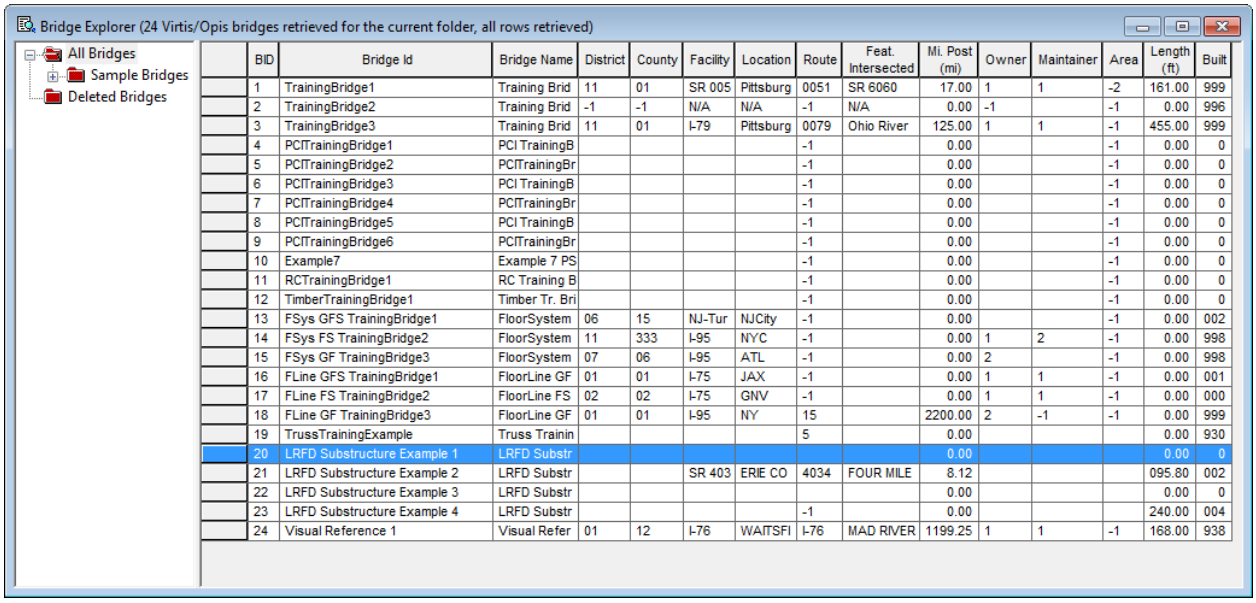
AASHTOWare Bridge Design Training - (BrD 6.4) - Drilled Shaft

Topics Covered

- Drilled Shaft Definition
- Drilled Shaft Reinforcement
- Drilled Shaft Analysis Control



	BID	Bridge Id	Bridge Name	District	County	Facility	Location	Route	Feat. Intersected	Mi. Post (mi)	Owner	Maintainer	Area	Length (ft)	Built
	1	TrainingBridge1	Training Brid	11	01	SR 005	Pittsburg	0051	SR 6060	17.00	1	1	-2	161.00	999
	2	TrainingBridge2	Training Brid	-1	-1	N/A	N/A	-1	N/A	0.00	-1		-1	0.00	996
	3	TrainingBridge3	Training Brid	11	01	I-79	Pittsburg	0079	Ohio River	125.00	1	1	-1	455.00	999
	4	PCITrainingBridge1	PCI TrainingB					-1		0.00			-1	0.00	0
	5	PCITrainingBridge2	PCITrainingBr					-1		0.00			-1	0.00	0
	6	PCITrainingBridge3	PCI TrainingB					-1		0.00			-1	0.00	0
	7	PCITrainingBridge4	PCITrainingBr					-1		0.00			-1	0.00	0
	8	PCITrainingBridge5	PCI TrainingB					-1		0.00			-1	0.00	0
	9	PCITrainingBridge6	PCITrainingBr					-1		0.00			-1	0.00	0
	10	Example7	Example 7 PS					-1		0.00			-1	0.00	0
	11	RCTrainingBridge1	RC Training B					-1		0.00			-1	0.00	0
	12	TimberTrainingBridge1	Timber Tr. Bri					-1		0.00			-1	0.00	0
	13	FSys GFS TrainingBridge1	FloorSystem	06	15	NJ-Tur	NJCity	-1		0.00			-1	0.00	002
	14	FSys FS TrainingBridge2	FloorSystem	11	333	I-95	NYC	-1		0.00	1	2	-1	0.00	998
	15	FSys GF TrainingBridge3	FloorSystem	07	06	I-95	ATL	-1		0.00	2		-1	0.00	998
	16	FLine GFS TrainingBridge1	FloorLine GF	01	01	I-75	JAX	-1		0.00	1	1	-1	0.00	001
	17	FLine FS TrainingBridge2	FloorLine FS	02	02	I-75	GNV	-1		0.00	1	1	-1	0.00	000
	18	FLine GF TrainingBridge3	FloorLine GF	01	01	I-95	NY	15		2200.00	2	-1	-1	0.00	999
	19	TrussTrainingExample	Truss Trainin					5		0.00				0.00	930
	20	LRFD Substructure Example 1	LRFD Substr							0.00				0.00	0
	21	LRFD Substructure Example 2	LRFD Substr			SR 403	ERIE CO	4034	FOUR MILE	8.12				095.80	002
	22	LRFD Substructure Example 3	LRFD Substr							0.00				0.00	0
	23	LRFD Substructure Example 4	LRFD Substr					-1		0.00				240.00	004
	24	Visual Reference 1	Visual Refer	01	12	I-76	WAITSFI	I-76	MAD RIVER	1199.25	1	1	-1	168.00	938

Fig 1. Bridge Explorer

From the Bridge Explorer (Fig 1) select LRFD Substructure Example 1(BID20) and double click (or right click and select open) to open it.

Once Bridge Workspace tree shows up expand “PIERS” under “BRIDGE ALTERNATIVES”- “2 Span Bridge (E)(C)” by clicking on “+” . Then expand “pier 1” and select “3 – column pier (E)(C)” under “PIER ALTERNATIVES”.

Expand “3 – column pier (E)(C)” by clicking on “+” and select “Column1” under COLUMNS. Select “FOUNDATION ALTERNATIVES” and expand it. Now the Bridge Workspace tree will be as shown in Fig 2.

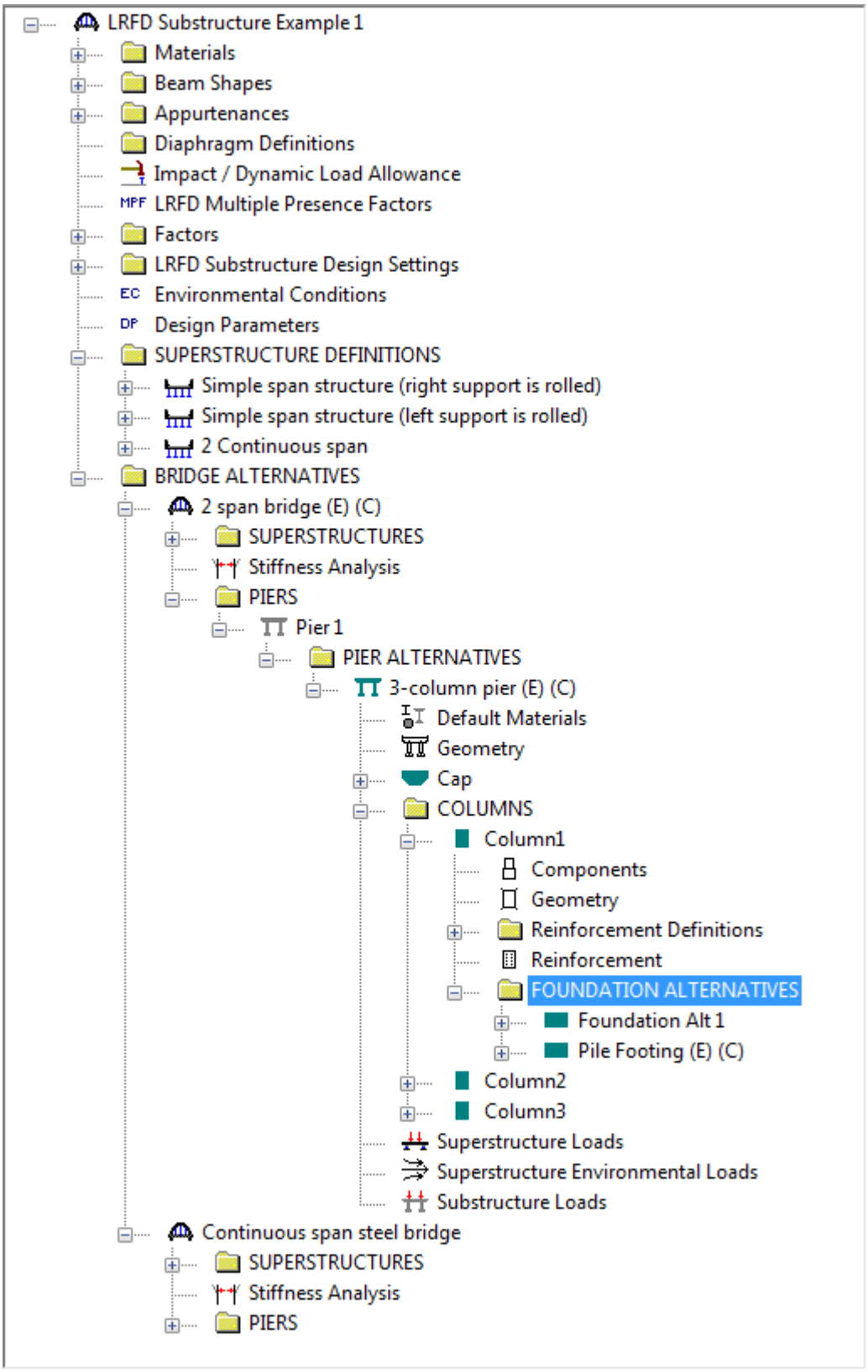


Fig 2. Bridge Workspace Tree – Foundation Alternatives

Double click on “FOUNDATION ALTERNATIVES” to open New Foundation Alternative Wizard window (Fig 3).

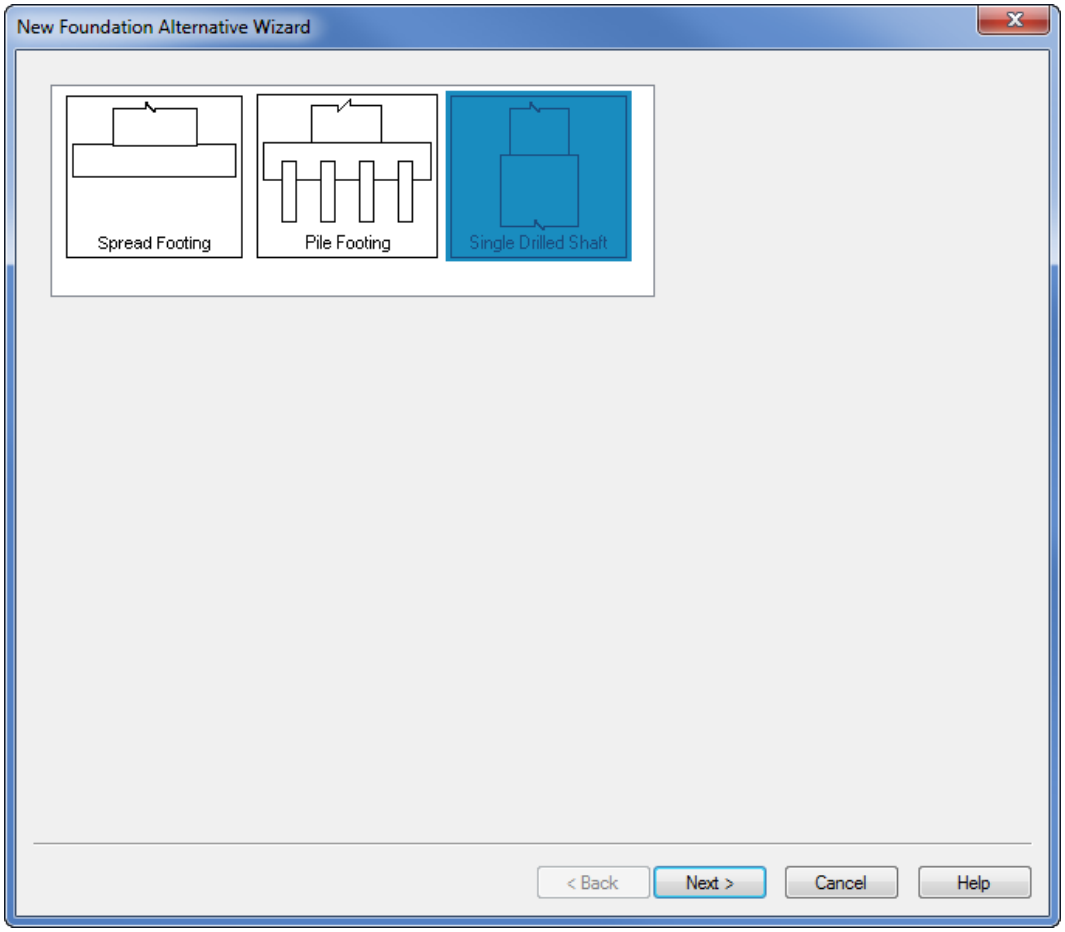


Fig 3. New Foundation Alternative Wizard Window

Select Single Drilled Shaft alternative and click on “Next” button. Enter the data on next window as shown in (Fig 4).

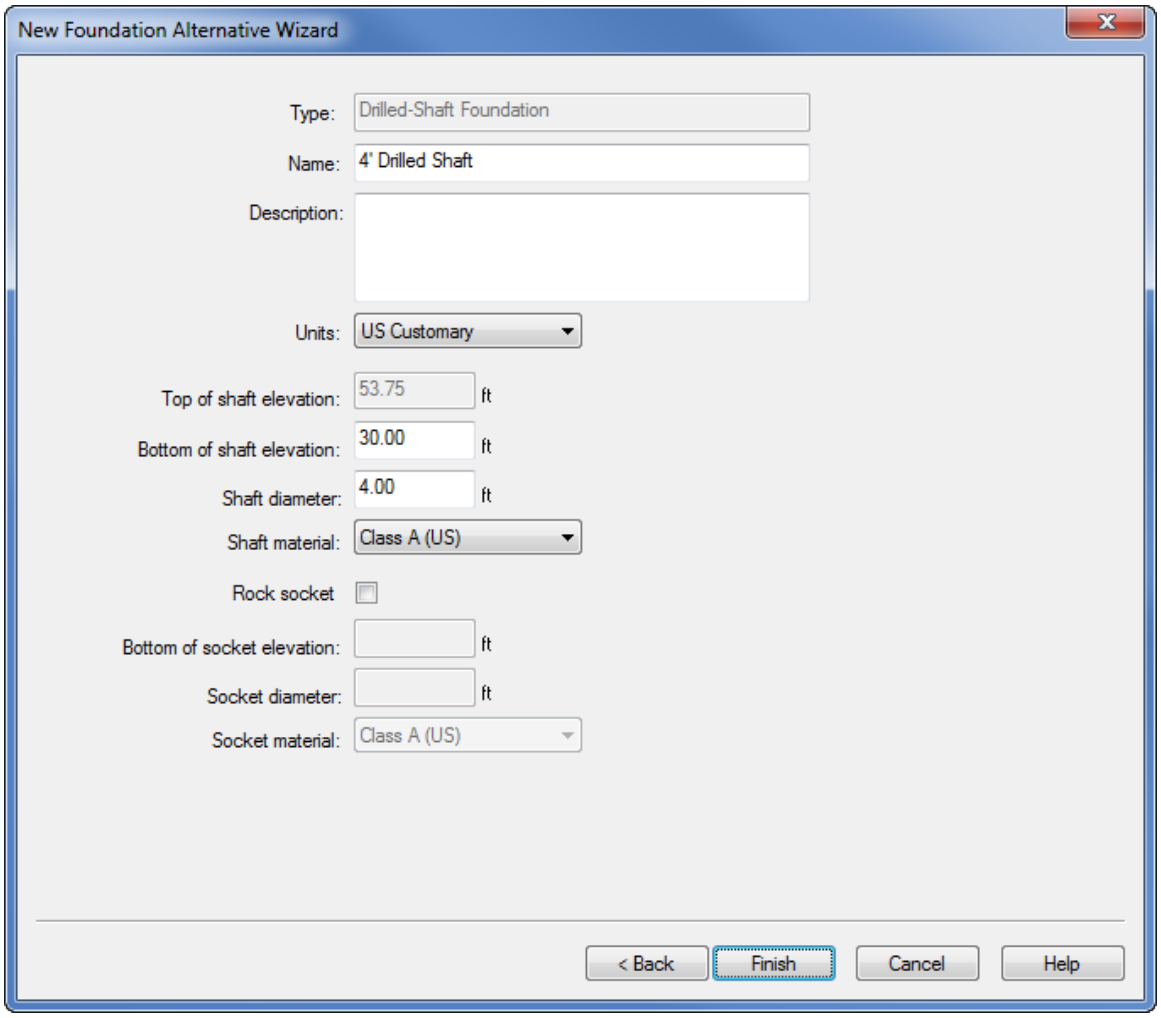


Fig 4. New Foundation Alternative Wizard Window

Click on “Finish” button to save and close the window. Once “Finish” button has been clicked Foundation Properties window (Fig 5) will pop up. On Foundation Properties window go to Soil tab enter Water Elevation as 40 ft. Click on “New” button to add a new row for Soil Profile. Add two new rows and enter the data as shown in Fig. 6. Click on “OK” button to save and close the window.

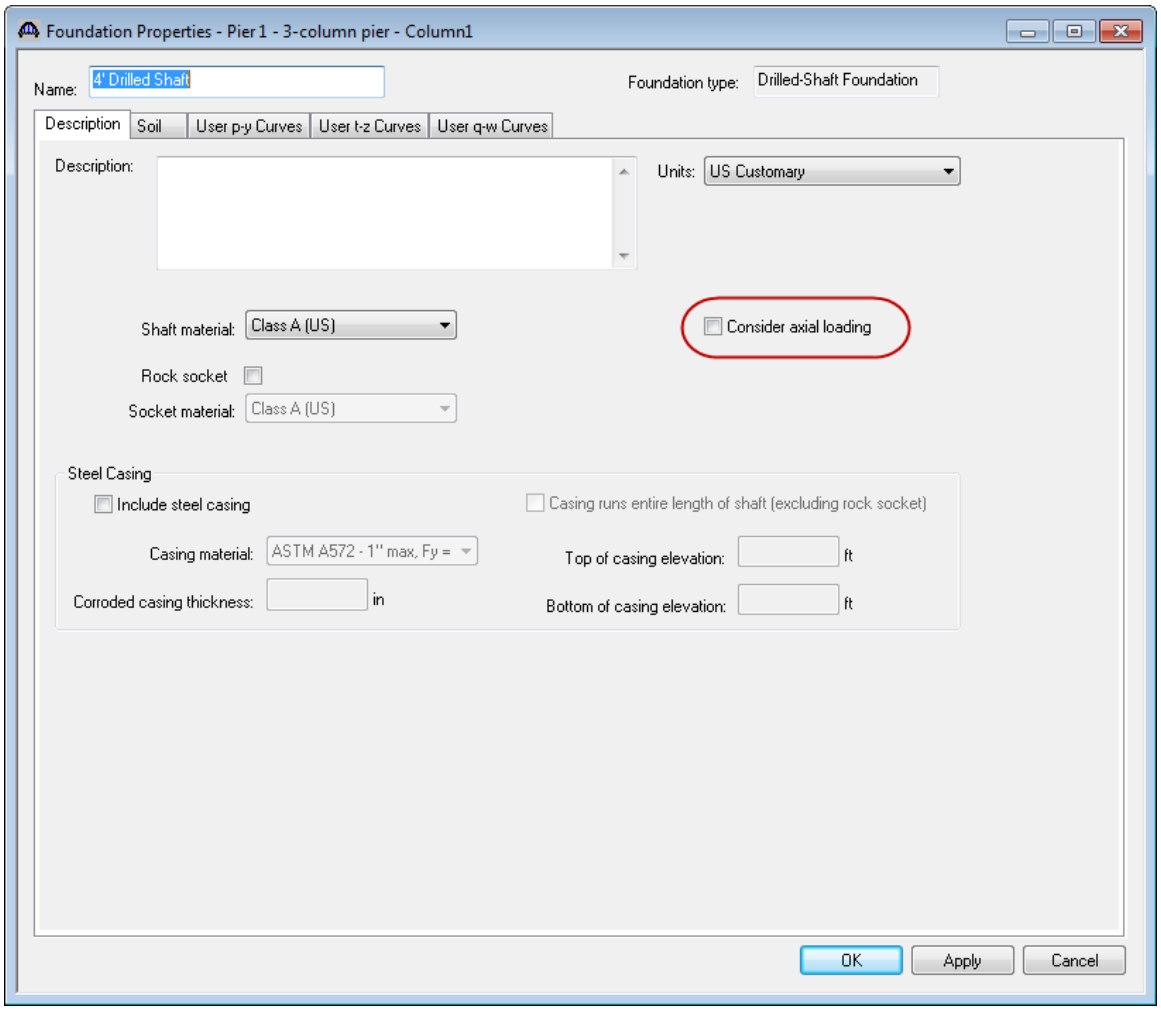


Fig 5. Foundation Properties Window

If the 'Consider axial loading' box is checked, the analysis will consider the axial loading (t-z, q-w curves) of the shaft in addition to the lateral loading (p-y curves). If the box is not checked, the analysis will only consider the lateral loading (p-y curves) of the shaft.

Enter the following data to describe the soil profile.

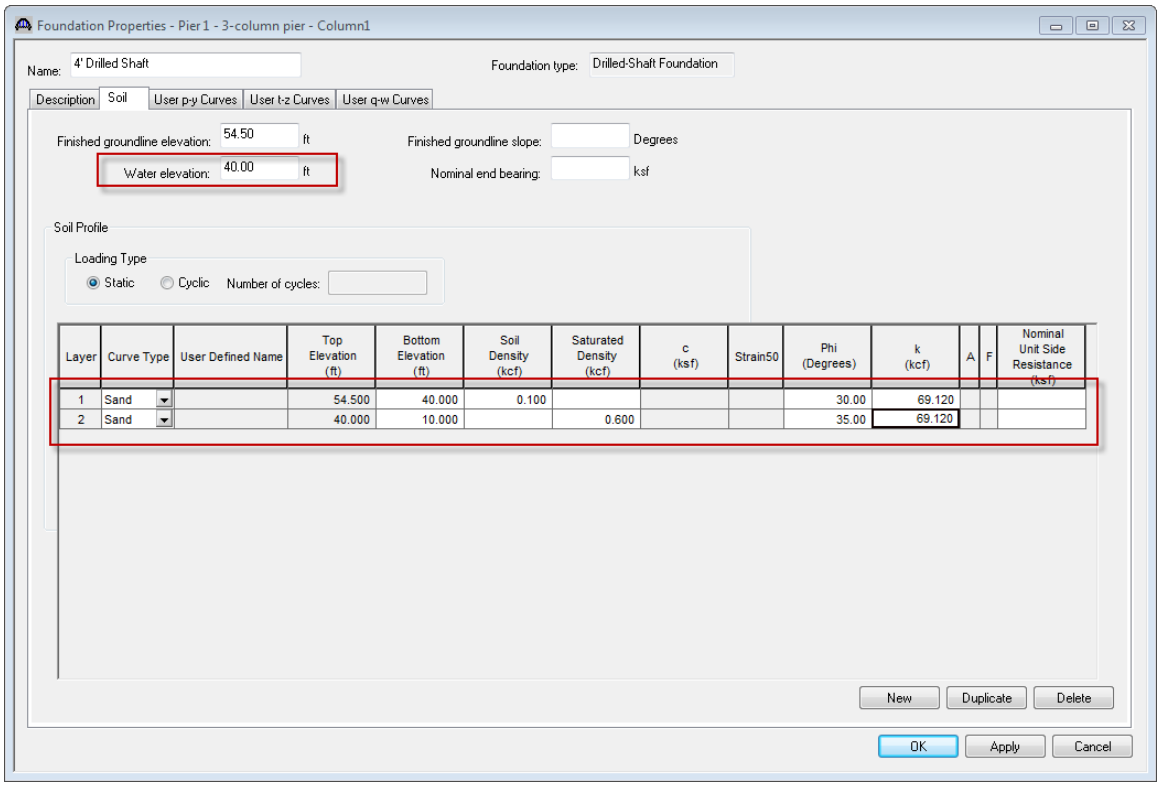


Fig 6. Foundation Properties Window – Soil Tab

The Nominal end bearing and nominal unit side resistance data are only required if you have chosen to consider the axial loading in the shaft analysis.

Soil resistance curves (p-y, t-z, q-w curves) will be developed based on the data entered here in accordance with procedures specified in the FHWA report “Handbook on Design of Piles and Drilled Shafts Under Lateral Load” and AASHTO LRFD 10.8.2.2.2.

The user also has the ability to enter user defined soil curves.

Graphical plots of computed and user entered soil curves will be available in the software.

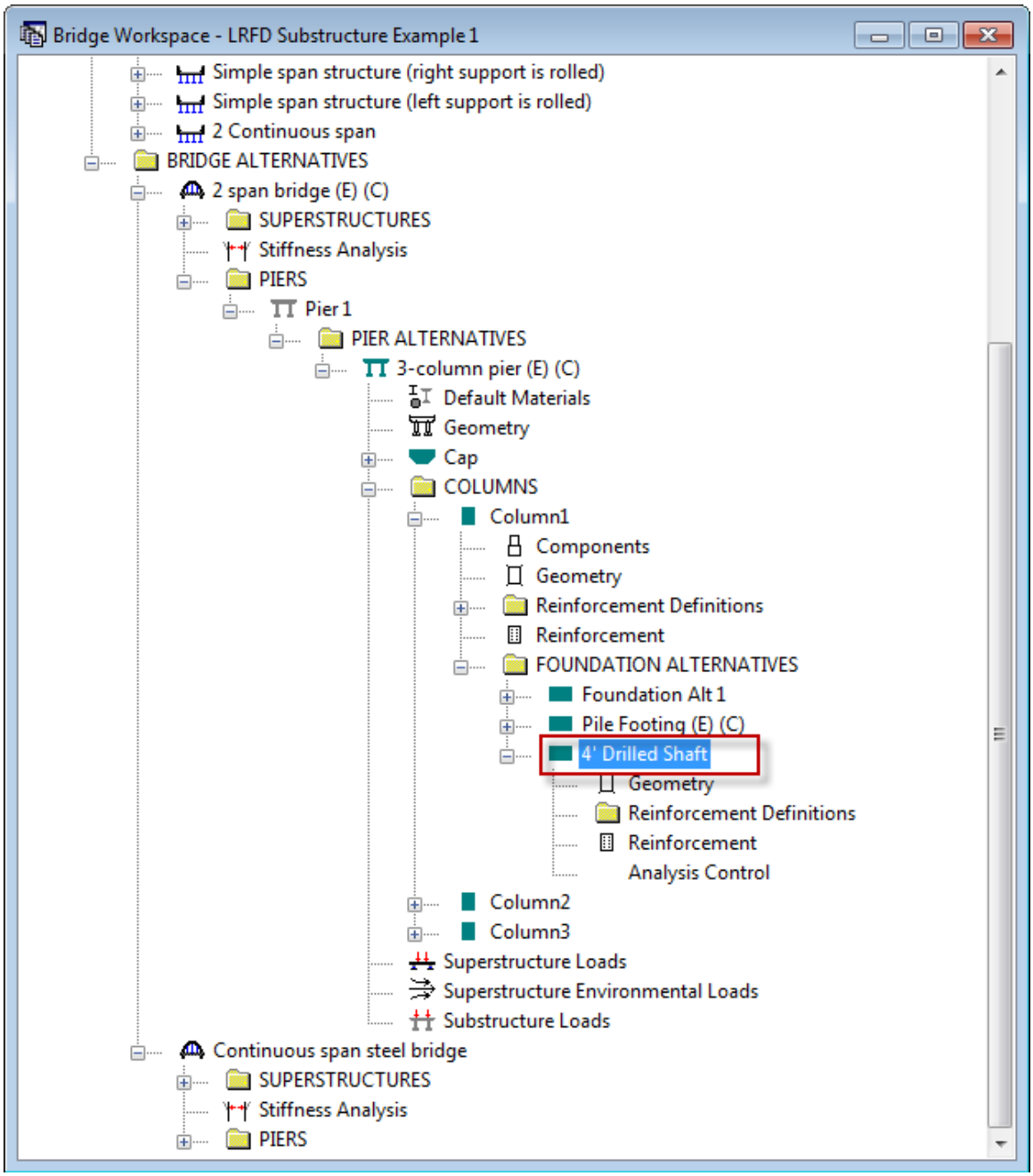


Fig 7. Bridge Workspace Tree – 4' Drilled Shaft

After Drilled Shaft has been defined, a 4' Drilled Shaft has been added to the Bridge Workspace tree as shown in Fig. 7. Expand 4' Drilled Shaft by clicking on "+". Under "4' Drilled Shaft" select and double click on "Geometry" to open Drilled Shaft Geometry window (Fig 8).

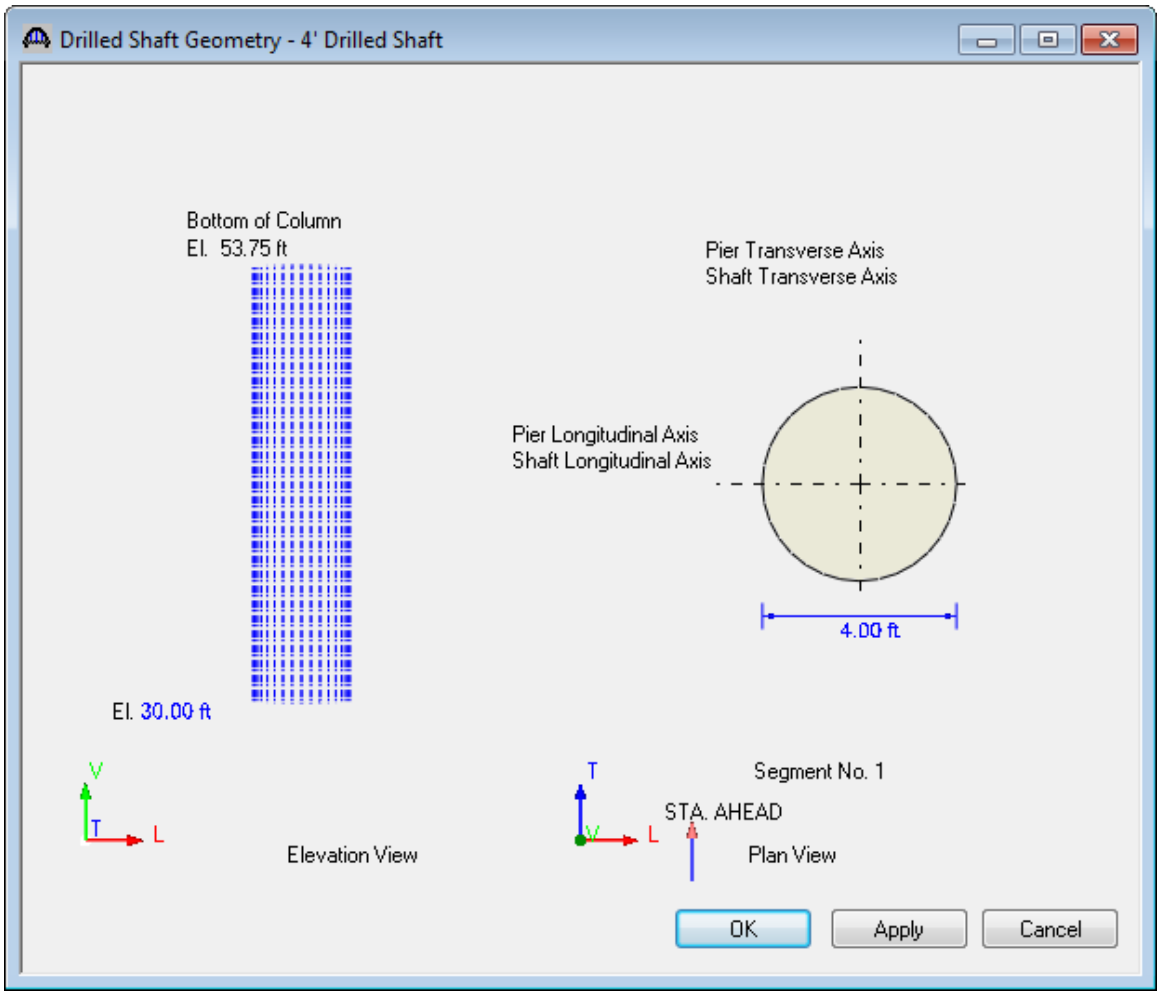


Fig 8. Drilled Shaft Geometry Window

Click on “OK” button to save and close the window.

Select and double click on Reinforcement Definitions to open Reinforcement Definition window (Fig 9). On this window click on “Generate Pattern” button to open Generate Pattern Wizard (Fig 10).

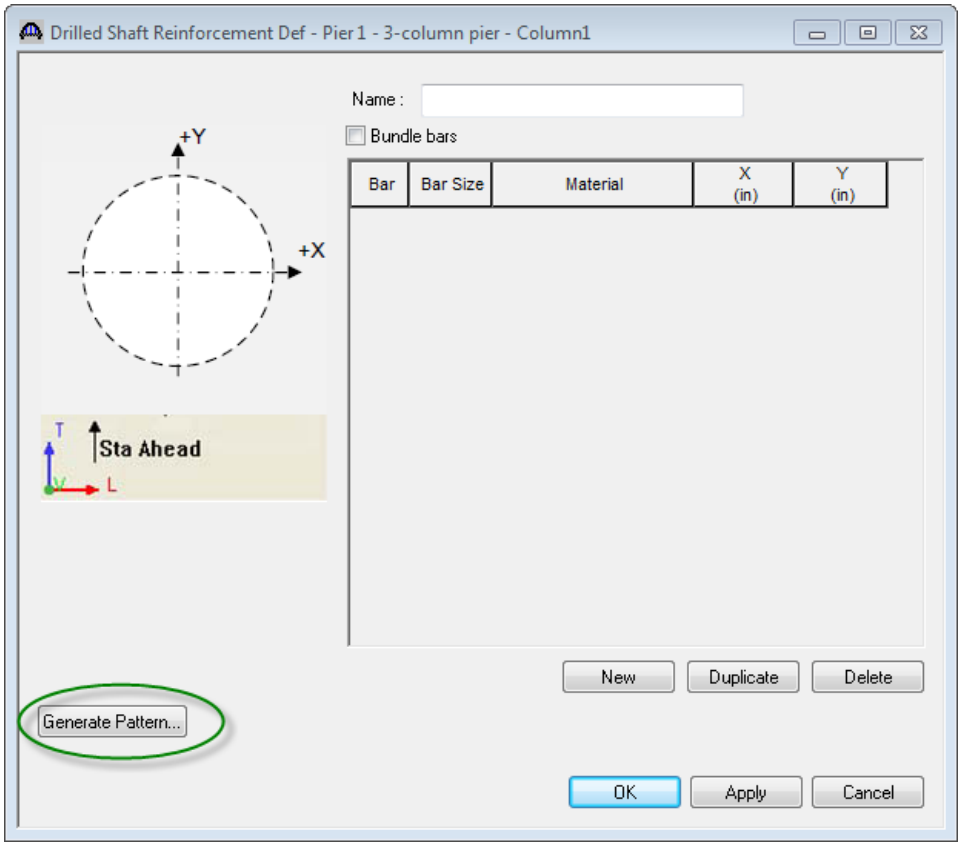


Fig 9. Drilled Shaft Reinforcement Definition Window

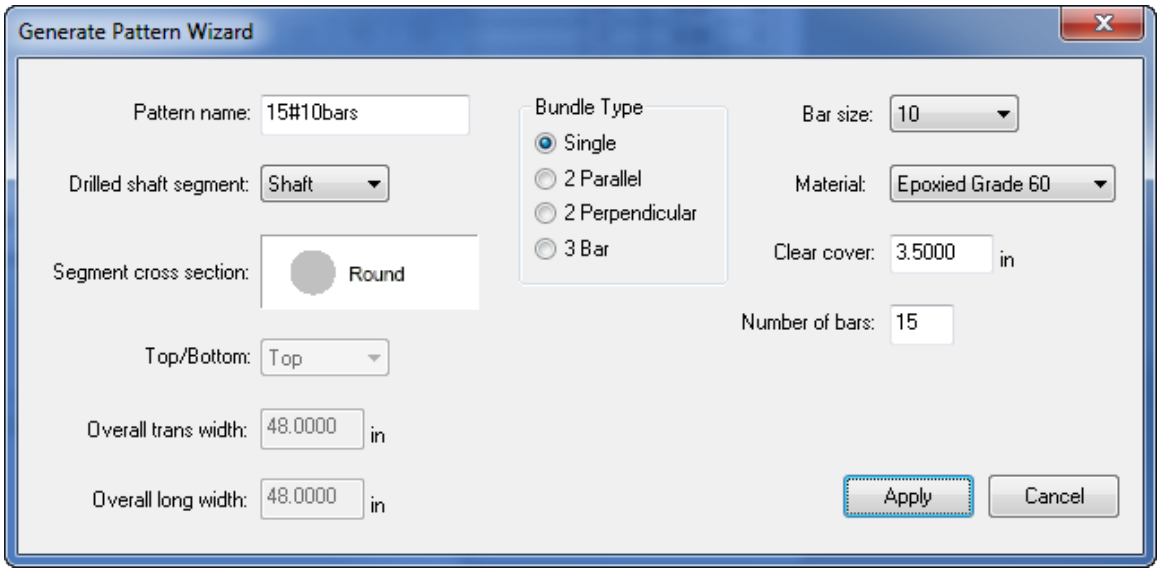


Fig 10. Generate Pattern Wizard

On Generate Pattern Wizard window enter data as shown in Fig 10 and click on “Apply” button. Once “Apply” button is clicked reinforcement will be populated on Reinforcement Definition window (Fig 11).

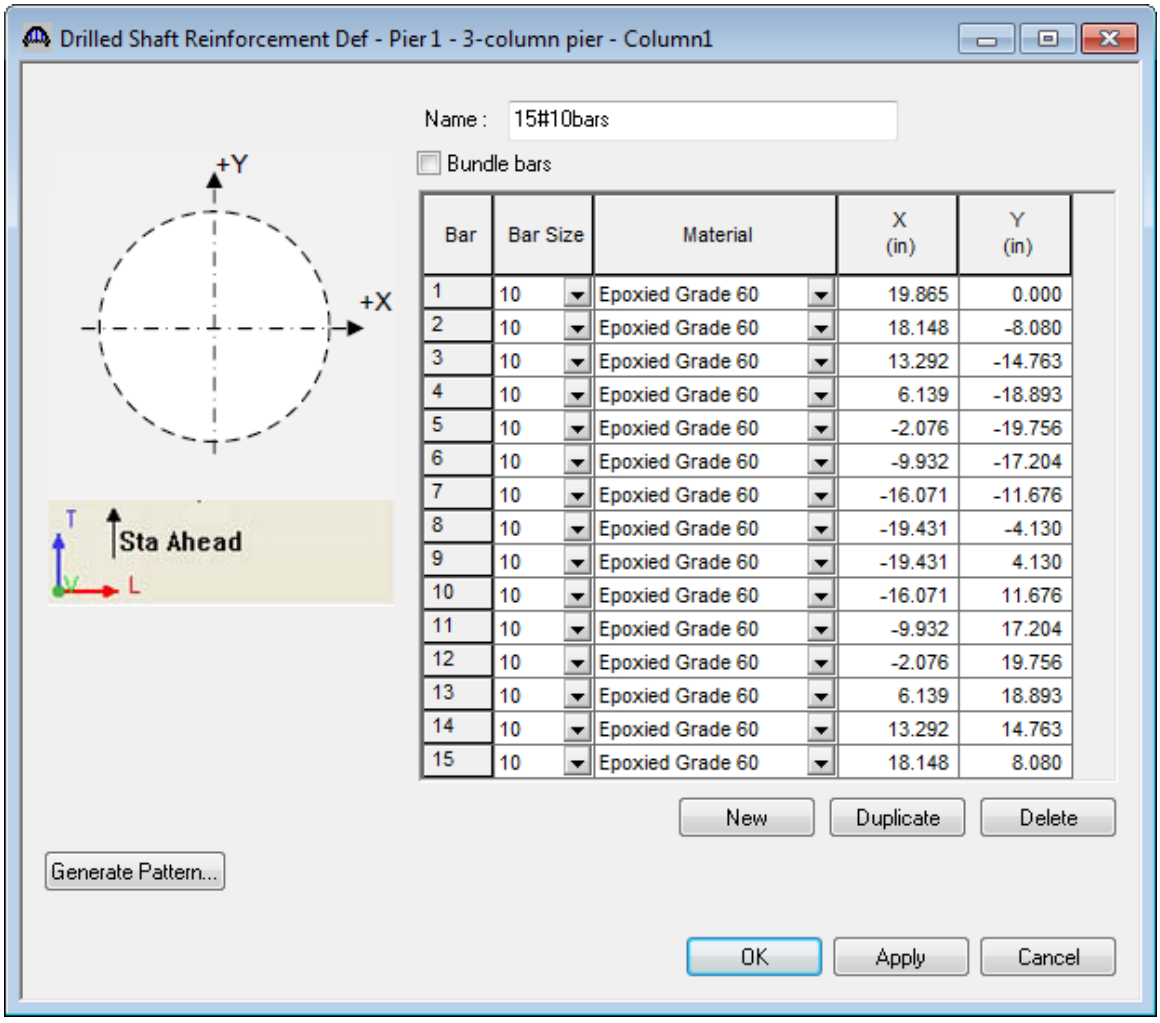


Fig 11. Reinforcement Definition Window

Now click on “OK” button to save and close the Drilled Shaft Reinforcement Definition Window.

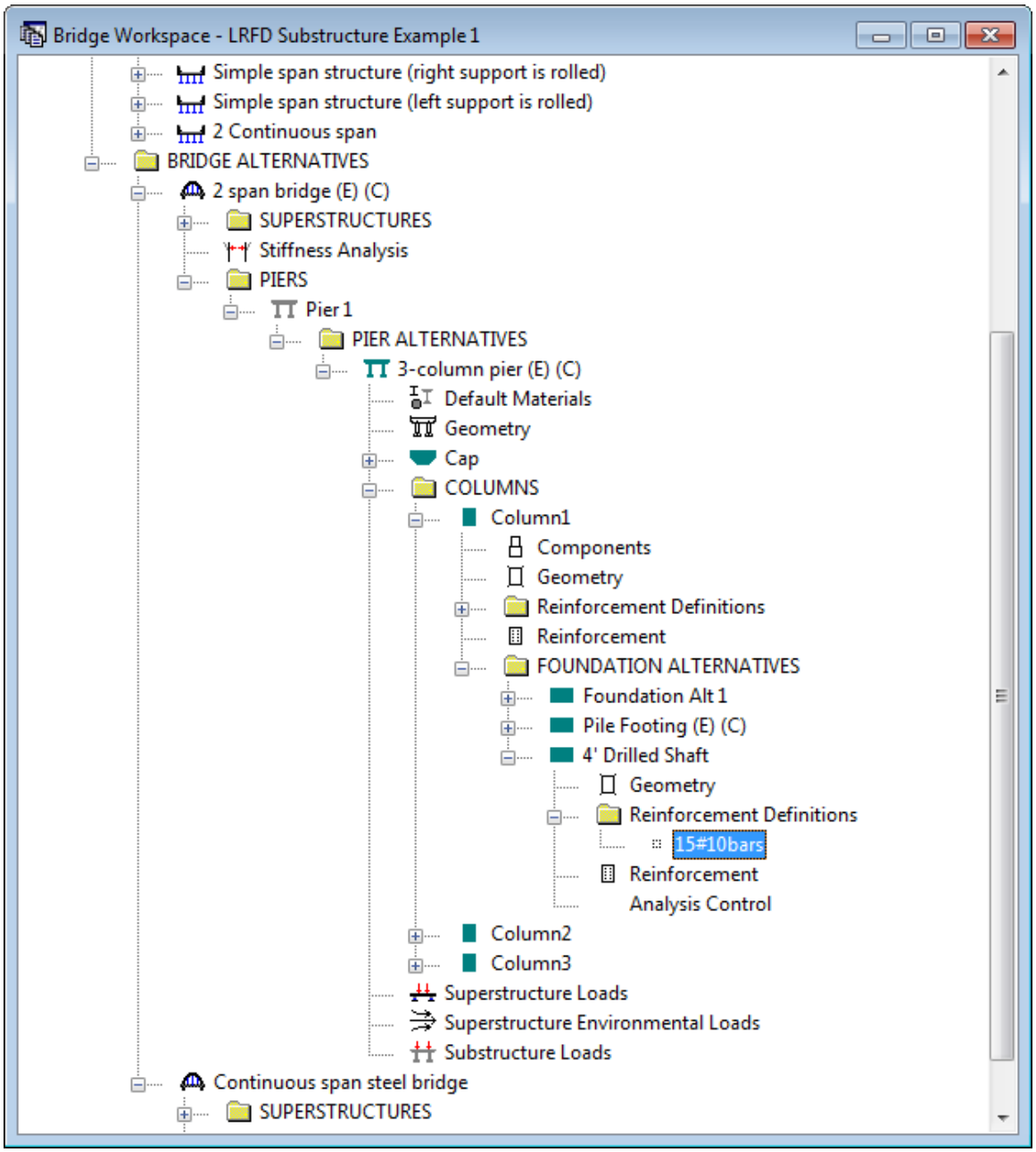


Fig 12. Bridge Workspace Tree – Reinforcement Definition

Now we can see 15#10bars reinforcement definition has been add to the Bridge Workspace tree. To apply this reinforcement definition to drilled shaft, double click on “Reinforcement” to open Drilled Shaft Reinforcement window.

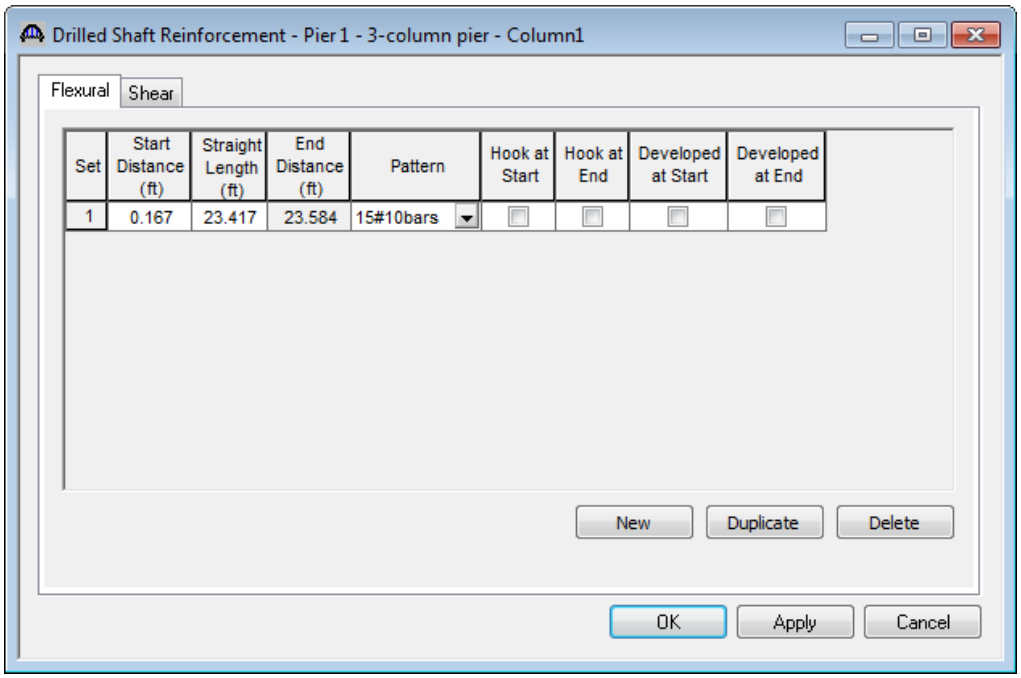


Fig 13. Drilled Shaft Reinforcement Definition Window – Flexure Tab

Enter data on Drilled Shaft Reinforcement Definition Window – Flexure Tab as shown in Fig 13. Now go to Shear tab and enter data as shown in Fig. 14. Click on "OK" button to save and close the window.

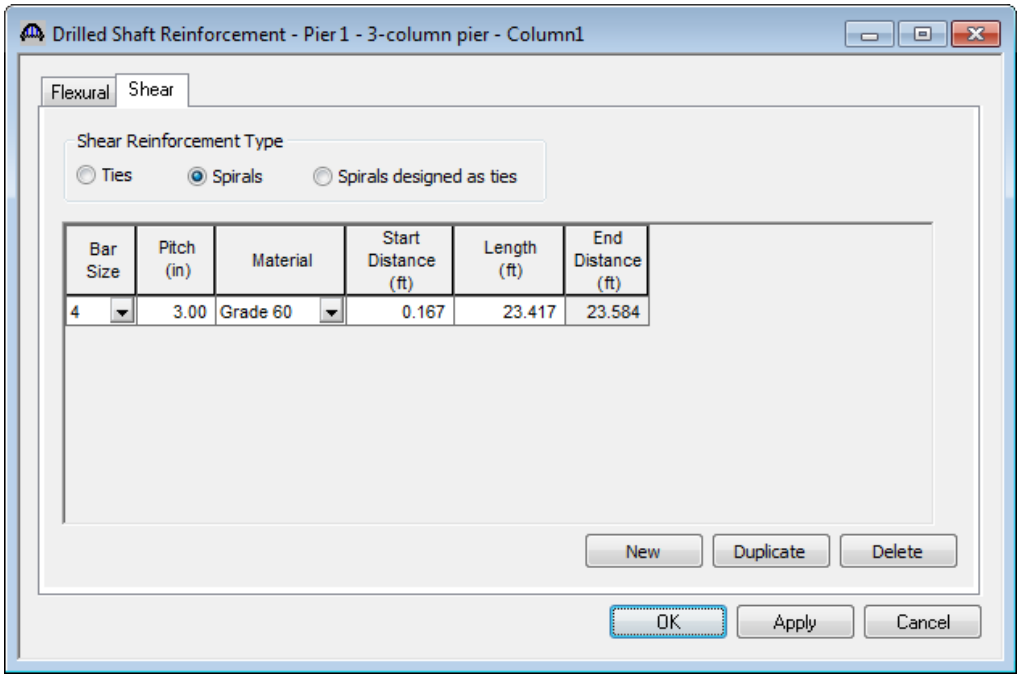


Fig 14. Drilled Shaft Reinforcement Definition Window – Shear Tab

Select and double click on Analysis Control in the Bridge Workspace tree to open Drilled Shaft Analysis Control window. On this window on FE Control tab enter the data as shown in Fig 15.

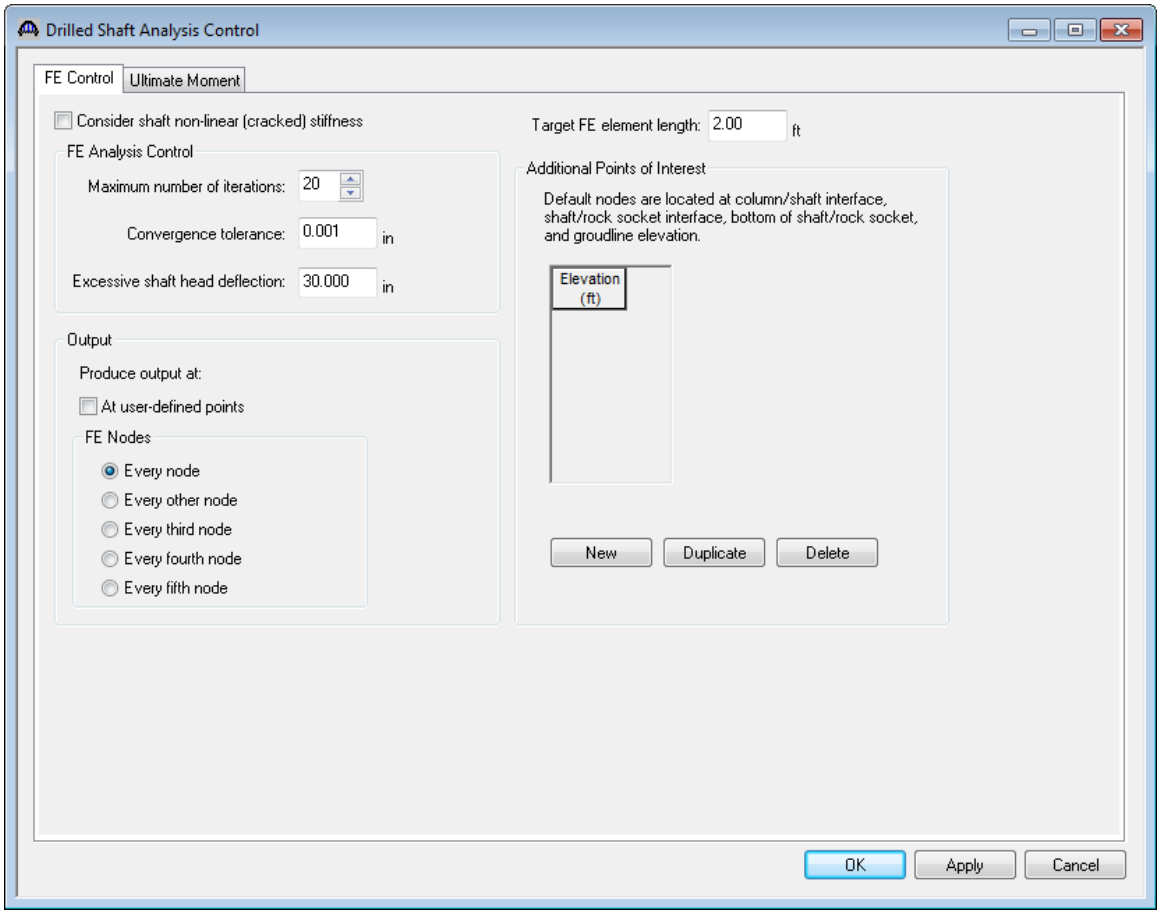


Fig 15. Drilled Shaft Analysis Control Window – FE Control tab

Convergence tolerance: when the maximum change in deflection at any node for successive iterations is less than this value, iteration stops.

Excessive shaft head deflection: the value of deflection at the top of the shaft that is considered grossly excessive and stops the analysis.

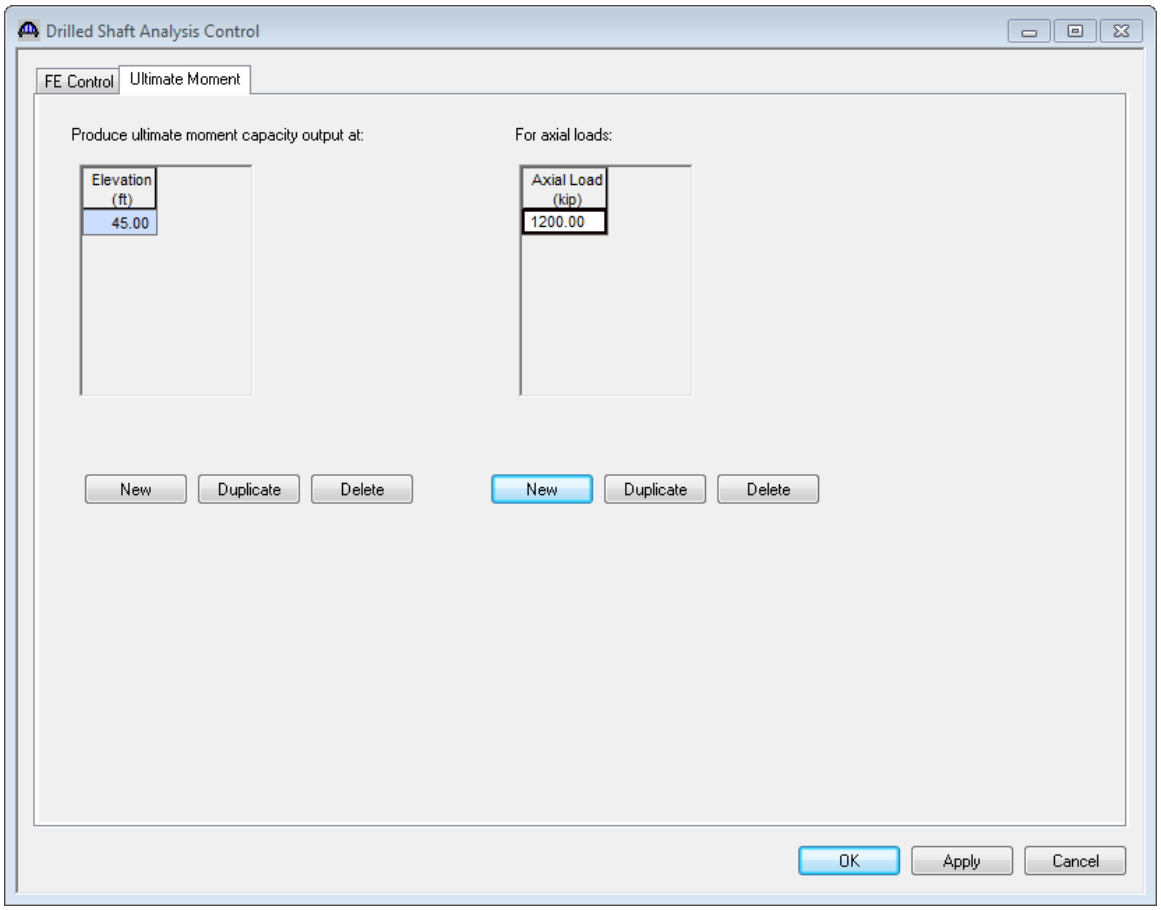


Fig 16. Drilled Shaft Analysis Control Window – Ultimate Moment tab

Go to the Ultimate Moment tab and enter data as shown in Fig. 16. To add a new row to Elevation and Axial Load column click on "New" button under corresponding columns. Click on "OK" button to save and close the window.

This tab allows the user to specify locations where the ultimate moment capacity output is desired. At a location and for a specified axial load, the following ultimate moment capacity output will be generated:

1. Report containing moment capacity, EI, curvature, maximum strain, neutral axis location
2. Results graphs showing moment vs. curvature, EI vs. moment

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