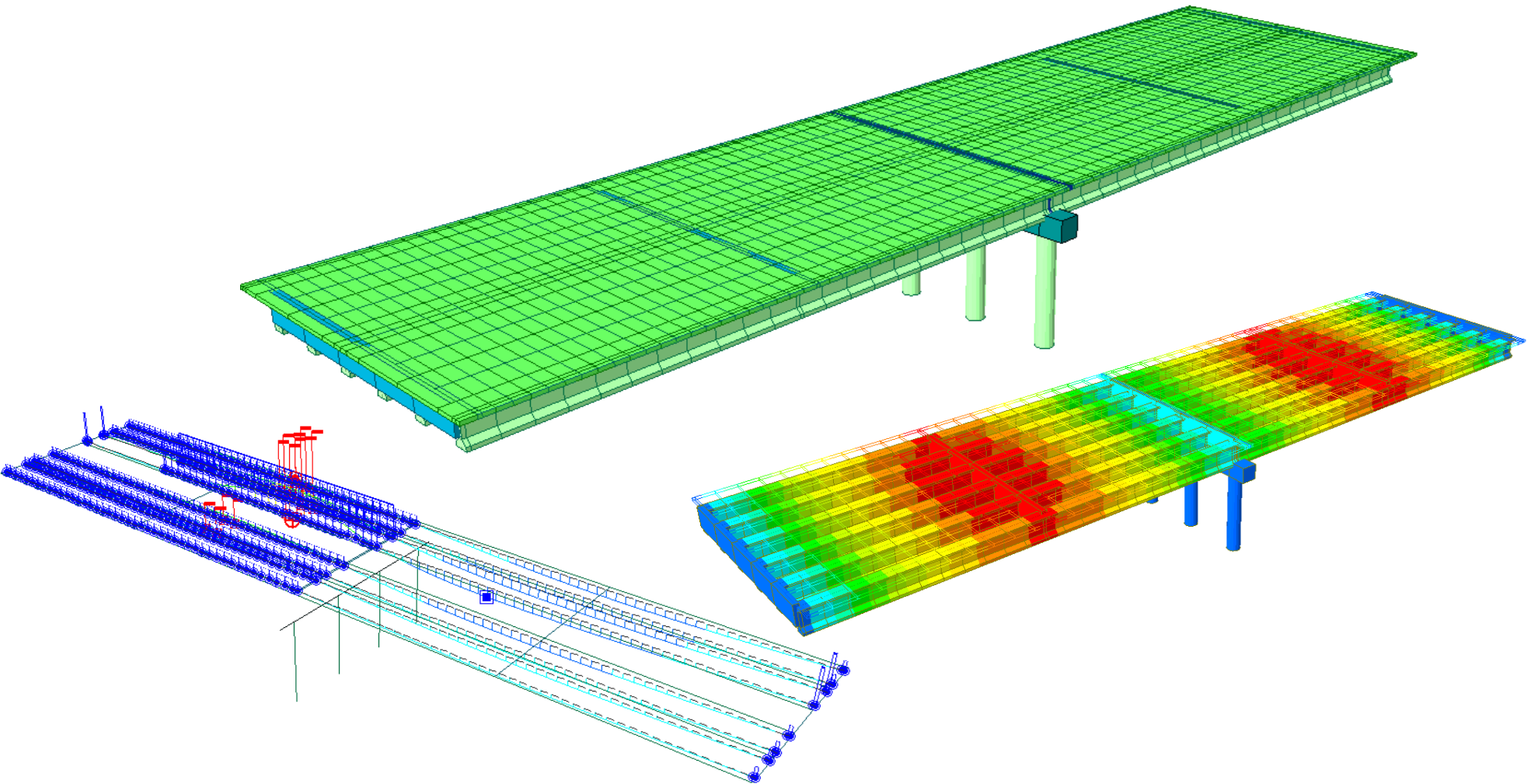


# Prestressed Composite Girder Bridge Analysis & Design



## *Overview*

### ▪ Properties

- Material / Section

### ▪ Prestressed Composite Bridge Wizard

- Layout
- Section
- Tendon
- Load
- Construction Stage

### ▪ Load

- Time Dependent Material
- Moving load
- Response Spectrum Analysis

### ▪ Analysis

- Moving Load

### ▪ Results

- Load Combination
- Reaction/Force/Displacement
- Moving Tracer
- Concurrent Force
- Tendon Losses
- Mode Shape

### ▪ Design

- PSC Design

### ▪ Tips

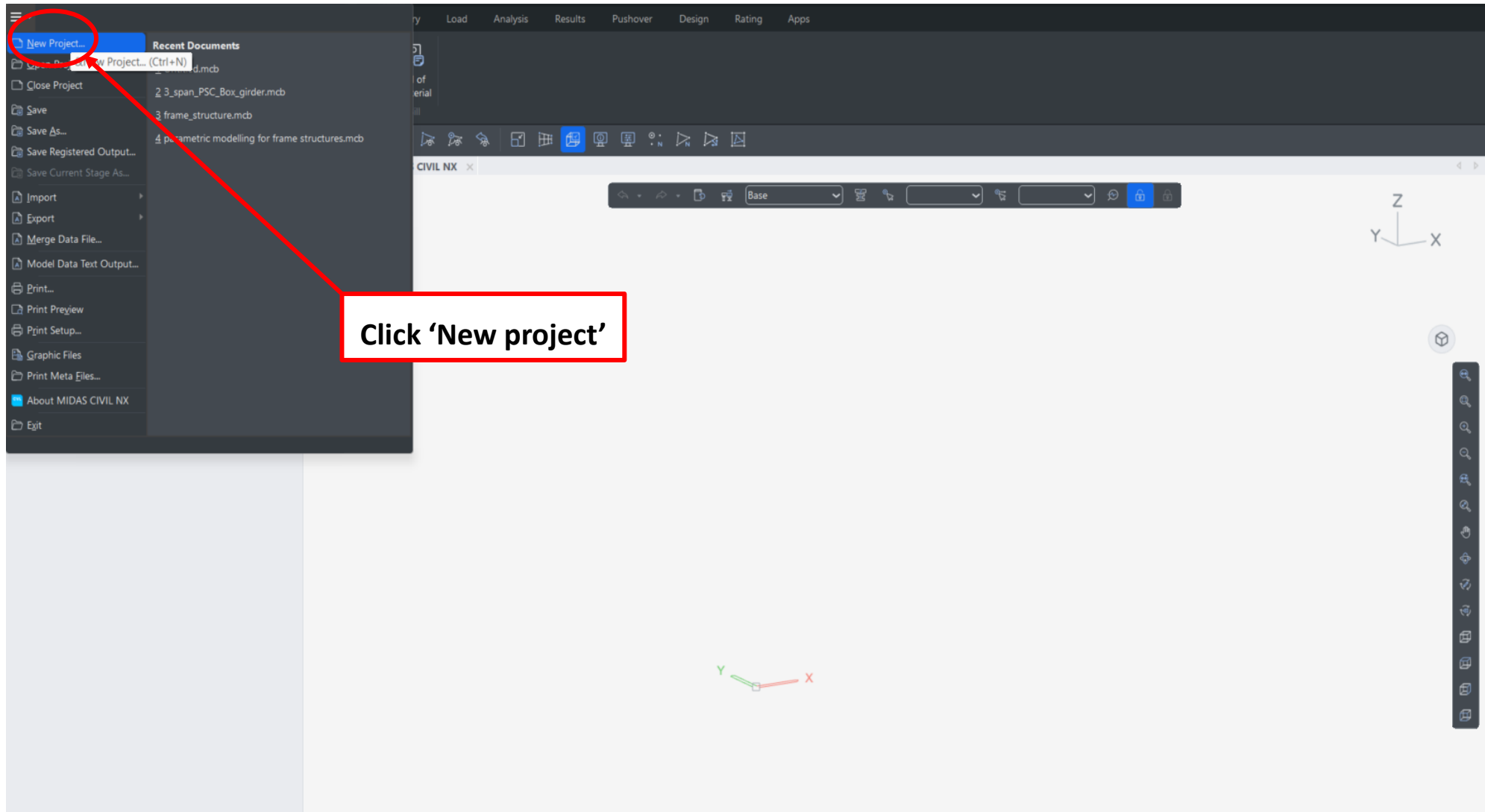
- Smart Report
- MCT Command Shell
- Tendon Template
- Import tendon from AutoCAD

### ▪ Appendix. Load Combinations

# Step 1. Properties

# 3

## Start

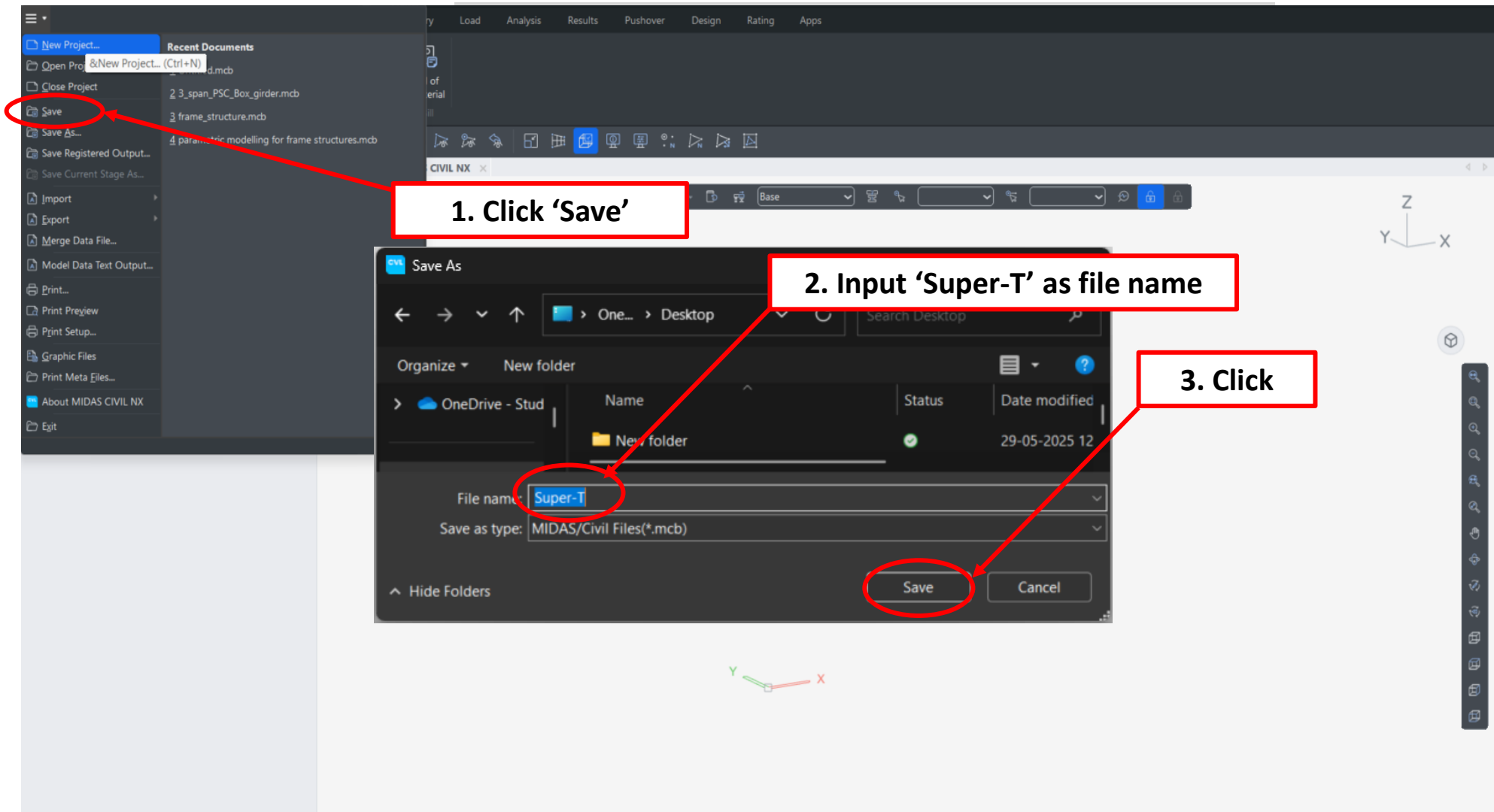


### Procedure

Create a new project file.

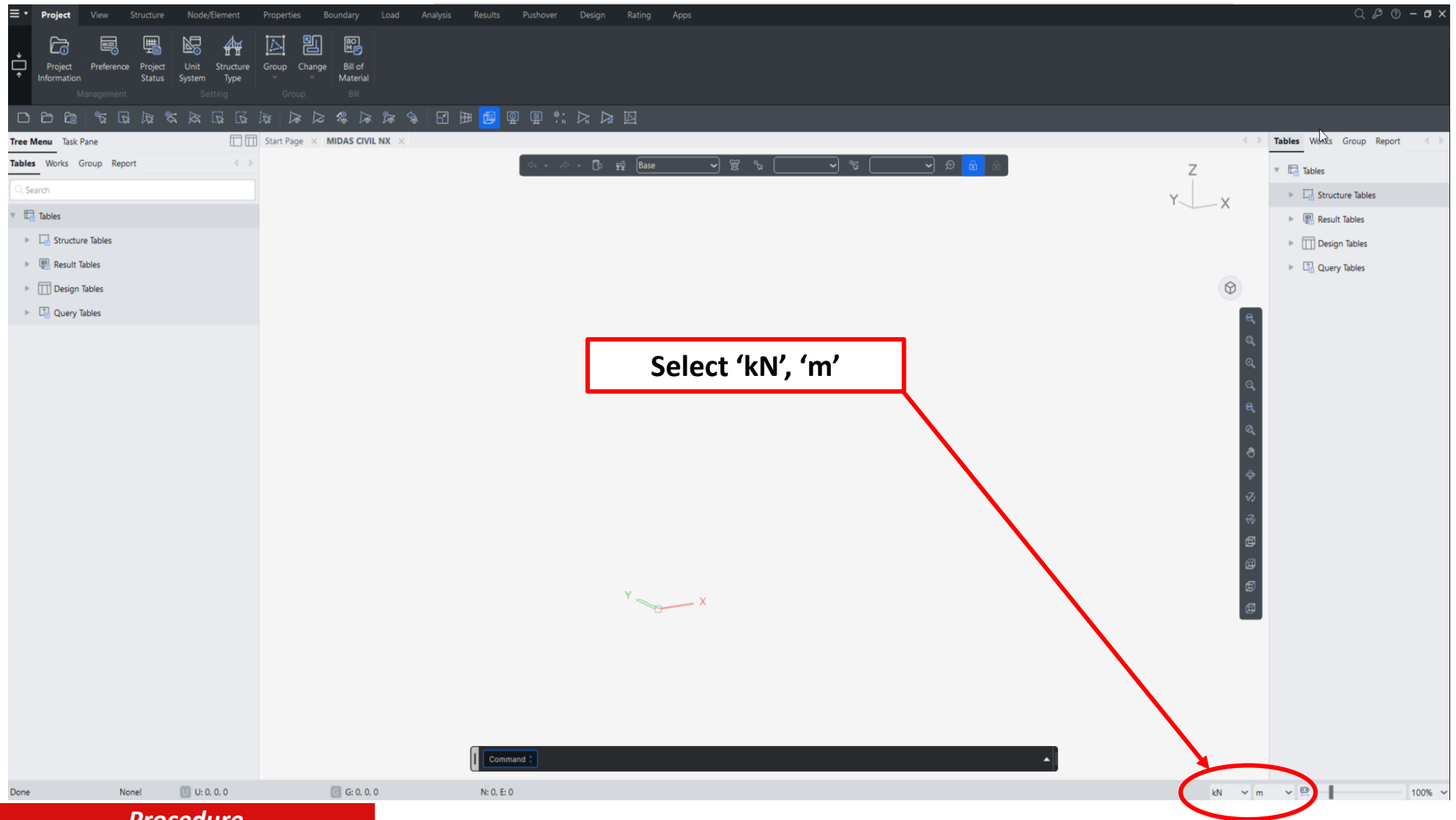
# 4

## Start



### Procedure

Save the current work in a project file. Save As dialog will prompt if a project file has not been saved previously.

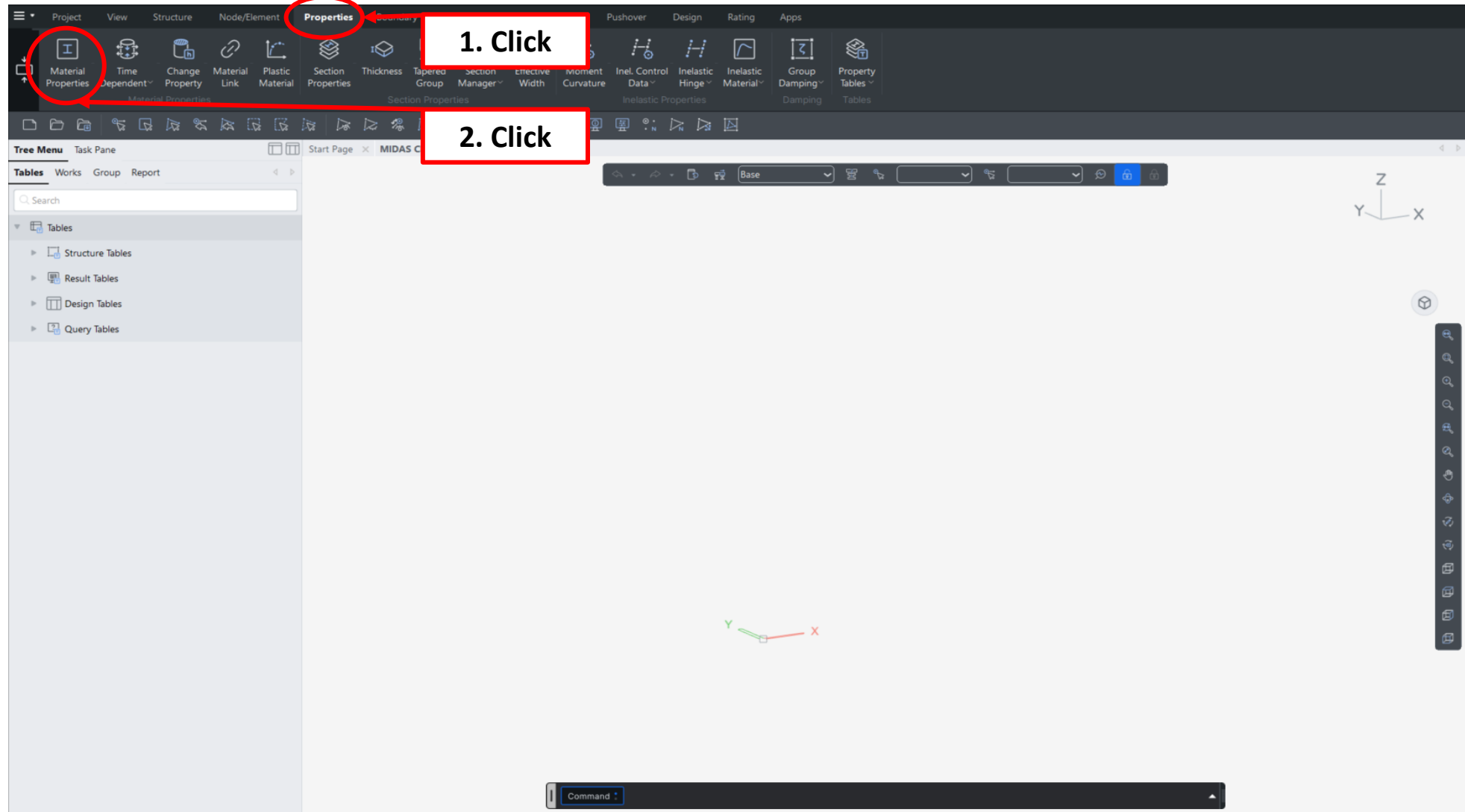


### Procedure

At any point of pre- and post-processing, the unit can be changed at the Status Bar without opening the Unit System dialog box. Also, every input and output values are converted accordingly at every change.

# 6

## Material / Section



### Procedure

Define material

The screenshot displays the MIDAS CIVIL NX interface. The 'Properties' dialog box is open, showing the 'Material' tab. The 'Add...' button is highlighted with a red circle and labeled '1. Click'. The 'Material ID' field is set to 'C50'. The 'Type of Design' dropdown is set to 'Concrete' (labeled '2. Select 'Concrete''). The 'Standard' dropdown is set to 'AS17(RC)' (labeled '3. Select 'AS17(RC)''). The 'Code' dropdown is set to 'C50' (labeled '4. Select 'C50''). The 'Apply' button is highlighted with a red circle and labeled '5. 'Apply''. The 'Material Properties' dialog box is also visible, showing the 'Concrete' material properties.

**1. Click**

**2. Select 'Concrete'**

**3. Select 'AS17(RC)'**

**4. Select 'C50'**

**5. 'Apply'**

### Procedure

Define material for the girder. AS17 is equal to Australian Standard 5100.5 2017.  
 Select 'None' as 'Standard' to modify the values such as Modulus of Elasticity, Weight Density, etc.

**1. Select 'C40'**

**2. 'Apply'**

**Procedure**

Define material for the slab.

Click 'Apply' to apply the input data on the dialog and not to close the dialog. Click 'OK' to apply the input data on the dialog and to close the dialog.

# 9

## Material / Section

**1. Select 'Steel'**

**2. Select 'AS/NZS 4672.1(S)'**

**3. Select '1670'**

**4. 'OK'**

### Procedure

Define material for the tendon

**1. Click**

**2. Click**

**3. Input 'Pier Column'**

**4. Select 'Solid Round'**

**5. Select 'User'**

**6. Input '1.2' m**

**7. 'Apply'**

| ID | Name | Type     | Standard   | DB   |
|----|------|----------|------------|------|
| 1  | C50  | Concrete | AS17(RC)   | C50  |
| 2  | C40  | Concrete | AS17(RC)   | C40  |
| 3  | 1670 | Steel    | AS/NZS ... | 1670 |

Section Data

Section ID: 1

Name: Pier Column

Section Type: Solid Round

Sect Name: User

Diameter (D): 1.2 m

Offset: Center-Center

Consider Shear Deformation: ☒

Buttons: Show Calculation Results..., OK, Cancel, Apply

### Procedure

Define section for pier.

Check 'Show Calculation Results..' to view sectional properties such as area, moment of inertia and etc.

**1. Input 'Pier Cap'**

**2. Select 'Solid Rectangle'**

**3. Select 'User'**

**4. Input H '0.85' m  
B '2.1' m**

**5. Click**

**6. Offset 'Center-Top'**

**7. 'OK'**

**8. 'Apply'**

**Procedure**

Define section for pier cap. Element line locates on the center of section shape and it can be on the center-top when 'Change Offset' is applied.

**1. Input 'Cross Beam'**

**2. Select 'User'**

**3. Input H '1' m  
B '0.6' m**

**4. Click**

**5. Offset 'Center-Top'**

**6. 'OK'**

**7. 'Apply'**

**Procedure**

Define section for cross beam

**Offset:** Specify the section Offset from the location options.

**Horizontal Offset:** Specify the Offset in the transverse direction. "to Extreme Fiber" assigns the offset to the outer-most point. For a specific location of Offset, select "User" and enter the distance from the "Centroid" to the desired Offset location. Unless the Offset is "Center-Center" the Horizontal Offset can be entered as the "User" type. For a tapered (non-prismatic) section, data input for the J-end also becomes activated.

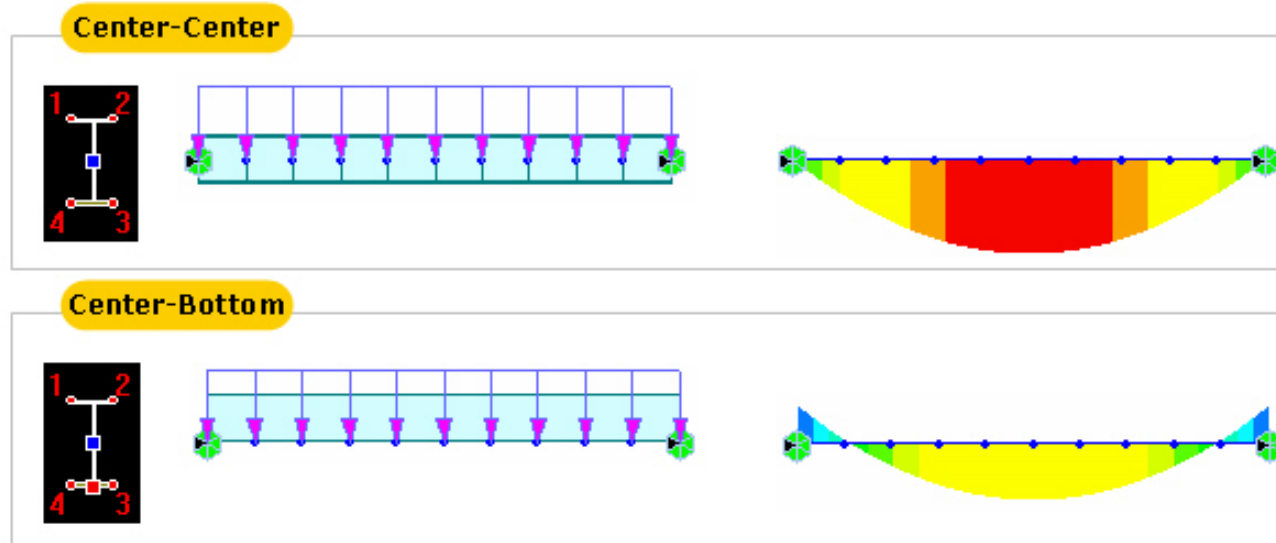
**Vertical Offset:** Specify the Offset in the vertical direction. "to Extreme Fiber" assigns the offset to the outer-most point. For a specific location of Offset, select "User" and enter the distance from "Centroid" to the desired Offset location. Unless the Offset is "Center-Center" the Vertical Offset can be entered as the "User" type. For a tapered (non-prismatic) section, data input for the J-end also becomes activated.

**Note 1**

When Offset distance is specified, a positive (+) sign applies to Center-to-outward for Centroid reference and Extreme-to-inward for Extreme Fiber reference.

**Note 2**

Node-based loads such as Nodal Loads and Specified Displacements are always applied at the nodes. However, element-based loads such as Beam Loads and Temperature Loads are applied on the center line of the element section. Please find the difference in the following example.



**User Offset Reference:** When section offset distance is specified as the "User" type, define the reference location.

**Centroid:** Specify the offset distance relative to the centroid of the section.

**Extreme Fiber(s):** Specify the offset distance relative to Left/Right & Top/Bottom.

### Note 3

When User type is specified, the Offset distance and direction are entered relative to Centroid irrespective of the Center option (Centroid or Centre of Section). For example, specifying "Offset: Left-Center", "Center Loc.: Center of Section" and "Horizontal offset: 0.5 " User type" will result in an Offset 0.5" to the left of the Centroid. And if the Offset option is "Left-Center" and the Center option is Center of Section the User type for Horizontal offset becomes activated and the User type for Vertical offset becomes inactivated. The Horizontal offset defined as User type here becomes the Centroid, and the Vertical offset fixed to Center becomes the "Center of Section"

The image shows two overlapping software windows. The background window is the 'Section Data' dialog box, and the foreground window is the 'Select PSC DB' dialog box. Red boxes and arrows indicate the following steps:

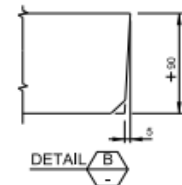
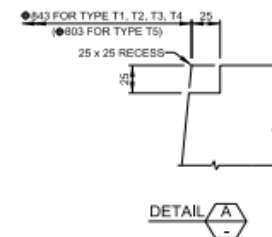
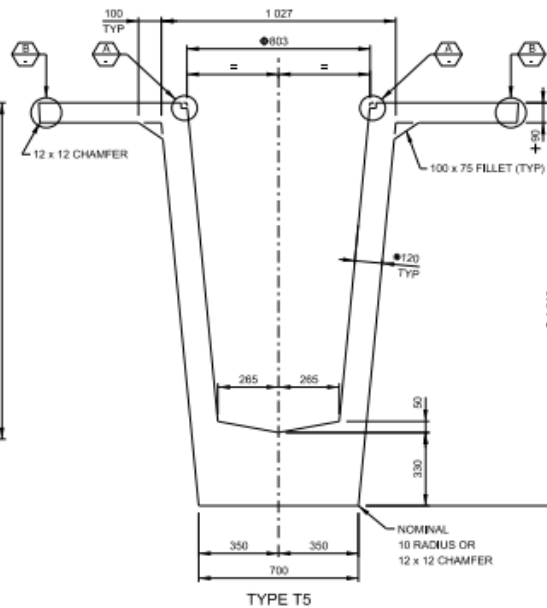
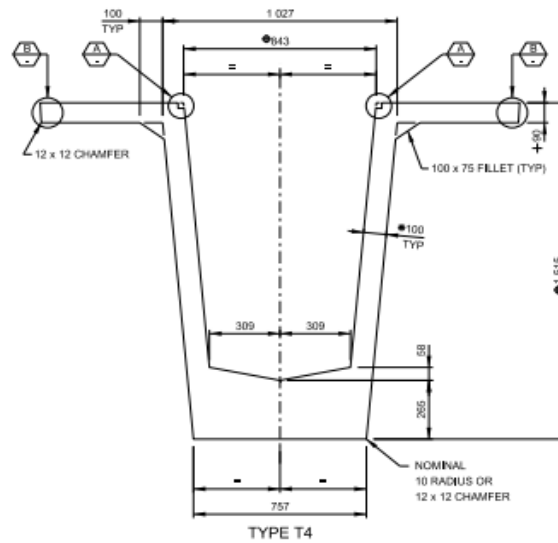
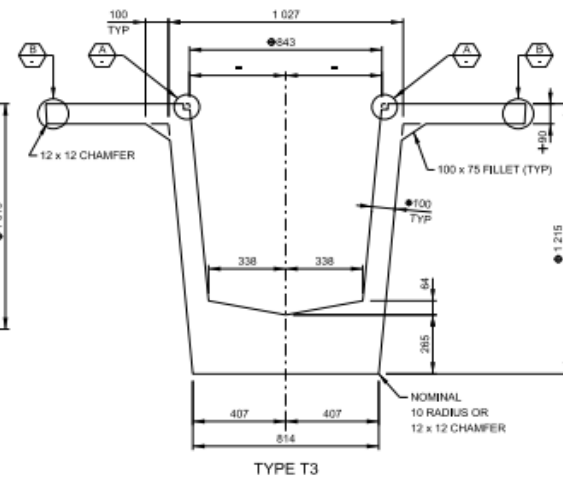
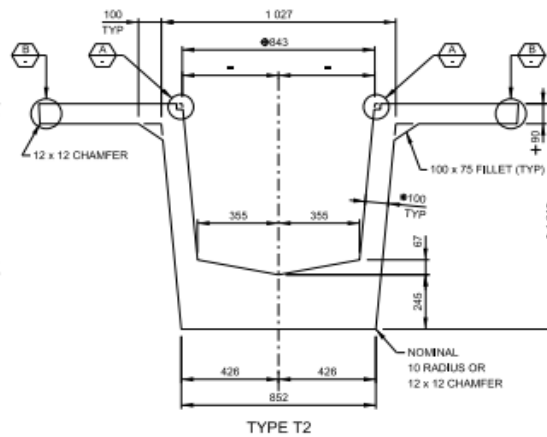
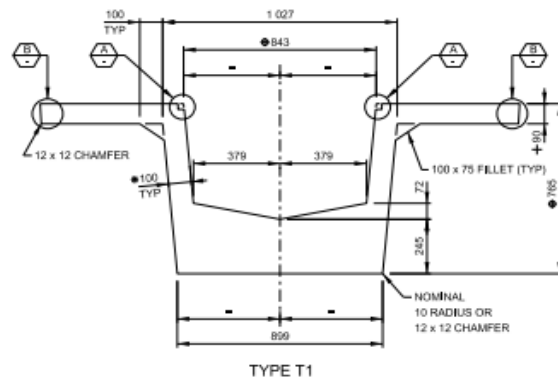
- 1. 'PSC'**: Points to the 'PSC' tab in the 'DB/User' section of the 'Section Data' dialog.
- 2. 'PSC-Value'**: Points to the 'PSC-Value' dropdown menu in the 'Section Data' dialog.
- 3. 'Section Data' – 'DB...'**: Points to the 'Section Data' dropdown menu in the 'Section Data' dialog.
- 4. 'AS'**: Points to the 'Code' dropdown menu in the 'Select PSC DB' dialog, which is set to 'AS'.
- 5. 'AS-Super-T\_RMS\_2019'**: Points to the 'Type' dropdown menu in the 'Select PSC DB' dialog, which is set to 'AS-Super-T\_RMS\_2019'.
- 6. '4:T4'**: Points to the list of section properties in the 'Select PSC DB' dialog, where '4:T4' is selected.
- 7. 'OK'**: Points to the 'OK' button at the bottom of the 'Select PSC DB' dialog.

The 'Section Data' dialog box also displays a table of section properties:

| Calc. Section Properties |                |
|--------------------------|----------------|
| Area                     | 0.00000e+00 m² |
| Asy                      | 0.00000e+00 m² |
| Asz                      | 0.00000e+00 m² |
| Ixx                      | 0.00000e+00 m⁴ |
| Iyy                      | 0.00000e+00 m⁴ |
| Ixy                      | 0.00000e+00 m⁴ |
| Czp                      | 0.0000 m       |
| Czm                      | 0.0000 m       |
| Qyb                      | 0.0000 m²      |
| Qzb                      | 0.0000 m²      |
| Peri:O                   | 0.00000e+00 m  |
| Peri:I                   | 0.00000e+00 m  |

### Procedure

Define section for the girder



### Procedure

Super-T section from AS5100.5 2017

**1. Input**  
 T1 : '0.075'm  
 T2 : '0.26'm  
 BT : '0.58'm  
 HT : '1.333'm  
 Thk : '0.12'm

**2. Input**  
 Z1 : '1.425' m  
 Z3 : '0.318' m

**3. Check on 'Auto' for all position**

**4. 'Apply'**

| DB/User | Value   | SRC       | Combined     |
|---------|---------|-----------|--------------|
| PSC     | Tapered | Composite | Steel Girder |

Section ID: 4  
 Name: T4  
 Mesh Size for Stiff. Calc.: m

**Section Properties**  
 Calc. Section Properties

|        |             |                |
|--------|-------------|----------------|
| Area   | 5.77579e-01 | m <sup>2</sup> |
| Asy    | 9.23800e-02 | m <sup>3</sup> |
| Asz    | 2.68504e-01 | m <sup>3</sup> |
| Ixx    | 6.28483e-03 | m <sup>4</sup> |
| Iyy    | 1.72086e-01 | m <sup>4</sup> |
| Izz    | 1.17715e-01 | m <sup>4</sup> |
| Cyp    | 1.0500      | m              |
| Cym    | 1.0500      | m              |
| Czp    | 0.8132      | m              |
| Czm    | 0.7018      | m              |
| Qyb    | 0.7191      | m <sup>2</sup> |
| Qzb    | 0.4268      | m <sup>2</sup> |
| Peri:O | 9.06872e+00 | m              |
| Peri:I | 0.00000e+00 | m              |

**Param. for Design**

T1: 0.075 m  
 T2: 0.260 m  
 BT: 0.58 m  
 HT: 1.333 m  
 Thk for Torsion(min.): 0.12 m (Auto)

☒ Consider Shear Deformation  
☐ Consider Warping Effect (7th DOF)  
 Warping Check: ☐ Auto ☐ User

**Shear Check**

| Position     | Qy               | Qz for Shear(total) |
|--------------|------------------|---------------------|
| Z1: 1.425 m  | 0 m <sup>3</sup> | 0 m <sup>3</sup>    |
| Z2: Centroid | 0 m <sup>3</sup> | 0 m <sup>3</sup>    |
| Z3: 0.318 m  | 0 m <sup>3</sup> | 0 m <sup>3</sup>    |

Offset: Center-Center  
 Change Offset...  
 Display Centroid

Show Calculation Results... OK Cancel **Apply** Command

**PSC Viewer**

Viewer

**Procedure**

Click 'Display Centroid' to check stress points on the cross section. Stress results are shown at the stress points.

**Param. for Design:** Enter the section dimensions to be used for design, referring to PSC Viewer. The dimensions are used for calculating the shear strength. If 0 is inputted in T2, then the program automatically recognizes the section as a Tee section, and uses BT as web thickness. The parameters for closed section and open section are calculated using the following equations:

For closed section:  $k_t = 2F \cdot t$

For open section:  $k_t = \sum \frac{1}{3} b t^3$

Where, F = the area enclosed by the centerlines of the plates of the closed section, t = the thickness of the plate

For Chinese Design Spec. Roark's Formula is used:

$$k_t = \frac{8ab^2}{3[1 + 0.6095\frac{b}{a} + 0.8865(\frac{b}{a})^2 - 1.8023(\frac{b}{a})^3 + 0.9100(\frac{b}{a})^4]}$$

**Thk. for Torsion (min.):** Enter the minimum web thickness for calculating torsional stress.

**Shear Check:** Check shear stresses at Z1, Z2 and Z3 locations. Enter Z1 and Z3 directly. Qy and Thk. for Shear (total)" can be either directly inputted by the user or specified automatically.

Tree Menu Task Pane

Tables Works Group Report

Section Data

DB/User Value  
PSC Tapered

Section ID 9 PSC-Value

Name T2-2 Mesh Size for Stiff C

Define by Coordinates...

Section Data

Param. for Design

T1 0 m

T2 0 m

BT 0 m

HT 0 m

Thk. for Torsion(min.) 0 m Auto

☒ Consider Shear Deformation ☐ Consider Warping Effect(7th DOF)

Warping Check ☐ Auto ☐ User

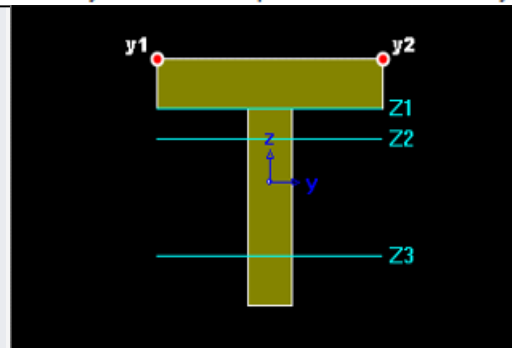
Shear Check

| Position     | Qy   | Auto                     | Thk. for Shear(total) | Auto                     |
|--------------|------|--------------------------|-----------------------|--------------------------|
| Z1: 0 m      | 0 m³ | <input type="checkbox"/> | 0 m                   | <input type="checkbox"/> |
| Z2: Centroid | 0 m³ | <input type="checkbox"/> | 0 m                   | <input type="checkbox"/> |
| Z3: 0 m      | 0 m³ | <input type="checkbox"/> | 0 m                   | <input type="checkbox"/> |

Offset: Center-Center

Change Offset ... Display Centroid

Show Calculation Results... OK Cancel Apply



**Change the section shape by changing the coordinates in the cross-section.  
Solid type section can be defined by dragging the number and pressing 'Delete' key.**

The screenshot displays the 'Define by Coordinates' dialog box in the software. The 'Outer Polygon' list is highlighted with a red circle, and a red arrow points to the instruction. The background shows the 'Section Properties' and 'Section Data' panels.

**Section Properties**

| Property | Value          |
|----------|----------------|
| Area     | 5.7709e-01 m²  |
| Asy      | 9.23800e-02 m² |
| Asz      | 2.68584e-01 m² |
| Ixx      | 6.28483e-03 m⁴ |
| Iyy      | 1.72086e-01 m⁴ |
| Izz      | 1.17715e-01 m⁴ |
| Cyp      | 1.0500 m       |
| Cym      | 1.0500 m       |
| Czp      | 0.8132 m       |
| Czm      | 0.7018 m       |
| Qyb      | 0.7191 m²      |
| Qzb      | 0.4268 m²      |
| Peri:O   | 9.06872e+00 m  |
| Peri:I   | 0.00000e+00 m  |

**Section Data**

Section ID: 4

Name: T4

Define by Coordinates

Section Data

Param. for Design

T1: 0.075 m

T2: 0.26 m

BT: 0.58 m

HT: 1.333 m

Thk. for Torsion(min.): 0.12 m

Consider Shear Deformation: ☒ Consider Warping Effect(7th DOF): ☐ Warping Check: ☐ Auto ☐ User

Shear Check

| Position     | Qy              | Auto                                | Thk. for Shear(total) | Auto                                |
|--------------|-----------------|-------------------------------------|-----------------------|-------------------------------------|
| Z1: 1.425 m  | 0.086432150 m²  | <input checked="" type="checkbox"/> | 0.400988293 m         | <input checked="" type="checkbox"/> |
| Z2: Centroid | 0.144158074 m²  | <input checked="" type="checkbox"/> | 0.200470587 m         | <input checked="" type="checkbox"/> |
| Z3: 0.318 m  | 0.1293551074 m² | <input checked="" type="checkbox"/> | 0.2525283151 m        | <input checked="" type="checkbox"/> |

Offset: Center-Center

Change Offset...

Display Centroid

Show Calculation Results... OK Cancel Apply

**Define by Coordinates**

Input Method: ☒ X, Y ☐ DX, DY

Polygon Number: Outer 1 Inner 0

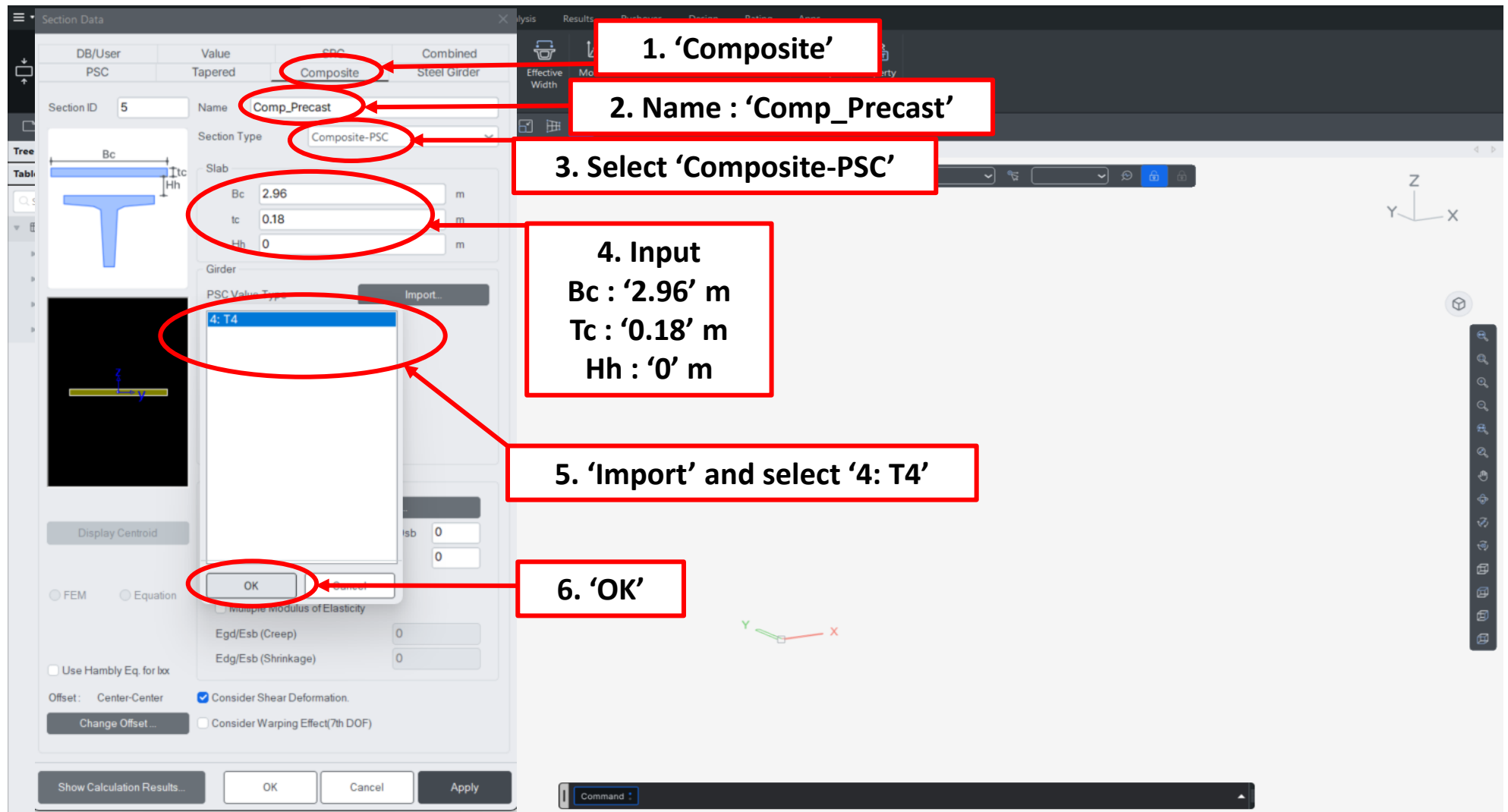
Define Polygon Number

Outer Polygon 1

|    | X (m)       | Y (m)       |
|----|-------------|-------------|
| 10 | 1.05000000  | 0.81318000  |
| 11 | 0.44650000  | 0.81318000  |
| 12 | 0.44650000  | 0.78818000  |
| 13 | 0.4100      | 0.78818000  |
| 14 | 0.89000000  | -0.37882000 |
| 15 | 0.00000000  | -0.43682000 |
| 16 | -0.30000000 | -0.37882000 |
| 17 | -0.4100     | 0.78818000  |
| 18 | -0.44650000 | 0.78818000  |
| 19 | -0.44650000 | 0.81318000  |
| 20 |             |             |

Import Export

OK Cancel



### Procedure

Define section for composite girder. Import the girder section which was defined under PSC tap.

**1. Click**

**2. 'AS17(RC)'**

**3. 'C40'**

**4. 'AS17(RC)'**

**5. 'C50'**

**6. 'OK'**

**7. Click**

**8. Offset 'Center-Top'**

**9. 'OK'**

**10. 'OK'**

### Procedure

Define section for composite girder. The ratio of material properties decides composite sectional properties. Check with 'Show Calculation Results...' button.

## ***Overview***

### ▪ **Properties**

- Material / Section

### ▪ **Prestressed Composite Bridge Wizard**

- Layout
- Section
- Tendon
- Load
- Construction Stage

### ▪ **Load**

- Time Dependent Material
- Moving load
- Response Spectrum Analysis

### ▪ **Analysis**

- Moving Load

### ▪ **Results**

- Load Combination
- Reaction/Force/Displacement
- Moving Tracer
- Concurrent Force
- Tendon Losses
- Mode Shape

### ▪ **Design**

- PSC Design

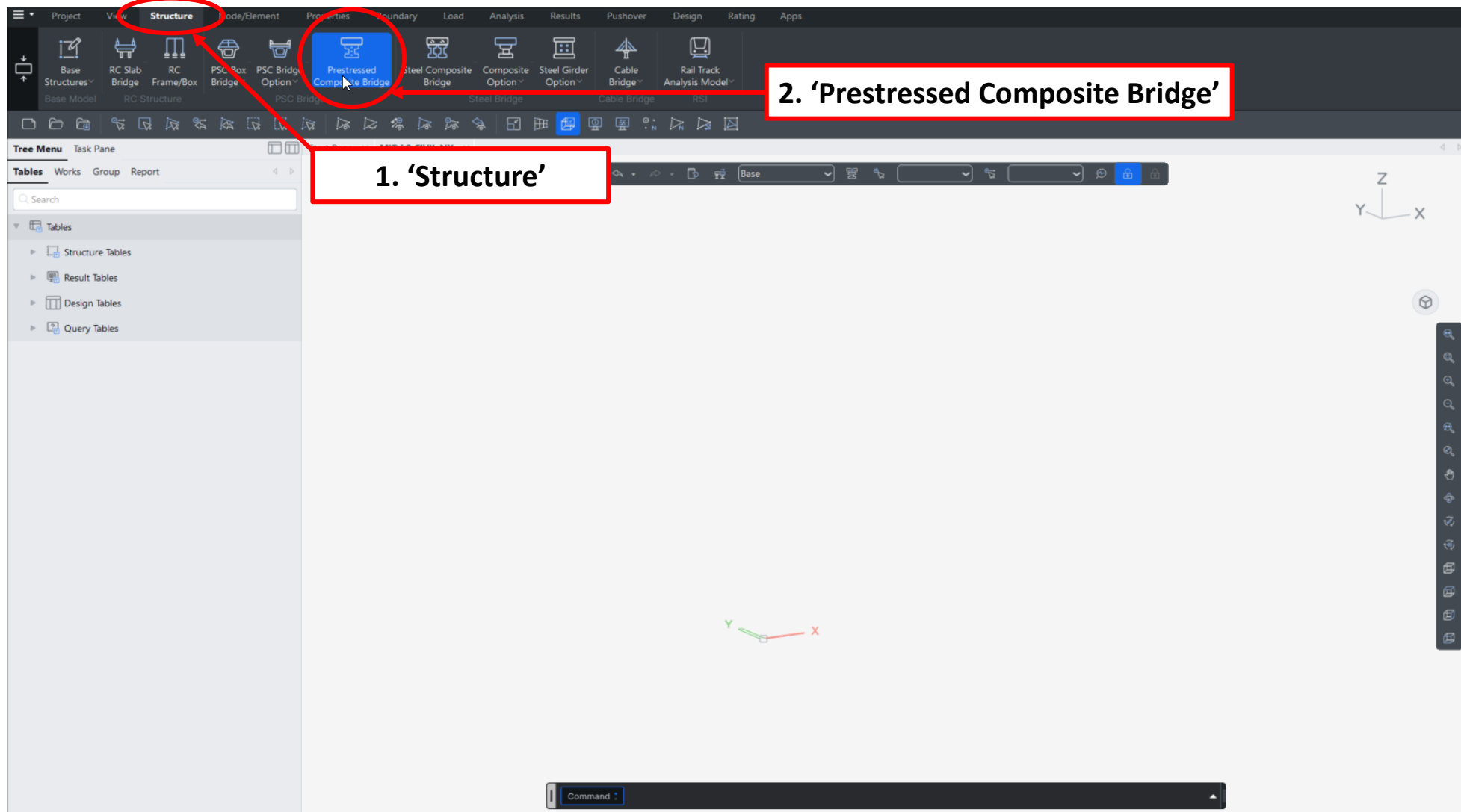
### ▪ **Tips**

- Smart Report
- MCT Command Shell
- Tendon Template
- Import tendon from AutoCAD

### ▪ **Appendix. Load Combinations**

# **Step 2. Prestressed Composite Bridge Wizard**

# Prestressed Composite Bridge Wizard



## Procedure

Execute Prestress Composite Bridge wizard.

**Pre/Post-Tensioned Composite Girder Bridge Wizard**

**Layout** | Section | Tendon | Load | Construction Stage

Reference Line  
Skew Angle  
Centroid of deck  
Span 1  
Layout Offset (+)  
P1  
Pn (-)  
Deck width  
A1  
A2

Girder Type: **Precast Girder Type** | Modeling Type: **All Frame**

Span Information: **32,24,36,32,24** m | Deck Width: **17.76** m

Layout Offset: **0** m | Spacing(a): **0.15** m

Support Skew Angle: **0** deg | Spacing(b): **0.25** m

☒ Continuous Girder

☐ Radius: **0** m | ☐ Concave | ☐ Convex

☐ Multi-Curve | ☐ Curve Data | ☐ Coordinate Data | **Advanced...**

Girder Alignment: **Same Spacing** | **Guide...** | Reference Support: **Abutment 1**

**Boundary/Substructure**

☐ Without Substructure | ☒ With Substructure | **Guide...**

Bearing Type/Elastic Link Stiffness

Abutment: **Fixed** | Kx: **729695** kN/m | Ky: **1459.39** kN/m | Kz: **1459.39** kN/m

Pier: **Elastic Link** | Kx: **1.5e+06** kN/m | Ky: **3000** kN/m | Kz: **3000** kN/m

☐ **Advanced...** | Elastic Link Length: **0.3** m

Pier

Material: **1** | **1: C50**

☒ Pier Cap

Section: **2** | **2: Pier Cap**

Length: **15.5448** m

Column

Section: **1** | **1: Pier Column**

Height: **9** m | **Advanced...**

Spacing: **12** m

Pier Support: **Fixed** | Horizontal: **0** kN/m | Vertical: **0** kN/m | **Advanced...**

**Open...** | **Save As...** | **OK** | **Cancel**

**1. Girder Type : 'Precast Girder Type'**

**2. Span Information : '32.24, 36, 32.24'**

**3. Deck Width : '17.76'**

**4. Spacing (a) : '0.15'**

**5. Spacing (b) : '0.25'**

**6. Select 'With Substructure'**

**7. Abutment : 'Fixed'**

**8. Pier : 'Elastic Link'**

**9. Kx : '1.5e+6'**

**10. Ky : '3000'**

**11. Kz : '3000'**

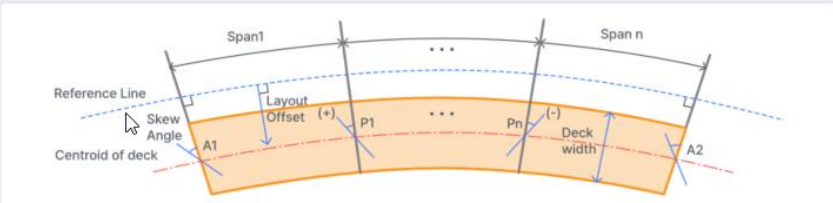
**12. Elastic Link Length : '0.3'm'**

## Procedure

Shell(Plate) elements are generated for the slab if 'Modelling Type' is 'Deck as Plate, Girder as Frame'.  
Kx is vertical direction, Ky is transverse direction and Kz is longitudinal direction for bearing stiffness.

Pre/Post-Tensioned Composite Girder Bridge Wizard

Layout Section Tendon Load Construction Stage



Girder Type: Precast Girder Type  
 Span Information: 32,24,36,32,24 m  
 Layout Offset: 0 m  
 Support Skew Angle: 0 deg  
 Modeling Type: All Frame  
 Deck Width: 17.76 m  
 Spacing(a): 0.15 m  
 Spacing(b): 0.25 m  
☒ Continuous Girder  
☐ Radius: 0 m  
☐ Multi-Curve  
☐ Curve Data  
☐ Coordinate Data  
 Girder Alignment: Same Spacing  
 Reference Support: Abutment 1

Boundary/Substructure

☐ Without Substructure  
☒ With Substructure

Bearing Type/Elastic Link Stiffness

Abutment: Fixed  
 Kx: 729695 kN/m  
 Ky: 1459.39 kN/m  
 Kz: 1459.39 kN/m

Pier: Elastic Link  
 Kx: 1.5e+006 kN/m  
 Ky: 3000 kN/m  
 Kz: 3000 kN/m  
 Elastic Link Length: 0.3 m

Pier

Material: 1: C50  
☒ Pier Cap  
 Section: 2: Pier Cap  
 Length: 15.548 m  
 Pier Support: Fixed  
 Horizontal: 0 kN/m  
 Vertical: 0 kN/m

Column

Section: 1: Pier Column  
 Height: 9 m  
 Spacing: 12 m

Open... Save As... OK Cancel

## -Pier-

1. Material : '1: C50'
2. Check on 'Pier Cap'
3. Section : '2: Pier Cap'
4. Length : '17.76' m

## -Column-

1. Section : '1: Pier Column'
2. Height : '9'
3. Spacing : '12'

**Procedure**

Pre/Post-Tensioned Composite Girder Bridge Wizard

Layout **Section** Tendon Load Construction Stage

Deck Thickness:  m

Haunch Height:  m

Material

Deck:  2: C40

Girder:  1: C50

Diaphragm:  2: C40

☒ Diaphragm

Define Diaphragm Section...

Intermediate Spacing:  ☐ Advance

| Diaphragm    | Name          | Divisions per Span |
|--------------|---------------|--------------------|
| End Support  | 3: Cross Beam |                    |
| Pier Support | 3: Cross Beam |                    |
| Intermediate | 3: Cross Beam | 1                  |

Spacing

Distances:  m

Angle type:

Girder Information

Span 1 Span 2 Span 3

No. of Divisions:

| No. | Name            | Start (m) | End (m) |
|-----|-----------------|-----------|---------|
| 1   | 5: Comp_Precast | 0         | 32.165  |

Number of Girders:

| Girder No. | Girder Offset (m) |
|------------|-------------------|
| 1          | -7.4              |
| 2          | -4.44             |
| 3          | -1.48             |
| 4          | 1.48              |
| 5          | 4.44              |
| 6          | 7.4               |

Define Girder Section...

☐ Generate 10th points elements

Deck Thickness : '0.18' m  
Material  
Deck : '2: C40'  
Girder '1: C50'  
Diaphragm : '2: C40'

Number of Girder : '6'  
1 : '-7.4'  
2 : '-4.44'  
3 : '-1.48'  
4 : '1.48'  
5 : '4.44'  
6 : '7.4'

## Procedure

Move to other cells by pressing 'Tap' or 'Shift + Tap' key or arrows on the keyboard. Overwrite input data by just typing the value after moving to other cells.

Pre/Post-Tensioned Composite Girder Bridge Wizard

Layout **Section** Tendon Load Construction Stage

Deck Thickness: 0.18 m

Haunch Height: 0.0762 m

Material:

Deck: 2: C40

Girder: 1: C50

Diaphragm: 2: C40

Number of Girders: 6

| Girder No. | Girder Offset (m) |
|------------|-------------------|
| 1          | -7.4              |
| 2          | -4.44             |
| 3          | -1.48             |
| 4          | 1.48              |
| 5          | 4.44              |
| 6          | 7.4               |

Transverse Deck Element

Spacing: Distances 1 m

Angle type: Perpendicular

Diaphragm Information

| Diaphragm    | Name          | Divisions per Span |
|--------------|---------------|--------------------|
| End Support  | 3: Cross Beam |                    |
| Pier Support | 3: Cross Beam |                    |
| Intermediate | 3: Cross Beam | 1                  |

Girder Information

Span 1 Span 2 Span 3

No. of Divisions: 1

| No. | Name            | Start (m) | End (m) |
|-----|-----------------|-----------|---------|
| 1   | 5: Comp_Precast | 0         | 32.165  |

Define Girder Section...

☒ Generate 10th points elements

OK Cancel

Intermediate Spacing : 'Divisions per Span'

End Support : '3: Cross Beam'

Pier Support : '3: Cross Beam'

Intermediate Support : '3: Cross Beam'

Divisions per Span : '1'

Spacing : 'Distance' '1' m

Angle type : 'Perpendicular'

Span 1, Span 2, Span 3

No. of Divisions '1'

Select '5:Comp\_Precast'

Check off 'Generate 10<sup>th</sup> Points elements'

## Procedure

Diaphragm Information is to define cross beams. 'Generate 10<sup>th</sup> Points elements' option is to cut elements as per AASHTO LRFD code. Input the number on 'No. of Divisions' if there are more than 1 different girder section within one span.

**2. Click 'Add'**

**1. Click '...'**

**3. Input and Select**  
**Tendon Name : 'Tendon'**  
**Tendon Type : 'Internal(Pre-Tension)'**  
**Material : '3: 1670'**

**4. Select**  
**'15.2mm(1x7)'**

**5. Input '1'**

**6. Click 'OK'**

**7. Relaxation Coefficient : 'AS 5100.5-2017'**

**8. Click 'OK'**

**Tendon Property**

| Name  | Type  |
|-------|-------|
| Span1 | Span1 |

**Add/Modify Tendon Property**

Tendon Type: Tendon

Tendon Name: Tendon

Tendon Type: Internal(Pre-Tension)

Material: 3: 1670

Total Tendon Area: 0.00014 m<sup>2</sup>

Strand Diameter: 0.01335116247 m

☒ Relaxation Coefficient: AS 5100.5-2017 Rb(%) 5

Name: AS 5100.5-2017 Rb(%) 5

Characteristic Value of Strength (fpb): 1.86326e+06 kN/m<sup>2</sup>

Yield Strength (fpy): 1.56906e+06 kN/m<sup>2</sup>

Curvature Friction Factor: 0

Wobble Friction Factor: 0 1/m

External Cable Moment Magnifier: 0 kN/m<sup>2</sup>

Anchorage Slip(Draw in)

Begin: 0 m

End: 0 m

Bond Type: ☐ Bonded ☐ Unbonded

**Tendon Area**

Strand Diameter: 12.7mm(0.5")

Number of Strands: 1

OK Cancel

**Tendon Assignment List**

| No. | Name  | Total Tendon |
|-----|-------|--------------|
| 1   | Span1 | 48           |
| 2   | Span2 | 48           |
| 3   | Span3 | 48           |

Jacking Stress: 1396188.7 kN/m<sup>2</sup> Grouting

Open... Save As... OK Cancel

## Procedure

Define tendon property. Total Tendon Area can be calculated automatically or can be input manually. Select 'User Defined' option to define your own creep/shrinkage/relaxation function. Input data for function can be pasted from Microsoft Excel Spread Sheet.

**1. 'Auto Generation'**

**2. Check tendon property and section**

**3. 'OK'**

**4. 'Add'**

**Tendon Property Dialog:**

- Tendon Property: Tendon
- Code: AS
- Type: AS-Super-T\_RMS\_2019
- Name: T4
- Origin Point: 0.000, 0.000 m
- ☒ Initialize Tendon Template
- Buttons: OK, Cancel

**Tendon Assignment Table:**

| No. | Type     | Tendon Property | Number of Tendons | Transvers Distance(S) | D (m) | H1 (m) | H2 (m) | L1 (m) | R1 (m) |
|-----|----------|-----------------|-------------------|-----------------------|-------|--------|--------|--------|--------|
| 1   | Straight | Tendon          | 8                 | -0.1, 5@-0.05, -0.1   | 0     | 1.455  | 0      | 0      | 0      |
| 2   | Straight | Tendon          | 12                | 11@-0.05              | 0     | 1.405  | 0      | 0      | 0      |
| 3   | Straight | Tendon          | 12                | 11@-0.05              | 0     | 1.355  | 0      | 0      | 0      |
| 4   | Straight | Tendon          | 12                | 11@-0.05              | 0     | 1.305  | 0      | 0      | 0      |
| 5   | Straight | Tendon          | 2                 | -0.55                 | 0     | 1.255  | 0      | 0      | 0      |
| 6   | Straight | Tendon          | 2                 | -0.99                 | 0     | 0.08   | 0      | 0      | 0      |

Jacking Stress: 1396188.7 kN/m<sup>2</sup>    Grouting: After 0 Stages    Detailed...

**Tendon Assignment List:**

| No. | Name  | Total Tendon |
|-----|-------|--------------|
| 1   | Span1 | 48           |
| 2   | Span2 | 48           |
| 3   | Span3 | 48           |

Buttons: Open..., Save As..., Add, Modify, Delete, OK, Cancel

## Procedure

D : Transverse location of the tendon in the cross section / H : Vertical location of the tendon from the top of the section / Grouting : Grouting stage after jacking the tendon. Go to 'Detailed...' to define debonding length.

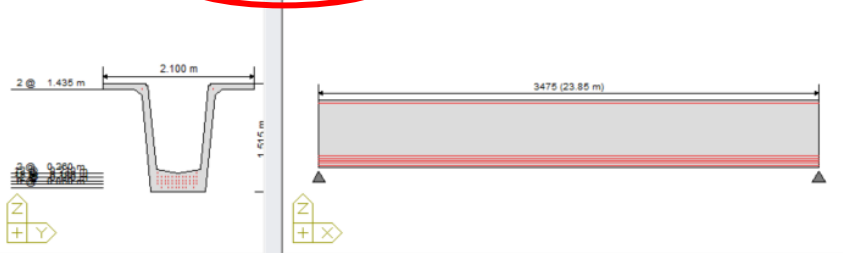
Pre/Post-Tensioned Composite Girder Bridge Wizard

Layout Section Tendon Load Construction Stage

Tendon Assignment Table Guide...

Tendon Assignment Name  Tendon Property ...

Segments



Auto Generation

| No. | Type     | Tendon Property | Number of Tendons | Transvers Distance(S) | D (m) | H1 (m) | H2 (m) | L1 (m) | R1 (m) |
|-----|----------|-----------------|-------------------|-----------------------|-------|--------|--------|--------|--------|
| 1   | Straight | Tendon          | 8                 | -0.1, 5@-0.05, -0.1   | 0     | 1.455  | 0      | 0      | 0      |
| 2   | Straight | Tendon          | 12                | 11@-0.05              | 0     | 1.405  | 0      | 0      | 0      |
| 3   | Straight | Tendon          | 12                | 11@-0.05              | 0     | 1.355  | 0      | 0      | 0      |
| 4   | Straight | Tendon          | 12                | 11@-0.05              | 0     | 1.305  | 0      | 0      | 0      |
| 5   | Straight | Tendon          | 2                 | -0.55                 | 0     | 1.255  | 0      | 0      | 0      |
| 6   | Straight | Tendon          | 2                 | -0.99                 | 0     | 0.08   | 0      | 0      | 0      |

Jacking Stress  kN/m<sup>2</sup> Grouting After  Stages ☐ Detailed...

Tendon Assignment List

| No. | Name  | Total Tendon |
|-----|-------|--------------|
| 1   | Span1 | 48           |
| 2   | Span2 | 48           |
| 3   | Span3 | 48           |

Open... Save As... OK Cancel

1. Select 'Span2'

2. Click 'Add'

## Procedure

Adding same tendon definitions for Span 2

Pre/Post-Tensioned Composite Girder Bridge Wizard

Layout Section Tendon Load Construction Stage

Tendon Assignment Table Guide...

Tendon Assignment Name Span3 Tendon Property ...

Segments Span3

1. Select 'Span3'

Auto Generation

| No. | Type     | Tendon Property | Number of Tendons | Transvers Distance(S) | D (m) | H1 (m) | H2 (m) | L1 (m) | R1 (m) |
|-----|----------|-----------------|-------------------|-----------------------|-------|--------|--------|--------|--------|
| 1   | Straight | Tendon          | 8                 | -0.1, 5@-0.05, -0.1   | 0     | 1.455  | 0      | 0      | 0      |
| 2   | Straight | Tendon          | 12                | 11@-0.05              | 0     | 1.405  | 0      | 0      | 0      |
| 3   | Straight | Tendon          | 12                | 11@-0.05              | 0     | 1.355  | 0      | 0      | 0      |
| 4   | Straight | Tendon          | 12                | 11@-0.05              | 0     | 1.305  | 0      | 0      | 0      |
| 5   | Straight | Tendon          | 2                 | -0.55                 | 0     | 1.255  | 0      | 0      | 0      |
| 6   | Straight | Tendon          | 2                 | -0.99                 | 0     | 0.08   | 0      | 0      | 0      |
| 7   |          |                 |                   |                       |       |        |        |        |        |

Jacking Stress 1396188.7 kN/m<sup>2</sup> Grouting After 0 Stages Detailed...

Tendon Assignment List

2. Click 'Add'

| No. | Name  | Total Tendon |
|-----|-------|--------------|
| 1   | Span1 | 48           |
| 2   | Span2 | 48           |
| 3   | Span3 | 48           |

Open... Save As... OK Cancel

## Procedure

Adding same tendon definitions for Span 3

**1. Check deck width and dead load values**

**3. Select 'Australia' Click 'OK'**

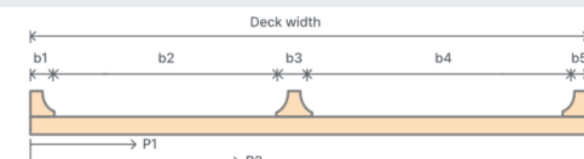
**Procedure**

When 'Equally to All girder' is checked on, total dead loads are divided by the number of girder, and load values are same for each girder; Or the loads on each girder may be different because of the division ratio of dead load with different distances between the girders.

Pre/Post-Tensioned Composite Girder Bridge Wizard

Layout Section Tendon **Load** Construction Stage

Pavement and Barrier



b1 0.4572 m b2 8.118 m b3 0.6096 m b4 8.118 m b5 0.4572 m

Dead Loads

Equally to All Girder

☒ DC(Before Composite) ☐ DC(After Composite) ☒ DW(After Composite)

DC DW

☒ Self Weight

Composite

Thickness 0.18 m

Form Work 0 kN/m<sup>2</sup>

S.I.P forms

After Composite

☒ Barrier 6 kN/m

☒ Median Strip 4 kN/m

☐ Additional Load 0 kN/m

Positions (P1) m

☒ Wearing Surface

Weight Density 20 kN/m<sup>3</sup>

Thickness 0.1 m

☐ Utilities 0 kN/m

Positions (P2) m

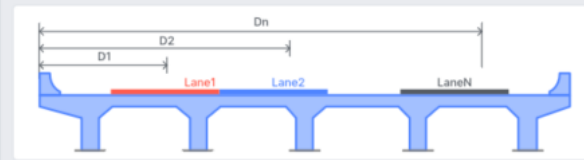
**1. Check on 'Live Loads'**

☒ Live Loads Define Moving Load Case... Define Traffic Lanes... Define Vehicles...

Open... Save As... OK Cancel

Define Traffic Lanes

Traffic Lanes



No. of Lanes 4

| No. | Distance(m) |
|-----|-------------|
| D1  | 3.63        |
| D2  | 7.13        |
| D3  | 10.63       |
| D4  | 14.13       |

**2. No. of Lanes : '4'**  
**D1 : '3.63'**  
**D2 : '7.13'**  
**D3 : '10.63'**  
**D4 : '14.13'**

**3. Click 'OK'**

## Procedure

D1~D4 : Transverse distance from the left side of the bridge.

**Define Standard Vehicular Load**

Standard Name: AS 5100.2 - Road Traffic

Vehicular Load Properties

Vehicular Load Name: M1600

Vehicular Load Type: M1600

Dynamic Load Allowance: 0.3

| No | Load(kN) | Spacing(m) |
|----|----------|------------|
| 5  | 120      | 1.25       |
| 6  | 120      | 6.25       |
| 7  | 120      | Infinite   |
| 8  | 120      | 1.25       |
| 9  | 120      | 1.25       |
| 10 | 120      | 5          |
| 11 | 120      | 1.25       |
| 12 | 120      | 1.25       |

**1. Standard Name**  
**'AS 5100.2 – Road Traffic'**

**2. Vehicular Load Type**  
**'M1600'**

**3. 'Apply'**

## Procedure

Vehicles are provided based on the design codes. Use 'Add User Defined' to define special vehicles.

**Define Standard Vehicular Load**

Standard Name: AS 5100.2 - Road Traffic

Vehicular Load Properties:

- Vehicular Load Name: M1600 tri-axle group
- Vehicular Load Type: M1600 tri-axle group
- Dynamic Load Allowance: 0.35

Diagram showing load positions P1, P2, P3 and spacing D1, D2.

| No | Load(kN) | Spacing(m) |
|----|----------|------------|
| 1  | 120      | 1.25       |
| 2  | 120      | 1.25       |
| 3  | 120      | end        |

W 6 kN/m

**1. Select 'M1600 tri-axle group'**

**2. 'OK'**

## Procedure

Vehicles are provided based on the design codes. Use 'Add User Defined' to define special vehicles.

**1. Check on 'Construction Stage'**

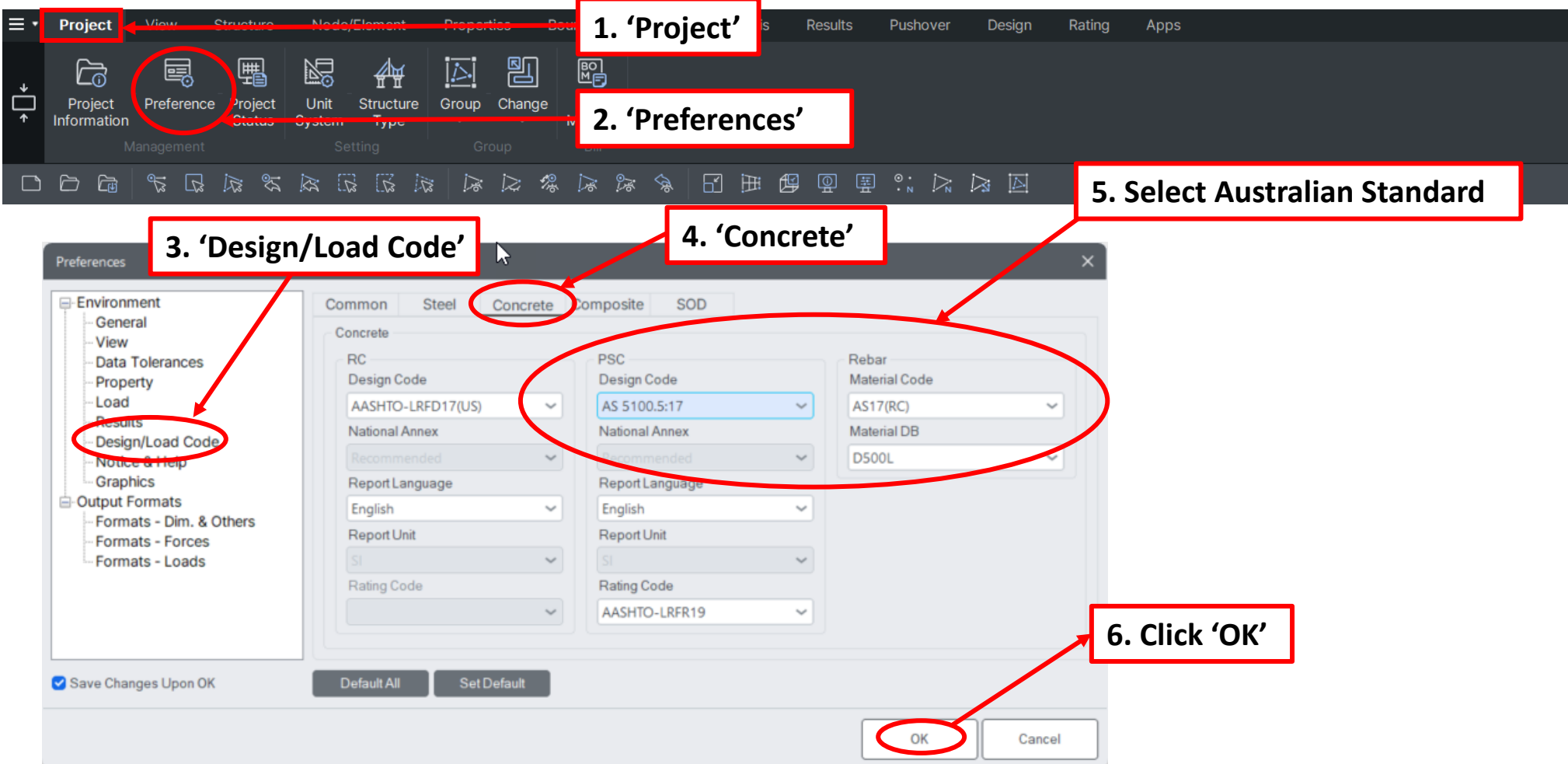
| Stage | Stage Description                           | Load Condition                   | Duration (Day) |
|-------|---------------------------------------------|----------------------------------|----------------|
| 1     | Substructure is Activated                   | Self Weight is Activated         | 10             |
| 2     | Girder(Part1), Diaphragm is Activated       | Prestress load in Precast Girder | 10             |
| 3-1   | Deck is Activated as a Load                 | Wet Concrete Load is Activated   | 10             |
| 3-2   | Deck is in Composite Stage, span continuous | Wet Concrete Load is deactivated |                |
| 4     | After-Composite Load is Activated           | DC2, DW Load is Activated        | 10             |
| 5     | Long Term Effect is Considered              | -                                | 10000          |

**2. Save input values**

**3. Click 'OK'**

## Procedure

Construction stage analysis generate creep/shrinkage/tendon primary and secondary load cases. Time dependent material properties has to be defined manually to view creep/shrinkage effect.



## Procedure

The unit of rebar changes depends on the setting of Preferences.

**1. Section Manager - Reinforcement**

**2. Select '5: Comp\_Precast'**

**3. Check on 'Guide Line' Input : '0.05' m**

**4. Select 'Input Method B'**

**5. 'CTC' '0.15' Check on 'Edge Bar' Dia : 'D6' Part : 'Part 2'**

**Procedure**

Input cover value on 'Guide Line'.  
Part 1 : Girder | Part 2 : Slab

The screenshot shows the MIDAS CIVIL NX 2025 software interface. The 'Section Manager' dialog is open, displaying a cross-section of a bridge. The 'Longitudinal Reinforcement' panel is active, showing options for 'Input Method A' and 'Input Method B'. The 'Add' button is highlighted with a red circle and an arrow labeled '3. Click'. The 'Section Manager' dialog also shows a list of sections on the left, including 'Section: 3', '4: T4', '5: Comp\_Precast', and '6: Comp\_Precast'. The main area shows a cross-section of a bridge with a grid of 0.1 m. The 'Guide Line' is visible, and the 'Add' button is highlighted with a red circle and an arrow labeled '3. Click'. The 'Section Manager' dialog also shows a list of sections on the left, including 'Section: 3', '4: T4', '5: Comp\_Precast', and '6: Comp\_Precast'. The main area shows a cross-section of a bridge with a grid of 0.1 m. The 'Guide Line' is visible, and the 'Add' button is highlighted with a red circle and an arrow labeled '3. Click'.

**1. Click**

**2. Click**

**3. Click**

**Procedure**

Snap the corner of the Guide line.  
Zoom-in or Zoom-out by scrolling the mouse.

**1. Click**

**2. Check**

**3. Check**

**4. Pitch : '0.15' m  
Angle : '90' [deg]**

**5. Dia : 'D12'  
Num. '1'  
Click 'OK'**

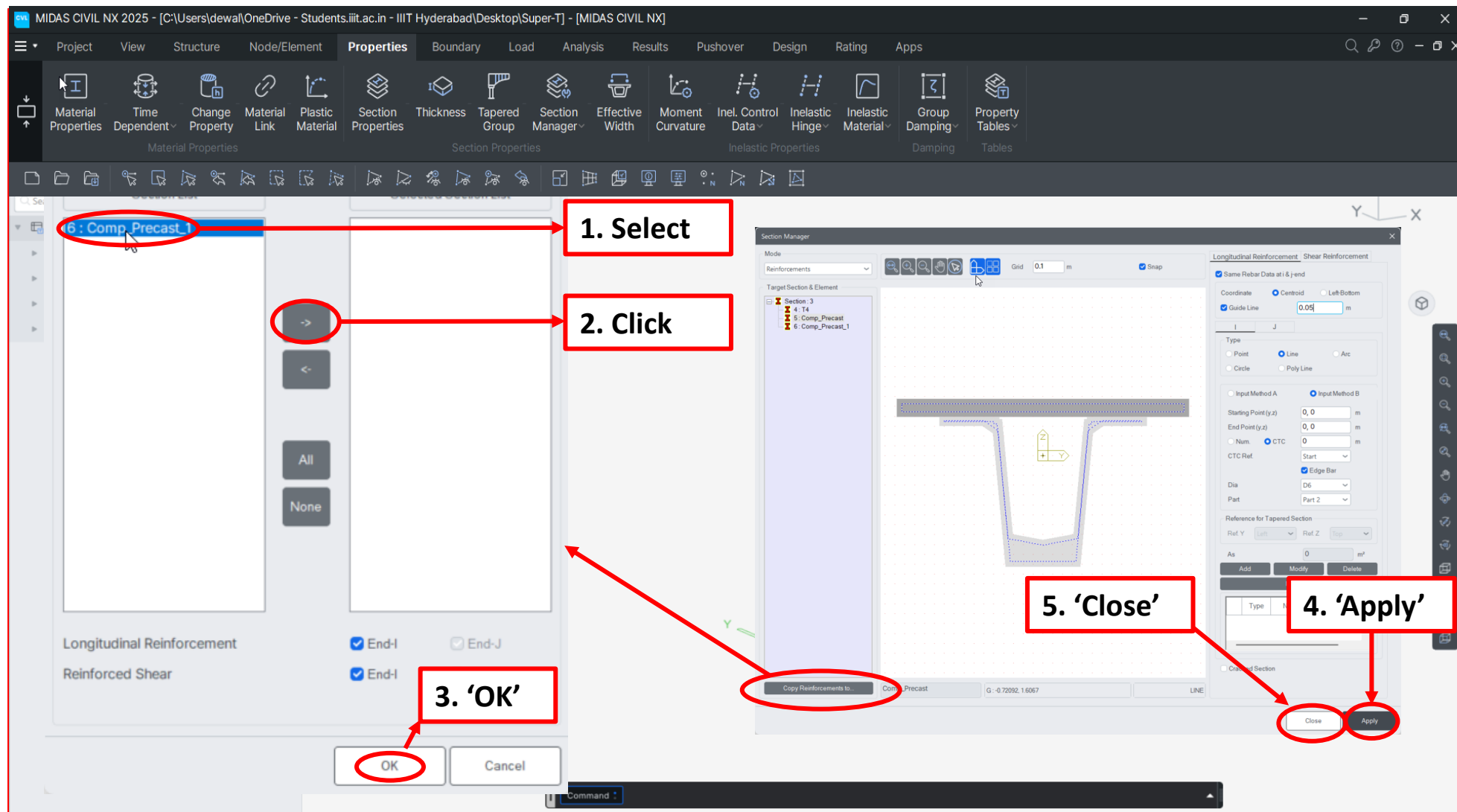
**6. 'Torsional Reinforcement'  
Pitch : '0.15'  
Awt : '0.0001131'  
Alt : '0.0001131'**

**7. 'Enclosing Stirrup'  
Cover : '0.05'**

**8. 'Apply'**

## Procedure

Awt: Total Area of transverse torsional reinforcement  
Alt : Total Area of longitudinal torsional reinforcement



## Procedure

Copy reinforcement details to other sections

## *Overview*

### ▪ Properties

- Material / Section

### ▪ Prestressed Composite Bridge Wizard

- Layout
- Section
- Tendon
- Load
- Construction Stage

### ▪ Load

- Time Dependent Material
- Moving load
- Response Spectrum Analysis

### ▪ Analysis

- Moving Load

### ▪ Results

- Load Combination
- Reaction/Force/Displacement
- Moving Tracer
- Concurrent Force
- Tendon Losses
- Mode Shape

### ▪ Design

- PSC Design

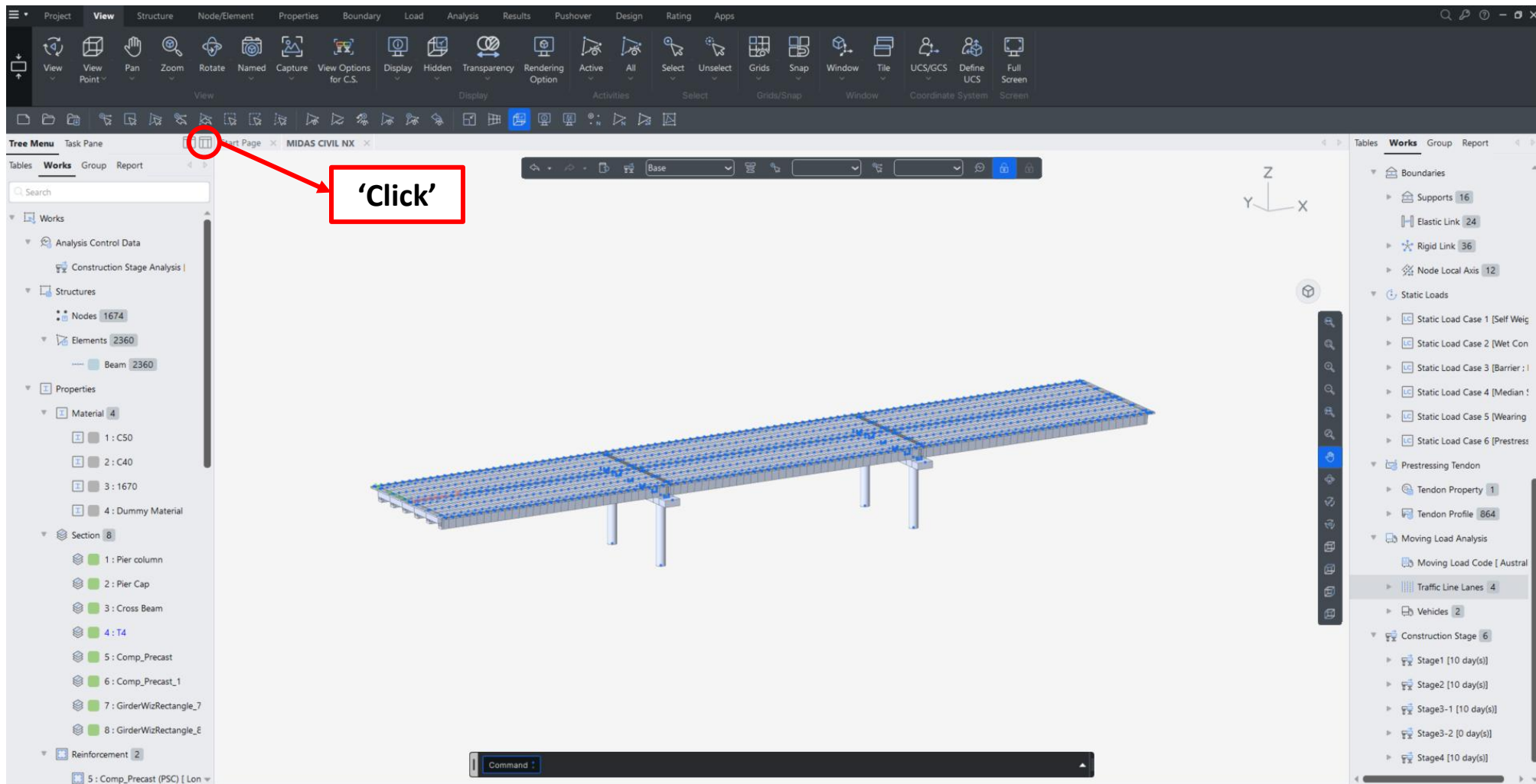
### ▪ Tips

- Smart Report
- MCT Command Shell
- Tendon Template
- Import tendon from AutoCAD

### ▪ Appendix. Load Combinations

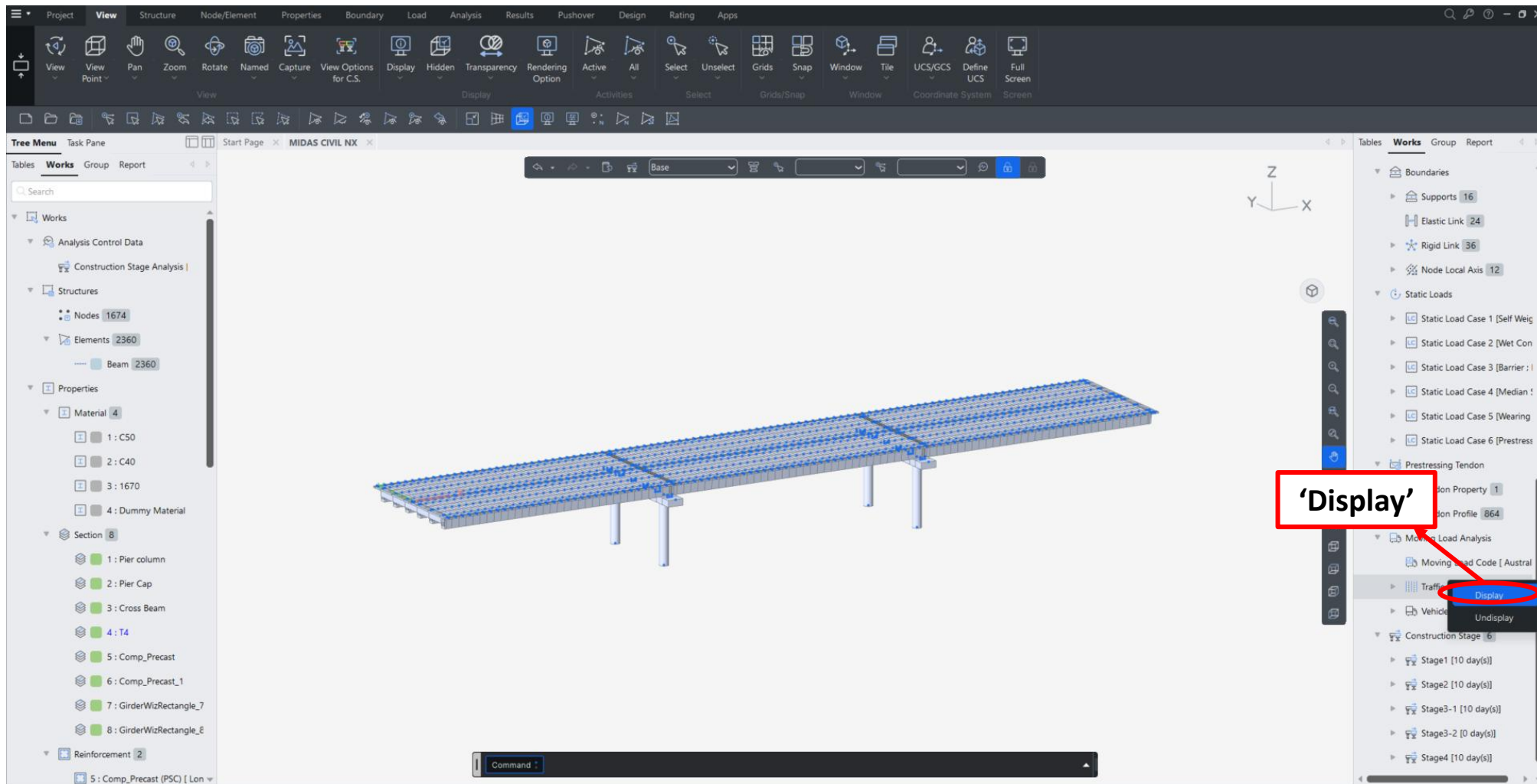
# Step 3. Load

## -TDM / Moving Load / Response Spectrum



## Procedure

Click on the icon shown above to Activate Tree Menu 2

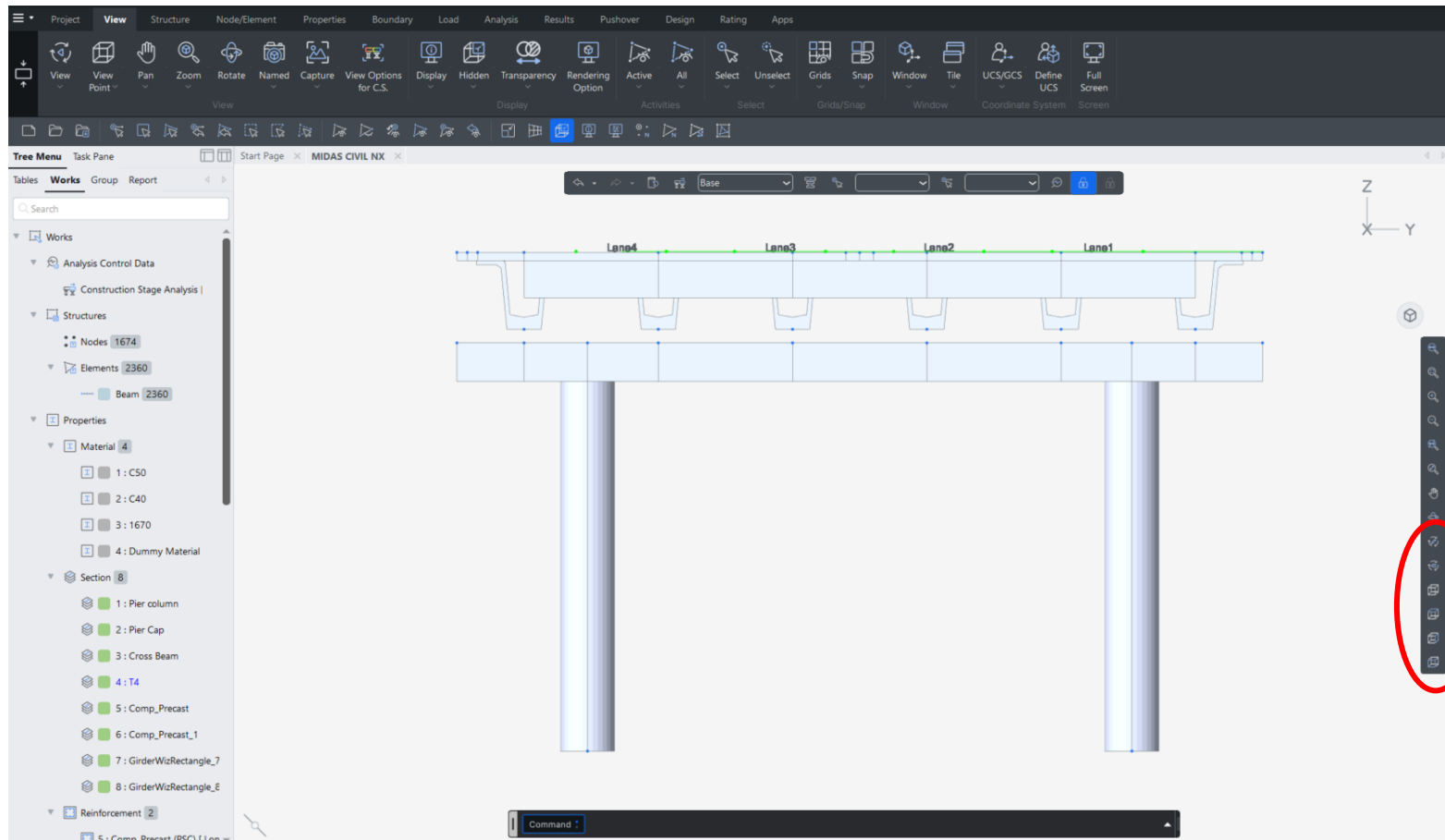


### Procedure

Display or Undisplay Traffic Line Lane which has been defined by the wizard from the context menu.  
Check and modify other functions as well using Works tree menu.

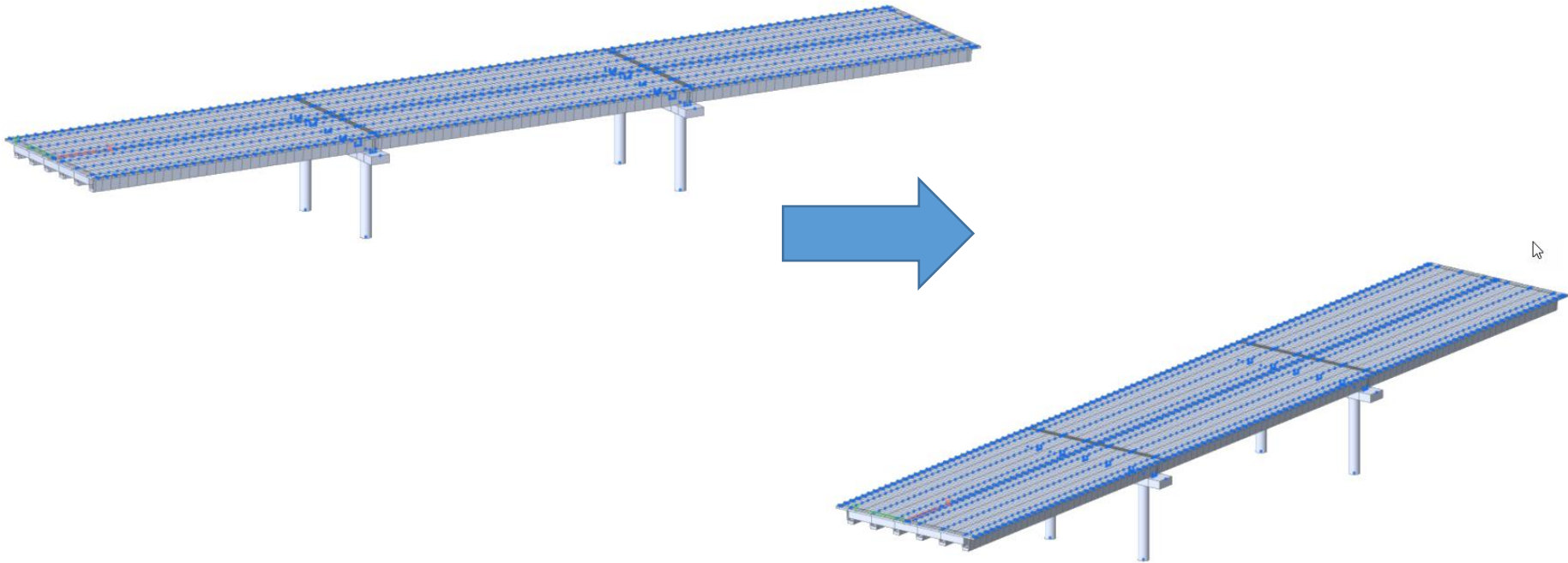
## Tip

Use 'Dynamic View Control' or view icons to change the model angle



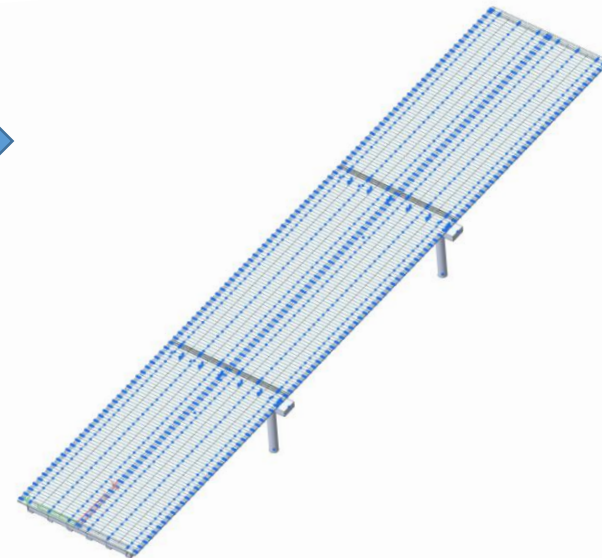
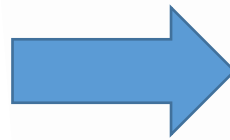
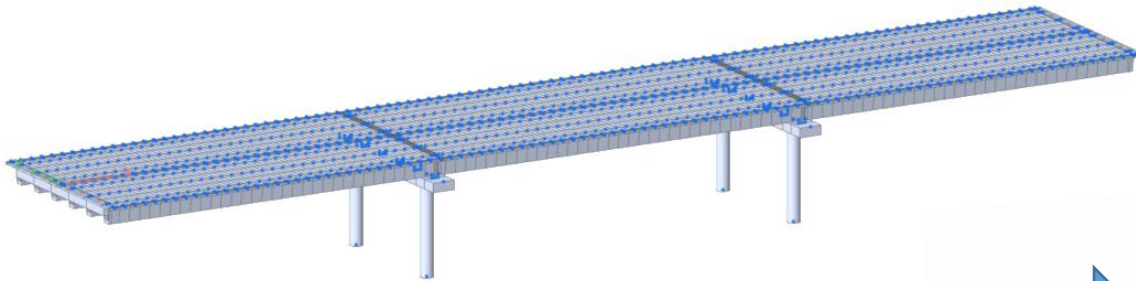
**Tip**

Scroll the mouse wheel to zoom in and out the model



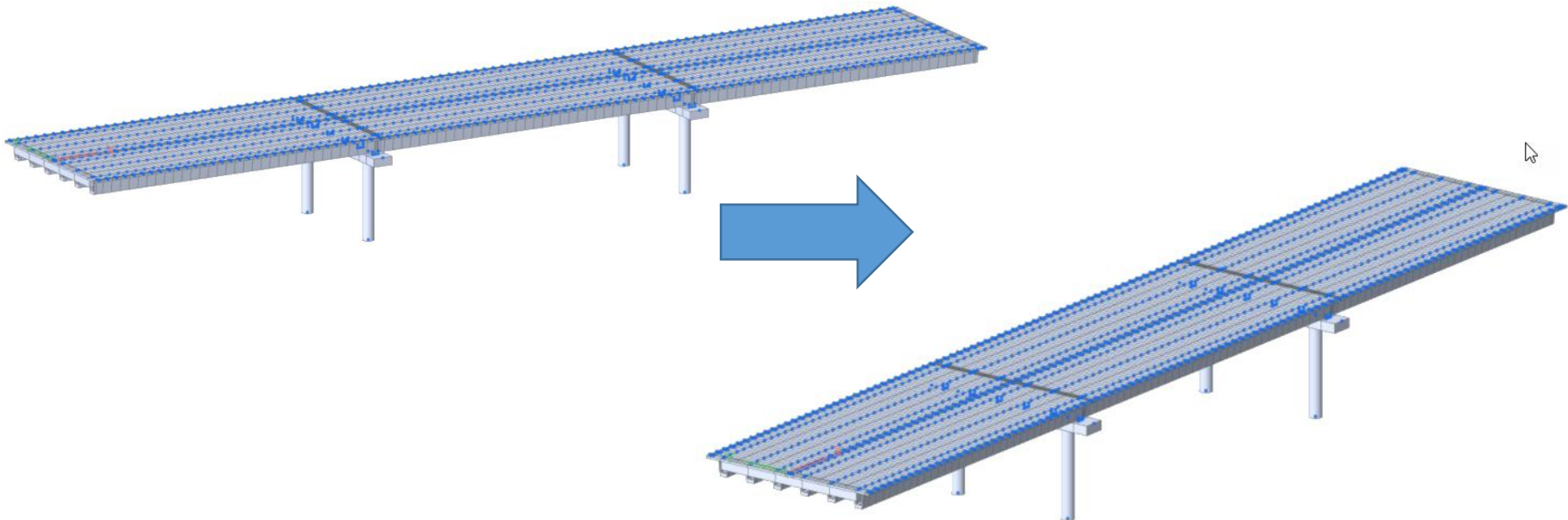
## Tip

Move mouse cursor pressing 'Ctrl+mouse wheel' to change the model angle



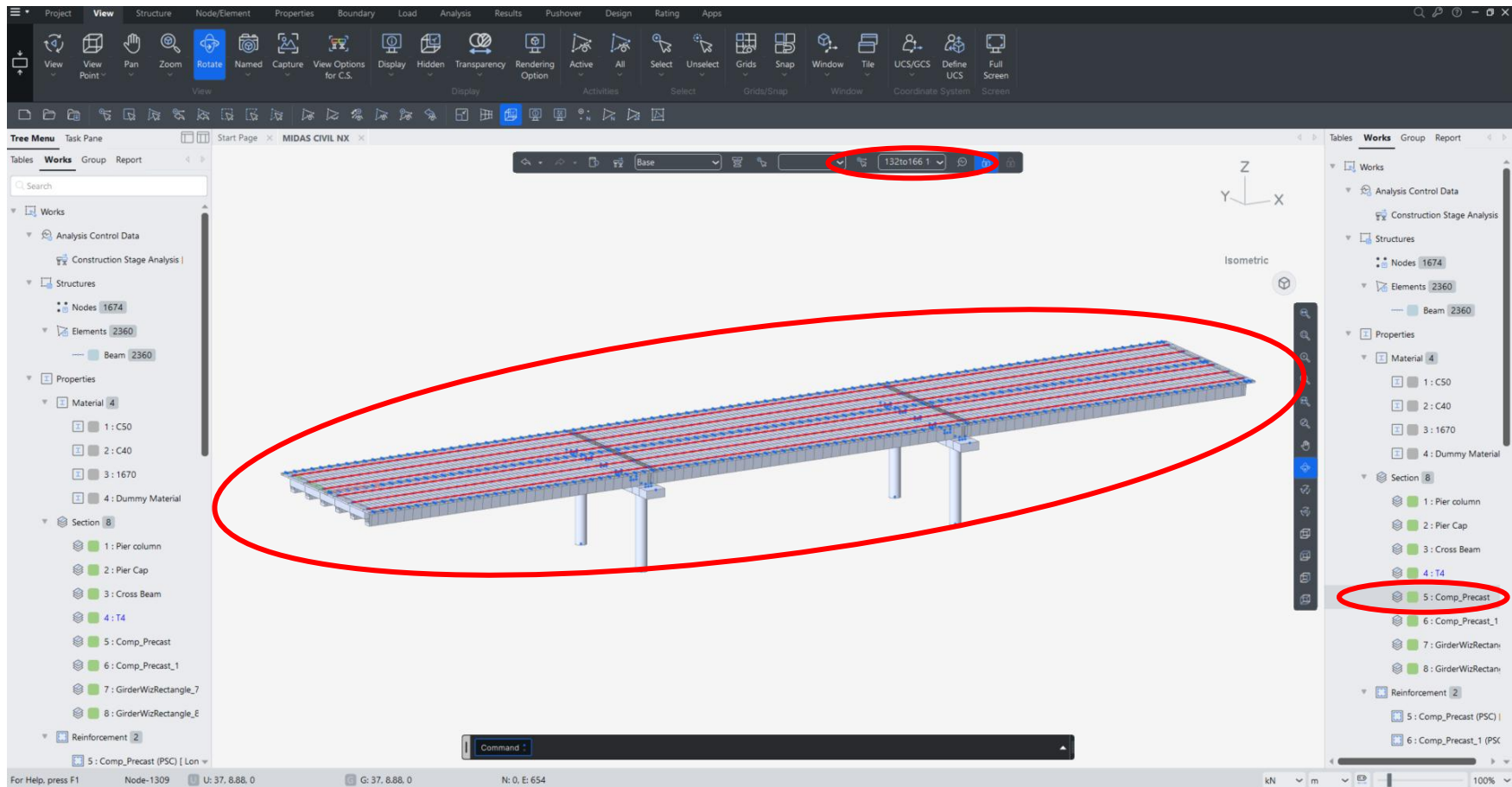
**Tip**

Move mouse cursor **pressing mouse wheel** to move the model



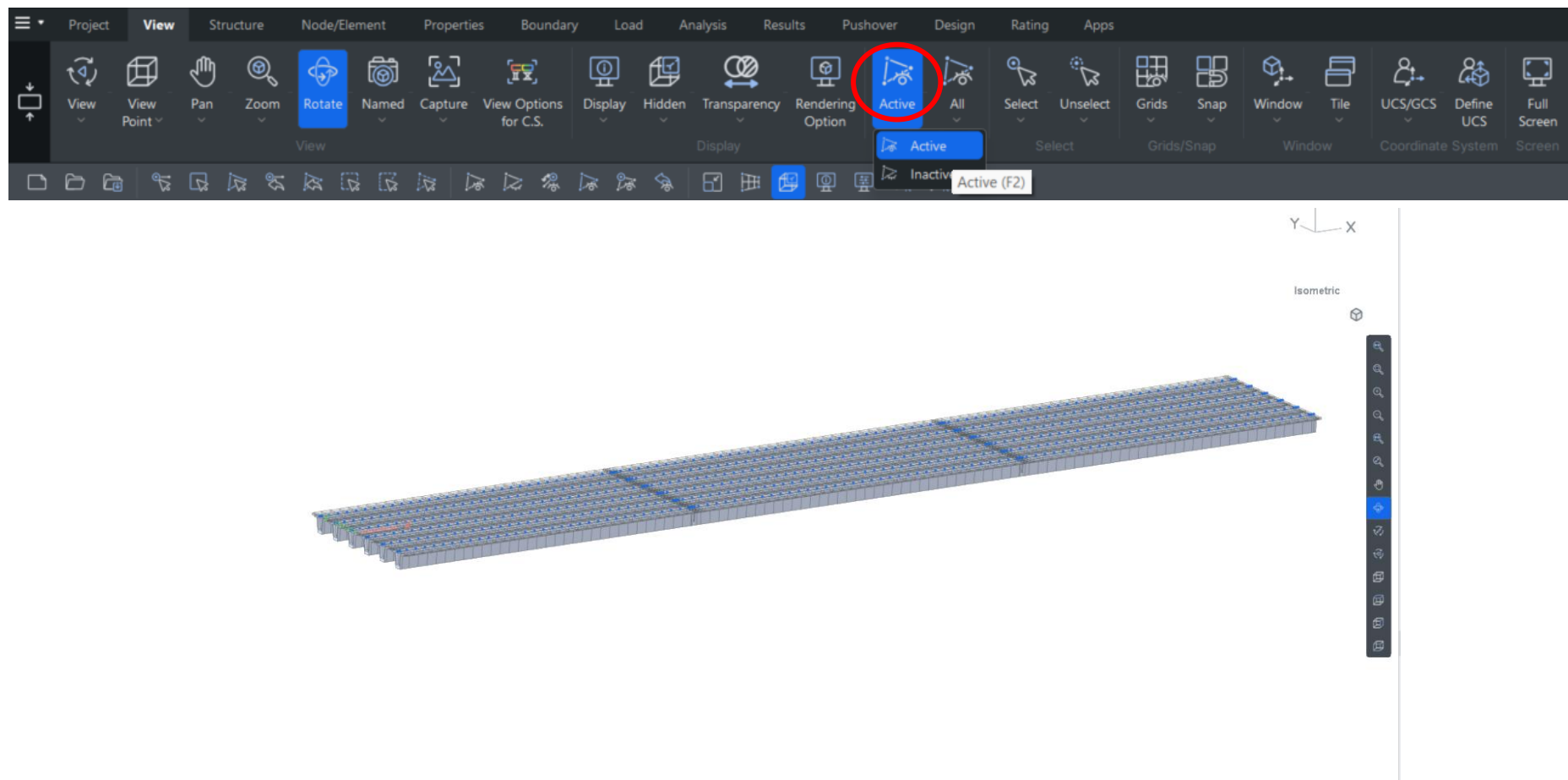
## Tip

Double click any section or material, then assigned elements will be selected.  
And Element number will be shown.



**Tip**

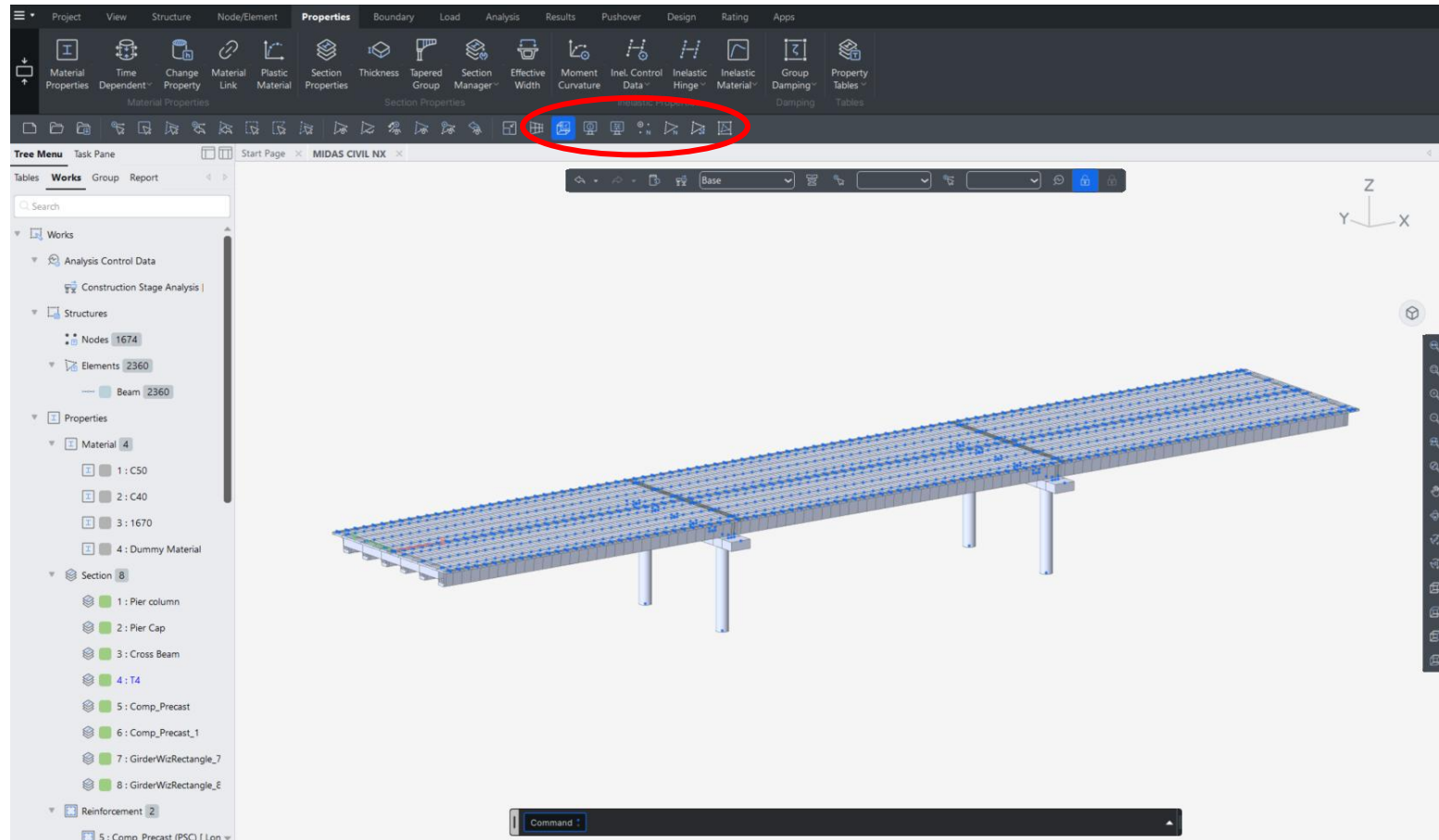
Use activation functions to activate or deactivate certain elements.  
It is also valid when viewing results.

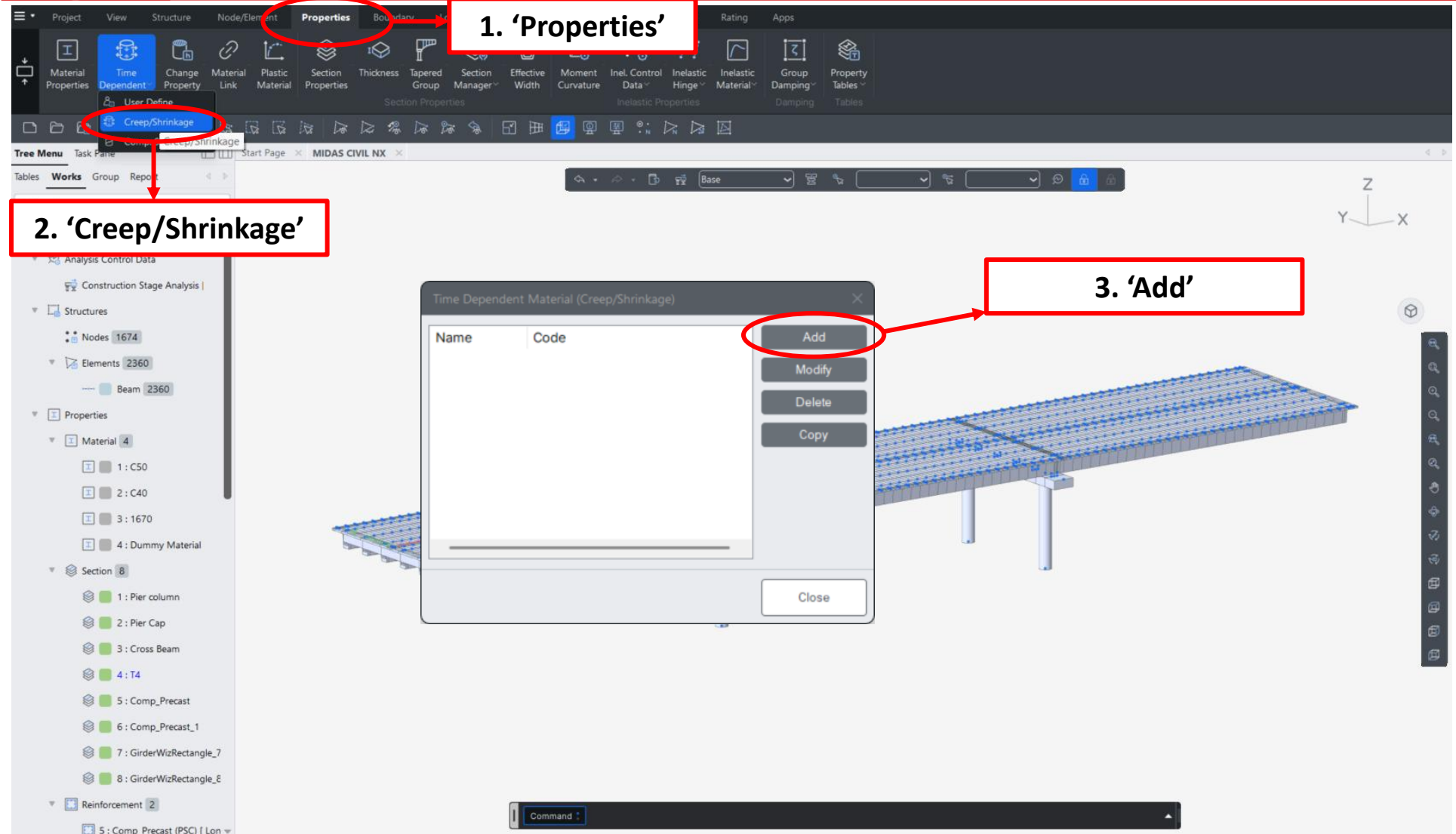


**Tip**

Try out various display options.

Check the online manual(F1) for more information(Start-View-Display)





### Procedure

Define Creep/Shrinkage and Compressive Strength under Time Dependent Material menu. These properties change with time.

The screenshot displays the MIDASIT software interface with the 'Add/Modify Time Dependent Material (Creep / Shrinkage)' dialog box open. The dialog box contains the following fields and options:

- Name:** C50
- Code:** AS 5100.5-2017
- Compressive strength of concrete at the age of 28 days:** 50000 kN/m<sup>2</sup>
- Exposure Environment:** Arid (selected)
- Hypothetical Thickness:** 1 m
- Drying Basic Shrinkage Strain (10<sup>-6</sup>):** 800.0 (Sydney, Brisbane) (selected)
- Age of concrete at the beginning of shrinkage:** 3 day
- Buttons:** Show Result, OK, Cancel, Apply

The 'Show Time Dependent Material Function' graph is also visible, showing the Creep Coefficient over Time (day). The graph includes a table of data points:

| Time (day) | Value    |
|------------|----------|
| 1          | 13.34    |
| 2          | 17.78    |
| 3          | 23.71    |
| 4          | 31.62    |
| 5          | 42.17    |
| 6          | 56.23    |
| 7          | 74.99    |
| 8          | 100.00   |
| 9          | 133.35   |
| 10         | 177.83   |
| 11         | 237.14   |
| 12         | 316.23   |
| 13         | 421.70   |
| 14         | 562.34   |
| 15         | 749.96   |
| 16         | 1000.00  |
| 17         | 1333.54  |
| 18         | 1778.28  |
| 19         | 2371.43  |
| 20         | 3162.28  |
| 21         | 4217.00  |
| 22         | 5623.41  |
| 23         | 7499.57  |
| 24         | 10000.00 |

Red boxes and arrows highlight the following steps:

1. 'C50'
2. 'AS 5100.5-2017'
3. '50000' kN/m<sup>2</sup>
4. '1' m
5. 'Apply'

**Procedure**

Different Creep Coefficient and Shrinkage Strain along the time will be applied to the model with Construction stage analysis. Input 1m for Notional size of member and use Composite Section for CS function later on to auto-calculate the notional value.

**1. 'C40'**

**2. 'AS 5100.5-2017'**

**3. '40000' kN/m<sup>2</sup>**

**4. '1' m**

**5. 'OK'**

**Procedure**

Defining Creep/Shrinkage properties.

**Show Time Dependent Material Function**

Creep Function Data Type

☒ Creep Coefficient

☐ Shrinkage Strain

Start Loading: 10 Day

End Loading: 10000 Day

Num. of Steps: 24

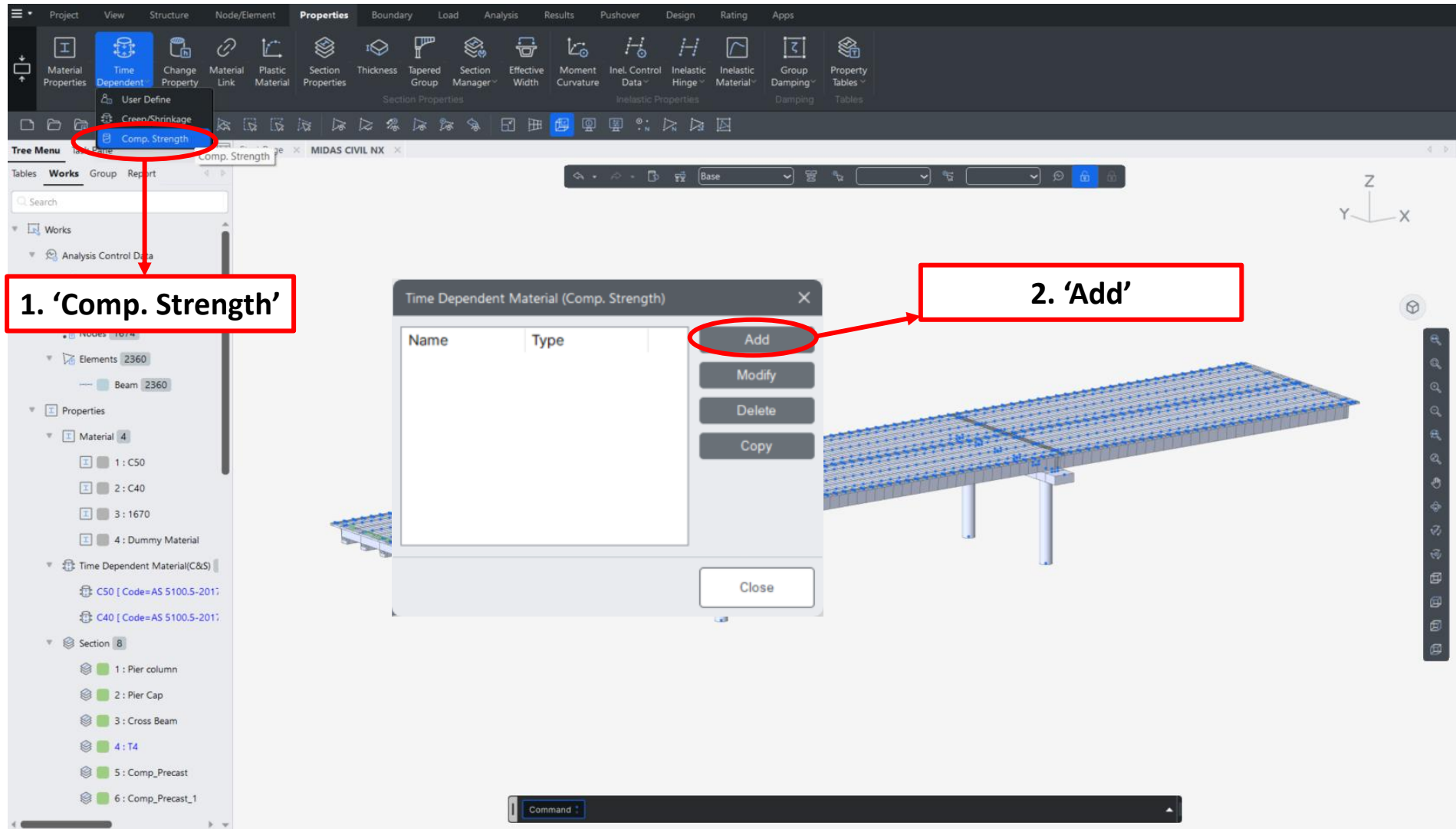
|    | Time (day) | Value      |
|----|------------|------------|
| 1  | 13.34      | 3.8966e-02 |
| 2  | 17.78      | 7.5496e-02 |
| 3  | 23.71      | 1.1656e-01 |
| 4  | 31.62      | 1.6408e-01 |
| 5  | 42.17      | 2.1952e-01 |
| 6  | 56.23      | 2.8417e-01 |
| 7  | 74.99      | 3.5906e-01 |
| 8  | 100.00     | 4.4494e-01 |
| 9  | 133.35     | 5.4208e-01 |
| 10 | 177.83     | 6.5010e-01 |
| 11 | 237.14     | 7.6790e-01 |
| 12 | 316.23     | 8.9358e-01 |
| 13 | 421.70     | 1.0245e+00 |

Graph Options

☐ X-axis log scale ☐ Y-axis log scale

Creep Coefficient vs Time (day) graph showing a curve starting at 0 and increasing towards 2.2.

Redraw Close



### Procedure

Defining Compressive Strength.

The screenshot shows the 'Add/Modify Time Dependent Material (Comp. Strength)' dialog box in the MIDASIT software. The dialog is used to define a concrete material with a time-dependent compressive strength. The interface includes a tree menu on the left, a top toolbar, and a central graph area. Red callouts with numbers 1 through 5 highlight specific steps in the procedure:

- 1. 'C50'**: The material name 'C50' is entered in the 'Name' field.
- 2. 'AS 5100.5-2017'**: The code 'AS 5100.5-2017' is selected in the 'Code' dropdown menu.
- 3. '50000' kN/m<sup>2</sup>**: The concrete compressive strength at 28 days is set to 50000 kN/m<sup>2</sup>.
- 4. 'Redraw Graph'**: The 'Redraw Graph' button is clicked to update the graph.
- 5. 'OK'**: The 'OK' button is clicked to confirm the material definition.

The graph shows the development of strength over time (day). The Y-axis represents strength (kN/m<sup>2</sup>) from 0 to 75000, and the X-axis represents time (day) from 0 to 1050. The curve starts at 0 and rises to a plateau of 50000 kN/m<sup>2</sup> around day 100.

### Procedure

Defining Compressive Strength.

1. 'C40'

2. 'AS 5100.5-2017'

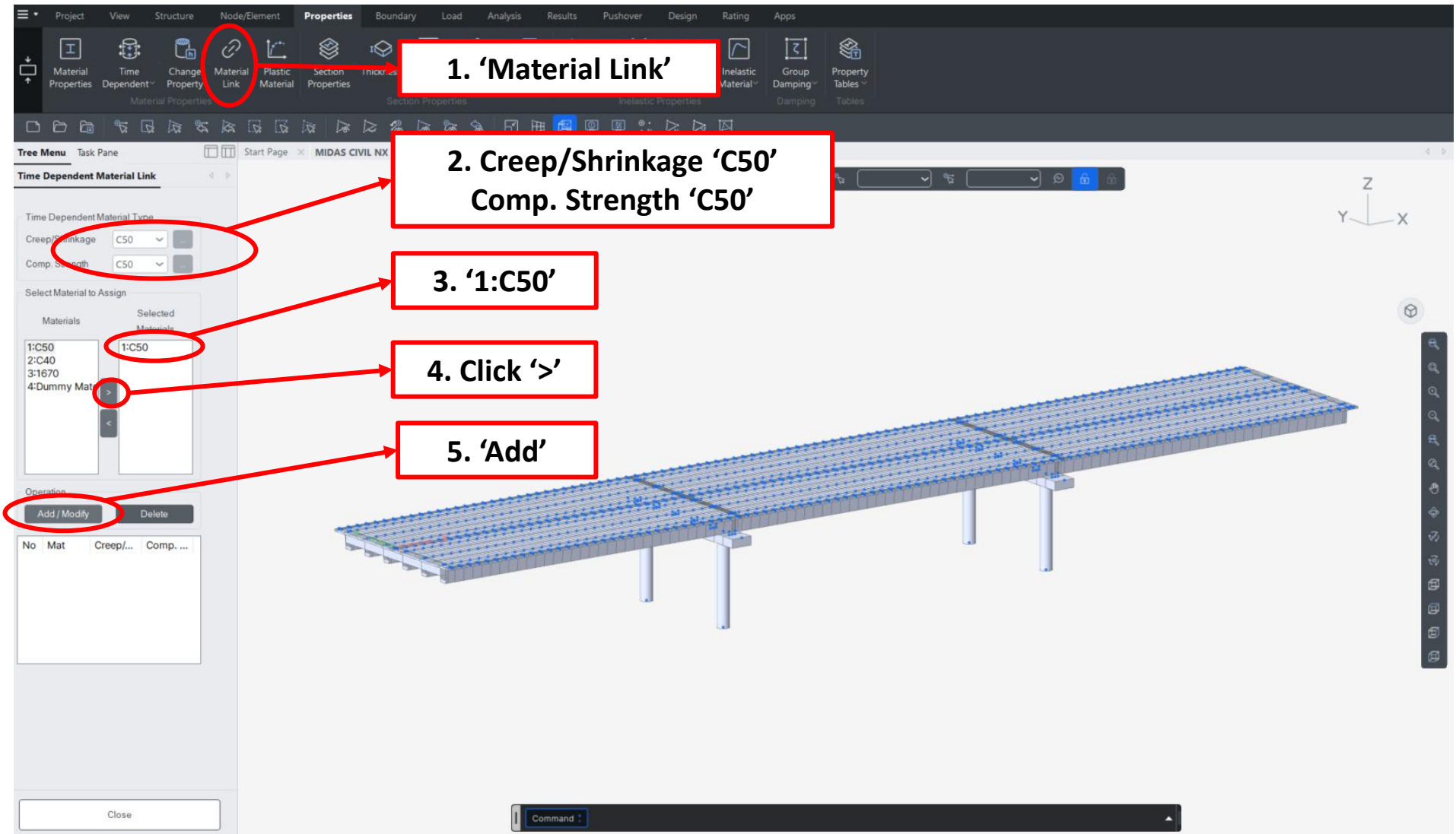
3. '40000' kN/m<sup>2</sup>

4. 'Redraw Graph'

5. 'OK'

### Procedure

Defining Compressive Strength.



### Procedure

Apply time dependent material to Material which has been defined at the first step.

**1. Creep/Shrinkage 'C40'**  
Comp. Strength 'C40'

**2. '2:C40'**

**3. Click '>'**

**4. 'Add'**

**5. 'Close'**

| No | Mat | Creep/... | Comp. ... |
|----|-----|-----------|-----------|
| 1  | C50 | C50       | C50       |

**Procedure**

Apply time dependent material to Material which has been defined at the first step.

**1. 'Load'**

**2. 'Construction Stage'**

**3. 'Composite Section For C.S.'**

**4. Select no.1 section**

**5. 'Modify'**

**6. Input**

|        | Age | h    |
|--------|-----|------|
| Part 1 | 7   | 0.12 |
| Part 2 | 10  | 0.18 |

**7. 'OK'**

**Add/Modify Composite Section for Construction Stage**

Active Stage: Stage2  
 Section: 5: 5: Comp\_Precast  
 Composite Type: Normal  
 Section Type: Composite  
 Section Shape: CPPC  
 Element List: 132to166 169to207 210to27

Construction Sequence

| Material Type | Material | Composite Stage | Age | h    | vs | M | Stiff. | Stiff. Scale | Comp. Stiff. |
|---------------|----------|-----------------|-----|------|----|---|--------|--------------|--------------|
| Element       |          | Active Stage    | 7   | 0.12 | 0  | 0 | ...    | ...          | ...          |
| Material      | 2: C40   | Stage3-2        | 10  | 0.18 | 0  | 0 | ...    | ...          | ...          |

OK Cancel Apply

**Procedure**

h : Notional size of member to consider Creep/Shrinkage for composite section

Different element age for each girder and slab are applied to construction stage analysis and the element age on 'Define C.S.' will be ignored.

# Modification of Construction Stage

1. 'Load'

2. 'Construction Stage'

3. 'Define C.S'

4. Select no.1 section

5. 'Modify'

| Name     | Duration | Date  | Stop | Result |
|----------|----------|-------|------|--------|
| Stage1   | 10       | 10    | 0    | Stage  |
| Stage2   | 10       | 20    | 0    | Stage  |
| Stage3-1 | 10       | 30    | 0    | Stage  |
| Stage3-2 | 0        | 30    | 0    | Stage  |
| Stage4   | 10       | 40    | 0    | Stage  |
| Stage5   | 10000    | 10040 | 0    | Stage  |

## Procedure

Modify the Construction Stages and its parameters according to the activities on site.

**Compose Construction Stage**

Stage: Stage1  
 Name: Stage1  
 Duration: 10 day(s)

Save Result:  
☒ Stage ☐ Additional Steps

Additional Steps:  
 Day: 0  
 ( Example: 1, 3, 7, 14 )  
 Auto Generation: Step Number 0  
 Generate Steps

Current Stage Information...

Element Boundary Load

Group List

Activation

Age: 100 day(s)

Group List

| Name         | Age |
|--------------|-----|
| Substructure | 100 |
| Coping       | 100 |

Deactivation

Group List

| Name | Redist. |
|------|---------|
|------|---------|

Load Incremental Steps for Material Nonlinear Analysis: 5

OK Cancel Apply

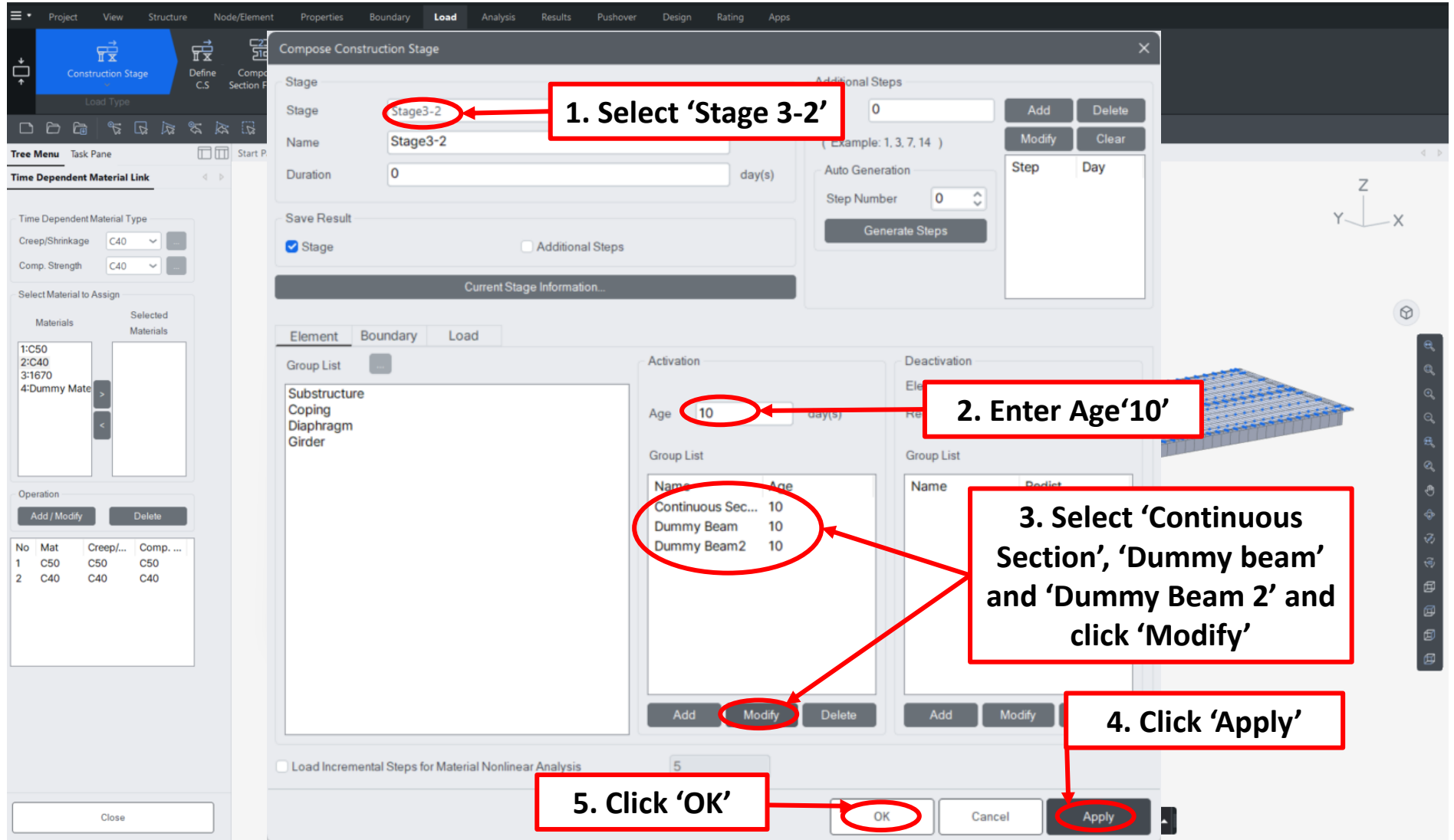
**1. Enter Age '100'**

**2. Select 'Substructure' and 'Coping' and click 'Modify'**

**3. Click 'Apply'**

**Note**

Age reflects the effects of creep and shrinkage on the elements. The Age represents the time elapsed from the time of concrete casting prior to the start of the current construction stage being defined. The Age typically represents the time span from the time of concrete casting to the time of removal of formwork for members such a slabs.

**Procedure**

Modify the Age of elements.

The screenshot displays the MIDASIT software interface with the 'Moving Load' procedure. The interface includes a top menu bar with 'Project', 'View', 'Structure', 'Node/Element', 'Properties', 'Boundary', 'Load', 'Analysis', 'Results', and 'Post-Processing'. The 'Load' menu is open, showing options like 'Moving Load Code', 'Traffic Line Lanes', 'Traffic Surface Lanes', 'Vehicle', 'Moving Load Cases', 'Concurrent Group', and 'Vehicle Classes'. The 'Moving Load Cases' option is selected. A 'Load Case' dialog box is open, showing 'Load Case Name' as 'MV' and 'Description' as 'MV'. The 'Load Case Data' section shows 'Vehicle Class' as 'VL:M1600', 'Scale Factor' as '1', 'Min. Number of Loaded Lanes' as '0', and 'Max. Number of Loaded Lanes' as '4'. The 'Assignment Lanes' section shows 'List of Lanes' as 'Lane1, Lane2, Lane3, Lane4' and 'Selected Lanes' as 'Lane1, Lane2, Lane3, Lane4'. The 'Sub-Load Cases' section shows 'Loading Effect' as 'Independent'. The 'Accompanying Lane Factor' section shows 'Num of Loaded Lanes' as '1' and 'Scale Factor' as '1'. The 'Sub-Load Cases' table is empty. The 'Add' button is highlighted. The 'OK' button is highlighted. The 'Add' button is highlighted. The 'Add' button is highlighted. The 'Add' button is highlighted. The 'Add' button is highlighted. The 'Add' button is highlighted. The 'Add' button is highlighted. The 'Add' button is highlighted. The 'Add' button is highlighted. The 'Add' button is highlighted. The 'Add' button is highlighted.

1. 'Load'
2. 'Moving Load'
3. 'Moving Load Cases'
4. 'Add'
5. Input 'MV'
6. 'Independent'
7. 'Add'
8. 'VL:M1600'
9. Input '4'
10. Select lanes and click '->'
11. 'OK'

### Procedure

All cases from zero lanes to four lanes are considered and the Min&Max results will be shown.

Moving Load Optimization option can be applied when Traffic Lane is used as 'Moving Load Optimization' function.

The screenshot shows the MIDAS CIVIL NX interface with the 'Moving Load Cases' dialog box open. The dialog box has several tabs: 'General', 'Fatigue', 'Heavy Load Platform', 'Rail Traffic Load', and 'B-Double Load'. The 'General' tab is selected. The 'Vehicle Class' is set to 'VL:M1600 tri-axe group'. The 'Scale Factor' is 1. The 'Min. Number of Loaded Lanes' is 0, and the 'Max. Number of Loaded Lanes' is 4. The 'Assignment Lanes' section shows 'List of Lanes' with Lane1, Lane2, Lane3, and Lane4. The 'Selected Lanes' section is empty. The 'Type of Load Factor for Design Combination' is set to 'Ultimate Limit State'. The 'Accompanying Lane Factor' section shows 'Num of Loaded Lanes' and 'Scale Factor' for 1, 2, and 3 or more lanes. The 'Sub-Load Cases' section shows 'Loading Effect' set to 'Independent'. The 'Vehicle class' table shows 'VL:M1600' with 'Scale' 1 and 'Lane1' 'Lane2' 'Lane3' 'Lane4'. The 'Add' button is highlighted with a red circle and labeled '1. Add'. The 'VL:M1600 tri-axe group' dropdown is highlighted with a red circle and labeled '2. VL:M1600 tri-axe group'. The input field for 'Max. Number of Loaded Lanes' is highlighted with a red circle and labeled '3. Input 4'. The right arrow button is highlighted with a red circle and labeled '4. Select lanes and click ->'. The 'OK' button is highlighted with a red circle and labeled '5. OK'. The 'OK' button at the bottom is highlighted with a red circle and labeled '6. OK'.

**1. 'Add'**

**2. 'VL:M1600 tri-axe group'**

**3. Input '4'**

**4. Select lanes and click '->'**

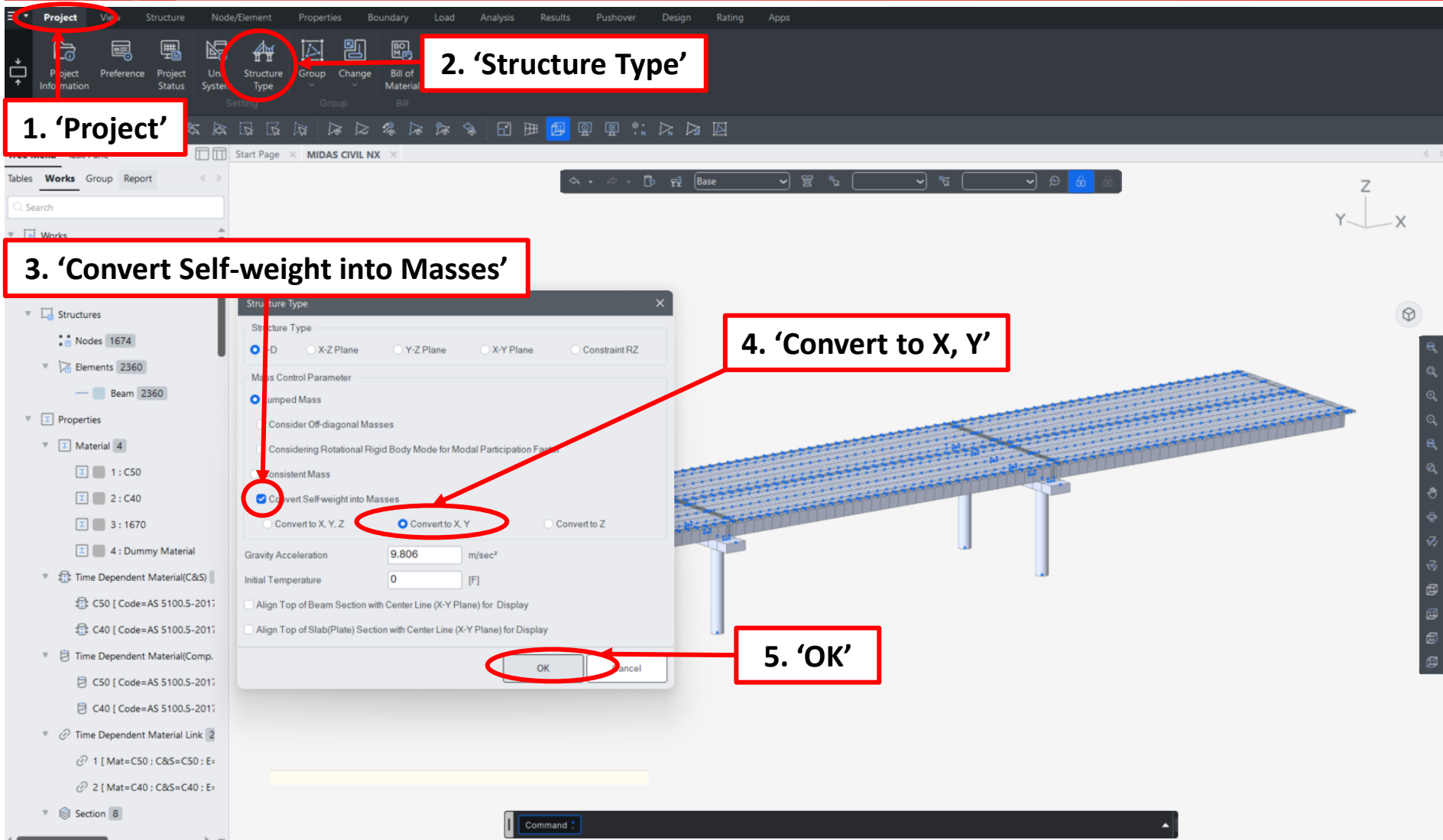
**5. 'OK'**

**6. 'OK'**

### Procedure

All cases from zero lanes to four lanes are considered and the Min&Max results will be shown.

Moving Load Optimization option can be applied when Traffic Lane is used as 'Moving Load Optimization' function.



### Procedure

Select 'Convert to X,Y' to consider horizontal effect of Response Spectrum analysis.

**1. 'Load'**

**2. 'Static Loads'**

**3. 'X, Y'**

**4. Select 'Barrier' and Click 'Add'**  
**5. Select 'Median Strip' and Click 'Add'**  
**6. Select 'Wearing Surface' and Click 'Add'**

**7. 'OK'**

**Loads to Masses**

Mass Direction

☐ X ☐ Y ☐ Z

☒ X, Y ☐ Y, Z ☐ X, Z

☐ X, Y, Z

Load Type for Converting

☒ Nodal Load

☒ Beam Load

☒ Floor Load

☒ Pressure (Hydrostatic)

Gravity 9.806 m/sec<sup>2</sup>

Load Case / Factor

Load Case Wearing Surf...

Scale Factor 1

| LoadCase     | Scale |
|--------------|-------|
| Barrier      | 1     |
| Median St... | 1     |
| Wearing S... | 1     |

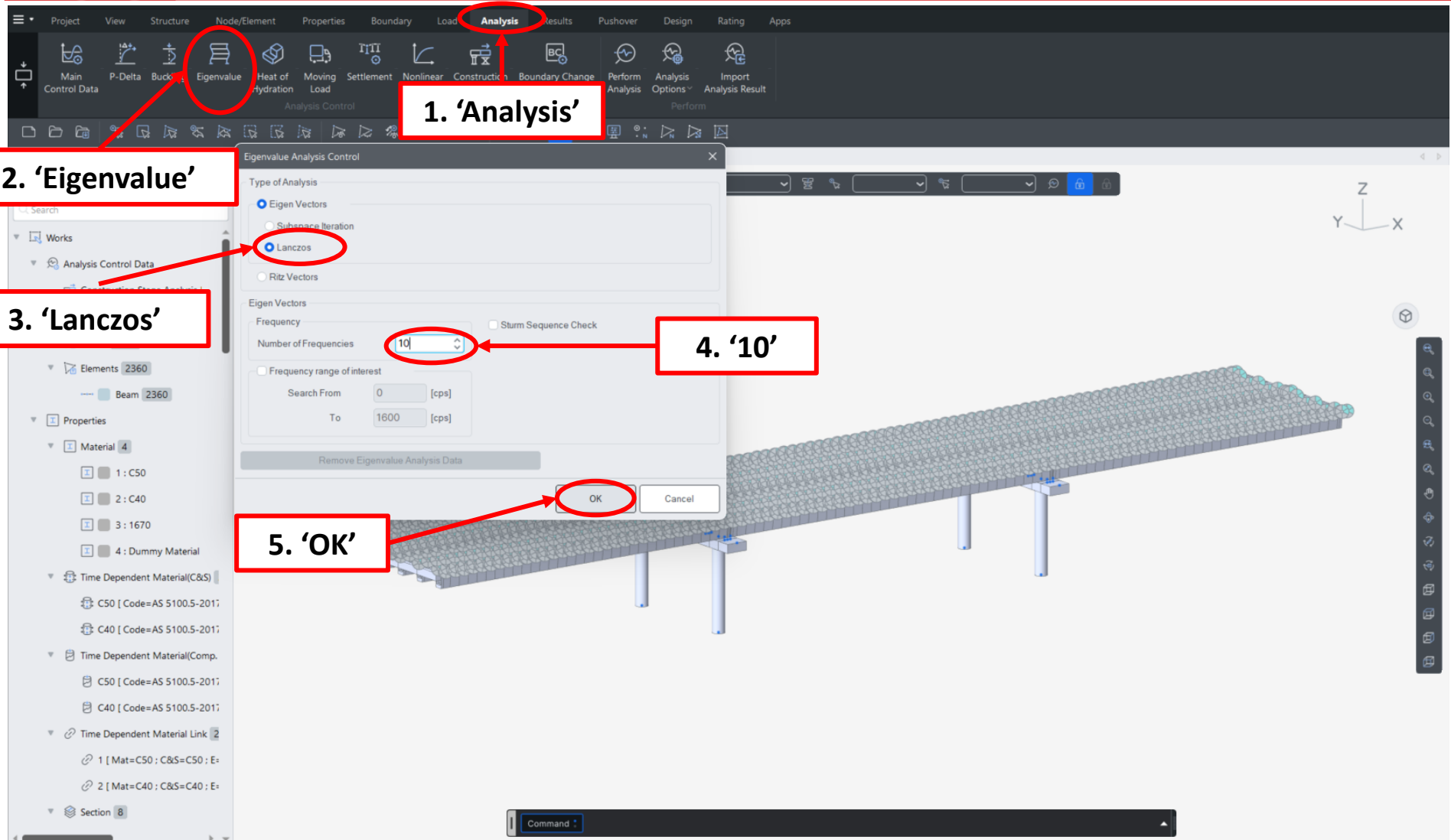
Add Modify Delete

Remove Load to Mass Data

OK Cancel

**Procedure**

Convert the permanent dead load cases to masses.



### Procedure

Lanczos is commonly used method for simpler structure. Increases the number of frequencies if more modes are required.

**1. 'Load'**

**2. 'Dynamic Loads'**

**3. 'RS Functions'**

**4. 'Add'**

**5. 'Design Spectrum'**

**6. 'AS 5100.2(2017)'**

**7. 'OK'**

**8. 'OK'**

**Generate Design Spectrum**

Design Spectrum: AS 5100.2(2017)

Sub Soil Class: Ae

Probability Factor (kp): 1.3

Hazard Factor (Z): 0.08

Design Ductility Factor ( $\mu$ ): 1.5

Max. Period: 6 (Sec)

OK Cancel Apply

**Procedure**

Copy & paste the data from the excel if it is preferred.

**1. 'RS Load Cases'**

**2. Load Case Name : 'RSx'**

**3. Direction : 'X-Y'**

**4. Excitation Angle : '0' deg**

**5. Click**

**6. 'Add'**

**Procedure**

**1. Load Case Name : 'RSy'**

**2. Direction : 'X-Y'**

**3. Excitation Angle : '90' deg**

**4. Click**

**5. 'Add'**

| LoadCase | Direction | Scale |
|----------|-----------|-------|
| RSx      | X-Y       | 1     |
| RSy      | X-Y       | 1     |

## Procedure

## *Overview*

### ▪ Properties

- Material / Section

### ▪ Prestressed Composite Bridge Wizard

- Layout
- Section
- Tendon
- Load
- Construction Stage

### ▪ Load

- Time Dependent Material
- Moving load
- Response Spectrum Analysis

### ▪ Analysis

- Moving Load

### ▪ Results

- Load Combination
- Reaction/Force/Displacement
- Moving Tracer
- Concurrent Force
- Tendon Losses
- Mode Shape

### ▪ Design

- PSC Design

### ▪ Tips

- Smart Report
- MCT Command Shell
- Tendon Template
- Import tendon from AutoCAD

### ▪ Appendix. Load Combinations

# Step 4. Analysis

**1. 'Analysis'**

**2. 'Moving Load'**

**3. 'Normal + Concurrent Force/Stress'**

**4. 'OK'**

**Moving Load Analysis Control Data**

Truck/Train Load Control Option

Analysis Method

☒ Exact ☐ Pivot ☐ Quick

Load Point Selection

☒ Influence Line Dependent Point ☐ All Points

Influence Generating Points

☒ Number/Line Element ☐ Distance between Points

Number/Line Element: 3

Distance between Points: 0.3 m

Analysis Results

Plate

☐ Center ☒ Center + Nodal ☐ Stress ☐ Concurrent Force

Frame

☐ Normal ☒ Normal + Concurrent Force/Stress ☒ Combined Stress

☒ Concurrent Force of Elastic/General Links

Calculation Filters

☒ Reactions

☒ Displacements

☒ Forces/Moments

☒ Elastic/General Links

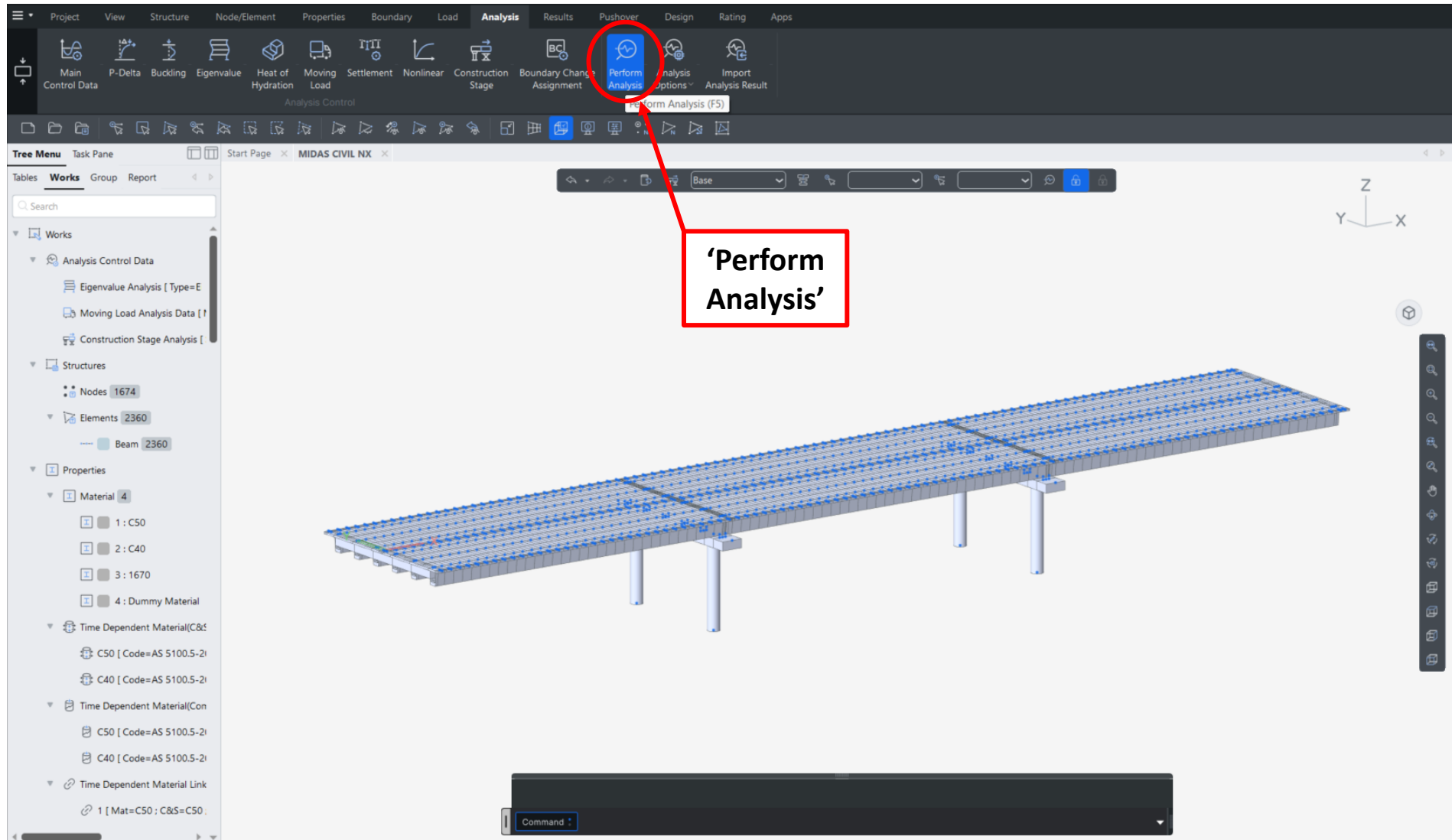
☐ Apply Multiple B-Double Trucks in the Same Lane

Maximum Successive Vehicles: 10

**OK** **Cancel**

### Procedure

Check off items which are not necessary to check for the project. It reduces analysis time.



## Procedure

Perform structural analysis. Message Window should be checked for warning or errors.

## *Overview*

### ▪ Properties

- Material / Section

### ▪ Prestressed Composite Bridge Wizard

- Layout
- Section
- Tendon
- Load
- Construction Stage

### ▪ Load

- Time Dependent Material
- Moving load
- Response Spectrum Analysis

### ▪ Analysis

- Moving Load

### ▪ Results

- Load Combination
- Reaction/Force/Displacement
- Moving Tracer
- Concurrent Force
- Tendon Losses
- Mode Shape

### ▪ Design

- PSC Design

### ▪ Tips

- Smart Report
- MCT Command Shell
- Tendon Template
- Import tendon from AutoCAD

### ▪ Appendix. Load Combinations

# Step 5. Results

**1. 'Results'**

**2. 'Load Combinations'**

**3. 'Concrete Design'**

**4. 'Auto Generation'**

**5. 'AS 5100.2:17'**

**6. Select 'Both'**

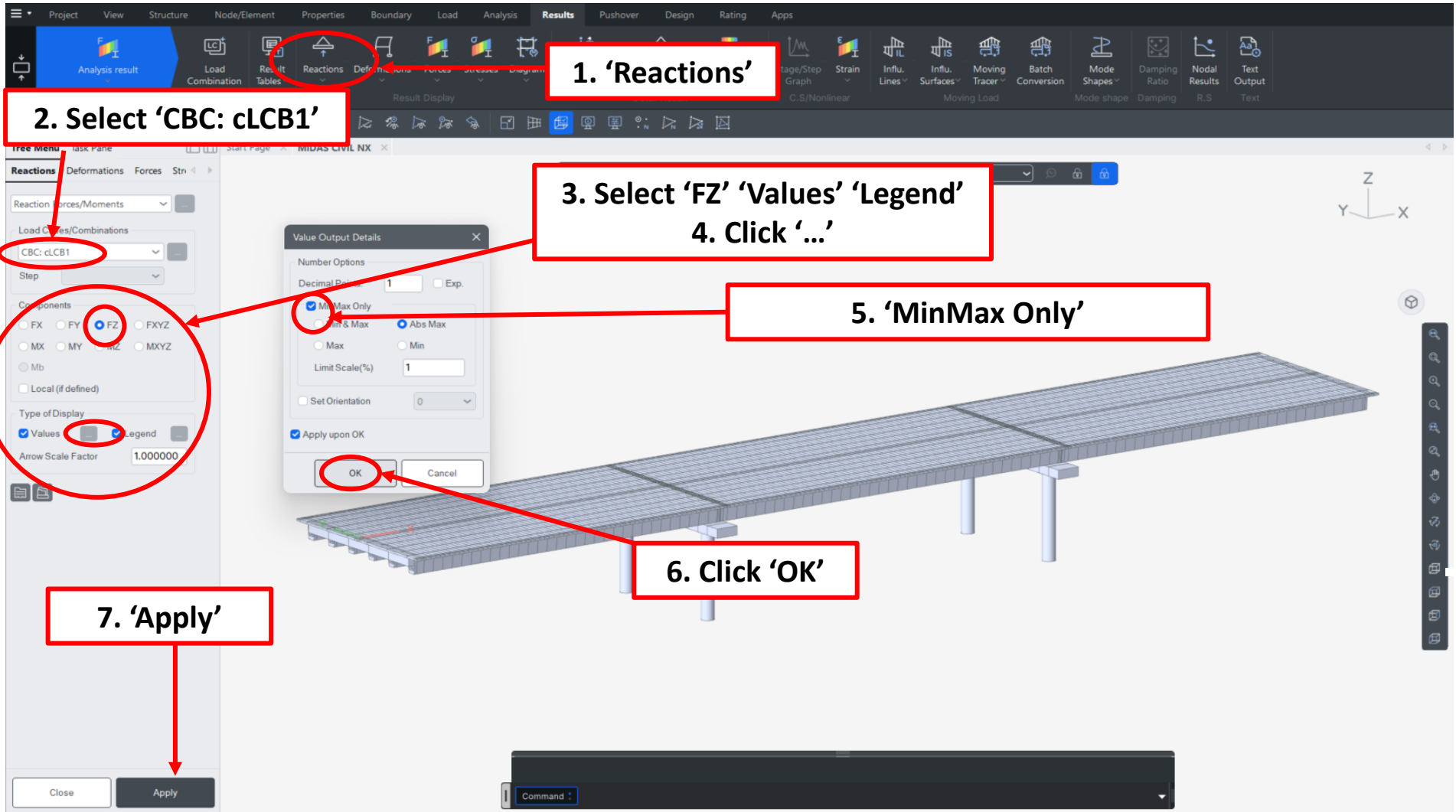
**7. 'OK'**

**8. 'Close'**

The screenshot shows the MIDAS CIVIL NX software interface. The top menu bar includes Project, View, Structure, Node/Element, Properties, Boundary, Load, Analysis, Results, Post-processor, Design, and Rating. The left tree menu shows the project structure, including Analysis Control Data, Structures, and Properties. The central workspace displays the 'Load Combinations' dialog box, which is divided into several tabs: General, Steel Design, Concrete Design, and Composite Design. The 'Concrete Design' tab is active, showing a table for 'Load Cases and Factors'. The 'Automatic Generation of Load Combinations' dialog box is also open, showing options for 'Design Code' (AS 5100.2:17), 'Manipulation of Construction Stage Load Case' (ST+CS), and 'Load Factors for Permanent Loads' (Type of Load, R.S., I.S., Both). The 'Both' option is selected for the 'Load Factor' column. The 'OK' and 'Close' buttons are highlighted.

### Procedure

Create automatic load combinations as per AS. Use 'Spread Sheet Form' to copy&paste the data from EXCEL.



### Procedure

Check reactions under load combinations. Check on 'Legend' to see the maximum/minimum result on the right side.

The screenshot shows the MIDAS CIVIL NX software interface. The top toolbar includes tabs for Project, View, Structure, Node/Element, Properties, Boundary, Load, Analysis, Results, Pushover, Design, Rating, and Apps. The Results tab is active, showing a 3D model of a bridge structure. A red circle highlights the 'PostCS' dropdown menu, and a red arrow points to it with the text 'Select the stage'. The left sidebar shows the 'Reactions' tab selected, with options for Reaction Forces/Moments, Load Cases/Combinations, Components, and Type of Display. The right sidebar shows the 'REACTION FORCE' data for 'FORCE-Z', including MIN, REACTION, NODE= 1542, FZ: 6.4675E+02, MAX, REACTION, NODE= 1674, FZ: 9.4411E+03. The bottom status bar shows the Command line.

### Procedure

Check the results along the stages.

**1. Select 'Displacement Contour'**

**2. Select 'Stage3-1'**

**3. Activate 'Hidden'**

**4. Select 'CS: Dead Load'**

**5. Select 'DZ'**

**6. Click**

**Procedure**

Check the results under dead load along the stages.

**1. Click**

**2. 'OK'**

Save Dialog Information For Batch Output Generation

Base File Name  
DeformCont\_DZ

OK Cancel

STAGE: Stage3-1  
CS: DEAD LOAD  
LAST  
MAX : 1651  
MIN : 775  
FILE: PSC COM-  
UNIT: m  
DATE: 06/03/2025  
VIEW-DIRECTION  
X: 0.562  
Y: 0.788  
Z: 0.250

The project will be saved by the auto-save feature.

### Procedure

Save Components(DX, DY, DZ and etc.) to create automatic screen shots.

**1. Click**

**2. Select the saved components and load combination to generate result image files**

**3. Assign the path for result image files**

**4. 'Make Output'**

**Procedure**

Select the saved components and load cases(load combinations) to create screen shots.

**Go to Saved folder location and check auto-generated screen shots**

The screenshot displays the MIDAS CIVIL NX software interface. The main window shows a 3D model of a bridge deck. The 'Results' tab is active, and the 'Deformations' sub-tab is selected. The 'Displacement Contour' is displayed. The 'Tree Menu' on the left shows the 'Reactions' and 'Deformations' sections. The 'Command' bar at the bottom shows 'Command :'. A red circle highlights a folder named '201902 AU' on the Desktop, which contains a sub-folder 'tutorial model'. This folder contains 27 auto-generated screenshot files (e.g., Super-T\_DeformCont\_DZ\_CBC\_...).

**Procedure**

**1. Click 'Beam Diagrams'**

**2. 'PostCS'**

**3. Select 'MVmax: MV'**

**4. Select 'My'**

**5. Apply**

**Maximum results at No.258 element**

MIDAS CIVIL NX  
POST-PROCESSOR  
BEAM DIAGRAM

MOMENT -y

|             |
|-------------|
| 4.27994e+03 |
| 3.89085e+03 |
| 3.50177e+03 |
| 3.11268e+03 |
| 2.72360e+03 |
| 2.33451e+03 |
| 1.94543e+03 |
| 1.55634e+03 |
| 1.16726e+03 |
| 7.78171e+02 |
| 3.89085e+02 |
| 0.00000e+00 |

PostCS  
MOMAX: MV  
MAX : 258  
MIN : 31  
FILE: PSC COM-  
UNIT: kN-m  
DATE: 06/03/2025  
VIEW-DIRECTION  
X: -0.562  
Y: -0.798  
Z: 0.250

**Procedure**

Check the beam moment diagram under moving load

1. Click 'Beam Force/Moments'  
under 'Moving Tracer'

**2. Input '258'**

**3. Select 'My'**

**4. Apply**

**Influence line values**

**Procedure**

The project will be saved by the auto-save feature.

Check the position of vehicles for the element selected.

**1. 'Write Min/Max Load to File'**

**2. Click 'OK'**

### Procedure

Copy and paste the text into MCT Command Shell under Tools menu.

1. 'Apps'

Apps

2. 'MCT Command Shell'

3. Paste the data by pressing 'Ctrl + V'

4. 'Run'

The screenshot displays the MIDAS CIVIL NX software interface. The 'MVL Tracer' window is active, showing a 3D model of a bridge structure with a moving load case defined. The 'MCT Command Shell' window is open, showing a list of commands for the moving load case. The 'Run' button in the MCT Command Shell is highlighted. The 'MCT Command Shell' window contains the following data:

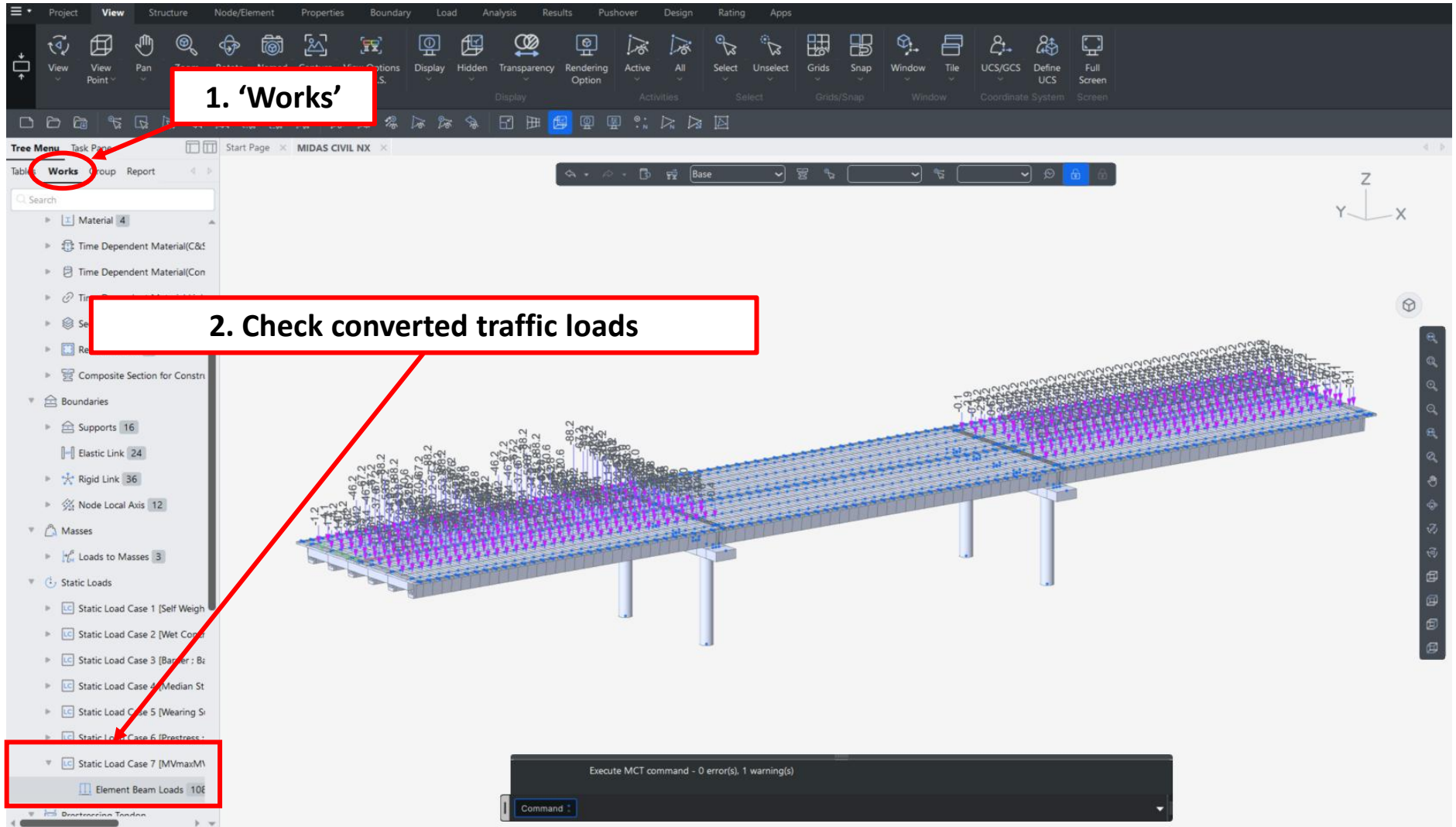
| Command or Data | *NODE           | Insert Command | Insert Data | Delete Data      |
|-----------------|-----------------|----------------|-------------|------------------|
| 2217, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.68       | 0.0000000000, 0, |
| 2231, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.68       | 0.0000000000, 0, |
| 2245, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.68       | 0.0000000000, 0, |
| 2259, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.68       | 0.0000000000, 0, |
| 2273, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.68       | 0.0000000000, 0, |
| 2287, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.68       | 0.0000000000, 0, |
| 2301, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.68       | 0.0000000000, 0, |
| 2315, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.68       | 0.0000000000, 0, |
| 2329, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.68       | 0.0000000000, 0, |
| 2343, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -1.13347    | 0.0000000000, 0, |
| 2357, BEAM      | CONLOAD, GZ, NO | 0.6110000000   | -0.092251   | 0.0000000000, 0, |

The 'Run' button is highlighted in the MCT Command Shell window. The 'MCT Command Shell' window also includes a 'Close' button and a 'Goto Line' field.

**Procedure**

Copy and paste the text into MCT Command Shell under Apps menu.

Extract data in the model file as text format using 'Insert Data' if you need. Check MCT Command List on Appendix in the online manual.



### Procedure

Check imported vertical static load Case.

**1. Click 'Results Tables'**

**2. Select Beam/Force**

**3. Input '258'**

**4. Select 'MV' load cases**

**5. Check**

**6. 'OK'**

| Shear-y (kN) | Shear-z (kN) | Torsion (kN m) | Moment-y (kN m) | Moment-z (kN m) |
|--------------|--------------|----------------|-----------------|-----------------|
| 19.07        | 306.79       | 358.92         | 4237.75         | 136.17          |
| 19.07        | 306.79       | 358.92         | 4234.15         | 135.11          |
| 358.92       | 4244.50      | 134.89         |                 |                 |
| 358.92       | 4261.97      | 135.48         |                 |                 |
| 358.92       | 4279.94      | 136.10         |                 |                 |
| 8.31         | -814.55      | -199.82        |                 |                 |
| -118.31      |              |                |                 |                 |
| -118.31      |              |                |                 |                 |
| -118.31      |              |                |                 |                 |
| 19.07        | -318.76      | 358.92         | 4234.15         | -200.01         |
| 19.07        | -318.76      | 358.92         | 4244.50         | -200.86         |
| 19.07        | -318.76      | 358.92         | 4261.97         | -201.73         |
| 19.07        | -318.76      | 358.92         | 4279.94         | -202.64         |

## Procedure

The output comes from 5 points (Part i, 1/4, 2/4, 3/4, j) of elements.

**1. 'View by Max Value Item...'**

**2. Check**

**3. 'OK'**

| Elem | Load    | Part   | Axial (kN) | Shear-y (kN) | Shear-z (kN) | Torsion (kN-m) | Moment-y (kN-m) | Moment-z (kN-m) |
|------|---------|--------|------------|--------------|--------------|----------------|-----------------|-----------------|
| 258  | MV(max) | I[200] | 136.79     | 19.07        | 302.79       | 358.92         | 4237.75         | 136.17          |
| 258  | MV(max) | 1/4    | 136.79     | 19.07        | 302.79       | 358.92         | 4234.15         | 135.11          |
| 258  | MV(max) | 2/4    | 136.79     | 19.07        | 302.79       | 358.92         | 4244.50         | 134.89          |
| 258  | MV(max) | 3/4    | 136.79     | 19.07        | 302.79       | 358.92         | 4261.97         | 135.48          |
| 258  | MV(max) | J[215] | 136.79     | 19.07        | 302.79       | 358.92         | 4279.94         | 136.10          |
| 258  | MV(min) | I[200] | -68.3      | -118.31      | -833.11      | -118.31        | -814.55         | -199.82         |
| 258  | MV(min) | 1/4    | -68.3      | -118.31      | -833.11      | -118.31        | -851.68         | -200.01         |
| 258  | MV(min) | 2/4    | -68.3      | -118.31      | -833.11      | -118.31        | -870.25         | -201.73         |
| 258  | MV(min) | 3/4    | -68.3      | -118.31      | -833.11      | -118.31        | -888.82         | -202.64         |
| 258  | MV(min) | J[215] | -68.3      | -118.31      | -833.11      | -118.31        | -898.82         | -202.64         |
| 258  | MV(all) | I[200] | 136.79     | 19.07        | 302.79       | 358.92         | 4237.75         | -199.82         |
| 258  | MV(all) | 1/4    | 136.79     | 19.07        | 302.79       | 358.92         | 4234.15         | -200.01         |
| 258  | MV(all) | 2/4    | 136.79     | 19.07        | 302.79       | 358.92         | 4244.50         | -200.86         |
| 258  | MV(all) | 3/4    | 136.79     | 19.07        | 302.79       | 358.92         | 4261.97         | -201.73         |
| 258  | MV(all) | J[215] | 136.79     | 19.07        | 302.79       | 358.92         | 4279.94         | -202.64         |

**Result View Items**

Items to Display:

- ☒ Axial
- ☒ Shear-y
- ☒ Shear-z
- ☒ Torsion
- ☒ Moment-y
- ☒ Moment-z

Load Cases to Display:

- ☐ MVmaxMVMy258(ST)
- ☐ RSx(RS)
- ☐ RSy(RS)
- ☒ MV(MV:all)
- ☒ MV(MV:max)
- ☒ MV(MV:min)
- ☐ cLCB1(CBC)
- ☐ cLCB2(CBC)
- ☐ cLCB3(CBC)
- ☐ cLCB4(CBC)
- ☐ cLCB5(CBC:all)
- ☐ cLCB5(CBC:max)
- ☐ cLCB5(CBC:min)
- ☐ cLCB6(CBC:all)
- ☐ cLCB6(CBC:max)

### Procedure

'View by Max Value Item...' option provides concurrent forces.

The screenshot displays the MIDAS CIVIL NX software interface. The top menu bar includes Project, View, Structure, Node/Element, Properties, Boundary, Load, Analysis, Results, Pushover, Design, Rating, and Apps. The 'Results' tab is active, showing a toolbar with icons for Bridge Specialization, Bridge Girder Diagram, Tendon Loss Graph, General Camber, FCM Camber, ILM Reaction, and Cable Control. A red circle highlights the 'Bridge Specialization' icon, with an arrow pointing to a text box labeled '1. Select 'Bridge Specialization''. Another red circle highlights the 'Tendon Loss Graph' icon, with an arrow pointing to a text box labeled '2. Click 'Tendon Loss Graph''. A third red circle highlights the 'Tendon' dropdown menu in the 'Tendon Time-dependent Loss Graph' dialog box, with an arrow pointing to a text box labeled '3. Select Tendon/Stage/Step'. The dialog box also shows 'Span1-002' for Tendon, 'Stage5' for Stage, and 'Last Step' for Step. The graph area shows a plot of Tendon Force (kN) versus Distance (m) for Tendon Span1-002, Stage Stage5, Step last. The force starts at approximately 100 kN, peaks at about 130 kN around 15m, and ends at 100 kN. The background shows a 3D model of a bridge structure with tendons highlighted in purple.

**1. Select 'Bridge Specialization'**

**2. Click 'Tendon Loss Graph'**

**3. Select Tendon/Stage/Step**

**Tendon Time-dependent Loss Graph**

Tendon: Span1-002 Stage: Stage5 Step: Last Step

Tendon Span1-002 Stage Stage5 Step last

Tendon Force (kN)

Distance (m)

Close

### Procedure

Check tendon losses with graph format.

## 1. 'Results Tables'

The screenshot shows the MIDAS CIVIL NX software interface. The 'Results' tab is selected in the top menu. The 'Results Tables' menu is open, showing various analysis results. The 'Tendon Loss' option is highlighted. The table below shows the results of the tendon loss analysis.

| Elem                                                 | Part         | Stress (After Immediate Loss) A (kN/m²) | Elastic Deform. Loss B (kN/m²) | Stress(Elastic Loss/Stress(Immediate Loss)) | Creep/Shrinkage Loss (kN/m²) | Relaxation Loss (kN/m²) | Stress(After All Loss)/Stress(After Immediate Loss) | Effective Num. |
|------------------------------------------------------|--------------|-----------------------------------------|--------------------------------|---------------------------------------------|------------------------------|-------------------------|-----------------------------------------------------|----------------|
| Tendon group [Tendon-Span1] at the stage of [Stage2] |              |                                         |                                |                                             |                              |                         |                                                     |                |
| Tendon Group                                         | Tendon-Span1 | Stage                                   | Stage2                         | Apply                                       |                              |                         |                                                     |                |
| 132 I                                                | 1190957 8259 | 19615 6933                              | 1 0165                         | -142363 5969                                | -43159 6524                  | 0 8607                  | 48 0000                                             |                |
| 132 J                                                | 1190957 8259 | 19646 3967                              | 1 0164                         | -142444 7298                                | -43159 6524                  | 0 8606                  | 48 0000                                             |                |
| 133 I                                                | 1190957 8259 | 19545 3967                              | 1 0164                         | -142444 7298                                | -43159 6524                  | 0 8606                  | 48 0000                                             |                |
| 133 J                                                | 1190957 8259 | 22086 7125                              | 1 0185                         | -140560 1622                                | -43159 6524                  | 0 8643                  | 48 0000                                             |                |
| 134 I                                                | 1190957 8259 | 22086 7125                              | 1 0185                         | -140560 1622                                | -43159 6524                  | 0 8643                  | 48 0000                                             |                |
| 134 J                                                | 1190957 8259 | 25283 1400                              | 1 0212                         | -138227 4667                                | -43159 6524                  | 0 8689                  | 48 0000                                             |                |
| 135 I                                                | 1190957 8259 | 25283 1400                              | 1 0212                         | -138227 4667                                | -43159 6524                  | 0 8689                  | 48 0000                                             |                |
| 135 J                                                | 1190957 8259 | 28260 1459                              | 1 0237                         | -136054 8413                                | -43159 6524                  | 0 8732                  | 48 0000                                             |                |
| 136 I                                                | 1190957 8259 | 28260 1459                              | 1 0237                         | -136054 8413                                | -43159 6524                  | 0 8732                  | 48 0000                                             |                |
| 136 J                                                | 1190957 8259 | 31017 7360                              | 1 0260                         | -134042 2859                                | -43159 6524                  | 0 8773                  | 48 0000                                             |                |
| 137 I                                                | 1190957 8259 | 31017 7360                              | 1 0260                         | -134042 2859                                | -43159 6524                  | 0 8773                  | 48 0000                                             |                |
| 137 J                                                | 1190957 8259 | 33555 9030                              | 1 0282                         | -132189 8005                                | -43159 6524                  | 0 8809                  | 48 0000                                             |                |
| 138 I                                                | 1190957 8259 | 33555 9030                              | 1 0282                         | -132189 8005                                | -43159 6524                  | 0 8809                  | 48 0000                                             |                |
| 138 J                                                | 1190957 8259 | 33555 9030                              | 1 0282                         | -132189 8005                                | -43159 6524                  | 0 8809                  | 48 0000                                             |                |
| 139 I                                                | 1190957 8259 | 33555 9030                              | 1 0282                         | -132189 8005                                | -43159 6524                  | 0 8809                  | 48 0000                                             |                |
| 139 J                                                | 1190957 8259 | 33555 9030                              | 1 0282                         | -132189 8005                                | -43159 6524                  | 0 8809                  | 48 0000                                             |                |
| 140 I                                                | 1190957 8259 | 33555 9030                              | 1 0282                         | -132189 8005                                | -43159 6524                  | 0 8809                  | 48 0000                                             |                |
| 140 J                                                | 1190957 8259 | 33555 9030                              | 1 0282                         | -132189 8005                                | -43159 6524                  | 0 8809                  | 48 0000                                             |                |
| 141 I                                                | 1190957 8259 | 33555 9030                              | 1 0282                         | -132189 8005                                | -43159 6524                  | 0 8809                  | 48 0000                                             |                |
| 141 J                                                | 1190957 8259 | 33555 9030                              | 1 0282                         | -132189 8005                                | -43159 6524                  | 0 8809                  | 48 0000                                             |                |
| 142 I                                                | 1190957 8259 | 41514 3696                              | 1 0349                         | -126380 5595                                | -43159 6524                  | 0 8925                  | 48 0000                                             |                |
| 142 J                                                | 1190957 8259 | 42955 4352                              | 1 0361                         | -125328 4243                                | -43159 6524                  | 0 8946                  | 48 0000                                             |                |
| 143 I                                                | 1190957 8259 | 42955 4352                              | 1 0361                         | -125328 4243                                | -43159 6524                  | 0 8946                  | 48 0000                                             |                |
| 143 J                                                | 1190957 8259 | 44177 0804                              | 1 0371                         | -124436 3592                                | -43159 6524                  | 0 8964                  | 48 0000                                             |                |
| 144 I                                                | 1190957 8259 | 44177 0804                              | 1 0371                         | -124436 3592                                | -43159 6524                  | 0 8964                  | 48 0000                                             |                |
| 144 J                                                | 1190957 8259 | 45179 3052                              | 1 0379                         | -123704 3642                                | -43159 6524                  | 0 8978                  | 48 0000                                             |                |
| 145 I                                                | 1190957 8259 | 45179 3052                              | 1 0379                         | -123704 3642                                | -43159 6524                  | 0 8978                  | 48 0000                                             |                |
| 145 J                                                | 1190957 8259 | 45962 1097                              | 1 0386                         | -123132 4392                                | -43159 6524                  | 0 8990                  | 48 0000                                             |                |
| 146 I                                                | 1190957 8259 | 45962 1097                              | 1 0386                         | -123132 4392                                | -43159 6524                  | 0 8990                  | 48 0000                                             |                |
| 146 J                                                | 1190957 8259 | 46525 4938                              | 1 0391                         | -122720 5842                                | -43159 6524                  | 0 8998                  | 48 0000                                             |                |
| 147 I                                                | 1190957 8259 | 46525 4938                              | 1 0391                         | -122720 5842                                | -43159 6524                  | 0 8998                  | 48 0000                                             |                |
| 147 J                                                | 1190957 8259 | 46869 4576                              | 1 0394                         | -122468 7993                                | -43159 6524                  | 0 9003                  | 48 0000                                             |                |
| 148 I                                                | 1190957 8259 | 46869 4576                              | 1 0394                         | -122468 7993                                | -43159 6524                  | 0 9003                  | 48 0000                                             |                |
| 148 J                                                | 1190957 8259 | 46994 0010                              | 1 0395                         | -122377 0844                                | -43159 6524                  | 0 9005                  | 48 0000                                             |                |
| 149 I                                                | 1190957 8259 | 46994 0010                              | 1 0395                         | -122377 0844                                | -43159 6524                  | 0 9005                  | 48 0000                                             |                |
| 149 J                                                | 1190957 8259 | 46899 1241                              | 1 0394                         | -122445 4396                                | -43159 6524                  | 0 9003                  | 48 0000                                             |                |
| 150 I                                                | 1190957 8259 | 46899 1241                              | 1 0394                         | -122445 4396                                | -43159 6524                  | 0 9003                  | 48 0000                                             |                |
| 150 J                                                | 1190957 8259 | 46584 8268                              | 1 0391                         | -122673 8648                                | -43159 6524                  | 0 8999                  | 48 0000                                             |                |
| 151 I                                                | 1190957 8259 | 46584 8268                              | 1 0391                         | -122673 8648                                | -43159 6524                  | 0 8999                  | 48 0000                                             |                |
| 151 J                                                | 1190957 8259 | 46051 1091                              | 1 0387                         | -123062 3600                                | -43159 6524                  | 0 8991                  | 48 0000                                             |                |
| 152 I                                                | 1190957 8259 | 46051 1091                              | 1 0387                         | -123062 3600                                | -43159 6524                  | 0 8991                  | 48 0000                                             |                |
| 152 J                                                | 1190957 8259 | 45297 9711                              | 1 0380                         | -123610 9253                                | -43159 6524                  | 0 8980                  | 48 0000                                             |                |
| 153 I                                                | 1190957 8259 | 45297 9711                              | 1 0380                         | -123610 9253                                | -43159 6524                  | 0 8980                  | 48 0000                                             |                |
| 153 J                                                | 1190957 8259 | 44325 4128                              | 1 0372                         | -124319 5607                                | -43159 6524                  | 0 8966                  | 48 0000                                             |                |
| 154 I                                                | 1190957 8259 | 44325 4128                              | 1 0372                         | -124319 5607                                | -43159 6524                  | 0 8966                  | 48 0000                                             |                |

## 3. Select Tendon Group/Stage and Click 'Apply'

## 2. 'Tendon Loss'

## Procedure

Check tendon losses.

## 1. 'Results Tables'

The screenshot shows the MIDASIT software interface. The 'Results' tab is active, and the 'Results Tables' menu is open. The 'Tendon' option is selected, and the 'Tendon Elongation' sub-option is highlighted. A table of tendon elongation data is displayed on the right side of the screen.

| Tendon Name | Stage  | Step       | Tendon Elongation |         | Element Elongation |         | Summation |         |
|-------------|--------|------------|-------------------|---------|--------------------|---------|-----------|---------|
|             |        |            | Begin (m)         | End (m) | Begin (m)          | End (m) | Begin (m) | End (m) |
| Span1-001   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-002   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-003   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-004   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-005   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-006   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-007   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-008   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-009   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-010   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-011   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-012   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-013   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-014   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-015   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-016   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-017   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-018   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-019   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-020   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-021   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-022   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-023   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-024   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-025   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-026   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-027   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-028   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-029   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-030   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-031   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-032   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-033   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-034   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-035   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-036   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-037   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-038   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-039   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-040   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-041   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-042   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-043   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-044   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-045   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-046   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |
| Span1-047   | Stage2 | 001(first) | 0.1095            | 0.1095  | 0.0002             | 0.0002  | 0.1097    | 0.1097  |

## 2. 'Tendon Elongation'

### Procedure

Check tendon elongation.

**1. 'Mode Shapes' – 'Vibration Mode Shapes'**

**2. 'Mode 2'**

**3. Check on 'Legend' and 'Contour'**

**4. 'Apply'**

The screenshot shows the MIDAS CIVIL NX software interface. The top toolbar contains various analysis and design tools. The left sidebar has a 'Mode Shapes' section with a dropdown menu set to 'Vibration Mode Shapes'. Below this, the 'Load Cases/Mode Numbers' section shows 'Mode 2' selected. The 'Components' section has radio buttons for 'Md-X', 'Md-Y', 'Md-Z', 'Md-XY', 'Md-YZ', 'Md-XZ', and 'Md-XYZ' (selected). The 'Type of Display' section has checkboxes for 'Md Shp.', 'Undeformed', 'Values', 'Legend' (checked), 'Contour' (checked), and 'Animate'. The 'Apply' button is highlighted. The main 3D view area shows a bridge structure with a color-coded mode shape. A legend on the right side of the 3D view shows a color scale from 0.00000e+00 to 2.24024e-02. The bottom status bar shows 'Command :'. The right sidebar contains a 'PostCS' section with 'MODE 2' selected, and a 'VIEW-DIRECTION' section with 'X: -0.562', 'Y: -0.788', and 'Z: 0.250'.

### Procedure

Check mode shapes

Check on 'Repeat Full Cycle' on 'Animate ...' option if full cycle of the shape is preferred.

**Click '...'**

| Node    | Mode | UX        | UY       | UZ       | RX          | RY | RZ |
|---------|------|-----------|----------|----------|-------------|----|----|
| Mode No |      | (rad/sec) | (cyc)    |          |             |    |    |
| 1       |      | 4.473282  |          |          |             |    |    |
| 2       |      | 13.350813 | 2.124848 | 0.470622 | 0.0000e+00  |    |    |
| 3       |      | 30.200297 | 4.806527 | 0.208050 | 1.9111e-102 |    |    |
| 4       |      | 30.514074 | 4.856466 | 0.205911 | 1.7574e-102 |    |    |
| 5       |      | 30.939122 | 4.924114 | 0.203082 | 7.8554e-102 |    |    |
| 6       |      | 35.400272 | 5.634128 | 0.177490 | 8.1080e-94  |    |    |
| 7       |      | 36.243647 | 5.768356 | 0.173360 | 2.2354e-91  |    |    |
| 8       |      | 36.437709 | 5.799241 | 0.172436 | 9.5588e-90  |    |    |
| 9       |      | 36.446694 | 5.800672 | 0.172394 | 2.8440e-90  |    |    |
| 10      |      | 53.621865 | 8.534185 | 0.117176 | 4.9522e-78  |    |    |

| MODAL PARTICIPATION MASSES PRINTOUT |         |        |         |        |         |        |         |        |         |        |         |        |  |
|-------------------------------------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|--|
| Mode No                             | TRAN-X  |        | TRAN-Y  |        | TRAN-Z  |        | ROTN-X  |        | ROTN-Y  |        | ROTN-Z  |        |  |
|                                     | MASS(%) | SUM(%) | MASS(%) | SUM(%) | MASS(%) | SUM(%) | MASS(%) | SUM(%) | MASS(%) | SUM(%) | MASS(%) | SUM(%) |  |
| 1                                   | 96.96   | 96.96  | 0.00    | 0.00   | 0.00    | 0.00   | 0.00    | 0.00   | 37.70   | 37.70  | 0.00    | 0.00   |  |
| 2                                   | 0.00    | 96.96  | 77.68   | 77.68  | 0.00    | 0.00   | 28.84   | 28.84  | 0.00    | 37.70  | 0.00    | 0.00   |  |
| 3                                   | 0.00    | 96.96  | 0.00    | 77.68  | 0.00    | 0.00   | 0.00    | 28.84  | 0.00    | 37.70  | 0.00    | 0.00   |  |
| 4                                   | 3.04    | 100.00 | 0.00    | 77.68  | 0.00    | 0.00   | 0.00    | 28.84  | 62.30   | 100.00 | 0.00    | 0.00   |  |
| 5                                   | 0.00    | 100.00 | 0.00    | 77.68  | 0.00    | 0.00   | 0.00    | 28.84  | 0.00    | 100.00 | 52.31   | 52.31  |  |
| 6                                   | 0.00    | 100.00 | 3.53    | 81.21  | 0.00    | 0.00   | 60.64   | 89.48  | 0.00    | 100.00 | 0.00    | 52.31  |  |
| 7                                   | 0.00    | 100.00 | 0.00    | 81.21  | 0.00    | 0.00   | 0.00    | 89.48  | 0.00    | 100.00 | 3.43    | 55.74  |  |
| 8                                   | 0.00    | 100.00 | 0.00    | 81.21  | 0.00    | 0.00   | 0.03    | 89.51  | 0.00    | 100.00 | 0.00    | 55.74  |  |
| 9                                   | 0.00    | 100.00 | 0.00    | 81.21  | 0.00    | 0.00   | 0.00    | 89.51  | 0.00    | 100.00 | 0.04    | 55.79  |  |
| 10                                  | 0.00    | 100.00 | 7.73    | 88.94  | 0.00    | 0.00   | 4.71    | 94.22  | 0.00    | 100.00 | 0.00    | 55.79  |  |

| MODAL PARTICIPATION FACTOR PRINTOUT (mm) |        |       |        |       |        |       |        |       |        |       |        |  |  |
|------------------------------------------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|--|--|
| Mode No                                  | TRAN-X |       | TRAN-Y |       | TRAN-Z |       | ROTN-X |       | ROTN-Y |       | ROTN-Z |  |  |
|                                          | Value  | Value | Value  | Value | Value  | Value | Value  | Value | Value  | Value | Value  |  |  |
| 1                                        | 47.16  | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   |  |  |
| 2                                        | -0.00  | 42.21 | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   |  |  |
| 3                                        | 0.00   | -0.00 | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   |  |  |
| 4                                        | 8.35   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   |  |  |
| 5                                        | 0.00   | -0.01 | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   |  |  |
| 6                                        | 0.00   | 9.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   |  |  |
| 7                                        | -0.00  | 0.04  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   |  |  |
| 8                                        | 0.00   | 0.17  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   |  |  |

### Procedure

Accumulated modal participation masses should be over than around 90%.

Increase the number of modes on Analysis menu if it is less than that.

## *Overview*

### ▪ Properties

- Material / Section

### ▪ Prestressed Composite Bridge Wizard

- Layout
- Section
- Tendon
- Load
- Construction Stage

### ▪ Load

- Time Dependent Material
- Moving load
- Response Spectrum Analysis

### ▪ Analysis

- Moving Load

### ▪ Results

- Load Combination
- Reaction/Force/Displacement
- Moving Tracer
- Concurrent Force
- Tendon Losses
- Mode Shape

### ▪ Design

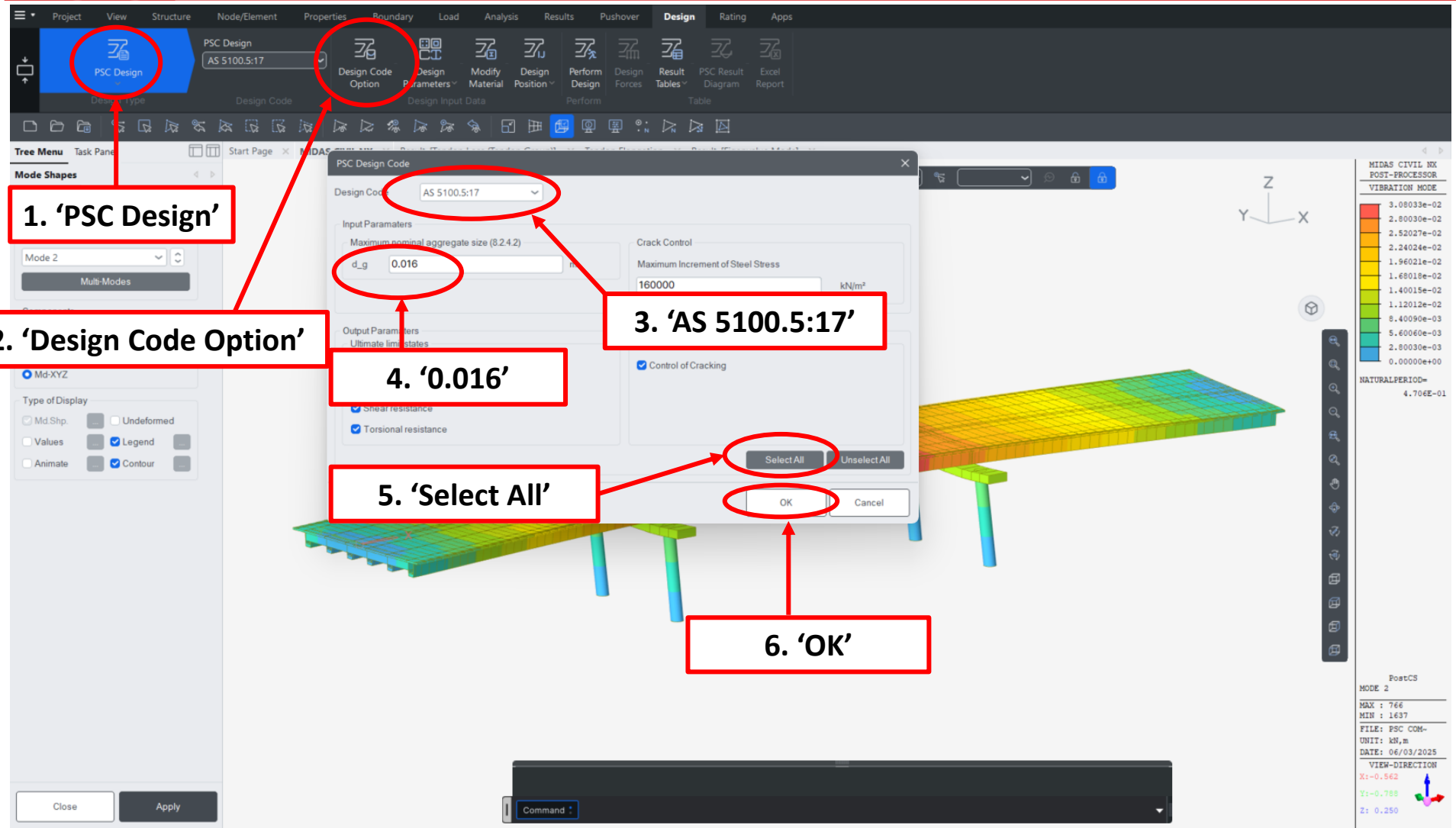
- PSC Design

### ▪ Tips

- Smart Report
- MCT Command Shell
- Tendon Template
- Import tendon from AutoCAD

### ▪ Appendix. Load Combinations

# Step 6. Design



### Procedure

Enter output parameters

**1. 'Modify Material'**

**2. Select material**

**3. 'Modify' & 'Close'**

**Modify Composite Concrete Materials**

| ID | Name | Conc.(Gird... | Main-bar(G... | Sub-bar(Gl... | Conc.(Slab) | Ma |
|----|------|---------------|---------------|---------------|-------------|----|
| 1  | C50  | C50           |               |               |             |    |
| 2  | C40  | C40           |               |               |             |    |

**Girder**

Concrete Material Selection

Code: AS17(RC) Grade: C50

Specified Compressive Strength (fc/fck): 50000 kN/m<sup>2</sup>

☐ Compressive Strength Transfer, fci (Pre-tension): 0 kN/m<sup>2</sup>

☐ Light Weight Concrete Factor (Lambda): 1

**Rebar Selection**

Code: AS17(RC)

Grade of Main Rebar: D500E Fy: 500000 kN/m<sup>2</sup>

Grade of Sub-Rebar: D500E Fys: 500000 kN/m<sup>2</sup>

**Slab**

Concrete Material Selection

Code: AS17(RC) Grade: C40

Specified Compressive Strength (fc/fck): 40000 kN/m<sup>2</sup>

☐ Light Weight Concrete Factor (Lambda): 1

**Rebar Selection**

Code: AS17(RC)

Grade of Main Rebar: D500E Fy: 500000 kN/m<sup>2</sup>

Grade of Sub-Rebar: D500E Fys: 500000 kN/m<sup>2</sup>

Close Modify

### Procedure

Enter parameters for MIDAS CIVIL NX to calculate Capacity of the section

**1. 'Design Position'**

**2. '258to268' Enter**

**3. 'Apply'**

**Procedure**

Enter elements to consider for Design calculation.

**1. 'Output Position'**

**2. '258' Enter**

**3. 'Apply'**

**Procedure**

Enter the elements for Excel report.

The screenshot displays the MIDAS CIVIL NX software interface. The 'Design' tab is active, and the 'Perform Design' button is highlighted with a red circle and a red arrow pointing to a text box that reads '1. Perform Design'. The interface includes a top menu bar with options like Project, View, Structure, Node/Element, Properties, Boundary, Load, Analysis, Results, Pushover, Design, Rating, and Apps. Below the menu bar is a toolbar with various icons. The main workspace shows a 3D model of a bridge structure with a color-coded stress distribution. On the left, there is a 'Tree Menu' and a 'Task Pane' with settings for 'PSC Design'. On the right, there is a 'VIBRATION MODE' color scale and a 'PostCS' section with numerical data.

**1. 'Perform Design'**

## Procedure

**PSC Result Diagram**

MIDAS CIVIL NX  
POST-PROCESSOR  
PSC DESIGN  
Flexure - y  
1.31324e+04  
1.19396e+04  
1.07447e+04  
9.55087e+03  
8.35701e+03  
7.16315e+03  
5.96930e+03  
4.77544e+03  
3.58158e+03  
2.38772e+03  
1.19396e+03  
0.00000e+00

PostCS  
ALL COMBINA-  
MAX : 766  
MIN : 1637  
FILE: PSC COM-  
UNIT: kN-m  
DATE: 06/03/2025  
VIEW-DIRECTION  
X: 0.000  
Y: -1.000  
Z: 0.000

\*\*\* Reading PSC Design Result

## Procedure

Capacity/demand diagram is shown for the element which are assigned under 'Design Position'.

The screenshot shows the MIDAS CIVIL NX software interface. The 'Design' tab is active, and the 'PSC Design' menu is open. A red circle highlights the 'Check Combined Shear and Torsion Strength' option. A red arrow points from a text box below to this option. The interface includes a Tree Menu, Task Pane, and a main window displaying a design result diagram.

**Check various design results with table format**

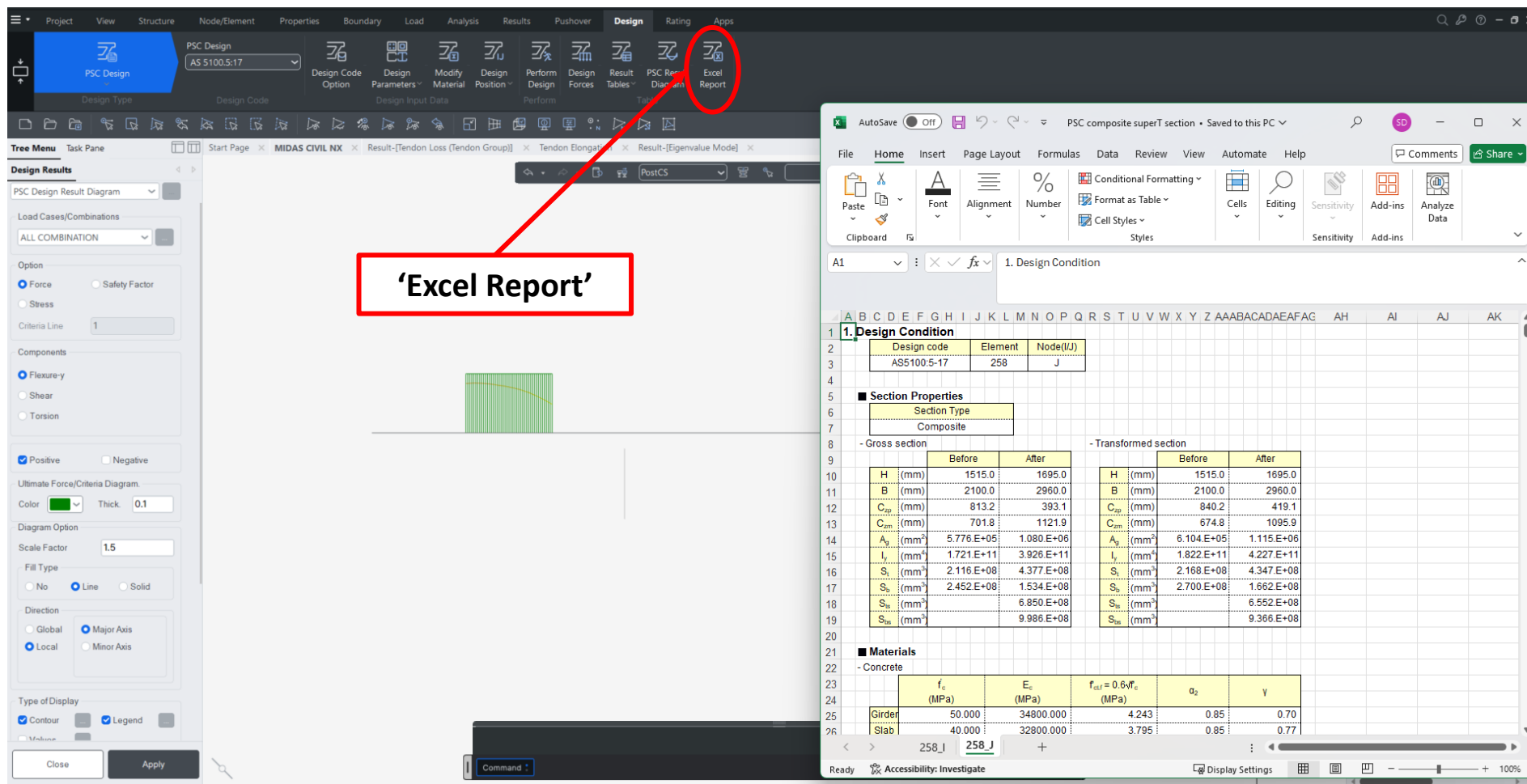
\*\*\* Reading PSC Design Result

Command :

PostCS  
ALL COMBINA-  
MAX : 766  
MIN : 1637  
FILE: PSC COM-  
UNIT: kN-m  
DATE: 06/03/2025  
VIEW-DIRECTION  
X: 0.000  
Y: -1.000  
Z: 0.000

### Procedure

Table shows the results for the element which are assigned on 'Design Position'.



The screenshot displays the MIDAS CIVIL NX software interface. The 'Design' tab is active, and the 'Excel Report' button is highlighted with a red circle. A red arrow points from a text box labeled 'Excel Report' to this button. The software window shows a 'PSC Design' project with a 'Design Code' of 'AS 5100.5:17'. The 'Design Results' panel on the left shows 'Load Cases/Combinations' set to 'ALL COMBINATION' and 'Option' set to 'Force'. The 'Ultimate Force/Criteria Diagram' is displayed, showing a green curve. The 'Excel Report' button is located in the 'Design' tab, next to the 'PSC Report' button. The report preview on the right shows the following data:

| 1. Design Condition                |                      |                      |                                             |                |            |
|------------------------------------|----------------------|----------------------|---------------------------------------------|----------------|------------|
| Design code                        | Element              | Node(I/J)            |                                             |                |            |
| AS5100.5-17                        | 258                  | J                    |                                             |                |            |
| ■ Section Properties               |                      |                      |                                             |                |            |
| Section Type                       |                      |                      |                                             |                |            |
| Composite                          |                      |                      |                                             |                |            |
| - Gross section                    |                      |                      |                                             |                |            |
|                                    | Before               | After                | - Transformed section                       |                |            |
|                                    | Before               | After                |                                             | Before         | After      |
| H (mm)                             | 1515.0               | 1695.0               | H (mm)                                      | 1515.0         | 1695.0     |
| B (mm)                             | 2100.0               | 2960.0               | B (mm)                                      | 2100.0         | 2960.0     |
| C <sub>top</sub> (mm)              | 813.2                | 393.1                | C <sub>top</sub> (mm)                       | 840.2          | 419.1      |
| C <sub>bot</sub> (mm)              | 701.8                | 1121.9               | C <sub>bot</sub> (mm)                       | 674.8          | 1095.9     |
| A <sub>g</sub> (mm <sup>2</sup> )  | 5.776.E+05           | 1.080.E+06           | A <sub>g</sub> (mm <sup>2</sup> )           | 6.104.E+05     | 1.115.E+06 |
| I <sub>g</sub> (mm <sup>4</sup> )  | 1.721.E+11           | 3.926.E+11           | I <sub>g</sub> (mm <sup>4</sup> )           | 1.822.E+11     | 4.227.E+11 |
| S <sub>x</sub> (mm <sup>3</sup> )  | 2.116.E+08           | 4.377.E+08           | S <sub>x</sub> (mm <sup>3</sup> )           | 2.168.E+08     | 4.347.E+08 |
| S <sub>y</sub> (mm <sup>3</sup> )  | 2.452.E+08           | 1.534.E+08           | S <sub>y</sub> (mm <sup>3</sup> )           | 2.700.E+08     | 1.662.E+08 |
| S <sub>xx</sub> (mm <sup>3</sup> ) | 6.850.E+08           | 6.552.E+08           | S <sub>xx</sub> (mm <sup>3</sup> )          | 6.552.E+08     | 6.552.E+08 |
| S <sub>yy</sub> (mm <sup>3</sup> ) | 9.986.E+08           | 9.986.E+08           | S <sub>yy</sub> (mm <sup>3</sup> )          | 9.366.E+08     | 9.366.E+08 |
| ■ Materials                        |                      |                      |                                             |                |            |
| - Concrete                         |                      |                      |                                             |                |            |
|                                    | f <sub>c</sub> (MPa) | E <sub>c</sub> (MPa) | f <sub>ctd</sub> = 0.6√f <sub>c</sub> (MPa) | α <sub>2</sub> | γ          |
| Girder                             | 50.000               | 34800.000            | 4.243                                       | 0.85           | 0.70       |
| Slab                               | 40.000               | 32800.000            | 3.795                                       | 0.85           | 0.77       |

**Procedure**

## *Overview*

### ▪ Properties

- Material / Section

### ▪ Prestressed Composite Bridge Wizard

- Layout
- Section
- Tendon
- Load
- Construction Stage

### ▪ Load

- Time Dependent Material
- Moving load
- Response Spectrum Analysis

### ▪ Analysis

- Moving Load

### ▪ Results

- Load Combination
- Reaction/Force/Displacement
- Moving Tracer
- Concurrent Force
- Tendon Losses
- Mode Shape

### ▪ Design

- PSC Design

### ▪ Tips

- Smart Report
- MCT Command Shell
- Tendon Template
- Import tendon from AutoCAD

### ▪ Appendix. Load Combinations

# Step 7. Tips

The screenshot displays the MIDASIT software interface. The top menu bar includes Project, View, Structure, Node/Element, Properties, **Dynamic Report**, Load, Analysis, Results, Pushover, Design, Rating, and Apps. The 'Dynamic Report' menu is highlighted with a red box. Below it, the 'Dynamic Report Table' dialog box is open, showing the 'Name' field as 'TDNElong' and a list of components including Tendon Name, Stage, Step, Tendon Elongation, Element Elongation, and Summation. The 'OK' button is highlighted with a red circle. A red arrow points from the 'Dynamic Report Table' option in the context menu to the 'OK' button. Another red arrow points from the 'Dynamic Report Table' option in the context menu to the 'Dynamic Report Table' dialog box.

**1. Click 'Dynamic Report Table' on the context menu**

**2. Click 'OK'**

### Procedure

Execute Dynamic Report Generator and drag & drop the figures and the tables from Tree Menu to Microsoft Word. Add all input & output figures & tables to Tree Menu by clicking on 'Dynamic Report Table' on the context menu. Modified results will be updated after re-performing analysis automatically by 'Dynamic Report Auto Regeneration'.

Extract only the text data on the command from the model file.

**Find command from the online manual  
(- Appendix – MCT Command List)**

**Apply the text data to the model file.**

**Run**

```

; AREA, ASy, A
; CyP, CyM, Cz
; Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8, Y9, Y10
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, ELAST, DEN, POIS, POIC, SF, TH
; D1, D2, [SRC]
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, 1, DB, NAME1, NAME2, D1, D2
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, 2, D11, D12, D13, D14, D15, D2
; iSEC, TYPE, SNAME, [OFFSET2], bSD, bWE, SHAPE, iyVAR, izVAR, STYPE
; iSEC, TYPE, SNAME, [OFFSET2], bSD, bWE, bHUMBLY, SHAPE, iyVAR, izVAR, STYPE
; DB, NAME1, NAME2
; [DIM1], [DIM2]
; D1, D12, D13, D14, D15, D16, D17, D18
; AREA1, ASy1, ASz1, Ixx1, Iyy1, Izz1
; CyP1, CyM1, CzP1, CzM1, QyB1, QzB1, PERI OUT1, PERI IN1, Cy1, Cz1
  
```

Modify or add functions with text format.

Save text data for specific functions(section, load, boundary, analysis and etc.) so it wouldn't be necessary to input same input data for various model files.

## Menu – Structure – Wizard – PSC Bridge – Tendon Template

☒ Use Prefix Name    strand

Assigned Elements    163    Add    163    ▾

| No | Name       | Property |
|----|------------|----------|
| 1  | strand_001 | Tendon   |
| 2  | strand_002 | Tendon   |
| 3  | strand_003 | Tendon   |
| 4  | strand_004 | Tendon   |
| 5  | strand_005 | Tendon   |
| 6  | strand_006 | Tendon   |

Add  
 Modify  
 Set Property  
 Move/Copy  
 Delete  
 Import  
 Export  
 Auto Generation  
 Reset Name

Tendon

Plane View  
 Elevation View  
 Section  
 163

Pos.    ☐ i    ☐ j

OK    Cancel    Apply

Select elements to apply tendons

Add the selected elements

Select tendon from the drawing view at the bottom of the dialog by drag the mouse and move or copy the tendons

Import tendon template from other model files

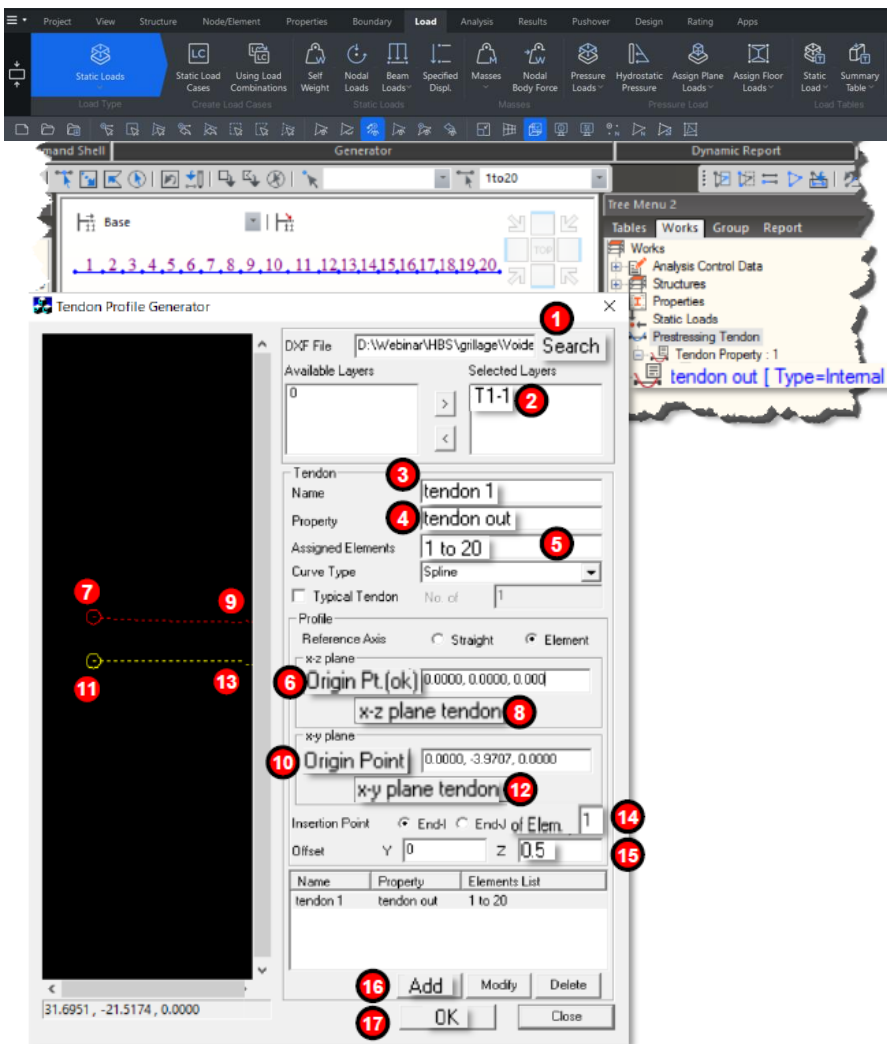
Export inputted tendon template data

Generate tendons automatically for typical section

Import tendon template from the previous model file it the section is typical for the projects, so it is not necessary to model the tendon repeatedly.

## Menu – Tools – Tendon Profile Generator

- 1.Import the.DXF file which contains the tendon profile.
- 2.Select the layer with the tendon profile.
- 3.Enter tendon name.
- 4.Enter appropriate tendon property. The '*tendon property*' should be predefined in the model file.
- 5.Enter the element numbers to which the tendon profile has to be assigned.
- 6.Click on locations shown by step no.6 to 9 in sequence. This is to select the starting point of the tendon and the x-z plane coordinates for the tendon
- 10.Click on locations shown by step no.10 to 13 in sequence. This is to select the starting point of the tendon and the x-y plane coordinates for the tendon
- 14.Enter the element number at which the tendon has to be inserted.
- 15.Enter the required offset distance for the profile insertion if necessary.
- 16.Click 'Add'
- 17.Then OK to create the tendon coordinates on text format.
- 18.Copy the content
- 19.Open MCT Command Shell from **Apps > MCT > MCT Command Shell**
- 20.Paste the contents in the 'MCT command shell' dialogue box
- 21.Click 'Run'. The profile should now be inserted in the model.



## *Overview*

### ▪ Properties

- Material / Section

### ▪ Prestressed Composite Bridge Wizard

- Layout
- Section
- Tendon
- Load
- Construction Stage

### ▪ Load

- Time Dependent Material
- Moving load
- Response Spectrum Analysis

### ▪ Analysis

- Moving Load

### ▪ Results

- Load Combination
- Reaction/Force/Displacement
- Moving Tracer
- Concurrent Force
- Tendon Losses
- Mode Shape

### ▪ Design

- PSC Design

### ▪ Tips

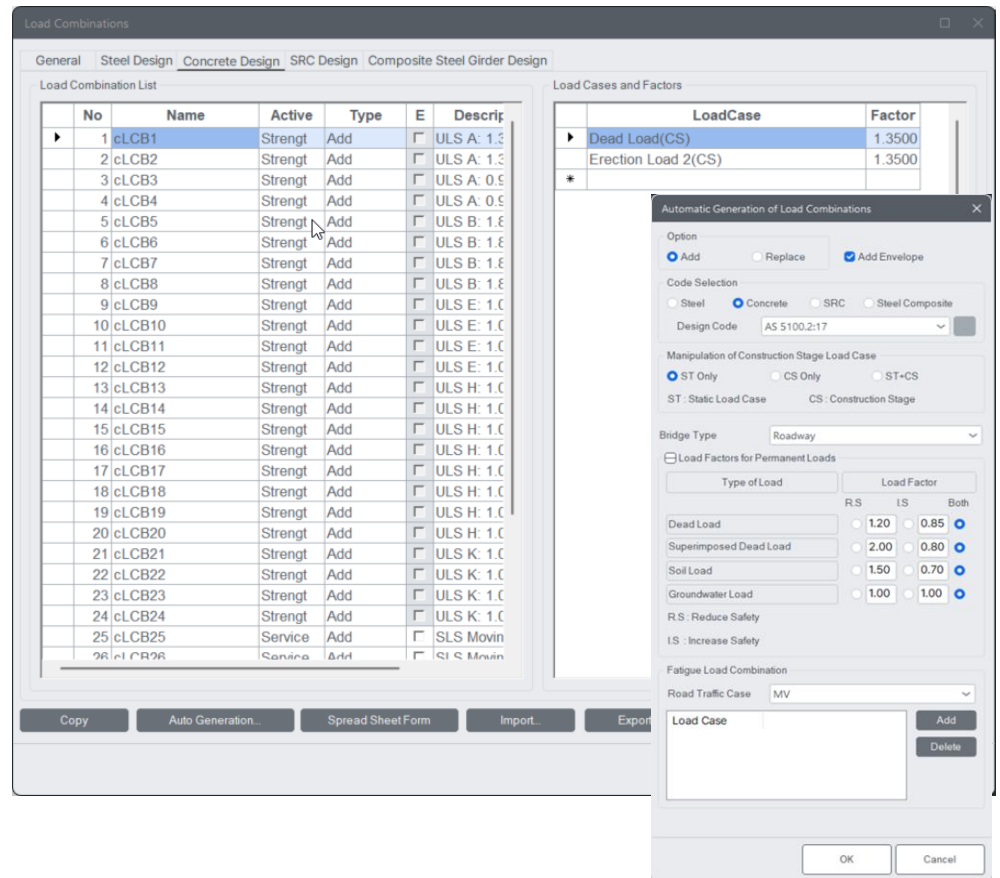
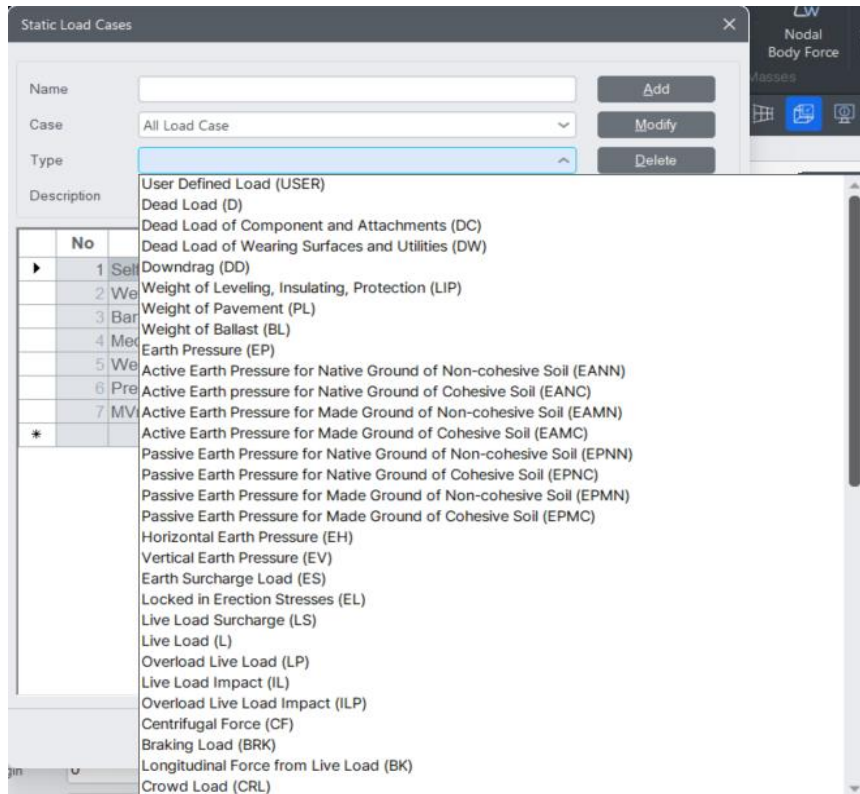
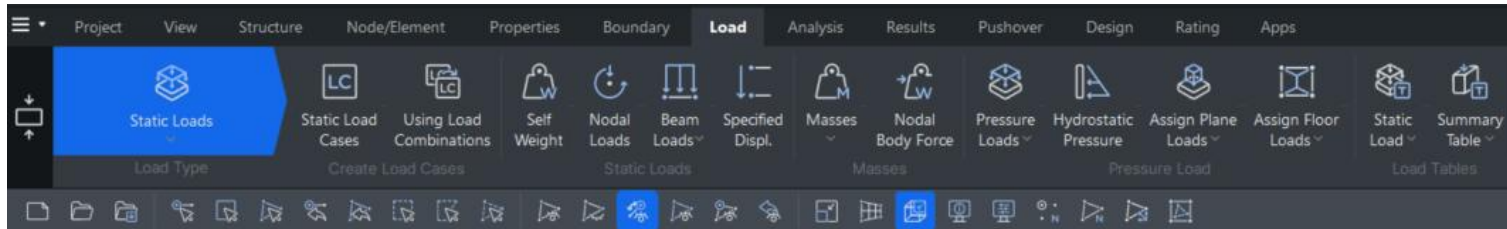
- Smart Report
- MCT Command Shell
- Tendon Template
- Import tendon from AutoCAD

### ▪ Appendix. Load Combinations

# Appendix. Load Combinations

## Appendix. Load Combinations

Automatic load combination function defines load factors based on Static Load Case Type according to AS5100.2:2017.  
Static Load Cases function includes any load functions from Static Loads and Temp./Prestress Load Type.



| Static Load Case Type                                         |      | *Excluded |
|---------------------------------------------------------------|------|-----------|
| Dead Load                                                     | D    |           |
| Dead Load of Component and Attachments                        | DC   |           |
| Dead Load of Wearing Surfaces and Utilities                   | DW   |           |
| Downdrag                                                      | DD   | X         |
| Weight of Leveling, Insulating, Protection                    | LIP  | X         |
| Weight of Pavement                                            | PL   | X         |
| Weight of Ballast                                             | BL   | X         |
| Earth Pressure                                                | EP   |           |
| Active Earth Pressure for Native ground of Non-cohesive Soil  | EANN | X         |
| Active Earth Pressure for Native Ground of Cohesive Soil      | EANC | X         |
| Active Earth Pressure for Made Ground of Non-cohesive Soil    | EAMN | X         |
| Active Earth Pressure for Made Ground of Cohesive Soil        | EAMC | X         |
| Passive Earth Pressure for Native ground of Non-cohesive Soil | EPNN | X         |
| Passive Earth Pressure for Native Ground of Cohesive Soil     | EPNC | X         |
| Passive Earth Pressure for Made Ground of Non-cohesive Soil   | EPMN | X         |
| Passive Earth Pressure for Made Ground of Cohesive Soil       | EPMC | X         |
| Horizontal Earth Pressure                                     | EH   |           |
| Vertical Earth Pressure                                       | EV   |           |
| Earth Surcharge Load                                          | ES   | X         |
| Locked in Erection Stresses                                   | EL   | X         |
| Live Load Surcharge                                           | LS   | X         |
| Live Load                                                     | L    | X         |
| Overload Live load                                            | LP   | X         |
| Live Load Impact                                              | IL   | X         |
| Overload Live Load Impact                                     | ILP  | X         |
| Centrifugal Force                                             | CF   |           |

| Static Load Case Type     |     | *Excluded |
|---------------------------|-----|-----------|
| Crowd Load                | CRL | X         |
| Prestress                 | PS  |           |
| Buoyancy                  | B   |           |
| Ground Water Pressure     | WP  |           |
| Fluid Pressure            | FP  |           |
| Stream Flow Pressure      | SF  | X         |
| Wave Pressure             | WPR | X         |
| Wind Load on Structure    | W   |           |
| Wind Load on Live Load    | WL  | X         |
| Settlement                | STL |           |
| Creep                     | CR  |           |
| Shrinkage                 | SH  |           |
| Temperature               | T   |           |
| Temperature Gradient      | TPG |           |
| Collision Load            | CO  |           |
| Vehicular Collision Force | CT  |           |
| Vessel Collision Force    | CV  |           |
| Earthquake                | E   |           |
| Friction                  | FR  | X         |
| Ice Pressure              | IP  | X         |
| Construction Stage Load   | CS  | X         |
| Erection Load             | ER  | X         |
| Rib Shortening            | RS  | X         |
| Grade Effect              | GE  | X         |
| Roof Live Load            | LR  | X         |
| Snow Load                 | S   | X         |
| Rain Load                 | R   | X         |
| Soil Heaving              | SHV | X         |

\*Excluded : Excluded load case types are not included in the automatic load combinations.

Load combination has to be defined manually for the excluded load case types if it is necessary.

## Appendix. Load Combinations

MIDAS CIVIL NX decides load factors according to AS5100.2 based on load type of Static Load Cases.

For example, if user define a load case which type is Dead Load(D) or (DC), 1.20 or(and) 0.85 would be applied as a load factor from auto generation of load combination for Ultimate check. And 2.0 or(and) 0.7 would be applied for Dead Load of Wearing Surfaces and Utilities(DW). Both 'reduces safety' and 'increases safety' factors are generated when 'Both' option is checked on.

AS 5100.2 : 2017

LOAD FACTORS

| Loading                                      |                                   | Limit state |                |
|----------------------------------------------|-----------------------------------|-------------|----------------|
|                                              |                                   | Ultimate    | Serviceability |
| Dead load of structure that reduces safety   | Steel                             | 1.10        | 1.0            |
|                                              | Concrete                          | 1.20        | 1.0            |
|                                              | Concrete at transfer of prestress | 1.15        | N/A            |
|                                              | Timber                            | 1.25        | 1.0            |
| Dead load of structure that increases safety | Steel                             | 0.90        | 1.0            |
|                                              | Concrete                          | 0.85        | 1.0            |
|                                              | Concrete at transfer of prestress | 0.90        | N/A            |
|                                              | Timber                            | 0.80        | 1.0            |
| Superimposed dead load that reduces safety   | Permanent                         | 2.0         | 1.3            |
|                                              | Removable                         | 2.0         | 1.3            |
|                                              | Special case permanent            | 1.4         | 1.0            |
|                                              | Special case removable            | 1.4         | 1.0            |
| Superimposed dead load that increases safety | Permanent                         | 0.7         | 1.3            |
|                                              | Removable                         | 0.0         | 1.3            |
|                                              | Special case permanent            | 0.8         | 1.0            |
|                                              | Special case removable            | 0.0         | 1.0            |

(continued)

| Static Load Case Type from midas Civil      |    |
|---------------------------------------------|----|
| Dead Load                                   | D  |
| Dead Load of Component and Attachments      | DC |
| Dead Load of Wearing Surfaces and Utilities | DW |

Automatic Generation of Load Combinations

Option  
☒ Add ☐ Replace ☒ Add Envelope

Code Selection  
☐ Steel ☒ Concrete ☐ SRC ☐ Steel Composite  
 Design Code AS 5100.2:17

Manipulation of Construction Stage Load Case  
☒ ST Only ☐ CS Only ☐ ST+CS  
 ST : Static Load Case CS : Construction Stage

Bridge Type Roadway

☐ Load Factors for Permanent Loads

| Type of Load           | RS                         | IS                         | Both                             |
|------------------------|----------------------------|----------------------------|----------------------------------|
| Dead Load              | <input type="radio"/> 1.20 | <input type="radio"/> 0.85 | <input checked="" type="radio"/> |
| Superimposed Dead Load | <input type="radio"/> 2.00 | <input type="radio"/> 0.80 | <input checked="" type="radio"/> |
| Soil Load              | <input type="radio"/> 1.50 | <input type="radio"/> 0.70 | <input checked="" type="radio"/> |
| Groundwater Load       | <input type="radio"/> 1.00 | <input type="radio"/> 1.00 | <input checked="" type="radio"/> |

RS : Reduce Safety  
 IS : Increase Safety

Fatigue Load Combination

Road Traffic Case MV

Load Case

Add  
Delete

OK Cancel

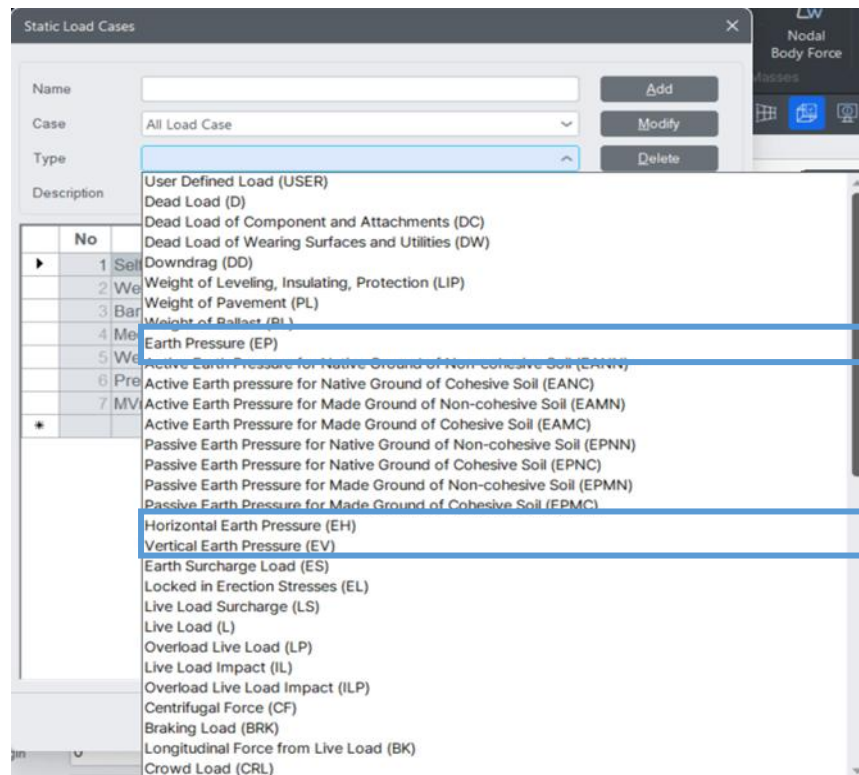
Same procedure for earth pressure load types

AS 5100.2 : 2017

|                                                 |                                                      |      |     |  |
|-------------------------------------------------|------------------------------------------------------|------|-----|--|
| Soil and groundwater load that reduces safety   | Controlled fill with regular testing of soil density | 1.25 | 1.0 |  |
|                                                 | All other fills and in situ soils                    | 1.5  | 1.2 |  |
|                                                 | Groundwater                                          | 1.0  | 1.0 |  |
| Soil and groundwater load that increases safety | Controlled fill with regular testing of soil density | 0.85 | 1.0 |  |
|                                                 | All other fills and in situ soils                    | 0.7  | 1.2 |  |
|                                                 | Groundwater                                          | 1.0  | 1.0 |  |

|                           |    |
|---------------------------|----|
| Earth Pressure            | EP |
| Horizontal Earth Pressure | EH |
| Vertical Earth Pressure   | EV |
| Ground Water Pressure     | WP |



The load combination of 'Pedestrian cyclist path and maintenance traffic loads' is generated when 'Pedestrian/Cyclist' option is selected as Bridge Type.

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|                                                                                                 |     |     |
|-------------------------------------------------------------------------------------------------|-----|-----|
| Centrifugal force from road traffic (HLP factors shall be determined by the relevant authority) | 1.8 | 1.0 |
| Braking force from road traffic (HLP factors shall be determined by the relevant authority)     | 1.8 | 1.0 |
| Pedestrian cyclist path and maintenance traffic loads                                           | 1.5 | 1.0 |

|                   |     |
|-------------------|-----|
| Centrifugal Force | CF  |
| Braking Load      | BRK |

Static Load Cases

Name:  Add

Case: All Load Case Modify

Type:  Delete

Description: User Defined Load (USER)

| No | Description                                                          |
|----|----------------------------------------------------------------------|
| 1  | Dead Load (D)                                                        |
| 2  | Dead Load of Component and Attachments (DC)                          |
| 3  | Dead Load of Wearing Surfaces and Utilities (DW)                     |
| 4  | Downdrag (DD)                                                        |
| 5  | Weight of Leveling, Insulating, Protection (LIP)                     |
| 6  | Weight of Pavement (PL)                                              |
| 7  | Weight of Ballast (BL)                                               |
| 8  | Earth Pressure (EP)                                                  |
| 9  | Active Earth Pressure for Native Ground of Non-cohesive Soil (EANN)  |
| 10 | Active Earth pressure for Native Ground of Cohesive Soil (EANC)      |
| 11 | Active Earth Pressure for Made Ground of Non-cohesive Soil (EAMN)    |
| 12 | Active Earth Pressure for Made Ground of Cohesive Soil (EAMC)        |
| 13 | Passive Earth Pressure for Native Ground of Non-cohesive Soil (EPNN) |
| 14 | Passive Earth Pressure for Native Ground of Cohesive Soil (EPNC)     |
| 15 | Passive Earth Pressure for Made Ground of Non-cohesive Soil (EPMN)   |
| 16 | Passive Earth Pressure for Made Ground of Cohesive Soil (EPMC)       |
| 17 | Horizontal Earth Pressure (EH)                                       |
| 18 | Vertical Earth Pressure (EV)                                         |
| 19 | Earth Surcharge Load (ES)                                            |
| 20 | Locked in Erection Stresses (EL)                                     |
| 21 | Live Load Surcharge (LS)                                             |
| 22 | Live Load (L)                                                        |
| 23 | Overload Live Load (LP)                                              |
| 24 | Live Load Impact (IL)                                                |
| 25 | Overload Live Load Impact (ILP)                                      |
| 26 | Centrifugal Force (CF)                                               |
| 27 | Braking Load (BRK)                                                   |
| 28 | Longitudinal Force from Live Load (BK)                               |
| 29 | Crowd Load (CRL)                                                     |

Automatic Generation of Load Combinations

Option: ☒ Add ☐ Replace

Code Selection: ☐ Steel ☒ Concrete ☐ SRC ☐ Steel Composite

Design Code: AS 5100.2:17

Manipulation of Construction Stage Load Case: ☐ ST Only ☐ CS Only ☒ ST+CS

ST : Static Load Case CS : Construction Stage

Bridge Type: Pedestrian/Cyclist

☐ Load Factors for Permanent Loads

| Type of Load           | Load Factor                           |                            |                       |
|------------------------|---------------------------------------|----------------------------|-----------------------|
|                        | R.S                                   | I.S                        | Both                  |
| Dead Load              | <input checked="" type="radio"/> 1.20 | <input type="radio"/> 0.85 | <input type="radio"/> |
| Superimposed Dead Load | <input checked="" type="radio"/> 2.00 | <input type="radio"/> 0.80 | <input type="radio"/> |
| Soil Load              | <input checked="" type="radio"/> 1.50 | <input type="radio"/> 0.70 | <input type="radio"/> |
| Groundwater Load       | <input checked="" type="radio"/> 1.00 | <input type="radio"/> 1.00 | <input type="radio"/> |

R.S : Reduce Safety  
I.S : Increase Safety

Fatigue Load Combination

Road Traffic Case: MV

Load Case:  Add

Delete

OK Cancel

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|                                                       |      |     |
|-------------------------------------------------------|------|-----|
| Collision load from road traffic                      | 1.0  | N/A |
| Loads on protection beams                             | 1.0  | N/A |
| Collision loads from rail traffic                     | 1.0  | N/A |
| Derailment load case A                                | 1.2  | N/A |
| Derailment load case B                                | 1.0  | N/A |
| Derailment load on kerbs                              | 1.0  | N/A |
| Road traffic barrier loads                            | 1.0  | N/A |
| Road traffic barrier connection loads                 | 1.05 | N/A |
| Road traffic barrier loads transmitted to bridge deck | 1.1  | N/A |
| Pedestrian and cyclist path barrier load              | 1.8  | 1.0 |

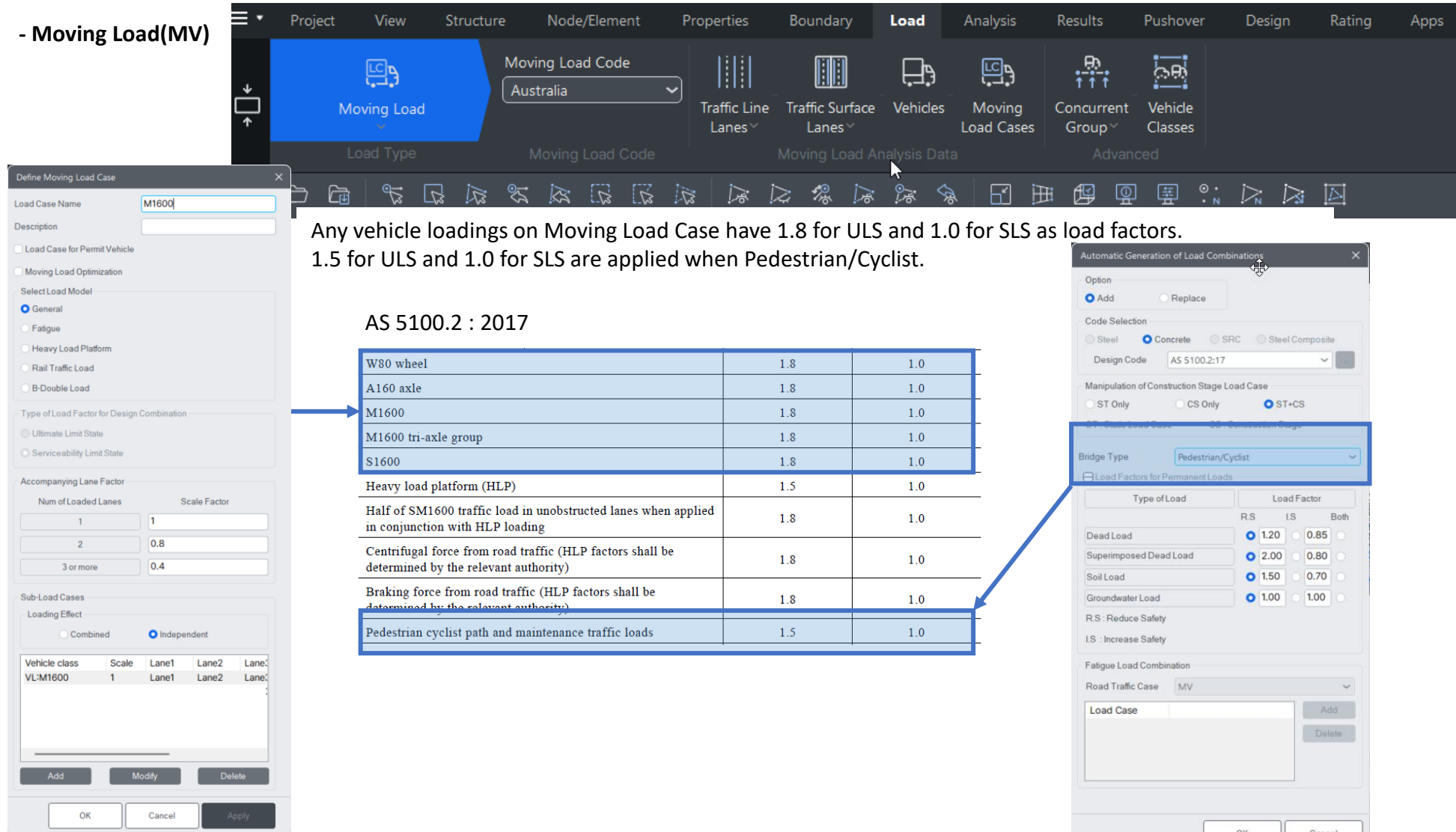
|                           |    |
|---------------------------|----|
| Collision Load            | CO |
| Vehicular Collision Force | CT |
| Vessel Collision Force    | CV |

| Loading                                             |                                                | Limit state         |                |
|-----------------------------------------------------|------------------------------------------------|---------------------|----------------|
|                                                     |                                                | Ultimate            | Serviceability |
| Earth pressure from traffic loads                   |                                                | Refer to AS 5100.3  |                |
| Earthquake forces (for appropriate ARI)             |                                                | 1.0                 | 1.0            |
| Water flow (for appropriate ARI)                    |                                                | 1.3                 | 1.0            |
| Wind loads (for appropriate ARI)                    |                                                | 1.0                 | 1.0            |
| Thermal                                             |                                                | 1.25                | 1.0            |
| Shrinkage and creep                                 |                                                | 1.2                 | 1.0            |
| Prestress secondary effects                         |                                                | 1.0                 | 1.0            |
| Prestress effects at transfer                       |                                                | 1.15                | 1.0            |
| Differential settlement effects                     |                                                | 1.5                 | 1.0            |
| Mining subsidence                                   | Accurate records and information are available | 1.5                 | 1.0            |
|                                                     | Other sites                                    | 2.0                 | 1.0            |
| Forces from bearings                                |                                                | 1.3                 | 1.0            |
| Loading                                             |                                                | Fatigue limit state |                |
| A160 axle (determined from 70% of the load)         |                                                | 1.0                 |                |
| M1600 (determined from 70% of the load without UDL) |                                                | 1.0                 |                |
| 300LA rail traffic                                  |                                                | 1.0                 |                |

|                        |     |
|------------------------|-----|
| Earthquake             | E   |
| Fluid Pressure         | FP  |
| Buoyancy               | B   |
| Wind Load on Structure | W   |
| Temperature            | T   |
| Temperature Gradient   | TPG |
| Creep                  | CR  |
| Shrinkage              | SH  |
| Prestress              | PS  |
| Settlement             | STL |

Moving Load, Settlement and Construction Stage(Creep/Shrinkage/Tendon/Dead) Load Types on Load menu generate load cases on the automatic load combinations.

### - Moving Load(MV)



Any vehicle loadings on Moving Load Case have 1.8 for ULS and 1.0 for SLS as load factors.  
1.5 for ULS and 1.0 for SLS are applied when Pedestrian/Cyclist.

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| Load Type                                                                                       | ULS | SLS |
|-------------------------------------------------------------------------------------------------|-----|-----|
| W80 wheel                                                                                       | 1.8 | 1.0 |
| A160 axle                                                                                       | 1.8 | 1.0 |
| M1600                                                                                           | 1.8 | 1.0 |
| M1600 tri-axle group                                                                            | 1.8 | 1.0 |
| S1600                                                                                           | 1.8 | 1.0 |
| Heavy load platform (HLP)                                                                       | 1.5 | 1.0 |
| Half of SM1600 traffic load in unobstructed lanes when applied in conjunction with HLP loading  | 1.8 | 1.0 |
| Centrifugal force from road traffic (HLP factors shall be determined by the relevant authority) | 1.8 | 1.0 |
| Braking force from road traffic (HLP factors shall be determined by the relevant authority)     | 1.8 | 1.0 |
| Pedestrian cyclist path and maintenance traffic loads                                           | 1.5 | 1.0 |

Automatic Generation of Load Combinations

Option: ☒ Add ☐ Replace

Code Selection: ☐ Steel ☒ Concrete ☐ SRC ☐ Steel Composite

Design Code: AS 5100.2:17

Manipulation of Construction Stage Load Case: ☐ ST Only ☐ CS Only ☒ ST+CS

Bridge Type: Pedestrian/Cyclist

Load Factors for Permanent Loads

| Type of Load           | RS                                    | IS                         | Both                  |
|------------------------|---------------------------------------|----------------------------|-----------------------|
| Dead Load              | <input checked="" type="radio"/> 1.20 | <input type="radio"/> 0.85 | <input type="radio"/> |
| Superimposed Dead Load | <input checked="" type="radio"/> 2.00 | <input type="radio"/> 0.80 | <input type="radio"/> |
| Soil Load              | <input checked="" type="radio"/> 1.50 | <input type="radio"/> 0.70 | <input type="radio"/> |
| Groundwater Load       | <input checked="" type="radio"/> 1.00 | <input type="radio"/> 1.00 | <input type="radio"/> |

RS: Reduce Safety  
IS: Increase Safety

Fatigue Load Combination

Road Traffic Case: MV

Load Case:

\*Automatic load combination considers 'AS5100.2:2017 23.4 SLS load combinations' for SLS load combinations

## Appendix. Load Combinations

Moving Load, Settlement and Construction Stage(Creep/Shrinkage/Tendon/Dead) Load Types on Load menu generate load cases on the automatic load combinations.

### - Moving Load(MV)

The screenshot illustrates the workflow in MIDASIT for generating a Fatigue load combination. It consists of three main panels:

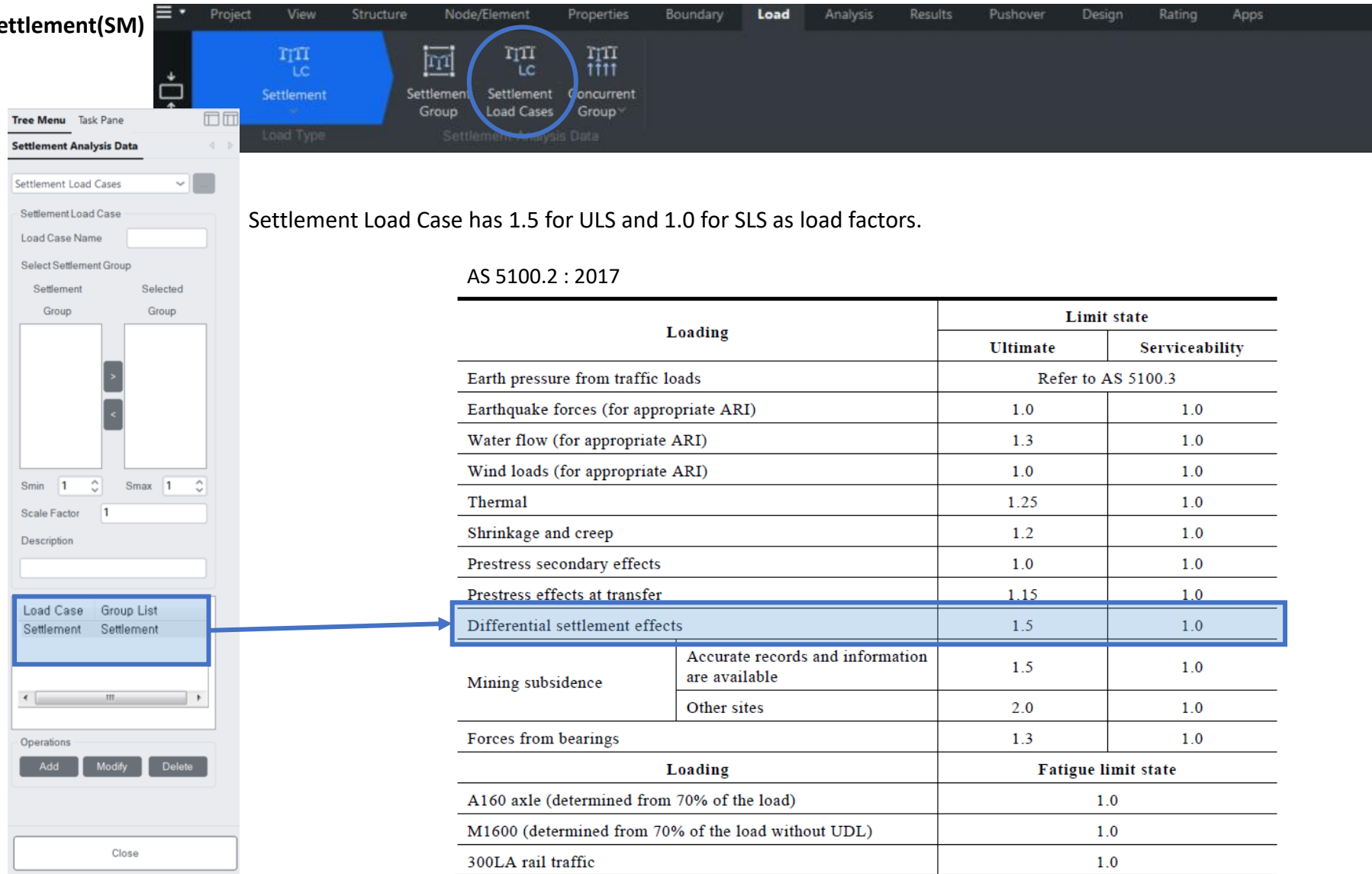
- Top Panel (Main Menu):** Shows the 'Load' menu with options like 'Moving Load Code' (set to Australia), 'Traffic Line Lanes', 'Traffic Surface Lanes', 'Vehicles', 'Moving Load Cases', 'Concurrent Group', and 'Vehicle Classes'.
- Left Panel (Define Moving Load Case):** A dialog box for defining a 'Fatigue' load case. It includes options for 'Load Case Name', 'Description', 'Load Case for Permit Vehicle', 'Moving Load Optimization', 'Select Load Model' (General, Heavy Load Platform, Rail Traffic Load, B-Double Load), 'Type of Load Factor for Design Combination' (Ultimate Limit State, Serviceability Limit State), 'Accompanying Lane Factor' (Num of Loaded Lanes, Scale Factor), 'Sub-Load Cases' (Loading Effect: Combined, Independent), and 'Vehicle class' (VC:M1600 witho...). The 'Fatigue' option is selected under 'Select Load Model'.
- Right Panel (Load Combinations):** A dialog box showing a list of generated load combinations. The 'Fatigue(MV)' case is highlighted, showing a factor of 1.0000. The list includes various load cases (e.g., cLCB1, cLCB2, etc.) and their corresponding factors.

Arrows indicate the flow of information: from the 'Define Moving Load Case' dialog to the 'Load Combinations' dialog, and from the 'Load Combinations' dialog to the 'Fatigue Load Combination' section in the 'Define Moving Load Case' dialog.

**Fatigue load combination is generated when fatigue load case is assigned.**

Moving Load, Settlement and Construction Stage(Creep/Shrinkage/Tendon/Dead) Load Types on Load menu generate load cases on the automatic load combinations.

## - Settlement(SM)



Settlement Load Case has 1.5 for ULS and 1.0 for SLS as load factors.

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| Loading                                             | Limit state                                    |                     |     |
|-----------------------------------------------------|------------------------------------------------|---------------------|-----|
|                                                     | Ultimate                                       | Serviceability      |     |
| Earth pressure from traffic loads                   | Refer to AS 5100.3                             |                     |     |
| Earthquake forces (for appropriate ARI)             | 1.0                                            | 1.0                 |     |
| Water flow (for appropriate ARI)                    | 1.3                                            | 1.0                 |     |
| Wind loads (for appropriate ARI)                    | 1.0                                            | 1.0                 |     |
| Thermal                                             | 1.25                                           | 1.0                 |     |
| Shrinkage and creep                                 | 1.2                                            | 1.0                 |     |
| Prestress secondary effects                         | 1.0                                            | 1.0                 |     |
| Prestress effects at transfer                       | 1.15                                           | 1.0                 |     |
| Differential settlement effects                     | 1.5                                            | 1.0                 |     |
| Mining subsidence                                   | Accurate records and information are available | 1.5                 | 1.0 |
|                                                     | Other sites                                    | 2.0                 | 1.0 |
| Forces from bearings                                | 1.3                                            | 1.0                 |     |
| Loading                                             |                                                | Fatigue limit state |     |
| A160 axle (determined from 70% of the load)         |                                                | 1.0                 |     |
| M1600 (determined from 70% of the load without UDL) |                                                | 1.0                 |     |
| 300LA rail traffic                                  |                                                | 1.0                 |     |

Moving Load, Settlement and Construction Stage(Creep/Shrinkage/Tendon/Dead) Load Types on Load menu generate load cases on the automatic load combinations.

## - Construction Stage : Dead Load(CS)

Dead Load(CS) load case appears on Load Combination dialog and includes dead loads such as Self Weight which are activated on construction stage. It has same load factors with D and DC load types.

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**TABLE D1**  
**LOAD FACTORS**

| Loading                                      |                                   | Limit state |                |
|----------------------------------------------|-----------------------------------|-------------|----------------|
|                                              |                                   | Ultimate    | Serviceability |
| Dead load of structure that reduces safety   | Steel                             | 1.10        | 1.0            |
|                                              | Concrete                          | 1.20        | 1.0            |
|                                              | Concrete at transfer of prestress | 1.15        | N/A            |
|                                              | Timber                            | 1.25        | 1.0            |
| Dead load of structure that increases safety | Steel                             | 0.90        | 1.0            |
|                                              | Concrete                          | 0.85        | 1.0            |
|                                              | Concrete at transfer of prestress | 0.90        | N/A            |
|                                              | Timber                            | 0.80        | 1.0            |
| Superimposed dead load that reduces safety   | Permanent                         | 2.0         | 1.3            |
|                                              | Removable                         | 2.0         | 1.3            |
|                                              | Special case permanent            | 1.4         | 1.0            |
|                                              | Special case removable            | 1.4         | 1.0            |
| Superimposed dead load that increases safety | Permanent                         | 0.7         | 1.3            |
|                                              | Removable                         | 0.0         | 1.3            |
|                                              | Special case permanent            | 0.8         | 1.0            |
|                                              | Special case removable            | 0.0         | 1.0            |

(continued)

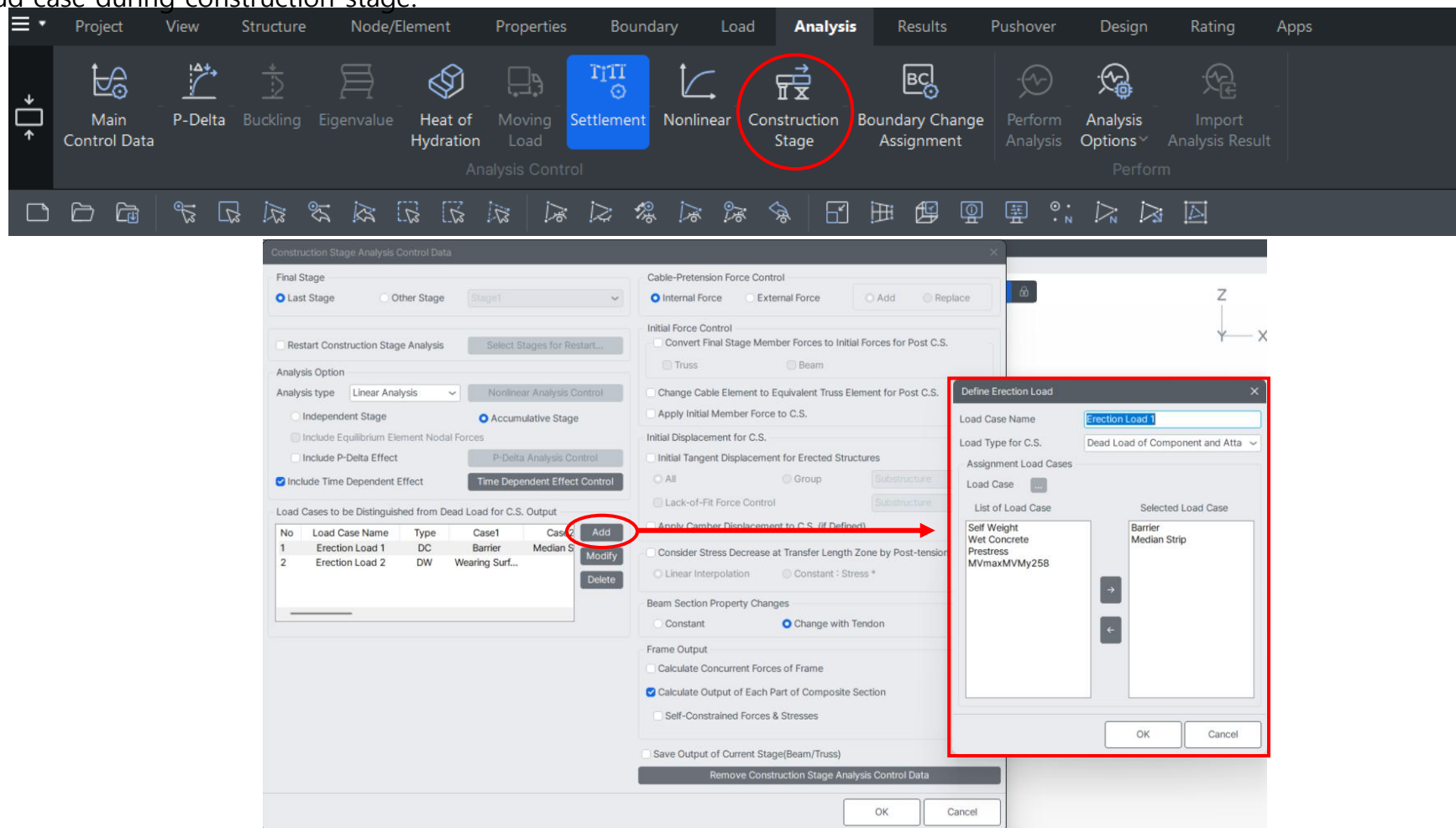
| Static Load Case Type from midas Civil      |    |
|---------------------------------------------|----|
| Dead Load                                   | D  |
| Dead Load of Component and Attachments      | DC |
| Dead Load of Wearing Surfaces and Utilities | DW |

Load cases should have Construction Stage Load (CS) type on Static Load Cases dialog if those are activated on a construction stage. Otherwise, automatic load combination generates both static load case(ST) and Dead Load(CS).

Moving Load, Settlement and Construction Stage(Creep/Shrinkage/Tendon/Dead) Load Types on Load menu generate load cases on the automatic load combinations.

## - Construction Stage : Erection Load(CS)

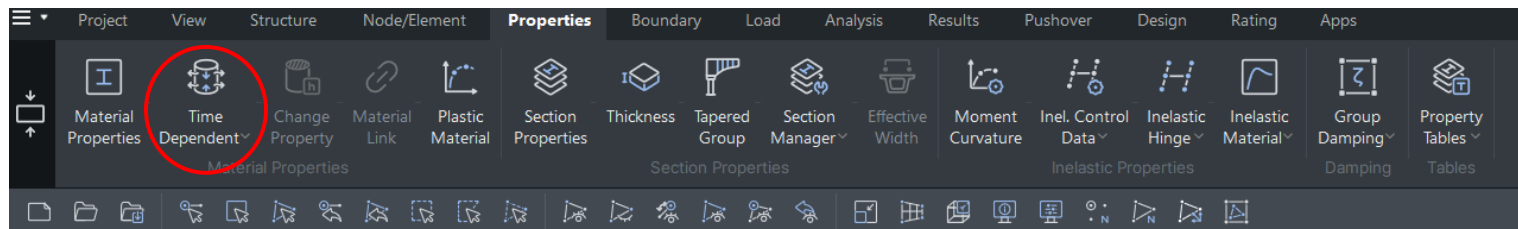
Erection Load(CS) load case appears on Load Combination dialog and includes load cases which are defined on Construction Stage Analysis Control Data to set different load factors from Dead Load(CS) load case. It is necessary to be applied to DW load case during construction stage.



Moving Load, Settlement and Construction Stage(Creep/Shrinkage/Tendon/Dead) Load Types on Load menu generate load cases on the automatic load combinations.

**- Construction Stage : Creep Primary(CS) / Creep Secondary(CS) / Shrinkage Primary(CS) / Shrinkage Secondary(CS)**

Creep/Shrinkage function with construction stage analysis generates primary and secondary load cases for both creep and shrinkage. Automatic load combination includes secondary load cases.



**Add/Modify Time Dependent Material (Creep / Shrinkage)**

Name:  Code:

AUSTRALIA

Compressive strength of concrete at the age of 28 days:  kN/m<sup>2</sup>

Exposure Environment:  
☒ Arid ☐ Interior ☐ Temperate Inland ☐ Tropical or Near Coastal

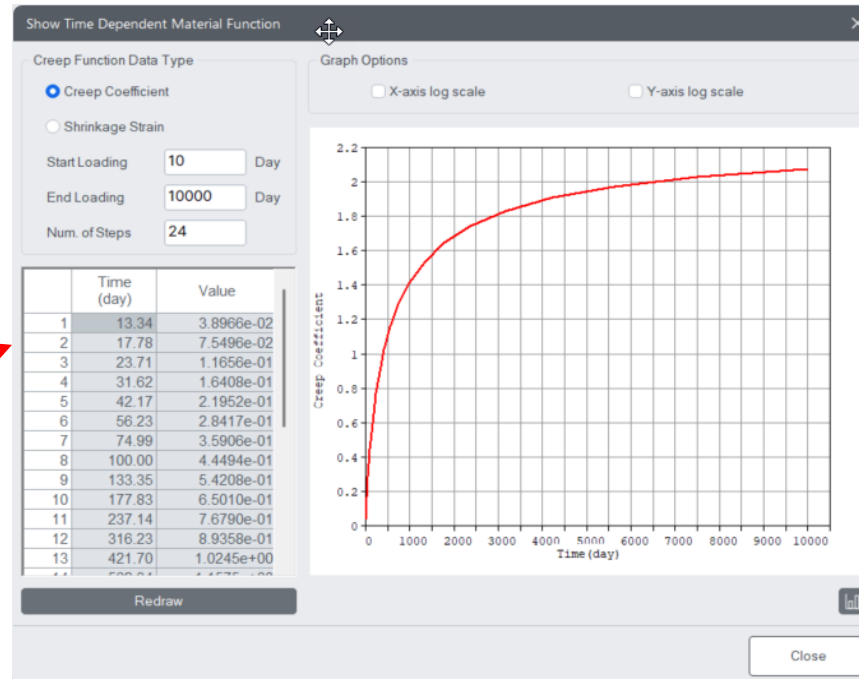
Hypothetical Thickness:  m

$h = 2 A_g / u$  ( $A_g$ : Section Area,  $u$ : Perimeter in contact with atmosphere)

Drying Basic Shrinkage Strain ( $10^{-6}$ ):  
☒ 800.0 (Sydney, Brisbane) ☐ 900.0 (Melbourne) ☐ 1000.0 (Elsewhere)  
☐ User Define

Age of concrete at the beginning of shrinkage:  day

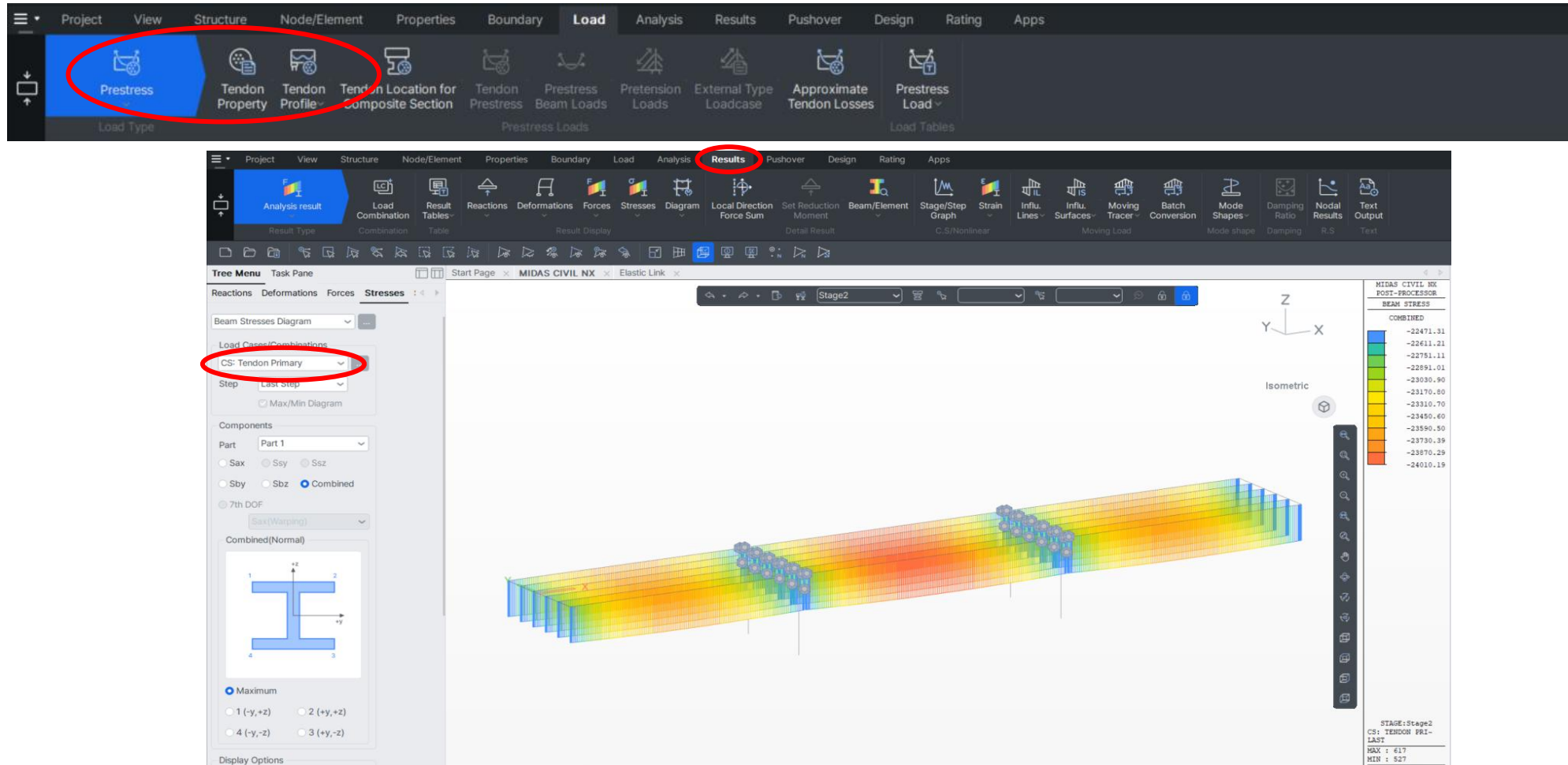
**Show Result...** OK Cancel Apply



Moving Load, Settlement and Construction Stage(Creep/Shrinkage/Tendon/Dead) Load Types on Load menu generate load cases on the automatic load combinations.

## - Construction Stage : Tendon Primary(CS) / Tendon Secondary(CS)

Prestress load function with construction stage analysis generates primary and secondary load cases and both load cases are included in the automatic load combination. Also, each load cases are shown under the results separately.



## Appendix. Load Combinations

The following Load Cases are automatically generated when construction stage analysis is completed.

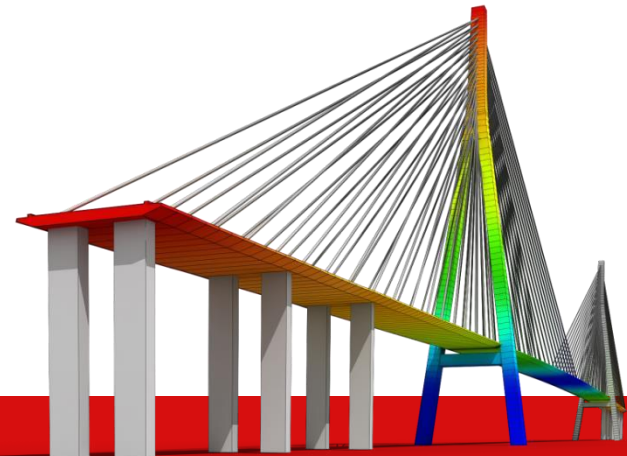
| Load Case                  | Results       | Description                                                                                                                   |
|----------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------|
| 1. CS: Dead Load           |               | Results due to all loadings excluding Erection Load and the effects of Creep, Shrinkage and Tendon Prestress                  |
| 2. CS: Erection Load       |               | Results due to dead loads, which are separated from CS: Dead Load, defined in Construction Stage Analysis Control Data dialog |
| 3. CS : Tendon Primary     | Reaction      |                                                                                                                               |
|                            | Deformation   | Deformation resulting from tendon prestress                                                                                   |
|                            | Force         | Member forces resulting from tendon prestress                                                                                 |
| 4. CS: Tendon Secondary    | Reaction      | Reactions caused by Tendon Prestress in an indeterminate structure.                                                           |
|                            | Force         | Member forces caused by Tendon Prestress in an indeterminate structure.                                                       |
| 5. CS: Creep Primary       | Reaction      |                                                                                                                               |
|                            | Deformation   | Deformation due to imaginary forces required to cause creep stain                                                             |
|                            | Force         | Imaginary forces required to cause creep stain                                                                                |
| 6. CS: Creep Secondary     | Reaction      | Reactions caused by creep in an indeterminate structure                                                                       |
|                            | Force         | Member forces caused by creep in an indeterminate structure                                                                   |
| 7. CS: Shrinkage Primary   | Reaction      |                                                                                                                               |
|                            | Deformation   | Deformation due to imaginary forces required to cause shrinkage stain                                                         |
|                            | Force         | Imaginary forces required to cause shrinkage stain                                                                            |
| 8. CS: Shrinkage Secondary | Reaction      | Reactions caused by shrinkage in an indeterminate structure                                                                   |
|                            | Force         | Member forces caused by shrinkage in an indeterminate structure                                                               |
| CS: Summation              | Reaction      | 1+2+4+6+8                                                                                                                     |
|                            | Deformation   | 1+2+3+5+7                                                                                                                     |
|                            | Force(Stress) | 1+2(+3)+4+6+8                                                                                                                 |

### - Tendon Primary (CS) vs. Secondary (CS)

Tendon Primary represents member forces caused by Tendon Prestress forces. Tendon Secondary represents member forces resulting from Tendon Prestress forces acting in an indeterminate structure. To check analysis results, Primary and Secondary can be regarded as internal forces and external forces respectively. For design, however, the program internally recalculates member forces due to Primary considering the translation of neutral axis so as to use them as internal forces, and member forces due to Secondary are used as external forces.

Midas Tech Support:

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