Dartis Foundation

User Manual Help
2023

Table of content

About

"Dartis Foundation" calculates the bearing capacity of shallow foundations considering shear failure and settlement. Various methods are employed for the determination of shear failure. Elastic, primary and secondary consolidation settlements can be calculated using various options.
Fully detailed reports are also presented that are self-explanatory.

General Features
• Fine calculations report, including formulas and step_by_step calculations.
• Supports "SI" units.
• Introduction of unlimited soil layers.
• Determination of the bearing capacity of shallow footings with different dimensions considering shear failure and settlement (Elastic, Primary & Secondary Consolidation).
• Calculation of settlement corresponding to the allowable pressure.
• Presentation of load-settlement graphs.
• Saving files with minimal size.

Shear Failure
• Employment of various methods.
• Alteration of general the factor of safety.
• the water table effect is applied.
• Load eccentricity and inclination can be applied.
• Plain_Strain correction of friction angle can be applied.
• Option for calculating cohesion, unit weight, and friction angle of soil based on soil layers.

Settlement
• Alteration of allowable settlement.
• Flexible and rigid footing types are available.
• Option to ignore elastic settlement when consolidation settlement is calculated.
• Elastic settlement calculations are performed by 3 methods; Schmertmann (1978) and Theory of elasticity for granular soils and Janbu (1956) for saturated clay.
• A specified fraction of consolidation settlement will be taken into account by the user's will.
• Option to calculate three dimensional effect by Leonards (1974) method for primary consolidation settlement.

License Agreement

Visit our online [End User License Agreement](#)

Licensing

View our online Purchase Guide.
View our online Licensing Help.

Getting Started

• We recommend minimum 1024*768 screen resolution.
• Make sure you save your data periodically. Each project can be saved as a separate file on your local hard drive as a .DFo document.
After each installation, please open the "Parameters" page and set the default parameters and choose your favorite analyses methods. This is a very important step, otherwise you may end up with incorrect results.
• Please contact us at support@dartistech.com with any questions or suggestions.

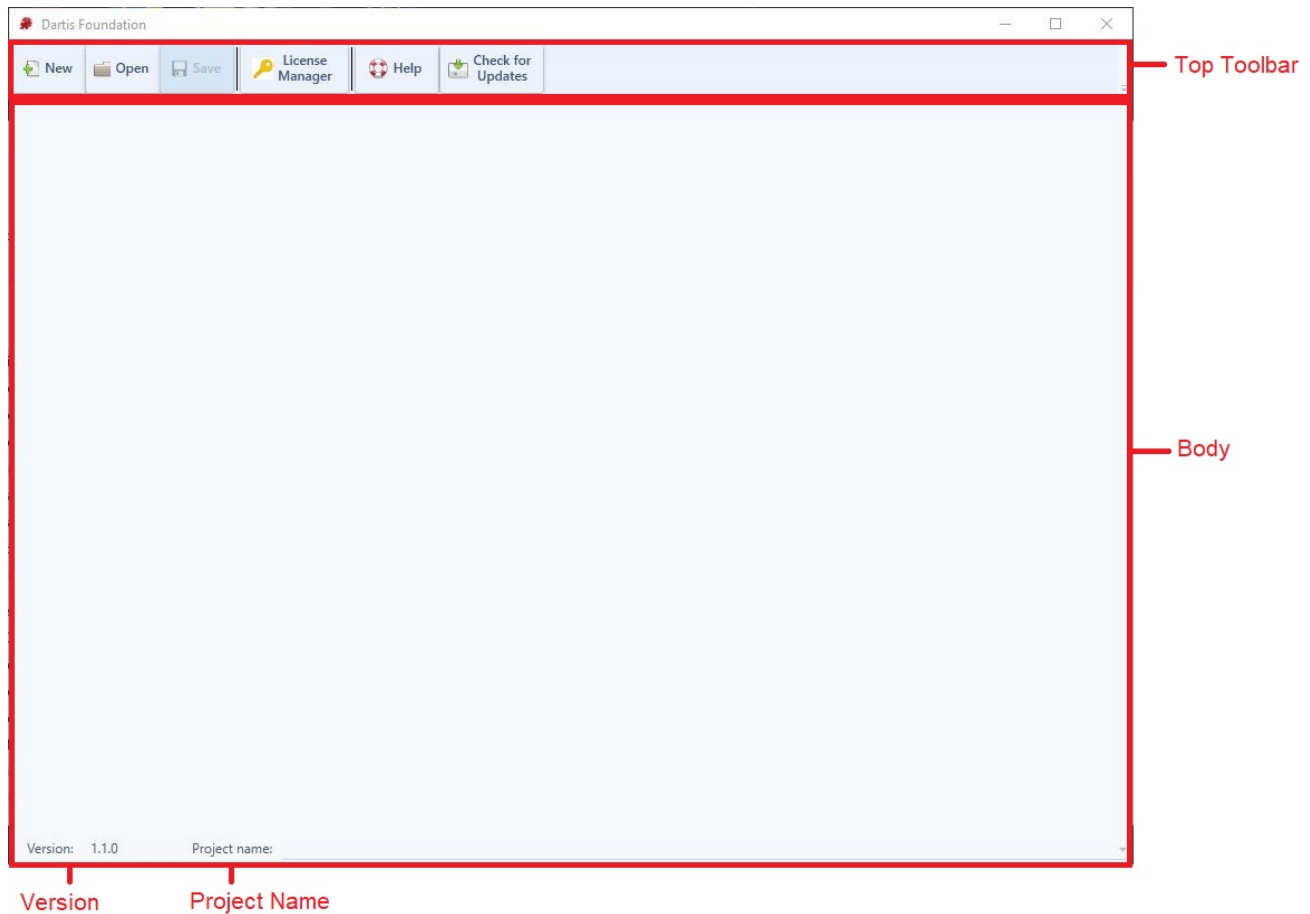
Save File

Save file is a .DFo format file created upon specifying a local path on your hard drive. You can do this by clicking the New button.
Any further changes in your project will update the current save file upon clicking the Save button.

Note1: To open a previously created project, click the Open button and choose the save file.

Contents

Main Screen

This is the screen encountered when opening the program.

Top Toolbar

The toolbar provides you the access to create/load/save projects, license information, help file, etc.

In the first application run, create a "New" project. This provides you with the tab control to work with.
To open a previously created project, click on "Open" button and choose the saved .DFo file on your local hard drive.
Click on "Save" button to save changes in your project. Make sure you save your data periodically.
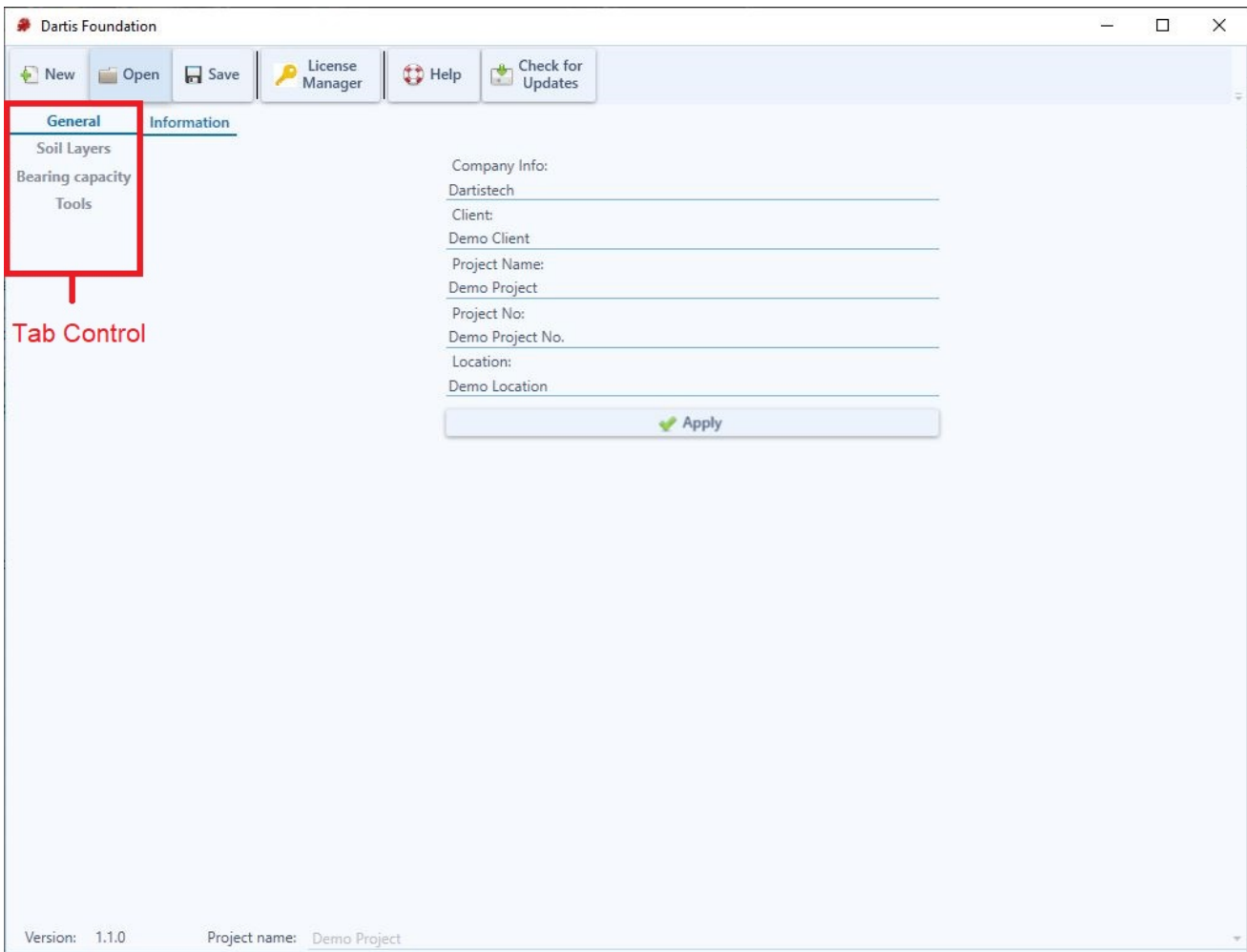
The License Manager page includes the current license information. it also allows you to activate a new license (e.g. to upgrade from Evaluation / Trial Version to Registered Version) or to de-activate the license on this computer. Click on License Manager button to open the License Manager page.
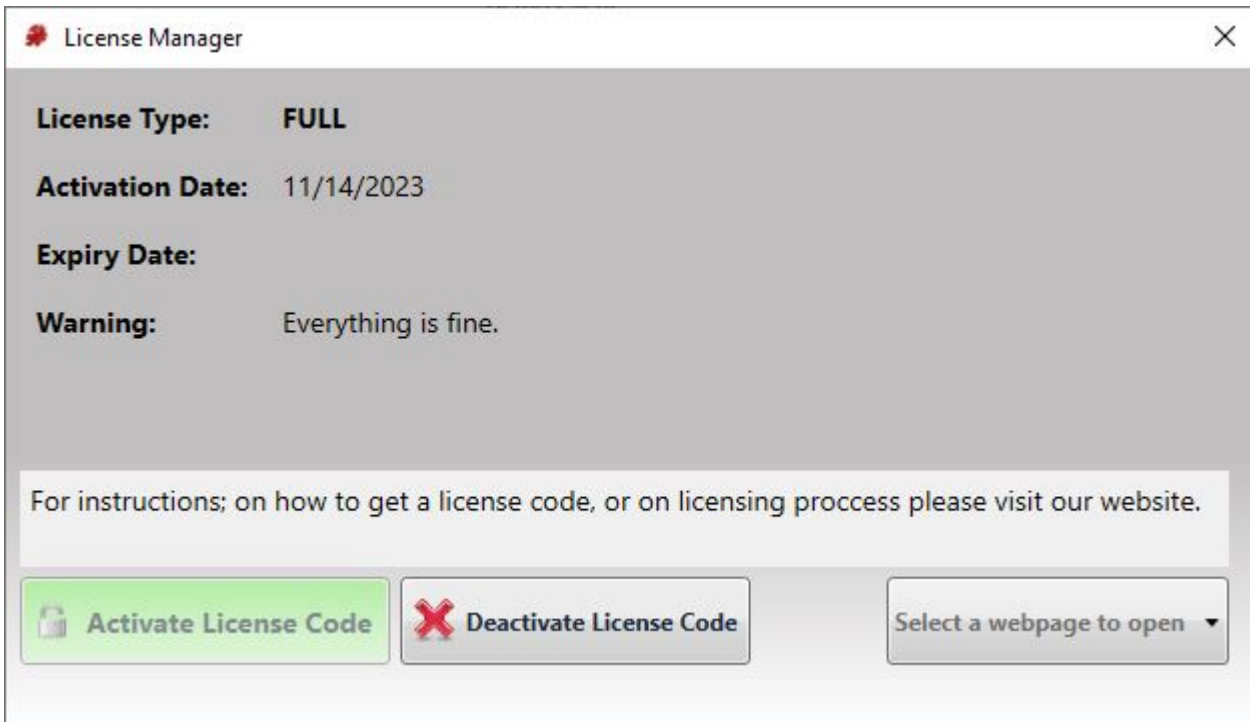
"Help" button opens help manual.

"Check for Updates" button checks online for available updates.

Project Information

Basic project information including name, client, location, company info. and project No are entered in this section. This data will be shown in the fine calculations report.

Soil Layers

Your stratigraphy model may contain unlimited soil layers. Please specify the following parameters for each layer:

• **Soil Description:** simple description for layer. This field is only for user's information and does not have any effect on bearing capacity analysis
• **Thickness**: thickness of the layer.
• **γ:** Total unit weight.
• **φ (deg):** Internal angle of friction (between zero and 45 degrees).
• **C:** Coefficient of cohesion.
• **Es:** Modulus of elasticity.
• **Consolidation:** determines whether consolidation settlements are calculated or not.
• **Cc , Cs:** Consolidation compression and re-compression indexes. They should only be entered when you want the consolidation settlement to be calculated for this layer.
• **Pc:** Pre-consolidation stress for consolidation settlement.
• **eo:** Void ratio.

New Row: Inserts a new soil layer.
Save as Excel: Exports Soil Layers table to Excel (You need to have Excel installed on your pc).
Clear Table: Removes all soil layers.

Bearing Capacity

This module is used to calculate allowable bearing capacity of shallow foundations with simultaneously checking both shear failure and settlement. Each part of this tab is explained below.

Parameters

_General
• **Gw:** Depth to water table measured from the ground surface.
• **FS:** Factor of safety. The allowable bearing capacity based on shear failure is obtained by dividing the ultimate bearing capacity by the factor of safety.
• **Df:** depth of footing base measured from the ground surface.

_Eccentricity and Inclination
• **Ecc. in B & L Directions:** Load eccentricity in footing's width and length directions expressed as percentage.
• **Inclination:** Inclination of the load on the foundation with respect to the vertical.

_Auto calculate c, φ, γ: If checked the parameters are calculated based on soil layers information. Uncheck to insert manually as shown in figure below:

_Plain-Strain Correction of Friction Angle: Meyerhof (1963) suggested the following equation to interpolate the friction angle for rectangular foundations:

$$\phi'_{\text{rectangle}} = \phi'_{\text{triaxial}}\left(1.1 - 0.1\frac{B}{L}\right)$$

The bearing capacity factors N_c, N_q, and N_γ are very sensitive to the friction angle. Therefore, it is necessary to select the appropriate friction angle.

_Bearing Capacity
__Qu
Choose calculation method for each factor and click on "Apply Qu settings".

_Settlement
__Basic
• **Allowable settlement:** In order to control the settlement of the footing and its superstructure, the allowable settlement (sum of elastic and consolidation settlements) is limited to this value.
 Effective stratum depth: Effective depth in settlement calculation is determined by each of the following criteria:
1. **Multiple of footing width – xB:** Effective stratum depth is considered equal to an optional multiple of footing width.
2. **Manual, Below Foundation:** Effective stratum depth is considered at the specific depth.
• **Rigidity:** Two footing types, flexible and rigid are available. Rigidity factor (Ir) is less than one and depends on rigidity of the footing (usually 0.9 to 1). Dartis Foundation applies this factor to the total settlement of the footing S=(Se+Sc)*Ir where Se and Sc are elastic and consolidation settlements, respectively. For flexible footing this factor is one.
• **Ignore Elastic settlement when Consolidation settlement is calculated:** If marked, Elastic settlement is ignored when there is a soil layer with consolidation settlement.
• **a:** this factor is used for calculation of un-saturated consolidation settlement. If a fine-grained layer is unsaturated (e.g. S=80%), then the actual consolidation settlement is a fraction of calculated saturated consolidation settlement.

__Elastic (Se)
Method: Three methods can be chosen for elastic (immediate) settlement calculation of footings. For further reference and detailed description of each methodology please refer to reference books.

__Primary Consolidation (Sc(p))
• **Stress Distribution Method:** Two methods are available; Boussinesq and approximate 2V:1H. Calculations are performed in top, middle and bottom of the layer and the result is obtained by the use of Simpson's rule.
Three-dimensional Effect: Leonards (1976) examined the correction factor K_{cr} for a three-dimensional consolidation effect in the field for a circular foundation located over *overconsolidated clay*. The interpolated values of K_{cr}(OC) from Leonard's 1976 work are given below:

Variation of $K_{cir(OC)}$ with OCR and B/H_c

OCR	$B/H_c = 4.0$	$B/H_c = 1.0$	$B/H_c = 0.2$
	$K_{cir(OC)}$		
1	1	1	1
2	0.986	0.957	0.929
3	0.972	0.914	0.842
4	0.964	0.871	0.771
5	0.950	0.829	0.707
6	0.943	0.800	0.643
7	0.929	0.757	0.586
8	0.914	0.729	0.529
9	0.900	0.700	0.493
10	0.886	0.671	0.457
11	0.871	0.643	0.429
12	0.864	0.629	0.414
13	0.857	0.614	0.400
14	0.850	0.607	0.386
15	0.843	0.600	0.371
16	0.843	0.600	0.357

B = Foundation width
Hc = Effective stratum depth

__Secondary Consolidation (Sc(s))
• *Ca* = secondary compression index.
• *t1*, *t2* = time.

Graph

Dartis Foundation calculates both shear failure and settlement criteria for a range of footing widths (i.e. B1 to B2). At each footing size:

1. **Shear Failure (Brown Curve):** The allowable bearing pressure based on shear failure is calculated.
2. **Settlement Failure (Green Curve):** This curve shows the allowable stress, provided that the total settlement is around the allowable settlement already introduced by the user.
Allowable Bearing Capacity Curve (Orange Curve): This curve is the lower intersection of two above-mentioned curves and assures that on each point along the curve, both settlement and shear failures are within the allowable limits.

_**Settlement Graph:** This includes 4 curves representing Immediate (elastic), Primary Consolidation, Secondary Consolidation and Total settlements. Please be advised that these settlement values are calculated based
on the resulting allowable bearing capacity calculated for each specific footing size.

_**Graph Report:** Click on "Report" button. Image below is an example report of this page saved as .Png. This report can be saved as Word, Excel, Image, etc.

Rigidity Factor (Ir)	a
0.93	1.00

S total = Ir (Se + a (Scp + Scs))

L/B=1.00, Df=1.00(m), GW=2.00(m), FS=3.00

L/B=1.00, Df=1.00(m), GW=2.00, a=1, Ir= 0.93

■ Elastic ■ Primary Consolidation ■ Secondary Consolidation ■ Total Settlement
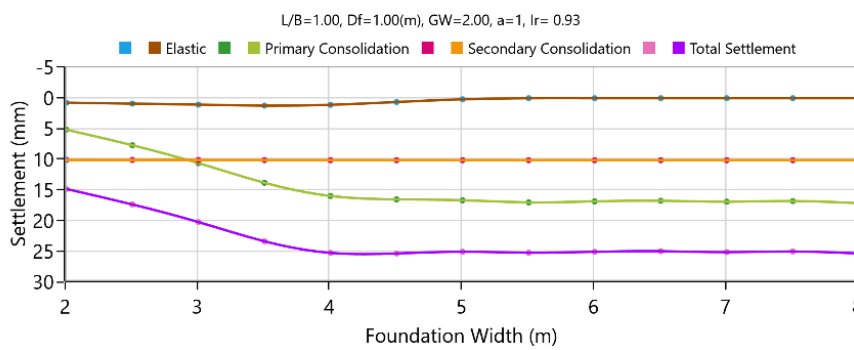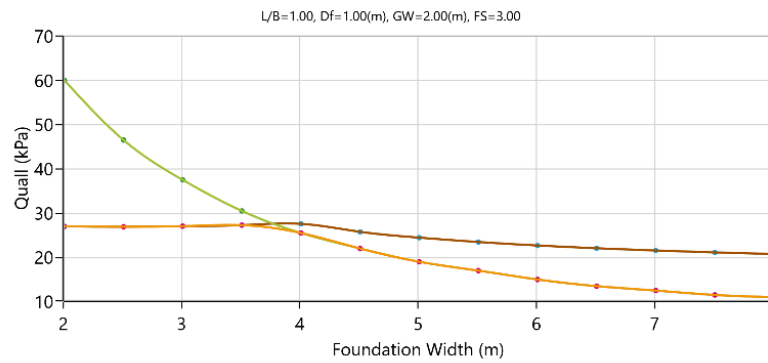
B(m)	L(m)	A(m^2)	Qu Shear (kPa)	Qu Settlement (kPa)	Qu Allowed (kPa)	Allowed Load (kN)	Se (mm)	Scp (mm)	Scs (mm)	S total (mm)
2.00	2.00	4.00	27.09	60.10	27.09	108.34	0.73	5.12	10.05	14.79
2.50	2.50	6.25	27.02	46.60	27.02	168.89	0.89	7.66	10.06	17.31
3.00	3.00	9.00	27.15	37.60	27.15	244.32	1.05	10.58	10.07	20.18
3.50	3.50	12.25	27.38	30.60	27.38	335.39	1.21	13.77	10.08	23.31
4.00	4.00	16.00	27.68	25.60	25.60	409.60	1.08	15.93	10.09	25.20
4.50	4.50	20.25	25.87	22.10	22.10	447.53	0.62	16.48	10.09	25.29
5.00	5.00	25.00	24.56	19.10	19.10	477.50	0.18	16.62	10.09	25.01
5.50	5.50	30.25	23.57	17.10	17.10	517.28	0.00	16.97	10.09	25.17
6.00	6.00	36.00	22.79	15.10	15.10	543.60	0.00	16.81	10.09	25.01
6.50	6.50	42.25	22.16	13.60	13.60	574.60	0.00	16.71	10.09	24.93
7.00	7.00	49.00	21.65	12.60	12.60	617.40	0.00	16.87	10.09	25.07
7.50	7.50	56.25	21.22	11.60	11.60	652.50	0.00	16.75	10.09	24.96
8.00	8.00	64.00	20.85	11.10	11.10	710.40	0.00	17.11	10.09	25.30
8.00	8.00	64.00	20.85	11.10	11.10	710.40	0.00	17.11	10.09	25.30

Page: 1   Total page count: 1

Bearing Capacity and Settlement graphs can also be printed separately.

Print Bearing Capacity Chart

Print Settlement Chart

Fine Calculations

New | Open | Save | License Manager | Help | Check for Updates

General | Parameters | Graph | **Fine calculations**
Soil Layers
Bearing capacity | Parameters
Tools

L: 4.00 (m)
B: 4.00 (m)
Load: 410.00 (kN)
Ecc. (B Dir.): 0.00 (m)
Ecc. (L Dir.): 0.00 (m)
Inclination: 0.00 (deg.)

✔ Generate Report | 🖨 Save as Word | 🖨 Save as PDF

2_ Settlement criterion (S_total)

$q_0 = \frac{load}{BL} = 25.63 \text{kN/m}^2$

Elastic Settlement of Shallow Foundation using strain influence factor proposed by Schmertmann et al. (1978):

using relations suggested by Salgado (2008) for interpolation of Iz at z = 0, z1, and z2 for rectangular foundations:

$z_1 = 0.5B + 0.0555(L - B) \le B = 2.00\text{m}$

$z_2 = 2B + 0.222(L - B) \le 4B = 8.00\text{m}$

at z = 0,

$I_z = 0.1 + 0.0111(\frac{L}{B} - 1) \le 0.2 = 0.100$

effective stress at the base of the foundation (q)= 18.00 kN/m^2

effective stress at a depth of z1 before construction of the foundation (qz(1))= 44.20 kN/m^2

$I_{zm} = 0.5 + 0.1\sqrt{\frac{q_0 - q}{q_{z(1)}}} = 0.542$

Layer no.	Δz (m)	Es (kN/m^2)	Iz at middle of layer	(Iz/Es)*Δz (m^3/kN)
1	2	10000	0.320767240561591	6.41534481123182E-05
2	2	10000	0.451278734269318	9.02557468538636E-05
3	4	15000	0.180511493707727	4.81363983220606E-05

In this section fine calculation report is generated based on parameters introduced by user.
This is a full detailed report including formulas, considerations, methods, etc. This report can be exported as Word and PDF formats.

System Requirements

Dartis Foundation Minimal System Requirements:
• Microsoft Windows 7/8/10/Vista
• 500 MHz processor
• 512 MB RAM
• At least 150 MB free hard drive space

Contacts

Product website:
http://www.dartistech.com

Support e-mail:
support@dartistech.com