Project Control: Control of Work and Cost Versus Time

Part #4

October 1, 2002

Hide/Unhide Exercises?

Purpose

- Describe how to use the combined sets of S-Curves to:
  - Control Cost (Budget) versus Schedule.
  - Control Progress (Quantity and Quality of Work) versus Schedule.
  - Use the combined curves to control Cost versus Work versus Schedule.
- Describe possible counter-measures for the four possible general situations.

Learning Objectives

◆ Given a set of S-Curves be able to determine:

- Cost Variance – over or under cost based solely upon Schedule
- Schedule Variance – behind or ahead of schedule based upon planned and actual work.
- Budget Variance – over or under budget based upon Schedule Variance

Combine As-Planned and As-Built

At the end of day 8 we are 7% (55-47) over budget and 7% ahead of schedule based upon elapsed time.

| Day	Cost %	Work %	Cost %	Work %
1	0%	4%	0%	4%
2	1%	7%	1%	8%
3	9%	14%	9%	15%
4	16%	21%	17%	22%
5	24%	29%	28%	32%
6	32%	36%	35%	37%
7	40%	43%	42%	50%
8	47%	50%	55%	57%
9	55%	57%		
10	63%	64%		
11	71%	71%		
12	82%	79%		
13	92%	86%		
14	96%	89%		
15	100%	93%		
16	100%	96%		
17	100%	100%		

Combining the As-Built with the As-Planned.

Note the relative positions of the curves.

Combined S-Curves
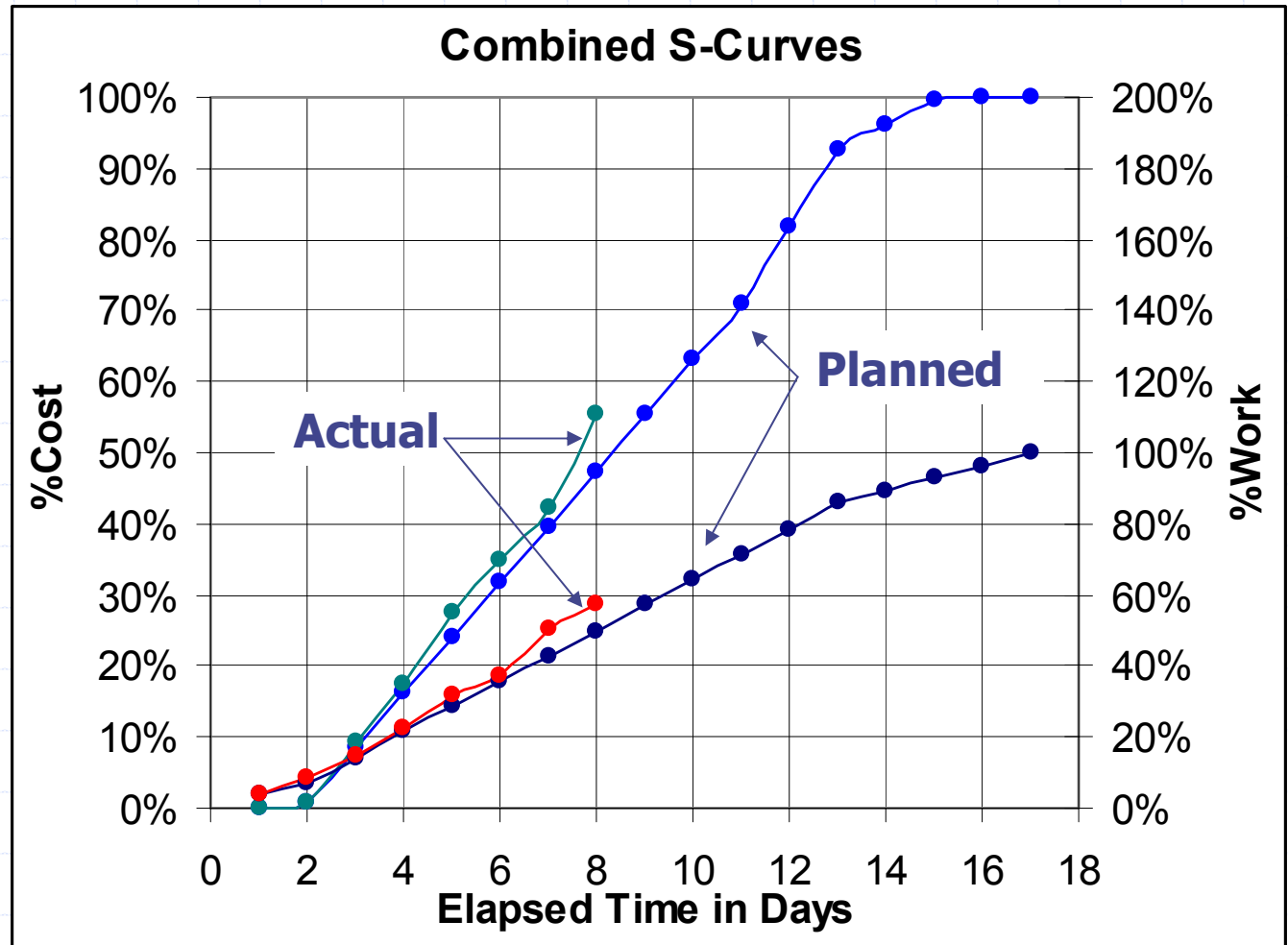
Cost Variance Independent of Work Accomplished at Day 8.

7% Over Cost

Making cost assumptions, independent of actual work may lead to misjudgments of actual job status.

Combined S-Curves

55%-47%
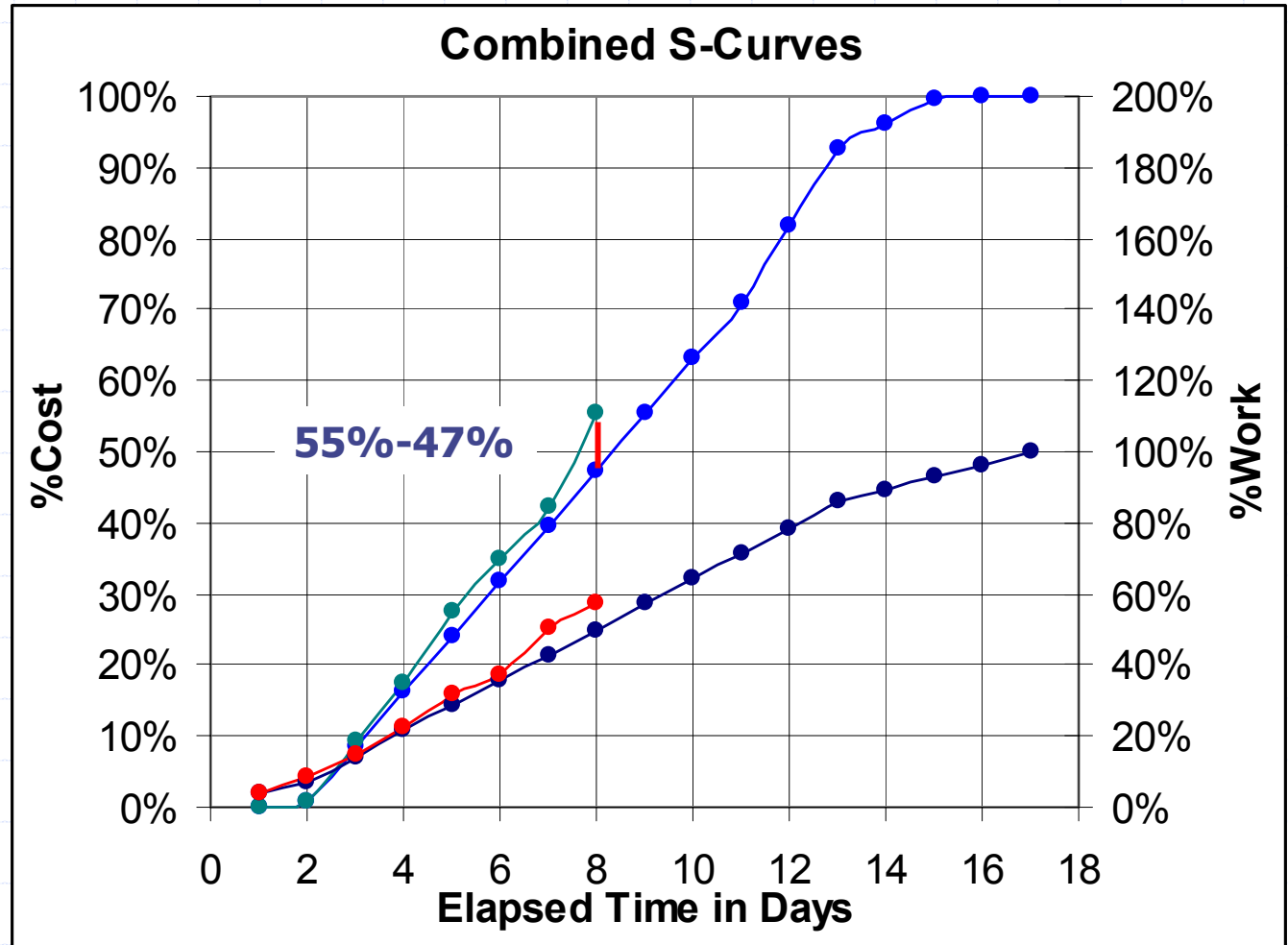
Schedule Variance based on Work Accomplished at Day 8.

This implies the project is 1 day ahead of schedule.

This is because, work has been completed earlier than planned.

Combined S-Curves

Actual (1)

Planned (2)

%Cost

%Work

Elapsed Time in Days
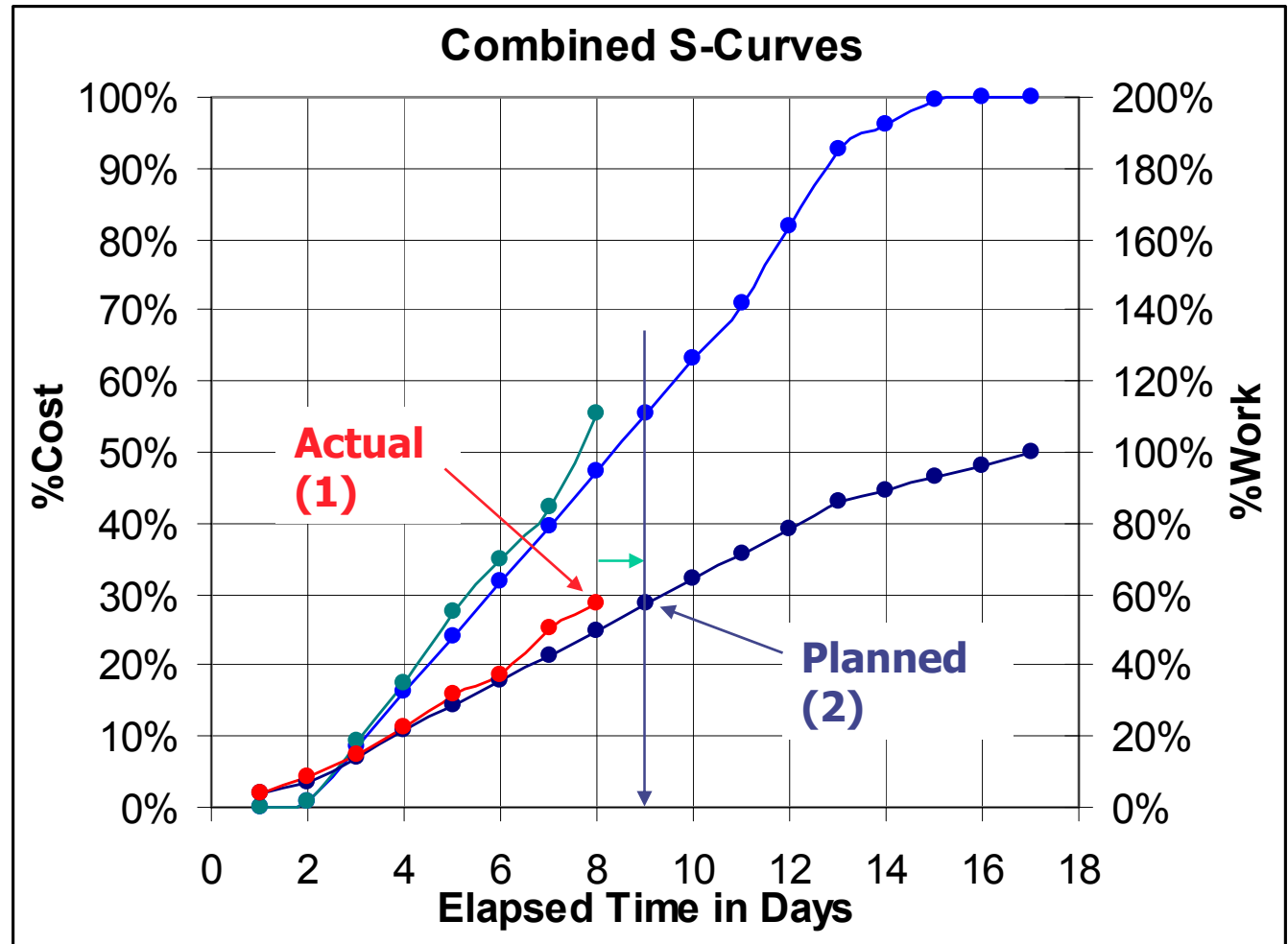
Budget Variance as a function of Schedule Variance at Day 8.

This implies that the project is on budget and 1-day ahead of schedule.

This is the budgeted cost of the actual work is equal to the cost incurred to date.

Combined S-Curves

Actual

Planned

(4)   (3)

(2)

%Cost

%Work

Elapsed Time in Days
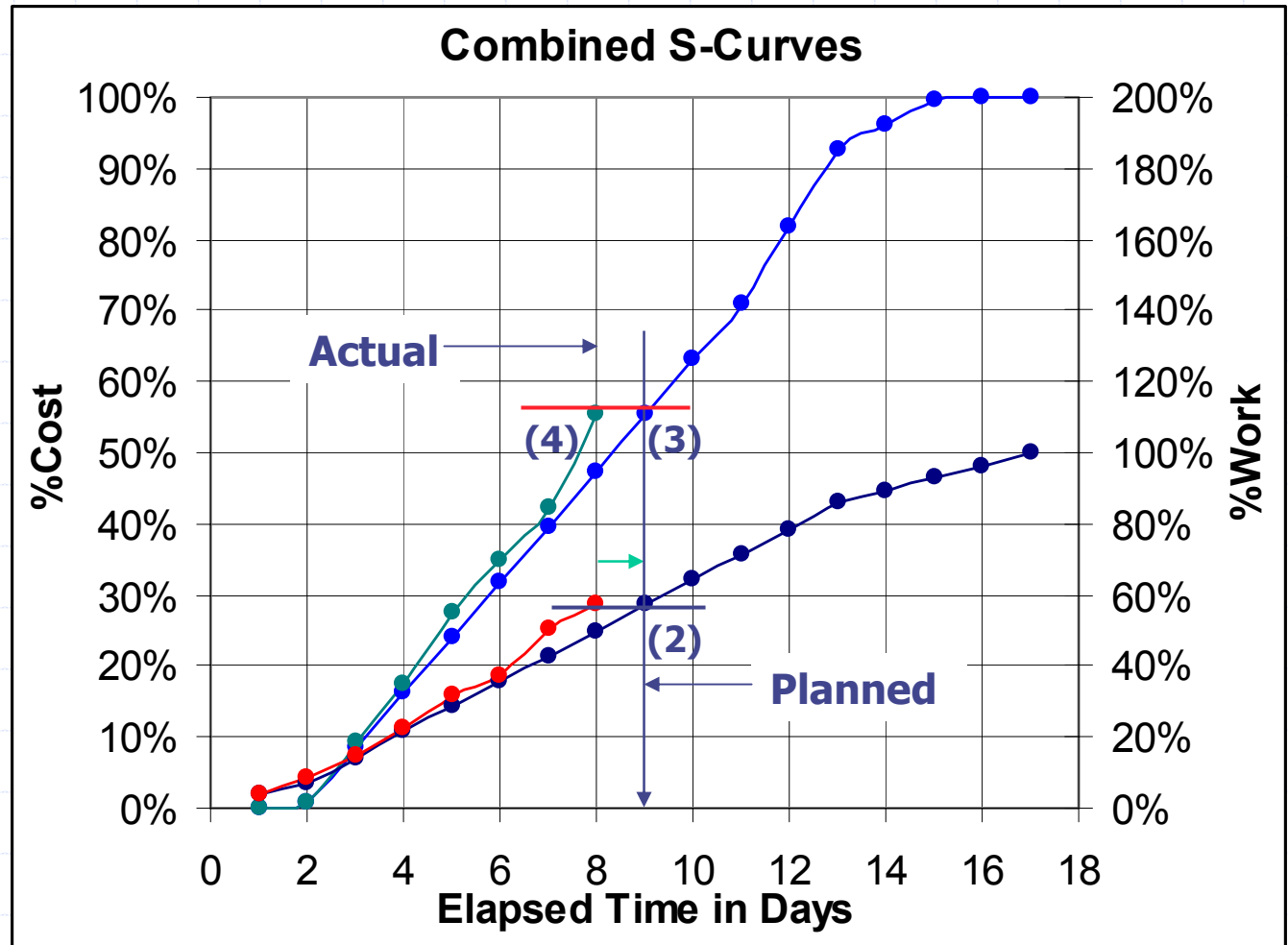
Class Exercise 4.1:

- Individuals, plot and interpret the S-Curves from the data.
- Pairs, compare answers.
- Teams, be prepared to discuss possible counter-measures.

Day	Cost %	Work %	Cost %	Work %
1	0%	4%	0%	4%
2	1%	7%	1%	8%
3	9%	14%	9%	17%
4	16%	21%	17%	25%
5	24%	29%	26%	34%
6	32%	36%	34%	39%
7	40%	43%	43%	49%
8	47%	50%	52%	60%
9	55%	57%	58%	66%
10	63%	64%	66%	75%
11	71%	71%	72%	81%
12	82%	79%	87%	91%
13	92%	86%		
14	96%	89%		
15	100%	93%		
16	100%	96%		
17	100%	100%		

The 4 Possible Cases.

1. Most likely
   - Over Budget
   - Behind Schedule

2. Common
   - Over Budget
   - Ahead of Schedule

3. Common
   - Under Budget
   - Behind Schedule

4. Least Likely
   - Under Budget
   - Ahead of Schedule

Case 1: Over Budget, Behind Schedule

Use these data to solve for Schedule and Cost Variance.

Day	Cost %	Work %	Cost %	Work %
1	0%	4%	0%	3%
2	1%	7%	1%	6%
3	9%	14%	9%	12%
4	16%	21%	19%	18%
5	24%	29%	27%	24%
6	32%	36%	35%	32%
7	40%	43%	41%	41%
8	47%	50%	51%	49%
9	55%	57%	56%	47%
10	63%	64%	70%	63%
11	71%	71%	82%	62%
12	82%	79%	93%	67%
13	92%	86%		
14	96%	89%		
15	100%	93%		
16	100%	96%		
17	100%	100%		

Case 1: Behind and Over
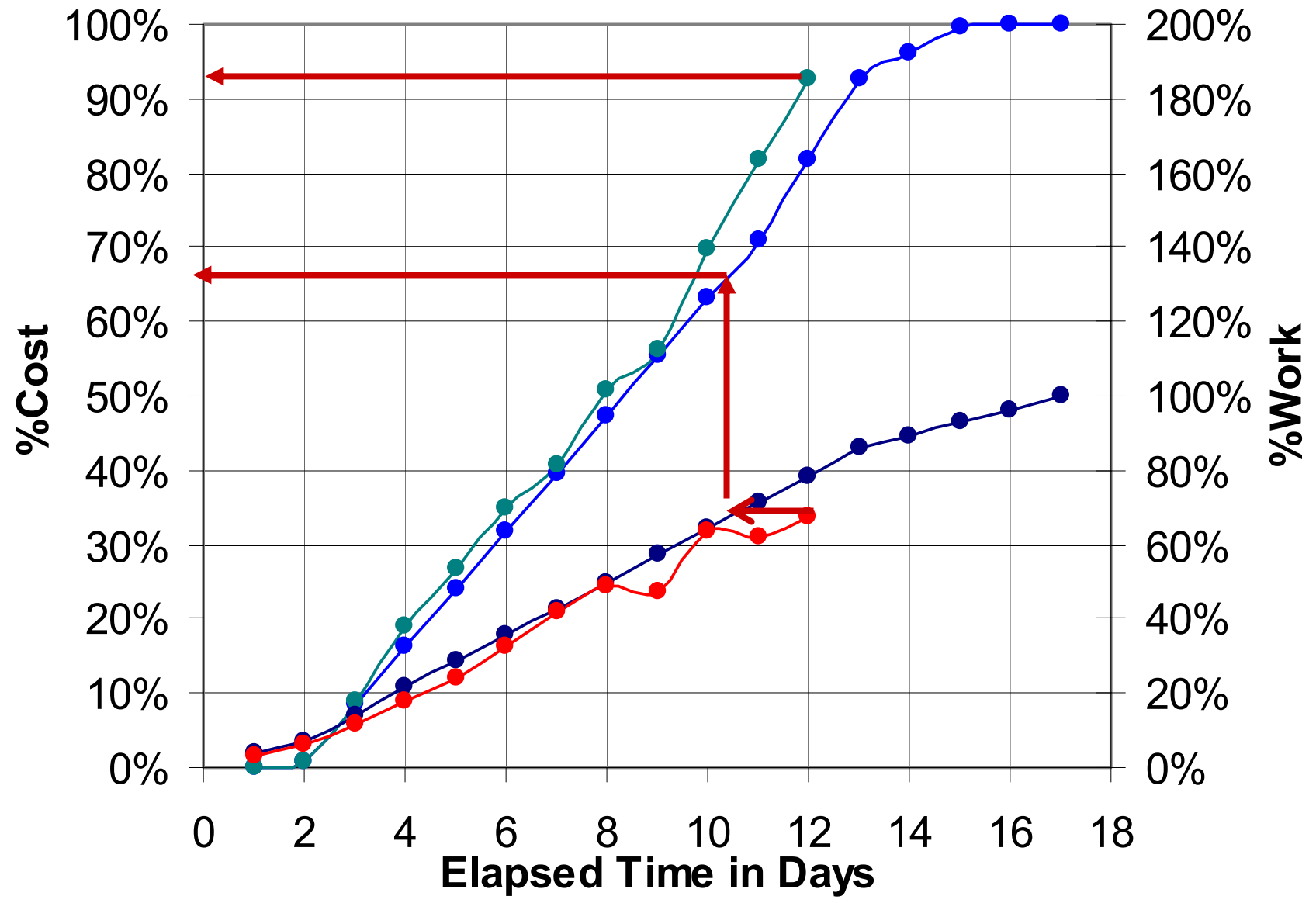
Answer to Case 1:

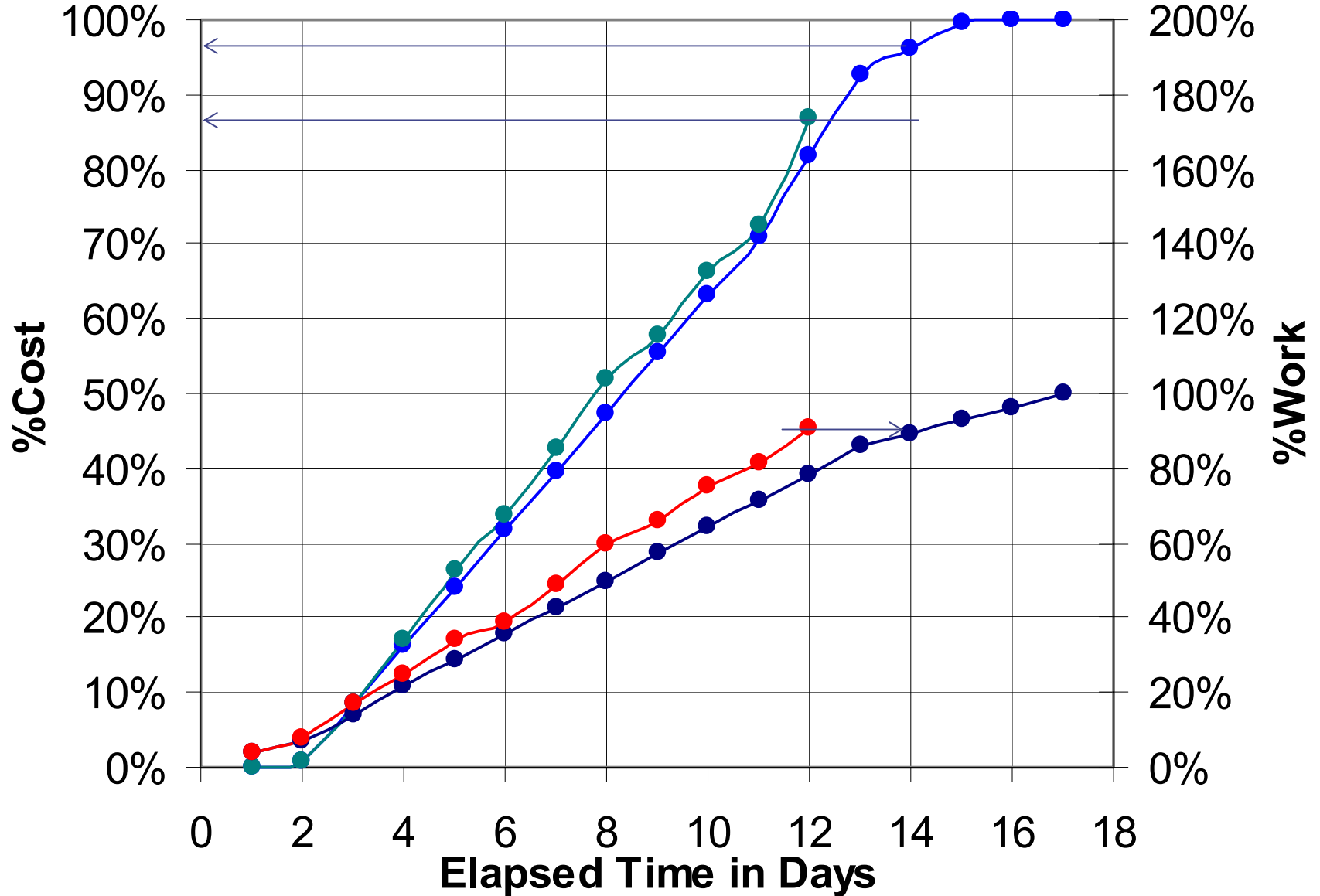- **Cost Variance** based upon schedule is 10% over budget.
- **Schedule Variance** based upon progress to date is (12 – 10.4 = 1.6 days) 10% behind schedule.
- **Budget Variance** based upon progress to date is (92% - 66%) 26% over budget,
- Since 70% of the schedule has elapsed at this point, you are in BIG trouble.

Case 2: Over Budget, Ahead of Schedule

Use these data to solve for Schedule and Cost Variance.

Day	Cost %	Work %	Cost %	Work %
1	0%	4%	0%	4%
2	1%	7%	1%	8%
3	9%	14%	9%	17%
4	16%	21%	17%	25%
5	24%	29%	26%	34%
6	32%	36%	34%	39%
7	40%	43%	43%	49%
8	47%	50%	52%	60%
9	55%	57%	58%	66%
10	63%	64%	66%	75%
11	71%	71%	72%	81%
12	82%	79%	87%	91%
13	92%	86%		
14	96%	89%		
15	100%	93%		
16	100%	96%		
17	100%	100%		

Case 2: Ahead and Over

Answer to Case 2:

- **Cost Variance** based upon schedule is 5% over budget.
- **Schedule Variance** based upon progress to date is (14 – 12) 2 days ahead of schedule at day 12.
- **Budget Variance** based upon progress to date is (98% - 88%) 10% under budget,
- Since 70% of the schedule has elapsed at this point, maintain momentum to finish early and close to budget.

Case 3: Under Budget, Behind Schedule

Use these data to solve for Schedule and Cost Variance.

Day	Cost %	Work %	Cost %	Work %
1	0%	4%	0%	4%
2	1%	7%	1%	7%
3	9%	14%	8%	13%
4	16%	21%	16%	20%
5	24%	29%	22%	26%
6	32%	36%	29%	36%
7	40%	43%	39%	39%
8	47%	50%	43%	47%
9	55%	57%	55%	53%
10	63%	64%	57%	59%
11	71%	71%	68%	71%
12	82%	79%	79%	72%
13	92%	86%		
14	96%	89%		
15	100%	93%		
16	100%	96%		
17	100%	100%		

Case 3: Behind and Under
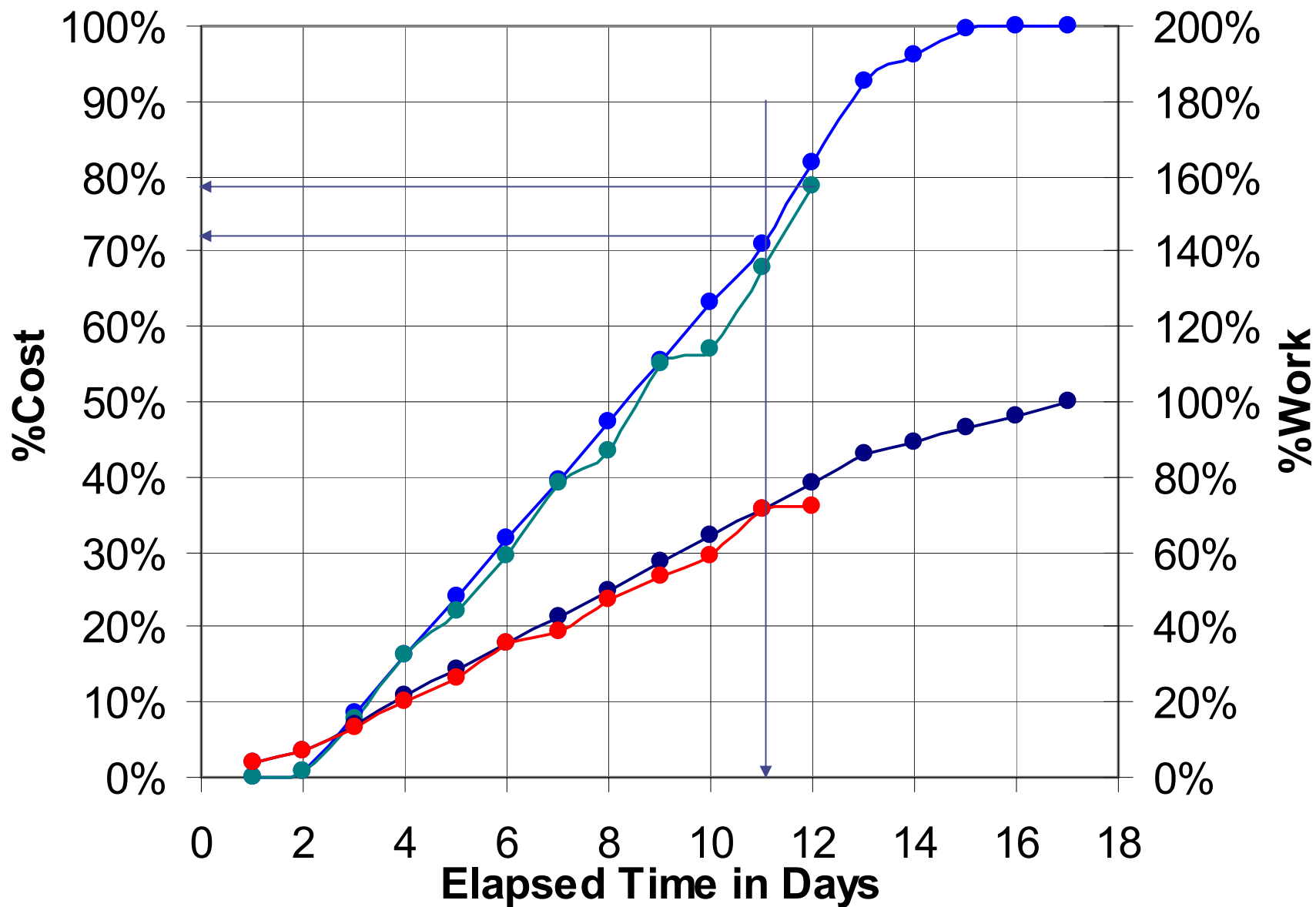
Answer to Case 3:

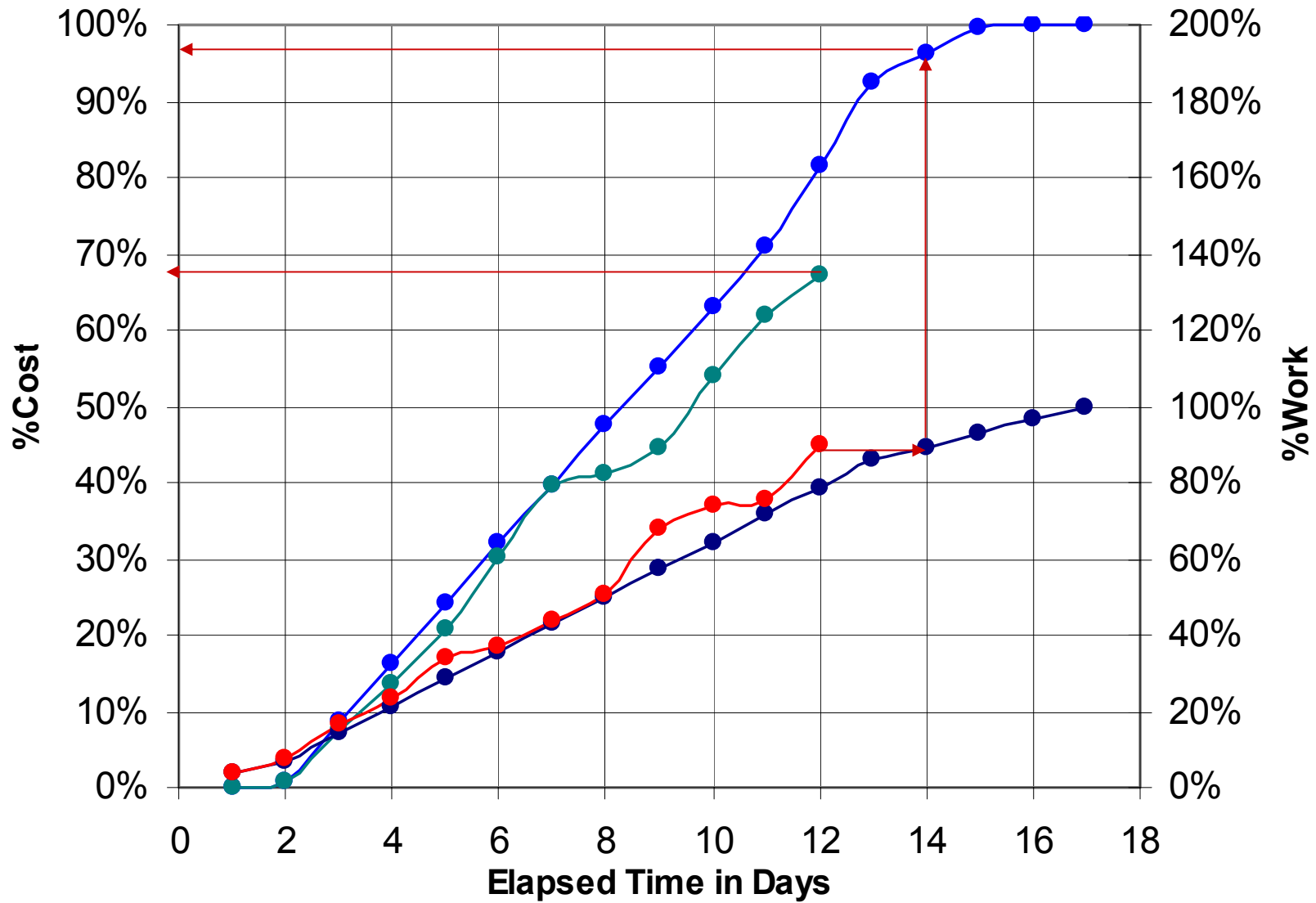- Budget Variance based upon schedule is 2% under budget.
- Schedule Variance based upon progress to date is (11 – 12) 1 days behind of schedule at day 12.
- Budget Variance based upon progress to date is (78% - 72%) 6% over budget,
- Since 70% of the schedule has elapsed at this point, increase momentum to finish on time and over budget OR … …

Case 4: Under Budget, Ahead of Schedule

Use these data to solve for Schedule and Cost Variance.

Day	Cost %	Work %	Cost %	Work %
1	0%	4%	0%	4%
2	1%	7%	1%	7%
3	9%	14%	7%	17%
4	16%	21%	13%	23%
5	24%	29%	21%	34%
6	32%	36%	30%	37%
7	40%	43%	40%	44%
8	47%	50%	41%	51%
9	55%	57%	44%	68%
10	63%	64%	54%	74%
11	71%	71%	62%	76%
12	82%	79%	67%	90%
13	92%	86%		
14	96%	89%		
15	100%	93%		
16	100%	96%		
17	100%	100%		

Combined S-Curves

Case 4: Answer

◆ Budget Variance based upon schedule is 15% under budget.

◆ Schedule Variance based upon progress to date is (12 – 14) 2 days ahead of schedule at day 12.

◆ Budget Variance based upon progress to date is (68% - 98%) 30% under budget,

◆ Since 70% of the schedule has elapsed at this point, maintain momentum to finish early and 30% under budget.

Important Points to remember

- Cost Variances based solely on schedule may yield misleading results.

- Schedule Variances may be difficult to determine because actual progress to date may be difficult to measure.

- Budget Variances based upon progress to date and schedule variances yield the best result.

Some Control Issues

- Coming out of the start-up phase, it is essential to achieve max productivity as quickly as possible. Otherwise, unrecoverable time may be lost.

- Therefore it is important to have an early check point to confirm early productivity.

Some Control Issues, cont'd.

- It is essential to establish an accurate check point before the 50% cost to complete point is reached.
- This will yield an estimate of status at completion, if trends continue.
- This becomes input to a successful completion strategy.
- It may be required in the Terms and Conditions of the contract.

Some Control Issues , cont'd.

- There is no substitute of constant monitoring.
  - For keeping progress on track and hitting payment milestones.
  - Designing counter-measures for unforeseen delays and cost estimation errors.
  - Provide accurate data for the "claims" negotiation exercise at the end of the project.

Reminder!
Class Assessment Questions

- In 1 sentence what was the muddiest part of this module?
- In 1 sentence, what part of this module could be improved the most?