



Autodesk Revit 2015 API News

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About the Presenter

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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

- Product Themes
- Application Porting
- Features + API

Revit 2015 Themes

Construction

Modeling and detailing solutions for construction and fabrication

Analysis + Simulation

Predicting building performance and behavior

Scalability

Supporting projects and teams of any size and complexity

Interoperability

Leveraging the Autodesk portfolio and industry standards

Productivity

Providing increased value for existing customers

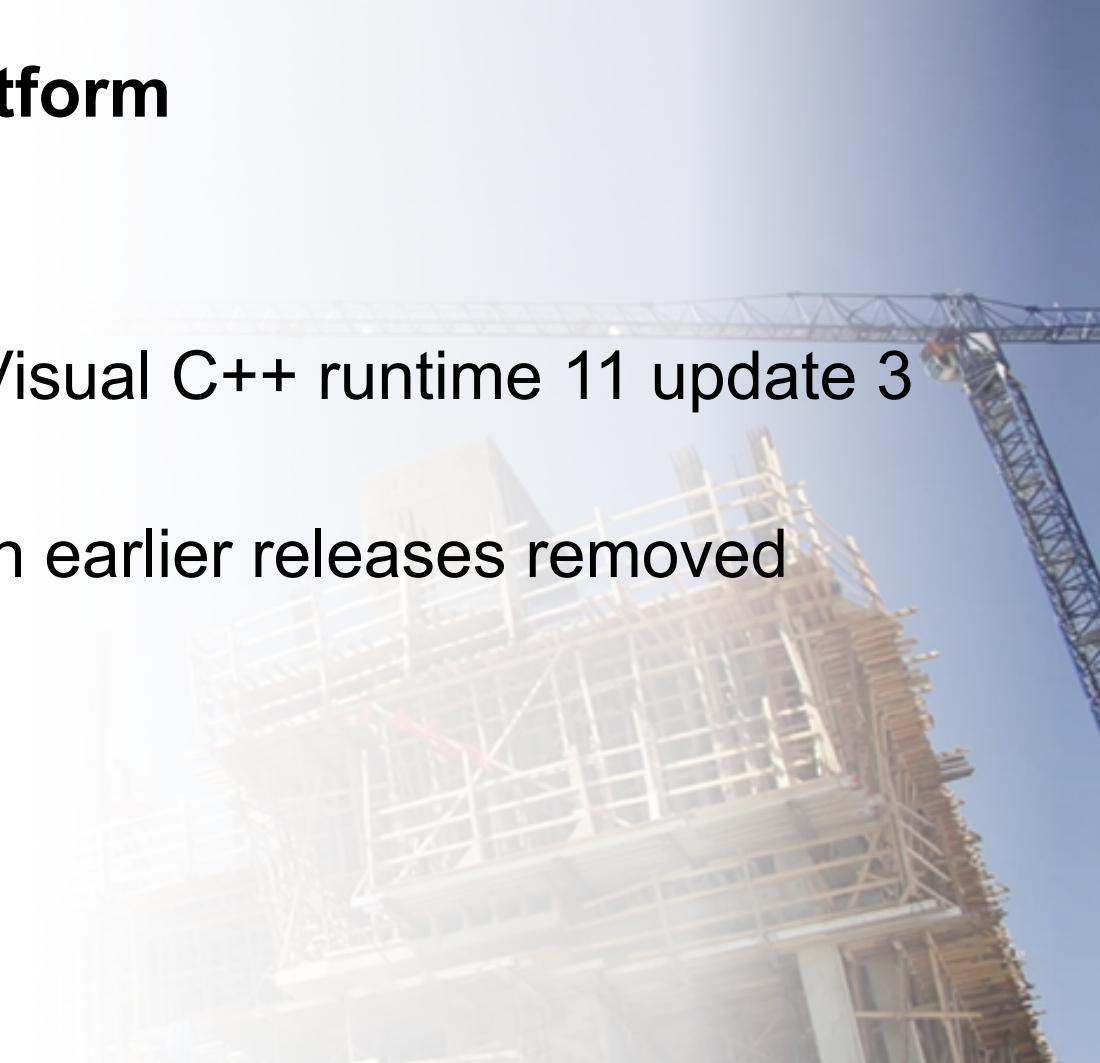
Application Porting

Steps required to support the next release



Application Porting | Platform

- **.NET 4.5**
 - Native runtimes: Visual C++ runtime 11 update 3
- APIs marked obsolete in earlier releases removed



Application Porting | Units

A small API set introduced in Revit 2014 is obsolete

Replacements existed in Revit 2014 and should be used from now on

Obsolete member	Replacement
ValueParsingOptions.FormatOptions	ValueParsingOptions.GetFormatOptions()
Units.SetDigitalSymbolAndGrouping()	Units.DecimalSymbol, Units.DigitGroupingSymbol, Units.DigitGroupingAmount (setters)
Units.IsValidDigitalSymbolAndGrouping()	All combinations are now valid
Units.GetDisplayUnitType()	Units.GetFormatOptions(UnitType.UT_Length).DisplayUnits
UnitFormatUtils.FormatValueToString()	UnitFormatUtils.Format()
FormatValueOptions.IsFormatOptionsValidForUnitType()	FormatOptions.IsValidForUnitType()
FormatUtils.Format()	UnitFormatUtils.Format()
FormatOptions.UseGrouping	FormatOptions.UseDigitGrouping
FormatOptions.HasRounding()	All display units have accuracy values
FormatOptions.GetRounding()	FormatOptions.Accuracy
FormatOptions.GetName()	UnitUtils.GetTypeCatalogString()
FormatOptions(UnitSymbolType, DisplayUnitType) (constructor)	FormatOptions (DisplayUnitType, UnitSymbolType)
DigitGroupingSymbol.Tick (enum value)	DigitGroupingSymbol.Apostrophe

Application Porting | Parameters

Obsolete

- `Element.Parameter[String]`

Replaced by

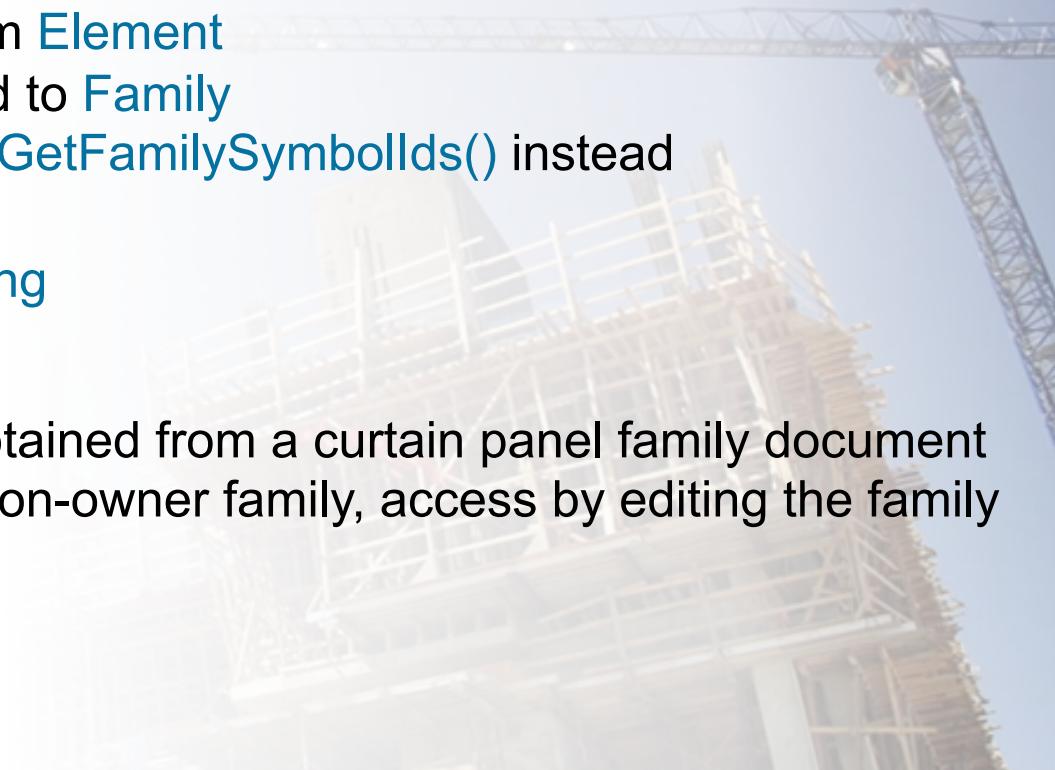
- `Element.GetParameters(String)`
 - Returns all parameters matching the input name
- `Element.LookupParameter(String)`
 - Returns the first matching parameter with the input name
- `Element.Parameters`
 - Includes Schedule and Tags parameters as well as Properties Palette ones
- `Element.GetOrderedParameters()` returns parameters in the Properties Palette

Application Porting | Settings

- Settings class are now Elements
- Limited Element functionality
 - Checkout via id
 - Add ExtensibleStorage
 - FilteredElementCollector now returns:
 - DefaultDivideSettings
 - StructuralSettings
 - ElectricalSetting
 - DuctSettings
 - DuctSizeSettings
 - PipeSettings
 - ReinforcementSettings
 - WorksetDefaultVisibilitySettings
 - RevisionSettings
 - ConceptualSurfaceType
 - EnergyDataSettings
 - StartingViewSettings
 - AreaVolumeSettings

Application Porting | Families

- FamilyBase class **removed**
 - Family now inherits directly from Element
 - Members of FamilyBase moved to Family
 - Family.Symbols obsolete | use GetFamilySymbolIds() instead
- Family.CurtainPanelHorizontalSpacing
- Family.CurtainPanelVerticalSpacing
 - Accessed from owner family obtained from a curtain panel family document
 - If previously accessed from a non-owner family, access by editing the family



Application Porting | Selection

Obsolete

- SelElementSet class
- Selection.Elements

Replaced by

- Selection.[SetElementIds\(ICollection<ElementId> ids\)](#)
 - Set Selected Elements in the active document.



Application Porting | Worksharing

Obsolete

- `WorksetConfiguration.CloseAll()`
- `WorksetConfiguration.OpenLastViewed()`
- `SynchronizeWithCentralOptions.CompactCentralFile` (duplicated `SWCO.Compact`)

Replaced by

`WorksetConfiguration` constructor accepting options for:

- `WorksetConfigurationOption.OpenAllWorksets`
- `WorksetConfigurationOption.CloseAllWorksets`
- `WorksetConfigurationOption.OpenLastViewed`



Application Porting | Reinforcement

Obsolete

- `AreaReinforcement.GetCurveElementIds()`
- `FabricArea.GetCurveElementIds()`

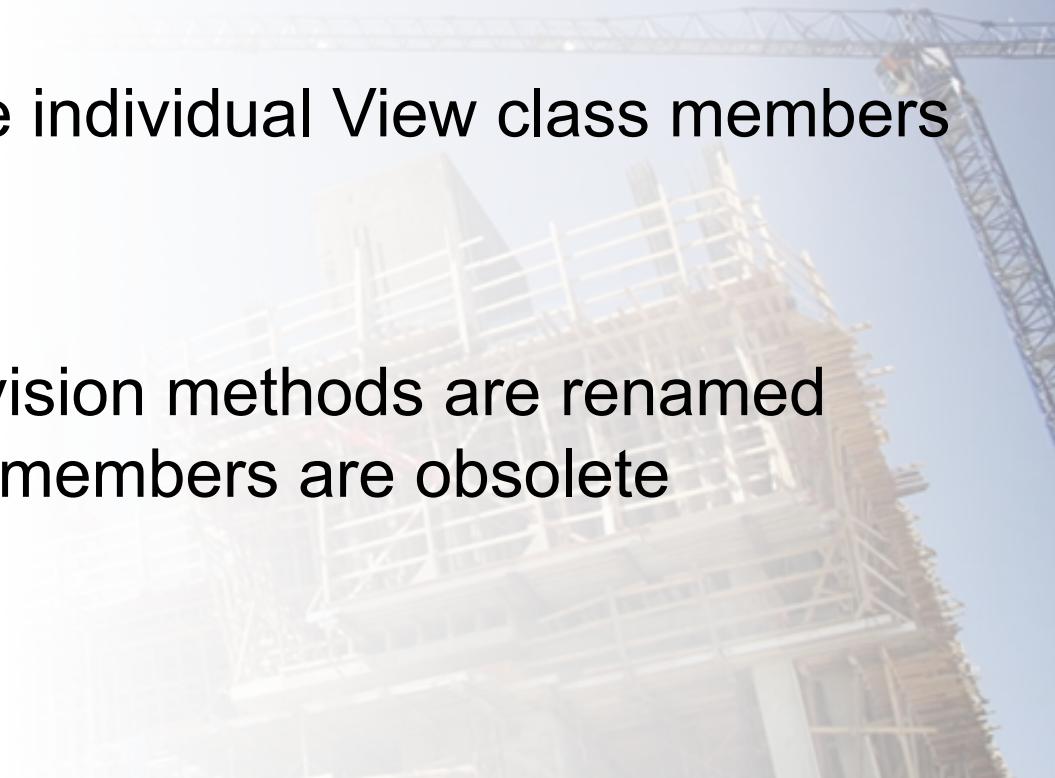
Replaced by

- `GetBoundaryCurvelds()`



Application Porting | Views

- **ViewDisplayModel**
 - Display settings replace individual View class members
- **ViewSheet**
 - Several ViewSheet Revision methods are renamed
 - Corresponding original members are obsolete



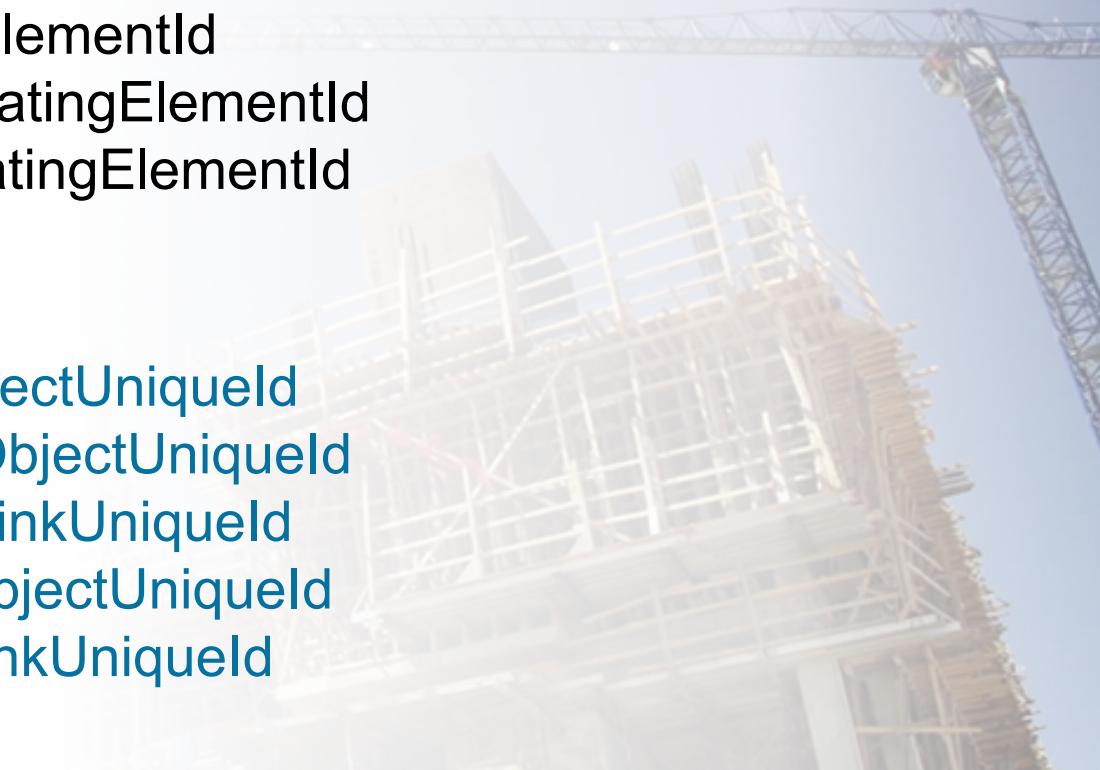
Application Porting | Energy Model

Obsolete

- EnergyAnalysisSpace.SpatialElementId
- EnergyAnalysisOpening.OriginatingElementId
- EnergyAnalysisSurface.OriginatingElementId

Replaced by

- EnergyAnalysisSpace.CADObjectUniqueId
- EnergyAnalysisOpening.CADObjectUniqueId
- EnergyAnalysisOpening.CADLinkUniqueId
- EnergyAnalysisSurface.CADObjectUniqueId
- EnergyAnalysisSurface.CADLinkUniqueId



Application Porting | Other

Namespace changes

- BoundaryCondition
 - Autodesk.Revit.DB to Autodesk.Revit.DB.Structure
- ExtensibleStorageFilter
 - Autodesk.Revit.DB to Autodesk.Revit.DB.ExtensibleStorage
- Parameter changes
 - BuiltInCategory.OST_MassWindow renamed to OST_MassGlazing



Application Porting | Other

- **ElementIntersectsElementFilter**
 - Filter no longer passes target element
- **MeshTriangle**
 - No longer inherits from **APIObject**
- **CurtainGridLine.Move()** obsolete
 - Use **ElementTransformUtils.MoveElement**
- **TableSectionData.InsertColumn (int index, bool bCreateCellData)**
 - Replaced by **TableSectionData.InsertColumn (int index)**
- **Wire API**
 - **NewWire** obsolete and replaced by **Wire.Create**



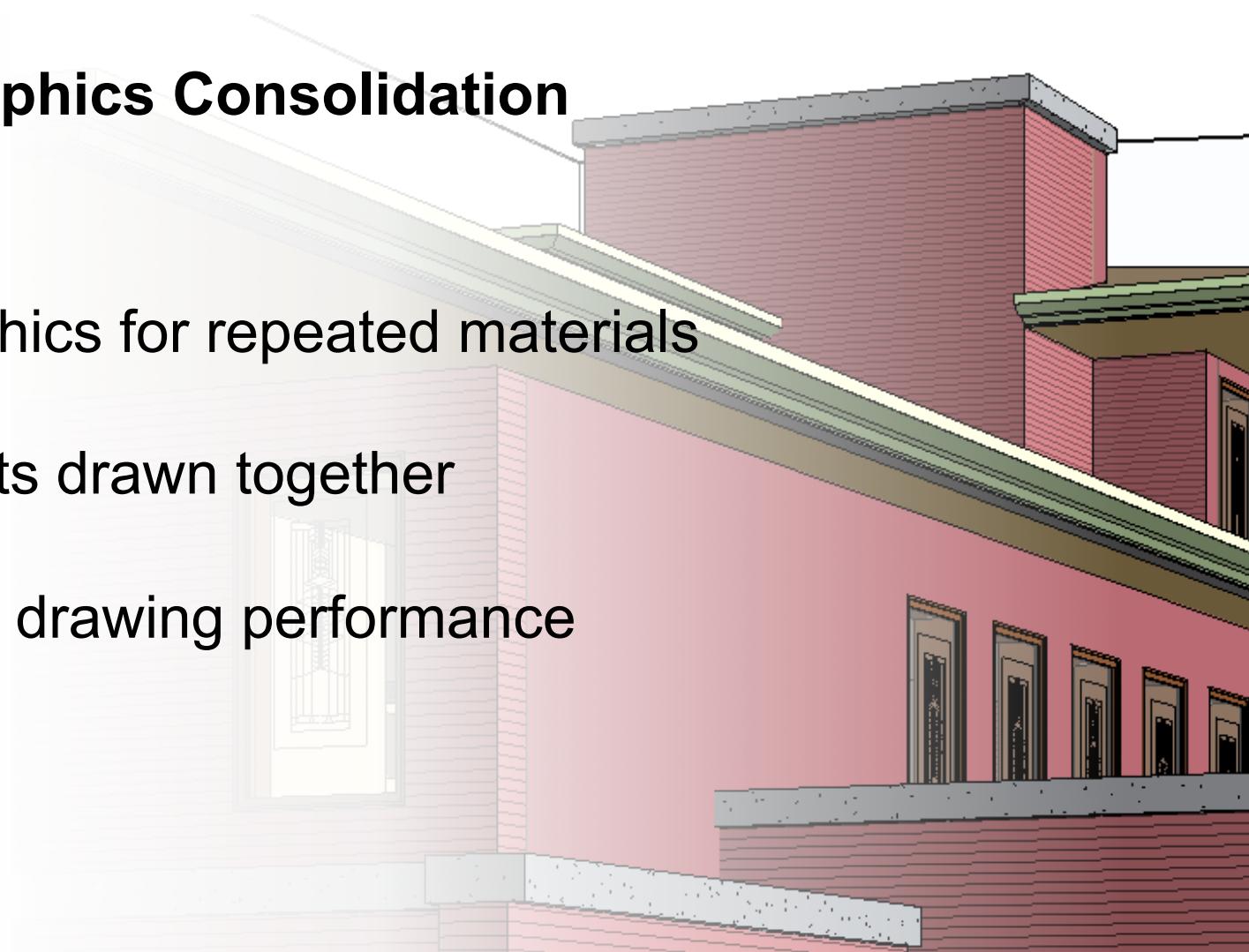
Features + API

Opportunities for new automation and customization

Potential for improvements to existing add-ins

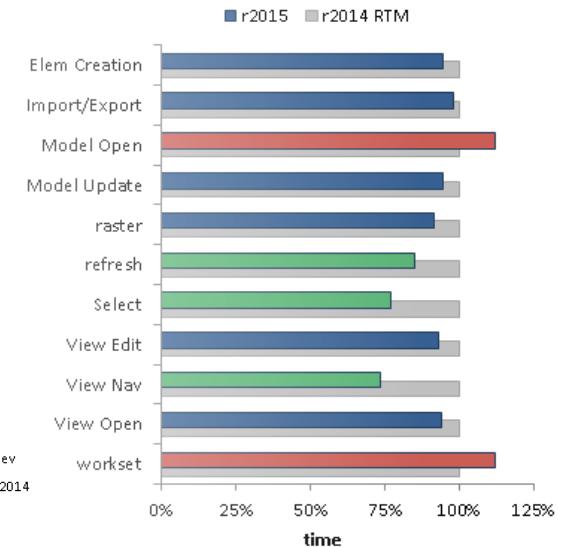
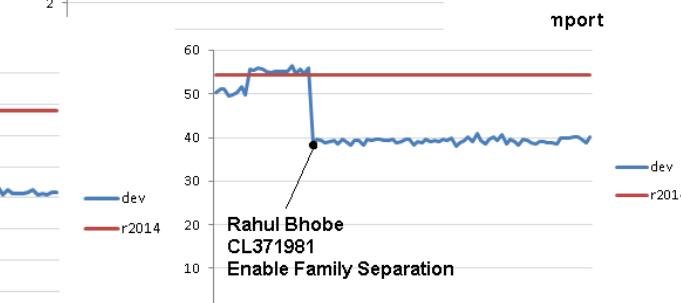
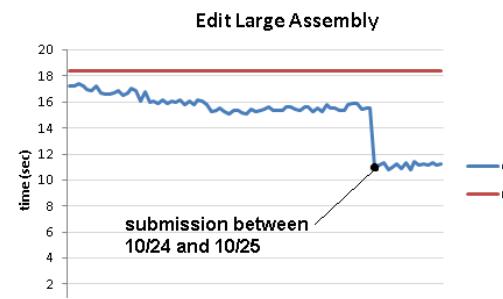
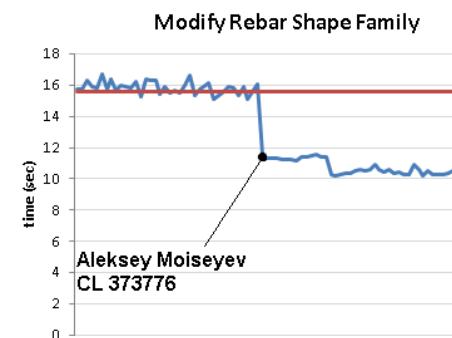
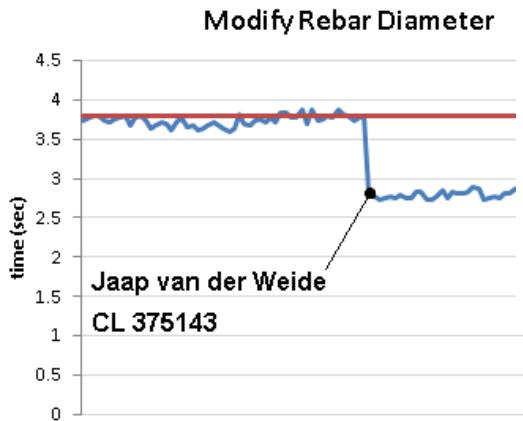
Scalability | Graphics Consolidation

- Optimized graphics for repeated materials
- Similar Elements drawn together
- Increased View drawing performance



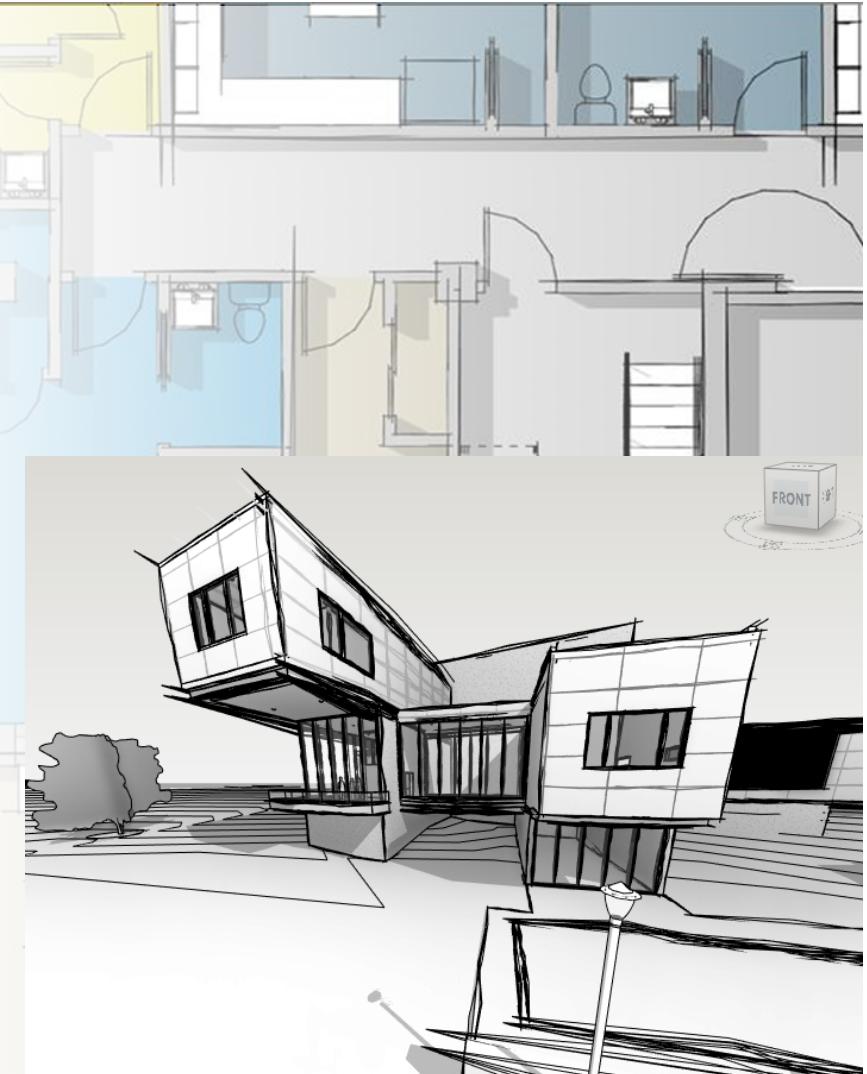
Scalability | Performance Improvements

- Optimized family handling in memory
- Improved geometry handling
- Regeneration optimizations

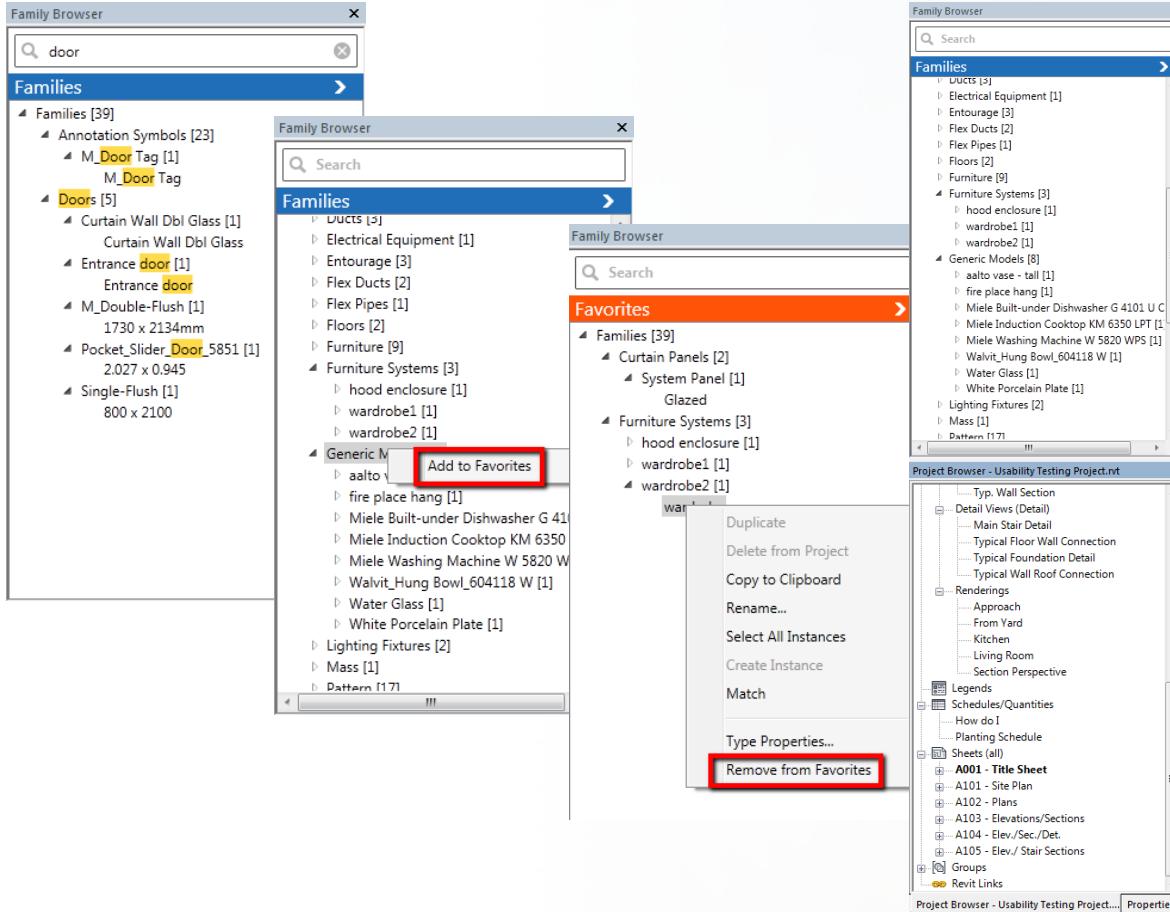


Productivity | Sketchy Lines

- New visualizations in standard Views
- Modify Sketchy Lines visibility in Views
 - `View.GetSketchyLines()`
 - `View.SetSketchyLines()`
- `1_sketchy_lines.mp4`

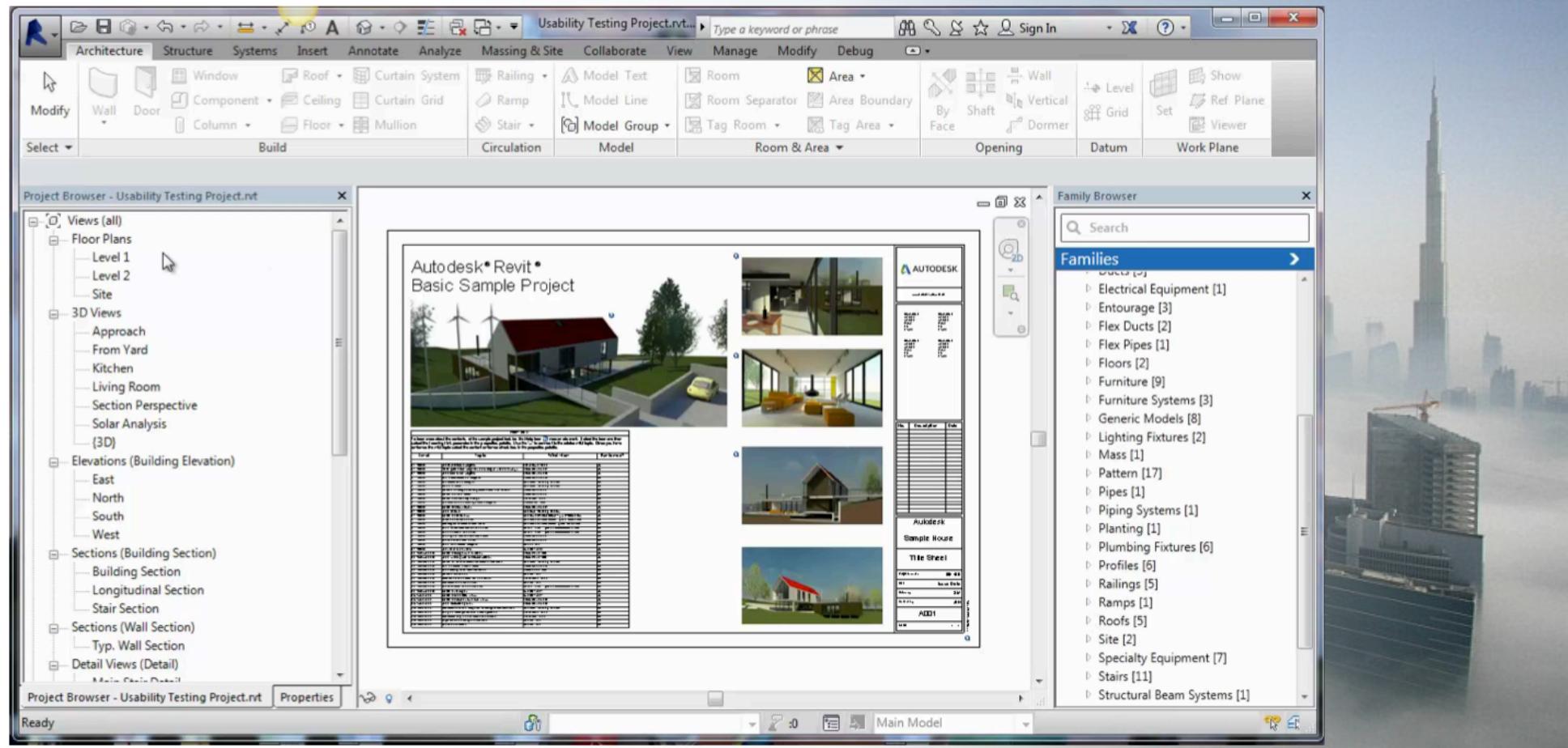


Productivity | Family Browser



- Dockable Family Browser
- Intelligent Search
- Favorites Management
- Sub-item quantity display

Productivity | Family Browser



Productivity | Family Browser View Interaction

- **UIDocument.ActiveGraphicalView**
 - Returns the active *graphical* View of the active Document canvas
 - Excludes Project Browser, System Browser, and similar Views
- **UIDocument.RequestViewChange()**
 - Request to change the active View
 - Executes on return from API context
 - Works from **Idling** and **ExternalEvent**

Productivity | Family Browser Prompts

- `UIDocument.PostRequestForElementTypePlacement()`
 - Request the user to place instances of the specified `ElementType`
 - Executes on return from API context
- `UIDocument.PromptToPlaceViewOnSheet()`
- `UIDocument.PromptToPlaceElementTypeOnLegendView()`
- `UIDocument.PromptToMatchElementType()`

Productivity | Family Browser Drag + Drop

- **IControllableDropHandler**
 - Inherits from IDropHandler.
 - Includes an extra interface executed when custom data is dragged and dropped into the Revit UI
 - Validates the drop event for the specified View
- **IControllableDropHandler.CanExecute()**
 - Implement to validate the drop event for the specified View

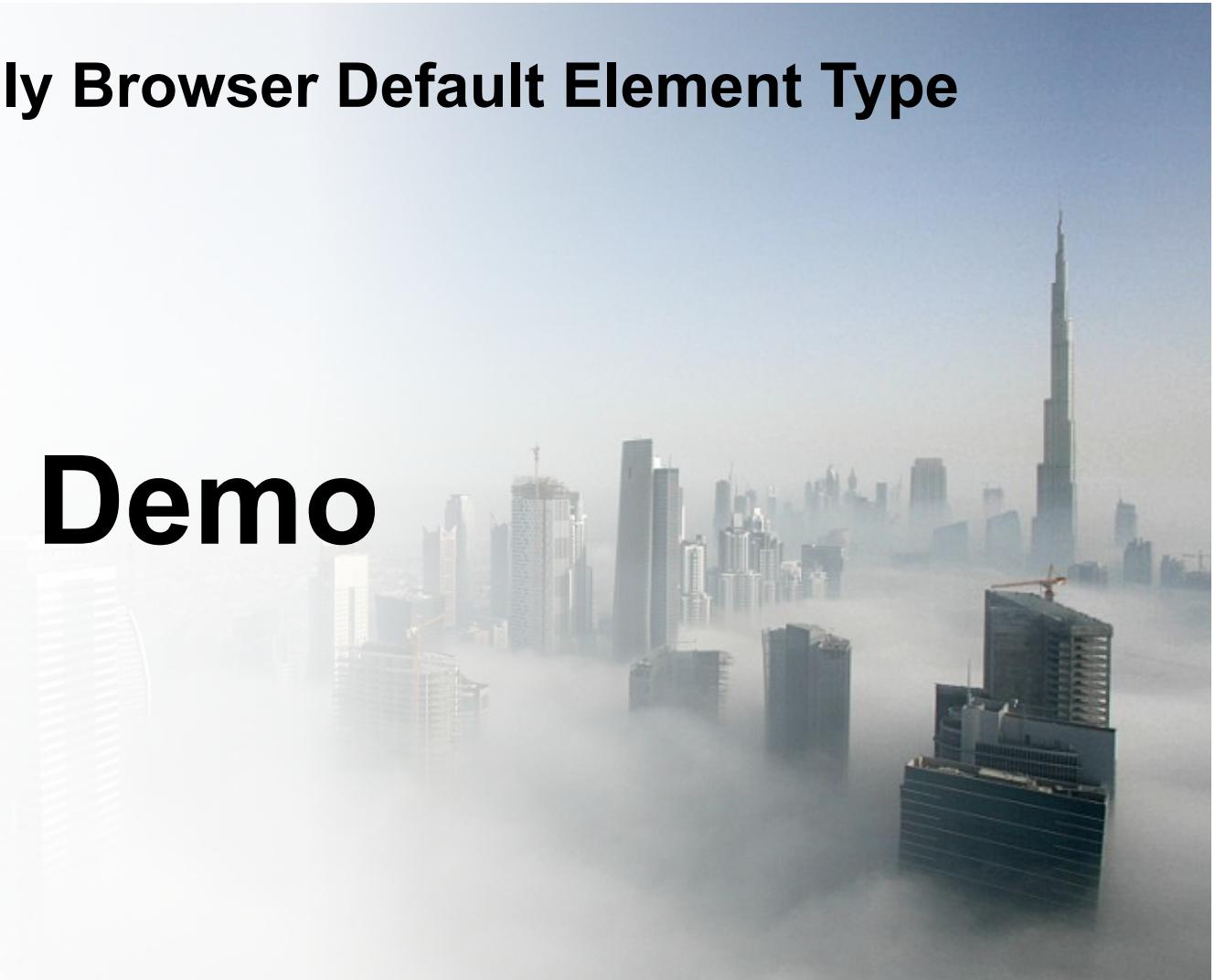
Productivity | Family Browser Default Element Type

Revit maintains a default Element type for each category, displayed by Revit when a related tool is invoked to create a new Element

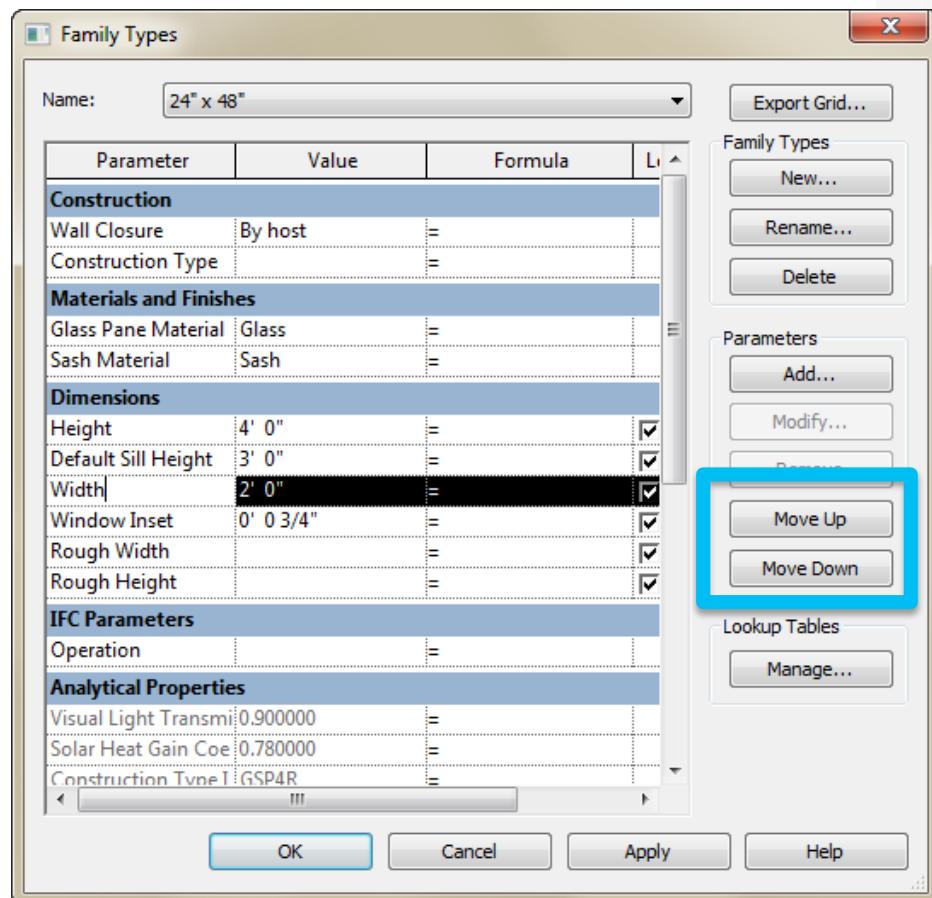
- Families
 - Document.[GetDefaultFamilyTypeld](#) (categoryId)
 - Document.[SetDefaultFamilyTypeld](#) (categoryId, familyTypeld)
 - Document.[IsDefaultFamilyTypeldValid](#) (categoryId, familyTypeld)
 - ElementType.[IsValidDefaultFamilyType](#) (familyCategoryId)
- Other types
 - Document.[GetDefaultElementTypeld](#) (ElementTypeGroup)
 - Document.[SetDefaultFamilyTypeld](#) (ElementTypeGroup, elementTypeld)
 - Document.[IsDefaultFamilyTypeldValid](#)(ElementTypeGroup, elementTypeld)

Productivity | Family Browser Default Element Type

Demo



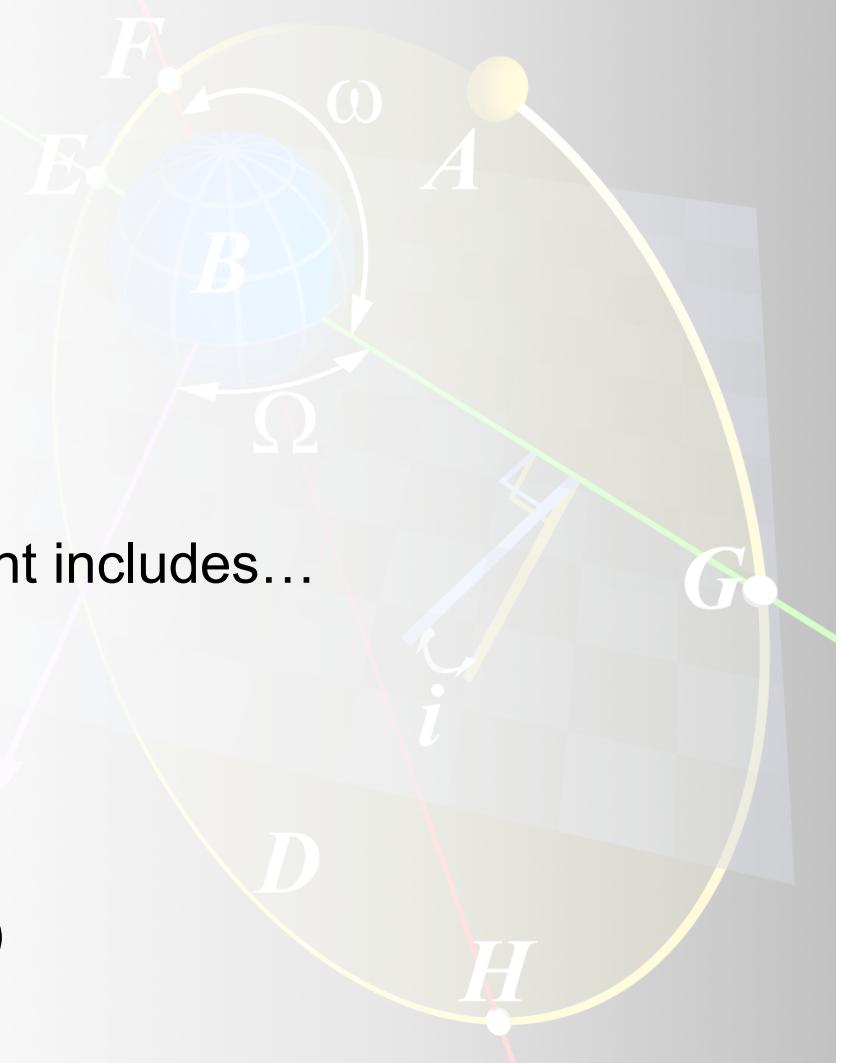
Productivity | Ordered Parameters



- Move parameters in parameter group
- New Parameters added at group end
- `FamilyManager.GetParameters()`
- `Element.GetOrderedParameters()`
- `FamilyManager.ReorderParameters()`

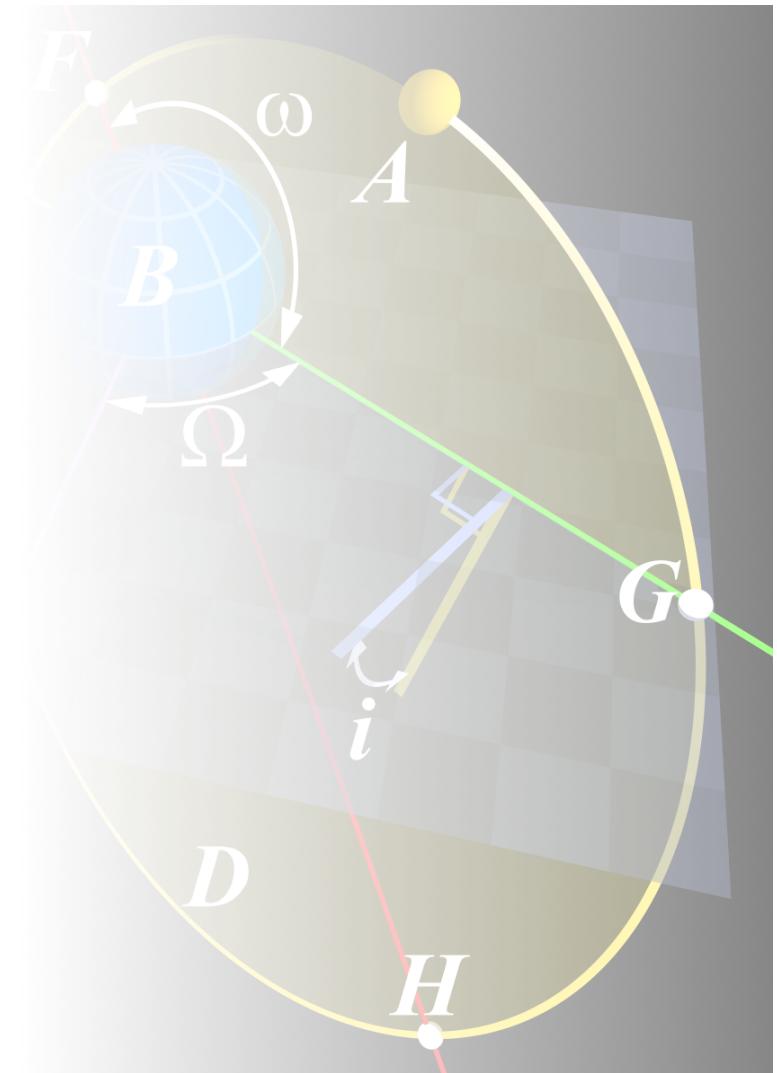
Productivity | Shared Parameters

- Create read-only Shared Parameters
- Editable by any API application
- `Definitions.Create()` options class argument includes...
 - Name
 - Type
 - GUID
 - Visibility
 - Description (displayed as UI Tooltip)



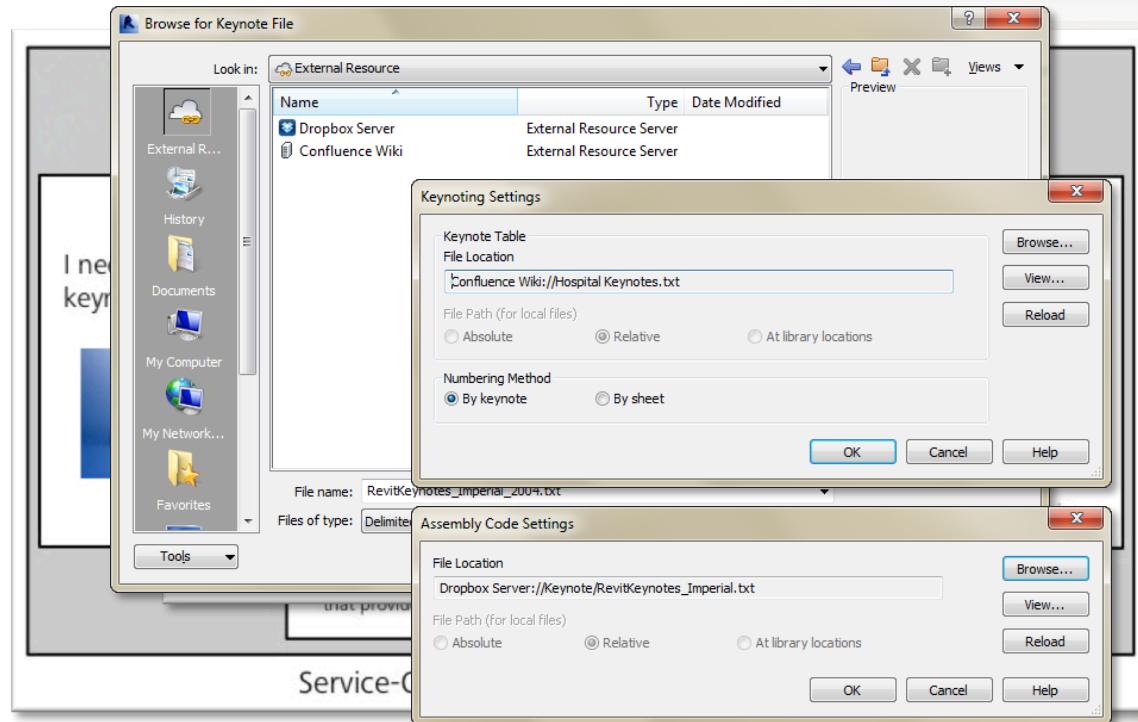
Productivity | Shared Parameters

Demo



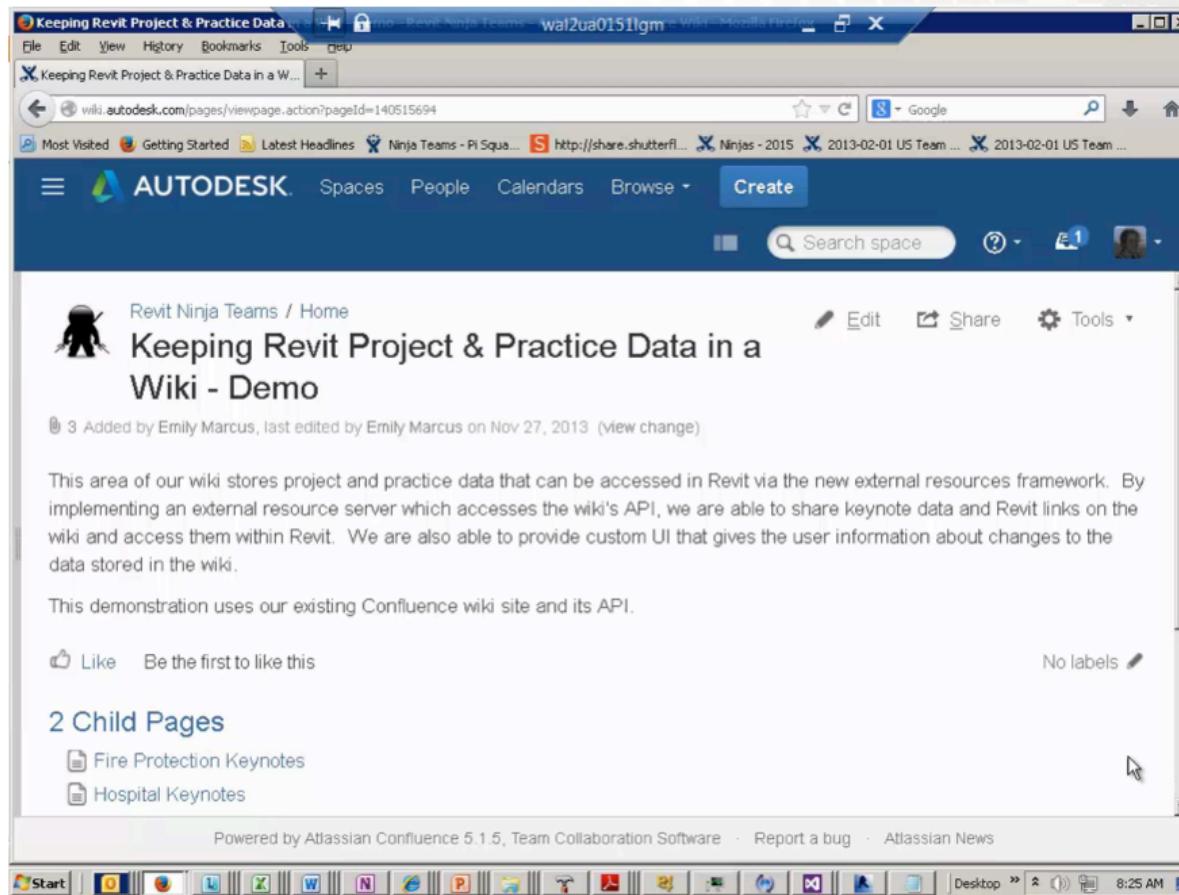
Productivity | Referenced File Service

Provide Revit with content from arbitrary external sources



- Reference Service Framework
 - RVT Links
 - Keynote File
 - Assembly Code File
- Link Assembly Code file
- Provide Keynote and Uniformat standards
- Realtime online update

Productivity | Referenced File Service



RevitLinkType.Create()

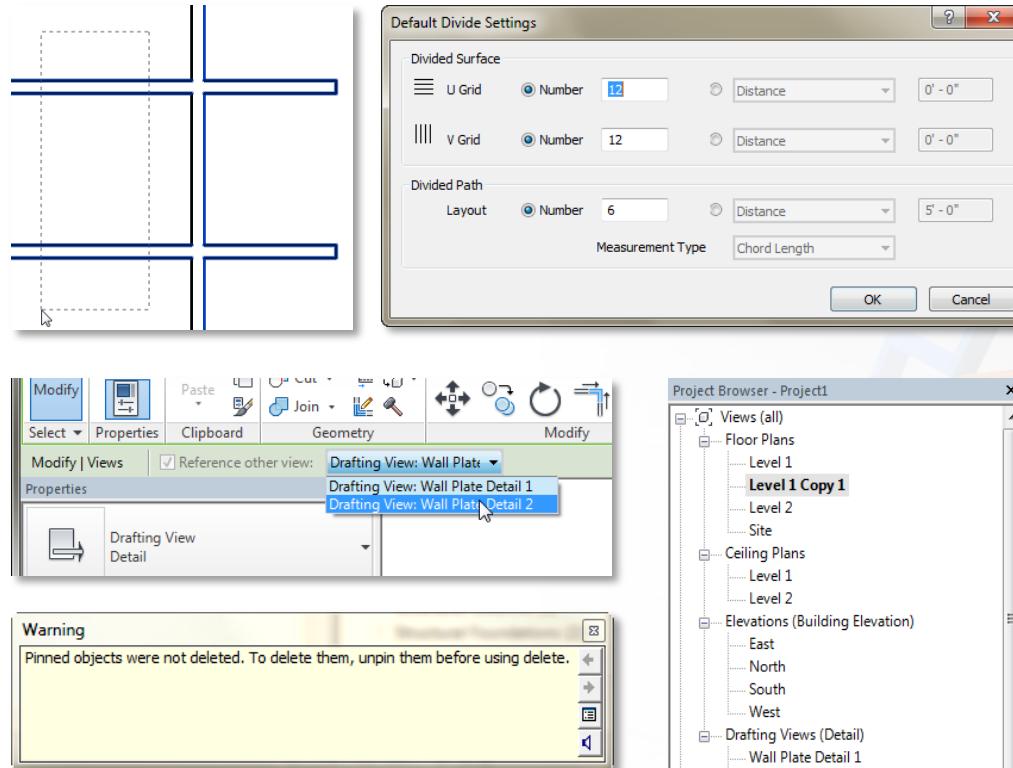
RevitLinkType.LoadFrom()

- ModelPath
- ExternalResourceReference

RevitLinkType.AttachmentType

- Attachment
- Overlay

Productivity | ...and more!



- Trim + Extend multiple elements
- Duplicate View Naming
- Pinned Element retention
- Add Links in Manage Links dialog
- Tag Leader consistency
- MEP calculation per segment
- Change referenced views
- Shared Parameters in View Titles
- Default Divide Path settings
- Customizable tooltips

- Category.CategoryType
- ElementType.FamilyName
- ElementType duplication event
- Family loading Event

Productivity | ...and even more!

View Interaction

- `View.Title`
- `View.AreModelCategoriesHidden`
- `View.AreAnnotationCategoriesHidden`
- `View.AreAnalyticalModelCategoriesHidden`
- `AreImportCategoriesHidden`
- `View.IsAssemblyView`
- `ViewDrafting.Create()`
- `View3D.OrientTo(XYZ forwardDirection)`
- `ReferenceableViewUtils` manages reference sections and callouts
- `ChangeReferencedView()`
- `GetReferencedViewId()`

Interoperability | Energy Model

- **gbXML export**
 - GBXMLExportOptions.[ExportEnergyModelType](#)
 - [SpatialElement](#) – Energy Model defined by Rooms or Spaces
 - [BuildingElement](#) – Energy model defined by analysis of building volumes
- **BuildingEnvelopeAnalyzer**
 - Identifies Elements composing the building envelope
 - Finds building Elements bounding enclosed volumes

Interoperability | Analytical Model Alignment

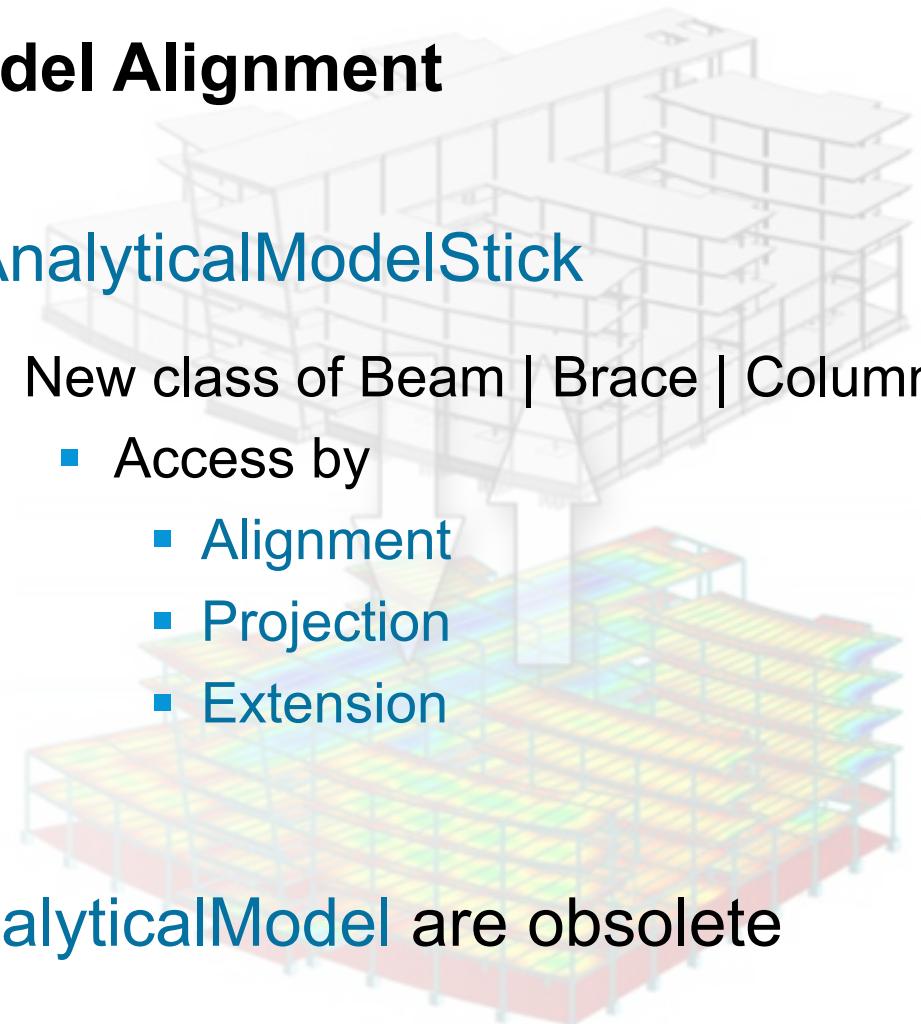
AnalyticalModelSurface

- Existing class of Floor | Wall | Slab
 - New members
 - Alignment
 - Projection
 - Extension

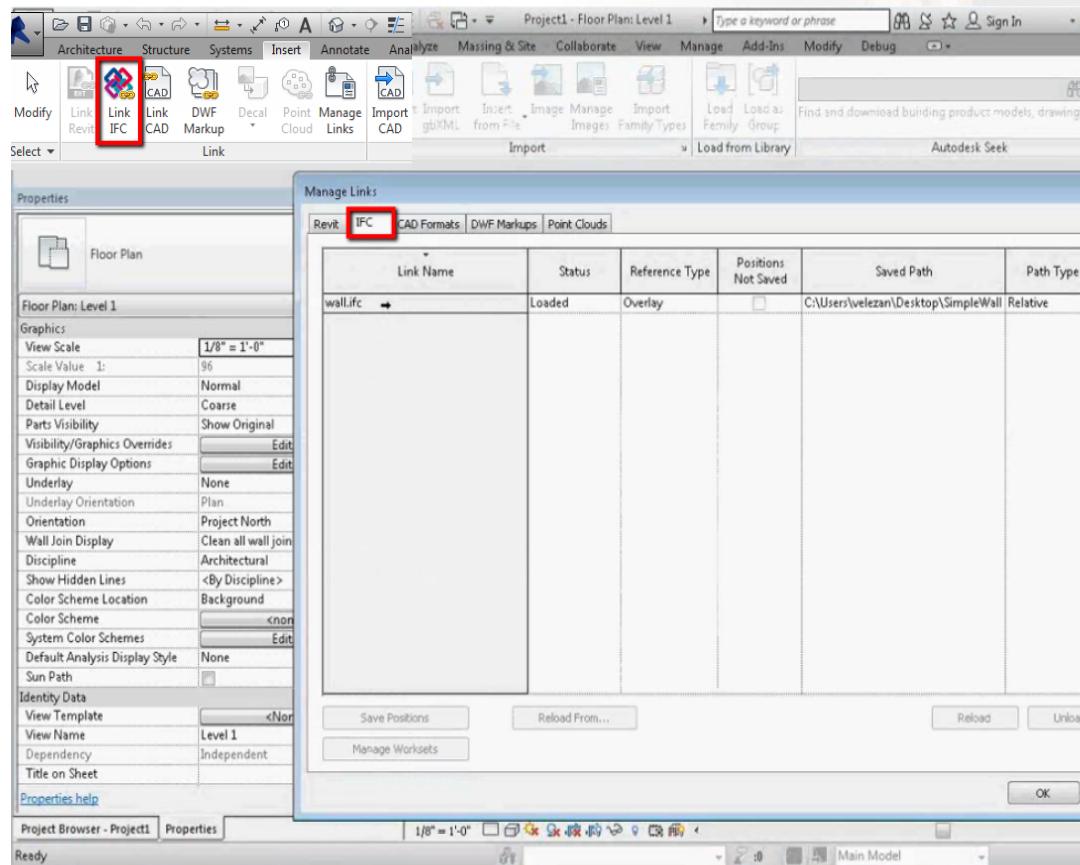
AnalyticalModelStick

- New class of Beam | Brace | Column
 - Access by
 - Alignment
 - Projection
 - Extension

Corresponding members of **AnalyticalModel** are obsolete



Interoperability | IFC Import + Linking



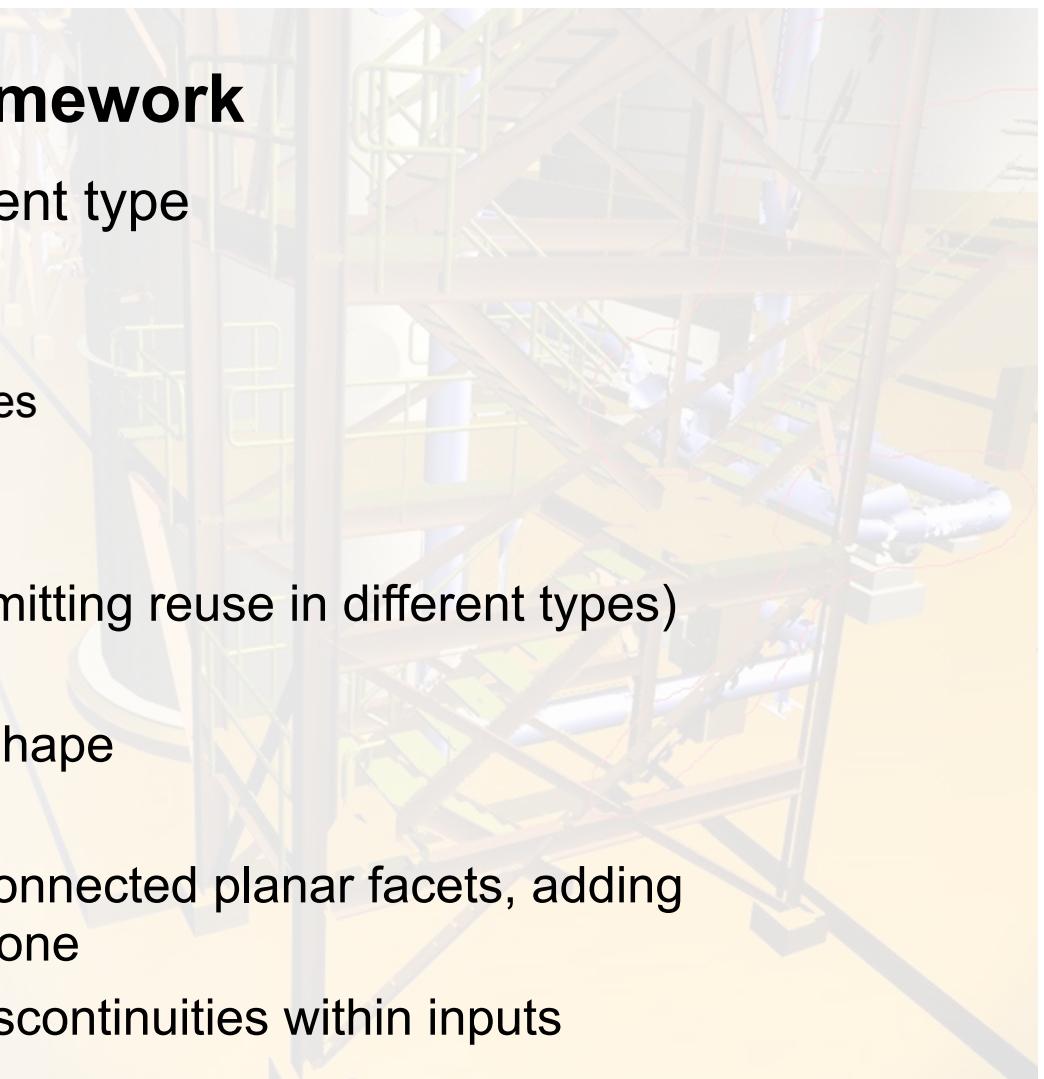
- Link IFC files
- Reference IFC geometry
- IFC Manage Links dialog tab
- Improved geometry performance
- Uses new API Import Framework
- OpenSource Importer

Interoperability | IFC Import + Linking

- `RevitLinkType.CreateFromIFC()`
 - Create a new linked IFC type
 - Place with `RevitLinkInstance` methods
- `Application.OpenIFCDocument(string, IFCImportOptions)`
 - `IFCImportOptions.Action` (open or link)
 - `IFCImportOptions.Intent` (parametric or reference)
 - `IFCImportOptions.AutoJoin` (applies to parametric only)

Interoperability | Import Framework

- DirectShape - New import Element type
 - Category assignment
 - Geometry validated for Revit
 - Brep (solids | shells) or faceted bodies
 - Maintained in the Project
- DirectShapeLibrary
 - Stores geometry of shapes (permitting reuse in different types)
- DirectShapeType
 - The type element for the direct shape
- TessellatedShapeBuilder
 - Create solid or polymesh from connected planar facets, adding TessellatedFace objects one by one
 - Heals some imprecisions and discontinuities within inputs



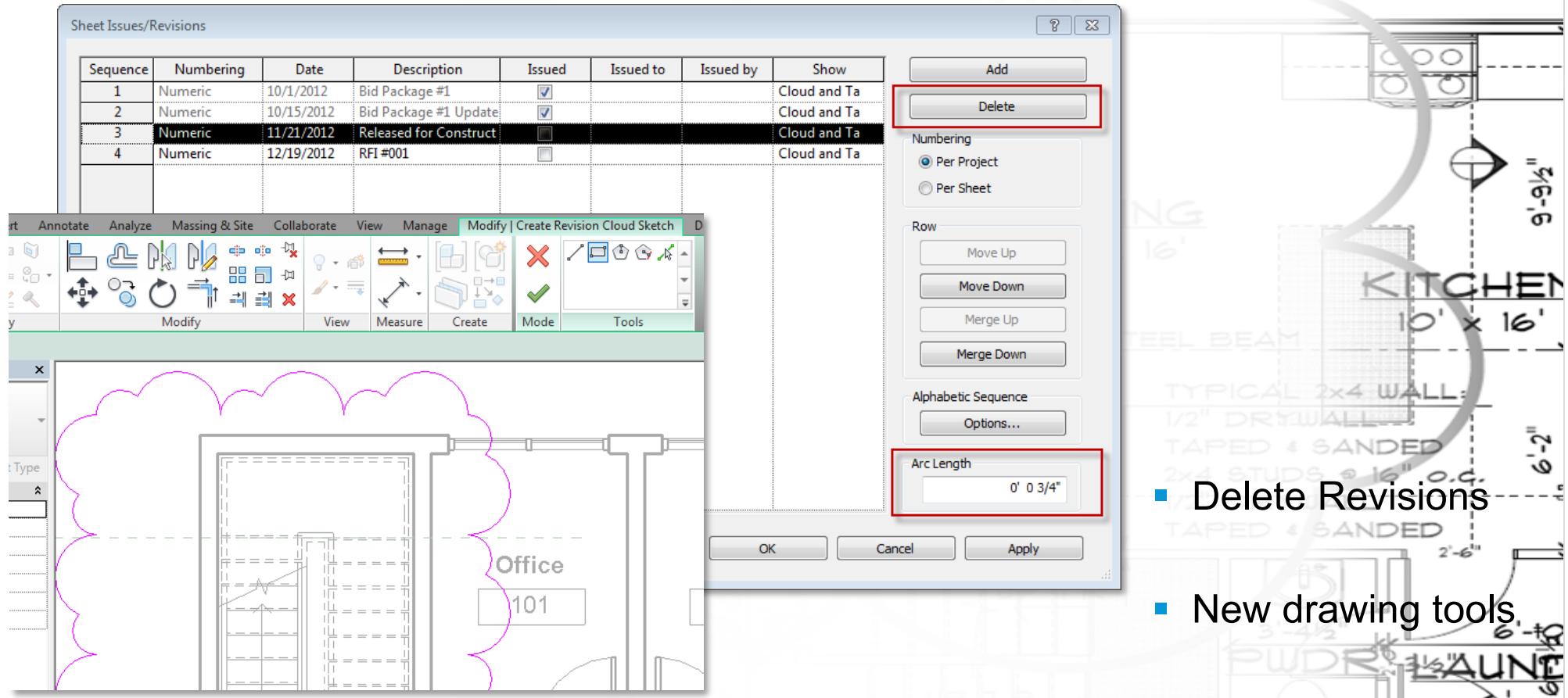
Interoperability | Import Framework

Demo

Interoperability | ...and more!

- Load Orientation
 - `LoadBase.OrientTo`
 - `LoadBase.HostElementId`
 - `LoadBase.WorkPlaneId`
- Boundary Condition Orientation + Type
 - `BoundaryConditions.GetOrientTo()`
 - `BoundaryConditions.SetOrientTo()`
 - `BoundaryConditions.GetDegreesOfFreedomCoordinateSystem()`
 - `BoundaryConditions.GetBoundaryConditionsType()`

Construction | Revisions



- Delete Revisions
- New drawing tools

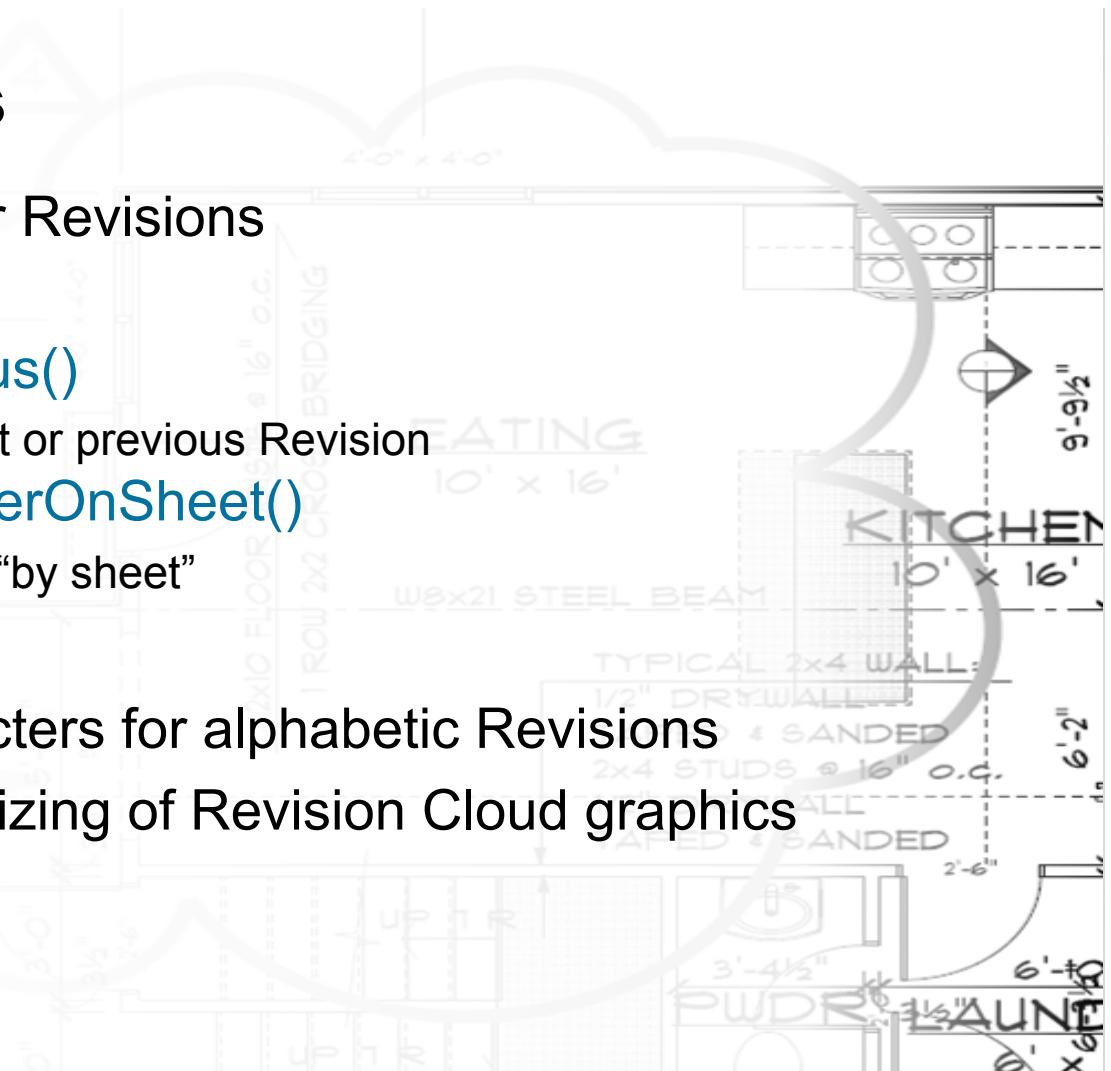
Construction | Revisions

Read | Modify | Create | Reorder Revisions

- Revision.[CombineWithNext\(\)](#)
- Revision.[CombineWithPrevious\(\)](#)
 - Combine a Revision with the next or previous Revision
- ViewSheet.[GetRevisionNumberOnSheet\(\)](#)
 - Revision Number for sequences “by sheet”

Project Revision Settings

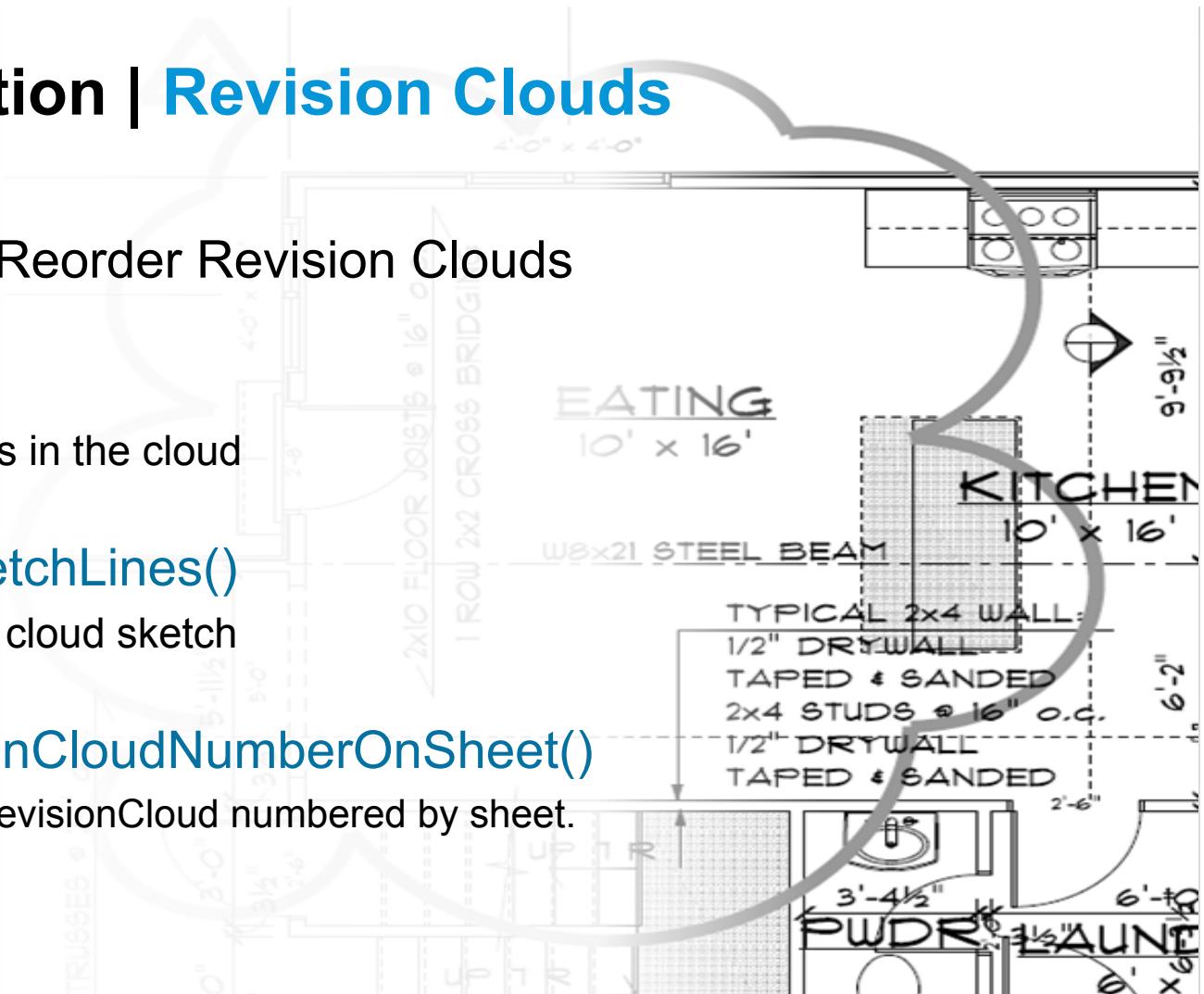
- RevisionAlphabet - Characters for alphabetic Revisions
- RevisionCloudSpacing - Sizing of Revision Cloud graphics
- RevisionNumbering
 - by sheet
 - by project



Customer Satisfaction | Revision Clouds

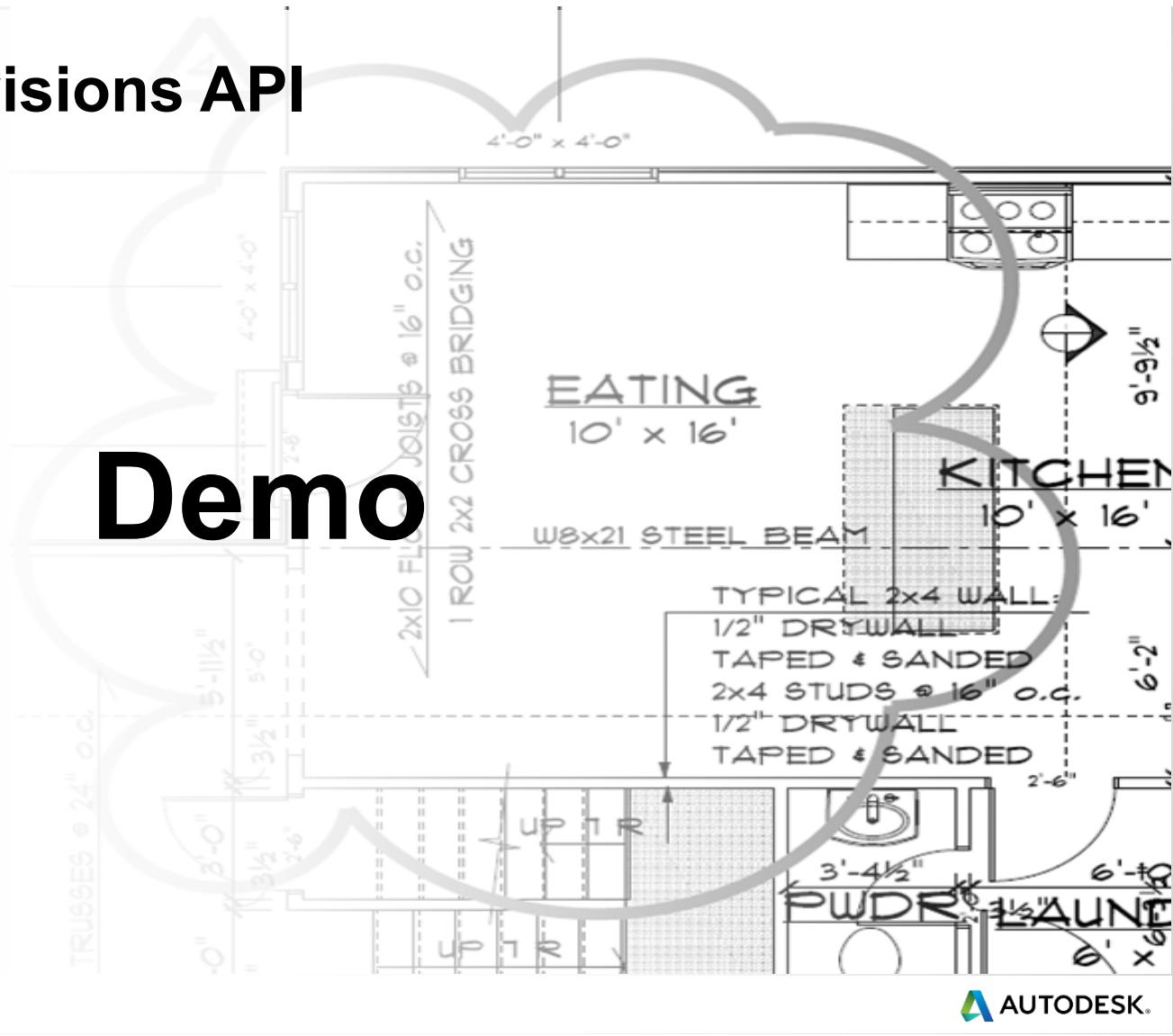
Read | Modify | Create | Reorder Revision Clouds

- `Element.Geometry`
 - Returns the curved lines in the cloud
- `RevisionCloud.GetSketchLines()`
 - Returns the lines in the cloud sketch
- `ViewSheet.GetRevisionCloudNumberOnSheet()`
 - Revision Number for a RevisionCloud numbered by sheet.

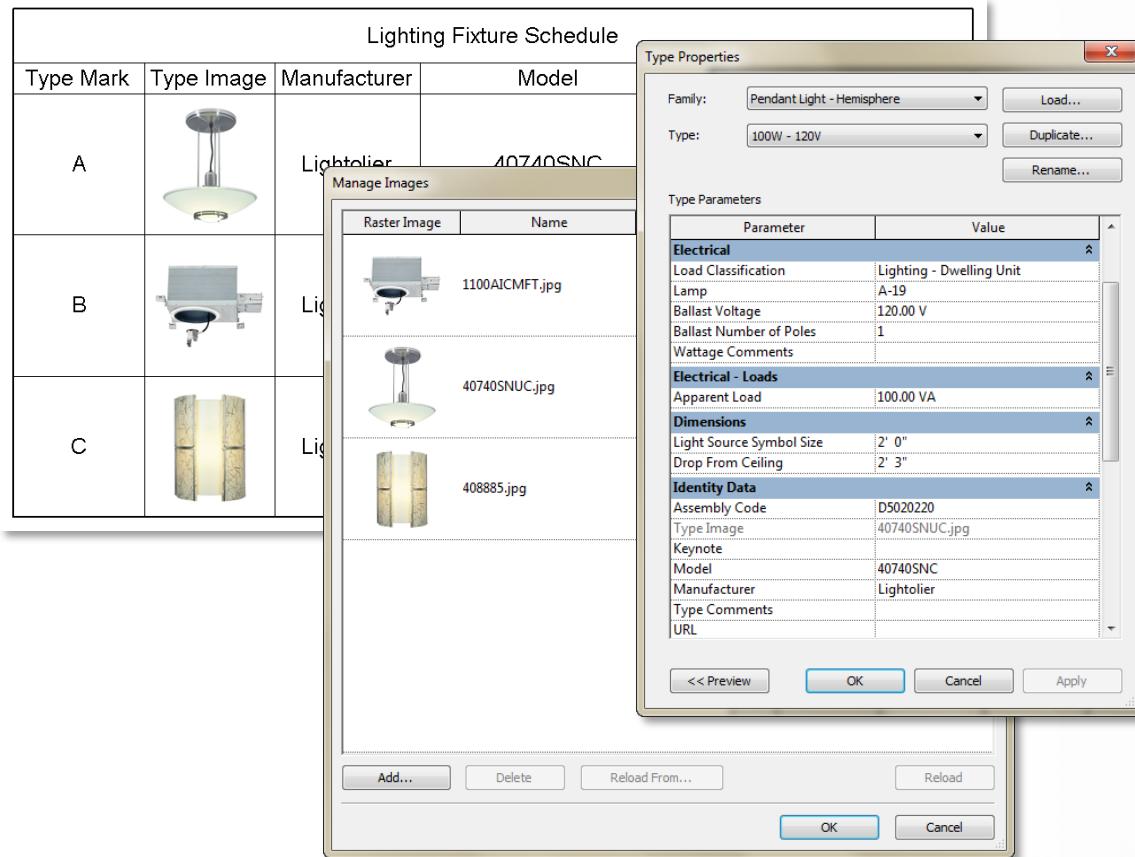


Construction | Revisions API

Demo



Construction | Schedules



- Type and Instance Images
 - ParameterType.Image
 - ElementId of ImageType
 - ImageType.Create()
 - ImageType.Reload()
 - ImageType.ReloadFrom()
- Additional Wall Parameters
 - Base Constraint
 - Base Offset
 - Unconnected Height
 - Top Constraint
 - Top Offset
- Custom Grand Total Title
- More Schedule Filters

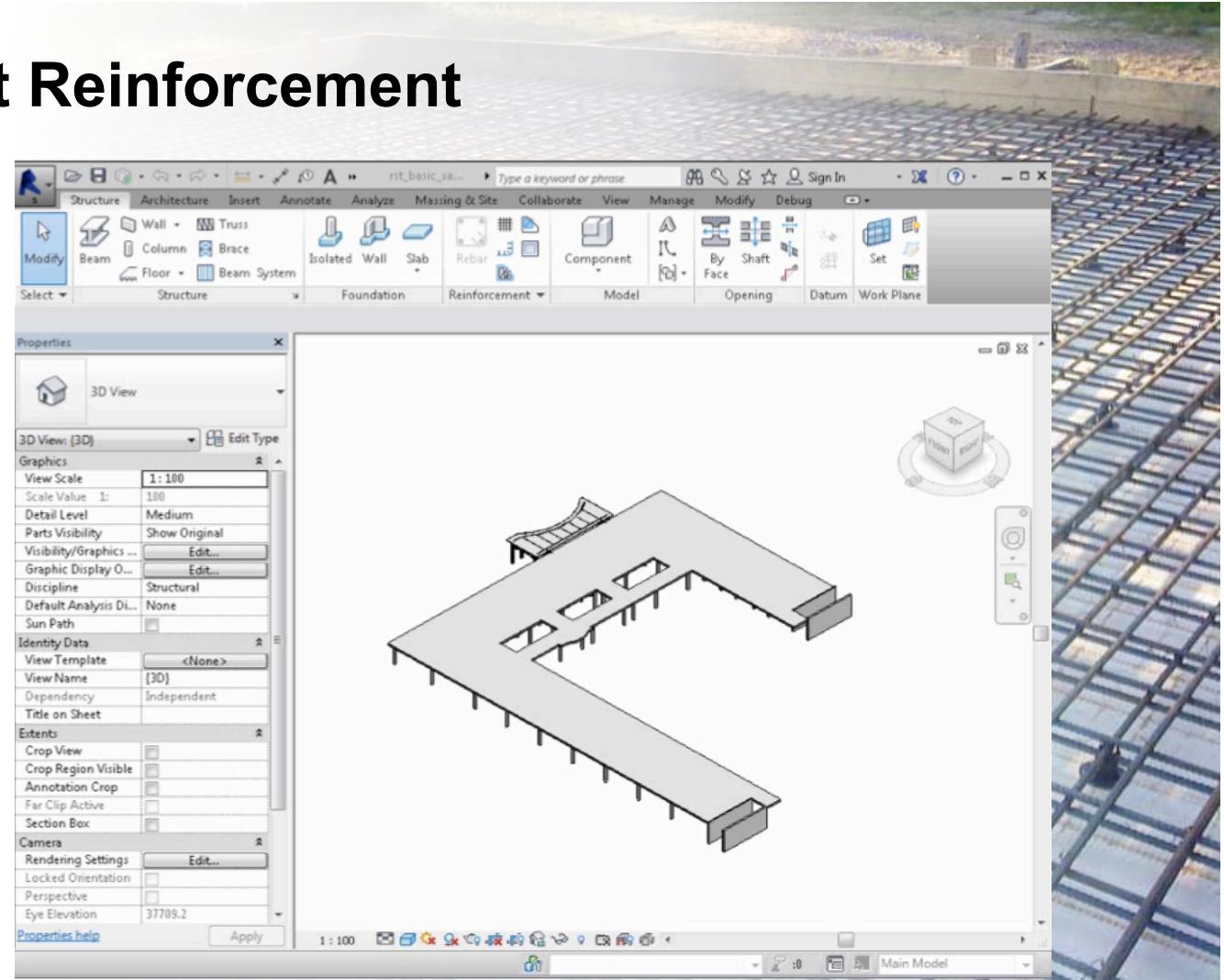
Construction | Schedules

Demo

Type Mark	Type Image	Manufacturer	Lighting
A		Lightolier	
B		Lightolier	
C		Lightolier	Pi

Construction | Part Reinforcement

- Reinforcement hosted by parts



Construction | Part Reinforcement

Existing reinforcement creation functions accept part element hosts

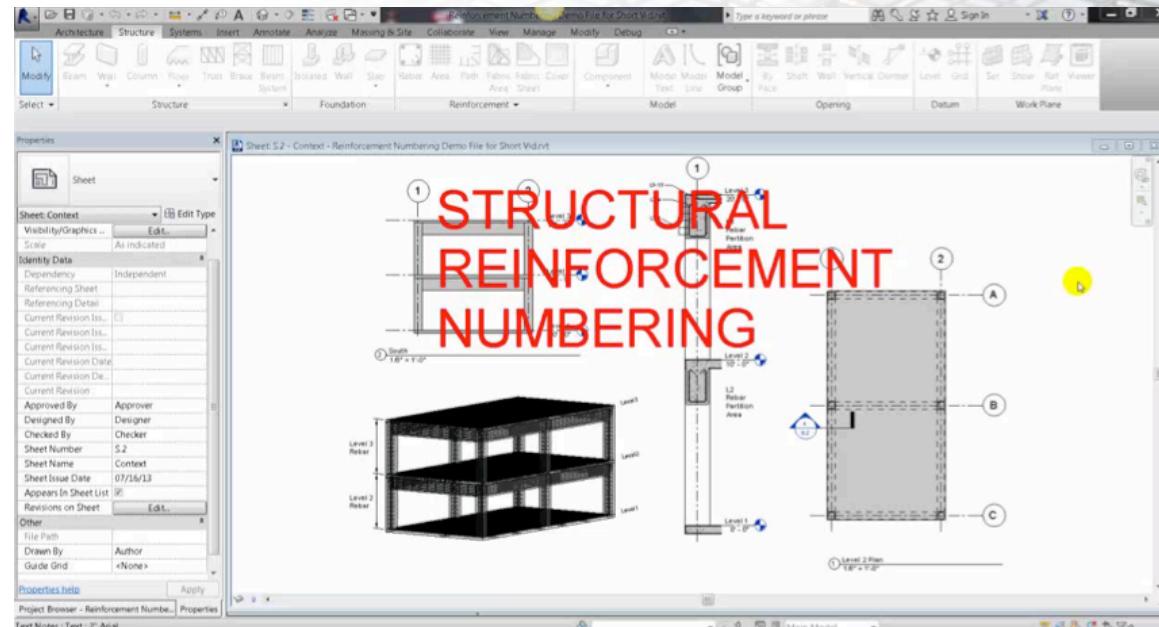
- Rebar.CreateFromCurves()
- Rebar.CreateFromCurvesAndShape()
- Rebar.CreateFromRebarShape()
- AreaReinforcement.Create()
- PathReinforcement.Create()

New function identifies valid host elements for reinforcement

- RebarHostData.**IsValidHost()**

Construction | Reinforcement Numbering

- Automatic numbering
- Configurable schemas
- Numbering by host



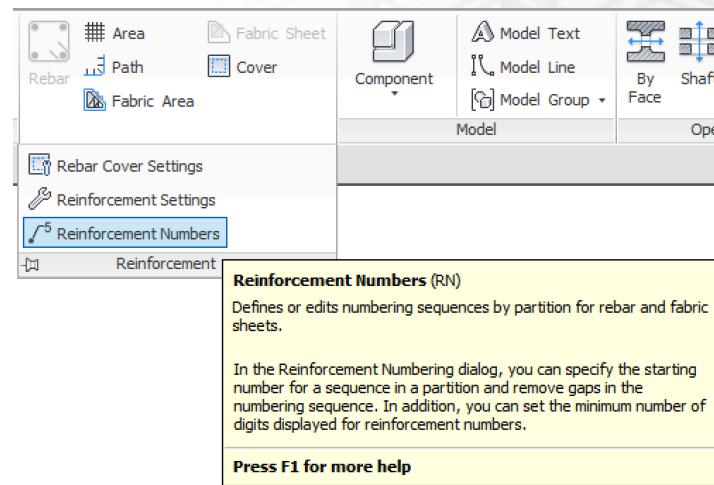
Construction | Reinforcement Numbering

Define Element organization for Numbering + Tagging

- **NumberingSchema**
 - Controls Element numbering for a Category
- **NumberingSchemaType**
 - Rebar
 - Fabric Reinforcement

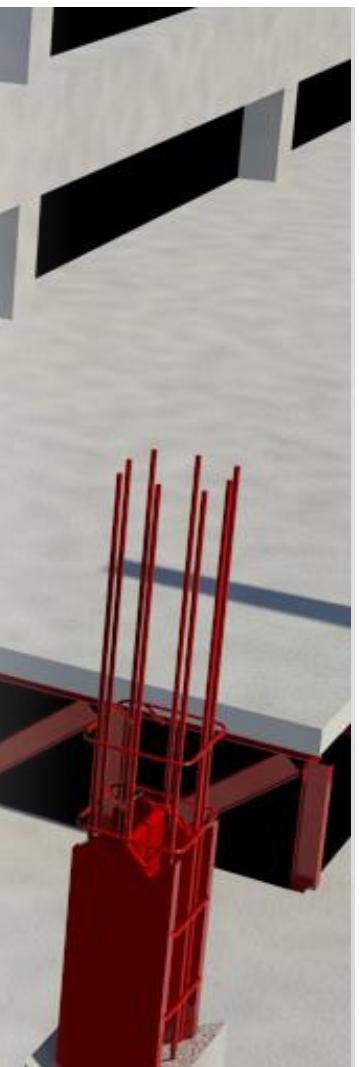
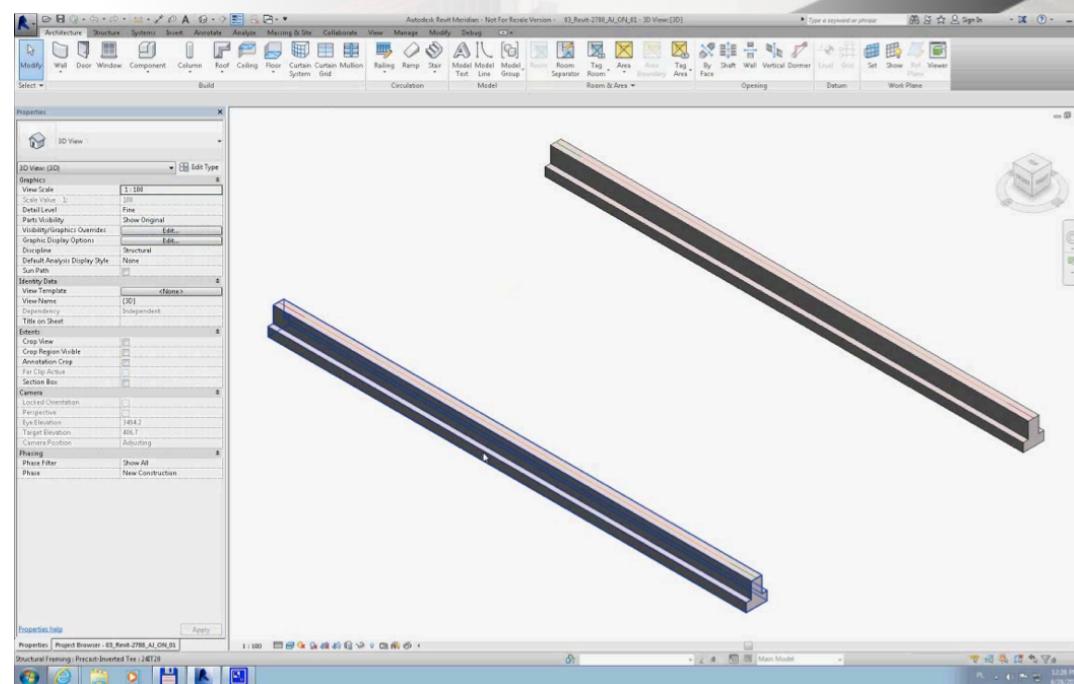
Construction | Reinforcement Numbering

Demo



Construction | Framing References

- Set Position of Framing Ends



Construction | Framing References

- StructuralFramingUtils
 - Supports choice of face for setback calculation
 - StructuralFramingUtils.[CanSetEndReference\(\)](#)
 - StructuralFramingUtils.[RemoveEndReference\(\)](#)
 - StructuralFramingUtils.[GetEndReference\(\)](#)
 - StructuralFramingUtils.[SetEndReference\(\)](#)

Construction | Structural Sections

- **StructuralSection**
 - Adjunct class associated with steel framing [FamilySymbols](#)
 - Multiple subclasses for different configurations
 - [StructuralSectionWideFlange](#)
 - [StructuralSectionRoundHSS](#)
 - Etc...
 - Get | Set section dimensions consistently
 - Access by [FamilySymbol.GetStructuralSection\(\)](#)
 - Section type by [FamilySymbol.GetStructuralSectionType\(\)](#)

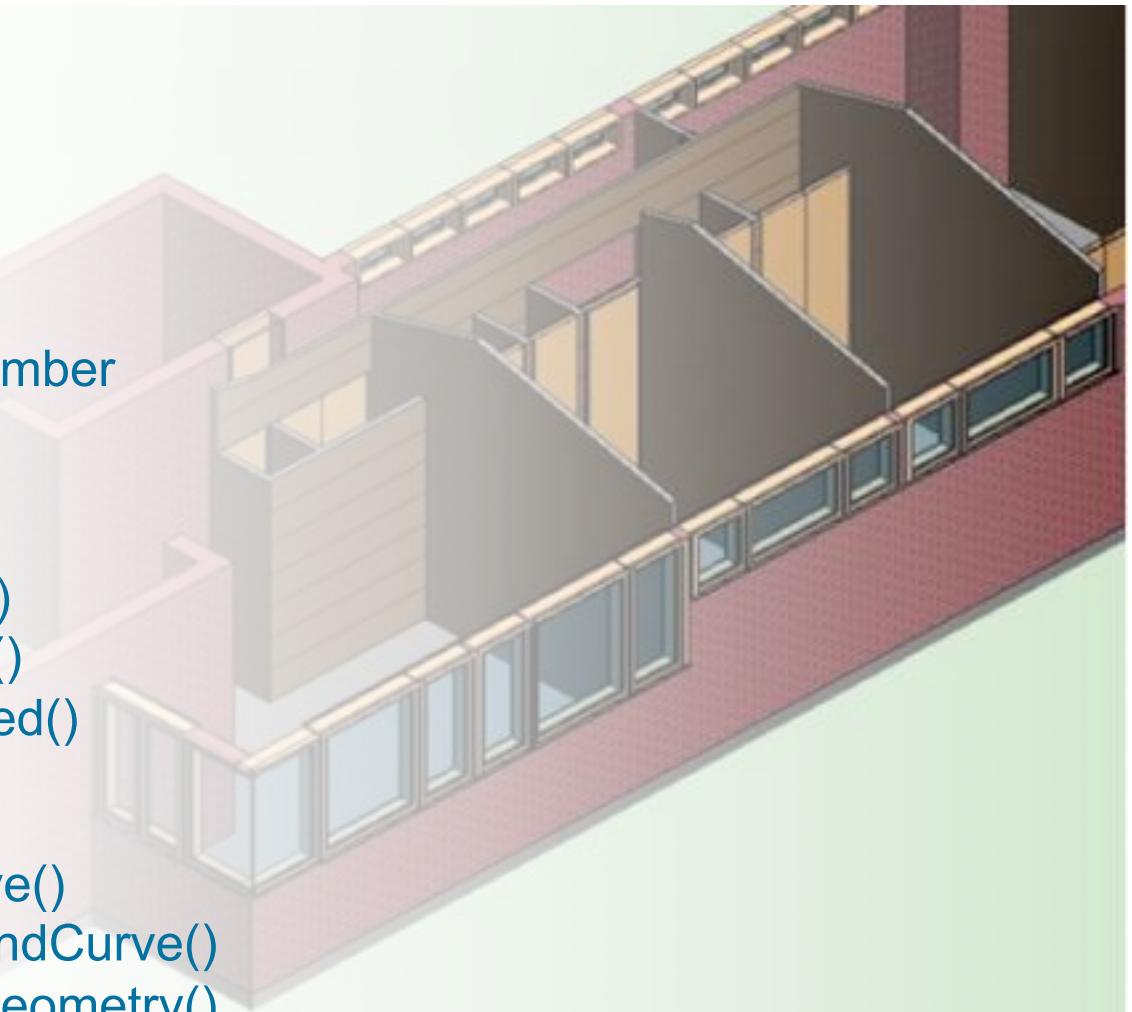
Construction | Wire

- **Wire.Create**
 - Create straight, arc, chamfer, and spline wires.
- **Wire read | write**
 - [WiringType](#)
 - [NumberOfVertices](#)
 - [AppendVertex\(\)](#)
 - [InsertVertex\(\)](#)
 - [GetVertex\(\)](#)
 - [SetVertex\(\)](#)
 - [RemoveVertex\(\)](#)
 - [ConnectTo\(\)](#) – connect wires via connectors

... and more!

Stacked Walls

- `GetStackedWallMemberIds()`
- `IsStackedWall`, `IsStackedWallMember`
- `StackedWallOwnerId`



Dynamic Updater Control

- `UpdaterRegistry.EnableUpdater()`
- `UpdaterRegistry.DisableUpdater()`
- `UpdaterRegistry.IsEnabled()`

Geometry

- `CurveElement.SetGeometryCurve()`
- `CurveElement.SetSketchPlaneAndCurve()`
- `FreeFormElement.UpdateSolidGeometry()`



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