CYPE Soil Retention Elements

Simple and trustworthy programs for soil retention

Analysis, check and design of reinforced concrete elements comprising embedded retaining walls and cantilever retaining walls.

Embedded retaining walls

Embedded retaining walls. This has been developed for the design and check of generic embedded retaining walls composed of any material; reinforced concrete, reinforced concrete secant pile walls, mini pile screen and steel sheet piles. The program designs the reinforcement in the case of reinforced concrete walls. An assistant is available to help introduce the data for the most common cases of several basement levels in buildings. A simple assistant is also available for buildings with one or two basement levels.

A program for **site and civil works** that carries out the **design and Code check of embedded retaining walls** of the following types: generic of any material, reinforced concrete slurry, reinforced concrete in-situ piles, steel sheet piles, and mini pile screens, incorporating the design and detailing of the reinforcement for the reinforced concrete types.

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Modules

Three modules are available to design and check specific types of walls. These modules can be acquired together or separately:

- **Reinforced concrete retaining walls**
  Analysis, design and reinforcement of reinforced concrete, concrete pile and mini pile retaining walls.

- **Steel sheet pilings**
  Analysis and design of ArcelorMittal Catalogue and generic steel sheet piling.

- **Worst case slip circle**
  More information on this module can be found in the Safety checks section.

Construction Phases
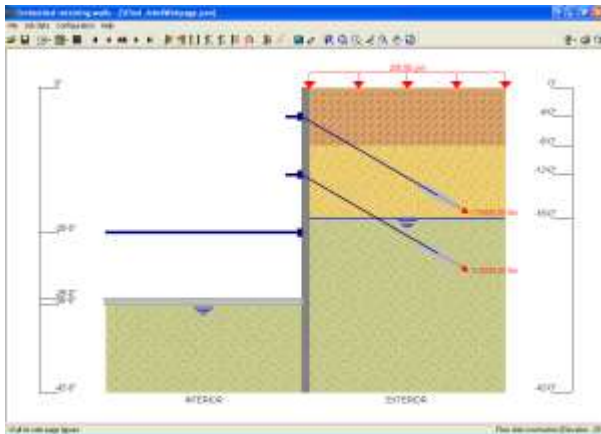
One can define the different phases or **stages of construction**, indicating:

- Different depths of excavation.
- Struts or braces.
- Passive anchors (temporary or permanent).
- Active anchors (temporary or permanent).
- Foundation at the bottom of the excavation.
- Floor slabs at different levels.
- Exterior loads applied on the ground.
- Loads transmitted by the basement floors.
- Loads at the top of the retaining wall.
- Shrinkage in the floors slabs.
- Temperature effects in the struts.
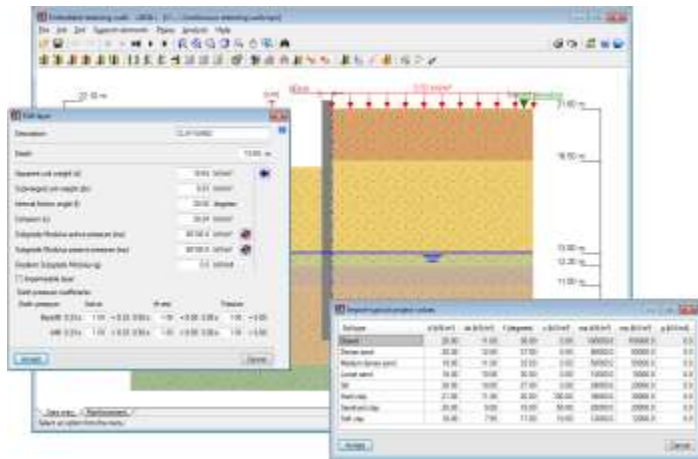
Soil

Users can define layers with different thicknesses with the properties obtained from the **soils library**, which contains the most common types of soils. User-defined soils can also be added.

Berms can be applied at the infill and excavations at the backfill in specific phases.

Users can indicate the **water table** and **rock layer** levels. The program also allows users to define **impermeable layers** to indicate there may be layers with very different permeability.
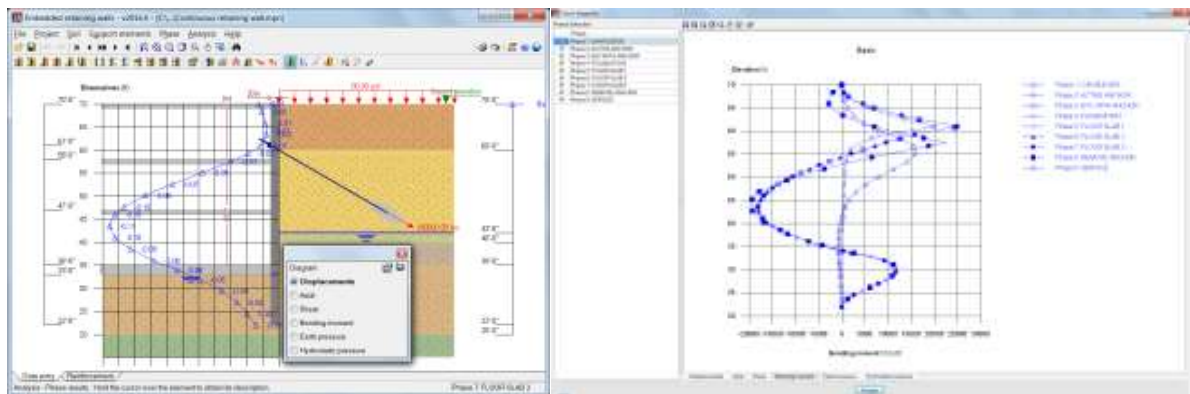
Analysis Model
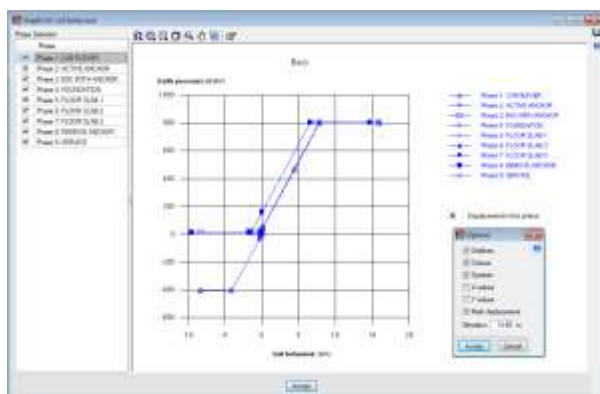
The analysis model used to obtain the forces and displacements of the wall is based on soil-wall interaction methods, where the magnitude of soil pressures acting on the wall depends on its displacement. To calculate the action and/or reaction the soil produces on the wall, the wall is considered to have an elasto-plastic (non-linear) behaviour, obtained by approximating the real behaviour of the soil, which includes its plastification. The range of linear behaviour is associated with the lateral subgrade modulus concept of the soil, and the plastic range to the active or passive concept, depending on the displacement direction. Furthermore, support

elements (anchors, struts and floor slabs) introduce a series of additional restrictions and actions, which are considered at the elevations at which they are located.

Since the solution of the problem depends on the deformation of the wall, the method requires the program to go through an iterative process until the equilibrium situation for iteration "i" is sufficiently close to that obtained for iteration "i+1".
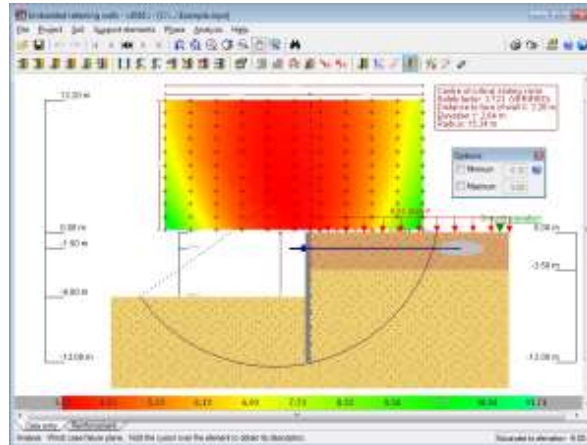
Results

See the diagrams for displacements, axial load, shears, bending moments, total earth pressure, and hydrostatic pressure. Additionally, you can see force diagrams for different phases, simultaneously, in various colors and showing the significant points and their values. The graphical results can be sent to a printer or make a DXF file.

Safety checks

The program carries out three global stability checks:

- **Ratio between the balancing moment of the passive pressure at the infill and the unbalancing moment of the active pressure at the backfill**
  This check is carried out for phases in which no supports have been provided for the wall, or maximum, only one, since the wall is already in equilibrium in other phases for which more than one support has been provided.

- **Safety factor of passive pressure at the infill**
  As occurs in the previous check, this check is carried out for phases in which no supports, or maximum, only one has been provided for the wall, since the wall is already in equilibrium in other phases for which more than one support has been provided.

- **Worst case slip circle**
  This check is carried out on retaining walls in phases where floor slabs have not yet been built, since the retaining wall is already in equilibrium in phases containing them.
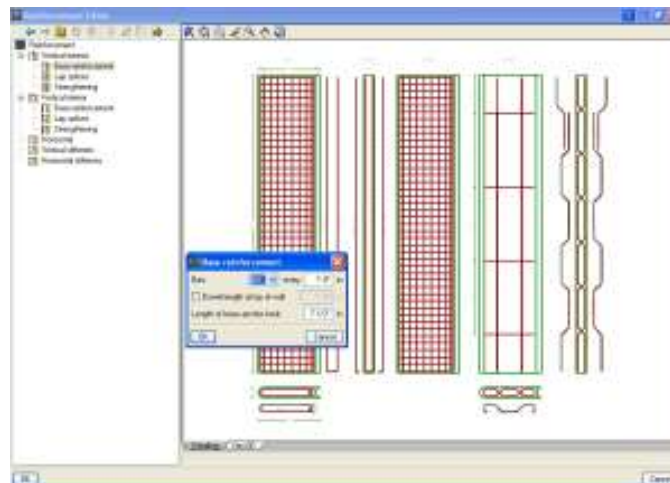
Reinforcement

The reinforcement of a concrete wall or in-situ piles may be user-defined or designed by the program from a reinforcement table. A Code check verifies that the reinforcement meets the Code requirements.

Generates complete reports that outline the checks performed on reinforced concrete sections.

Reports

For all of the **data**, sketches of the **construction phases**, calculation results, **force and displacement diagrams**.

Reports can be sent to the printer or generated as a TXT, HTML, PDF or DOCX (Word2007 – Office OpenXML) file.

Prints the text in an organized layout with the graphics.

Seismic analysis

For the evaluation of pressures, the program employs a pseudo-static method, with the coefficients of dynamic pressure based on the Mononobe-Okabe equations.

Drawings

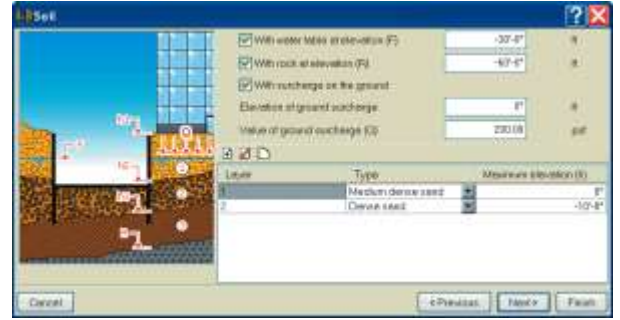Of the detailing of reinforcement in reinforced concrete walls.

The drawings can also be exported in DXF and DWG format.

DXF and DWG construction details can also be added.
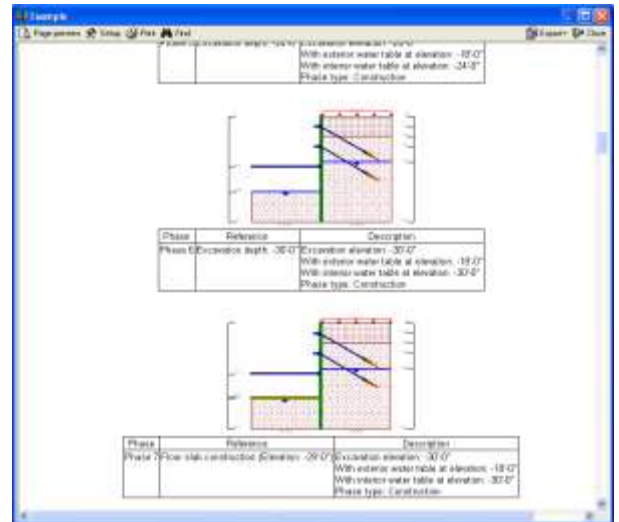
Assistant for various basement levels

Will help you to introduce the data for typical projects.

Reinforced concrete cantilever walls

Reinforced concrete cantilever walls. Program designed for the design and check of reinforced concrete cantilever soil retaining walls. Provides the automatic optimum design of the geometry, calculates the section reinforcement and carries out the geometric and reinforcement design of the foundation.

Program to design and check reinforced cantilever walls for soil retention. An automatic geometric pre-design is carried out as well as the section reinforcement and geometric and reinforcement design of the wall foundation.

Allows for the definition of different soil layers, indication of the water table depth, rock layer and any type of loads acting on the exterior and interior.
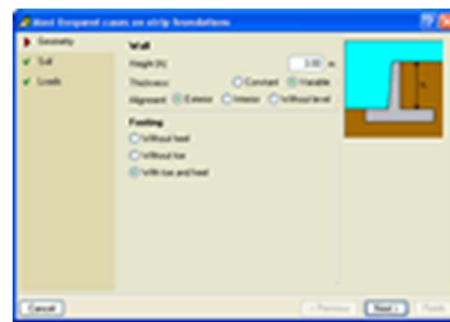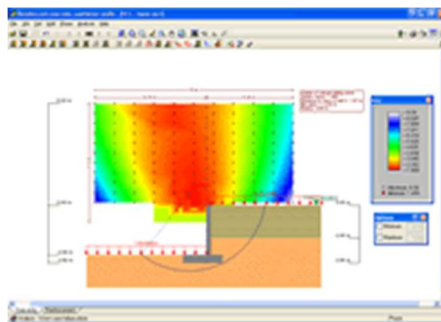
Different construction phases or stages can be defined:

The program analyses the global stability of the wall by performing the following checks against:

- Overturning
- Sliding

Worst case failure plane

The wall foundation can be a strip footing or capping beam.

Reports may be obtained containing all the introduced data, phase diagrams, analysis results, force and displacement diagrams for each phase or selected group of phases, and reinforcement detail drawings.

A simple and easy to use assistant is available to generate the wall and its loads.

The reports can be sent to the printer (with optional previous view, page setup, etc.) or generated as a TXT, HTML, PDF, RTF and DOCX (Word2007 – Office Open XML) file.

The drawings can be exported to the printer, in DXF or DWG format and to any graphic peripheral.

Required user license permits

To be able to work with Soil Retention Elements module, users must have the corresponding permission to use the program.

For project consultancy and detailed information; cype@cype.ist or support@cypetr.com