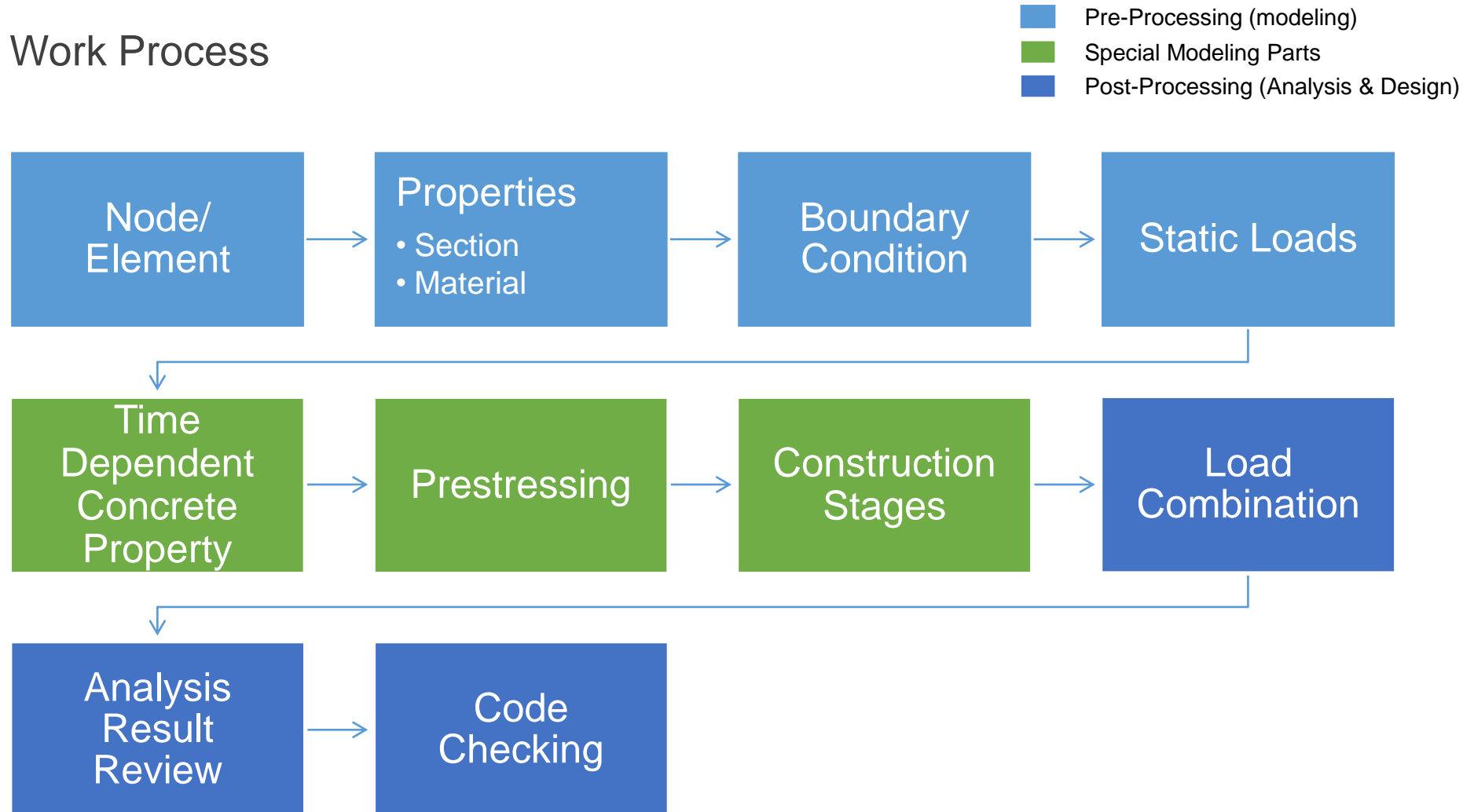




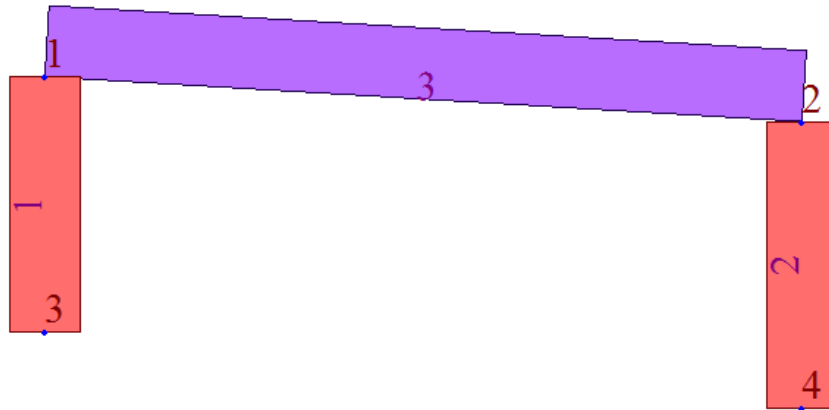
MIDAS Training Post-Tensioned Bent Cap

Overview

Work Process



1 Node / Element



| Nodes | | | | |
|-------|------|----------|-----------|------------|
| | Node | X(ft) | Y(ft) | Z(ft) |
| | 1 | 0.000000 | 80.000000 | 2.000000 |
| | 2 | 0.000000 | 0.000000 | -2.750000 |
| | 3 | 0.000000 | 80.000000 | -25.000000 |
| | 4 | 0.000000 | 0.000000 | -33.000000 |

2 Properties – Section & Material

Material

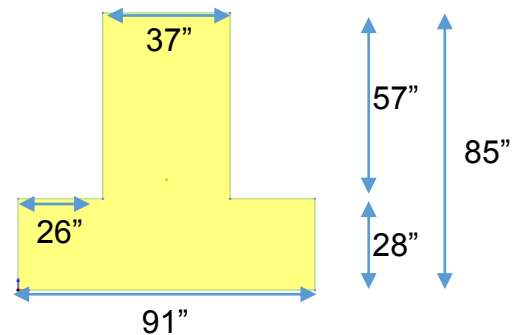
- Bent Cap & Pier: ASTM(RC) Grade C6000
- Tendons
 - Type: Steel
 - Modulus of Elasticity: 4.0349e6 ksf
 - Poisson's Ratio: 0.3
 - Thermal Coefficient: 6.5e-6 1/F
 - Weight Density: 0.4908 kcf

2 Properties – Section & Material

Sections

- Bent Cap
 - Solid Rectangle
 - Height 7.5 ft by Width 6ft
 - Create this section using Section Property Calculator

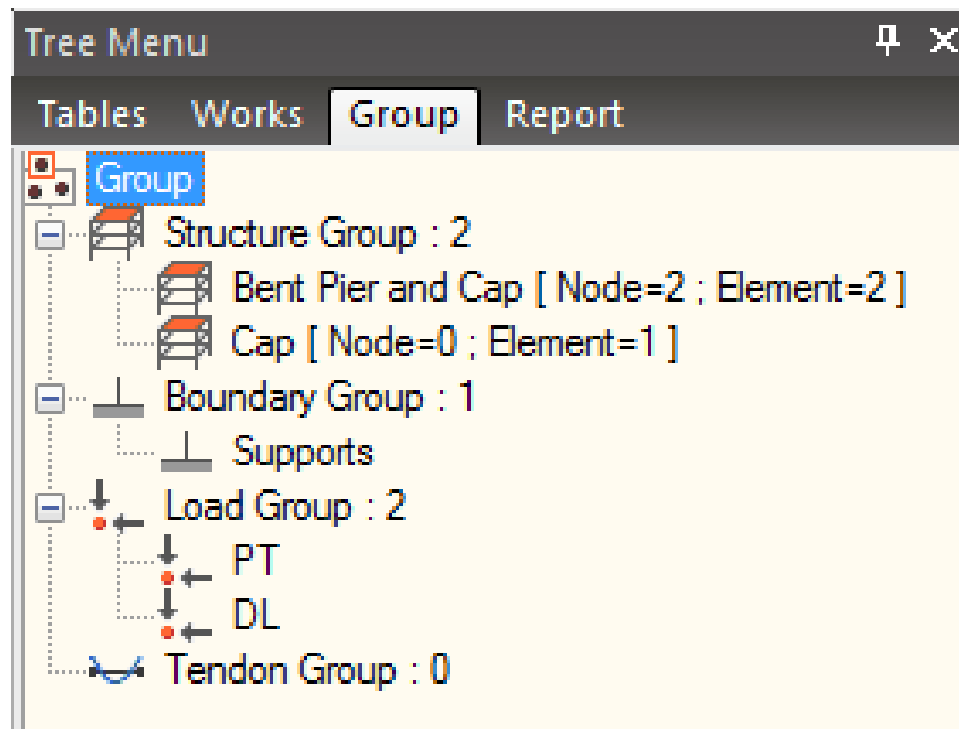
- Inverted T



- Pier
 - Solid Rectangle
 - Height 7.5ft by Width 7.5ft

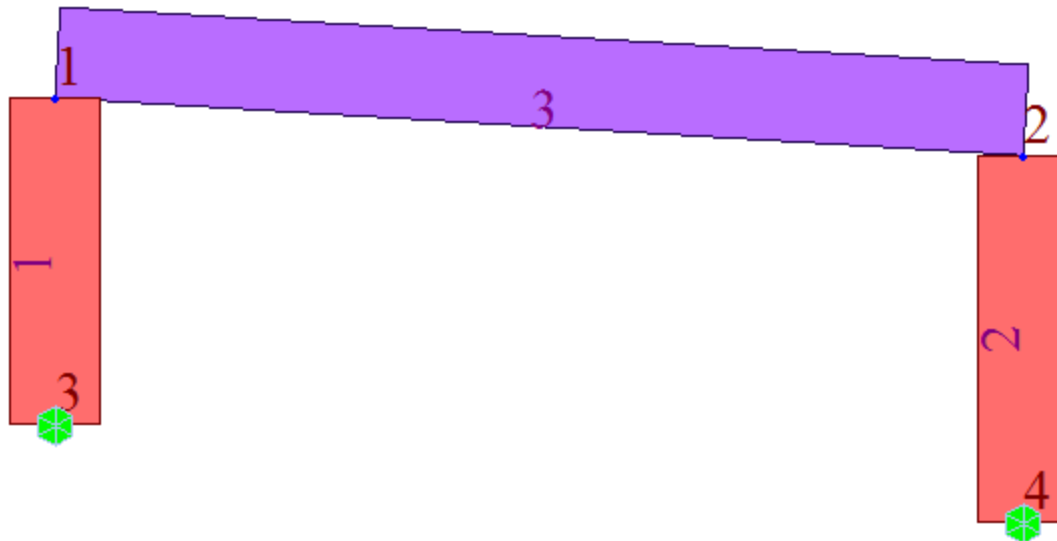
* Group Creation (related to Construction Sequencing)

Create the following groups



3 Boundary Condition

Fix Support at the end of the columns



4 Static Loads

Create load cases

- Name: DL / Type: Dead Load (D)
- Name: PT / Type: Prestress (PS)

Assign Self Weight

- Go to Static Loads > Self Weight
 - Load Case: DL
 - Assign -1 Self Weight Factor in Z direction

5 Time Dependent Concrete Property

Add Creep/Shrinkage Function

- Code: CEB-FIP 1990
- Characteristic compressive strength: 6 ksi
- Relative Humidity: 70%
- Notational Size of member: 19 inch
- Type of cement: Normal
- Age of Concrete at the beginning of shrinkage: 3 day

5 Time Dependent Concrete Property

Add Compressive Strength

- Code: CEB-FIP 1990
- Mean compressive strength: 6 ksi
- Cement Type: N,R: 0.25

Then, link the time dependent properties with C6000 material

6 Prestressing

Add Tendon Property

- Code: CEB-FIP 1990

The screenshot shows the 'Add/Modify Tendon Property' dialog box with the following fields and values:

| Field | Value | Unit |
|---------------------------------|---|-----------|
| Tendon Name | 1206 | |
| Tendon Type | Internal(Post-Tension) | |
| Material | 2 | 2: CABLES |
| Total Tendon Area | 0.01809583333 | ft² |
| Duct Diameter | 0.27559 | ft |
| Relaxation Coefficient | <input checked="" type="checkbox"/> Relaxation Coefficient | |
| Name | | |
| Ultimate Strength | 38710.2 | kips/ft² |
| Yield Strength | 34839.2 | kips/ft² |
| Curvature Friction Factor | 0.3 | |
| Wobble Friction Factor | 0.001524 | 1/ft |
| External Cable Moment Magnifier | 0 | kips/ft² |
| Anchorage Slip(Draw in) | Begin : 0.0196850393700 End : 0.0196850393700 | ft |
| Bond Type | <input checked="" type="radio"/> Bonded <input type="radio"/> Unbonded | |

Buttons: OK, Cancel, Apply

6 Prestressing

Add Tendon Profile

Use Tendon Profile.xlsx provided

Add/Modify Tendon Profile

Tendon Name : A1 Group : Default

Tendon Property : 1206

Assigned Elements : 3

Input Type : ☒ 2-D ☐ 3-D

Curve Type : ☒ Spline ☐ Round

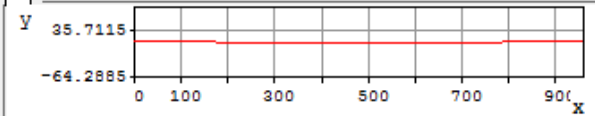
Straight Length of Tendon : Begin : 0 in End : 0 in

☐ Typical Tendon No. of Tendons : 1

Transfer Length : User defined Length Begin : 0 in End : 0 in

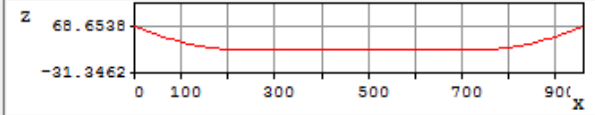
Profile Reference Axis : ☐ Straight ☐ Curve ☒ Element

Y



| | x(in) | y(in) | fix | Rz(deg) |
|---|----------|---------|-------------------------------------|---------|
| 1 | 0.0000 | 10.5000 | <input checked="" type="checkbox"/> | 0.00 |
| 2 | 111.0000 | 10.5000 | <input checked="" type="checkbox"/> | 0.00 |
| 3 | 207.0000 | 9.0000 | <input type="checkbox"/> | 0.00 |
| 4 | 753.0000 | 9.0000 | <input type="checkbox"/> | 0.00 |

Z



| | x(in) | z(in) | fix | Ry(deg) | BOT |
|---|----------|---------|-------------------------------------|---------|--------------------------|
| 1 | 0.0000 | 66.0000 | <input type="checkbox"/> | 0.00 | <input type="checkbox"/> |
| 2 | 207.0000 | 19.0000 | <input checked="" type="checkbox"/> | 0.00 | <input type="checkbox"/> |
| 3 | 753.0000 | 19.0000 | <input checked="" type="checkbox"/> | 0.00 | <input type="checkbox"/> |
| 4 | 960.0000 | 66.0000 | <input type="checkbox"/> | 0.00 | <input type="checkbox"/> |

Point of Sym.: ☐ First ☒ Last Make Symmetric Tendon

Profile Insertion Point : ☒ End-I ☐ End-J of Elem. 3

x Axis Direction : ☒ I -> J ☐ J -> I of Elem. 3

x Axis Rot. Angle : 0 [deg] ☒ Projection

Offset y : 0 in z : 0 in

OK Cancel Apply

6 Prestressing

Define Tendon Prestress Loads

at Load > Temp./Prestress > Prestress Loads > Tendon Prestress

| Tendon Prestress Loads | | | | | | | | | | |
|------------------------|--------|-----------|--------|---------|---|---------------------------------------|-----------------------|---------------------|----------|------------|
| | Tendon | Load Case | Type | Jacking | Stress Begin (kips/in ²) | Stress End (kips/in ²) | Force Begin (kips) | Force End (kips) | Grouting | Load Group |
| | A1 | PT | Stress | Begin | 211.50 | 211.50 | 0.00 | 0.00 | 0 | PT |
| | A2 | PT | Stress | Begin | 211.50 | 211.50 | 0.00 | 0.00 | 0 | PT |
| | A3 | PT | Stress | Begin | 211.50 | 211.50 | 0.00 | 0.00 | 0 | PT |
| | B1 | PT | Stress | Begin | 211.50 | 211.50 | 0.00 | 0.00 | 0 | PT |
| | B2 | PT | Stress | Begin | 211.50 | 211.50 | 0.00 | 0.00 | 0 | PT |
| | B3 | PT | Stress | Begin | 211.50 | 211.50 | 0.00 | 0.00 | 0 | PT |
| * | | | | | | | | | | |

7 Construction Stages

Load > Construction Stage > Define CS

| Stage | Duration | Purpose | Structure | Boundary | Load |
|-------|----------|------------------------------|-------------------------------|----------|------|
| 1 | 7 | Pier Erected | Bent Pier and Cap (Age: 7) | Support | DL |
| 2 | 7 | Cap Erected | Cap (Age: 7) | - | - |
| 3 | 1 | Prestresssed | - | - | PT |
| 4 | 10,000 | Long-Term Creep/Shrinkage | - | - | - |

7 Construction Stages

Load > Construction Stage > Define CS

| Stage | Duration | Purpose | Structure | Boundary | Load |
|-------|----------|--------------|-------------------------------|----------|------|
| 1 | 7 | Pier Erected | Bent Pier and Cap (Age: 7) | Support | DL |

Compose Construction Stage

Stage :
 Name :
 Duration : day(s)

Save Result
☒ Stage ☐ Additional Steps

Current Stage Information...

Additional Steps
 Day :
 (Example: 1, 3, 7, 14)

Auto Generation
 Step Number :

| Step | Day |
|------|-----|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Element | Boundary | Load

Group List

Cap

Activation
 Age : day(s)
 Group List

| Name | Age |
|------------------|-----|
| Bent Pier and... | 7 |

Deactivation
 Element Force
 Redistribution : %
 Group List

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

7 Construction Stages

Load > Construction Stage > Define CS

| Stage | Duration | Purpose | Structure | Boundary | Load |
|-------|----------|--------------|-------------------------------|----------|------|
| 1 | 7 | Pier Erected | Bent Pier and Cap (Age: 7) | Support | DL |

Compose Construction Stage

Stage :
 Name :
 Duration : day(s)

Save Result
☒ Stage ☐ Additional Steps

Current Stage Information...

Additional Steps
 Day :
 (Example: 1, 3, 7, 14)

Auto Generation
 Step Number :

| Step | Day |
|------|-----|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Element | Boundary | Load

Group List

Cap

Activation
 Age : day(s)
 Group List

| Name | Age |
|------------------|-----|
| Bent Pier and... | 7 |

Deactivation
 Element Force
 Redistribution : %
 Group List

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

8 Load Combination

9 Analysis Result Review

10 Design

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