



فرآیند جامع آنالیز تاخیرات در پروژه

بخش نهم:
آنالیز زمانی تاخیرات

آنالیز زمانی تاخیرات بعد از وقوع تاخیر و اختلاف
(After-the-Fact Schedule Analysis)

ارائه دهنده:

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What we will learn?

- ❑ After-the-Fact schedule analysis
 - ❖ Concepts
 - ❖ Retrospective IAP and TIA
 - ❖ Time slice windows analysis (TSWA)
 - ❖ As-planned vs. as-built windows analysis (APAB)
 - ❖ Retrospective longest path analysis (RLPA)
 - ❖ Collapsed as-built analysis (CAB)
- ❑ How to choose the methods?
- ❑ The most three types of logic
- ❑ Effects of three logic types on delay analysis

After-the-Fact Schedule Analysis

(Collapsed As-Built Analysis (CAB))

FSA methods

Method of Analysis	Analysis Type	Critical Path Determined	Delay Impact Determined	Requires
Time Slice Windows Analysis	Effect & Cause	Contemporaneously	Retrospectively	- Logic linked baseline programme. - Update programmes or progress information with which to update the baseline programme.
As-Planned versus As-Built Windows Analysis	Effect & Cause	Contemporaneously	Retrospectively	- Baseline programme. - As-built data.
Retrospective Longest Path Analysis	Effect & Cause	Retrospectively	Retrospectively	- Baseline Programme. - As-built programme.
Collapsed As-Built Analysis	Cause & Effect	Retrospectively	Retrospectively	- Logic linked as-built programme. - A selection of delay events to be modelled.

FSA methods

The Information Required					
	Baseline programme	Logic linked baseline programme	As-built data	Delay events to model	Up to date programmes/ process information
Time Slice Windows					
As-Planned v As-Built Windows					
Longest Path					
Collapsed As-Built					
The table above shows the evidence required for each delay analysis method. The table has been simplified.					

Collapsed as-built analysis – Definition

❑ SCL Protocol:

- ❖ Very **similar** to **impacted as-planned** (**in reverse**)
- ❖ Also known as “**As-Built But for (ABBF)**” analysis
- ❖ This is a **what if scenario**
- ❖ It involves the **extraction of delay events** from the **as-built schedule** to provide a **hypothesis** of what **might have happened** had the **delay events not occurred**.
- ❖ It does **not require** a **baseline schedule**.
- ❖ It requires a **detailed logic-linked as-built schedule**.
 - ✓ It is **rare** that such a schedule would **exist** on the project
 - Therefore the analyst is usually required to **introduce logic** to a **verified as-built schedule**.
- This can be **very time consuming** and **complex endeavor**.

Collapsed as-built analysis – Definition

❑ SCL Protocol:

❖ Once **completed (logic-linked as-built created)**,

sub-networks for the delay events within the as-built programme are identified

they are **‘collapsed’ or extracted** in order to determine the **net impact** of the delay events.

❖ This method is sometimes done in windows, using interim or **contemporaneous programmes** which contain detailed and comprehensive as-built data.

Collapsed as-built analysis – Definition

❑ SCL Protocol says:

‘4.7 Collapsed as-built is based on the effect of employer risk events on the programme of work as it was actually built. Similar to the as-planned versus as-built, the use of this technique is restricted by its inability to identify concurrency, resequencing, redistribution of resources or acceleration. This is particularly the case when the nature of the as-built logic is complex, requiring subjective reconstruction of as-built logic. Where acceleration, redistribution of resources or resequencing has taken place during the course of the works to overcome the effects of events, this form of analysis may produce unreliable results’.

❑ The SCL Protocol is justifiably cautious about recommending the **CAB approach**.

Collapsed as-built analysis – Definition

- ❑ AACE method implementation protocol (MIP) 3.8 and 3.9 say:
 - ❖ **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**

Collapsed as-built analysis – How to use?

NTP = NET TIME PRESENT

AS=ACTUAL START

ABCP=ACTUAL BASED CRITICAL PATH

Collapsible As-Built

- Schedule created with a Data Date equal to NTP, original durations equal to actual durations, and logic designed to make ES/EF equal to AS/AF.
- Also contains activities representing delays.
- ABCP is calculated.

Collapsed As-Built

- Delay activities are dissolved, in reverse order.
- Schedule is recalculated after each dissolution.
- Method purports to demonstrate what would have happened “but for” the dissolved events.

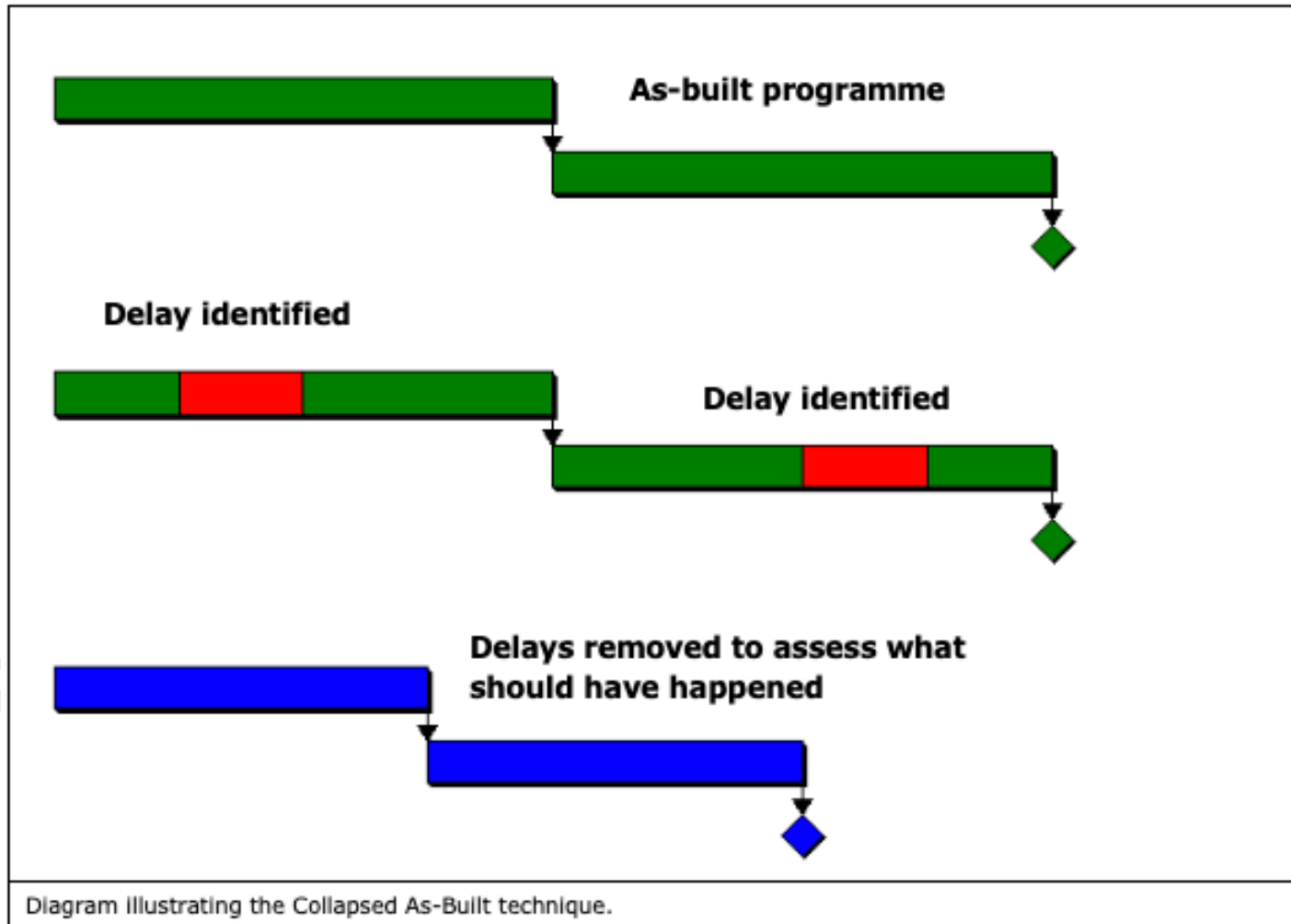
Collapsed as-built analysis – How to use?

1. Develop a **detailed logic-linked as-built schedule**.
 2. **Sub-networks** (fragnets) for the **delay events** are **identified** within **as-built schedule**
 3. **Collapse** and **extract Sub-networks** (fragnets) for the **delay events** in order to determine the **net impact** of the **delay events**
- ☐ This method is **sometimes** done in **windows**, using **interim** or **contemporaneous** schedules which contain **detailed** and **comprehensive as-built data**.

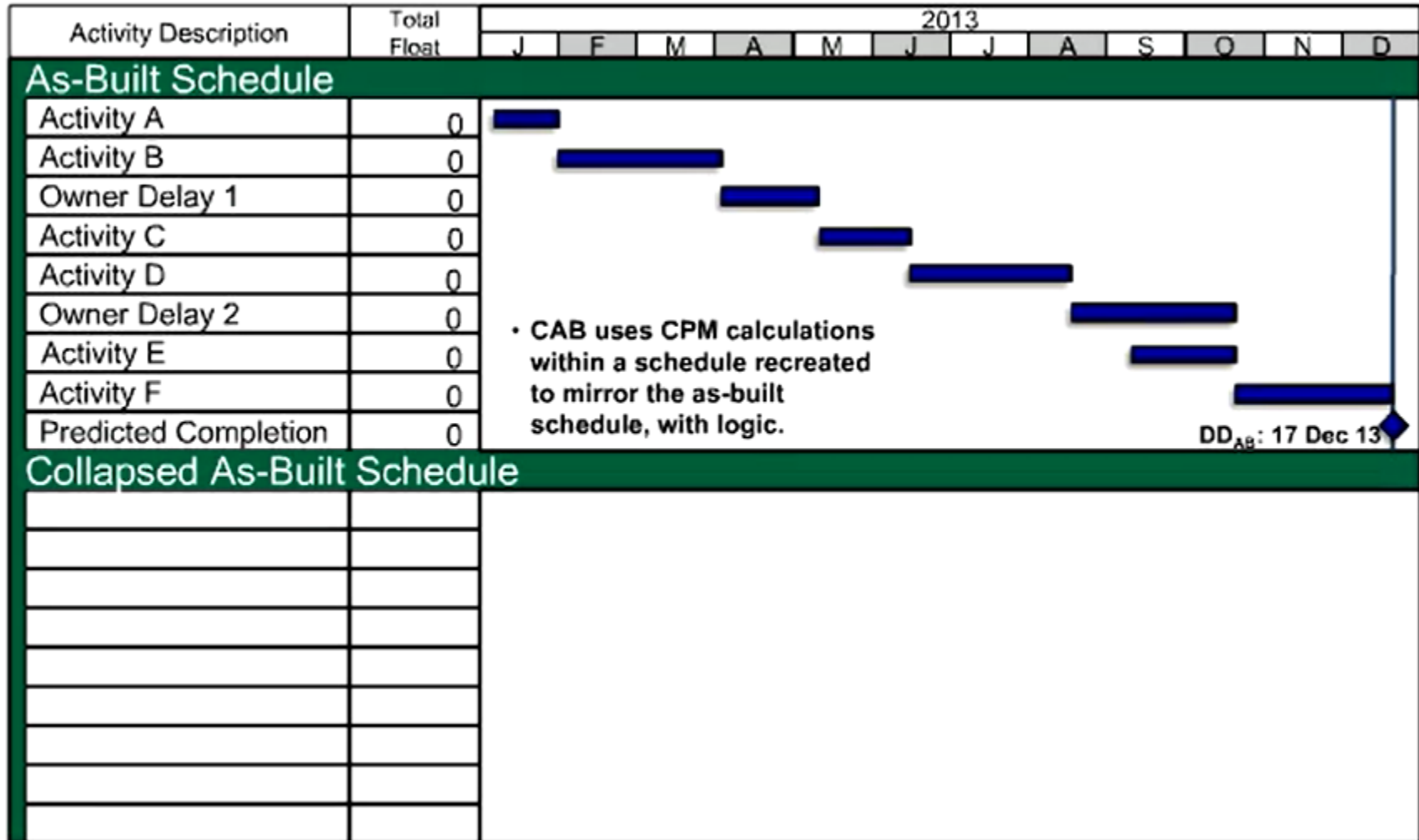
Before any collapsing can take place, the delay events relied on EDE, CDE, or both, must be discretely identified among the as-built activities.

These can be in the form of “fragnets.”

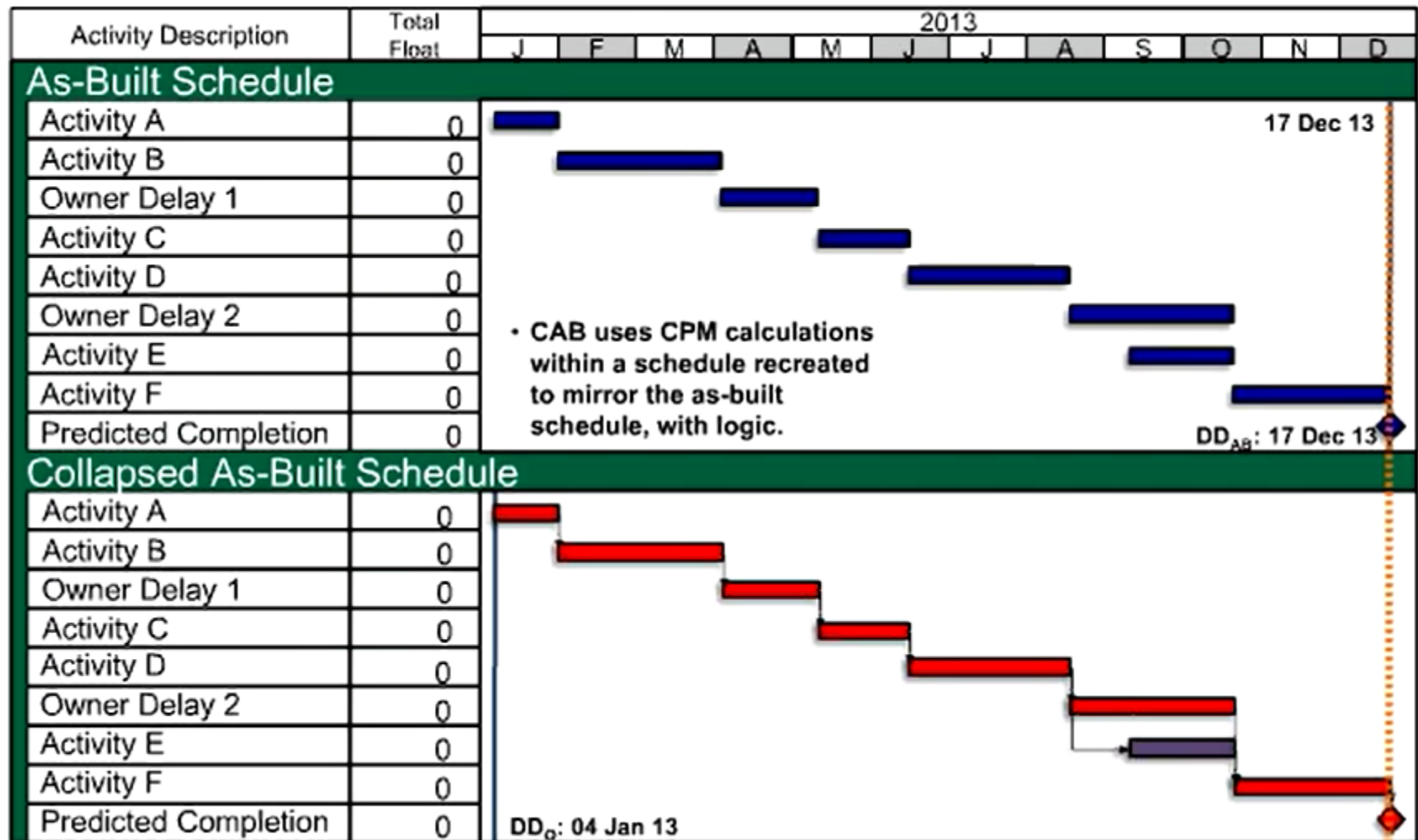
Collapsed as-built analysis – Example



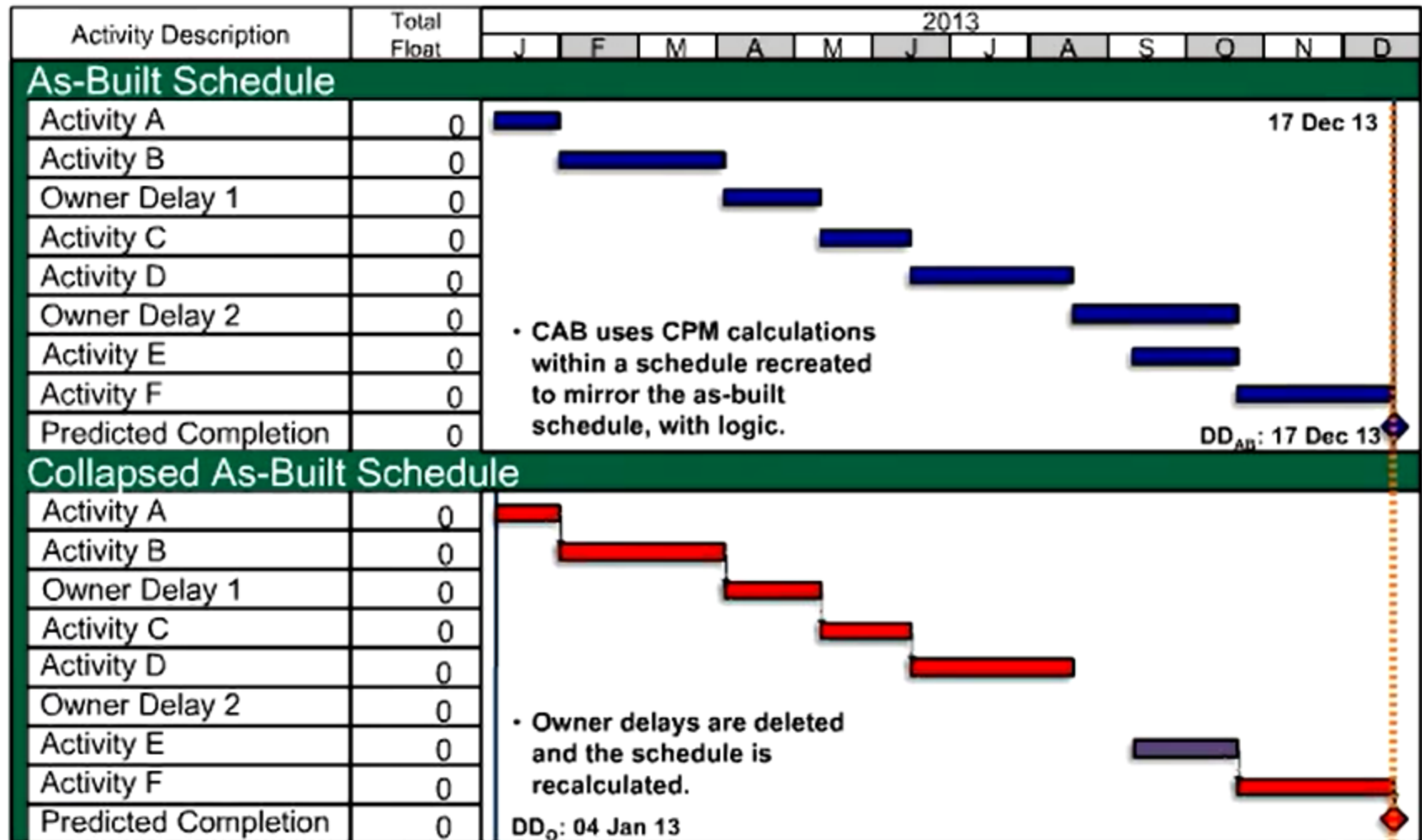
Collapsed as-built analysis – Example



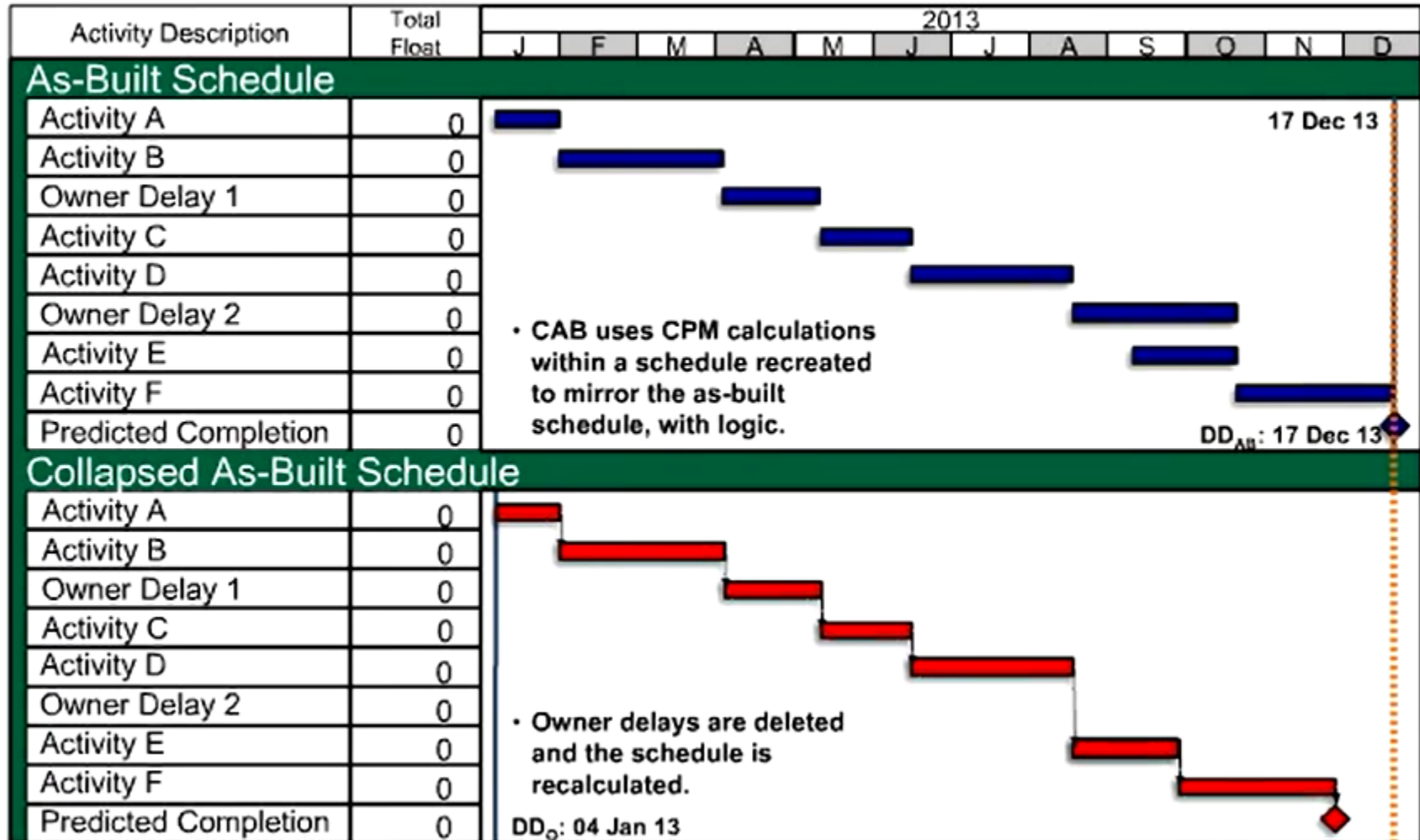
Collapsed as-built analysis – Example



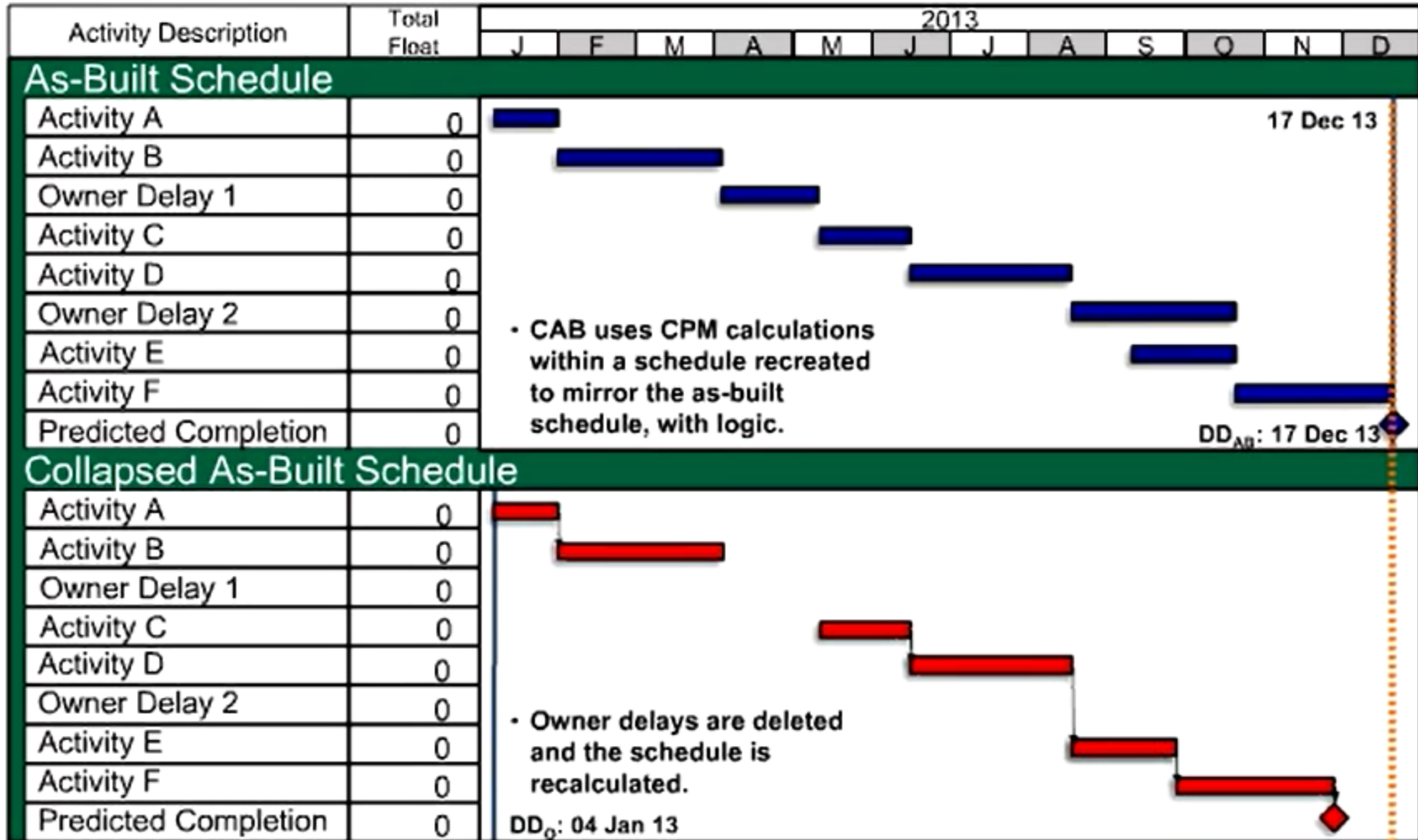
Collapsed as-built analysis – Example



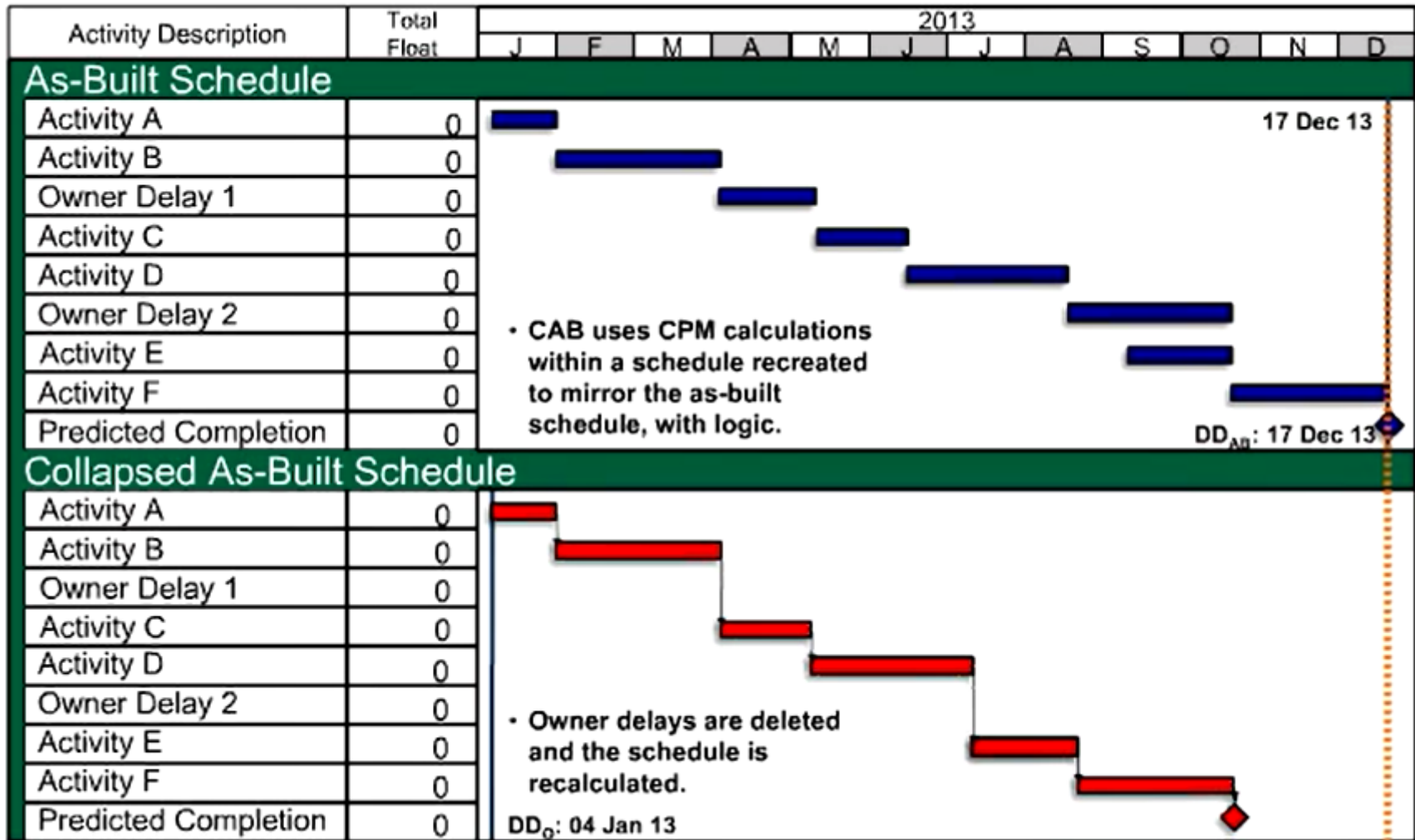
Collapsed as-built analysis – Example



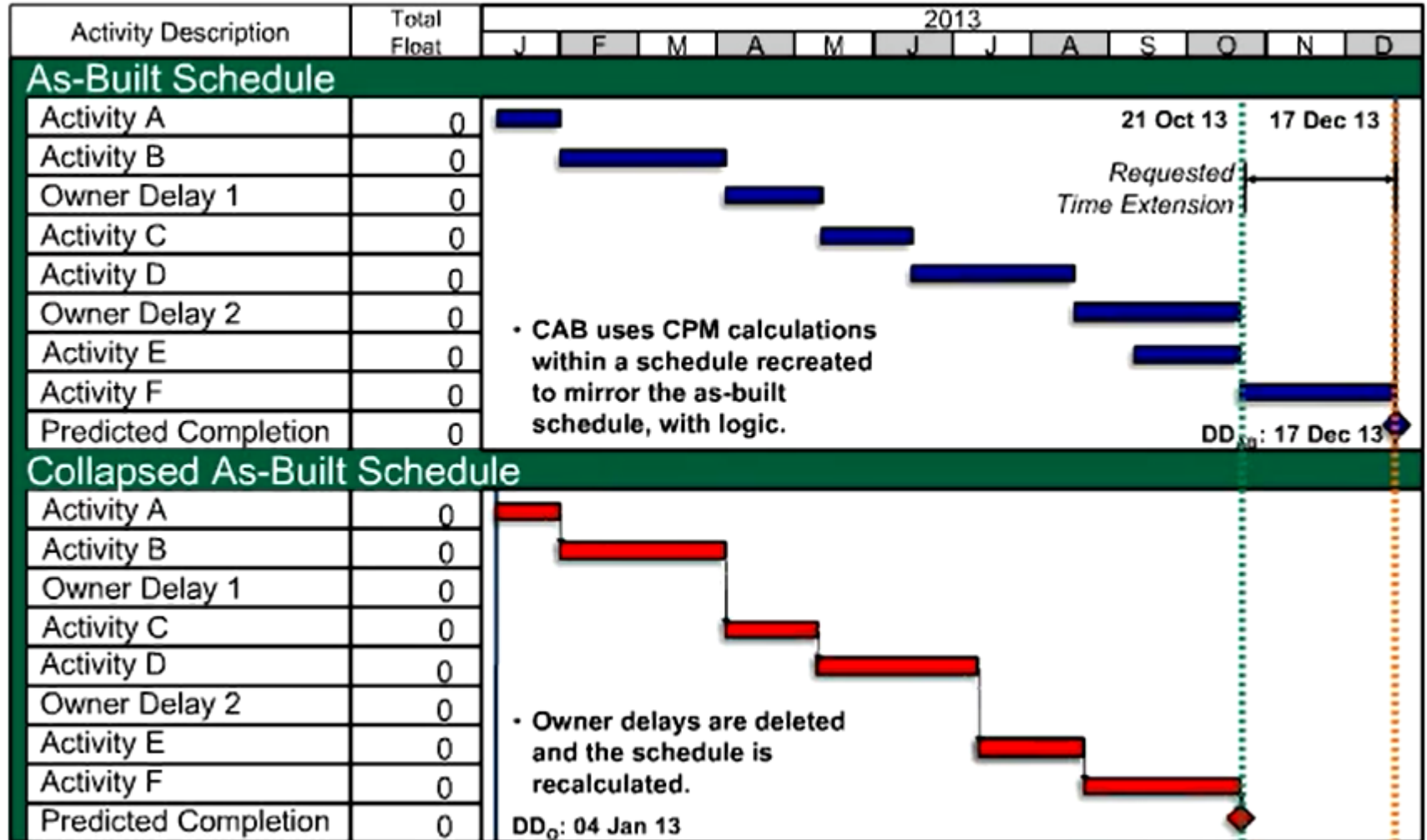
Collapsed as-built analysis – Example



Collapsed as-built analysis – Example



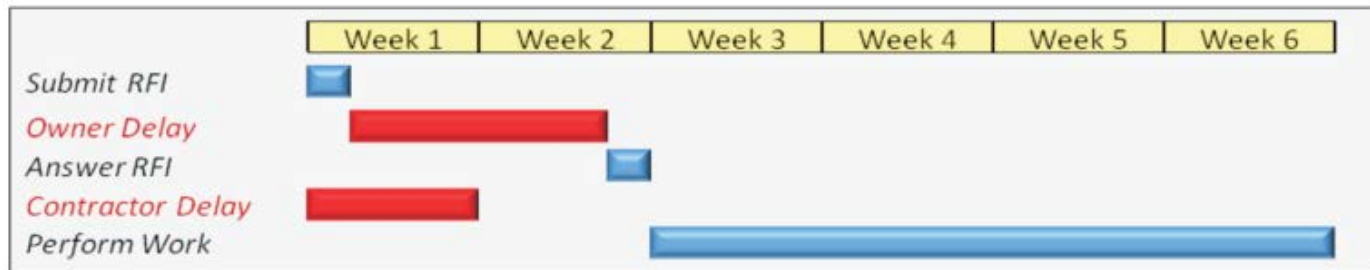
Collapsed as-built analysis – Example



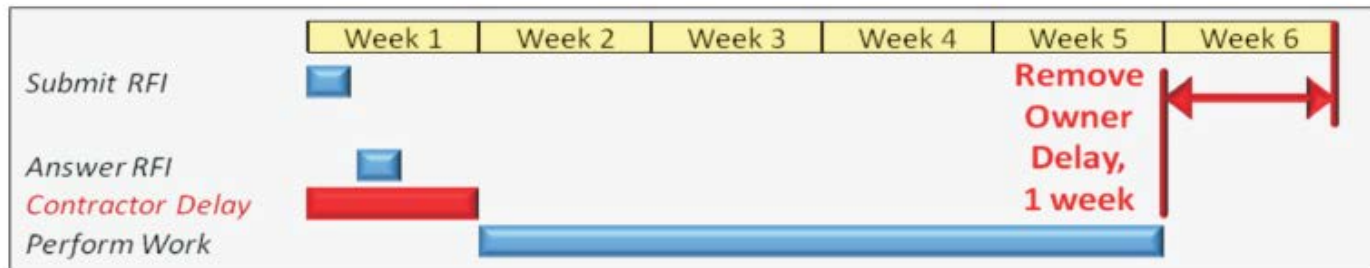
IS IT ALWAYS THAT SIMPLE?

Collapsed as-built analysis – Example

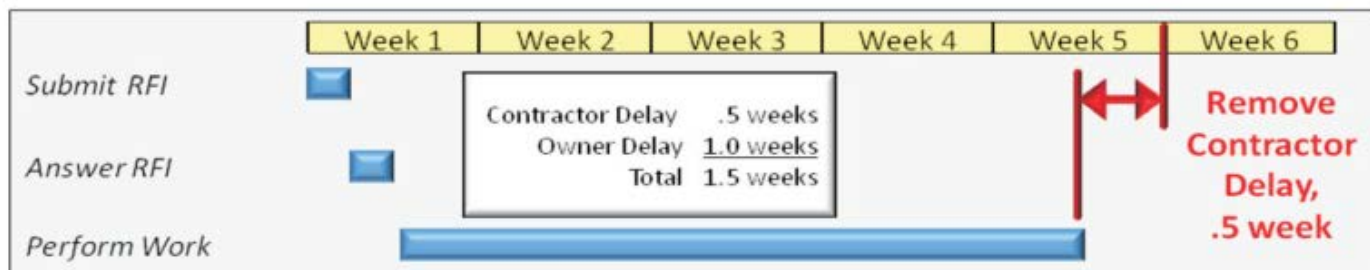
As-Built Schedule with Delays



As-Built Schedule with Owner Delay Removed First

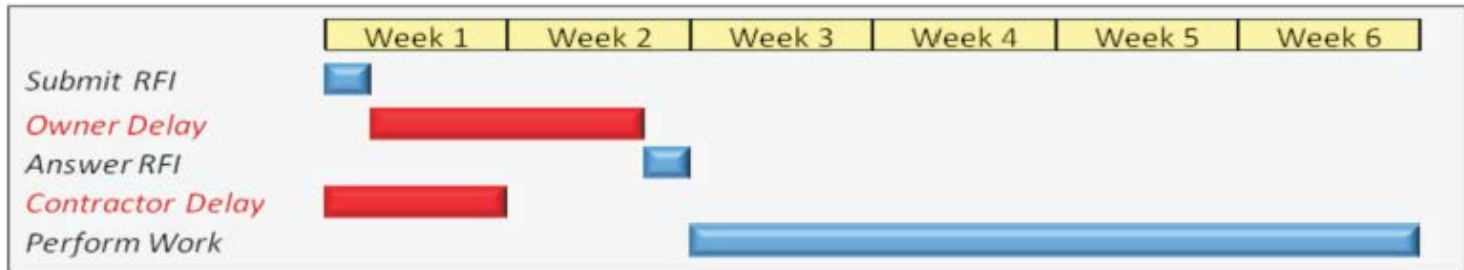


As-Built Schedule with Contractor Delay Then Removed

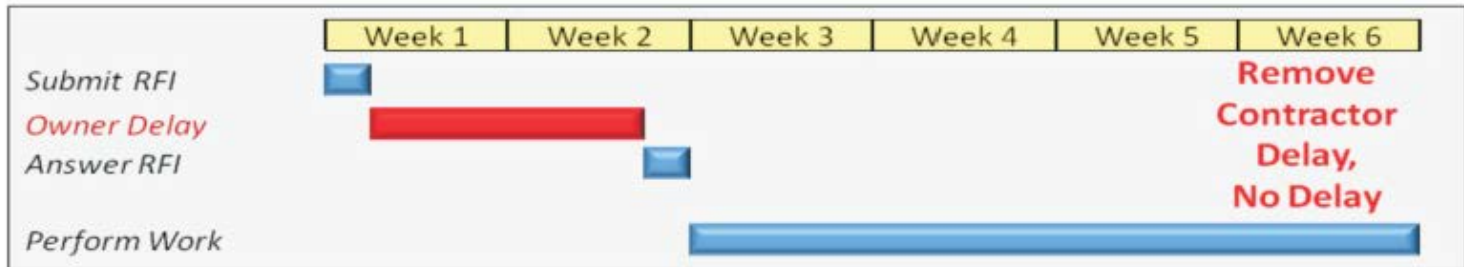


Collapsed as-built analysis – Example

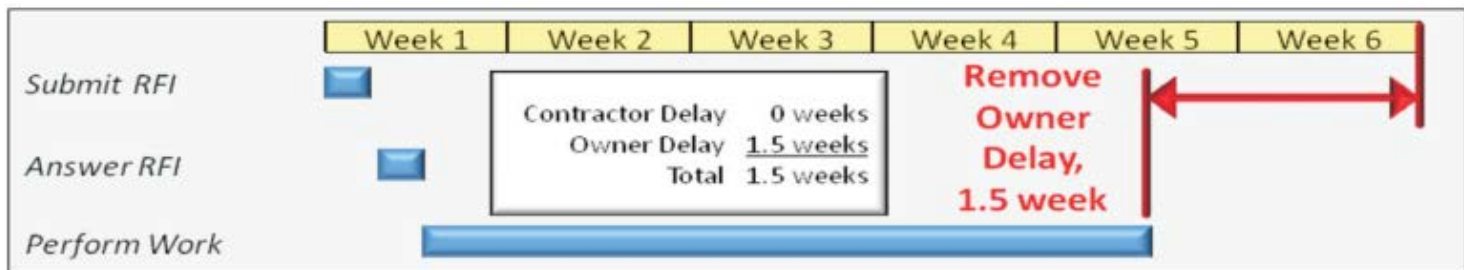
As-Built Schedule with Delays



As-Built Schedule with Contractor Delay Removed First



As-Built Schedule with Owner Delay Then Removed



Collapsed as-built analysis – Pros and cons

- ✓ Often known as “but-for” analysis
- ✓ Easy to understand
- ✓ Does not require **baseline programme**
- ✓ Can isolate impact of EDE from CDE when **iterative applications** applied
- ✓ Used for **after-the-fact** schedule (**retrospective delay impact**)

Collapsed as-built analysis – Pros and cons

- × **Rejected by many courts especially** if the as-built schedule is not well developed
- × **Static analysis (Retrospective critical path)**
 - × Collapsed As-Built Analysis “freezes” the critical path.
 - ✓ It could be improved **if step-based approach and window analysis** used.
 - × The critical path then **changes depending on the “subtraction” made**, but these critical path “shifts” **rarely match** the shifts shown in the **contemporaneous project schedules**.
- × **Subjective** in terms of **actual progress** and **changes** (using all **new logic and progress**)
- × **Ignores plan** because you heavily **rely** on **as-built**
- × **Can be extremely complicated**
- × **Susceptible to manipulation** during as-built logic assignments
- × **Moderate to very high** in terms of **time** and **cost**
- × **No consideration of concurrent delays** if no step-based approach is used.

Collapsed as-built analysis – When to use?

- ☐ The **actual effect** of the delay event is **known**.
- ☐ An **accurate as-built schedule** is available or can be **developed**.
- ☐ A **baseline schedule** is **not available**.

Before using this method, the analyst needs to ask some questions!

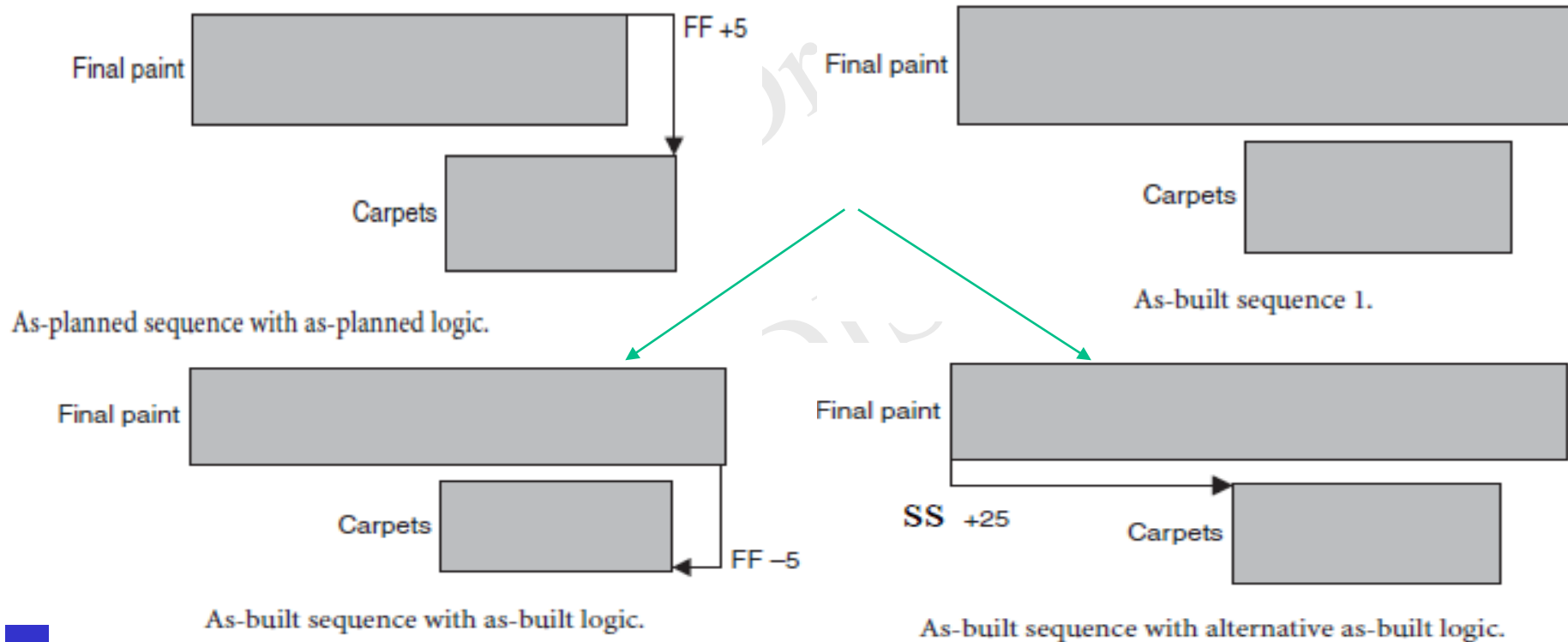
Collapsed as-built analysis – When to use?

Before carrying out the delay analysis, the analyst needs to ask many questions of the data...Let's see!

1. Is there an **appropriately detailed as-built programme** in existence, or does one need to be constructed from base raw documents?
 - ❖ If not, does **sufficient data exist** to allow one to be **reconstructed**?
2. Secondly, **if a detailed as-built programme exists**, can the **start and finish dates** for each activity be **verified**?
3. Thirdly, **once the as-built start and finish dates have been verified**, and corrected where necessary, can **periods of inactivity** be **identified** along any of the **tasks**?
4. Lastly, **if all of the above can be verified**, can the **as-built logical relationships** and **dependencies** between each activity on the programme be **accurately identified** and **simulated** in the base programme?

Collapsed as-built analysis – When to use? – Example

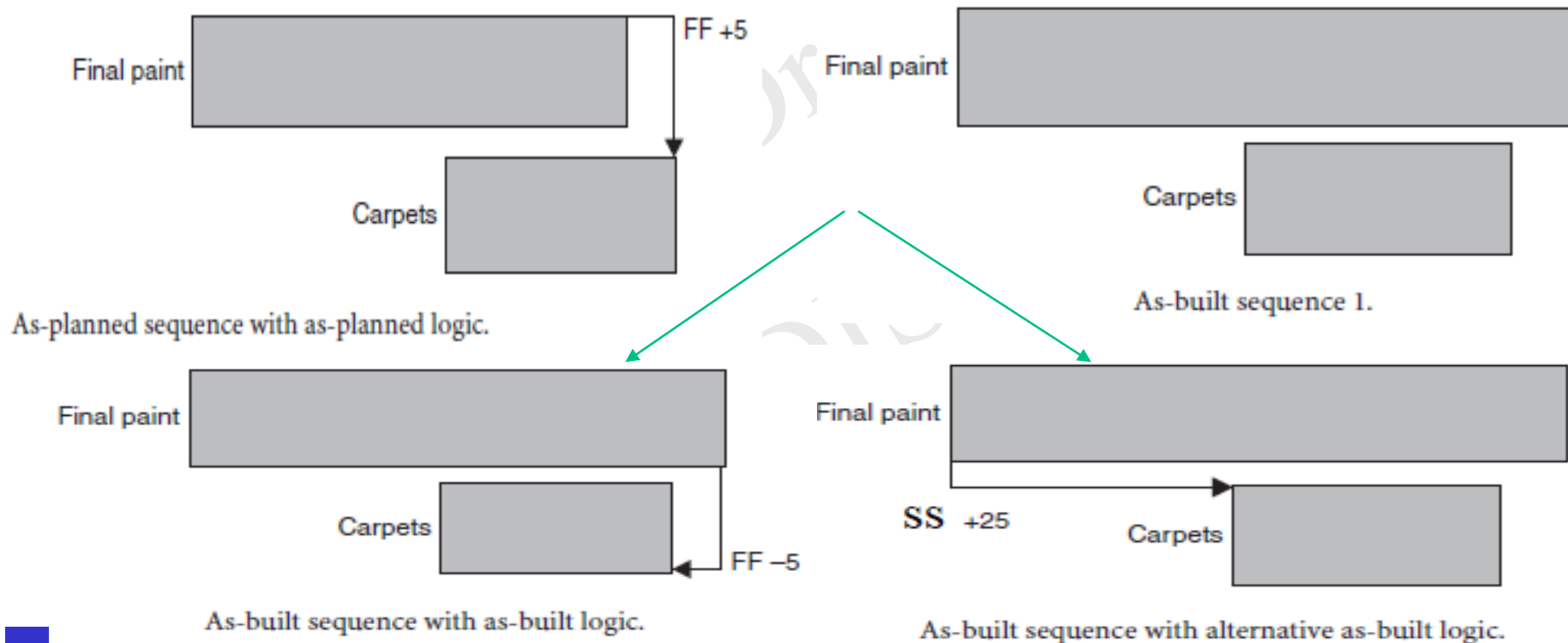
- ❑ In the **CAB base model**, the **‘as-built’ dates** are **actually calculated**.
- ❑ The **start and finish date** of each activity must rely **on its as-built duration** and one of **four types of logical relationships** used in CPM networks to connect related tasks to their successors



Which one?

Collapsed as-built analysis – When to use? – Example

- ❑ The logical relationship illustrated in **SS LOGIC** would more accurately represent what actually happened. **Carpets** commenced following 25 days of Final Paint progress and **finished in accordance with their as-planned duration**. Final Paint on the other hand **overran its as-planned duration**, but with **no resulting delay to Carpets**.



On a project with thousands of activities, the analyst may have to make literally thousands of amendments such as the one demonstrated above!

Collapsed as-built analysis – Practical procedure

❑ There are several ways to perform a Collapsed As-Built Analysis. Two of them are:

1. **Unit** subtractive as-built (**window analysis**)
2. **Gross** subtractive as-built (**single base analysis**)

*First, a model of the **as-built schedule**, which is called the **As-Built Calculation Schedule**, is developed with **actual schedule logic** and **actual activity durations**.*

Collapsed as-built analysis – Practical procedure

1. Identify the window for analysis.

- a) If the analysis is a **“single base,”** then CAB model window is the entire project duration.
- b) If the analysis is carried out as a **“window” analysis**, then **justification** for each window needs to be given.

Collapsed as-built analysis – Practical procedure

2. Identify all known delay events in the as-built model.

- ❖ The owner-caused, contractor-caused, concurrent delays are then identified in the **As-Built Calculation Schedule**.

Example of an Owner-Caused Delay Quantified by a Duration Variance Calculation

Activity No.	Activity Original Duration (WD)	Activity Actual Duration (WD)	Activity Duration Variance Delay (WD)	Delay Responsibility
A	10	10	0	–
B	5	5	0	–
C	10	20	10	Owner
D	5	5	0	–
E	25	30	5	Contractor

Collapsed as-built analysis – Practical procedure

3. Identify the sequence of extraction of delay events in each window.

- a) Extracted **all at once**
- b) Extracted one at a time on a **“stepped basis”**
 - ✓ The **usual approach** in this case is to collapse activities in **reverse order**, based on the **latest actual finish date** and working back to the **beginning of the window**, one at a time.
 - ✓ The **traditional approach** is to extract **both EDE and CDE** from the same CAB model, with **CDE removed first**, to allow the **contractor the benefit** of any **concurrent** or **pacing** delays.
 - i. **Calculate delays caused by the owner**
 - ii. **Calculate delays caused by the contractor**

If delays cannot be demonstrated to be EDE, they are treated as CDE

Collapsed as-built analysis – Practical procedure**4. Identify the method of extracting delay events.**

❖ The process can be carried out by simply

a) **Deleting** the delay events (not recommended)

b) **Dissolving** the delay events (can be done by Primavera)

✓ The delay events' successor activities are tied to their predecessor activities to maintain schedule logic continuity instead of deleting.



c) **Reducing** the delay event duration to zero

Each method could result in a different answer!

The analyst should be consistent in the method of extraction to avoid criticism for inconsistent application of methodology.

Collapsed as-built analysis – Practical procedure

5. Remove the first delay (or set of delays) from the CAB as-built.

- ❖ **Log the movement**, if any, to the CAB calculated completion date.
 - ✓ By **removing delays** that were caused by the delay, the As-Built Calculation Schedule for each schedule window **may or may not collapse**.
 - i. Complete movement
 - ii. No movement or partial movement
- ❖ If **near critical paths** are being tracked, note the **change in float** along the path of the delay event extracted.

Collapsed as-built analysis – Practical procedure**5. Remove the first delay (or set of delays) from the CAB as-built.**

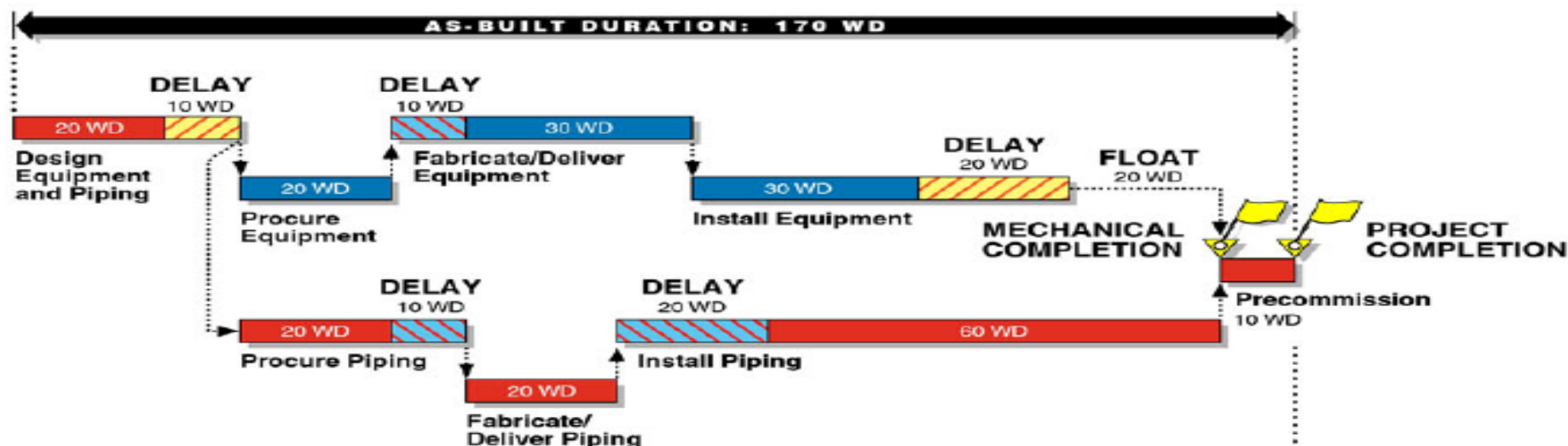
i. **Complete movement:** If the **As-Built Calculation Schedule completion date** **collapses exactly to the duration of the delays**, the **net duration** of the schedule

collapse is the **amount** of EDE, CDE, or neutral!

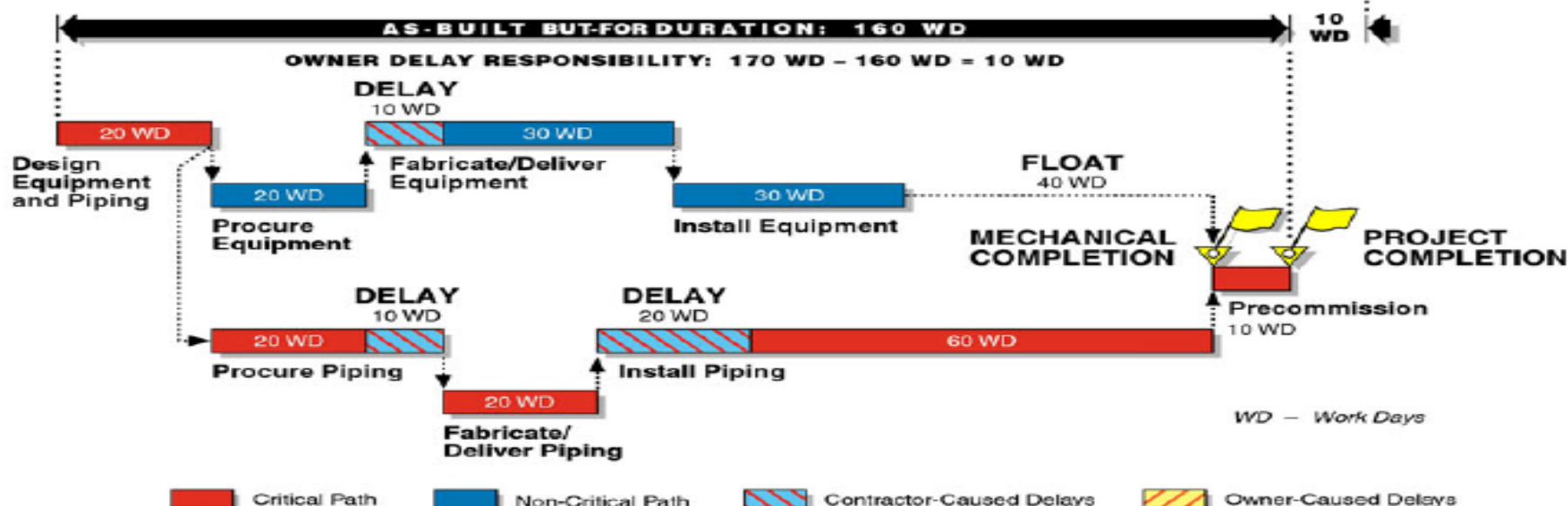
- ❖ Because there were **no concurrent delays** to the **critical path** that were caused by the **others**.
- ❖ EDE may have caused increases to the **contractor's home office overhead costs**, and/or the **contractor's** and its **subcontractors' field office overhead costs**.

Actual time-related cost increases would still need to be demonstrated with **evidence** to prove that the **contractor or its subcontractors** **actually incurred compensable delay damages**.

As-Built Schedule Showing Owner-Caused and Contractor-Caused Delays



As-Built But-For Schedule With Owner-Caused Delays Removed



Note: Because of contractor-caused delays on the critical path, the Project Completion could have been achieved only 10 WD earlier if the owner-caused delays did not occur. Therefore, the owner's responsibility for a compensable delay is 10 WD.

Collapsed as-built analysis – Practical procedure

5. Remove the first delay (or set of delays) from the CAB as-built.

ii. **No movement or partial movement:** If the As-Built Calculation Schedule does **not collapse at all or partially collapse**,

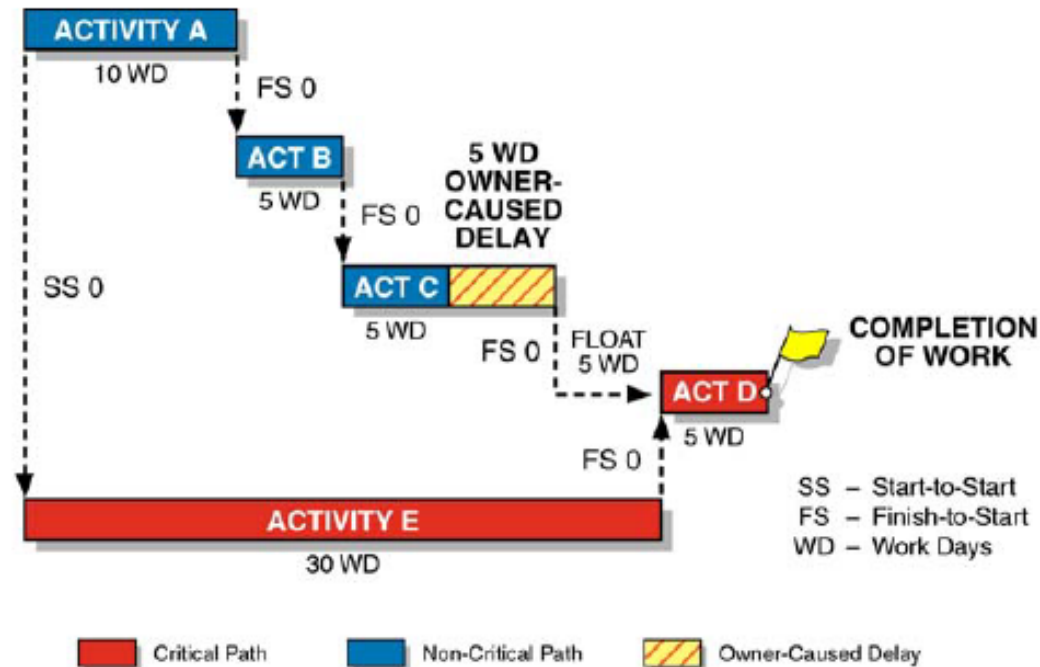
the **caused delays** that were removed were **either**:

a) **Not on the critical path** and, therefore, the caused delay would not have affected the completion date(s).

Collapsed as-built analysis – Practical procedure

In this case, the 5- work day owner-caused delay affected Activity C, which still had 10 work days of available float after the delay occurred because the Activity E and Activity D were the actual critical path to the Completion of Work

Owner-Caused Delays Were Not on the Critical Path



Because the 5 WD owner-caused delay is not on the critical path, removal of the 5 WD owner-caused delay would not have resulted in an earlier completion date.

Collapsed as-built analysis – Practical procedure

5. Remove the first delay (or set of delays) from the CAB as-built.

ii. **No movement or partial movement:** If the As-Built Calculation Schedule does **not collapse at all or partially collapse**,

the **caused delays** that were removed were **either**:

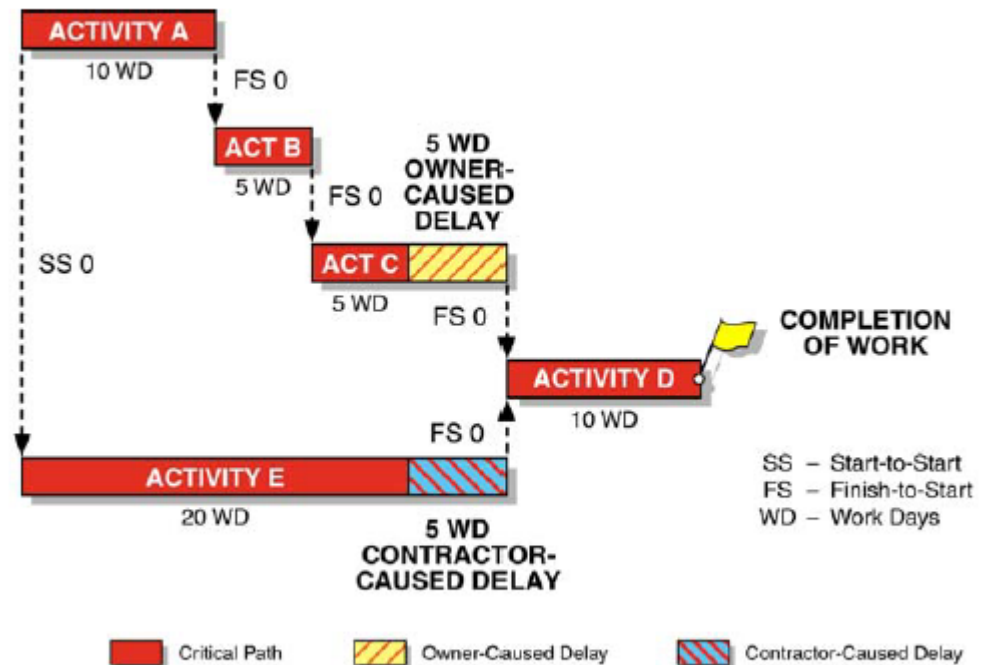
b) **Concurrent** with **other caused-delays** that were also on the **as-built critical path** which **prevented** the **schedule completion date** from **collapsing** to the **original projected completion** date at the start of the window.

Collapsed as-built analysis – Practical procedure

In this example, the 5-work day owner-caused delay and the 5-work day contractor-caused delay affected two parallel activity paths, were independent delays, and both delays would have extended the completion of the project.

1. Total delays: 5 days
2. EDE: 0 days
3. CDE or concurrent: 5 days
 - ❖ CDE: 0 days
 - ❖ Concurrent: 5 days

Owner-Caused Delays Were Fully Concurrent with Contractor-Caused Delays



Because the owner-caused delay and contractor-caused delay are independent, concurrent, and both equal to 5 WD, removal of the 5 WD owner-caused delay would not have resulted in an earlier completion date.

Collapsed as-built analysis – Practical procedure

5. Remove the first delay (or set of delays) from the CAB as-built.

ii. **No movement or partial movement:** If the As-Built Calculation Schedule does **not collapse at all or partially collapse**,

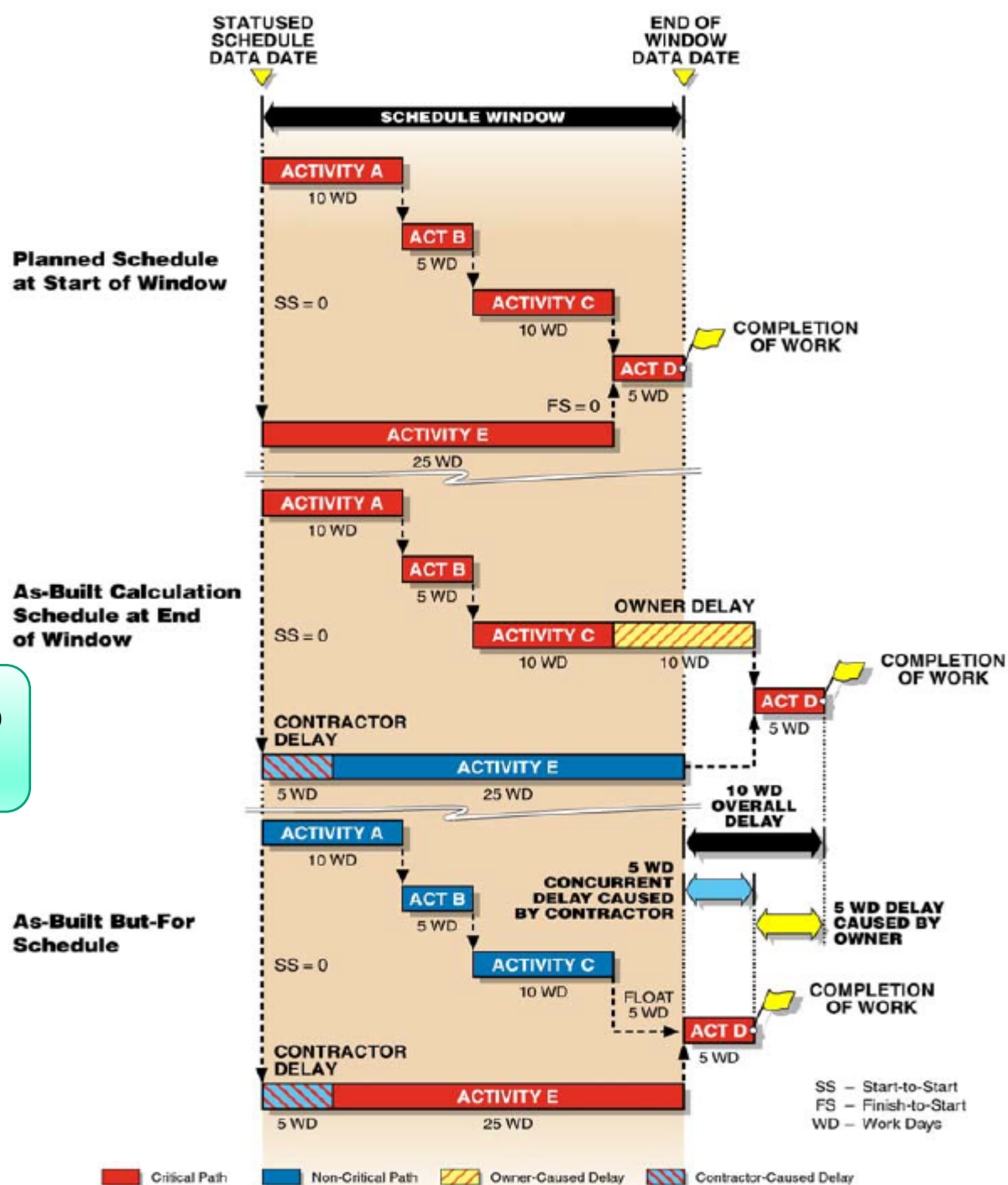
the **caused delays** that were removed were **either**:

c) **Concurrent in part**, but **not for the entire caused delay period**.

□ Stepped basis

- ❖ Total delays: 10 days
- ❖ EDE: 5 days
- ❖ CDE: 5 days

Could stepped basis always help with **concurrent delays**?



Collapsed as-built analysis – Practical procedure

1. Stepped basis

- ❖ Total delays: 5 days
- ❖ EDE: 2 days
- ❖ CDE: 3 days

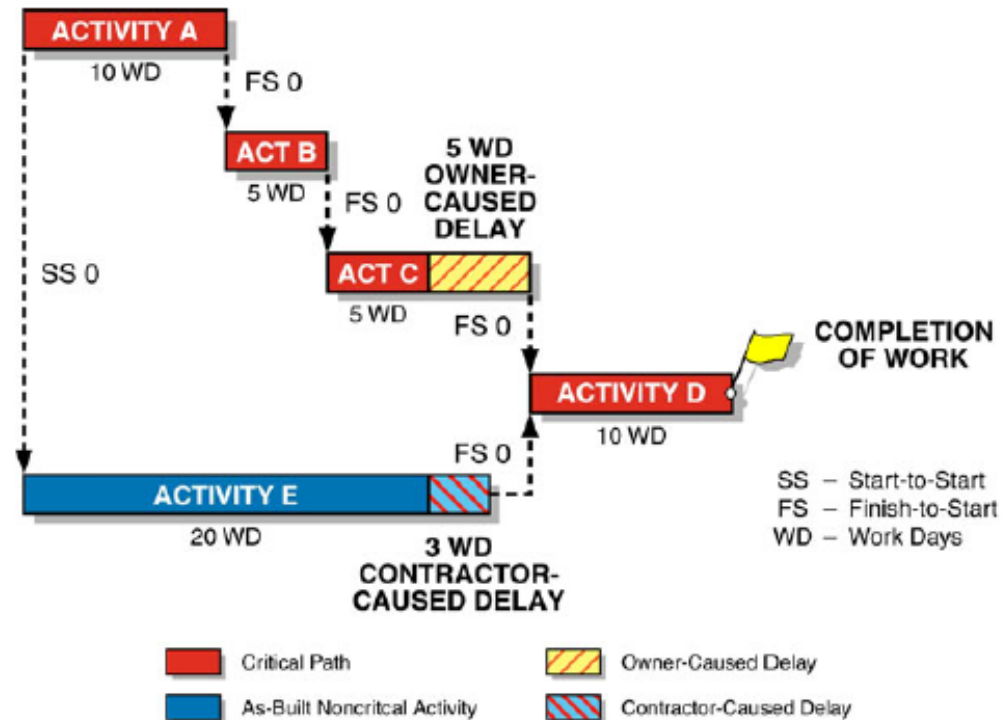
If you extracted based on stepped basis, you **would** have problem with concurrent delays

2. CDE first

- ❖ Total delays: 5 days
- ❖ CDE: 0 days
- ❖ EDE: 5 days

Which one is correct?

Owner-Caused Delays Were Partially Concurrent with Contractor-Caused Delays



Because the 3 WD contractor-caused delay is only partially concurrent with the 5 WD owner-caused delay, removal of the 5 WD owner-caused delay would result only in a 2 WD earlier completion.

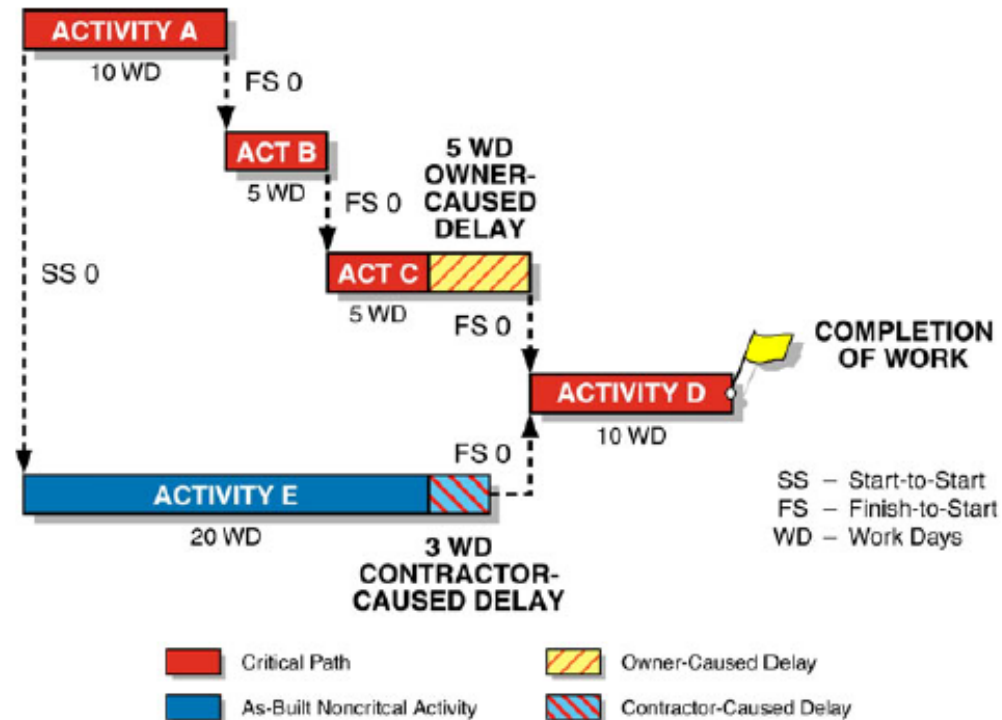
Collapsed as-built analysis – Practical procedure

1. Concurrent delays

- ❖ Total delays: 5 days
- ❖ EDE: 2 days
- ❖ CDE or concurrent: 3 days
 - ✓ CDE: 0 days
 - ✓ Concurrent: 3 days

Concurrent delays need to be considered case by case!

Owner-Caused Delays Were Partially Concurrent with Contractor-Caused Delays



Because the 3 WD contractor-caused delay is only partially concurrent with the 5 WD owner-caused delay, removal of the 5 WD owner-caused delay would result only in a 2 WD earlier completion.

Collapsed as-built analysis – Practical procedure

5. Remove the first delay (or set of delays) from the CAB as-built.

EDE is considered compensable unless it cannot be proved.

Then, the non-compensable delays should be checked if document is **not enough**

The CAB Schedule Delay Analysis that **removes contractor-caused delays** is used to determine the time period between the **actual completion date** and the **as-built but-for completion date** for assessment of liquidated damages by the owner

If delays could not be assigned to EDE, it would probably be considered as CDE



Collapsed as-built analysis – Practical procedure

6. Confirm the residual CAB is reasonable for the purpose of collapsing further.

- ❖ If any **anomalous results** are encountered after collapsing the programme, these require **adjustment** prior to any **subsequent collapsing**.

- ✓ **If** the correction affects the critical path,

it is advisable to make the **same correction** to the **original CAB base as-built programme** and **repeat** the process of extracting delays (Step 5) from the **first delay event**.

Collapsed as-built analysis – Practical procedure

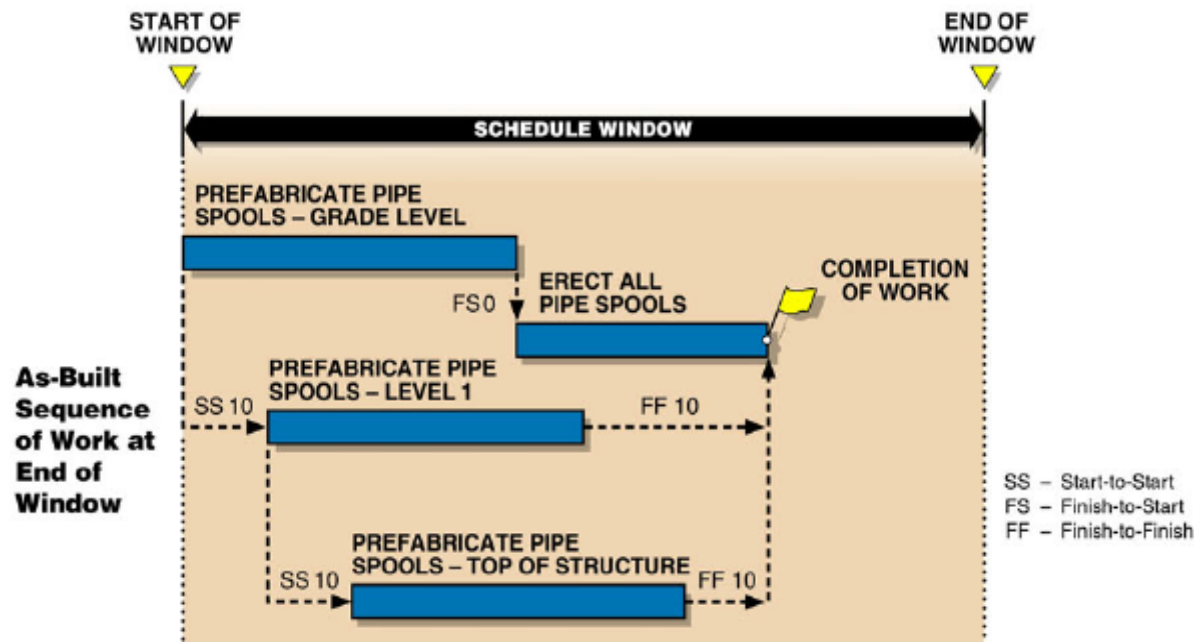
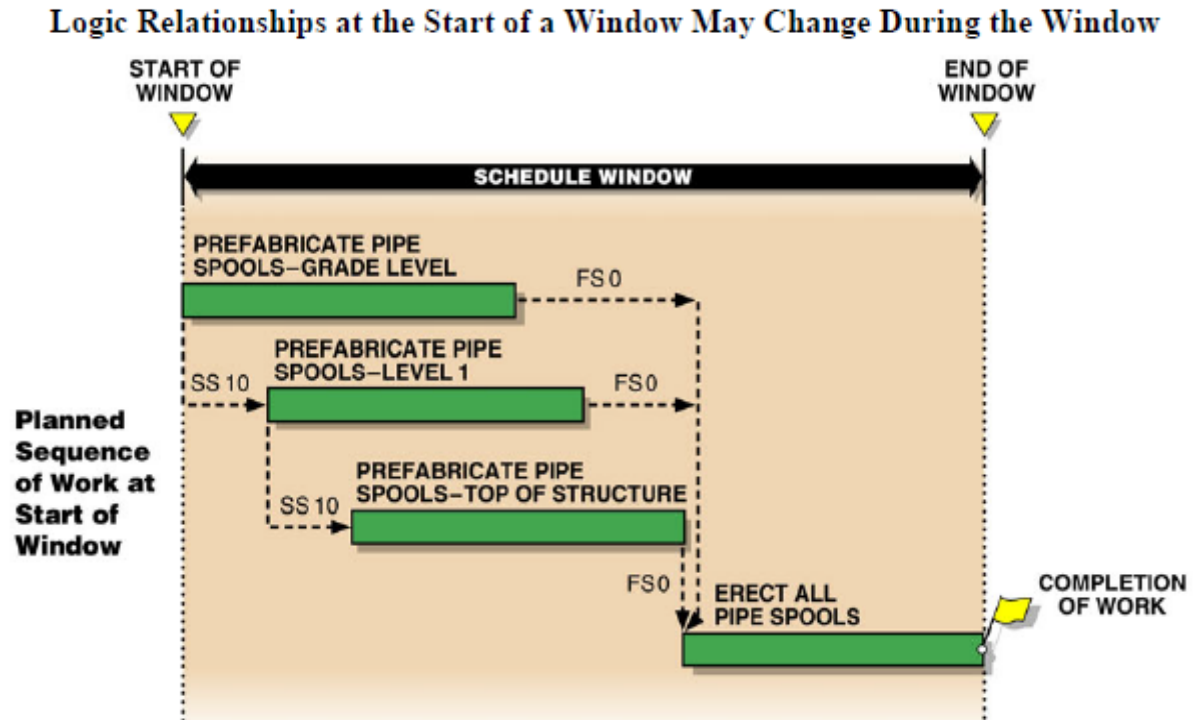
6. Confirm the residual CAB is reasonable for the purpose of collapsing further.

❑ An examination for **out-of-sequence work** should be made of the **logical relationships** in the **statused schedules** that depicted the **actual manner** in which the work was **accomplished** during **each window**.

❖ Often, the **actual sequence of work** that was **examined** at the **end of the window** was **different** from the **contractor's planned sequence of work** at the **beginning of the window**.

Therefore, the **logical relationships** between the **schedule activities** in the **as-built schedule** **at the end of a window** are **different** from the **planned logical relationships** between the schedule activities at the **beginning of the window**.

If the **actual sequence** of work indicates that a **different logical relationship** model between the activities is **warranted**, the **analyst** would **adjust** the **schedule logic** in the **As-Built Calculation Schedule** to represent the **as-built conditions**.



Collapsed as-built analysis – Practical procedure

7. Extract the next delay event (or set of delays).

- ❖ **Repeat Steps 5 and 6** again until all delays exhausted.
- ❖ If a **windows approach** is being used, repeat Steps 5 and 6 for those events whose **completion dates** **fall within** the **window** being analyzed.

Collapsed as-built analysis – Practical procedure

8. Record all movement to the calculated completion date from all CAB simulations.
9. Repeat the process in revise chronological order, until all delays have been accounted for and their impact on the CAB model recorded on a liability summary table.

Collapsed as-built analysis – Practical procedure

- ❑ Actual completion date of Jan 18, 2009.
- ❑ The CAB analysis is carried out using multiple windows.
 - ❖ Fragnets 001 and 002 occurred in the first window being analyzed (August 31, 2008).
- ❑ The CAB analysis is carried out using the “stepped-extraction” technique (**No concurrency considered**).
- ❑ Both updates (e.g., UD03) and CABs are used for the analysis.
 - ❖ The contemporaneous progress update UD02, dated July 31, 2008, indicated a loss of 3 days from July 31, 2008 to August 14, 2008.
 - ✓ This is attributable to a CDE of 3 days.
- ❑ A dissolve function in P6 was used.

What happened here?

What is this and why it is attributed to the CDE?

Impact liability table – collapsed as-built technique.

Event (Fragnet)	Event Type	Event Actual Start Date	Event Actual Finish Date	Event Duration (Days)	CAB Base Schedule	Base Schedule Data Date	Projected Completion Date	Net Loss/Gain	Cumulative delay		
									EDE	CDE	Con-current
001	EDE	7-Sep-08	11-Sep-08	4	CAB	31-Aug-08	18-Jan-09				
					CAB	31-Aug-08	18-Jan-09	0			
002	CDE	4-Sep-08	8 Sep-08	4	CAB	31-Aug-08	15-Jan-09	3		3	
					UD03	31-Aug-08	14-Jan-09	1		1	
003	CDE	15-Aug-08	24-Aug-08	9	CAB	14-Aug-08	9-Jan-09	5		5	
					UD02	31-Jul-08	6-Jan-09	3		3	
004	EDE	2-Jul-08	7-Jul-08	5	CAB	30-Jun-08	1-Jan-09	5	5		
005	CDE	2-Jul-08	5-Jul-08	3	CAB	30-Jun-08	1-Jan-09	0			
					UD01	30-Jun-08	5-Jan-09	-4		-4	
006	EDE	5-Jun-08	8-Jun-08	3	CAB	1-Jun-08	5-Jan-09	0			
007	EDE	31-Jun-08	6-Jun-08	3	CAB	1-Jun-08	2-Jan-09	3	3		
Contract Completion Date:							1-Jan-09	1		1	
Totals								17	8	9	0

How To Choose the Methods?

(Comparison Between Methods)

Comparison between methods

Factor	TIA	Planned Vs As Built	Impacted Baseline	Collapsed As Built	Window Analysis
Time Required	Moderate to High depends on data	Minimal unless as-built creation required	Lesser Time required compared to TIA	Moderate to High	Most Time consuming compared to other methods
Level of Effort	High	Minimal unless as-built creation required	Moderate	High	High

Comparison between methods

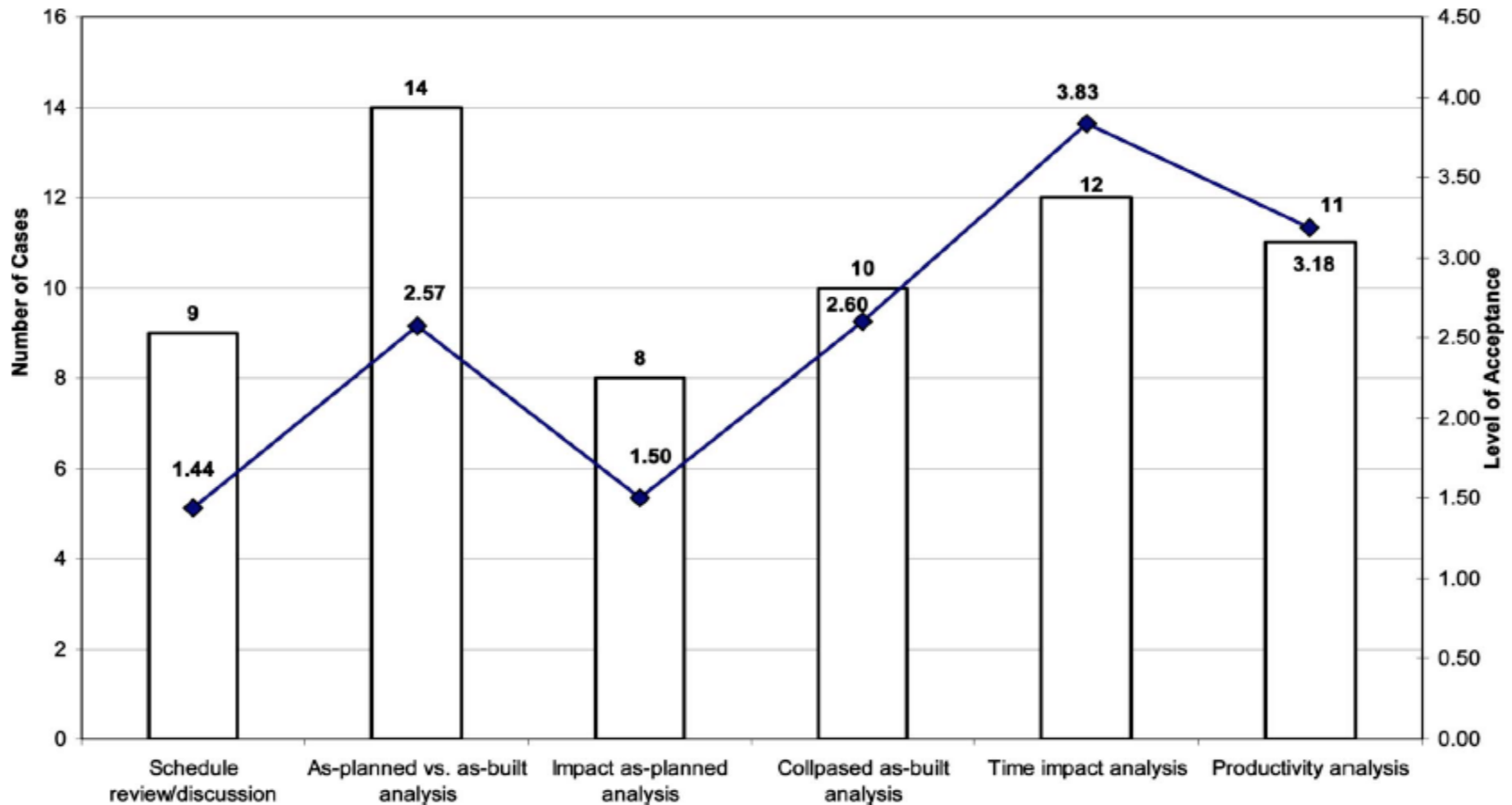
Comparing Factor	TIA	Planned Vs As Built	Impacted Baseline	Collapsed As Built	Window Analysis
Expertise Level Required	High	Moderate	Moderate	Moderate	High
Complexity	High	Low	Low	Moderate	High
Data Requirement	High	Low to Moderate	Moderate	High	High

Comparison between methods

Comparing Factor	TIA	Planned Vs As Built	Impacted Baseline	Collapsed As Built	Window Analysis
Accuracy of Result	More accurate with Perspective Analysis	Low	Moderate	High	High
Prospective or Retrospective Application	Both, Prospective and Retrospective	Retrospective	Both, Prospective and Retrospective	Retrospective	Retrospective

Comparison between methods – Performed in USA

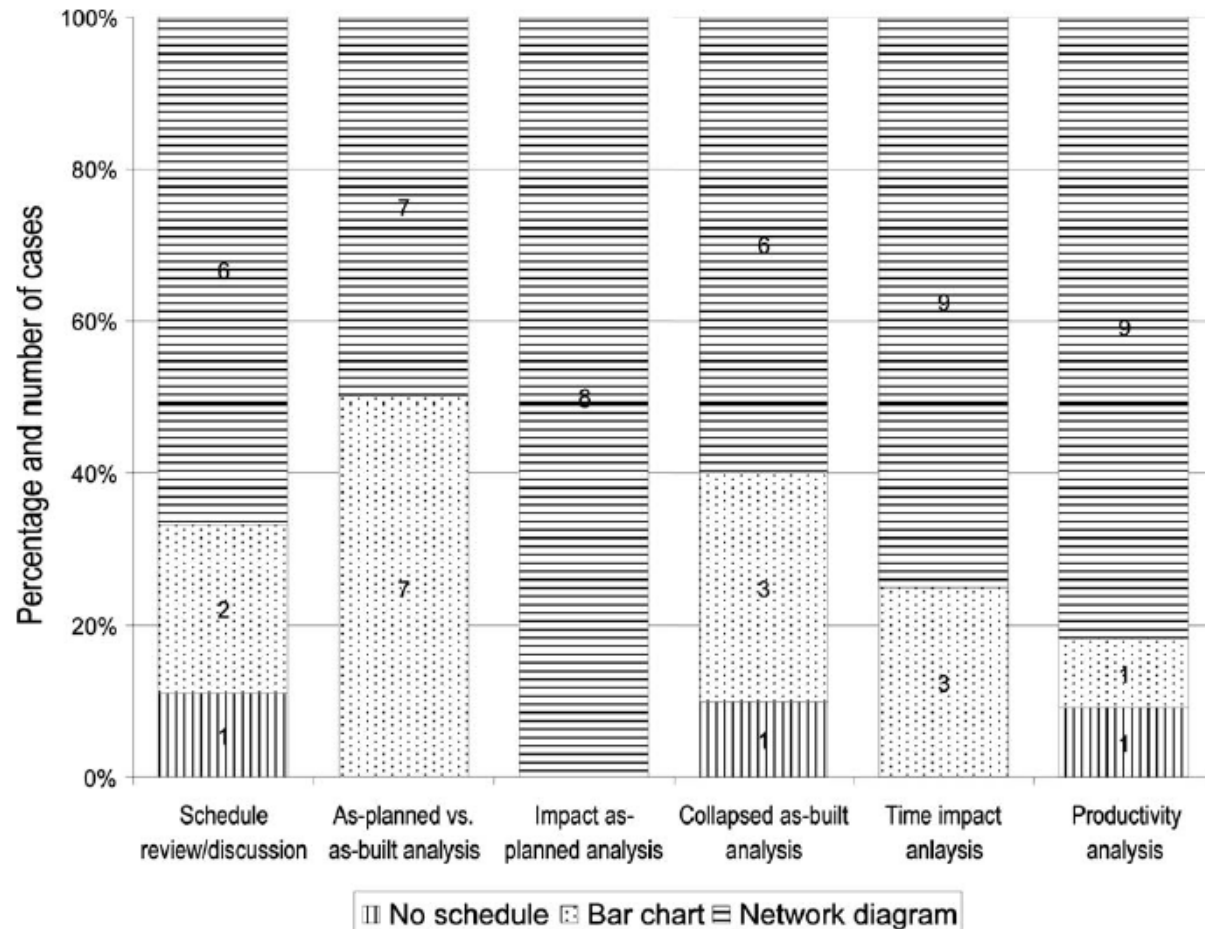
❑ Research done by Arditi and Pattanakitchamroon, Analysis Methods in Time-Based Claims, 2008 (**NOTE THAT THIS IS BEFORE AACE 29R-06 2011**)



Delay analysis methods used and acceptance index by courts/boards

Comparison between methods – Performed in USA

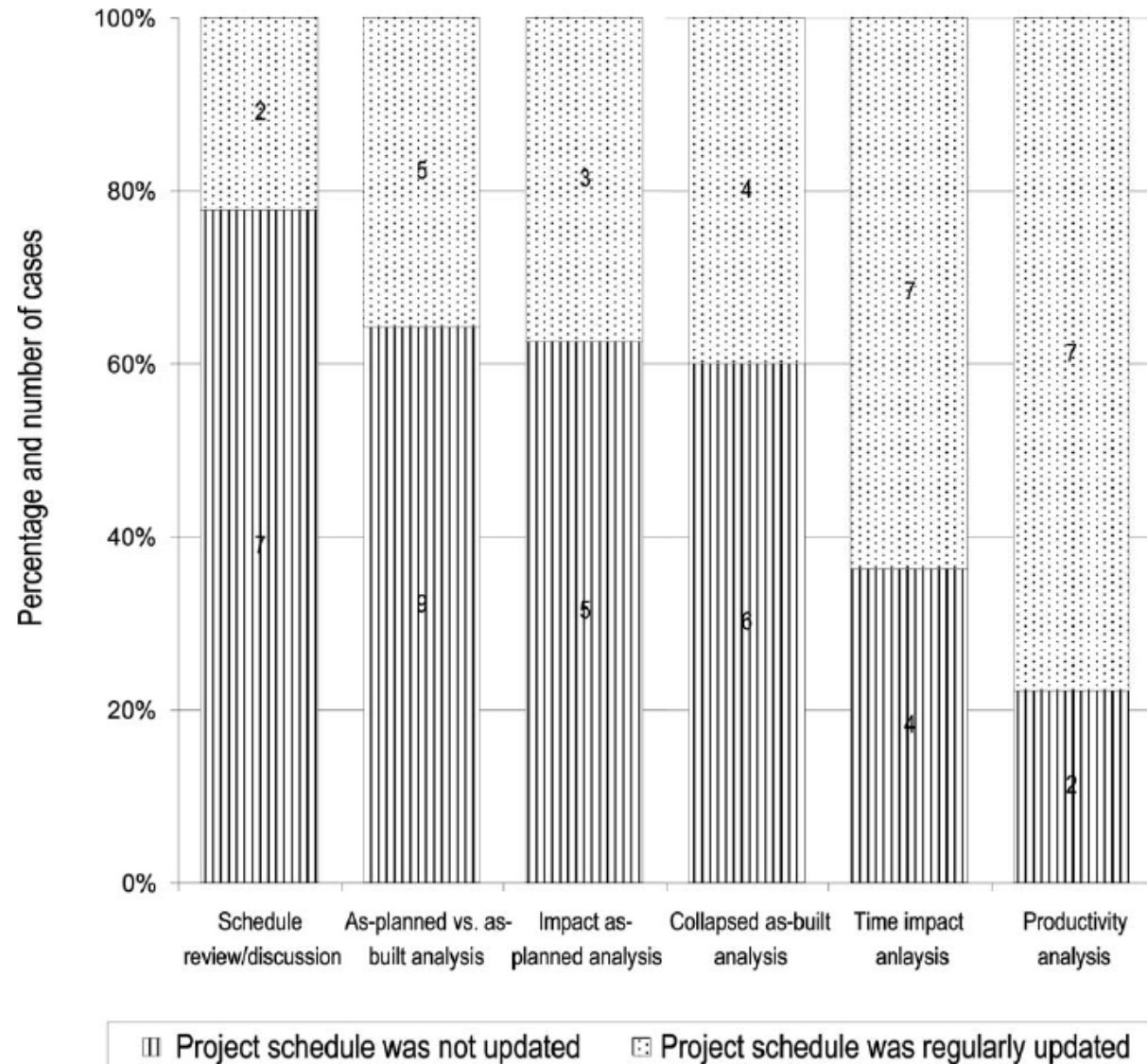
□ Research done by Arditi and Pattanakitchamroon, Analysis Methods in Time-Based Claims, 2008



Delay analysis methods by type of schedule used

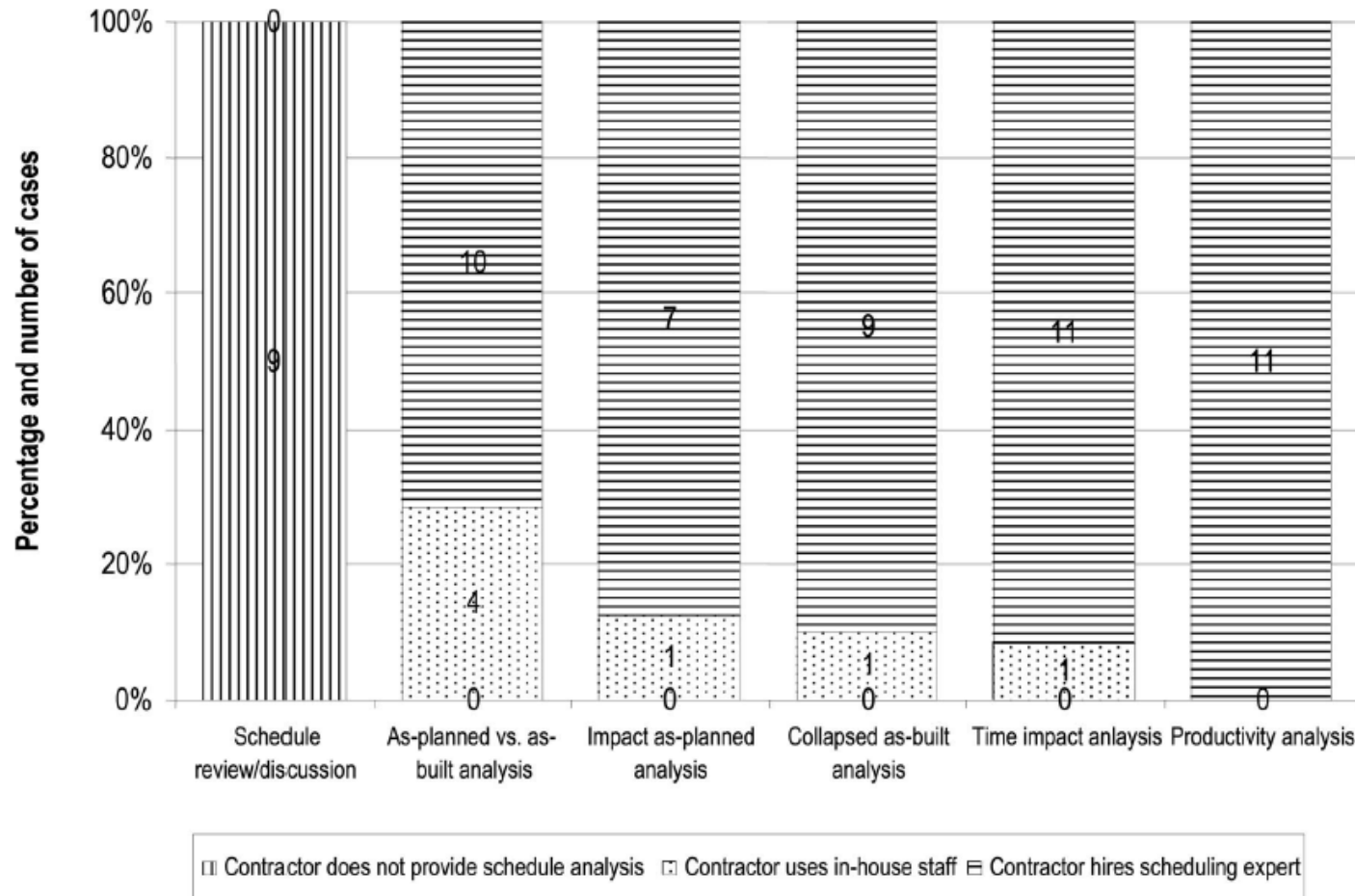
Comparison between methods – Performed in USA

□ Research done by Arditi and Pattanakitchamroon, Analysis Methods in Time-Based Claims, 2008



Comparison between methods – Performed in USA

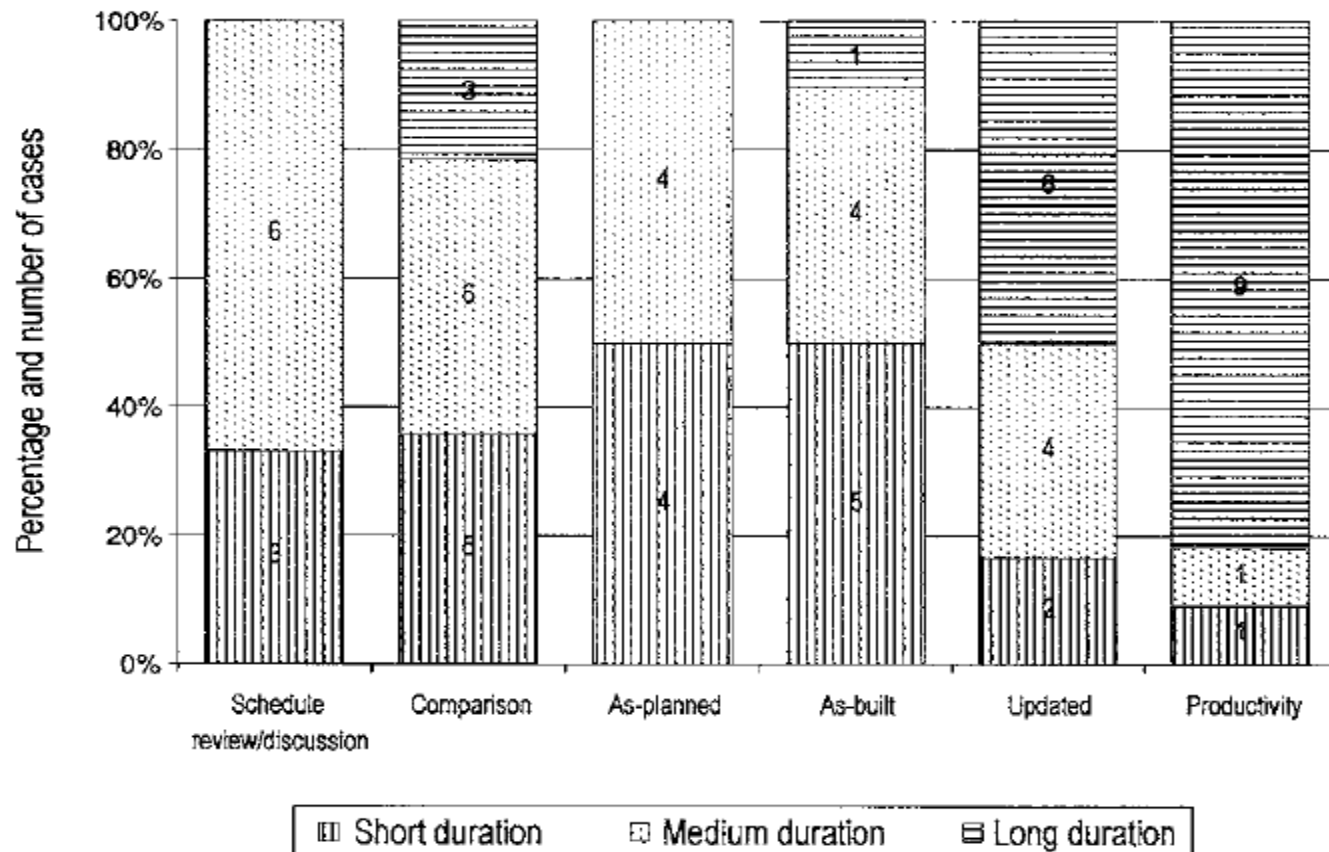
- Research done by Arditi and Pattanakitchamroon, Analysis Methods in Time-Based Claims, 2008



Delay analysis methods by quality of expertise and data used

Comparison between methods – Performed in USA

- Research done by Arditi and Pattanakitchamroon, Analysis Methods in Time-Based Claims, 2008



Delay analysis methods by project duration

Comparison between methods – Performed in U.K.

- ❑ What is the most popular method? Research attempting to answer this question is **scares**.
- ❑ Braimah, N. & Ndekugri, I. 2008. Factors influencing the selection of delay analysis methodologies. International Journal of Project Management, 26(8):789-799.

Delay Analysis Method	Usage Index	Rank
As-planned vs as-built	65.7	1
Impacted as-planned	59.4	2
Collapsed as-built	54.8	3
Time impact analysis	48.2	4
Net impact	45.7	5
Global	45.5	6
Window analysis	40.2	7
S-Curve	33.8	8

How To Choose the Methods?

(Selection Between Methods)

Selection between methods

- ❑ The **analyst** should **first** consider **several key factors** to assess **whether** a **contemporaneous period analysis** is the most **appropriate methodology** for the unique project circumstances.
- ❑ It is the **responsibility** of the **party asserting** the **claim** to **demonstrate** that it is entitled to an **extension of time** and/or **compensable delay damages** from other party.
 - ❖ If a **contractor** is **requesting**, they are **responsible** for providing the **proof of the delay**.
 - ✓ It is **not** the **responsibility** of the **owner** to **perform** such an analysis to **demonstrate** that the **contractor** is or is **not entitled** to a **time extension** or to **time-related damages**.

SCL Protocol

□ According to SCL delay Protocol

❖ **Irrespective** of **which method** of delay analysis is **deployed**, the **conclusions** derived from that analysis should **make sense**.

{ *How to choose the method of delay analysis?* }

1. The relevant conditions of contract
2. The nature of the causative events
3. To ensure a proportionate approach, the value of the project or dispute
4. The time available
5. The nature, extent and quality of the records available
6. The nature, extent and quality of the programme information available
7. The programmer's skill level and familiarity with the project

AACE 29R-06

□ According to AACE RP29R-03:

1. Contractual requirements
2. Purpose of analysis
3. Source data availability and reliability
4. Size of the dispute
5. Complexity of the dispute
6. Budget for forensic schedule analysis
7. Time allowed for forensic schedule analysis
8. Expertise of the forensic schedule analyst and resources available
9. Forum for resolution and audience
10. Legal or procedural requirements
11. Past history/methods and what method the other side is using

SCL Protocol vs. AACE 29R-03

Factors for choosing an appropriate delay analysis technique.

SCL Protocol	AACEI RP-FSA
● the relevant conditions of contract ● the nature of the causative events ● the value of the dispute ● the time available ● the records available ● the programme information available ● the programmer's skill level and familiarity with the project	● contractual requirements ● purpose of analysis ● source data availability and reliability ● size of the dispute ● complexity of the dispute ● budget for forensic schedule analysis ● time allowed for forensic schedule analysis ● expertise of the forensic schedule analyst and resources available ● forum for resolution and audience ● legal or procedural requirements ● past history/methods and what method the other side is using

Long International Inc.

□ According to Long International Inc.:

1. Purpose of the analysis and contract requirements
2. Change order development
3. Negotiated, mediation, arbitration or litigation Settlement
4. Complexity of the project and schedules
5. Length of the period being analyzed
6. Availability and quality of the project schedules
7. Time and budget

*If logic linked baseline schedule in addition to up to date schedules and information exist, we use **observational method (especially time slice windows analysis)**, however if this is not the case, the modeled method should be used.*

HOW MUCH THE MODELED METHOD SHOULD BE DETAILED?

Selection between methods

❑ According to Long International Inc.:

1. Purpose of the analysis and contract requirements

*While modeled analysis methods may be **appropriate** for the contractor, observational analysis methods may be more **appropriate** for the owner.*

2. Change order development

*Detailed modeled schedule analysis may **not be necessary***

Selection between methods

❑ According to Long International Inc.:

3. Negotiated, mediation, arbitration or litigation Settlement

*Detailed modeled schedule analysis may **not** be **necessary** for **negotiation**, while it is **necessary** for mediation, arbitration or even litigation.*

4. Complexity of the project and schedules

*A **large** and **complex** project with **multiple critical** and **near-critical paths** may require a less detailed modeled approach, where a simplified approach may **not be sufficient** in the event of multiple concurrent delays.*

Selection between methods

❑ According to Long International Inc.:

5. Length of the period being analyzed

*If the **analysis period is short**, a detailed modeled approach may **not be necessary**.*

6. Availability and quality of the project schedules

*The **analyst** must consider (**but not necessarily use**) each available schedule update.*

*Additionally, the quality of the **schedules** must be evaluated at a **high level** to determine the usability of the schedules and if, and to what extent, **corrections** are required.*

Selection between methods

❑ According to Long International Inc.:

7. Time and budget

Final consideration, and one that encompasses each of the previous factors.

A detailed modeled analysis may be **time consuming** and, therefore **expensive** to develop.

If a **schedule analysis** must be completed quickly and or **budget** is limited, a detailed approach is most likely **not an option**.

Selection between methods

❑ According to Ramskill Martin:

Ramskill Martin (Regional Director Planning & Delay Analysis) says:

The nature and quality of the records available is the single most important factor affecting the decision as to what technique to adopt.

The Most Three Types of Logic



The most three types of logic

1. Contractual logic
2. Mandatory logic
3. Discretionary logic
 - ❖ Contractors choice
 - ❖ Most likely to be out of sequence

Effects of three logic types on delay analysis

- ❑ These three groupings of logic appear in **virtually all schedules**
- ❑ Usually have **little impact** on **forensic delay analysis**
 - ❖ **Forensic delay analysis** is an art and science.
 - ✓ If the **project goes smoothly** and you use **contemporaneous schedule analysis**, you **do not need** that.
- ❑ **Delay methodologies** are **impacted differently** by **these logic types**.

What is the issue with discretionary logic?

- ❑ Performing a forensic schedule delay analysis on a project with excessive **discretionary logic** can make certain FSA methodologies **unreliable**
- ❑ It is **likely** to be the **most out of the sequence**



Out-of-sequence work

- ❑ Out of sequence work can occur **regardless** of the **logic group** involved with the activity
- ❑ The **contractor may install** the **footings** and **foundations** and **then come back** and excavate for **utility access afterwards**,
despite the **logic** of **installing** the **underground utilities** **prior** to the **foundation or footings**



Out-of-sequence work

- ❑ But the **most common** type of **out-of-sequence** work occurs when the **successor** activity **starts before** the **predecessor** is **complete**
 - ❑ This is very normal and happens all the time

WHY?

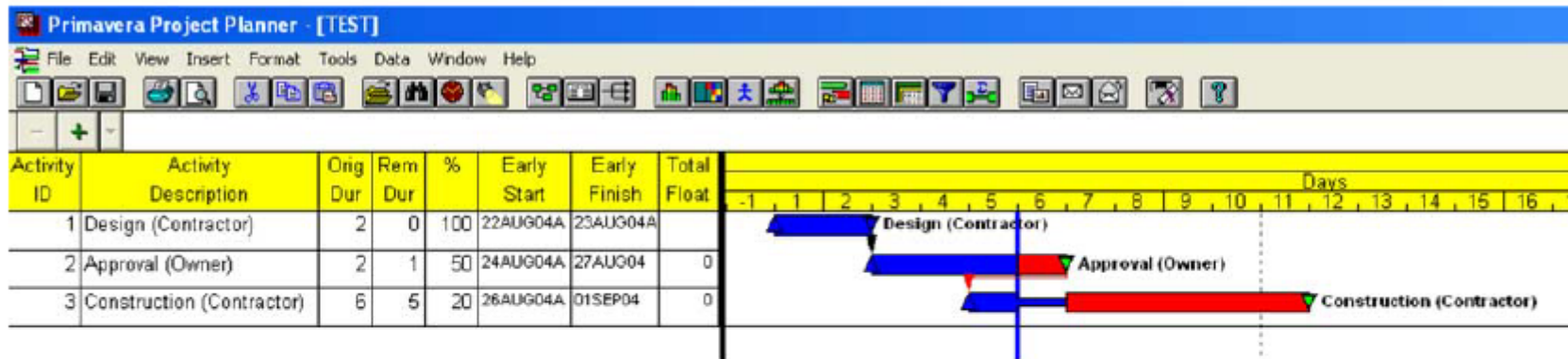
*Because we **always think** when activity is **done at 95%**, we already **finished***

Out-of-sequence work

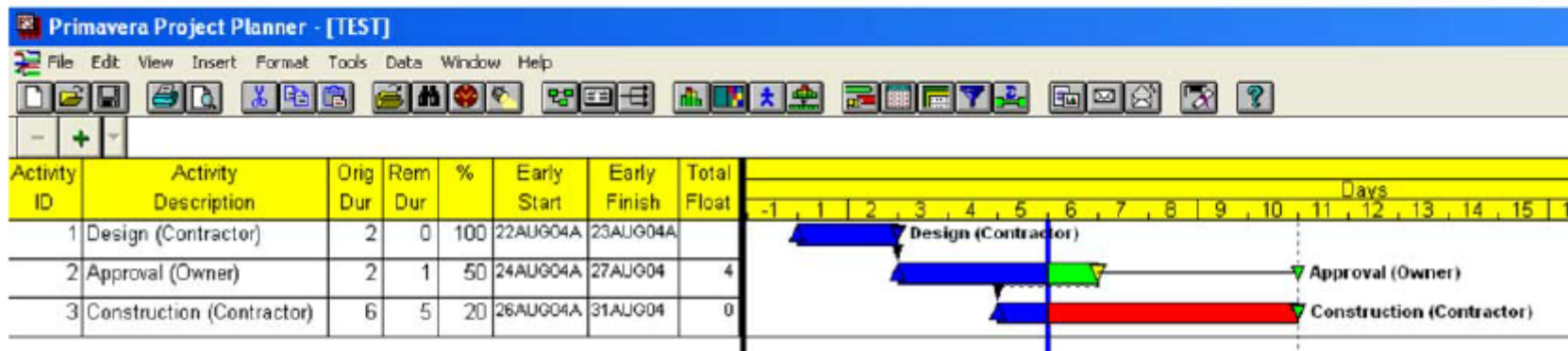
Why this may affect the delay analysis?

Out-of-sequence work

Network analysis using retained logic



Network analysis using progress override



Out-of-sequence work

What should be done?

- ❑ When delay analysis is conducted, **disputes** may arise **if the contract does not specify which logic mode** is to be used.
- ❑ While the **retained logic mode** is preferred by some for **updating schedules**, **others claim** that it makes it **impossible** to get an **accurate update schedule**

Which FSA methods may get mostly affected by out of sequence?

FSA methodologies and out-of-sequence work

❑ From the **least impact** to the **highest impact**

1. Collapsed as-built
2. Time slice windows analysis (Contemporaneous period analysis)
3. Time impact analysis (Retro)
4. As planned vs. as-built windows analysis

Time slice windows analysis and out-of-sequence work

- ❑ If updates are corrected each time to revise the **logic** (as is often recommended as proper update procedure)

Then **out of sequence** work should be **irrelevant**

Time impact analysis and out-of-sequence work

- ☐ Same as issues for the “time slice windows analysis”
- ☐ Fragnet should address delays, not resequencing,

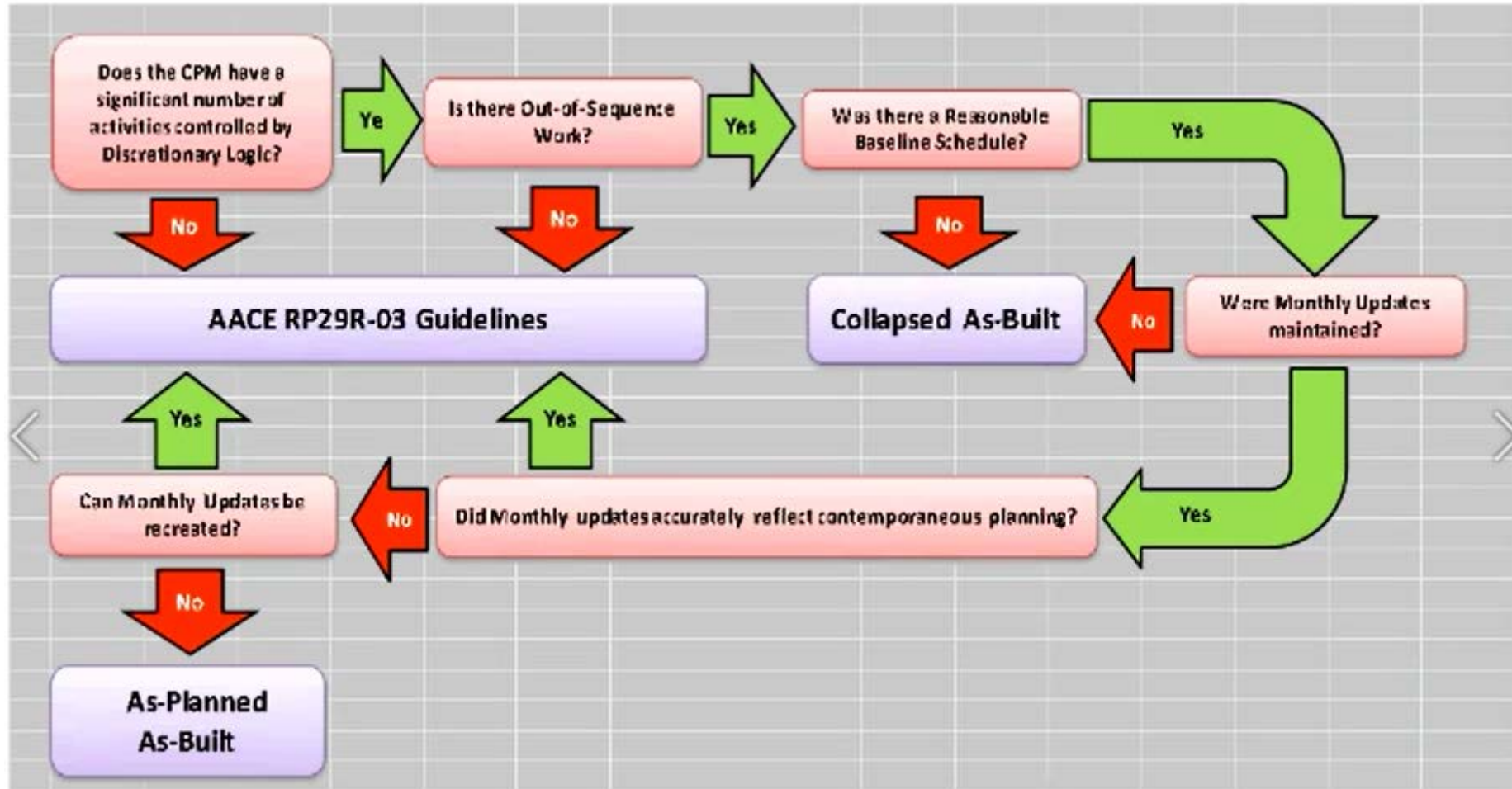
that should be part of update process

As-planned vs. as-built and out-of-sequence work

- ❑ Affected the most by discretionary logic
- ❑ Default methodology
 - ❖ Many people and projects use this method because usually there are no accurate updates.
 - ❖ Often used in situations with lots of discretionary logic, out of sequence work and poor schedules
 - ❖ Other methodologies not appropriate because updates not maintained

Which one is the worst? IAP or APAB?

Discretionary logic method selection





فرآیند جامع آنالیز تاخیرات در پروژه

بخش دهم:
آنالیز مالی تاخیرات

آنالیز خسارت وارده به کارفرما (Liquidated Damages)

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا



What we will learn?

- ☐ What is liquidated damages (LDs)?
- ☐ How to estimate liquidated damages?
- ☐ When do liquidated damages begin and end?
- ☐ Types of liquidated damages estimates
- ☐ Enforceability
- ☐ Bonus or incentive clauses

What is Liquidated Damages (LDs)?



Liquidated damages – Introduction

- ❑ An Owner's delay damages may include the loss of income, the cost of alternate facilities, increased financing costs, extended overhead costs, and lost profits.
 - ❖ Because these costs are **difficult to measure**, the liquidated damages clause is often a **preferred alternative** to the reimbursement of **actual damages**.
- ❑ Liquidated damages are **predetermined** prior to the **execution of the Contract**.
- ❑ The exact amount of the liquidated damages is **specified** in the **Contract**.
- ❑ Liquidated damages clauses can take **many forms**.



Liquidated damages – Introduction

- ❑ The **Owner** should **seek the assistance** of **qualified counsel** in:
 1. **Structuring** the **wording** of the **clause**
 2. **Computing** the **damages** it may reasonably sustain **if a delay occurs** to **all** or a **portion** of the Project.
- ❑ Projects such as **highways** and **transit systems** have a **value to the public**, but **delay damages** for such often **cannot be easily calculated**.

Therefore, the **Owner** cites a **liquidated damages amount** to cover the **estimated damages** that will be sustained **if the Project is completed late**.



Liquidated damages – Introduction

- ❑ One might ask why an Owner would specify a liquidated damages amount **in advance** as opposed to **seeking recovery** for actual damages if a delay occurs.

*The answer is that liquidated damages are **desirable** when it is difficult or impossible to accurately determine the **actual damages** that the Owner would incur in the event of a delay, particularly for public projects.*

- ❑ The Owner should check with counsel before **calculating** the amount of liquidated damages to ensure that all legalities are **considered**.

Liquidated damages – Sample of contract clause

Sample Liquidated Damages Clause

Should the contractor fail to complete the contract within the time allowed by the contract to include time extensions allowed by executed change orders, then for each calendar day of delay, the owner has the right to withhold the amount of \$500 per calendar day as liquidated damages.

These liquidated damages are compensation to the owner for costs the owner may experience due to the contractor's delay and are not to be construed as penalties.



Liquidated damages – Example

- ❑ If a contractor falls behind schedule due to **un-excusable delays** during the project, the **liquidated damages clause** allows it to **determine** whether recovery efforts would be cost effective.

For example, if a contractor is behind schedule due to un-excusable delays by ten days on a project and the liquidated damages are \$300 per day, the potential exposure is \$3,000. If the cost of accelerating the work to make up the ten days is \$7,000, then the cost-effective decision is to finish late.

The contractor may still decide to accelerate the work because of other considerations.

ماده ۵۰ - هزینه تسريع کار، خسارت تأخير کار

❑ خسارت تاخیرات غیرمجاز

۵۰-ب)

در پایان کار، در صورتیکه مدت انجام کار، بیش از مدت اولیه پیمان به علاوه مدتهای تمدید شده پیمان باشد، مهندس مشاور با رعایت ماده ۳۰ و رسیدگی به دلایل پیمانکار، مدت تأخیر غیرمجاز پیمانکار را تعیین می‌کند، تا پس از تصویب کارفرما، به شرح زیر، ملاک محاسبه خسارت تأخیر قرار گیرد.

۵۰-ب-۵)

در صورتیکه پیمان، طبق ماده ۴۶ فسخ گردد یا طبق ماده ۴۸، به پیمان خاتمه داده شود، تأخیر کار نسبت به برنامه زمانی تفصیلی با رعایت ماده ۳۰ بررسی شده، میزان مجاز و غیرمجاز آن بررسی می‌شود. بابت تأخیر غیرمجاز پیمانکار، طبق مفاد این بند، پرداخت **خسارت تاخیر** به پیمانکار تعلق می‌گیرد. در این حالت، مبلغ باقیمانده کار که در اجرای آن تأخیر شده است، عبارتست از مبلغ کارهای که طبق برنامه زمانی تفصیلی و با در نظر گرفتن تأخیر مجاز پیمانکار باید تا تاریخ فسخ یا خاتمه پیمان انجام می‌شد، منهای مبلغ کار انجام شده.

خسارت تاخیر غیرمجاز در ۴۳۱۱

ماده ۵۰: هزینه تسریع کار، خسارت تاخیر کار

ب) **در پایان کار** در صورتی که مدت انجام کار بیش از مدت اولیه پیمان به علاوه مدتهای تمدید شده پیمان باشد مهندس مشاور با رعایت ماده ۳۰ و رسیدگی به دلایل پیمانکار مدت تاخیر غیرمجاز پیمانکار را تعیین میکند تا پس از تصویب کارفرما به شرح زیر ملاک محاسبه خسارت تاخیر قرار گیرد.

(1) هرگاه جمع مدت تاخیر غیر مجاز از یک دهم مدت پیمان بیشتر نشود، برای **هر روز تاخیر**، یک دو هزارم **مبلغ باقی مانده کار** که در اجرای آن تاخیر شده است.

(2) هرگاه جمع مدت تاخیر غیر مجاز از یک دهم مدت پیمان بیشتر شود، تا یک دهم مدت پیمان طبق بند ۱ و برای مازاد بر آن تا یک چهارم مدت پیمان برای هر روز تاخیر یک هزارم **مبلغ باقی مانده کار** که در اجرای آن تاخیر شده است.

(3) هرگاه جمع مدت تاخیر غیرمجاز از یک چهارم مدت پیمان بیشتر شود ولی پیمان ادامه یابد، مجموع خسارتهای تاخیر قابل دریافت از پیمانکار نمیتواند از جمع خسارت محاسبه شده بر پایه بند (۲) بیشتر شود و مدت اضافه بر یک چهارم مدت پیمان برای ادامه و انجام کار بدون دریافت خسارت منظور میشود.

خسارت تاخیر غیرمجاز در ۴۳۱۱

ماده ۵۰: هزینه تسریع کار، خسارت تاخیر کار

ب) در پایان کار در صورتی که مدت انجام کار بیش از مدت اولیه پیمان به علاوه مدتهای تمدید شده پیمان باشد مهندس مشاور با رعایت ماده ۳۰ و رسیدگی به دلایل پیمانکار مدت تاخیر غیرمجاز پیمانکار را تعیین میکند تا پس از تصویب کارفرما به شرح زیر ملاک محاسبه خسارت تاخیر قرار گیرد.

۴) مبلغ باقیمانده کار که در اجرای آن تاخیر شده عبارت است از مبلغ پیمان منهای مبلغ صورت وضعیت مربوط به کارهای انجام یافته تا آخرین روز مدت پیمان

۵) در صورتی که پیمان طبق ماده ۴۶ فسخ گردد یا طبق ماده ۴۸ به پیمان خاتمه داده شود، تاخیر کار نسبت به برنامه زمانی تفصیلی با رعایت ماده ۳۰ بررسی شده میزان مجاز و غیرمجاز آن بررسی میشود. بابت تاخیر غیرمجاز پیمانکار، طبق مفاد این بند، پرداخت خسارت تاخیر به پیمانکار تعلق میگیرد. در این حالت، مبلغ باقی مانده کار که در اجرای آن تاخیر شده است، عبارت است از مبلغ کارهایی که طبق برنامه زمانی تفصیلی و با در نظر گرفتن تاخیر مجاز پیمانکار باید تا تاریخ فسخ یا خاتمه پیمان انجام میشد، منهای مبلغ کارهای انجام شده.

۶) در مواردی که اخذ خسارت تاخیر بیش از ارقام درج شده در این ماده ضروری باشد و در اسناد و مدارک پیمان میزان آن پیشبینی شده باشد خسارت تاخیر را بر اساس آن محاسبه میکنند.

فرآیند جامع آنالیز تاخیرات در پروژه
آنالیز مالی تاخیرات: آنالیز خسارت وارده به کارفرما (Damages)
خسارت تاخیر غیرمجاز در ۴۳۱۱

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جمهوری اسلامی ایران

سازمان برنامه ریزی و نظارت راهبردی رئیس جمهور

شماره: ۴۵۵۴۰

تاریخ: ۱۳۹۲/۰۵/۲۹

پوست ندارد

بسمت

دبیر محترم کانون سراسری پیمانکاران عمرانی ایران
موضوع: ماده ۵۰ شرایط عمومی پیمان

باسلام:

بازگشت به نامه شماره ۲۱۲۷۶ مورخ ۱۳۹۲/۵/۵ به آگاهی می‌رساند:

مفاد بند (۶) ماده ۵۰ شرایط عمومی پیمان به این شرح است: «در مواردی که اخذ خسارت تاخیر بیش از ارقام درج شده در ماده ۵۰ ضروری می‌باشد و در اسناد و مدارک پیمان، میزان آن پیش‌بینی شده باشد، خسارت تاخیر را براساس آن محاسبه می‌کنند.»
بنابراین در صورتی که مفاد بند (۶) فوق در قرارداد مورد بحث منظور شده باشد مطابق شرحی که در قرارداد پیش‌بینی شده خسارت تاخیر به پیمانکار تعلق می‌گیرد.

غلامحسین حمزه مصطفوی
رئیس امور نظام فنی

ثبت دفتر کانون سراسری
شماره: ۴۵۴
تاریخ: ۱۳۹۲/۵/۲۹

شماره: ۴۵۴

تهران - میدان بهارستان - خیابان دانشسرا - مرکز تلفن: ۲۲۷۷۱ - دفتر مرکزی: ۲۲۷۷۲ - ۱۶۵ - ۲۲۷۷۱



□ شرایط خصوصی

ماده ۵-ب (۶)

خسارت تاخیر غیرمجاز پیمان (ناشی از کار پیمانکار)، به میزان و ترتیب زیر، از پیمانکار وصول می‌شود.

.....

.....

.....

□ موافقت نامه

۴-۵-

خسارت تأخیر در تکمیل به موقع کار

هرگاه به دلیل قصور پیمانکار (ماده ۶۶) شرایط عمومی، در اتمام طبق برنامه کار یا قسمت‌های اصلی آن، تأخیر پیش آید، **خسارت تأخیر** در تکمیل به موقع کار، به میزان تعیین شده در شرایط خصوصی، از پیمانکار وصول می‌شود. مجموع مبلغ مربوط به این نوع تأخیرها، از درصد مبلغ پیمان بیشتر نمی‌شود.

□ شرایط عمومی

ماده ۶۶ - تأخیر در اتمام به موقع کار

پیمانکار، موظف به انجام کارها، طبق برنامه زمانی منضم به پیمان و آخرین تجدید نظرهای آن است. هرگاه در تاریخ تعیین شده در برنامه زمانی منضم به پیمان و یا آخرین تجدید نظر آن، انجام کار یا قسمت‌های اصلی آن به پایان نرسیده باشد، کارفرما به پیمانکار اخطار می‌کند که حداکثر در طول مدت ۱۴ روز، کارها را به پایان برساند. پیمانکار، در طول این مدت باید نسبت به اتمام عملیات اقدام کند، و یا با ارسال اسناد و مدارک لازم، تمدید مدت پیمان را طبق بند «۱-۶۴»، درخواست نماید. در صورت عدم اتمام کار در طول مدت یاد شده، یا عدم قبول دلایل وی از سوی کارفرما برای تمدید، پیمانکار ملزم به پرداخت **خسارت تأخیر** در کار، به میزان درج شده در شرایط خصوصی خواهد بود. حداکثر مبلغ خسارت نیز، در بند «۴-۵» موافقت‌نامه درج شده است. تاریخ مبنای محاسبه تأخیرها، آخرین تاریخ تغییر یافته طبق بند «۱-۶۴» یا «۲-۶۴» است.

هرگاه تأخیر پیمانکار، بیشتر از حدی باشد که کارفرما را محق به دریافت حداکثر خسارت مشخص شده در موافقت‌نامه بنماید، کارفرما می‌تواند با اخطار قبلی، طبق ماده (۶۸)، پیمانکار را برکنار کند.

□ شرایط خصوصی

ماده ۶۶-

در صورت تأخیر پیمانکار در تکمیل طبق برنامه کار، یا قسمت‌های اصلی آن، **خسارت تأخیر**، به شرح زیر از پیمانکار وصول می‌شود.

ماده ۶۴ - تغییرات مدت پیمان

۶۴-۱ تمدید مدت پیمان

۶۴-۱-۱ شرایط تمدید مدت پیمان

تمام زمان‌ها و مدت‌های پیش‌بینی شده برای شروع و خاتمه و مقاطع زمانی قسمت‌های اصلی کارها، تنها در صورت وقوع هریک از شرایط زیر، می‌توانند افزایش یابند.

۶۴-۱-۲-۲ در پایان مدت پیمان باید تمامی درخواست‌های پیمانکار درخصوص تمدید مدت پیمان بررسی و نتایج آن لحاظ شود. در صورتی که در پایان مدت پیمان (مدت پیمان با احتساب تمدید)، کار پیمان به اتمام نرسیده باشد، کلیه مفاد پیمان همچنان دارای اعتبار بوده و از مسئولیت پیمانکار در انجام تعهداتش کاسته نمی‌شود و پیمانکار باید برنامه زمانی کارهای باقی‌مانده را به کارفرما ارائه نماید. در صورت تصویب برنامه زمانی توسط کارفرما، مدت پیمان مطابق برنامه زمانی مصوب، به دلیل قصور پیمانکار تطویل می‌شود. همچنین پیمانکار به تناسب تأخیر در تحویل موقت کار، ملزم به پرداخت خسارت تأخیر مطابق ماده ۶۶ به کارفرما می‌باشد.

تبصره: در صورت عدم ارائه برنامه زمانی کارهای باقی‌مانده توسط پیمانکار، وی موظف است مطابق برنامه ارائه شده توسط کارفرما اقدام نماید. در صورت نقض تعهد مستمر پیمانکار در انجام کارهای موضوع پیمان از جمله انجام کارهای باقی‌مانده، کارفرما محق به فسخ پیمان مطابق ماده ۶۸ خواهد بود.

ماده ۶۶ - تأخیر در اتمام به موقع کار یا قسمت‌های اصلی کار

پیمانکار موظف به انجام کارها، طبق برنامه زمانی منضم به پیمان و آخرین تجدید نظرهای آن است. هرگاه در تاریخ‌های تعیین شده در برنامه زمانی منضم به پیمان و یا آخرین تجدید نظر آن، انجام کار یا قسمت‌های اصلی کار که در پیوست شماره ۱۴ پیمان مشخص شده است، به پایان نرسیده باشد، پیمانکار باید به منظور اتمام کارهای باقی‌مانده، برنامه زمانی مربوط را برای تصویب به کارفرما ارائه نماید. پیمانکار به تناسب تأخیر در تحویل موقت کار یا اتمام قسمت‌های اصلی کار، ملزم به پرداخت خسارت تأخیر، به میزان درج شده در شرایط خصوصی خواهد بود. حداکثر مبلغ خسارت نیز، در بند ۴-۵ موافقت‌نامه درج شده است. تاریخ مبنای محاسبه تأخیرها، آخرین تاریخ تغییر یافته طبق بند ۱-۶۴ یا ۲-۶۴ است. هرگاه تأخیر پیمانکار، بیشتر از حدی باشد که کارفرما را محق به دریافت حداکثر خسارت مشخص شده در موافقت‌نامه بنماید، کارفرما می‌تواند با اخطار قبلی، پیمان را طبق ماده ۶۸ به دلیل نقض تعهد پیمانکار، فسخ نماید.

تبصره: چنانچه تأخیر در اتمام قسمت‌های اصلی کار، منجر به تأخیر در تحویل موقت کار گردد، با توجه به پرداخت خسارت تأخیر در اتمام قسمت‌های اصلی کار توسط پیمانکار، آن بخش از تأخیر در تحویل موقت کار که ناشی از تأخیر در اتمام قسمت‌های اصلی کار می‌باشد، شامل خسارت تأخیر نمی‌شود.

۴-۵ ← تأخیر در انجام به موقع کار:

در صورت تأخیر پیمانکار در اتمام به موقع کار یا قسمت‌های اصلی کار با لحاظ ماده ۶۶ شرایط عمومی، پیمانکار ملزم به پرداخت خسارت تأخیر در انجام کار به میزان تعیین شده در شرایط خصوصی است. مجموع مبلغ مربوط به این نوع تأخیرها حداکثر درصد مبلغ پیمان مندرج در بند ۳-۱ موافقت نامه می باشد.

۵-۵ ← پاداش تسریع کار:

به ازای هر روز تسریع در تکمیل کارهای موضوع پیمان، به میزان تعیین شده در شرایط خصوصی مرتبط با جزء ۶۴-۲-۱-۳ شرایط عمومی، پاداش تسریع کار محاسبه و به پیمانکار پرداخت می شود. مجموع مبلغ مربوط به پاداش تسریع کار حداکثر درصد مبلغ پیمان مندرج در بند ۳-۱ موافقت نامه است.

تبصره: چنانچه تاخیر در اتمام قسمت‌های اصلی کار، منجر به تاخیر در تحویل موقت کار گردد، با توجه به پرداخت خسارت تاخیر در اتمام قسمت‌های اصلی کار توسط پیمانکار، آن بخش از تاخیر در تحویل موقت کار که ناشی از تاخیر در اتمام قسمت‌های اصلی کار می‌باشد، شامل خسارت تاخیر نمی‌شود.

How To Estimate Liquidated Damages?



How to estimate liquidated damages?

Owner should consider the following items when preparing an estimate of LD:

- Cost for project inspection
- Costs for continued design services
- Costs for the Owner's staff
- Costs for maintaining current facilities
- Costs for additional rentals
- Costs for additional storage
- Lost revenues
- Costs to the public for not having the facility
- Additional moving expense
- Escalation costs
- Financing costs

While other costs may be included in the liquidated damages estimate, this list provides a general idea of the types of costs to consider.



How to estimate liquidated damages?

A note of caution: Liquidated damages are specific for each Project.

- ❑ Unfortunately, Owners **often** use **standard tables** for liquidated damages that may **not reasonably** reflect the damages they will **sustain if a delay occurs** on their Project.



How to estimate liquidated damages?

- ❑ Owners must recognize that **liquidated damages** do **not** necessarily bear a **direct relationship** to the **Contract amount**.

Two different projects of equal value can have very different potential damages.



Hourly fees

- ☐ For some projects, liquidated damages are specified on an **hourly basis**.
- ☐ In certain critical highway projects, the Owner specifies **hourly liquidated damages** for **failing to open portions of the roadway to traffic at set times for each day** of the Project.



Graduated damages

- ❑ In some cases, liquidated damages may be **graduated**.

For example, the liquidated damages may be \$1,000 per day up to a certain date or for a defined number of days, and then may increase to \$1,500 per day for delays beyond the date or in excess of the initial number of days.

These graduated liquidated damages should reflect the Owner's increase in damages as the delay continues.



Graduated damages: Example

State Departments of Transportation have liquidated damages clauses similar to the one shown below

Sample Liquidated Damages Clause

Should the contractor fail to complete the contract within the time allowed by the contract to include time extensions allowed by executed change orders, then for each calendar day of delay, the owner has the right to withhold the amount of \$500 per calendar day as liquidated damages.

These liquidated damages are compensation to the owner for costs the owner may experience due to the contractor's delay and are not to be construed as penalties.

From More Than	To and Including	Daily Charge
\$ 0	\$ 100,000	\$ 300
100,000	500,000	550
500,000	1,000,000	750
1,000,000	2,000,000	900
2,000,000	5,000,000	1,150
5,000,000	10,000,000	1,350
10,000,000	—	1,400



Graduated damages: Example

8.8

Delay Damages

1.1.25 "day" means a calendar day.

If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of Delay Damages by the Contractor for this default. Delay Damages shall be the amount stated in the Contract Data, which shall be paid for every day which shall elapse between the relevant Time for Completion and the relevant Date of Completion of the Works or Section. The total amount due under this Sub-Clause shall not exceed the maximum amount of Delay Damages (if any) stated in the Contract Data.

These Delay Damages shall be the only damages due from the Contractor for the Contractor's failure to comply with Sub-Clause 8.2 [Time for Completion], other than in the event of termination under Sub-Clause 15.2 [Termination for Contractor's Default] before completion of the Works. These Delay Damages shall not relieve the Contractor from the obligation to complete the Works, or from any other duties, obligations or responsibilities which the Contractor may have under or in connection with the Contract.

This Sub-Clause shall not limit the Contractor's liability for Delay Damages in any case of fraud, gross negligence, deliberate default or reckless misconduct by the Contractor.



Graduated damages: Example

8.7. Delay Damages

If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall subject to notice under Sub-Clause 2.5 [Employer's Claims] pay delay damages to the Employer for this default. These delay damages shall be the sum stated in the Appendix to Tender, which shall be paid for every day which shall elapse between the relevant Time for Completion and the date stated in the Taking-Over Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the Appendix to Tender.

These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [Termination by Employer] prior to completion of the Works. These damages shall not relieve the Contractor from his obligation to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.

When Do Liquidated Damages Begin and End?



When do liquidated damages begin and end?

❑ The **Contract** should **clearly specify** when the assessment of liquidated damages will **begin and end**.

1. **Often**, the Contract will state that the liquidated damages will **apply** to the time **period** from the **specified Contract completion date until the completion of all work**.
2. **Sometimes** the Contract will tie the assessment of liquidated damages to the **substantial completion date**.
3. **Another common milestone** for liquidated damages is the date **when** the **Owner obtains beneficial use or occupancy of the Project**.

۵۰-ب) در پایان کار در صورتی که مدت انجام کار بیش از مدت اولیه پیمان به علاوه مدتهای تمدید شده پیمان باشد مهندس مشاور با رعایت ماده ۳۰ و رسیدگی به دلایل پیمانکار مدت تاخیر غیرمجاز پیمانکار را تعیین میکند تا پس از تصویب کارفرما به شرح زیر ملاک محاسبه خسارت تاخیر قرار گیرد.



When do liquidated damages begin and end?

❑ Regardless of the time period specified:

- ❖ Contract should be as **clear as possible on this point**
- ❖ Estimate **used** to **determine** the **liquidated damages amount** should be **as clear as possible on this point**



When do liquidated damages begin and end? – Example

- ❑ If the Owner assesses liquidated damages from the Contract completion date to the completion of all work,

the **Contractor** may be able to **successfully argue** that the **Project** achieved **substantial completion** and the **Owner** gained **use** of the Project **well before** the date that **all work** was **completed** and that

*because the **liquidated damage amount** was based on the Owner not having use of the Project, the amount assessed was **excessive**.*



When do liquidated damages begin and end? – Example

- ❑ In another case, the Contract may refer to **substantial completion** **without a clear definition** of precisely what needs to be complete **in order to achieve that milestone.**

Again, the parties may have an argument as to the proper period for assessing the liquidated damages.



Application to project milestones

- ☐ **Liquidated Damages clauses** can also be written to apply to **milestone dates** or **events during the Project.**
- ☐ The **amounts** of these **milestone liquidated damages** may be **separate** from the **liquidated damages amount** that applies to **Project completion.**



Application to project milestones – Example

A project may involve the construction of **several buildings**. In the Contract, the

Liquidated Damages clause may specify **separate damages** for

1. **Completion of each building**
2. **Overall completion of the project**

A **highway construction Project** may specify liquidated damages for the completion of **each bridge** and for **Project completion**.

Enforceability



Enforceability

- ☐ One of the **Owner's major concerns** when using a **Liquidated Damages** clause is **whether or not** it will be **enforceable**.
- ☐ If a **Contractor** completes a **Project late** and is **assessed liquidated damages** by the **Owner**, it is possible that the **assessment may be challenged**.

How?



Enforceability

❑ There are **two basic approaches** that a **Contractor** may use to **overcome** the assessment of the liquidated damages.

1. **Contractor** may attack the propriety of the assessment by **disclaiming responsibility** for the delay.
2. **Contractor** may **claim** that the **specified amount** of the liquidated damages is **excessive** and, consequently, acts as more of a **penalty** than a damages compensation.



Approach 1

- ❑ If a **Contractor challenges** responsibility for a **given delay**, it **must show** through a delay analysis that the delays to the Project were **excusable delays** and, therefore, **warrant a time extension**.
- ❑ Similarly, the **Contractor** may **attempt to show only partial responsibility** for **delays** to a Project, arguing that the **Owner also caused some concurrent delays**.
 - ❖ As previously discussed, then the **Contractor may** be **granted relief** from the assessment of **some or all** of the liquidated damages.



Approach 2

- ❑ The **Contractor** may **argue** that the amount **specified was excessive** and was in effect a **penalty rather than** a statement of the **Owner's loss**.
- ❖ **Some Owners** may feel that it does **not matter** whether the amount reflects a penalty or a loss, **since the damages were clearly specified** in the Contract that **bears the Contractor's signature**.

Does it really matter?



Approach 2

In construction Contract law in the United States, **penalties** in a construction Contract are not enforceable.

If it is found that the **amount specified was too high**, it may be judged as a penalty and not a liquidated damage.

In such cases, the courts will not enforce the clause.

For this reason, most knowledgeable attorneys carefully avoid the use of the **word penalty** anywhere in the Contract.

Judges have been known to disallow clauses **merely because** the word was used in the Contract wording.



Approach 2

If a **Liquidated Damages clause** is considered a **penalty** and becomes **void**, the Owner may sue for actual damages, which **may exceed** the amount under the Liquidated Damages clause.



Approach 2

Sub-Clause 8.8 Delay Damages

Under the laws of many countries or other jurisdictions, the amount of these pre-defined damages must be a reasonable estimate of the anticipated or actual loss caused to the Employer by the delay. Therefore if the Delay Damages are fixed at an unreasonably large amount, they may be unenforceable in common law jurisdictions or subject to downward adjustment in civil law jurisdictions.



Approach 2

<https://www.lexology.com/library/detail.aspx?g=d413e9e1-6489-439e-82b9-246779648efb>

USA | May 12 2008

In the United States, a liquidated damage clause is intended to estimate damages in the event of non-performance or breach of contract. A liquidated damages clause will be enforced where the court finds that the harm caused by the breach is difficult to estimate, but where the amount of liquidated damages is reasonable compensation and not disproportionate to the actual or anticipated damage. The intent of liquidated damages is simply to measure damages that are hard to prove once incurred. If the liquidated damages are disproportionate, they can, however, be declared a penalty. The clause is then void, and recovery will be limited to the actual damage that results from the breach.



Approach 2

<https://www.lexology.com/library/detail.aspx?g=d413e9e1-6489-439e-82b9-246779648efb>

Most other common law countries such as England, Australia, Ireland and Canada have similar rules with regard to liquidated damages, and do not allow for liquidated damages that are used as a penalty.¹ One exception to the rule is India, where the Contracts Act makes no distinction between liquidated damages and penalties, and allows for contractual damages for failure to perform even if the intention is to penalize.²

What does that mean?



Approach 2

- ❑ Once **liquidated damages** are involved in **litigation**, there are **further issues** to be addressed.

***Even if** a Contractor is successful in challenging the amount of the liquidated damages, it **does not mean** the Owner is not entitled to any damages.*

It **simply means** that the Owner must prove the **actual damages**

How should that be proved?

Who should prove that?



Approach 2

- ❑ In case the **contractor proves** the damages agreed are **considerably greater** and **disproportionate** to the **actual damages suffered**,

then the **courts** have **powers** to **reduce the amount of damages** to a degree **equal to the damages suffered by the employer**.

However, the **burden of proof** lies with the **contractor to prove** that the damages in the agreed condition are **considerably greater** than the damages suffered.

*It is **not enough** that the agreed amount of damages is **greater than the actual damages**.*

How about French law?



Approach 2

- ❑ French Law does **not interfere** into what has been **agreed by the parties**.
- ❑ French Law does **not allow** any **reduction in delay damages** as it follows the principle that the amount of damages **agreed** by the parties is **an agreed sum** and was in the contemplation of the parties

How about middle east?



Approach 2

- ❑ There is a difference here between the **Omani and UAE laws** from the **French Law**.
- ❑ **Omani Law and the UAE Law** including the MENA region **allows the courts** to
 1. **Reduce** the damages in case the **contractor proves** the damages are **considerably greater** than what are suffered.
 2. **Completely waive** it if the **contractor proves** that **no damages** have been suffered by the employer.

Types of Liquidated Damages Estimates



Types of liquidated damages estimates

❑ Three conditions may occur during the project compared to the liquidated damages:

1. **High estimates**
2. **Low estimates**
3. **Actual damages**



High estimates

❑ When the **Contractor challenges** the amount of liquidated damages, the **Owner must substantiate the validity of the damages**.

❖ This **does not mean** that the Owner must **demonstrate that actual damages** are comparable to the liquidated damages specified in the Contract.

In other words, when the Contract was drafted, given what was known at that time, was the estimate a reasonable one?

Clearly, it is in the **Owner's best interest** to maintain the **documentation** used to estimate the **liquidated damages figure**.



High estimates – Example

- ❑ If it is determined that the Owner's estimate was **not reasonable** or did **not reasonably approximate** the liquidated damages amount specified, the clause may **not be enforceable**.

*For example, if the Owner's estimate showed potential damages of \$4,500 per day, but the liquidated damages amount specified in the **Contract was \$10,000 per day**, then the amount specified most likely would be **construed as a penalty** and, therefore, **not be enforced**.*



Low estimates

*Most of the time, the amount of liquidated damages specified in a Contract is too low.
Can the **Owner** recover its damages when they are greater than the specified liquidated damages?*

- ☐ In most cases, the Owner is **limited** to the liquidated damages **amount specified**.
- ☐ The **argument** is that the Owner wrote the **Contract** and calculated the damages and is **not entitled** to collect **more than the specified amount**.



Low estimates

Just remember that a **Liquidated Damages clause** is often used **because** it was **difficult to accurately calculate** the actual damages.

While the **Owner** has the opportunity to **recover actual damages**, it may be **very difficult to substantiate** that the Owner is entitled to damages **above those specified** in the **Liquidated Damages clause**.



Actual damages

When the Owner may seek actual damages for a delay caused by a Contractor?

1. If the Owner does **not include a Liquidated Damages clause** in the **Contract**
2. If the **clause** is deemed **legally unenforceable**

The Owner should seek qualified counsel to properly prepare the damage computations. In order to assess all the damages of a Contractor-caused delay, the Owner should document all damage items to the maximum extent possible.

HOW? Let's see.



Actual damages

The items listed below should be considered

1. Increase in **costs for inspection, site visits, and so forth.**
2. Increase in its **moving costs**
 - ❖ Such as **escalation of moving costs, storage of items, temporary facilities, and so on.**
3. **Additional rent** to occupy its previous facilities **longer than planned**
4. Any **extended staff costs**
 - ❖ If the owner had **staff involved** with the construction project
5. Any **costs associated with temporary lodging**, particularly with respect to housing development.



Actual damages

The items listed below should be considered

6. **Additional interest expense** relative to the cost of financing.
7. **Damages** from other **follow-on contractors**
 - ❖ Those who have been **delayed by the delay** caused by the **first contractor**.
 - ❖ These damages would then be a part of the **owner's actual delay damages**
8. **Lost revenues from not being able to produce its product**
 - ❖ Lost revenues and profits—is **often difficult to recover**.
 - ❖ However, this does **not mean** that owners should **not claim** for lost revenues and lost profits.
 - ❖ **Chance of recovery of lost revenues or profits** may be **enhanced**, for instance, if the **owner** is able to show a **measurable difference** in the **production rates** of the old facility and the new facility.



Actual damages – Example

Statement of Actual Damages—ABC Corporation

As noted by our expert report prepared by Trauner Consulting Services, Inc., the project was delayed 150 calendar days, attributable to the contractor. Based on a delay of 150 calendar days, the following damages are claimed by the ABC Corporation.

Additional Design Services

Based on the records of our design firm, the A/E made 22 more site visits than the number originally scheduled. The exact cost for these 22 site visits was \$10,560.

Moving Costs

Because of the delay, ABC Corporation was forced to renegotiate its contract with its moving company. The renegotiated contract was \$6,520 higher than the original moving contract.

Rental Costs

ABC Corporation was forced to stay in its previous facilities for an additional five months. The documented rental costs during this period were \$617,000.

Actual damages – Example

Staff Costs

ABC Corporation's in-house construction staff remained active on the project for an additional 150 days. The staff costs based on salaries and benefits were \$61,845.

Temporary Lodging

ABC Corporation's plant start-up engineer moved to the project site based on a promised completion date (four months later than the original date) by the contractor. The contractor exceeded that date by 35 days. The lodging and subsistence paid to the start-up engineer during that 35-day period totaled \$2,265.

Finance Cost

ABC Corporation financed this project at an interest rate of .5% over prime. Because of the delay, ABC Corporation recorded additional financing costs of \$792,000.

Claims by Follow-On Contractor

ABC Corporation received a delay claim from its start-up contractor. The claim was settled for the amount of \$29,000.

Lost Revenues

Because of the delay, ABC Corporation was unable to benefit from the increased production capability of the new facility. Based on sales records, the lost revenues total \$2,675,000.

Total Damages due ABC Corporation: \$4,174,190.

استاد دکتر کاتوزیان در کتاب خود چنین مرقوم داشته‌اند «چنانکه اشاره شد، ضرر مالی که به شخص می‌رسد ممکن است در اثر از بین رفتن مالی باشد (اعم از عین یا منفعت یا حق) یا در نتیجه از دست دادن منفعتی، پیش از این تردید داشتند که از دست دادن منفعت را نیز در زمره ضررها آورند. ولی امروزه در متون گوناگون «عدم النفع، نیز در شمار خسارات آمده است، که از جمله به همین ماده اشاره داشته‌اند. معیاری آن عرفی می‌باشد و درجه احتمال فوت منفعت باید به اندازه‌ای باشد که در دید عرف بتوان ضرر مورد مطالبه را «مسلم» شمرد نه از دست دادن بخت و امکان.

همچنین قانونگذار تجارت نیز در لایحه اصلاح قسمتی از قانون تجارت مصوب ۲۴ اسفند ۱۳۴۷ در قسمت اخیر ماده ۱۳۳ اشعار می‌دارد «... منظور از ضرر در این ماده اعم است از ورود خسارت یا تفویت منفعت» در اینجا واژه تفویت منفعت دلالت بر عدم النفع دارد.

منبع: vista.ir

موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

دفتر آموزش



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