Advanced Revit 2014 API Features and Samples

Jeremy Tammik
Principal Developer Consultant

Class summary

- Grasp the enhancements and new functionality provided by the expanded Revit 2014 API
- Know all the new Revit SDK samples and be able to reuse the sample code provided
- Make use of the new direct access to the Revit graphics pipeline to easily access and export geometry primitives
- Explore and reuse advanced Revit API sample code not found in the standard SDK samples

Key learning objectives

At the end of this class, you will have

- Grasped the enhancements and new functionality provided by the expanded Revit 2014 API
- Knowledge of all the new Revit SDK samples and be able to reuse the sample code provided
- Seen the use of the new direct access to the Revit graphics pipeline to easily access and export geometry primitives
- Understood how to explore and reuse advanced Revit API sample code not found in the standard SDK samples

About the Presenter

Jeremy Tammik
Principal Developer Consultant
Developer Technical Services
EMEA, Autodesk SARL

Jeremy is a member of the AEC workgroup of the Autodesk Developer Network ADN team, providing developer support, training, conference presentations, and blogging on the Revit API.

He joined Autodesk in 1988 as the technology evangelist responsible for European developer support to lecture, consult, and support AutoCAD application developers in Europe, the U.S., Australia, and Africa. He was a co-founder of ADGE, the AutoCAD Developer Group Europe, and a prolific author on AutoCAD application development. He left Autodesk in 1994 to work as an HVAC application developer, and then rejoined the company in 2005.

Jeremy graduated in mathematics and physics in Germany, worked as a teacher and translator, then as a C ++ programmer on early GUI and multitasking projects. He is fluent in six European languages, vegetarian, has four kids, plays the flute, likes reading, travelling, theatre improvisation, yoga, carpentry, loves mountains, oceans, sports, dancing, and especially climbing.

Agenda

- Revit 2014 API news
- New SDK samples
- Additional highlights

Revit 2014 API News

Revit 2014 API News

- Structural Analysis SDK
- Copy and paste API – within or between documents, incl. view specific elements
- Project browser API – commands, macros, selected elements
- Schedule API – formatting, read-write access to data items
- Command API – launch macros, add-in and built-in commands
- Displaced elements API – exploded views
- Join geometry API – create, remove and control joins
- FreeForm element API – modification of imported solids
- Site API – editing of topography surface points and sub-regions
- Add-in API – mid-session loading and execution
- Macro API – list, create, delete and execute
- MEP calculations in external services
- Direct API access to rendering pipeline

Revit 2014 API News Sources

- What's New
  - Full details of all enhancements in the SDK help file RevitAPI.chm
    http://thebuildingcoder.typepad.com/blog/2013/04/whats-new-in-the-revit-2014-api.html
- More information and recorded sample presentations
  - DevDays presentation, recording and sample code
    http://thebuildingcoder.typepad.com/blog/2013/03/revit-2014-api-and-room-plan-view-boundary-polygon-loops.html#2
- The Revit SDK

Structural Analysis Software Development Toolkit

- Code checking framework
  - Facilitate code checking workflows
  - For both users and developers
  - Complete extensible add-in
  - User interface, report generator, data storage
  - Documentation, samples, Visual Studio templates
- Results builder framework
  - Store and access results data in Revit
  - High-level API for consumption, exchange, remote providers

    http://thebuildingcoder.typepad.com/blog/2013/06/structural-analytical-code-checking-and-results-builder.html

Structural Code Checking Sample Applications

- ExtensibleStorageUI and ExtensibleStorageDocumentation
  - Exercise ExtensibleStorage user interface and reporting
- CodeCheckingConcreteExample
  - Concrete code checking application with step-by-step document
- ConcreteCalculationsExample
  - Concrete calculations component for cases listed in calculation manual
- SectionPropertiesExplorer
  - Demonstrate use of the engineering component
- StoringResults and QueryingResults
  - Store and query structural analysis results BIM using results builder

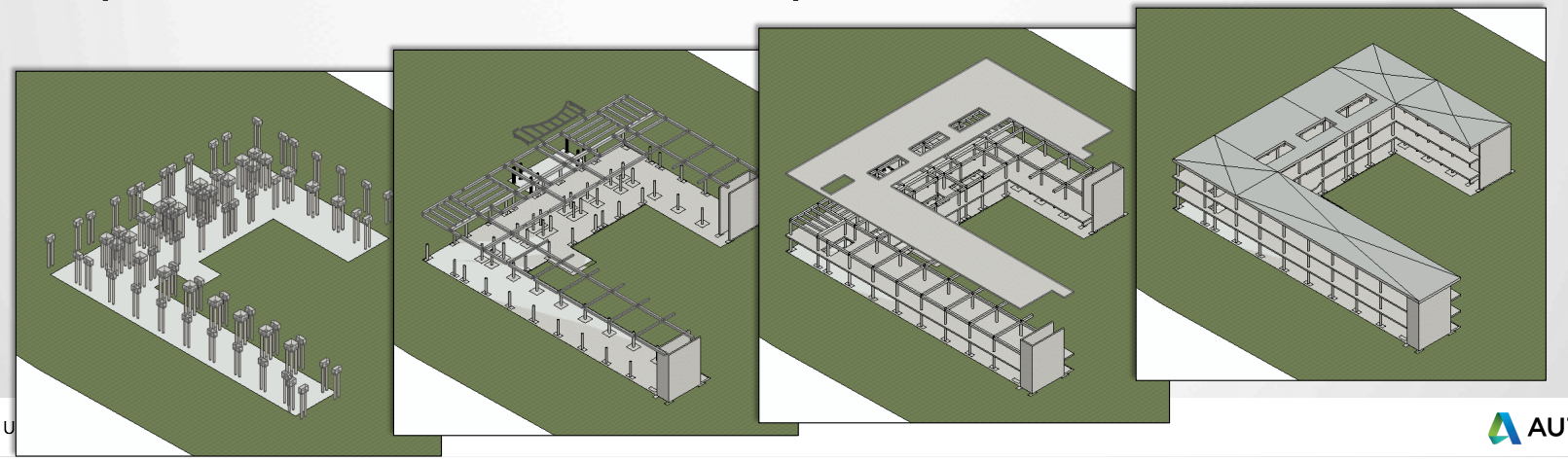
New SDK Samples

New SDK Samples

- DisplacementElementAnimation
- DockableDialogs
- DuplicateViews
- ExtensibleStorageUtility
- FreeFormElement
- PostCommandWorkflow
- ScheduleAutomaticFormatter
- ScheduleToHTML
- SinePlotter
- Site
- Units
- WinderStairs

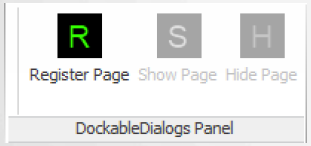
DisplacementElementAnimation

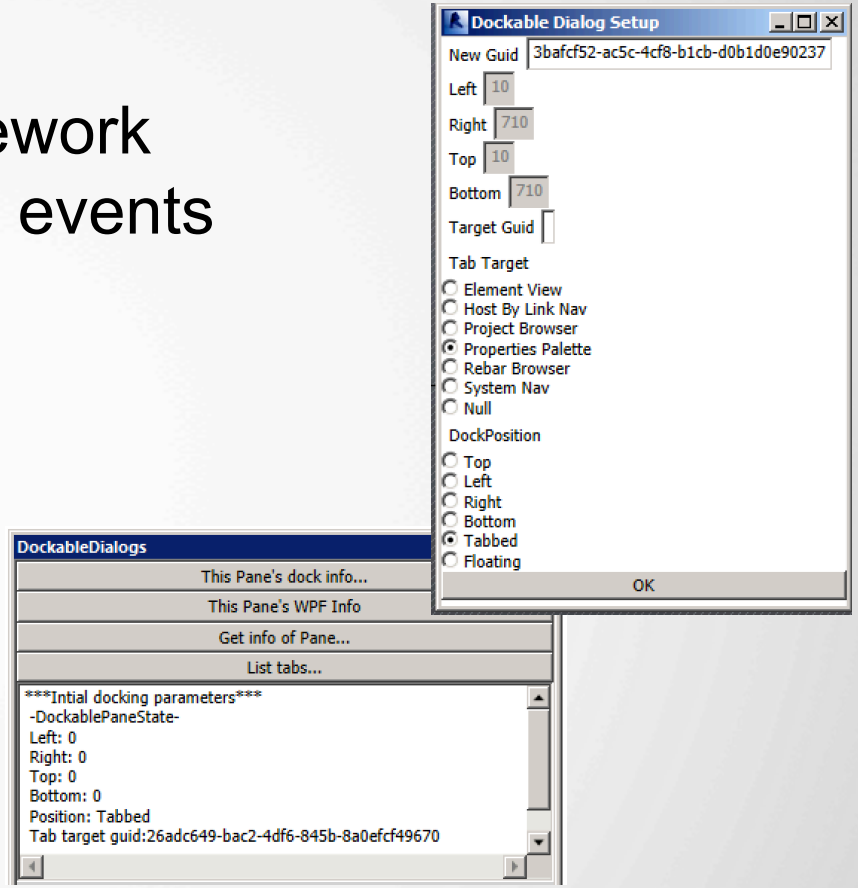
- Programmatically drive element displacement
- Animated exploded view using Idling event
- Sort members into groups based on category and level
- Displace from actual position at command begin
- Animate group by group back to original position
- DisplacementElement and DisplacementPath



DockableDialogs

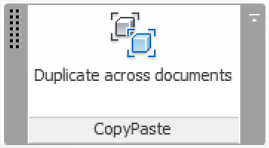
- Dockable panel UI API framework
- External app driving external events
- Modeless dialogue design
- Simpler samples on blog
- Revit Ruby Shell sample
- Zero document issue fixed





DuplicateViews

- Use the copy and paste API
- Copy drafting views and schedules to new document
- Drafting view contents are also copied
- Numerous other uses for this important API

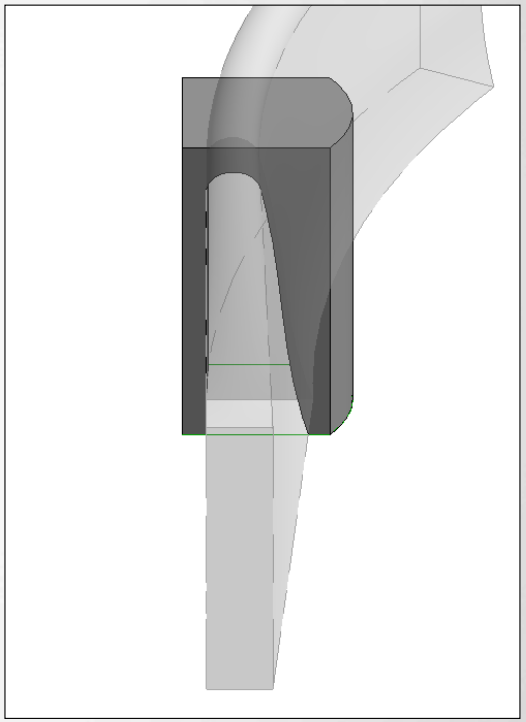


ExtensibleStorageUtility

- Element.GetEntitySchemaGuids
  - Return schema GUIDs of entities present on element
- ExtensibleStorageFilter
  - Quick filter retrieving all elements with a given schema GUID
- Schema GetField and ListFields
  - Honour access restricted by schema read permission setting
- ExtensibleStorageUtility SDK sample
  - Query whether storage for given schema exists in doc
  - Retrieve elements
  - Delete

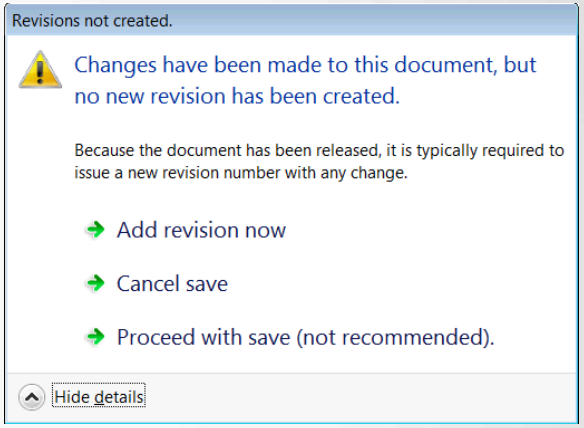
FreeFormElement

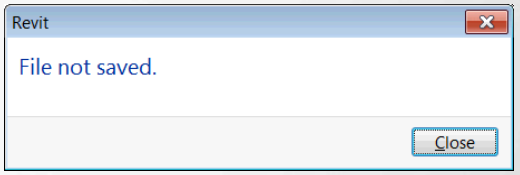
- FreeFormElement enables parametrisation of non-parametric imported geometry
- Create a new family representing a negative of a selected non-parametric element
- Select target solid element template and closed loop of curves
- Create a generic model family
- Create a FreeFormElement extrusion
- Subtract target solid from extrusion
- Load family into project
- Place an instance aligned with curves



PostCommandWorkflow

- Demonstrate custom workflow after command execution
- Handle DocumentSaving event
- Modify save behaviour based on number of revision elements
- Implement complex workflows with custom events
- Custom event type implements IExternalEventHandler
- Determine id key from journal
- Custom add-in ribbon command





ScheduleAutomaticFormatter

- Colour format alternating columns of a schedule table
- Format columns of active schedule in alternating colors
- Store formatting data in extensible storage
- Use dynamic updater to auto-reformat columns
- TableCellStyle and TableCellStyleOverrideOptions

<Door Schedule>

A	B	C	D	E	F	G
Door #	Size		Hardware Group	Frame		Comments
	Width	Height		Type	Material	
101A	6' - 8"	7' - 0"	3	1	Alum.	
101B	6' - 8"	7' - 0"	3	1	Alum.	
101C	6' - 8"	7' - 0"	3	1	Alum.	
101D	6' - 8"	7' - 0"	3	1	Alum.	
102	5' - 8"	7' - 0"	1	3	Wood	
103	3' - 0"	7' - 0"	(none)	3	Wood	
104A	3' - 0"	7' - 0"	(none)	3	Wood	
104B	3' - 0"	7' - 0"	(none)	3	Wood	
105A	3' - 0"	7' - 0"	(none)	3	Wood	
105B	3' - 0"	7' - 0"	(none)	3	Wood	
106A	3' - 0"	7' - 0"	(none)	3	Wood	
106B	3' - 0"	7' - 0"	(none)	3	Wood	

<Door Schedule>

A	B	C	D	E	F	G
Door #	Size		Hardware Group	Frame		Comments
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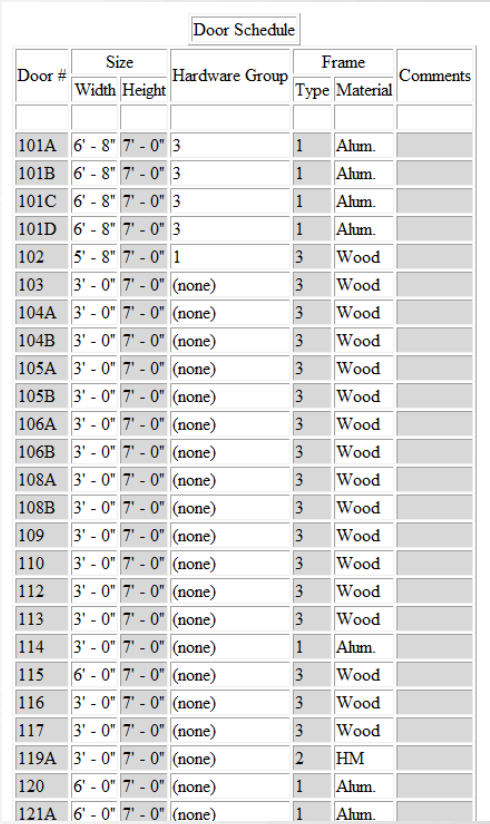
102	5' - 8"	7' - 0"	1	3	Wood	
103	3' - 0"	7' - 0"	(none)	3	Wood	
104A	3' - 0"	7' - 0"	(none)	3	Wood	
104B	3' - 0"	7' - 0"	(none)	3	Wood	
105A	3' - 0"	7' - 0"	(none)	3	Wood	
105B	3' - 0"	7' - 0"	(none)	3	Wood	
106A	3' - 0"	7' - 0"	(none)	3	Wood	
106B	3' - 0"	7' - 0"	(none)	3	Wood	

ScheduleToHTML

- Export and display schedule in formatted HTML
- Handle header, body, background color, bold, italic, underline, horizontal alignment, merged cells
- Exercise ViewSchedule, TableData, TableSectionData, TableCellStyle and TableMergedCell classes

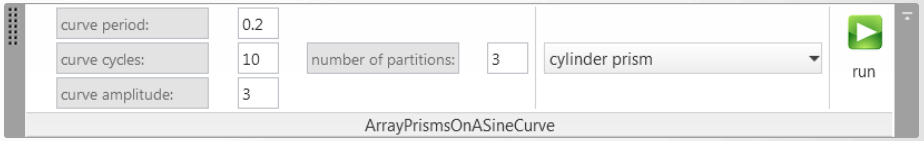


Door Schedule

Door #	Size		Hardware Group	Frame		Comments
	Width	Height		Type	Material	
101A	6' - 8"	7' - 0"	3	1	Alum.	
101B	6' - 8"	7' - 0"	3	1	Alum.	
101C	6' - 8"	7' - 0"	3	1	Alum.	
101D	6' - 8"	7' - 0"	3	1	Alum.	
102	5' - 8"	7' - 0"	1	3	Wood	
103	3' - 0"	7' - 0"	(none)	3	Wood	
104A	3' - 0"	7' - 0"	(none)	3	Wood	
104B	3' - 0"	7' - 0"	(none)	3	Wood	
105A	3' - 0"	7' - 0"	(none)	3	Wood	
105B	3' - 0"	7' - 0"	(none)	3	Wood	
106A	3' - 0"	7' - 0"	(none)	3	Wood	
106B	3' - 0"	7' - 0"	(none)	3	Wood	
108A	3' - 0"	7' - 0"	(none)	3	Wood	
108B	3' - 0"	7' - 0"	(none)	3	Wood	
109	3' - 0"	7' - 0"	(none)	3	Wood	
110	3' - 0"	7' - 0"	(none)	3	Wood	
112	3' - 0"	7' - 0"	(none)	3	Wood	
113	3' - 0"	7' - 0"	(none)	3	Wood	
114	3' - 0"	7' - 0"	(none)	1	Alum.	
115	6' - 0"	7' - 0"	(none)	3	Wood	
116	3' - 0"	7' - 0"	(none)	3	Wood	
117	3' - 0"	7' - 0"	(none)	3	Wood	
119A	3' - 0"	7' - 0"	(none)	2	HM	
120	6' - 0"	7' - 0"	(none)	1	Alum.	
121A	6' - 0"	7' - 0"	(none)	1	Alum.	

SinePlotter

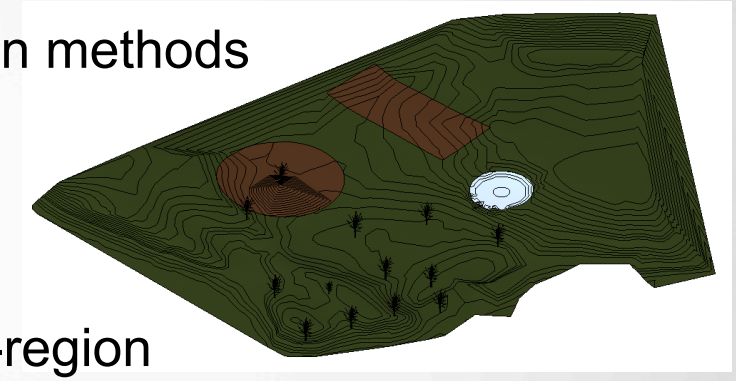
- Demonstrate ribbon widgets
- Sine curve representation
  - Array of prism family instances
- Prism family types
  - Cylinder, Rectangular, Regular Polygon, Isotriangle
- Modifiable settings
  - Curve Period: 0.1 to 3.0
  - Curve Cycles: > 0.0
  - Curve Amplitude: -4.0 to 4.0
  - Number of partitions: > 0.0



- Note: Hit “Enter” key for text box edits to be accepted

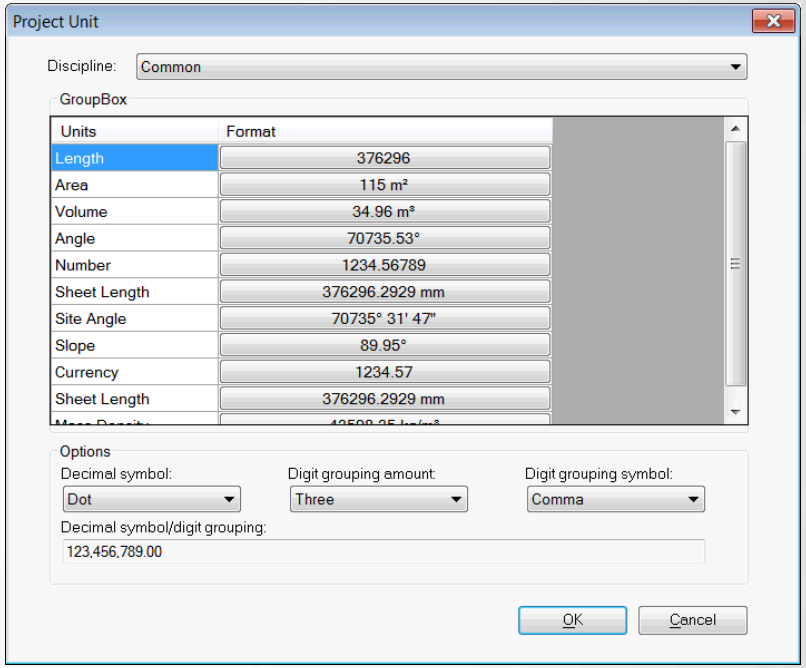
Site

- New API functionality
  - TopographyEditScope class
  - TopographySurface point manipulation methods
  - SiteSubRegion proxy class
  - BuildingPad class
- Circular retaining pond sample
  - Edit topography surface and site sub-region
  - Create topography family at user specified location
  - Move sub-region and points, raise and lower terrain
  - Normalize sub-region terrain
  - Delete sub-region and its points



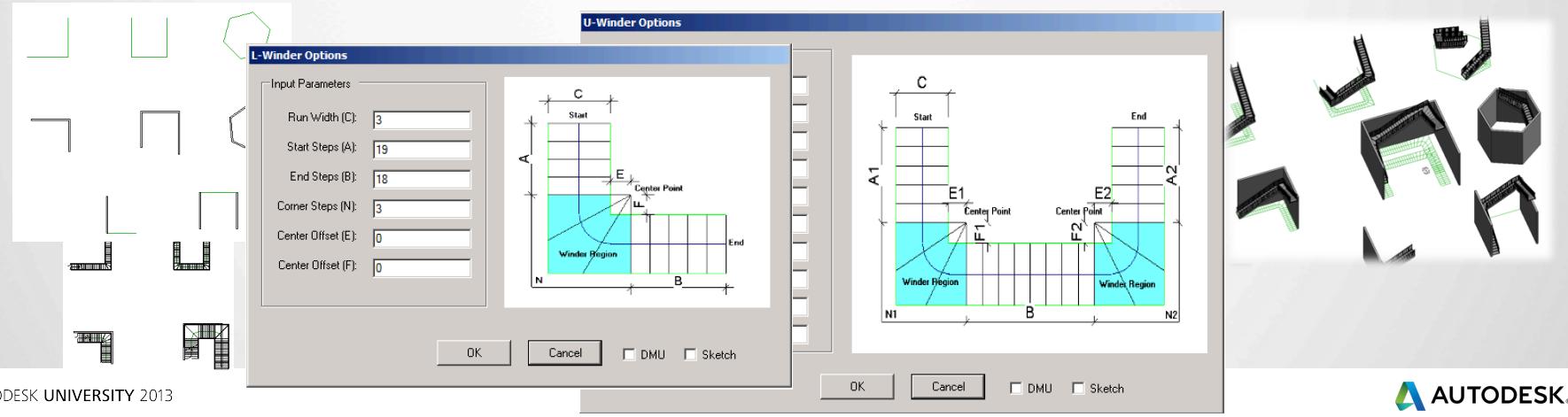
Units

- Unit API renovation
- List units in current project
- Display format information
- Modify format options for each unit type



WinderStairs

- Revit 2013 new stair element expanded
- Create winder stairs via sketched stairs API
  - Support L-Winder and U-Winder layout algorithms
  - Use DMU (dynamic model update) for regeneration
  - Select model lines or walls, specify run numbers, width



External MEP Calculations

User MEP Calculation Sample

- External services framework introduced in Revit 2013
- Revit MEP 2014 uses external services itself
- Implementations in product sub-folder

  C:\Program Files\Autodesk\Revit 2014\AddIns\MEPCalculation
- Sample code on The Building Coder

  http://thebuildingcoder.typepad.com/blog/2013/07/user-mep-calculation-sample.html

Access to Graphics Rendering Pipeline

CustomExporter

- Implement IExportContext interface
- Instantiate CustomExporter from doc and context
- Call Export method

CustomExporterXml

- Export all accessible rendering pipeline data to XML

CustomExporterCollada

- Export model geometry to Collada – www.collada.org

CustomExporterObj

- Export to OBJ file format
- Work in progress...

Learning More

Revit Developer Center: DevTV and My First Plugin Introductions, SDK, API Help, Samples

http://www.autodesk.com/developrevit

Developer Guide and Online Help

http://www.autodesk.com/revitapi-wikihelp

Revit API Trainings, Webcasts and Archives

http://www.autodesk.com/apitraining > Revit API

Discussion Group

http://discussion.autodesk.com > Revit Architecture > Revit API

API Training Classes

http://www.autodesk.com/apitraining

ADN AEC DevBlog

http://adndevblog.typepad.com/aec

The Building Coder, Jeremy Tammik's Revit API Blog

http://thebuildingcoder.typepad.com

ADN, The Autodesk Developer Network

http://www.autodesk.com/joinadn and http://www.autodesk.com/adnopen

DevHelp Online for ADN members

http://adn.autodesk.com

The End is just the Beginning...