فرآیند جامع آنالیز تاخیرات در پروژه

بخش هفتم:
آنالیز زمانی تاخیرات

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

ارائه دهنده:

سید محمدرضا علوی‌پور

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا

What we will learn?

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

Time Impact Analysis (TIA)

(Practical Procedure)

Time impact analysis – Practical procedure: Stage 1

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 <u>submitted</u> to ensure that <u>any resulting EOT</u> is both reasonable and consistent with the <u>factual circumstances.</u>***

<u>Remember the records and documents mentioned in previous section?</u>

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).

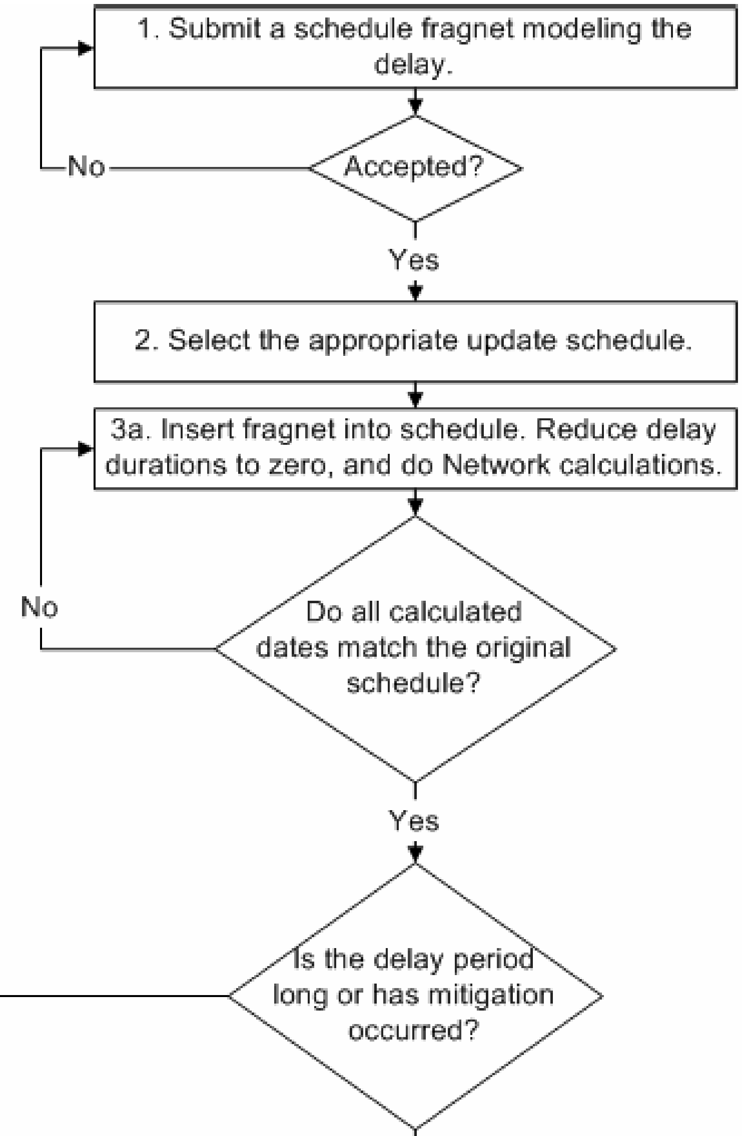
When using retrospectively, the analyst has the option of using as-built durations for the "fragnets."

How to continue from this step?

Time impact analysis – Practical procedure: Stage 7

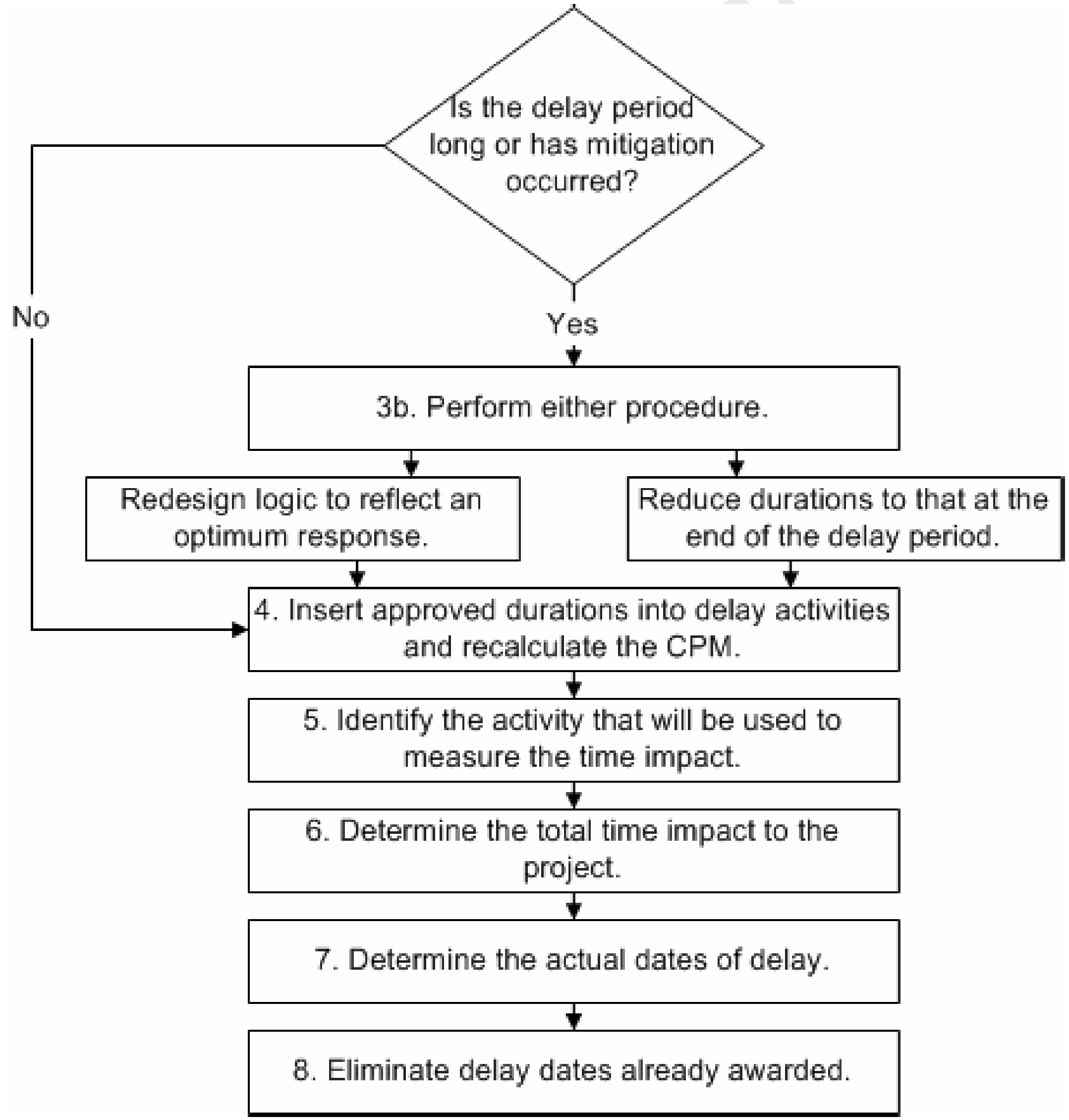
- **TIA Flowchart**
  - **Recommended by AACE 52R-06**

- **My experience**
- **Book written by Caletka**
- **Book written by Trauner**



Time impact analysis – Practical procedure: Stage 7

- TIA Flowchart
  - Recommended by AACE 52R-06

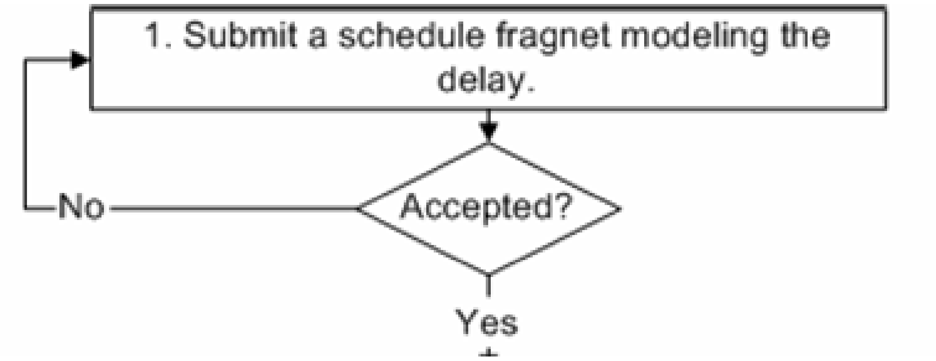


- My experience
- Book written by Caletka
- Book written by Trauner

Time impact analysis – Practical procedure: Stage 7

- **STEP 1: Submit a schedule fragnet modeling the delay**

Let's first look at <u>fragnet</u>!



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**

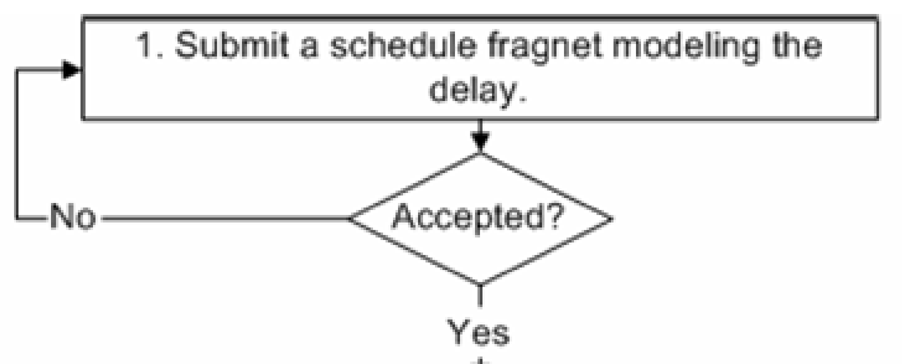
What is the recommended procedure to submit a schedule fragnet?

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**

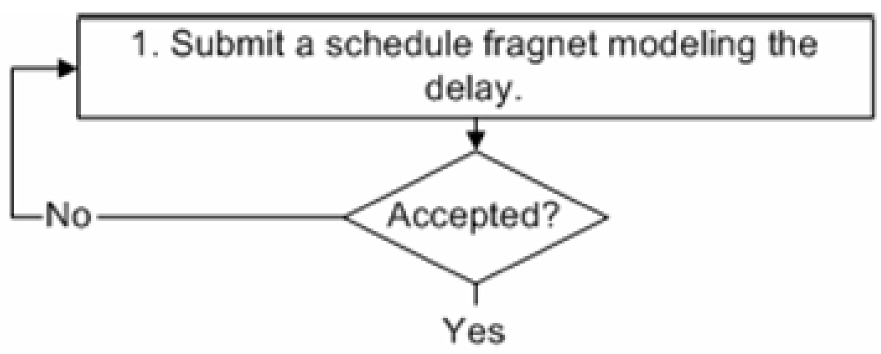


Time impact analysis – Practical procedure: Stage 7

STEP 1: Submit a schedule fragnet modeling the delay

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

- 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**

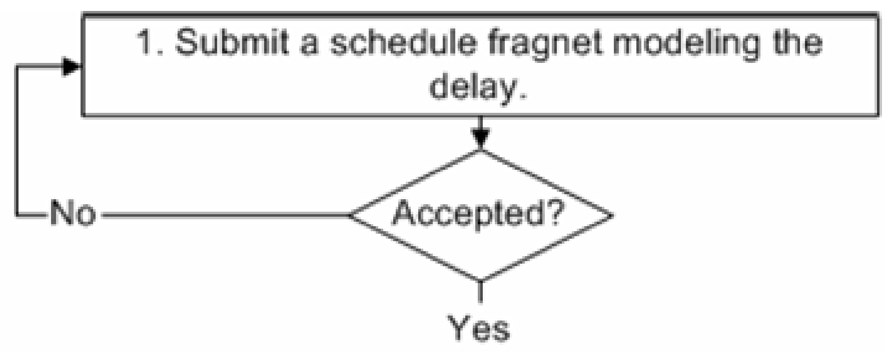


Time impact analysis – Practical procedure: Stage 7

❑ 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"**)

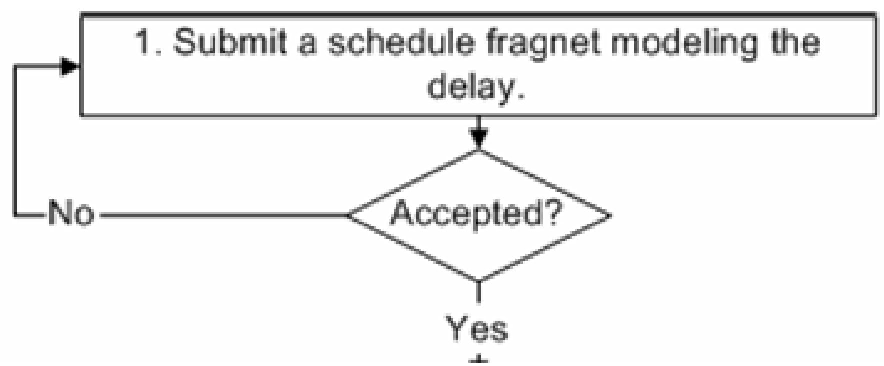
- It may be appropriate to break the fragnet into three discrete base programmes:
  - X100 and X200 in May
  - X300 and X400 in June
  - X500 and X600 in July

Activity ID	Description	Original duration	2008 Apr	2008 May	2008 Jun	2008 Jul	2008 Aug
×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**



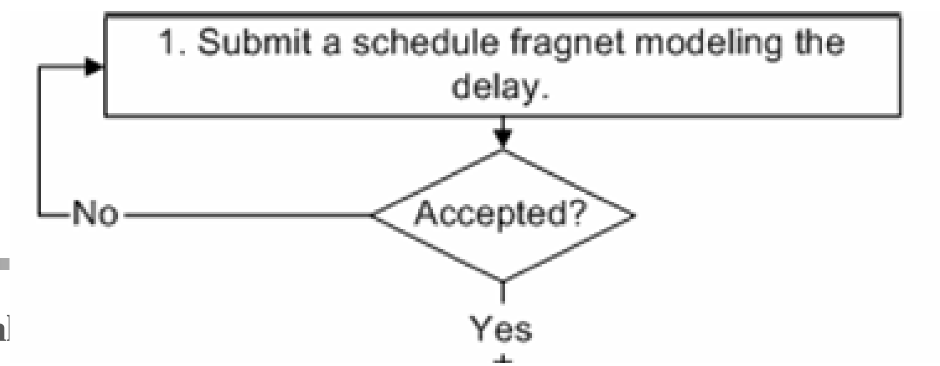
What if the CA concludes that the event or cause of delay is not an Employer Risk Event?

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.**

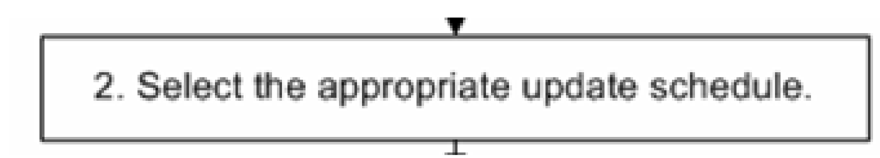
Time impact analysis – Practical procedure: Stage 7

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);



ACEMI

Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

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

- ❖ The **<u>Contractor</u>** may elect to <u>first</u> provide a **new schedule status** and **update with a status date** immediately **<u>prior</u>** to the **start of the delay**.
  - ❖ **<u>Before</u>** this **new update schedule** is to be **used**, it should first be submitted to the **<u>Owner</u>** 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

<u>Example 1</u> and <u>Example 2</u>

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 <u>commence</u> on the same day?

Time impact analysis – Practical procedure: Stage 7

STEP 2: Select the appropriate update schedule

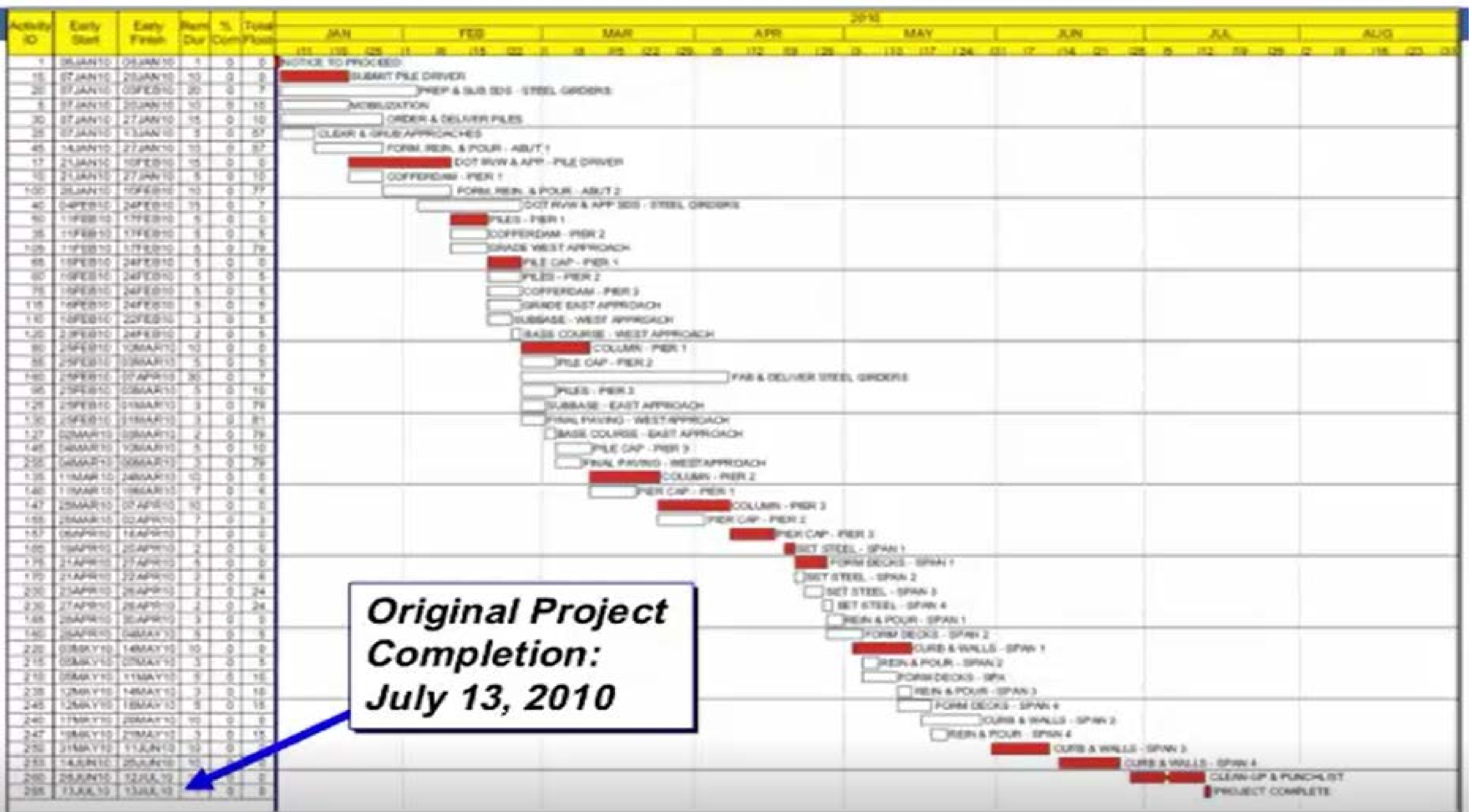
- The delays should be analyzed **before fragnet inserted** into the **current schedule.** This could be carried out:
  - a) One to demonstrate the impact of the EDE
  - b) One to demonstrate the impact of the CDE
  - c) One to demonstrate the combined impact of both in the same base programme
    - ✓ 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

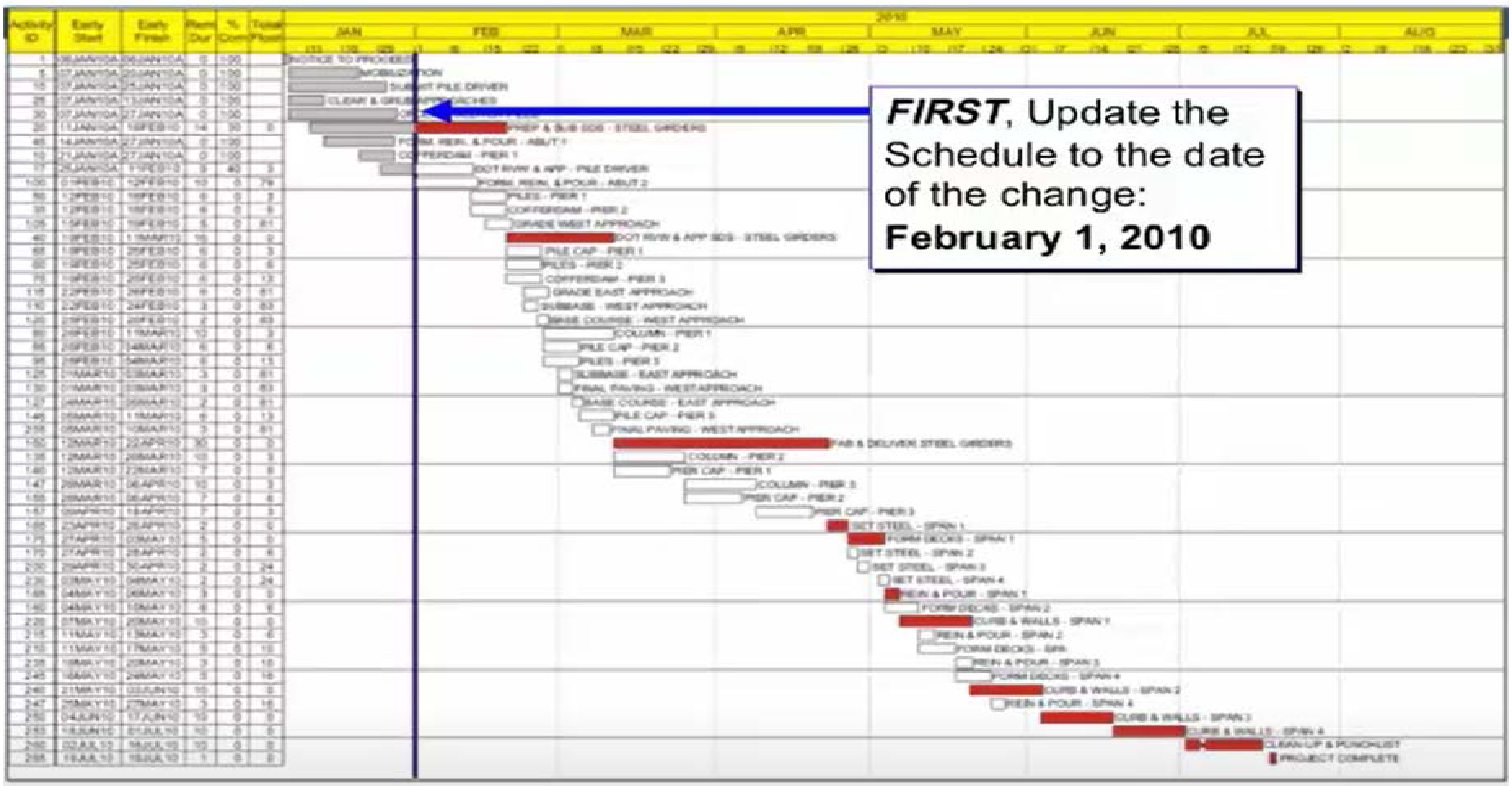
- **STEP 2: Select the appropriate update schedule**
  - **Example 1:** Baseline schedule



Time impact analysis – Practical procedure: Stage 7

❑ STEP 2: Select the appropriate update schedule

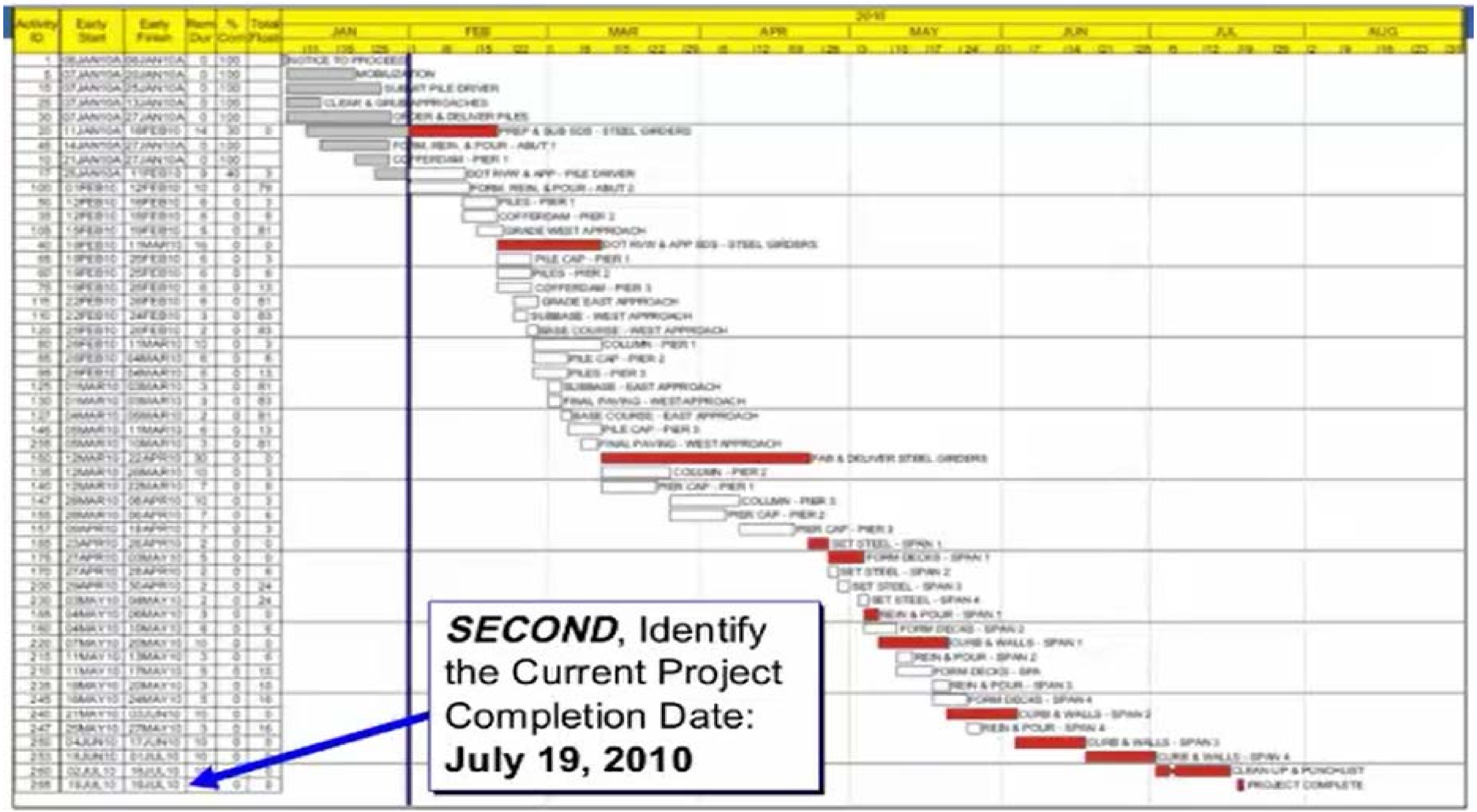
- ❖ **Example 1: Update for change** (**update to date of Feb 1** by putting all actual starts, actual finishes, changes, and durations)



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**.

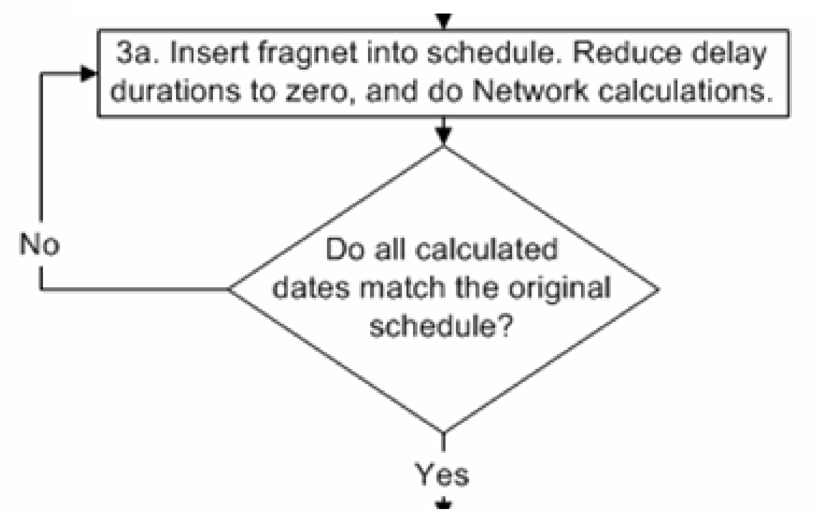
Window 1	is the Baseline to the first update, UD01
Window 2	is from UD01 to UD02
Window 3	is from UD02 to an updated version of UD02 through August 14, 2008 – UD02A
Window 4	is from UD02A to UD03
Window 5	is UD03 to completion

Time impact analysis – Practical procedure: Stage 7

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

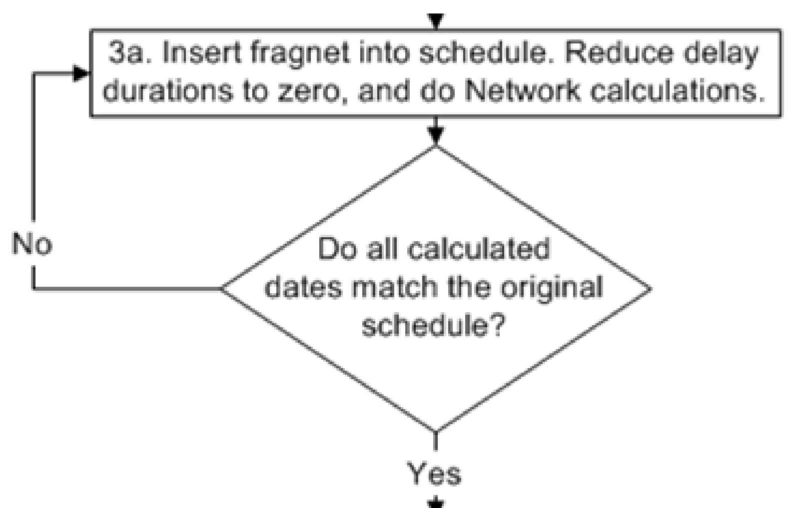
1. **<u>Insert</u>** the **fragnet** into a **copy** of the **<u>current schedule update</u>** prepared as **described**.
2. **Using** the **accepted fragnet** as a **template**, add the **<u>impact activities</u>** and **<u>logic</u>**.
3. **<u>Set</u>** the **duration** of the **delay activities**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

<u>How to insert?</u>



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

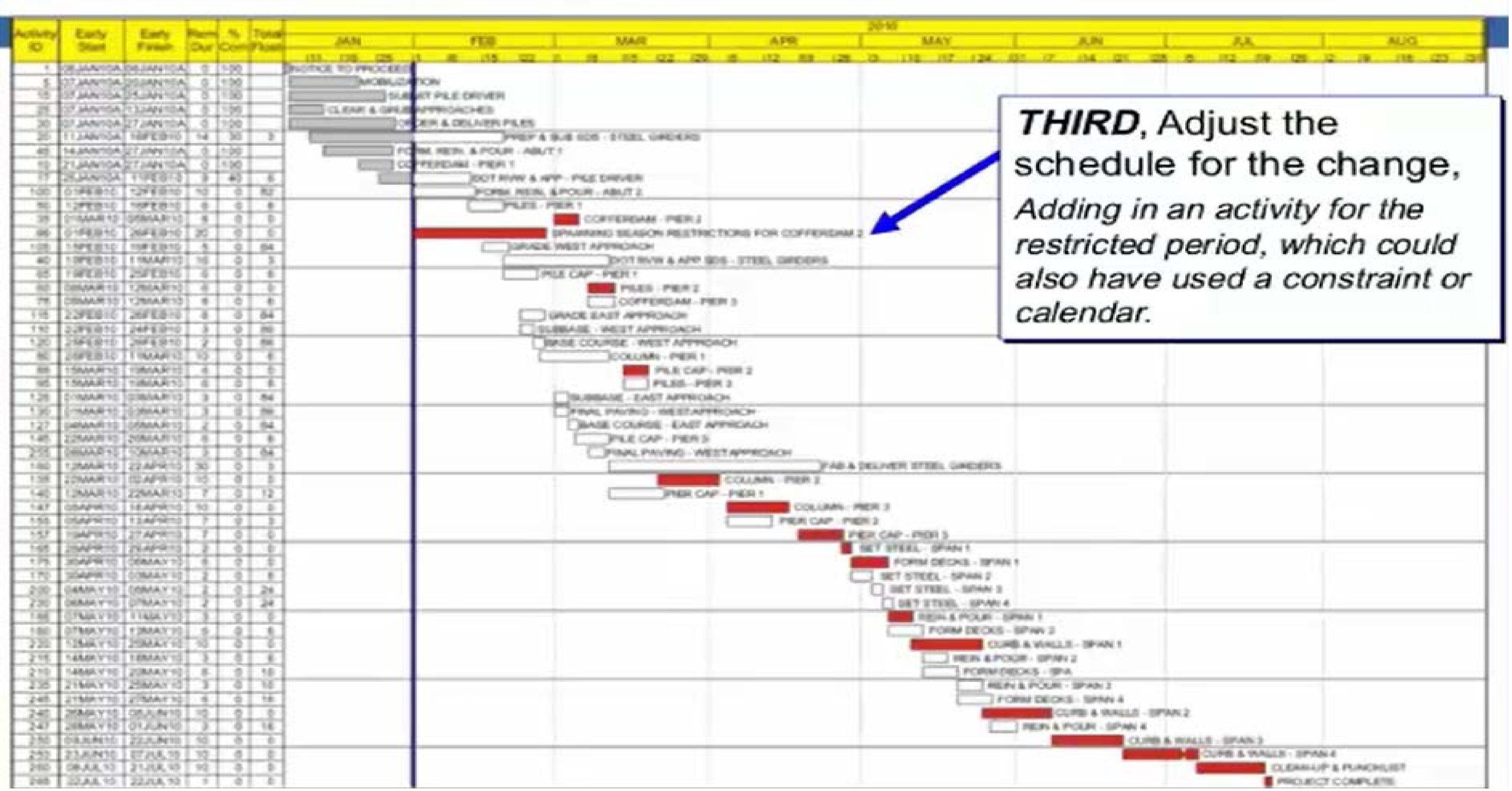
- **STEP 3a: Insert fragnet into schedule. Reduce delay durations to zero, and do network calculations.**
  - **Example 1:** The change

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

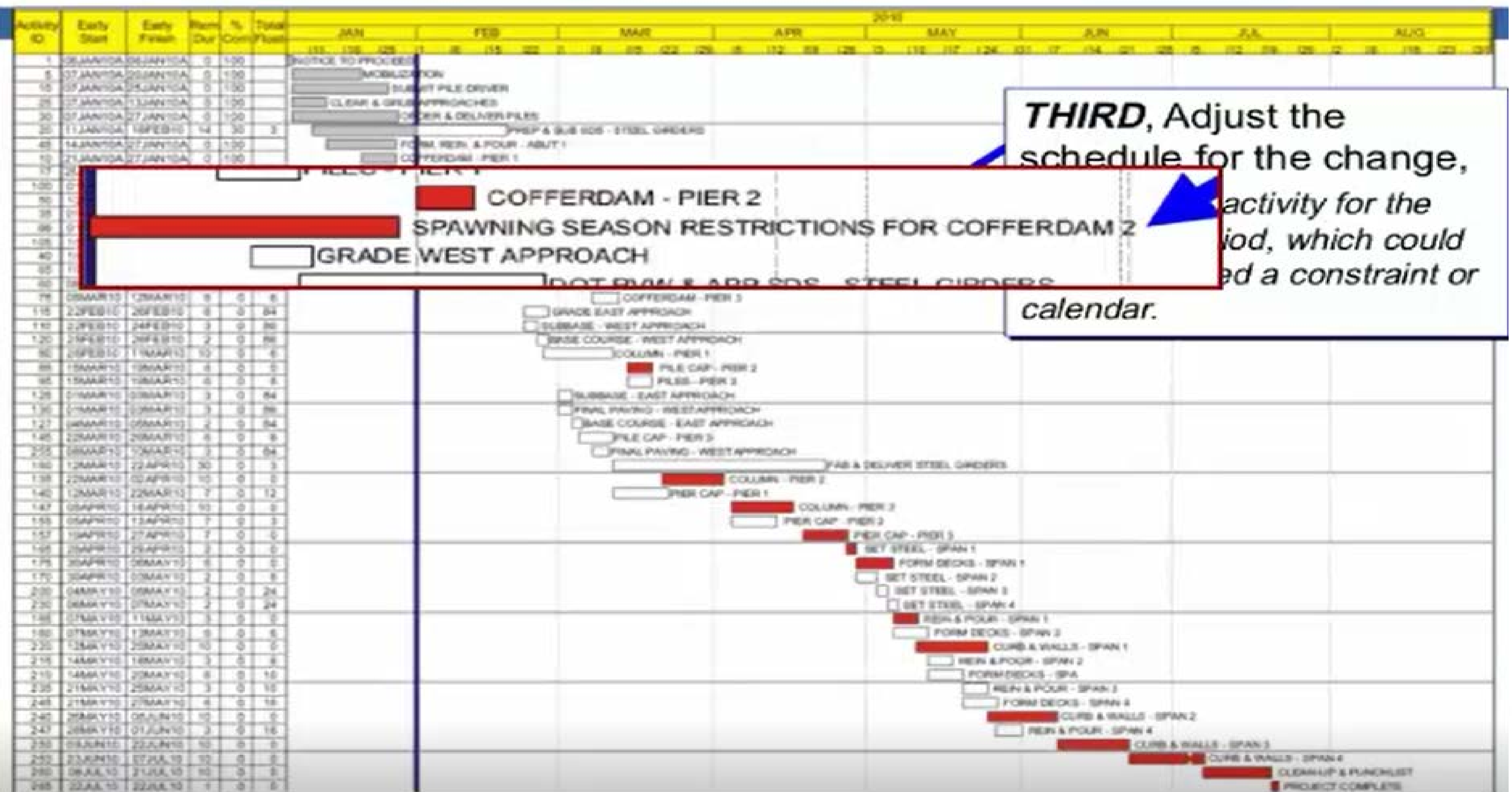
Time impact analysis – Practical procedure: Stage 7

- **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

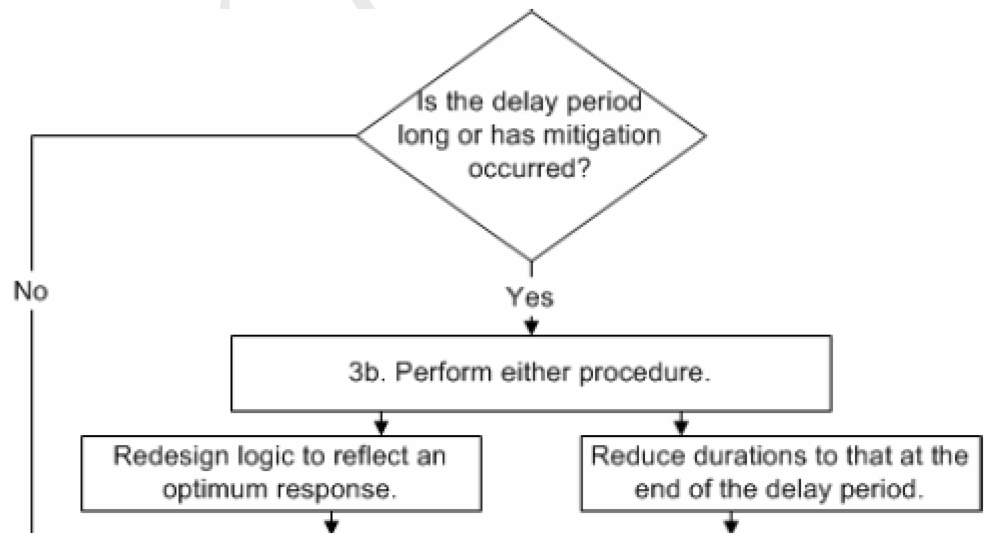
- **STEP 3a: Insert fragnet into schedule. Reduce delay durations to zero, and do network calculations.**
  - **Example 2:**

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**.

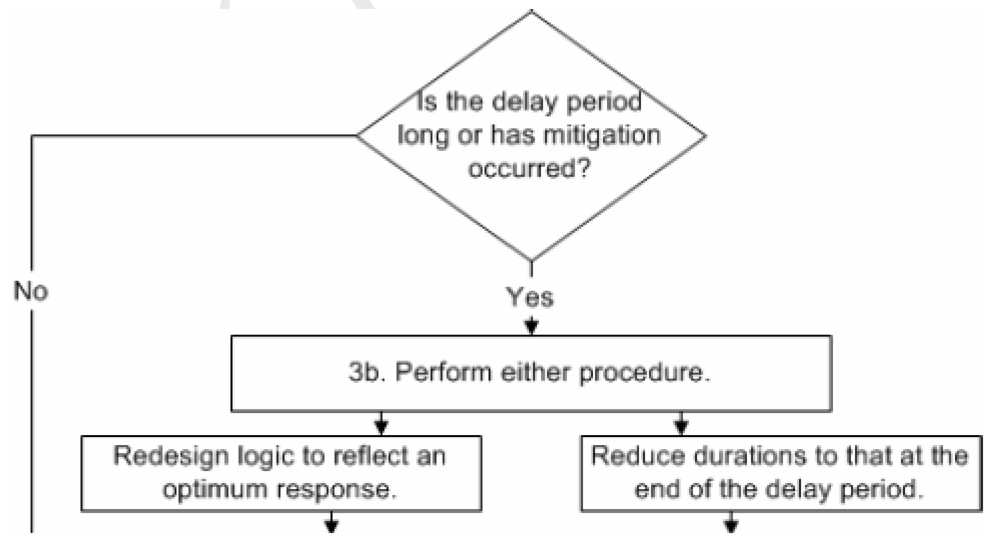


Time impact analysis – Practical procedure: Stage 7

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**.

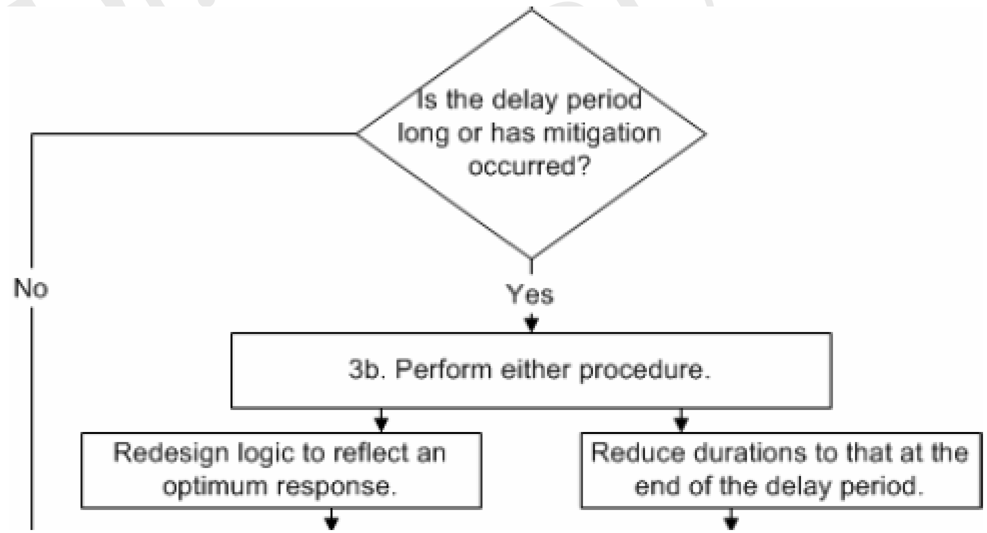


Time impact analysis – Practical procedure: Stage 7

❑ 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:

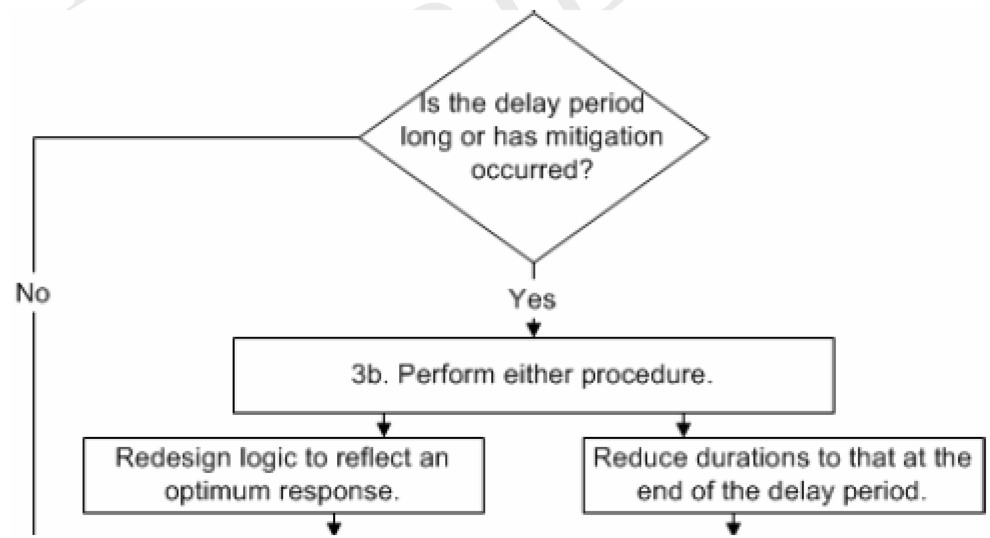
- ✓ A frozen work plan
- ✓ Forward-looking impact analysis
- ✓ Shortness of duration of the delay



Time impact analysis – Practical procedure: Stage 7

OPTIONAL STEP 3b: Consider the effects of mitigation

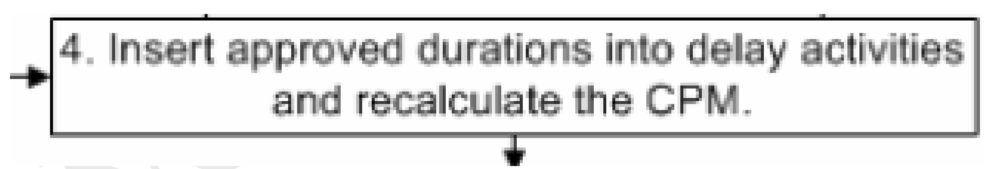
- **Whatever changes** made to the schedule to satisfy the **Step 3b requirements**, should be **fully documented** and included as **part** of the **TIA submittal**.
  - ✓ These **changes** are subject to **review**, **negotiation**, and **acceptance** by the **owner**.



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.

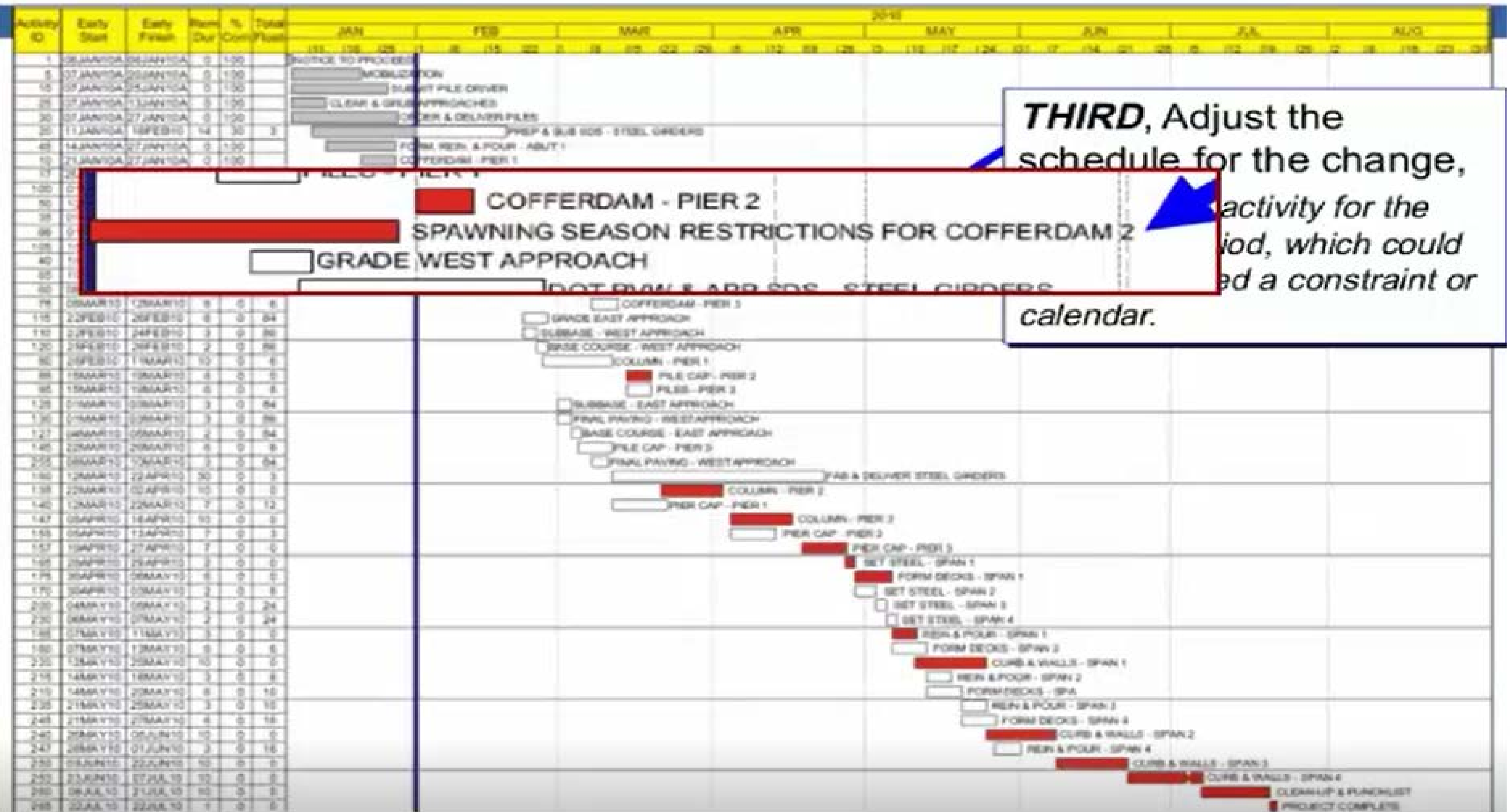


Time impact analysis – Practical procedure: Stage 7

- **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**.

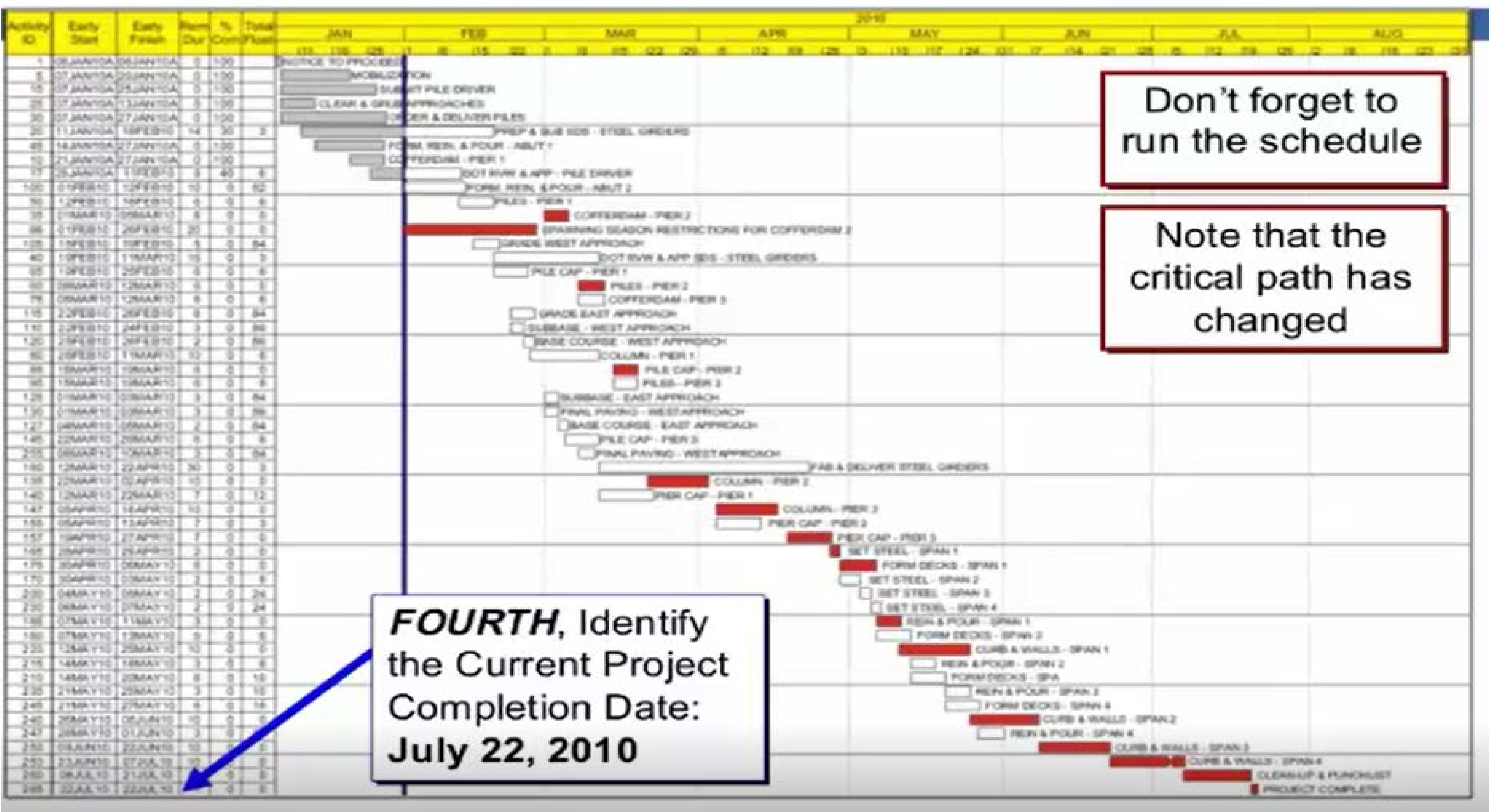
Time impact analysis – Practical procedure: Stage 7

- **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

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	Cumulative delay CDE	Cumulative delay 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?

Time impact analysis – Practical procedure: Stage 7

- **STEP 5: Identify the activity that will be used to measure the time impact.**
  - **Acceleration** and **disruption** accompanying the delay may be considered to be **incorporated in a TIA**, and

    may account for the **apparent difference** between predicted and actual effects of a delay.
  - The **projected completion date** is also **adjusted** according to the **actual progress** achieved in each 'window.'

    any resulting gain, or loss, **calculated in each subsequent** base programme is allocated to the **benefit of the contractor**.
    - ✓ This occurred in the above analysis when **UD02** was updated,

Time impact analysis – Practical procedure: Stage 7

- **STEP 5: Identify the activity that will be used to measure the time impact.**
  - Losses and gains achieved due to the **natural progress of the work** are **not EDE**, and any delay which is **unexplained** is by definition a **CDE**.
    - ✓ This occurred in the above analysis when **UD02A** was updated,

Is it always perfect and possible to do so?

Time impact analysis – Practical procedure: Stage 7

- **STEP 5: Identify the activity that will be used to measure the time impact.**
  - A **predictive modelling** technique cannot, by itself, identify actual results.

    *While imperfect, the **ease and quickness** of preparing and reviewing a **TIA** should compensate for the **lack of exactness** in modeling the exact features of the impacts to a project due to delay **(AACE 52R-06).***

Is it always easy to use TIA after delay already occurred?

Time impact analysis – Practical procedure: Stage 7

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

- When **many small delay events** are being evaluated, the **process of calculating and rationalizing the impact of each event**, using a **new base programme** for each event,

  becomes a project in and of itself, **requiring many assessments** regarding the status (%complete, remaining duration) of each activity in the programme.

This approach should only be adopted if

1. Appropriately **detailed data** exists, and
2. Resulting impacts can be **reconciled with as-built data** and grounded in fact

Time impact analysis – Practical procedure: Stage 7

STEP 6: Determine the total time impact to the project

- **Determine** the **correct time impact** for the **project delay**.
  1. **Cumulative** loss or gains are determined for **EDE**, **CDE**, and **concurrent** periods.
     - ✓ **Neutral events (excusable but non-compensable)** such as **force majeure** are treated the same as **concurrent delays**.
     - ✓ **If** the **contract specifies work days**, then this unit of measurement should be made in **work days**.
     - ✓ **If** the **contract specifies calendar days** or specifies an **absolute date** for **completion**, then the unit of measure should be made in **calendar days**.
  2. Any **anomalous results** are **reviewed** and where **corrections** are necessary, the process is repeated as required.

6. Determine the total time impact to the project.

Time impact analysis – Practical procedure: Stage 7

- **STEP 6: Determine the total time impact to the project**

Example 1

- If you put the change in the **baseline** instead of schedule update or
- If you put the change in **schedule revision** back on **January**,

  what would happen?

  All you know is that we went from July 13 to July 21===9 days

- But if you put the change on **schedule update**:
  - **Split it up into two delays:**
    - 6 days of delays because of project progress **(non-excusable delays)**
    - 3 days for the actual change from owners **(excusable delays + may compensable)**

1. What was the completion date?
   a. Before the change: July 19
   b. After the change: July 22
2. The change order issued for the permit revision should include a 3-day time extension.
3. Alternately, the work could be accelerated to mitigate the delay and achieve timely completion.

Time impact analysis – Practical procedure: Stage 7

STEP 6: Determine the total time impact to the project

Example 2

Total delay experienced	17
Total pure EDE delay experienced	9
Total pure CDE delay experienced	4
Concurrent delay experienced	4

- 9 days of excusable–compensable extension of time,
- 4 days excusable-non-compensable extension of time.
  - In total, 13 days of additional extension of time and relief from liquidated damages should be recognized.
- 4 days of liquidated damages (assuming the project actually completes on January 18, 2009) and no further critical EDE events are identified.

Time impact analysis – Practical procedure: Stage 7

STEP 7: Determine the actual dates of delay

- **Using** the **original schedule update**, determine when the **successor activity** to the **delay impact** actually became a **project critical activity**.

7. Determine the actual dates of delay.

1. The **procedure** mentioned before **assumes** (**either** by **contract** or **standard default**) that **project float belongs to the party who uses it first**.
2. It also **assumes** that the **project** does **not meet all legal requirements** for a **declared early project completion**.

If either of these assumptions is incorrect, then the appropriate adjustment should be made in counting the delay days.

What should be done when granting or refusing an EOT?

Time impact analysis – Practical procedure: Stage 7

- **STEP 7: Determine the actual dates of delay**
  - The **CA** makes **decision**. When **granting** or **refusing** an EOT:
    - ✓ The **CA** should so **notify** the **contractor**
    - ✓ **Sufficient information** should be **provided** by **CA** as the **reasons** for decision

What should be done in the absence of a submission that complies with TIA instructions?

Time impact analysis – Practical procedure: Stage 7

STEP 7: Determine the actual dates of delay

- **CA (unless the contract otherwise provides)** should make its **own determination** of the EOT (if any) that is due, based on such **information as is available** to it.

What if no sufficient information exists?

Time impact analysis – Practical procedure: Stage 7

STEP 7: Determine the actual dates of delay

- Given that it is **difficult if not impossible** to withdraw an **EOT once granted**, it is **reasonably to be expected** that, where the **CA has not been presented with the information** on which to base its decision, *the CA will award only the* ***minimum EOT that can be justified*** *at the time.*

What should be done If the Contractor does not agree with the CA's decision?

Time impact analysis – Practical procedure: Stage 7

- **STEP 7: Determine the actual dates of delay**

If the **contractor** does **not agree** with the **CA's decision**, it should so **inform the CA immediately**.

- **Disagreements** on **EOT** should **not be left** to be **resolved** at the **end of the project**.

What if no agreement can be reached quickly?

Steps should be taken by either party to have the dispute resolved in accordance with the contract dispute resolution provisions

Time impact analysis – Practical procedure: Stage 7

STEP 8: Eliminate delay dates already awarded

- **Eliminate** **delay dates** from the **TIA request** that have **previously** been **awarded**.
- Delays that are **excusable** but **non-compensable** should be considered as a **concurrent delay**.
- **No more than one day** of **excusable delay** should be assigned to a **single date**.

8. Eliminate delay dates already awarded.

Could it be a time limit to submit the analysis?

Time Impact Analysis (TIA)

(Important notes and Conclusion)

Time impact analysis – Important notes

Could it be a time limit to submit the analysis?

1. For change orders and delays **before occurrence**, the analysis discussed for **TIA** shall be submitted within **14 calendar days** following
   i. Owner's issuance of the change order or
   ii. Initiation of the delay

   as a part of

   i. **Contractor's proposal** for the work or

   ii. Delay contemplated by the **proposed change order**

You will see how this could greatly work in claim management course!

Time impact analysis – Important notes

Could it be a time limit to submit the analysis?

2. For change orders or delays **after delay already occurred**, the analysis discussed for TIA shall be submitted within **14 calendar days** following
   ii. Completion of the work related to the change order or
   iii. Conclusion of the delay

You will see how this could greatly work in claim management course!

What software should be used?

Time impact analysis – Important notes

What software should be used?

- **No matter how powerful the software becomes**, the **capabilities** of the **user** are still the **most important** ingredient in using scheduling software as an effective management tool.

- **No matter what software** was **used** to **manage** the project schedule, the **basic principles** of **analyzing** a project for **delays and improvements** **remain the same**.

- **Primavera software** is the **most widely used** software in the **industry**, terminology from Primavera scheduling software is used.

Time impact analysis – Conclusion

TIA is **not an attempt** to simulate reality, only to **approximate it**.

It is a recognized **analytical technique** intended to facilitate a **reasonable estimate** of the time delay to the project caused by a single delay or a discrete series of delays.

TIA is not completely accurate, instead it is approximate

It is **not reasonable** to require that a **delay modeled in a TIA** manifest itself in that **exact number of days** that a project **actually ends up being late**.

Time impact analysis – Conclusion

4.12 The methodology described in this section is known as '**time impact analysis**'. This methodology requires a logic linked baseline programme (which ordinarily would be the Accepted Programme), updated programmes (which ordinarily would be the Updated Programmes) or progress information with which to update the baseline programme and the selection of delay events to be modelled. If the parties have not followed the guidance to Core Principle 1 in Part B, such that there is no Accepted Programme and/or Updated Programmes, this is likely to lead to more disputes regarding the contemporaneous assessment of EOT applications.

Time Impact Analysis (TIA)

(TIA vs. IAP)

Time impact analysis vs. impacted as planned

Factor	TIA	Impacted Baseline
Time Required	Moderate to High depends on data	Lesser Time required compared to TIA
Level of Effort	High	Moderate

Time impact analysis vs. impacted as planned

Comparing Factor	TIA	Impacted Baseline
Expertise Level Required	High	Moderate
Complexity	High	Low
Data Requirement	High	Moderate

Time impact analysis vs. impacted as planned

Comparing Factor	TIA	Impacted Baseline
Accuracy of Result	More accurate with Perspective Analysis	Moderate
Prospective or Retrospective Application	Both, Prospective and Retrospective	Both, Prospective and Retrospective

Time impact analysis vs. impacted as planned

- ✓ Many Methods available for Delay Analysis
- ✓ Each method could give different results
- ✓ Many factors to be considered while selecting one
- ✓ Most Important – contractual requirement
- ✓ Owners should give more options
- ✓ Contractors should not always go for simplest one

Non-Critical Path Techniques

Techniques

- Under some circumstances, a critical path project schedule is **not available for a project**.
- It is more prevalent in **smaller projects**.
- When faced with this **challenging set of circumstances** one of the following methods can be **considered** to determine the impact of a delay, however not recommended.
    1. **S-Curve**
    2. Global impact
    3. Net impact

ACEMI

S-Curve

- The **S-curve method** makes use of a **time-cost chart** where the **cumulative expenditure** during the construction period is expressed.
- The one **axis** of the chart depicts project expenditure and the other project duration.
- To apply this method a **baseline S-curve** and an **as-built S-curve** without any additional cost are required.
- This method is based on the **assumption** that **slow progress** would result in a **lower than planned expenditure**.
- By **comparing** the baseline S-curve with the as-built S-curve the **impact of the delay** can be determined.

Is it correct?

S-Curve

There is a widely held

but mistaken belief

that the dollar value of the work performed is directly related to the

time progress of the job.

Let's see some of the arguments!

Delay analysis based on dollars

❑ Example

❖ ***Contractor*: ** I was able to complete **90 percent of the work** in **ten months** on the job. Then, **because** of the **Owner delays** in **inspection** and **punch list**, it took **four months to complete** the **last 10 percent of the work**.

❖ ***Owner*: ** During the **period** of the **claimed delay** to the Contractor, he was able to **perform 25 percent of the dollar value** of his work on the Project. The **dollar value** of work accomplished during that period **reflected** the **same rate of progress** as that **before and after the delay**. Therefore, we could **not possibly** have **delayed** the **Contractor**.

Which one is true?

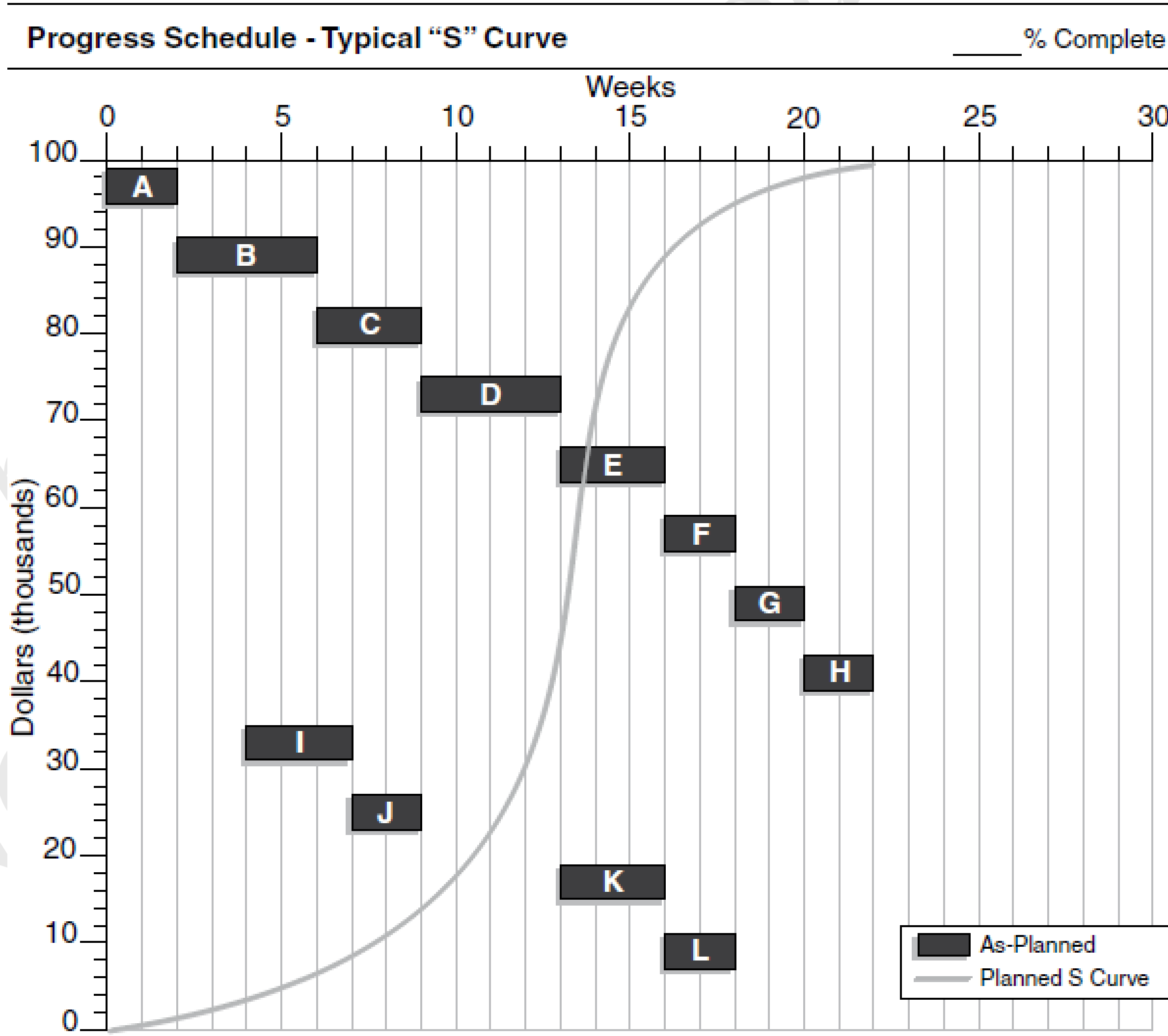
Delay analysis based on dollars

- **Example**
  - **While both** of these arguments may **appear plausible** and **logical**, there is **no quantifiable linear relationship** between **time progress** and **dollars** on **any Project**.
    1. The **dollar value** at each stage of the Project **depends** on the **(1) nature** and **(2) cost assigned** to the specific activities completed.
       - For instance, some **high-dollar-value** items of work may be performed in a **short period of time**, whereas some **low-dollar-value** items of work may **take more time**.
    2. Dollar value method does **not identify** and **track** the activities on the **critical path** of the Project, as the **most reliable method** for determining delays.

Delay analysis based on dollars

S-Curves

- In the **past**, the **Corps of Engineers** required **Contractors** to **provide "S" curves** to show **job progress**.

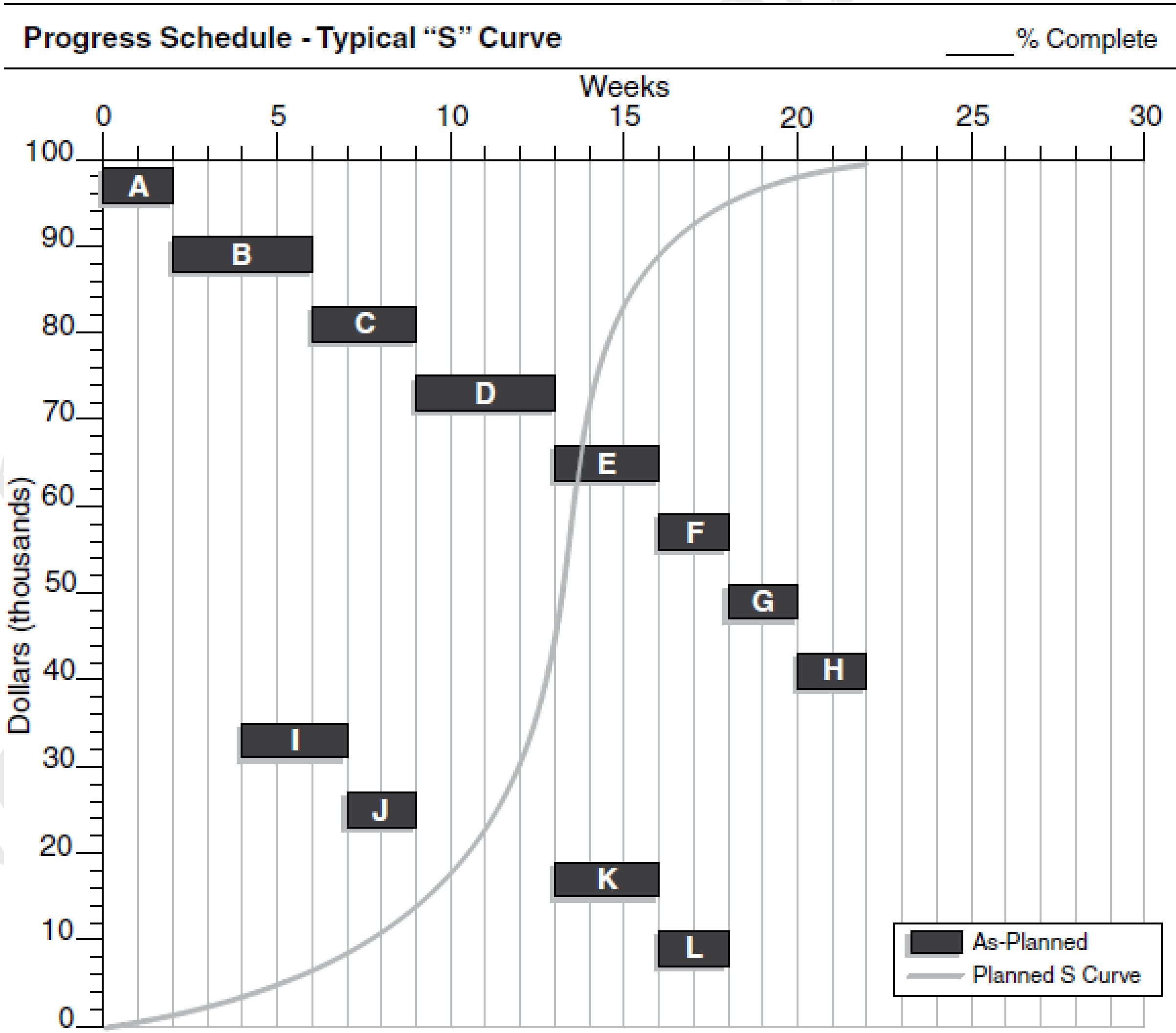


Delay analysis based on dollars

❑ S-Curves

1. The **Contractor** provides a **<u>bar chart of the major activities</u>** on the job and **applies** the **dollar value** from the **schedule of values** to the **<u>bar chart</u>**.

❖ By **<u>summing</u>** the **dollars over time**, an **<u>"S" curve</u>** is **generated**.

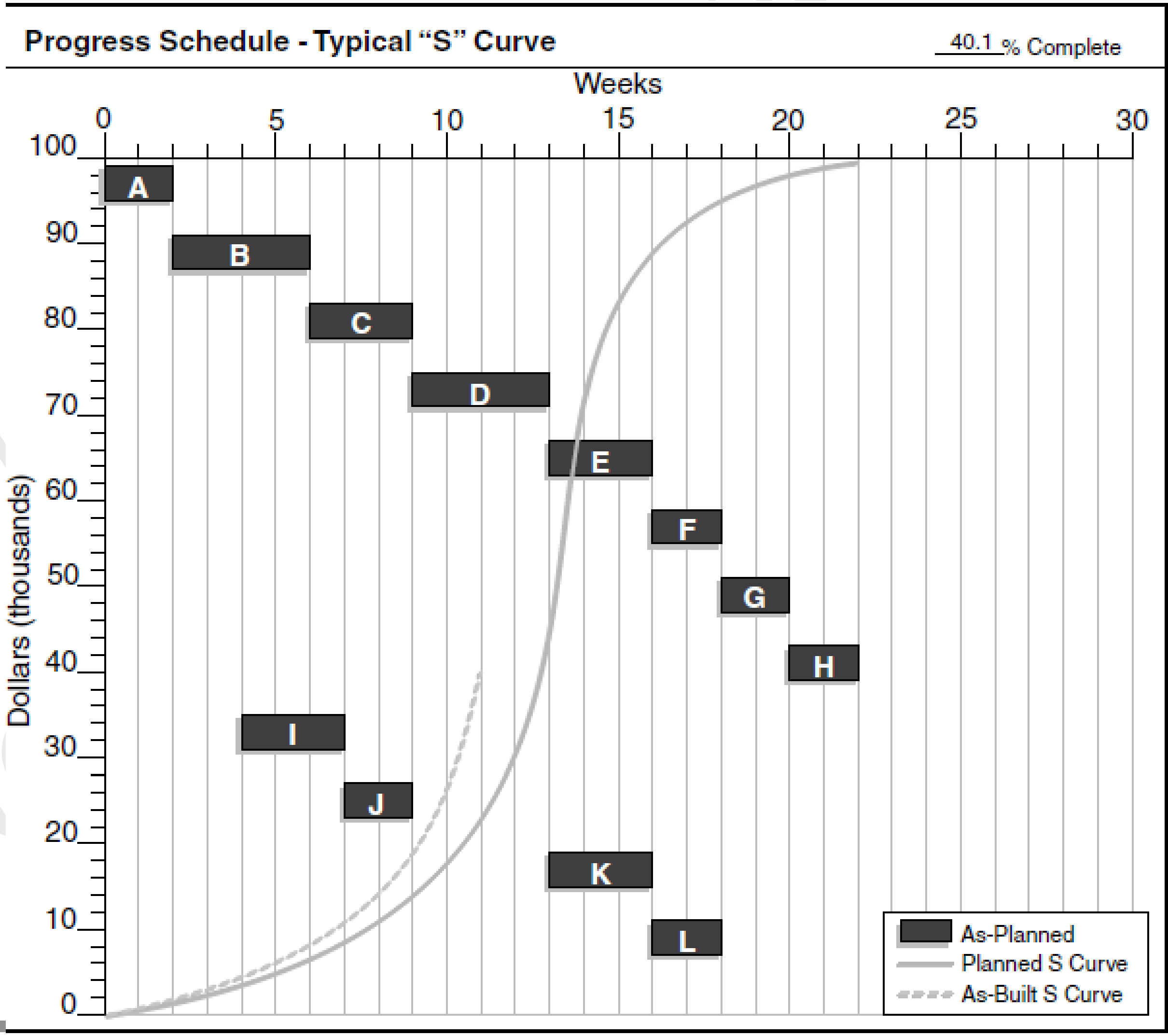


Delay analysis based on dollars

❑ S-Curves

2. The **Contractor** must then **submit** an **updated "S" curve** with **__each monthly pay request__**.

❖ __Unfortunately__, the **monthly submission** also has an **entry** for **"progress to date,"** **recorded** as a **percentage.**

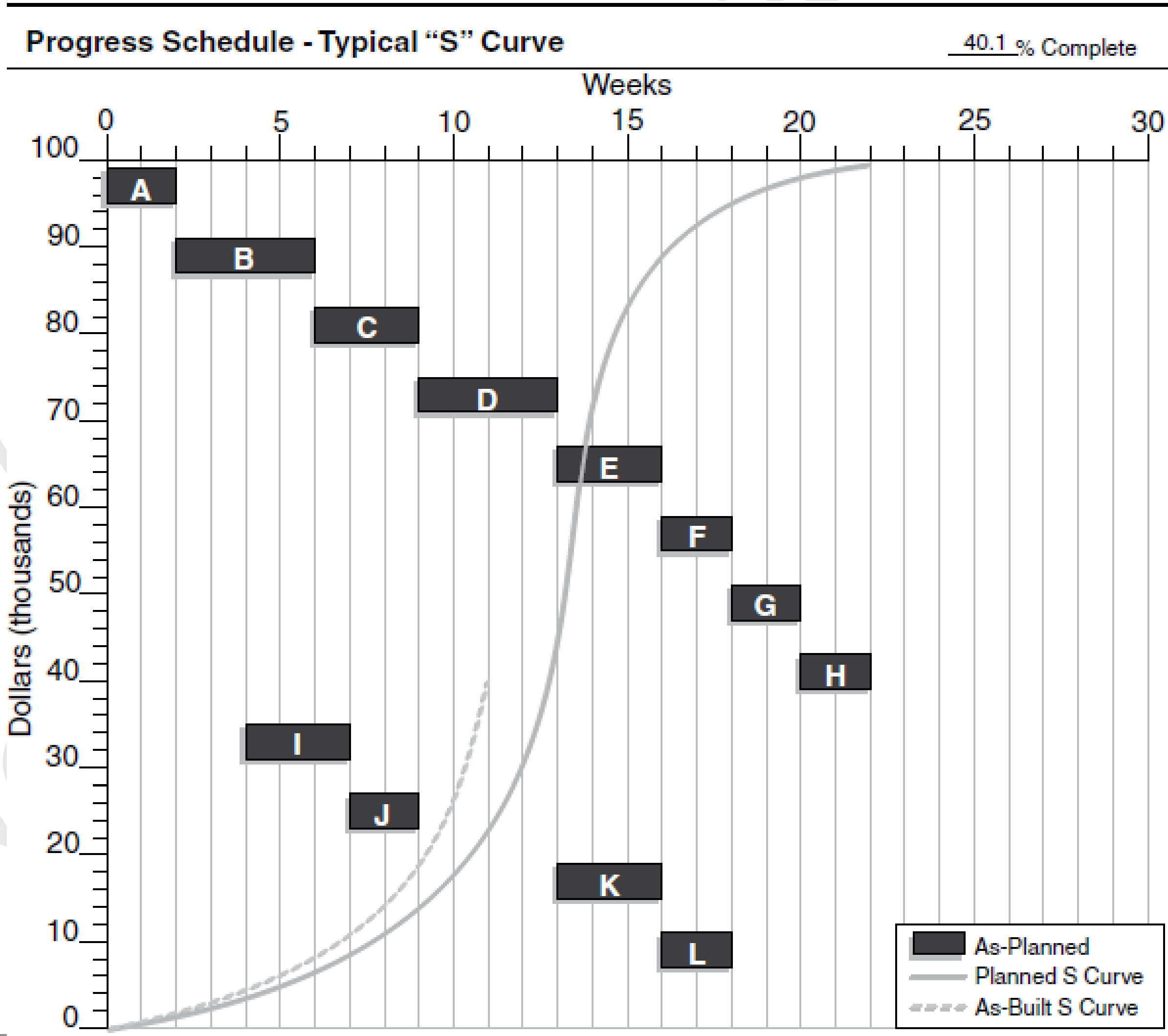


Delay analysis based on dollars

S-Curves

- **This update** has often been **used** to **measure** the **Contractor's progress** in time, which is **very often misleading**.

- **"S" curves** developed from a **Contractor's total billing dollars** do **not measure** the **time progress** of the Project but **merely show** the **progress of billings** over the course of time.



Delay analysis based on dollars

S-Curves

- There are **several reasons** why the we **do not recommend** using an this kind of **"S" curve** for **determining** **job progress**.

   1. The **original planned "S" curve** **might not be accurate** due to **"front end loading,"** or other factors.
   2. The **updated "S" curve** information **might** be **misleading** because of **payments** for **stored materials** and **equipment**.

The Contractor could overbill or "front end load" its bid items to recover its costs as early as possible, and, therefore, reliance on the "S" curve could portray more "progress" than had actually occurred.

Because they are unreliable, time-to-dollar relationships should not be used to establish delays on a Project.

Delays By Subcontractors

Delays by subcontractors – State of the problem

When a Project is managed by a well-thought-out and periodically updated CPM schedule, the analyst has many tools at his disposal to determine the delays to the Prime Contractor's performance period.

However, in the case of delays to the Subcontractor's performance period, these tools are less effective.

As a result, we must apply a more in-depth knowledge of both the subcontracting process and of the Project management process in order to determine the most appropriate way to resolve disputes related to Subcontractor delays.

Delays by subcontractors – How to investigate and analyze delays?

1. **When investigating** potential delays to a **Subcontractor's performance**, we **begin** by **evaluating** the **performance requirements** of the **subcontract** (**contract with SC)**.
   - ❖ The **objective** of this **evaluation** is to **determine** the **period of performance** for which the **Subcontractor is obligated under** the **terms of the subcontract**.
     - ✓ **Often**, a **Subcontractor** is required to **perform its work according** to the **Project schedule**.

Delays by subcontractors – How to investigate and analyze delays?

2. **If required to perform according to the project schedule:**

- **Typically**, the **Prime Contractor** reserves **its right** to **modify the schedule as necessary** to **complete the work** in a **timely fashion**.
  - The **subcontract** will then **require** the **Subcontractor** to **perform according** to these **modifications** as well.
    - Because these **modifications** are **not known** at the **time of the subcontract agreement**, there is a **certain expectation** that the parties have regarding the **Subcontractor's performance period** that results in **negotiation** **before** signing **subcontracts**.

While the Subcontractor typically takes on some risk regarding the Prime Contractor's right to modify the schedule, this risk is typically not without limits in subcontracts.

Delays by subcontractors – How to investigate and analyze delays?

2. **If required to perform according to the project schedule:**
   - **What limits in subcontracts?**
     - The **Contract CPM schedule** will **identify** **early and late dates** for **all of the Subcontractor's work activities**.
       - ✓ The **Subcontractor** is obligated to be **on site** from the **projected early start date** of its **first activity** to the **late finish** of its **last work activity**.
         - The **work activities** **do not need** to be **performed** on the **early dates** for the Project to complete on time.
           - **Thus**, **performance** of the work **within** the e**arly and late date** ranges are **foreseeable**, **even if** such performance **affects** the **continuity** of the **trade Subcontractor's work activities**.

Delays by subcontractors – How to investigate and analyze delays?

Unlimited modifications to the sequence and duration of the work are generally not anticipated by the parties.

Modifications by prime contractors should be limited in subcontracts

Delays by subcontractors – How to investigate and analyze delays?

3. **Once the subcontract period of performance has been established**

- A **comparison** to the **Subcontractor's** **actual performance period** provides a measure of the **total delay** experienced by the **Subcontractor**.

But this is only the beginning of the story

- **Next**, it is necessary to **determine the causal link** between the **actions of the parties** and the **delays incurred** in order to determine **if** the **Subcontractor's delays** were **caused** by **others**.

The Subcontractors may be able to recover the delay costs caused by others (usually overhead costs)

Delays by subcontractors – How to investigate and analyze delays?

3. Once the subcontract period of performance has been established

- It is **necessary** to **determine** the **critical path of the Subcontractor's work**.
  - The **critical path** of the **Subcontractor's work** is the **longest path of activities leading** from the **first work activity** to be performed by the **Subcontractor to the last**.
    - ✓ **This path** may consist of **some** or **all** of the **Subcontractor's work activities**, as well as **work activities** performed **by others**.
      - o Because **these activities** are **integrated** within the **entire schedule network**, the **analyst cannot simply isolate** the **Subcontractor's work activities** and **evaluate** the paths among these in a **vacuum**.

Delays by subcontractors – How to investigate and analyze delays?

3. **Once the subcontract period of performance has been established**

As a result of these complexities, it may not be possible to <u>determine</u> the longest path between the Subcontractor's start and end points through <u>electronic analysis</u> of the schedules.

- **As an alternative**, it may be **necessary** to **determine** the **Subcontractor's critical path** through a **detailed evaluation** of the **<u>Subcontractor's daily work progress</u>**.

This evaluation is similar to the <u>As-Built Delay Analysis</u> discussed later.

Delays by subcontractors – How to investigate and analyze delays?

4. Process of a detailed evaluation of the subcontractor's daily work progress begins

- This **process** **begins** with the **preparation** of a **detailed as-built diagram** that **tracks** **all** of the **Subcontractor's actual performance**.
  - This **performance** is then **compared** to **all of the available planned performance information**.
    - To begin with, the **analyst** **determines** if the **Subcontractor** was **able** to meet **planned durations** for its work and, if not, **why not**.
      - Did the Subcontractor provide **sufficient resources** to accomplish the work?
      - Was the Subcontractor **in control of the pace** of the work, or was **something else controlling the pace**?

Delays by subcontractors – How to investigate and analyze delays?

4. **Process of a detailed evaluation of the subcontractor's daily work progress begins**
   - By evaluating the **Subcontractor's as-built work performance** moving forward **through the Project** and considering the **work that remains**, we can **determine:**
     1. **Critical path** of the subcontractor's work
     2. **Factors** that extended the work along this path

فرآیند جامع آنالیز تاخیرات در پروژه

بخش هشتم:

آنالیز زمانی تاخیرات

آنالیز تاخیرات در شرایطی که برنامه زمانبندی وجود ندارد!

ارائه دهنده:

سید محمدرضا علوی‌پور

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا

What we will learn?

- Introduction
- STEP 1: Use of contemporaneous documents for sequence and timing
  1. Contract documents
  2. Correspondence between the general contractor and the owner or owner's representative
  3. Subcontract agreements
  4. Correspondence with subcontractors
  5. Partial schedules produced during the project
  6. Meetings minutes
  7. Daily log or diary entries by either the general contractor's personnel or the owner's representative
  8. Purchase orders with suppliers
- STEP 2: Use of as-built analysis to quantify delays

Introduction

- The **preceding sections** discussed the performance of a delay analysis using a **detailed CPM schedule**.
- **This section** addresses the **"worst case"** situation: the Project with **no as-planned schedule**.
- This is the **most difficult situation** in which to perform a delay analysis.
- Again, as the **available information** **decreases**, the **analyst** must make **more assumptions**, and the analysis becomes **more subjective**.

However, while this type of analysis is difficult, it is not impossible.

Introduction

IMPORTANT NOTE:

When no schedule exists or the schedule so flawed, the analyst may be tempted to create an "after the fact" schedule, reasoning that it will allow the analysis to be more precise.

It is best not to create such a schedule, but sometimes it is unavoidable!

This practice may bias the analysis and not reflect the Contractor's original planned sequence of the work.

Introduction

- **Two steps** should be adopted in this case:
  1. Use of **contemporaneous documents** for **sequence** and **timing** to
     - ✓ **Define** some form of an **as-planned schedule**

       or

     - ✓ **Establish** a **general sequence**

  2. Use of **as-built analysis** to **quantify delays**

STEP 1: Use Of Contemporaneous Documents For Sequence and Timing

STEP 1: Use of contemporaneous documents for sequence and timing

- When there is **no as-planned schedule**, it is usually because the **General Contractor** did **not prepare** a **schedule** for the Project.

- In this situation, the **analyst** should begin by **reviewing all available documentation** to determine **if** any **information exists** that may **provide:**
  1. Some idea of a **proposed sequence** of the work for specific activities
  2. Some idea of a **proposed timing** for specific activities

What documents should be investigated in this case?

STEP 1: Use of contemporaneous documents for sequence and timing

- **The analyst should investigate the following documents:**
  1. Contract documents
  2. Correspondence between the general contractor and the owner or owner's representative
  3. Subcontract agreements
  4. Correspondence with subcontractors
  5. Partial schedules produced during the project
  6. Meetings minutes
  7. Daily log or diary entries by either the general contractor's personnel or the owner's representative
  8. Purchase orders with suppliers

STEP 1: Use of contemporaneous documents for sequence and timing

1. Contract documents

- The **contract documents** for any specific **sequence**, **phasing**, or **staging** specified as a requirement on the project.
  - *The **Contract** **required** that **all abutment work** be **completed** before **any paving** was **performed** on the approaches.*
  - *The **Contract** also required that **completion** of the Project **occur** by the **middle of the 24th week**.*

Special Conditions of the Contract-West Street Bridge-Section 1.01, paragraph 5.a:
In staging its work the contractor must complete all abutment construction activities prior to paving of the approaches on both the east and west sides of the bridge.

Special Conditions of the Contract-West Street Bridge-Section 0.01, paragraph 3.b:
TIME FOR COMPLETION: All contract work must be completed by the middle of the 24th week after the Notice to Proceed.

STEP 1: Use of contemporaneous documents for sequence and timing

2. Correspondence between the general contractor and the owner or owner's representative

- ❖ The **correspondence** for **references** to **sequence** or **timing**, **even if** only for a **portion** of the project.
- ❖ *The Contractor planned to work from east to west, or from abutment #1 to abutment #2, and from pier #1 to pier #3.*

June 15, 2007

John Lewis
Owner's Representative
Job Trailer
West Street Bridge
Podunk, New York 00001

June 15, 2007 contractor correspondence

Dear Mr. Lewis:

As we discussed yesterday during our meeting, we plan to work our construction operations on the West Street Bridge from an east to west direction. In other words, we will construct abutment #1 first and then abutment #2. Our paving of our approaches will follow the same sequence.

Similarly, our operations on the piers will progress from east to west direction, starting with pier #1 and progressing through pier #3.

I trust this answers the question you raised, and you can notify the Township authorities accordingly so they may effect the appropriate detours during the course of the project.

Sincerely,
Joe Super
Ace Construction

ACEMI

STEP 1: Use of contemporaneous documents for sequence and timing

- *The* ***Owner's representative*** *noted that the* ***review and approval*** *of the shop drawings for the reinforcing steel in the pier caps had* ***taken longer*** *than required and were* ***not returned to the Contractor*** *until* <u>*five weeks later than requested*</u>.

August 20, 2007 owner correspondence

August 20, 2007

Mr. Joe Super
Ace Construction
Job Trailer/West Street Bridge
Podunk, New York 00001

Dear Mr. Super:

Returned herein are the shop drawings submitted by Ace Construction for the reinforcing steel for the pier caps. As you will note, the drawings are approved as noted. Fabrication of the reinforcing steel can begin in accordance with the corrections noted.

I must note these drawings are being returned to you five weeks later than you requested. There are two reasons why the return of the shop drawings is five weeks beyond your requested date. First, you did not allow the engineer adequate time to review the drawings. As a minimum, the engineer requires three weeks to review, but you allowed only one week if they were to be returned within the time frame requested.

Second, the drawings were not prepared in accordance with normal shop drawing practices and consequently required much more time to review. As submitted, the drawings were extremely difficult to understand. While the engineer could have returned them disapproved and required resubmission in the proper manner, it was decided to take the extra time to correct them on the first submission in order to expedite the process.

If you have any questions, please feel free to call.

Sincerely,
John Lewis
Owner's Representative

STEP 1: Use of contemporaneous documents for sequence and timing

3. Subcontract agreements

- Subcontract agreements to look for **any sequence** or **timing** dictated to the **subcontractors** by the **general contractor** concerning specific **subcontract work**.

ACEMI

STEP 1: Use of contemporaneous documents for sequence and timing

4. Correspondence with subcontractors

- Correspondence with subcontractors for **any discussion** concerning **schedules**, **sequence**, or **timing**.

- *The Contractor planned on erecting the steel at the beginning of the 13th week of the Project*

June 25, 2007 correspondence to subcontractor

June 25, 2007

Mr. Grey Ferrous
Ferrous Steel Erectors
Iron Street
Steeltown, New York 00002

Dear Mr. Ferrous:

In accordance with our previous conversations, Ace Construction will require the delivery and erection of the steel for the West Street Bridge to begin by the beginning of the 13th week of the project. Based on your present fabrication schedule, it appears that this should not be a problem.

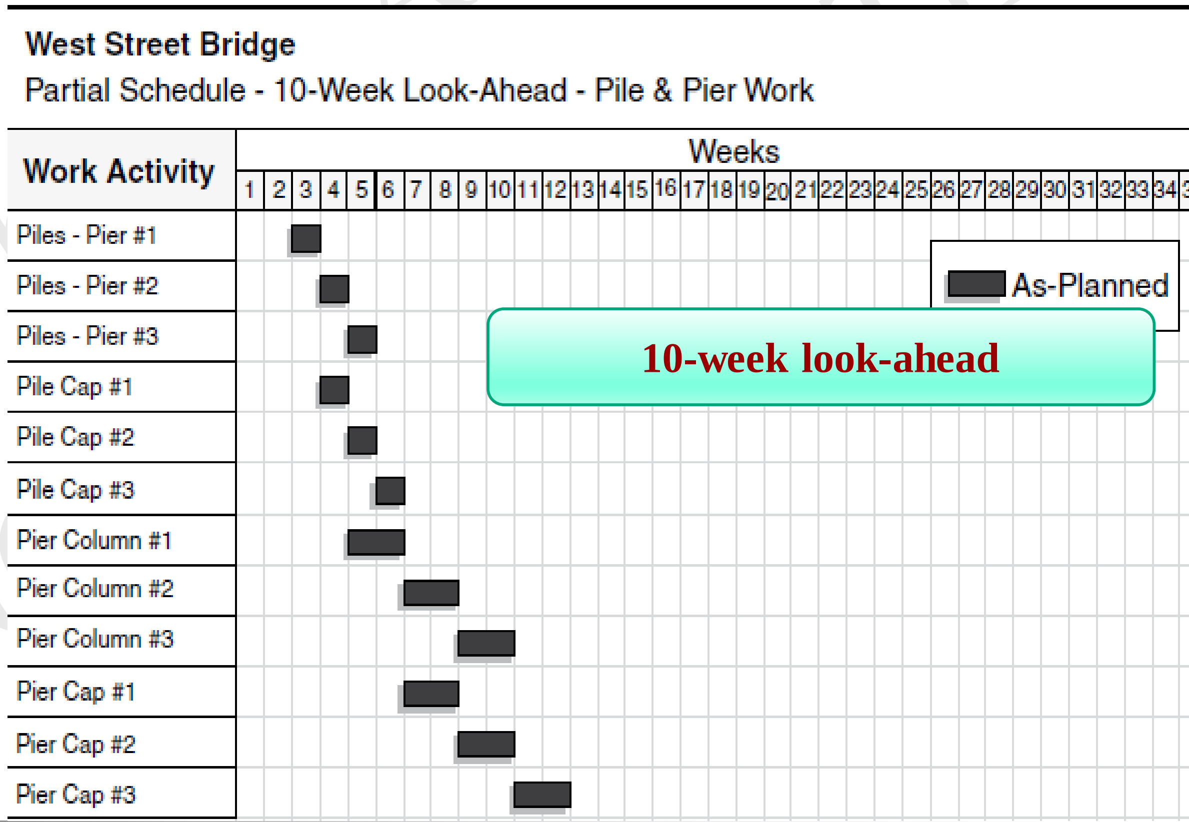
Please be advised that time is of the essence on this contract. In the past, we have had problems with steel suppliers promising delivery dates and not adhering to them. Action such as this will not be tolerated on this project. Your delivery and erection of steel is critical to our timely completion of the project.

Sincerely,
John Lewis
Owner's Representative

STEP 1: Use of contemporaneous documents for sequence and timing

5. Partial schedules produced during the project

- ❖ Partial schedules produced during the project, which may describe **any planned sequence** or **timing** for **portions of the project**.
- ❖ *The Contractor produced at least one ten-week "look-ahead" schedule that addressed the work on the piers and described the specific sequence for this work, including the piles, pile caps, pier columns, and pier caps*



STEP 1: Use of contemporaneous documents for sequence and timing

6. <u>Meeting minutes</u>

- ❖ Meeting minutes for **any discussions** concerning **<u>scheduling</u>**, particularly the **preconstruction meeting minutes**.

- ❖ *The Contractor anticipated a <u>two-week duration</u> for the forming,* ***reinforcing, and placing of*** *each of the concrete deck spans*

Pre-construction meeting minute

Contractor noted that the forming, reinforcing, and placing of the concrete deck spans will take two weeks per span. Contractor will proceed from east to west constructing span #1 through span #4.

STEP 1: Use of contemporaneous documents for sequence and timing

7. **Daily log or diary entries by either the general contractor's personnel or the owner's representative**

- *The Contractor expected four-week durations for each of the **abutments** and two-week durations for each of the **approaches**.*

Inspector's Daily Diary (Excerpt)

Daily diary

During discussion today with Joe Super (Ace Construction), he noted that the abutment work would take about four weeks to perform for each abutment, and the paving of the approaches would take about two weeks for each side of the bridge. Joe noted that the existing abutment sills are acceptable as shown on the contract drawings. Therefore, they can accept the steel as is. The remainder of the work on the abutments can be performed either before the steel is in place or after it is set. He is going to try to have the abutments completed before he sets any steel, since the work will be easier that way. However, he is concerned about the lead time allowed for obtaining the epoxy material called for in the contract. He said that, if necessary, he would set the steel so as not to delay the deck work that he feels controls his completion of the job.

STEP 1: Use of contemporaneous documents for sequence and timing

8. Purchase orders with suppliers

- **Purchase orders with suppliers** that show **planned dates for delivery** of materials or equipment.

STEP 1: Use of contemporaneous documents for sequence and timing

Conclusion based on the information reviewed

1. The contract required that all abutment work be completed before any paving was performed on the approaches. The contract also required that completion of the project occur by the middle of the 24th week ***(from Fig. 1).***
2. The contractor planned to work from east to west, or from Abutment #1 to Abutment #2, and from Pier #1 to Pier #3 ***(from Fig. 2).***
3. The owner’s representative noted that the review and approval of the shop drawings for the reinforcing steel in the pier caps had taken longer than required and were not returned to the contractor until 5 weeks later than requested ***(from Fig. 3).***
4. The contractor planned on erecting the steel at the beginning of the 13th week of the project ***(from Fig. 4).***
5. The contractor produced at least one, 10-week “look-ahead” schedule that addressed the work on the piers and described the specific sequence for this work, including the piles, pile caps, pier columns, and pier caps ***(from Fig. 5).***
6. The contractor anticipated a 2-week duration for the forming, reinforcing, and placing of each of the concrete deck spans ***(from Fig. 6).***
7. The contractor expected 4-week durations for each of the abutments and 2-week durations for each of the approaches ***(from Fig. 7).***

STEP 1: Use of contemporaneous documents for sequence and timing

- The **analyst** should use **all the available information** to:
  1. **Define** some form of an **as-planned schedule** or
  2. **Establish** a **general sequence**

     for the **work** on the Project for **different points** or **portions** of the Project.

Based on this information, the analyst can proceed with the analysis, despite the lack of a complete as-planned schedule.

STEP 1: Use of contemporaneous documents for sequence and timing

- Keep in mind that the **goal is not** to prepare an **"alternative" or "after-the-fact" baseline** or **new as-planned schedule** for the project.
  - Rather, the goal is to **mine the project information** in search of the **contractor's original plan** for construction.
- To the extent a "planned" schedule is **drafted as the basis of the analysis**, it should be done so with
  1. Only the information that can be gleaned from **project documents**, such as the examples outlined in this course,
  2. **Mandatory sequencing** dictated by the physical construction attributes and conditions.
  3. **Understanding** that the as-planned is **incomplete and limited** in terms of its **precision**.

STEP 2: Use Of As-built Analysis To Quantify Delays

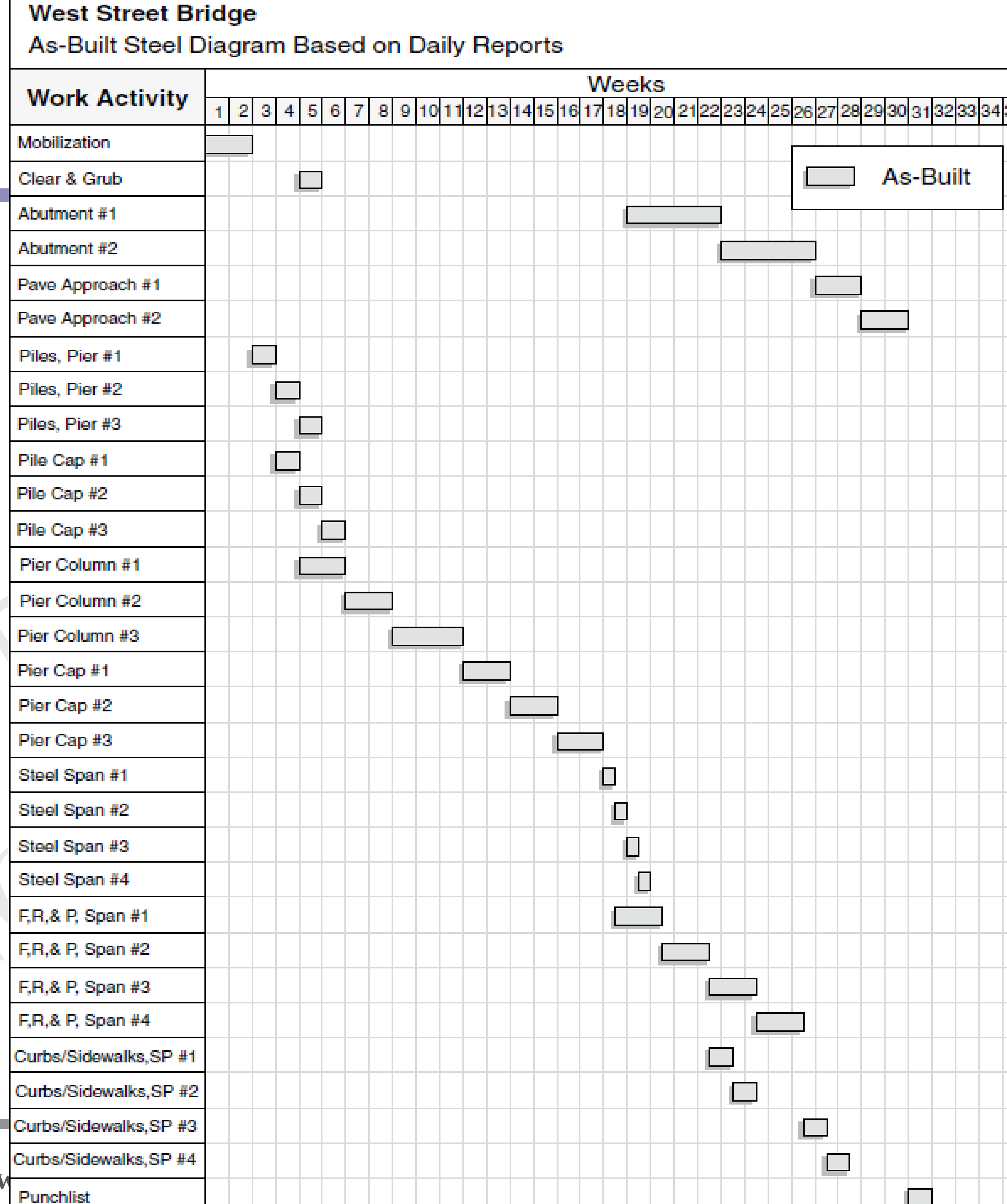
STEP 2: Use of as-built analysis to quantify delays

- Although **no updated schedules exist** for this Project, **detailed daily reports** do **exist**.

- **Daily reports** allow the analyst to **prepare an as-built diagram** for the job.

STEP 2

- In reviewing the **as-built diagram**, the **first obvious** conclusion is that the Project was **delayed seven and one-half weeks**.
  - It was to be **completed** by the **middle of the 24th week** but was **not actually finished** until the **end of the 31st week**.
    - ***This is net delay***



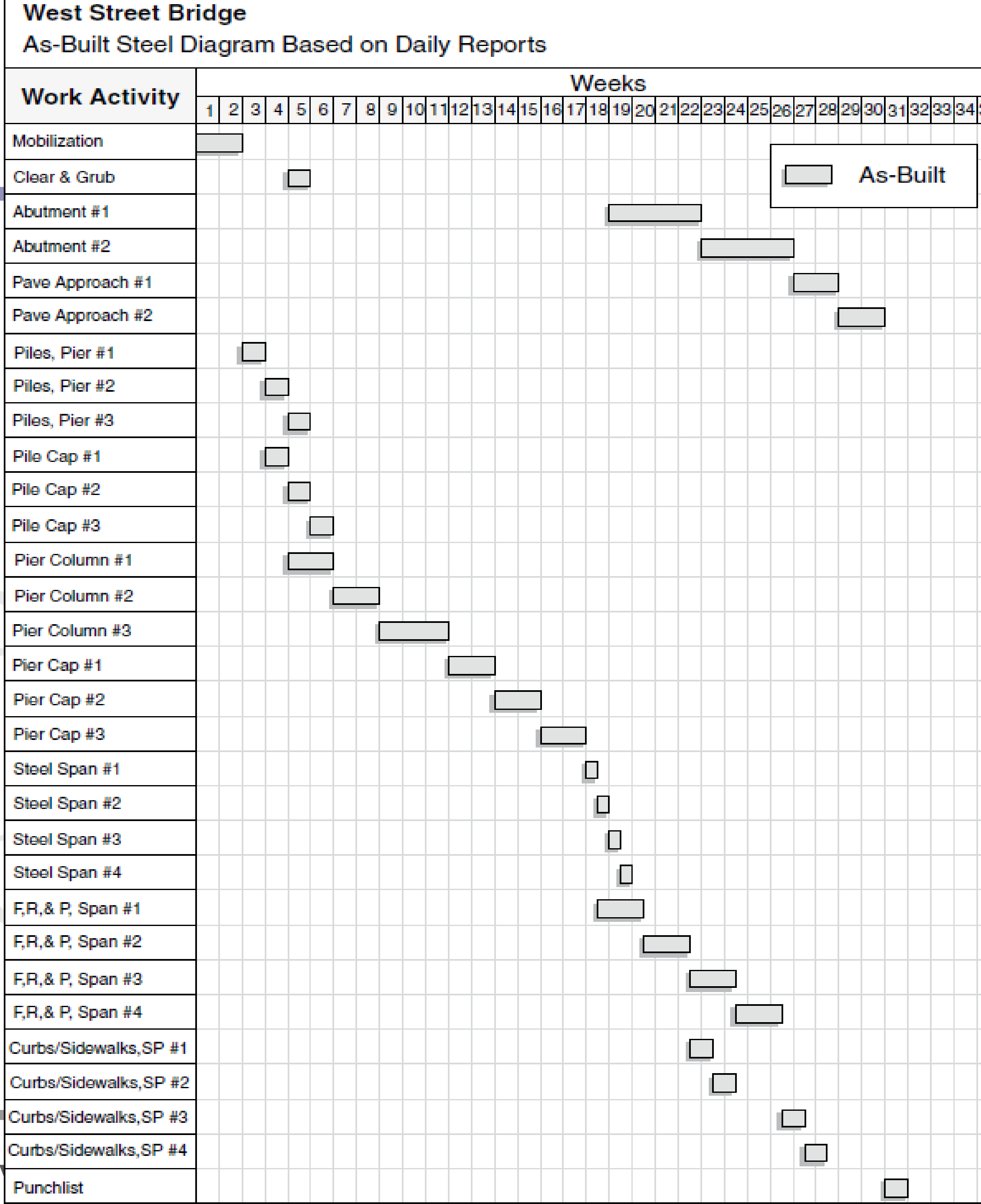
ACEMI

STEP 2

- **Analyst** must account for at least **seven and one-half weeks of net delay**.

- The delay **could**, in fact, be **greater <u>if</u>** the C**ontractor had planned** to **finish** the Project **<u>early</u>**.
  - However, **<u>no such plans</u>** were indicated in the **Project correspondence**, so this **assumption** will **not be made**.

- The **as-built diagram** also shows that the **<u>Contractor did work</u>** from **east to west as planned**.

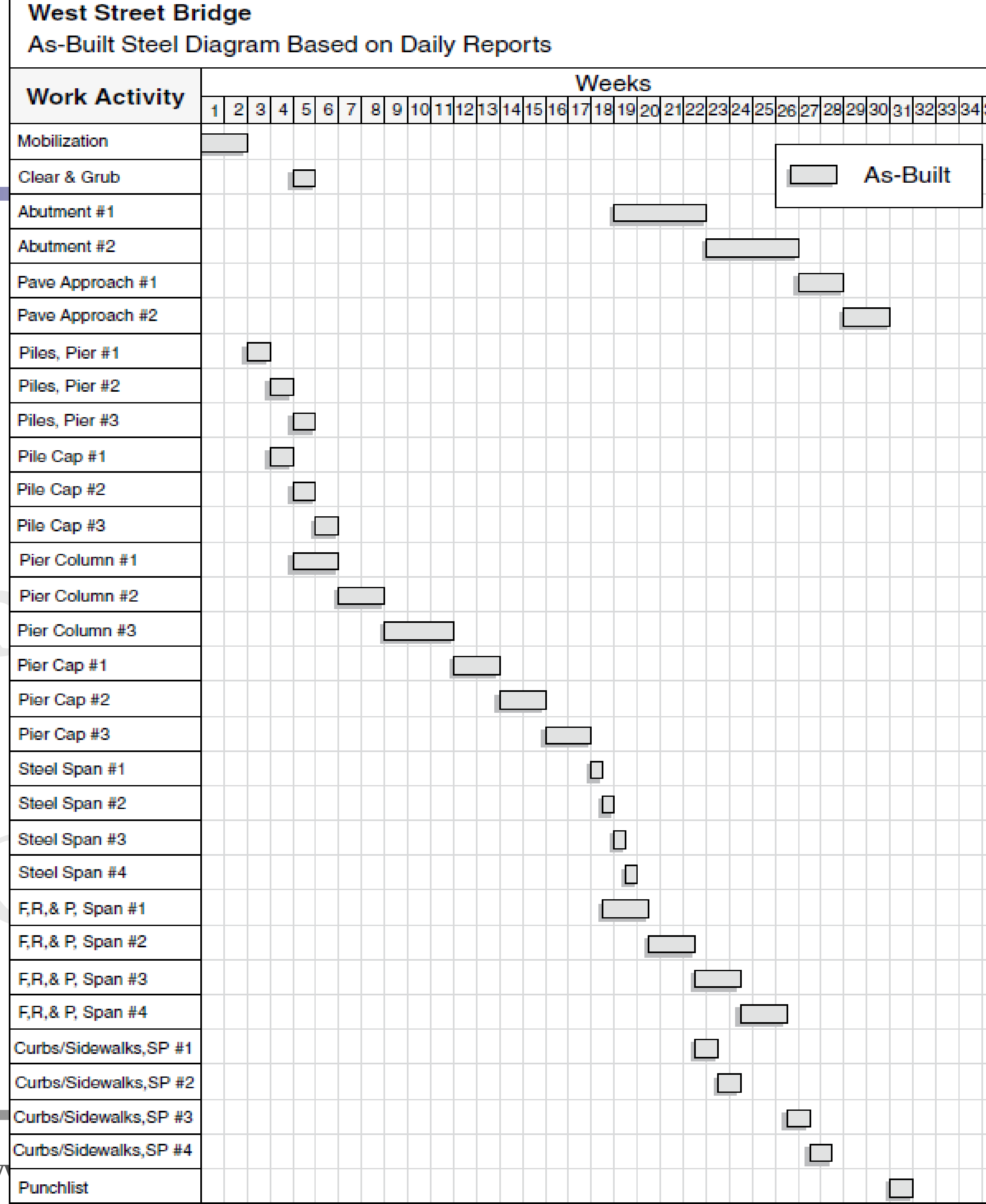


STEP 2

- Based on the **letter** to **Ferrous Steel Erectors**, the Contractor planned to **start steel erection** at the beginning of the **13th week**.

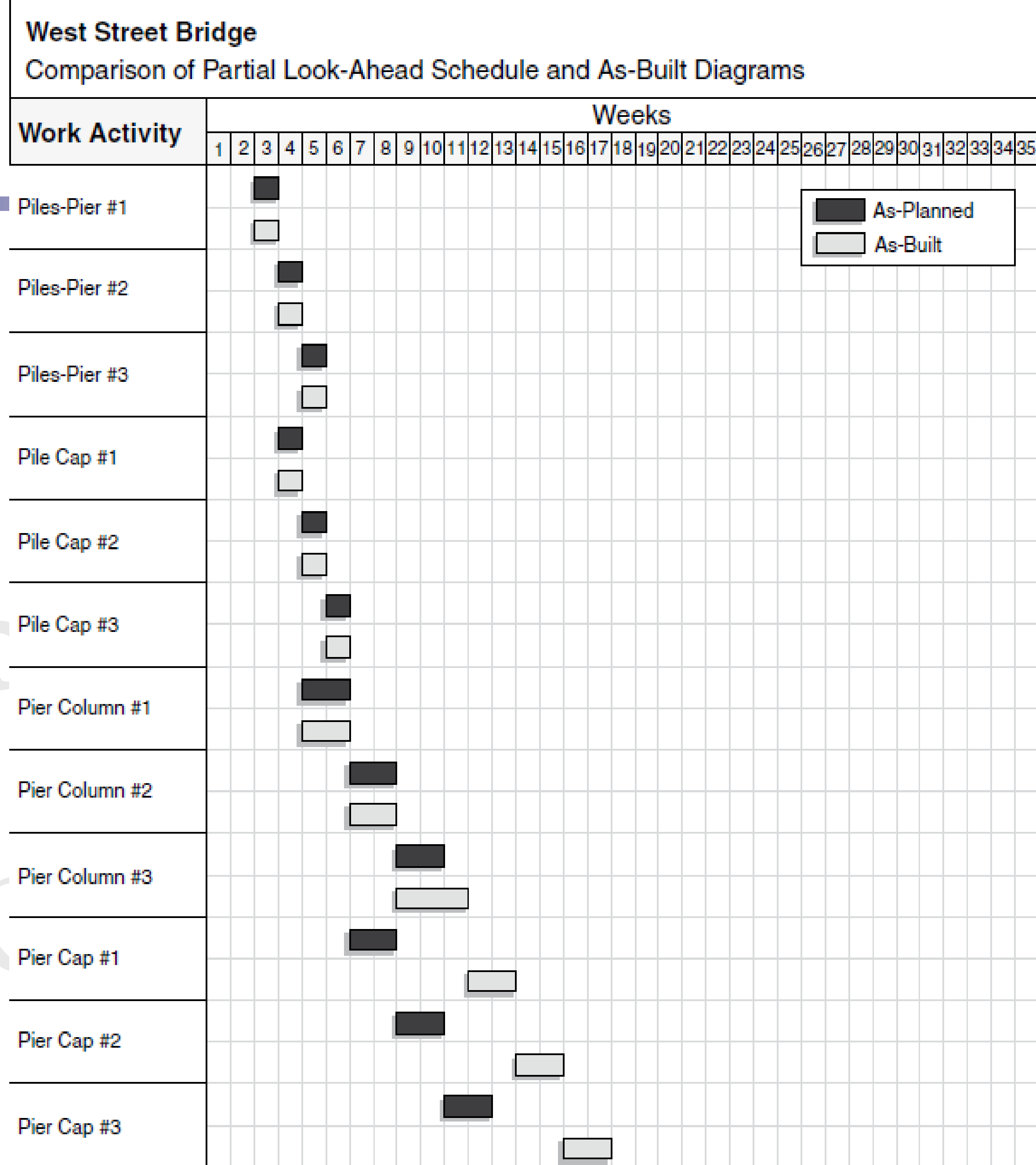
- The **as-built diagram** shows that **steel erection** began at the **beginning** of the **18th week**.

***A five-week delay** can be identified for the **start of the steel erection**.*



STEP 2

- **Analyst** **breaks down** the activities that **precede** the **start of steel erection**.
- **Analyst** uses the **ten-week "look-ahead" schedule,** which the **Contractor produced** at the **end of the second week** of the Project.

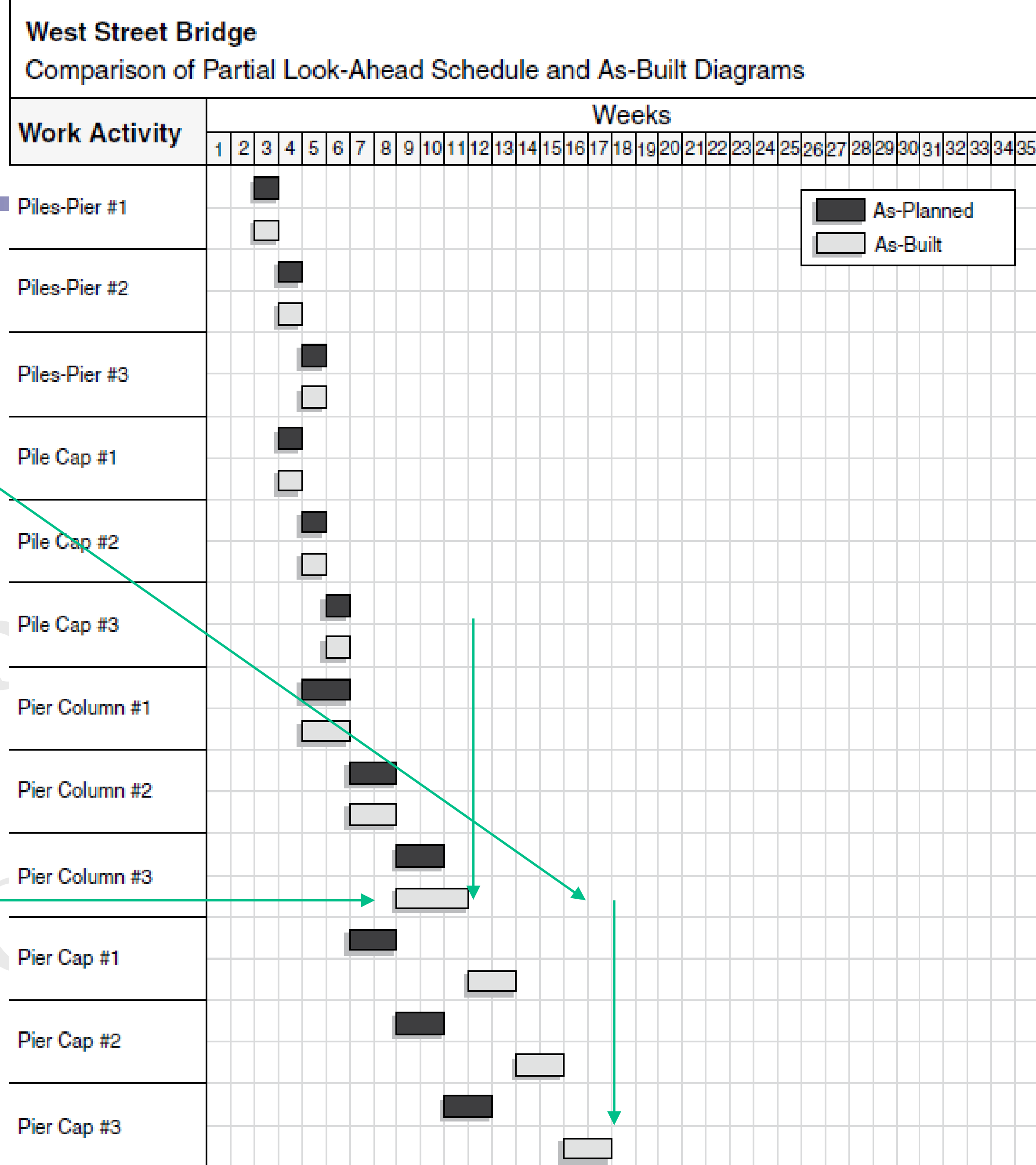


STEP 2

- A **comparison** shows that a **delay** occurred to the **construction of the pier caps**.

- A **delay** also appears in the **construction of pier column #3**, which took **three weeks instead of two weeks** to complete.

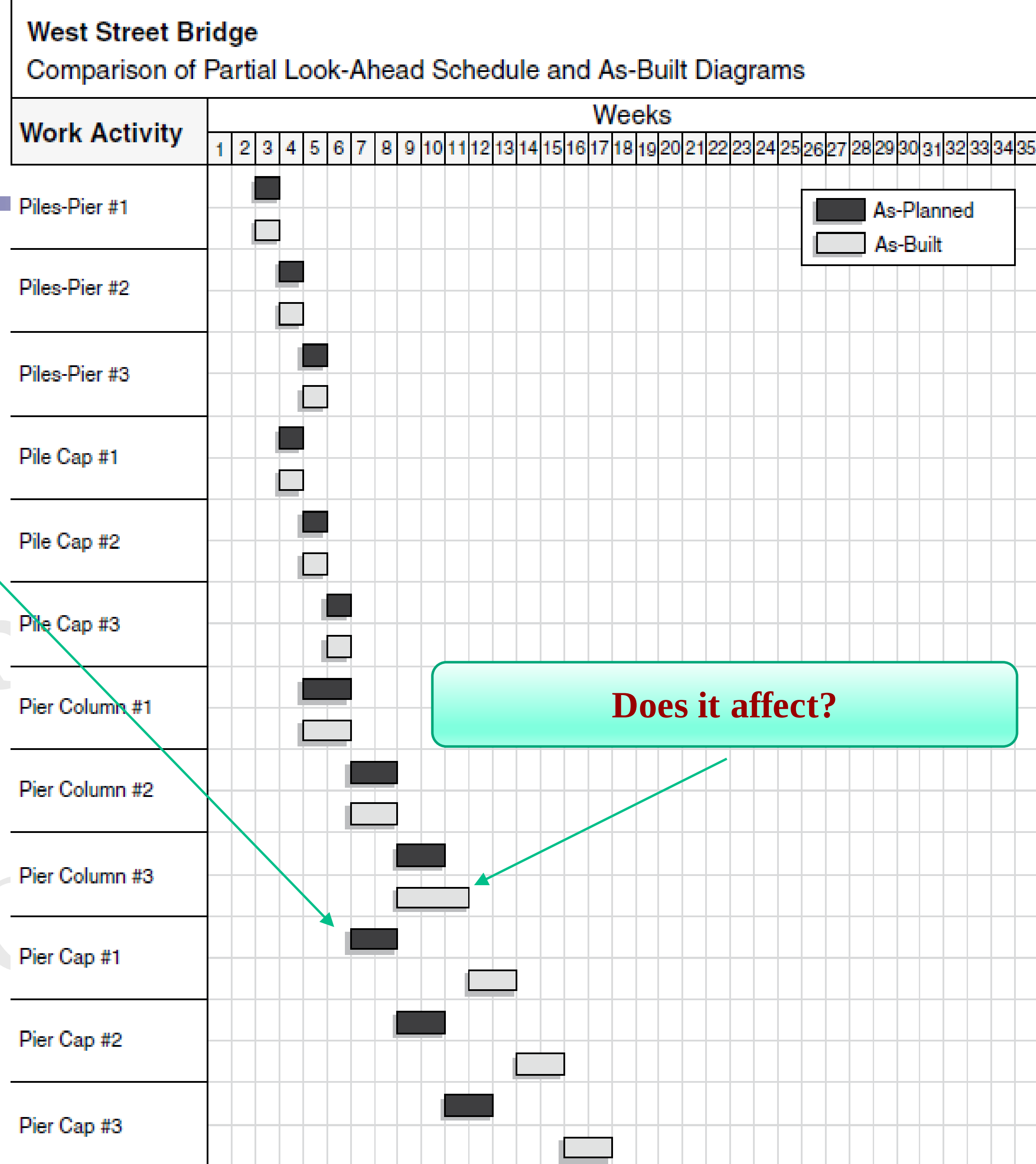
Is it the first critical delay?



STEP 2

- A **comparison** shows that the **controlling delay** was the **delay** to the **Pier Cap #1.**

- This may have been the **result** of the **five-week delay** in **approval** of the **shop drawings** to which the **Owner's representative** had referred in **correspondence** *(Fig. 2)*.

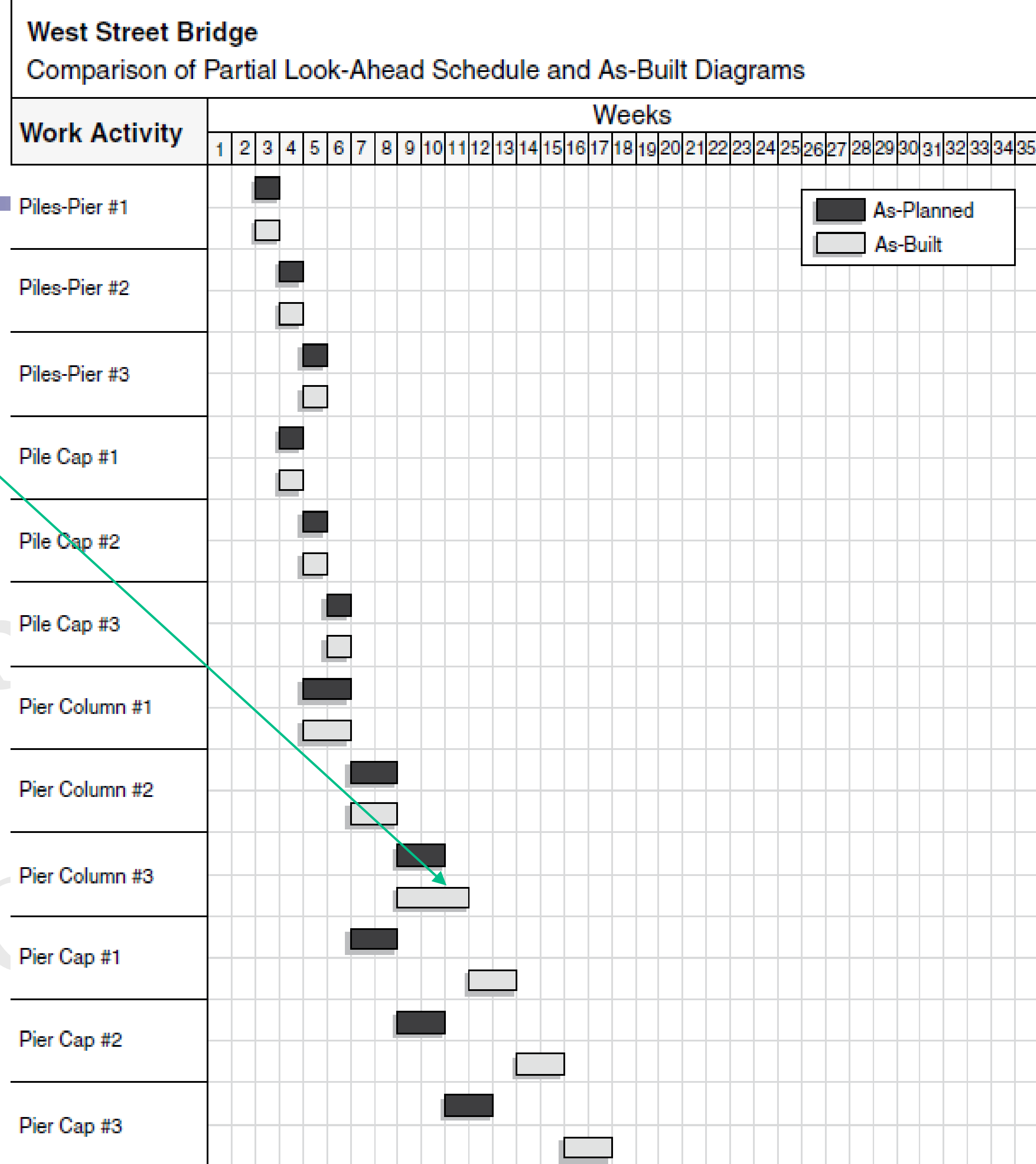


ACEMI

STEP 2

- It does **not appear** that the delay in the **completion of pier column #3** affected the **completion of the Project**.

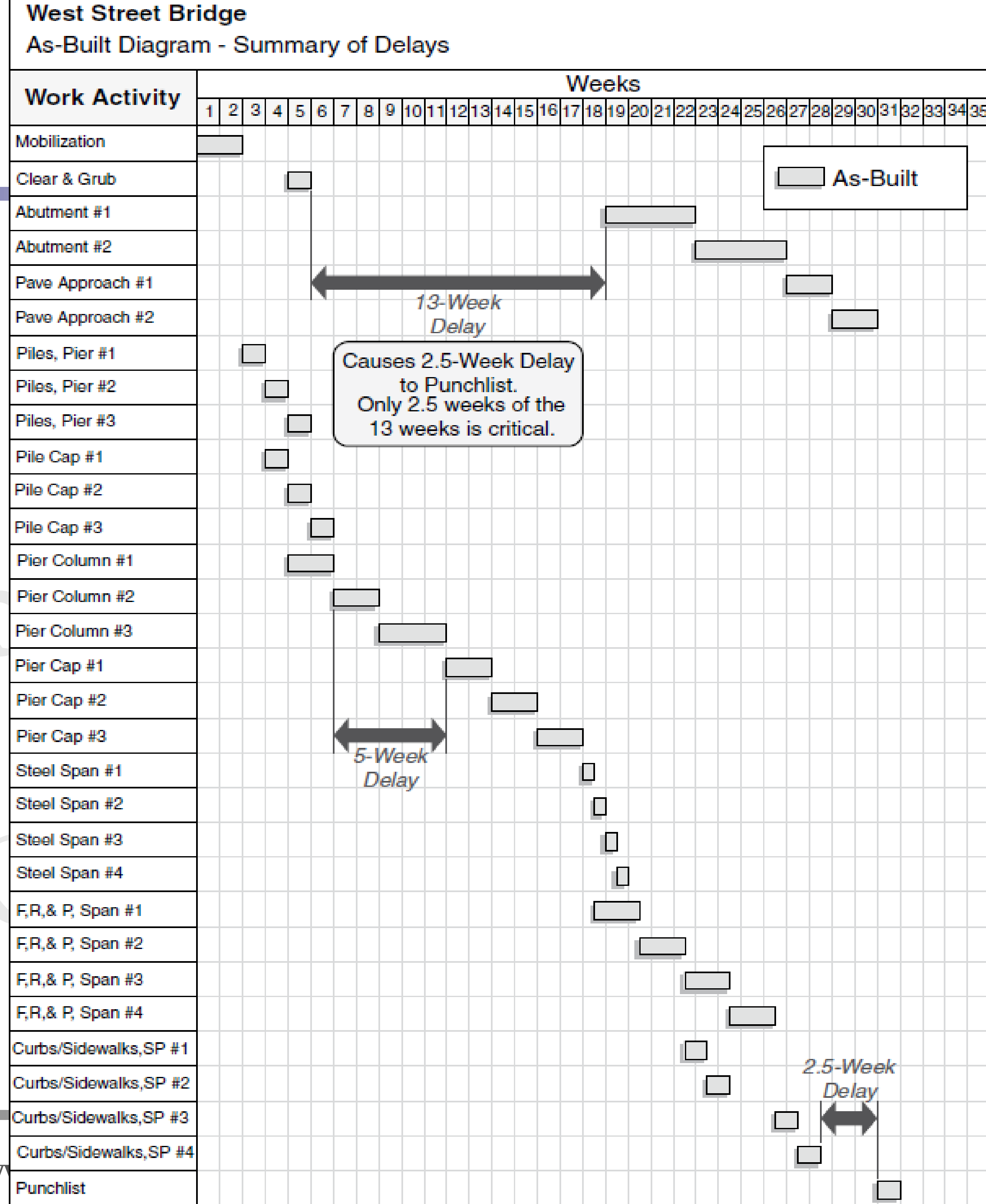
- The **remainder of the work** along the **pier/deck path** appears to have been performed in a **logical**, **sequential fashion** and **does not** indicate **further delay**.



STEP 2

- There is, **however**, a **gap** between the **completion** of the **curbs** and **sidewalks** and the **beginning** of the **punch list work**.

- The **punch list work** did **not start until** the **abutments** and **approaches** were completed.

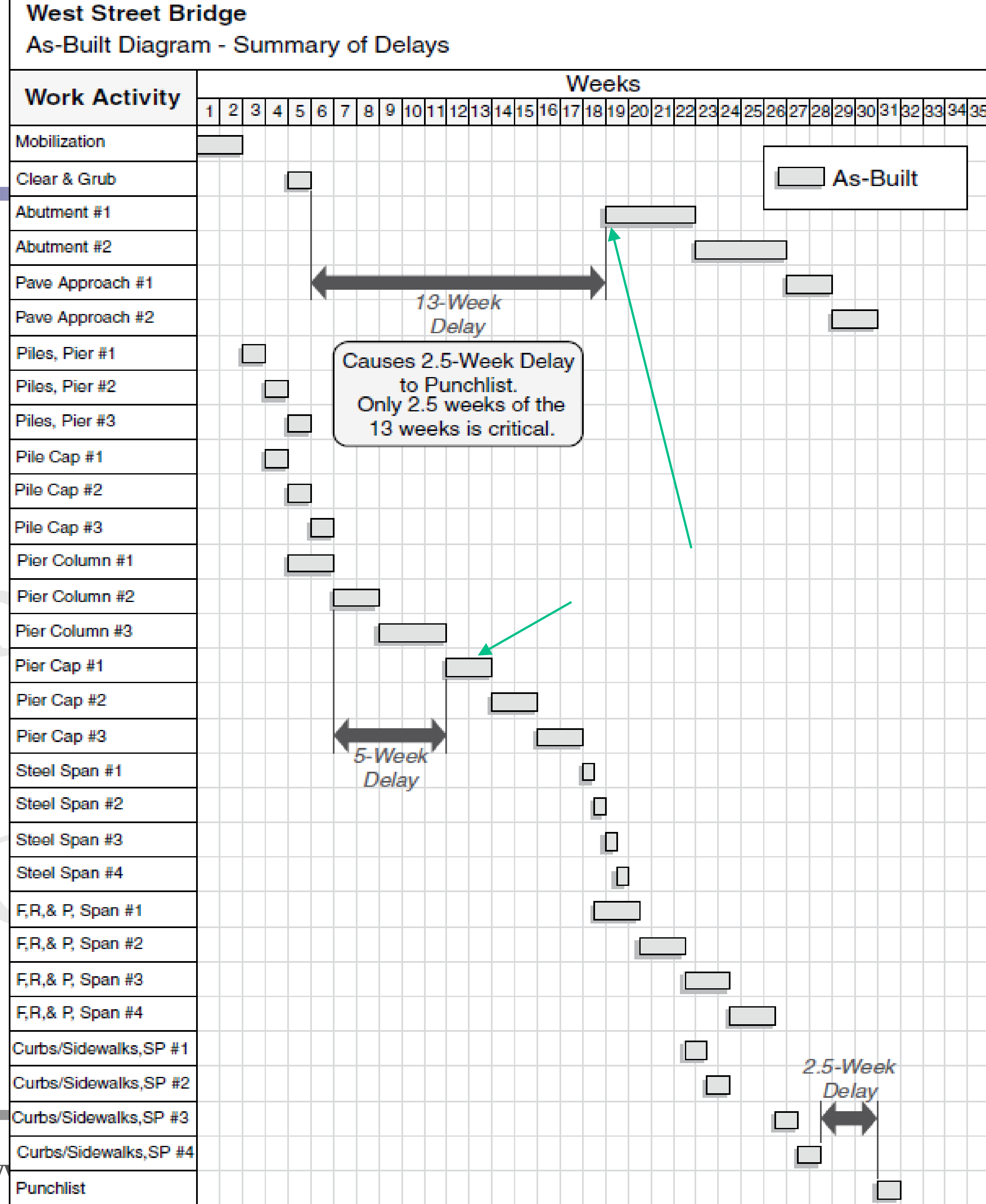


STEP 2

- The **delay of seven and one-half weeks** is from:

(1) Five weeks of delay to the **start** of the **pier cap work.**

(2) Two and one-half weeks of delay to the **start** of the **abutment/approach work**.



موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

دفتر آموزش

تهران، بلوار فردوس شرق، مجتمع آبگینه، طبقه سوم اداری، واحد C42

+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۵۰

+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۴۵

---

www.dralavipour.com

info@dralavipour.com

@acemi_social

@alavipour_pm

@IRANACEMI

@alavipour_pm