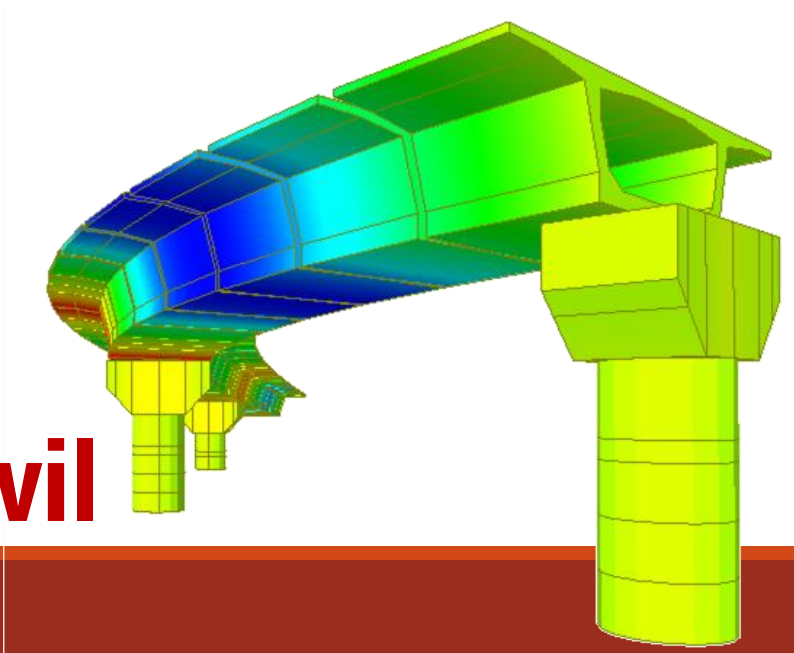
Three- Span Continuous Horizontally Curved Composite Steel TUB Girder Bridge

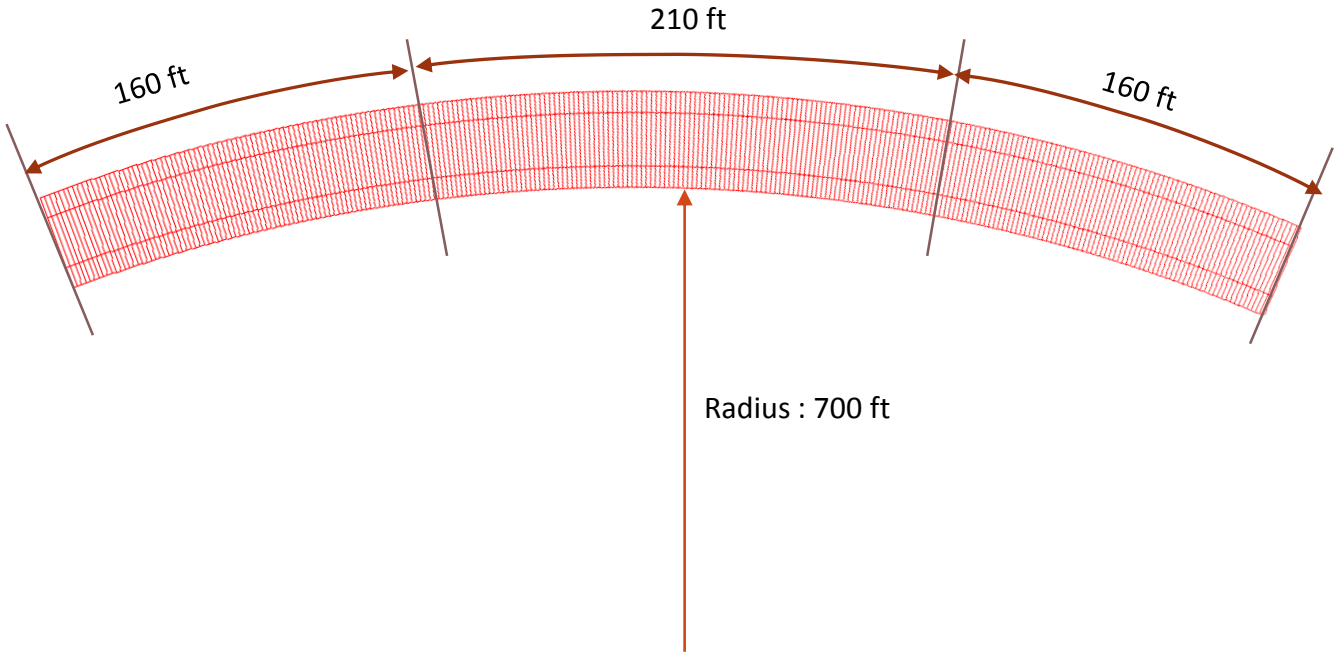
WIZARD, ANALYSIS AND DESIGN

Contents



midas Civil

Bridge Information

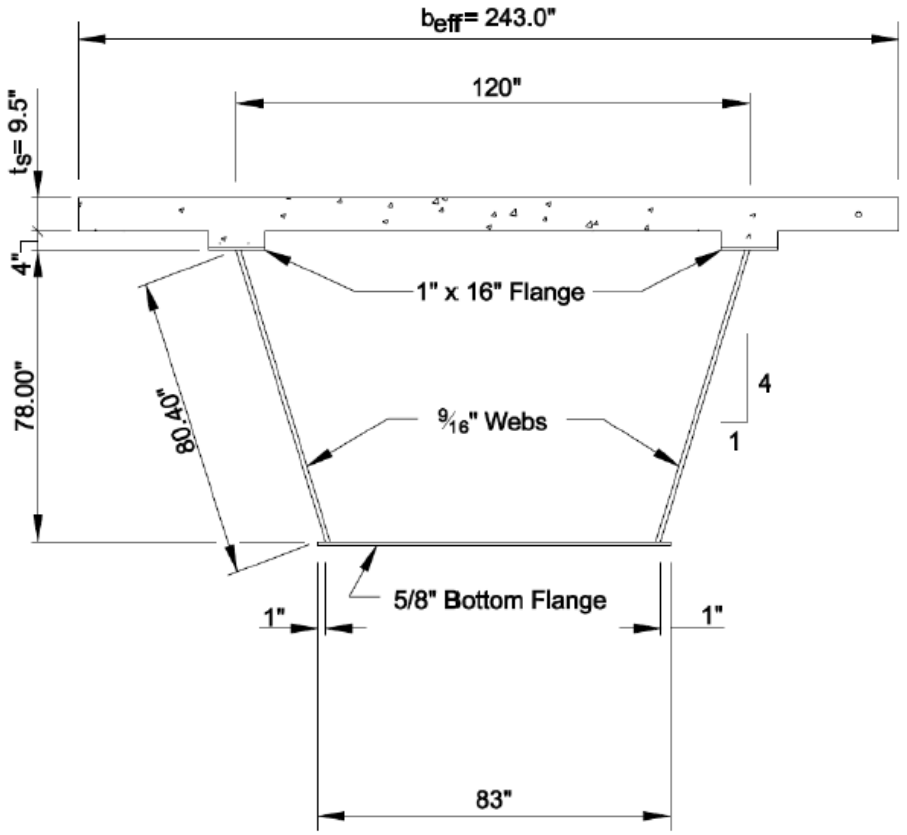

210 ft
160 ft
160 ft
Radius : 700 ft

Material Properties

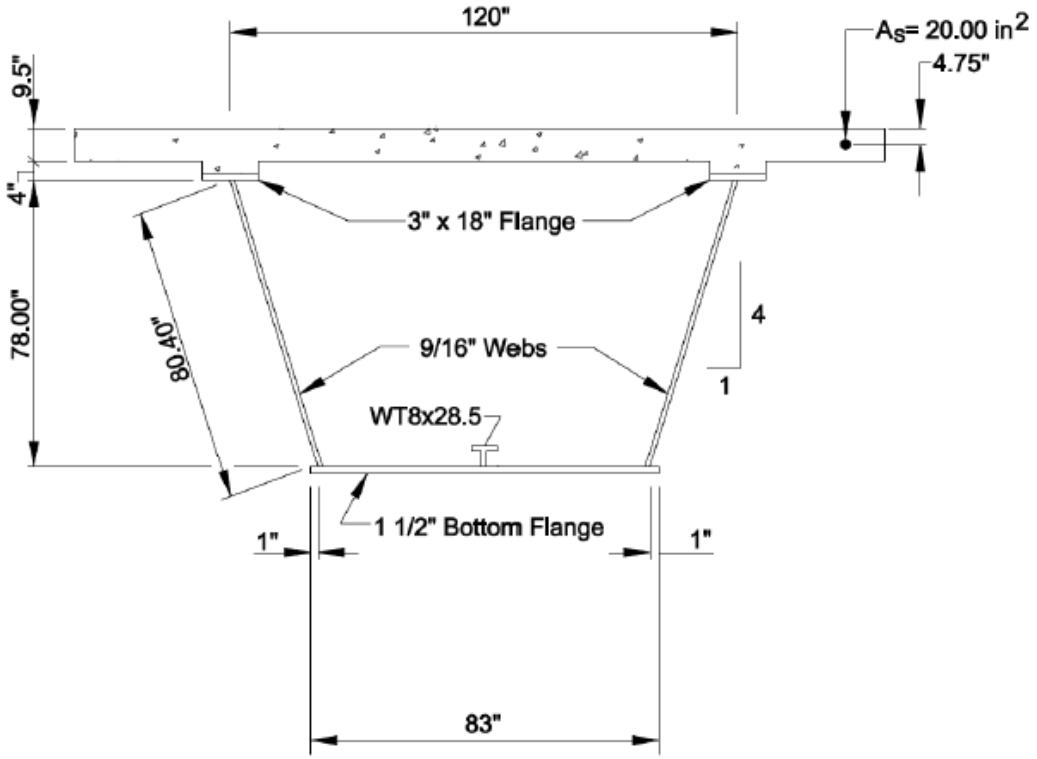
Structural Steel :	Grade 50W (ASTM A709)
Concrete :	f'c = 4.0 ksi
Slab Reinforcing Steel :	Grade 60 with Fy = 60ksi

Loadings on the Bridge

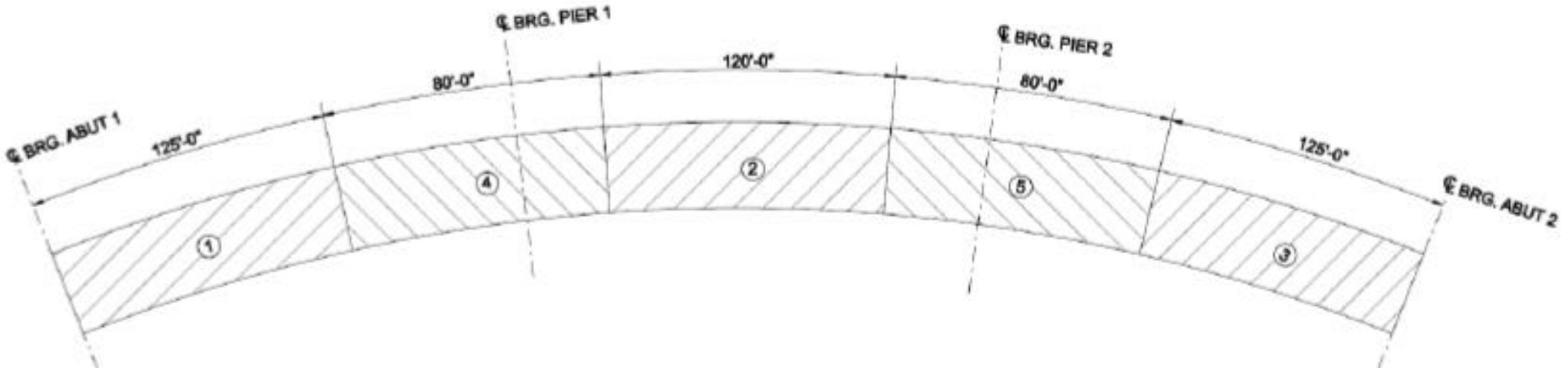
Self Weight of the Bridge
Live Load : Three 12ft Traffic Lanes HL-93
Wearing Surface : 25 psf
Parapets/Barriers : 495 lb/ft



Section 1 : For Span 1 and 3

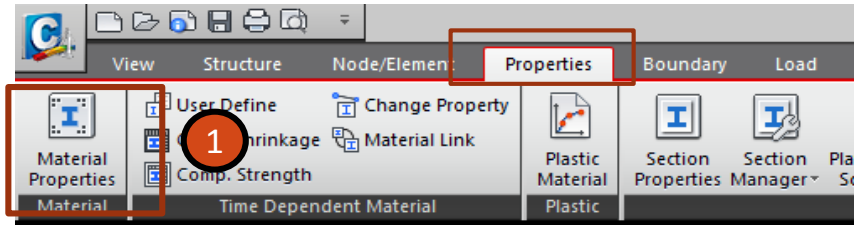


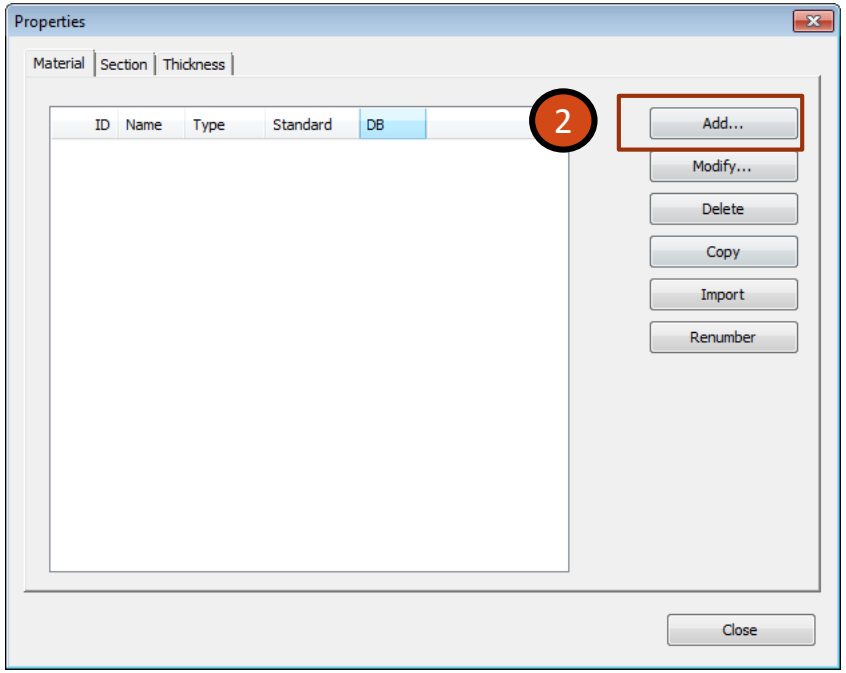
Section 2 : For Span 2

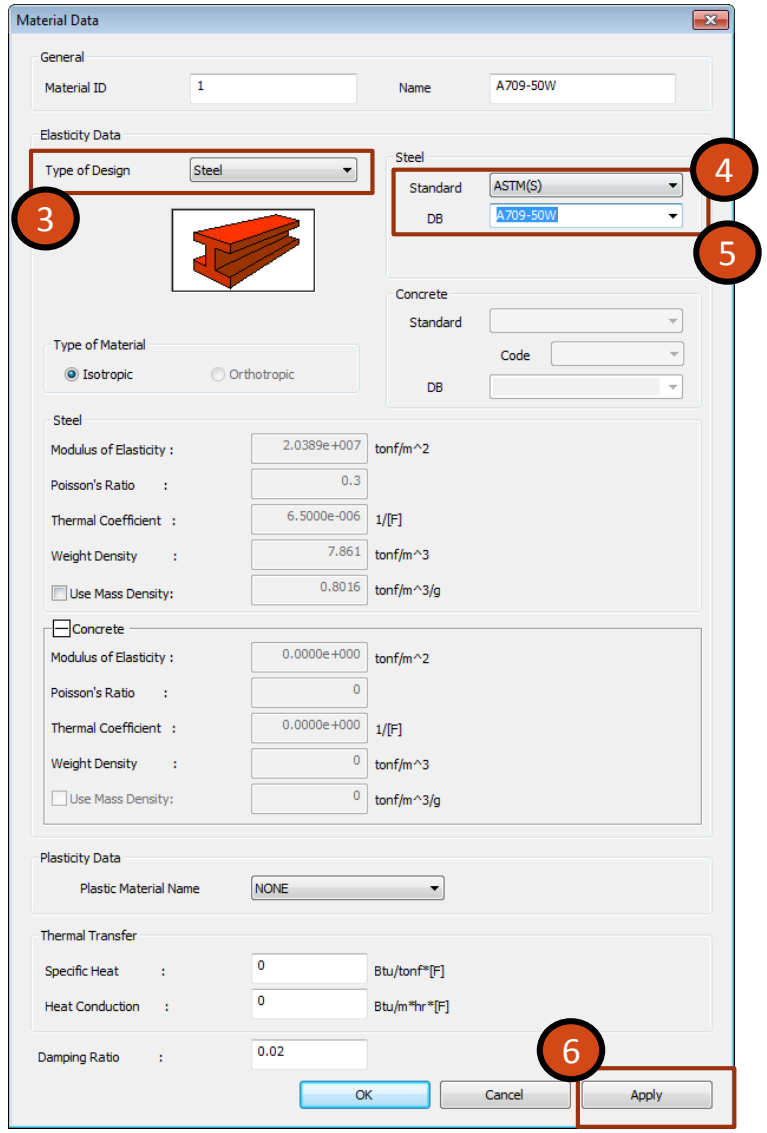

℄ BRG. ABUT 1
125'-0"
80'-0"
℄ BRG. PIER 1
120'-0"
℄ BRG. PIER 2
80'-0"
125'-0"
℄ BRG. ABUT 2
1
2
3
4
5

2. Material and Section Properties

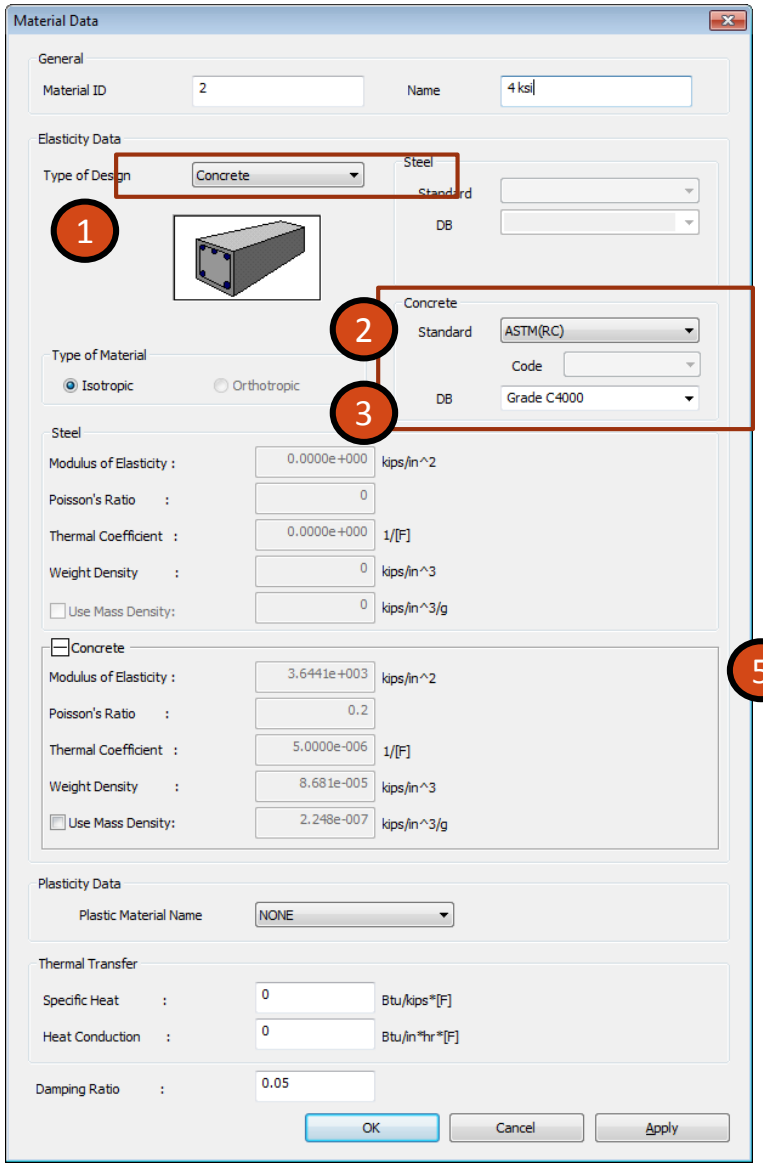
1. From the Ribbon Menu Go To **Properties > Material Properties**
2. Click on **Add**
3. From **Type of Design** choose **Steel**
4. Standard : **ASTM(S)**
5. DB : **A709-50W**
6. Click **Apply**

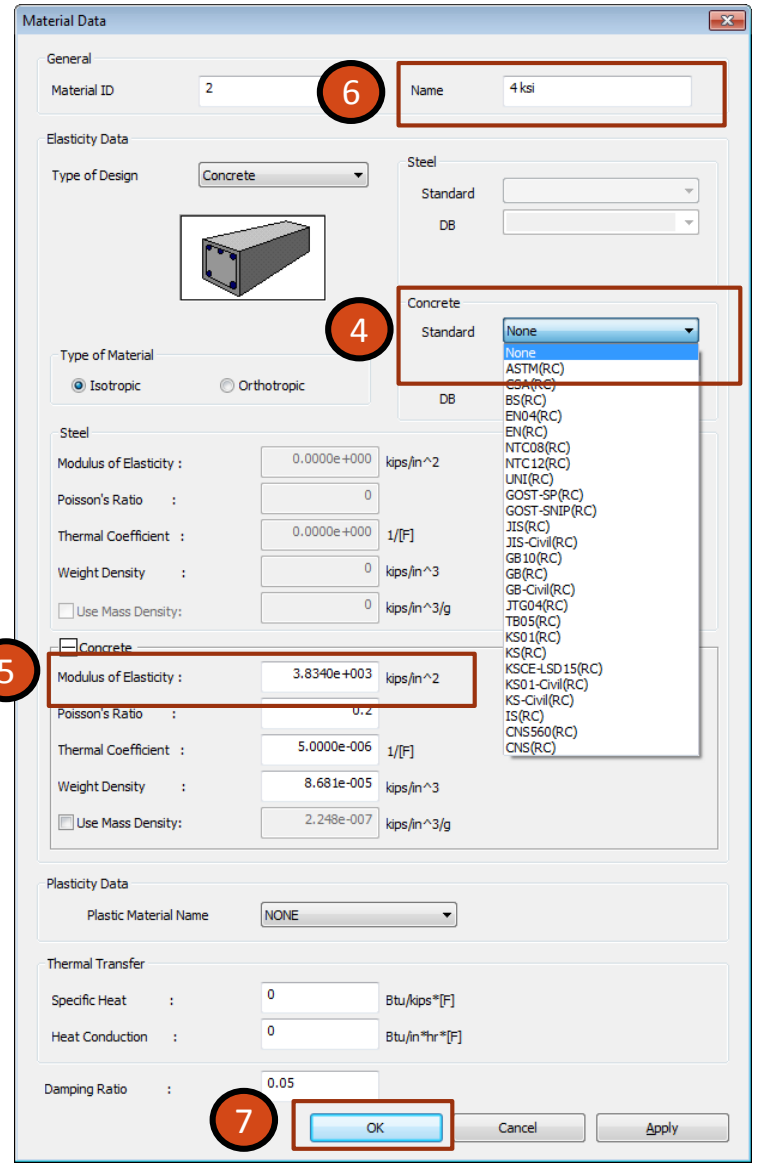






1. Type of Design : **Concrete**
2. Standard : **ASTM(RC)**
3. DB : **C4000**
4. Standard : **None**
5. Edit Modulus of Elasticity : 3.8340e+003 kips/in^2
6. Name : **4 ksi**
7. Click **OK**





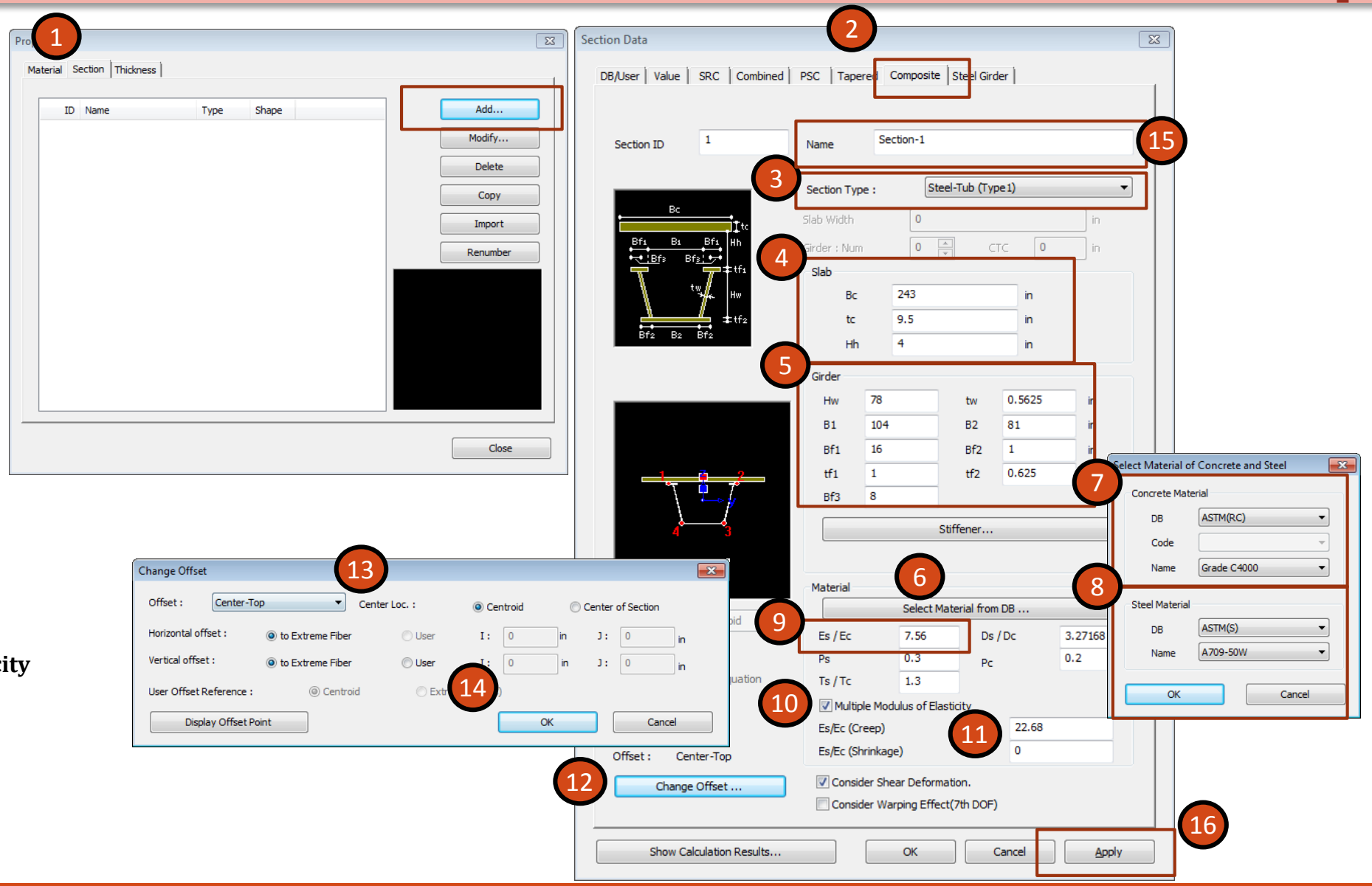
1. Go To : Section Tab > Add
2. Go To : Composite Tab
3. Section Type : Steel-Tub (Type-1)
4. Slab Information
   Bc : **243** in
   tc : **9.5** in
   Hh: **4** in

5. Girder Information
   Hw : **78**, B1: **104**, Bf1: **16**, tf1: **1**, Bf3: **8**
   tw: **.5625**, B2: **81**, Bf2: **1**, tf2: **.625**

6. Material > **Select Material from DB…**
7. Concrete Material :
   DB: **ASTM (RC)**, Name : **Grade C4000**

8. Steel Material :
   DB: **ASTM (S)**, Name : **A709-50W**
   Click **OK**

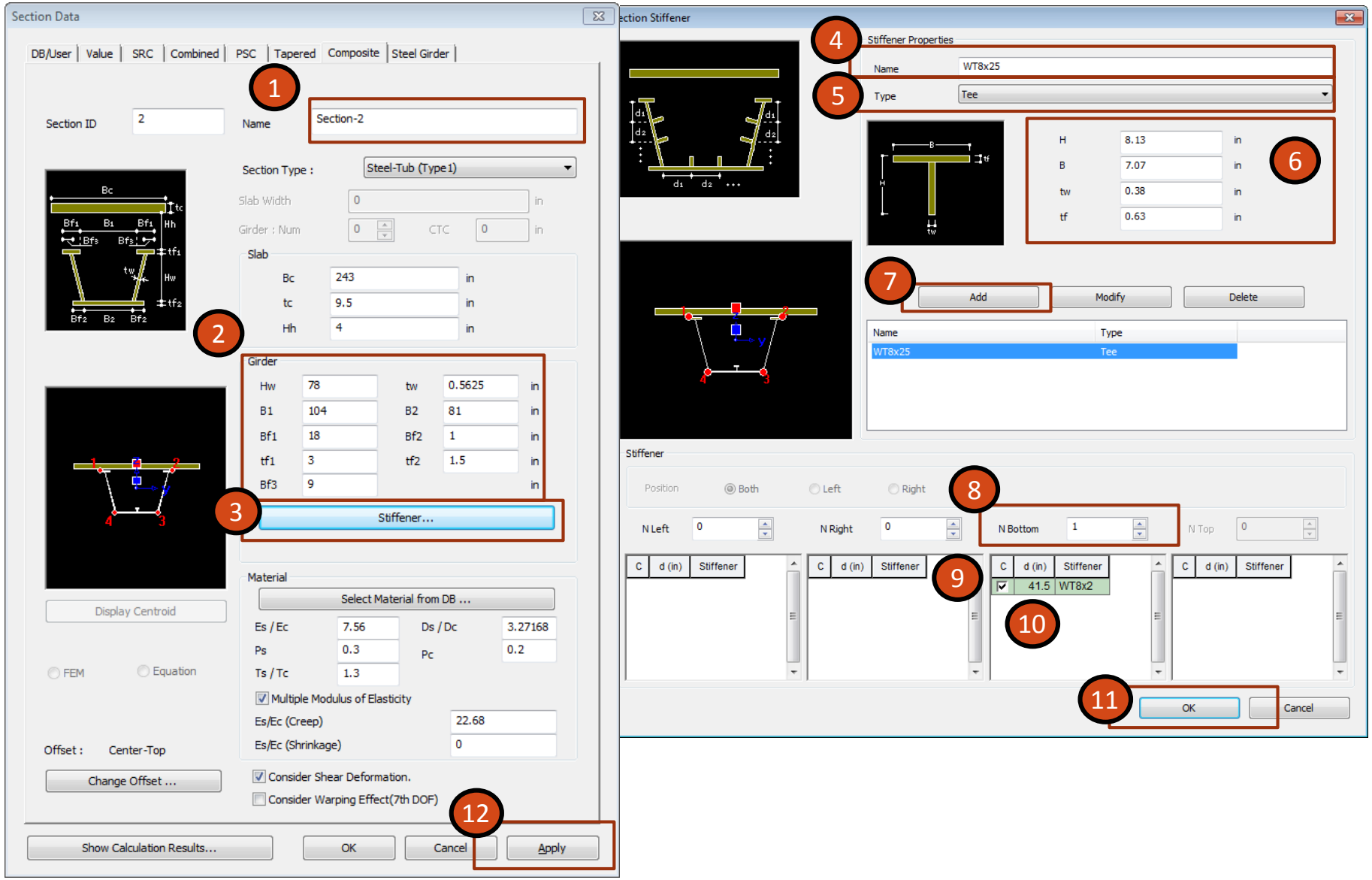
9. Modify **Es/Ec** : **7.56**
10. Check on **Multiple Modulus of Elasticity**
11. Es/Ec (Creep) : 22.68
12. Click on **Change Offset…**
13. Offset: **Center-Top**
14. Click **OK**
15. Name : **Section-1**
16. Click **Apply**



1. Name : Section-2

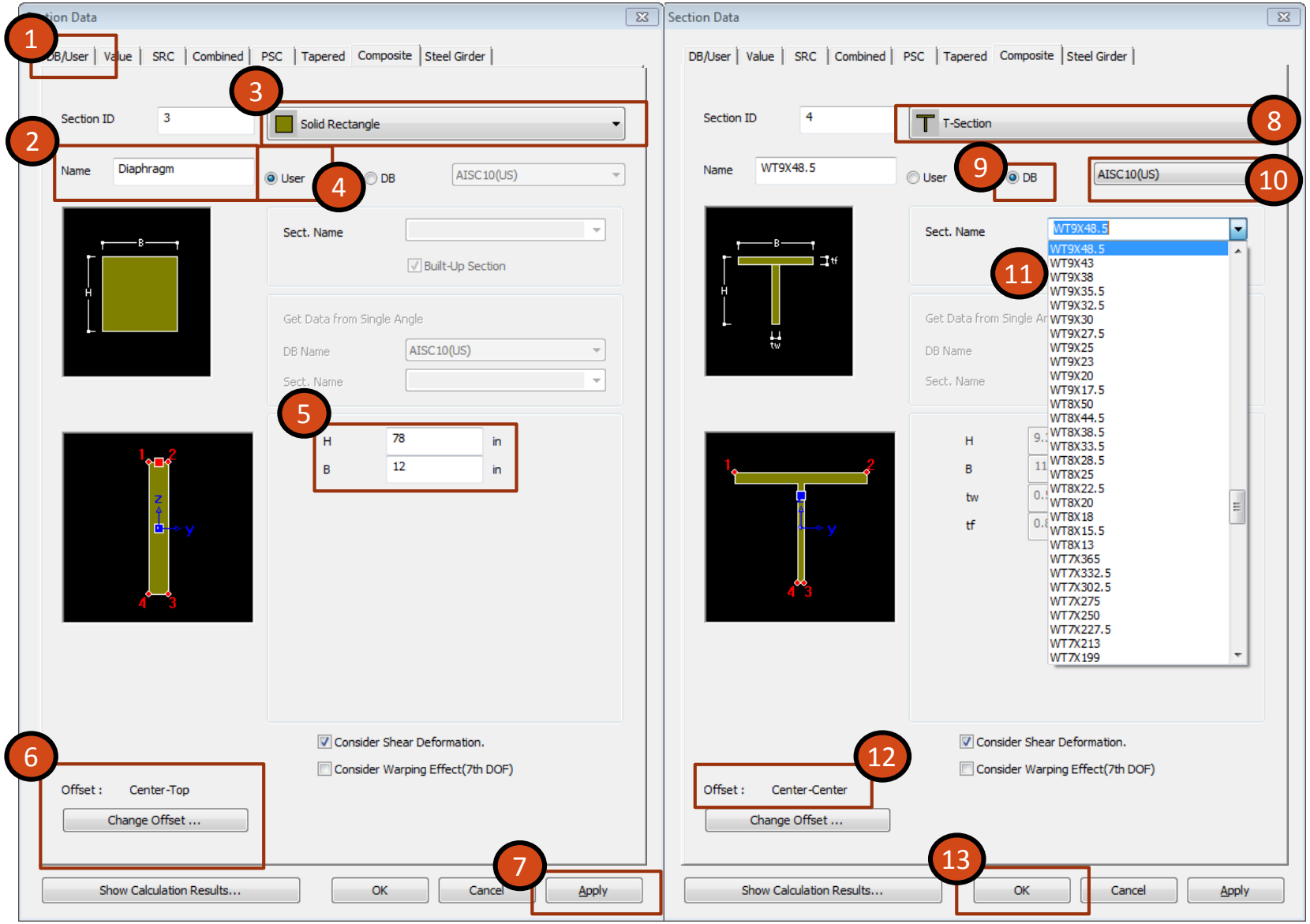
2. Girder Information
   Hw : **78**, B1: **104**, Bf1: **18**, tf1: **3**, Bf3: **9**
   tw: **.5625**, B2: **81**, Bf2: **1**, tf2: **1.5**

3. Click on **Stiffener…**
4. Name: **WT8x25**
5. Type : **Tee**
6. H: **8.13**, B: **7.07**, tw: **0.38**, tf: **0.63**
7. Click **Add**
8. Give **NBottom** as **1**
9. Check on **C**
10. d(in) : **41.5**
11. Click **OK**
12. Click **Apply**



1. Shift to **DB/User**
2. Name : **Diaphragm**
3. Choose **Solid Rectangle** from Type
4. Shift to **User**
5. H : **78 in**, B: **12 in**
6. Offset: **Center-Top**
7. Click **Apply**

8. Choose **T-Section** from Type
9. Shift to **DB**
10. Choose Code : **AISC10 (US)**
11. From Sect. Name Choose **WT9x48.5**
12. Offset: **Center-Center**
13. Click **OK**
14. Click **Close** to exit the Properties Window

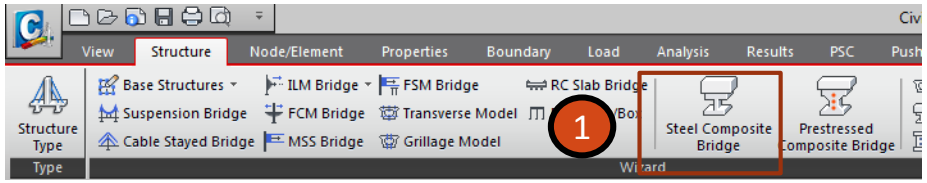


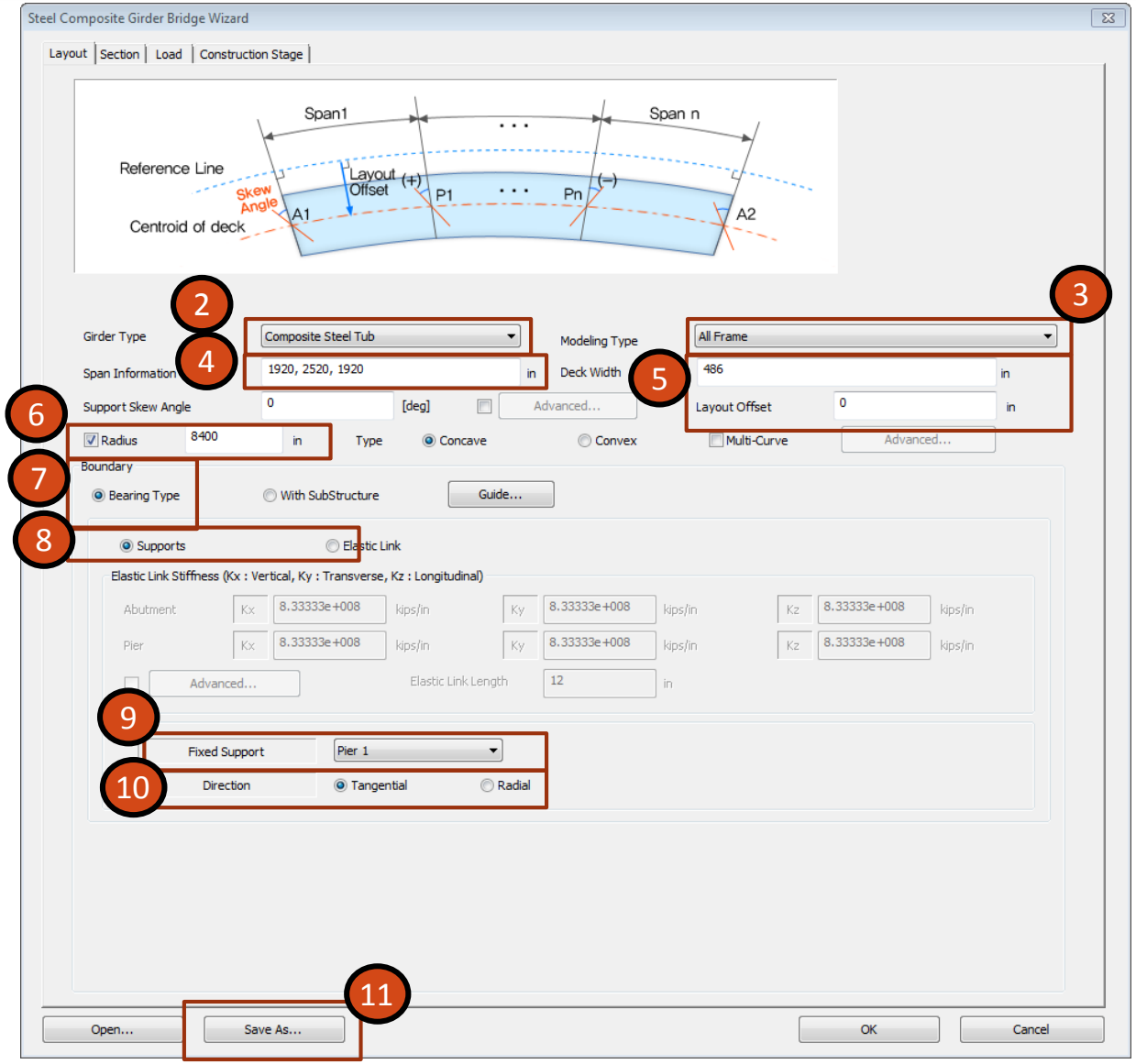
3. Wizard

1. From Ribbon Menu Go to
   Structure > Steel Composite Bridge

   This will open the LAYOUT Tab

2. Girder Type : **Composite Steel Tub**
3. Modeling Type : **All Frame**
4. Span Information : **1920,2520,1920** (in)
5. Deck Width : **486** in
6. Radius : **8400** in , Type: **Concave**
7. Boundary : **Bearing Type**
8. Support Type: **Supports**
9. Fixed Support : **Pier 1**
10. Direction: **Tangential**
11. Click **Save As…**
12. Save the Wizard file as **Main Wizard**





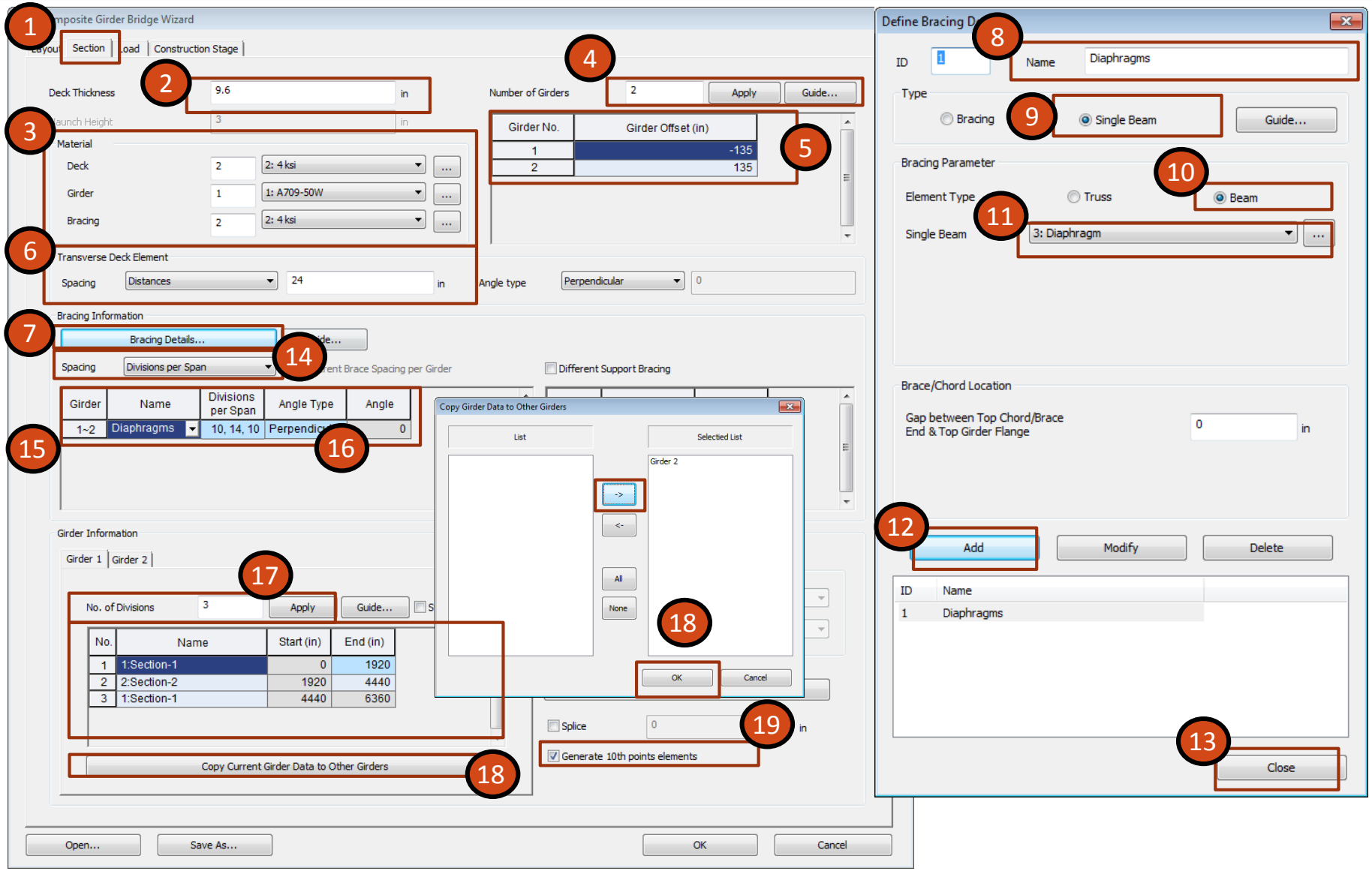
1. Go to the **Sections** Tab
2. Deck Thickness : **9.6** in
3. Material:
   Deck : **4 ksi**
   Girder: **A709-50W**
   Bracing: **4 ksi**
4. Number of Girders : **2**, **Apply**
5. Girder Offset: For 2 Girders.
   -135, 135
6. Transverse Deck Element
   Spacing : Distances : **24** in

Bracing Information

7. Click on **Bracing Details**
8. Name: **Diaphragms**
9. Type : **Single Beam**
10. Element Type : **Beam**
11. Choose **Diaphragm**
12. Click **Add**
13. Click **Close**
14. Spacing : **Divisions per Span**
15. Choose **Diaphragms** in **Name** and Divisions per **Span** as **10,14,10**
    Angle Type: **Perpendicular**

Girder Information

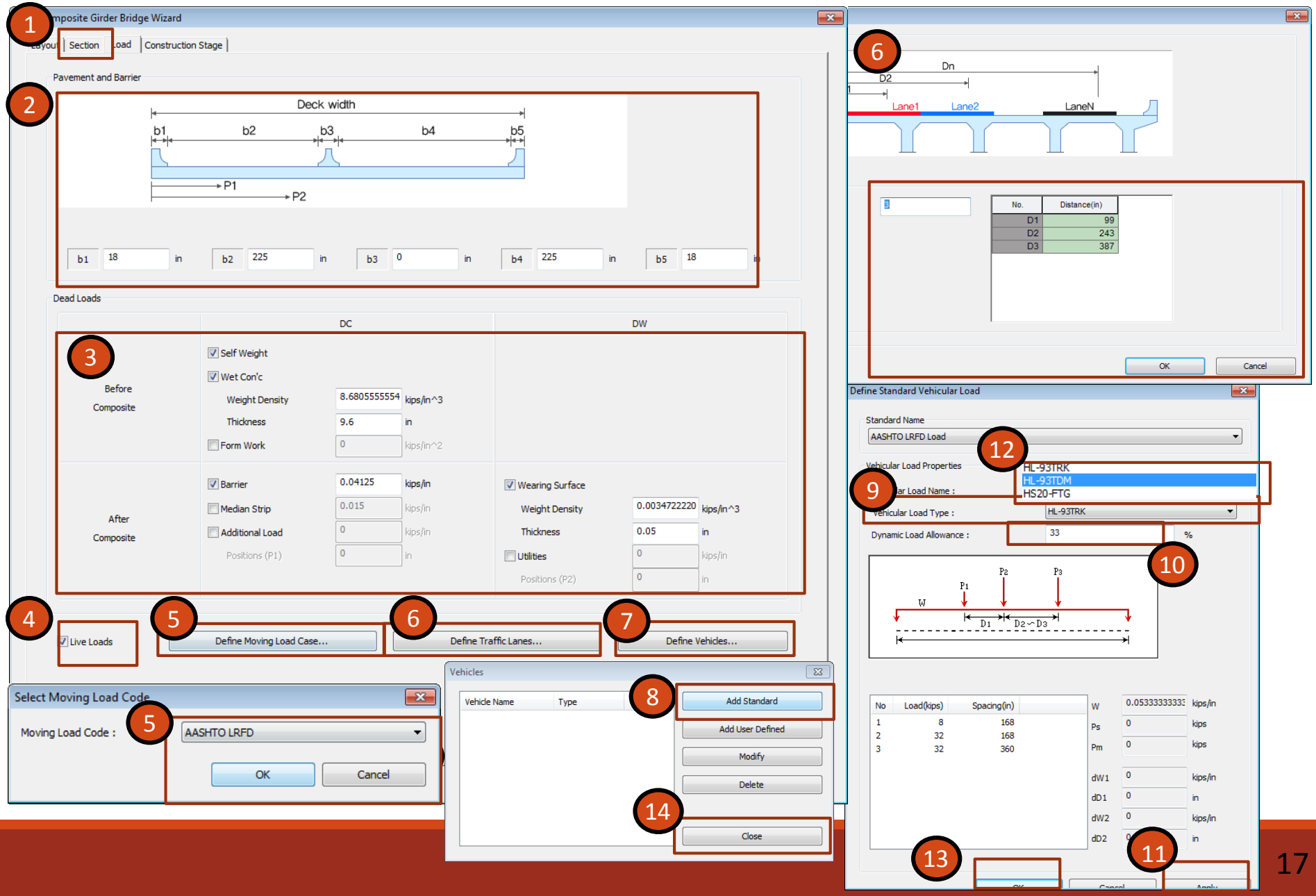
16. No. of Divisions : **3, Apply**
17. 1. Section-1, End: **1920** in
    2. Section-2, End: **4440** in
    3. Section-1, End: **6360** in
18. Click on **Copy Current Girder Data to Other Girders**
    Select Girder 2 and Click OK
19. Check On **Generate 10th points elements**



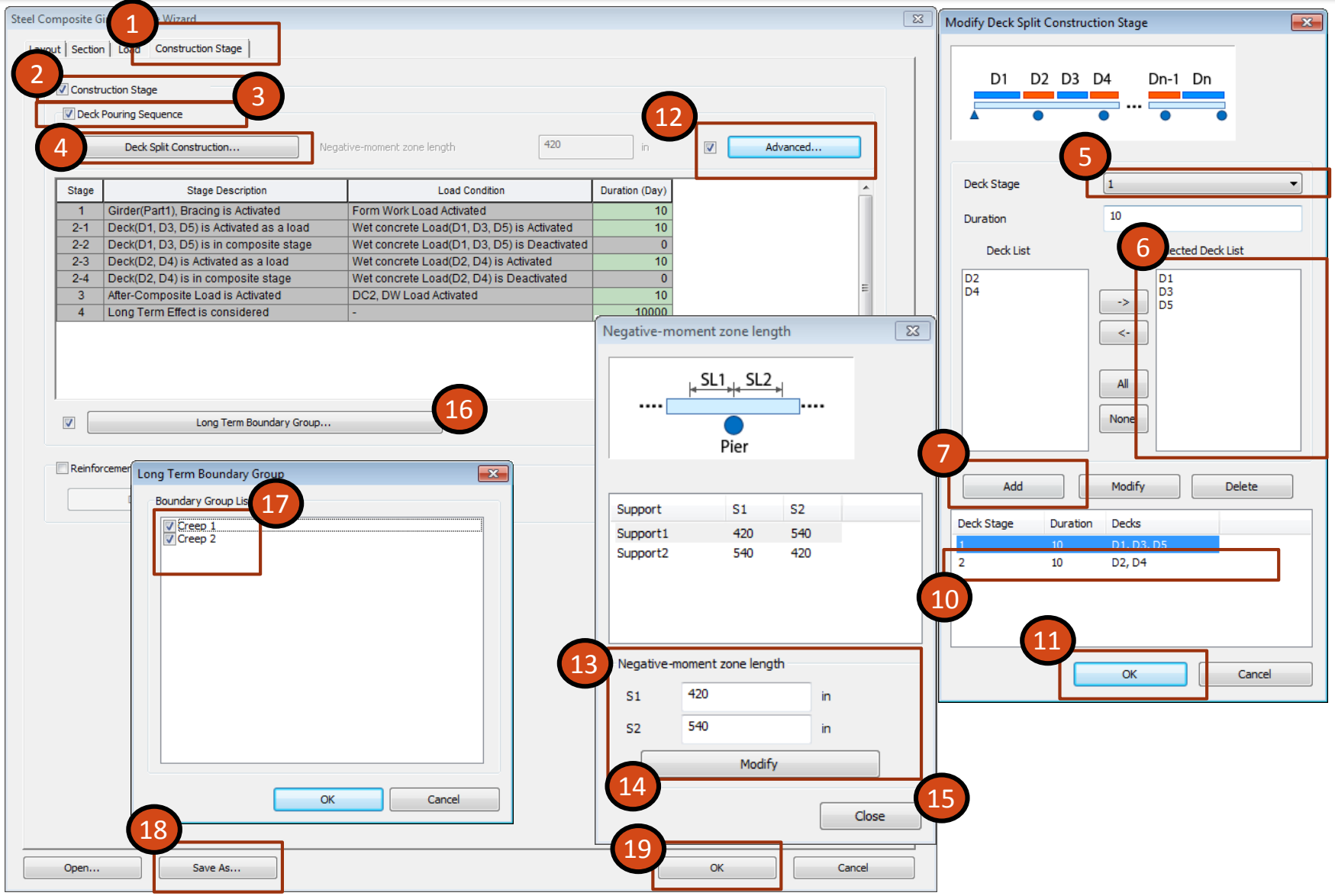
1. Go to the **Loads** Tab
2. Pavement and Barrier:
   b1: **18** in, b2: **225** in, b3: **0** in
   b4: **225** in, b5: **18** in
3. Dead Loads:
   Self Weight : **Check ON**
   Wet Concrete : **Check ON**
   Weight Density: **8.68**
   Thickness: **9.6**
   Barrier : **0.04125**
   Wearing Surface: **Check ON**
   Weight Density: **0.003472**
   Thickness: **0.05** in

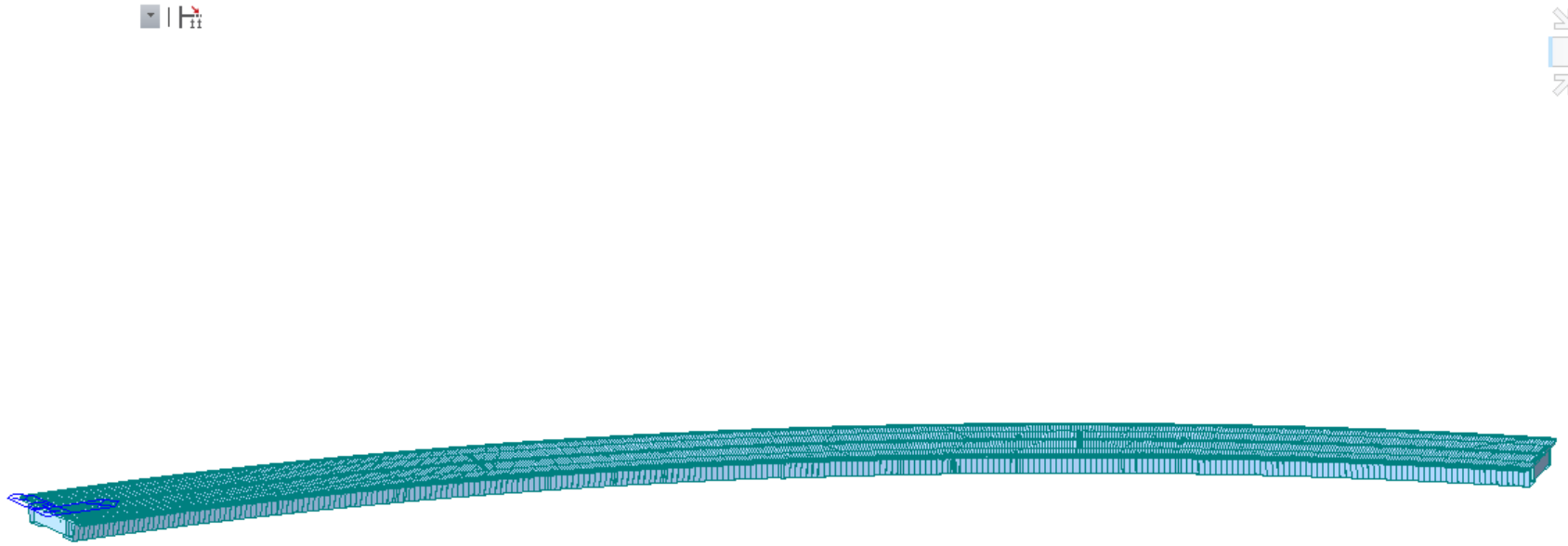
4. Live Loads : **Check ON**
5. Click on **Define Moving Load Case…**
   Choose : **AASHTO LRFD**
6. Click **Define Traffic Lanes…**
   Number of Lanes : **3**
   D1: **99**
   D2: **243**
   D3: **387**
   Click **OK**

7. Click on **Define Vehicles…**
8. Click on **Add Standard**
9. Vehicle Load Type: **HL-93TRK**
10. Dynamic Load Allowance: **33**%
11. Click **Apply**
12. Vehicle Load Type: **HL-93TDM**
13. Click **OK**
14. Click **Close**

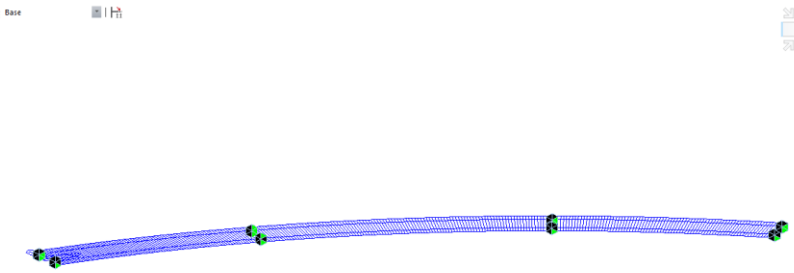


1. Go to **Construction Stage** Tab
2. Construction Stage : **Check ON**
3. Deck Pouring Sequence : **Check ON**
4. Click on **Deck Split Construction**
5. Deck Stage : **1**
6. Duration : **10**
7. Select **D1**, **D3** & **D5** to Selected Deck List
8. Click **Add**
9. Similarly Deck Stage: **2**
10. Select **D2** & **D4** and Click **Add**
11. Click **OK**
12. Click on **Advanced**
13. For **Support1**:
    Negative-moment zone length:
    S1: **420** in
    S2: **540** in
14. Click **Modify**
15. Click **Close**
16. Check on **Long Term Boundary Group…**
17. Check on **Creep 1** and **Creep 2**
18. Click **Save As…** save the wizard file again.
19. Click **OK**

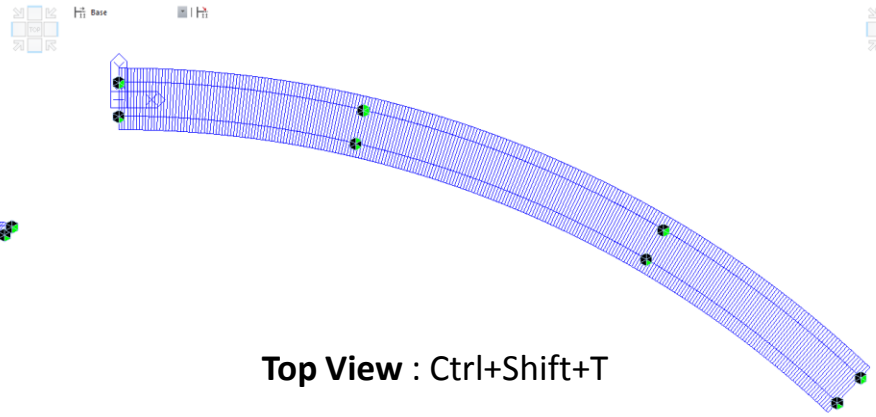



Base
TOP

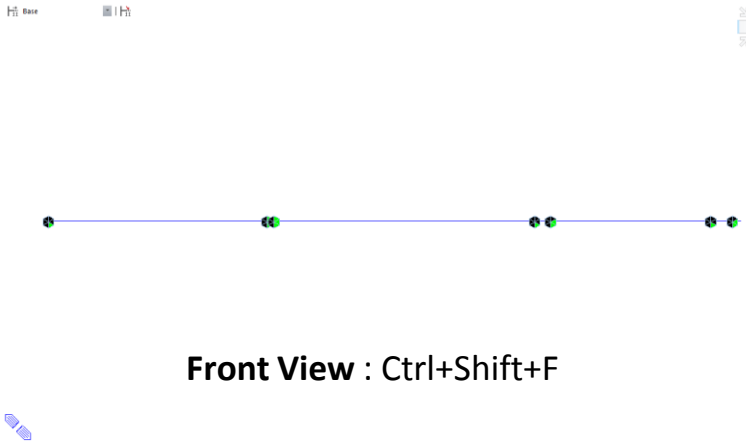
4. Modeling Tweaks



Wireframe View : Ctrl+H



Top View : Ctrl+Shift+T

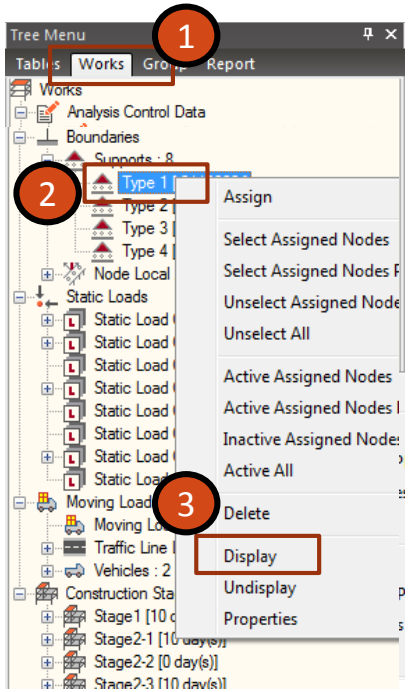


Front View : Ctrl+Shift+F

Isometric View : Ctrl + Shift + I
Right View : Ctrl + Shift + R
Left View : Ctrl + Shift + L

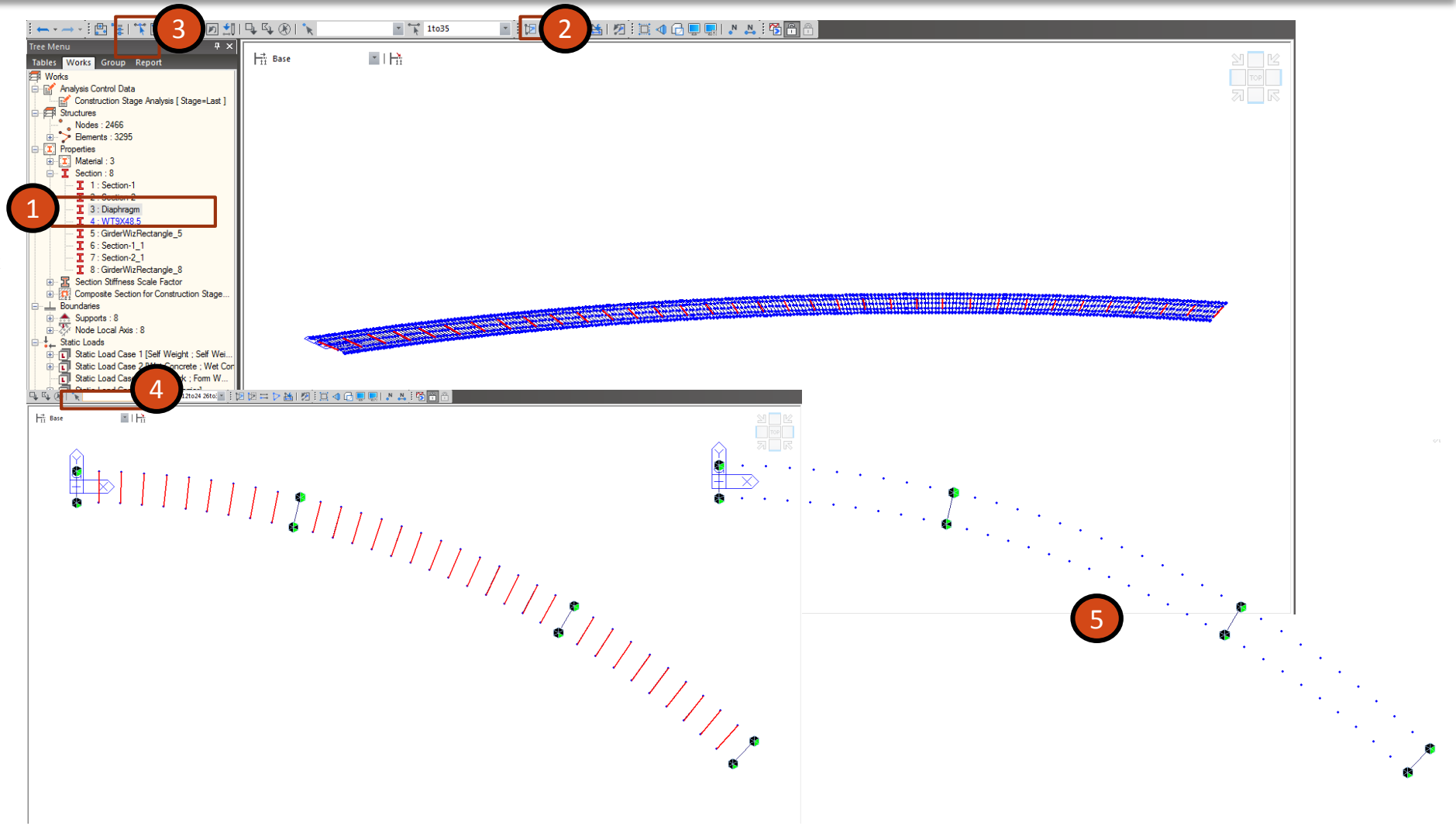
<u>To Display Boundaries / Other Entities</u>

1. Switch to Works Tree
2. Maximize Boundaries
3. Maximize Supports
4. Right Click on Type 1> Display

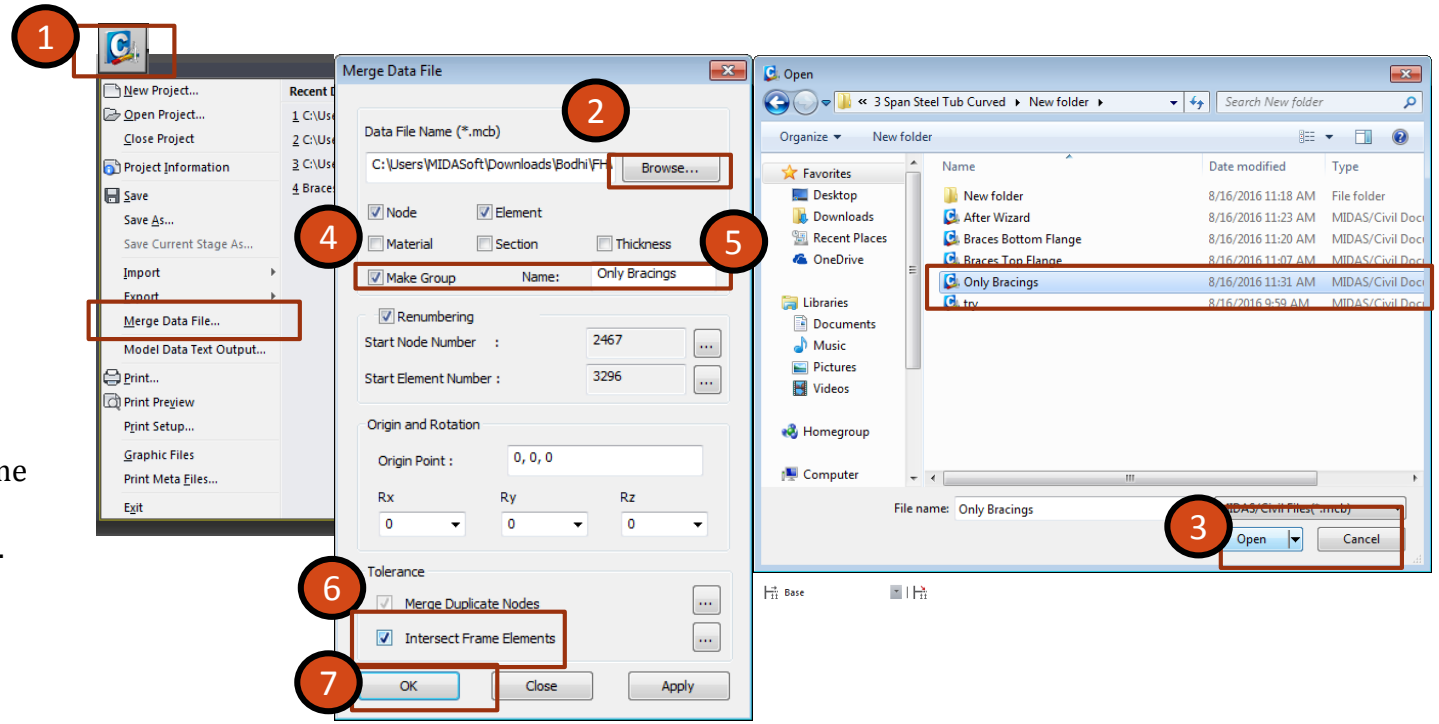


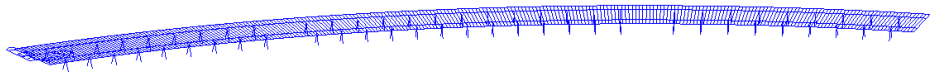
Delete Extra Diaphragms

1. In the Works Tree, under Sections, **Double Click** on **Diaphragms**, to select all the Diaphragms.
2. Click on **Activate** to activate all the Diaphragms
3. Click on **Select Single** and Select the **Interior Diaphragms**
4. Clear all the nodes in the **Node Selection Bar,** to unselect the nodes
5. **Click Delete from KeyBoard.**

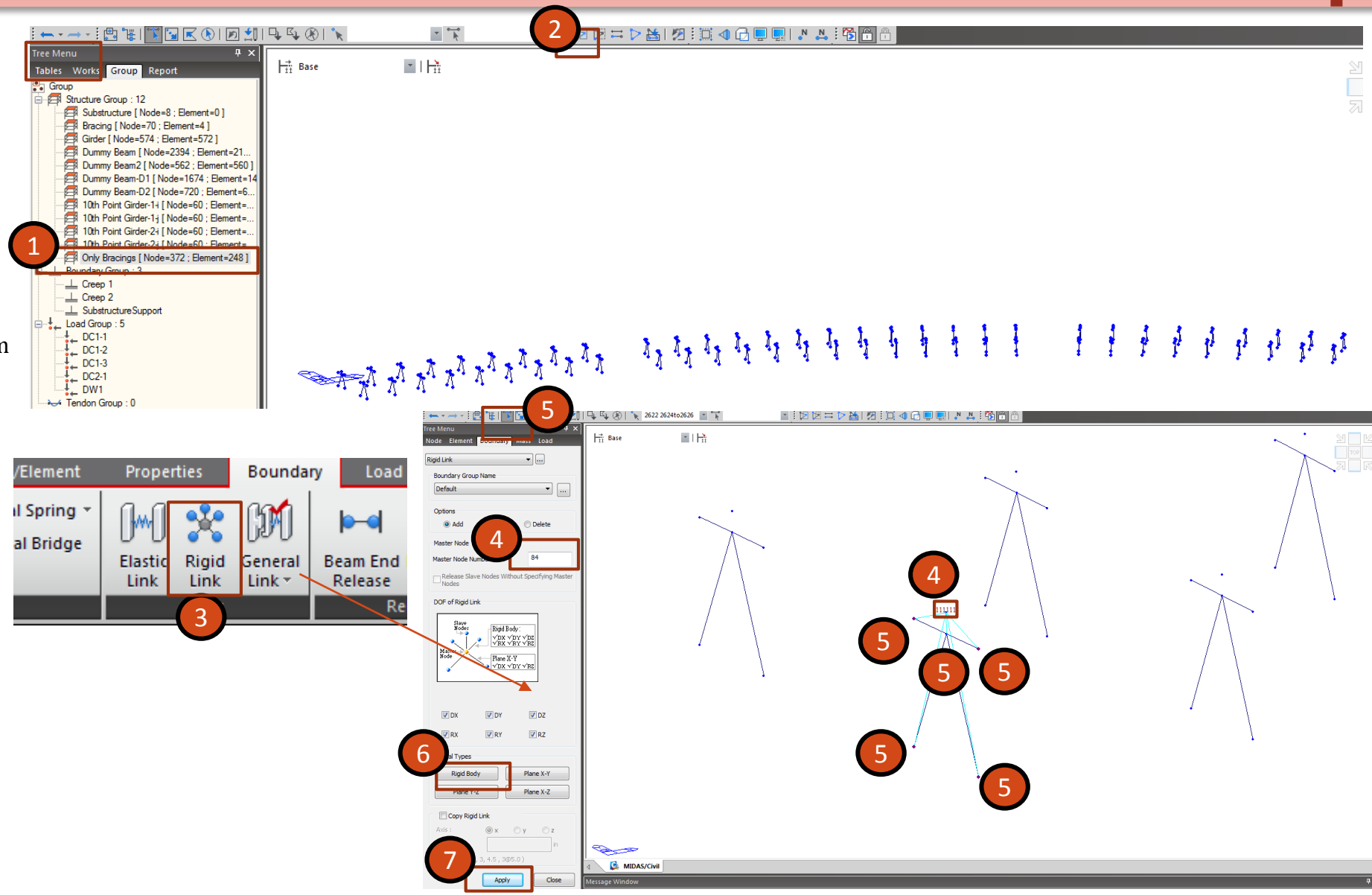


1. Go to **File > Merge Data File**
2. Click on **Browse…**
3. Look for file **Only Bracings.mcb** and **Open** it.
4. Uncheck **Material,Section,Thickness**
5. Check on **Make Group** and Group Name **Only Bracings**
6. Check **ON Intersect Frame Elements**.
7. Click on **OK**



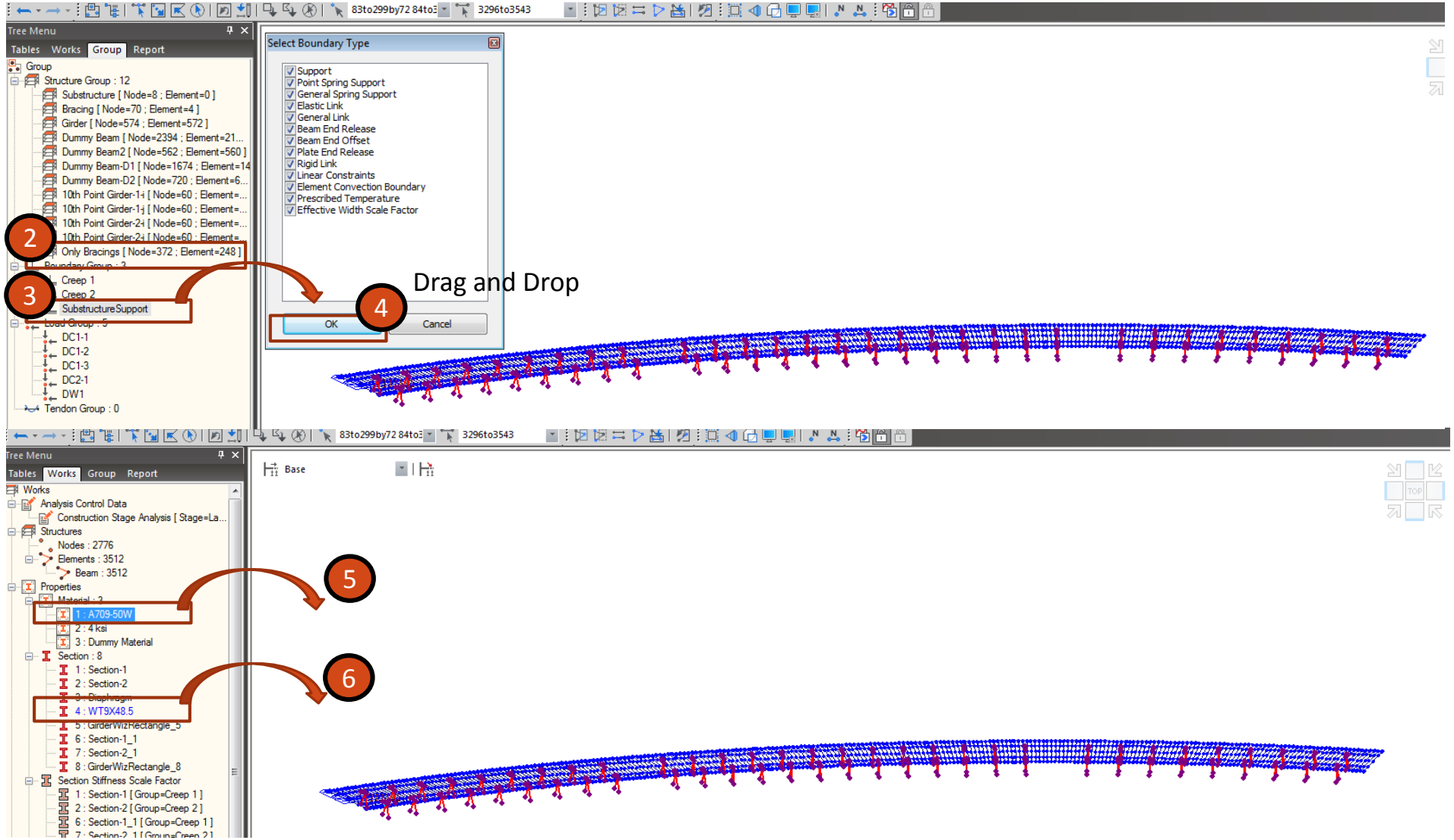


1. Go to **Groups >** Double Click on **Only Bracings**
2. Click **Activate** to Activate the Bracings
3. Go to **Boundary** > **Rigid Link**
4. Scroll your Middle Mouse Button, to zoom into first Bracing, Click on **Master Node** Box and click on the **topmost node**.
5. **Select Single** and select all the other nodes (Slave Nodes)
6. Click on **Rigid Body**
7. Click on **Apply**
8. Repeat the same for all the bracings.



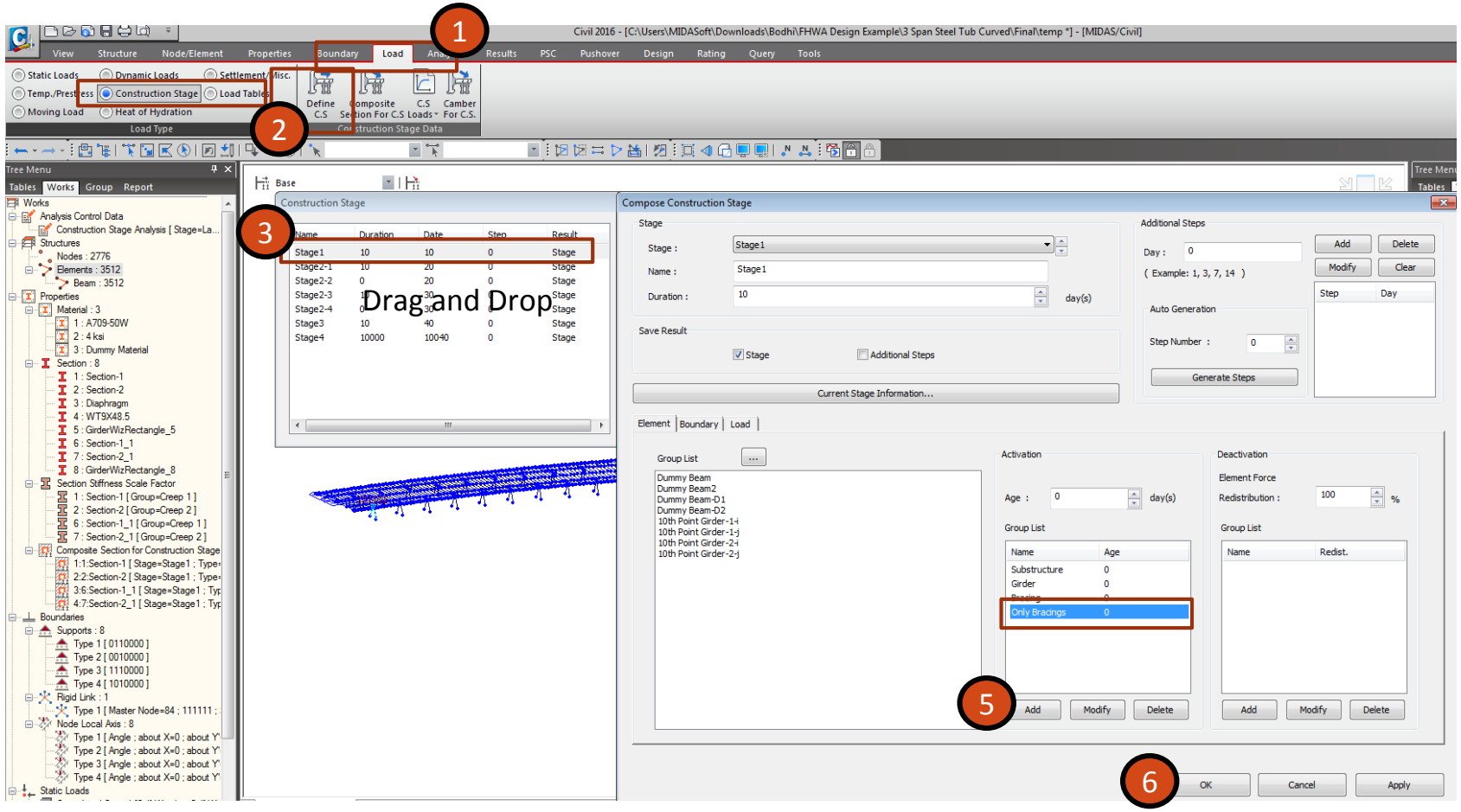
Material and Section Properties for the Cross Beams

1. Press Ctrl+A to Activate All
2. Go to Group and Double Click on Only Braces
3. From Boundary Groups Drag and Drop > Substructure
4. Click OK
5. Press Ctrl+Q (Select Previous) From Works Tree, Drag and Drop Material > A709-50W
6. Press Ctrl+Q and Drag and Drop Section > WT9x48.5



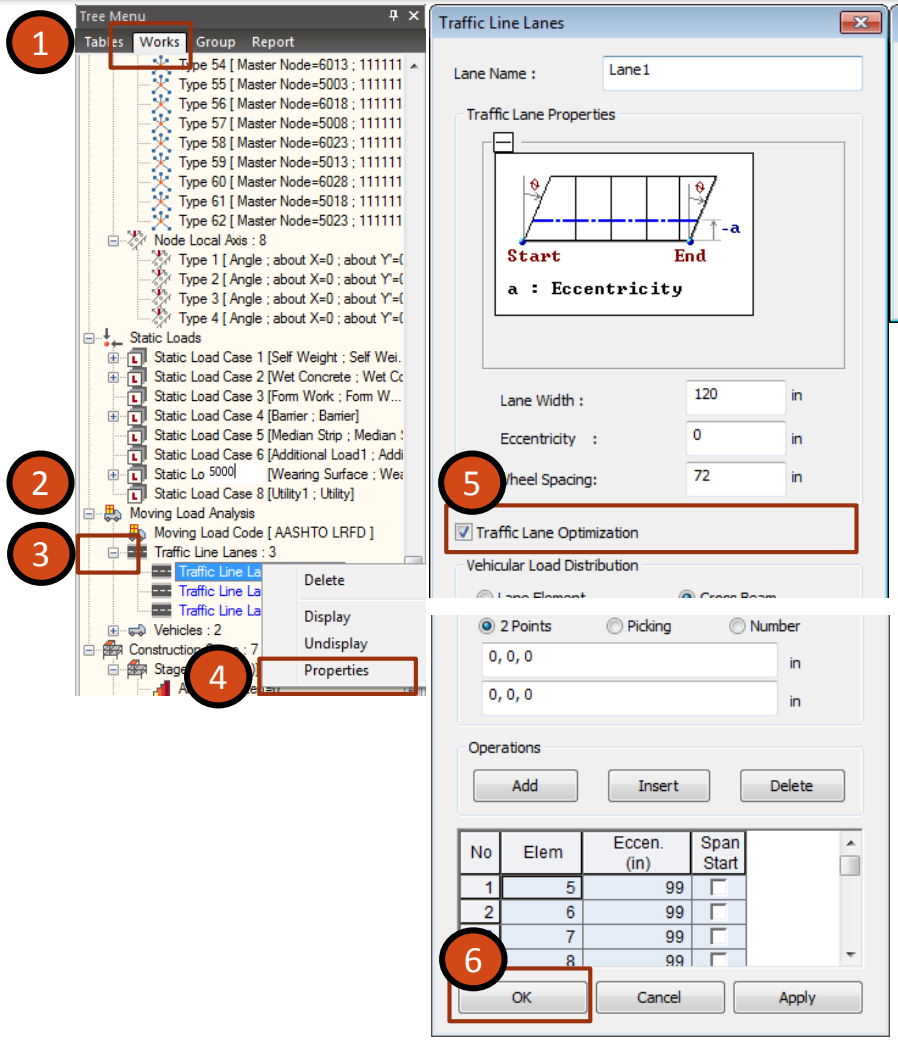
Include the Cross Beams in the Construction Stages

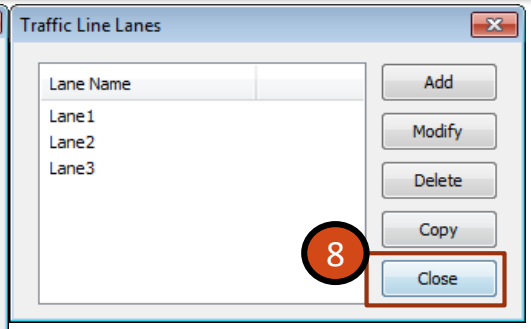
1. Go to **Loads > Construction Stage Loads**
2. Go to **Define Construction Stages**
3. **Double Click** on **CS1**
4. From **Element Group** List
   Select **Only Bracings**
5. Click on **Add** under **Activation**
6. Click **OK**
7. Click **Close** to **Close** the **Construction Stage Definition**

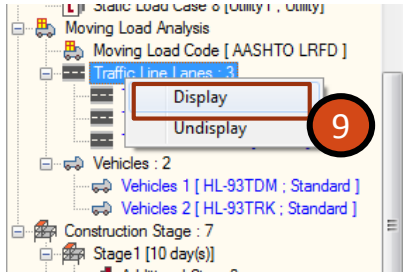


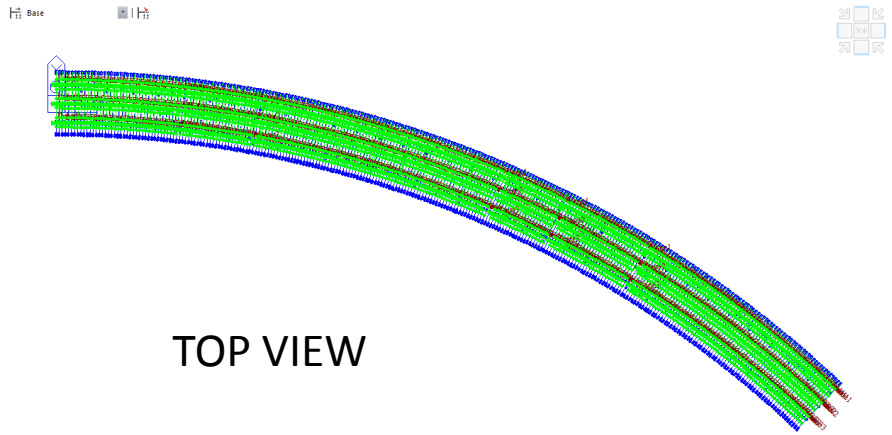
Traffic Lane Optimization

1. Go To **Works Tree**
2. Drag Down to **Moving Load Analysis**
3. Maximize **Traffic Line Lanes**
4. Right Click on **Traffic Line Lane 1** and Click **Properties**
5. Check on **Traffic Lane Optimization.**
6. Click on **OK**
7. Similarly do the same for all other Lanes.
8. Click **Close** on Traffic Line Lanes
9. Right Click on **Traffic Line Lanes** and click **Display**
10. Right Click and **Undisplay** to Undisplay.



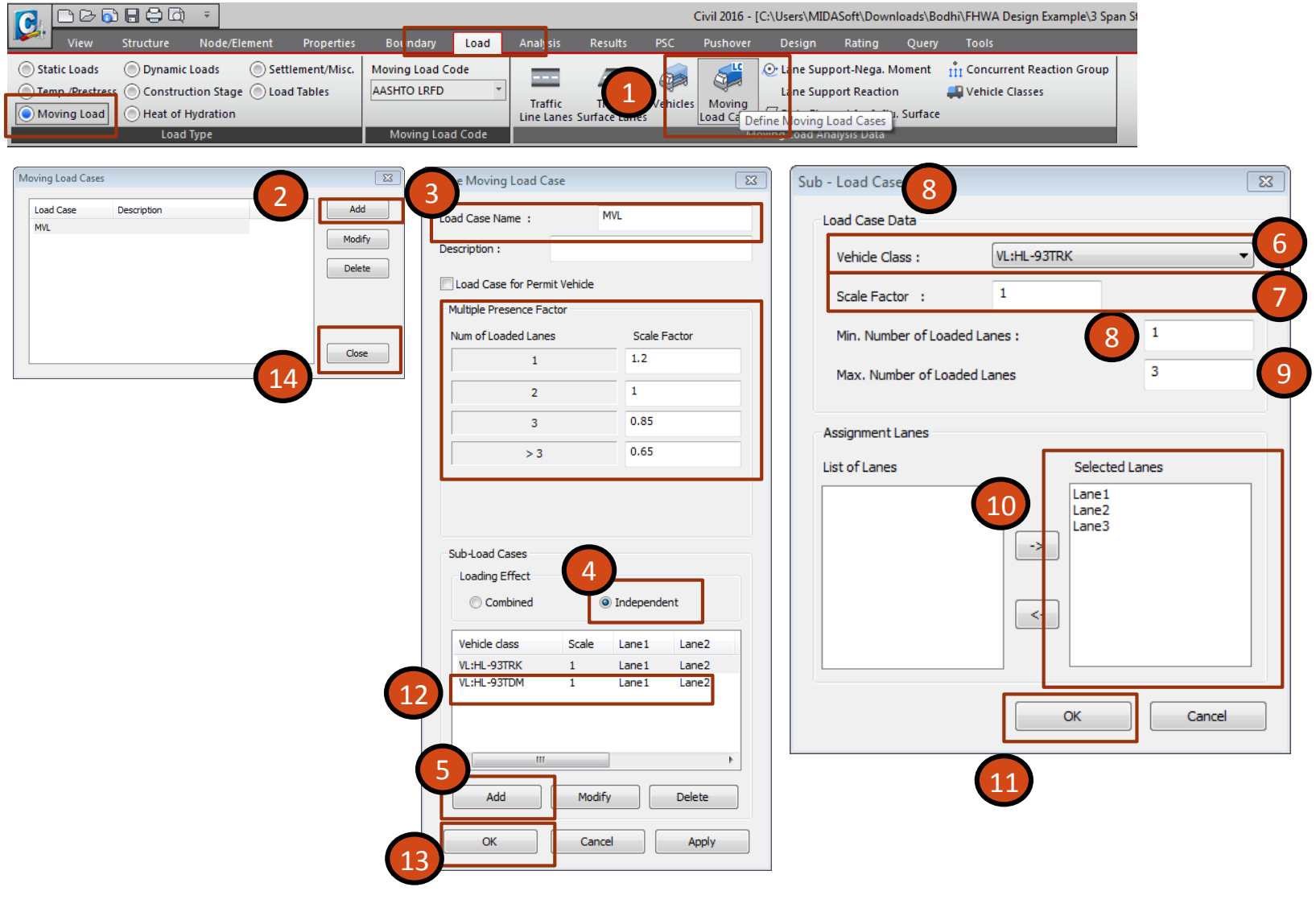






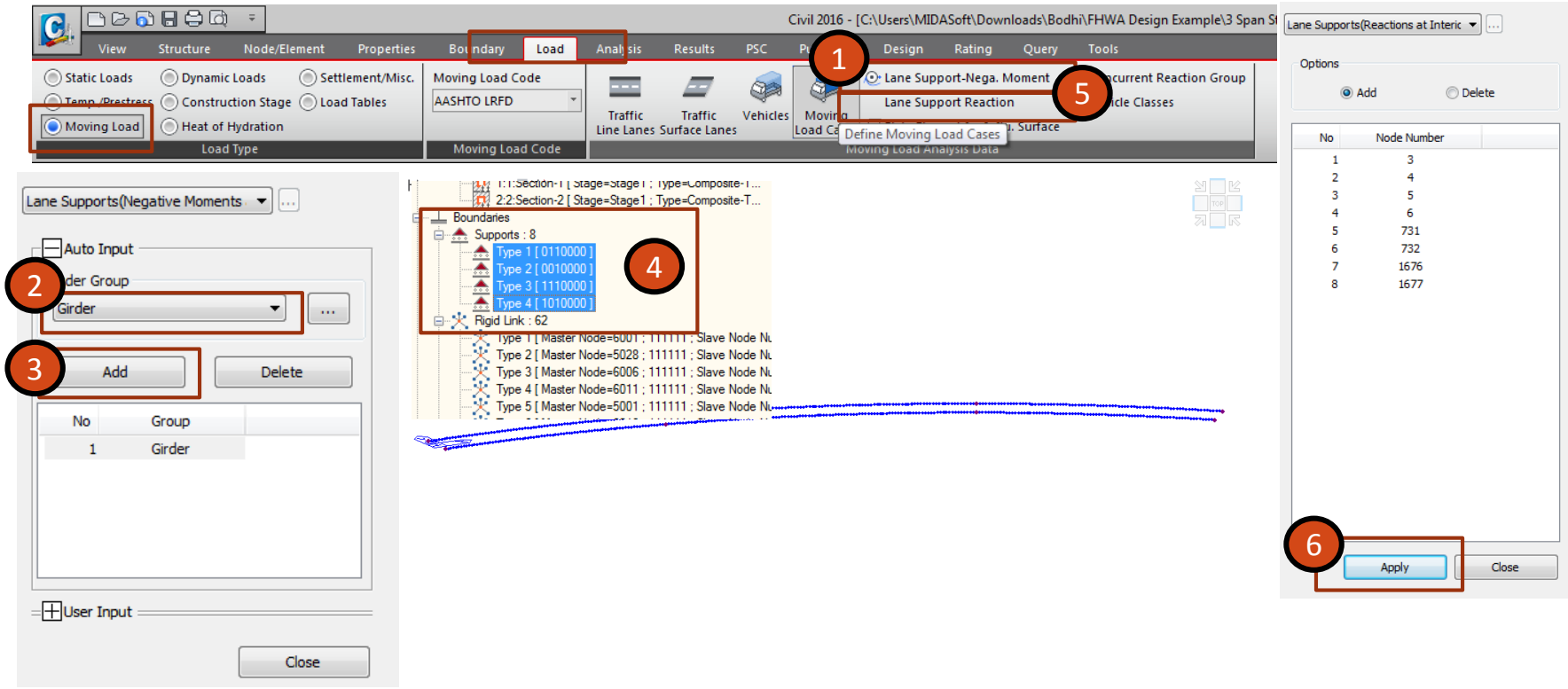
TOP VIEW

1. Go To **Load > Moving Load > Moving Load Cases**
2. Click on **Add.**
3. Load Case Name: **MVL**
4. Loading Effect: **Independent**
5. Click **Add**
6. Vehicle Class : **VL: HL-93TRK**
7. Scale Factor: **1**
8. Min. Number of Loaded Lanes : **1**
9. Max. Number of Loaded Lanes : **3**
10. Select All the lanes from the List of Lanes to **Selected Lanes.**
11. Click **OK**.
12. Similarly, repeat the same for VL-HL93 TDM
13. Click **OK.**
14. Click **Close.**



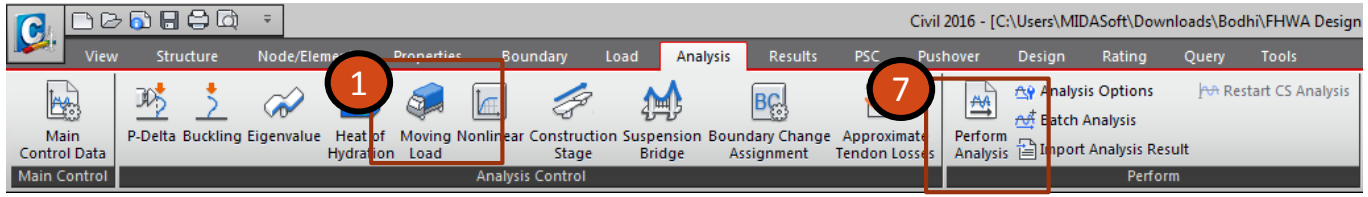
Lane Support Negative Moments

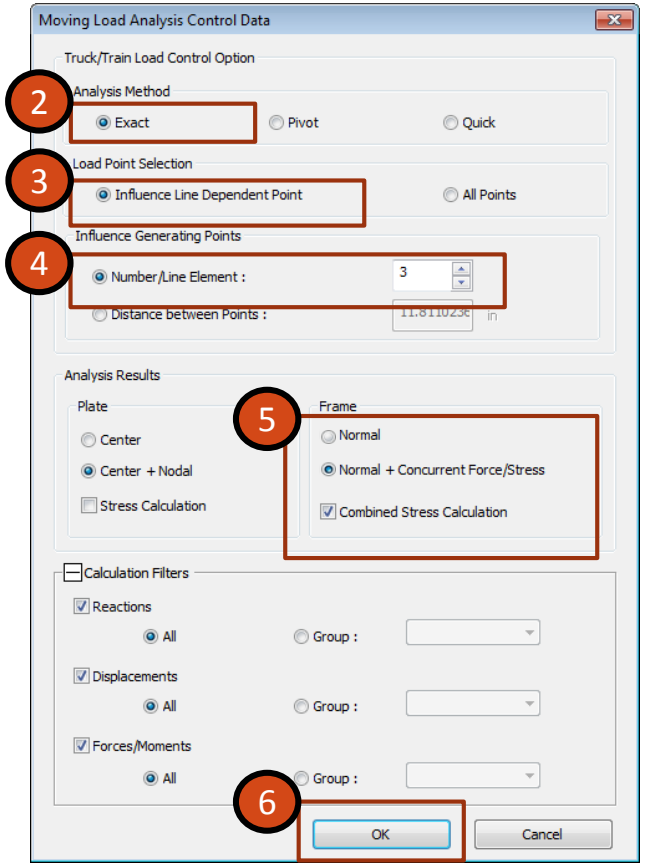
1. Go To **Load > Moving Load > Lane Support Negative Moment**
2. Inside **Girder Group** choose **Girder**
3. Click **Add**
4. In the Works Tree, Press Ctrl and Double Click on the first Support and Press Shift and Double Click on the last. (It will select all the Boundary Nodes)
5. Go To **Load > Moving Load > Lane Support Reaction**
6. Click on **Apply**



5. Analysis Control

Moving Load Analysis Control





1. Go To **Analysis > Moving Load**
2. Analysis Method : **Exact**
3. Load Point Selection: **Influence Line Dependent Point**
4. Number/Line Element : **3**
5. Analysis Results:
   Frame : **Normal + Concurrent Force/Stress**
   Check **On Combined Stress Calculation**
6. Click **OK**
7. Click **Perform Analysis**

Please join for the upcoming webinars

For further queries and doubts write a mail to : **techsupport@midasit.com**