

Virtual Building in Lean Project
Delivery Process

Panel Presentations
Lean Construction Institute
Design Forum
Berkeley, December 8, 2005



What we learned during the MEP/FP Coordination on the Camino Medical Group MOB Using 3D/4D Tools and Lean Project Delivery Process

Atul Khanzode, DPR Construction, Inc.
Dean Reed, DPR Construction, Inc.
John Mack, Southland Industries

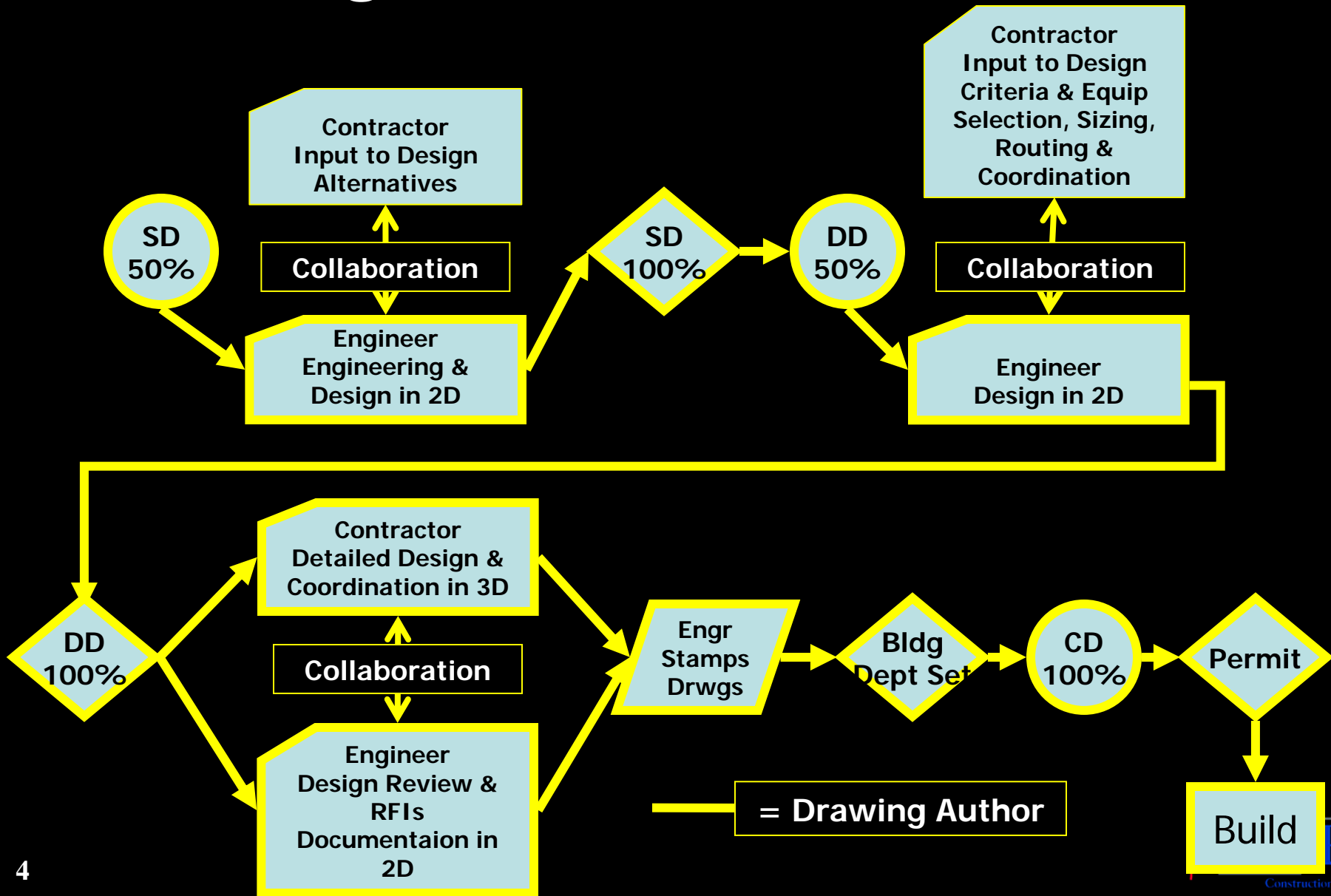
Objectives

- Share Lessons Learned from the MEP / FP Coordination Process using 3D / 4D Tools on the Camino MOB
- Provide Specific Examples of the Clash Detection and Resolution Process
- Identify Opportunities for Improvement in the process

MEP / FP Coordination Process for Camino MOB

1. How we defined the MEP/FP Design Collaboration process?
2. How we implemented the Design to Engineering handoffs?
3. How we performed coordination and resolved conflicts using 3D tools?
4. Lessons we learned by Pulling design coordination from construction?
5. When we do this again...?

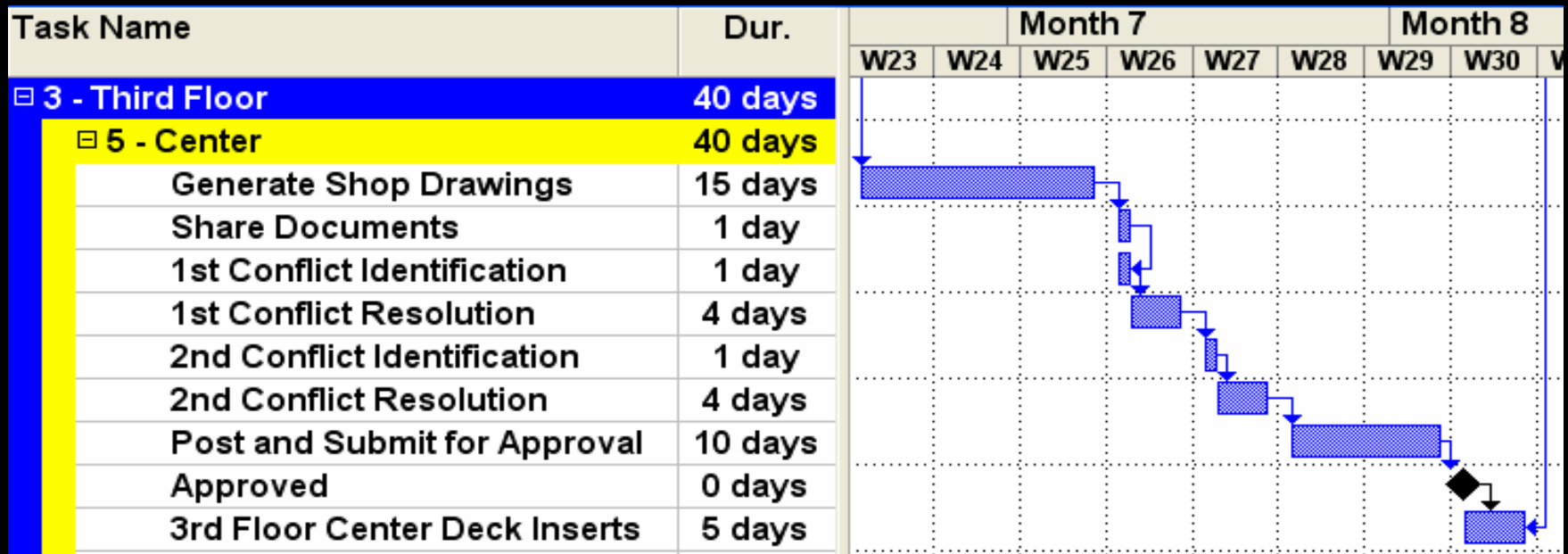
MEP Design Collaboration Process



Design to Engineering Process

1. Created a Pull schedule for Engineering and Design based on construction schedule
2. Agreed to work by quadrants to match the construction schedule
3. Worked backwards to determine the completion date milestone for Engineering and Design
4. Used Navisworks to identify and resolve conflicts

3D Coordination Drawings Pulled from Construction Schedule



A screenshot of the Pull Design Schedule By Quadrant for the Camino MOB MEP / FP Coordination process using Lean process and 3D / 4D tools. Coordination is driven by Insert Schedule

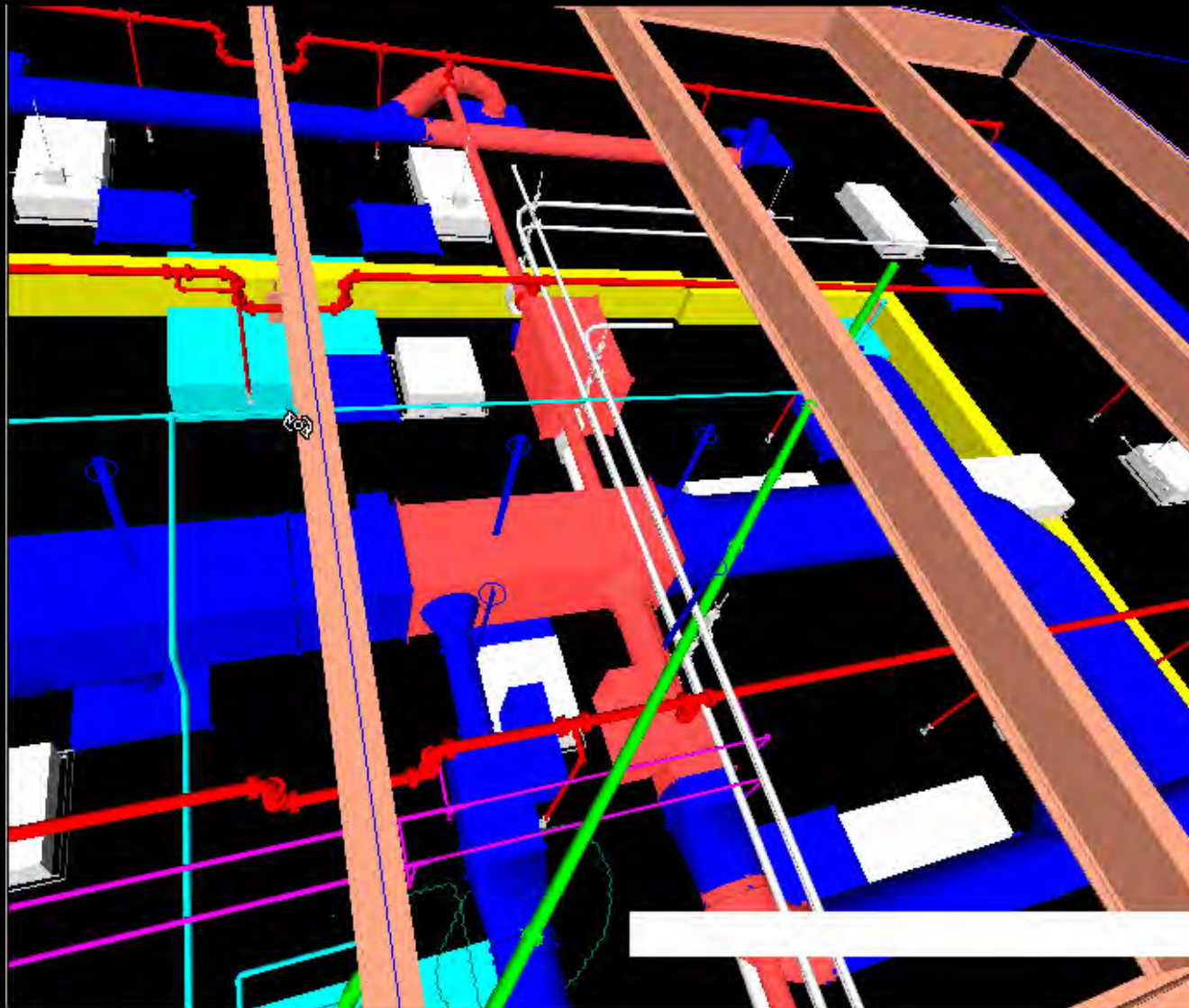
Camino MOB MEP/FP Guidelines Coordination & Conflict Resolution Process Established

Test 1 Clash

Tolerance 0.0000000000
 Total 12
 New 12
 Active 0
 Approved 0
 Resolved 0
 Type Hard
 Status OK

Camino MOB MEP/FP Clash Detection

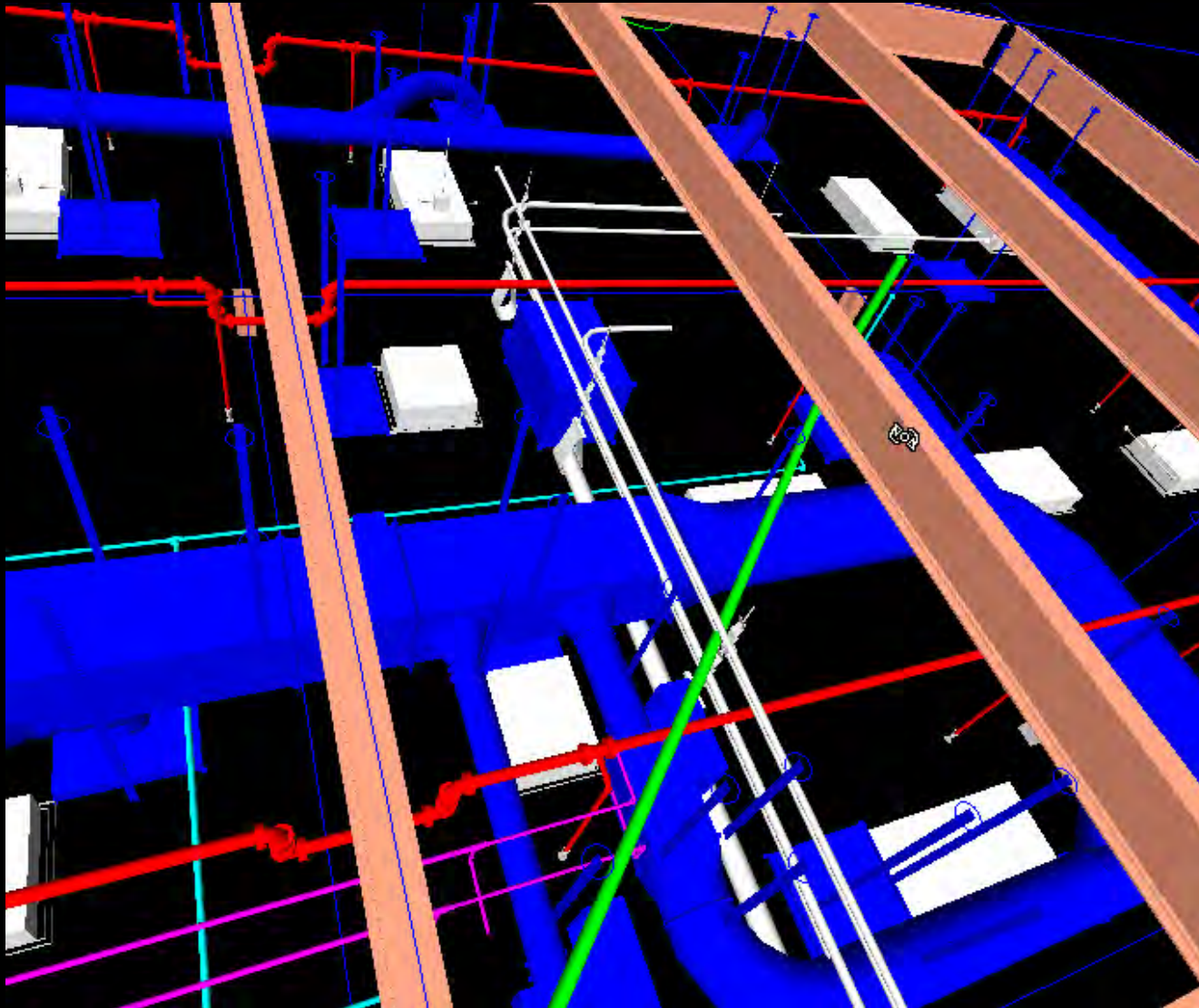
Specific Examples – 1st Floor SE Quad



Screenshot from 1st Clash Detection session on 7/19/05 shows multiple clashes between the Sprinkler main and supply ducts on south side. It was decided to move the main to correct the issue

Camino MOB MEP/FP Clash Detection

Specific Examples – 1st Floor SE Quad

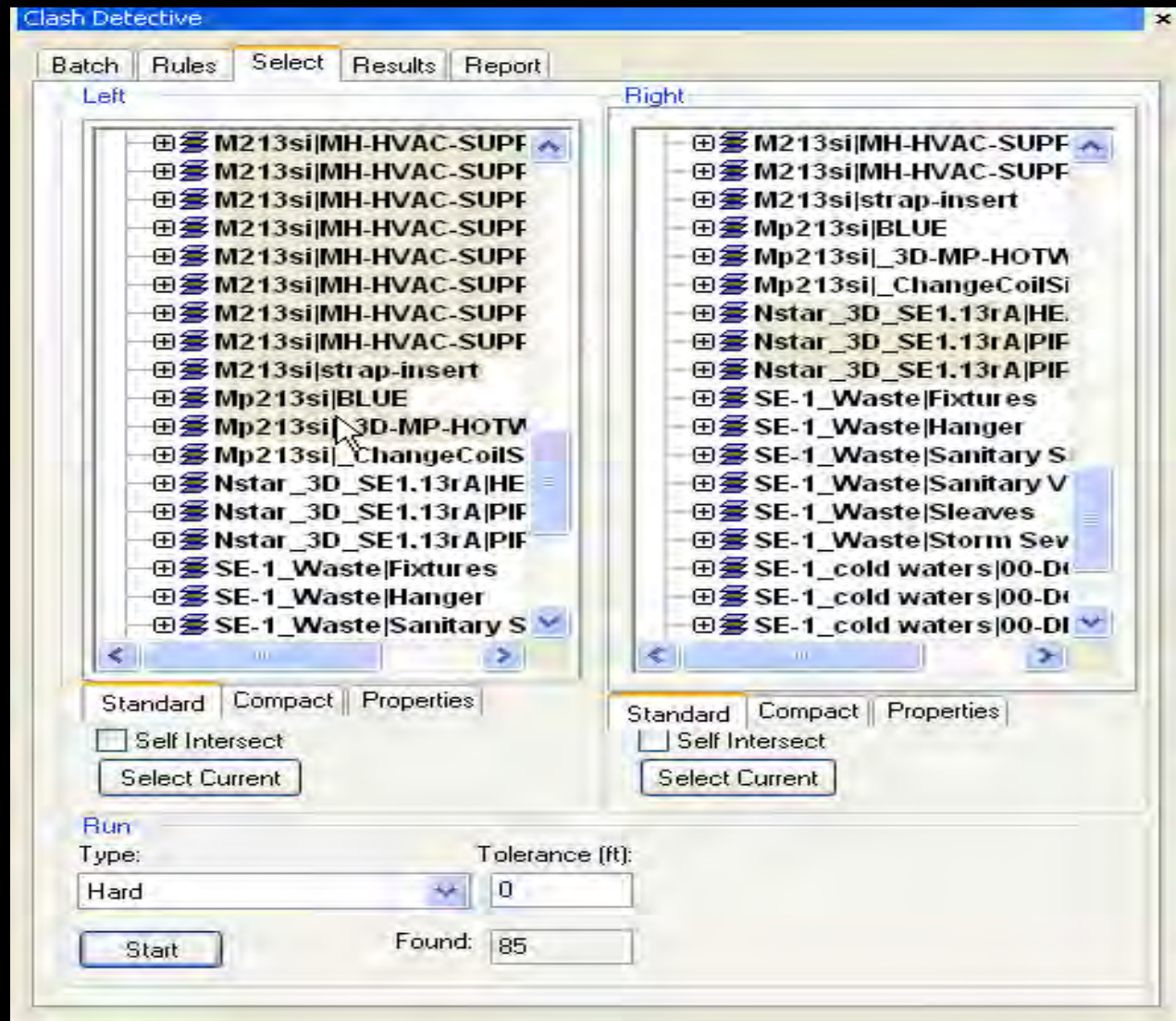


Screenshot from 2nd Clash Detection session on 7/26/05 shows that the Sprinkler main was moved and clashes with supply ducts on south side have been resolved



Camino MOB MEP/FP Clash Detection

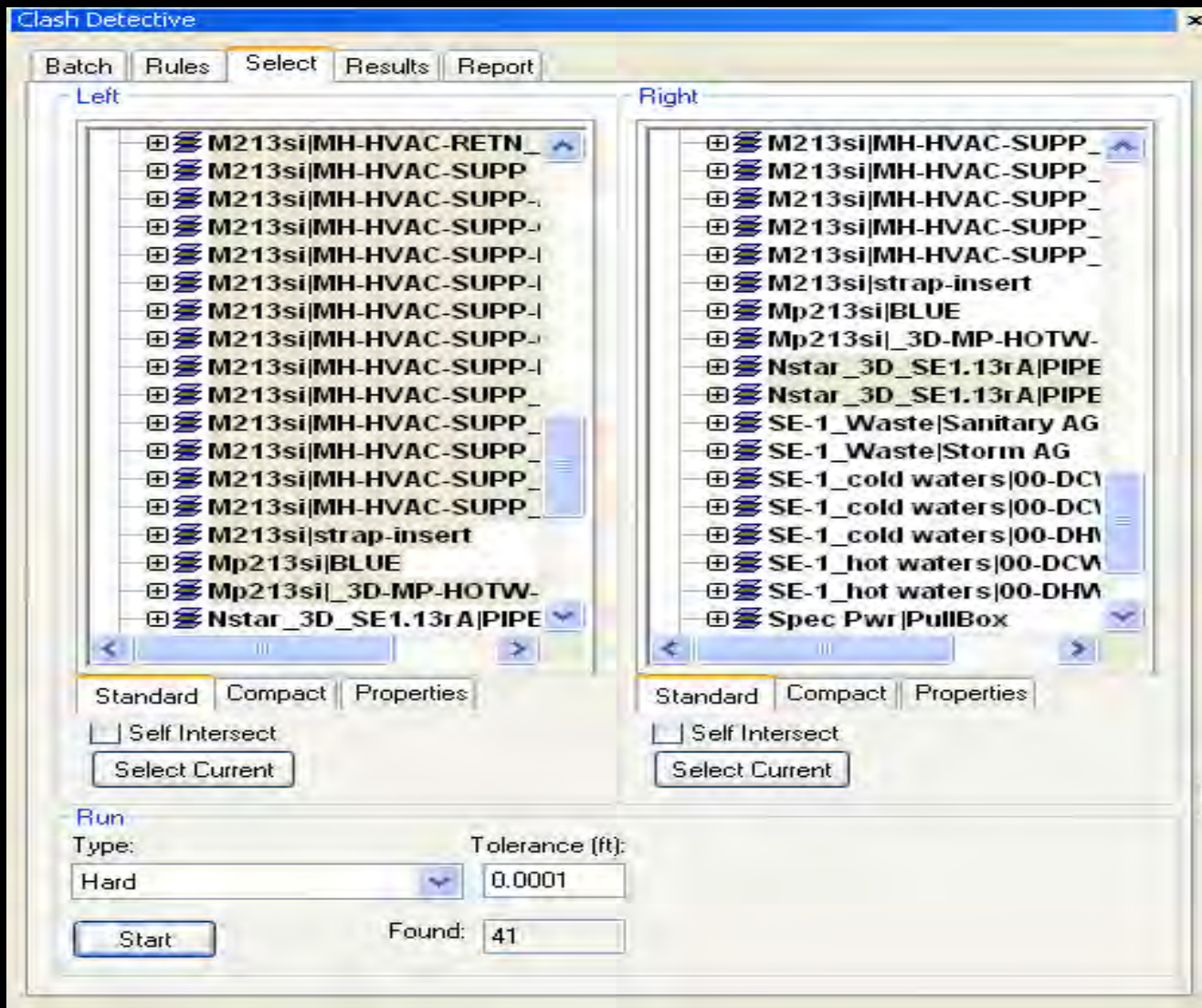
Specific Examples – 1st Floor SE Quad



Clash
Detection
Test to
check
clashes
between
HVAC and
Fire
Sprinkler
Pipe on
7/19/05
shows 85
Hard
Clashes

Camino MOB MEP/FP Clash Detection

Specific Examples – 1st Floor SE Quad



Clash Detection Test to check clashes between HVAC and Fire Sprinkler Pipe on 7/26/05 shows 41 Hard clashes

Camino MOB MEP/FP Clash Detection

Specific Examples – 1st Floor SE Quad

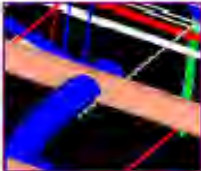
Clashes Page 1 of 73

Clashes

Report Batch

Steel And HVAC_Piping Clash

Tolerance	0.0000833333
Total	1
New	0
Active	0
Approved	0
Resolved	1
Type	Hard
Status	OK



Name	Clash1
Distance	-0.1264546111
Description	Hard
Status	Resolved
X	314.0125325514
Y	174.1347789418
Z	12.6843895890
Date	2005/8/4


Approved By	
Entity Handle	925
Entity Handle	425F

Comment 1

Status	Resolved
User	AtulK
Text	This is not a clash. The flex duct will be routed around the beam.
Date	2005/8/4

Clash Detection Report published for the Review of the Super plot of MEP / FP by the AE Team

12



Lessons Learned

What worked and what didn't?

- There was a disconnect between Design and Engineering
- Design team worked in large batches before the right Design information was made available to the Engineering team
- Engineering team expected design released by quadrant, which did not happen for the first 4 quadrants

Lessons Learned

Managing the Design Process

- Design Team did not prioritize the client decisions that were needed to make the schedule work
- The Last responsible moment for key client decisions was not determined and probably exceeded to make the process work as planned
- Inadequate investment in Programming effort

Lessons Learned

Design Information Batch Problem

- Design Team wanted to hold Engineering (detailing) work until Design was complete for the whole project
- At the outset had an agreement between Design and Engineering Team on how the Detailed Engineering models would be developed (By Quadrant)
- This agreement broke down

When we do this again...

Design Information Batch Solution

- The Batch issue can be managed using a Buffer solution and identifying the Last Responsible Moment for critical Design Decisions that need to be made

When we do this again...

Create a Buffer between Design and Engineering

- Right Buffer between Design and Engineering
 - Time Buffer ~ Preferred by Designers, Extends the Project
 - Capacity Buffer ~ Detailers available early
 - Information Buffer ~ Have enough Design information available before you can start

When we do this again...

Camino Buffer Solution

- Value Proposition: Budget was critical than Time
- Solution that we should have delayed the Engineering work until we were confident that enough Design info was available
- One possible solution to mitigate the Information Buffer could be to work by system (Plumbing / Mechanical) rather than by Geographical Areas (Quadrants)

When we do this again...

Last Responsible Moment

- LRM is important for prioritizing and sequencing Design decisions
- When is the Last Responsible moment for making a decision?
 - Example: The structural fabricator needed information on Mechanical Equipment before sizing roof members. Until this was committed to the members could not be sized.
- Depends on downstream process – Engineering and fabrication lead times and buffer solution

When we do this again...

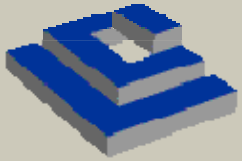
Pull Design Decisions from Delivery to the Customer

Coordination Quadrant	A/E Drwgs for Construction	MEP Insert Start	MEP Insert Finish	Target Release for Fab Sign-off	Fab Order	Release for Fab Date	Date of DA Team Acceptance of SI Medium Pressure Duct	Date of DA Team Acceptance of JWM DW&V	Date of DA Team Acceptance of CEI Feeder Design	Date of DA Team Acceptance of NSF Mains & Branches Routing
1st Floor Southeast	11/22/05	40/27/2005	44/3/2005	12/7/05	1	12/6/05	12/16/05	1/2/06	1/18/06	12/6/05
1st Floor Southwest	11/22/05	44/15/2005	44/22/2005	12/21/05	2	12/21/05	12/29/05	1/12/06	2/8/06	12/21/05
2nd Floor Southeast	11/22/05	44/22/2005	42/4/2005	1/4/06	3	1/4/06	1/17/06	2/1/06	2/23/05	1/4/06
2nd Floor Southwest	11/22/05	12/9/2005	12/16/2005	1/11/06	4	1/22/06	1/31/06	2/18/06	3/2/05	1/22/06
1st Floor Northeast	11/22/05	12/30/2005	1/9/2006	1/18/06	5	2/5/06	2/14/06	3/2/06	3/22/05	2/5/06
2nd Floor Northeast	11/22/05	1/19/2006	1/26/2006	1/25/06	6	2/19/06	2/28/06	3/18/06	3/29/05	2/19/06
2nd Floor Northwest	11/22/05	1/24/2006	1/31/2006	2/1/06	7	3/5/06	3/14/06	4/2/06	4/20/05	3/5/06
3rd Floor Southeast	11/22/05	12/13/2005	12/21/2005	2/8/06	8	3/19/06	3/28/06	4/16/06	5/4/05	3/19/06
3rd Floor Southwest	11/22/05	12/19/2005	12/27/2005	2/10/06	9	4/2/06	4/11/06	4/30/06	5/22/05	4/2/06
3rd Floor Northeast	11/22/05	2/7/2006	2/15/2006	2/15/06	10	4/16/06	4/26/06	5/14/06	6/5/05	4/16/06
3rd Floor Northwest	11/22/05	2/15/2006	2/27/2006	2/17/06	11	5/2/06	5/11/06	5/30/06	6/21/05	5/2/06
1st Floor Northwest	11/22/05	1/5/2006	1/12/2006	2/23/05	12	5/16/06	5/25/05	6/13/06	6/28/05	5/16/06
1st Floor Center	11/22/05	2/24/2006	3/1/2006	12/21/05	13	6/10/06	6/19/06	7/8/06		6/10/06
2nd Floor Center	11/22/05	2/27/2006	3/2/2006	1/11/06	14	6/17/06	6/23/06	7/15/06		6/17/06
3rd Floor Center	11/22/05	2/28/2006	3/3/2006	2/17/06	15	7/1/06	6/30/06	7/29/06		7/1/06

A screenshot of the Pull Design Schedule By Quadrant for the Camino MOB MEP / FP Coordination process showing the Fabrication Dates by system

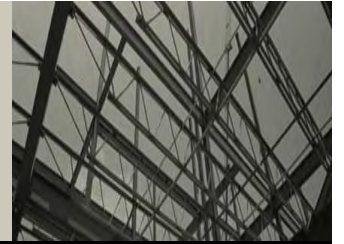
Building a Team to Make the Process Work

- *Dr. Slavin*
Camino Medical Group
- *Curtis, Henry, David, Gary, Mark, Kevin, Corey*
Hawley, Peterson & Snyder
- *Bryan, Steve*
Capital Engineering Consultants
- *Christina*
The Engineering Enterprise
- *Bruce*
Sandis Humber Jones
- *Blake, Rich*
KPFF – SF
- *Heather, Ken*
Watry
- *Dave C, Dave P, Will, John, Amaya*
Sutter Health
- *Scott, Mark, John, Jerry and Cesar*
Southland
- *Jeremy, Tim, Norbert*
Cupertino Electric
- *Clint, Ray, David, Sean*
JW McClenahan
- *Harry, David*
Northstar Fire Protection
- *Eric, George, Bill, Ian, Tracy, Scott, Ralph, Dan, Eddie, Atul, Dean*
DPR



Virtual Building in Lean Project
Delivery Process

Panel Presentations
Lean Construction Institute
Design Forum
Berkeley, December 8, 2005



Discussion

Questions & Answers