Earned Value

Earned Value

- We have seen the different method of measuring progress on a project.
- The next step is to develop a method for determining overall percent complete for a combination of **dissimilar** work tasks or an **entire project**.
- The method for accomplishing this is called earned value.

Earned Value

- The earned value (EV) is keyed to the budget; which can be expressed in terms of Money (SR/$) or Work-Hours (WH).
- Monetary value and WH are the only common units among all the different accounts on a project (accounts are established on the basis of WBS.)
- The work-hour budgets are more commonly used.

Earned Value

- For any account the earned value is defined as:
  - Earned value = % completed x budget for the account
- Notice that the max that can be earned by any account is the amount already established in the budget.

Simple Example

- Assume a SR 50,000 and 300 WH have been budgeted for a specific account.
- Suppose that progress was estimated (by one of the methods of progress measurement) at 40% complete.
- Therefore; EV=SR 20,000 (in SR terms)
  EV=120 WH (in terms of WH)

Earned Value is used for measuring overall progress

- The earned value provides a way of determining progress on a single task or a combination of tasks, even if the tasks are of dissimilar nature (with different units of measure)
- For any account
  Earned value = % complete x Account budget

Measuring Percentage Completion

- It is possible to determine overall percentage completion for the entire project as:
  Percent Complete = Earned value of all accounts / Budgeted Value for all accounts (SR or WH)

Cost & Schedule Performance

- The EV method is used to determine performance of the overall project with regards to cost and schedule.
- In order to do that, we require three pieces of information:
  - The budgeted cost for work scheduled (BCWS).
  - The actual cost for work performed (ACWP).
  - The budgeted cost for work performed (BCWP) ➔ Earned Value.

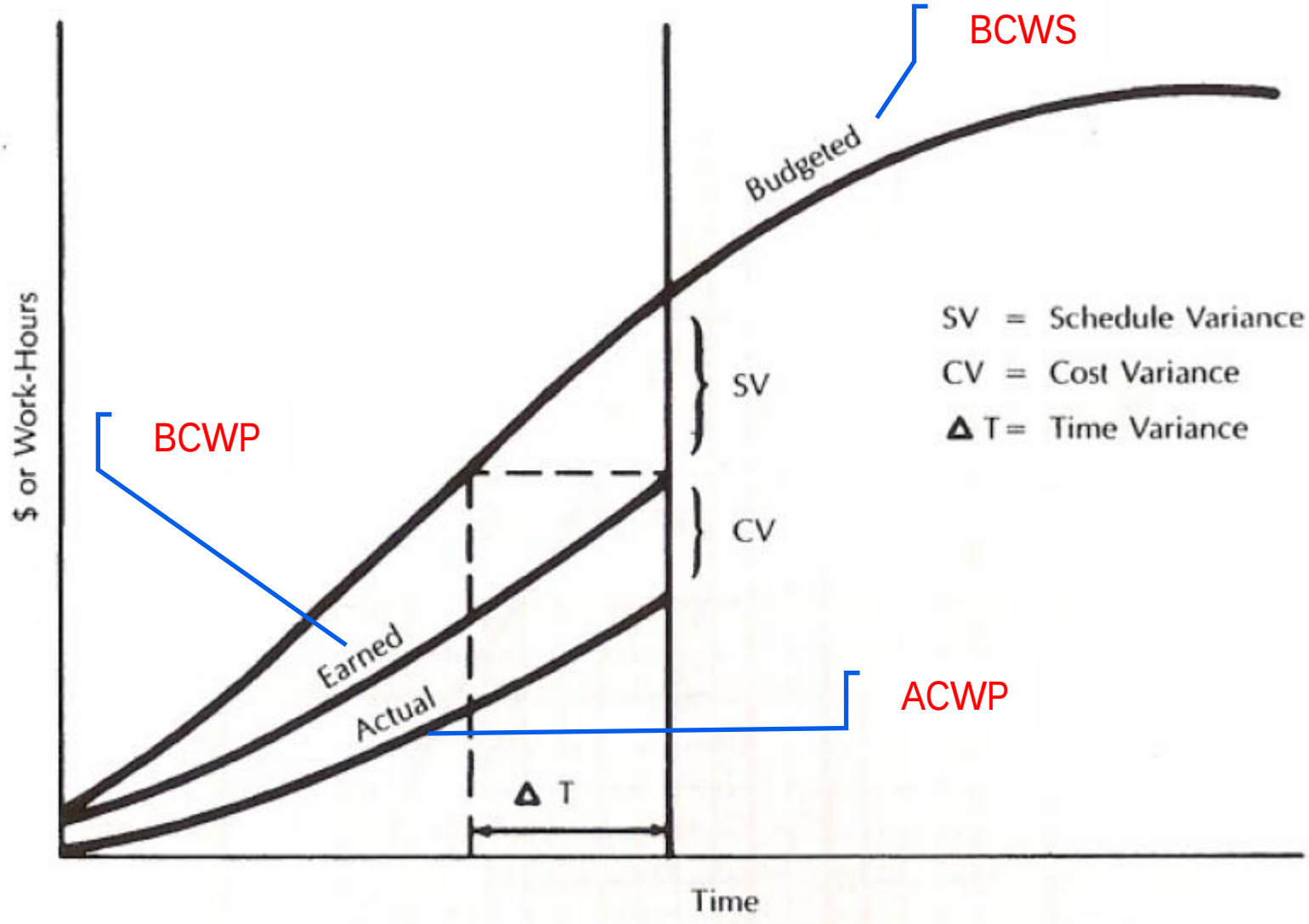

Figure 5. Cost and Schedule Performance Graph

A Sample Project Report Based on Earned Value

	1	2	3	4	5 = 1x 3	5-4	5-2
Activity	Total Budget	Budget (BCWS)	% Complete	Actual Cost (ACWP)	Earned Value (BCWP)	Cost Variance	Schedule Variance
Site Work	50,000	50,000	100%	52,000	50,000	-2,000	0
Concrete	430,000	230,000	55%	232,000	236,500	4,500	6,500
Walls	210,000	70,000	30%	68,000	63,000	-5,000	-7,000
Plumbing	125,000	90,000	70%	95,000	87,500	-7,500	-2,500
Electrical	105,000	80,000	75%	87,000	78,750	-8,250	-1,250
HVAC	420,000	100,000	20%	104,000	84,000	-20,000	-16,000
Roofing	150000	35,000	20%	30,500	30,000	-500	-5,000
Finishing	2,900,000	315,000	10%	310,000	290,000	-20,000	-25,000
Project	4,390,000	970,000	21%	978,500	919,750	-58,750	-50,250

- The Budgeted Cost for Work Scheduled (BCWS): This is the budget amount allocated to the task.
- The Actual Cost for Work Performed (ACWP): This is the amount actually spent on the task.
- The Budgeted Cost for Work Performed (ACWP): This is the budget amount for completed work.

Variances

- The cost variance, CV:
  - *CV = BCWP – ACWP*
- The cost performance Index:
  - *CPI= BCWP/ACWP*
- The schedule variance, SV:
  - *SV = BCWP – BCWS*
- The schedule performance Index:
  - *SPI=BCWP/BCWS*

Note: Positive variance and an index greater/equal 1.0 indicates favorable performance; e.g. CV>0 or CVI>1 indicates cost underrun.

Project Percentage Completion

- To determine the project percentage completion:
  - Sum the earned values for all activities to obtain the project earned value.
  - Sum the budgeted amounts for all activities to obtain total project budget.
- The project percentage complete = The project earned value ÷ The project budget

A Sample Project Report Based on Earned Value

	1	2	3	4	5 = 1x 3	6=5-4	7=5-2	8 = 5/4	9 = 5/2
Activity	Total Budget	Budget (BCWS)	% Com-plete	Actual Cost (ACWP)	Earned Value (BCWP)	CV	SV	CVI	SVI
Site Work	50,000	50,000	100%	52,000	50,000	-2,000	0	0.96	1
Concrete	430,000	230,000	55%	232,000	236,500	4,500	6,500	1.02	1.03
Walls	210,000	70,000	30%	68,000	63,000	-5,000	-7,000	0.93	0.9
Plumbing	125,000	90,000	70%	95,000	87,500	-7,500	-2,500	0.92	0.97
Electrical	105,000	80,000	75%	87,000	78,750	-8,250	-1,250	0.91	0.98
HVAC	420,000	100,000	20%	104,000	84,000	-20,000	-16,000	0.81	0.84
Roofing	150000	35,000	20%	30,500	30,000	-500	-5,000	0.98	0.86
Finishing	2,900,000	315,000	10%	310,000	290,000	-20,000	-25,000	0.94	0.92
Project	4,390,000	970,000	21%	978,500	919,750	-58,750	-50,250	0.94	0.95

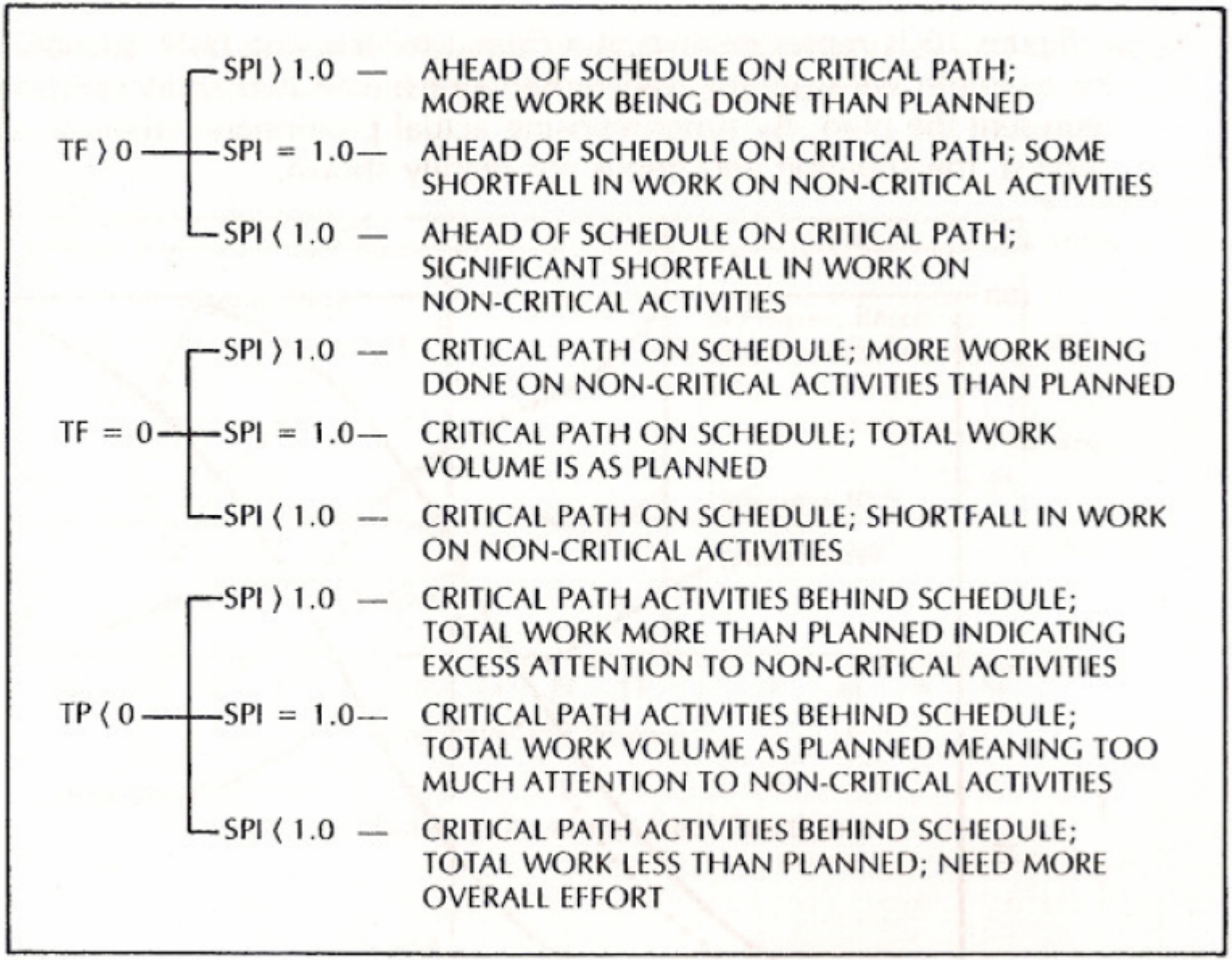

Figure 11. Analysis Tree – Total Float and SPI

Earned Value:
Variable Budget Projects

- This method is applicable for situations when the project is not well defined, the budget may not be fixed. This is the case for cost plus contracts, for example.
- Work packages are assigned budgets (WH/Money) based on the best available information at the time.
- As a work package definition improves, its budget is adjusted to reflect current estimates of the budget.

Earned Value:
Variable Budget Projects

- The updated budget is referred to as the Quantity Adjusted Budget (QAB).
- The earned value is:
  Percent Complete x QAB
- The calculations for project % complete, SV, SVI, CV, CVI are the same as in the case of fixed budgets.
- As a work package definition improves, its budget is adjusted to reflect current estimates of the budget.

Original Budget

	1	2	3	4=3/2	5	6=4x5
Work Item	UOM	Quantity	WH	Budgeted Unit Rate	Design Quantity	QAB WH
Earthwork	CM	234	193	0.825	257	212
Concrete	CM	94	2201	23.415	102	2388
Steel erection	TON	2.5	119	47.6	2.2	105
Mechanical equipment	EA	1.1	152	138.182	1.3	180
Piping	LM	180	470	2.611	210	548
Electrical Systems	LM	84	220	2.619	79	207
Total			3355			3640

Job-to-Date

	1	2	3	4	5=4/2	6=5x3
Work Item	UOM	Design Quantity	WH	Quantity to-date	Percent Complete	Earned WH
Earthwork	CM	257	212	100	0.389	82
Concrete	CM	102	2388	42	0.412	983
Steel erection	TON	2.2	105	0.85	0.386	41
Mechanical equipment	EA	1.3	180	0.4	0.308	55
Piping	LM	210	548	35	0.167	91
Electrical Systems	LM	79	207	22	0.278	58
Total			3,640		0.36	1,311