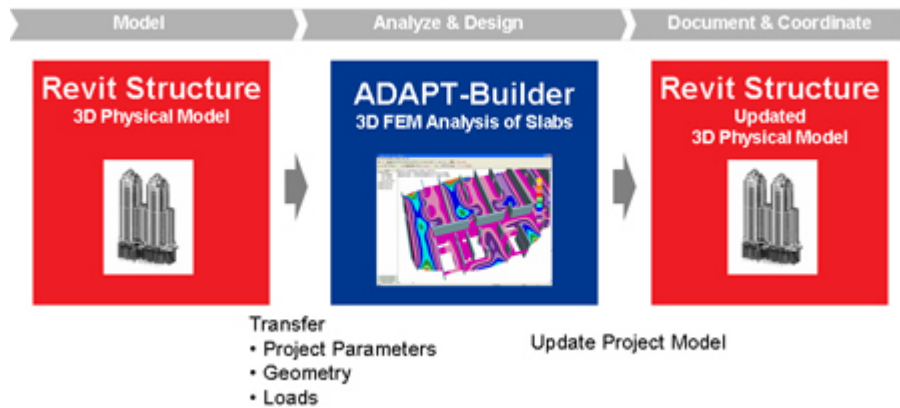
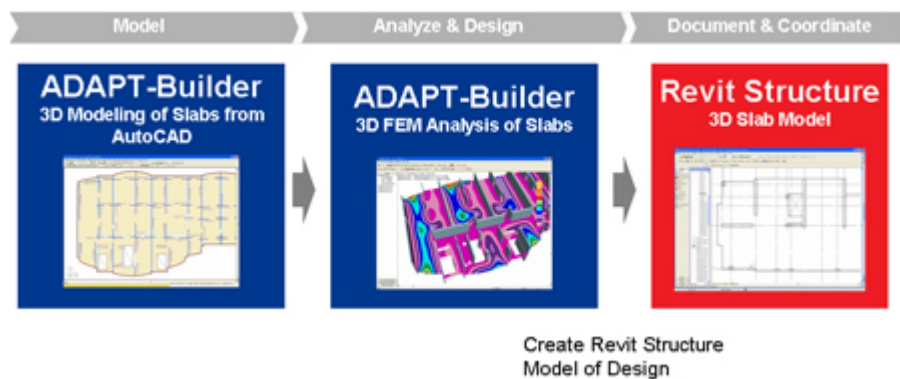


Quick Reference Guide for ADAPT-Revit® Structure Link:

This document describes how to use the ADAPT-Revit Structure Link. The link enables bi-directional transfer of model information between Autodesk Revit® Structure 4 and the ADAPT-Builder™ v3 suite of programs, ADAPT-Modeler, ADAPT-Floor Pro, ADAPT-MAT, and ADAPT-SOG. Additionally, this guide shows how to automatically generate a Revit Structure model from a project originally created in ADAPT-Builder. The two diagrams below show the primary integration workflows supported by the link.



Workflow for bi-directional integration.



Workflow for creation of Revit Structure model from ADAPT-Builder suite.

Installation:

Before installing the link, Revit Structure has to be installed on the computer. Once it is installed, you can install the link on your computer in a desired location. The link will not appear in your Revit Structure environment unless you close and open it after the link is installed. Please note that the setup will modify the initialization file of Revit Structure (Revit.ini) and therefore, if you change the initialization file manually, the link may not operate properly. In case the initialization file is corrupted, a copy of the original initialization file is stored in your Revit link folder.

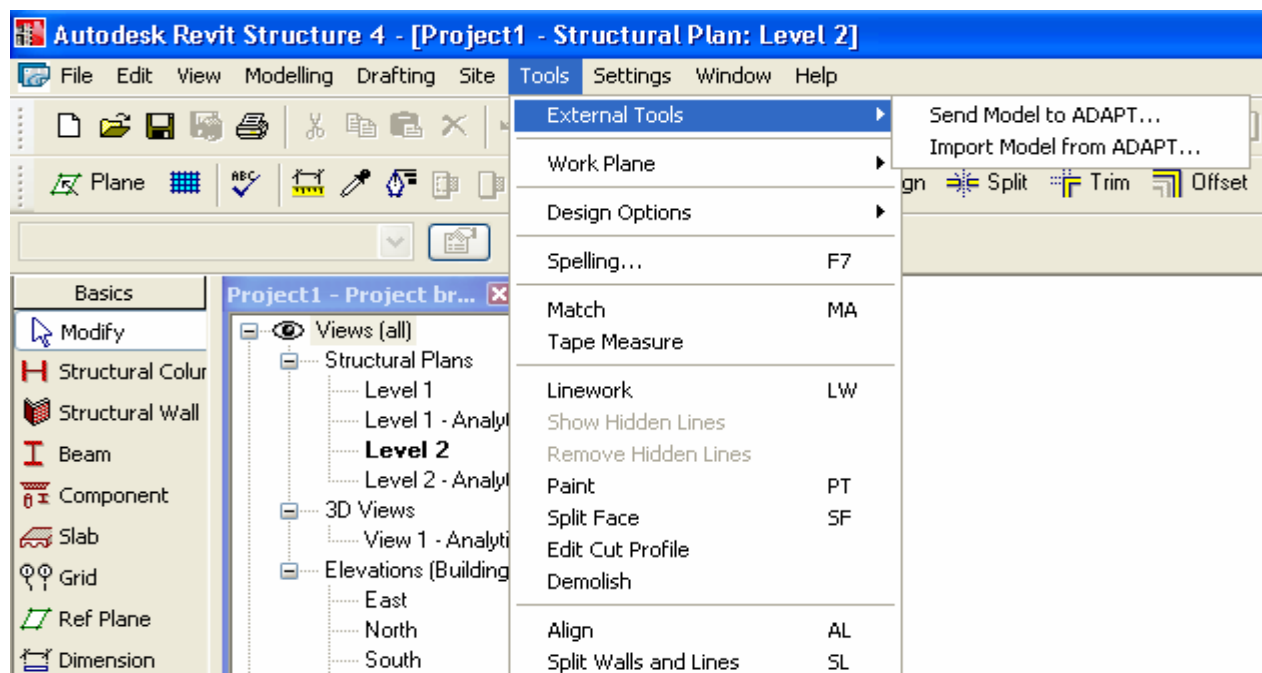


Figure 1 – menu items added to Revit Structure that import/export data to/from ADAPT-Builder suite

Once you finish installing the link, two new items will be added to the 'Tools' menu item in Revit Structure. They can be found under 'External Tools' as shown in Figure 1. As it can be seen, the first item exports data from Revit Structure to ADAPT-Builder suite and the second item imports an ADAPT-Builder model.

Export Data from Revit Structure to ADAPT-FloorPro:

To export a model from Revit-Structure to ADAPT-Builder suite, select 'Send Model to ADAPT' from the 'External Tools' menu. It takes a few seconds for the program to read

the current model and stores it in memory for further processing. Once the data is loaded, the following window shown in Figure 2 will appear on the screen. The screen is divided into three tabs: Levels, Components/Loads and Load Cases. At the bottom, there is help information about the link and ADAPT.

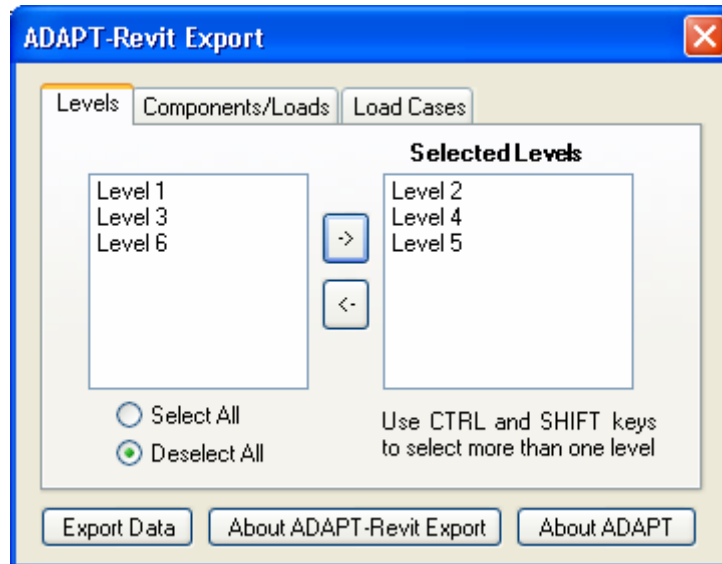


Figure 2 – ADAPT-Revit Export screen – Levels

In the list box shown in Figure 2, all levels of the model are listed. As the default, all levels are selected which means that once the model is exported, the information of all levels of the structure is transferred to ADAPT-Builder. The user has the option of selecting which floors have to be exported. Levels can be moved from the left list box to the right list box and vice versa using the 'Select All', 'Deselect All', or by highlighting the desired levels and moving them with arrow buttons.

ADAPT-Builder imports one slab or foundation model at a time from the ADAPT-Revit transfer file regardless of whether it contains the entire project model or just a few levels. Therefore, for performance reasons, the user may choose to limit the number of floors exported at a time.

The user has the option of which components should be exported and which ones should be ignored. Figure 3 shows the screen which let users select between different objects.

Materials:

The link only transfers components that are made of concrete. All other components that are made of other materials such as steel, wood or generic material will be ignored. In addition to components selected by the dialog box shown in Figure 3, all

concrete material properties are also exported as default. The following properties of concrete are exported to ADAPT-Builder suite:

- 1) Material Name, 2) Unit Weight, 3) Poisson Ratio, 4) Thermal Expansion Coefficient, 5) Modulus of Elasticity, 6) Shear Modulus, 7) Compressive Strength and 8) Concrete Type

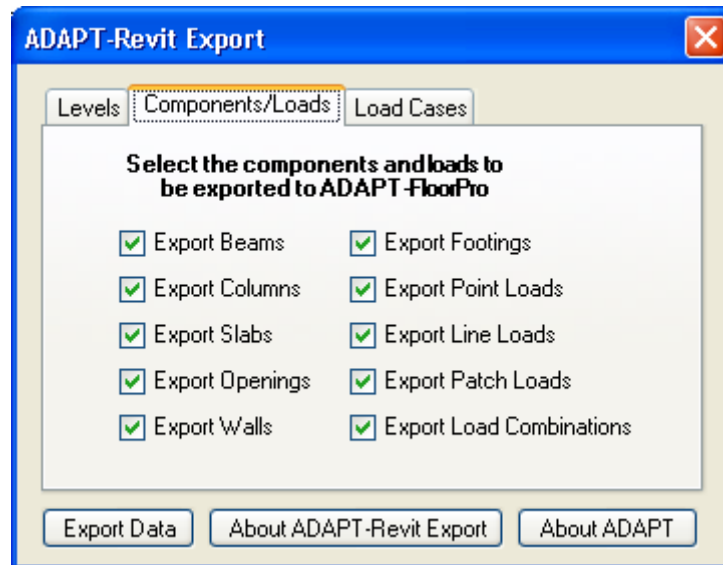


Figure 3 – ADAPT-Revit Link – Components/Loads

The following geometrical objects are exported to ADAPT-Builder suite:

Beams:

Concrete beams with rectangular cross sections are exported if 'Export Beams;' is checked. The rectangular cross section must have been defined with parameters 'b' as width and 'h' as depth. The following beam properties are exported:

- 1) Coordinates of end points, 2) Width, 3) Depth, 4) Offset and 5) Material.

The offset is the average offset of the two ends of the beam. Since FloorPro only supports horizontal beams, the object is placed at its average height.

Columns:

Concrete columns with rectangular, square or circular cross sections are exported if 'Export Columns' is checked. Rectangular sections are identified by parameters 'b' as

width and 'h' as depth. Square and Circular columns are identified by 'b' as their dimension or diameter. Since both square and circular columns are identified with the same 'b' parameter, if the 'Family Type' has the word 'Round' in it, the link assumes the column is circular otherwise, square. For each level, columns above and below the level are exported. If a column has been modeled continuous, it is broken into pieces for export. We recommend users model discrete columns for each level. The modeling of discrete columns enables the re-importing of changes from ADAPT-Builder back to Revit Structure. The following properties of columns are exporter to FloorPro:

- 1) Coordinate, 2) Angle, 3) Width, 4) Depth, 5) Shape, 6), Offset at Top, 7), Offset at Bottom and 8) Material

Walls:

Walls which have at least one layer of concrete are exported. Walls are similar to columns in the sense that they will be broken into pieces if modeled continuously and walls above and below of the selected levels are exported. Only straight walls are supported and walls with curved geometries are ignored. The following information for each wall is transferred to ADAPT-Builder:

- 1) Coordinates of each end, 2) Thickness, 3) Offset at the top, 4) Offset at the bottom and 5) Material

Slabs:

Concrete floors as well as mat foundations are exported as slab regions if 'Export Slabs' is checked. The total thickness of the slab is reported. If the slab is layered, the material of the first structural layer will be reported. The following properties are exported:

- 1) Slab Geometry, 2) Material, 3) Thickness and 4) Offset

Openings:

Openings are exported if 'Export Openings' is checked. The geometry of all the openings for the selected levels will be exported.

Footings:

Wall footings and isolated footings are exported if 'Export Footings' is checked. Footings with material other than concrete are ignored. Geometry of isolated footings is identified by 'Width' and 'Length' and geometry of the wall foundation is governed by the geometry of the host walls connected to the foundation. The information transferred for footings is same as those of slabs.

Point Loads:

All point loads for the selected levels and selected load cases are exported if 'Export Point Loads' is checked. The following information is exported for each point load:

- 1) Coordinate, 2) Intensity and 3) Load Case

Line Loads:

All line loads for the selected levels and selected load cases are exported if 'Export Point Loads' is checked. The following information is exported for each line load:

- 2) Coordinates of the two ends, 2) Intensity and 3) Load Case

Patch Loads:

All patch loads for the selected levels and selected load cases are exported if 'Export Point Loads' is checked. The following information is exported for each patch load:

- 3) Patch load geometry , 2) Intensity and 3) Load Case

Load Combinations:

All the load combinations defined in Revit Structure can be exported to ADAPT-Builder. The load combination automatically eliminates the load cases that are not selected for export. For each load combination, the following information is transferred:

- 1) Name, 2) State, 3) List of Load Cases and 4) List of Load Case Factors

State of a load combination can be 'ultimate' or 'serviceability' and will appear in ADAPT-Builder programs as 'Strength' or 'Serviceability' load combination.

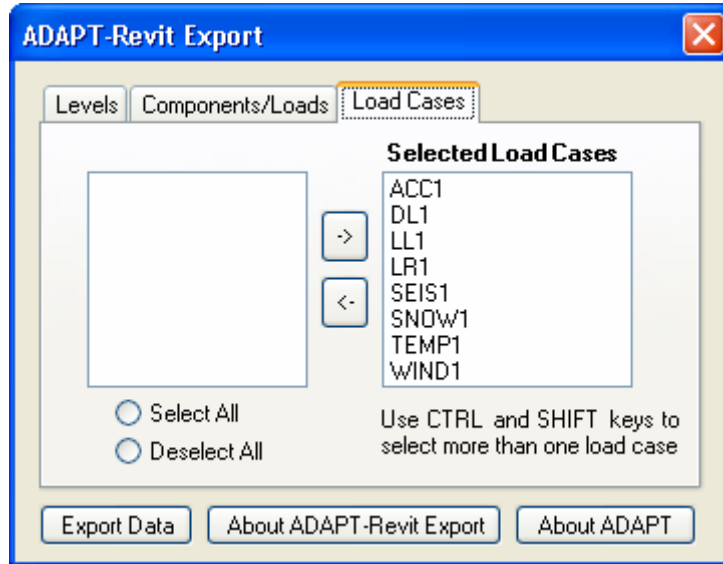


Figure 4 – ADAPT-Revit Link – Load Cases

The user has control over which load cases should be exported. Thus, if point, line or patch load is checked to be exported, only those instances of the loads which have a load case same as one of the selected cases will be exported. Selection of load cases is similar to selected of levels discussed earlier (Figure 4).

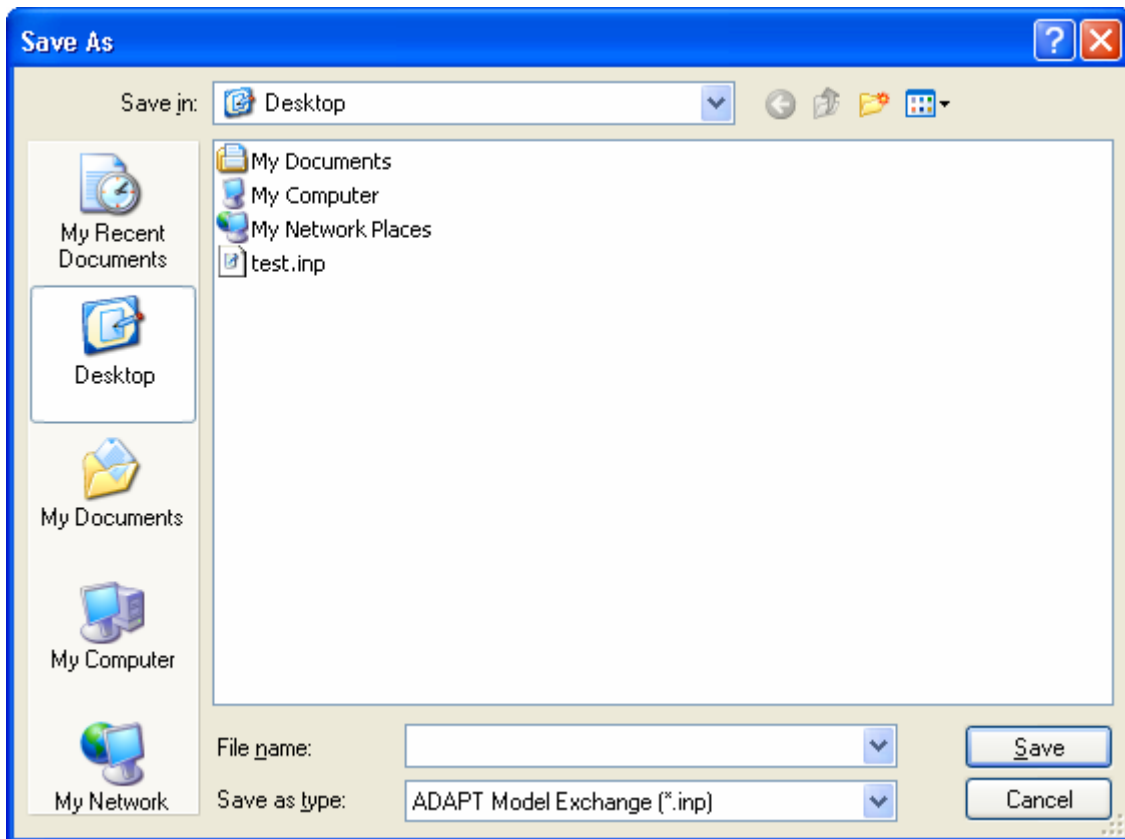


Figure 5 – Save Dialog window of ADAPT Model Exchange file

Once the desired data for export is set, the user should export the data by pressing the button 'Export Data'. This operation extracts the relevant project model information and writes it to the ADAPT Model Exchange (AME) file. When the operation is complete, the user is asked to specify a location and file name to save the AME file which can be later read by ADAPT-Builder programs (Figure 5).

Data Modification in ADAPT-Builder programs:

After a model is exported from Revit Structure to the AME file, the user can open any of the ADAPT-Builder programs and import a selected floor of the model to import. The location of the import function in ADAPT-Builder programs is shown in figure 6.

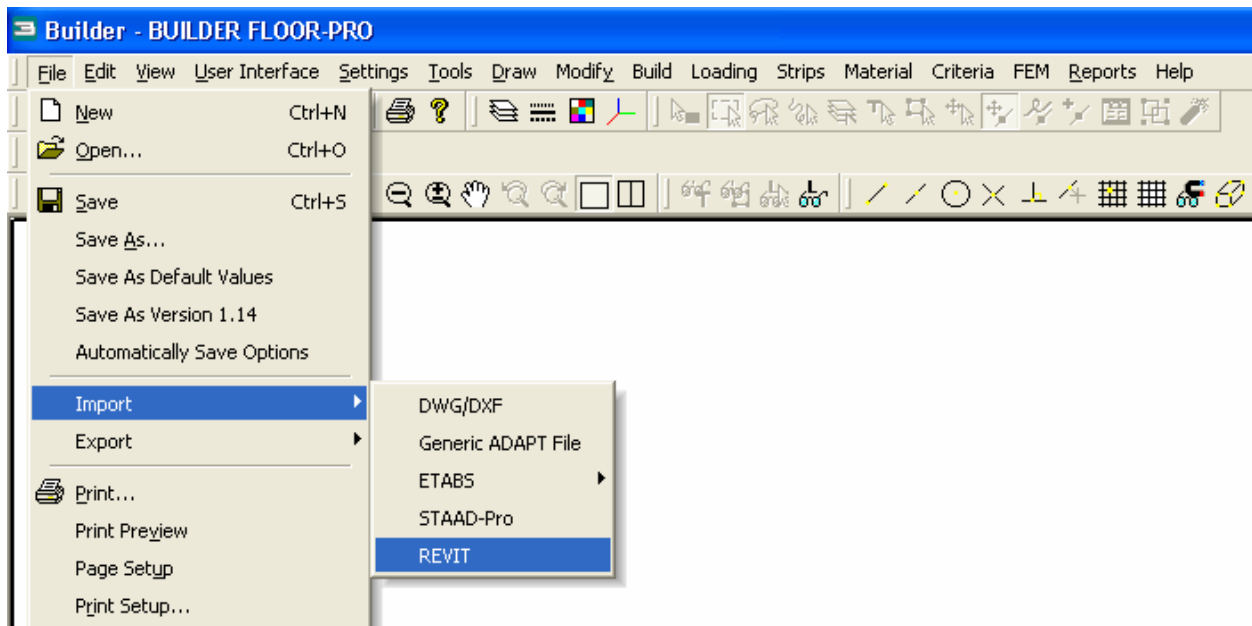


Figure 6 – Importing Revit Model into ADAPT-Builder programs

After the analysis and design process is complete in ADAPT-Builder, the model can be exported to Revit Structure. Modifications made to the model in ADAPT-Builder, for example, the addition, modification, or deletion of components to the model can be transferred back to the main Revit Model. The following explains the types of changes to a model that can be transferred back to Revit Structure:

Material Properties:

Material properties can be modified inside ADAPT-Builder programs. Also new materials can be added to the list. The material list in Revit Structure will be modified once the model is imported. New materials will be added and those materials initially exported from Revit Structure to ADAPT-Builder will be modified. Materials are identified by their name so if the name of a material changes, it is considered a new material.

Load Cases:

New load cases created in ADAPT-Builder will be added in Revit Structure once imported. Load cases are identified by their name and a change in the name of a load case create a new load case in Revit Structure.

Load Combinations:

Load Combinations can be added, deleted or modified in ADAPT-Builder. Load cases and load case factors can be changed; the state of a load combination and the name of the load combination can also be changed in ADAPT-Builder. These changes are updated in Revit Structure once a model is re-imported.

Levels:

Elevation of each level can be changed in ADAPT-Builder and once the model is imported to Revit Structure, the elevation of the levels will be updated.

Beams and columns:

All properties of beams and columns can be modified in ADAPT-Builder. A new component can be added to the model, or an existing component can be deleted. Components added or updated in ADAPT can be re-imported into Revit Structure. In the current implementation of the link, new components can only be created in Revit Structure if the cross section of the column or beam class is pre loaded. Changes made to components with cross sections that are not pre loaded will be ignored.

Walls:

All properties of walls can be modified. New walls can be added or existing walls can be deleted. Similar to columns and beams, the wall compound structure has to be preloaded in Revit Structure before you import the data; otherwise the modification will

be ignored. In the current implementation of the link, changes made to walls with openings cannot be re-imported to ADAPT-Builder.

Slabs and footings:

The only modification to slabs that can be re-imported back to Revit Structure is the offset. Neither the geometry of the slab nor the thickness and material of it can be modified. A slab can be deleted or added. For new slabs, all properties such as material, thickness, geometry and offset is exported to Revit Structure. Openings added to slabs will be ignored.

Point, Line and Patch Loads:

All properties of loads such as location and intensity as well as load case can be modified. A new load can be added or an existing load can be deleted. All changed will be sent back to the original Revit Structure model.

Once all the modifications to the model are complete, one has to export the data to an ADAPT Model Exchange file as shown in Figure 7.

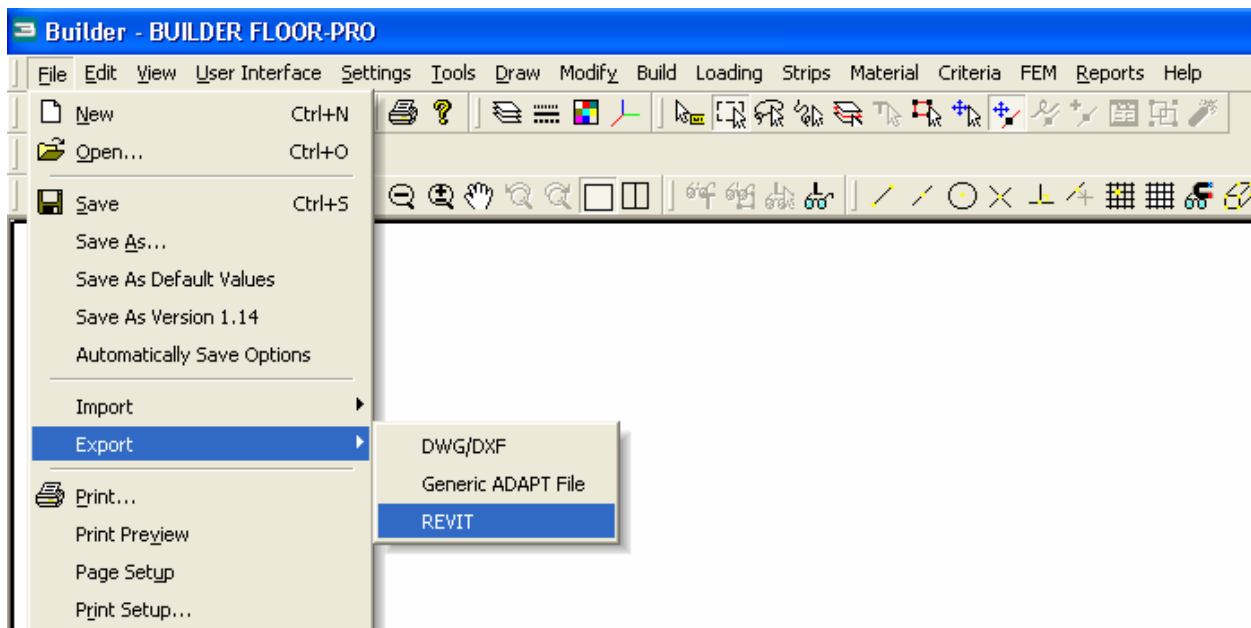


Figure 7 – Exporting an ADAPT-Builder model to Revit Structure

Importing Data from ADAPT-FloorPro to REVIT Structure:

The tool provided here enables user to modify an existing Revit Structure model or to create a new model based on a model exported from ADAPT-Builder. The latter feature lets users automatically create a full 3D Revit Structure project model from their single 3D ADAPT-Builder slab models by importing them one-by-one. This feature is shown in Figure 8. If the option 'Original file created in ADAPT' is checked, it means that there is no Revit model available and the user selects only one file for 'File Exported from ADAPT to Revit'.

In case the Revit model is being modified, the option of 'Original file created in ADAPT' should be unchecked and the original file exported from Revit Structure should be selected also. Once the files are selected, the data has to be loaded and list boxes will be populated according to the data. In case of modification of existing model, the two files are loaded and then compared and the Revit Structure model will be updated based on the differences of the two files. In case of creating the Revit Structure model from an ADAPT-Builder model, no comparison will be made and all of the objects in the data file will be added to the new model.

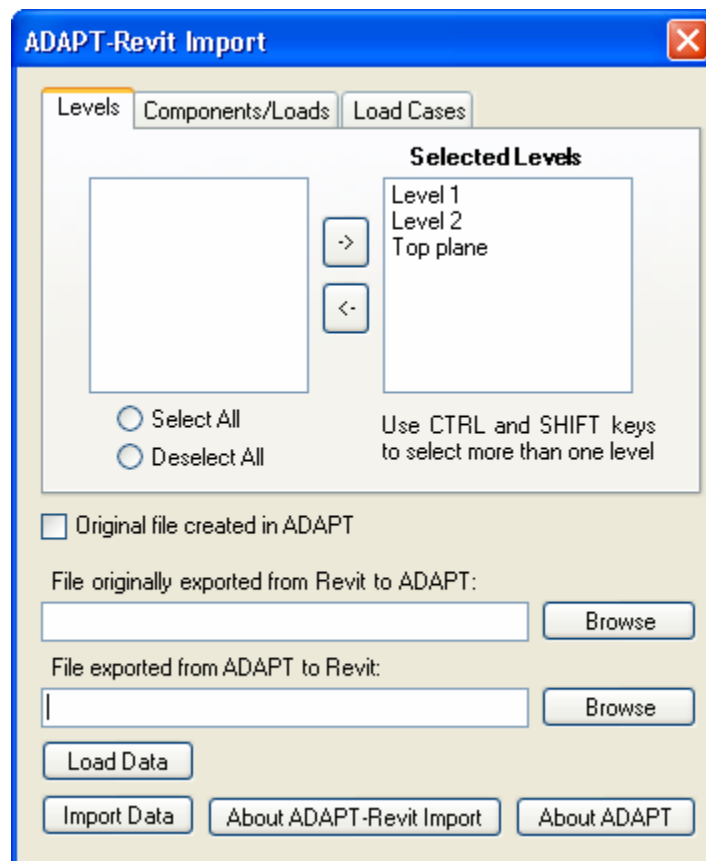


Figure 8 – ADAPT-Revit Import Link Screen – Levels

Once the data is loaded, you will see three levels in 'Selected Levels' list box. These levels are the 'current', 'upper' and 'lower' levels of the ADAPT-Builder model. Since the level has to be selected for possible change of the elevation of each level, all levels have to be selected. The user has control over which components should be modified. The selection is similar to the export process and any of the geometrical objects as well as loads and load combination can be selected (Figure 9).

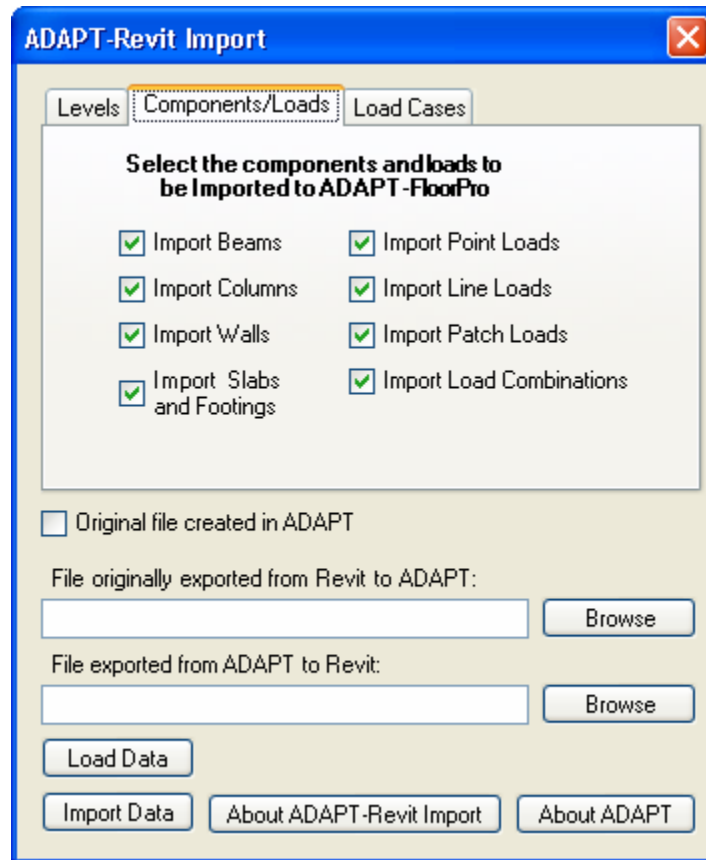


Figure 9 – ADAPT-Revit Import Link Screen – Components/Loads

When data is loaded, all the load cases available in the model will appear in the 'Load Cases' list box (Figure 10). Similar to export process, the user can select which load cases should be modified. For example, if some of the dead loads and live loads have been changed in ADAPT-Builder and the user does not want to modify the dead loads, only live loads have to be selected for modification.

Once the selection is complete, the model can be modified by 'Importing Data'. By activating this command, components will be modified one by one and progress screen shows which class of object is being modified.

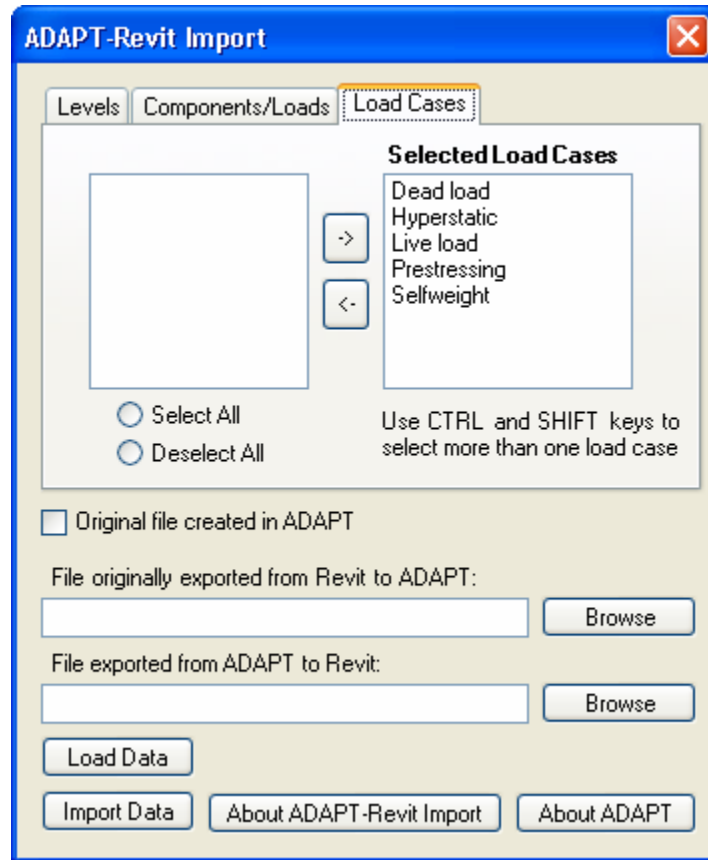


Figure 10 – ADAPT-Revit Link Screen – Load Cases