

BIM and API Extensions

This whitepaper explains how the utility of BIM solutions such as Revit Structure software can be broadened through the use of specialized software “extensions”: programs written by independent application developers that interface directly with the BIM solution using an application programming interface (API).

Currently there are over 150 add-on software applications that access the Revit® platform building information model using an application programming interface (API). Add-on developers provide specialized domain knowledge for specialized applications—applications such as steel detailing, energy analysis, or cost estimating—that operate on the information created by building information modeling. A recent example of applications that tap the Revit platform building information model is a new series of API-based software applications from Robobat (subsequently acquired by Autodesk in the beginning of 2008) that extend the capabilities of Revit® Structure software.

Interacting with a Building Information Model

There are a variety of methods that developers use to interact with a building information model and integrate their software application with a BIM solution. For example, many software applications rely on open file formats—such as STEP, IFC or CIS/2—to pass building data back and forth to between the software programs. Other integrations are based on a neutral database driver like ODBC, which acts as a translator between the software programs.

An integration based on an API offers a very close link between software applications. For example, the Revit API allows independent software developers to create software programs that can access elements in the Revit building information model. Application developers can use the Revit API to query and change element properties, and also add and modify some elements. Even individual Revit-based application users and companies are taking advantage of the API to create their own custom tools and add-on modules.

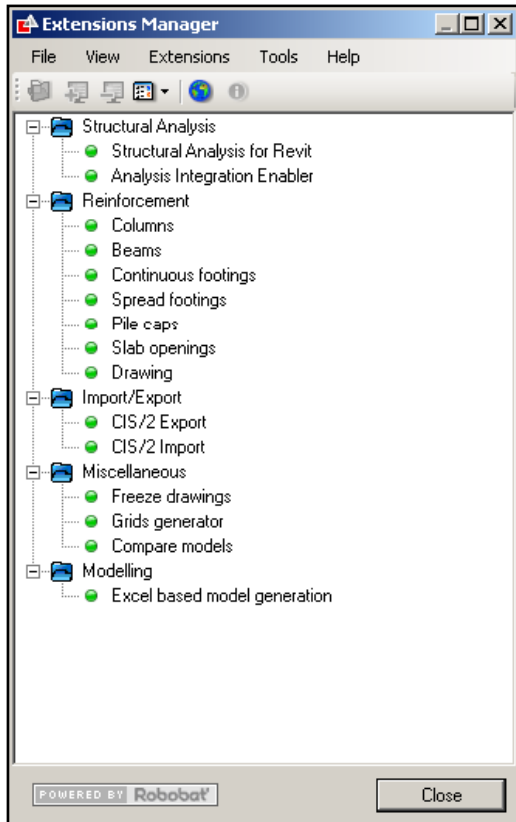
Integrations that use an API to link software applications are often termed “dynamic” because the API enables software applications to interact with each other directly. For instance, one software solution that uses the Revit API is Trelligence Affinity™, a software application for architectural programming and schematic design typically used in building pre-design. A schematic design developed in Affinity can be linked to an emerging architectural design created with Revit® Architecture software to compare the Revit-based design and the Affinity-based program requirements, such as a room’s actual square footage versus its target square footage.

Because the Revit API enables such close integrations, it's being used by a variety of software partners for a variety of applications such as the architectural programming module from Trelligence mentioned above or specification management software (e-SPECS) by InterSpec. Another prominent example of applications that tap the Revit platform building information model is a new set of API-based software applications from Robobat—software programs that extend the capabilities of Revit Structure software for structural analysis and documentation.

Revit Extensions

Robobat, which was acquired by Autodesk in January 2008, specializes in analysis, design, and steel and concrete detailing software for the structural engineering industry. Robobat is the developer of Robot™ Millennium, a popular solution for structural analysis and design with over 23,000 licenses sold worldwide.

The downloadable Revit Extensions for Revit Structure (www.extensions4revit.com) are a series of easy-to-use applications that extend the capabilities of Revit Structure 2008 software in various key areas including structural analysis and reinforced concrete drafting. All extensions for Revit Structure software developed by Robobat, both for fee and free, are available through the Autodesk Subscription Program. Once the extensions are downloaded, an Extension Manager option is added to the Revit Structure toolbar and the user simply clicks on this option to launch the Extensions dialog box (see figure



below).

Figure 1:

The Revit Extensions for Revit Structure include a variety of structural applications that complement Revit Structure.

Extensions for Analysis

The Structural Analysis Enabler allows the analysis model defined in Revit Structure (created simultaneously as the Revit Structure model is built) to be transferred and used directly for analysis within Robot Millennium. Once the analysis is complete, any changes—a larger column size for instance—are automatically reflected in the Revit Structure model thanks to the dynamic, API-based link between the two software applications.

In addition, the parametric change technology within the Revit platform coordinates those changes in all affected project views and construction drawings. Revit Structure users can analyze their own models and update them even after the documentation has been created. Bidirectional linking between Revit Structure and Robot Millennium provides round tripping capabilities—without losing data defined separately in each program.

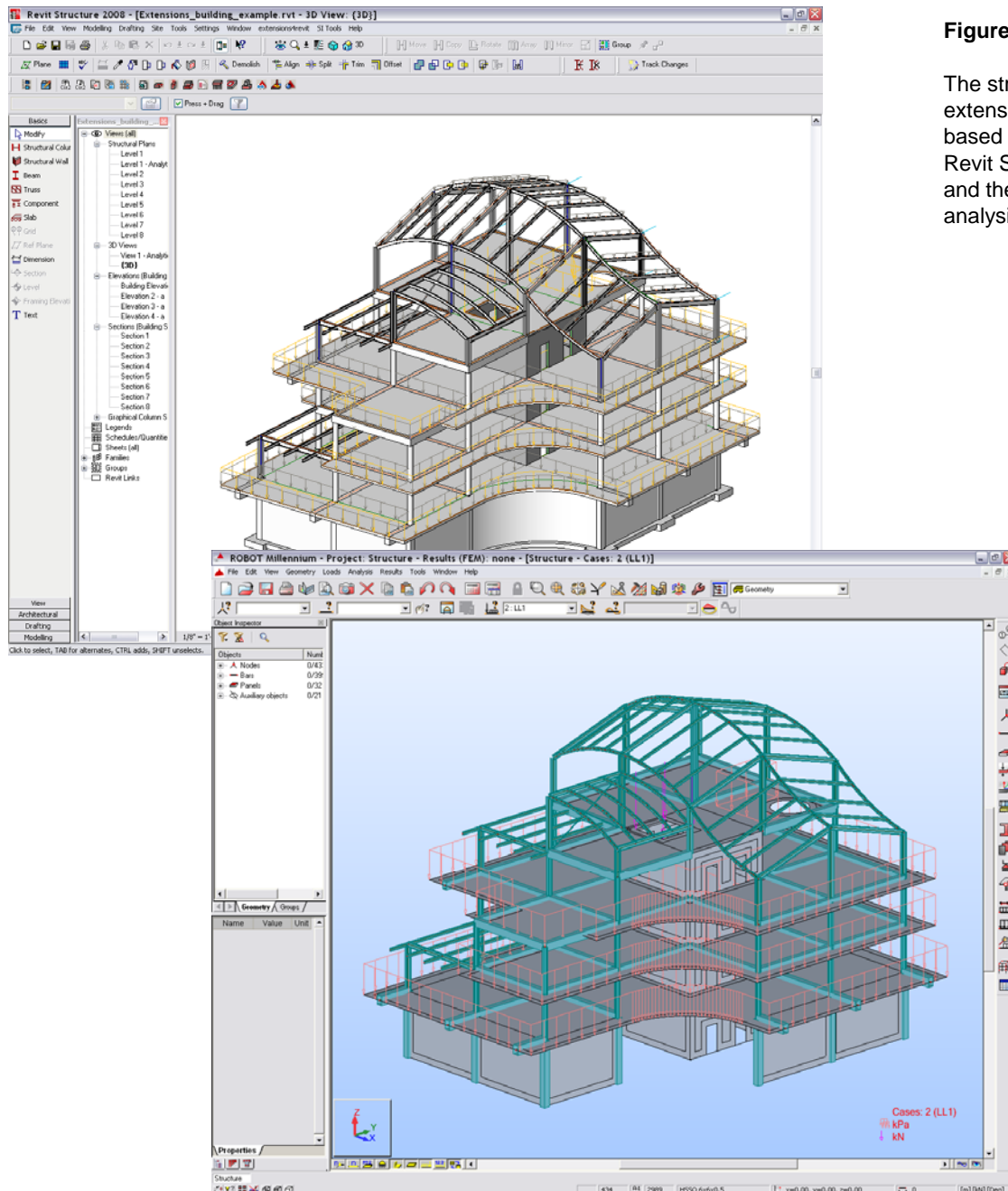


Figure 2: The structural analysis extension feature an API-based link between the Revit Structure model (left) and the Robot Millennium analysis module (below).

The Static Analysis of Slabs extension allows the static analysis of a slab defined in a Revit Structure model. It includes the loading of necessary information from Revit Structure such as: slab geometry, constraints and supports, load cases, load combinations, and other loads. Results obtained for a defined slab model are displayed in graphical and tabular forms.

Extensions for Reinforced Concrete

The extensions for reinforcement provide facilities to define both simple and complex reinforcement patterns for reinforced concrete members, including: beams, columns, spread footings, continuous footings, slab openings, and pile caps.

The user begins by selecting a representative Revit Structure model element (such as the beam in the figure below), and then launches the extension. The API-based integration enables the extension to “read” the Revit Structure model and automatically preset the reinforcement dialog box (also shown below) to reflect the initial state of that model element. Note that the spans and supports are detected automatically.

The dialog box directs the user through the process of defining the reinforcement type and pattern. Once complete, the extension automatically updates the Revit Structure model elements by including the embedded rebar. If needed, the user can reselect that beam at any time to modify the reinforcement—change a distribution type for example—and then regenerate the reinforcement.

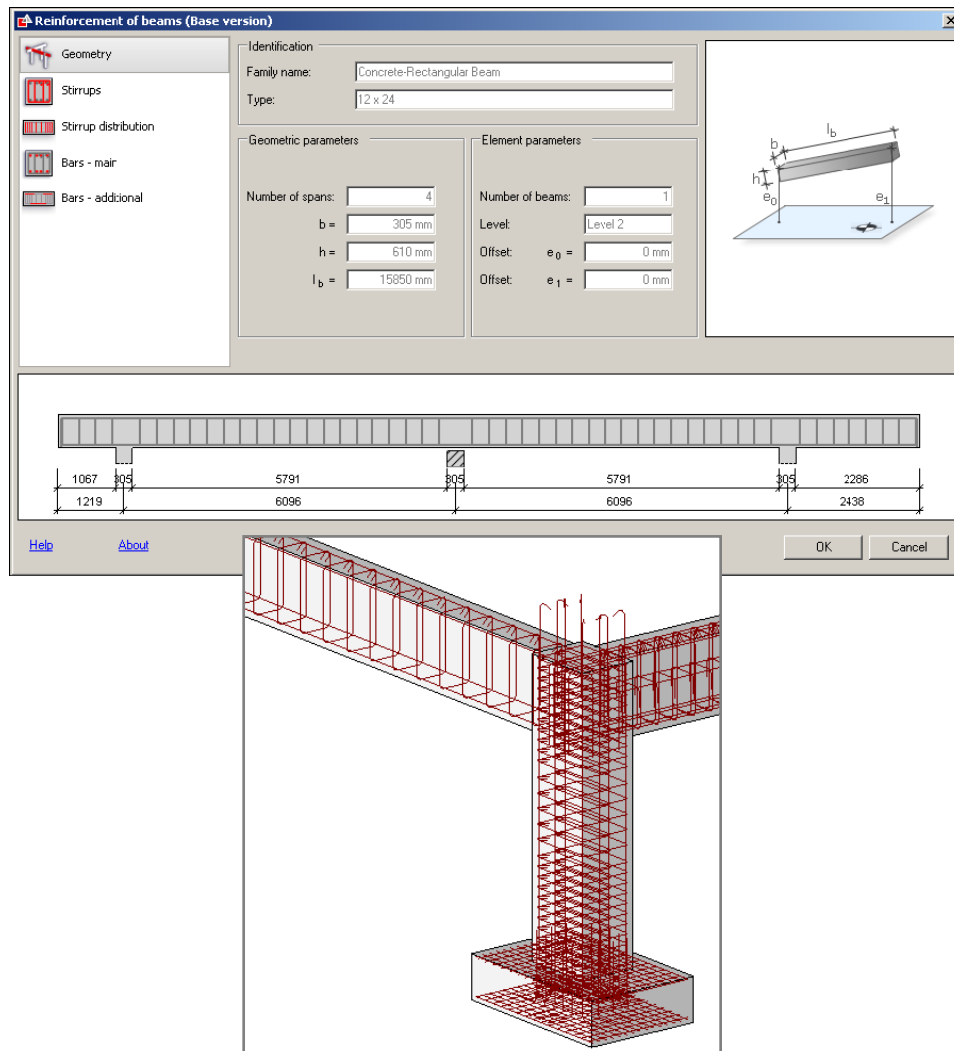


Figure 3:

The reinforcement extension allows Revit Structure users to define reinforcement patterns for reinforced concrete members (left). Once the patterns are defined, the user clicks OK and the appropriate members are automatically created in the Revit Structure building information model (below).

The reinforced concrete extensions also include the ability to generate AutoCAD-based reinforcement drawings for the newly created reinforced concrete members. The drawing extension uses the Robobat RCAD Reinforcement “engine” to create the drawings. RCAD Reinforcement is a software solution for automatic generation of detailed documentation (drawings and reinforcement tables). The extension includes many templates that comply with the detailing practices of different countries around the world, to ensure that local detailing methods can be used and the appropriate bar schedules produced automatically.

Additional Extension Functionality

Revit Structure extensions may also include utilities for CIS/2 import and export, model generation, and other miscellaneous tasks. For example, recent extensions include a wizard that enables the user to define and generate axes grids and levels in Revit Structure projects and automatically generate columns, beams, walls and footings on those grid intersections.

There's also a module that enables users to create Revit-based structures based on data defined in a Microsoft® Excel® spreadsheet, useful for creating very repetitive multi-story structural designs or very complex structural geometry that has been defined based on mathematical formulas. And the import/export to CIS/2 functionality enables interoperability with popular steel detailing software—allowing the Revit Structure building information model to be used for digital fabrication.

Summary

Add-on software programs created by independent application developers provide extended BIM capabilities for specialized building applications. API-based integrations that interact directly with the BIM solution can be a very effective method of linking these add-on software applications to a building information model.

The growing number of independent software developers that are tapping into Revit platform building information models using the Revit API is testament to API-based integration methods as well as the underlying value of the Revit platform building information model.

About Revit

The Revit platform is Autodesk's purpose-built solution for building information modeling. Applications such as Revit Architecture, Revit Structure, and Revit® MEP built on the Revit platform are complete, discipline-specific building design and documentation systems supporting all phases of design and construction documentation. From conceptual studies through the most detailed construction drawings and schedules, applications built on Revit help provide immediate competitive advantage, better coordination, and quality, and can contribute to higher profitability for architects and the rest of the building team.

At the heart of the Revit platform is the Revit parametric change engine, which automatically coordinates changes made anywhere — in model views or drawing sheets, schedules, sections, plans... you name it.

For more information about building information modeling please visit us at <http://www.autodesk.com/bim>. For more information about Revit and the discipline-specific applications built on Revit please visit us at <http://www.autodesk.com/revit>.

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