AUTODESK® REVIT® STRUCTURE
AUTODESK® ROBOT™ STRUCTURAL ANALYSIS PROFESSIONAL

Integrating Revit Structure and Robot Structural Analysis Professional

This paper explores the interoperability between Revit Structure and Robot Structural Analysis Professional, including recommended workflows, analytical modeling best practices, and the details of the data exchange between the two software solutions.

CONTENTS

Structural engineers typically start the design process by interpreting architectural drawings, creating design documentation, and creating various analytical models. These analytical models must be consistently coordinated with respect to general framing layout, material and section properties, and loading. Once analysis and design is complete, the design documentation is modified to reflect the most current design. This workflow is repeated for each iteration of the design process.

The link between Autodesk Revit Structure and Autodesk Robot Structural Analysis streamlines this workflow by facilitating the coordination of design documentation with structural analytical design information. Revit Structure supports the building information modeling (BIM) process for structural engineers by providing a physical model to use for documentation and an associated analytical model to use for structural analysis and design.

Robot Structural Analysis supports this process with its advanced analysis and multi-material design functionality. This interoperability reduces the time needed to create and update multiple analysis models and helps to avoid potential errors resulting from a manual coordination between analysis results and construction documentation.

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Workflows

Some structural engineering firms begin the design process by creating documentation. Others start by creating an analytical model.” The link between Revit Structure and Robot Structural Analysis supports both workflows. However, there are some advantages to starting the design process with a model in Revit Structure instead of Robot Structural Analysis.

For instance, in addition to creating construction documents, many firms use the Revit Structure model to coordinate their designs with other disciplines. Therefore, structural drafters can begin modeling, documenting using company standards, and coordinating the structure. By starting the design in Revit Structure, there is both a physical model created for coordination and early documentation, as well as a simplified analytical model. Each model is independently editable but also maintains a consistent relationship to the other.

Furthermore, models created in analysis and design applications often contain only simplified analytical models with no regard to physical characteristics. For example, most analysis programs don’t recognize whether a beam symbolizes the centerline or top of flange. All that matters is that there are diaphragms that transmit loads to the beams and that the beams are supported at their nodes. If the modeling effort starts in Robot Structural Analysis, all the “physical” representations are created using the “centerline” positions instead of the “Top of Beam” or a particular offset below the Slabs. Then, when the model is sent to Revit Structure, the CAD technician has to correct all these positions and reassign material properties and other “physical” or graphic parameters. In addition, the drafter has to wait until the engineer has completed the structural analysis and design before starting the coordination and documentation tasks.

The link between Revit Structure and Robot Structural Analysis allows engineers to send selected portions of a Revit Structure model to Robot Structural Analysis, and vice versa. This flexibility allows the engineer to work with the structure in separate analysis models.

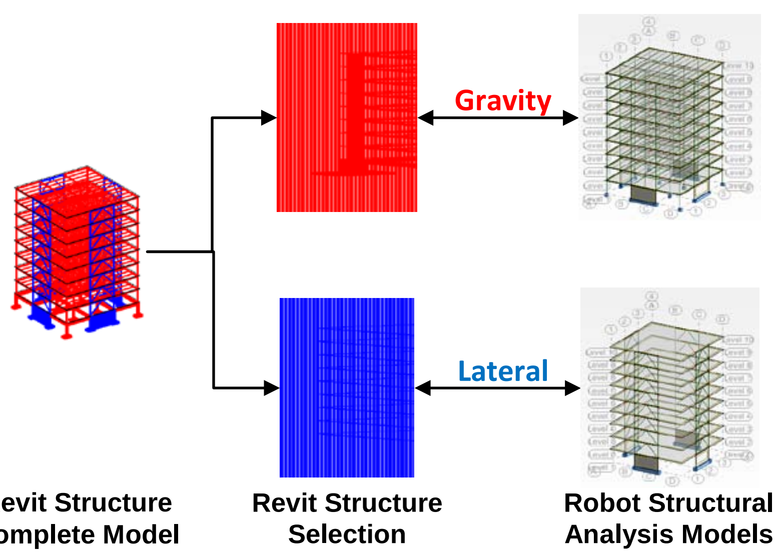

Figure 1

Filtered views in Revit Structure are used to create separate analysis models in Robot Structural Analysis.

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For example, the engineer can create separate analysis and design models for:

- Gravity and lateral systems,
- Structural steel and reinforced concrete systems,
- Logical separations in structure,
- Evaluations of specific elements,
- Phased construction and design options.

Users may prefer some of the modeling tools in Revit Structure over those in Robot Structural Analysis. However, certain elements or parameters may be easier to model and adjust in Robot Structural Analysis such as member end releases, loads, and boundary conditions. For example, the creation of *Load Combinations* is more robust in Robot Structural Analysis, which can auto-generate numerous combinations at once. Additionally, more options exist in Robot Structural Analysis for creating loads. However, there are instances where it may be necessary or preferable to model *Loads* in Revit Structure—primarily for use in other Revit Structure Extensions for analysis and design.

A suggested approached for analysis and design is as follows:

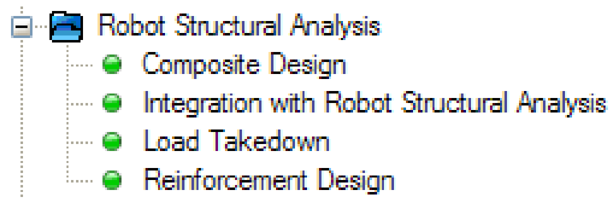
- Model these elements in Revit Structure:
    - Grids and levels,
    - Structural columns and framing,
    - Structural floors and foundations,
    - Preliminary design load cases and loads.
- Perform preliminary analysis and design with Extensions.
- Send to Robot Structural Analysis.
- Model these elements in Robot Structural Analysis:
    - Final design load cases, loads, and load combinations,
    - Boundary conditions and bar end releases,
    - Meshing and advanced analysis parameters.
- Perform final analysis and design in Robot Structural Analysis.
- Then update these Revit Structure elements from Robot Structural Analysis:
    - Members,
    - Internal forces and reactions (if desired),
    - Designed concrete reinforcement.
- Repeat for each design iteration as needed.

There is no correct or incorrect workflow for analysis interoperability. What is best for one firm or a particular project may be different for another. Factors to consider include:

- Division of modeling, analysis, and documentation tasks by CAD technicians and engineers,
- Number and types of licenses for Revit Structure and Robot Structural Analysis,
- Use of multiple analysis tools on one project,
- Network architecture and workstation capabilities.

Interoperability with Robot™ Structural Analysis Extension

Robot Structural Analysis Extensions for Revit Structure provide interoperability between Revit Structure and Robot Structural Analysis. These Extensions are available for download for Subscription customers.



- **Composite Design** helps structural engineers design and analyze composite steel framing directly in Revit Structure.
- **Integration with Robot Structural Analysis** sends and updates the Revit Structure model to and from Robot Structural Analysis. All analyses and design are performed in Robot Structural Analysis.
- **Load Takedown** allows the structural engineer to simulate load distribution throughout the structure; calculating loads for framing, columns, and foundations.
- Finally, **Reinforcement Design** enables structural engineers to use Robot Structural Analysis to interactively design concrete reinforcement for concrete framing, and create or update Structural Rebar in Revit Structure.

Note: This paper focuses only on the Integration with Robot Structural Analysis Extension.

Sending and Updating

After selecting the Integration with Robot Structural Analysis Extension, the structural engineer has the option to send a model to—or update a model from—Robot Structural Analysis. The option to use an RTD file (the native format of the Robot software) allows the engineer to transfer data to a separate Robot Structural Analysis file. This option allows the drafter to continue to work in the Revit Structure file while the structural engineer works in the Robot Structural Analysis model. If unchecked, it creates a Robot file and opens Robot software automatically. This may beneficial for a quick analysis check or small design update.

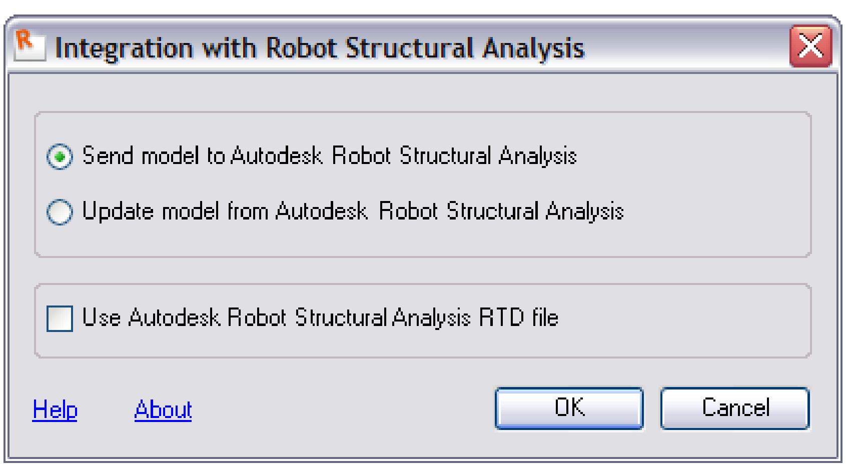


Figure 2

The send and update dialog box for the Integration with Robot Structural Analysis Extension.

Send – Basic Options

There are a few basic options to consider when sending a model to Robot Structural Analysis. The engineer can send the entire model to Robot Structural Analysis or select a specific portion of the model to send to Robot Structural Analysis. Users can send only a selection of the model when they need to perform analysis and design for certain elements or structural systems, or to make small modifications in layout or design.

The option to execute model correction in Robot Structural Analysis will apply the default model correction procedure to the model in Robot Structural Analysis. For complete information regarding the model correction settings and behaviors, please reference the Robot Structural Analysis help files.

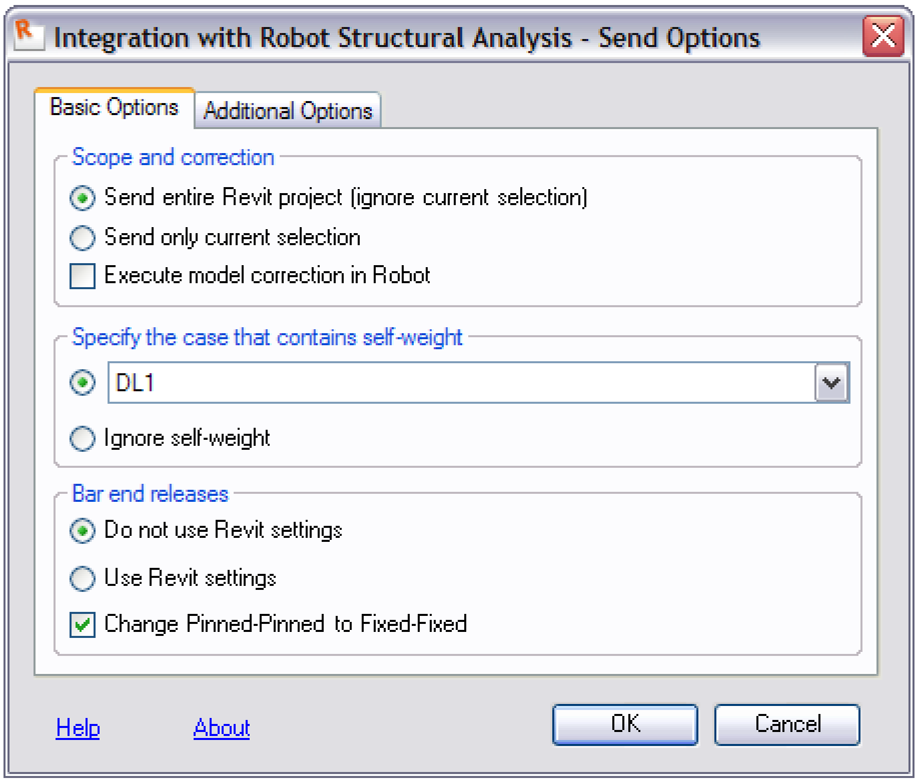


Figure 3

Dialog box showing options for sending Revit Structure models to Robot Structural Analysis.

Self-weight of the structure can be ignored or placed on the *Load Case* of the engineer's choosing. Create the Load Cases in Revit Structure prior to running the Extension.

Finally, member end releases can be set for each member in Revit Structure, in which case the engineer has the option to send these settings to Robot Structural Analysis or to ignore the Revit Structure settings and make all end release adjustments in Robot Structural Analysis. Member end releases are set to Pinned-Pinned by default in Revit Structure. If they are left unchanged and sent to Robot Structural Analysis, an initial analysis calculation will invariably reveal numerous instabilities resulting in calculation errors.

The Bar end release options allow the engineer to use Revit Structure settings in Robot Structural Analysis or ignore those settings and optionally change all Pinned-Pinned releases to Fixed-Fixed. In the latter case, the engineer then uses Robot Structural Analysis for the assignment of all end releases.

Send – Additional Options

Users can send materials defined in Revit Structure to Robot Structural Analysis as new materials. Alternatively, the engineer may choose to use Robot Structural Analysis default materials or let the Extension map the Revit Structure material to the best matching Robot Structural Analysis material. Since Revit Structure materials have parameters related to graphic standards, rendering materials, and other attribute information, the use of Revit Structure materials is recommended. By selecting this option, the Revit Structure materials are retained in the model and new corresponding materials are defined in Robot Structural Analysis.

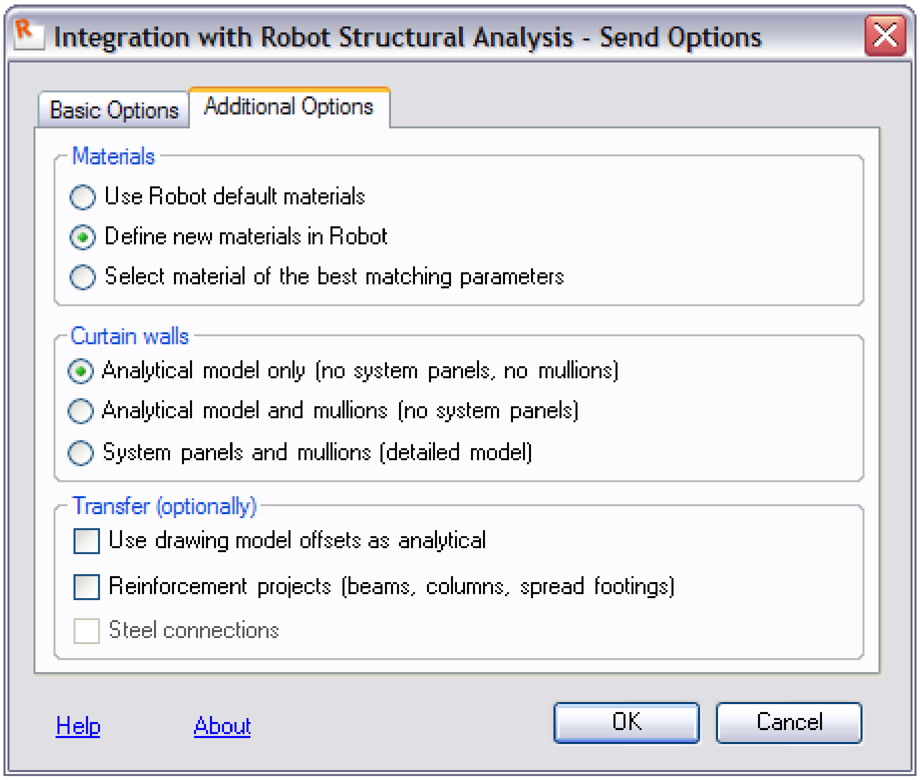


Figure 4

Additional options when sending models to Robot Structural Analysis.

Curtain walls defined in Revit Structure can also be transferred to Robot Structural Analysis. These are transferred as *Cladding* elements rather than finite (*Panel*) elements in order to assign area loads and direction of span.

Transferring the model using drawing model offsets gives additional control over the location of certain elements in Robot Structural Analysis. Selecting this option is useful in certain situations where a particular alignment of geometry is important for analysis as well as documentation.

By choosing to “Transfer Reinforcement”, the option will send modeled concrete reinforcing bars to Robot Structural Analysis.

Update

The options for updating a Revit Structure model from Robot Structural Analysis are similar to the options for sending models from Revit Structure to Robot Structural Analysis. Note that in addition to updating the entire model, selected elements from either Robot Structural Analysis or Revit Structure can be updated.

If the “Select modified elements” option is checked, the Revit Structure software will highlight all the new or revised elements that were updated from Robot Structural Analysis, helping the engineer or CAD technician more easily review the model. Additionally, the Extension can transfer *Internal Forces* and *Reactions* calculated in Robot Structural Analysis to Revit Structure for use in documentation.

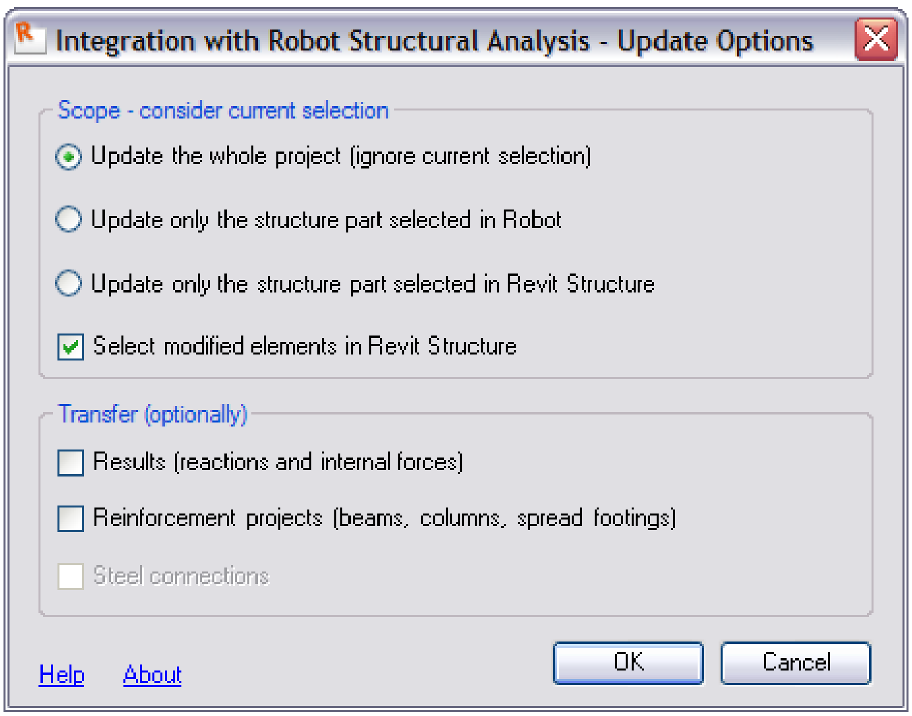


Figure 5

Options for updating a Revit Structure model from Robot Structural Analysis.

Best Practices

The following tips are suggested to facilitate the transfer of elements between Revit Structure and Robot Structural Analysis.

Alignment and Constraints

Creation of duplicate nodes at intersections is a common issue engineers encounter when linking a Revit Structure model to analysis software. This often occurs when framing elements are not joined properly. One way to eliminate or reduce duplicate nodes is to align or constrain structural elements to grids, levels, and named reference planes in Revit Structure. This is particularly relevant for braced frames and where structural elements are offset from the primary grids.

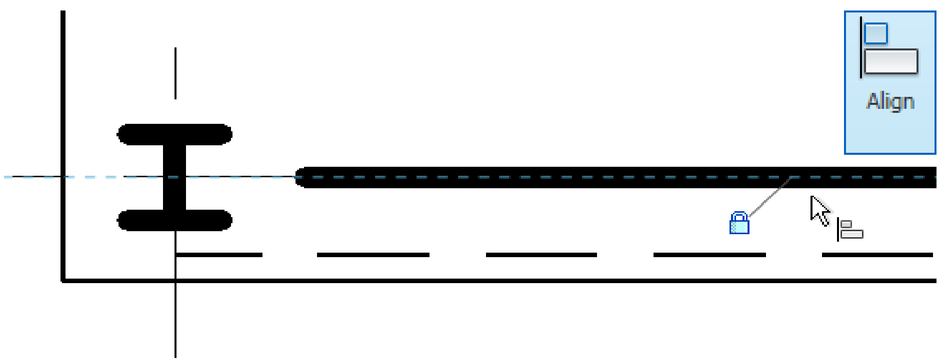


Figure 6

Explicitly constraining a *Beam* to a *Grid* using the Align tool.

Warnings

Be sure to inspect and correct all elements that trigger a warning such as: “Beam or Brace is slightly off axis…” The corrective action is typically to align and constrain the element to a grid or reference plane.

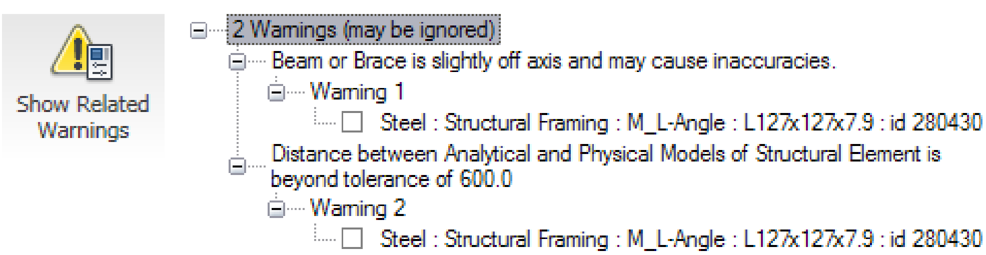


Figure 7

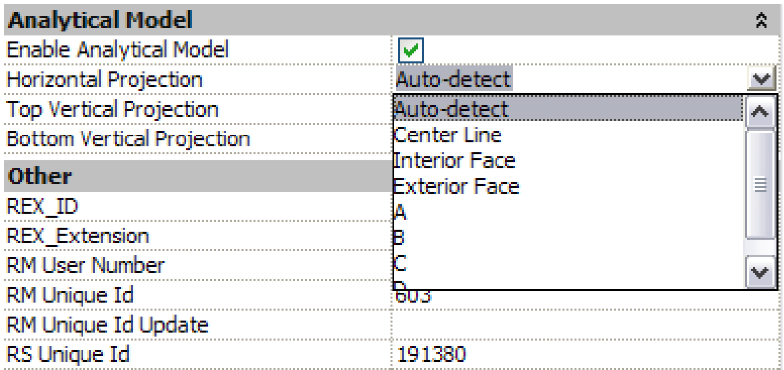
Review warnings and make appropriate corrections.

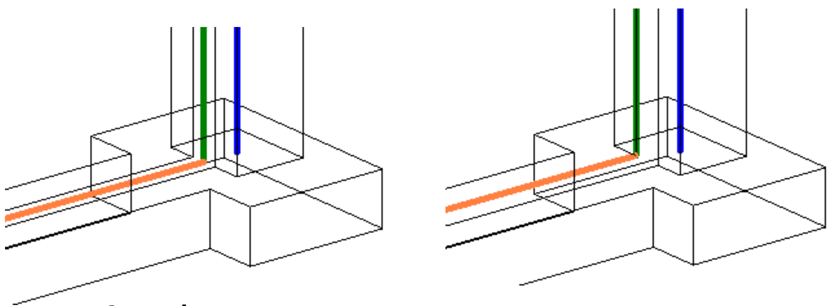
Analytical Model Projections

By default, Revit Structure assigns “Auto-detect” parameters for the horizontal and vertical projections. When using Auto-detect, Revit Structure will try to determine the best logical location for the analytical model lines. In most cases Revit Structure correctly determines the best analytical line location. Therefore, using the default Auto-detect is suggested. Override this parameter only if needed.

Figure 8

The effect of the analytical projection parameter on an analytical model.





Auto-detect or Center Line

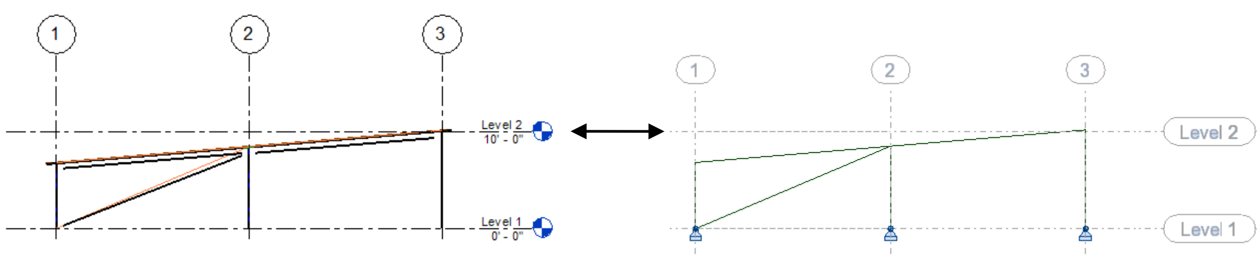
Interior Face

Sloped Framing

The link between Revit Structure and Robot Structural Analysis supports the exchange of sloped framing. Multiple levels (e.g. levels at low and high sides) may be used in Revit Structure for construction documents, but they are not needed to link with Robot Structural Analysis. Instead, a single level or even no level and element offsets are sufficient for interoperability with Robot Structural Analysis.

Figure 9

Sloped framing in Revit Structure and Robot Structural Analysis.



Revit Structure

Robot Structural Analysis

Coplanar framing of a sloped floor having the projection parameter(s) set to "Auto-detect" will automatically align the analytical framing line to the analytical plane of the floor where the floor is set to Top of Slab or Bottom of Slab.

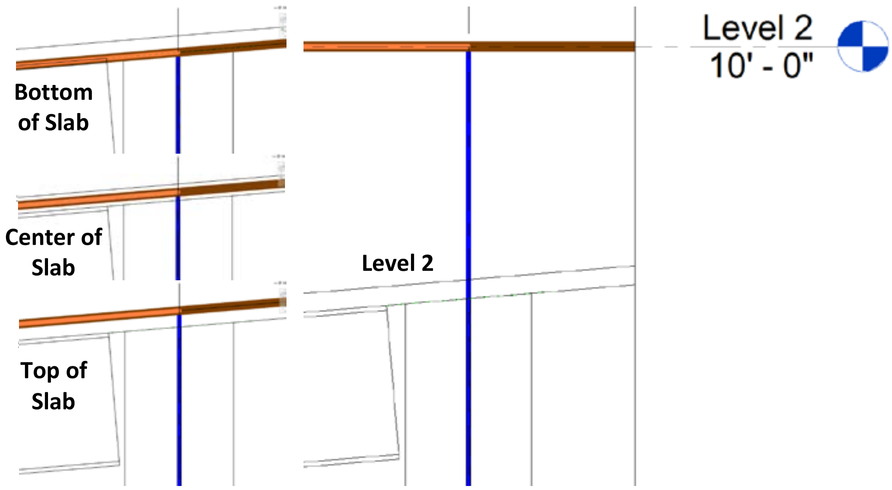


Figure 10

The relationship of beam (shown here in orange) and slab (shown here in brown) analytical lines for various Projections of Slab.

Phases and Design Options

The link between Revit Structure and Robot Structural Analysis does not support the Revit Structure *Phase* parameters. Therefore it is recommended that users send selected elements filtered by *Phase* to Robot Structural Analysis, resulting in multiple analytical models. Sending the entire model will send all elements—regardless of the phase (i.e. created or demolished.

A similar approach is recommended for Design Options.

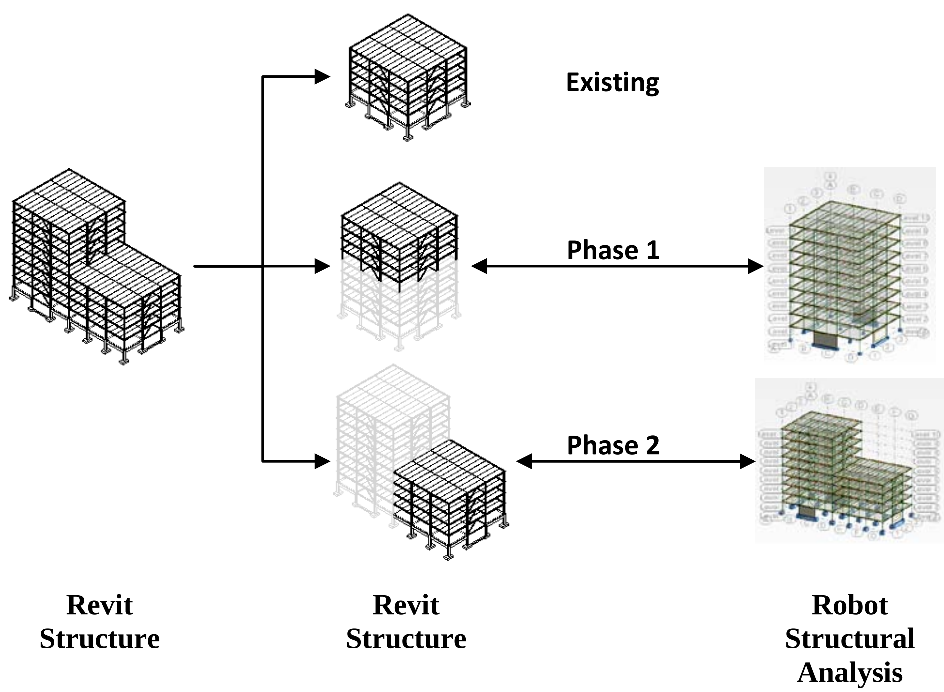


Figure 11

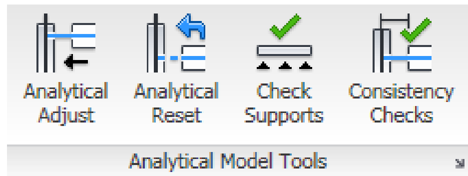
Multiple analytical models created from Phase-filtered view selections.

Check Tools for Analytical Model

Before sending a Revit Structure model to Robot Structural Analysis, it is important to use the Member Supports and Analytical/Physical Model Consistency checks.

Performing these checks will also prevent the creation of duplicated nodes and the generation of other errors or warnings during the link to Robot Structural Analysis.

The Member Support automatic check will inspect each Structural element to verify it is correctly supported. A typical beam, for example, should be supported by another beam, a column, or a wall. For each element that is not supported, Revit Structure will generate a warning message. The Member Support check will also identify circular support conditions.



These checks are available in the structural settings – as shown in Fig 12 – as well as directly in the user interface ribbon, under the analytical model tools.

The Analytical/ Physical Model Consistency check will inspect the relationship between an element's physical location and its analytical line. Tolerances can be configured in the Structural Settings dialog box. For example, a warning will be generated if the analytical model line is greater than 12" (1'-0") from the "physical" model per the settings shown below.

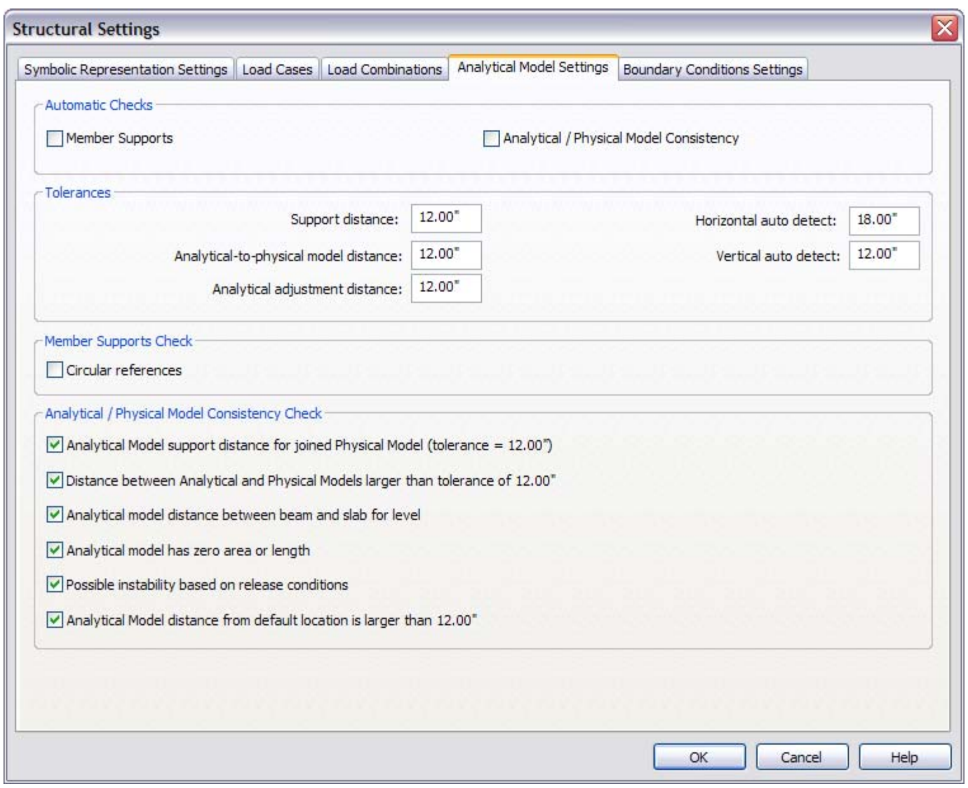


Figure 12

Analytical model settings in Revit Structure.

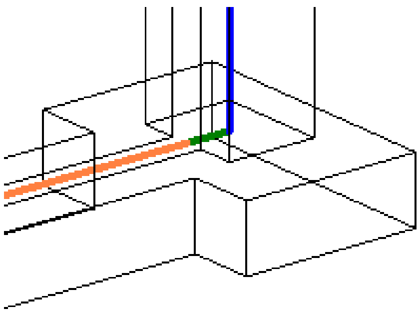
This check is particularly important for elements that have overridden Horizontal or Vertical projections. During the design process, an element may be significantly moved or adjusted. If the overridden Projection parameter is not updated, the analytical model will be significantly different than the physical model.

Both of these checks can be performed manually or automatically. Automatic checking is not recommended during the initial creation of a Revit Structure model or during significant revision to a structure. Turn on automatic checking (by selecting the Auto-check parameter) once the design process has stabilized and only minor changes occur.

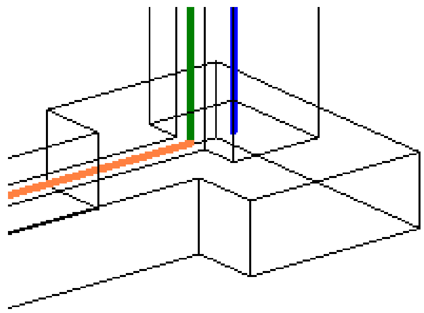
Manual Analytical Model Adjustment

Revit Structure provides two additional tools to help with the adjustment of the analytical model: Analytical Adjust and Analytical Reset. These tools allow the engineer to fine-tune or override the default Revit Structure analytical model location.

Users can take advantage of the Analytical Adjust tool (keyboard shortcut “AA”) to override the analytical model location. For example, when aligning the analytical model lines of a concrete wall to a concrete column, the column-to-wall join is “physically” represented—with the wall end meeting the face of the column. However, for analysis purposes, the user needs to move the analytical wall-end to the centerline of the “physical” column and align both analytical model lines (vertical edge of wall with analytical model of column). Then use Analytical Reset (RA) to move the analytical model back to the default location determined by the Horizontal and Vertical Projection parameters.



Analytical Adjust (AA)



Analytical Reset (RA)

Figure 13

Analytical Adjust aligns the analytical wall line with the analytical column line (left). Analytical Reset relocates all analytical wall lines back to default positions (right).

Member End Releases

Member end releases may be adjusted in both Revit Structure and Robot Structural Analysis, but it is recommended that those adjustments be made using the comprehensive toolset in Robot Structural Analysis. Therefore, during the initial export to Robot Structural Analysis, select “Do not use Revit Settings” and make all adjustments in Robot Structural Analysis. All of the end release adjustments will be transferred back to Revit Structure during the next update from Robot Structural Analysis.

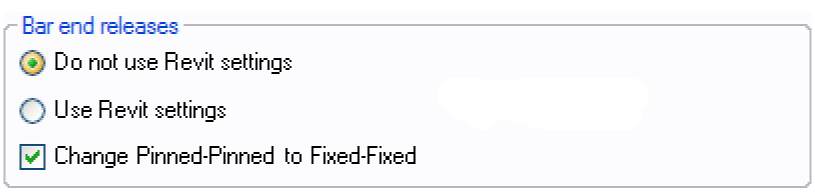


Figure 14

Send Options recommended for first export to Robot Structural Analysis.

For subsequent exports to Robot Structural Analysis, select the “Use Revit Settings” option.

Figure 15

Recommended options for subsequent exports to Robot Structural Analysis.

Bracing

The use of the guidelines mentioned in the sections above will help prevent the creation of duplicate nodes at bracing intersections. It is recommended to use Grids, Levels, and named Reference Planes for braced frames offset from the primary Grid lines.

Structural Usage	Vertical Bracing	
Start Attachment Level Reference	Level 3 - TOS	Column/Level Intersection Snap
Start Attachment Elevation	0' 0"	
End Attachment Type	Distance	Beam End Snap
End Attachment Distance	9' 0"	
End of Referenced Element	End	

Figure 16

Difference in element property parameter for braces based on attachment type.

For a definition of the brace, it is recommended to attach the brace Start and End nodes to Beams instead of Columns. Notice the parameter distinctions in the Element Properties window. This affects where the Cutback distance is located (cut by column or by beam) and the behavior of how the bracing node moves when other analytical elements are

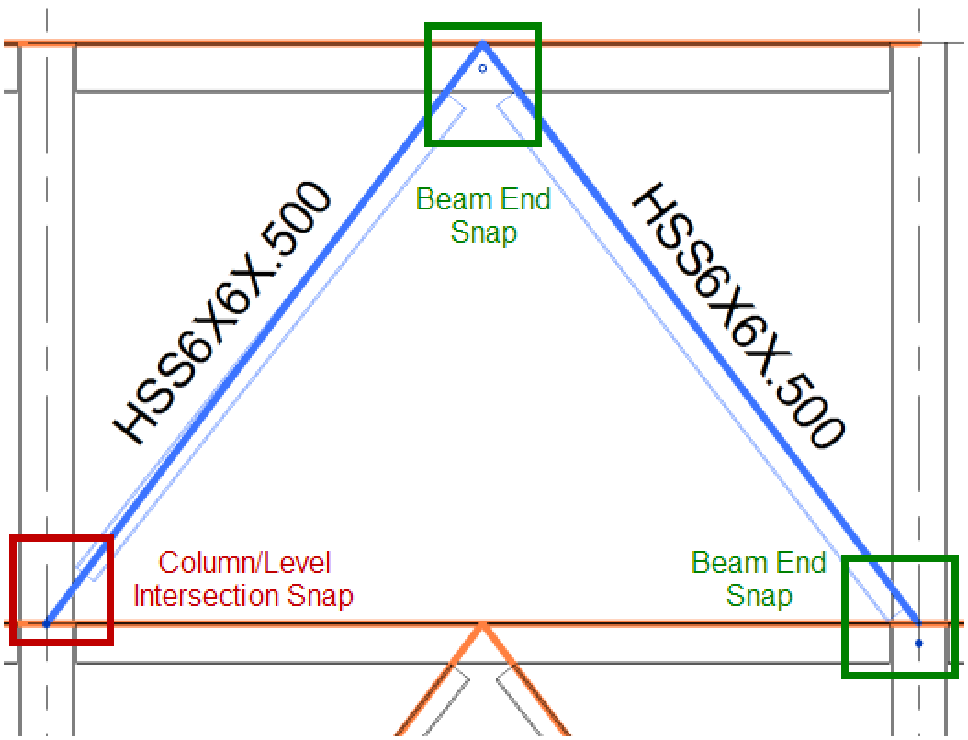


Figure 17

Notice the location of element end points and physical member setbacks for each attachment at the lower level.

adjusted.

Carefully inspect bracing intersections at sloped roofs or floors by zooming in and enabling Thin Lines to verify that the brace node intersects the other elements.
If it does not, use the Analytical Adjust tool to manually adjust the location to the beam-end node, using Tab to iterate through each element.

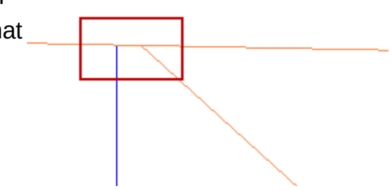


Figure 18

Multiple nodes are possible—use the Analytical Adjust tool to merge bracing intersections.

Model Elements

The following sections describe how model elements in Revit Structure and Robot Structural Analysis are transferred between the applications. The tables indicate whether an element is transferred in both directions (<>), in one direction only (> or <), is not transferred (NA), or is not eligible for transfer but preserved during iterative round-trip processes (P). Any limitations related to the transfer of an element are noted as well.

Nodal Elements

Isolated Foundations and Point Boundary Conditions modeled in Revit Structure are transferred to Robot Structural Analysis as *Nodal Supports*. The relationship between *Nodal Supports* in Robot Structural Analysis created from Isolated Foundations in Revit Structure is preserved on subsequent exchanges between Revit Structure and Robot Structural Analysis. However, *Nodal Supports initially* modeled in Robot Structural Analysis are transferred to Revit Structure as Point Boundary Conditions regardless of their release settings or location (e.g. base of Column). *Nodal Supports* created from Isolated Foundations in Revit Structure are initially transferred to Robot Structural Analysis as fully Fixed, so the engineer may need to adjust the Nodal Support releases in Robot Structural Analysis for accurate analysis.

Figure 19: Table of Nodal Elements

Revit Structure		Robot Structural Analysis
Isolated Foundation	<>	Nodal Support
Point Boundary Condition	<>	Nodal Support

In the case of sending selected portions of a model (for instance the top level of a building), new Boundary Conditions will need to be modeled in Robot Structural Analysis. When updating the selected portion, consider deselecting the new Robot Structural Analysis *Nodal Supports* prior to updating the Revit Structure model. Otherwise, the *Nodal Supports* will be transferred to Revit Structure. These same practices apply when using a single Revit Structure model with other structural analysis software.

Figure 20: Table of Nodal Element Parameters

Revit Structure		Robot Structural Analysis Professional
	P	Inactive Status

The Inactive Status of Nodes in Robot Structural Analysis is preserved in the Revit Structure model.

Bar and Linear Elements

Structural Columns, Beams, and Braces modeled in Revit Structure are transferred to Robot Structural Analysis as bar elements: Columns, Beams, and Simple Bars, respectively. Revit Structure parameters such as Analyze As (e.g. Lateral, Gravity) and Framing Type (e.g. Girder, Joist) have no bearing on the Robot Structural Analysis element.

Revit Structure elements such as Structural Columns spanning multiple levels are transferred intact to Robot Structural Analysis as “physical” members. During analysis these “physical” members are split into finite elements at intersecting framing nodes.

Wall Foundations and Line Boundary Conditions modeled in Revit Structure are transferred to Robot Structural Analysis as Linear Supports. The mode of transfer between Revit Structure and Robot Structural Analysis is the same as that of *Nodal Supports*.

Curved Beams modeled in Revit Structure are transferred to Robot Structural Analysis as discretized linear Beams. Robot Structural Analysis will by default provide a fine discretization unless the discretization parameters (Approximate Curve) are defined for the element in Revit Structure. When updating the Revit Structure model from Robot Structural Analysis, Robot Structural Analysis will preserve the discretized beam segment information in Revit Structure as new hidden data rather than creating a new—or updating an existing—single curved beam.

Beam Systems and Trusses are container objects in Revit Structure. The individual framing elements contained in Beam Systems and Trusses are transferred to Robot Structural Analysis as Beams or Bars while the Beam System and Truss container objects are not. The individual framing members hosted by Beam Systems and Trusses are editable in Robot Structural Analysis and updated accordingly in Revit Structure. However, the best practice is that modification of the member layout be performed in Revit Structure rather than Robot Structural Analysis. Also, note that the Beam System Tag will not update since this is a function of the Beam Type Parameter of the Beam System in Revit Structure.

Figure 21: Table of Bar and Linear Elements

Revit Structure		**Robot Structural Analysis Professional**
Line Boundary Condition	>	Linear Support
Wall Foundation	<>	Linear Support
Structural Column	<>	Column
Beam	<>	Beam
Brace	<>	Bar
Curved Beam	P>	Discretized Beams
Beam System	NA	
Truss	NA	

Several of the Element Parameters in Revit Structure are transferred bidirectionally with Robot Structural Analysis. Other Robot Structural Analysis design parameters such as slenderness and buckling coefficients are preserved in the Revit Structure model.

Figure 22: Table of Bar and Linear Element Parameters

Revit Structure		**Robot Structural Analysis Professional**
Offset	<>	Offset
Rigid Link	>	Rigid Link
Cross-Section Rotation	<>	Gamma Angle
	P	Cable
	P	Elastic Ground
	P	Geometric Imperfection
	P	Non-linear Hinge
End Release	<>	End Release
	P	Member Type
	P	Inactive Status
	P	Shear force respect in deformation
	P	Tension / Compression Member
	P	Axial Forces Only

Planar Elements

Area Boundary Conditions modeled in Revit Structure are transferred to Robot Structural Analysis as Planar Supports. Both Pinned and User-defined supports are transferred. Planar Supports in Robot Structural Analysis are not transferred to or preserved in Revit Structure.

Structural Floors and Structural Walls modeled in Revit Structure are transferred to Robot Structural Analysis as Floor and Wall panel elements, which can be meshed into finite elements for analysis and design. Revit Structure roofs are considered non-structural and are not transferred to Robot Structural Analysis. If steel roof decking is needed in Robot Structural Analysis for analysis and design, it should be modeled in Revit Structure as a Structural Floor.

Foundation Slabs are transferred to Robot Structural Analysis as Floors and will return to Revit Structure as a Structural Floor instead of a Foundation Slab. Concrete floors in Robot Structural Analysis have the same cross-sectional and material properties as those in Revit Structure. Floors with corrugated steel decking are transferred to Robot Structural Analysis with transformed section and material properties.

Curved Structural Walls modeled in Revit Structure are transferred to Robot Structural Analysis as curved Walls. Similar to curved beams, curved Walls in Robot Structural Analysis are transferred to Revit Structure and preserved there as hidden data.

Figure 23: Table of Planar Elements

Revit Structure		Robot Structural Analysis Professional
Area Boundary Condition	>	Planar Support
Foundation Slab	>	Floor
Structural Floor	<>	Floor
Structural Wall	<>	Wall
Structural Curtain Walls	>	Cladding
Curved Structural Wall	P>	Wall
Wall Opening & Window	P>	Opening
Door	P>	Opening
Vertical or Shaft Opening	P>	Opening
Slab Edge	NA	

Wall, Vertical, and Shaft openings, Windows, and openings created by Editing Profile modeled in Revit Structure are transferred to Robot Structural Analysis as Openings. The perimeter shape of a Floor, Wall, and Slab including arcs are transferred as the contour shape of the panel in Robot Structural Analysis. Doors modeled in Revit Structure are transferred to Robot Structural Analysis as part of the perimeter panel definition rather than openings. No relationship is maintained between the Revit Structure openings and the Robot Structural Analysis openings. So any modifications made to openings in Robot Structural Analysis and new openings are not updated in Revit Structure.

Structural Curtain Walls modeled in Revit Structure can be transferred to Robot Structural Analysis as a single Wall panel, or as a single Wall panel with mullions transferred as Bar elements, or as multiple Cladding contours for each Curtain Wall Panel with mullions transferred as Bar elements.

Finite element auto-meshing of the transferred Floor and Wall panels is not done automatically during the transfer, and must be completed by the engineer in Robot Structural Analysis. The auto-meshing and other planar parameters are preserved as hidden data in Revit Structure during subsequent transfers. However, the auto-mesh should be reviewed after significant revision to the Floor layout.

Figure 24: Table of Planar Element Parameters

Revit Structure		Robot Structural Analysis Professional
	P	Load Distribution
	P	Reinforcement Design Parameters
	P	Calculation Model
	P	Meshing Parameters
	NA	Emitters

Concrete Reinforcement and Structural Connections

Structural Rebar modeled with Reinforcement Extensions in Revit Structure is only transferred to Robot Structural Analysis for Structural Columns, Beams, and Spread Footings. Area and Path Reinforcement and Structural Rebar modeled in other elements or modeled manually in Revit Structure are not transferred to Robot Structural Analysis. Rebar designed in Robot Structural Analysis for Columns, Beams, and Spread Footings are transferred to Revit Structure.

Figure 25: Table of Rebar Elements

Revit Structure		Robot Structural Analysis Professional
Area Reinforcement	NA	
Path Reinforcement	NA	
Structural Rebar	<>	Rebar
Structural Connections	NA	

Loads

Loads, Load Natures, Load Cases, and Load Combinations are transferred between Revit Structure and Robot Structural Analysis. Load elements created in Revit Structure and transferred to Robot Structural Analysis are editable; however, changes made in Robot Structural Analysis are not propagated back into Revit Structure. Loads created in Robot Structural Analysis stay in the Robot model rather than directly being transferred to the Revit Structure model.

Figure 26: Table of Load Elements

Revit Structure		Robot Structural Analysis Professional
Load Nature	>	Load Nature
Load Case	>	Load Case
Load Combination	>	Load Combination
(Hosted) Point Load	>	Nodal or Bar Load
(Hosted) Line Load	>	Linear Load
(Hosted) Area Load	>	Planar Load

Other Elements and Element Parameters

Materials, Grids, and Levels modeled in Revit Structure are created as Materials, Structural Axes, and Stories in Robot Structural Analysis. There is limited bidirectionality for these elements, therefore it is recommended that the user creates and adjusts them in Revit Structure. Many of the other project-wide and structural analysis parameters in Robot Structural Analysis are sent to and preserved in Revit Structure.

Figure 27: Table of Other Elements and Element Parameters

Revit Structure		Robot Structural Analysis Professional
Material	>	Material
Grid	>	Structural Axis
Level	<>	Story
	P	Global Mesh Parameters
	P	Active Section Databases
	P	Units
	P	Analysis Parameters
	P	Model Generation Parameters

Summary

The integration between Revit Structure and Robot Structural Analysis facilitates the coordination of design information and construction documentation. The integration supports multiple workflows stemming from choices regarding initial modeling platform and the use of multiple analytical models to split the work load. Additionally, Revit Structure offers many tools and modeling practices to prepare a model for smooth interoperability with Robot Structural Analysis and other leading structural analysis software applications.

The result of better interoperability is a more streamlined and productive design process, the opportunity to perform more analysis to find the optimal structural design option, and a better understanding of design intent yielding less errors and omissions.