



Cumulative Impact Claims

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What is a Cumulative Impact?

- According to the Electrical Contracting Foundation:

“The costs associated with impact on distant work, which are not as readily foreseeable or, if foreseeable, not as readily computable as direct impact costs. The source of such costs is the sheer number of and scope of changes to the contract. The result is an unanticipated loss of efficiency and productivity...”

Change Order's effect on Project Cost

- The actual direct cost and time of performing the change;
 - Labor,
 - Materials,
 - Equipment
- The impact the change may have on other unchanged or contractual work

As the Number of Changes Increases...

- ...the differential between estimated work-hours and actual work hours widens at an increasing rate.
- Studies by:
 - Charles A. Leonard – 1988;
 - William Ibbs – 1995, 1997, 2005

Cumulative Impact (Ripple Effect)

Sources:

- Dilution of supervision
- Out-of-sequence work
- Piecemeal work
- Reassignment of manpower
- Stacking of trades
- Rework
- Morale and attitude

Guiding Case: *Bell BCI Company v. United States*

- Project Statistics:
 - \$21.4 million or 34% over budget:
 - 19-1/2 months completion delay
 - Over 200 contract modifications addressing more than 730 Extra Work Orders.
- Award:
 - \$6,207,672 in damages – 100% of request
 - Contract Disputes Act interest

What's behind Bell BCI Co.'s successful presentation?

- Documentation
- Documentation
- Documentation

Bell BCI Co.'s key presentation elements:

- Support of detailed cost reporting and scheduling practices;
- Routinely updated Critical Path Method (CPM) schedule;
- Contemporaneous project records;
- Anecdotal evidence

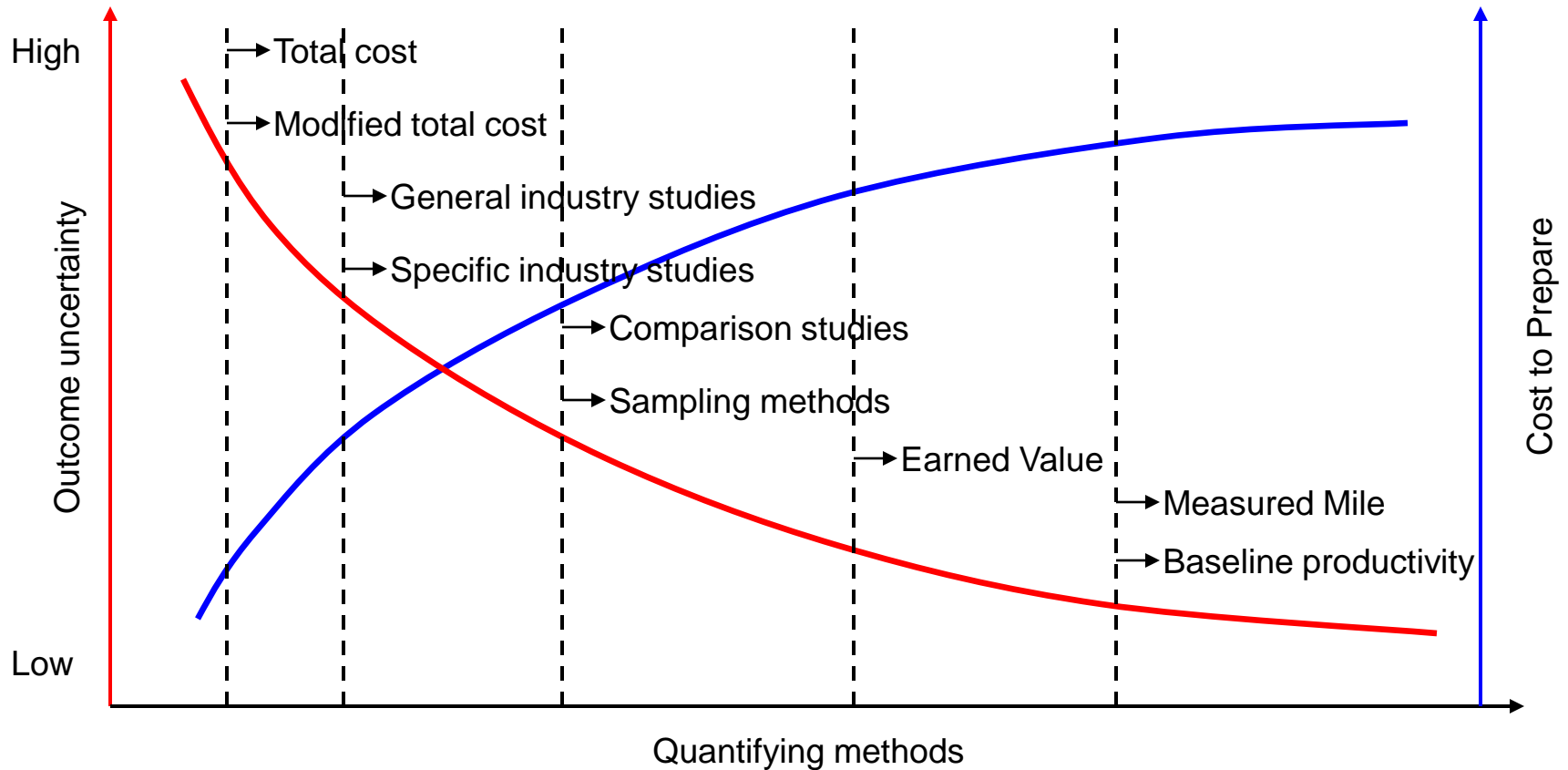
Bell BCI Co.'s impact analysis

- Time impact analysis of the changes using “windows analysis”;
- Established “measured mile” – measure of productivity during unimpacted period;
- Comparison of actual to benchmark installation efficiency;
- Anecdotal evidence

Measurement Approaches and Their Ranking

- Total Cost
- Modified Total Cost
- Industry Studies
- Earned Value
- “Measured Mile”
- Specific Allocation

Reliability of quantifying methods



AACE Recommended Practice Estimating Lost Labor Productivity in Construction Claims

- Identifies estimating methodologies;
- Provides ranking order;
- Defines and discusses each methodology;
- Identifies selected studies to each methodology;

Total Cost Method

Total Hours Incurred			4,688
Less Hours Estimated			(3,600)
Excess Hours			1,088
Average Labor Rate			\$ 50
Total Claimed			\$ 54,400

Modified Total Cost

Total Hour Incurred	4,688
Less Hours Estimated	<u>(3,600)</u>
Excess Hours	1,088
Less: Change Orders	(100)
Hours Under Bid	(150)
Less XYZ's Errors	<u>(75)</u>
Net Excess Hours	763
Average Labor Rate	<u>\$ 50</u>
Total Claimed	<u>\$ 38,150</u>

Industry Studies

Month	Hours	Inefficiency % ¹	Excess Hours
Jan '02	200	5%	10.0
Feb '02	250	5%	12.5
Mar '02	400	10%	40.0
Apr '02	480	20%	96.0
May '02	460	20%	92.0
June '02	500	25%	125.0
Total Excess Hours			375.5
Average Rate			\$ 60.00
Total Claimed			\$ 22,530.00

¹ Per XYZ Association Study, Stacking of Trades typically results in inefficiencies in the range of 5% to 25%

Measured Mile

Unimpacted Period

Jan thru March '02

Total Hours Incurred	2,400.00
Feet of Pipe Run	10,000.00
Hours per Foot	0.24

Impacted Period

April through December

Total Hours Incurred	12,000.00
Feet of Pipe Run	30,000.00
Hours Per Foot	0.40

Excess Hours Per Foot During Impacted Period	0.16
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# of Impacted Feet Run	30,000.00
Excess Labor Hours	4,800.00
Average Labor Rate	\$ 55.00

\$ 264,000.00

Earned Value Measures of Productivity

Earned Value analysis is a method for measuring project performance. It indicates how much of the budget should have been spent in view of the amount of work done so far and the baseline costs for the tasks, assignments, or resources

Most Common Measurements:

- Schedule Variance is a subjective indicator that does not reveal the critical path. A positive schedule variance is an indication that work in process is ahead of schedule.
- Cost Variance is an objective indicator stating the value of what was accomplished for the resources expended. A positive cost variance indicates that work was accomplished with less resources than planned

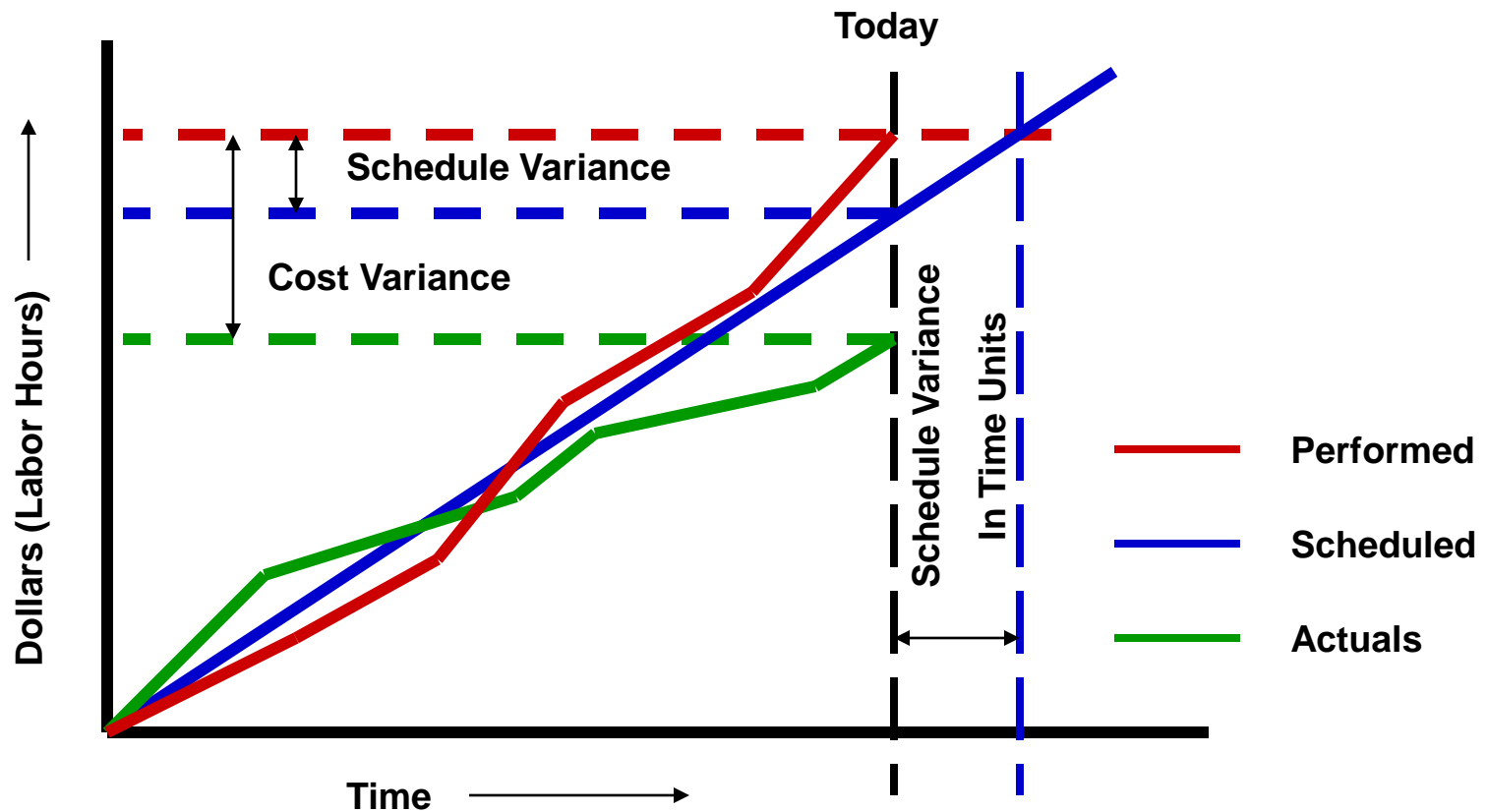
Most Common Measurements:

- Cost Variance:
$$CV = \text{Budget Cost of Work Performed (BCWP)} \\ - \text{Actual Cost of Work Performed (ACWP)}$$
- Cost Performance Index:
$$CPI = BCWP/ACWP$$
- Cost Variance Percentage:
$$CV\% = (BCWP - ACWP) / BCWP$$

Most Common Measurements:

- Schedule Variance:
 $SV = \text{Budget Cost of Work Performed (BCWP)} - \text{Budget Cost of Work Scheduled (BCWS)}$
- Schedule Performance Index:
 $SPI = BCWP/BCWS$
- Schedule Variance Percentage:
 $SV\% = (BCWP - BCWS) / BCWS$

Schedule and Cost Variances



Earned Value Measurement of Lost Labor Productivity:

- Unimpacted Period Sample Data:
 - Budgeted Cost of Work Scheduled = \$80,000
 - Budgeted Cost of Work Performed = \$92,000
 - Actual Cost of Work Performed = \$90,000
- Schedule Performance Index:
 $SPI = \$92,000 / \$80,000 = 1.15$ (ahead of schedule)
- Labor Cost Performance Index:
 $CPI = \$92,000 / \$90,000 = 1.02$

Earned Value Measurement of Lost Labor Productivity:

- Impacted Period Sample Data:
 - Budgeted Cost of Work Scheduled= \$160,000
 - Budgeted Cost of Work Performed = \$150,000
 - Actual Cost of Work Performed = \$180,000
- Schedule Performance Index:
 - $SPI = \$150,000 / \$160,000 = 0.94$ (behind schedule)
- Labor Cost Performance Index:
 - $CPI = \$150,000 / \$180,000 = 0.83$

Earned Value Measurement of Lost Labor Productivity:

- Unimpacted versus Impacted Period Comparison:

Unimpacted Cost Performance Index = 1.02

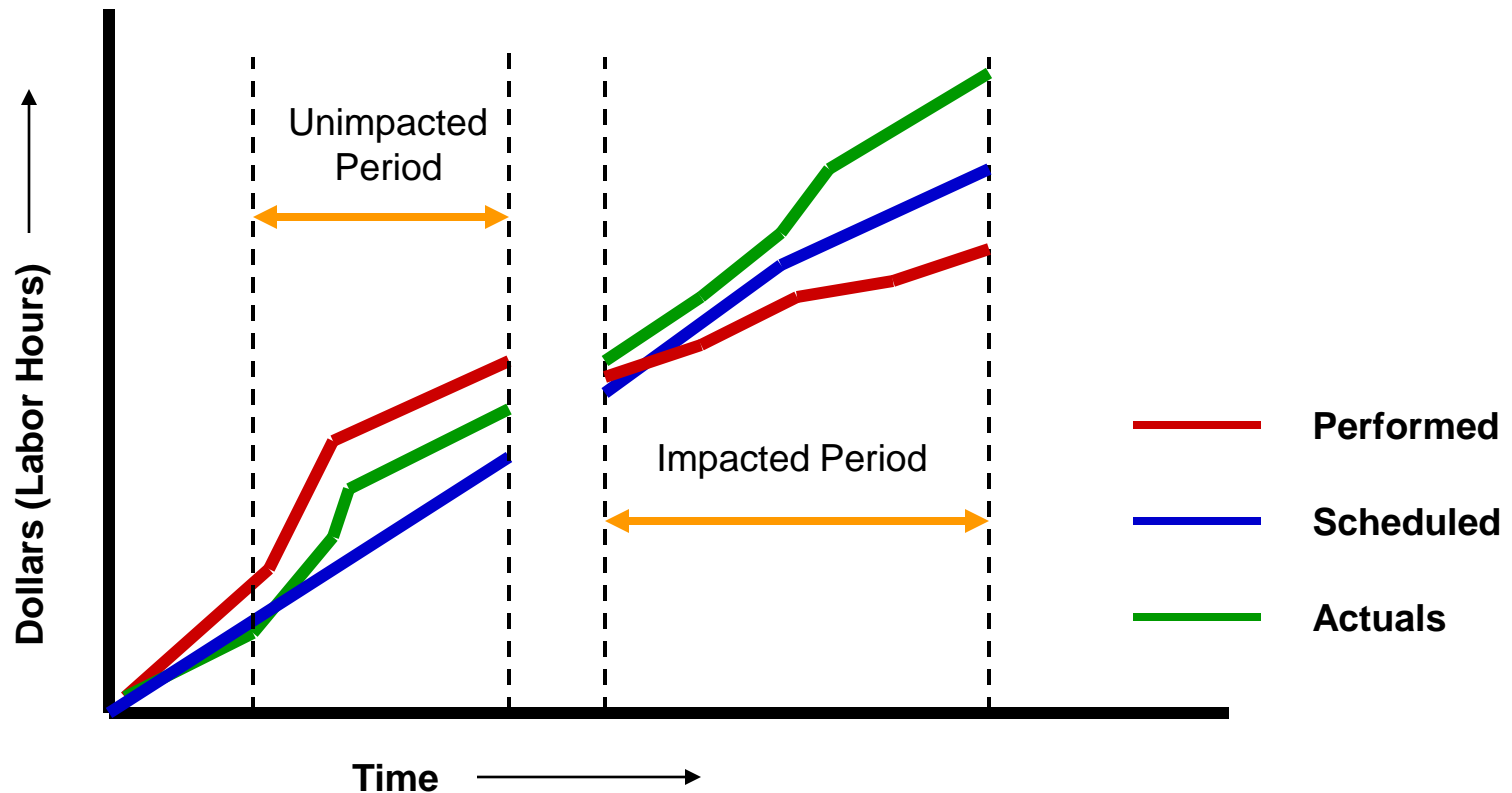
Less

Impacted Cost Performance Index = 0.83

Lost Productivity 0.19

- Lost Labor Productivity Cost:
 $0.19 \times \$180,000 = \$34,200$

Labor Productivity Measurement



Specific Allocation

Issues Requiring System Specialist Time Beyond Scope

Expanded Fuel Oil Wiring	30.00 hrs	1
Incorrectly Installed Return Isolation Dampers	18.00 hrs	2
Open & Close Floor to Install Sensors	516.00 hrs	3
Manually Opening Cooling Control Valves	54.00 hrs	4
Out of Sequence Installation of VAV's & FPB's on Floors 2-6	60.00 hrs	5
Low Voltage at Panels in areas B & C on Floors 3, 4, & 5	30.00 hrs	6
Total Excess System Specialist Hours	708.00 hrs	
Hourly Rate 7	<u>\$ 81.00</u>	
Total Excess System Specialist Labor	<u>\$ 57,348.00</u>	

Wage Escalation

Mechanics	Year 2000		Year 2001		Year 2002		Year 2003		Total Hours	Total Labor Cost
	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half		
Effective Labor Rates	\$ 55.10	\$ 56.08	\$ 63.25	\$ 67.09	\$ 69.05	\$ 70.01	\$ 70.64	\$ 71.76		
Actual Hours				606	585	706	400	25	2,322	\$ 160,528
Proforma Actual Hrs in Planned Period		111	297	1,914					2,322	\$ 153,421
As-Planned Budgeted Hours		95	254	1,638					1,987	
Escalation										\$ 7,107
Electricians	Year 2000		Year 2001		Year 2002		Year 2003		Total Hours	Total Labor Cost
	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half		
Effective Labor Rates			\$ 34.10	\$ 36.30	\$ 38.50	\$ 40.20	\$ 43.10	\$ 46.40		
Actual Hours				43	21	545	1,208	296	2,113	\$ 90,078
Proforma Actual Hrs in Planned Period			1,101	1,012					2,113	\$ 74,281
As-Planned Budgeted Hours			1,087	1,000					2,087	
Escalation										\$ 15,797

Extended Job Site Overhead

Analysis of Extended Site Costs

	Costs Per Month
Trailers	\$ 600
Phones	350
Supplies	300
Clerical Support	1,600
Special Tools	1,037
Bond	<u>1,154</u>
Total	\$ 5,041
Extended period (06/01/01 through 10/31/01) 5 months	<u>5</u>
Extended site cost	<u>\$ 25,205</u>

Material Escalation/Extended Warranty

	<u>Material Purchases</u>	<u>Escalation Factor</u> ¹	<u>Escalation Amount</u> ²	<u>Extended Warranty Factor</u> ³	<u>Extended Warranty Amount</u> ⁴
Total @ December 2001	\$ 122,607			4.500%	\$ 5,517
January 2002	\$ 3,073	0.167%	\$ 5	4.500%	\$ 138
February 2002	\$ 11,843	0.333%	\$ 39	4.500%	\$ 533
March 2002	\$ 78,637	0.500%	\$ 393	4.500%	\$ 3,539
April 2002	\$ 23,364	0.667%	\$ 156	4.500%	\$ 1,051
May 2002	\$ 17,509	0.833%	\$ 146	4.500%	\$ 788
June 2002	\$ 62,602	1.000%	\$ 626	4.500%	\$ 2,817
July 2002	\$ 1,751	1.167%	\$ 20	4.167%	\$ 73
August 2002	\$ 13,476	1.333%	\$ 180	3.833%	\$ 517
September 2002	\$ 51,592	1.500%	\$ 774	3.500%	\$ 1,806
October 2002	\$ 19,177	1.667%	\$ 320	3.167%	\$ 607
November 2002	\$ 752	1.833%	\$ 14	2.833%	\$ 21
December 2002	\$ 33,210	2.000%	\$ 664	2.500%	\$ 830
January 2003	\$ 1,455	2.167%	\$ 32	2.167%	\$ 32
Total Actual	\$ 441,048		\$ 3,369		\$ 18,269

Extended/Unabsorbed Overhead

Extended Branch and Home Office Overhead -Eichleay Formula

Contract Billings	A	²	\$	2,195,609	
Total Billings During Contract Period	B	³	\$	175,868,000	
Total Overhead During Contract Period	C	^{3,4}	\$	29,929,000	
Overhead Allocable to Contract	D		\$	373,646	(A/B)*C
Days of Contract Performance	E	⁵		1,156	
Daily Rate	F		\$	323	D/E
Days of Delay/Extension	G			315	
Gross Extended Overhead	H		\$	101,815	F*G
Less O/H Claimed Elsewhere	I		\$	<u>25,320</u>	
Total Net Extended Overhead			\$	<u>76,495</u>	

Extended/Unabsorbed Overhead

Excess Overhead due to Delay - Manshul Formula ¹

Base Contract Billings		\$ 2,200,000
Revenue as of 6/30/02		<u>\$ 824,420</u>
Unearned Revenue	2	\$ 1,375,580
Net of Overhead and Profit @ 100/122.44	3	\$ 1,123,473
Excess Overhead @ 11.13%	4	\$ 125,043
Less Overhead on Added Direct Cost	5	<u>\$ 11,454</u>
Net Excess Overhead		\$ 113,588
Profit @ 10%		<u>\$ 9,087</u>
Total Excess Overhead and Profit		<u>\$ 122,675</u>