



USER MANUAL

Technical changes and
errors reserved

Version: 06.10.2023*

R-DESIGN SUITE

WALL SHOE DESIGN
APPLICATION

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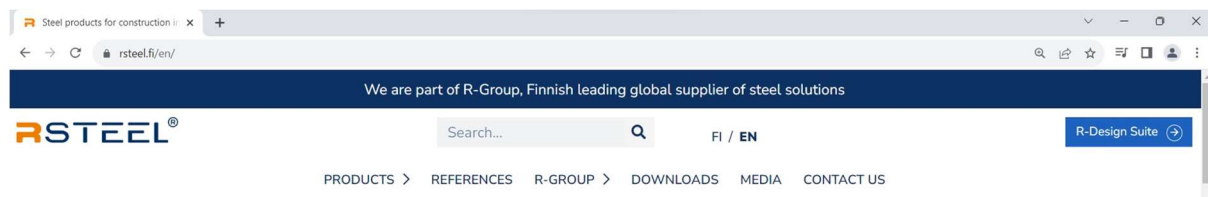
1. INTRODUCTION


The R-Design Suite, developed by RSteel Structure & Software Engineers, aims to assist clients in optimising their utilisation of RSteel products. Calculations are based on the rules of design codes, such as EN 1992, EN 1993, and ETA TR 029. The application includes comprehensive reports that facilitate users to better understand the calculation methods.

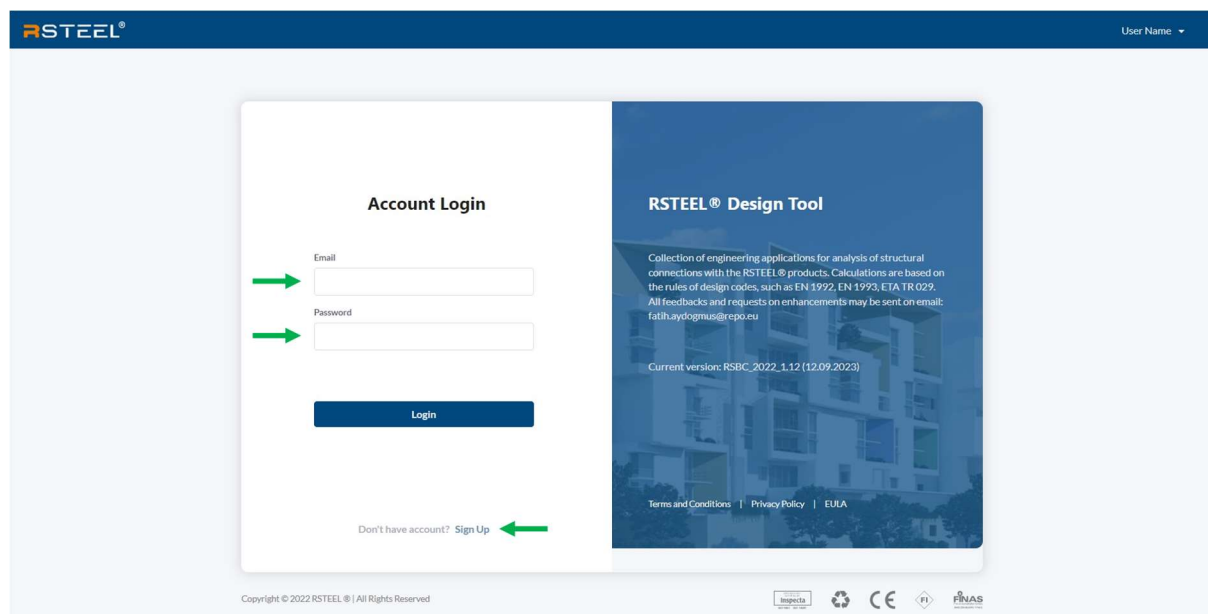
The use of the program and results require good expert knowledge in the field of the program (structure designer). R-Group Baltic OÜ and authors take no responsibility for direct or indirect costs incurred by faults in the program or its applications.

1.1. Application registry

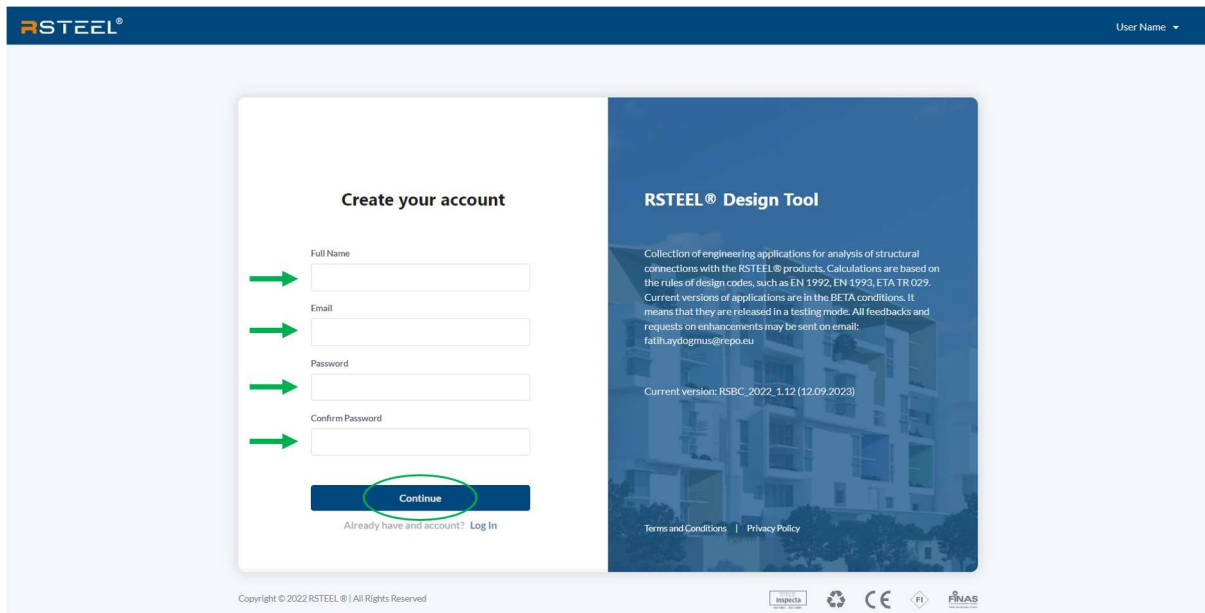
The link for the “R-Design Suite” application can be found at the top right corner of the <https://rsteel.fi/en/> webpage.



Once the  button is clicked, you will be directed to the login page.



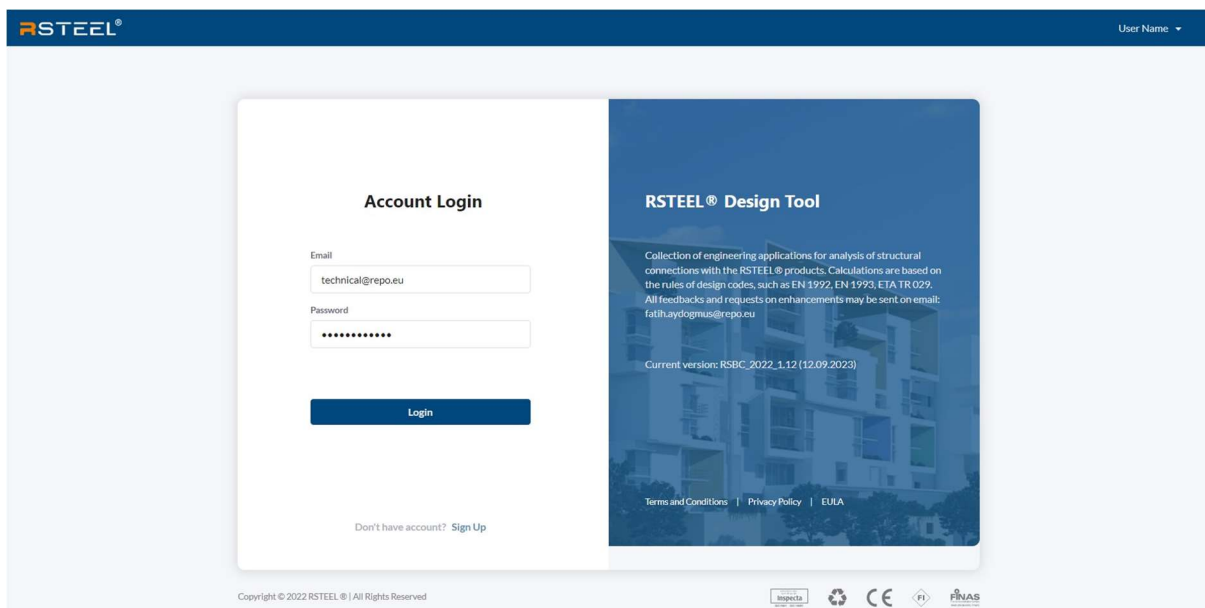
If you already have an account, simply log in using your email address and password. Otherwise, you can register and create your account by clicking the “Sign Up” link located at the bottom right.



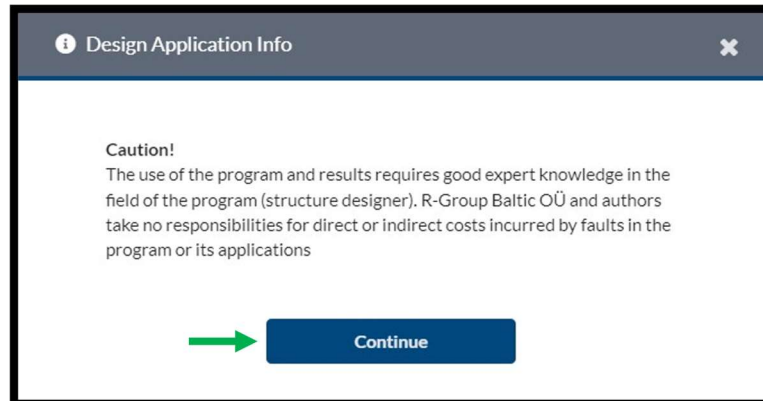
If you misplace your password and encounter difficulties logging into your account, please be aware that we do not currently have a "forgot password" feature. To initiate the password recovery process, we kindly request you to send an email to us at technical@repo.eu using your registered email address. We will send you instructions on how to retrieve your password.

1.2. Login

Once you have been directed to the Account Login page, you can proceed to log in to your account.

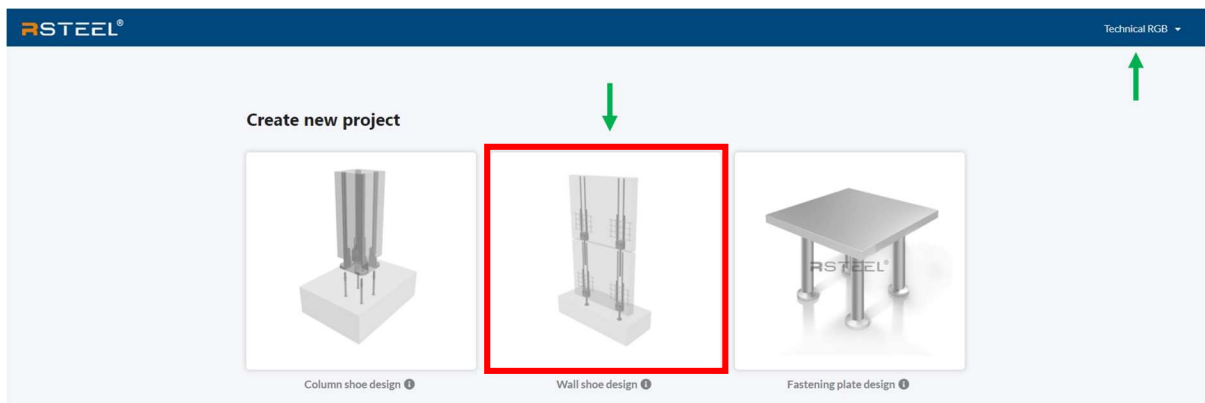


After successfully logging into your account, a caution message will appear. Please press the "Continue" button to access the "Create New Project" page.



1.3. Create new project page

The "Create New Project" page comprises three calculation applications: column shoe design, wall shoe design, and fastening plate design applications. Your username will be displayed at the upper right corner of the screen.



To access the "Wall Shoe Design Application", simply click on the designated image.

Afterward, the "Project Details" window will pop up. While you can choose to skip it by clicking the "Cancel" button, it is recommended to input the project information because it will be included in your report.

In the "Project Details" window, users will also have the option to select the National Annexes based on their location. This choice will have an impact on the safety factor values displayed on the "FACTORS" page. A more detailed explanation regarding the safety factor values will be provided in section 5.

The screenshot shows a 'Project Details' form with the following fields and values:

- Project Name: Example 2023
- Project ID: 007
- Design Code: Eurocode
- National Annex: BDS:2011 (Bulgaria) (highlighted with a red box)
- Project Location: Helsinki
- Name: Technical
- Surname: RGB
- Organization: RSTEEL
- Address: (empty)
- Phone: +372 57 83 9676
- Email: technical@repo.eu
- Project Notes: This example is prepared for the user manual.

Buttons for 'Cancel' and 'Save' are located at the bottom right of the form.

The National Annexes can be selected from the dropdown menu. If users choose "Without Annex", the R-Design Suite application will use default values from Eurocode.

National Annex

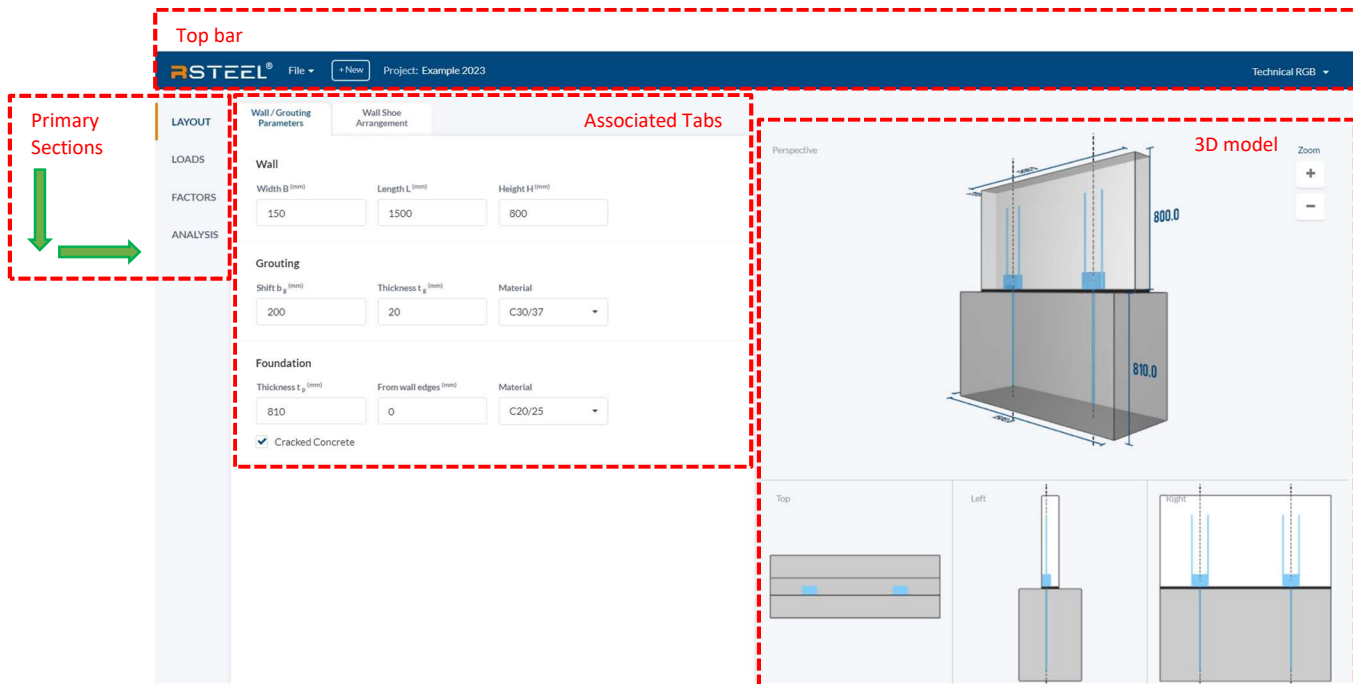
The dropdown menu for National Annex is shown with the following options:

- Without Annex (selected)
- Without Annex
- BDS:2011 (Bulgaria)
- BS:2005 (United Kingdom)
- CSN:2016 (Czech Republic)
- DIN:2015 (Germany)
- DK:2013 (Denmark)

After the project information has been entered, and the National Annexes have been selected, the "Save" button can be clicked, and you will be directed to the main application page.

2. MAIN APPLICATION PAGE

The main application page is comprised of four primary sections, each with associated tabs for navigation. Users should input their desired values on these pages by following a top-to-bottom order, and within each page, they should proceed from left to right through the tabs.



Main structure of the primary sections and associated tabs are given below:

LAYOUT

- Wall/GROUTING Parameters
- Wall Shoe Arrangement

LOADS

- Loads After GROUTING

FACTORS

- Wall and Anchors

ANALYSIS

- General Report
- Design Input Information
- Detail Report

For a detailed explanation of the primary sections and their corresponding tab functions, please refer to the next section.

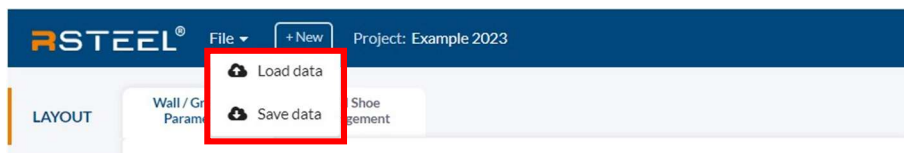
Top bar:


Top bar consists of **File**, **New File**, **Project Name**, **Username** and **Log out**



When the "File" dropdown menu is clicked, the "Load Data" and "Save Data" options will appear. To save the entered inputs in this application, select the "Save Data" option, and a JSON extension file will be downloaded to the computer's download folder. To reload data, choose the "Load Data" option and locate the JSON extension file on the computer.

R-Design Suite does not store any data on the server. This solution has been created to address file sharing challenges, and the saving option will be addressed in the future.



The  button can be found on the left side of the project name. Clicking this button will initiate the creation of a new, blank wall shoe design application, leading you to the "Project Details" page.



Prior to creating a new file, please ensure that you have downloaded your file or printed your report. Additionally, it is strongly advised to review the PDF report pages to confirm that there are no printing issues.

The project name will be displayed here if you have previously entered the information on the "Project Details" page.



If the "Save Data" option is used, you will see that the downloaded JSON file is named after the project and includes the date for better file organization. The JSON file can be viewed using the default Windows Notepad application.



After you have completed your tasks within the "R-Design Suite" application, you can log out by locating the log out button situated on the right side of the top bar. It is important to note that you will need to click the arrow next to your username to access the log out button.



3D model and views:

Users can manipulate the 3D model as follows:

- **Zoom In and Out:** Use the mouse wheel to zoom in and out on the 3D model.
- **Rotate:** Left-clicking the mouse enables users to rotate the model.
- **Pan:** Right-clicking the mouse activates the pan option.

Additionally, on the view windows, you will find the following options:

- **Zoom option:** This option allows you to zoom in or out on the model.

3. LAYOUT

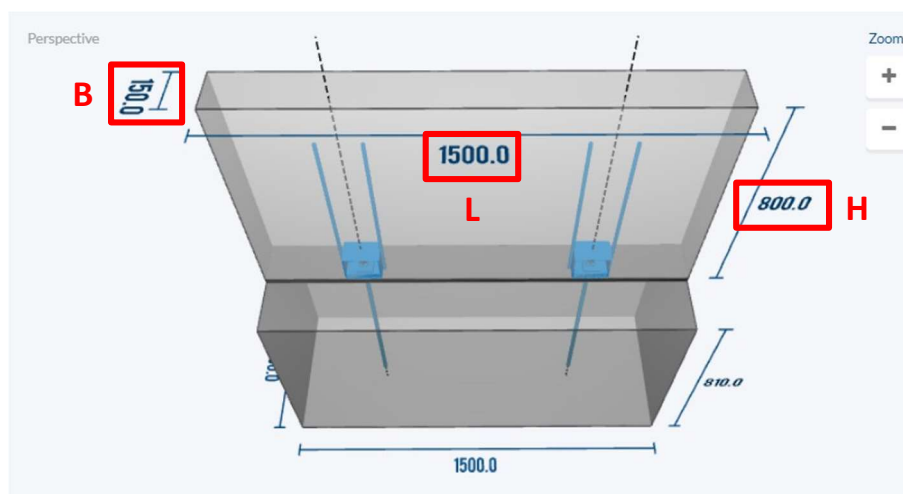
All crucial information, such as the wall/grouting parameters and wall shoe arrangement, can be configured on the "LAYOUT" page and its associated tabs.

3.1. Wall/Grouting Parameters

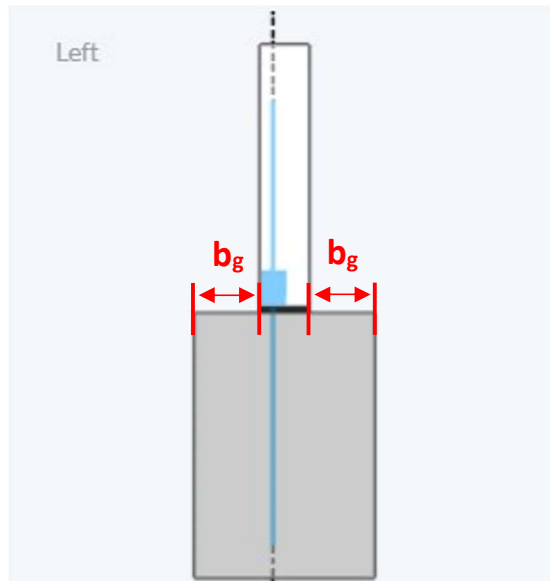
In this tab, users can define the dimensions and materials for the wall, grouting and foundation.

Wall / Grouting Parameters	Wall Shoe Arrangement						
<p>Wall 1</p> <table border="1"> <tr> <td>Width B (mm)</td> <td>Length L (mm)</td> <td>Height H (mm)</td> </tr> <tr> <td>150</td> <td>1500</td> <td>800</td> </tr> </table>		Width B (mm)	Length L (mm)	Height H (mm)	150	1500	800
Width B (mm)	Length L (mm)	Height H (mm)					
150	1500	800					
<p>Grouting 2 3 4</p> <table border="1"> <tr> <td>Shift b_g (mm)</td> <td>Thickness t_g (mm)</td> <td>Material</td> </tr> <tr> <td>200</td> <td>20</td> <td>C30/37</td> </tr> </table>		Shift b_g (mm)	Thickness t_g (mm)	Material	200	20	C30/37
Shift b_g (mm)	Thickness t_g (mm)	Material					
200	20	C30/37					
<p>Foundation 5 6 7</p> <table border="1"> <tr> <td>Thickness t_p (mm)</td> <td>From wall edges (mm)</td> <td>Material</td> </tr> <tr> <td>810</td> <td>0</td> <td>C20/25</td> </tr> </table> <p><input checked="" type="checkbox"/> Cracked Concrete 8</p>		Thickness t_p (mm)	From wall edges (mm)	Material	810	0	C20/25
Thickness t_p (mm)	From wall edges (mm)	Material					
810	0	C20/25					

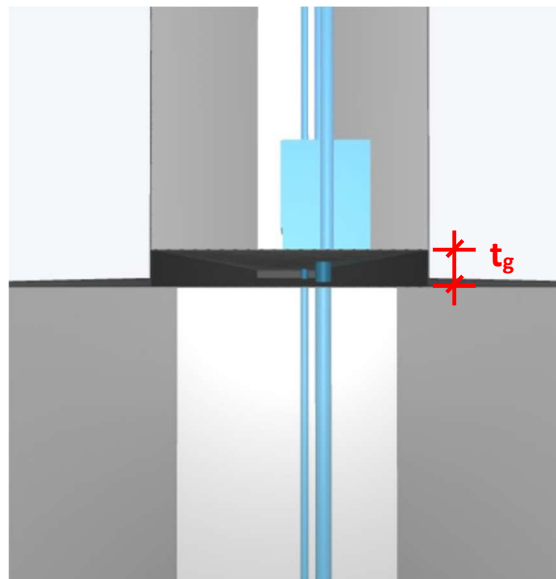
1 The wall dimensions can be customised by users as needed. Any adjustments made will be automatically reflected in the 3D model on the right-hand side. Below, you will find an explanation of these dimensions.



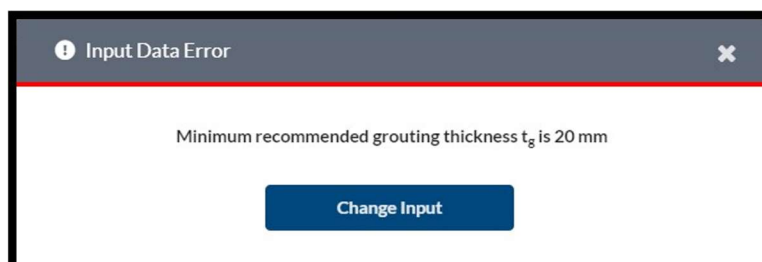
2 This dimension is relevant to the grouting and foundation. The "Shift b_g " is measured from the edge of the precast wall for both the front and back sides.



3 The recommended thickness of grouting " t_g " is 20mm.

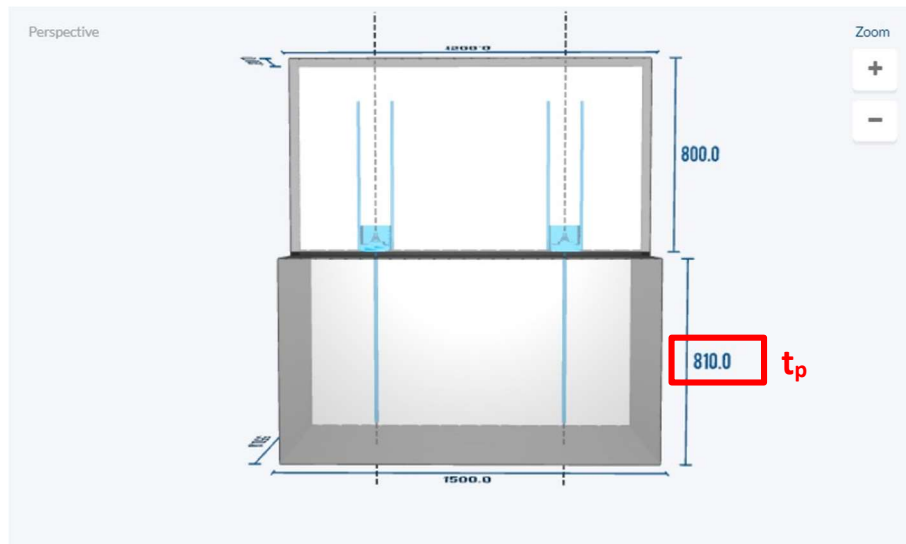


If users input a thickness other than 20mm, a pop-up window labeled "Input Data Error" will appear to prompt users to revise their input.

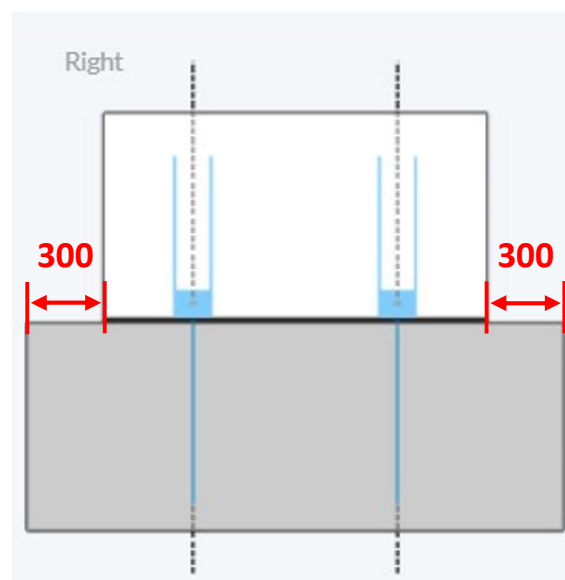


4 Users can select the material strength of the grouting by clicking the dropdown menu for the material. The material strength options range from C30/37 up to C90/105.

5 The foundation thickness “ t_p ” can be modified by the users as required. Any adjustments made will be automatically reflected in the 3D model on the right-hand side.



6 This dimension is associated with the foundation and is measured from the edge of the precast wall on both the right and left sides. Here is an example where a 300mm from the wall edges is required.



7 Users can choose the material strength for the foundation by selecting from the dropdown menu for the material. The available material strength options range from C20/25 up to C50/60.

8 By default, cracked concrete is selected. If the calculation for non-cracked concrete is required, the checkbox can be unchecked by users.

3.2. Wall Shoe Arrangement

On the "Wall Shoe Arrangement" tab, which is the second tab on the "LAYOUT" page, you have the option to configure the positioning of the wall shoe, select the type of shoe and anchor, and specify the anchor diameter.

Wall / Grouting Parameters
Wall Shoe Arrangement

Arrangement

	1	2	3
	Space (mm)	Side	Edge shift (mm)
1	350.0	Front	0.0
2	800.0	Front	0.0
3			
4			
5			
6			

Type

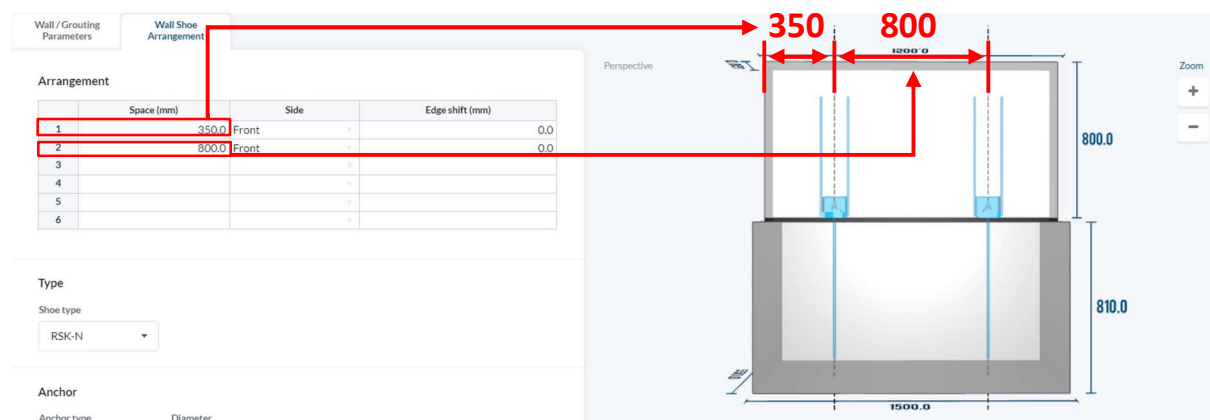
Shoe type
 RSK-N

Anchor

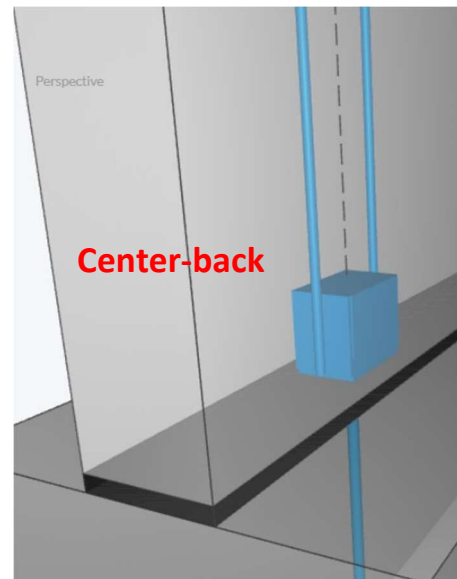
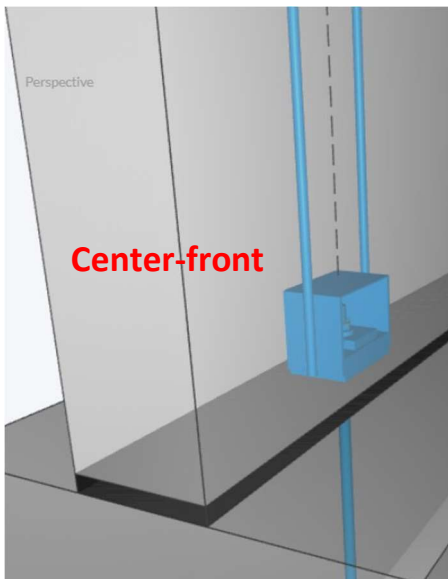
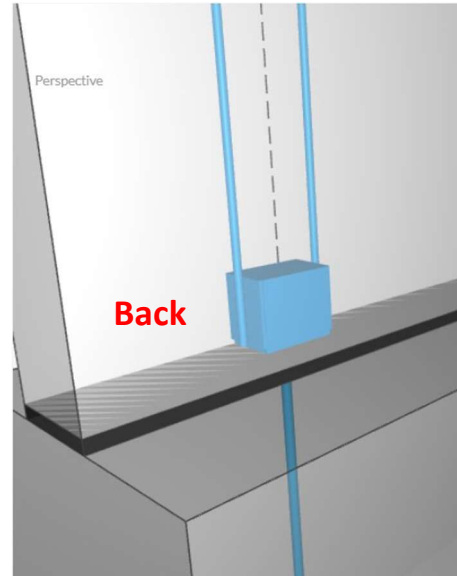
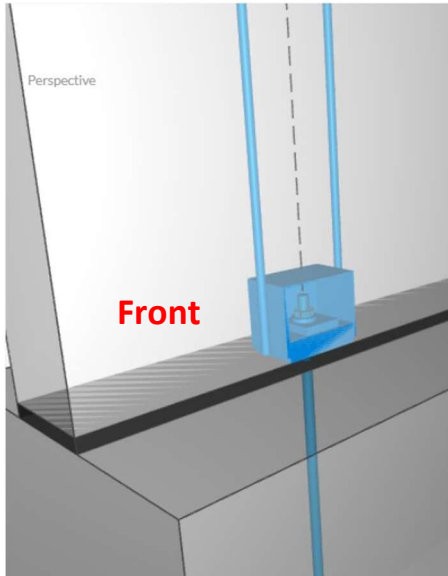
Anchor type
 RPP-P

Diameter
 M16

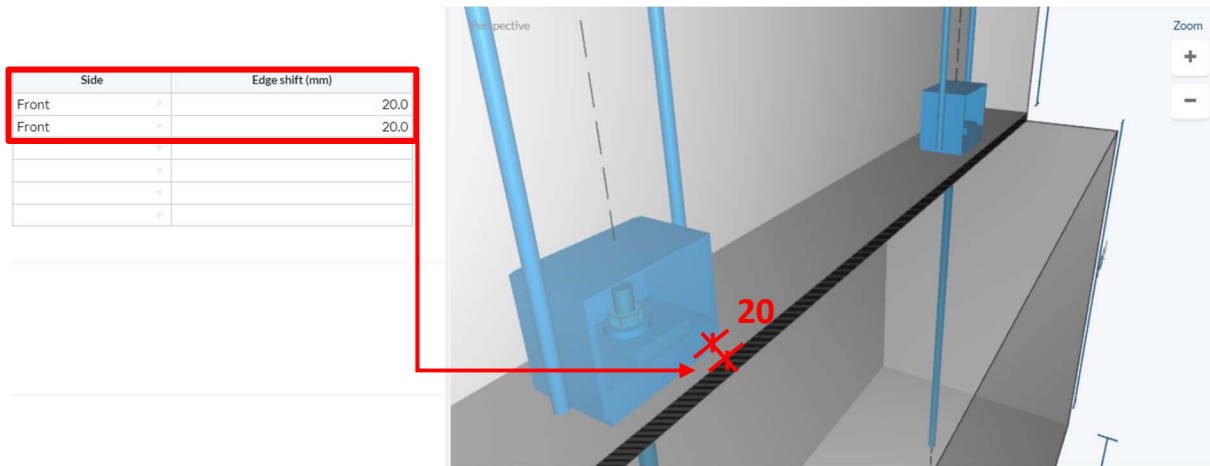
1 The number of wall shoes and the distance between them can be adjusted by users. The distance for the first shoe is measured from the left edge of the precast wall, and for subsequent shoes, it is measured from the previous shoe. A more comprehensive explanation of the wall shoe arrangement will be provided in the example calculations later on.



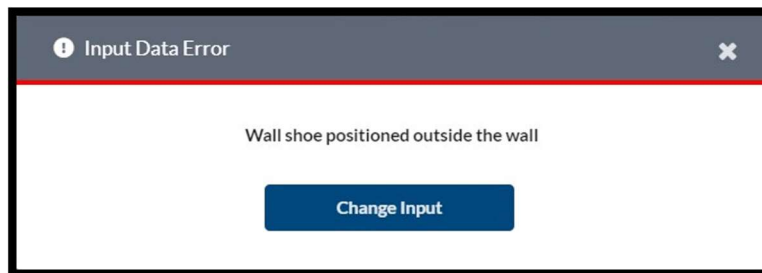
2 After positioning the wall shoes, users can designate the face side of the shoes by selecting one of the options available from the dropdown menu. There are four available face side choices: front, back, center-front, and center-back. The front and back sides are positioned at the edges of the precast wall, whereas the center-front and center-back are located in the middle of the precast wall.



3 The positioning of the wall shoes can be adjusted by users to meet specific requirements other than center-front or center-back. When users choose either front or back, the edge shift can be defined according to their preferences. Here is an example of front side wall shoes with a 20mm edge shift.



If users enter a value that places the wall shoe outside the precast wall, a pop-up window labeled "Input Data Error" will appear to prompt users to revise their input.

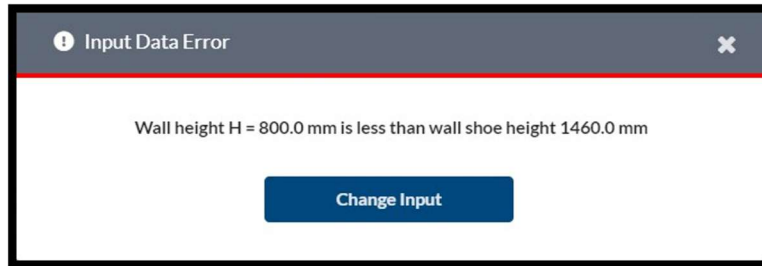


4 The wall shoe type can be chosen from the dropdown menu options, including RSK-N and RSK-E types. Based on this selection, the application will automatically choose the corresponding anchor type: RPP base bolt for RSK-N wall shoe and RPP-E base bolt for RSK-E wall shoe.



If users select the RSK-E wall shoe and their input does not meet the minimum concrete requirements, a pop-up error message will appear, asking users to check and adjust the foundation plate thickness and precast wall height.





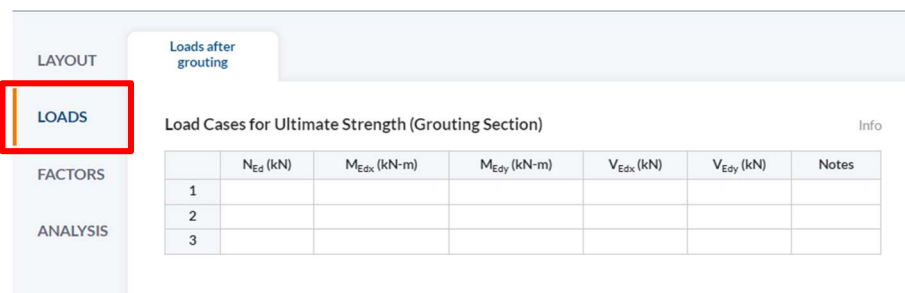
5 The anchor type options will be automatically available based on the user's selection of the wall shoe type: RPP Base bolt for RSK-N wall shoe and RPP-E base bolt for RSK-E wall shoe. Each option will include two types of bolts: P type for the long bolt and L type for the short bolt.

6 The available options for bolt diameters will be determined by the anchor type selected. For the RPP type, the diameter options range from M16 to M39, while for the RPP-E type, the available diameters are from M30 to M52.

4. LOADS

In the "LOADS" page, there is only one tab available. Within this tab, all load cases for ultimate strength (grouting section) will be specified. These loads include axial (N_{Ed}), moments in the x (M_{Edx}) and y (M_{Edy}) directions and shears in x (V_{Edx}) and y (V_{Edy}). Users have the option to display the load directions as either positive or negative. After entering the loads, the 3D model on the right-hand side will automatically adjust to visually represent the applied loads.

Additionally, there is a "Notes" section where users can input load-related information.



5. FACTORS

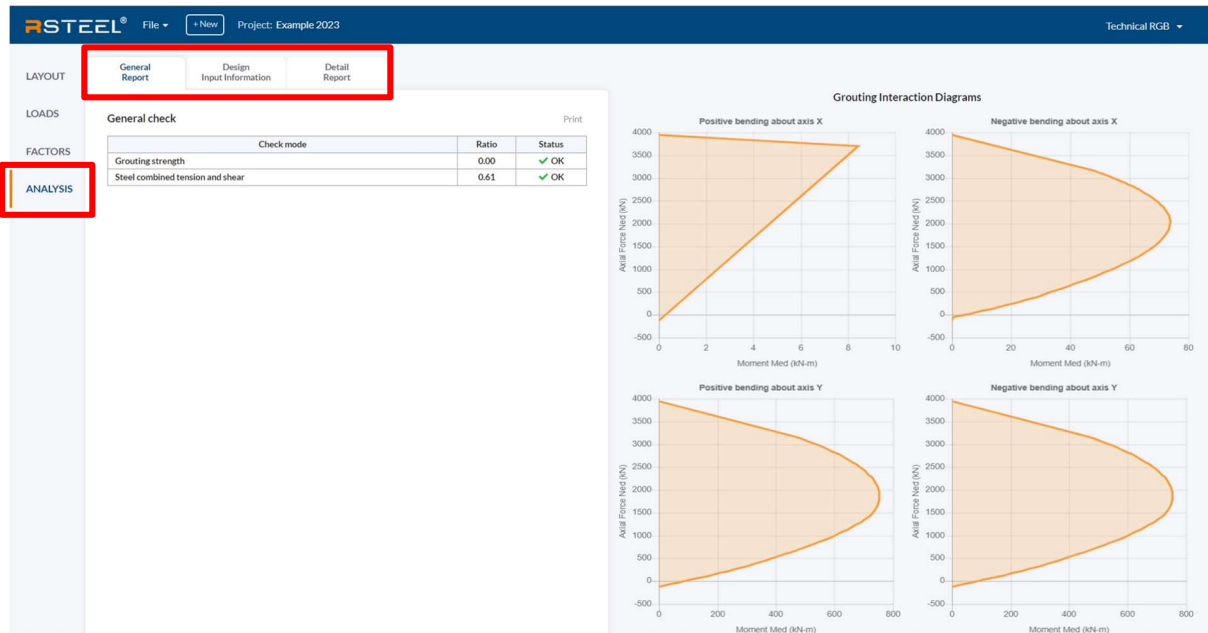
Similar to the "LOADS" page, the "FACTORS" page also contains only one tab for users to access. The values on this page are related to the National Annexes selected in the "Project Details" window when users created a new project in section 1.3. Users can choose the National Annexes based on their location, or they can allow the application to use default values from Eurocode by selecting "Without Annex". Alternatively, users have the option to manually adjust the values according to their specific requirements.

The screenshot shows the 'FACTORS' page for 'Wall and Anchors'. The left sidebar has a red box around the 'FACTORS' tab. The main content area is divided into two sections: 'Wall Strength' and 'Anchor Strength'. Each section contains several input fields with numerical values.

Section	Parameter	Value
Wall Strength	Safety Factor for Concrete (γ_c)	1.5
	Safety Factor for Steel (γ_s)	1.15
	Long-Term and Unfavorable Effects (α_{cc})	0.85
Anchor Strength	Safety Factor for anchor (γ_{M2})	1.25
	Safety Factor for anchor (γ_s)	1.25
	Shear Force Factor (α_b)	1.0
	Shear Force Factor (k_1)	1.0
	Anchor Reduction factor (η_d)	1.0
	Grout-Foundation Friction Coefficient (μ)	0.2

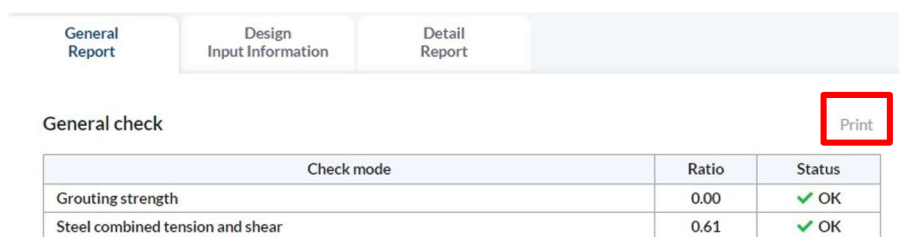
6. ANALYSIS

The application does not include a "run" button. Instead, calculations are performed when the "ANALYSIS" page is selected. After the calculation is done, the reports are generated in three tabs: General Report, Design Input Information and Detail Report.



6.1. General Report

In this tab, a general check summary can be viewed, including ratios, with values required to be less than 1.00. Users have the option to either print them directly to a printer or save them as PDF files by clicking the "Print" button. An example of the general report will be provided in the appendix.



6.2. Design Input Information

In this tab, users can view all the information that has been entered, including project details, input data, grouting anchors, and loads after grouting. Users have the option to either print them directly to a printer or save them as PDF files by clicking the “Print” button. An example of the design input information report will be provided in the appendix.

General Report
Design Input Information
Detail Report

Print

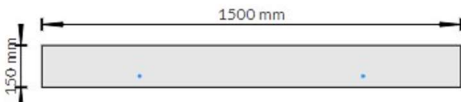
Project Information

Engineer Name: Technical RGB
 Organization: RSTEEL
 Address:
 Phone: +372 57 83 9676
 Email: technical@repo.eu
 Project Name: Example 2023
 Project ID: 007
 Project Location: Helsinki
 Project Notes: This example is prepared for the user manual.

Input Data

Wall Length L:	1500 mm	Grouting Length:	1500 mm
Wall Width B:	150 mm	Grouting Width:	150 mm
Foundation Length:	1500 mm	Grouting Thickness:	20 mm
Foundation Width:	550 mm	Grouting Material:	C30
Foundation Thickness:	810 mm	Shoe Type:	RSK-N
Foundation Material:	C20	Anchor Type:	RPP-P-M16

Grouting anchors



Anchor ID	X, mm	Y, mm	Size, mm
1	-400.00	-35.00	M16
2	400.00	-35.00	M16

Loads after grouting - Anchors section

Load Case	N _{Ed} , kN	M _{Edx} , kN-m	M _{Edy} , kN-m	V _{Edx} , kN	V _{Edy} , kN	Notes
1	10	0	0	10	10	

6.3. Detail Report

In this tab, users can access a detailed analysis of the wall shoe design. Users can choose to either print these details directly to a printer or save them as PDF files by clicking the "Print" button. An example of the detail report will be included in the appendix.



Wall Shoe Resistance (RSK-N/M16)

Print

Stress area in thread of anchor bolt $A_{bolt} = 157.00 \text{ mm}^2$
 Thickness of the shoe base plate $t_{base} = 15.00 \text{ mm}$
 Diameter of nominal stress area in thread of anchor bolt $d_n = 14.14 \text{ mm}$
 Nominal diameter of anchor bolt $d_0 = 16.00 \text{ mm}$
 Yield strength of the steel in the anchor bolt $f_{bolt,y} = 500.00 \text{ MPa}$
 Ultimate strength of the steel in the anchor bolt $f_{bolt,u} = 550.00 \text{ MPa}$
 Ultimate strength of the foundation $f_{base,u} = 510.00 \text{ MPa}$
 Grouting concrete characteristic strength $f_{grout,ck} = 30.00 \text{ MPa}$
 Grouting concrete design strength $f_{grout,cd} = \alpha_{cc} \cdot f_{grout,ck} / \gamma_c = 0.85 \cdot 30.00 / 1.50 = 17.00 \text{ MPa}$
 Resistance of a column shoe in tension and compression:

$$N_{Rd} = \eta_d \cdot \min \left\{ \frac{f_{bolt,u} \cdot 0.9}{\gamma_{M2}}; \frac{f_{bolt,y}}{1.15} \right\} \cdot A_{bolt} = 1.00 \cdot \min \left\{ \frac{550 \cdot 0.9}{1.25}; \frac{500}{1.15} \right\} \cdot 157 \cdot 10^{-3} = 62.17 \text{ kN}$$

Shear resistance of a column shoe (EN 1993-1-8, 6.2.2):

$$\alpha_b = 0.44 - 0.0003 \cdot f_{bolt,y} = 0.44 - 0.0003 \cdot 500.00 = 0.290$$

$$F_{1,vb,Rd} = \frac{k_1 \cdot a_b \cdot f_{base,u} \cdot d_b \cdot t_{base}}{\gamma_{M2}} = \frac{1 \cdot 1 \cdot 510 \cdot 14.14 \cdot 15}{1.25} \cdot 10^{-3} = 86.53 \text{ kN}$$

$$F_{2,vb,Rd} = \frac{\alpha_b \cdot f_{bolt,u} \cdot A_{bolt}}{\gamma_{M2}} = \frac{0.290 \cdot 550 \cdot 157}{1.25} \cdot 10^{-3} = 20.03 \text{ kN}$$

$$F_{3,vb,Rd} = \frac{0.5 \cdot f_{bolt,u} \cdot A_{bolt}}{\gamma_{M2}} = \frac{0.5 \cdot 550 \cdot 157}{1.25} \cdot 10^{-3} = 34.54 \text{ kN}$$

$$V_{Rd} = \min \{ F_{1,vb,Rd}; F_{2,vb,Rd}; F_{3,vb,Rd} \} = 20.03 \text{ kN}$$

Anchors (Stage II)

Characteristic strength of concrete f_{ck} : 30.00 MPa
 Design strength of concrete f_{cd} : 17.00 MPa
 Characteristic strength of rebar f_{yk} : 500.00 MPa
 Design strength of rebar f_{yd} : 396.00 MPa
 Load Case 1. Axial compression check

7. EXAMPLES

7.1. Example 1

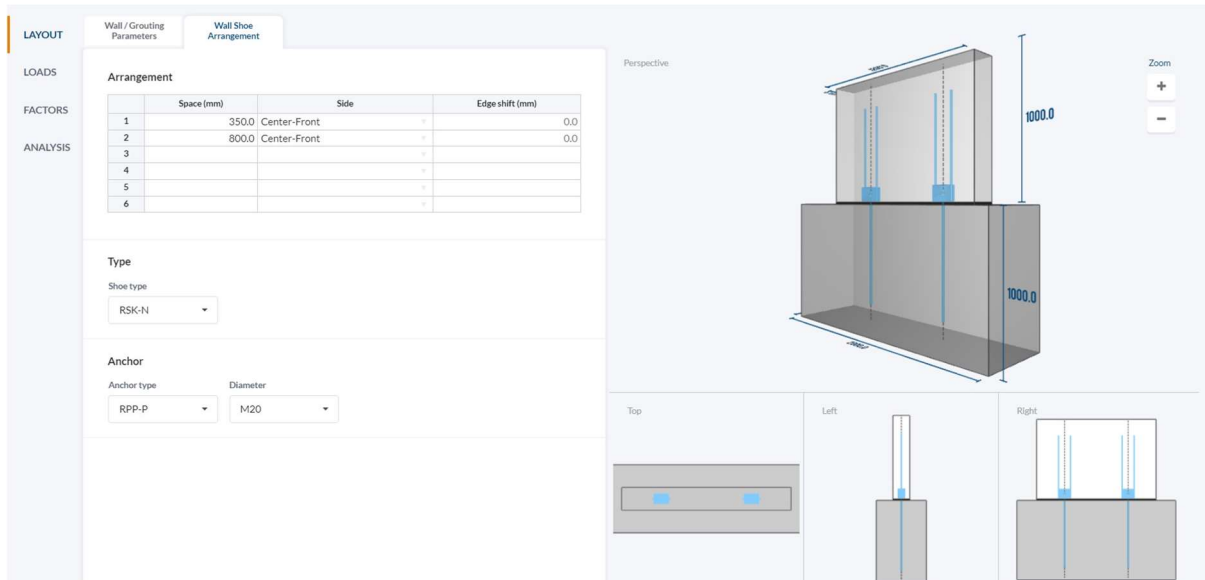
In this example, the design calculation for two wall shoe connections in a precast wall will be performed. When filling in the project information in the "Project Details" window, the default factor values from Eurocode will be selected by choosing "Without Annex," as shown below.

On the "Wall/Grouting Parameters" tab, a precast wall with dimensions of 200x1500x1000 has been selected. The grouting parameters include a 200mm shift b_g , a 20mm thickness t_g , and a material grade of C30/37. For the foundation, the thickness is set to 1000mm, with 250mm from the wall edges, and a material grade of C30/37 is chosen. The concrete condition is set to cracked concrete.

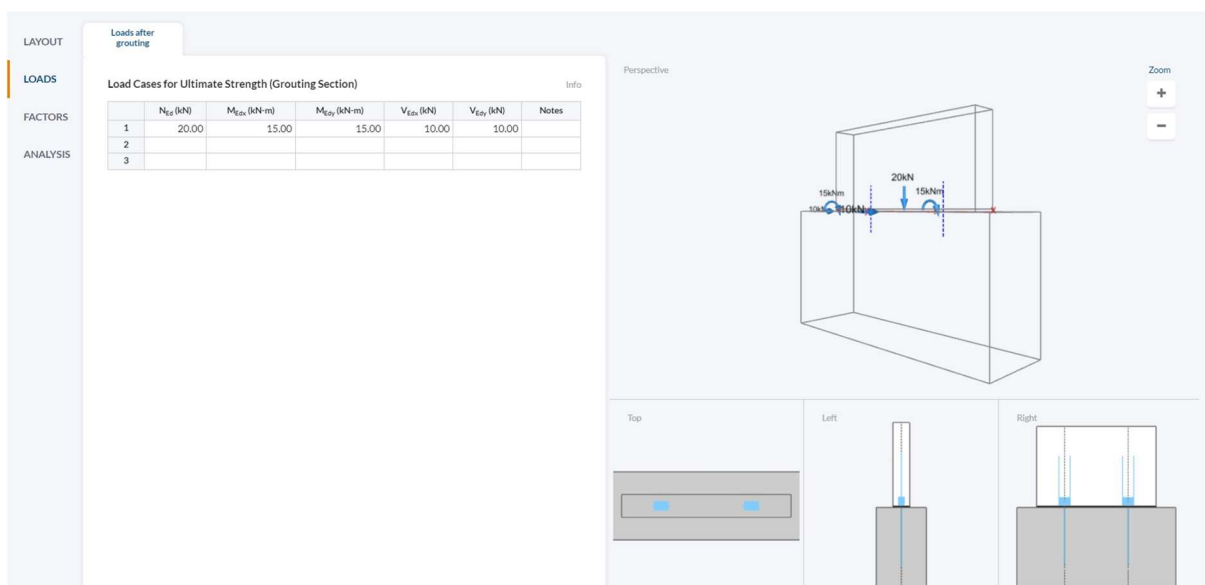
For the wall shoe arrangement, a 350mm edge distance will be chosen. It is advisable to position the wall shoes symmetrically. Therefore, the spacing between the wall shoes will be as follows:

$$Spacing = Wall\ Length\ L - (2 \cdot Edge\ Distance) = 1500 - (2 \cdot 350) = 800mm$$

The wall shoe RSK-N type will be selected along with the matching RPP-P anchor type, specifically with a diameter of M20. In this example, the center-front face side will be used with no edge shift.



Moving on to the "LOADS" page, the following load values have been selected: an axial load of 20.00 kN, a moment value in the x-direction of 15.00 kN, a moment value in the y-direction of 15.00 kN, a shear value in the x-direction of 10.00 kN, and a shear value in the y-direction of 10.00 kN.



Since the "Without Annex" option has already been selected in the "Project Details" window, no changes will be made to the factor values in this "FACTORS" page.

Wall and Anchors

Wall Strength

Safety Factor for Concrete (γ_c)

Safety Factor for Steel (γ_s)

Long-Term and Unfavorable Effects (α_{cc})

Anchor Strength

Safety Factor for anchor (γ_{M2})

Safety Factor for anchor (γ_s)

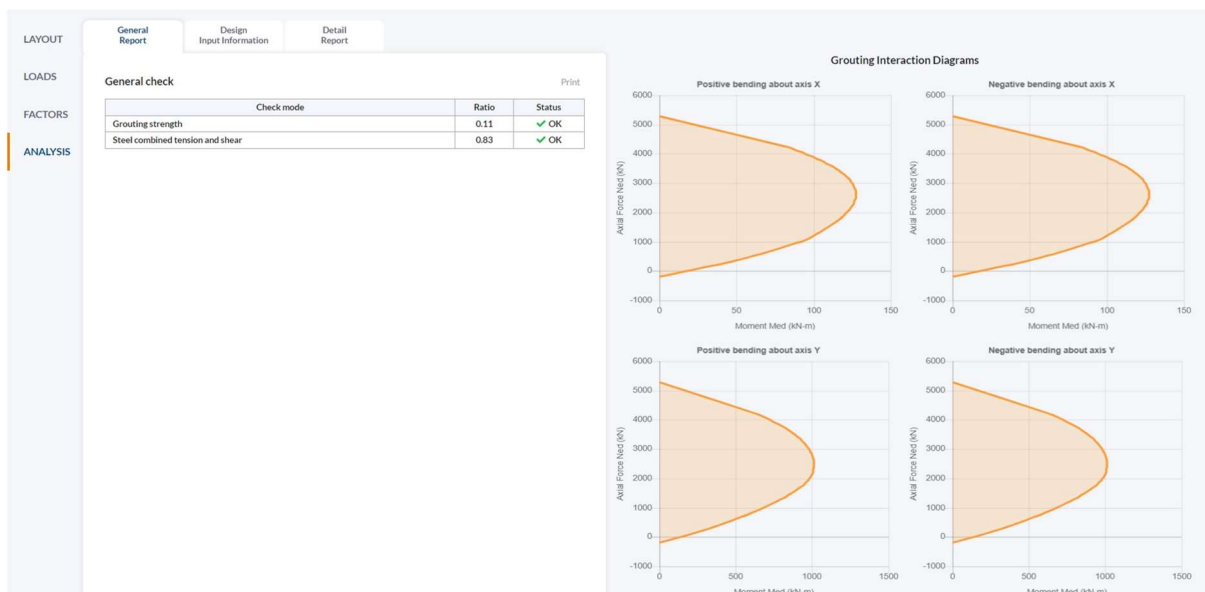
Shear Force Factor (α_b)

Shear Force Factor (k_1)

Anchor Reduction factor (η_d)

Grout-Foundation Friction Coefficient (μ)

The final step is to click on the "ANALYSIS" page to generate all the reports. In this page, three tabs will be available: General Report, Design Input Information, and Detail Report. The calculation summary can be reviewed in the general report, where the ratios should be less than 1.00. All the reports will be provided in the appendix for convenient reference.



7.2. Example 2

In this example, the design calculation for three wall shoes in a precast wall will be performed. All the parameters and loads from the first example will be used to assess if the size of the wall shoe can be reduced by using more wall shoes in the arrangement.

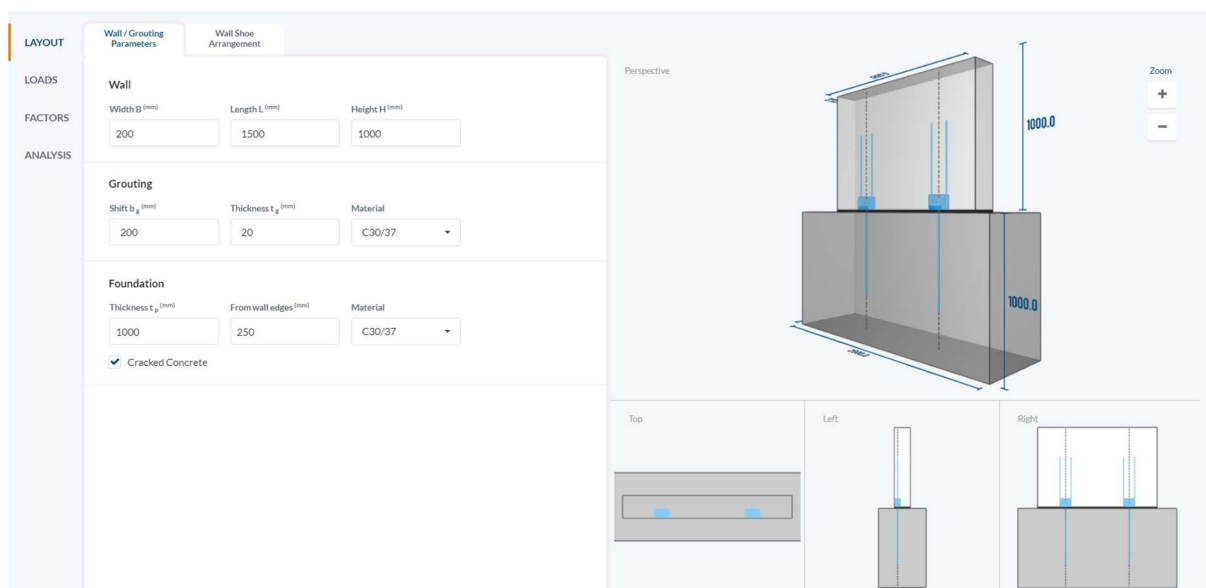
The default factor values, labeled as "Without Annex," will be chosen in the "Project Details" window.

The 'Project Details' window includes the following fields:

- Project Name: Example 2 - 2023
- Project ID: 007
- Design Code: Eurocode (dropdown)
- National Annex: Without Annex (dropdown, highlighted with a red box)
- Project Location: Helsinki
- Name: Technical
- Surname: RGB
- Organization: RSTEEL
- Address: Kõrtsi tee 7/1, Lehmja, Estonia
- Phone: +372 57 83 9676
- Email: technical@repo.eu
- Project Notes: This example is prepared for the user manual.

Buttons: Cancel, Save

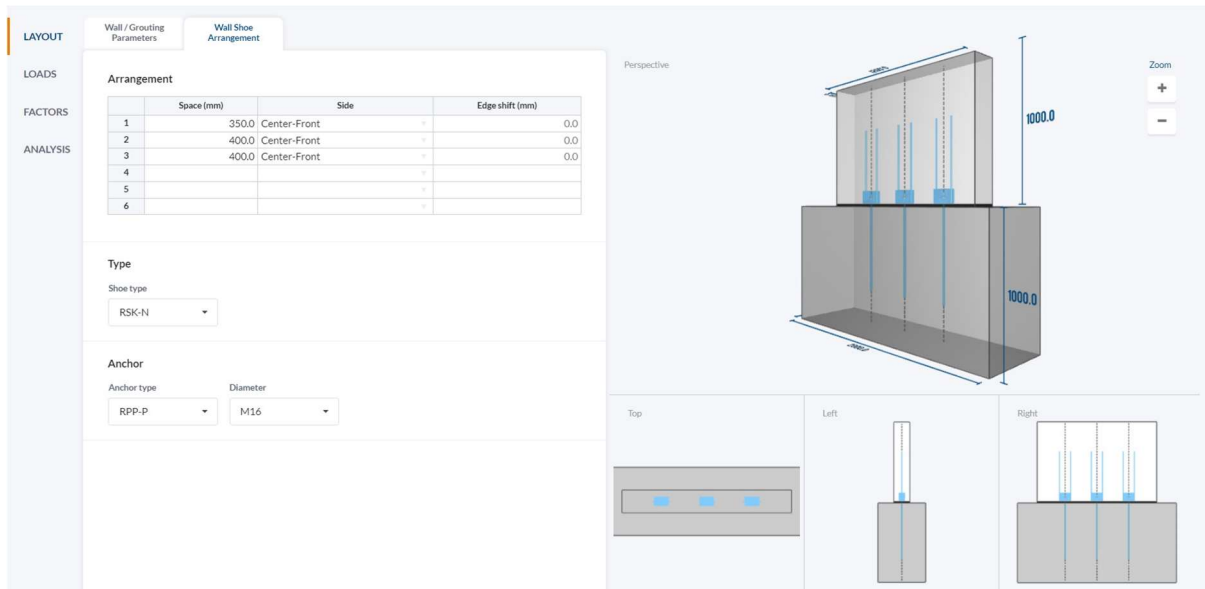
On the "Wall/Grouting Parameters" tab, a precast wall with dimensions of 200x1500x1000 has been selected. The grouting parameters include a 200mm shift b_g , a 20mm thickness t_g , and a material grade of C30/37. For the foundation, the thickness is set to 1000mm, with 250mm from the wall edges, and a material grade of C30/37 is chosen. The concrete condition is set to cracked concrete.



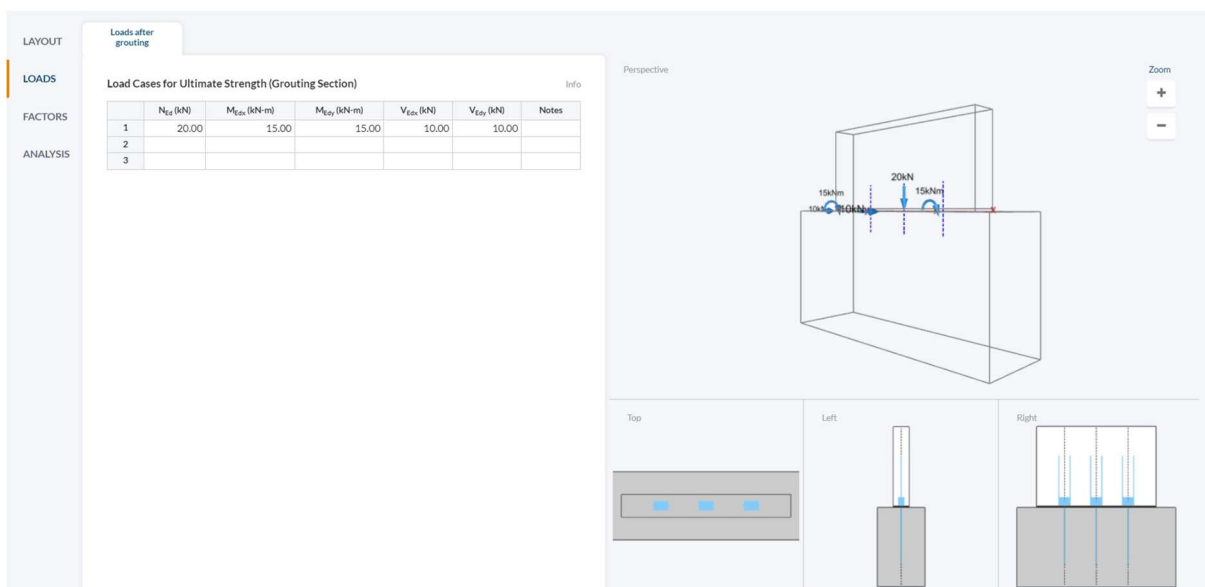
For the wall shoe arrangement, a 350mm edge distance will be chosen. It is advisable to position the wall shoes symmetrically. Therefore, the spacing between the wall shoes will be as follows:

$$Spacing = \frac{Wall\ Length\ L - (2 \cdot Edge\ Distance)}{2} = \frac{1500 - (2 \cdot 350)}{2} = 400mm$$

The wall shoe RSK-N type will be selected along with the matching RPP-P anchor type, specifically with a diameter of M16. In this example, the center-front face side will be used with no edge shift.



Moving on to the "LOADS" page, the following load values have been selected: an axial load of 20.00 kN, a moment value in the x-direction of 15.00 kN, a moment value in the y-direction of 15.00 kN, a shear value in the x-direction of 10.00 kN, and a shear value in the y-direction of 10.00 kN.



Since the "Without Annex" option has already been selected in the "Project Details" window, no changes will be made to the factor values in this "FACTORS" page.

Wall and Anchors

Wall Strength

Safety Factor for Concrete (γ_c)

Safety Factor for Steel (γ_s)

Long-Term and Unfavorable Effects (α_{cc})

Anchor Strength

Safety Factor for anchor (γ_{M2})

Safety Factor for anchor (γ_s)

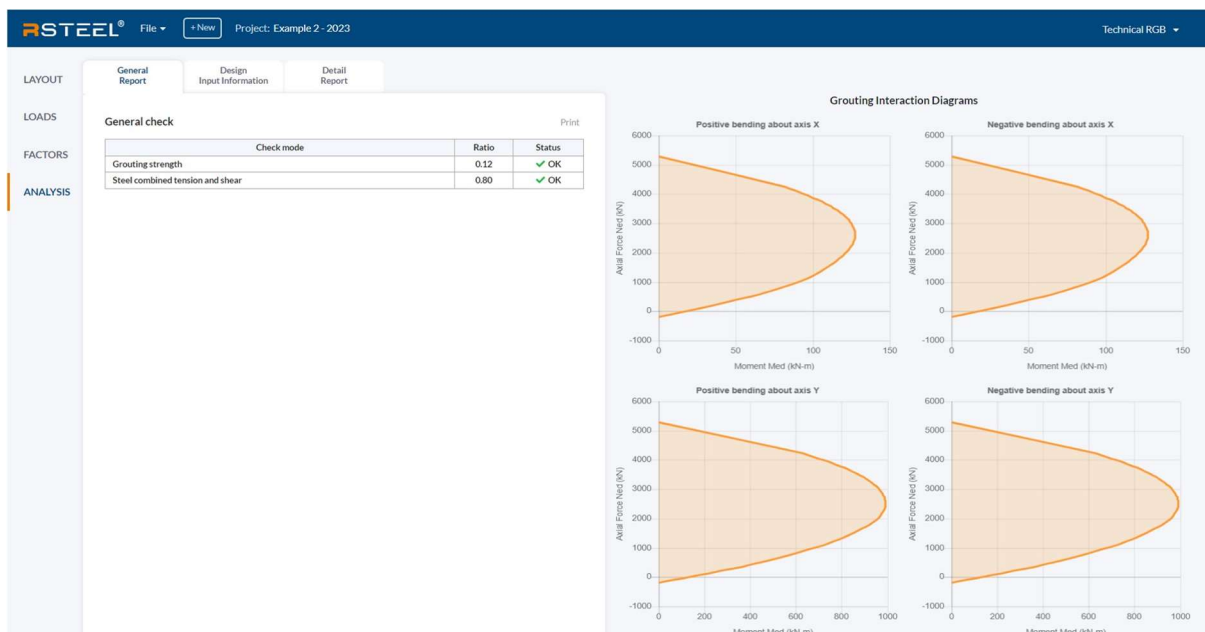
Shear Force Factor (α_b)

Shear Force Factor (k_1)

Anchor Reduction factor (η_d)

Grout-Foundation Friction Coefficient (μ)

The final step is to click on the "ANALYSIS" page to generate all the reports. In this page, three tabs will be available: General Report, Design Input Information, and Detail Report. The calculation summary can be reviewed in the general report, where the ratios should be less than 1.00. All the reports will be provided in the appendix for convenient reference.



Appendix

- A. Example 1 – General Report
- B. Example 1 – Design Input Information
- C. Example 1 – Detail Report
- D. Example 2 – General Report
- E. Example 2 – Design Input Information
- F. Example 2 – Detail Report

USER MANUAL REVISIONS

06.10.2023 (FA/GA)

- First edition

Appendix A

Example 1 – General Report

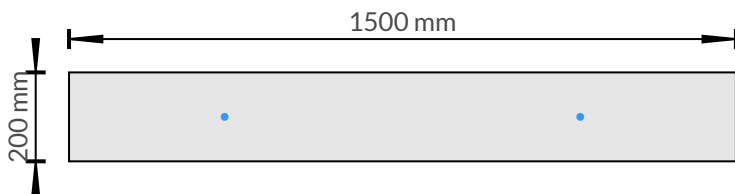
Project Information

Engineer Name: Technical RGB
Organization: RSTEEL
Address: Kõrtsi tee 7/1, Lehmja, Estonia
Phone: +372 57 83 9676
Email: technical@repo.eu
Project Name: Example 1 - 2023
Project ID: 007
Project Location: Helsinki
Project Notes: This example is prepared for the user manual.

Input Data

Wall Length L:	1500 mm	Grouting Length:	1500 mm
Wall Width B:	200 mm	Grouting Width:	200 mm
Foundation Length:	2000 mm	Grouting Thickness:	20 mm
Foundation Width:	600 mm	Grouting Material:	C30
Foundation Thickness:	1000 mm	Shoe Type:	RSK-N
Foundation Material:	C30	Anchor Type:	RPP-P-M20

Grouting anchors



Anchor ID	X, mm	Y, mm	Size, mm
1	-400.00	0.00	M20
2	400.00	0.00	M20

Loads after grouting - Anchors section

Load Case	N_{Ed} , kN	M_{Edx} , kN-m	M_{Edy} , kN-m	V_{Edx} , kN	V_{Edy} , kN	Notes
1	20	15	15	10	10	

General check

Check mode	Ratio	Status
Grouting strength	0.11	✓ OK
Steel combined tension and shear	0.83	✓ OK

Appendix B

Example 1 – Design Input Information

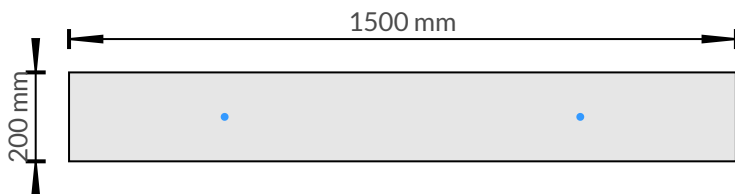
Project Information

Engineer Name: Technical RGB
Organization: RSTEEL
Address: Kõrtsi tee 7/1, Lehmja, Estonia
Phone: +372 57 83 9676
Email: technical@repo.eu
Project Name: Example 1 - 2023
Project ID: 007
Project Location: Helsinki
Project Notes: This example is prepared for the user manual.

Input Data

Wall Length L:	1500 mm	Grouting Length:	1500 mm
Wall Width B:	200 mm	Grouting Width:	200 mm
Foundation Length:	2000 mm	Grouting Thickness:	20 mm
Foundation Width:	600 mm	Grouting Material:	C30
Foundation Thickness:	1000 mm	Shoe Type:	RSK-N
Foundation Material:	C30	Anchor Type:	RPP-P-M20

Grouting anchors



Anchor ID	X, mm	Y, mm	Size, mm
1	-400.00	0.00	M20
2	400.00	0.00	M20

Loads after grouting - Anchors section

Load Case	N_{Ed} , kN	M_{Edx} , kN-m	M_{Edy} , kN-m	V_{Edx} , kN	V_{Edy} , kN	Notes
1	20	15	15	10	10	

Appendix C

Example 1 – Detail Report

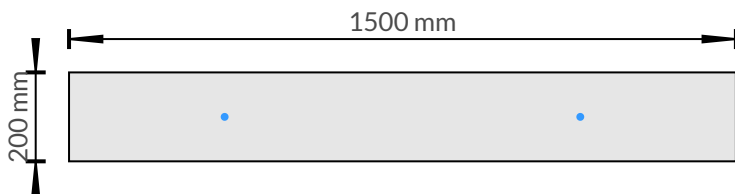
Project Information

Engineer Name:	Technical RGB
Organization:	RSTEEL
Address:	Kõrtsi tee 7/1, Lehmja, Estonia
Phone:	+372 57 83 9676
Email:	technical@repo.eu
Project Name:	Example 1 - 2023
Project ID:	007
Project Location:	Helsinki
Project Notes:	This example is prepared for the user manual.

Input Data

Wall Length L:	1500 mm	Grouting Length:	1500 mm
Wall Width B:	200 mm	Grouting Width:	200 mm
Foundation Length:	2000 mm	Grouting Thickness:	20 mm
Foundation Width:	600 mm	Grouting Material:	C30
Foundation Thickness:	1000 mm	Shoe Type:	RSK-N
Foundation Material:	C30	Anchor Type:	RPP-P-M20

Grouting anchors



Anchor ID	X, mm	Y, mm	Size, mm
1	-400.00	0.00	M20
2	400.00	0.00	M20

Loads after grouting - Anchors section

Load Case	N_{Ed} , kN	M_{Edx} , kN-m	M_{Edy} , kN-m	V_{Edx} , kN	V_{Edy} , kN	Notes
1	20	15	15	10	10	

Wall Shoe Resistance (RSK-N/M20)

Stress area in thread of anchor bolt $A_{bolt} = 245.00 \text{ mm}^2$

Thickness of the shoe base plate $t_{base} = 20.00 \text{ mm}$

Diameter of nominal stress area in thread of anchor bolt $d_b = 17.66 \text{ mm}$

Nominal diameter of anchor bolt $d_0 = 20.00$ mm

Yield strength of the steel in the anchor bolt $f_{bolt,y} = 500.00$ MPa

Ultimate strength of the steel in the anchor bolt $f_{bolt,u} = 550.00$ MPa

Ultimate strength of the foundation $f_{base,u} = 510.00$ MPa

Grouting concrete characteristic strength $f_{grout,ck} = 30.00$ MPa

Grouting concrete design strength $f_{grout,cd} = \alpha_{cc} \cdot f_{grout,ck} / \gamma_c = 0.85 \cdot 30.00 / 1.50 = 17.00$ MPa

Resistance of a column shoe in tension and compression:

$$N_{Rd} = \eta_d \cdot \min \left\{ \frac{f_{bolt,u} \cdot 0.9}{\gamma_{M2}}; \frac{f_{bolt,y}}{1.15} \right\} \cdot A_{bolt} = 1.00 \cdot \min \left\{ \frac{550 \cdot 0.9}{1.25}; \frac{500}{1.15} \right\} \cdot 245 \cdot 10^{-3} = 97.02 \text{ kN}$$

Shear resistance of a column shoe (EN 1993-1-8, 6.2.2):

$$\alpha_b = 0.44 - 0.0003 \cdot f_{bolt,y} = 0.44 - 0.0003 \cdot 500.00 = 0.290$$

$$F_{1,vb,Rd} = \frac{k_1 \cdot \alpha_b \cdot f_{base,u} \cdot d_b \cdot t_{base}}{\gamma_{M2}} = \frac{1 \cdot 1 \cdot 510 \cdot 17.66 \cdot 20}{1.25} \cdot 10^{-3} = 144.12 \text{ kN}$$

$$F_{2,vb,Rd} = \frac{\alpha_b \cdot f_{bolt,u} \cdot A_{bolt}}{\gamma_{M2}} = \frac{0.290 \cdot 550 \cdot 245}{1.25} \cdot 10^{-3} = 31.26 \text{ kN}$$

$$F_{3,vb,Rd} = \frac{0.5 \cdot f_{bolt,u} \cdot A_{bolt}}{\gamma_{M2}} = \frac{0.5 \cdot 550 \cdot 245}{1.25} \cdot 10^{-3} = 53.90 \text{ kN}$$

$$V_{Rd} = \min \{ F_{1,vb,Rd}; F_{2,vb,Rd}; F_{3,vb,Rd} \} = 31.26 \text{ kN}$$

Anchors (Stage II)

Characteristic strength of concrete f_{ck} : 30.00 MPa

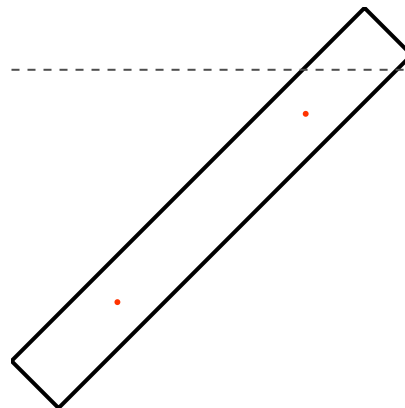
Design strength of concrete f_{cd} : 17.00 MPa

Characteristic strength of rebar f_{yk} : 500.00 MPa

Design strength of rebar f_{yd} : 396.00 MPa

Load Case 1. Axial + Flexure check

Angle of section neutral axis rotation: 45.00 deg.



– NA, • Tensioned bar, • Compressed bar

Actual bending moment in section

$$M_{zy} = \sqrt{M_z^2 + M_y^2} = \sqrt{-15^2 + 15.00^2} = 21.21 \text{ kN-m}$$

$$e_{xy} = M_{zy} / N_{Edx} = 21.21 / 20.00 = 1.06066$$

Axial load capacity for concentric loading (10.10.4)

$$N_{Rd} = \eta \cdot f_{cd} \cdot (A_c - A_{st}) + f_{yd} \cdot A_{st} = (17.00 \cdot (300000.00 - 490.00) + 396.00 \cdot 490.00) \cdot 0.001 = 5285.71 \text{ kN}$$

Axial + flexure capacity

$$N_r = 181.45 \text{ kN}, M_{Rd} = 188.26 \text{ kN-m}$$

$$N_{Edx} = 20.00 \text{ kN} \leq N_r = 181.45 \text{ kN} \text{ (Ratio: 0.110)}$$

$$M_{zy} = 21.21 \text{ kN-m} \leq M_{Rd} = 188.26 \text{ kN-m} \text{ (Ratio: 0.113)}$$

$$N_{Edx} = 20.00 \text{ kN} \leq N_{Rd} = 5285.71 \text{ kN} \text{ (Ratio: 0.004)}$$

Status: ✔ OK

Anchor forces distribution

Load Case 1

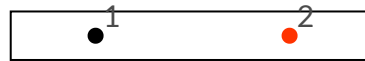
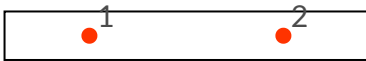
N_{Ed} , kN	M_{xEd} , kN-m	M_{yEd} , kN-m	V_{xEd} , kN-m	V_{yEd} , kN-m
20.00	15.00	15.00	10.00	10.00

Axial loading:

- Tensioned (-)
- Compressed (+)

Shear loading:

- Active
- Inactive



Capacity check

$$\text{Combined Force: } \frac{|N_{Ed,1}|}{1.4 \cdot N_{Rd}} + \frac{|V_{Ed,1}|}{V_{Rd}} < 1.0$$

ID	$\sigma_{Ed,1}$, MPa	$N_{Ed,1}$, kN	N_{Rd} , kN	Axial Ratio	$V_{Ed,1}$, kN	V_{Rd} , kN	Shear Ratio	Combined Ratio	Combined Status
1	-297.68	-72.93	97.02	0.75	0.00	31.26	0.00	0.00	✔ OK
2	-282.90	-69.31	97.02	0.71	10.14	31.26	0.32	0.83	✔ OK

Appendix D

Example 2 – General Report

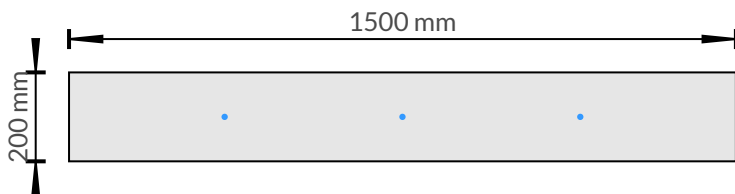
Project Information

Engineer Name: Technical RGB
Organization: RSTEEL
Address: Kõrtsi tee 7/1, Lehmja, Estonia
Phone: +372 57 83 9676
Email: technical@repo.eu
Project Name: Example 2 - 2023
Project ID: 007
Project Location: Helsinki
Project Notes: This example is prepared for the user manual.

Input Data

Wall Length L:	1500 mm	Grouting Length:	1500 mm
Wall Width B:	200 mm	Grouting Width:	200 mm
Foundation Length:	2000 mm	Grouting Thickness:	20 mm
Foundation Width:	600 mm	Grouting Material:	C30
Foundation Thickness:	1000 mm	Shoe Type:	RSK-N
Foundation Material:	C30	Anchor Type:	RPP-P-M16

Grouting anchors



Anchor ID	X, mm	Y, mm	Size, mm
1	-400.00	0.00	M16
2	0.00	0.00	M16
3	400.00	0.00	M16

Loads after grouting - Anchors section

Load Case	N_{Ed} , kN	M_{Edx} , kN-m	M_{Edy} , kN-m	V_{Edx} , kN	V_{Edy} , kN	Notes
1	20	15	15	10	10	

General check

Check mode	Ratio	Status
Grouting strength	0.12	✓ OK
Steel combined tension and shear	0.80	✓ OK

Appendix E

Example 2 – Design Input Information

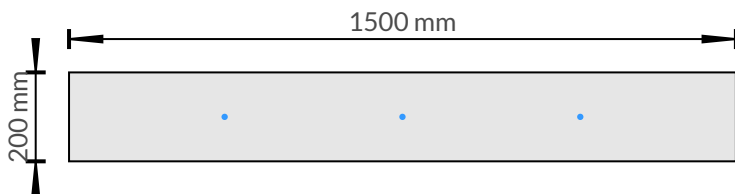
Project Information

Engineer Name: Technical RGB
Organization: RSTEEL
Address: Kõrtsi tee 7/1, Lehmja, Estonia
Phone: +372 57 83 9676
Email: technical@repo.eu
Project Name: Example 2 - 2023
Project ID: 007
Project Location: Helsinki
Project Notes: This example is prepared for the user manual.

Input Data

Wall Length L:	1500 mm	Grouting Length:	1500 mm
Wall Width B:	200 mm	Grouting Width:	200 mm
Foundation Length:	2000 mm	Grouting Thickness:	20 mm
Foundation Width:	600 mm	Grouting Material:	C30
Foundation Thickness:	1000 mm	Shoe Type:	RSK-N
Foundation Material:	C30	Anchor Type:	RPP-P-M16

Grouting anchors



Anchor ID	X, mm	Y, mm	Size, mm
1	-400.00	0.00	M16
2	0.00	0.00	M16
3	400.00	0.00	M16

Loads after grouting - Anchors section

Load Case	N_{Ed} , kN	M_{Edx} , kN-m	M_{Edy} , kN-m	V_{Edx} , kN	V_{Edy} , kN	Notes
1	20	15	15	10	10	

Appendix F

Example 2 – Detail Report

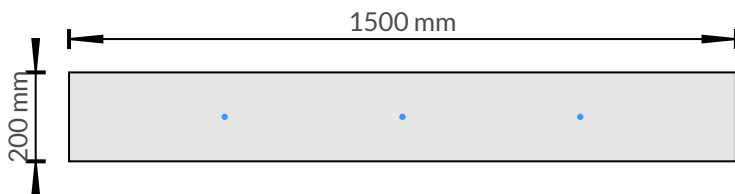
Project Information

Engineer Name:	Technical RGB
Organization:	RSTEEL
Address:	Kõrtsi tee 7/1, Lehmja, Estonia
Phone:	+372 57 83 9676
Email:	technical@repo.eu
Project Name:	Example 2 - 2023
Project ID:	007
Project Location:	Helsinki
Project Notes:	This example is prepared for the user manual.

Input Data

Wall Length L:	1500 mm	Grouting Length:	1500 mm
Wall Width B:	200 mm	Grouting Width:	200 mm
Foundation Length:	2000 mm	Grouting Thickness:	20 mm
Foundation Width:	600 mm	Grouting Material:	C30
Foundation Thickness:	1000 mm	Shoe Type:	RSK-N
Foundation Material:	C30	Anchor Type:	RPP-P-M16

Grouting anchors



Anchor ID	X, mm	Y, mm	Size, mm
1	-400.00	0.00	M16
2	0.00	0.00	M16
3	400.00	0.00	M16

Loads after grouting - Anchors section

Load Case	N_{Ed} , kN	M_{Edx} , kN-m	M_{Edy} , kN-m	V_{Edx} , kN	V_{Edy} , kN	Notes
1	20	15	15	10	10	

Wall Shoe Resistance (RSK-N/M16)

Stress area in thread of anchor bolt $A_{bolt} = 157.00 \text{ mm}^2$

Thickness of the shoe base plate $t_{base} = 15.00 \text{ mm}$

Diameter of nominal stress area in thread of anchor bolt $d_b = 14.14 \text{ mm}$

Nominal diameter of anchor bolt $d_0 = 16.00$ mm

Yield strength of the steel in the anchor bolt $f_{bolt,y} = 500.00$ MPa

Ultimate strength of the steel in the anchor bolt $f_{bolt,u} = 550.00$ MPa

Ultimate strength of the foundation $f_{base,u} = 510.00$ MPa

Grouting concrete characteristic strength $f_{grout,ck} = 30.00$ MPa

Grouting concrete design strength $f_{grout,cd} = \alpha_{cc} \cdot f_{grout,ck} / \gamma_c = 0.85 \cdot 30.00 / 1.50 = 17.00$ MPa

Resistance of a column shoe in tension and compression:

$$N_{Rd} = \eta_d \cdot \min \left\{ \frac{f_{bolt,u} \cdot 0.9}{\gamma_{M2}}; \frac{f_{bolt,y}}{1.15} \right\} \cdot A_{bolt} = 1.00 \cdot \min \left\{ \frac{550 \cdot 0.9}{1.25}; \frac{500}{1.15} \right\} \cdot 157 \cdot 10^{-3} = 62.17 \text{ kN}$$

Shear resistance of a column shoe (EN 1993-1-8, 6.2.2):

$$\alpha_b = 0.44 - 0.0003 \cdot f_{bolt,y} = 0.44 - 0.0003 \cdot 500.00 = 0.290$$

$$F_{1,vb,Rd} = \frac{k_1 \cdot \alpha_b \cdot f_{base,u} \cdot d_b \cdot t_{base}}{\gamma_{M2}} = \frac{1 \cdot 1 \cdot 510 \cdot 14.14 \cdot 15}{1.25} \cdot 10^{-3} = 86.53 \text{ kN}$$

$$F_{2,vb,Rd} = \frac{\alpha_b \cdot f_{bolt,u} \cdot A_{bolt}}{\gamma_{M2}} = \frac{0.290 \cdot 550 \cdot 157}{1.25} \cdot 10^{-3} = 20.03 \text{ kN}$$

$$F_{3,vb,Rd} = \frac{0.5 \cdot f_{bolt,u} \cdot A_{bolt}}{\gamma_{M2}} = \frac{0.5 \cdot 550 \cdot 157}{1.25} \cdot 10^{-3} = 34.54 \text{ kN}$$

$$V_{Rd} = \min \{F_{1,vb,Rd}; F_{2,vb,Rd}; F_{3,vb,Rd}\} = 20.03 \text{ kN}$$

Anchors (Stage II)

Characteristic strength of concrete f_{ck} : 30.00 MPa

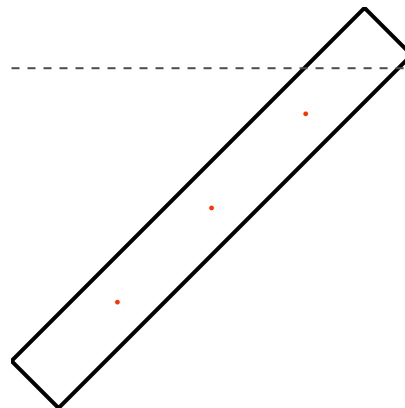
Design strength of concrete f_{cd} : 17.00 MPa

Characteristic strength of rebar f_{yk} : 500.00 MPa

Design strength of rebar f_{yd} : 396.00 MPa

Load Case 1. Axial + Flexure check

Angle of section neutral axis rotation: 45.00 deg.



– NA, • Tensioned bar, • Compressed bar

Actual bending moment in section

$$M_{zy} = \sqrt{M_z^2 + M_y^2} = \sqrt{-15^2 + 15.00^2} = 21.21 \text{ kN-m}$$

$$e_{xy} = M_{zy} / N_{Edx} = 21.21 / 20.00 = 1.06066$$

Axial load capacity for concentric loading (10.10.4)

$$N_{Rd} = \eta \cdot f_{cd} \cdot (A_c - A_{st}) + f_{yd} \cdot A_{st} = (17.00 \cdot (300000.00 - 471.00) + 396.00 \cdot 471.00) \cdot 0.001 = 5278.51 \text{ kN}$$

Axial + flexure capacity

$$N_r = 170.36 \text{ kN}, M_{Rd} = 179.99 \text{ kN-m}$$

$$N_{Edx} = 20.00 \text{ kN} \leq N_r = 170.36 \text{ kN} \text{ (Ratio: 0.117)}$$

$$M_{zy} = 21.21 \text{ kN-m} \leq M_{Rd} = 179.99 \text{ kN-m} \text{ (Ratio: 0.118)}$$

$$N_{Edx} = 20.00 \text{ kN} \leq N_{Rd} = 5278.51 \text{ kN} \text{ (Ratio: 0.004)}$$

Status: ✔ OK

Anchor forces distribution

Load Case 1

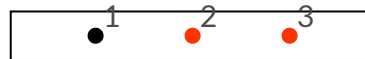
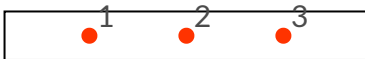
N_{Ed} , kN	M_{xEd} , kN-m	M_{yEd} , kN-m	V_{xEd} , kN-m	V_{yEd} , kN-m
20.00	15.00	15.00	10.00	10.00

Axial loading:

- Tensioned (-)
- Compressed (+)

Shear loading:

- Active
- Inactive



Capacity check

$$\text{Combined Force: } \frac{|N_{Ed,1}|}{1.4 \cdot N_{Rd}} + \frac{|V_{Ed,1}|}{V_{Rd}} < 1.0$$

ID	$\sigma_{Ed,1}$, MPa	$N_{Ed,1}$, kN	N_{Rd} , kN	Axial Ratio	$V_{Ed,1}$, kN	V_{Rd} , kN	Shear Ratio	Combined Ratio	Combined Status
1	-309.35	-48.57	62.17	0.78	0.00	20.03	0.00	0.00	✔ OK
2	-301.57	-47.35	62.17	0.76	5.07	20.03	0.25	0.80	✔ OK
3	-293.78	-46.12	62.17	0.74	5.07	20.03	0.25	0.78	✔ OK