

PEYSANJ 3.0

Geotechnical Eng. Software



Designed & Developed by : Novo Tech Software Ltd.
www.novotechSoftware.com

INTRODUCTION

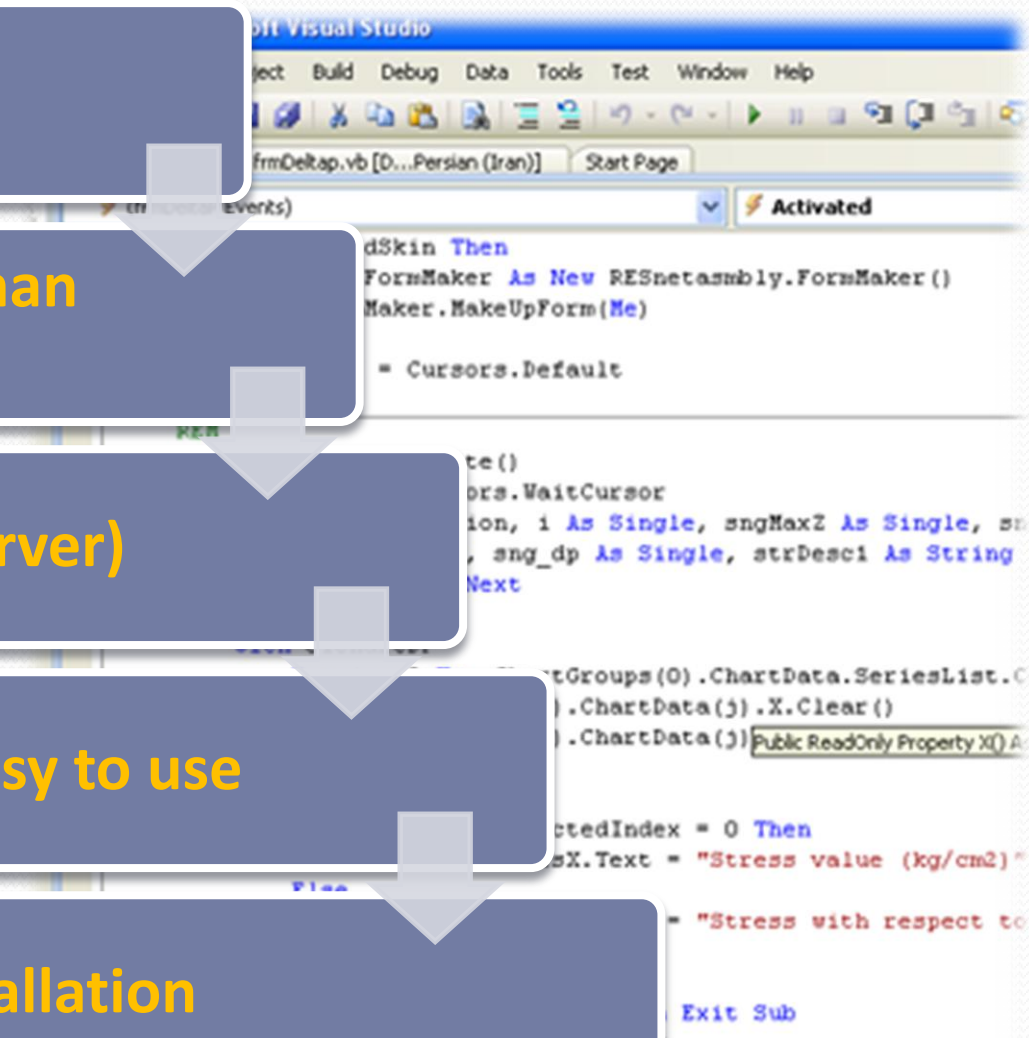
PEYSANJ Started at 1997 with Bearing Capacity Module

Current version with more than 5 modules

Database (Access / SQL Server)

User friendly design, easy to use

Single / Network installation



PEYSANJ MODULES:

Shallow Footings

- Shear Failure
- Settlement
- Bearing Capacity
- Stress variation below footing

Retaining Walls

- Lateral earth pressures coefficients
- Stress distribution behind wall

Slope stability

- Limit equilibrium analysis based on Fang handbook' table

Plate Load Test

- Computing K_{s30}
- K_{s30} Correction
- K_{s30} Conversion

Pressure Meter Test

- Menard Modulus (E_m)
- Limit Pressure (PI)
- Considering calibration

Liquefaction

- Based on SPT, BPT, V_s
- 6 Methods for CRR
- Considering MSF
- CRR, CSR, Safety factor calculation along depth
- Lateral displacement

REFERENCES :

Soil Shear Failure

Hansen

Effect of water level

Liquefaction

Lateral Disp. Method:

- Zhang & Robertson, 2004

CRR methods

- Japan' highway code
- Kokusho 1983
- Chinese code
- Seed 1983
- Shibata 1981
- Tokimatsu/Yushimi 1983
- NCEER workshop 1996
- Vancouver Task Force 2007

Supported tests:

- SPT
- BPT
- Shear Wave Velocity

Settlement

Goodier & Timoshenko

Rigid (semi-infinite)

Average (semi-infinite)

Saturated/Un-saturated consolidation

Slope stability

Limit equilibrium analysis
Fang handbook

Stress below footing

Westergard

2:1 slope

Lateral Earth Press.

Rankin (Static)

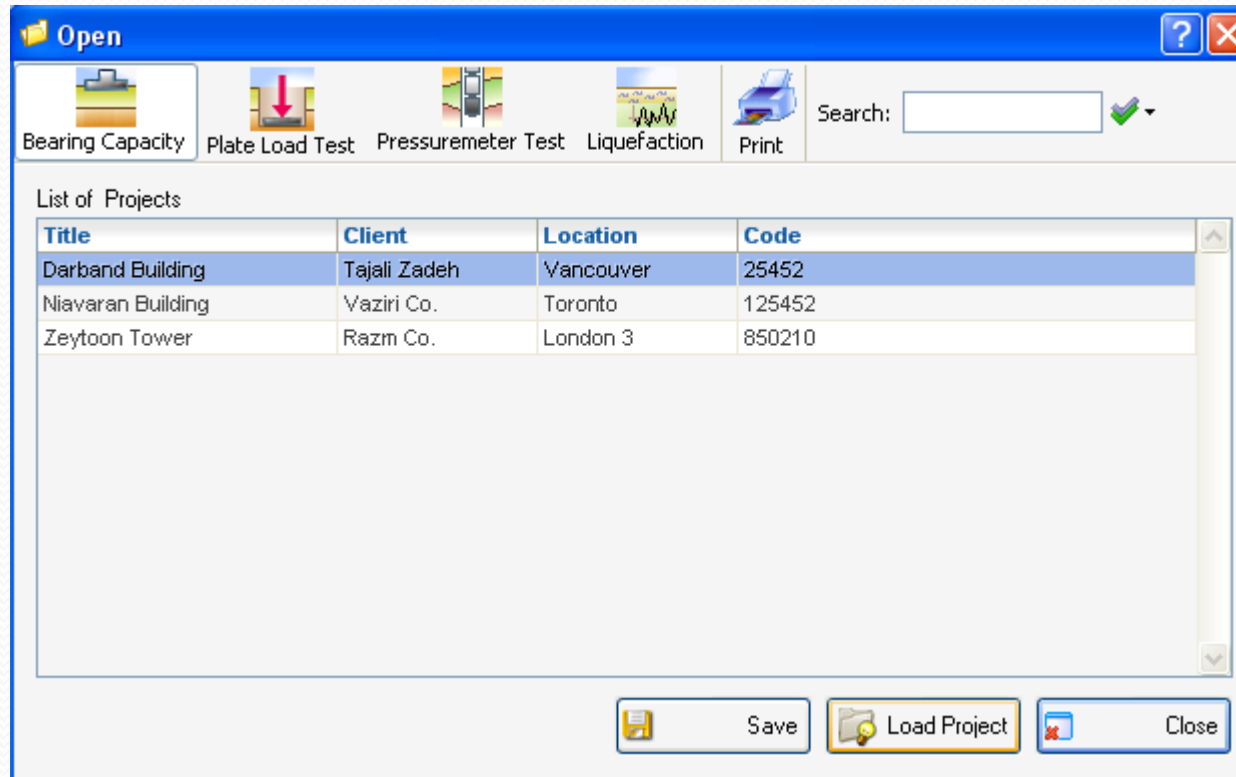
Columb (Static)

Mononobe-Okabe

Pressure-meter

ASTM D4719

PROJECTS LIST



The screenshot shows a software application window titled "Open". The window has a blue title bar with a question mark icon and a close button. Below the title bar is a toolbar with several icons: a clipboard for "Bearing Capacity", a plate with a red arrow for "Plate Load Test", a pressuremeter for "Pressuremeter Test", a graph for "Liquefaction", and a printer for "Print". To the right of the toolbar is a search box with a green checkmark icon and a dropdown arrow.

Below the toolbar is a section titled "List of Projects" containing a table with the following data:

Title	Client	Location	Code
Darband Building	Tajali Zadeh	Vancouver	25452
Niavaran Building	Vaziri Co.	Toronto	125452
Zeytoon Tower	Razm Co.	London 3	850210

At the bottom of the window are three buttons: "Save" (with a floppy disk icon), "Load Project" (with a folder and lightbulb icon), and "Close" (with a red X icon).

SETTING & PREFERENCES

Options

Bearing Capacity | Liquefaction & PMT | Methods | Misc. | Advanced

Strip footing

Foundation width range (cm):

From : 100 To : 400 Step : 25

Stress Step (kg/cm²): 0.005

Excel L/B : 1,2,5,8,10

Mat footing : stress range (kg/cm²):

From : 0 To : 3 Step : 0.02

Settings

Stress influence depth (H) for calculating settlement is calculated based on the theory in which, delta P reaches ? % of stress below foundation.

percent : 15 Stress below foundation

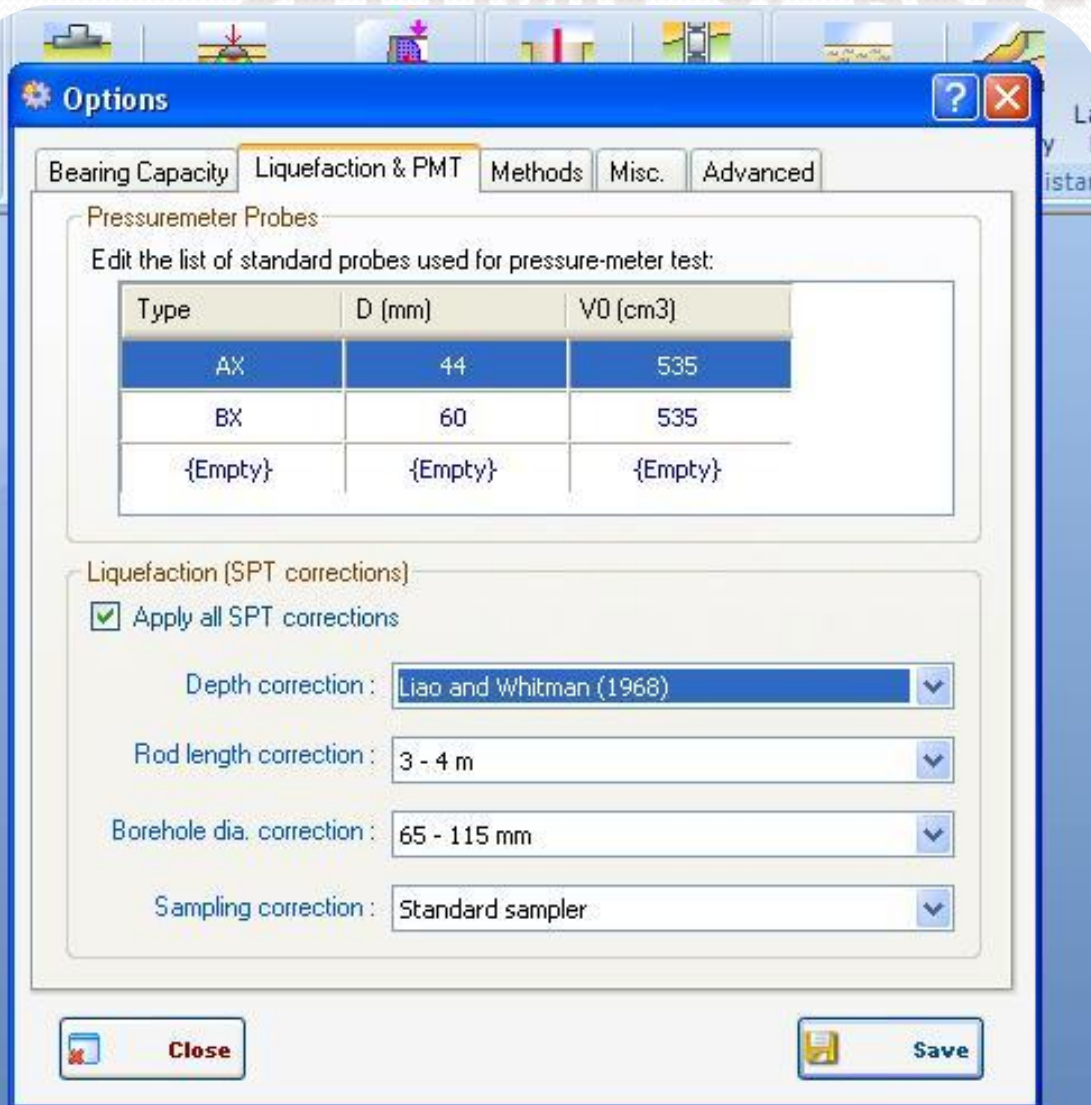
Stress variation in soil layers for calculating stress influence depth of settlement, should be calculated based on this method:

method : Westergaard

Close Save

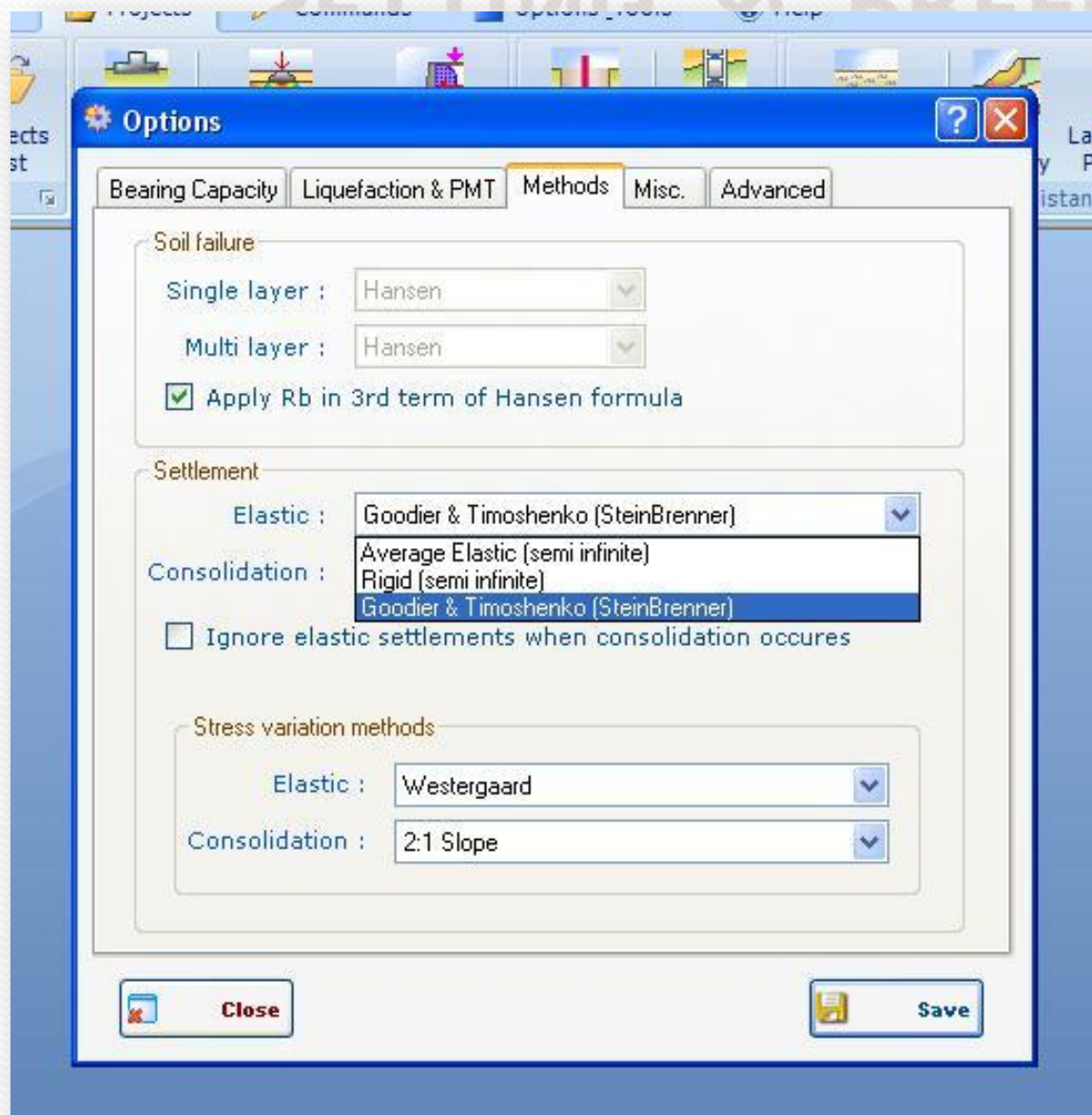
All settings for level of accuracy in bearing capacity analysis of multi-layer soils can be set by user

SETTING & PREFERENCES



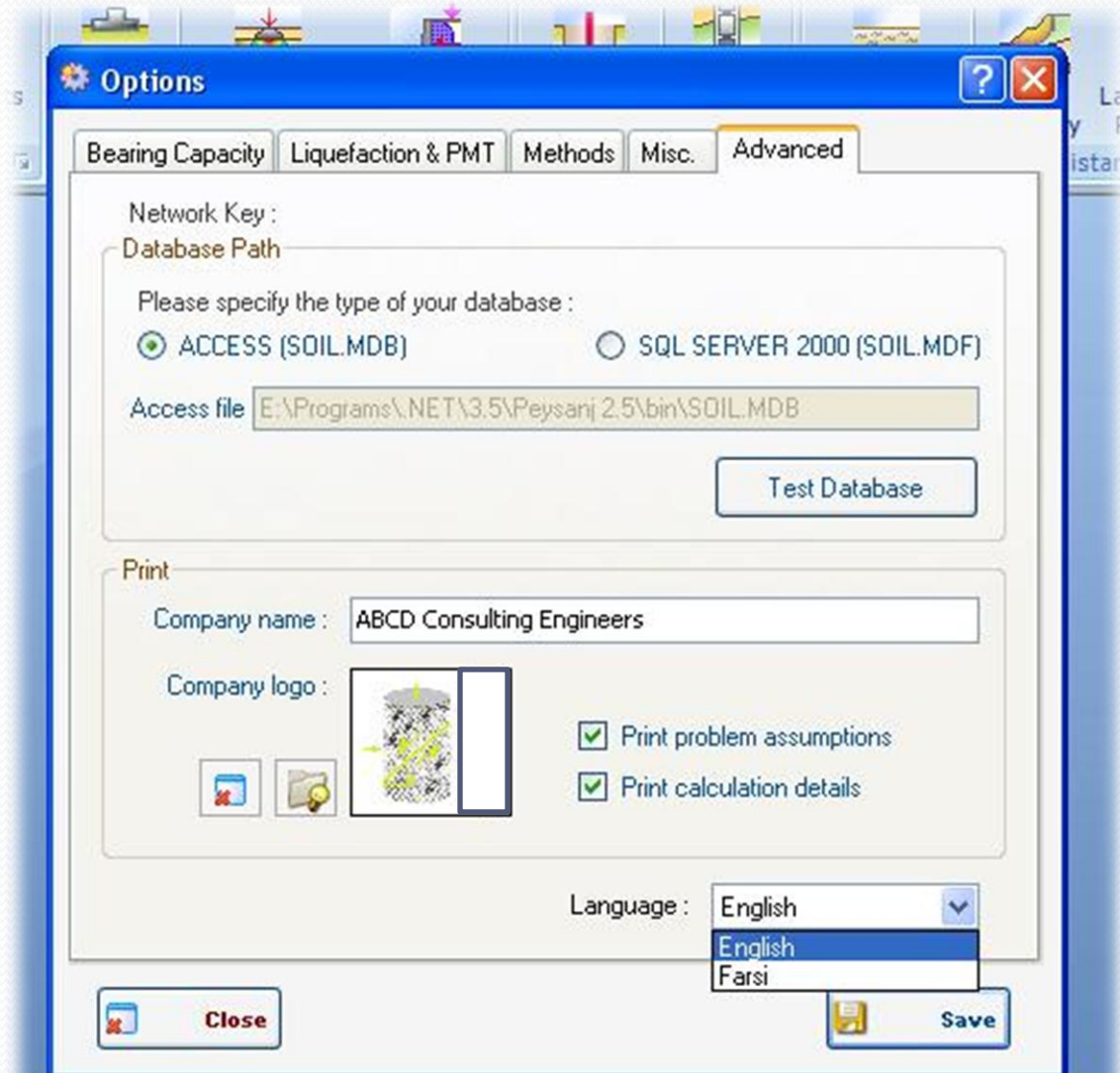
Correction factor for SPT during liquefaction analysis and list of pressure-meter tubes can be defined

SETTING & PREFERENCES



Settlement and soil failure parameters

SETTING & PREFERENCES



BEARING CAPACITY

ALLOWABLE BEARING CAPACITY

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Print Preview
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Y Scale
Save As Text
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Horizontal Gridlines
Save As...
3D View
View Data
Setting
Print

Tasks
Bearing Capacity

Title : Zeytoon Tower
Client : Razm Co.
Location : London 3
Code : 850210

Soil Layers Below Foundation

Layer	Z1	Z2	Density	C	Fi
sand	0	2	1.85	0.14	30
gravel	2	100	2.1	0.1	35

Es	v	Su	Cc	Cs	Pc	e	PreConsolidated
350	0.35	0	0	0	0	.55	<input type="checkbox"/>
450	0.35	0	0	0	0	.45	<input type="checkbox"/>

Foundation Size

Shape : Strip / Pad footing

L/B : Rigidity Factor :

Df (m) : D (m) : All. Settl. (cm) :

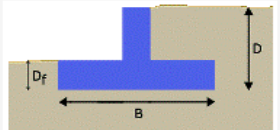
MB (t.m)

ML (t.m)

HB (t)

HL (t)

V (t)



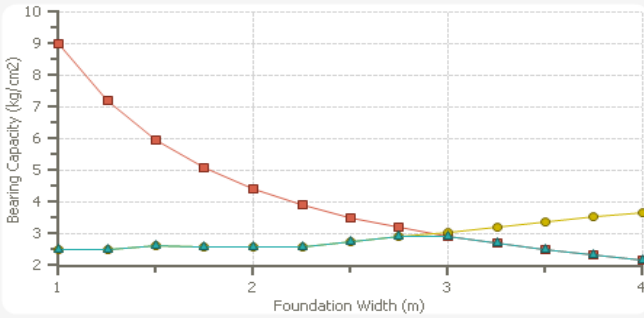
General Settings

Wet density of soil above foundation (gr/cm3) : Water level below foundation (m) : Er / Es :

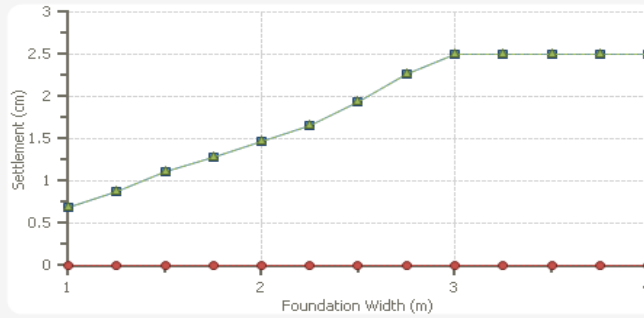
Shear Failure Safety Factor : α :

Un-saturated consolidation settlements will be taken into account even if the layer is above water level. Set AxB=0 if you want this settlement to be ignored.

■ Settlement
 ■ Soil Failure
 ■ Allowable



■ Elastic
 ■ Consolidation
 ■ Total



BEARING CAPACITY

SETTLEMENTS

PEYSANJ
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Bearing capacity

Title:

Client:

Location:

Code:

Layer Desc	C (kg/cm ²)	Fi (deg)	Es(kg/cm ²)	v	g (gr/cm ³)	Z1 (m)	Z2 (m)	Su (kg/cm)	Cc	Cs	Pc(kg/cm ²)	e.	PreCons
Gravel	0.06	32	400	0.35	1.85	0	3.5	0	0	0	0	0.45	<input type="checkbox"/>
Sand	0.1	28	300	0.35	1.75	3.5	100	0	0	0	0	0.5	<input type="checkbox"/>

General

Wet density of soil above foundation (gr/cm³):

Water level below foundation (m):

Principal

All. Settl. (cm): Er / Es:

Rigidity Factor: A x B:

Safety Factor:

Foundation Size

Shape:

L/B:

DF (m):

D (m):

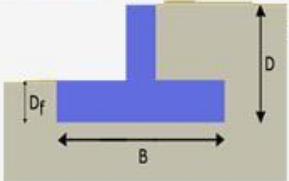
MB (t.m):

ML (t.m):

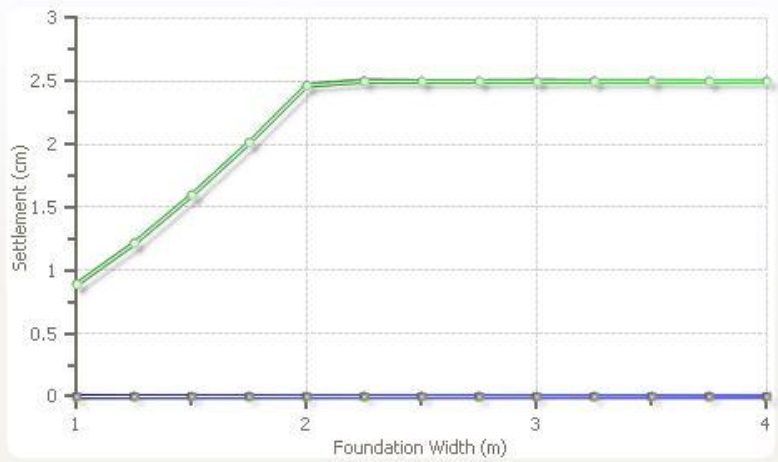
HB (t):

HL (t):

V (t):



Un-saturated consolidation settlements will be taken into account even if the layer is above water level. Set AxB=0 if you want this settlement to be ignored.



Foundation Width (m)	Elastic Settlement (cm)	Consolidation Settlement (cm)	Total Settlement (cm)
1	0.8	0	0.8
2	2.5	0	2.5
3	2.5	0	2.5
4	2.5	0	2.5

BEARING CAPACITY

CALCULATION DETAILS

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Bearing capacity of foundation 1x4 m2
 HANSEN : $Q_{ult} = C.N_c.Sc.dc.ic.gc.bc + q'.N_q.Sq.dq.iq.gq.bq + 0.5g.B'.Ng.Sg.dg.ig.gg.bg$
 Effective $H=0.5B\tan(45+Fi/2)=90.2$ cm
 Average : $C=0.05$ kg/cm² , $Fi=32$ deg , $g=2.05$ gr/cm³
 $eB=MB/V=0$, $eL=ML/V=0$
 $B'=B-2eB=1$ m , $L'=L-2eL=4$ m
 $Nc=35.49$, $Nq=23.18$, $Ng=20.79$
 $Sc=1.16$, $Sq=1.13$, $Sg=0.9$
 $Df/B < 1$: $K=Df/B=1$
 $dc=1.4$, $dq=1.28$, $dg=1$
 $Ca \sim 0.8C=0.04$ kg/cm² , $Af=B'*L'=4$ m²
 $Ic=1$, $Iq=1$, $Ig=1$
 $bc=1$, $bq=1$, $bg=1$
 $gc=1$, $gq=1$, $gg=1$
 $q'=Df*(sdl \text{ density above foundation})=100*0.00205=0.205$ kg/cm²
 Shear Failure $Q_u = 2.89+6.87+1.92=11.67$ kg/cm²
 ~
 Elastic Settlement for Center of Foundation 1 x 4 m2
 GOODIER & TIMOSHENKO (1961) : $S=4\{q.B'.(1-v2).Is.If/Es\}$
 for center, $B'=B/2=50$ cm
 Er/Es is used? False
 average $Es=400$ kg/cm² , $v=0.3$
 $i1=0.6$, $i2=0.089$: $Is=0.651$
 $Df/B=1$, $L/B=4$: $If=0.651$
 Stress (Q)=1.44 kg/cm²
 $H=2.91$ m (based on $dP=15$ % of 'Footing stress' {you've chosen in Peysanj preferences})
 $m=L'/B'=4$, $n=H/B'=5.82$
 Settlement (Se)=0.278 cm
 Consolidation Settlement For Foundation 1x4 m2
 ~~~~~  
 Layer 1  
 From  $Z1=0$  m to  $Z2=2.91$  m : UN-SATURATED SUB-LAYER  
 $Zo=2+1.46=3.46$  m ,  $Po=0.708$  kg/cm<sup>2</sup>  
 $dpt=1.44$  ,  $dpm=0.43$  ,  $dpb=0.213$   
 $dp(ave)=(dpt + 4dpm + dpb)/6=0.562$  kg/cm<sup>2</sup>  
 un-sat  $Sc=3.434$  cm  
 $Sc1 = UNsat + sat = 3.434*0.65+0 = 2.232$  cm  
 ~~~~~  
 Settlement (Sc)=2.232 cm
 Total $S=(Se+Sc).Ir=(0.278 + 2.232)*1 = 2.5$ cm

PLATE LOAD TEST

PEYSANJ

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Save Calculate Show Details Print Preview Close Form

X Scale Y Scale Save As Text Vertical Gridlines Horizontal Gridlines Save As... 3D View View Data Setting Print

Tasks Charts

Plate Load Test

General **Field Tests**

Job Information

Title : Jamalabad Building

Client : Mr. Chizari

Location : Tehran

Code : 831102

Test

Test Depth (m) : 0

Plate Diameter (cm) : 30

Moisture : Dry

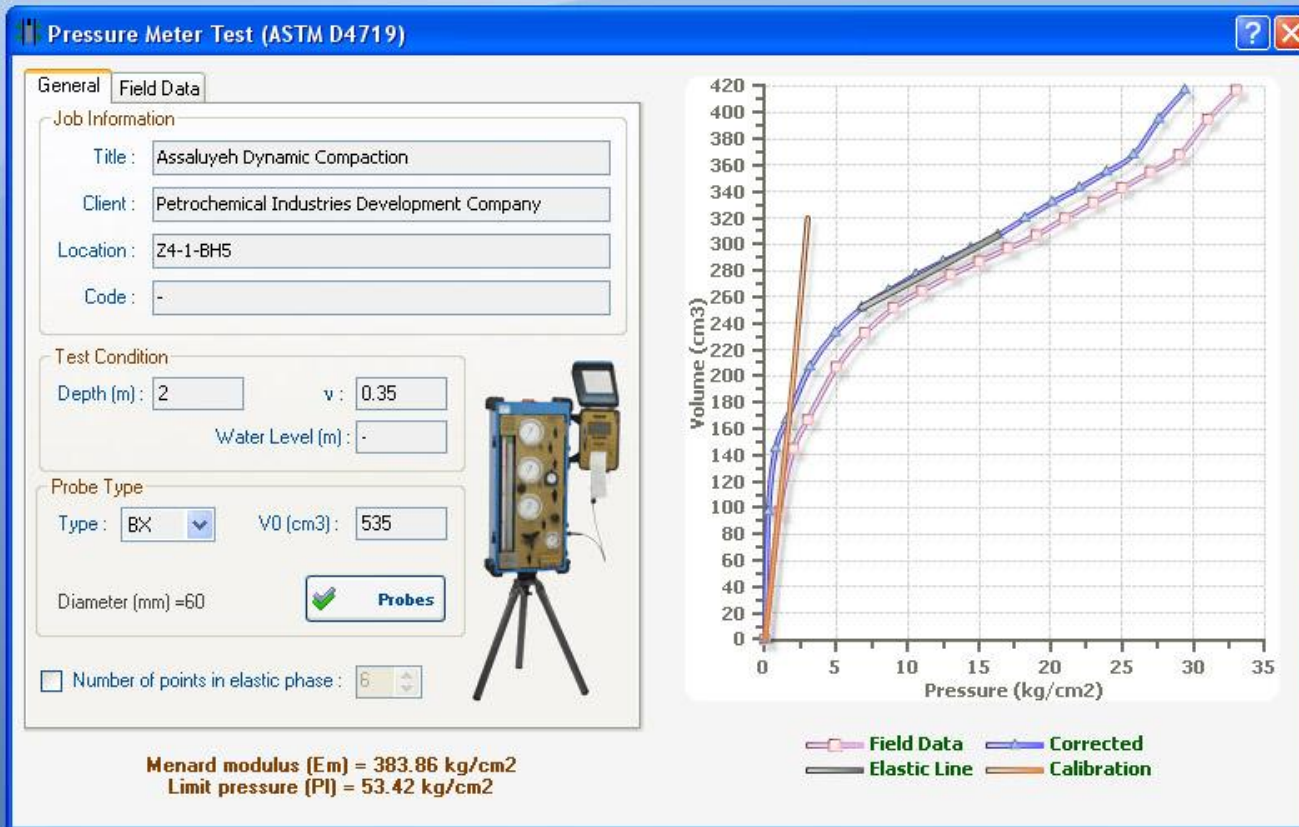
Modify Ks for plate thickness

Average modified Ks (kg/cm3) : 28.1

Modified Ks (kg/cm3) = 16.8

P1 (kg/cm2)	P2 (kg/cm2)	Calculated Ks (kg/cm3)	Modified Ks (kg/cm3)
<input checked="" type="checkbox"/> 0	8.49	32.9	19.2
<input checked="" type="checkbox"/> 8.49	22.64	23.3	14.4

PRESSURE-METER TEST (ASTM D4719)



SLOPE STABILITY



Slope stability analysis (limit equilibrium)

Soil and Slope parameters

$\phi = 28$

$\alpha = 5$

S.F. = 1

Soil density (gr/cm3) = 1.85

C (kg/cm2) = 0.1

Slope Height (m) = 6

$N_s = 11.1$

$\beta \sim 68.4$

The diagram illustrates a slope stability analysis. A yellow soil mass is shown with a failure surface. The slope height is labeled as $H=6\text{ m}$. The base width is labeled as $W=2.37\text{ m}$. The failure surface angle is labeled as $\alpha=5$. The failure surface angle $\beta=68.4$ is also indicated.

STRESS BEHIND RETAINING WALL

LINEAR LOAD

PEYSANJ

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File Bearing Capacity Field Tests Assistant

Stress Distribution

Stress below footing Stress behind wall

Load

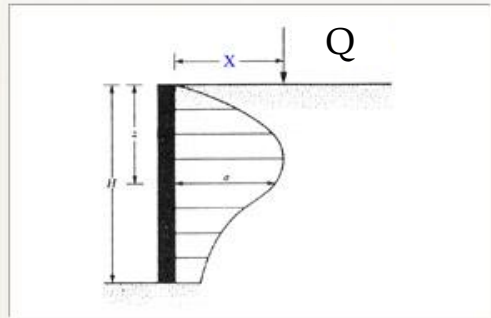
Linear load Spread load

Wall height (m): Q(kg / m):

X (m):

Add active earth pressure (Rankin)

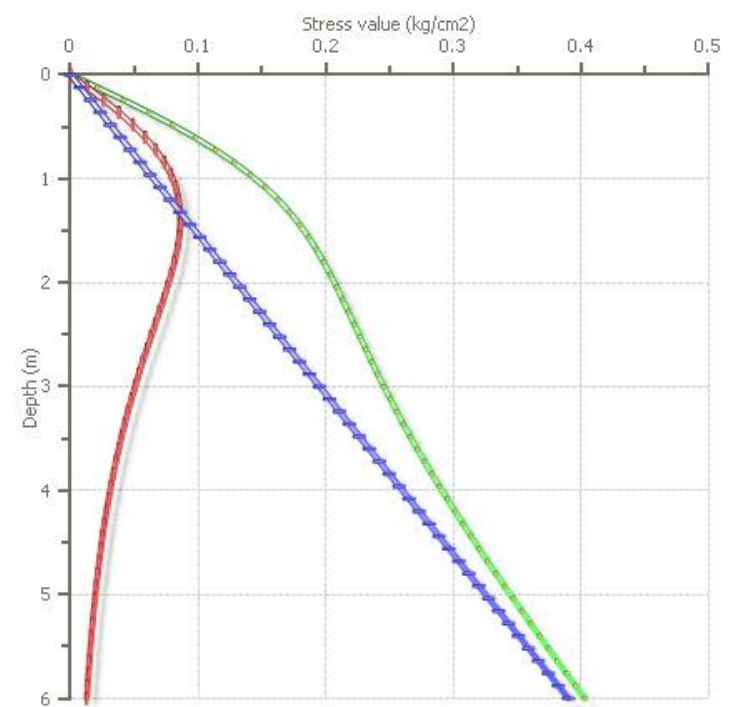
$\phi =$ g (gr/cm3):



Close Calculate

Stress value (kg/cm²)

Depth (m)



deltaP Overburden Rankin

RETAINING WALL

STRIP LOAD



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 Stress Behind Wall
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 Pressure Meter
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 Slope Stability
 Lateral Earth Pressures
 Ks calculator
 Assistant

Stress Distribution

Stress below footing Stress behind wall

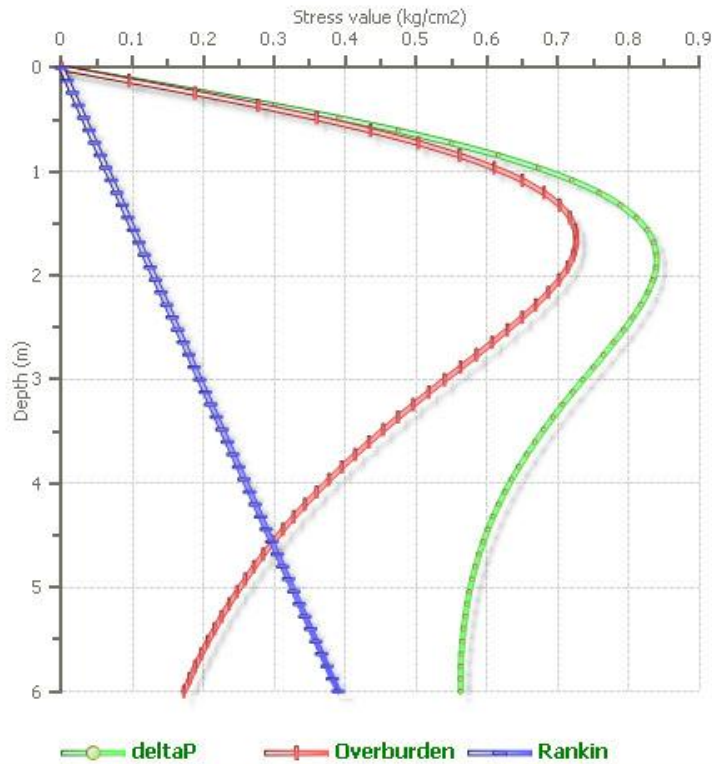
Load
 Linear load Spread load

Wall height (m): Q(kg / cm2):

X (m): B (m):

Add active earth pressure (Rankin)

$\phi =$ g (gr/cm3):



RETAINING WALL

LATERAL EARTH PRESSURE K (STATIC & EARTHQUAKE)

PEYSANJ

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Lateral earth pressure coefficients

Data

$\Phi = 32$ $\delta = 0.6\Phi$ $\alpha = 5$ $\beta = 85$

Mononobe-Okabe Kpa

Y-axis: $K_p (e)$ (2 to 8)
X-axis: $K_h (ah/g)$ (0 to 0.8)

Legend: $K_v = 0, 0.1, 0.2, 0.3, 0.4, 0.5$

Mononobe-Okabe Kae

Y-axis: $K_a (e)$ (0.2 to 1.6)
X-axis: $K_h (ah/g)$ (0 to 0.5)

Legend: $K_v = 0, 0.1, 0.2, 0.3, 0.4, 0.5$

Rankin Earth Pressures (static)
 $K_a = 0.311$
 $K_p = 3.196$

Columb Earth Pressures (static)
 $K_a = 0.333$
 $K_p = 7.718$

STRESS DISTRIBUTION

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Stress Distribution ? X

Stress below footing Stress behind wall

Foundation

B (m): Q (kg/cm²):

L (m):

Options

Method: Westergaard Westergaard 2:1 Slope

X Axis: value

Close Calculate

Stress value (kg/cm²)

Depth (m)

—○— deltaP
 —+— Overburden
 —■— Rankin

LIQUEFACTION ASSESSMENT



Soil Liquefaction Assessment

General | Stratigraphy | Field Tests

Project

Title:

Client:

Location:

Code:

Calculation methods

PGA:

Eq. Magnitude (M):

Water Level (m):

Required Safety Factor:

Magnitude Scale Factor (MSF) method:

Cyclic Resistance Ratio (CRR) Method:

- Japan' Bridge Code
- Chinese Code
- Seed et al. (1983)
- Tokimatsu-Yoshimi (1983)
- Shibata (1981)
- Kokusho et al. (1983)
- NCEER Workshop (1996)
- Vancouver Task Force (2007)

Main Results | Post - Liquefaction Parameters

— Cyclic Stress Ratio
— Cyclic Resistance Ratio

— Calculated Safety Factor
— Criteria

— SPT
— SPT (corrected)

Peysanj 2.50.2008.0908 (www.peysanj.com) 10/09/2008 Blue Silver Black Hide Ribbon Developed by : Alireza Afkhami (www.afkhami.com)

LIQUEFACTION ASSESSMENT

FIELD DATA

Soil Liquefaction Assessment

General Stratigraphy **Field Tests** LD

Soil Layers

Z1 (m)	Z2 (m)	D50 (m)	g (gr/cm3)	FC
0	3	0.02	1.86	11
3	8	0.005	1.92	5
8	15	0.002	1.76	22
15	30	0.004	1.83	31

Depth (m)

Compare All!

Soil Liquefaction Assessment

General Stratigraphy **Field Tests** LD

Please specify the type of field test performed:

- Standard Penetration Test (SPT)
- Becker Penetration Test (BPT)
- Shear Wave Velocity

SPT

Z (m)	SPT
1	15
3	17
5	18
7	19
9	20
11	22
13	22
15	26
17	29
19	28
21	25
24	29
26	27
28	28
30	29
34	26

Depth (m)

Load from File ... [Help](#)

Compare All!

LIQUEFACTION ASSESSMENT

MAGNITUDE SCALE FACTOR (MSF)



LIQUEFACTION ASSESSMENT

CRR CALCULATION METHODS

Magnitude Scale Factor (MSF) method:
Seed & Idriss (1982)

Cyclic Resistance Ratio (CRR) Method:
Japan' Bridge Code
Japan' Bridge Code
Chinese Code
Seed et al. (1983)
Tokimatsu-Yoshimi (1983)
Shibata (1981)
Kokusho et al. (1983)
NCEER Workshop (1996)
Vancouver Task Force (2007)

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Blue Silver Black Hide Ribbon
Blue Silver Black Hide Ribbon

24 26 28 30 32 34

24 26 28 30 32 34

Cyclic Stress Ratio
Cyclic Resistance Ratio
Calculat
Criteria

LIQUEFACTION ASSESSMENT

LATERAL DISPLACEMENT, VERT. SETTLEMENT, RESIDUAL SHEAR STRENGTH AFTER LIQUEFACTION

PEYSANJ

Projects Commands Options_Tools Help

Soil Liquefaction Assessment

General Stratigraphy Field Tests

Project

Title: Yacht storage building

Client: 2nd narrows, North vancou

Location: BDT08 - 1

Code: 108-2254

Calculation methods

PGA: 0.455

Eq. Magnitude (M): 7

Water Level (m): 6

Required Safety Factor: 1

Magnitude Scale Factor (MSF) method:
Seed & Idriss (1982)

Cyclic Resistance Ratio (CRR) Method:
NCEER Workshop (1996)

Safety Factor = CRR / CSR * MSF * K

Compare All!

Main Results Post - Liquefaction Parameters

$$LDI = \int_0^{z_{max}} \gamma_{max} dz = 5.11$$

Slope

Gently sloped Free-face

S (%) = 0.6

Post-Liquefaction Deformations

Ignore deformations (e.g. densification) at:
0 < Z (m) < 8

Lat. Disp. ~ 4.09 m

Vertical Settlement = 42.29 cm

* Lateral displacements and vertical settlements are only calculated for depths in which available safety factor is less than required.

Residual Shear Strength

please see Sr charts for details

* Use upper values if drains does NOT exist beneath and above liquefiable layers, otherwise use lower values.

References :

- Lateral displacement : Zhang & Robertson (2004)
- Vertical displacement : Wu (2002)
- Residual shear strength : Idriss & Boulanger (2007)

Shear Strain (%)

Vol. Strain (%)

Sr (kg/cm2)

Depth (m)

Sr (upper)

Sr (lower)

LIQUEFACTION ASSESSMENT

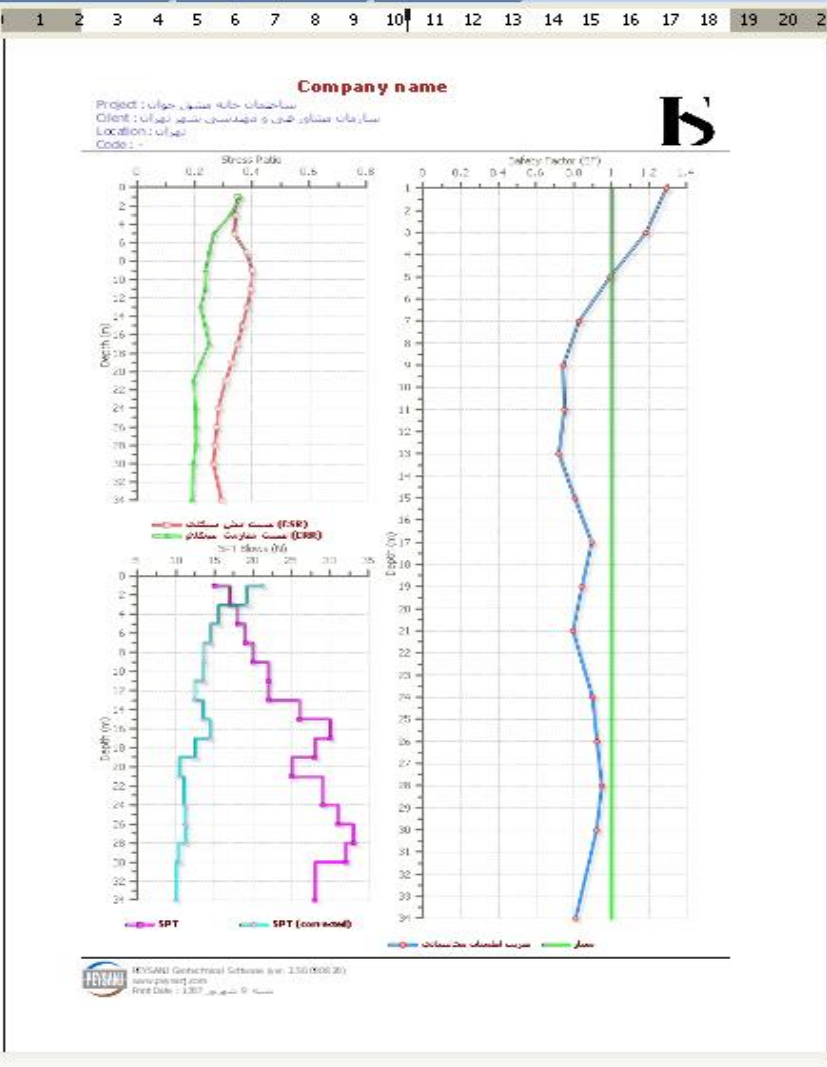
PRINT PREVIEW



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www.novotechSoftware.com/peysanj/

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