Using Functional and Generative Components for Custom OpenBridge Substructure Elements

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Functional Components

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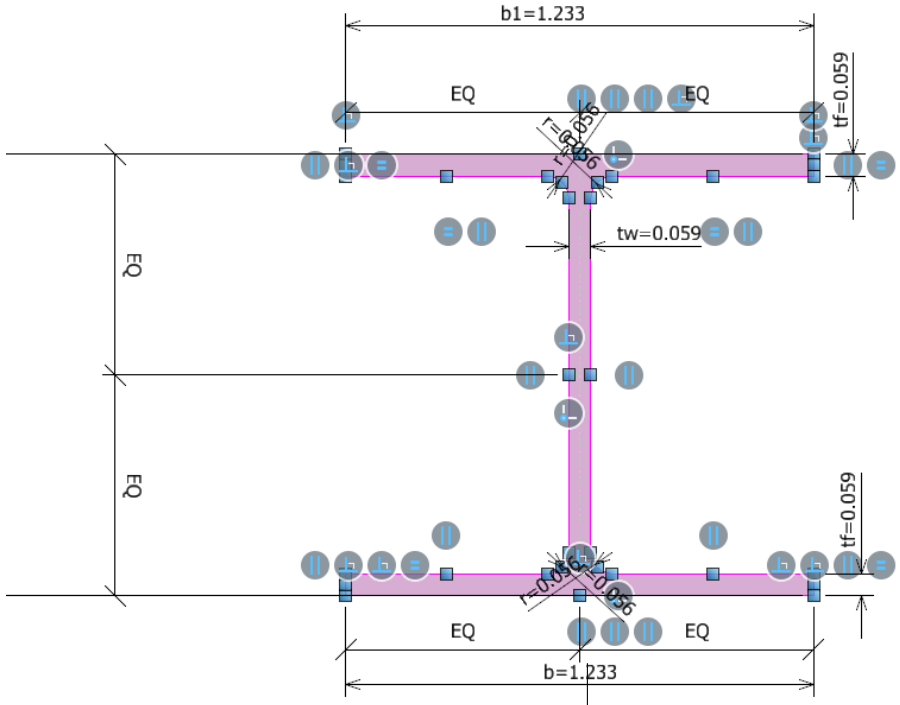
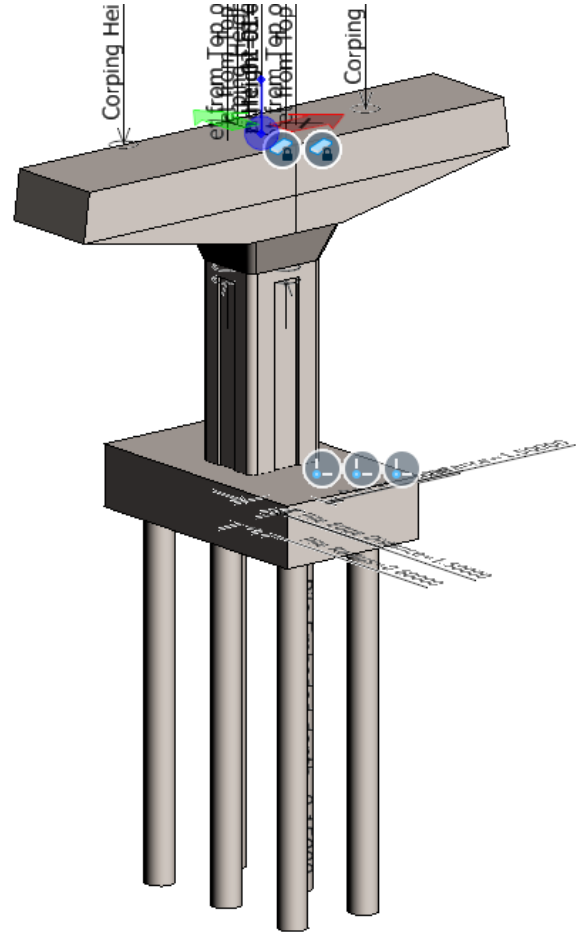
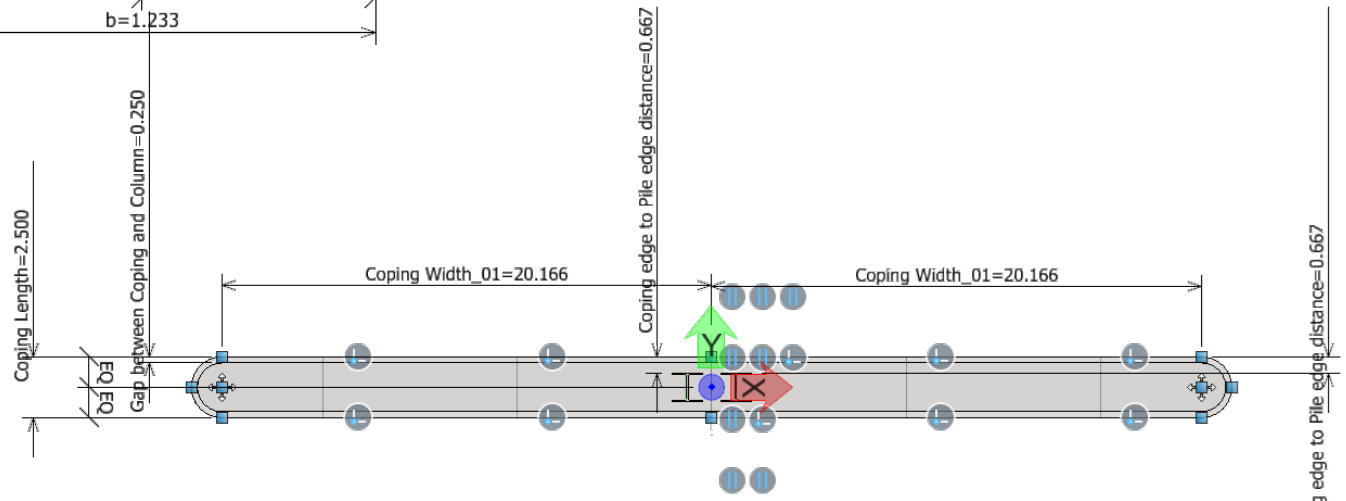
When and How to use Functional Components in Bridge







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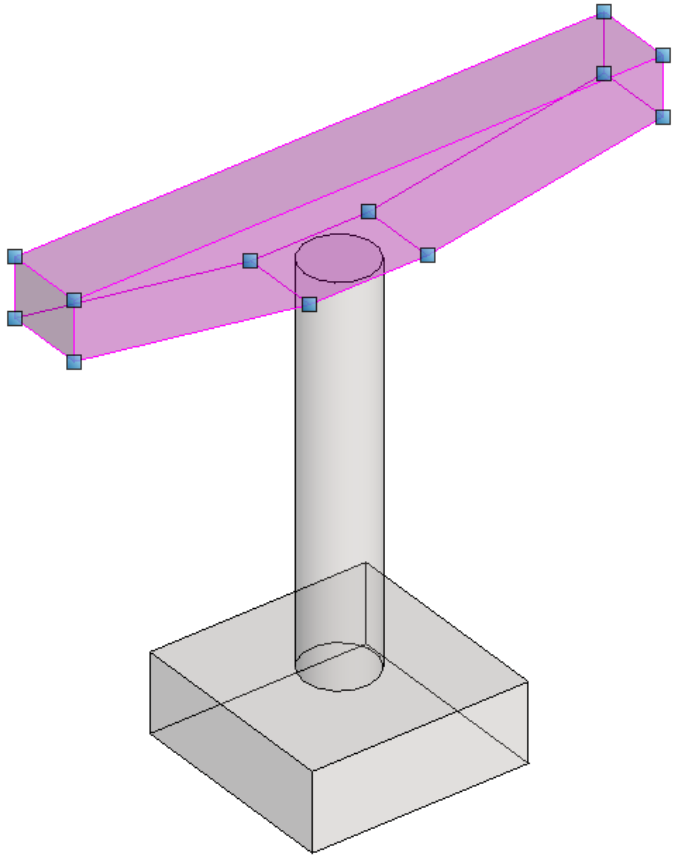
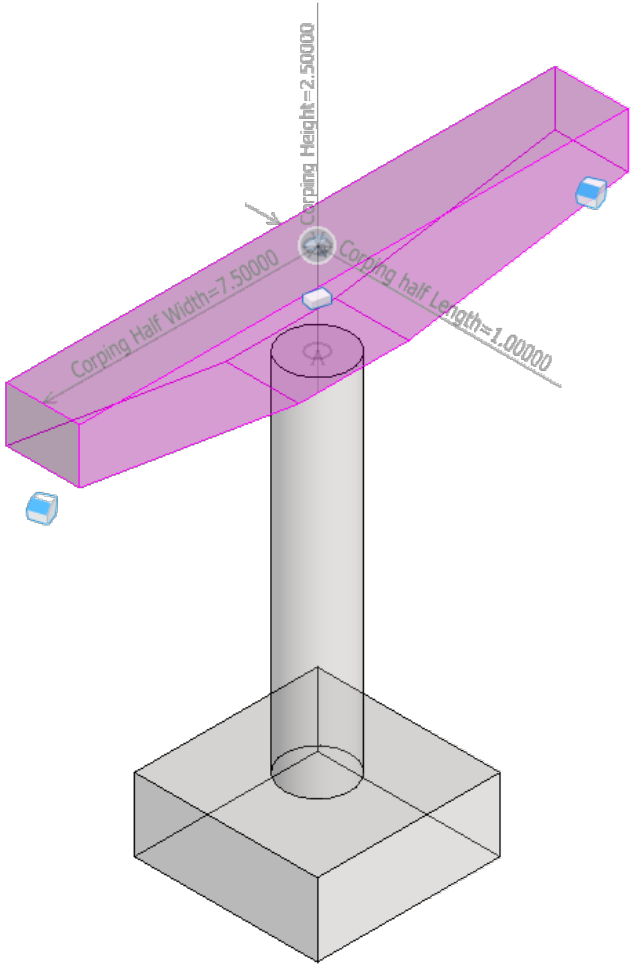
Modeling Method Transition

Template → **Functional Component**





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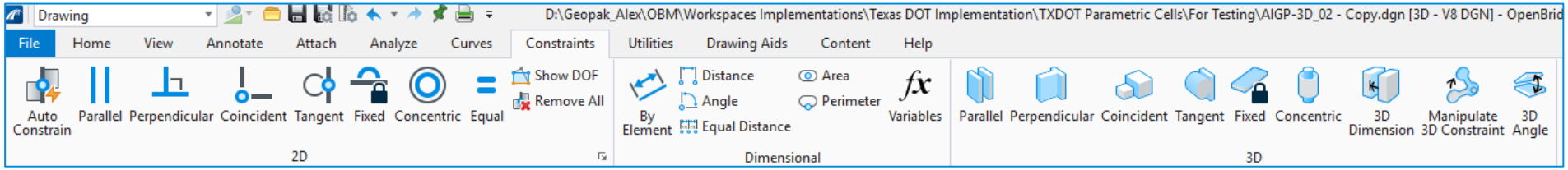
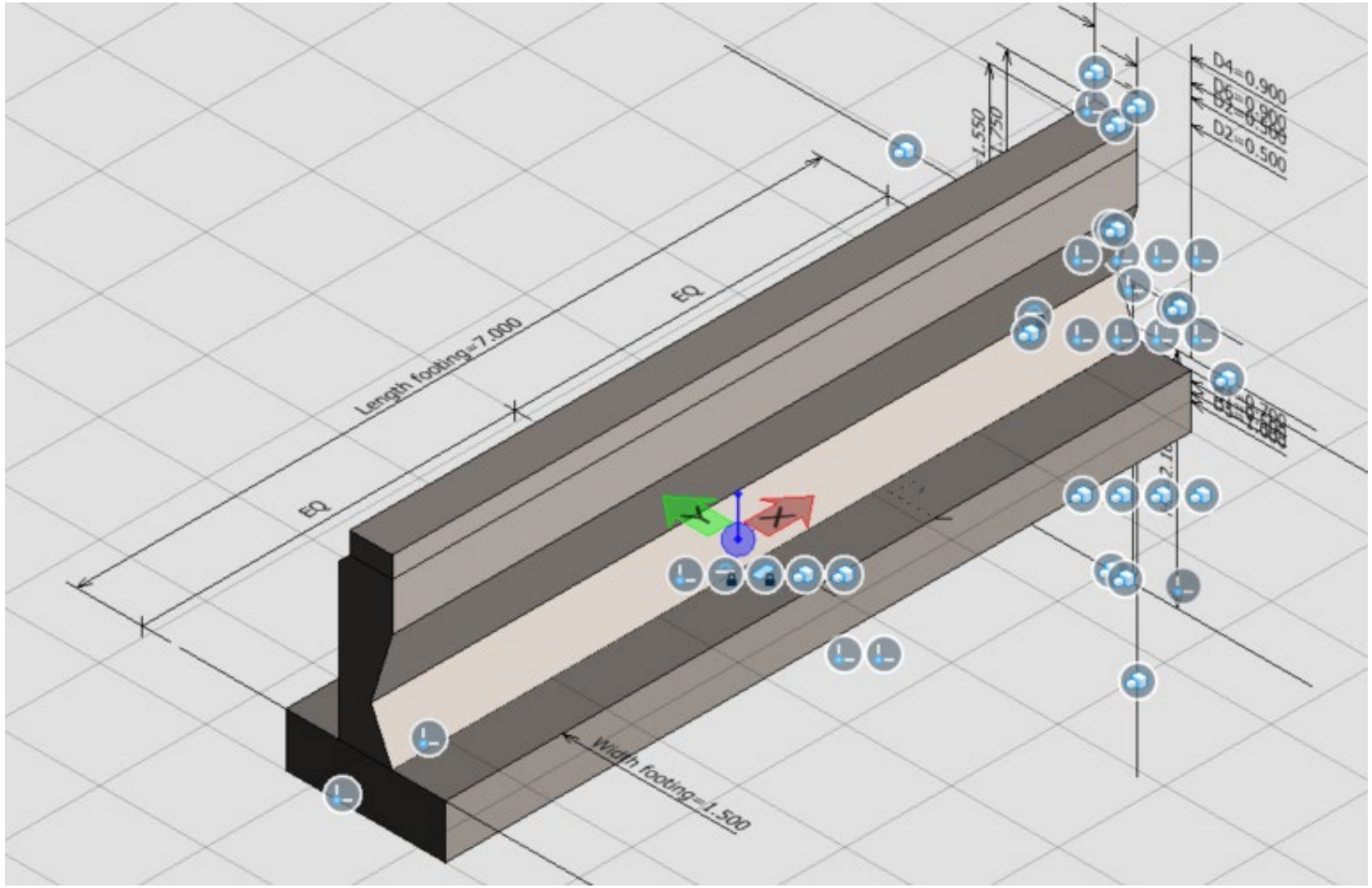


- Modeling > 2D Constraints
- Modeling > 3D Constraints



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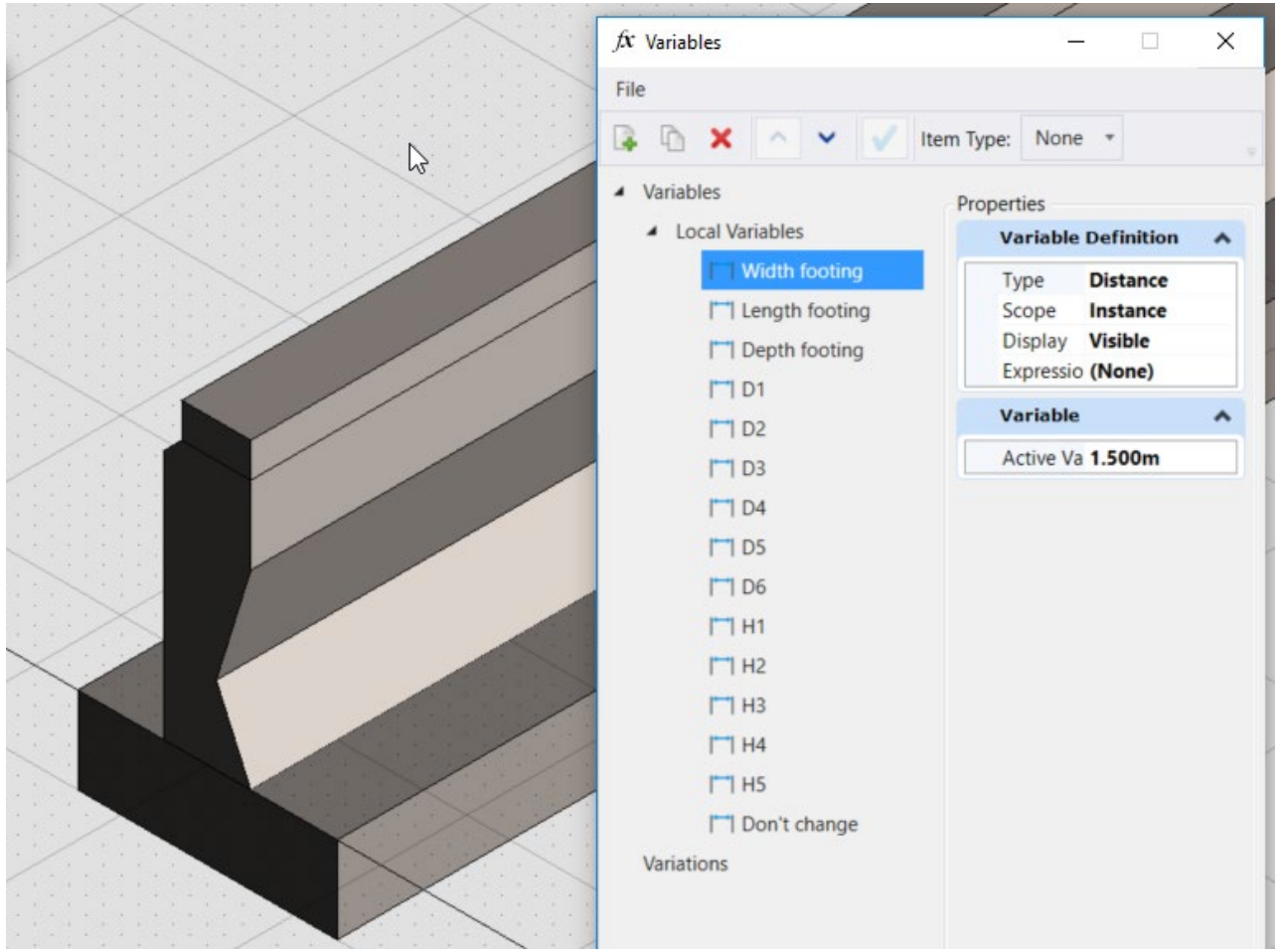
Variables

- Modeling > 2D Constraints
- Modeling > 3D Constraints
- Modeling > Variables



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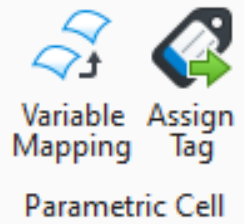
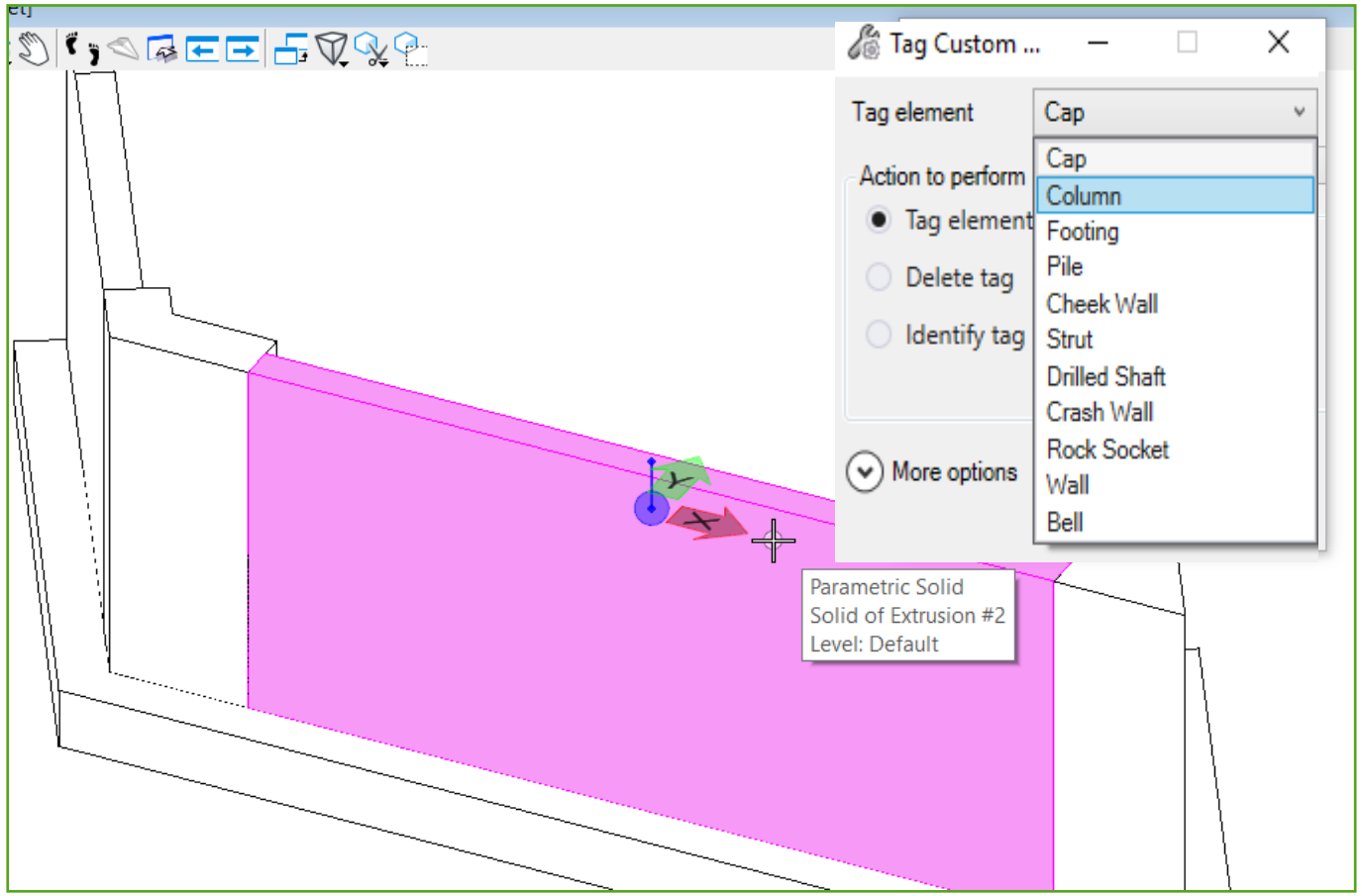
Assigning Tags



- Tag different parts of the cell with OBM specific object tags, so they are recognized and reported on as needed.

- E.g. tagging a solid as a column allows OBM to report the volume, and as a pile to report the length.



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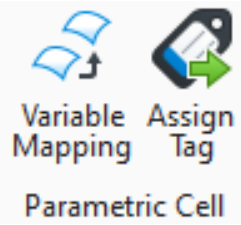
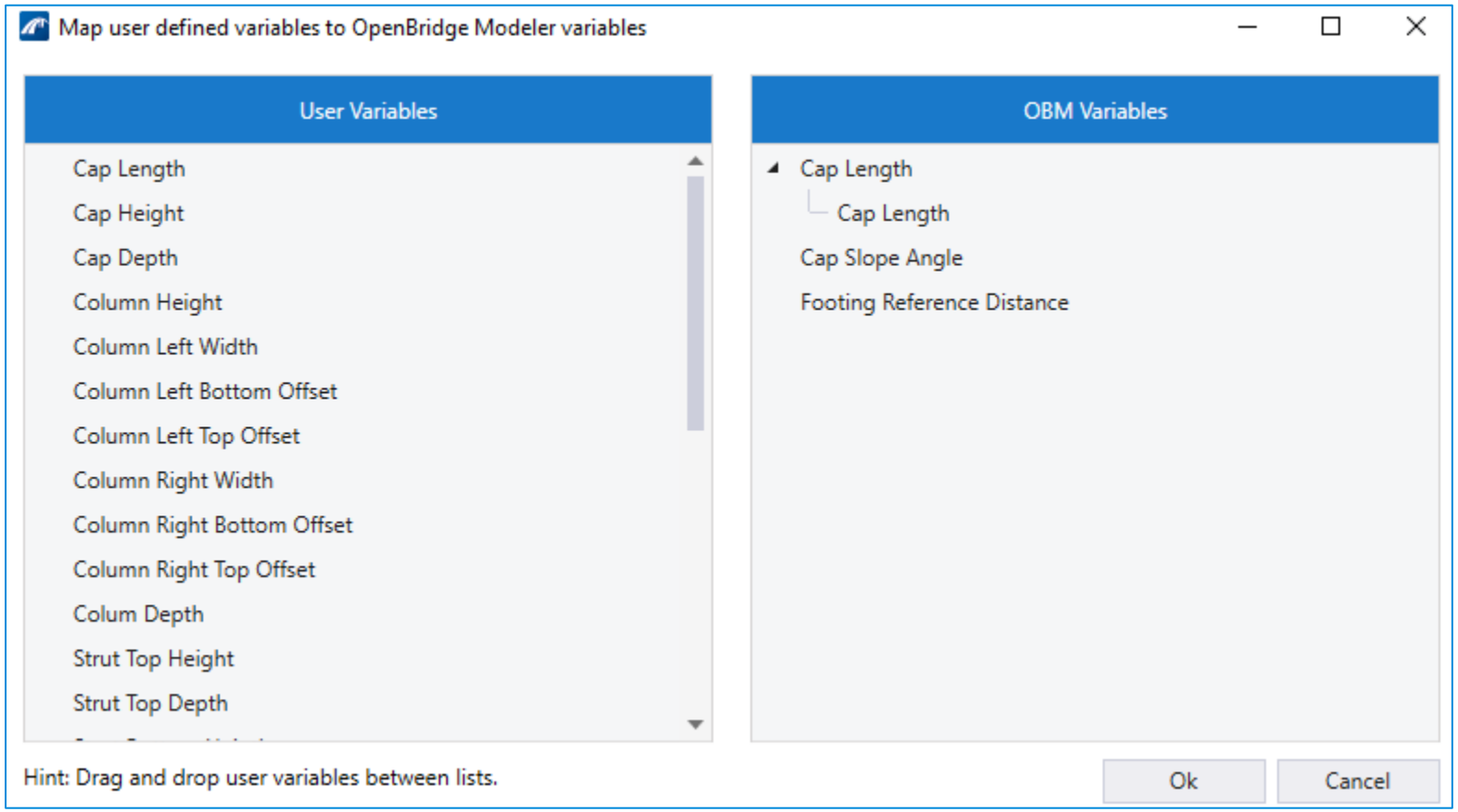
Variable Mapping



- Variable Mapping
  - Map user defined variables to OBM variables to allow the functional component to react to changes parametrically in OBM.
  - Variables exposed
    - Cap Length
    - Cap Slope
    - Footing Reference Distance



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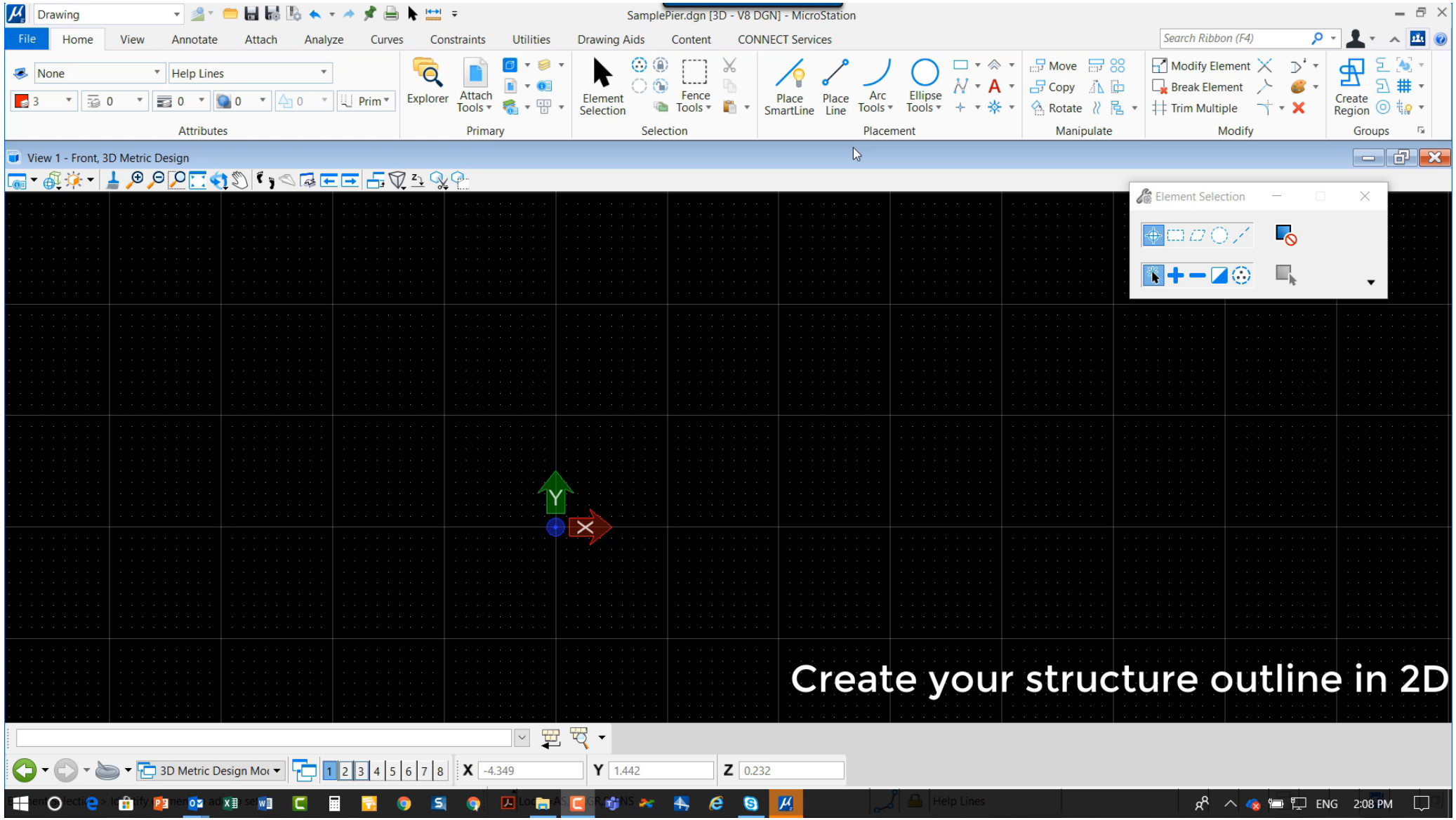
Creating a Bridge Functional Component



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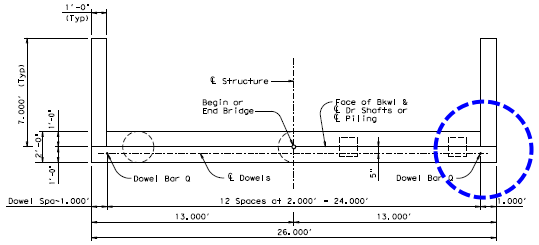
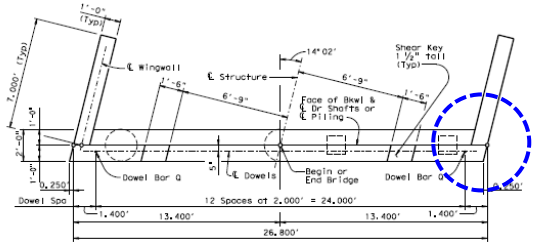
Using Parametric Models in Abutments

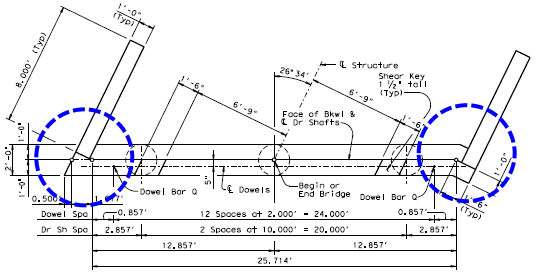
Case 1



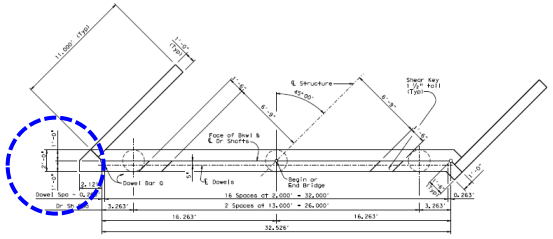
Case 2 and Case 5

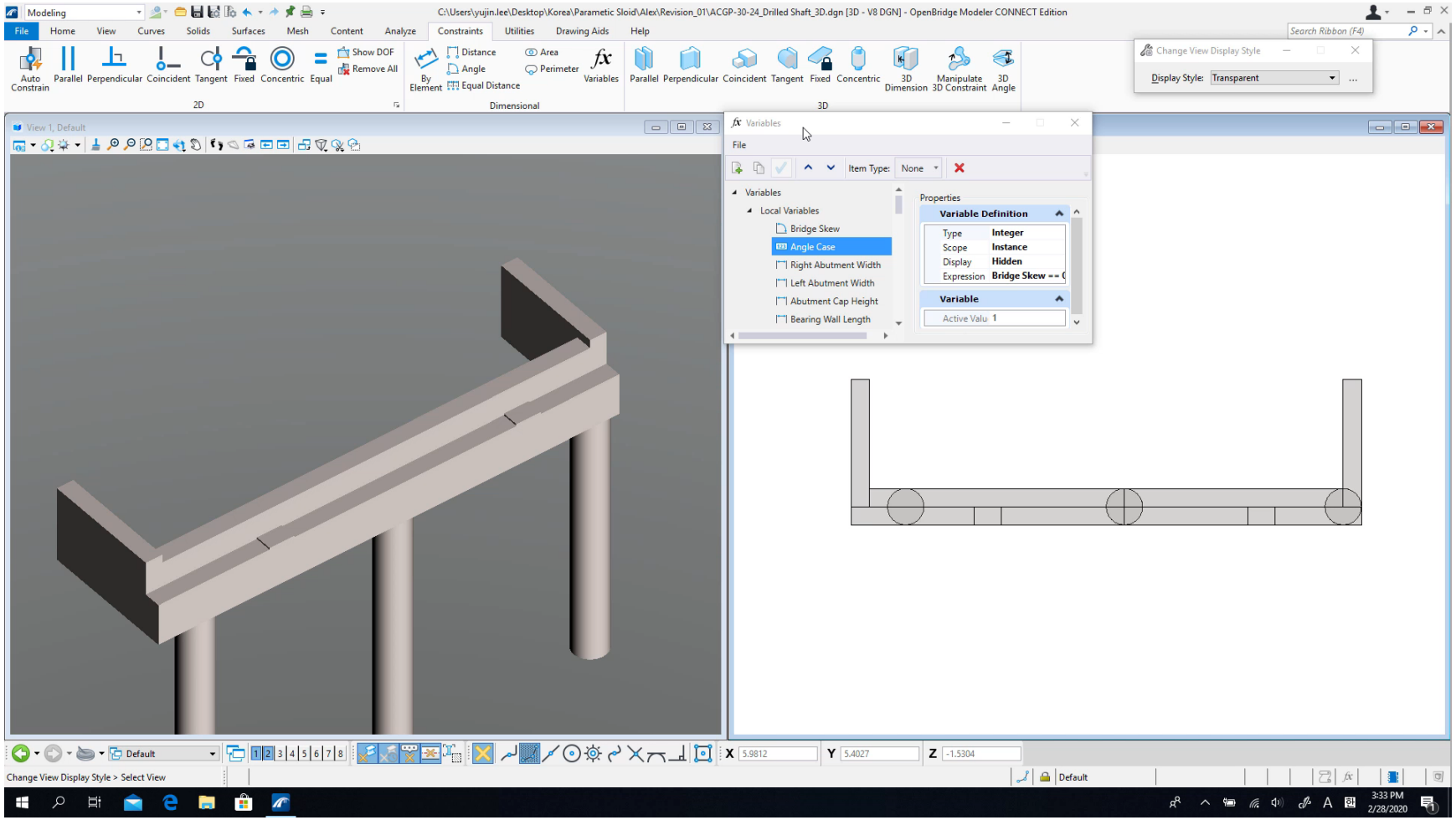


Case 3 and Case 6



Case 4 and Case 7





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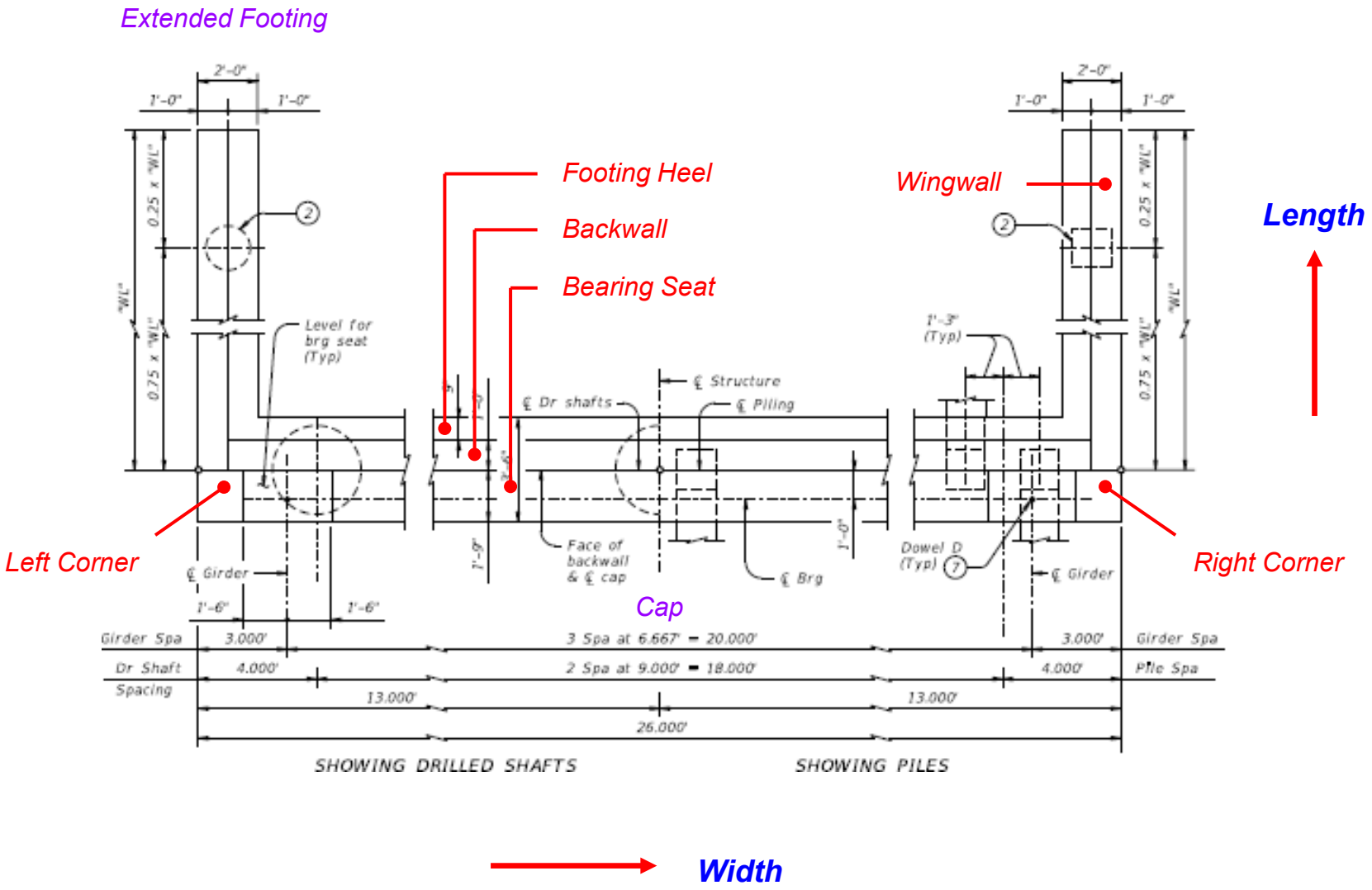
Modeling Description for the Custom Abutment



Bridge Skew Angles

(1) 0

(2) 0.1 ~ 15.0

(3) 15.1 ~ 30.0

(4) -0.1 ~ -15.0

(5) -15.1 ~ -30.0

Pile Type

Ignored Pile arrangement.

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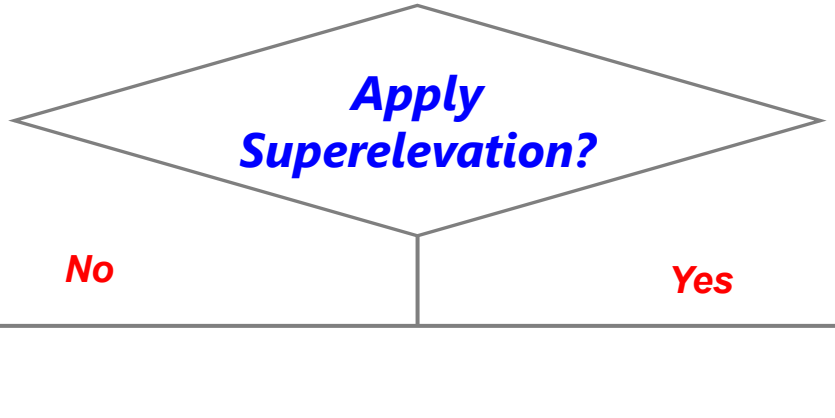
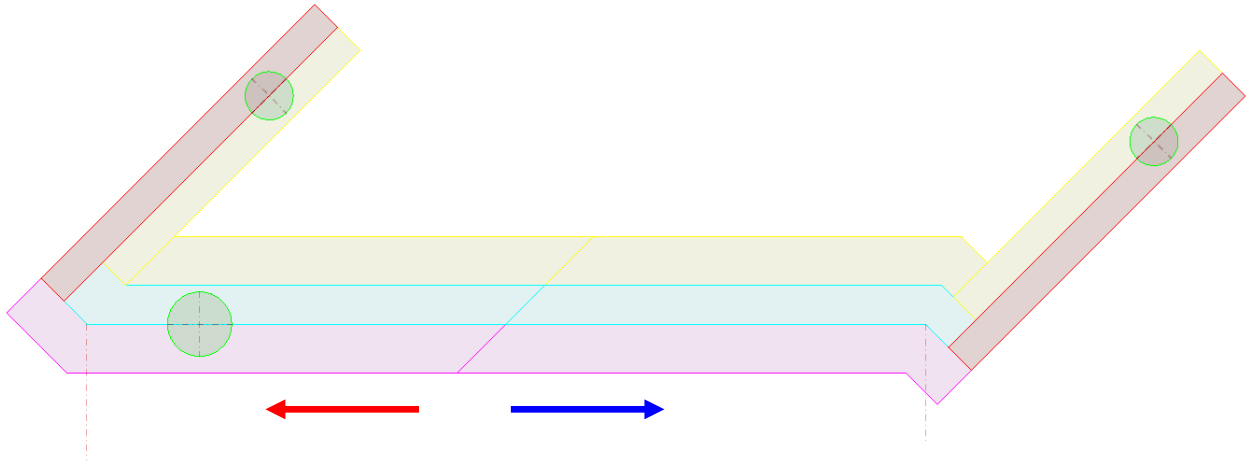
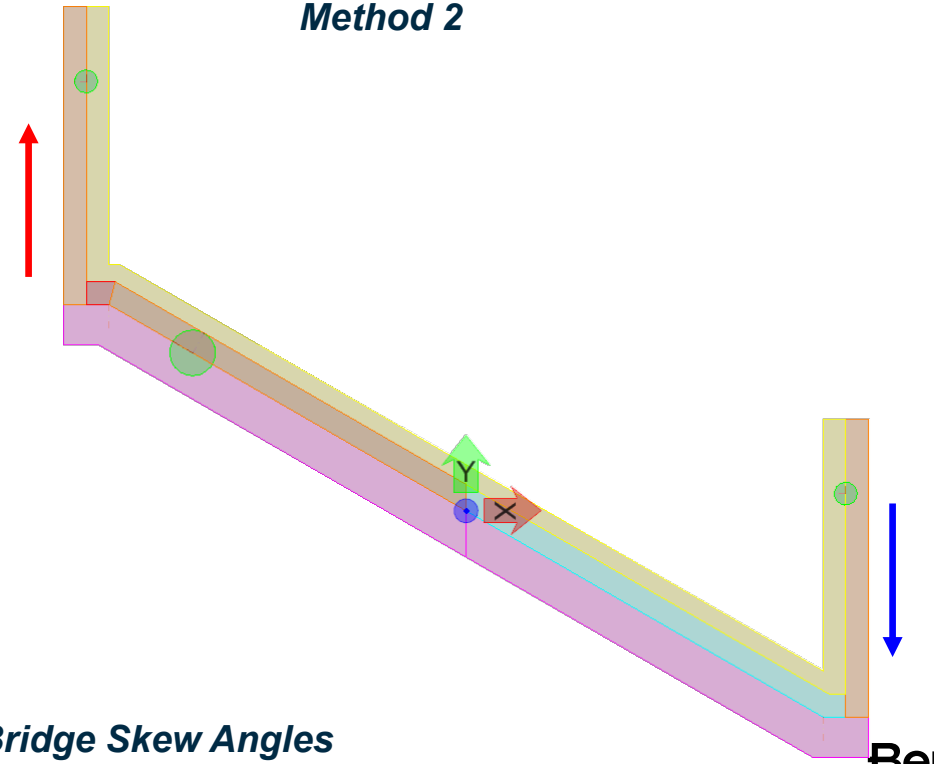
Modeling Methods for the Abutment



Method 1



Method 2



Movement Directions due to Bridge Skew Angles

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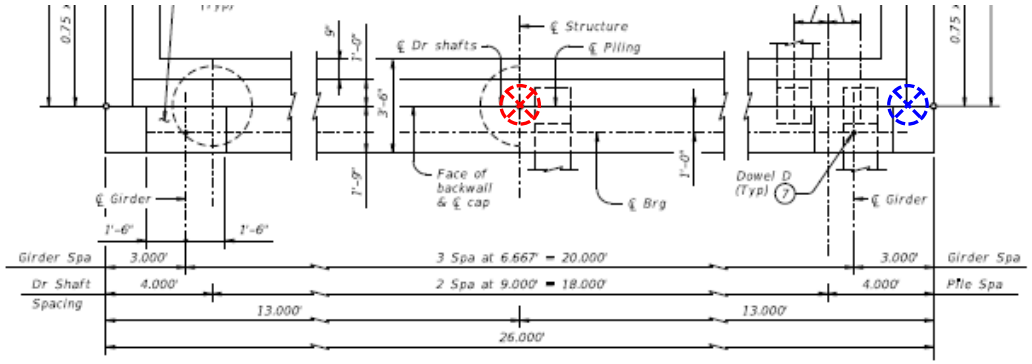
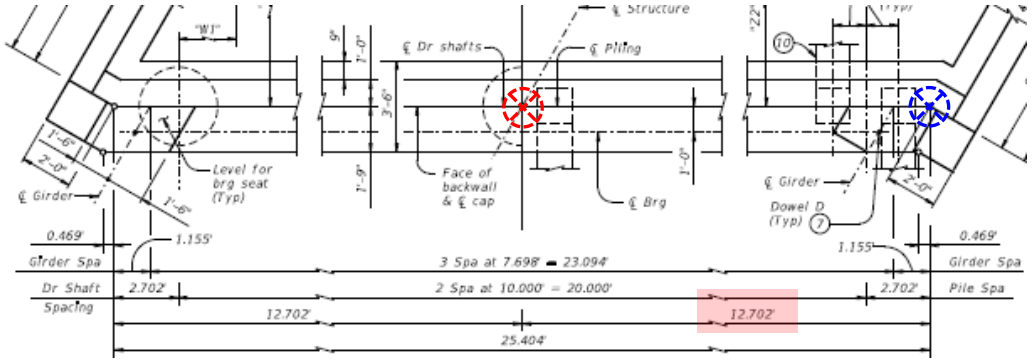
Backwall Width Definition

Skew Angle = 0



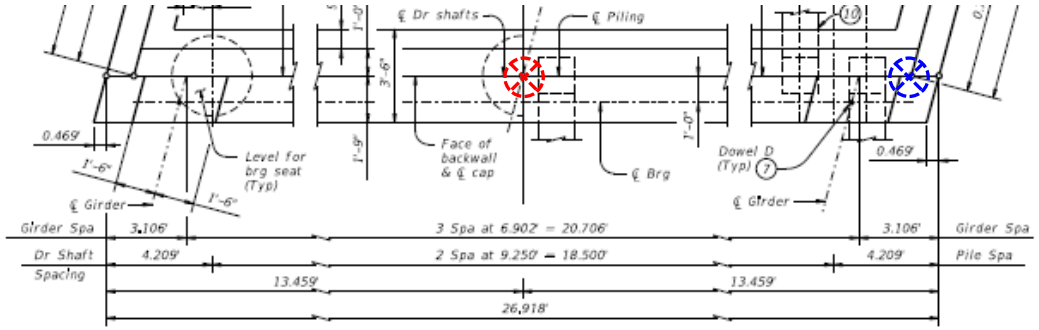
Roadway Width / 2 – Wingwall Thickness = 12.000'

Skew Angle = 30



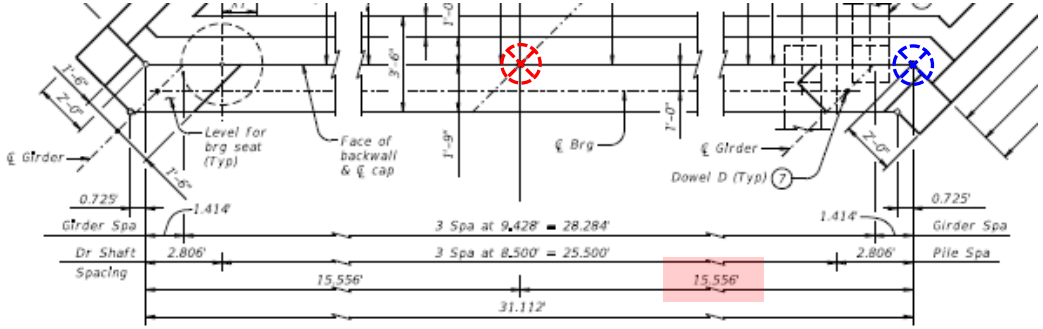
(Roadway Width / 2 – Extended Footing Width) / cos(Skew Angle) = 12.702'

Skew Angle = 15



(Roadway Width / 2 – Wingwall Thickness) / cos(Skew Angle) = 12.423'

Skew Angle = 45



(Roadway Width / 2 – Extended Footing Width) / cos(Skew Angle) = 15.556'

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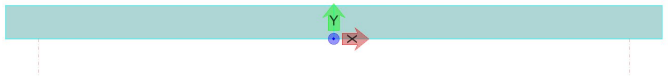
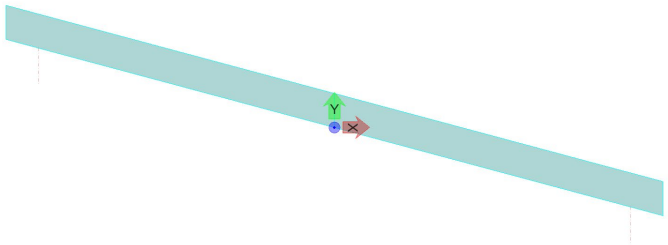
Bridge Skew Angle Cases

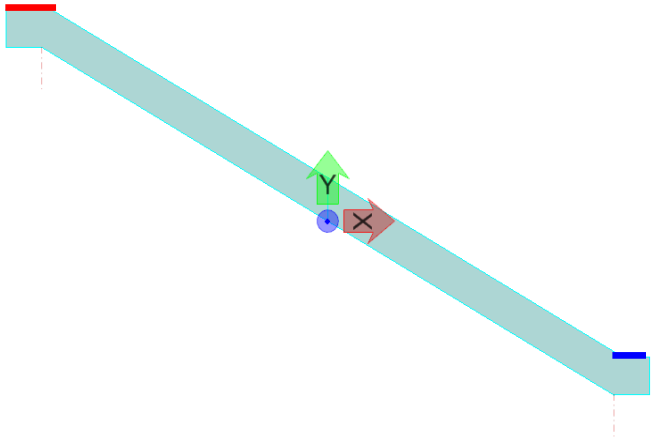
Case 1 for Skew Angle = 0



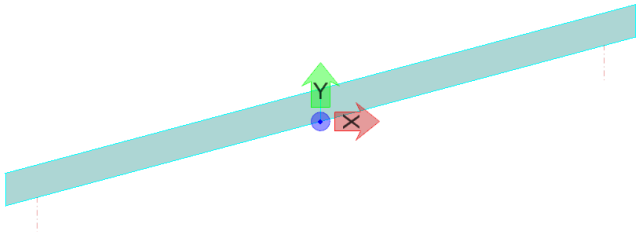
Case 2 for 0 < Skew Angle ≤ 15



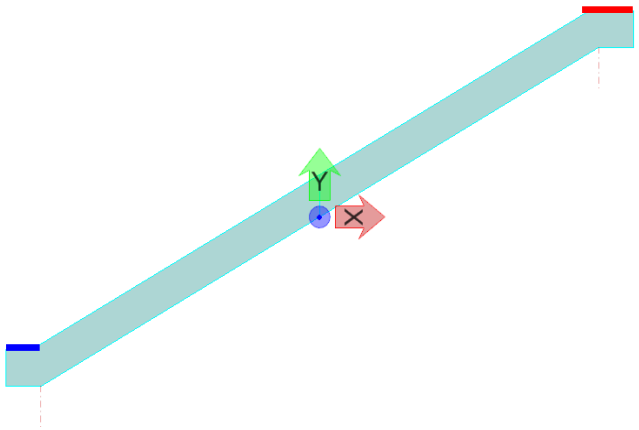
Case 3 for Skew Angle > 0 and Skew Angle > 15



Case 4 for Skew Angle < 0 and ABS(Skew Angle) ≤ 15



Case 5 for Skew Angle < 0 and ABS(Skew Angle) > 15



Conditional statement ? True : False

Skew Angle == 0 ? 1 : (Skew Angle > 0 && Skew Angle <= 15) ? 2 : (Skew Angle > 0 && Skew Angle > 15) ? 3 : (Skew Angle < 0 && abs(Skew Angle) <= 15) ? 4 : 5

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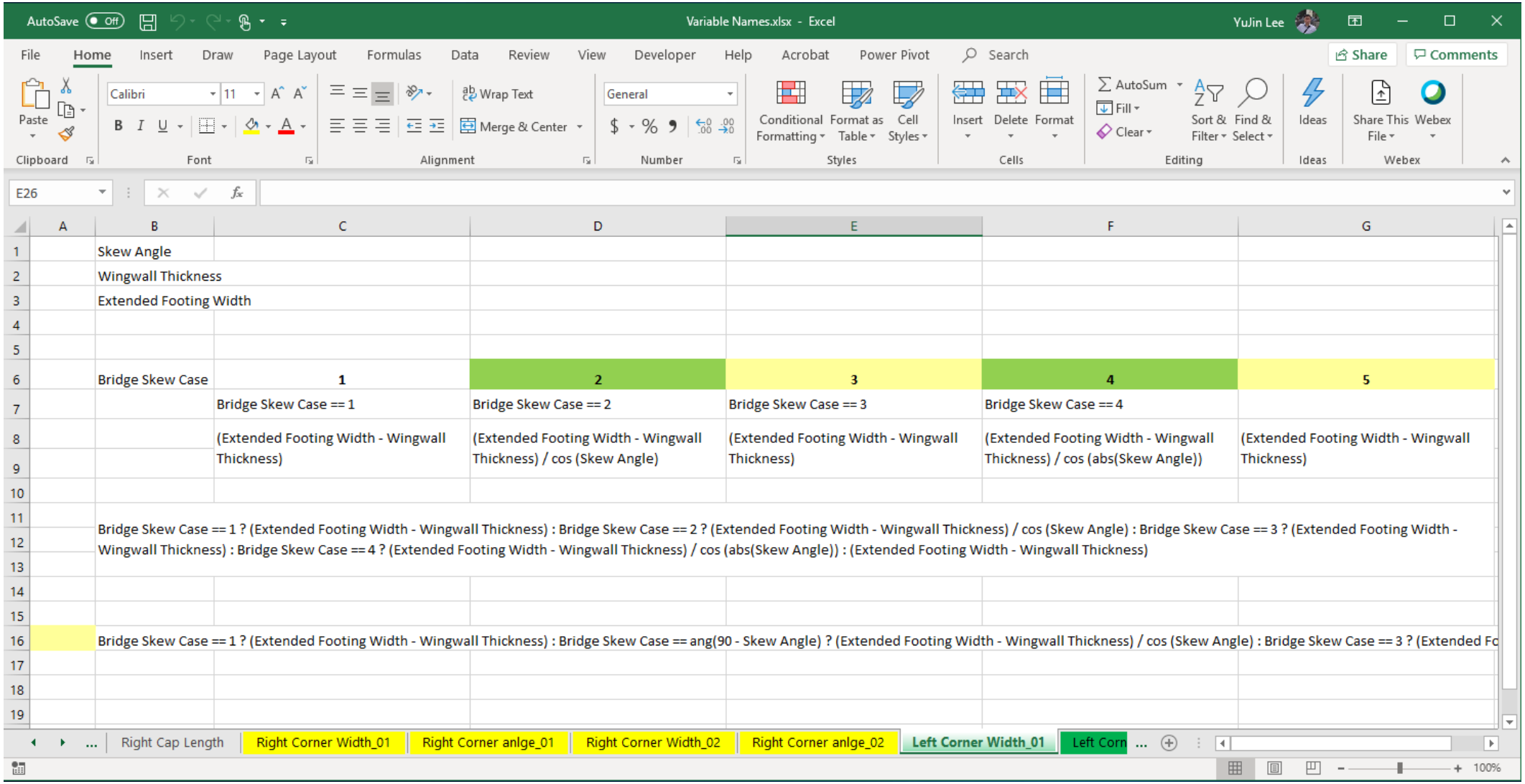
Variable Names Summary in Excel



	A	B	C	D	E	F	G
1		Skew Angle					
2		Wingwall Thickness					
3		Extended Footing Width					
4							
5							
6		Bridge Skew Case	1	2	3	4	5
7			Bridge Skew Case == 1	Bridge Skew Case == 2	Bridge Skew Case == 3	Bridge Skew Case == 4	
8			(Extended Footing Width - Wingwall Thickness)	(Extended Footing Width - Wingwall Thickness) / cos (Skew Angle)	(Extended Footing Width - Wingwall Thickness)	(Extended Footing Width - Wingwall Thickness) / cos (abs(Skew Angle))	(Extended Footing Width - Wingwall Thickness)
9							
10							
11		Bridge Skew Case == 1 ? (Extended Footing Width - Wingwall Thickness) : Bridge Skew Case == 2 ? (Extended Footing Width - Wingwall Thickness) / cos (Skew Angle) : Bridge Skew Case == 3 ? (Extended Footing Width - Wingwall Thickness) : Bridge Skew Case == 4 ? (Extended Footing Width - Wingwall Thickness) / cos (abs(Skew Angle)) : (Extended Footing Width - Wingwall Thickness)					
12							
13							
14							
15							
16		Bridge Skew Case == 1 ? (Extended Footing Width - Wingwall Thickness) : Bridge Skew Case == ang(90 - Skew Angle) ? (Extended Footing Width - Wingwall Thickness) / cos (Skew Angle) : Bridge Skew Case == 3 ? (Extended Fc					
17							
18							
19							

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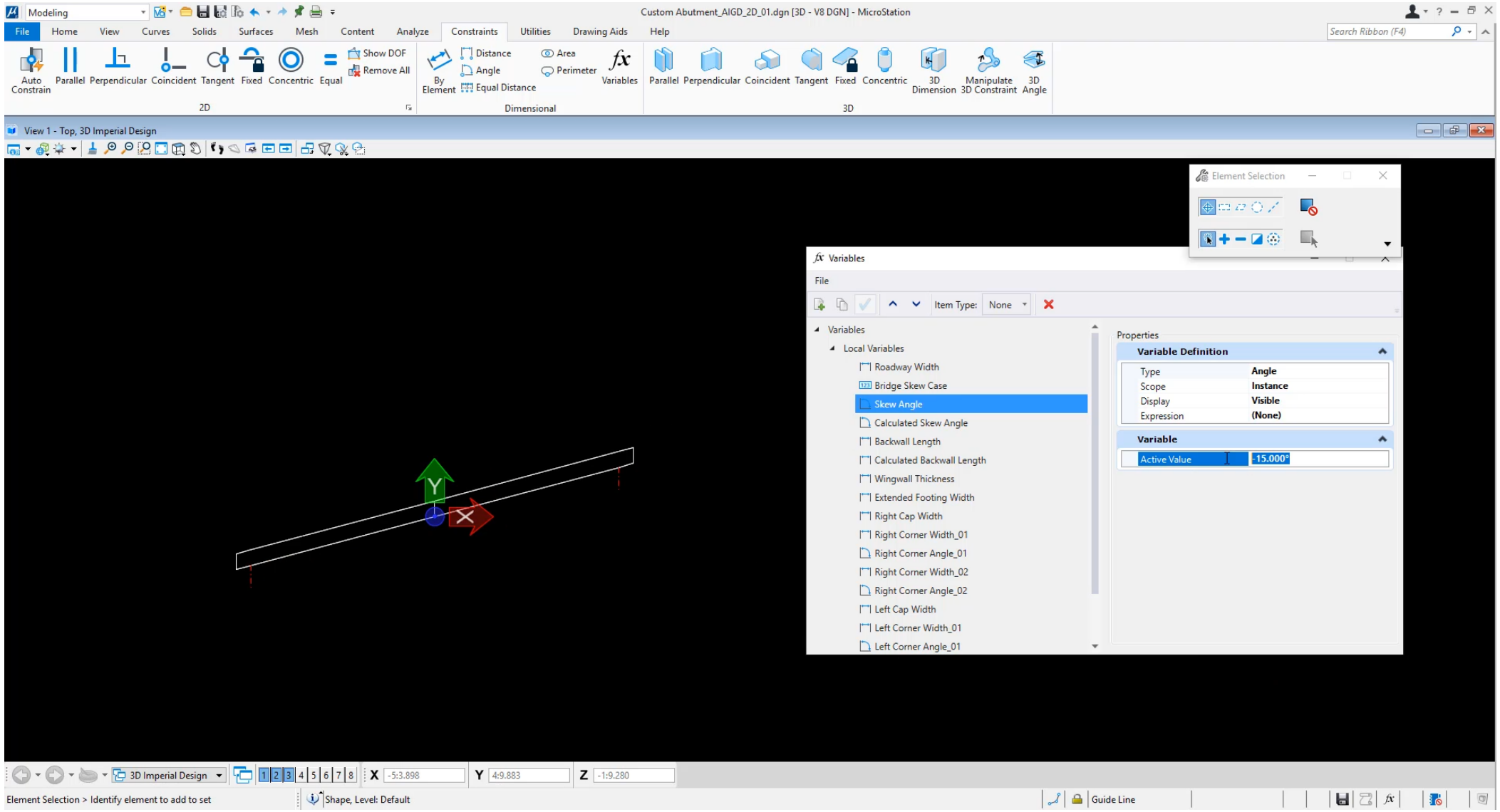
Backwall 2D Plan



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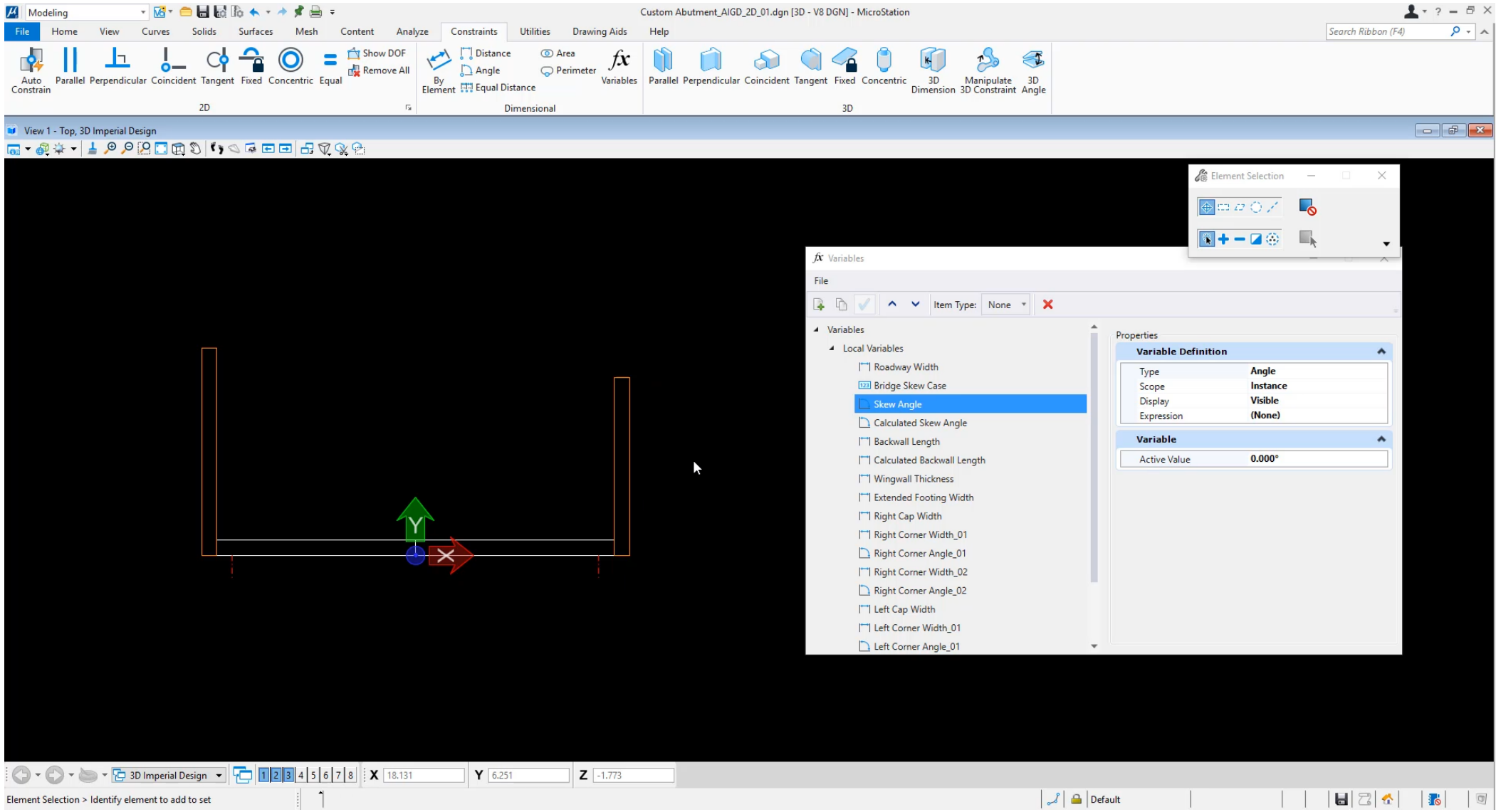
Wingwall 2D Plan



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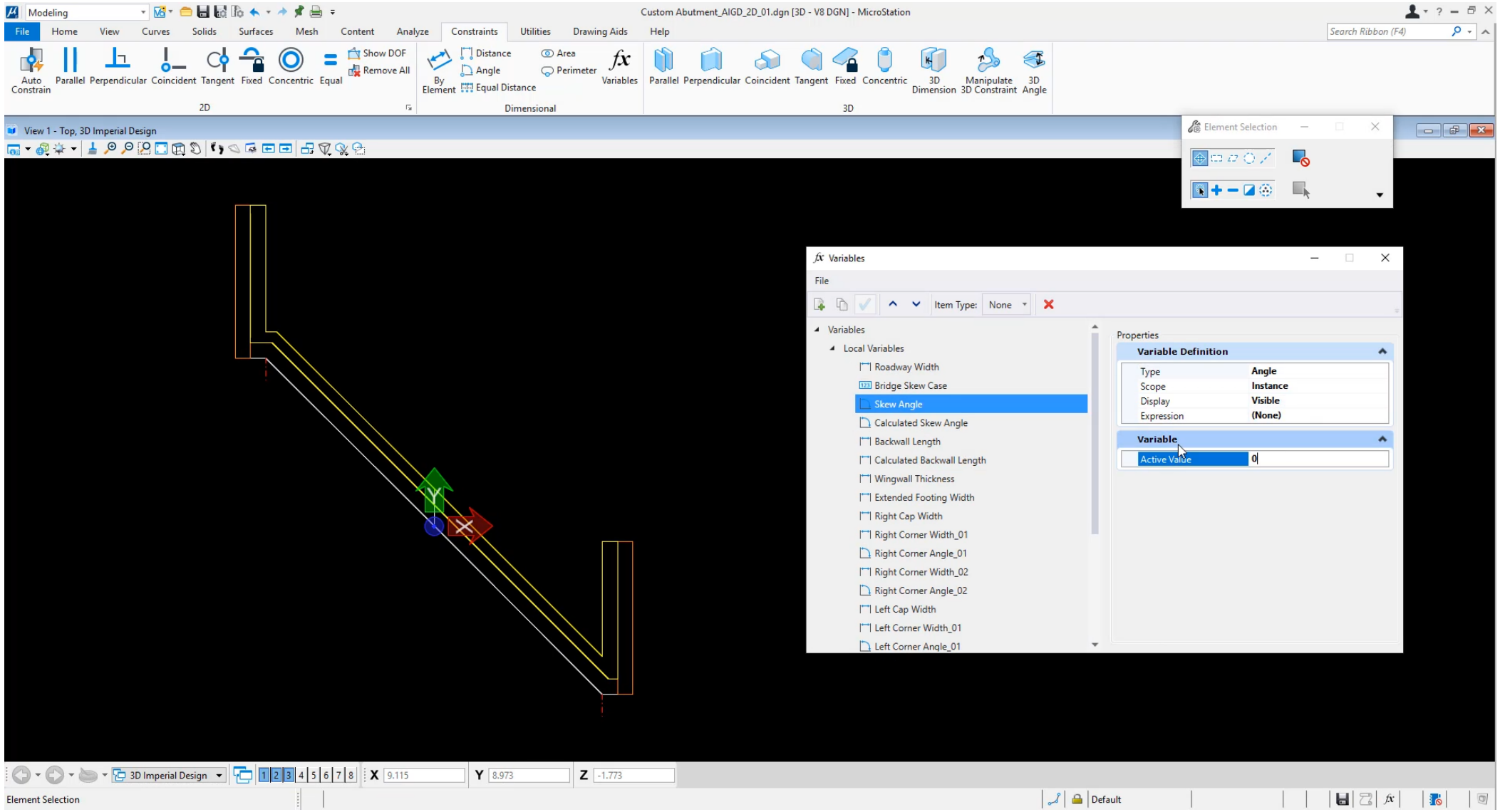
Footing Heel 2D Plan



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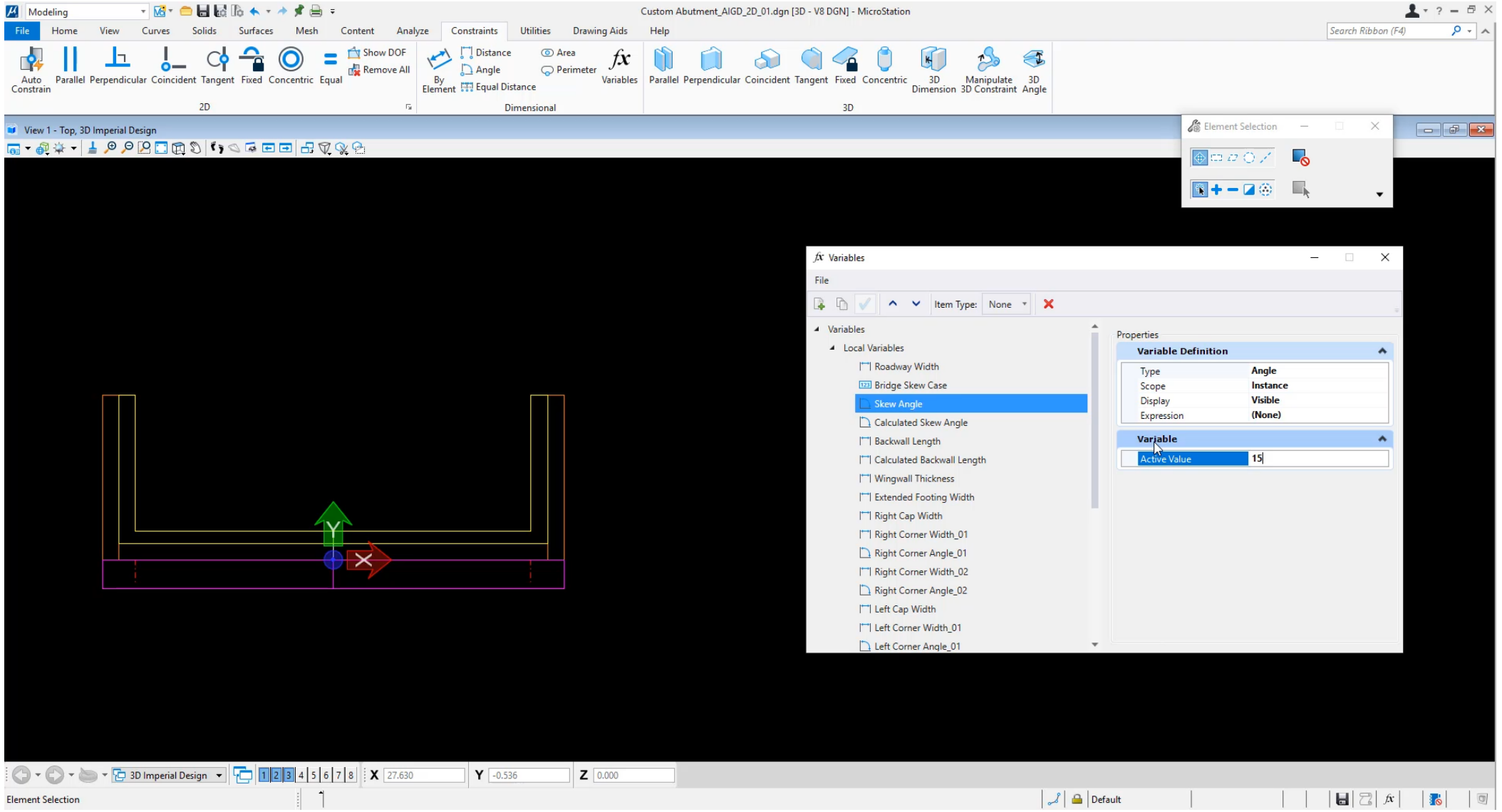
Bearing Seat 2D Plan



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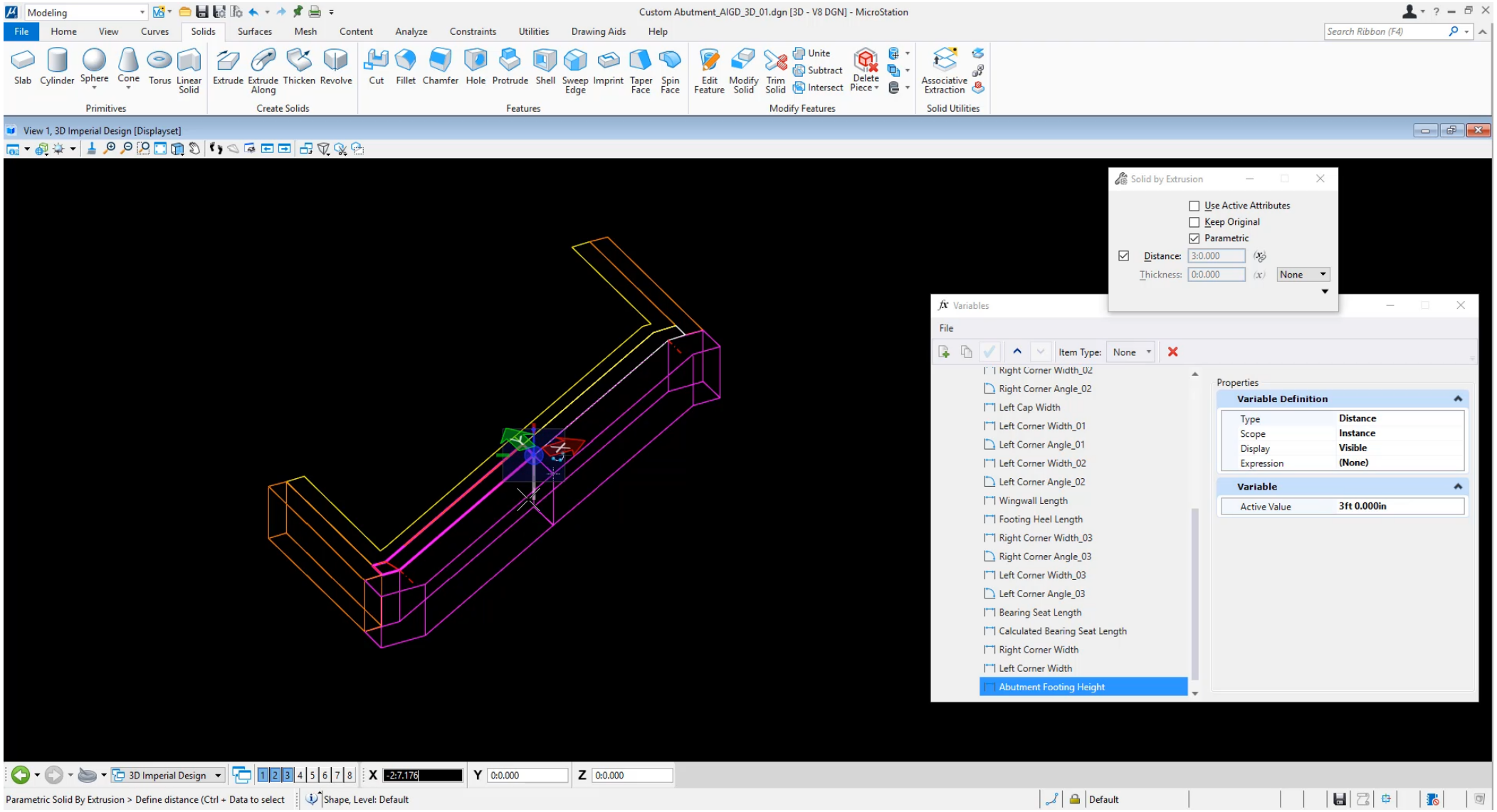
Extrude 3D for Footing



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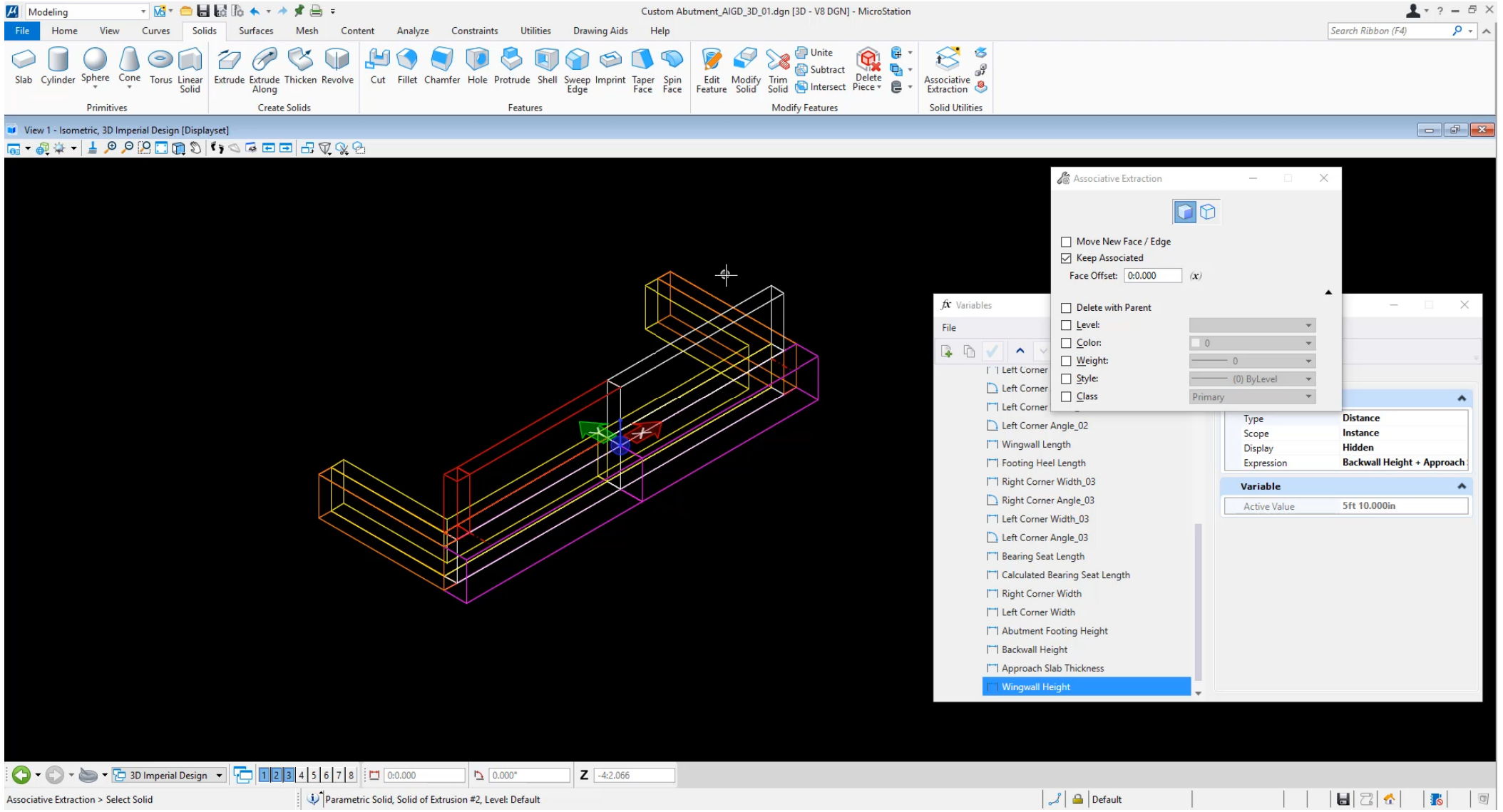
Extrude 3D for Backwall and Wingwall



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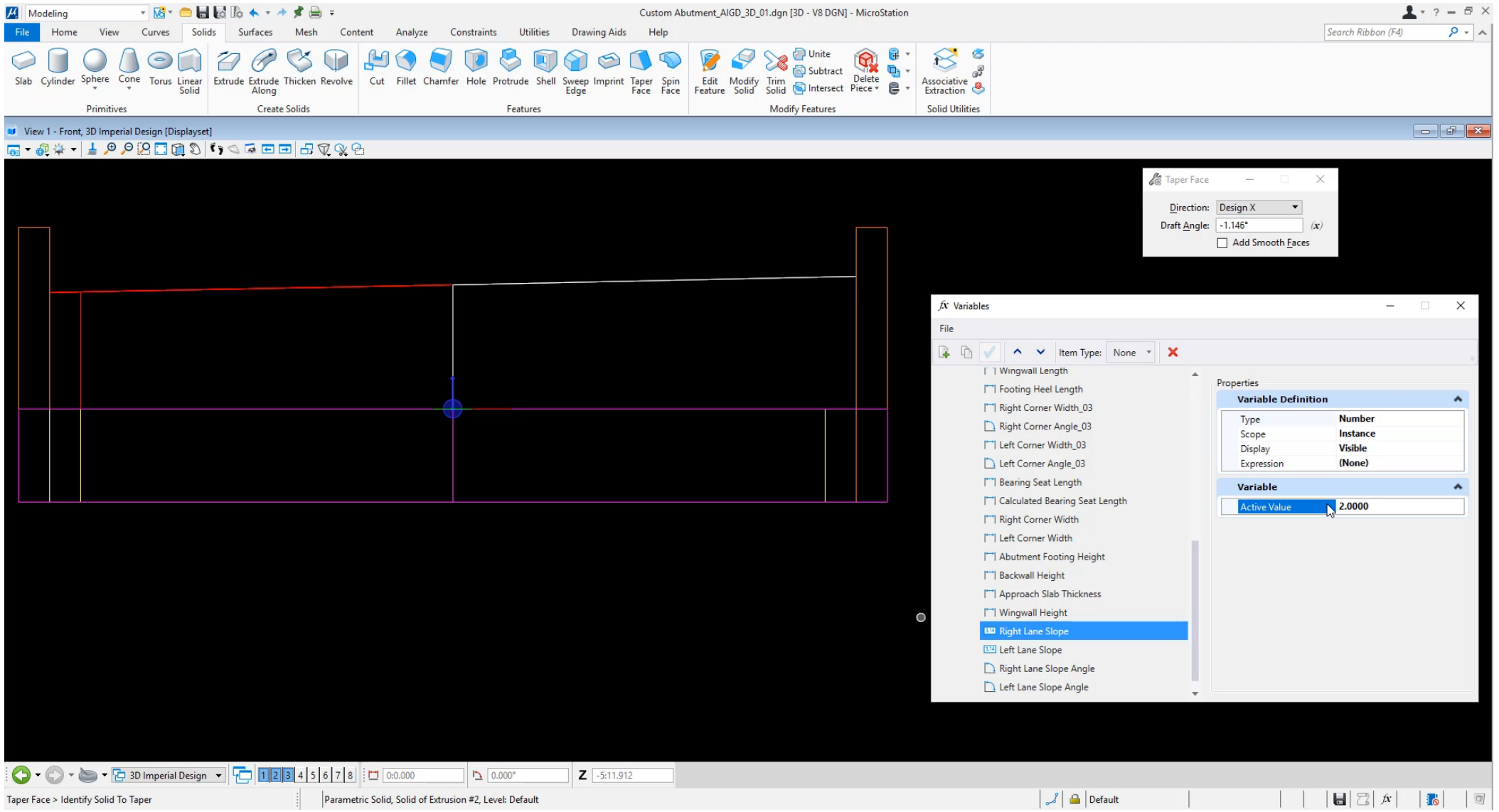
Assign Superelevation



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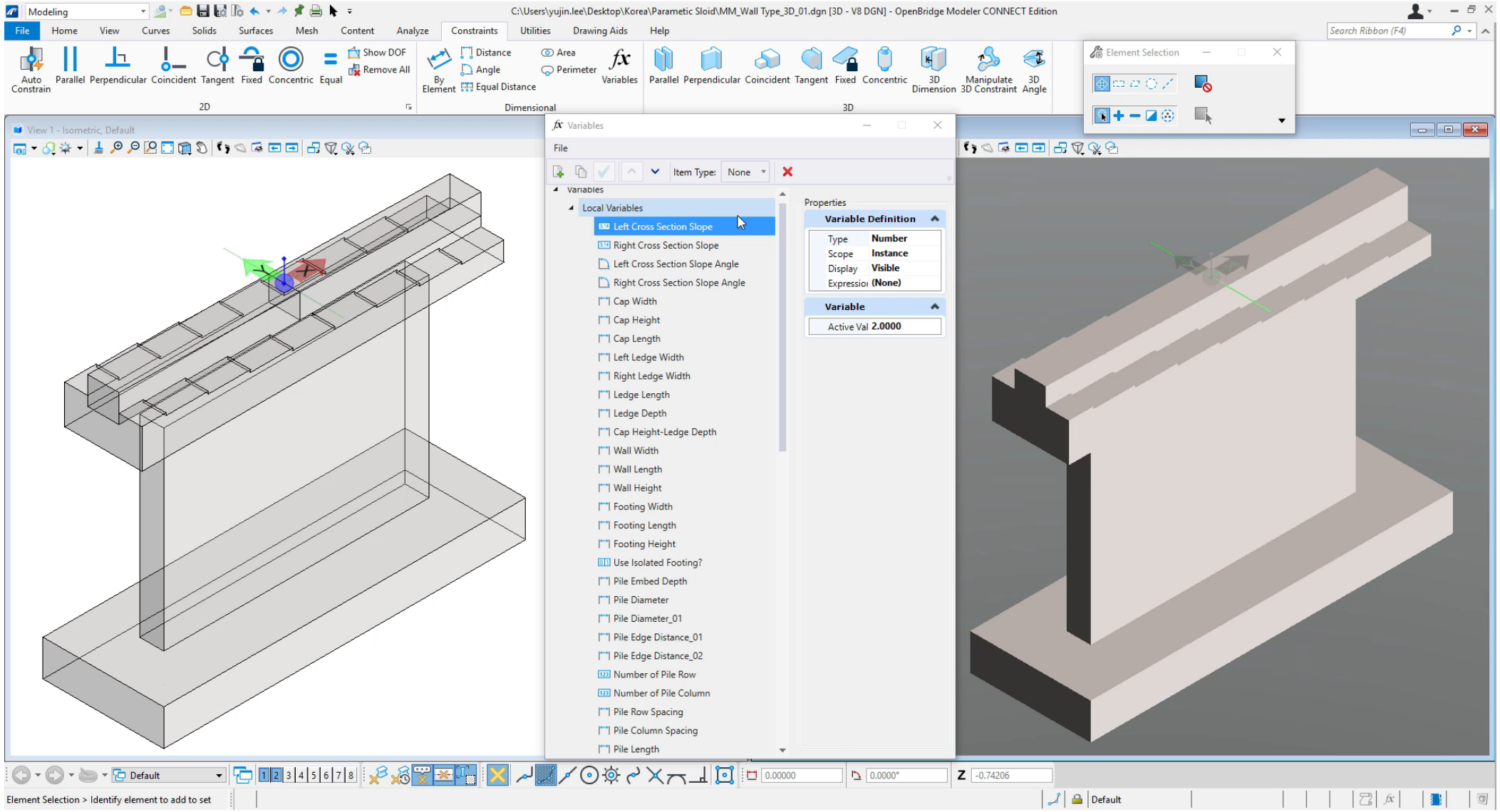
Piers as Functional Components



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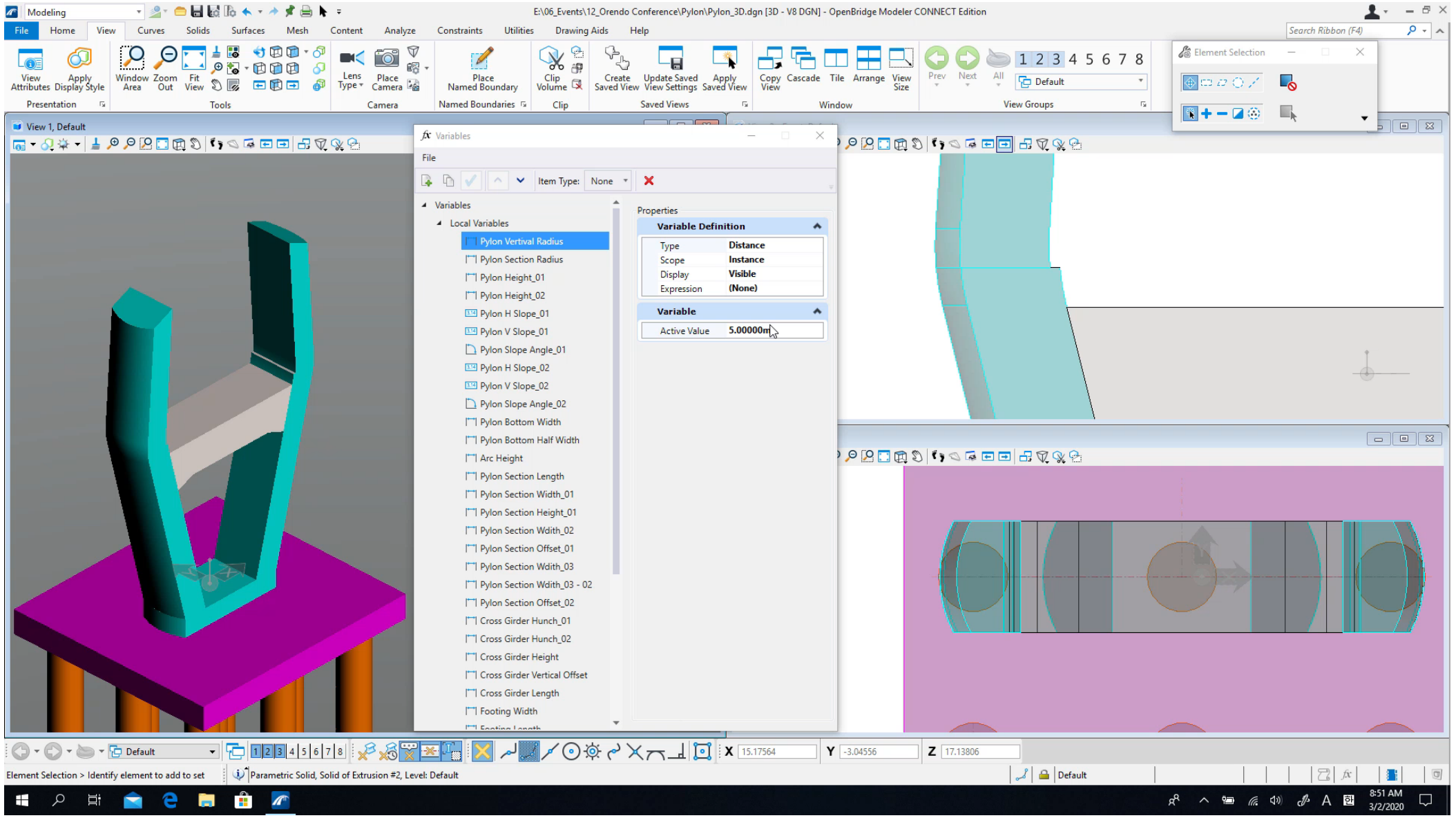
Pylons as Functional Components



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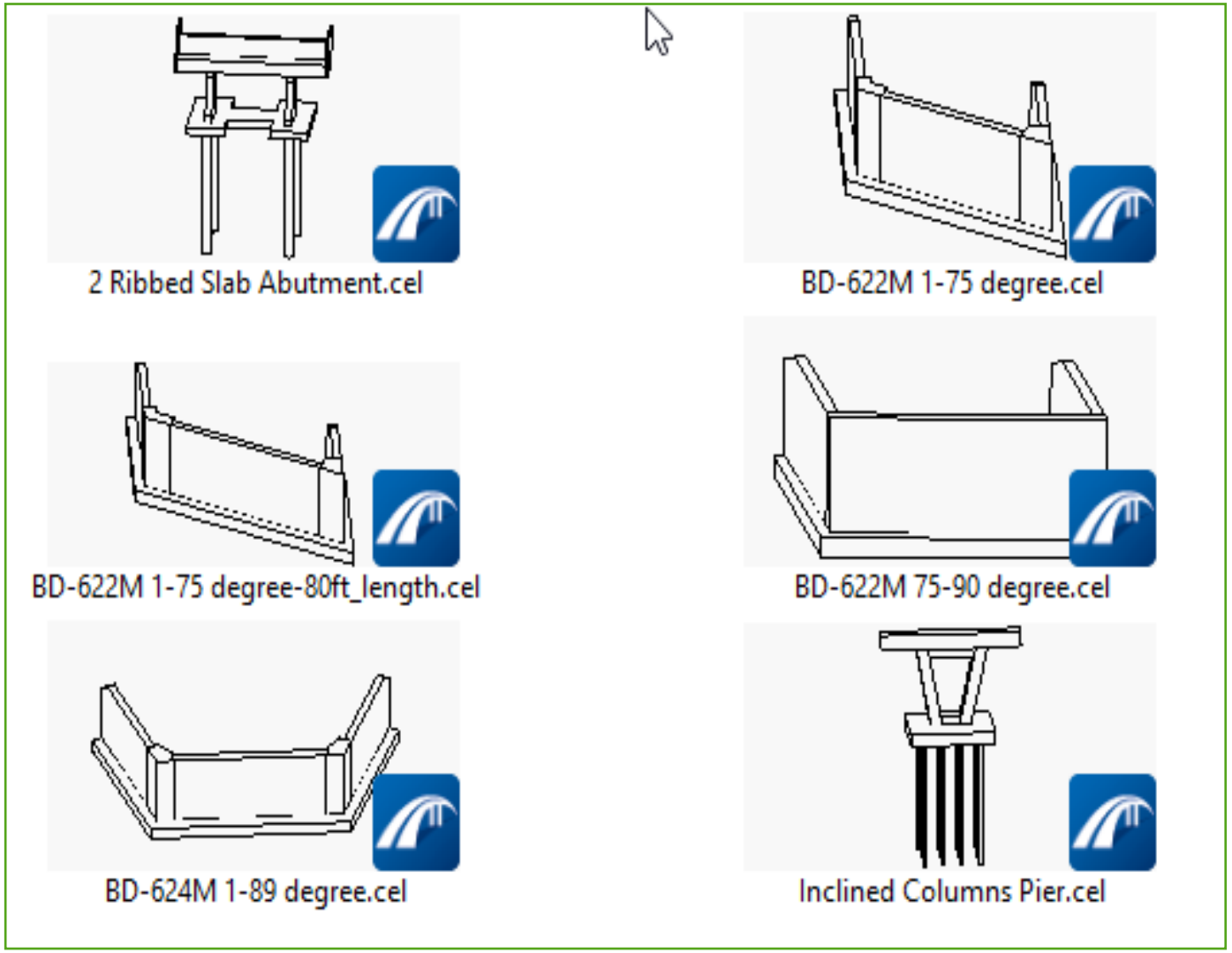
Library of Functional Components

- Install Path
  - C:\ProgramData\Bentley\OpenBridge Modeler CE10.12\Configuration\Organization-Civil_Bridge Default Standards - Imperial\OpenBridge Modeler\Bridge Templates\Functional Components
- Parametric Cells:
  - Inclined Columns Pier
  - Flared Wing Wall Abutment (< 75 degrees)
  - Flared Wing Wall Abutment (75-90 degrees)
  - U Type Abutment (2)
  - Ribbed Slab Abutment (China)



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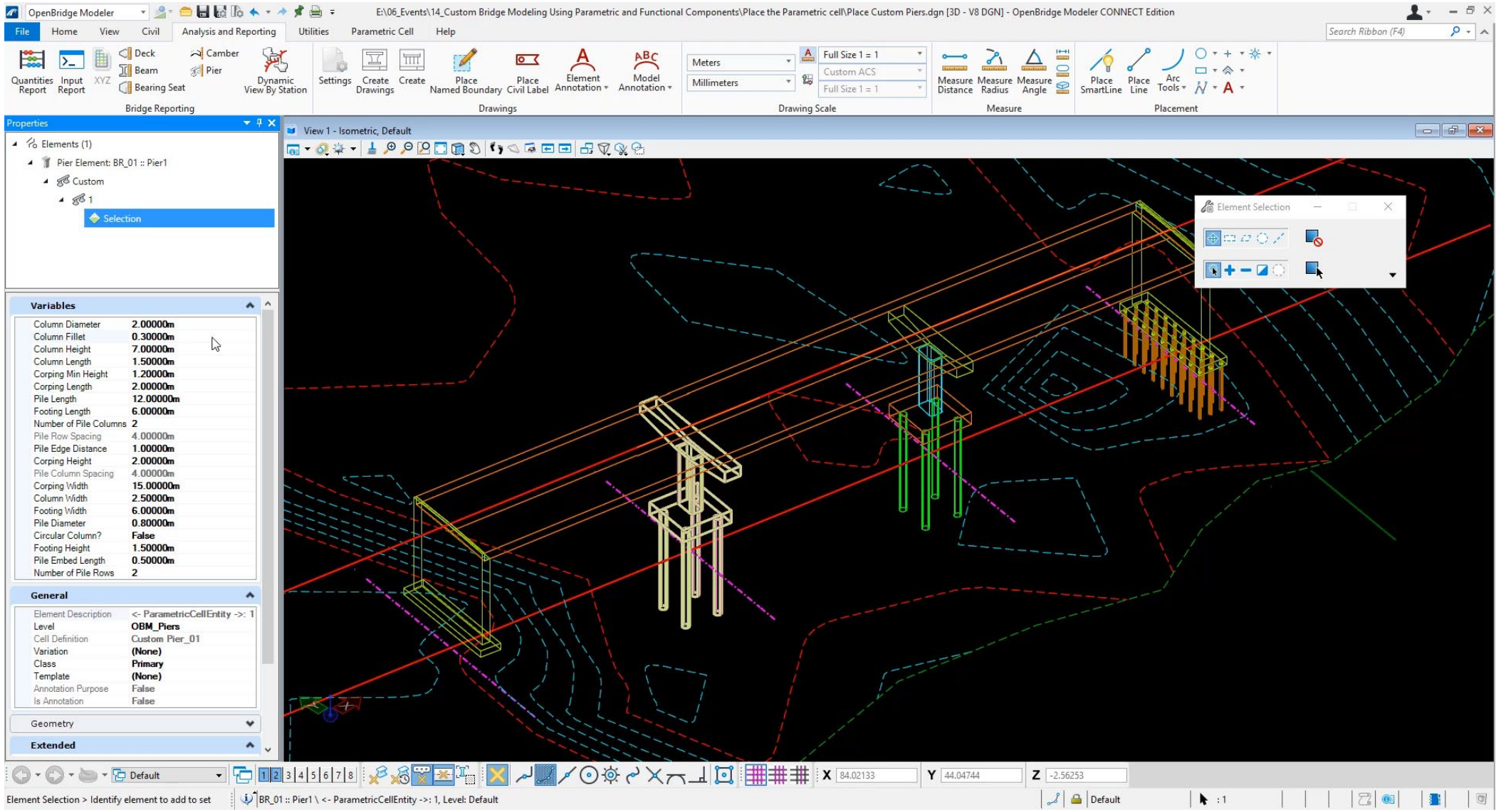
Place Custom Piers



Q&A

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