Autodesk University

CR3845

Using Autodesk® Building Design Suite Premium to Deliver a Lean Modularized Project

In this class, we will dive into the concepts and practices we used to bring the most to the deliverable for the owner through use of Autodesk® Navisworks® Manage, Autodesk® Revit® Architecture, AutoCAD® MEP, AutoCAD®, and Autodesk® Inventor® software. We will show you how to work towards bringing only value-added work to a project by eliminating non-value-adding steps while also working towards better quality assurance and quality control by modularizing the construction process where it has proven possible through studies using the design suite.

Speakers
RJ Reed, The Whiting Turner Contracting Company - Speaker
rj.reed@whiting-turner.com

RJ Reed is the Southeast Regional Manager for the Whiting-Turner VDC Building Group. Since joining the company in 2008, he has been instrumental in the Whiting-Turner Building Information Modeling efforts. He trains staff across the country on emerging technologies, maintains a company newsletter highlighting technology trends, and delivers presentations for project teams, architects and engineers throughout the country. Reed joined Whiting-Turner after five years as an architect, where he employed virtual design on highly themed entertainment construction projects. Reed graduated from the University of Florida with a B.D. in Architecture, and has extensive experience working with information models to coordinate complex construction projects. With over a decade of experience working in the AEC industry, Reed understands the value BIM can bring to the industry, and champions the use of it on every project.

Matthew Vanture, The Whiting-Turner Contracting Company - Co-Speaker
matt.vanture@whiting-turner.com

Matthew Vanture is an Engineer for the Whiting-Turner Contracting Company's Virtual Design & Construction (VDC) Group. Bringing two years of BIM experience with him from college, he joined Whiting-Turner in 2011. He is responsible for the implementation, training, and support of Building Information Modeling (BIM) and VDC to Whiting-Turner's Southeast Regional offices as well as works closely with Project Teams to help support VDC/BIM through preconstruction, construction, and facilities management. Vanture leads Whiting-Turner's national Initiative Group for Field technology and implementation. Vanture graduated from the University of Florida with a B.S. in Building Construction, and has worked on numerous complex projects with VDC totaling more than $500 million since joining Whiting-Turner.

Key Learning Objective 1:

Create a workflow to make your team more reliable by tracking construction issues with Navisworks

Key Learning Objective 2:

Collaborate better with Autodesk® BIM 360™ Glue® cloud-based BIM solution and eliminate unused intellectual capacity by enabling everyone to do the job

Key Learning Objective 3:

Analyze modularization possibilities by integrating Inventor components into Revit and Navisworks

Key Learning Objective 4:

Define a methodology for tracking materials through the delivery process to facilitate the Last Planner® System

OUTLINE

INTRODUCTION 3 MIN - RJ

LEAN PRINCIPLES FOR A PROJECT 7 MIN - MV

- GENERAL OVERVIEW
  - Lean is Eliminating Waste
  - Learn to see waste
    - Excess Transportation
    - Excess Inventory
    - Excess Motion
    - Waiting
    - Over processing
    - Defects
    - Unused Intellectual Capacity
    - Variation
    - Chase-Up
- THE LAST PLANNER SYSTEM – Managing Production through Workflow
  - Pull technique is based on working from target backwards
  - Only do work that is being requested of you from the pull
    - Can eliminate work that has been customarily been done, but does not add value
  - EXP.
    - 1st Meeting – What are you doing?
    - 2nd Meeting – Did you do what you said you were going to?
      - If not,
        - Why not in a few words
        - Categorize [weather, planning, coordination, materials…]
      - What are you doing?
    - 3rd Meeting - Did you do what you said you were going to?
      - If not,
        - Why not in a few words
        - Categorize [weather, planning, coordination, materials…]
      - What are you doing?
    - Ect.
  - Commitment Reliability Index
    - Actual Complete./Number committed

MODULAR ADVANTAGES 5 MIN - RJ

AUTODESK SOLUTIONS 5 MIN - RJ

- BROAD OVERVIEW OF AVAILABLE SOLUTIONS

REVIT 5 MIN - MV

- PARAMETRIC TOOLS TO HELP CONST.

    - RJ?
- SAFETY
    - Open Source in Company
        - Marine – Every man is a rifleman

INVENTOR 5 MIN - RJ

- DETAILED MODELING FOR PREFAB
    - Taking models to Inventor, Applying loads and studying

NAVISWORKS 10 MIN – MV & RJ

- COORDINATION USING NAVISWORKS MANAGE
    - Tracking
    - Painless Continuous Improvement
        - 0.05% Improvement everyday
            - 14 Seconds Saved per Day
        - 250 working days * 14 seconds = 3500 seconds
        - By the last day of the year you are 12.2% more productive
- TIMELINER INTEGRATION INTO PULL SCHEDULING
    - Visualize the situation

BIM360 GLUE 10 MIN - RJ

BIM360 FIELD 10 MIN - MV

- MATERIAL TRACKING
    - PODS
- QA/QC
    - Productivity
        - 196 QA/QC
        - April 19 through November 13, 2012
        - Standard says 29 weeks; 3 man team; 2 per week;= 174
        - 197/174= 112.64% Efficiency
    - 43 Conforming Safety and QA/QC
- TASKS
    - RJ?
- PUNCHLIST
    - Avoid

MANUFACTURING MINDSET 10 MIN - RJ

CLOSING 5 MIN - RJ

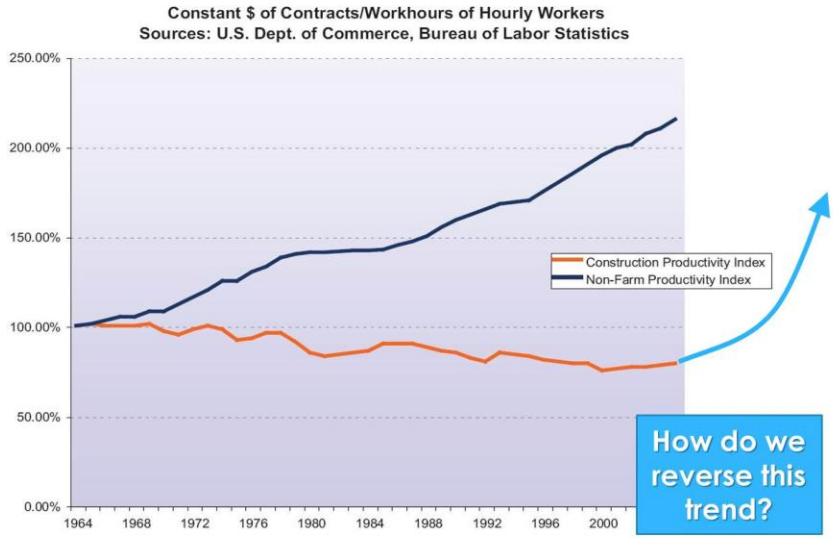
QUESTIONS 15 MIN

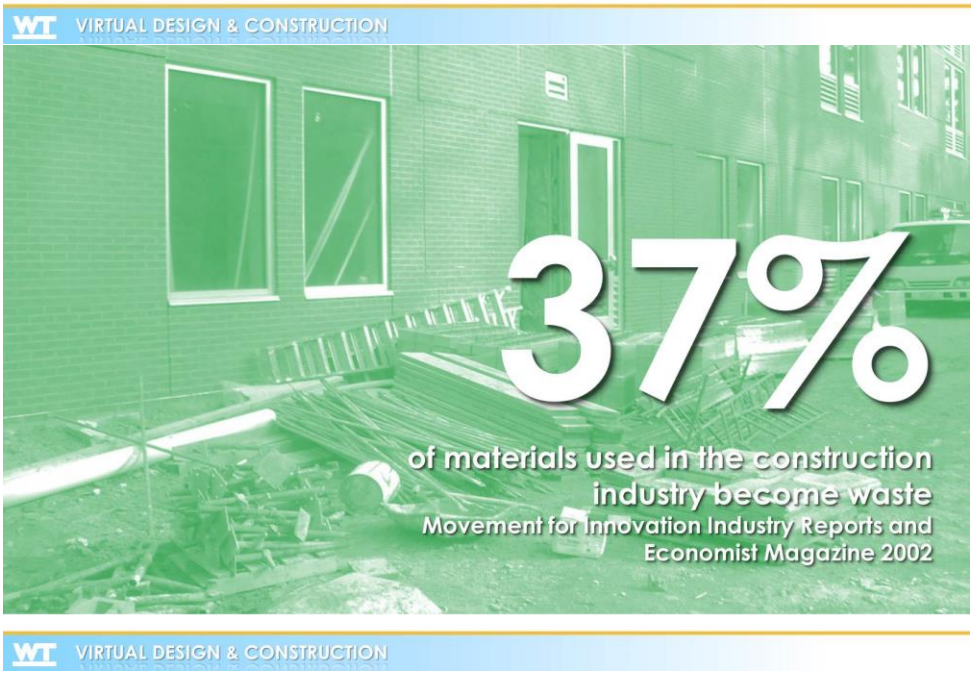
Intro:

Let us start by saying lean is not a program you can buy, or something you can set up for a one time deal. Lean is a way of thinking, a philosophy. Once you establish that, you can then look for tools to assist your philosophy. At Whiting-Turner, we were able to see the Autodesk Suite help produce the right result.

LEAN PRINCIPLES FOR A PROJECT

As we stated, to become lean, you must have a philosophical sense of purpose that suspends any short-term decision making. Your philosophical mission is the foundation. From there you have to establish what to do next, we saw waste as the biggest issue to tackle.





Whiting-Turner's general principle of lean is eliminating waste. Waste is anything that does not add value to the product. By eliminating waste we have the best quality, lowest cost, shortest lead time, best safety and highest morale on a project.

Waste is everywhere; it is in excess Transportation, Excess Inventory, Excess Motion, Waiting, Over processing, Defects, Unused Intellectual Capacity, Variation, Chase-Up, and so much more, but you have to learn to see it. Great ways to find these areas of waste is through The Last Planner System.

The Last planner System is all about managing production through Workflow. You do this by using pull technique, which simply put is working from your target, backwards. Only do work that is being requested of you from the "pull". This will eliminate work that has been customarily been done, but does not add value.

We were able to integrate this into our VDC coordination efforts on our Fantasyland Site Redevelopment Project – Princess Fairytale Hall.

1st Meeting – What are you expecting to get done this week?

- Record commitments and send out Tracking List

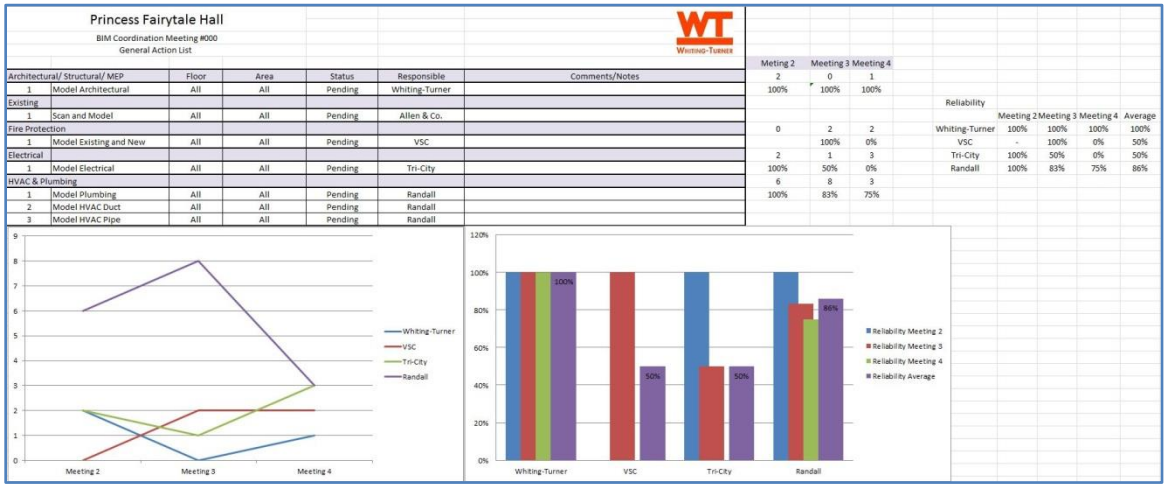
2nd Meeting – Did you do what you said you were going to?

- If not,
  - Why not in a few words
  - Categorize [weather, planning, coordination, materials…]
- What are you doing?

3rd Meeting – Did you do what you said you were going to?

- If not,
  - Why not in a few words
  - Categorize [weather, planning, coordination, materials…]
- What are you doing?

Ect.



Princess Fairytale Hall

BIM Coordination Meeting #000
General Action List

Architectural/ Structural/ MEP		Floor	Area	Status	Responsible	Comments/Notes
1	Model Architectural	All	All	Pending	Whiting-Turner	
Existing						
1	Scan and Model	All	All	Pending	Allen & Co.	
Fire Protection						
1	Model Existing and New	All	All	Pending	VSC	
Electrical						
1	Model Electrical	All	All	Pending	Tri-City	
HVAC & Plumbing						
1	Model Plumbing	All	All	Pending	Randall	
2	Model HVAC Duct	All	All	Pending	Randall	
3	Model HVAC Pipe	All	All	Pending	Randall	

	Meting 2	Meeting 3	Meeting 4
	2	0	1
	100%	100%	100%
	0	2	2
		100%	0%
	2	1	3
	100%	50%	0%
	6	8	3
	100%	83%	75%

Reliability

	Meeting 2	Meeting 3	Meeting 4	Average
Whiting-Turner	100%	100%	100%	100%
VSC	-	100%	0%	50%
Tri-City	100%	50%	0%	50%
Randall	100%	83%	75%	86%

From this, we were able to establish our Commitment Reliability Index. The Commitment Reliability Index is not a measure of productivity, but is Actual Complete work divided by the number committed work. This allows us a chance to learn and see where waste is and how to make everyone more reliable.

MODULAR ADVANTAGES

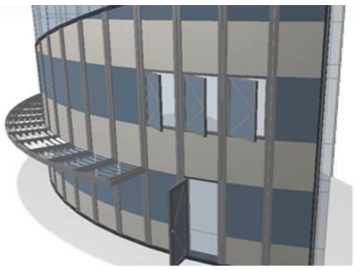
Advantages to Modular

- Reduced Waste
- Improved Schedule
- Reduced on-site man hours
- Increased Quality

VIRTUAL DESIGN & CONSTRUCTION

Manufacturing Infrastructure

Precast concrete



Curtain Wall

Bathroom pods

Pre-packaged mechanical penthouse

Modular home building

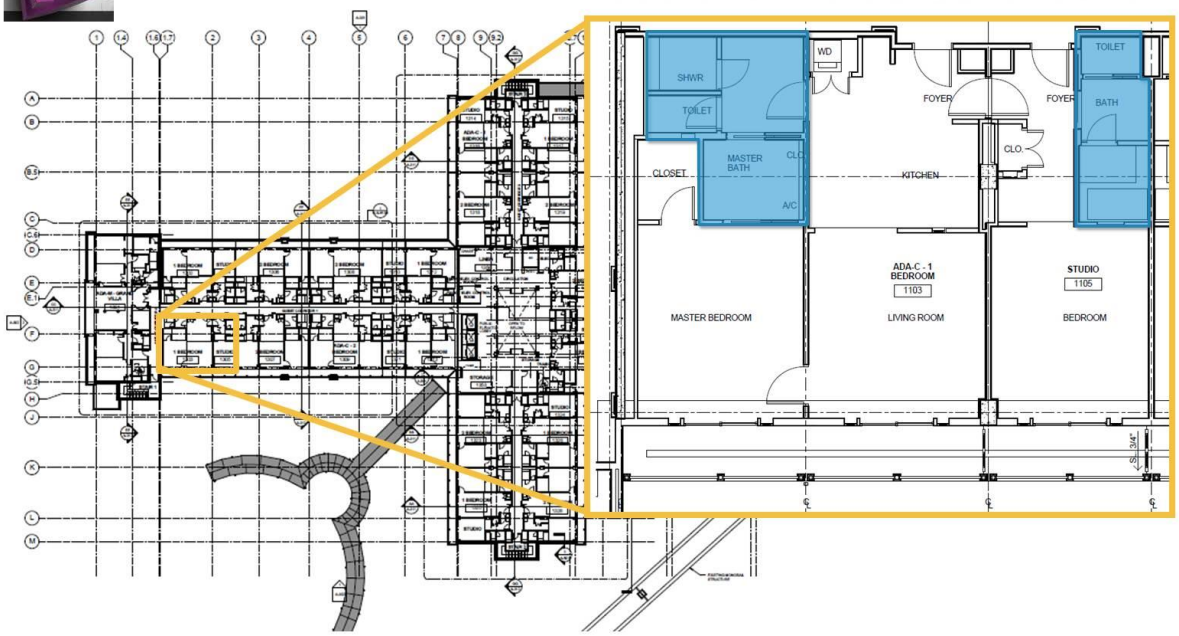
VIRTUAL DESIGN & CONSTRUCTION

Whiting-Turner
Modular & Prefab Experience

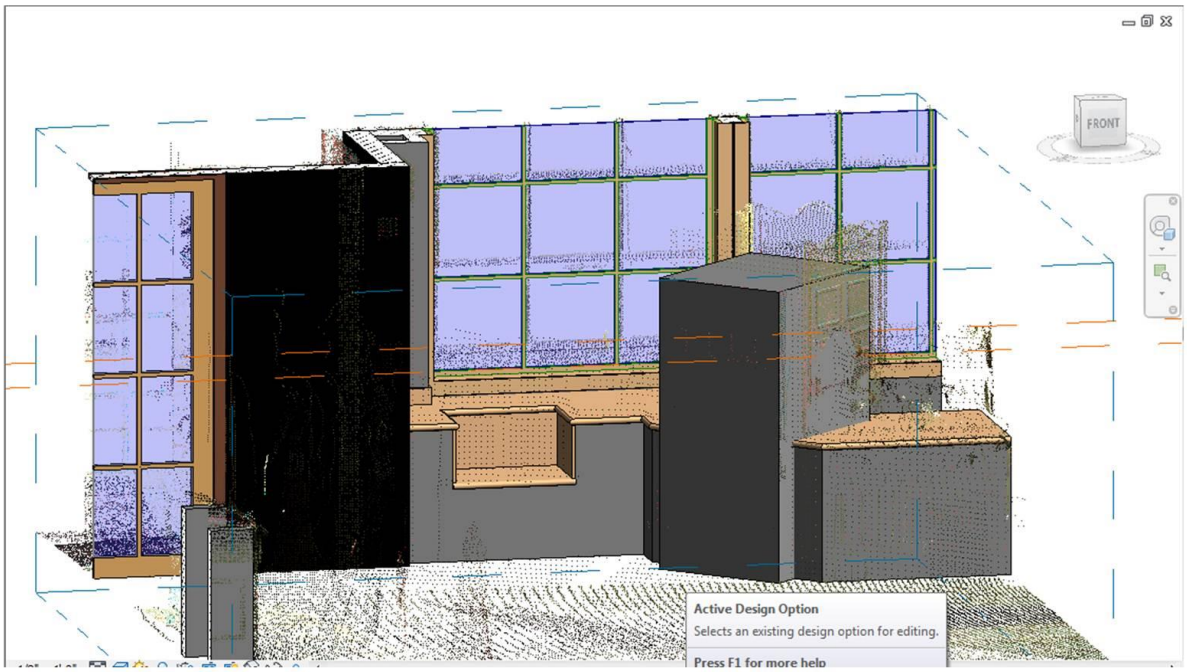
WT VIRTUAL DESIGN & CONSTRUCTION

AUTODESK SOLUTIONS

Orlando Area Resort
Modular & Prefab Construction



WT VIRTUAL DESIGN & CONSTRUCTION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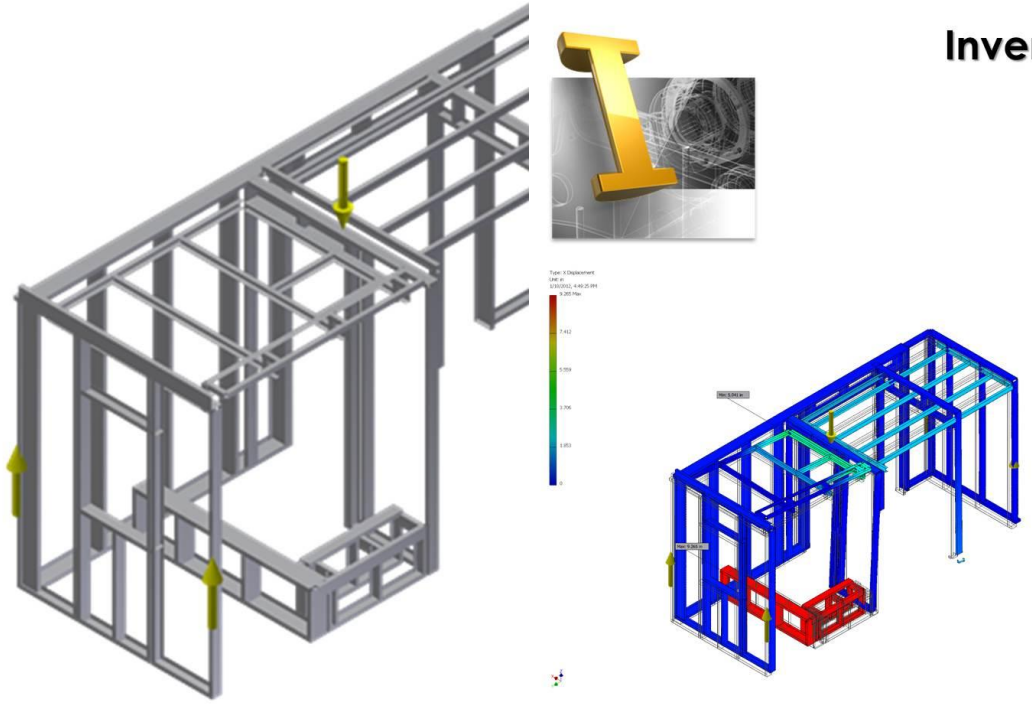
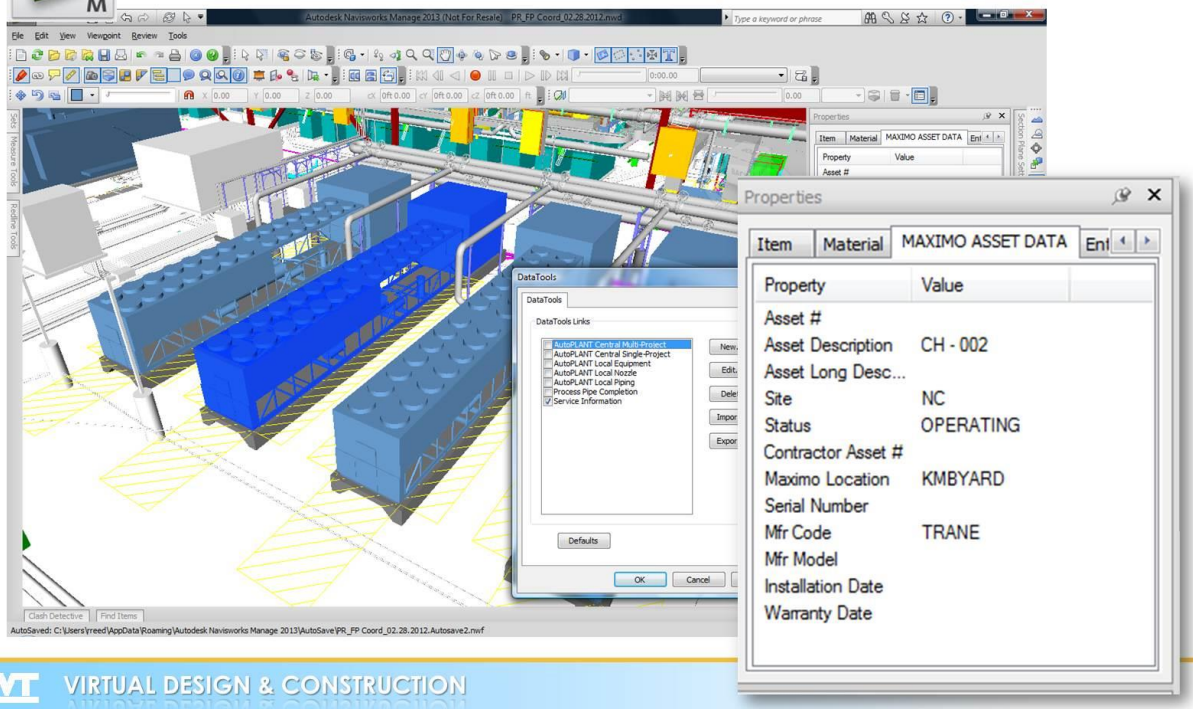
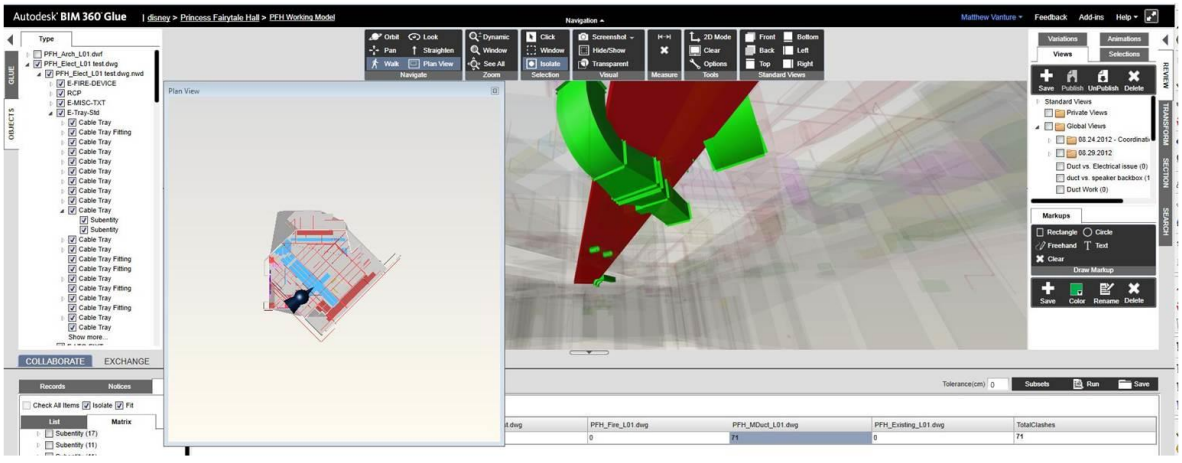

Inventor

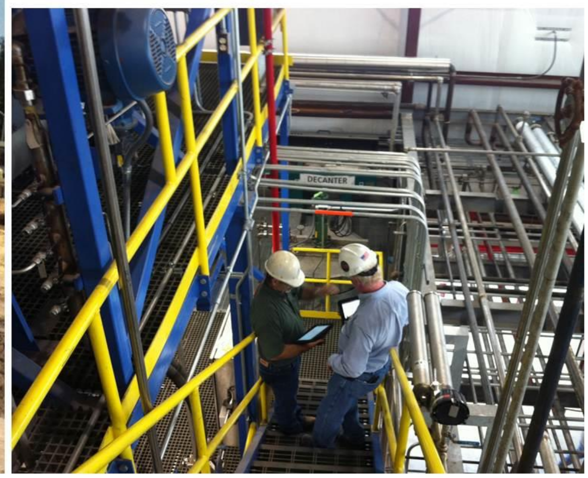
NavisWorks Manage



BIM360Glue



BIM360Field



VIRTUAL DESIGN & CONSTRUCTION

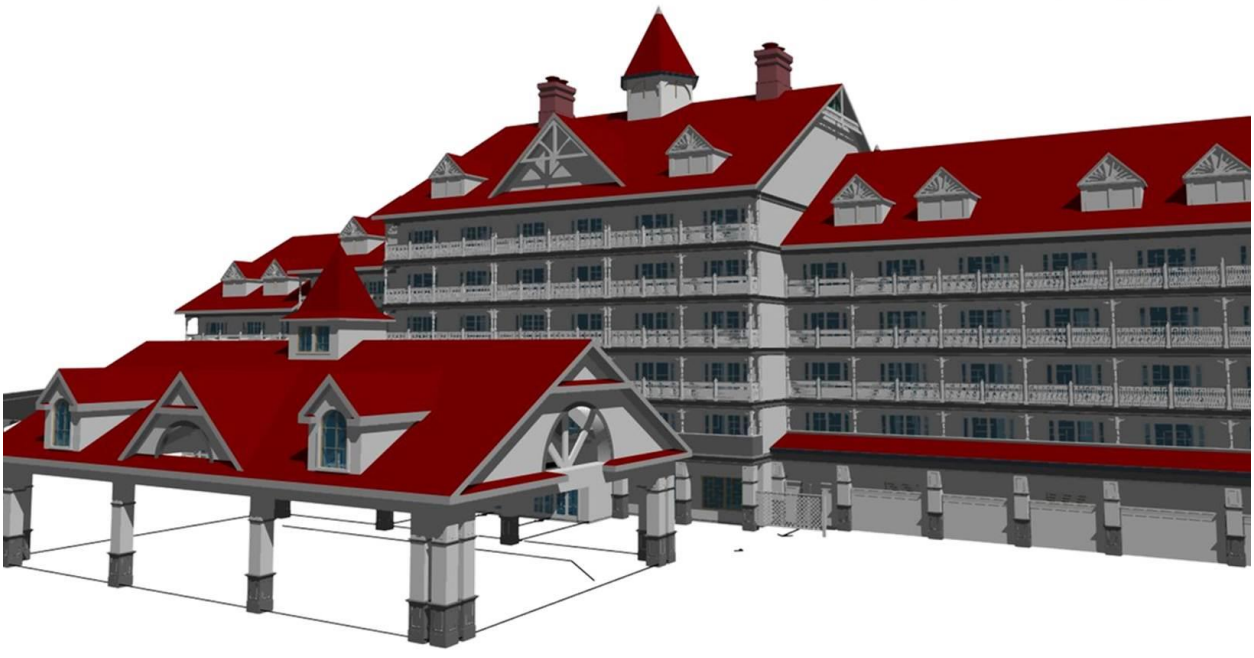
MANUFACTURING MINDSET

CASE STUDY – HOW TO SEE AN INNOVATIVE STRATEGY THROUGH

OFF-SITE MODULAR DIY

WT VIRTUAL DESIGN & CONSTRUCTION

Orlando Area Resort



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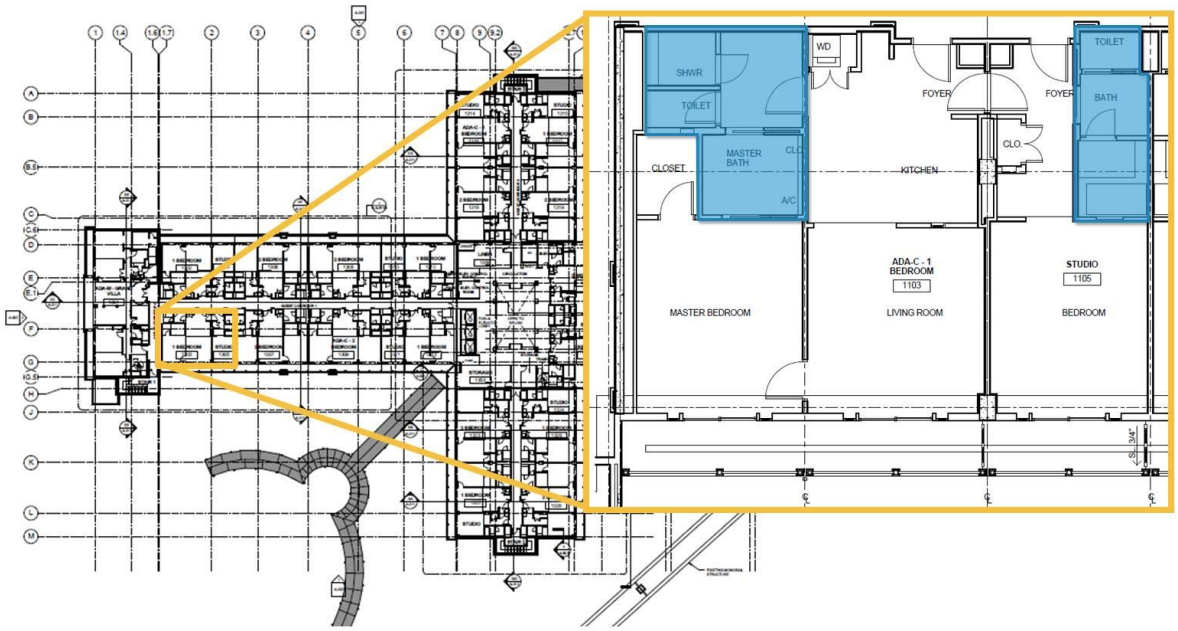
Orlando Area Resort
Modular & Prefab Construction



VIRTUAL DESIGN & CONSTRUCTION

Whiting-Turner
Bathroom Pod Experience

VIRTUAL DESIGN & CONSTRUCTION

Potential Modular / Prefab Applications
Guestroom Bathrooms

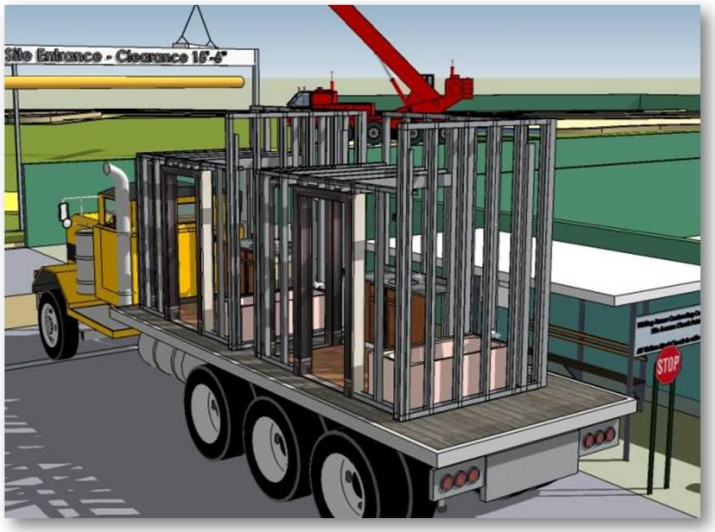
eggrock™ MODULAR SOLUTIONS

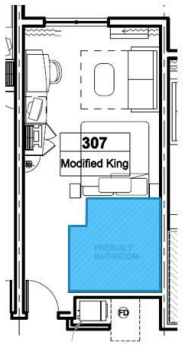
Co-located vs. Turn Key Pods

RFQ went out to 4 companies:
- Eggrock
- Neopod
- Ameripod
- Kullman

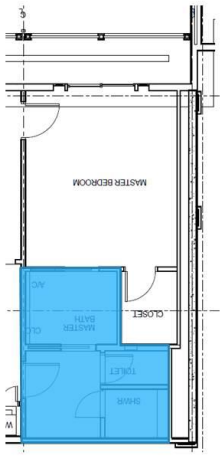
Constructability concerns:
- Size of pods
- Required depressed slabs
- No experience with high-end finishes
- Requires early finish information to begin manufacturing

Modular Challenges
Size Restrictions





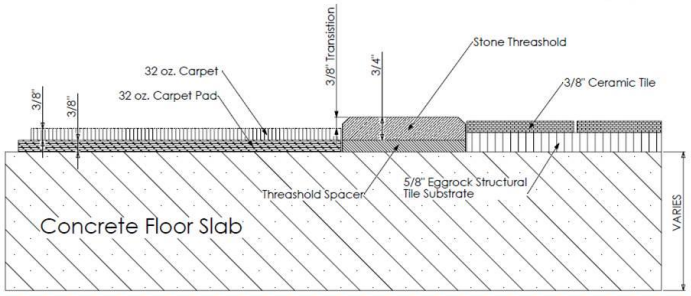
Typ. Eggrock Floor Plan



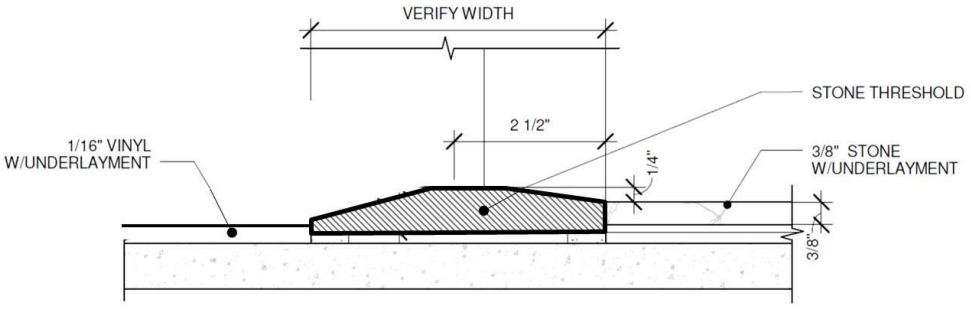
Orlando Area Resort Floor Plan

Modular Challenges
Flooring Transitions

Eggrock Detail



Orlando Area Resort Detail



COST

	Eggrock			Neopod			Kullman		
Contact	Paul Reibel			Juan Bermudez			Chuck Savage		
Phone	267-615-4585			954-603-3100			908-236-0220		
RFP Comparison	**Unit Cost**	**Qty.**	**Total**	**Unit Cost**	**Qty.**	**Total**	**Unit Cost**	**Qty.**	**Total**
Master Bathroom Pod (Fabrication)	$28,717	94	$2,699,398	$30,000	94	$2,820,000	$37,488	94	$3,523,872
Master Bathroom Pod (Installation)	$988	94	$92,872	$750	94	$70,500	$3,149	94	$296,006
Guest Bathroom Pod (Fabrication)	$20,971	94	$1,971,274	$19,500	94	$1,833,000	$21,505	94	$2,021,470
Guest Bathroom Pod (Installation)	$988	94	$92,872	$700	94	$65,800	$1,692	94	$159,048
3-Bay Pod Subtotal			**$4,856,416**			**$4,789,300**			**$6,000,396**
Grand Villa Bathroom Pod (Fabrication)	$0	0	$0	$0	0	$0	$0	0	$0
Grand Villa Bathroom Pod (Installation)	$0	0	$0	$0	0	$0	$0	0	$0
Grand Villa Subtotal			**$0**			**$0**			**$0**
Tax			**$315,000**			**Included**			**Included**
Totals			**$5,171,416**			**$4,789,300**			**$6,000,396**
Bonds		1%	$48,587		1.25%	$60,000			Bond not Provided
Insurance		4.10%	$608		5%	$6,400			TBD
Deduct for General Liability if OCIP			($4,048)			($6,400)			($5,892)
D/A Fee			$5,000			$4,200			N/A

Co-Located Pod Solution

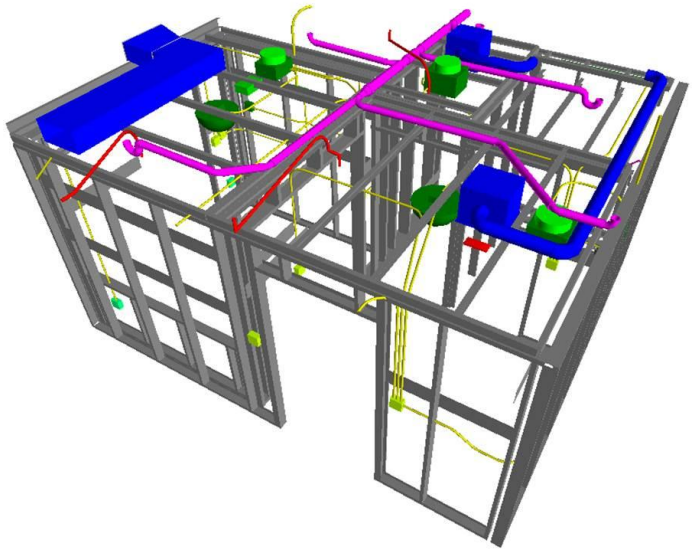
Maintains key advantages of turn-key pods, while overcoming some of the constructability issues.

- Reduced Waste
- Improved Schedule
- Reduced on-site man hours
- Increased Quality

Design/Assist – Co-Located Pods

What's In?

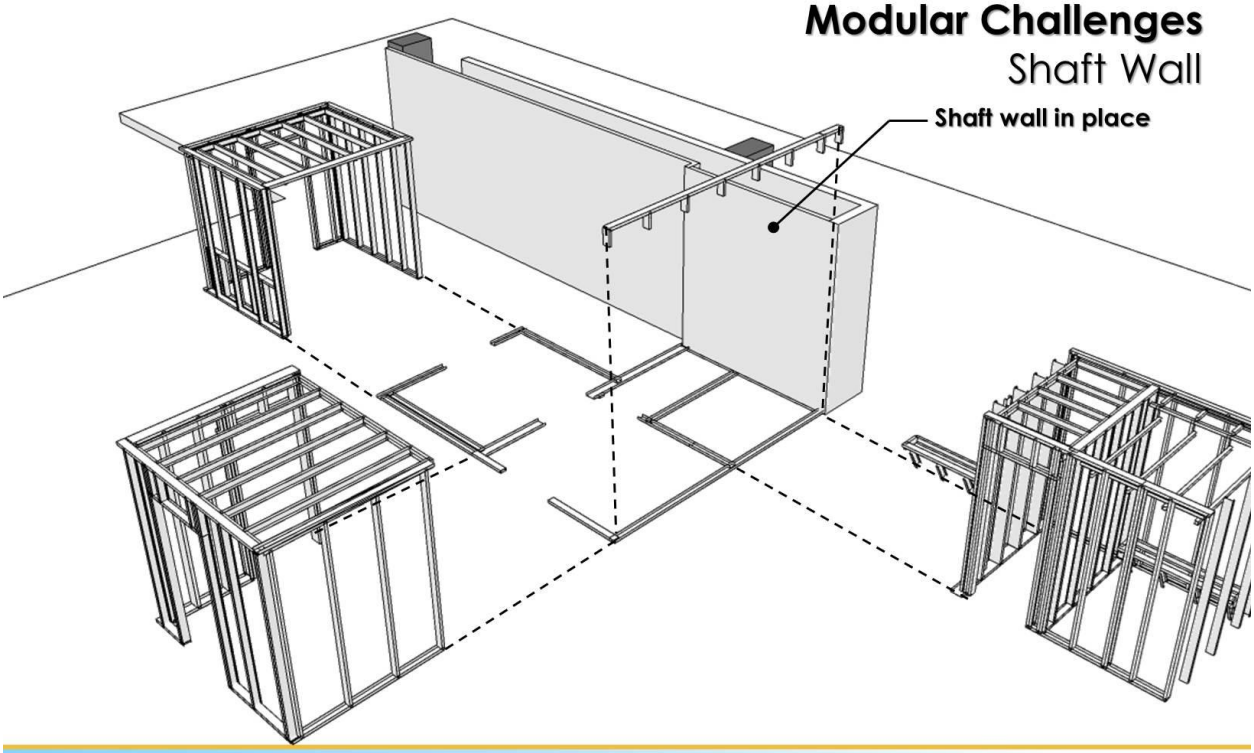
- Framing and Drywall
- Blocking
- Door Frames)
- Electrical Rough-in
- Plumbing
- Mechanical Ductwork and Exhaust Fans
- Fire Protection Heads



VIRTUAL DESIGN & CONSTRUCTION

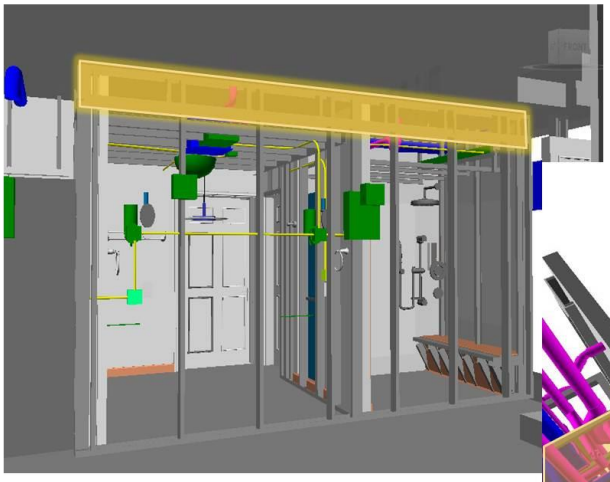
Modular Challenges

Shaft Wall



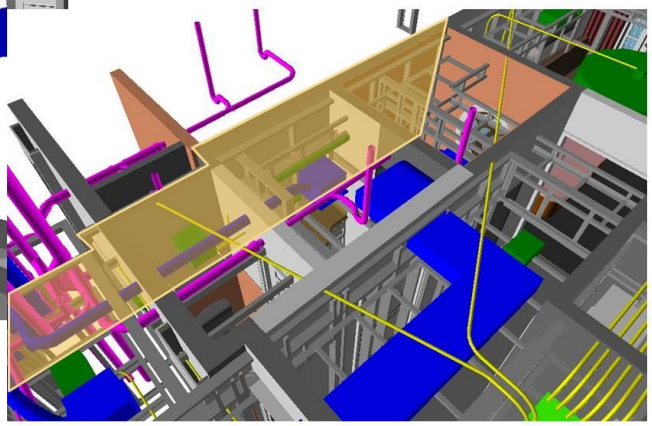
VIRTUAL DESIGN & CONSTRUCTION

Modular Challenges
Corridor Walls, Rated Penetrations & Inspections



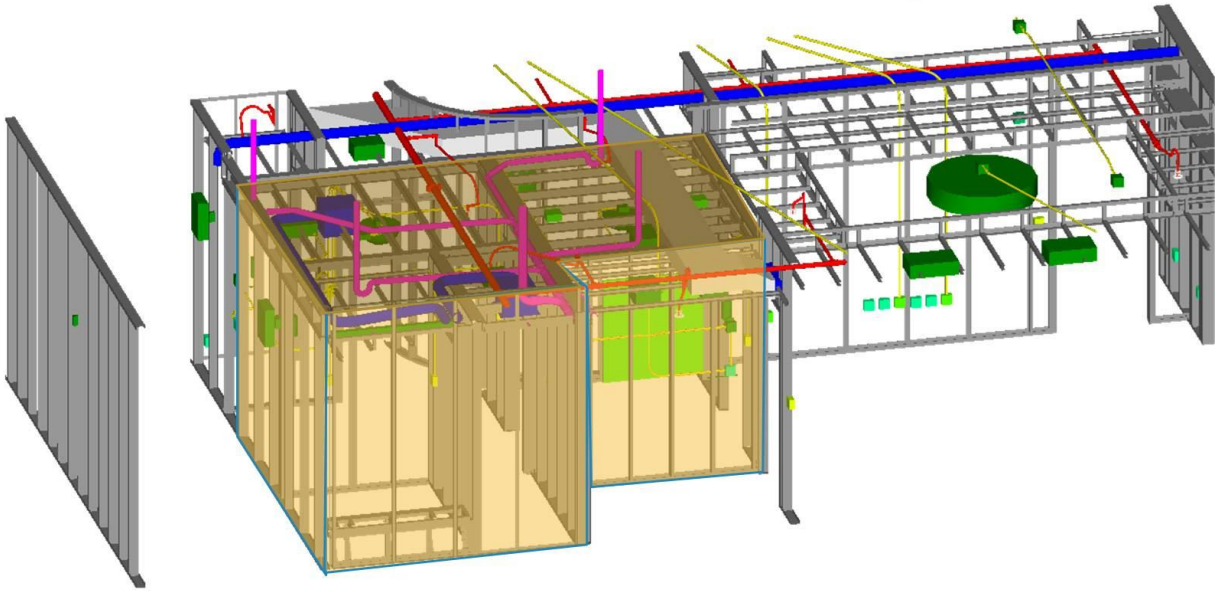
Corridor Wall in 2 Sections

Shaft wall in place



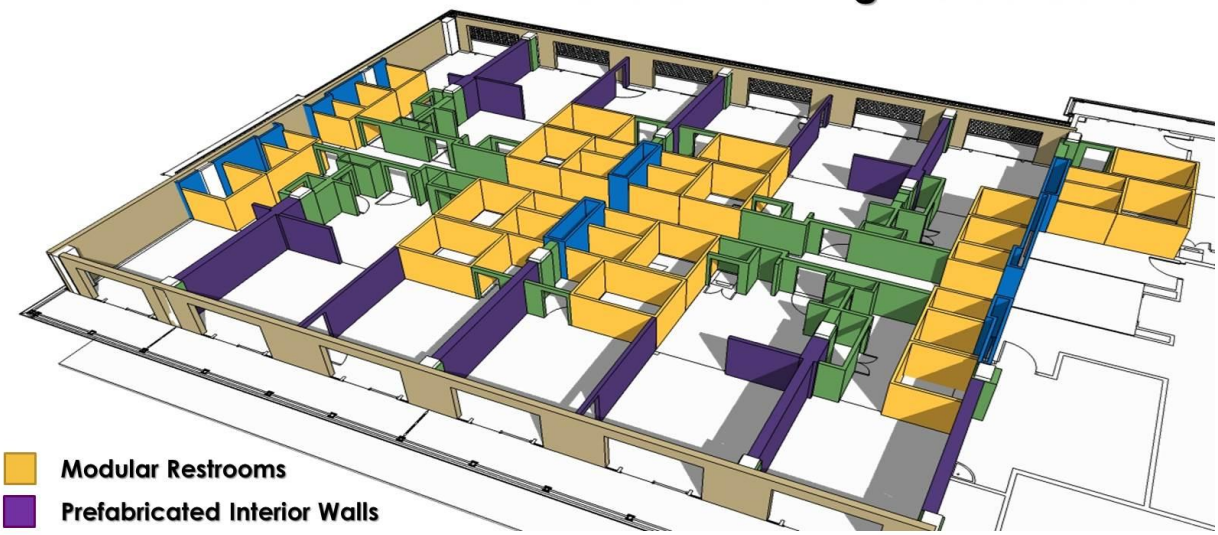
Modular Challenges
Overhead Connections

Modular Challenges
Height Concerns



WT VIRTUAL DESIGN & CONSTRUCTION

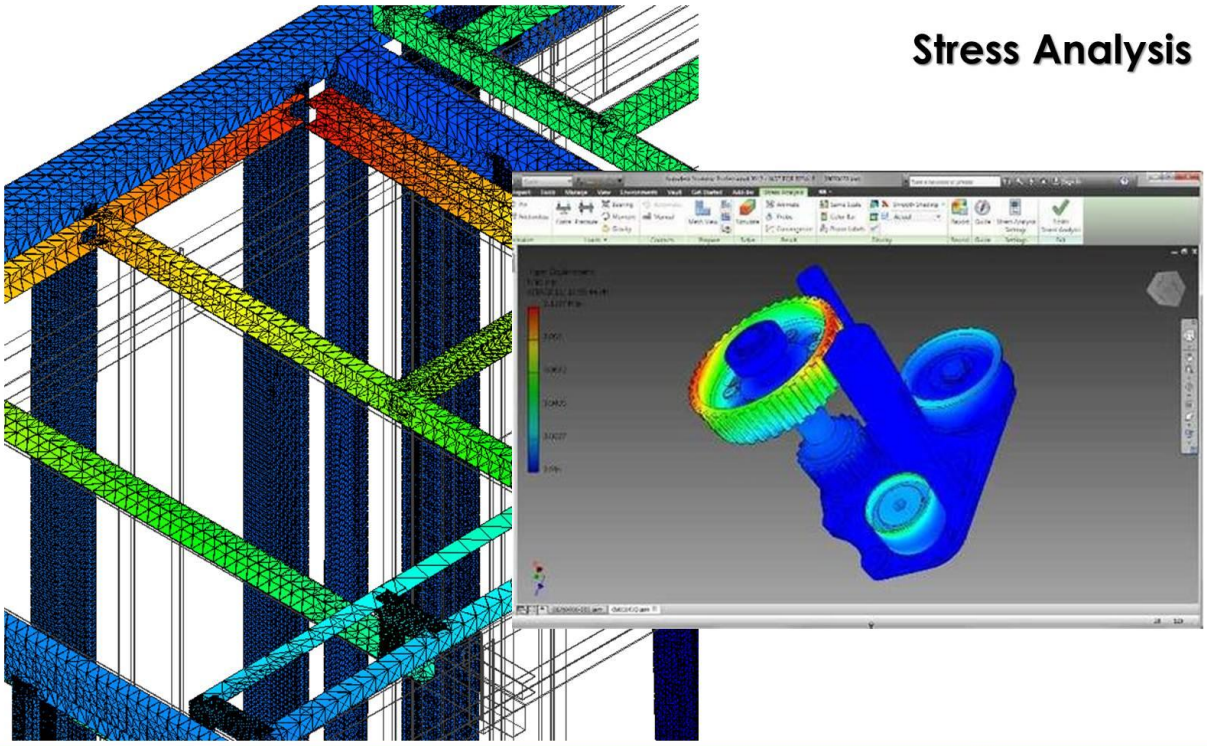
Overall Framing Prefabrication



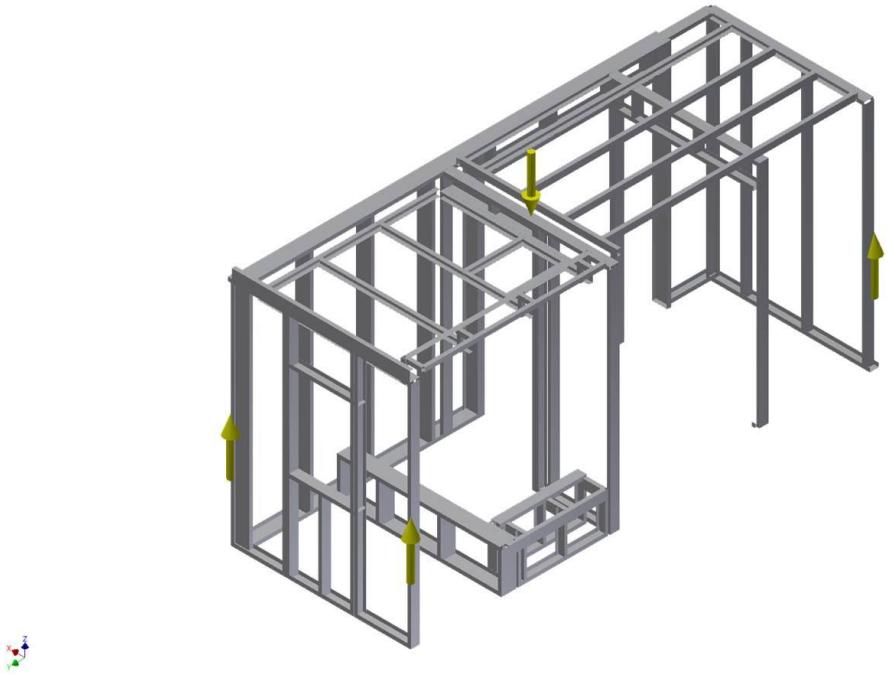
- Modular Restrooms
- Prefabricated Interior Walls
- Conventional Framing
- Conventional Shaft Wall Framing
- Prefabricated Exterior Wall Framing

WT VIRTUAL DESIGN & CONSTRUCTION

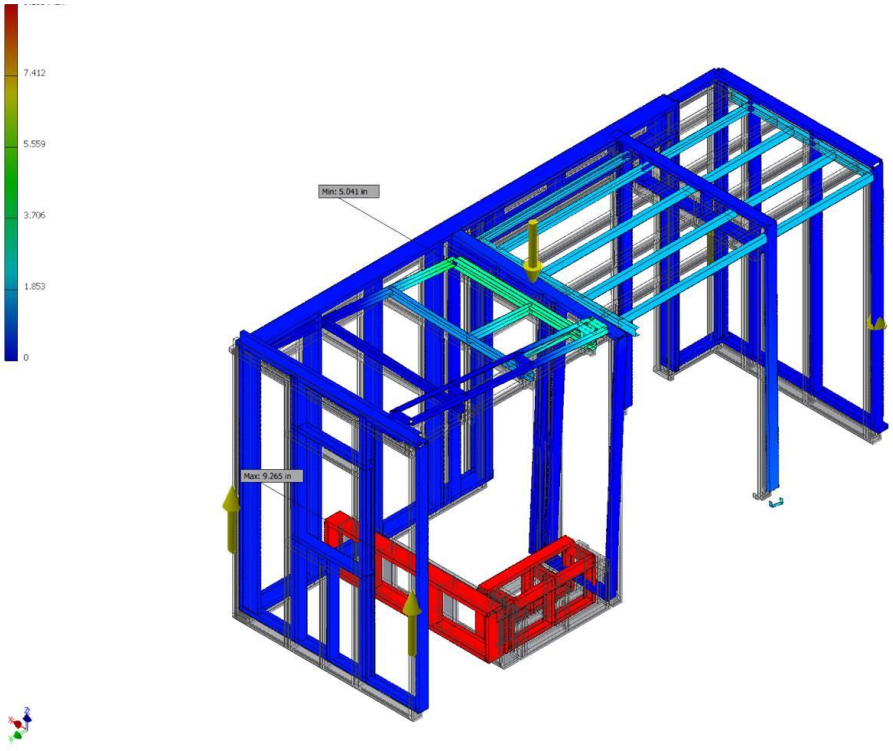
Stress Analysis



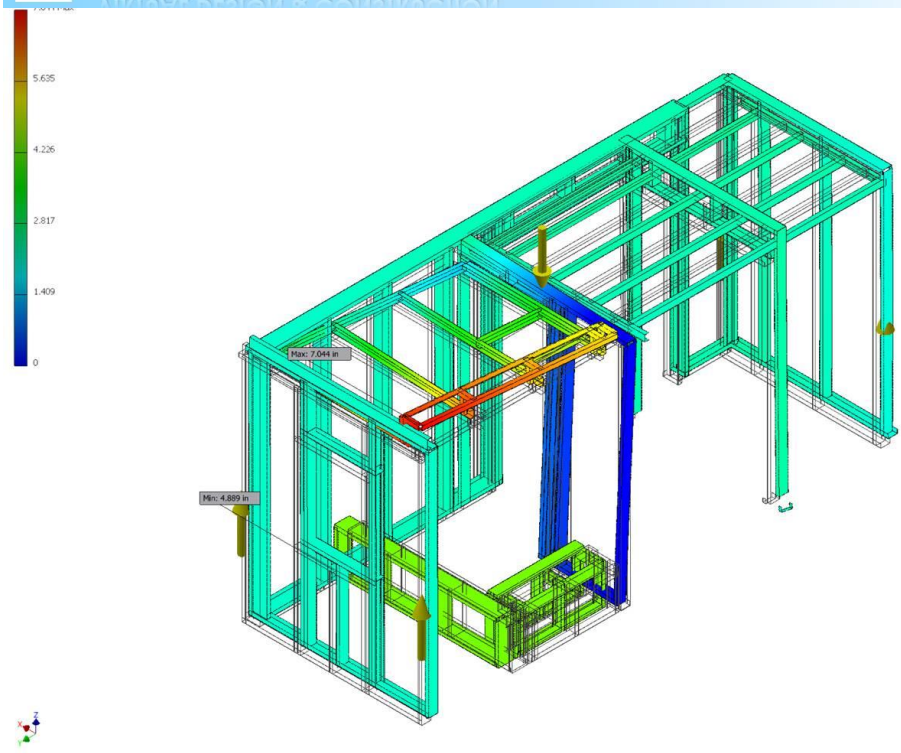
Stress Analysis



VIRTUAL DESIGN & CONSTRUCTION

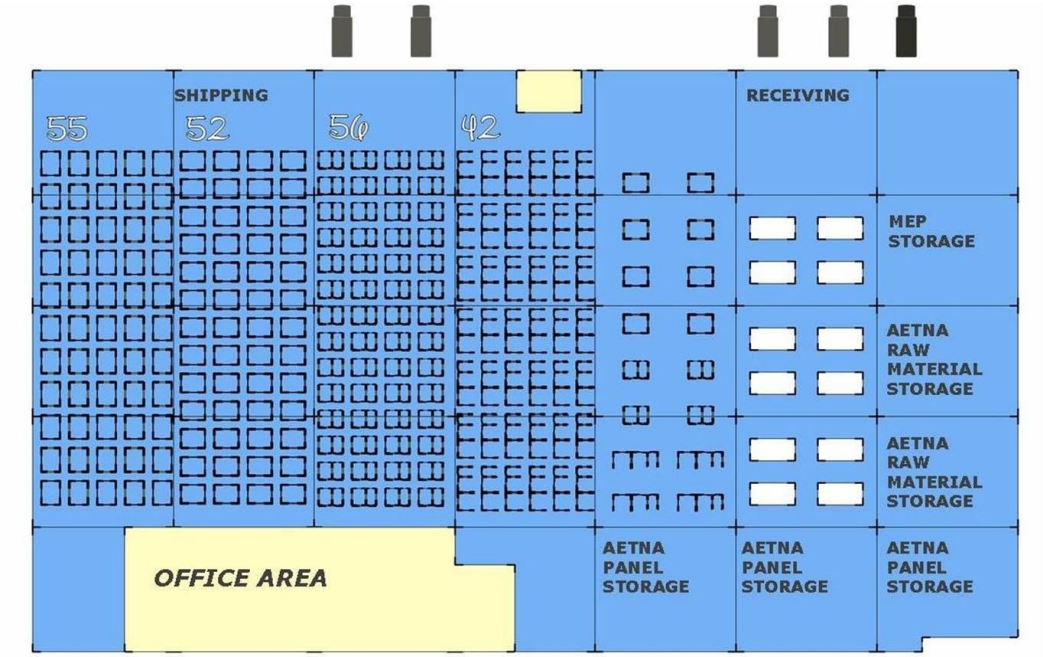


Stress Analysis



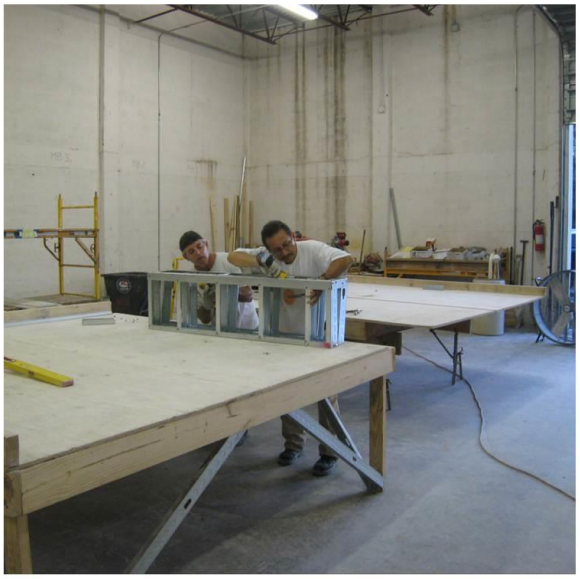
Stress Analysis

Warehouse Concepts



Manufacturing Mindset

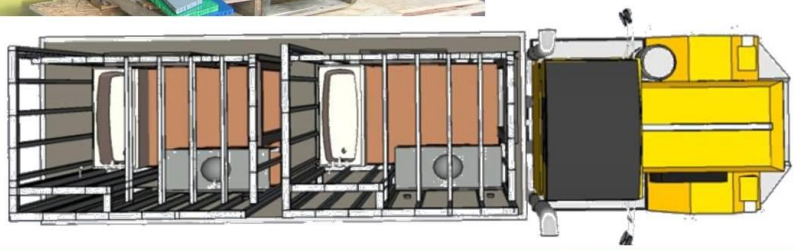
Manufacturing Mindset



Manufacturing Mindset

VIRTUAL DESIGN & CONSTRUCTION

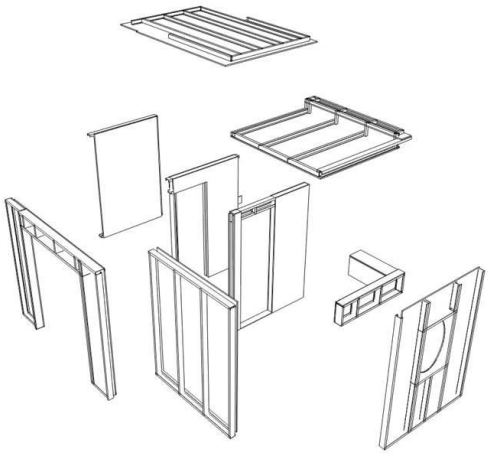
Pod Delivery



Change of Mindset

This level of prefabrication requires a change to the way we traditionally deliver projects:

- Need design decisions made earlier in the process
- Can reduce the ability to make changes without significant impacts
- Requires some design flexibility to maximize efficiencies
- Absolutely requires GC and Design Assist input at early stages of design process



Food for Thought

Design-Build, Design/Assist & IPD help fuel the possibilities for prefabrication / modularization.

The **BIM tools** allow for greater analysis and execution of prefab opportunities.

Push the envelope –
Don't accept the ways things have always been done as the metric for what is possible.