Contents of DC-Integra

The program DC-Integra consists of the following parts:

DC-Integra (2D):   Display of a foundation pit in a plan (2D) and interface to the analysis programs

DC-Integra 3D: Construction of a 3D model of the foundation pit with automatic calculation of slopes and 3D display of the foundation pit with ground surface model

DC-Integra 3D/Volume: Calculation of excavation volumes and masses.

DC-Integra supports an integrated foundation engineering statics for an overview of the layout of single excavation wall sections to their analysis and the display of the results. To analyze the single wall types DC-Integra processes with the programs
- DC-Pit: Construction pit walls
- DC-Nail: Ground nailing
- DC-Underpinning: Building underpinnings and retaining walls
- DC-Slope: Slope stability.

In addition plan views of the following programs may be imported:
- DC-Settle: Settlement analysis
- DC-Vibro: Soil improvement by stone columns.

Starting from a layout, which is either already existing and imported with DXF import from CAD, or may directly be created in DC-Integra with the extensive CAD tools, you may manage different types of walls of an entire construction pit and make the required analysis with the relevant calculating programs.

You may assign different wall types to separate outlines of the construction pit:
- Bore pile walls
- Diaphragm walls
- Sheet pilings
- Girder plank walls
- Mixed In Place (MIP)
- Underpinnings
- Nail walls
- Slopes.

The single walls are precisely displayed in the layout with macro functions. By means of these functions you may define the relevant parameters as e.g. diameter and spacing of bore piles, girder types and spacing, sheet piling profiles, etc. Variable macros are automatically re-created again, if you modify the position and the direction of the outlines. You may flexibly and precisely display the lining situations by shortening and lengthening the lining area. The program enables you thus e.g. to bond sheet pilings into bore pile walls.

All preferred analysis sections are defined in the layout. Depending on the lining type DC-Integra immediately creates the assignment to the relevant analysis program: DC-Pit, DC-Underpinning, DC-Nail or DC-Slope.

DC-Integra directly manages global information such as the layer thickness and parameters, the ground water level, etc. Having additionally assigned information about the data to the single outlines (depth outside and inside the construction pit), the program transfers the whole information about the geometry and the type to the relevant analysis program. It is thus possible to forward also information about inclined construction pit walls or slopes, by linking several lines in the layout by a section line.

The analysis is started by the analysis section displayed. The branching into the relevant analysis program is made automatically. This program displays the transferred information graphically and enables the after-treatment in order to define the excavation stages, anchor positions, etc. Having performed and estimated the analysis, you may integrate the preferred result images (system graphic, earth and water pressures, section forces and deformations) directly on the layout depending on the load case and the excavation. It is possible to edit at any time the result graphics such as shifting, scale change or automatic update in case of changes in the analyzed section.

A permanent overview of all sections of a project and the management of the whole system through the layout is possible with this conception of the integrated foundation engineering statics. You do not need to treat single sections separated from the entire project, you may clearly see all the components coherently.

For the general approach using the program see the chapter "Approach".

With **DC-Integra 3D** a complete 3D model of the construction pit may be created, with photorealistic display of the wall types with different materials. Slopes between sections of different depths are created automatically with their intersections.

With **DC-Integra 3D/Volume** you may calculate the excavation volume of the 3D foundation pit as well as the excavation masses – for single layers and the total volumes and masses.

For the approach to create and edit the 3D model see the chapter "Approach 3D".

Approach

For **DC-Integra 3D** see the following chapter **Approach 3D**.

With the following steps (activate with the button on the Function Bar or with the defined menu item), you may use the tools of DC-Integra:

- Create layout either by importing from CAD in DXF format (menu item File - Import - DXF) or

  draw with the CAD tools of the menu Draw correspondingly the buttons Line ![button], Polyline

  ![button], closed Polygon ![button], Parallel ![button], Circle ![button], etc.

- Define information about soil layers (that are globally valid), the ground water level and

  (predominant) construction pit depth with Project – Soil Layers: ![button] and Project – Change

  subsoil: ![button]. Variable layerings may be defined with bore points by ![button].

- Assignment of the lining type to a line with Analysis – Define Type : ![button] by defining the
  relevant parameters. You may define here also information about the data: Depth inside ≠
  depth outside at a line with vertical walls, or two lines which correspondingly have different
  depths inside = outside and are linked with a section, for inclined walls.

- Definition of a analysis section, which intersects one or several lines with lining type, by

  Draw – Section line : ![button]. The section line with the known lining type performs the
  assignment to an analysis program. Additionally, a section line may link several outlines with
  different depths (inclined walls or slopes).

- Start the analysis with the section line when defining the section, or later by a double click on
  the section line: Create a new file with New file in the dialog box, open an available file with
  Open file, Start the analysis with Start. The relevant analysis program will be started.

- Enter further information in the analysis program such as the excavation stages, anchor
  positions, analysis parameters etc. and perform the analysis.

- When you finish the analysis and return to DC-Integra, you may integrate in the layout result

  graphics with Analysis – Insert Layout : ![button]. The preferred section line is defined and the
  graphic is started in the analysis program afterwards.

- Result graphics are locked by default, so no parts may be shifted or changed by mistake. With

  Settings – Edit Layout On/Off : ![button] you may release the layouts in order to edit them.

Approach 3D

To create a 3D picture of your foundation pit, you may either edit an available plan (e.t. from DXF) or create the 3D model anew.

In addition to the lines which represent different types of walls, the programs has to know the foundation pit areas with their depths and eventually available slopes between them. For this purpose, we draw a foundation pit area with arbitrary contour or follow existing lines after selecting the menu item 3D Elements – Draw excavation or the icon . After closing the polygon, we assign a depth below ground surface to the area.

For the surrounding lines of such an area, we may define a wall type with its parameters by double-clicking it – alternatively by editing several lines by clicking them with pressed *Strg* key and then menu item Edit – Properties or Properties Macro parameters in the context menu with right mouse button.

Foundation pit areas may the be divided into sections with 3D Elements – Draw slope or the icon . Slope lines resp. dividing lines between two foundation pit ares of different depth may start and end at a border line or at another dividing line. Slopes are displayed by two lines as their upper and lower edge, with a hatching between. The construction line which divides the two partial areas is displayed as a dashed line.

The intersections of slopes between sections of different depth are automatically determined by the program and created for the 3D model. If the slopes should not be created immediately in every step, the automatic may be swithed off or on again with the icon . If the automatic is switched off, the generation of the slopes may be requested by the icon . With the display of the slopes may be switched off to distinguish the construction lines better.

With double click on a partial area, its depth may be changed at any time. By selecting the area with a single mouse click and pressing the *Del* key resp. *Ctrl*-X, a partial area is deleted. If there are several other areas connected to the selected area, you will have to select the area to merge with by clicking it with the left mouse button.

You may switch to the 3D display with menu item View – 3D view or the icon . The spatial model is drawn realistically and with exact measures by photo-based textures for the different materials (steel, concrete, wood, soil). The model may be turned by „touching" it with pressed left mouse button and moving the mouse. Turning is controlled best by "touching" it at an outward position, like at the border of a sphere surrounding the total model.

By pressing the right mouse button and moving the mouse to the left and to the right, the observer is moving nearer to the model or farther away. With pressed *Shift* or *Ctrl* key the model may be moved. With the icon the presentation is centered again to a top view.