EARNED VALUE

MANAGEMENT SYSTEM

PROJECT LIFE CYCLE
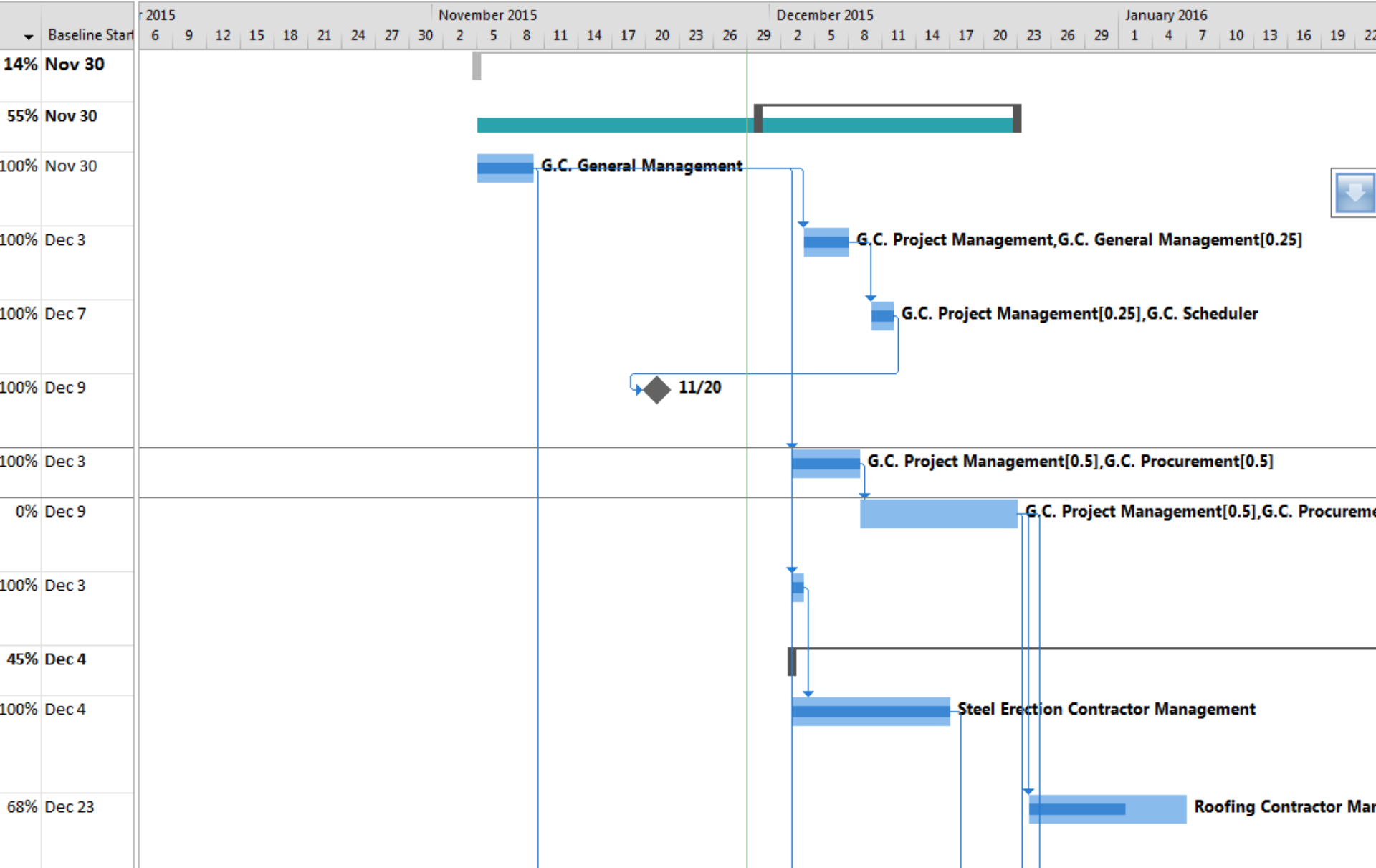
Concept ✓

Definition ✓

Plg & Org ✓

Formulation

Execution Performance

Evaluation Post Accomplishment

Time

2

Jan 25

Long Lead Procurement
Dec 3 - Mar 10

Masonry Work
May 3 - Oct 3

Today

Start

December | January | February | March | April | May | June | July | August | Sep

Mobilize on Site | Site Grading and Utilities | Foundations | Steel Erection | Elevators | Carpentry

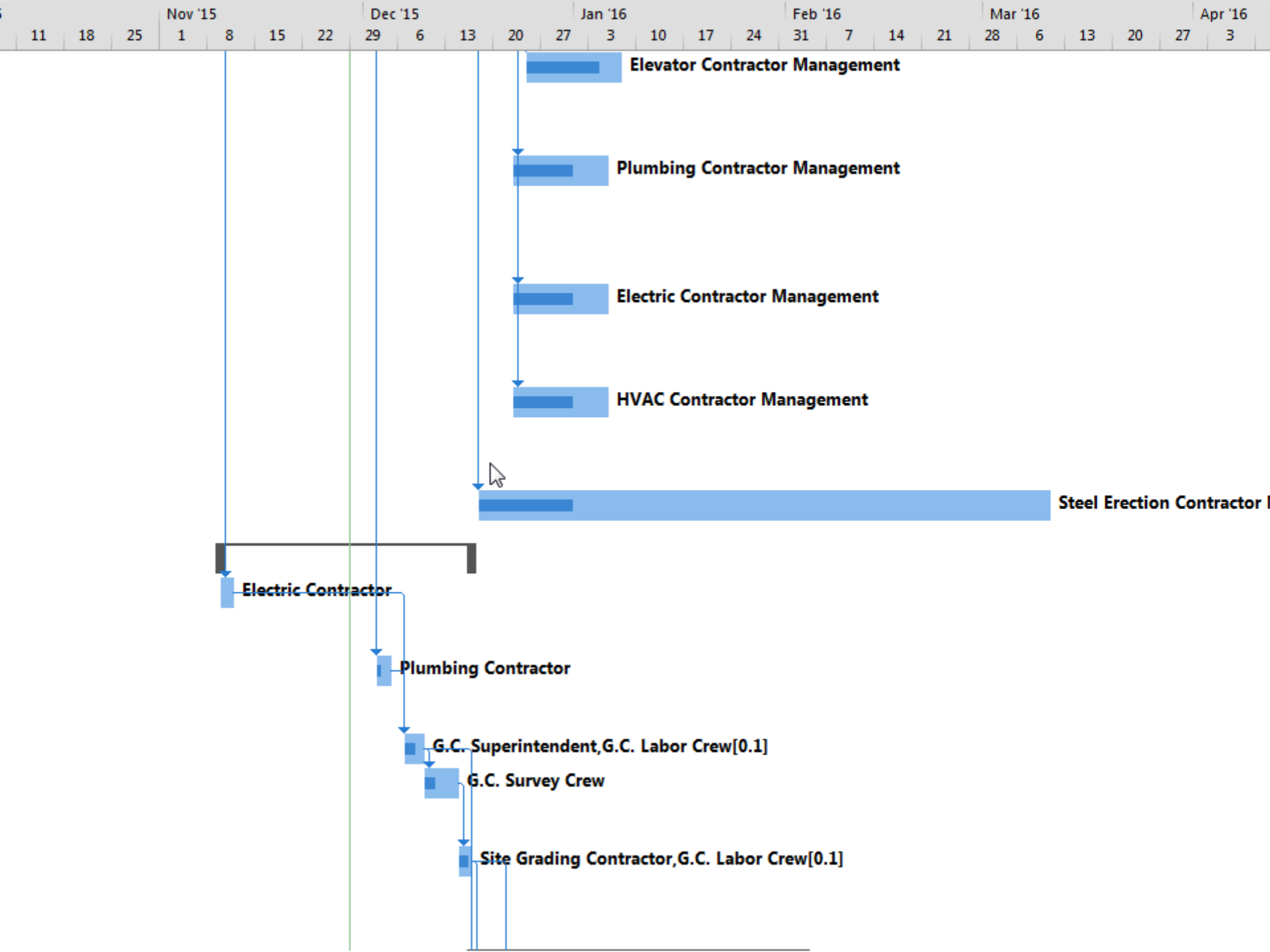|	Task Name	Duration	Start	Finish	Predecessors	Resource Names	% Complete	Baseline Star	2015								Nove
									6	9	12	15	18	21	24	27	30	2
0	**Commercial Construction**	**361 days**	**Nov 5**	**Mar 23**			**14%**	**Nov 30**										
1	◢ General Conditions	17 days	Nov 30	Dec 22			55%	Nov 30										
2	Receive notice to proceed and sign contract	3 days	Nov 5	Nov 9		G.C. General Management	100%	Nov 30										
3	Submit bond and insurance documents	2 days	Dec 4	Dec 7	2	G.C. Project Management G.C. General	100%	Dec 3										
4	Prepare and submit project schedule	2 days	Dec 10	Dec 11	3	G.C. Project Management[0.: G.C. Scheduler	100%	Dec 7										
5	Prepare and submit schedule of	0 days	Nov 12	Nov 20	4	G.C. General Management[0.: G.C. Project	100%	Dec 9										
6	Obtain building permits	4 days	Dec 3	Dec 8	2	G.C. Project Management[0.!	100%	Dec 3										
7	Submit preliminary shop drawings	2 wks	Dec 9	Dec 22	6	G.C. Project Management[0.! G.C.	0%	Dec 9										
8	Submit monthly requests for	1 day	Dec 3	Dec 3	2		100%	Dec 3										
9	◢ Long Lead Procurement	71 days	Dec 3	Mar 10			45%	Dec 4										
10	Submit shop drawings and order long lead items - steel	2 wks	Dec 3	Dec 16	8	Steel Erection Contractor Management	100%	Dec 4										
11	Submit shop drawings and order long lead	2 wks	Dec 24	Jan 6	7	Roofing Contractor Management	68%	Dec 23										

Masonry Work
May 3 - Oct 3

Electrical
Jul 13 - Jan 23

Building Finishes
Nov 1 - Feb 20

| June | July | August | September | October | November | December | January | February | March |

Elevators | Carpentry | Roofing | Final Clean-up and Occupancy | Compl | Finish

| Baseline Start | 2015 | November 2015 | December 2015 | January 2016 |

6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8 11 14 17 20 23 26 29 1 4 7 10 13 16 19 22

14%	Nov 30
55%	Nov 30
100%	Nov 30	G.C. General Management
100%	Dec 3	G.C. Project Management,G.C. General Management[0.25]
100%	Dec 7	G.C. Project Management[0.25],G.C. Scheduler
100%	Dec 9	11/20
100%	Dec 3	G.C. Project Management[0.5],G.C. Procurement[0.5]
0%	Dec 9	G.C. Project Management[0.5],G.C. Procureme...
100%	Dec 3
45%	Dec 4
100%	Dec 4	Steel Erection Contractor Management
68%	Dec 23	Roofing Contractor Man...

Gantt chart timeline (Nov '15 – Apr '16):

- Elevator Contractor Management
- Plumbing Contractor Management
- Electric Contractor Management
- HVAC Contractor Management
- Steel Erection Contractor
- Electric Contractor
- Plumbing Contractor
- G.C. Superintendent,G.C. Labor Crew[0.1]
- G.C. Survey Crew
- Site Grading Contractor,G.C. Labor Crew[0.1]

- **% of Budget spent ?**
- **% of Work done ?**
- **% of Time elapsed ?**
- **% of PROJECT completed ?**
- **Did I get my money's worth?**
- **Did I spend my hours, days and weeks wisely?**
  - subjective, incomplete
  - draws false conclusions
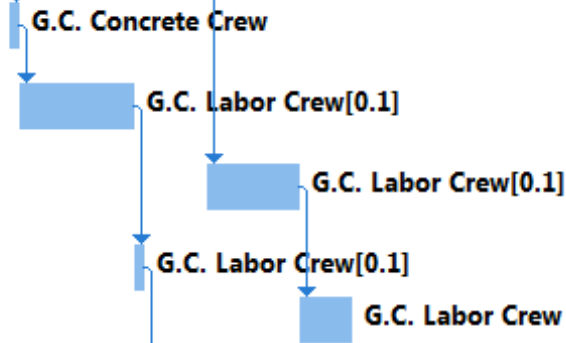
EVMS Helps In….

- **Knowing where you are on schedule?**

- **Knowing where you are on budget?**

- **Knowing where you are on work accomplished?**

FINANCIAL MONITORING OF PROJECTS – EARNED VALUE

CONCEPT : EARNED VALUE

While managing projects we look at the

Cost Dimension &

Time Dimension separately.

Earned Value __converts__ this function of Time and Cost into a single dimension of Cost alone

WHAT IS EVMS

EVMS is a technique used to track the Progress of a Project & forecast its future performance.

It integrates the scope, schedule and cost of a project.

Shows the past & current performance and predicts the future performance.

EARNED VALUE

The **budgeted amount of cost** for **work performed** in a given **period of time**

BCWP

THREE KEY INDEPENDENT VALUES OF THE EVMS

PV

EV

AC

PV

PV or Planned Value *PRP or Status Date*

Also called BCWS: (Budgeted Cost of Work Scheduled)

The approved budget that has been allocated to complete a scheduled task during a specific time period.

Serves as a baseline against which actual performance is measured

EV

EV or Earned Value.

Also BCWP – Budgeted Cost For **Work Performed**.

Budgeted cost of **work that has actually been performed** in carrying out a task during a specific time pd.

It is based on budgeted cost for completing the work & is measure of work completed.

AC

AC or Actual Cost

Also ACWP – Actual Cost of **Work Performed**.

The **actual amount that has been spent** during a specific time period.

Actual amt payable for work done to date. Can be higher or lower than planned cost.

PV	BCWS	Budgeted Cost of Work Scheduled
EV	BCWP	Budgeted Cost of Work Performed
AC	ACWP	Actual Cost of Work Performed

EVMS - EXAMPLE

- **A job is undertaken to construct a 100 ft wall at a total cost of Rs 10,000/- in 10 days. At the end of 10 days, 90 ft wall has come up and Rs 11,000/- has been expended. Analyse the Situation.**

10 DAYS   **90 ft**
(Rs 11,000)

100 ft
(Rs 10,000)

EVMS - EXAMPLE

- **A job is undertaken to construct a 100 ft wall at a total cost of Rs 10,000/- in 10 days. At the end of 10 days, 90 ft wall has come up and Rs 11,000/- has been expended. Analyse the Situation.**

PV = Rs 10000

Rs 10,000/-

100 ft

Review after 10 days
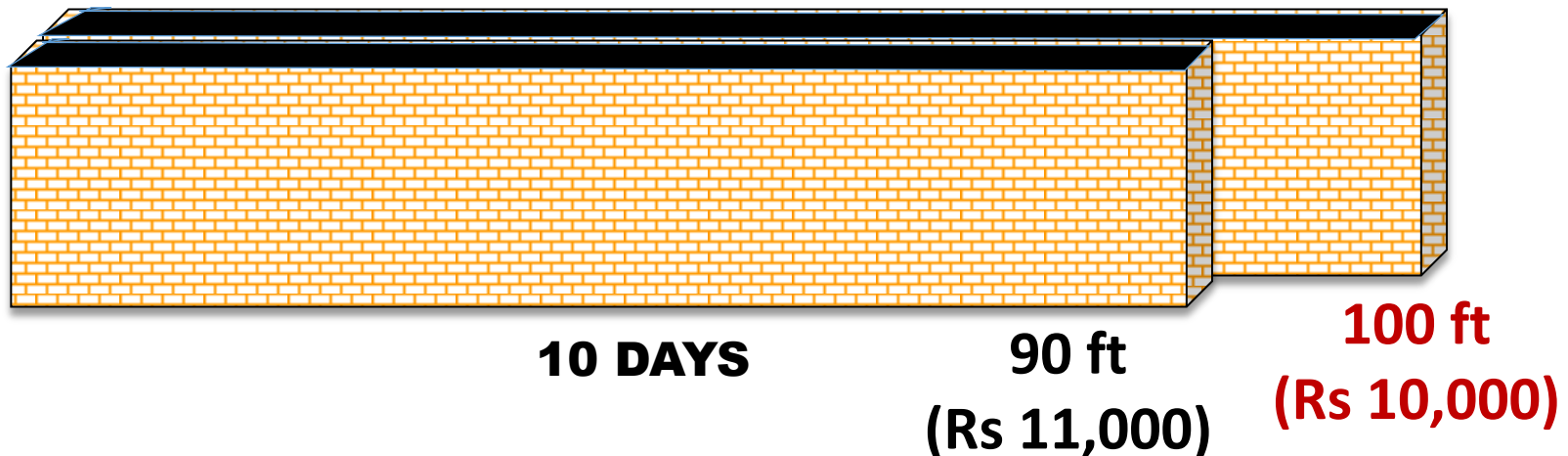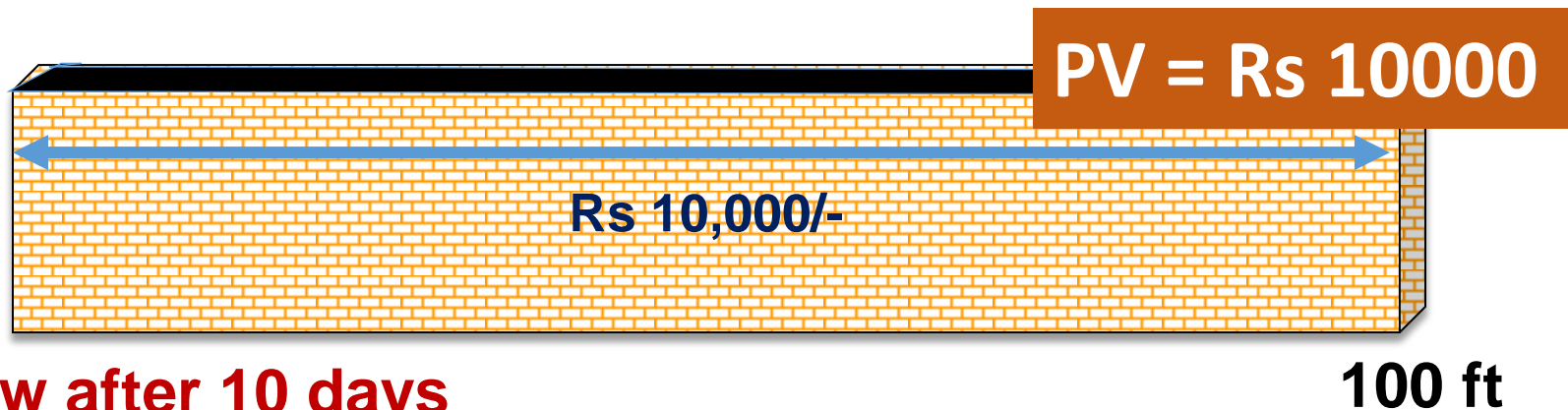
Work Scheduled – 100 ft wall

PV = Budgeted Cost of Work Scheduled
   Or Budgeted Cost for 100 ft wall = Rs 10000/-

EVMS - EXAMPLE

- **A job is undertaken to construct a 100 ft wall at a total cost of Rs 10,000/- in 10 days. At the end of 10 days, 90 ft wall has come up and Rs 11,000/- has been expended. Analyse the Situation.**
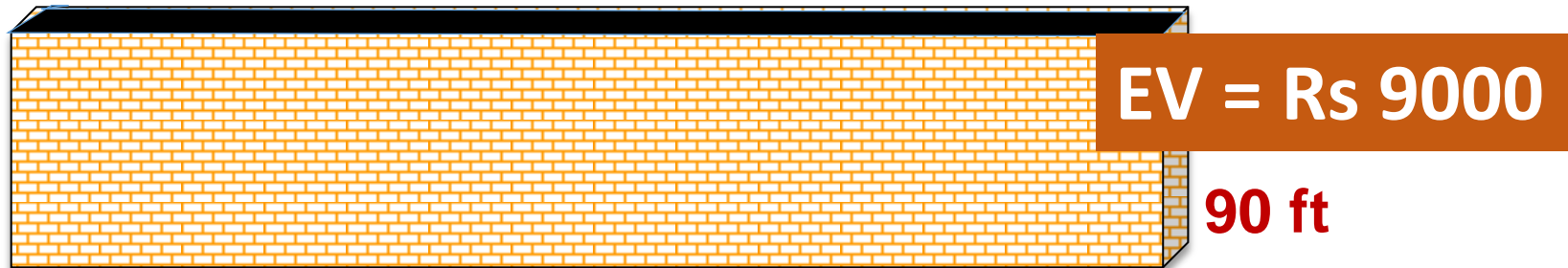
EV = Rs 9000

90 ft

Review after 10 days

Work Performed – 90 ft wall

EV = Budgeted Cost of Work Performed
Or Budgeted Cost for 90 ft wall = Rs 9000/-

EVMS - EXAMPLE

- A job is undertaken to construct a 100 ft wall at a total cost of Rs 10,000/- in 10 days. At the end of 10 days, 90 ft wall has come up and Rs 11,000/- has been expended. Analyse the Situation.

Review after 10 days

PV = Rs 10000

EV = Rs 9000

AC = Actual Cost of Work Performed
Or Actual Cost for 90 ft wall = **Rs 11000/-**

AC = Rs 11000

CALCULATING PROJECT DEVIATION USING EVMS

DEVIATIONS

Schedule Variance = **EV – PV**

- This is measure of conformance of actual progress to the schedule.

Cost Variance = **EV – AC**

- This is measure of conformance of actual cost for performing work to the budget.

SCHEDULE VARIANCE

Scheduled work 100 ft
- **PV for 100 ft wall = Rs 10,000/-**

Performed work 90 ft
- **EV for 90 ft wall   = Rs 9,000/-**

Schedule variance   = EV-PV
= 9,000 – 10,000
= – 1000

(time lag in performance ≡ 10 ft of wall i.e. one day)

COST VARIANCE

Actual work performed = 90 ft
Actual cost of 90 ft wall = Rs 11,000/-
- **AC** = Rs 11,000/-

Performed work = 90 ft
- **EV for 90 ft wall** = Rs 9,000/-

Cost variance = EV – AC
= 9,000 – 11,000
= – 2,000

(a Cost Overrun of Rs 2000/- for the job done)

SV & CV can be converted to Efficiency Indicators of a Project.

Performance Indices:

- SPI

- CPI

TIME DIMENSION

SCHEDULE PERFORMANCE INDEX (SPI)

$$SPI = \frac{EV}{PV}$$

>1 is a good performance
=1 is on target
<1 is poor performance

Compares work earned with time work Scheduled.

COST DIMENSION

COST PERFORMANCE INDEX (CPI)

$$CPI = \frac{EV}{AC}$$

>1 Good Performance
=1 On Target
<1 Poor Performance

Compares work performed (EV) with Actual Cost (AC)

CRITICAL RATIO

CRITICAL RATIO = SPI * CPI

$$[\frac{(EV)}{(PV)}] \times [\frac{(EV)}{(AC)}]$$

✓CR < 1   Poor Project Performance

✓CR = 1   Project on Target

✓CR > 1   Good Project Performance

➤ Generally, CR < 0.9 is critical and shall raise serious concerns for PM

PROJECT GUARD FENCE
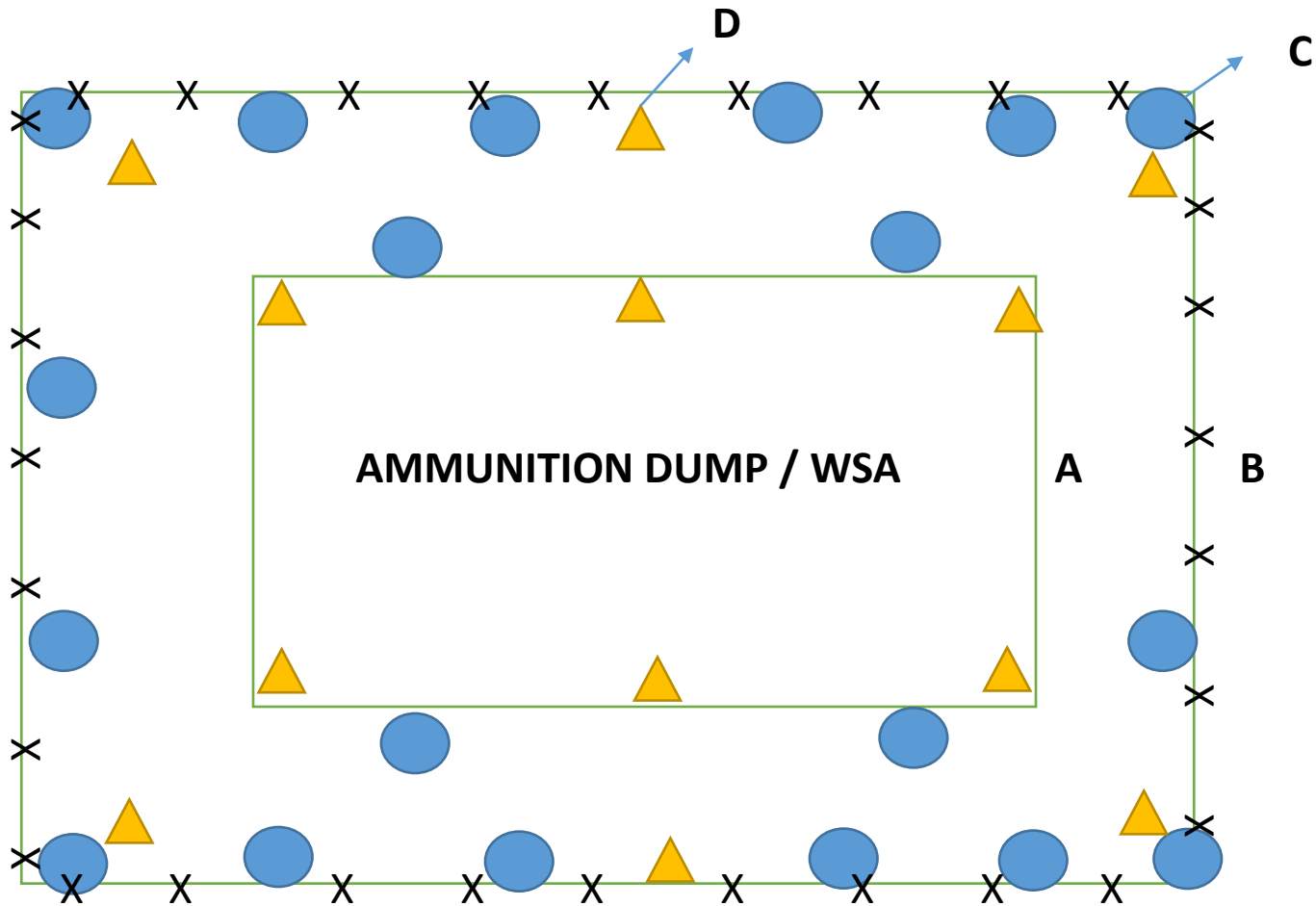
PROJECT GUARD FENCE

- An Ammunition Dump/WSA in Central India was to be secured by construction of a boundary wall (Task A), Double Wire Fencing (Task B), Perimeter Lighting (Task C) and CCTV Cameras (Task D).

- The planned cost of the activities (A , B , C & D)-

SL NO	TASK	COST IN LAKHS (RS)
1	A- Construction boundary Wall	600
2	B- Double Fence	200
3	C-Perimeter Lighting	300
4	D- CCTV Camera's	100

PROJECT GUARD FENCE -TABLE

SL No	Activity	Planned Cost in Rs (in Lakhs)
1.	A -Construction of Boundary Wall	600
2.	B - Double fencing	200
3.	C - Perimeter Lighting	300
4.	D - Installation of CCTV camera's	100
	Total	1200

PROJECT GUARD FENCE

- Work Commenced on 01 Sep Y and
- Work Expected to be completed by 28 Feb Y +1
- As on Jan Y +1 work completed is as given in the table below
- Activity A was planned to cost Rs. 600 Lakhs (PV)
- The actual cost was Rs 540 Lakhs (AC)
- Project review Point 31 Dec Y

PROJECT CONTROL WITHOUT EV

Task	Sep	Oct	Nov	Dec	PRP Jan	Feb	Task Budget
A	**Sch=600**	Act-540					**600**
B		**Sch=200**	Act-200				**200**
C			**Sch=200**	Act-150			**300**
D					**Sch=0**	Act-0	**100**
Total		**Sch-1000**	**Actuals – 890**		**110 Underspent**		**1200**

PROJECT CONTROL WITH EV

Task	Sep	Oct	Nov	Dec	PRP Jan	Feb	Task Budget
A	Sch=600 Performed =600	Act-540					600
B	Sch=200	Perf-60	Act-				200
C	Sch=200	Pe...	Act-150				300
D			Sch=0	Perf-0		Act-0	100
Total	Sch- 1000 Perf-870 Actual-890		Behind Over	Schedule Budget	130 20		1200

PROJECT IS BEHIND SCHEDULE AND OVER BUDGET

PROGRESS SCENARIOS
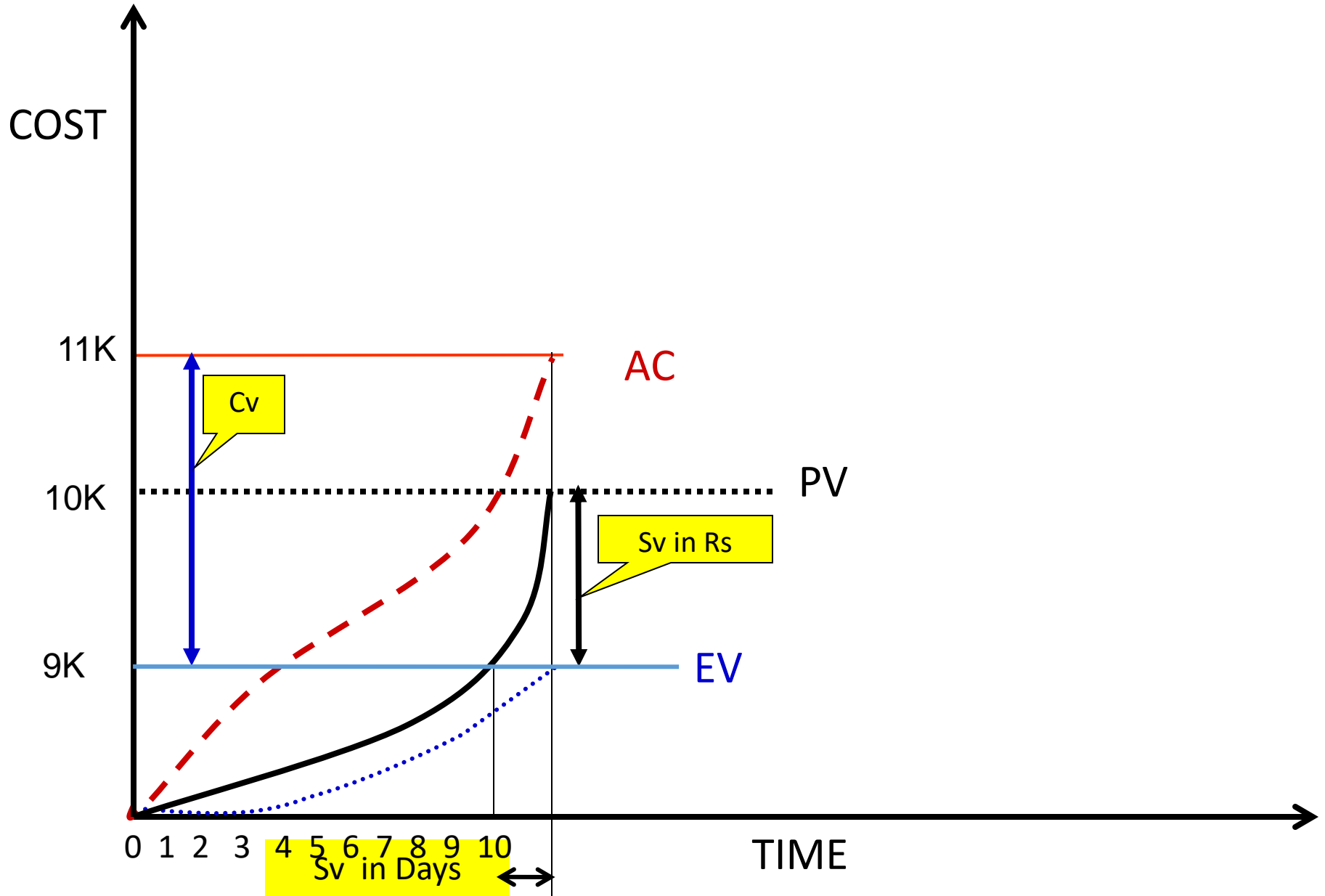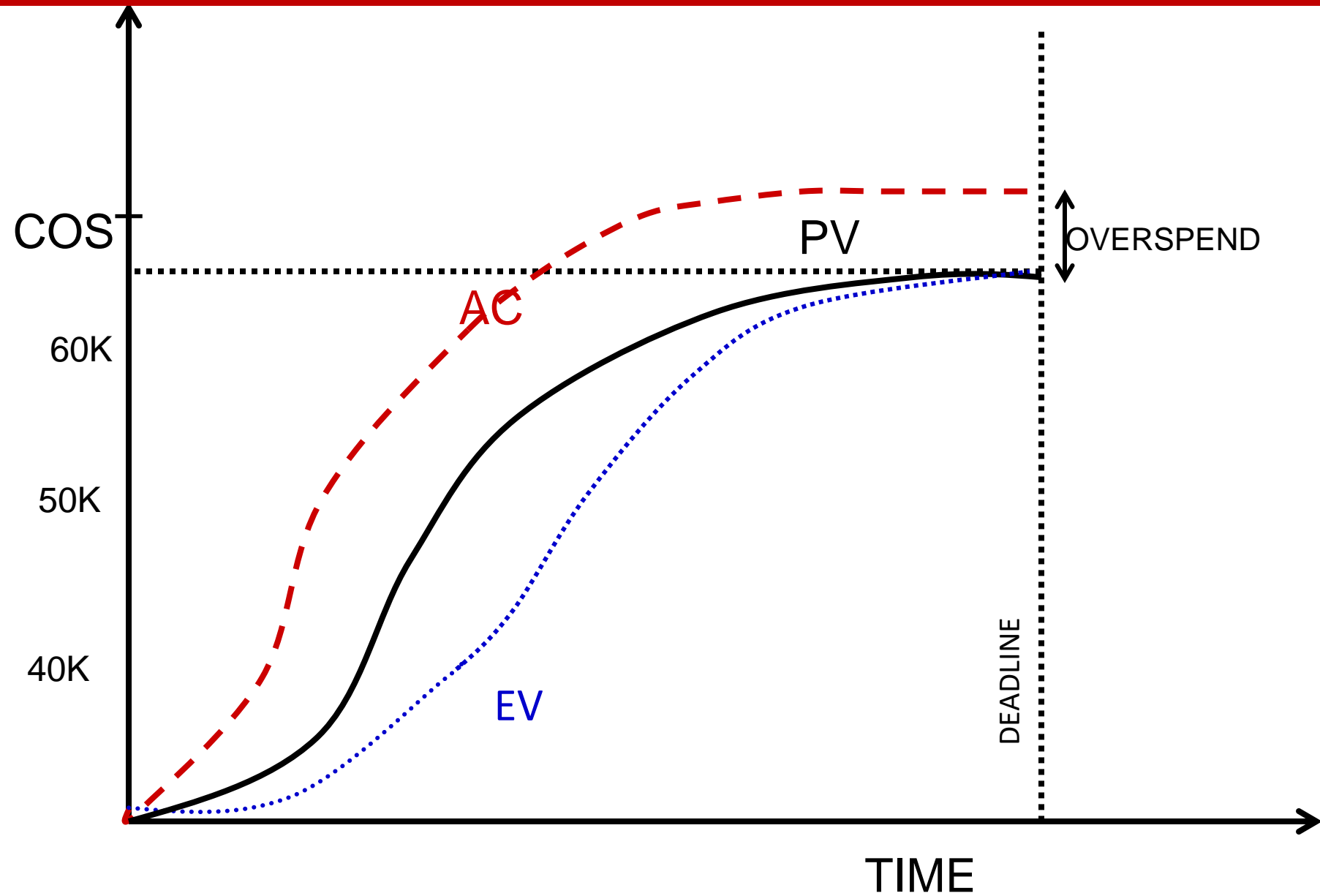
AHEAD OF SCHEDULE & SPENDING CORRECTLY
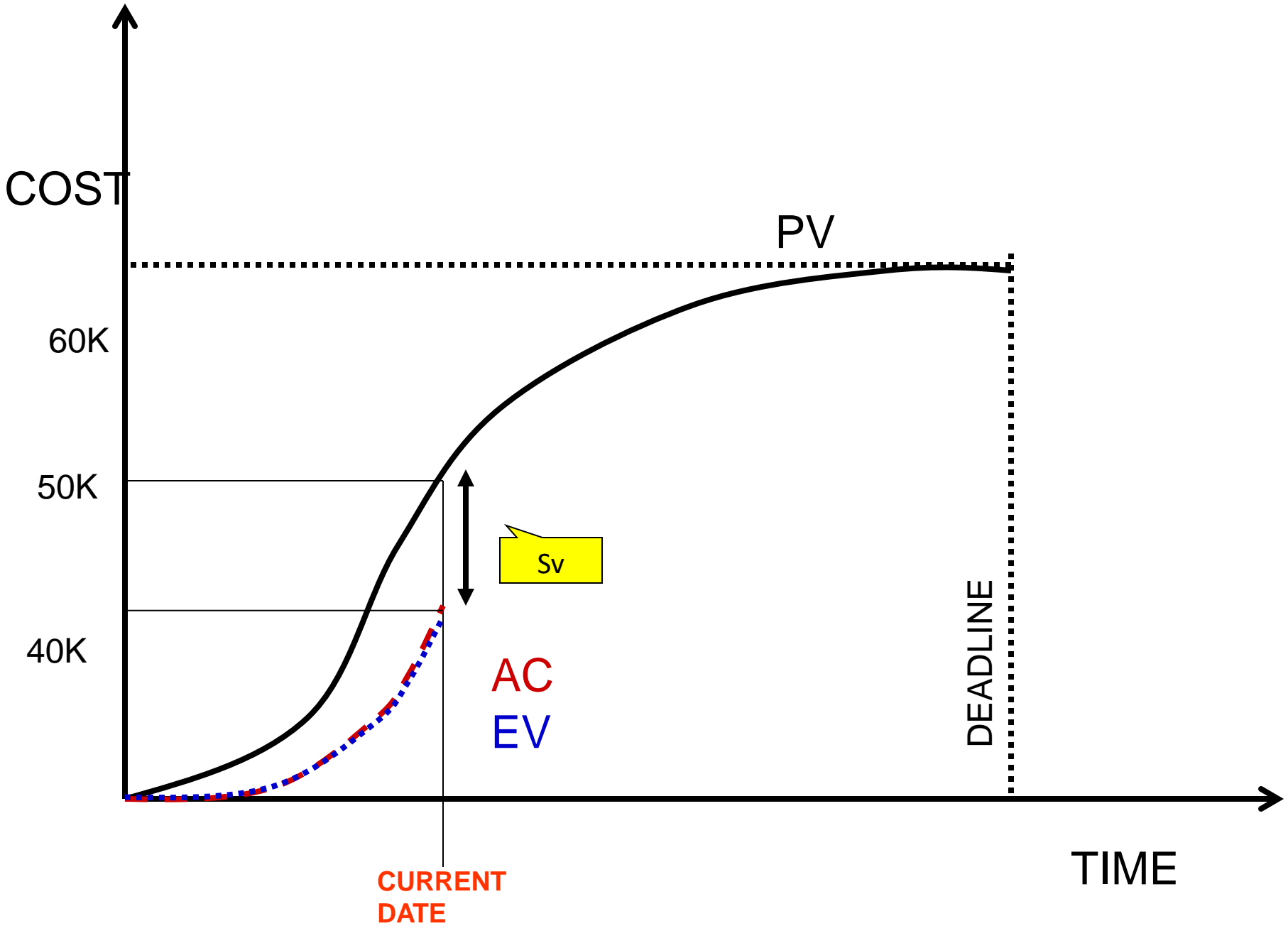
PROJECT SEAGULLS NEST 2000

- Provide covered parking space for four vessels in Western Coast. Planning parameters are :-
  - ✓ Budget at Completion (BAC) is Rs. 564 Lakhs
  - ✓ Planned time for completion of Project – 52 Weeks

- At End of 26 Weeks review Project and find :-
  - ✓ Planned Value (PV) – Rs. 282 Lakhs
  - ✓ Earned Value (EV) – Rs. 220 Lakhs
  - ✓ Actual Cost (AC) – Rs. 240 Lakhs

- Calculate BAC or **Budget at Completion** for three different conditions .

ASSUMPTION 1

- <u>Current rate of using capital continues till end of Project completion.</u>
- CPI= EV/AC
  - 220/240 = 0.9167 ~ 0.92 (rounded off)
- EAC = BAC/CPI
  - 564/0.92
  - Rs 613.4 Lakhs
- Budget at Completion would be Rs.613.4 Lakhs

ASSUMPTION 2 (A)

- CPI Improves to 100%

  - Balance work = BAC-EV
  - 564-220= Rs. 344 Lakhs

- EAC = AC + Balance work/ new CPI
  - Rs 240 + (344/ 1)
  - Rs 584 Lakhs
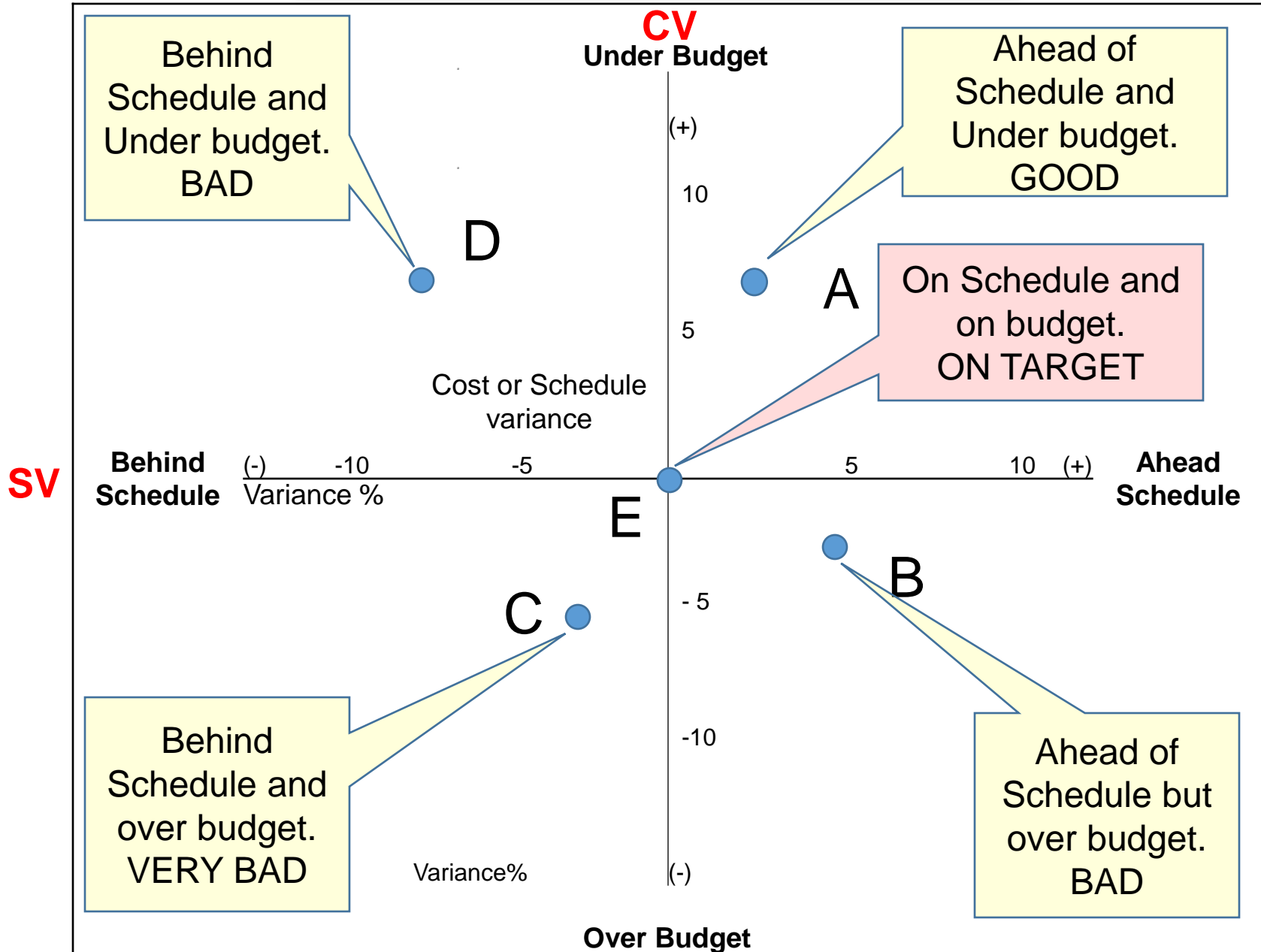
- Budget at Completion would be Rs 584 Lakhs

ASSUMPTION 2 (B)

- **<u>CPI</u> changes to 0.95**
- Lets us compute new EAC.
- Balance Work= BAC minus EV as on date
- Rs 564-220 Lakhs = **344** Lakhs
- EAC= AC +(BAC-EV)/ CPI
  - 240 + (344/ 0.95)= 240 + 362.11
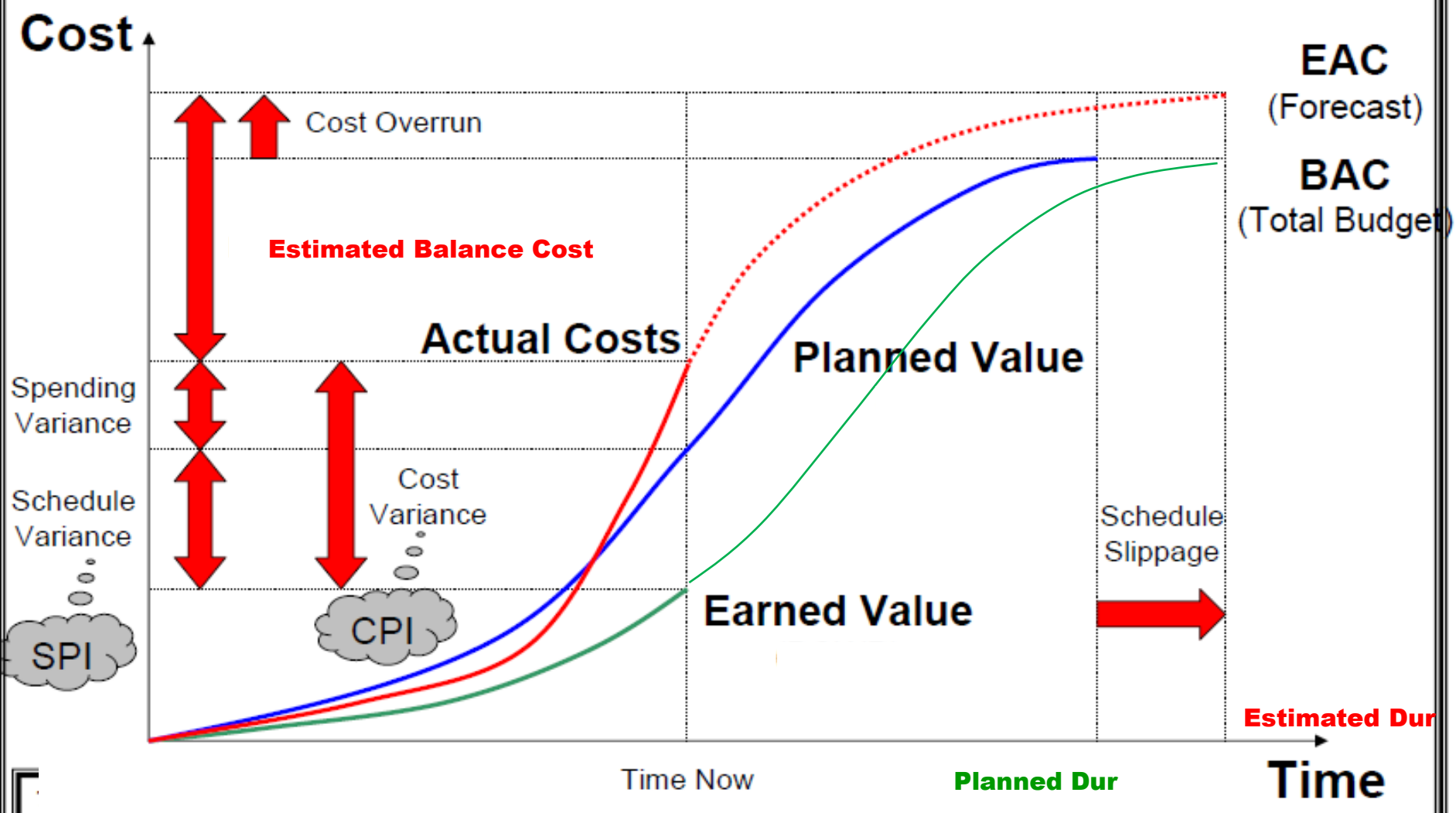 - Rs. 602.11 lakhs

ASSUMPTION 3

- If Old BAC is wrong / erroneous then there is a need to review our calculations. (if Rs. 344 Lakhs is wrong)

- Totally new rate of CPI (old BAC erroneous, Bal Work Rs. 400 Lakhs)

- EAC = AC + Bal Work

  = 240 + 400 = 640 Lakhs

TIME-COST MATRIX

CV
Under Budget

(+)

10

5

Behind Schedule and Under budget. BAD

D

Ahead of Schedule and Under budget. GOOD

A

On Schedule and on budget. ON TARGET

Cost or Schedule variance

SV
Behind Schedule (-) Variance % -10 -5 5 10 (+) **Ahead Schedule**

E

- 5

C

Behind Schedule and over budget. VERY BAD

B

Ahead of Schedule but over budget. BAD

-10

Variance%

(-)

Over Budget

COMMON PROBLEMS

- Poor estimating techniques-unrealistic budgets
- Inadequate WBS
- Out of sequence execution
- Unforeseen technical problems
- Material escalation factors

CONCLUSION

- EV Concept mandatory in US Govt contracts since 1960s.

- Technique has been used in most of recent & ongoing civil & Defence Projects in India.

ASSUMPTION 2 (B)

Project

- Lay 10 Kms of road at a budget of 10 Cr
- In 10 mths at uniform pace
- BAC - 10 Cr
- Total Time - 10 mths

Review after 5 mnths

- Actual expenditure - 6 Crs & Work completed 4 Kms

ASSUMPTION 2 (B)

- PV = 5 Crs
- EV = 4 Crs
- AC = 6 Crs

- EAC = AC + (BAC - EV) / CPI(new)
- TAC = AT + (TT – AT + Delay) / SPI(new)
  - AT=ACTUAL TIME
  - TT=TOTAL TIME

The PMP $10 Backyard Project