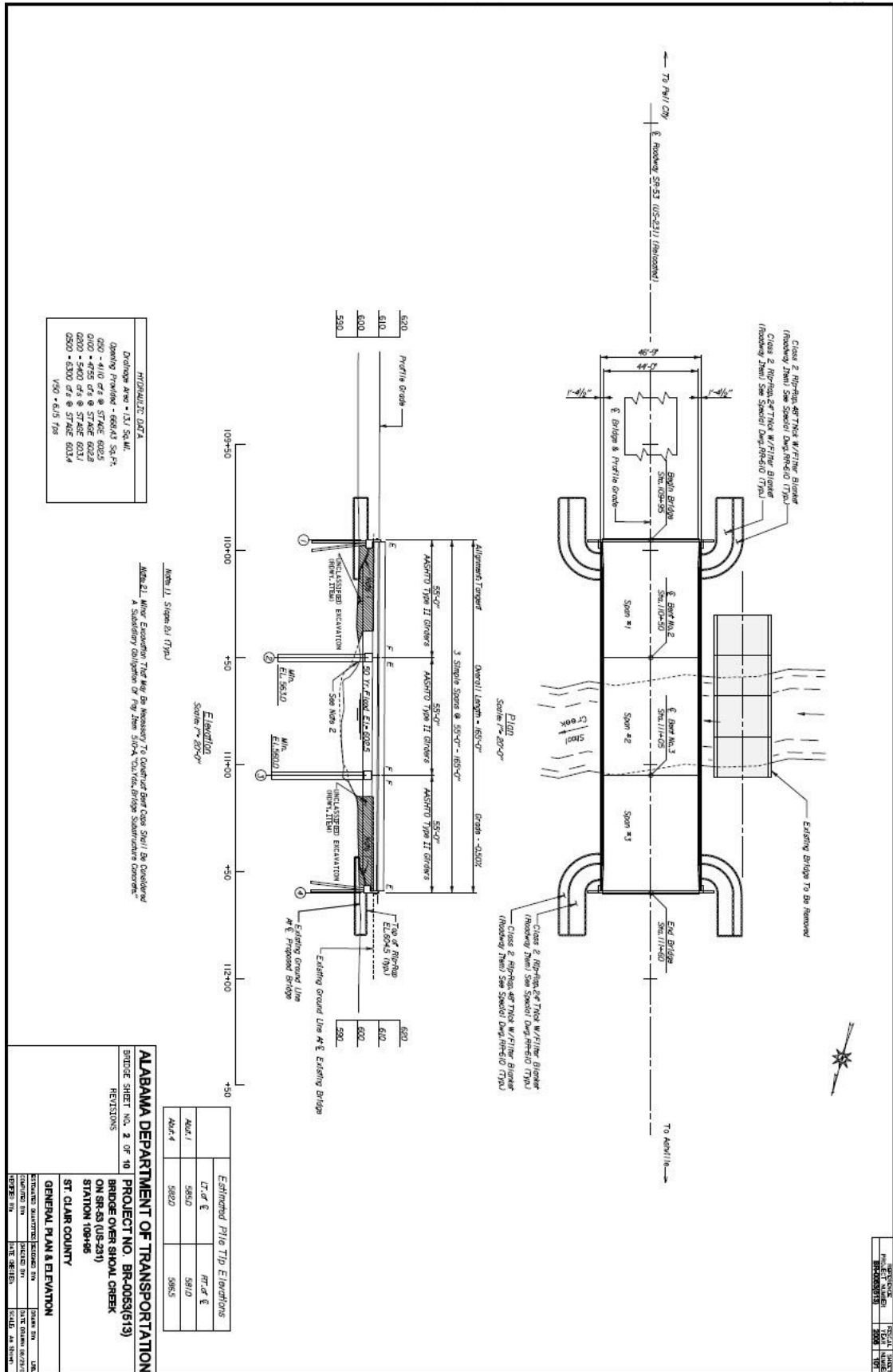


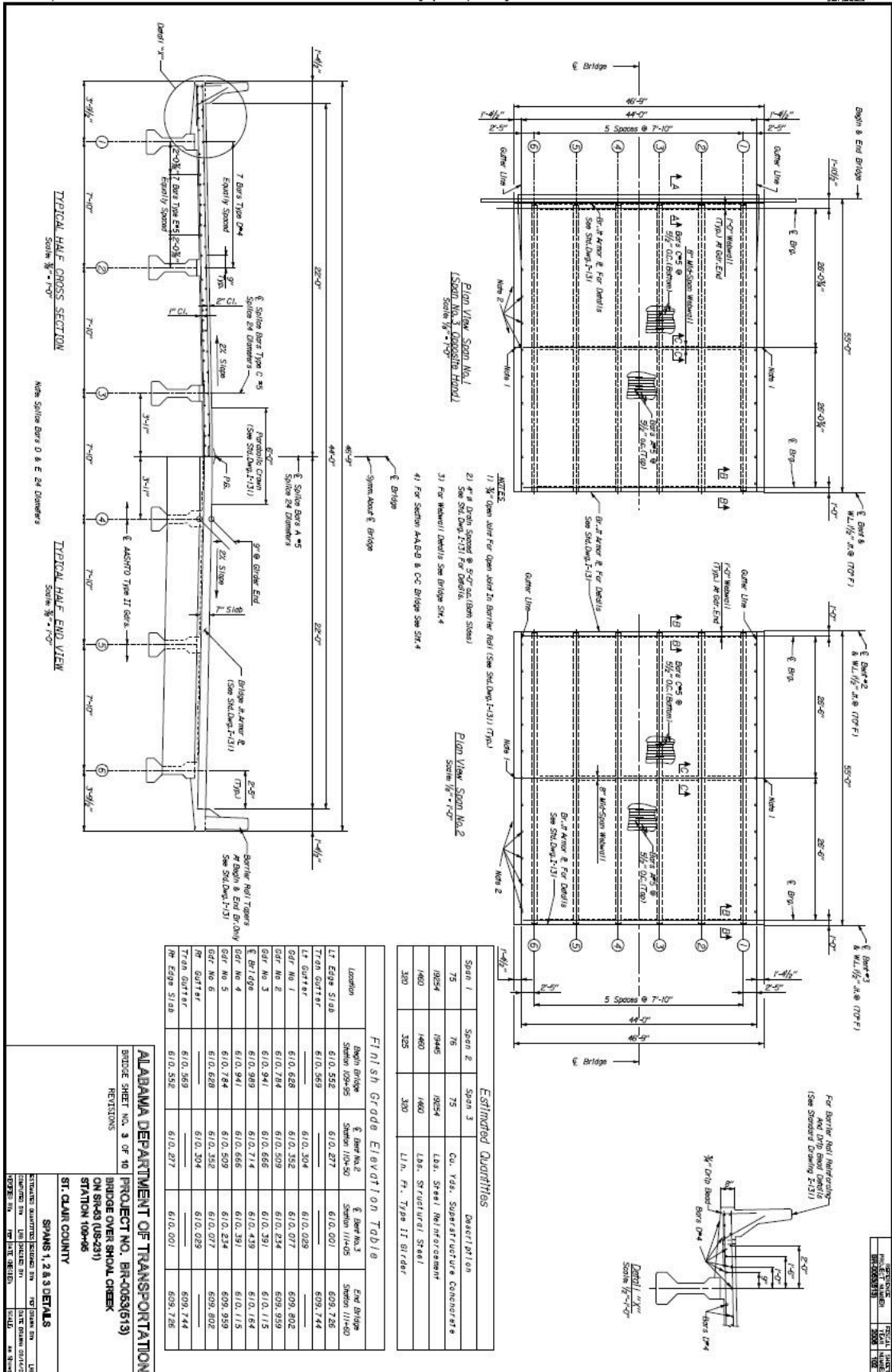
AASHTOWare BrD 6.8

Substructure Tutorial
Frame Pier Drilled Shaft Example

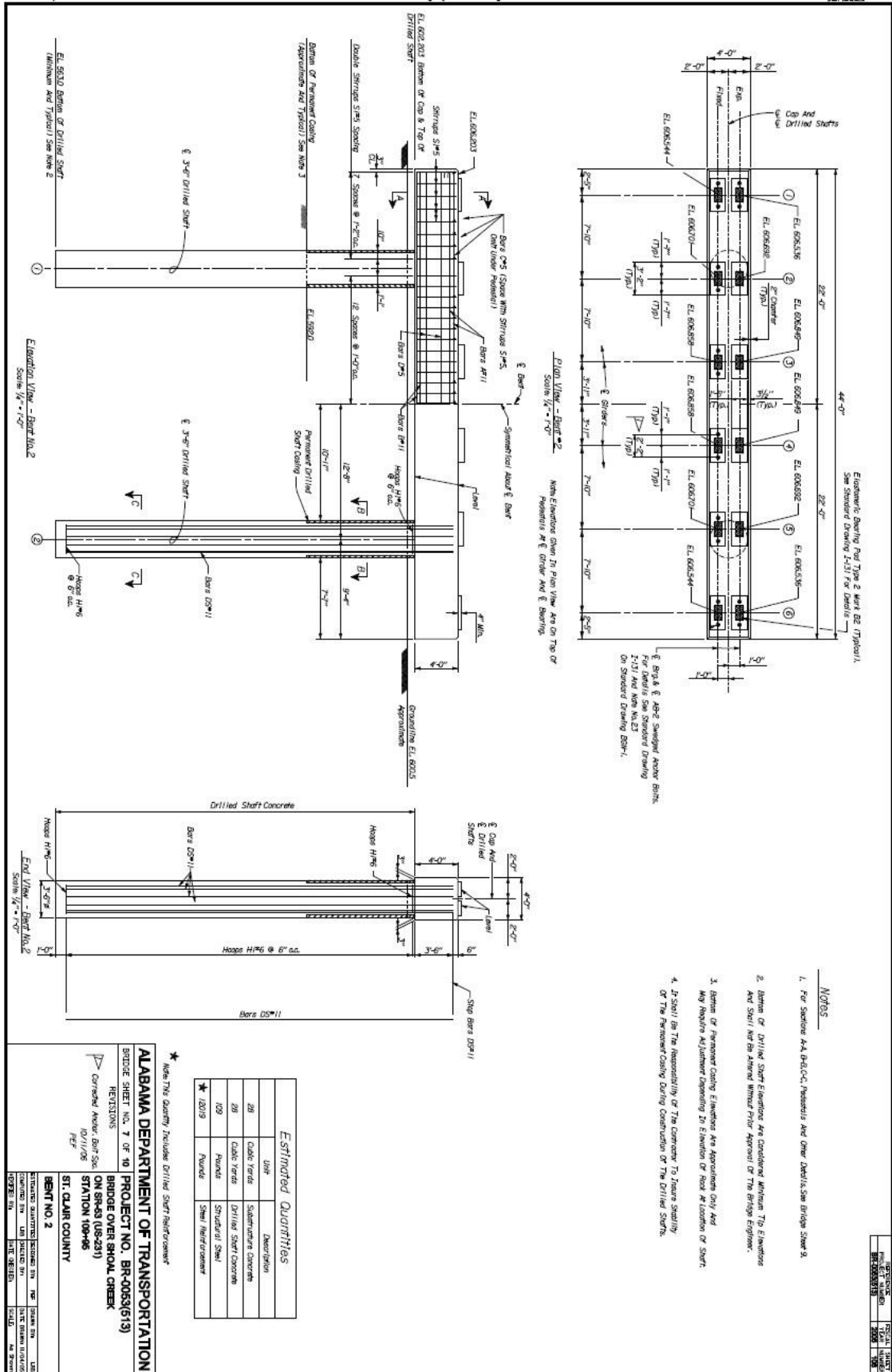
Frame Drilled Shaft Example



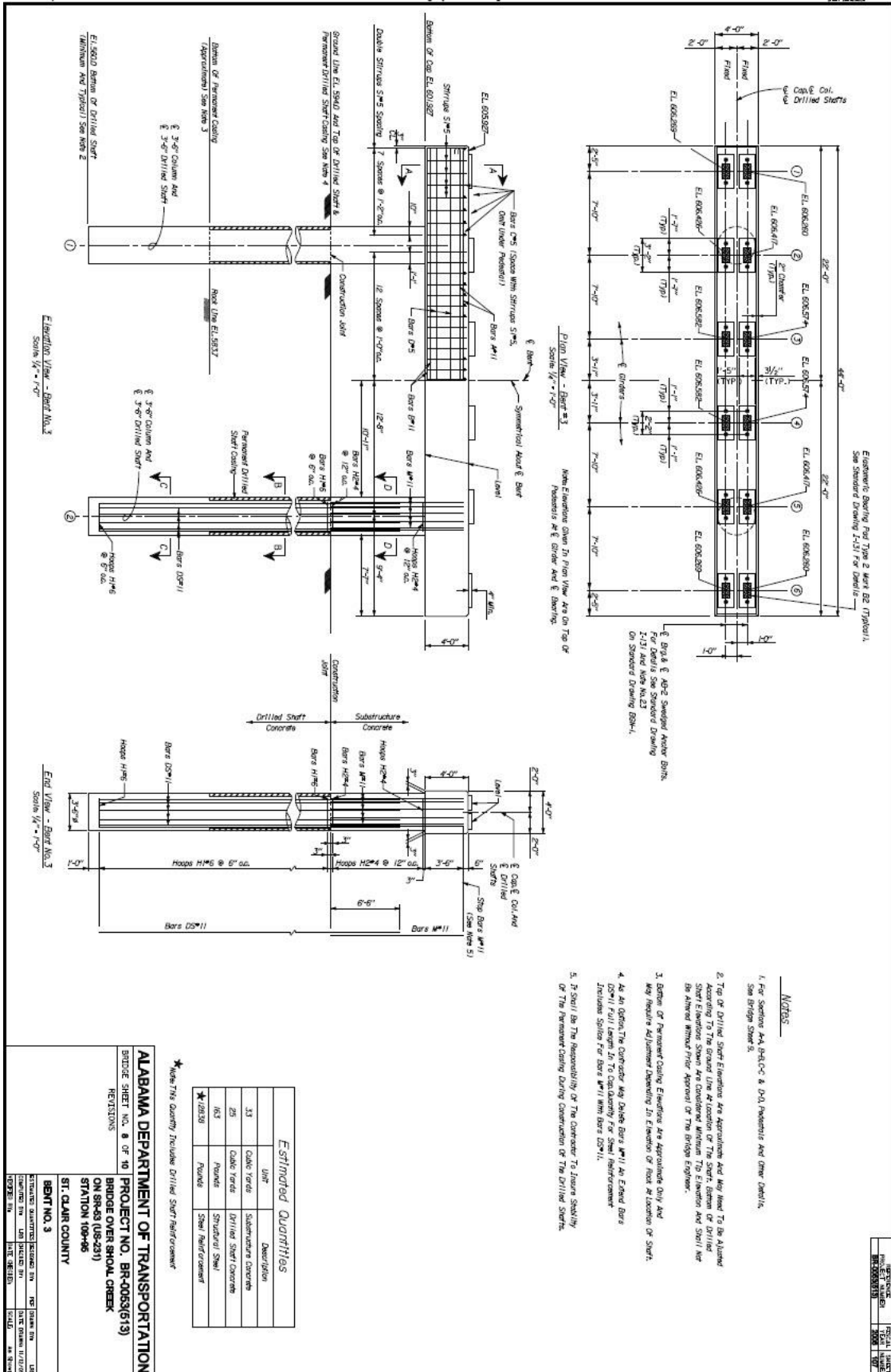
Frame Drilled Shaft Example



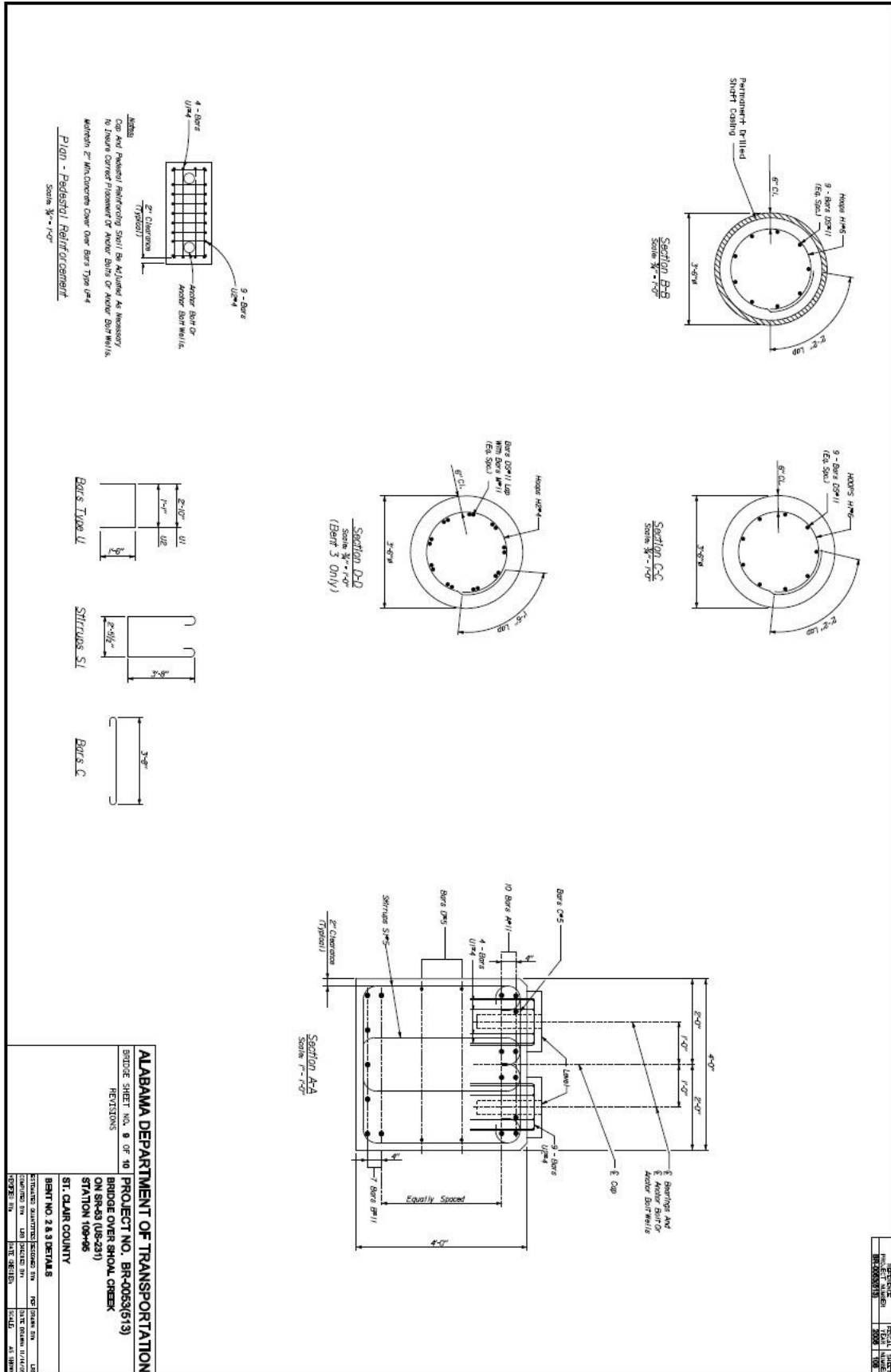
Frame Drilled Shaft Example



Frame Drilled Shaft Example



Frame Drilled Shaft Example



Frame Drilled Shaft Example

This example describes the entry of piers for a 3 simple span superstructure previously entered into BrD as part of the Alabama BrD superstructure training session. This example is part of the design portion of the training where users attempt to enter data on their own instead of following screen by screen captures. As such this example does not describe data entry for each window. Instead it shows only certain windows and describes important modeling concepts on these windows.

Locating Substructure Units

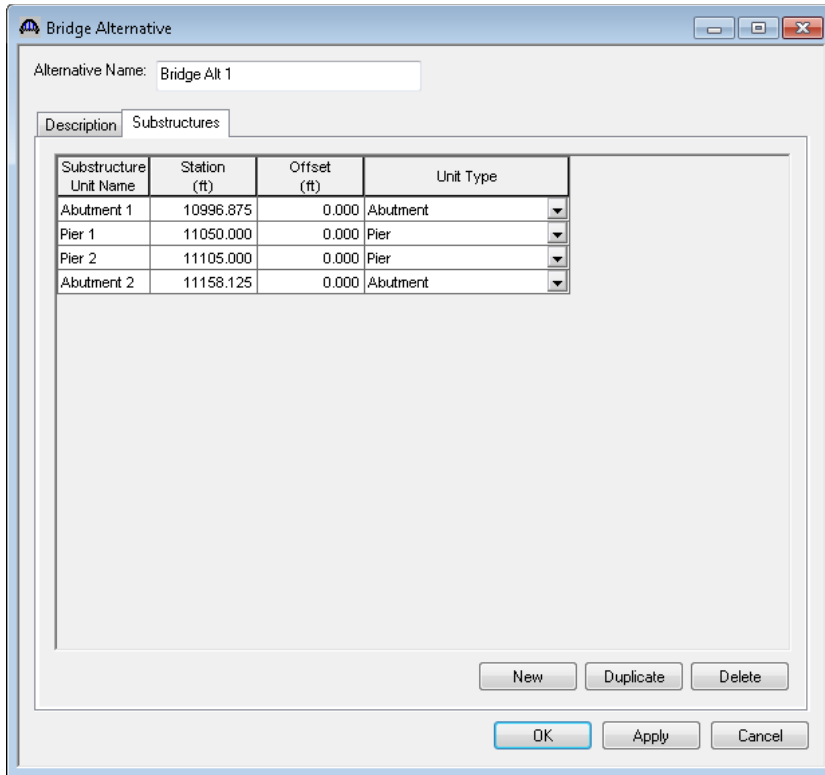
Open the bridge workspace for the PS 8 example and open the Bridge Alternative window shown below. The reference line length is the length between the abutment bearings. The staking station is abutment 1 CL Brg station.

The screenshot shows the 'Bridge Alternative' dialog box with the following configuration:

- Alternative Name: Bridge Alt 1
- Description: Substructures
- Horizontal curvature:
- Reference Line Length: 161.25 ft
- Start bearing: End bearing:
- Starting Station: 10996.88 ft
- Bearing: N 90° 0' 0.00" E
- Global Positioning: Distance = 0.000 ft, Offset = 0.000 ft, Elevation = [] ft
- Bridge Alignment: Curved, Tangent, curved, tangent, Tangent, curved, Curved, tangent
- Start tangent length: [] ft
- Curve length: [] ft
- Radius: [] ft
- Direction: []
- End tangent length: [] ft
- Buttons: Superstructure Wizard..., Culvert Wizard..., OK, Apply, Cancel

Frame Drilled Shaft Example

The substructure locations are defined as follows:

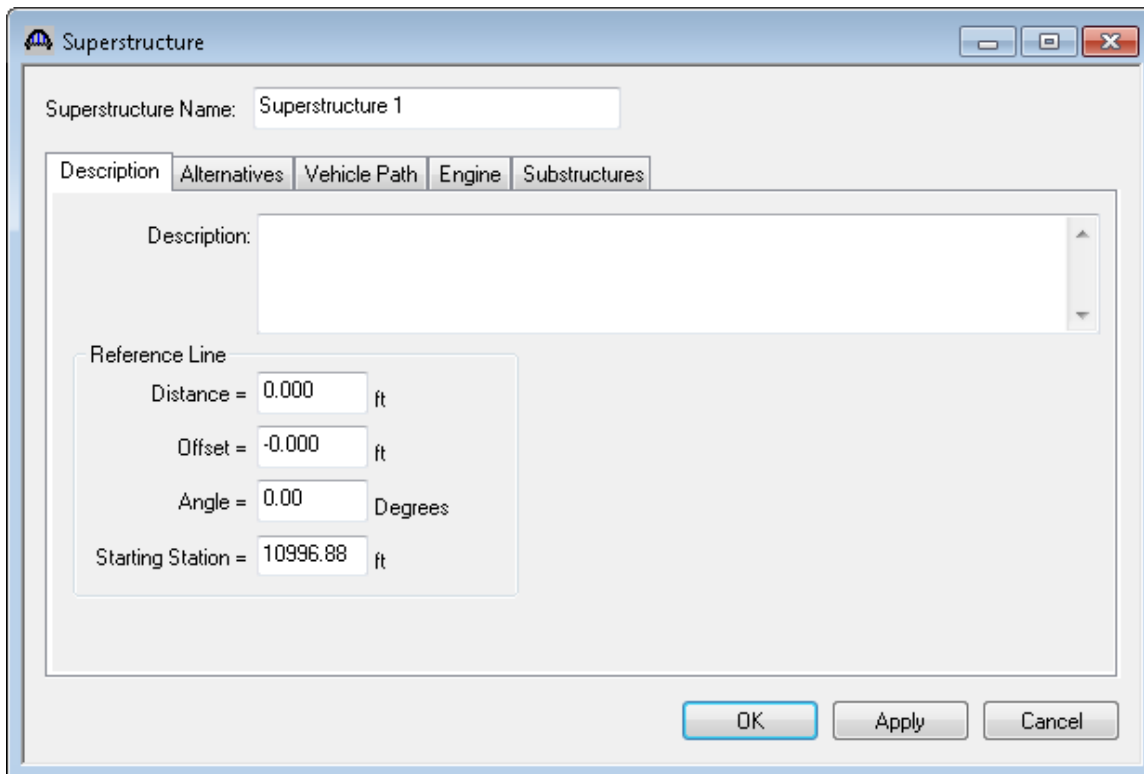


The screenshot shows the 'Bridge Alternative' dialog box. The 'Alternative Name' is 'Bridge Alt 1'. The 'Substructures' tab is active, displaying a table with the following data:

Substructure Unit Name	Station (ft)	Offset (ft)	Unit Type
Abutment 1	10996.875	0.000	Abutment
Pier 1	11050.000	0.000	Pier
Pier 2	11105.000	0.000	Pier
Abutment 2	11158.125	0.000	Abutment

Buttons at the bottom include 'New', 'Duplicate', 'Delete', 'OK', 'Apply', and 'Cancel'.

The individual Superstructure windows are shown below.

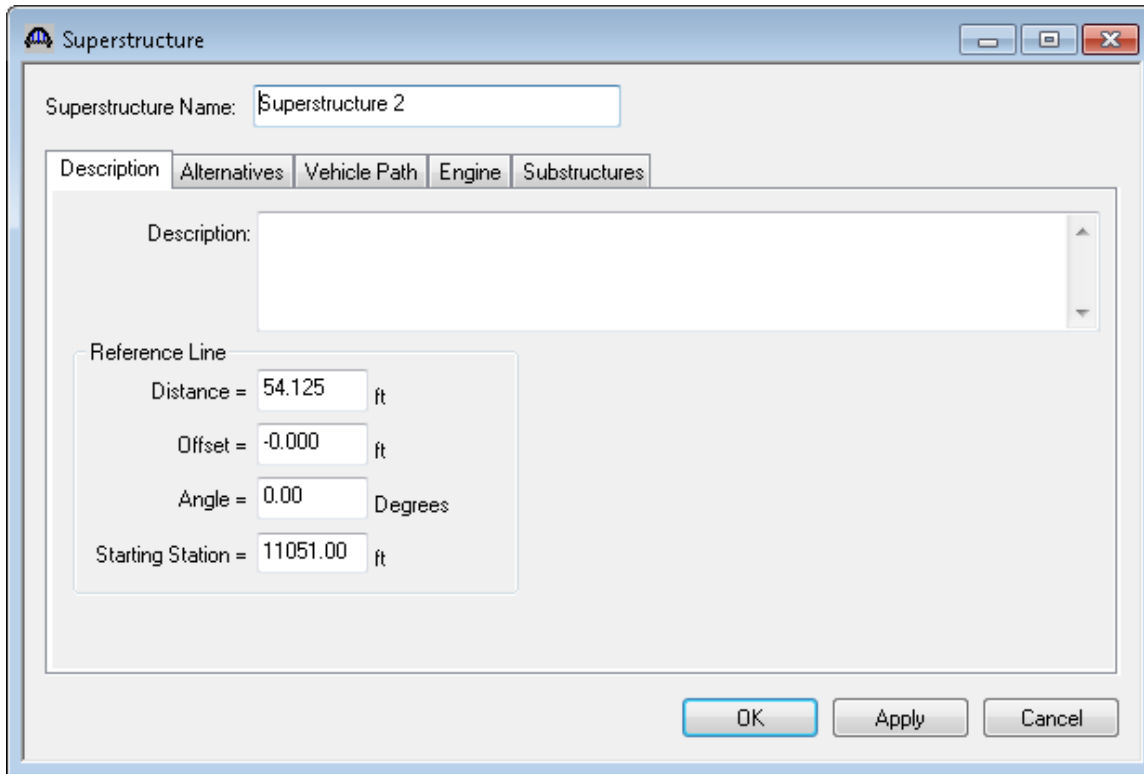


The screenshot shows the 'Superstructure' dialog box. The 'Superstructure Name' is 'Superstructure 1'. The 'Substructures' tab is active. The 'Reference Line' section contains the following settings:

- Distance = 0.000 ft
- Offset = -0.000 ft
- Angle = 0.00 Degrees
- Starting Station = 10996.88 ft

Buttons at the bottom include 'OK', 'Apply', and 'Cancel'.

Frame Drilled Shaft Example



Superstructure Name:

Description Alternatives Vehicle Path Engine Substructures

Description:

Reference Line

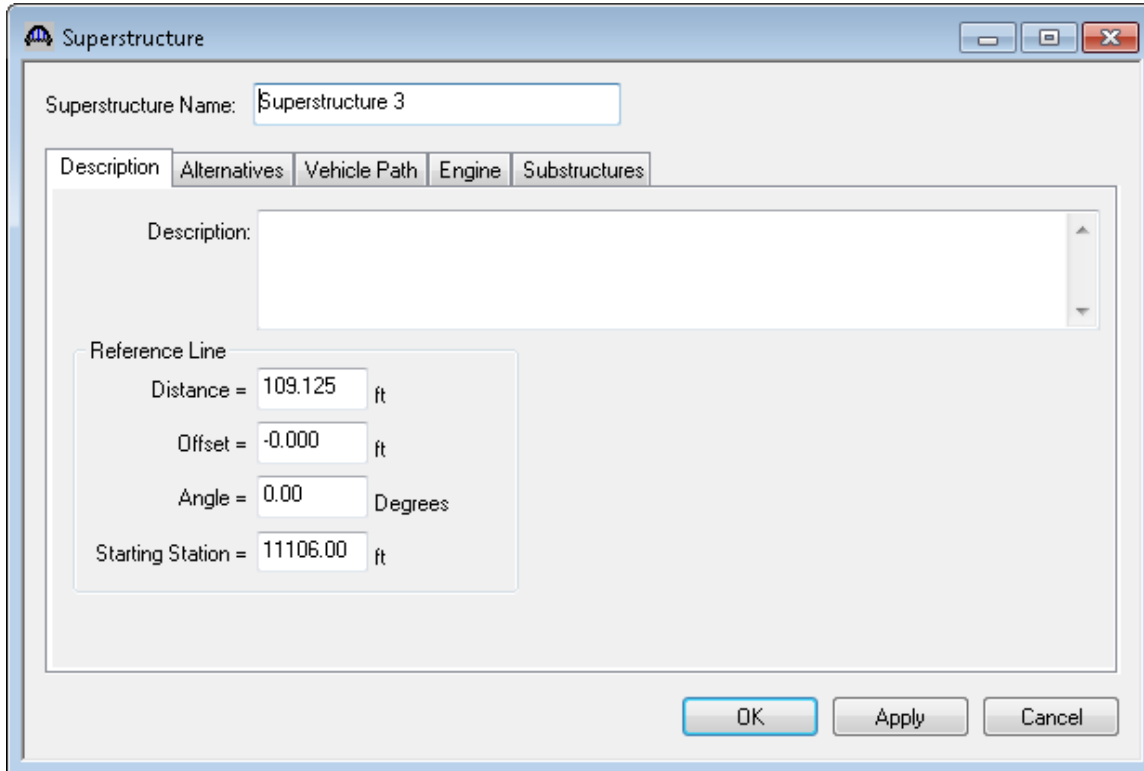
Distance = ft

Offset = ft

Angle = Degrees

Starting Station = ft

OK Apply Cancel



Superstructure Name:

Description Alternatives Vehicle Path Engine Substructures

Description:

Reference Line

Distance = ft

Offset = ft

Angle = Degrees

Starting Station = ft

OK Apply Cancel

Frame Drilled Shaft Example

Revise the bearing types as follows:

Bridge Alternative Name:

Bearing Data | Bearing Data (Cont'd) | Relative Stiffness

Substructure Unit Data:

Unit Type	Substructure Unit Name	Station (ft)	Offset (ft)	Current Alternative	Geometry Defined
Abutm	Abutment 1	10996.875	-0.000		<input type="checkbox"/>
Pier	Pier 1	11050.000	-0.000		<input type="checkbox"/>
Pier	Pier 2	11105.000	-0.000		<input type="checkbox"/>
Abutm	Abutment 2	11158.125	-0.000		<input type="checkbox"/>

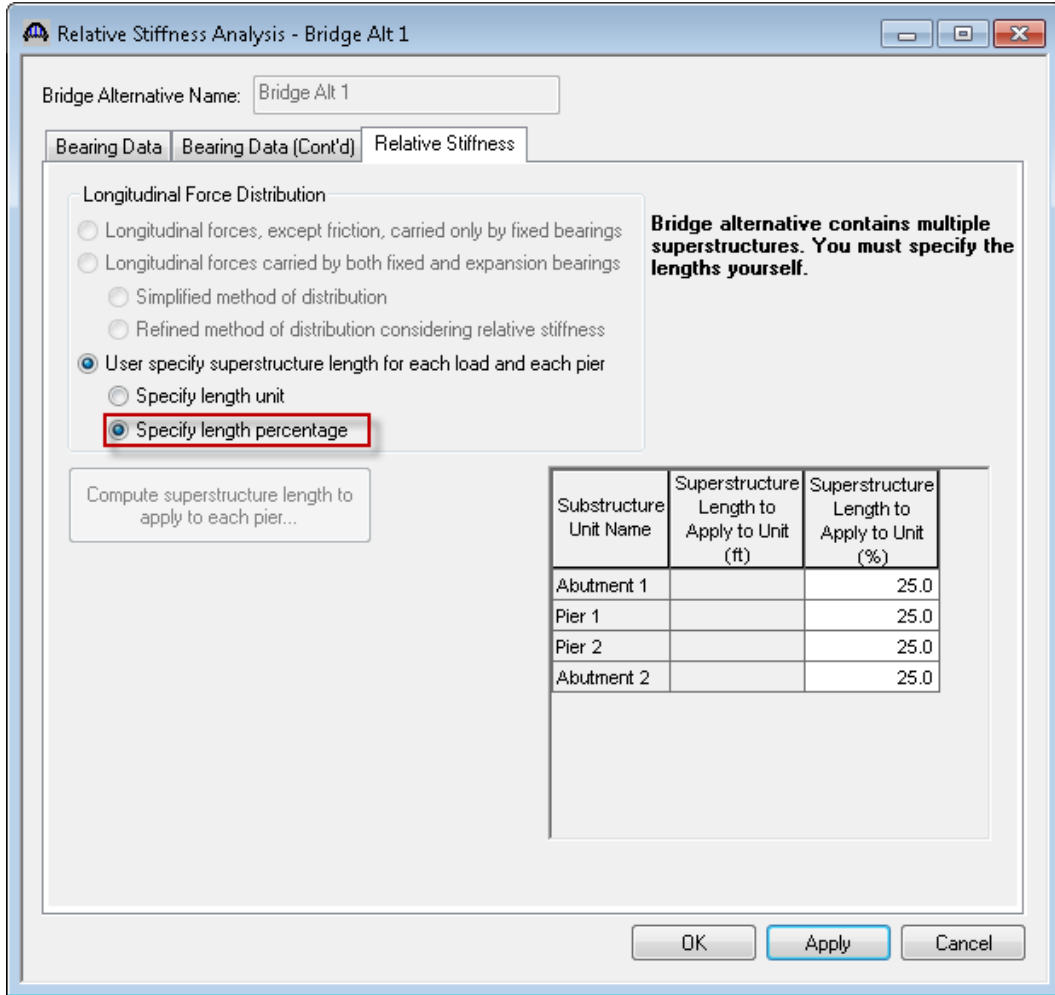
Bearing Types:

Support Line	Substructure Unit Name	Longitudinal Movement Type	Number of Bearings	Bearing Type
Support Line	Abutment 1	Expansion	6	Elastomeric
Support Line	Pier 1	Fixed	6	Elastomeric
Support Line	Pier 1	Expansion	6	Elastomeric
Support Line	Pier 2	Fixed	6	Elastomeric
Support Line	Pier 2	Fixed	6	Elastomeric
Support Line	Abutment 2	Expansion	6	Elastomeric

OK Apply Cancel

Since this bridge alternative contains multiple superstructures you must specify the length of superstructure to load for each pier. We are assuming both the fixed and expansion bearings carry the longitudinal forces.

Frame Drilled Shaft Example



Bent #3 Description:

The cap reinforcement is entered as follows.

Cap Reinforcement - Pier 2 - Bent #2

Flexural Shear

Longitudinal Skin
 Bar size: 5 Bar spacing: 11.110 in Bar material: Grade 60 Stirrup clear cover: 2.0000 in

Primary Flexural
 Reinforcement Input Method: Simplified Advanced Reinforcement follows cap profile

Set	Measure From Cap	Vertical Distance (in)	Bar Size	Number	Material	Start Distance (ft)	Straight Length (ft)	End Distance (ft)	Hook at Start	Hook at End	Developed at Start	Developed at End
1	Top	3.330	11	6.000	Grade 6	0.250	43.500	43.750	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Top	7.330	11	4.000	Grade 6	0.250	43.500	43.750	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Bottom	7.330	11	2.000	Grade 6	0.250	43.500	43.750	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Bottom	3.330	11	5.000	Grade 6	0.250	43.500	43.750	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

New Duplicate Delete

OK Apply Cancel

Cap Reinforcement - Pier 2 - Bent #2

Flexural Shear

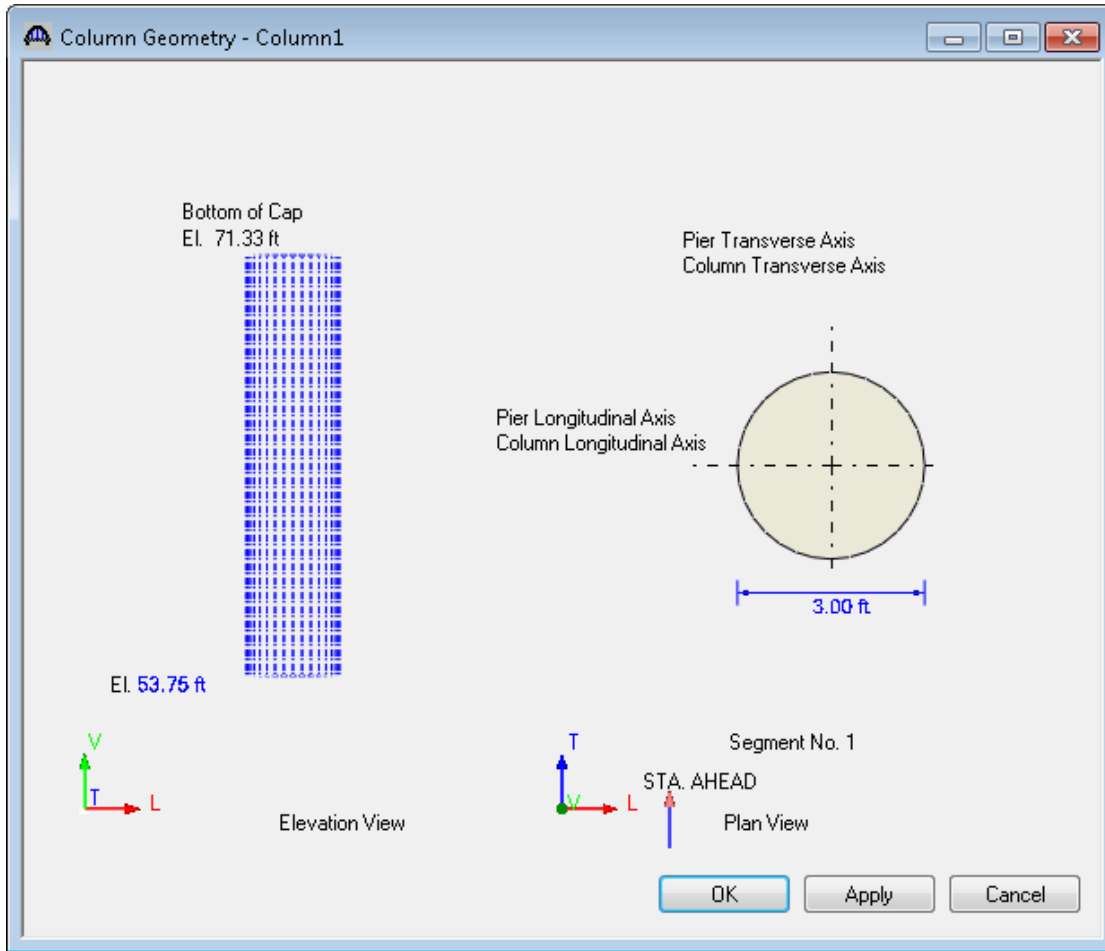
Bar Size	Number of Legs	Material	Measure From	Direction	Start Distance (ft)	Number of Spaces	Spacing (in)	Length (ft)	End Distance (ft)
5	4.000	Grade 6	Left Edge o	Right	0.250	1	0.000	0.000	0.250
5	4.000	Grade 6	Left Edge o	Right	0.250	7	14.000	8.167	8.417
5	4.000	Grade 6	Left Edge o	Right	8.417	1	19.000	1.583	10.000
5	4.000	Grade 6	Left Edge o	Right	10.000	24	12.000	24.000	34.000
5	4.000	Grade 6	Left Edge o	Right	34.000	1	19.000	1.583	35.583
5	4.000	Grade 6	Left Edge o	Right	35.583	7	14.000	8.167	43.750

Dup & Mirror New Duplicate Delete

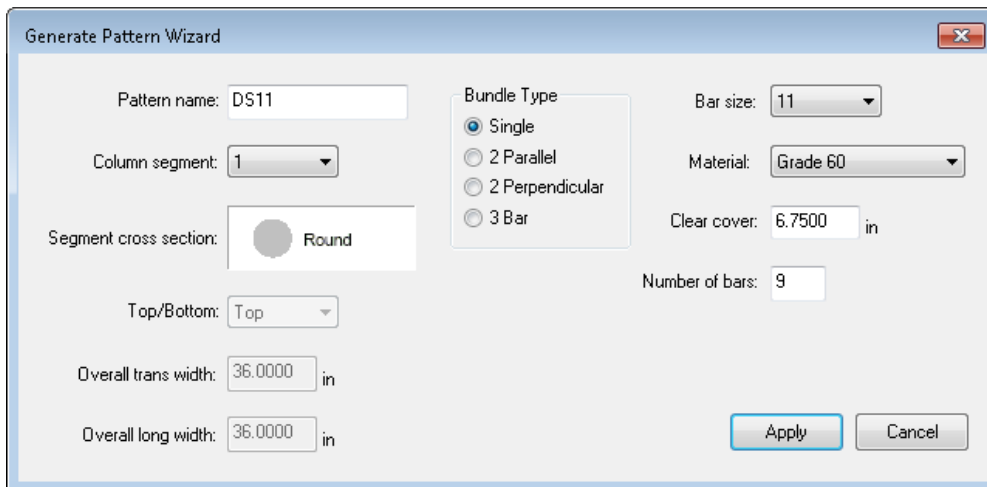
OK Apply Cancel

Frame Drilled Shaft Example

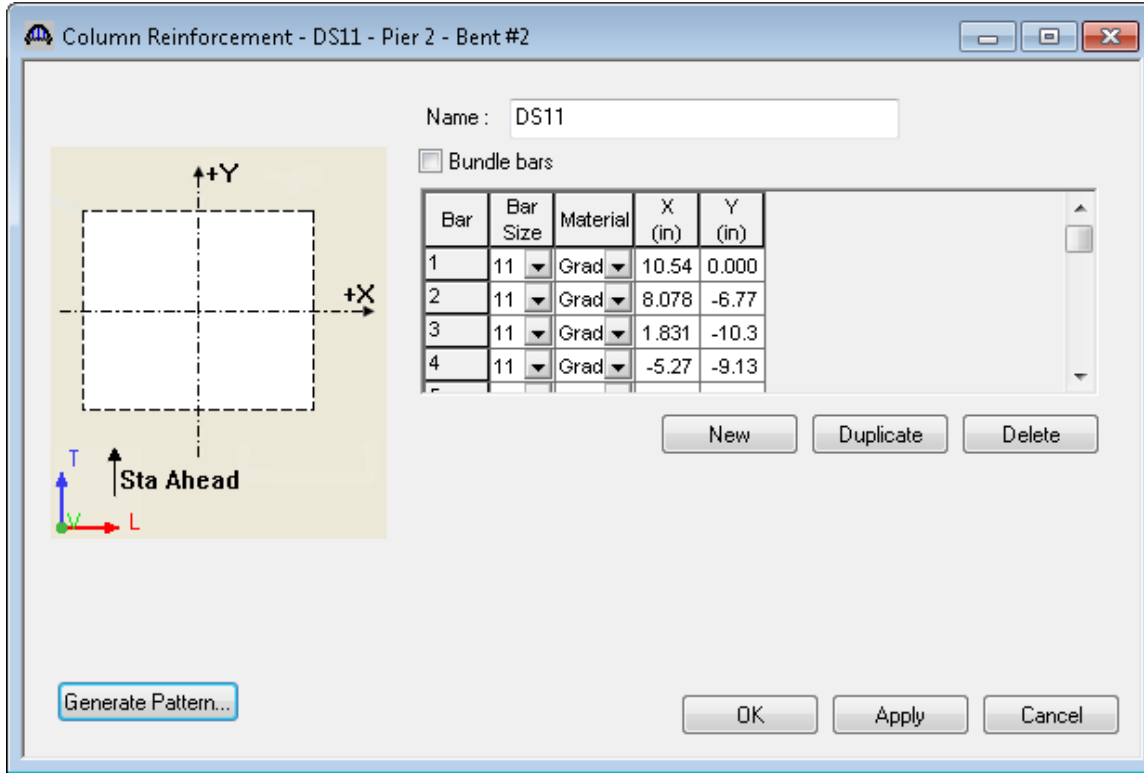
The column geometry is defined as follows:



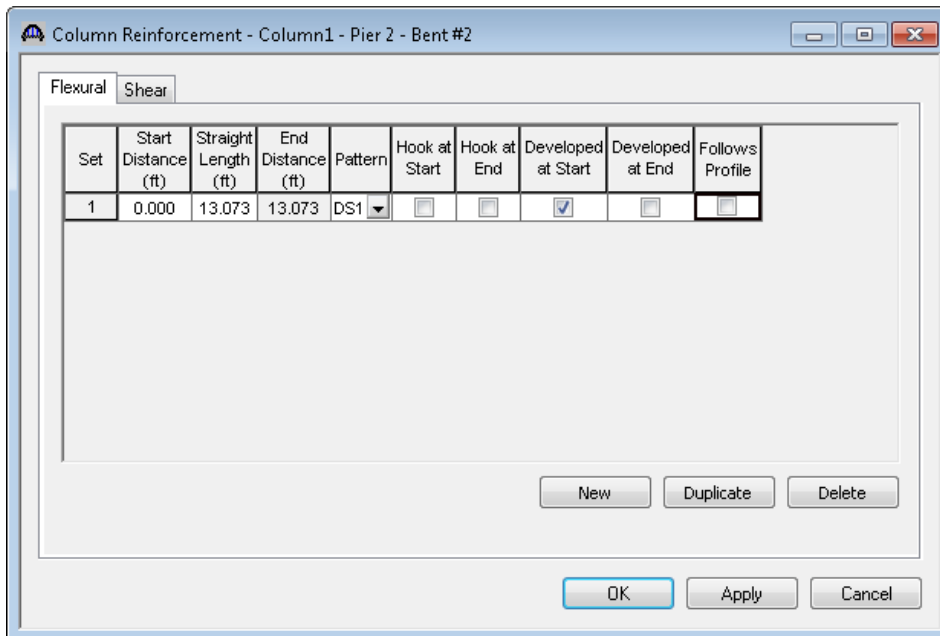
Enter the concrete column diameter as 3.5' and neglect the steel casing.



Frame Drilled Shaft Example



We checked Developed at Start to assume actual length of drilled shaft below point of fixity provides enough length for bars to be developed.



Frame Drilled Shaft Example

Column Reinforcement - Column1 - Pier 2 - Bent #2

Flexural Shear

Shear Reinforcement Type

Ties Spirals Spirals designed as ties

Bar Size	Trans. Number of Legs	Long. Number of Legs	Material	Start Distance (ft)	Number of Spaces	Spacing (in)	Length (ft)	End Distance (ft)
6	2.00	2.00	Epoxied	0.000	1	0.0000	0.000	0.000
6	2.00	2.00	Epoxied	0.000	20	6.0000	10.000	10.000

New Duplicate Delete

OK Apply Cancel