KeyWallPRO QuickStart Guide
- Simple Wall Design – Section Analysis -

This QuickStart guide is an introduction to preparing a simple section wall design. KeyWallPRO is a powerful design program with numerous features so the User should utilize the Help files and experimentation to learn about all the features and options prior to preparing estimates and designs.

New Wall Section Analysis is selected from the New Project listing under the File menu.

This guide assumes the User has reviewed the File Management and Saving Guide to set up a project backup path and can fill in the appropriate client, project name, backup path, etc. information during this process.

The following steps are the simplest and fastest way to generate a wall design without addressing the many setting and variations that KeyWallPRO allows. Preliminary design estimates and final wall designs in the real world require complying with specifications, design methodologies, and more complex design situations than a simple example can address.

Step 1 - Review Program Options and Settings.
Step 2 - Select Design Methodology and Create Wall.
Step 3 - Review Empirical Design Criteria.
Step 4 - Select Keystone Wall Unit Type and Batter.
Step 5 - Select Reinforcement Type.
Step 6 - Select Soil Condition Parameters.
Step 7 - Enter Extreme Event criteria if applicable.
Step 8 - Design, Enter Section Height, Embedment and Top of Wall Surcharges.
Step 9 - Print Trial Wall Design.

The Simple Wall Design is intended to show the basic steps necessary to perform a wall section analysis. Every program tab permits modification too many parts of the design walls in practice may be considerably more complicated than this simple example.
Step 1 - Review Program Options and Settings

Reviewing the KeyWallPRO Options is a good place to start when first using the software prior to designing a wall. These global settings apply to all wall designs generated by KeyWallPRO and should be set at the beginning of program use, although they can be changed at any time.

1. Select Options from the Settings drop-down menu list.
2. Review the various options under the tabs prior to program use.

Step 2 - Select Design Methodology & Create Wall

A design methodology is the User's choice but can be mandated by project requirements. Each design methodology has its own requirements and methods, so the answers will be different for each method for the same retaining wall. The User should become familiar with each methodology before selection to understand the benefits and limitations of each.

3. Select a design methodology from the Methodology drop-down menu list (NCMA selected in this example)
4. Press the Create Wall button.
5. Enter name or number of wall in the dialog box and press the OK button. Wall names or numbers will be listed along the top of program window for easy access.
Step 3 - Review Empirical Design Criteria

Design Criteria can be modified for each wall and reflects both empirical design criteria as well as factors of safety and load/resistance factors depending on design methodology.

The empirical criteria is the most useful to review since they control aspects of the wall and reinforcement layout that would be of most interest to the wall designer. The example below looks at the empirical criteria for the Reinforced Analysis and Common Criteria for the selected wall under NCMA criteria for this example.

1. Select the **Design Criteria** tab then the Reinforced Analysis type and Empirical Checks.
2. Review and edit the reinforcement spacing criteria as needed.
   - Max. Reinforcement Separation limits reinforcement spacing between levels (ft.).
   - Max. Multiple of Hu limits reinforcement spacing from the top and bottom of wall in block height increments (no. of blocks).
3. Review and edit the reinforcement length criteria as needed.
   - Min. anchorage length is the minimum distance beyond failure plane (ft.).
   - Min L/H ratio is the minimum base to height ratio regardless of calculation (ratio)
   - Min. reinforcement length is the minimum length regardless of calculation (ft.)
4. Select the Common Criteria type and Empirical Checks (criteria applies to reinforced or gravity walls).
5. Review and edit the minimum embedment criteria as needed.
Step 4 - Select Unit Type & Batter

The **Wall Unit** tab is for selecting the appropriate Keystone unit for the wall design. The User should have knowledge of locally available Keystone products and the appropriateness of selected products for a given project's structural and aesthetic requirements.

Under the **Wall Unit** tab, Keystone units can be selected first from the Product Line dropdown menu box that defines the product type and then from the Units dropdown menu box which provides a list of possible products for that product line included in the software data file.

The **Wall Unit** tab also allows the User to define wall batter for units that allow variable batter and also specify the capping size on top of the wall. Design information is provided after the unit is selected. There is also an option to define leveling pad dimension.

1. Select Product Line and select Keystone Pinned Systems for this example.
2. Select Wall Unit and select Compac III unit.
3. Leave Fascia Batter set at 8˚ default.
4. Leave Cap Height set at Half Height default
5. Leave Leveling Pad at defaults shown.

![KeyWall PRO](image)
Step 5 - Select Reinforcement Type

The **Reinforcement** tab is for selecting the appropriate soil reinforcement that goes with the selected Keystone unit for the wall design. The User should have knowledge of locally available geosynthetic products and the appropriateness of selected products for a given project’s geotechnical and structural requirements.

Under the **Reinforcement** tab, a geosynthetic supplier/manufacturer can be selected from the Suppliers dropdown menu box. Then the products tested with the Wall Units selected previously will be presented in the Available Products listing. One or more products can be selected for use in the wall by double-clicking on the selection or using the arrow buttons.

After the Reinforcement and the Soil Category are selected, the design parameters are filled in on the remainder of the screen.

1. Select Supplier dropdown menu and select TenCate Mirafi - Miragrid for this example.
2. Select 3XT - Miragrid 3XT from the product listing.
3. Double-click or press right arrow key to move 3XT - Miragrid 3XT to "Used in this wall" list.
4. Select appropriate reinforced fill type, sands is selected for this example.
5. Review the Generation Increment setting. For this example the geogrid length generation Increment has been set to one foot.
Step 6 - Set Soil Condition Parameters

The Soil Conditions tab is for inputting the appropriate soil design properties for use in the analysis. The User should have knowledge of project soil conditions and proposed backfill materials. The Soil Conditions tab also allows for the optional definition of basic wall drainage elements.

The User will enter the appropriate effective stress parameters for the zones defined in the input table and can add descriptions as needed.

1. Enter the friction angle (\( \phi \) angle) for the reinforced, retained, and foundation soil zones, 30° used in this example.
2. Enter the in-place unit weight (\( \gamma \)) for the reinforced, retained, and foundation soil zones, 120 pcf used in this example.
3. Leveling pad material properties are only used for gravity wall design and can be ignored in this example.
4. Soil description will not be added in this example.
5. To include a depiction in typical section of the drainage behind the wall check include drainage.
Step 7 - Extreme Event

The Extreme Events tab is for inputting seismic parameters and will be ignored in this simple example. See Keystone design manual for further information regarding seismic design.

Step 8 - Design

The Design tab is where the reinforcement design generation and analysis takes place. KeyWall Pro will perform a trail generation based on the Design Criteria spacing criteria and the reinforcement type specified in the Reinforcement tab.

For this example, a trial generation will be done from the information previously input and from the design tab.

1. Use Add button to add a section to analyze. Enter name or wall station for new section. Multiple sections can be analyzed under the Wall #1 tab by clicking the Add button to add additional sections.

2. Enter Design Height and Embedment. KeyWall Pro will calculate exposed height and facing height based on entered values. Check include cap in height if it’s considered in wall design. Adjust as necessary to match required design height.

3. Enter slope angle, live load and/or dead load surcharges along with corresponding offsets based on loading geometry above wall.

4. Reinforcement type is based on reinforcement selections made on Reinforcement tab. When checked the Force Uniform Grid Length will adjust all geogrid layers to the same length based on longest required length for wall section.
Step 8 - Design

5. Once wall design height and loading conditions are representative of design section click **Generate**. KeyWallPRO will create a geogrid layout based on the design criteria selected previously.

6. If the generated design is acceptable continue on to Step 8. If changes are required to geogrid spacing or geogrid length, highlight the block below the geogrid layer.

7. With the block below the geogrid layer highlighted the geogrid length, strength can be adjusted or removed. To adjust the geogrid length enter a new length and click the green edit button. To change geogrid strength use the drop down menu to select different geogrid strength and click the red edit button. Multiple geogrid layers can be selected by using shift key. To remove layer click the remove button. Alternatively, double chick block below geogrid layer to remove.

8. If a geogrid layer needs to be added, highlight the block below where the new layer should be added and click the add button or double click block to add layer. Adjust length and strength as necessary.

9. If changes have been made to the geogrid layout in the design section the user must click **Analyze** to re-evaluate section.
Step 9 - Printout Design

When the wall design is complete, a printout of the selected design section summaries is typically required by the User.

1. Select **PDF Report** from **File** menu.
2. Select Section(s) from the **Wall/Sections** window. (Control-Click to select multiple sections)
3. Select **Summary Report** check Section Analysis Summary to print design calculations for section(s) highlighted above.
4. Press **Preview/Print button**. A PDF report will be generated. This report can be printed or saved. Report can also be saved clicking the save button.