

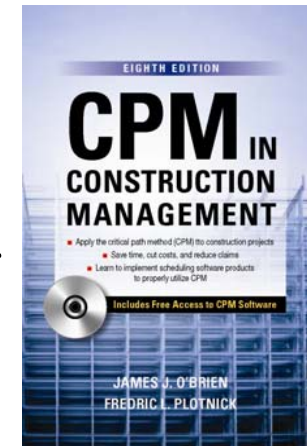
Plotnick on Analysis of Delay and Disruption

The industry bible, CPM in Construction Management by James J O'Brien and Fredric L Plotnick, describes a protocol for analysis of delay or disruption on a project. The methodology has been honed over the years to provide a result neutral analysis where opposing practitioners should obtain very similar findings on cause and quantum of delay, leaving to other experts and attorneys to argue responsibility. Published, peer reviewed repeatedly, updated based upon peer review comments, and cited in many specifications, this protocol is a gold standard for preparation, presentation and review of a claim. Come to this session to walk through the methodology.

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Two Days with Fred

- **Presented by Fredric L. Plotnick, Ph.D., Esq., P.E.**
- BSCE Geotechnical - Drexel 1975 • MSCE Construction Mgmt - Drexel 1977
- JD Law - Widener 1980 • PhD Civil Engineering - Drexel 2008
- Focusing Upon Legal and Technical Aspects of Project Controls
- Founder and host of Construction CPM Conference
- Teaching – Drexel U – U of P – Temple U
- City of Philadelphia – Bechtel – Hill – IUUCS – Fuller
- EnProMaC 1983 – present
- USN Guideline Specification, 1986
- CPM in Construction Management, 5th, 6th, 7th, 8th
- Contracts and the Legal Environment for Engineers and Architects, 7th
- PSPE, ASCE, AACEi, PMICOS, PMICPM, ...
- ABA•FC, PBA, NJSBA, ...
- also enjoys fishing

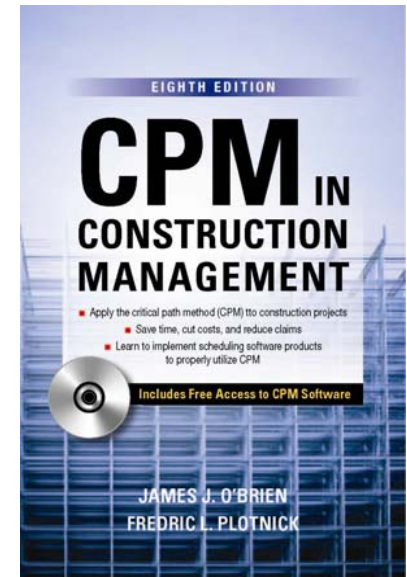
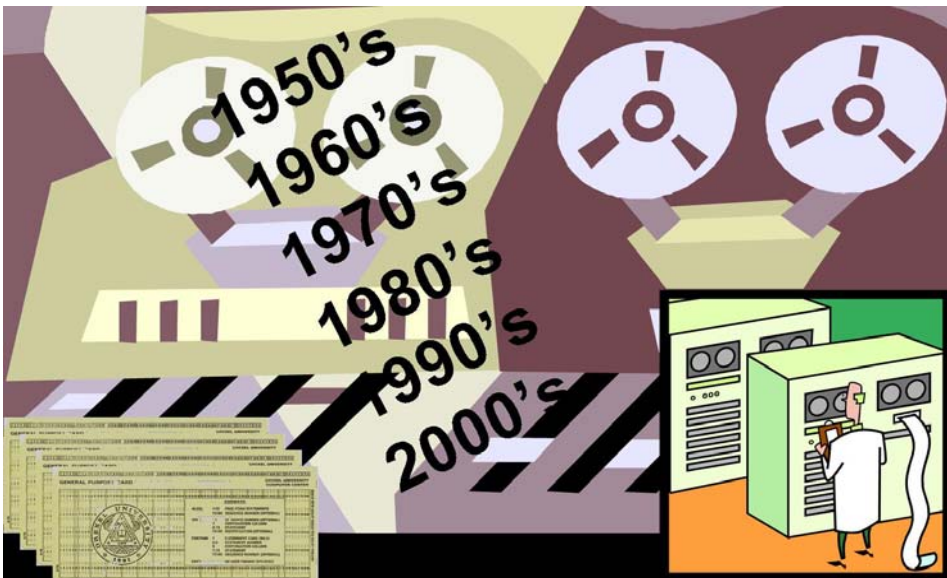
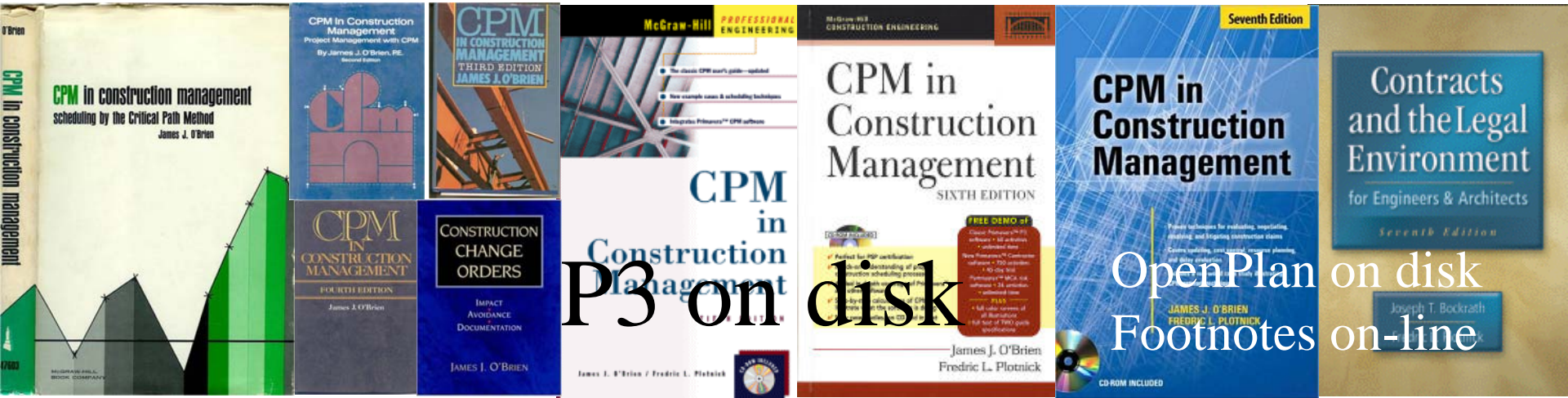


Chapter 33

Delay Analysis

The principal dimension measured by schedules is time. And when a project is not completed on time, it is the CPM logic plan and calculated schedule that must be used to measure delay. In the past, delays in construction used to be a mutually accepted condition. Courts, on occasion, even recognized that delay was a normal situation in the construction process. Today, however, delay is a very problematic area because owners have tighter budgets and contractors who stay on a job longer than planned incur real costs.

from the 1950s to today



- How reliable is CPM to establish a claim of delay or disruption?
- Claims before CPM
- Claims after CPM
- Current State-of-the-Art
- Frye v Daubert
- Intrinsic Unreliability of CPM
- Daubert **II**
- Robinson Factor Analysis
- Analytical Gap Test



Prospective Time Impact Evaluation



- A “What If” Scenario – Looking Forward
- Starting from NOW – Using most recent PROPER update
- As-Planned Logic – plus APPROVED revisions – plus AS AF RD to date
- What if contemporaneous update is not proper?
- Known & significant prior Causative Events and Factors now in play
- Significant anticipated Causative Events and Factors to be considered
- Choice of network activity impacted – most difficult step of this process
- Estimating durations of impacted old and necessary new activities
- Run calculation – does it match intuition?
- Zero-out backward pass – concurrency?
- Run risk calculation – check for alternate critical paths
- Support documentation for assignment of responsibility





Retrospective Time Impact Evaluation

- An “Archeological Dig” – Looking Backward
- Starting from initial As-Planned Logic – the anticipated road map
- Starting from reBaseline APPROVED revisions – signed CO – including TIME
- Compare to As-Built Schedule – if project not complete: AS AF RD to date
- Compare As-Built Schedule to contemporaneous updates
- ALL known & significant prior Causative Events and Factors
- Choice of network activity impacted – most difficult step of this process
- Recorded durations of impacted old and necessary new activities
- Run calculation – does it match intuition?
- Zero-out backward pass – concurrency?
- Run risk calculation – check for alternate critical paths
- Support documentation for assignment of responsibility

Preparing the TIE Analysis

- **As–Planned Logic Network**
 - Based upon thinking of contractor at/before NTP
 - Initially submitted CPM / Bar-chart / Contemporaneous
 - May require technical adjustments
 - Should NOT include knowledge post-NTP
- **As–Built Schedule**
 - As-Built DATES applied to As-Planned Logic Network
 - Based upon contemporaneous CPM – correct as reqd.
 - To be used for validation of TIE & for Windows analysis

Preparing the TIE Analysis

- **Causative Events**
 - All known events that MAY impact a network activity
 - *Look at contemporaneous “update” revisions for more
 - Avoid assigning responsibility / fault at this time
 - May include “added” activities between event / network
- **Choice of network activity impacted**
 - Most difficult step of this process
 - Compare As-Built dates to Event dates - reasonableness
 - Adjust choice as required

Preparing the TIE Analysis

- Calculate As-Impacted Schedule
 - Compare to As-Built Schedule
 - if $As-B > As-I$, have we missed a Event – or then why?
 - if $As-B < As-I$, need to adjust As-I logic – or acceleration?
 - Compare to As-Planned Schedule – Total delay to job
 - Last Event pushes Completion – but by how much?
- Zeroing Out Analysis
 - Trace Longest Path from job completion (or milestone)
 - Delete (or dissolve) Root Cause of Longest Path
 - Re-schedule – Repeat Process – Until Root = NTP



Retrospective Windows Evaluation

- An “Archeological Dig” – Looking Backward
- Starting from initial As-Planned Logic – the anticipated road map
- Starting from reBaseline APPROVED revisions – signed CO – including TIME
- Compare to As-Built Schedule – if project not complete: AS AF RD to date
- Compare As-Built Schedule to contemporaneous updates
- ALL known & significant prior Causative Events and Factors
- Choice of network activity impacted – most difficult step of this process
- Recorded durations of impacted old and necessary new activities
- Run calculation – does it match intuition?
- Zero-out backward pass – concurrency?
- Run risk calculation – check for alternate critical paths
- Support documentation for assignment of responsibility

Preparing Windows Analysis

- Choose Appropriate Windows of Time
 - To/From Selected Event dates from Zeroing-Out exercise
- Perform Windows Analysis
 - Copy As-Planned to Window #00
 - Add appropriate filters / views for graphic review
 - Copy Window #00 to Window #01
 - set Target to Window #00 to compare impact of THIS Window
 - Update all activities from As-B data up to data date
 - Add Events occurred (or started) prior to Data Date
 - Re-Calculate schedule – Compare to As-P & last Window
 - Repeat process to end of project

GL-W1 RW17 - Global Change

Title: Window Analysis - Calc Approx RD - part 1 of 2

Change Selection

Level 1 must meet All of the following criteria:
 Any

Selection criteria:

Select if	Is	Low Value	High Value
AS67 - Act Start UP67	LT	01FEB01	

Transfer... OK Cancel Help

GL-W1 RW17 - Global Change

Title: Window Analysis - Calc Approx RD - part 1 of 2

Change Selection

Selection criteria: Any All

Specifications:

	Data Item	Criteria	Data Item/Value	Operation	Data Item/Value
If:	AF67	LT	01FEB01		
or					
or					
Then:	AS	EQ	AS67		
	AF	EQ	AF67		
	RD	EQ	0		
Else:	AS	EQ	AS67		
	RD	EQ	AF67	-	01FEB01

Transfer... OK Cancel Help

Update to Window Data Date

GL-W2 RW17 - Global Change

Title: Window Analysis - Calc Approx RD - part 2 of 2

Change Selection

Level 1 must meet All of the following criteria:
 Any

Selection criteria:

Select if	Is	Low Value	High Value

Transfer... OK Cancel Help

GL-W2 RW17 - Global Change

Title: Window Analysis - Calc Approx RD - part 2 of 2

Change Selection

Selection criteria: Any All

Specifications:

	Data Item	Criteria	Data Item/Value	Operation	Data Item/Value
If:	RD	GT	0D		
or					
or					
Then:	RD	EQ	0D		
Else:					

Transfer... OK Cancel Help

Still approximate - may possibly improve - see last contemporaneous update submittal

Structure for database: C:ce7.dbf

Structure for database: C:im000701.dbf

Field	Field Name	Type	Width
1	ACT	Character	10
2	DWG1	Character	5
3	DWG2	Character	10
4	DWGREV	Character	1
5	SWO	Character	6
6	COR	Character	6
7	SA	Character	6
8	DATE1	Date	8
9	DATE2	Date	8
10	DATE3	Date	8
11	SADATE	Date	8
12	SAAMT	Character	14
13	AS67	Date	8
14	AF67	Date	8
15	CAL	Character	3
16	AD67	Numeric	5
17	ECON	Character	2
18	ECON1	Date	8
19	CON	Character	2
20	COND	Date	8
21	TITLE	Character	48
22	SUCS	Character	48
23	SUCS2CE	Character	10
24	IMPACTED	Character	10
25	SUCWHY	Character	48
26	STITLE	Character	48
27	SOD	Numeric	5
28	SAS	Date	8
29	SAF	Date	8
30	LOG1	Character	48
31	LOG2	Character	48
32	LOG3	Character	48
33	WINDOW	Character	6
** Total **			518

Field	Field Name	Type	Width
1	ACT	Character	10
2	CAL	Character	3
3	AD67	Character	5
4	AS67	Date	8
5	AF67	Date	8
6	ECON	Character	2
7	ECOND	Date	8
8	CON	Character	2
9	COND	Date	8
10	TITLE	Character	48
11	SUC	Character	10
12	REL	Character	2
13	LAG	Numeric	3
14	LOG1	Character	48
15	LOG2	Character	48
16	LOG3	Character	48
17	WINDOW	Character	6
** Total **			268

Structure for database: C:is000701.dbf

Field	Field Name	Type	Width
1	ACT	Character	10
2	SUC	Character	10
3	REL	Character	2
4	LAG	Numeric	4
5	WINDOW	Character	6
** Total **			33

Structure for database: C:ce7sucs.dbf

Field	Field Name	Type	Width
1	ACT	Character	10
2	SUC	Character	10
3	REL	Character	2
4	LAG	Numeric	4
5	STITLE	Character	48
6	SOD	Numeric	5
7	SAS	Date	8
8	SAF	Date	8
9	SUCWHY	Character	48
10	WINDOW	Character	6
** Total **			150

** Total **

518

** Total **

150

```

*im991031 - create files for input to windows
clear all
use ce7
index on act to ce7
sele 2
use ce7sucs
index on act to ce7sucs
sele 1
set rela to act into b
repl all window with ' ',b->>window with ' '
set filt to as67<ctod('11/01/1999') .and. af67<ctod('11/01/1999')
repl all window with '991031', b->>window with '991031'
* window#1 is CE's finished before 11/01/99, #2 for started & in-
progress on 11/01/99
set filt to as67<ctod('11/01/1999') .and. af67>ctod('11/01/1999')-1
repl all window with '991101', b->>window with '991101'
* window#3, etc. for CE's between each window chosen
set filt to as67>ctod('11/01/1999')-1 .and. as67<ctod('12/08/1999')
repl all window with '991208', b->>window with '991208'
set filt to as67>ctod('12/08/1999')-1 .and. as67<ctod('01/03/2000')
repl all window with '000103', b->>window with '000103'
set filt to as67>ctod('01/03/2000')-1 .and. as67<ctod('02/03/2000')
repl all window with '000203', b->>window with '000203'
set filt to as67>ctod('02/03/2000')-1 .and. as67<ctod('03/06/2000')
repl all window with '000306', b->>window with '000306'
set filt to as67>ctod('03/06/2000')-1 .and. as67<ctod('04/09/2000')
repl all window with '000409', b->>window with '000409'

...

set filt to as67>ctod('07/09/2001')-1 .and. as67<ctod('08/04/2001')
repl all window with '010804', b->>window with '010804'
set filt to as67>ctod('08/04/2001')-1 .and. as67<ctod('09/03/2001')
repl all window with '010903', b->>window with '010903'
set filt to as67>ctod('09/03/2001')-1 .and. as67<ctod('10/08/2001')
repl all window with '011008', b->>window with '011008'
*

```

```

sele 2
set index to
dele for act=' '
pack
sele 1
*
clear all
use im991030
zap
copy stru to im991031
copy stru to im991101
copy stru to im991208

...

copy stru to im010804
copy stru to im010903
copy stru to im011008
*
use is991030
zap
copy stru to is991031
copy stru to is991101
copy stru to is991208

...

copy stru to is010804
copy stru to is010903
copy stru to is011008
*copy stru to is001
*...
*

```

```

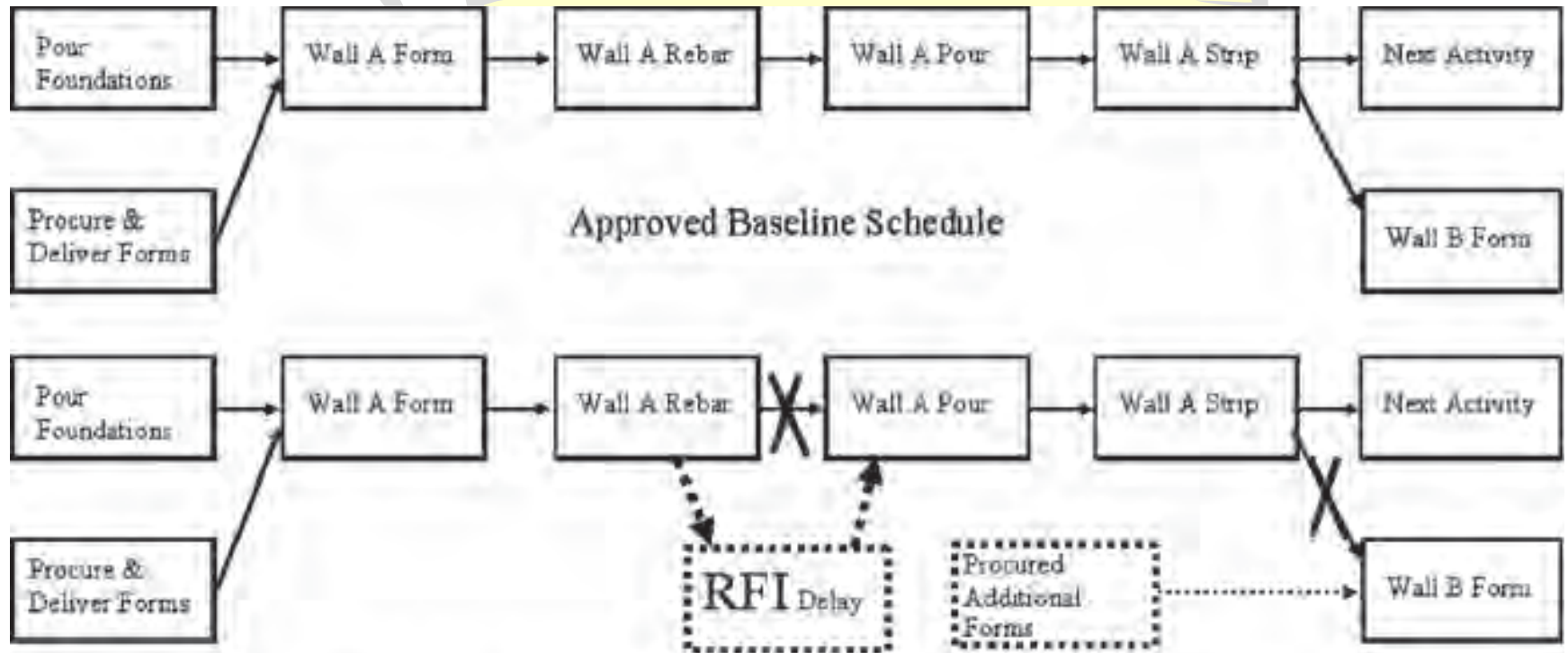
use im991031
appe from ce7 for window='991031'
use is991031
appe from ce7sucs for window='991031'
use im991101
appe from ce7 for window='991101'

...

use is010804
appe from ce7sucs for window='010804'
use im010903
appe from ce7 for window='010903'
use is010903
appe from ce7sucs for window='010903'
use im011008
appe from ce7 for window='011008'
use is011008
appe from ce7sucs for window='011008'
*...
use
Return

```

Not a Collapsed As-Built



“When was decision to procure additional forms made and why?”

Comparing Claims Analyses

CPM in Construction Management

v

AACE RP-29



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