Forensic Schedule Analysis and Discretionary Logic

Prepared by: John Livengood, AIA, Esq., FAACE, PSP, CFCC, CCP
Navigant Consulting

Presented by: Ali Al-Ahmad, Eng., MBA and Robert Garven, Eng.
Revay and Associates Limited

AACE International
www.aacei.org

What Is the Issue?

Performing a forensic schedule delay analysis on a project with excessive discretionary logic can make certain FSA methodologies unreliable

Three Types of Logic

1. **Contractual Logic**
2. **Mandatory Logic**
3. **Discretionary Logic**

1. Contractual Logic

- **This logic is derived from the contract itself and is usually identified by the owner**
- **For example, a school project may mandate that the classrooms be opened by the start of school in September, but allow the gymnasium facilities to lag until the start of winter**
- **John's definition:** *"Logic required by the contract and/or scope of work that mandates certain of the owners sequence requirements*."

2. Mandatory Logic

- **Most construction schedules are developed around the contractual and mandatory logic requirements**
- **For example, excavation needs to precede the foundations, followed by the structure, and so-on**
- **John's definition:** *"Logic required by the physical necessity of the materials and design."*

3. Discretionary Logic

- **This is the logic that is developed when, there is no contractual or physical necessity to perform the work in a certain order**
- **For example, if the contractor is erecting the partitions and sheetrock on the fifth floor of a building under construction, there is probably no contractual or mandatory logic for erecting it from south to north**
- **AACE's definition:** *"Dependency defined by preference, rather than necessity. These are typically employed in preferential or soft logic."*

Three projects with discretionary logic

Bridge on piles
- 7000 feet
- 58 bents

High Tension Line
- 200 miles
- 800 towers

Transit Line
- 10.2 miles
- 2 stations

FSA METHODOLOGIES

AACE International

www.aacei.org

FSA Methodologies

- **AACE says nine methodologies**
- **Others say seventeen or more**
- **An argument could be made for a near infinite number**
- **We'll discus four major types –**
  All others are simply variations of these four

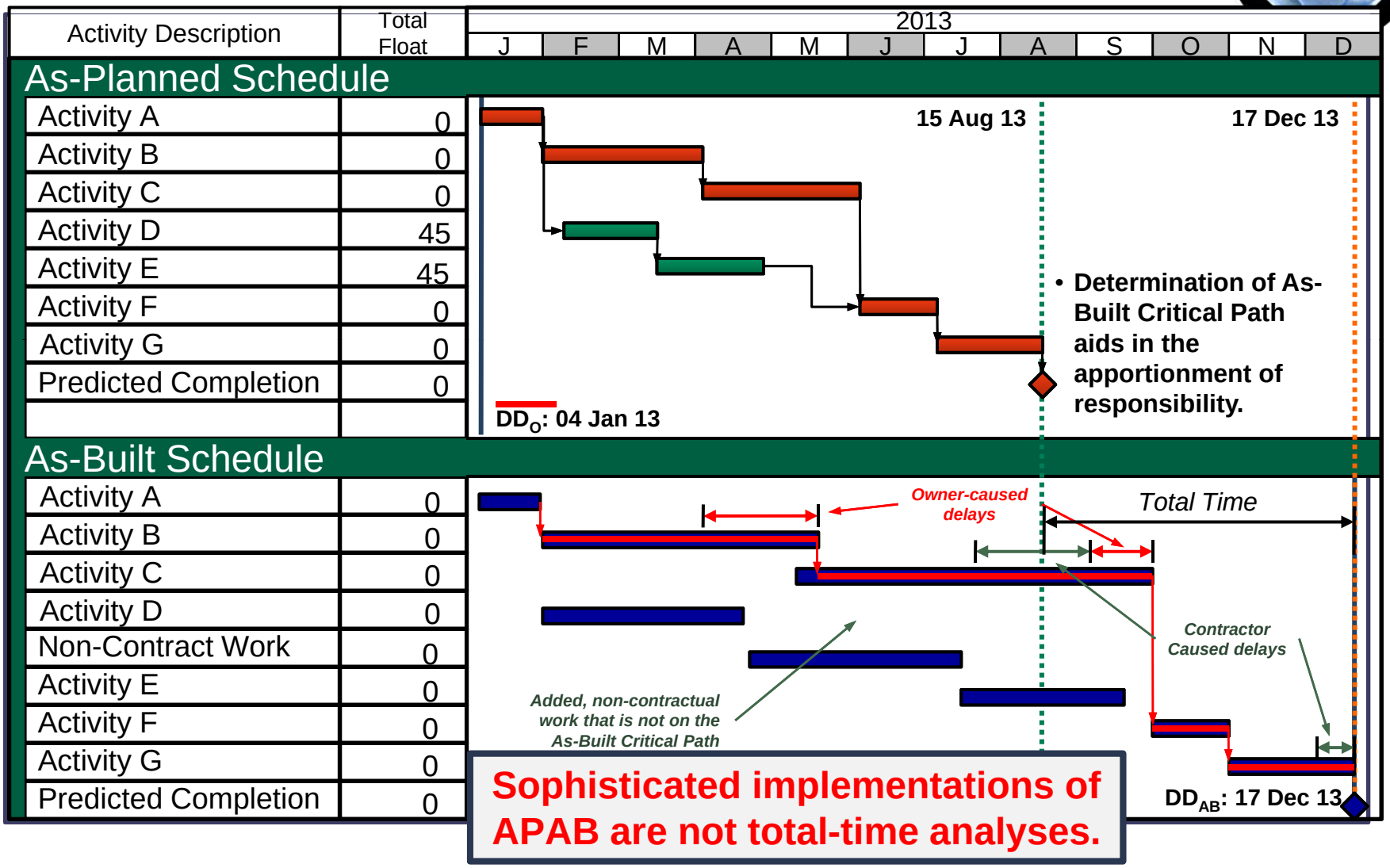
FSA Methodologies Chart

Observational	As-Planned As-Built	Gross	As-Planned vs. As-Built (MIP 3.1)
		Periodic	As-Planned vs. As-Built (MIP 3.2)
	Contemporaneous Period Analysis (Windows)	Contemporaneous As-Is	Contemporaneous Period Analysis (MIP 3.3)
		Bifurcated Contemporaneous	Bifurcated CPA (MIP 3.4)
		Recreated / Modified	Recreated CPA (MIP 3.5)
Modeled	Time Impact Analysis	Single Base	Impacted As-Planned (MIP 3.6)
		Multiple Base	Retrospective TIA (MIP 3.7)
	Collapsed As-Buiult	Single Simulation	Collapsed As-Built (Single) (MIP 3.8)
		Multiple Simulation	Collapsed As-Built (Multiple) (MIP 3.9)

As-Planned vs. As-Built (APAB)

- Compares the as-planned schedule to the as-built, establishes an as-built critical path, and determines what events actually drove project completion (MIP3.1 & 3.2)
- Does not inherently rely upon contemporaneous view of criticality

As-Planned vs. As-Built (APAB)



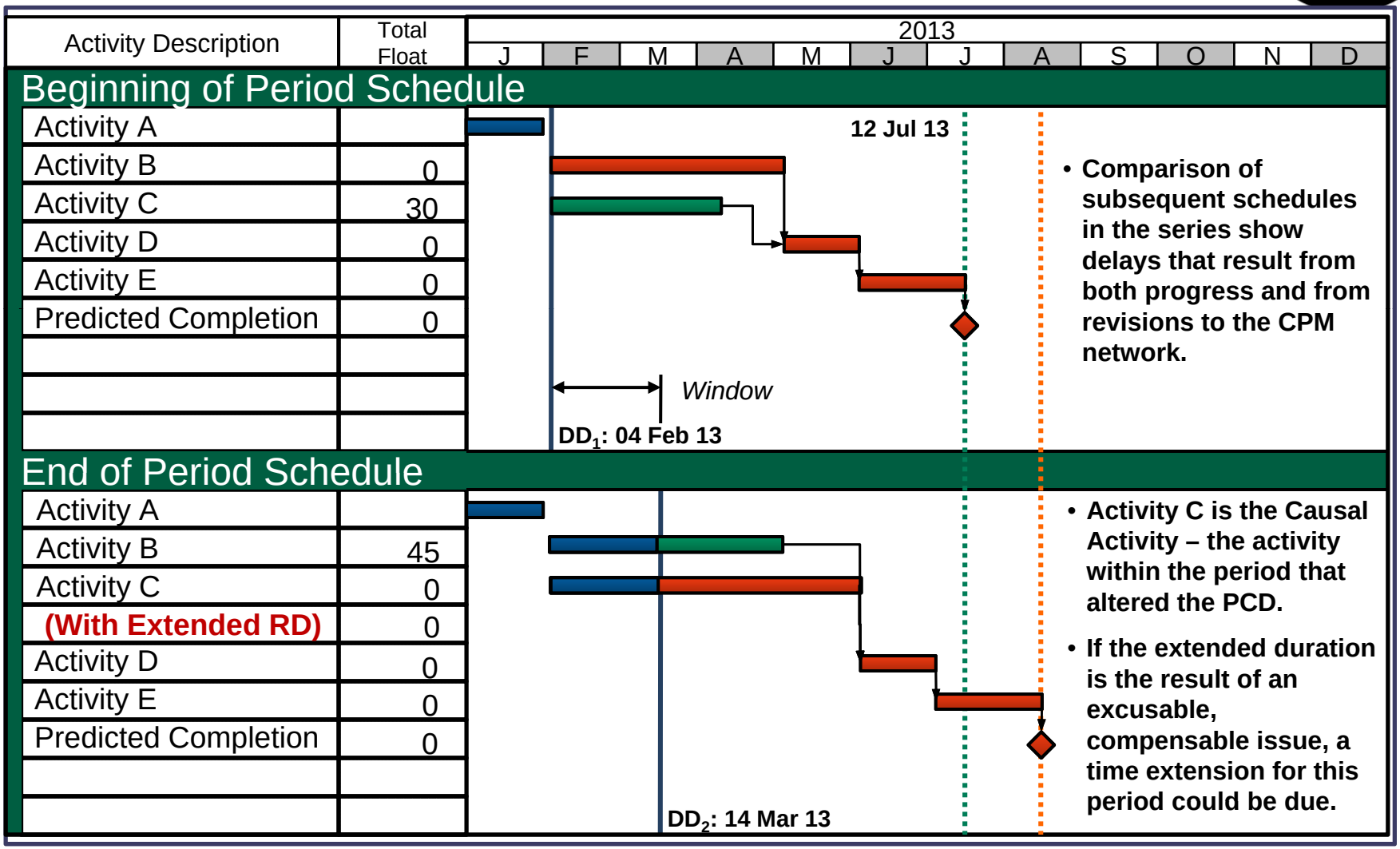
As-Planned vs. As-Built (APAB)

- Accepted by most courts
- Easy to understand
- Extremely persuasive if correctly performed
- Can be utilized when data is scarce
- Need not be "TOTAL TIME"
- Not suitable for long project durations
- Not suitable for projects built in a manner significantly different than planned
- Susceptible to unintentional or intentional manipulation by choice of as-built data that is incorporated into schedule

Contemporaneous Period Analysis (CPA)

- Compares two schedules with successive data dates in order to determine the driving critical path activities ("causal activities")
- Most often performed after project completion, but can be done while project is ongoing as well (MIP 3.3, 3.4 and 3.5)
- Relies heavily on the contemporaneous understanding of criticality

Contemporaneous Period Analysis (CPA)



Contemporaneous Period Analysis (CPA)

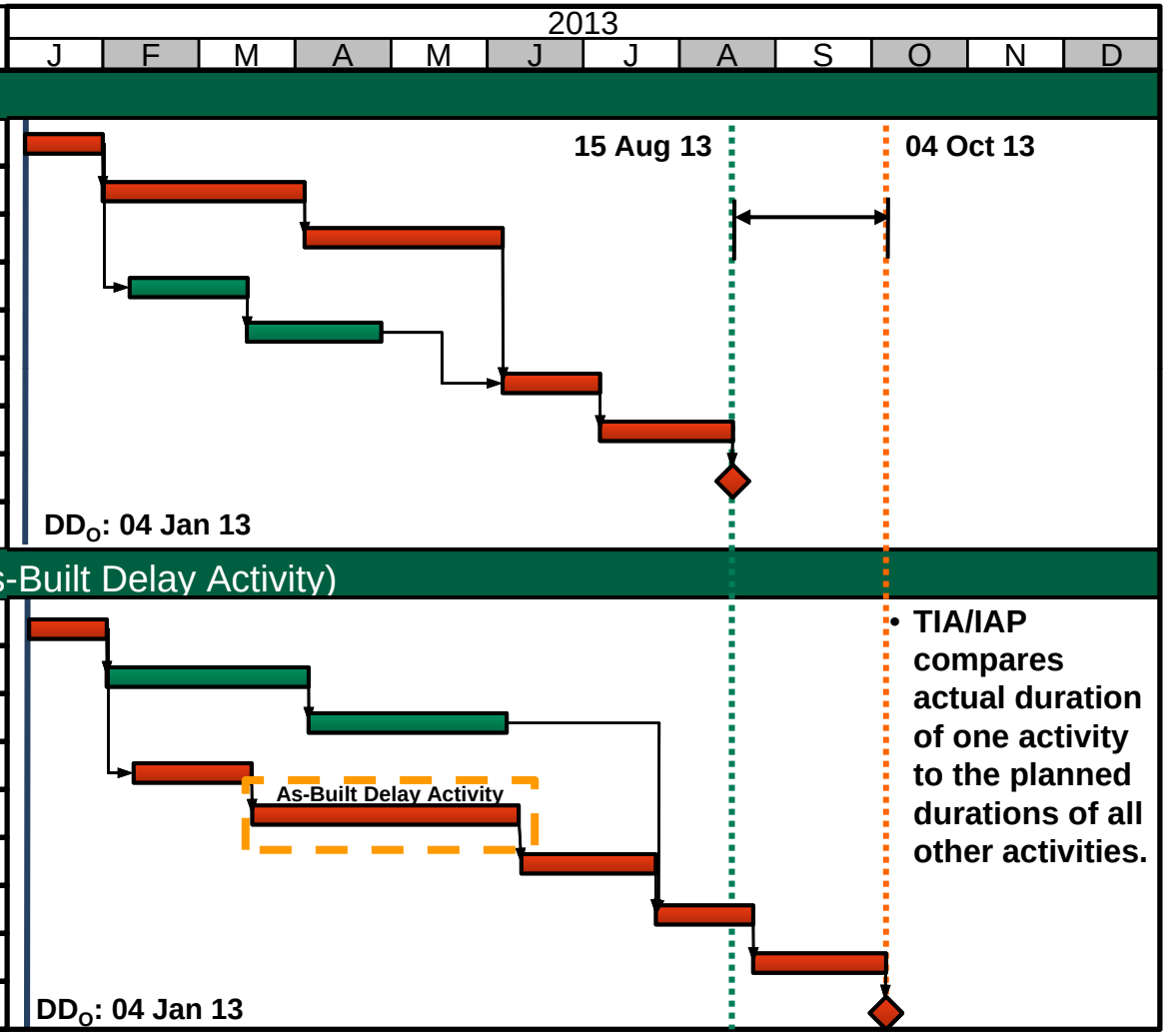
- Extremely accurate if:
  - Accurate updates
  - Bifurcated methodology
- Probably the most widely used by experts
- Recognized by Federal Boards
- The critical path may be different from contemporaneous schedule updates
- Contemporaneous schedule updates must be validated as accurate

Time Impact Analysis (TIA)

- Takes a delay event, using its actual duration, and inserts it into the as-planned schedule to show that event's alleged impact on the contractor's original plan
- IAP is less accurate than TIA; however, proper performance of a TIA is very difficult if not impossible (MIP 3.7 & 3.8)
- Can possibly relate to contemporaneous understanding of criticality – but it's difficult

Time Impact Analysis (TIA)

Activity Description	Total Float
Unimpacted Schedule	
Activity A	0
Activity B	0
Activity C	0
Activity D	45
Activity E	45
Activity F	0
Activity G	0
Predicted Completion	0
Impacted Schedule (with As-Built Delay Activity)	
Activity A	0
Activity B	60
Activity C	60
Activity D	0
Non-Contract Work	0
Activity E	0
Activity F	0
Activity G	0
Predicted Completion	0



- **TIA/IAP compares actual duration of one activity to the planned durations of all other activities.**

Time Impact Analysis (TIA)

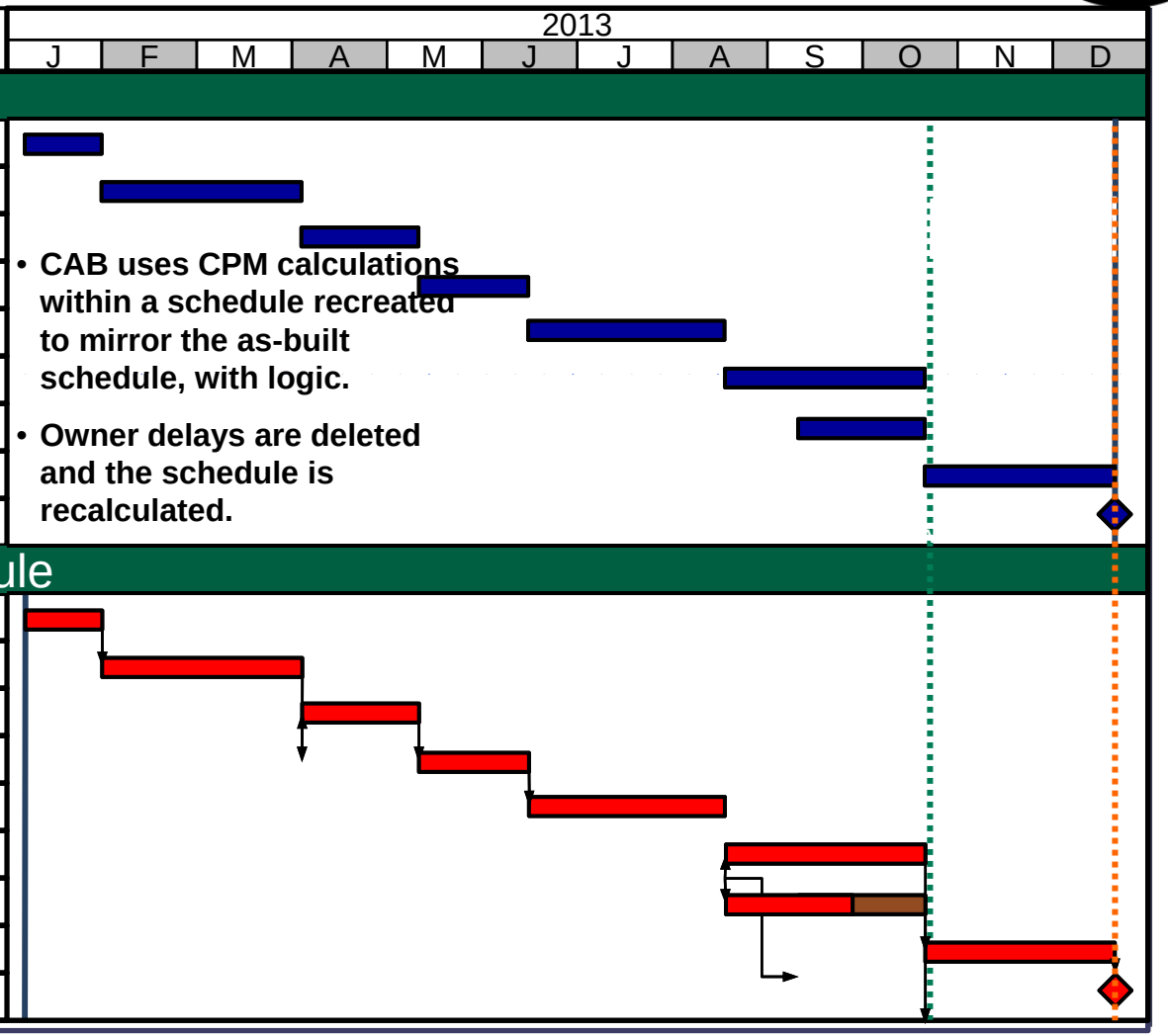
- **Recognized by Federal Boards**
- **Best analysis solution for complicated networks**
- **Can be extremely complicated**
- **Subject to excessive expert decision making**
- **Hypothetical model**
- **Susceptible to unintended or intended manipulation**
- **Extremely sensitive to the order of fragnet insertion**

Collapsed As-Built (CAB)

- **Recreates a CPM model starting with the as-built schedule, then deletes selected delay activities in order to show what would have happened, had that event not taken place (MIP 3.8 and 3.9)**
- **Does not relate to contemporaneous understanding of criticality**

Collapsed As-Built (CAB)

Activity Description	Total Float
As-Built Schedule	
Activity A	0
Activity B	0
Owner Delay 1	0
Activity C	0
Activity D	0
Owner Delay 2	0
Activity E	0
Activity F	0
Predicted Completion	0
Collapsed As-Built Schedule	
Activity A	0
Activity B	0
Owner Delay 1	0
Activity C	0
Activity D	0
Owner Delay 2	0
Activity E	0
Activity F	0
Predicted Completion	0



Collapsed As-Built (CAB)

- Often known as “but-for” analysis
- Easy to understand
- Rejected by many courts
- Subject to excessive expert decision-making
- Can be extremely complicated
- Perceived to be purely an after-the-fact
- Susceptible to manipulation during as-built logic assignments

OUT OF SEQUENCE WORK AND FSA METHODOLOGIES

AACE International

www.aacei.org

Out-of-Sequence Work

The most complicated type of out-of-sequence work:

- **Largely repetitive and have no need for immediate construction successors**
- **Are installed in a sequence other than that planned – discretionary logic is the issue**
- **Can occur on many types of projects**
- **Most common on linear projects**

FSA Methods and Out of Sequence Work

- Collapsed as-Built
- Contemporaneous Period Analysis
- Time Impact Analysis
- As-Planned As-Built

As-Planned As-Built (APAB)

- **Traditional APAB will not work**
- **Out of sequence activities give false sense of early or late performance**
- **Two related solutions:**
  1. **Production based Daily Delay Measure (DDM)**
  2. **Cost Based**

As-Planned As-Built (APAB)

1. Production based Daily Delay Measure (DDM)

- DDM recognized as a specialized method inside APAB (RP29R-03)
- Calculates actual delay status of activities on a day-by-day
- Permits a detailed identification of CP shifts

As-Planned As-Built (APAB)

2. Cost Based

- Compares planned dollars by time vs actual dollars by time
- Calculates “delay” predicated on $ installation rate
- Adjustments for stored materials or large equipment buys

Conclusion

Why was this method adopted for three projects with lots of discretionary logic?

- **High Tension Line**
- **Pile Bridge**
- **Transit line**

Factors:

- **Poor Updates**
- **Unrealistic Future Sequences**
- **None of the other FSA methodologies produced believable results**