

Geocentrix

ReActiv 2

Quick-Start Guide

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The ReActiv Quick-Start Guide was written by Andrew Bond.

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Introducing ReActiv

ReActiv® is an interactive program that helps you to design reinforced slopes in a variety of different soil types, using reinforced soil or soil nails.

What's new in ReActiv 2?

New features

- New user interface, based on Geocentrix's **Re/x technology**
- Interactive **Drawing Board**, with items automatically updated as their properties are changed
- **Project Manager**, with all items clearly visible in one place
- **Property Inspector**, provides easy-to-use controls for setting and changing properties of items
- **Stockyard**, containing over 50 pre-built engineering items
- **Graph Paper**, showing the top-10 potential failure mechanisms and a "heat plot" of required ground resistance
- **Reporter**, providing flexible page-based reporting capabilities
- **Program Options** allows the program to be customized per installation
- **Customizable catalogue** of commonly used geogrids, geotextiles, and soil nails
- Separate **Quick-Start Guide**, **User Manual**, and **Reference Manual**

Improved features

- Support for Windows 10 and Windows 11
- Improved - grid and "critical" mechanism calculations combined into same analysis
- Improved - support for wide area network licences
- Improved - support for virtual private networks (VPN)
- Simplified program registration

Documentation

ReActiv is supplied with a Quick-start Guide (this document), User Manual, and Reference Manual. The latest versions of these documents (including any corrections and/or additions since the program's first

release) are available in Adobe® Acrobat® format from the Geocentrix website. (www.geocentrix.co.uk/ReActiv and follow links to ReActiv's documentation).

Quick-Start guide (this document)

The ReActiv 2 Quick-Start Guide includes three tutorials that show you how to use the main features of ReActiv. Each tutorial provides step-by-step instructions on how to drive the program. The tutorials increase in difficulty and are designed to be followed in order.

User manual

The ReActiv 2 User Manual explains how to use ReActiv. It provides a detailed description of the program's user interface and explains how to employ it to maximum effect.

Reference manual

The ReActiv 2 Reference Manual gives detailed information about the engineering theory that underpins ReActiv's calculations. The manual assumes you have a working knowledge of the geotechnical design of reinforced slopes but provides appropriate references for further study if you do not.

Help system

ReActiv's help system contains detailed information about the program, including most of the content of the Quick-Start Guide, User Manual, and Reference Manual – plus additional information that is not found in any of these documents.

Help appears in a separate window to ReActiv, allowing you to view the help topics while you continue to work with ReActiv itself. To open the help system:

- Press F1
- Click the Help button in any dialog box
- Click on the Help button on the right hand side of ReActiv's Ribbon

Note

Screenshots in this document were produced on Windows 10. Their appearance may differ on your computer.

In this document, '<Documents>' refers to the folder where the documents that ship with ReActiv were installed, typically here:

C:\Users\Public\Documents\Geocentrix\ReActiv\2

Software Re-Assurance™

Software Re-Assurance for ReActiv (including updates, upgrades, and technical support) is available direct from Geocentrix or through your local distributor. To obtain Re-Assurance, contact Geocentrix as follows:

ReActiv Technical Support

Geocentrix Ltd, Scenic House, 54 Wilmot Way, Banstead, Surrey, SM7 2PY, United Kingdom

T: +44 (0)1737 373963, E: support@geocentrix.co.uk

W: www.geocentrix.co.uk/support

Please be at your computer and have your licence number ready when you call. Please quote your licence number and on all correspondence.

Tutorial 1: embankment in dense sand

Introduction

This tutorial demonstrates the basic features of ReActiv, through a worked example involving the analysis of an embankment in dense sand:

- The embankment comprises an 8m high reinforced slope in dense sand, which is to be reinforced by horizontal geogrids so that it can stand at 70° to the horizontal.
- The sand has an angle of friction of 35° and a bulk density of 20 kN/m³. These are design values rather than peak values, hence they should be used with partial safety factors of 1.0.
- The reinforcement comprises horizontal geogrids with a characteristic tensile strength of 20 kN/m
- Partial factors $f_d = 1.1$, $f_e = 1.1$, and $f_m = 1.15$ must be applied to the geogrid's tensile strength
- There is no surcharge at the top of the slope
- The geogrid's bearing factor (α') is 0.95 and its interface sliding factor (α) is 0.8. See Sections 2.33 and 2.23 of the Advice Note for the definition of these parameters¹
- This tutorial shows you how to determine the most critical mechanism in the slope and how to calculate the depth, length, and spacing of the reinforcement needed to stabilize that slope.

This tutorial is written for users of the Standard and Trial Editions of ReActiv.

The worked example described in this chapter is identical to Example 1 in Appendix J of the UK Highways Agency's Advice Note (see pages J/1 to J/2). If you have a copy of the Advice Note, you may find it helpful to read the relevant pages before working through this chapter.

¹ Note that ReActiv uses different terms and symbols for these parameters: the bearing factor is given the symbol f_b and the interface sliding factor is called the direct shear factor and given the symbol f_{ds}

Overview

- In Step 1, you will use the Project Wizard to enter project information, select a design standard, and create a scenario to represent the specified design situation.
- In Step 2, you will modify the properties of the slope to match the project specification.
- In Step 3, you will use the Borehole Wizard to create a borehole containing a sand layer.
- In Step 4, you will create a geogrid and use it as reinforcement in the slope.
- In Step 5, you will modify one of the partial factors in the design standard.
- In Step 6, you will use the Calculation Wizard to create the calculations you want ReActiv to perform.
- In Step 7, you will perform the stability calculations to determine the reinforcement required to stabilize the slope.
- In Step 8, you will transfer the required reinforcement to the slope.
- In Step 9, you will produce a report summarising your calculations.
- In Step 10, you will close (and optionally save) the project.

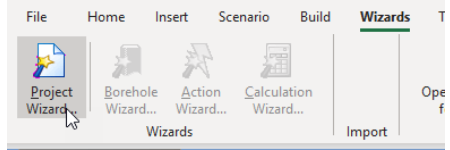
If ReActiv is not already running, open the program by pressing the Windows key, typing “ReActiv 2” in the search bar, and clicking on the ReActiv 2 item that should appear. Once the splash screen has disappeared, ReActiv displays its Welcome screen.

If you have an existing project open, click Close on the program’s File menu. (You will be prompted to save your work if you have not already done so.)

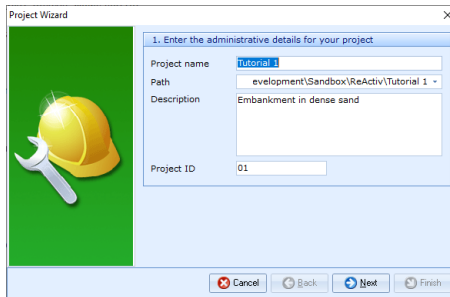
Step 1 – create the project

In Step 1, you will use the Project Wizard to enter project information, select a design standard, and create a scenario to represent the design situation.

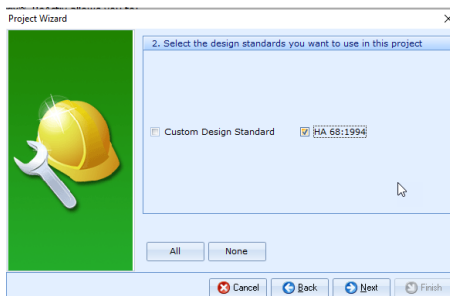
1. Open the Project Wizard by selecting the **Wizards** tab on ReActiv's ribbon and clicking on the **Project Wizard** button.



2. When the Wizard appears, type "Tutorial 1" in the **Project name** box. Choose the folder where you want to save this project by using the **Path** control. (If you do not change the setting here, it will be saved in your Documents folder.)
3. Enter "Embankment in dense sand" in the **Description** box and "01" in the **Project ID** box.

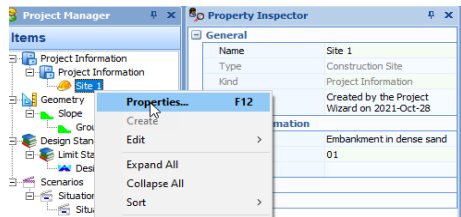


4. Click **Next** to display the next page. Select HA 68:1994 by clicking on the relevant checkbox (a tick mark appears when a standard is selected).



5. Click **Next** to display the next page. Change the Design Situation of Scenario 1 to "Transient".

6. Click **Next** to display the final page. If you wish to review any of the settings you have made, click **Back** to return to the relevant page.
7. When you are ready, click **Finish** to generate the project. The Project Wizard then:
 - Creates Site 1, Slope 1, Design Standard 1, and Situation 1
 - Adds Slope 1 to Situation 1
 - Creates and saves a new project named Tutorial 1.rvx with all these items
8. You can view these items by right-clicking anywhere inside the Project Manager to display its context menu and selecting the **Expand All** command. The Project Manager will then look as shown in the picture alongside.
9. To view the properties of any particular item, select the item you want to inspect in the program's Project Manager (e.g. Site 1)
10. Display the Property Inspector for the item by:
 - Right-clicking on the item, to display its context menu, and clicking the **Properties...** command
 - Or ... Double-clicking on the item
11. The program's Property Inspector will open and display the properties of the selected item. (For example, for Site 1 the description is shown as "Embankment in dense sand" and the Project ID as "01".)



[Docs]\Tutorials\Tutorial 1\Step 1.rvx captures everything so far.

Step 2 – modify the slope

In Step 2, you will modify the slope properties to match the project specification.

1. In the Project Manager, right-click on “Slope 1” (under the heading Geometry > Slopes) and select **Properties...** The Property Inspector will open and display the properties of the slope.
2. In the Property Inspector, change the **Name** of the slope to “One-part slope”.
3. Enter 8 into the **Height** box and press ENTER.
4. Enter 70 into the **Main Slope** box and press ENTER. The **Breadth** should change to 2.91 m.
5. Leave the **Crest Slope** as 0 °

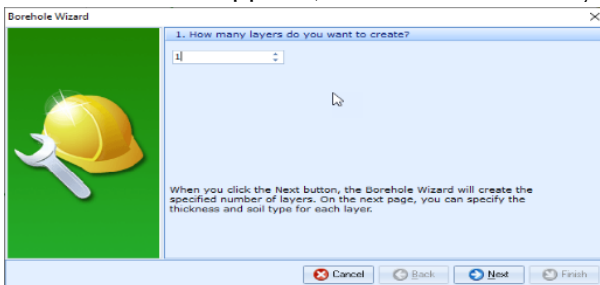
General	
Name	One-Part Slope
Type	Linear Slope
Category	Slope
Kind	Geometry
Notes	Created by the Project Wizard on 2021-Oct-28
Location	
Relative Position	
X-position	0 m
Y-position	0 m
Depth	0 m
Absolute Position	
Dimensions	
Height	8 m
Main slope	70 °
Breadth	2.91 m
Crest slope	0 °

[Docs]\Tutorials\Tutorial 1\Step 2.rvx captures everything so far.

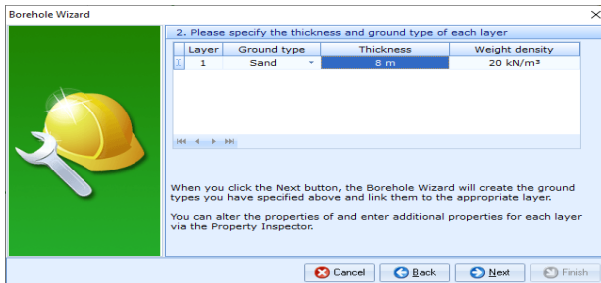
Step 3 – create the borehole

In Step 3, you will use the Borehole Wizard to create a borehole containing the sand layer.

1. Open the Borehole Wizard by selecting the **Wizards** tab on ReActiv’s ribbon and clicking on the **Borehole Wizard** button.
2. When the Wizard appears, set the number of layers to 1.



3. Click **Next** to display the next page. Change Layer 1's thickness to 8 m and (if necessary) its soil type to “Sand” and weight density to 20 kN/m³.

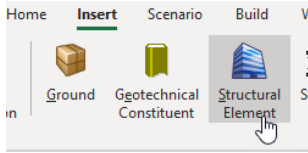
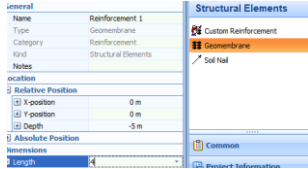
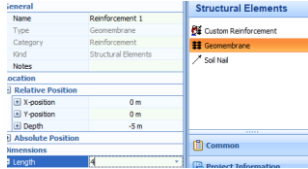


4. Click **Next** to display the next page. Change the sand's **Internal friction** to 35° and tick the box **At Critical State?** to signify that this is a critical state value, not a peak value. Leave the sand's **Cohesion** unchanged at 0 kPa.
5. Click **Next** to display the next page. The sand layer does not appear on this page since it does not have undrained properties.
6. Click **Next** to display the next page. Tick Situation 1 to add the borehole to the existing scenario.
7. Click **Next** to display the next page. If you wish to review any of the settings you have made, click **Back** to return to the relevant page.
8. When you are ready, click Finish to generate the borehole. The **Borehole Wizard** then:
 - Creates Soil 1, Layer 1, and Borehole 1
 - Links Soil 1 to Layer 1
 - Adds Layers 1 to Borehole 1
9. Back in the **Project Manager**, click on "Soil 1" (under the heading Materials > Soils). Its properties will automatically be displayed in the Property Inspector.
10. In the **Property Inspector**, change the **Name** of the soil to "Dense sand" and its **State** to "Dense".

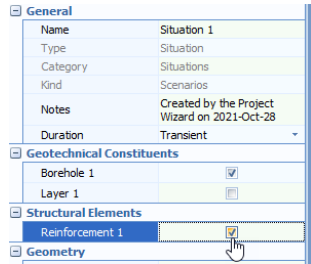
[Docs]\Tutorials\Tutorial 1\Step 3.rvx captures everything so far.

Step 4 – create the reinforcement

In Step 4, you will create a geogrid and use it as reinforcement in the slope.

1. Open the Stockyard by selecting the Insert tab on ReActiv's ribbon and clicking on the **Structural Element** button. The Stockyard will open.
 
2. In the Stockyard, create the reinforcement by selecting the item labelled "Geomembrane" and then right-clicking to display a pop-up menu. Choose **Create 'Geomembrane'**. The geomembrane will appear in the Project Manager under the heading Structural Elements > Reinforcement and its properties will appear in the Property Inspector.
 
3. In the Property Inspector, change the **Depth** of the reinforcement to 1 m, and its **Length** to 4 m (this is our initial estimate of the depth and length required). Select "One-part slope" in the **Tether To** box.
 
4. Right-click on the Stockyard and chose the **Geogrids** command.
5. Create the material used for the reinforcement by holding the control key down and clicking on the item labelled "Tensar SS20". The new material will appear in the Project Manager under Materials > Geogrids with the name "Geogrid 1" and its properties will be displayed in the Project Inspector.
6. In the Property Inspector, check that the **Tensile Strength** of the geogrid is 20 kN/m.
7. In the Project Manager, select "Reinforcement 1" once again to display its properties in the Property Inspector.
8. Change the **Material Name** to "Geogrid 1".

9. In the Project Manager, click on “Situation 1” to display its properties in the Property Inspector.
10. In the Property Inspector, tick “Reinforcement 1” to add it to Situation 1. The reinforcement will appear on the Drawing Board.

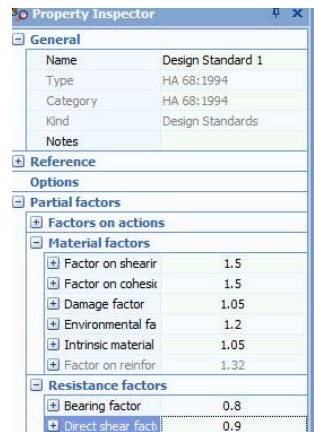


[Docs]\Tutorials\Tutorial 1\Step 4.rvx captures everything so far.

Step 5 – amend the design standard

In Step 5, you will modify one of the partial factors in the design standard.

1. In the Project Manager, click on “Design Standard 1” to display its properties in the Property Inspector.
2. In the **Property Inspector**, change the **Intrinsic material factor** to 1.15. The **Factor on reinforcement strength** will change to 1.39.



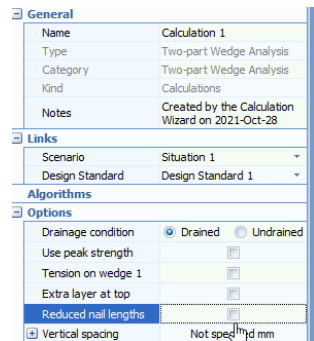
[Docs]\Tutorials\Tutorial 1\Step 5.rvx captures everything so far.

Step 6 – create the calculation

In Step 6, you will use the Calculation Wizard to create the calculation you want to perform.

1. Open the Calculation Wizard by selecting the **Wizards** tab on ReActiv’s ribbon and then clicking on the **Calculation Wizard** button.
2. When the Wizard appears, select “Two-part Wedge Analysis”.
3. Click **Next** to display the next page. Select “Design Standard 1” (this is the HA 68:1994 design standard created in Step 1 of this tutorial).
4. Click **Next** to display the next page. Select “Situation 1”.

5. Click **Next** to display the final page. If you wish to review any of the settings you have made, click **Back** to return to the relevant page.
6. When you are ready, click **Finish** to generate the calculation. The Calculation Wizard then:
 - Creates Calculation 1
 - Links Situation 1 to Calculation 1
 - Links Design Standard 1 to Calculations 1
7. In the Project Manager, click on “Calculation 1” to display its properties in the Property Inspector.
8. In the Property Inspector, set the **Drainage Condition** to “Drained”.
9. Untick the options **Use peak strength**, **Tension on wedge 1**, **Extra layer at top**, and **Reduced nail lengths** (these options are explained in the Reference Manual).
10. Finally, tick the box next to **Reinforcement 1** (under the heading Reinforcements) to use this reinforcement to stabilize the slope.



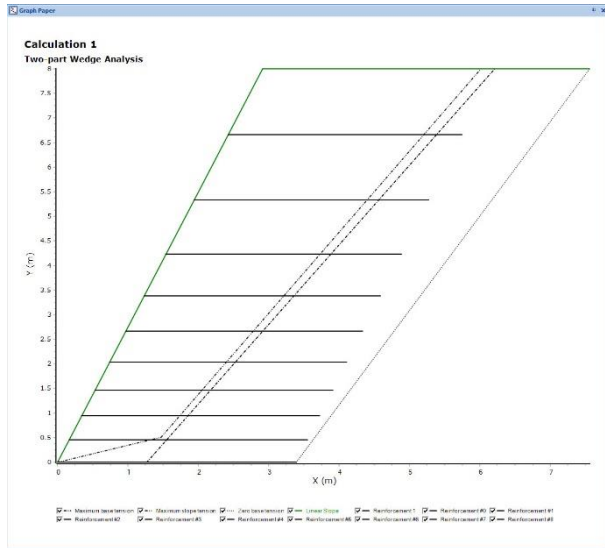
[Docs]\Tutorials\Tutorial 1\Step 6.rvx captures everything so far.

Step 7 – calculate critical mechanisms and required reinforcement

In Step 7, you will perform the stability calculations to determine the reinforcement required to stabilize the slope.

1. Run the calculation by selecting the **Build** tab on ReActiv’s ribbon and then clicking on the **Run All** button.

2. ReActiv will perform Calculation 1 and then display the Workbook and Graph Paper. You can switch to this display at any time by clicking on the **Check** button on the ribbon's **View** tab. Your screen will now look something like this:



3. The Graph Paper shows the reinforcement needed to stabilize the slope together with three key mechanisms with:
 - the maximum tension in the slope
 - the maximum tension along the base
 - zero tension along the base
4. The Workbook shows the same information but in tabular format. To display the worksheet that provides details of all the mechanisms, click on the **Mechanisms** tab at the bottom of the Workbook. The mechanism with the largest out-of-balance force has the following properties (which agree closely with the results given in the Advice Note):
 - **Type:** Standard (Type 1)
 - **Status:** Maximum base tension
 - **X-position:** 1.26 m

- **Y-position:** 0.00 m
 - **Angle:** 58.28°
 - **Tension:** 113.52 kN/m
5. Each worksheet contains a lot more information than is initially shown. To display this additional information, click on the button labelled '*' in the top-left-hand corner of the Workbook (to the left of the heading **General**) and select the data you want to see. For example, by selecting **Parameters**, you will see the intermediate variables W1, W2, K1, K2, K12, U1, U2, and U12 defined in the Advice Note.
 6. The Workbook also details the reinforcement needed to stabilize the slope. To display the worksheet that provides this information, click on the **Reinforcement** tab at the bottom of the Workbook. There are nine layers listed at various depths below the slope crest, varying in length from 3.32 m at the top to 3.39 m at the bottom:
 - Layer 1 at 1.41 m
 - Layer 2 at 2.83 m
 - Layer 3 at 4.00 m
 - Layer 4 at 4.90 m
 - Layer 5 at 5.66 m
 - Layer 6 at 6.32 m
 - Layer 7 at 6.93 m
 - Layer 8 at 7.48 m
 - Layer 9 at 8.00 m

[Docs]\Tutorials\Tutorial 1\Step 7.rvx captures everything so far.

Step 8 – transfer the reinforcement to the slope

In Step 8, you will transfer the required reinforcement to the slope.

1. Select the **View** tab on the Ribbon and select the **Normal Desktop**.
2. Then select the **Scenario** tab and click on the **Transfer Reinforcement** button.
12. ReActiv then:

- Transfers Reinforcements 1-9 to the **Project Manager**
- Adds and tethers the reinforcements to the slope

[Docs]\Tutorials\Tutorial 1\Step 8.rvx captures everything so far.

Step 9 – produce a report

In Step 9, you will produce a report summarising your calculations.

1. Display ReActiv’s reporting tools by selecting the View tab on the ribbon and then clicking on the **Review** button. The Reporter tab will be displayed on the ribbon.
2. Click the **Refresh** button to generate a report and display it, together with a set of thumbnails, in the Reporter.
3. You can navigate around the report using the controls on the Reporter tab on the ribbon: **First Page**, **Previous Page**, **Next Page**, and **Last Page**. You can jump to specific pages by clicking on the thumbnails on the left-hand side.
4. You can also re-size the report using the **Fit Width**, **Fit Height**, **Zoom In**, and **Zoom Out** controls.
5. You can choose what to include in your report by selecting or deselecting individual items in the **Report Elements** group, then clicking the **Refresh** button.
6. You must close this window in order to return to ReActiv. You can do this by going to **File** and then selecting **Exit**.
7. Finally, you can output the report onto paper using the **Print** command and choosing from the options provided in the dialog box that appears on your screen.

Step 10 – close the project

In Step 10, you will close and – optionally – save the project. (Note: this is not available in the Trial Edition.)

1. Close the project by clicking on the File menu’s **Close** command.

2. If you have made changes to the project since it was last saved, ReActiv will ask you if you want to save before proceeding. Click the appropriate button to answer **Yes** or **No**.
3. ReActiv will then (if requested) save and close the project.

[Docs]\Tutorials\Tutorial 1\Tutorial 1.rvx. captures everything in this tutorial.

What next?

Tutorial 2 shows you how to analyze a cutting in stiff clay.

Tutorial 2: cutting in stiff clay

Introduction

This tutorial demonstrates how to solve a more complicated reinforced slope problem using ReActiv. It assumes that you have already been through Tutorial 1 and that you are familiar with the basic layout of ReActiv.

- A 6 m cutting will be made in stiff clay, which is to be reinforced by horizontal geogrids so that it can stand at 70° to the horizontal
- The clay has a characteristic angle of friction of 20° , characteristic effective cohesion of 0 kPa, and characteristic weight density of 20 kN/m^3
- Groundwater conditions within the slope will be modelled by setting Bishop's pore pressure parameter r_u to 0.15
- The reinforcement comprises 16 mm diameter soil nails inclined at 10° to the horizontal and spaced at 1m intervals horizontally. The nails will be grouted into 150 mm diameter predrilled holes
- The steel used for the nails has a characteristic yield strength of 275 MPa
- Partial factors $f_d = 1.05$, $f_e = 1.2$, and $f_m = 1.05$ must be applied to the nail's yield strength
- There is no surcharge at the top of the slope
- The direct shear factor f_{ds} for soil nails is 0.9 (this is called the interface sliding factor in HA68)
- This tutorial shows you how to determine the most critical mechanism in the slope and how to calculate the depth, length, and spacing of the reinforcement needed to stabilize that slope

This tutorial is written for users of the Standard and Trial Editions of ReActiv.

The worked example described in this chapter is identical to Example 3 in Appendix J of the Advice Note (see pages J/5 to J/7). If you have a copy

of the Advice Note, you may find it helpful to read the relevant pages before working through this example.

Overview

- In Step 1, you will create a new project from scratch, enter project information, create a scenario, and add a slope to it.
- In Step 2, you will create a stiff clay, add it to a layer, and place that layer in a borehole.
- In Step 3, you will define groundwater conditions within the slope.
- In Step 4, you will create a soil nail and use it as reinforcement in the slope.
- In Step 5, you will use the Calculation Wizard to create the calculations you want ReActiv to perform.
- In Step 6, you will perform the calculations and review the results.
- In Step 7, you will produce a report summarising the results of the calculations.
- In Step 8, you will close (and optionally save) the project.

If ReActiv is not already running, open the program by pressing the Windows key, typing “ReActiv 2” in the search bar, and clicking on the ReActiv 2 item that should appear. Once the splash screen has disappeared, ReActiv displays its Welcome screen.

If you have an existing project open, click Close on the program’s File menu. (You will be prompted to save your work if you have not already done so.)

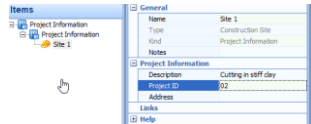
Step 1 – create the project, scenario, and slope

In Step 1, you will create a new project from scratch, enter project information, create a scenario, and add a slope to it.

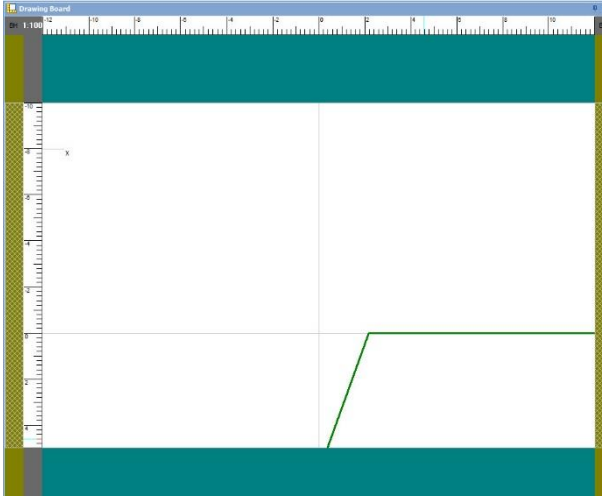
1. On the ribbon, click on the button **New** to create a new project. ReActiv will automatically open its Drawing Board, Project Manager, and Stockyard.



2. In the **Stockyard**, create a Construction Site by clicking on the item labelled “Construction Site” and dragging it to the **Project Manager**. “Site 1” will appear in the Project Manager under the heading Project Information.
3. Double-click on Site 1 in the Project Manager to open its Property Inspector.
4. In the Property Inspector, enter “Cutting in stiff clay” in the **Description** box and “02” in the **Project ID** box.
5. Back in the **Stockyard**, click on the item labelled “Situation” and drag it to the **Project Manager**. “Situation 1” will appear in the Project Manager under the heading Scenarios > Situations. The **Drawing Board** will show a blank canvas with a horizontal and a vertical line across it.
6. In the **Property Inspector**, if necessary, change the **Duration** of “Situation 1” to “Transient”.
7. In the **Stockyard** once more, click on the item labelled “Linear Slope” and drag it to the **Project Manager**. “Slope 1” will appear in the Project Manager under the heading Geometry > Slopes.



8. Select “Slope 1” in the **Project Manager** and drag it onto the **Drawing Board**. The slope will appear on the drawing.
9. In the Property Inspector, change the **Name** of the slope to



“6 m high slope”, change its **Height** to 6 m, and its **Main Slope** to 70°. The **Breadth** changes to 2.18 m. The new dimensions of the slope are reflected in the **Drawing Board**.

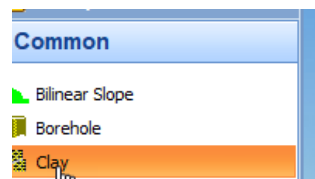
10. The default scale of the drawing is 1:100. To make the drawing larger, right-click on one of the **Drawing Board**’s rulers and select 1:50.

[Docs]\Tutorials\Tutorial 2\Step 1.rvx captures everything so far.

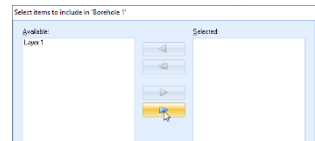
Step 2 – create a soil, layer, and borehole

In Step 2, you will create a stiff clay, add it to a layer, and place that layer in a borehole.

1. In the **Stockyard**, drag a “Clay” onto the **Project Manager**. “Soil 1” will appear under the heading Materials > Soils.
2. In the **Property Inspector**, change the **Name** of the soil to “Stiff clay”, its **State** to “High strength”, and its **Weight Density** to 20 kN/m³.



3. Open the **Drained Strength** category, enter 20° into the **Critical State Friction** box, and press ENTER. The value of the clay's **Critical State Cohesion** defaults to 0 kPa.
4. Back in the **Stockyard**, drag a "Soil Layer" onto the **Project Manager**. "Layer 1" will appear under the heading Geotechnical Constituents > Layers.
5. In the **Property Inspector**, change the **Thickness** of the layer 6 m and the **Soil** to "Stiff clay".
6. Finally in the **Stockyard**, drag a "Borehole" onto the **Project Manager**. "Borehole 1" will appear under the heading Boreholes.
7. In the **Property Inspector**, if necessary change the **Depth** of the borehole to 0 m. Then click the **Select** button and, in the box that appears, click on the >> button to move "Layer 1" from the **Available Items** to the **Selected Items** box. Click OK to close the dialog box.
8. Select "Borehole 1" in the **Project Manager** and drag it onto the **Drawing Board**. The borehole will appear on both sides of the drawing.



[Docs]\Tutorials\Tutorial 1\Step 2.rvx captures everything so far.

Step 3 – define groundwater conditions

In Step 3, you will define groundwater conditions within the slope.

1. In the **Stockyard**, drag a "Slope Groundwater" onto the **Project Manager**. "Water Table 1" will appear under the heading Water Tables.
2. In the **Property Inspector**, change the **Name** of the groundwater to "Custom ru" and its **Flow** to "Custom Flow". Enter a value of 0.15 in the **Custom ru** box.
3. Change the depth of "Custom ru" to 6 m.

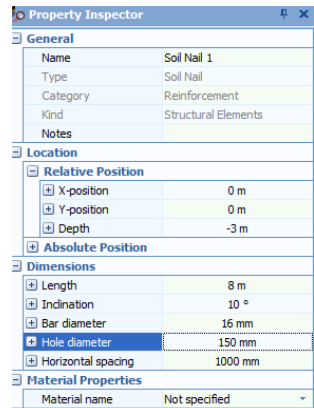
4. Select “Custom ru” in the **Project Manager** and drag it onto the **Drawing Board**. The water table will appear within the slope.

[Docs]\Tutorials\Tutorial 1\Step 3.rvx captures everything so far.

Step 4 – create the reinforcement

In Step 4, you will create a soil nail and use it as reinforcement in the slope.

1. In the **Stockyard**, drag a “Soil Nail” onto the **Project Manager**. “Reinforcement 1” will appear under the heading Structural Elements > Reinforcements.
2. In the **Property Inspector**, change the **Depth** of the soil nail to 1 m and its **Length** to 8 m (this is our initial estimate of the depth and length required). Change the nail’s **Inclination** to 10° , its **Bar Diameter** to 16 mm, and **Hole Diameter** to 150 mm. Leave the bar’s **Horizontal Spacing** as 1000 mm.
3. Right-click on the Stockyard and select the **Steels** command.
4. Drag an “S275” steel onto the **Project Manager**. “Steel 1” will appear under the heading Materials >> Steels.
5. Select “Reinforcement 1” again in the **Project Manager**.
6. Change the **Material Name** to “Steel 1” and select “6 m high slope” in the **Tether To** box. Confirm that the nail’s tensile strength is 55.29 kN/m.

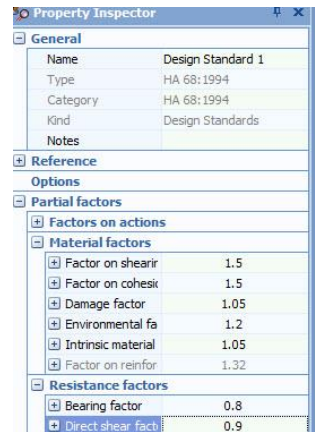


[Docs]\Tutorials\Tutorial 1\Step 4.rvx captures everything so far.

Step 5 – create the design standard

In Step 5, you will create a design standard to apply to your calculations.

3. Right-click on the **Stockyard** and select Design Standards. Drag the item “HA68:1994” onto the **Project Manager**. “Design Standard 1” will appear under the heading Design Standards > Limit State Standards.
4. In the **Property Inspector**, change the **Damage factor** to 1.05, the **Environmental factor** to 1.2, and the **Intrinsic material factor** to 1.05 (these are the values used in HA68’s worked example). The **Factor on reinforcement strength** will change to 1.32.
5. Change the **Direct shear factor** to 0.9.



[Docs]\Tutorials\Tutorial 1\Step 5.rvx captures everything so far.

Step 6 – create the calculation

In Step 6, you will create the calculation you want to perform.

1. Right-click on the **Stockyard** and select Calculations. Drag the item “Two-part wedge analysis” onto the **Project Manager**. “Calculation 1” will appear under the heading Calculations.
2. In the **Property Inspector**, select “Situation 1” in the **Scenario** box and “Design Standard 1” in the **Design Standard** box.
3. Under Options, set the **Drainage Condition** to “Drained” and untick the options **Use peak strength** and **Extra layer at top**. The options **Tension on wedge 1** and **Reduced nail lengths** should remain ticked. (These options match what are given in HA68’s worked example.)
4. Under Search Options, tick the box **At grid points** and, under Search Grid, make sure that the **Automatic grid** box is also ticked.

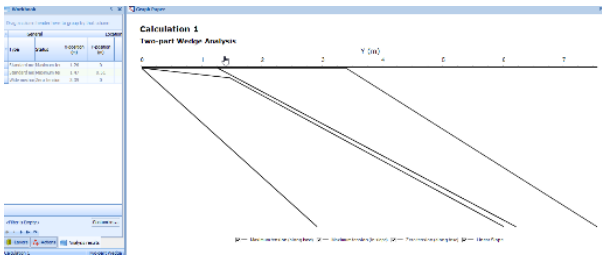
- Finally, tick the box next to **Reinforcement 1** (under the heading Reinforcements) to use this reinforcement to stabilize the slope.

[Docs]\Tutorials\Tutorial 1\Step 6.rvx captures everything so far.

Step 7 – perform and review the calculation

In Step 7, you will perform the calculation and review the results obtained.

- Run the calculation by selecting the Build tab on ReActiv's ribbon and then clicking on the **Run All** button.
- ReActiv will perform Calculation 1 and then change to its Checking Desktop. Your screen will now look something like this:



GOT TO HERE

- The Graph Paper shows the three mechanisms that are needed to define the required reinforced zone, namely the mechanisms with:
 - the maximum tension in the slope
 - the maximum tension along the base
 - zero tension along the base
- The Workbook shows the same information but in tabular format. The Workbook contains a lot more information than is initially shown. To display this additional information, click on the button labelled *1** in the top-left-hand corner of the

Workbook (to the left of the heading 'General') and select the data you want to see.

ReActiv displays a dialog box giving you the new result:

- $X = 1.54 \text{ m}$
- $Y = -0.27 \text{ m}$
- $\theta_1 = 59.2^\circ$
- $T = 207.90 \text{ kN/m}$

These values are in close agreement with the results given in the **Advice Note**.

[Docs]\Tutorials\Tutorial 1\Step 7.rvx captures everything so far.

Step x – close the project

In Step x, you will close and – optionally –save the project. (Note: this is not available in the Trial Edition.)

4. Close the project by clicking on the File menu's Close command.
5. If you have made changes to the project since it was last saved, ReActiv will ask you if you want to save before proceeding. Answer Yes or No by clicking the appropriate button.
6. ReActiv will then (if requested) save and close the project.

You will find a copy of the project in its current form here:

<Documents>\Tutorial 2\Step 5.rav

According to ReActiv, the slope being analysed requires six layers of reinforcement and, for the most efficient layout, the layers would be placed at the following depths:

- Layer 1 at 1.34 m
- Layer 2 at 2.68 m
- Layer 3 at 3.79 m
- Layer 4 at 4.65 m
- Layer 5 at 5.37 m
- Layer 6 at 6.00 m

The length of the first layer of reinforcement is 10.05 m.

Reducing the nail lengths

The Advice Note describes a method of reducing the required length of soil nails by reducing the horizontal spacing of the first row of nails and determining the layout of the other layers based on the length of the second row. A discussion of this is given in paragraphs 4.20-4.22 of the Advice Note.

To take advantage of this alternative method of calculating the required reinforcement, choose **Design > Reduce Nail Lengths** from the menu bar. Then choose **Build > Calculate All** to re-calculate the required reinforcement based on the alternative method and display the results in the Reinforcement View.

According to ReActiv, the length of the top row of soil nails may be reduced to 8.36 m (a saving of 1.69 m) provided its horizontal spacing is reduced to 775 mm. The lengths of the other layers of reinforcement are reduced as well.

You will find a copy of the project in its final form here:

<Documents>\Tutorial 2\tutorial 2.rav

Tutorial 3: fixed vertical spacings

Introduction

This tutorial shows you how to optimize your reinforced slope designs using ReActiv. It assumes that you have already been through Tutorials 1 and 2.

- The worked example comprises a 9.5 m high slope in sand, which will be reinforced by horizontal geotextiles.
- The lower part of the slope has an inclination of 70° and height of 8 m, while the upper part has an inclination of 15° and height of 1.5 m.
- The sand has an angle of shearing resistance of 32° , zero effective cohesion, and a bulk density of 20 kN/m^3 . These parameters are critical state values and hence should be used with partial safety factors of 1.
- Bishop's pore pressure parameter for the slope (r_u) is 0.15.
- There is a 10 kPa surcharge at the top of the slope.
- Five different grades of geotextile are available with the following characteristic tensile strengths: 6, 25, 35, 50, and 60 kN/m. The geotextiles will be placed at a constant vertical spacing of 600 mm.
- The bearing and direct shear factors are both 0.8 and the interwedge friction factor is 0.25.

Overview

- In Step 1, you will create a new project from scratch, enter project information, create a scenario, and add a slope to it.
- In Step 2, you will use the Borehole Wizard to create a borehole containing a sand layer and then modify the properties of the sand.
- In Step 3, you will define groundwater conditions within the slope.
- In Step 4, you will apply a uniform surcharge loading to the slope crest.


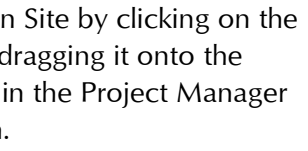
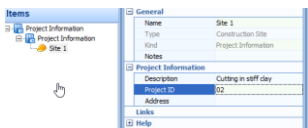
- In Step 5, you will create a range of geotextiles and use them as reinforcement in the slope.
- In Step 6, you will create a design standard and calculation.
- In Step 7, you will perform the calculations and review the results.
- In Step 8, you will close (and optionally save) the project.

If ReActiv is not already running, open the program by pressing the Windows key, typing “ReActiv 2” in the search bar, and clicking on the ReActiv 2 item that should appear. Once the splash screen has disappeared, ReActiv displays its Welcome screen.

If you have an existing project open, click Close on the program’s File menu. (You will be prompted to save your work if you have not already done so.)

Step 1 – create the project, scenario, and slope

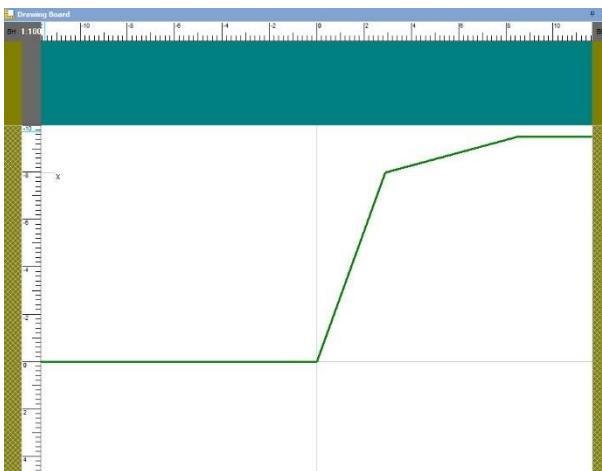
In Step 1, you will create a new project from scratch, enter project information, create a scenario, and add a slope to it.

1. On the ribbon, click on the button **New** to create a new project. ReActiv will automatically open its Drawing Board, Project Manager, and Stockyard.
 
2. In the **Stockyard**, create a Construction Site by clicking on the item labelled “Construction Site” and dragging it onto the **Project Manager**. “Site 1” will appear in the Project Manager under the heading Project Information.
 
3. Double-click on Site 1 in the Project Manager to open its Property Inspector.
4. In the Property Inspector, enter “Geogrids at fixed vertical spacing” in the **Description** box and “03” in the **Project ID** box.
 
5. Back in the **Stockyard**, click on the item labelled “Situation” and drag it to the **Project Manager**. “Situation 1” will appear in the Project Manager under the heading Scenarios >

Situations. The **Drawing Board** will show a blank canvas with a horizontal and a vertical line across it.

6. In the **Property Inspector**, if necessary, change the **Duration** of “Situation 1” to “Transient”.
7. In the **Stockyard** once more, click on the item labelled “Bi-linear Slope” and drag it to the **Project Manager**. “Slope 1” will appear in the Project Manager under the heading Geometry > Slopes.
8. Select “Slope 1” in the **Project Manager** and drag it onto the **Drawing Board**. The slope will appear on the drawing.
9. In the Property Inspector, change the **Name** of the slope to “Two-part slope”, change its **Lower height** to 8 m, **Lower slope** to 70°, **Upper height** to 1.5 m, and **Upper slope** to 15°. The total height of the slope will change to 9.5 m and its breadth to 8.51 m.

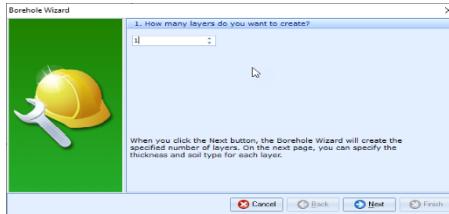
[Docs]\Tutorials\Tutorial 3\Step 1.rvx captures everything so far.



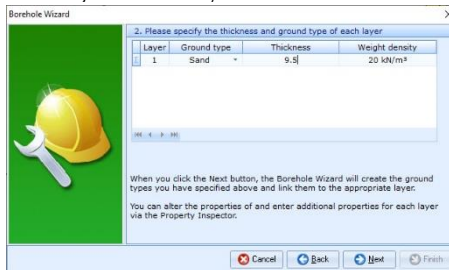
Step 2 – create the borehole and modify the soil properties

In Step 2, you will use the Borehole Wizard to create a borehole containing a sand layer and then modify the properties of the sand.

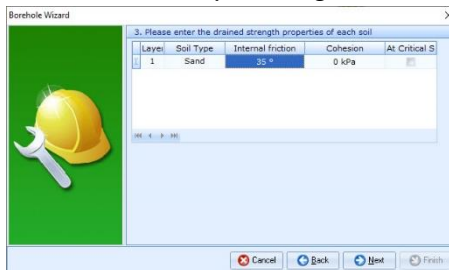
1. Open the Borehole Wizard by selecting the Wizards tab on ReActiv's ribbon and clicking on the **Borehole Wizard** button.
2. When the Wizard appears, set the number of layers to 1.



3. Click **Next** to display the next page. Change Layer 1's thickness to 9.5 m and (if necessary) its soil type to "Sand" and weight density to 20 kN/m³.



4. Click **Next** to display the next page. Change the sand's **Internal friction** to 35° but leave its **Cohesion** unchanged at 0 kPa. This is the sand's peak angle of friction.



5. Click **Next** to display the next page. The sand layer does not appear on this page since it does not have undrained properties.
6. Click **Next** to display the next page. Tick Situation 1 to add the borehole to the existing scenario.

7. Click **Next** to display the next page. If you wish to review any of the settings you have made, click **Back** to return to the relevant page.
8. When you are ready, click Finish to generate the borehole. The Borehole Wizard then:
 - Creates Soil 1, Layer 1, and Borehole 1
 - Links Soil 1 to Layer 1
 - Adds Layer 1 to Borehole 1
9. In the **Project Manager**, click on “Soil 1” (under the heading Materials > Soils). Its properties will automatically be displayed in the **Property Inspector**.
10. In the **Property Inspector**, change the **Name** of the soil to “Sand” and enter 32° into the **Critical State Friction** box and press ENTER. The value of the sand’s **Critical State Cohesion** defaults to 0 kPa.

[Docs]\Tutorials\Tutorial 3\Step 2.rvx captures everything so far.

Step 3 – define groundwater conditions

In Step 3, you will define groundwater conditions within the slope.

1. In the **Stockyard**, drag a “Slope Groundwater” onto the **Project Manager**. “Water Table 1” will appear under the heading Water Tables.
2. In the **Property Inspector**, change the **Name** of the groundwater to “Custom ru” and its **Flow** to “Custom Flow”. Enter a value of 0.15 in the **Custom ru** box.
3. Change the depth of the water table to 9.5 m.
4. Select “Custom ru” in the **Project Manager** and drag it onto the **Drawing Board**. The water table will appear at the base of the slope.

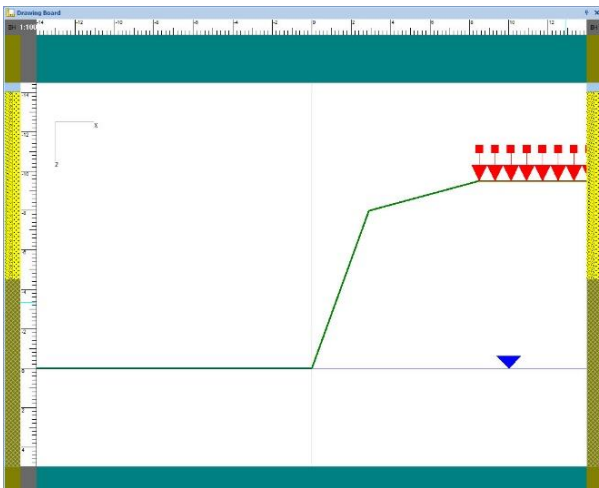
[Docs]\Tutorials\Tutorial 3\Step 3.rvx captures everything so far.

Step 4 – apply a surcharge

In Step 4, you will apply a uniform surcharge loading to the slope crest.

1. Right-click on the **Stockyard** and select “Actions”. Drag a “Custom Uniform Surcharge” onto the **Project Manager**. “Surcharge 1” will appear under the heading Actions > Surcharges.
2. In the **Property Inspector**, change the **Magnitude** of the surcharge to 10 kPa and select “Two-part slope” in the **Tether To** box.
3. Select “Surcharge 1” in the **Project Manager** and drag it onto the **Drawing Board**. The surcharge will appear at the crest of the slope.

[Docs]\Tutorials\Tutorial 3\Step 4.rvx captures everything so far.

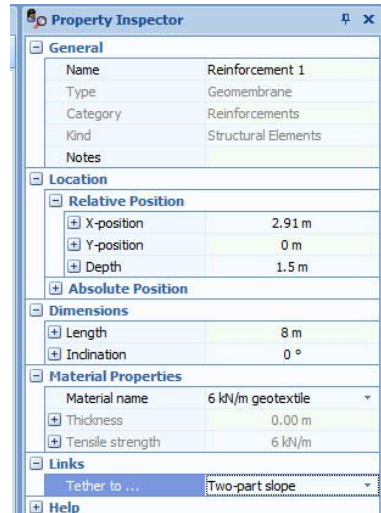


Step 5 – create the reinforcement

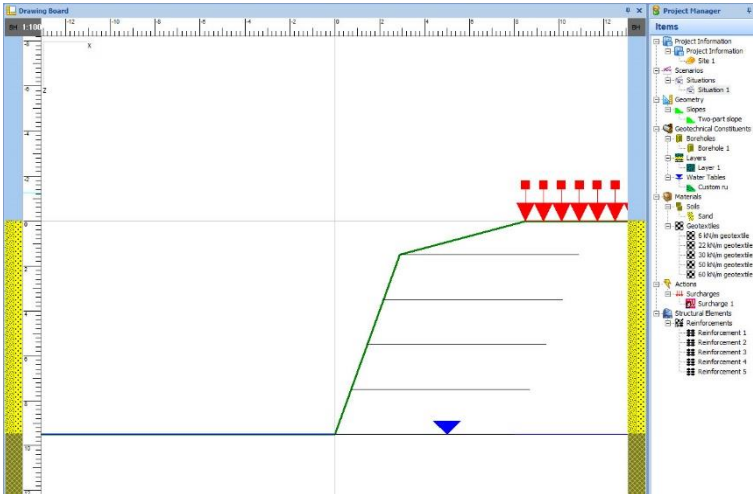
In Step 5, you will create a range of geotextiles and use them as reinforcement in the slope.

1. Right-click on the **Stockyard** and select “Geotextiles”. Hold the CTRL key down and click on the items “Terram T700”, “Terram RG4”, “Terram RG6”, “Terram RG9”, and “Terram RG11” to add them to the **Project Manager**. These items will appear under the heading Materials > Geotextiles.

2. In the **Project Manager**, select “Geotextile 1” and then, in the **Property Inspector** change its **Name** of Geotextile 1 to “6 kN/m geotextile”.
3. Repeat the previous step for Geotextiles 2 to 5, naming each item according to the value of its tensile strength, i.e. “22 | 30 | 50 | 60 kN/m geotextile” respectively.
4. Right-click on the **Stockyard** and select “Common”. Drag a Geomembrane onto the **Project Manager**.
5. In the **Property Inspector**, change the **Depth** of Reinforcement 1 to 1.5 m and its **Length** to 8 m (this is our initial estimate of the depth and length required). Change the **Material Name** to “6 kN/m geotextile” and select “Two-part slope” in the **Tether To** box. Confirm that the reinforcement’s tensile strength is 6 kN/m.
6. Drag “Reinforcement 1” from the **Project Manager** onto the **Drawing Board**. The reinforcement will appear within the slope.
7. In the **Project Manager**, right-click on “Reinforcement 1” and select Edit > Duplicate.
8. Then, in the **Property Inspector** change the **Name** of “Reinforcement 1 – Copy” to “Reinforcement 2”, its **Depth** to 3.5 m, and its **Material Name** to “22 kN/m geotextile”.
9. Drag “Reinforcement 2” from the **Project Manager** onto the **Drawing Board**.
10. Repeat the previous three steps to create Reinforcement 3 at 5.5 m **Depth** with **Material Name** “30 kN/m geotextile”.



11. Repeat again to create Reinforcement 4 at 7.5 m **Depth** with **Material Name** “50 kN/m geotextile”.
12. Repeat again to create Reinforcement 5 at 9.5 m **Depth** with **Material Name** “60 kN/m geotextile”.



[Docs]\Tutorials\Tutorial 3\Step 5.rvx captures everything so far.

Step 6 – create the design standard and calculation

In Step 6, you will create a design standard and calculation.

1. Right-click on the **Stockyard** and select Design Standards. Drag the item “HA68:1994” onto the **Project Manager**.
2. Right-click on the **Stockyard** again, select Calculations, and then drag the item “Two-part Wedge Analysis” onto the **Project Manager**. “Calculation 1” will appear under the heading calculations > Two-part Wedge Analysis.
3. In the **Property Inspector**, select “Situation 1” in the **Scenario** box and “Design Standard 1” in the **Design Standard** box.
4. Under Options, set the **Drainage Condition** to “Drained”, untick the options **Use peak strength** and **Tension on wedge 1**. The other options should remain ticked.
5. Enter 600 mm in the **Constant vertical spacing** box and 0.25 in the **Interwedge friction ratio** box.

6. Finally, tick the boxes next to **Reinforcement 1-5** (under the heading Reinforcements) to use these reinforcements to stabilize the slope.

[Docs]\Tutorials\Tutorial 3\Step 6.rvx captures everything so far.

[GOT TO HERE]

Note how the program chooses the weakest reinforcement that provides sufficient strength at each depth to support the slope. The program will issue an error message if none of the reinforcements you specify are strong enough to support the slope.

Further examples

Introduction

The examples described in this chapter are identical to the examples given in Appendix J of the UK Highways Agency's Advice Note. If you have a copy of the Advice Note, you may find it helpful to read the relevant pages before working through this chapter.

Exploring ReActiv's capabilities

If you have worked through the tutorials given earlier in this document, you will already know how easy ReActiv is to use and how quickly it performs the calculations necessary to design a reinforced slope. Moreover, there is still plenty of scope for you to experiment with the program. In particular, you can:

- Change the water regime in the slope
- Change the surcharge that acts at the crest of the slope
- Change the type and properties of the reinforcement
- Calculate the reinforcement required to stabilize the slope
- Change various options that control those calculations
- Change the project information attached to the document
- Print the input and output data for the supplied examples
- Preview the printer's output on screen

In order to obtain a better appreciation of ReActiv's technical capabilities, we recommend that you try changing some or all of the options listed above and see what effect this has on the results of the calculations.

If you want to check that ReActiv is producing correct results, you can run one or more of the supplied examples and compare the results with those given in the Advice Note.

Supplied examples

A number of example projects are copied onto your hard disk when you install ReActiv. The projects have been given the names EXAMPLE<n>.RAV, where <n> is an integer between 1 and 7. The

examples have been taken from Appendix J of the Advice Note and are described briefly on the following pages (please note that Example 4 is intentionally missing).

Example 1: embankment in dense sand

Example 1 is described in Tutorial 1 on page 10.

Example 2: embankment in stiff clay

Example 2 comprises a 10m high slope made out of stiff clay, which is reinforced by horizontal geotextiles so that it can stand at 30° to the horizontal.

The clay has an angle of shearing resistance of 20°, effective cohesion of 1 kN/m², and a bulk density of 19 kN/m³. Bishop's pore pressure parameter for the slope (r_u) is 0.25. There is a surcharge of 10 kN/m² at the top of the slope.

The reinforcement has a design strength of 28.9 kN/m (after applying various factors-of-safety to it). The geotextile's direct shear factor is 0.95 (in the Advice Note, this parameter is called the interface sliding factor, α). Since the Advice Note does not allow for interwedge friction, the interwedge friction factor is set to zero.

You will find a copy of this project here:

<Documents>\Examples\Example 2.rav

T_{\max} mechanism

According to ReActiv, the mechanism with the largest out-of-balance force anywhere in the slope (i.e. the T_{\max} mechanism) has the following properties:

$$X = 13.27 \text{ m}, Y = 0.00 \text{ m}, \theta_1 = 46.4^\circ, T_{\max} = 301.68 \text{ kN/m}$$

In the Advice Note, the equivalent height of the slope (H') is rounded down to 10.5 m from 10.53 m. This causes the Advice Note to give

slightly different results to those obtained by ReActiv (i.e. $T_{\max} = 298 \text{ kN/m}$).

T_{ob} mechanism

The critical mechanism that requires exactly zero reinforcement to be stable (i.e. the Tob mechanism) has the following properties:

$$X = 22.46 \text{ m}, Y = 0.00 \text{ m}, \theta_1 = 55.0^\circ, T_{\max} = 0.00 \text{ kN/m}$$

The X-value is in close agreement with the length LB given in the Advice Note (despite the rounding mentioned above).

Required reinforcement

The slope being analysed requires twelve layers of reinforcement and, for the most efficient layout, the layers would be placed at the following depths:

$$1.06, 2.65, 3.96, 4.97, 5.82, 6.57, 7.25, 7.87, 8.45, 9.00, 9.51, 10.00 \text{ m}$$

These depths are identical to those given in the Advice Note. The required length of the layers varies from 8.14 m at the top to 22.46 m at the bottom.

Example 3: cutting in stiff clay

Example 3 is described in Tutorial 2 on page 23.

Example 4

Example 4 is not included as an example with ReActiv.

Example 5: slip repair in stiff clay

Example 5 comprises a 7 m high embankment made out of stiff clay. The embankment has suffered a surface slip which is to be repaired by replacing the slipped material with soil reinforced by geotextiles. The slope is to stand at an angle of 26.56° to the horizontal (i.e. 1:2 vertical to horizontal).

From a back analysis of the slip, the clay has an angle of shearing resistance of 20° , effective cohesion of 1.5 kN/m^2 , and a bulk density of 20 kN/m^3 , assuming Bishop's pore pressure parameter for the slope (r_u) is 0.0. For design purposes, however, the angle of shearing resistance is to be reduced to 18.3° and the effective cohesion to 0 kN/m^2 . There is no surcharge at the top of the slope.

The reinforcement has a design strength of 15.8 kN/m (after applying various factors-of-safety to it). The geotextile's direct shear factor is 0.8 (in the Advice Note, this parameter is called the interface sliding factor, α). Since the Advice Note does not allow for interwedge friction, the interwedge friction factor is set to zero.

You will find a copy of this project here:

<Documents>\Examples\Example 5.rav

T_{max} mechanism

According to ReActiv, the T_{max} mechanism has the following properties:

$$X = 8.79 \text{ m}, Y = 0.00 \text{ m}, \theta_1 = 42.3^\circ, T_{\max} = 76.96 \text{ kN/m}$$

These values are in close agreement with the Advice Note.

T_{ob} mechanism

The T_{ob} mechanism has the following properties:

$$X = 13.90 \text{ m}, Y = 0.00 \text{ m}, \theta_1 = 54.1^\circ, T_{\max} = 0.00 \text{ kN/m}$$

The X-value is in close agreement with the length *LB* given in the Advice Note.

Required reinforcement

The slope being analysed requires six layers of reinforcement and, for the most efficient layout, the layers would be placed at the following depths:

1.57, 3.13, 4.43, 5.42, 6.26, and 7.00 m

These depths are identical to those given in the Advice Note. The required length of the layers varies from 4.83 m at the top to 13.90 m at the bottom.

Example 6: cutting with unstable upper slope

Example 6 comprises a 9 m high two-part slope, made out of stiff clay. The lower part of the slope is 3 m high and is to stand at 60° to the horizontal. The upper part of the slope is 6m high and is to stand at 27° to the horizontal. The slope is reinforced by inclined soil nails.

The clay has an angle of shearing resistance of 22° , effective cohesion of 2 kN/m^2 , and a bulk density of 20 kN/m^3 . Bishop's pore pressure parameter for the slope (r_u) is 0.25. There is no surcharge at the top of the slope.

The reinforcement has a design strength of 41.8 kN/m (after applying various factors-of-safety to it). The 16 mm diameter soil nails are inclined at 10° to the horizontal and are spaced at 1 m intervals horizontally in the lower slope and at 2 m intervals horizontally in the upper slope. The holes in which they are installed are 150 mm in diameter. The nails' direct shear factor is 0.8 (in the Advice Note, this parameter is called the interface sliding factor, α). Since the Advice Note does not allow for interwedge friction, the interwedge friction factor is set to zero.

Analysing two-part slopes

When ReActiv analyses a Two-part slope, it determines the reinforcement required to stabilize the lower part, assuming that the upper slope is stable (and therefore requires no reinforcement). If the upper slope is not stable, it is necessary to conduct a second analysis in order to determine what reinforcement should be placed in the upper slope to correct this.

To analyse the upper slope, all you need to do is the regard the lower slope as a competent bearing foundation and to treat the upper slope as if it were a One-part slope. In the example considered here, that means

treating the upper slope as a 6m high slope standing at 27° to the horizontal.

The example project that are supplied with ReActiv illustrate how this can be done. The file EXAMPLE6.RAV can be used to determine the reinforcement required to stabilize the lower slope and EXAMPLE7.RAV to determine the reinforcement required to stabilize the upper slope.

You will find a copy of Example 6 here:

<Documents>\Examples\Examples 6.rav

T_{max} mechanism

According to ReActiv, the T_{\max} mechanism for the lower slope has the following properties:

$$X = 9.54 \text{ m}, Y = 2.00 \text{ m}, \theta_1 = 46.4^\circ, T_{\max} = 140.13 \text{ kN/m}$$

These values differ from the Advice Note because, by default, ReActiv applies all the reinforcement force to Wedge 2 (the lower wedge), whereas in the Advice Note the reinforcement force is applied to Wedge 1 (the upper wedge). A full discussion of these issues can be found in the ReActiv Reference Manual.

To reproduce the results given in the Advice Note, choose **Design > Tension on Wedge 1** from the main menu and answer Yes to the question asking whether you want to proceed. When you recalculate T_{\max} , it has the following properties:

$$X = 8.92 \text{ m}, Y = 1.44 \text{ m}, \theta_1 = 47.1^\circ, T_{\max} = 159.4 \text{ kN/m}$$

These values are in reasonable agreement with the Advice Note (which gives $X = 8.0 \text{ m}$, $Y = 0.8 \text{ m}$, $\theta_1 = 45^\circ$, and $T_{\max} = 160 \text{ kN/m}$).

T_{ob} mechanism

With the **Tension on Wedge 1** option set, the T_{ob} mechanism has the following properties:

$$X = 10.93 \text{ m}, Y = -1.93 \text{ m}, \theta_1 = 53.8^\circ, T_{\max} = 0.00 \text{ kN/m}$$

The X -value is in reasonable agreement with the length LB (= 10.7 m) given in the Advice Note.

Required reinforcement

The slope being analysed requires five layers of reinforcement and, for the most efficient layout, the layers would be placed at the following depths:

$$0.75, 1.50, 2.12, 2.60, \text{ and } 3.00 \text{ m}$$

The required length of the layers varies from 10.39 m at the top to 11.0 m at the bottom.

Example 7: upper slope of Example 6

Example 7 comprises the upper slope of Example 6 (see above).

You will find a copy of Example 7 here:

<Documents>\Examples\Example 7.rav

T_{max} mechanism

According to ReActiv, the T_{\max} mechanism for the upper slope has the following properties:

$$X = 7.24 \text{ m}, Y = 0.10 \text{ m}, \theta_1 = 41.5^\circ, T_{\max} = 32.17 \text{ kN/m}$$

These values differ from the Advice Note because, by default, ReActiv applies all the reinforcement force to Wedge 2 (the lower wedge), whereas in the Advice Note the reinforcement force is applied to Wedge 1 (the upper wedge). A full discussion of these issues can be found in the ReActiv Reference Manual.

To reproduce the results given in the Advice Note, choose **Design > Tension on Wedge 1** from the main menu and answer **Yes** to the question asking whether you want to proceed. When you recalculate T_{\max} , it has the following properties:

$$X = 5.31 \text{ m}, Y = -0.94 \text{ m}, \theta_1 = 37.9^\circ, T_{\max} = 36.41 \text{ kN/m}$$

These values differ slightly from the results given in the Advice Note, but the difference is not of engineering significance.

T_{ob} mechanism

With the **Tension on Wedge 1** option set, the T_{ob} mechanism has the following properties:

$$X = 8.52 \text{ m}, Y = -1.50 \text{ m}, \theta_1 = 49.6^\circ, T_{\max} = 0.00 \text{ kN/m}$$

The X -value is in reasonable agreement with the length LB ($= 8.4 \text{ m}$) given in the Advice Note.

Required reinforcement

The slope being analysed requires three layers of reinforcement and, for the most efficient layout, the layers would be placed at the following depths:

2.12, 4.24, and 6.00 m

The required length of the layers varies from 9.14 m at the top to 8.65 m at the bottom.