فرآیند جامع آنالیز تاخیرات در پروژه

بخش پنجم:
آنالیز زمانی تاخیرات

فرآیند جامع و مدارک و مستندات لازم برای پیش بینی و آنالیز تاخیرات

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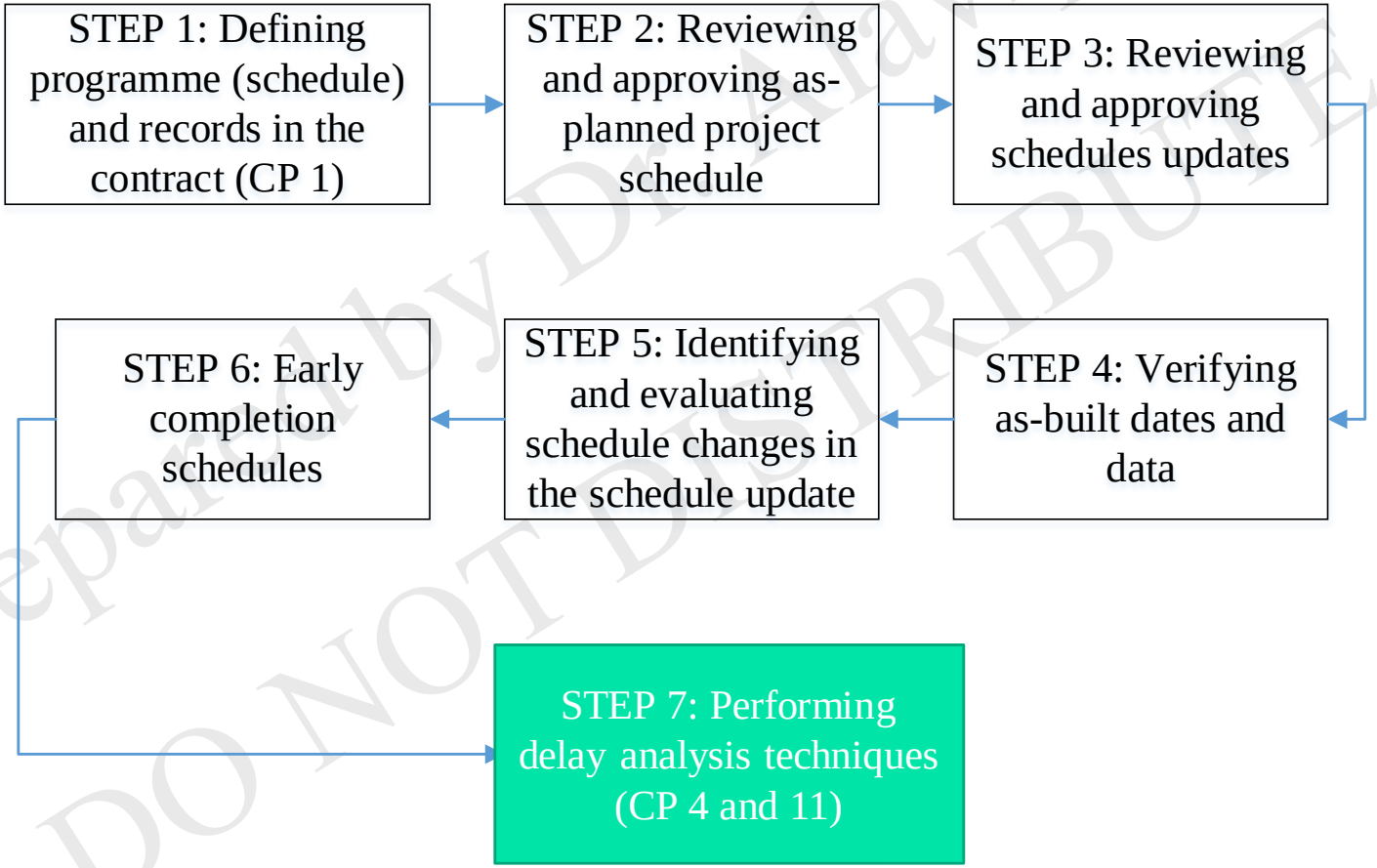
What we will learn?

- General Procedure for analysis
  - **STEP 1:** Defining programme (schedule) and records in the contract (CP 1)
  - **STEP 2:** Reviewing and approving as-planned project schedule
  - **STEP 3:** Reviewing and approving schedules updates
  - **STEP 4:** Verifying as-built dates and data
  - **STEP 5:** Identifying and evaluating schedule changes in the schedule update
  - **STEP 6:** Early completion schedules
  - **STEP 7:** Performing delay analysis procedure (CPs 4 and 11)

Delay analysis procedure

- **The following Steps needed to be taken for contemporaneous analysis:**



STEP 1: Defining programme (schedule) and records in the contract (CP 1)

1. Programme and records

Contracting parties should reach a clear agreement on the type of records to be kept and allocate the necessary resources to meet that agreement. Further, to assist in managing progress of the works and to reduce the number of disputes relating to delay and disruption, the Contractor should prepare and the CA should accept a properly prepared programme showing the manner and sequence in which the Contractor plans to carry out the works. The programme should be updated to record actual progress, variations, changes of logic, methods and sequences, mitigations or accelerations measures and any EOTs granted. If this is done, then the programme can be more easily used as a tool for managing change and determining EOTs and periods of time for which compensation may be due.

- ***The guideline presented here describes the typical records needed for effectively managing progress of the works and proving***
  1. ***EOT claim***
  2. ***Compensation claim***

STEP 1: Defining programme (schedule) and records in the contract (CP 1)

We talked about schedule in the contract in Planning and Scheduling Course

We talked about records in the contract in Document Management Course

However, we will make the link between CP 1 and delay analysis in this course.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Introduction to records

- To reach a **clear** and **documented agreement** on **record keeping**, the parties should **consider**:

(a) the types of records to be produced and the information to be contained therein;

(b) who is responsible for both producing and checking those records;

(c) the frequency with which those records are to be updated or produced;

(d) the distribution list for those records;

(e) the format of those records (for example, to ensure compatibility with any project-wide database); and

(f) the ownership (including any relevant intellectual property rights) and storage of, and access to, those records.

It is recommended that the items mentioned included in the bidding documents.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Introduction to records

Should owner also keep the records?

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Introduction to records

- The **employer (owner)** should consider **whether it is appropriate** to **produce** and **maintain** its own **independent set of relevant records**.

- **Why is it helpful?** Such records **assist** to:
  1. Have **better management control**
  2. **Support any claims** the employer or contractor may have **against each other**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Format and storage of records

❑ Format and storage of records:

- ❖ **Records** should be **produced** and **stored** **electronically (at least in PDF format)**
  - ✓ **Emails**, **programmes** and **spreadsheets** containing formula should be kept in **their electronic format**.
  - ✓ **Some records** may need to be **shared by other parties** such as contractor. ***DO NOT FORGET TO DEFINE ACCESS AT THE OUTSET***
  - ✓ **Technology** is quickly **changing**, therefore use **standard document management systems** that are **flexible**.
  - ✓ Regarding the **growing use of building information modeling (BIM)**, the effective use of **BIM requires specific agreement** between the parties regarding:
    1. Content of records
    2. Use of records
    3. Ownership of records

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Records

- The **"Records"** recommended here **divided** into the following **six categories**:
  1. Programme records
  2. Progress records
  3. Resource records
  4. Costs records
  5. Correspondence and administration records
  6. Contract and tender documents

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

1. Programme records

- These records **set out** the **contractor's plan** for **carrying out the works**.
- Include **three major items:**
  1. Main programmes
  2. Supplemental detailed programmes
  3. Explanatory records

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

1. Programme records

- **Main programmies** include:
  1. **Tender programmes**
  2. **Contractor's proposed** programmes (**submitted for acceptance**)
  3. **Baseline** (as-planned) programme (**accepted programme**)
  4. **Updated** programmes (**the last of which should be an as-built programme**)
  5. **Revised** programmes to take account of
     - **Re-sequencing**
     - **Acceleration measures**
     - **Mitigation measures**
  6. **Detailed short-term look ahead programmes** such as four week look-ahead programmes
  7. **Contractor's internal target programmes**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

1. Programme records

- **Supplemental detailed programmes** in a suitable format such as **CPM**, **LOB**, **time location analysis**, **tabular spreadsheet**, or **database** for:

(a) design;

(b) approvals (including the CA's approvals and public authority approvals);

(c) procurement or manufacturing;

(d) delivery;

(e) installation;

(f) construction of key aspects of the works; and

(g) testing and commissioning.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

1. Programme records

- **Explanatory records** that explain in **words**, **graphics**, and **spreadsheets**
  - This is **schedule narrative report**
  - These **records are used** to:
    1. **Explain contractor's plan** in detail
    2. **Explain activities** in the programmes
    3. **Explain** how the **durations**, **logic**, and **sequences** of **activities** were **determined**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

1. Programme records

- Some examples of **explanatory records:**

1. **Narrative programme** for **contractor's proposed programme for baseline**
   - Set out the **assumptions** at a **minimum**: **key resources**, **risks**, **sequencing constraints**, and the **critical path**
2. **Narrative programme** for **updated programme** or **proposed revised programme**
   - *For example:*
     1. ***Identification*** *of any* ***delay*** *or* ***disruption*** *events*
     2. ***Key changes*** *to the* ***sequence*** *and* ***duration*** *of* ***activities*** *or* ***as-built data*** *from:*
        1. *Last updated programme*
        2. *Critical path*
        3. *Near critical path*

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

1. Programme records

- Some examples of **explanatory records:**
  3. **Progress curves** for:
     - Costs
     - Resources
     - Physical construction
  4. **Tabular report** of **milestones**
     - **Scheduled**
     - **Forecast**
     - **Actual**
  5. **As-built database** for each activity
  6. **BIM files** where BIM is **being used** for the **activities**
  7. **Marked-up drawings** showing the **anticipated completion** and **as-built dates** for activates

COLOR	DESCRIPTION OF USE
Red	Items to be added to the drawing
Green	Items to be removed from a drawing
Blue	Comments that are not to be added to the drawing
Yellow Highlighter	Used for marked items as completed by the designer

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- **Identify** the **progress** of the works at a **particular time**.
- **Contain** **as-built data**, both **(1) On-site** and **(2) Off-site**
- **Cover** all the activities that **affect completion** of the works (**near critical** or **critical path**)
- **Progress records** are required to **establish the progress** of the works **at the time of a delay** or **disruption event**, the **impact of that event**, and **its effect on the works**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- **Progress records** should be **connected with**
  - As-planned programme
  - Updated programme
  - Costs records

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- Include **three major items:**
  1. Raw data records
  2. Compiled records
  3. Procurement records

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- **Raw data records** are those that should be **compiled** on a **regular basis, normally daily** which record **how relevant parts of the work** are **being carried out**.
- **Progress achieved:**
  - **Before** periods of **delay or disruption**
  - **During** periods of **delay or disruption**
  - **After** periods of **delay or disruption**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- Sample of **Raw data records:**

1. Reports

- For each major work area recording weather conditions, manpower, deliveries of key materials, discovery of adverse site conditions, working hours, major plant and equipment used, and work activities underway

2. Health, safety, environmental and/or security issues log

3. Obstruction data

4. Evidence of area handovers between contractors/others

- Identifying **which contractor/other party** should **perform each work** in **each area** at **what time**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- Sample of **Raw data records:**

Labor Time Reporting

Daily Labor Time Card

Project: Highway Bridge | Project No.: 200808-05 | Weather: Cloudy-windy
Date: July 20 | Prepared by: G.A.S.

Employee Number	Name	Craft	Time Classification	Hourly Rate	Cost Code 03157.10.3	Cost Code 03157.20.3				Total Hours	Gross Amount
132	Winnowich, N.	F	ST	34.00		8				8	$272.00
			OT								
221	Clouten, S.	C	ST	$31.00		8				8	$248.00
			OT								
248	Schluder, L.	C	ST	$31.00		8				8	$248.00
			OT								
319	Mills, R.	O	ST	$33.00		2				2	$66.00
			OT	0							
143	Gibson, E.	L	ST	$22.00		8				8	$176.00
			OT								
417	Sears, K.	L	ST	$22.00		8				8	$176.00
			OT								
176	Sibanda, M.	L	ST	$22.00	2	6				8	$176.00
			OT								
Total Hours					2	48				50	
Total Cost					$44.00	$1,318.00					$1,362.00

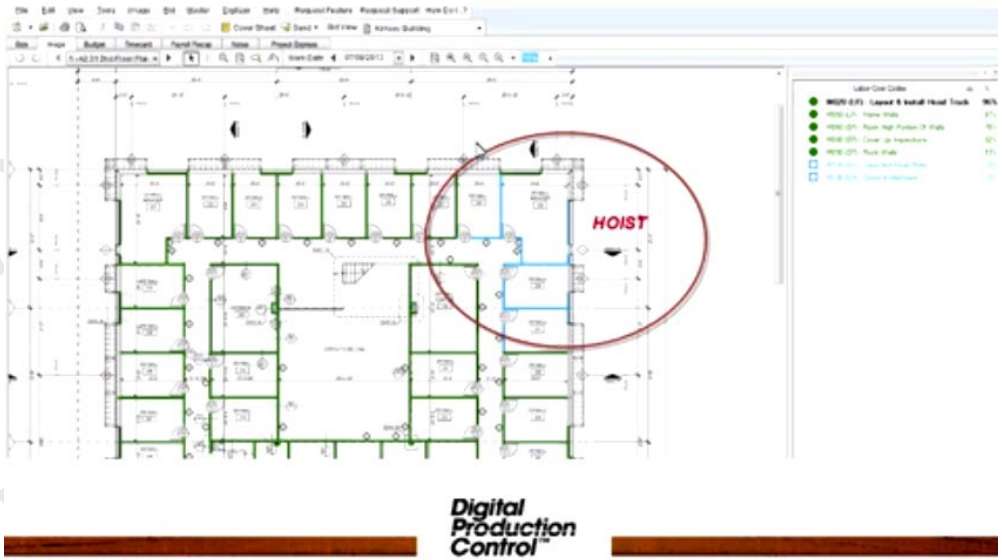
Highway bridge, daily labor time card

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- Sample of **Raw data records:**

Description	Begin Time	End Time	Quantity (LF)
Excavating Soil	700	913	
Excavating Rock	913	1400	
Excavation Soil	1400	1500	
		Quantity	14.5
		Duration	8



Description	Begin Time	End Time	Duration	Quantity (LF)	Productivity
Excavating Soil	700	910	2.1	20	9.52
Excavating Rock	910	1400	4.9	10	2.04
Excavation Soil	1400	1500	1	10	10.00

By: Alavipour, PhD, PMP, CMIT

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- Sample of **Raw data records:**
  4. **Geological mapping** records
  5. **Inspection requests/inspection** reports
  6. **Site test** records
  7. **Testing and commissioning** records (including certificates)
  8. **Webcam videos**
  9. **Progress photographs**
     - With **date taken** and if possible **GPS coordinates**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- **Compiled records:** These are records **prepared** from the (1) **raw data records** and (2) **programme records.** These include:
  1. **Detailed monthly progress** reports
  2. **Weekly progress** reports setting out the following:
     - a) **Overview of progress** in the **main work areas**
       - Including design and procurement or manufacturing
     - b) **Work status** in **each area of the works**
       - Covering the relevant programme activities underway
     - c) **Illustrations of progress achieved**
       - Such as drawing of pile locations with piles completed, level and section of concrete cast, etc.
     - d) **Weather reports**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- **Compiled records:** These are records **prepared** from the (1) **raw data records** and (2) **programme records.** These include:

Activity		Scheduled		Actual/Expected		Status	Notes
D	Description	Start	Finish	Start	Finish	%	

Activity Status Report to Monitor Project Schedule Status.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- **Compiled records:** These are records **prepared** from the (1) **raw data records** and (2) **programme records.** These include:

Construction Progress Chart

Project: Highway Bridge — Date: July 21 — Job No.: 200808-05

Activity	Activity Number	July: 8	9	12	13	14	15	16	19	20	21	22	23	26	27	28	29	30	August: 2	3	4	5
Forms & rebar footing #1	130																					
Drive piles, abutment #2	140					80%																
Demobilize pile-driving rig	160																					
Pour footing #1	150																					
Strip footing #1	170																					
Forms & rebar, footing #2	190																					
Pour footing #2	210																					
Forms & rebar, abutment #1	180																					
Strip footing #2	230																					
Pour abutment #1	200																					
		18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38

Working Days

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- **Compiled records:** These are records **prepared** from the (1) **raw data records** and (2) **programme records.** These include:

Weekly Labor Time Card

Craft C

Name Clouten, S.
Employee No. 221
Week Ending July 21

Project Highway Bridge
Project No. 200808-05
Prepared by S.K.S.

Cost Code	Time Classification	Hourly Rate	Thursday	Friday	Monday	Tuesday	Wednesday	Total Hours	Total Cost
03157.10.3	ST	$31.00	8					8	$248.00
	OT								
03157.20.3	ST	$31.00		8	8	8		24	$744.00
	OT								
03311.10.3	ST	$31.00					8	8	$248.00
	OT								
	ST								
	OT								
	ST								
	OT								
Total Hours	ST		8	8	8	8	8	40	
	OT								
Gross Amount			$248.00	$248.00	$248.00	$248.00	$248.00		$1,240.00
Weather			Clear-hot	Clear-hot	Cloudy-gusty	Cloudy-windy	Cloudy-windy		

Highway bridge, weekly labor time card

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

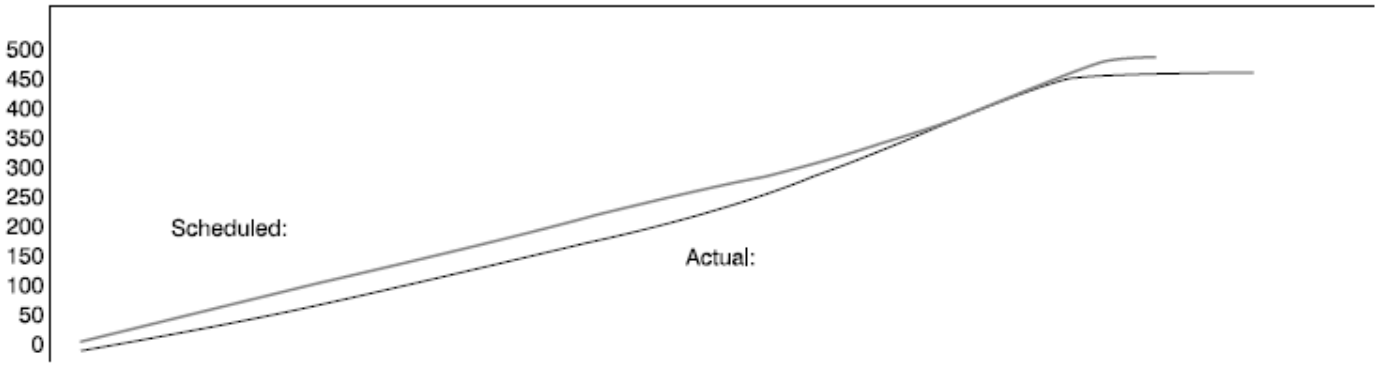
2. Progress records

- **Compiled records:** These are records **prepared** from the (1) **raw data records** and (2) **programme records.** These include:

Project: Olympic Hotel and Resort — Foreman: Joe Wallace
System/Area: Doors, Frames, and Hardware — Date Developed: 11/20/19

Work Days:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Totals:
Estimated Crew Size:	3	3	3	3	3	4	4	4	4	4	4	4	4	4	3	0	0	
Estimated Daily Hours:	24	24	24	24	24	32	32	32	32	32	32	32	32	32	24	0	0	
Accumulated Hours:	24	48	72	96	120	152	184	216	248	280	312	344	376	408	432	432	432	432
Actual Crew Size:	2	2	2	3	3	3	4	4	4	5	5	5	5	2	2	1	1	
Actual Daily Hours	16	16	16	24	24	24	32	32	32	40	40	40	40	16	16	8	8	
Accumulated Hours:	16	32	48	72	96	120	152	184	216	256	296	336	376	392	408	416	424	424

Manpower Curve:
Hours:



Foreman's cost control work package

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- **Compiled records:** These are records **prepared** from the (1) **raw data records** and (2) **programme records.** These include:

Weekly Labor Cost Report

Project: Highway Bridge — Project No.: 200808-05
Week ending: July 21 (working day 27) — Prepared by: S.K.S.

Cost Code (1)	Work Type (2)	Unit (3)	Quantity			Direct Labor Cost				Labor Unit Cost			To Date		Projected	
			Budget (4)	This Week (5)	To Date (6)	Budget (7)	Budget to Date (8)	This Week (9)	To Date (10)	Budget (11)	This Week (12)	To Date (13)	Savings (14)	Loss (15)	Savings (16)	Loss (17)
31220.10.3	Excavation, unclassified	cy	1,667	0	1,667	$2,643	$2,643	$0	$2,459	$1.59	-	$1.48	$184		$184	
31222.10.3	Excavation, structural	cy	120	0	120	$2,985	$2,985	$0	$3,353	$24.88	-	$27.94		$368		$368
31350.00.3	Pile-driving rig, mob. & demob.	job	–	–	–	*$4,374	*$4,374	$0	$4,004	$4,374	-	$4,004	$370		$370	
31361.10.3	Piling, steel, driving	lf	2,240	560	2,016	$8,224	$7,402	$6,373	$15,762	$3.67	$11.38	$7.82		$8,360		**$9,293
03150.10.3	Footing forms, fabricate	sf	360	0	360	$936	$936	$0	$963	$2.60	-	$2.68		$27		$27
03150.20.3	Abutment forms, prefabricate	sf	1,810	0	1,810	$3,548	$3,548	$0	$2,780	$1.96	-	$1.54	$768		$768	
03157.10.3	Footing forms, place	sf	720	0	360	$360	$180	$0	$165	$0.50	-	$0.46	$15		$30	
03159.10.3	Footing forms, strip	sf	720	360	360	$158	$79	$48	$48	$0.22	$0.13	$0.13	$31		$62	
03157.20.3	Abutment forms, place	sf	3,620	1,810	1,810	$7,312	$3,656	$3,504	$3,504	$2.02	$1.94	$1.94	$152		$304	
03311.10.3	Concrete, footing, place	cy	120	0	60	$1,200	$600	$0	$554	$10.00	-	$9.23	$46		$92	
												Subtotals	$1,566	$8,755	$1,810	$9,688
												Totals	®	$7,189	®	$7,878

*67% of budget for mobilization
**Based on last week, will probably be $10,087

Highway bridge, weekly labor cost report (#1)

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

2. Progress records

- **Procurement records:** These establish the **procurement** of **materials** and **permanent equipment** for the **works** that required to **provided timely.**
- *Examples include:*
  1. **Quotations** from **sub-contractors** and **suppliers**
  2. **Supplier contracts** including any **amendments**
  3. **Shipment** records
  4. **Delivery** records

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

3. Resource records

- Capture the resources used to **deliver the works**, including:
  - Management
  - Labor
  - Equipment
  - Materials
  - Subcontractors

productivity should be considered!

Without records of planned and utilized resources, it will be more difficult for the contractor to prove entitlement to time and costs incurred arising from additions or changes to the **works** and **other delay** or **disruption events**

Resource records should be detailed and comprehensive and where possible should be allocated to the as-planned/updated programme activities.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

4. Cost records

- Include a **sufficient level of detail** such that **costs** can be **linked to delay** or **disruption events**.
  - Labor
  - Material
  - Equipment
  - Subcontractors
  - Project overhead
  - **General overhead**

However,
Could you always claim for HOOH?

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

4. Cost records

- Regarding **subcontractors**
  1. Subcontract agreements
  2. Subcontractor correspondence (communication)
  3. Claims made by subcontractors and responses
  4. Subcontractor applications for payment
  5. Details of all payments made to subcontractors

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

4. Cost records

- Regarding **suppliers**
  1. Supply agreements
  2. Supplier correspondence (communication)
  3. Claims made by suppliers and responses
  4. Supplier invoices
  5. Details of all payments made to suppliers

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

4. Cost records

- If the **contractor** wants to **use a formula** for the **assessment** of **lost profits** and **general overheads (unabsorbed overheads)**, it will need to **produce evidence** that the delay caused by owner **avoid** **contractor** to take a **new project**.

What you need to be able to use a formula?

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

4. Cost records

- To **prove**, you **need the following**:
  1. **Business plans** prior to delay **caused by employer**
  2. Contractor's **bidding history**
  3. Records of **acceptance** or **rejection of bidding**
  4. Records that **support** the **inputs into the formula** used, in particular **contractor's company accounts** for:
     a) **Periods** immediately **preceding and succeeding** the **employer delay**
     b) **Period** when the **employer delay occurred**

Let's see more in detail!

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

4. Cost records

- Regarding **contractor general overhead**

1. **Financial statements** documenting **annual general overhead costs** and **revenue** (**Planning and Scheduling course**)
2. **Business plans** for **generating profit (Company Cash flow forecast)** (**Planning and Scheduling course**)
3. Records regarding **bidding history**
4. Records regarding **bidding opportunities**
5. **Internal meeting minutes** to review **future bidding opportunities** and **staff availability**
6. **Short interval schedule** and **project reporting** (**Planning and Scheduling course**)

Copies of all invoices should be kept in an easily retrievable filing system preferably with electronic copies.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

4. Cost records

- You may need to disclose some of your **confidential information** if the case is taken **to the court**…

a claiming party has to accept some loss of confidentiality

How we can avoid this problem?

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

4. Cost records

The parties might therefore consider agreeing relevant rates in the contract, rather than requiring proof of actual costs or loss for certain eventualities

Example?

An agreement regarding staff rates to be charged in the event of an employer delay to completion

THIS IS BENEFICIAL TO BOTH PARTIES

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **All written communications** between the **employer**, the **CA**, and **third parties** relevant to the **progress of the works**.

- **Written communications** should be:
  - Uniquely **numbered**
  - Contain a **descriptive** subject line
  - Dated and issued to the agreed **distribution list**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- This **includes:**
  1. Letters/emails
  2. Contract management
  3. Technical
  4. Milestones
  5. Claims

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **Letters/emails** covers:
  1. **Letters** and **material emails** between **parties involved** in the works
  2. **Other emails** (including **internal emails**)

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **Email communications** should have a **protocol** from the **outset of each project**.
- **Emails communications** should be **archived in native format.**
- **Email communications** that are **internal** should also **be archived**.
- **Even** with the **best system** for managing and achieving emails, **some emails** may be **lost**. To **reduce the adverse effect** of these issues:

1. **Material communications** (**of whatever nature**) should be:
   a) Prepared in the form of a letter
   b) Uniquely numbered
   c) Carefully retained
2. **Key emails** should be
   a) Kept in a centralized folder
   b) Given unique correspondence number

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **Contract management** covers **all notices** or **documents** issued under the contract, **with the exception** of:
  a) Letters/emails
  b) Claims related records

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **Contract management examples** include:
  - a) **CA instructions** and **confirmation of instructions**
  - b) **Early warning notices** (and their **close out**)
  - c) **Variations/change** requests or **proposals**
  - d) **Bonds, insurance documents or guarantees**
  - e) **All other documents** issued under or required by **the contract** (**other than claims related records**)

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **Technical records:** these are **technical documentation** submitted **during** the course of the **works**,

  along with the **final documentation submitted** by the **contractor**.

  - Technical documentation is **needed to**

    demonstrate compliance by the **contractor** with

    1. Contract drawings
    2. Specifications

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **Technical records examples** include:

1. **Submission logs**, including **date of submission**, **date of response**, **status** and **follow up required** and **underlying documentation** for:
   - ✓ Design drawings and calculations
   - ✓ Method statements
   - ✓ Subcontractor approval requests
   - ✓ Material submittals
   - ✓ Shop drawings
   - ✓ Requests for information and responses

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **Technical records examples** include:

2. **Approvals** by the **CA**
3. **Agendas** for **minutes of meetings**, including:
   - Design
   - Construction progress
   - Programme review
   - Management
   - Health & safety, environmental and security
   - Quality
4. **Deficiency/non-compliance notices** (and **their close out**)
5. **As-built drawings/documents**
6. **Operations** and **maintenance manuals**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **Milestones** include:
  - Achieving **certificates**
  - **Contractor's request** for a **certificate** that the works are **complete**
    - ✓ And the **CA's response** including a report on any areas of **disagreement**
  - **CA's certificate** that the **works are complete**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

5. Correspondence and administration records

- **Claims records** include:

1. **EOT claims/responses** including the CA's determinations
2. Claims for **additional payment/responses** including the CA's determinations
3. **Notices of dissatisfaction** with **determinations**
4. **Referrals** to further stages of the **dispute resolution procedure**
5. **Documents** produced for the **purposes of further stages** of the **dispute resolution procedure**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

6. Contract and tender (bidding) documents

- These documents **establish** the **contractor's requirements** in
  1. Carrying out the **works**
  2. **Assumed baseline** in terms of time and costs for carrying out the works
     - **A complete copy** of construction contracts including **any amendments** should be maintained by **both parties**.
     - **Tender documents** include **all correspondence** between the parties regarding the **contract negotiations**.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

6. Contract and tender (bidding) documents

- **Tender documents** include:

1. On the part of employer

(a) Tender **submissions** by all tenders,

(b) Tender **evaluations**, and

(c) **Employer's calculations** of any **liquidated damages rates**

2. On the part of the contractor

- Records **demonstrating**
  1. **Build-up** to its **tender price**
  2. Any **amendments** to the price
  3. **Assumptions** on which the **tender price** is **based.**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

6. Contract and tender (bidding) documents

- **Contract documents:**

1. **Contract agreement**
2. **Correspondence** relating to the **contract negotiations**
   - Including any **letter of intent** and **letter of award**
3. **Conditions of contract**
   - **General conditions** and **special/particular conditions**
4. **Specifications** and the **employer's requirements**
5. **Drawings**
6. **Schedule of prices** or **bills of quantities**
7. **Contractor's tender submission** and any **clarifications** to that **submission**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Categories of records

6. Contract and tender (bidding) documents

- **Tender documents:** Documents **produced** or **issued** by both the **employer** and the **contractor** **pre-contract** and include the following:
  1. **Instructions** issued by the **employer** to **tenderers**, including a **draft copy** of the **contract**
  2. **Any clarifications** issued by the **employer** regarding those **instructions** or the **draft contract**
  3. **Submissions** from **all tenderers**
     - **Technical** and **commercial** **submissions** including **all clarifications** to those **submissions**
  4. **Contractor's tender build-up** including **all estimating information**
  5. **Employer's tender evaluation**
  6. **Employer's calculations** for any **liquidated damages rates** in the contract

STEP 2: Reviewing and approving as-planned project schedule

- As defined, the **as-planned schedule** is the schedule created either:
  1. **Before construction begins**
  2. **Very early** in the **first stage of the project**

- **As-planned** should represent the **Contractor's plan** to construct the project based on the **information** it had at **the time of bid**.

- It is **erroneous** to use the **Owner's version** as the **as-planned schedule** for the project because the **Contractor** may plan to **construct** the Project in a **different sequence** or **manner**.

STEP 2: Reviewing and approving as-planned project schedule

- **After identifying the schedule**, the **analyst** should **review** that schedule for **sequencing** and **feasibility**.

A note of caution:

Often the analyst, or the person assessing the Project for delays, **reviews** the Contractor's schedule and decides that it **did not correctly portray**:

(1) Sequencing of the project

(2) **Durations** for the activities

STEP 2: Reviewing and approving as-planned project schedule

- The **reviewer** of the **as-planned schedule** should **ultimately** be able to **conclude** that the **as-planned schedule:**
  1. **Complies** with the **contract requirements**,
  2. **Depicts** the **contractor's plan** to complete the project, and
  3. **Represents** a plan that is **constructible**, with a **critical path** that **makes sense**

STEP 2: Reviewing and approving as-planned project schedule

- Although there is **no single checklist** that defines what constitutes a **"good" Project schedule**, it is recommended that the **reviewer** should take the **following steps** when performing the review of the **Contractor's as-planned schedule**.
  - For the purposes of this discussion, it is **assumed** that the **as-planned schedule** is a **Critical Path Method (CPM) schedule**.

1. **Understand** the **contract requirements**
2. **Verify** the **contents** of the schedule **submission**
3. Does the schedule **conform** to the **contract requirements**?
4. Is the schedule **contractible** and are the **durations reasonable**?
5. Do the **critical path** and **near critical paths** make **sense**?

STEP 2: Reviewing and approving as-planned project schedule

1. **Understand** the **contract requirements**

- **Reviewer** should have a **thorough understanding** of the **contract documents**
- The **contract documents** will **provide** the reviewer with **necessary information** including, but **not limited to**:
  1. Project's scope of work
  2. Project's staging or phasing
  3. Contract milestones
  4. Owner review times
  5. Third-party responsibilities
  6. Contract restrictions and constraints

STEP 2: Reviewing and approving as-planned project schedule

2. **Verify** the **contents** of the **schedule submission**

- The **first step** is to determine whether or not the **contractor's schedule submittal** meets the **requirements** of the **contract's scheduling specification.**
- Most **CPM scheduling specifications** require the contractor to **submit**
  1. A copy of **electronic schedule file**
  2. **Schedule narrative**
  3. Multiple schedule or **tabular reports**

  and requires the contractor to **submit** the schedule **within a certain time**.

In the written review, the reviewer should state:

1. **Whether the submission was submitted on time**
2. **Missing reports**
3. **Deadline to submit missing reports**

STEP 2: Reviewing and approving as-planned project schedule

3. Does the schedule **conform** to the **contract requirements**?

- After **reviewing contract documents comprehensively (Step 1)** and after **checking the contents of the schedule submission (Step 2)**,

  the reviewer should determine whether the **project schedule conforms** to the **contract documents**.

STEP 2: Reviewing and approving as-planned project schedule

- **Sample of items** to **evaluate** when reviewing the **schedule's conformance** to the **contract requirements**:
  1. Does the schedule **conform** to the **contract milestones**, **phasing**, **sequencing requirements**, and so forth?
  2. Does the **schedule conform to the CPM scheduling & time extension provisions?**
  3. Include **all of the tasks** necessary to **complete the scope of work**

STEP 2: Reviewing and approving as-planned project schedule

3. Does the schedule **conform** to the **contract requirements**?
    1. Does the schedule **conform** to the **contract milestones**, **phasing**, **sequencing requirements**, and so forth?
        - **As-planned schedule** should **conform** to the **contract's phasing**.
        - **As-planned schedule** should **not forecast** **project milestone dates later** than the **contract milestone dates**.

Why milestones are important?

STEP 2: Reviewing and approving as-planned project schedule

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

5.4 IF MULTIPLE MILESTONES HAVE DELAY DAMAGES ASSOCIATED WITH THEM, A SEPARATE DELAY ANALYSIS SHOULD BE PERFORMED FOR EACH MILESTONE

- **Float values** are affected by **different constraints** in the CPM network.
- In instances where the schedule contains **milestone constraints**,

  it may be **more accurate** to identify the **critical path** through

  1. Subject milestone or
  2. Activities

  that must be progressed to **keep that milestone on time**.

Why phasing and sequencing requirements are important?

STEP 2: Reviewing and approving as-planned project schedule

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

- **Chronology** of delay is an important part of a **critical path analysis** as the **basis for segregation** of delays to allow related costs and time impacts to be attributed to the parties involved (***apportionment***).
- **A chronological evaluation** is critical in determining when events occurred, their impact on the contemporaneous project schedules, and the contemporaneous decisions made by the parties, emphasizing the importance of **keeping project records and schedule updates** throughout the project.
- The **schedule** is **not static and changes continually** on the basis of events as they unfold on a project,

  and this **must** be reflected in a proper **evaluation** of project delays.

STEP 2: Reviewing and approving as-planned project schedule

3. Does the schedule **conform** to the **contract requirements**?

2. Does the **schedule conform to the CPM scheduling & time extension provisions?** Some of **contract's scheduling provision**:

- **Limit** the **duration of activities**
- **Limit** the use of **unnecessary** or **inappropriate constraints**
- **Prohibit activities** with **open ends**
- **Prescribe** the use of certain **logic relationships**, **lags**, and **leads**
- **Establish** the required **level of detail** in the **schedule**

Let's look at them more in detail!

STEP 2: Reviewing and approving as-planned project schedule

- **Limit** the **duration of activities**
  - As a guide, **no activity or lag** (other than a summary activity) should **exceed 28 days** in duration.
  - Wherever possible, an **activity** should not **encompass more than one trade** or operation.

How about the time when rolling wave planning used?

STEP 2: Reviewing and approving as-planned project schedule

- **Limit** the use of **unnecessary** or **inappropriate constraints**
  - **Manually applied constraints** such as 'must start' or 'must finish' fixed dates, 'zero float' and other programming techniques that can have the effect of inhibiting a programme from reacting **dynamically to change** should be **avoided** (or, if unavoidable, properly explained in the programme narrative) (SCL).

How about other hard constraints?

STEP 2: Reviewing and approving as-planned project schedule

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

5.3 EXCESSIVE CONSTRAINTS ON ACTIVITIES THAT INTERFERE WITH A LOGIC-DRIVEN CRITICAL PATH MAY COMPLICATE EVALUATION OF CRITICAL DELAYS AND SHOULD BE CONSIDERED IN A DELAY ANALYSIS

- **Excessive constraints** should generally be **avoided**.
- In a constrained schedule, **total float may be driven** by constrained dates **instead of** the **project end date**.
- The **use of constraints complicates** the use of total float as a **time prioritizing tool**.
- Particularly, the **use of** specified constraints on individual activities or specifying float values on individual activities **may interrupt a logic-driven critical path** and **is not preferred.**

STEP 2: Reviewing and approving as-planned project schedule

- **Prohibit activities** with **open ends**
  - The **Contractor's proposed programme** (and any revisions) should be prepared with **sufficient detail using logic links** (i.e. each activity is linked to **both a predecessor and successor activity or milestone**)

    to provide **proper forward visibility** so that the **effect of delay** and **disruption events** can be **predicted** with as **much accuracy** as possible (SCL).

Remember dangling logic in Planning and Scheduling Course?

STEP 2: Reviewing and approving as-planned project schedule

- **Prescribe** the use of certain **logic relationships**, **lags**, and **leads**
  - **Lags** may be introduced for **non-work periods** (**such as curing of concrete**) but **better visibility and understanding** is provided if such matters are **shown as activities** in themselves
  - Where utilized, the **Contractor should provide an explanation** in the programme narrative as to **why particular leads and lags** have been applied (SCL).
  - **Leads and lags** may result in **incorrect progress tracking if delays prevent** the project from being performed as **planned**.
  - A **preferred alternative** to leads and lags is to **break activities up into smaller segments** and use **finish-to- start relationships** (ASCE)

STEP 2: Reviewing and approving as-planned project schedule

3. Does the schedule **conform** to the **contract requirements**?
    3. Include **all of the tasks** necessary to **complete the scope of work**
        - **Tasks** and **activities** to **construct the project**
        - **Activities** for **preparation** and **submission** of:
            1. **Key submittals**,
            2. **Time** for the **procurement** of **key equipment** and **materials**,
            3. **Adequate time** for **certain owner activities**:
                1. Submittal reviews
                2. Procurement of owner-furnished materials or equipment

STEP 2: Reviewing and approving as-planned project schedule

3. Does the schedule **conform** to the **contract requirements**?
   3. Include **all of the tasks** necessary to **complete the scope of work**
      - **For example**, the **schedule** should include:
        - Time for permitting or third-party/regulatory activities
        - Concrete cure times
        - surcharge durations for settlement
        - Winter shutdown periods
        - Permitting restrictions
        - Work area restrictions
        - Coordination with adjacent projects

STEP 2: Reviewing and approving as-planned project schedule

3. Does the schedule **conform** to the **contract requirements**?

If one of three major items missed in the schedule, the reviewer asks the contractor to revise and resubmit the schedule.

STEP 2: Reviewing and approving as-planned project schedule

4. Is the schedule **contractible** and are the **durations reasonable**?

- After **verifying** that the **as-planned schedule** meets the **Contract requirements**, the **next step** involves an evaluation of
  1. **Schedule's sequencing** of the **work activities**
  2. **Activity durations**

STEP 2: Reviewing and approving as-planned project schedule

4. Is the schedule **contractible** and are the **durations reasonable**?
    1. **Schedule's sequencing** of the **work activities**
        1. Contractual logic
        2. Mandatory logic
        3. Discretionary logic
            - ✓ Contractors choice
            - ✓ Most likely to be out-of sequence

Remember that we talked about this in Planning and Scheduling Course?

Contractual logic – AACE Definition

- The ***AACE*** defines this type of logic as:

  *"Clearly **understood** **work scope** allows one to **define work activities** and logic with **precision**. The **opposite of soft logic**."*

- But this definition **fails** to **distinguish** between **logic** that is required by the **laws of man (contract)** or the **laws of physics**.

So the better definition of this type of logic is (John C. Livengood):

Logic required by the contract and/or scope of work that mandates certain of the owners sequence requirements

Mandatory logic – AACE Definition

1. The **AACE** offers the following **definition** for this type of relationship:

   *"A **dependency inherent** in the **nature of the work** being done, such as a **physical limitation**. Used in **hard logic**."*

2. The **AACE** **also** offers definitions of **Irrefutable Logic**

   *"**Network logic** that is **rational** and **compelling** and **cannot be disputed** on the **basis of reason**,"*

So the better definition of this type of logic is (John C. Livengood):

Logic required by the physical necessity of the materials and design

Discretionary logic – AACE Definition

1. The **AACE** has a **definitions** for discretionary logic:

   "***Dependency*** *defined by* ***preference***, ***rather than necessity***. *These are typically employed in* ***preferential*** *or* ***soft logic***."

2. **Another AACE** definition proposes:

   "***Preferential logic***: ***contractor's approach*** *to* ***sequencing work*** *over and above those sequences indicated in or required by contract documents.* ***Examples*** *include* ***equipment restraints***, ***crew movements***, ***form reuse***, ***special logic restraints***, *etc., factored into the* ***progress schedule***."

STEP 2: Reviewing and approving as-planned project schedule

4. Is the schedule **contractible** and are the **durations reasonable**?

   1. **Schedule's sequencing** of the **work activities**

1.54 The Contractor (not the CA) controls the method and sequence of the works (and bases its tender price on its ability to do so). Therefore, provided the Contractor complies with the contract and all applicable laws, the Contractor may perform the works in the manner it thinks appropriate. The contract provisions for accepting the Contractor's proposed programme should reflect that fact, subject to any Employer constraints identified in the contract.

STEP 2: Reviewing and approving as-planned project schedule

4. Is the schedule **contractible** and are the **durations reasonable**?
    1. **Schedule's sequencing** of the **work activities**

If the schedule contains instances that show the Project work occurring in a sequence that violates the project's contractual and mandatory logic,

Then the reviewer should ask the contractor to revise and resubmit the schedule correcting the logics.

STEP 2: Reviewing and approving as-planned project schedule

4. Is the schedule **contractible** and are the **durations reasonable**?

2. Activity durations

- The reviewer **must** also evaluate the **reasonableness of the activity durations**, which is perhaps the **most subjective part** of a schedule review.

1. **An activity's duration** can **vary based on productivity**.
   - In most cases, the reviewer does **not have access** to this information and has to **rely on his or her own experience**, which in most cases is **sufficient** to **identify overly optimistic** or **exaggerated durations**.

2. **Material procurement durations** with **long lead times**
   - If a **material procurement** activity has a **duration greater** than the **maximum activity duration** specified in the **Contract**,
     and if it seems **reasonable**,
     then the reviewer should **accept the new duration**.

STEP 2: Reviewing and approving as-planned project schedule

4. Is the schedule **contractible** and are the **durations reasonable**?

2. Activity durations

If the reviewer feels that he is not qualified to evaluate the reasonableness of activity durations,

then it is recommended that the reviewer rely on a colleague or co-worker who has more experience with those kinds of operations.

STEP 2: Reviewing and approving as-planned project schedule

4. Is the schedule **contractible** and are the **durations reasonable**?

- The **reviewer** should also be aware that the **manipulation of logic relationships** and **inflation of activity durations**

  are **methods** that a Contractor can use to take **advantage of float**.

  - Doing so may provide the **Contractor with a sense of security**, but this is **false** and may result in **claims in the future**.
  - It is **very difficult** to identify instances when the **Contractor is attempting** to take **advantage of float** in activity durations **without the knowledge** of the **Contractor's planned resources**, and this has led

many Owners to **request** **resource-loaded schedules**.

STEP 2: Reviewing and approving as-planned project schedule

4. Is the schedule **contractible** and are the **durations reasonable**?

If **logic relationships** or **activity durations** do not appear **correct** or **reasonable**, then the **reviewer must ask the Contractor** to further **explain** or **address** the item(s) in **question**.

Opening a line of communication between **reviewer** and the **Contractor** will assist the parties in **developing a culture** of **cooperation**, **transparency**, and **trust** **early in the Project**.

STEP 2: Reviewing and approving as-planned project schedule

5. Do the **critical path** and **near critical paths** make **sense**?

- With a **thorough understanding** of the **scope of work**, the reviewer should be able to recognize if the Project's critical path and near critical paths are **reasonable**.

Due to the importance of the critical path to the overall schedule, if there are questions related to the reliability of the critical path, these provide sufficient justification to ask the Contractor for clarification or to revise and resubmit the schedule.

STEP 2: Reviewing and approving as-planned project schedule

1. It is far wiser to perform a detailed review,
2. Provide feedback to the Contractor,
3. Jointly resolve any problems or questions, and
4. Ultimately accept the initial schedule and move on

How about the duration to respond the contractor to review and approve the as-planned schedule?

STEP 2: Reviewing and approving as-planned project schedule

1.55 Also, to avoid uncertainty, the contract should contain wording to the effect that if the CA does not respond to the Contractor regarding the proposed programme within a specified time, it is deemed accepted and becomes the 'Accepted Programme'. The parties should consider at the outset whether to incorporate a provision into the contract which incentivises the Contractor to submit a proposed programme that complies with the contractual requirements (such as a portion of the contract sum being withheld pending the submission of a compliant programme). Otherwise, if the Contractor fails to meet its contractual obligations with respect to programming, the CA may consider invoking the contract provisions for dealing with general defaults by the Contractor. In this situation, the CA should also (to the extent possible) maintain and update a programme with actual progress based on its own knowledge.

ماده ۴۶- موارد فسخ پیمان

۴۶-الف-۲)

تأخیر در ارائه برنامه زمانی تفصیلی به مدت بیش از نصف مهلت تعیین شده برای تسلیم آن.

STEP 2: Reviewing and approving as-planned project schedule

سلام
🔷 یکسوال در خصوص تمدید مدت پیمان داشتم:
اگر در ابتدای پروژه به دلیل مشکلات نقشه ای از جانب کارفرما تاخیر چند ماهه در کار پیش بیاد و برنامه زمانبندی هم هنوز تایید نهایی نشده باشه(در حال رفت و برگشت اصلاحی)
❓ آیا میشه از کارفرما درخواست اضافه کردن مدت پیمان کرد؟ اساسا در این مورد دستوالعملی چیزی وجود داره یا اینکه باید صبر کرد تا مدت اولیه پیمان تموم بشه و جز لایحه تاخیرات اوردش؟

1.53 The proposed programme should not encompass any changes or delays that have occurred since the contract commencement date. Any such post-commencement changes or delays should be dealt with in accordance with the EOT procedure in the guidance to Core Principle 5 in Part B after the proposed programme has been accepted.

STEP 2: Reviewing and approving as-planned project schedule

1.56 The Protocol regards the agreement of the Accepted Programme as being very important both for managing progress of the works and assessing any EOT applications. Disagreements over what constitutes the Accepted Programme should be resolved straight away and not be allowed to continue through the works. An unaccepted Contractor's proposed programme or update can become the source for disputes. Accordingly, the CA should specify what contractual requirements are not met before determining that a proposed programme or an update is inadequate.

What if we could not resolve this at the outset?

STEP 2: Reviewing and approving as-planned project schedule

1.57 Acceptance by the CA constitutes an acknowledgement that the Accepted Programme represents a reasonable, realistic and achievable depiction of the sequence and timing for carrying out the works. Acceptance does not turn Contractor's proposed programme into a contract document, or mandate that the works should be constructed exactly as set out in the Accepted Programme.

Nor does it amount to a warranty by the CA to the Contractor or the Employer that the Accepted Programme can be achieved.

STEP 2: Reviewing and approving as-planned project schedule

Who is responsible for erroneous in the schedule?

Should the analyst change the schedule?

STEP 2: Reviewing and approving as-planned project schedule

- The **analyst might** then **change** the schedule to reflect his **judgment about the errors**.

The analyst should avoid this practice at all costs!

- ✓ The **decision** as to **whether or not** the **Contractor's schedule** was practicable is a **highly subjective one**.
  - Therefore, it is **far better** to give the **Contractor** the **benefit** of the **doubt** than to **disallow**, **ignore**, or **even change** the schedule.
    - If there are **minor errors** or **inconsistencies** in the **Contractor's as-planned schedule**, contractor will be **accounted** for **during the analysis of the delays**.

You should answer many questions here!

STEP 2: Reviewing and approving as-planned project schedule

1. To what extent the CM can interfere in contractor's schedule?
2. Could CM make suggestions not required by the contract?
3. Could the CM consider means and methods of contractor while approving the baseline?
4. Where CM could find this information?
5. So, how the review comments should be worded?
6. What if contractors take unreasonable positions on reasonable review comments?
7. What factors should CM consider while reviewing and accepting the baseline?
8. Should subcontractors sign off on the schedule?

There is a Time Management Standard published by CMAA that we taught in advanced level of Scheduling course!

STEP 3: Reviewing and approving schedules updates

- **Reviewing** and **approving** **schedule updates** submitted by the Contractor follows the **same process** as the **review** and **approval** of an **as-planned schedule**.

- However, there are **two additional items** that the reviewer should consider when reviewing a **schedule update**:
  1. **Verification** of the **as-built data**
  2. **Identification** and **evaluation** of the **schedule changes** made in the **new schedule update**

No longer than one month

All documents are consistent in this rule.

Do you know why?

STEP 4: Verifying as-built dates and data

- The **reviewer** should find a way to track and verify the **actual performance** of activities **during the update period**.

- While it is always important to **ensure** that the **as-built information is correct**, this is **even more important** for **cost-loaded schedules being used by**
  1. **Contractor** to **forecast monthly cash flow projections**
  2. **Owner** to **pay the Contractor** based on the **monthly progress reported** in the **schedule**

STEP 4: Verifying as-built dates and data

- **One** of the **best places** to find **as-built information** is in the **Project schedule updates**, because the **periodic updates** typically **record** the **dates** that specific **activities start** and **finish**.

- **Even if** the **updates** contain the **Project's as-built information**, it is **always** wise to **verify information** in the **updates**, using as **many independent sources** as possible.
  - *For example, the **analyst** might **review** the **Project daily reports** to **verify** that **specific activities started** and **finished** on the dates **indicated in the updates**.*

Retained and Override Logic?

STEP 4: Verifying as-built dates and data

1.59 The Updated Programmes should be archived as separate electronic files and the saved versions should be copied electronically to the CA (again, in native format, not as a PDF), along with a report describing revisions made to activity durations or logic as compared to the Accepted Programme (or a previous Updated Programme) and the reasons for the revisions. The purpose of saving Updated Programmes is to provide a contemporaneous record of revisions to the Contractor's intended work sequences and activities. No version of any programme should be overwritten – all versions need to be saved separately.

What if the CA disagrees with the progress the contractor considers it has achieved!

STEP 4: Verifying as-built dates and data

1.60 If the CA disagrees with the progress the Contractor considers it has achieved, it should notify the Contractor, and the CA and Contractor should then attempt to reach agreement. If they do not agree, the CA's view should prevail (unless and until it is reviewed and replaced under the contract dispute resolution procedures), and the CA's view on progress should be reflected in the Updated Programmes. The Contractor's position on the areas of disagreement should be recorded and submitted with the Updated Programmes.

What if the updates do not provide the information required or do not exist

STEP 4: Verifying as-built dates and data

What if the updates do not provide the information required or do not exist

- The **analyst** has **no alternative** but to **prepare** his **own as-built diagram**, **using** the **contemporaneous project documents**.

STEP 4: Verifying as-built dates and data

- Note that in the **creation** of an **as-built diagram**, the **analyst** should **document every day** that work is **recorded** for **each activity**.
  - It is **not enough** to **merely record** the **start date** and then the **finish date**.
    - ✓ **While** the **start and finish** dates are **extremely important**, the **determination** of **whether work** was **continuous** or **interrupted** may also be **significant**.

An as-built is not truly a schedule but rather a history of when specific work is performed.

STEP 5: Identifying and evaluating schedule changes in the schedule update

1.62 Specifically, the Contractor should attempt to reasonably revise its planned logic, sequence, and activity durations for the remainder of the works whenever there is or may be Contractor Delay to Completion or variations so as to ensure the contract completion date will be achieved. The contract should contain provisions allowing the CA to require the Contractor to produce a proposed revised programme in such circumstances. These revisions should be made to the most recent Updated Programme (or the Accepted Programme if no Updated Programme has yet been produced).

What should be done before?

STEP 5: Identifying and evaluating schedule changes in the schedule update

- If the **Contractor** makes any schedule **changes** that **affect** the **critical path**, **near critical paths**, or **Project milestones**, the reviewer should **require the Contractor** to:

Provide an explanation of:

1. **Why** the schedule was **altered**
2. **Explain** its **effect**

Best practice is to require that the contractor explain all logic changes.

Do we need to notify the CA or CM?

STEP 5: Identifying and evaluating schedule changes in the schedule update

1.63 The Contractor should notify the CA of any proposed revisions and provide an electronic copy of the proposed revised programme, together with any consequential revision to the Contractor's method statements and a programme narrative that reflects the proposed revised programme. The CA should review and if appropriate accept the proposed revised programme. Once a revised programme is accepted by the CA it replaces the former Accepted Programme as the tool for monitoring actual progress.

STEP 5: Identifying and evaluating schedule changes in the schedule update

Like the review of the as-planned schedule, once the reviewer has completed his review of the Contractor's schedule update, he should approve the update.

The reviewer's goal should be to always have a current version of the Project schedule that provides an accurate representation of the Contractor's current plan to complete the Project.

STEP 6: Early completion schedules

- **Most construction contracts** specify the **maximum time** allowed for the **Contractor to perform the work**.

- **Few**, if any, contracts specify a **minimum duration**.

- However, a **Contractor** has both the **right** and the **financial incentive** to finish a **Project early**, if possible.

*Thus, it is important for **Owners** and **Contractors** alike to **deal with early completion schedules** fairly and effectively.*

STEP 6: Early completion schedules

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

- Generally, the **contractor has the right** to finish early.

- The **owner gains the benefit** of early project use, and the **contractor gets offsite** and **no longer incurs general conditions costs**.

- The additional contractor **cost savings** of early completion also are reflected in a **lower bid price** anticipating early completion.
  - Although the **owner should not have** to spend **additional costs** to meet a **contractor's early completion schedule**, the **owner should not interfere** with the **contractor's ability** to finish early.

STEP 6: Early completion schedules

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

6.1 A PLAN TO FINISH EARLY SHOULD BE REASONABLE

- Parties should **address early completion as early** in the project as possible.
- It is good practice for the **contractor to inform the owner** that the contractor plans on **finishing early**.
- An **owner** should review and validate the **potential** of the contractor to finish early.
- If an owner takes exception,

  owner should **inform and discuss** this with the contractor

  before making a decision to acknowledge the contractor's intent.

STEP 6: Early completion schedules

- If **early Project completion** is intended by the **Contractor**, it needs **two requirements**:
  1. **Early finish date** should be **shown** on the **official project schedule**
  2. **Multiple schedules** should **always be avoided**

*The **Contractor** **benefits** from these practices because it is **extremely difficult** for a **Contractor** to **convince** an **Owner** or the **courts** that he planned to **finish early** when the **schedule did not reflect this plan**.*

- **Owners** and **Contractors** are sometimes **resistant to these practices**.
  - **Owners** are resistant because some **Contractors will claim** for damages if they believe the **Owner prevented** them from **finishing early**.

STEP 6: Early completion schedules – Example

- **Some Owners** will **not accept schedules** that show a **duration less than the Contract duration**.
  - Usually, **there is no contractual basis** for the **Owner's insistence** on this requirement.

What is the solution?

STEP 6: Early completion schedules

1. In this situation, the **Contractor** should **ask the Owner** to **show where** in the Contract the **minimum time is specified**.
   - **If** the **Owner still insists** on a schedule using all the Contract time **even though no minimum time is specified**,

then:

STEP 6: Early completion schedules

2. **Contractor** should **submit the same early completion schedule** with **one additional activity** at the **end** **making up the difference** between the **planned early finish date** and **the Contract's duration**.
   - ❖ This activity could be called **"Contractor contingency."**

- ✓ The **schedule** should be **accompanied** by a **letter** that **clearly explains** that the **Contractor plans** to **finish early** and has **added the contingency activity only** to **get the schedule approved**.

- ✓ The **letter** should also state that the **Contractor expects** to **receive compensation** if it is **prevented from finishing early** because of the **Owner's actions**.

STEP 6: Early completion schedules

- The **Owner (or Owner's representative) must review** an **early completion schedule** carefully to ensure that
  1. It is complete
  2. Logic is correct
  3. Durations are reasonable given the contractor's resources
- **Resources** and **productivity** should be **checked** and **tracked** carefully!

If an early completion schedule is accepted, the Owner's representative must closely monitor the work on the Project and note any deviations between planned and actual durations as they occur.

STEP 6: Early completion schedules

What if the contractor is unable to finish the project early, should he/she pay the compensation?

STEP 6: Early completion schedules

Even if the Contractor exceeds the early completion duration through its own actions, it faces no greater exposure to damages from the Owner.

- Contract's duration is **300 calendar days** but that the **Contractor** plans to complete **the work in 200 calendar days**. If a **Liquidated Damages clause** is included in the Contract, the damages will **not** become **effective until day 301**.

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

- **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)

عملیات تکمیل باقیمانده کاسه استادیوم

سرداران سبزوار - اولویت اول بهره‌برداری

کارفرما

مشاور

پیمانکار

قرارداد تاریخ ۱۳۹۳/۰۴/۲۴

شناسنامهٔ موارد منجر به تاخیر

عنوان	تغییر زیرسازی پیست تارتان و جابه‌جایی حوضچه‌های شیرفلکه		
شماره ردیف	۳۲	کد در برنامه زمان‌بندی تحلیل تاخیر	football05-11, football05-12
فعالیت تاثیرپذیرفته	ساخت گاتر و حوضچهٔ زهکش		football05
وضعیت فعالیت	روی مسیر بحرانی	شناوری کل	صفر روز
نحوهٔ اعمال در برنامه	fragnet ۱۱ روزه	تاریخ شروع ۱۳۹۸/۰۹/۲۷	تاریخ خاتمه ۱۳۹۸/۱۰/۰۸

شرح

به دلیل تغییر شیب عرضی پیست تارتان، ارتفاع دیوارهٔ گاتر بتنی کنار پیست در یک سمت افزایش یافت. با توجه به اینکه لایهٔ بیس براساس نقشه‌های اولیه اجرا شده بود، عملیات اضافه‌نمودن ارتفاع که شامل همهٔ مراحل ساخت ابنیهٔ بتن مسلح است، به ناچار از ابتدا شروع شد.

همچنین به دلیل تغییر جنس روسازی بخش شمالی و جنوبی زمین فوتبال (فضای D)، کلیهٔ حوضچه‌های برداشت آب نیز تخریب و تغییر محل داده شدند. از آنجا که عملیات پخش لایهٔ زهکش برای روسازی قبلی انجام شده بود، ناگزیر کلیهٔ عملیات از نو تجدید گردید.

مستندات

ردیف	موضوع	تاریخ	شماره
۱	نامهٔ مشاور - پیشنهاد دستور کار اصلاح زیرسازی پیست تارتان	۱۳۹۸/۰۹/۱۹	۹۸-۰۸۰۸۱
۲	نامهٔ مشاور - ابلاغ دستور کار اصلاح شیب زیرسازی پیست تارتان و جابه‌جایی حوضچه‌های شیر فلکه. ابلاغ دستور کارهای ۱۰۲۵ و ۱۰۲۶	۱۳۹۸/۰۹/۲۷	۹۸-۰۸۳۵۰
۳	دستور کار ۱۰۲۵: اجرا و تخریب حوضچه‌های شیر فلکه‌های زمین فوتبال و اجرای لوله پلی‌اتیلن	پیوست نامه ۹۸-۰۸۳۵۰	۱۰۲۵
۴	دستور کار ۱۰۲۶: جزئیات افزایش ارتفاع دیواره کانال‌های پیست تارتان	پیوست نامه ۹۸-۰۸۳۵۰	۱۰۲۶
۵	نامهٔ پیمانکار - پیشنهاد تغییر روش اجرای زیرسازی پیست تارتان	۱۳۹۸/۱۰/۰۳	۹۸/۲۴۰۸/۸۵۹۸
۶	نامهٔ مشاور - جزئیات زیرسازی پیست تارتان	۱۳۹۸/۱۰/۰۸	۹۸-۰۸۷۰۸
۷	نامهٔ مشاور - ارسال دستور کار ۱۰۲۵: اجرا و تخریب حوضچه‌های شیر فلکه و اجرای لوله پلی‌اتیلن	۱۳۹۸/۱۱/۱۶	۹۸-۱۰۱۴۴
۸	نامهٔ کارفرما - ابلاغ دستور کار ۱۰۲۵: تخریب و اجرای حوضچه‌های شیر فلکه و اجرای لوله پلی‌اتیلن	۱۳۹۸/۱۲/۰۷	۹۸/۶۴۳۶/ش ف
۹	نامهٔ مشاور - ارسال صورت‌جلسات	۱۳۹۹/۰۲/۲۰	۹۹-۰۰۹۳۲

صفحه ۱ از ۱۶

ردیف	موضوع	تاریخ	شماره
۱۰	نامهٔ کارفرما - ابلاغ صورت‌جلسات	۱۳۹۹/۰۲/۱۹	۹۹/۶۱۰/ش ف
۱۱	ابلاغ صورت‌مجلس ۲۱۶: اجرای اولیه و تخریب حوضچه‌های زمین فوتبال	پیوست نامه ۹۹/۶۱۰/ش ف	۲۱۶
۱۲	ابلاغ صورت‌مجلس ۲۱۷: ساخت و نصب حوضچه و دریچه فلزی شیر فلکه‌ها و شیرهای برداشت زمین فوتبال	پیوست نامه ۹۹/۶۱۰/ش ف	۲۱۷

تاثیر بر برنامه زمان‌بندی مصوب

ردیف	عنوان	ID	نوع	مدت زمان	پیش‌نیازها	پس‌نیازها
۱	ساخت گاتر و حوضچه زهکش	football05	فعالیت	۴۵ روز	Football03	Football0
۲	ابلاغ تغییرات جدید زیرسازی پیست تارتان جهت اصلاح شیب و افزایش ارتفاع گاترها	football05-delay08	مورد منجر به تاخیر	۱۱ روز	M-delay-field042	football05-11
۳	ابلاغ دستورکار تخریب و اجرای مجدد حوضچه‌های شستوشو و شیرفلکه‌ها	football05-delay09	مورد منجر به تاخیر	۱۱ روز	M-delay-field043	football05-12
۴	اجرای گاترها و کانال آب	football05-11	فعالیت تفکیک شده	۴۰ روز	football05-delay01	football05 FF
۵	اجرای حوضچه شیر فلکه شستوشوی چمن	football05-12	فعالیت تفکیک شده	۱۰ روز	football05-delay01, football05-delay07	football05 FF

صفحه ۲ از ۱۶

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)

- These projects are more likely to **avoid long-term disputes**

  due to the **transparency** of these emerging events,

  allowing issues to be **resolved in the first instance**, on the ground level.

- If prepared **forensically**, a **register of events** should remain a **working document** throughout the **forensic fact finding research phase**

  and be added to or **amended accordingly**.

What forensic fact finding research could include?

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

- Once the initial list of
  1. **Delay issue files** and **event analysis sheets** has been **prepared**, and
  2. **Delay register** is up and **running**,

  main phase of **forensic research** can be undertaken.
- This essentially comprises a **review** of
  - All job-specific documentation,
  - Media and records

  demonstrating what actually happened.

In the course of this exercise, the delay analyst will require access to a wide range of records

Let's see samples!

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

- This is **just an overview** of the likely **sources of data**
- During this process, the delay register and event analysis sheets should be **developed**, **revisited** and **continually refined**.

What should be done next?

Tender documents:
- Tender programmes
- Drawings issued for construction

Contract documents:
- Contract form(s)
- Specifications
- Employer's requirements
- Contractor's proposals
- Bills of quantities
- Drawings issued for construction

Construction programmes:
- Construction programme
- Subcontractor programmes
- Short-term programmes
- Revised programmes
- Updated 'as-built' programmes
- Information required by

Project and site records:
- Programmes
- Project meeting minutes
- Contractors' progress reports
- Subcontractors' reports
- Photographs and videos
- Site diaries or logs
- Job correspondence
- Requests for information (RFI)
- Labour returns
- Drawing issue registers
- Plant hire registers
- Certificates (time and money)
- Confirmation of verbal instructions (CVI)

Project documents:
- Drawing revisions
- Document/drawing transmittal sheets
- Instructions
- Design change orders
- Project staff list and attendance record
- Computer discs and hard-drives

Claim related records:
- Computer-aided 3D simulations
- Delay notices
- Failure to release information notices
- Claim specific files/documents (e.g. previous claim submissions, time extension awards)
- BIM data

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

- Once the **documentation** and **records** have been **compiled**,

  the next stage is to **marshal this information** into a **format** in which it can be used effectively,

  regardless of **which delay analysis technique** is being pursued.

Let's look at techniques first!

Delay analysis using common methods

- **Two major sources:**
  1. **Recommended Practice No. 29R-03 (2011)**
     - American Association of Cost Engineering (AACE) International
  2. **SCL Delay Protocol (2nd Edition published in Feb 2017)**
     - Society of Construction Law Delay and Disruption Protocol

Common methods of analyzing delays

- **SCL** says **six** methods
- **AACE** says **nine** methodologies
- **Others** say **seventeen or more**
- **An argument** could be made for a **near infinite number**

- We will discuss **major types**
  - **All others** are simply **variations** of **these types**

Delay analysis – Key terms: Contemporaneous vs. Forensic

Contemporaneous [of the time]	After-the-Fact
Schedules prepared and used during the project to manage the work	Schedules created after the project has been completed

- All too often, **analysts** will **create a schedule** well **after** the **Project is completed** or, alternatively,

  will **modify** the **Project schedule**, asserting there **were errors** that needed **correction**.

  limited adjustments to a schedule may be **appropriate**, but

  - Making significant changes or
  - Creating a new schedule is

    very subjective and **not an accepted practice** for an **analysis of delays** to a Project.

Delay analysis – Key terms: 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**

Delay analysis – Key terms: Cause and effect vs. Effect and cause

- **Six methods** mentioned in **SCL protocol**.

How these methods work?

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**

Delay analysis – Key terms: Cause and effect vs. Effect and cause

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**.

Delay analysis – Key terms: Importance of the critical path

- **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.

Delay analysis – Key terms: Importance of the critical path

The analyst should never assume that the critical path is static and remains unchanged throughout the Project.

Experience teaches us that the reverse is more often true.

Changes in the critical path are normal and should be expected.

Delay analysis – Key terms: Importance of the critical path

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

7.1 **Delays** should be evaluated as they occur in **chronological sequence**

7.2 A **schedule delay analysis** should reflect an analysis of prior entitlement so as to reflect a **current adjusted completion** date **prior to evaluating delay**.

7.3 Consideration should be included as to **how delays were evaluated** by the participants during the project

7.4 Evaluation of **delay chronology** should be documented and supported with **contemporaneous records**

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

7.1 DELAYS SHOULD BE EVALUATED AS THEY OCCUR IN CHRONOLOGICAL SEQUENCE

- Generally, **delays** should be evaluated **chronologically** and **cumulatively** in the order in which they occur on the project.
- The **delay recognized** to have **started first** in time that affects the schedule will be **fully evaluated** until that **delay is resolved.**
- This **may have no impact** on the critical path or directly affect or **change the critical** path.
- It **may absorb float** on one or more paths and/or create float on others.
  - Likewise, **changes to the work** through change orders should be **incorporated** into the schedules **as they occur**, **whether** they have a direct overall schedule impact to the critical path or they only reflect the absorption of float.

Delay analysis – Key terms: SCL 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.
Time Slice Windows Analysis	Effect & Cause	Contemporaneously	Retrospectively	• Logic linked baseline programme. • Update programmes or progress information with which to update the baseline programme.

Delay analysis – Key terms: SCL Methods

Method of Analysis	Analysis Type	Critical Path Determined	Delay Impact Determined	Requires
As-Planned versus As-Built Windows Analysis	Effect & Cause	Contemporaneously	Retrospectively	• Baseline programme. • As-built data.
Retrospective Longest Path Analysis	Effect & Cause	Retrospectively	Retrospectively	• Baseline Programme. • As-built programme.
Collapsed As-Built Analysis	Cause & Effect	Retrospectively	Retrospectively	• Logic linked as-built programme. • A selection of delay events to be modelled.

Delay analysis – Key terms: AACE Methods

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

Delay analysis – Key terms: SCL vs. AACE methods

Which one is the best?

We will see comparison between methods at the end

when you learned techniques

فرآیند جامع آنالیز تاخیرات در پروژه

بخش ششم:
آنالیز زمانی تاخیرات

آنالیز تاخیرات در شرایطی که تنها Gantt Chart در دسترس است!

ارائه دهنده:

سید محمدرضا علوی‌پور

CMAA Authorized Trainer

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا

What we will learn?

- Gantt Chart
  - Introduction
  - Major shortcomings
- How to perform delay analysis using Gantt Chart?
  - Step 1: Identifying the critical path on a Gantt Chart
  - Step 2: Quantifying delays using Gantt Chart
  - Example 1
  - Example 2

Introduction

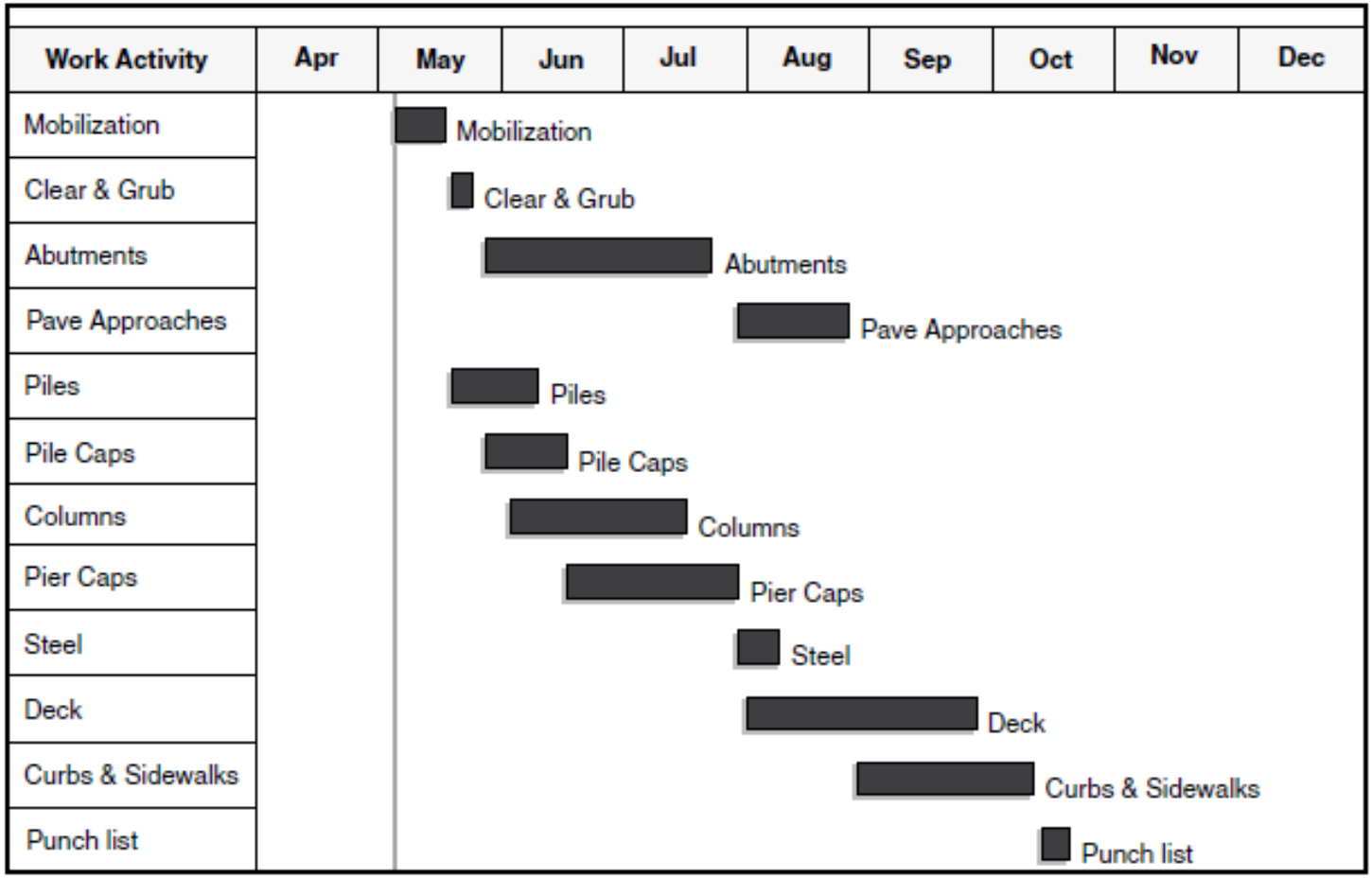
- **Many projects** are **scheduled** using a **Gantt Chart** **even though** with a **complex project**, a Gantt Chart is **not as desirable** as a **CPM schedule**.

- There is **nothing inherently wrong** with **scheduling** a project with a **Gantt Chart**.
  - A **detailed Gantt chart** can provide **almost as much information** as a **CPM schedule**.

- **One** should still **perform a meaningful** analysis using a **Gantt Chart**.
  - However, as the **level of existing detail** and the **quality** of **information decrease**, the **delay analysis** becomes **more subjective**.

Gantt Chart

- **Gantt chart** shows the **general sequence of work**
- The **project manager** can easily **define each activity** in **more detail**



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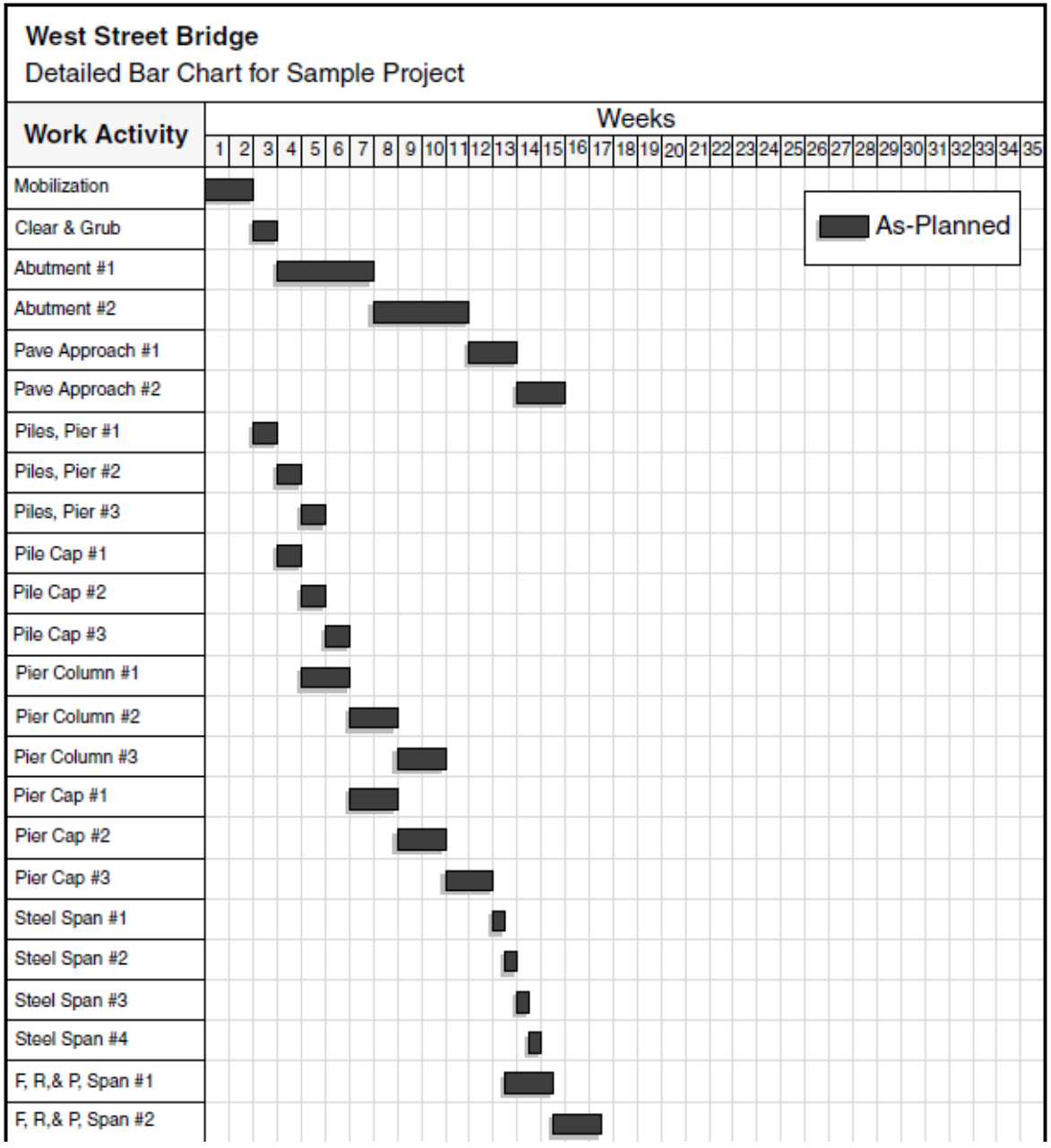
Gantt Chart

- The **figure** below is a **more detailed Gantt Chart** for the one shown in **previous slide**.



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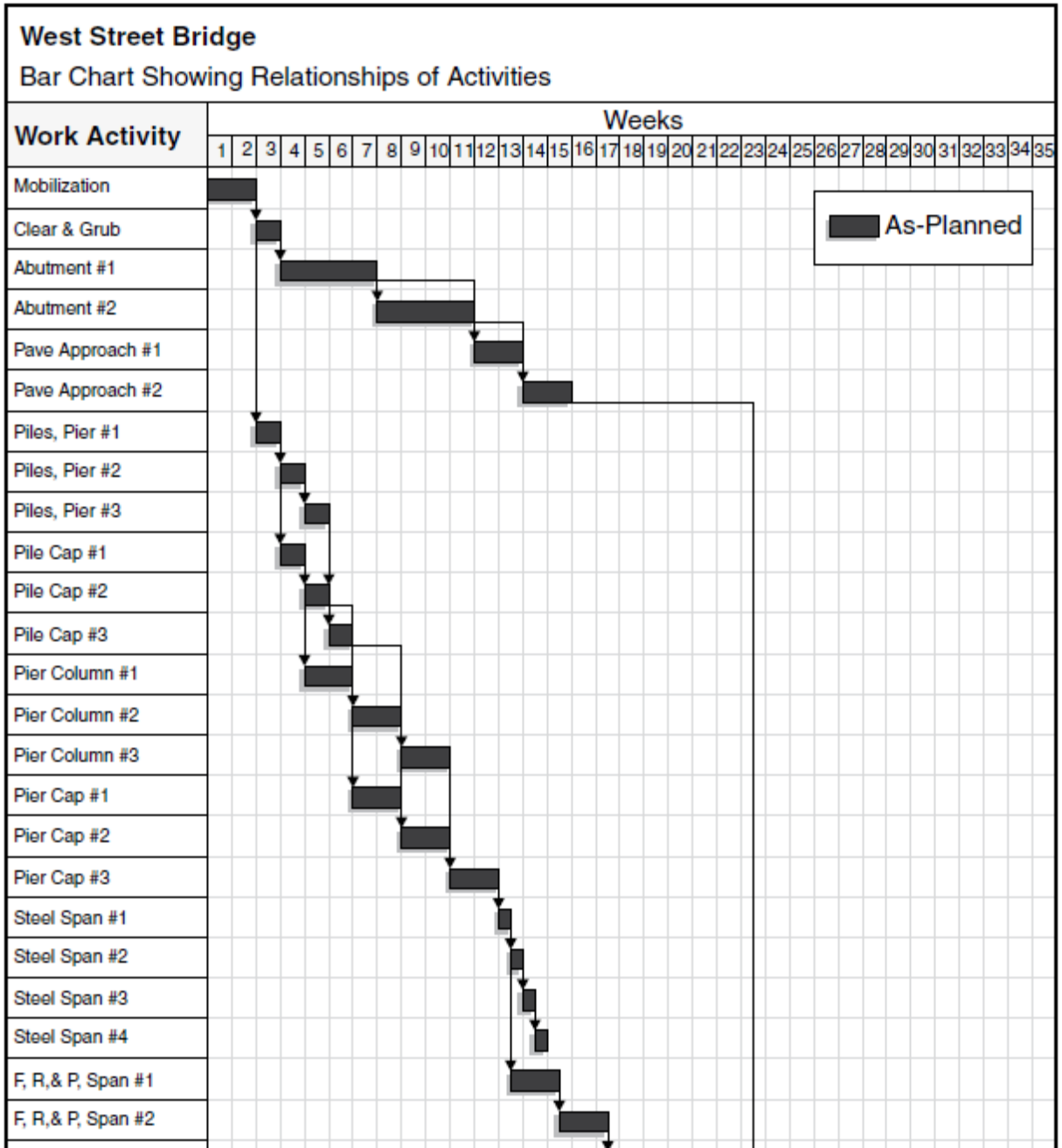
Gantt Chart

- With **very little effort**, the **project manager** or **project scheduler** can modify the **Gantt Chart shown in previous slide** to **show interrelationships** among the activities as **shown in this figure**.
- With **minimal effort**, one could **produce** a **CPM schedule** for the project.



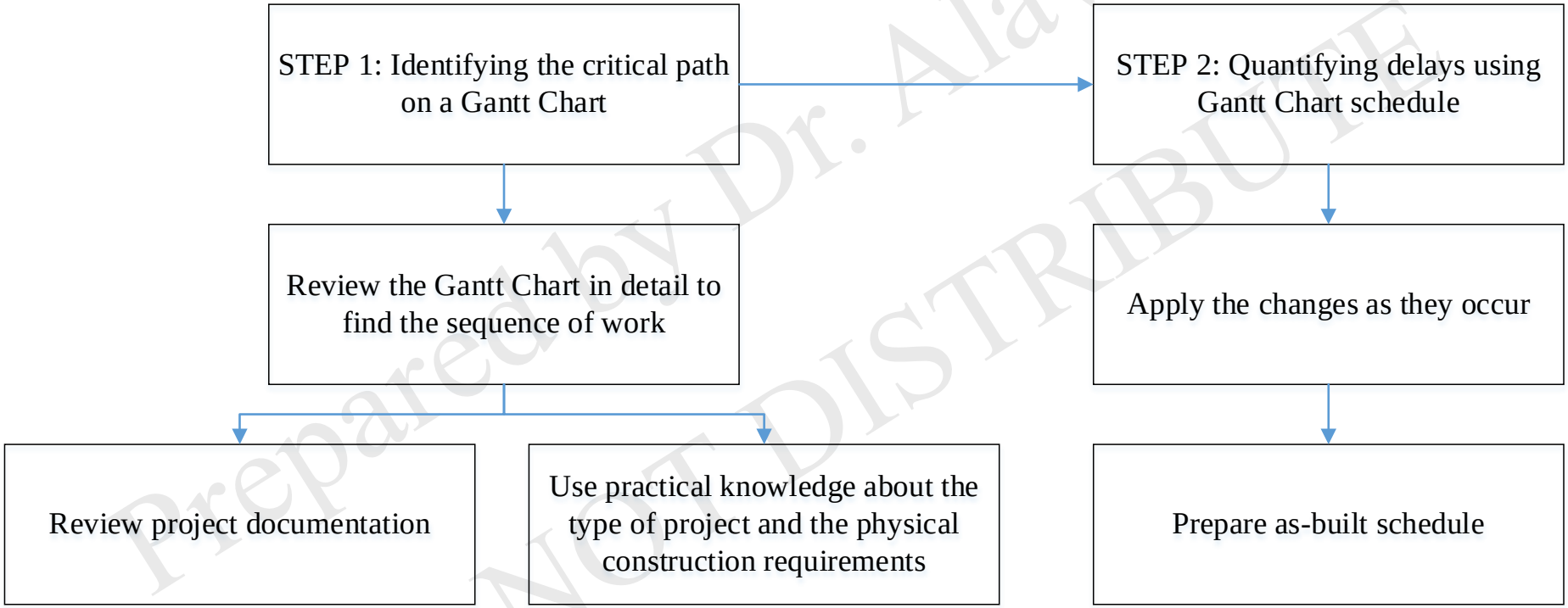
Gantt Chart – Major shortcomings

BUT

- **Most projects** that use **Gantt chart do not include** as **much detail** in **their Gantt chart**.
- **Major shortcomings** that **diminish** the **usefulness of Gantt chart** as a **(1) management tool** and **(2) tool for measuring delays**:
  1. **Lack of detail**—**too few activities** for the amount and **complexity of the work**
  2. **No indication** of the **interrelationships** among the **activities**
  3. **No definition** of the **critical path** of the Project

Obviously, these weaknesses hamper the ability of the analyst to perform a delay analysis, but they do not make it impossible.

How to perform delay analysis using Gantt Chart?



STEP 1: Identifying the critical path on a Gantt Chart

- The **first step** in analyzing a **Gantt chart** is to **define the critical path**.
  - **Every Project** has a **critical path**.
  - **Even** if a Project **does not** have a **CPM schedule**, it does **not mean** that it does **not have a critical path**.
    - ✓ **Critical path** is the **longest path of work activities** through the **network diagram** that **control** the **project completion date**.

Whether the critical path is defined in a CPM schedule or a Gantt chart, every Project has a series of interrelated activities that will control the Project completion time.

STEP 1: Identifying the critical path on a Gantt Chart

- The **analyst must review** the **Gantt chart** in **detail** for **obvious conclusions** about the **sequence of work**.
  1. The **review** should be based on **project documentation** that might **clarify** the **thought process** that:
     - **(1) Went into creating** the **Gantt chart**
     - **(2) Defining** the **planned work sequence**
     - **Documentation** that can be **helpful** includes:
       1. Contract documents (which may dictate staging or phasing)
       2. Preconstruction meeting minutes
       3. Internal Contractor documentation
       4. Project correspondence

Find contractual and discretionary logic

STEP 1: Identifying the critical path on a Gantt Chart

- The **analyst must review** the **Gantt chart** in **detail** for **obvious conclusions** about the **sequence of work**.

2. **Practical knowledge** of **(1) type of Project** and **(2) physical construction requirements** is also **necessary**.
   - For example, to analyze a **Gantt chart of a high-rise structure**, the **analyst must know** that **interior finishes usually cannot start** until the building is **"constructed."**

Find Mandatory (Physical) logic

STEP 1: Identifying the critical path on a Gantt Chart

- The **analyst must review** the **Gantt chart** in **detail** for **obvious conclusions** about the **sequence of work**.

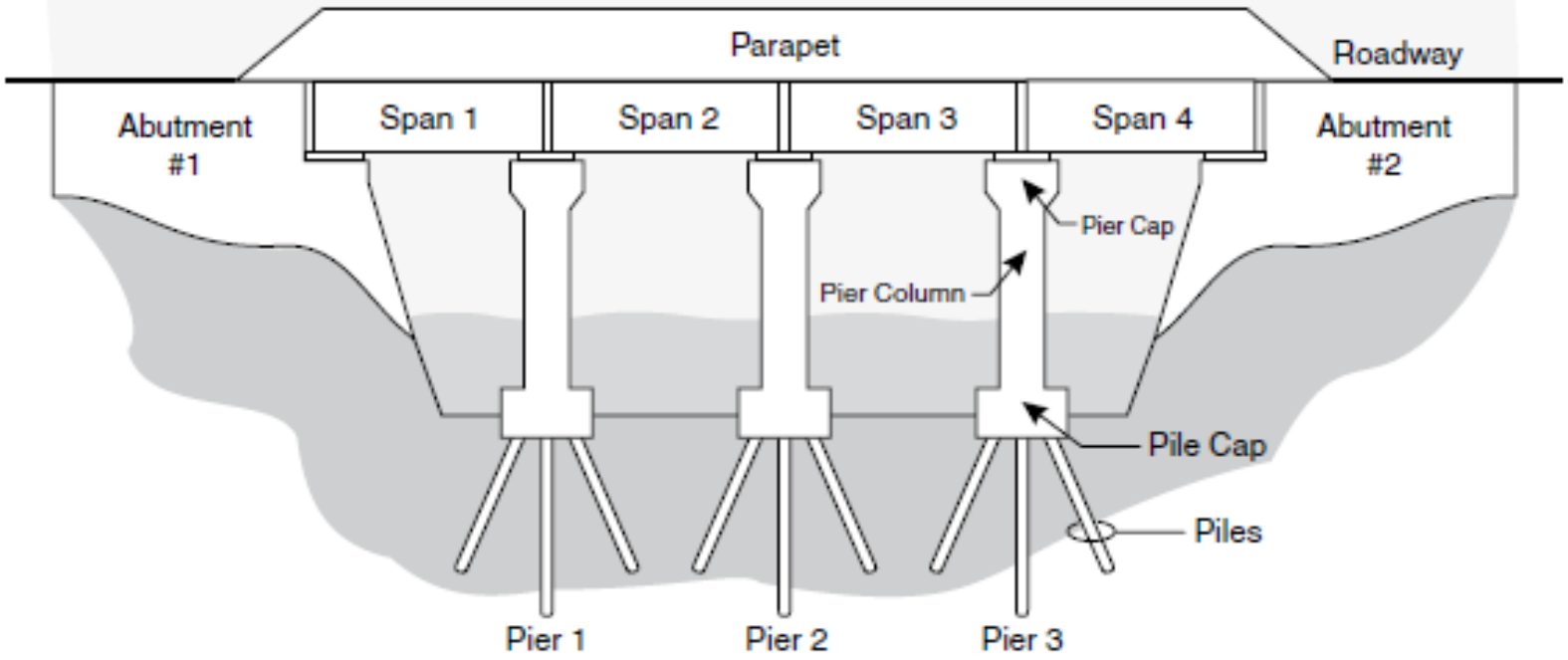
A note of caution:

The analyst should resist the temptation to interpret the Gantt chart schedule based solely on his or her own experience.

Merely because one has performed work in a particular sequence in the past does not mean that the Contractor on the Project being analyzed has planned it the same way.

Now, the critical path is identified!

STEP 1: Identifying the critical path on a Gantt Chart – Example 1



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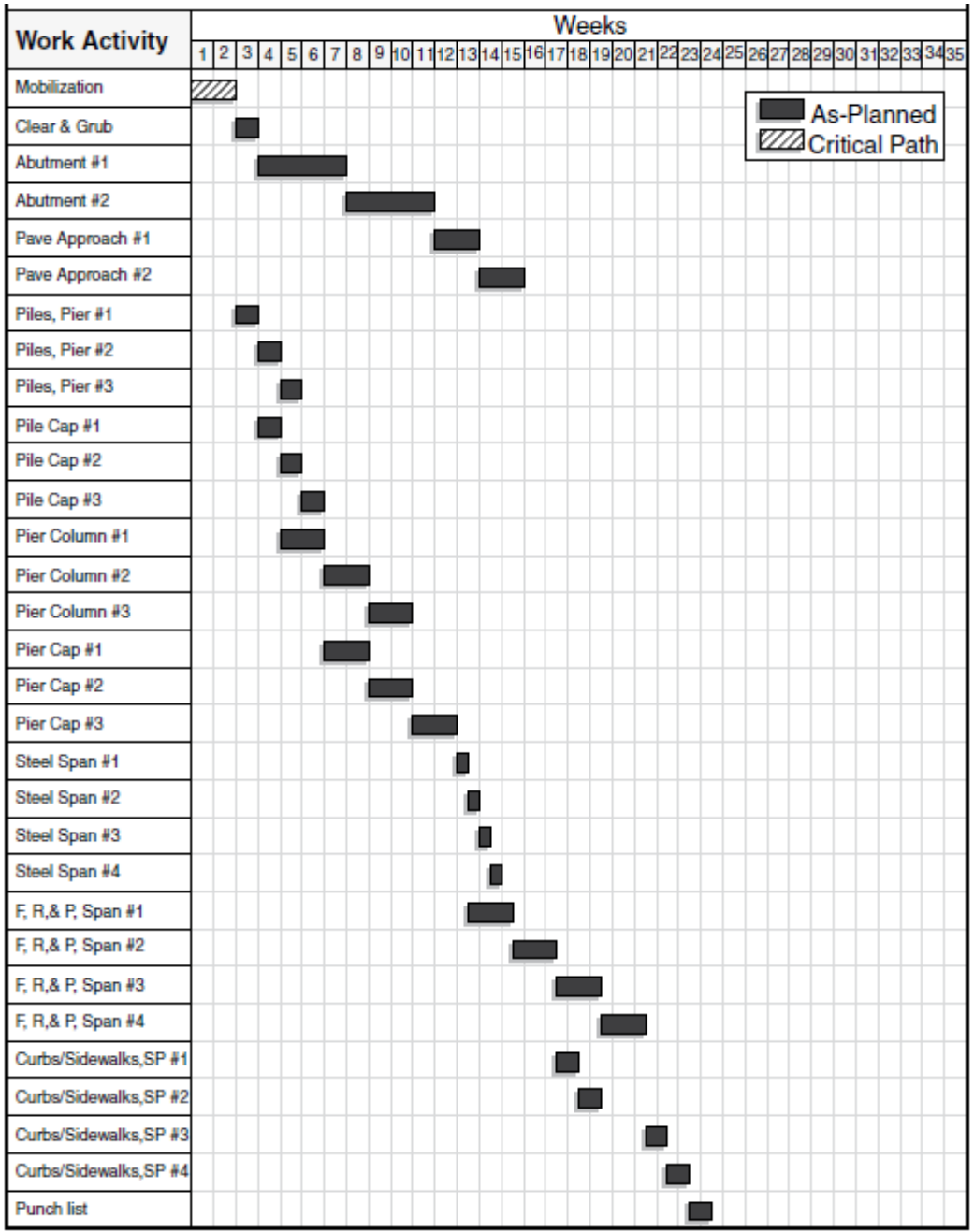
STEP 1: Identifying the critical path on a Gantt Chart – Example 1

- The **critical path starts** with the **mobilization activity** since **no other activity** is scheduled to **occur during this period**.
- The **next two activities** are:
  1. Clear and grub activity
  2. Piles at pier #1
- In **reviewing** the **sequence of activities**, the **clear and grub activity** is related to **abutment and approach work**.



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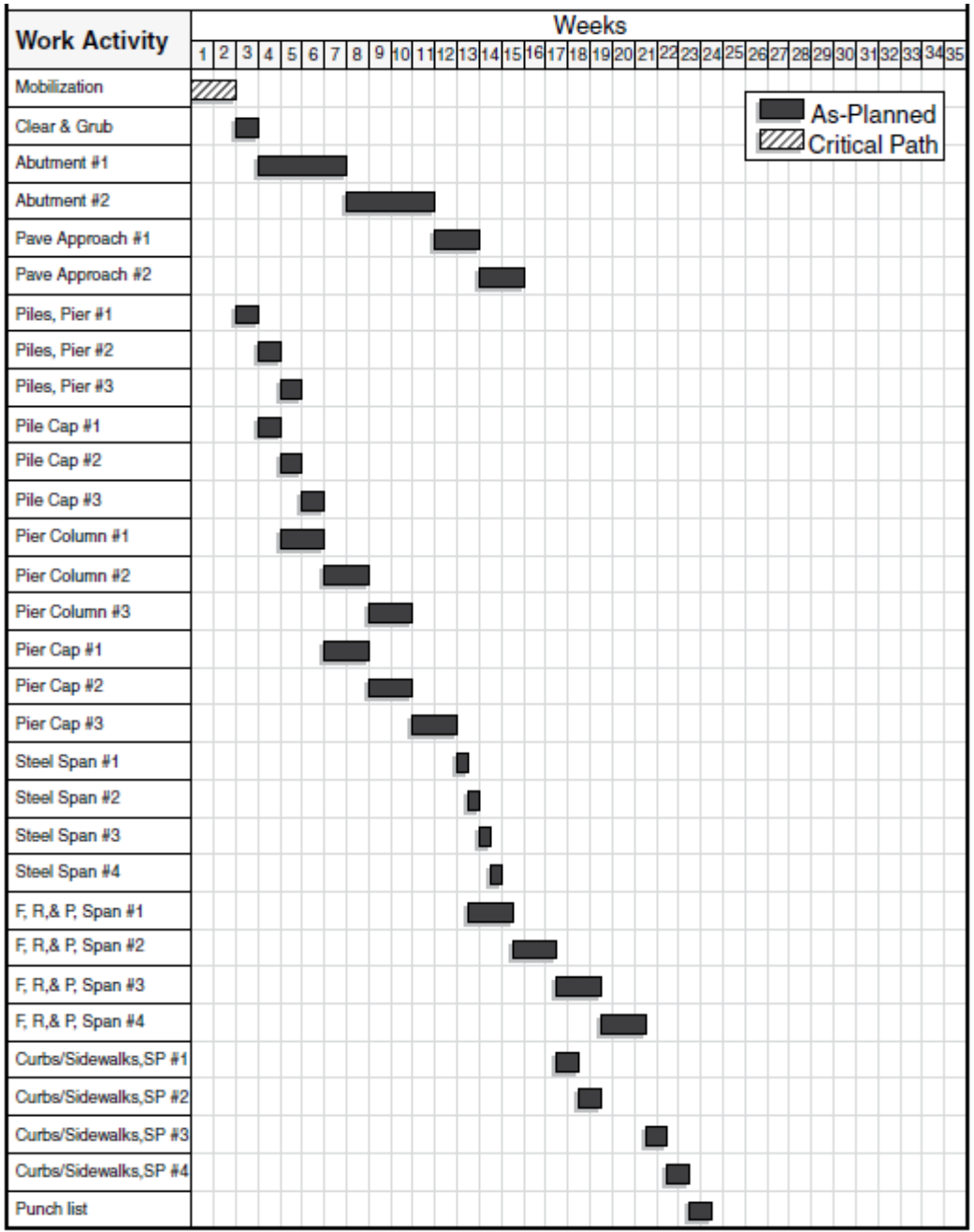
STEP 1: Identifying the critical path on a Gantt Chart – Example 1

- The **abutment and approach work** is scheduled to **finish** well **before the end of the Project** but **does not appear** to be **related** to the **schedule of activities** for **bridge construction**.
- Contract says the **"approaches"** are **not concrete**, therefore there is **no contractual or mandatory constraint** to **coordinate the placement** for the **bridge with the approaches**.



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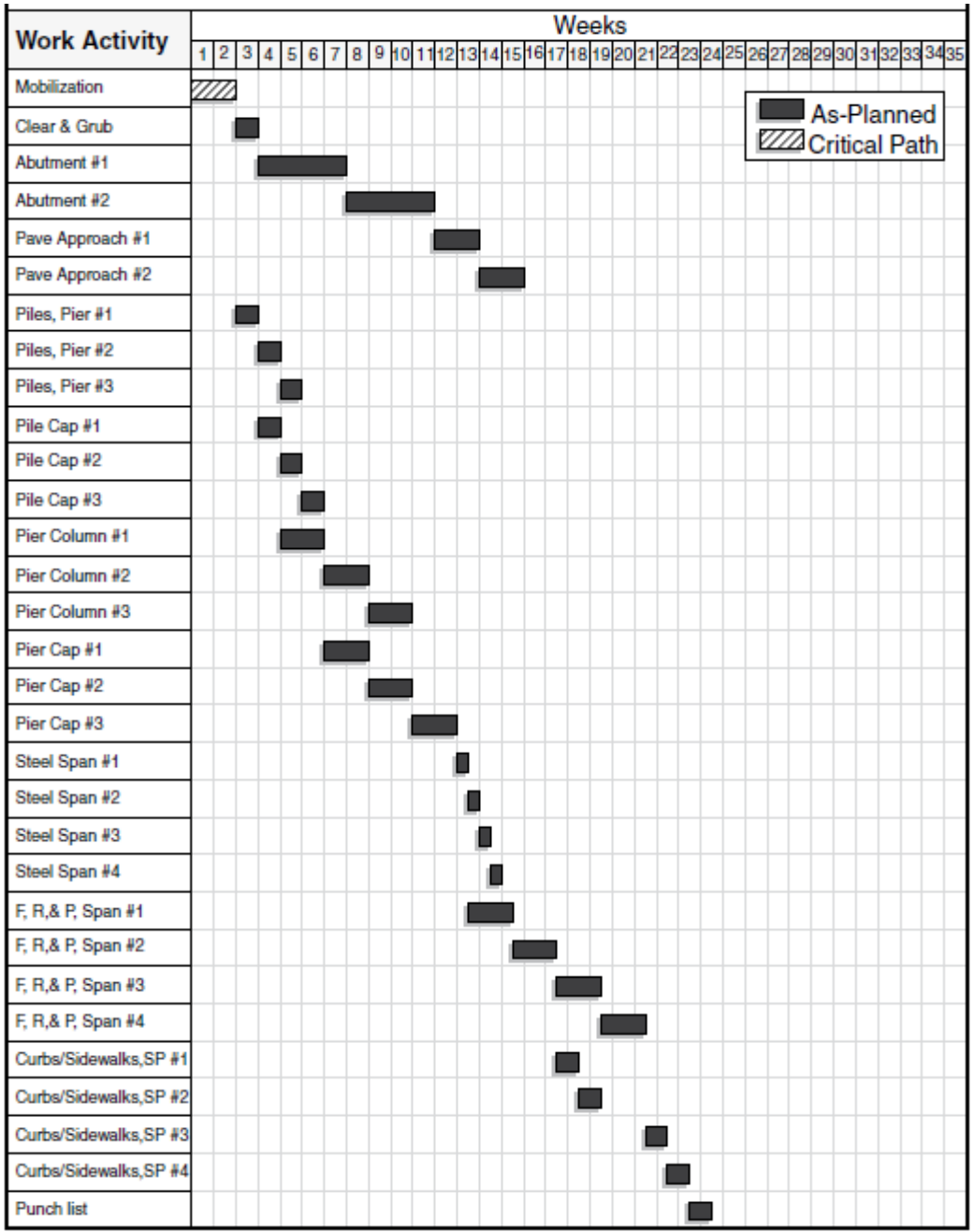
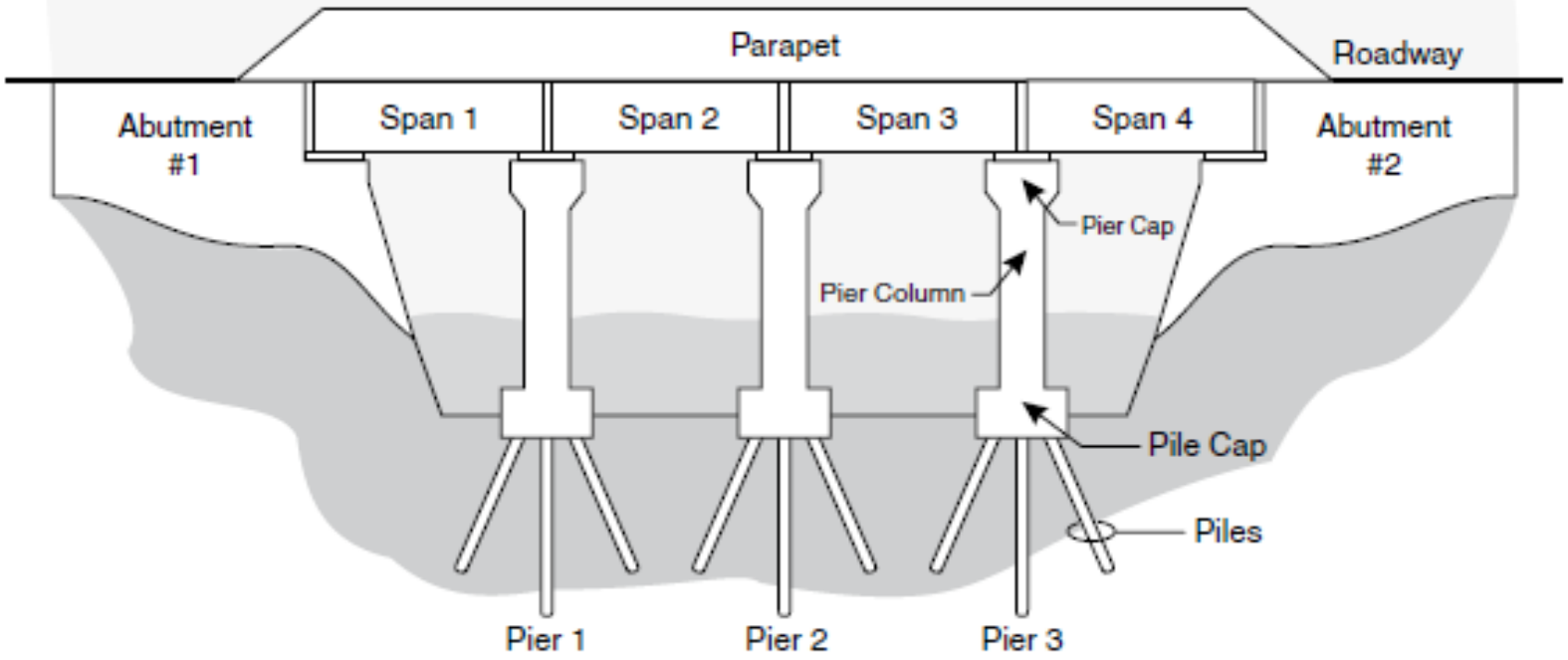
STEP 1: Identifying the critical path on a Gantt Chart – Example 1

Abutment and approach work are not on the critical path

Therefore, the critical path must be through the piles and piers.



STEP 1: Identifying the critical path on a Gantt Chart – Example 1



STEP 1: Identifying the critical path on a Gantt Chart – Example 1

RE: Bridge Project
Narrative Schedule

Dear Engineer,

The bridge construction project consists of two abutments (Abutment #1 and Abutment #2), three pile-supported piers (labeled Pier #1, Pier #2, and Pier #3 from west to east), and four spans with steel girders and concrete decking (labeled Span 1, Span 2, Span 3, and Span 4 from west to east).

I will mobilize to the site on April 1, 2008, and plan to construct this bridge by moving from west to east. I plan to construct the bridge abutments and piers concurrently. One crew will construct Abutment #1 and then Abutment #2 and at the same time Piers #1 through #3 will be constructed starting at Pier #1 through Pier #3. The construction of the spans will follow the installation of the piers.

I expect the construction of each abutment to take approximately 6 weeks and the construction of each pier to take approximately 8 weeks. I expect that all of the abutments and piers will be in place and ready to accept the steel girders for the spans by the end of July.

From the end of July until the middle of October, I plan to erect the steel for the four spans, form and pour the decks, and form and pour the parapets and sidewalks. After completing any punchlist work, I plan to open the bridge to traffic on October 20, 2008.

Please feel free to contact me with any questions.

Sincerely,
Bob Smith
Project Manager

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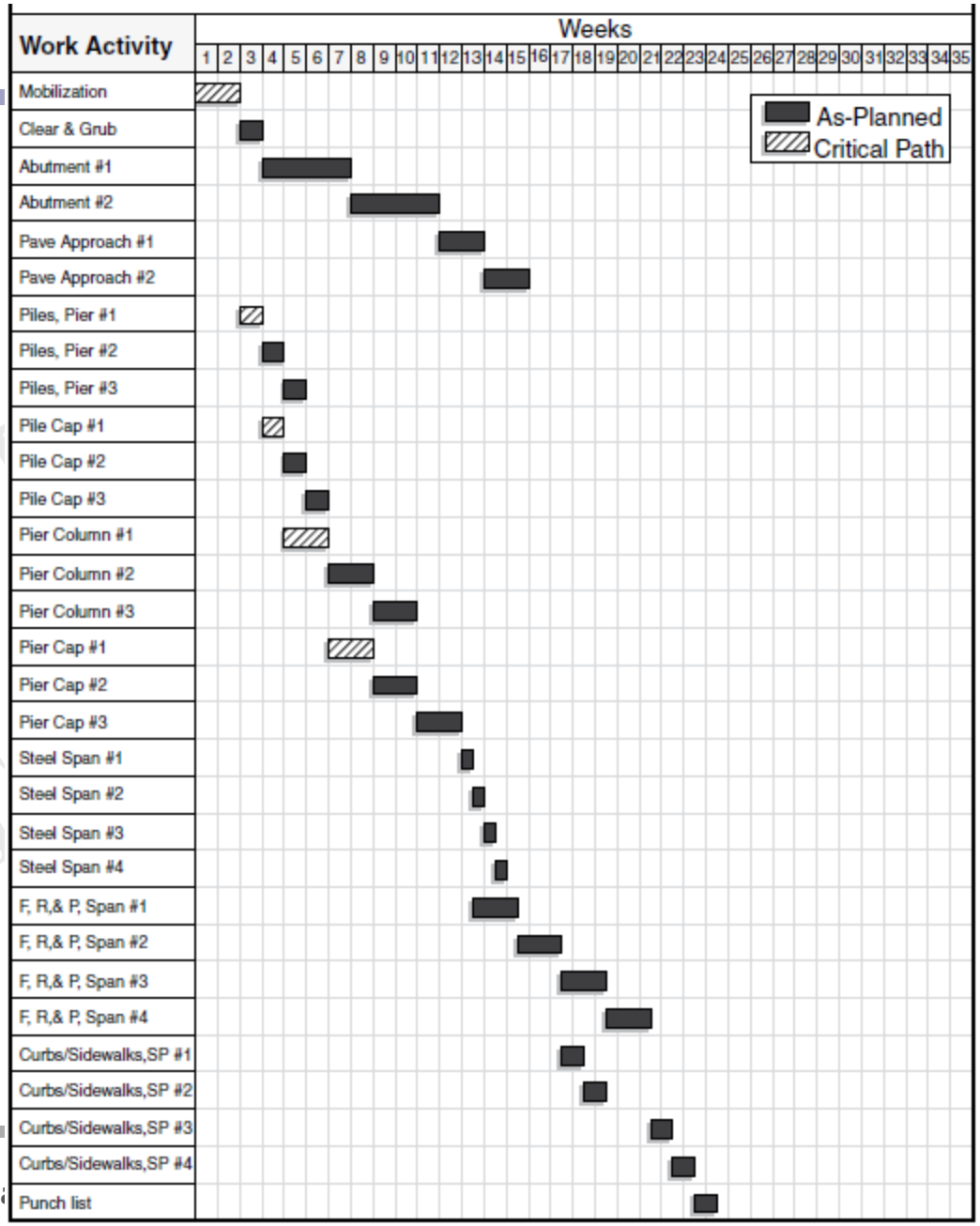
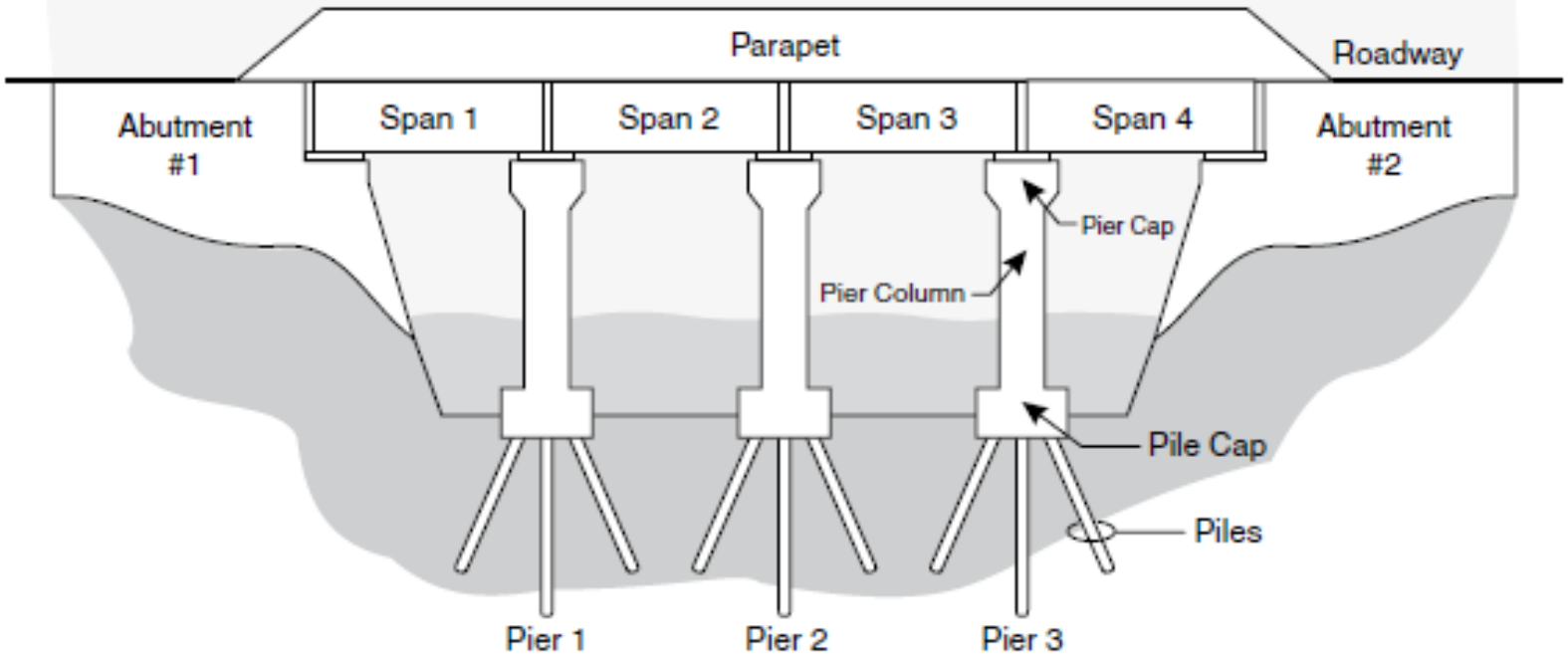
STEP 1: Identifying the critical path on a Gantt Chart – Example 1

- The **critical path** must **move through** the **piles and piers**.
- When **viewing** this **Gantt chart**, the analyst sees that the work is **"stair-stepped"** through the specific activities for **each pier**.
  - Thus, the **piles at pier #1** are **complete** and the **piles at pier #2** are **starting**.
- **Critical path appears to follow:**

  ==> Piles—Pier #1
  ==> Pile Cap #1
  ==> Pier Column #1
  ==> Pier Cap #1



STEP 1: Identifying the critical path on a Gantt Chart – Example 1



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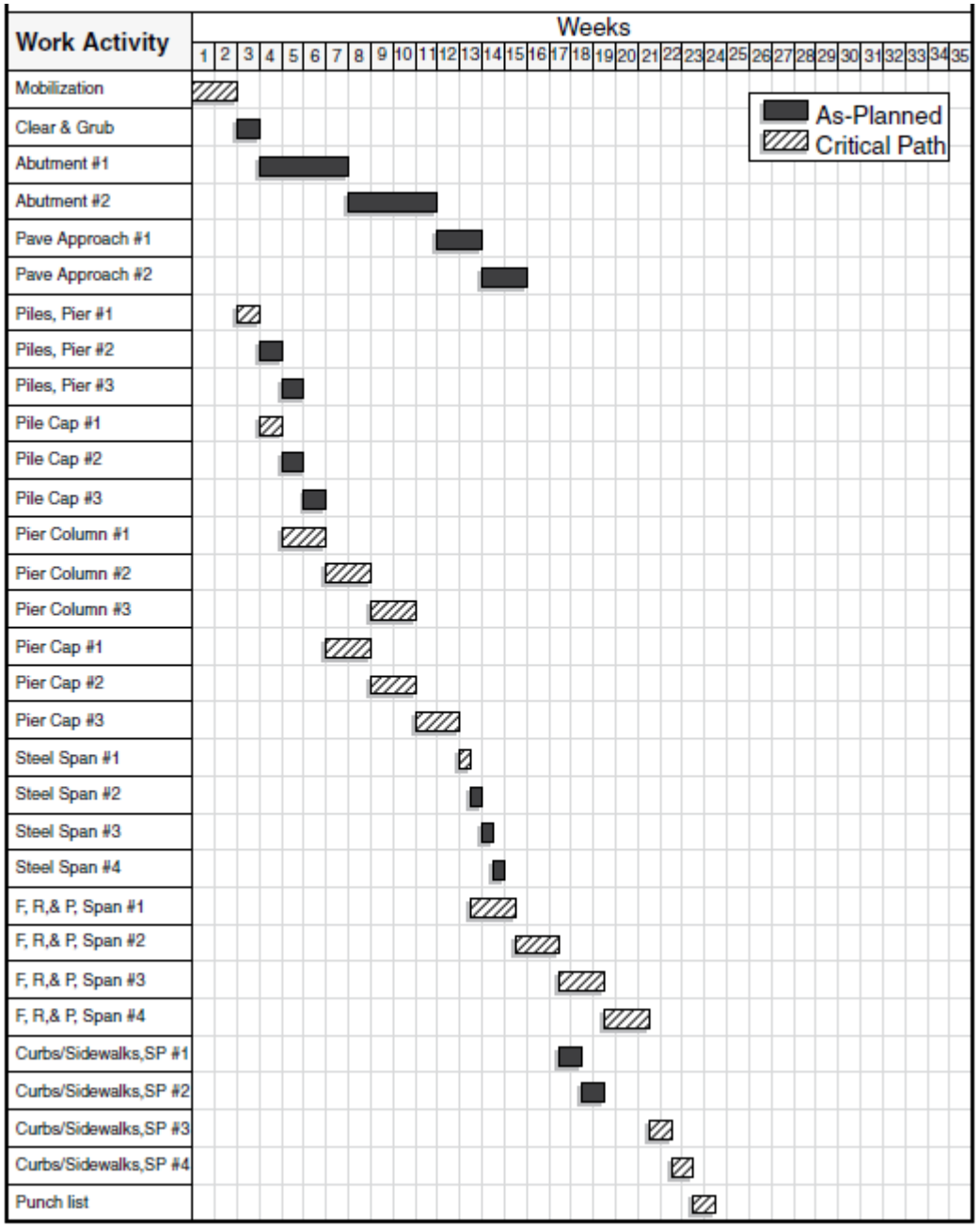
STEP 1: Identifying the critical path on a Gantt Chart – Example 1

- **Pier column #1** can be started when **Pile cap #1** is finished.
- **Steel span #1** can be **started when only all pier columns** and **caps completed**.
- **Span deck #2** can **only** be started when **span deck #1** is **finished**.
- **Punch list** can **be started** when **only all sidewalks** are **finished**.



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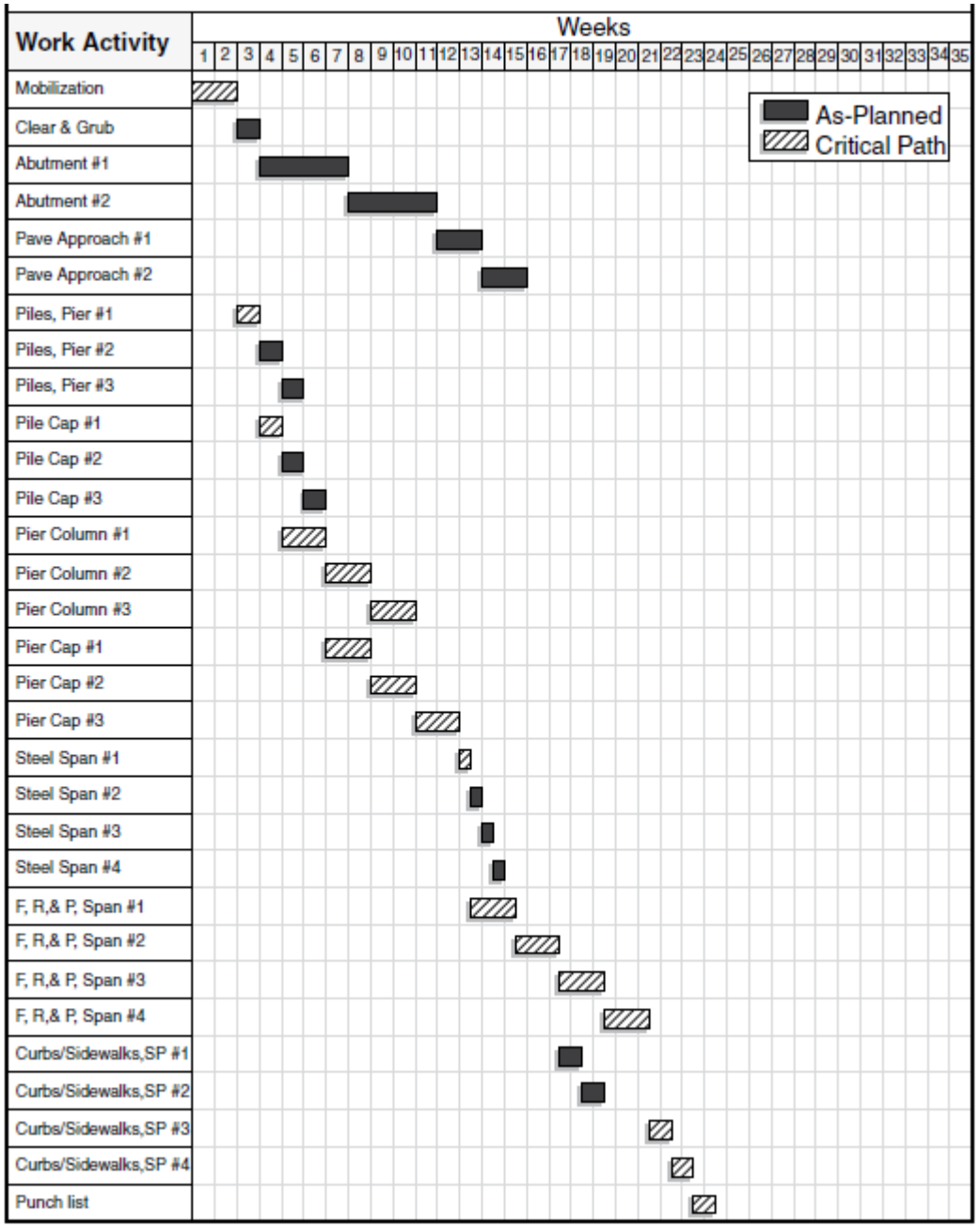
STEP 1: Identifying the critical path on a Gantt Chart – Example 1

- **The overall critical path is:**
  - ==> Mobilization
  - ==> Piles—Pier #1
  - ==> Pile Cap #1
  - ==> Pier Column #1
  - ==> Pier Column #2
  - ==> Pier Cap #1
  - ==> Pier Column #3
  - ==> Pier Cap #2
  - ==> Pier Cap #3
  - ==> Steel Span #1
  - ==> F, R, & P Span #1
  - ==> F, R, & P Span #2
  - ==> F, R, & P Span #3
  - ==> F, R, & P Span #4
  - ==> Curbs & Sidewalks Span #3
  - ==> Curbs & Sidewalks Span #4
  - ==> Punch list



STEP 2: Quantifying delays using Gantt Chart schedule

- The **process of quantifying** the delays using a **Gantt chart** is **similar** to the process when a **CPM schedule is available**.

- To **start the process**, the analyst **must prepare** a **detailed as-built diagram** that shows as specifically as possible when the **work was actually performed**.

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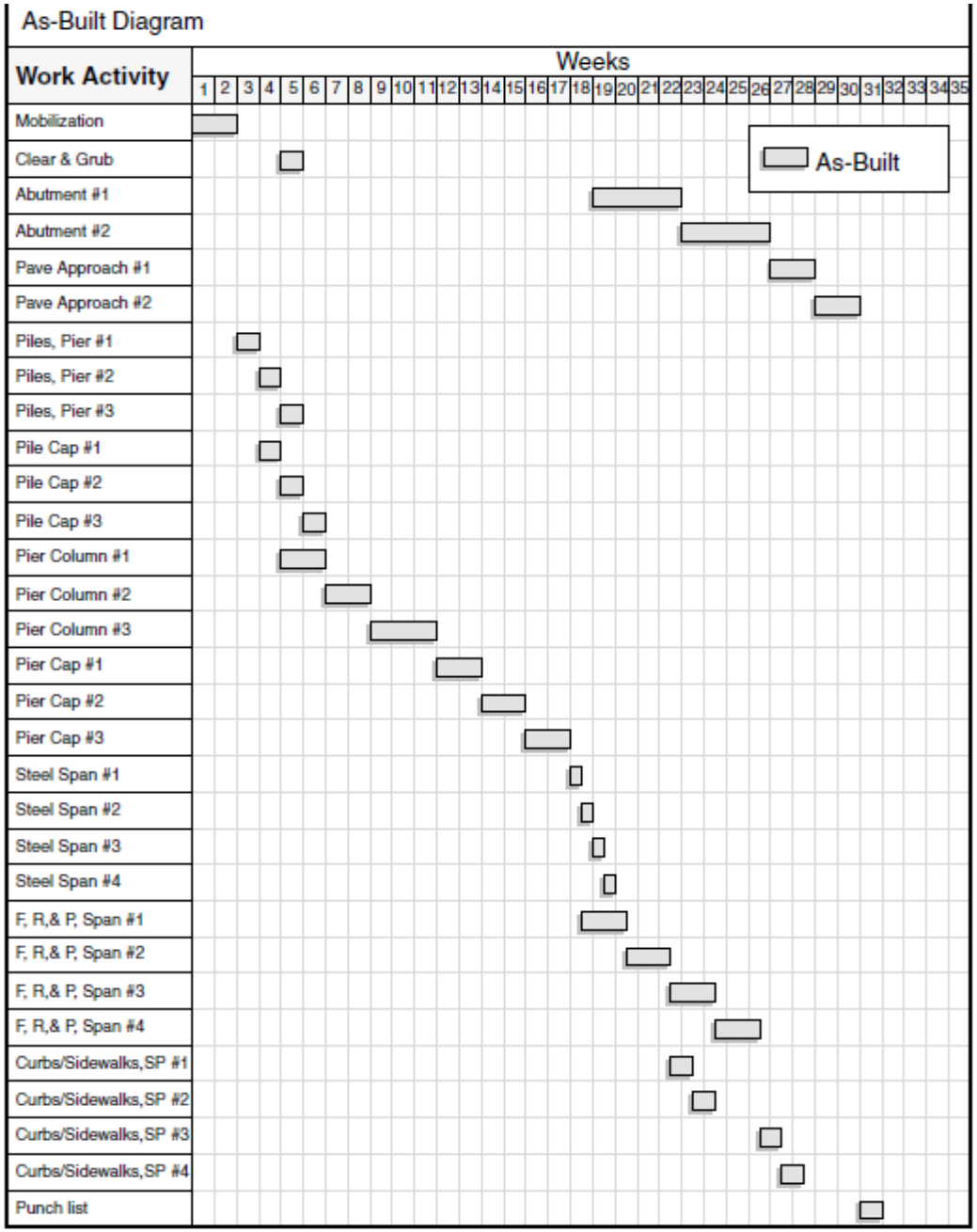
STEP 2: Quantifying delays using Gantt Chart schedule – Example 1

Project should have been completed during week 24, whereas it takes 31 weeks

- **Mobilization** is on time.
- **Remaining activities did not** processed **similar** to **as-planned schedule.**
- Let's look at the **first three delays** to **demonstrate** the **delay analysis methodology** that can be applied to the **rest of the project**.



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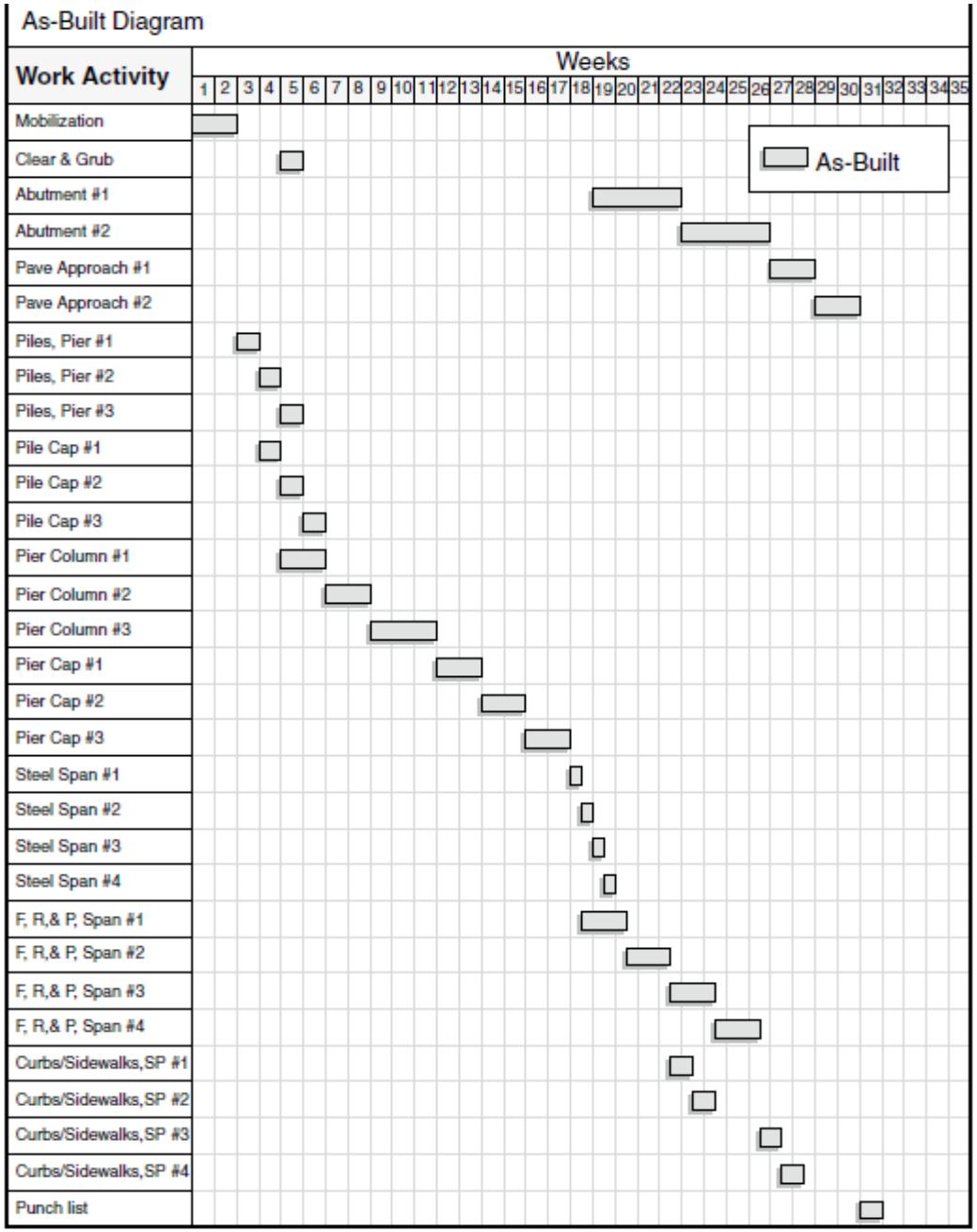
STEP 2: Quantifying delays using Gantt Chart schedule – Example 1

- At the end of 5th week.
- As the **as-built diagram** shows, the pile driving at
  1. **Piers #1, #2, and #3**;
  2. **Pile caps at piers #1 and #2**;
  3. **Pier column #1**

were accomplished **as-planned** in the three weeks immediately following the **mobilization activity**.



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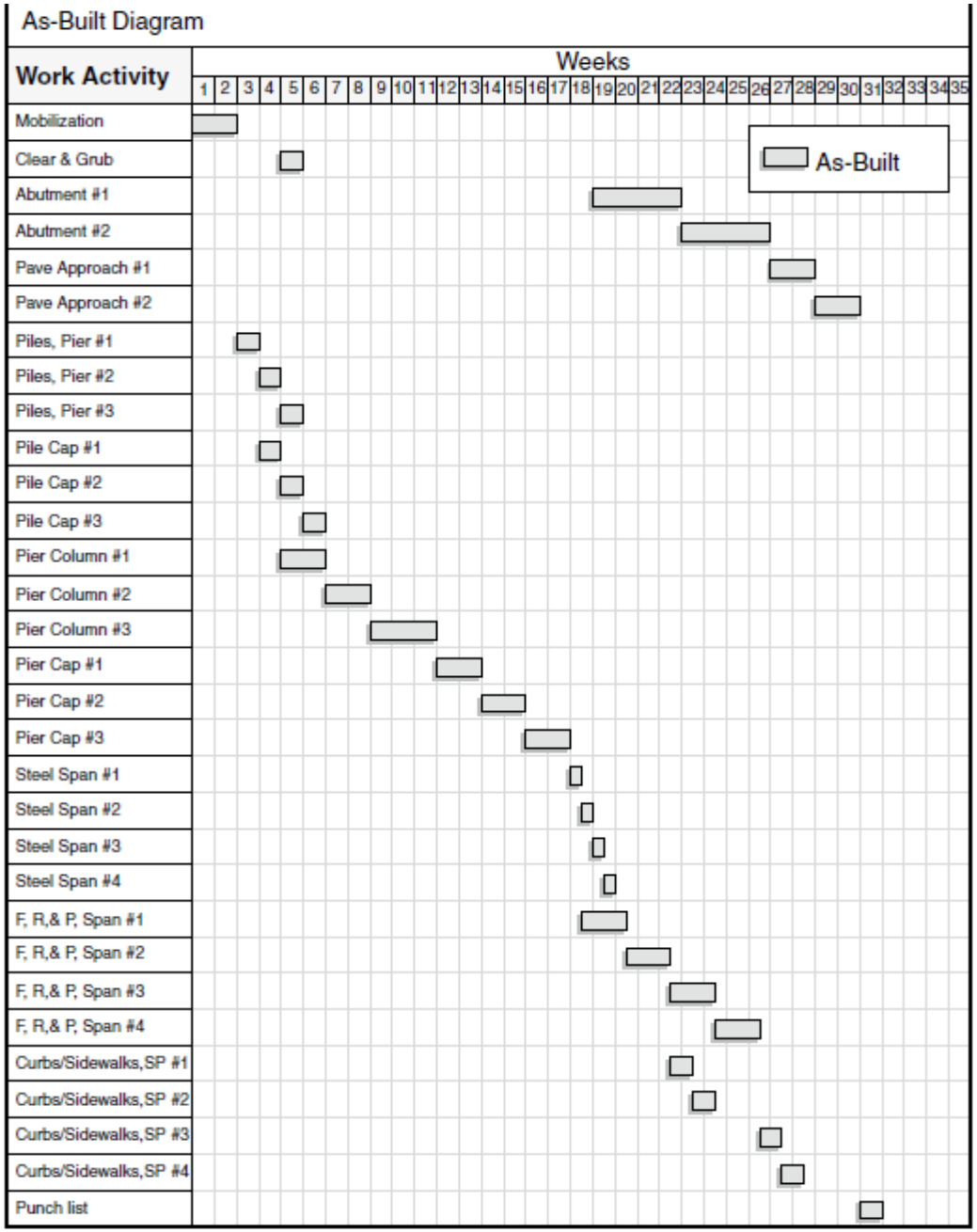
STEP 2: Quantifying delays using Gantt Chart schedule – Example 1

- At the end of 5th week.
- The **clear and grub activity**, however, did **not proceed as planned** but started **two weeks** late and **finished in a duration** of one week (**the planned duration**).
  - If the **previous conclusions concerning the critical path were correct**, the delay to the start of **clearing and grubbing** should **not have resulted** in a **delay to the Project**.



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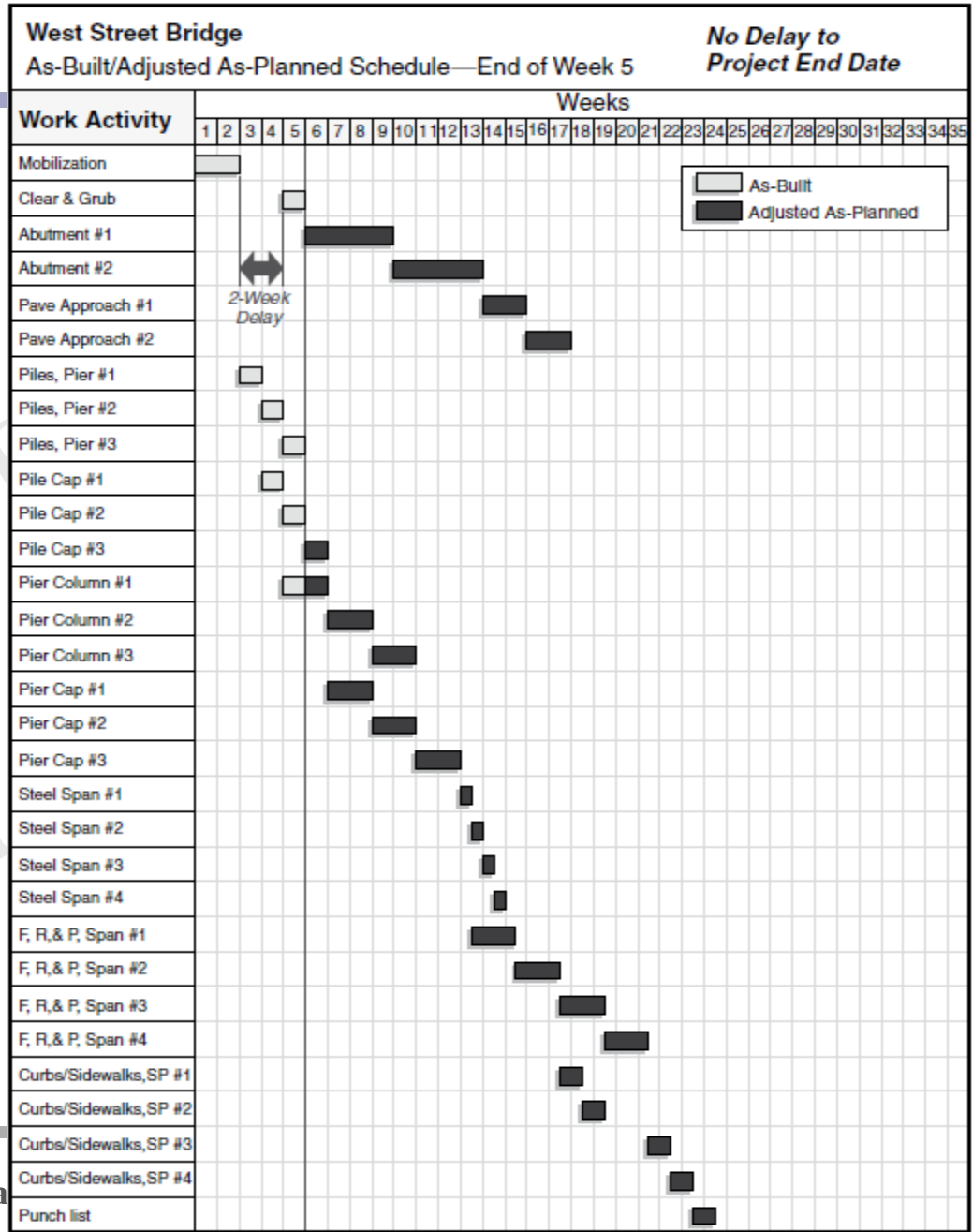
STEP 2: Quantifying delays using Gantt Chart schedule – Example 1

- At the end of 5th week.
- To check the **conclusion in previous slide**, the **analyst** can **"update"** the **Gantt chart** as of the **end of week five**, as shown in this figure.

The abutment and approach work has been delayed in time, however there is no delay to the critical path and the Project is still on schedule.



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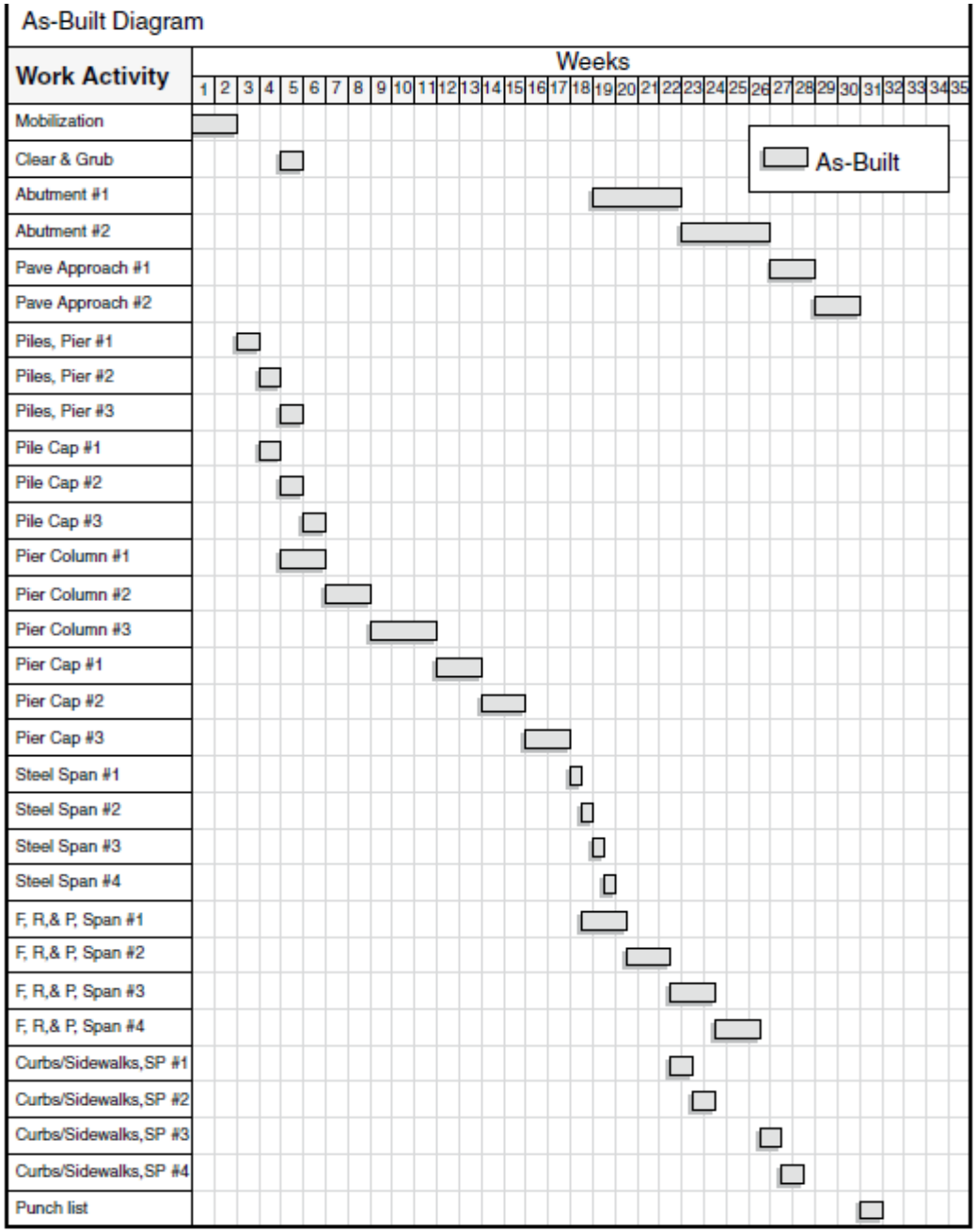
STEP 2: Quantifying delays using Gantt Chart schedule – Example 1

- The analyst decides to "update" the schedule as of the end of **week 11.**
- The **abutment/approach work** has **not yet begun.**
- The **pier cap work** also has **not yet begun**.
- **Pier columns #1 and #2** were completed **on schedule**.
- **Pier column #3**, however, took **one week longer** to complete than planned.



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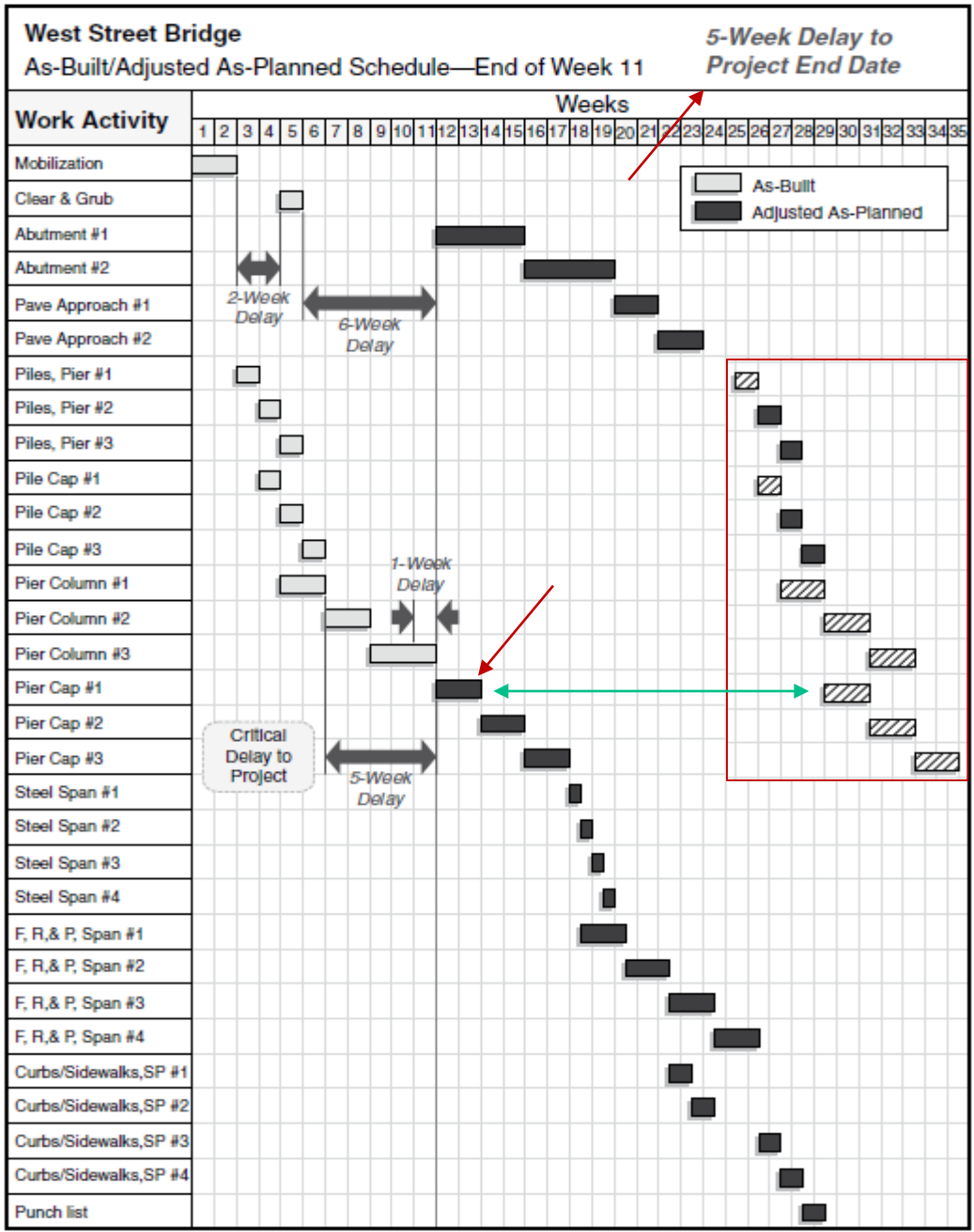
STEP 2: Quantifying delays using Gantt Chart schedule – Example 1

- Project is now **five weeks behind**.
- The delay was caused by the **late start of pier cap #1 work**.
- Although **pier column #3** was **late** in finishing and was **on the original critical path**, once the **pier cap #1** activity did **not start on time**, the **critical path shifted** to **depend solely** on the **pier cap work**.
- The **pier column #3 activity** was effectively **given float** by virtue of the **delay to the pier cap activity**.



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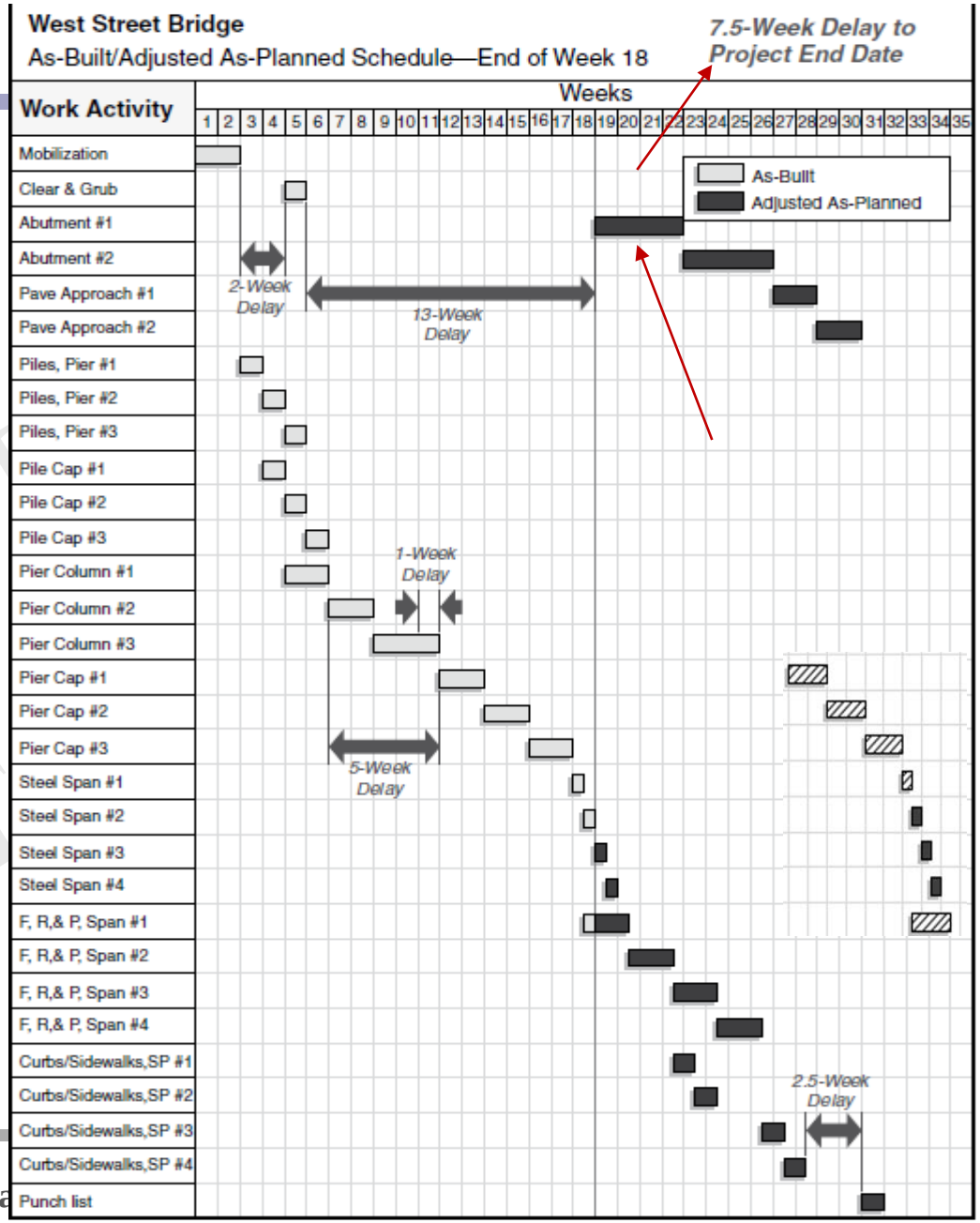
STEP 2: Quantifying delays using Gantt Chart schedule – Example 1

- Next, the **analyst** decides to **"update" the schedule** at the end of **week 18**.
  - This **point is chosen because** the **critical path shifts**.
- The **additional two and one-half weeks delay** appears to be the result of a **lack of progress** on the **abutment/approach path**.



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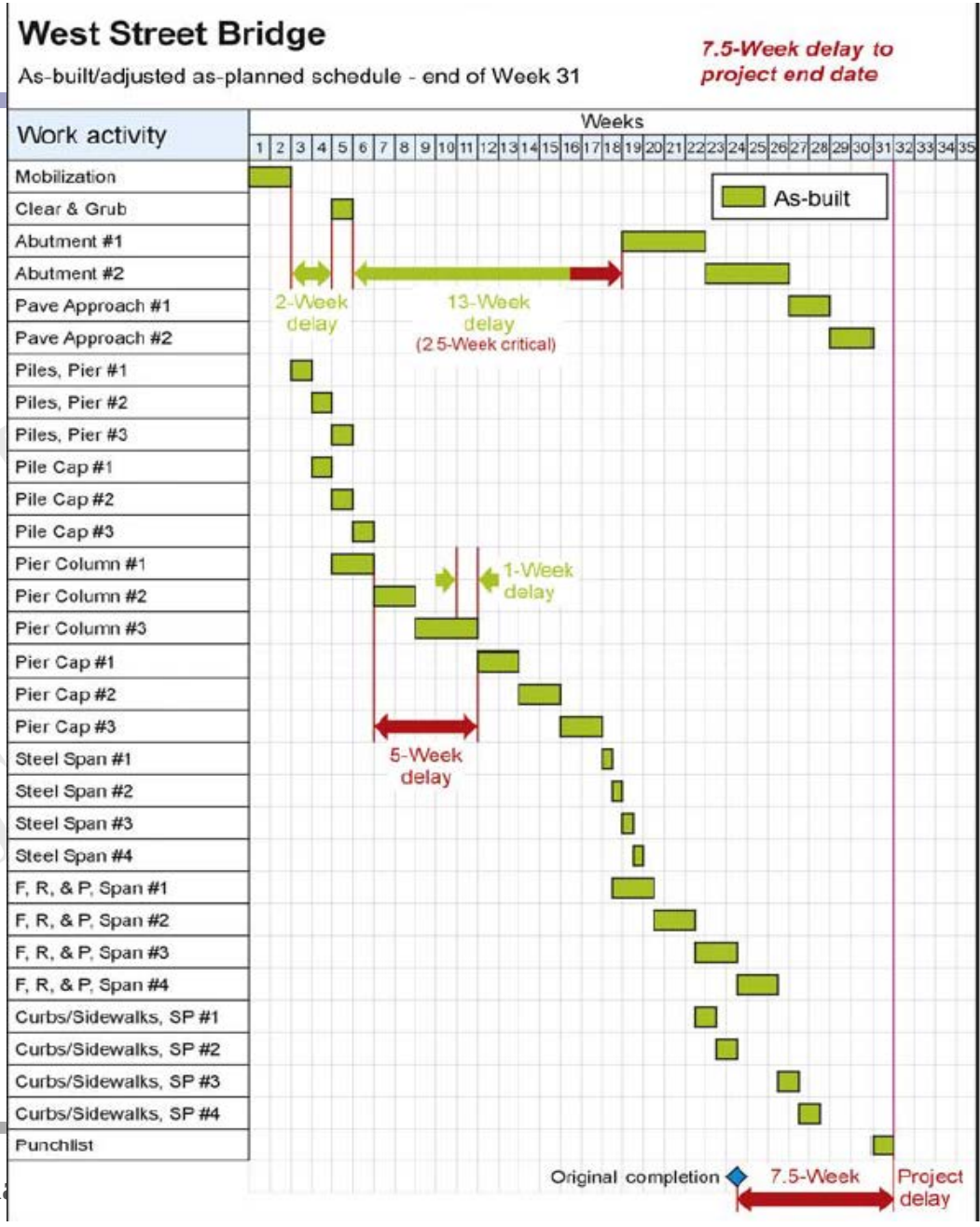
STEP 2: Quantifying delays using Gantt Chart schedule – Example 1



STEP 2: Quantifying delays using Gantt Chart schedule

BUT

We did not follow the process…

Why?

Because changes should have been added to the Gantt Chart as they occurred

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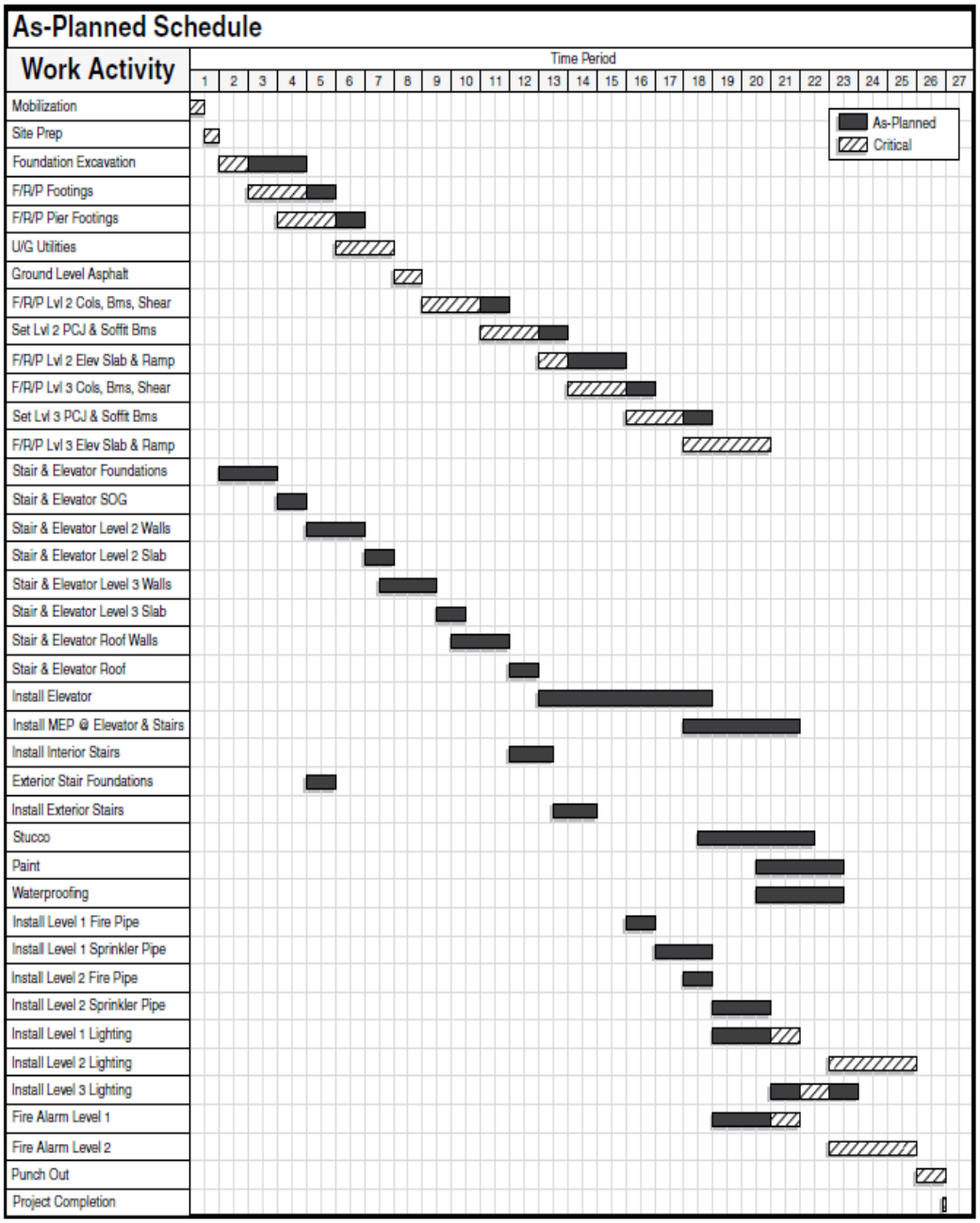
STEP 1: Identifying the critical path on a Gantt Chart – Example 2

AS-PLANNED SCHEDULE

- To **further illustrate** the process of determining delays with a **Gantt chart**, the following example of the construction of a **simple, three-story building** will be used.
- Based on a **review** of the schedule, the **critical path** has been shown with **cross-hatched bars**.



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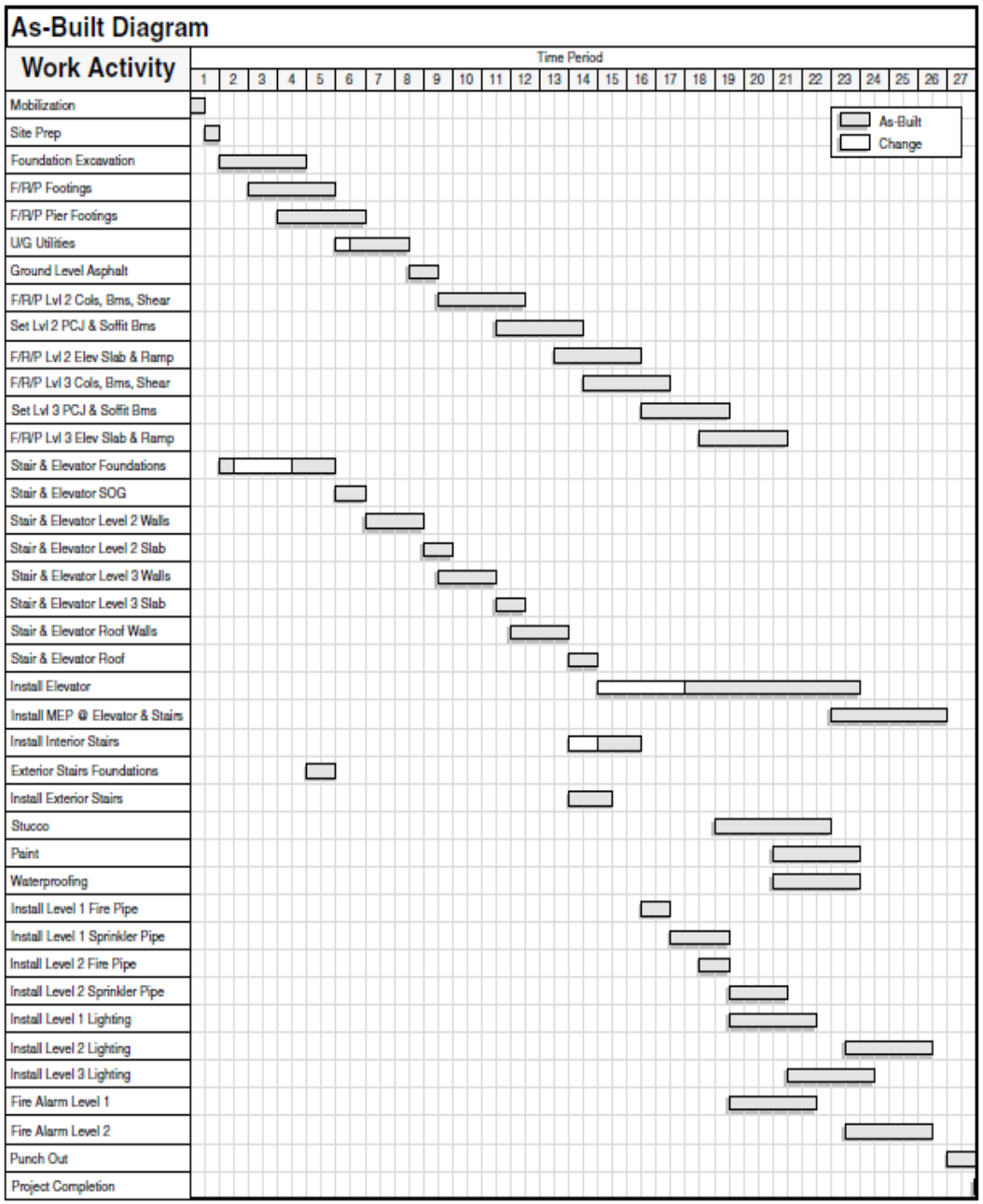
STEP 2: Quantifying delays using Gantt Chart schedule – Example 2

AS-BUILT SCHEDULE

- **During the course of the Project**, there were **four changes** that occurred that **might have affected** the **Project completion date**.
- The **as-built diagram** with the changed work highlighted in white is shown in the figure.



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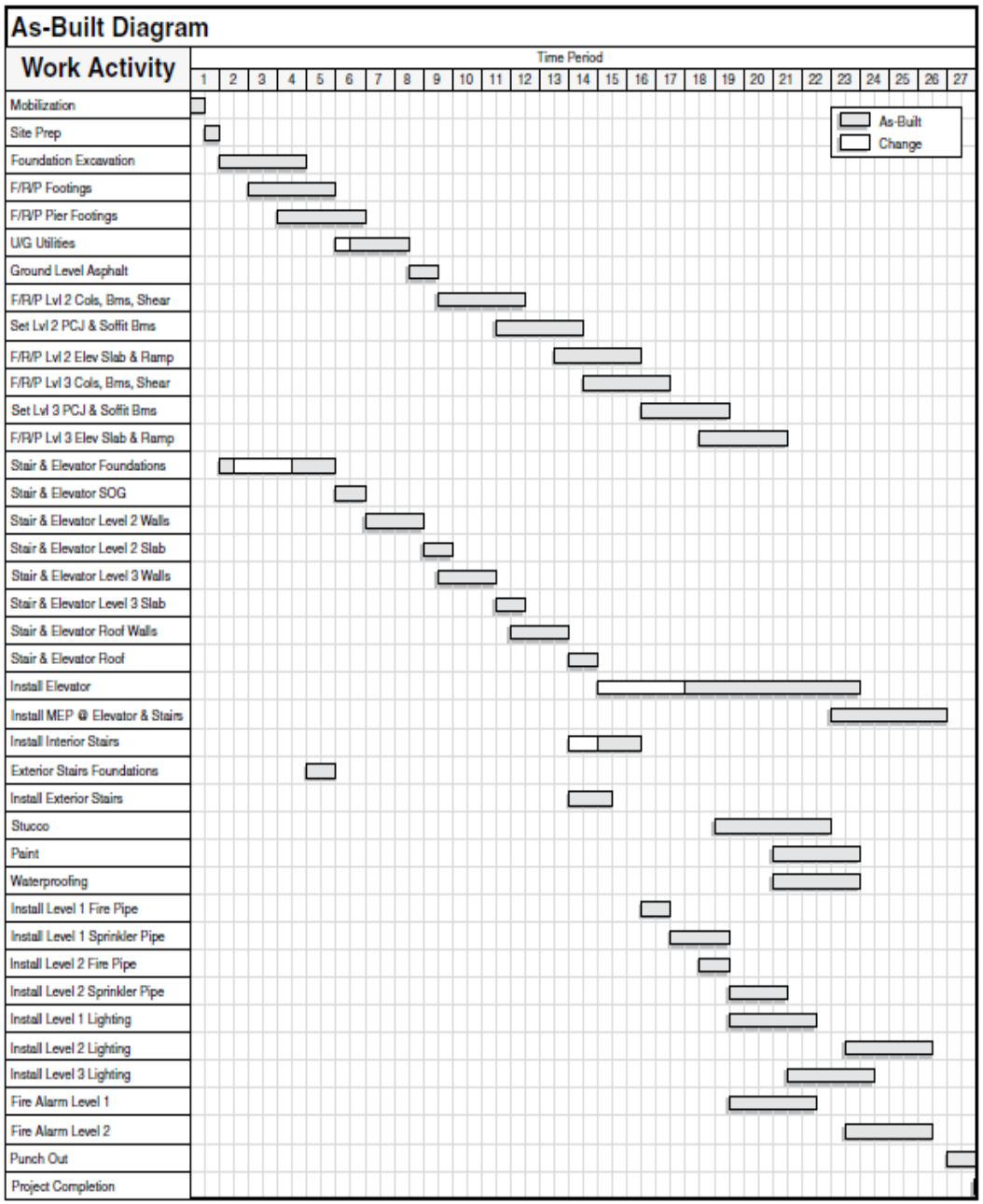
STEP 2: Quantifying delays using Gantt Chart schedule – Example 2

AS-BUILT SCHEDULE

- You should be aware that you **cannot only look** at a **comparison** of the **as-planned schedule** and the **as-built diagram** and **draw conclusion**.
- **Instead**, the analysis **must apply** the **changes** as they **occur** and **measure** any **delay**, as it would **have occurred**.



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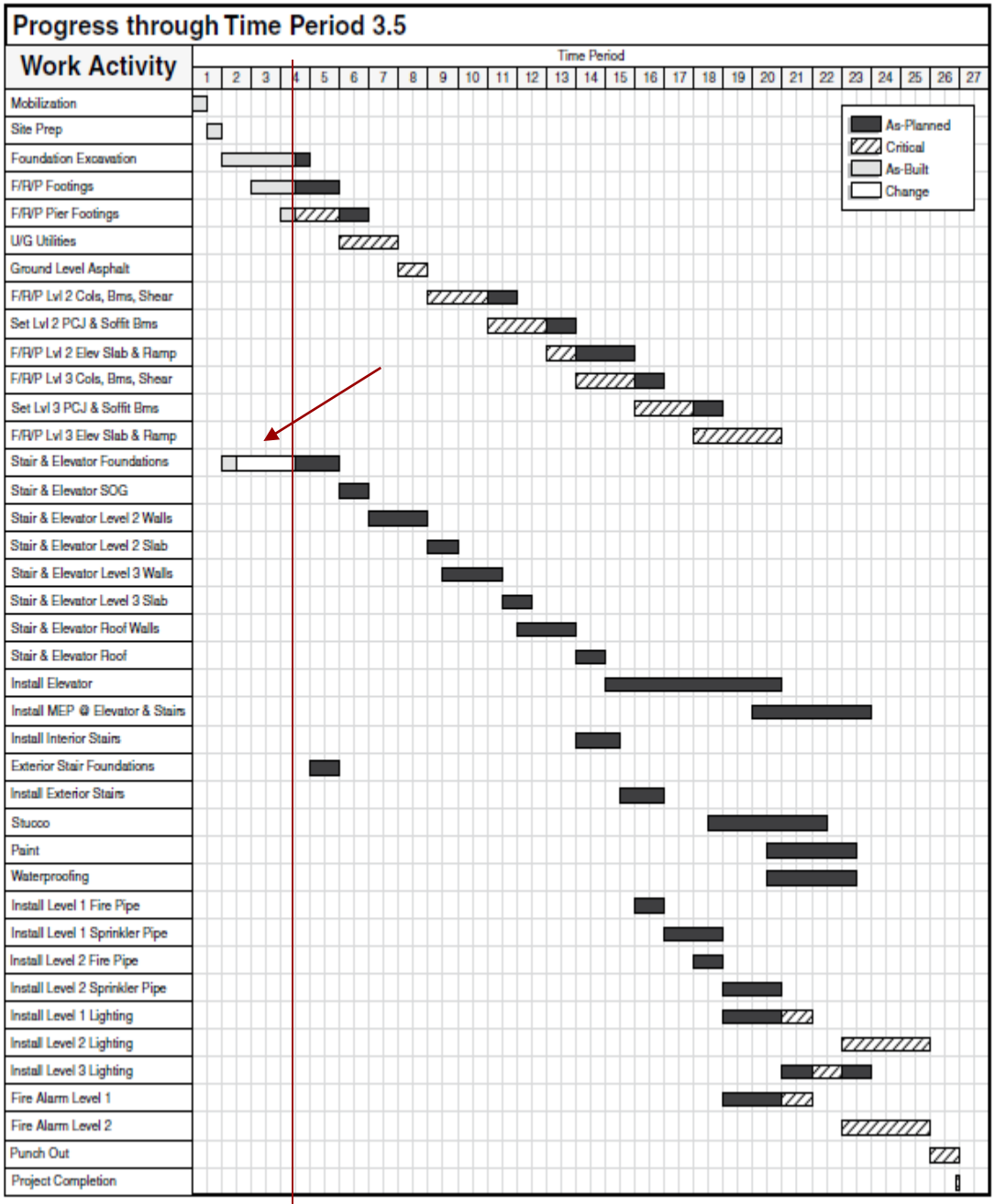
STEP 2: Quantifying delays using Gantt Chart schedule – Example 2

- **Analyst** could be performing the analysis **contemporaneously** as the **Project progresses**.
- In this case, the **as-built diagram** would be **prepared up to the date** of the **change** and **any delays determined at that time**.
- The figure shows the project as of **time period 3.5**.



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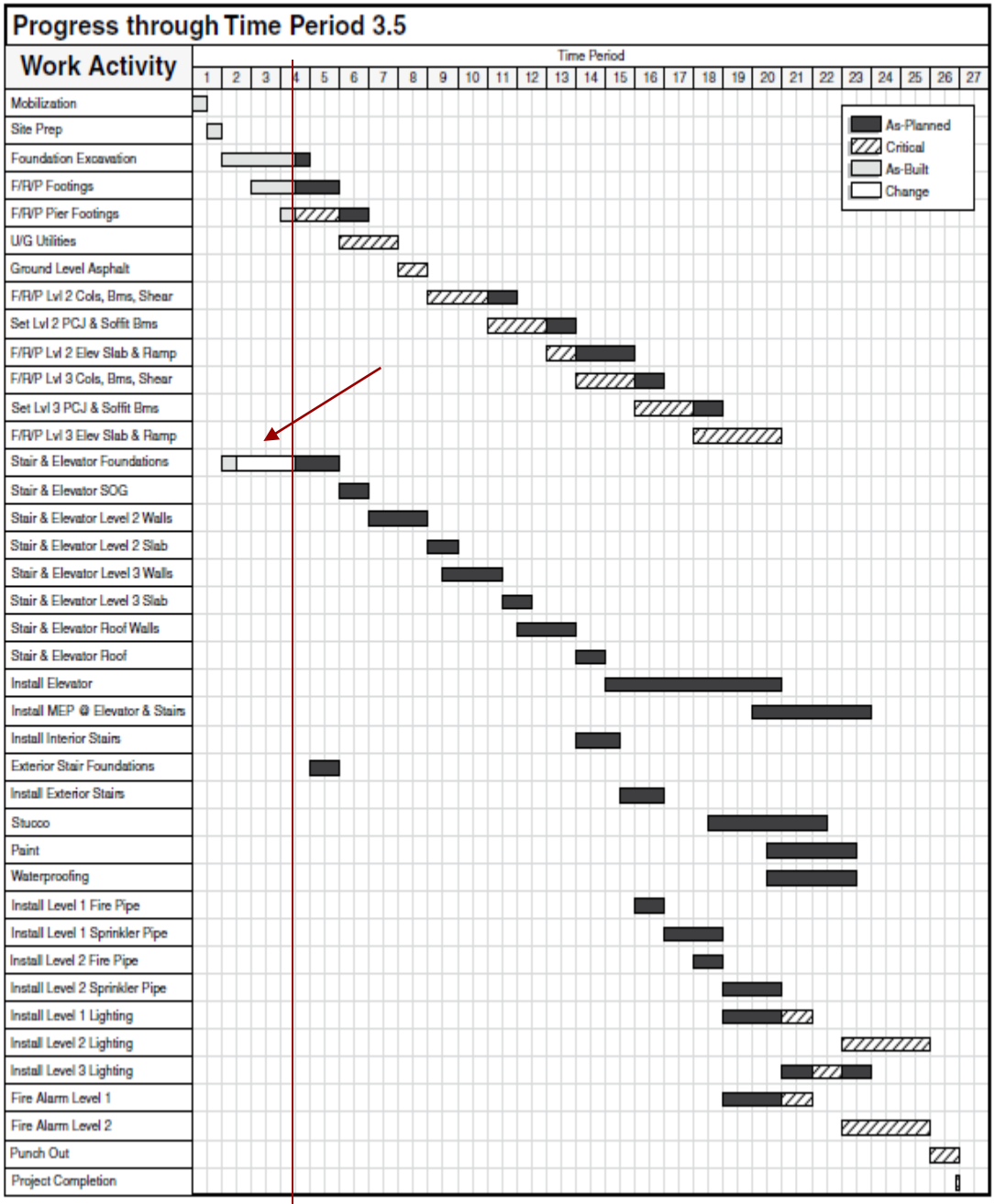
STEP 2: Quantifying delays using Gantt Chart schedule – Example 2

- **Comparing as-planned schedule** and **updated schedule** in time **period of 3.5**, the project is still **on time** and will be finished at the end of **time period 26**.
- **No delay** was **caused** by the **first change**.



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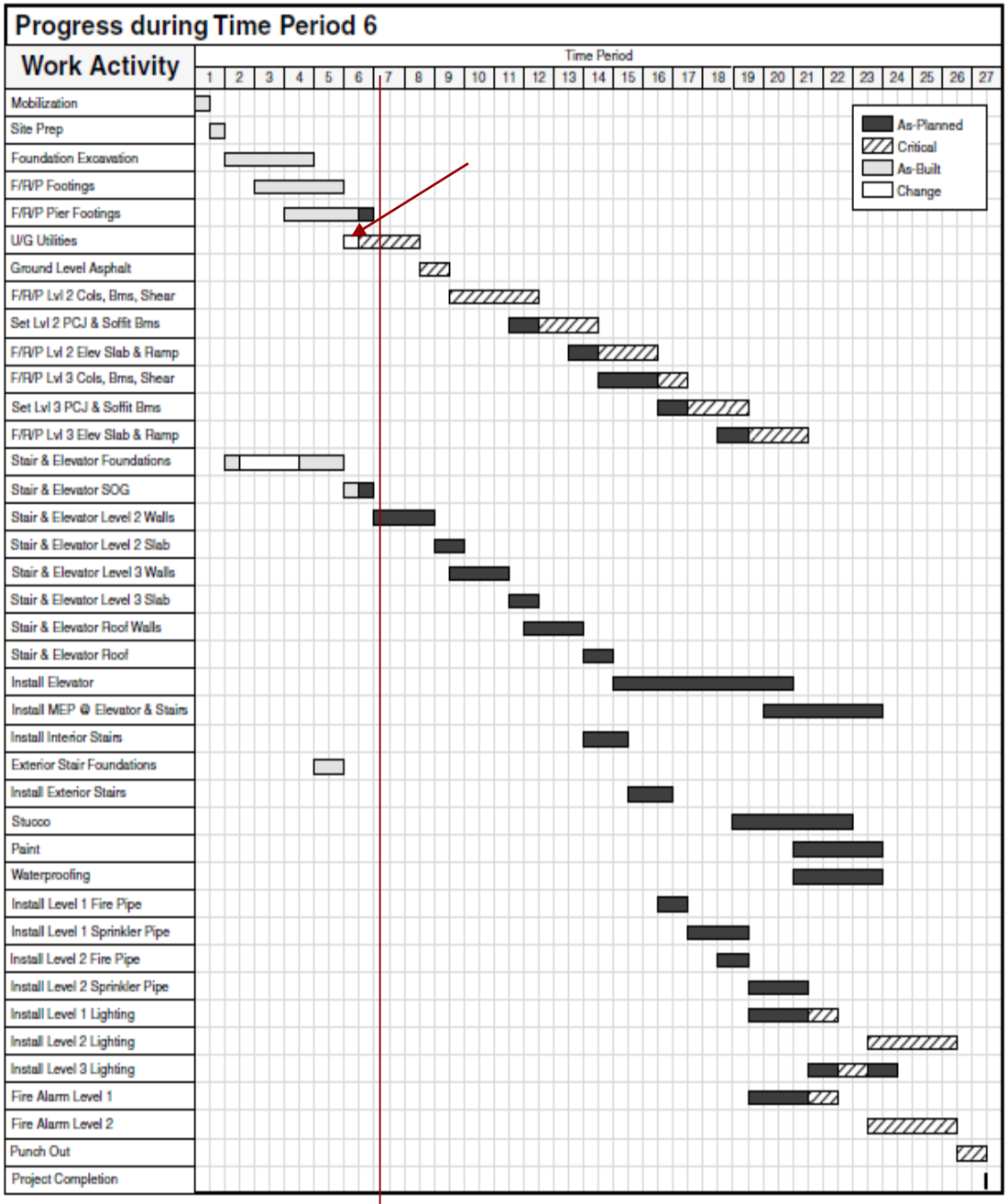
STEP 2: Quantifying delays using Gantt Chart schedule – Example 2

- The **next change** to the Project occurs during **time period 6**.
- **Comparing** the first update (**previous figure**) and the present update (**this figure**) of the schedule, the Project has been **delayed one-half time period** and will now finish in the **middle of time period 27**.
- **Change #2** affected the **critical work of the underground utilities**. So a **delay** has occurred **because of change #2.**



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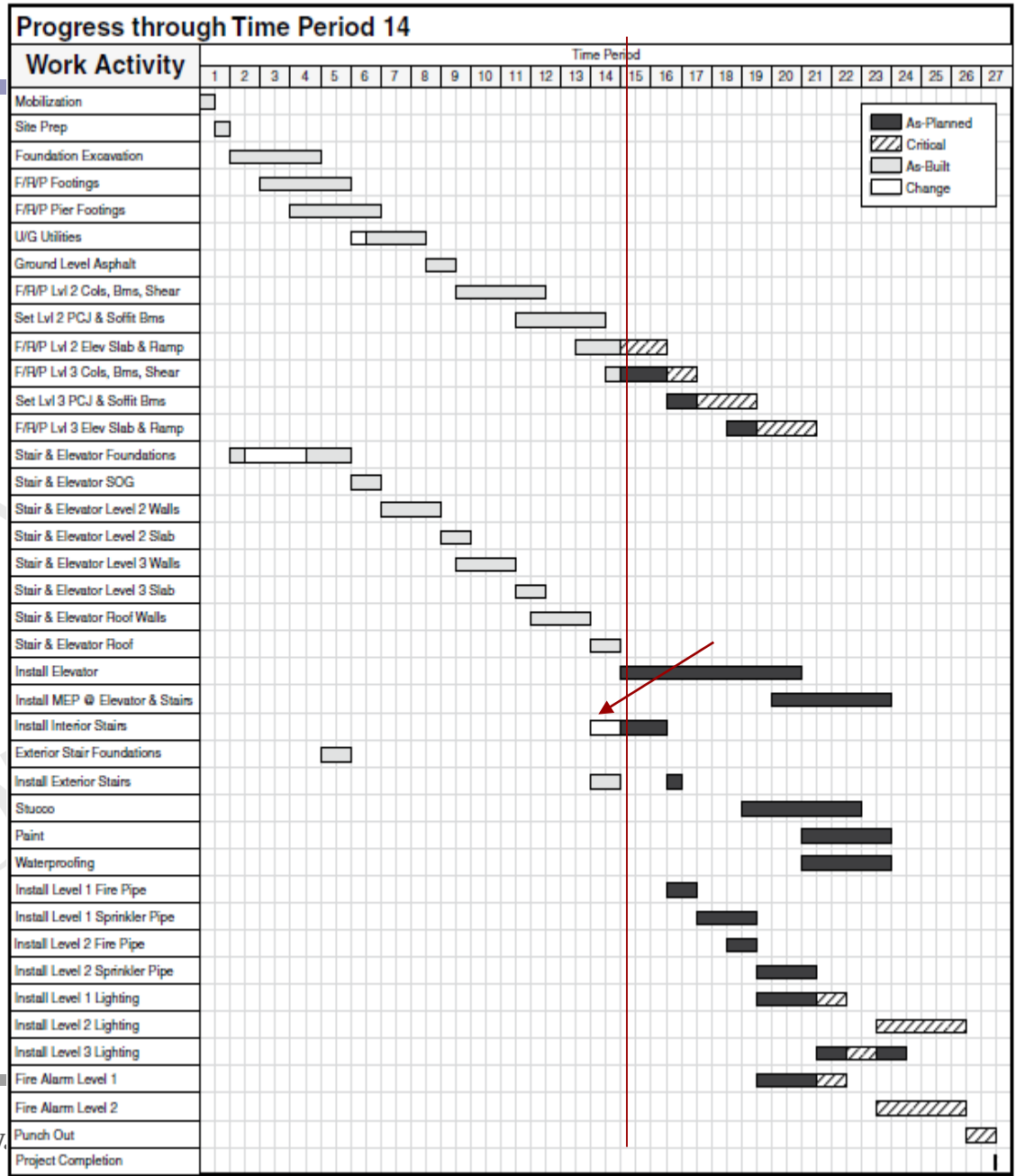
STEP 2: Quantifying delays using Gantt Chart schedule – Example 2

- The **next change** to the Project, **change #3**, occurred during **time period 14**.
- **Comparing** the **preceding update** and **this update**, the **end date** of the Project has **not changed**; therefore, the changed work **did not affect** the **critical path**, and **no delay resulted**.



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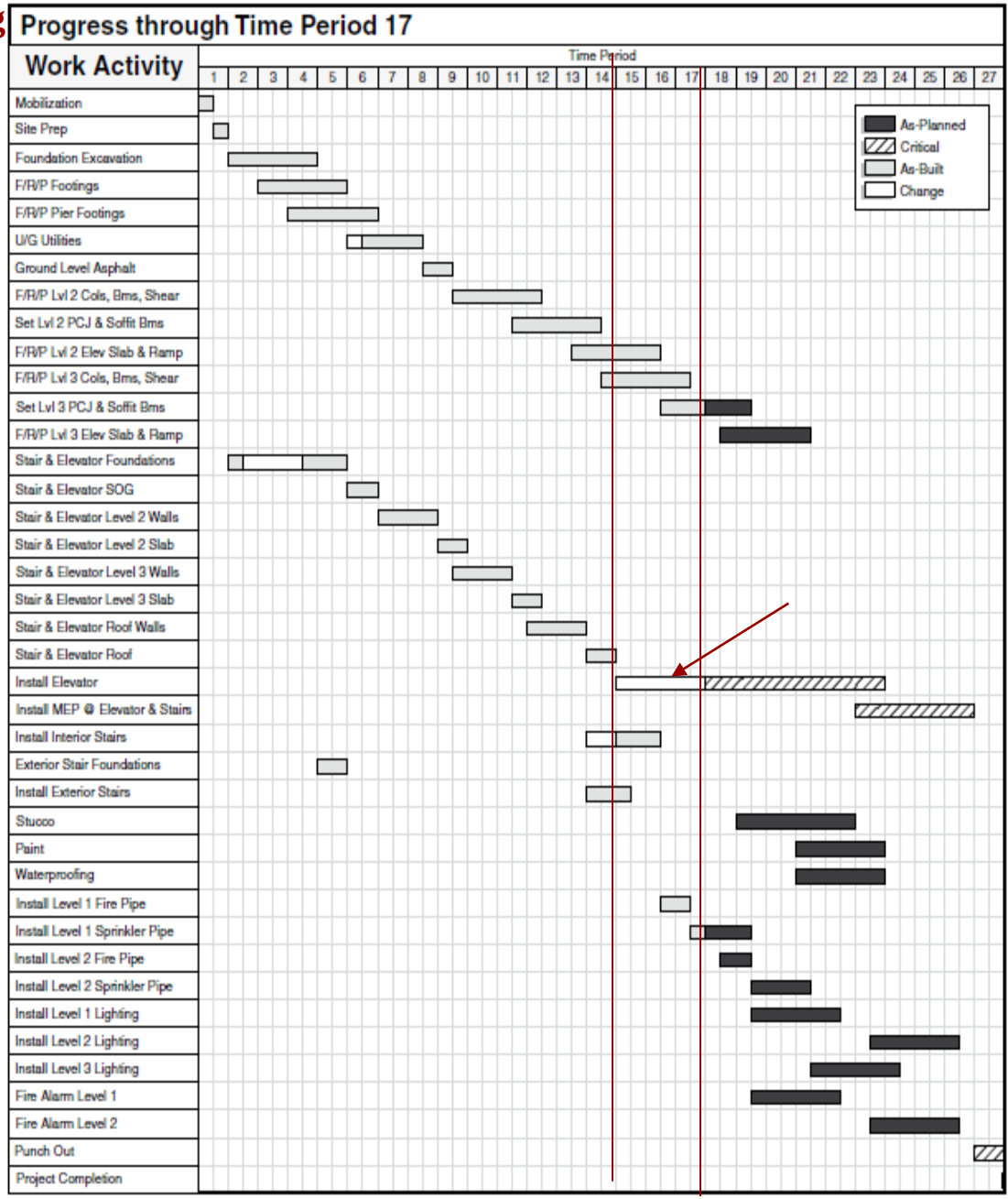
STEP 2: Quantifying delays using Gantt Chart schedule – Example 2

- The next change, **change #4**, occurred during **time periods 15 through 17**.
- The Project will now complete at the **end of time period 27** and has been **delayed half a time period**.
- Note that the **critical path** has **changed**. Because of the duration of the **changed work**, a **path** that previously **had float** is **now** the **critical path** and **caused** the **delay** that was measured.



STEP 2: Quantifying delays using Gantt Chart schedule

This section demonstrated how one can update a Gantt chart and determine delays contemporaneously while the project progresses and also identify changes in the critical path.

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

CMAA Authorized Trainer

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا

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**.

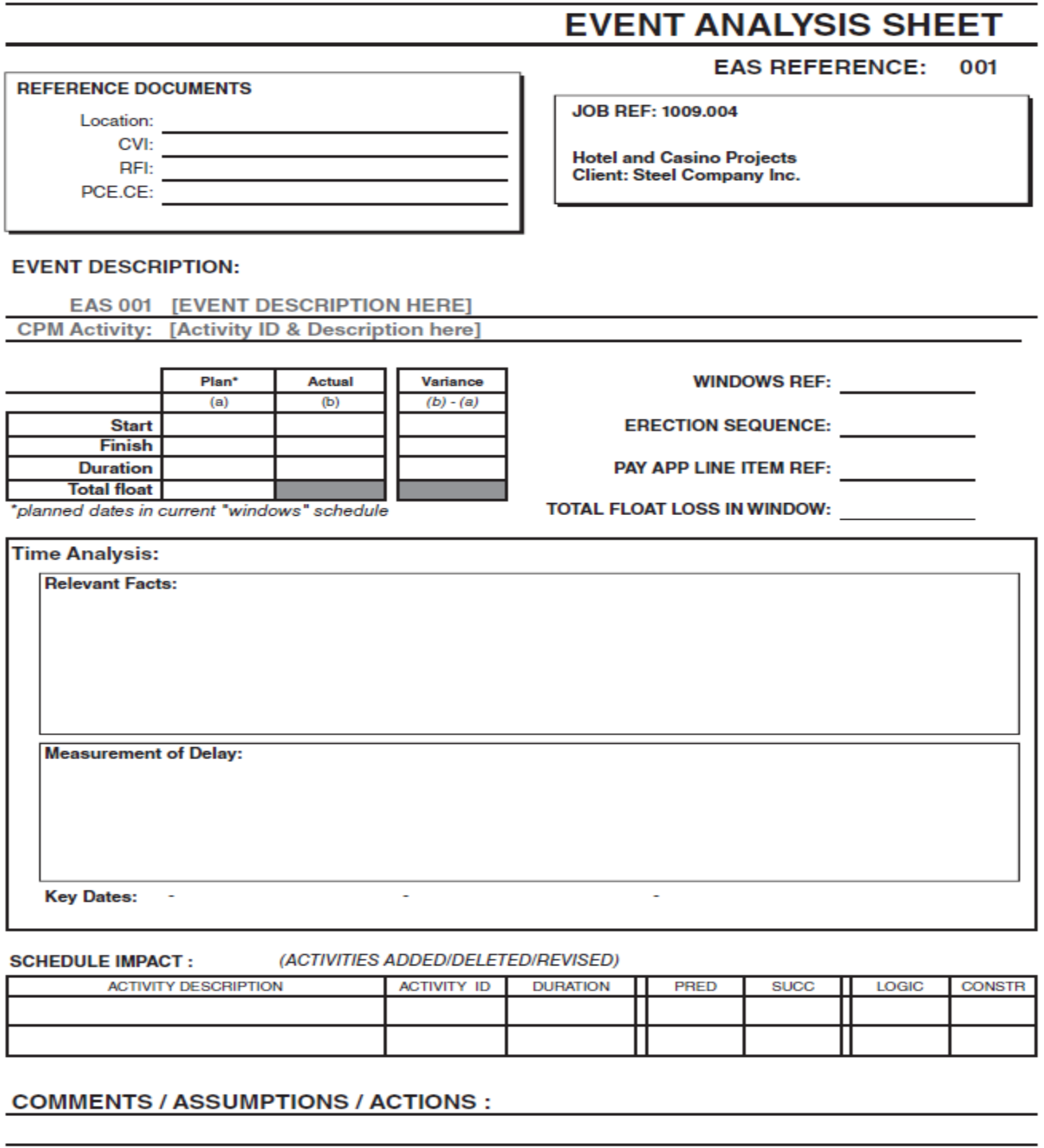
***For simplicity purposes**, **most of the examples** used in this course will **refer to zero float critical paths**.*

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
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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**

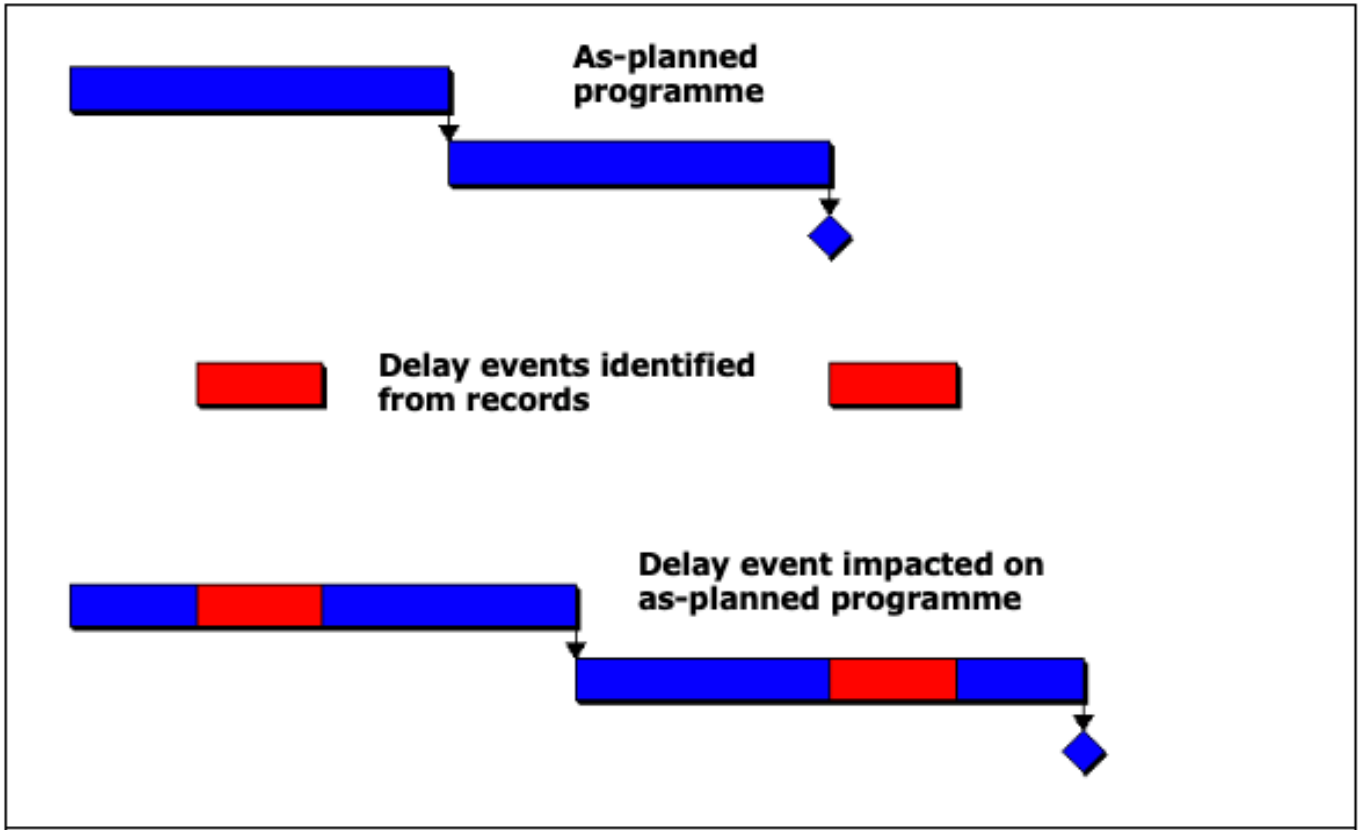
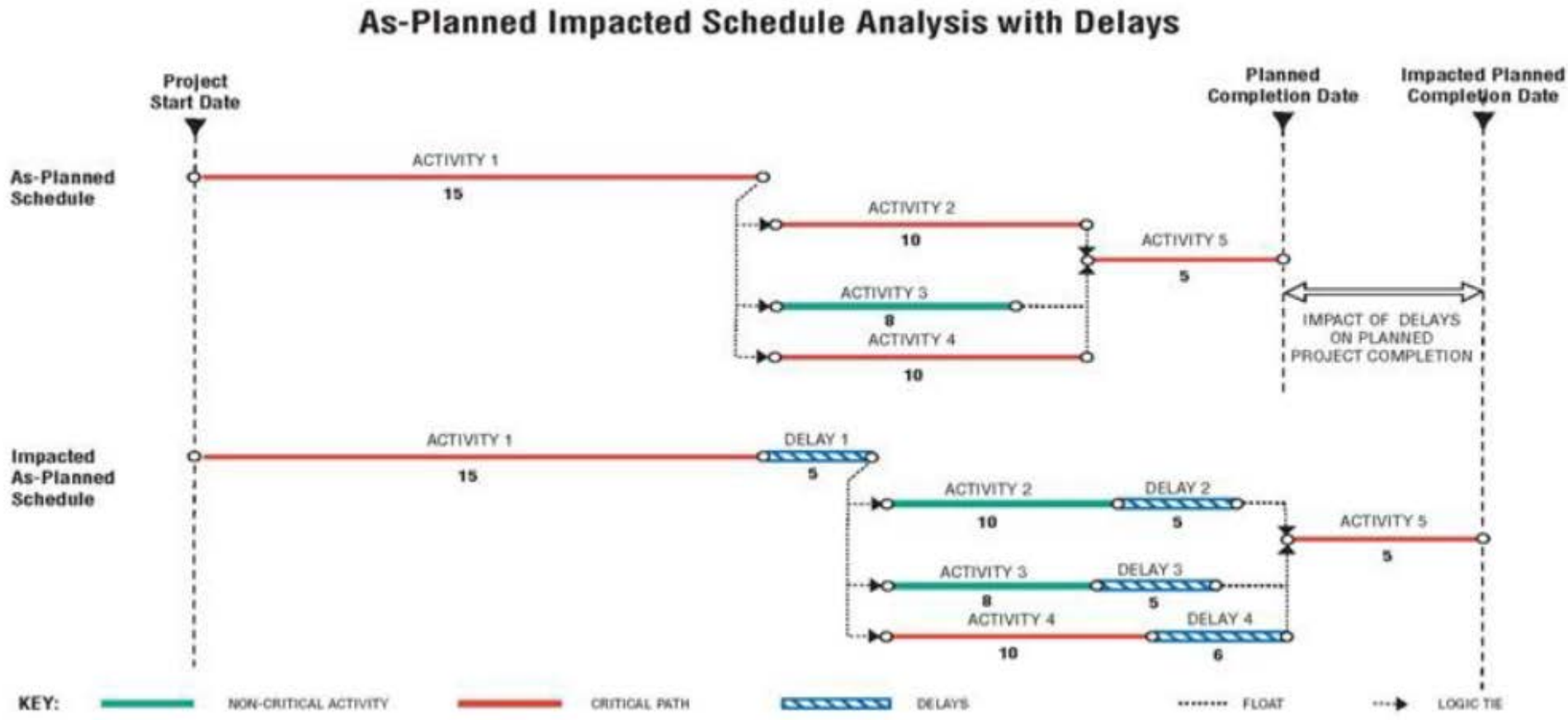


Diagram illustrating the Impacted As-Planned technique.

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)

موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

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