فرآیند جامع آنالیز تاخیرات در پروژه

بخش هفتم:
آنالیز زمانی تاخیرات

آنالیز زمانی تاخیرات قبل از وقوع تاخیر
(Contemporaneous Schedule Analysis)

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What we will learn?

- Critical path techniques
  - Delay analysis key terms – Review
  - Delay analysis using prospective methods
    - ✓ Impacted as planned analysis (IAP)
    - ✓ Time impact analysis (TIA)
- Non-critical path techniques
- Delays by subcontractors

Critical Path Techniques

(Delay analysis key terms – Review)

Cause and effect vs. effect and cause

1. **Cause and effect type analysis**
   - ❖ Start with the **identification** and **description** of a **cause** and **then** its **impact**

2. **Effect and cause type analysis**
   - ❖ **Identifying critical delay (an effect)** and then what might **have caused** that **delay**

Cause			*Effect*	
Delay Event	***Risk Owner***	***Delay***	***Activity Impacted***	***Delay***
Late completion of sample	Contractor	5 days	Façade construction	5 days
Late inspection	Owner	5 days	Façade construction	5 days

Contemporaneous vs. after-the-fact

1. For **Contemporaneous analysis**
   - ❖ **Cause and effect methods** are recommended
     - ✓ Time impact analysis

1. For **After-the-fact analysis**
   - ❖ **Effect and cause methods** are **generally** more reliable

Because consider **all causes** of the **delay incurred**.

Prospective vs. retrospective

- **Delay impact** is determined in **one** of **two different ways**:

1. **Prospective** delay analysis
   - It identifies the **likely impact** of **historical progress** or **delay events** on a **completion date**.
   - The **conclusion** of this analysis **may not match** the **as-built schedule** because

     *the **contractor's actual performance** **may** well have been **influenced** by the effects of attempted **acceleration**, **re-sequencing** or **redeployment** of **resources** in order to **try to avoid liability** for **liquidated damages** or due to **other Employer and Contractor Risk Events**.*

2. **Retrospective** delay analysis
   - It identifies the **actual impact** of the **delay events** on the **identified actual** or **as-built critical path**

Prospective vs. retrospective

1. The delay events are **happening** or **going to happen**, and

   your **objective** is to **ESTIMATE** the impacts from the delays so that the contractor and owner can make **new agreement**.

   ❖ This analysis is often performed while the project is **in progress**.

   ✓ **"Contemporaneous Delay Analysis" or "Prospective Delay Analysis"**

2. The delay events **have happened already**, and

   your **objective** is to **QUANTIFY** the delays and **IDENTIFY** the Responsibility by using **actual data**.

   ❖ This analysis is usually performed **after** the events **happened** or after the project is **completed**.

   ✓ **"Forensic Delay Analysis" or "Retrospective Delay Analysis"**

Criticality

- **Criticality** is determined in **one** of **three different ways**:

1. **Purely prospective critical path assessments**
   - It adopts the **perspective evident** at the **outset** of the project **only** and **take no account** of **progress achieved**.

2. **Contemporaneous critical path assessments**
   - It adopts an **evolving perspective** **over** the **course of the works** and **take account** of the **effect** that **both historical progress** and **changes** in the strategy for the **future prosecution** of the works have on **predicted criticality.**

3. **Retrospective critical path assessments**
   - It adopts the **perspective evident** at the **end** of the project.

Importance of critical path

- **CPM schedules** can **benefit Owners** and **Contractors**
  - **But Contractors**, **Owners**, and **schedule analysts** must all become **proficient** in the **application** of **these scheduling tools**.
- The **longest path** may **have zero float** along its **(1) entire path**, **(2) a portion of its path**, or **(3) nowhere on the path.**
  - **This means** that it is **possible**, **even likely**, that **certain activities** on the **critical path** will **actually have float**.
    - ✓ A **close look** at the **schedule logic** will reveal **why the float** on these activities **makes sense**.

Often, this float is a function of a constraint that is modeling a Contract requirement or other known construction restriction

Importance of critical path

Understanding how to identify shifts in the critical path is essential to properly allocate critical Project delays.

- The **analysis techniques** employed by the **analyst** should be such that the **critical path** of the Project is **known for every day of the Project**.
  - The **advanced features** of **current CPM software** have given us **powerful tools** that provide a **high level of precision** in the **analysis process**.

While the activities along the **critical path** may have **varying float values**, many schedules **still have critical paths** with **zero float**.

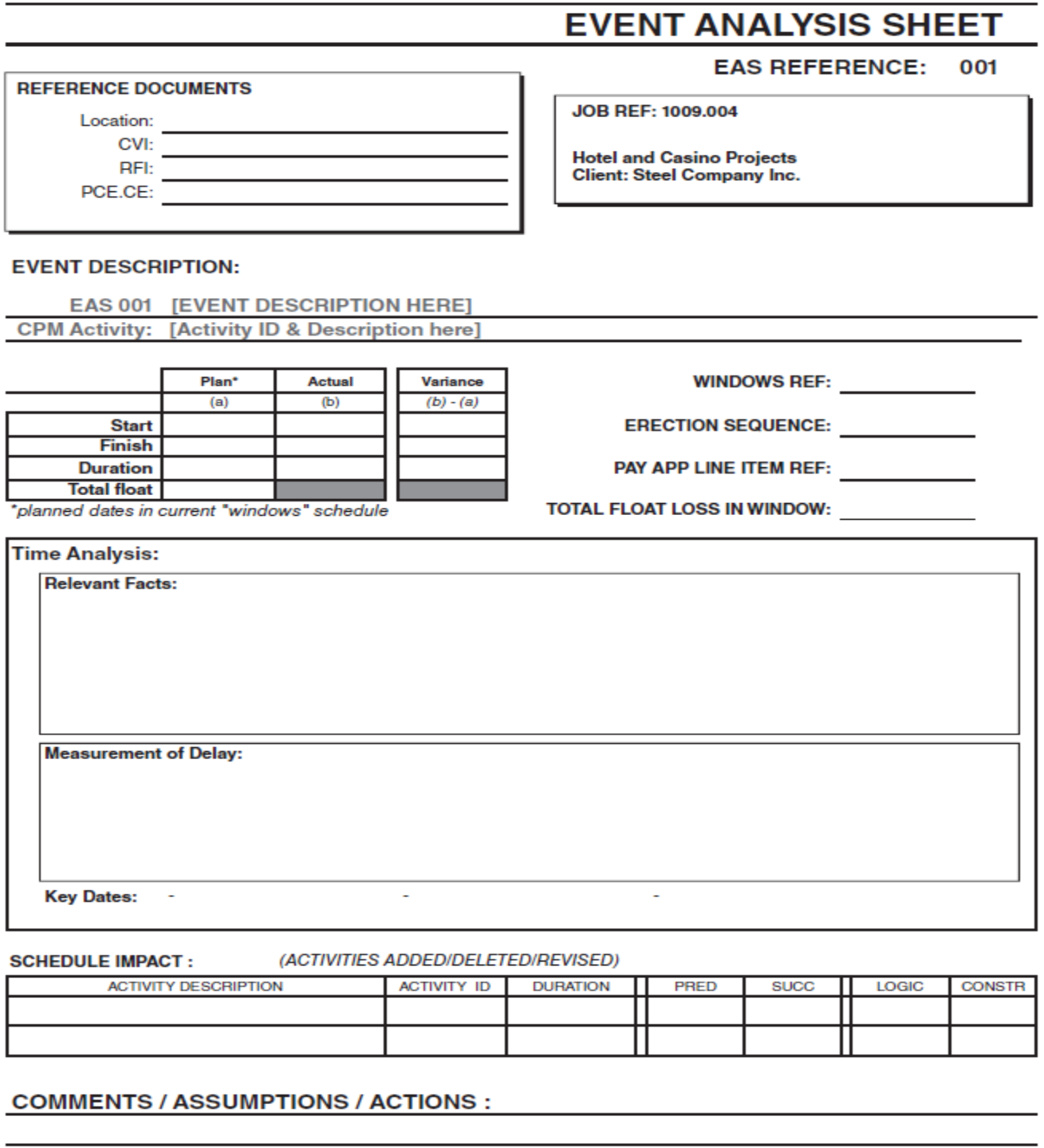
***For simplicity purposes**, **most of the examples** used in this course will **refer to zero float critical paths**.*

Critical Path Techniques

(Delay Analysis Using Prospective Methods)

STEP 7: Performing delay analysis procedure (CPs 4 and 11) (Contempo

- **Event Analysis Sheet**
- **CVIs** (confirmation of verbal instructions)
- **PCEs** (potential compensation events)
- A **list of potential delay events** should then be created.
- For **each potential delay event**, an **"event analysis sheet"** should be prepared.



EVENT ANALYSIS SHEET

EAS REFERENCE: 001

REFERENCE DOCUMENTS

Location: _____
CVI: _____
RFI: _____
PCE.CE: _____

JOB REF: 1009.004

Hotel and Casino Projects
Client: Steel Company Inc.

EVENT DESCRIPTION:

EAS 001 [EVENT DESCRIPTION HERE]
CPM Activity: [Activity ID & Description here]

	Plan* (a)	Actual (b)	Variance (b) - (a)
Start			
Finish			
Duration			
Total float			

*planned dates in current "windows" schedule

WINDOWS REF: _____
ERECTION SEQUENCE: _____
PAY APP LINE ITEM REF: _____
TOTAL FLOAT LOSS IN WINDOW: _____

Time Analysis:

Relevant Facts:

Measurement of Delay:

Key Dates: - - -

SCHEDULE IMPACT : (ACTIVITIES ADDED/DELETED/REVISED)

ACTIVITY DESCRIPTION	ACTIVITY ID	DURATION	PRED	SUCC	LOGIC	CONSTR

COMMENTS / ASSUMPTIONS / ACTIONS :

STEP 7: Performing delay analysis procedure (CPs 4 and 11)

- **Details of all the delay issues** identified should be recorded in a **delay register** (below table).
- This table should capture **all delays**.
- This table could be more complex.

Ref no.	Cause and effect of delay or disruption	Delay to section or part of works	Delay to competition date	Contract clause relevant to delay	Date of delay notice and particulars
1.	**Under-slab drainage** Additional works arising out of discovery of ground beam clash	16 days	4 days	25 Relevant event 25.4.5.1	Contractor's letters: November 23 2005

STEP 7: Performing delay analysis procedure (CPs 4 and 11)

❑ CP 4 in SCL Protocol:

4. Do not 'wait and see' regarding impact of delay events (contemporaneous analysis)

The parties should attempt so far as possible to deal with the time impact of Employer Risk Events as the work proceeds (both in terms of EOT and compensation). Applications for an EOT should be made and dealt with as close in time as possible to the delay event that gives rise to the application. A 'wait and see' approach to assessing EOT is discouraged. Where the Contractor has complied with its contractual obligations regarding delay events and EOT applications, the Contractor should not be prejudiced in any dispute with the Employer as a result of the CA failing to assess EOT applications. EOT entitlement should be assessed by the CA within a reasonable time after submission of an EOT application by the Contractor. The Contractor potentially will be entitled to an EOT only for those events or causes of delay in respect of which the Employer has assumed risk and responsibility (called in the Protocol Employer Risk Events) that impact the critical path.

STEP 7: Performing delay analysis procedure (CPs 4 and 11)

❑ Contemporaneous analysis procedure

- ❖ **Step 7** sets out a **recommended procedure** to be **followed in order** to deal **efficiently and accurately** with EOT applications during the **course of the project.**
- ❖ **This procedure** assumes **Steps 1 to 6** have been **followed.**
- ❖ **Step 7** does **not intend** to be **incorporated into a contract.**

Contemporaneous analysis – Why preferred?

- The **contemporaneous** project schedules are the **preferred tool** to **measure Project delay** because they were used by the **project participants** to

  manage and **construct** the project at a **moment in time** based on the **known Project conditions**.

  1. By using the **contemporaneous schedules** and **updates**, and
  2. By **tracking delays** as they **occur throughout the project**,

     there is **no need** to attempt to **inject information** that is **known at a later date**.

Contemporaneous analysis – Why preferred?

ASCE Standard ANSI/ASCE/CI 67-17 (Schedule Delay Analysis)

7.3 CONSIDERATION SHOULD BE INCLUDED AS TO HOW DELAYS WERE EVALUATED BY THE PARTICIPANTS DURING THE PROJECT

- Although **delay events** should be **recognized and measured during the project** as the project progresses,

  in practice they are **not always identified contemporaneously**.

- During expert analysis, the **more common industry practice** is to measure the delays in an **after-the-fact analysis**,

  which **more accurately** defines the delay events that **occurred** on a project.

- **Although** this process may reveal what may be considered **bad decisions with hindsight**,

  contemporaneous decisions affecting project delay **still may be justifiable**.

Contemporaneous analysis – What schedule to measure delay?

Do not create schedules after-the-fact to measure delays

- Using a **schedule** created **after the fact** to measure and identify project delay, however, has **two weaknesses**:
  1. The schedule does **not depict** the **original construction plan**
  2. The schedule may include **predetermined conclusions** concerning delays

When possible, it is always best to use the contemporaneous Project schedules to measure Project delay while the analyst may make very minor modifications to the contemporaneous schedule to account for obvious errors.

Delay analysis using prospective methods – Introducing methods

Method of Analysis	Analysis Type	Critical Path Determined	Delay Impact Determined	Requires
Impacted As-Planned Analysis	Cause & Effect	Prospectively	Prospectively	• Logic linked baseline programme. • A selection of delay events to be modelled.
Time Impact Analysis	Cause & Effect	Contemporaneously	Prospectively	• Logic linked baseline programme. • Update programmes or progress information with which to update the baseline programme. • A selection of delay events to be modelled.

Delay analysis using prospective methods – Comparing methods

	The Information Required				
	Baseline programme	Logic linked baseline programme	As-built data	Delay events to model	Up to date programmes/ process information
Impacted As-Planned					
Time Impact					

By: Alavipour, PhD, PMP, CMIT

Delay analysis using prospective methods – References

Delay analysis using prospective methods

The following procedure proposed in this course provided by combining

1. ***AACE 52R-06***
2. ***AACE 29R-03***
3. ***SCL Protocol***
4. ***Construction Delays Book (Third Edition)***
5. ***Delay Analysis in Construction Contracts Book (Second Edition)***
6. ***My experience***

Impacted As-Planned (IAP)

Delay analysis using prospective methods – Introducing methods

Method of Analysis	Analysis Type	Critical Path Determined	Delay Impact Determined	Requires
Impacted As-Planned Analysis	Cause & Effect	Prospectively	Prospectively	• Logic linked baseline programme. • A selection of delay events to be modelled.
Time Impact Analysis	Cause & Effect	Contemporaneously	Prospectively	• Logic linked baseline programme. • Update programmes or progress information with which to update the baseline programme. • A selection of delay events to be modelled.

Delay analysis using prospective methods – Impacted as planned analysis

❑ Definition

❖ In this approach, the **analyst** identifies the **as-planned schedule** and then **inserts** into this schedule the **changes** that it **believes**

1. **Will cause** project delays
2. **May have caused** project delays

Why should not be used as forensic analysis?
Think about it!

✓ The **source** for **these changes** is **only** the **perceived delays** noted during **construction**.

✓ **This type** of analysis considers **only** the project team's **original plan** and the **delay** being analyzed.

This is done on "As-planned schedule"

Impacted As-Planned (IAP)

(Contemporaneous or Prospective)

Impacted as planned analysis – Contemporaneous or prospective

How to use?

1. **Use** the **initial as-planned (baseline)** schedule for the project.
2. **Incorporate** the **delay event** as **activity** in the as-planned schedule and **link it to all activities** that it will impact.
3. **Recalculate** the **completion date**.
4. The **difference** between
   1. **Initial completion date** in the as-planned (baseline) schedule and
   2. **Completion date** on the recalculated schedule

   will constitute the effect of the delay.

Impacted as planned analysis – Contemporaneous or prospective

- **Example**

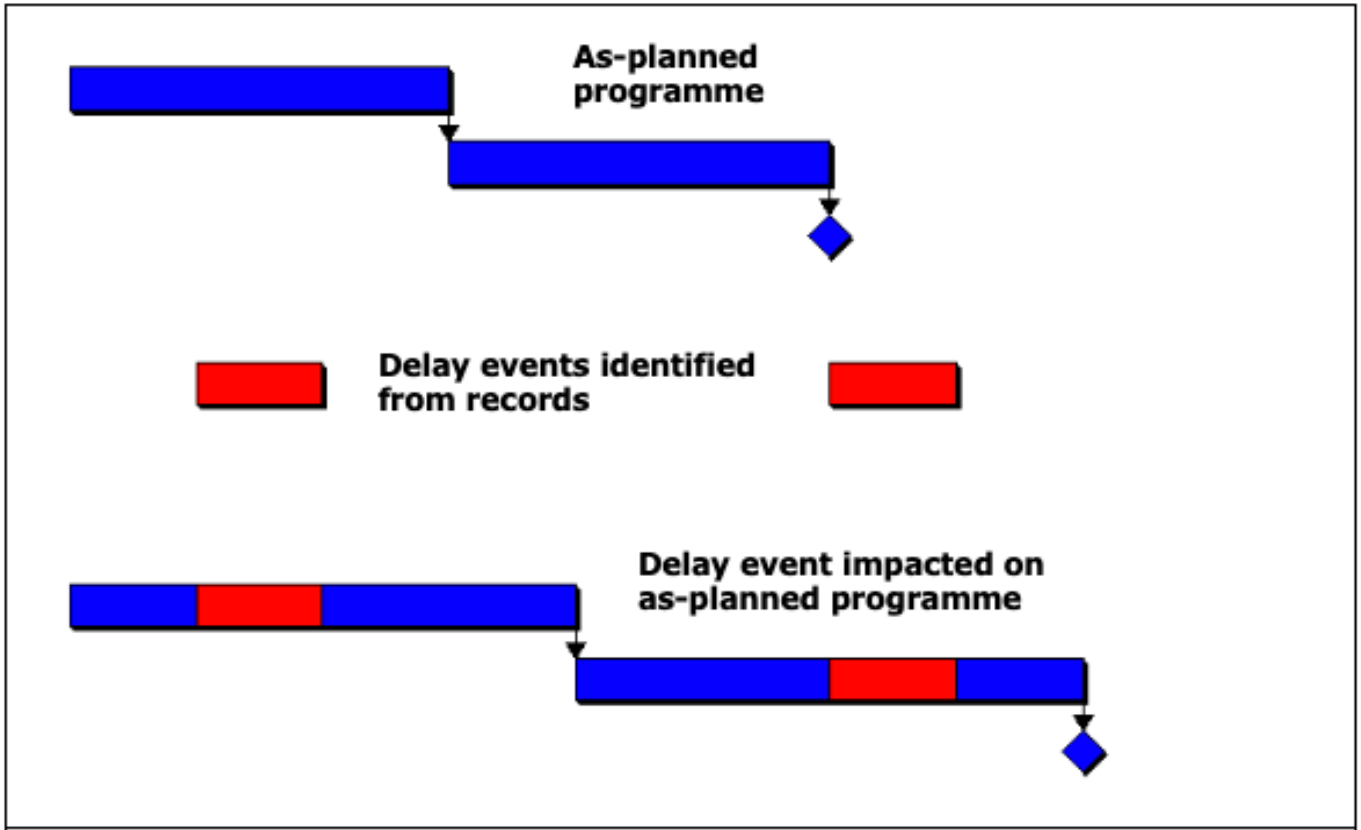
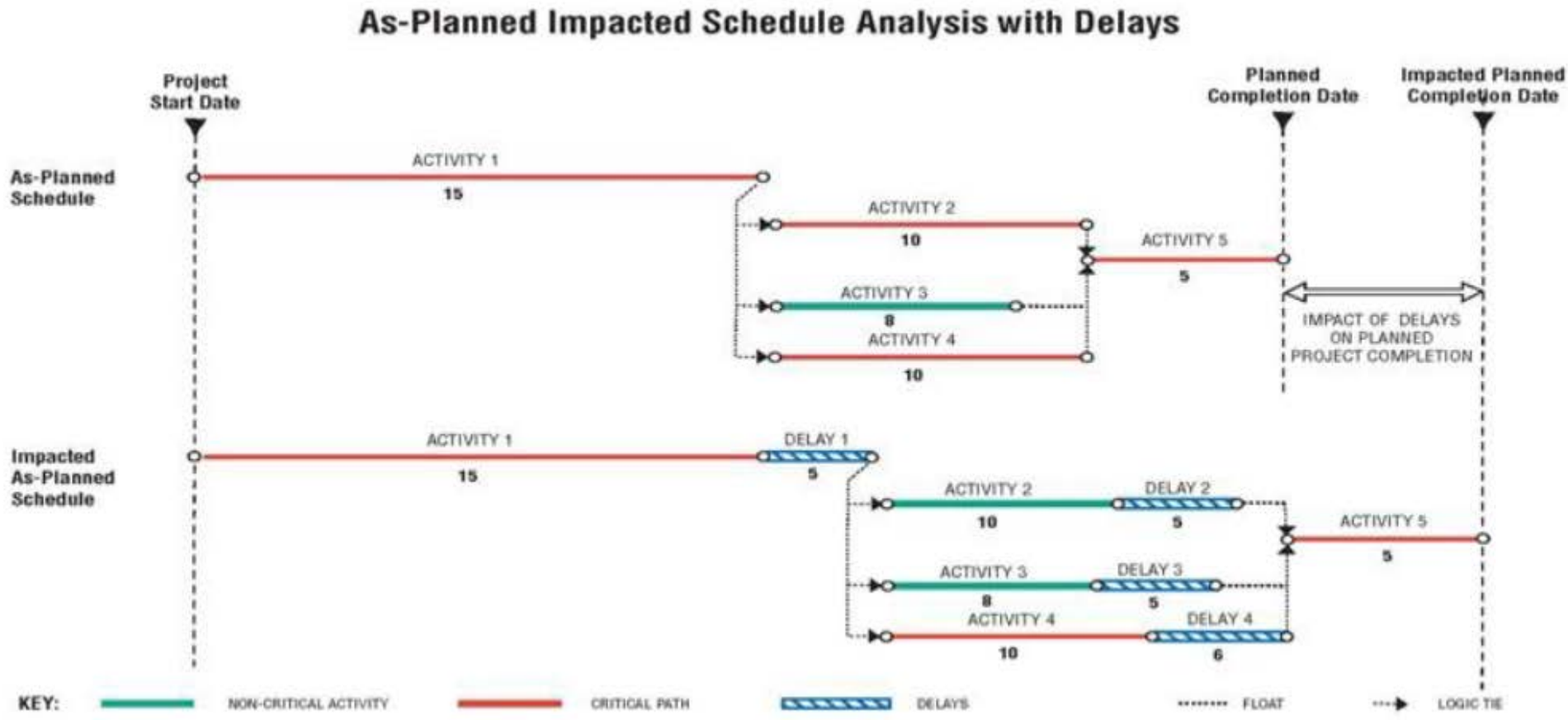


Diagram illustrating the Impacted As-Planned technique.

Could it be performed using windows?

Impacted as planned analysis – Contemporaneous or prospective

- **Example:**



Do the courts accept it as a <u>forensic analysis</u>?

Impacted as planned analysis – Contemporaneous or prospective

- **Example: Court decision**

"We have found that [his] analysis systematically excluded all delays and disruptions except those allegedly caused by the Government … We conclude that his analysis was inherently biased, and could lead to but one predictable outcome … To be credible, a contractor's CPM analysis ought to take into account, and give appropriate credit for all of the delays which were alleged to have occurred."

Haney v. United States 30 CCF ¶ 70, 1891], 676 F.2d 584 (Ct. Cl. 1982); Pathman Construction Co. , ASBCA No. 23392, 85-2 BCA ¶ 18,906

Could it be used for compensation calculation?

Impacted as planned analysis – Contemporaneous or prospective

❑ SCL view

❖ *The **SCL Protocol** envisaged the IAP technique as one which would **assist** in demonstrating **extension of time entitlement only**, and **not prolongation costs**.*

❖ While **IAP models** can only estimate the impact of events prospectively,

It is foreseeable that the IAP model could be used as the basis for estimating prolongation on the basis of **pre-agreed rates**

if parties are inclined to **accept** the results of such an analysis.

How about concurrency?

Impacted as planned analysis – Contemporaneous or prospective

❑ SCL view

- ❖ *It was **not concerned** with using the IAP technique for identifying **concurrent delays** if used as a **retrospective**.*
  - o *Because SCL believes in **true concurrency**!*
    - ✓ *This can only be done with **as-built records** and approaches which rely on **as-built programmes**.*

Cannot calculate true concurrency!

**So, if used prospective,
what to do to resolve this problem?**

Impacted as planned analysis – Contemporaneous or prospective

- *However, the **AACEI** recognizes that the approach is able to identify **'approximate concurrency'** for the purposes of estimating*
  1. *Concurrent delay and*
  2. *Extension of time entitlement*

Because AACE believes in functional theory as well!

Now, you know why I recommended using functional theory if you consider to use prospective methods!

What are the requirements of using IAP?

Impacted as planned analysis – Contemporaneous or prospective

The only schedule required to carry out an IAP is a baseline schedule that

1. Contractually compliant
2. Represents a contractor's true intention prior to commencing any works

What if the available baseline contains identifiable logical or duration errors?

Impacted as planned analysis – Contemporaneous or prospective

What if the available baseline contains identifiable logical or duration errors?

Don't use this method,

unless

there is an agreement to use it as a negotiating tool between contractor and employer!

Impacted as planned analysis – Contemporaneous or prospective

Could it be used as a retrospective method?

Yes, but not recommended at all!

This is the reason that SCL Protocol considers this as Prospective approach!

But it have been using in Iran and it is so prevalent?

Ok, I will teach you how to improve the accuracy of this approach when using as Retrospective!

Impacted As-Planned (IAP)

(Forensic or Retrospective)

Impacted as planned analysis – Forensic or retrospective

How to use?

1. Once a **baseline** for analysis is **identified**, then either, or both, **employer delay event (EDE)** and **contractor delay event (CDE)** are added to the baseline programme.
   a) If they are added **independently**, this is known as a **'non-integrated IAP'** (with either CDE or EDE, but not both).
   b) If both are added **jointly**, then this is a **'combined IAP'.**
      - Combined IAP models require the impacts to be inserted in the **chronological order** in which they **first arose**.

Impacted as planned analysis – Forensic or retrospective

How to use?

1. Once a **baseline** for analysis is **identified**, then either, or both, **employer delay event (EDE)** and **contractor delay event (CDE)** are added to the baseline programme.

- The insertion can take may forms, including:
  - Delaying the start of an existing, or inserted, activity with a constrained start date.
  - Delaying the finish of an existing, or inserted, activity with a constrained finish date.
  - Increasing the duration of an existing activity.
  - Increasing or decreasing the hours available during a working week.
  - Inserting a new fragnet or activity, logically linked to existing activities in the programme.
  - Adding or deleting existing logical links to reflect the impact of changed conditions and dependencies.

Which method is recommended?

Impacted as planned analysis – Forensic or retrospective

How to use?

1. Once a **baseline** for analysis is **identified**, then either, or both, **employer delay event (EDE)** and **contractor delay event (CDE)** are added to the baseline programme.

- The insertion can take may forms, including:
  - Delaying the start of an existing, or inserted, activity with a constrained start date.

Some analysts insert activities with start constraints, thus avoiding the need to provide a predecessor in the existing baseline programme.

This is appropriate in certain circumstances but should be avoided when natural construction predecessors can be identified in the baseline programme.

  - Delaying the finish of an existing, or inserted, activity with a constrained finish date.
    Same thing…

Impacted as planned analysis – Forensic or retrospective

How to use?

1. Once a **baseline** for analysis is **identified**, then either, or both, **employer delay event (EDE)** and **contractor delay event (CDE)** are added to the baseline programme.

- The insertion can take may forms, including:
  - Increasing the duration of an existing activity.
  - Increasing or decreasing the hours available during a working week.
  - Adding or deleting existing logical links to reflect the impact of changed conditions and dependencies.

So, which one?

Impacted as planned analysis – Forensic or retrospective

How to use?

1. Once a **baseline** for analysis is **identified**, then either, or both, **employer delay event (EDE)** and **contractor delay event (CDE)** are added to the baseline programme.

This is performed by inserting additional tasks as discrete activities, complete with logical relationships and durations to the original contract baseline schedule.

Each CDE or EDE activity requires the following:

1. **Estimated duration**
2. **List of logical predecessors**
3. **List of logical successor**

Impacted as planned analysis – Forensic or retrospective

❑ How to use?

Any method of insertion must be recorded as part of a transparent and auditable process.

Impacted as planned analysis – Forensic or retrospective

How to use?

CDE and EDE can be inserted:

1. **One at a time**
2. **All at once**

2. The resulting delay impact on the completion date, is then measured and recorded.

   a) **<u>One at a time:</u>** then the impacted completion date is recorded **event by event.**

      ✓ Both CDE and EDE can be inserted in this way.

      ✓ Concurrent effect is better calculated in this method.

   b) **<u>All at once:</u>** then impacted completion date is recorded **once at a time**.

Impacted as planned analysis – Forensic or retrospective

❑ Practical procedure for CC-IAP:

What should be done for <u>combined chronological</u> impacted as planned (CC-IAP)?

1. <u>Both</u> CDE and EDE delays are identified and listed <u>chronologically</u>.
2. <u>Each delay</u> is inserted <u>individually</u> and <u>cumulatively</u> until <u>all delays</u> have been inserted into the program ***(CC-IAP developed).***
3. <u>Depending</u> on whether the impact was caused by either a CDE or an EDE, the critical delay to completion is **"banked"** into a respective category and **tabulated**.
   - ✓ *Sum of CDEs = Non-excusable, non-compensable delays, and LDs*
   - ✓ *Sum of EDEs = Excusable and Compensable delays*

So, what to do for <u>concurrent delays</u>?

Impacted as planned analysis – Forensic or retrospective

❑ Practical procedure for CC-IAP:

What should be done for <u>combined chronological</u> impacted as planned (CC-IAP)?

4. Prepare and insert only EDE in IAP to find concurrent delays ***(EDE-IAP developed)***
   - ✓ *Sum of EDE-IAP – EDEs-CC-IAP = Concurrent delays (excusable but non-compensable)*
     - o While this is **<u>not true concurrent delay</u>**, because it is based on a <u>theoretical prospective model</u>, it provides a measure of **<u>approximate concurrency</u>**.

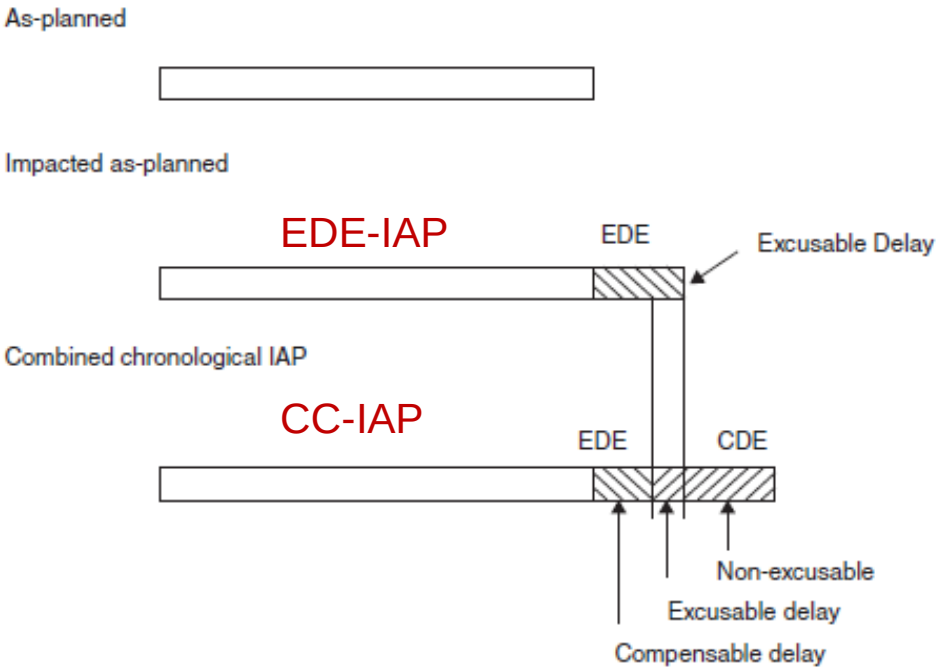
This is again the reason I told you to use "Functional Theory"

What should be done for <u>Excusable but non-compensable</u>?

Impacted as planned analysis – Forensic or retrospective

❑ Practical procedure for CC-IAP:

Combined



This could calculate the **approximate concurrency**

Impacted as planned analysis – Forensic or retrospective

However, payment for time-related costs during this approximate period can only be estimated by way of average daily rates, or some other pre-agreed daily rate which is acceptable to both parties.

The resulting compensable delay period will not identify

1. **Actual period in which the delay was being experienced, or**
2. **Actual delay which was experienced to the completion date**

Impacted as planned analysis – Forensic or retrospective

❑ Practical procedure for NI-IAP:

What should be done for Non-integrated impacted as planned (NI-IAP)?

1. Impact of CDE separately from the EDE in two isolated models.
2. Compare two models:

I. Sum of CDEs > Sum of EDEs

- ✓ *CEDs = Non-excusable and LDs*
- ✓ *EDs = Excusable*
- ✓ *No compensation*

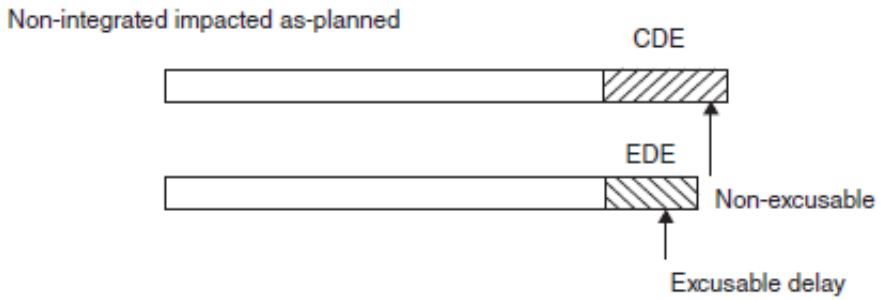
II. Sum of CDEs < Sum of EDEs = Difference is compensable delay

- ✓ *CEDs = Non-excusable and LDs*
- ✓ *EDs = Excusable*
- ✓ *Difference is compensable delay*

Impacted as planned analysis – Forensic or retrospective

❑ Practical procedure for NI-IAP:

Non-integrated



So, what to do for <u>concurrent delays</u>?

Impacted as planned analysis – Forensic or retrospective

❑ Practical procedure for NI-IAP:

What should be done for Non-integrated impacted as planned (NI-IAP)?

3. Estimate **CC-IAP** (again we need CC-IAP)
4. Compare **non-integrated CDE** with **CC-IAP**
   - ✓ *CC-IAP – Non-integrated CDE*
5. Compare the duration achieved from Step 4 with Non-integrated EDE
   - ✓ *Number achieved in Step 4 > Non-integrated EDE = No concurrency*
   - ✓ *Number achieved in Step 4 < Non-integrated EDE = Difference is concurrency*

Impacted as planned analysis – Forensic or retrospective

❑ Example

Combined

Combined IAP model results.

Combined impacted liability table			Cumulative delay	
Event	Event type	Impacted completion date	EDE	CDE
Baseline		1-Jan-09		
001	EDE	2-Jan-09	1	
002	EDE	5-Jan-09	3	
003	CDE	8-Jan-09		3
004	EDE	10-Jan-09	2	
005	CDE	15-Jan-09		5
006	CDE	15-Jan-09		0
007	EDE	18-Jan-09	3	

Don’t forget to use negative sign for acceleration

Impacted as planned analysis – Forensic or retrospective

- It must be remembered that **these assessments** are **only estimates** of **approximate liability.**

- The **actual delay** experienced in total may **not be equal to the 17 days** of total delay determined by the **IAP model**.

Why?

Impacted As-Planned (IAP)

(Weaknesses)

Impacted as planned analysis – Weaknesses

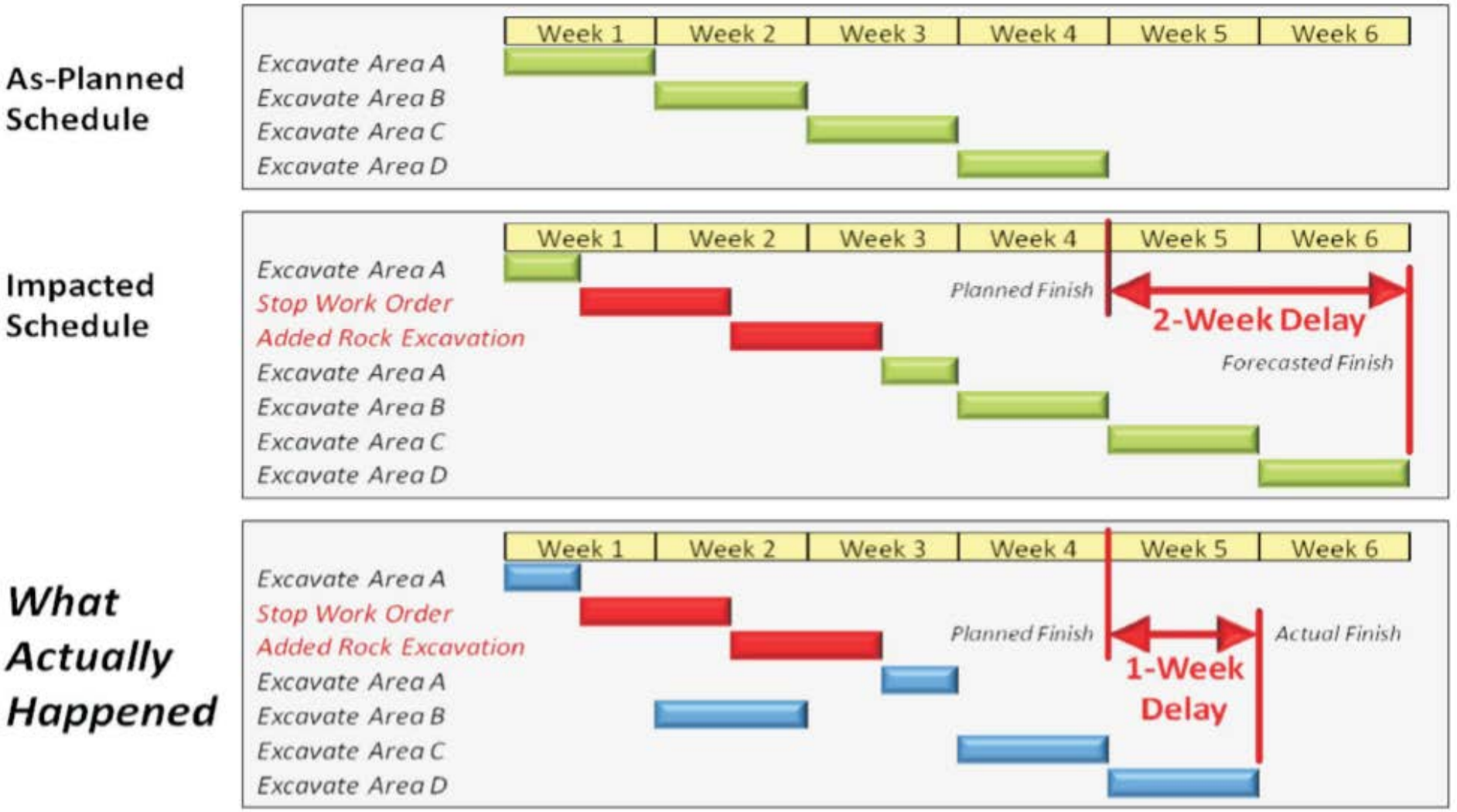
❑ Major weaknesses of this approach

❖ The difference between the **IAP impacted contract completion date** and the **actual contract duration** achieved can be explained by several factors:

- ✓ **Deviations** from the as-planned sequence,
  - o Out-of-sequence
- ✓ **Deviations** from the as-planned durations,
  - o Documentation problem and contemporaneous records
- ✓ **Additional delays** not considered in the IAP model
  - o Often **subjective** and **one-sided**
- ✓ **Mitigation** achieved along the critical path
- ✓ Changes in critical path
  - o **Most significantly**, it **does not consider** the **dynamic nature** of a **project** and the **critical path**.

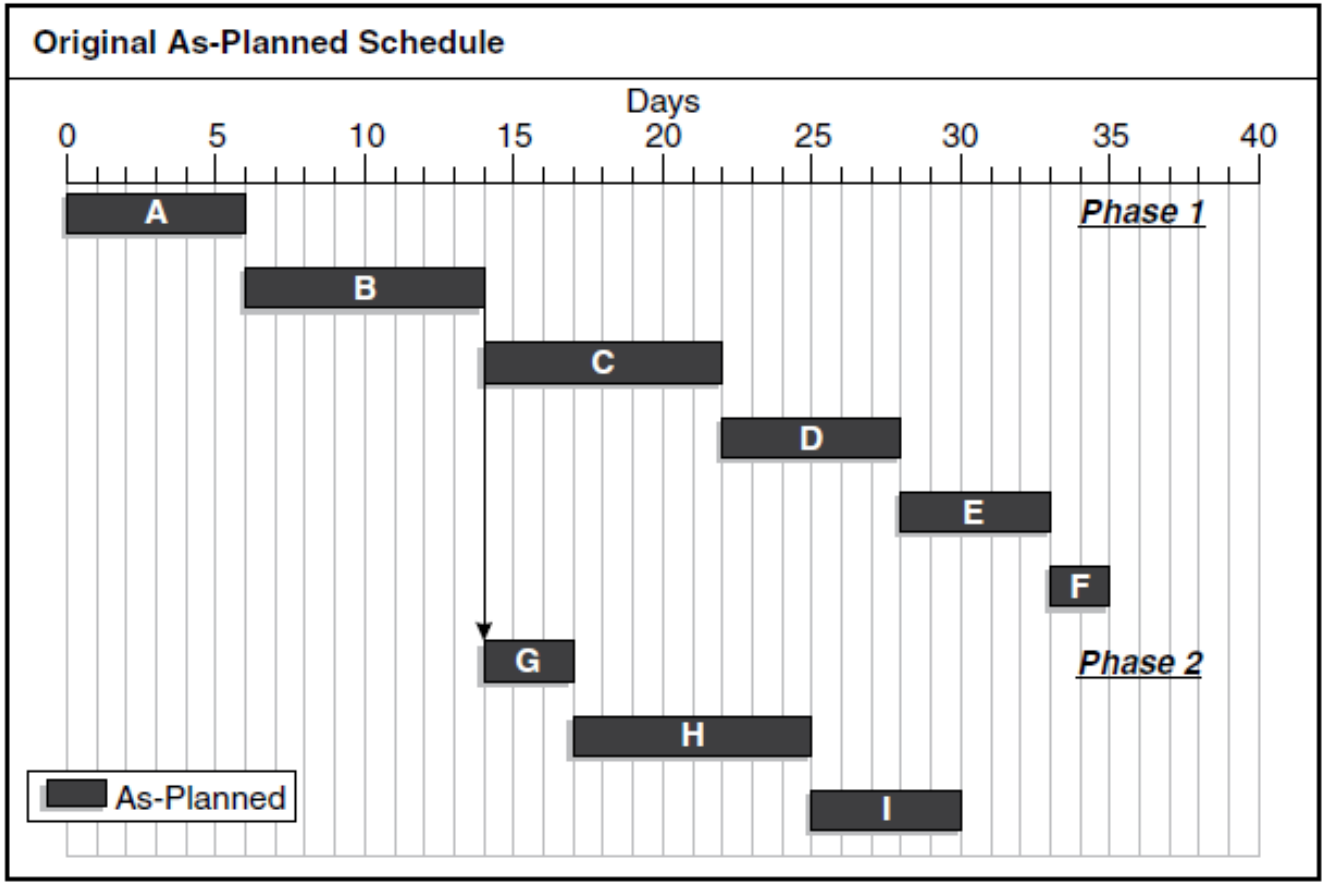
Impacted as planned analysis – Weaknesses

- **Major weaknesses of this approach**



Impacted as planned analysis – Weaknesses

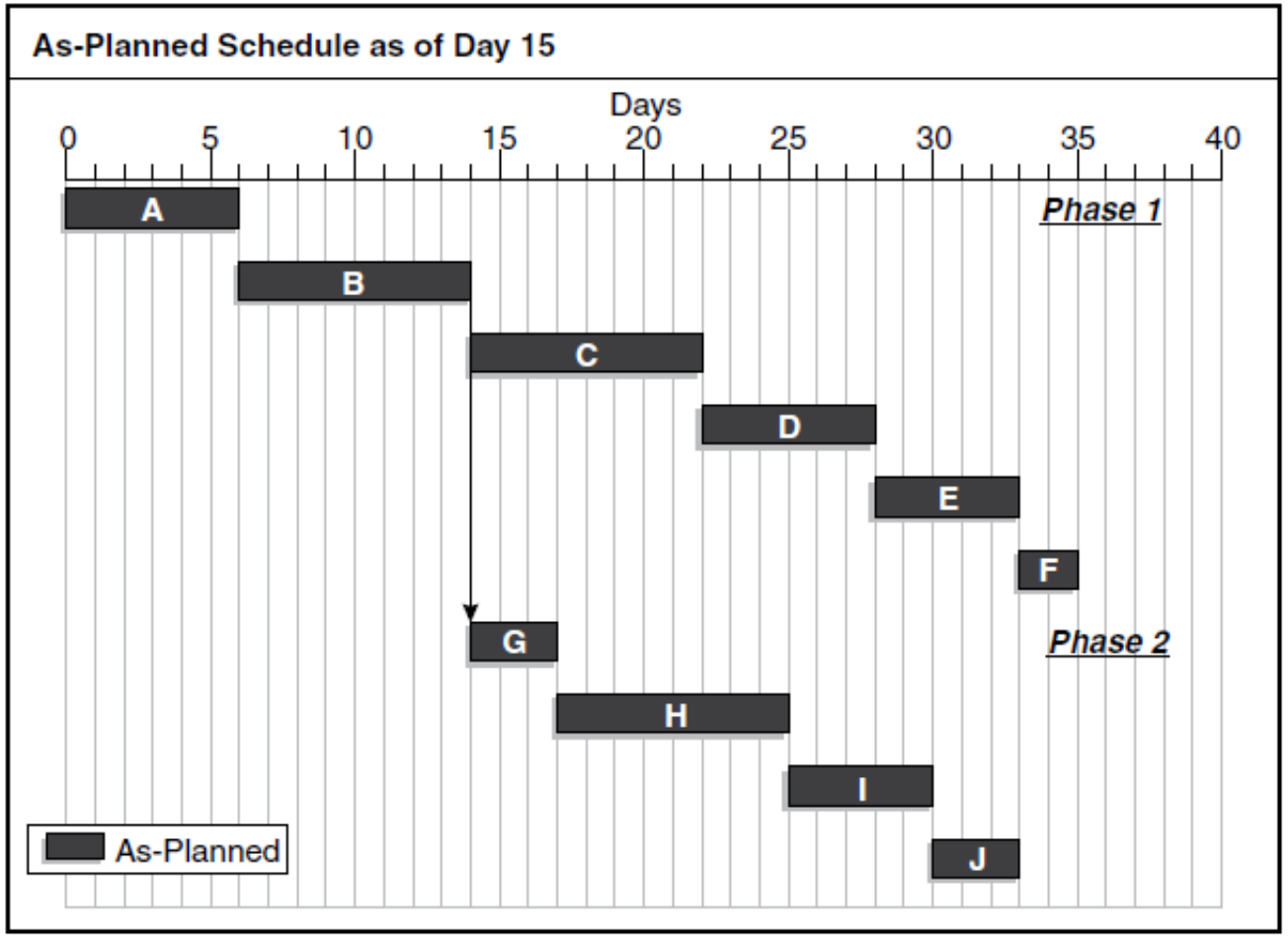
- **Example:** A through F must be performed in sequence.



Impacted as planned analysis – Weaknesses

- **Example:** On day 15, the contractor modifies its work and adds J with a duration of three days.

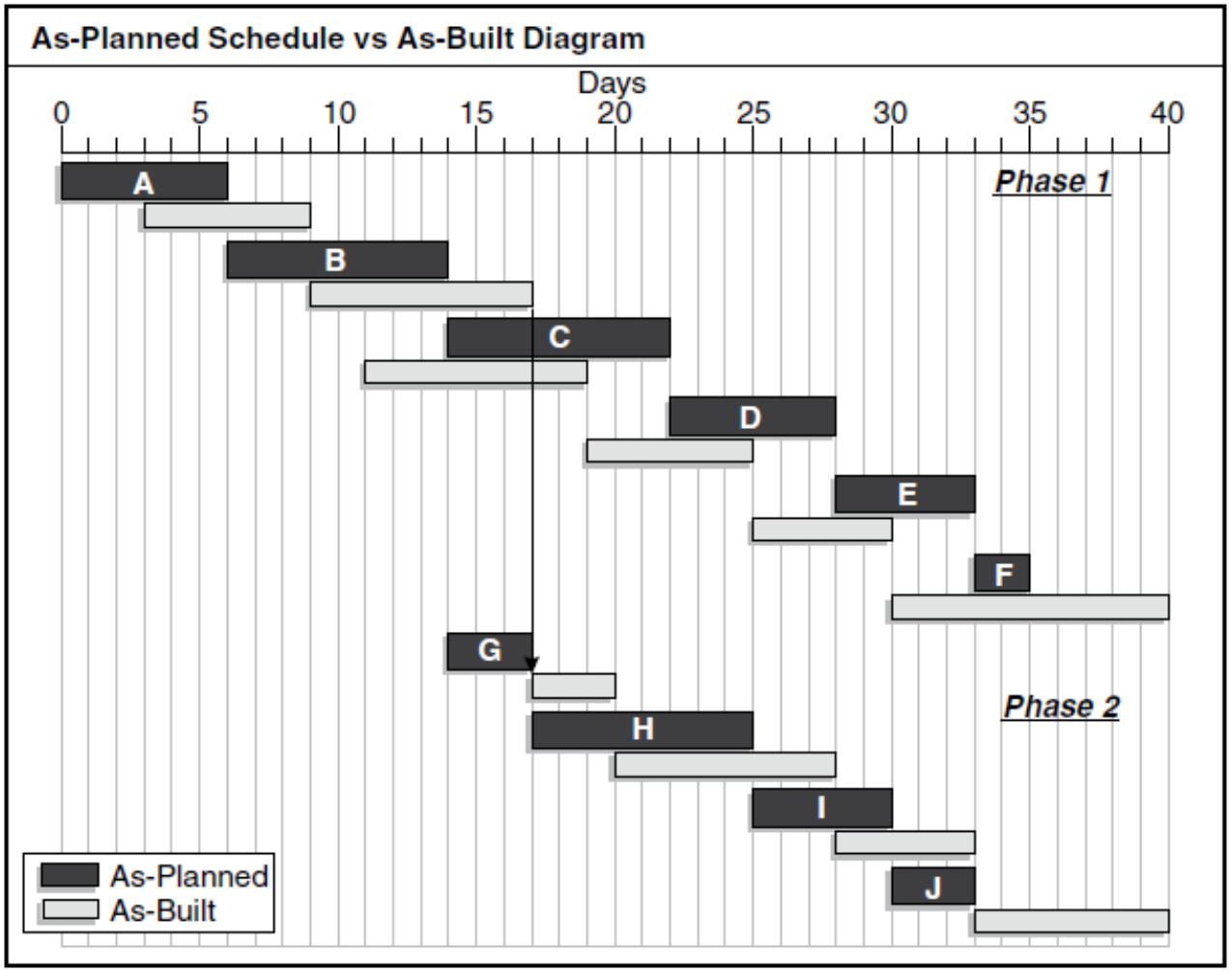
- So, nothing should be changed so far.



Impacted as planned analysis – Weaknesses

❑ **Example:** As-planned vs. as-built

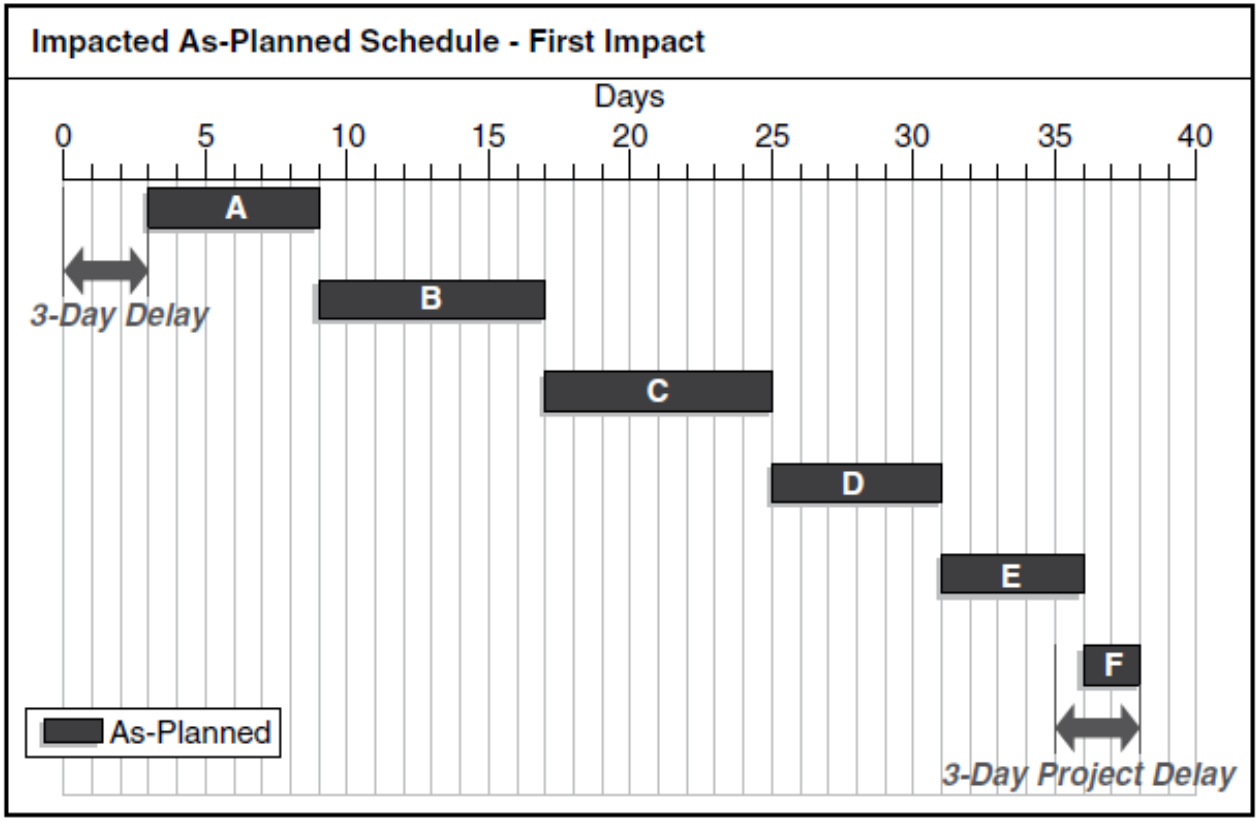
- The project is actually completed in 40 days (5 days delay)
- Activity A started three days late.
- Activity C started six days early and out of sequence.
- Activity F took eight days longer.
- Activity J took four days longer.



Impacted as planned analysis – Weaknesses

❑ **Example:** Impacted as-planned – First impact

❖ Project delayed by three days because of the late start of Activity A.

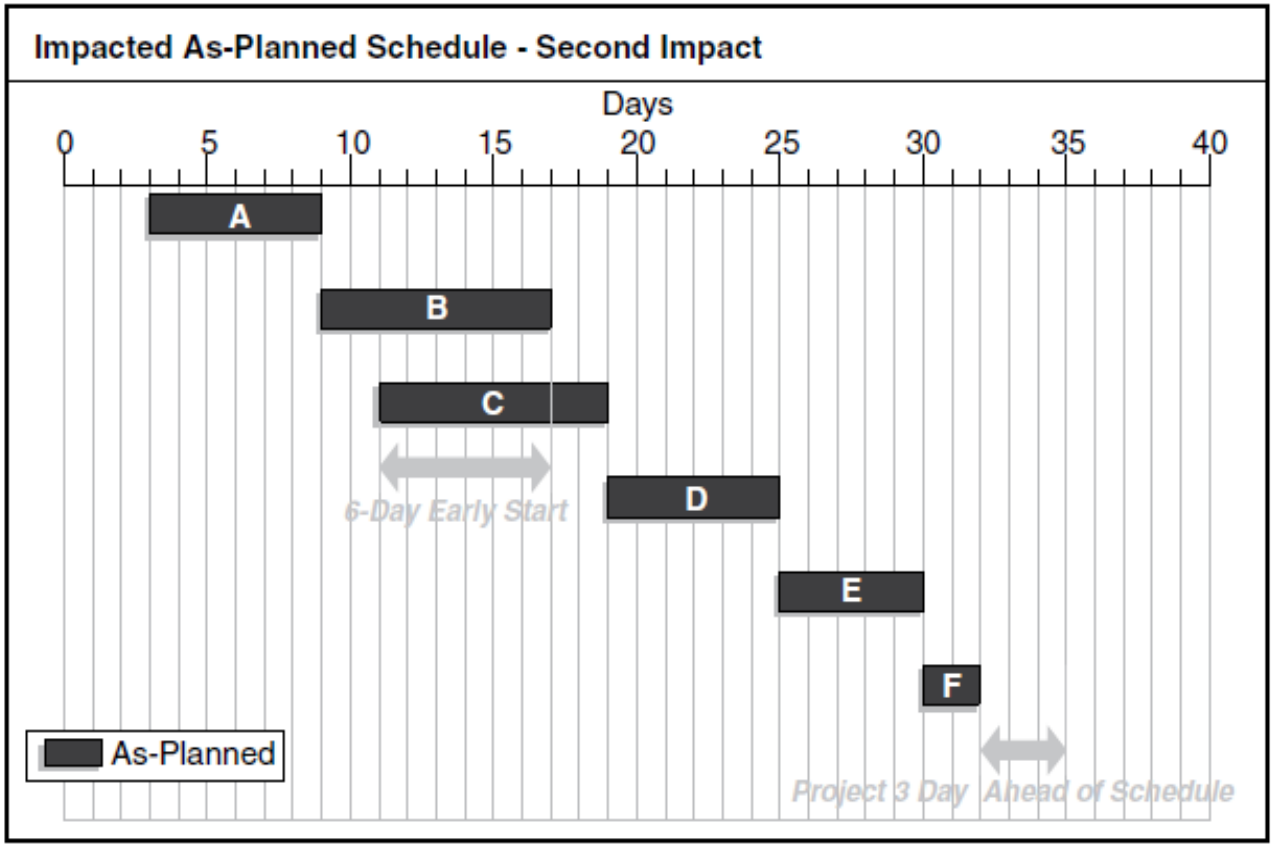


By: Alavipour, PhD, PMP, CMIT

Impacted as planned analysis – Weaknesses

❑ **Example:** Impacted as-planned – Second impact

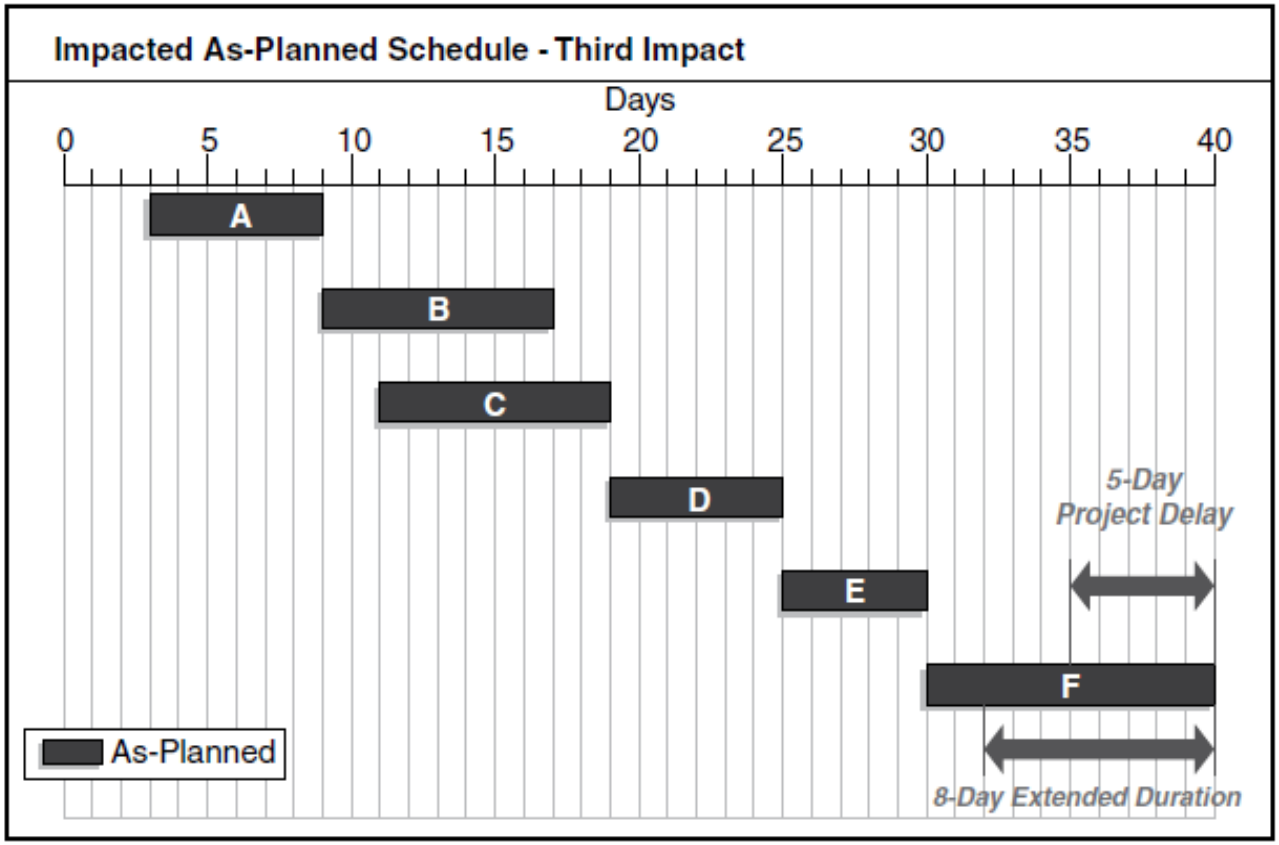
❖ Project ahead of schedule by three days because of the early start of Activity C.



Impacted as planned analysis – Weaknesses

❑ **Example:** Impacted as-planned – Third impact

❖ Project delayed a total of five days due to the extended duration of Activity F.



Impacted as planned analysis – Weaknesses

❑ **Example:** Impacted as-planned – Final conclusion

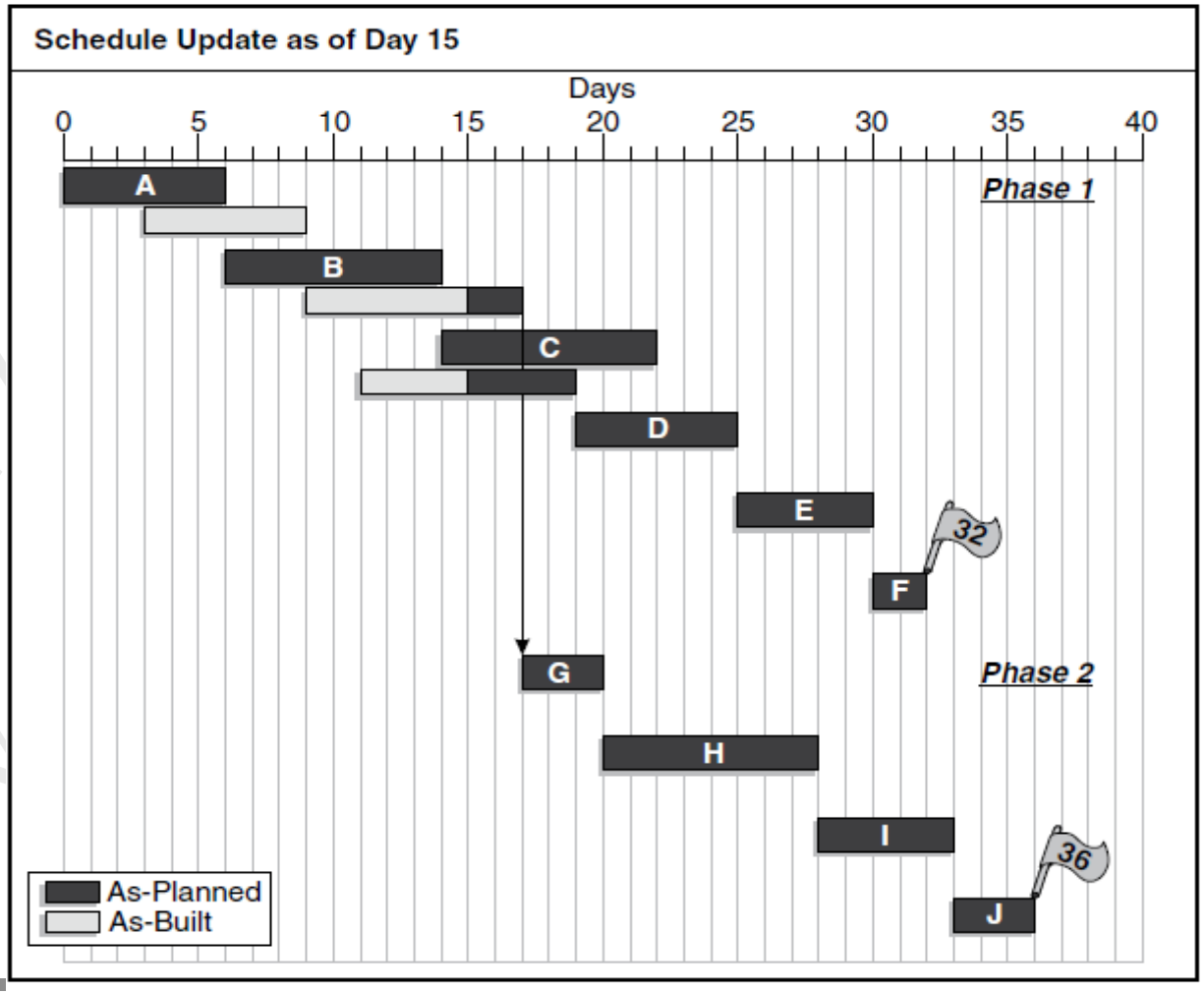
The overall conclusion is that the Project was delayed by five days, primarily because of the late finish of activity F.

This conclusion is erroneous.

Impacted as planned analysis – Weaknesses

❑ **Example:** What if the CPM approach is used?

- Schedule is updated as of **day 15**, the day the Contractor added activity J.
- The critical path has shifted to the **Phase 2 path** of activities, G through J due to the delay to **activity A**.
- The original critical path never becomes critical again and the project is delayed by **1 day** due to **activity J**.



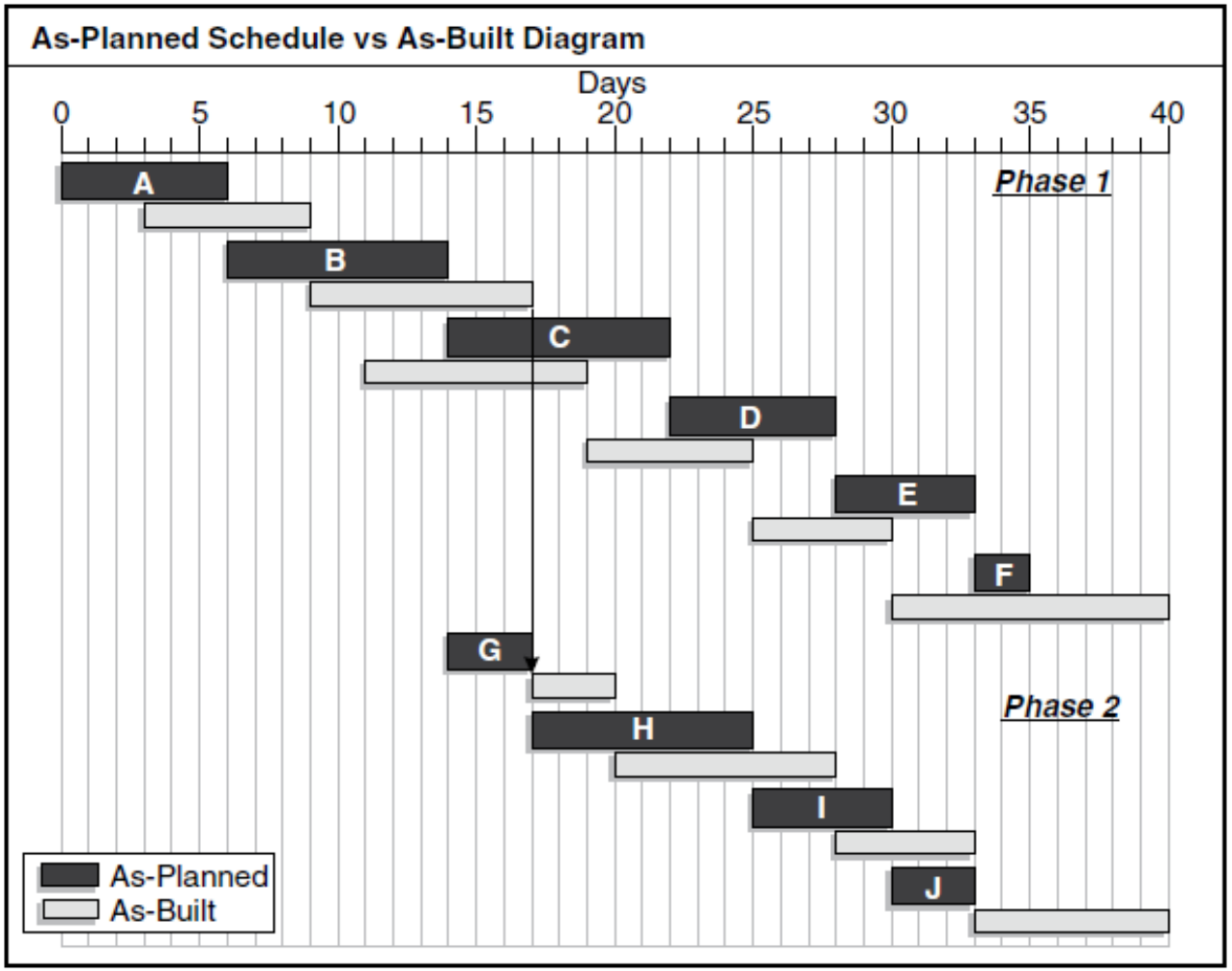
Impacted as planned analysis – Weaknesses

❑ **Example:** What if the CPM approach is used?

❖ Although

- ✓ Activity F took eight days longer.
- ✓ Activity J took four days longer.

Is it concurrent?



Impacted as planned analysis – Weaknesses

❑ **Example:** What if the CPM approach is used?

❖ **Impacted as-planned**

✓ Project was delayed **by five days**, primarily because of the **late finish of activity F**.

❖ **CPM approach using contemporaneous update:**

✓ **1 day** of delay due to **activity J**

✓ **4 days** of delay due to **concurrency**

Impacted as planned analysis – Weaknesses

❑ Example: Court decision

Mr. Maurer, appellant's expert, testified about the critical delays to the Project.... The analysis about the critical delays was based on appellant's original schedule, the schedule updates, the daily reports, Project correspondence, and the contract documents. Mr. Maurer described his analysis as a step-by-step process, beginning with the original schedule and proceeding chronologically through the Project, updating the sequence at intervals to see what happens as the Project progressed [(tr. 262) ASBCA No. 34, 645, 90–3 BCA ¶ 12, 173 (1990)].

Impacted as planned analysis – Weaknesses

❑ Example: Court decision

- ❖ The **judge's criticism** was that the **outcome of an impacted as-planned analysis**, because it **ignores** **everything other than the as-planned schedule.**

- ❖ It would **overstate the delay**, if any, associated with the **inserted delay**.
  - ✓ **Years of experience analyzing impacted as-planned analyses** have **confirmed** this judgment.

- ❖ **Employing** an **impacted as-planned analytical technique** is **flawed** and to be **avoided**.

Impacted as planned analysis – Weaknesses

❑ Example: Court decision

❖ Taken together, **these decisions** have an **important message**:

When analyzing delays, it is important to evaluate Project events relying on the documents in use on the Project at the time the delay occurred.

❖ In **summary**, the **only valid perspective** for the analyst is to adopt a **view of the Project contemporaneous** to the delay itself—**not from the beginning** of the Project or the **end of the Project**.

Impacted As-Planned (IAP)

(Conclusion)

Impacted as planned analysis – Conclusion

❑ Pros and Cons:

- ✓ **Simplest** and **low** in terms of **time** and **cost**
- ✓ **Only** requires **as-planned schedule** or original plan
- ✓ **Could be** used for **contemporaneous** schedule (**prospective delay impact**)
- × **Static analysis** (**prospective critical path**)
  - ❖ Assumes that **critical path never shifted**
- × It does **not consider actual progress** and **changes (hypothetical)**
- × **Subjective** because it is **one-sided:** typically **only** considers **owner delays** and does not consider contractor delays
- × **No consideration** of **true concurrent delays**
- × **Typically rejected** by the **courts**, **panels**, and **boards**

Impacted as planned analysis – Conclusion

❑ When to use?

1. Useful as **negotiation tools** when,

   for whatever reason, more in-depth and detailed methods of analysis are ruled out or **not available** to the parties.

2. If a **pre-agreed daily rate** for prolongation is available, accounting for **compensable delay** in a cumulative,

   combined and **forward-looking manner is also possible** using the **IAP modelling approach**.

Impacted as planned analysis – Conclusion

❑ When to use?

- ✓ The as-planned **logic** was accurate
- ✓ The as-planned **durations** were accurate
- ✓ The **delay events** were recorded

1. **As prospective analysis when:**
   - ✓ I usually **do not recommend** to use it, however
     - ➢ *If time and budget for the analysis is **very limited** and the **accuracy** of the outcome is **not that important***
2. **As a retrospective analysis**
   - ✓ I **do not recommend** to use it, unless
     - ➢ **Contractor followed** the as-planned logic or there is **no as-built data**
     - ➢ Both the owner and contractor **agree to use** this procedure

Time Impact Analysis (TIA)

Time impact analysis

❑ Definition

- ❖ **Invented immediately** after **CPM scheduling method** (maybe 1950) and developed in the early 1980s.
- ❖ **Two** forms:
  1. Contemporaneous analysis = **prospective** method
     - ✓ **Originally** developed for **prospective analysis**
  2. After-the-fact analysis = **retrospective** method
- ❖ They are very similar – **SCL prospective** and **AACE retrospective**
  - ✓ The **application** of this method in **post-contract dispute resolution** is deeply **questionable**.
    - o **Proponents** of **SCL Protocol** does **not appreciate this view**.

Time impact analysis

❑ Definition

❖ **TIA** is **more effective** as a **forward-looking tool** than as a **backward-looking** (or forensic) tool.

✓ This is partially **due to** the ability of the **Owner** to

1. **Forecast** and **respond** to the **results** of the analysis and
2. **Minimize** the **cost impacts** of a delay.

➢ **However**, **TIA** is an **acceptable** and **useable** tool for the **determination** of the **effects** of a **past delay** when employed for **forensic analysis**.

*The **longer the period** between the **delay** and the **approval of the TIA**, the **less useful** and **valid** the **TIA becomes**.*

Time impact analysis

❑ Definition

- ❖ This **TIA prospective practice** concerns itself with **time aspects**,

  not cost aspects of projects.

- ❖ The **time impact must** be **quantified prior** to **determining any cost** implications.
- ❖ **Linking time** and **cost** into **one analysis** implies that **time impacts** are a **function of costs**,

  which for the purposes of a prospective TIA is **not true**.

- ❖ **Separating time analysis** from **cost analysis** makes TIA inherently **easier** to accomplish and accept contractually.

Maintaining a set of timely, accepted, schedule updates is very important to the TIA success.

Time impact analysis

How to use (general steps)?

1. Identify **contemporaneous schedule** (**contemporaneously updated baseline schedule**)
2. Update the schedule, if necessary, to date of the change
   - If an **updated schedule** is not available,

     update the baseline schedule with **current progress information**.
3. Insert **delay event sub-networks (fragnet)** into a **update schedule**
4. **Recalculate CPM** using CPM programming software
5. **Determine** the **impact** **of** sub-networks (fragnet) have on the **predicted contract completion dates** shown **within** the **update schedule**

This is done on "Updated Schedule"

Time impact analysis

Example

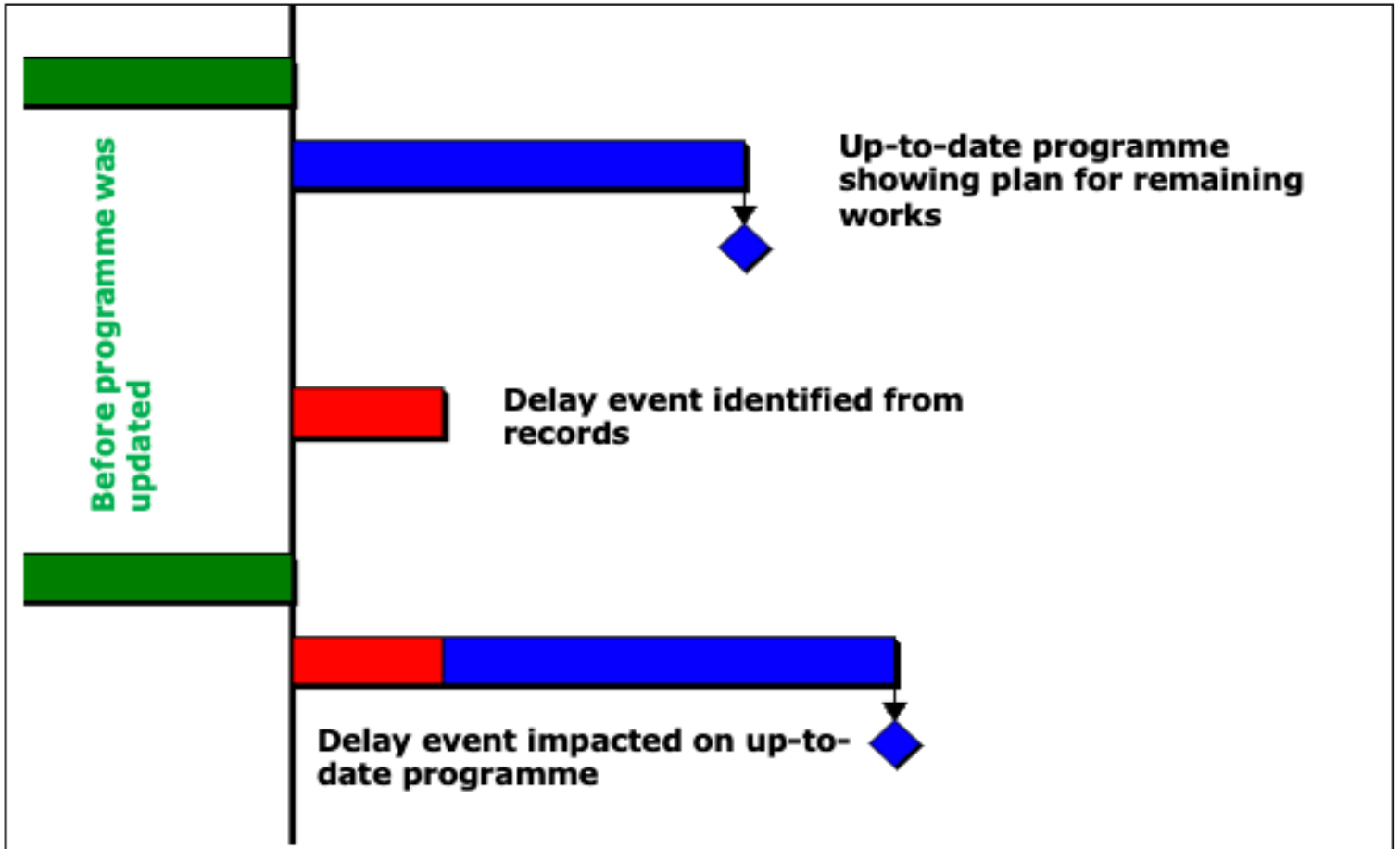
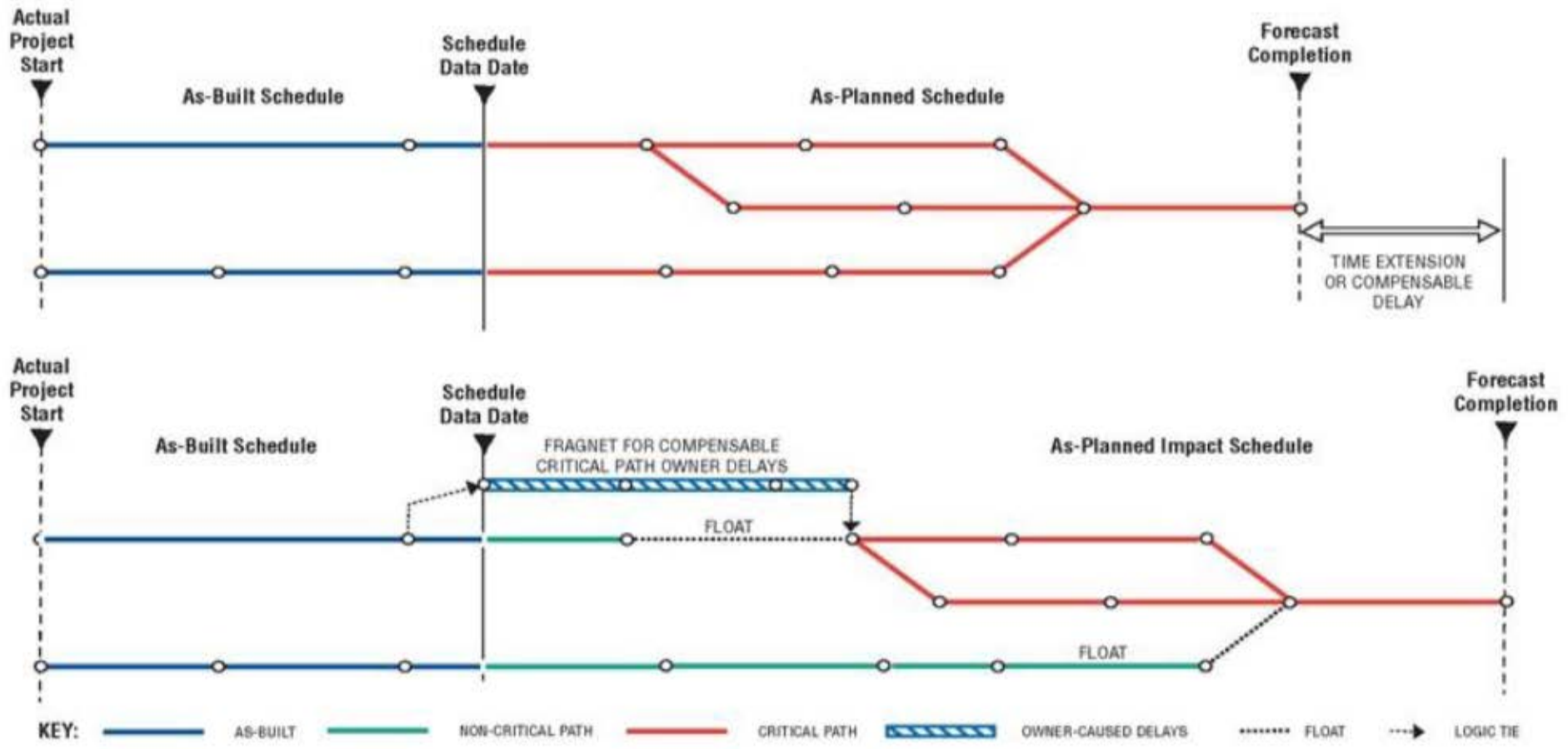


Diagram illustrating the Time Impact technique.

Time impact analysis

❑ Example



Time impact analysis

Pros and cons

- ✓ It is **recommended** by **SCL CP 4**.
- ✓ **Dynamic analysis** (**contemporaneous critical path**)
- ✓ **Can** be used for both **contemporaneous** and **after-the-fact** schedule (**prospective and retrospective delay impact**)
  - × It is the most **time-consuming** and **costly** method when performed **forensically**
- ✓ It **considers actual progress** and **changes** (**not hypothetical**)
- ✓ **Subjectivity** is **eliminated** or **reduced** (**because of day to day analysis**)

Time impact analysis

❑ Pros and cons

× It **requires** a **detailed data** to analyze

× **High** in terms of **time** and **cost**

× **Requires** reliable periodic **schedule updates**

× **Typically** does **not consider** **concurrency** unless **functional theory** is considered

× **Subjective**, **when** only the delays of **one party are considered**, because the method cannot account for delays that are **not inserted**.

1. If **updated up** to the fragnet and
2. If **functional theory** is considered,

subjectivity **reduced**.

× **Susceptible to manipulation** when actual or as-built durations are compared to estimated durations

× **Extremely sensitive** to

1. Order of fragnet
2. Logic insertion

Time impact analysis

❑ When to use?

- ❖ When **project** is **ongoing** (prospective analysis)
- ❖ When **time** is really important for the project
- ❖ When there are
  1. **Logic linked baseline** schedule
  2. **Delay events** to model
  3. **Contemporaneous schedules** with process information

TIA is more or less acceptable and useable for the determination of delay impacts under some circumstances.

Let's see!

Time impact analysis

❑ When to use?

1. **More useable**

a) Frozen work plan

- If the **contractor** has **not** been **given** the **right** and is **not able** to **redeploy** his **work force** in order to **resume the work**, then the work plan is said to be **"frozen"** and **TIA** can be very **useable**.

b) Forward looking

- The **tendency** for parties to **wait and observe** the **actual durations** is in **conflict** with the **primary purpose** of **timely resolution in TIAs**.

c) Short duration of delay

- **TIAs** are **intended** to model delays of **less than one reporting period**.
- **If longer periods** are **considered**,
  then an **additional step** (**detailed later**) must be considered to **address** the **legal requirement** and **natural tendency** of the Contractor to **mitigate** any delays where the mitigation **does not** involve **additional costs**.

Time impact analysis

❑ When to use?

2. **Less useable**

a) The more your schedule update does not reflect actual conditions at the time of the delay

- The **longer time period** between the **updated schedule** and when the **delay started**.
  - ✓ It is because **more conditions** will have **changed** between times.

b) The less linear of the work plan

- **Work plans** with **more physical constraints** are **harder** than work plans with **resource constraints** that can be **allocated** to **mitigate**.

c) If more mitigation was accomplished during the delay

- This is **opposite** of a **"frozen" work plan**.
- The **more work** performed **"out-of-sequence,"**
  the **more effort** performed by either owner or contractor to **reduce** the **effects of a delay**, and
  the **less effective** a **TIA** due to **many changes**.

Time impact analysis

❑ When to use?

- ❖ The product of this method of analysis is a conclusion as to the **likely delay** of the **modelled delay events**

  on the programme/critical path that is m**ost reflective of the contemporaneous position** when the delay events arose.

- ❖ This method usually **does not capture** the **eventual actual delay** caused by the delay events as **subsequent project progress** is **not considered**.

Time impact analysis

❑ Guide to the TIA

1. **List all identified delay** events in a table:
   - ❖ Duration
   - ❖ predecessors
   - ❖ successors
   - ❖ commencement date (when the event was first identified or first had an effect on the work).

Time impact analysis – Practical procedure: Stage 2

2. **Assess** the **liability** for **each delay event** based on circumstances, risks and **contractual obligations**.
   - ❖ Who is responsible (EDE, CDE, or concurrent)
     - ✓ EAS and delay register sheets

Why CDE is also considered?

Time impact analysis – Practical procedure: Stage 3

3. **Obtain progress data** for **all activities** in the programme at the **point immediately prior to (or as close as reasonably possible to)** each **subsequent delay commencement date**.

Why prior to or as close as possible?

Time impact analysis – Practical procedure: Stage 4

4. **Create** a **series of TIA** base programmes by either:
   a) **Based on the time of schedule update:**
      - **Relying** on updated contemporaneous progress programmes closest to **each commencement date**
        - *This is a 'contemporaneous update TIA'*
   b) **Based on the time of each delay occurs:**
      - **Identifying** the contemporaneous **progress** programmes closest to the **date of each delay event** and
      - **Updating** each of those programmes with **progress data** up to the **point immediately prior** to the commencement date of each delay event.
        - *This is a 'chronological event analysis'*

In which one concurrent delays cause problem?

Time impact analysis – Practical procedure: Stage 4

4. **Create** a **series of TIA** base programmes

Note:

***Prior** to **determining** the **effect** of an employer risk event on the **updated schedule**:*

1. ***Any unreasonable penalty***
2. ***Unrealistic logic***
3. ***Unrealistic constraints***
4. ***Unrealistic durations***

Should be corrected by agreement

Time impact analysis – Practical procedure: Stage 4

4. **Create** a **series of TIA** base programmes

❑ **Constraints:**

- **Constraints not required** by **contract** and **not included** in the **Accepted Baseline Schedule** should **not** be included in the **analysis**.
  - **Non-contractual constraints** should be **removed**.
  - **Contractual constraints** should be **reduced** to the **least restrictive**, **before** proceeding to the **next step**
- **Other constraints** may be considered on a **case-by-case basis**, but this should be **fully documented**.

Time impact analysis – Practical procedure: Stage 4

4. **Create** a **series of TIA** base programmes

All contemporary evidence** should be **submitted** to ensure that **any resulting EOT** is both **reasonable** and **consistent** with the **factual circumstances.

Remember the records and documents mentioned in previous section?

What if CA and contractor disagree?

Time impact analysis – Practical procedure: Stage 4

4. **Create** a **series of TIA** base programmes
   - ❖ **CA's view** should **prevail** unless and until overturned under the contract dispute resolution Provisions (SCL).

Time impact analysis – Practical procedure: Stage 5

5. **Tabulate**

   a) **Data dates**

   b) **Projected completion date**

   of **each of the base programmes prior** to **inserting** any of the **delay events**

   i. Copy

   ii. Rename

   iii. Save each of the base programmes for impacting

Time impact analysis – Practical procedure: Stage 6

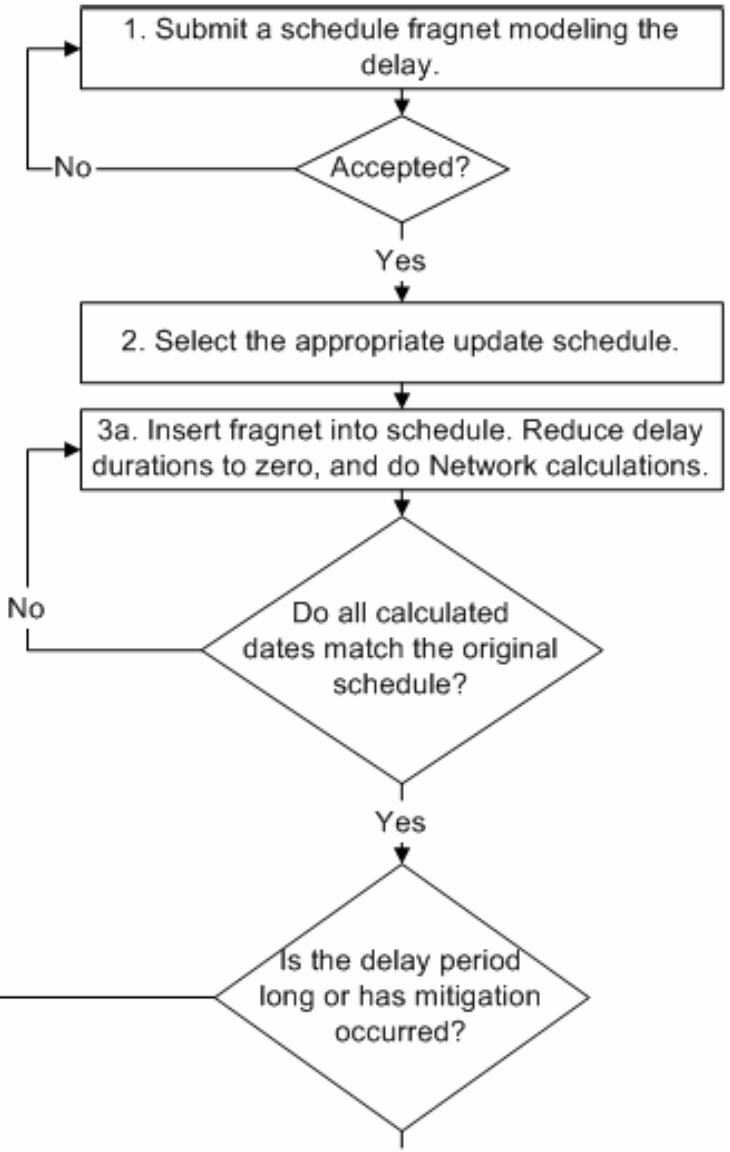
6. **Convert each delay event to a new subset of activities (Fragnet)**
   a) **Estimated durations**
   b) **Identified predecessor activities**
   c) **Identified successor activities**
   d) **Commencement date** (when the event was first identified or first had an effect on the work).

When using retrospectively, the analyst has the option of using as-built durations for the "fragnets."

How to continue from this step?

Time impact analysis – Practical procedure: Stage 7

- **TIA Flowchart**
  - **Recommended by AACE 52R-06**
- **My experience**
- **Book written by Caletka**
- **Book written by Trauner**



Time impact analysis – Practical procedure: Stage 7

- TIA Flowchart
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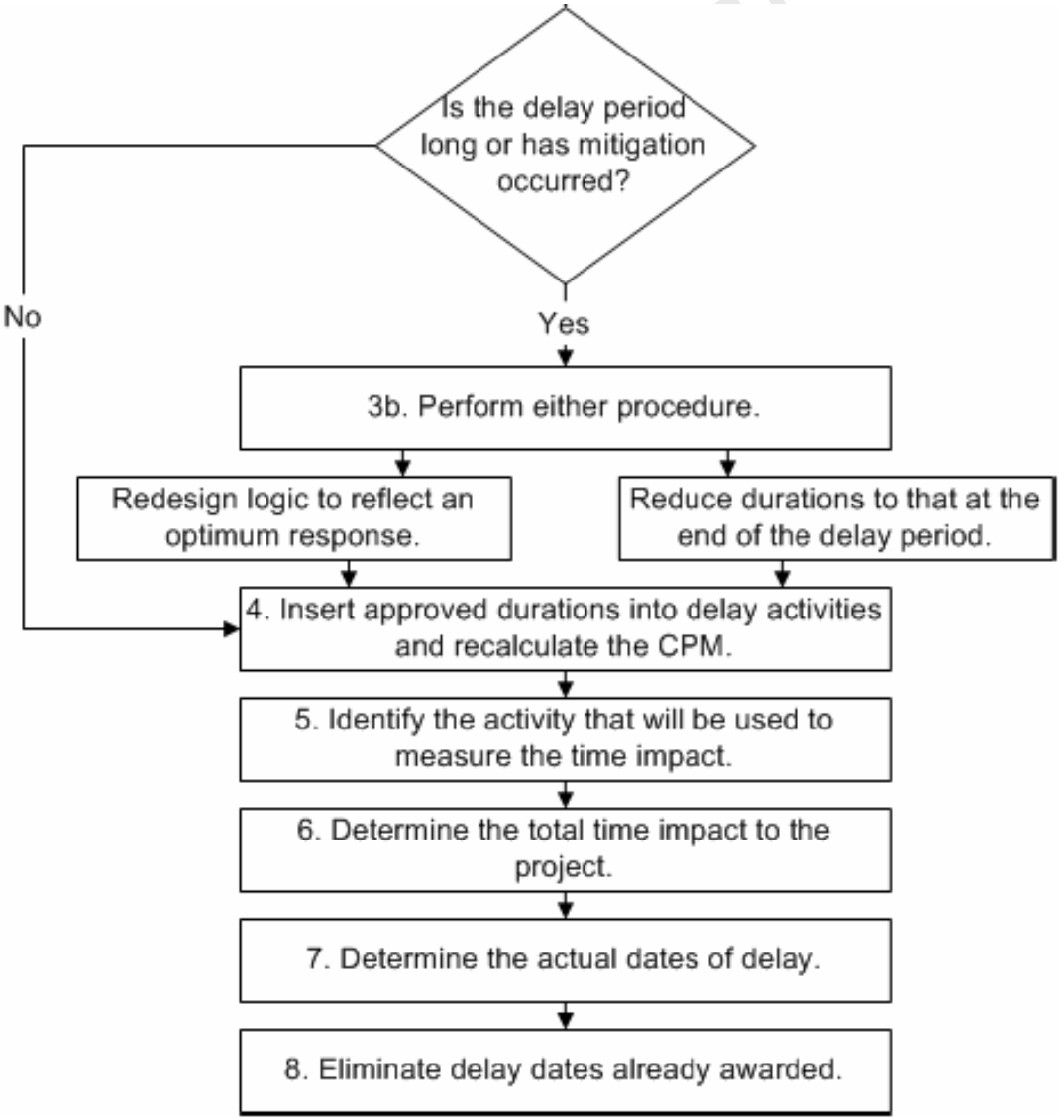
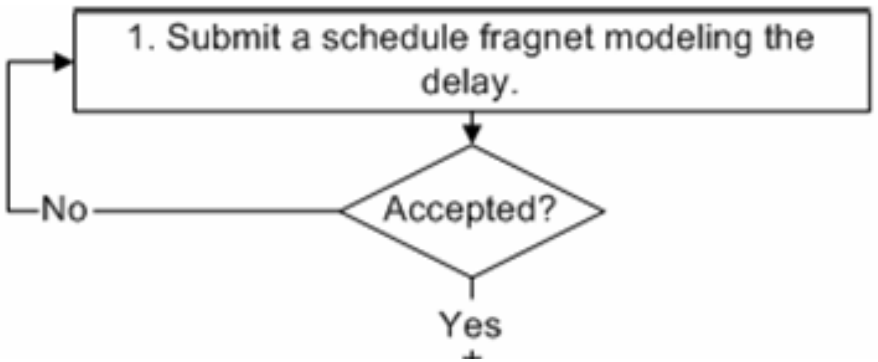


Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

Let's first look at fragnet!



Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

❖ **Fragnet** can be the **result of:**

1. Change order
2. Specific portion of the existing CPM

Many **private** and **public Owners** require **Contractors** to use **fragnets** to express, in a **CPM format**, the activities associated with **change orders** and use this to **request time extensions**.

The **U.S. Army Corps of Engineers**, the **Department of Veterans Affairs**, and the **Florida Department of Transportation** are just a few of the **public owners** that require **contractors** to use **fragnets**.

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

❖ Fragnet disadvantages:

✓ The **two biggest disadvantages** are:

1. The **time** it takes to **develop** and **negotiate** a fragnet
2. **Determining** into **which CPM update** the fragnet should be **inserted**

You should establish the date on which the change directive was issued or delay initiated.

Why?

Because the deadline would be set from the time that

1. **Change directive issued or**
2. **Delay initiated**

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

❖ Fragnet disadvantages:

1. **The time it takes to develop and negotiate a fragnet**

- ✓ **Many contracts** allow the Contractor **30 calendar days** to provide its **change order proposal**.
- ✓ **Once** the **proposal** has been **received** and **reviewed**, it may take an **Owner several weeks** before it is prepared to **negotiate** the **costs** and the **time**.
- ✓ The **negotiations** themselves may take **several weeks** depending on the **amount in question** and the **support** provided by the **Contractor**.
- ✓ Therefore, it **could** be **more than two months after** the **Contractor** was directed to **perform the work** that the parties **agree** upon the **fragnet**.

In many instances the parties do not agree, and time is not discussed until the end of the Project.

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

❖ Fragnet disadvantages:

2. **Determining into which CPM update the fragnet should be inserted**

✓ The **fragnet** should be **inserted** into the **CPM update** that was in **effect at the time:**

1. **Change** was **issued**
2. **Both parties understood** that there **was a change**
3. **Contractor began** its **work related** to the **change**

Whichever was the earliest!

In addition to using a fragnet to analyze change orders,

CPM fragnets are also used to evaluate delays to:

1. **Specific features of work**
2. **Specific subcontractor's work**

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

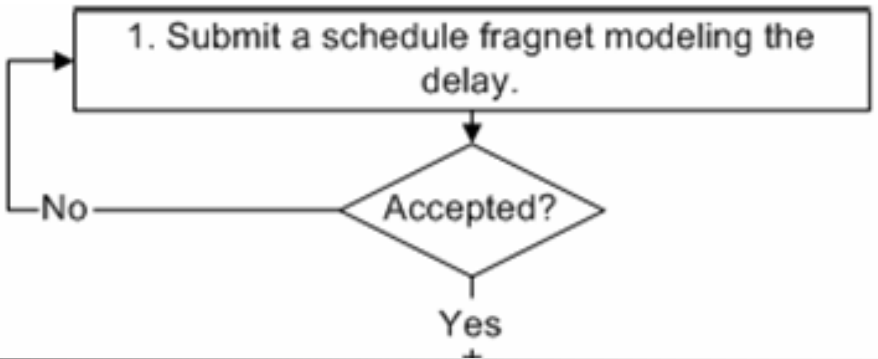
What is the recommended procedure to submit a schedule fragnet?

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

1. The **contractor** should **submit** a **sub-network** (also called a **"fragnet"**) **showing:**
   - ❖ **Actual** or **anticipated** **effect** of the **employer risk event**
   - ❖ **Employer risk event linkage** into the **updated schedule**

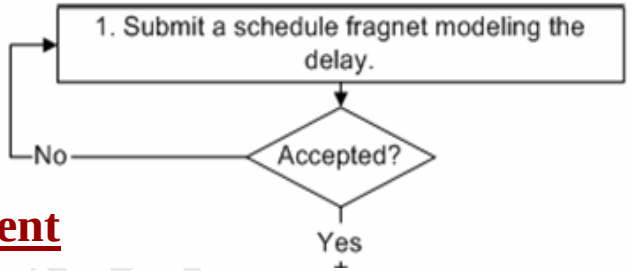
     to the **CA for agreement**.
   - ❖ The **sub-network** should be **prepared** by the **contractor**:
     a) In the **same manner** as the **accepted schedule**
     b) Using the **same software** as the **accepted schedule**



Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

1. The **contractor** should **submit** a **sub-network** (also called a **"fragnet"**)



❖ It should **consist of**:

a) **Activities** resulting **employer risk event**

b) **Durations** resulting from the **employer risk event**

✓ **For example**, the sub-network for a **variation (change order from owner)** should consist of:

I. **Instruction** for the **variation**

II. **Activities** required to **carry out that variation**

III. **Variation linkage** to the **activities in the updated schedule**

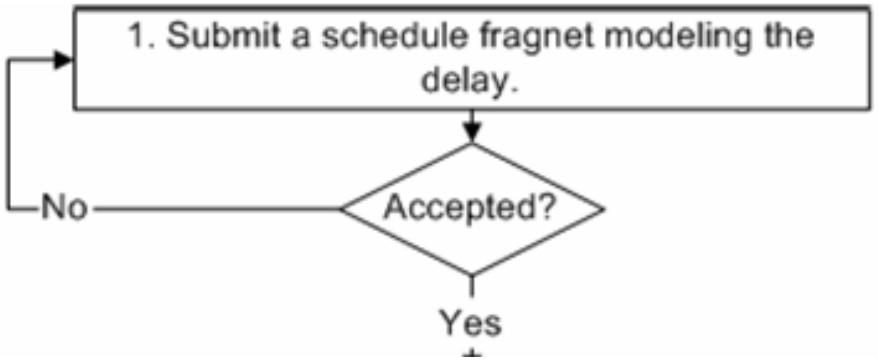
Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

1. The **contractor** should **submit** a **sub-network** (also called a **"fragnet"**)

❖ Use the **fewest number** of activities and **relationships**

❖ **Added activities** should be **numbered** in a **logical manner** to make it **easy** to **distinguish** them as **new activities** associated with the **delay**



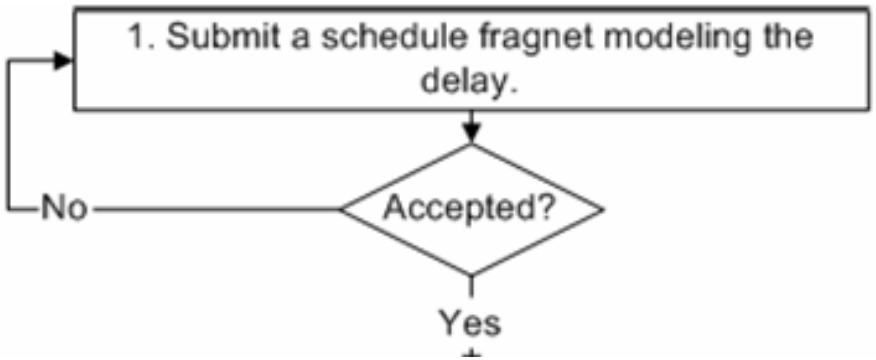
Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

1. The **contractor** should **submit** a **sub-network** (also called a **"fragnet"**)

❖ **Newly created activities** should be **consistent** with the **original baseline programme requirements**.

✓ For instance, the **contract specification** may have required the **duration of each programme activity** to be **less than 15 days**.



What should be done if delay event exceeds the duration of several windows?

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

1. The **contractor** should **submit** a **sub-network** (also called a **"fragnet"**)

❖ If the duration of a delay event **exceeds** the **duration of several windows**, the analyst should attempt to **break** the impact down to **several events**

Why this may cause a problem?

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

1. The **contractor** should **submit** a **sub-network** (also called a **"fragnet"**)

❖ Inserting **fragnets** with **excessive durations** (spanning **several updating cycles**)

1. Will effectively **override progress** achieved during that **entire period**
2. Will **not allow** to account for any **delays** due to
   - ✓ Concurrent events,
   - ✓ Lack of progress or
   - ✓ Logic changes

   Implemented in the relevant monthly updates.

Now you may know why this analysis is time-consuming?

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

1. The **contractor** should **submit** a **sub-network** (also called a **"fragnet"**)

❖ **Breaking events** into **bite-sized chunks** for analysis is one of the reasons the TIA approach is known as being **labor intensive and technically complex**.

- ✓ *The longer the fragnet, and*
- ✓ *The longer the duration between each base programme,*

*the **more prospective** and **theoretical** the results will be.*

Let's see an example!

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

1. The **contractor** should **submit** a **sub-network** (also called a **"fragnet"**)

❖ If the duration of a delay event **exceeds** the **duration of several windows**, the analyst should attempt to **break** the impact down to **several events**

a) For example, the fragnet (access manhole to a pipeline issued in May) is **68 working days** or 95 calendar days.

b) The impact represented over a period of **three updating cycles** (May, June, and July) assuming **monthly updating cycles**.

Time impact analysis – Practical procedure: Stage 7

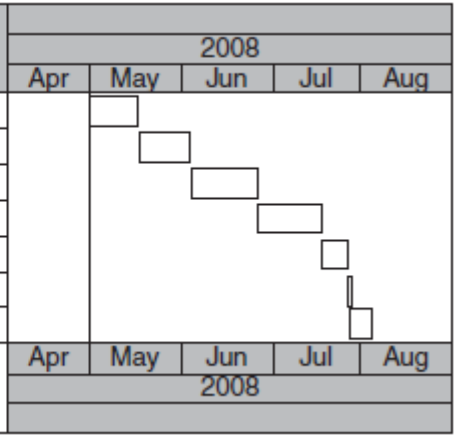
❑ STEP 1: Submit a schedule fragnet modeling the delay

1. The **contractor** should **submit** a **sub-network** (also called a **"fragnet"**)

❖ It may be appropriate to break the fragnet into three discrete base programmes:

- ❖ X100 and X200 in May
- ❖ X300 and X400 in June
- ❖ X500 and X600 in July

Activity ID	Description	Original duration
×100	Engineer issues revised design requirements	10
×200	Prepare and submit shop drwgs for approval	14
×300	Engineer - Review and Approve Drawings	14
×400	Formwork, embedment and reinforcing steel	16
×500	Place concrete and curing period	9
×600	Strip formwork	1
×700	Remove seal and re-test pipeline	4



Time impact analysis – Practical procedure: Stage 7

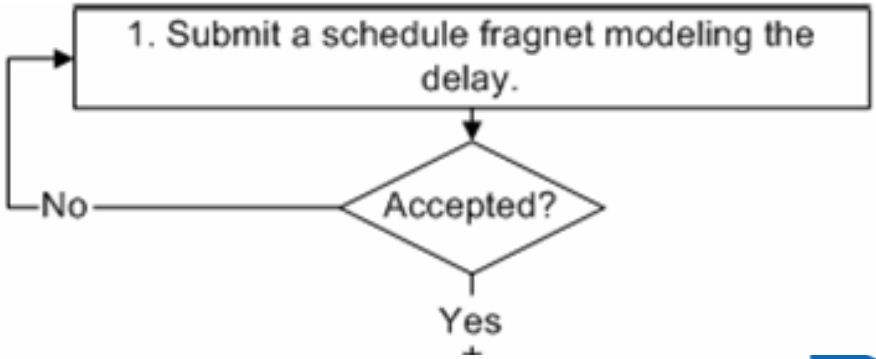
❑ STEP 1: Submit a schedule fragnet modeling the delay

2. The **CA** should **consider** the **sub-network** and, **if agreed**, the **sub-network** should be **inserted** into the **contractor's updated schedule**.

   ❖ **CA** should **consider whether** the **claimed event** or **cause of delay** is an **Employer risk event or not**.

   a) Should be on **critical path**

   b) Can be considered as **Excusable or owner/designer delays**



What if the CA concludes that the event or cause of delay is not an Employer Risk Event?

Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

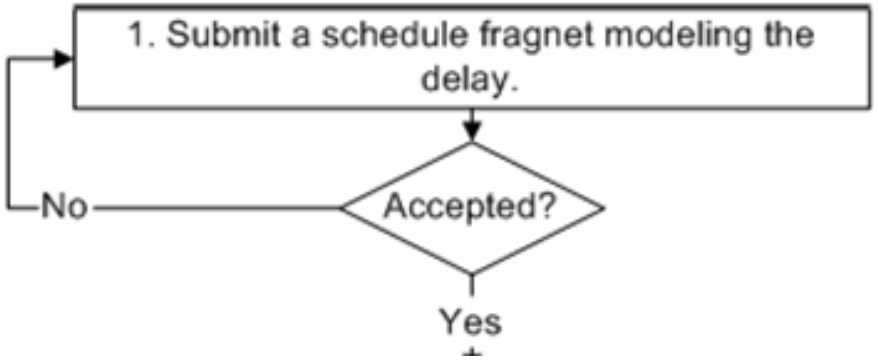
2. The **CA** should **consider** the **sub-network** and, **if agreed**, the **sub-network** should be **inserted** into the **contractor's updated schedule**.

   - ❖ If the **CA concludes** that the event or cause of delay is **not an Employer Risk Event**,

     the CA should so **notify the Contractor**.

   - ❖ **Any disagreement** about the **sub-network** should be **resolved quickly** and (**like all delay issue**) **not left until after completion**.

   - ❖ **Without prejudice** to that, the **CA may wish to comment** on **other aspects** of the Contractor's submission.



Time impact analysis – Practical procedure: Stage 7

❑ STEP 1: Submit a schedule fragnet modeling the delay

❖ Cost Considerations:

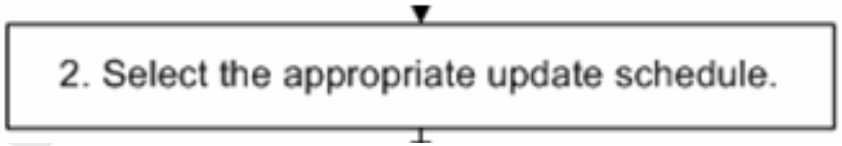
- ❖ **Costs** should be **separated** and **impacted fragnet** should **first** be **isolated** from the schedule to be **analyzed**
- ❖ **Owners** who **claim** that they **cannot approve** a fragnet **until** they know the extent of the **impact on project completion** are **trying** to **make time** a **function of costs**.
  - ✓ This is **not true** and the **time impact** is a function of **impacting activity**.
  - ✓ The **time impact** is a **function** of the **impacting activity.**

The owner should review and approve the step considerations in order to approve the TIA

Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

- ❖ The **appropriate accepted schedule** should be the **last owner-accepted schedule** and **updated prior** to the time of the **change** or **delay**.
- ❖ The **schedule** to be **impacted** is called, the "**original schedule update**."
- ❖ This **sub-network** is **inserted** into that **updated schedule** which was **submitted** by the **contractor as close as possible** to the **date of the Employer risk event**
  - ✓ **Most recent updated schedule**, if **none**, **accepted schedule**.
- ❖ The **baseline schedule** should be used if the **delay began** prior to the **first schedule update.**



Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

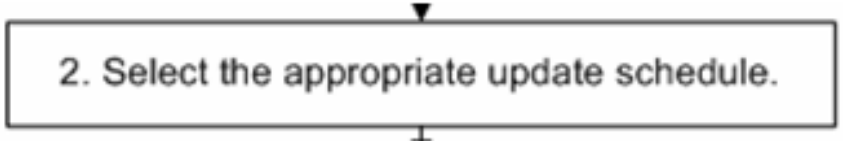
❖ Steps provided by SCL Protocol

a) Programme should be brought **fully up to date** (as to **progress** and the **effect of all delays** that have **occurred up to that date**,

whether Employer Delays or Contractor Delays to the **point immediately before the occurrence** of the **Employer Risk Event**;

b) Programme should **then be modified** to reflect the Contractor's reasonable, realistic and achievable plans to **recover any delays** that **have occurred**,

including any **changes in the logic of the Updated Programme** proposed for that purpose (subject to CA review and acceptance);



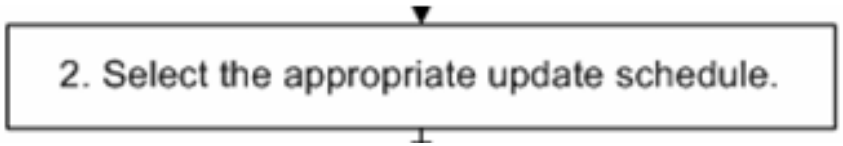
Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

1. **What if the time interval between the start of the delay and the last accepted schedule update is too great?**
2. **What if significant deviation to the schedule was experienced between the last update and the start of the delay?**

❖ The **Contractor** may elect to first provide a **new schedule status** and **update with a status date** immediately **prior** to the **start of the delay**.

❖ **Before** this **new update schedule** is to be **used**, it should first be submitted to the **Owner** for **review** and **acceptance**, just like any other schedule update ***(AACE 52R-06).***



Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

From this point, you will see two types of analysis

Example 1* and *Example 2

Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

- ❖ The delays should be analyzed **before fragnet inserted** into the **current schedule.** This could be carried out:
  a) Once for EDE and separately for CDE, or
  b) Same series of TIA base calculations in a combined model

What if two or more events commence on the same day?

Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

❖ The delays should be analyzed **before fragnet inserted** into the **current schedule.** This could be carried out:

a) One to demonstrate the impact of the EDE

b) One to demonstrate the impact of the CDE

c) One to demonstrate the combined impact of both in the same base programme

✓ The TIA model can also incorporate **'neutral' events** such as force majeure and weather impacts.

o These are treated the same as **concurrent delays** in the TIA model.

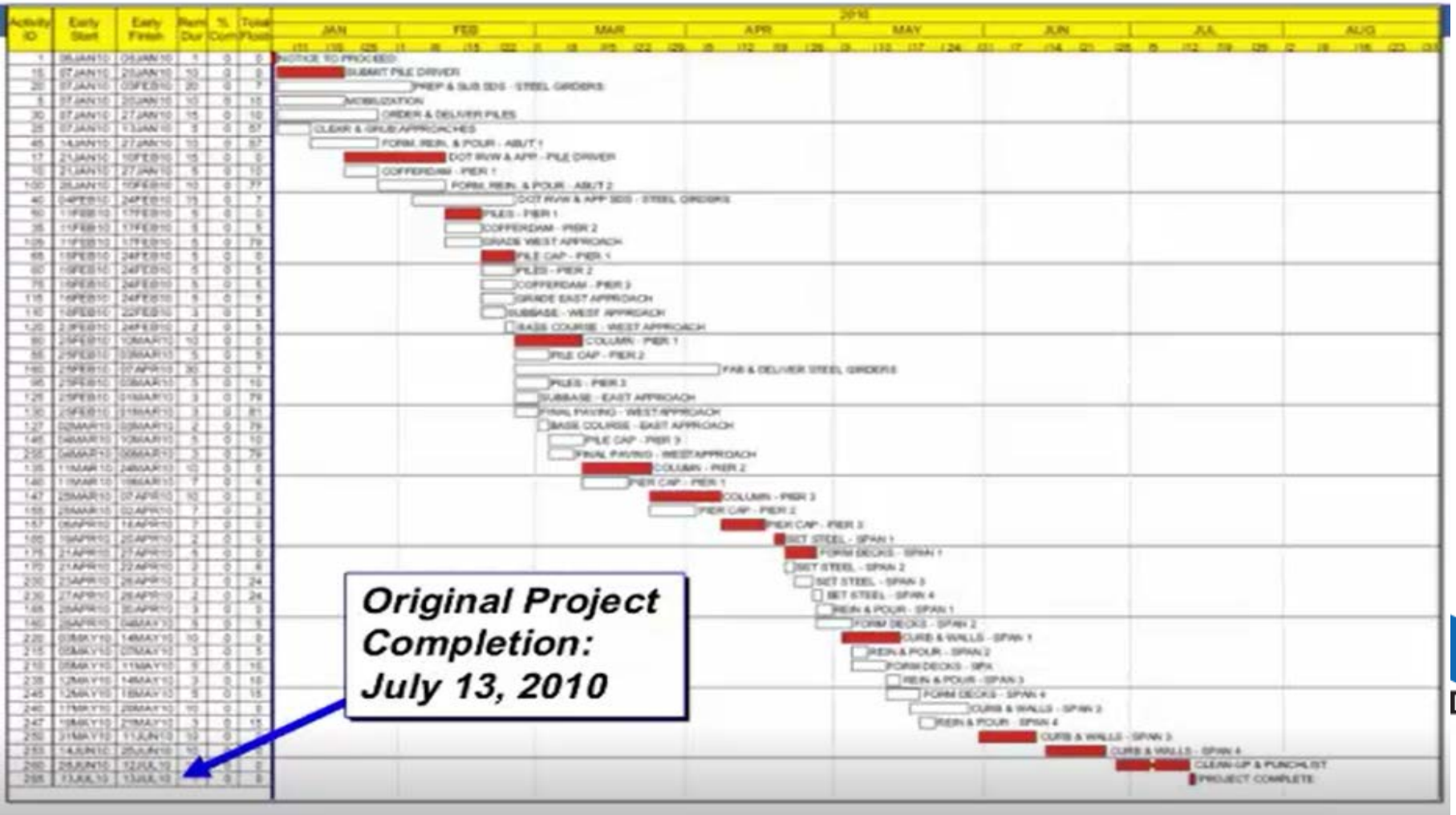
Same as what we did for IAP!

You can also perform step-basis analysis in one model!

Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

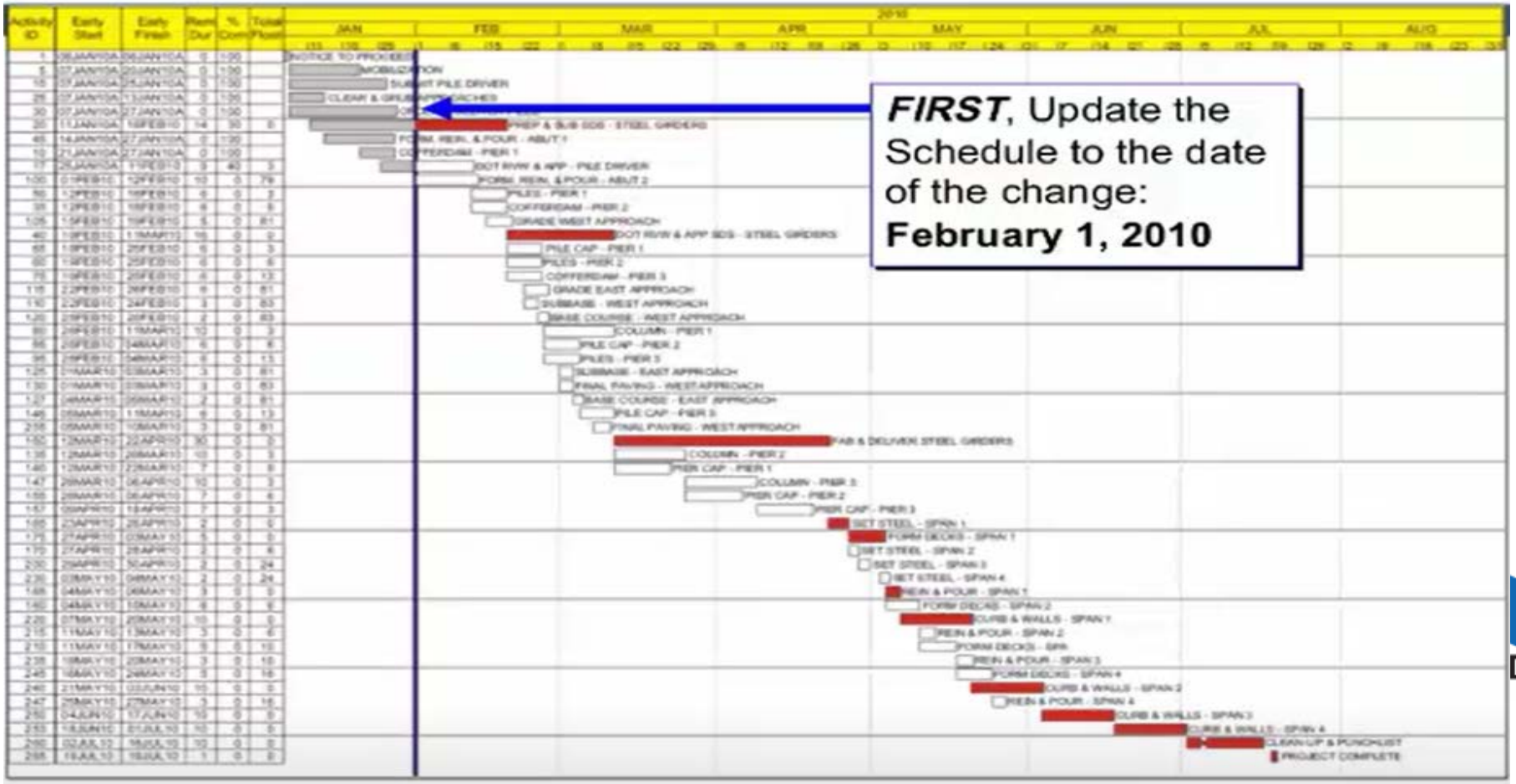
❖ **Example 1:** Baseline schedule



Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

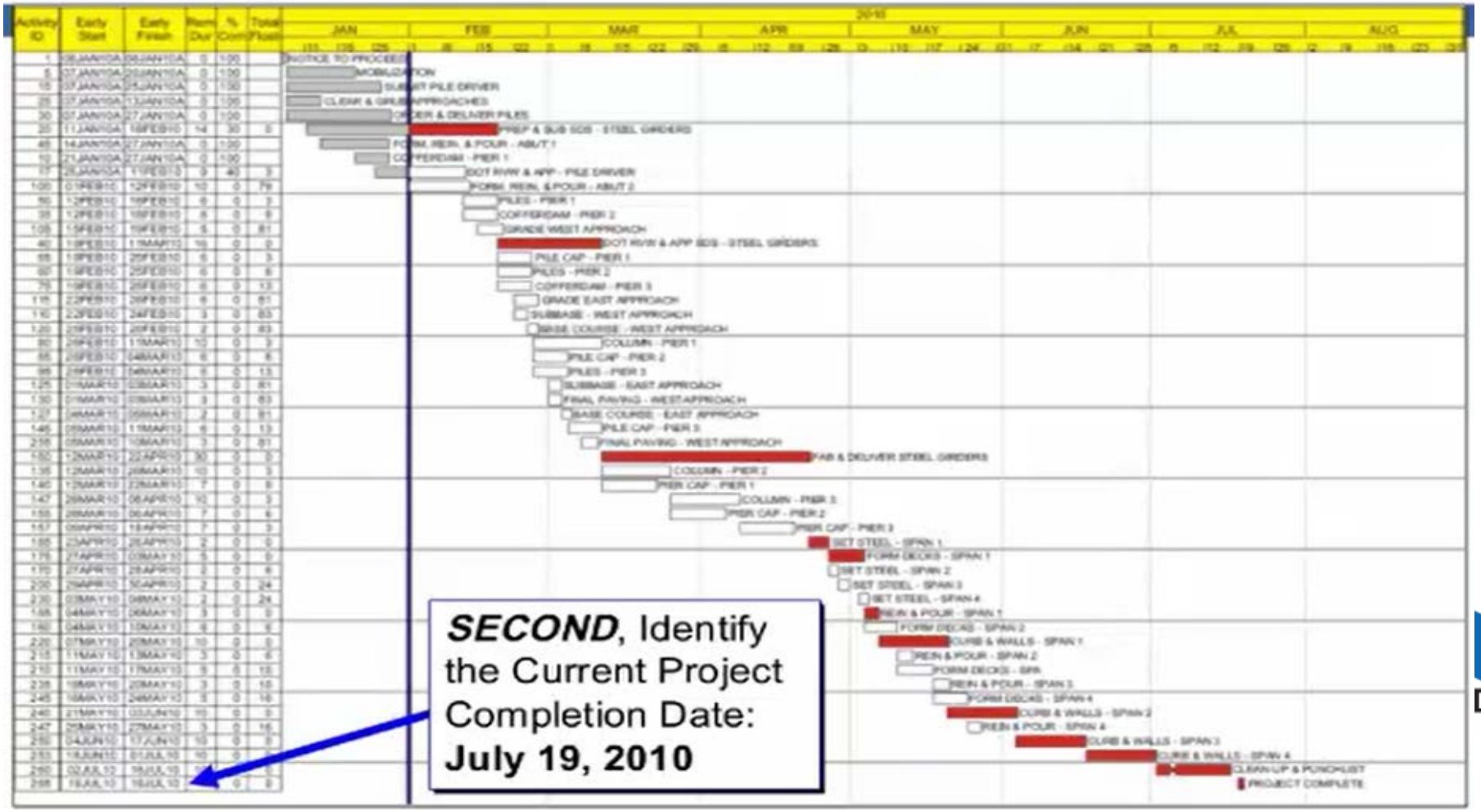
- ❖ **Example 1: Update for change** (**update to date of Feb 1** by putting all actual starts, actual finishes, changes, and durations)



Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

❖ Example 1: Update for change (new completion date - we lost 6 calendar dates)



Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

- ❖ **Example 2:**
- ❖ In this model, there were **five base programmes** relied on.
- ❖ In this model, there are **both EDE and CDE events** analyzed in a **cumulative**, transparent and **forward-looking fashion**, while the 'events' could be **discrete single activities** or **fragnets of several related activities**.

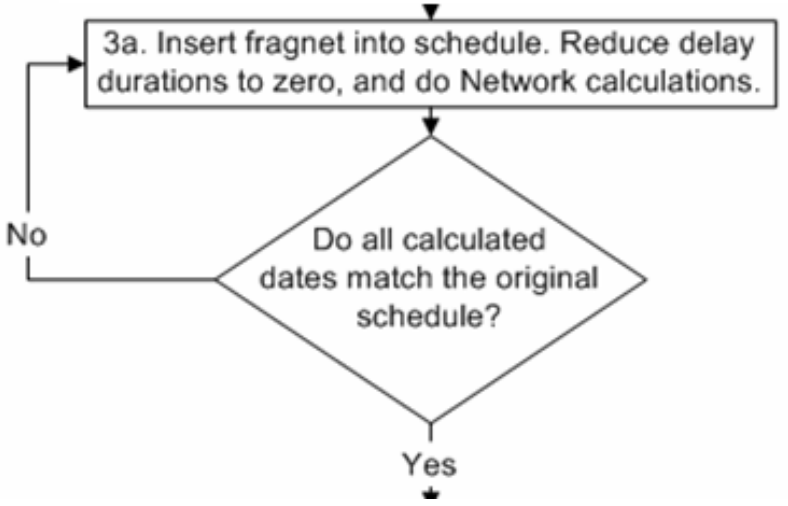
Window 1	is the Baseline to the first update, UD01
Window 2	is from UD01 to UD02
Window 3	is from UD02 to an updated version of UD02 through August 14, 2008 – UD02A
Window 4	is from UD02A to UD03
Window 5	is UD03 to completion

Time impact analysis – Practical procedure: Stage 7

- **STEP 3a: Insert fragnet into schedule. Reduce delay durations to zero, and do network calculations.**

1. **Insert** the **fragnet** into a **copy** of the **current schedule update** prepared as **described**.
2. **Using** the **accepted fragnet** as a **template**, add the **impact activities** and **logic**.
3. **Set** the **duration** of the **delay activities** to **zero** and **recalculate** the CPM.
4. All **computed** and **actual dates** in the **original schedule update** should **match**.

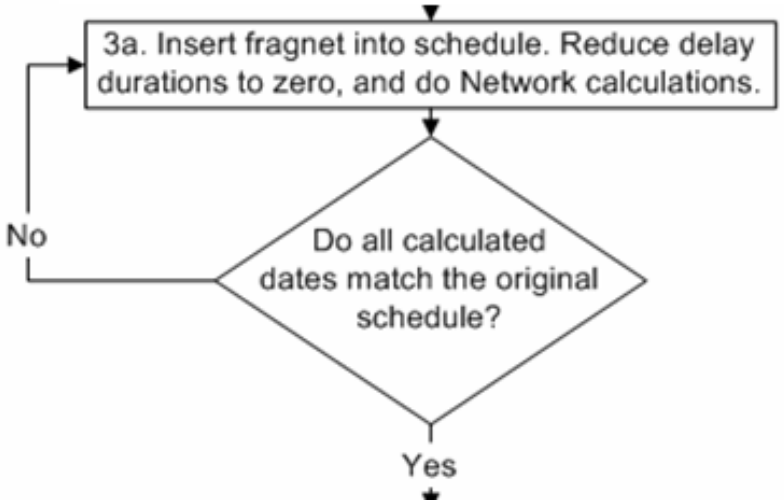
How to insert?



Time impact analysis – Practical procedure: Stage 7

- **STEP 3a: Insert fragnet into schedule. Reduce delay durations to zero, and do network calculations.**

1. It is **acceptable** to add a delay as a **successor to an activity** when in fact, that delay occurred **during the activity** and delayed **its completion**.
2. It is **acceptable** to **split** existing **delayed activity** into **two activities**:
    1. One representing the **portion of the planned work** to be performed **before** delay
    2. Other portion of the **planned work after** the delay



Time impact analysis – Practical procedure: Stage 7

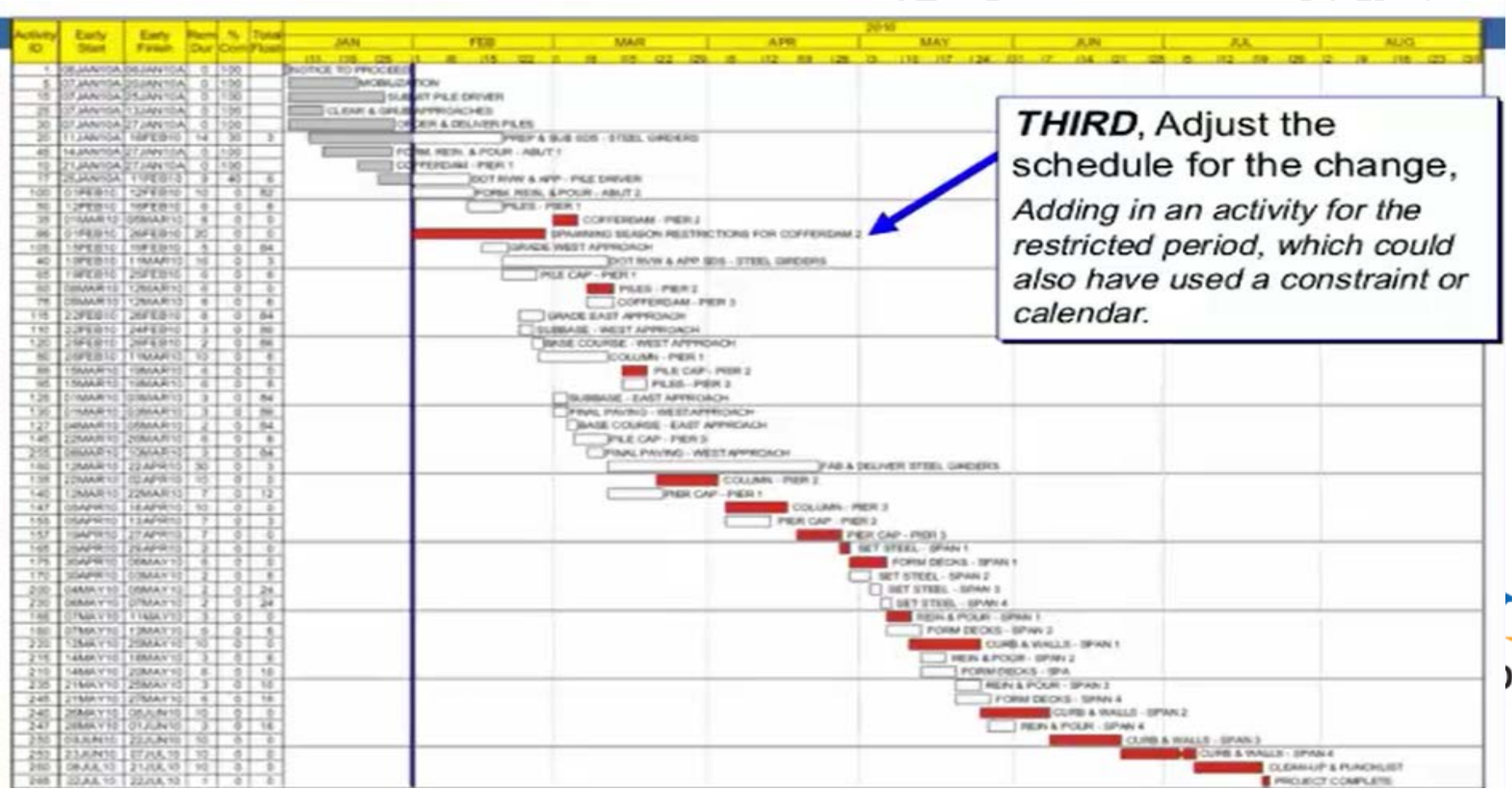
- **STEP 3a: Insert fragnet into schedule. Reduce delay durations to zero, and do network calculations.**
  - **Example 1:** The change

On February 1, the owner informed the contractor that to accommodate the spawning season this year, the project's environmental permit had been modified. The second cofferdam, located in a flowing portion of the river, could not be installed until March.

We know this ahead of time and want to see how it changes the schedule

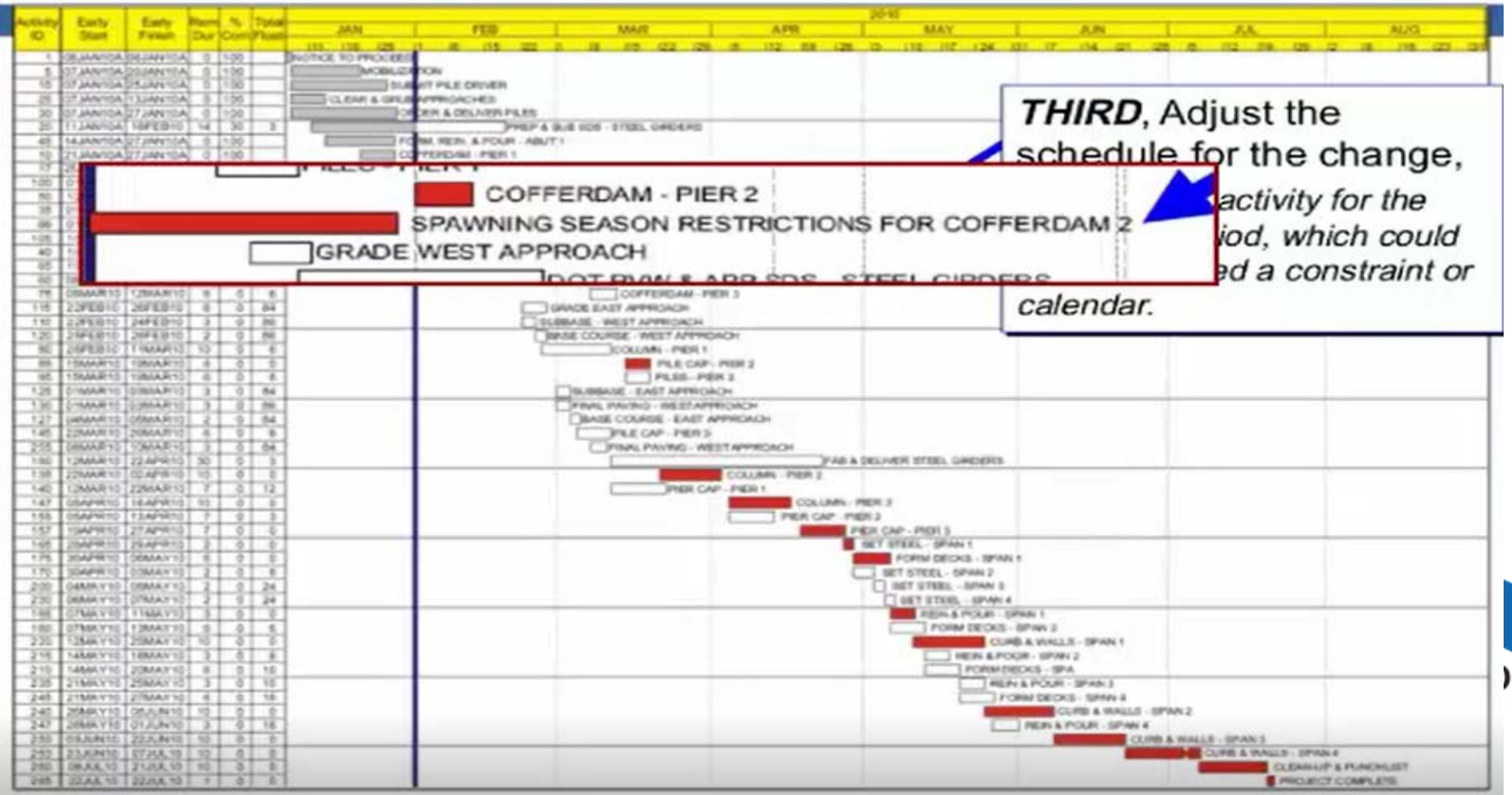
Time impact analysis – Practical procedure: Stage 7

- **STEP 3a: Insert fragnet into schedule. Reduce delay durations to zero, and do network calculations.**
  - **Example 1: Adjust for change** (create **fragnet**, **what activities** do we need, **duration** and **logic**)



Time impact analysis – Practical procedure: Stage 7

- **STEP 3a: Insert fragnet into schedule. Reduce delay durations to zero, and do network calculations.**
  - **Example 1: Adjust for change** (create **fragnet**, **what activities** do we need, **duration** and **logic**)



Time impact analysis – Practical procedure: Stage 7

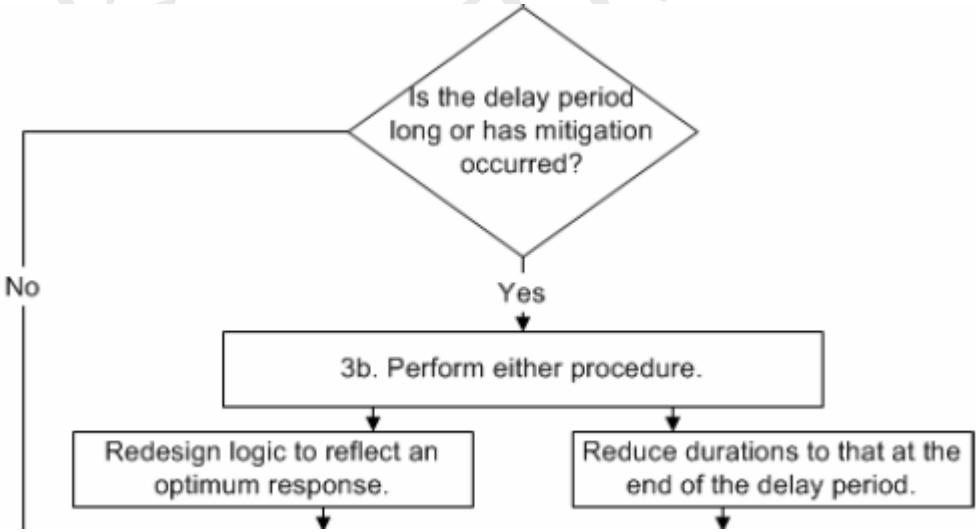
- **STEP 3a: Insert fragnet into schedule. Reduce delay durations to zero, and do network calculations.**
  - **Example 2:**

Event (fragnet)	Event type	Event actual start date	Base schedule	Base schedule data date
			Baseline	1-Jun-08
001	EDE	3-Jun-08		1-Jun-08
002	EDE	5-Jun-08		1-Jun-08
			UD01	30-Jun-08
003	CDE	2-Jul-08		30-Jun-08
004	EDE	2-Jul-08		30-Jun-08
			UD02	31-Jul-08
			UD02A	*14-Aug-08*
005	CDE	15-Aug-08		31-Jul-08
			UD03	31-Aug-08
006	CDE	4-Sep-08		31-Aug-08
007	EDE	7-Sep-08		31-Aug-08

Time impact analysis – Practical procedure: Stage 7

❑ OPTIONAL STEP 3b: Consider the effects of mitigation

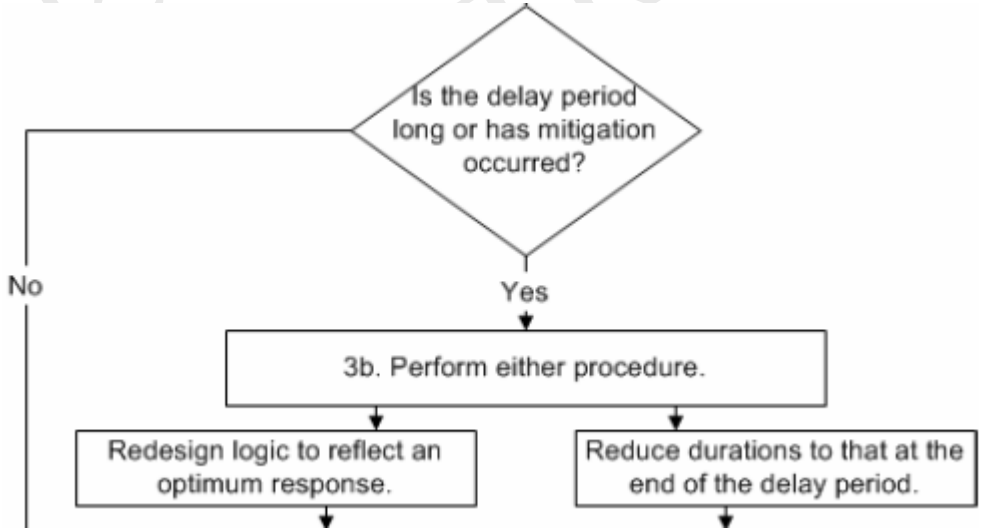
- ❖ **This step** is **necessary** if **mitigation** efforts by either the **owner** or **contractor** have **modified** the **actual impact** of a delay on **project completion**.
- ❖ **Skipping this step** in this circumstance may result in a calculated time impact that **does not closely relate** to the **actual impact**.



Time impact analysis – Practical procedure: Stage 7

❑ OPTIONAL STEP 3b: Consider the effects of mitigation

- ❖ If it is used **after the delay occurred**,
  - ❖ contractor may elect to **revise the remaining duration status** of **every activity** in the schedule to remaining duration status evidenced at the time of the **actual end of the delay**.

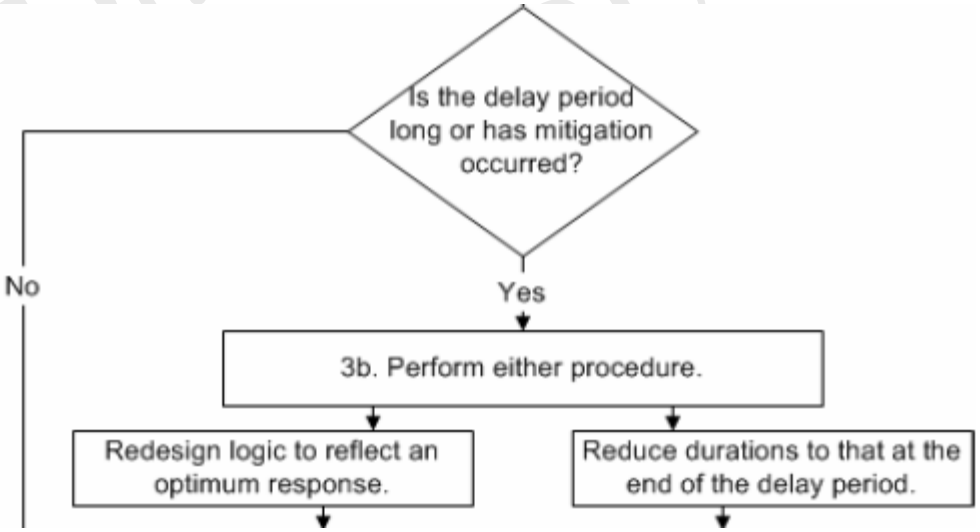


Time impact analysis – Practical procedure: Stage 7

❑ OPTIONAL STEP 3b: Consider the effects of mitigation

❖ If this step is **not implemented**, a **statement** should be provided with the **TIA** to explain **why** this step was unnecessary. Some of the **reasons** may be:

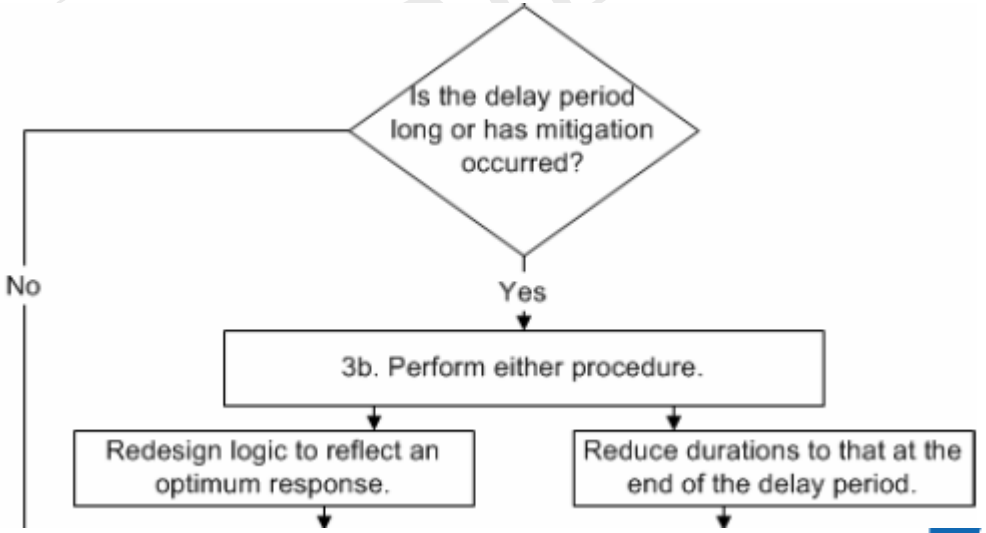
- ✓ A frozen work plan
- ✓ Forward-looking impact analysis
- ✓ Shortness of duration of the delay



Time impact analysis – Practical procedure: Stage 7

❑ OPTIONAL STEP 3b: Consider the effects of mitigation

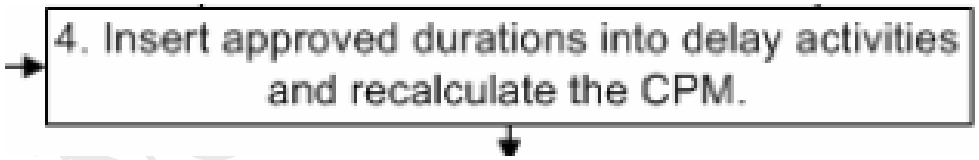
- ❖ **Whatever changes** made to the schedule to satisfy the **Step 3b requirements**, should be **fully documented** and included as **part** of the **TIA submittal.**
  - ✓ These **changes** are subject to **review**, **negotiation**, and **acceptance** by the **owner**.



Time impact analysis – Practical procedure: Stage 7

❑ STEP 4: Insert approved durations into delay activities and recalculate the CPM

1. **Insert** the **durations** used in the **fragnet** into the **added delay activities** and **re-compute the CPM**.
2. The **calculated change** to the **completion date** (loss or gain) for each successive delay event is **tabulated** and **inserted chronologically** into the table.



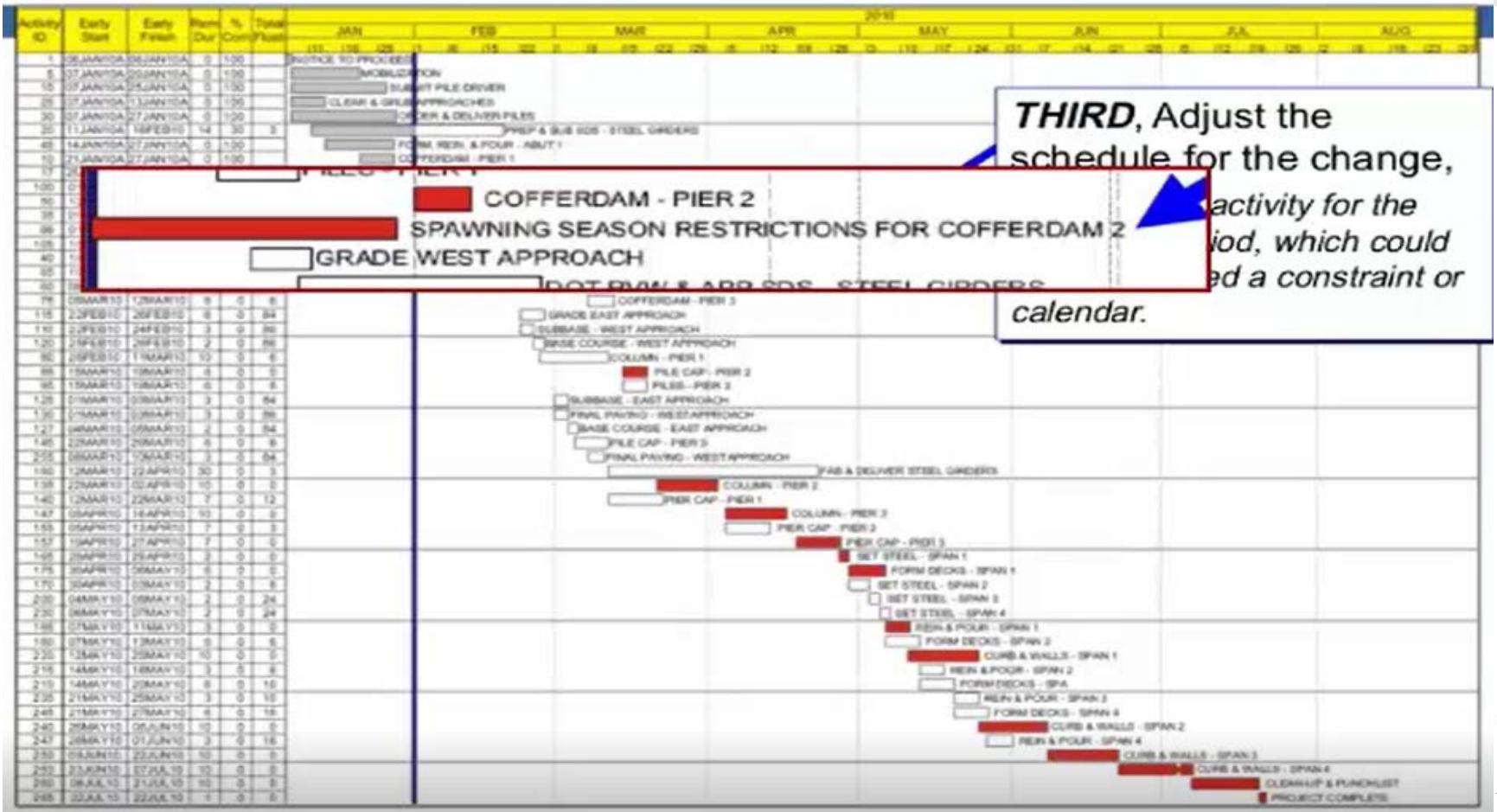
Time impact analysis – Practical procedure: Stage 7

❑ STEP 5: Identify the activity that will be used to measure the time impact.

- ❖ **Identify** the **activity** indicating **project completion**
- ❖ **Note** any **change** in the **project completion date**.
- ❖ The **delay** or **acceleration** **effect** to **all contractual milestones** **not completed** should be **noted** and **documented**.

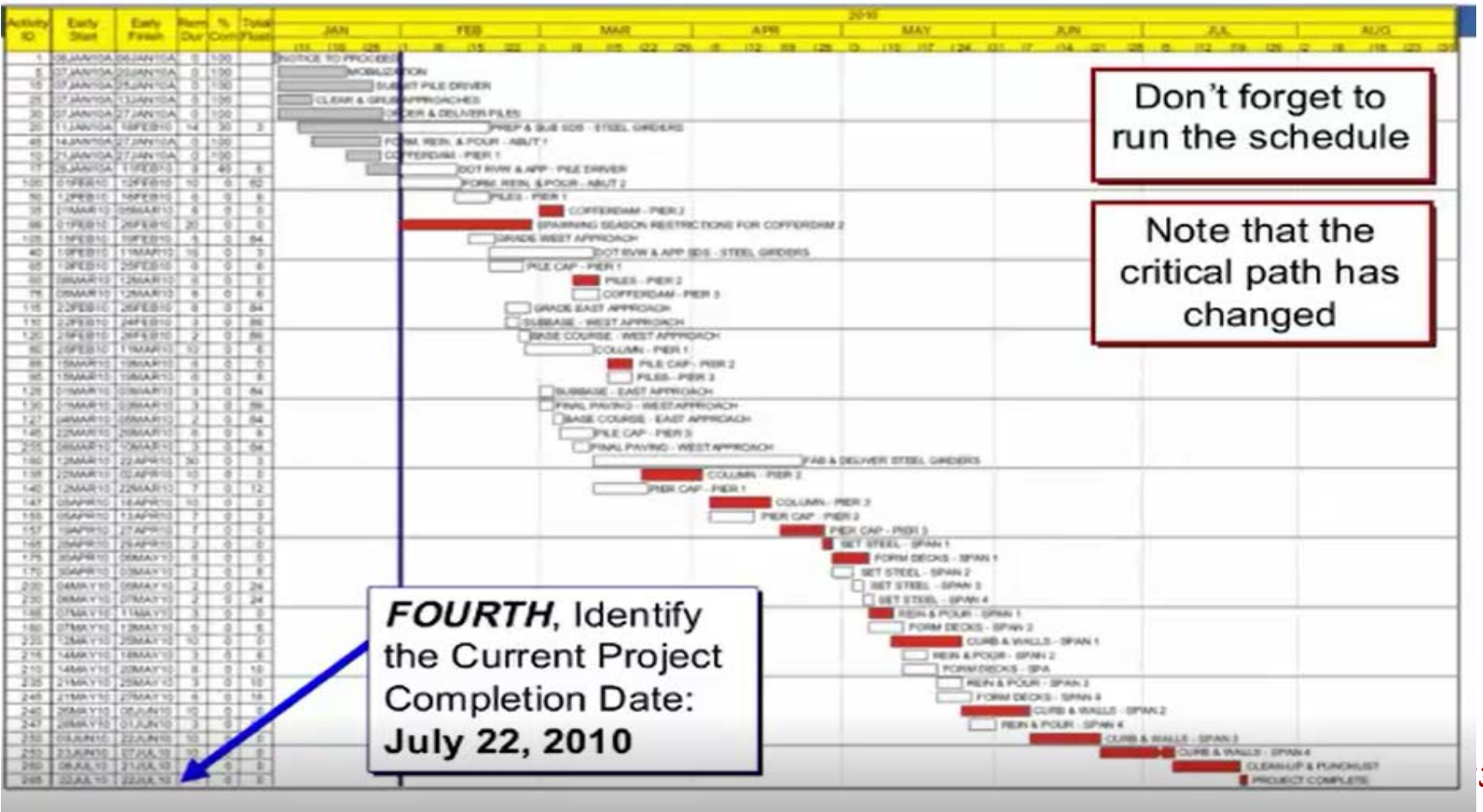
Time impact analysis – Practical procedure: Stage 7

- **STEP 5: Identify the activity that will be used to measure the time impact.**
  - **Example 1: Adjust for change** (create **fragnet**, **what activities** do we need, **duration** and **logic**)



Time impact analysis – Practical procedure: Stage 7

- **STEP 5: Identify the activity that will be used to measure the time impact.**
  - **Example 1:** Adjust for change (new update – **we have lost 3 additional days**)



Time impact analysis – Practical procedure: Stage 7

❑ STEP 5: Identify the activity that will be used to measure the time impact.

❖ Example 2:

Event (fragnet)	Event type	Event actual start date	Base schedule	Base schedule data date
			Baseline	1-Jun-08
001	EDE	3-Jun-08		1-Jun-08
002	EDE	5-Jun-08		1-Jun-08
			UD01	30-Jun-08
003	CDE	2-Jul-08		30-Jun-08
004	EDE	2-Jul-08		30-Jun-08
			UD02	31-Jul-08
			UD02A	*14-Aug-08*
005	CDE	15-Aug-08		31-Jul-08
			UD03	31-Aug-08
006	CDE	4-Sep-08		31-Aug-08
007	EDE	7-Sep-08		31-Aug-08

Window 1	is the Baseline to the first update, UD01
Window 2	is from UD01 to UD02
Window 3	is from UD02 to an updated version of UD02 through August 14, 2008 – UD02A
Window 4	is from UD02A to UD03
Window 5	is UD03 to completion

By: Alavipour, PhD, PMP, CMIT

Time impact analysis – Practical procedure: Stage 7

❑ STEP 5: Identify the activity that will be used to measure the time impact.

❖ Example 2:

Window 1	is the Baseline to the first update, UD01
Window 2	is from UD01 to UD02
Window 3	is from UD02 to an updated version of UD02 through August 14, 2008 – UD02A
Window 4	is from UD02A to UD03
Window 5	is UD03 to completion

- In Window 1, there were two events. These were both EDE and both occurred within a week of the baseline data date, June 1, 2008. It was decided that the baseline was an appropriate base to impact for these purposes.
- In Window 2, there were two events, a CDE and EDE. These were impacted both individually and in tandem. When impacted individually, the CDE had a delay impact of three calendar days and the EDE had a delay impact of five calendar days (3 days concurrent with the CDE and 2 days in excess of the CDE). Therefore, it was determined that 3 days were concurrent and not solely due to the contractor.

Time impact analysis – Practical procedure: Stage 7

STEP 5: Identify the activity that will be used to measure the time impact.

Example 2:

Window 1	is the Baseline to the first update, UD01
Window 2	is from UD01 to UD02
Window 3	is from UD02 to an updated version of UD02 through August 14, 2008 – UD02A
Window 4	is from UD02A to UD03
Window 5	is UD03 to completion

- In Window 3, UD02 to UD02A, there were no events.
- In Window 4, there was one CDE delay event. This event commenced 15 days after the most recent contemporaneous update, and it was deemed necessary to create an intermediate (or bifurcated) schedule on August 14, 2008, immediately before the CDE commencement, which is between update UD02 and UD03. This update was referred to as UD02A.
- In Window 5, there were two delay events, a CDE and an EDE. In this window, the results concluded that the contractor delay of 1 day was concurrent with the EDE, and that the EDE caused a delay of 3 days in excess of the CDE. Therefore, 1 day of delay was considered neutral or concurrent.

Time impact analysis – Practical procedure: Stage 7

❑ STEP 5: Identify the activity that will be used to measure the time impact.

❖ **Example 2:**

WHY?

Event (fragnet)	Event type	Event actual start date	Base schedule	Base schedule data date	Projected completion date	Net loss/gain	Cumulative delay		
							EDE	CDE	Concurrent
			Baseline	1-Jun-08	1-Jan-09				
001	EDE	3-Jun-08		1-Jun-08	2-Jan-09	1	1		
002	EDE	5-Jun-08		1-Jun-08	5-Jan-09	3	3		
			UD01	30-Jun-08	5-Jan-09	0			
003	CDE	2-Jul-08		30-Jun-08	8-Jan-09	3			3
004	EDE	2-Jul-08		30-Jun-08	10-Jan-09	2	2		
			UD02	31-Jul-08	6-Jan-09	−4		−4	
			UD02A	*14-Aug-08*	*8-Jan-09*	2		2	
005	CDE	15-Aug-08		31-Jul-08	15-Jan-09	7		7	
			UD03	31-Aug-08	14-Jan-09	−1		−1	
006	CDE	4-Sep-08		31-Aug-08	15-Jan-09	1			1
007	EDE	7-Sep-08		31-Aug-08	18-Jan-09	3	3		
					Totals:	**17**	**9**	**4**	4

Why 3 days of CDE have no impact?

موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

دفتر آموزش

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