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Technology as a Tool:

Facilitating Coordination Across a Building's Life Cycle

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Two-Part Presentation

Implementing BIM for Owners

T.J. Meehan AIA, LEED AP
VP of Technology Solutions
CADD Microsystems, Inc.

CADD MICROSYSTEMS

Re-Think Coordination

Matt Vanture
VDC Manager
The Whiting-Turner Construction Co.

WHITING-TURNER

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Technology as a Tool

AIA CONTINUING EDUCATION

National Institute of Building Sciences

Provider Number: G168

Technology as a Tool

WE4A

Matt Vanture
T.J. Meehan AIA, LEED AP

01.10.18

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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Course Description

Implementing BIM for Owners

Are you a building owner or a designer working with them? Are you interested in the building information modeling (BIM) movement and how it may positively affect the design, construction and operations of your facilities? This presentation will help bring clarity and provide you with some practical next steps. We will spend time discussing BIM requirements and Project Execution Plans, including valuable tips to creating your own. We will also review other components of a successful implementation and discuss what a timeline may look like -- short, medium and long term.

Re-Thinking Coordination

Coordination of system designs and constructible sets is an effort that punishes too many engineers at Whiting-Turner. Many of the practices for working with this data can consume well over half a week, if not more, and can devoid our projects of the true optimization of our talented engineers. After identifying what the southeast virtual design and construction (VDC) effort considers laborious and wasteful tasks, we drove towards a program that would automate the tasks and reduce the engineers' time by 90%. It also creates new outputs of data the team never had traditional access to for more powerful decision making both on the active project and projecting for future projects. With the freeing of our engineers' time and providing them a stronger, recipe based data set to review the system designs and constructible sets, we can begin to have more people involved in the model and reviewing areas that make the largest impact to the project.

CONTINUING EDUCATION AIA

Learning Objectives

At the end of the this course, participants will be able to:

1. Gain a better understanding of how BIM (Building Information Modeling) applies to owners
2. Learn about the steps to take in order to start implementing BIM in your workflows
3. Understand BIM Requirements, BIM Project Execution Plans, and Levels of Development (LOD)
4. Discover ways to generate BIM models of your facilities
5. Identify laborious tasks ripe for automation
6. Recognize rule based coordination efforts for system design and constructible data sets
7. Learn new tools to enhance your coordination efforts
8. Gain an appreciation for data in the coordination process

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Implementing BIM for Owners

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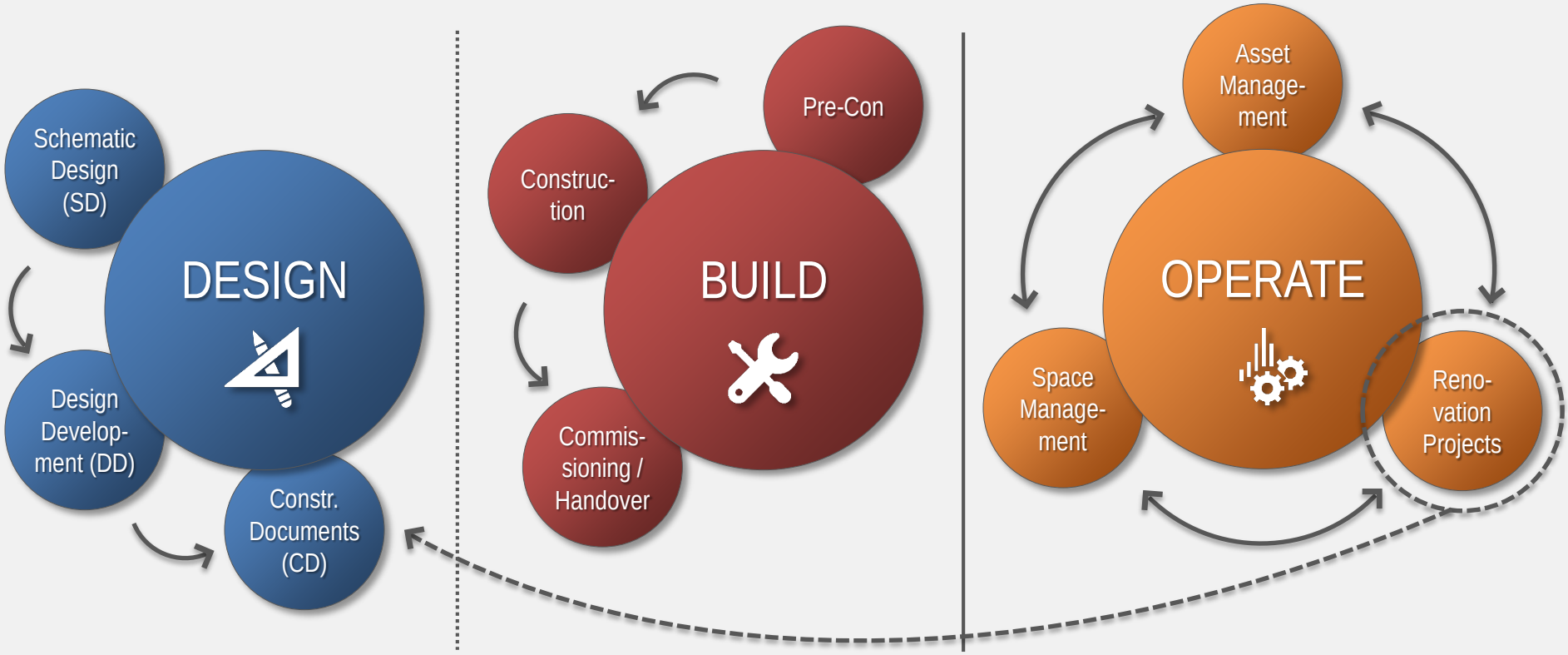
Implementing BIM for Owners

LAYING THE FOUNDATION


Schematic Design (SD)
DESIGN
Design Develop-ment (DD)
Constr. Documents (CD)
Pre-Con
Construc-tion
BUILD
Commis-sioning / Handover
Asset Manage-ment
OPERATE
Space Manage-ment
Reno-vation Projects

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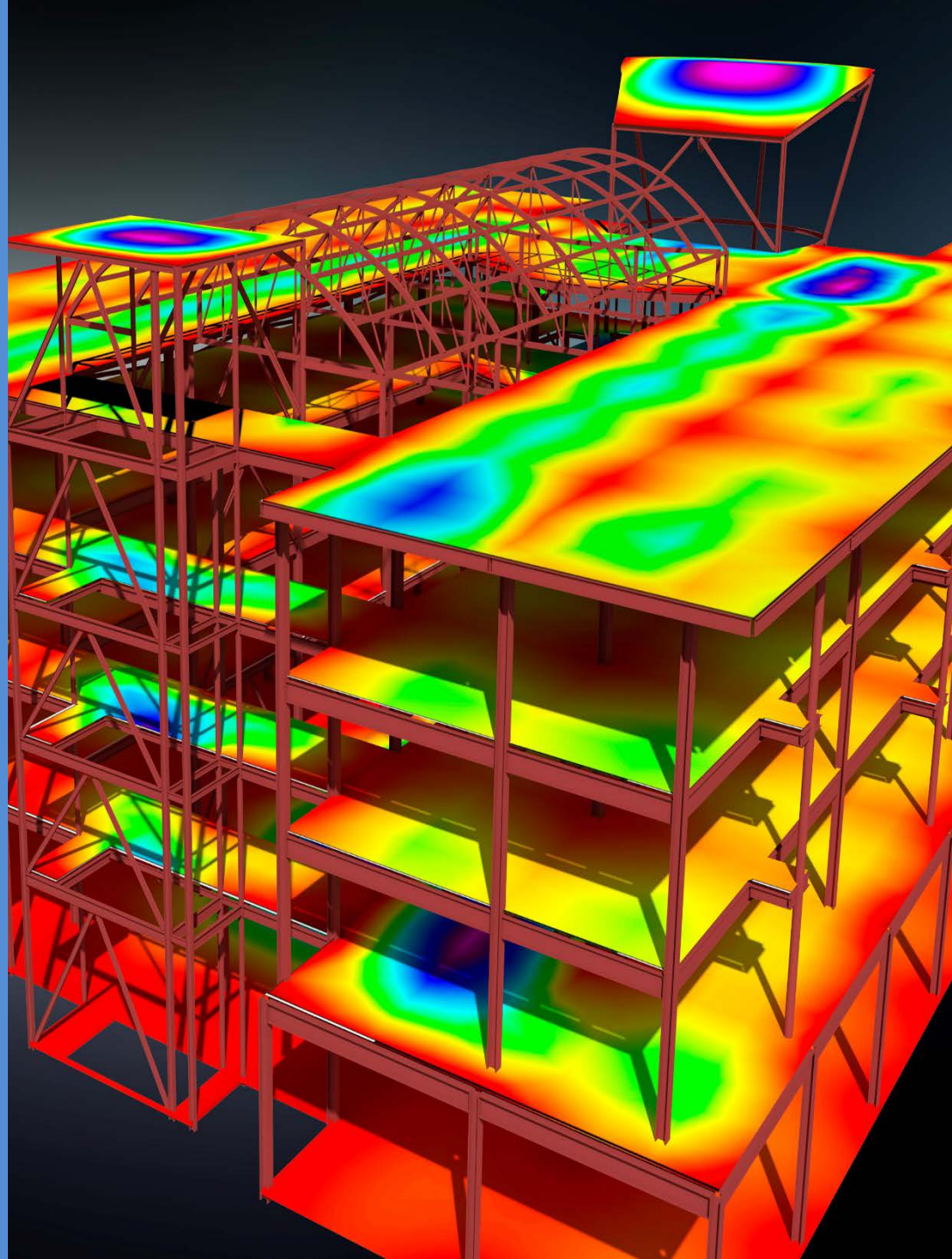
Implementing BIM for Owners

TOP ADVANTAGES OF BIM FOR OWNERS

Better Designs through Analysis

- Energy consumption
- Heating and cooling loads
- Computational fluid dynamics (CFD)
- Solar radiation
- LEED calculations
- And more



More Coordinated Designs

Allows the different design disciplines to coordinate their designs virtually

Reduces costly design changes and change orders during construction

Better Visualization

To help stakeholders better see what they're getting

Help contractors better understand the design intent

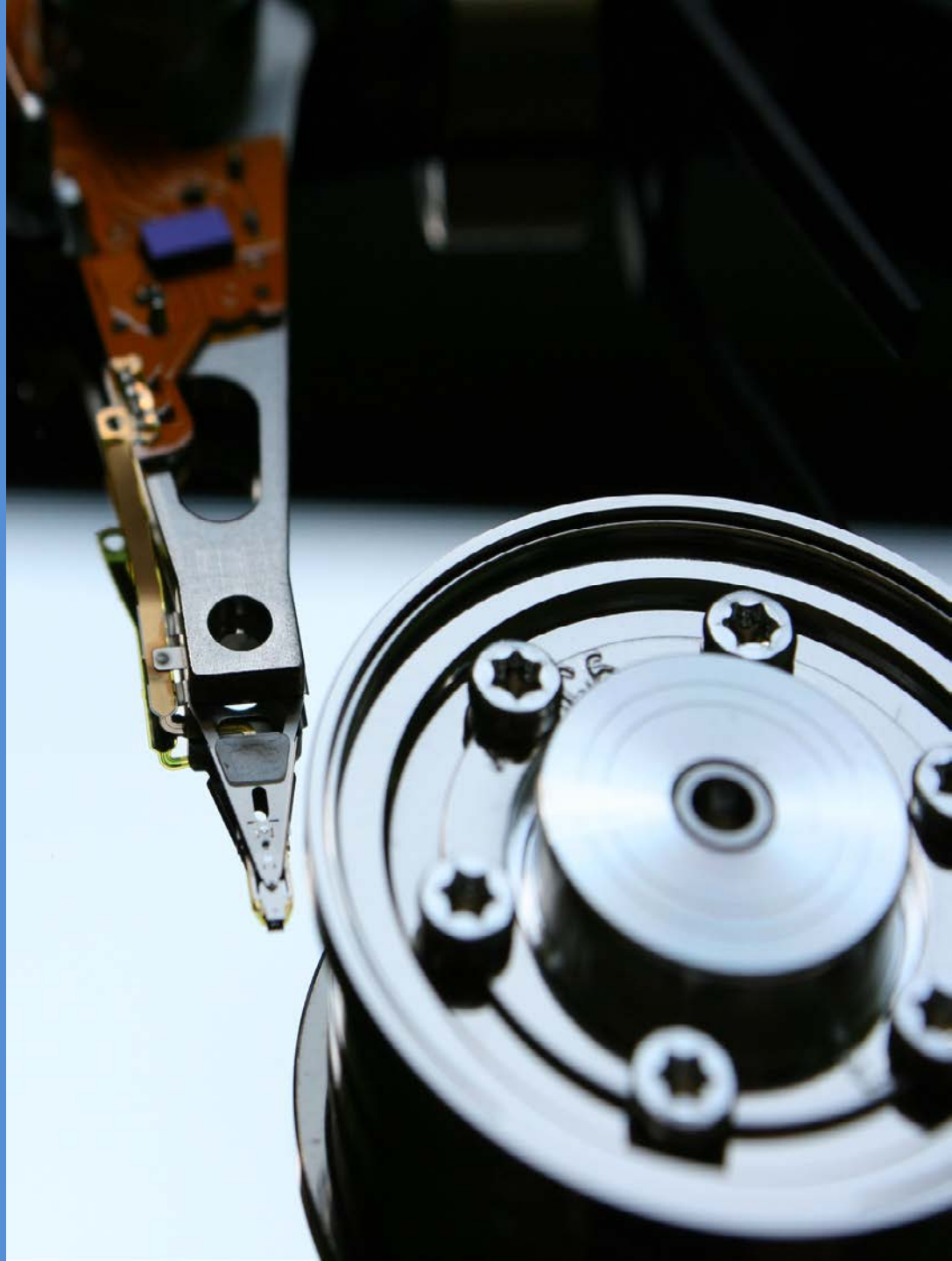
Include more views in the construction documents, including 3D

More Data Available

Models can maintain this data throughout the design and construction process

Data can then transition into building operations

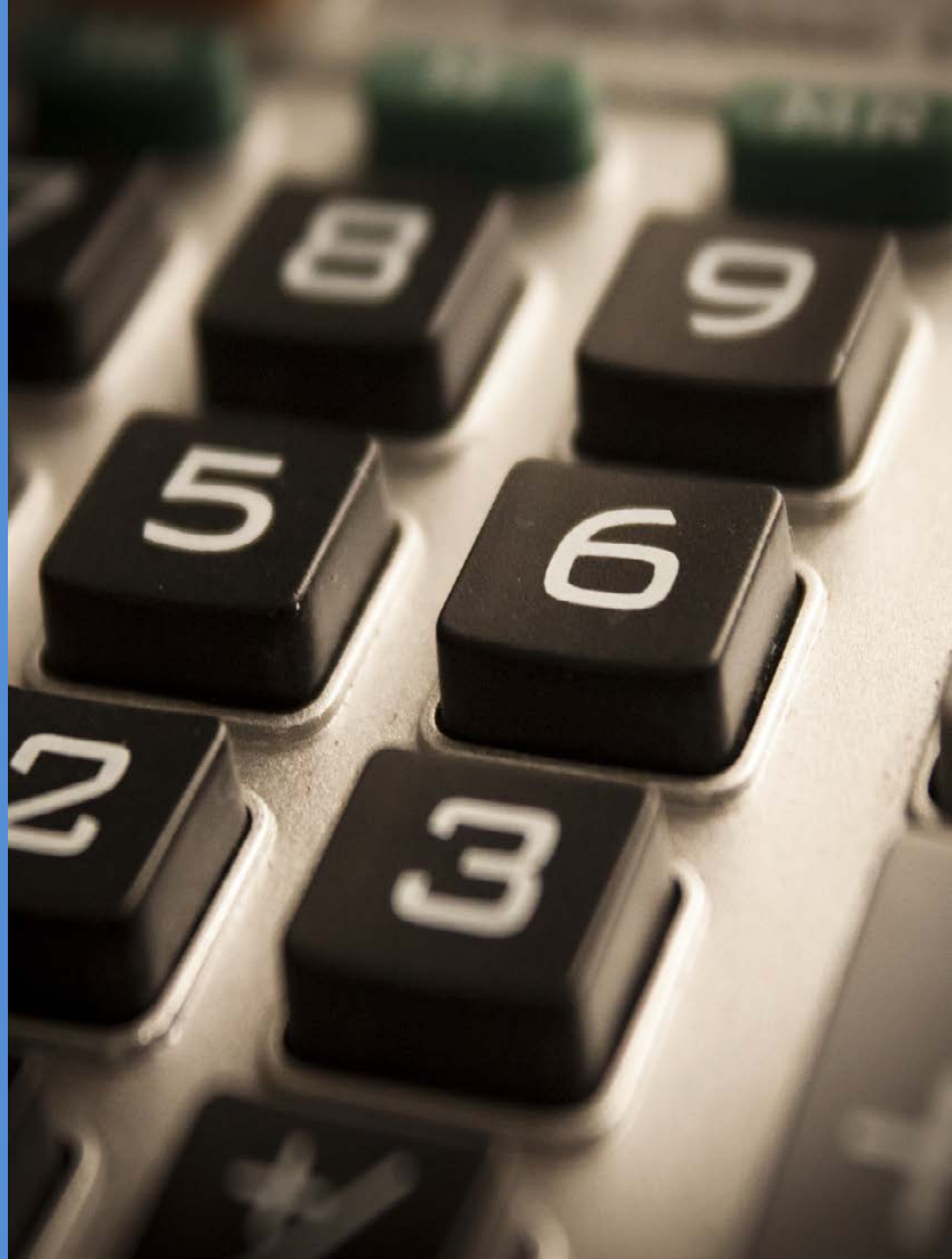
Specifications, preventative maintenance schedules, warranty information, etc.



Accurate Estimates

Models can quickly generate very detailed cost estimates

Bills of Material (BOM)



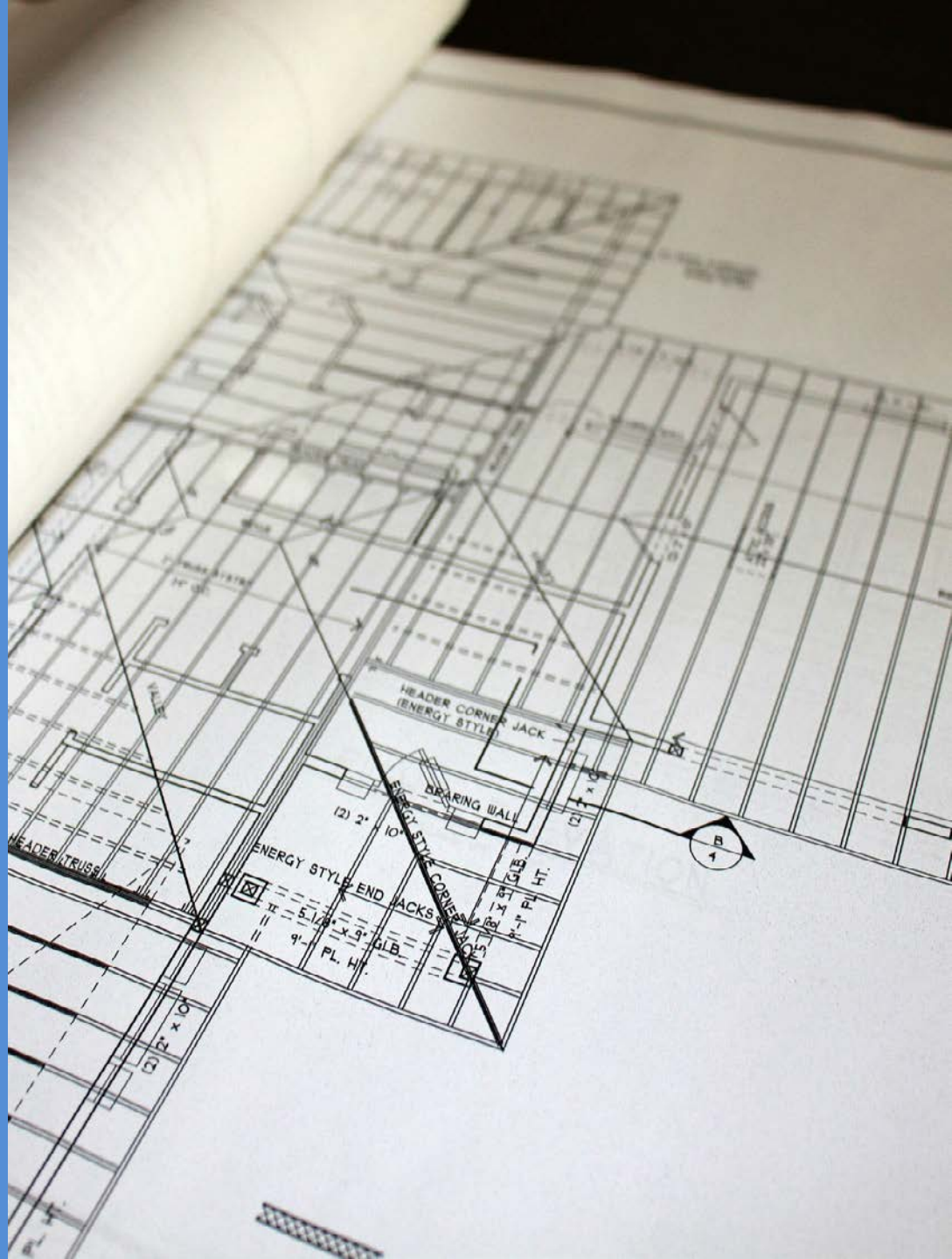
Maintaining Current Drawings

BIM is uniquely suited for this

Models of buildings are one file with all the building data

As opposed to many different CAD files

Revit can manage who owns what down the individual element



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Implementing BIM for Owners

COMPONENTS OF A BIM IMPLEMENTATION

BIM Strategy

Define Your Goals and Strategies

- Short Term (6-12 months)
- Medium Term (1-3 years)
- Long Term (3-5 years)

Layout Your Tactics

- What steps will you take specifically to achieve those goals?
- Consider all departments / groups that are affected

Develop the Roadmap

- What can you do in-house and what will require help from outside experts?
- We'll discuss a recommended one later

BIM Requirements

- Defines specifically what you want out of a BIM model deliverable
- Will probably end up being a contract addendum
- Allows for the creation of consistently formatted models – both graphics and data
- Addresses the critical new task of collecting and organizing data
- Sooner this is in place, the sooner you can start building your model library

Sections Typically Include:

- General Requirements
- Submittal Requirements
- Modeling Requirements
- Additional BIM Tasks
- Appendices

BIM Project Execution Plan

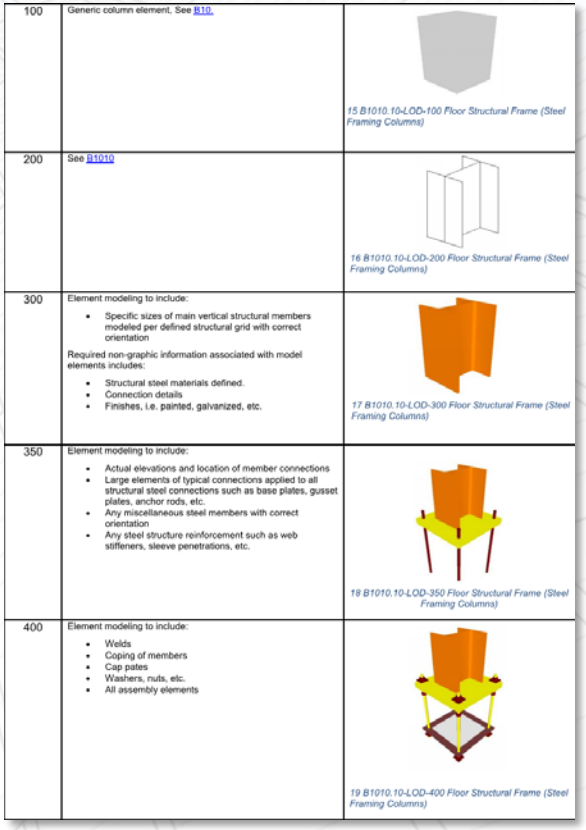
- Project-specific BIM information
- Project contacts and milestone dates
- Defines:

WHO:	WHAT:	HOW:	WHEN:
Which parties	Is being modeled	To what LOD	Submit dates

- Method and frequency of exchanging models
- What data is important

Level of Development (LOD)

- How detailed are the graphics and how much data is embedded
- Broken down by building elements
- Often, UniFormat is used to organize
- Top 3 Industry Definitions:
  - American Institute of Architects (AIA): G202, Project Building Information Modeling Protocol Form
  - U.S. Army Corps of Engineers (USACE): Minimum Modeling Matrix (M3), part of their BIM Requirements
  - BIMForum: Level of Development Specification 2017



100	Generic column element. See B10.	15 B1010.10-LOD-100 Floor Structural Frame (Steel Framing Columns)
200	See B1010	16 B1010.10-LOD-200 Floor Structural Frame (Steel Framing Columns)
300	Element modeling to include: • Specific sizes of main vertical structural members modeled per defined structural grid with correct orientation Required non-graphic information associated with model elements includes: • Structural steel materials defined. • Connection details • Finishes, i.e. painted, galvanized, etc.	17 B1010.10-LOD-300 Floor Structural Frame (Steel Framing Columns)
350	Element modeling to include: • Actual elevations and location of member connections • Large elements of typical connections applied to all structural steel connections such as base plates, gusset plates, anchor rods, etc. • Any miscellaneous steel members with correct orientation • Any steel structure reinforcement such as web stiffeners, sleeve penetrations, etc.	18 B1010.10-LOD-350 Floor Structural Frame (Steel Framing Columns)
400	Element modeling to include: • Welds • Coping of members • Cap plates • Washers, nuts, etc. • All assembly elements	19 B1010.10-LOD-400 Floor Structural Frame (Steel Framing Columns)

Image courtesy of the BIMForum Level of Development Specification, version 2017

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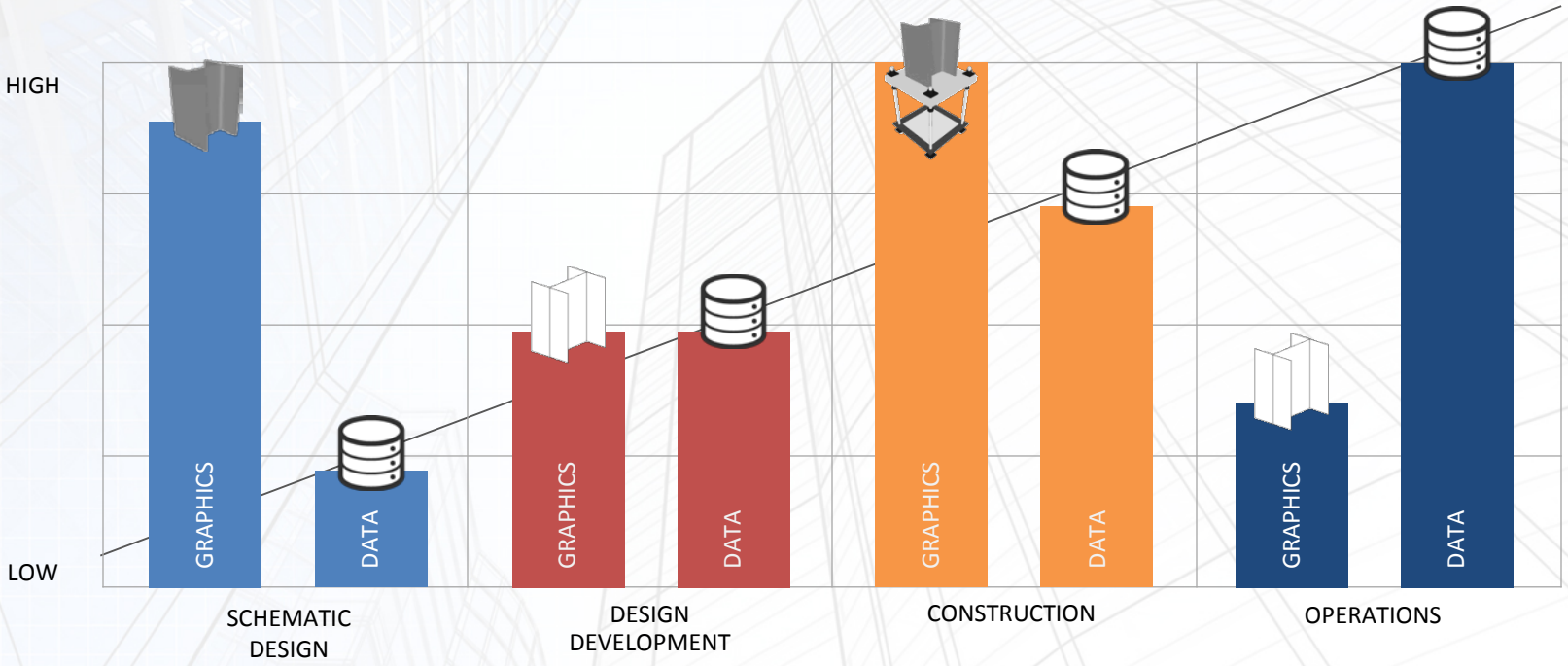
Level of Development (LOD)



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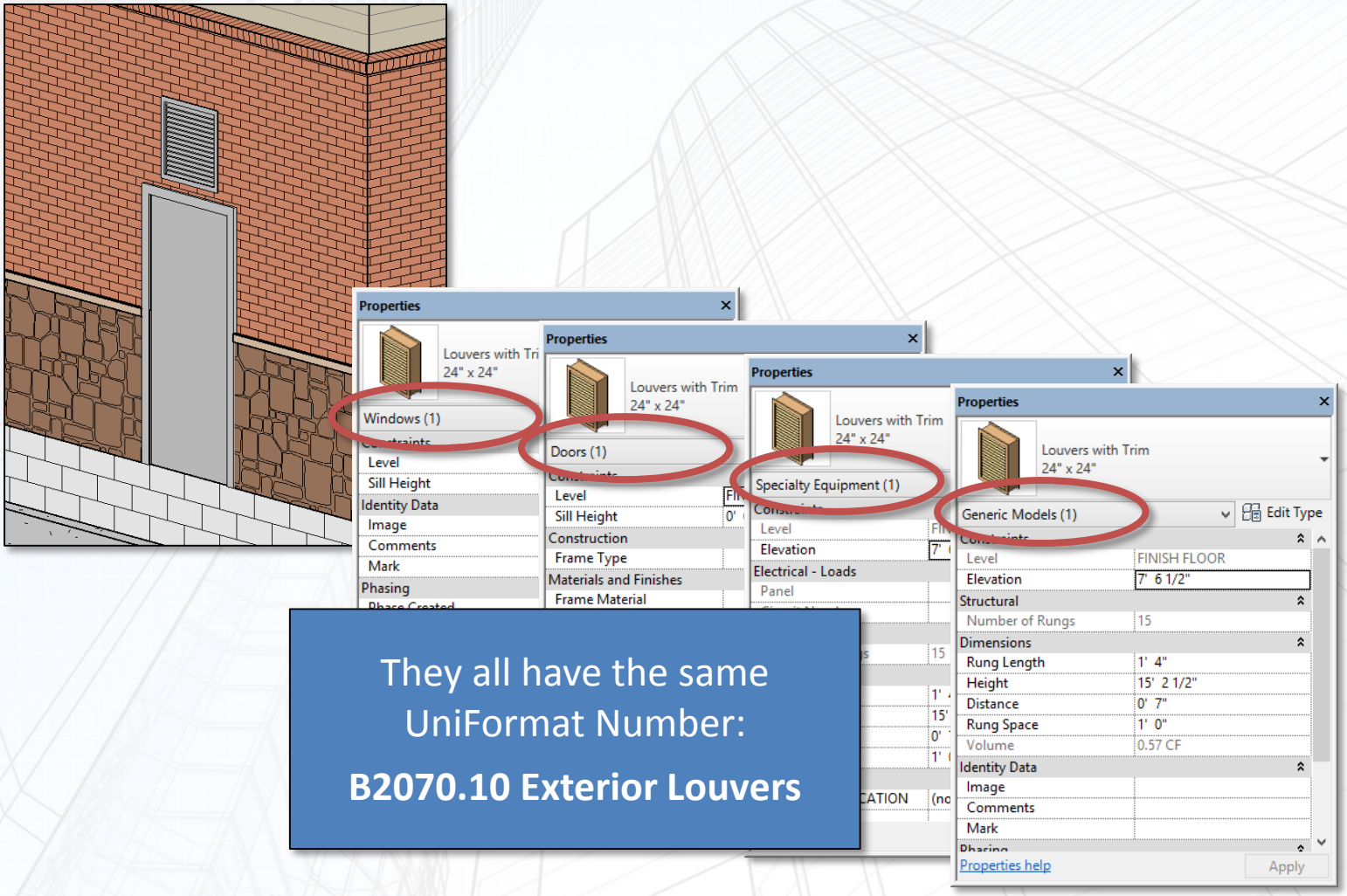
Level of Development (LOD)



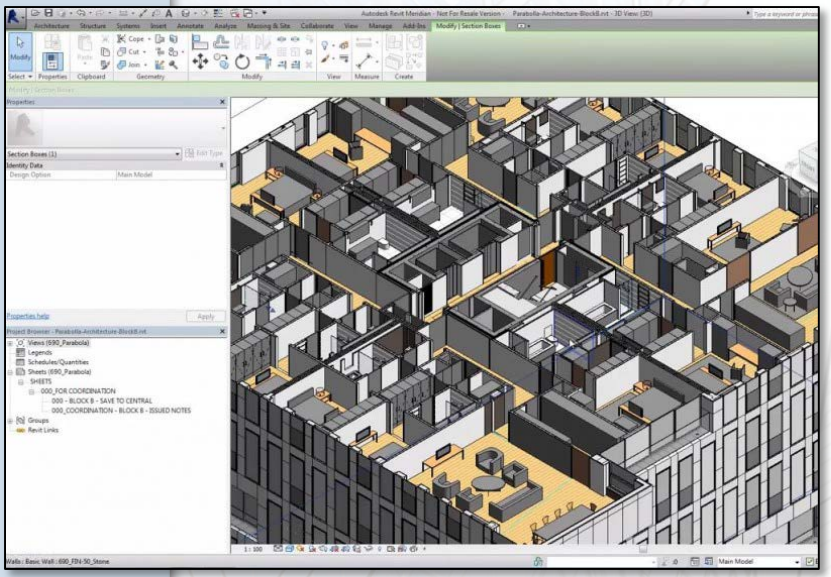
They all have the same UniFormat Number:

B2070.10 Exterior Louvers

Recommendations

1	2	3	4
Define LOD for both graphics **AND** data	Be very specific about what should and **SHOULD NOT** be modeled	Be very specific about the **DATA FIELDS**	If possible, require **ONLY REVIT**
As they do not always run in parallel	So as to avoid over-modeling	So data connections outside of Revit can be maintained and to minimize redundancy	Organize elements based on Revit categories

“Revitizing” Your Facilities



1. Get from your consultants
   - They’re probably already modeling in Revit
   - They just give you DWGs because that’s all you ask for
2. Make them Yourself
   - In-house teams using drawings, scans, and field measurements
3. Contract them Out
   - Some firms specialize in this at an affordable price

QA / QC

- **Quality Assurance (QA)**
  - Tools to provide to model authors (in-house or outside consultants)

BIM Req's BEP

Designer's Guide

Revit Project Templates

Revit Content (Families)

- **Quality Control (QC)**
  - Tools to help you check the models for compliance

Manual Checklist

Automatic Software

FREE UTILITY | Autodesk Model Checker for Revit

Master Files

- Maintaining a master set of files for each facility to use for continued design & construction projects

CURRENT ISSUES	BIM MODEL SOLUTIONS
Out-of-date or inaccurate information	No more missing drawings or not knowing which is current
Files not updated in a timely manner	Can update Master Files quickly – in a matter of hours
Simultaneous projects overwrite each others' work	Allows for simultaneous projects, even if adjacent
Projects need a costly survey before proceeding	Allows for work in-house or by outside consultants

COBie

- A standardized format for taking data from BIM models to O&M applications
- COBie becoming the norm for data exchange at construction completion
- COBie format is strict and not specific to any one BIM application
- Many O&M solutions directly import COBie data to quickly get the building engineers up-and-running

FREE UTILITY | Autodesk COBie Extension for Revit

BIM Manager

- Helps manage this new process
- Part-time role at first
- Expand to full-time dedicated role depending on your needs
- Responsible for long-term planning and immediate troubleshooting

TACTICAL RESPONSIBILITIES:

Standards
Update and enforce BIM software related standards

Oversee Model Managers
Maintain level of quality for higher level staff

Model Responsibilities
Review models for compliance and QC

STRATEGIC RESPONSIBILITIES:

Technology Trends
Keep up to speed on new technology and assess for potential uses

Staffing and Training
Monitor staffing needs and develop and deploy training as required

Education

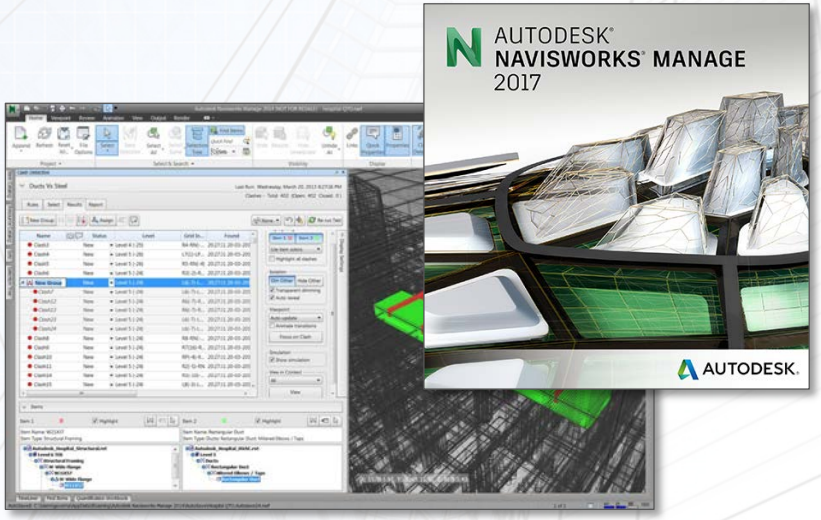
- **Initial**, targeted training for:
  - Software tools
  - New processes
  - Utilizing standards created
- **Ongoing** education:
  - Utilize and on-demand source
  - General curriculum
  - Customized courses

Include courses for each role:

- BIM Manager
- Designers
- Space Managers
- Construction Administrators
- Project Managers
- Leadership

Software

- Model authoring tool for Arch, MEP, Structure
- Used by most architects and many engineers
- Relational database with graphics
- A change in one place is a change everywhere
- Can link, import, and export DWG files
- Single file that can be edited by multiple individuals



- Model aggregator that supports dozens of formats, Autodesk or other
- Designed to perform the following Clash detection, Construction sequencing, Visualization, Quantification / takeoffs
- Makes lightweight models that can be viewed on lower-end computers

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Re-Think Coordination

Matt Vanture

The Whiting-Turner Contracting Company

How did we get here?

TRADITIONAL WORKFLOW

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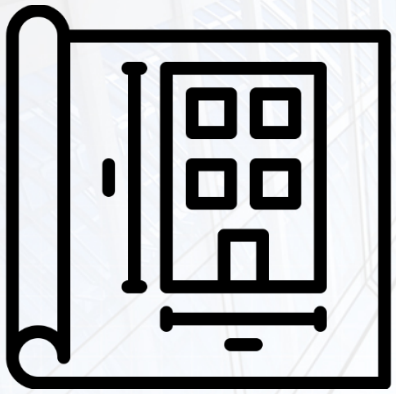
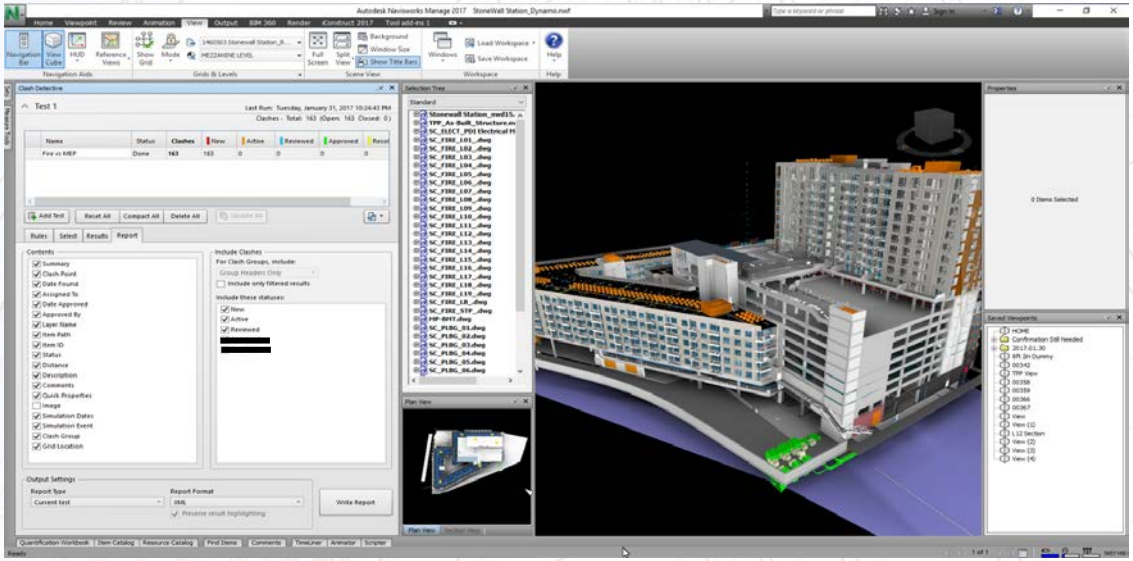
Understanding the Process





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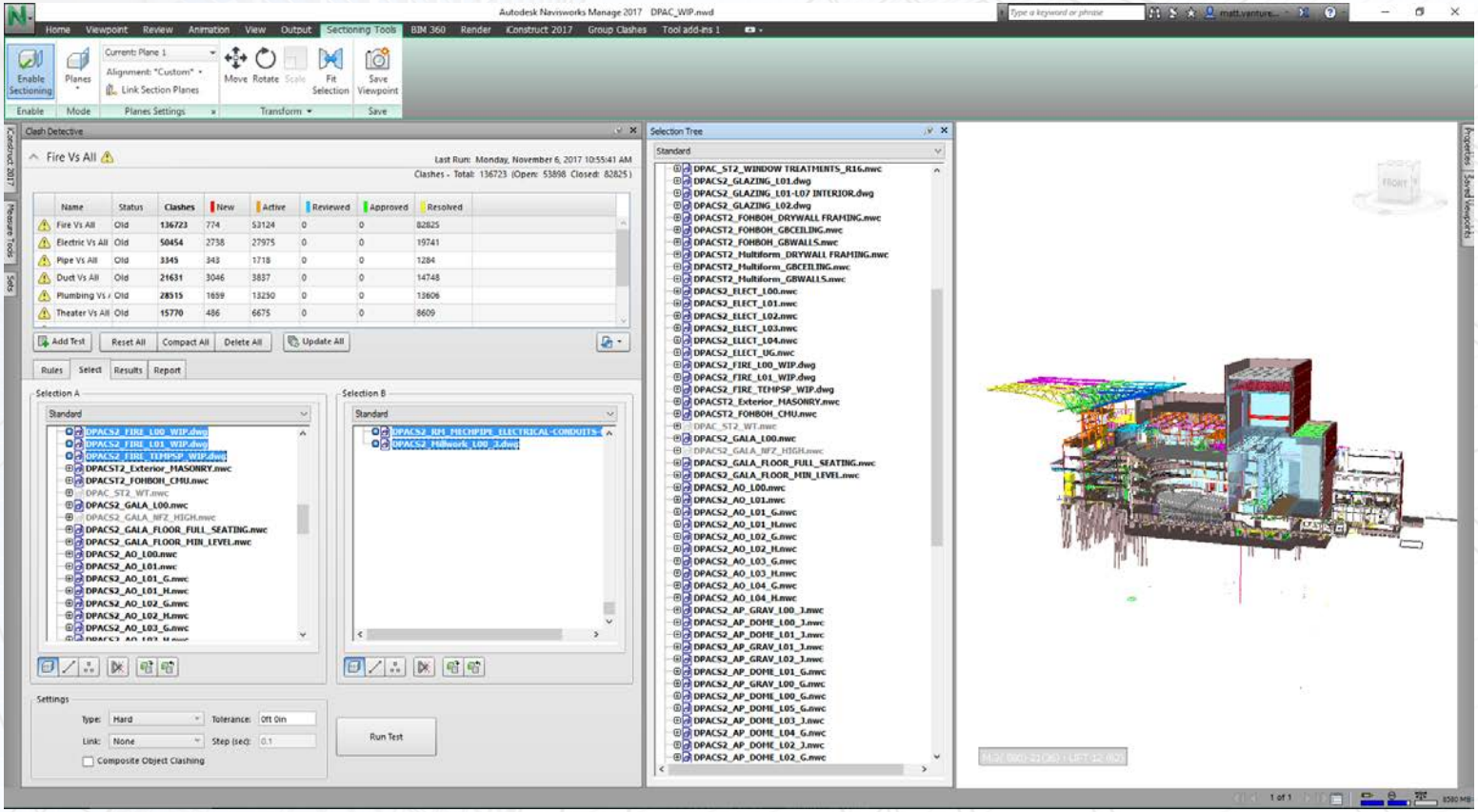
250,000+ Clashes



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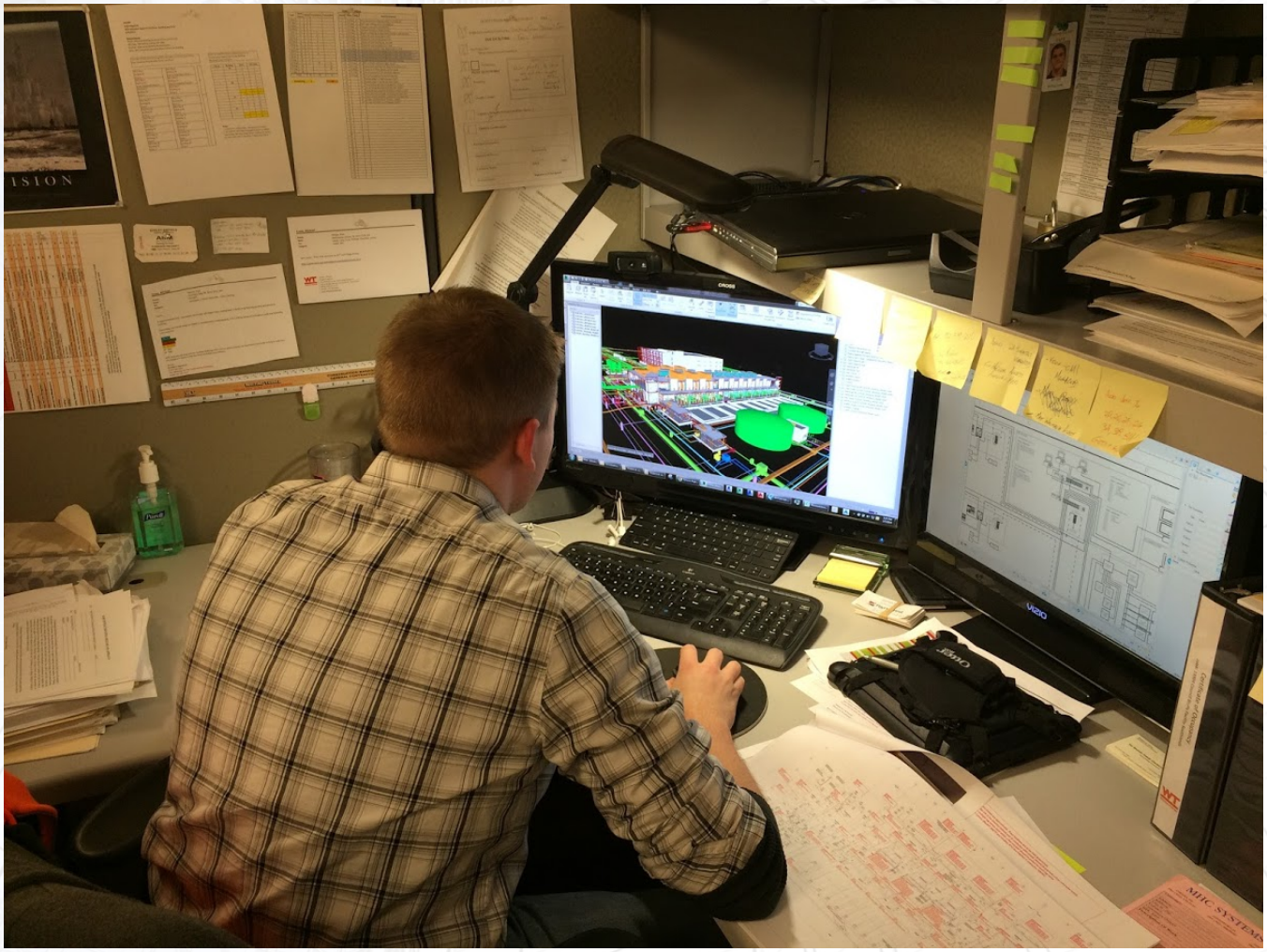

Objectives

1. Liberate the WT team from Clash Detection while providing more data
2. Drive team to look at the model as a whole and leverage our years of experience to catch issues
3. Empower subscontractors to head directly to their largest issues

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CLASH GROUPER WORKFLOW

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Accessing Source

Clash_Util GitHub

Edit file | Preview changes | Spaces | 4 | No wrap

```
# imports modules
from xml.etree.ElementTree import parse
from ConfigParser import SafeConfigParser
import csv
import argparse

# pulls in data from .xml file
arg_parser = argparse.ArgumentParser(description="Group clashes in a Navisworks clash detective XML file.")
arg_parser.add_argument('CLASH_FILE', help="Clash XML file")
arg_parser.add_argument('--config_file', default="clash_util.ini", help="Name of the configuration file to use")
arg_parser.add_argument('--box_size', type=float, default="3.0", help="Size of the box in feet")
arg_parser.add_argument('--clash_output_filename', default="clash_group.csv", help="Name of output CSV")

args = arg_parser.parse_args()

# sets variables so that user can input parameters
config_file = args.config_file
box_size = args.box_size
clash_data_file = args.CLASH_FILE
clash_output_filename = args.clash_output_filename

doc = parse(clash_data_file)

config_parser = SafeConfigParser()
config_parser.read(config_file)

# creates header for csv file
CSV_HEADER = "CLASH_GROUP_NAME, ORIGIN_CLASH, CLASH_GROUP_COUNT, TOTAL_CLASHES, PATH_COMBO, PATH_BLAME, CLASH_D

# create a list with path priority order
path_order = []
for path_order_num, path_file_name in config_parser.items("path"):
    path_order.append(path_file_name)

parsed_data = {}
clash_count = 0
```

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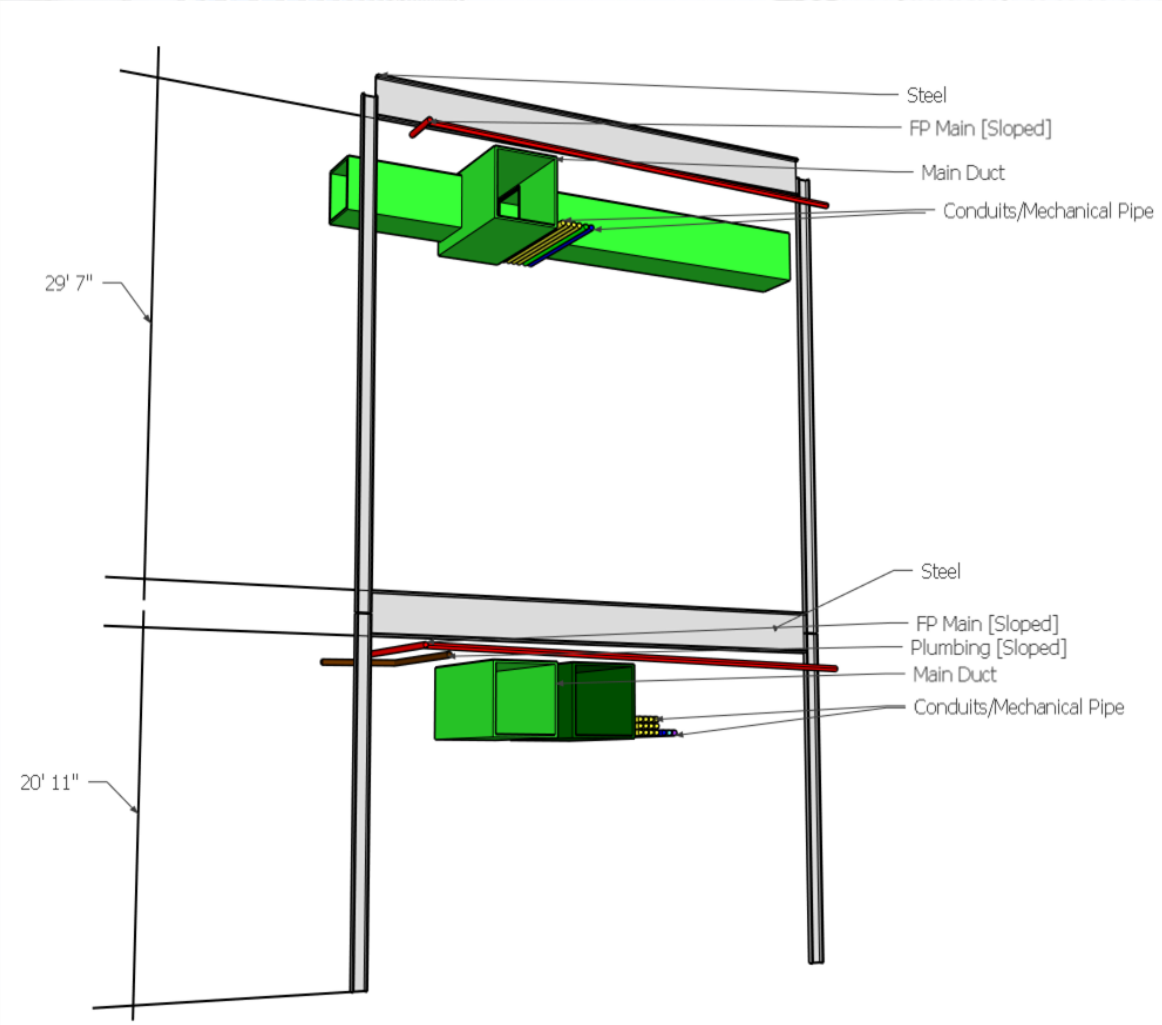
Setting Up Project



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Hierarchy

clash_util.ini

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[path]
DPACS2_FIRE_L00_WIP.dwg
DPACS2_FIRE_L01_WIP.dwg
DPACS2_FIRE_TEMPSP_WIP.dwg
DPACS2_ELECT_L04.nwc
DPACS2_ELECT_L03.nwc
DPACS2_ELECT_L02.nwc
DPACS2_ELECT_L01.nwc
DPACS2_ELECT_L00.nwc
DPACS2_ELECT_UG.nwc
DPACS2_AP_DOME_L00_J.nwc
DPACS2_AP_DOME_L00_G.nwc
DPACS2_AP_DOME_L01_J.nwc
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DPACS2_RM_MECHPIPE-00.0.dwg
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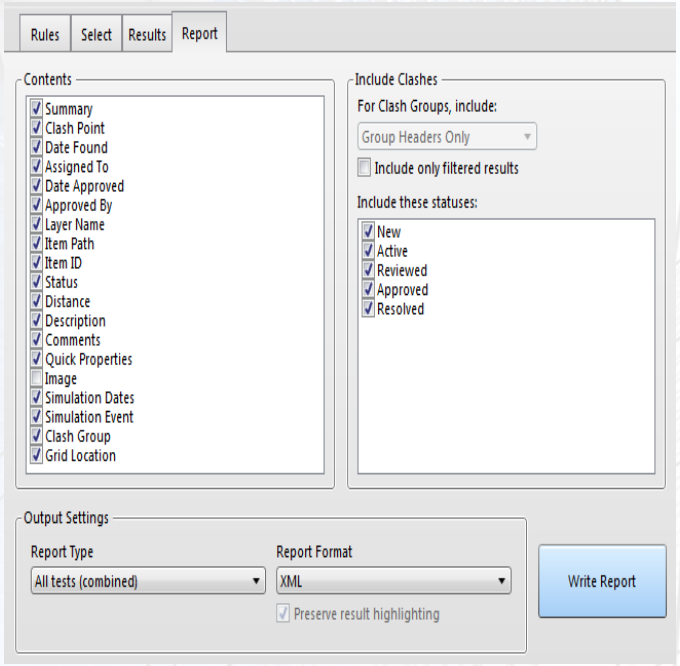
Dump Data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Results
Report
Contents
Summary
Clash Point
Date Found
Assigned To
Date Approved
Approved By
Layer Name
Item Path
Item ID
Status
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Description
Comments
Quick Properties
Image
Simulation Dates
Simulation Event
Clash Group
Grid Location
Include Clashes
For Clash Groups, include:
Group Headers Only
Include only filtered results
Include these statuses:
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Active
Reviewed
Approved
Resolved
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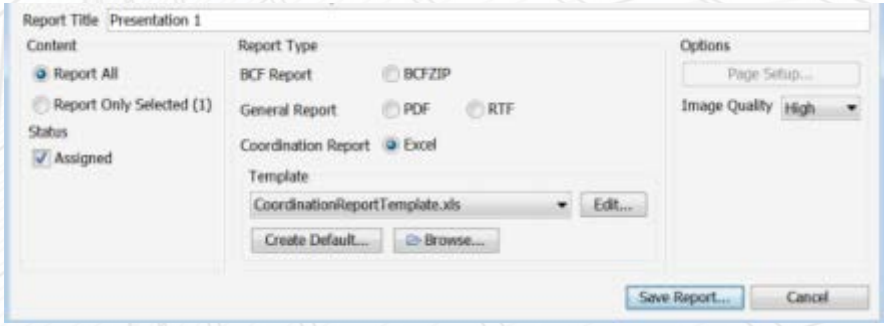
Report Type
All tests (combined)
Report Format
XML
Preserve result highlighting
Write Report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RTF
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Excel
Template
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Understand the ClashGrouper

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Understand the ClashGrouper

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201             <gridlocation>B-10 : FINISHED FLOOR</gridlocation>
202             <createddate>
203               <date year="2017" month="2" day="21" hour="16" minute="36" second="21"/>
204             </createddate>
205             <clashobjects>
206               <clashobject>
207                 <objectattribute>
208                   <name>Element ID</name>
209                   <value>3821191</value>
210                 </objectattribute>
211                 <layer>FINISHED FLOOR</layer>
212                 <pathlink>
213                   <node>File</node>
214                   <node>File</node>
215                   <node>VB_DC_ELEC_VDC_Cluster Tray.nwc</node>
216                   <node>FINISHED FLOOR</node>
217                   <node>Cable Trays</node>
218                   <node>Cable Tray with Fittings</node>
219                   <node>Solid Bottom Cable Tray</node>
220                   <node>Cable Tray with Fittings</node>
221                   <node>Cable Tray</node>
```

Understand the ClashGrouper

```
<?xml version="1.0" encoding="UTF-8" ?>

<exchange xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" units="ft" filename="" filepath="">
  <batchtest name="Report" internal_name="Report" units="ft">
    <clashtests>
      <clashtest name="Faith v USE" test_type="hard" status="ok" tolerance="0.0000" merge_composites="1">
        <linkage mode="none"/>
        <rules>
        <summary total="1039" new="1039" active="0" reviewed="0" approved="0" resolved="0">
        <clashresults>
          <clashresult name="Clash1" guid="f05e7db6-038a-4b88-acef-3b2b9ed77f09" status="new" distance="-2.2657">
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            <resultstatus>New</resultstatus>
            <clashpoint>
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            <createddate>
              <date year="2017" month="2" day="21" hour="16" minute="36" second="21"/>
            </createddate>
            <clashobjects>
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                </objectattribute>
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                  <node>File</node>
                  <node>VB_DC_ELEC_VDC_Cluster Tray.nwc</node>
                  <node>FINISHED FLOOR</node>
                  <node>Cable Trays</node>
                  <node>Cable Tray with Fittings</node>
                  <node>Solid Bottom Cable Tray</node>
                  <node>Cable Tray with Fittings</node>
                  <node>Cable Tray</node>
```

Understand the ClashGrouper

```
<?xml version="1.0" encoding="UTF-8" ?>

<exchange xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" units="ft" filename="" filepath="">
  <batchtest name="Report" internal_name="Report" units="ft">
    <clashtests>
      <clashtest name="Faith v USE" test_type="hard" status="ok" tolerance="0.0000" merge_composites="1">
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        <rules>
        <summary total="1039" new="1039" active="0" reviewed="0" approved="0" resolved="0">
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            <resultstatus>New</resultstatus>
            <clashpoint>
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            <createddate>
              <date year="2017" month="2" day="21" hour="16" minute="36" second="21"/>
            </createddate>
            <clashobjects>
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                  <node>FINISHED FLOOR</node>
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                  <node>Solid Bottom Cable Tray</node>
                  <node>Cable Tray with Fittings</node>
                  <node>Cable Tray</node>
```

Understand the ClashGrouper

```
<?xml version="1.0" encoding="UTF-8" ?>

<exchange xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" units="ft" filename="" filepath="">
  <batchtest name="Report" internal_name="Report" units="ft">
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            <resultstatus>New</resultstatus>
            <clashpoint>
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            </createddate>
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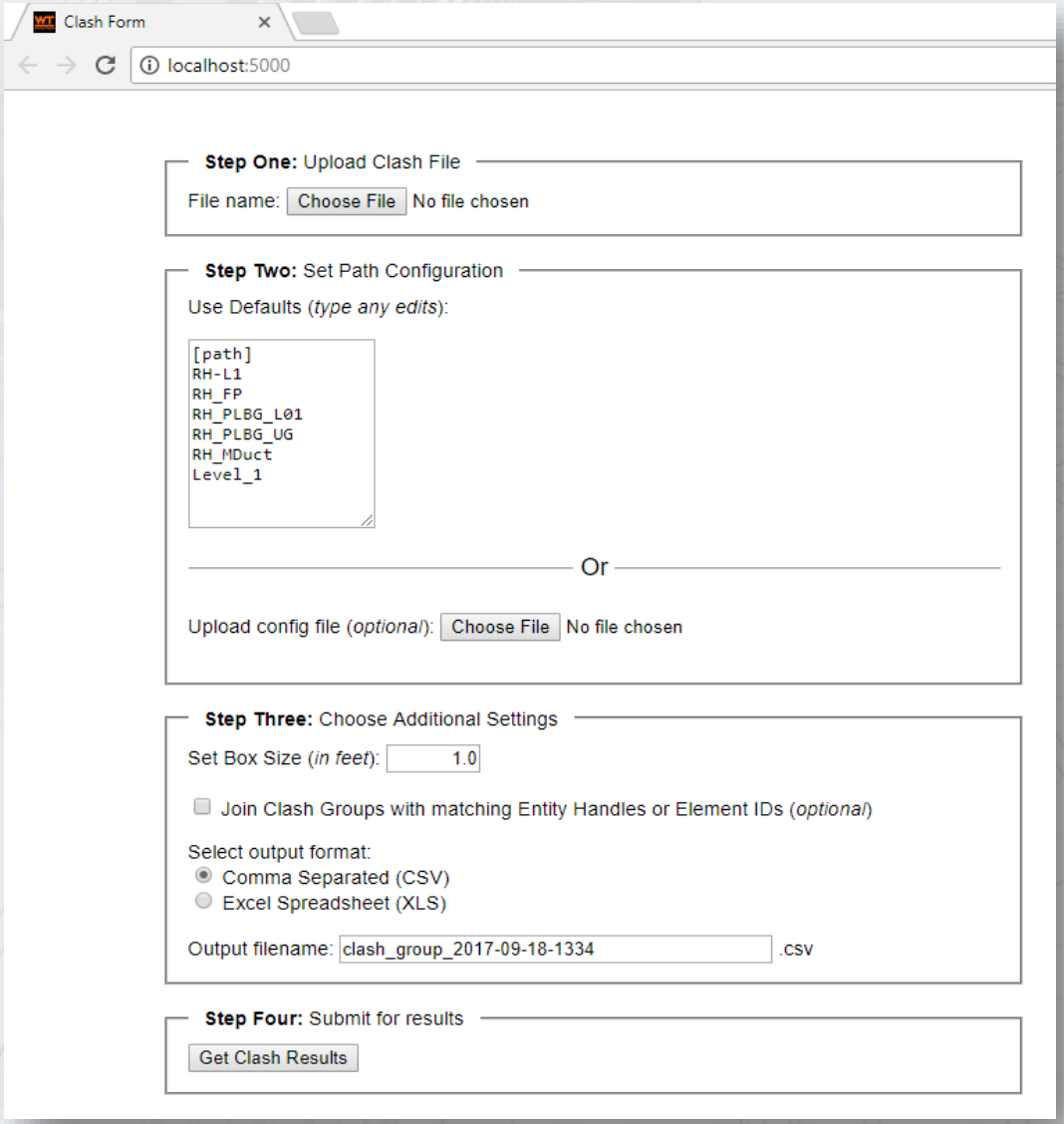
                  <node>File</node>
                  <node>VB_DC_ELEC_VDC_Cluster Tray.nwc</node>
                  <node>FINISHED FLOOR</node>
                  <node>Cable Trays</node>
                  <node>Cable Tray with Fittings</node>
                  <node>Solid Bottom Cable Tray</node>
                  <node>Cable Tray with Fittings</node>
                  <node>Cable Tray</node>
```


Clash Form
localhost:5000
Step One: Upload Clash File
File name: Choose File No file chosen
Step Two: Set Path Configuration
Use Defaults (type any edits):
[path]
RH-L1
RH_FP
RH_PLBG_L01
RH_PLBG_UG
RH_MDuct
Level_1
Or
Upload config file (optional): Choose File No file chosen
Step Three: Choose Additional Settings
Set Box Size (in feet): 1.0
Join Clash Groups with matching Entity Handles or Element IDs (optional)
Select output format:
Comma Separated (CSV)
Excel Spreadsheet (XLS)
Output filename: clash_group_2017-09-18-1334 .csv
Step Four: Submit for results
Get Clash Results

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Step Three: Choose Additional Settings

Set Box Size (*in feet*): 1.0

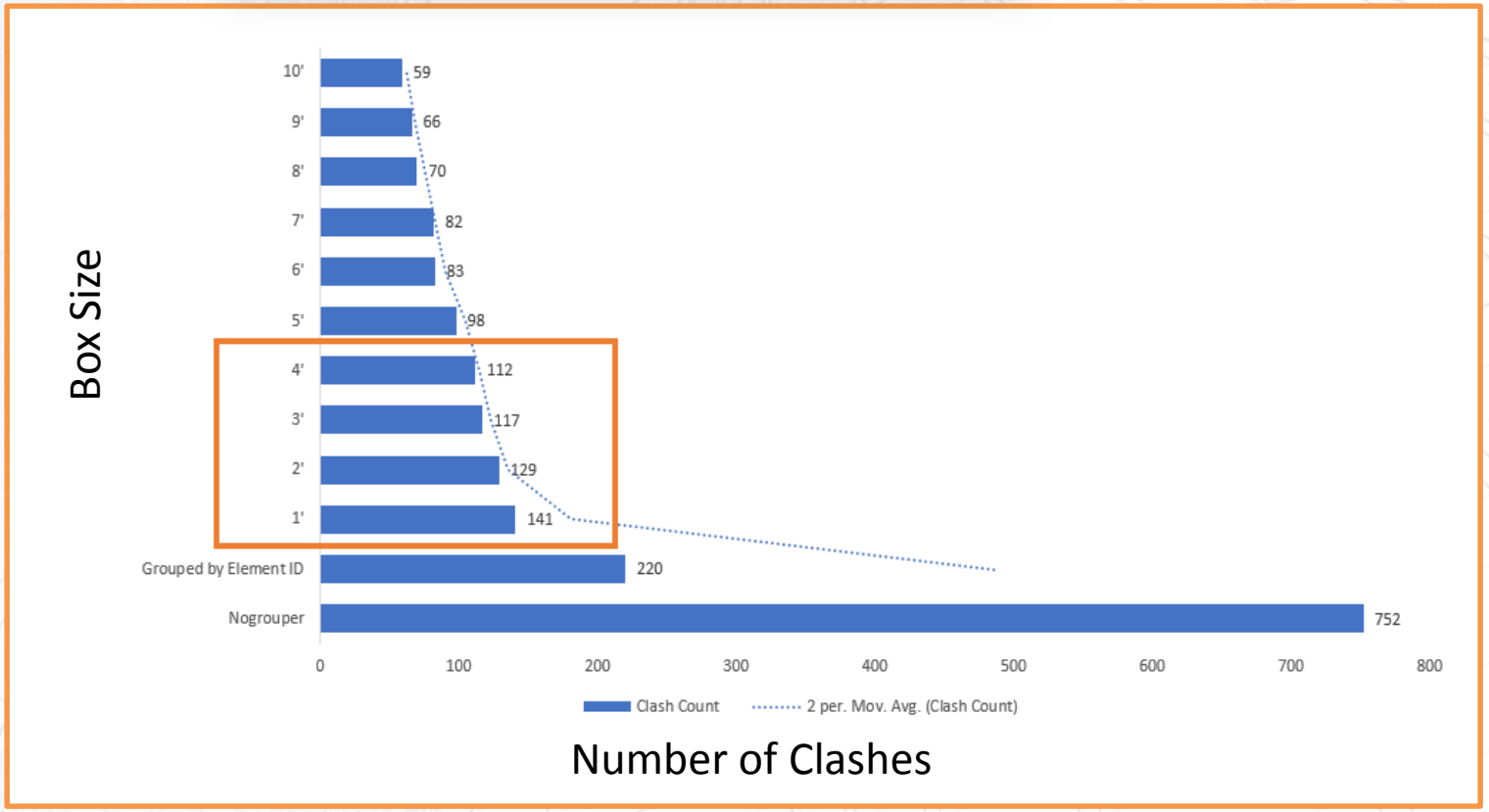
Join Clash Groups with matching Entity Handles or Element IDs (*optional*)

Select output format:
- Comma Separated (CSV)
- Excel Spreadsheet (XLS)

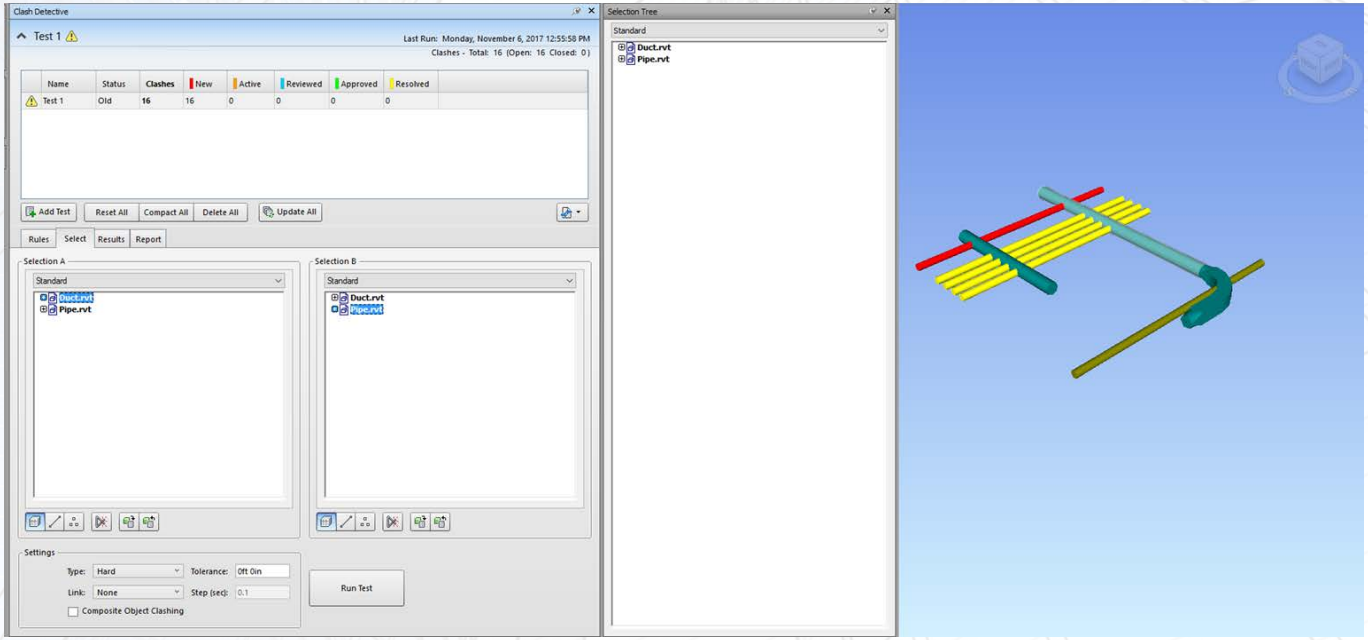
Output filename: clash_group_2017-09-18-1334 .csv

Step Four: Submit for results

Get Clash Results



More Understanding



16 Clashes

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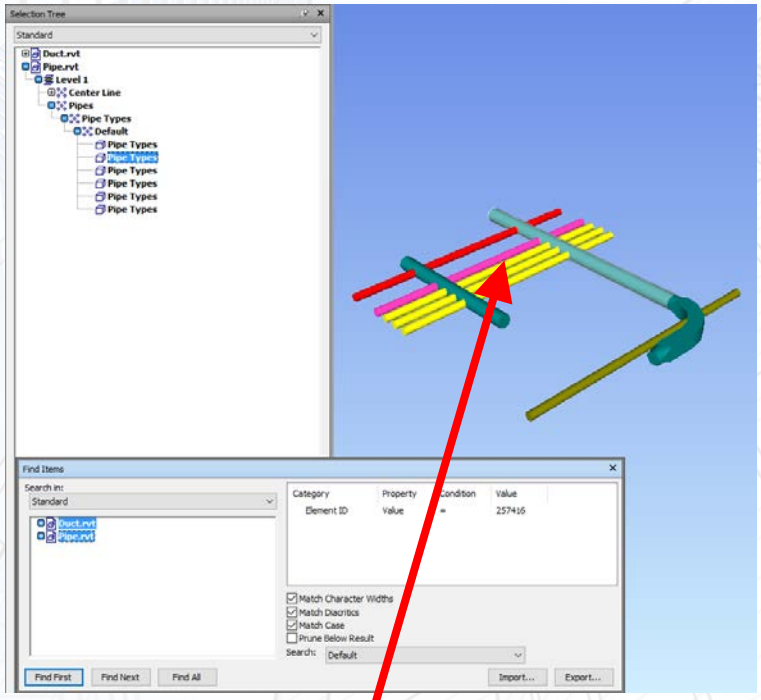
More Understanding



10 Clashes

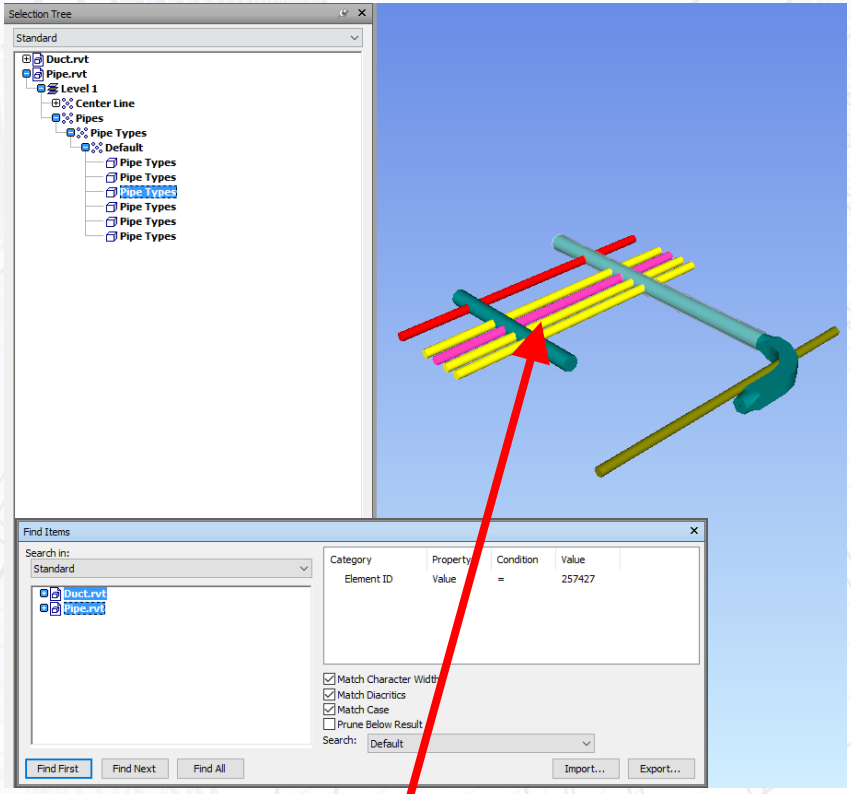
(37.5% reduction)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Clash T	Origin C	Clash G	Group Cou	Origin F	Origin	Origin Attribute Valu	Group A	Group A	X Coord	Y Coord	Z Coord	Date	Status
2	Test 1	Clash2	Clash2, Cl	2	Pipe.rvt	Element ID	257379	Element ID	257379	-6.4256	29.878	8.7792	20171106	new
3	Test 1	Clash10	Clash10	1	Pipe.rvt	Element ID	257379	Element ID	257379	-6.4981	21.8002	9.1318	20171106	new
4	Test 1	Clash5	Clash3,	4	Pipe.rvt	Element ID	257416	Element ID	257427, 25	-3.504	30.8801	8.9021	20171106	new
5	Test 1	Clash9	Clash9, Cl	2	Pipe.rvt	Element ID	257416	Element ID	257416, 25	-3.9635	20.8818	9.1857	20171106	new
6	Test 1	Clash3	Clash3, Cl	4	Pipe.rvt	Element ID	257427	Element ID	257427, 25	-3.0195	30.9609	9.0981	20171106	new
7	Test 1	Clash13	Clash4, Cl	3	Pipe.rvt	Element ID	257442	Element ID	257451, 25	-1.5093	30.8827	9.1119	20171106	new
8	Test 1	Clash4	Clash3, Cl	3	Pipe.rvt	Element ID	257442	Element ID	257427, 25	-2.0195	30.962	9.0981	20171106	new
9	Test 1	Clash16	Clash16	1	Pipe.rvt	Element ID	257451	Element ID	257451	-1.0376	29.8163	9	20171106	new
10	Test 1	Clash15	Clash11, C	2	Pipe.rvt	Element ID	257451	Element ID	257451, 25	-1.0198	21.8186	8.9029	20171106	new
11	Test 1	Clash1	Clash1	1	Pipe.rvt	Element ID	257464	Element ID	257464	10.6928	30.5078	8.732	20171106	new

More Understanding

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Clash T	Origin C	Clash Group	Group C	Origin F	Origin Attribute Name	Origin Attribute Valu	Group A	Group Attribute Values	X Coord	Y Coord	Z Coord	Date	Status
2	Test 1	Clash2	Clash2, Clash12	2	Pipe.rvt	Element ID	257379	Element ID	257379	-6.4256	29.878	8.7792	20171106	new
3	Test 1	Clash10	Clash10	1	Pipe.rvt	Element ID	257379	Element ID	257379	-6.4981	21.8002	9.1318	20171106	new
4	Test 1	Clash5	Clash3, Clash5, Clash6, Clash8	4	Pipe.rvt	Element ID	257416	Element ID	257427, 257416	-3.504	30.8801	8.9021	20171106	new
5	Test 1	Clash9	Clash9, Clash7	2	Pipe.rvt	Element ID	257416	Element ID	257416, 257427	-3.9635	20.8818	9.1857	20171106	new
6	Test 1	Clash3	Clash3, Clash5, Clash4, Clash6	4	Pipe.rvt	Element ID	257427	Element ID	257427, 257442, 257416	-3.0195	30.9609	9.0981	20171106	new
7	Test 1	Clash13	Clash4, Clash13, Clash14	3	Pipe.rvt	Element ID	257442	Element ID	257451, 257442	-1.5093	30.8827	9.1119	20171106	new
8	Test 1	Clash4	Clash3, Clash4, Clash13	3	Pipe.rvt	Element ID	257442	Element ID	257427, 257442	-2.0195	30.962	9.0981	20171106	new
9	Test 1	Clash16	Clash16	1	Pipe.rvt	Element ID	257451	Element ID	257451	-1.0376	29.8163	9	20171106	new
10	Test 1	Clash15	Clash11, Clash15	2	Pipe.rvt	Element ID	257451	Element ID	257451, 257442	-1.0198	21.8186	8.9029	20171106	new
11	Test 1	Clash1	Clash1	1	Pipe.rvt	Element ID	257464	Element ID	257464	10.6928	30.5078	8.732	20171106	new

More Understanding



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Clash Test	Origin Clas	Clash Grou	Group Cou	Origin Path	Origin Attri	Origin Attribute Value	Group Attr	Group Attr	X Coordina	Y Coordina	Z Coordina	Date	Status
2	Test 1	Clash1	Clash1	1	Pipe.rvt	Element ID	257464	Element ID	257464	10.6928	30.5078	8.732	20171106	new
3	Test 1	Clash3	Clash5, Cl	12	Pipe.rvt	Element ID	257427	Element ID	257416, 25	-3.0195	30.9609	9.0981	20171106	new
4	Test 1	Clash2	Clash2, Cl	3	Pipe.rvt	Element ID	257379	Element ID	257379	-6.4256	29.878	8.7792	20171106	new

3 Clashes

(81.25% reduction)

Results

Clash Groups - SPC1A

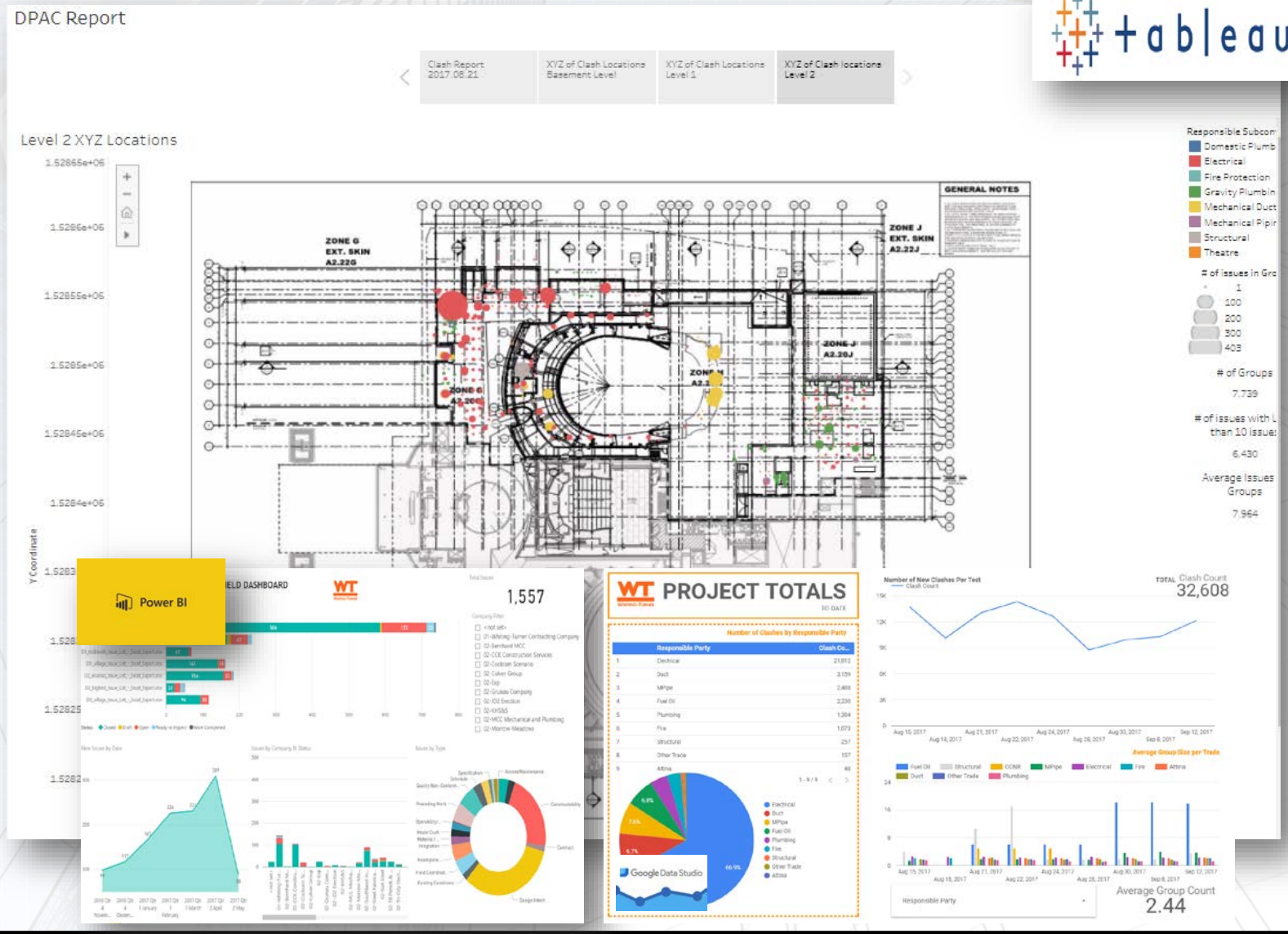
File Edit View Insert Format Data Tools Add-ons Help Last edit was made 2 days ago by Daniel Graf

Clash Test

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Clash Test	Origin Clash	Clash Gr	Group Count	Origin Path Blame	Origin Attribute Na	Origin Attribute Value	Group At	Group At	X Coordi	Y Coordi	Z Coordi	Status	Date
2	Elec v All	Clash53	Clash53	3	SPC1A_DC_FP-02	Element ID	264618	Element	264618	-350.015	12.234	44.6	new	20170815
3	Elec v All	Clash64	Clash64	3	SPC1A_DC_FP-02	Element ID	264382	Element	264382	-210.013	293.779	44.63	new	20170815
4	OFE v FP	Clash732	Clash732	1	SPC1A_DC_FP-02	Element ID	262601	Element	262601	-127.742	210.853	49.115	new	20170815
5	OFE v FP	Clash344	Clash642	3	SPC1A_DC_FP-02	Element ID	263557	Element	263557	-98.417	21.101	47.721	new	20170815
6	OFE v FP	Clash822	Clash822	1	SPC1A_DC_FP-01	Element ID	262644	Element	262644	-269.962	309.082	22.675	new	20170815
7	OFE v FP	Clash729	Clash729	1	SPC1A_DC_FP-02	Element ID	262241	Element	262241	-31.402	244.088	48.692	new	20170815
8	OFE v FP	Clash708	Clash708	2	SPC1A_DC_FP-01	Element ID	262368	Element	262368	-88.251	363.344	24.5	new	20170815
9	OFE v FP	Clash791	Clash791	1	SPC1A_DC_FP-02	Element ID	262417	Element	262417	-10.27	347.219	46.779	new	20170815
10	OFE v FP	Clash743	Clash743	1	SPC1A_DC_FP-01	Element ID	261355	Element	261355	-28.515	95.367	23.667	new	20170815
11	OFE v FP	Clash716	Clash716	2	SPC1A_DC_FP-01	Element ID	262371	Element	262371	-93.598	355.252	24.5	new	20170815
12	OFE v FP	Clash522	Clash522	1	SPC1A_DC_FP-01	Element ID	260800	Element	260800	-39.499	160.769	23.667	new	20170815
13	OFE v FP	Clash457	Clash457	1	SPC1A_DC_FP-01	Element ID	262155	Element	262155	-42.942	244.179	23.667	new	20170815
14	OFE v FP	Clash563	Clash563	1	SPC1A_DC_FP-01	Element ID	262133	Element	262133	-24.933	250.775	23.667	new	20170815
15	OFE v FP	Clash613	Clash613	1	SPC1A_DC_FP-01	Element ID	260728	Element	260728	-4.51	247.418	23.667	new	20170815
16	OFE v FP	Clash501	Clash501	1	SPC1A_DC_FP-01	Element ID	260662	Element	260662	-50.572	329.53	23.667	new	20170815
17	OFE v FP	Clash647	Clash647	1	SPC1A_DC_FP-01	Element ID	261378	Element	261378	-4.499	5.356	23.667	new	20170815
18	OFE v FP	Clash455	Clash455	1	SPC1A_DC_FP-01	Element ID	262099	Element	262099	-41.447	9.48	23.667	new	20170815
19	OFE v FP	Clash705	Clash705	1	SPC1A_DC_FP-01	Element ID	262878	Element	262878	-67.412	333.671	23.667	new	20170815
20	OFE v FP	Clash700	Clash700	1	SPC1A_DC_FP-01	Element ID	262653	Element	262653	-376.968	294.952	23.667	new	20170815
21	OFE v FP	Clash813	Clash771	2	SPC1A_DC_FP-02	Element ID	261112	Element	261112	-157.383	25.459	44.616	new	20170815
22	OFE v FP	Clash537	Clash537	1	SPC1A_DC_FP-01	Element ID	260688	Element	260688	-39.486	303.768	23.667	new	20170815
23	OFE v FP	Clash592	Clash592	1	SPC1A_DC_FP-01	Element ID	261114	Element	261114	-14.091	248.168	23.667	new	20170815
24	OFE v FP	Clash523	Clash523	1	SPC1A_DC_FP-01	Element ID	260827	Element	260827	-39.499	65.117	23.667	new	20170815
25	OFE v FP	Clash748	Clash748	1	SPC1A_DC_FP-01	Element ID	261157	Element	261157	-121.999	150.148	23.667	new	20170815
26	OFE v FP	Clash542	Clash542	1	SPC1A_DC_FP-01	Element ID	260636	Element	260636	-39.499	335.553	23.667	new	20170815
27	OFE v FP	Clash595	Clash595	1	SPC1A_DC_FP-01	Element ID	262127	Element	262127	-20.269	247.06	23.667	new	20170815
28	OFE v FP	Clash676	Clash676	1	SPC1A_DC_FP-01	Element ID	260631	Element	260631	-15.499	363.09	23.667	new	20170815
29	OFE v FP	Clash334	Clash334	1	SPC1A_DC_FP-02	Element ID	263457	Element	263457	-51.015	65.976	50.358	new	20170815
30	OFE v FP	Clash483	Clash483	1	SPC1A_DC_FP-01	Element ID	261287	Element	261287	-40.975	6.487	23.667	new	20170815
31	OFE v FP	Clash307	Clash307	1	SPC1A_DC_FP-02	Element ID	258264	Element	258264	-85.936	188.375	49.629	new	20170815
32	OFE v FP	Clash582	Clash582	1	SPC1A_DC_FP-01	Element ID	261105	Element	261105	-43.326	257.112	23.667	new	20170815
33	OFE v FP	Clash800	Clash764	3	SPC1A_DC_FP-02	Element ID	261094	Element	261094	-185.383	25.459	44.616	new	20170815
34	OFE v FP	Clash810	Clash778	2	SPC1A_DC_FP-01	Element ID	261412	Element	261412	-185.384	286.552	20.116	new	20170815
35	OFE v FP	Clash738	Clash738	1	SPC1A_DC_FP-01	Element ID	260836	Element	260836	-39.514	43.295	23.667	new	20170815
36	OFE v FP	Clash625	Clash625	1	SPC1A_DC_FP-01	Element ID	260669	Element	260669	-27.499	329.53	23.667	new	20170815
37	OFE v FP	Clash666	Clash666	1	SPC1A_DC_FP-01	Element ID	261323	Element	261323	-28.499	51.254	23.667	new	20170815
38	OFE v FP	Clash564	Clash564	1	SPC1A_DC_FP-01	Element ID	260616	Element	260616	-24.933	311.549	23.667	new	20170815
39	OFE v FP	Clash540	Clash540	1	SPC1A_DC_FP-01	Element ID	260667	Element	260667	-39.499	329.53	23.667	new	20170815
40	OFE v FP	Clash711	Clash711	1	SPC1A_DC_FP-01	Element ID	261120	Element	261120	-94.185	180.323	23.667	new	20170815
41	OFE v FP	Clash670	Clash670	1	SPC1A_DC_FP-01	Element ID	262165	Element	262165	-16.51	234.582	23.667	new	20170815
42	OFE v FP	Clash636	Clash636	1	SPC1A_DC_FP-01	Element ID	260634	Element	260634	-27.499	354.459	23.667	new	20170815
43	OFE v FP	Clash635	Clash635	1	SPC1A_DC_FP-01	Element ID	260624	Element	260624	-3.499	344.398	23.667	new	20170815

Copy of Clash Groups | 2017.10.02 | 2017.09.25 | 2017.09.18 | 2017.09.12 | 2017.09.08 | 2017.08.30 | 2017.08.28 | 2017.08.24 | 2017.08.22 | 2017.08.21

Use BI for Reporting



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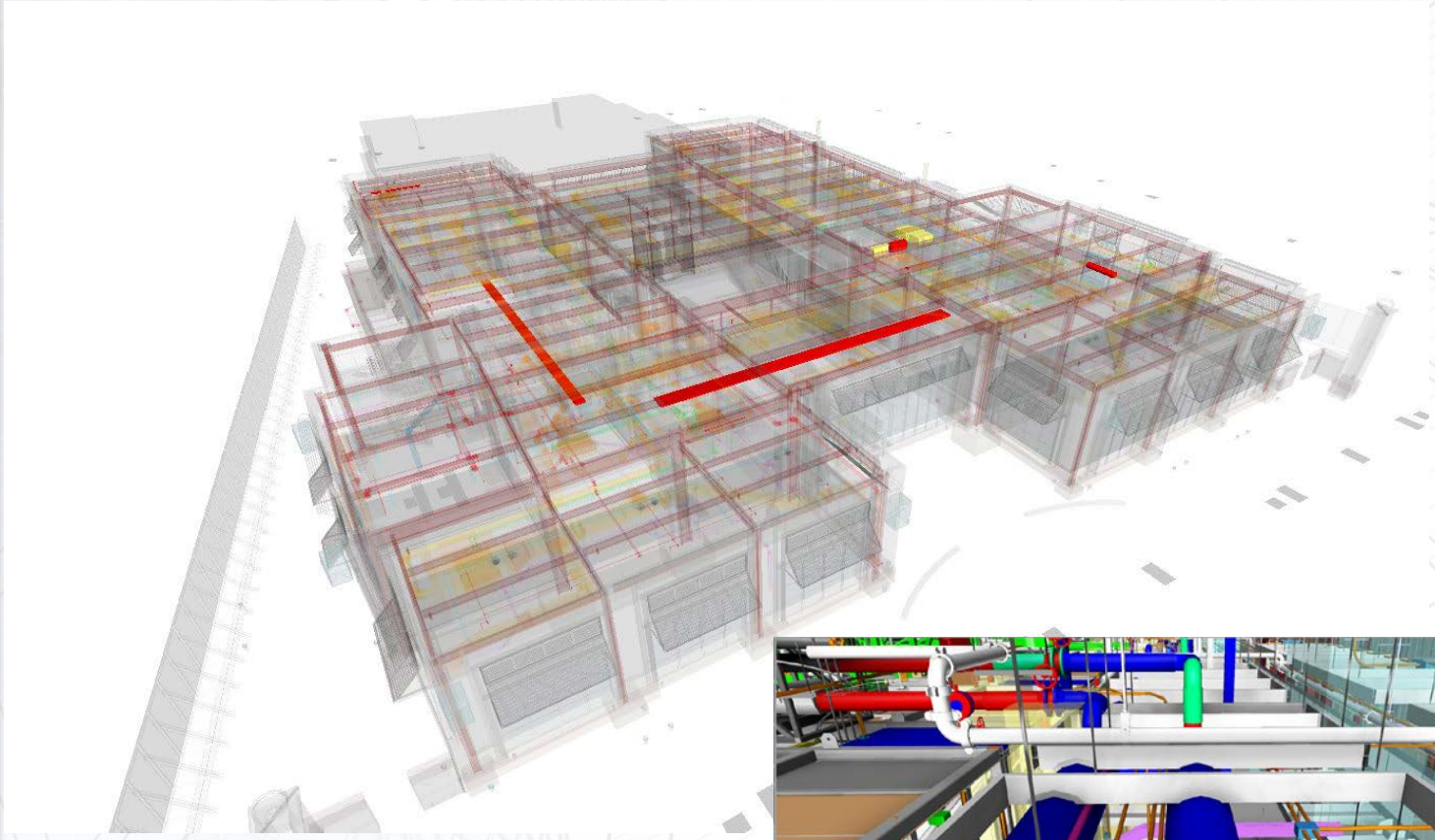
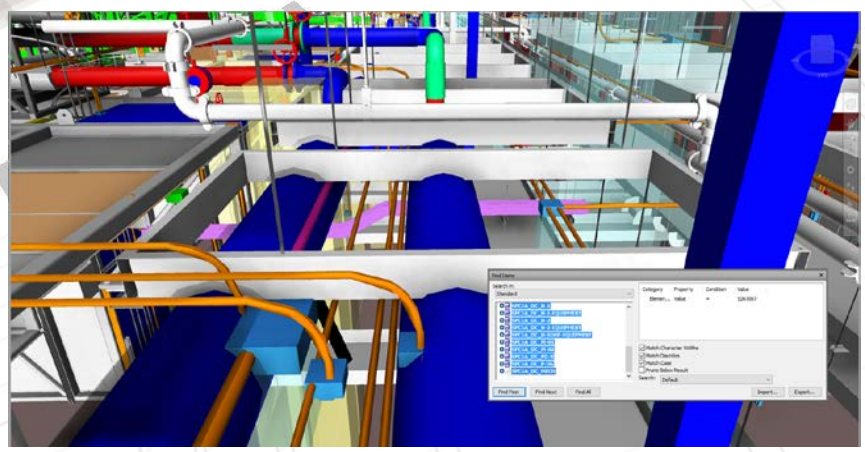
OTHER WAYS TO REVIEW DATA





Wrap-up

- Focus on the rules and the data
- Get the information back to the authoring arena
- Get your employees back!

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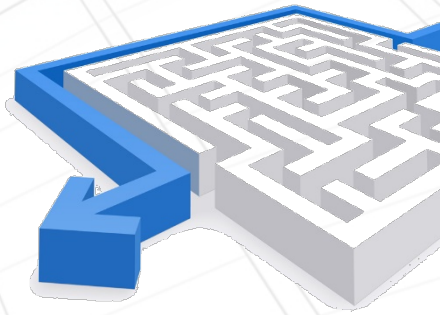
Implementing BIM for Owners

A BIM IMPLEMENTATION ROADMAP

Short Term (6-12 Months)

1. Get a BIM Strategy, BIM Requirements document, and BIM Project Execution Plan (BEP) template in place
2. Appoint a BIM Manager (part-time role)
3. "Revitize" at least one facility
4. Ensure you have the correct Software in place
5. Begin to Provide Training to your Teams
6. Implement a Pilot Program

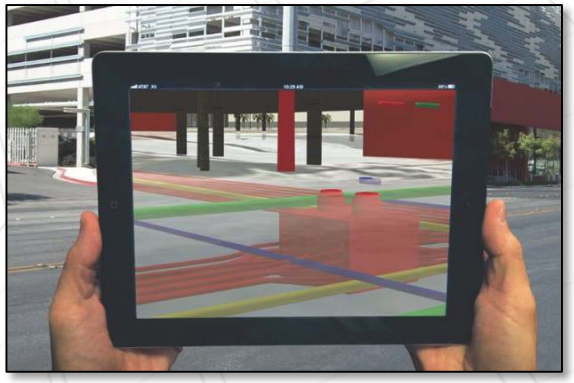


Medium Term (1-3 Years)

1. Refine your BIM Documents
2. Continue "Revitizing" facilities = Build your Library
   - By receiving models from consultants or having them modeled yourself
3. Implement a Master Files Process
4. Pass Data from D&C to O&M
   - COBie or equivalent
5. Expand the Pilot Program
   - Multiple project types and multiple teams
   - Try each combination to test and refine the process

Long Term (3-5 Years)

1. Have all your facilities "Revitized"
2. Retire the Pilot Program
   - All new design and construction projects now done in BIM
3. Direct Integration of D&C and O&M Systems
   - Revit and Maximo connected
4. Other Future Technologies
   - Data accessed and updated in the field
   - Augmented reality
   - Cloud-based data and software



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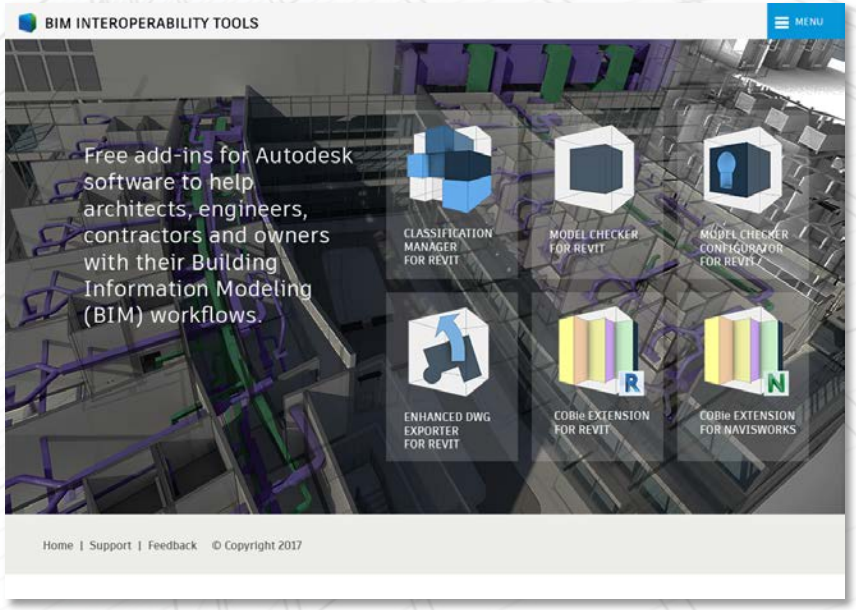
Implementing BIM for Owners

WRAP UP

Free BIM Tools

www.biminteroperabilitytools.com

- Installation Files
- Samples
- Help Pages
- Quick Start Guides
- Videos
- and other resources…



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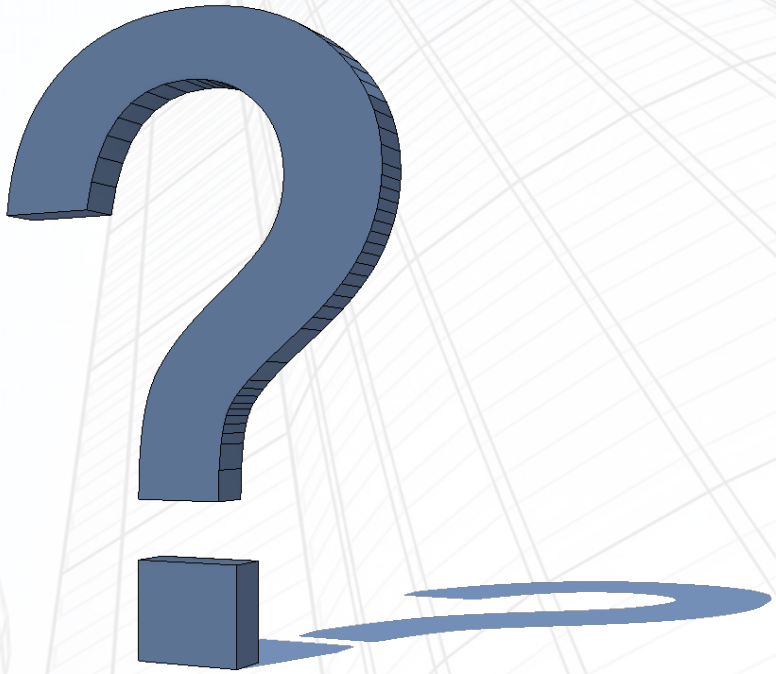
Questions?



This concludes The American Institute of Architects Continuing Education Systems Course