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On Track

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Earned Value and Fixed Price Contracts

By: Dick Cowan, PE, PMP, trustee

Of the many questions asked of Project Managers the most serious are, "when will this project (really) be complete," and "what will this project have cost me when it is complete?" The "Earned Value" concepts discussed so well in the PMI Journal and PMI Network magazines are powerful tools to make very accurate early predictions of the Cost at Completion (CAC) and Time at Completion (TAC) of projects. These concepts rely on knowing the Actual Cost of Work Performed (ACWP) and extrapolating the experience in the first part of the project to the overall project. But many important projects use fixed priced contracts to execute the work of the project. And these contracts don't usually call for the contractor's sharing of Actual Costs. Owners contemplate paying only the contract price, plus the cost of change orders to the contract executed as the work progresses.

Without actual cost data, some project managers forecast not the CAC, but the amount of budget obligated, the amount of contract invoiced, or the amount of contingency not yet used up by formal change orders. All of these fail to even remotely predict CAC.

How can Project Managers on projects using fixed priced contracts gain the value of Earned Value concepts to predict Cost at Completion and Time at Completion?

Here is a simple approach demonstrated with data from a sample project shown in the accompanying chart. *(see back of February flyer for chart)*

Use the Schedule of Values (1) which for progress payment purposes breaks the contract amount into line items. Assume the line items are the "work packages" contemplated in a Work Breakdown Structure. The latest progress payment request (2) will have estimated the percentage completion of each line item, and, therefore, calculated the amount earned to date for each line item, which we can assume is the Budgeted Cost of Work Performed (BCWP) (3).

Take the baseline schedule (4), and comparing it to the Schedule of Values, calculate what the line items percentage

(See Earned Value, continued on page 2)

Inside. . .

Special inserts:

Flyer for February meeting

Earned Value Chart

PMP Certification Study Group

"Sacramento Marathon"

Our speaker this month will be Doug Thurston. Doug got his start in event management after he competed in a particularly poorly organized road race in his junior year at the University of Oklahoma. After sending a letter to the race director, he was invited to help organize a future event. Eighteen years later, he continues to organize races in Sacramento and around the country as an independent contractor. A highlight of his career includes directing the 1992 U.S. Men's Olympic Marathon Trials in Columbus, Ohio. Locally, Doug works on the Race for the Cure, the California International Marathon, and Eppies' Great Race. Doug was nominated in 1992 as Race Director of the Year and has received several service awards from USA Track and Field, the governing body of road racing.

Thursday, February 19

Sudwerks of Sacramento
1375 Exposition Blvd., Sacramento
No host bar starts at 5:30 p.m.
Dinner served at 6:15 p.m.

Menu choices: braised brisket of beef, sausage combination platter, or stuffed chicken breast.

Reserve your place by February 18th by calling Susan Reid (916) 442-3779. The cost is $20 per person for dinner and presentation. Please make checks payable to PMI and remit to: Kitchell, Attention: Susan Reid, 501 J Street, Suite 630, Sacramento, CA 95814-2336

Earned Value, *continued from page 1*

completion would have been if the project had been exactly on the baseline schedule. This is the Budgeted Cost of Work Scheduled (BCWS) **(5)**.

The cost variable in fixed priced contracts is measured in change orders. At any time in a project, the team will have formally approved a family of change orders, but have another family of change orders in various stages of maturity: being priced, being negotiated, or being formalized. Let's call these immature change orders Pending Change Orders. Formal claims which are not yet resolved or which have been denied but for which the contractor has reserved rights represent a special class of risk of future cost changes. Additionally, every astute project manager keeps a list of issues that may become pending changes. Although we don't usually track contract change orders in the same categories as the schedule of values, our substitute work breakdown structure, it's not hard to re-calculate them that way **(6)**.

If we do this, then the sum of Budgeted Cost of Work Performed (our progress billing to date) plus the line item's share of change order costs, pending change orders costs and issues cost will add up to the Actual Cost of Work Performed. **(7)** Let's think about what this means. If executing the first 20% of a line item, we have earned $20,000, the BCWP, and that line item's share of change orders, pending change orders, and issues is another $8000, we are saying it has actually cost us $28,000 (ACWP) to perform work for which we budgeted $20,000. A critic of this approach might say that some of those changes or issues may not have been executed yet, although many have, and we are overstating the cost to do the work so far. A counter argument is that, when the line item's work is 100% done, pending changes and issues are usually not yet finalized, we have recognized $8000 worth of additional cost items in doing the first 20%, and we will recognize additional cost items in doing the last 20%.

A side benefit of looking changes in this way is that the Cost Variance **(8)** identifies which line items are tending the most over budget, pointing the way to which line items may need management attention. An additional benefit of looking at this line item ACWP is that it allows us to multiply our percentage of line item work yet to perform (merely 100 minus earned to date) by the ACWP for that line item to get an order of magnitude figure for where our best opportunities lie for adjusting costs if necessary to bring the contract back under budget **(9)**.

Someone will ask whether or not the TAC estimated using the SPI incorrectly ignores whether or not the schedule's critical path is on target. It's true that SPI ignores whether critical or non-critical work has been performed. But here's the point that CPM misses. If all of the activities with float consume their float early in the job, then more and more activities will become near critical, more and more paths will become near critical, and then any delay anywhere on the project will delay the entire project. Not only that, but as more work is crowded together in the last part of the job, trade crowding and trade interferences prevent that work from really being accomplished simultaneously. The Schedule Performance Index predicts that if scheduled work slips, it will continue to slip.

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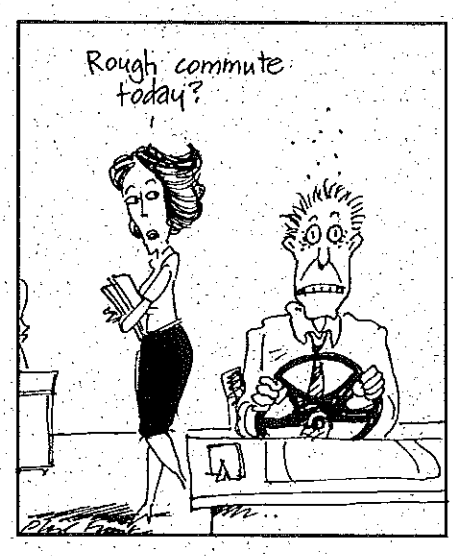
Then, using our formulas we calculate the CPI and SPI, and estimate the CAC and TAC. **(10)** Here we have a logically arrived at forecast on which to base our answers to the serious questions, "when" and "how much."



Earned Value and Fixed Priced Contracts

(see page 1)

	1		2	3	6	6	6	6	7	4	5	8		9	
	Schedule of Values		Progress Payment Request	BCWP					ACWP						
CSI Div.	Trade	Contract Amount	%Earned to date	$ Earned to date	Approved Changes	Pending Changes	Likely Claims	Issues	Total Actual Cost	% Baseline Schedule	BCWS	CV Cost Variance	% yet to perform	Opportunities for Adjusting Cost	
1	General Conditions	485,000	52	252,200	100000	22432	290364	340000	1004996	55	266750	-752796	48	-361342.08	big
2	Sitework/Landscape	1,400,000	75	1,050,000	350000		50000	53000	1503000	80	1120000	-453000	25	-113250	big
3	Concrete	1,500,000	95	1,425,000	25000		20000		1470000	95	1425000	-45000	5	-2250	
4	Masonry	190,000	100	190,000	10000			5000	205000	100	190000	-15000	0	0	
5	Steel	800,000	100	800,000	50000	100000	200000		1150000	100	800000	-350000	0	0	
6	Wood Framing	2,752,000	50	1,376,000	125000	300000	123000	27000	1951000	75	2064000	-575000	50	-287500	really big
7	Insulation/Weatherproofing	1,080,000	30	324,000	0				324000	40	432000	0	70	0	
8	Doors and Hardware	1,650,000	10	165,000	0				165000	10	165000	0	90	0	
9	Finishes	1,200,000	10	120,000	20000			10000	150000	10	120000	-30000	90	-27000	
10	Specialties	790,000	10	79,000	0				79000	10	79000	0	90	0	
11	not used			0	0				0	0	0	0	100	0	
12	not used			0	0				0	0	0	0	100	0	
13	Equipment	125,000	40	50,000	50000			55000	155000	55	68750	-105000	60	-63000	medium
14	Elevators	345,000	38	131,100	50000				181100	45	155250	-50000	62	-31000	
15	Mechanical HVAC	1,100,000	60	660,000	100000				760000	62	682000	-100000	40	-40000	
15	Mechanical Plumbing	1,200,000	60	720,000	50000	100000		25000	895000	62	744000	-175000	40	-70000	medium
16	Electrical	1,600,000	68	1,088,000	86271	80000		25000	1279271	70	1120000	-191271	32	-61206.72	medium
	TOTAL	$16,217,000		$8,432,840	$1,016,271	0	-100000	540000	11272367		9431750	-2842067			
	Original Contract Time = 12 months														
10	Schedule Performance Index=BCWP/BCWS=				8432840/9431750			0.89							
	Cost Performance Index=BCWP/ACWP= 8432840/11272367								0.75						
	Cost at Completion = B/CPI= $16217000/0.75						$21,677,629								
	Time at Completion = original Contract Time/ SPI = 12 months/ 0.89								13.5	months					

Earned Value concepts say:

Schedule Performance Index (SPI)=Budgeted Cost of Work Performed (BCWP)/ Budgeted Cost of Work Scheduled (BCWS)

Cost Performance Index (CPI)=Budgeted Cost of Work Performed (BCWP)/Actual Cost of Work Performed (ACWP)

Cost Variance (CV) = BCWP-ACWP

Cost at Completion (CAC)=Budget/CPI

Time at Completion (TAC)=Original Contract Duration/SPI