



Schedule Management & Delay Analysis

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Presenters

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- How to Analyze a Delay Claim
- Baseline Schedule
- Schedule Updates & Reviews
- Case Study covering:
 - Right to Finish Early
 - Constructive Acceleration
 - Float Ownership

Delay Analysis

Bruce Stephan



- Most construction disputes involve delay
- Each *critical* delay event should be analyzed
- Proving **cause and effect** is essential
- A convincing presentation is required

- Generally involves “gray” area
- Usually involves elements difficult to prove
 - Suspended/Disruption of activities
 - Out-of-sequence performance of work
 - Acceleration — directed or constructive
 - Productivity losses
 - Compensable extended duration of project

CONTRACT DELAYS

CONTRACTOR DELAYS	OWNER DELAYS	THIRD PARTY DELAYS (GR 8.10)
Lack of proper resources	Differing Site Conditions	Acts of God
Lack of proper planning	Design Changes	Weather
Underestimation of duration	Suspension	Labor Strikes
Material delivery delays	Other Prime Contractor delays	Utilities
Subcontractor delays	Late site access	Acts of the Government
Failure to follow schedule	Later permits	Acts of the State
		Acts of others beyond parties' control

**** Note that the Owner may be due a credit for overhead or other time-related costs when an event occurs which shortens the Contract Time.**

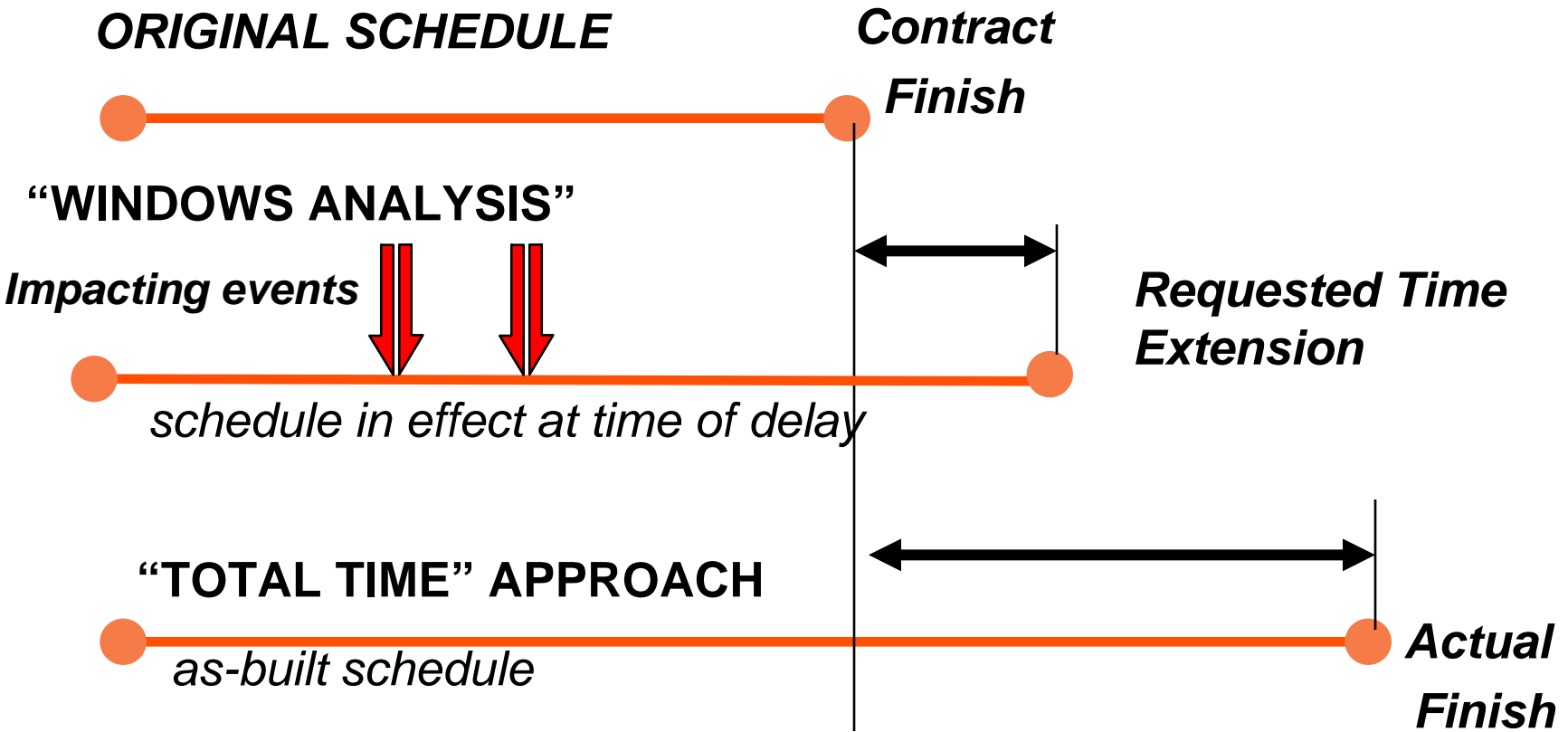
Delay Claims

Type Of Delay	Cause Of Delay	Time Extension	Kor Delay Costs	Owner Delay Costs
INEXCUSABLE DELAYS	Due solely to contractor	No	No	Yes
EXCUSABLE DELAYS	Outside control of Contractor	See below		
Non-compensable	Concurrent delays, 3d Party & Force Majeure	Yes	No	No
Compensable	Due solely to Owner	Yes	Yes	No

- Total Time approach
- But-For approach (Collapsed As-Built)
- Impacted As-Planned
- Should-Have-Been approach (Acceleration)
- Window Analysis



Requests For Time



Windows Method - Recognized Standard For Delay Analysis

*The impact of each change, or delay, on the previously charted sequences must be fitted into the network. . . . Activities that were not critical prior to the new event may be rendered critical; and conversely, formerly critical activities may develop float. **Whether the change or delay affects the critical path must be determined on the basis of conditions existing immediately prior to its occurrence. Norair Engineering Corp., ENG BCA Nos. 3804, et al., 90-1 BCA P 22,327 at p. 112,205***

1. Research Delay
2. Determine start date for delay & select schedule
3. Verify schedule update and modify as needed
4. Add delay activities to show impact to schedule
5. Determine successor and tie in to new activity
6. Calculate and measure impact to project completion
7. Concurrent Delay Analysis
8. Verify dates against as-built & analyze mitigation
9. Consider other options

1. Research Delay

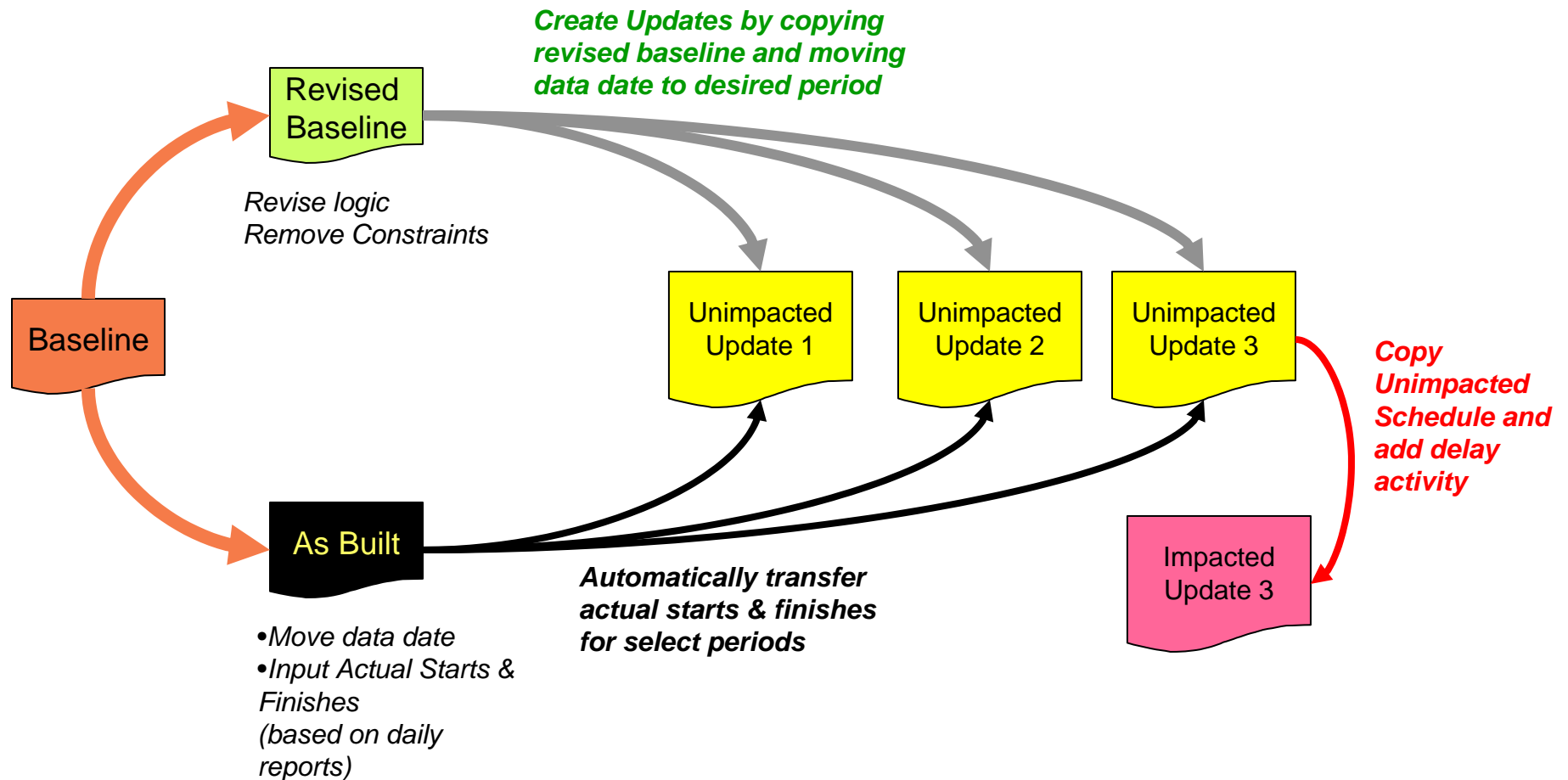
- Read Contractor's Claim
- Compare Baseline to As-Built Schedule
- Talk to Field Personnel, Designer, Owner, Contractor
- Analyze schedule reports to determine timing of delay
- Review field reports, correspondence, meeting minutes
- Using the information gained:
 - Determine start and end dates of delay or extra work
 - Determine affected activities
- Create a chart summarizing your findings

2. Determine Schedule to Use

Determining proper schedule to use for analysis

- Use schedule in effect at start of delay
- Determining delay “Start” is subject to negotiation
- “Consumed” float automatically accounted for
- Time Extension measured from “current” delay
 - Presumes any delay to that was caused by other party
- May have to create schedule if not updated

2. Methodology for Creating Schedule Updates (if needed)



3. Verification of Schedule Update

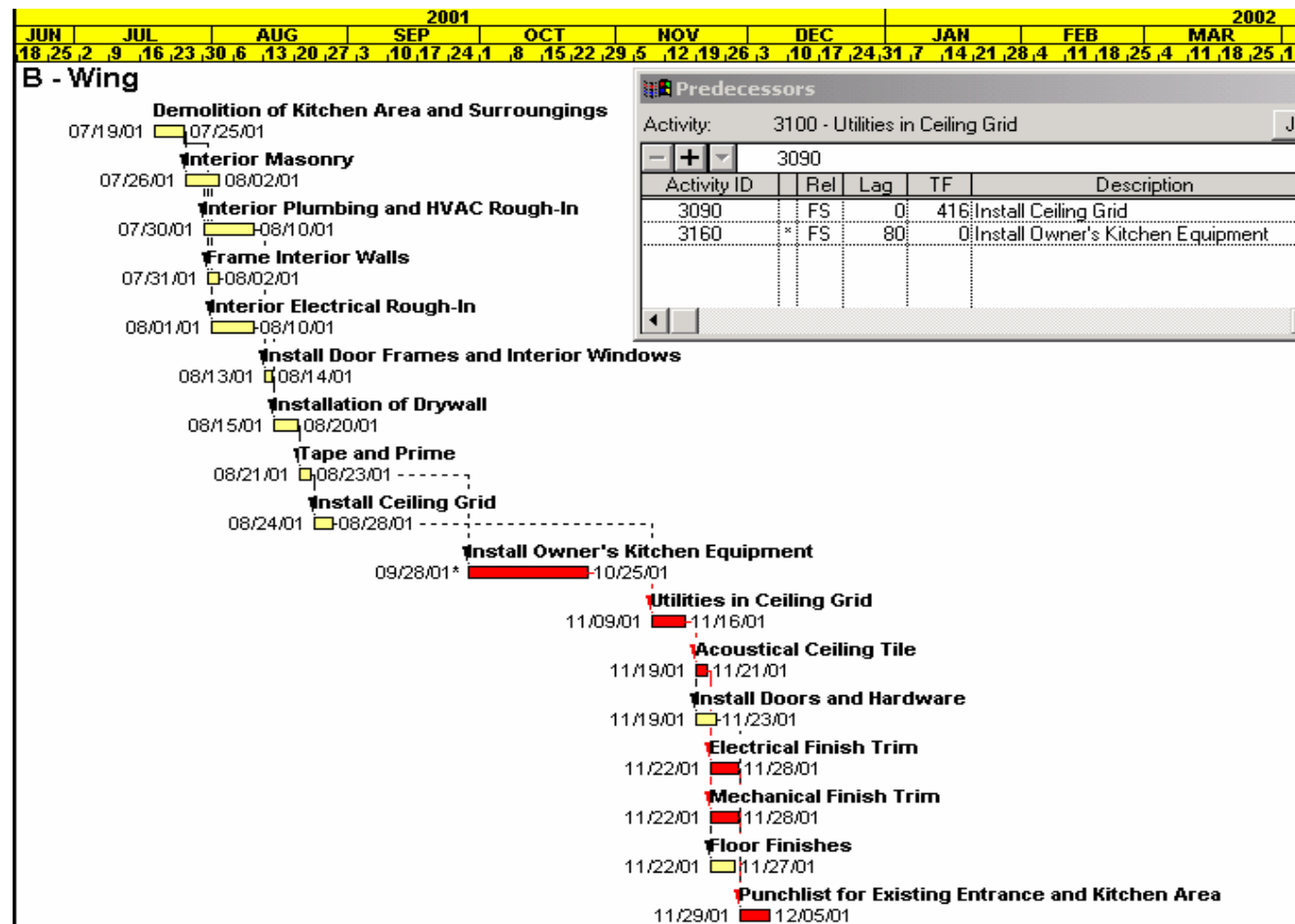
- Schedule updates may need to be revised if:
 - Does not reflect how work was planned
 - Baseline logic improperly revised
 - Constraints affect schedule calculation
 - Actual starts and finishes are incorrect
 - Prior impacts analyzed in earlier period
 - Adjust Milestones to reflect prior time adjustments
 - Include subnets for all delays previously analyzed
- How to determine if revision needed
 - Compare baseline and latest schedule update
 - Check impacted result against as-built
 - Talk to field personnel familiar with work

3. Sample Schedule Needing Revision

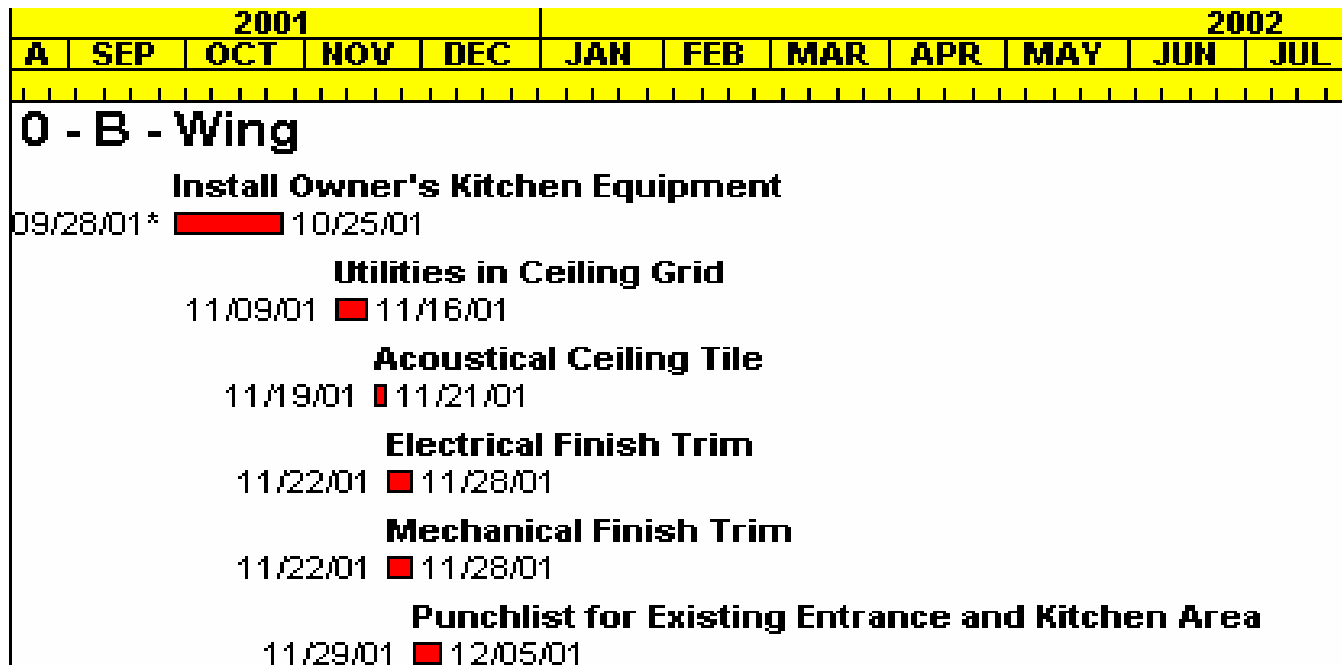
The longest path goes through kitchen work. This path was driven by a constrained start and a 10-day lag

The schedule did not contain a contractually-required logic tie showing the B Wing work done by the end of summer recess. However, if the tie were made the schedule would have incorrectly shown a very late finish

In the original schedule, all the B-Wing activities were lumped together. However, only the work east of the corridor had to be done by the end of Summer Recess



3. Sample Schedule Needing Revision



The longest path goes through kitchen work. This path was driven by a constrained start and a 10-day lag

3. Thoroughly Document Revisions



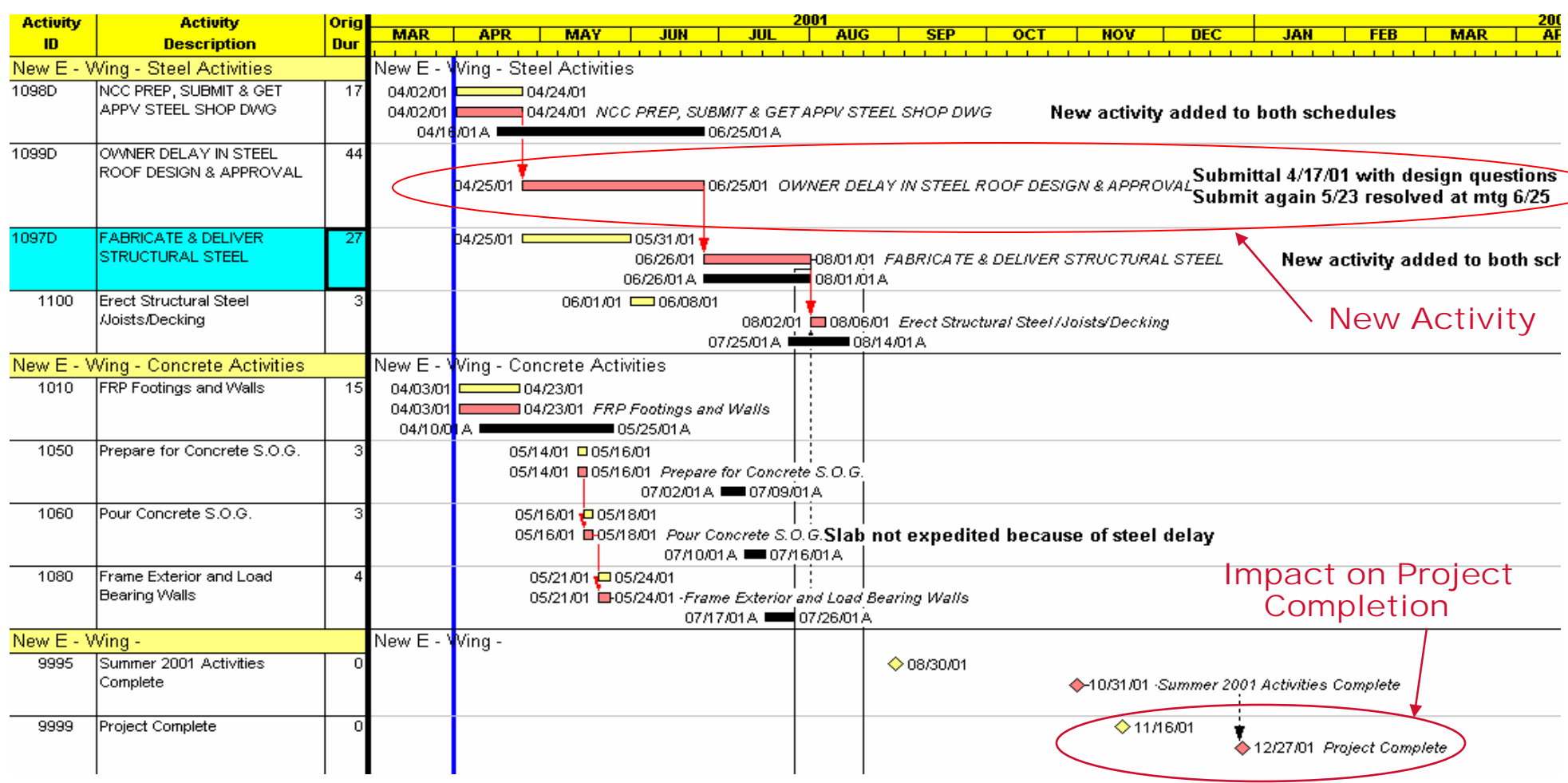
This program is registered for sole use to: Name: Bruce Stephan #501823 Page 6 of 11
 Company: PMA Consultants LLC
 Target Name: MH02
 Revised Name: 0706 5/22/2003 11:10:47PM
 Report Title: Changes Made to July 6th Schedule Update

26. These relationships have been added by the update.

<u>PREC</u>	<u>DESCRIPTION</u>	<u>LINK</u>	<u>LAG</u>
0000	Project Start		
1000	Excavate	SS	0
1000	Excavate		
1030	Install Underdrain System	FS	0
1010	FRP Footings and Walks		
1050	Prepare for Concrete S.O.G.	FS	0
1071	DEMO CONCRETE		
1050	Prepare for Concrete S.O.G.	FS	0
1040	Install Underground Plumbing		
1060	Pour Concrete S.O.G.	FS	0
1010	FRP Footings and Walks		
1071	DEMO CONCRETE	SS	5
1070	Repour East Wall		
1080	Frame Exterior and Load Bearing Walls	FS	0
1090	Exterior Sheathing		
1210	Installation of EIFS	FS	0
1190	Install RTUs		
1250	Utilities in Ceiling Grid	FS	0
1180	Install Door Frames		
1280	Doors and Hardware	FS	0
1210	Installation of EIFS		
1330	Punchlist East Wing	FS	0
1280	Doors and Hardware		

A report of all changes is included as Attachment A

4/5. Add Delay Activities & Tie In



Steel Supplier submitted its steel shop drawings on 4/17, and expected approval 4/24. Design changes and a lack of dimensions delayed approval until 6/25. This caused a **41-day slippage** to Project Completion (11/16/01- 12/27/01)

6. Measure Impact to Substantial Completion



LEGEND: Yellow bars = Un-impacted schedule
 Pink bars = Impacted schedule
 Black bars = As-built schedule

Activity ID	Activity Description	Orig Dur	Total Float	Unimpact Finish	Impacted Finish	Var Fin	2000												2001													
							M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O								
second floor																																
1580	roughing in walls at 2nd floor	15	41	08/21/00	08/21/00	0	06/30/00A	08/21/00	roughing in walls at 2nd floor																							
1410	close sheetrock walls at 2nd floor	15	-73	08/21/00	08/21/00	0	06/30/00A	08/21/00	close sheetrock walls at 2nd floor																							
2410	Water & Med Gas Rough - 2nd Fl	15	517	08/21/00	08/21/00	0	07/20/00A	08/21/00	Water & Med Gas Rough - 2nd Fl																							
D1410	EXTENDED TIME TO CLOSE SHEETROCK WALLS 2nd FL	63	-73		11/17/00	0	07/20/00A	11/17/00	EXTENDED TIME TO CLOSE SHEETROCK WALLS 2nd FL																							
1400	1st coat of taping at 2nd floor	3	-73	08/24/00	11/22/00	-63	08/22/00	11/22/00	1st coat of taping at 2nd floor																							
3rd floor																																
1400	roughing in walls at 3rd floor	15	-94	08/21/00	08/21/00	0	07/19/00A	08/21/00	roughing in walls at 3rd floor																							
1400	Water & Med Gas Rough - 3rd Fl	15	-109	08/22/00	08/22/00	0	07/19/00A	08/22/00	Water & Med Gas Rough - 3rd Fl																							
1480	close sheetrock 3rd floor	15	-109	09/13/00	09/13/00	0	08/02/00	09/13/00	close sheetrock 3rd floor																							
D1480	EXTENDED TIME TO CLOSE SHEETROCK WALLS 3rd FL	88	-109		01/18/01	0	08/23/00	01/18/01	EXTENDED TIME TO CLOSE SHEETROCK WALLS 3rd FL																							
1490	1st coat taping 3rd floor	3	-109	09/18/00	01/23/01	-88	09/19/00A	01/23/01	1st coat taping 3rd floor																							
2890	Test and Inspect Elevator	3	-109	01/08/01	05/07/01	-85	09/14/00	01/08/01	Test and Inspect Elevator																							
1700	Punch List, Inspections Complete	0	-109	01/08/01	05/07/01	-85	10/26/00A	05/07/01	Punch List, Inspections Complete																							

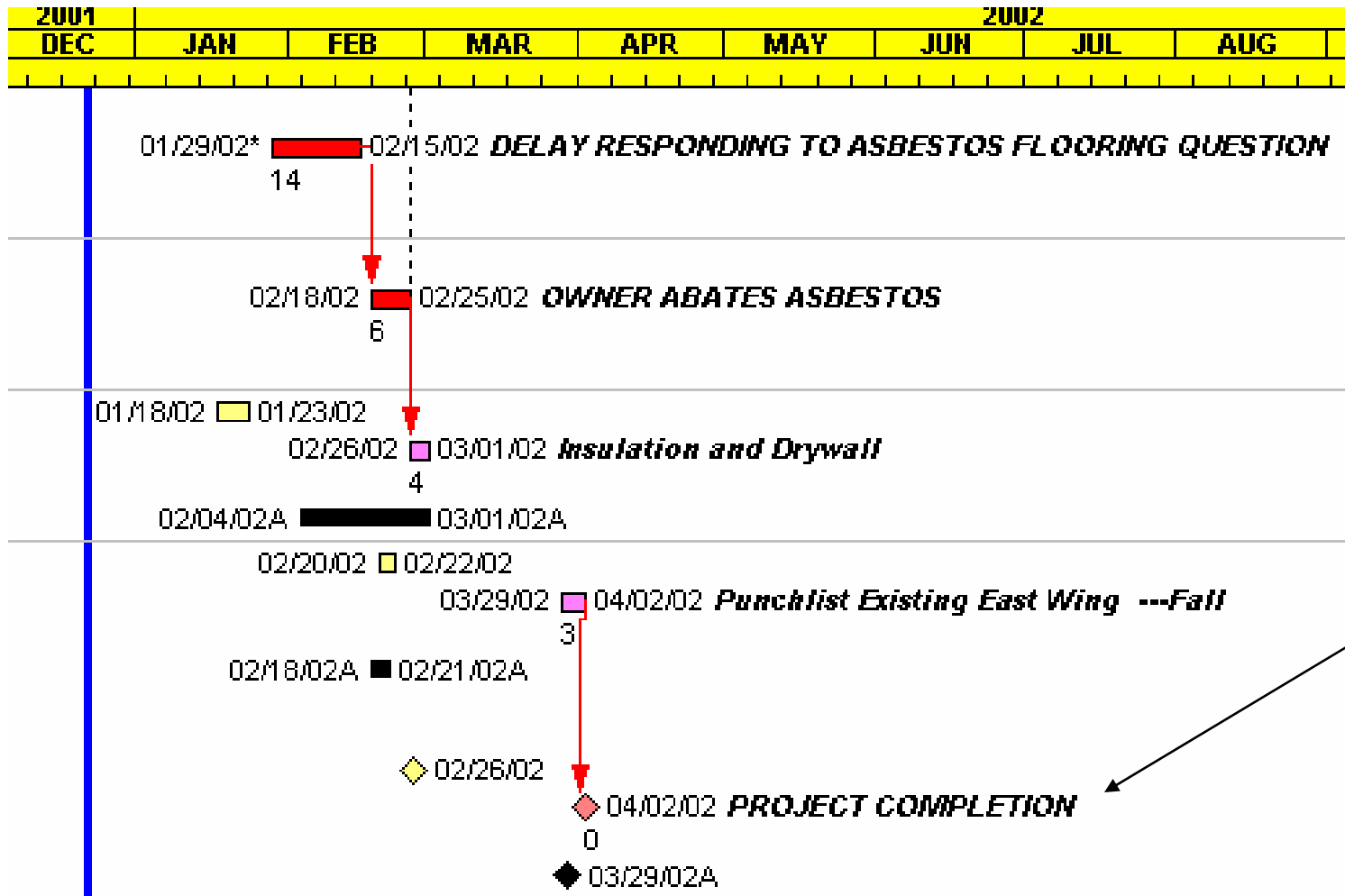
The delay activity is shown in CAPS

Impact on Project Completion

7. Concurrent Delay Analysis

- Repeat the analysis for other sides delays
 - Limit to critical delays
- Hard to determine if one delay “tracking” to other
- Does not have to be during same time period

6. Verify As Built/ Mitigation



Calculated time is later than actual Completion date

8. Consider Alternatives To Extending Time



- No cost logic changes (preferential logic)
- Low cost mitigation (2nd crew, equipment, etc.)
- Acceleration (overtime, etc.)
- Re-define Interim Milestone (defer scope)
- Transfer scope to follow-on Contractor

Obviously, these are only useful if work is ongoing

CHANGE ORDER/CLAIM ENTITLEMENT GRADIENT



CLEAR
ENTITLEMENT

DEBATABLE ENTITLEMENT

NO
ENTITLEMENT

Negotiation Strategies

- Inform client/management of 3 possible dollar amounts
 - Starting Position (white only)
 - Realistic settlement offer (middle of grey)
 - Final offer (all gray and white- no black)
- Get Independent evaluation of position
- Be prepared to give something away

- Run comparisons and challenge client
- Use Windows Analysis
- Schedule Update just prior to delay
- Show Causation
- Consider Concurrency
- Compare results to As-Built
- Consider Alternatives to extending time

Baseline & Schedule Updates

Ellen Thomsen

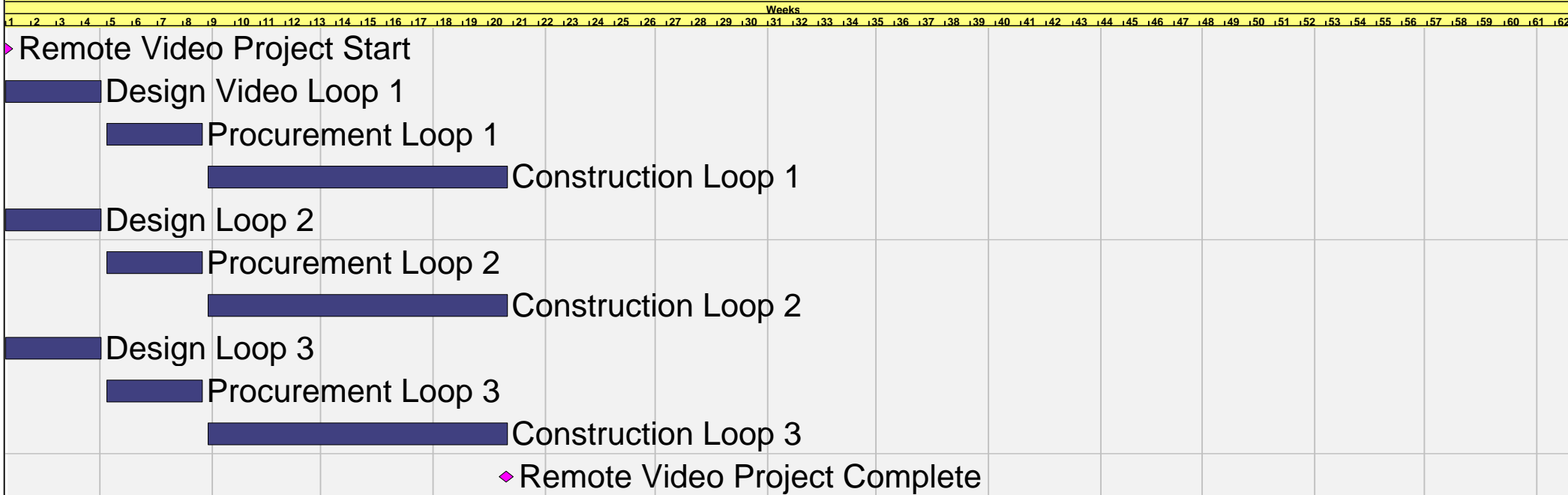


- Contract requirement
- Logical methodology for project planning and coordination
- Manage project
- Plan acceleration or mitigate delays
- Determine time extensions
- Establish entitlement to delay claims

Critical Path Method

“An analysis technique that calculates a single early and late start and finish date for each activity based on sequential, network logic and a single duration estimate.”

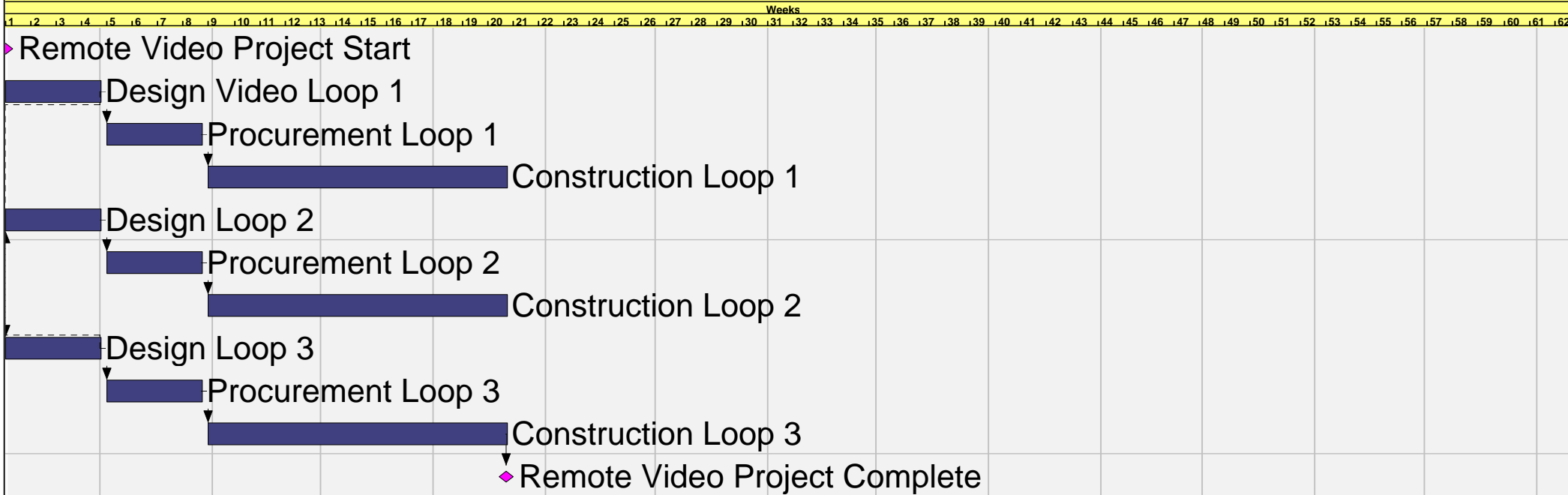
Reasons for CPM Scheduling



Bar Charts Do Not

- Show interrelationships / dependencies

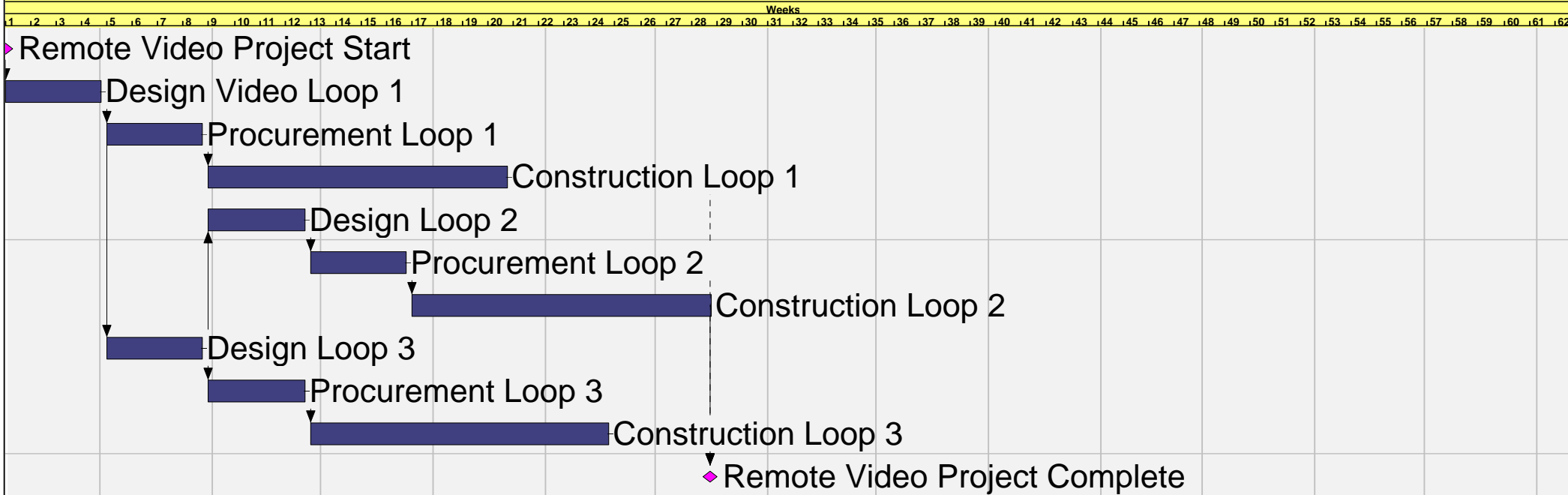
Reasons for CPM Scheduling



Bar Charts Do Not

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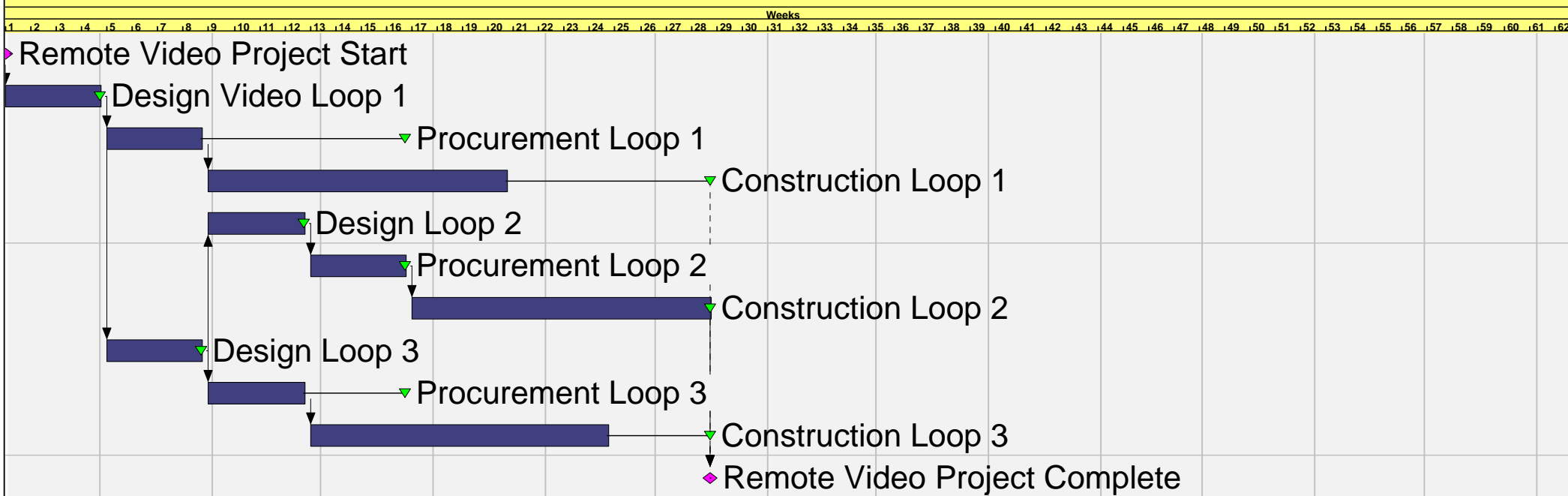
Reasons for CPM Scheduling



Bar Charts Do Not

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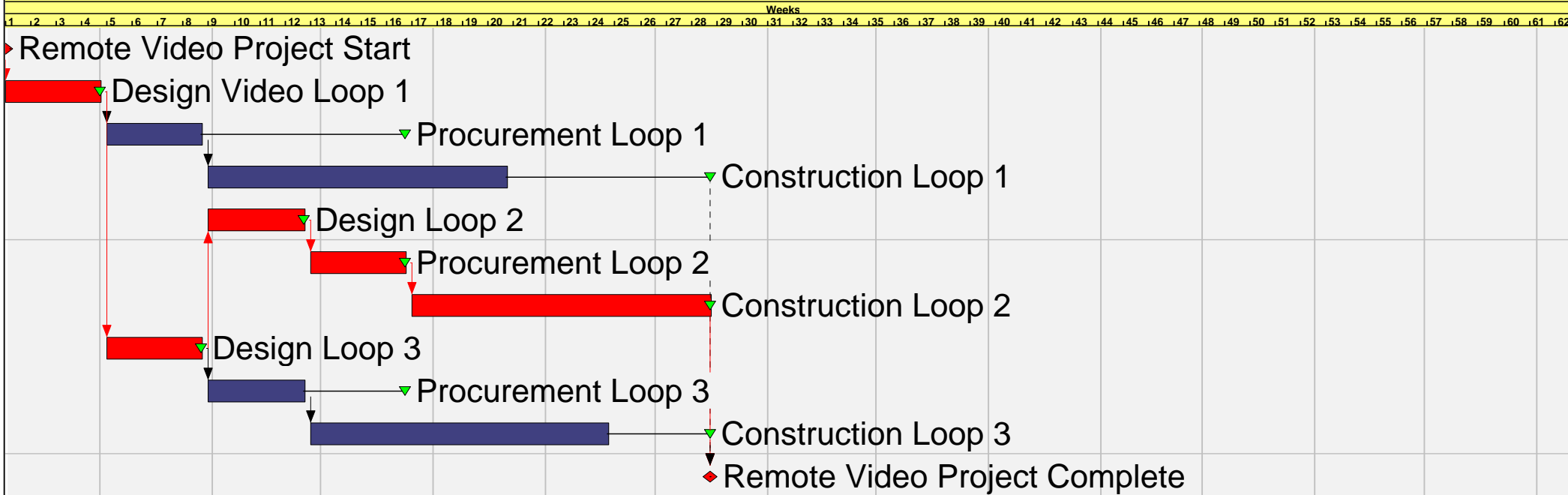
Reasons for CPM Scheduling



Bar Charts Do Not

- Show float / contingent time

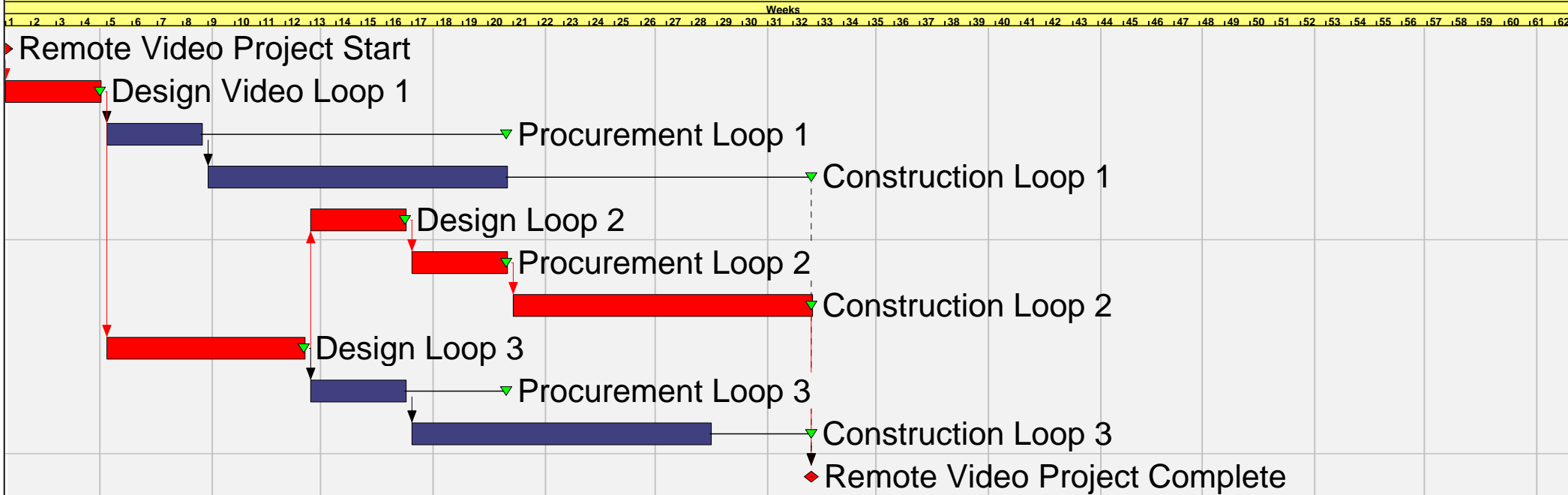
Reasons for CPM Scheduling



Bar Charts Do Not

- Identify critical tasks

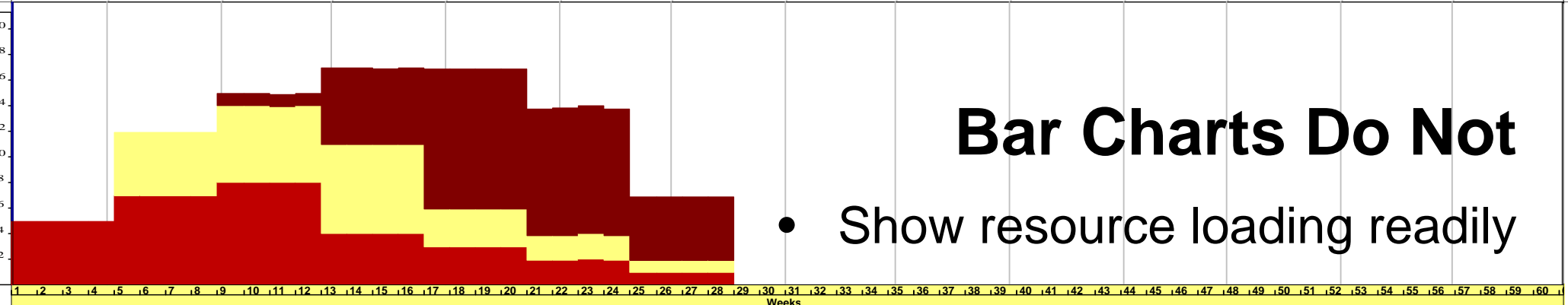
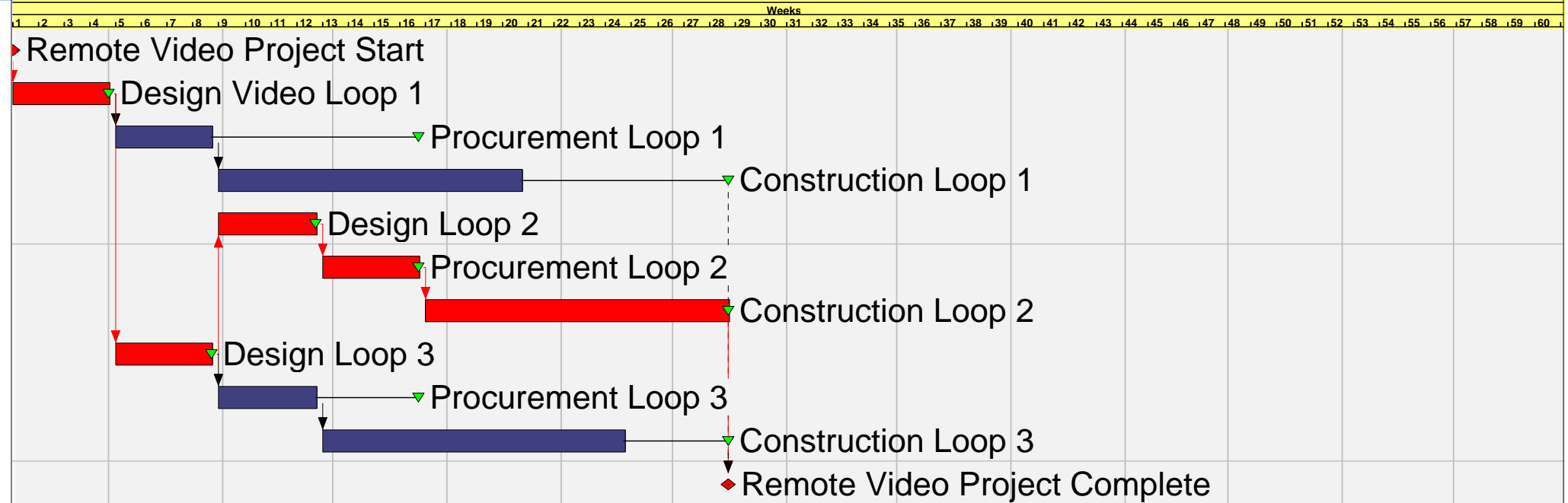
Reasons for CPM Scheduling



Bar Charts Do Not

- Demonstrate the impact of changes

Reasons for CPM Scheduling



Bar Charts Do Not

- Show resource loading readily

Run Date: 24APR04

PMID

Sheet 1 of 1

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Classic Schedule Layout

Resource/Cost Profile Legend

- e
- p
- c

Average early usage per Week (Current Estimate)
Detail scale (left):

Legend:

- Early Bar
- Float Bar
- Progress Bar
- Critical Activity

Getting Started

Project Schedule

Shall be sufficiently detailed to accurately depict all the Work and shall graphically represent the logical sequence and duration of activities. The information provided shall also include the interdependencies between the Contractor's Activities and all other Activities required for the successful completion of the Contract.

Creating a Baseline

- Scope of Work
- Select level of detail

Creating a Baseline

- Scope of Work
- Select level of detail
- List activities
 - Submittal packages
 - Deliverables
 - Milestone Dates
 - Owner Interfaces
 - Design Reviews
 - Start-Up and Testing

Creating a Baseline

- Scope of Work
- Select level of detail
- List activities
- Draw logic diagrams
 - Templates

Creating a Baseline

- Scope of Work
- Select level of detail
- List activities
- Draw logic diagrams
- Estimate durations
 - (assumed resources)
 - Contingency
- Calculate Event Dates

Creating a Baseline

- Scope of Work
- Select level of detail
- List activities
- Draw logic diagrams
- Estimate durations
- Calculate Event Dates
- Identify Interfaces

Creating a Baseline

- Identify Interfaces
 - Owner to Contractor
 - Contractor to Owner
 - Contractor to Vendor
 - Contractor to Regulatory Authorities

Key Information to Include in Baseline

- Permits
- Owner Furnished Equipment or Material
- Design Submittals and Approvals
- Constructability Concerns
- Subcontractor Schedules
- Activity Coding
- Payment Milestones

Schedule Review

INITIAL SCHEDULE REVIEW

Insist on timely submittals

- Preliminary Progress Schedule
- Baseline Schedule

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Should not accept baseline schedule if there are problems

- Sufficient detail
- No payment to Contractor if Progress Schedule not accepted

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- Preliminary Progress Schedule
- Baseline Schedule

Should not accept baseline schedule if there are problems

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Review

- All Submissions
- Allow reasonable time for review

Owner Acceptance/Approval

- Do not approve with comments
 - question logic
 - question durations
 - question resources
- Responsibility remains with Contractor

The Life of the Project

- No changes to the baseline
 - No additions
 - No Deletions
 - No Activity re-numbering
-

The Life of the Project

- No changes to the baseline
 - No additions
 - No Deletions
 - No Activity re-numbering
- Regular Status Updates
 - Supported by management
 - Supported by back-up
 - Supported by field personnel

Common Scheduling Deficiencies

- Open-ended activities
- Improper logic ties
- Unrealistic durations
- Constraints
- Omitted activities
- Front end loading
- Zero float schedules

Bad Scheduling Practices

- Schedule update logic revisions
- Changing activity ID's
 - Deleting and adding blocks of activities
- Status updates that don't match submittals and daily reports
- Late schedule update submissions
- Schedule updates that are not reviewed and accepted by the Owner
- Failure to incorporate Owner's comments

Case Study

Pradip Mehta

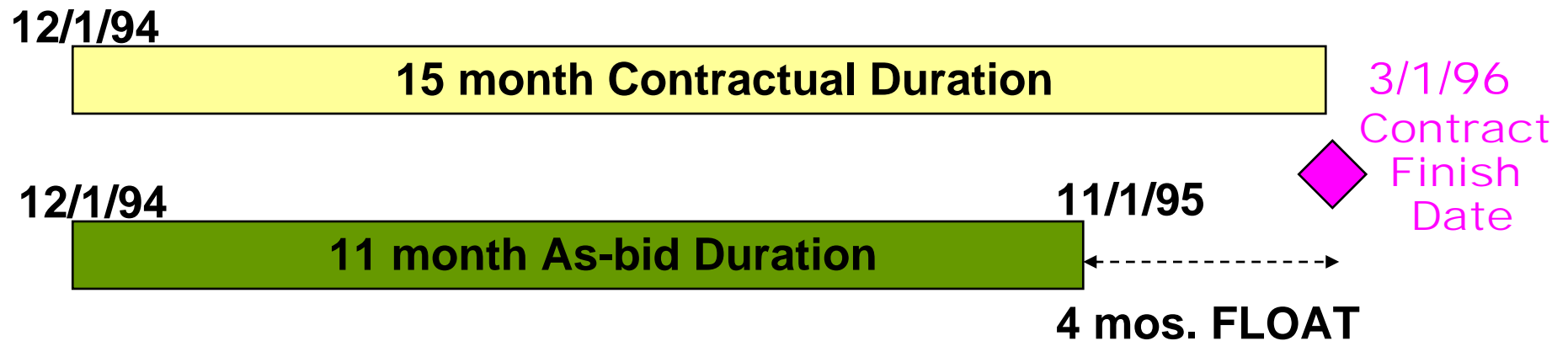


Recognition of Contractor's Right to Finish Early

- Case law increasingly makes it clear that federal courts, administrative boards and state courts recognize contractor's right to finish early
- The typical right to finish early involves a situation in which contractor's schedule at the beginning of the project shows completion before the contractually specified completion date
- The early completion schedule should be based on the reasonable plan for performance approved by the owner

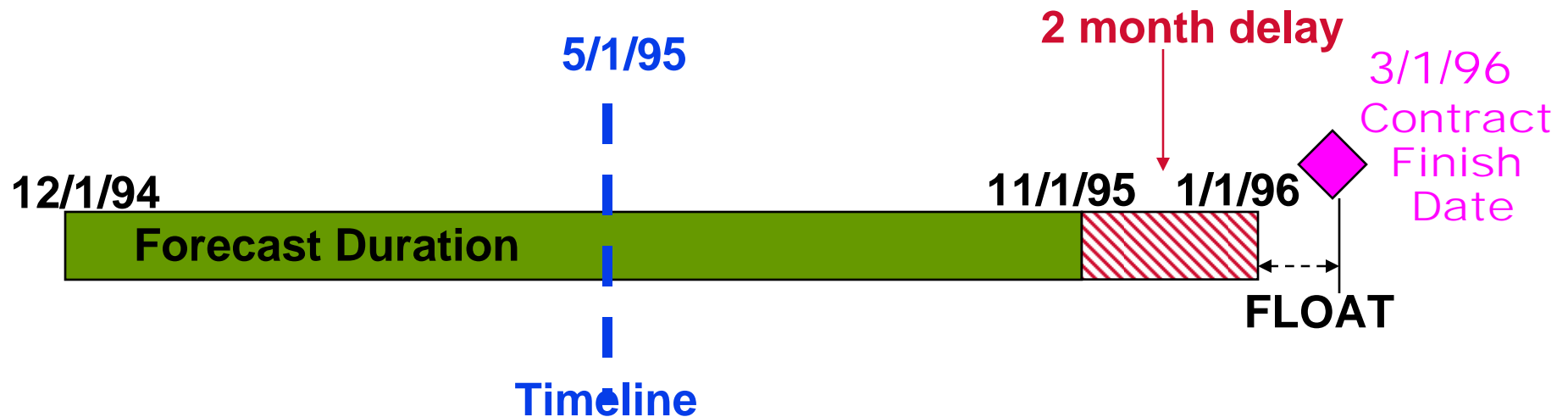
Case Study

- Remediation project involving excavation, solidification, and disposal of contaminated soil
- Original contract duration was 15 months
- As-Bid duration was 11 months



Contractor's Right To Finish Early

On 5/1/95, the contractor notified the owner that due to an increase in the quantity of the contaminated soil, the contractor's early completion schedule was delayed by two months.



Contractor submitted a request for change order for the following items:

1. For increased quantity at a contract unit price
2. Extra cost associated with the two-month time extension to the early completion, including the following:
 - a) Trailer rental/ utilities
 - b) Resident Engineering staff at the site @ field multiplier
 - c) Home office staff (project control, etc.) at an office multiplier

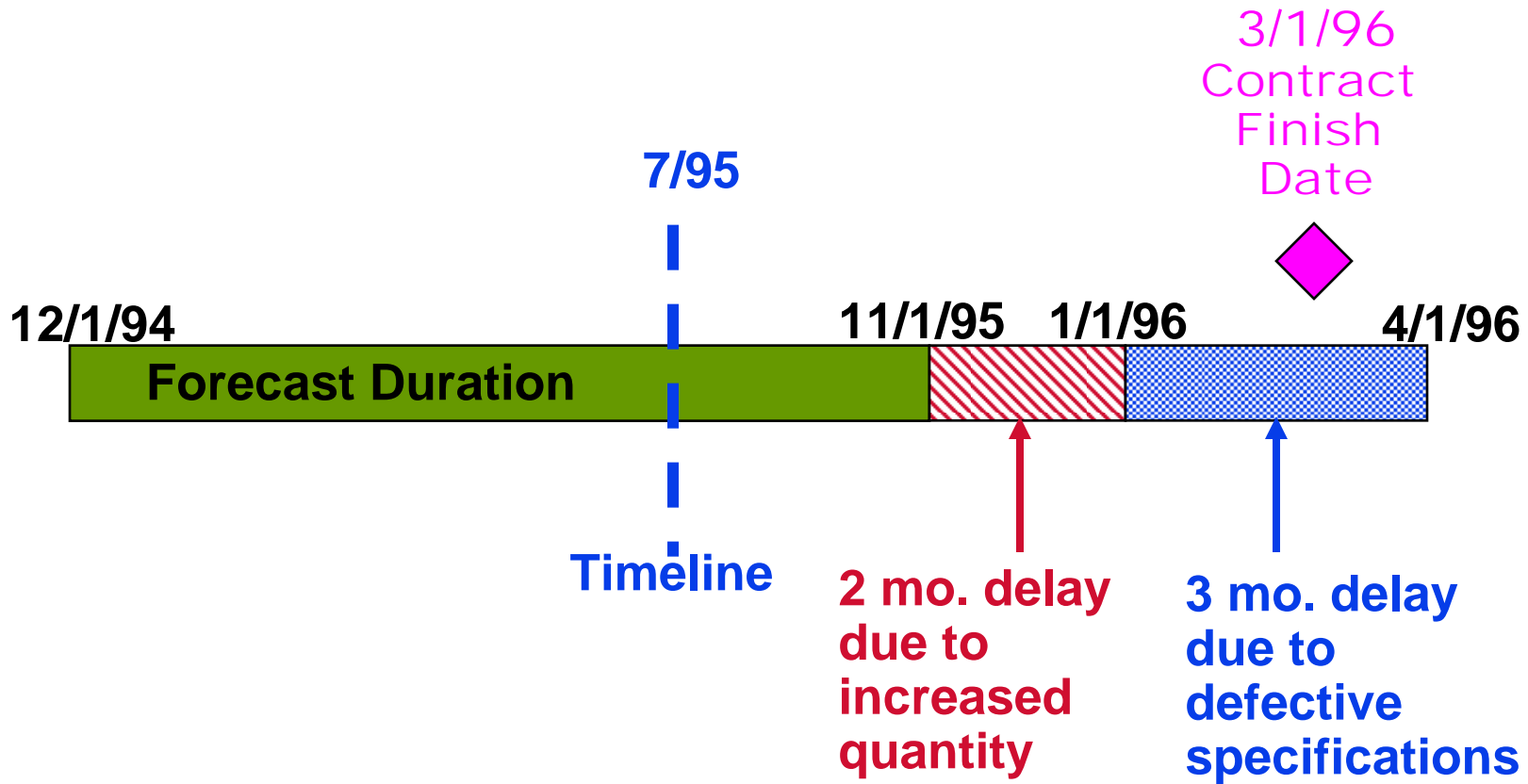
- Owner approved CO #1 for increased quantity but denied CO#2 for delay-related costs, arguing that the projected completion was within the contractual completion date
- The Contractor cited the contractor's right to finish early (Green Builders* case), which allowed recovery of these kinds of damages if:
 - Contractor indicated intent to finish early during bidding process
 - Owner approved the early completion schedule after the contractor has started the project
 - The delay was solely caused by the owner

* ASBCA No. 35,518,88-2 BCA ¶ 20, 734 (1988)

Additional Changes:

- On 6/2/95, the owner issued a stop work order due to leaking from containers that were lined in accordance with the contract specifications
- The leaking was caused by the interaction of the sludge and polyethylene at temperatures above 70 degrees F
- On 6/28/95 the stop order was released and the contractor was directed to modify the container lining to comply with a new specification
- In 7/95, the contractor submitted a three-month delay claim from the previous extension claim

Delay Summary



- The Owner rejected the claim on 9/95, citing a clause in the contract that the contractor was responsible for “maintenance of the containers”
- To avoid exposure to liquidated damages (one month after contract completion date) the contractor accelerated the schedule to meet the required date of 3/1/96
- On 12/1/95, Contractor claimed for lost productivity due to congestion on site due to the acceleration

- The project was completed on time 3/1/96
- On 4/96 a negotiated settlement was reached with the contractor. The owner agreed to pay as follows:
 - Two-month time extension due to increase in quantity
 - Two-month of delay damages due to defective specifications
 - Productivity losses due to constructive acceleration

More recent decisions hold that a contractor can recover even if it failed to notify the owner that it intended to finish early

The important inquiry is whether the government's actions prevented the contractor from early completion*

*Weaver-Bailey Contractors, Inc. v. The United States, 24 Cl. Ct. 576 (1991)

Early Completion Schedule

- Owner may consider to bring a level playing field in dealing with the Contractor's early completion delay claims by calling out in the specifications that an approved early completion schedule will move the contract date and liquidated damages to the earlier date
- Owner can refuse to approve the early completion schedule so long as the owner can establish that the submitted schedule does not reflect a reasonable plan for performance

- Float is an expiring resource available to all parties working on the project
- Float belongs to the party who gets to it first
- If the delay pushes the activity onto the critical path and the entire project is extended the party responsible for that delay will be held to have proximately caused delays to the project
- It is good practice to recognize that float exists for the benefit of all participants, and that judicious use of float creates a harmonious atmosphere. Allowing use of float by a distressed party will encourage completion of the work



Questions?