

# CONSTRUCTION PROJECT DOCUMENTATION FOR EFFICIENT PROJECT CONTROL

by

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*McCullough & Associates*

*[www.mccullough-group.com](http://www.mccullough-group.com)*

# Goals

- ▣ Complete Project on time
- ▣ On budget
- ▣ With specified quality
- ▣ Avoid Claims

# How?

- ▣ Document your work
  - Schedule
  - Document changes to the plan – Change Proposals
- ▣ Examples
  - Monthly schedule narratives
  - Lessons Learned
  - Status Reports (cost and Schedule)
  - Correspondence
  - Daily Reports
  - Cost Reports

# Claims Avoidance

- ▣ Document well
  - Understand your obligations
  - Provide required notice
  - Document actual progress
  - Have a system set up to capture changes
    - ▣ Schedule
    - ▣ Budget
  - Show cause and effect
  - Team with best documents wins!

# Planning/Control Cycle

- ▣ 4 Step AGC Method
  - **Plan** - CPM schedule development
  - **Do** - Perform the work
  - **Compare** - planned schedule to actual performance
  - **Act** - Recovery plan or notice letter

# Schedule Example

- ▣ When there is a delay, how do you identify it and its impact?
  - Variance from plan
  - Impact to Critical Path

# What are Critical Activities?

- ▣ Activities with direct impact to the completion date
- ▣ Critical - “the logical sequence of activities with the least TF or the longest path of an unconstrained project”
- ▣ May or may not be logically tied together

# Critical Path

- ▣ Technical Definition
  - Least float path
  - The longest path through the project
- ▣ Implied Meaning
  - The path of activities that delayed the project
  - In reality, does not necessarily represent a logical driven path through the network



# Managing the Schedule (During Construction)

- ▣ Goal - compare current progress to plan to see if slippage occurred
  - Step 1 - run update
  - Step 2 - compare updated schedule to previous schedule
  - Step 3 - determine who is responsible for slippage

## Step 2 - Three Stages

- ▣ Compare critical path from previous update to current status
- ▣ Compare new critical path from current update to status in previous update
- ▣ Evaluate these two comparisons

# Analyzing Completed Project (After the Fact)

- ▣ What delayed the project?
  - Courts specify only delay to critical path cause time extensions and costs
- ▣ Evaluate Critical Delays on completed projects similar to projects in progress
- ▣ No shortcuts on completed projects

# Process

- ▣ Phase 1 - Identify critical path from previous update and track its as-built status
- ▣ Phase 2 - Identifying activities currently on critical path and track progress for the update period
- ▣ Phase 3 - Compare steps 1 and 2
  - Evaluate shift in critical path

# Phase 1

## Previous Critical Path

- ▣ See how activities on forecasted critical path actually performed during update period
  - Previous month's critical path
    - ▣ Exhibit 1

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish	Total Float	2005												
						2004 DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP			
DD 1 1500	Structural Stucs/Sneating - to Roof	8	12JAN05A	21JAN05	0													
DD 0 1650	Brick/CMU Walls	25	24JAN05	25FEB05	0													
DD 0 1700	StoreFront / Windows	14	15FEB05	04MAR05	0													
DD 0 3150	Drywall One Side - 1st Floor	7	24FEB05	04MAR05	0													
DD 0 9500	Building Dry	0		04MAR05	0													
DD 0 3100	Cover Up Inspections - 1st Floor	5	07MAR05	11MAR05	0													
DD 0 3200	Drywall Second Side - 1st Floor	7	14MAR05	22MAR05	0													
DD 0 3250	Tape & Bed - 1st Floor	10	23MAR05	05APR05	0													
DD 1 3250	Tape & Bed - 2nd Floor	10	06APR05	19APR05	0													
DD 1 3300	Prime One Coat Paint - 2nd Floor	5	20APR05	26APR05	0													
DD 1 4050	Ceiling Grid - 2nd Floor	7	27APR05	05MAY05	0													
DD 1 4150	Fire Sprinkler Heads - 2nd Floor	7	04MAY05	12MAY05	0													
DD 1 4250	Ceiling Inspections - 2nd Floor	5	13MAY05	19MAY05	0													
DD 1 4300	Ceiling Tiles - 2nd Floor	5	20MAY05	26MAY05	0													
DD 1 4400	Flooring - 2nd Floor	5	27MAY05	02JUN05	0													

Start Date 01JUN04  
 Finish Date 12AUG05  
 Data Date 14JAN05

CPY  
 to Critical

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Sheet 1 of 2



# Phase 1

## Previous Critical Path

- ▣ See how activities on forecasted critical path actually performed during update period
  - Current month's critical path
    - ▣ Exhibit 2



Activity ID	Activity Description	Orig Dur	Early Start	Early Finish	Total Float	2005												
						JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP				
DC 0 2150	Electrical Rough In - 1st Floor	15	09FEB05A	01 MAR05	0													
DC 1 2150	Electrical Rough In - 2nd Floor	10	02MAR05	15MAR05	0													
DC 1 3100	Cover Up Inspections - 2nd Floor	5	16MAR05	22MAR05	0													
DC 1 3200	Drywall Second Side - 2nd Floor	7	23MAR05	31 MAR05	0													
DC 1 3250	Tape & Bed - 2nd Floor	10	01APR05	14APR05	0													
DC 1 3300	Prime One Coat Paint - 2nd Floor	5	15APR05	21APR05	0													
DC 1 4000	Ceiling Grid - 2nd Floor	7	22APR05	02MAY05	0													
DC 1 4100	Fire Sprinkler Heads - 2nd Floor	7	29APR05	09MAY05	0													
DC 1 4250	Ceiling Inspections - 2nd Floor	5	10MAY05	16MAY05	0													
DC 1 4300	Ceiling Tiles - 2nd Floor	5	17MAY05	23MAY05	0													
DC 1 4400	Flooring - 2nd Floor	5	24MAY05	30MAY05	0													
DC 1 4650	Folding Partitions - 2nd Floor	7	31MAY05	08JUN05	0													
DC 1 4750	Doors & Hardware - 2nd Floor	7	31MAY05	08JUN05	0													
DC 0 5000	Clean & Contractor Punch	5	09JUN05	15JUN05	0													
PM C 9000	Division C - Ready for Walkthru and Punch	0		15JUN05	0													
DC 0 9900	Ready for Owner Walkthru and Punch	0	16JUN05		0													
DC 0 6000	Final Punchlist Work	5	17JUN05	23JUN05	0													
DD 0 6000	Final Punchlist Work	5	24JUN05	30JUN05	0													
PM T 9000	Project Substantial Completion	0		30JUN05	0													
TO 0 9000	PROJECT SUBSTANTIAL COMPLETION	0		30JUN05	0													
TO 0 1300	CLOSEOUT PHASE	30	01JUL05	12AUG05	0													
TO 0 9900	Project Final Completion	0		12AUG05	0													

Note:  
This is a new set of activities on the critical path.

Update Period

Start Date 01JUN04  
Finish Date 12AUG05  
Data Date 11FEB05

Legend  
MS - Project Critical Path

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Sheet 1 of 1

- Early Bar
- Progress Bar
- Critical Activity

School Construction Project  
This Months Critical Path

Exhibit 2



# Phase 1

## Previous Critical Path

- ▣ See how activities on forecasted critical path actually performed during update period
  - Last month's critical path with Target
    - ▣ Exhibit 3

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish	TF	ES Prev. Month	EF Prev. Month	Start Var.	Final Var.	TF ev. Month	2004												
											DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP			
<b>Last Month Critical Path</b>												<b>Phase 1 Activities</b>											
DD 1 1500	Structural Studs/Sheathing - to Roof	8	12JAN05A	21JAN05A		12JAN05A	21JAN05	0	0	0													
DD 0 1650	Brick/CMU Walls	25	24JAN05A	24FEB05	1	24JAN05	25FEB05	0	1	0													
DD 0 1700	StoreFront / Windows	14	14FEB05	03MAR05	1	15FEB05	04MAR05	1	1	0													
DD 0 9500	Building Dry	0		03MAR05	1		04MAR05	1	1	0													
<b>Critical Path</b>												<b>Phase 2 Activities</b>											
DD 0 2050	HVAC Rough In - 1st Floor	9	29DEC04A	17JAN05A		29DEC04A	17JAN05	0	0	2													
DC 0 2050	HVAC Rough In - 1st Floor	9	20JAN05A	01FEB05A		18JAN05	28JAN05	-2	-2	2													
DC 0 3000	Interior Wall Framing - 1st Floor	15	02FEB05A	21FEB05	1	31JAN05	18FEB05	-2	-1	2													
DC 0 2150	Electrical Rough In - 1st Floor	15	09FEB05A	01MAR05	0	07FEB05	25FEB05	-2	-2	2													
DC 1 2150	Electrical Rough In - 2nd Floor	10	02MAR05	15MAR05	0	28FEB05	11MAR05	-2	-2	2													
DC 1 3100	Cover Up Inspections - 2nd Floor	5	16MAR05	22MAR05	0	14MAR05	18MAR05	-2	-2	2													
DC 1 3200	Drywall Second Side - 2nd Floor	7	23MAR05	31MAR05	0	21MAR05	29MAR05	-2	-2	2													
DC 1 3250	Tape & Bed - 2nd Floor	10	01APR05	14APR05	0	30MAR05	12APR05	-2	-2	2													
DC 1 3300	Prime One Coat Paint - 2nd Floor	5	15APR05	21APR05	0	13APR05	19APR05	-2	-2	2													
DC 1 4000	Ceiling Grid - 2nd Floor	7	22APR05	02MAY05	0	20APR05	28APR05	-2	-2	2													
DC 1 4100	Fire Sprinkler Heads - 2nd Floor	7	29APR05	09MAY05	0	27APR05	05MAY05	-2	-2	2													
DC 1 4250	Ceiling Inspections - 2nd Floor	5	10MAY05	16MAY05	0	06MAY05	12MAY05	-2	-2	2													
DC 1 4300	Ceiling Tiles - 2nd Floor	5	17MAY05	23MAY05	0	13MAY05	19MAY05	-2	-2	2													
DC 1 4400	Flooring - 2nd Floor	5	24MAY05	30MAY05	0	20MAY05	26MAY05	-2	-2	2													
DC 1 4650	Folding Partitions - 2nd Floor	7	31MAY05	06JUN05	0	27MAY05	06JUN05	-2	-2	2													
DC 1 4750	Doors & Hardware - 2nd Floor	7	31MAY05	06JUN05	0	27MAY05	06JUN05	-2	-2	2													
DC 0 5000	Clean & Contractor Punch	5	09JUN05	15JUN05	0	07JUN05	13JUN05	-2	-2	2													

Activity DD 1 1050 started on time, finished on time.

Activity DD 1 1650 started on time, as of data date is finishing 1 day early.

Start Date 01JUN04  
 Finish Date 12AUG05  
 Data Date 11FEB05

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Sheet 1 of 2  
 Legend:  
 Early Bar (Green)  
 Target Bar - Previous Month (Grey)  
 Progress Bar (Blue)  
 (Red bar)

Critical Paths  
 This Month and Previous Months with Target to last Month

Exhibit 3

# Phase 2

## Current Critical Path

- ▣ Compare progress
  - Current schedule update
    - ▣ Exhibit 4
    - ▣ Critical path has shifted

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish	TF	ES Prev. Month	EF Prev. Month	Start Var.	Finish Var.	TF, ev. Mon	2005												
											DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP			
<b>Last Month Critical Path</b>												<b>Phase 1 Activities</b>											
DD 1 1500	Structural Studs/Sheating - to Roof	8	12JAN05A	21JAN05A		12JAN05A	21JAN05	0	0	0													
DD 0 1650	Brick/CMU Walls	25	24JAN05A	24FEB05	1	24JAN05	25FEB05	0	1	0													
DD 0 1700	StoreFront / Windows	14	14FEB05	03MAR05	1	15FEB05	04MAR05	1	1	0													
DD 0 9500	Building Dry	0		03MAR05	1		04MAR05	1	1	0													
<b>Critical Path</b>												<b>Phase 2 Activities</b>											
DD 0 2050	HVAC Rough In - 1st Floor	9	29DEC04A	17JAN05A		29DEC04A	17JAN05	0	0	2													
DC 0 2050	HVAC Rough In - 1st Floor	9	20JAN05A	01FEB05A		18JAN05	28JAN05	-2	-2	2													
DC 0 3000	Interior Wall Framing - 1st Floor	15	02FEB05A	21FEB05	1	31JAN05	18FEB05	-2	-1	2													
DC 0 2150	Electrical Rough In - 1st Floor	15	06FEB05A	01MAR05	0	07FEB05	25FEB05	-2	-2	2													
DC 1 2150	Electrical Rough In - 2nd Floor	10	02MAR05	15MAR05	0	28FEB05	11MAR05	-2	-2	2													
DC 1 3100	Cover Up Inspections - 2nd Floor	5	16MAR05	22MAR05	0	14MAR05	18MAR05	-2	-2	2													
DC 1 3200	Drywall Second Side - 2nd Floor	7	23MAR05	31MAR05	0	21MAR05	29MAR05	-2	-2	2													
DC 1 3250	Tape & Bed - 2nd Floor	10	01APR05	14APR05	0	30MAR05	12APR05	-2	-2	2													
DC 1 3300	Prime One Coat Paint - 2nd Floor	5	15APR05	21APR05	0	13APR05	19APR05	-2	-2	2													
DC 1 4000	Ceiling Grid - 2nd Floor	7	22APR05	02MAY05	0	20APR05	28APR05	-2	-2	2													
DC 1 4100	Fire Sprinkler Heads - 2nd Floor	7	29APR05	09MAY05	0	27APR05	05MAY05	-2	-2	2													
DC 1 4250	Ceiling Inspections - 2nd Floor	5	10MAY05	16MAY05	0	06MAY05	12MAY05	-2	-2	2													
DC 1 4300	Ceiling Tiles - 2nd Floor	5	17MAY05	23MAY05	0	13MAY05	19MAY05	-2	-2	2													
DC 1 4400	Flooring - 2nd Floor	5	24MAY05	30MAY05	0	20MAY05	26MAY05	-2	-2	2													
DC 1 4650	Folding Partitions - 2nd Floor	7	31MAY05	06JUN05	0	27MAY05	06JUN05	-2	-2	2													
DC 1 4750	Doors & Hardware - 2nd Floor	7	31MAY05	06JUN05	0	27MAY05	06JUN05	-2	-2	2													
DC 0 5000	Clean & Contractor Punch	5	09JUN05	15JUN05	0	07JUN05	13JUN05	-2	-2	2													

Activity DD 0 2050 started on time, finished on time.

Activity DC 0 2050 started and finished 2 days late.

Activity DC 0 3000 started 2 days late but, as of the data date, is finishing only 1 day late.

Activity DC 0 2150 started and finished 2 days late.

Start Date 01JUN04  
 Finish Date 12AUG05  
 Data Date 11FEB05

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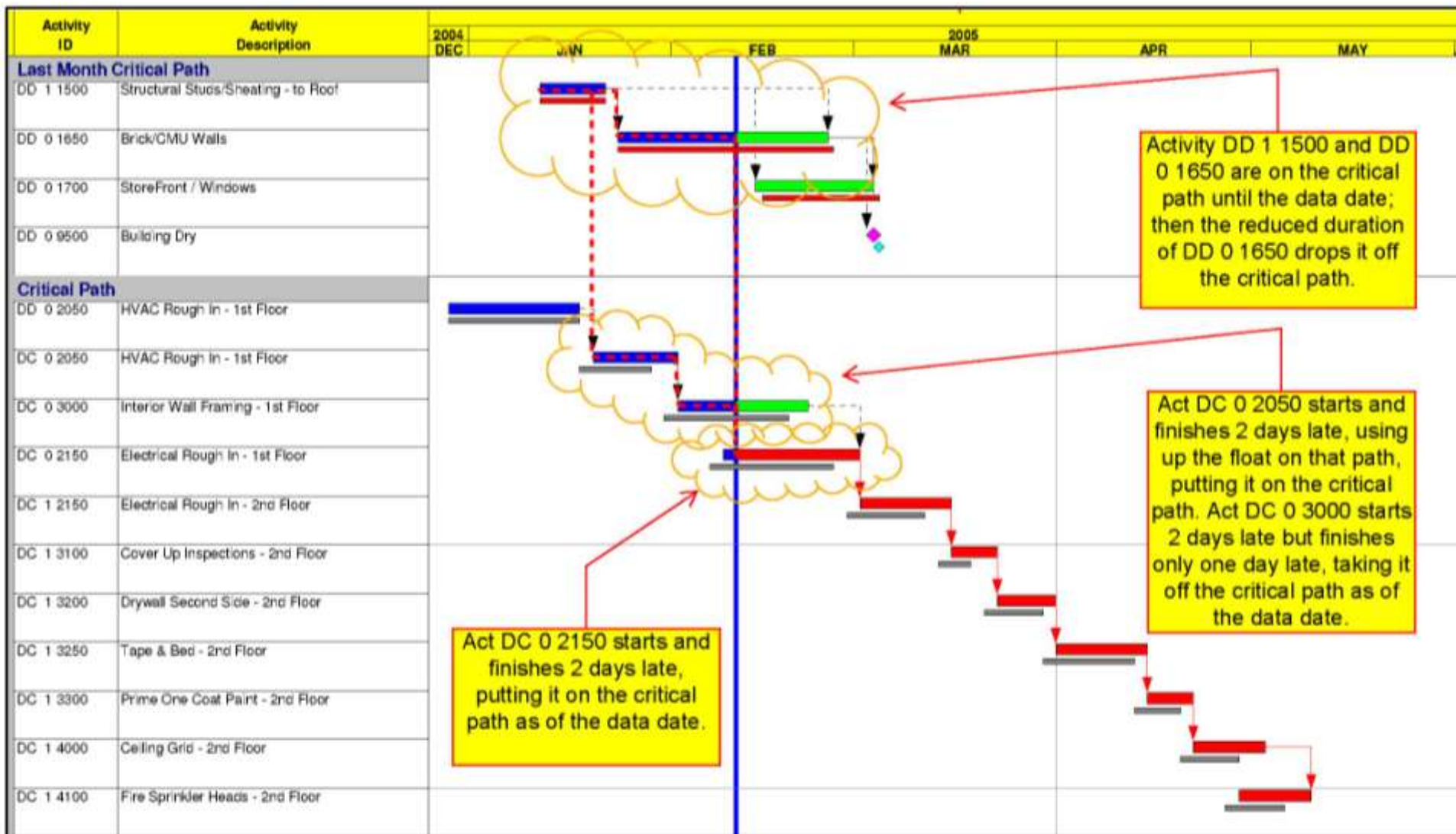
Sheet 1 of 2  
 Legend:  
 Early Bar (Green)  
 Target Bar - Previous Month (Grey)  
 Progress Bar (Blue)  
 (Red bar)

# Phase 3

## Comparing Evaluations

- ▣ Compare results from Phase 1 and 2
  - Establish when and where critical path shifted from previous to current path
    - ▣ When activities are delayed beyond float then path shifts to new path
    - ▣ May not occur through logic tie
    - ▣ Exhibit 5





Start Date 01JUN04  
 Finish Date 12AUG05  
 Data Date 11FEB05

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Critical Paths  
 This Month and Previous Months with Target to last Month

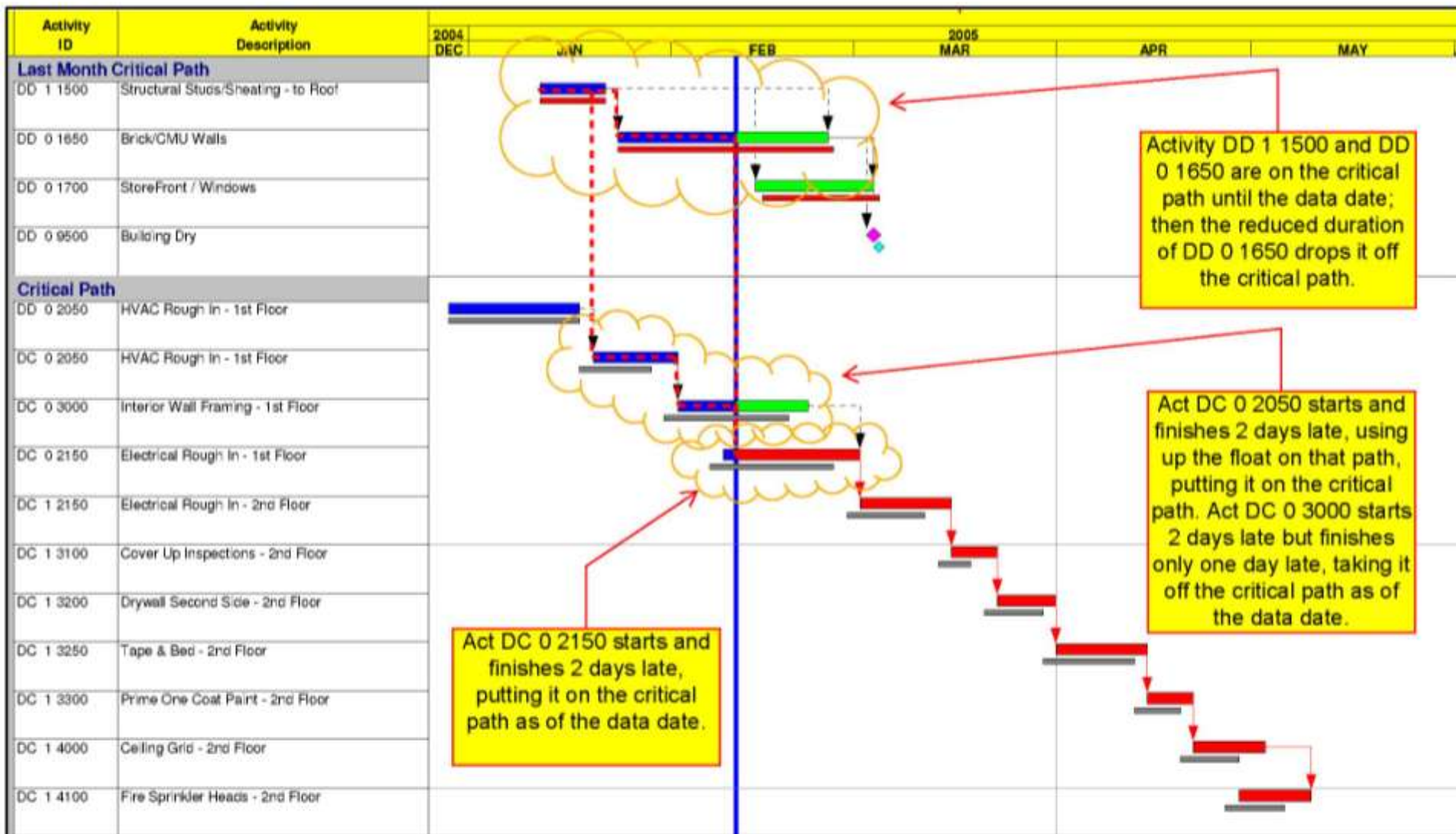
Sheet 1 of 1

Legend:  
 Early Bar  
 Target Bar - Previous Month  
 Progress Bar  
 Critical Path Bar

**Exhibit 5**

# Documenting Results

- ▣ To be effective, analysis must be effectively documented and communicated
  - Graphical representation of last months critical path activities and current critical path from current update compared to target with overlaid notes to show shift works well
    - ▣ Exhibit 5
    - ▣ Exhibit 6



Start Date 01JUN04  
 Finish Date 12AUG05  
 Data Date 11FEB05

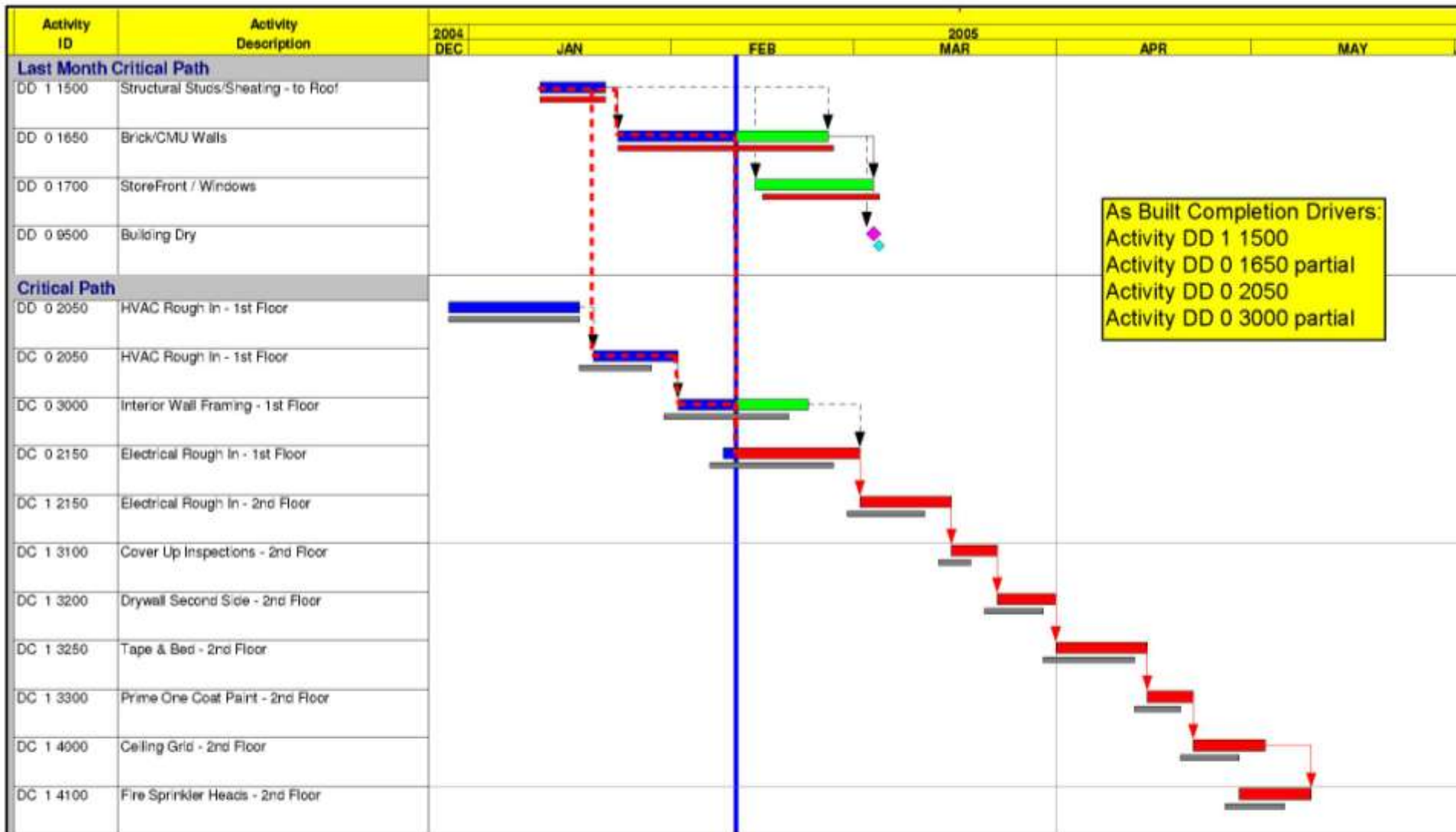
© Primavera Systems, Inc. Using the Release Date/Target and Plan CP icons  
**McCullough & Associates**  
 &  
**Milestone Consultants, Inc**

Sheet 1 of 1  
 Legend:  
 [Green Bar] Early Bar  
 [Grey Bar] Target Bar - Previous Month  
 [Blue Bar] Progress Bar  
 [Red Bar] Critical Path

**Critical Paths**  
 This Month and Previous Months with Target to last Month

**Exhibit 5**





Start Date 01JUN04  
 Finish Date 12AUG05  
 Data Date 11FEB05

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U:\mg...  
 Target and Prev. CP from

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Sheet 1 of 1

**Critical Paths  
 This Month and Previous Months with Target to last Month**

Early Bar  
 Target Bar - Previous Month  
 Progress Bar  
 ...

**Exhibit 6**

# USING THE ANALYSIS

# So What's the point?

- ▣ During Construction - to use this information practically and effectively you must ACT!
  - 1 - If analysis shows no impact, inform project team and work should be completed on time
  - 2 - If delays occur, decide who is responsible
    - ▣ If contractor responsible, identify reasons and correct delay
    - ▣ If owner responsible, identify reasons and acquire time extension
  - 3 - Analysis is used to confirm delay request or recovery plan

# Using ABCD to Document Delay

- ▣ Claim analysis - after the fact
  - Identifies the activities that drove the completion date of the Project
  - Allows correlation between delay events and schedule impact
  - Provides a solid basis for entitlement for delays

# Example Project

# PIPING INSTALLATION DURATION

**Schedule SA00 7/1/98**  
**14 MONTHS**  
**CONTRACT SCHEDULE**

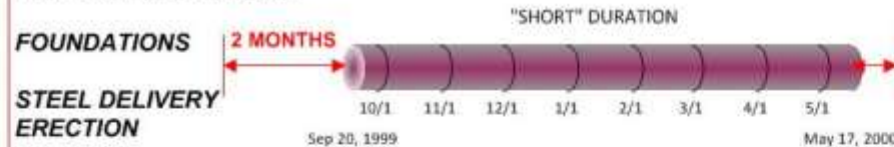


**Schedule AN07 7/1/98**  
**7 MONTHS**  
**EARLY COMPLETION SCHEDULE**  
**JANUARY 1999**



*FD DELAYS,*  
*MANILA ENGINEERING*  
*SUBCONTRACT AWARD*

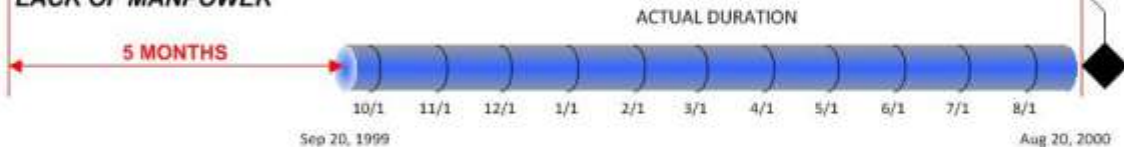
**Schedule AN35 11/27/99**  
**8 MONTHS**  
**NEW BASELINE SCHEDULE**



*FOUNDATIONS*  
*STEEL DELIVERY*  
*ERECTION*

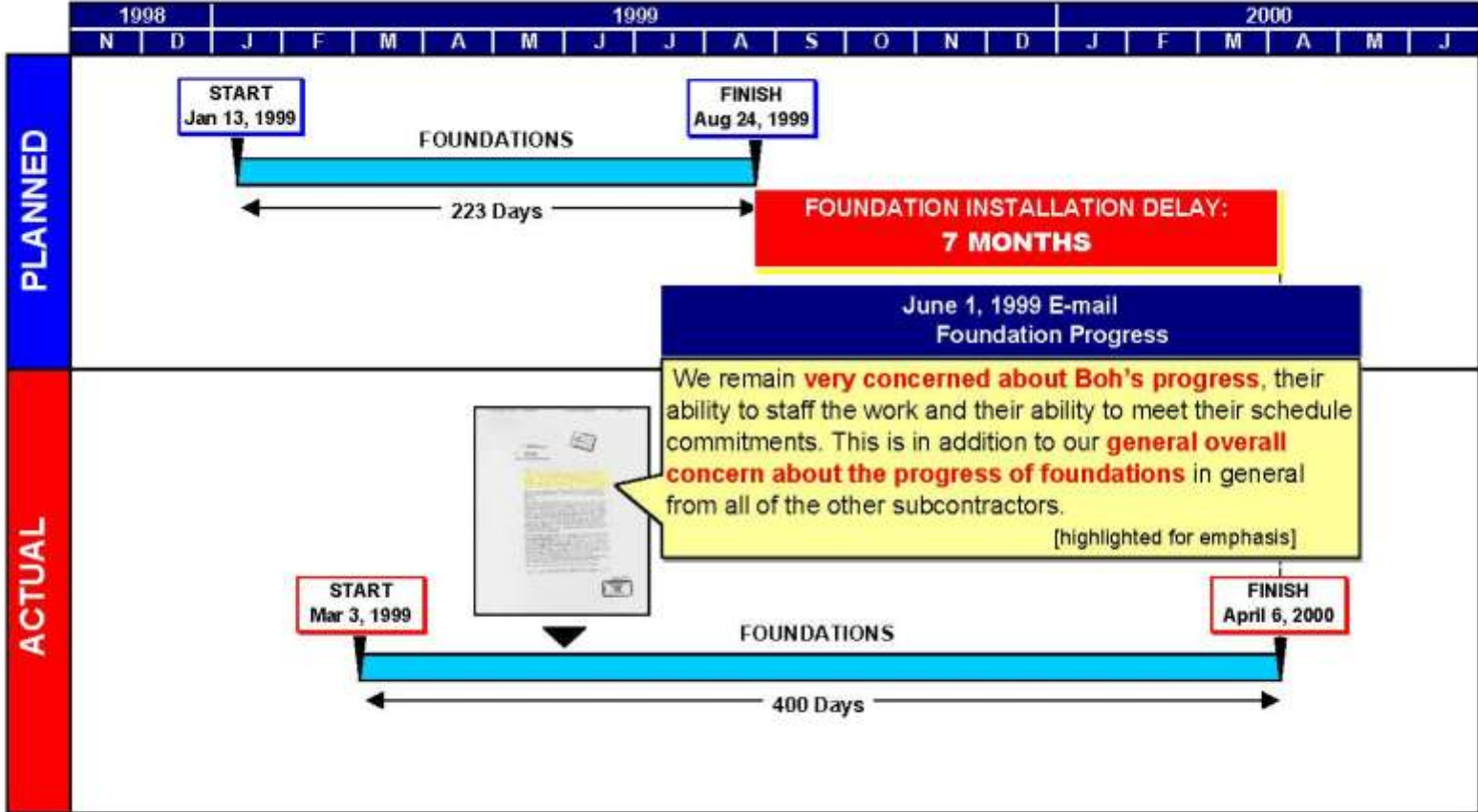
*FAB/DELIVER PIPE*  
*LACK OF MANPOWER*

**Schedule ANX1 10/5/00**  
**11 MONTHS**  
**AS-BUILT SCHEDULE**



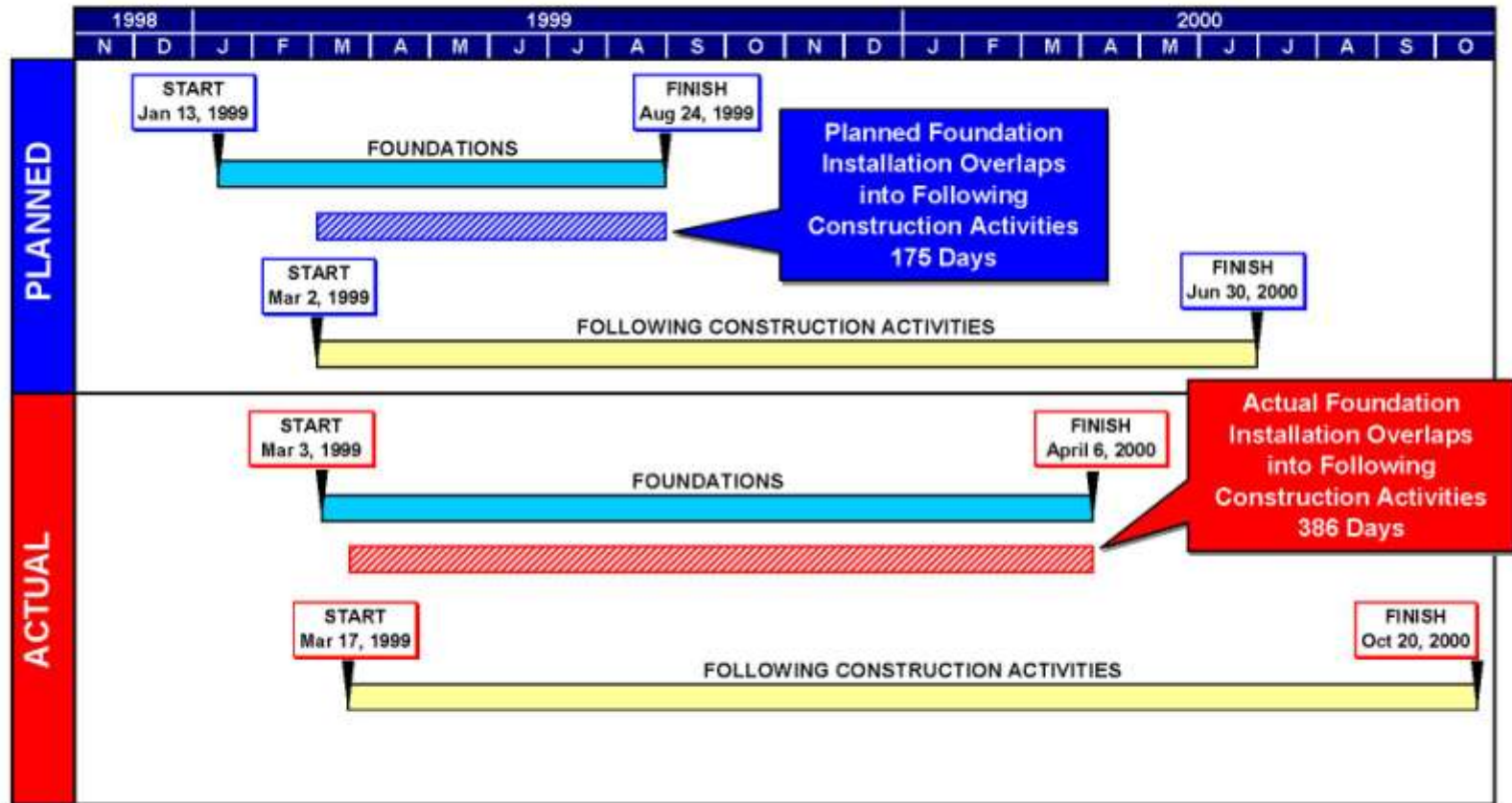
# ACRYLONITRILE PROJECT

# Late Start and Late Finish of Foundation Installation





## Late Foundation Installation Pushed Further into Following Activities than Originally Planned





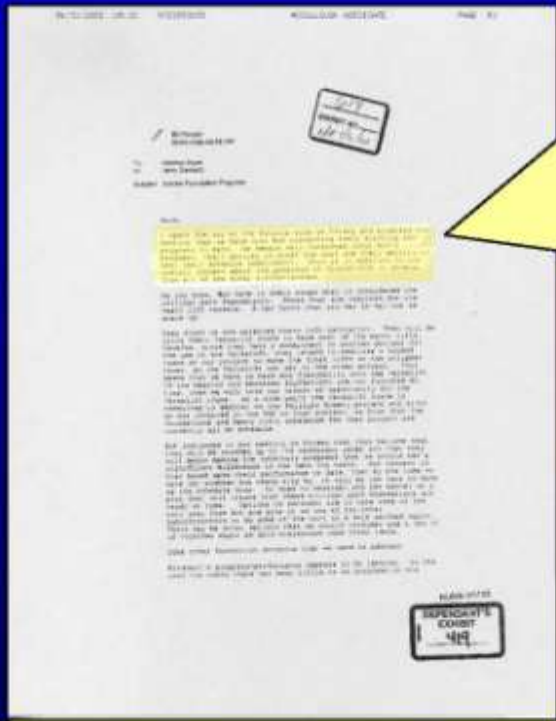
# Late

# Construction

## Late Foundation Installation

June 1, 1999 E-mail

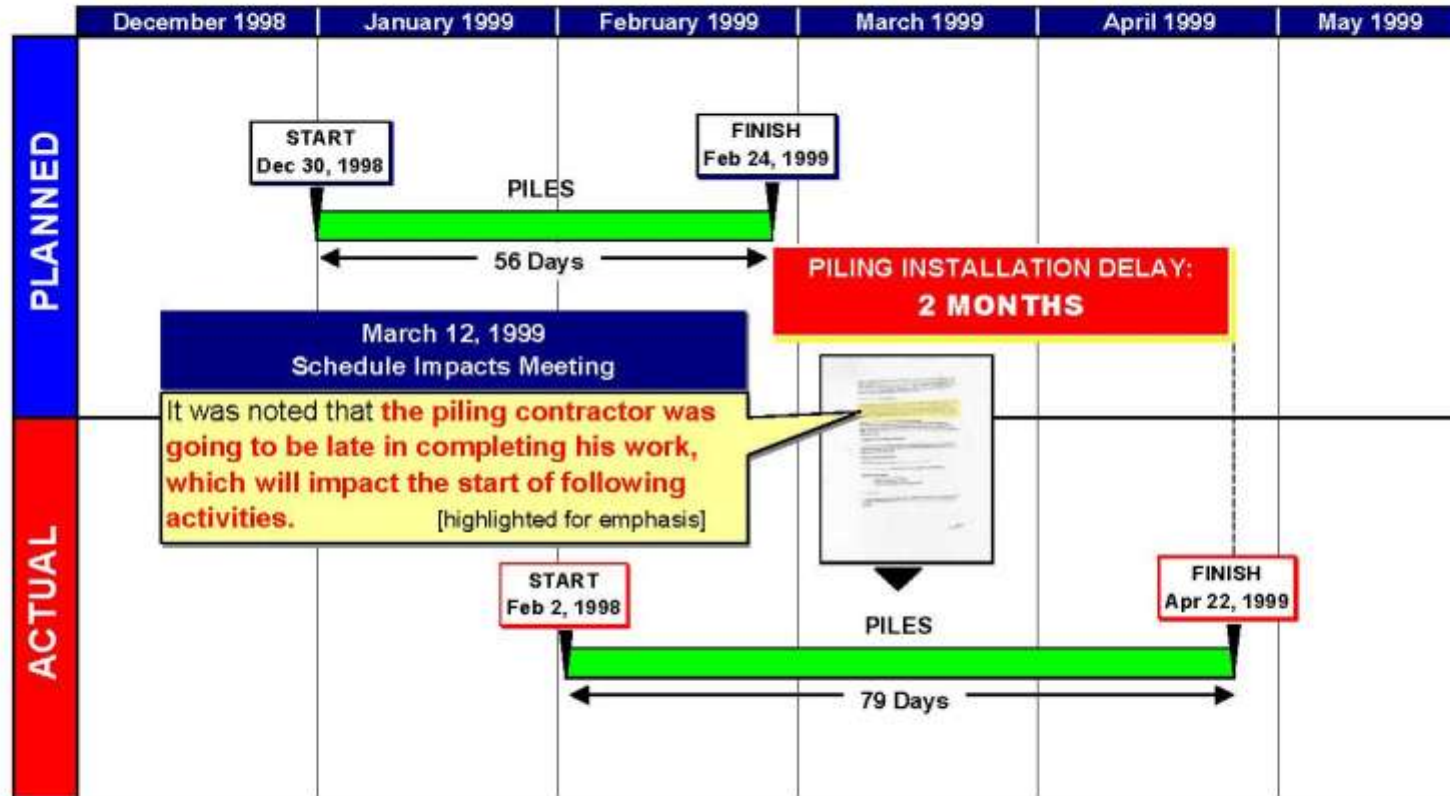
Foundation Progress



I spent the day on the \_\_\_\_\_ site on Friday and attended the meeting that we held with Boh concerning their staffing and progress to date. **We remain very concerned about Boh's progress, their ability to staff the work and their ability to meet their schedule commitments. This is in addition to our general overall concern about the progress of foundations in general from all of the other subcontractors.**

*[highlighted for emphasis]*

## Late Start and Late Finish of Piling Installation

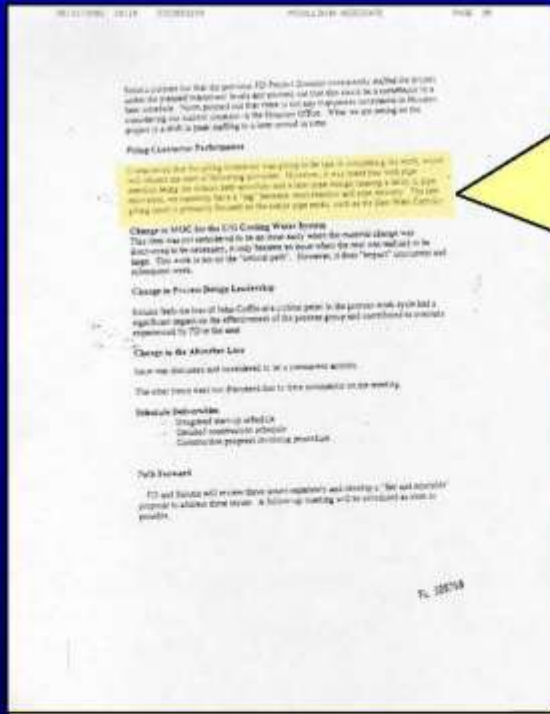


# Late

# Construction

## Late Piling Installation

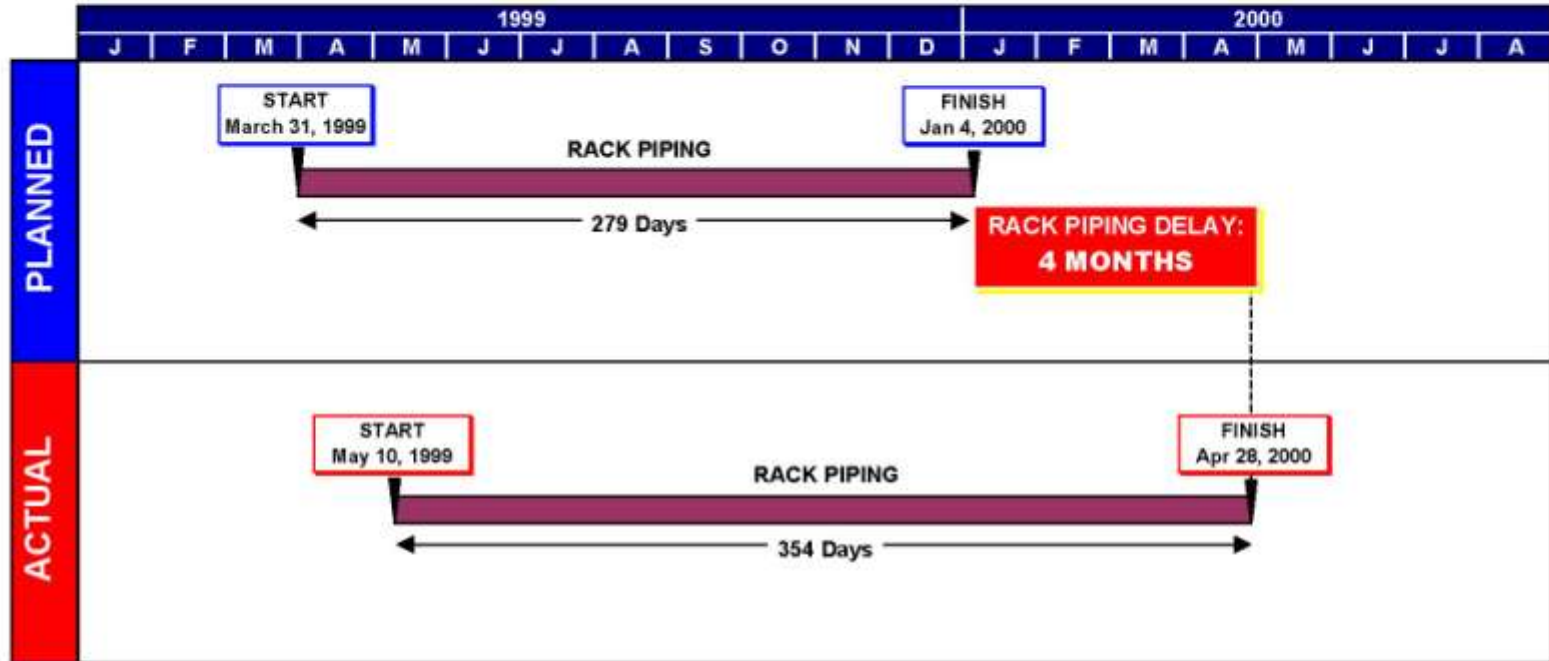
March 12, 1999  
Schedule Impacts Meeting



It was noted that **the piling contractor was going to be late in completing his work, which will impact the start of following activities.** However, it was noted that with pipe erection being the critical path activities and a later pipe design causing a delay in pipe deliveries, we currently have a "lag" between steel erection and pipe delivery. **The late piling issue is primarily focused on the major pipe racks, such as the East-West Corridor.**

*[highlighted for emphasis]*

# Late Start and Late Finish of Rack Piping Installation



# Late Start and Late Finish of Steel Erection

