

# From Laser Scan to Facilities Management: A Workflow Case Study

### Aaron Maller BIM Manager- The Beck Group

# Class Agenda (Why are we here?)

- How do I use a Laser Scan to Build a Model?

- How and what data do I put in the model for use downstream?

- What are some unexpected issues I'm going to run in to?

How do I get this information in to an FM program?
(What did I sign up for, and where is my easy button??)

# Learning Objectives

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

Work with Laser Scans, to build a model

Populate a model with data for more than just Design

Format the Data in a way that someone else can use it

what isnt...

- Know what to expect, and how to communicate what's possible, and

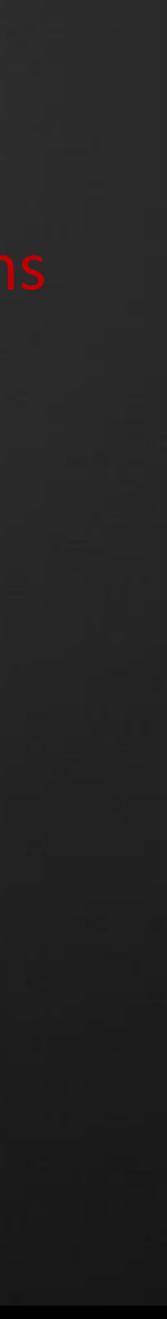
# About your speaker

# Housekeeping and Twecklers alike

- Output of the Othebeckgroup
   The Beck Group on Twitter
- www.beckgroup.com
- www.facebook.com/beckgroup
- **204-303-6200**
- www.MalleristicRevitation.blogspot.com
- www.RevitForum.org
- aaronmaller@Beckgroup.com
- **204-303-6285**

#Mallerisms





**Aaron Maller** Native New Yorker (sorry!) University at Buffalo, SA&P- Class of 2005 "Fell in to BIM" -AutoCAD and ADT / ACA / 3DS Max

-Digital Project -Vectorworks -ArchiCAD -Revit (since version 8)

Implemented at 4 Revit firms since 2005

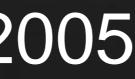


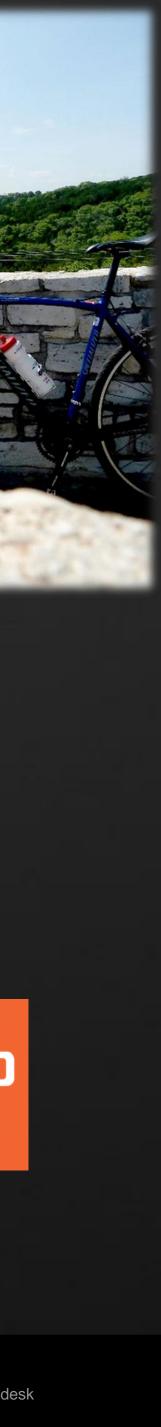












# The Beck Group

### Founded in 1912 7 primary offices nationwide

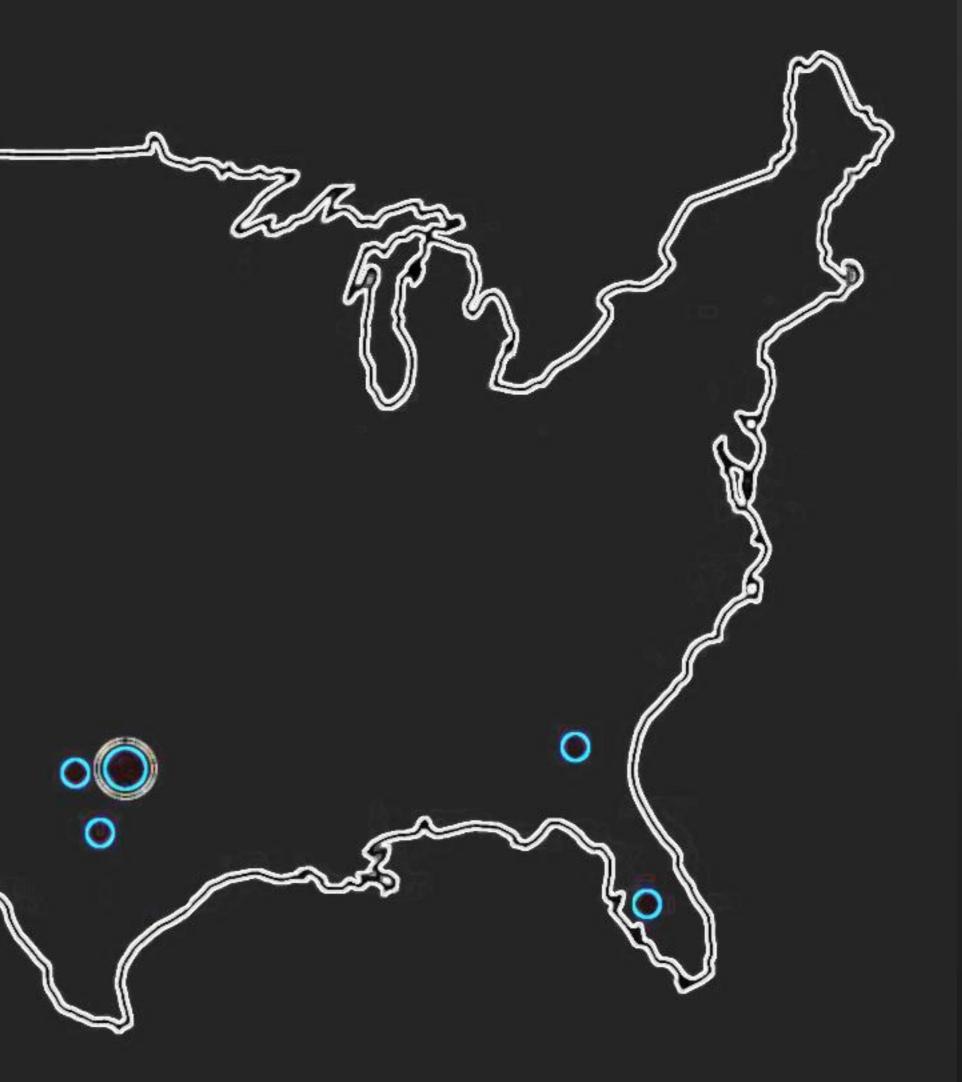
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### Ft. Worth Denver Tampa

### Architecture

Construction

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### Development

### Technology

### Sustainability

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### Architecture

Construction



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### Development

### Technology

### Sustainability

### have no idea what you're talking about...

# ....so here's a bunny with a pancake on its head.

### Architecture

Construction

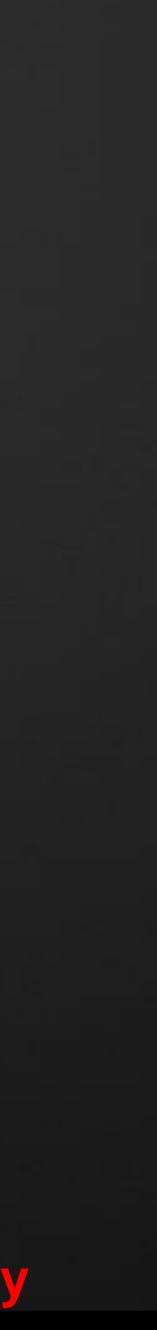
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### Development

Technology

### **Sustainability**

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# **Project Introduction**

- 3 buildings, largest was 10,000 Square Feet

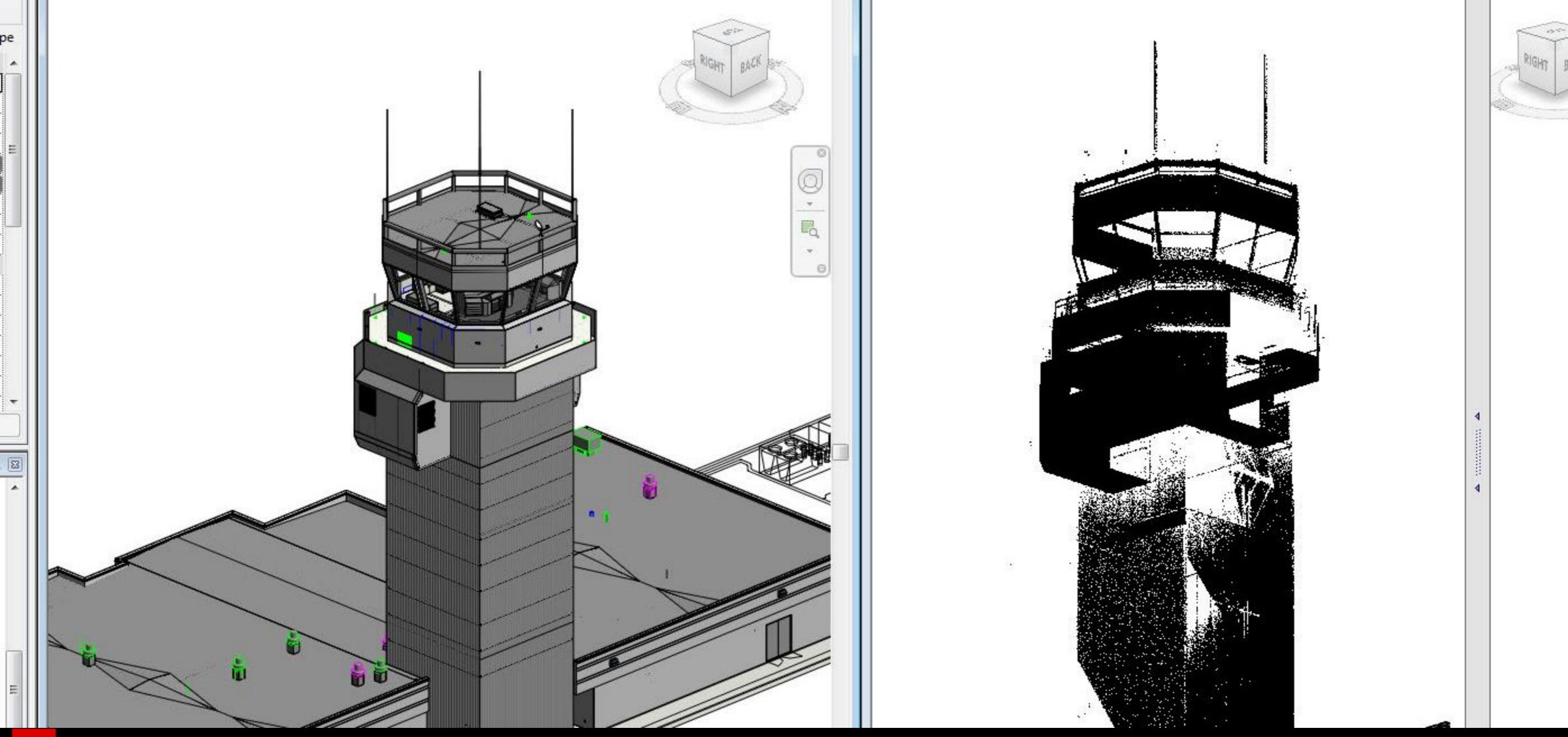
Limited Drawings, plus Laser scans to model from

- The goal: Complete the models, input asset data in to objects, load in to FM software for Client's evaluation

# Working with Laser Scans to Build Models

Why are we using a Laser scan? It's the only source of documentation Its to verify what we have for documentation What takes precedence / Whats the intended level of accuracy? What is the purpose of the model? What was asked for, and why? (Who is hoping for an easy button?)

# Why are we using a Laser scan?





# Who is responsible for the laser scan?

Quality is a concern: Is it good enough? Is it \*too good?\*

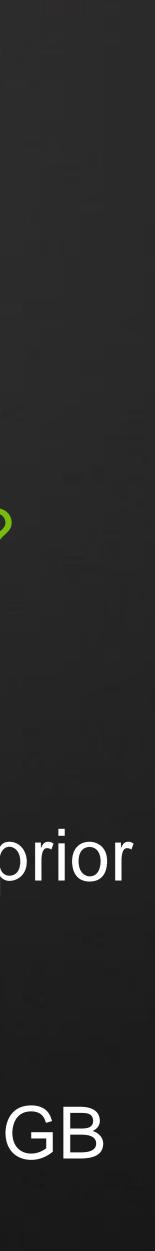
### Registration and coordinates- Are the Point clouds assembled correctly?

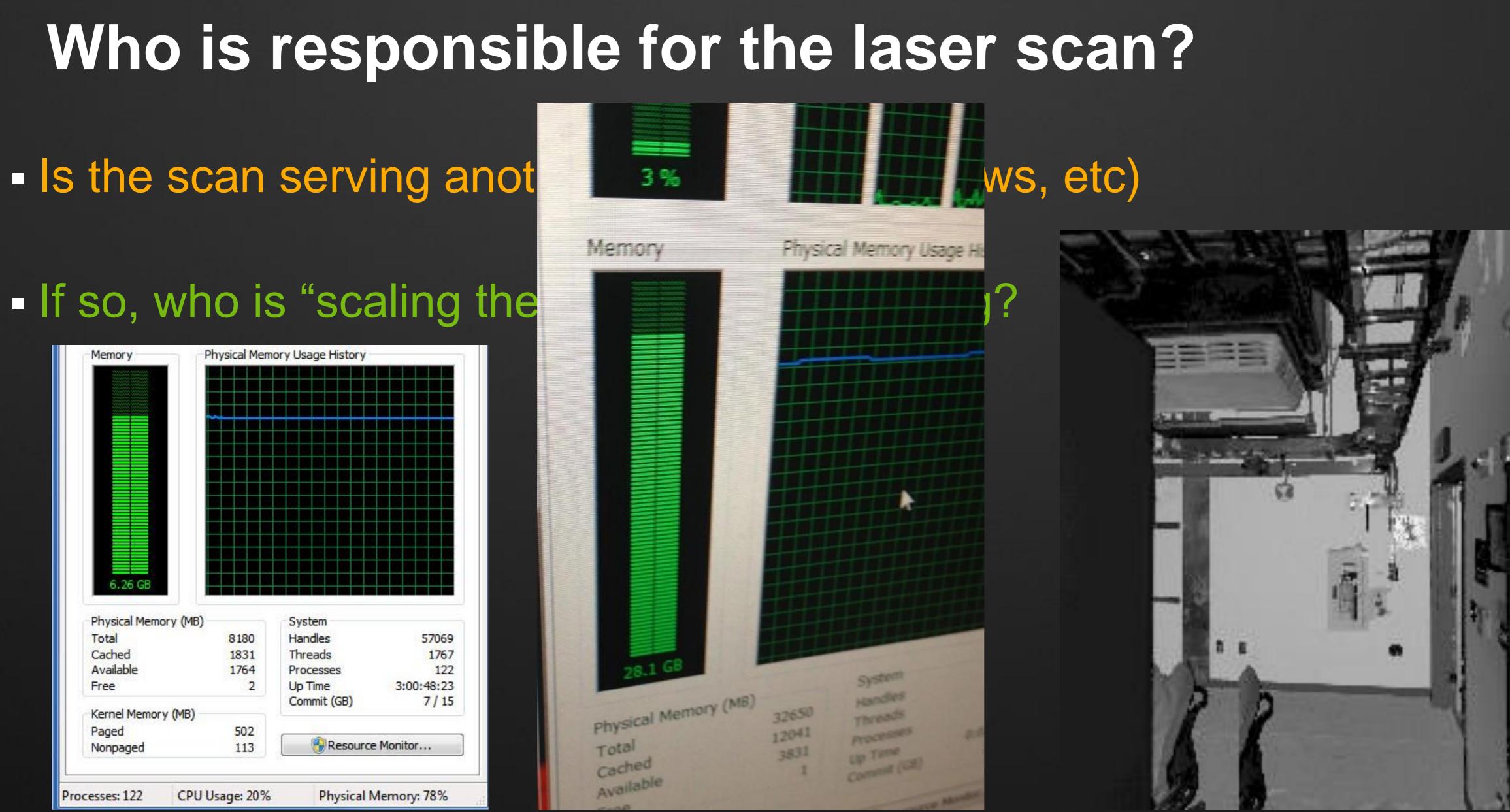
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FBC.imp	10/25/2008 9:59 AM	I IMP File	3,186,688 KB
Points and Coordinates.nwd	4/30/2009 12:32 PM	Navisworks Docu	654,320 KB
ZONE F - TOWER EXTERIOR.pcg	1/16/2012 5:23 PM	PCG File	2,868,245 KB
ZONE G - EMERGENCY GENERATOR.pcg	1/18/2012 11:07 AM	PCG File	973,241 KB
ZONE H - IFR EQUIP RM.pcg	1/18/2012 10:07 PM	PCG File	14,887,672 KB

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• 10k SF - 93.4GB (after compression) Was almost 250GB prior (yikes!!!)

block – 6GB Full city (uncompressed)





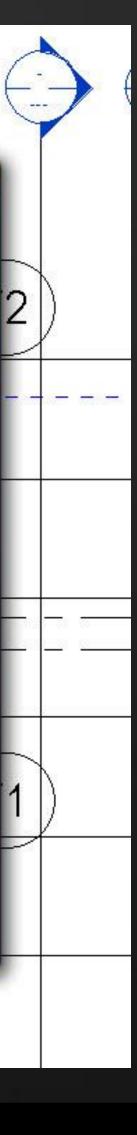


# (TruView Demonstration)

# Getting the scan in to Revit (2012)

- Link Directly:
  - Center to Center
  - Origin to Origin
- Manage Links: Point Clouds

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# Getting the scan in to Revit (2012)

Link Directly (in to RVT Link) Revit coordinates to position scans

Manage Links: RVT Links In Linked File, PC under Manage Links: Point Clouds

- (2013)- Can Link Directly with Shared Coordinates

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Manage Links

CAD Formats DWF Markups Point Clouds

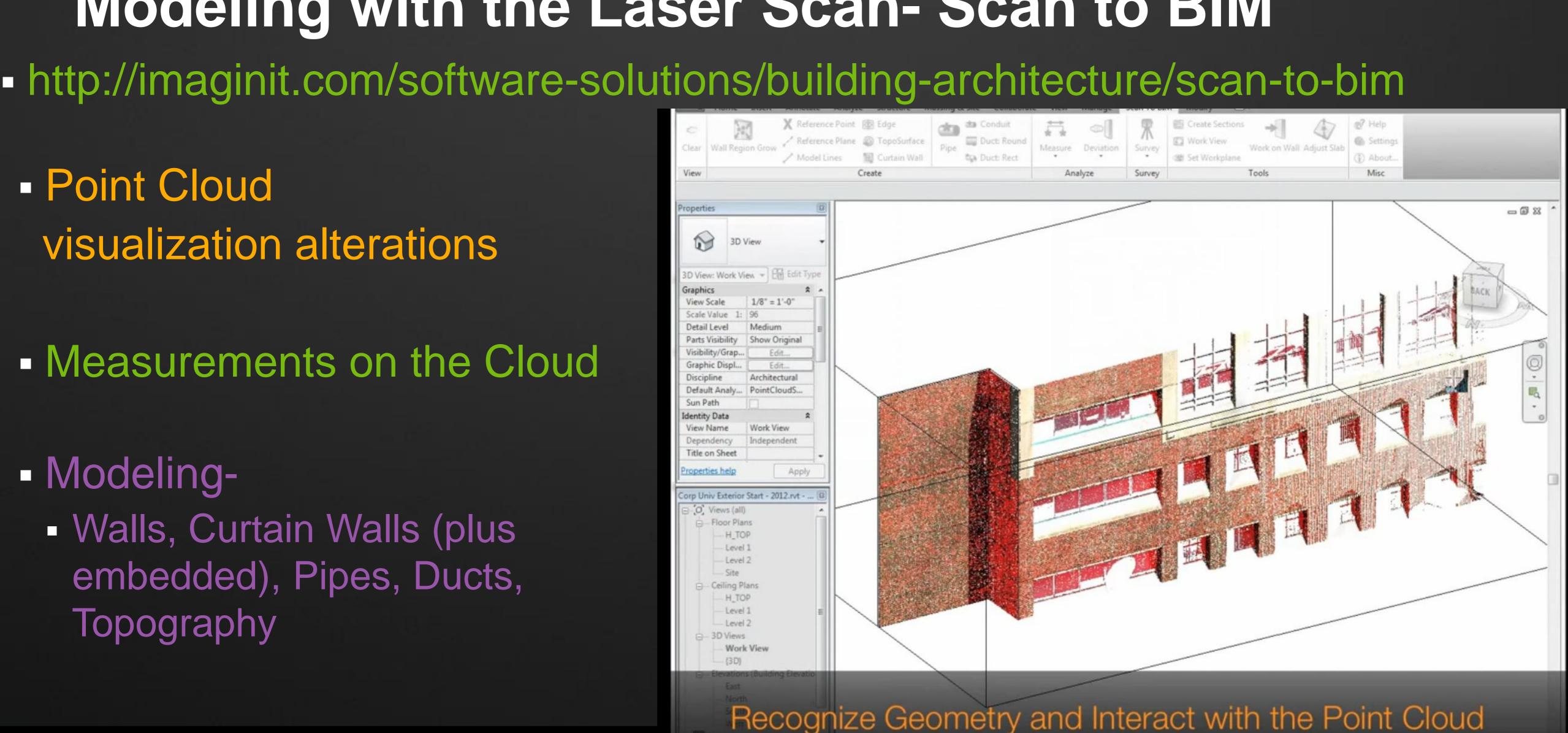
Linked File	Status	Reference Type	Positions Not Saved	Saved Path	Pat
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FAA231-PointCloud-ATC-Zone1-Mech-RAC2012.rvt	Not Loaded	Overlay		FAA231-PointCloud-ATC-Zo	Relat
FAA231-PointCloud-ATC-Zone2-IFR Control-RAC2012.rvt	Loaded	Overlay		FAA231-PointCloud-ATC-Zo	Relat
FAA231-PointCloud-ATC-Zone3-Utility-RAC2012.rvt	Not Loaded	Overlay		FAA231-PointCloud-ATC-Zo	Relat
FAA231-PointCloud-ATC-Zone4-Offices-RAC2012.rvt	Not Loaded	Overlay		FAA231-PointCloud-ATC-Zo	Relat
FAA231-PointCloud-ATC-Zone5-Garage-RAC2012.rvt	Not Loaded	Overlay		FAA231-PointCloud-ATC-Zo	Relat
FAA231-PointCloud-ATC-Zone6-TowerExt-RAC2012.rvt	Not Loaded	Overlay		FAA231-PointCloud-ATC-Zo	Relat
FAA231-PointCloud-ATC-Zone7-Generator-RAC2012.rvt	Not Loaded	Overlay		FAA231-PointCloud-ATC-Zo	Relat
FAA231-PointCloud-ATC-Zone8-IFR Equipment Rm-RAC2012.rvt	Not Loaded	Overlay		FAA231-PointCloud-ATC-Zo	Relat
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OK



# Modeling with the Laser Scan-Scan to BIM

- Point Cloud visualization alterations
- Measurements on the Cloud
- Modeling-
  - Walls, Curtain Walls (plus embedded), Pipes, Ducts, Topography



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# Modeling with the Laser Scan- Tracing

Loading and Unloading Depends on Memory and size of scans

View Range and Section Boxes

- Try to eliminate as much noise as you can
- (Show Plan- Level 3/5, Section 20)

- (2013)- Can Link Directly with Shared Coordinates

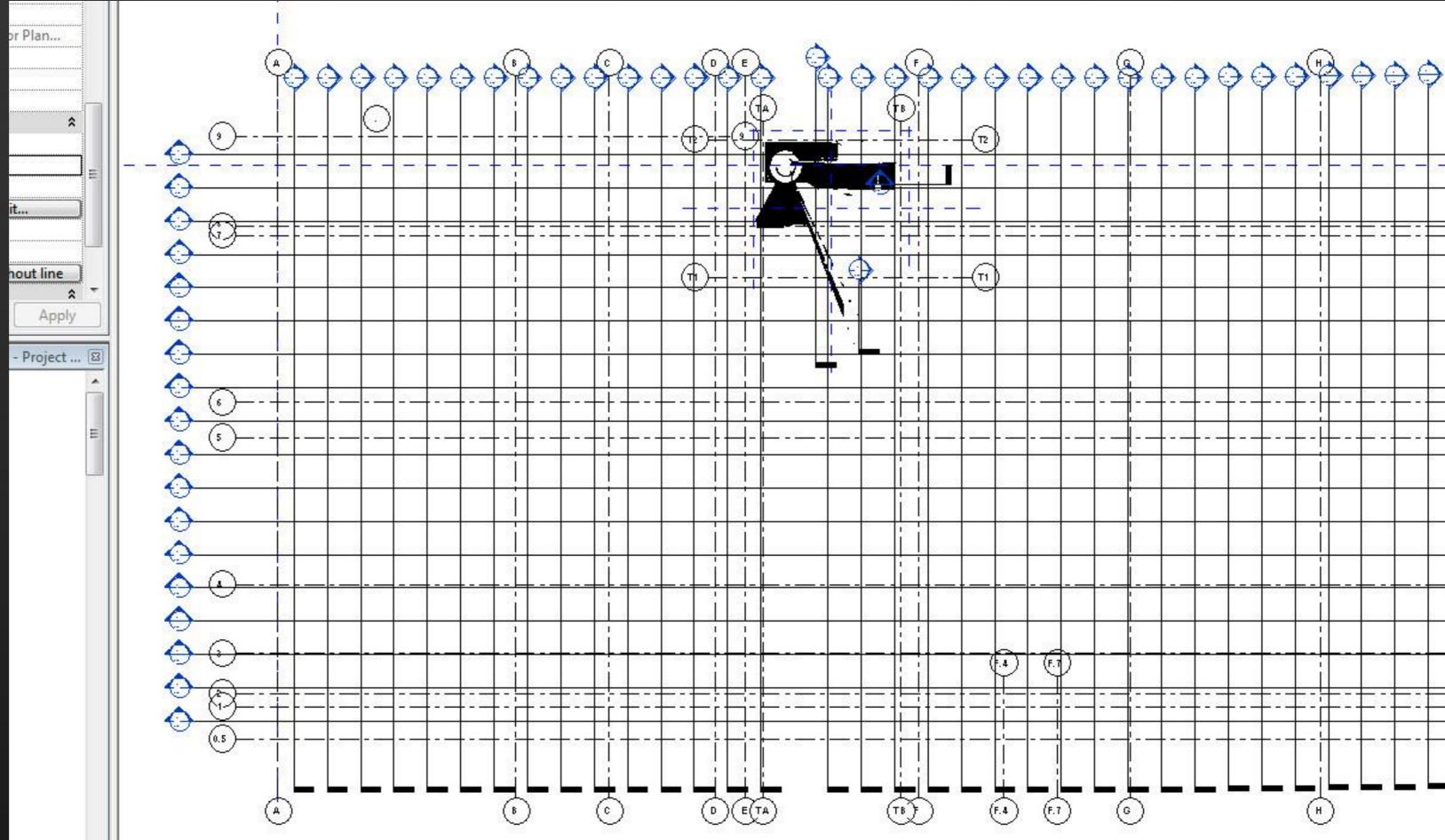




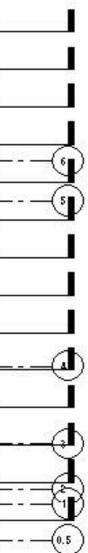
# Modeling with the Laser Scan- Tracing

Make a "View grid," of shortened views.
 \*\* I link the Point Clouds in one phase early. With multiple Clouds, its easier to shut them all off with the Phase Selector. Reversing that to see ONLY the clouds works too.

The game is "not to regenerate." Panning, Zooming, moving, view depths, etc.







desk

# Putting Data inside the Model... What has to change about the model?

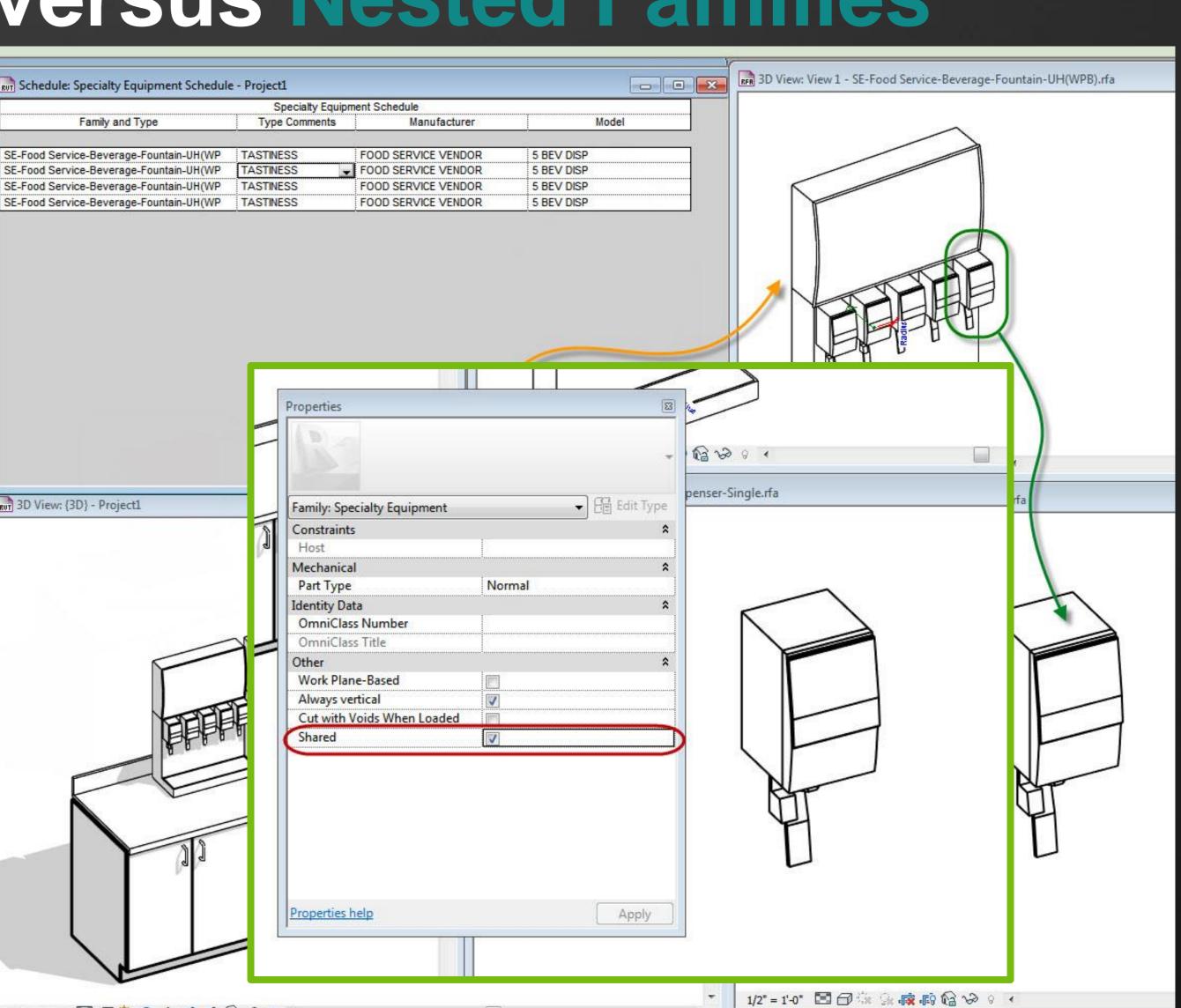
# **Recap- Shared Nested versus Nested Families**

- In Project-Only "Parent Family" Appears. Only "Parent" Schedules and can be Tagged

"Child" familes definition Lives in Parent, NOT In Project.

2 Parents with same Child (haha)can have Different definitions

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# **Recap- Shared Nested versus Nested Families**

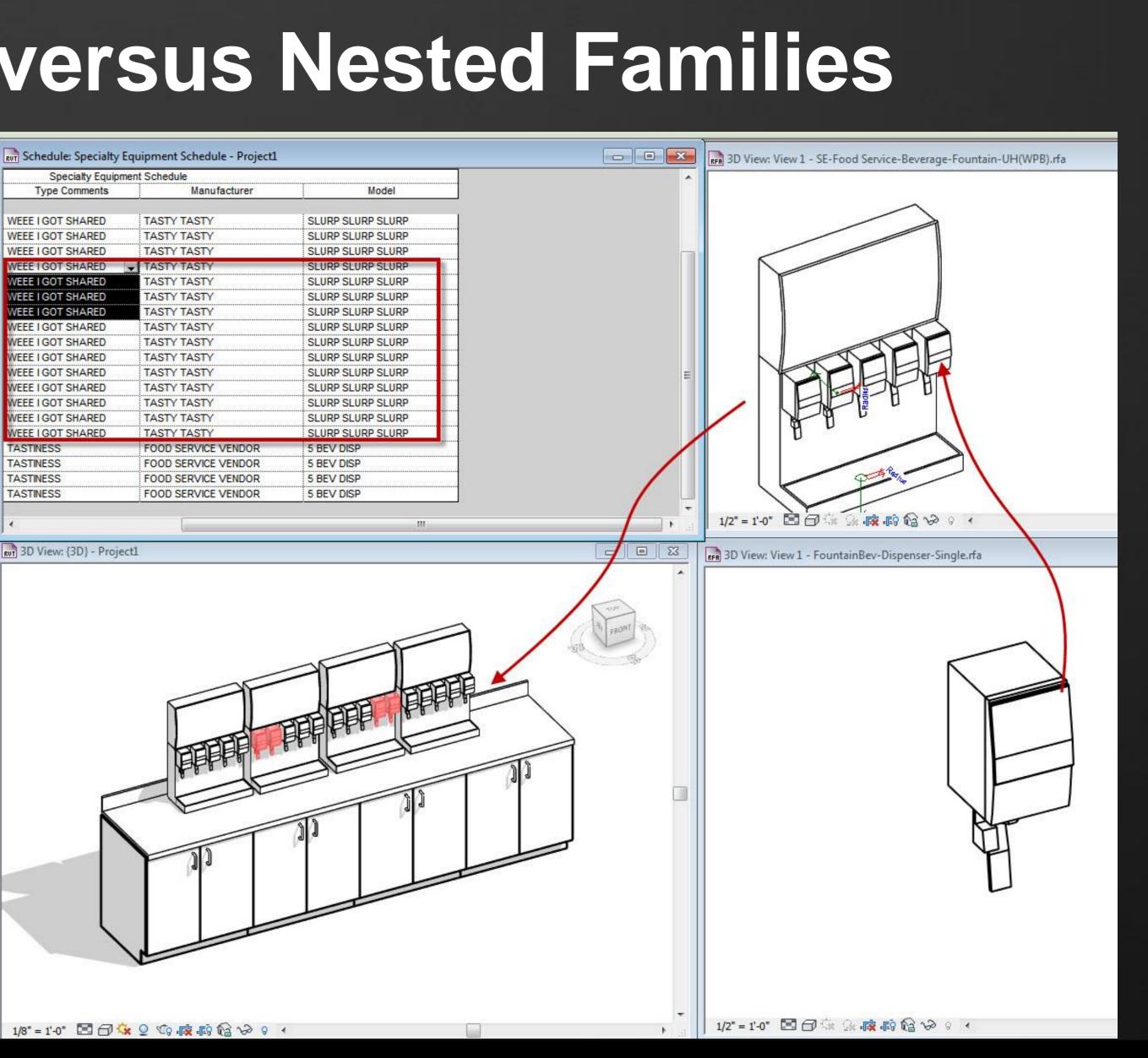
- In Project-All Families appear Appears. All families schedule and tag, and have Identity Data

"Child" families definition Lives in Project, NOT In Parent.

2 Parents with same Child must have the same definition (its driven in project)

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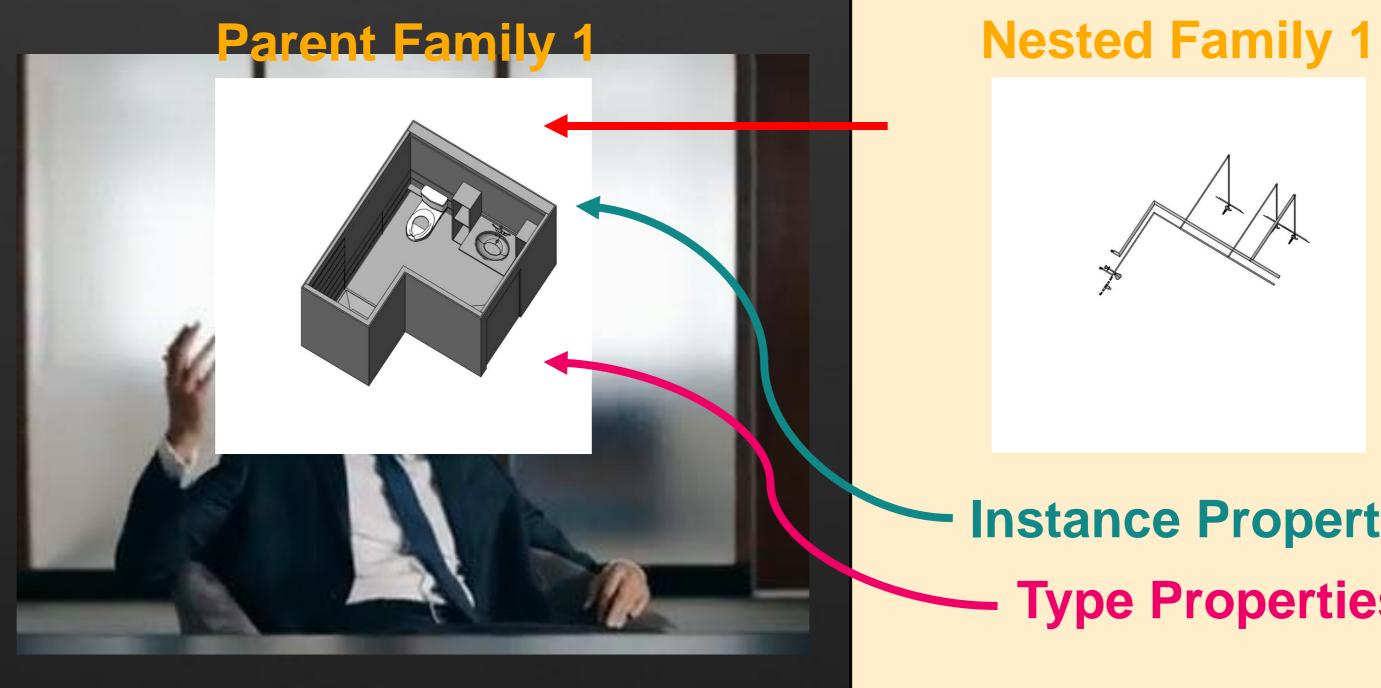
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Stairs	
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🛨 ····· Walls	
- (D) Groups	
📾 Revit Links	



### So uh... Why don't I just share all of them? Unshared → Parameters Controlled by Parent Family, local definition







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### **Instance Properties Type Properties**

Nesting things for "Revit Convenience"

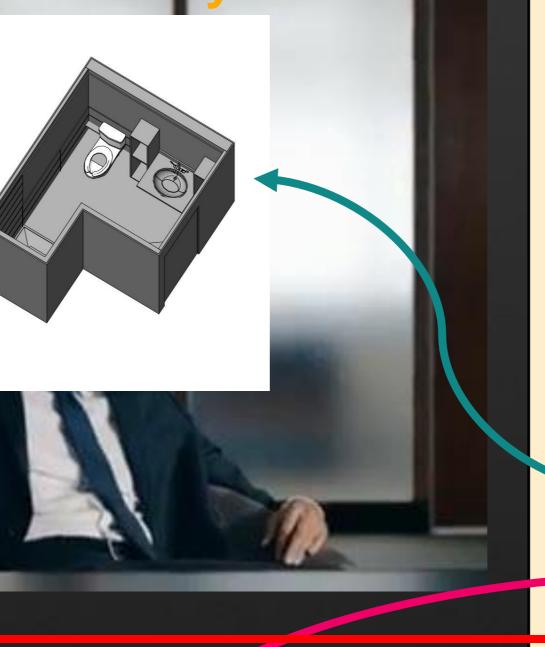
# Shared -> Parameters Controlled by BOTH, plus Global definition



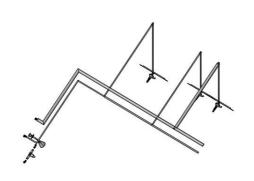


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### **Parent Family 1**







Instance Properties
Type Properties

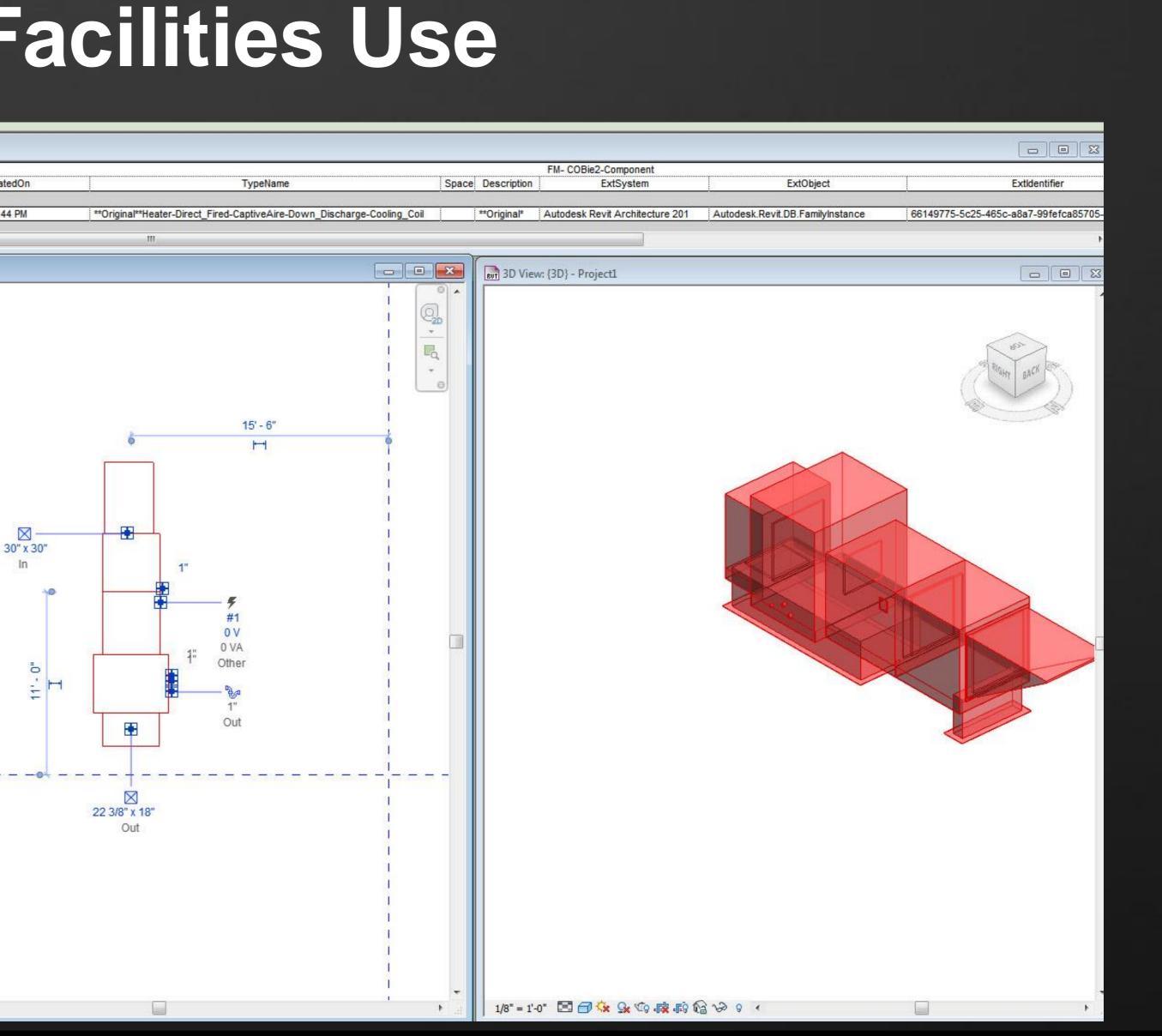
Nesting things for "real association"

# **Changing Content for Facilities Use**

- CaptiveAire unit (Autodesk Seek).
- Built with Nested Components (unshared). Done so they SubFamily *Type parameters can be* nested to the parent

 Allows for many options in **Design and Documentation** 

Name	Level	CreatedBy	Created
1	Level 1	aaronmaller@beckgroup.co	11/25/2012 1:46:44



# **Changing Content for Facilities Use**

- Modified to have all Nested (important) parts Shared.
- Loses its ability to be parametric, where Type Properties were linked to Parent Family.
- All Nested Parts now schedule as unique Assets.

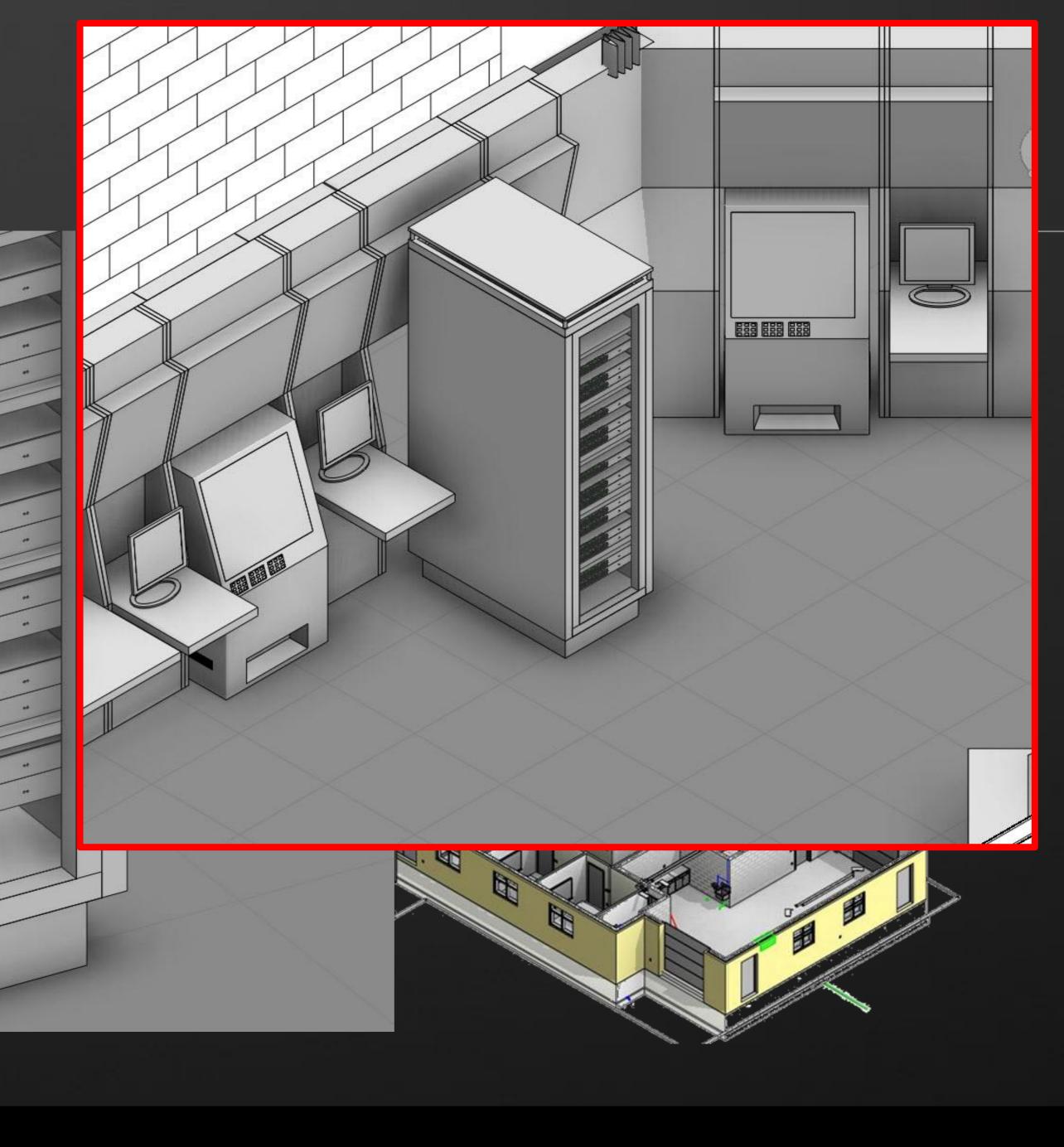
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# **Content for this Project**

 Wherever an item was deemed "trackable asset" it became its own family (Shared and Nested) More important to have right number and locations of families, than to have

over detailed models.



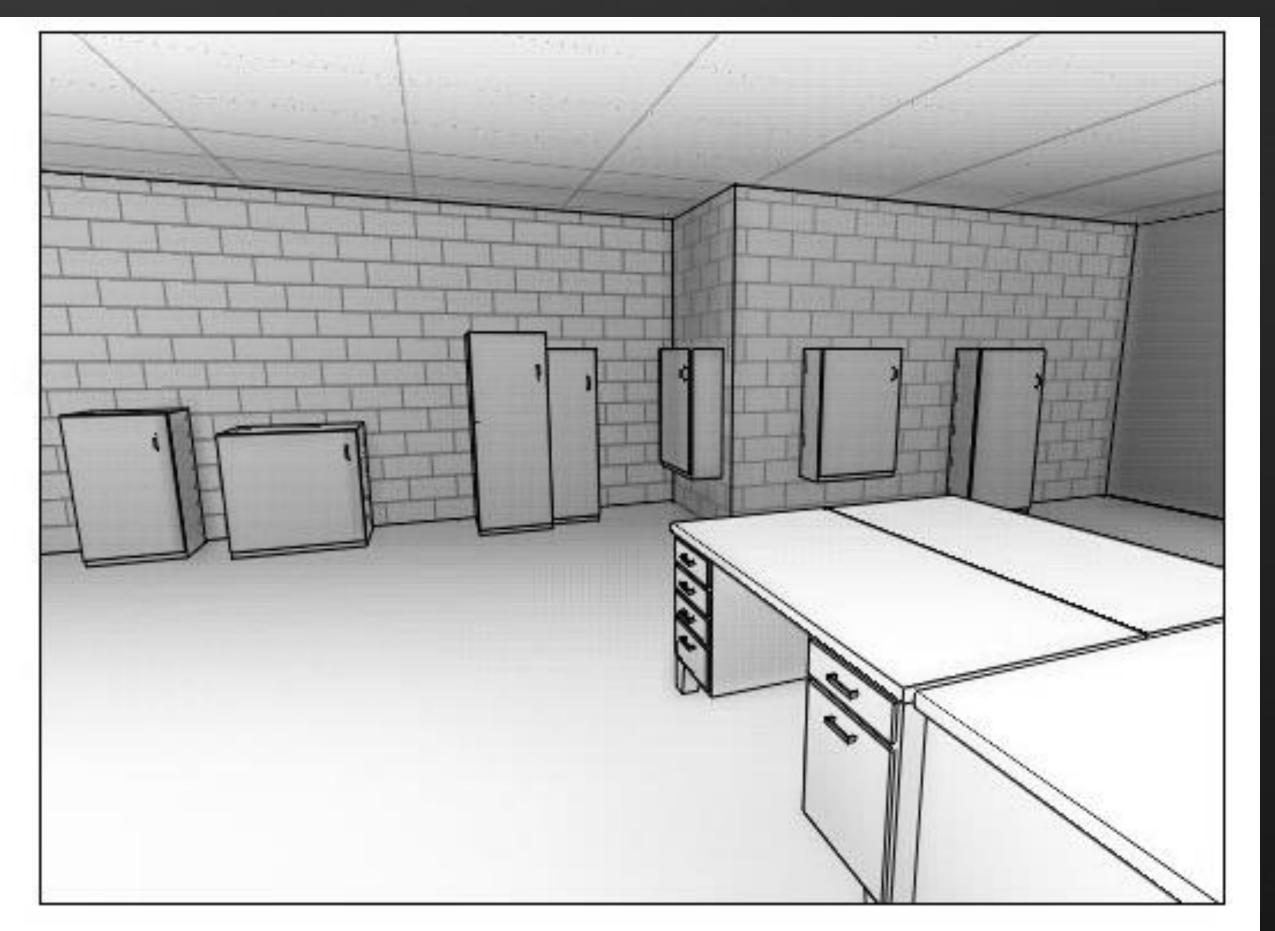


# Content for this Project



∧U Autodesk University

### Repurposed Millwork Content



# Putting Data in to the Model

# Data Standards.... OMGFail.

- OmniClass: - (Uniformat): (MasterFormat): - COBie:

http://www.omniclass.org/ http://www.masterformat.com/

Client Specific (or Client Amended)

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- http://uniformat.com/index.php/background
- (Construction Operations Building Information Exchange) http://www.wbdg.org/resources/cobie.php

### Where do you put all of the data?

## Parameters (Hardcoded versus created)

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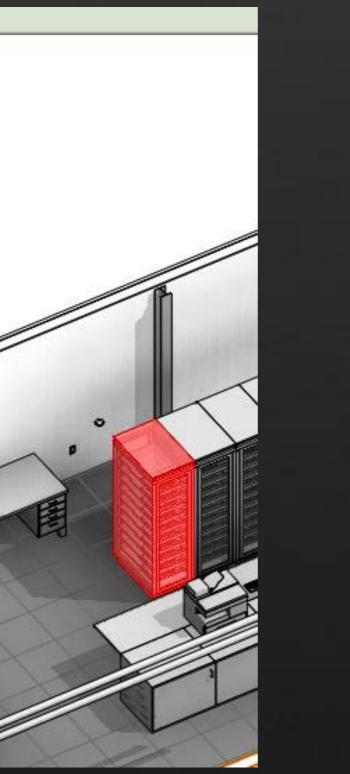


# **COBie Data parameters and app**

http://usa.autodesk.com/adsk/servlet/oc/offer/form?siteID=123112&id=18070390 Download Link for the App and the Shared Parameters SP's and COBie schedules also in the Datasets for this class

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Phasing	\$	
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COBieAssetIdentifier		
COBieBarCode		
COBieCreatedBy	aaronmaller@beckgroup.com	
COBieCreatedOn	11/25/2012 7:14:57 PM	
COBieDescription	SE-Office-Infrastructure-Server-Rack-UH:	
COBieInstallationDate		
COBieSerialNumber		
COBieTagNumber		
COBieWarrantyStartDate		
RevitExternalIDName	2c468de8-30cc-4ad4-9537-14a11c75aaf7-0	
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# Handy uses of the Adsk COBie App / COBie parameters

- Your Clients Naming convention probably isnt the same as yours.
- Use the COBie AssetID and AssetIDType parameters for these things
- Make tags (if you need FM/O&M drawings) that reference these parameters
- In some cases I've seen Client Mandated names mean the same name for Different Families
- The app is a free way to get the EID or GUID inside Revit Parameters (not a huge value add, since most API apps don't need it, but its handy for those than don't write API well yet (me...)

### **Real Purpose of COBie parameters**

	Get External Data		Connections Sort & Filter	Data Tools	Outline	5			
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18	aaronmaller@beckgroup.com	2012-11-25T19:14:57	SE-Office-Computing-PC Station-UH(WPB): SE-Office-Computing-PC Stat	tion-UH(WPB) 127 SE-Office-Com	puting-PC Station-UH(WPB): SE-Office-Comp	uting-PC Station-UH(WPB)	Autodesk Revit Architecture 2012	Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8:
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22	aaronmaller@beckgroup.com	2012-11-25T19:14:57	Furn-Desk-UH: 5-0x2-6	131 Furn-Desk-UH:	5-0x2-6		Autodesk Revit Architecture 2012	Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8:
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32	aaronmaller@beckgroup.com	2012-11-25T19:14:57	SE-Restroom Acc-Locker-Single-UH: SE-Restroom Acc-Locker-Single-U	H 149 SE-Restroom A	cc-Locker-Single-UH: SE-Restroom Acc-Loc	ker-Single-UH		Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8
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50	aaronmaller@beckgroup.com	2012-11-25T19:14:57	SE-Restroom Acc-Locker-Single-UH: SE-Restroom Acc-Locker-Single-U	H 149 SE-Restroom A	cc-Locker-Single-UH: SE-Restroom Acc-Loc	ker-Single-UH	Autodesk Revit Architecture 2012	Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8:
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53			SE-Restroom Acc-Locker-Single-UH: SE-Restroom Acc-Locker-Single-U SE-Restroom Acc-Locker-Single-UH: SE-Restroom Acc-Locker-Single-U		cc-Locker-Single-UH: SE-Restroom Acc-Loc cc-Locker-Single-UH: SE-Restroom Acc-Loc			Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8:
54	aaronmaller@beckgroup.com	2012-11-25T19:14:57	SE-Restroom Acc-Locker-Single-UH: SE-Restroom Acc-Locker-Single-U	H 149 SE-Restroom A	cc-Locker-Single-UH: SE-Restroom Acc-Loc	ker-Single-UH	Autodesk Revit Architecture 2012	Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8:
55			SE-Restroom Acc-Locker-Single-UH: SE-Restroom Acc-Locker-Single-U		cc-Locker-Single-UH: SE-Restroom Acc-Loc			Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8:
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59	aaronmaller@beckgroup.com	2012-11-25T19:14:57	SE-Restroom Acc-Locker-Single-UH: SE-Restroom Acc-Locker-Single-U	H 149 SE-Restroom A	cc-Locker-Single-UH: SE-Restroom Acc-Loc	ker-Single-UH	Autodesk Revit Architecture 2012	Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8:
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	aaronmaller@beckgroup.com	2012-11-25T19:14:57	SE-Restroom Acc-Locker-Single-UH: SE-Restroom Acc-Locker-Single-U	H 149 SE-Restroom A	cc-Locker-Single-UH: SE-Restroom Acc-Loc	ker-Single-UH	Autodesk Revit Architecture 2012	Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8:
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58	aaronmaller@beckgroup.com	2012-11-25T19:14:57	SE-Restroom Acc-Locker-Single-UH: SE-Restroom Acc-Locker-Single-U	H 147 SE-Restroom A	cc-Locker-Single-UH: SE-Restroom Acc-Loc	ker-Single-UH	Autodesk Revit Architecture 2012	Autodesk.Revit.DB.FamilyInstance	062e5062-d9d3-493f-973d-8:
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## The COBie "Do I count" parameter

 COBie App only populates things Marked Yes.

- Use this in your Revit Schedules, in leiu of \*other parameters\* we use for the same purpose

(That's sort of the trick with ) DBie)

Category	Family and Type	COBieTypeSchedule	Count
Casework	B01-: 24x18.5x24A	<b>V</b>	2
Casework	B02-: 36x16x24A		14
Casework	B03-: 15x34x24A	V	2
Casework	B05-: 36x34x24A		5
Casework	B06-: 24x34x24A		3
Casework	B06-: 36x34x24A		3
Casework	BF: 18.5x24A		2
Casework	Casework 1: Casework 1		1
Casework	CW Hardware-Handle-FB: CW Hardware-Handle-FB	V	76
Casework	CW Hardware-Lock-FB: CW Hardware-Lock-FB		2
Casework	CW- Control Tower Casework 2: CW- Control Tower Casework 2		1
Casework	CW-Countertop-Control Tower: CW-Countertop-Control Tower		1
Casework	U01-: 15x24x12A	V	2
Casework	U02-: 32x12x12A		1
Casework	U02-: 36x12x12A		2
Casework	U02-: 36x18x12A		1
Curtain Panels	CW-Panel-Mechanical Louver-Horiz-UH: CW-Panel-Mechanical Louver-Horiz		2
Curtain Panels	System Panel: (Chainlink)		2
Curtain Panels	System Panel: (GLS-1)-(1")- Insulated Glazing		65
Curtain Systems	Curtain System: Tower Glazing System		1
Data Devices	SE-Office-Infrastructure-Network Switch-UH(WPB): Wireless		190
Doors	Door- Double: Exterior	<b>V</b>	3
Doors	Door- Double: Interior		2
Doors	Door- Single: Exterior		5
Doors	Door- Single: Interior		65
Doors	F00: F00		73
Doors	NF: NF		2
Doors	NP: NP		1
Doors	P00: P00		77
Doors	P65: P65		2



### **Revit "Placement tools" and data**

- Right now FM/O&M data is stored just like all other data:
  - Instances
  - Types

### There are three Revit Items that are (right now) going to let you down:

- Model Groups (Instances don't get "instance" data, they get "copied" data
  - Need to be ungrouped
- Stacked Walls (the nested walls don't get Identity Data at all)
  - Need to be "Broken Up"
- Multiple Instances of Linked Files
  - Need to be Bound

## Putting the model in the FM tool!

This is probably the part youre hoping for the easy button on....
 So I hope you don't get disappointed

Unfortch... Different FM tools will use the model differently

## Putting the model in the FM tool!

- Some downstream tools will use a DWF export
- Some (Ecodomus) will use a Navisworks Export
- to text, import to Excel; or a Database Export)

In addition, they may also require the COBie Exports (schedule export)

### The "gotchas" of exporting models

Can they see what you see?

 DWF and item transparancy: Sounds silly, but if they cant touch it... they cant touch it!

Translations:
IFC, did you look at it? Does it look like your project still?

Navisworks:
 Did you try to export Nested Links? Did you get Legend Views in your model?

## The "gotchas" of exporting models

### Model Review:

### What's realistic, and who is setting those standards?

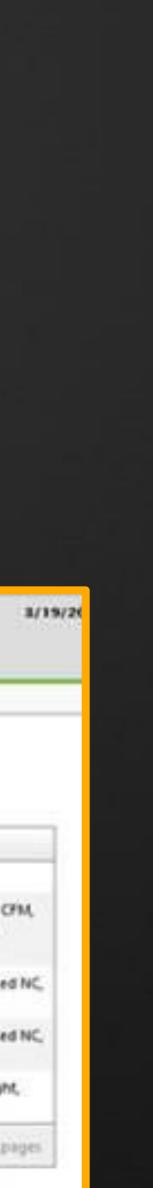
Combined\_Nov17\_2012

Time: 2011-11-19 14:50:22 Application: Autodesk Revit Architecture 2012 IFC: IFC2X3

GST/IDFGeneratorRuleSetV8.2	Acc	Rej	Maj	Nor	Min	EcoDomus un
BasicRules				x		
1 - Unique GUID	OK					
1 - Model Structure (relations to building and building story)				×		Missing attributes
2 - Required Components				x		L
2 - Check for orphaned doors or windows				x		OmniClass Type
3 - Storey Elevations	OK					23-75 70 21 24 14 Variable Volume Air Term
Space Checking			x	x	x	23-75 35 14 Air Handling Units
1 - The Model Must Have Spaces				x		
1 - Space Validation			x	x	x	23-75 70 21 24 14 Variable Volume Air Term
1 - SpaceBoundary check			x			23-75 70 21 24 14 Variable Volume Air Term
2 - Internal walls must bound at least two spaces	OK					
3 - Spaces Must Have a Type, a Name and Number				x		H 4 1 > H Page size: 10
Geometric rules			x	x	x	
2 - Allowed Profiles for columns			a - a	x	x	
2- Wall Validation				x		

sshboard Project Data Tasks Reports Settings				roject: <u>USC SCRIERS</u> ( Pr	
	Dashboard	Project Data	Taska	Reports	Settings

Search	Oper	Export to POF
	Name.	Missing attributes
minal Units	VAV w Reheat 10 Inch	Minimum OFM, Model Number, Operating Weight, Radiated NC, Tag
	AHU DI D-1	Cooling/Heating Coll CFM, Cooling/Heating Coll Fins Per Inch, Manufacturer, Model Number, Supply Fan CF Supply Fan Ext Static Pressure, Supply Fan Motor Break Horse Power, Supply Fan Motor Hertz, Supply Fan Rotations Per Minute, Supply Fan Total Static Pressure, Tag
minal Units	XXX w.Rebeat 6. Inch	Branch Pipe Size, Discharge NC, Maximum CFM, Minimum CFM, Model Number, Operating Weight, Radiated Tag
minal Units	YAV w Reheats Inch CAV	Branch Pipe Size, Discharge NC, Maximum CFM, Minimum CFM, Model Number, Operating Weight, Radiated Tag
minal Units	VAX w Reheats Insh	Branch Pipe Size, Discharge NC, Inlet Size, Maximum CFM, Minimum CFM, Model Number, Operating Weight Radiated NC, Tag
		5 items in 1 pa

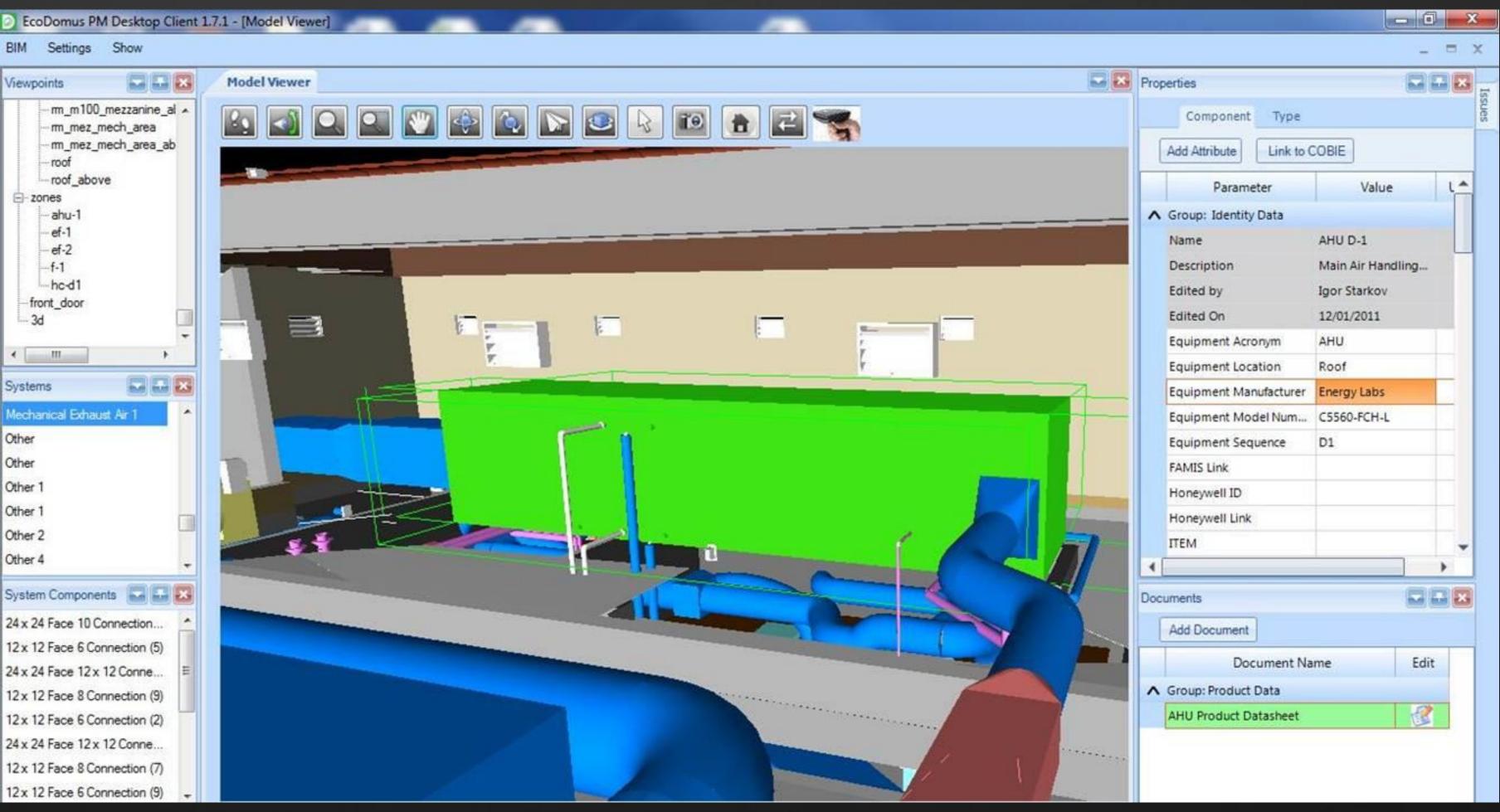


# What happens in the FM Software that relates to CMMS?

### - Components:

#### From the Model:

- What are they
- Where are they
- What are they doing
- What are they connected to?



## What happens in the FM Software that relates to CMMS?

#### From the FM Tool:

- Work backwards from Space
- Find the Systems
- Find the pieces
- Find the data



# What happens in the FM Software that relates to CMMS?

### - Components:

### From the Model:

- What are they
- Where are they
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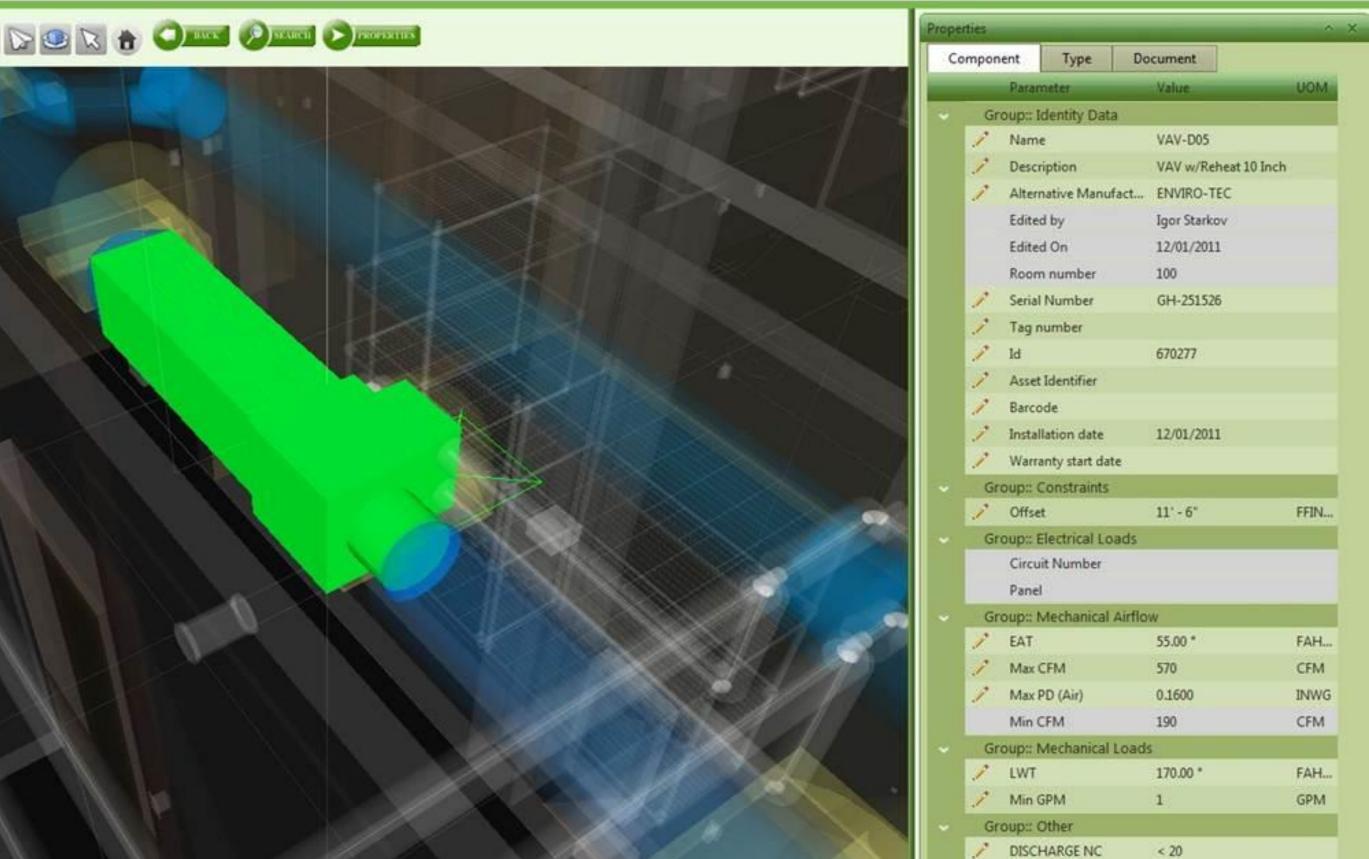
#### From the FM Tool:

- Work backwards from Space
- Find the Systems
- Find the pieces
- Find the data
- What's already been worked on, and what could be our problem?

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Eco®o	mus		
Viewpoints	_	~	×
System			x
System Compo	ne	~	×
Room Data She	eet	÷	×
Search Compo	nent		×
Search Space		~	×
BAS Informatio	'n	*	x
Damper position	42		
Discharge temp	61.32424		
Room setpoint	69.99667		
Room Temp	70.17637		
Supply airflow	188.5803		
Supply airflow setpointt	190.6992		
Work Order		-	×
W0528221	OPEN		ĥ
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W0169956	CLOSE		
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# Monday Morning Quarterbacking

### What didn't go well?

Time to convert Point Clouds to PCG from native file format
 Order of magnitude more time than expected, due to file sizes. (Lesson learned)

Data Associations (ask how the downstream software works)
 Space association from System Browser, not from FamilyInstance

Model Review:
If you're building a true as-built, you cant always correct "Revit warnings."

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