

BIM in designing AAC buildings

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BIM is not just about drawing and modeling tools. It is a concept assuming the exchange of information about the model and the designed facility at every stage of the building's life cycle. This is a process that helps to coordinate between the design team, the contractor team and the facility managers. Despite the fact that the main factor on which the effective use of BIM depends, are the people who plan, execute and implement the whole process, its operation also requires efficient tools, which are often complex, technologically advanced, and requiring special skills from designers. Such tools include, among others, the Revit and ArchiCAD design platforms, which make it possible to integrate information from many industries and at various stages of designing and implementation of a construction project.

Parts of the largest design platforms

Revit and ArchiCAD are comprehensive, autonomous pieces of software with advanced functionalities and a very wide range of applications. This versatility, which in most cases determines their strength, may also be a constraint that prevents them from taking into account solutions specific to manufacturers of building materials or building equipment. To streamline them in the context of certain technology-specific solutions, manufacturers of building materials and equipment prepare various libraries or add-in's that are used to design within a particular technology. This is an excellent way of disseminating manufacturer technologies and solutions not only in the marketing context, but above all in the context of solution correctness.

An interesting example of such an approach is a set of tools which the authors developed under an order from Solbet, one of the largest manufacturers of autoclaved concrete components in Europe.

BIM tools prepared for Solbet

The tools have been developed for leading design software, such as: Revit and ArchiCAD, to be used in the context of work in a BIM environment.

They include:

- Solbet RevDesigner add-in for Revit
- Template and family library for Revit and Revit LT™
- library for ArchiCAD program

Both methods lead to the same goal: to build a model from appropriately selected Solbet products which meet the requirements (fig. 1). In this selection the user is assisted by filters that narrow down the list of items.



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Inserting lintels

The Solbet system also has lintels, therefore the add-in includes an effective tool for selecting and adding lintels in walls. It can be found in the same dialog box on the second tab. After selecting a wall or walls containing openings, the software analyzes their geometry (thickness of the supporting layer, width of the opening, available space for the support) and then offers three possible types of lintels. Every choice is good, because the software watches over its correctness. The lintel selection menu is transparent, so the user can track which opening is being considered.

After selection, the lintels are automatically inserted into the model, which saves the designer's time. (fig. 2).

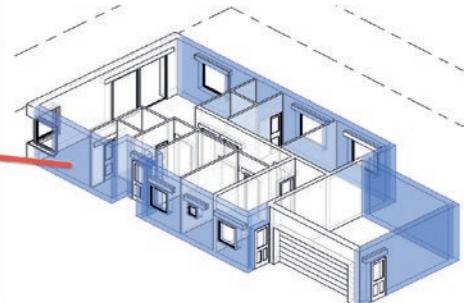
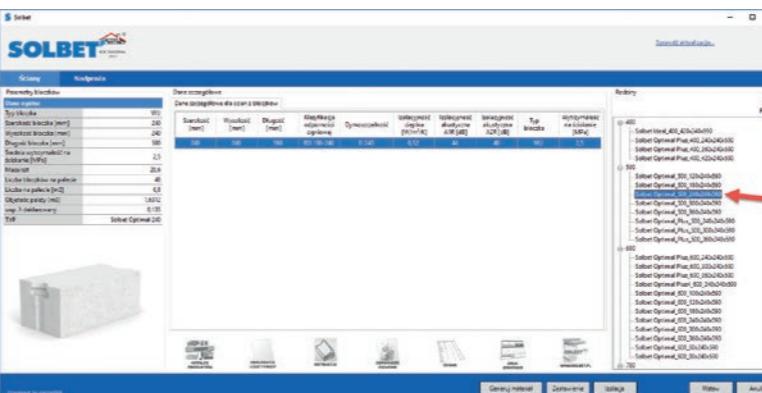


Fig. 1:
Generating walls.

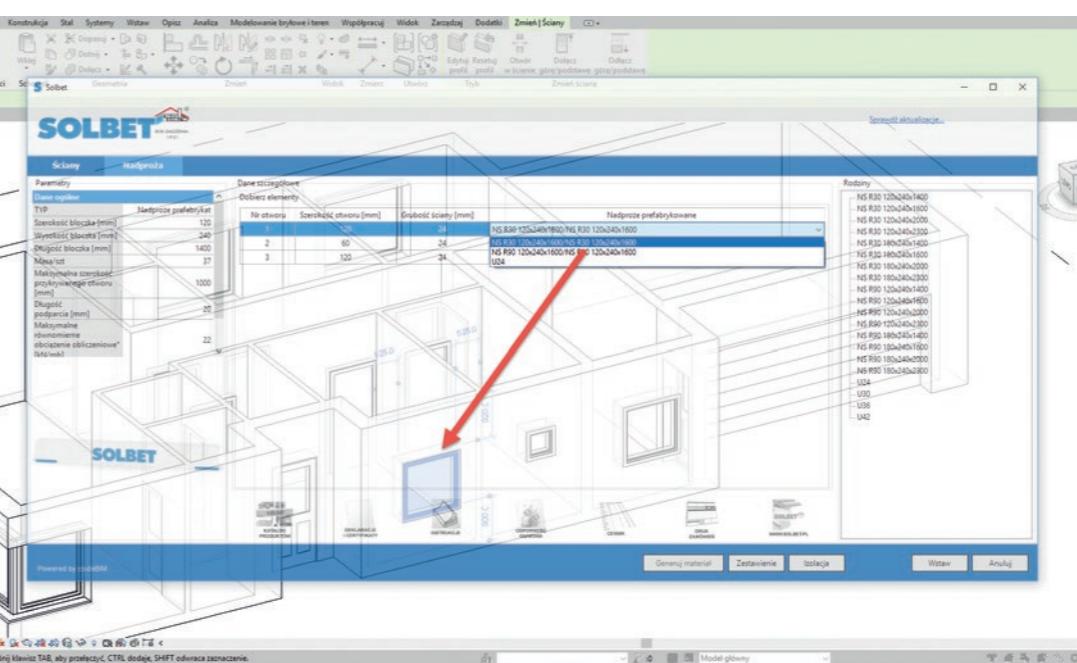


Fig. 2:
Lintel insertion module.

If the user modifies the position or geometry of a window or door opening, he simply reselects the wall and enters the Solbet/Lintel menu and confirms the selection with the "insert" button, and the tool will adjust the lintels to the changes made.

Professional tool for calculating the U-heat transfer coefficient

One of the important functionalities of the Solbet RevDesigner is the calculator that helps choose the right insulation thickness for the selected block.

What is important, the calculation algorithm assumes the calculation of the U-heat transfer coefficient based on the calculation values of the thermal conductivity coefficients of lambda heat. This finally avoids the risk of underestimating the thickness of the insulation.

The program offers two options:

1. Calculation of the U-heat transfer coefficient at the selected Solbet wall and the selected thermal insulation material with the required thickness of this material.
2. Determination of the thermal insulation thickness for a particular heat transfer coefficient, for a partition made of a structural layer made of Solbet blocks (fig. 3).

This way, the designer, having a selected structural layer of Solbet blocks, can calculate the U-heat transfer coefficient – selecting the thermal insulation layer, or having a selected structural layer of Solbet blocks and the target U-coefficient, the thickness of the thermal insulation layer will be adjusted.

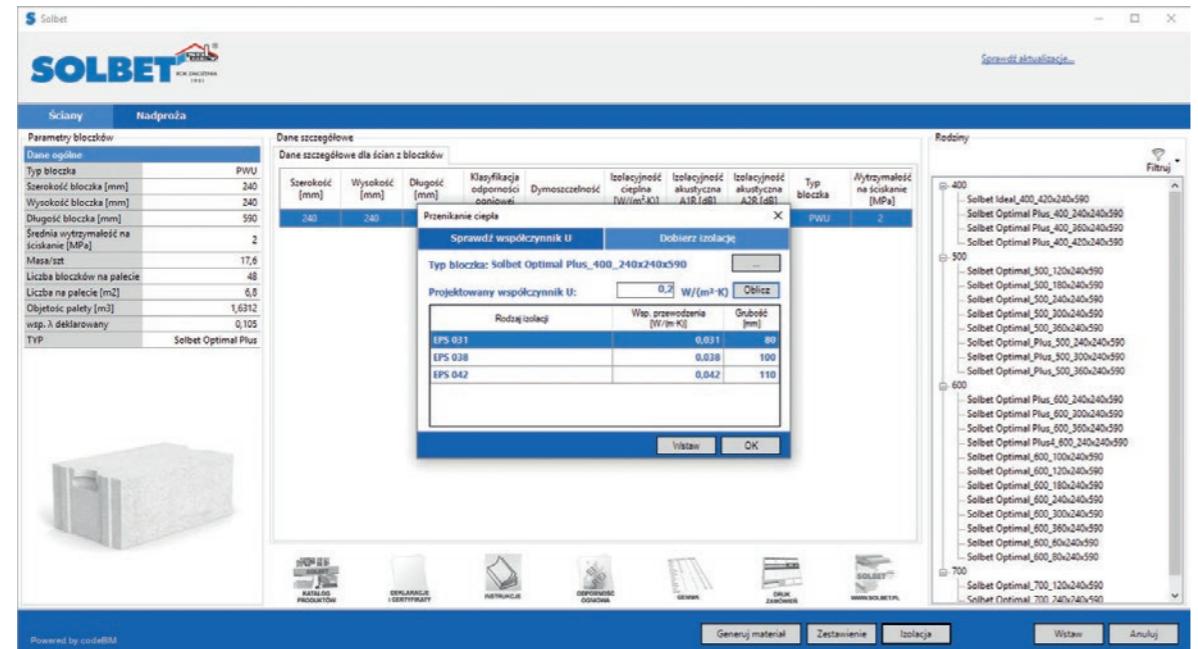


Fig. 3: Determination of thermal insulation thickness for a particular heat transfer coefficient for a partition.

After selecting the wall type and partition solution in the context of heat transfer coefficient and clicking "insert", the selected solution will be added to the design and will be available from the drop-down menu in the Properties window.

Generating bills of materials

Having made a model containing the parameters describing the applied products, the designer can generate a list of materials. The bill of materials algorithm takes into account Solbet logistic guidelines; therefore, the generated bill of materials provides information which is helpful also in the context of preparation of deliveries. The generated bills can be exported to Excel- or PDF-files.

Without leaving the design software, using the right buttons, the designer has access to source materials and CAD details that are located on the manufacturer's server, so the time needed to find the necessary documentation is much shorter (fig. 4).

Library for Revit LT

For Revit LT users who do not have the API (Application Programming Interface), i.e. the option to use the Solbet RevDesigner add-in, there is a template containing a full library of Solbet solutions. The template contains system families and loadable families. Its use is very simple and intuitive.

To import a suitable product to the design, simply copy it from the template and paste it into the target design and it will immediately appear in the list of types in the properties window. This template can also be used by those users who do not want to install the add-in, but would like to implement Solbet solutions in their designs.

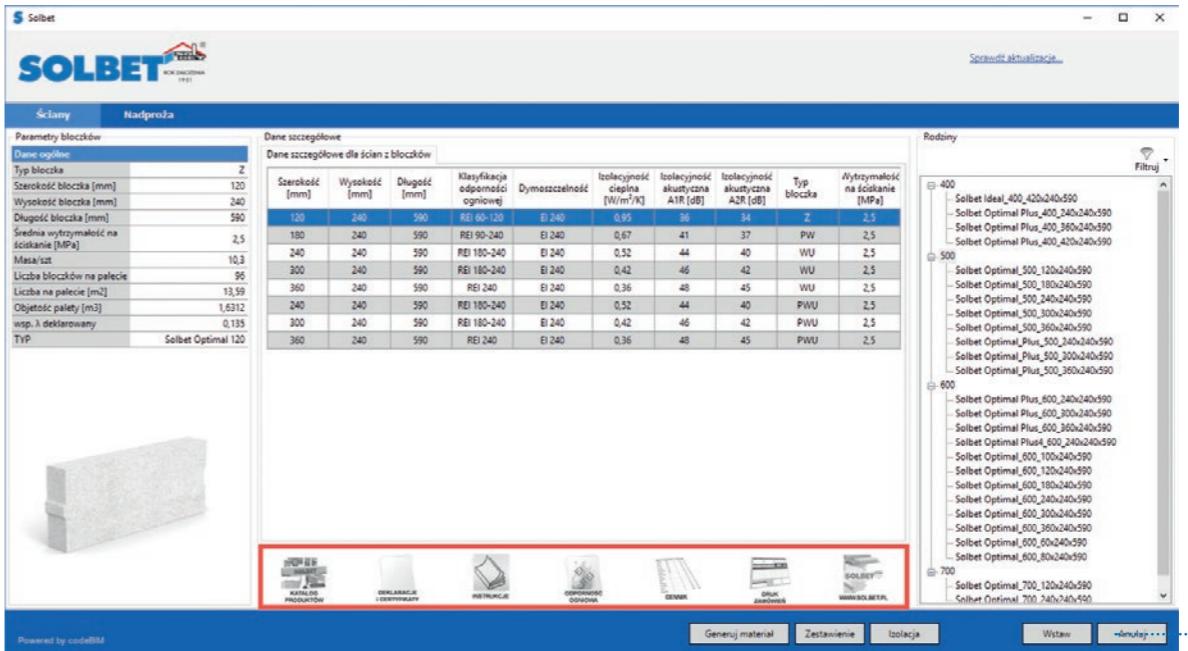


Fig. 4: Access to source materials on the Solbet RevDesigner add-in platform

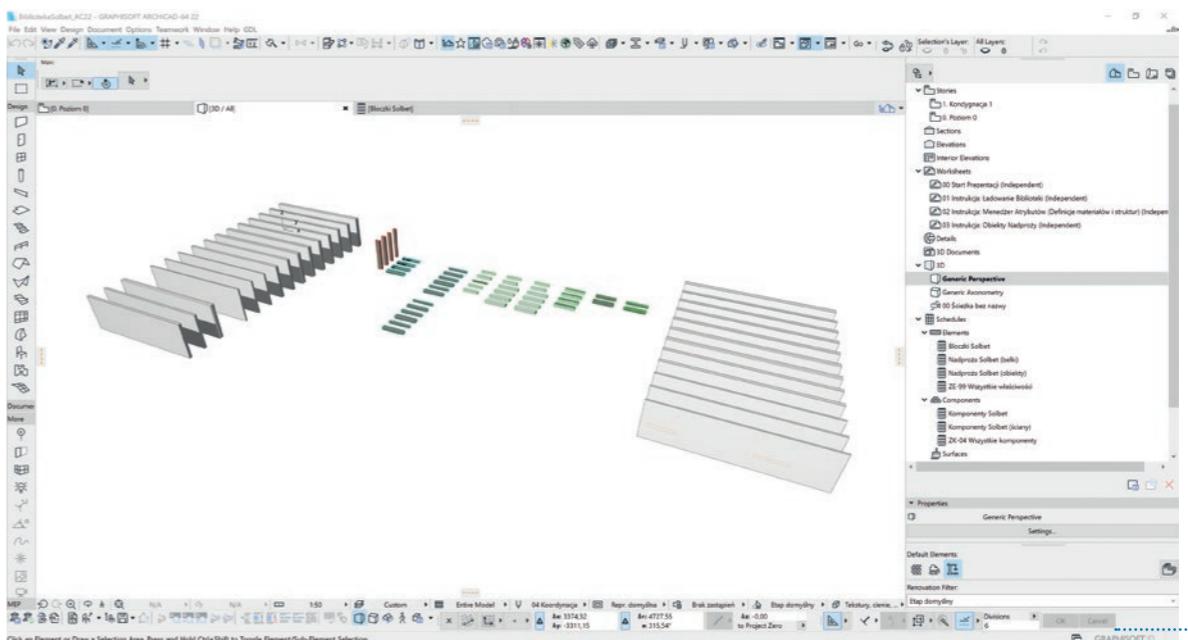


Fig. 5: ArchiCAD project with Solbet solutions

Solbet library for ArchiCAD

This solution is based on the native mechanisms contained in the software and does not require installing add-ons. Access to the manufacturer's solutions is provided for both more and less advanced users. The package contains the ArchiCAD project file (*.pln) and the library (*.lcf).

The design includes solutions in the form of inserted and configured components such as: walls, columns, beams and library objects. Such a design can be opened in parallel with the design being developed and the necessary solutions and can be copied to the current design. Alternatively, more advanced users can use the library design in the system's attribute manager without having to open Solbet solutions in parallel. (fig. 5)

In addition to the components mentioned in the previous paragraph, the library also contains textures for the proper representation of the manufacturer's materials in 3D window.

After the library has been loaded in the system and the necessary solutions have been inserted (in one of the ways described above), they are available as composite walls and profiled columns and beams. Lintels, however, can also be made of library components – available from the "object" tool and the "window" tool.

While solutions for composite walls and profile elements do not allow direct insertion of information (metadata) or links to the manufacturer's website,

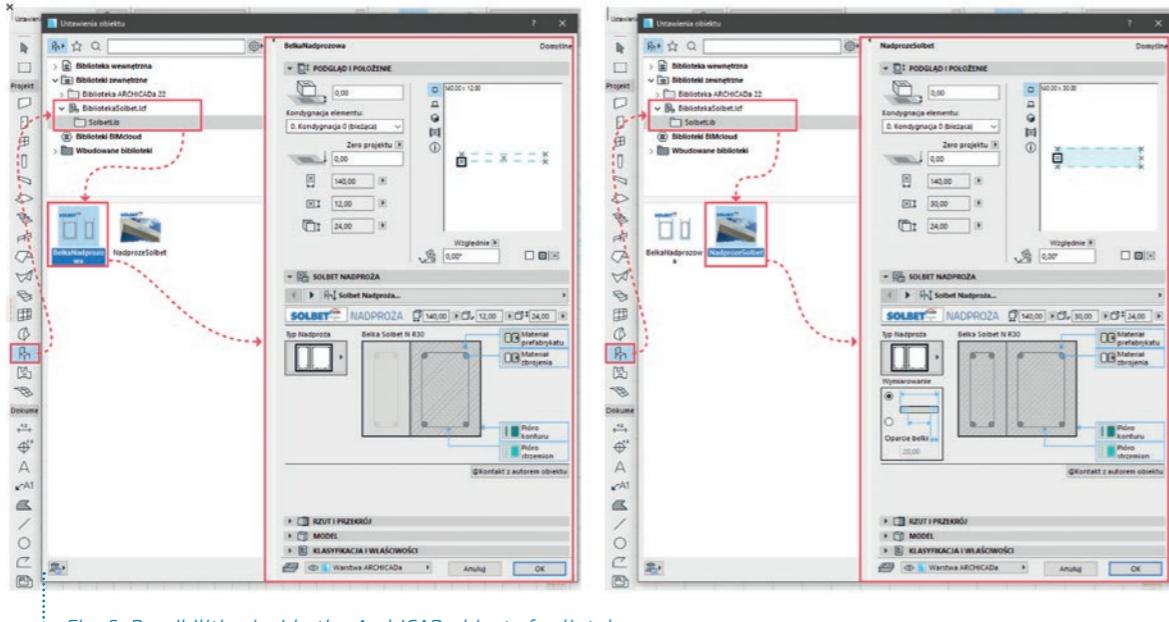


Fig. 6: Possibilities inside the ArchiCAD objects for lintels

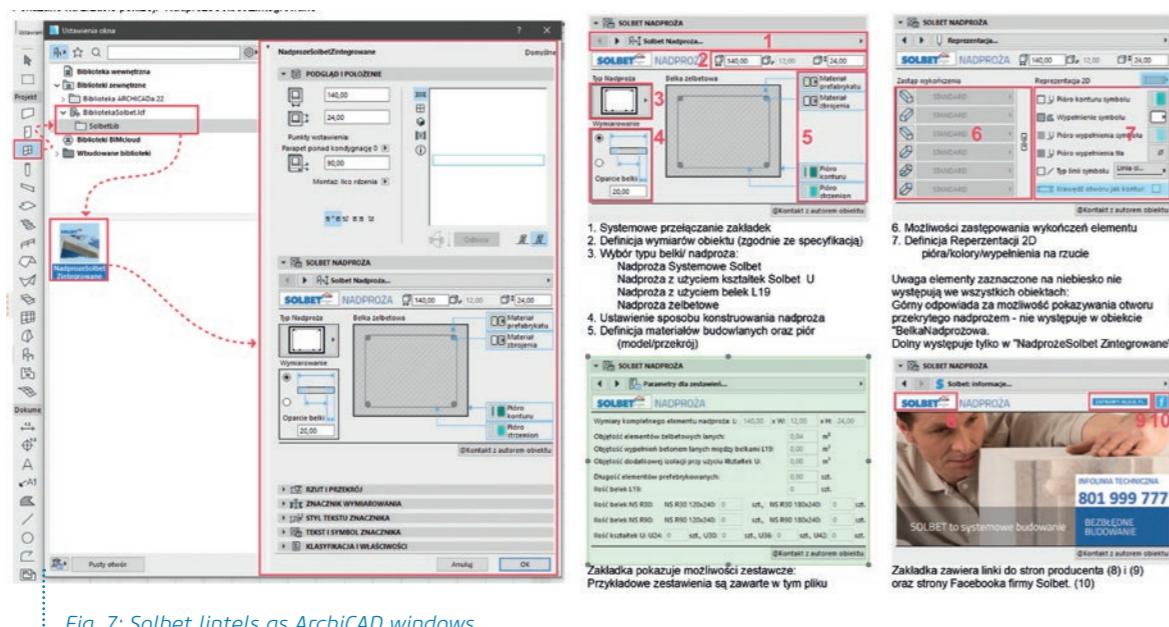


Fig. 7: Solbet lintels as ArchiCAD windows

library objects contain their own user interface, where such information is placed, because each library part is actually a program running in the ArchiCAD environment.

Due to the fact that the loaded solutions contain defined materials, all information concerning these materials and their quantities can be compiled in different ways. The bills are generated in the ArchiCAD system. In order to speed up this process, the Solbet design file contains templates of the relevant bills to be used in any design. Among other things, a list of surfaces and material volumes was prepared, broken down by layer thicknesses, which additionally takes into account the volume of plaster and mortar needed to build a particular wall.

In a design containing the solutions, there are also pre-set the respective properties with expressions for the calculation of the number of blocks of particular types, which have been used in the design.

Library objects prepared for system lintels need to be discussed separately (fig. 6). They take the form of intelligent configurators allowing only feasible solutions to be inserted. During insertion, the wall structural layer to which the lintel is added, is automatically detected.

For example, in the case of a wall with 24 cm thick blocks as its structural layer, the configurator will offer the use of two 12 cm thick system beams (Solbet NS 12x24), while in the case of a 36 cm thick wall,

it will suggest two 18 cm beams (Solbet NS 18x24) - and all possible combinations of 12 cm and 18 cm beams. The user can also choose other solutions, provided they are feasible for a particular wall thickness, e.g. "L" type beams filled with additional concrete. There is also a solution available for thicker walls in the form of "U" shaped pieces (Solbet U24, U30, U36, U42).

All lintels are constructed in such a way that their length varies in steps and must not exceed the limit values specified by the manufacturer. Additionally, on the "bill parameters" tab information is available about the type of components in the lintel and their number. This data will later be used in the bills, the relevant templates of which can be found in the design (fig. 7).

The library also contains a label, which enables semi-automatic calculation of the "U" coefficient for the partition. The user only needs to define the partition type and direction of heat flow. In the solution-based design, a user manual with screenshots is also available, and the manual is also available as a PDF file.

Conclusion

The development of Solbet tools for the largest Revit and ArchiCAD design platforms is the manufacturer's response to changes in the approach to the preparation and implementation of construction designs. The changes are brought about by the increasingly widespread use of the BIM concept. The purpose of ready-made tools is to support designers in their work, among others, through quick access to documentation and significant reduction of time needed to select and add appropriate products to the model, while maintaining appropriate detail, as well as recommendations for implementation.

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