Maintaining Models with Value: What OSU Learned Moving to BIM

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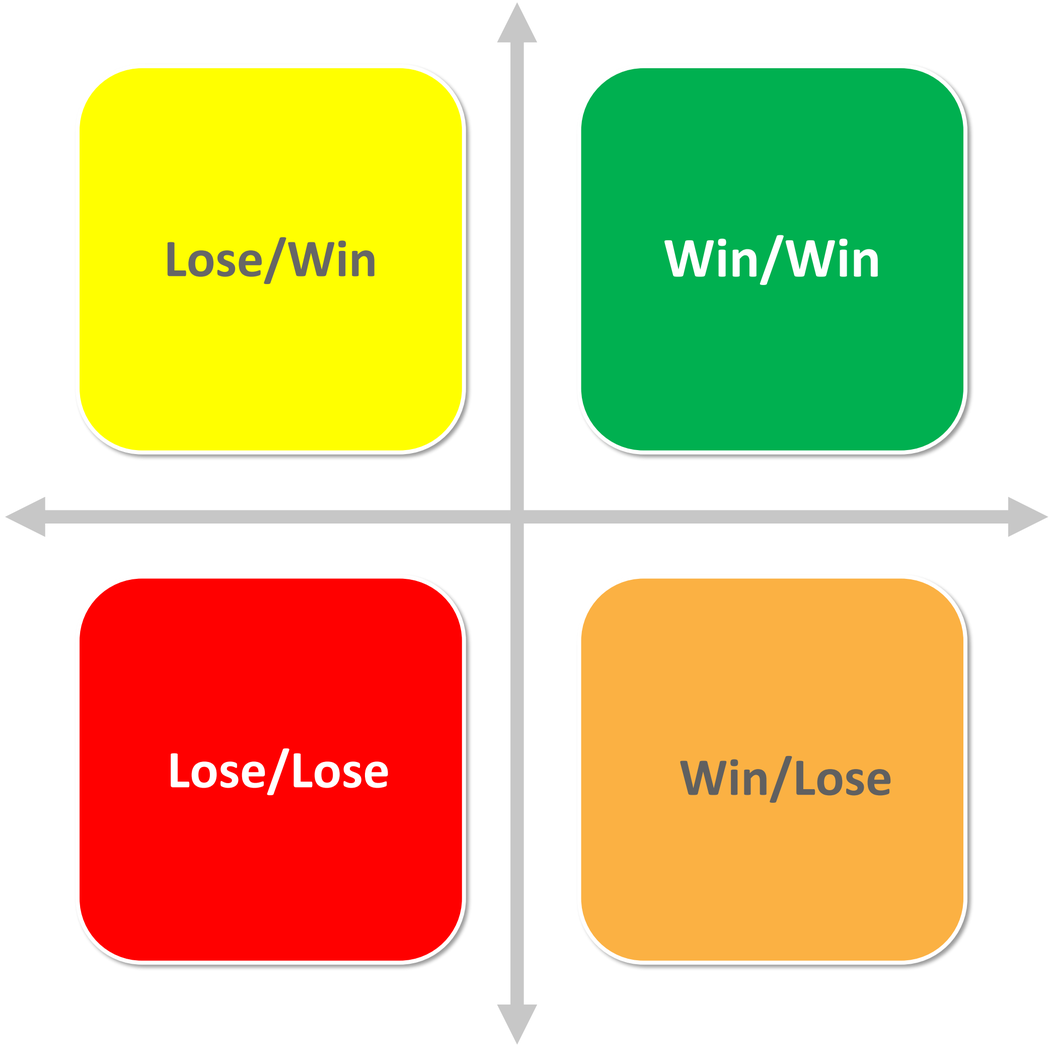
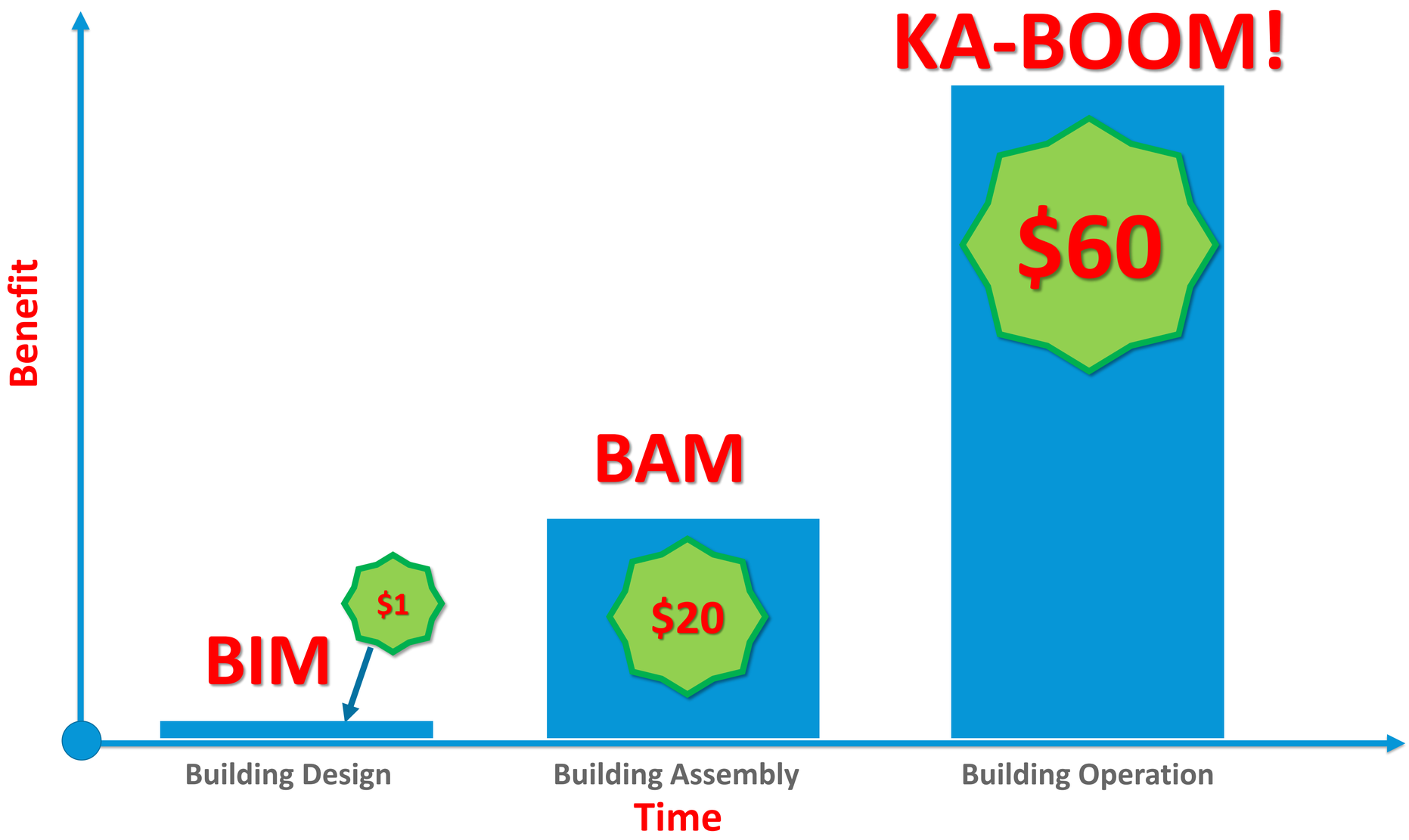
The Problem

- Owners Increasing BIM Usage
- Most Owners Don’t Understand BIM
  - WRONG people engaged
  - What it is
  - What data to ask for
  - How to leverage it
- Most AEC Professionals Don’t Understand FM
  - What it is….really
  - Talking to WRONG people
  - Who to ask about
  - How to leverage it



BIM – Show Me the Money



3 Simple Questions

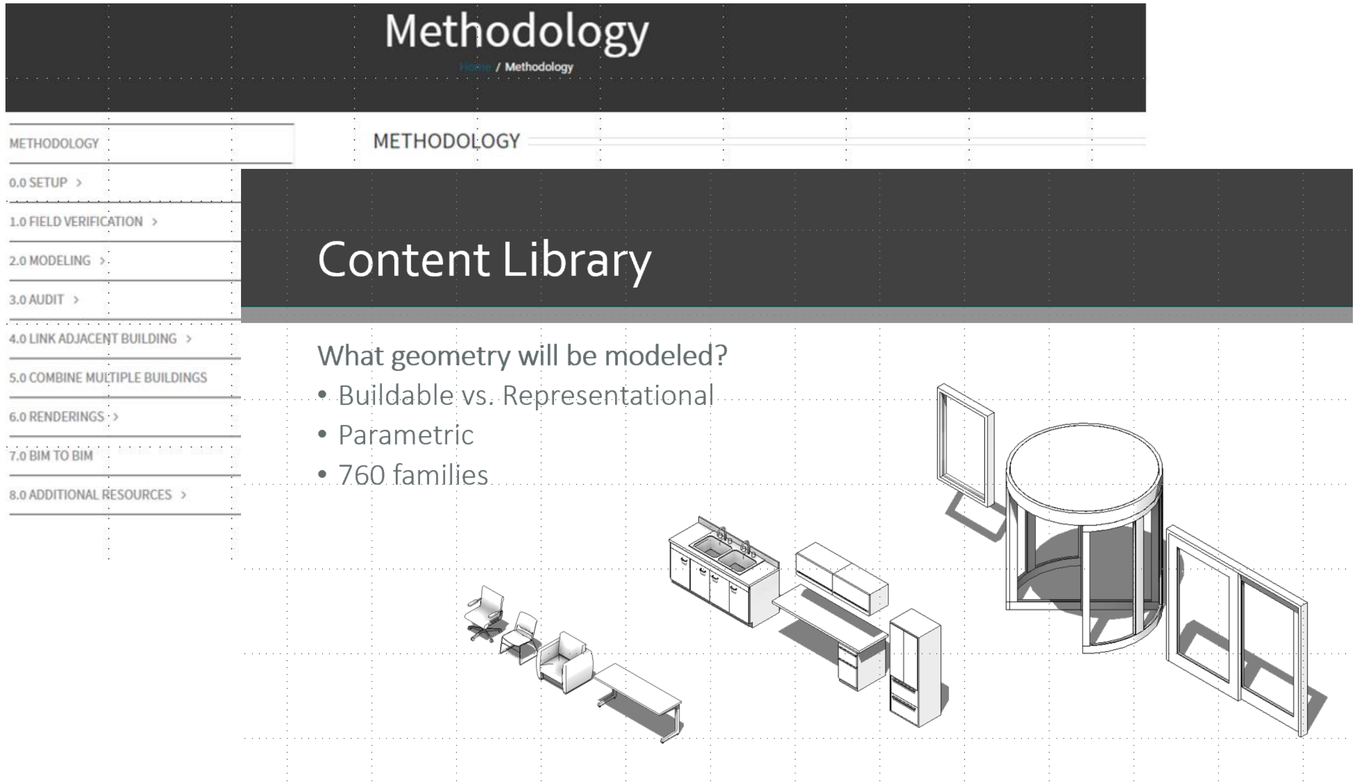
What data do you need?

How will you collect it?

How will it be kept up to date?

OSU Conversion Process

- Methodology
- Content library
- Productivity tools



Buckeye BIM Initiative

Buckeye BIM Initiative

BIM for Existing Buildings

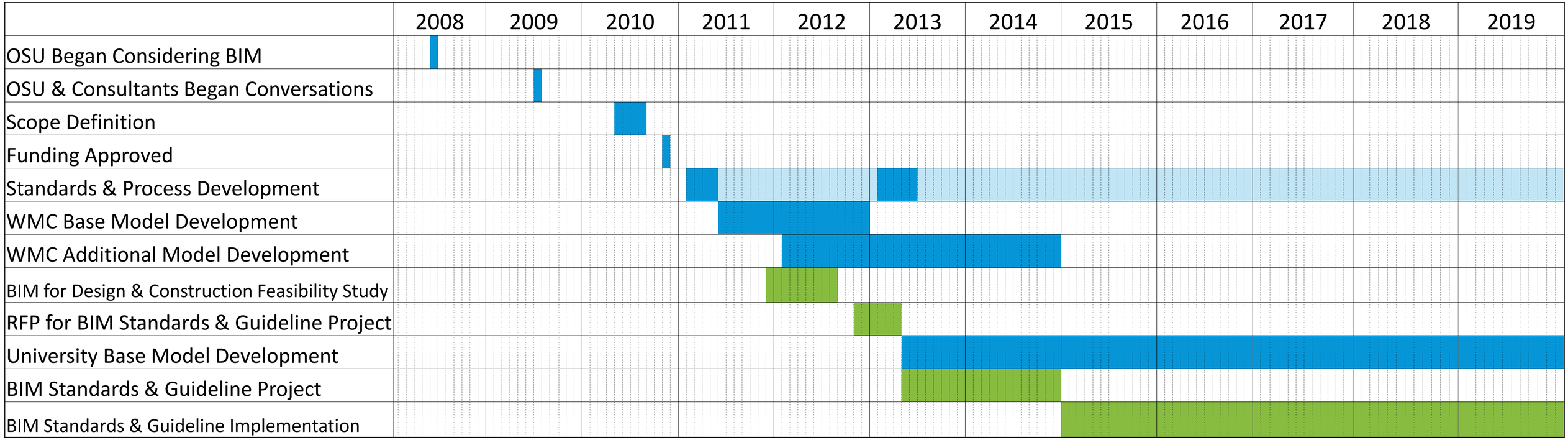
BIM for Design & Construction

BIM for Operations

Project Objective

Enhance planning and communication resulting in improved quality and speed of decision-making.

Buckeye BIM Initiative Timeline



BIM for Existing Buildings

BIM for Existing Buildings Progress

Total Buckeye BIM Implementation

Total Goal: 36,600,000 sqft

Base Model Development

Owner’s Model

- Design Intent vs. Work Intent vs. As-Built vs. As-Maintained
- What do we need?
- What do we not need?

What supports our planning and operations efforts?

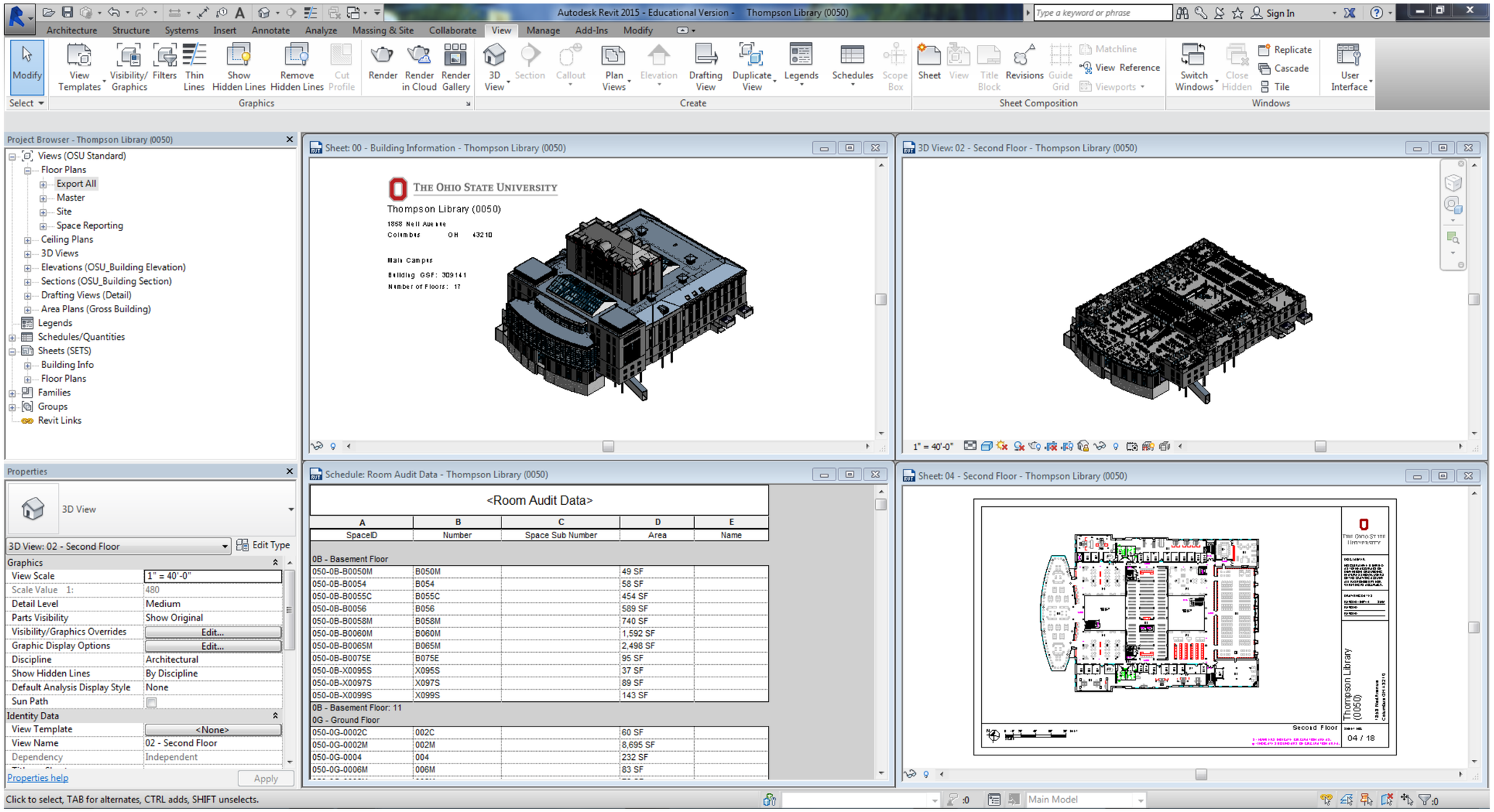
What can be reasonably maintained?

Owner’s Model

Base Model Includes:

- Walls
- Doors
- Windows
- Columns
- Column Grid
- Elevator / Elevator Car
- Escalators
- Stairs (Basic)
- Floors
- Ceilings
- Roof (Basic)
- Casework (Some)
- Plumbing (Basic)
- Furniture (Some)
- Fume Hoods
- Catwalks

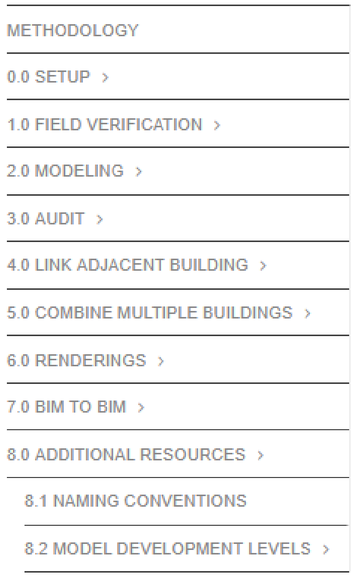
Standards Development



Standards Development

Naming Conventions

- Floor Plans
- Ceiling Plans
- Elevations
- Sections
- Area Plans
- Sheets
- Families
- Model in Place
- Profiles
- Room/Space data



8.1 Naming Conventions

Floor Plans

- Note: Floors -TL thru 20, 30, RF naming is: Number(space)hyphen(space)Name(space)Name
- Each word starts with a capital letter: 02 - Second Floor
- Floors 21 – 29 naming is: Number(space)hyphen(space)Name(hyphen)name(space)Name(space)Name
- Each word except the one after the 2nd hyphen starts with a capital letter: Twenty-first Floor

- Master
  - -TL - Tunnel Level
  - .SB - Sub-Basement
  - 0B - Basement Floor
  - 0G - Ground Floor
  - 01 - First Floor
  - 02 - Second Floor
  - 02M - Second Floor Mezzanine
  - 03 - Third Floor
  - 21 – Twenty-first Floor
  - 22M – Twenty-second Floor Mezzanine
  - RF – Roof
- Site
  - Site_Project North
  - Site_True North
- Space Reporting
  - First Floor _Space Function Legend
  - First Floor _Space Organization Name Legend
  - First Floor _Space Room Type Legend

Content Library

Family File Naming (MasterFormat)

Toilet-Commercial-Wall-3D.rfa

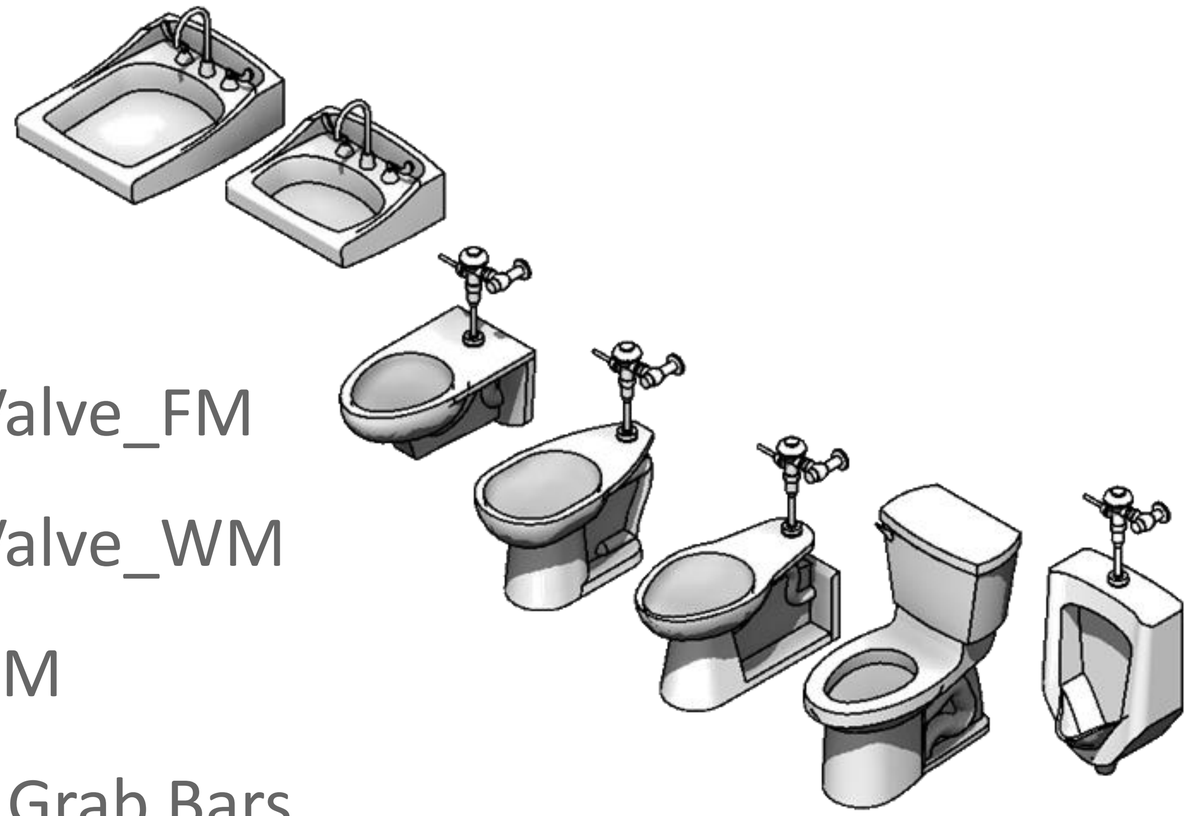
vs.

OSU_22_Plmb_Water Closet_Flush Valve_FM

OSU_22_Plmb_Water Closet_Flush Valve_WM

OSU_22_Plmb_Water Closet_Tank_FM

OSU_22_Plmb_Water Closet_WM w Grab Bars



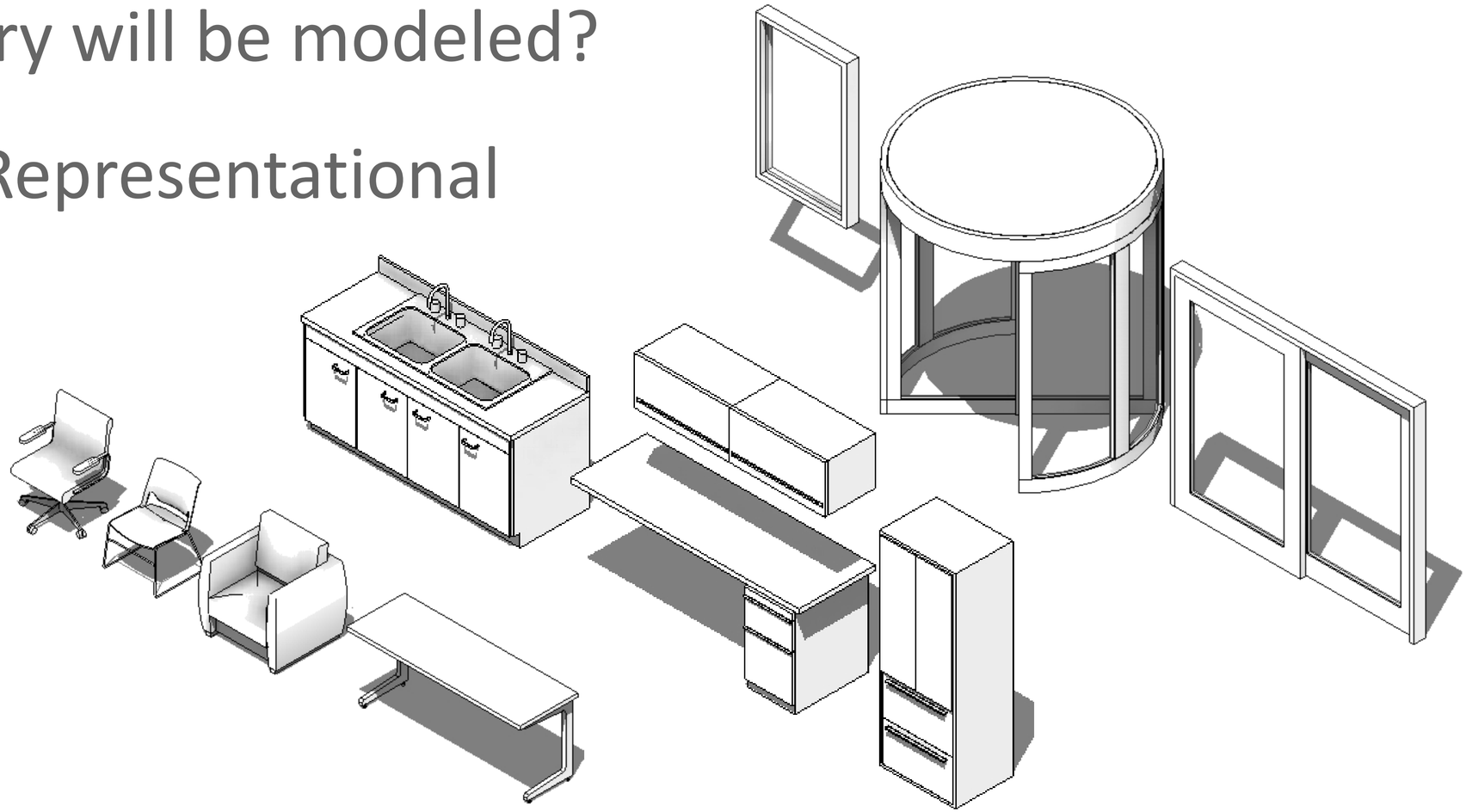
Content Library

What geometry will be modeled?

Buildable vs. Representational

Parametric

760 families



Model Development Levels

Base Model

Residence Hall

Parking Garage

Additional Data Model

8.2.2 Residence Hall

Base Model plus:

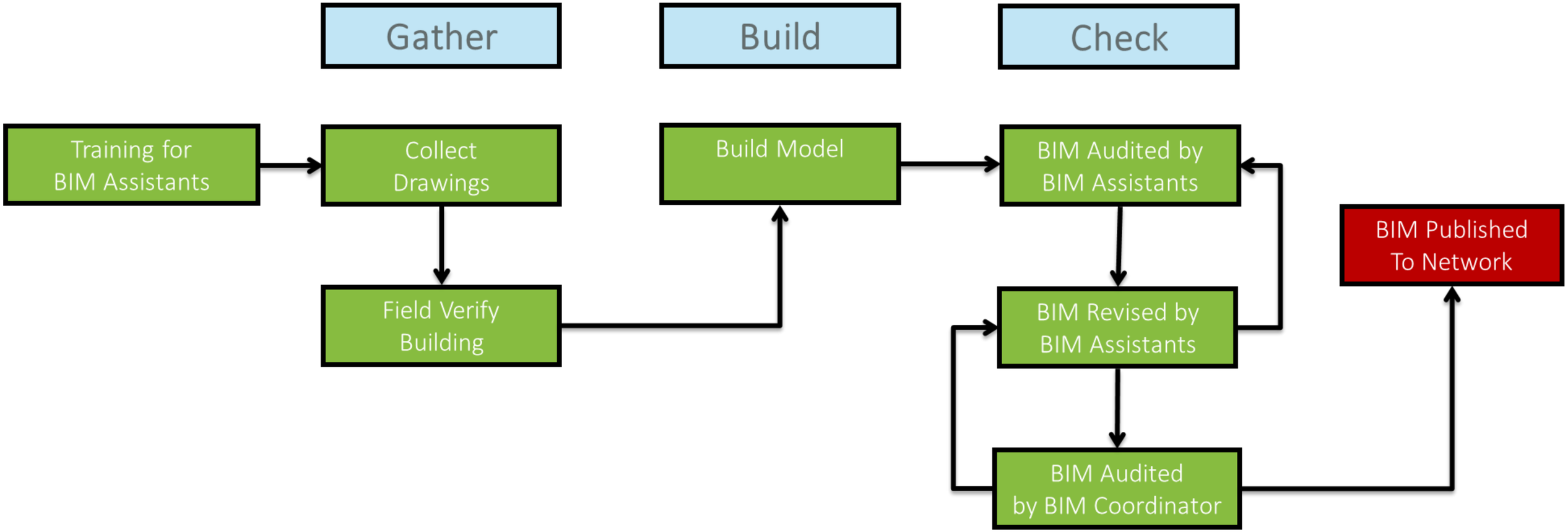
- Casework
  - Registration / Information Areas (Built-in)
  - Retail Counters / Casework
  - Cafeteria / Dining Areas
  - Wardrobes (Built-in)
  - Lockers
  - Mailboxes (Postal – Built-in)
- Plumbing
  - Radiator and supply pipes
- Furniture
  - Registration / Information Areas (Systems furniture)
  - Public / Common Areas (Lounges, waiting, study areas)
  - Cafeteria / Dining Areas
  - Dressers
  - Desk(s) & Chair(s)
  - Beds (bunk/single/loft/full)

8.2.4 Additional Data Model

Base Model plus:

- Casework
  - Nurse stations (Built-in)
  - Registration / Discharge Stations (Built-in)
  - Information Desks (Built-in)
  - Retail Counters / Casework
  - Cafeteria / Dining Areas
  - Laboratory Detail (Benches, counters, shelving)
  - Lockers
  - Mailboxes (Postal)
  - Shelving (Warehouse, etc.)
- Plumbing
  - Specialty Plumbing Fixtures (Medical)
  - Detailed Fixtures (Wall or floor mounted fixtures)
  - ADA Sinks (Research whether this is in the basic model)
  - ADA Handrails (Research whether this is in the basic model)
- Furniture
  - Nurse stations (Systems furniture)
  - Registration / Discharge Stations (Systems furniture)
  - Information Desks (Systems furniture)
  - Waiting Areas / Lobbies

Processes


Gather
Build
Check
Training for BIM Assistants
Collect Drawings
Field Verify Building
Build Model
BIM Audited by BIM Assistants
BIM Revised by BIM Assistants
BIM Audited by BIM Coordinator
BIM Published To Network

Processes

BIM switch

Home Methodology Downloads Tracking Logout

1.0 Field Verification

Home / Methodology / 1.0 Field Verification

1.0 Field Verification

The purpose of field verification is to confirm any existing AutoCAD drawings are accurate and up-to-date. Field verification is best done in pairs, one person to measure while the other records the information. During your visit to the building collect as much information as possible.

You will walk every floor of your building taking pictures, sketches, and measurements.

Keep in mind you may not get a chance to visit the building again, so be vigilant in taking pictures, noting any layout changes and document all existing room signage.

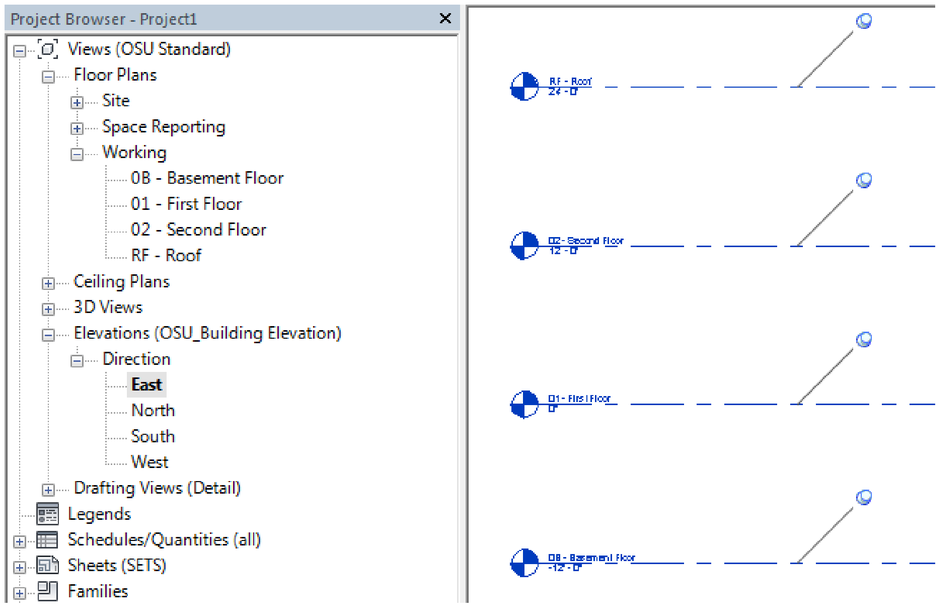
NEXT →

Processes

2.0 Modeling

2.0 Modeling

This process map will walk you through the steps of creating a new Revit project, importing in an AutoCAD underlay, and building a Revit model based on the existing AutoCAD information.



NEXT →

Processes

BIM switch

Home | Methodology | Downloads | Tracking | Logout

2.0 Modeling

Home / Methodology / 2.0 Modeling

2.0 Modeling

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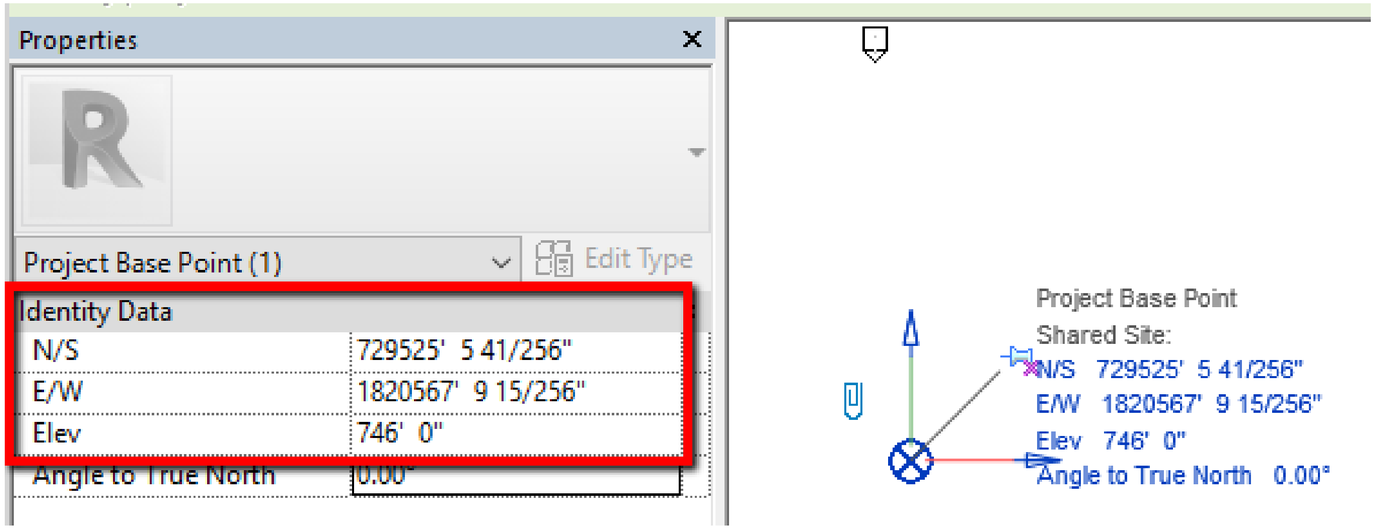
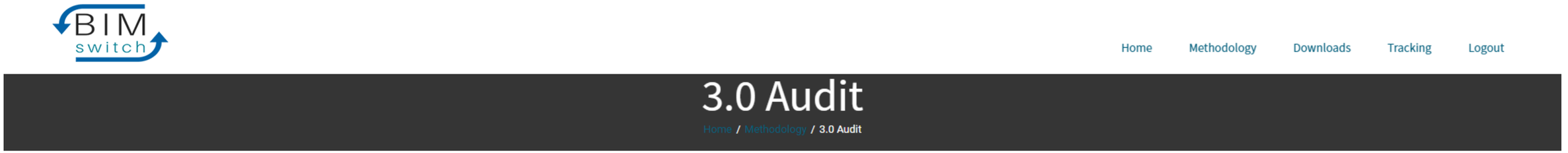


Project Base Point

Why This Matters

- Revit
- BIM 360
- Navisworks
- GIS

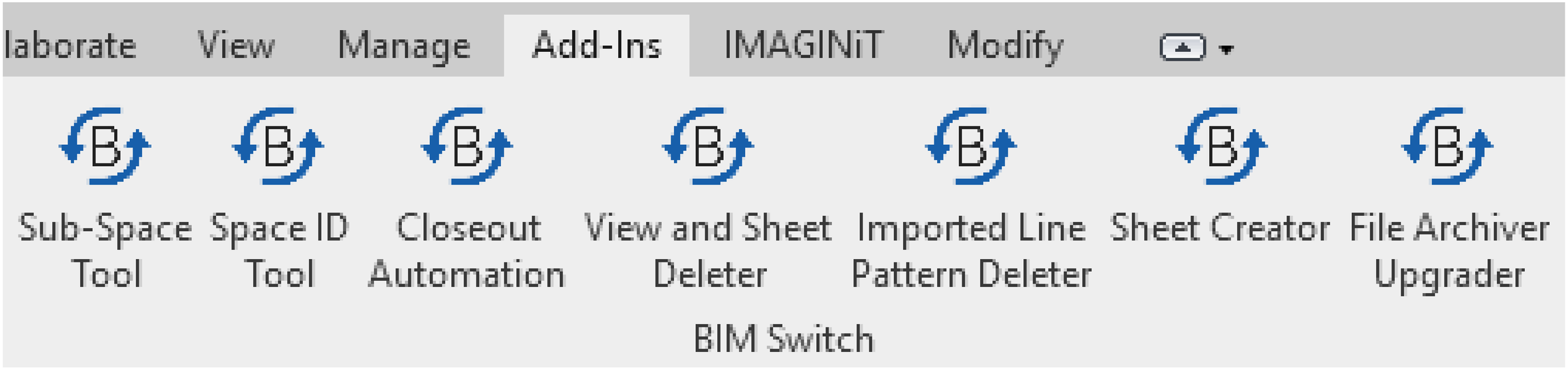
Processes



History

- Manual Audit: 2011
- Added Solibri: 2013
- Added Revit Model Checker: 2016

Tools


laborate
View
Manage
Add-Ins
IMAGINiT
Modify
Sub-Space Tool
Space ID Tool
Closeout Automation
View and Sheet Deleter
Imported Line Pattern Deleter
Sheet Creator
File Archiver Upgrader
BIM Switch

Tools

laborate | View | Manage | Add-Ins | IMAGINiT | Modify

Sub-Space Tool | Space ID Tool | seout mation | View and Sheet Deleter | Imported Line Pattern Deleter | Sheet Creator | File Archiver Upgrader

BIM Switch

Properties

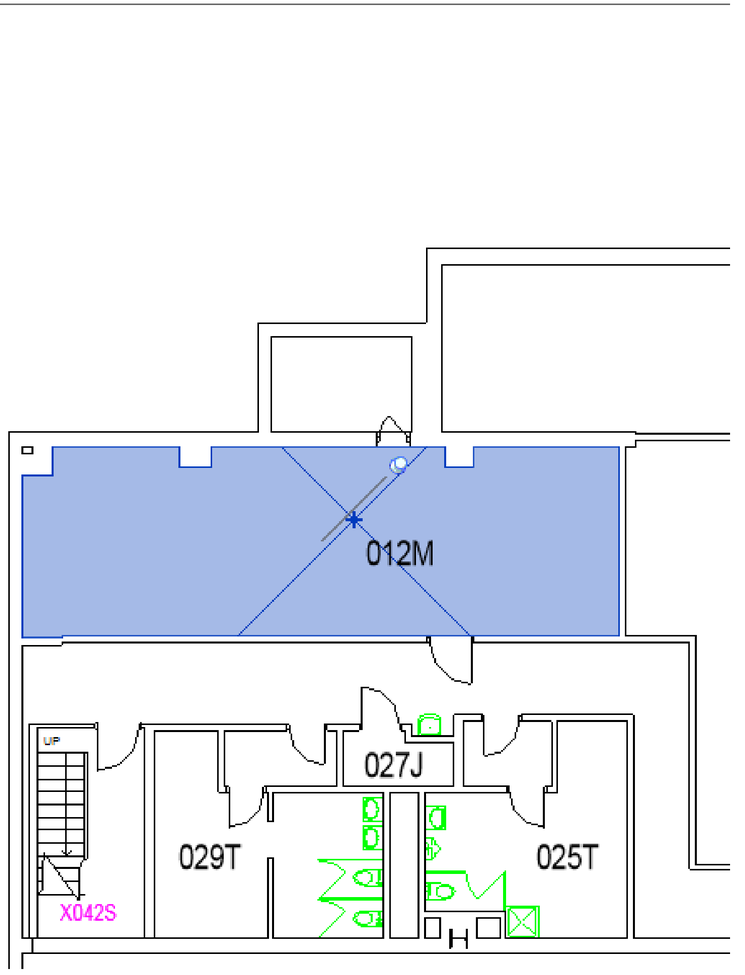
Rooms (1) | Edit Type

Computation Height	0' 0"
Identity Data	
Number	012M
Name	
Image	
Comments	
Occupancy	
Department	
Base Finish	
Ceiling Finish	
Wall Finish	
Floor Finish	
SpaceID	242-0B-0012M
Space Organization Nu...	
Space Organization Na...	

Properties help | Apply

Project Browser - Ackerman Rd, 660 (0242).rvt

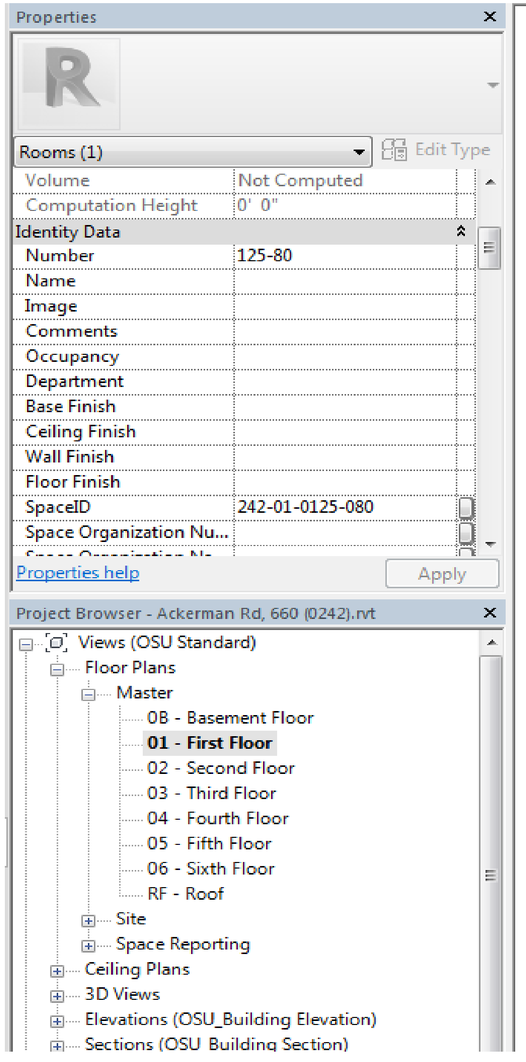
- Views (OSU Standard)
  - Floor Plans
    - Master
      - **0B - Basement Floor**
      - 01 - First Floor
      - 02 - Second Floor
      - 03 - Third Floor

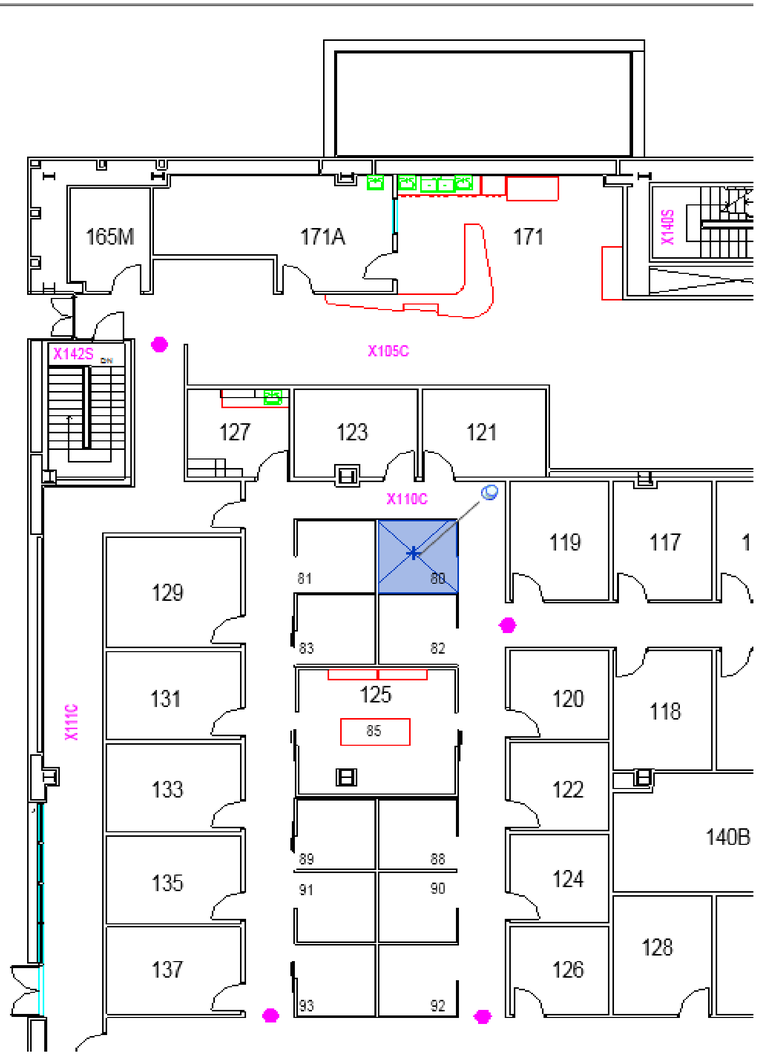


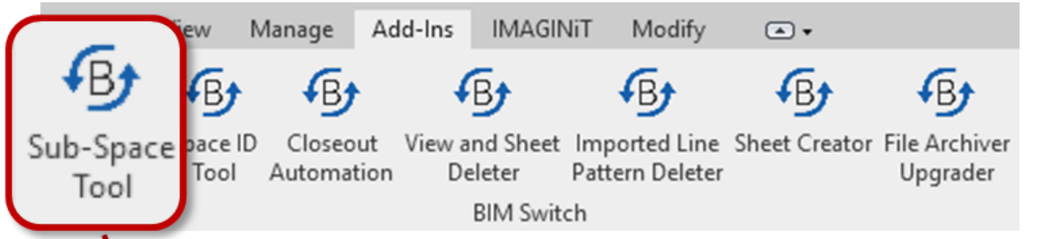
<Room Audit Data>

A	B	C	D	E	F
SpaceID	Number	Space Sub Number	Area	Name	Unbounded Height
0B - Basement Floor					
242-0B-0001M	001M		342 SF		10' - 0"
242-0B-0003M	003M		59 SF		10' - 0"
242-0B-0009M	009M		517 SF		10' - 0"
242-0B-0010M	010M		1,464 SF		10' - 0"
242-0B-0012M	012M		568 SF		10' - 0"
242-0B-0025T	025T		196 SF		10' - 0"
242-0B-0027J	027J		29 SF		10' - 0"
242-0B-0029T	029T		222 SF		10' - 0"
242-0B-X0004S	X004S		157 SF		10' - 0"
242-0B-X0005C	X005C		1,122 SF		10' - 0"
242-0B-X0025E	X025E		213 SF		10' - 0"
242-0B-X0042S	X042S		116 SF		10' - 0"
01 - First Floor					
242-01-0100	100		101 SF		8' - 0"
242-01-0105	105		277 SF		8' - 0"
242-01-0105A	105A		129 SF		8' - 0"
242-01-0105B	105B		22 SF		8' - 0"
242-01-0106	106		270 SF		8' - 0"
242-01-0108	108		134 SF		8' - 0"
242-01-0110	110		134 SF		8' - 0"
242-01-0113	113		134 SF		8' - 0"
242-01-0114	114		134 SF		8' - 0"
242-01-0115	115		134 SF		8' - 0"
242-01-0117	117		132 SF		8' - 0"
242-01-0118	118		134 SF		8' - 0"
242-01-0119	119		134 SF		8' - 0"
242-01-0120	120		100 SF		8' - 0"
242-01-0121	121		125 SF		8' - 0"
242-01-0122	122		100 SF		8' - 0"
242-01-0123	123		122 SF		8' - 0"
242-01-0124	124		100 SF		8' - 0"
242-01-0125-080	125-80	80	65 SF		8' - 0"
242-01-0125-081	125-81	81	65 SF		8' - 0"
242-01-0125-082	125-82	82	63 SF		8' - 0"
242-01-0125-083	125-83	83	63 SF		8' - 0"
242-01-0125-085	125-85	85	219 SF		8' - 0"
242-01-0125-088	125-88	88	63 SF		8' - 0"
242-01-0125-089	125-89	89	63 SF		8' - 0"
242-01-0125-090	125-90	90	63 SF		8' - 0"
242-01-0125-091	125-91	91	63 SF		8' - 0"
242-01-0125-092	125-92	92	65 SF		8' - 0"
242-01-0125-093	125-93	93	64 SF		8' - 0"

Tools







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	242-0B-X0042S	X042S		116 SF		10' - 0"
0B - Basement Floor: 12						
01 - First Floor						
	242-01-0100	10		101 SF		8' - 0"
	242-01-0105	105		277 SF		8' - 0"
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	242-01-0119	119		134 SF		8' - 0"
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	242-01-0124	124		100 SF		8' - 0"
	242-01-0125-080	125-80	80	65 SF		8' - 0"
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	242-01-0125-083	125-83	83	63 SF		8' - 0"
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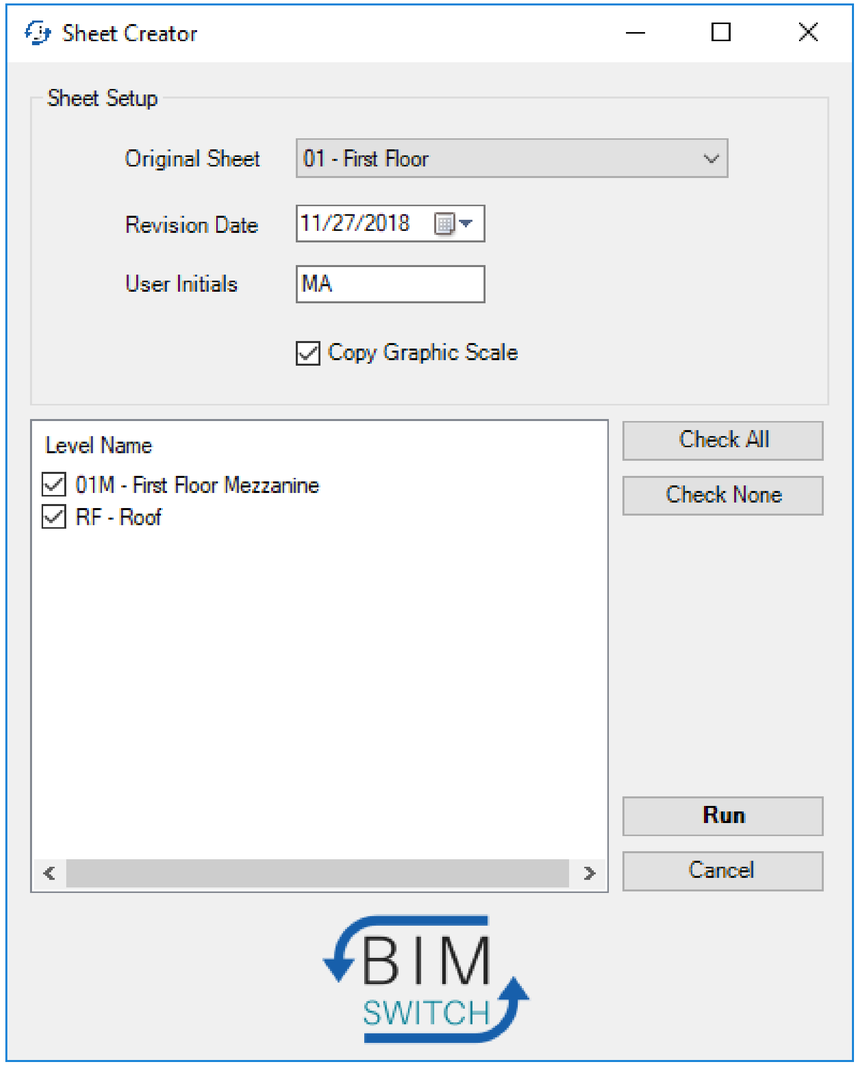
	242-01-0125-090	125-90	90	63 SF		8' - 0"
	242-01-0125-091	125-91	91	63 SF		8' - 0"
	242-01-0125-092	125-92	92	65 SF		8' - 0"
	242-01-0125-093	125-93	93	64 SF		8' - 0"

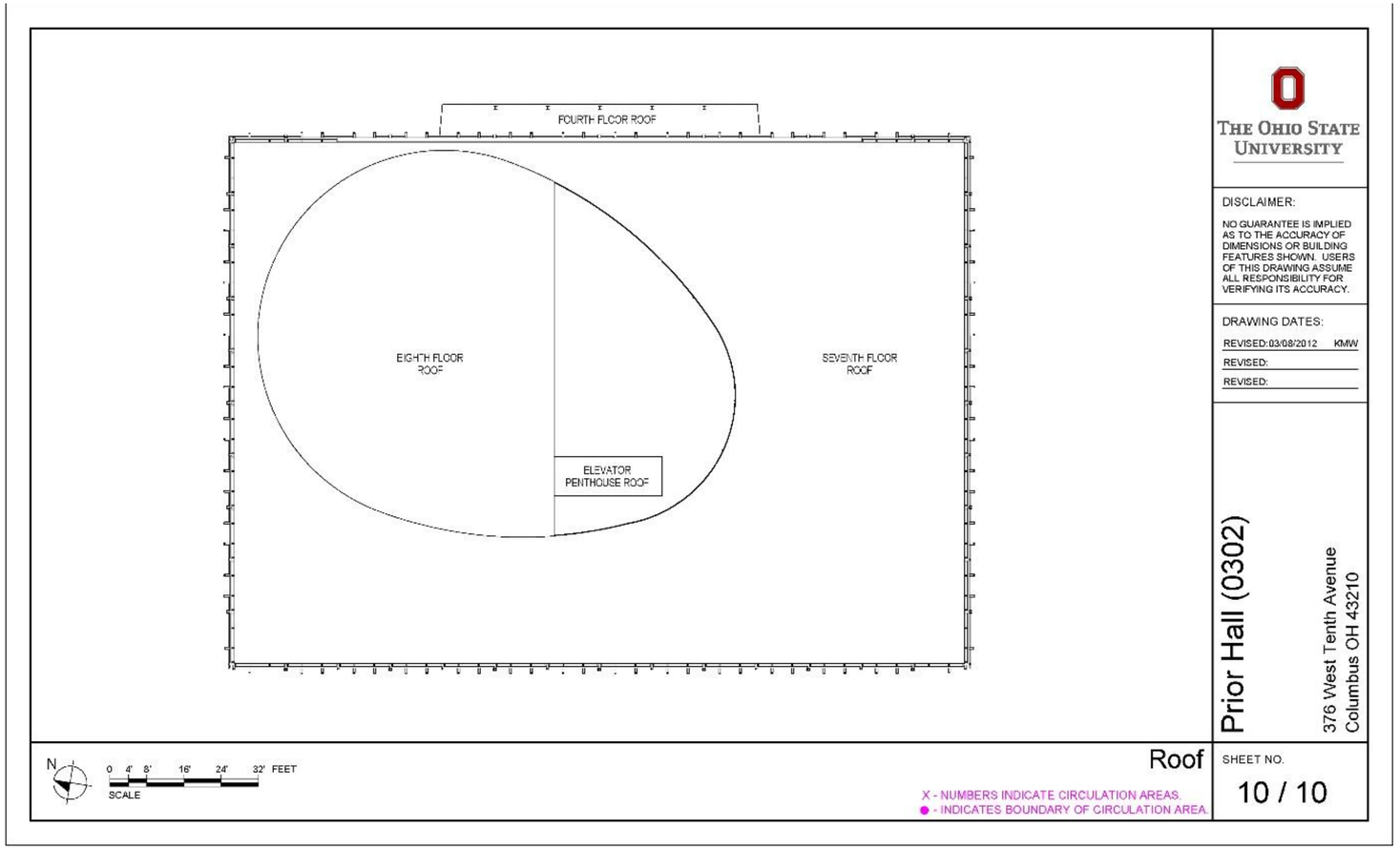
Tools

laborate | View | Manage | Add-Ins | IMAGINiT | Modify

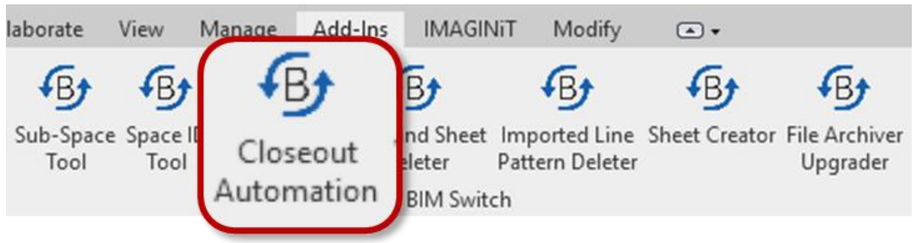
Sub-Space Tool | Space ID Tool | Closeout Automation | View and Sheet Deleter | Imported Line Pattern Deleter | Sheet Creator

BIM Switch





Tools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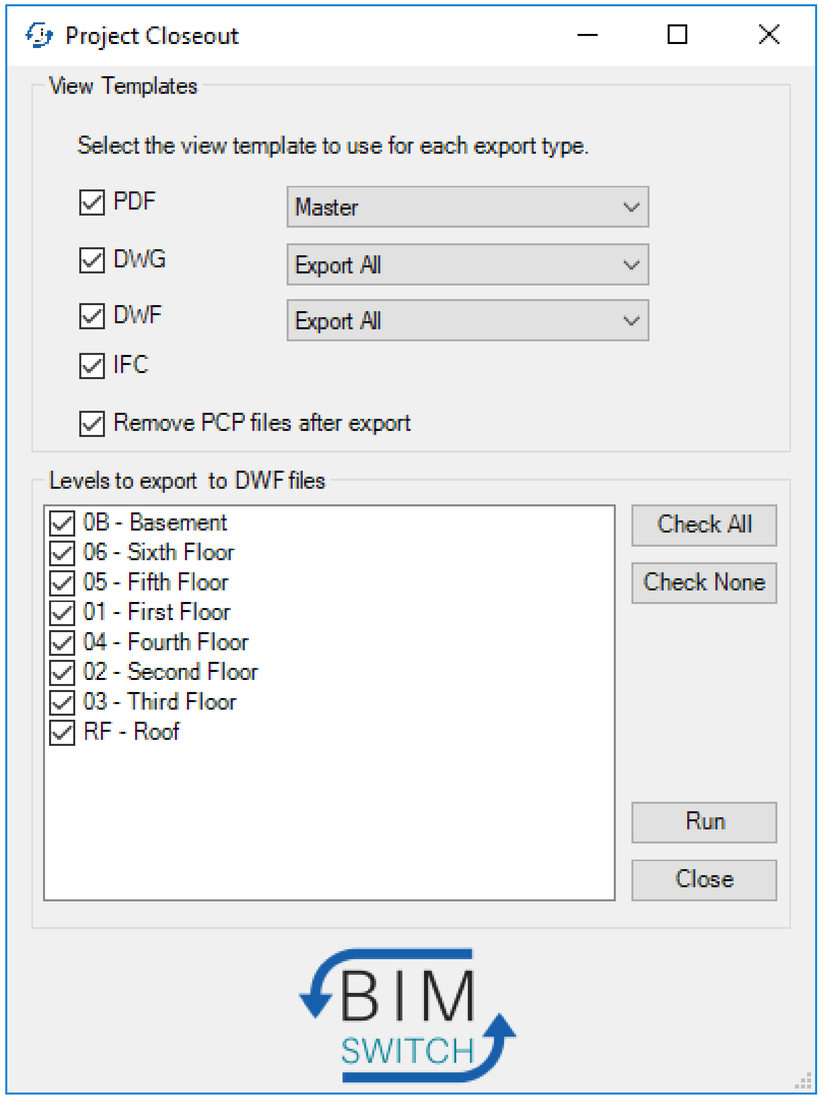
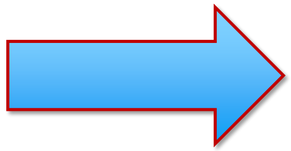
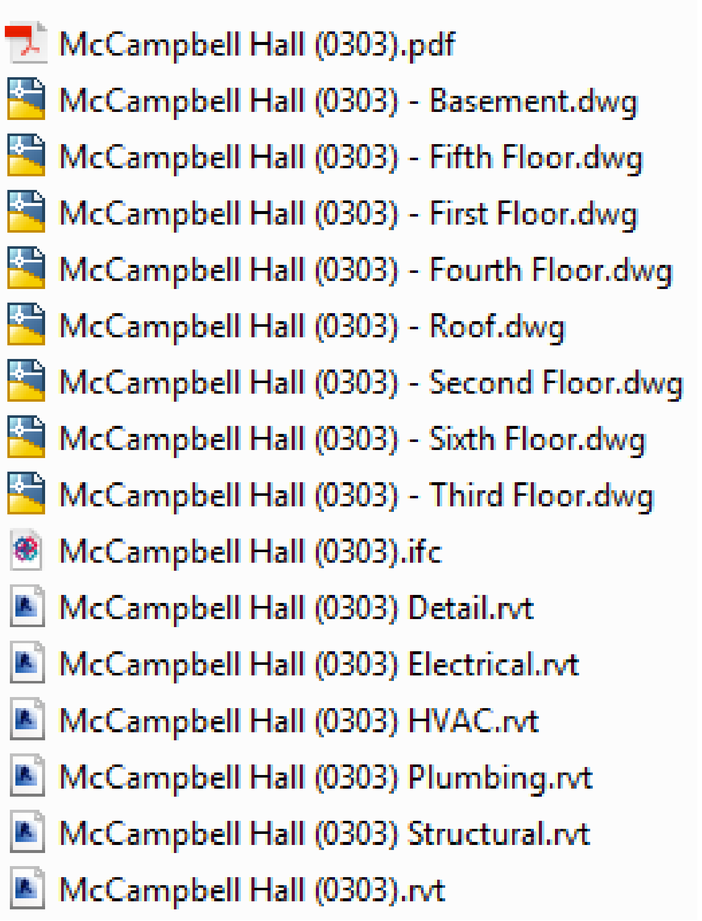
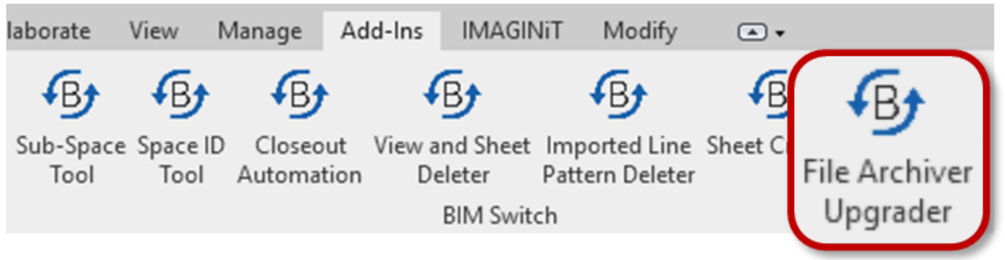

Project Closeout
View Templates
Select the view template to use for each export type.
PDF
Master
DWG
Export All
DWF
Export All
IFC
Remove PCP files after export
Levels to export to DWF files
0B - Basement
06 - Sixth Floor
05 - Fifth Floor
01 - First Floor
04 - Fourth Floor
02 - Second Floor
03 - Third Floor
RF - Roof
Check All
Check None
Run
Close
BIM SWITCH




McCampbell Hall (0303).pdf
McCampbell Hall (0303) - Basement.dwg
McCampbell Hall (0303) - Fifth Floor.dwg
McCampbell Hall (0303) - First Floor.dwg
McCampbell Hall (0303) - Fourth Floor.dwg
McCampbell Hall (0303) - Roof.dwg
McCampbell Hall (0303) - Second Floor.dwg
McCampbell Hall (0303) - Sixth Floor.dwg
McCampbell Hall (0303) - Third Floor.dwg
McCampbell Hall (0303).ifc
McCampbell Hall (0303) Detail.rvt
McCampbell Hall (0303) Electrical.rvt
McCampbell Hall (0303) HVAC.rvt
McCampbell Hall (0303) Plumbing.rvt
McCampbell Hall (0303) Structural.rvt
McCampbell Hall (0303).rvt

Tools


laborate
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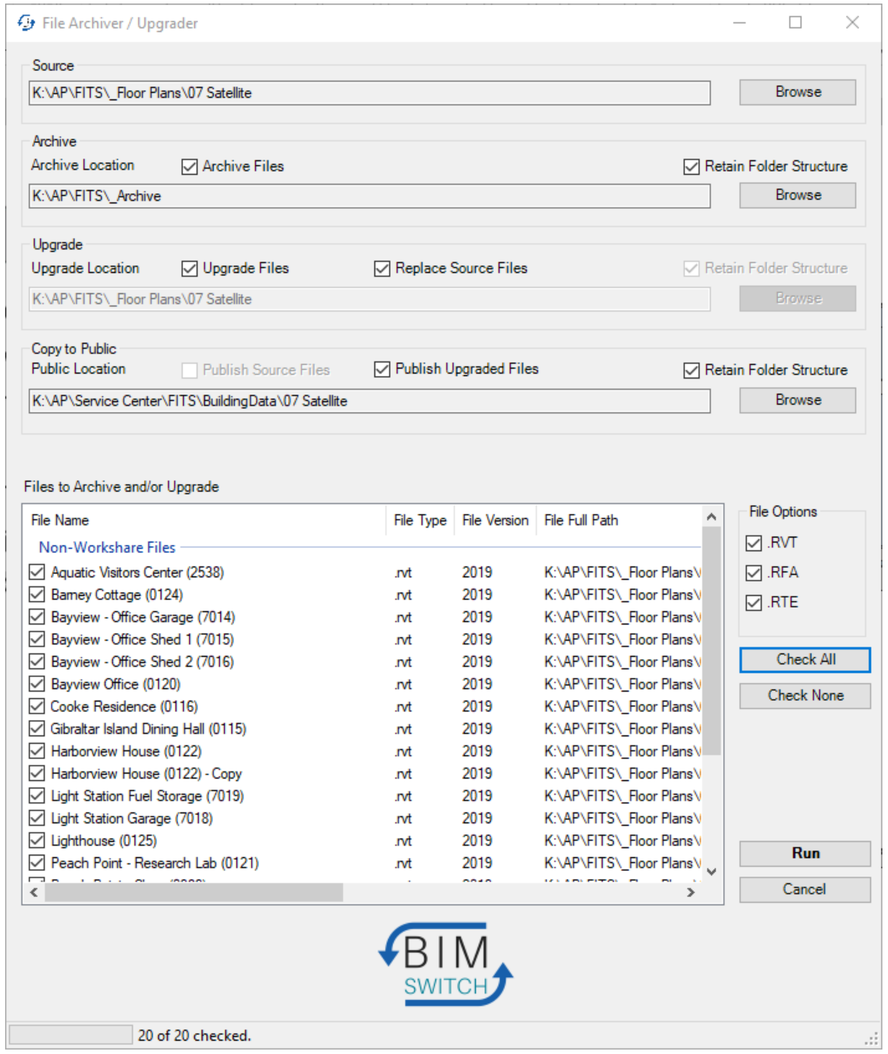
Sheet C
File Archiver Upgrader
BIM Switch


File Archiver / Upgrader
Source
K:\AP\FITS_Floor Plans\07 Satellite
Browse
Archive
Archive Location
Archive Files
Retain Folder Structure
K:\AP\FITS_Archive
Browse
Upgrade
Upgrade Location
Upgrade Files
Replace Source Files
Retain Folder Structure
K:\AP\FITS_Floor Plans\07 Satellite
Browse
Copy to Public
Public Location
Publish Source Files
Publish Upgraded Files
Retain Folder Structure
K:\AP\Service Center\FITS\BuildingData\07 Satellite
Browse
Files to Archive and/or Upgrade
File Name
File Type
File Version
File Full Path
Non-Workshare Files
Aquatic Visitors Center (2538) .rvt 2019 K:\AP\FITS_Floor Plans\
Barney Cottage (0124) .rvt 2019 K:\AP\FITS_Floor Plans\
Bayview - Office Garage (7014) .rvt 2019 K:\AP\FITS_Floor Plans\
Bayview - Office Shed 1 (7015) .rvt 2019 K:\AP\FITS_Floor Plans\
Bayview - Office Shed 2 (7016) .rvt 2019 K:\AP\FITS_Floor Plans\
Bayview Office (0120) .rvt 2019 K:\AP\FITS_Floor Plans\
Cooke Residence (0116) .rvt 2019 K:\AP\FITS_Floor Plans\
Gibraltar Island Dining Hall (0115) .rvt 2019 K:\AP\FITS_Floor Plans\
Harborview House (0122) .rvt 2019 K:\AP\FITS_Floor Plans\
Harborview House (0122) - Copy .rvt 2019 K:\AP\FITS_Floor Plans\
Light Station Fuel Storage (7019) .rvt 2019 K:\AP\FITS_Floor Plans\
Light Station Garage (7018) .rvt 2019 K:\AP\FITS_Floor Plans\
Lighthouse (0125) .rvt 2019 K:\AP\FITS_Floor Plans\
Peach Point - Research Lab (0121) .rvt 2019 K:\AP\FITS_Floor Plans\
File Options
.RVT
.RFA
.RTE
Check All
Check None
Run
Cancel
BIM SWITCH
20 of 20 checked.

Outcomes

Improved Accuracy

- Field verified floor plans
- Original AutoCAD supplemented with field verifications
- Buildings stack correctly, thus improving overall accuracy

Outcomes

Additional Building Data

- Exteriors, roofs, window placement
- Height and volume
- Ceilings and floors
- GIS location data

Outcomes

Effort Improvements

- Shorter process to update Revit models following building changes than AutoCAD
- Ability to manage models in a more systematized way

Outcomes

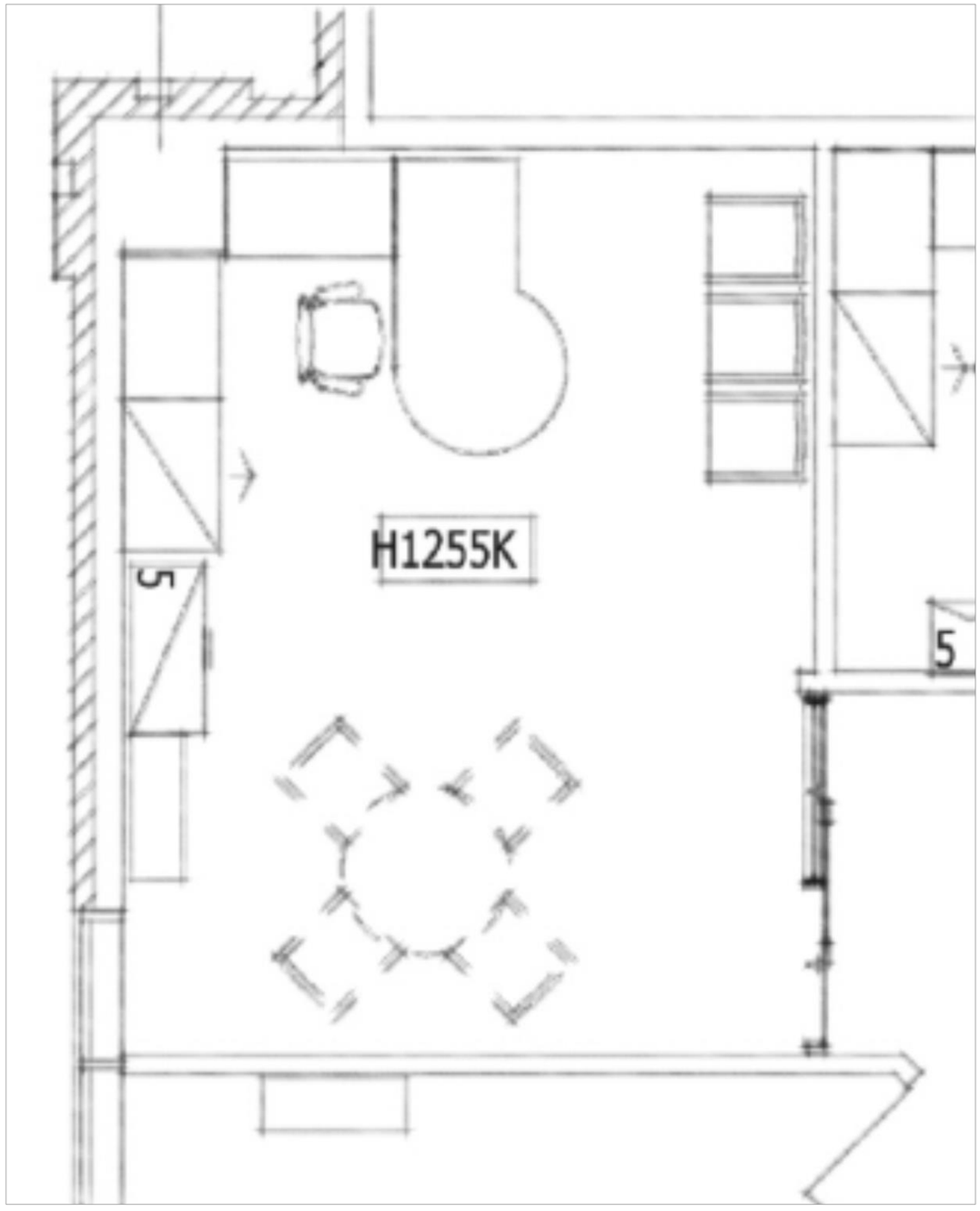
Intelligent Models

- Ability to manage more intelligent information within a model than AutoCAD
- Provide for the ability to connect to other systems/data

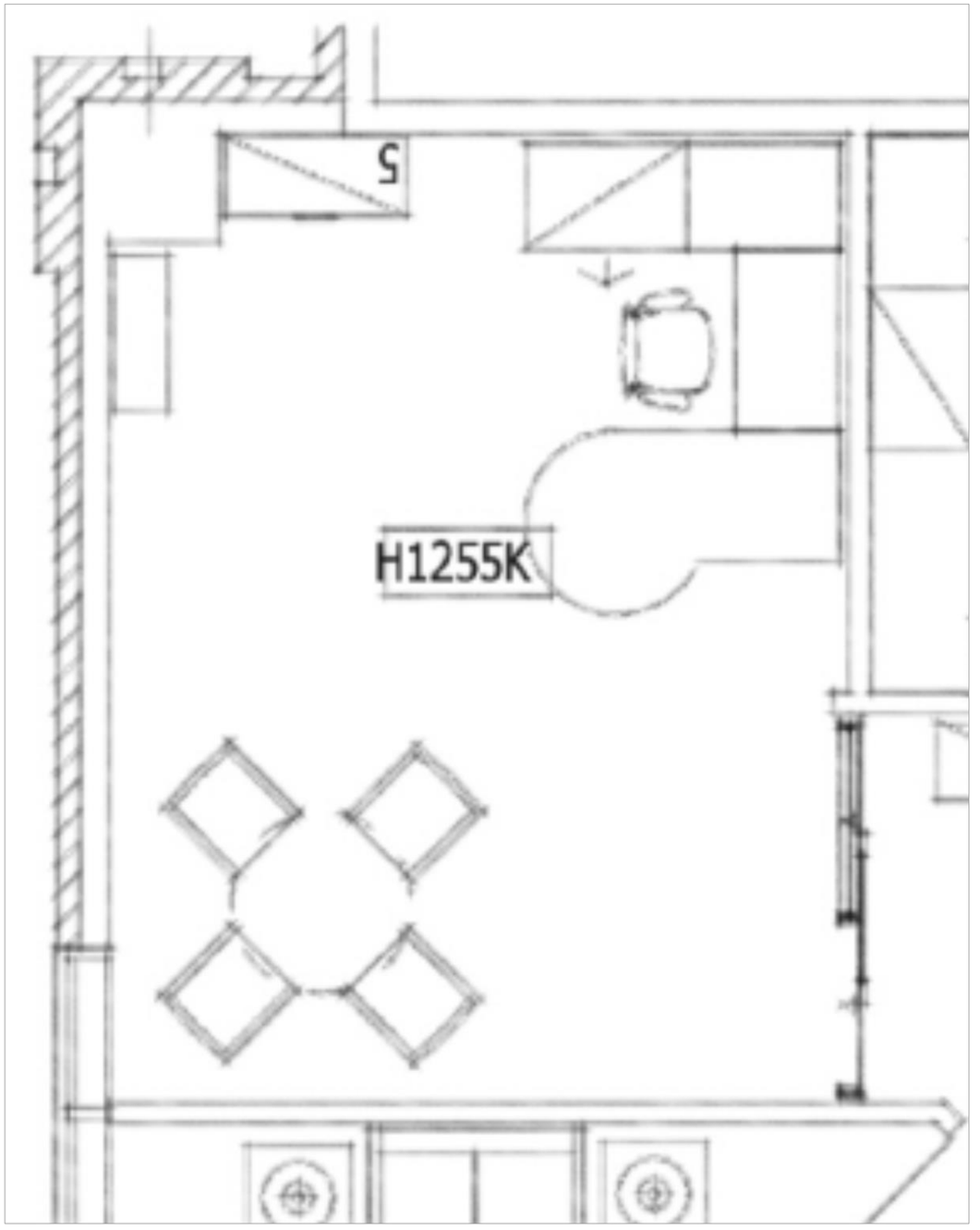
Outcomes

Future Foundation

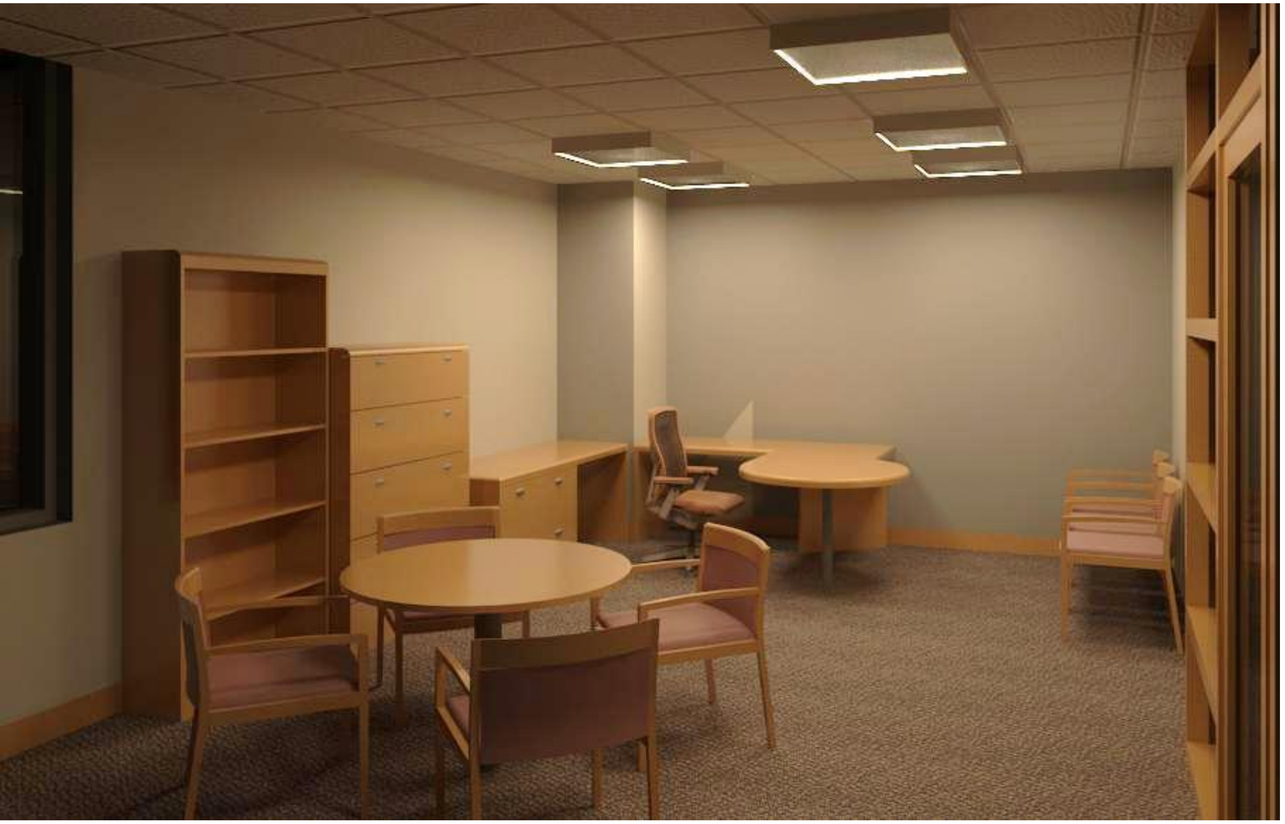
- Developed architectural models become the foundation for firm delivered discipline models
- Better support of future design and construction work
- Foundation for BIM for Operations



Option A

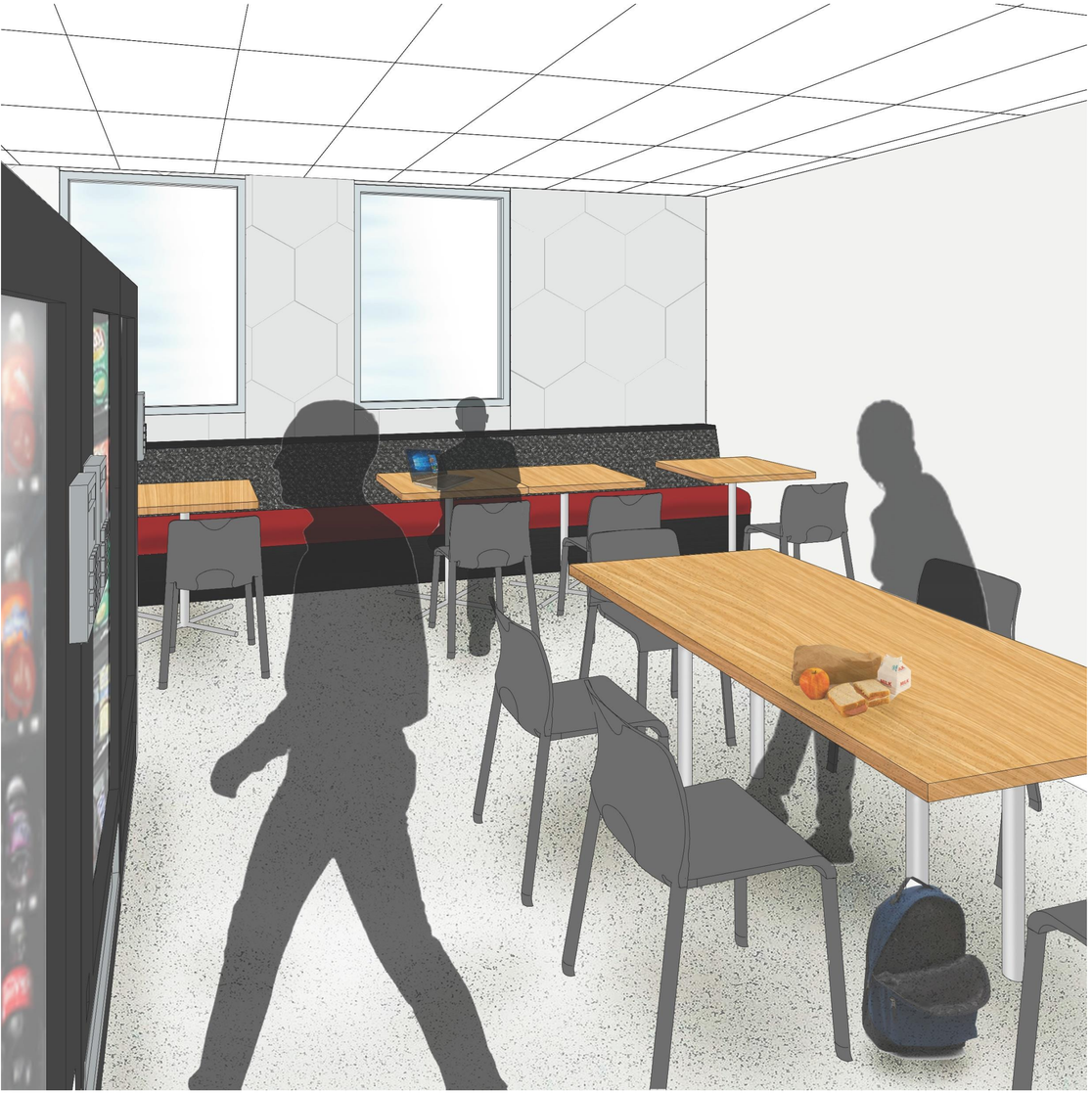


Option B

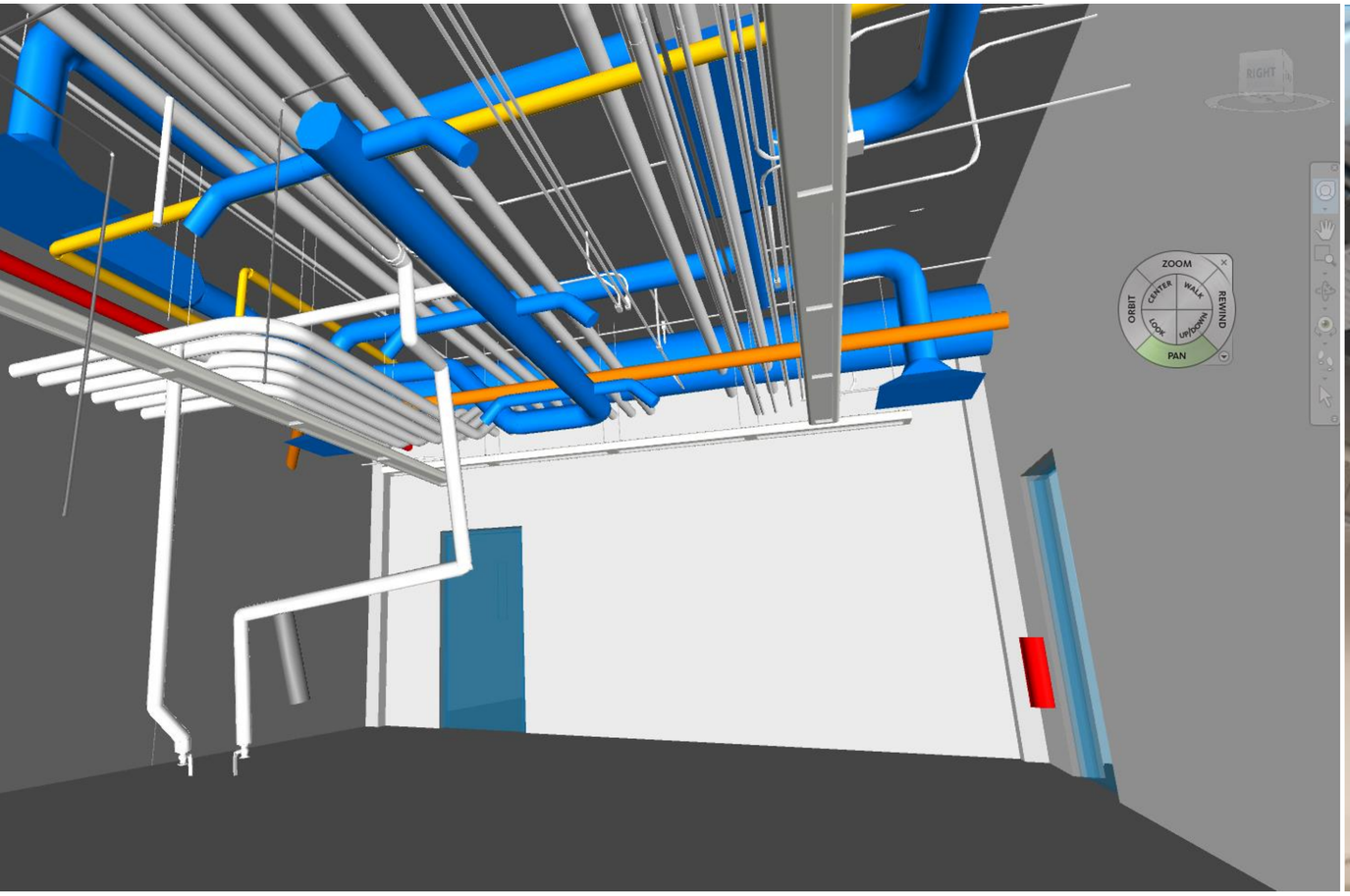


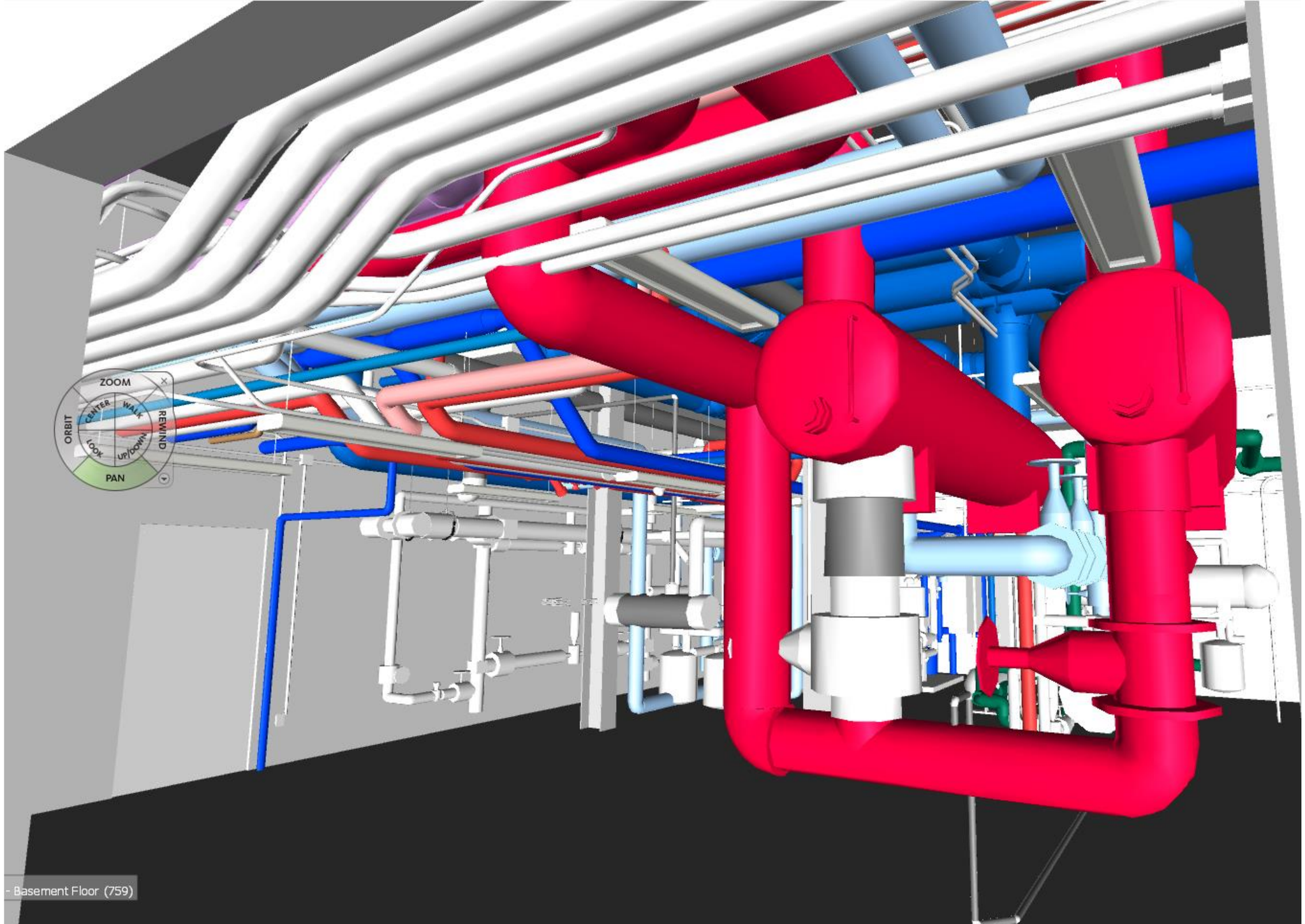
Option A

Option B




FONTANA ENGINEERING COMPLEX


RIGHT
ZOOM
ORBIT
CENTER
WALK
REWIND
LOOK
Up/Down
PAN


ZOOM
CENTER
WALK
REWIND
ORBIT
LOOK
UP/DOWN
PAN
- Basement Floor (759)


OHIO STATE
BUCKEYES

BIM for Design and Construction

Project Delivery Standard

How project will be executed?

How deliverables will be formatted?

Project Delivery Standard

OSU’s Focus

- Not prescriptive about how to run a project
- Focuses almost entirely on turnover documentation

Available at fod.osu.edu/resources

BIM Execution Plan

Project Information
Project Schedule and Milestones
Project BIM Goals
BIM Project Participants
Model Collaboration, Transmission & Permitted Use Strategies and Supporting Software
BIM Meeting Procedures
Model Element Table
Model Coordinate Systems
Model Structure
Floor/Level and Elevation Naming Conventions

LOD Matrix

THE OHIO STATE UNIVERSITY

LOD Matrix of BIM Deliverables

Model Elements (Utilizing CSI UniFormat 2010)	Design								Construct		Operate		LOD Notes	Asset Tag & COBie Required (Notes)	Addl WMC Asset Tag & COBie Required (Notes)
			Project Stakeholder				Design Intent BIM		Trade Coordination BIM		Conformed Design Intent BIM				
	LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA			
B3080.30 – Exterior Bulkheads							300				300		16	-	-
C: Interiors															
C10 Interior Construction															
C1010 – Interior Partitions															
C1010.10 – Interior Fixed Partitions							300				300		1, 16	-	-
C1010.20 – Interior Glazed Partitions							300				300			-	-
C1010.40 – Interior Demountable Partitions							200				200		16	-	-
C1010.50 – Interior Operable Partitions							200				200		16	-	-
C1010.70 – Interior Screens							200				200			-	-
C1010.90 – Interior Partition Supplementary Components													5	-	-

Turnover Documentation

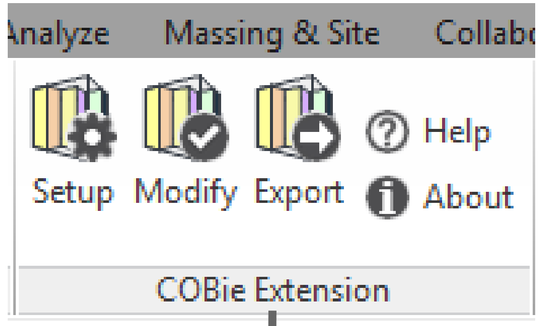
- Conformed Design Intent Architectural and Structural BIM Submittal (75% Construction)
- Conformed Design Intent Models (Record Set)
- Revit Model Checker Results
- COBie and Asset Worksheet

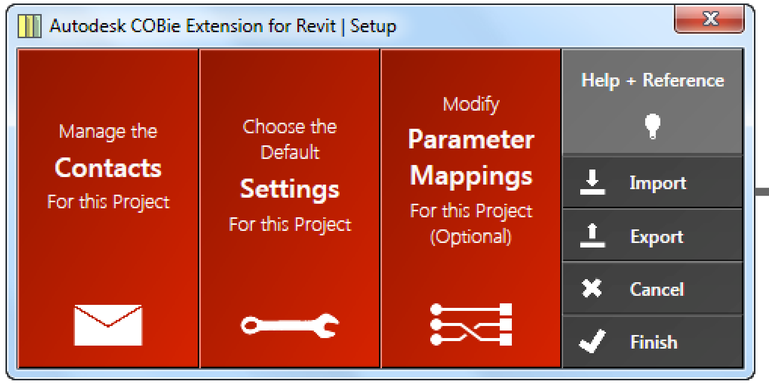
Conformed Design Intent Models

Additional Modeling Requirements

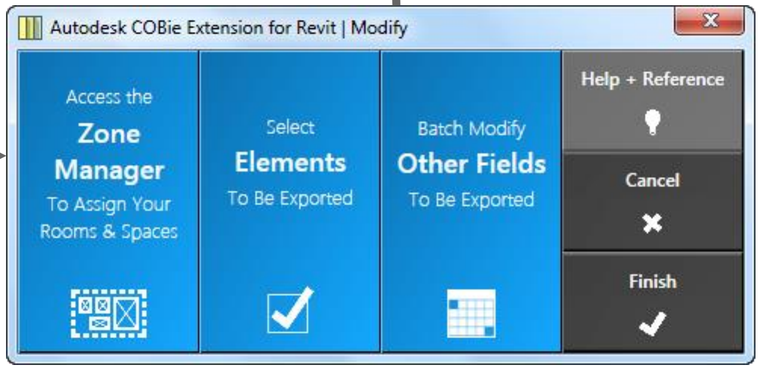
- Rooms/Spaces Development
- Hosting of elements to approved floor levels
- No typicals or prototypes. All geometry must be modeled
- Use of clear and descriptive family names

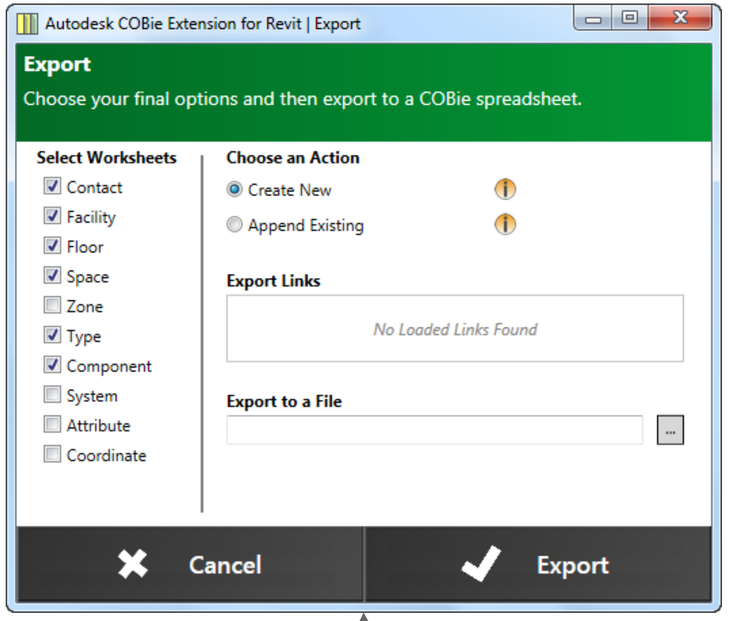
Tools


Analyze
Massing & Site
Collabo
Help
Setup
Modify
Export
About
COBie Extension


Autodesk COBie Extension for Revit | Setup
Manage the
Contacts
For this Project
Choose the
Default
Settings
For this Project
Modify
Parameter
Mappings
For this Project
(Optional)
Help + Reference
Import
Export
Cancel
Finish


OSU_COBie_Extension


Autodesk COBie Extension for Revit | Modify
Access the
Zone
Manager
To Assign Your
Rooms & Spaces
Select
Elements
To Be Exported
Batch Modify
Other Fields
To Be Exported
Help + Reference
Cancel
Finish


Autodesk COBie Extension for Revit | Export
Export
Choose your final options and then export to a COBie spreadsheet.
Select Worksheets
Contact
Facility
Floor
Space
Zone
Type
Component
System
Attribute
Coordinate
Choose an Action
Create New
Append Existing
Export Links
No Loaded Links Found
Export to a File
Cancel
Export

Tools

AE Delivers COBie Export
(End of 3D Coordination)

OSU Runs Macro to Convert
to Simple Spreadsheet

Contractor Fills in
Remaining Information
(Occupancy)

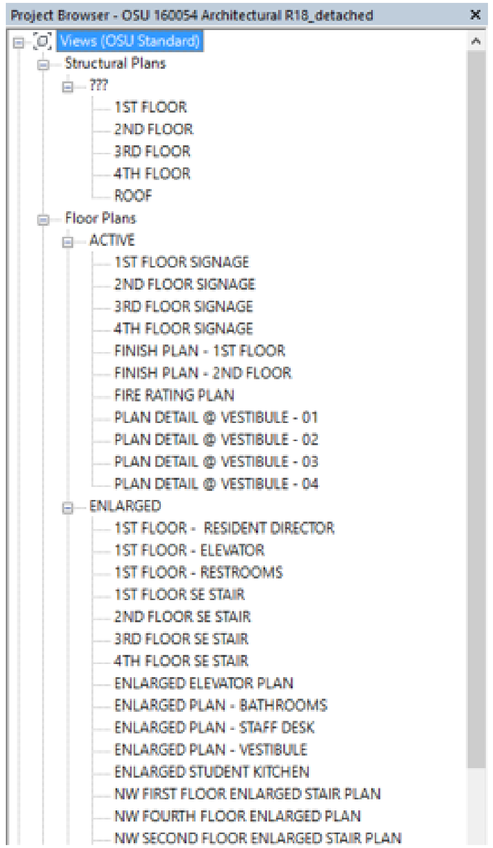
Spreadsheet Loaded into
CMMS

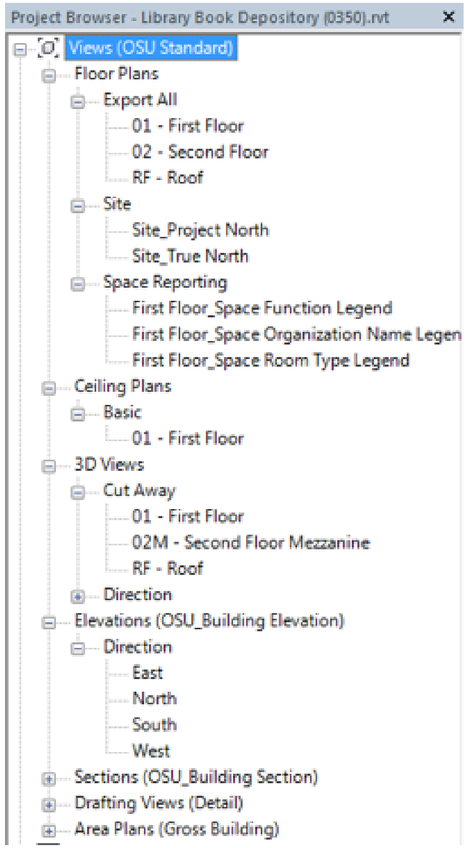
AssetWORKS

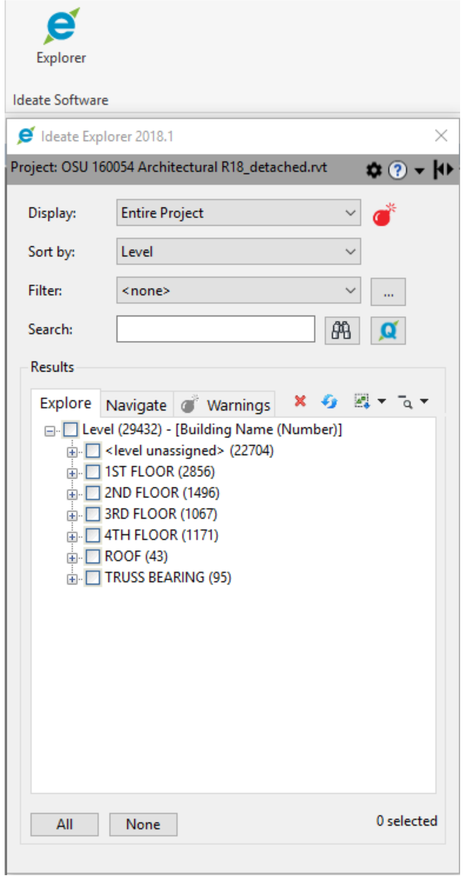
FSI
Facilities Survey

Process

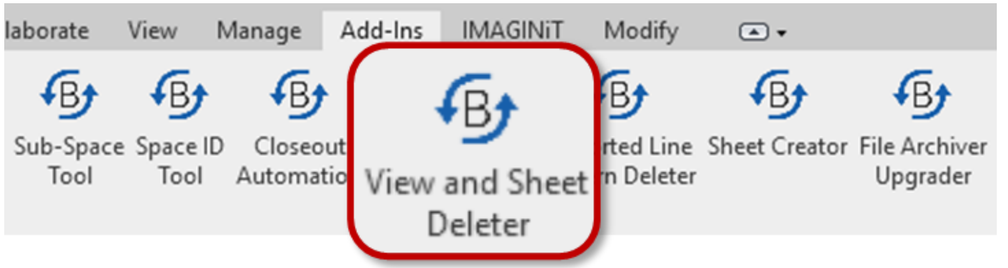
7.0 BIM to BIM

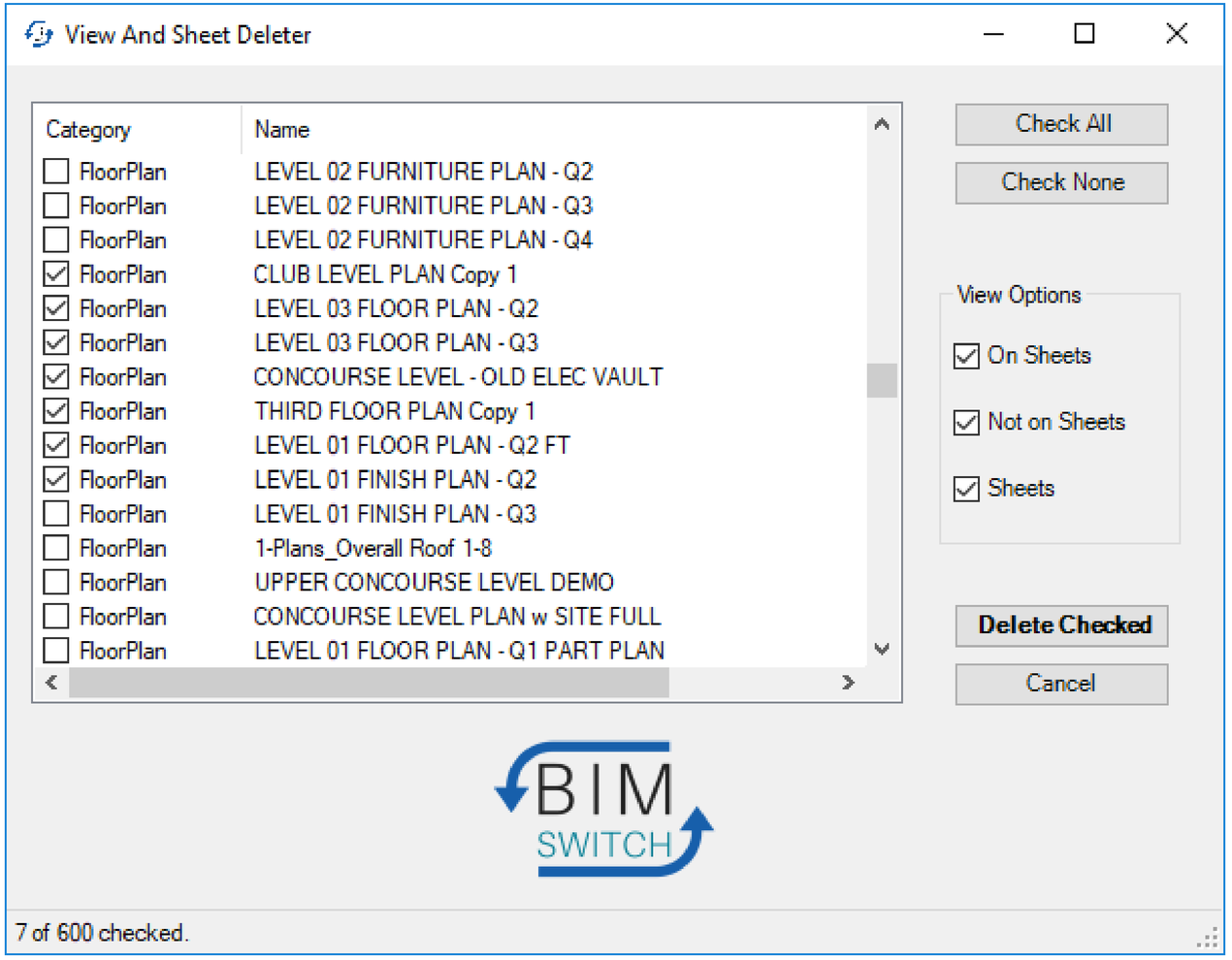




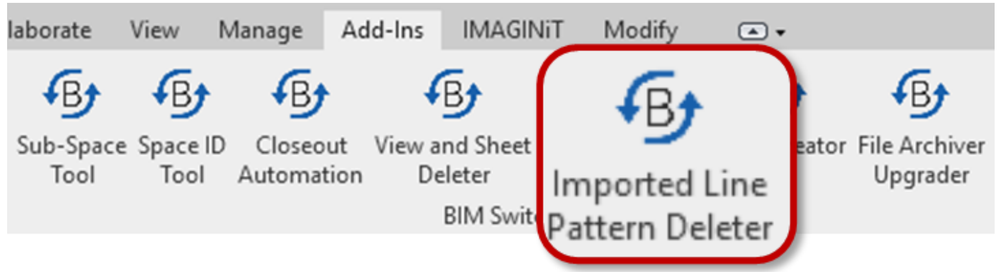


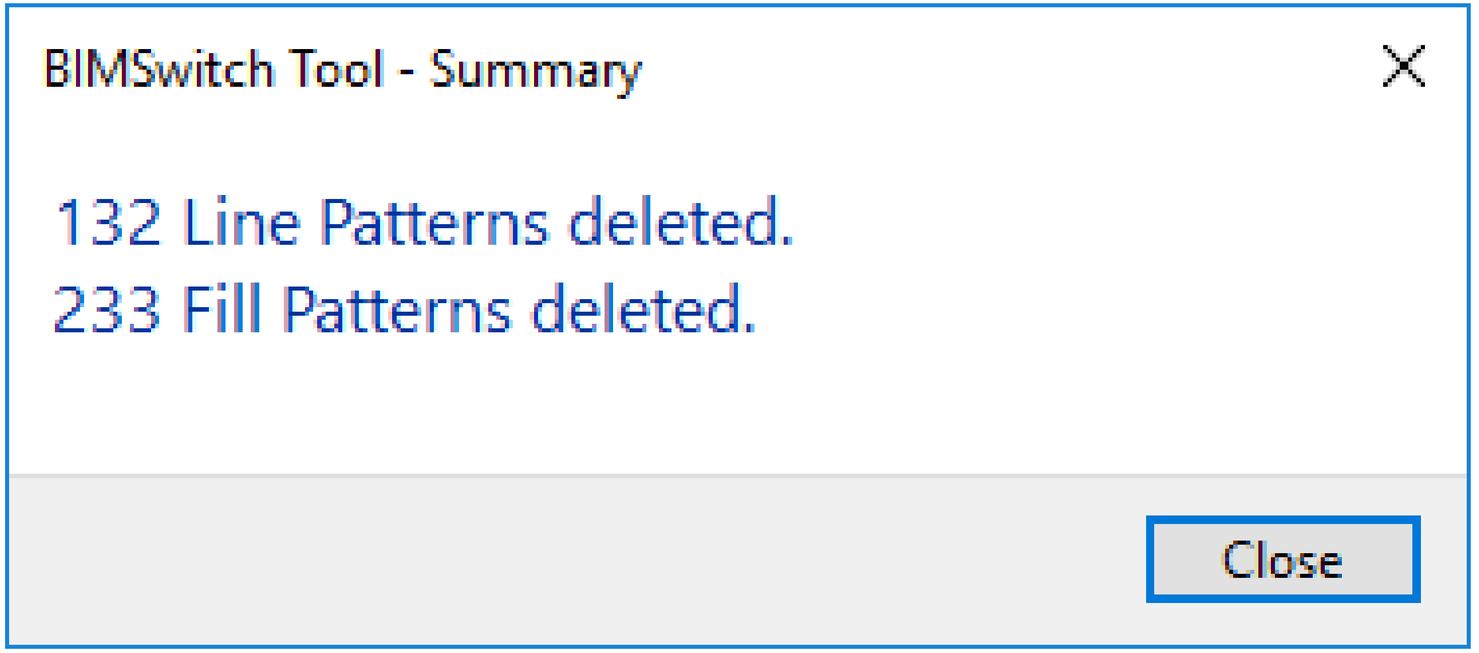
Tools


laborate
View
Manage
Add-Ins
IMAGINiT
Modify
Sub-Space Tool
Space ID Tool
Closeout Automatio
View and Sheet Deleter
rted Line n Deleter
Sheet Creator
File Archiver Upgrader


View And Sheet Deleter
Category
Name
FloorPlan LEVEL 02 FURNITURE PLAN - Q2
FloorPlan LEVEL 02 FURNITURE PLAN - Q3
FloorPlan LEVEL 02 FURNITURE PLAN - Q4
FloorPlan CLUB LEVEL PLAN Copy 1
FloorPlan LEVEL 03 FLOOR PLAN - Q2
FloorPlan LEVEL 03 FLOOR PLAN - Q3
FloorPlan CONCOURSE LEVEL - OLD ELEC VAULT
FloorPlan THIRD FLOOR PLAN Copy 1
FloorPlan LEVEL 01 FLOOR PLAN - Q2 FT
FloorPlan LEVEL 01 FINISH PLAN - Q2
FloorPlan LEVEL 01 FINISH PLAN - Q3
FloorPlan 1-Plans_Overall Roof 1-8
FloorPlan UPPER CONCOURSE LEVEL DEMO
FloorPlan CONCOURSE LEVEL PLAN w SITE FULL
FloorPlan LEVEL 01 FLOOR PLAN - Q1 PART PLAN
Check All
Check None
View Options
On Sheets
Not on Sheets
Sheets
Delete Checked
Cancel
BIM SWITCH
7 of 600 checked.

Tools


laborate
View
Manage
Add-Ins
IMAGINiT
Modify
Sub-Space Tool
Space ID Tool
Closeout Automation
View and Sheet Deleter
Imported Line Pattern Deleter
File Archiver Upgrader


BIMSwitch Tool - Summary
132 Line Patterns deleted.
233 Fill Patterns deleted.
Close

PDS Evolution

Version 1: Released January 2015

Version 2: Released January 2017

Version 3: Released January 2018

Version 4: Released January 2019

Version 5: Estimated January 2020

PDS Evolution

Expanded LOD Matrix from UniFormat level 3 to level 4

Removed use of LOD 500

Removal of Construct Team turnover documents

COBie and Asset Worksheet improvements

Release of OSU BIM PDS Tools

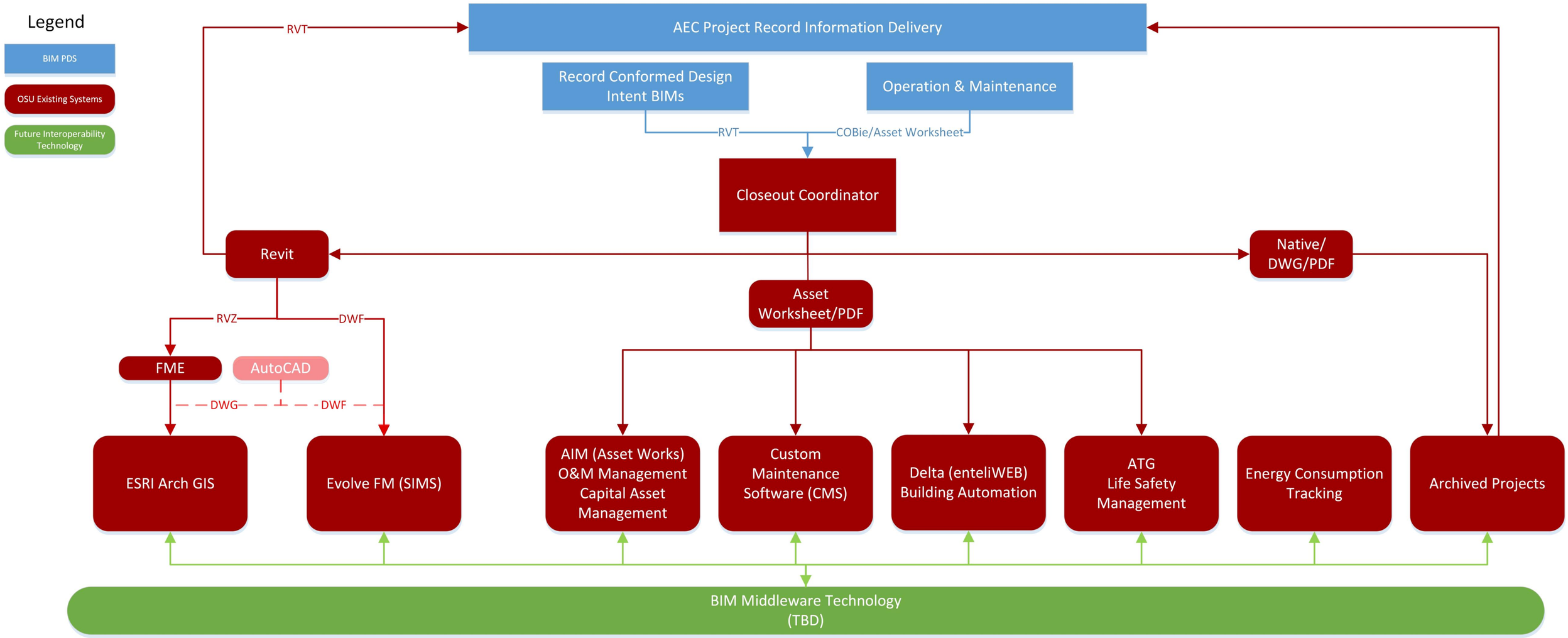
<$4m project requirements

BIM for Operations

Future State

THE OHIO STATE UNIVERSITY

The OSU Buckeye BIM Initiative Map



Lessons Learned

Lessons Learned

Single owner, lots of buildings, for a long time

Proper Planning and Focus

What needs to be modeled?

What will actually be used for planning and operations?

What can be reasonably maintained?

What has the best ROI for the organization?

Effective Training

Well developed and documented processes

Onboarding and training of modelers

Training for all users

Continual Improvement

Process adjustments

Template adjustments

Family adjustments

Project Delivery Standard & BIM Execution Plan updates

Turnover data processes

Standardize Everything

Process

Template

Families

Naming Conventions

Project Delivery Standard

Automate Everything

Model checking software

Plug-ins

Family management (Unifi)

Model management

Partner and Collaborate

Internally: All potential users and stakeholder

Externally: Experts to fill knowledge gaps

Ongoing Challenges

Model maintenance and upgrades

Maintaining MEP models

Collaboration with other campus departments

Simplifying data transfer for new projects

Leveraging the transfer of data for use in operations

Visualizing the entire campus three dimensionally

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