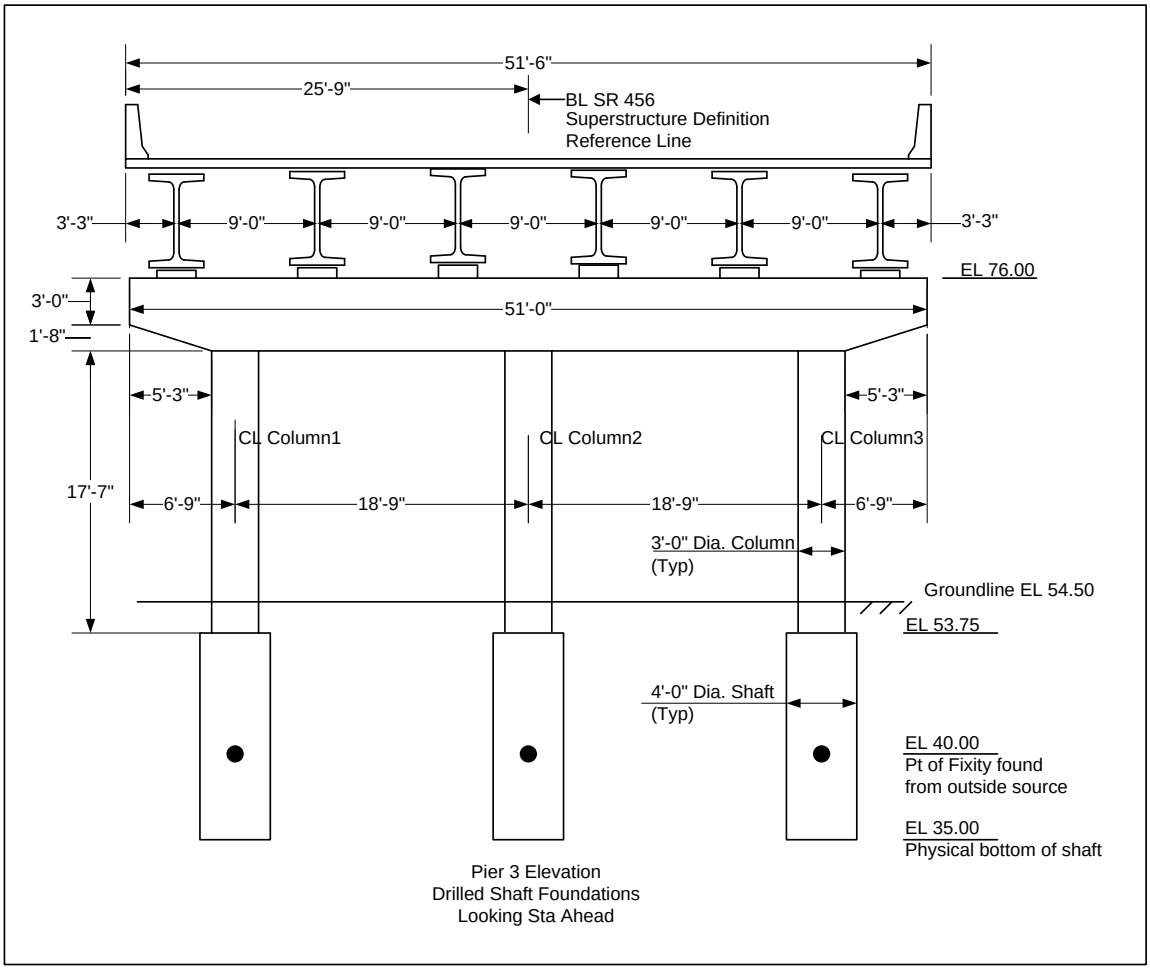
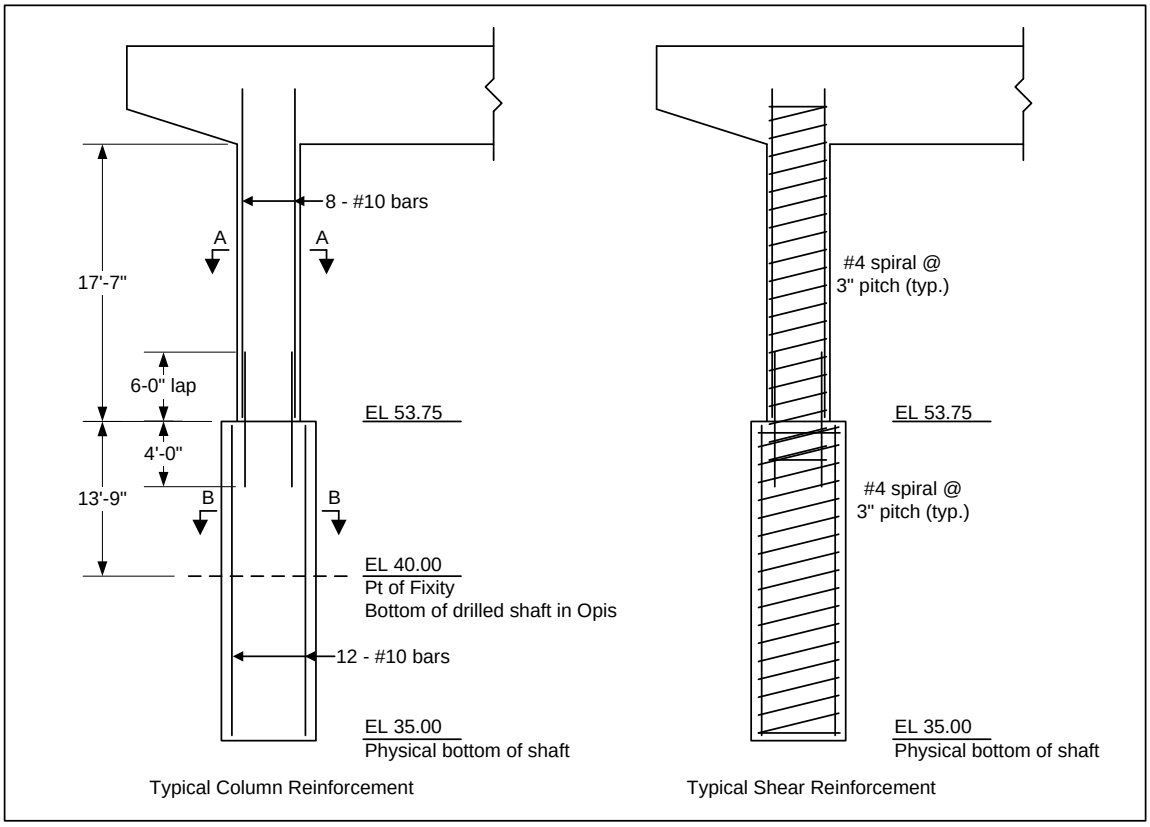
AASHTOWare BrD 6.8

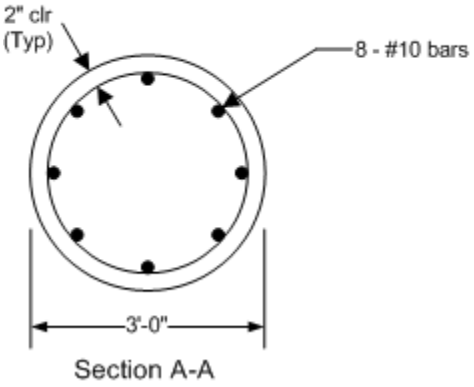
Substructure Tutorial

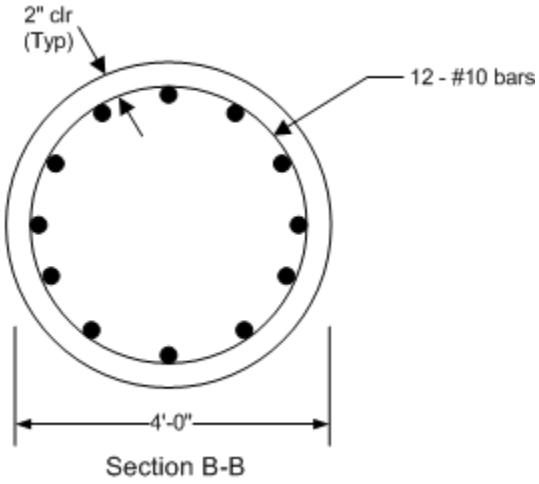
Modify Footing Example



Pier 3 Elevation
Drilled Shaft Foundations
Looking Sta Ahead


8 - #10 bars
A
A
17'-7"
6-0" lap
EL 53.75
4'-0"
13'-9"
B
B
EL 40.00
Pt of Fixity
Bottom of drilled shaft in Opis
12 - #10 bars
EL 35.00
Physical bottom of shaft
Typical Column Reinforcement
#4 spiral @
3" pitch (typ.)
EL 53.75
#4 spiral @
3" pitch (typ.)
EL 35.00
Physical bottom of shaft
Typical Shear Reinforcement


2" clr
(Typ)
8 - #10 bars
3'-0"
Section A-A


2" clr
(Typ)
12 - #10 bars
4'-0"
Section B-B

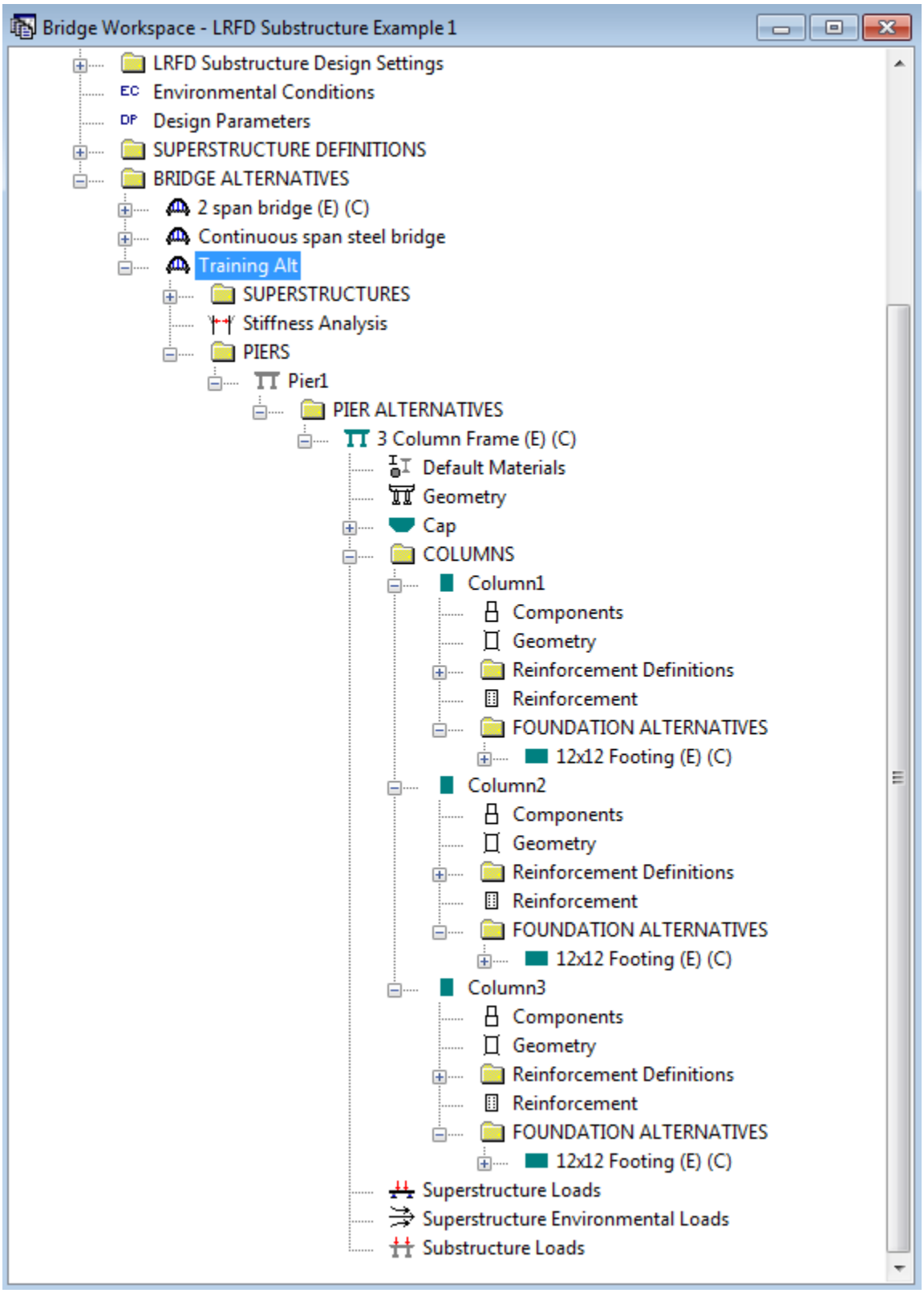
BrD Substructure Training

Pier 3 – Modify Footing Example

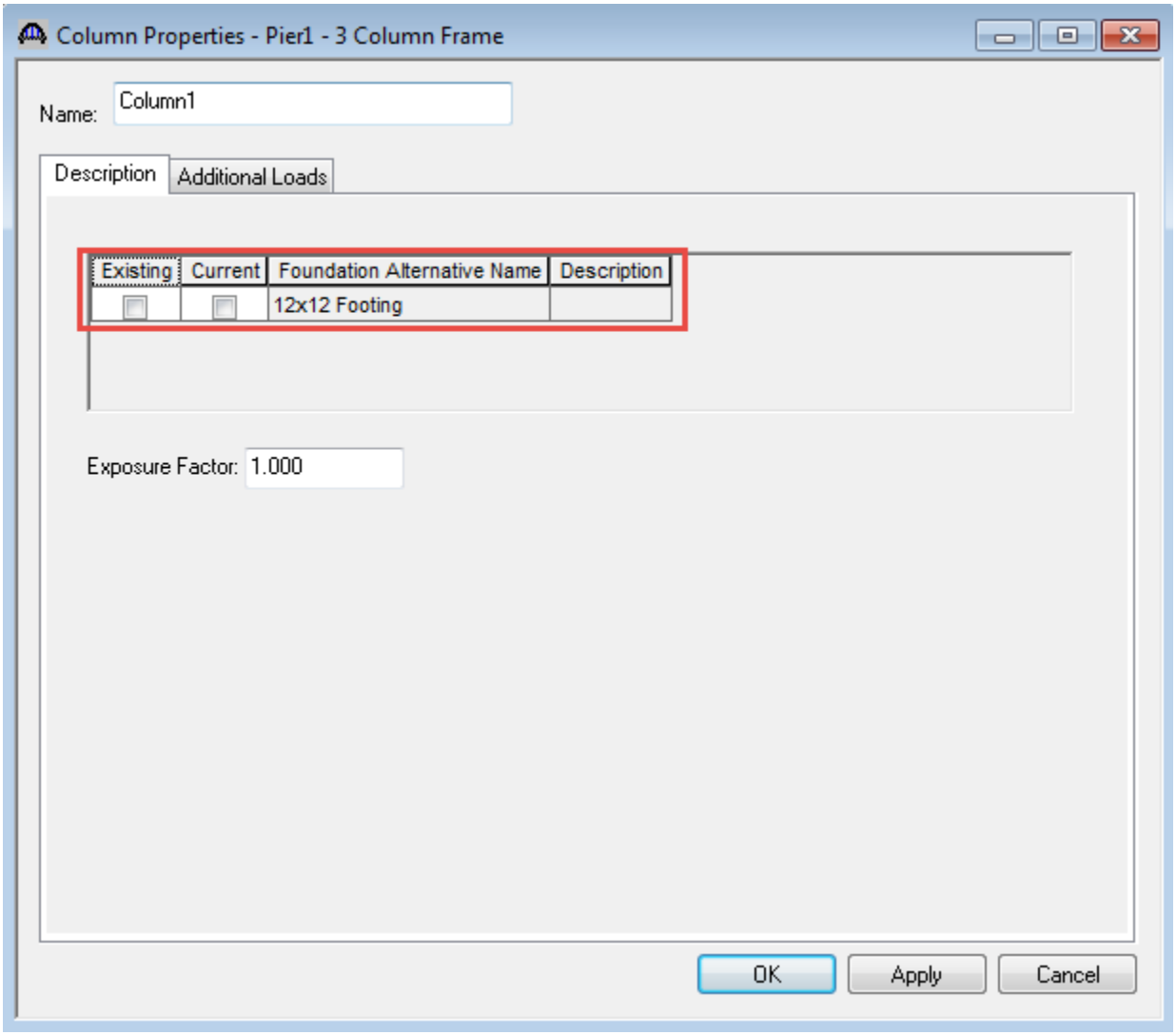
This example modifies one of the spread footings in the BID20 example to be a drilled shaft foundation. BrD substructure has the ability to perform a soil-structure interaction analysis. You can find an example describing the analysis in tutorial "3 Drilled Shaft" in 2012 User Group – Training.

In the event that you do not wish to use the BrD soil-structure interaction analysis, this example describes how to analyze a pier with drilled shafts considering a user-defined point of fixity. You can enter a point of fixity found from an outside source, such as LPile or COM624, as the base of the drilled shaft in BrD. BrD can then perform a finite element analysis and spec check of the pier considering that point of fixity.

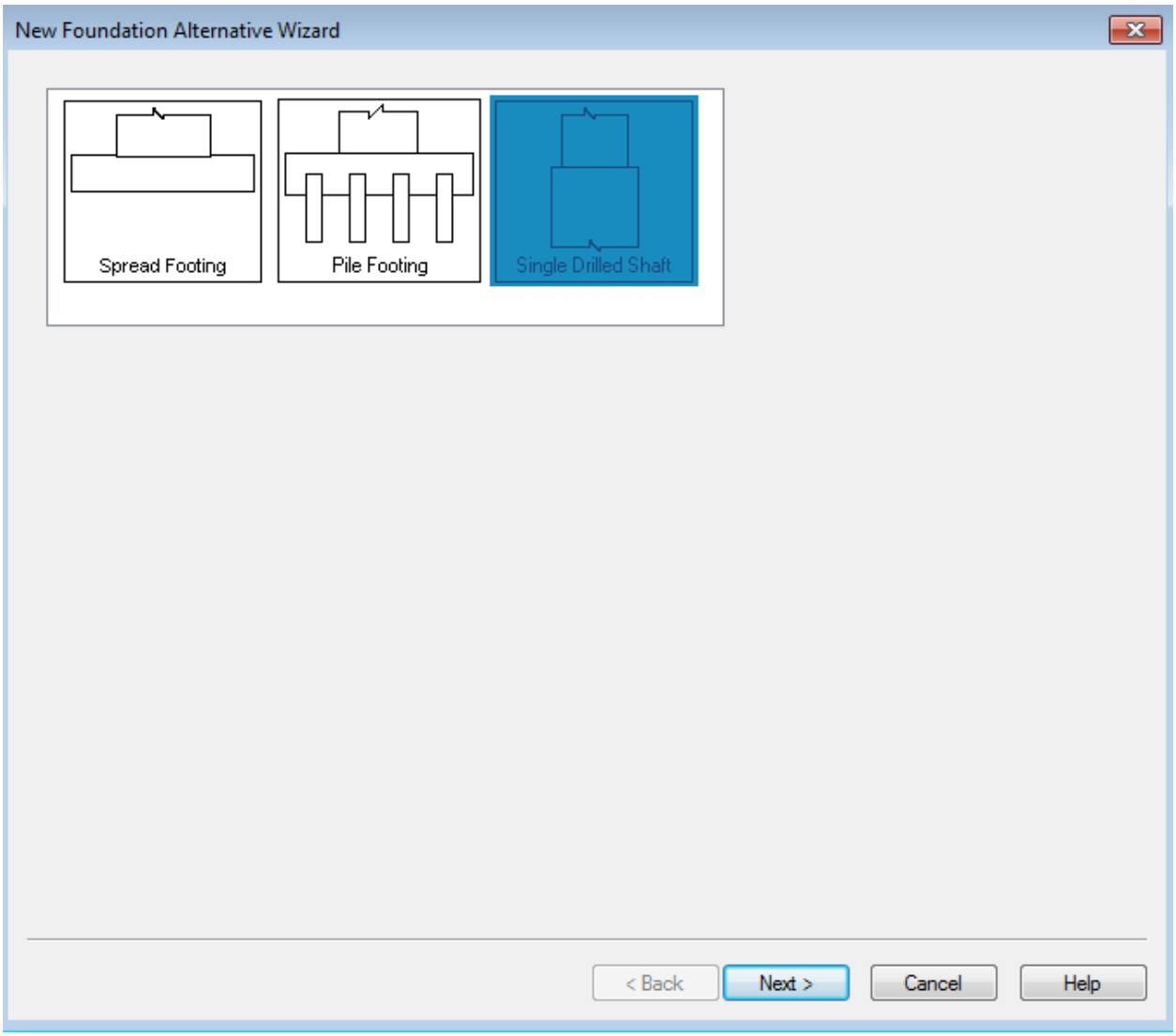
Open the Bridge workspace for BID 20 with our Pier 3 example as shown below:



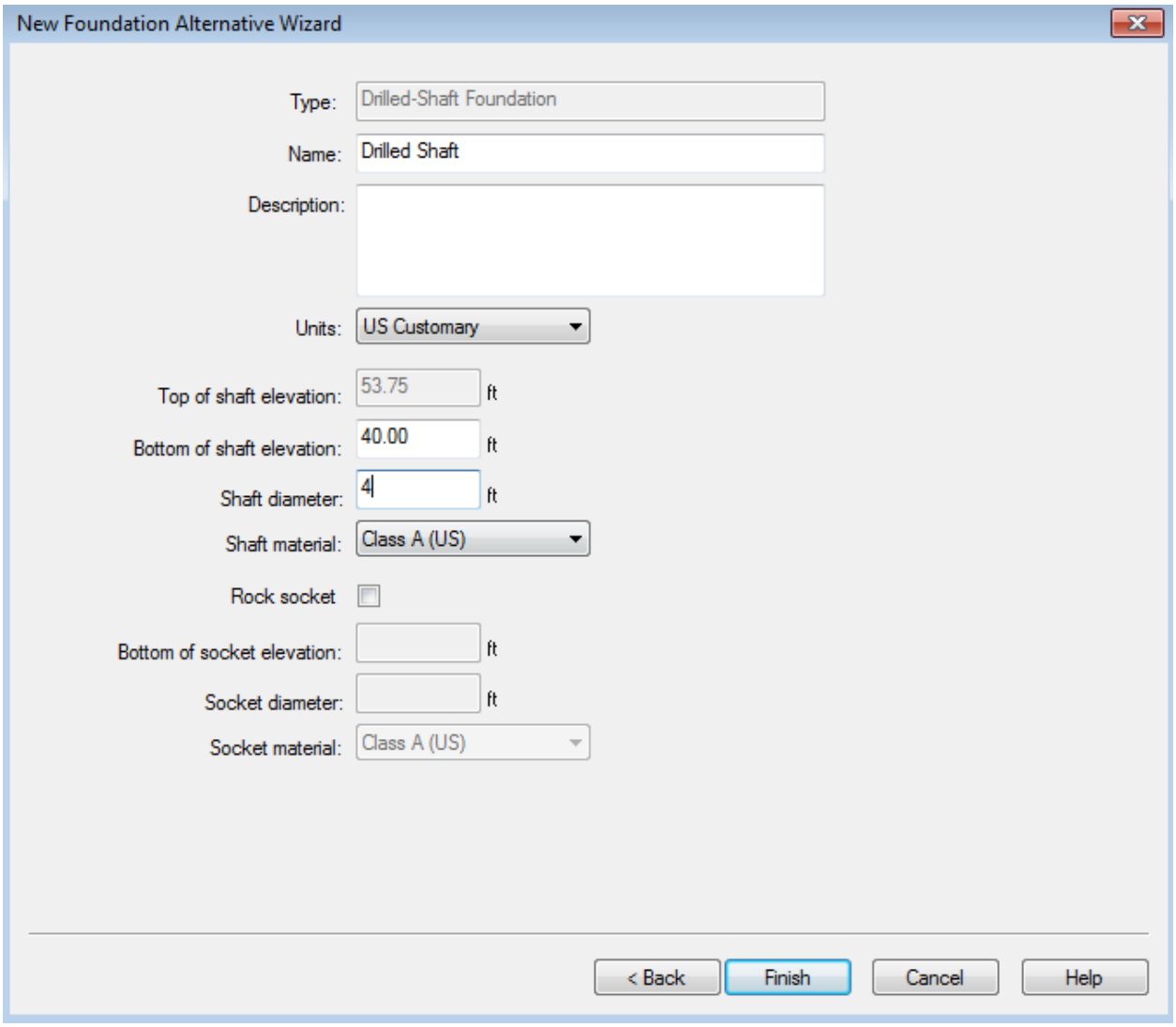
Open the window for Column 1 and un-check the checkboxes for the existing and current foundation as shown below:



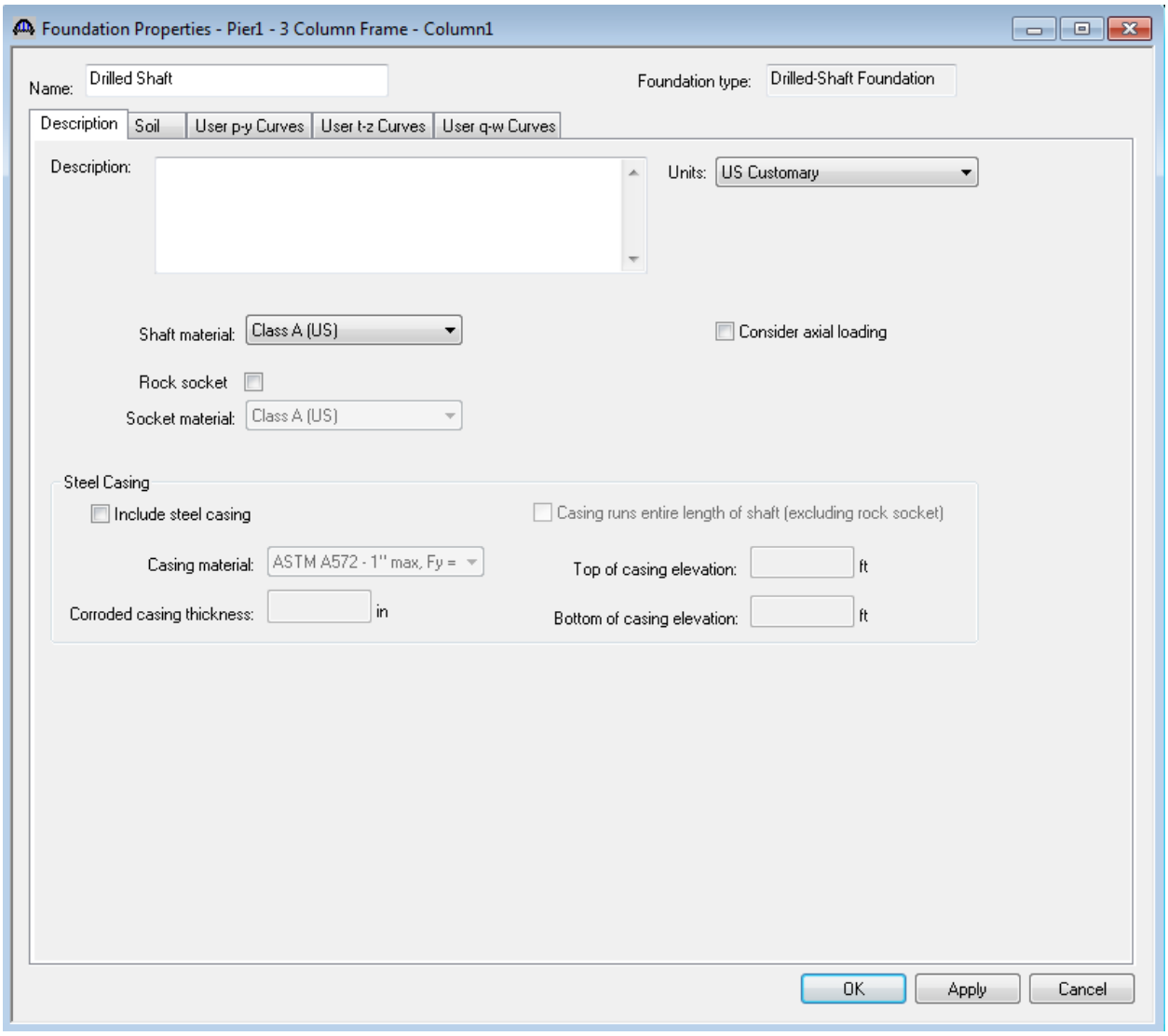
Double click the FOUNDATION ALTERNATIVES label and the New Foundation Alternatives wizard will open. Select the Single Drilled Shaft and click Next.



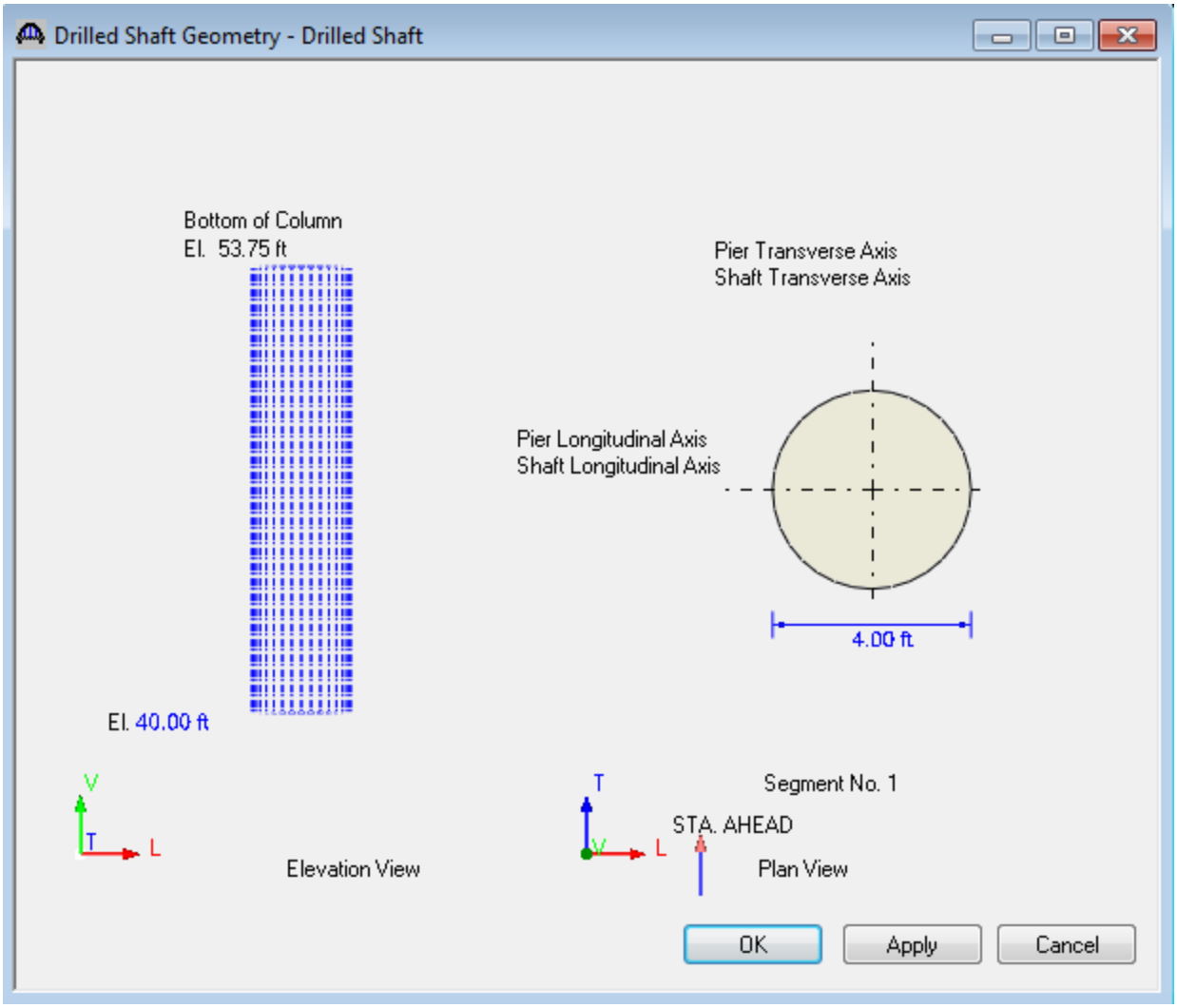
Enter the following description of the foundation.



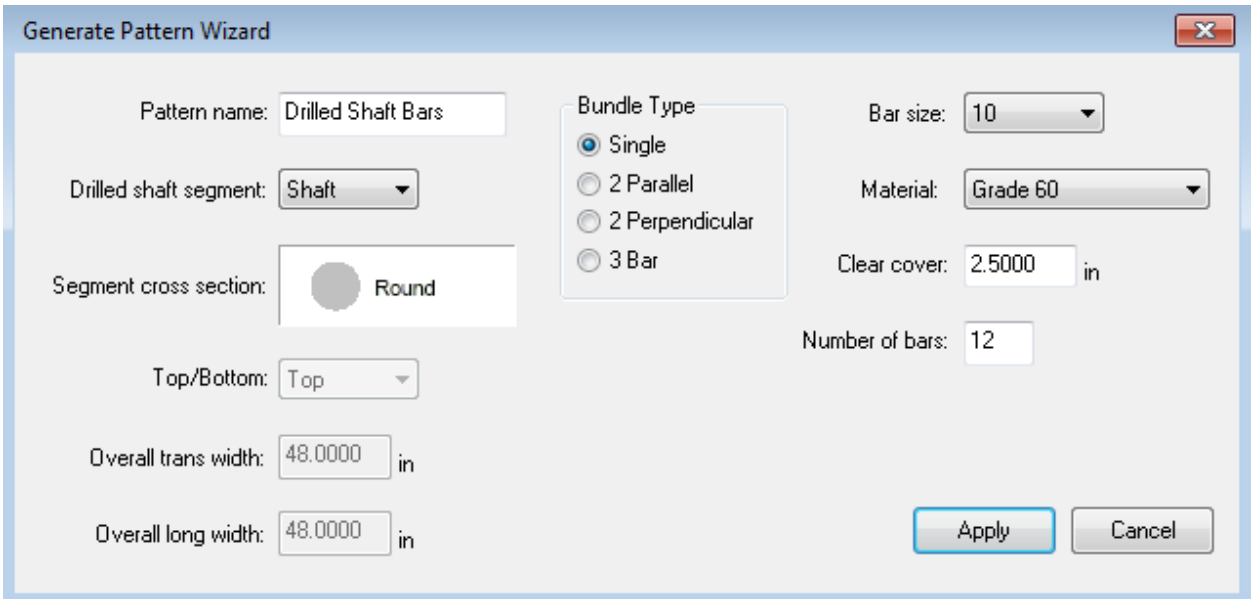
Click Finish and the Foundation Properties window will open.

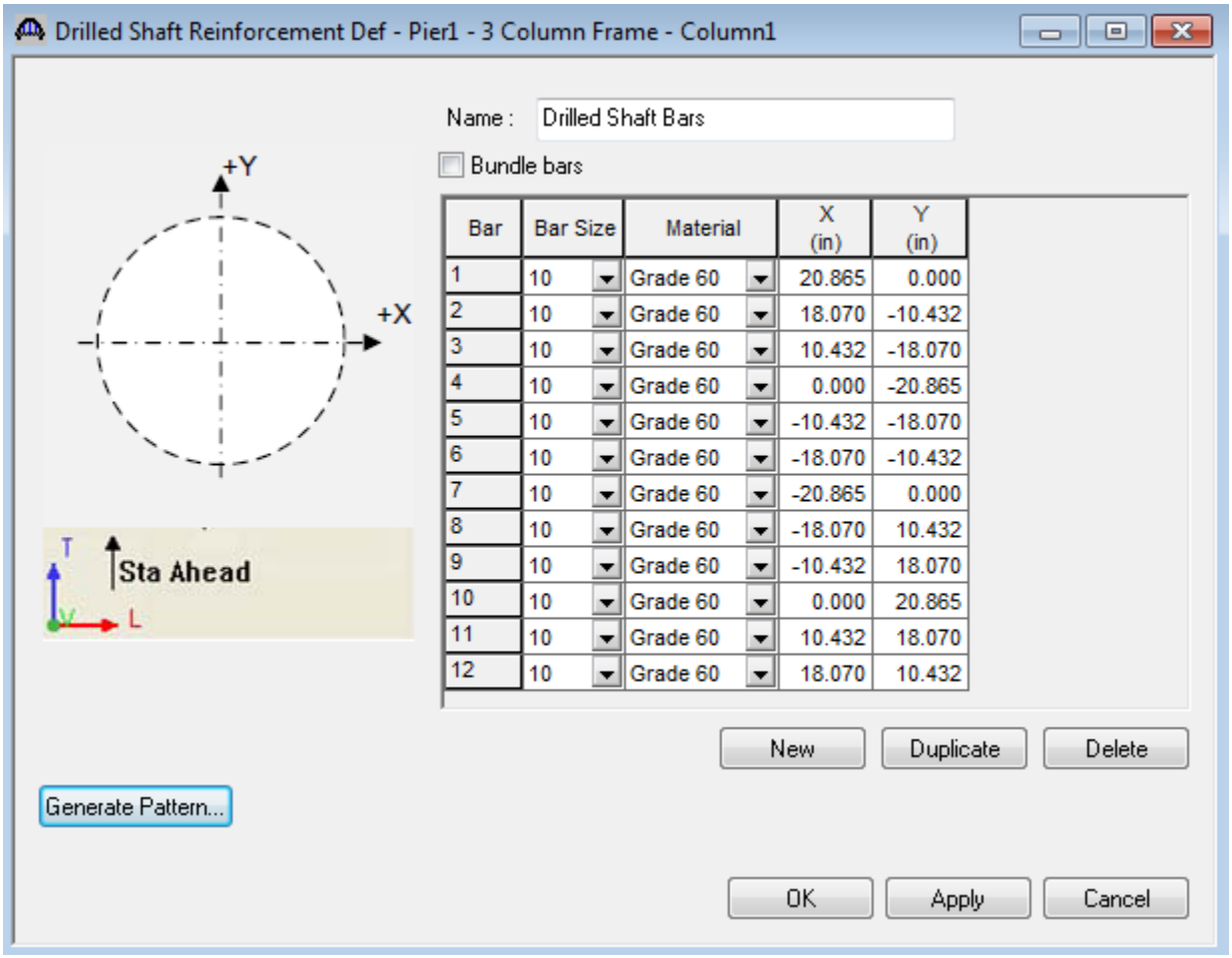


Open the Drilled Shaft Geometry window and view the geometry data. The drilled shaft point of fixity is at 40’.

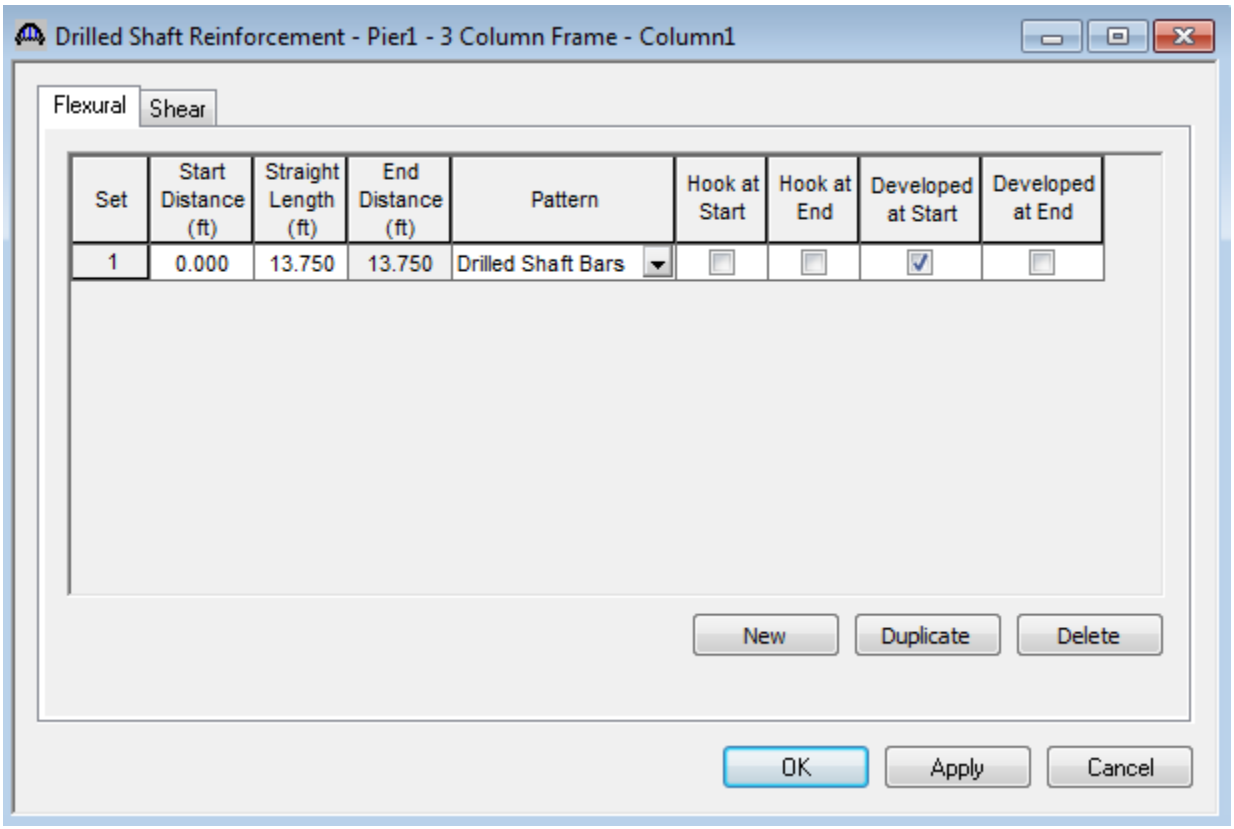


Create a reinforcement definition for the drilled shaft segment using the Pattern Wizard as shown below. Be sure to select the shaft as shown so the reinforcement bar coordinates will be generated correctly for the 4' wide drilled shaft segment.



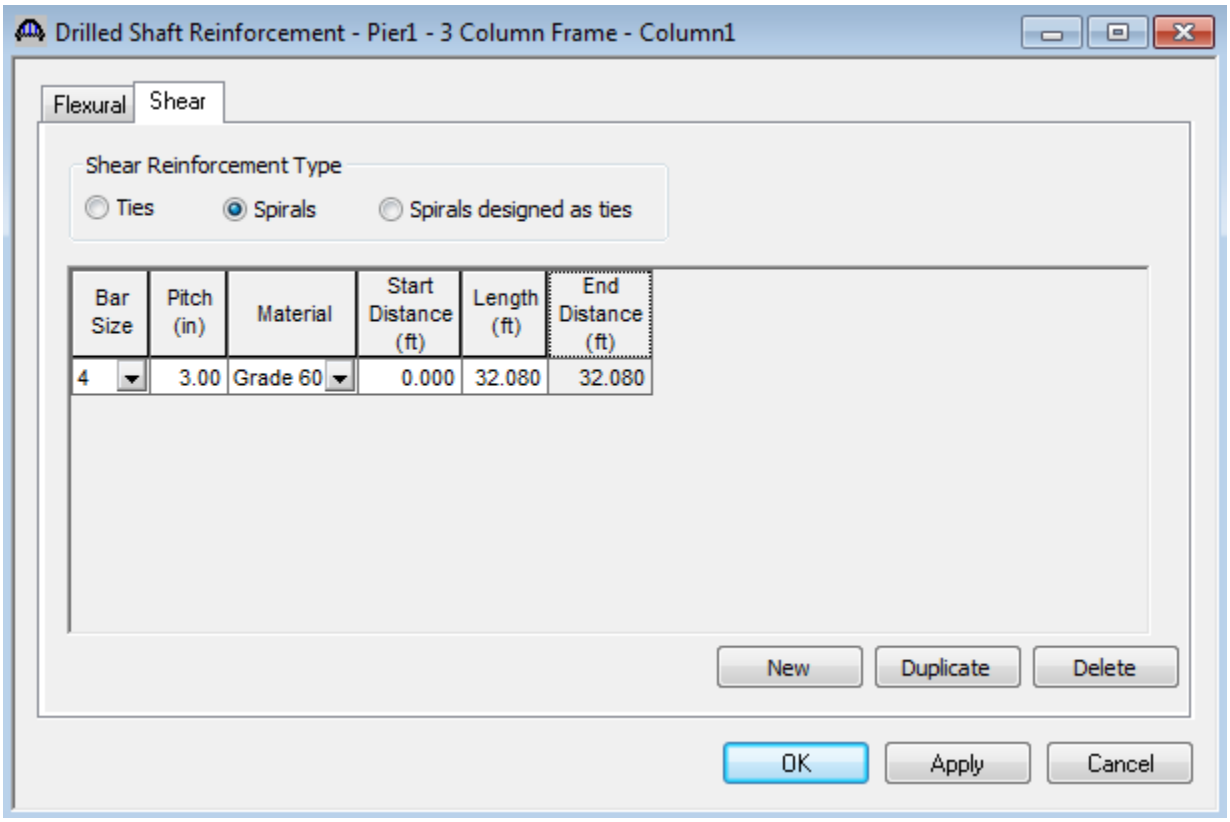

Drilled Shaft Reinforcement Def - Pier1 - 3 Column Frame - Column1
Name : Drilled Shaft Bars
Bundle bars
+Y
+X
T
L
Sta Ahead
Bar | Bar Size | Material | X (in) | Y (in)
1 | 10 | Grade 60 | 20.865 | 0.000
2 | 10 | Grade 60 | 18.070 | -10.432
3 | 10 | Grade 60 | 10.432 | -18.070
4 | 10 | Grade 60 | 0.000 | -20.865
5 | 10 | Grade 60 | -10.432 | -18.070
6 | 10 | Grade 60 | -18.070 | -10.432
7 | 10 | Grade 60 | -20.865 | 0.000
8 | 10 | Grade 60 | -18.070 | 10.432
9 | 10 | Grade 60 | -10.432 | 18.070
10 | 10 | Grade 60 | 0.000 | 20.865
11 | 10 | Grade 60 | 10.432 | 18.070
12 | 10 | Grade 60 | 18.070 | 10.432
New
Duplicate
Delete
Generate Pattern...
OK
Apply
Cancel

Assign the flexural reinforcement as follows:



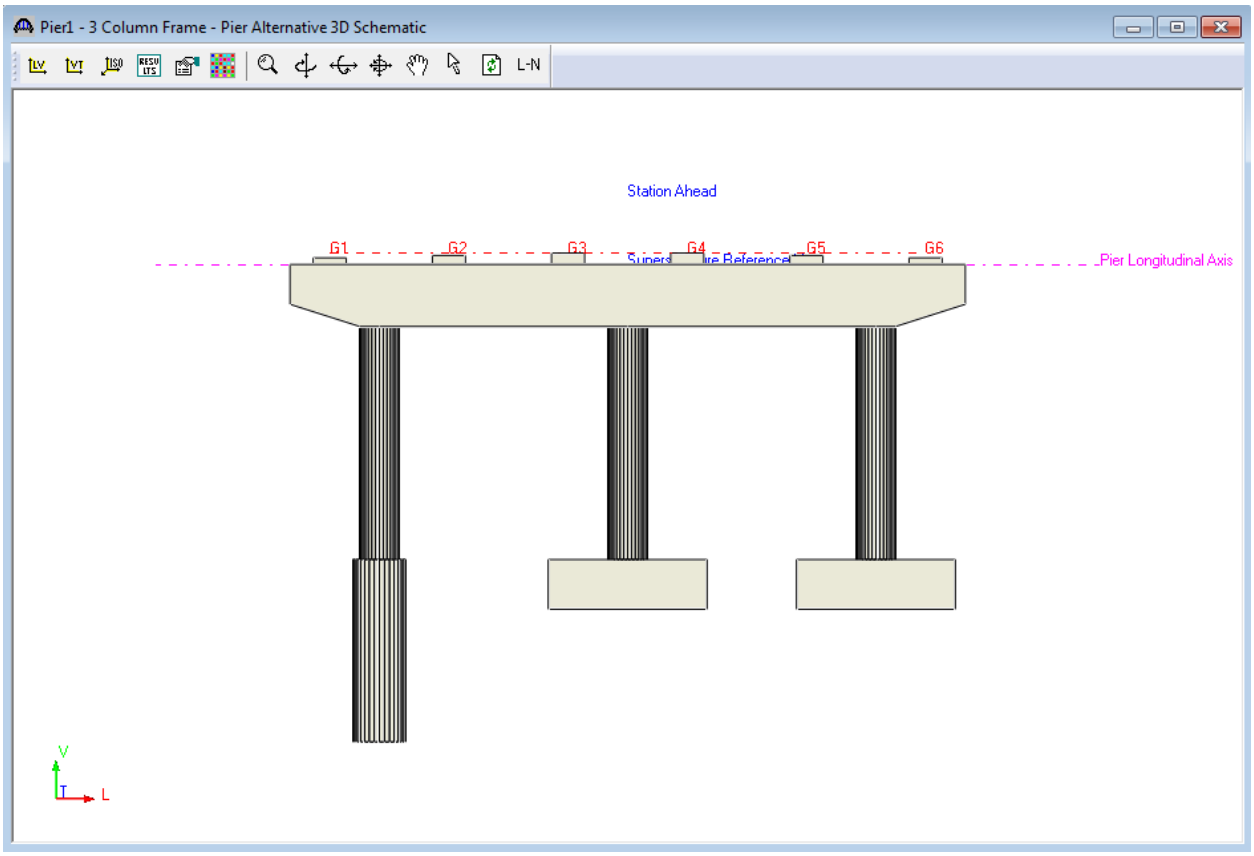
The first row describes the rebar in the drilled shaft. Mark these bars as "developed at start" since we can assume that the actual length of the drilled shaft segment below the point of fixity at elevation 40.0ft provides enough length for these bars to be fully developed.

The shear reinforcement in the drilled shaft is described as follows:



The overlap of spirals at the column-drilled shaft connection is a detailing requirement that can be ignored in our BrD description.

The 3D schematic for the pier alternative appears as follows.

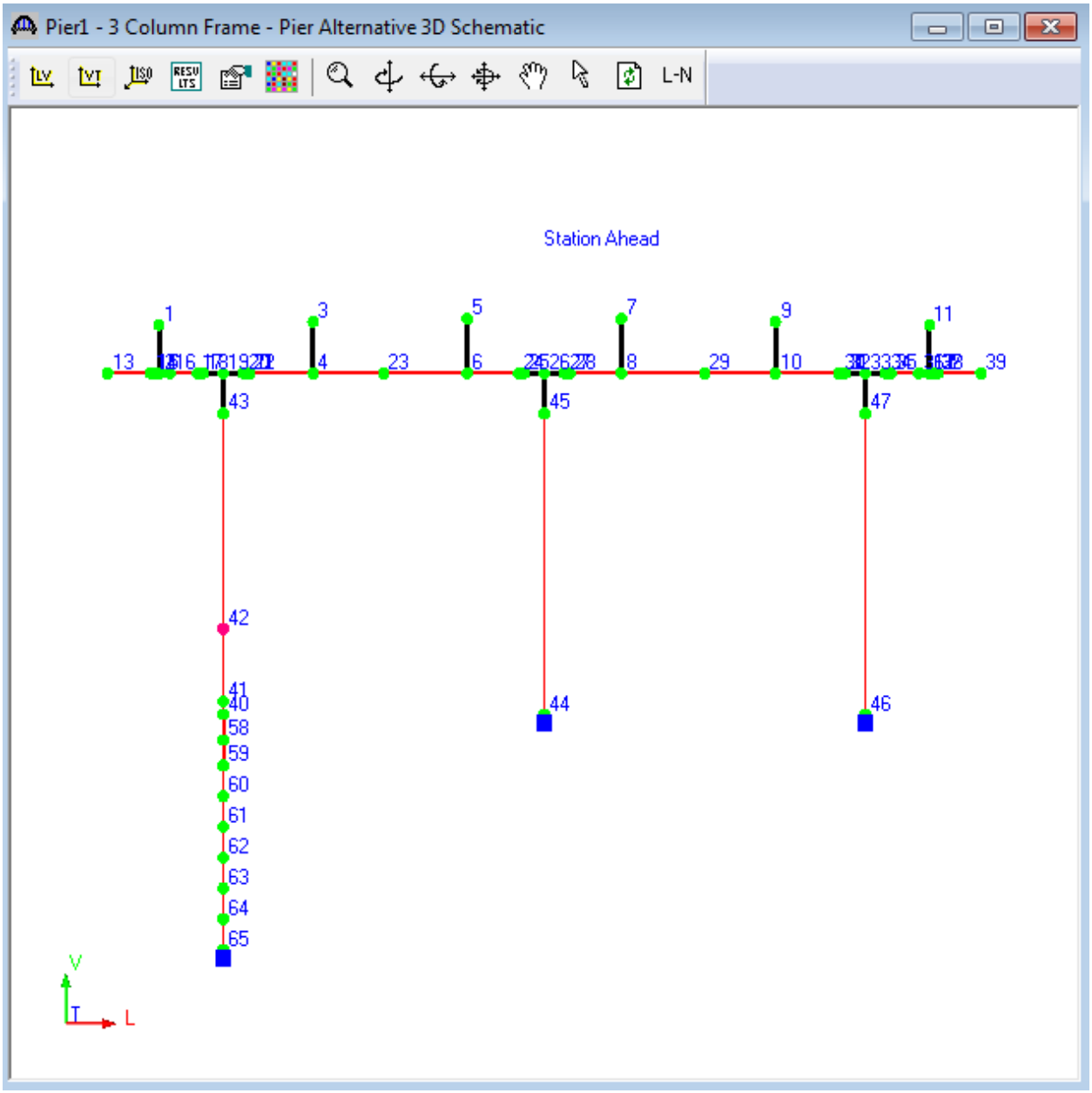


We will now do a spec-check of the pier but we must first re-analyze the pier. The program is configured such that you can perform a spec-check after you revise your geometry or reinforcement without having to do a finite element analysis every time you make such a change. This capability allows you to quickly refine your reinforcement and geometry. However, we have made a significant change to our pier by extending the length of Column1 to include the drilled shaft. If we try to do a spec-check now without redoing the FE analysis, we will get an error that the existing FE model does not match the pier structure we currently have.

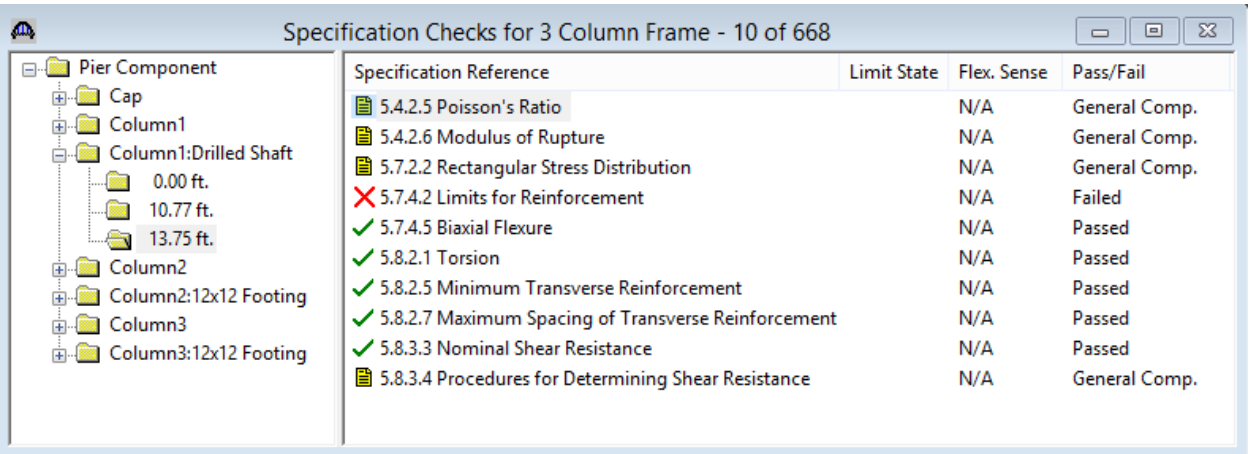
So we will first re-analyze the pier

and then perform a spec-check of the pier.

The FE model generated by the program is shown below.



Specification checks are performed at the following locations in Column 1:



We are primarily interested in the following 2 points:

The 0.00 ft location is the base of the column in BrD which is the point of fixity for the drilled shaft segment.

The 13.75 ft location is the interface of the column and drilled shaft segment.

The spec-check at the point of fixity is shown below: