June 20, 2014

3:00pm – 4:00pm

LEAN CONSTRUCTION

Customer Focused Construction

Building Value for our Customers

Lean is a production system that eliminates waste, improves flow of work and creates a culture of continuous improvement.

Andy Davis
Healthcare Project Executive
Southeast Region Lean Champion

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Challenges of Traditional Approach

"Oh no, a few more change orders from Mrs. Fergenson, right?"

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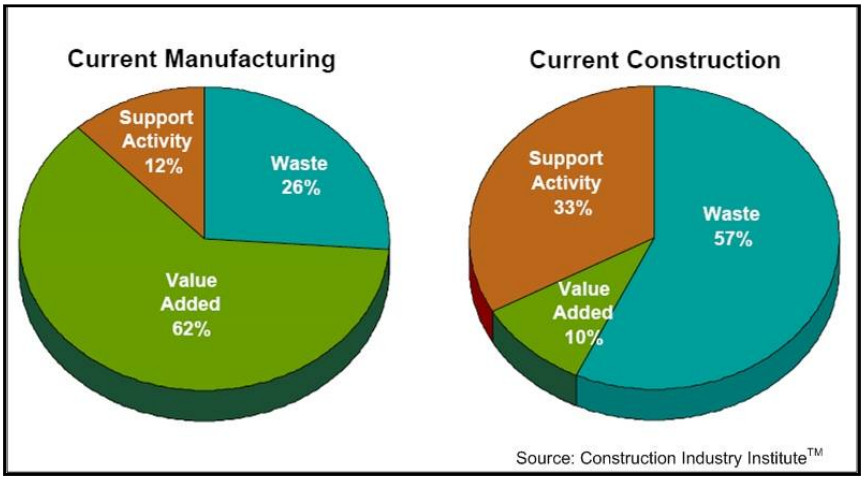
Eliminated Waste Adding Value



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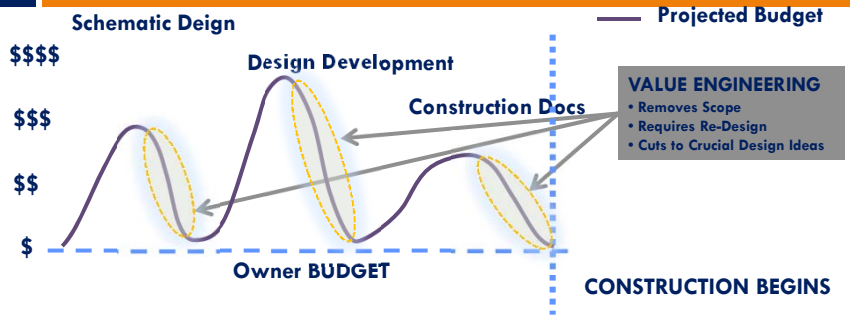
Never confuse motion with action -- Benjamin Franklin

TYPICAL BUDGETING APPROACH



- ✓ Little Communication Between Project Team
- ✓ Lack of Understand Owner's Needs and Wants
- ✓ Budget is contingent on Designer and Value Engineering

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Defining Risk

- "We believe that much of the risk encountered on projects is inherent in the way the work is structured and the project is managed, rather than from external sources… To be blunt, traditional project management practices increase risk." Greg Howell, Lean Construction Institute 5/21/10
- "The biggest cost impacting construction today is that of inefficiencies built into the way projects are run and managed – not costs of raw material like steel and concrete, or the cost of labor." CMAA

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Lean is…

Two pillars of "The Toyota Way"*

- Continuous Improvement
  - Challenge - form a vision
  - Kaizen - drive for innovation & evolution
  - Genchi Genbutsu - go to the source; find the facts; build consensus
- Respect for people
  - Respect - respect & understand each other; take responsibility and build mutual trust
  - Teamwork – stimulate personal & professional growth

LEXUS
The Relentless Pursuit Of Perfection.

One million ideas every year..

* Source: The Toyota Business Practices, © Toyota Motor Corporation 2006

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LEAN IS…

Delivering
VALUE
Effectively

Customer

RESPECT FOR PEOPLE

CONTINUOUS IMPROVEMENT

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CUSTOMERS ARE…

Internal

External

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What is it all about?

- **LEAN PRINCPLES**

1. **INNOVATION**
2. **COLLABORATION**
3. **BUILDING TRUST**
4. **RELIABILITY**
5. **IMPECCABLE COORDINATION**
6. **IMPROVEMENT**
7. **ACCOUNTABILITY**

Leadership – It takes leadership to make LEAN a success

Eliminating Waste – Removing waste from the process or material

Acting Now – Timely responses to constraints

Never-Ending – You can never stop finding improvement to the process

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It is about Reducing Waste while Adding Value to the Client.

What is Integrated Project Delivery?

Integrated Project Delivery (IPD):

A design and construction delivery method that incorporates LEAN construction tools in an enhanced collaborative process. This process results in a seamless construction / design team, contractually obligated and incentivized to work together while being focused on meeting project goals and objectives, while bringing the greatest value possible to the client.

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Beyond Teamwork Alone

Collaborative Process so that:

- ✓ The builder knows what is being designed and how he's going to build it.
- ✓ The designer knows what will be built (and how) and how he's going to design it.
- ✓ The Owner knows what he's getting and what it costs…….**At the same time.**

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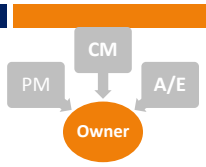
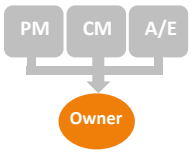
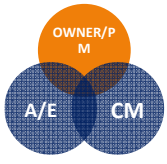
Three Types of IPD



Teaming Approach to Selection Process/ Traditional Contract **1**



Team Selected Individually/Traditional Contract Tied with Partnering Agreement with Incentives **2**



Team Selected Individually/One Contract (Integrated Form of Agreement) **3**

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Definition of Integration

"…aligning incentives and giving people a reason to collaborate closely in the best interest of the project regardless of the contract"

Howard Ashcraft, Hanson Bridgett LLP, Construction Attorney

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Design Assist Subcontractors

- ✓ **Minimizes the Potential of Costly Redesign – Design to Budget**
- ✓ **Allows for Purchase of Long Lead Items Early, Potentially Minimizing Escalation**
- ✓ **Improves Coordination of all MEP Work Items (Early Use of Building Information Modeling BIM)**
- ✓ **Enhances the Ability to Start Construction Earlier**
- ✓ **Allows for Earlier Cost Guarantee**
- ✓ **Reduces Field Coordination Issues**
- ✓ **Creates LEAN design**
- ✓ **Target Value Design**

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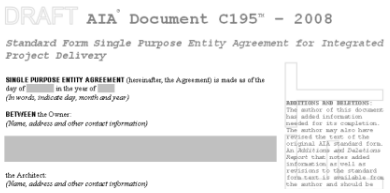
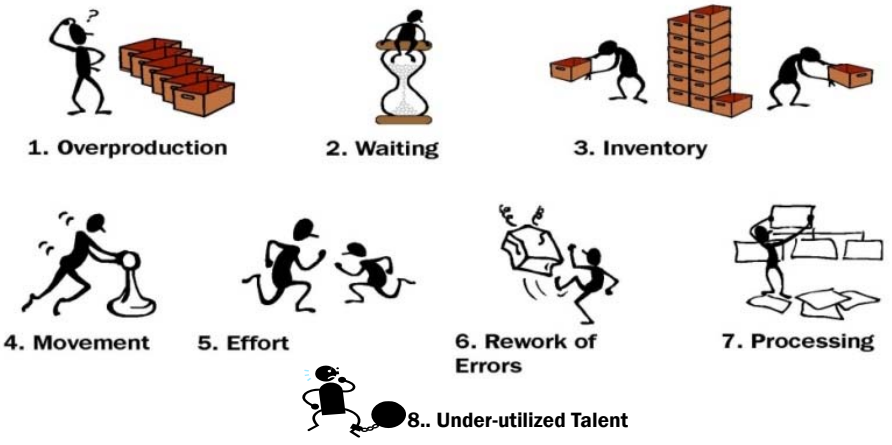
IPD Agreement Types

ConsensusDOCS



AIA A195 / A295 / B195

What is Waste? (aka MUDA)



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5 "S" Plan

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Off-Site Construction

- Ductwork w/Taps
- Elec. Panels
- Patient Window
- Sink Supports
- Waste Risers
- Mechanical Piping
- Medical Gas Piping
- Electrical Homeruns

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Off-Site Construction

- BIM enables Pre-Fabrication
- Levels of Prefabrication
  - Within a trade (Electrical, Mechanical, etc.)
  - Within a space, multiple trades
  - Within a building, multiple spaces, entire buildings
- Prefabrication Techniques/Locations
  - In the Field
  - On-site Shop
  - Off-Site Shop
  - Manufacturing Environment

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Prefabrication Bathroom & Headwalls

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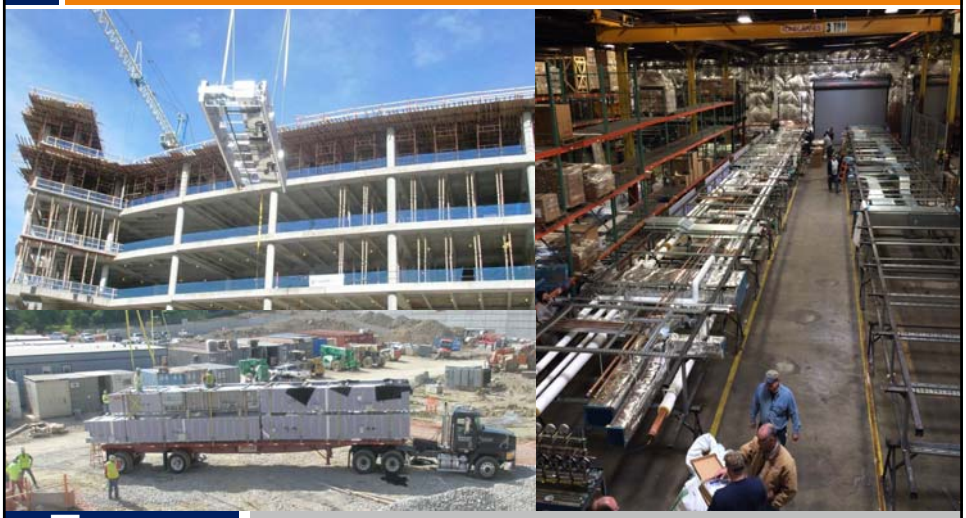
MEP Racks



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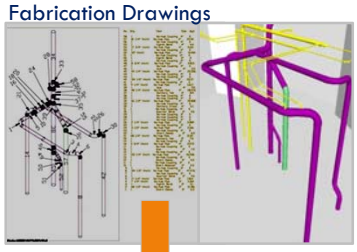
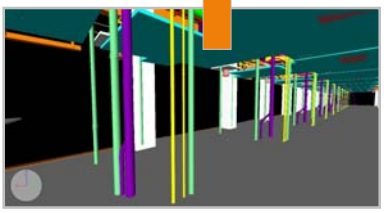
Plumbing

Fabrication Drawings



Prefabrication of waste lines

Final assembled waste line



Coordination of MEP Systems in BIM

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Low Voltage
Off Site Pre Fabrication

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Low Voltage
Off Site Pre Fabrication

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Low Voltage
Pre Fabrication Field Installation

Previous slide: Cable being transferred from original plastic spools and placed on mobile carrier for installation in the field.

Above: Pre Fabricated cable carriers being used for installation in the field.

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High Voltage
Off Site Pre Fabrication

Electrical Room Panels are pre assembled with feeder cables, packaged and labeled according to room.

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Plumbing
Off Site Pre Fabrication

Water Closet Mobile Plumbing Carriers

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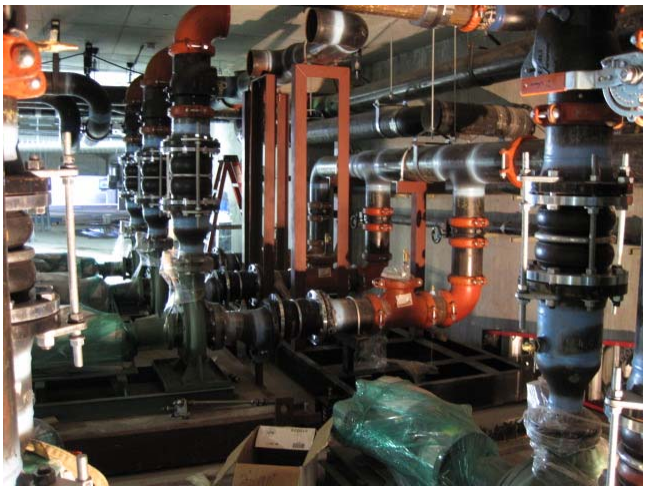
Plumbing
Off Site Pre Fabrication



Left: Pump Rooms piping was shop welded and brought partially assembled on skids.

Above: Piping run connections prefabricated.

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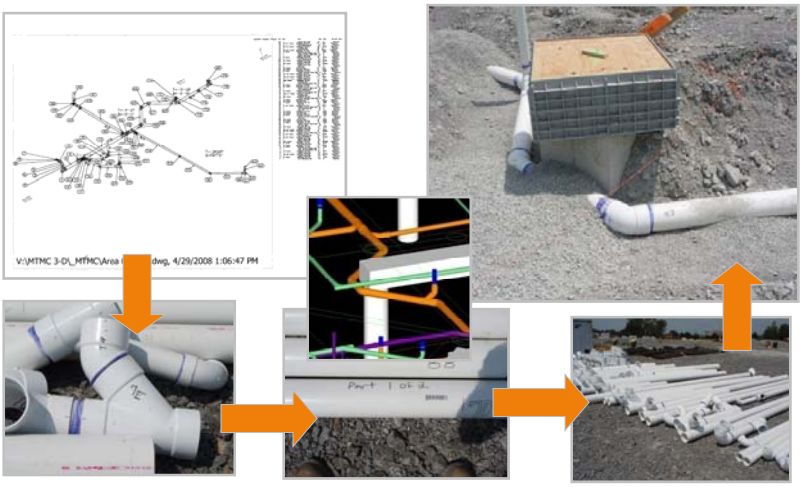
Plumbing Underground
Off Site Pre Fabrication



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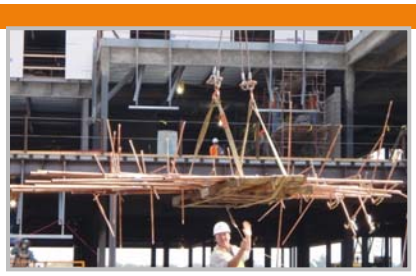
Plumbing
Off Site Pre Fabrication

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Exterior Panels
Off Site Pre Fabrication

PCS began the pre fabricating process in late April at one of their suppliers warehouses.

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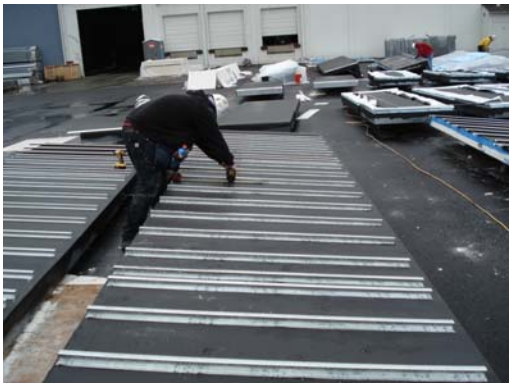
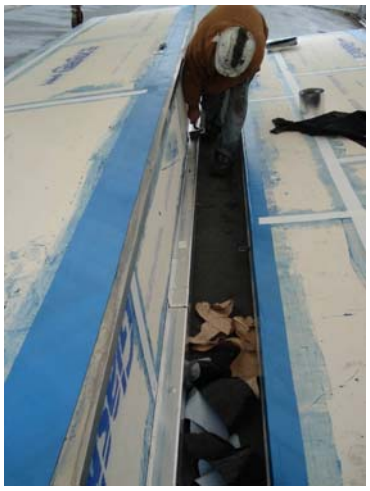
Exterior Panels
Off Site Pre Fabrication





The exterior panels received all weather protection applications prior to departure from the off site prefabrication site.

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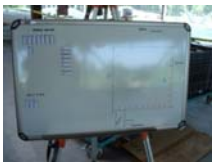
Exterior Panels
On Site Installation



Installation of the panels began on June 5th, 2009 and was completed on June 24th, 2009 (15 working days).

Left: Coordination on the staging and transportation of panels played important roll in installation process.

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Exterior Panels
On Site Installation

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Exterior Panels
On Site Installation

On the project there were a total of 206 exterior columns/spandrels. The crew installed an average of 14 columns/spandrels per day.

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Punched Windows Staging

All the punched windows were loaded onto mobile carriers. The wheels on the carriers eliminated any need for a forklift.

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Punched Windows Installation

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SOG & Elevated PT Decks

Average of 8,636 sqft elevated deck panels placed per day.

95,000 sqft of elevated decking was completed in 11 working days.

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Structural Steel Erection

On average a piece of steel was installed every 2 minutes 59 seconds.

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Structural Steel Erection

The exterior slab edge and handrails were welded prior installation, which significantly reduced the installation time of the structural steel.

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Electrical

271 Patient Rooms
32 Components per a Pallet
1 Pallet per a Room
Labor Savings: > 42 %
Accuracy: 100%

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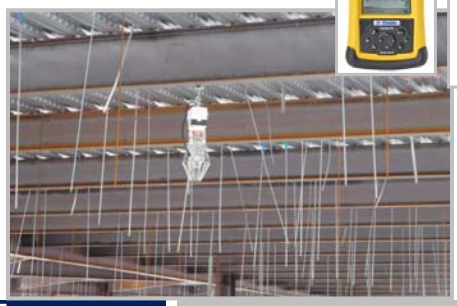
Hanger Installation

Systems Utilized:
Mechanical, Plumbing,
Electrical, Fire Protection
Labor Savings: > 50 %
Accuracy: > 96%



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Metal Stud & Drywall Installation

Creating a Visual Work Place

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Metal Stud & Drywall Installation

Creating a Visual Work Place

Each subcontractor is assigned a specific color that identifies when work is complete and ready for cover inspection.

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Visual Work Place

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Visual Work Place

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Visual Work Place

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Visual Work Place

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Everything on Wheels

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Conversation is Planning

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LEAN SCHEDULING

- Highlights of Collaborative Scheduling
- One Area, One Trade
- Daily Huddle in Field
- Predictable Workflow
- Remove Constraints
- Make it Visible
- Posted Throughout Jobsite
- 6 & 10 Pull Plan Meeting
- Weekly Work Plans Submitted for the Following Week
  - Area Conflict Evaluation
  - Track % Complete
- Improves team work through collaboration
- More Reliable Promises

Pull Plan Meeting

Weekly Work Plans

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Principles for Making Informed Decisions

1. Identify the root cause
2. Understand the problem
3. Define metrics for success
4. Standardize the process
5. Keep it simple
6. Small changes can have big impacts

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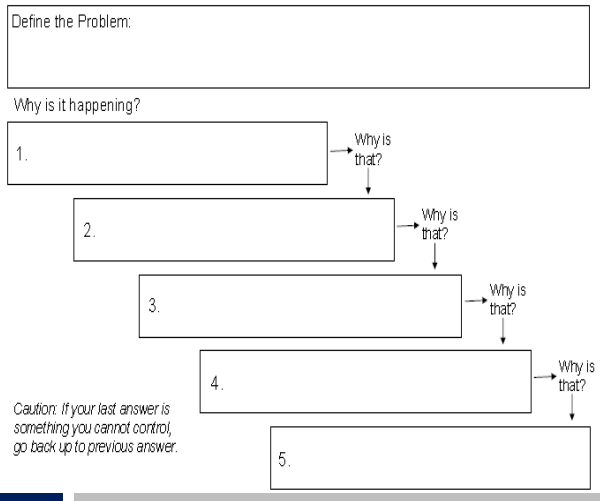
5 Whys Root Cause Analysis



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373	Sconce decision at patient room family area	NGHS	RL	08/22/13																
373	CT area change	NGHS	RL	08/22/13																
375	Present pricing on traffic signal at main entrance	Turner	KM	08/22/13	09/05/13															
377	LEED Final CPR	HGA	MT	08/22/13	08/30/13															
378	Provide information on Domestic tap for irrigation (exhibit)	KH	LF	08/22/13	08/29/13															
379	Finalize easement with town of Braselton (forced/gravity/reuse)	NGHS	RL	08/22/13	09/05/13															
380	Provide budget price for CT area expansion	Turner	KM	08/22/13	09/06/13															
381	Revised bathroom locations in CT area	NGHS	RL	08/22/13	08/29/13															
382	Provide feedback on POE locks (pros/cons/cost deltas)	SSR	JDW	08/22/13	09/05/13															
383	Window washing access issues	HGA	MT	08/22/13	09/05/13															
384	Document Update by Design Team to coordinate with Med Equip Matrix conflicts	HGA	MT	08/22/13	09/05/13															
385	Determine if sheet waterproofing is required at electrical vault walls in Area "F"	HGA	MT	08/23/13																
								Percent Planned Complete	78%	82%	60%	100%	86%	92%	92%	100%	92%		
								Team Average	87%											

Project Milestones	Date
100% Sign off of Med/Surg Mock-up Room	9/1/13
Approval date for all casework	9/16/13

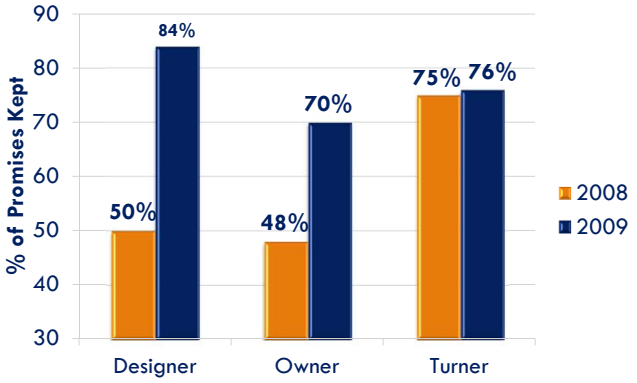
	Action Items						
#	Description	Responsible Company	Responsible Individual	Initiate Date	Needed Date	Completed Date	Notes
185	Army corps approval of pond remediation plan	KH	LF	06/20/13	08/22/13		
186	GA EPD approval of pond remediation plan	KH	LF	06/20/13	11/21/13		
187	Pricing CB #11	Turner	KM	06/20/13	08/13/13		
190	FAA helipad approval and final design	KH	LF	06/27/13	08/30/13		Currently under FAA review. FAA has been contacted to verify that they have received the permitting package. Will continue to track.
197	Schedule WebEx to review NGHS (TV)items on patient room				09/28/13		
198	Chapel design direction	NGHS	RL				
199	Army corps approval of pond remediation plan (additional item to provide sod in the area and document the stabilization)	Turner	JW	08/22/13			Need information on sod to be used from Lawson F.

CATEGORIES OF VARIANCE
1) New information gained 2) Prior work not complete by others 3) Info/data availability 4) Qualified staff availability 5) Materials/supplies availability
6) Protocols/specs 7) Condition of acceptance 8) Schedule/sequence 9) Incorrect time estimate10) Off project demands

Constraint Log

Improving Reliability – Timely Decisions

Results from using the constraint log to add accountability to the process



Promises Kept 2008 vs. 2009

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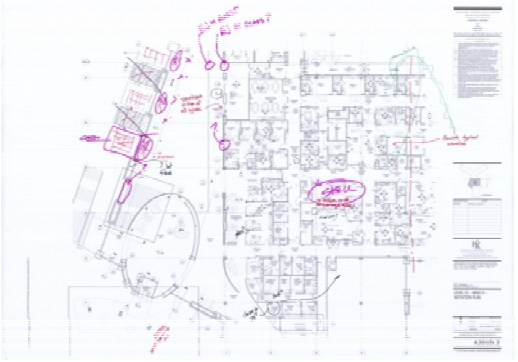
Enhanced Communication

- ✓ Final Check-Set Review
- ✓ Avoid RFI's
- ✓ Avoid Delay's



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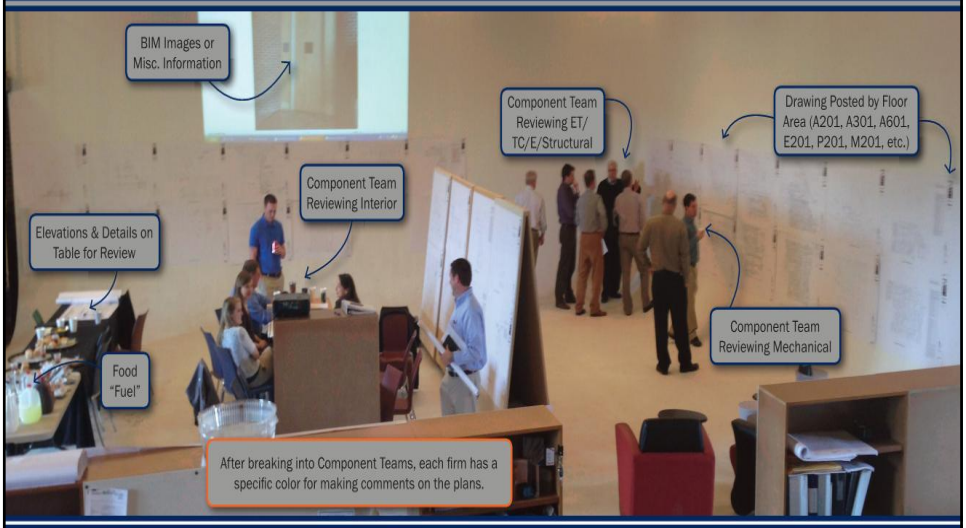
How to Check Final Drawings?



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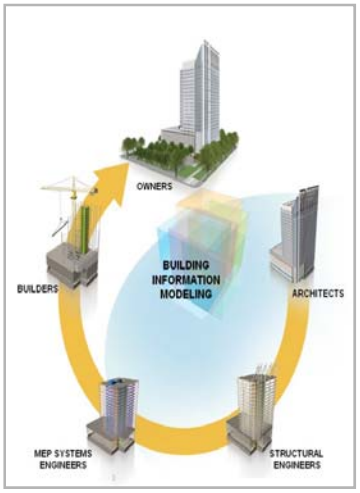
What is BIM (Building Information Modeling)?

Design Visualization – 3D
Visualize building early in the process to support and accelerate the decision making process

Design Validation – 3D
Integrate 3D models of all trades to identify interferences and constructability issues before they materialize in the field

Schedule Visualization – 4D
Visualize construction process to review and optimize the construction sequence and the schedule

Estimating – 5D
Tie scope of project to a price; Manage scope changes more efficiently



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Customer Focused Construction

- The Experience
  - Optimize our systems and people strengths to produce the best experience for our customer before and during construction.
    - Humility
    - Always think about "VALUE to the Customer"
    - Identify items that the customer can relate to during the process.
    - It is about "Their building" not "Our Construction"
- The Product
  - The process is the product
    - The end does not justify the means for those involved.
    - The "Building" is only a "Product" for those not involved in the construction process.
    - A better process produces a better product

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