FRILO INSIGHT

EDITION 02/2021

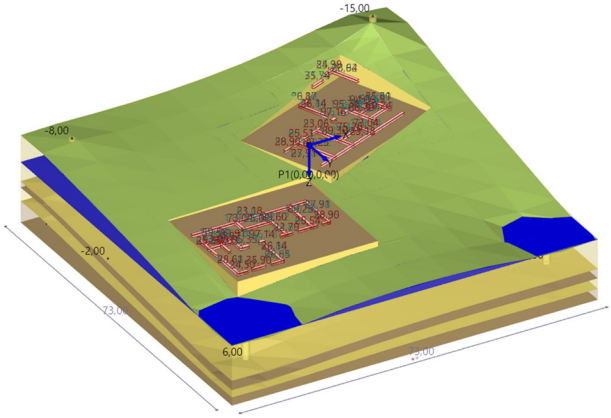
TOPICS OF THIS EDITION

- New functions in Soil Settlement SBR+
- New solution for cross-laminated timber beams HTB+
- Practice: Tips & tricks for users
- FRILO-Campus | Events, online-trainings, webinars!

FRILO
A NEMETSCHEK COMPANY

SBR+ convinces with functional extensions

Just last November, FRILO expanded its product portfolio in foundation engineering to include the SBR+ Soil Settlement solution. In the course of the most recent Release 2021-2, the program, which precisely determines the time-delayed settlement of a building in any subsoil, has now been equipped with new, appealing functionalities. For example, a polygonal soil model can be automatically interpolated by defining drilling profiles.



Thanks to an unlimited superposition of linearly variable line and area loads, structural engineers can use the new FRILO Program „Soil Settlement SBR+“ to calculate both constant and arbitrarily curved base stress profiles. As a result, not only settlement courses in the section, but also settlement depressions in the area can be mapped. In this way, the mutual influence of several foundations and load areas in the plane can be observed. This can be particularly important for the settlement calculation when building in existing structures.
On the basis of DIN 4019/ÖNORM B 1997-1-2, SBR+ can also be used to provide evidence of the size and the time course of settlement and foundation tilting caused by changes in the volume or shape of the subsoil. In this calculation, the external loads can be modeled in the form of infinite area loads, arbitrarily positioned limited block loads or asymmetrical trapezoidal loads. The number of terrain loads, their type of action as well as the limit state to be considered and the design situation can be selected as required.

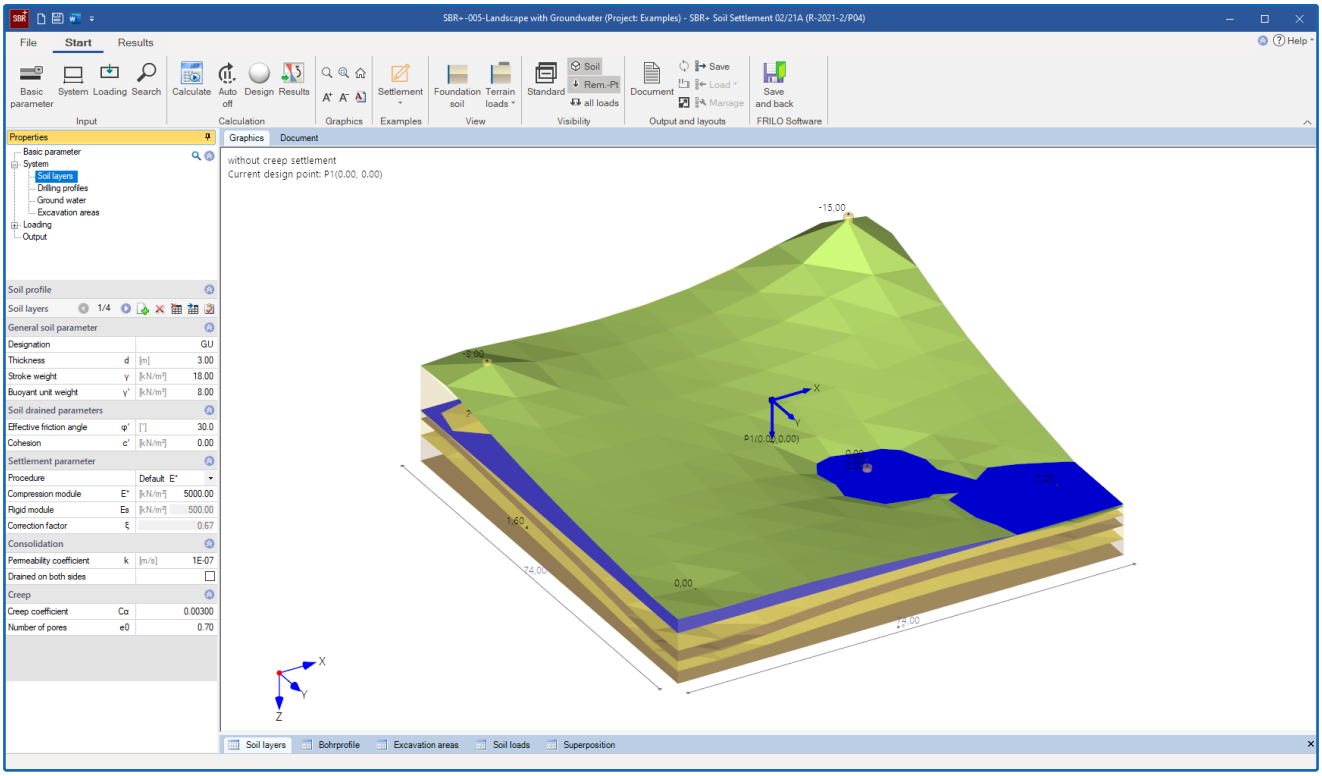


Fig.: The program interface of SBR+ with the new menu items drilling profiles and excavation areas.

The load cases are automatically superimposed. In addition, an excavation area can be freely defined in the program. Uplifts as a result of excavation relief can be calculated accordingly. The shares from immediate and consolidation setting are always calculated by default. Creeping can be added as an option.

Soil settlement from stresses

The analytical calculation method in the soil settlement solution SBR+ is based on the assumption of slack loads (structures). The indirect soil settlement calculation method is used. In this method, the subsoil stresses that are generated by a load are determined in the elastically isotropic half-space depending on the depth and the foundation geometry.

By assuming an elastically isotropic half-space, the theory of elasticity and thus the principle of superposition are fully valid. The proportional settlements in the observation point as a result of each individual load case can therefore be superimposed by adding them. The compressions in the soil in sub-layers are calculated on the basis of the calculated settlement-generating stress curve in the half-space. Real layer boundaries are taken into account. In the last step, the settlement is calculated by integrating the strains over the sub-layers mentioned up to a defined limit depth.

Interpolation of the soil layers from drilling profiles

The latest software update enables FRILO users to create a polygonal soil model by defining any number of drilling profiles, which is automatically interpolated from the information from the outcrops. The elevation of the top of the terrain and the individual layer boundaries are defined for each drilling profile. In addition, the geotechnical parameters of the respective layers can be determined. Basically, users can interpolate both the layer geometries and the soil properties of a single layer and thus model different stiffness ratios for one and the same layer. A linear interpolation is used for the automatic calculation of the soil model. The influence of a drilling profile on an observed section through the terrain decreases inversely proportionally with its distance.

Load transfer from the GEO and the FD+

The latest program version has another significant advantage for FRILO users. With the help of a load export, any number of foundation loads from the Building Model GEO and Foundation FD+ programs can be imported and superimposed at a freely definable point for a soil settlement calculation. In order to forward all the information required for the soil settlement calculation to SBR+, the global position of the foundations must be defined in the system input of the higher-level programs. In principle, any number of

foundation positions can be exported from GEO and FD + to SBR+. To illustrate the linked positions, position couplings are created between the positions from GEO or FD+ and the SBR+ model. From the Building Model, only foundation loads from single and strip foundations can currently be transferred to SBR+. An extension to foundation slabs will be available in a subsequent version. In addition, an expansion of the function is planned, by means of which an application time can be assigned to each load, so that the time-settlement components of individual loads applied at different times can be superimposed. In this way, a more differentiated consideration of the time-settlement history could be made in order to obtain a realistic assessment of the abatement of the consolidation and the creep.

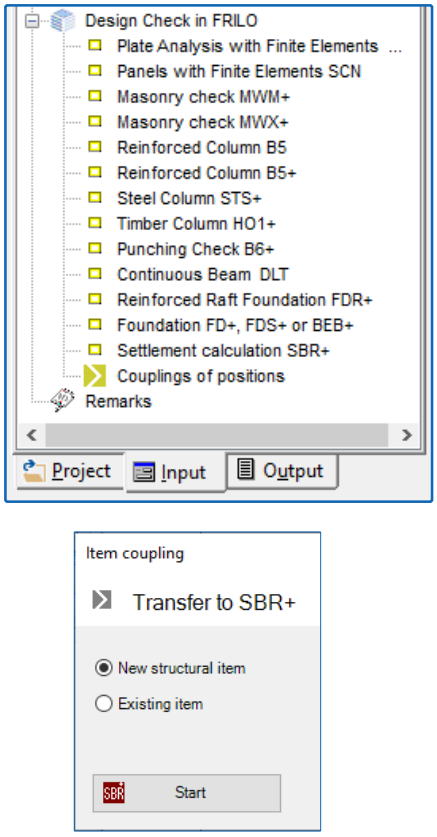


Fig.: Export from GEO and interim query for item coupling.

The evaluation of the results

The settlement can be output for any number of freely selectable design points. All stress influence values i, stress-settlement and time-settlement diagrams are graphically displayed for each load case and design point. Furthermore, a settlement depression can be displayed over the entire model area.

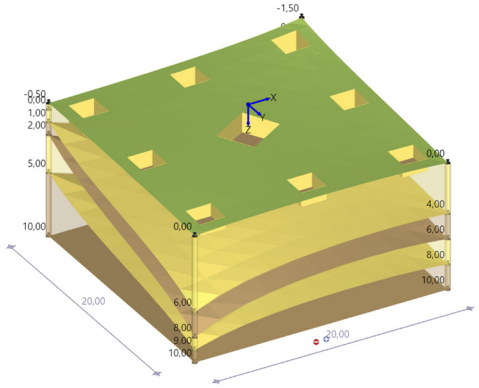


Fig.: Export of multiple loads from FD+.

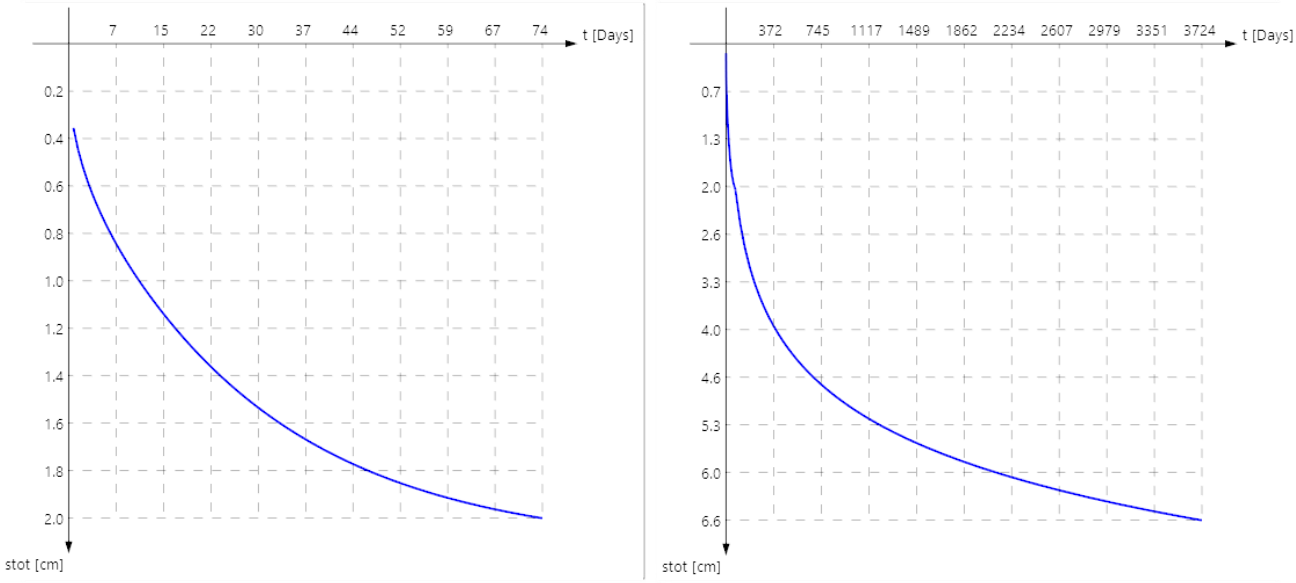


Fig.: Time settlement diagram, left without and right with creep settlement.

HTB+ as the answer to the timber construction trend

Calculation of cross-laminated timber beams possible since Release 2021-2

With the latest Release 2021-2, FRILO has expanded its product portfolio in timber construction and brought a completely new solution to the market. The HTB+ program is used by software users to calculate timber beams made of cross-laminated timber using the shear analogy method.

Building with the timber raw material is increasingly popular with architects, structural engineers and building owners across national borders. The development and establishment of cross-laminated timber as a revolutionary timber construction product is making a significant contribution to the widespread use of timber construction. Cross-laminated timber is a flat, solid and multilayer wood-based material that is used for the construction of load-bearing and space-defining components such as walls, ceilings and roofs. This wide range of applications has paved the way for solid wood as a construction material. Cross-laminated timber structures are used not only in the construction of single and multi-family houses but also in multi-storey residential construction or in the construction of tall buildings. A high load-bearing capacity, slim wall constructions and excellent fire and sound properties ensure that solid wood construction will continue to gain in importance, especially in urban areas. The inexpensive, uncomplicated and quick assembly of cross-laminated timber also promotes industrial construction with wood.

FRILO reacts to the increasing attractiveness of cross-laminated timber

With the new development of the Cross-Laminated Timber Beam program (HTB+ for short), FRILO has now provided an answer for structural planners to the ongoing boom in ecological building materials. The new program can be used to calculate cross-laminated timber elements that are stressed as panels as single-span and multi-span beams with or without cantilever arms. The cross-laminated timber to be calculated consists of at least three layers of sawn

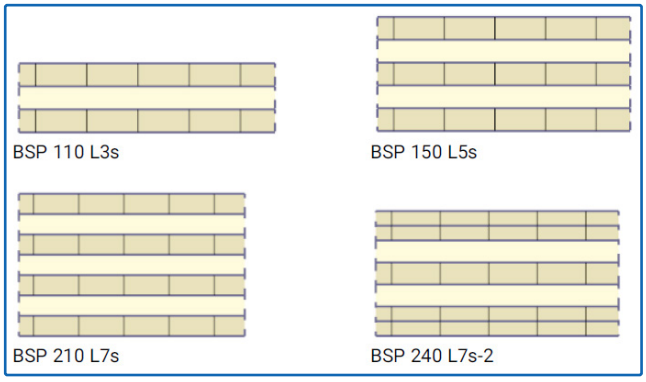
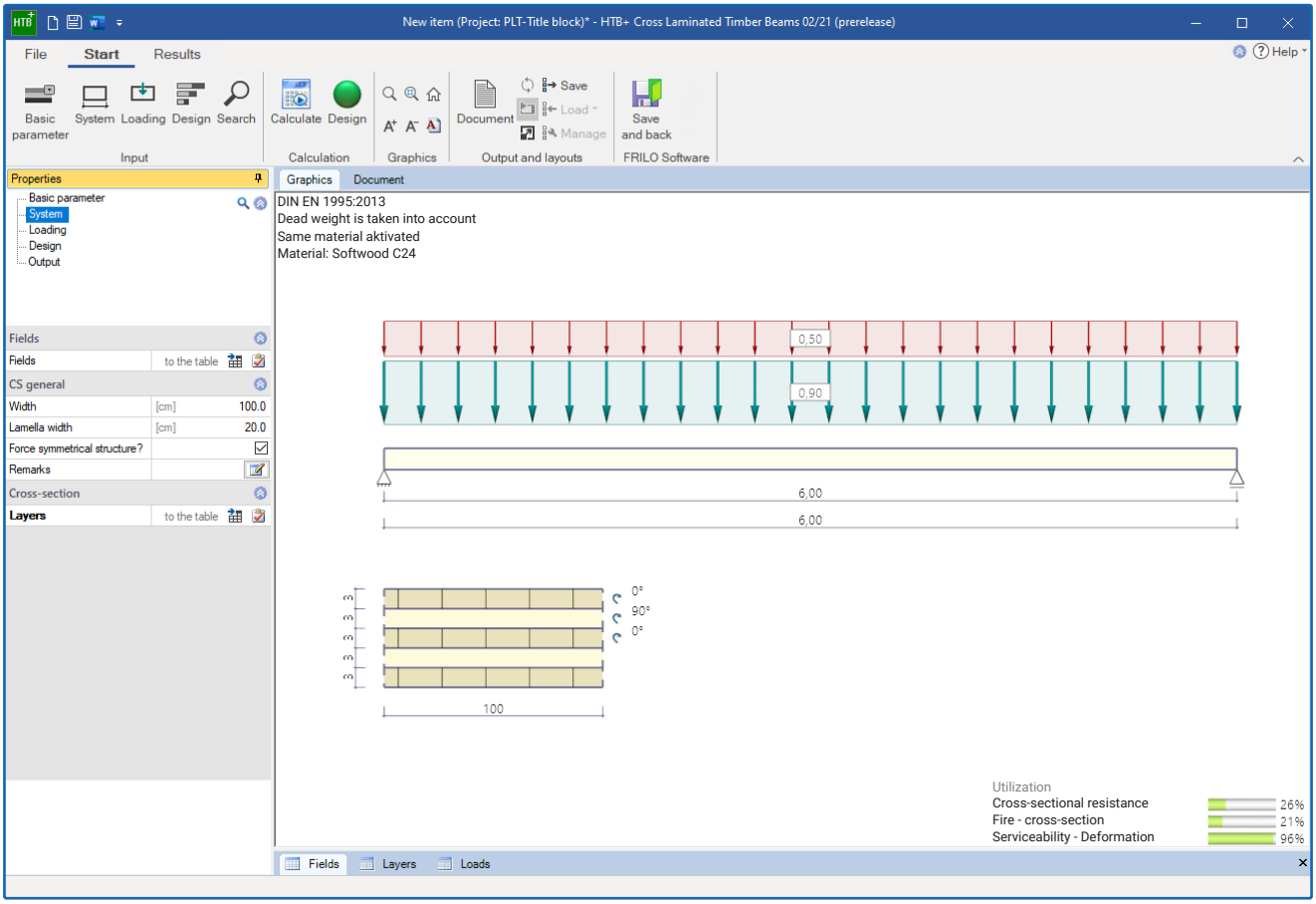


Fig.: Cross-section variants (with manufacturer-neutral designation).



timber glued together at right angles. When entering data, the layer structure can be designed individually with regard to the number of layers, layer thickness and orientation of the layer (lengthways/crossways). In addition, any materials made of softwood or special material parameters from a building authority approval of the cross-laminated timber manufacturer can be entered as user-defined values. In addition, a symmetrical structure can be optionally enforced when entering data.

Special features of the dimensioning

In the design, the cross-laminated timber panel is regarded as a uniaxially tensioned beam element. It is idealized by a strip one meter wide. The design is based on the shear analogy method. In this way the static systems and the loads are not subject to the restrictions of the gamma method. In the ultimate limit state, the situation is considered both permanently and temporarily. Proofs of normal stress, shear stress from shear force and rolling shear stress are provided in each case. In the ultimate limit state, the fire situation can also be assessed. In the event of fire, the dimensioning is based on the staircase model and, if necessary, takes into account sloping layers. In addition, the limit state of serviceability is examined.

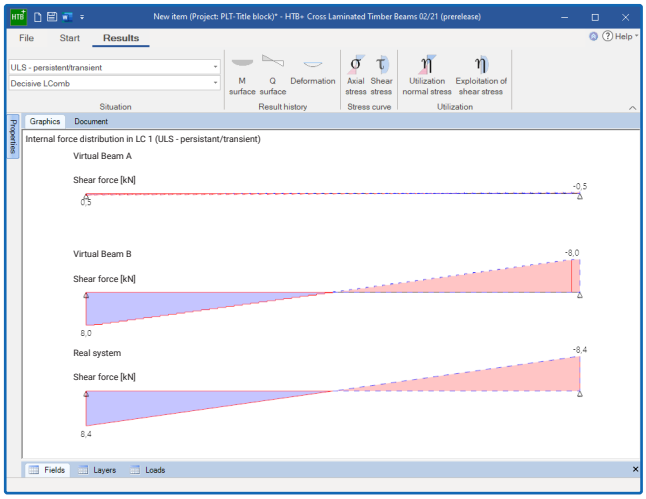


Fig.: The input interface of HTB + and the graphic representation of the results.

Standards

- DIN EN 1995:2013
- ÖNORM EN 1995:2019
- EN 1995:2014

TIPS AND TRICKS FOR USERS

- BIM-Connector® - Change model structure
- PLT - Create title block

Practice in the BIM-Connector®: Restructuring buildings

The problem

If several buildings are contained in an ifc file, the export is e.g. in the program Slabs by Finite Elements PLT not easily possible. The model structure may also not be suitable for your purposes.
To solve such problems, there have been functions since Release 2021-2 that you can use to automatically assign floors. The existing model structure can also be adapted to your own needs.

Example with two buildings

The example ifc file contains two buildings (Fig. 1). In the model structure on the left, the storeys for both buildings are summarized (Fig. 2). The aim is now to break down this building structure into individual buildings, i.e. to create a practical model structure that can be used for further processing or dimensioning in a FRILO solution.

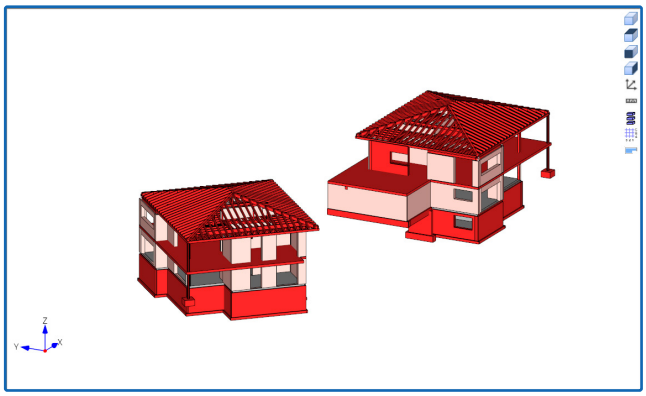


Fig. 1: An imported ifc file with two buildings in a model structure.

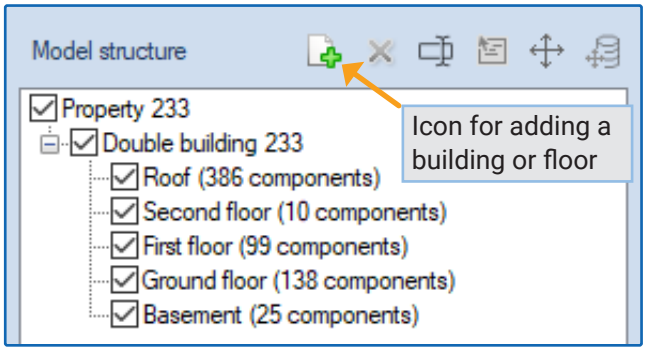


Fig. 2: The window with the representation of the model structure.

Automatic floor assignment

A first solution is now the function „**Floor allocation**“ in the upper menu ribbon (Fig. 3). The BIM-Connector automatically generates a more suitable model structure, which in simpler cases is already suitable for further processing.
If the result of the automatic assignment (Fig. 4) does not or does not yet meet the requirements, you can define a suitable (new) model structure yourself.

Define new model structure

To do this, click on the top entry in the model structure (here „Property 233“). You can now **add a new building** using the icon or the context menu (right mouse button). Let‘s call it „Building 1“ (Fig. 5).

With a mouse click (right) on the new entry „Building 1“, you can **Add a new floor** to this building (let‘s call it a roof).
In this way you can also create all the other floors (basement, ground floor, 1st and 2nd floor).

Move parts of the building into the new model structure

The new model structure is now defined - in the example Building 1 with the floors basement, ground floor, 1st floor, 2nd floor and roof. The next step is to move the parts of the building from the previous structure into the new structure.

To simply select the roof of the right house, double-click on floor 4 (roof) - then only this floor will be displayed.

Now only the roofs of the two buildings are visible and you can easily select the roof on the right (use the mouse to draw a selection frame around the roof - the marked components are highlighted in color, see also tip 1 on the following page)

Tip: you can first rotate the graphic by holding down the right mouse button so that it is easiest to select it using a drag-out rectangle.

Then click with the right mouse button on the selection and in the context menu on the function „Assign to another floor“ (Fig. 6).

The „Select target floor“ dialog opens. Now click on „Roof“ (Fig. 7). The right top floor has now been moved to the “Roof” floor in the model structure of Building 1.

For visual control you can switch the visibility tick for „Roof“ on and off.

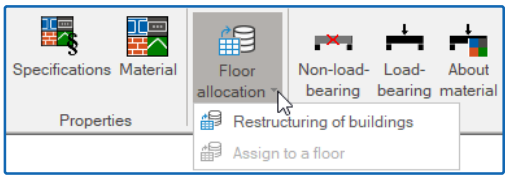


Fig. 3: Icon for the automatic floor assignment.

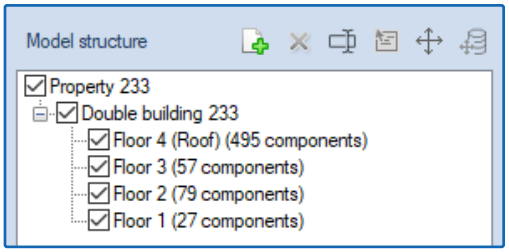


Fig. 4: Result of the automatic floor assignment.

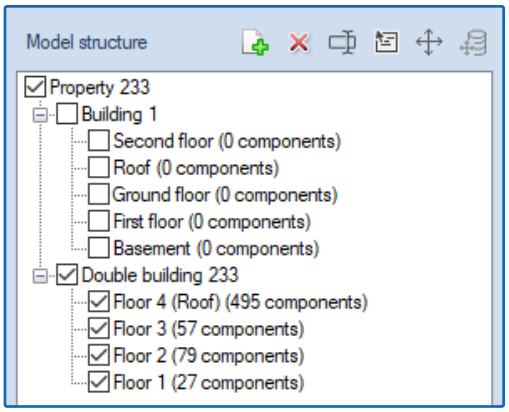


Fig. 5: The self-defined building 1 and the new floor allocation.

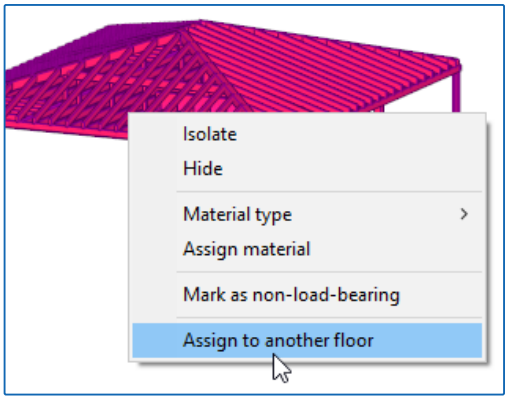


Fig. 6: The context menu for selected components.

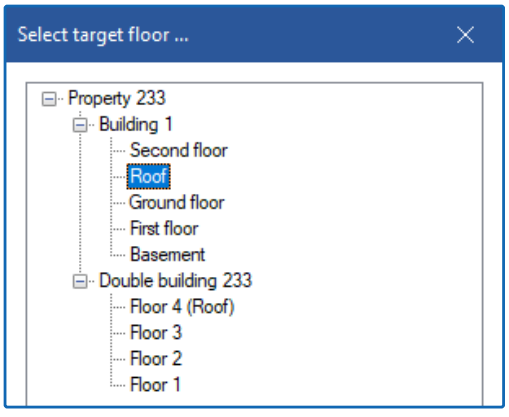


Fig. 7: Selection of the target floor to which the selection is to be moved.

According to this principle, you move the existing floors/components into your new model structure and thus have a suitable basis for further processing.

More tips

Tip 1: show or hide objects

Via the „Visibilities“ on the left edge of the window you can switch the display of components and/or materials on and off, so that the selection is even easier. If the materials are not correctly assigned in the ifc model, you can (and should) do this yourself by rotating the graphic (holding down the right mouse button) so that you can easily mark the corresponding components. After the selection you can assign a material to the respective component with the right mouse button.

Tip 2: duplicate the building structure

Since the two buildings are structured similarly, after entering the first building structure you can simply duplicate it via the context menu (Fig. 8).

Tip 3: Select the components in the background using „Ctrl“ + scroll wheel

In some cases components that are behind other components (hidden) have to be selected. In Figure 9a, for example, the opening should be assigned to the wall axis. If this situation is viewed from above, it is not easily possible for the user to select the wall lying under the opening.

The wall in the background can be selected by holding down the „Ctrl“ key and simultaneously pressing the scroll wheel of the mouse. A tool tip appears in which the currently highlighted component is always displayed (Fig. 9b).

If both components (opening + wall) have been selected, the opening contour can then be adapted to the wall axis using the **“Join manually”** function (Fig. 9c).

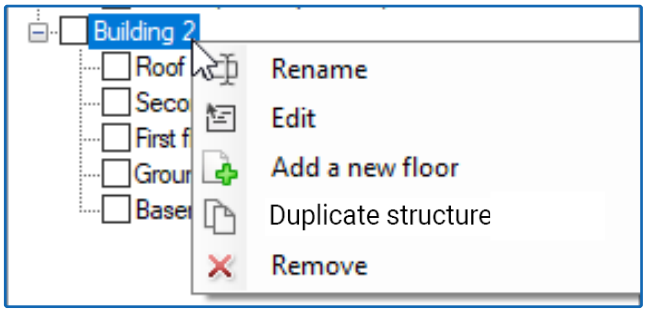


Fig. 8: Duplicate the building structure via the context menu.

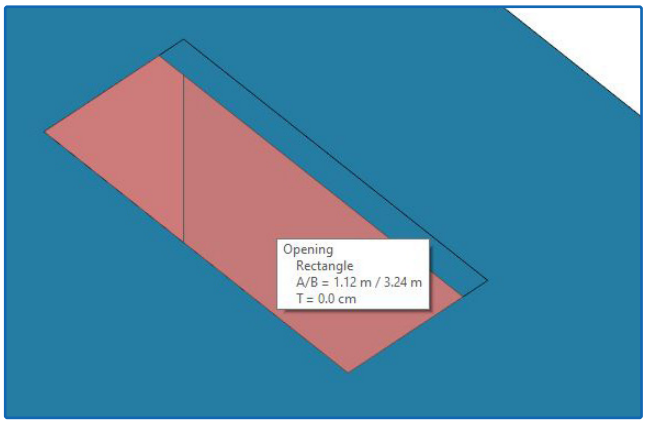


Fig. 9a: Opening and wall overlap and the wall cannot be selected at first.

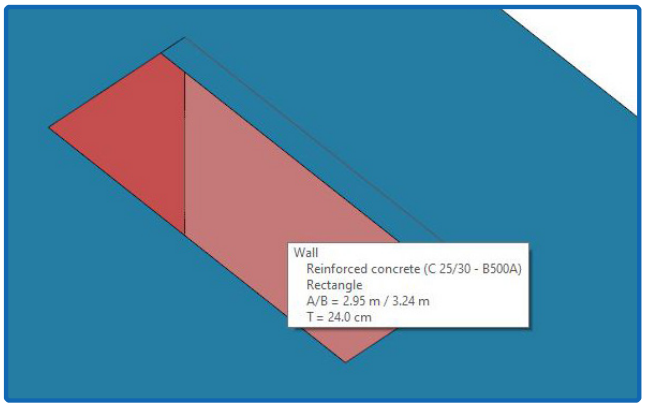


Fig. 9b: A hidden object can be brought into the foreground with the Ctrl key and the scroll wheel - note the tool tip.

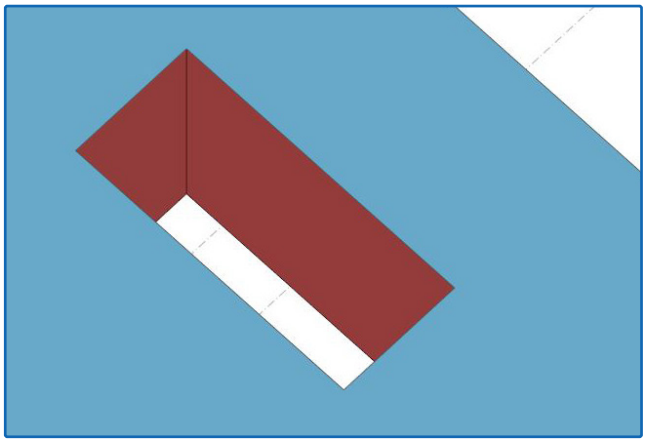


Fig. 9c: Manual joining adjusts the axes of the selected components.

Define the title block in the PLT

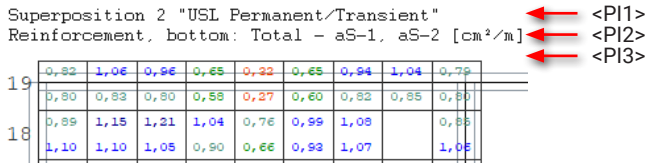
In the program Slabs by Finite Elements PLT, large-format plans can be attached to the end of the structural analysis document. Similar to the page header in the statics document, a „Title block“ can also be defined for the plans (Fig. 1).

Use one of the templates as a basis, which you can find in the FRILO Control Center under the menu item ▸ Extras ▸ Page layout ▸ Title block templates.
! Attention, please click directly on the small arrow pointing downwards in the symbol (the difference to clicking on the upper part of the symbol is explained in the operating principles) - see Fig. 2.

In the „Edit Template“ dialog you can then click on one of the installed templates and then on the „New“ button (Fig. 3). You will then see the structure of the template (Fig. 4). In this way, you can first have a look at the other templates and only then edit the template that is suitable for your adjustments.

Edit template

In the following example, the „Title block minimum“ is selected. Only the three (important) information texts are entered here, which can be seen by default above the graphics in the PLT and explain the meaning of the graphics shown.



Info texts for the graphic - inserted in the title block as placeholders <PI1>, <PI2>, <PI3> – in this case <PI3> is a blank line.

To adjust the font and size, color, alignment, border lines, etc., click on the individual text fields and change these text field properties. The individual options are described in the FDD manual under „Page layout“.

Dimensions of the title block

Under the “Common” tab you can specify the width and height in [mm] (in this example 120 x 74 mm). Here you also define the „Border lines“ for the title block and the margins for the entire plan page (Fig. 5). The macro and placeholder functions are described on the following page.

Insert logo

Now continue with the „Edit“ tab. To insert a logo, click on the “Image” icon and select your logo graphic. The inserted graphic can then be scaled appropriately using the handles and can be moved using the mouse or the arrow keys on the keyboard, for example be positioned on the right edge.

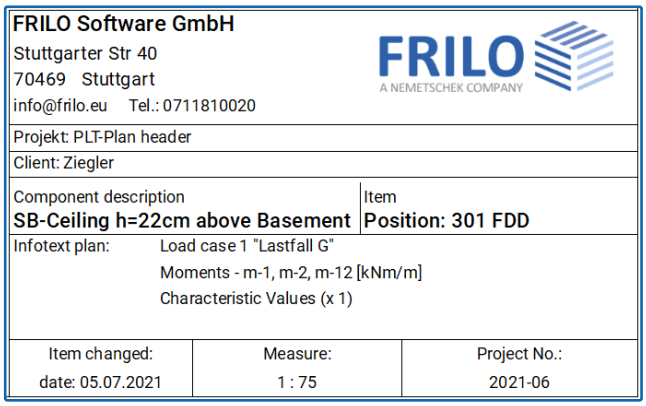


Fig. 1: Example of a self-defined title block.

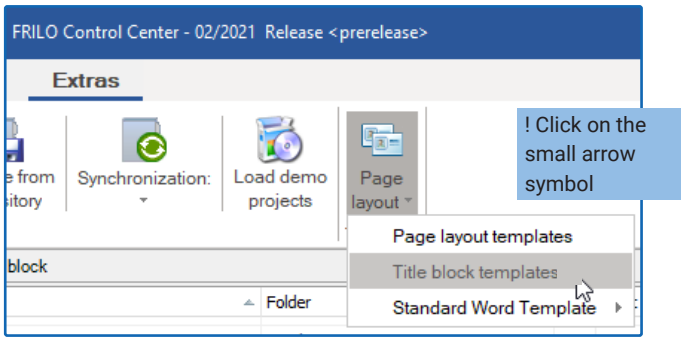


Fig. 2: Call up templates for title blocks.

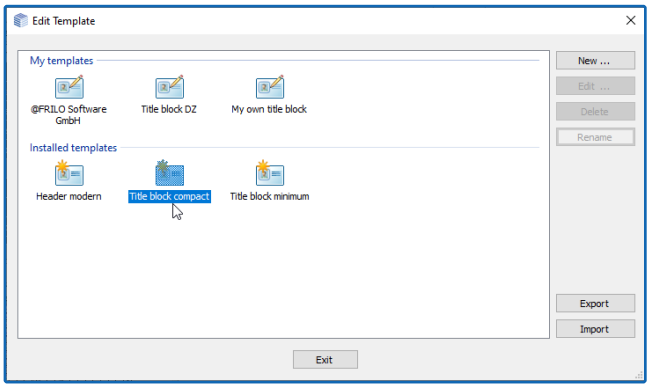


Fig. 3: Above the templates that have already been created, below the supplied, installed standard templates.

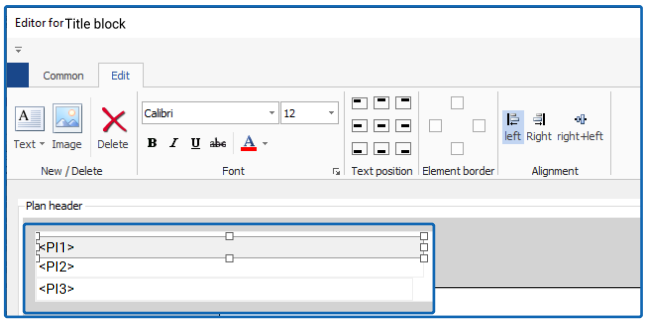


Fig. 4: The selected „Title block minimum“ in the editor.

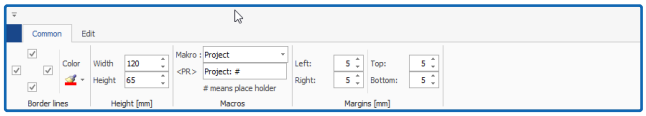


Fig. 5: Dimensions of the title block in the „Common“ tab.

Enter company name

Next, enter your company name. To do this, click on „Text“ and select „free text“ (Fig. 6).

Tip: If you mark an existing text field beforehand, the new text field will be created with the properties of the marked text field. That means the font and size, text position etc. will be adopted from the marked text field and you only have to adjust them slightly in the new text field.

The new text field appears. Position it (top left corner) and adjust the size using the handles. Choose a slightly larger font (14) and click on „B“ for bold text and choose a suitable color (dark blue). Double-click on the text field and change the content (FRILO Software, Fig. 7).

Repeat this for the next text fields such as street, zip code and city, telephone number, etc.

Tip: Before each new text field, click briefly on the existing text field <PI1>, for example, in order to adopt its properties (and to exit the editing mode of the text field just entered).

Finally, you can mark the last text field (Tel.), extend it to the full title block width using the middle handle on the right and assign it a lower element border line (Fig. 8) – structure your title block with border lines and ensure that the individual items are clearly displayed.

Insert placeholder

Click on „Text“ and here on „<PR> Project.“ A text field with the placeholder <PR> is inserted. If you assign this title block to your project, the associated project name will appear at this point.
Some of these placeholders are self-explanatory (page number, etc.). Placeholders e.g. for project number or client can be found under „Extended“ (Fig. 9). You can find the equivalent in the FRILO.Control. Center by right-clicking on the respective project under „Properties“ (Fig. 10).

Note: The entries „Item number“ and „Chapter“ only make sense with corresponding entries in the FRILO Document Designer.

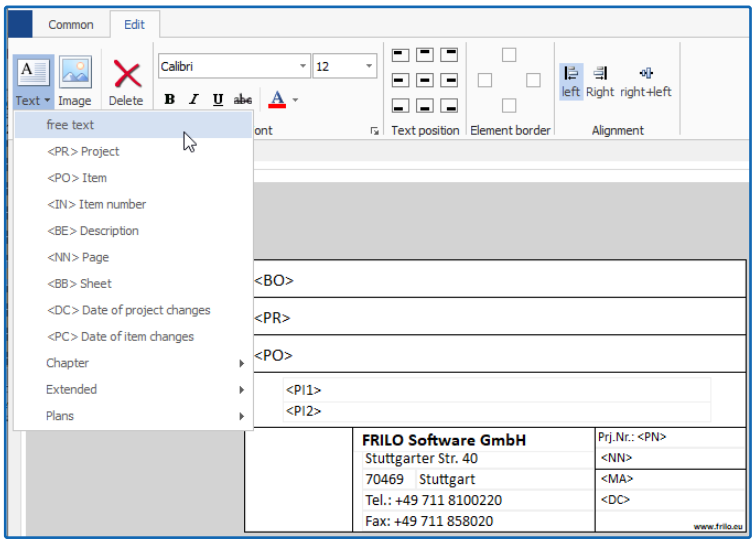


Fig. 6: Create a new text field with free text. The other entries are placeholders such as <PR> for the project name.

Fig. 7 The inserted and formatted company name.

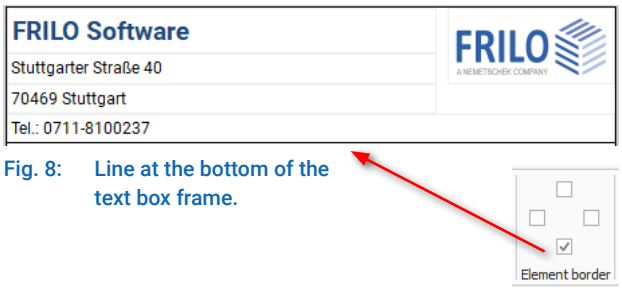


Fig. 8: Line at the bottom of the text box frame.

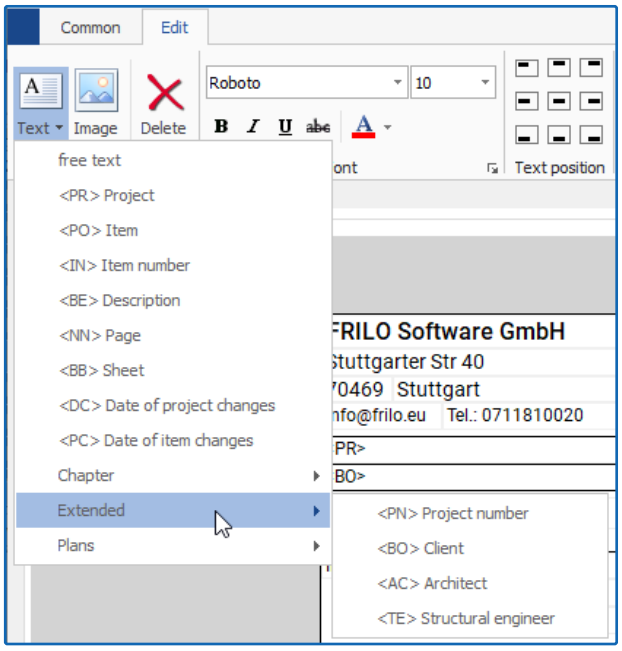
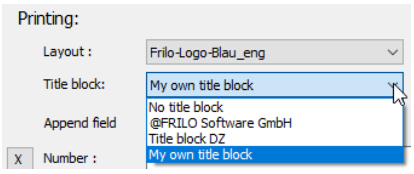


Fig. 9: Selection list of placeholders.

Project properties - extended placeholders

In the project properties dialog you will find the project name by default. In the area „Printing - Title block“ (Fig. 11) you can assign one of your existing/saved title blocks to the project.
The fields for the project number, designer, architect, client and description can be activated in the properties dialog via „Append field“.



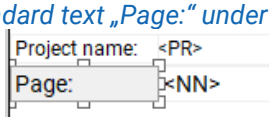
Save the new title block

Back to editing the title block. Insert all other text fields and placeholders as described and then click OK. Enter a name for this title block and save it.
The title block now appears in the „My templates“ section (Fig. 3). You can call it up again at any time for editing/changing.

Macros for the placeholders

You can create a prefix for the individual placeholders under the “Common” tab. For example, you can prefix the page placeholder <NN> with the text „Page:“. You can change or delete the standard header text here.

Tip: if you want to align the fields vertically flush with one another, you can alternatively insert a header text as a „free text field“ - then you should of course delete the standard text „Page:“ under „Macro“.



Plan view in the PLT

You can select the plan format (e.g. A3, portrait format, with/without title block) via the „Output“ tab (Fig. 12). The checkmarks for the plans to be output must be set in the output profile (right column „In Plan Format“).
Now call up the preview and click on the “Plans” tab. You can edit the title block for this project via the „Title block“ tab - the template itself is not affected by this (Fig. 13).

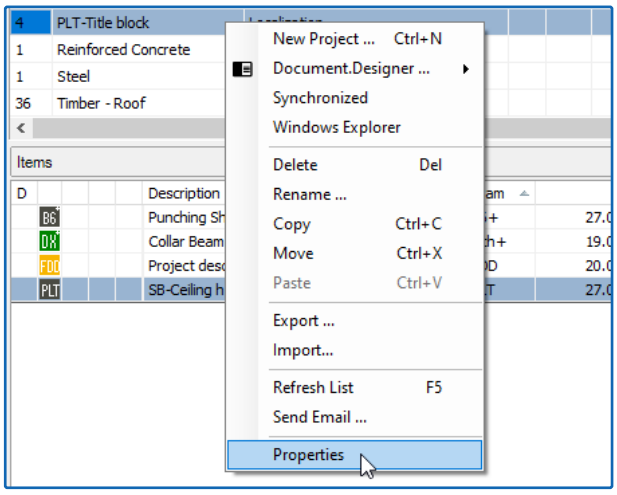


Fig. 10: Right click on the project in the FCC, call up the project properties.

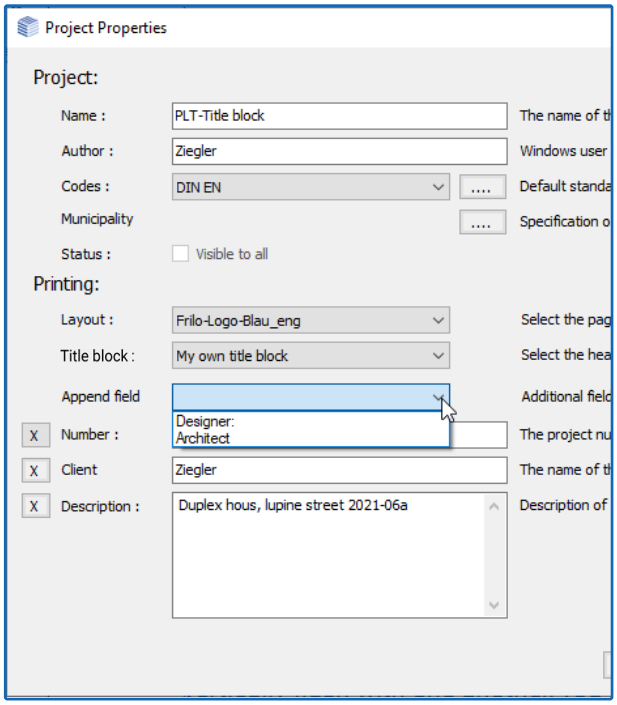


Fig. 11: In the project properties, you can assign an existing title block to the project and add extended property fields such as client, description, etc.

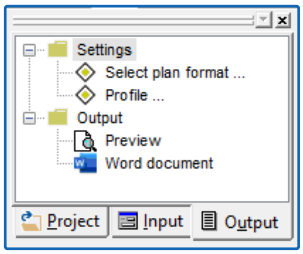
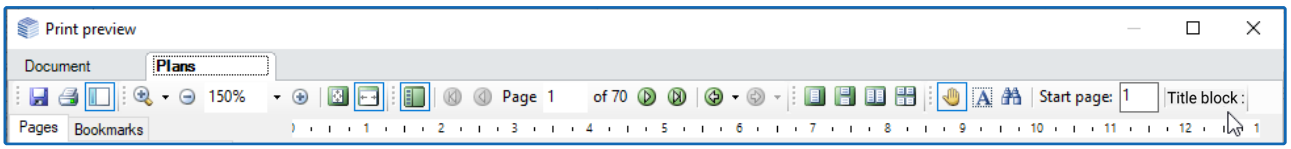


Fig. 12: The „Output“ tab in the PLT.

Fig. 13 below: Page preview with the „Plans“ tab and the „Title block“ button.



FRILO-Campus

ONLINE-TRAININGS

TRADE FAIRS AND EVENTS

TRAININGS
Due to the corona crisis, we currently do not offer any face-to-face training.

www.campus.frilo.eu

Imprint
FRILO Software GmbH
Stuttgarter Straße 40
70469 Stuttgart

Tel: +49 711 81002-0
Internet: www.frilo.eu
E-Mail: info@frilo.eu