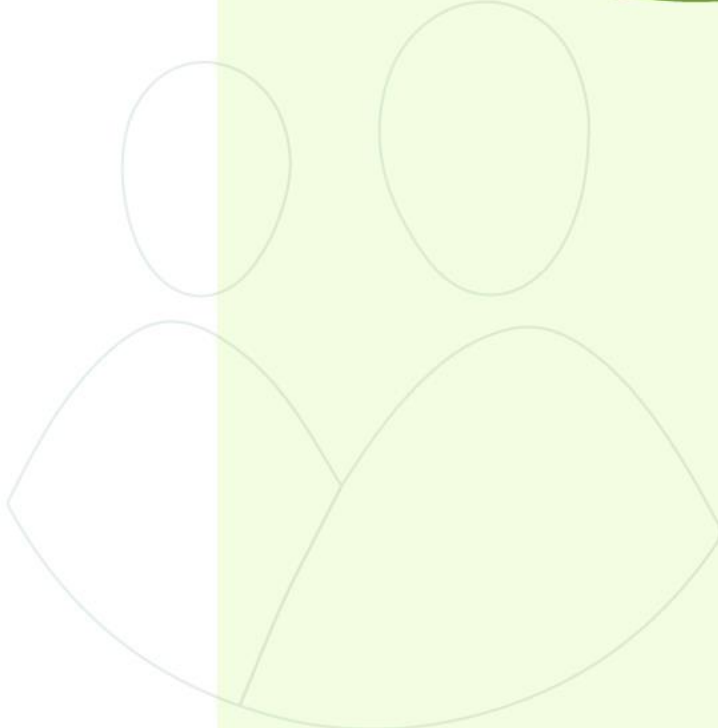


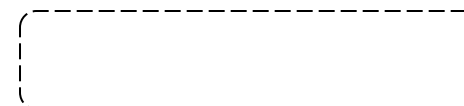
Changing SPI Methodology



Introduction



- Planning & Interface Manager, Ventia – Melbourne, Australia
- Previously:
 - Project Management Consultancy, KSA
 - Main Contractors, KSA
- Credentials:
 - Professional Engineer, NCEES
 - PSP, AACE International
 - PMP, PMI
 - MCI Arb, CI Arb
 - BS in Civil Engineering, Egypt



- In this presentation:

- New Methodology for computing the schedule performance index
- Four scenarios applying this methodology
 - Project finished on time,
 - Project is delayed,
 - Project finished on time, with activity(es) finished ahead,
 - In-progress project,



References:

- 10S-90: Cost Engineering Terminology – SPI and CPI
- 55R-09: Analyzing S-Curves – SPI and CPI
- 38R-06: Documenting the Schedule Basis
- 86R-14: Variance Analysis and Reporting – SPI and CPI
- 14R-90: Required Skills and Knowledge of Planning and Scheduling
- 90R-17: Statusing the CPM Schedule
- 50R-16: Trending and Forecasting of CPM Schedules
- 80R-13: Estimate at Completion (EAC)



What are CPI and SPI?

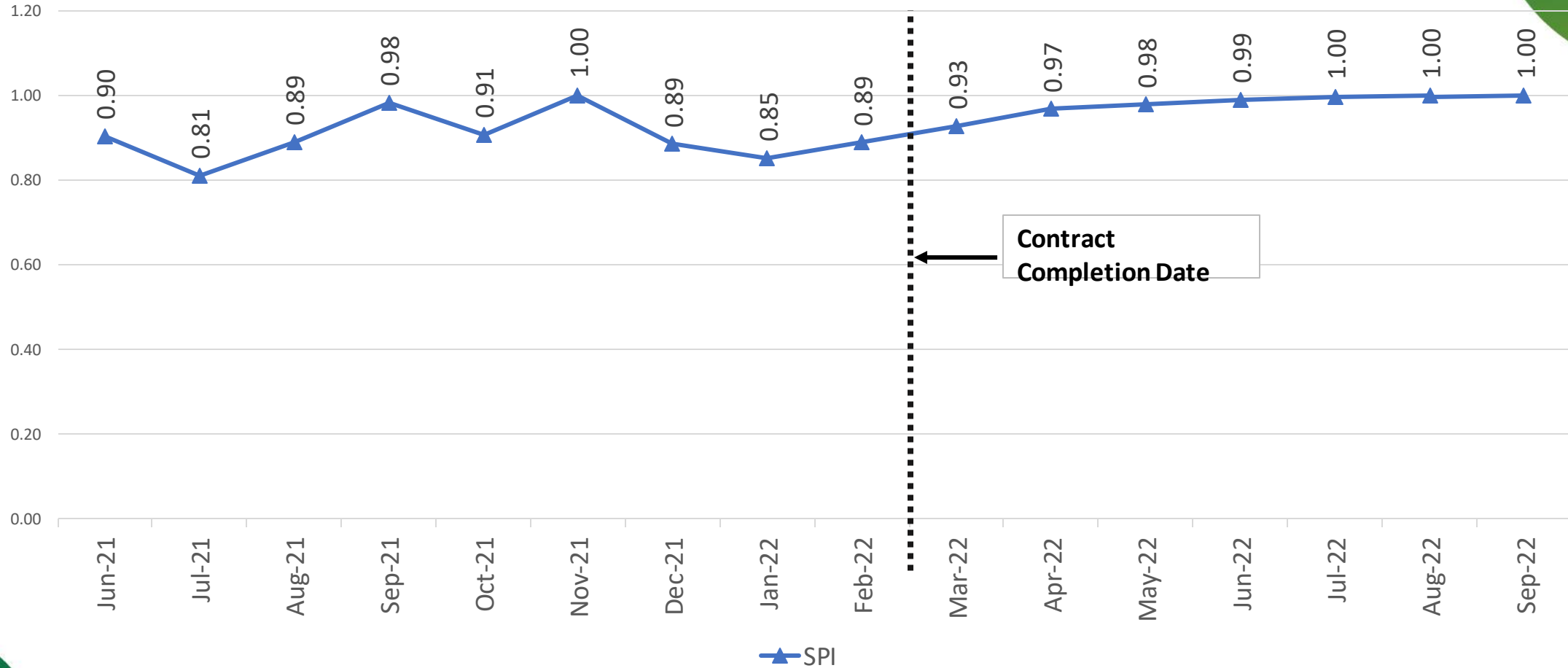


CPI & SPI:

- CPI, Cost Performance Index
 - $CPI = EV/AC = BCWP/ACWP$
- SPI, Schedule Performance Index
 - $SPI = EV/PV = BCWP/BCWS$

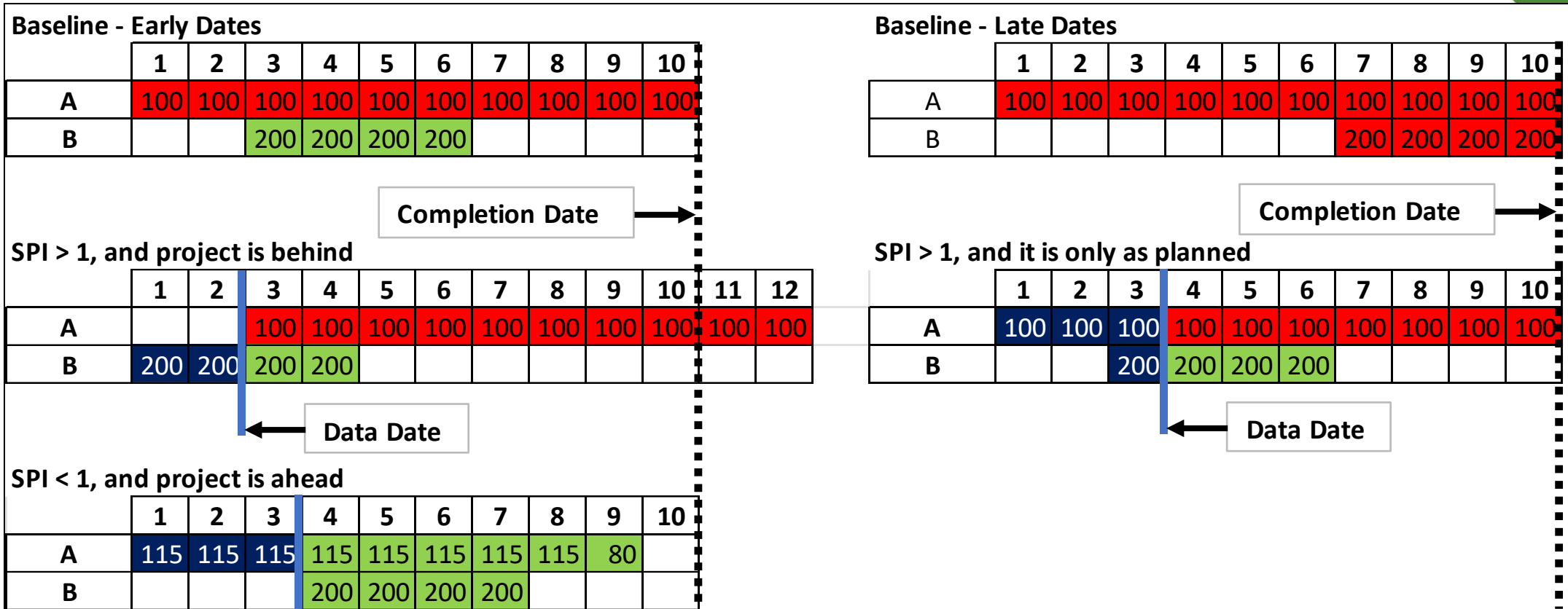


SPI Trend



Contract Completion Date

SPI Drawbacks



Introducing SPI(d)



List of terminologies & equations

- Actual Duration (AD)
 - Completed activities: actual finish – actual start date;
 - In progress activities: data date – actual start.
- At completion Duration (ACD)
 - Completed activities: actual duration = actual finish date – actual start date
 - In progress activities: forecast finish – actual start;
 - Not started activities: forecast finish – forecast start.
- Earned Duration
 - $\text{Earned Duration} = \text{Actual Progress\%} * \text{Baseline Duration}$



List of terminologies & equations

- Critical Duration Elapsed (CDE)
 - Critical Duration Elapsed= Minimum of [(data date – baseline late start date) and (actual finish date– baseline late start date)]
- Longest path earned duration (LED)
 - Longest Path Earned Duration (For longest path activities only) = Actual Progress %* Baseline duration
- Longest path actual duration (LAD)
 - Longest Path Actual Duration (For longest path activities only) = minimum duration from [(Data Date – Actual Start) and (Actual Finish – Actual Start)]





SPI(d)

- SPI(d), Schedule Performance Index duration-based
 - $\text{SPI(d)} = \text{Earned Duration} / \text{Actual Duration} = \text{ED} / \text{AD}$

More Indexes

- BCSPI(d), Baseline Critical Schedule Performance Index - Duration based
 - $BCSPI(d) = \text{Earned Duration} / \text{Critical Duration Elapsed} = ED / CDE$
- CSPI(d), Critical Schedule Performance Index – Duration based
 - $CSPI(d) = \text{longest path earned duration} / \text{longest path actual duration} = LED / LAD$
- ASPI(d), At Completion Schedule Performance Index – Duration based
 - $ASPI(d) = \text{Baseline duration} / \text{At Completion Duration}$

Scenarios



Scenario 1

Table 1 - Scenario 1

Activity	Baseline Duration	Baseline Start	Baseline Finish	Baseline Late Start	Baseline Late Finish	BL Longest Path	Actual Progress%	Actual Start	Actual Finish	Actual Duration	(1) Earned Duration	(2) Critical Duration Elapsed	(3) Longest Path Earned Duration	(4) Longest Path Actual Duration
A	6	1-Jan-23	6-Jan-23	1-Jan-23	6-Jan-23	Yes	100%	1-Jan-23	10-Jan-23	10	6	10	6	10
B	6	7-Jan-23	12-Jan-23	7-Jan-23	12-Jan-23	Yes	100%	5-Jan-23	12-Jan-23	8	6	6	6	8
C	6	1-Jan-23	6-Jan-23	7-Jan-23	12-Jan-23	No	100%	1-Jan-23	11-Jan-23	11	6	5	0	0
Total	18									29	18	21	12	18

- Data Date = 20 Jan 23
- SPI = 1
- $SPI(d) = ED/AD = 18/29 = 0.62$
- $ASPI(d) = N/A$
- $BCSPI(d) = ED/CDE = 18/21 = 0.86$
- $CSPI(d) = LED/LAD = 12/18 = 0.67$

		1-Jan-23	2-Jan-23	3-Jan-23	4-Jan-23	5-Jan-23	6-Jan-23	7-Jan-23	8-Jan-23	9-Jan-23	10-Jan-23	11-Jan-23	12-Jan-23
Activity A	Baseline Duration (Late Dates)												
	Actual Duration												
	Earned Duration												
	Critical Duration Elapsed												
	Longest Path Earned Duration												
	Longest Path Actual Duration												
Activity B	Baseline Duration (Late Dates)												
	Actual Duration												
	Earned Duration												
	Critical Duration Elapsed												
	Longest Path Earned Duration												
	Longest Path Actual Duration												
Activity C	Baseline Duration (Late Dates)												
	Actual Duration												
	Earned Duration												
	Critical Duration Elapsed												
	Longest Path Earned Duration												
	Longest Path Actual Duration												

Scenario 2

Table 2 - Scenario 2

Activity	Baseline Duration	Baseline Start	Baseline Finish	Baseline Late Start	Baseline Late Finish	BL Longest Path	Actual Progress%	Actual Start	Actual Finish	Actual Duration	(1) Earned Duration	(2) Critical Duration Elapsed	(3) Longest Path Earned Duration	(4) Longest Path Actual Duration
A	6	1-Jan-23	6-Jan-23	1-Jan-23	6-Jan-23	Yes	100%	1-Jan-23	10-Jan-23	10	6	10	6	10
B	6	7-Jan-23	12-Jan-23	7-Jan-23	12-Jan-23	Yes	100%	10-Jan-23	18-Jan-23	9	6	12	6	9
C	6	1-Jan-23	6-Jan-23	7-Jan-23	12-Jan-23	No	100%	1-Jan-23	11-Jan-23	11	6	5	0	0
Total	18									30	18	27	12	19

- Data Date = 20 Jan 23
- SPI = 1
- $SPI(d) = ED/AD = 18/30 = 0.60$
- $ASPI(d) = N/A$
- $BCSPI(d) = ED/CDE = 18/27 = 0.67$
- $CSPI(d) = LED/LAD = 12/19 = 0.63$

		1-Jan-23	2-Jan-23	3-Jan-23	4-Jan-23	5-Jan-23	6-Jan-23	7-Jan-23	8-Jan-23	9-Jan-23	10-Jan-23	11-Jan-23	12-Jan-23	13-Jan-23	14-Jan-23	15-Jan-23	16-Jan-23	17-Jan-23	18-Jan-23
Activity A	Baseline Duration (Late Dates)																		
	Actual Duration																		
	Earned Duration																		
	Critical Duration Elapsed																		
	Longest Path Earned Duration																		
	Longest Path Actual Duration																		
Activity B	Baseline Duration (Late Dates)																		
	Actual Duration																		
	Earned Duration																		
	Critical Duration Elapsed																		
	Longest Path Earned Duration																		
	Longest Path Actual Duration																		
Activity C	Baseline Duration (Late Dates)																		
	Actual Duration																		
	Earned Duration																		
	Critical Duration Elapsed																		
	Longest Path Earned Duration																		
	Longest Path Actual Duration																		

Baseline Completion Date

Scenario 3

Table 3 - Scenario 3

Activity	Baseline Duration	Baseline Start	Baseline Finish	Baseline Late Start	Baseline Late Finish	BL Longest Path	Actual Progress%	Actual Start	Actual Finish	Actual Duration	(1) Earned Duration	(2) Critical Duration Elapsed	(3) Longest Path Earned Duration	(4) Longest Path Actual Duration
A	6	1-Jan-23	6-Jan-23	1-Jan-23	6-Jan-23	Yes	100%	1-Jan-23	12-Jan-23	12	6	12	6	12
B	6	7-Jan-23	12-Jan-23	7-Jan-23	12-Jan-23	Yes	100%	1-Jan-23	6-Jan-23	6	6	0	6	6
C	6	1-Jan-23	6-Jan-23	7-Jan-23	12-Jan-23	No	100%	1-Jan-23	11-Jan-23	11	6	5	0	0
Total	18									29	18	17	12	18

- Data Date = 20 Jan 23
- SPI = 1
- $SPI(d) = ED/AD = 18/29 = 0.62$
- $ASPI(d) = N/A$
- $BCSPI(d) = ED/CDE = 18/17 = 1.06$
- $CSPI(d) = LED/LAD = 12/18 = 0.67$

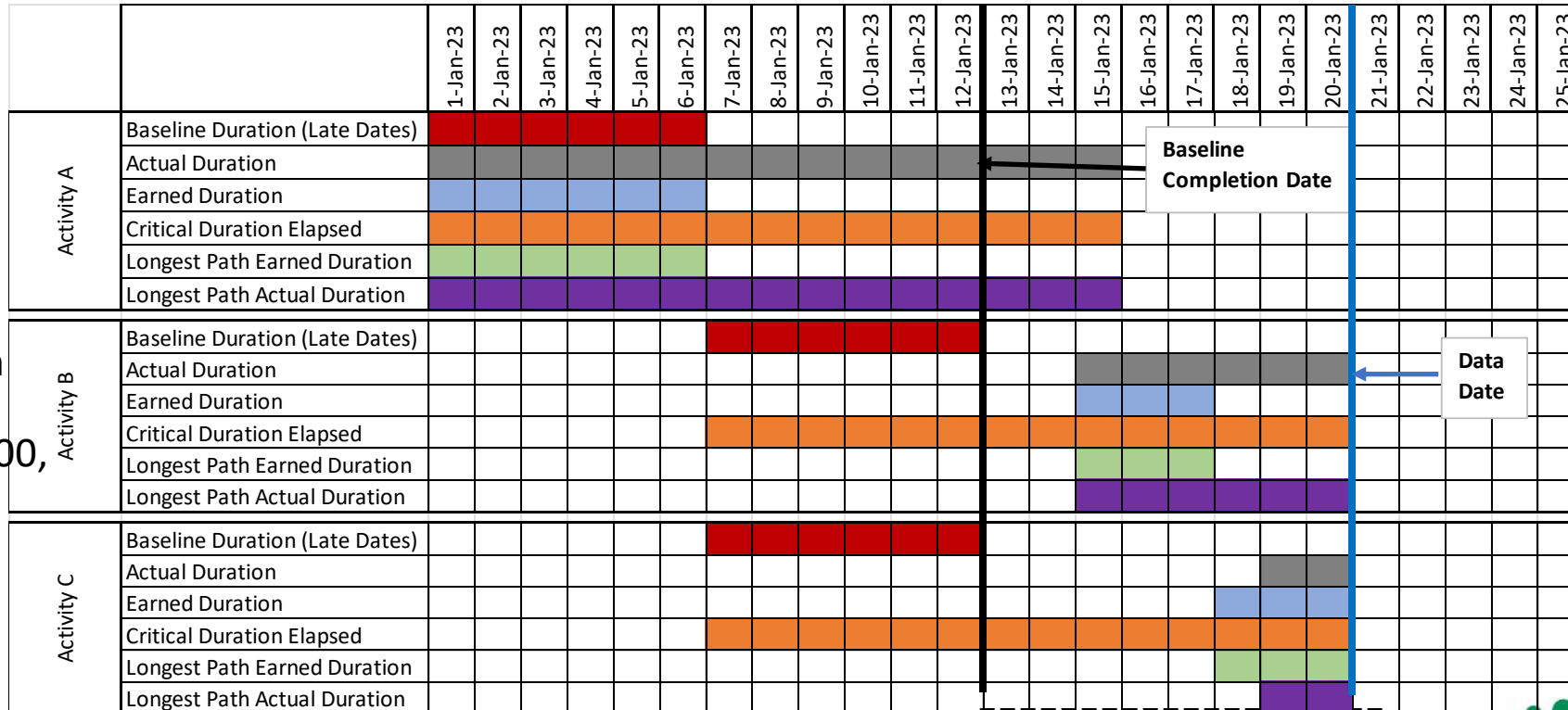
		1-Jan-23	2-Jan-23	3-Jan-23	4-Jan-23	5-Jan-23	6-Jan-23	7-Jan-23	8-Jan-23	9-Jan-23	10-Jan-23	11-Jan-23	12-Jan-23
Activity A	Baseline Duration (Late Dates)												
	Actual Duration												
	Earned Duration												
	Critical Duration Elapsed												
	Longest Path Earned Duration												
	Longest Path Actual Duration												
Activity B	Baseline Duration (Late Dates)												
	Actual Duration												
	Earned Duration												
	Critical Duration Elapsed												
	Longest Path Earned Duration												
	Longest Path Actual Duration												
Activity C	Baseline Duration (Late Dates)												
	Actual Duration												
	Earned Duration												
	Critical Duration Elapsed												
	Longest Path Earned Duration												
	Longest Path Actual Duration												

Scenario 4

Table 4 - Scenario 4

Activity	Baseline Duration	Baseline Start	Baseline Finish	Baseline Late Start	Baseline Late Finish	BL Longest Path	Update Longest Path	Actual Progress %	Actual/Fo recast Start	Actual/Fo recast Finish	Actual Duration	(1) Earned Duration	(2) Critical Duration Elapsed	(3) Longest Path Earned Duration	(4) Longest Path Actual Duration	At Completion Duration	(5) Forecast Critical Duration
A	6	1-Jan-23	6-Jan-23	1-Jan-23	6-Jan-23	Yes	Yes	100%	1-Jan-23	15-Jan-23	15	6	15	6	15	15	15
B	6	7-Jan-23	12-Jan-23	7-Jan-23	12-Jan-23	Yes	Yes	50%	15-Jan-23	25-Jan-23	6	3	14	3	6	11	19
C	6	1-Jan-23	6-Jan-23	7-Jan-23	12-Jan-23	No	Yes	50%	19-Jan-23	25-Jan-23	2	3	14	3	2	7	19
Total	18										23	12	43	12	23	33	53

- Data Date = 20 Jan 23
- SPI = 0.67 (Assuming All Activities have equal values)
- SPI = 0.75 (With the assumption A=3,000, B=2,000, C=1,000)



- $SPI(d) = ED/AD = 12/23 = 0.52$
- $ASPI(d) = BD/ACD = 18/33 = 0.55$
- $BCSPI(d) = ED/CDE = 12/43 = 0.28$
- $CSPI(d) = LED/LAD = 12/23 = 0.52$

Application on a real project

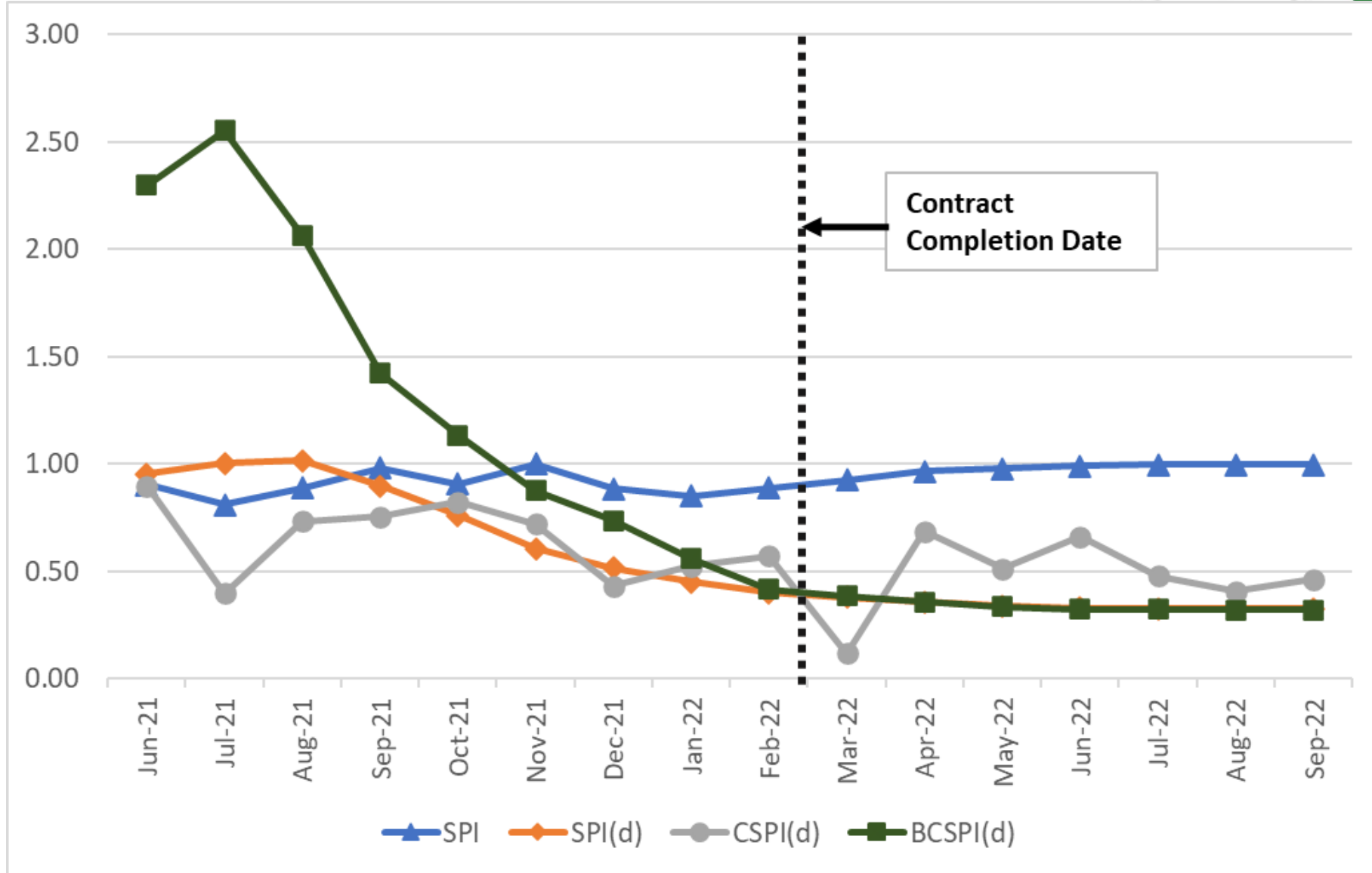


Project Description

- Project Contractual Start= April 2021
- Project Contractual Finish= February 2022
- Project Actual Finish= September 2022
- Frequency of schedule updates= Weekly
- The contractor planner was reporting no changes to the contractual finish date up to January 2022, 1 month before the contractual finish date.
- From January 2022, onwards the schedule update was showing an increase of one week to the contractual completion date, every week.

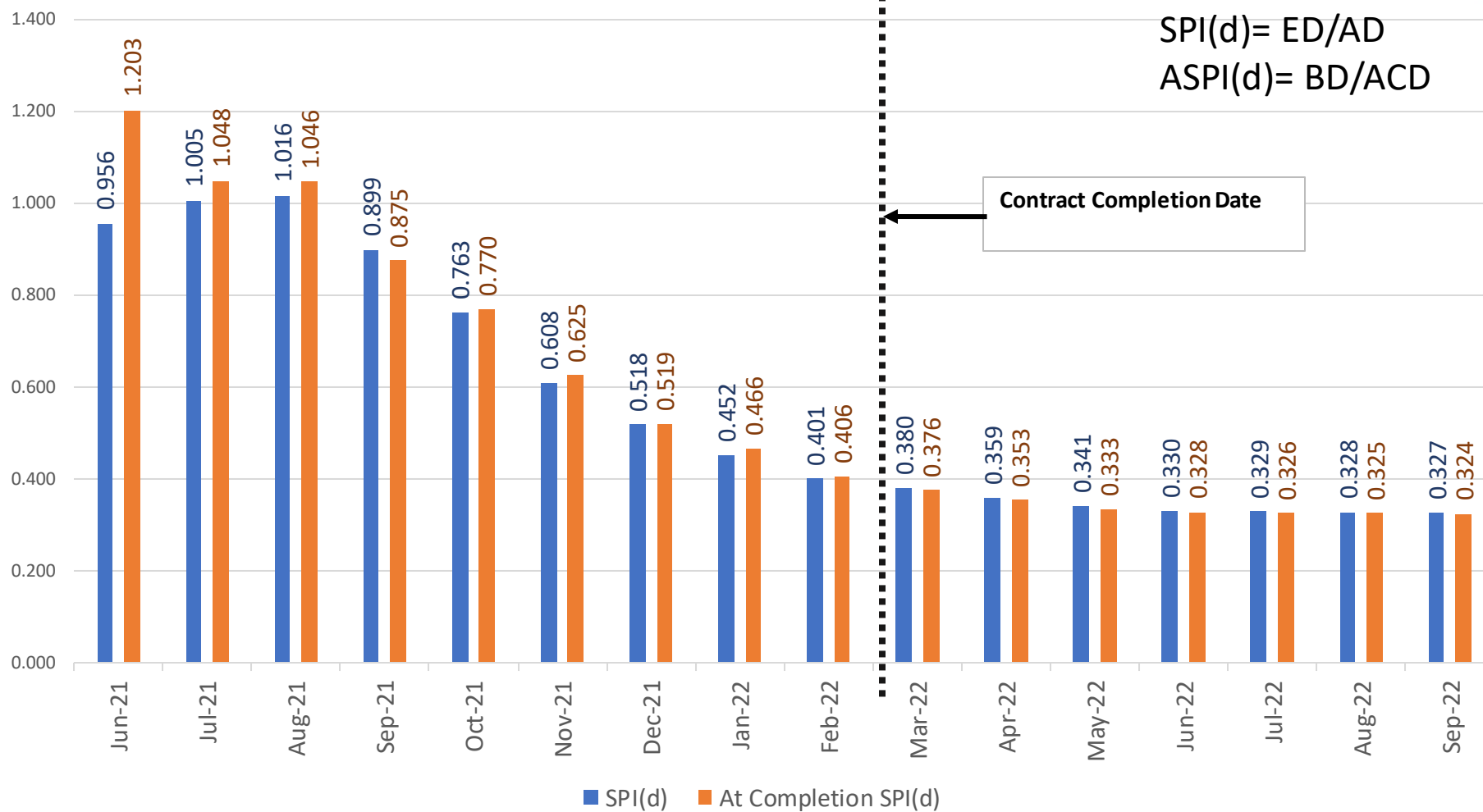


Schedule Indexes Trends



Comparing SPI(d) with ASPI(d)

SPI(d) vs. ASPI(d)



Costs and disruption

- Costs

- Indexes mentioned here measures efficiency of utilizing time.
- Especially useful for indirect costs
- Example; $SPI(d) = 0.5$, this means for every 1 planned day it takes two days to complete it. This will be an indication, that more supervision is required or the supervision of the project would be extended.
- This can be discovered early in the project

- Disruption

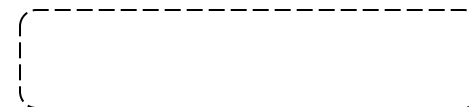
- The $SPI(d)$ would be calculated before and after the added event to calculate how this event has disrupted the works

- The costs and disruptions utilization may be detailed in another paper.



Conclusion

- SPI(d), CSPI(d), BCSPi(d) resolves the following SPI fallbacks:
 - Schedule requirement to be cost loaded.
 - SPI tendency to 1 at the project completion
 - SPI closure at 1 at the project completion
 - SPI is just for the status of schedule, and the value is only representing status not used for future estimates.
- It shows the efficiency of how every planned day is utilized.
- It shows trends which can help track schedule performance during the lifecycle of the project with trends to help for corrective actions and plan for preventive actions.





THANK YOU