

#ITCon22

# Innovation Meets Construction

Advice, Tips, Tricks, and That Was Dumb!  
Benjamin Crosby – Yates Construction

 **CONFERENCE**  
FOR CONSTRUCTION PROFESSIONALS

#ITCon22

# Cool – Christmas 2015



# Blowing money – 2016



NBCNEWS.COM  
James Eng  
Dec. 16, 2015



IMAGE: CHAPPAQUA FIRE DEPARTMENT  
MASHABLE.COM  
Adario Strange  
Jan 21 2016

## Half a million hoverboards recalled due to fires, explosions and injuries

Mass recall comes after reports of hoverboard battery packs that exploded or caught fire and caused injuries such as burns to the neck, legs and arms



THEGAURDIAN.COM  
Associated Press

Wed 6 Jul 2016  
0:00 / 0:32

▲ Hoverboard explodes during a test drive

#ITCon22

# Great Investment – October 2019



# Things to know – Practical Application

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- 1. Don't try to go cheap
- 2. Check/Get Certification
- 3. Check for quality/history
- 4. Don't overdo it
- 5. Check on progress
- 6. {insert snide remark or catch phrase}

# Lean = Not an acronym

## AGC CM-Lean = Foundation

Lean Construction Education Program [SHARE THIS](#)



**Optional** Take the free **Lean 101 Course**

This optional, free 50 minute eLearning course introduces key CM-Lean concepts

Click on the dots below to learn how to earn your CM-Lean credential

• • • • •

Everyone related to the construction process has an incentive to get the project done faster

What people are... 

 Course Calendar

[View upcoming classes!](#)

 Supplemental Courses

[Learn More!](#)

# Lean

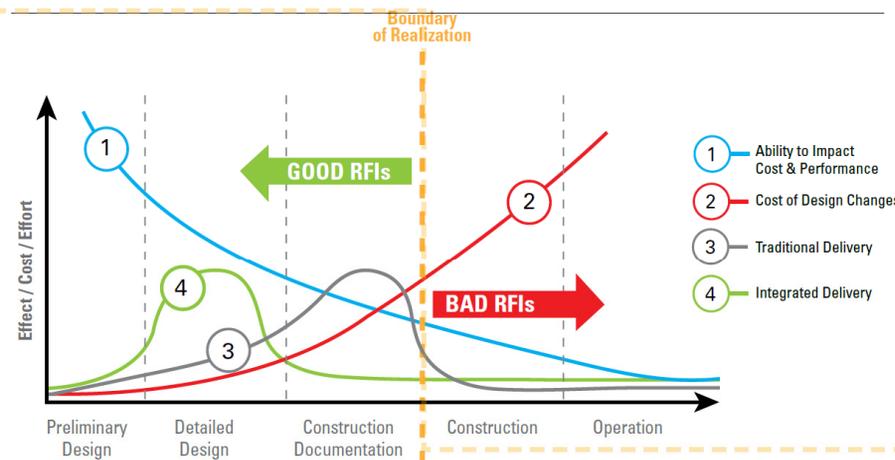
Last Planner System = Better Meetings – Better Schedule



# Lean

Lean Design = BIM < iterative design < model review < VDC

The MacLeamy Curve

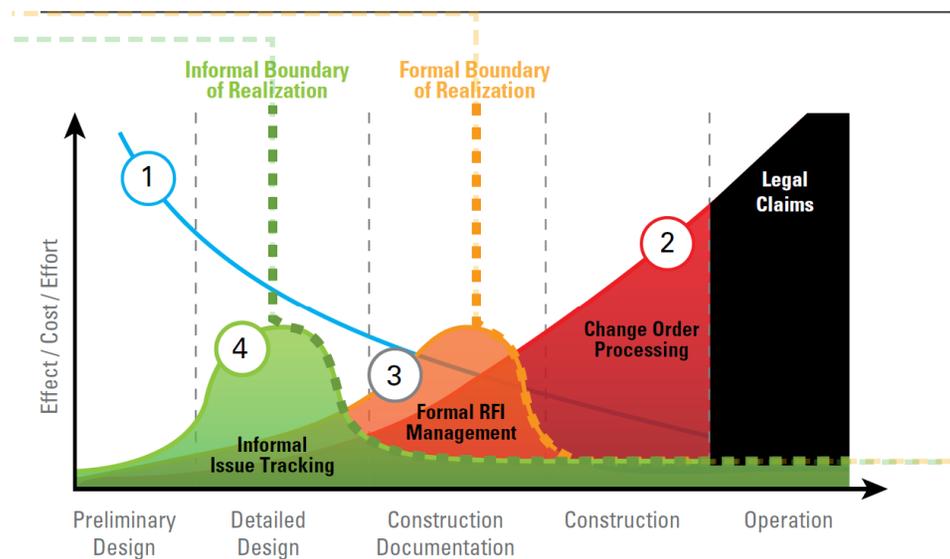


OPEN INTEGRATION SUMMIT 2017 | CONSTRUCTION PROGRESS COALITION

# Lean

## Problem Solving

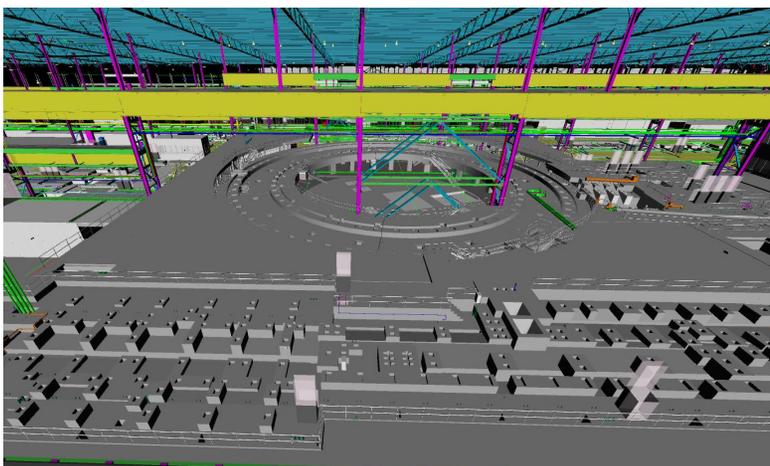
### Informal vs. Formal Boundaries



- 1 - Ability to Impact Cost & Performance
- 2 - Cost of Design Changes
- 3 - Traditional Delivery
- 4 - Integrated Delivery

# Lean

## Prefabrication < Manufacturing



# Lean

## It is a Social Tech – not a Program



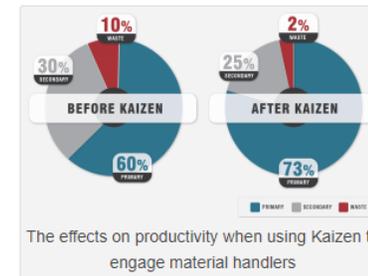
0



### Making Productivity Gains Through Material Handling and Kaizen

November 27, 2018 by [Derek Buehler](#) under the topic of: [Faith Technologies, Productivity](#)

At **Faith Technologies**, continuous improvement and innovation are at the heart of our work. Through focused, gradual improvements over a nine-year span, Faith has increased primary, or value-added, time from 39 percent to 66 percent. This represents a 69 percent improvement in time spent on what the customer pays us to do, while the construction industry overall has stagnated at 42 percent primary time throughout the same period.



# Lean

1. Hard Bid is usually not the low-cost option.
2. Get your team educated – request certification for others.
3. Request history / results in qualification documents.
4. Don't ask for everything – hit the important parts.
5. Actively participate.
6. Lean is a culture, not a bolt on.

# LOD = Level of Development

<http://bimforum.org/lod/>

# 2020

## BIM FORUM

### LEVEL OF DEVELOPMENT (LOD) SPECIFICATION PART I & COMMENTARY

*For Building Information Models and Data*

**December 2020**

Committee Co-Chairs  
Jim Bedrick, FAIA, Will Ikerd, P.E., Jan Reinhardt

PARTICIPATING ORGANIZATIONS

The American Institute of Architects  
AGC of America  
THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA  
Quality People. Quality Projects.  
BIM-M  
Building Information Modeling for Masonry  
NISD  
NATIONAL INSTITUTE OF STEEL BUILDING  
Founded 1988  
Precast/Prestressed PCI Concrete Institute  
USIBD  
U.S. Institute of BUILDING DOCUMENTATION

Copyright © 2016 BIM Forum



# LOD



# LOD = Level of Development

1. The Specification is free to use.
2. Lots of webinars on how to use it. [BIMForum.org](http://BIMForum.org)
3. LOD 200 and 300 for A/Es – LOD 350 and 400 for Shop Models.
4. Don't ask for 400, 450, 500, 789.
5. Review models frequently (at least monthly).
6. No risk here, just do it.

# BIM = Building Information Modeling

## AGC CM-BIM = Foundation

Building Information Modeling Education Program [SHARE THIS](#)



**1<sup>st</sup> step** **Locate your classes**  
Use the National Course Calendar to find upcoming classes in your area

Click on the dots below to learn how to earn your CM-BIM credential



Building Information Modeling (BIM) is changing the way projects are constructed. Whether you are a prime contractor using BIM across an entire project or a subcontractor impacted by

Meri Woods  
Senior Director, Education Advancement and Credentialing  
[meri.woods@agc.org](mailto:meri.woods@agc.org)  
Phone: (703) 837-5366

 Course Calendar

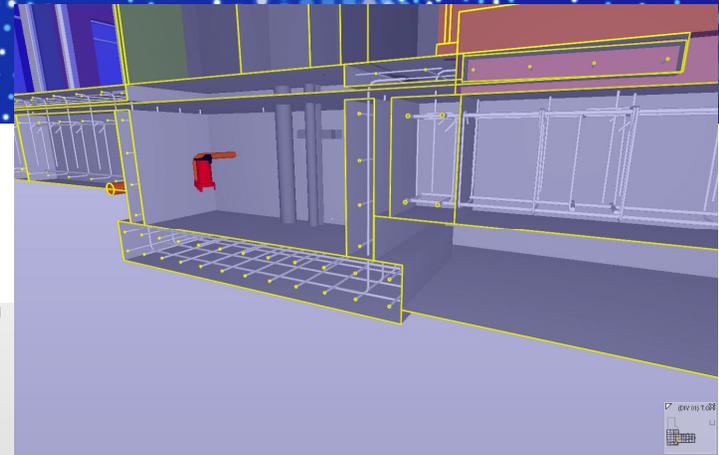
[View upcoming classes!](#)

 CM-BIM Exam

[Earn Your Credentials!](#)

# BIM

What do you use the models for during design?



CHECKING Check Model Report 3D

Ruleset - Checked Model

- Model Hierarchy OK
- Clearance in Front of Window
- Clearance in Front of Doors Warning
- Clearance Above Suspended Ceiling

RESULT SUMMARY Report

Issue Count	Warning	Error	Info	OK	Total
4	1	0	0	4	4

RESULTS No Filtering Automatic

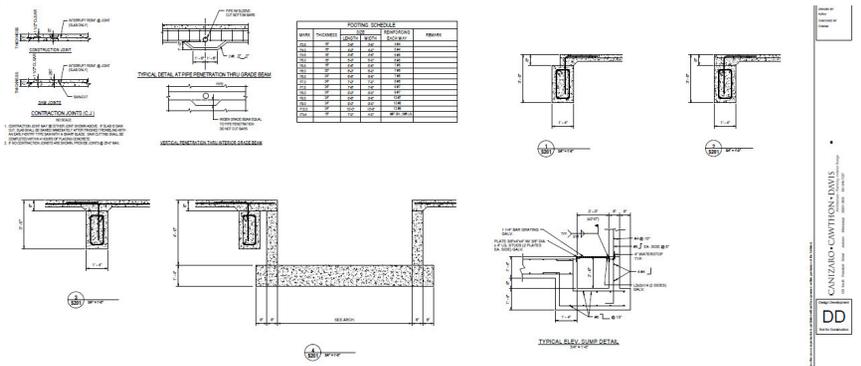
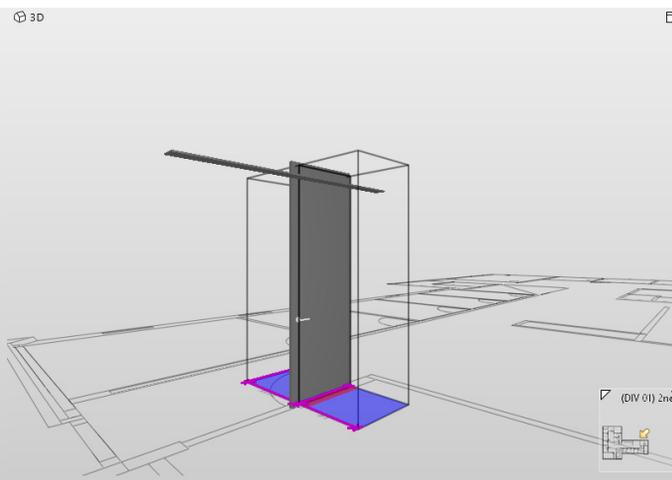
Results

- Door too close to Door component [1/1]
- Suspended Ceiling too close to Door component [0/1]
- 5/8" Gyp Only too close to Door-Curtain-Wall-Single-Woo

INFO

Suspended Ceiling too close to Door component

Description Hyperlinks



NO.	DESCRIPTION	AMOUNT	UNIT	REMARKS
1	ASPH/FLT	1000	SQ FT	
2	FLY	500	SQ FT	
3	GRASS	200	SQ FT	
4	PAV	100	SQ FT	
5	CONC	50	SQ FT	

TYPICAL DETAIL AT RECEPTION AREA UNDER SHAW

TYPICAL BLIND SHIMP DETAIL

# BIM

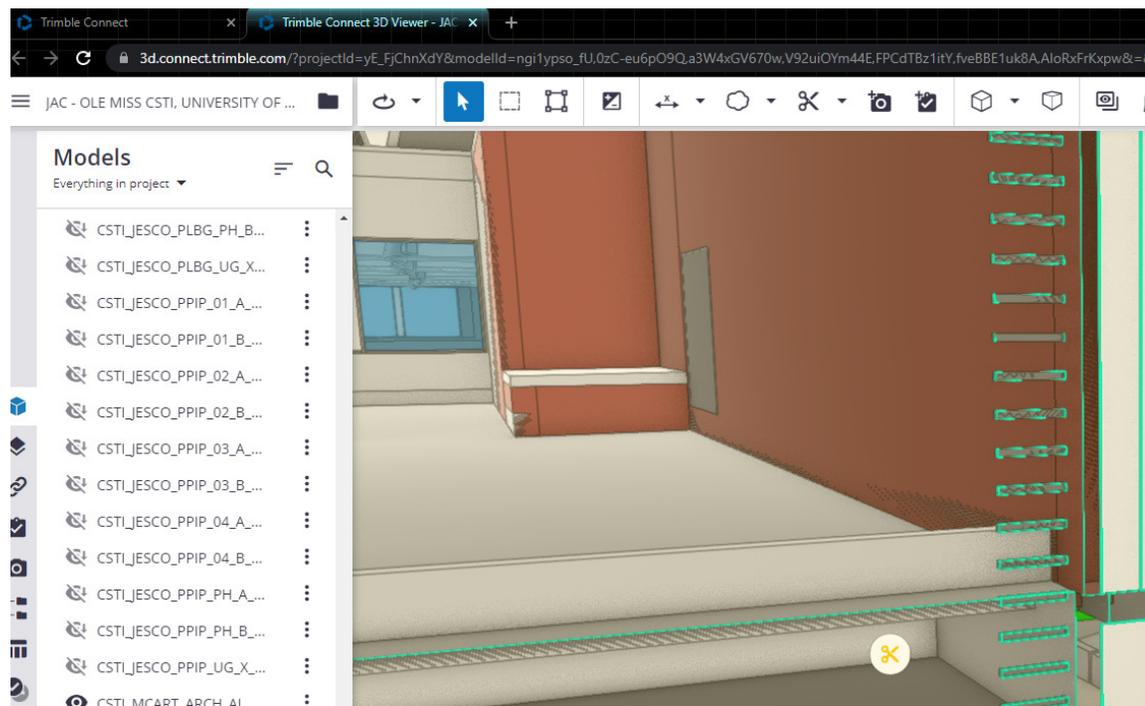
Review model progress regularly (don't waste time on drawings).

The screenshot displays a software interface for comparing two versions of a BIM model. On the left, two version selection boxes are shown: 'A V19 20190708 07/16/2019' and 'B V18 20190607 06/07/2019'. Below these is a 'SHOW VARIANCES FOR' section with a checked box and a green circle, labeled 'Added (75)'. The main part of the interface is a table with columns for item name, length, and area. The table lists various structural elements such as 'Generic Models', 'Structural Columns', 'Structural Connections', and 'Structural Framing'. A row for '4551445' is highlighted in yellow, showing a variance of 34.42 LF. To the right of the table is a 3D perspective view of a structural frame with columns and beams in different colors (green, blue, red) against a purple background.

Item Name	Length	Area
Generic Models : #SY - DrapeText_Start : Default	2	2.00 EA
Structural Columns	65.75	18.00 47.75 LF
Structural Columns : #CIP - Column - Rectangular : 18x18	29.33	12.00 17.33 LF
Structural Columns : #CIP - Column - Rectangular : 18x36		6.00 (6.00) LF
Structural Columns : #STL - Column - HSS Rectangular	36.42	36.42 LF
Structural Connections	12	0 12.00 EA
Structural Connections : #CN - Anchor Bolts No Plate : Co...	8	0 8.00 EA
Structural Connections : #CN - Plate - Embed - Horizontal...	2	0 2.00 EA
Structural Connections : #CN - Plate - Embed - Vertical	2	0 2.00 EA
Structural Framing	118.83	73.50 45.33 LF
Structural Framing : #CIP - Framing - Rectangular : BM40	31.08	31.08 0.00 LF
Structural Framing : #STL - Framing - C Shape - 2017v1 ...	11.67	17.75 (6.08) LF
Structural Framing : #STL - Framing - C Shape - 2017v1 ...	7.25	7.25 LF
Structural Framing : #STL - Framing - L Shape - 2017v1 ...		7.33 (7.33) LF
Structural Framing : #STL - Framing - W Shape - 2017v1 ...		17.33 (17.33) LF
Structural Framing : #STL - Framing - W Shape - 2017v1 ...	68.83	68.83 LF
4551445	34.42	34.42 LF

# BIM

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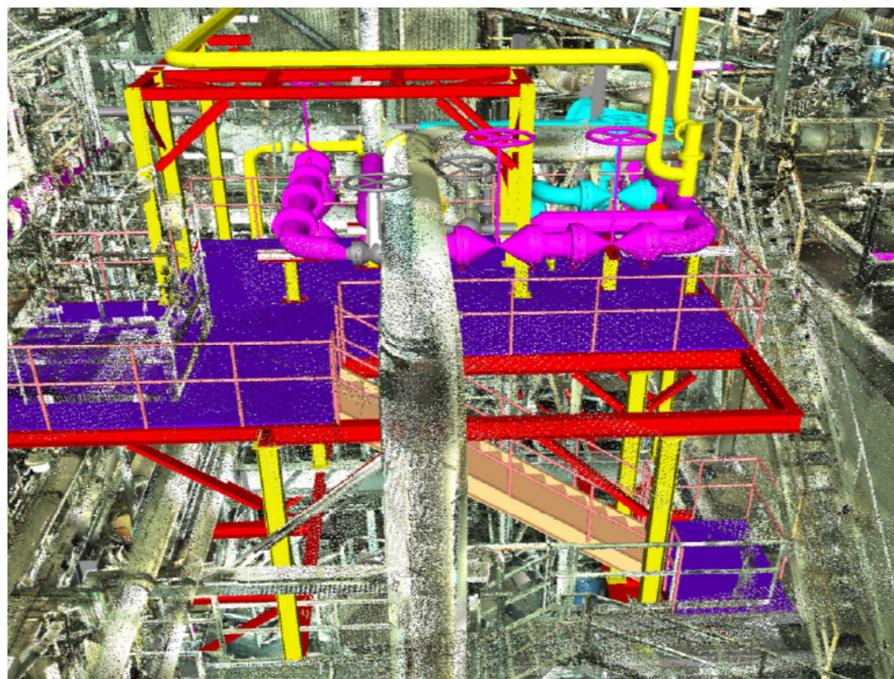
Review model progress regularly  
(don't waste time on drawings).

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# BIM

Existing facility

= Laser scan.



# BIM

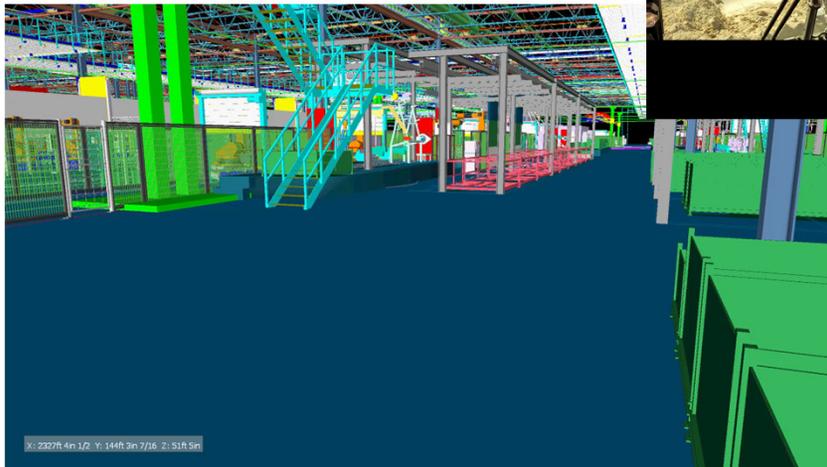
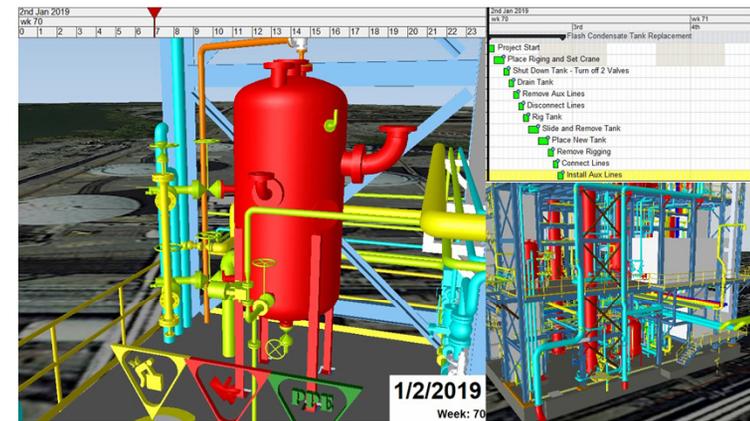
1. Your top 20-25% design firms are doing it right.
2. Do they have a BIM person, or are they practicing 3D Design?
3. How have they used the models (consultants too) in the past?
4. COBie can be a killer, just ask for what is needed.
5. Review the models regularly (scope, alignment, progress).
6. If it cost more, they're doing it wrong.

# VDC = Virtual Design and Construction

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Virtual Design and Construction > BIM

What do you do with the models?



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# VDC

## Process for better building

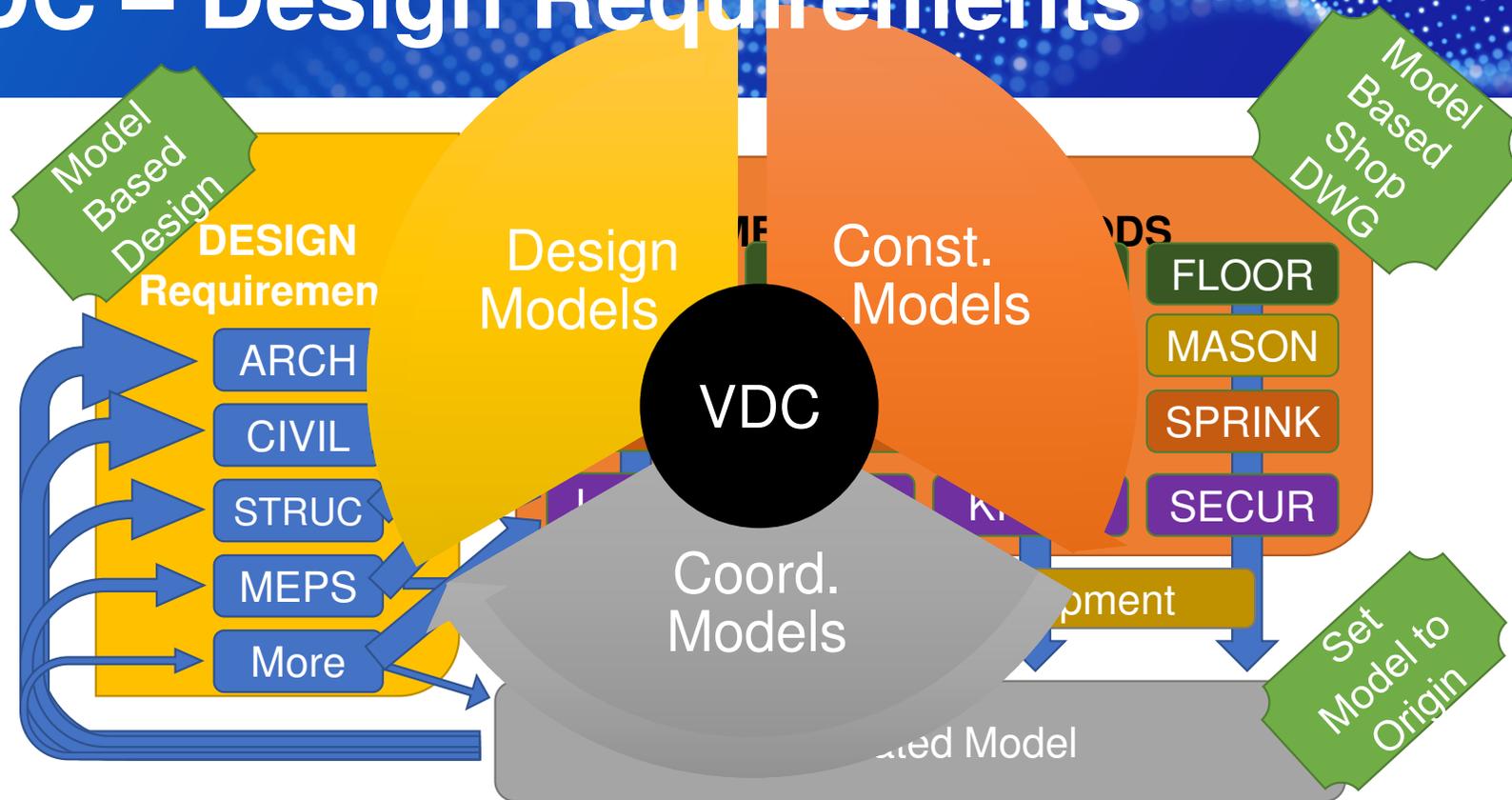


### Collaboration



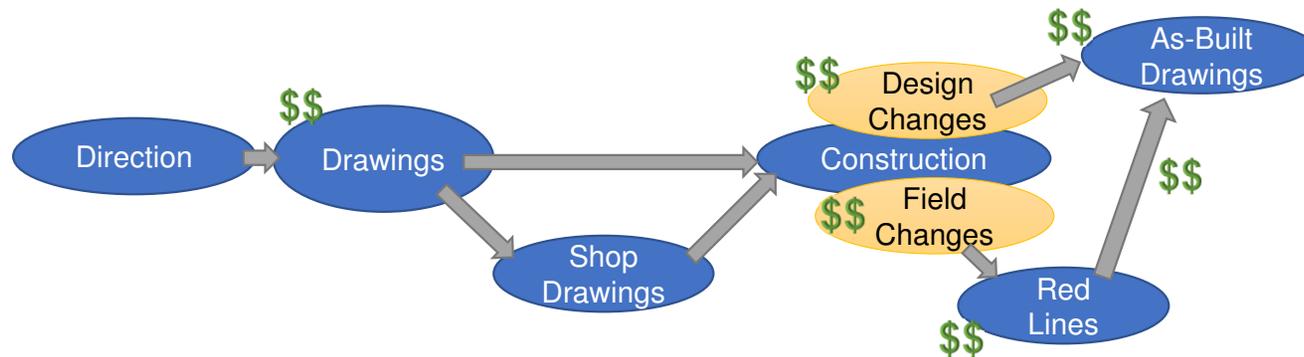
- A key to success is acknowledging and respecting the skillsets of the project team members, from different backgrounds and organizations.

# VDC – Design Requirements



# VDC

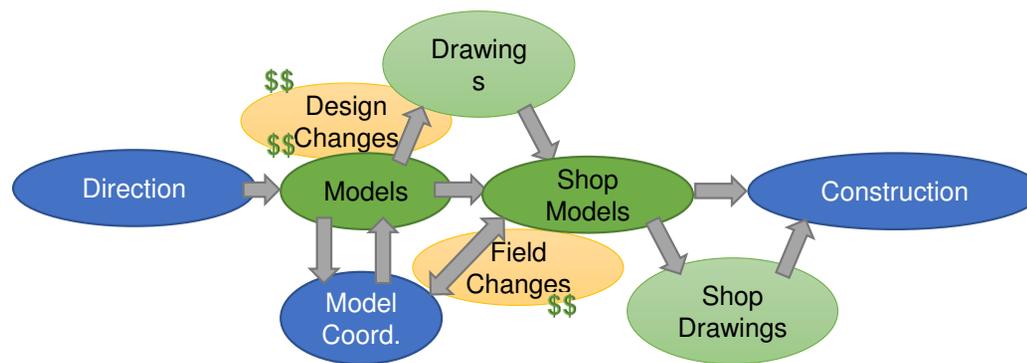
## As-builts (trash) vs Record Models and Fabrication Models



Design changes are not incorporated into documents until the end. Building with loosely coordinated documents and sometimes uncoordinated changes (RFI's, Sketches, ASI's)

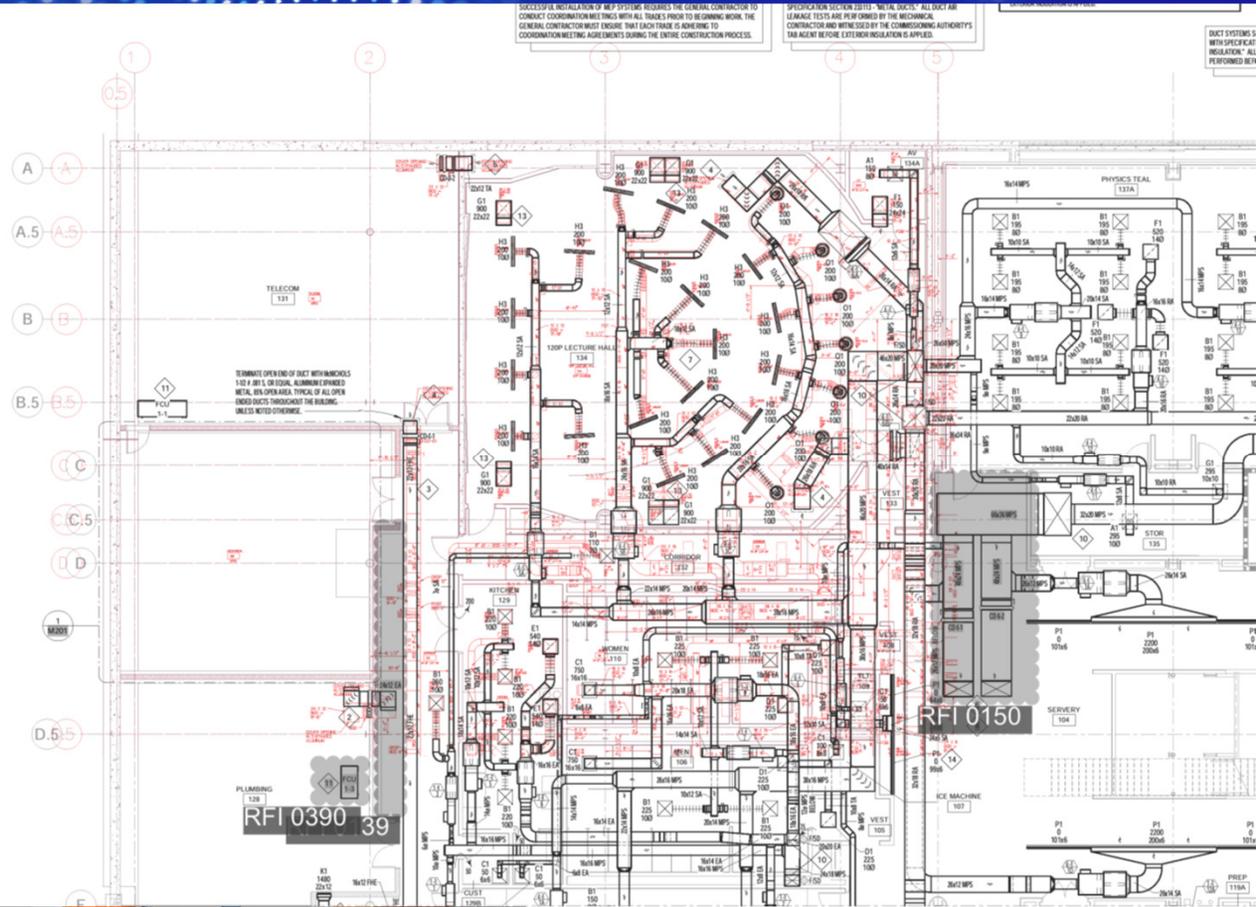
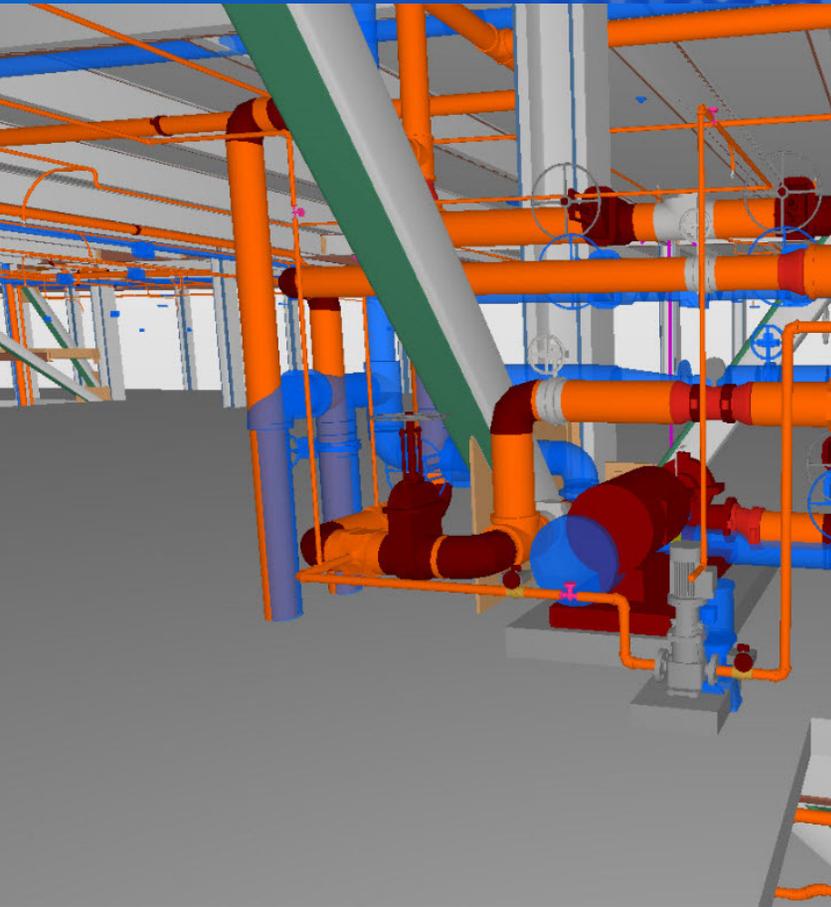
# VDC

## As-builts (trash) vs Record Models and Fabrication Models



# VDC

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SUCCESSFUL INSTALLATION OF MEP SYSTEMS REQUIRES THE GENERAL CONTRACTOR TO CONDUCT COORDINATION MEETINGS WITH ALL TRADES PRIOR TO BEGINNING WORK. THE GENERAL CONTRACTOR MUST ENSURE THAT EACH TRADE IS AWARE OF THE COORDINATION MEETING AGREEMENTS DURING THE ENTIRE CONSTRUCTION PROCESS.

SPECIFICATION SECTION 23115 "METAL DUCTS" - ALL DUCT AIR LEAKAGE TESTS ARE PERFORMED BY THE MECHANICAL CONTRACTOR AND WITNESSED BY THE COMMISSIONING AUTHORITY'S TAG AGENT BEFORE EXTERIOR INSULATION IS APPLIED.

GENERAL CONTRACTOR'S OBLIGATION

DUCT SYSTEMS SHALL BE INSULATED AS SPECIFIED BY THE ARCHITECT. ALL INSULATION SHALL BE PERFORMED BY THE MECHANICAL CONTRACTOR.

# VDC

## Use a good contract

- Responsibility for accuracy
- Standard of care
- Models need to grow into reliability
- Software defects
- Copywrite and intellectual property
  - Design and Trade models
- Owner use of Models



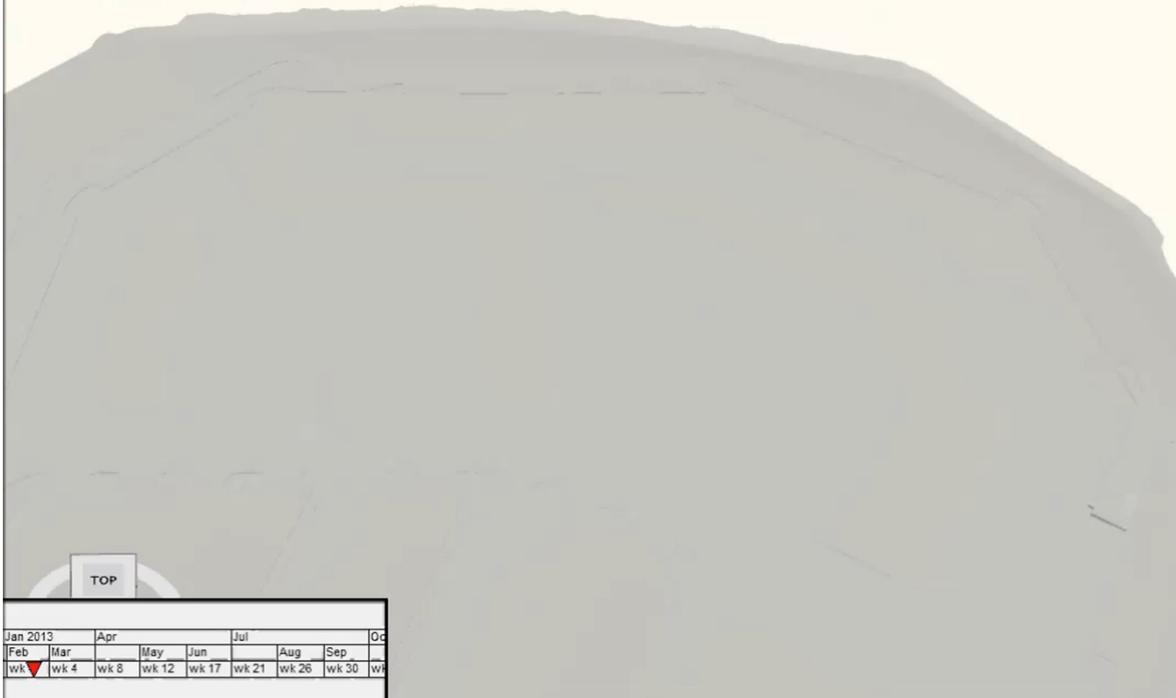
Consensus Docs: 301  
2011 version

# VDC

1. Top 20-25% of firms do it right.
2. AGC CM-BIM – Design Team, Contractor, Trades, Owner Reps.
3. If it costs more, they don't know how to do it right.
4. Model all design, shops, coordination, and cut sheets.
5. Weekly coordination and frequent scope, quality, schedule, cost, 6D checks.
6. Don't build or remodel.

# 4D – Combine 3D models with Time

Tue, 19 Feb, 2013



Sitework Pad Ready for Four  
Sitework Pad Ready for Four

Jan 2013	Apr	Jul	Oct					
Feb	Mar	May	Jun	Aug	Sep	Oct		
wk 1	wk 4	wk 8	wk 12	wk 17	wk 21	wk 26	wk 30	wk 31

# 4D

1. General Contractors Responsibility.
2. Certified 4D Personnel?
3. How do they use it? See past projects, not just Marketing.
4. Not made for detail; work with your typical schedule.
5. Monthly Updates, Revisions, Fragnets, Critical path.
6. Settle for late deliveries and claims.

# 5D

## Check quantities regularly.

A V19 20190708 07/16/2019

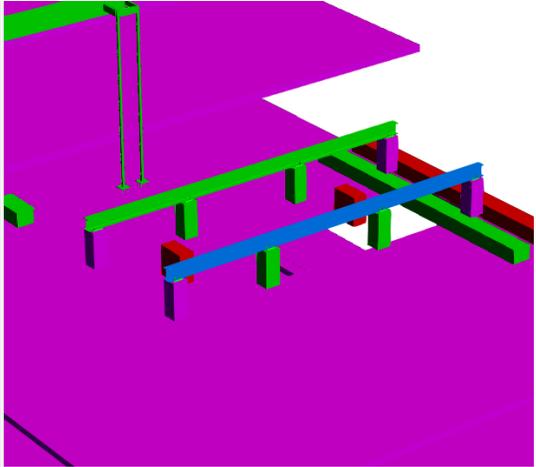
compared to

B V18 20190607 06/07/2019

Category	Quantity A	Quantity B	Variance	Unit
Generic Models : #SY - DrapeText_Start : Default	2	0	2.00	EA
Structural Columns	65.75	18.00	47.75	LF
Structural Columns : #CIP - Column - Rectangular : 18x18	29.33	12.00	17.33	LF
Structural Columns : #CIP - Column - Rectangular : 18x36		6.00	(6.00)	LF
Structural Columns : #STL - Column - HSS Rectangular - ...	36.42		36.42	LF
Structural Connections	12	0	12.00	EA
Structural Connections : #CN - Anchor Bolts No Plate : Co...	8	0	8.00	EA
Structural Connections : #CN - Plate - Embed - Horizontal...	2	0	2.00	EA
Structural Connections : #CN - Plate - Embed - Vertical : ...	2	0	2.00	EA
Structural Framing	118.83	73.50	45.33	LF
Structural Framing : #CIP - Framing - Rectangular : BM40	31.08	31.08	0.00	LF
Structural Framing : #STL - Framing - C Shape - 2017v1...	11.67	17.75	(6.08)	LF
Structural Framing : #STL - Framing - C Shape - 2017v1 ...	7.25		7.25	LF
Structural Framing : #STL - Framing - L Shape - 2017v1 : ...		7.33	(7.33)	LF
Structural Framing : #STL - Framing - W Shape - 2017v1 ...		17.33	(17.33)	LF
Structural Framing : #STL - Framing - W Shape - 2017v1 ...	68.83		68.83	LF
4551445	34.42		34.42	LF

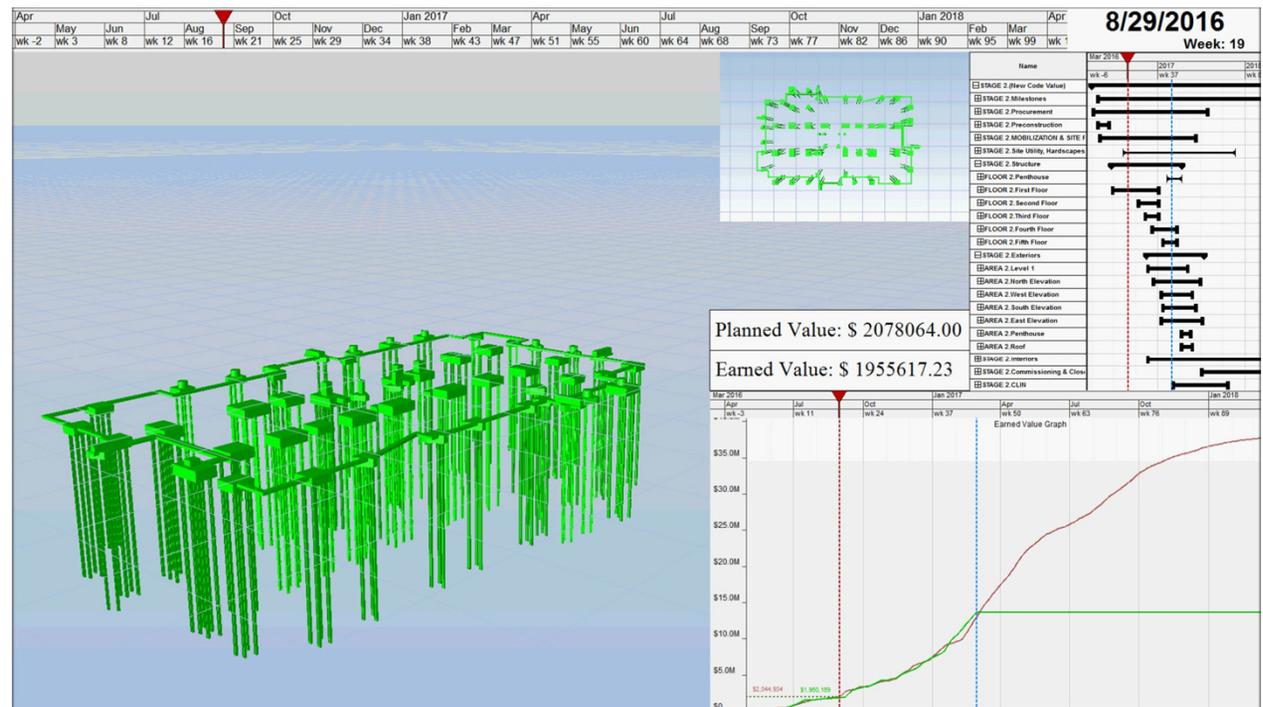
SHOW VARIANCES FOR

Added (75)



# 5D – Models for Quantities

4D- 5D Combo



## 5D

1. Have GC provide access and reports.
2. Check model quantities with traditional quantities/estimating.
3. What is in model and what is not.
4. Don't change design model process for quantities sake.
5. Compare them regularly.
6. Get cost breakdowns as usual, be uninformed.

# IFC – Industry Foundation Classes

1. Specify all your model be delivered in IFC format.
2. Use software that is IFC compatible/certified.
3. Be sure your Design team and Contractors have done it before.
4. Ask for the Add/Deduct for using IFC up front.
5. Collect models monthly for review.
6. Hope your current software will still open your record model in 5 years.



# COBie = 6D

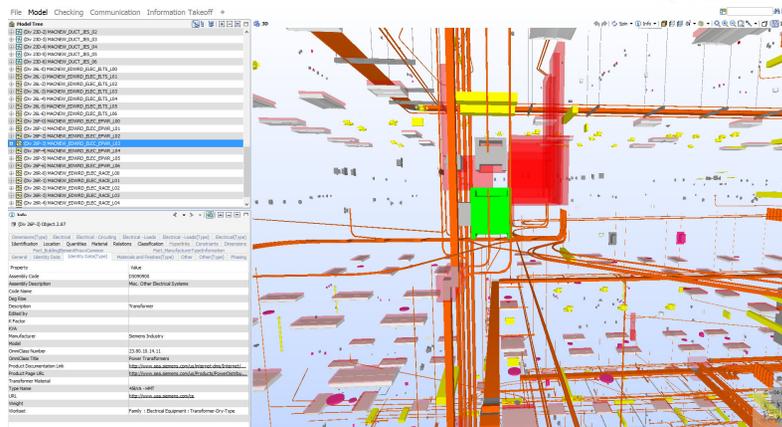
COBie = Construction Operations

Building information exchange

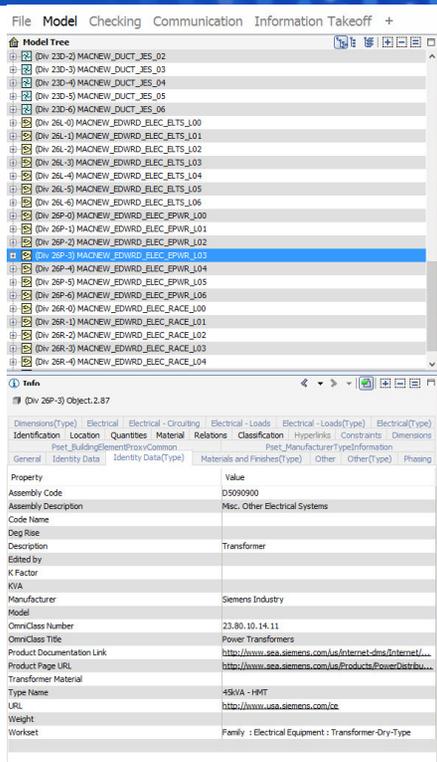
- The stuff a maintenance crew needs to know
- 6D information

Encapsulated Transformers  
.050 - 3.0 KVA Single Phase  
3.0 - 15 KVA Three Phase

- UL listed designs which comply with applicable ANSI, NEMA, IEEE standards
- Totally enclosed, non-ventilated, heavy gauge steel enclosure
- Core and coil completely embedded within a resin compound for quiet, low temperature operation
- Encapsulation seals out moisture and air
- UL listed indoor/outdoor enclosure features integral wall mounting brackets
- Rugged design resists weather, dust, and corrosion



# Use the BIM Forum LOD Specification



Do we want to know the “Model” of this transformer?  
It is currently blank.

Do we want “Serial Number” for the transformer?

Do we want to know the “Room” the transformer is in?  
Do we want “Room”, “Room Name”, “Room Number”, etc...

What Tab (“General”, “Location”, “Type”) do you want the information on?

Do we want to know the “Manufacturer” for the transformer?  
Do we want to know the “Manufacturer” for the concrete?  
Do we want to know the “Manufacturer” for the hangers?  
Do we want to know the “Manufacturer” for the outlets?

Do we want to know the “Serial Number” for the outlets?

# Use the BIM Forum LOD Specification



BIMForum LOD Specification 2018 Part II					
D50 - Electrical					
Baseline	<a href="#">This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License</a>				
Additional					
Attribute	Data Type	Units - Imp.	Units - Metric	Option Examples	Commentary
<b>Global Attributes</b>					
Component ID	Text				Part or Equipment Tag
Condition Status	Text			New, Existing, Demolish, Temporary, User Defined	Status of the element, predominately used in renovation or retrofitting projects
Room Number	Text				Room number where component <b>to be</b> /is installed
Room Name	Text				Room name where component <b>to be</b> /is installed
Story Number	Text				Floor or level room is located
Manufacturer Name	Text				The organization that manufactured and/or assembled the item.
Product Name	Text				The manufacturers model name of the product model (or product line)
Model Designation	Text				The manufacturers model number or designator of the product model (or product line)
Target LOD	Text			100, 200, 300, 350, 400	
Current LOD	Text			100, 200, 300, 350, 400	

# COBie

1. Your top 20-25% design firms and Trade Contractors are doing it right.
2. Do they have a BIM person, are they practicing 3D Design, will they embed the data?
3. Look at a past COBie/6D model they have produced.
4. Just ask for what is needed.
5. Review the models regularly (scope, alignment, progress).
6. If it cost more, they're doing it wrong.

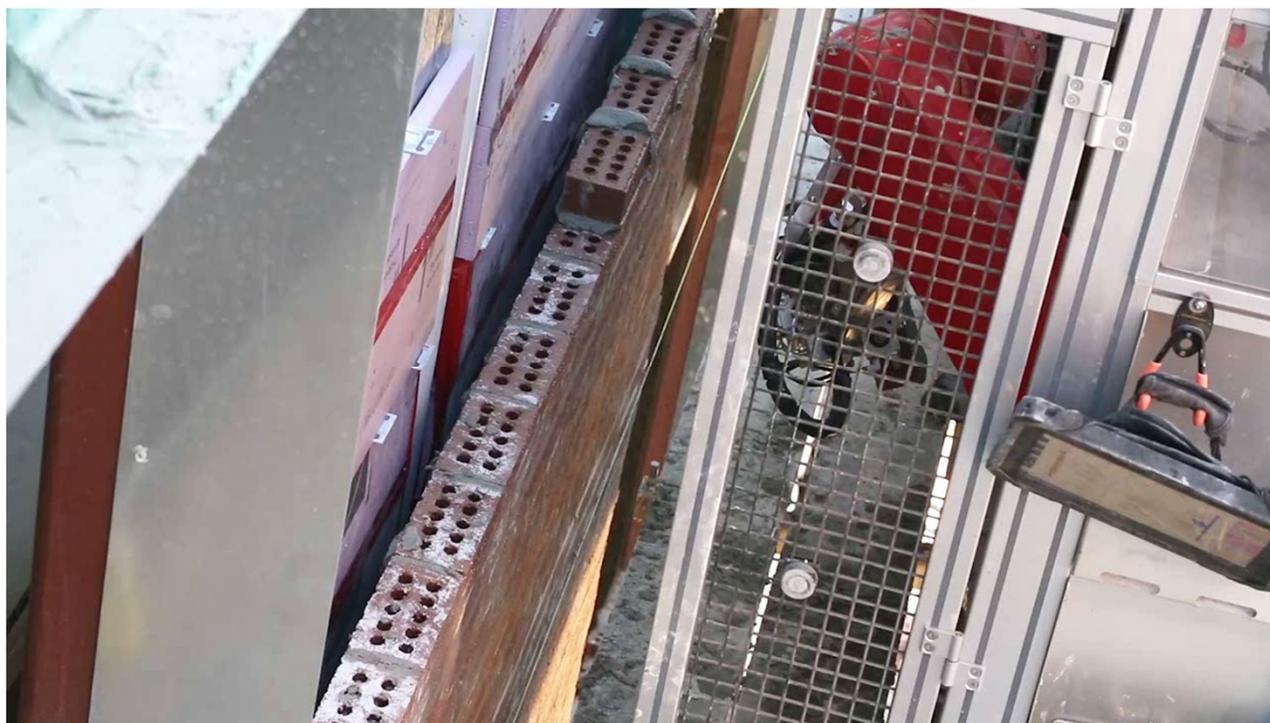
# UAV - Drones

1. Get the Drone that meets your needs.
2. Pilot company has to have the FAA certification, registration, and insurance.
3. See results from the model/software.
4. Skip new, go with proven.
5. Stay up to date on laws, uses.
6. Hire a plane for aerals, walk the piles.



# SAM – Semi-Automated Mason

Robots are here  
More are coming



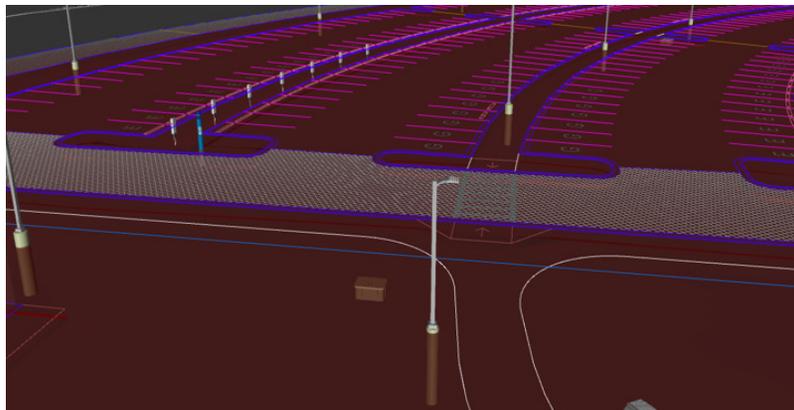
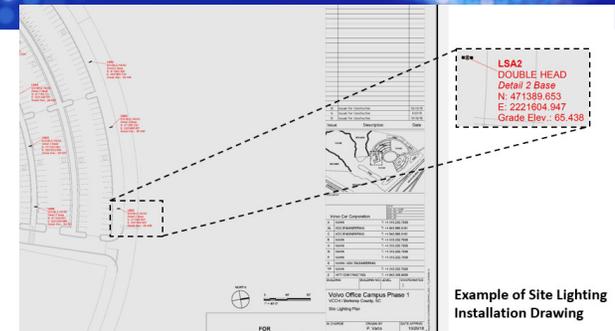
# SAM – Semi-Automated Mason

1. Spend the right money; look for repetitive, physical tasks.
2. Have your trades figure it out.
3. Each construction site is different; you will need to figure it out.
4. Don't pay more for it; just expect it to come.
5. Collect daily progress and check the quality.
6. Don't use a robot.

# RTS – Robotic Total Station

Every layout crew should be using them

- Model based layout

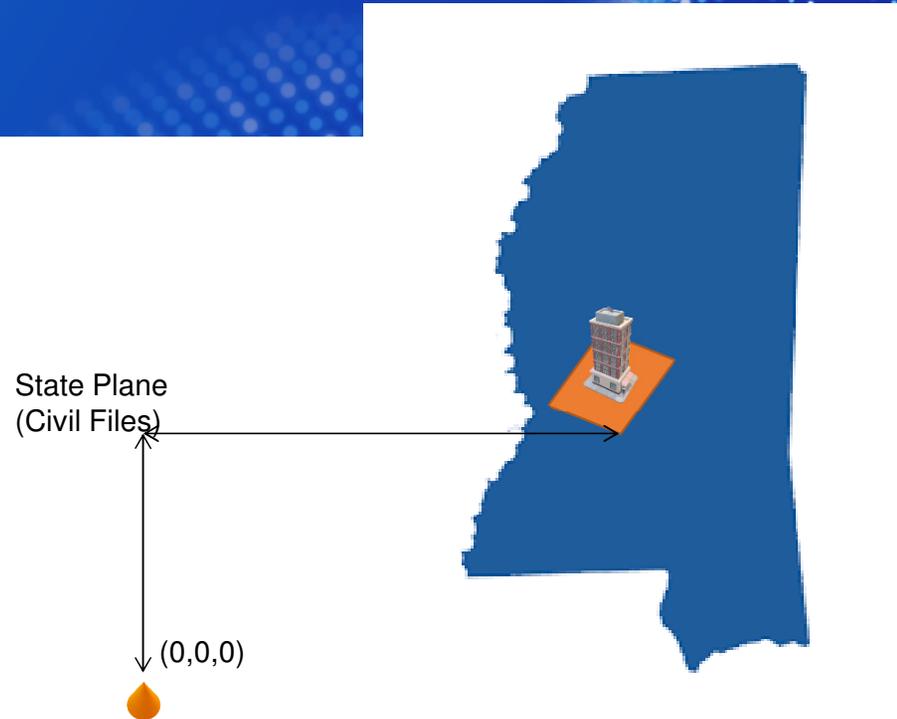


Coordination Model

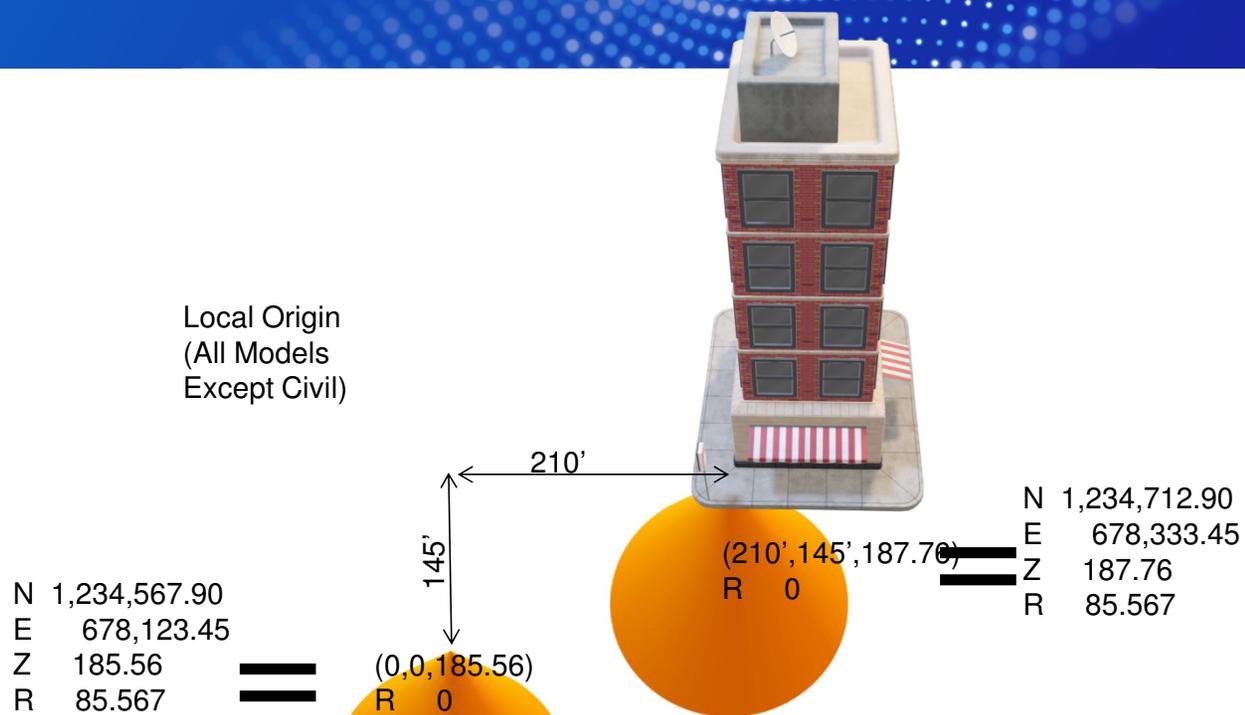


Actual Picture

# RTS



# RTS



# RTS

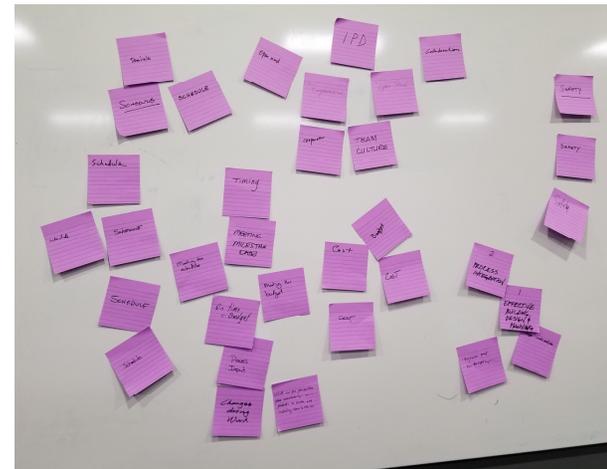
1. Civil and MEP are different machines.
  - A. Get the green laser
  - B. Get embedded photos
2. Get licensed surveyor to set control points.
3. Have models embed the control points.
4. Set the controls, let the trades and GC do the work.
5. Make sure everything aligns.
6. Wondering if your as-builts are any good.



# “Cool” issues

Fancy / Expensive software does not fix a bad process; it makes it worse.

Have a good process first.





#ITCon22

# Cool is a terrible business plan!

Advice, Tips, Tricks, and That Was Dumb!

Benjamin Crosby – Yates Construction

@BIMjamin

[www.wgyates.com](http://www.wgyates.com)

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