



Developer Days Online: Revit 2016 API News

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DevTech ADN



Developer Days 2014

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Revit Today





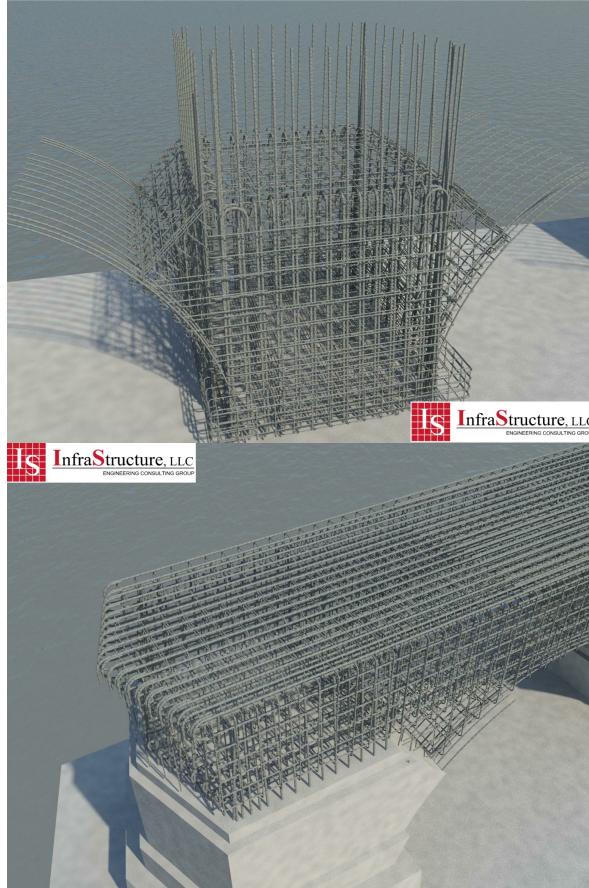
Cosmopolitan

Las Vegas, Nevada

\$3.9 billion

7000 m² casino
28000 m² retail
3700 m² fitness
14000 m² conference
1800 seat theater
2995 rooms

Customer Models | Infrastructure LLC



IS InfraStructure, LLC
ENGINEERING CONSULTING GROUP



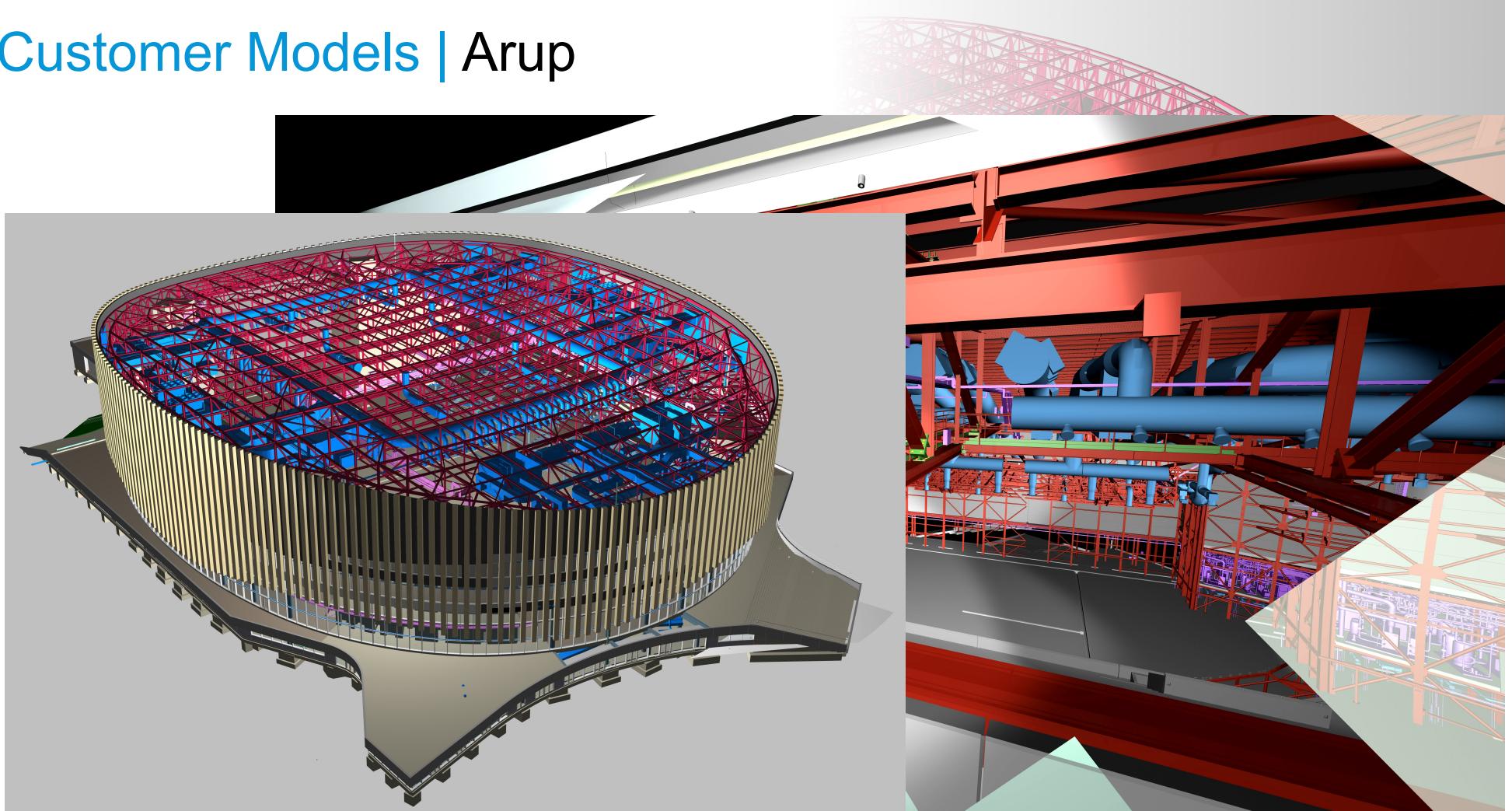
IS InfraStructure, LLC
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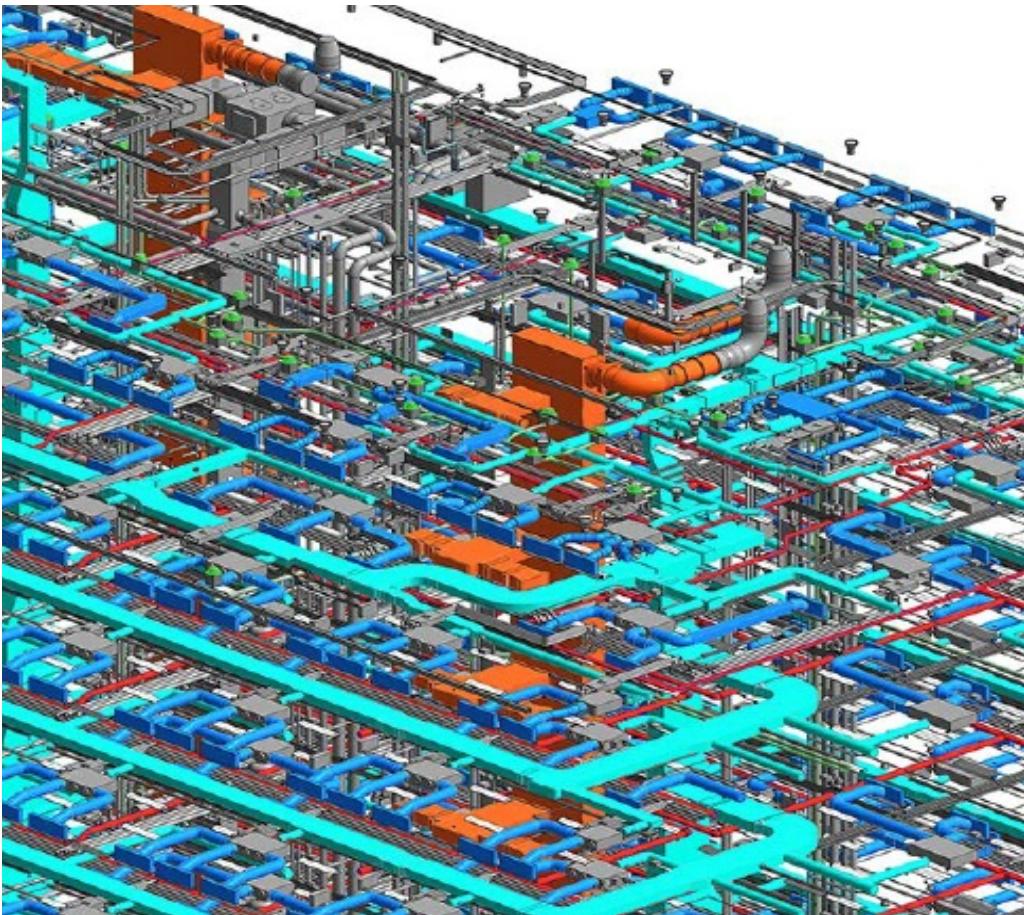
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Customer Models | Arup



Customer Models | BAM Design





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Revit 2016



Scalability | API Changes

ReferenceIntersector

- `ReferenceIntersector.FindReferencesInRevitLinks`
- Set flag to look for elements in Revit links

CompoundStructure.SetLayers

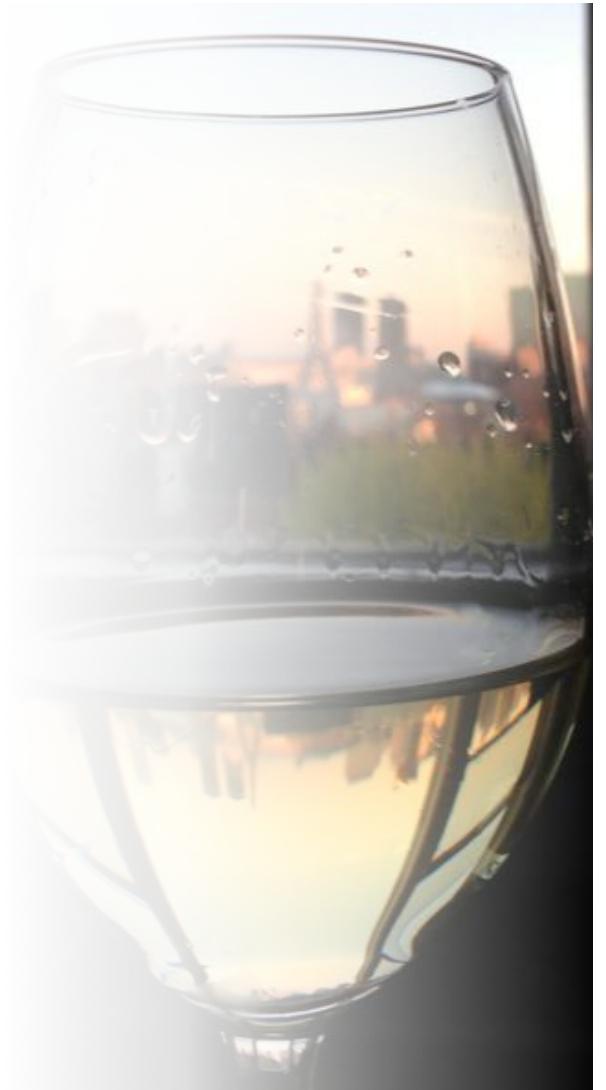
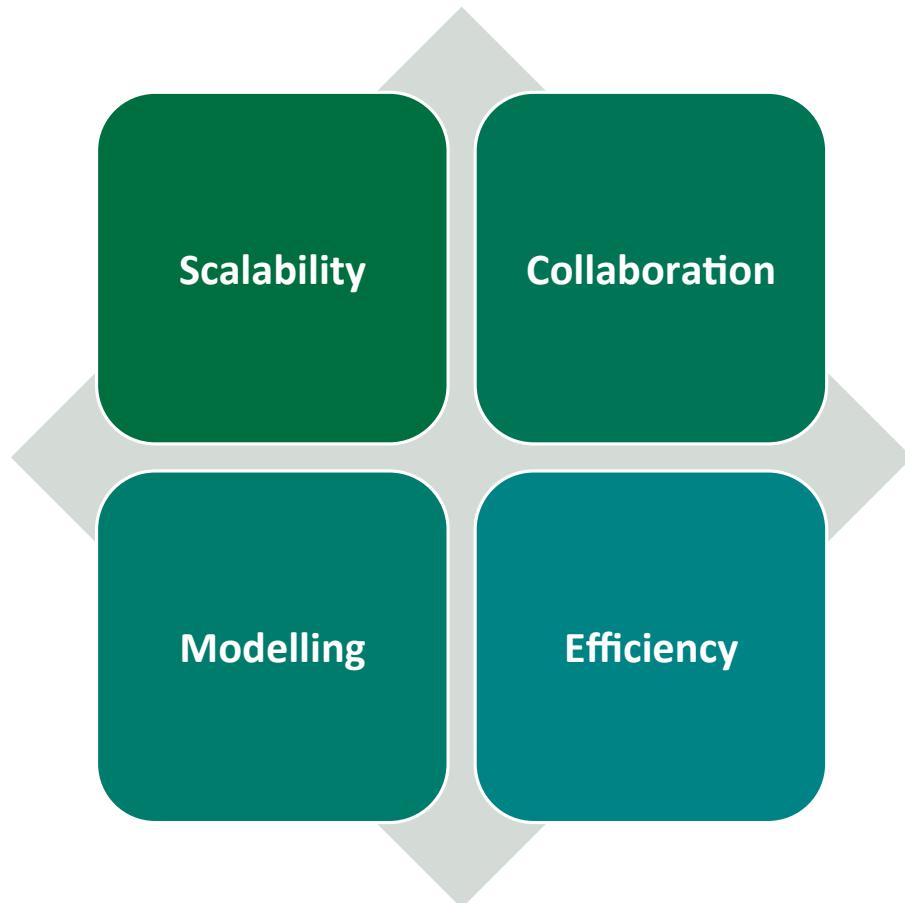
- Unset the structural material layer index automatically

NewFamilyInstance overloads

- Now throws an exception if family symbol is not active
- Test by calling `FamilySymbol.IsActive`
- Activate by calling `FamilySymbol.Activate`

All methods marked deprecated in 2015 have been removed

Revit 2016 | Areas of Investment





Scalability



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"If you increase the number of highways in a city by one percent, it causes driving to also increase by one percent."

"As you add roads to a city those roads get filled up. There are people waiting to use that capacity."

The Fundamental Law of Road Congestion
Matthew Turner
University of Toronto



Scalability | Customer Experience Goals

- Model splitting only for business purposes
- Multiple disciplines in single models
- Unified MEP Systems
- Complex as-built buildings represented
- Easily derived documentation

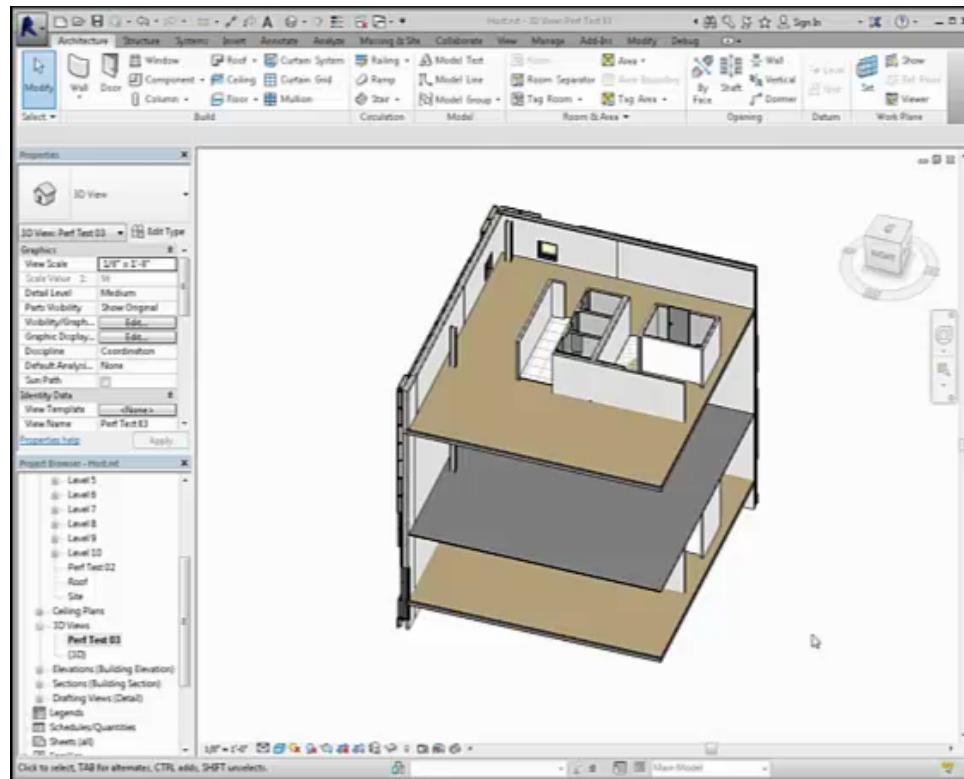
Scalability | Projects

- Progressive Display
- Symbol Sharing – MEP System Families
- Symbol Sharing – Reinforcement
- Graphics Instancing
- Parallel Computation of Colorfills
- Linked Model Performance
- Camera-based GRep Generation

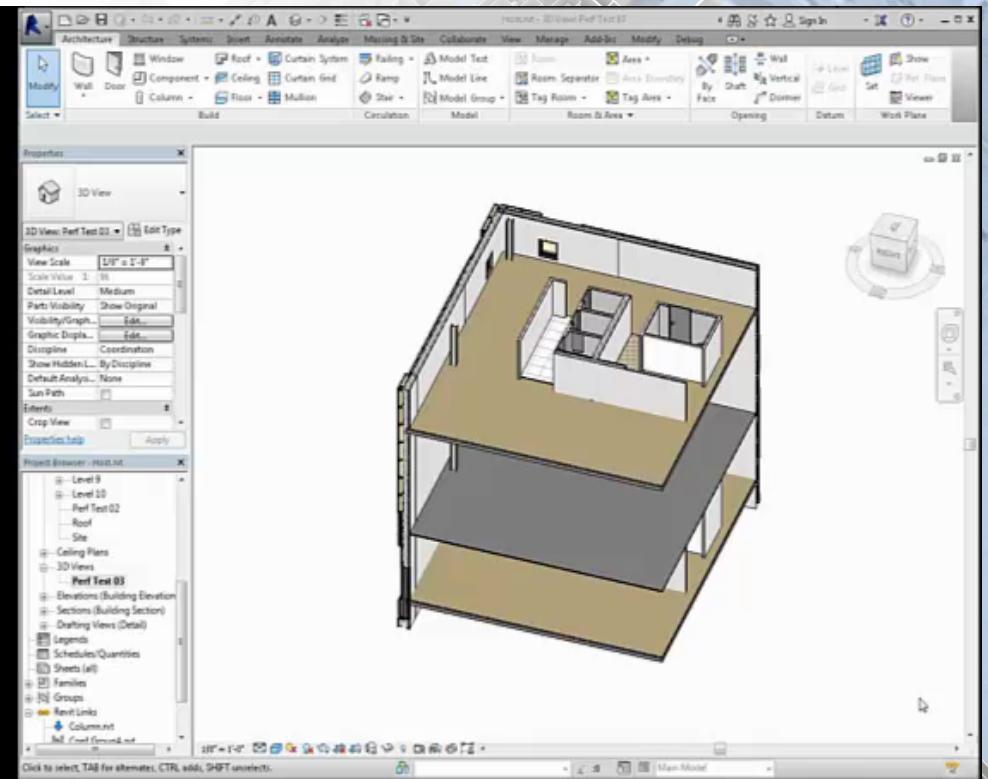


Scalability | Linked Models

2015



2016



Scalability | Parallel Derived Data Update

Objective

Return control to the user during derivative data update

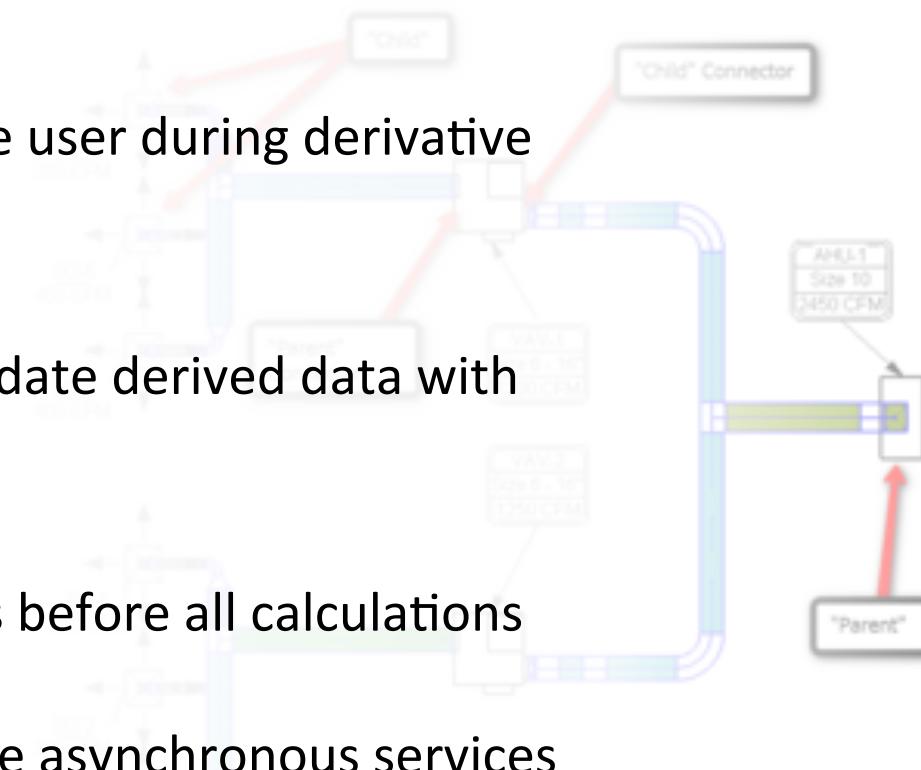
Concept

Opportunistically update derived data with secondary CPU

Benefits

Interact with models before all calculations complete

Framework for future asynchronous services



Scalability | Progressive Display

Objective

Allow model interaction during View update

Concept

Adopt Navisworks-like update of geometry

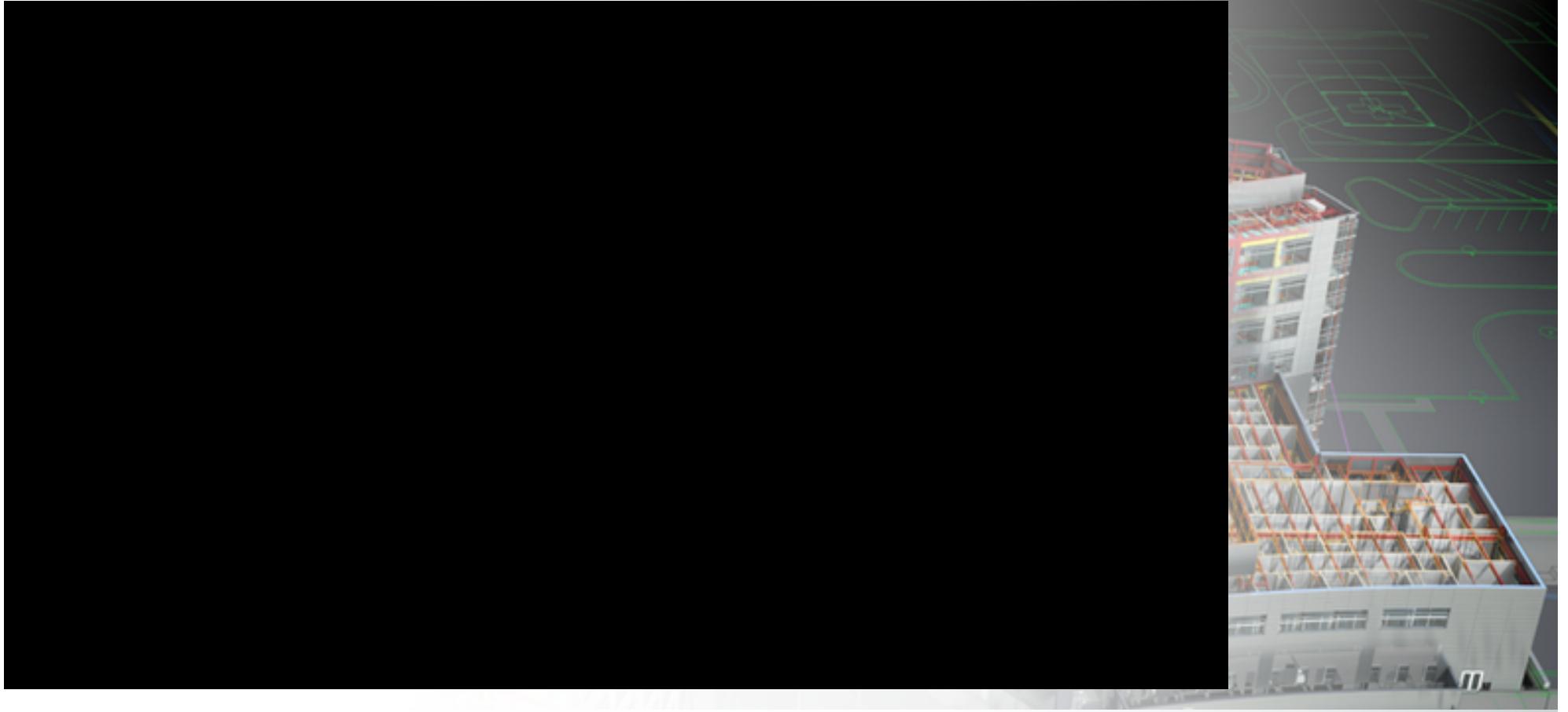
Allow user interruptions during navigation

Benefits

Fewer pauses during model navigation



Scalability | Progressive Display





Collaboration



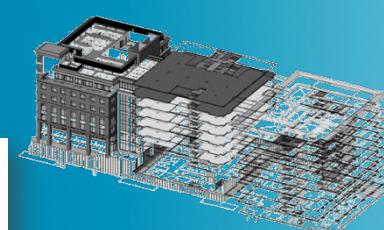
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Collaboration | for Revit

Team
Single location
Firewalled



File Worksharing

Enterprise
Multiple locations
Firewalled



Revit Server
Vault

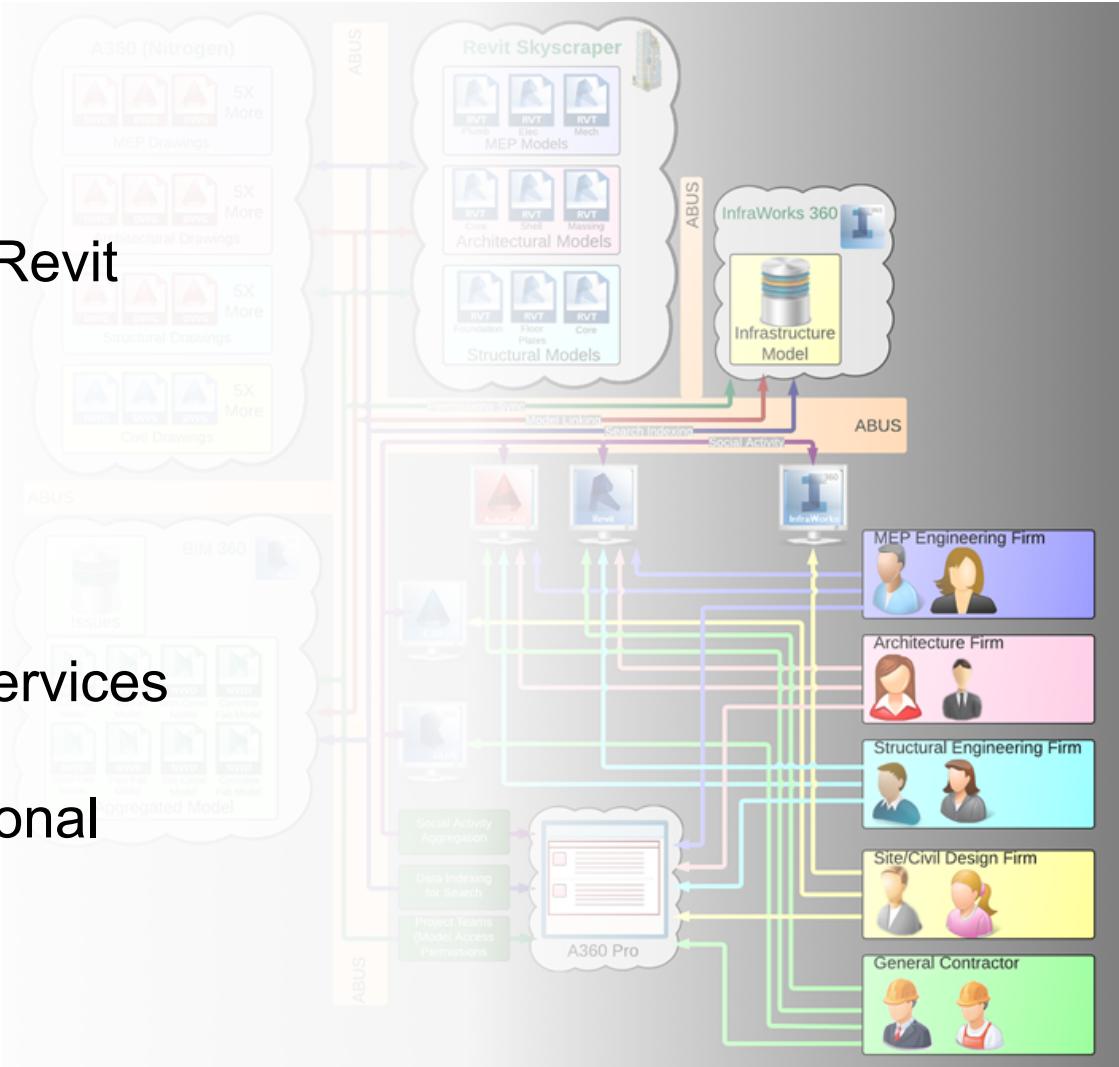
Project
Multiple companies
Multiple locations
Managed access



A360
Services

Collaboration | for Revit

- Multi-firm collaboration within Revit
- Unified experience with...
 - Revit worksharing
 - Revit Server
- Access to associated model services
- Integration with A360 Professional
- No special APIs at this time



Collaboration | for Revit

The screenshot shows the Autodesk 360 project dashboard for the "SaRang Global Ministry" project. The top navigation bar includes links for "AUTODESK® 360", "Dashboard", "All Projects", and the current project "SaRang Global Ministry". The search bar contains the project name. On the far right of the header are icons for "Invite", "Upload", "Create", a user profile, and help.

The main content area features a large image of a building under construction on the left, followed by a sidebar with project management links: "Project", "Data", "People", "Calendar", and "Wiki". Below this is a "Recent" activity feed, which is currently empty. The central area displays the project title "SaRang Global Ministry" and a brief description: "New construction of the SaRang Global Ministry". It also shows a "Settings" icon and a "PROJECT MEMBERS" section listing five team members: Greg, Art, Tom Anderso, Hans, and Paul Sanders, each with a small profile picture. At the bottom of the central area is an "ACTIVITY" section. A large green box highlights the profile picture of "Paul" at the bottom left, with his name "Paul" overlaid in green text. The footer contains copyright information: "© Copyright 2014 Autodesk, Inc. All rights reserved. Privacy Policy Terms and Conditions About".

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Modelling



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Modeling | Direct Shape API

Referencing

- `DirectShape` elements now support element references
- New property `DirectShapeOptions.ReferencingOption` defaults to true

RoomBounding

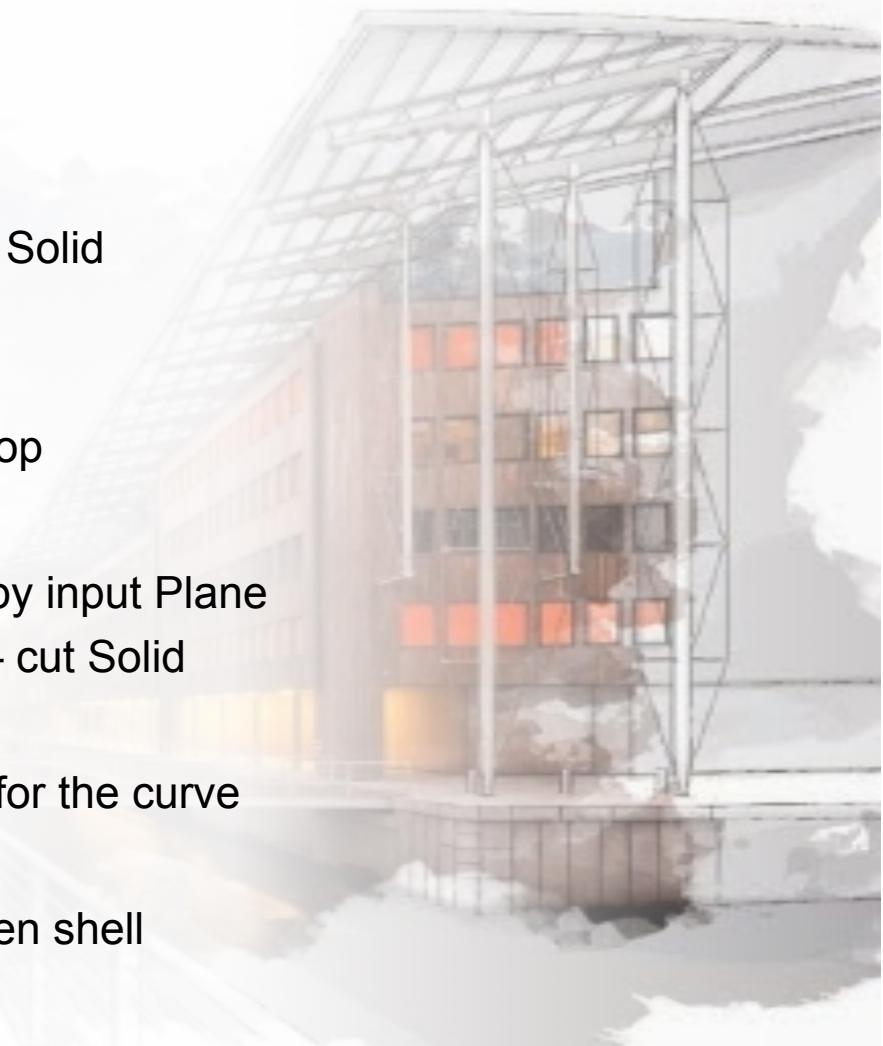
- `DirectShape` elements can participate in room boundary calculation
- New property `DirectShapeOptions.RoomBoundingOption` defaults to false

Curves & Points

- New class `WireframeBuilder` creates geometry from curves & points
- Curves and points are now valid inputs to `SetShape` and `AppendShape` methods

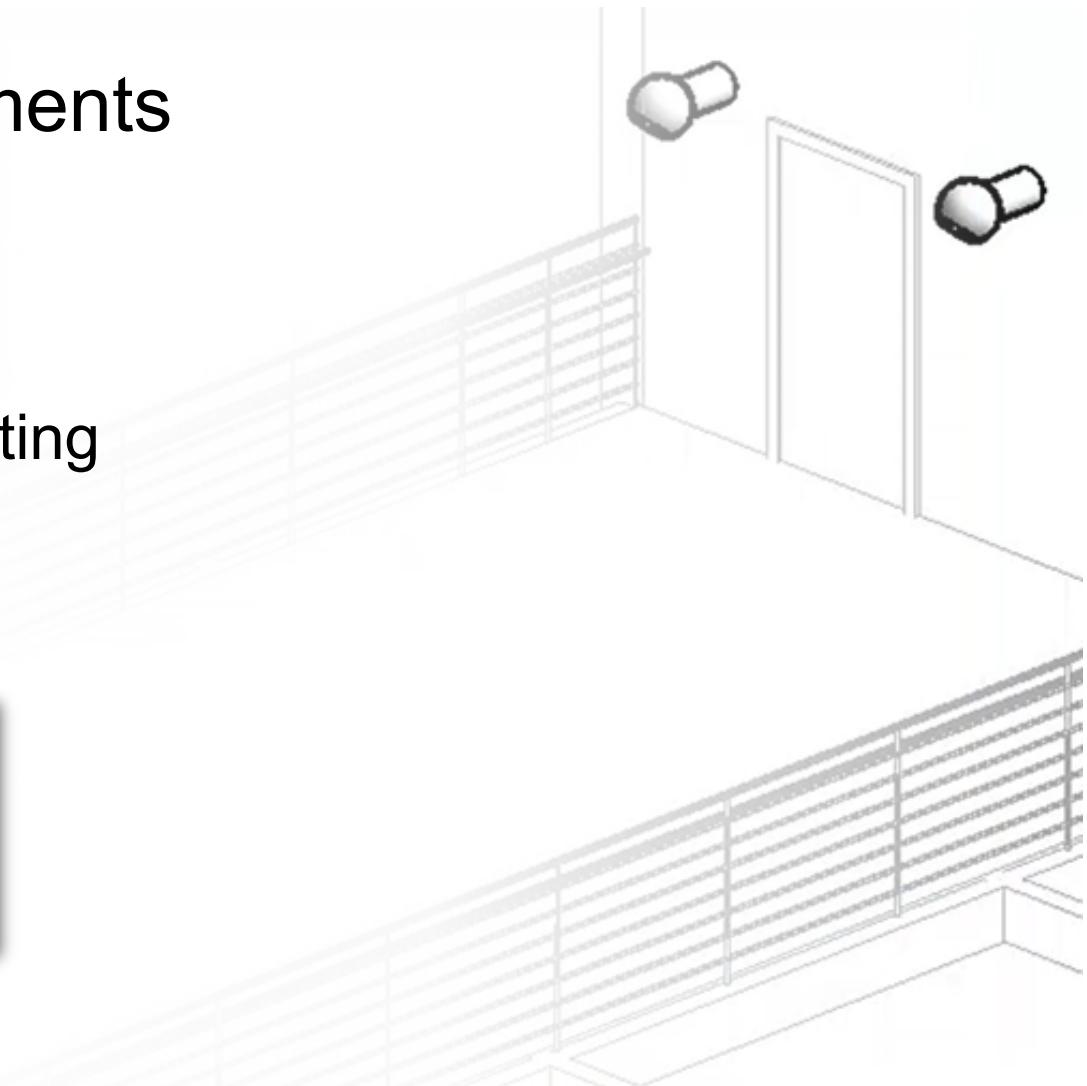
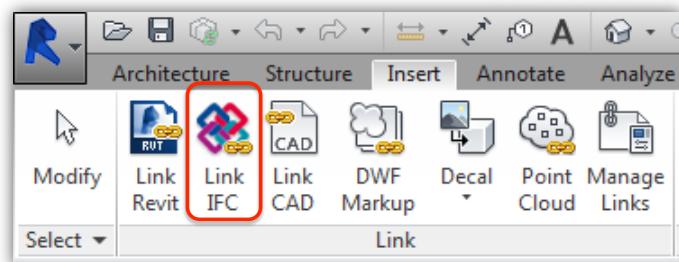
Modeling | Geometry API

- **SolidUtils**
 - [Clone\(\)](#) | [CreateTransformed\(\)](#) – create new Solid
- **CurveLoop**
 - [Transform\(\)](#) – transform original curve loop
 - [CreateViaTransform\(\)](#) – create new curve loop
- **BooleanOperationsUtils**
 - [CutWithHalfSpace\(\)](#) – create new Solid cut by input Plane
 - [CutWithHalfSpaceModifyingOriginalSolid\(\)](#) – cut Solid
- **Curve**
 - [SetGraphicsStyleId\(\)](#) – set graphics style id for the curve
- **GeometryCreationUtilities**
 - [CreateLoftGeometry\(\)](#) – create a solid or open shell geometry by lofting between curve loops



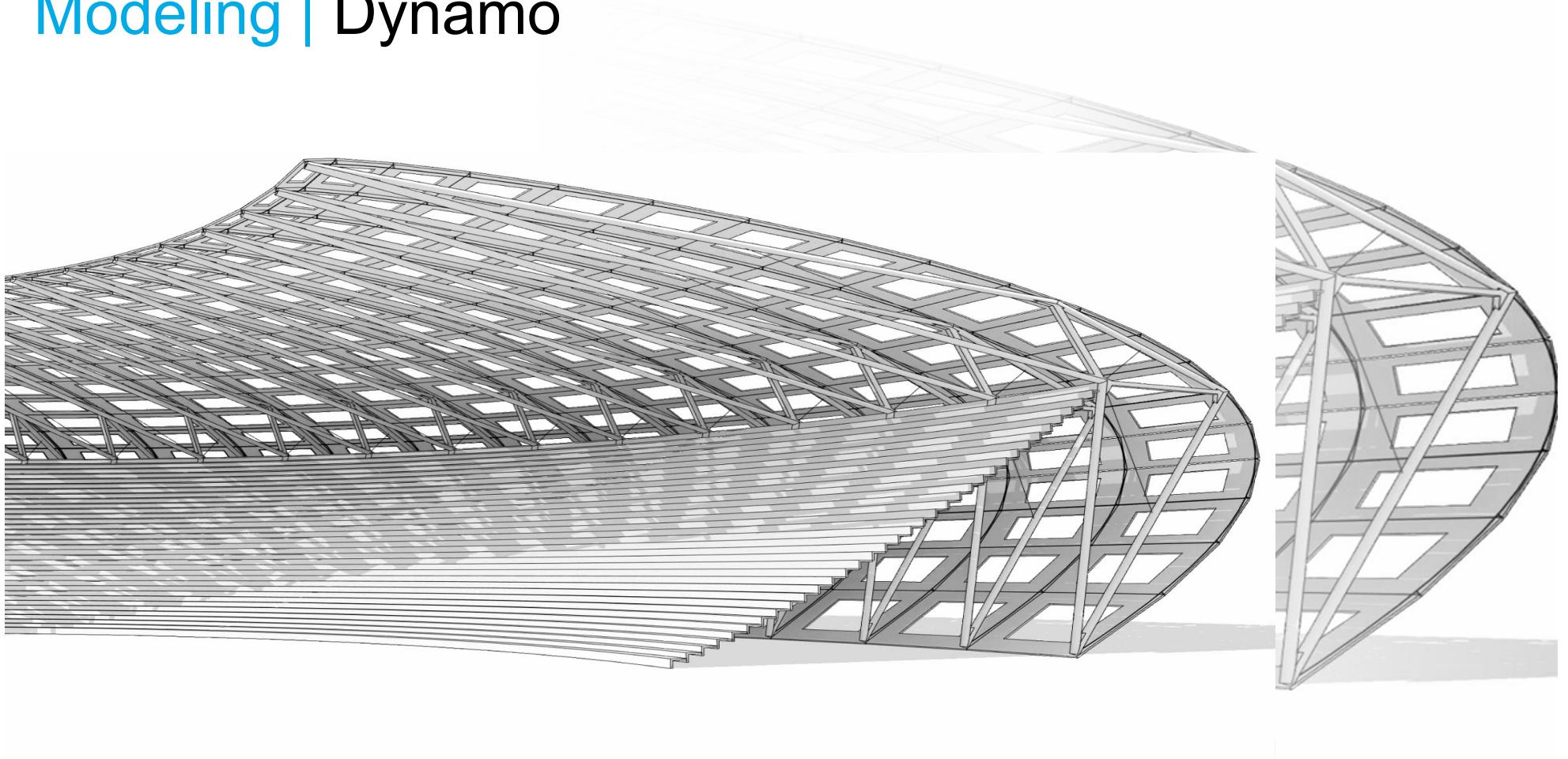
Modeling | IFC Improvements

Use linked IFC models as a reference for dimensions, alignment, snapping, and hosting of face-based families



Direct Shape + Geometry API Demo

Modeling | Dynamo

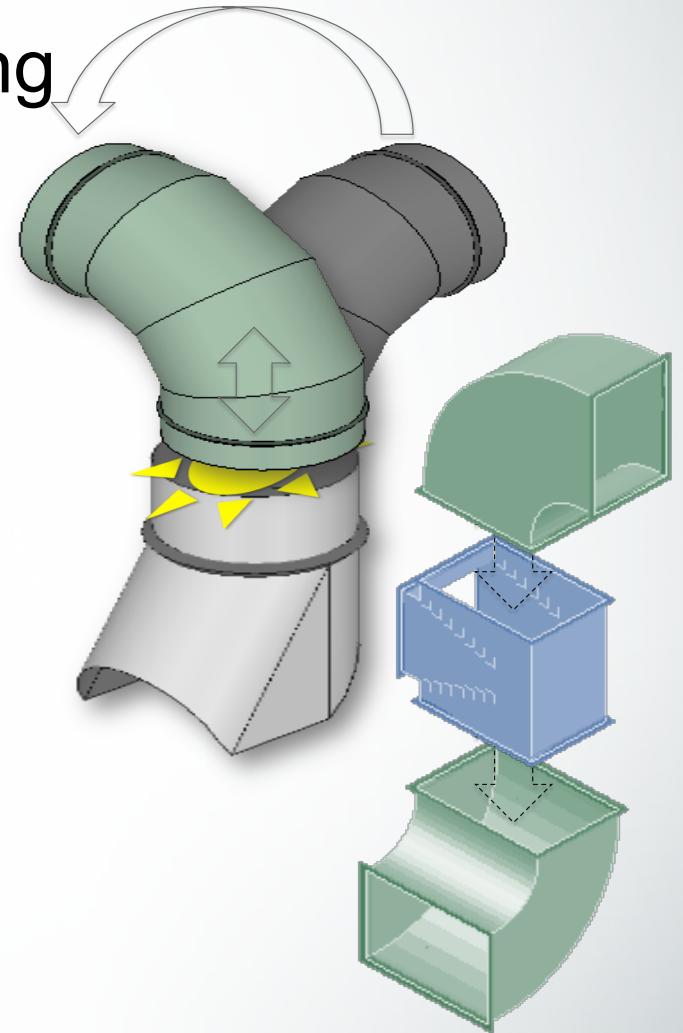


Modeling | Custom Exporter

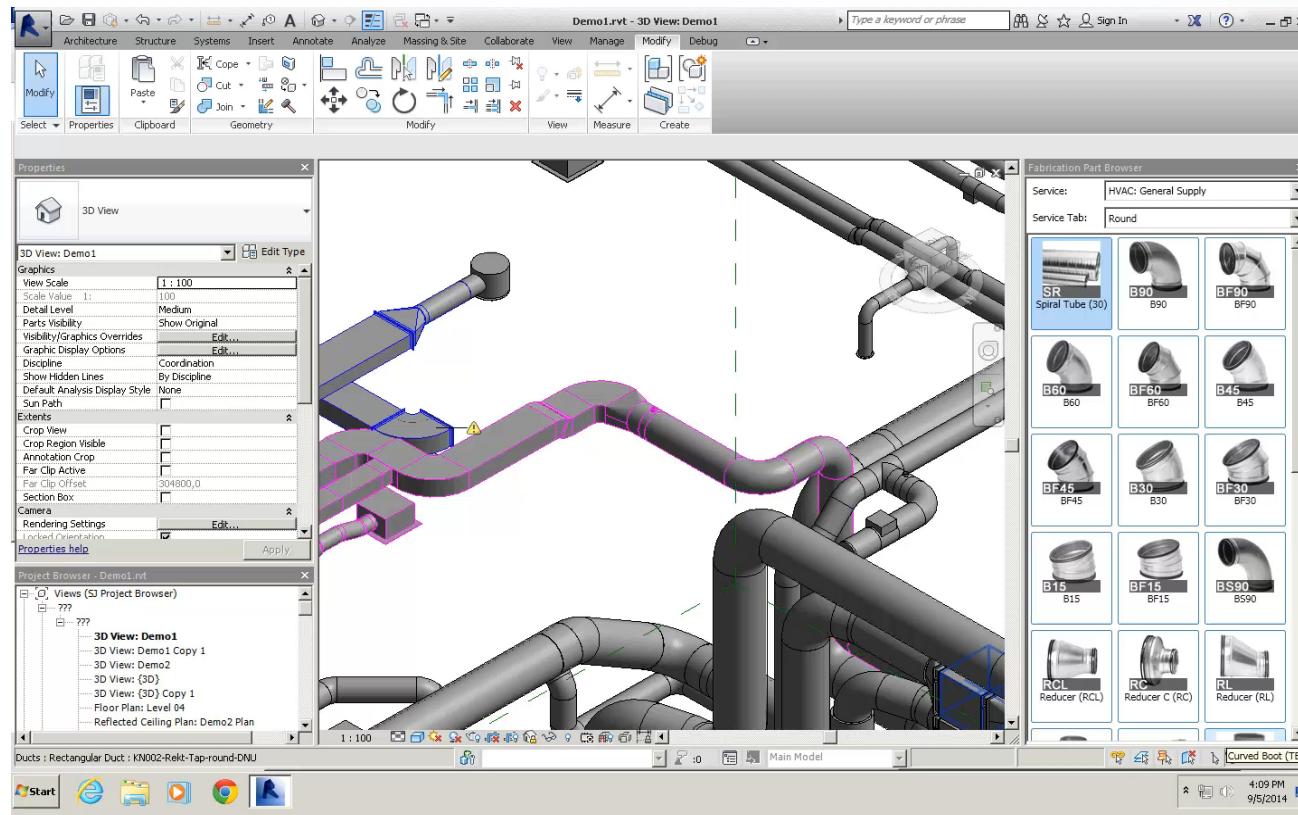
- **IExportContext**
 - Now base class for two interfaces.
- **IPhotoRenderContext**
 - Process elements visible in Revit render command
 - Equivalent to 2015 IExportContext
- **IModelExportContext**
 - Process elements visible in Revit 3D views
 - Supports export of curves, polylines, points, and text

Modeling | MEP Fabrication Detailing

- Part-by-part placement of segments, fittings, and hangers
- Enable higher Level of Development (LOD)
 - Detailed connectors
 - Specification driven lengths
 - Automatic couplings
 - Grouped libraries
 - Validation of size, shape, direction, orientation, connectivity
- Content with realistic behavior, detail, and data to aid coordination modeling



Modeling | MEP Fabrication Detailing



Modeling | MEP Fabrication Detailing API

New classes:

- **FabricationService** services available to create fabrication parts
- **FabricationServiceButton** defines service behavior for given conditions
- **FabricationPartType** defines part types for given service buttons and conditions
- **FabricationPart** represents a fabrication component

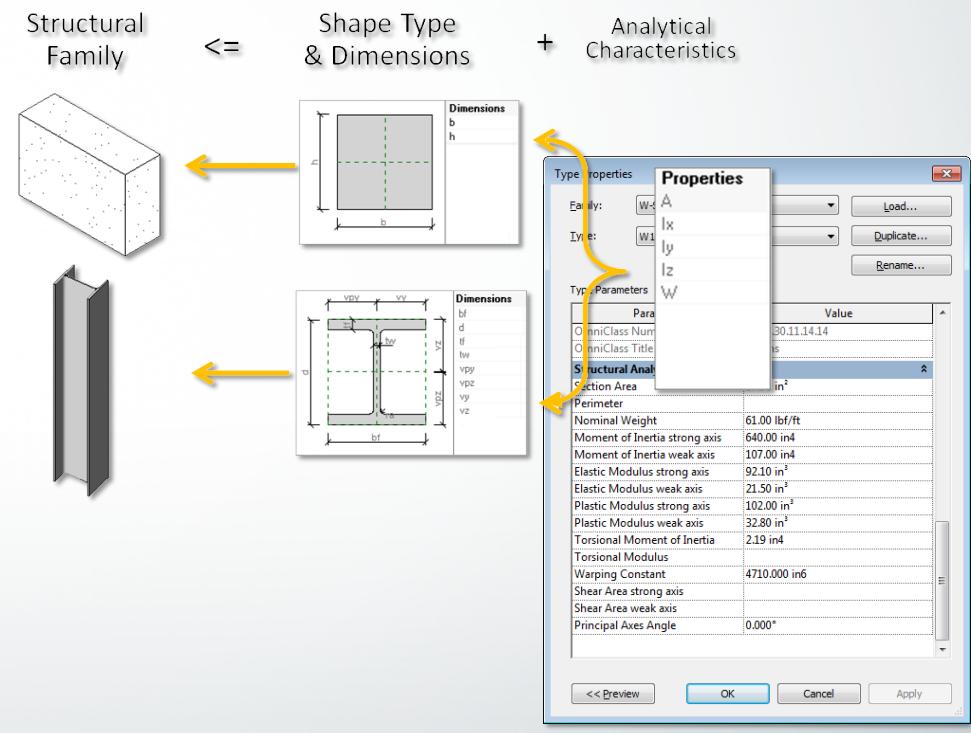
New method:

- FabricationUtils.**AlignPartByConnectors()** – moves and aligns a FabricationPart

Fabrication Hanger Demo

Modeling | Structural Section Properties

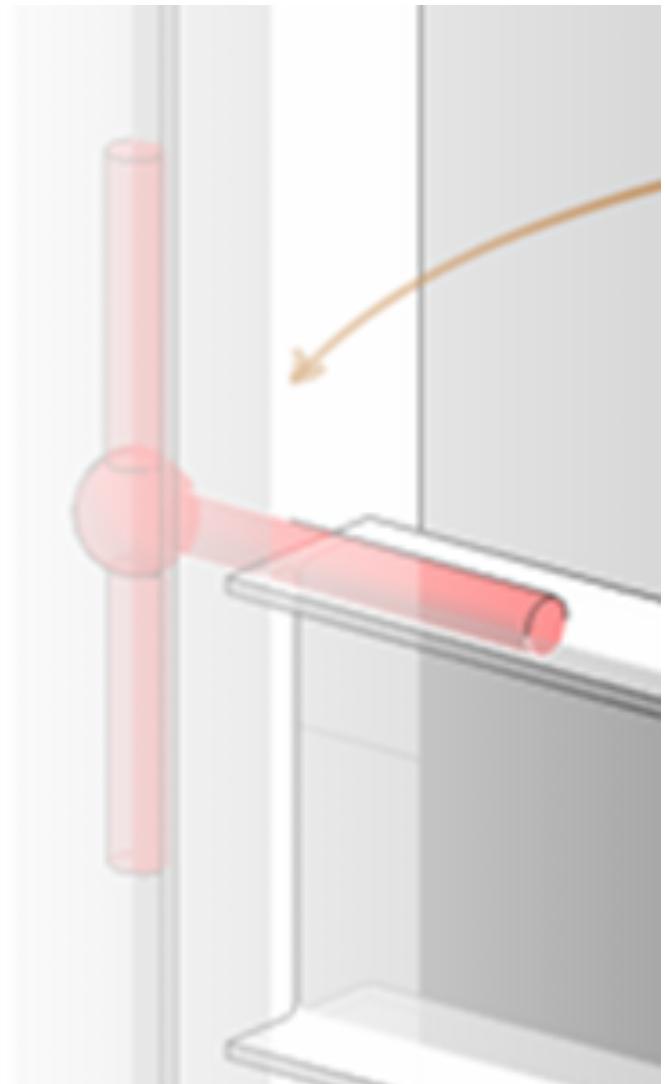
- New properties for detailing
- New Shape Types
 - Cold-formed Steel
 - Concrete
- Improved integration of Simulation, Code checking and Detailing products within BIM workflows



Modeling | Structural Connections

New class **StructuralConnectionHandler** contains information about connected structural elements

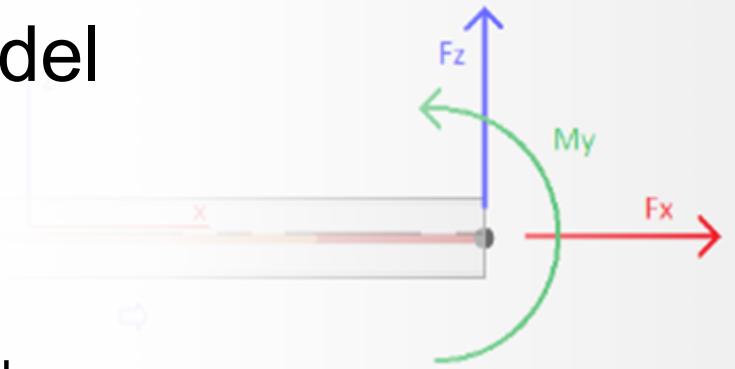
- **Create()** – Create new connection between given elements
- **AddElementIds()** – Add elements to connection handler
- **RemoveElementIds()** – Remove elements from connection handler
- **GetConnectedElementIds()** – Return connected elements
- **GetOrigin()** – Retrieve origin point of connection handler
- **ConnectionName** – Retrieves or changes the name



Modeling | Structural Analytical Model

Local Coordinate System (LCS)

- New method on `AnalyticalModelStick` + `AnalyticalModelSurface`
- `GetLocalCoordinateSystem()` – LCS at a specified point



New class **MemberForces** defines internal forces

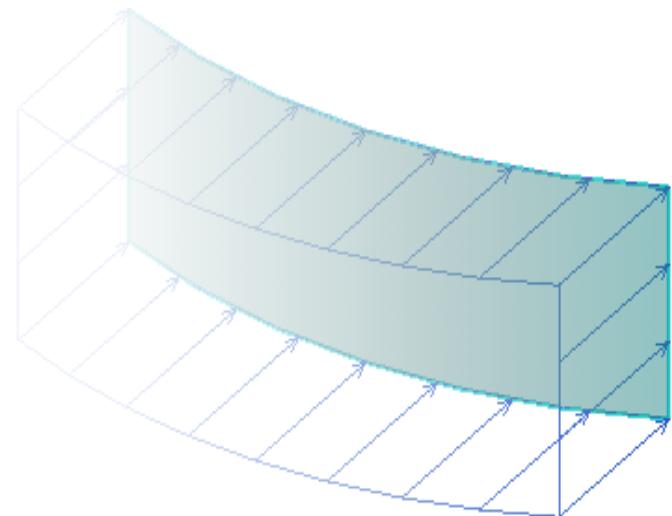
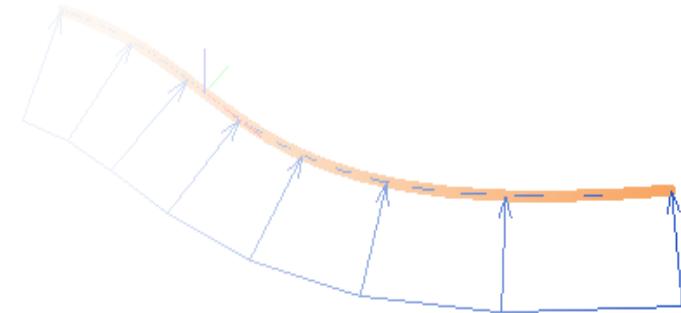
- New methods on `AnalyticalModelStick` elements to get, set, add, and remove member forces
- `MemberForces.Position` – position of force on element
- `MemberForces.Force` – translational force
- `MemberForces.Moment` – rotational force

End	31.000
	32.000
	33.000
	:0.00
	:0.00
	:0.00

Modeling | Structural Loads

Load and **LoadCombination** classes have been significantly renovated:

- **LoadBase** – new base class for **PointLoad**, **LineLoad** and **AreaLoad**
- LoadBase subclasses have significant changes
- **LoadCombination**, **LoadCase**, **LoadNature** and **LoadUsage** also have significant changes

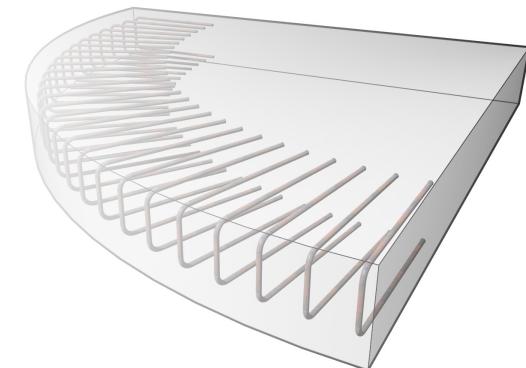
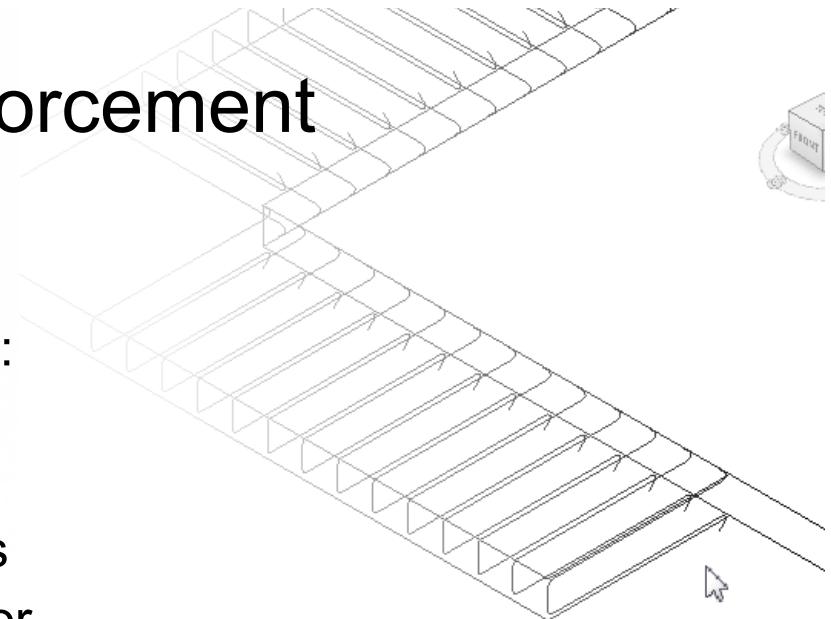


Modeling | Structural Path Reinforcement



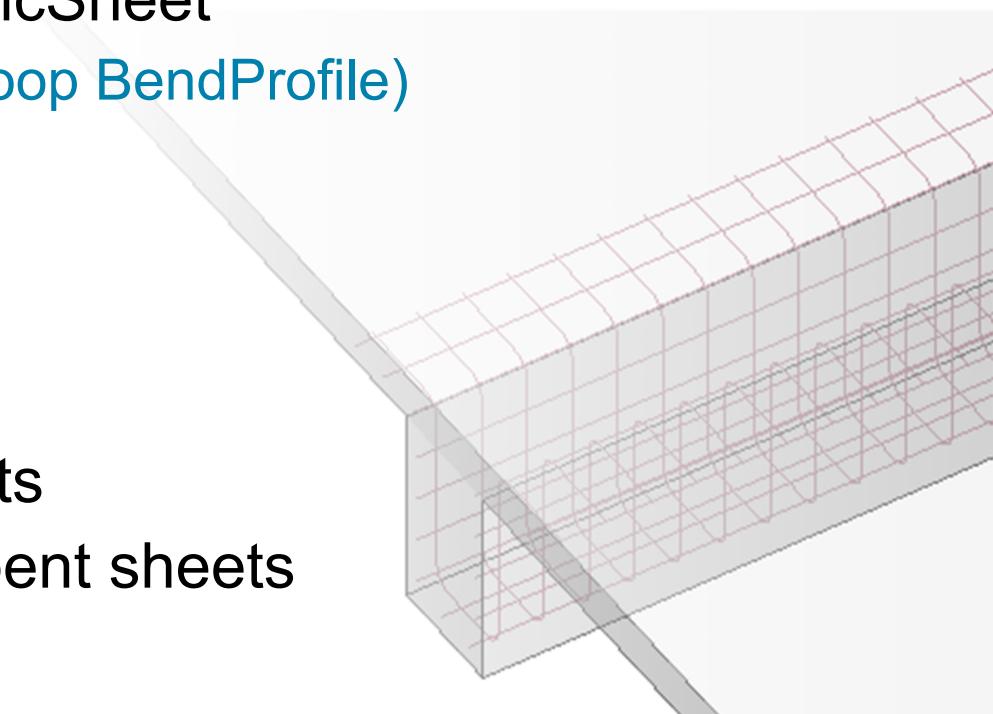
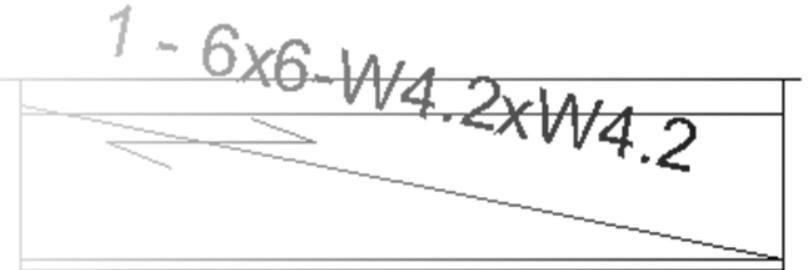
PathReinforcement new methods and properties:

- `Create()`
- `GetOrCreateDefaultRebarShape()` – return RebarShape that fulfills bending requirements
- `SetDefaultRebarShape()` – set RebarShape for primary and alternating bars
- `PrimaryBarShapeld` – RebarShape of primary bars
- `AlternatingBarShapeld` – RebarShape of alternating bars



Modeling | Bent Fabric Sheets

- API-only capability
- Specify a bend profile on a FabricSheet
 - `FabricSheet.Create(..., CurveLoop BendProfile)`
 - `FabricSheet.SetBendProfile()`
- New enums:
 - `BentFabricBendDirection`
 - `BentFabricWiresOrientation`
- Works with all structural elements
- Cannot convert between flat & bent sheets



Bent Fabric Sheet Demo



Efficiency



Developer Days 2014

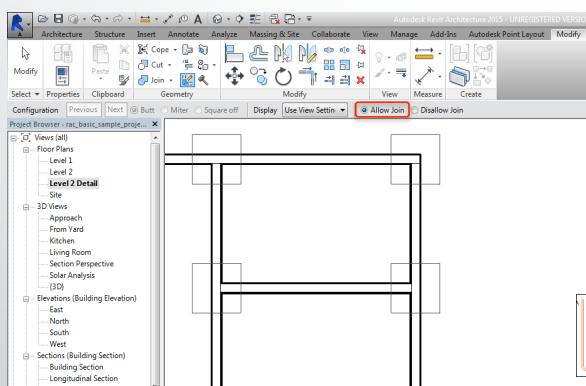
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Efficiency | Productivity Enhancements in 2015 R2

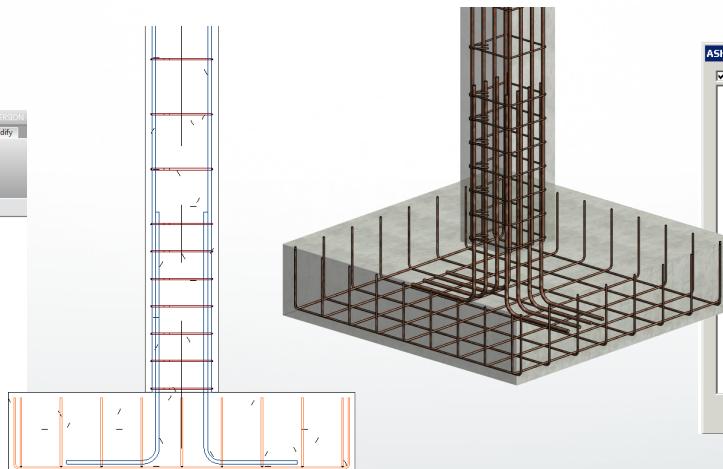
Platform & Architectural enhancements

- Batch wall join editing
- Schedules
- Shaft openings
- Perspective views Editing tools
- Reference other view
- View updates
- Select host for tags
- Annotate stair treads and risers



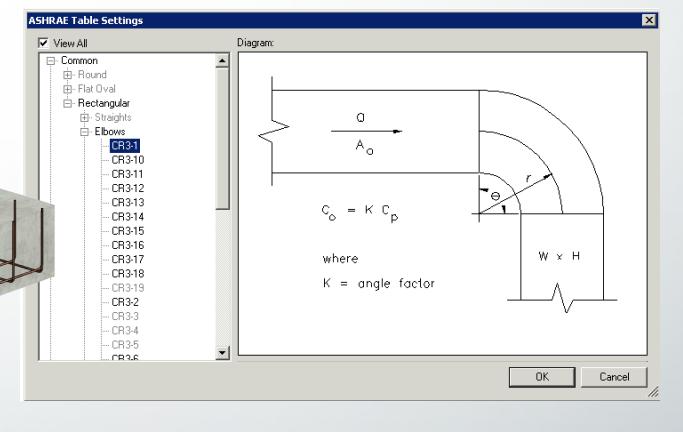
For Structural engineers

- Rebar placement
- Reverse the orientation of structural framing elements
- Snapping to model lines
- Setback reference enhancements
- User interface for structural elements



For MEP engineers

- Panel list search enhancement
- Most recently used panel list
- Circuit default to last used
- Move circuits in panel schedule enhancement
- Pressure loss table visibility



Efficiency | Workset API

Creation:

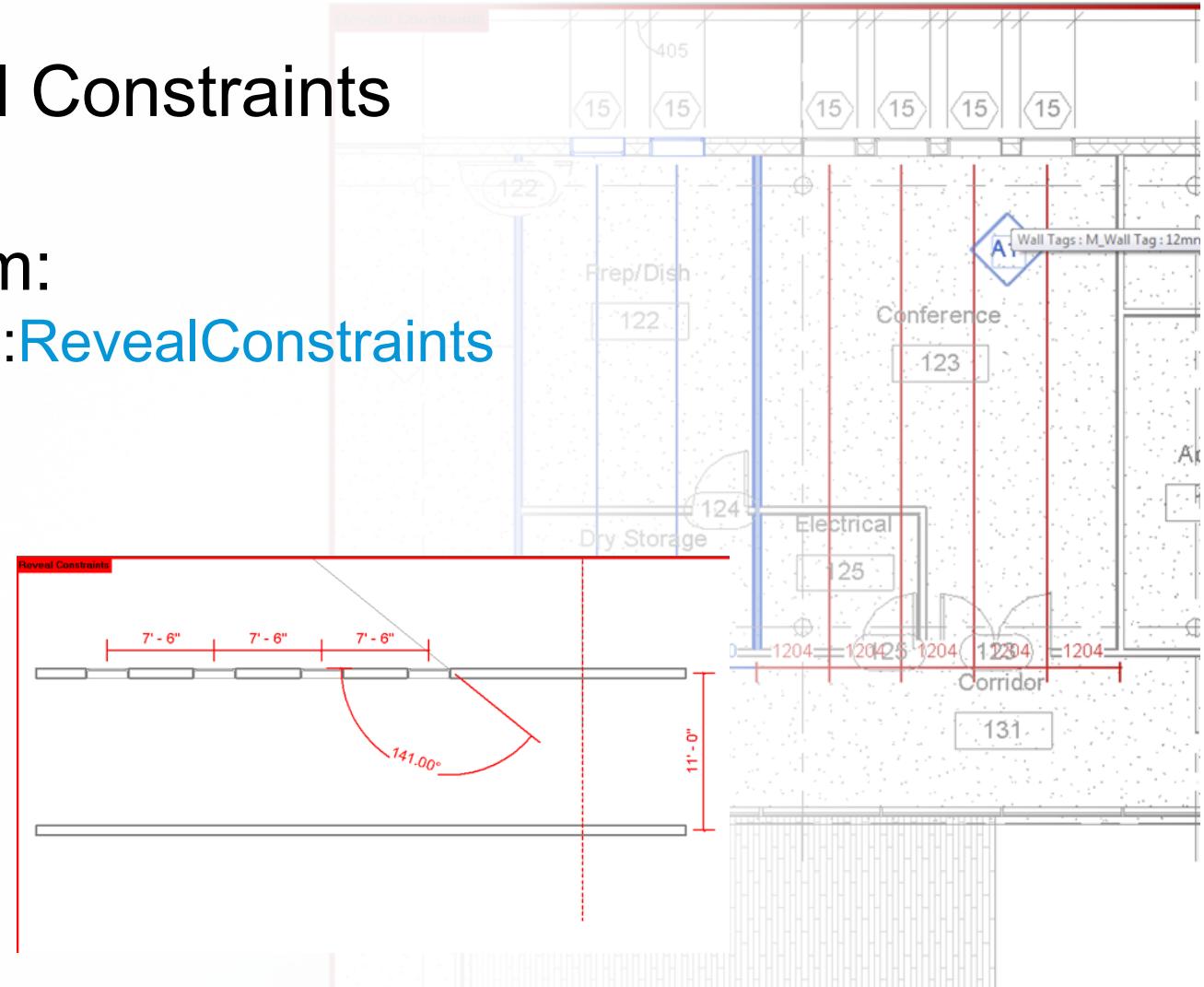
- The new static method: `Workset.Create()`

Workset Modification:

- New method: `WorksetTable.RenameWorkset()`
- New method: `WorksetTable.SetActiveWorksetId()`

Efficiency | Reveal Constraints

New value in enum:
TemporaryViewMode::RevealConstraints



Efficiency | Schedule API

New Properties:

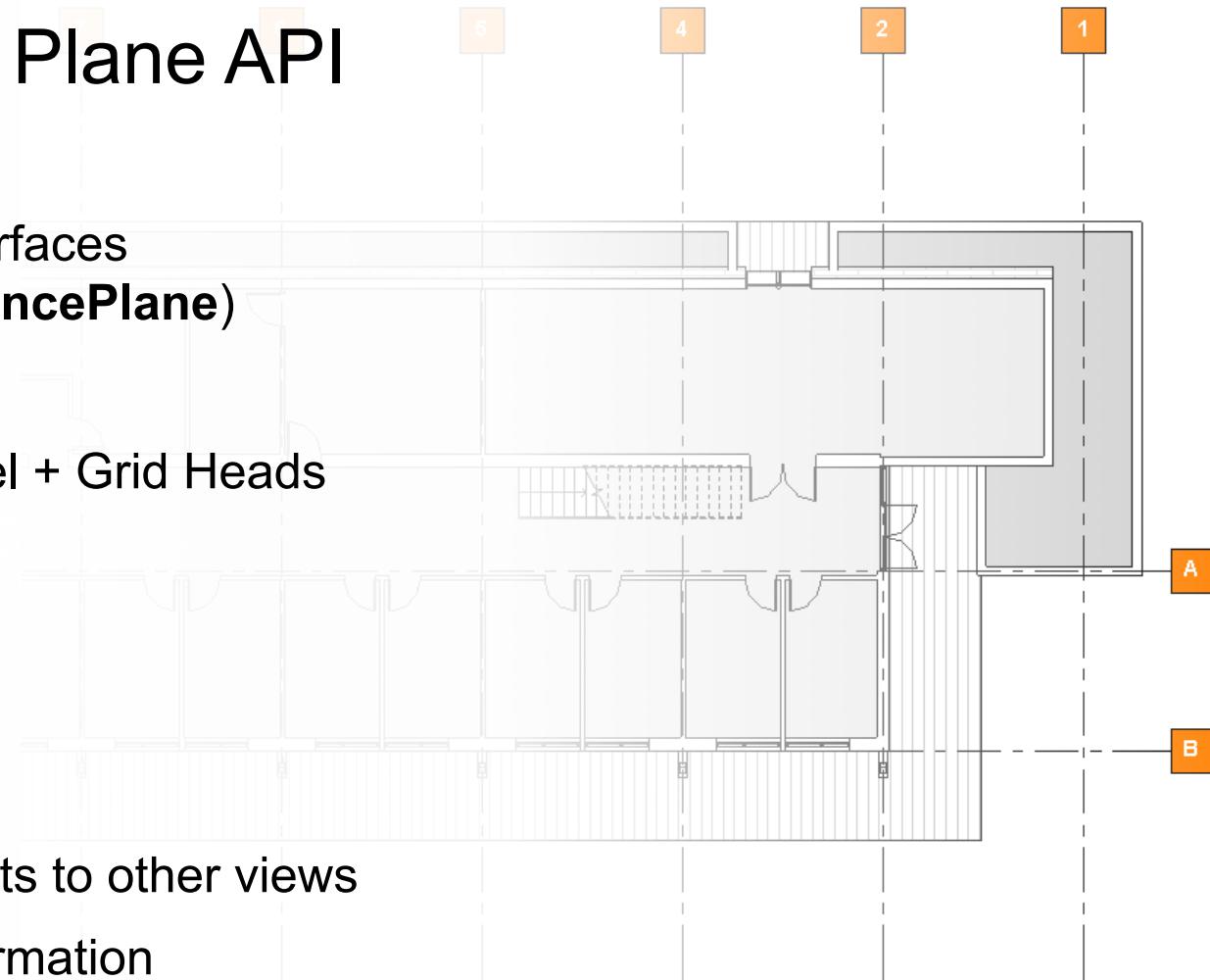
- `ScheduleDefinition.ShowTitle` indicates if schedule displays title
- `ScheduleDefinition>ShowHeader`s indicates if schedule displays headers

A	B	C	D
Area	Level	Name	Number
316 SF	FIRST FLOOR	CONFERENCE	1
197 SF	FIRST FLOOR	RECEPTION	2
310 SF	FIRST FLOOR	READING ROOM	3
205 SF	FIRST FLOOR	MENS	4
205 SF	FIRST FLOOR	WOMENS	5
335 SF	FIRST FLOOR	CONFERENCE	6
248 SF	FIRST FLOOR	CONFERENCE	7
697 SF	GROUND FLOOR	GATHERING	8
122 SF	GROUND FLOOR	OFFICE	9
122 SF	GROUND FLOOR	OFFICE	10
122 SF	GROUND FLOOR	OFFICE	11
122 SF	GROUND FLOOR	OFFICE	12
122 SF	GROUND FLOOR	OFFICE	13
122 SF	GROUND FLOOR	OFFICE	14
122 SF	GROUND FLOOR	OFFICE	15
122 SF	GROUND FLOOR	OFFICE	16
122 SF	GROUND FLOOR	OFFICE	17
117 SF	GROUND FLOOR	OFFICE	18
2164 SF	FIRST FLOOR	CIRCULATION	19
1808 SF	FIRST FLOOR	OFFICE	20
517 SF	GROUND FLOOR	LIBRARY	21
1339 SF	GROUND FLOOR	CIRCULATION	22
264 SF	GROUND FLOOR	MENS	23
193 SF	GROUND FLOOR	WOMENS	24
72 SF	GROUND FLOOR	VESTIBULE	25
252 SF	GROUND FLOOR	STORAGE	26
264 SF	GROUND FLOOR	KITCHEN	27
134 SF	GROUND FLOOR	STORAGE	28
753 SF	GROUND FLOOR	VIDEO PROJ	29
263 SF	GROUND FLOOR	MECHANICAL	30
122 SF	GROUND FLOOR	MECH.	31
96 SF	GROUND FLOOR	ENTRY	32

Efficiency | Datum Plane API

New class **DatumPlane**

- Base class for datum surfaces
(Level, Grid and ReferencePlane)
- Now you can:
 - Show and hide Level + Grid Heads
 - Check view visibility
 - Set 3D extents
 - Maximize extents
 - Set 2D extents
 - Propagate 2D extents to other views
 - Get/Set Leader information



Efficiency | Text Note API

Modified methods and properties

TextNote.Create .O. F
2
Creates a new text note element with given properties

TextNote.LeaderCount .O. F
2
Number of attached leaders

TextNote.GetLeaders .O. F
1
List leaders currently attached to the text note

TextNote.LeaderLeftAttachment .O. F
1
Get/set the attachment position of leaders

TextNote.LeaderRightAttachment .O. F
1

TextNote.HorizontalAlignment .O. F
1
Control text alignment

TextNote.VerticalAlignment .O. F
1

TextNote.KeepRotatedTextReadable .O. F
1
Control text behavior within a rotated text box

Efficiency | Dimension & Leader API

Dimension | DimensionSegment new properties:

- **Origin** (Dimension only) – return dimension origin
- **LeaderEndPoint** – position of leader end point
- **TextPosition** – position of the drag point
- **ResetTextPosition()** – reset to initial position

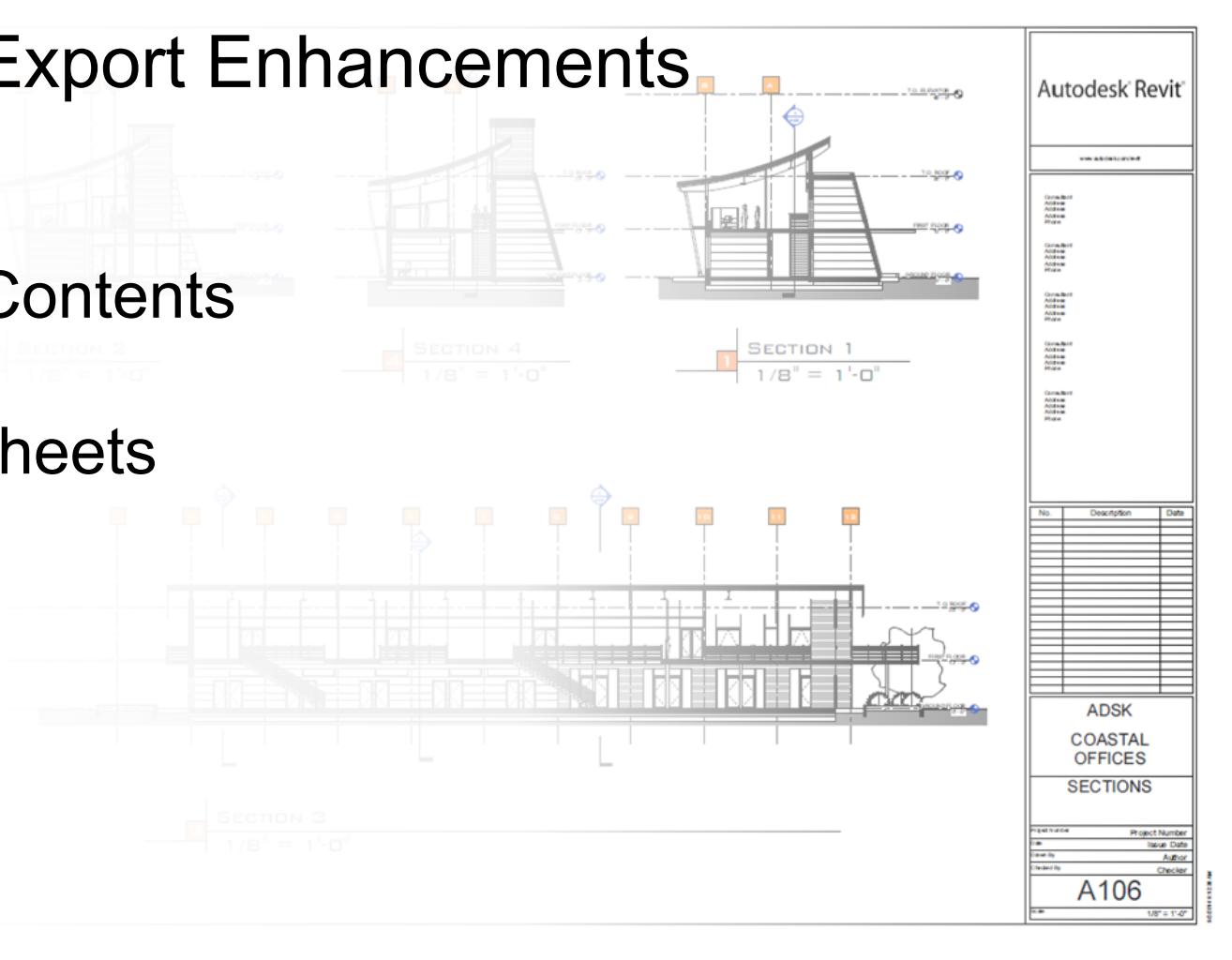
Leader new properties:

- **Anchor** – leader anchor point
- **LeaderShape** – geometric style of the leader

Dimension & Leader API Demo

Efficiency | PDF Export Enhancements

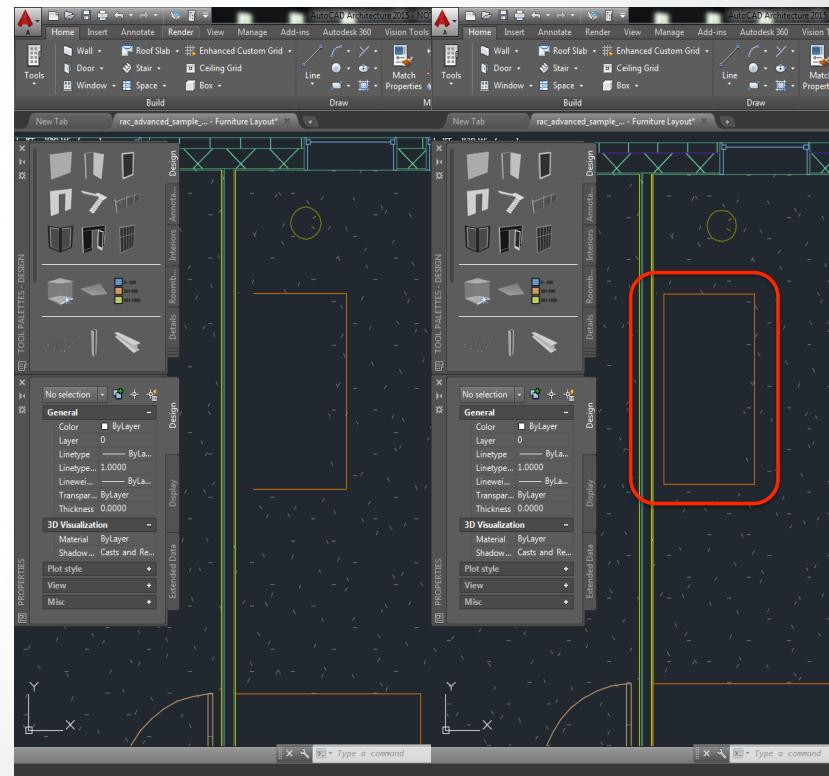
- Linked Table of Contents
- Link views and sheets
- Hyperlinks



Efficiency | Coincident Lines to CAD

BaseExportOptions

- New property:
PreserveCoincidentLines
preserves coincident lines
during export to DWG, DXF
or DGN



Efficiency | Energy Analysis

Show the Energy Analytical Model

<Analytical Spaces>

A	B	C	D
Room Name	Count	Area	Volume
Cafeteria 121	1	239 m ²	497.81 m ³
Lounge 223	1	126 m ²	321.22 m ³
	1	50 m ²	41.37 m ³
Library 219	1	122 m ²	293.42 m ³
	1	33 m ²	27.42 m ³
Instruction 218	1	122 m ²	108.35 m ³
	1	10 m ²	22.4 m ³
Computer Lab 222	1	57 m ²	135.71 m ³
Instruction 221	1	41 m ²	98.91 m ³
Sprinkler 119	1	10 m ²	31.25 m ³
Electrical 118	1	19 m ²	60.84 m ³
Electrical 220	1	17 m ²	56.85 m ³
			1614.3 m ²

<Analytical Surfaces>

A	B	C	D
Surface Type	Opening Type	Count	Area
Air	24	404 m ²	
Fixed Window	1234	3525 m ²	
Non-swing Door	33	176 m ²	
Operable Window	24	27 m ²	
Ceiling	67	3246 m ²	
Exterior Wall	271	1101 m ²	
Interior Floor	110	2966 m ²	
Interior Wall	1119	3814 m ²	
Roof	36	1572 m ²	
Shade	72	638 m ²	
Slab on Grade	34	1672 m ²	
			16143 m ²

Use Conceptual Massing and Building Elements Together

Real time, Interactive Feedback + Energy Plus Engine in the Cloud

Energy Cost Mean

23.8 USD / m² / yr

MIN MAX

Equipment Power Density

Building Site: [Address]

Parameters:

- Occupancy Schedule: [Schedule]
- People 102.04 M.
- People 102.04 L.
- People Density (m²): 73
- People Latent Heat Gain (W/person): 59
- People Sensible Heat Gain (W/person): 200
- People Latent Heat Gain (W/m²): 1.2
- Equipment Load Density (W/m²): 1.8
- Electrical Equipment Radiant Percentage: 0%
- Condition Type: 2
- On/Off Period: 3.7
- CAW Free Pct Area (sq. M. Area): 0.12

Daylighting/Occupancy Sensors

Insulation is a material in the exterior walls that block or slows the flow of heat. The current range includes design options between Both off - Both off

Roof U-Value

Insulation is a material in the roof or ceiling of the top occupied or that blocks or slows the flow of heat. The current range includes design options between R10 over - R15 over

Building

Information

Modeling

Yesterday

application

desktop

locally collaborative

design level of detail

limited building information

capturing design intent

physical modeling

Tomorrow

platform

client

socially shared

construction + fabrication ready

integrated simulation

exploring design alternatives

behavioral modeling



Q+A



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