Assessing and Preventing Project Delays: A Prospective Approach

Presented by:

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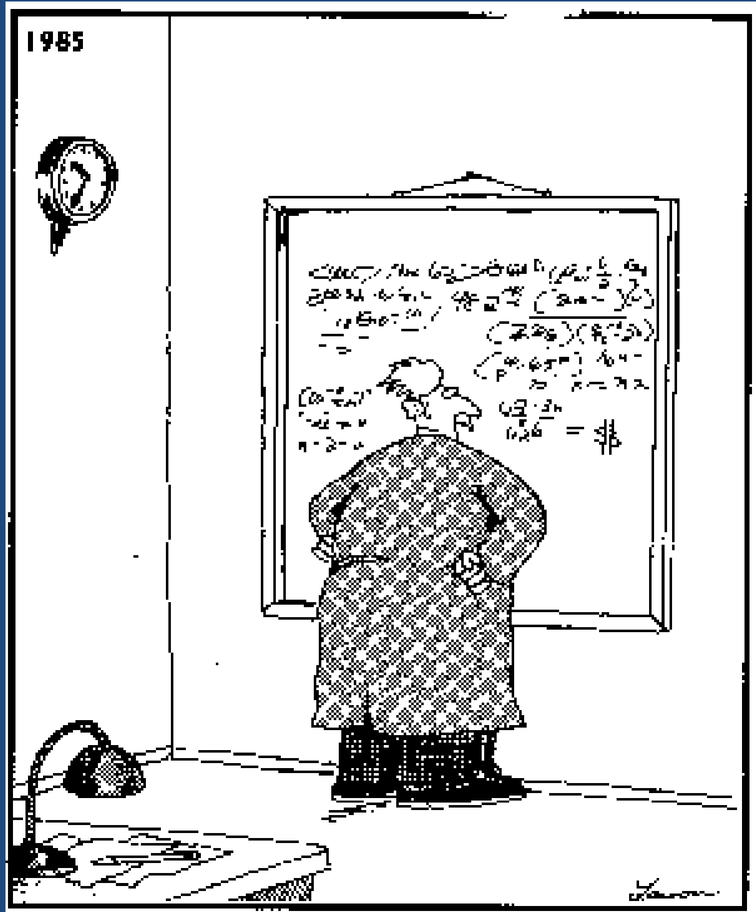
My Background

- Brian Furniss
- Director, *Trauner Consulting Services*
- Over 10 Yrs. Experience
- Experience: Scheduling, Analysis of Delays and Inefficiencies, Change Orders, Entitlement, Claims, Claims Avoidance, and Damages.
- Co-Author of *Construction Delays: Understanding Them Clearly, Analyzing Them Correctly – 2nd Ed.*
- Planning and Scheduling Professional, AACEI
- Assists contractors, owners, architects, and attorneys.
- Analyst, Scheduler, Author, Instructor, Dog Lover

Agenda

I. Preventing Delays Using Current Indicators
   A. Duration
   B. Longest Path
   C. Total Float
II. Reasons New Indicators are Needed
   A. Constraints
   B. Calendars
III. A Detailed Method for Prospectively Assessing and Preventing Delays
IV. Real-Life Example – Applying the Method

I. Preventing Delays Using Current Indicators



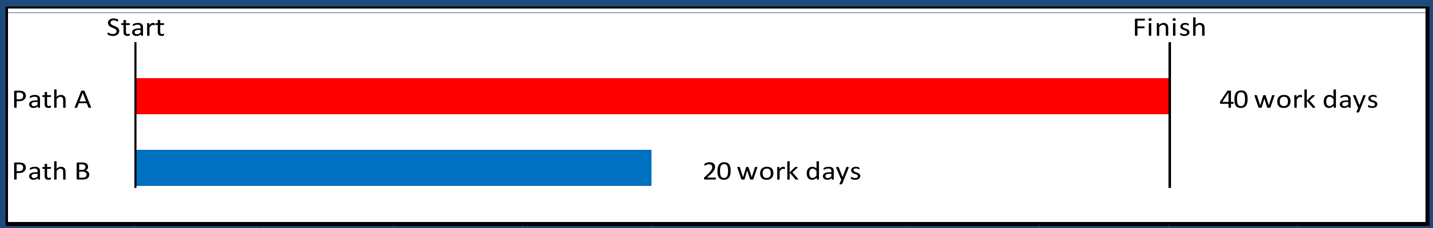
Einstein discovers that time is actually money.

Preventing Delays Using Current Indicators

- Why prevent delays?
- Ways to assess delays.
  - Retrospectively – what actually occurred.
    - Analysis of plan that *was* used to manage project.
  - Prospectively – what may occur.
    - Analysis of plan that *is being* used to manage project.
- Focus today will be on prospectively *preventing* delays and not on prospectively modeling changes or retrospectively analyzing delays.
- What is the critical path?
  - Can be measured through any project milestone.
  - Varying definitions.
  - Often incorrectly associated with total float.

Preventing Delays Using Current Indicators

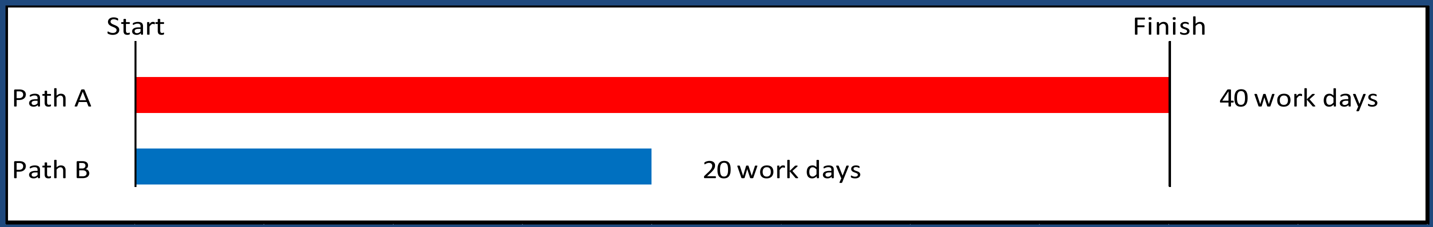
- What are the current indicators to identify what must be progressed to prevent delays?
  - Duration
    - Compares duration of paths of work.
    - Useful if all activities use the same calendar.
    - Easy to understand.



    - Path A controls the critical path.
    - Progress Path A to prevent delay – may have to progress Path B to prevent delays if update periods are greater than 20 work days.
    - If Path A makes 20 more days of progress than Path B, the critical path will shift to Path B.

Preventing Delays Using Current Indicators

- What are the current indicators to identify what must be progressed to prevent delays?
  - Longest Path
    - The measurement of the Longest Path is static, while the Longest Path, by nature, is dynamic.
    - Changes based on the progress, or lack of progress, to all activities in the schedule.
    - Often equated with the critical path.
    - Defined as the longest continuous chain of activities that controls the early finish date of the milestone.



    - May or may not accurately identify the activities that must be progressed in order to prevent delays.

Preventing Delays Using Current Indicators

- What are the current indicators to identify what must be progressed to prevent delays?
  - Total Float (Float)
    - Uses forward and backward passes to calculate early dates and late dates.
    - Total Float = Late Date – Early Date
    - Often defined as the amount of time an activity can be delayed, in work days, before it will delay the critical path of the project.
    - Has been used through the evolution of CPM scheduling – AOA, AON, PDM.
    - As with duration, by concept, it is easy to understand.
    - What does it mean if the float value is negative, zero, or positive?
    - Often is incorrectly correlated with the critical path of the project.
    - Reason: Float can easily be manipulated.

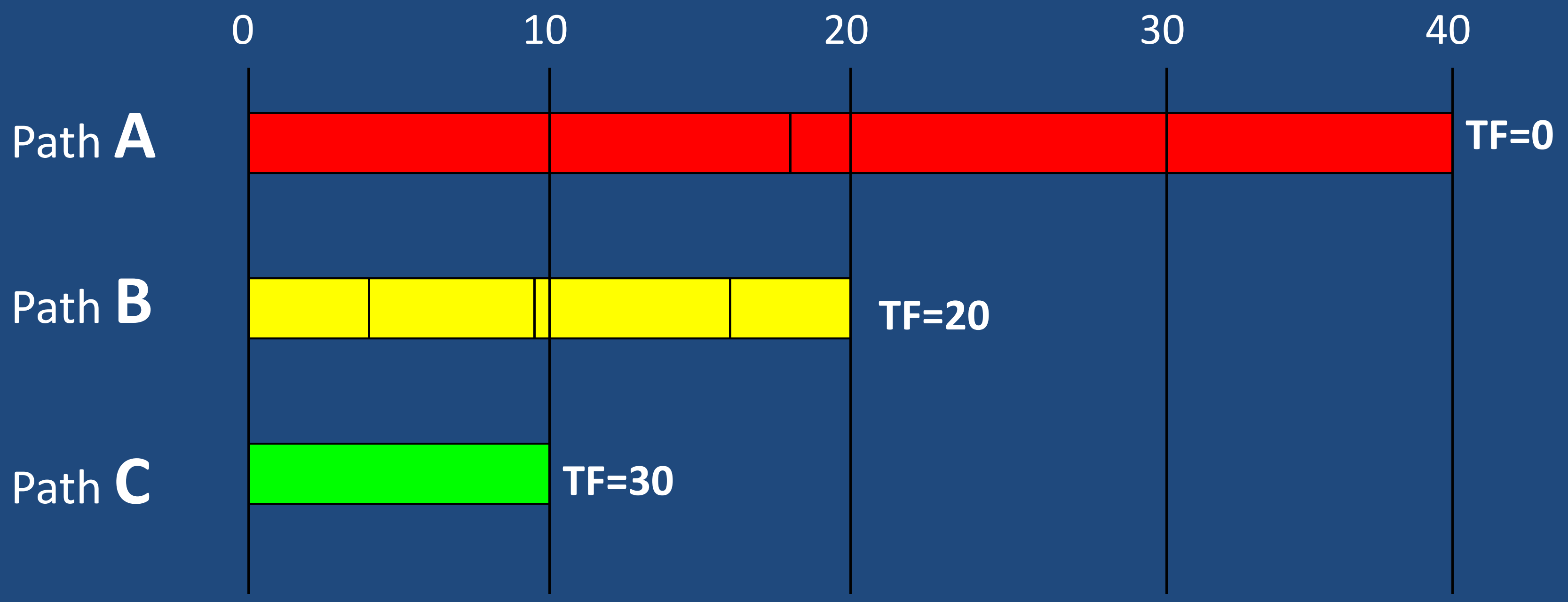
II. Reasons New Indicators are Needed

Reasons New Indicators are Needed

- Duration – impractical for most projects because its use is limited to single calendar projects.
- Longest Path – may not identify what must be progressed in order to prevent delays.
- Float
  - Constraints can change dates, and as a result, float values.
  - Multiple calendars may cause float values to vary along a path of work.
  - When both are combined, the float value may become useless as a project management tool to prevent delays.
  - Examples with Constraints and Multiple Calendars.

Constraints

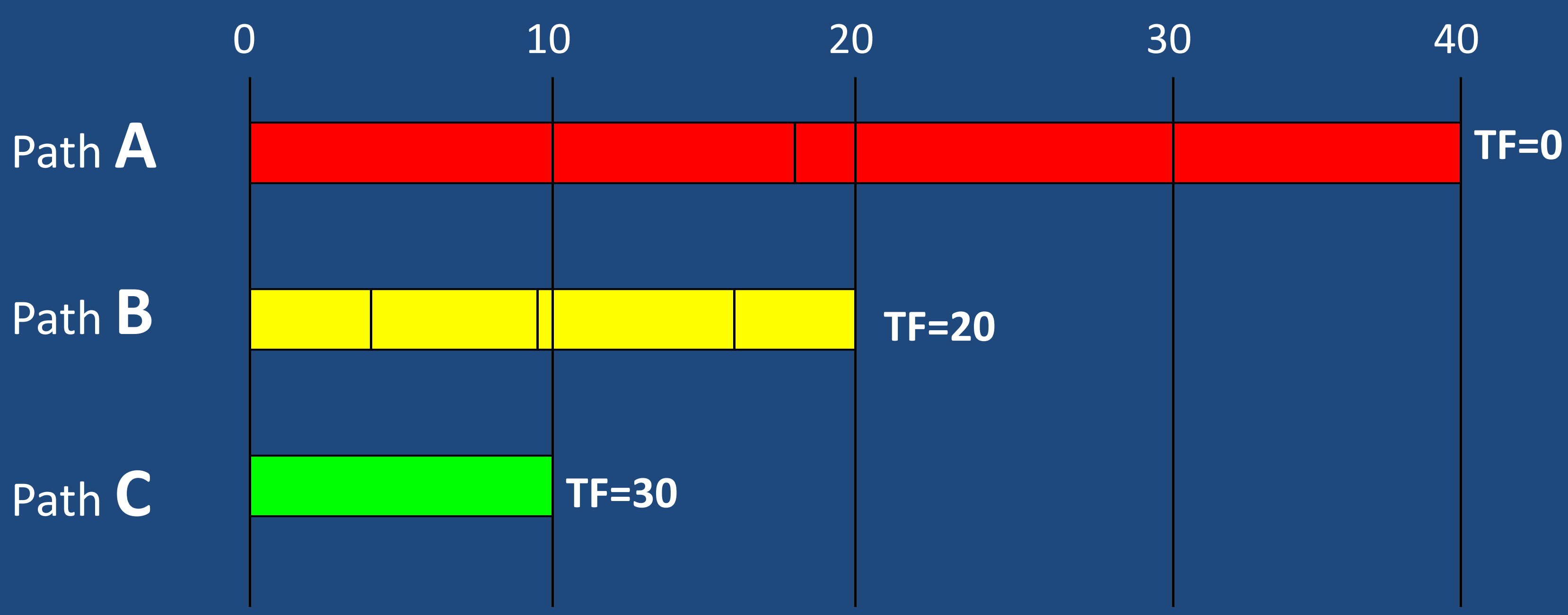
- When will the Project finish?



TF = Total Float

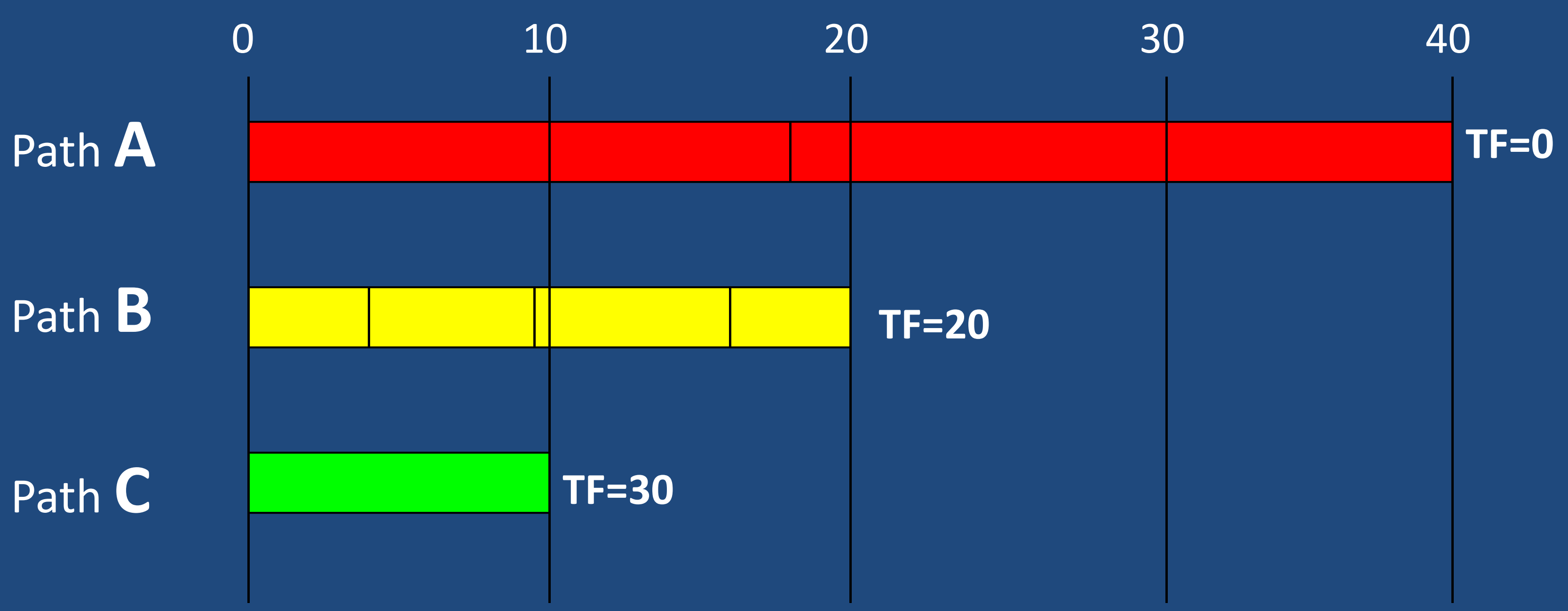
Constraints

- How long can Path A be delayed without delaying the Project?



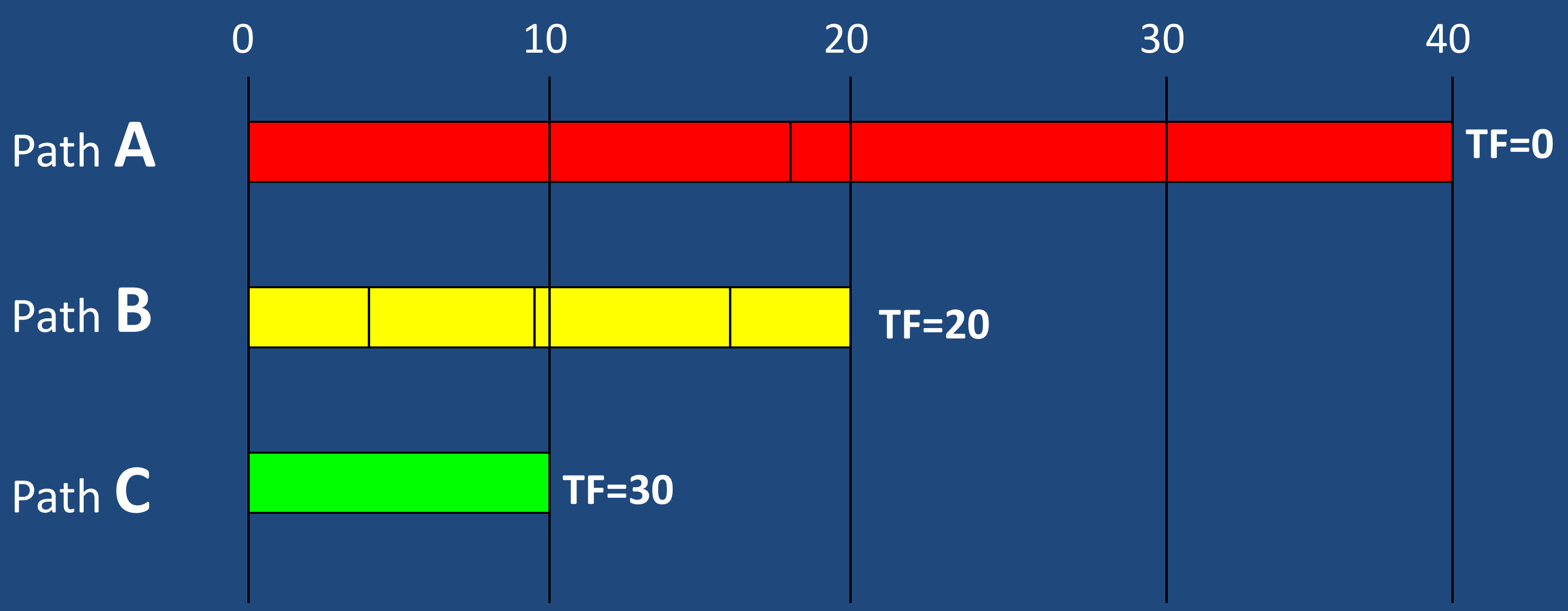
Constraints

- How long can Path B be delayed without delaying the Project?



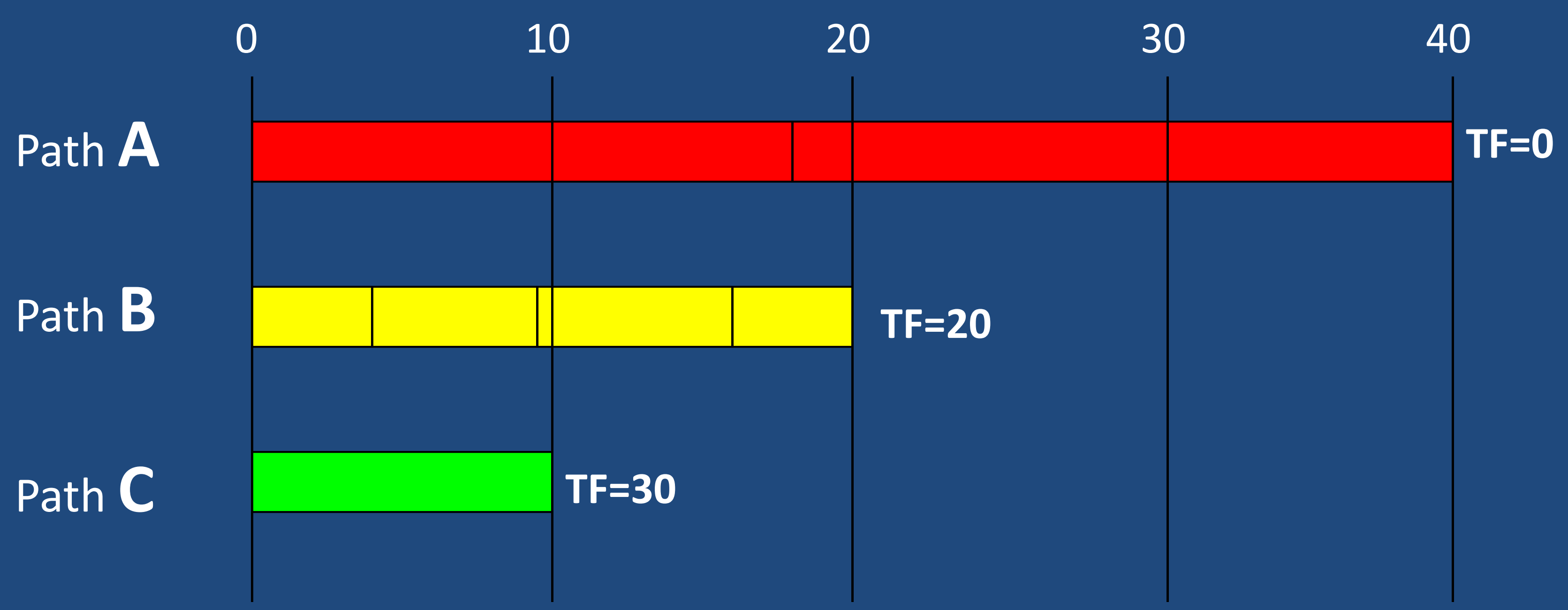
Constraints

- How long can Path C be delayed without delaying the Project?



Constraints

- Can we assume that the path with zero float is the critical path? NO!

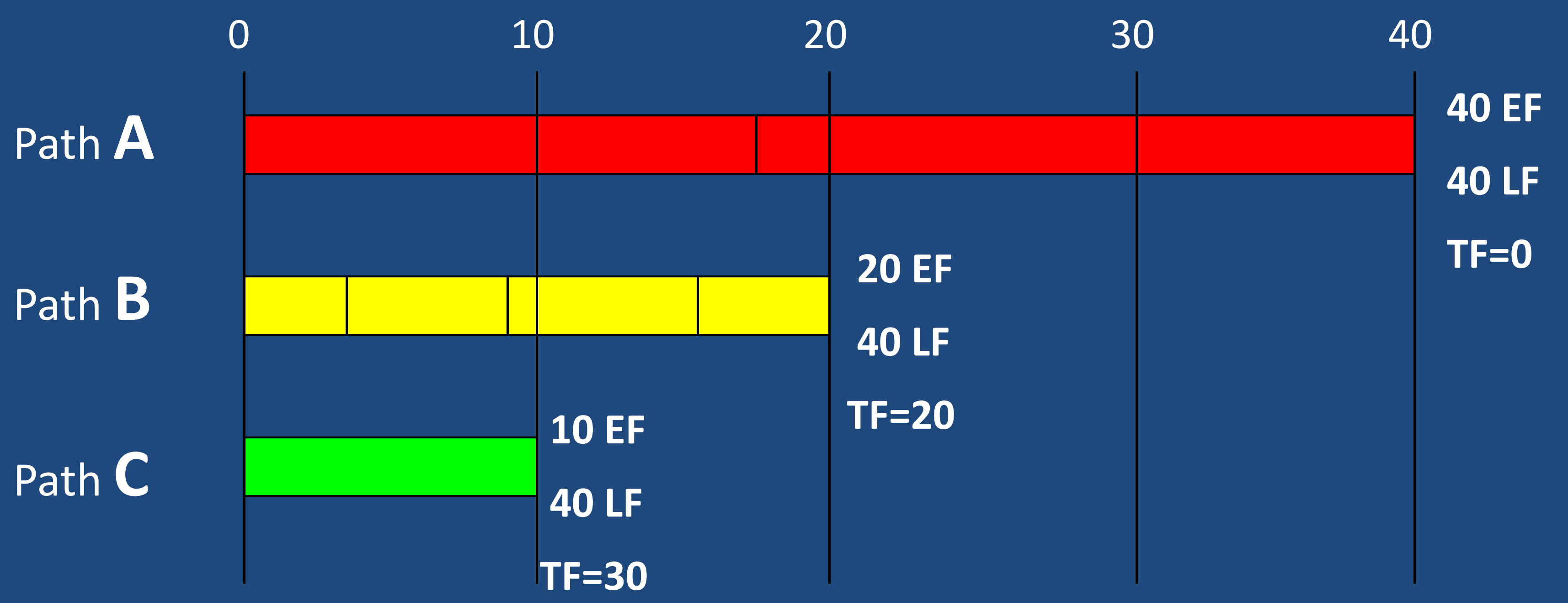


Constraints

- Allow the scheduler to fix times and dates in the logic network.
- Often affect the calculation of float.

Constraints

- Using the earlier example, note the early and late finish dates of each of path.

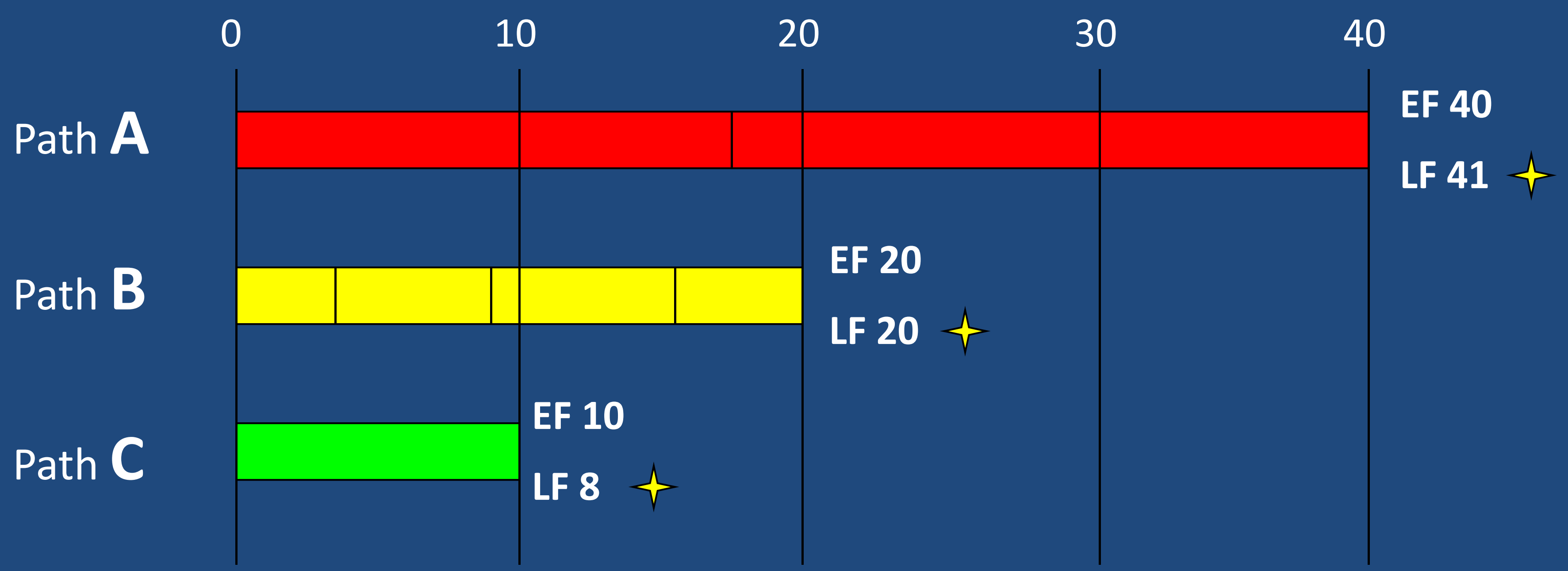


Constraints

- Using a constraint, we can choose to fix the late finish date.
- We constrain Path A to finish on day 41.
- We constrain Path B to finish on day 20.
- We constrain Path C to finish on day 8.

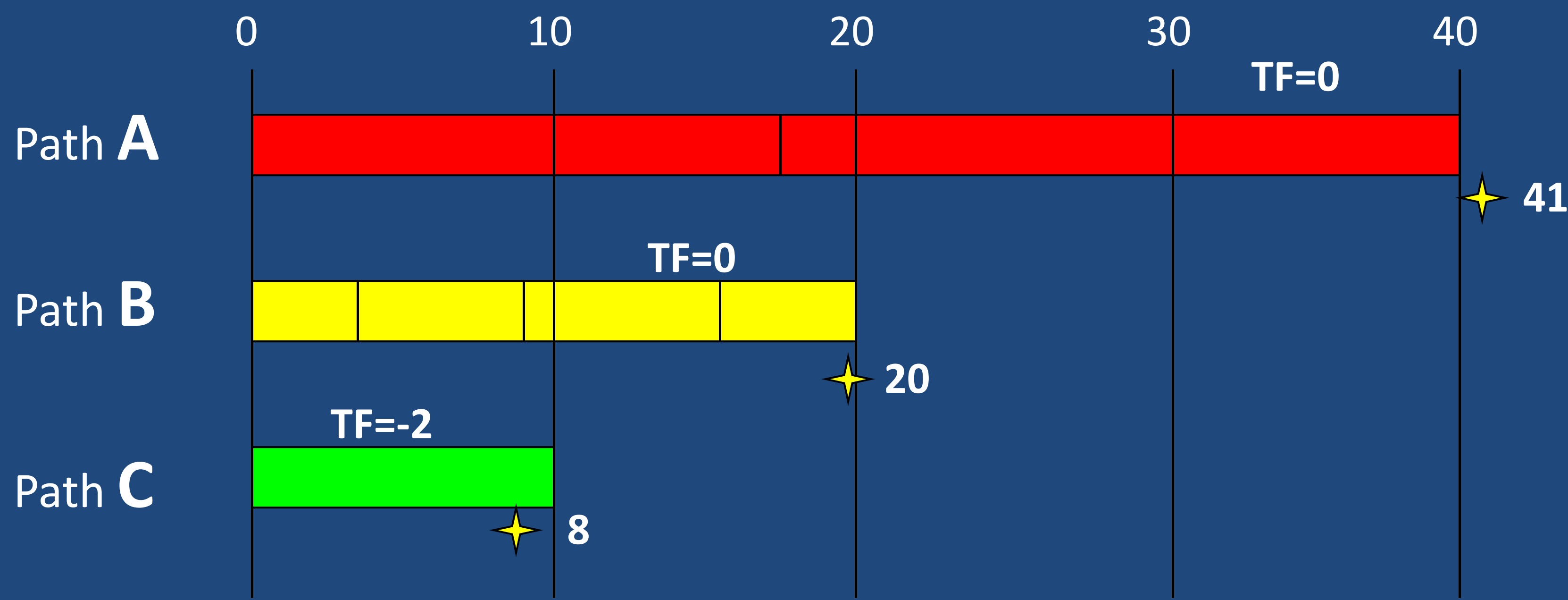
Constraints

- The constrained late finish dates replace the original late finish dates.



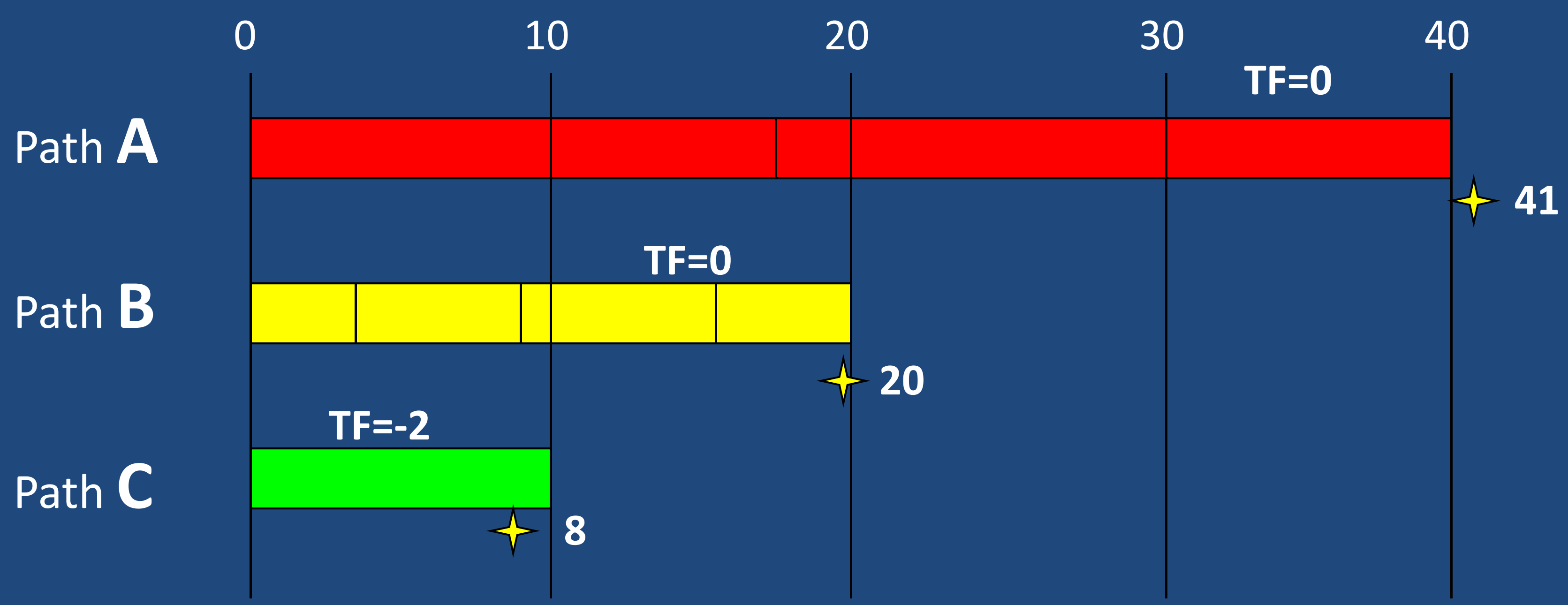
Constraints

- When will the Project finish?
- What path has the most negative float?



Constraints

- How long can Path C be delayed without delaying the Project?
- Which path is critical to the Scheduled Project Completion Date?

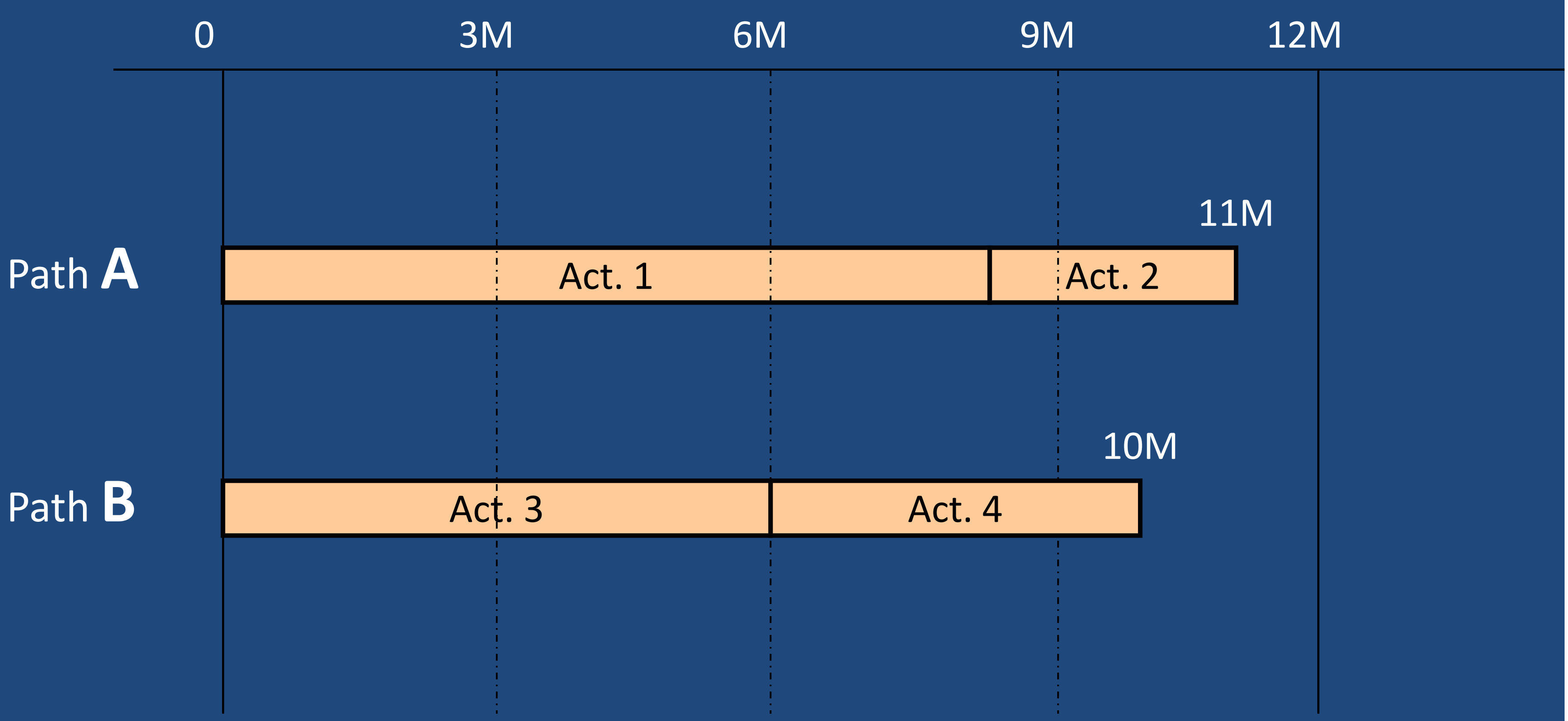


Constraints

- Not limited to finish constraints.
  - Float constraints
  - Start constraints
- Often affect the calculation of float.
- Let’s talk about how multiple calendars affect the use of float.

Multiple Calendars

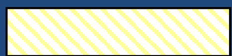
Time Line without Multiple Calendars



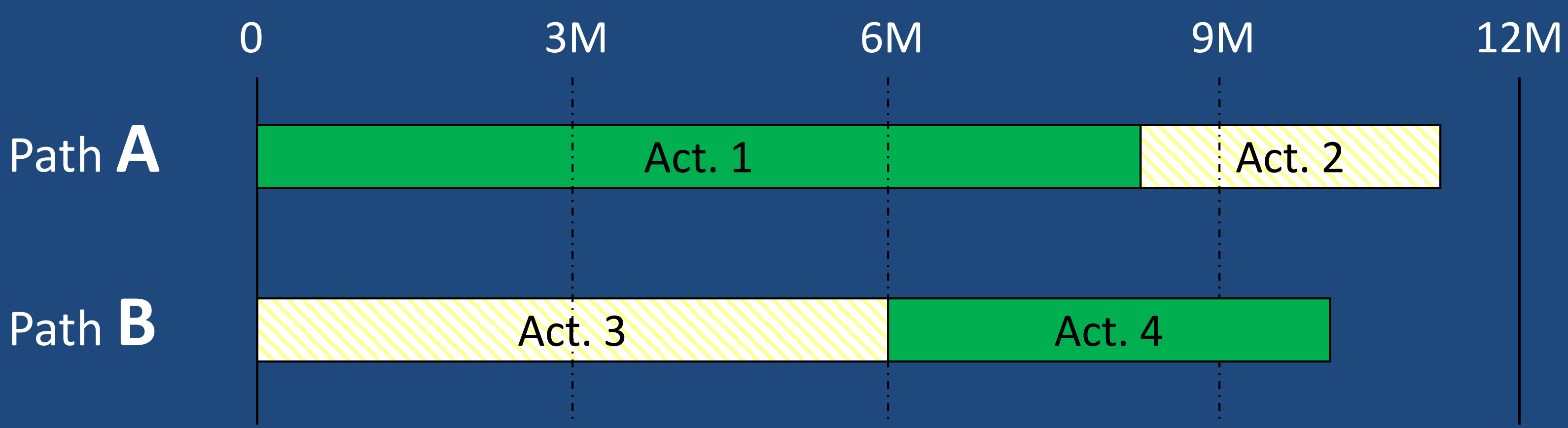
Multiple Calendars

Identifying the work restrictions

Activities that can be worked on any time.



Activities that cannot be worked on during turtle season (Months 7 – 9).

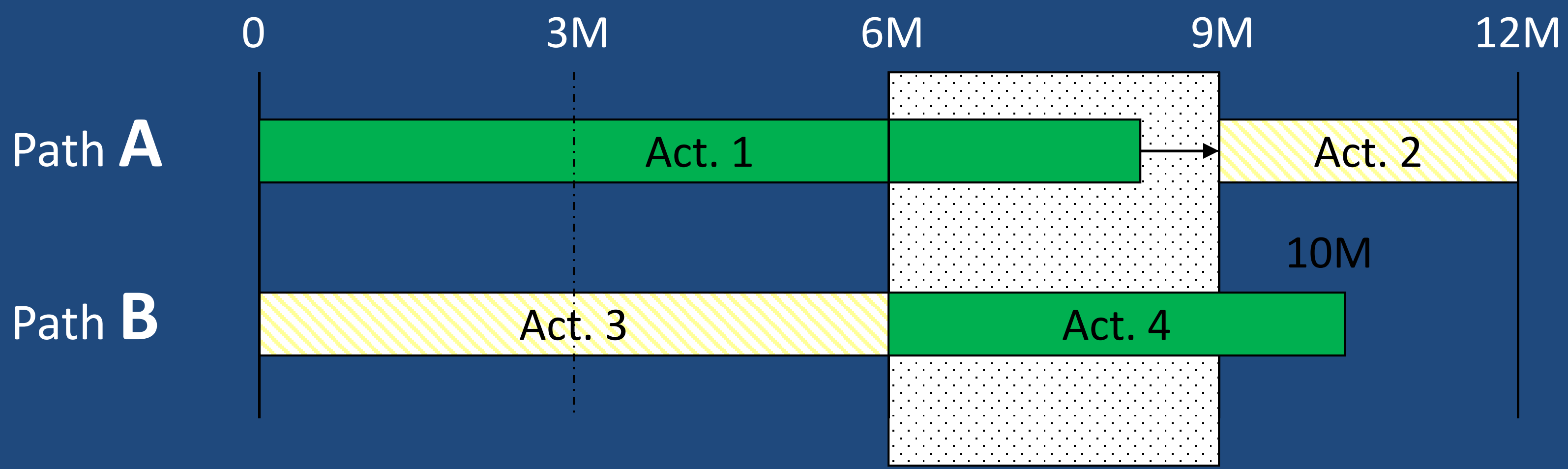


Multiple Calendars

Incorporating the work restrictions

Activities that can be worked on any time.

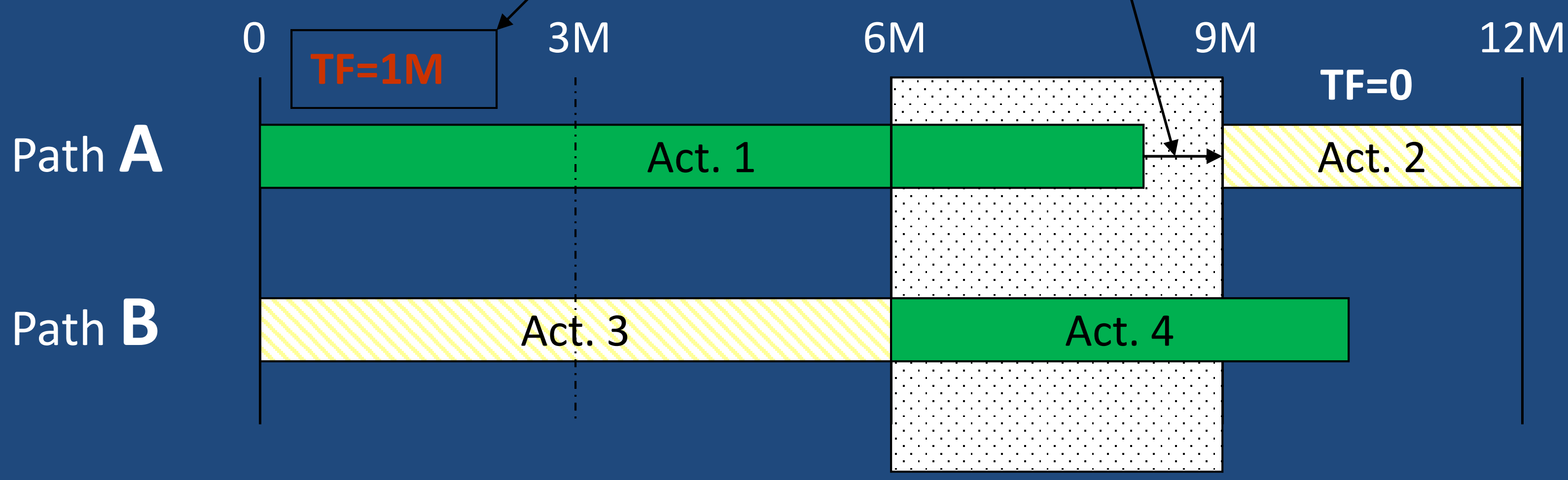
Activities that cannot be worked on during turtle season (Months 7 – 9).



Multiple Calendars

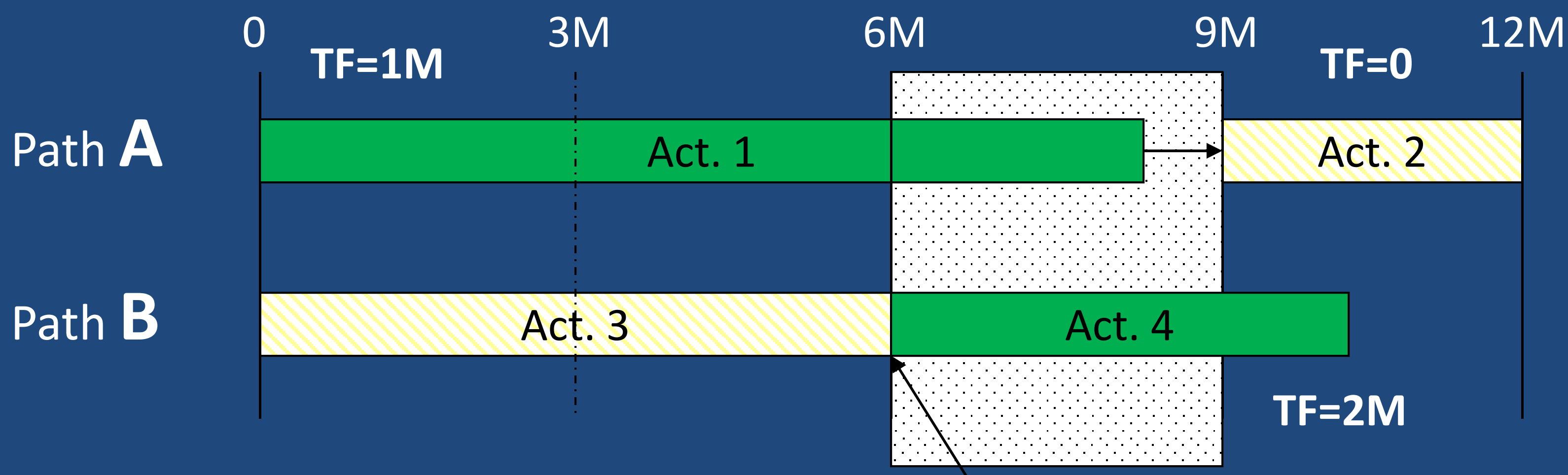
Calculation of float with calendars

Because the first activity on Path A will not affect the Schedule Project Completion Date for a month, it has a month of float.



Multiple Calendars

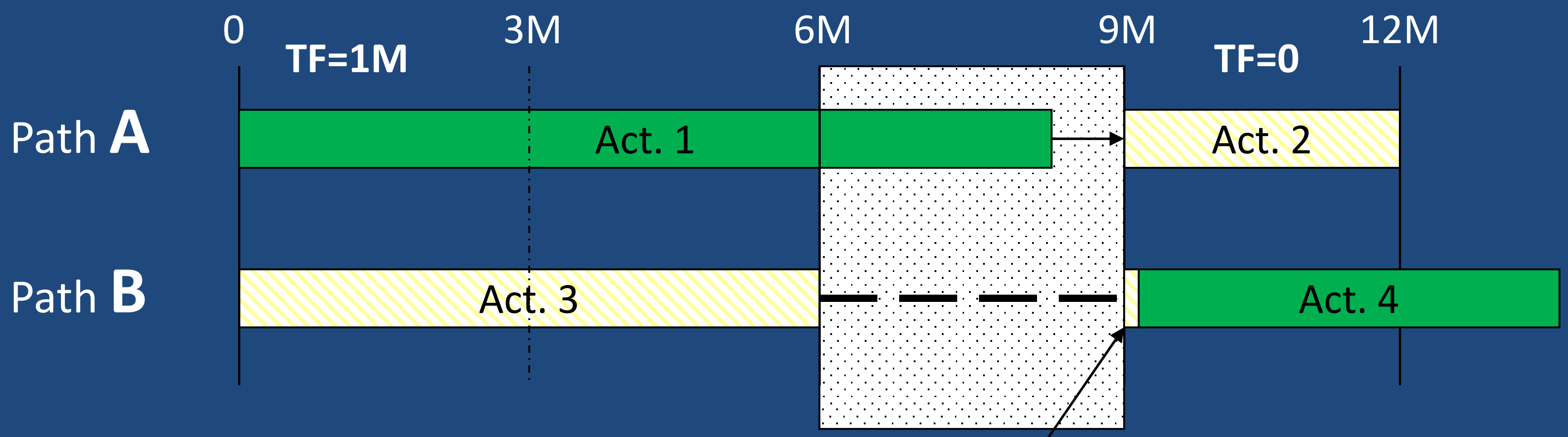
Calculation of float with calendars



The first activity on Path B must finish on time or it will "spill over" into turtle season.

Multiple Calendars

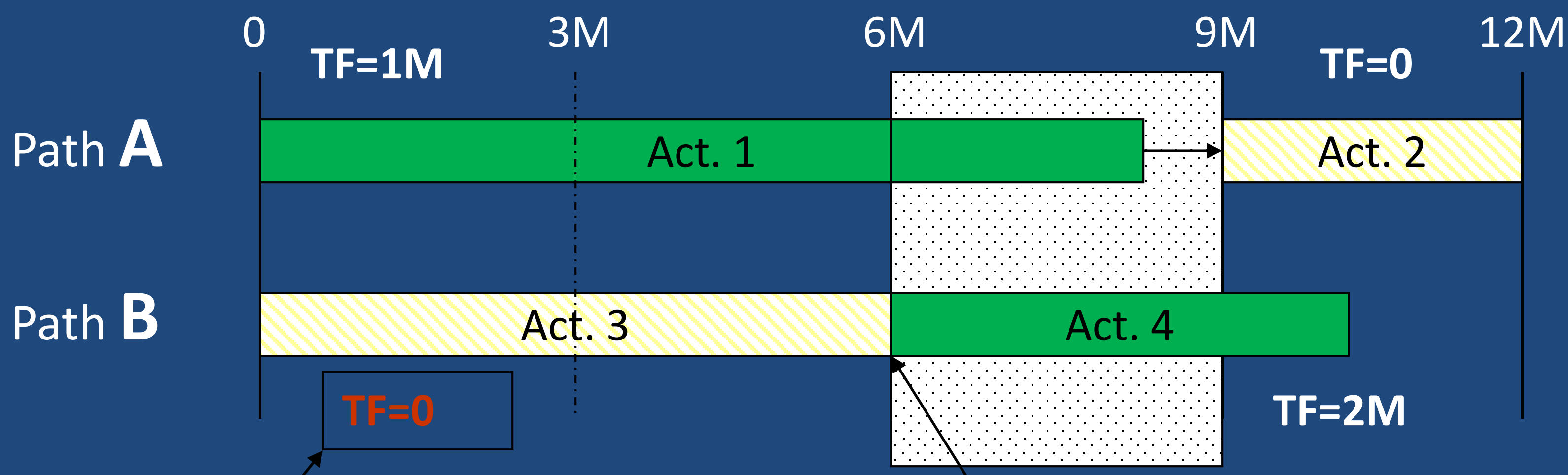
Calculation of float with calendars



If Path B were delayed, it would finish after turtle season and delay the Scheduled Project Completion Date.

Multiple Calendars

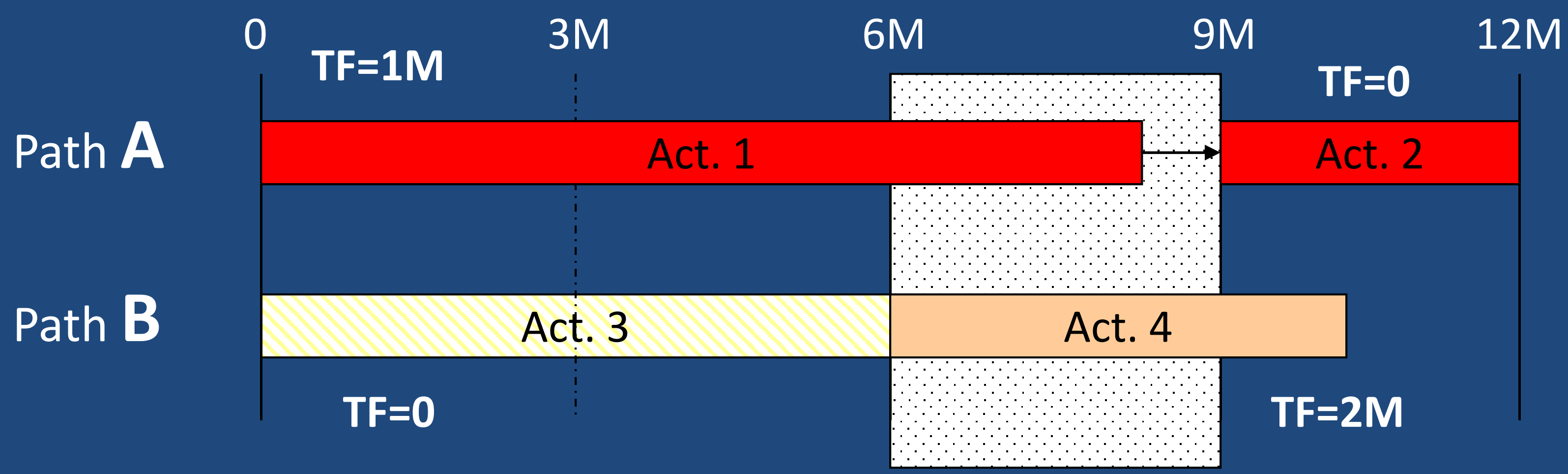
Calculation of float with calendars



Because the first activity on Path B must be completed on time (before turtle season) or delay the project, it has no float.

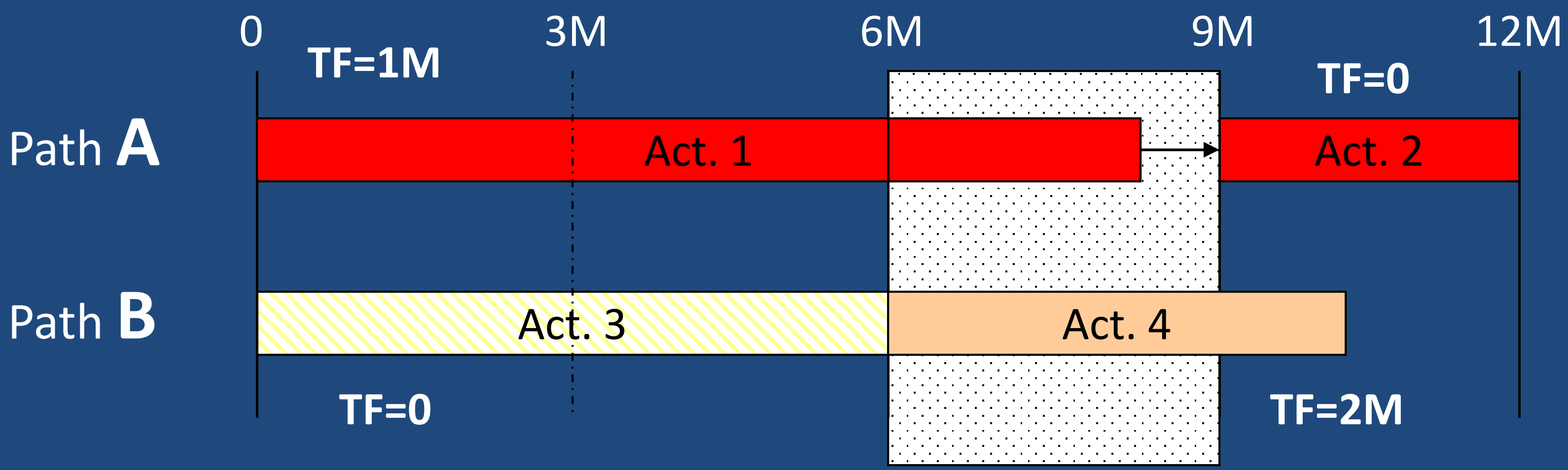
Multiple Calendars

- When will the Project finish?
- Which path is critical?
- Which path must be progressed in 1st month to prevent delays?



Multiple Calendars

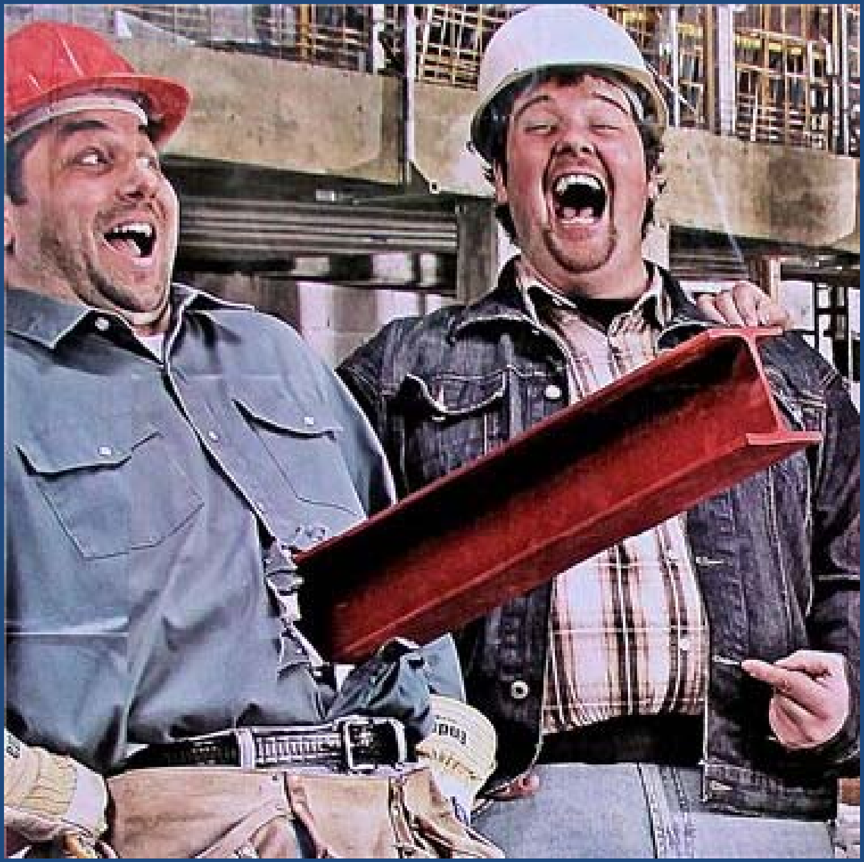
When there are multiple calendars, (with no constraints) float helps determine when a delay to completion *could* occur, but it cannot be relied upon to identify the path that leads to completion.



Reasons for New Indicators

- The current indicators only work sometimes, and are only practical if certain scheduling options are avoided.
  - No constraints.
  - No multiple calendars.
- These options are used frequently, so the current indicators are impractical.
- No indicator exists that will allow project managers to accurately and consistently identify the activities that must be progressed in order to prevent delays.

III. A Detailed Method for Prospectively Assessing and Preventing Delays



A Detailed Method for Prospectively Assessing and Preventing Delays

1. Take the schedule currently being used to manage the project.
2. Identify the Longest Path through a milestone – phase, shutdown, project completion?
3. Note the scheduled completion date (early finish) of that milestone.
4. Identify the frequency of updates – weekly, monthly?
5. Change the data date to the date of the next anticipated update.
6. Note the new scheduled completion date of the milestone.

A Detailed Method for Prospectively Assessing and Preventing Delays

7. Assess the first week of progress:
   a. Provide as-expected progress to the activities controlling the Longest Path.
   b. Start off with a week's worth of expected progress.
   c. Add in expected progress for the week (AS, AF, RD).
8. Reschedule project to complete new forward and backward passes.
9. Note the new scheduled completion date of that milestone.
10. Again, identify the Longest Path through the milestone.

A Detailed Method for Prospectively Assessing and Preventing Delays

11. If the new scheduled completion date is equal to or less than original scheduled completion date (Step 3 - before the data date was changed) then STOP! If not, proceed to the next step.
12. Repeat Steps 7 through 11 until the new scheduled completion date is equal to or less than the old scheduled completion date.

The completion of this process would represent the progress necessary to prevent a delay to the milestone.

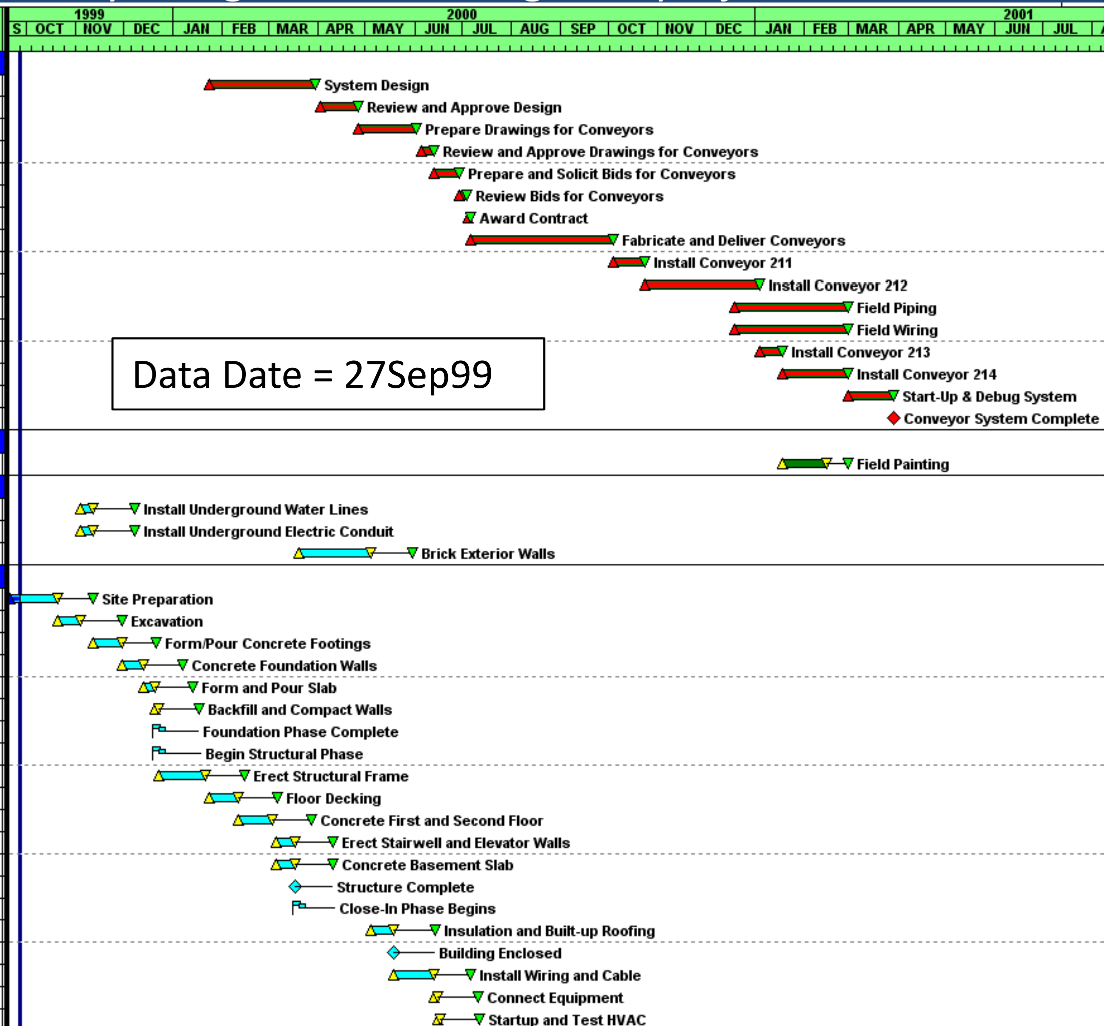
A Detailed Method for Prospectively Assessing and Preventing Delays

Let’s apply the process!

A Detailed Method for Prospectively Assessing and Preventing Delays

1. Take the schedule currently being used to manage the project.

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Total Float	Cal ID
0								
CS300	System Design	40	40	0	24JAN00*	30MAR00	0	4
CS310	Review and Approve Design	15	15	0	03APR00	26APR00	0	4
CS430	Prepare Drawings for Conveyors	20	20	0	27APR00	01JUN00	0	4
CS440	Review and Approve Drawings for Conveyors	5	5	0	05JUN00	12JUN00	0	4
CS400	Prepare and Solicit Bids for Conveyors	10	10	0	13JUN00	28JUN00	0	4
CS410	Review Bids for Conveyors	2	2	0	29JUN00	03JUL00	0	4
CS420	Award Contract	1	1	0	05JUL00	05JUL00	0	4
CS450	Fabricate and Deliver Conveyors	50	50	0	06JUL00	03OCT00	0	4
CS700	Install Conveyor 211	14	14	0	04OCT00	23OCT00	0	1
CS710	Install Conveyor 212	50	50	0	24OCT00	03JAN01	0	1
CS740	Field Piping	50	50	0	19DEC00	28FEB01	0	1
CS750	Field Wiring	50	50	0	19DEC00	28FEB01	0	1
CS720	Install Conveyor 213	10	10	0	04JAN01	17JAN01	0	1
CS730	Install Conveyor 214	30	30	0	18JAN01	28FEB01	0	1
CS305	Start-Up & Debug System	20	20	0	01MAR01	28MAR01	0	1
CS800	Conveyor System Complete	0	0	0		28MAR01	0	1
10								
CS760	Field Painting	20	20	0	18JAN01	14FEB01	10	1
13								
BA660	Install Underground Water Lines	5	5	0	04NOV99	11NOV99	13	4
BA670	Install Underground Electric Conduit	5	5	0	04NOV99	11NOV99	13	4
BA750	Brick Exterior Walls	28	28	0	20MAR00	04MAY00	13	4
16								
BA640	Site Preparation	20	18	10	21SEP99A	20OCT99	16	1
BA650	Excavation	10	10	0	21OCT99	03NOV99	16	1
BA680	Form/Pour Concrete Footings	10	10	0	12NOV99	29NOV99	16	1
BA681	Concrete Foundation Walls	10	10	0	30NOV99	13DEC99	16	1
BA690	Form and Pour Slab	5	5	0	14DEC99	20DEC99	16	1
BA700	Backfill and Compact Walls	2	2	0	21DEC99	22DEC99	16	1
BA701	Foundation Phase Complete	0	0	0		22DEC99	16	1
BA702	Begin Structural Phase	0	0	0	23DEC99		16	1
BA710	Erect Structural Frame	20	20	0	23DEC99	21JAN00	16	1
BA712	Floor Decking	14	14	0	24JAN00	10FEB00	16	1
BA730	Concrete First and Second Floor	15	15	0	11FEB00	03MAR00	16	1
BA720	Erect Stairwell and Elevator Walls	10	10	0	06MAR00	17MAR00	16	1
BA731	Concrete Basement Slab	10	10	0	06MAR00	17MAR00	16	1
BA732	Structure Complete	0	0	0		17MAR00	16	1
BA741	Close-In Phase Begins	0	0	0	20MAR00		16	1
BA780	Insulation and Built-up Roofing	10	10	0	05MAY00	18MAY00	16	1
BA800	Building Enclosed	0	0	0		18MAY00	16	1
BA850	Install Wiring and Cable	15	15	0	19MAY00	12JUN00	16	1
BA870	Connect Equipment	3	3	0	13JUN00	15JUN00	16	1
BA871	Startup and Test HVAC	1	1	0	16JUN00	16JUN00	16	1

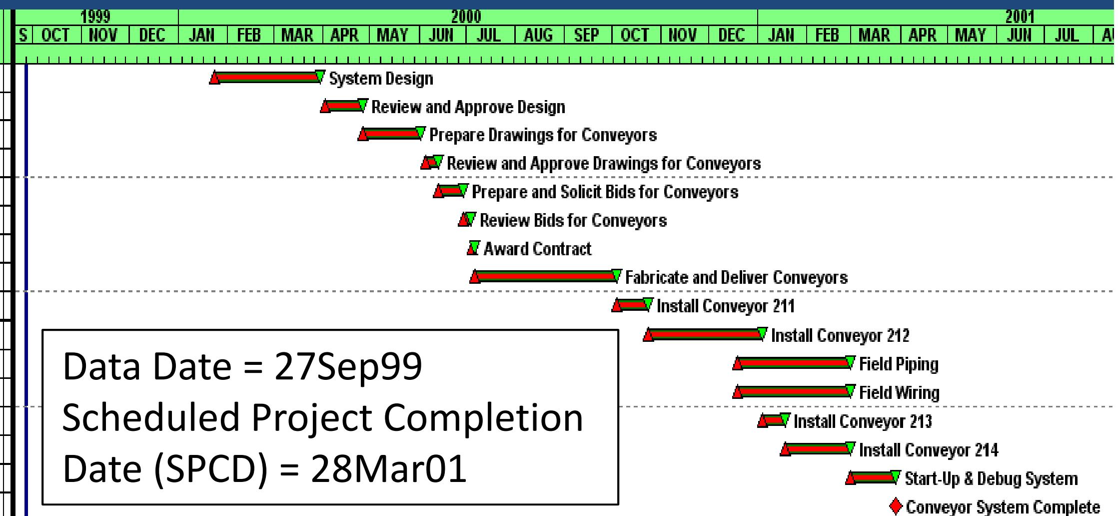


Grouped by Total Float; Critical Path = Longest Path; Not all Activities Shown

A Detailed Method for Prospectively Assessing and Preventing Delays

2. Identify the Longest Path through a milestone – Project Completion.
3. Note the scheduled completion date (early finish) of that milestone.
4. Identify the frequency of updates. Presume there are monthly updates.

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Total Float	Cal ID
CS300	System Design	40	40	0	24JAN00*	30MAR00	0	4
CS310	Review and Approve Design	15	15	0	03APR00	26APR00	0	4
CS430	Prepare Drawings for Conveyors	20	20	0	27APR00	01JUN00	0	4
CS440	Review and Approve Drawings for Conveyors	5	5	0	05JUN00	12JUN00	0	4
CS400	Prepare and Solicit Bids for Conveyors	10	10	0	13JUN00	28JUN00	0	4
CS410	Review Bids for Conveyors	2	2	0	29JUN00	03JUL00	0	4
CS420	Award Contract	1	1	0	05JUL00	05JUL00	0	4
CS450	Fabricate and Deliver Conveyors	50	50	0	06JUL00	03OCT00	0	4
CS700	Install Conveyor 211	14	14	0	04OCT00	23OCT00	0	1
CS710	Install Conveyor 212	50	50	0	24OCT00	03JAN01	0	1
CS740	Field Piping	50	50	0	19DEC00	28FEB01	0	1
CS750	Field Wiring	50	50	0	19DEC00	28FEB01	0	1
CS720	Install Conveyor 213	10	10	0	04JAN01	17JAN01	0	1
CS730	Install Conveyor 214	30	30	0	18JAN01	28FEB01	0	1
CS305	Start-Up & Debug System	20	20	0	01MAR01	28MAR01	0	1
CS800	Conveyor System Complete	0	0	0		28MAR01	0	1



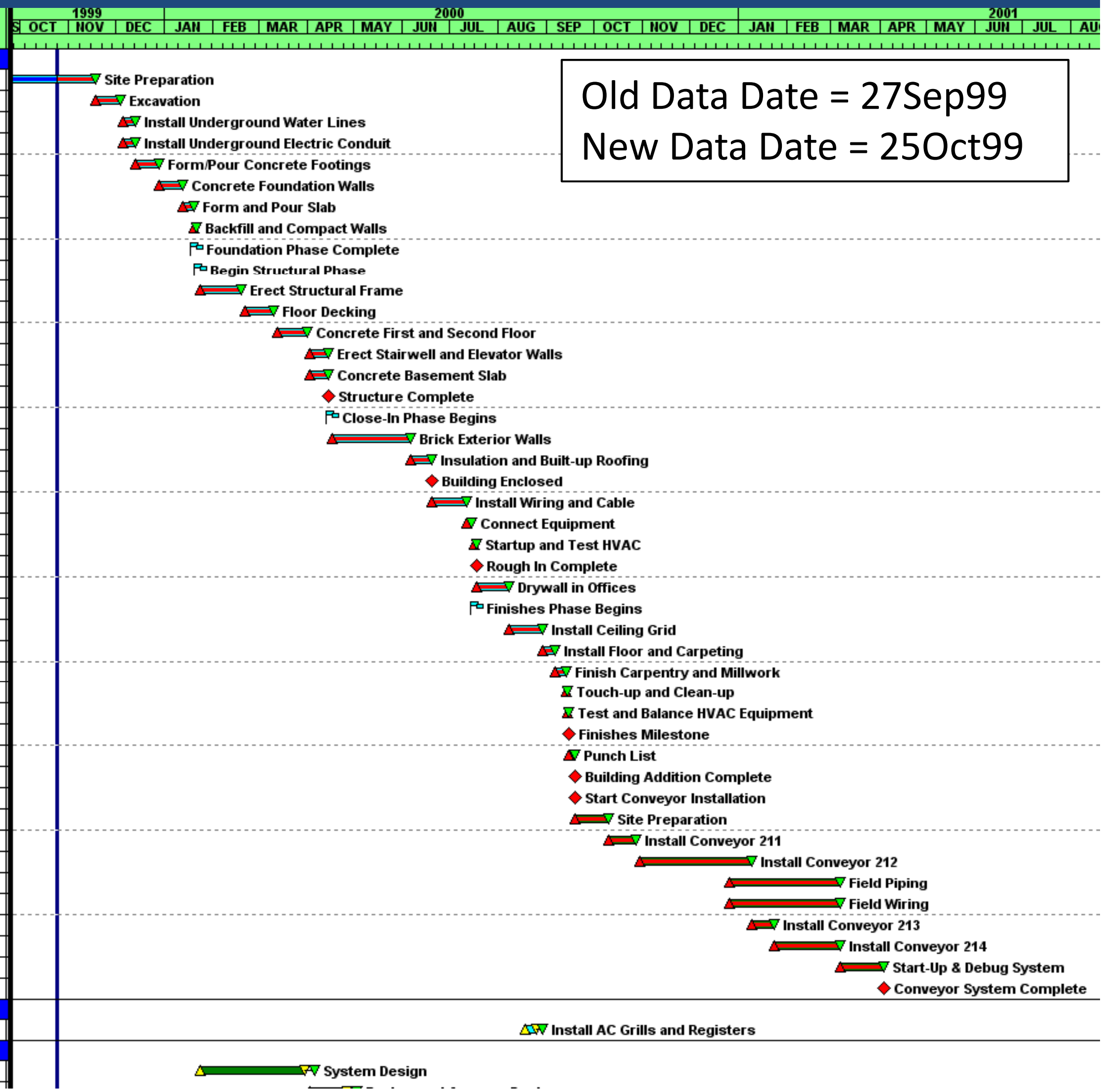
Data Date = 27Sep99
Scheduled Project Completion Date (SPCD) = 28Mar01

Note: Critical Path is from *System Design* through *Conveyor System Complete*.

A Detailed Method for Prospectively Assessing and Preventing Delays

5. Change the data date to the date of the next anticipated update – 25Oct99.

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Total Float	Cal ID
0								
BA640	Site Preparation	20	18	10	21SEP99A	17NOV99	0	1
BA650	Excavation	10	10	0	18NOV99	03DEC99	0	1
BA660	Install Underground Water Lines	5	5	0	06DEC99	13DEC99	0	4
BA670	Install Underground Electric Conduit	5	5	0	06DEC99	13DEC99	0	4
BA680	Form/Pour Concrete Footings	10	10	0	14DEC99	28DEC99	0	1
BA681	Concrete Foundation Walls	10	10	0	29DEC99	12JAN00	0	1
BA690	Form and Pour Slab	5	5	0	13JAN00	19JAN00	0	1
BA700	Backfill and Compact Walls	2	2	0	20JAN00	21JAN00	0	1
BA701	Foundation Phase Complete	0	0	0		21JAN00	0	1
BA702	Begin Structural Phase	0	0	0	24JAN00		0	1
BA710	Erect Structural Frame	20	20	0	24JAN00	18FEB00	0	1
BA712	Floor Decking	14	14	0	22FEB00	10MAR00	0	1
BA730	Concrete First and Second Floor	15	15	0	13MAR00	31MAR00	0	1
BA720	Erect Stairwell and Elevator Walls	10	10	0	03APR00	14APR00	0	1
BA731	Concrete Basement Slab	10	10	0	03APR00	14APR00	0	1
BA732	Structure Complete	0	0	0		14APR00	0	1
BA741	Close-In Phase Begins	0	0	0	17APR00		0	1
BA750	Brick Exterior Walls	28	28	0	17APR00	05JUN00	0	4
BA780	Insulation and Built-up Roofing	10	10	0	06JUN00	19JUN00	0	1
BA800	Building Enclosed	0	0	0		19JUN00	0	1
BA850	Install Wiring and Cable	15	15	0	20JUN00	11JUL00	0	1
BA870	Connect Equipment	3	3	0	12JUL00	14JUL00	0	1
BA871	Startup and Test HVAC	1	1	0	17JUL00	17JUL00	0	1
BA880	Rough In Complete	0	0	0		17JUL00	0	1
BA890	Drywall in Offices	15	15	0	18JUL00	07AUG00	0	1
BA899	Finishes Phase Begins	0	0	0	18JUL00		0	1
BA900	Install Ceiling Grid	15	15	0	08AUG00	28AUG00	0	1
BA910	Install Floor and Carpeting	5	5	0	29AUG00	05SEP00	0	1
BA911	Finish Carpentry and Millwork	5	5	0	06SEP00	12SEP00	0	1
BA940	Touch-up and Clean-up	1	1	0	13SEP00	13SEP00	0	1
BA941	Test and Balance HVAC Equipment	1	1	0	14SEP00	14SEP00	0	1
BA950	Finishes Milestone	0	0	0		14SEP00	0	1
BA960	Punch List	2	2	0	15SEP00	18SEP00	0	1
BA970	Building Addition Complete	0	0	0		18SEP00	0	1
CS311	Start Conveyor Installation	0	0	0	19SEP00		0	1
CS315	Site Preparation	15	15	0	19SEP00	09OCT00	0	1
CS700	Install Conveyor 211	14	14	0	10OCT00	27OCT00	0	1
CS710	Install Conveyor 212	50	50	0	30OCT00	09JAN01	0	1
CS740	Field Piping	50	50	0	26DEC00	06MAR01	0	1
CS750	Field Wiring	50	50	0	26DEC00	06MAR01	0	1
CS720	Install Conveyor 213	10	10	0	10JAN01	23JAN01	0	1
CS730	Install Conveyor 214	30	30	0	24JAN01	06MAR01	0	1
CS305	Start-Up & Debug System	20	20	0	07MAR01	03APR01	0	1
CS800	Conveyor System Complete	0	0	0		03APR01	0	1
2								
BA902	Install AC Grills and Registers	5	5	0	18AUG00	24AUG00	2	1
3								
CS300	System Design	40	40	0	24JAN00*	30MAR00	3	4

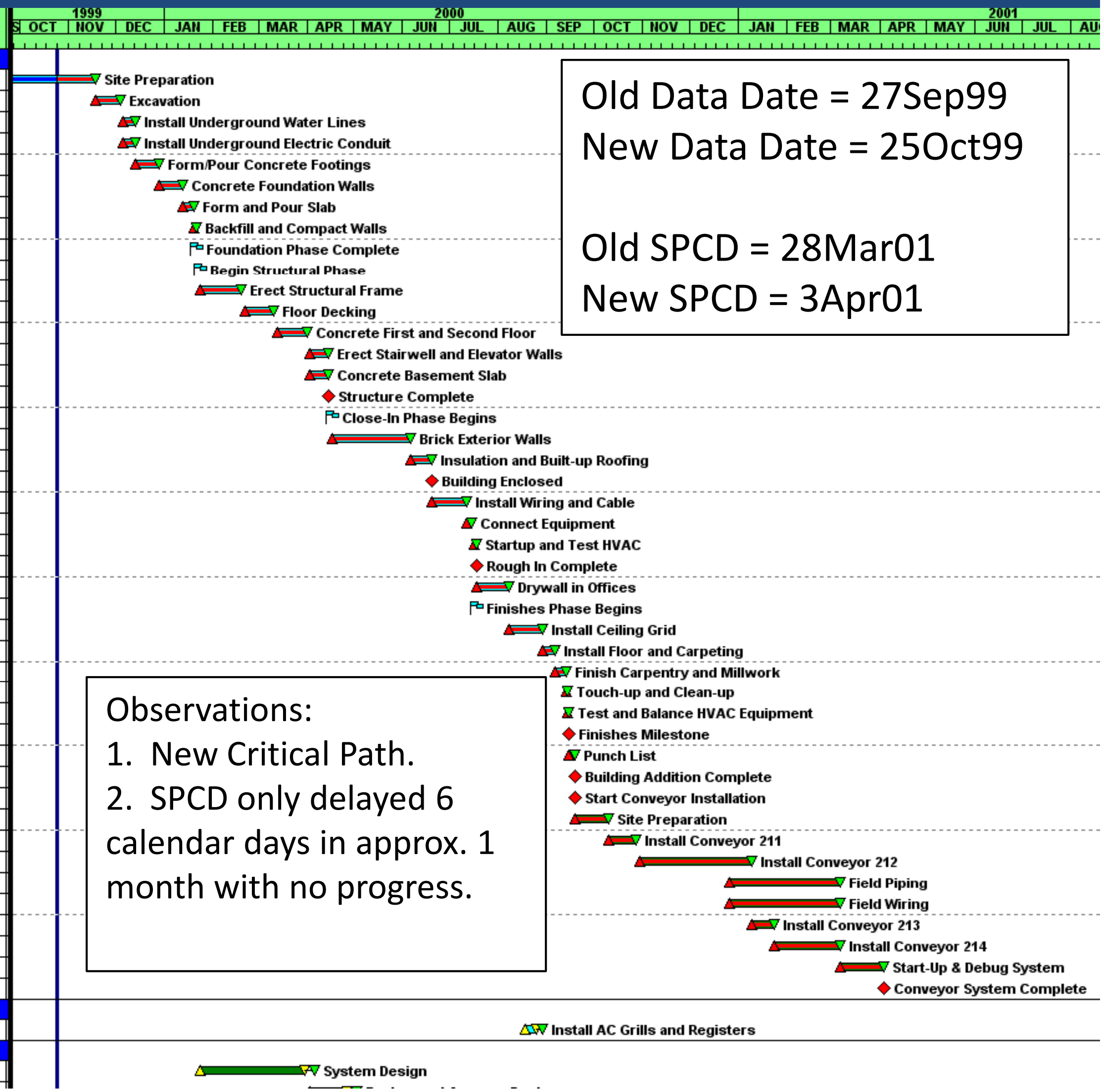


Old Data Date = 27Sep99
New Data Date = 25Oct99

A Detailed Method for Prospectively Assessing and Preventing Delays

6. Note the new Project Completion date.

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Total Float	Cal ID
0								
BA640	Site Preparation	20	18	10	21SEP99A	17NOV99	0	1
BA650	Excavation	10	10	0	18NOV99	03DEC99	0	1
BA660	Install Underground Water Lines	5	5	0	06DEC99	13DEC99	0	4
BA670	Install Underground Electric Conduit	5	5	0	06DEC99	13DEC99	0	4
BA680	Form/Pour Concrete Footings	10	10	0	14DEC99	28DEC99	0	1
BA681	Concrete Foundation Walls	10	10	0	29DEC99	12JAN00	0	1
BA690	Form and Pour Slab	5	5	0	13JAN00	19JAN00	0	1
BA700	Backfill and Compact Walls	2	2	0	20JAN00	21JAN00	0	1
BA701	Foundation Phase Complete	0	0	0		21JAN00	0	1
BA702	Begin Structural Phase	0	0	0	24JAN00		0	1
BA710	Erect Structural Frame	20	20	0	24JAN00	18FEB00	0	1
BA712	Floor Decking	14	14	0	22FEB00	10MAR00	0	1
BA730	Concrete First and Second Floor	15	15	0	13MAR00	31MAR00	0	1
BA720	Erect Stairwell and Elevator Walls	10	10	0	03APR00	14APR00	0	1
BA731	Concrete Basement Slab	10	10	0	03APR00	14APR00	0	1
BA732	Structure Complete	0	0	0		14APR00	0	1
BA741	Close-In Phase Begins	0	0	0	17APR00		0	1
BA750	Brick Exterior Walls	28	28	0	17APR00	05JUN00	0	4
BA780	Insulation and Built-up Roofing	10	10	0	06JUN00	19JUN00	0	1
BA800	Building Enclosed	0	0	0		19JUN00	0	1
BA850	Install Wiring and Cable	15	15	0	20JUN00	11JUL00	0	1
BA870	Connect Equipment	3	3	0	12JUL00	14JUL00	0	1
BA871	Startup and Test HVAC	1	1	0	17JUL00	17JUL00	0	1
BA880	Rough In Complete	0	0	0		17JUL00	0	1
BA890	Drywall in Offices	15	15	0	18JUL00	07AUG00	0	1
BA899	Finishes Phase Begins	0	0	0	18JUL00		0	1
BA900	Install Ceiling Grid	15	15	0	08AUG00	28AUG00	0	1
BA910	Install Floor and Carpeting	5	5	0	29AUG00	05SEP00	0	1
BA911	Finish Carpentry and Millwork	5	5	0	06SEP00	12SEP00	0	1
BA940	Touch-up and Clean-up	1	1	0	13SEP00	13SEP00	0	1
BA941	Test and Balance HVAC Equipment	1	1	0	14SEP00	14SEP00	0	1
BA950	Finishes Milestone	0	0	0		14SEP00	0	1
BA960	Punch List	2	2	0	15SEP00	18SEP00	0	1
BA970	Building Addition Complete	0	0	0		18SEP00	0	1
CS311	Start Conveyor Installation	0	0	0	19SEP00		0	1
CS315	Site Preparation	15	15	0	19SEP00	09OCT00	0	1
CS700	Install Conveyor 211	14	14	0	10OCT00	27OCT00	0	1
CS710	Install Conveyor 212	50	50	0	30OCT00	09JAN01	0	1
CS740	Field Piping	50	50	0	26DEC00	06MAR01	0	1
CS750	Field Wiring	50	50	0	26DEC00	06MAR01	0	1
CS720	Install Conveyor 213	10	10	0	10JAN01	23JAN01	0	1
CS730	Install Conveyor 214	30	30	0	24JAN01	06MAR01	0	1
CS305	Start-Up & Debug System	20	20	0	07MAR01	03APR01	0	1
CS800	Conveyor System Complete	0	0	0		03APR01	0	1
2								
BA902	Install AC Grills and Registers	5	5	0	18AUG00	24AUG00	2	1
3								
CS300	System Design	40	40	0	24JAN00*	30MAR00	3	4



Old Data Date = 27Sep99
New Data Date = 25Oct99

Old SPCD = 28Mar01
New SPCD = 3Apr01

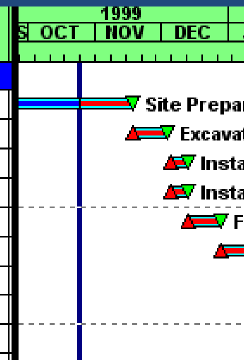
Observations:

1. New Critical Path.
2. SPCD only delayed 6 calendar days in approx. 1 month with no progress.

A Detailed Method for Prospectively Assessing and Preventing Delays

7. Assess the first week of progress.

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Total Float	Cal ID
0								
BA640	Site Preparation	20	18	10	21SEP99A	17NOV99	0	1
BA650	Excavation	10	10	0	18NOV99	03DEC99	0	1
BA660	Install Underground Water Lines	5	5	0	06DEC99	13DEC99	0	4
BA670	Install Underground Electric Conduit	5	5	0	06DEC99	13DEC99	0	4
BA680	Form/Pour Concrete Footings	10	10	0	14DEC99	28DEC99	0	1
BA681	Concrete Foundation Walls	10	10	0	29DEC99	12JAN00	0	1
BA690	Form and Pour Slab	5	5	0	13JAN00	19JAN00	0	1
BA700	Backfill and Compact Walls	2	2	0	20JAN00	21JAN00	0	1
BA701	Foundation Phase Complete	0	0	0		21JAN00	0	1



Old Data Date = 27Sep99
New Data Date = 25Oct99

Old SPCD = 28Mar01
New SPCD = 3Apr01

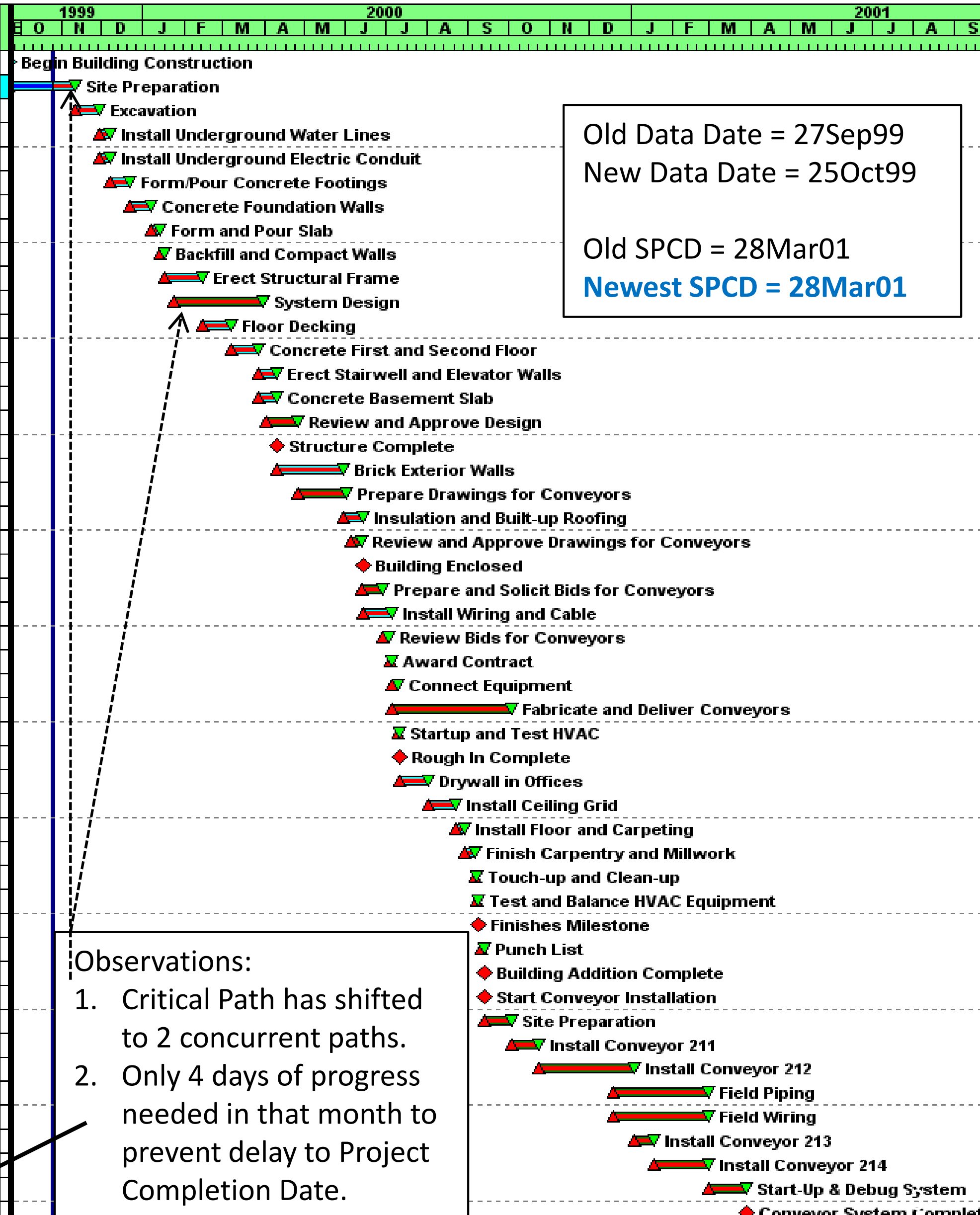
a. Provide as-expected progress to the activities controlling the Longest Path.
   - Activity BD640: *Site Preparation*
   - Determine As-Expected Progress to *Site Preparation*:
     - New Data Date is on a Monday – 5 day work week calendar for Site Preparation.
     - Site Preparation already started, so simply reduce remaining duration from 18 to 14 work days.
     - Note: This is only 4 out of the 5 days of progress expected for this week. Why? See Step 8…

8. Reschedule project to complete new forward and backward passes.

9. Note the new Project Completion date.

10. Again, identify the Longest Path through the Project Completion.

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Total Float	Cal ID
BA630	Begin Building Construction	0	0	100	21SEP99A			1
BA640	Site Preparation	20	14	30	21SEP99A	11NOV99	0	1
BA650	Excavation	10	10	0	12NOV99	29NOV99	0	1
BA660	Install Underground Water Lines	5	5	0	30NOV99	07DEC99	0	4
BA670	Install Underground Electric Conduit	5	5	0	30NOV99	07DEC99	0	4
BA680	Form/Pour Concrete Footings	10	10	0	08DEC99	21DEC99	0	1
BA681	Concrete Foundation Walls	10	10	0	22DEC99	06JAN00	0	1
BA690	Form and Pour Slab	5	5	0	07JAN00	13JAN00	0	1
BA700	Backfill and Compact Walls	2	2	0	14JAN00	17JAN00	0	1
BA710	Erect Structural Frame	20	20	0	18JAN00	14FEB00	0	1
CS300	System Design	40	40	0	24JAN00*	30MAR00	0	4
BA712	Floor Decking	14	14	0	15FEB00	06MAR00	0	1
BA730	Concrete First and Second Floor	15	15	0	07MAR00	27MAR00	0	1
BA720	Erect Stairwell and Elevator Walls	10	10	0	28MAR00	10APR00	0	1
BA731	Concrete Basement Slab	10	10	0	28MAR00	10APR00	0	1
CS310	Review and Approve Design	15	15	0	03APR00	26APR00	0	4
BA732	Structure Complete	0	0	0		10APR00	0	1
BA750	Brick Exterior Walls	28	28	0	11APR00	30MAY00	0	4
CS430	Prepare Drawings for Conveyors	20	20	0	27APR00	01JUN00	0	4
BA780	Insulation and Built-up Roofing	10	10	0	31MAY00	13JUN00	0	1
CS440	Review and Approve Drawings for Conveyors	5	5	0	05JUN00	12JUN00	0	4
BA800	Building Enclosed	0	0	0		13JUN00	0	1
CS400	Prepare and Solicit Bids for Conveyors	10	10	0	13JUN00	28JUN00	0	4
BA850	Install Wiring and Cable	15	15	0	14JUN00	05JUL00	0	1
CS410	Review Bids for Conveyors	2	2	0	29JUN00	03JUL00	0	4
CS420	Award Contract	1	1	0	05JUL00	05JUL00	0	4
BA870	Connect Equipment	3	3	0	06JUL00	10JUL00	0	1
CS450	Fabricate and Deliver Conveyors	50	50	0	06JUL00	03OCT00	0	4
BA871	Startup and Test HVAC	1	1	0	11JUL00	11JUL00	0	1
BA880	Rough In Complete	0	0	0		11JUL00	0	1
BA890	Drywall in Offices	15	15	0	12JUL00	01AUG00	0	1
BA900	Install Ceiling Grid	15	15	0	02AUG00	22AUG00	0	1
BA910	Install Floor and Carpeting	5	5	0	23AUG00	29AUG00	0	1
BA911	Finish Carpentry and Millwork	5	5	0	30AUG00	06SEP00	0	1
BA940	Touch-up and Clean-up	1	1	0	07SEP00	07SEP00	0	1
BA941	Test and Balance HVAC Equipment	1	1	0	08SEP00	08SEP00	0	1
BA950	Finishes Milestone	0	0	0		08SEP00	0	1
BA960	Punch List	2	2	0	11SEP00	12SEP00	0	1
BA970	Building Addition Complete	0	0	0		12SEP00	0	1
CS311	Start Conveyor Installation	0	0	0	13SEP00		0	1
CS315	Site Preparation	15	15	0	13SEP00	03OCT00	0	1
CS700	Install Conveyor 211	14	14	0	04OCT00	23OCT00	0	1
CS710	Install Conveyor 212	50	50	0	24OCT00	03JAN01	0	1
CS740	Field Piping	50	50	0	19DEC00	28FEB01	0	1
CS750	Field Wiring	50	50	0	19DEC00	28FEB01	0	1
CS720	Install Conveyor 213	10	10	0	04JAN01	17JAN01	0	1
CS730	Install Conveyor 214	30	30	0	18JAN01	28FEB01	0	1
CS305	Start-Up & Debug System	20	20	0	01MAR01	28MAR01	0	1
CS800	Conveyor System Complete	0	0	0		28MAR01	0	1



Old Data Date = 27Sep99
New Data Date = 25Oct99

Old SPCD = 28Mar01
Newest SPCD = 28Mar01

Observations:

1. Critical Path has shifted to 2 concurrent paths.
2. Only 4 days of progress needed in that month to prevent delay to Project Completion Date.

When New Project Completion Date = or < Original Project Completion Date, do we continue process?

NO!

Remember, the goal is to identify the minimum progress needed to prevent delay to the milestone.

Conclusions

1. The Longest Path is accurate to identify the activities that currently control the finish date of a milestone, but it *may* not indicate what must be progressed to prevent delays.
2. Multiple Calendars and Constraints alter the dates obtained in the forward and backward passes and change the float.
3. As a result, float is not an accurate indicator to identify what must be progressed in order to prevent delays to a milestone. It *can* be accurate, but it is not absolute.
4. When prospectively evaluating delays, focus on:
   a. The activities that are controlling the Longest Path of the milestone.
   b. The amount of progress that must occur in order to prevent delays to the milestone.
5. This method does not account for non-critical delays that may lead to inefficiencies.

Questions?

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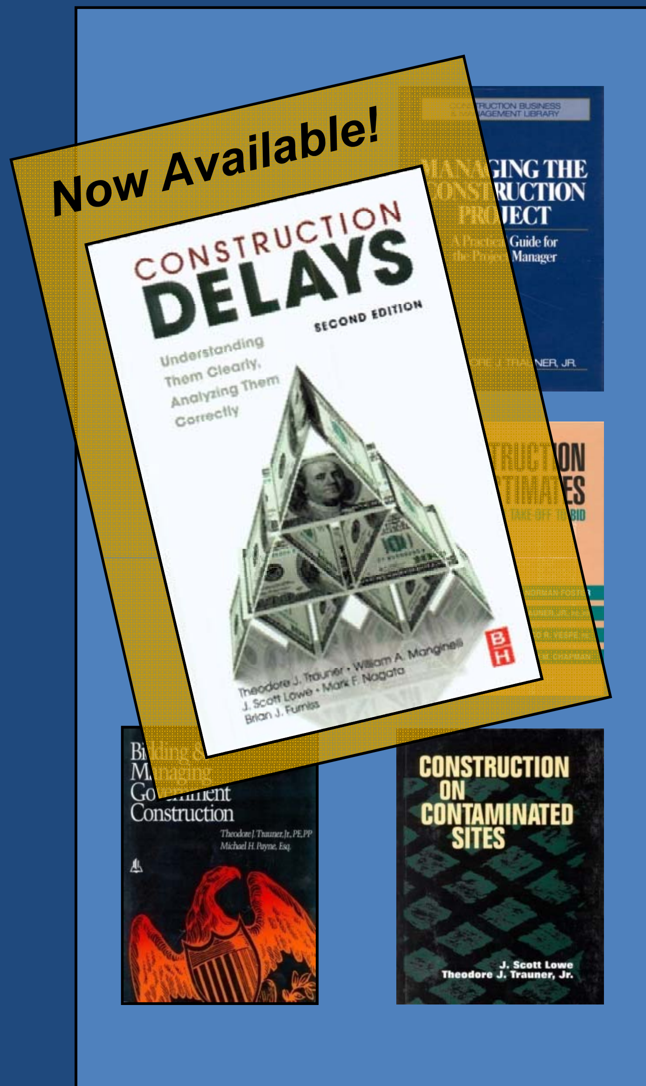

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