

Part D3:

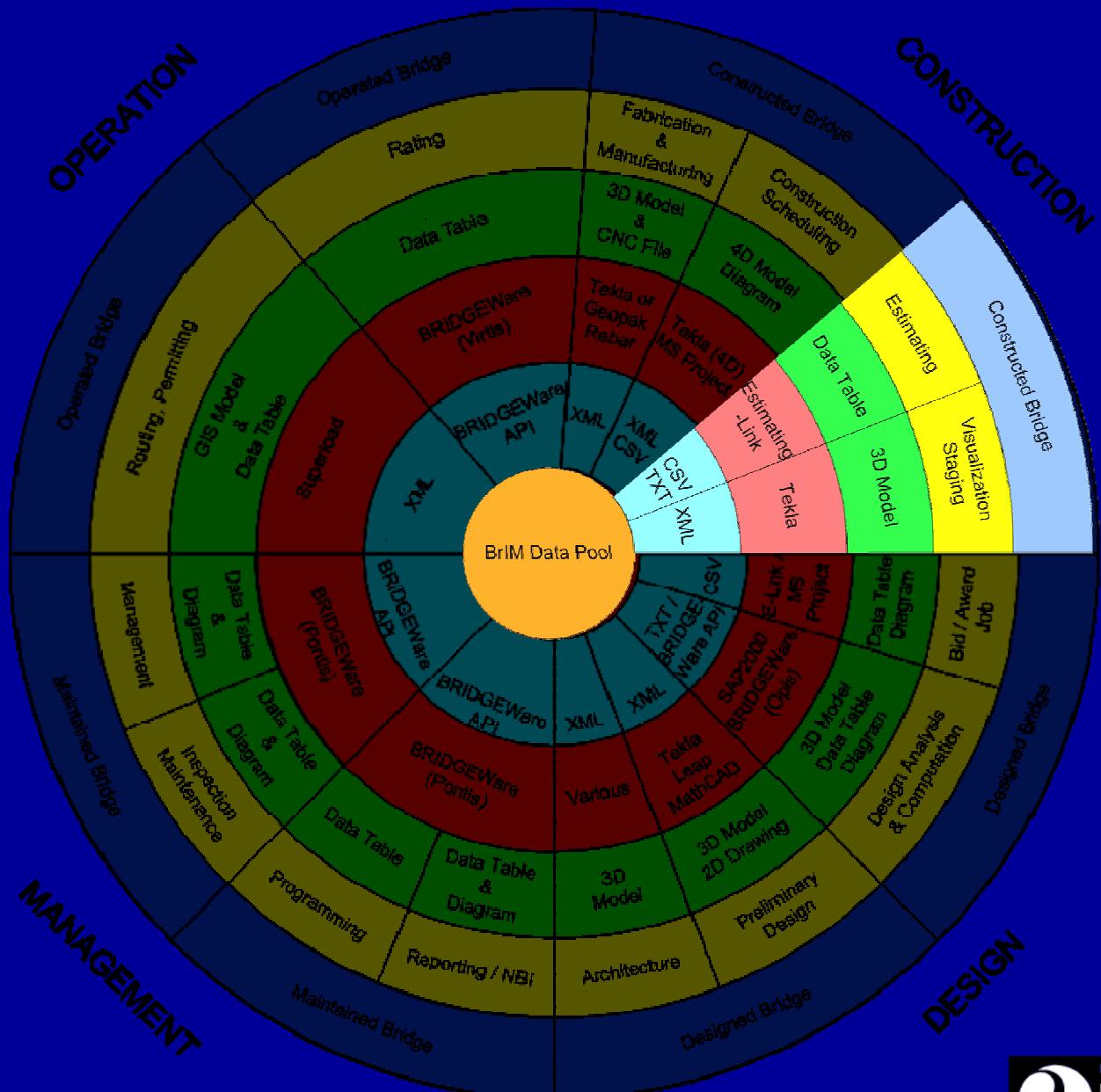
Construction

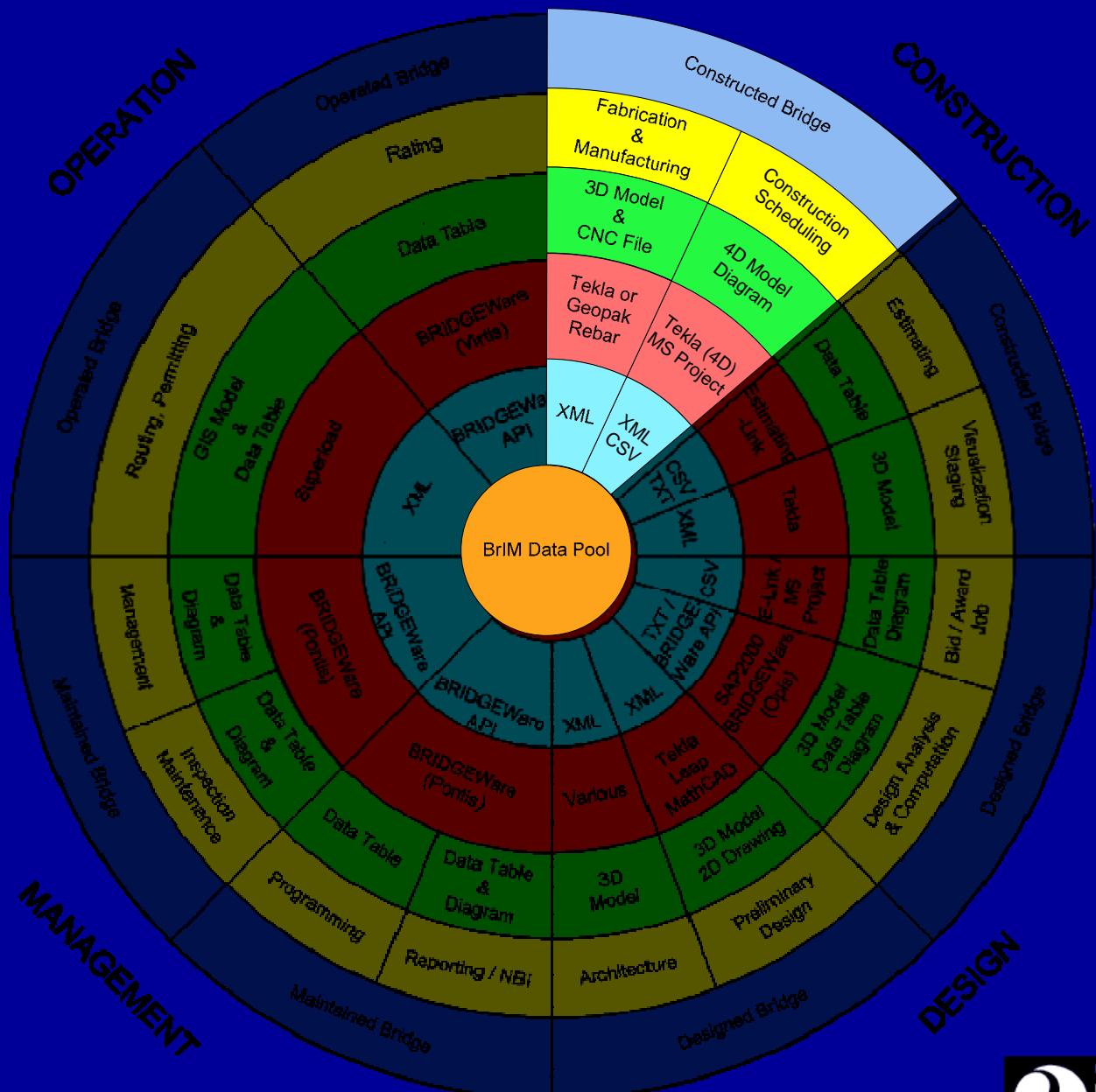


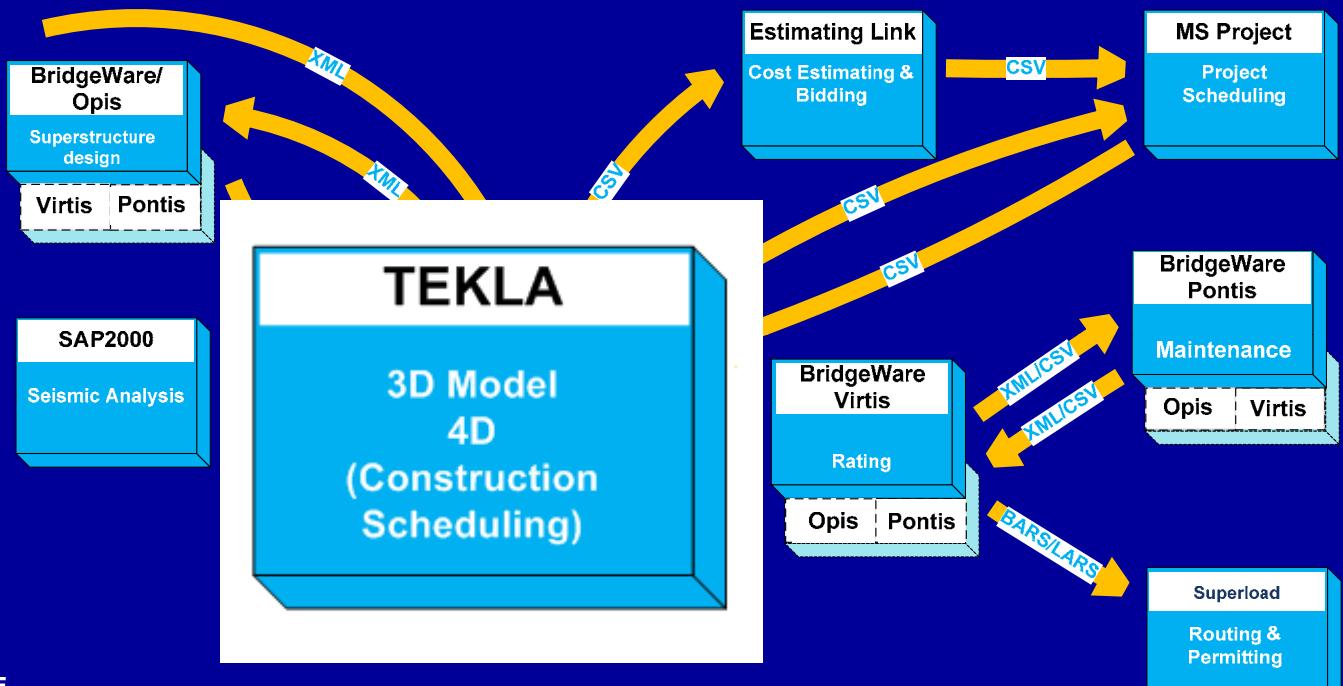
Overview (D3-Construction)

- Portion of Modeling Environment & Workflow
- Steel Superstructure Detailing (Splice, Stiffeners, Diaphragms)
- Superstructure Detailing (Rebar, Strands)
- Substructure & Overall Bridge Modeling
- Linkages and Workflows: Estimating
- Linkages and Workflows: Scheduling
- Feedback to 3D/4D Modeling Environment for downstream needs









METHOD OF DATA EXCHANGE

TXT – TEXT FILE

XML – EXTENSIBLE MARKUP LANGUAGE

LANDXML – LAND EXTENSIBLE MARKUP LANGUAGE

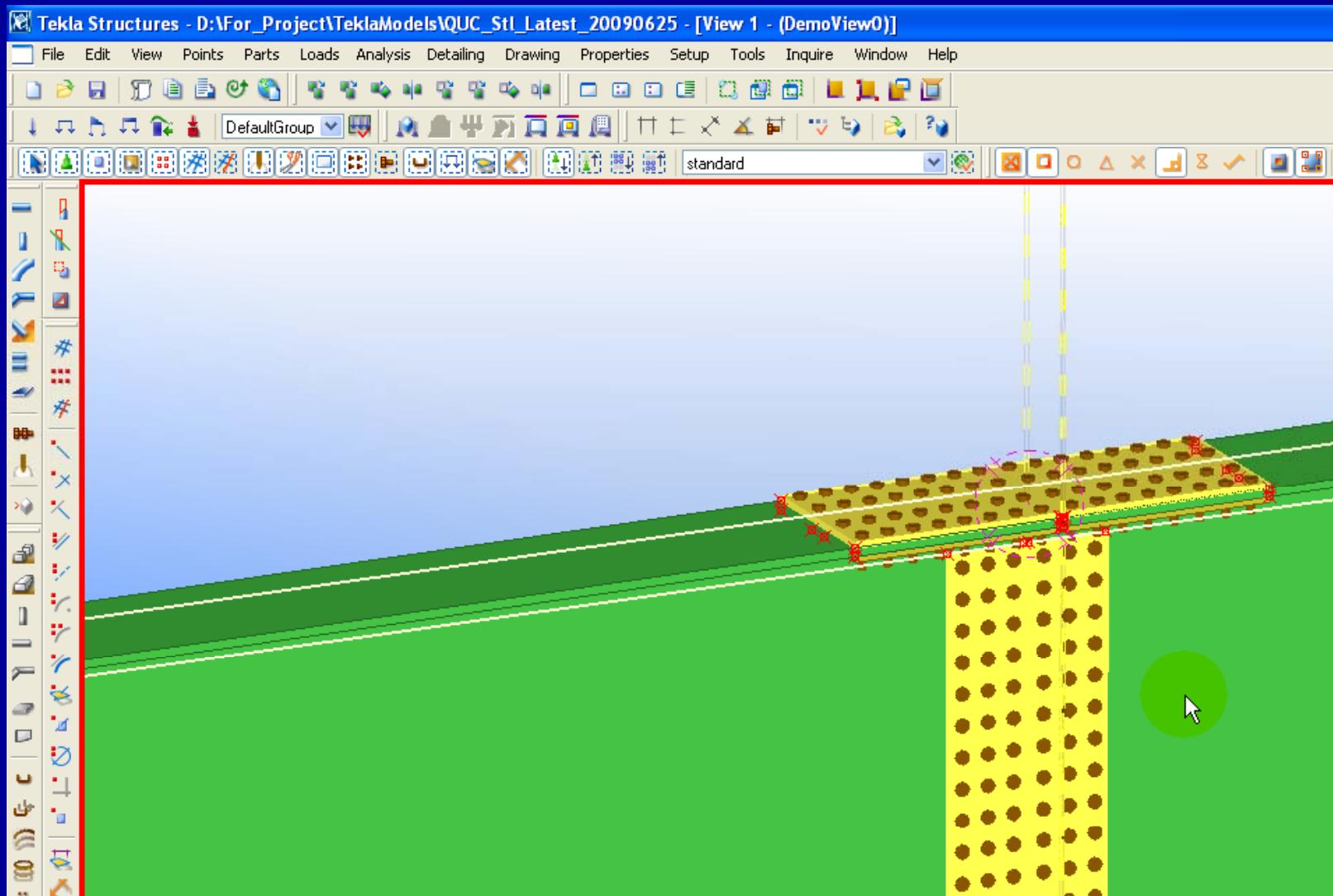
VBA – VISUAL BASIC FOR APPLICATIONS

CSV – COMMA SEPARATED VALUES

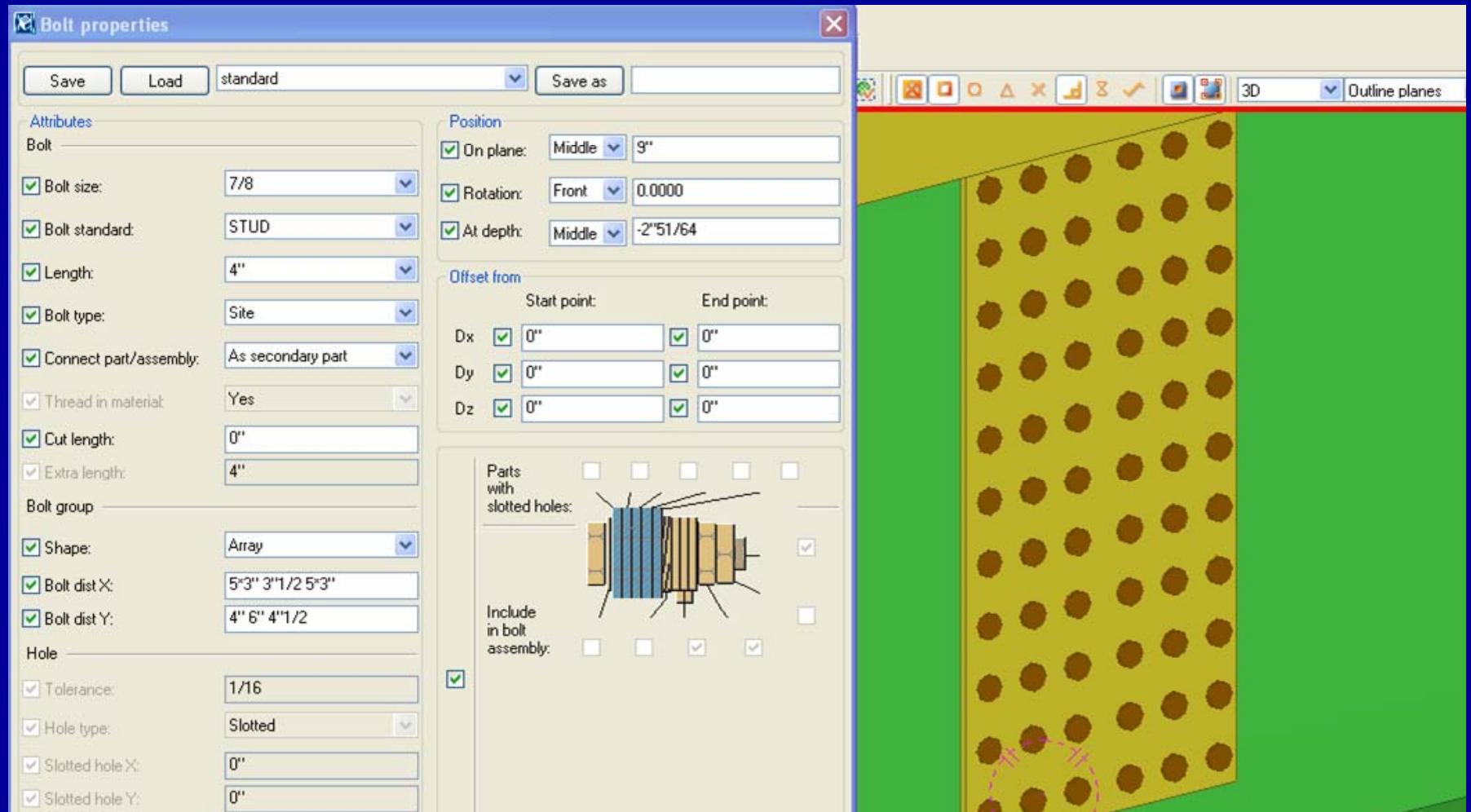
BARS/LARS – AASHTOWARE AND BENTLEY SOFTWARE



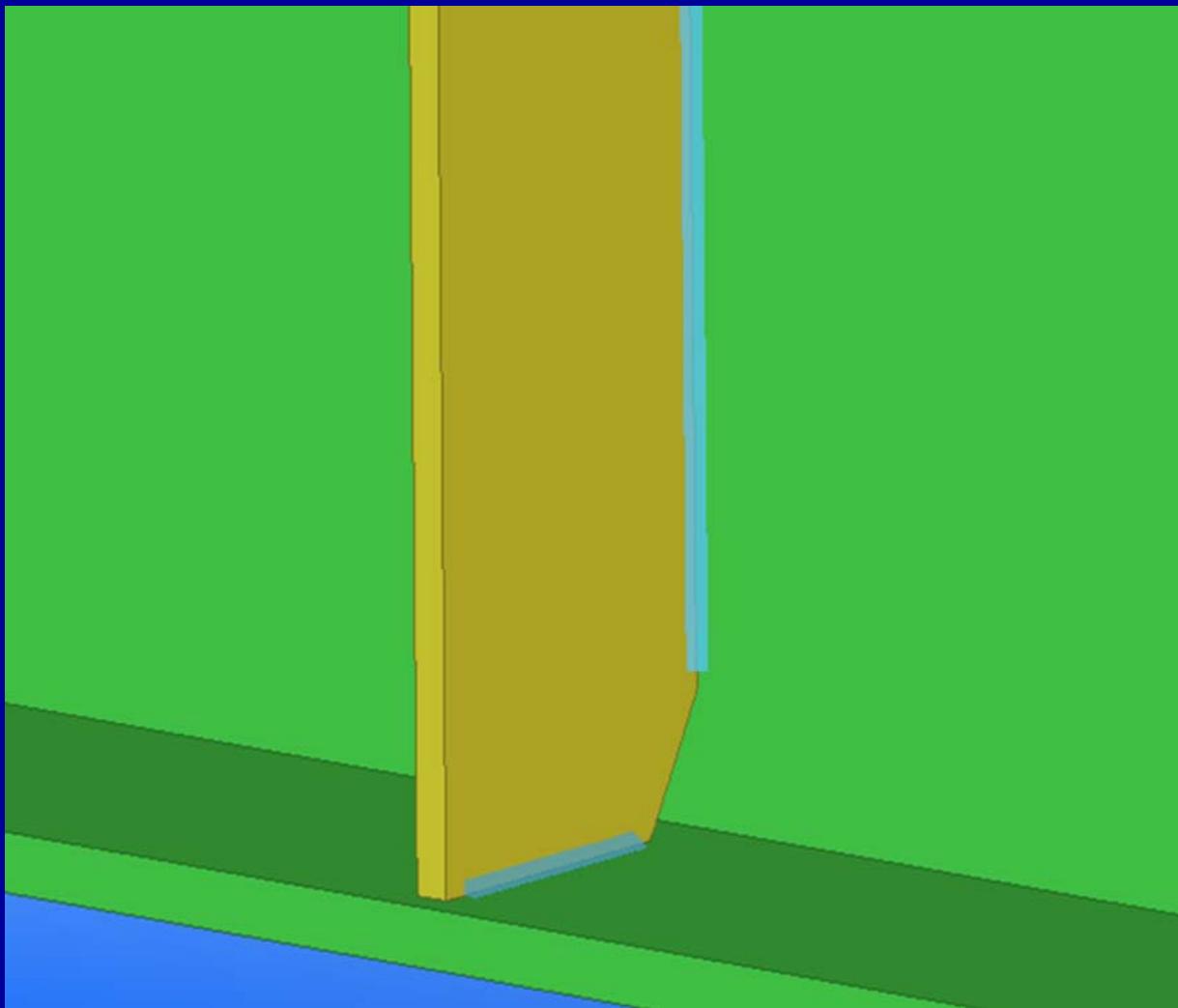
Steel Superstructure Detailing for Fabrication: Splice



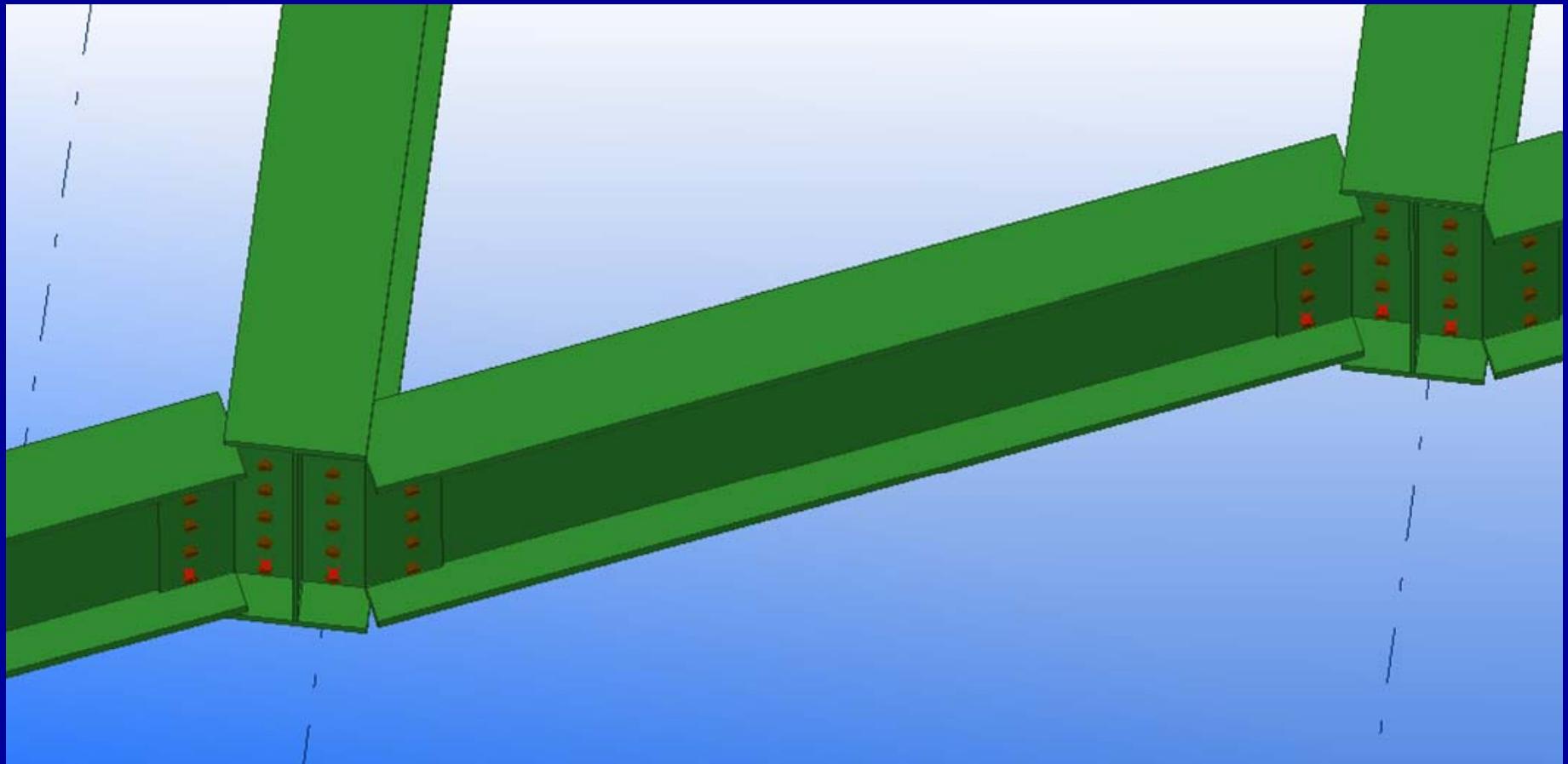
Steel Superstructure Detailing for Fabrication: Splice



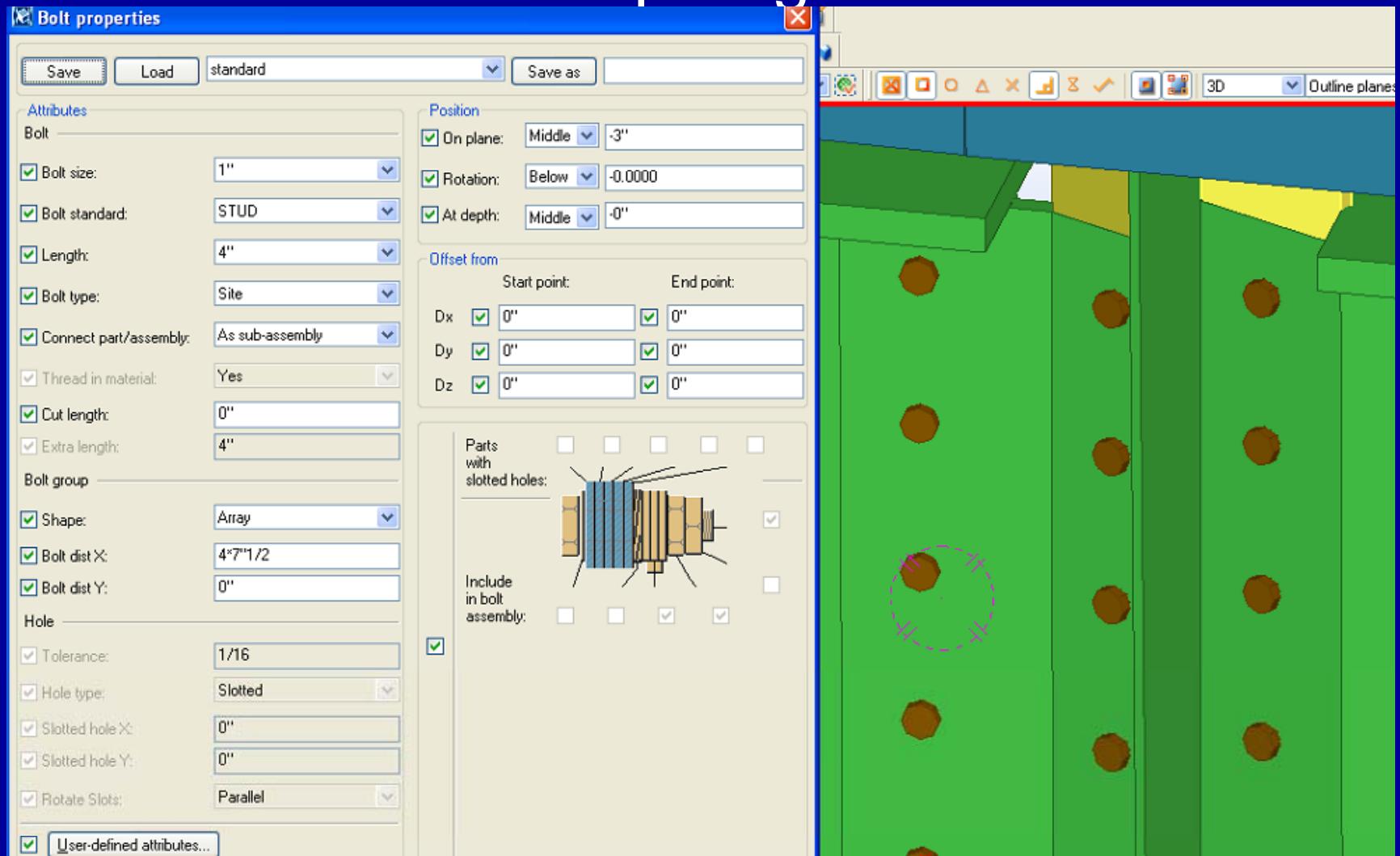
Steel Superstructure Detailing for Fabrication: Stiffener Welds



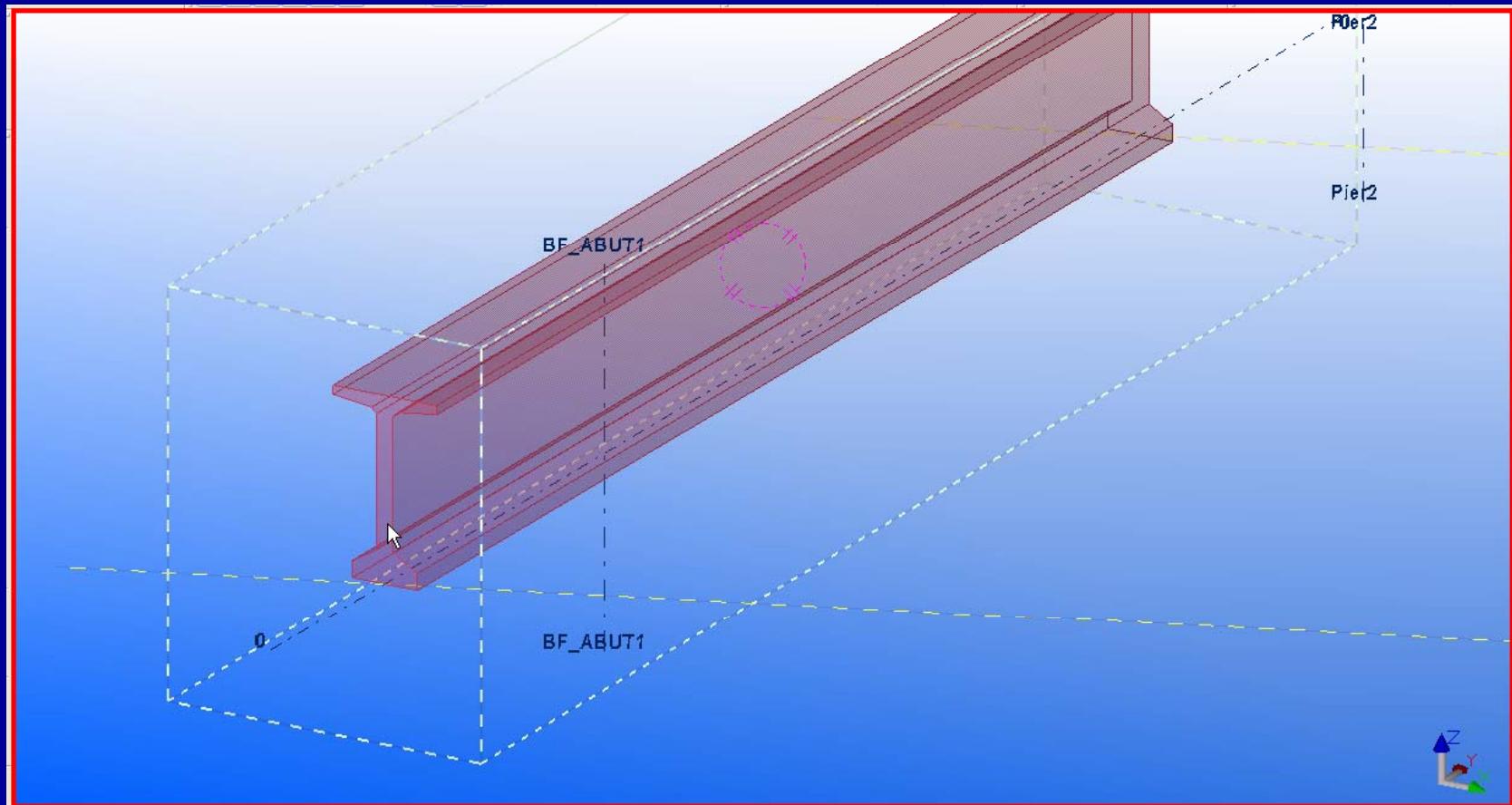
Steel Superstructure Detailing for Fabrication: Diaphragms



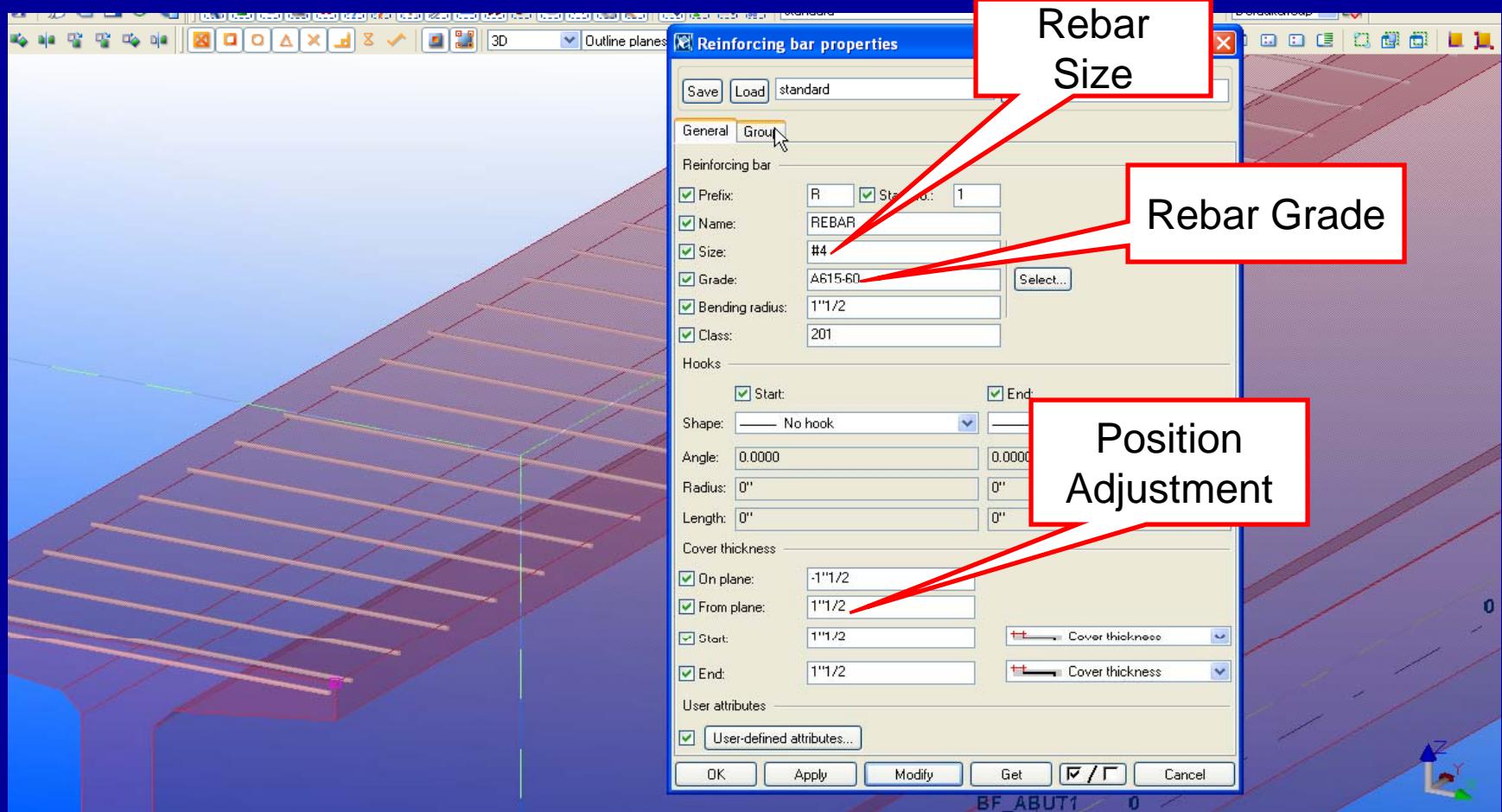
Steel Superstructure Detailing for Fabrication: Diaphragms



“Part Basic View” of a Concrete Girder in Tekla



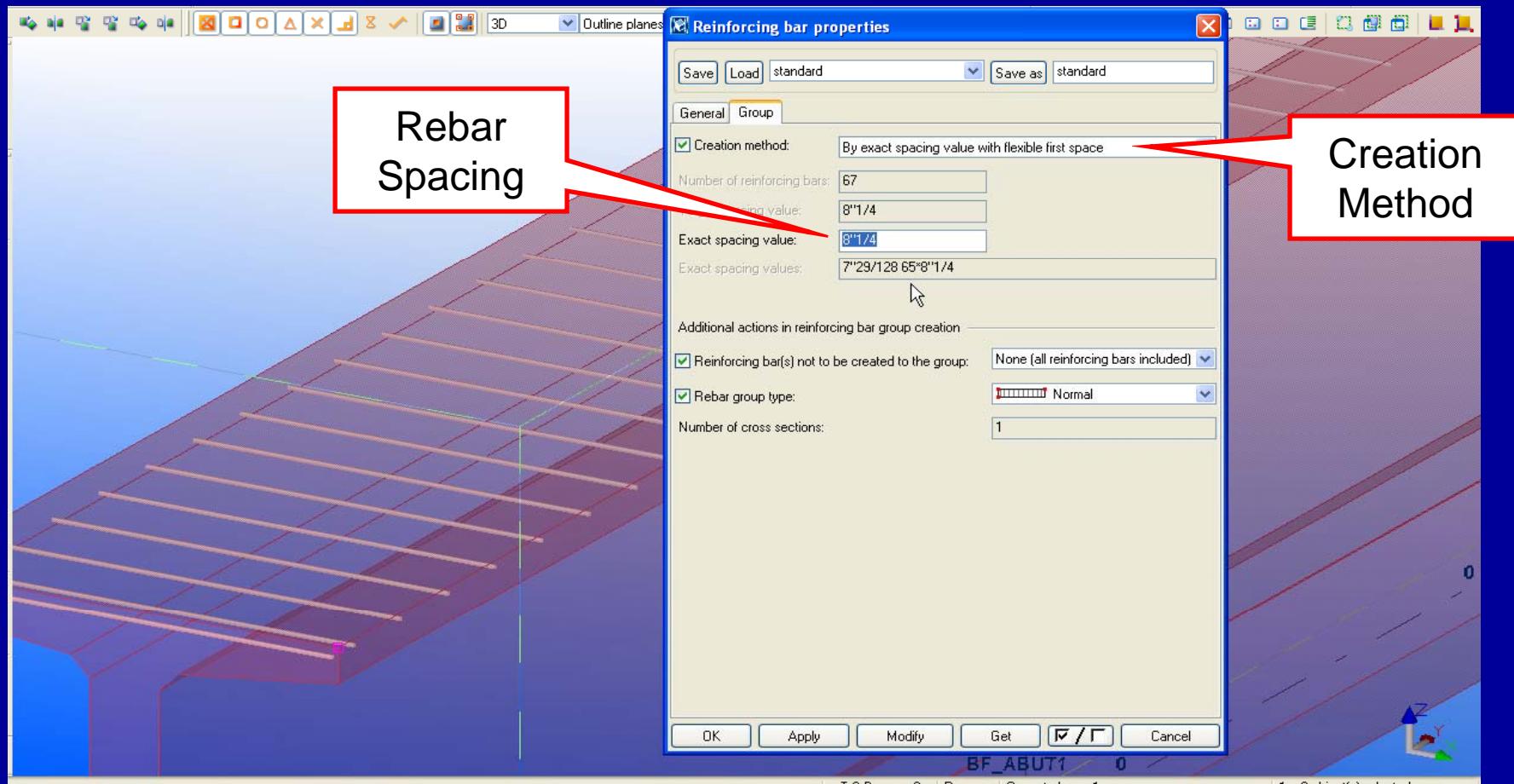
Reinforcement and Properties Adjustment



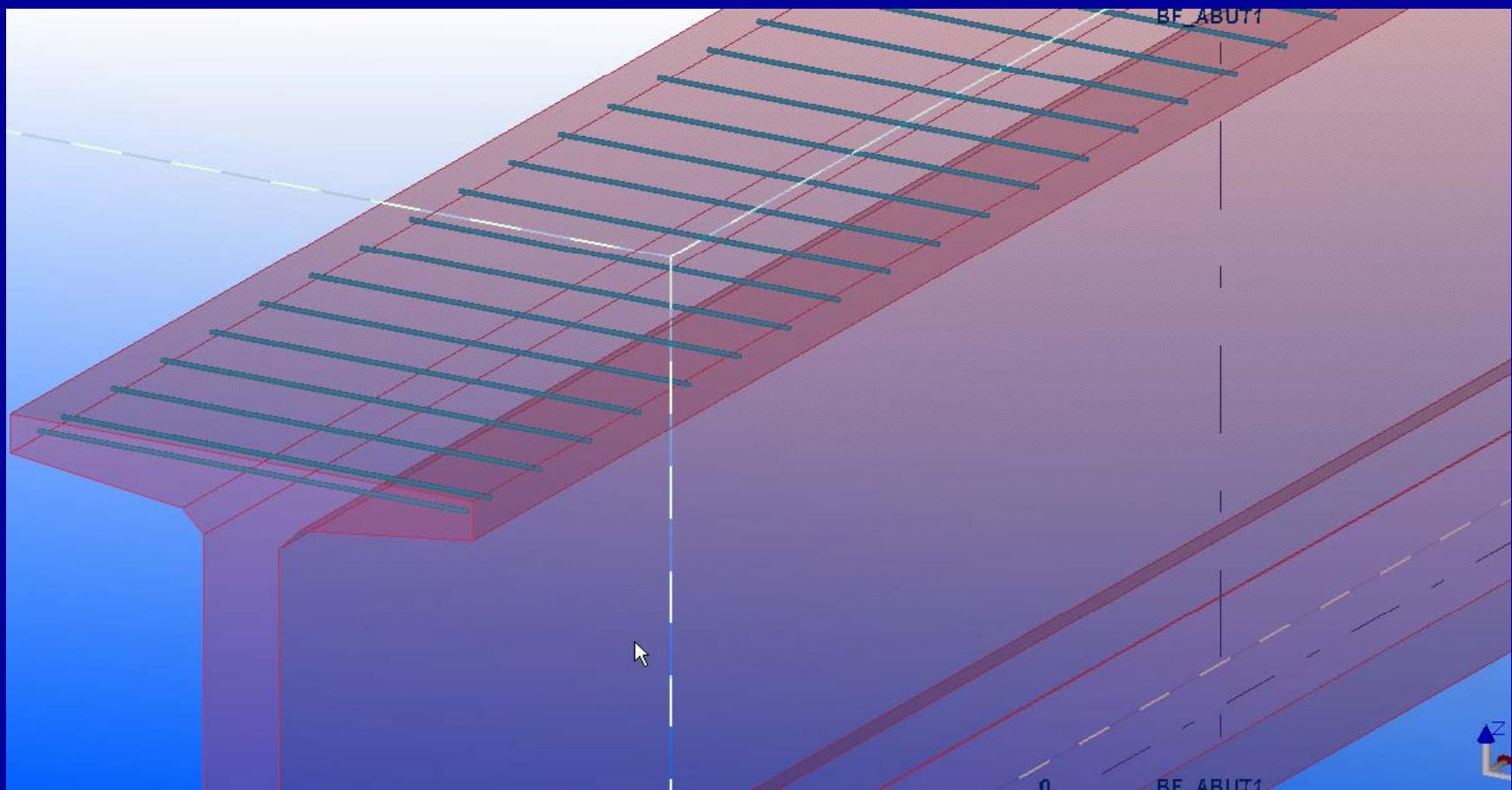
The procedure of reinforcement modeling....



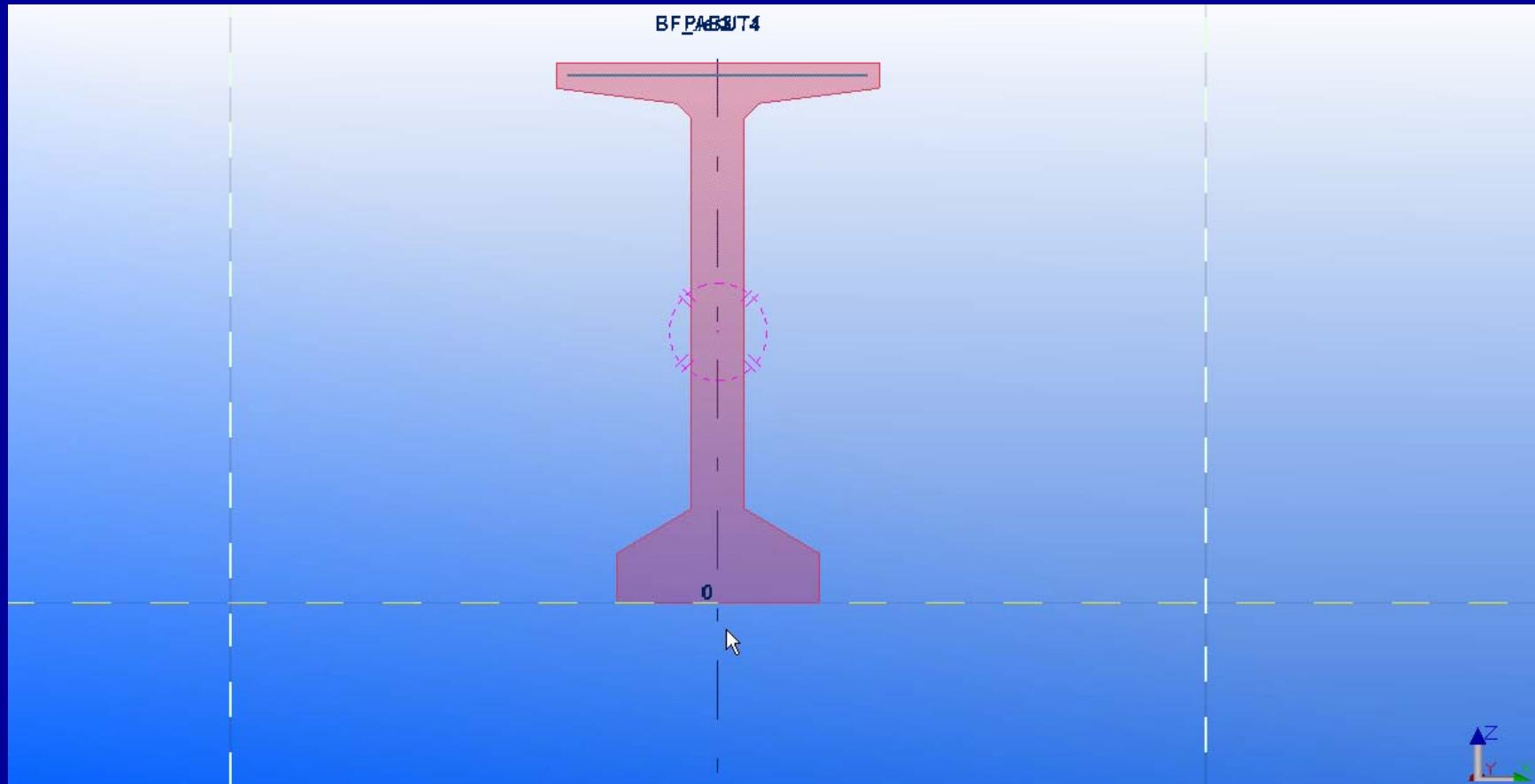
Rebar Group Definition



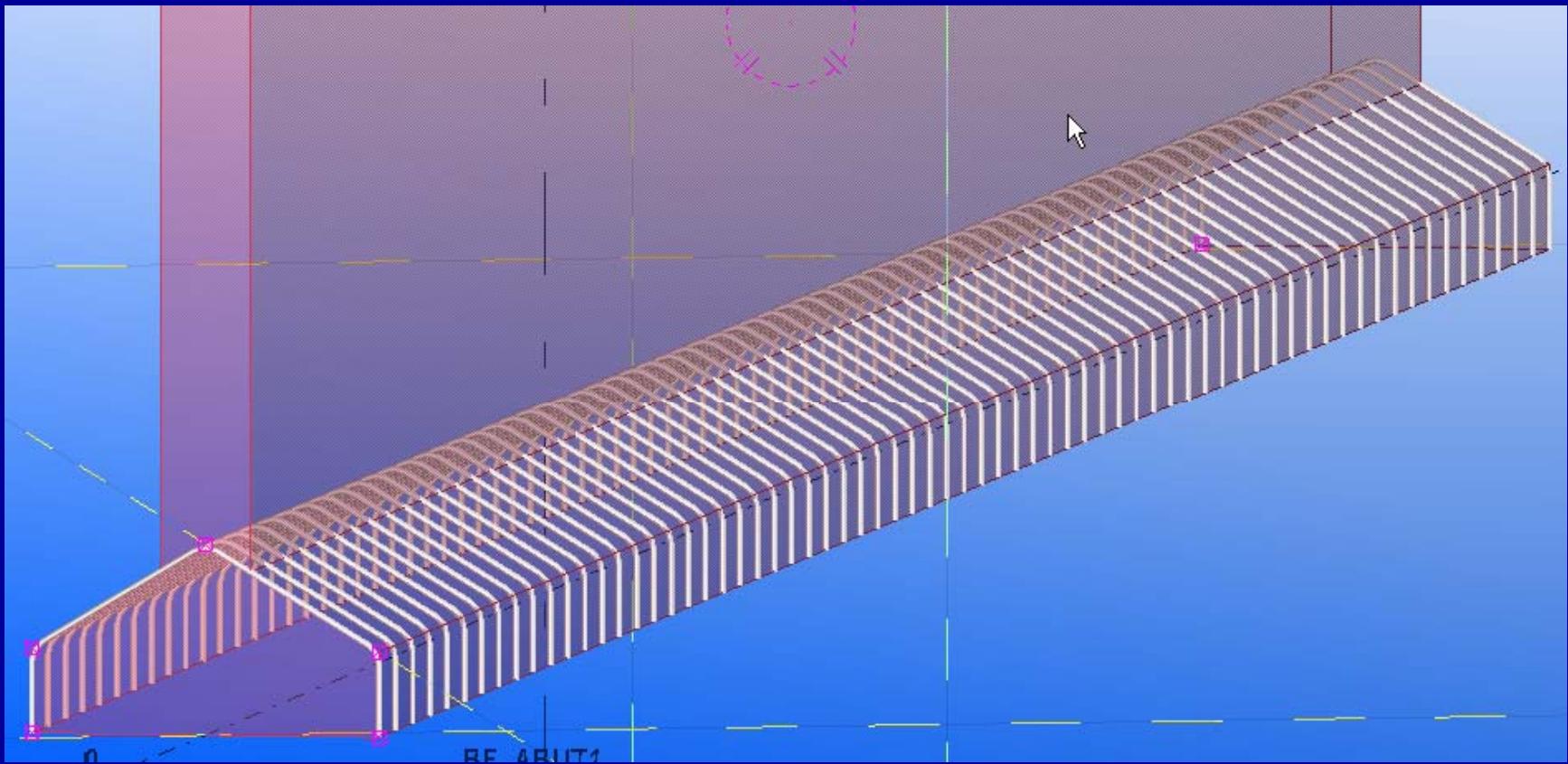
Reinforcement Output



Section View of a Girder in Tekla

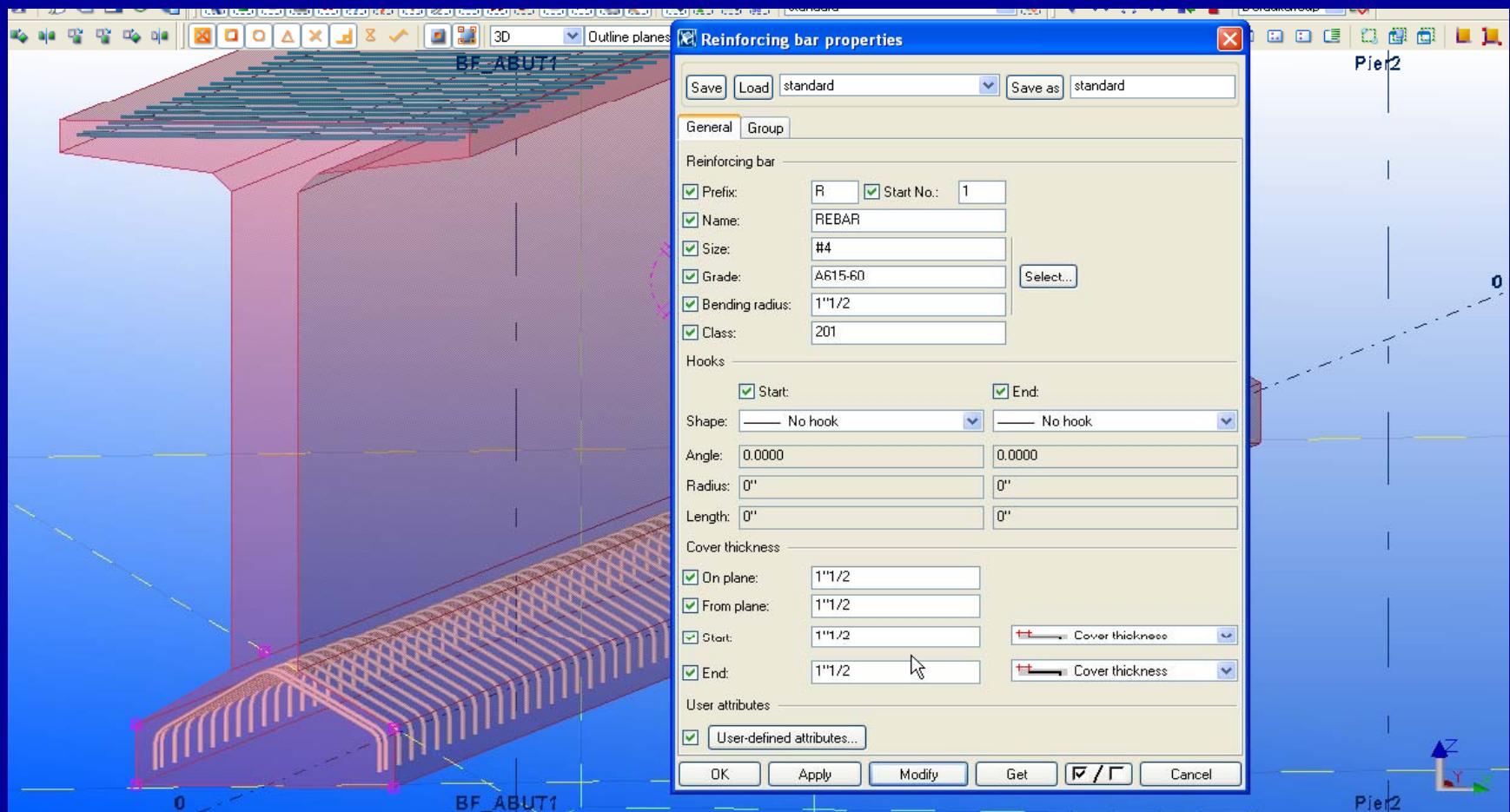


Rebar Group Creation (before adjustment)

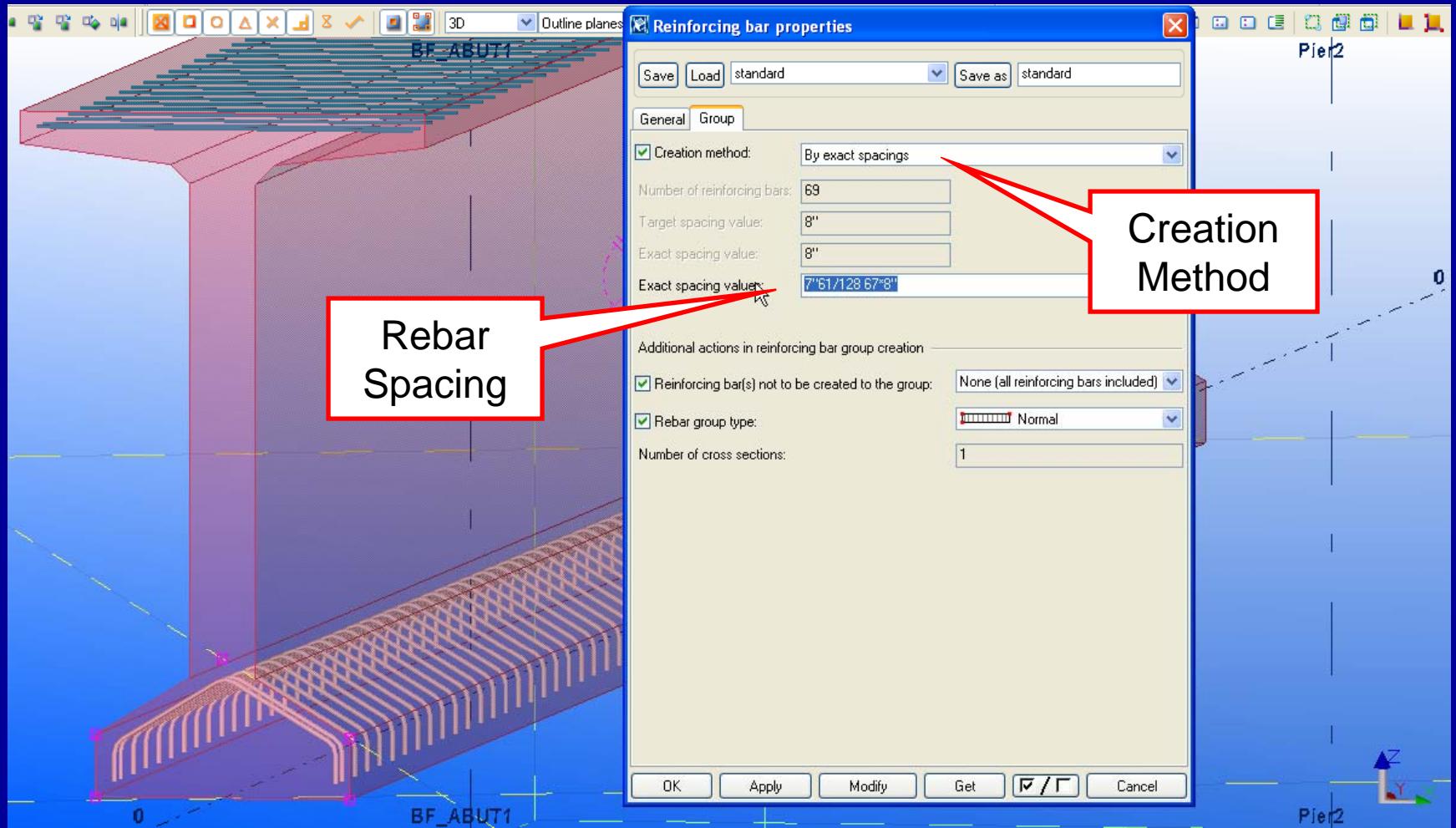


Stirrup reinforcement modeling....

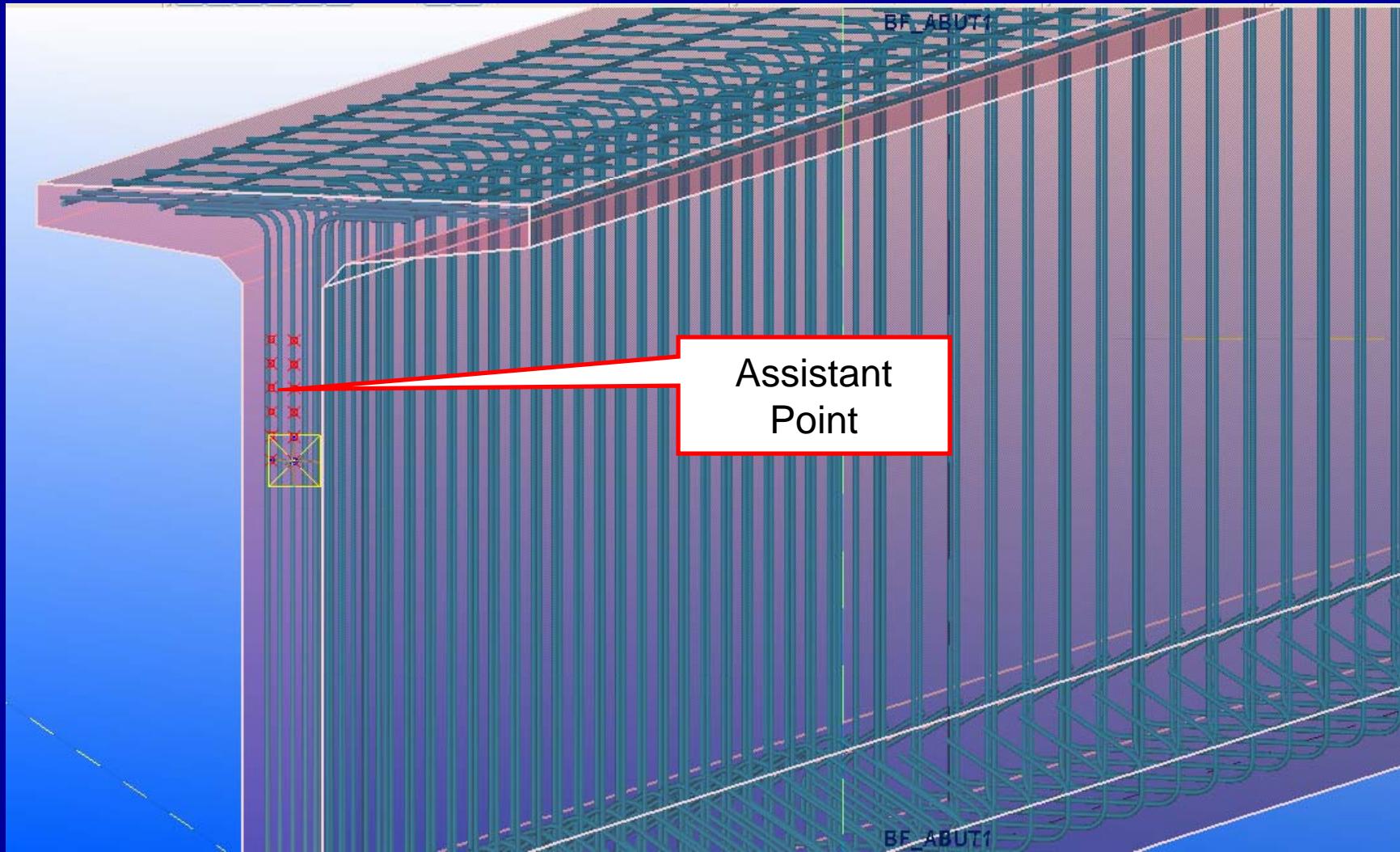
Properties and Positions Adjustment



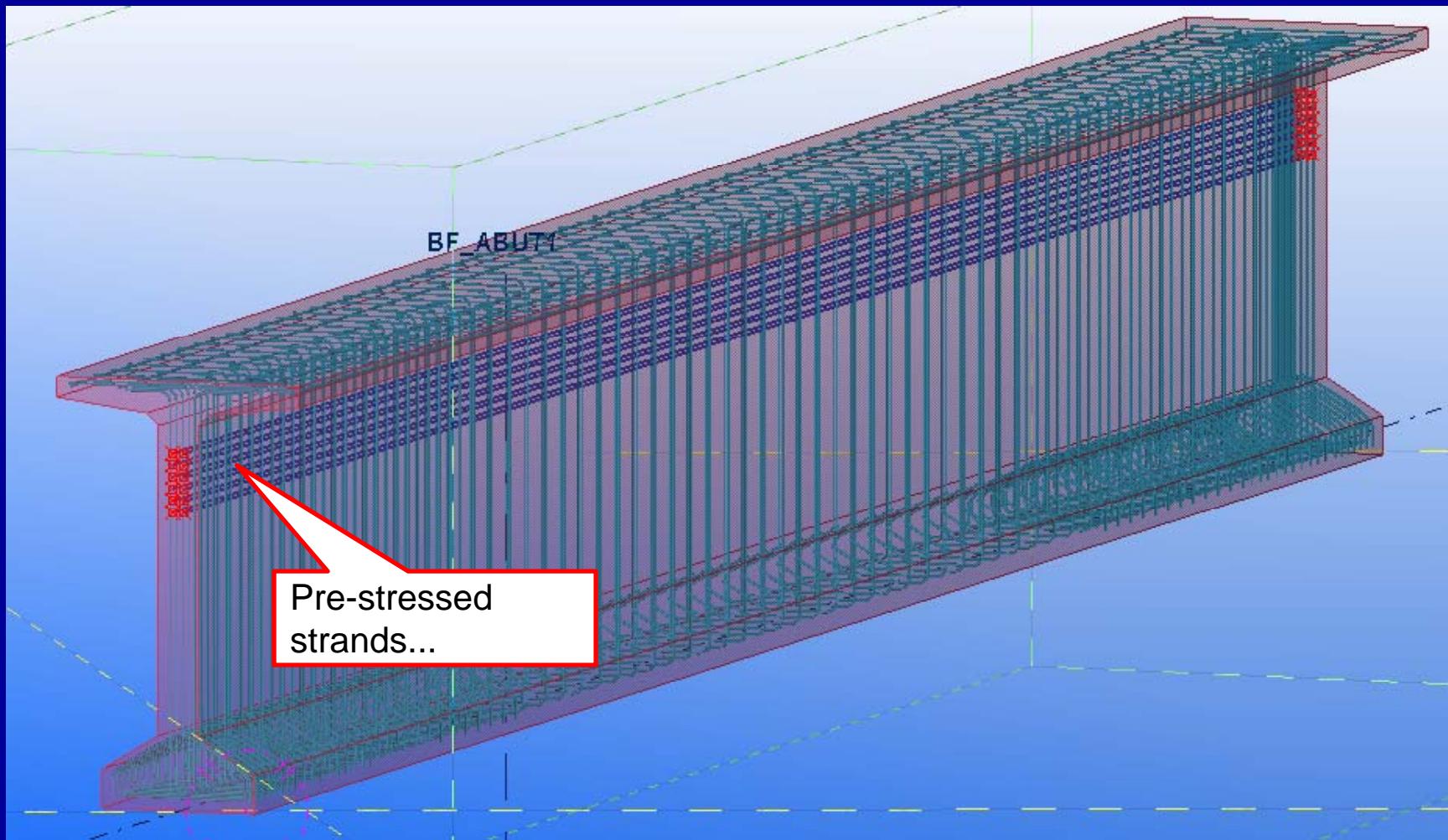
Rebar Group Definition



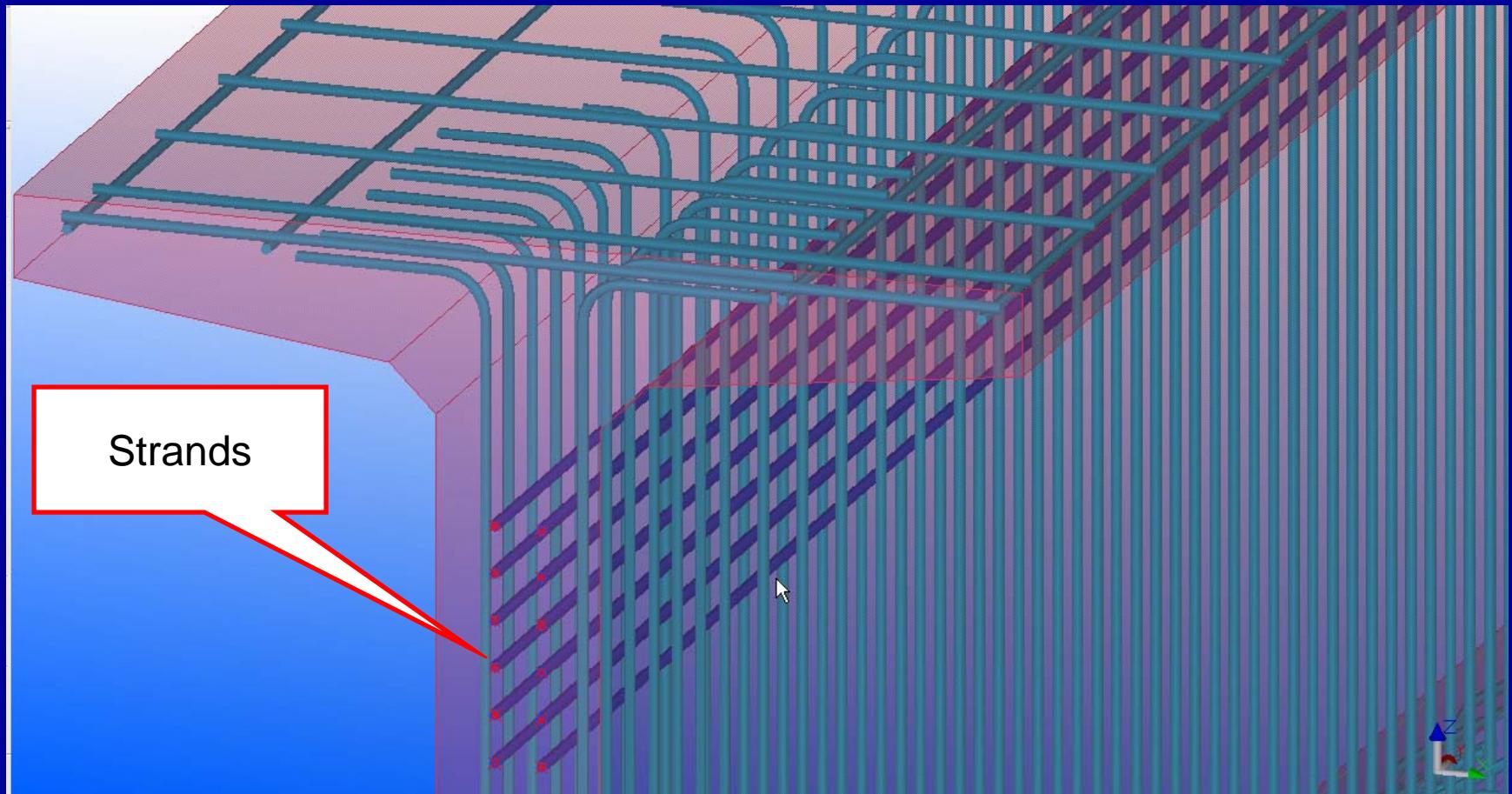
Strand End Positions



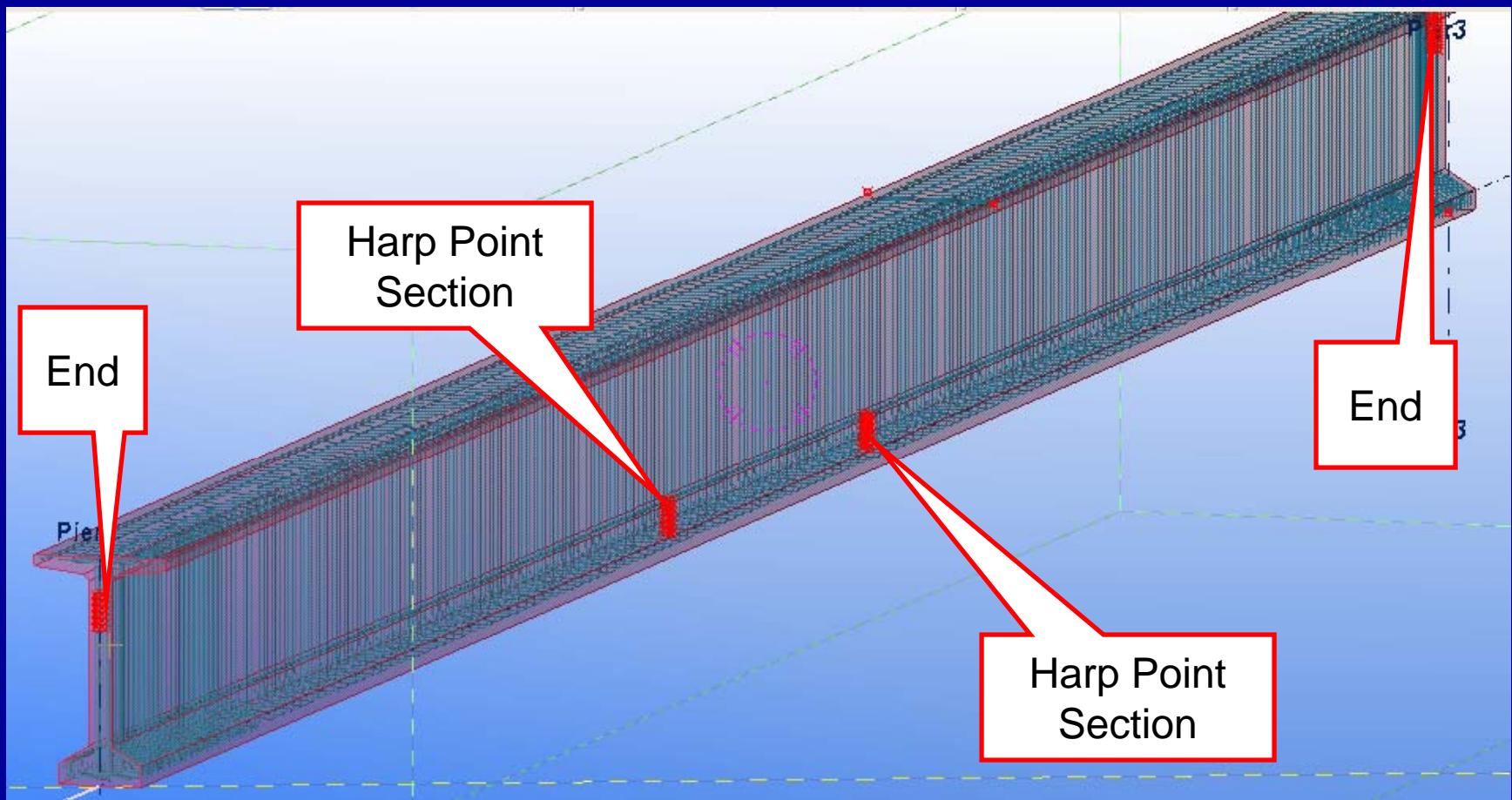
Pre-stressed Strands Generation



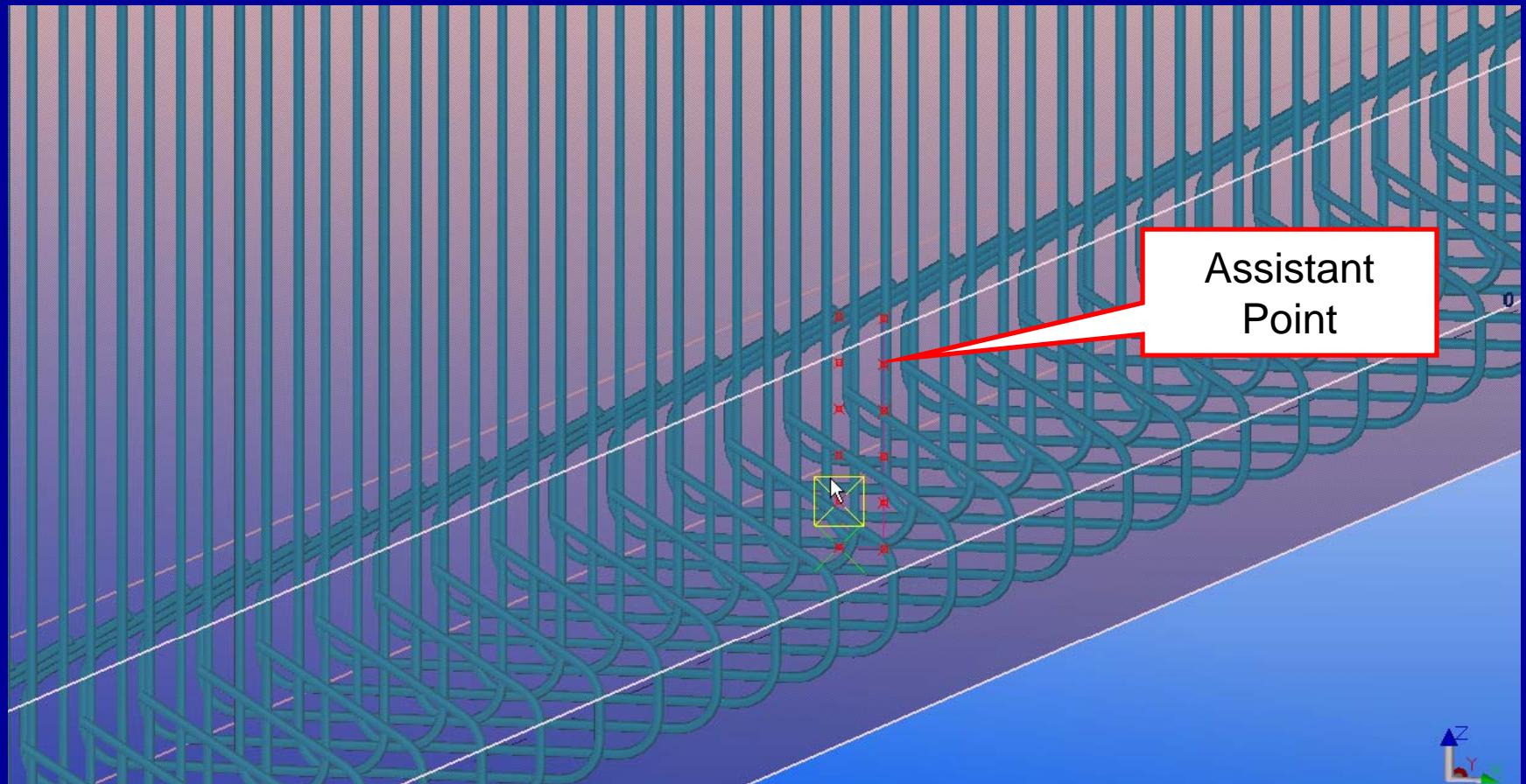
Pre-stressed Strands Generation



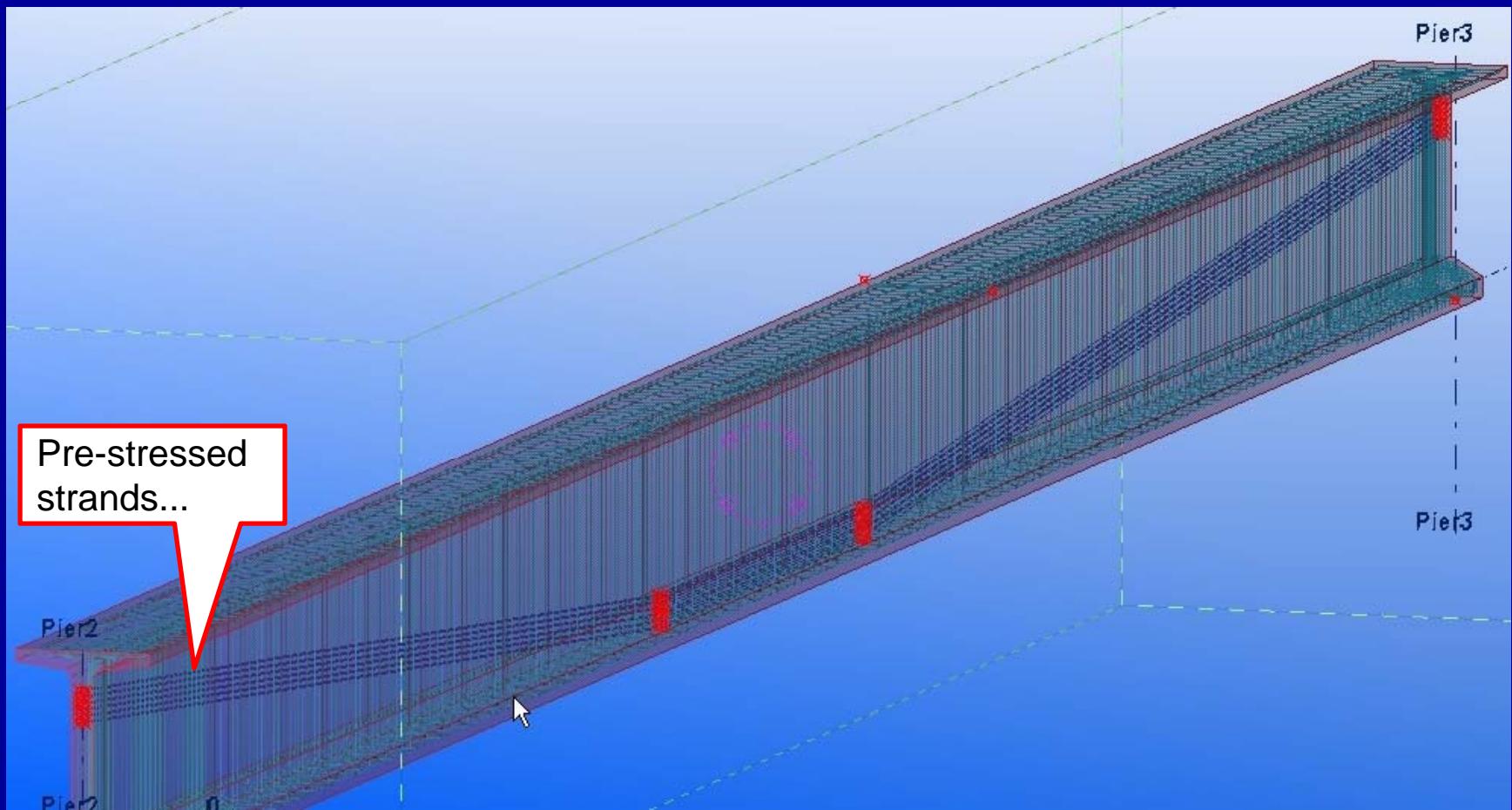
Strand Ends and Harp Point Sections



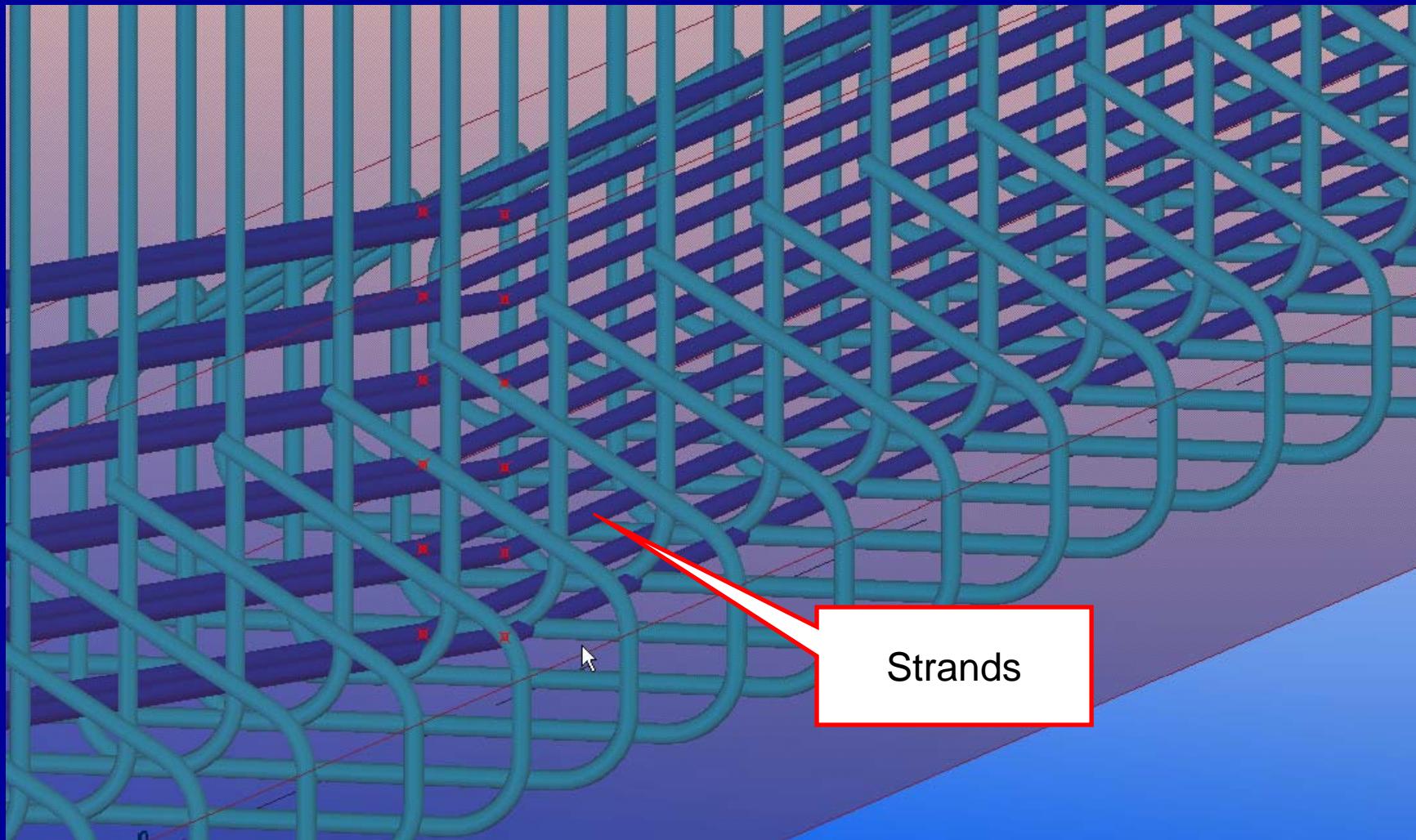
Harp Point Section



Pre-stressed Strands Generation (Harped Pattern)



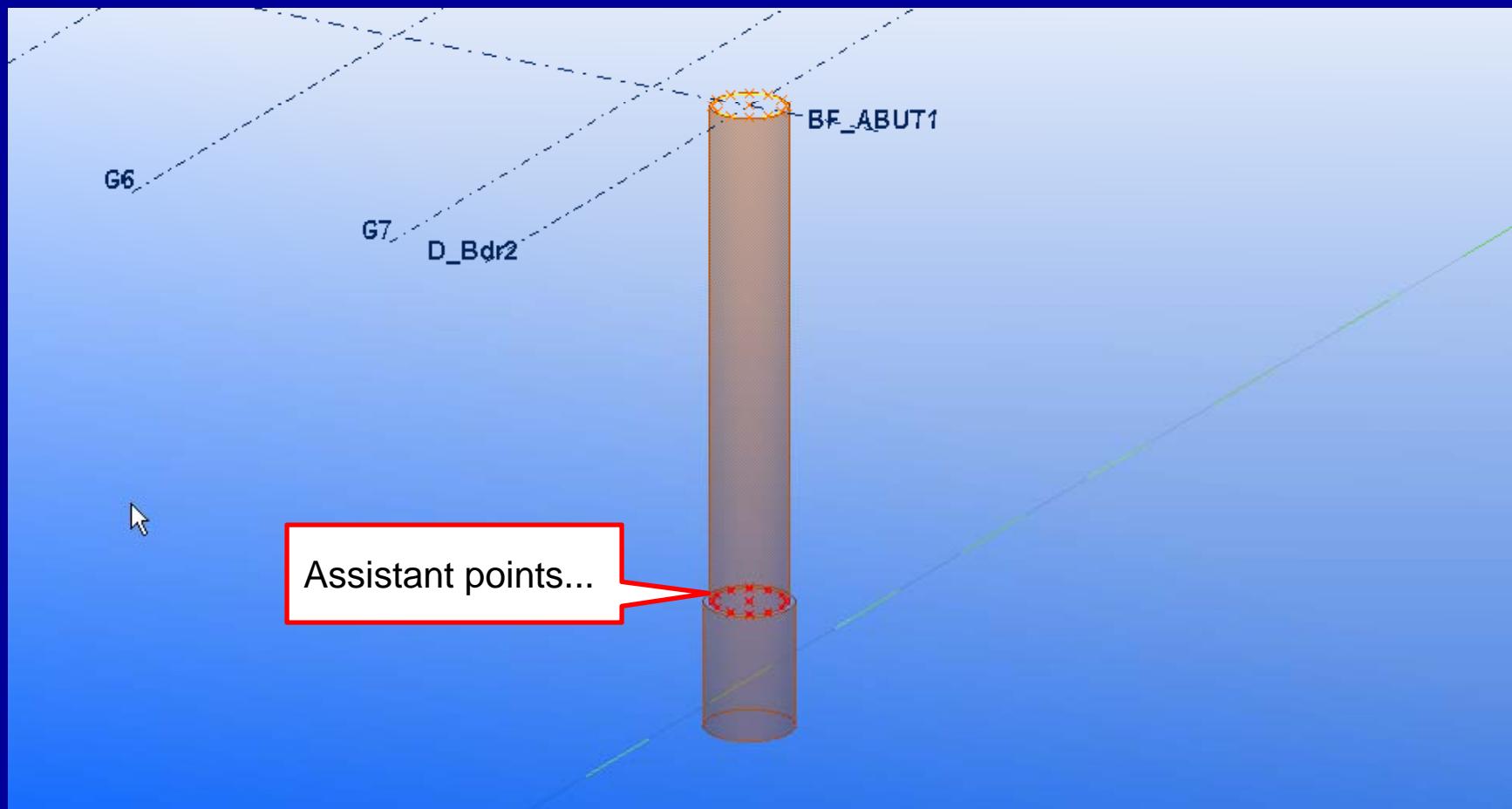
Harp View of Pre-stressed Strands



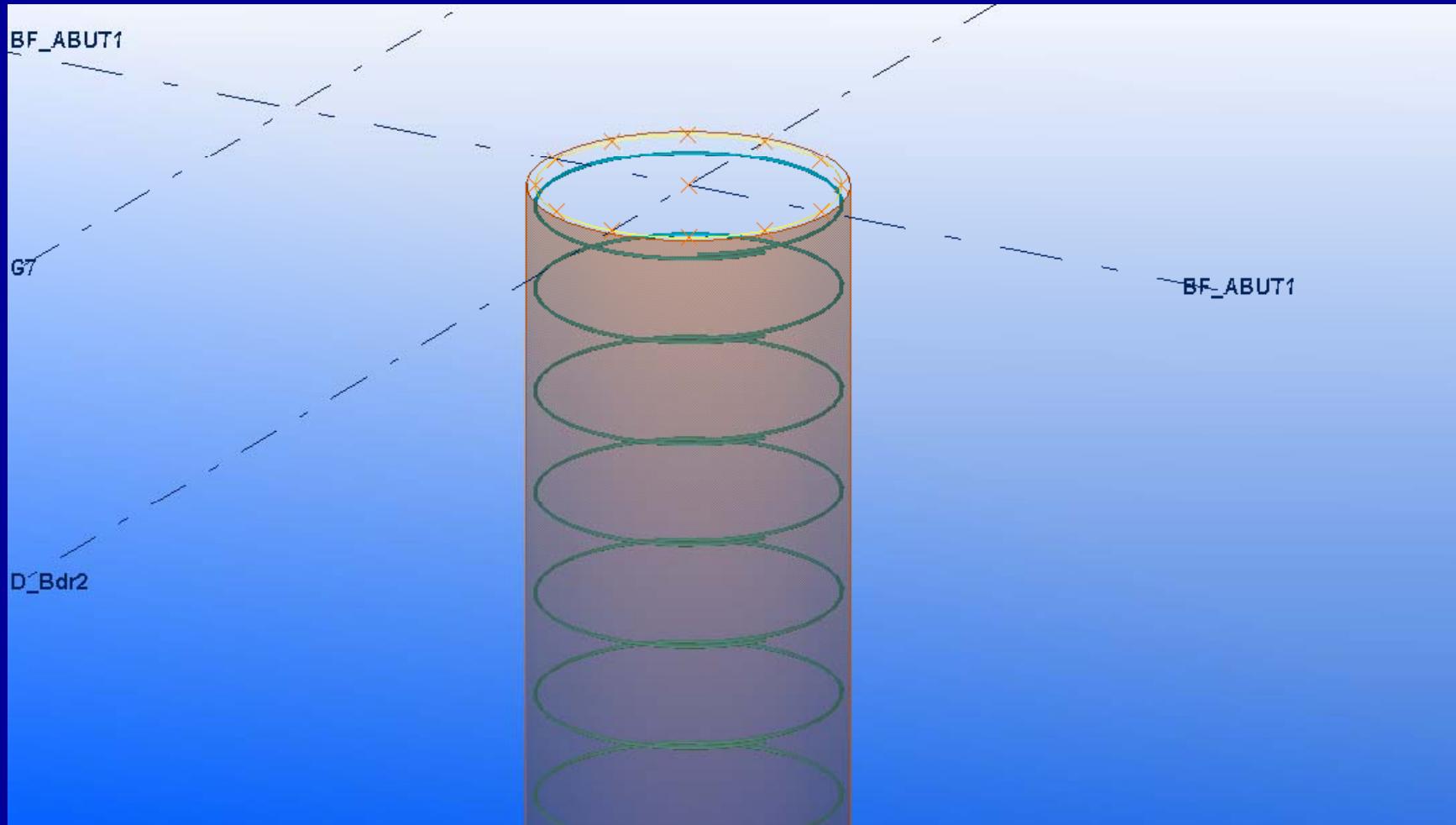
Pier Column Reinforcement Modeling



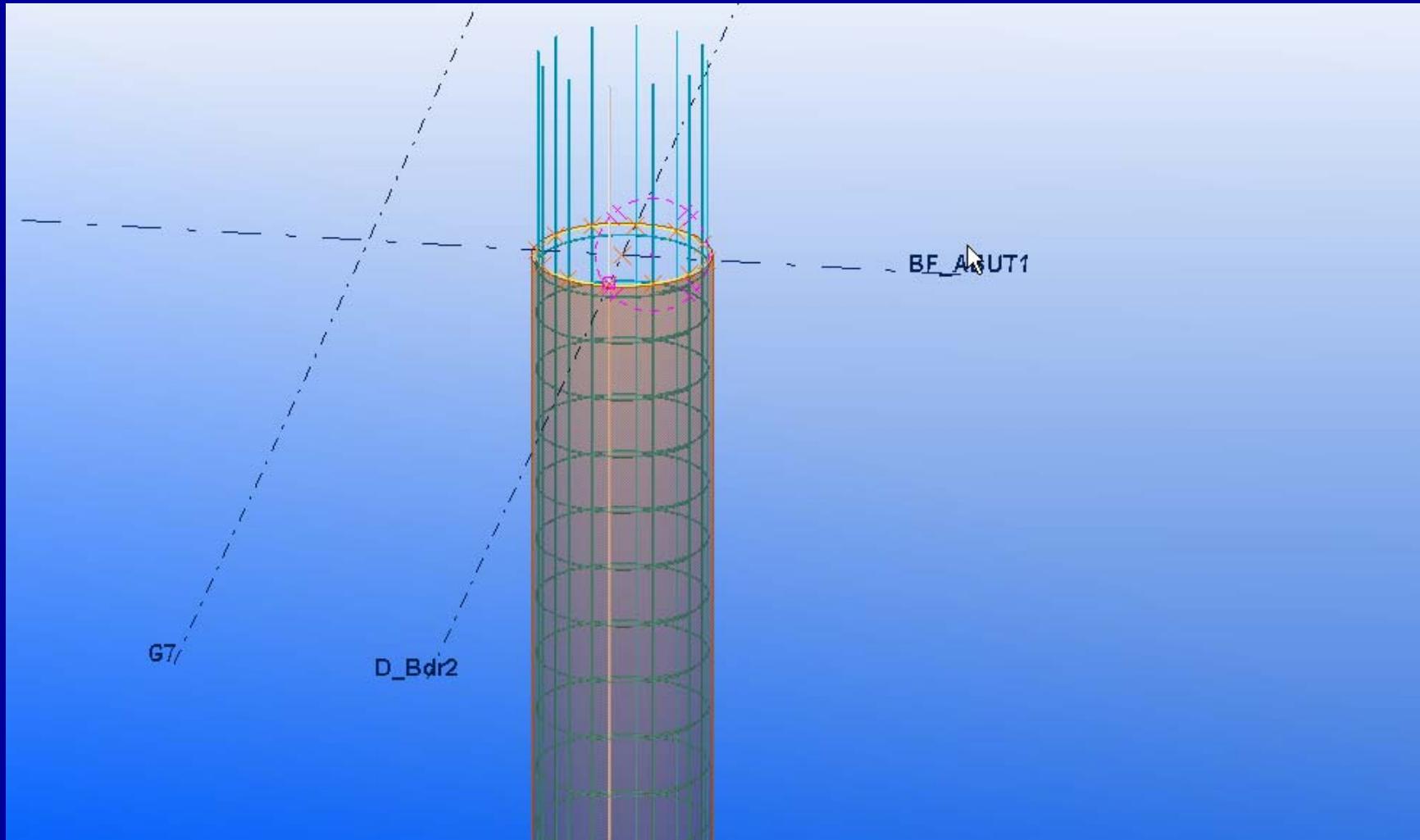
Pier Column Without Reinforcement



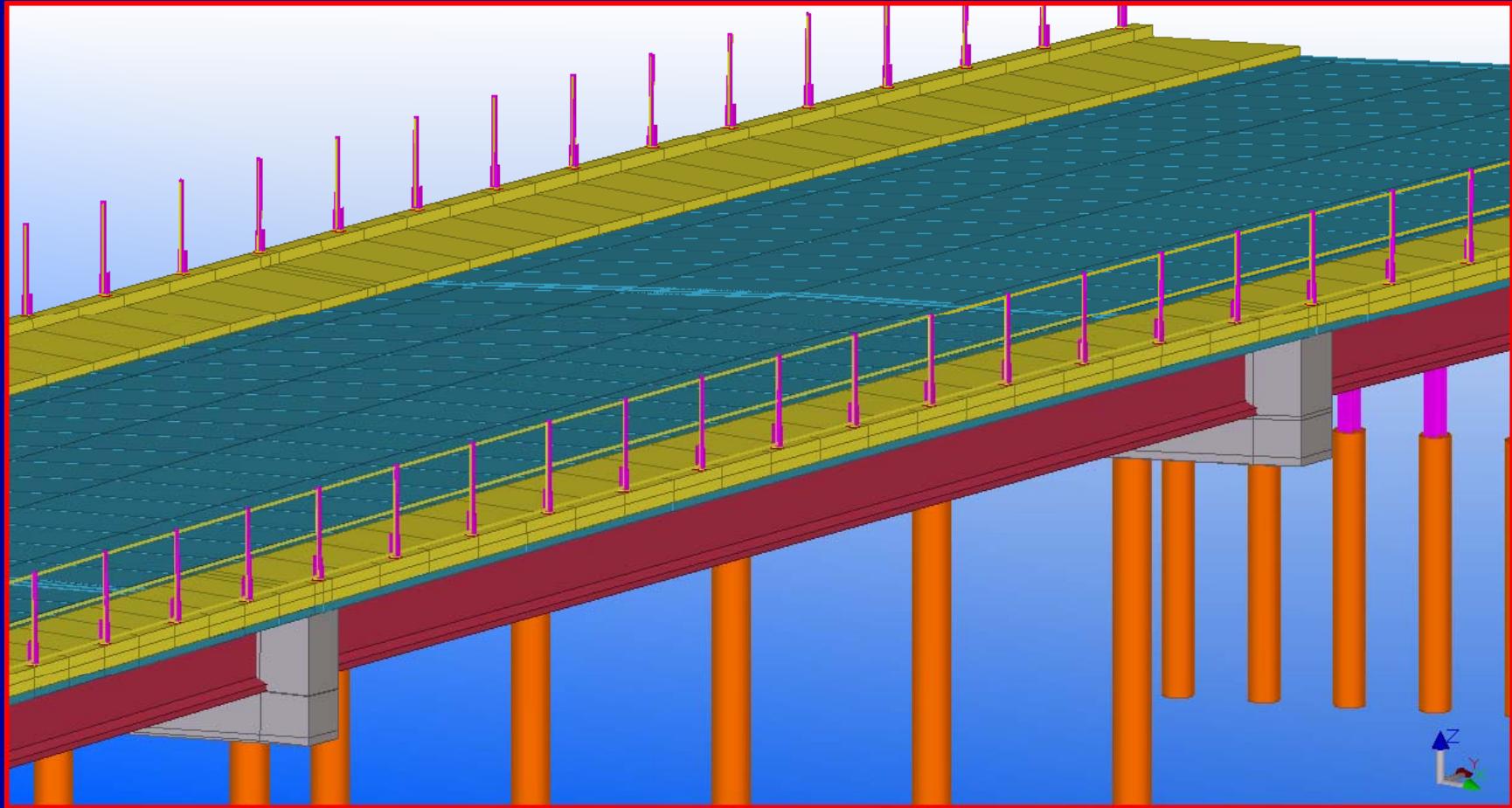
Stirrup Reinforcement Generation



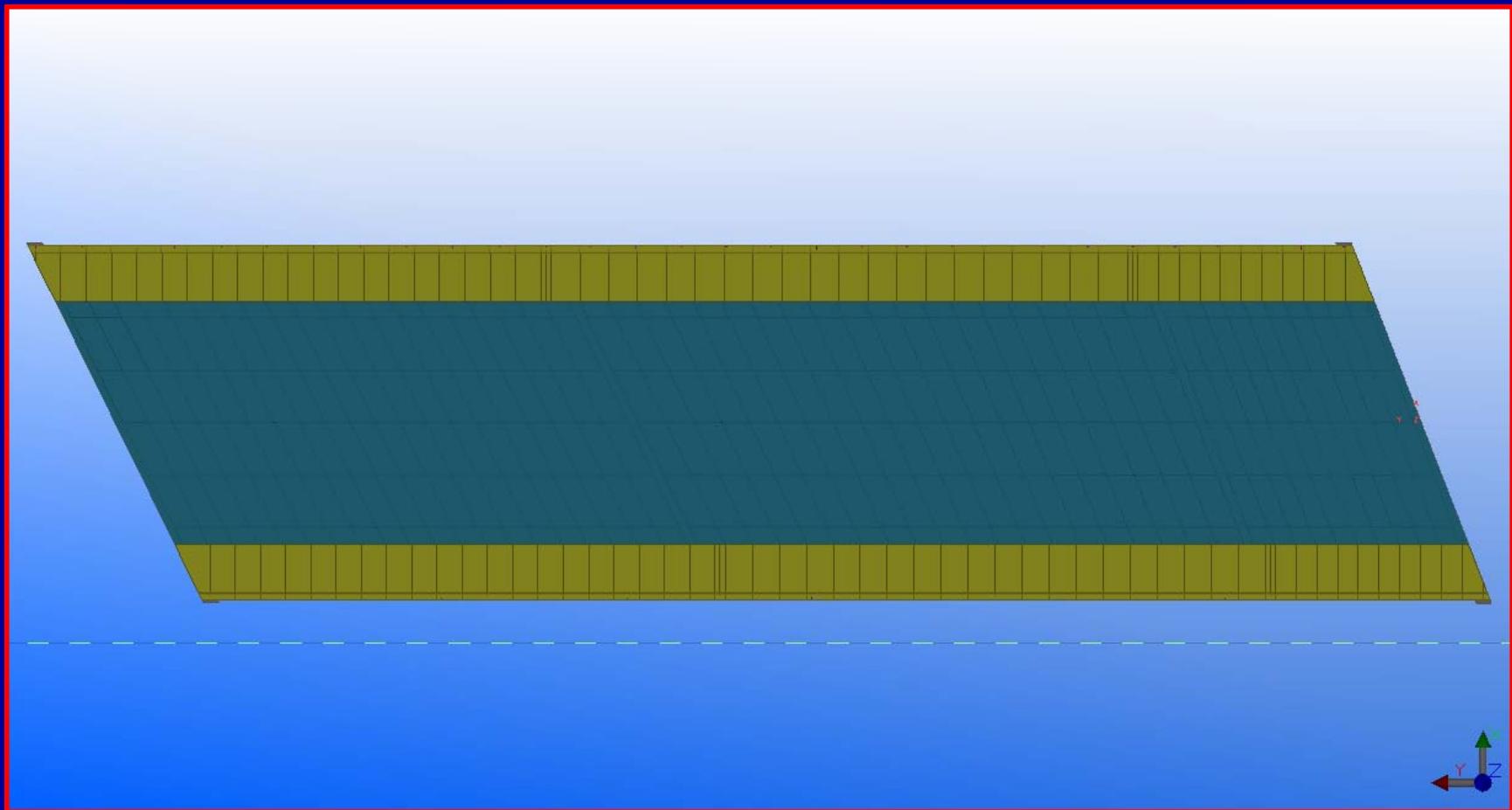
Pier Column Reinforcement Output



Bridge Model in Tekla



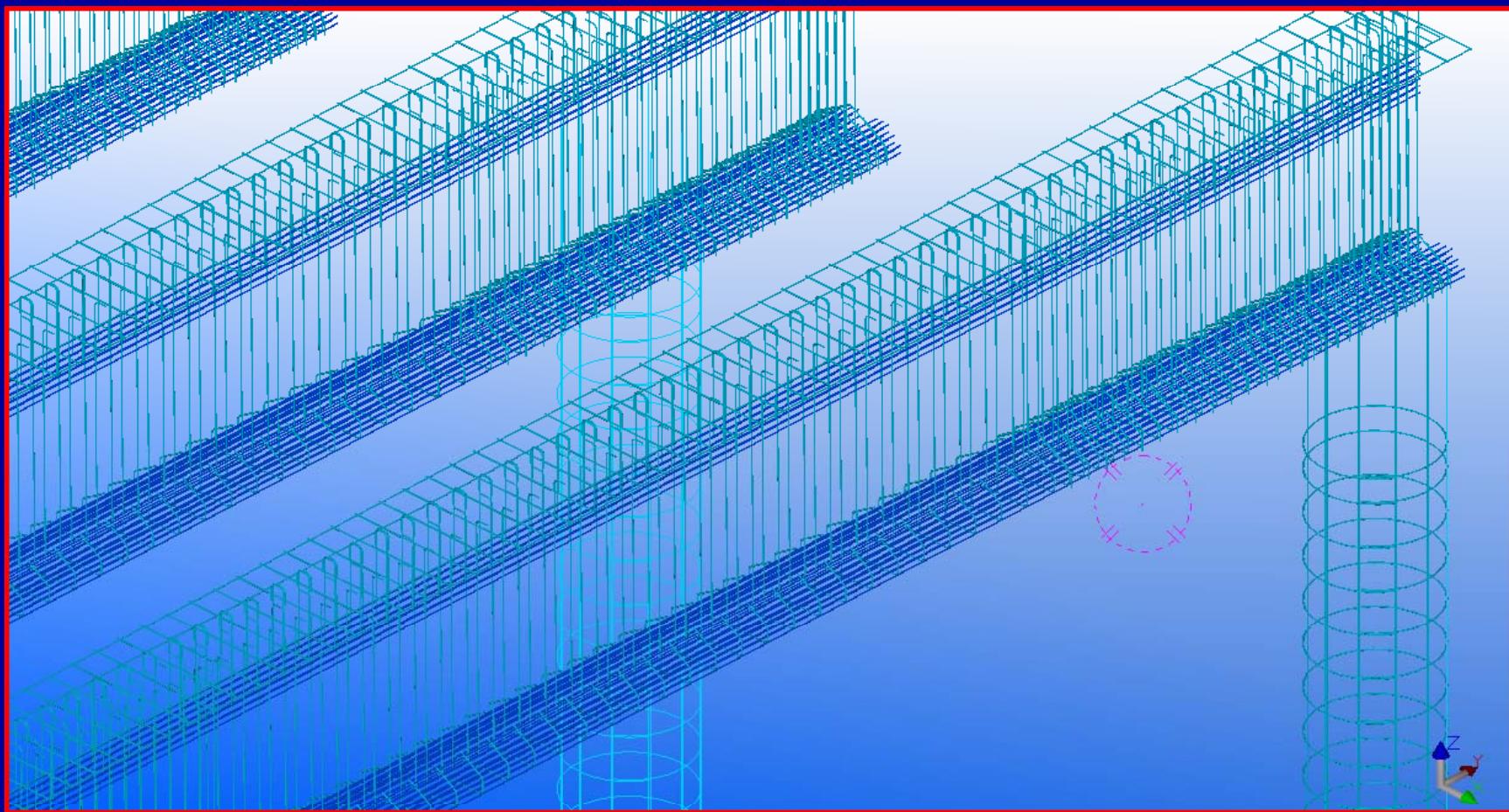
Bridge Model in Tekla



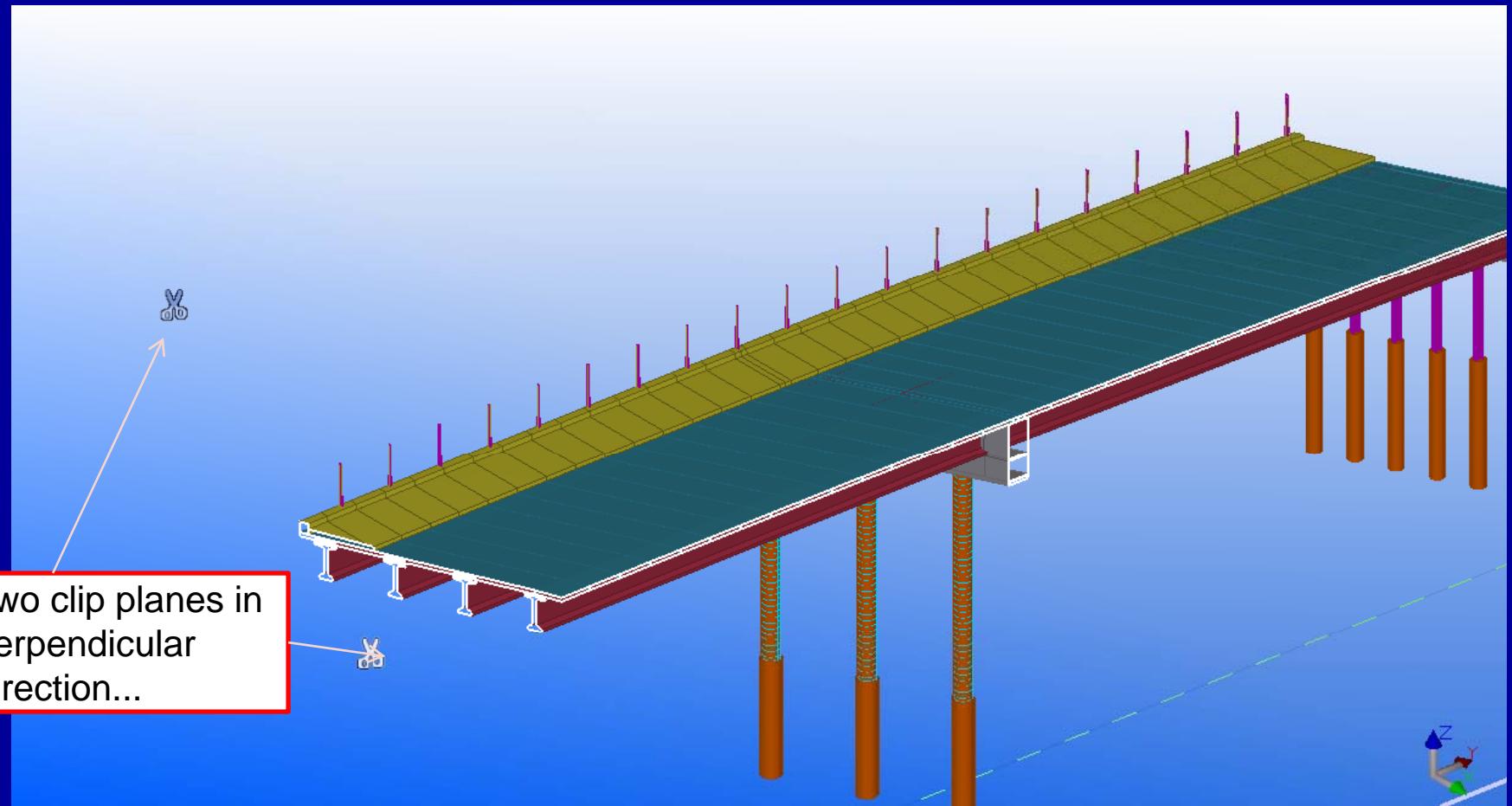
Plan View



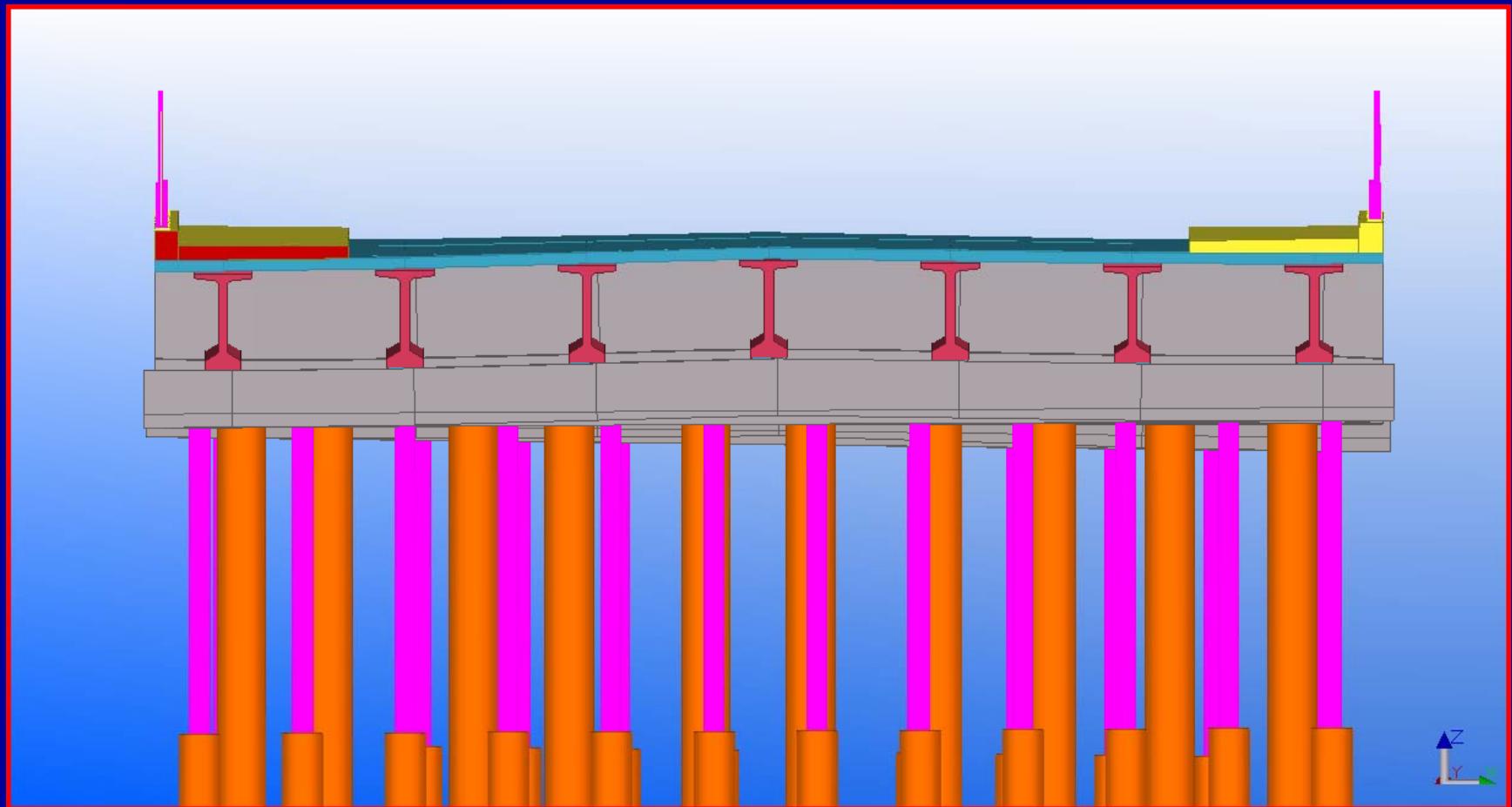
Bridge Model in Tekla Reinforcement



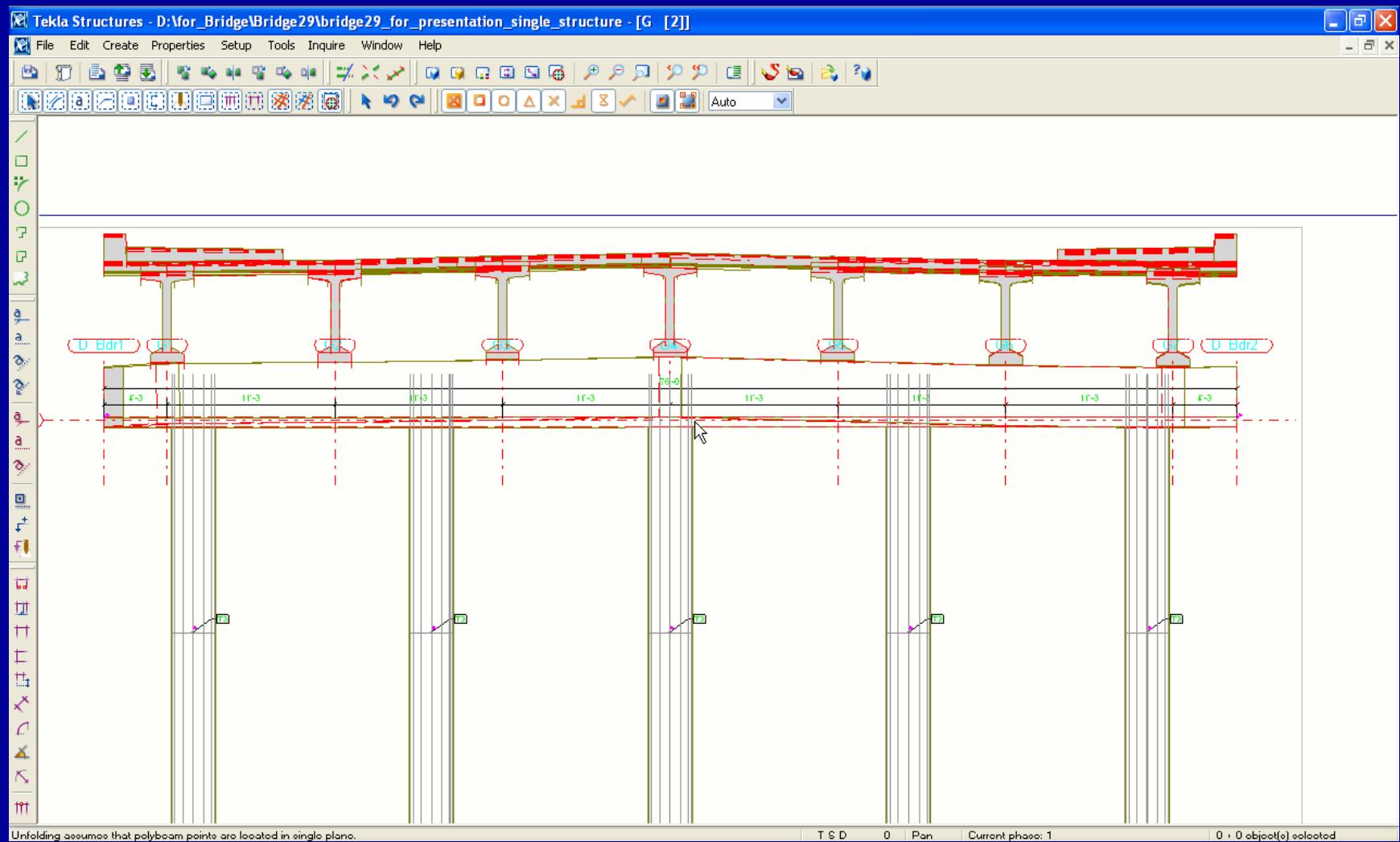
Bridge Model in Tekla Clip Plane Tool



Bridge Model in Tekla



Drawing from Tekla Model



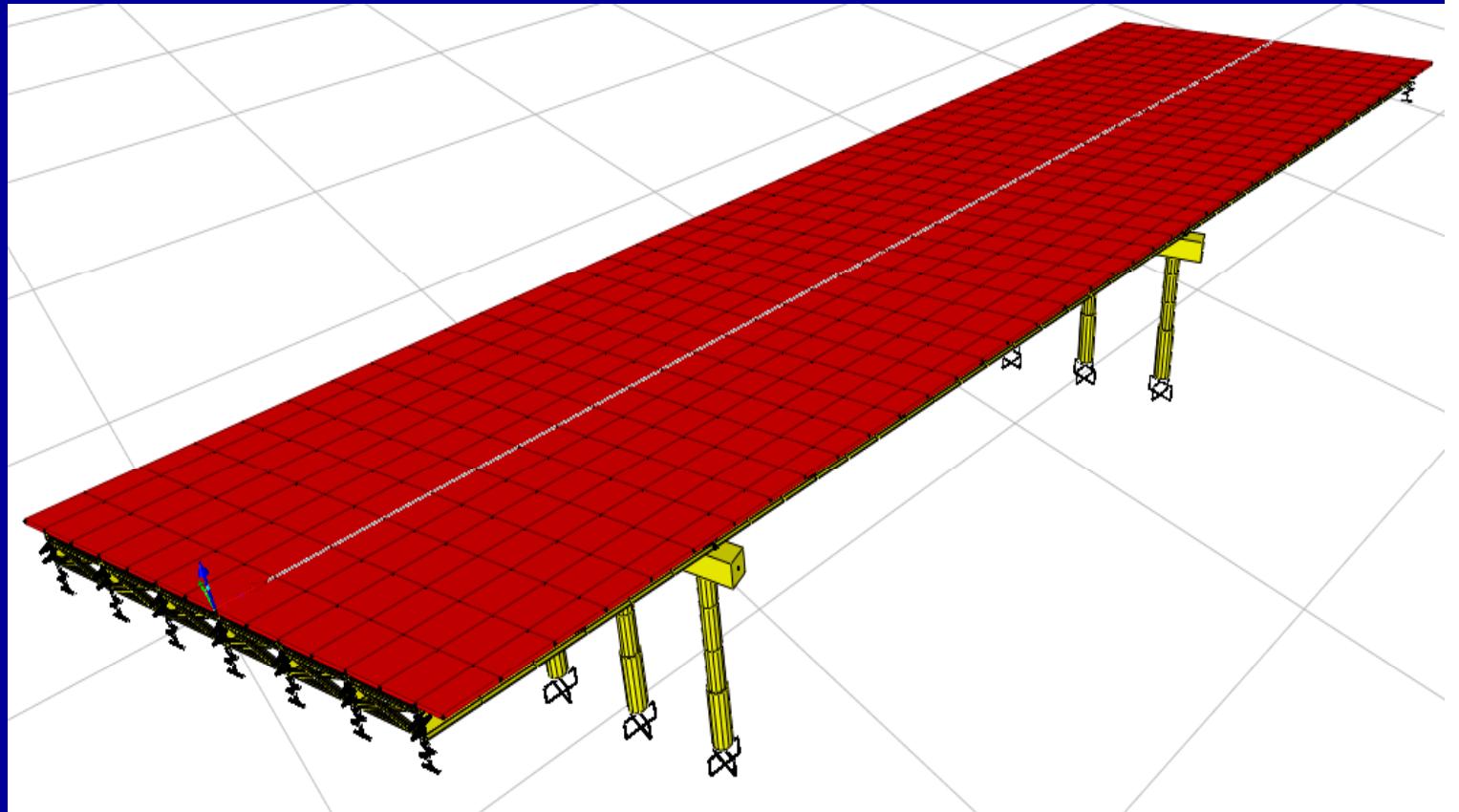
Steel Design Example

Virtual (pre)Assembly Aspects



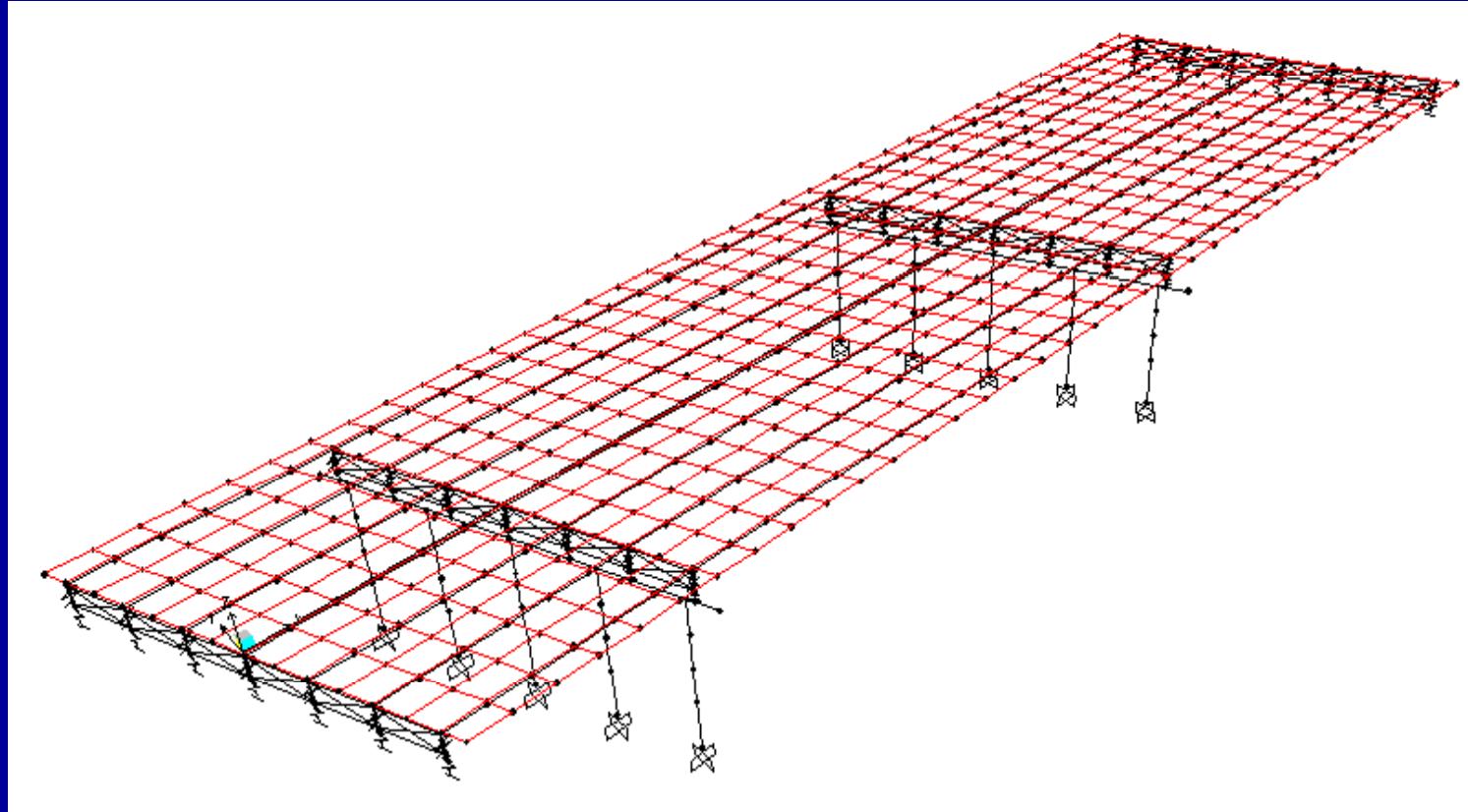
Virtual (pre)assembly Aspects

3D Model
of Quincy
Avenue
Bridge
(Extrude
View)



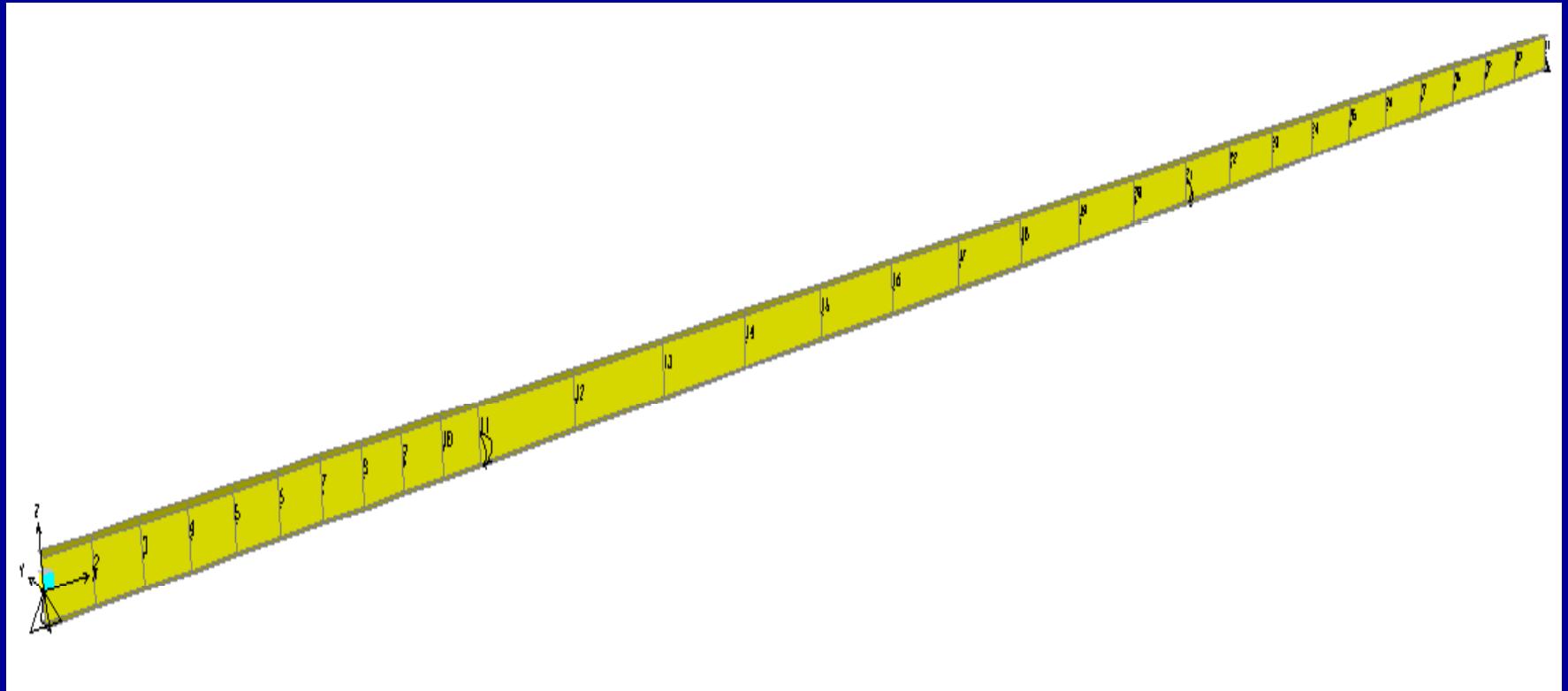
Virtual (pre)assembly Aspects

3D Model
of Quincy
Avenue
Bridge



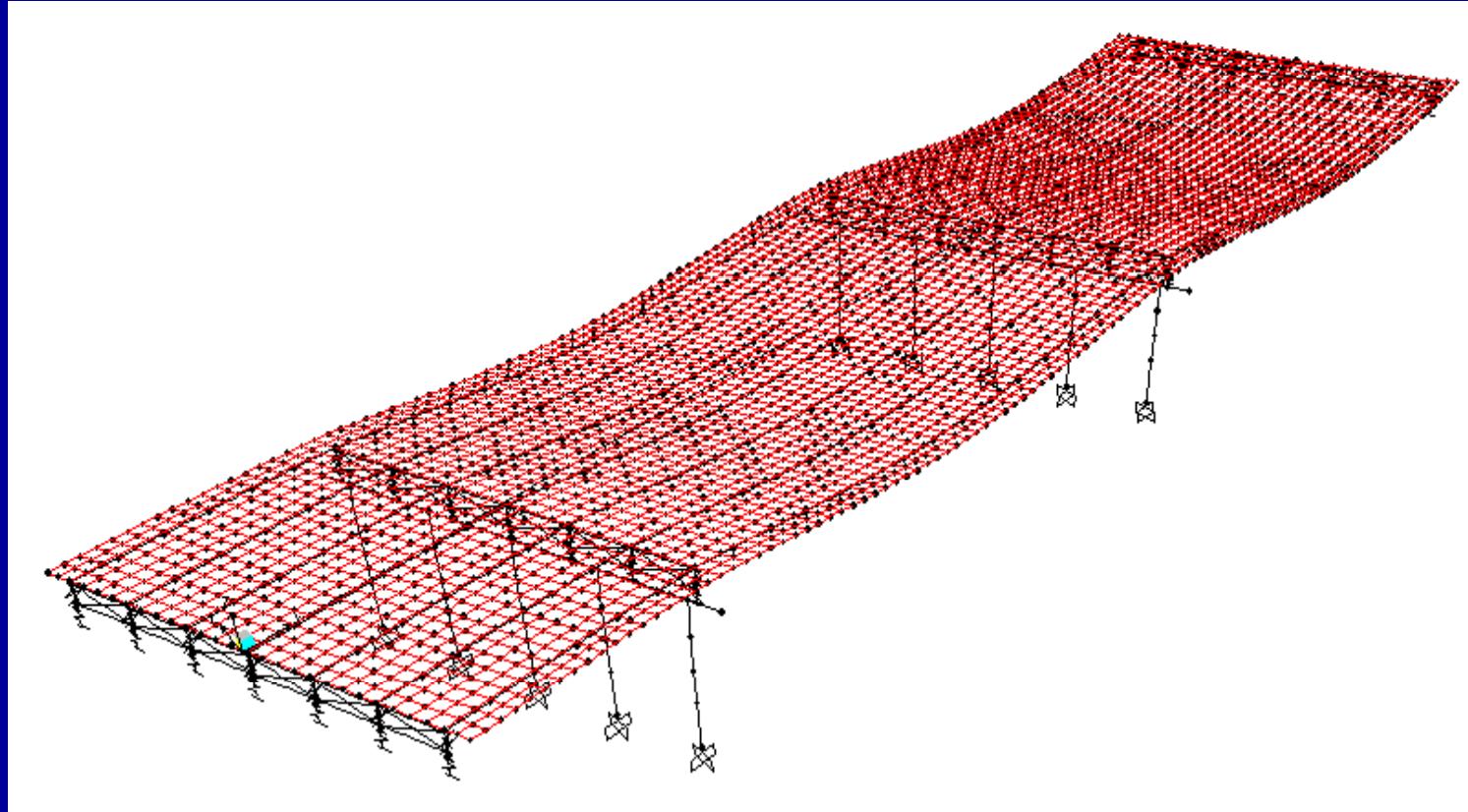
Virtual (pre)assembly Aspects

3D View of Exterior Girder



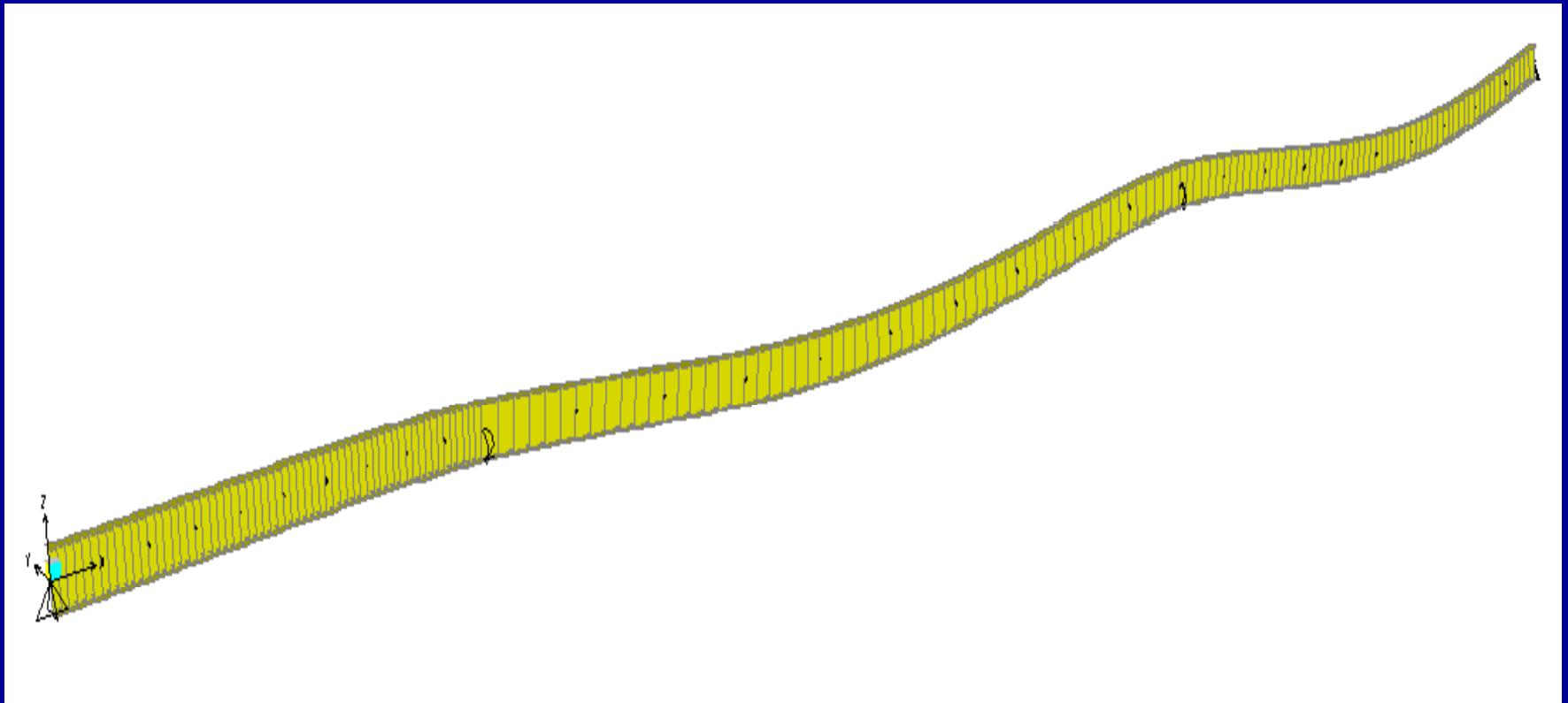
Virtual (pre)assembly Aspects

Deflection
of Girders
under Full
Dead Load
(→
camber
opposite)



Virtual (pre)assembly Aspects

Deflection of the Exterior Girder under Full Dead Load



Deflection
Values at
Tenth
Points
under Full
Dead Load

Joint Displacements

File View Format-Filter-Sort Select Options

Units: As Noted Joint Displacements

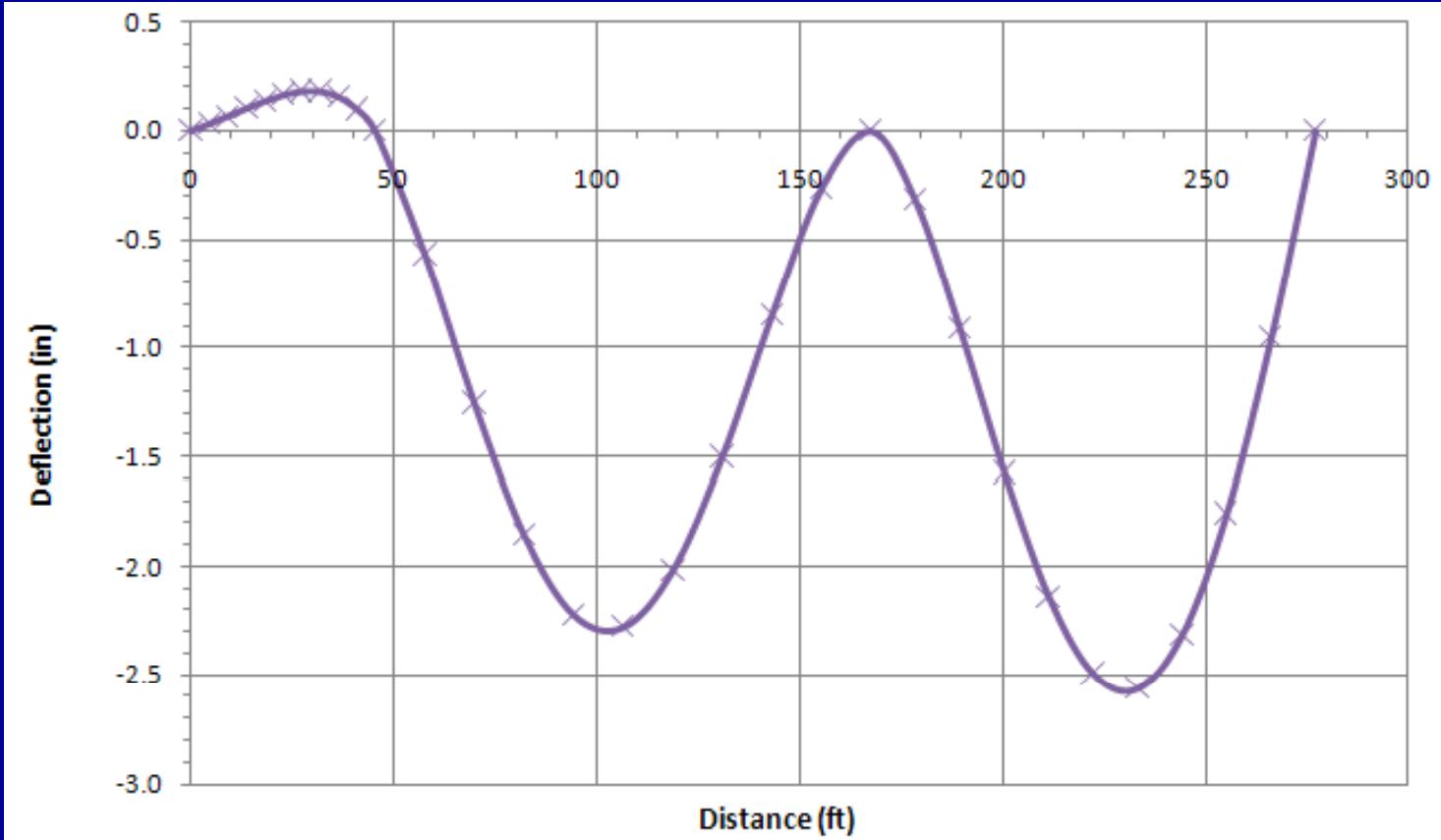
	Joint Text	OutputCase Text	CaseType Text	U1 in	U2 in	U3 in	R1 Radians	R2 Radians	R3 Radians
▶	1	DEAD	LinStatic	0	0	0	0	-.00061	0
	2	DEAD	LinStatic	0	0	.033124	0	-.000614	0
	3	DEAD	LinStatic	0	0	.06778	0	-.000611	0
	4	DEAD	LinStatic	0	0	.102915	0	-.000577	0
	5	DEAD	LinStatic	0	0	.136172	0	-.000487	0
	6	DEAD	LinStatic	0	0	.163892	0	-.000319	0
	7	DEAD	LinStatic	0	0	.181109	0	-.000048	0
	8	DEAD	LinStatic	0	0	.181554	0	.00035	0
	9	DEAD	LinStatic	0	0	.157653	0	.000899	0
	10	DEAD	LinStatic	0	0	.100529	0	.001622	0
	11	DEAD	LinStatic	0	0	0	0	.002544	0
	12	DEAD	LinStatic	0	0	-.566315	0	.004314	0
	13	DEAD	LinStatic	0	0	-1.254009	0	.004415	0
	14	DEAD	LinStatic	0	0	-1.852402	0	.003307	0
	15	DEAD	LinStatic	0	0	-2.218225	0	.001451	0
	16	DEAD	LinStatic	0	0	-2.27562	0	-.000693	0
	17	DEAD	LinStatic	0	0	-2.016142	0	-.002665	0
	18	DEAD	LinStatic	0	0	-1.498758	0	-.004004	0
	19	DEAD	LinStatic	0	0	-.849844	0	-.004249	0
	20	DEAD	LinStatic	0	0	-.263191	0	-.00294	0
	21	DEAD	LinStatic	0	0	0	0	.000383	0

Record: 1 of 31 Add Tables... Done



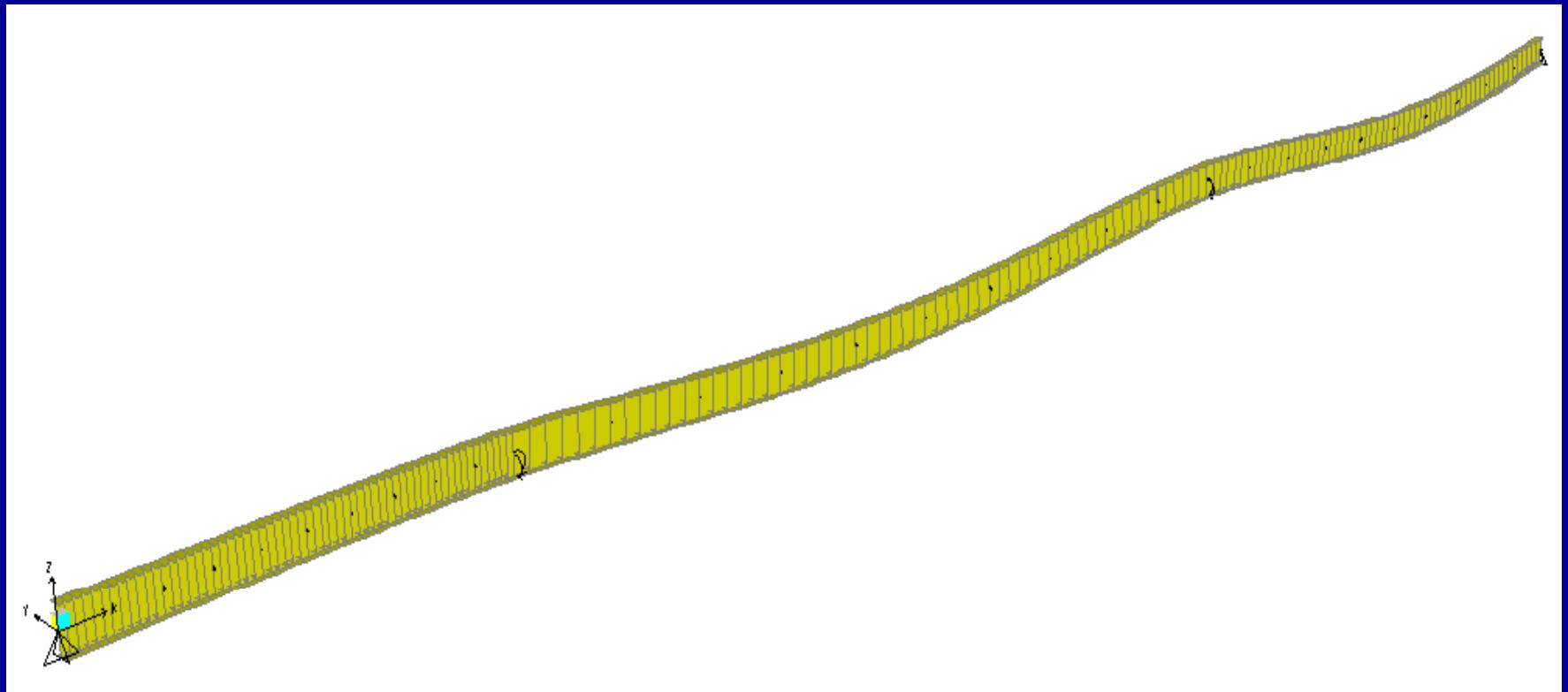
Virtual (pre)assembly Aspects

Deflection
Diagram
under Full
Dead Load



Virtual (pre)assembly Aspects

Deflection of Exterior Girder under Steel Portion of Dead Load



Virtual (pre)assembly Aspects

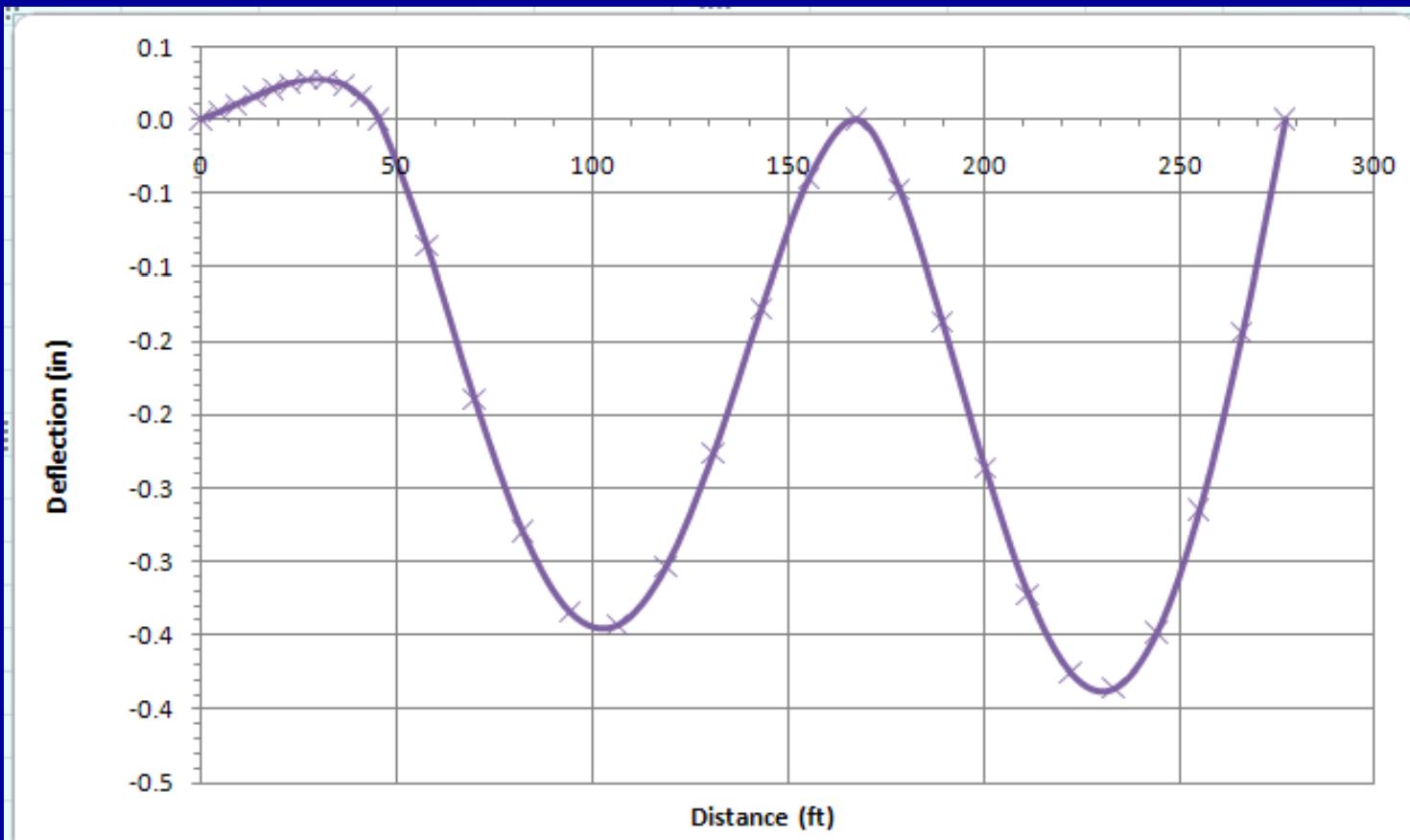
Deflection
Values at
Tenth
Points
under
Steel
Portion of
Dead Load

Joint Displacements											
File View Format-Filter-Sort Select Options											
Units: As Noted Joint Displacements											
Joint Text	OutputCase Text	CaseType Text		U1 in	U2 in	U3 in	R1 Radians	R2 Radians	R3 Radians		
► 1	DEAD	LinStatic		0	0	0	0	-.000092	0		
2	DEAD	LinStatic		0	0	.004995	0	-.000093	0		
3	DEAD	LinStatic		0	0	.01022	0	-.000092	0		
4	DEAD	LinStatic		0	0	.015518	0	-.000087	0		
5	DEAD	LinStatic		0	0	.020533	0	-.000074	0		
6	DEAD	LinStatic		0	0	.024713	0	-.000048	0		
7	DEAD	LinStatic		0	0	.027309	0	-.000007221	0		
8	DEAD	LinStatic		0	0	.027376	0	.000053	0		
9	DEAD	LinStatic		0	0	.023772	0	.000136	0		
10	DEAD	LinStatic		0	0	.015150	0	.000245	0		
11	DEAD	LinStatic		0	0	0	0	.000384	0		
12	DEAD	LinStatic		0	0	-.085392	0	.00065	0		
13	DEAD	LinStatic		0	0	-.189087	0	.000666	0		
14	DEAD	LinStatic		0	0	-.279316	0	.000499	0		
15	DEAD	LinStatic		0	0	-.334477	0	.000219	0		
16	DEAD	LinStatic		0	0	-.343131	0	-.000105	0		
17	DEAD	LinStatic		0	0	-.304005	0	-.000402	0		
18	DEAD	LinStatic		0	0	-.225991	0	-.000604	0		
19	DEAD	LinStatic		0	0	-.128144	0	-.000641	0		
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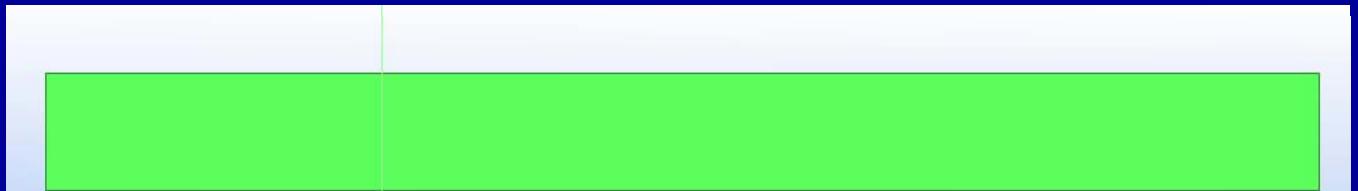
Virtual (pre)assembly Aspects

Deflection
Values at
Tenth
Points
under
Steel
Portion of
Dead Load



Distinct Geometries

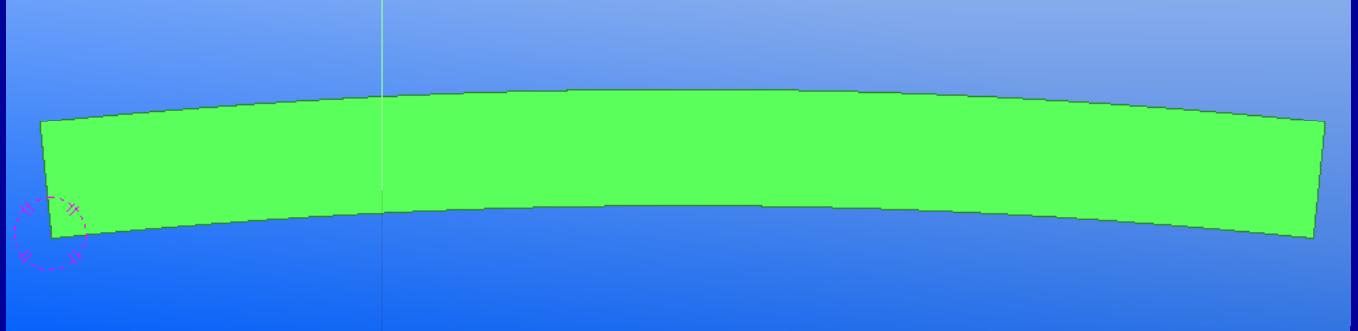
1. Under full dead load condition (complying with the highway geometry):



2. Under steel portion of dead load condition (resulting from having full-size holes line up):



3. Under no-load condition (e.g., to cut-camber the girder web):



One Way to Calculate and Transfer Cambering Information in BrIM System

- Step 1:
 - Calculate the deflections of girders and export the new coordinate data of each point of interest along the girders;
- Step 2:
 - Calculate the cambering geometries in different load conditions (full dead load, steel portion of dead load and no load) based on the deflection data (e.g., multiplied by -1) in linkage software between SAP2000 and Tekla Structures;

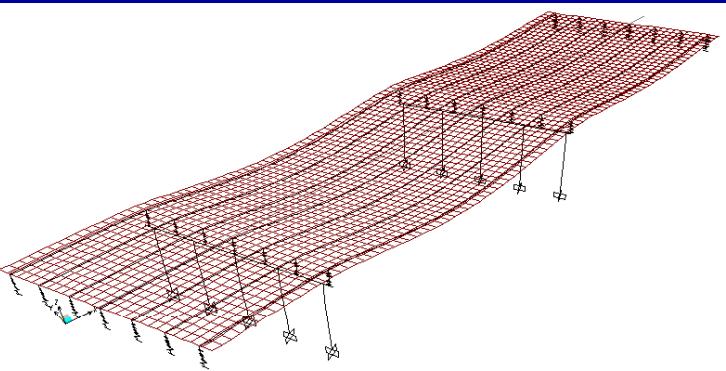


One Way to Calculate and Transfer Cambering Information in BrIM System

- Step 3:
 - Based on the cambering geometries, the Tekla models of steel girders for 3 distinct geometries can be automatically created by calling Tekla APIs in our linkage program;
- Step 4:
 - Do detailings in Tekla Structure: e.g., cutting girder web based on “no-load” geometry; installing bolted field splices based on the one with steel portion of dead load condition; the geometry with full load is the one to be transferred to downstream applications in workflow.

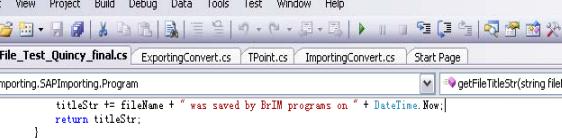


A Way to Calculate and Transfer Cambering Information in BrIM System (cont'd.)



Step 1: Calculate and export deflection data in SAP2000.

Transfer deflection data to linkage program (C# code)



The screenshot shows the Microsoft Visual Studio interface with the title bar "Importing.Beans - Microsoft Visual Studio". The menu bar includes File, Edit, View, Project, Build, Debug, Data, Tools, Test, Window, Help. Below the menu is a toolbar with various icons. The main window displays the code editor for the file "ExportingConvert.cs". The code contains several methods, including ones for generating titles based on file names and program controls, and another for active degrees of freedom. The code uses C# syntax with annotations like `///` and `/* */`.

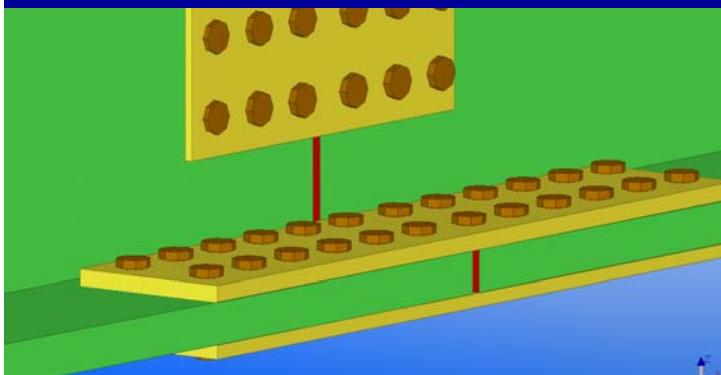
```
titleStr += fileName + " was saved by BrIM programs on " + DateTime.Now;
    return titleStr;
}
//1

public static string getPROGRAM_CONTROLS() {
    string titleStr = SAPConstants.TXT_TABLE_STR;
    titleStr = titleStr + "\\"PROGRAM CONTROL"";
    return titleStr;
}
//2

public static string getACTIVE_DEGREES_OF_FREEDOM() {
    string titleStr = SAPConstants.TXT_TABLE_STR;
    titleStr = titleStr + "\\"ACTIVE DEGREES OF FREEDOM"";
    return titleStr;
}
```

Step 2: Calculate cambering data under 3 load conditions.

Step 3:
Automatically
create the girder
models by using
Tekla APIs.



Step 4: Do detailing in Tekla Structures.

Some Considerations and Notes

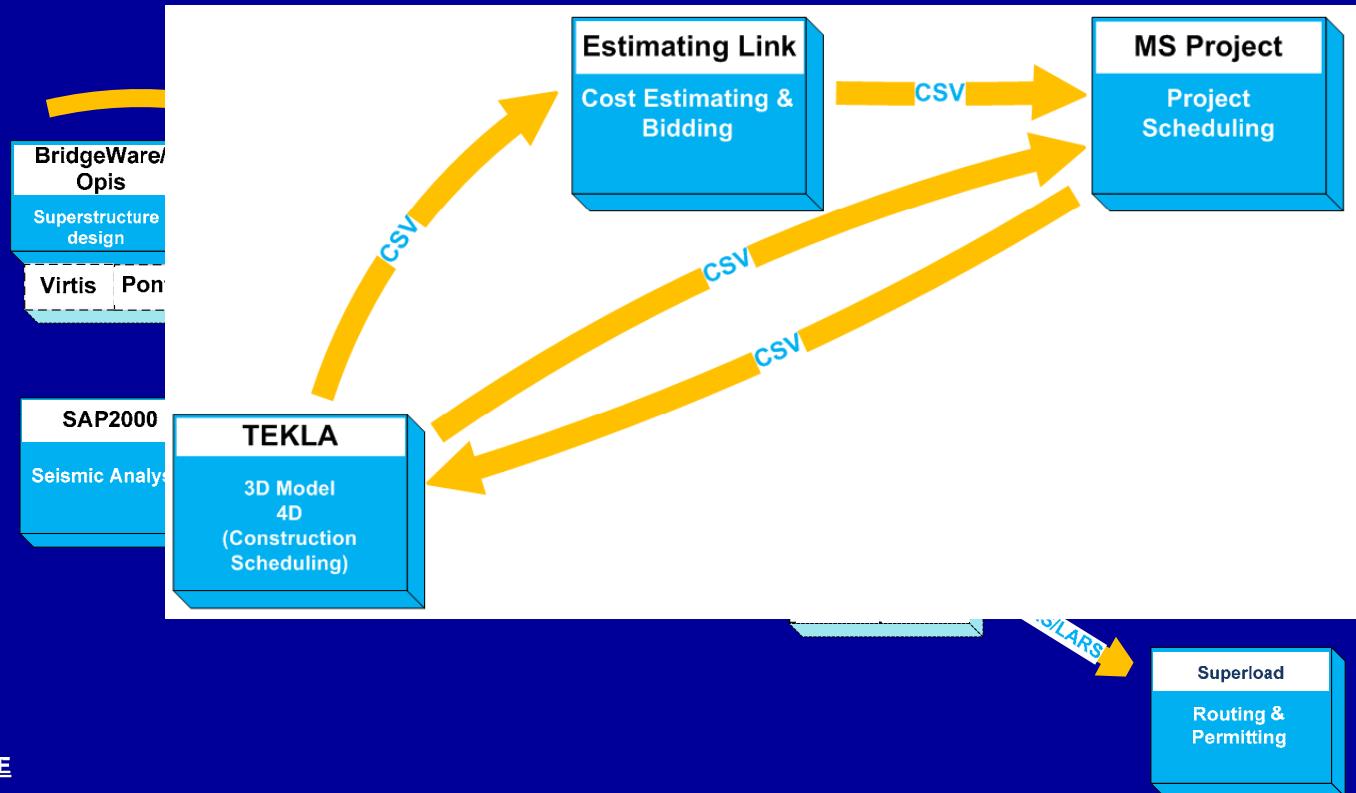
- Q: Why not using SAP2000 to model the cambering?
A: It is not convenient to model the cambering based on the original (entire) bridge model., we'd have to build other distinct geometries in the same way we'd build an entire new structure (which is not needed).
- Q: Why not using the direct link between SAP2000 and Tekla Structures provided by these two vendors?
A: 1) That link requires starting from the Tekla model, whereas we need to calculate the deflection in SAP2000 first;
2) the geometry changes cannot be updated from SAP2000 to Tekla directly. Only member section changes can be updated so far.



Some Considerations and Notes

- The cambering data are calculated based on the deflections of the points of interest, so the number of points selected has an impact on the accuracy of cambering and hence the accuracy of detailing.
- Here presented is one possible conceptual approach, which may not be the ideal way to go.





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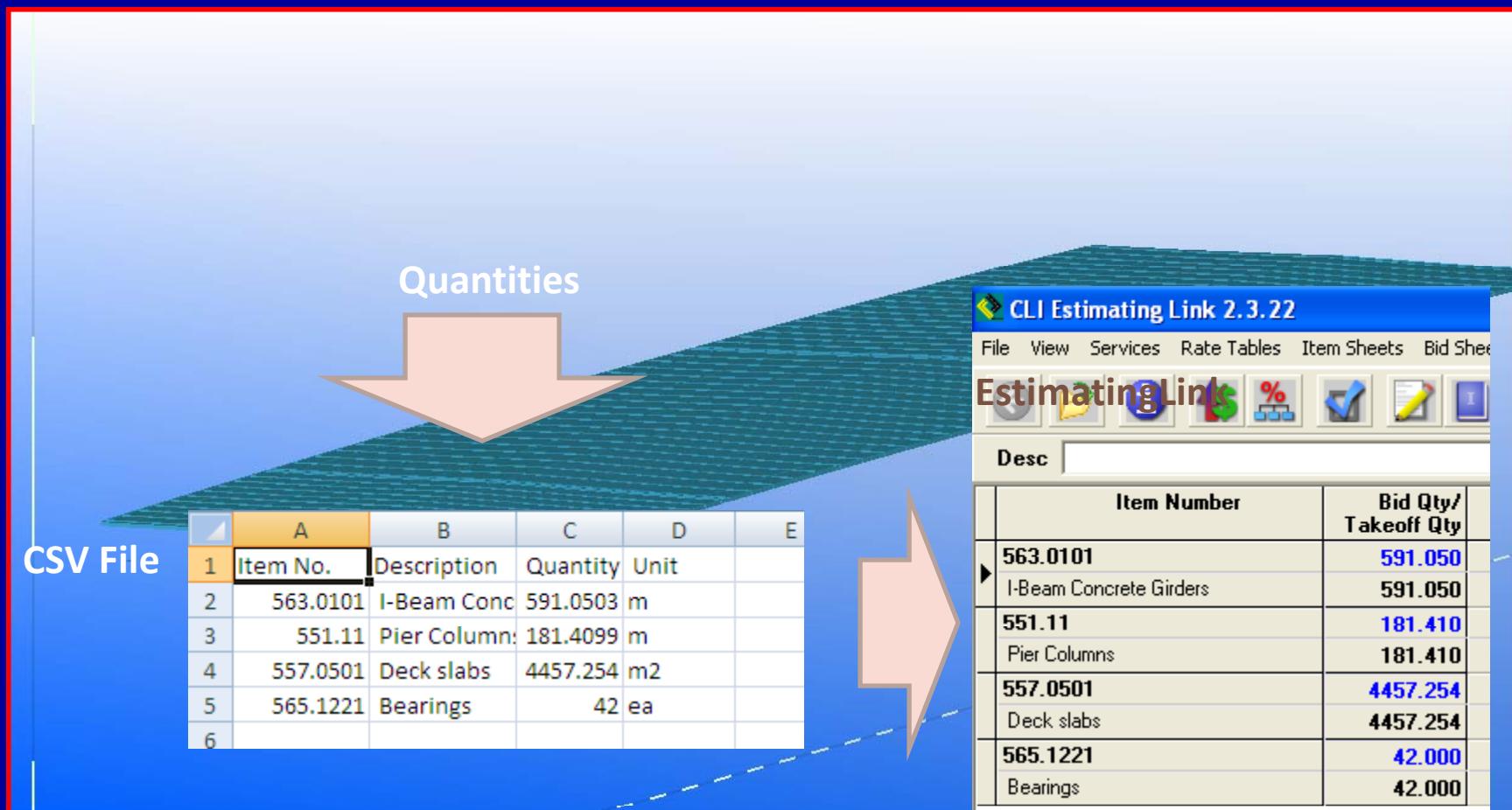
VBA – VISUAL BASIC FOR APPLICATIONS

CSV – COMMA SEPARATED VALUES

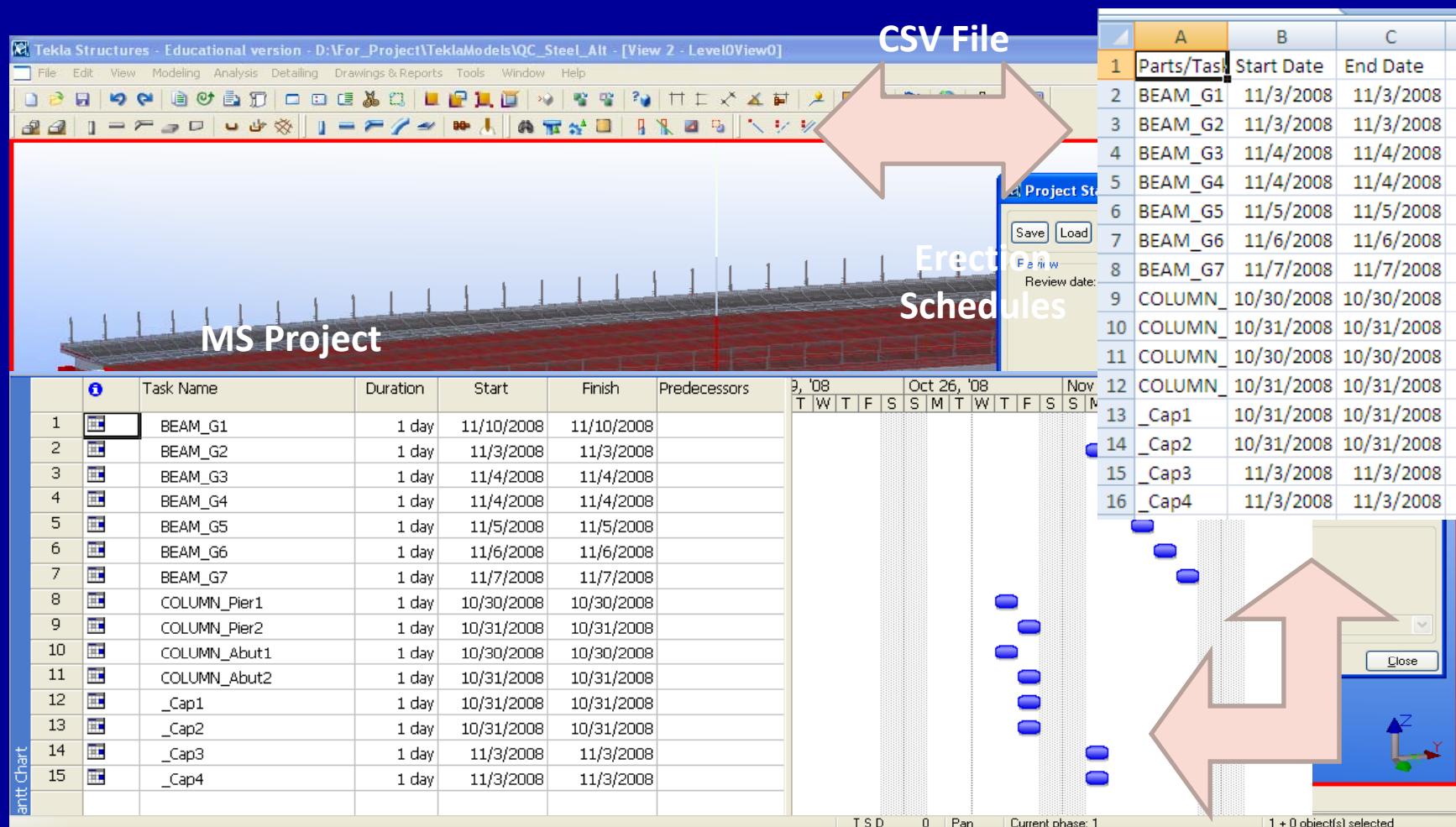
BARS/LARS – AASHTOWARE AND BENTLEY SOFTWARE

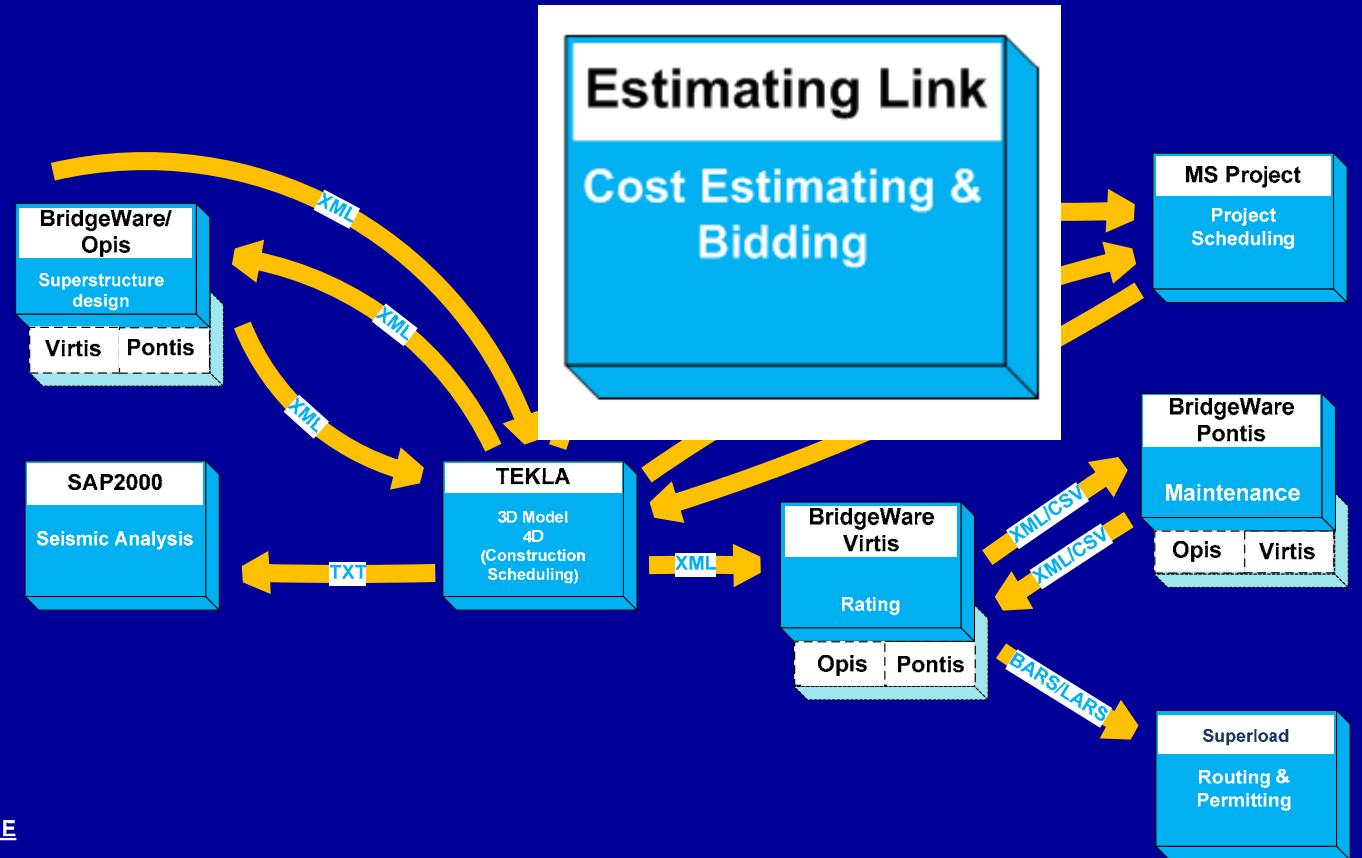


Linkage: Tekla-EstimatingLink (Bidding)



Linkage: Tekla 4D-MS Project (Scheduling)





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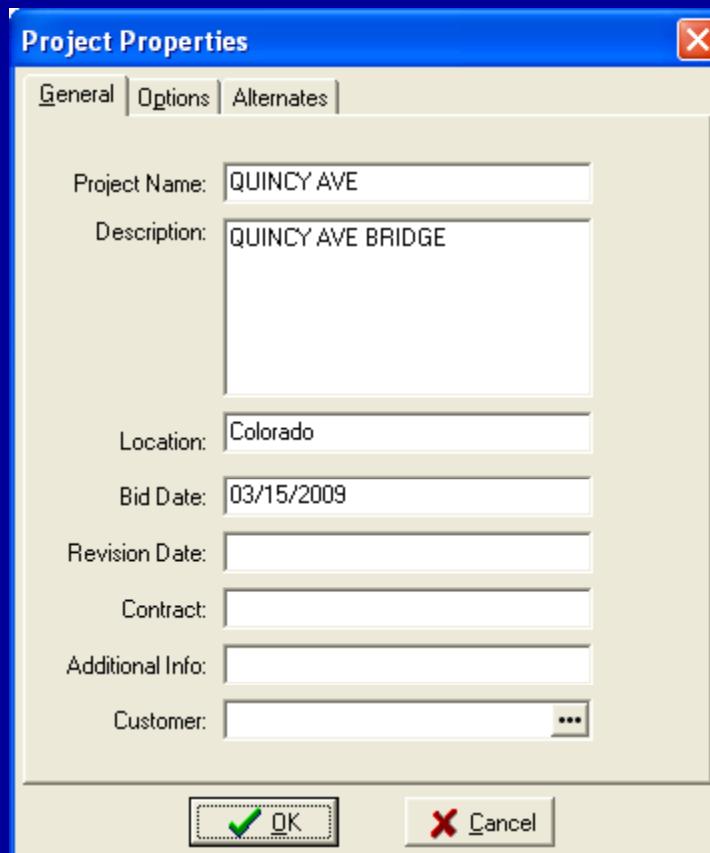
BARS/LARS – AASHTOWARE AND BENTLEY SOFTWARE



Create a new project

One way:

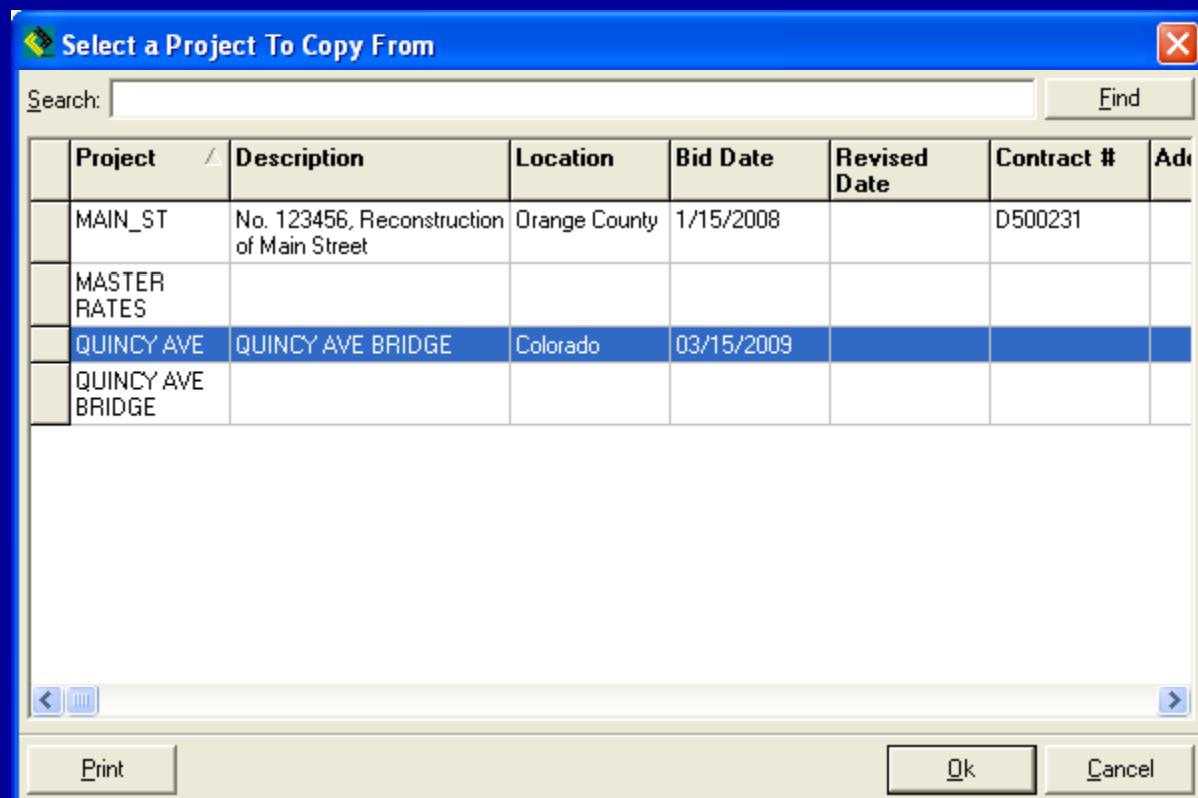
Create it manually



Create a new project

Another way:

Copy from another existing project whose rate tables can be shared



Rate Tables: Define Labor

CLI Estimating Link 2.3.22

File View Services Rate Tables Item Sheets Bid Sheet SMC RTC Setup Reports Window Help

Code Job Class Base Wage Benefits Payroll Taxes Hourly Wage Rate Per Day

Code	Job Class	Base Wage	Benefits	Payroll Taxes	Hourly Wage	Rate Per Day
CAR0001	Carpenter Heavy/Highway	17.290	8.160	8.21	33.66	269.24
ELE0001	Electrician - Journeyman	21.500	5.900	9.99	37.39	299.10
ELE0002	Electrician - Apprentice 3rd+	18.300	5.900	8.50	32.70	261.61
IRO0001	Ironworker - Reinforcing	19.200	8.080	8.92	36.20	289.60
LAB0001	Foreman	17.100	7.010	7.91	32.02	256.13
LAB0002	Skilled laborer	16.300	7.010	7.54	30.85	246.77
LAB0003	Basic Laborer	15.600	7.010	7.21	29.82	238.58
LAB0004	Pipe Layer	16.500	7.010	7.67	31.18	249.40
LAB0005	Asphalt Raker	16.500	7.010	7.67	31.18	249.40
MAS0001	Mason Heavy/Highway	17.260	6.450	8.02	31.73	253.83
OPR0001	Class A Operator	21.990	8.150	10.22	40.36	322.85
OPR0002	Class B Operator	21.280	8.150	9.89	39.32	314.53
TEA0001	Group 2 Teamster	16.980	6.270	5.72	28.97	231.73

Code: CAR0001
Description: Carpenter Heavy/Highway
FICA/FUTA/SUTA%: 14.100 % Other-1: 6.000 % Base wage \$: 17.290 Pyrl Taxes \$: 8.21
Workers Comp.%: 14.567 % Other-2: 0.000 % Benefits \$: 8.160 Hrly Wage \$: 33.66
General Liab.%: 12.789 % Rate/Day: 269.24

\Labor\Equipment\Rental\Material\Subcontract\Other\Crews\Factors\Defaults\

Rate Item Bid SMC RTC Open Close Exit Demo Mode Project: QUINCY AVE



Rate...

Rate Tables: Equipment

CLI Estimating Link 2.3.22

File View Services Rate Tables Item Sheets Bid Sheet SMC RTC Setup Reports Window Help

Code Description Vendor Cost Sales Tax Amt Fuel /Day Repairs /Day Insur /Day Other /Day Rate /Day

LRW-001	Pickup, 3/4 ton		15.910	0.00	43.800	1.000	0.250	0.000	60.96
LRW-002	6 Wh Dump truck		80.000	0.00	50.000	5.000	0.500	0.000	135.50
LRW-003	580 Case RT hoe		120.000	0.00	74.000	5.000	1.500	0.000	200.50
LRW-004	Compressor IR 185		55.000	0.00	15.000	1.000	0.500	0.000	71.50
LRW-005	Tamper, Plate or Jumping Jack		20.000	0.00	5.000	1.000	0.250	0.000	26.25
LRW-006	Allied Missile 2000C		75.000	0.00	0.000	2.000	0.250	0.000	77.25
LRW-007	Road Saw		75.000	0.00	20.000	2.000	0.250	0.000	97.25
LRW-008	T-300 Trencher		115.000	0.00	40.000	20.000	1.000	0.000	176.00
LRW-009	3 in trash pump		55.000	0.00	5.000	0.500	0.200	0.000	60.70
LRW-010	Concrete Vibrator		3.350	0.00	0.000	0.000	0.500	0.000	3.85
LRW-011	3.5 KW Generator		50.000	0.00	5.000	1.000	0.000	0.000	56.00

Code: LRW-001

Description: Pickup, 3/4 ton

Equipment Costs	Equip Rate	Sales Tax %	Sales Tax Amt	Rate/Day	Rate/Hr
	15.910	0.000	0.00	15.91	1.99
Operating Costs:	Fuel/Day	Repairs/Day	Insur./Day	Other/Day	
	43.800	#	1.000	0.000	45.05
Vendor:		...		Totals	60.96
					7.62

\Labor\Equipment\Rental\Material\Subcontract\Other\Crews\Factors\Defaults

Rate Item Bid SMC RTC Open Close Exit Demo Mode Project: QUINCY AVE



Rate...

Rate Tables: Material

CLI Estimating Link 2.3.22

File View Services Rate Tables Item Sheets Bid Sheet SMC RTC Setup Reports Window Help

Code Description Unit Vendor Unit Price

AGGR00001	Crusher Gravel	ton	EBER BROS	2.000
AGGR00002	Run of Bank Gravel	ton		4.000
AGGR00003	Screened Gravel	ton		4.250
AGGR00004	Pea Gravel	ton	EBER BROS	4.000
AGGR00005	Screened Sand	ton	EBER BROS	2.000
AGGR00006	Run of Bank Sand	ton		4.000
ASPH00001	Type 1 Base Asphalt Concrete	ton		24.000
ASPH00002	Type 2 Base Asphalt Concrete	ton		24.500
ASPH00003	Type 3 Binder Asphalt Concrete	ton		25.000
ASPH00005	Type 5 Shim Asphalt Concrete	ton		28.000
ASPH00006	Type 6 Top Course Asph. Conc.	ton		27.000
ASPH00007	Type 7 Top Course Asph. Conc.	ton		28.500
ASPH0006F	Type 6F Top Course (HF) Asph.	ton		29.000

Code AGGR00001

Description Crusher Gravel

U/M ton Discount% 0.00 Sales Tax% 0.00

Rate 2.000 Disc Amt Total: 2.000

Vendor EBER BROS ... Eber Brothers Sand and Gravel

\Labor\Equipment\Rental\Material\Subcontract\Other\Crews\Factors\Defaults\

Rate Item Bid SMC RTC Open Close Exit Demo Mode Project: QUINCY AVE



Rate...

Define Items

CLI Estimating Link 2.3.22

File View Services Rate Tables Item Sheets Bid Sheet SMC RTC Setup Reports Window Help

Item 501.01 Description Top Asphalt Course

Description	Quantity	U/M	Factor	Rate	Costs
Foreman	1.0		1.25	345.166	431.46
Skilled laborer	2.0		1.00	332.298	664.60
Basic Laborer	2.0		1.00	321.038	642.08
Asphalt Raker	2.0		1.00	335.918	671.84
Class A Operator	1.0		1.00	435.762	435.76
Class B Operator	3.0		1.25	424.324	1591.22
Pickup, 3/4 ton	1.0		1.25	76.200	95.25
Asphalt Paver	1.0		1.00	1187.500	1187.50
Roller - Asphalt	3.0		1.25	562.125	2107.97
Type 7F Top Course (HF) Asph.	430.5	ton	1.00	29.500	12699.75
1 1/2 inches of top	0.0		0.00	0.000	
CERTIFIED WBE	4.0	EA	1.00	325.000	1300.00

Total Cost: \$21,827.41

Unit Cost: \$53.238

Production: Days Hrs/Day: 10 10.0 ... Cost Code: []

Bid Quantity: 410.000 Take Off Qty: 410.000 Unit of Measure: TONS

Man Hours: 120.000 Units/MH: 3.417 MHS/Unit: 0.2927 Units/Day: 410.00 Days Reqd: 1.00

Rate Item Bid SMC RTC Open Close Exit Demo Mode Project: MAIN_ST

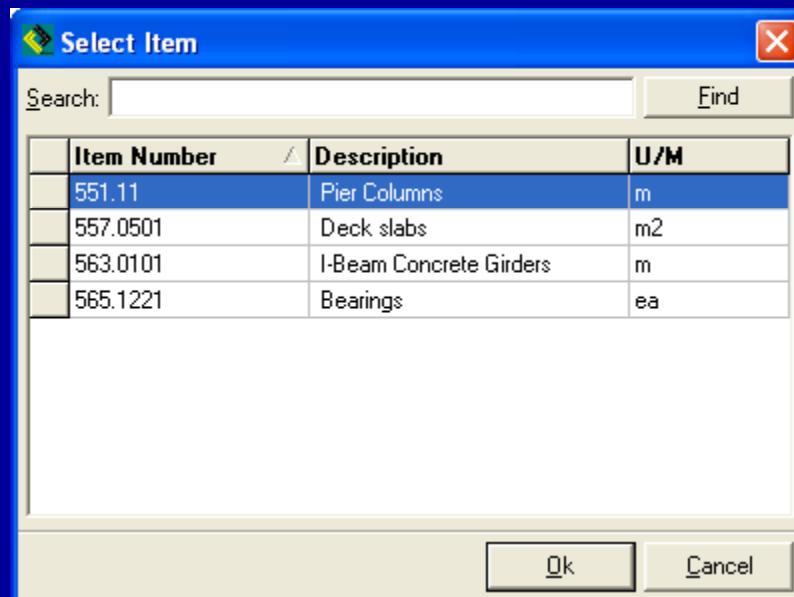


Item...

Item Table

Note:

It can be defined manually or imported from other software models, such as Tekla model.

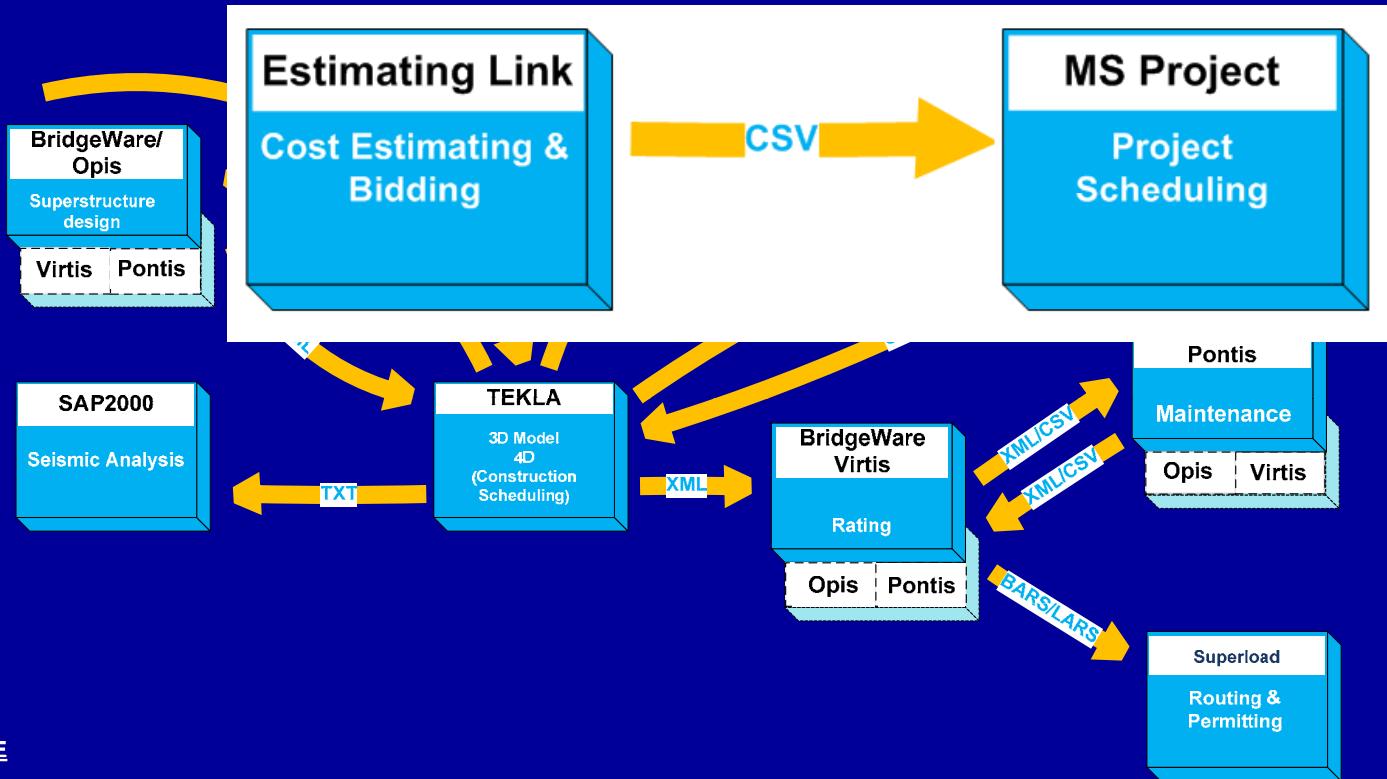


The screenshot shows a Windows-style dialog box titled "Select Item". At the top right is a close button (X). Below the title is a search bar with a placeholder "Search:" and a "Find" button. The main area is a table with three columns: "Item Number", "Description", and "U/M". The table contains five rows of data:

Item Number	Description	U/M
551.11	Pier Columns	m
557.0501	Deck slabs	m ²
563.0101	I-Beam Concrete Girders	m
565.1221	Bearings	ea

At the bottom are two buttons: "Ok" and "Cancel".





METHOD OF DATA EXCHANGE

TXT – TEXT FILE

XML – EXTENSIBLE MARKUP LANGUAGE

LANDXML – LAND EXTENSIBLE MARKUP LANGUAGE

VBA – VISUAL BASIC FOR APPLICATIONS

CSV – COMMA SEPARATED VALUES

BARS/LARS – AASHTOWARE AND BENTLEY SOFTWARE



Data In EstimatingLink

CLI Estimating Link 2.3.22

File View Services Rate Tables Item Sheets Bid Sheet SMC RTC Setup Reports Window Help

Desc Sample Project sent to Dr. Chen

									Bid Date	August 6, 2008	Loc	Anytown, USA		
	Item Number	Bid Qty/ Takeoff Qty	Calc. Unit/ Unit Cost	Bid Unit	Total Bid/ Total Cost	Markup %	Item Spread \$34,156....	Print Subtotal	Labor Unit	Labor Amt \$72,781....	Equipment Unit	Equipment Amt \$26,132....	Rental Unit	Rental Amt \$858....
▶	201.06	LS	1.000	2315.115	2300.000	2300.00	22.6	424.38	911.37	911.37	534.10	534.10	0.00	0.00
	CLEARING AND GRUBBING		1.000	1875.615		1875.62								
▶	203.02	CY	290.000	37.724	38.000	11020.00	24.3	2156.92	15.71	4556.83	7.43	2155.50	0.00	0.00
	UNCLASSIFIED EXCAVATION AND D		290.000	30.562		8863.08								
▶	203.21	CY	180.000	65.057	65.000	11700.00	23.3	2212.75	24.95	4490.65	9.65	1736.60	0.00	0.00
	SELECT STRUCTURE FILL		180.000	52.707		9487.25								
▶	206.01	CY	290.000	20.570	20.000	5800.00	20.0	967.13	11.31	3280.91	5.35	1551.96	0.00	0.00
	STRUCTURE EXCAVATION		290.000	16.665		4832.87								
▶	206.02	CY	70.000	10.930	19.000	1330.00	23.0	250.00	10.42	729.09	4.93	344.00	0.00	0.00
	TRENCH AND CULVERT EXCAVATI		70.000	15.342		1073.97								
▶	207.10	SY	270.000	7.107	7.000	1890.00	21.6	335.46	4.01	1081.54	0.00	0.00	0.00	0.00
	GEOTEXTILE BEDDING		270.000	5.758		1554.54								
▶	207.16	SY	50.000	12.672	12.000	600.00	16.9	86.69	4.33	216.31	0.00	0.00	0.00	0.00
	PREFABRICATED COMPOSITE INTE		50.000	10.266		513.31								
▶	304.15	CY	15.000	73.359	75.000	1125.00	26.2	233.51	36.45	546.82	6.68	100.17	0.00	0.00
	SUBBASE COURSE, OPTIONAL TYP		15.000	59.433		891.49								
▶	403.198902	TON	15.000	302.458	300.000	4500.00	22.4	824.40	121.44	1821.53	64.16	962.45	0.00	0.00
	HOT MIX ASPHALT, TYPE 7 TOP CO		15.000	245.040		3675.60								
▶	555.0104	CY	27.000	507.476	500.000	13500.00	21.6	2399.29	248.30	6704.15	45.58	1230.56	0.00	0.00
	FOOTING CONCRETE, CLASS A		27.000	411.137		11100.71								
▶	555.0105	CY	22.000	1917.929	1800.000	39600.00	15.8	5415.72	1056.67	23246.64	374.66	8242.44	0.00	0.00
	CONCRETE FOR STRUCTURES, CLA		22.000	1553.831		34184.28								
▶	556.0201	POUND	4200.000	1.251	1.250	5250.00	23.3	992.66	0.16	683.72	0.05	213.62	0.00	0.00
	UNCOATED BAR REINFORCEMENT		4200.000	1.014		4257.34								
▶	15558.50	SQ. FT.	852.000	4.118	4.000	3408.00	19.9	565.55	2.34	1994.13	0.27	230.82	0.00	0.00
	MEMBRANE WATERPROOFING SY		852.000	3.336		2842.45								

Total Bid

ACTUAL BID: \$179,873.50

BALANCED BID: \$179,861.88

UNBALANCED: \$11.62

Rate Item Bid SMC RIC Open Close Exit Educational Use Project: SAMPLE

Bid items...



Exporting Data from EstimatingLink

The screenshot shows the CLI Estimating Link 2.3.22 application window. The menu bar includes File, View, Services, Rate Tables, Item Sheets, Bid Sheet, SMC, RTC, Setup, Reports, Window, and Help. The 'File' menu is open, showing options like Create New, Open Existing Project..., Close Current Project, Project Information..., Project Comments..., Import, Export (which is highlighted), Delete Project..., and Exit Estimating Link. Below the menu is a toolbar with icons for percentage, checkmark, pencil, book, folder, dollar sign, and a wizard. The main area displays a bid sheet for a project named 'TRENCH AND CULVERT E'. The table has columns for Item, Bid Qty/Takeoff Qty, Calc. Unit/Unit Cost, Bid Unit, Total Bid/Total Cost, Markup %, and Item Sp. The table shows several rows of data, such as 207.10 GEOTEXTILE BEDDING and 304.15 SUBBASE COURSE, OPTIONAL TYP. A red callout box with the text 'Choose the format...' points to the 'Microsoft Project...' option in the 'Scheduling' submenu of the 'Export' menu.

Item	Bid Qty/ Takeoff Qty	Calc. Unit/ Unit Cost	Bid Unit	Total Bid/ Total Cost	Markup %	Item Sp.
207.10 GEOTEXTILE BEDDING	SY 1.000	2315.115	2300.000	2300.00	22.6	\$34,15
304.15 SUBBASE COURSE, OPTIONAL TYP	CY 15.000	73.359	75.000	1125.00	26.2	23
		59.433		891.49		



The Steps of Importing Data into MS Project

Step 1:
Create a new map...

Create new map or use existing map?
If you have used this wizard before you may have chosen to save your settings as a map.
In addition to maps you may have saved, Project offers a variety of ready-made maps you may find useful.
Choose New map to create your data settings.
Choose Use existing map to see the ready-made maps available to you.

New map
 Use existing map

Step 2:
Match the linkage file fields with the MS Project fields...

Import Wizard - Task Mapping

Map Tasks Data

Source table name: Task_Table1

Verify or edit how you want to map the data.

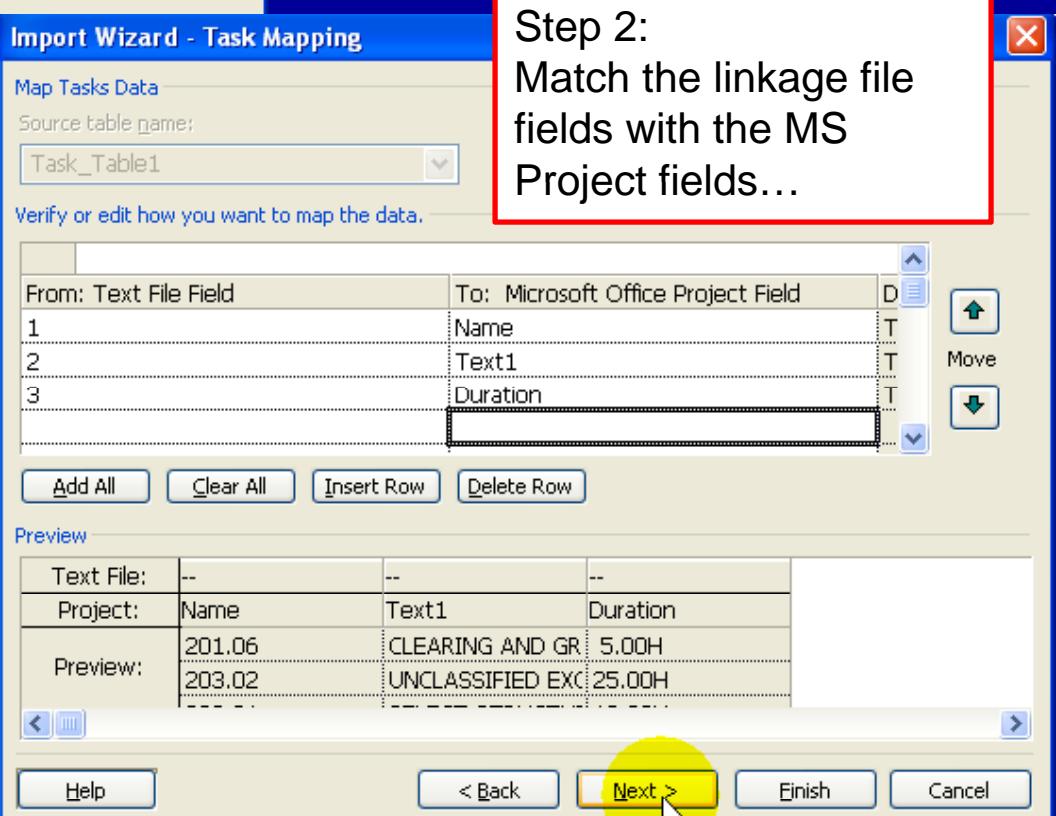
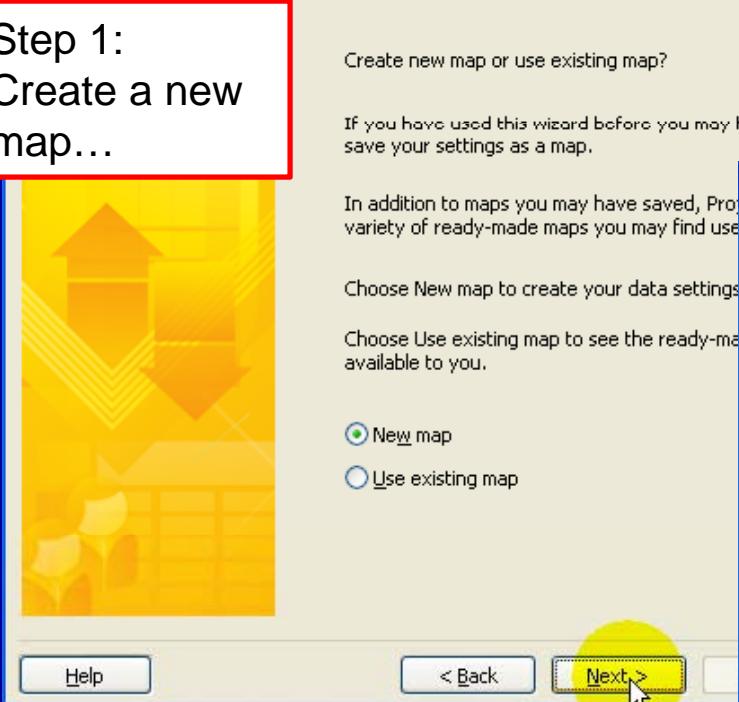
From: Text File Field	To: Microsoft Office Project Field
1	Name
2	Text1
3	Duration

Add All Clear All Insert Row Delete Row

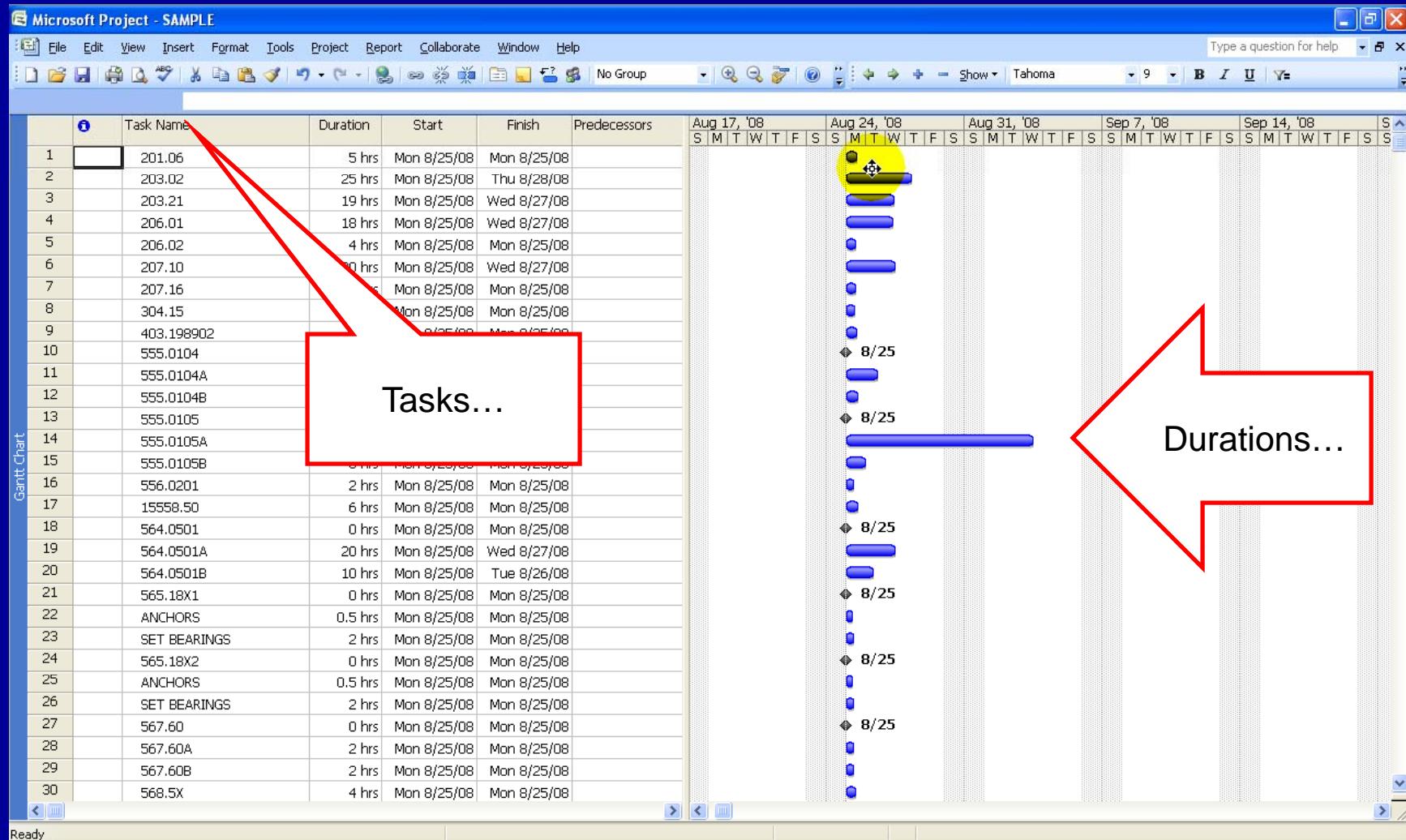
Preview

Text File:	--	--	--
Project:	Name	Text1	Duration
Preview:	201.06	CLEARING AND GR	5.00H
	203.02	UNCLASSIFIED EXC	25.00H

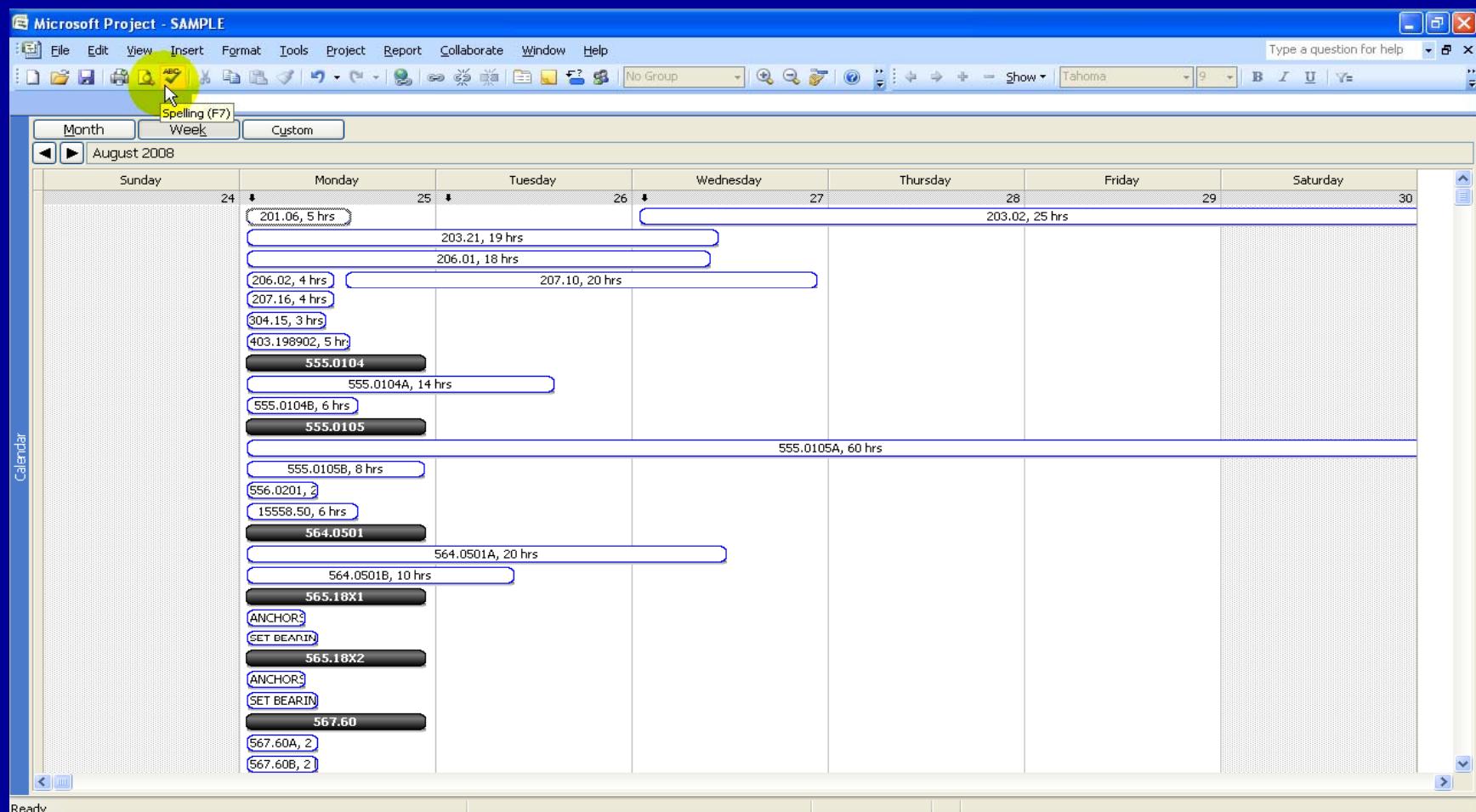
Help < Back Next > Finish Cancel



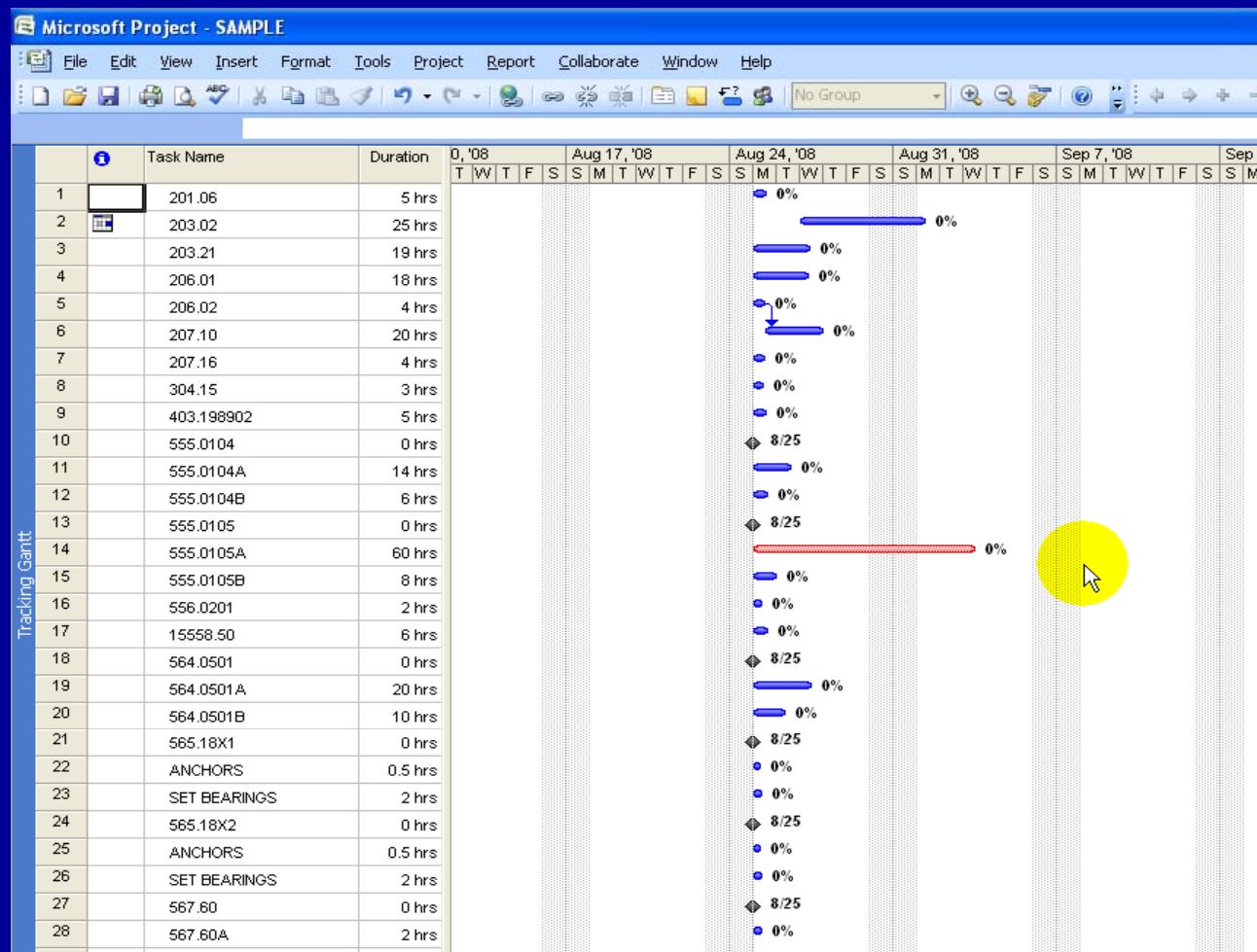
Imported Data in MS Project

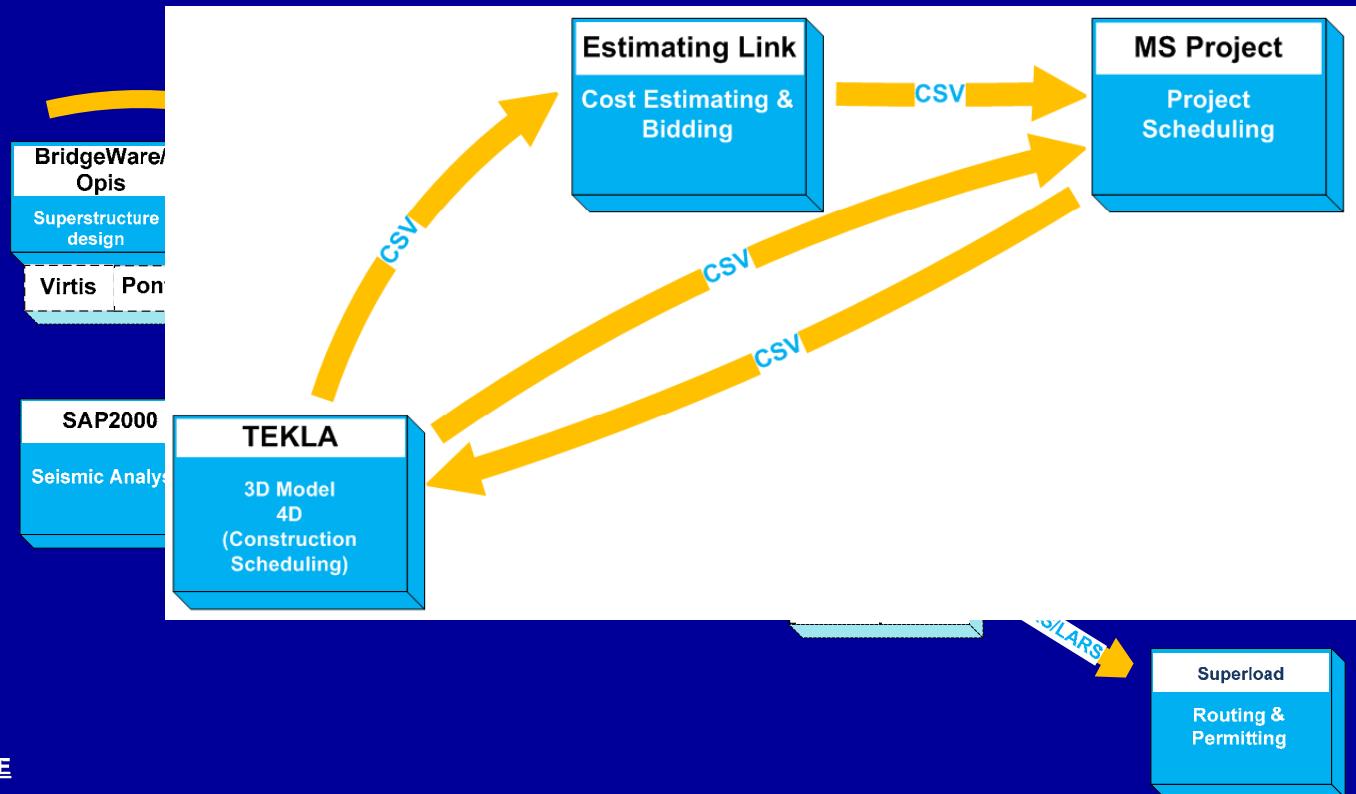


Imported Data in MS Project (Calendar)



Imported Data in MS Project (Tracking Gantt Chart)





METHOD OF DATA EXCHANGE

TXT – TEXT FILE

XML – EXTENSIBLE MARKUP LANGUAGE

LANDXML – LAND EXTENSIBLE MARKUP LANGUAGE

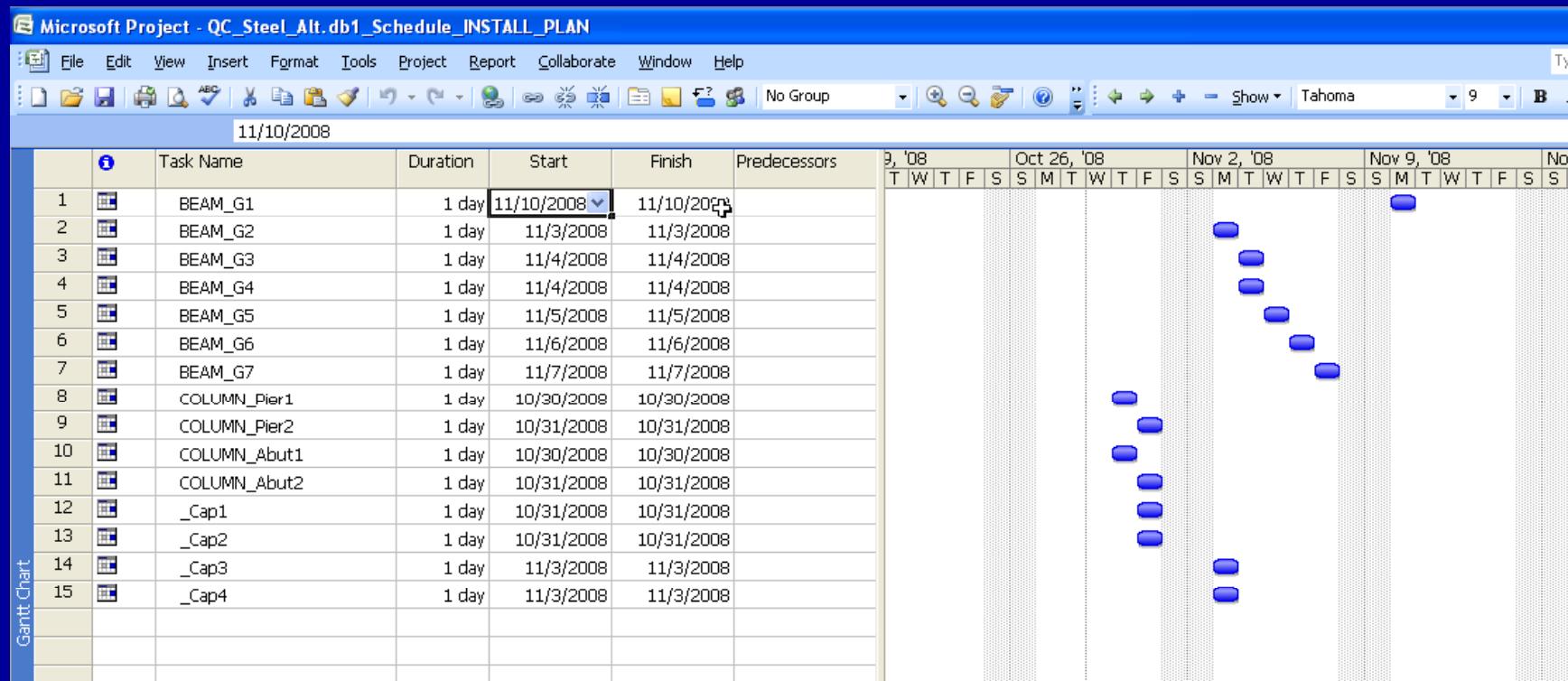
VBA – VISUAL BASIC FOR APPLICATIONS

CSV – COMMA SEPARATED VALUES

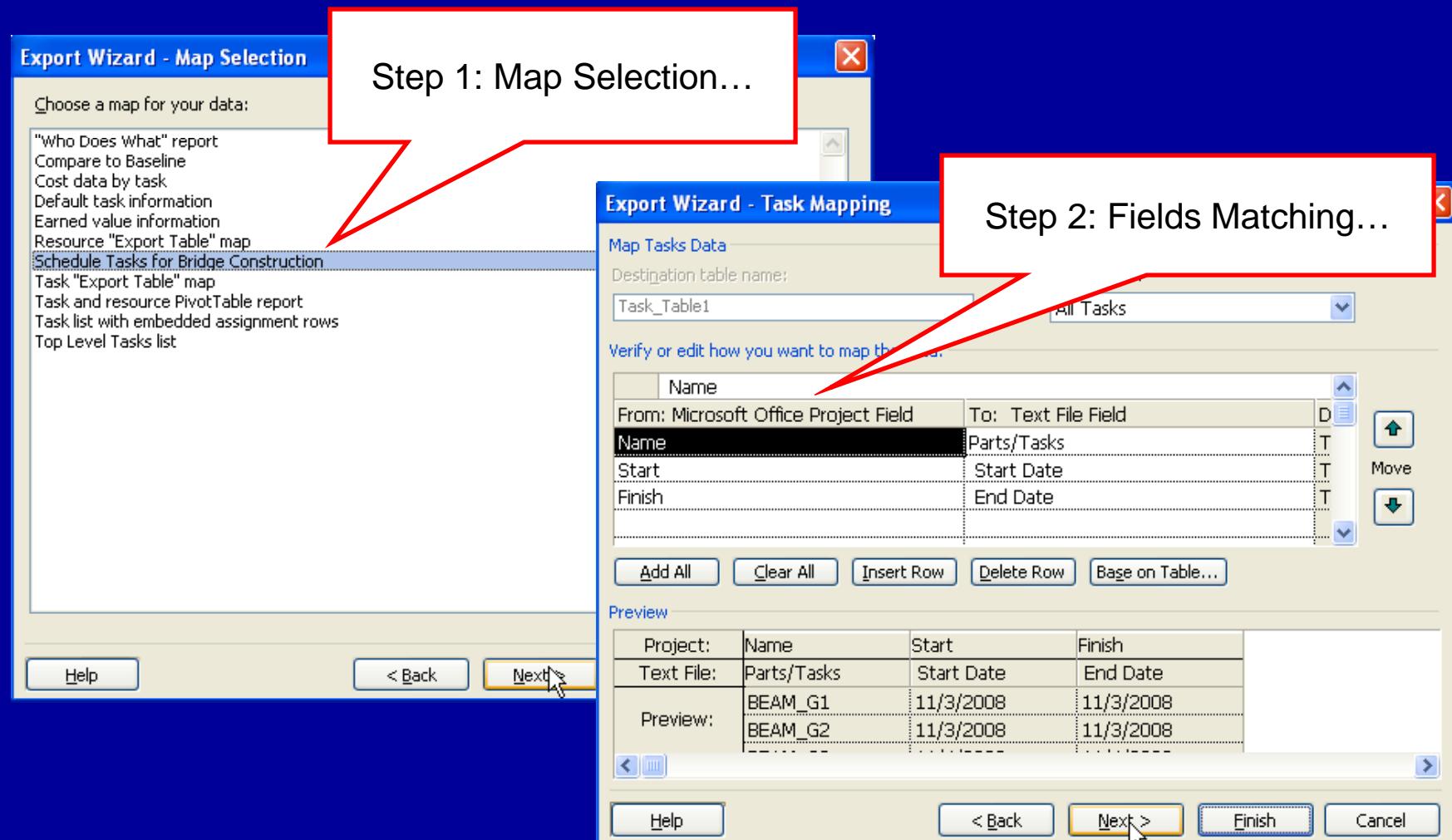
BARS/LARS – AASHTOWARE AND BENTLEY SOFTWARE



Schedule Data to Be Exported



Steps of Exporting Schedule Data From MS Project



Code Sample of Importing into Tekla 4D

The screenshot shows the Microsoft Visual Studio interface with the title bar "FundedProjectSolution - Microsoft Visual Studio". The menu bar includes File, Edit, View, Refactor, Project, Build, Debug, Data, Tools, Window, Community, Help. The toolbar has various icons for file operations. The solution explorer on the right lists projects like "TeklaExporting", "TeklaImporting", and "TeklaUtil". The code editor window displays C# code. A red callout box points to the line "importPlannedDateFromMSProject(csvFileName);". Another red callout box points to the line "Console.ReadLine();". A third red callout box at the bottom points to the text "This program calls Tekla APIs to update the schedule changes from MS Project...".

```
        }
    }
}
static void Main(string[] args)
{
    //exportTeklaModelToXML();
    //exportToXML();
    //export4DSchedule();
    //setUserDefinedProperties();

    //Set the modified dates from csv file...
    string csvFileName = @"D:\QC_Steel_Alt.db1_Schedule_INSTALL_PLAN.csv";
    importPlannedDateFromMSProject(csvFileName);

    Console.ReadLine();
}
```

Indicate the file need to be imported...

Call the subroutine of importing data...

This program calls Tekla APIs to update the schedule changes from MS Project...

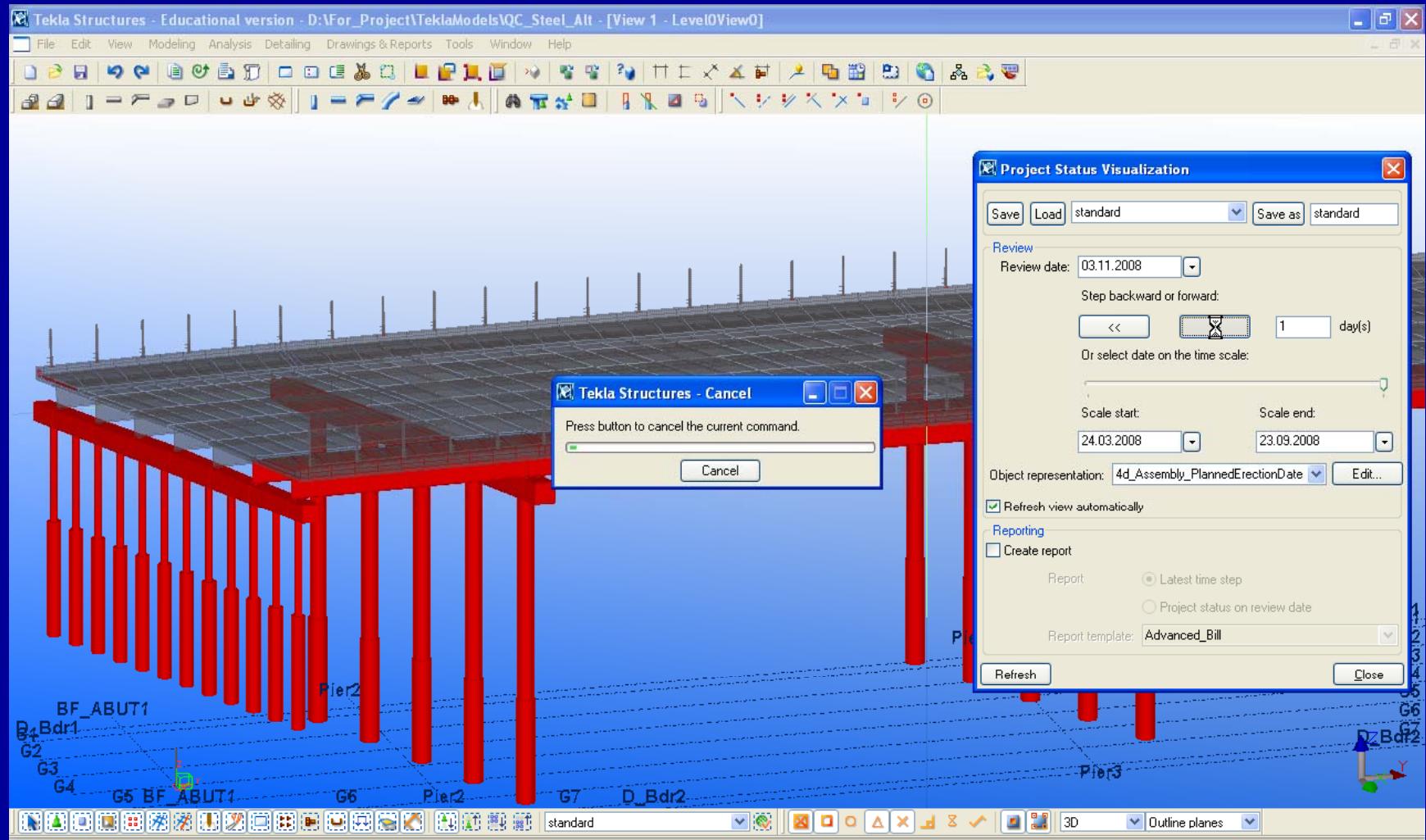


Importing Process

```
file:///D:/CSharpProjects/TeklaExporting/TeklaExporting/bin/Debug/TeklaExporting.EXE
The end Date is: 11/3/2008
Connecting to Tekla Structures process...
Connection succeeded
The end Date is: 11/3/2008
The end Date is: 11/4/2008
The end Date is: 11/4/2008
The end Date is: 11/5/2008
The end Date is: 11/6/2008
The end Date is: 11/7/2008
The end Date is: 10/30/2008
The end Date is: 10/31/2008
The end Date is: 10/30/2008
The end Date is: 10/31/2008
The end Date is: 10/31/2008
```



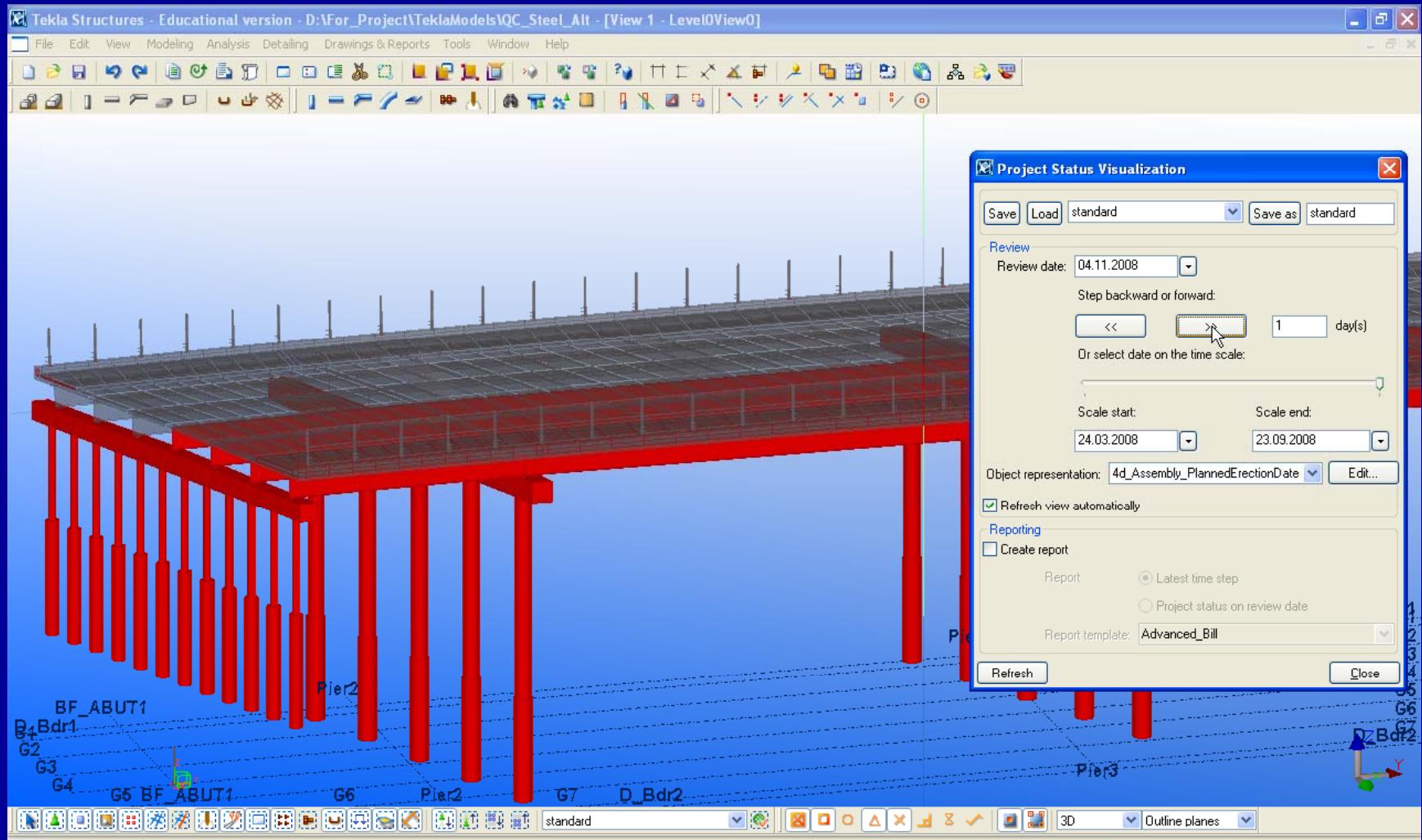
Updating Schedule in Tekla 4D



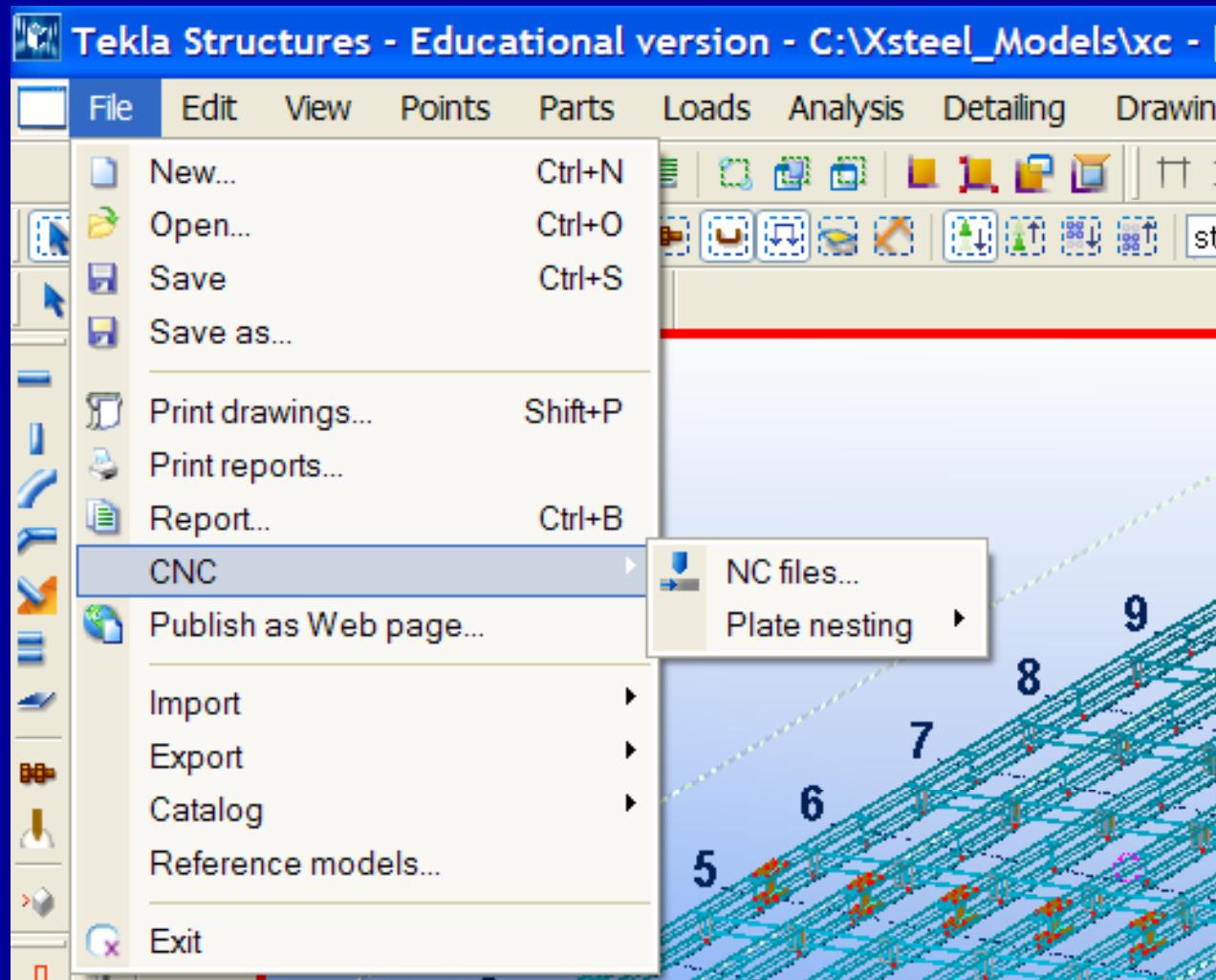
The schedule changes has been updated in
Tekla...



Construction Schedule in Tekla 4D



Link to Fabrication



Summary (D3-Construction)

- Workflow demonstrated leveraging design (model) downstream into construction, estimating, scheduling, etc.
- One of several possible such workflows
- Encompassing detailing for fabrication for construction, cost estimating, construction scheduling, and feedback into 3D/4D modeling environment for downstream uses

