Autodesk Consulting Add-on Utilities: COBie Toolkit and BIM Coordinator Tool

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We will demonstrate and discuss recent Autodesk Consulting add-on utilities, developed using mostly Revit and some AutoCAD Civil3D APIs:

- **COBie** (Construction Operations Building Information Exchange) Toolkit for Autodesk Revit software. COBie is XLS(X)-based standard for exchange of building systems information between designers, construction firms, and building owners that can now be populated directly from Revit’s BIM.

- **BIM Coordinator**, available from Autodesk Labs, assists project team members with building and site grids in Revit and AutoCAD Civil 3D software to effectively organize the project data in shared or related coordinates. This utility is essential for spatial collaboration across disciplines.

- Time permitting, some other generic BIM tools for Revit
Learning Objectives

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

- Understand details of the COBie standard, including the U.S. version and the more recent U.K. version
- Export COBie Excel files directly from Revit in a flexible and configurable manner
- Use the BIM Coordinator tool to improve interoperability and spatial integration between AutoCAD Civil 3D and Revit
- Define specifications for custom (API-based) add-on tools to extend Autodesk Building Information Modeling (BIM) applications
Speakers and Audience Background

Miro

- extensive combined engineering and IT background, with a Dipl.Ing. degree in Civil and Structural Engineering and Ph.D. in Numerical Methods in Engineering
- 25+ years’ experience in commercial engineering/AEC/BIM software development and customization.
- Fluent in English, Croatian (native), Italian, C#, VB.NET, C/C++, XML, STEP, OOA/OOD, old VBA/VB6, FORTRAN…
- at Autodesk for over 12 years, currently as Solution Architect with Autodesk Consulting (AC)
  - applying combined API, products, industry and process analyses knowledge to architecting and developing consulting solutions that extend the functionality of Autodesk BIM/AEC products and integrate them within various specific customer workflows and processes.
  - specializing in APIs for all Autodesk® AEC and BIM products, a topic on which he has conducted numerous training sessions, given many conference talks and designed/implemented many custom apps.

Rich

- responsible for advancing Building Information Modeling to building owners and promoting the role of BIM in the building lifecycle for Operations and Maintenance, Facilities Management, GIS and Building Control Applications.
- 30+ years industry experience in Facilities Management, Operations and Maintenance BIM, CAD, and GIS applications
- prior to Autodesk, worked for a software reseller as Vice President, managing all sales, support and consulting.
- at Autodesk for 15 years and has held various sales and technical positions, involved in
  - consulting, implementing and customization of these applications
  - integration with various systems and enterprise applications.

Audience - show of hands…
AcRvtClassification Tool
Revit’s Classification Options - OmniClass

- Available in RFAs to select OmniClassNumber/OmniClasTitle params
- When loaded in RVT, these Type params become read-only
- Defined centrally, once only, in RFA and then available in RVTs.
- Areas for improvement:
  - Not available for system (non-RFA) families like Walls, Floors, Pipes, etc…
  - Not available for classifiable instance-based elements, most importantly Rooms, Spaces and Facility (ProjectInformation)
  - Nomenclature not officially customizable, see taxonomy file: 
    C:\ProgramData\Autodesk\RVT\2013\UserDataCache\OmniClassTaxonomy.txt
Revit’s Classification Options - Uniformat

- Available via “Assembly Code” on Types
- Only within RVT, so can be changed in the model
- Not available for classifiable instance-based elements, most importantly Rooms, Spaces and Facility (ProjectInformation)
- Nomenclature not officially customizable, see definition file: 
  C:\ProgramData\Autodesk\RVT 2013\UserDataCache\UniformatClassifications.txt

- No concept for adding other classifications…
Classification Tool for Revit

- To address some of these issues, AC tool designed and developed:
  - Easy and customizable classification definitions in XML files
    - Simple XML Elements and Attributes
    - Flexible “hints” to which Revit categories a classification applies
    - Flexible nested structure for classification items
  - Automatic creation of shared parameters to store the data
  - Includes Type and Instance Bindings
  - Single-point “Manager” UI dialog to deal with:
    - Importing/updating/removing of XML file into Revit
    - User-friendly and flexible User Interface to view/assign the values to Types/Instances
Classification Tool for Revit – XML file structure

```xml
<?xml version="1.0" encoding="utf-8"?>
<RvtClassification>
<!-- Global Settings Values -->
<!-- NOTES:
    Id: not used at the moment, but a unique GUID
    Name: Unique Id used for this classification
    IdDescriptionSeparator: Id, this separator and Description are concatenated for display/param-value purpose
    SharedParamName: name of Revit's Shared Param to be used in conjunction with this classification
-->
<Id>12345678-2E91-44D3-A004-0123456789ABC</Id>
>Name>Uniclass2 Systems</Name>
<IdDescriptionSeparator> </IdDescriptionSeparator>
<SharedParamName>AcUniclass2</SharedParamName>
<Classification Id="sp.25" Description="Administrative, commercial and protective service spaces"/>
<Classification Id="sp.30" Description="Educational, scientific and information spaces">
    <Classification Id="sp.30.10.01" Description="adult education classrooms"/>
    <Classification Id="sp.30.10.04" Description="art studios"/>
    ...
    <Classification Id="sp.30.10.97" Description="Woodwork classrooms"/>
</Classification>
<Classification Id="sp.35" Description="Industrial spaces"/>
...
<Classification Id="sp.65" Description="Sanitary, cleaning, maintenance and storage spaces">
    <Classification Id="sp.65.10" Description="general circulation spaces"/>
    <Classification Id="sp.65.80.06" Description="Wall service voids"/>
</Classification>
</Classification>
</RvtClassification>
```
Classification Tool for Revit – Manager UI Dialog
Classification Tool for Revit

» Live Demo...
What is COBie?
COBie
Construction Operations Building Information Exchange

What is COBie?

- Internationally recognized data exchange standard
- Exchange building systems information between design & construction with building owners
- Format for delivering construction handover data
The Problem
Lack of Consistent and Useful Deliverables to Owners for O&M

- Support the operations, maintenance, and the management of the facilities
  - Commissioning
  - Facilities Management
  - Asset Management
  - CMMS
  - Document Management
- Facilitate of documentation handover
  - equipment lists
  - product data sheets
  - Warranties
  - spare part lists
  - preventive maintenance schedules
Graphic / Attribute Data Creation and Editing

- COBie is primarily textual information
- Organized data in electronic form
Graphic / Attribute Data Creation and Editing

- Attributes Increase as model progresses
- COBie is primarily textual information
- Organized data in electronic form
  - May use graphical information for visualization

Model Progression:
- Design
  - Graphic Original Design
  - Attribute Data
- Contractor
  - Graphic Design
  - Attribute Data
- Owner/Operator
  - Graphic Design
  - Attribute Data
# COBie Structure

## Sheet Contents

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>People and Companies</td>
</tr>
<tr>
<td>Facility</td>
<td>Project, Site, and Facility Information</td>
</tr>
<tr>
<td>Floor</td>
<td>Vertical levels (and exterior areas)</td>
</tr>
<tr>
<td>Space</td>
<td>Spaces/Rooms</td>
</tr>
<tr>
<td>Zone</td>
<td>Sets of spaces sharing a specific attribute</td>
</tr>
<tr>
<td>Type</td>
<td>Types of equipment, products, and materials</td>
</tr>
<tr>
<td>Component</td>
<td>Individually named or scheduled items</td>
</tr>
<tr>
<td>Assembly</td>
<td>Components having constituent components</td>
</tr>
<tr>
<td>System</td>
<td>Sets of components providing a service</td>
</tr>
<tr>
<td>Spare</td>
<td>Onsite and replacement parts</td>
</tr>
<tr>
<td>Resource</td>
<td>Required materials, tools, and training</td>
</tr>
<tr>
<td>Job</td>
<td>PM, Safety, and other job plans</td>
</tr>
<tr>
<td>Document</td>
<td>All applicable document references</td>
</tr>
<tr>
<td>Attribute</td>
<td>Property sets of referenced item</td>
</tr>
<tr>
<td>Connection</td>
<td>Logical connections between components</td>
</tr>
<tr>
<td>Coordinate</td>
<td>Spatial locations in box, line, or point format</td>
</tr>
<tr>
<td>Issue</td>
<td>Other required handover issues</td>
</tr>
<tr>
<td>Impact</td>
<td>Economic, Environmental and Social Impacts at various stages in the life cycle</td>
</tr>
</tbody>
</table>
COBie Sheets

Contact

Facility

Composed of

Served by

Floor

Type

Job

Resource

Spare

Space

Component

Assembly

Connection

Document

Coordinate

Zone

System

Impact

Attribute

Issue

Spatial

Equipment

Common

COBie Worksheets 1 through 8

COBie Worksheets 9 through 18

Project Lifecycle

Design + Documentation

Construction

Project Delivery
COBie Sheets

Worksheet/data typically created or maintained in Revit Model

Facility
  
  Composed of
  
  Floor

  Served by
  
  Type

  Located in
  
  Space

  Component

  Zone

  System

  Equipment

Spatial

Equipment
COBie Sheets

Facility
- Composed of
  - Floor
  - Space
  - Zone
- Located in Spatial
- Served by Equipment
  - Type
  - Component
  - System

Additional data typically derived from Revit Model
- Coordinates
- Attributes
COBie Organization

- One worksheet for each info type
- Worksheets have standard format
- Color coded
- Pick-lists link information on sheets
- Documents listed as references to external files
- Can be customized
## COBie Excel Spreadsheet

### Understanding the Structure and Fields

**Color Legend**
- **required**
- **required foreign key**
- **required if mapping to authoring software**
- **required if specified**
- regional, owner, or product specific data

**Fields Contained in Each Sheet**

<table>
<thead>
<tr>
<th>Name</th>
<th>Authors Identity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CreatedBy</td>
<td></td>
</tr>
<tr>
<td>CreatedOn</td>
<td>creation/publication date</td>
</tr>
<tr>
<td>ExtSystem</td>
<td>Name of Software</td>
</tr>
<tr>
<td>ExtObject</td>
<td>Object Name in Software</td>
</tr>
<tr>
<td>ExtIdentifier</td>
<td>Unique ID Generated by Software</td>
</tr>
</tbody>
</table>
### Picklists

**Data Validation and consistency**

- Data validation
- Limiting values which can be selected for certain columns

---

<table>
<thead>
<tr>
<th>Category Role</th>
<th>Coordinate Sheet</th>
<th>Connection Type</th>
<th>Coordinate Type</th>
<th>Document Type</th>
<th>Duration Unit</th>
<th>Floor Type</th>
<th>Issue Category</th>
<th>Issue Change</th>
<th>Issue Impact</th>
<th>Issue Risk</th>
<th>Job Status Type</th>
<th>Job Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>34-1: Management</td>
<td>Component</td>
<td>Control</td>
<td>point</td>
<td>Preconstruction Submittals</td>
<td>as required</td>
<td>Site</td>
<td>Change</td>
<td>Has Occurred</td>
<td>Very High</td>
<td>Very High</td>
<td>Not Yet Started</td>
<td>Adjustment</td>
</tr>
<tr>
<td>34-1: Executive Management</td>
<td>Floor</td>
<td>Floor</td>
<td>line-end-one</td>
<td>Shop Drawings</td>
<td>day</td>
<td>Floor</td>
<td>Claim</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Started</td>
<td>Calibration</td>
</tr>
<tr>
<td>34-11: Chief Executive</td>
<td>Space</td>
<td>Return</td>
<td>line-end-two</td>
<td>Product Data</td>
<td>minute</td>
<td>Roof</td>
<td>Coordination</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Completed</td>
</tr>
<tr>
<td>34-11: Vice President</td>
<td>Supply</td>
<td>box-lower-left</td>
<td>Samples</td>
<td>month</td>
<td>Environmental</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Inspection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-11: Chairman</td>
<td>Structural</td>
<td>box-upper-right</td>
<td>Design Data</td>
<td>quarter</td>
<td>Function</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-11: Board Member</td>
<td>Test Reports</td>
<td>week</td>
<td>IndoorAirQuality</td>
<td>lbs</td>
<td>PM</td>
<td>Installation</td>
<td>Safety</td>
<td>ShutDown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-11: Partner</td>
<td>Certificates</td>
<td>year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-11: Middle Management</td>
<td>Manufacturer Instructions</td>
<td>RFI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>StartUp</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-11: Supervisor</td>
<td>Manufacturer Field Reports</td>
<td>Safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-11: Coordinator</td>
<td>Operation and Maintenance</td>
<td>Specification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Trouble</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-11: Trainer</td>
<td>Closeout Submittals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-11: Planning Roles</td>
<td>Contract Drawings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-11: Developer</td>
<td>Design Review Comment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
From Revit to COBie
Putting it all together
### COBie Facility Tab

#### Facility Tab ↔ Revit Project Info

<table>
<thead>
<tr>
<th>Facility</th>
<th>Name</th>
<th>Category</th>
<th>Project Name</th>
<th>Site Name</th>
<th>Linear Units</th>
<th>Area Units</th>
<th>Volume Units</th>
<th>Currency Units</th>
<th>Area Measurement</th>
<th>Description</th>
<th>Project Description</th>
<th>Site Description</th>
<th>Phase</th>
</tr>
</thead>
</table>

- **Name**: Facility Tab
- **Category**: Revit Project Info

![Facility Tab Image](image-url)
COBie Data Structure – Spatial

Floor Tab <-> Revit Level

**Floor**
- Name
- Category
- Description
- Elevation
- Height

**Floor Data**
- Name
- Gross Area

**Revit Level**

<table>
<thead>
<tr>
<th>Name</th>
<th>Category</th>
<th>Description</th>
<th>Elevation</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOSCRN</td>
<td>Roof</td>
<td>T.O. Screen Wall</td>
<td>182.67</td>
<td>11.33</td>
</tr>
<tr>
<td>LEVELB</td>
<td>Floor</td>
<td>Basement</td>
<td>194.00</td>
<td>12.33</td>
</tr>
<tr>
<td>LEVEL1</td>
<td>Floor</td>
<td>1st Floor</td>
<td>206.33</td>
<td>12.33</td>
</tr>
<tr>
<td>LEVEL2</td>
<td>Floor</td>
<td>2nd Floor</td>
<td>218.67</td>
<td>13.21</td>
</tr>
<tr>
<td>LEVEL3</td>
<td>Floor</td>
<td>3rd Floor</td>
<td>231.88</td>
<td>9.13</td>
</tr>
<tr>
<td>TOSTEEL</td>
<td>Roof</td>
<td>T.O. Steel</td>
<td>241.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

LEVEL2
Floor
2nd Floor
218.67 SF
13.27 FT
...
COBie Data Structure – Spatial
Space Tab ↔ Revit Room / Revit MEP Space

Space
- Name
- Category
- Floor Name
- Description
- Room Tag
- Usable Height
- Gross Area
- Net Area

Room 211
Meeting Room A
13-11 21 17: Conference Room
Level2
125 SF
...
COBie Data Structure – Spatial

Zone Tab

Zone
Name
Category
Space Names
Description

OCCZone1
Occupancy Zone
201,202,203,204
Occupancy Zone 1

…
COBie Data Structure – Equipment

Type Tab ↔ Revit Family Type

One record for each Asset Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Warranty Guarantor</th>
<th>Warranty Duration</th>
<th>Warranty Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Titus FLS Fan Powered VAV w Elec RH: B,C 6</td>
<td>23-75 70 24 14: Variable Volume Air Terminal Units</td>
<td><a href="mailto:sales@titus-hvac.com">sales@titus-hvac.com</a></td>
<td>ATQP BC6</td>
<td>1 Year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

...
### Component Tab ↔ Revit Family Instance

<table>
<thead>
<tr>
<th>Name</th>
<th>Type Name</th>
<th>Space Names</th>
<th>Description</th>
<th>Serial Number</th>
<th>Installation Date</th>
<th>Warranty Start Date</th>
<th>Tag Number</th>
<th>Bar Code</th>
<th>Asset Identifier</th>
</tr>
</thead>
</table>

...
COBie Data Structure – Equipment Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Name</th>
<th>Category</th>
<th>Component Names</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HVACSys1</td>
<td>21-51 51: Heating: Ventilating and Air Conditioning (HVAC)</td>
<td>VAV2-1, DUCT2-12, DUCT2-15, DIFF435</td>
<td>…</td>
</tr>
</tbody>
</table>

- HVACSys1
- 21-51 51: Heating: Ventilating and Air Conditioning (HVAC)
- VAV2-1, DUCT2-12, DUCT2-15, DIFF435
- …
Customization

- Pick list customization
  - Headings may not be changed
  - Green pick lists may be updated based on local/language requirements
  - Yellow lists map to COBie requirements and may not be changed
  - Purple lists map the IFC model and may not be changed
- Regional classification schema may be substituted for pick lists
  - BOMA, FICM etc
  - International Standards
- Regional, owner, or product specific data may be added as new columns to the right of standard template columns
  - Finishes, Occupancy, etc.
- Custom properties
  - “Attributes” table
# Air Handling Unit (AHU) Insulation and Standard Class Reference Frequency Phase Angle Phase Reference Number of Poles Has Protective Earth Capacity in BTU Capacity in Tonnage Capacity in CFM Nominal cooling capacity in BTU Nominal cooling capacity in Tons Outside Air Flowrate Dual Deck Economizer Humidity Control Air Handler Construction Air Handler Fan Coil Arrangement Air Handler Unit Type Air Handler Type of Heating Air Handler Type of Cooling Air Filter Type Air Filter Change-out Schedule Supply fan motor size in hp Supply fan in cfm Return motor size in hp Return fan in cfm VFD Number of Belts Size of Belts Type of Belt (shape)

## Valves
- Body Material
- Water Inlet Temperature Range
- Water Storage Capacity
- Maximum Operating Pressure
- Valve Pattern
- Valve Operation
- Valve Mechanism
- Type of Valve
- Valve Body Material
- Valve Size (Inches)
- Number of Holes
- Pressure Rating of Valve
- Valve Movement
- Valve Actuator
- Location of shut-off valve
- Maximum Water, Oil, Gas Rating
- Access
- Connection
- Seat

## Motors
- Current
- Power
- Voltage
- Locked Rotor Current
- Electric Motor Efficiency
- Frame Size
- Start Current Factor
- Motor Size
- Frequency
- Phase Angle
- Phase Reference
- Has Protective Earth
- Maximum Power Output
- Number of Poles
- Is Guarded
- Motor Enclosure Type
- Rated load rpm
- Duty rating
- Location

---

Autodesk University

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### COBie Data Structure – Common Sheets

#### Additional Attributes

- Provides for additional attributes for a specific record in the spreadsheet

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Served</td>
<td>WH-1 Restroom, breakroom, janitor</td>
</tr>
<tr>
<td>Basis of Design</td>
<td>WH-1 Bradford White LD-30U3-1</td>
</tr>
<tr>
<td>Cold Water Supply</td>
<td>WH-1 Watts deta-20 expansion tank</td>
</tr>
<tr>
<td>Input Power</td>
<td>WH-1 1.5 kw</td>
</tr>
<tr>
<td>op. Weight</td>
<td>WH-1 331 lbs</td>
</tr>
<tr>
<td>Recovery at 100° F Rise</td>
<td>WH-1 6 GPH</td>
</tr>
<tr>
<td>Storage Capacity</td>
<td>WH-1 20 Gal</td>
</tr>
<tr>
<td>Voltage</td>
<td>WH-1 208/10 V</td>
</tr>
</tbody>
</table>
COBie Data Structure – Common Sheets

Coordinate

- Provides simple location information

**Simple Geometry**
- 3-D Rectangle
- Square
- Line
- Point

**Applied to**
- Facility
- Floor
- Space
- Component
Additional COBie Sheets

- **Contact** People and Companies
- **Document** All applicable document references
- **Assembly** Components having constituent components
- **Spare** Onsite and replacement parts
- **Resource** Required materials, tools, and training
- **Job** PM, Safety, and other job plans
- **Connection** Logical connections between components
- **Coordinate** Spatial locations in box, line, or point format
- **Issue** Other required handover issues
- **Impact** Economic, Environmental and Social Impacts at various stages in the life cycle
COBie – Revit Toolkit
COBie Toolkit for Revit

- The workflow and consequently the custom commands based on 3 steps:

  1. Create/Bind specific Shared Parameters used for COBie export
     - Needs to be done just once or not at all if already done in a template
     - Shared Params file provided to make sure GUIDs are unique
       (NOTE: It will work with any GIUDs since identification based on Param Names. There is even an option to create the params in the file. This requires caution if copying elements between models!)

  2. Populate these parameters
     - Comprehensive and flexible UI options to populate them from RVT BIM data
     - Can still “manually” edit params if fine-tuning needed before the export

  3. Export to COBie XLS(X) file (or optionally to XML)
     - Even more comprehensive and flexible UI options for many aspects
     - Exports data as a combination of directly from BIM model and above params
COBie Toolkit for Revit – Bind Params and Populate Params Custom Commands
COBie Toolkit for Revit – Export Command

The image shows the COBie Export Options window in the Autodesk Revit software. It includes options for exporting data to Excel files, with settings for selecting sheets, units, components/types, attributes, coordinates, systems, zones, and spaces. The window allows users to specify which data to include or exclude from the export, and how to handle existing data in the export file.
COBie Toolkit for Revit – Export Command Tabs
COBie Toolkit for Revit – Export Command Tabs

<table>
<thead>
<tr>
<th>Name</th>
<th>All</th>
<th>None</th>
<th>Select</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Area Reinforcement</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casework</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceilings</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curtain Wall Mullions</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curtain Panels</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doors</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducts</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duct Fittings</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duct Insulations</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duct Linings</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Terminals</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Equipment</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Fixtures</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fascias</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flex Ducts</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flex Pipes</td>
<td>True</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finishes</td>
<td>True</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Selected 3 of 5 Category ‘Columns’ Types will be considered:
- Metal Clad Column: 24”
- Rectangular Column: 18” x 18”
- Rectangular: 450 x 450mm
- Rectangular: 450 x 600mm
- Rectangular: 600 x 600mm
COBie Toolkit for Revit – Export Command Tabs
COBie Toolkit for Revit – Export Command Tabs
COBie Toolkit for Revit – Export Command Tabs
COBie Toolkit for Revit – Export Command Tabs

NOTE: These Zones are constructed from Yes No ([ZoneName] param bound with Spaces/Rooms and Text [ZoneName] COBieZone param bound with ProjectInformation)
COBie Toolkit for Revit – Export Command Tabs
COBie Toolkit for Revit

Live Demo...
BIM Coordinator
BIM Coordinator - Summary

- Add-on tools for Civil 3D and Revit to facilitate setting Shared Coordinates in Revit based on Civil 3D Locations (Coordinate Systems)
- 2012 version Installs and Docs published to Autodesk Labs: http://labs.autodesk.com/utilities/bim_coordinator/
- 2013 version recently completed (to be published to ADSK Subscriptions)
Coordinate Systems in Revit vs Civil 3D/AutoCAD

- **Revit**
  - Uses Architectural Terminology/Concepts
  - Shared Coordinates (or “Sites”), Project/True North, XY-plane always horizontal
  - See “Manage” Ribbon Tab -> “Project Location” Ribbon Panel
  - Very good detailed summary in: [AU2010 DL316-1, section 5](#)

- **Civil 3D/AutoCAD**
  - Uses CAD Terminology/Concepts
  - WCS, UCS-es, any XY-plane rotation
  - Various UI elements

- **Comparison**
  - Basically, both deal with the SAME mathematical/geometrical aspects
  - Confusion based on users being more Revit or AutoCAD – background centric
Problem Assessment

- AC Technical Consultants and Customer Success Managers were consistently reporting customers having problems spatially coordinating RVT models in C3D.
- With new C3D 2012 features enabling non-corridor entities being visible in cross-sections, it became very important to import full Revit 3D DWG models precisely in C3D models.

NOTE/CAVEATS regarding Revit’s ADSK-format export to Civil 3D:

- Full 3D DWG export should be used for the above-described requirements.
- The ADSK format export is still the main recommended workflow to get Revit models within Civil 3D, as it’s designed to produce more lightweight Revit shell, connection points, textures and BIM information.
- ADSK format does however have some issues with locating the model 😞. Its hard-coded location feature is based on the *survey* point in Revit which shared coordinates do not set, so ADSK format does not get affected/fixed by the current tools.
Problem Assessment

- Initial assessment produced the workflow document for a fully “manual” workflow:

  ➢ See Revit to Civil 3D Interoperability Workflow - Draft.docx

- The obvious weak points that could be automated are:
  - Manual, error-prone and slow recording of AutoCAD coordinates/angles
  - Manual, error-prone and slow creating of Revit Shared Coordinates, Rotation and Elevation based on the above.

- Hence…an opportunity for AC (or any developer) to design and develop appropriate add-ons based on Revit and AutoCAD/Civil 3D APIs 😊
Solution Design

- The workflow is Civil 3D-cetric, ie civil-site design determines the positions of building(s)

- Civil 3D and Revit users would typically be using different machines, possibly also in different locations.

- Therefore, the logical design was to:
  - Provide Civil3D/AutoCAD add-on to export “locations” into a “neutral” file
  - Provide Revit add-in to automatically create “Sites” (Shared Coordinates) from these neutral files
  - The obvious choice for neutral file is XML
Solution Modules

- There are a few C# projects in the Solution, dealing with specific tasks:

  - **DataFormats**: Defines neutral XML file format, independent of any ADSK APIs
  - **AcadClient**: References Acad.NET DLLs and DataFormats; provides Acad command
  - **RevitClient**: References Revit API DLLs and DataFormats; provides Revit command
  - **Acad/Revit ClientInstaller**: provide two separate installers
  - **AcadClientInstallerCustomActions**: provide custom step for Acad Installer (see later)
Solution Code

Solution/projects cannot be provided in the entirety, but most interesting source files are provided in the subfolders:

- See: Data Formats->CoordSysZup.cs
- See: Acad Client->CmdCoordSysExport.cs
- See: Revit Client->CmdACCSXMLImport.cs
- See: Installers->:
  - AcRVTDWGCoordsSync.addin
  - ToolboxCfg_AC_AcCoordSysExport.xml
  - AcadInstallerHelper.cs
BIM Coordinator – Full Functionality Demo

Accompanying video published to YouTube or available for Download
Other BIM Utilities
Data Transfer Tool (DTT)

- Tool that facilitates bi-directional exchange of data between a RVT model Parameters and XLS columns.
  - Also can create unplaced Rooms in RVT
    - (other elements requiring geometry cannot be created)
  - Automatically recognizes new/deleted/existing elements after the last export
    - Identification based on Revit Ids stored in each workbook
  - Automatically creates and binds new shared parameters in Revit if new columns in XLS detected
Data Transfer Tool (DTT)
Data Transfer Tool (DTT)

Live Demo...