



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

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FM3145 We will discuss recent Autodesk Consulting projects with a focus on two new utilities that we are using to help customers. First, we will present the functionality of the COBie (Construction Operations Building Information Exchange) Toolkit for Autodesk® Revit® software. COBie is a United States-originated data standard for exchange of building systems information between designers, construction firms, and building owners. The format for delivering construction handover data is a predefined spreadsheet file with specific worksheets, many of which can be populated directly from a Revit intelligent model. The standard has recently been adopted by the United Kingdom and tested on pilot projects using the evolving Revit COBie Toolkit. Next, we will discuss BIM Coordinator. This technology preview, 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.

Learning Objectives

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

- Understand details of the COBie standard, including the original U.S. and recent U.K. version
- Export comprehensive COBie XLS(X) files from Revit
- Use the BIM Coordinator tool to improve interoperability between AutoCAD Civil 3D and Revit
- Define specifications for custom add-on tools to extend Autodesk BIM applications

About the Speakers

Miro has an extensive combined engineering and IT background, with a Dipl.Ing. degree in Civil and Structural Engineering, Ph.D. in Numerical Methods in Engineering and 25 years' experience in commercial engineering software development and customization. He's been with Autodesk in UK for over 12 years, initially as Developer Consulting Specialist and currently as Solution Architect with Autodesk Consulting (AC). His specialty have been APIs for all Autodesk® AEC and BIM products, a topic on which he has conducted numerous training sessions, given many conference talks and provided direct technical support. For the last 7 years, he's been 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.

Rich is the AEC Business Development Manager for Autodesk, Inc., responsible for advancing Building Information Modeling to building owners. In this position, Rich promotes the role of BIM in the building lifecycle for Operations and Maintenance, Facilities Management, GIS and Building Control Applications. Rich has been at Autodesk for 15 years and has held various sales and technical positions. He has 30 years industry experience in Facilities Management, Operations and Maintenance BIM, CAD, and GIS applications and has been involved in consulting, implementing and customization of these applications as well as integration with various systems and enterprise applications. Prior to Autodesk, Rich worked for a software reseller as Vice President, managing all sales, support and consulting services.

Summary

The end-user functionalities and features of the tools demonstrated and discussed in this presentation are summarised in separate sections of this document, including all the relevant screenshots.

The tools emanate from a combination of specific customer engagements, overlapping requirements from wider Revit user community and strategic Autodesk initiatives. Some of them are (or will very soon be) available publicly on Autodesk Labs or Subscription sites, while the others are available via Autodesk Consulting offerings.

All the tools have been developed using Revit API. For those who want to learn more technical details on that topic, there are quite a few dedicated classes at AU, with the summary of resources is provided in the last section here. The presentation itself does not deal with any programming details, though some sample code is provided in additional materials for those interested.

Classification Tool for Revit

This tool can be used as a standalone utility, but any data added via it is also systematically integrated with the COBie tool (see later) for extracting the “Category” value therein.

Classification of BIM components is a very important aspect for specific users, and even more for many “downstream” usage of BIM data created in Revit. Attempts to standardize the nomenclature resulted in several standards, most notably Omniclass (mostly in USA) and Uniclass. For more details, see:

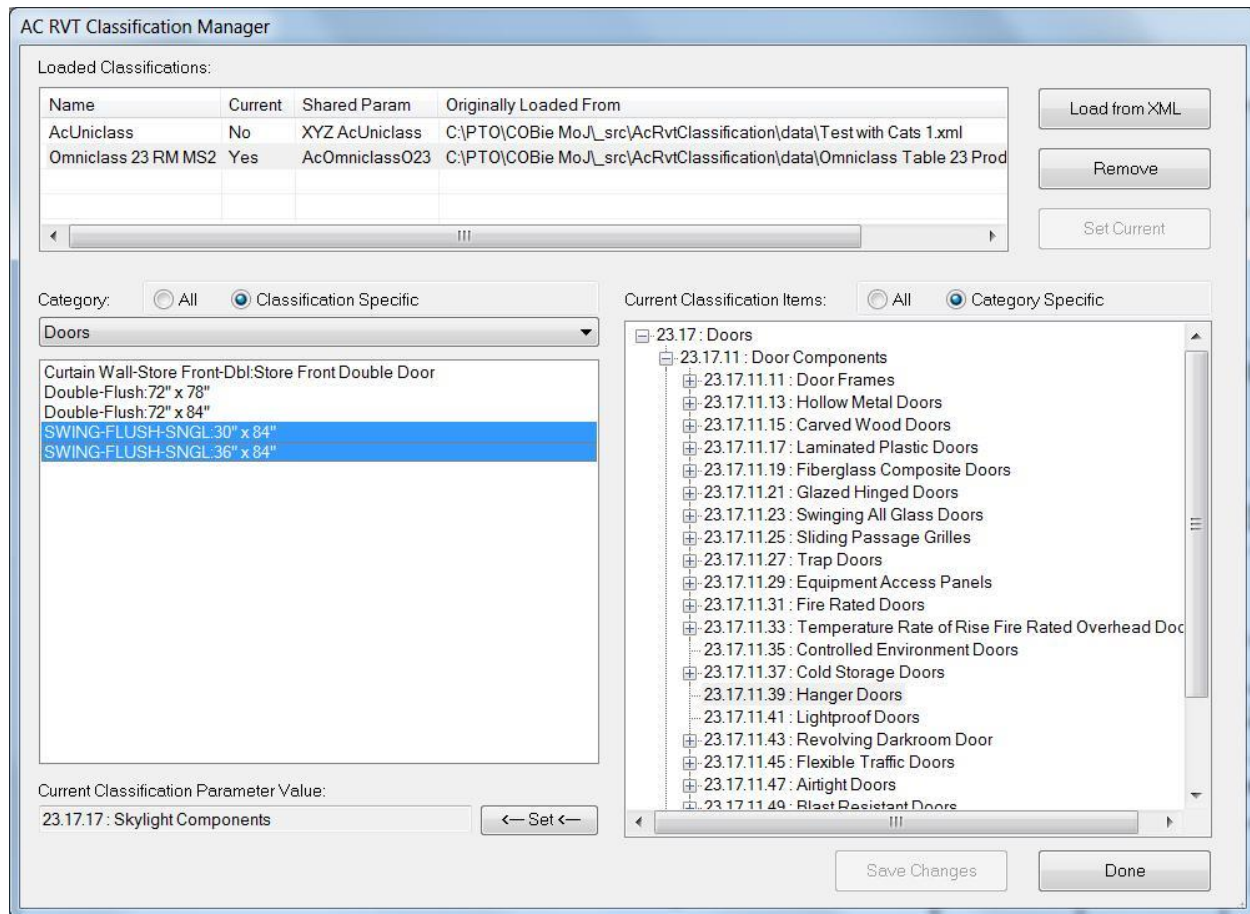
- <http://www.omniclass.org/>
- <http://www.cpic.org.uk/en/uniclass/>

Out-of-the-box Revit includes native Omniclass parameters for all RFAs, but no framework for adding any other classifications. The way that it has been natively implemented has some scope for improvement, mostly in the following areas:

- It can classify only standard (ie RFA) family instances and does not work with system and special family instances like walls, floors, roofs, pipes, ducts and importantly rooms/spaces.
- The naming can get quickly out-of-date based on new classification versions. Editing of the definitions in “” file is not officially supported, terse (categories represented by “magic” ID numbers) and only a single Revit category can be “associated” with each item

The tool developed to address some of these issues therefore uses share parameters to store any number of “AcRvtClassification”-s, each defined in an XML file that can also be re-imported to update definitions if they change later. The parameters are applied on the project (RVT) level, so that all components’ Types (system and standard ones, ie any category that can be used in Type-Binding) can be classified. Special cases include Instance-binding classification parameters for Rooms, MEP Spaces and the very facility via Projec singleton, all fully integrated within each AcRvtClassification XML and corresponding UI.

The parameters are created automatically in background and populated in a single-stop Classification manager UI Dialog via “<- Set <-” button:



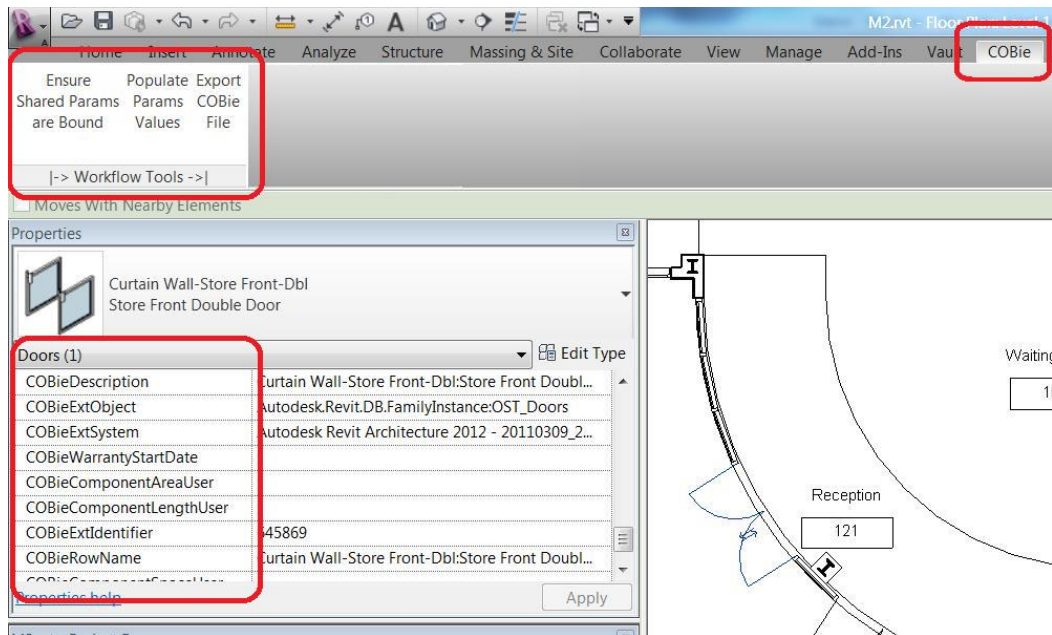
The full User Guide and XML samples are available in the additional class materials ZIP in "AcRvtClassification" subfolder.

For more information on the topic of BIM Classifications, including some usage of the very tool, we recommend FM3222 presentation at AU2012 on Tuesday 27th at 17:30 – "COBie and the Common Language".

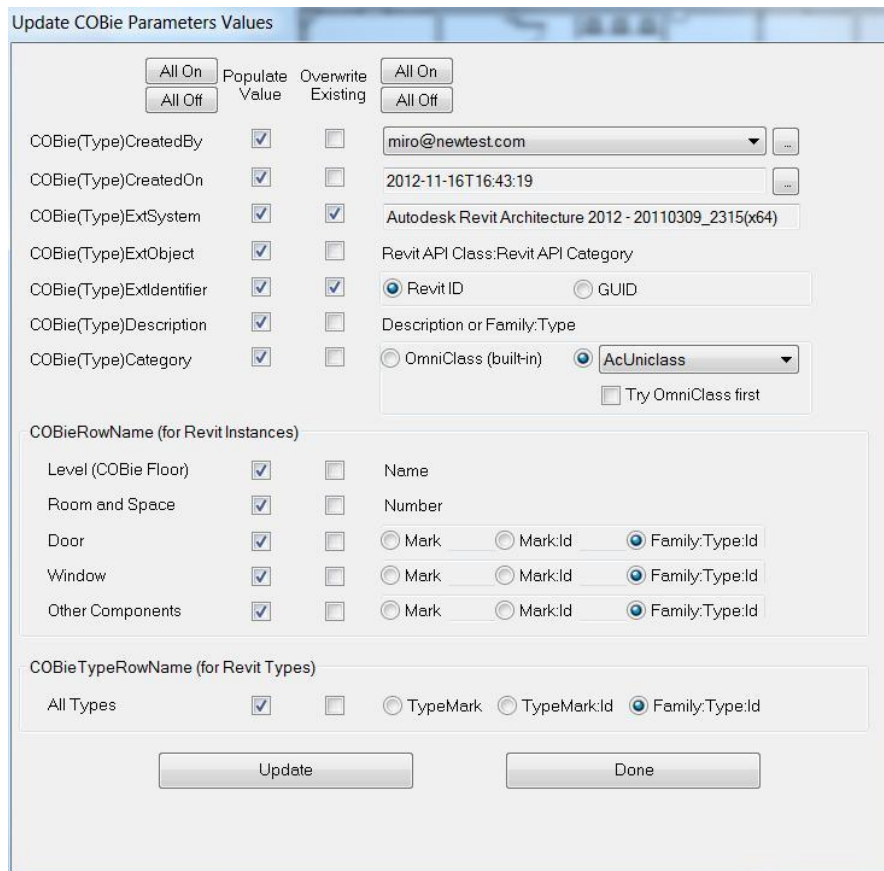
COBie Revit Toolkit

ToDo: add some references for more info

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COBie Ribbon and UI



Command Populate Params Values

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COBie Contacts

Contacts:

- 55@new.com
- aaaaanewcontact@xyz.com
- miro@newtest.com**
- miro2@new.com
- rich@a.com

Contact Details:

Company: Autodesk

Phone: 123-456

Department: Autodesk Consulting

Organization Code: 55987

Given Name: Miroslav

Family Name: Schonauer

Street: Abbey Road

Postal Box: PO Box 123

Town: London

State Region: Bucks

Postal Code: W123

Country: UK

Save Changes Discard Changes

Edit Remove Add: newcontact@xyz.com Done

Contacts (via CreatedBy ellipses button)

COBie Export Options

Template/Initial File:
C:\PTO\COBie\COBie-UK-2012-template.xlsx

SaveAs File:
C:\PTO\COBie\test data\MS Test 5.xlsx

Sheets Units Components/Types Attributes Coordinates Systems Zones Spaces

| | Select All | Select All | Select All | Untick All | Tick All |
|-------------|----------------------------|---------------------------------|--|---|----------|
| Contact: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |
| Facility: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |
| Floor: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |
| Space: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |
| Zone: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |
| Type: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |
| Component: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |
| System: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |
| Attribute: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |
| Coordinate: | <input type="radio"/> Omit | <input type="radio"/> Append to | <input checked="" type="radio"/> Overwrite | <input checked="" type="checkbox"/> Clear explicitly beforehand | |

OK Cancel

Command Export – Main form and Sheets Tab

COBie Export Options

Template/Initial File:
C:\PTO\COBie\COBie-UK-2012-template.xlsx

SaveAs File:
C:\PTO\COBie\test data\MS Test 5.xlsx

Sheets Units Components/Types Attributes Coordinates Systems Zones Spaces

Linear

☐ millimeters

☐ meters

☐ inches

☐ feet

☒ RVT project (feet)

Area

☐ square meters

☐ square kilometers

☐ square feet

☐ square miles

☒ RVT project (squarefeet)

Volume

☐ cubic meters

☐ cubic feet

☒ RVT project (cubicfeet)

Currency

☐ Pounds (GBP)

☒ Dollars (USD)

☐ Euros (EUR)

☐ RVT project (UST_NONE)

NOTE 1: All COBie-compliant units are listed in the options above. When RVT unit is not one of them, it will be disabled.

NOTE 2: Selected units will be recorded in the corresponding Facility columns and conversion applied explicitly to all relevant columns bar Attribute sheet's Value/Units columns - these are optionally settable in Attributes Tab.

OK Cancel

Command Export – Units Tab

COBie Export Options

Template/Initial File:
C:\PTO\COBie\COBie-UK-2012-template.xlsx

SaveAs File:
C:\PTO\COBie\test data\MS Test 5.xlsx

Sheets Units Components/Types Attributes Coordinates Systems Zones Spaces

☐ Pre-selected Components and their Types 0 Components; 0 Types (0 referenced)

☐ Active View Components and their Types 231 Components; 31 Types (31 referenced)

☐ Types with 'COBieTypeSchedule' param On and their Components 4624 Components; 125 Types (101 referenced)

☒ Interactively selected Types and their Components 4625 Components; 126 Types (102 referenced)

☐ All Model Types and Components 4626 Components; 126 Types (103 referenced)

☒ Omit non-referenced Types

NOTE: In all cases, only the Components and Types of relevant COBie Categories are considered.

OK Cancel

Command Export – Components/Types Tab

Per-Category Types Selector

Choose Types-selection option for each COBie Category:

| Name | All | None | Select |
|-----------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Casework | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Ceilings | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Columns | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Curtain Wall Mullions | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Curtain Panels | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Doors | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Ducts | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Duct Fittings | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Duct Insulations | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Duct Linings | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Air Terminals | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Electrical Equipment | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Electrical Fixtures | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Fascias | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Flex Ducts | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Flex Pipes | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Floors | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Furniture | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

☒ Hide Categories with NO Types

Set All Options to 'All'

Set All Options to 'None'

Set All Options to 'Select'

Selected 2 of 3 Category 'Air Terminals' Types will be considered:

- ☒ Exhaust Air Grill:24 x 24 Face 12 x 12 Connection
- ☐ Rectangular Diffuser - Round Connection:24x24 - 8 Neck
- ☒ Return Air Diffuser:24 x 24 Face 12 x 12 Connection

Tick All

Untick All

Cancel

Save Changes and Done

Types Selector

COBie Export Options

Template/Initial File:
C:\PTO\COBie\COBie-UK-2012-template.xlsx

SaveAs File:
C:\PTO\COBie\test data\MS Test 5.xlsx

Sheets Units Components/Types Attributes Coordinates Systems Zones Spaces

Filter Attributes to Export...

Description Column

☐ "n/a"

☐ Name

☒ Revit Param Info
(Display/Value, ReadOnly, IsShared, DefinitionType)

Value for ElementId Params

☒ Element Name Only

☐ Full Element Info
(Id, Category, Name)

Apply Units Conversion to Parameter Types

Linear to:

☒ Length

☒ HVACDuctSize

☒ HVACRoughness

☒ PipeSize

☒ PipingRoughness

☒ ElectricalCableTraySize

☒ ElectricalConduitSize

☒ WireSize

☒ ReinforcementLength

Area to:

☒ Area

Volume to:

☒ Volume

☒ PipingVolume

☒ ReinforcementVolume

NOTE 1: None of Empty/Null Parameters will be output, even if the filter set to True

NOTE 2: All Parameters starting with 'COBie...' (not case sensitive) will be automatically excluded, assumed to have been output to the dedicated columns in other sheets. They will not be available in filter selections either.

OK

Cancel

Command Export – Attributes Tab

Per-Category Attributes Selector

Choose Attributes-selection option for each COBie Category:

| Name | Binding | All | None | Select |
|-----------------------|----------|------|------|--------|
| Casework | Type | True | | |
| Casework | Instance | True | | |
| Ceilings | Type | True | | |
| Ceilings | Instance | True | | |
| Columns | Type | True | | |
| Columns | Instance | True | | |
| Curtain Wall Mullions | Type | True | | |
| Curtain Wall Mullions | Instance | True | | |
| Curtain Panels | Type | True | | |
| Curtain Panels | Instance | True | | |
| Doors | Type | | | True |
| Doors | Instance | True | | |
| Ducts | Type | True | | |
| Ducts | Instance | True | | |
| Duct Fittings | Type | True | | |
| Duct Fittings | Instance | True | | |
| Duct Insulations | Type | True | | |
| Duct Linings | Type | True | | |

☒ Hide Categories with NO Attributes

Set All Options to 'All'

Set All Options to 'None'

Set All Options to 'Select'

Selected 22 of 27 CategoryBinding 'DoorsType' Attributes will be considered:

- ☒ AcOmniclass023ForTypes
- ☒ Assembly Code
- ☒ Assembly Description
- ☒ Construction Type
- ☒ Description
- ☒ Door Material
- ☒ Fire Rating
- ☒ Frame Material
- ☒ Function
- ☒ Glazing Material
- ☒ Height
- ☒ Manufacturer
- ☒ Material
- ☒ Offset
- ☐ OmniClass Number
- ☐ OmniClass Title
- ☐ RevitTypeExternalIDName
- ☐ RevitTypeExtObject
- ☐ RevitTypeExtSystem
- ☒ Single Door Width
- ☒ Thickness
- ☒ Trim Projection Ext
- ☒ Trim Projection Int
- ☒ Trim Width
- ☒ Type Mark

Tick All

Untick All

Cancel

Save Changes and Done

Attributes Selector

COBie Export Options

Template/Initial File:
C:\PTO\COBie\COBie-UK-2012-template.xlsx

SaveAs File:
C:\PTO\COBie\test data\MS Test 5.xlsx

Sheets | Units | Components/Types | **Attributes** | Coordinates | Systems | Zones | Spaces

Components

- ☒ Location Point or Location Line (if it exists for given component instance/category)
- ☒ Bounding Box (for component's 'Fine Detail' 3D solid representation)

Spaces

- ☐ Location Point
- ☒ Bounding Box

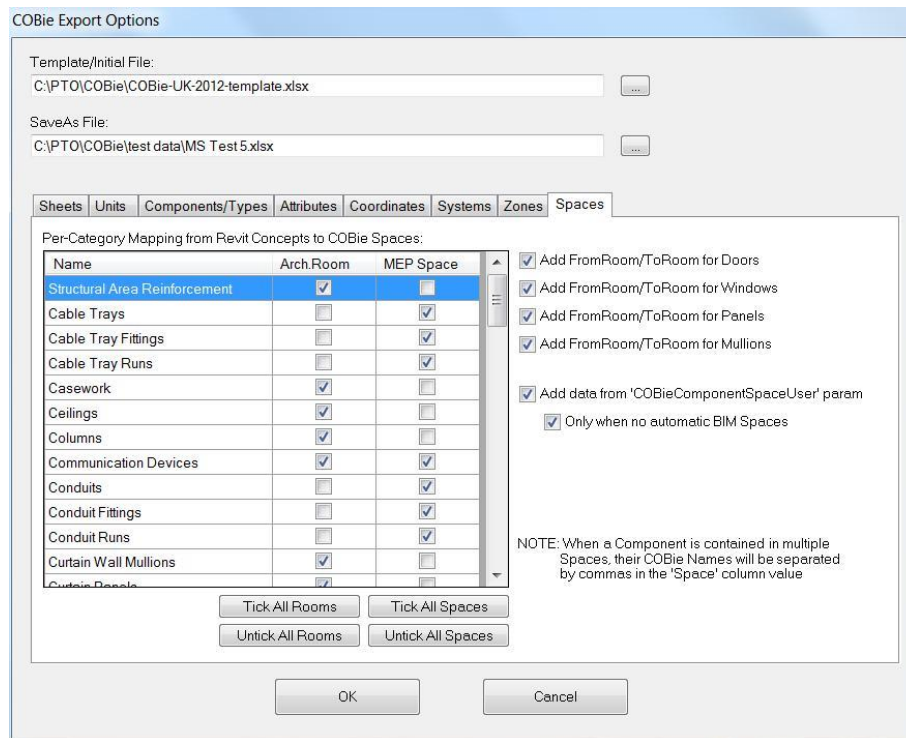
Floors

- ☒ Bounding Box (calculated as envelope of Arch Rooms and MEP Spaces on the given Level. (0, 0, Elevation) if none.)

OK

Cancel

Command Export – Coordinates Tab



Command Export – Spaces Tab

BIM Coordinator Tools for AutoCAD Civil 3D and Revit

ToDo... (will be updated in the Final version just before AU)

Data Transfer Tool for Revit

ToDo... (will be updated in the Final version just before AU)

Revit API Resources

Assuming that you are familiar with .NET programming (typically C# or VB.NET), the best place to start with is the Revit Developer Center: <http://www.autodesk.com/developrevit>. Also very useful:

- The Building Coder, Jeremy Tammik's Revit API Blog: <http://thebuildingcoder.typepad.com>
- Discussion Groups: <http://discussion.autodesk.com> > Revit Architecture > Revit API
- API Training Classes: <http://www.autodesk.com/apitraining> or
- Autodesk Developer Network: <http://www.autodesk.com/joinadn>
- DevHelp Online for ADN members: <http://adn.autodesk.com>

Revit SDK

The SDK is provided with the product:

- From installer under “Install Tools and Utilities”
- Web and download version <extraction folder>\Utilities\SDK\RevitSDK.exe

SDK Installer in Revit 2012 temporary setup files

- C:\Autodesk\Autodesk_Revit_Architecture_2012_ENU_Win_32-64bit\Utilities\SDK\RevitSDK.exe

Latest SDK update is posted to Revit Developer Center

- <http://www.autodesk.com/developrevit>

SDK Documentation

Read once:

- Read Me First.doc
- Getting Started with the Revit API.doc
- Revit Platform API Changes and Additions.doc

Keep at hand always:

- Revit API Developer Guide.pdf
- RevitAPI.chm
 - What's New section is similar to Changes and Additions doc

Read if needed:

- RevitAddInUtility.chm – installer
- Autodesk Icon Guidelines.pdf – user interface
- Revit Server SDK – file access on server
- Revit Structure – section definitions and material properties
- REX SDK – Revit extensions framework

Important utilities:

- Add-In Manager
- RevitLookup

SDK Samples

Documentation:

- Revit 20Xx New Samples.doc
- SamplesReadMe.htm

Utility

- RevitAPIDllsPathUpdater.exe

Main samples solution

- SDKSamples2012.sln + all the code projects