Applying a Value-Added, Timesaving Approach to the Building Construction Process

Rob Duceatt : Primary Speaker
BIM Manager

Steve Berry : Co-Speaker
BIM Manager
Introductions

- Kitchell Contractors
  - General Contractor
  - 64 years old
  - Based in AZ with offices in CA & TX
  - Primary Focus: Healthcare, Casinos, Higher Education, Hospitality

- Rob’s Background

- Steve’s Background
This lecture will examine the approach of various timesaving, value added processes utilized on a new 5-story healthcare addition. Prefabrication, integrated collocation (Big Room), quality install with laser scanning, and fully coordinated shop drawing creation are processes Kitchell used to introduce critical waste-cutting techniques in order to shorten an already aggressive schedule. Kitchell selected 3 key areas of construction that the prefabrication process would benefit, including corridor utility racks, patient room headwalls, and patient bathrooms. We will go over the various Autodesk, Inc., software platforms utilized by trade partners in the coordination process, and we will show how co-locating to the prefab shop was a must. Participants used laser scanning to spot check areas for install and cross-referencing issues with the coordination model. Given the success of the project, Kitchell has adopted prefabrication and timesaving processes as a quality approach to be put forth on present and future projects for Kitchell.
Class summary

This lecture will examine the approach of various timesaving, value added processes utilized on a new 5-story healthcare addition. Prefabrication, integrated collocation (Big Room), quality install with laser scanning, and fully coordinated shop drawing creation are processes Kitchell used to induce critical waste-cutting techniques in order to shorten an already aggressive schedule. Kitchell selected 3 key areas of construction that the prefabrication process would benefit, including corridor utility racks, patient room headwalls, and patient bathrooms. We will go over the various Autodesk, Inc., software platforms utilized by trade partners in the coordination process, and we will show how co-locating to the prefab shop was a must. Participants used laser scanning to spot check areas for install and cross-referencing issues with the coordination model. Given the success of the project, Kitchell has adopted prefabrication and timesaving processes as a quality approach to be put forth on present and future projects for Kitchell.
Key learning objectives

At the end of this class, you will be able to:

1) Define a value added process:

2) Understand the benefits achieved by Integrated Co-Location

3) Think about processes that add value and cut waste

4) Quality to the end…following through

5) Questions
Agenda

Define Value
- Define Value
- Define Waste
- Material Management

Co-Location
- Typical Process
- Prefab Process

The Processes
- Prefab Bathroom
- Prefab Headwall
- Prefab MEP Rack

Quality
- GC Supplemental Shop drawings
- Checking with Lasers

Questions
- Answers
About the Project

Project Overview:

- $78 Million – Design/Build
- 175K square foot expansion tower + 20K sf of remodel
- 3 floors of patient rooms:
  - 6 New ORs and new PACU/Pre-Op
  - New Emergency Department
  - New Central Sterile & Materials Management

Project Schedule Milestones:

- Demo of existing building 10/2012.
- First Stick Of Structural Steel 4/15/13.
- Original C of O scheduled for: 10/16/2014 (18 months after steel start).
- Achieved C of O of 7/3/14 (14½ months after steel start).
- **C of O – 3 ½ Months early**
- 1st Patient 3 Months early
- Less than $100,000 in changes
- Forecasted Return of 3 – 4 Million dollars in Savings
- Engaged and happy owner
About the Prefab

Project Prefab Metrics:

- 84 Patient Bath Rooms
- 42 MEP Racks
- 104 Headwalls
- Max number of workers in shop: 26
- Average number of workers in shop 15
- Total Worker Days In Shop 878
  - equates to over 1000 worker days removed from field
- Number of dumpsters filled at prefab shop: Less than 1
  - Less materials = less cleanup $$ on the job site
  - Metal studs, ductwork, conduit and pipe were ordered to length
- Working on floor rather than overhead allowed for 360 degree inspection of work.

C of O – 3 ½ Months early

Forecasted Return of 3 – 4 Million dollars in Savings
Objective 01:
What defines a value added process
**Define Value**: The very...very basics

**Traditional Business Model:**
- Quality, Cost and Time. Owner pick any 2

**Lean Business Model:**
- Value = quality **up** + schedule **down** + cost **down**
- Owner Gets all 3

**Basic Value Check:**
- High use and low cost = high value
- Low use and high cost = low value

**Value is anything that removes waste**

References From: Toyota Way and Lean Construction Guide
Define Waste

Waste is anything that uses resources, but does not add value.

Types of waste:

- Defects: requires rework / functions incorrectly
- Overproduction: creating more than the customer needs
- Waiting: Time is money or Cost up
- Over processing: unnecessary steps in a process
- Movement: AKA “treasure hunts”
- Transportation: although necessary does not add direct value
- Inventory: ties up space and hides defects

References From: Toyota Way and Lean Construction Guide
Example: Material Management

- Materials / tools must be on moveable cart or wheeled device.
- 3 days materials in the work area (JIT).
- All packaging materials to be removed by end of shift.
- Daily clean-up shall be done as you go.
Objective 02:
Integrated Co-Location and the benefits achieved
Lean Benefits of Co Location

Quality **Up** : Waste **Down**
- Communication : Waiting on information
- Real-time changes : Over processing
- Collaborative / cohesive shop drawings : Defects

Time / Schedule **Down** : Waste **Down**
- Communication : Waiting on information
- Real-time changes : Over processing
- Transferring information (Shared Severs) : waiting / movement

Cost **Down** : Waste **Down**
- Communication : Waiting on information
- Collaborative shop drawings : over processing / producing
Integrated Co-Location:

**Why**
- Construction Coordination Schedule not being met
- Needed to hit Milestone dates for Prefab

**When**
- At end of Level 01 coordination

**How**
- Co- Locate to the Mechanical Contractors Office/Shop
STANDARD PROCESS

1. **Receive Design Revit models**
2. **Review Design Revit models with Trades / Coordination team**
3. **Extract models (DWG/NWC) for Insertion into Navisworks & sharing with Trades**
4. **Insert Trades files (DWG) into Navisworks Coordination Model (NWF)**
5. **Create Coordination Model (NWD), share with Coordination team**
6. **Review Coordination Model (NWD), Clash reviews, etc**

**Design Revision**
REVISED CO-LOCATION
PREFAB PROCESS

Create Kitchell Models:
CM – Construction Management Model
  Link all Design Revit models – Section models
  by Floor levels
EQ – Additional Equipment detail
  MEP Racks
  Headwalls
  Misc Steel – Boom supports
  etc.
CL – Ceiling Grid Model (if no trade on board to provide)

Insert Trades DWG files into Revit:
- DWG files need to be prepared to be usable in Revit depending on software
  used by Duct/Pipe trade
  --Explode DWG files
  --Create IFC from DWG
  --Revit Models from Trades??

Extract Sheet layouts for Trades:
- Trades review layouts, add notes/text forPrefab Fabrication in Autocad
  - Provides for trades to take ownership of the Fabrication sheets
  since the trades will be building from the fabrication sheets
- All trades participate with creating prefab fabrication sheets:
  - Duct
  - Pipe/Plumbing
  - Electrical
  - Fire Protection

Create Fabrication Drawings:
- Revit Sheet Layouts

Extract models (DWG/NWC) for Insertion into Navisworks
  Coordination Model (NWF)

Insert Trades files (DWG) into Navisworks

Create Coordination Model (NWD), share with Coordination team

Review Coordination Model (NWD), Clash reviews, etc
Objective 03:
Adding value and cutting waste:

Prefabrication
- Bathrooms - Physical Mockups
- Headwalls - Sweet and Simple
- MEP Racks - All out Collaboration
Prefab Bathrooms:
Physical mockups
**Lessons Learned:Prefab Bathrooms**

**Key factors that would positively affect the success of this prefab process**

- Co-Location had not been setup yet
- The outcome was limited meeting time due to working in Silo’s
- Limited open Communication between Field & Coordination; The outcome was delayed Communication / Solutions between Field and Coordination

- Bathroom modules set on mobile platforms for easy shipping
- Included Shower stall pan
- Delivery of Patient room bathrooms—Raising up to appropriate floors

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**Prefab Bathrooms**
Time Line
Prefab Headwall:
Sweet and Simple
Lessons Learned: Prefab Headwalls

Key factors that would positively affect the success of this prefab process

- Co-Location removed the communication barriers between the Coordination team and the Field/Shop no Silos
- Daily walks to review the Headwall creation were easily conducted by all team members

- Headwall Framing
- Assembly line of Inwall installation
- Installed Headwall Units
Prefab MEP Racks:
All out Co-laboration
Lessons Learned: Prefab MEP Racks

Key factors that would positively affect the success of this prefab process
- Co-Location removed the communication barriers between the Coordination team and the Field/Shop, no Silos
- Daily walks to review the MEP Rack creation were easily conducted by all team members
- Prefab was not part of the design process, early adoption of prefab at the design phase would allow even more efficient coordination process

- Fabrication Drawings
- Assembly line installation
- MEP Racks ready for Shipping
Objective 04:
Quality to the end…following through

- **Supplemental Shop Drawings**: Boom Supports
- **Playing with lasers**: Quality Check with Laser Scanning
Supplemental Shop Drawings:
Boom Support Coordination

- Misc. Steel Trade with no Modeling capabilities
- Additional coordination for Supplemental Shop drawings
• Installed Boom Support Steel
Playing with Lasers:
Quality Checking with Laser scanning
Lean approach to costly lasers

How to increase Laser Scanners Value

Get high use out of a laser scanner to increase it’s bang for buck
- Basic Value Check
  - High use and low cost = high value
  - Low use and high cost = low value

Use more often and faster
- Make part of your regular work flow on site
- Use to validate installation against the coordinated model
- Spot Scan. Be selective. 2 / 3 scans in an area
- Leverage the right technology / software
- Scanning In the Dark
Quality Check: Things Change
Deviation Analysis: Reality is not Plumb

- Trade Partner questioned the Accuracy
- Field verify with tape measure
- Nothing is Square: Due to Human Error
- One furred column is 1” thicker on one side
- Cad software likes to draw straight
Deviation Analysis: Reality is not Plumb

Before

After

Deviation Analysis: Reality is not Plumb
Spot Check: Instant Gratification

Original Area
- 25 Scans
- 6 hours (Setup n Scan)
- Utilizing Targets
- Color adds 2 mins per scan
- 4 Hours Register
- 10 Hours Total

New Area
- 5 Scans
- 30 min (Setup n Scan)
- Utilizing Targets
- No Color
- 30 mins Register
- 1 Hour Total
In the Dark: Color

UCSD.1_Scan_092

UCSD Autopsy Scans
In the Dark: Black n White
Happy Owner & Team

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Forecasted Return of 3 – 4 Million dollars in Savings
Got Questions?

Chandler Regional Medical Center
Session Feedback

- Via the Survey Stations, email or mobile device
- AU 2015 passes given out each day!
- Best to do it right after the session
- Instructors see results in real-time
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