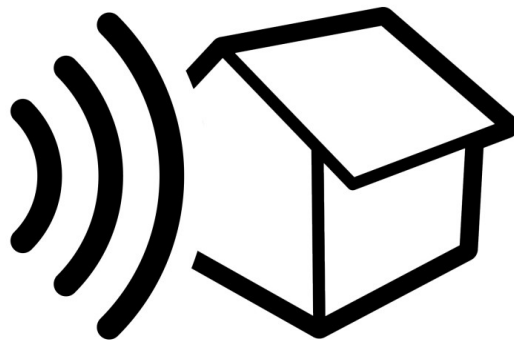
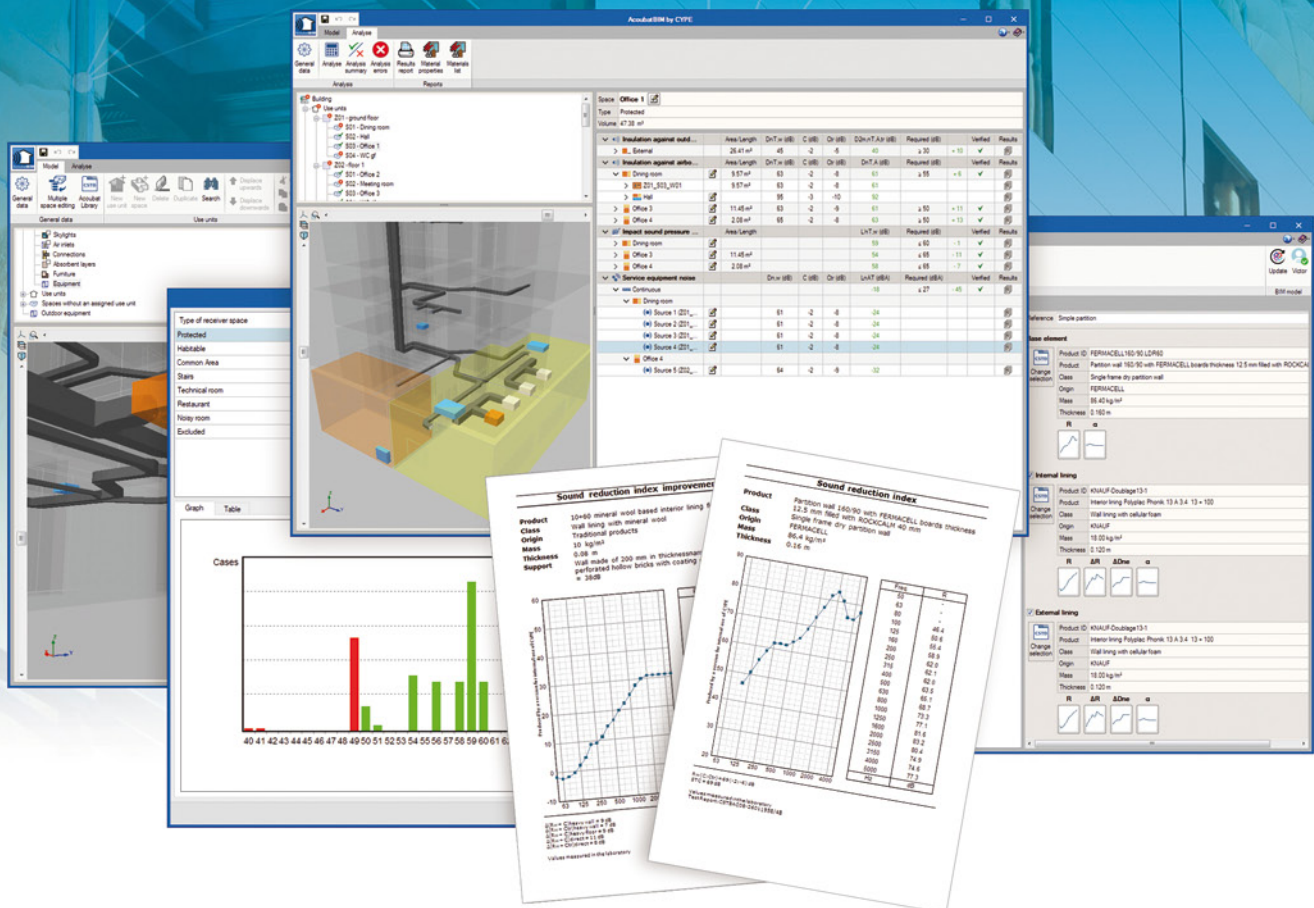


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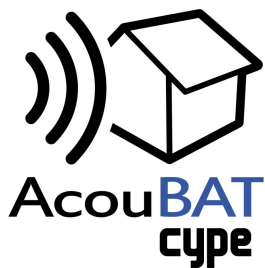


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AcouBAT by CYPE

Acoubat by CYPE is a tool developed by **CYPE** and the **CSTB (Centre Scientifique et Technique du Bâtiment)** with the aim to help users study the insulation and acoustic conditioning of buildings. It calculates the indices that evaluate the insulation of airborne sound (indoor and outdoor), impact sound insulation and the reverberation level in indoor spaces, in accordance with the procedure contained in the **EN ISO 12354:2017** code.



Area of application

Acoubat by CYPE is able to carry out the design and calculation of the insulation and acoustic conditioning of any type of building, complying with different predefined regulations included in the application, using customized configurations of other regulations, or utilising personal technical understanding:

Country	Standard
	Nouvelle Réglementation Acoustique (NRA)
	Regulamento dos Requisitos Acústicos dos Edifícios (RRAE)
	Determinazione dei requisiti acustici passivi degli edifici (D.P.C.M. del 5 dicembre 1997)
	NBR 15575
	Configurable standards

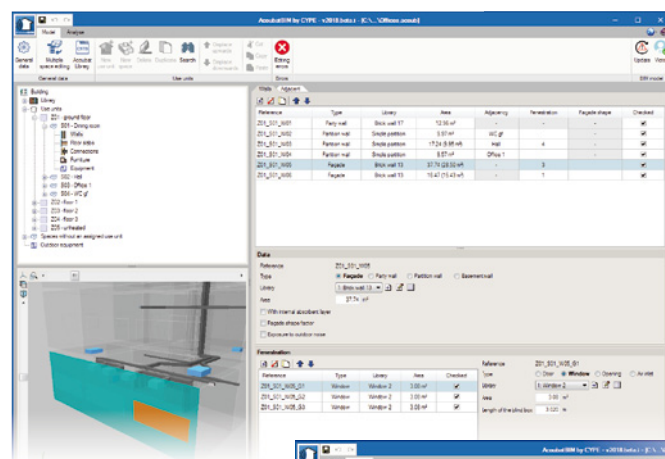
Principal characteristics

User interface

The Acoubat user interface is divided into two tabs:

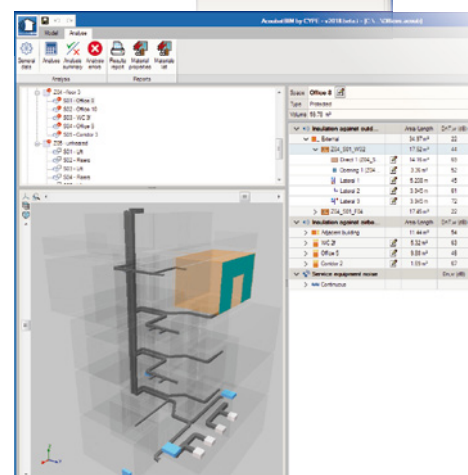
• Model.

The main parameters of the project are specified in this tab, as well as the acoustic properties of each component of the building that intervenes in the analysis. To do so, the program contains a library where the acoustic properties of all the elements can be defined to then apply them to each component of the building.



• Calculation.

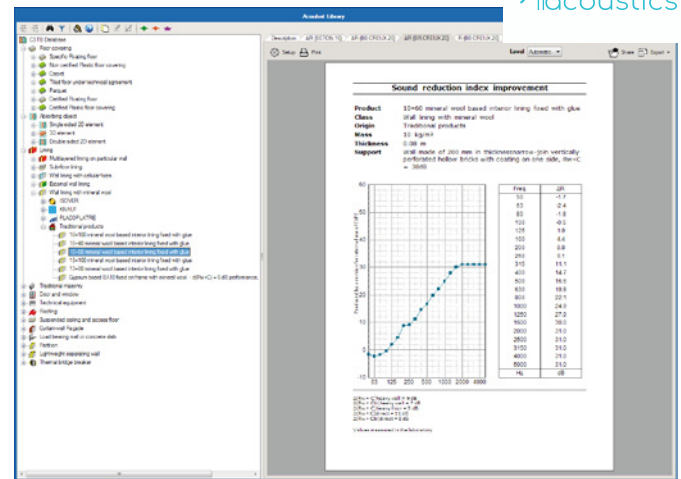
Once the model has been defined, users can launch the analysis in this tab. The program allows users to inspect the results obtained for each space and each element that is involved, so they can be compared to the levels required by the code.



Acoubat database

Acoubat incorporates the sound trial database of the Acoubat analysis engine, which is managed by the CSTB. Each product is classed in accordance with the following categories depending on its use in the building:

- Traditional masonry
- Load bearing walls and concrete slabs
- Partitions
- Lightweight partitions
- Floor covers
- Linings
- Doors and windows
- Technical equipment
- Suspended ceiling and access floors
- Curtain wall facades
- Thermal bridge breaker
- Absorbing object
- Roofing

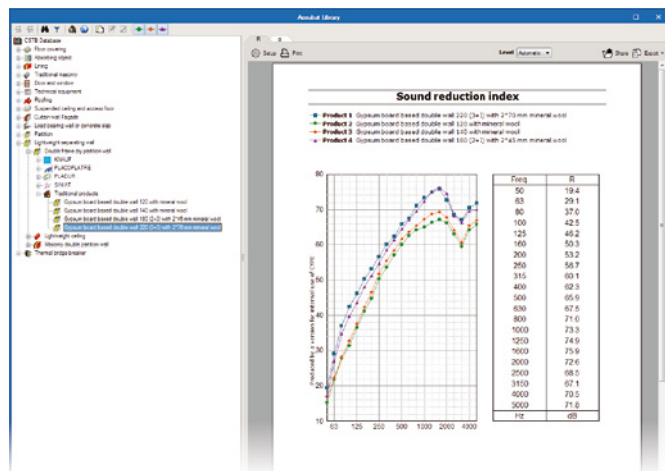


The products of the database are assigned by users to the types of elements defined in the program library (in the "Model" tab).

General parameters

• Calculation options.

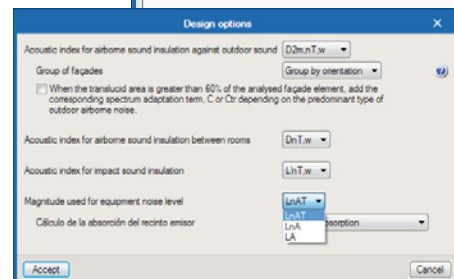
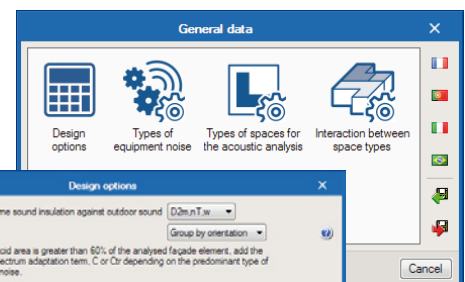
The user can indicate to the program what global acoustic index he wants to evaluate each type of isolation.



The program includes a search engine based on product reference and a comparison tool that allows the acoustic behaviour curves of up to four products to be superimposed in order to facilitate the final choice.

Apart from the products that Acoubat incorporates by default, the program allows adding new elements through the manual introduction of its acoustic characterization, with the possibility of using them in any project.

In addition, thanks to the copy and paste options, it is possible to insert the acoustic values of each test in the customized product quickly and precisely. This can be done by copying the data directly from a spreadsheet or through the connection with the acoustic system behaviour prediction program, **AcouSYS**, developed by the CSTB (Centre Scientifique et Technique du Bâtiment).



• Types of spaces for the acoustic calculation.

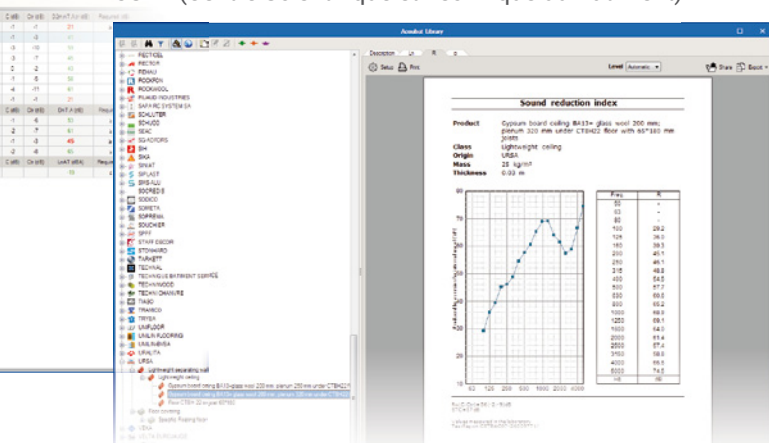
The program offers the possibility of defining a library of types of enclosures, and assigning to each of them isolation limit values to outdoor airborne noise and noise coming from adjacent buildings. Together you can activate the calculation of reverberation time and acoustic absorption inside.

• Types of equipment noise.

In order to evaluate the noise generated by the building's equipment, the application allows the establishment of different types of noise and verifies the sound pressure level of the machines belonging to each one of them.

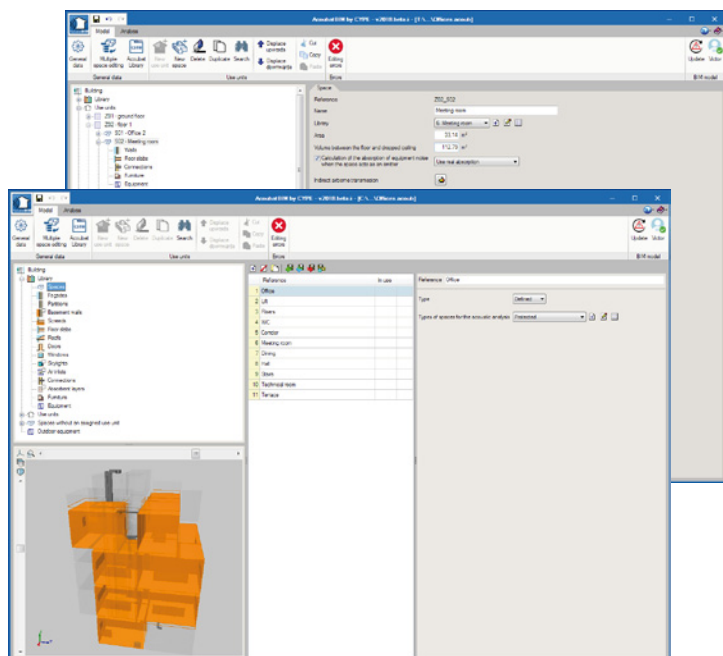
• Interaction between different types of spaces.

Acoubat allows users to calculate the level of indoor airborne noise insulation and impact sound between pairs of spaces based on their type. Users can indicate limit levels for each acoustic magnitude in order to verify the code in force.



Definition of spaces

The particular enclosures of the building must be linked to one of the existing typologies, in addition to introducing their geometric characteristics such as volume and surface. This data can be obtained from the information contained in the BIM model, in case it is being operated within the Open BIM workflow.



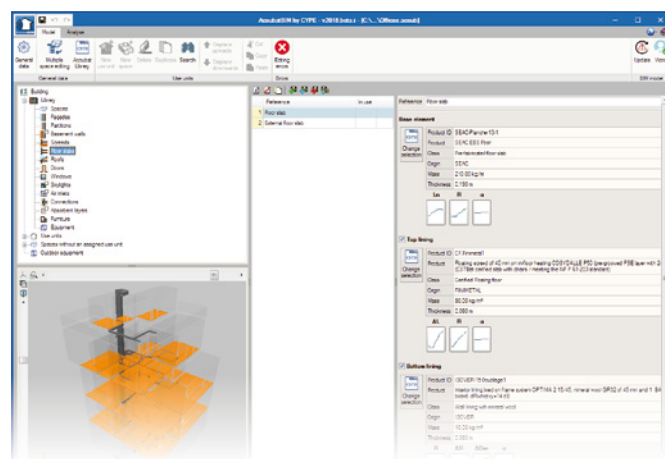
Once the types have been defined, they can be assigned to the spaces of the project, where their location and dimensions can be assigned. Similarly, the program allows users to indicate whether there are doors, windows or openings in partitions or facades.

For the calculation of insulation against outdoor airborne sound, for vertical facades of the building, Acoubat by CYPE allows users to include the level difference due to the shape of the facade for the shape facades and orientations of the sound source, as indicated in the **EN ISO 12354-3:2017** code.

Floor slabs

Horizontal separation elements are defined in a similar manner as are walls except, in these cases, the selected products can contain impact sound data. Contained in this group are screeds, floor slabs and roofs.

As occurs with walls, users can select a bottom cladding (dropped ceiling) and top cladding (floor covering).



Use units

The spaces of the building can be grouped in use units. The values for indoor airborne noise insulation and impact sound insulation that have been indicated in the Interaction between space types section, will not be calculated for pairs of spaces of the same use unit, unless indicated otherwise in "Space definition".

The spaces that do not belong to a use unit can be grouped in "Spaces without an assigned use unit", this way the program understands they act as independent units.

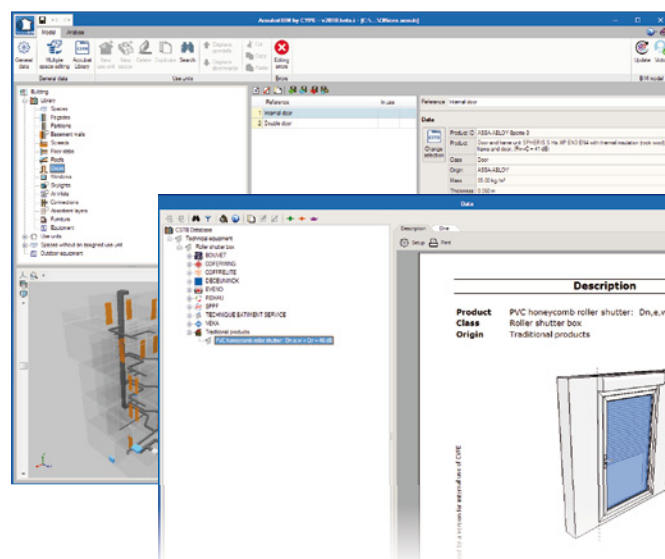
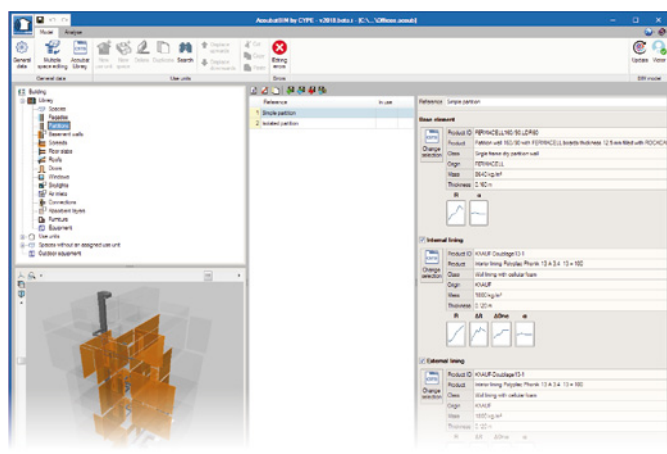
Openings

The definition of the types of openings like doors, windows, and skylights is completed from the program's library. The openings are introduced in each enclosure of the work, where its area is specified and related to one of the classes defined in the library.

In the case of windows, the user can assign a blind box type of the database, which will be calculated as an independent opening.

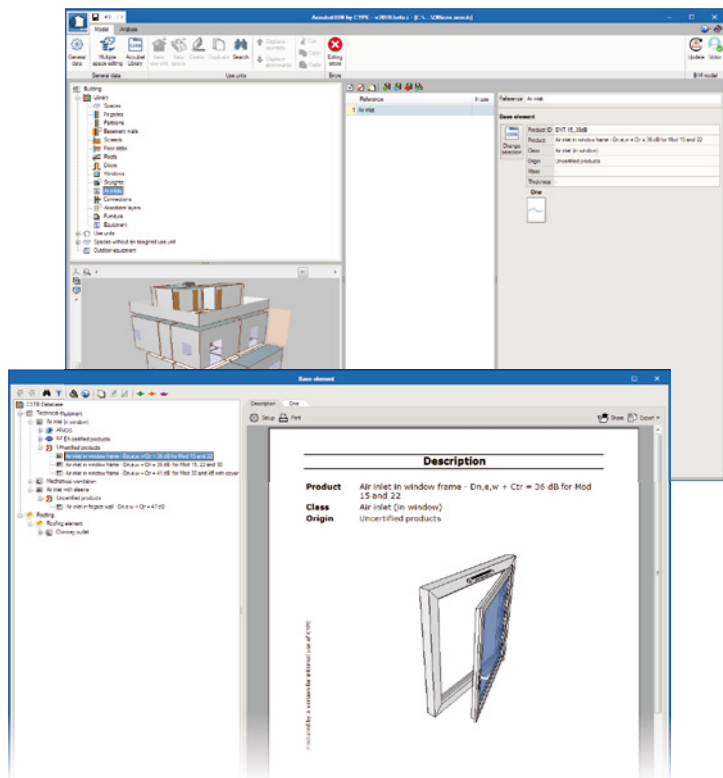
Walls

Users can define types of vertical separators such as facades, partitions and basement walls in the program library. The construction solution of the base element can be selected and internal and/or external linings can be introduced.



Aerators

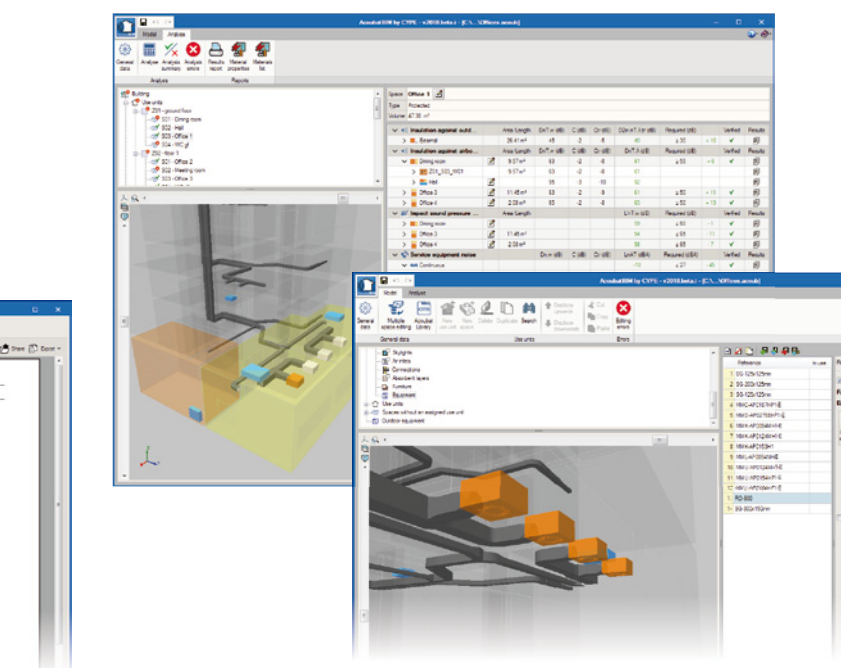
Unlike the rest of the gaps, the aerators are characterized by the normalized sound level difference of the element, $D_{n,r}$, instead of by the noise reduction index, R . Once the typologies in the program library have been defined, they can be inserted in the walls in the same way that it is carried out with the doors, windows and skylights.



Equipment

The application allows the introduction of sound sources in the building. For each of the sources of the library, an operating class must be specified, according to the types of noise introduced previously in the general parameters of the project. Likewise, to indicate the acoustic properties of the machine, the equipment must be related to one of the products of the Acoubat database.

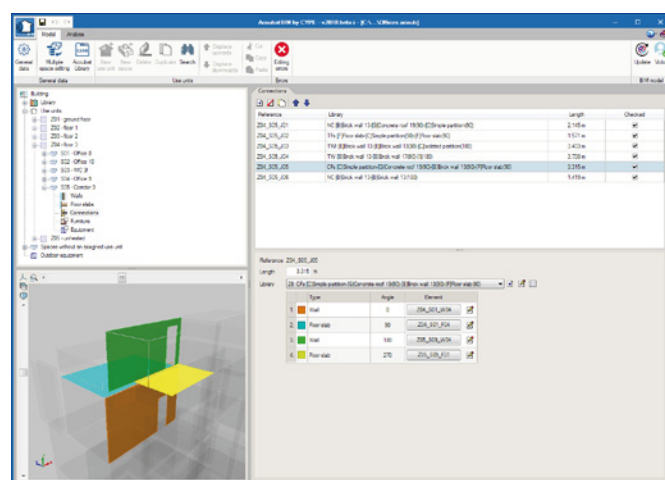
The equipment can be introduced in a specific room or outside the building. In the first case it is only necessary



to access the enclosure where the source is located and add a new element in the list that makes reference to the corresponding typology of the library. The external equipment, on the contrary, is introduced in a specific section within the application tree. In addition, indicate the distance between the source and the closest enclosure of each affected area (r) and, depending on the surfaces near the source, the value of the directivity factor (Q) of the machine.

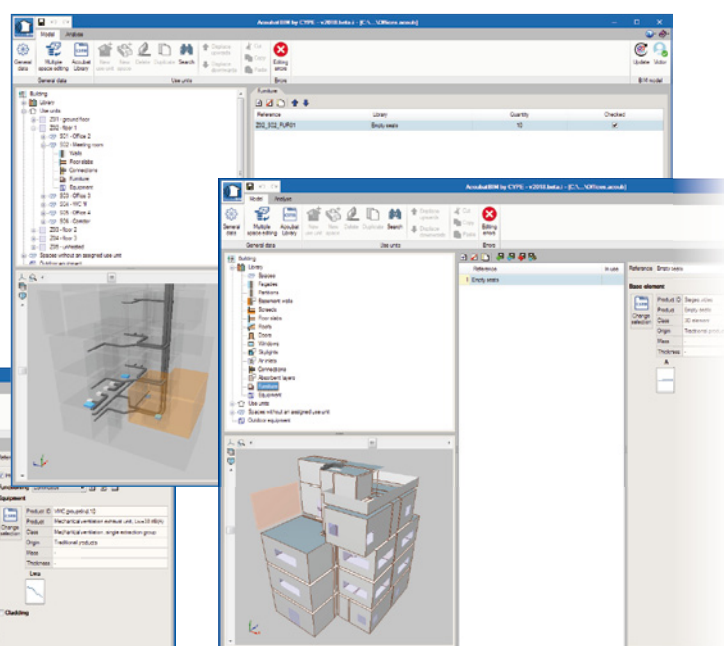
Connections

Acoubat allows users to define the connections between construction elements of the project, which are required to determine the vibration reduction index, K_{ij} , which is used in the indirect or flanking sound transmission. Users can indicate which components make up the connection, the angles formed between them and the length of the connecting edge, l_{ij} .



Furniture

Three-dimensional objects, such as people or furniture, with absorption area values can also be introduced inside spaces. These devices increase the sound absorption area of the space and consequently, reduce the reverberation time.



Absorbent layers

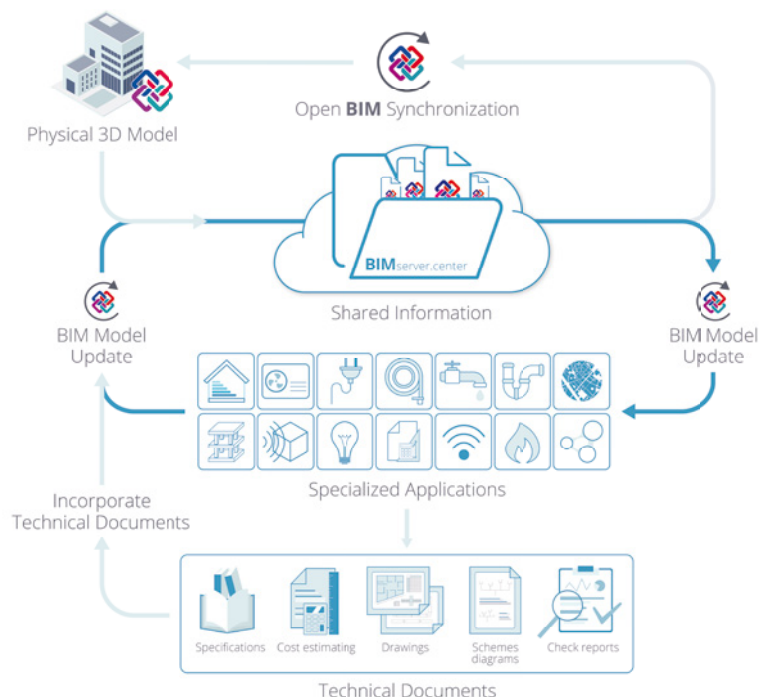
The absorbent layer library allows the introduction of 2D absorption elements in the model of the work. These, like furniture, are not taken into account in the calculation of acoustic insulation and only influence the prediction of the level of reverberation inside the space where they are installed.

As the types of absorbent layers are characterized by their sound absorption coefficient (α), they must be associated with the interior or exterior face of an enclosure.

Open BIM

Integration in the Open BIM workflow

Acoubat by CYPE is an application integrated in the Open BIM workflow. This integration is carried out through the exchange of IFC information files with a previously defined BIM model.



- **Link to a BIM project.**

The reading of a BIM model is done from files in IFC format generated by CAD / BIM programs such as IFC Builder, Allplan, Archicad or Revit. This allows "Acoubat by CYPE" to automatically incorporate the enclosures and the constructive elements that make up the building.

If the IFC file that is imported has been generated by IFC Builder, during the import process, the unions between separators and the edges that make them up are also processed, so that the user does not need to define unions manually. In addition to the geometry, AcoubatBIM allows other IFC entities to be integrated in the calculation model, such as:

- **Baths and showers.**

These objects, together with the rest of the sanitary equipment, can be introduced through IFC Builder.

- **Terminal elements of air conditioning ducts.**

For example, grids and diffusers can be entered in the BIM program for the design of air conditioning systems CYPETHERM HVAC.

- **VRF systems, Multisplit and Split 1x1.**

In the same way as the grids and diffusers, it is possible to introduce them in CYPETHERM HVAC.

- **Exporting information in the IFC files.**

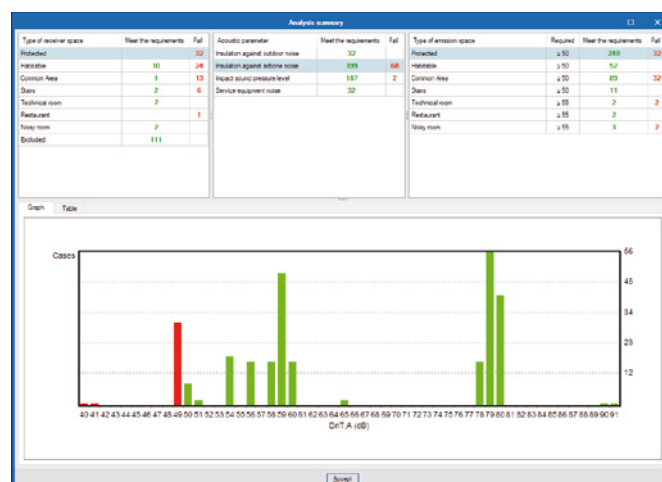
Acoubat by CYPE exports IFC files with the documentation of the acoustic study, in PDF format ("Listing of results", "Characteristics of the materials" and "Table of materials").

- **Synchronisation with the BIM model.**

Whenever there is a modification in the BIM model, the program can incorporate the changes into the AcoubatBIM project enabling the user to work in parallel with the specialists of other disciplines.

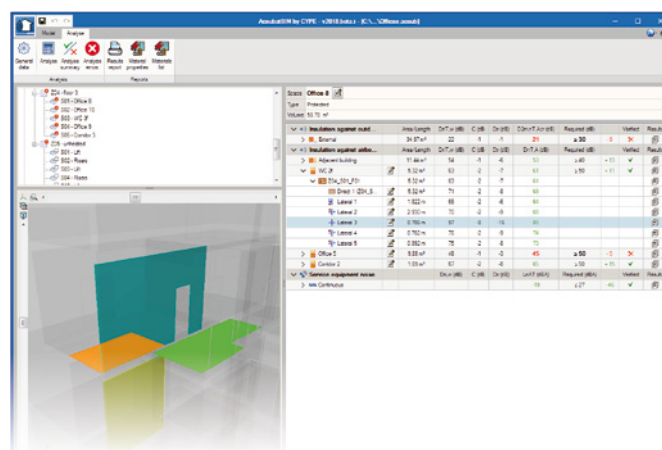
Results and checks

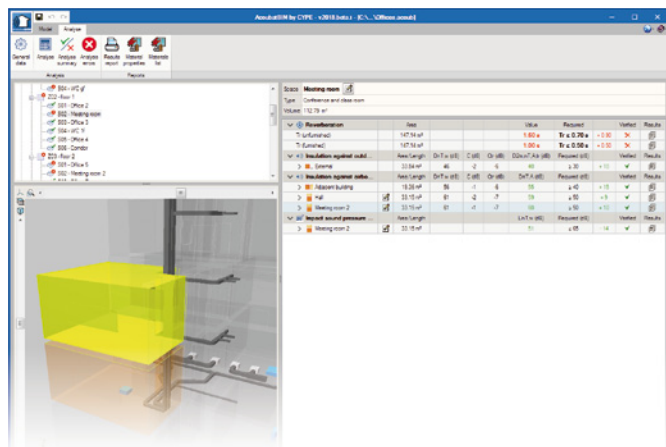
Once the analysis has been carried out, AcoubatBIM allows users to view the magnitude of the evaluated sound values, so they can analyse the results in the most efficient manner depending on their needs.



Global indices

When the analysis process has ended, a general summary, in histogram format, is displayed which allows users to quickly identify the values of the global sound indices that lie outside the allowable range.





Acoubat by CYPE displays a drop-down menu, for each receptor space, with the results of the global indices that have been selected to measure each sound magnitude. If the verification of a limit value has been selected, it will be viewed next to the value obtained for the sound index.

When work is carried out on a BIM model, a result is selected from the list, the elements involved in the analysis (pairs of spaces, connections, partitions...) are highlighted in the 3D view of the building.

Detailed results

For each analysis that is carried out, the program offers users the option to generate a report containing the values obtained in octave third bands. The document also includes information regarding the analysis, such as the spaces involved and formula used.

The results for each frequency can be viewed in three different ways:

- Results.**

A table and graph of the results are displayed in third octave bands of the sound index.

- Analysis (Table).**

The results, in third octave bands of the sound index, are displayed in table format, as well as the values of the variables used to calculate them.

- Analysis (Graph).**

The results, in third octave bands of the sound index, are drawn on a graph, as well as the values of the variables used to calculate them.

Finally, each of the paths of the connections (direct-flanking, flanking-direct and flanking-flanking) can be inspected, as well as the values obtained for the velocity difference in the connection ($D_{v,ij}$).

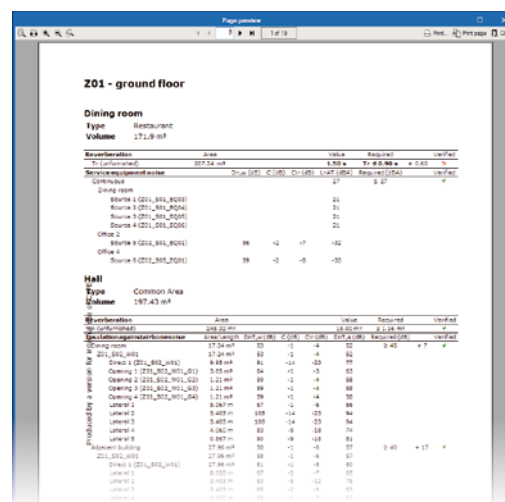
Documentation

When the calculation by Acoubat by CYPE has been completed the following project listings are automatically generated:

- Results list.**

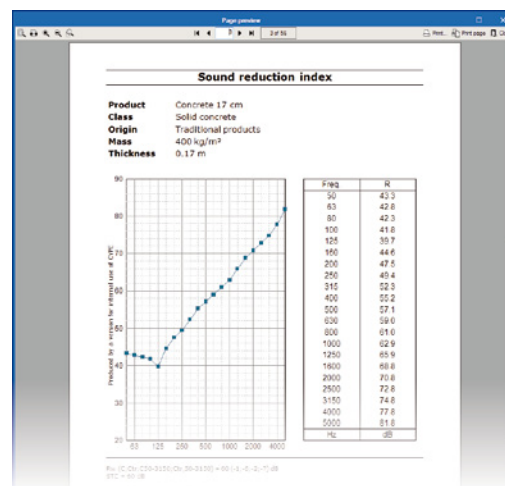
Acoubat by CYPE compiles a document as a summary with the results of the global acoustic indices obtained for each enclosure together with the verification of the limit values established by the user. It is also possible to

configure the elements that you wish to display, being able to see only the enclosures that do not meet the requirements or the values obtained for each separator and each joint.



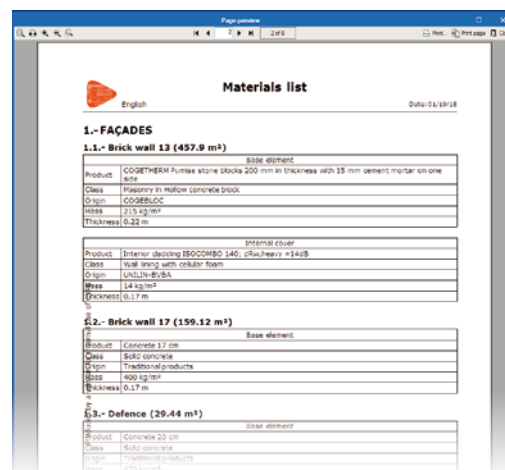
- Characteristics of the materials.**

The program extracts the set of files corresponding to the acoustic tests of the materials used in the project contained in the Acoubat database.



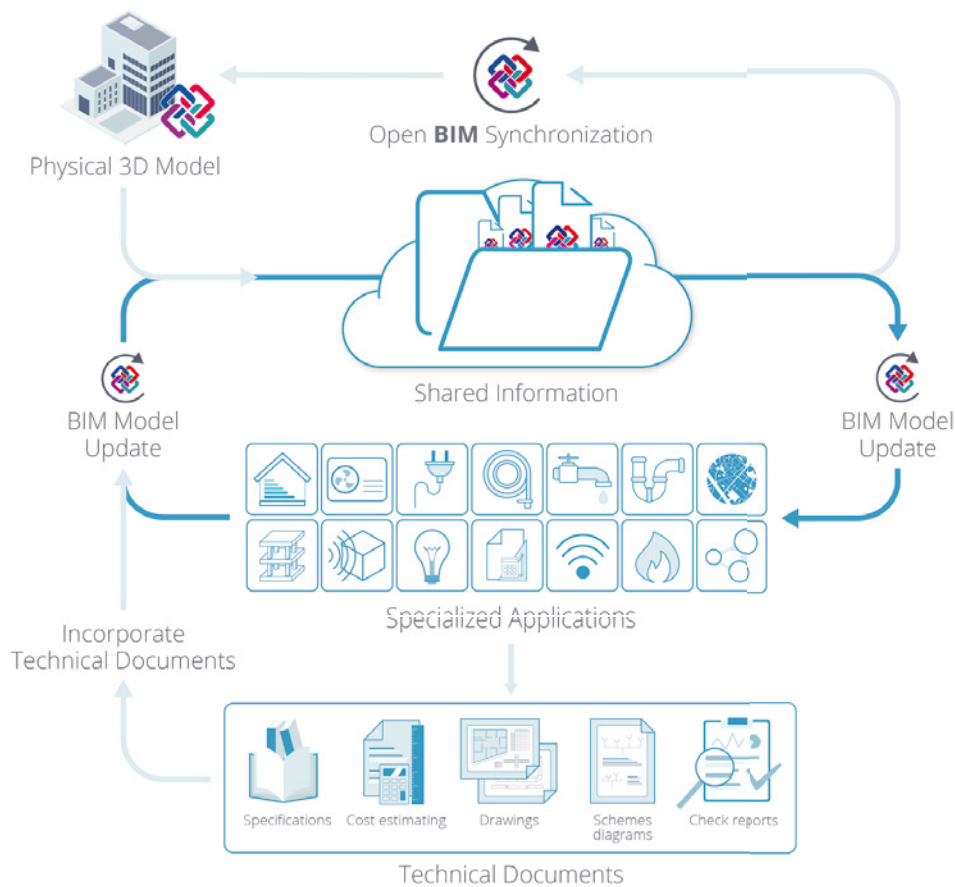
- Table of materials.**

The application generates a list that relates the types of elements defined in the project and the products of the Acoubat database that have been assigned to them. Additionally you can see the total area occupied by the enclosures in the work and the number of each type of door, window, skylight and aerator.



AcouBAT by CYPE

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