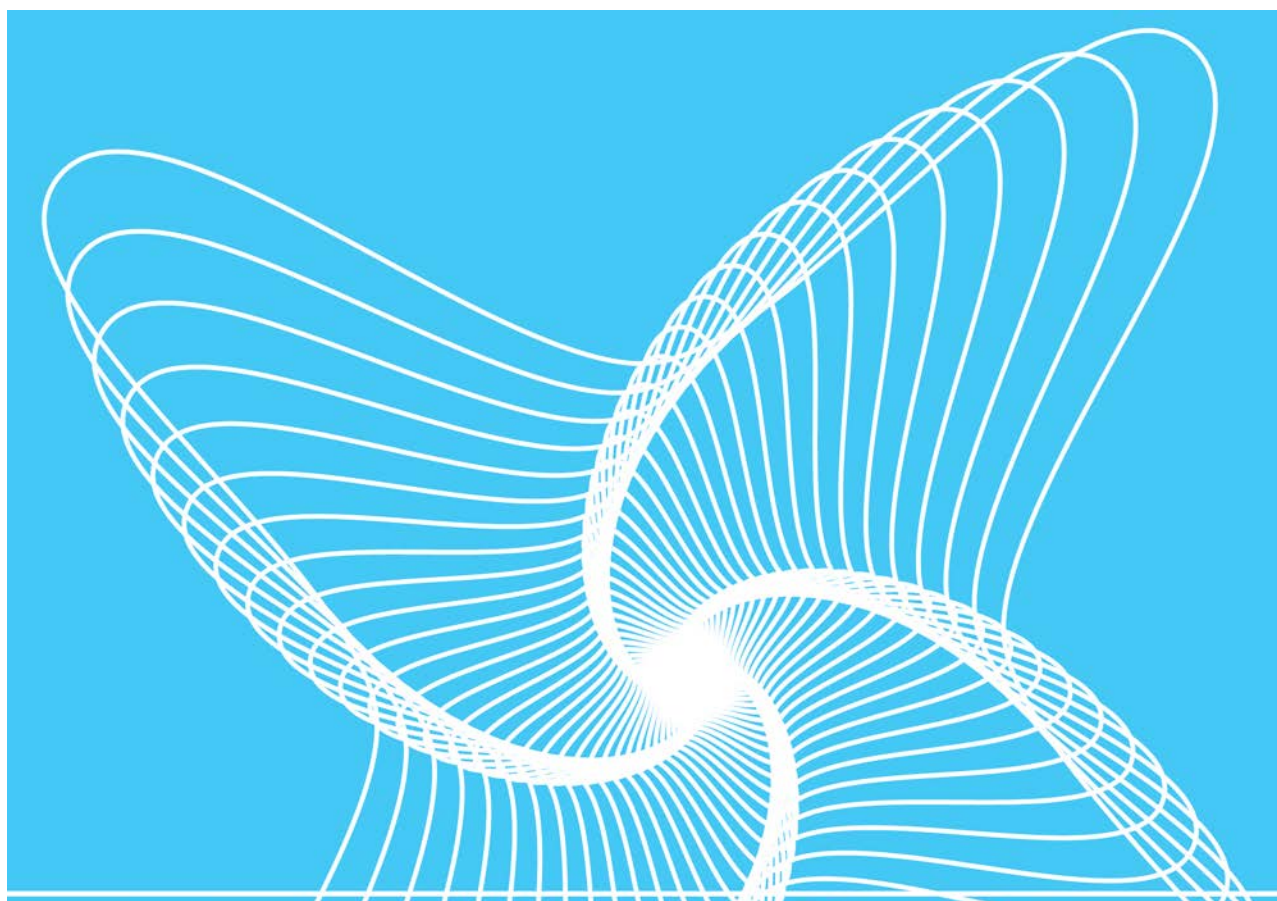



SESAM USER MANUAL

# Soil Utility Tool





Date: 21 January 2016

Prepared by DNV GL - Software

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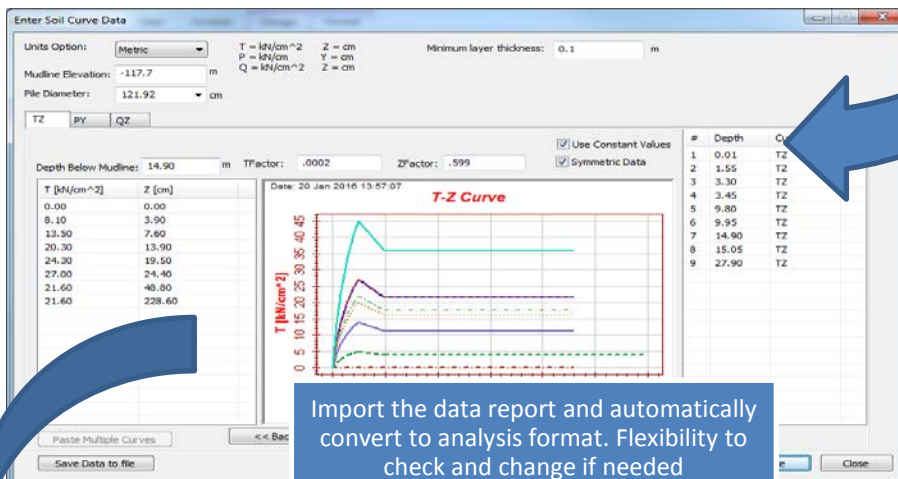
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# 1 SOIL UTILITY TOOL – INTRODUCTION

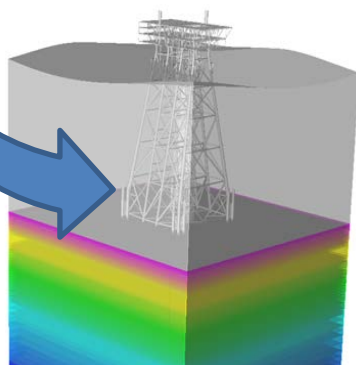
The Soil Utility Tool was developed to provide the Sesam user with an easy conversion of soil data from a design premise report into the analysis data format. Previously, this procedure would require the engineer to manually interpolate soil data to get T-Z, Q-Z, and P-Y curves for each soil layer and enter the soil curve data into the analysis program, which was tedious and error prone. This tool allows the user to copy the soil curve data directly from properly formatted soil report spreadsheets and automatically generate a script file in the correct format needed by the analysis program.

C	D	E	F	G	H	I	J	K	L	M
Mudline = -55.5		P Factor = 0.01								
Reference Diameter = 243.8 cm		Y Factor = 0.209								
Depth (m)		1	2	3	4	5	6	7	8	9
0.001	P	0								
1.40	Y	0								
	Y	0.00								
1.45	P	0.00	12.93	16.29	23.49	27.85	35.09	44.21	50.60	1.11
	Y	0.00	6.08	12.16	36.47	60.79	121.58	243.16	364.74	1823.70
2.50	P	0.00	35.21	44.36	63.98	75.85	95.57	120.41	137.83	16.20
	Y	0.00	4.33	8.66	25.98	43.31	86.61	173.23	259.84	1299.20
3.30	P	0.00	52.60	66.27	95.58	113.32	142.78	179.89	205.92	31.53
	Y	0.00	3.06	6.13	18.38	30.64	61.27	122.54	183.81	919.06
3.35	P	0.00	48.23	60.77	87.64	103.91	130.92	164.95	188.82	18.17
	Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25
4.50	P	0.00	59.56	75.04	108.23	128.32	161.67	203.70	233.17	40.70
	Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25
6.00	P	0.00	74.56	93.94	135.49	160.64	202.39	254.99	291.90	76.99
	Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25
7.30	P	0.00	88.28	111.22	160.41	190.19	239.62	301.91	345.60	115.82
	Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25
8.50	P	0.0								157.98
	Y	0.0								914.25
9.80	P	0.0								210.34
	Y	0.0								914.25
9.85	P	0.0								474.69
	Y	0.0								914.25
11.40	P	0.0								474.69
	Y	0.0								914.25

A typical design premise soil data report



Import the data report and automatically convert to analysis format. Flexibility to check and change if needed



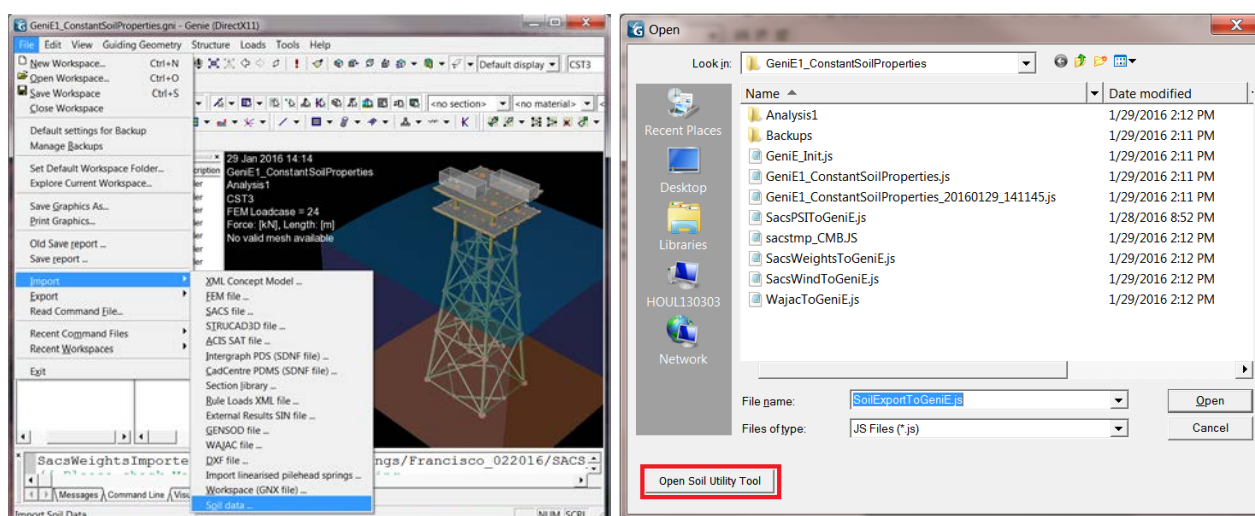
The soil data imported into GeniE ready for analysis

## 2 USER'S GUIDE

The following focuses on how to use the program, including how to launch the program, the available options, the steps needed to input the data from the soil report, how to add to or adjust the data as needed, and how to generate the script file for importing into GeniE.

### 2.1 Launch Soil Utility Tool from GeniE

In an opened GeniE workspace, click File -> Import -> Soil Data, and then click Open Soil Utility Tool to open the program.

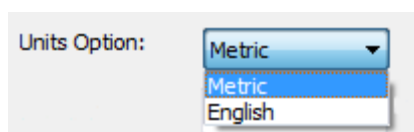


### 2.2 Main Options

The options in this section will apply to all the curve data entered in the program when the script file is generated.

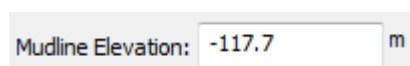
#### 2.2.1 The Units Option

This option allows the user to select Metric or English units according to the unit type in the soil data report.



#### 2.2.2 Mudline Elevation

This is the elevation of the seabed (mudline) based on the distance from the waterline. The value entered must be the same as the mudline elevation defined in the model.



#### 2.2.3 Pile Diameter

The Pile Diameter for which the soil data was created is entered here. Multiple pile diameters can be added by clicking the arrow on the box and selecting "<Add New Pile Diameter>" from the drop-down list. Each pile diameter will contain separate soil curve data.

Pile Diameter: 243.8 cm

243.8  
121.92  
< Add New Pile Diameter >

## 2.2.4 Minimum Layer Thickness

It is normal that soil properties have a sudden change at a certain level. For this case the soil report may have different soil data at that location with a very thin soil layer, such as 0.01m. In order to read the data at this thin soil layer, the default Minimum Layer Thickness is set up as 0.01m for Metric units and 0.033ft for English units.

The soil data with layer thickness less than Minimum layer thickness may be lost if Paste Multiple Curves feature is used.

It is not allowed to set up the Minimum Layer Thickness less than 0.01m for Metric units or 0.033ft for English units.

Minimum layer thickness: 0.01 m

## 2.3 Curve Data Options

The options in this section will apply to each individual curve entered.

### 2.3.1 Use Constant Values

The program will use constant soil properties for this layer when generating the script file when this box is checked. The program will linearly interpolate the soil properties for this layer if this box is not checked.

☒ Use Constant Values

### 2.3.2 Symmetric Data

The program will use only symmetric curve point data when generating the script file if this box is checked. The first entered point has to be (0, 0). It is allowed to input unsymmetrical TZ data if this box is not checked.

☒ Symmetric Data

### 2.3.3 T and Z Factor Options

The T and Z Factors will be applied to the curve point data input when the script file is generated. This applies to TZ and QZ curve type data only. The T and Z factors are individual for each curve. When you paste multiple curves, you need to set those values before pasting. To change the values, you would need to change them on each curve.

TFactor: .0001 ZFactor: 0.499

### 2.3.4 P and Y Factor Options

The P and Y Factors will be applied to the curve point data input when the script file is generated. This applies to PY curve type data only. The P and Y factors are individual for each curve. When you paste

multiple curves, you need to set those values before pasting. To change the values, you would need to change them on each curve.

PFactor:  YFactor:

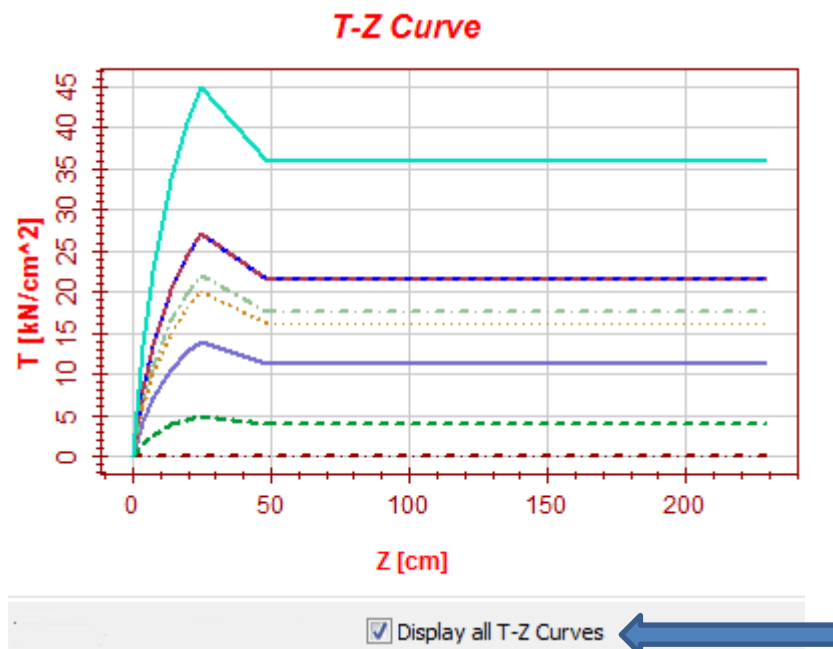
### 2.3.5 Use Curve Scaling/Reference Diameter

For PY curve type data, if Use Curve Scaling is selected, the program will scale the curve point input relative to the Reference Diameter entered, if different from the Pile Diameter. Y values would be changed.

☒ Use Curve Scaling Reference Diameter:  cm

### 2.3.6 Display all [T-Z,Q-Z,P-Y] Curves

If this option is selected, all of the curves for the current curve type will be displayed on the graph. If unchecked, only the currently selected curve will be displayed.



## 2.4 Entering the Soil Curve Data

There are two ways to enter in the soil curve data into the program – manually enter in each curve or copy and paste multiple curves.

The first step for both is to select the curve type for the data being entered. This can be done by clicking the TZ, PY or QZ tab at the top of the frame:

The second step is to enter in the factors and curve data options as described in the previous section (image below is an example for PY curve type).

☒ Use Curve Scaling    Reference Diameter:  cm    ☒ Use Constant Values  
 PFactor:     YFactor:     ☒ Symmetric Data

## 2.4.1 Manually Enter Curve Data

Once the curve data options are entered, the following steps can be used to enter each curve.

### 2.4.1.1 Enter Depth Below Mudline

The Depth Below Mudline field must be entered for each curve.

Depth Below Mudline:  m


Note: Each Depth entered for a curve type must be in increasing order. A warning will be issued by the program if the depth entered is less than the previous curve.

### 2.4.1.2 Manually Enter the Curve Data Points

Each curve point can be entered by clicking on the cells in the curve point list and typing in the data. The Tab and Arrow keys can be used to navigate within this list.

Depth Below Mudline:  m

T [kN/cm <sup>2</sup> ]	Z [cm]
0.00	0.00
1.50	3.90
2.50	7.60
3.80	13.90
4.50	19.50
5.00	<input type="text" value="24.40"/>



### 2.4.1.3 Copy and Paste Curve Data Points from Spreadsheet

As an alternative, if the soil report data is in a spreadsheet (Excel), each set of curve points can be copied from the spreadsheet and pasted into the curve point list. The curve points can be in two rows or two columns of data. The curve points can be highlighted and copied to the clipboard.

T	0.00	1.50	2.50	3.80	4.50	5.00	4.00	4.00
Z	0.00	3.90	7.60	13.90	19.50	24.40	48.80	228.60

P	Y
0.00	0.00
35.21	4.33
44.36	8.66
63.98	25.98
75.85	43.31
95.57	86.61
120.41	173.23
137.83	259.84
16.20	1299.20
16.20	1385.80



Once the data is copied, the first field in the curve point list should be selected and Ctrl-V can be used to paste the data to the list

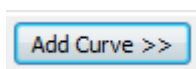
Depth Below Mudline: 1.55 m

T [kN/cm<sup>2</sup>]      Z [cm]

Ctrl-V to paste the data in the list

#### 2.4.1.4 Add Curve

Once the options have been properly set and the Depth and curve points have been entered, the curve is saved by clicking the “Add Curve >>” button. This will save the current curve and clear the Depth Below Mudline field as well as the curve point list to set up for the next curve entry.



### 2.4.2 Paste Multiple Curves

In order to use this feature, the soil data contained in an Excel file has to be in a specific format.

#### 2.4.2.1 Soil Data Format

If the soil data from the report is contained in an Excel spreadsheet, multiple curves of one curve type can be copied from the spreadsheet and pasted into the program at one time. This requires the spreadsheet to be in a specific format as shown below:

	Mudline = -55.5		P Factor = 0.01	"P" is kN/m								
	Pile Diameter = 121.92 cm		Y Factor = 0.209	"Y" is mm								
P-Y Data												
Number	Depth (m)		1	2	3	4	5	6	7	8	9	10
1	0.00	P	0.00	0.00								
		Y	0.00	1945.30								
2	1.55	P	0.00	12.93	16.29	23.49	27.85	35.09	44.21	50.60	1.11	1.11
		Y	0.00	6.08	12.16	36.47	60.79	121.58	243.16	364.74	1823.70	1945.30
3	5.50	P	0.00	48.23	60.77	87.64	103.91	130.92	164.95	188.82	18.17	18.17
		Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25	975.20
4	10.80	P	0.00	116.49	146.77	211.68	250.97	316.21	398.40	456.05	210.34	210.34
		Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25	975.20
5	15.05	P	0.00	80.91	101.94	147.03	174.32	219.63	276.72	316.76	316.76	316.76
		Y	0.00	6.09	12.19	36.56	60.93	121.85	243.71	365.56	1827.80	1949.70

Here, the Depth Below Mudline values have to be in an increasing order with all positive numbers. They are included in the first column of the first row of each individual curve. The second column, which is used to label the value types (P and Y in this example), is ignored by the program. The remaining columns are the curve data points.

#### 2.4.2.2 Copy Soil Data and Paste Multiple Curves

Once the multiple curves are highlighted, as shown below, and copied, they can be pasted into the program using the “Paste Multiple Curves” button.

	Mudline = -55.5		P Factor = 0.01	"P" is kNm								
	Pile Diameter = 121.92 cm		Y Factor = 0.209	"Y" is mm								
P-Y Data												
Number	Depth (m)		1	2	3	4	5	6	7	8	9	10
1	0.00	P	0.00	0.00								
		Y	0.00	1945.30								
2	1.55	P	0.00	12.93	16.29	23.49	27.85	35.09	44.21	50.60	1.11	1.11
		Y	0.00	6.08	12.16	36.47	60.79	121.58	243.16	364.74	1823.70	1945.30
3	5.50	P	0.00	48.23	60.77	87.64	103.91	130.92	164.95	188.82	18.17	18.17
		Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25	975.20
4	10.80	P	0.00	116.49	146.77	211.68	250.97	316.21	398.40	456.05	210.34	210.34
		Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25	975.20
5	15.05	P	0.00	80.91	101.94	147.03	174.32	219.63	276.72	316.76	316.76	316.76
		Y	0.00	6.09	12.19	36.56	60.93	121.85	243.71	365.56	1827.80	1949.70

The Depth Below Mudline is entered in automatically for each curve pasted.

Note: All factors for TZ/QZ/PY curves have to be input and all options have to be selected before multiple curves are pasted. "Mudline Elevation", "Minimum layer thickness" and "Pile Diameter" are global settings. For each type of soil curve, the other factors and options could be different. The factors include: T factor and Z factor for TZ curve, P factor and Y factor for PY curve, T factor and Z factor for QZ curve. Options include "Use Constant Values", "Symmetric Data", "Use Curve Scaling" and "Reference Diameter".

## 2.5 Saving/Loading Data

The current data entered into the program can be saved to a file and loaded at a later time.

### 2.5.1 Saving the Data

Click the "Save Data to file" button to save the current progress to a file. The program will prompt for the directory and filename.

Save Data to file

### 2.5.2 Loading the Data

If there is no soil data currently entered in the program, the "Load Data from file" button will be visible. Clicking this button will prompt for the location and filename of the previously saved data file.

Load Data from file

## 2.6 Reviewing and Changing

Previously entered data can be reviewed and altered prior to generating the script file.

### 2.6.1 Navigating the Soil Data

There are two basic ways to navigate through the soil data:

1. Using the << Back and Next >> buttons, the user may scroll back and forth through all the soil curves for the currently selected curve type.
2. Clicking on a curve item in the Soil Curve List will load that curve. If this list is already selected, the up and down arrow keys can be used to scroll through the curves in the list.

#	Depth	Curve Type
1	0.00	TZ
2	1.55	TZ
3	1.56	TZ
4	3.30	TZ
5	9.80	TZ
6	9.95	TZ
7	14.90	TZ
8	15.05	TZ
9	27.90	TZ
10	28.05	TZ
11	30.40	TZ
12	31.10	TZ


## 2.6.2 Editing the Data


The curve data entered can be edited before generating the script file.

### 2.6.2.1 Editing a Curve




Data for each individual curve, including Depth Below Mudline, Factors and individual curve points can be edited by the user simply by selecting the field and entering the data. The changes are saved when another curve is selected, or "Generate JS File" is clicked.

### 2.6.2.2 Adding/Deleting a Curve

Curves can be added or deleted from the Soil Curve List box. To add a curve, select one of the curves in the list and click the  button located below the list box. This will insert a blank curve above the currently selected curve. The data and curve points can then be entered/edited as described above.

To delete a curve, select one of the curves in the list box and click the  button. This will remove the selected curve from the list.

14	37.90	TZ
15	38.05	TZ
16	43.80	TZ
17	43.95	TZ
18	65.00	TZ
19	65.15	TZ
20	72.00	TZ

## 3 LIMITATIONS

### 3.1 Number of Curves

The allowed maximum number of generated curves is 450 for each pile diameter.

### 3.2 Number of Points on Each Curve

For a symmetric TZ, QZ or PY curve, the allowed maximum number of points on the curve is 12.

For an unsymmetrical TZ curve, the allowed maximum number of points on the curve is 23.

### 3.3 Generated Minimum Soil Layer Thickness

When the minimum layer thickness is set to 0.01m or 0.033ft, if a thickness of equal to or less than 0.01m or 0.033 ft in the input soil layer list is detected, the program will automatically increase the depth of the deeper curve so that there is a 0.05m difference. For this case a warning will be issued in the generated JS file.

## 4 EXAMPLE

An example soil report data spreadsheet has been provided. [Click here to open.](#)

### 4.1 Create Soil Scripts Using Paste Multiple Curve Feature

A 4 leg offshore platform is at a location with a water depth of 55.5m. The mudline elevation is -55.5m. All 4 piles have a diameter of 121.92cm. The soil TZ, QZ, and PY data provided in a soil report are with Excel format shown below. The feature of Copy and Paste Multiple Curves will be used in this example.

TZ data:

	Mudline = -55.5		T Factor = 0.0001							
	Pile Diameter = 121.92 cm		Z Factor = 0.500							
T-Z Data										
Number	Depth (m)		1	2	3	4	5	6	7	8
1	0.00	T	0.00	0.00						
		Z	0.00	228.60						
2	1.50	T	0.00	4.20	7.00	10.50	12.60	14.00	11.20	11.20
		Z	0.00	3.90	7.60	13.90	19.50	24.40	48.80	228.60
3	4.50	T	0.00	8.10	13.50	20.30	24.30	27.00	21.60	21.60
		Z	0.00	3.90	7.60	13.90	19.50	24.40	48.80	228.60
4	7.50	T	0.00	13.50	22.50	33.80	40.50	45.00	36.00	36.00
		Z	0.00	3.90	7.60	13.90	19.50	24.40	48.80	228.60
5	9.00	T	0.00	10.50	17.50	26.30	31.50	35.00	28.00	28.00
		Z	0.00	3.90	7.60	13.90	19.50	24.40	48.80	228.60
6	15.50	T	0.00	96.00	96.00					
		Z	0.00	2.50	243.80					
7	21.75	T	0.00	24.00	40.00	60.00	72.00	80.00	64.00	64.00
		Z	0.00	3.90	7.60	13.90	19.50	24.40	48.80	228.60
8	31.26	T	0.00	30.00	50.00	75.00	90.00	100.00	80.00	80.00
		Z	0.00	3.90	7.60	13.90	19.50	24.40	48.80	228.60
9	45.00	T	0.00	96.00	96.00					
		Z	0.00	2.50	243.80					
10	65.80	T	0.00	80.00	80.00					
		Z	0.00	2.50	243.80					
11	83.00	T	0.00	80.00	80.00					
		Z	0.00	2.50	243.80					
12	104.90	T	0.00	45.00	75.00	112.50	135.00	150.00	120.00	120.00
		Z	0.00	3.90	7.60	13.90	19.50	24.40	48.80	228.60

### QZ data:

	Mudline = -55.5		T Factor = 0.0214							
	Pile Diameter = 121.92 cm		Z Factor = 0.100							
Q-Z Data										
Number	Depth (m)		1	2	3	4	5	6	7	8
1	9.80	Q	0.00	0.30	0.60	0.90	1.10	1.30	1.30	1.30
		Z	0.00	4.90	31.70	102.40	178.00	243.80	365.70	487.60
2	27.90	Q	0.00	0.50	0.90	1.40	1.70	1.90	1.90	1.90
		Z	0.00	4.90	31.70	102.40	178.00	243.80	365.70	487.60
3	40.90	Q	0.00	1.80	3.50	5.30	6.40	7.10	7.10	7.10
		Z	0.00	4.90	31.70	102.40	178.00	243.80	365.70	487.60
4	65.00	Q	0.00	0.80	1.70	2.50	3.00	3.40	3.40	3.40
		Z	0.00	4.90	31.70	102.40	178.00	243.80	365.70	487.60
5	78.90	Q	0.00	6.50	13.00	19.40	23.30	25.90	25.90	25.90
		Z	0.00	4.90	31.70	102.40	178.00	243.80	365.70	487.60
6	91.80	Q	0.00	1.60	3.20	4.70	5.70	6.30	6.30	6.30
		Z	0.00	4.90	31.70	102.40	178.00	243.80	365.70	487.60
7	104.90	Q	0.00	1.60	3.20	4.70	5.70	6.30	6.30	6.30
		Z	0.00	4.90	31.70	102.40	178.00	243.80	365.70	487.60

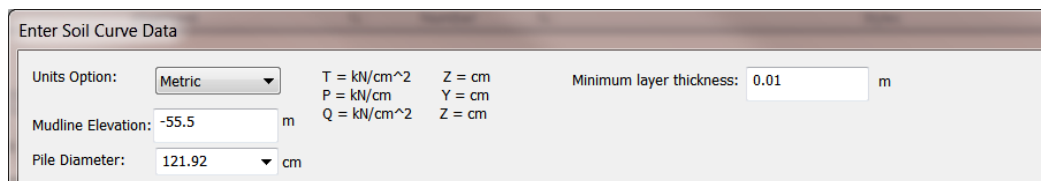
### PY data:

	Mudline = -55.5		P Factor = 0.01	"P" is kN/m								
	Pile Diameter = 121.92 cm		Y Factor = 0.209	"Y" is mm								
P-Y Data												
Number	Depth (m)		1	2	3	4	5	6	7	8	9	10
1	0.00	P	0.00	0.00								
		Y	0.00	1945.30								
2	3.00	P	0.00	12.93	16.29	23.49	27.85	35.09	44.21	50.60	1.11	1.11
		Y	0.00	6.08	12.16	36.47	60.79	121.58	243.16	364.74	1823.70	1945.30
3	6.00	P	0.00	48.23	60.77	87.64	103.91	130.92	164.95	188.82	18.17	18.17
		Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25	975.20
4	9.00	P	0.00	116.49	146.77	211.68	250.97	316.21	398.40	456.05	210.34	210.34
		Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25	975.20
5	15.05	P	0.00	80.91	101.94	147.03	174.32	219.63	276.72	316.76	316.76	316.76
		Y	0.00	6.09	12.19	36.56	60.93	121.85	243.71	365.56	1827.80	1949.70
6	26.00	P	0.00	167.11	210.55	303.66	360.03	453.61	571.51	654.22	654.22	654.22
		Y	0.00	3.49	6.99	20.96	34.93	69.86	139.72	209.57	1047.90	1117.70
7	31.25	P	0.00	141.52	178.30	257.16	304.90	384.15	483.99	554.03	554.03	554.03
		Y	0.00	3.05	6.10	18.29	30.48	60.95	121.90	182.85	914.25	975.20
8	43.80	P	0.00	1664.90	3209.30	5632.10	7101.20	7876.70	8256.30	8435.30	8518.10	8556.20
		Y	0.00	4.20	8.30	16.60	24.90	33.20	41.50	49.80	58.20	66.50
9	50.60	P	0.00	254.71	320.91	462.83	548.75	691.38	871.08	997.14	997.14	997.14
		Y	0.00	2.13	4.27	12.80	21.33	42.67	85.33	128.00	639.98	682.64
10	60.40	P	0.00	301.42	379.76	547.71	649.38	818.17	1030.80	1180.00	1180.00	1180.00
		Y	0.00	2.13	4.27	12.80	21.33	42.67	85.33	128.00	639.98	682.64
11	74.00	P	0.00	404.18	509.23	734.43	870.77	1097.10	1382.30	1582.30	1582.30	1582.30
		Y	0.00	1.52	3.05	9.14	15.24	30.48	60.95	91.43	457.13	487.60
12	91.80	P	0.00	606.26	763.84	1101.70	1306.20	1645.70	2073.40	2373.40	2373.40	2373.40
		Y	0.00	1.52	3.05	9.14	15.24	30.48	60.95	91.43	457.13	487.60
13	104.90	P	0.00	606.26	763.84	1101.70	1306.20	1645.70	2073.40	2373.40	2373.40	2373.40
		Y	0.00	1.52	3.05	9.14	15.24	30.48	60.95	91.43	457.13	487.60

### 4.1.1 Open Soil Utility Tool and Select Main Options

Unit = Metric; Mudline Elevation = -55.5m, Pile Diameter = 121.92cm;

Keep Min Layer Thickness = 0.01m

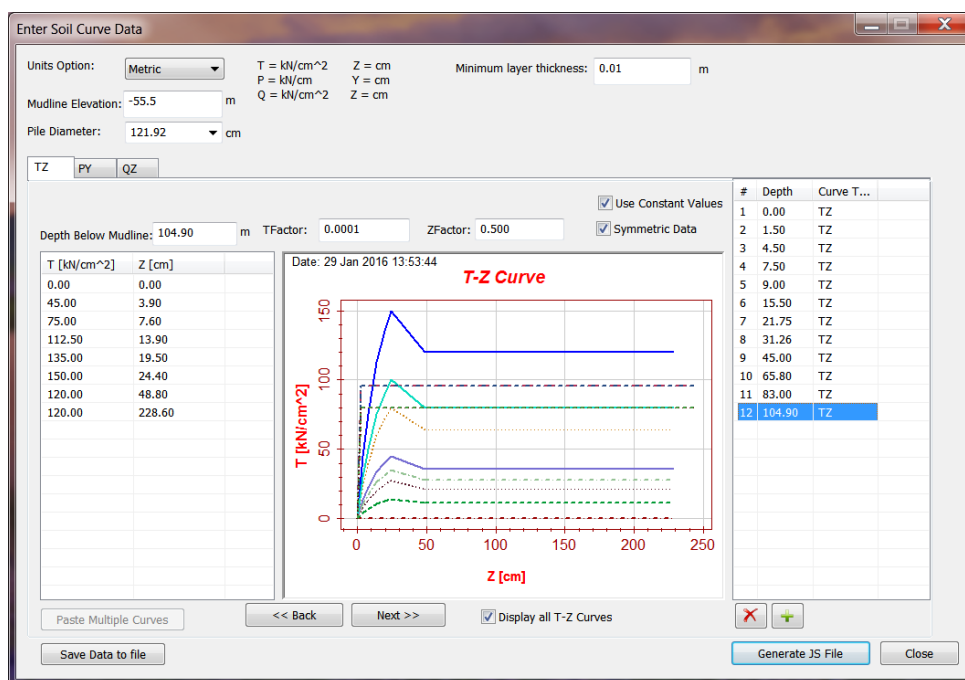


### 4.1.2 Enter TZ, PY, and QZ Data

Since the soil data provided are saved in an Excel file, we can use copy/paste multiple curves feature to enter all soil data.

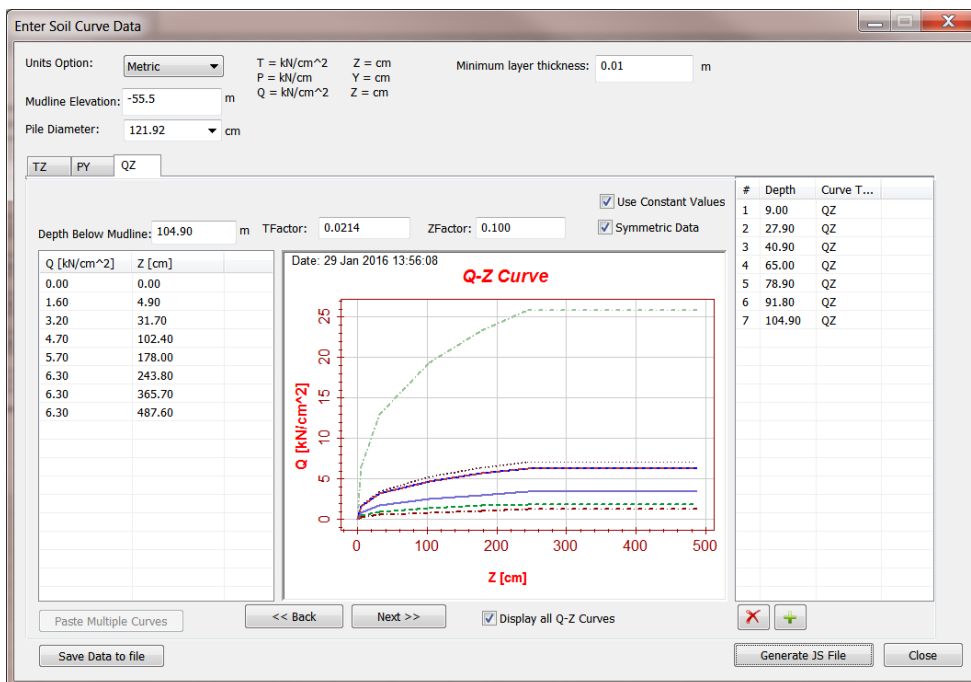
#### 4.1.2.1 TZ Data

Input T factor and Z factor first, and then check the options of Use Constant Values and Symmetric Data. Copy TZ data from the Excel file to the clipboard, then click Paste Multiple Curves to paste all TZ data into Soil Utility Tool. Check “Display all T-Z Curves” box so all T-Z curves can be seen.



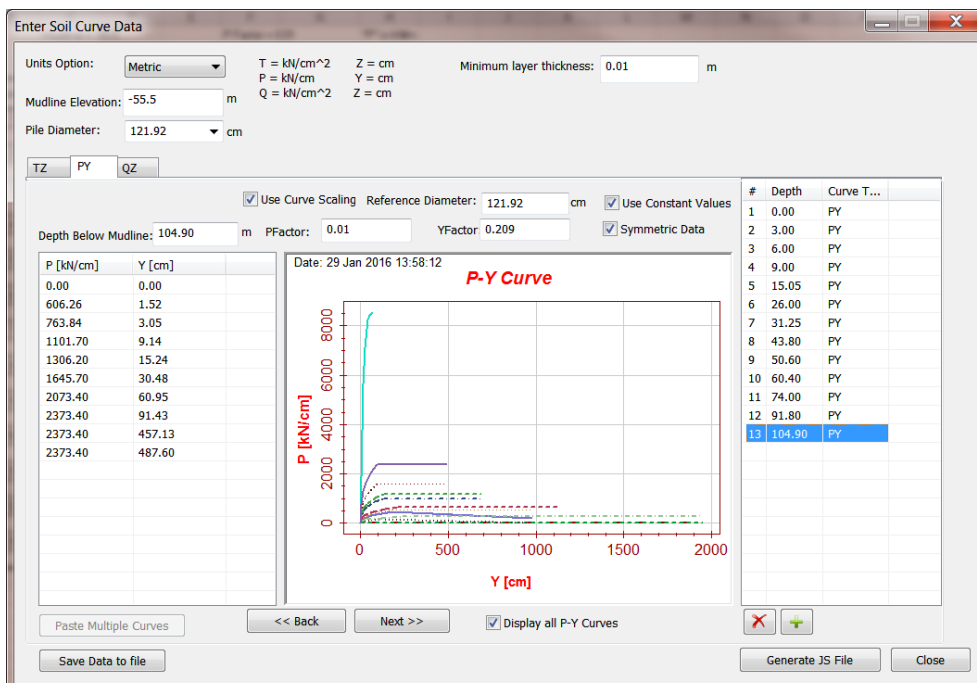
#### 4.1.2.2 QZ Data

Switch to the QZ tab. Input T factor and Z factor first, and then check the options of Use Constant Values and Symmetric Data. Copy QZ data from the Excel file to the clipboard, then click Paste Multiple Curves to paste all QZ data into Soil Utility Tool. The “Display all Q-Z Curves” box should already be checked so all Q-Z curves can be seen.



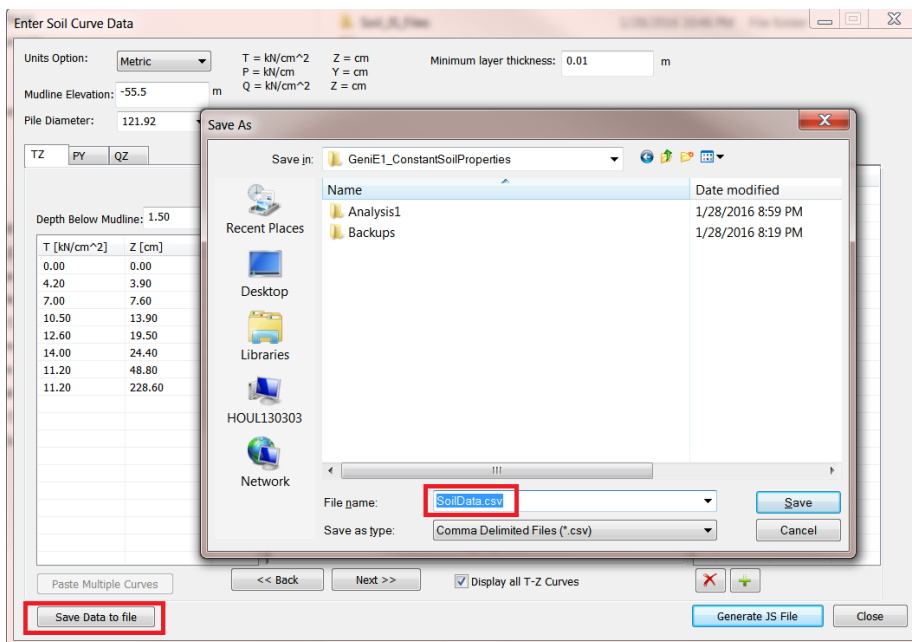
#### 4.1.2.3 PY Data

Switch to the PY tab. Check the "Use Curve Scaling" option and input the Reference Diameter as 121.92cm, input P factor of 0.01 and Y factor of 0.209, and then select Use Constant Values and Symmetric Data. Copy PY data from the Excel file to the clipboard, then click Paste Multiple Curves to paste all PY data into Soil Utility Tool. Check "Display all P-Y Curves" box so all P-Y curves can be seen.



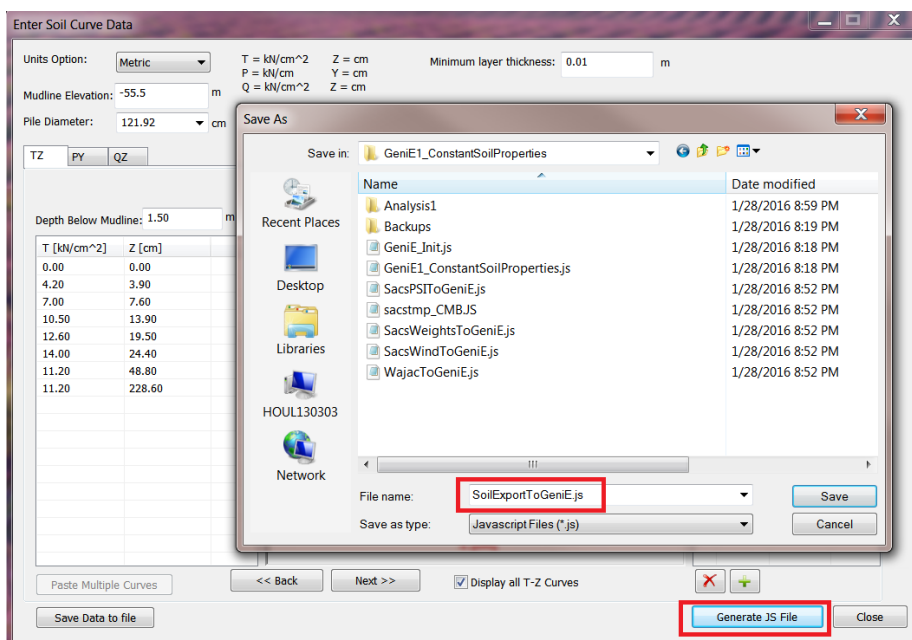
#### 4.1.3 Save Data to a File

Click Save Data to file button to save a CSV file for future use.



#### 4.1.4 Generate a Script File for Analysis

Click Generate JS File button to create a JS file and the JS file. If the working folder is the GeniE workspace folder, the generated JS command will be read into the model file automatically after it is generated. If the generated JS file is placed into another folder, it can be read into GeniE model file later.







## ABOUT DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.

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