (CPI)

- CPI greater than 1.0 are Favorable 😊
- CPI less than 1.0 are Unfavorable 😞
- Can be a lagging metric
- Often used for computing EAC

$$\text{CPI} = \frac{\text{Budget for the work completed}}{\text{Actual cost for the work completed}}$$
$$\text{CPI} = \frac{\text{BCWP}}{\text{ACWP}}$$

Plain Language Definition - Given a CPI of 0.95, for every dollar spent 95 cents of work or earned value was realized.



Current versus Cumulative Metrics

- Normally metrics are calculated using cumulative data, but they can also be calculated for a single month or as a moving average.
- How do we determine which metrics should we use?
 - Have we had major changes to the baseline?
 - How close are we to the end of the program?
 - Are the metrics stable?



Estimates at Completion

$$EAC = ACWP + \left[\frac{BAC - BCWP}{\text{Performance Factor}} \right]$$

Performance Factors

Single Index

- CPI_{cum}
- CPI_{cur}
- $CPI_{3\text{ mth}}$
- $CPI_{6\text{ mth}}$
- Other

Composite

$$(CPI_{cum} \cdot SPI_{cum})$$

$$MICOM = (CPI_{6\text{mth}} \cdot SPI_{cum})$$

Weighted

$$(0.8 \cdot CPI_{cum}) + (0.2 \cdot SPI_{cum})$$

$$(0.4 \cdot CPI_{factory}) + (0.4 \cdot CPI_{test}) + (0.2 \cdot CPI_{quality})$$



Estimate at Completion

- Responsibility of the Analyst
- Much more than plugging numbers into a formula
- Should include more than just EV status
- EVM performance factor metrics and EVM EAC equations can provide an EAC range but not an exact EAC
- Analysis of all program data is the foundation



To Complete Performance Index (TCPI)

- EVM Metric that quantifies the cost efficiency required to complete the remaining work within the “Target” Budget
- “Target” can be:
 - BAC
 - EAC
 - LRE (Contractor EAC)
 - Other?

$$\text{TCPI} = \frac{\text{Work Remaining}}{\text{Budget Remaining}}$$

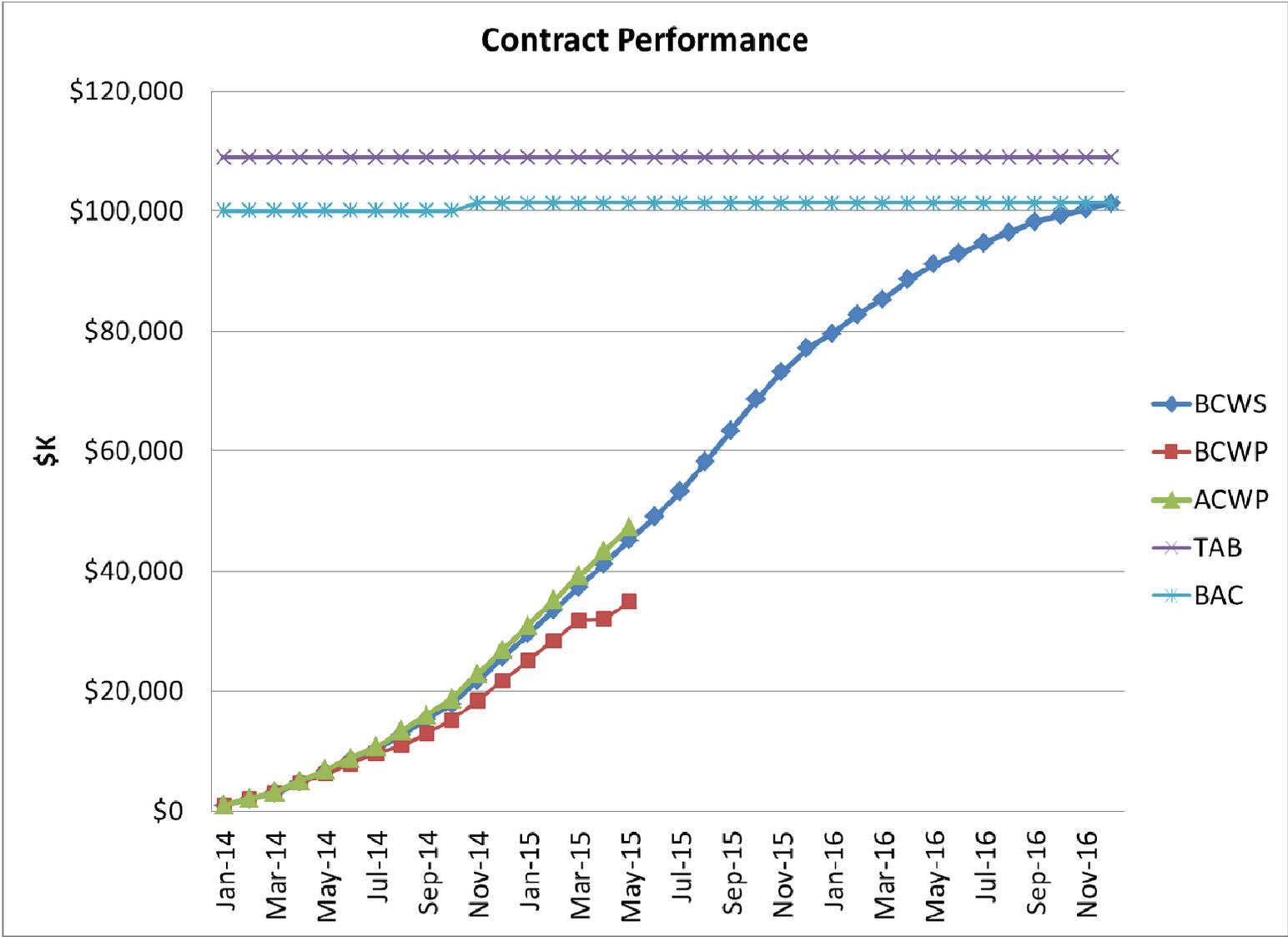
$$\text{TCPI} = \frac{\text{BAC} - \text{BCWP}}{\text{Target} - \text{ACWP}}$$

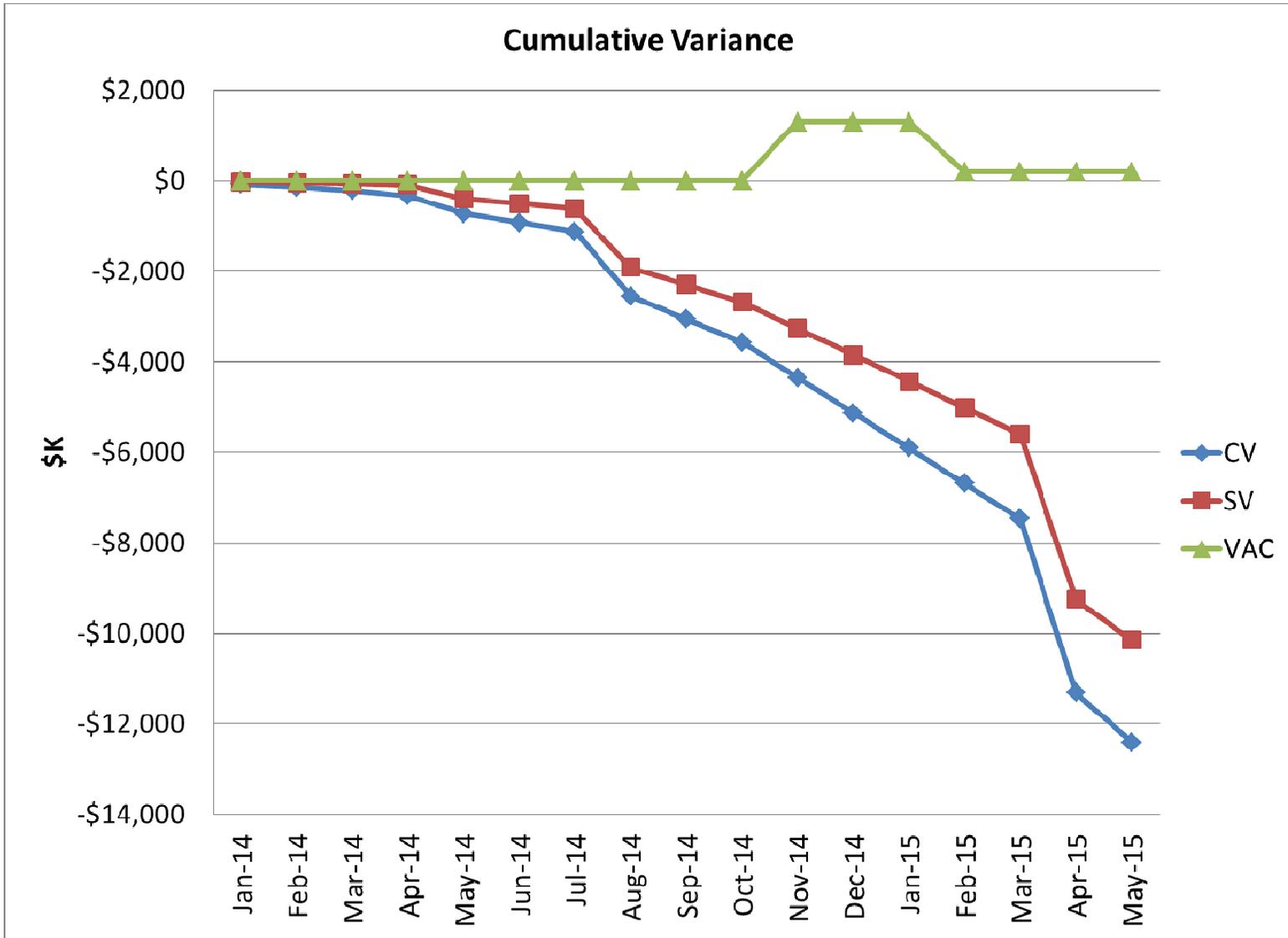
Use – The TCPI is compared to the CPI_{cum} to determine if it is reasonable to complete the remaining work within the Target Budget. If the TCPI exceeds the CPI by more than 0.05, it is not likely that the target will be met.



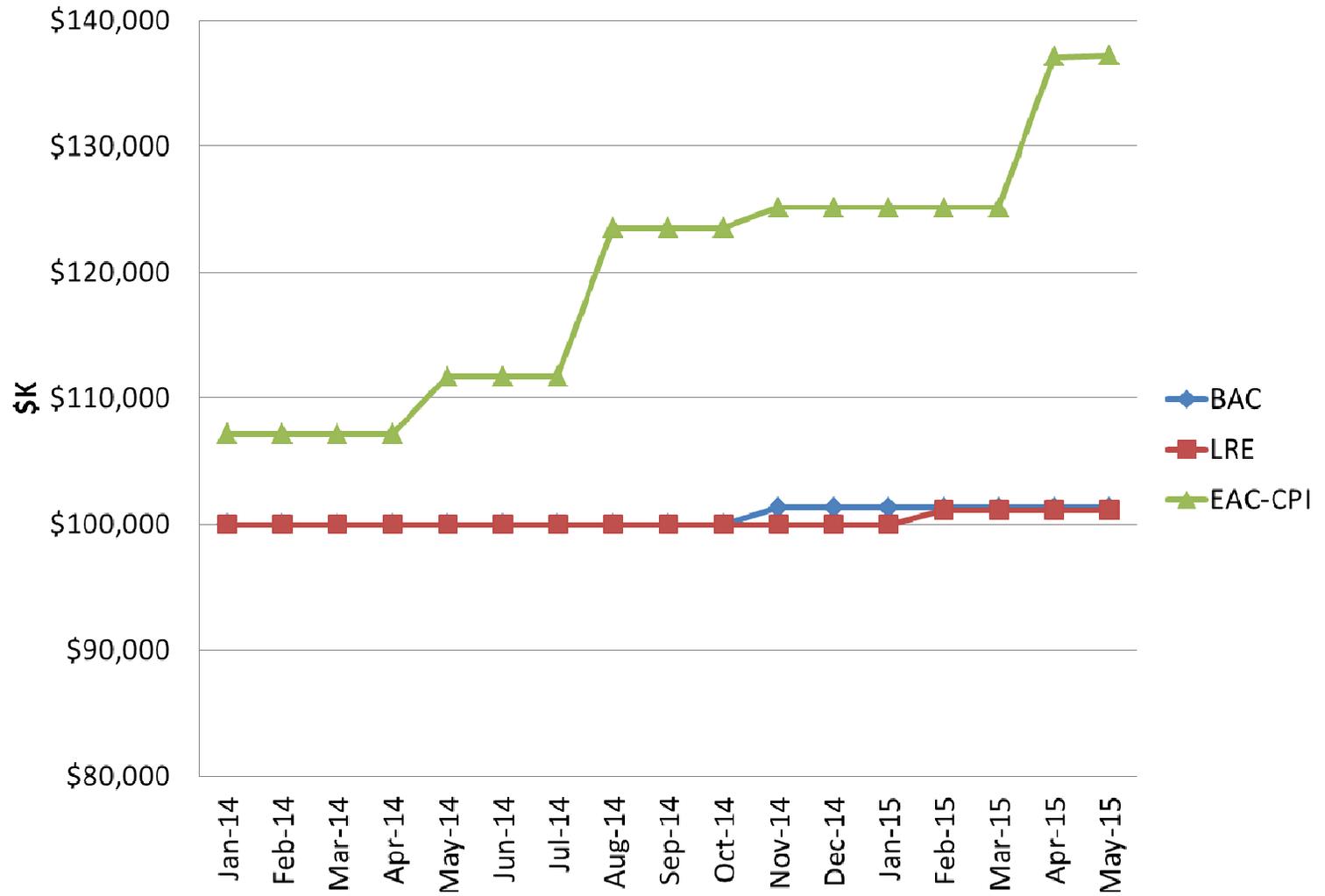
Interpreting Charts

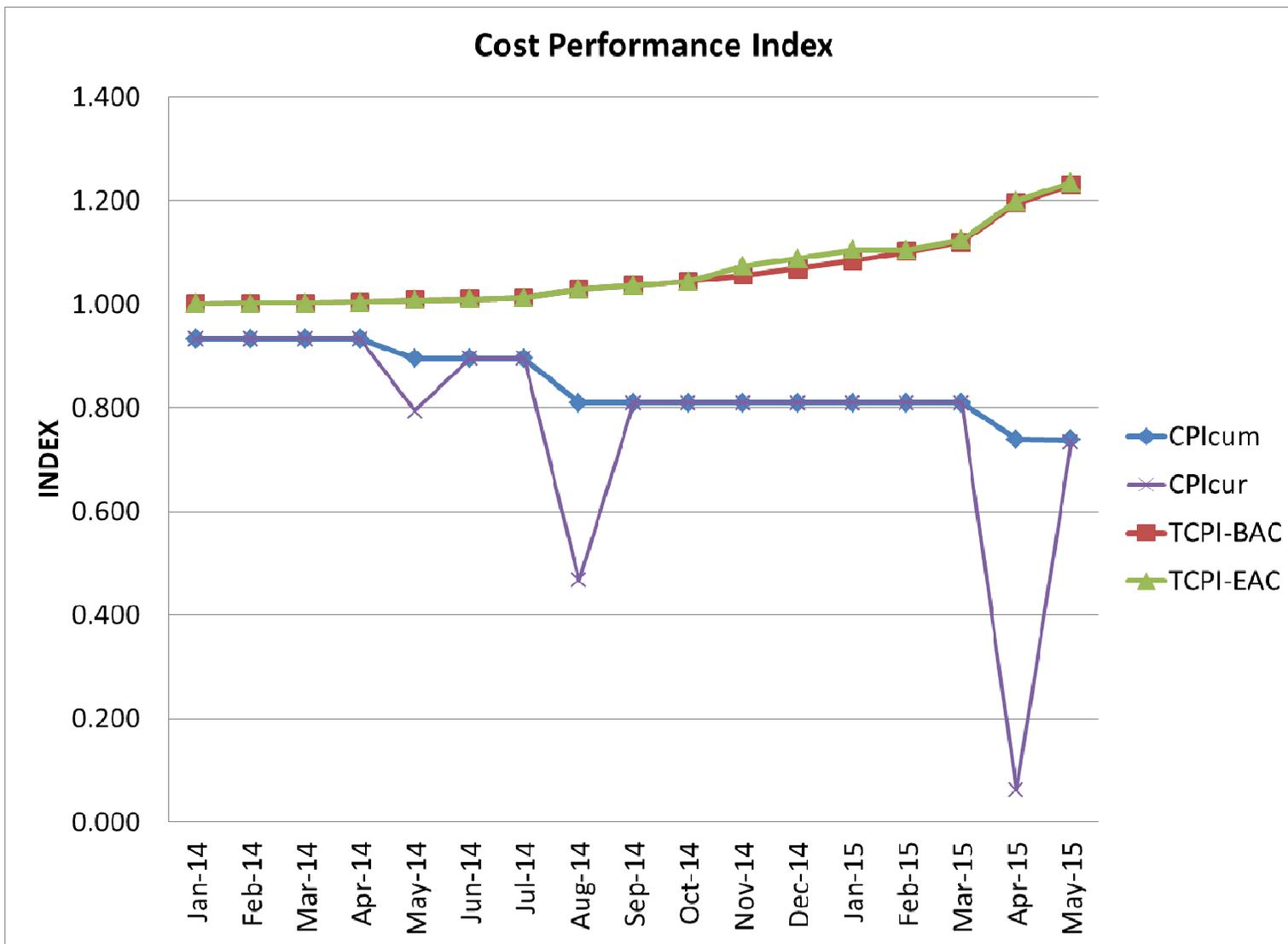
- Read the Title (Know what's being plotted)
- Read the Scale (What Units are being used)
- Look at the Legend (Understand what the symbols and lines represent)
- Is the data indicating a Trend? (Direction of Lines)





Estimates at Completion







Analysis of the Reported Data

BUILDING A DECK

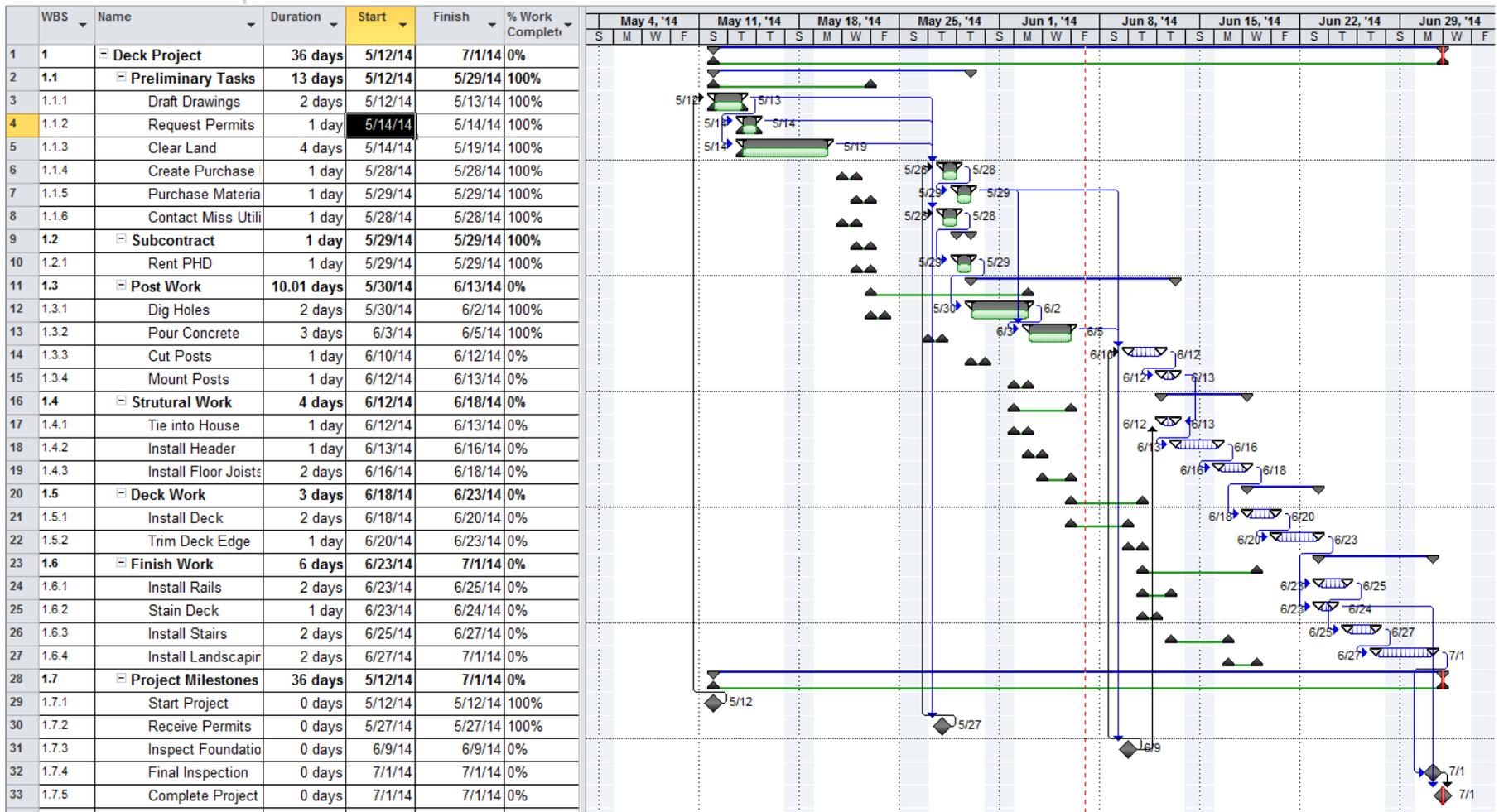


Deck Scope of Work & Assumptions

- Build an 10ft x 20ft Deck
- Need for 4th of July Picnic
- BAC (Planned budget) = \$3960
- TAB/CBB = \$4435, so MR = \$475
- Only additional tool needed is a PHD



DECK Updated Schedule (6/6/2014)





Let's Analyze the Deck Data

Date	BCWS	BCWP	ACWP	BAC	MR	TAB	LRE
5/16/2014	\$670	\$350	\$510	\$3,960	\$475	\$4,435	\$3,960
5/23/2014	\$1,980	\$690	\$720	\$3,960	\$475	\$4,435	\$4,435
5/30/2014	\$2,160	\$1,880	\$2,160	\$3,960	\$475	\$4,435	\$4,435
6/6/2014	\$2,800	\$2,180	\$2,500	\$3,960	\$475	\$4,435	\$4,435

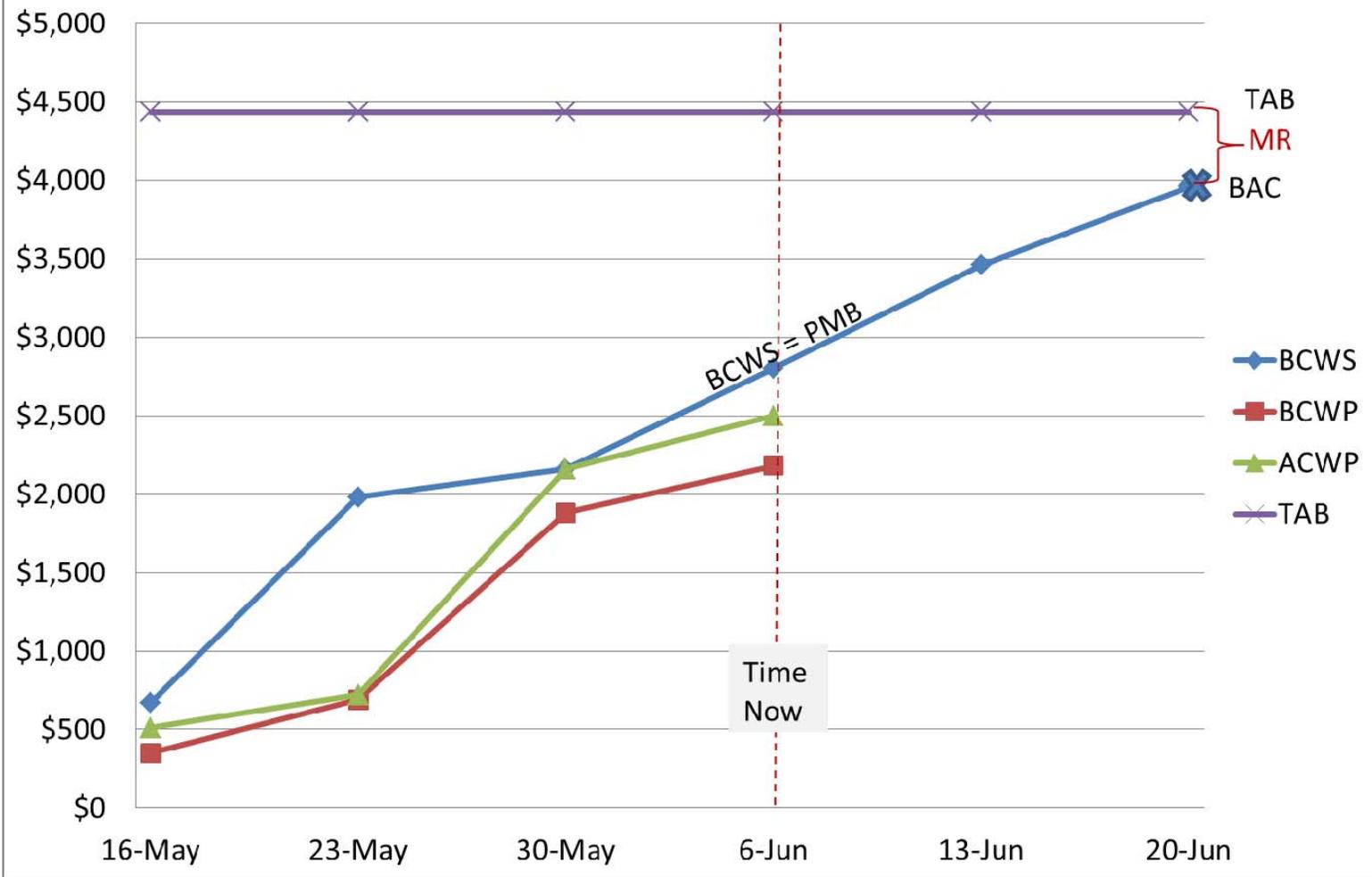
As of 6/6/2014:

- BCWS =
- BCWP =
- ACWP =

- CV =

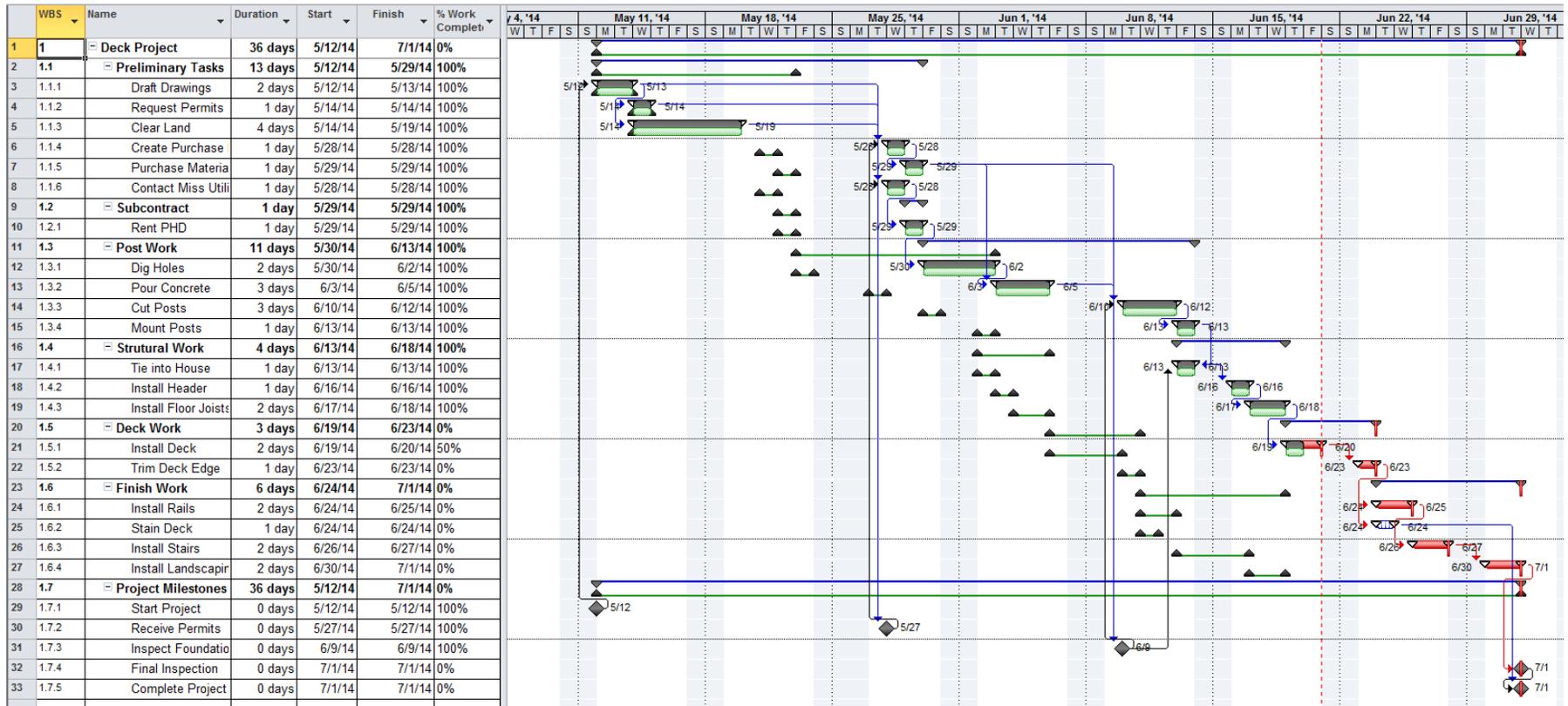
- SV =

Deck Contract Performance





Updated Schedule (6/20/2014)





Let's Analyze the Deck Data

Date	BCWS	BCWP	ACWP	BAC	MR	TAB	LRE
5/16/2014	\$670	\$350	\$510	\$3,960	\$475	\$4,435	\$3,960
5/23/2014	\$1,980	\$690	\$720	\$3,960	\$475	\$4,435	\$4,435
5/30/2014	\$2,160	\$1,880	\$2,160	\$3,960	\$475	\$4,435	\$4,435
6/6/2014	\$2,800	\$2,180	\$2,500	\$3,960	\$475	\$4,435	\$4,435
6/13/2014	\$3,460	\$2,340	\$2,700	\$3,960	\$475	\$4,435	\$4,435
6/20/2014	\$3,960	\$2,880	\$3,370	\$3,960	\$475	\$4,435	\$4,435

As of 6/20/2014:

- BCWS =
- BCWP =
- ACWP =

- CV =

- SV =

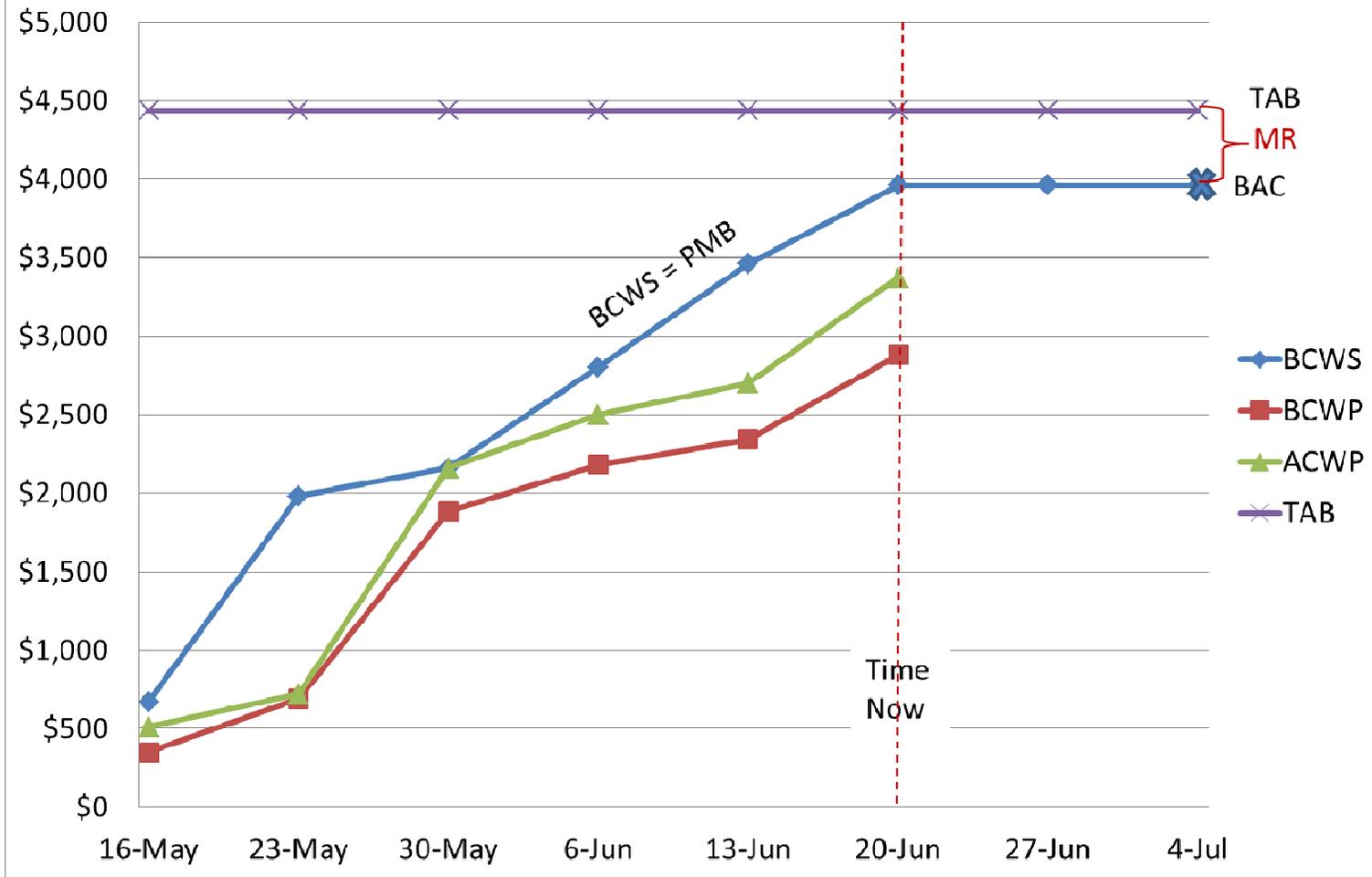


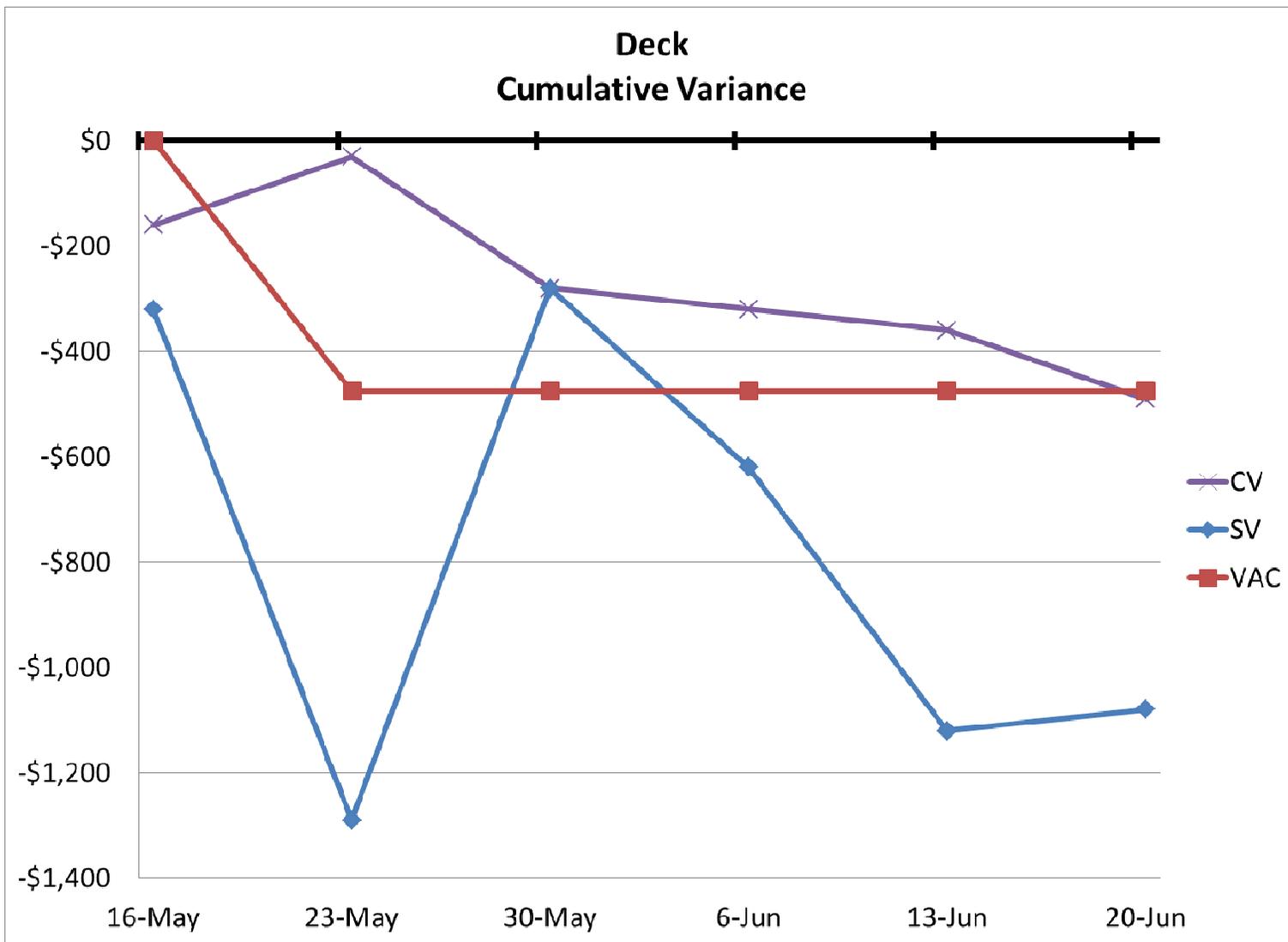
Analysis of Data

- CPI =
- SPI =
- Percent Complete =
- Percent Spent =
- Percent Scheduled =

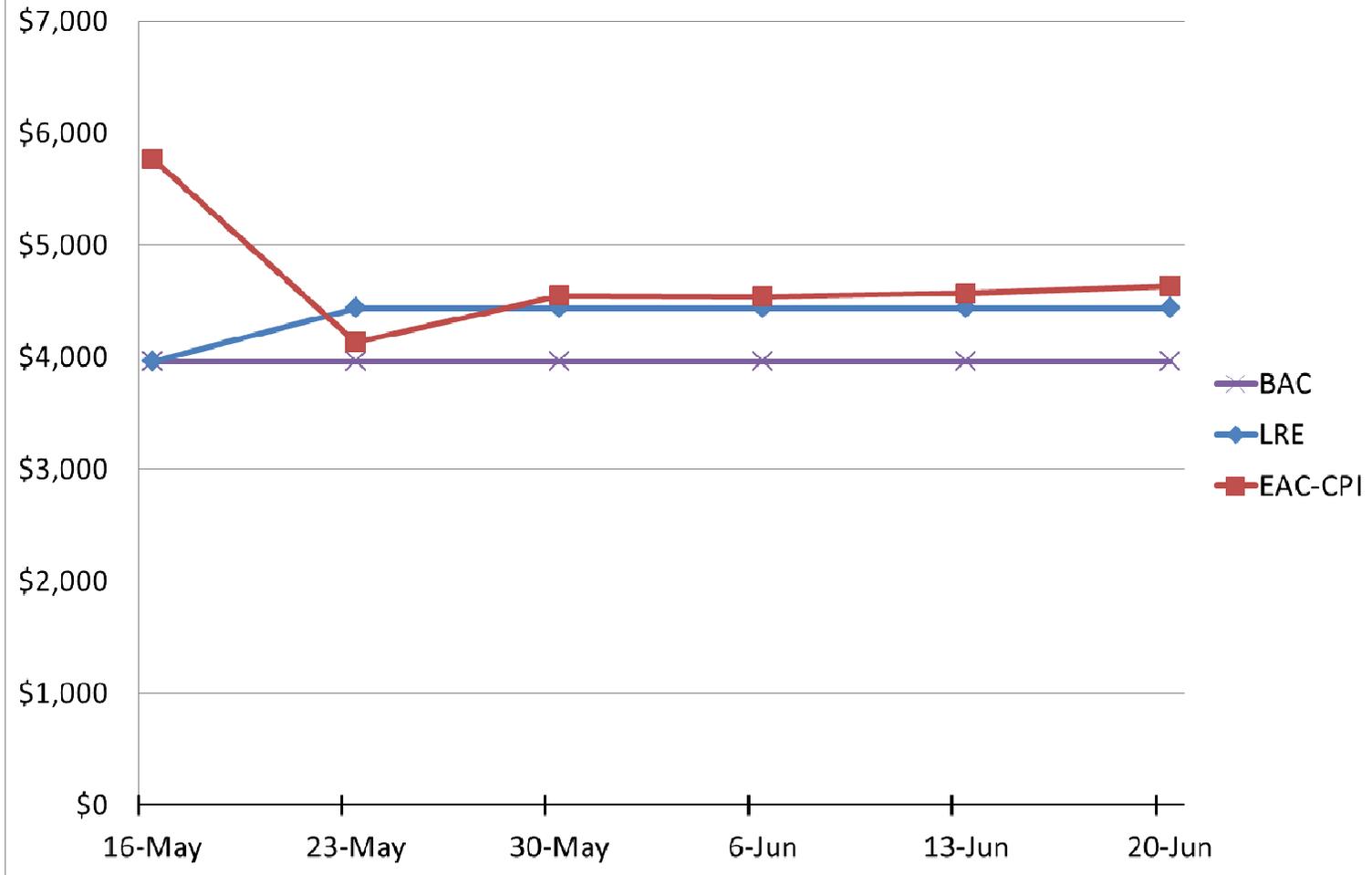
- TCPI (BAC) =

Deck Contract Performance

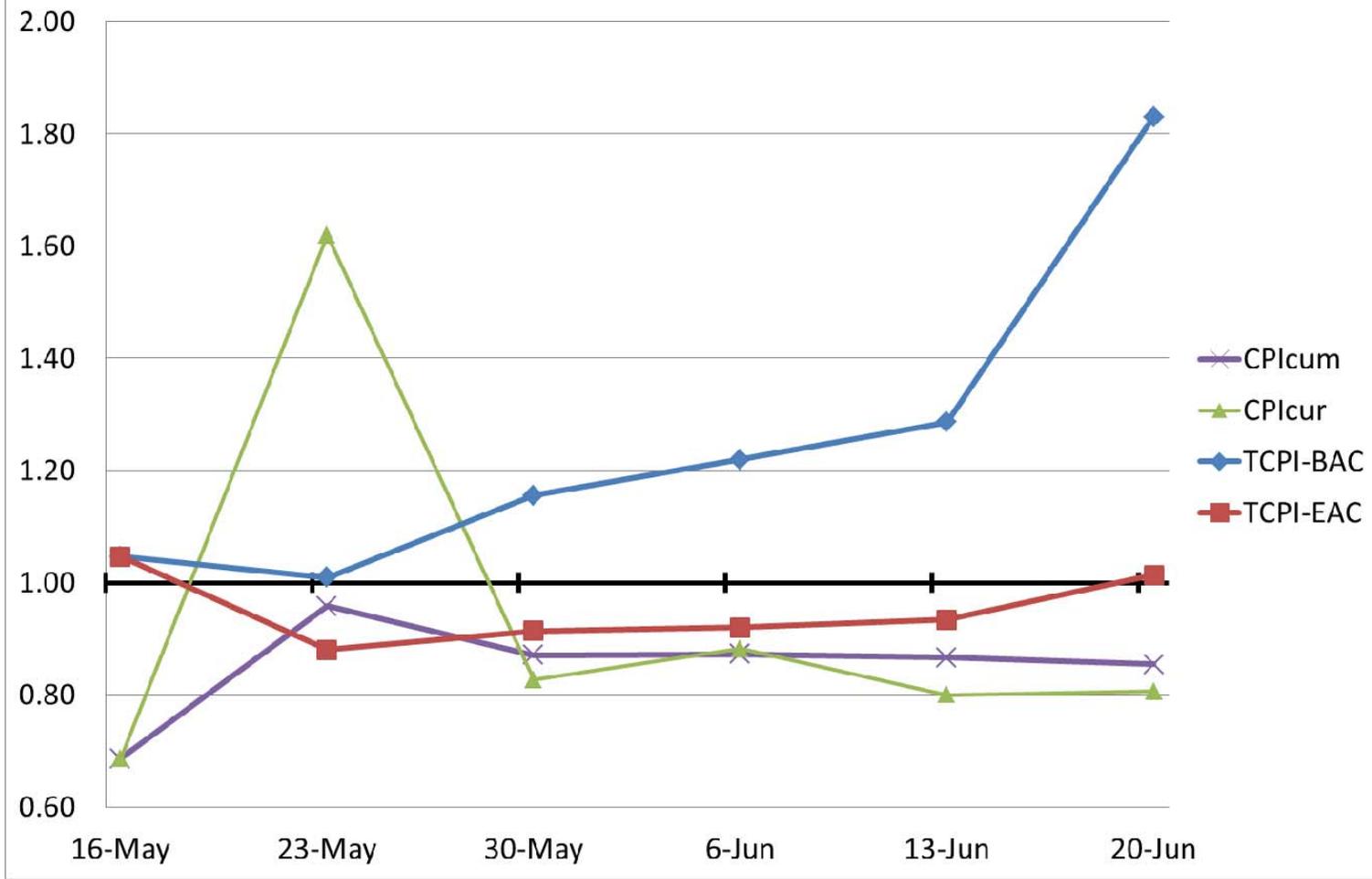




Deck Estimates at Completion



Deck Cost Performance Index





Analysis of Data

- $CPI = BCWP/ACWP = 2880/3370 = 0.855$ ←
- $EAC = ACWP + (BAC - BCWP)/CPI_{cum}$
 $3370 + (3960 - 2880)/0.855 = 3370 + 1080/0.855$
 $3370 + 1263 = \$4633$
- $TCPI (EAC) = (BAC - BCWP)/(EAC - ACWP)$
 $(3960 - 2880)/(4633 - 3370) = 1080/1263 = 0.855$ ←
- $TCPI (LRE) =$



Estimates at Completion

$$EAC = ACWP + \left[\frac{BAC - BCWP}{\text{Performance Factor}} \right]$$

Performance Factors

Single Index

- CPI_{cum}
- CPI_{cur}
- $CPI_{3\text{ mth}}$
- $CPI_{6\text{ mth}}$
- Other

Composite

$$(CPI_{cum} \cdot SPI_{cum})$$

$$MICOM = (CPI_{6\text{mth}} \cdot SPI_{cum})$$

Weighted

$$(0.8 \cdot CPI_{cum}) + (0.2 \cdot SPI_{cum})$$

$$(0.4 \cdot CPI_{factory}) + (0.4 \cdot CPI_{test}) + (0.2 \cdot CPI_{quality})$$



Analysis of Data

- $CPI = 0.855$
- $SPI = 0.727$
- $CPI_{3Month} = 0.829$

- $EAC =$

- $TCPI (EAC) =$



Lesson Summary

- Calculate Earned Value Management Metrics using earned value data
- Interpret and analyze trend charts