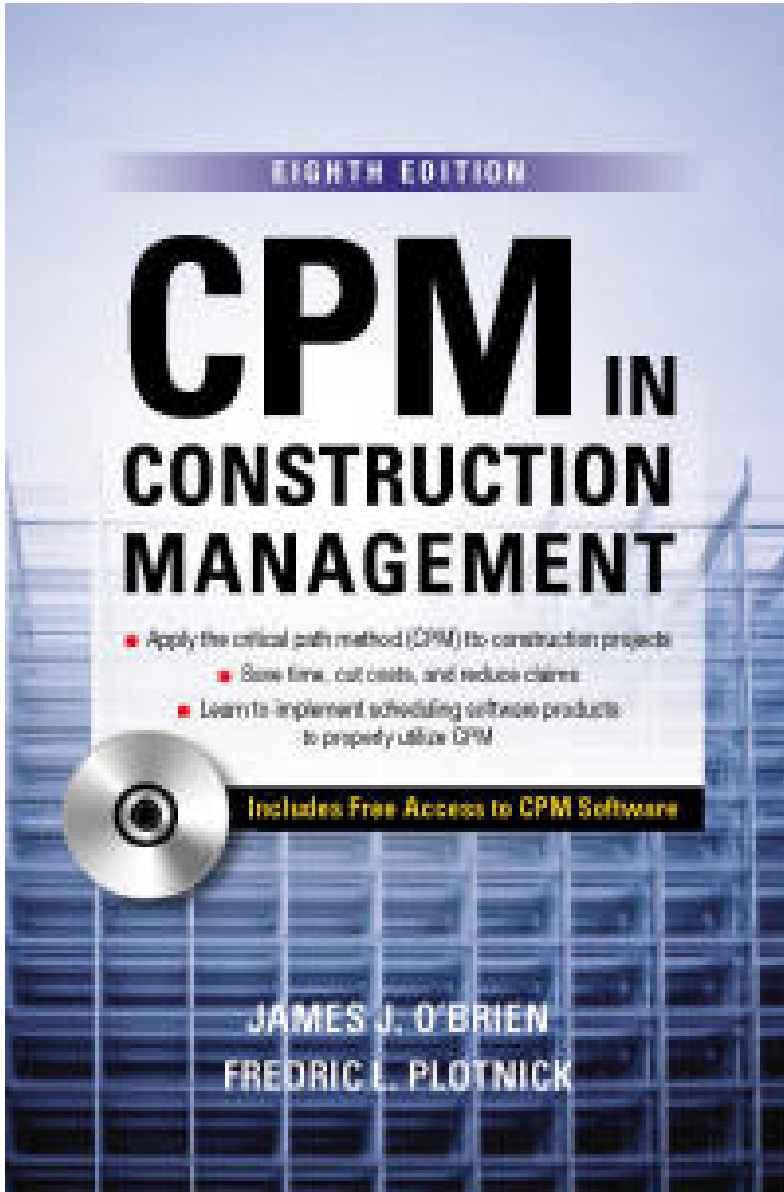


Evaluation of FSA Methods in “CPM in Construction Management, 8th Ed.”

Kenji P. Hoshino, PSP, CFCC

February 1, 2016

Construction CPM Conference New Orleans



AACE® International Recommended Practice No. 29R-03

FORENSIC SCHEDULE ANALYSIS
TCM Framework: 6.4 – Forensic Performance Assessment

Acknowledgments: (April 25, 2011 Revision)

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RP/FSA Rev 2



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O'Brien-Plotnick Method vs 29R-03

29R-03 MIP Classification

35.01	Delay vs Disruption	
35.02	Responsibility / Types / Force Majeure	
35.03	As-Planned Logic Network	}
35.04	As-Should-Have-Been CPM Network	
35.05	As-Planned Schedule	}
35.06	As-Built Schedule	
35.07	As-Built Logic Network	}
35.08	Causative Factors	

SVP 2.1

SVP 2.2.D.2

SVP 2.4

**OLD (7th Edition)
Reviewed in 2014**

35.09	As-Impacted Logic Network
35.10	As-Impacted Schedule
35.11	<u>Time Impact Evaluations</u>
35.12	Zeroing to a Collapsed As-Impacted Logic Network
35.13	Zeroing to a Collapsed As-Should-Have-Been CPM
35.14	Limitations of the TIE Methodology
35.15	TIE Example of John Doe Project

**Enhanced MIP 3.6.F (IAP)
w/ 'Not-Quite' MIP 3.8 (CAB)
verification**

35.16	<u>Windows Analysis</u>
35.17	Zeroing Out within the Windows Analysis
35.18	Windows Example of John Doe Project

**MIP 3.7 (TIA) Variable Period, Static logic
Using partially updated baseline
Or a impact-modeled MIP 3.2 (AP v AB)**

35.19 Summary

O'Brien-Plotnick Method vs 29R-03

29R-03 MIP Classification

- 33.01 Delay vs Disruption
- 33.02 Responsibility / Types / Force Majeure
- 33.03 As-Planned Logic Network
- 33.04 As-Should-Have-Been CPM Network
- 33.05 As-Planned Schedule
- 33.06 Validation of the As-Planned Logic Network & Calculated Schedule
- 33.07 As-Built Schedule
- 33.08 Validation of the As-Built Schedule
- 33.09 As-Built Logic Network
- 33.10 Causative Factors

NEW (8th Edition)

New subchapter added regarding source validation

- 33.11 As-Impacted Logic Network
- 33.12 As-Impacted Schedule
- 33.13 Time Impact Evaluations
- 33.14 Zeroing to a Collapsed As-Impacted Logic Network
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Evaluation and Ranking

“What is the Best Method?”

Pick the Best Tool



Pick the Better Tape Measure



Evaluation is Context Dependent

RP/FSA §5: Choosing a Method	
1	Contractual Requirement
2	Purpose of Analysis
3	Source Data Availability & Reliability
4	Size of Dispute
5	Complexity of Dispute
6	Budget for Analysis
7	Time Allowed for Analysis
8	Analyst's Expertise
9	Forum for Resolution
10	Legal & Procedural
11	Custom & Useage on Project

Prudent Choice of Method Depends on Purpose

Forensic Use of Analysis	METHOD								
	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
Non-Compensable Time Extension	OK	OK	OK	OK	OK	OK	OK	OK	OK
Compensable Delay	OK	OK	OK	OK	OK			OK	OK
Right to Finish Early Compensable Delay								OK	OK
Entitlement to Early Completion Bonus	OK	OK	OK	OK	OK	OK	OK	OK	OK
Disruption Without Project Delay	OK	OK	OK	OK	OK	OK	OK		
Constructive Acceleration				OK		OK	OK		

CDR.2047

Unified Evaluation Criteria for Delay & Productivity Analyses

Author: Kenji P. Hoshino, PSP, CFCC

Co-Presenter: Michael S. Dennis

Co-Presenter: Patrick Kelly

July 2015 – Las Vegas, NV

AACE International

www.aacei.org



Performance Criteria for Evaluating FSA and LOP Analysis Implementations

		Source Data Validation	Causation Support
1	Quality of Source Data for Unimpacted Condition	x	
2	Quality of Source Data for Impacted Condition	x	
3	Integration of Actual Events into the Analysis	x	
4	Granularity & Volume of Data Used for Analysis	x	
5	Validity of Comparison of Unimpacted to Impacted		x
6	Consideration of the Sensitivity of the Impacted Elements		x
7	Periodicity of Variance Measurement		x
8	Chronological Treatment of Cause & Effect		x
9	Proximity in Time of the Cause to the Claimed Effect		x
10	Consideration of Completeness of All Causal Elements	x	x
11	Segregation of Effects from Non-Claimable Causes		x
12	Overall Cleanliness / Minimizing Room for Manipulation	x	x

Evaluation or 'Ranking' Integrated with Method Selection

1. 'Unimpacted' Source Data
2. 'Impacted' Source Data
3. Integration of Actual Events
4. Granularity & Volume of Data
5. Validity of Comparison
6. Considers Sensitivity to Impacts
7. Periodicity of Variance Measure
8. Chronology of Events
9. Proximity of Cause to Effect
10. Considers All Causes
11. Segregation of Effects
12. Minimize Room for Manipulation

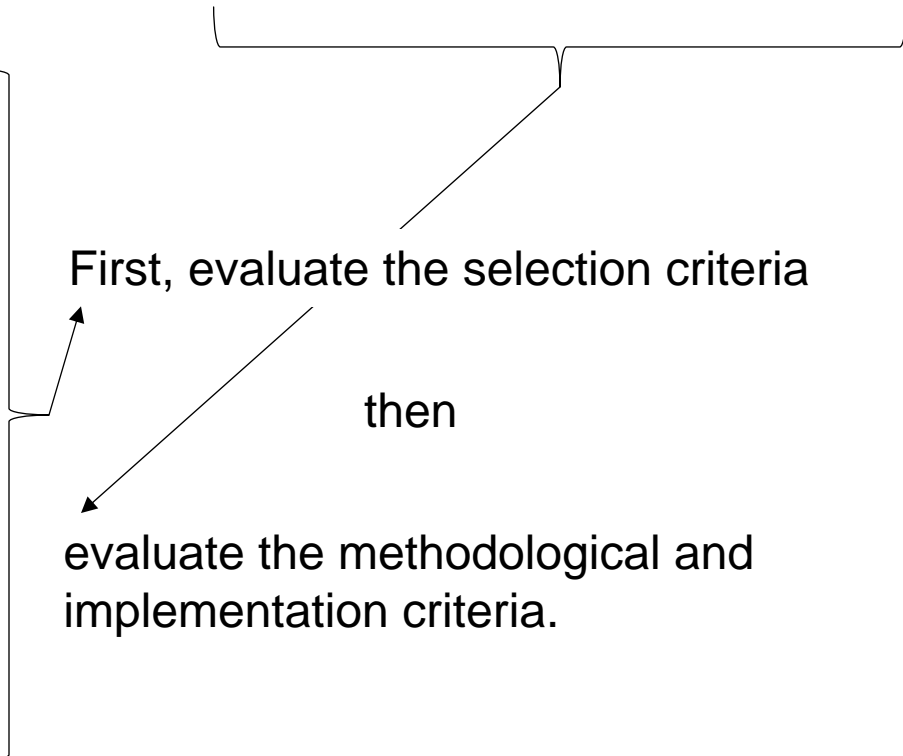
RP/FSA §5: Choosing a Method

1	Contractual Requirement
2	Purpose of Analysis
3	Source Data Availability & Reliability
4	Size of Dispute
5	Complexity of Dispute
6	Budget for Analysis
7	Time Allowed for Analysis
8	Analyst's Expertise
9	Forum for Resolution
10	Legal & Procedural
11	Custom & Usage on Project

First, evaluate the selection criteria

then

evaluate the methodological and implementation criteria.



O'Brien-Plotnick Method vs 29R-03

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- 33.01 Delay vs Disruption
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verification**

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Using partially updated baseline
Or a impact-modeled MIP 3.2 (AP v AB)**

Case Study Selection Assumptions

RP/FSA §5: Choosing a Method		Assumed Circumstances
1	Contractual Requirement	
2	Purpose of Analysis	
3	Source Data Availability & Reliability	
4	Size of Dispute	
5	Complexity of Dispute	
6	Budget for Analysis	
7	Time Allowed for Analysis	
8	Analyst's Expertise	
9	Forum for Resolution	
10	Legal & Procedural	
11	Custom & Usage on Project	

Case Study Selection Assumptions

RP/FSA §5: Choosing a Method		Assumed Circumstances
1	Contractual Requirement	No requirement other than "showing an impact to the critical path".
▶ 2	Purpose of Analysis	Compensable delay and rebuttal of liquidated damages.
3	Source Data Availability & Reliability	Disputed baseline; updates at irregular intervals; incomplete dailies
4	Size of Dispute	\$6 million compensable delay vs \$3 million liquidated damages
5	Complexity of Dispute	\$100M process plant / pushed into weather, multiple RFI impacts
6	Budget for Analysis	1,000 consultant hours
7	Time Allowed for Analysis	Three months until production of expert report w/ exhibits
8	Analyst's Expertise	Expert in all methods
9	Forum for Resolution	3-person arbitration panel
10	Legal & Procedural	International Chamber of Commerce rules
11	Custom & Usage on Project	2 "TIA"s submitted during the project; both rejected for entitlement

Purpose: Compensable Delay & Rebuttal of LDs

OBP Windows Analysis

- MIP 3.7 Variable Period, Static logic
- Using partially updated baseline
- Or a impact-modeled MIP 3.2

OBP Time Impact Evaluation

- Enhanced MIP 3.6.F
- w/ 'Not-Quite' MIP 3.8 verification

VS

Half-Step Update Analysis



Forensic Use of Analysis	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
Non-Compensable Time Extension	OK	OK	OK	OK	OK	OK	OK	OK	OK
Compensable Delay	OK	OK	OK	OK	OK			OK	OK
Right to Finish Early Compensable Delay								OK	OK
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4	Granularity & Volume of Data Used for Analysis	X	
5	Validity of Comparison of Unimpacted to Impacted		X
6	Consideration of the Sensitivity of the Impacted Elements		X
7	Periodicity of Variance Measurement		X
8	Chronological Treatment of Cause & Effect		X
9	Proximity in Time of the Cause to the Claimed Effect		X
10	Consideration of Completeness of All Causal Elements	X	X
11	Segregation of Effects from Non-Claimable Causes		X
12	Overall Cleanness / Minimizing Room for Manipulation	X	X

Scoring



OBP Methods vs MIP 3.4

1. Source Data for the Unimpacted Condition	
Examples of High End of the Scale	Examples of Low End of the Scale
* Approved baseline, validated with RP/FSA SVP 2.1 enhanced protocols. * Continuously approved updates validated with RP/FSA SVP 2.3 enhanced protocols.	*Overall planned duration based industry average duration of similar projects. * A claim consultant's estimate based on limited experience in other projects.

OBP – “Time Impact Evaluation”

Analyst's as-should-have-been

Does not use contemporaneous updates

2

OBP – “Windows”

Progress schedules recreated from above using AB

Does not use contemporaneous updates

1

MIP 3.4 (Half-Step)

Disputed baseline and contemporaneous updates

3

SCORE

OBP Methods vs MIP 3.4

2. Source Data for the Impacted Condition

Examples of High End of the Scale	Examples of Low End of the Scale
<ul style="list-style-type: none"> * As-built schedule targeted to baseline that has been checked against daily reports that contained status of work using schedule activity ID numbers. * Detailed daily as-built for each schedule activity and delays generated from several project documents including daily logs and labor / equipment time cards. 	<ul style="list-style-type: none"> * Lack of as-built schedules or data from which to reconstruct one. * An updated schedule which contains 100% status but no record of actual start and finish dates.

SCORE

OBP – “Time Impact Evaluation”

Validated as-built from various source data

3

OBP – “Windows”

Same as above

3

MIP 3.4 (Half-Step)

Uses actualized update dates, left of data date

2

OBP Methods vs MIP 3.4

3. Integration of Actual Events into the Analysis

Examples of High End of the Scale	Examples of Low End of the Scale
* As-built dates of all analyzed activities, which by definition, includes delay mitigation, are fully integrated into the analysis.	* Does not use as-built but relies on prospective impacted schedule which does not include mitigation.

SCORE

OBP – “Time Impact Evaluation”

Impacted completion date may not be actual

1

OBP – “Windows”

Same as above

1

MIP 3.4 (Half-Step)

Uses actualized update dates, left of data date

2

OBP Methods vs MIP 3.4

4. Granularity & Volume of Data Used for Analysis

Examples of High End of the Scale	Examples of Low End of the Scale
<ul style="list-style-type: none"> * Activity detail is level three or four and are logically linked. * Numerous discrete, delay events are tied to short duration specific activity impacts 	<ul style="list-style-type: none"> * Barchart planned duration is expressed as one bar from NTP to actual completion. * Single short-term delay event is used to explain long-duration delays to multiple activities.

SCORE

OBP – “Time Impact Evaluation”

(Assume acceptable granularity)

2

OBP – “Windows”

(Assume acceptable granularity)

2

MIP 3.4 (Half-Step)

(Assume acceptable granularity)

2

OBP Methods vs MIP 3.4

5. Validity of Comparison of Unimpacted to Impacted

Examples of High End of the Scale	Examples of Low End of the Scale
<p>* Activity identity, work sequence, means & methods and environmental conditions are almost identical between the as-planned and the as-built, but for delays.</p>	<p>* Poor match on activity ID and work description between as-planned and as-built (or updates). * Overall sequence of work changed fundamentally between before delay and after delay. * Besides the cause of the delay, there was significant change in work seasons and or means & methods to perform the work.</p>

SCORE

OBP – “Time Impact Evaluation”

Based on an as-planned and an as-built consisting of an actualized as-planned

3

OBP – “Windows”

Based on an as-planned progressed to a ‘window’ and an as-built consisting of an actualized as-planned

3

MIP 3.4 (Half-Step)

Based on successive updates which may or may not be the same schedule (but for progress)

2

OBP Methods vs MIP 3.4

6. Consideration of the Sensitivity of the Impacted Elements

Examples of High End of the Scale	Examples of Low End of the Scale
* Longest path clearly identified and near-longest path using a large threshold value considered in the analysis.	* Ignores float.

SCORE

OBP – “Time Impact Evaluation”

Identifies the longest path & accounts for float.

3

OBP – “Windows”

Identifies the longest path & accounts for float.

3

MIP 3.4 (Half-Step)

Identifies the longest path & accounts for float.

3

OBP Methods vs MIP 3.4

7. Periodicity of Variance Measurement

Examples of High End of the Scale	Examples of Low End of the Scale
* Daily reconstruction of each contemporaneous periodic update.	* Simple comparison of as-planned versus as-built.

SCORE

OBP – “Time Impact Evaluation”

IAP / AP vs AB; doesn't use update logic

1

OBP – “Windows”

TIA as of time of impact using AP logic

Attempts period analysis but doesn't use update logic

1

MIP 3.4 (Half-Step)

Uses all contemporaneous updates

3

OBP Methods vs MIP 3.4

8. Chronological Treatment of Cause & Effect

Examples of High End of the Scale	Examples of Low End of the Scale
* Daily-increment time impact analysis using reconstruction of each contemporaneous periodic update.	* Inserting fragnets for a delay at the end of the project before inserting fragnets for a delay at the start of the project.

OBP – “Time Impact Evaluation”

Step-inserted IAP / step-extracted “almost-CAB”

2

OBP – “Windows”

TIA using update created from AP, as of time of delay

2

MIP 3.4 (Half-Step)

Uses all available contemporaneous updates

3

SCORE

OBP Methods vs MIP 3.4

9. Proximity in Time of the Cause to Claimed Effects

Examples of High End of the Scale	Examples of Low End of the Scale
<p>* Inserting a short fragnet into an approved update progressed to the day before the start of delay.</p>	<p>* A simple impacted as-planned with many late-project delay events years after the start of the project. * A time impact analysis that uses a very long fragnet chain that spans across several update periods.</p>

SCORE

OBP – “Time Impact Evaluation”

IAP / AP vs AB; doesn't use update logic

1

OBP – “Windows”

TIA using update created from AP, as of time of delay

2

MIP 3.4 (Half-Step)

Uses all available contemporaneous updates

2

OBP Methods vs MIP 3.4

10. Consideration of Completeness of All Causal Elements

Examples of High End of the Scale	Examples of Low End of the Scale
* Accounts for all concurrent delays including those with large float values.	* No concurrency analysis at all.

SCORE

OBP – “Time Impact Evaluation”

Models all known delays regardless of responsibility

3

OBP – “Windows”

Models all known delays regardless of responsibility

3

MIP 3.4 (Half-Step)

Updates may not contain all delays, explicitly
Causal research must be performed separately

2

OBP Methods vs MIP 3.4

11. Segregation of Effects from Non-Claimable Causes

Examples of High End of the Scale

* Quantifies all excusable-compensable, excusable-non-compensable, and non-excusable-non-compensable days along with apportionment percentages where more than one cause caused the same delay.

Examples of Low End of the Scale

* Simple total-time claim for compensable delay.

OBP – “Time Impact Evaluation”

Scenario-based simulation allows for concurrency analysis.

3

OBP – “Windows”

Scenario-based simulation allows for concurrency analysis.

3

MIP 3.4 (Half-Step)

Enhanced protocol calls for near-longest path analysis

2

SCORE

OBP Methods vs MIP 3.4

12. Minimized Room for Manipulation / Overall Cleanness	
Examples of High End of the Scale	Examples of Low End of the Scale
* A well executed MIP 3.4 on a well documented six month project.	* A claim for compensable delay using a series of prospective fragnet-TIAs based on modified and recreated updates.

OBP – “Time Impact Evaluation”

Many steps; uses analyst created schedules; ignores updates

1

OBP – “Windows”

Same as above

1

MIP 3.4 (Half-Step)

Observation and interpretation of contemporaneous project schedules

3

SCORE

Total Score

Performance Evaluation Criteria		Raw Score			Weighted Score				Perfect	
		OBP - "Time Impact Evaluation"	OBP - "Windows"	MIP - 3.4 (Bifurcated CPA)	Weight Value	OBP - "Time Impact Evaluation"	OBP - "Windows"	MIP - 3.4 (Bifurcated CPA)	Raw	Weighted
1	Quality of Source Data for Unimpacted Condition	2	1	3	10%	0.20	0.10	0.30	3	0.30
2	Quality of Source Data for Impacted Condition	2	2	2	10%	0.20	0.20	0.20	3	0.30
3	Integration of Actual Events into the Analysis	1	1	2	10%	0.10	0.10	0.20	3	0.30
4	Granularity & Volume of Data Used for Analysis	2	2	2	10%	0.20	0.20	0.20	3	0.30
5	Validity of Comparison of Unimpacted to Impacted	3	3	2	10%	0.30	0.30	0.20	3	0.30
6	Consideration of the Sensitivity of the Impacted Elements	3	3	3	15%	0.45	0.45	0.45	3	0.45
7	Periodicity of Variance Measurement	1	1	3	10%	0.10	0.10	0.30	3	0.30
8	Chronological Treatment of Cause & Effect	2	2	3	5%	0.10	0.10	0.15	3	0.15
9	Proximity in Time of the Cause to the Claimed Effect	1	2	2	5%	0.05	0.10	0.10	3	0.15
10	Consideration of Completeness of All Causal Elements	3	3	2	5%	0.15	0.15	0.10	3	0.15
11	Segregation of Effects from Non-Claimable Causes	3	3	2	5%	0.15	0.15	0.10	3	0.15
12	Overall Cleanliness / Minimizing Room for Manipulation	1	1	3	5%	0.05	0.05	0.15	3	0.15
		24	24	29	100%	2.05	2.00	2.45	36	3.00

Strengths of the OBP Methods

1. Although it is an additive modeling method, it references the as-built schedule.
2. It compares the as-planned to an as-built that is an identical model of the as-planned, but for the as-built dates.
3. The protocol calls for the modeling of all delays, regardless of responsibility.
4. This allows for the modeling of scenarios for concurrency analysis.

Total Score

Performance Evaluation Criteria		Raw Score			Weighted Score				Perfect	
		OBP - "Time Impact Evaluation"	OBP - "Windows"	MIP - 3.4 (Bifurcated CPA)	Weight Value	OBP - "Time Impact Evaluation"	OBP - "Windows"	MIP - 3.4 (Bifurcated CPA)	Raw	Weighted
1	Quality of Source Data for Unimpacted Condition	2	1	3	10%	0.20	0.10	0.30	3	0.30
2	Quality of Source Data for Impacted Condition	2	2	2	10%	0.20	0.20	0.20	3	0.30
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4	Granularity & Volume of Data Used for Analysis	2	2	2	10%	0.20	0.20	0.20	3	0.30
5	Validity of Comparison of Unimpacted to Impacted	3	3	2	10%	0.30	0.30	0.20	3	0.30
6	Consideration of the Sensitivity of the Impacted Elements	3	3	3	15%	0.45	0.45	0.45	3	0.45
7	Periodicity of Variance Measurement	1	1	3	10%	0.10	0.10	0.30	3	0.30
8	Chronological Treatment of Cause & Effect	2	2	3	5%	0.10	0.10	0.15	3	0.15
9	Proximity in Time of the Cause to the Claimed Effect	1	2	2	5%	0.05	0.10	0.10	3	0.15
10	Consideration of Completeness of All Causal Elements	3	3	2	5%	0.15	0.15	0.10	3	0.15
11	Segregation of Effects from Non-Claimable Causes	3	3	2	5%	0.15	0.15	0.10	3	0.15
12	Overall Cleanness / Minimizing Room for Manipulation	1	1	3	5%	0.05	0.05	0.15	3	0.15
		24	24	29	100%	2.05	2.00	2.45	36	3.00

Weaknesses of the OBP Methods

1. Because it is an additive modeling method using as-planned logic, the model may not generate an actual completion date.
2. It has all the weaknesses of the IAP except for its reference to the as-built.
3. It ignores the changing logic of contemporaneous updates.
4. The many steps are difficult to explain; and the analyst creation or modifications introduces opportunities for manipulation.

OBP "TIE" vs MIP 3.6 (IAP)

Performance Evaluation Criteria		Raw Score		Weighted Score		
		OBP - "Time Impact Evaluation"	MIP - 3.6 (Impacted As-Planned)	Weight Value	OBP - "Time Impact Evaluation"	MIP - 3.6 (Impacted As-Planned)
1	Quality of Source Data for Unimpacted Condition	2	2	10%	0.20	0.20
2	Quality of Source Data for Impacted Condition	2	1	10%	0.20	0.10
3	Integration of Actual Events into the Analysis	1	1	10%	0.10	0.10
4	Granularity & Volume of Data Used for Analysis	2	2	10%	0.20	0.20
5	Validity of Comparison of Unimpacted to Impacted	3	3	10%	0.30	0.30
6	Consideration of the Sensitivity of the Impacted Elements	3	3	15%	0.45	0.45
7	Periodicity of Variance Measurement	1	1	10%	0.10	0.10
8	Chronological Treatment of Cause & Effect	2	2	5%	0.10	0.10
9	Proximity in Time of the Cause to the Claimed Effect	1	1	5%	0.05	0.05
10	Consideration of Completeness of All Causal Elements	3	2	5%	0.15	0.10
11	Segregation of Effects from Non-Claimable Causes	3	2	5%	0.15	0.10
12	Overall Cleanness / Minimizing Room for Manipulation	1	2	5%	0.05	0.10
		24	22	100%	2.05	1.90

Winner

OBP “Window” vs MIP 3.7 (TIA)

Performance Evaluation Criteria		Raw Score		Weighted Score		
		OBP - "Windows"	MIP - 3.7 (Time Impact Analysis)	Weight Value	OBP - "Time Impact Evaluation"	MIP - 3.7 (Time Impact Analysis)
1	Quality of Source Data for Unimpacted Condition	1	3	10%	0.10	0.30
2	Quality of Source Data for Impacted Condition	2	1	10%	0.20	0.10
3	Integration of Actual Events into the Analysis	1	1	10%	0.10	0.10
4	Granularity & Volume of Data Used for Analysis	2	2	10%	0.20	0.20
5	Validity of Comparison of Unimpacted to Impacted	3	2	10%	0.30	0.20
6	Consideration of the Sensitivity of the Impacted Elements	3	3	15%	0.45	0.45
7	Periodicity of Variance Measurement	1	3	10%	0.10	0.30
8	Chronological Treatment of Cause & Effect	2	2	5%	0.10	0.10
9	Proximity in Time of the Cause to the Claimed Effect	2	2	5%	0.10	0.10
10	Consideration of Completeness of All Causal Elements	3	2	5%	0.15	0.10
11	Segregation of Effects from Non-Claimable Causes	3	2	5%	0.15	0.10
12	Overall Cleanness / Minimizing Room for Manipulation	1	2	5%	0.05	0.10
		24	25	100%	2.00	2.15

Winner

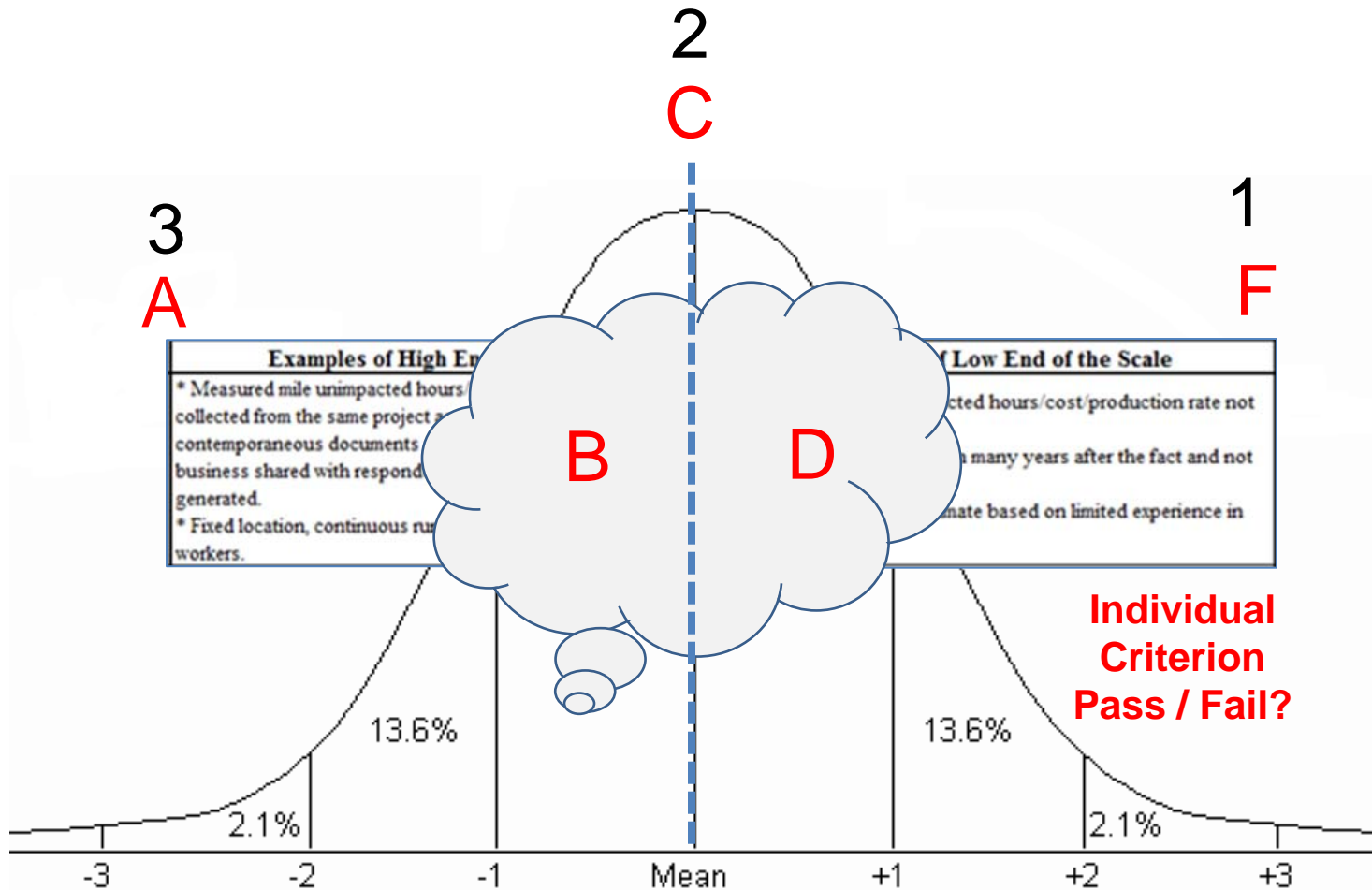


Path Forward

1. Peer review and input

- a. Add, delete, edit, reclassify, regroup, etc.
- b. Develop metrics
 - Weighting of the criteria
 - Scaling
 - Mid-point between the 'bookends'
 - Pass / Fail thresholds

Scaling / Mid-Points



Path Forward

1. Peer review and input

- a. Add, delete, edit, reclassify, regroup, etc.
- b. Develop metrics
 - Weighting of the criteria
 - Scaling
 - Mid-point between the 'bookends'
 - Pass / Fail thresholds

2. Inclusion in revisions to 29R-03 (FSA) & 25R-03 (LOP)

- a. Integration with 'Selection Criteria' (FSA Section 5)

Questions?