2016 MIDAS Complex Bridge Test Drive Event

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May.03	**Segmental Bridge Analysis & Design** - Modeling through Wizards - Generation of numerous tendon profiles / Tapered Section / Construction Stage Sequence - Precise Analysis(Time dependent Material/Tendon Loss)
May.04	**High Speed Rail Road** - Rail Track Analysis Model Wizard 1. Automatic Modeling for a simplified separate analysis 2. Automatic Modeling for a stage analysis 3. Automatic Modeling for a moving load analysis
May.09	**Steel Composite Bridge Analysis & Design** - Different Modeling Methods - Modifying a model from Wizard - Analysis / Design
May.11	**Cable Stayed Bridge Analysis** - Modeling through Wizard/Modification - Auto-adjusting Cable Pretension forces - Construction Stages
May.12	**Suspension Bridge Analysis** - Modeling through Wizard/Modification - Auto calculation of tensions in main Cables and Coordinates - Steel column design of irregular sections

About MIDAS

Company Size

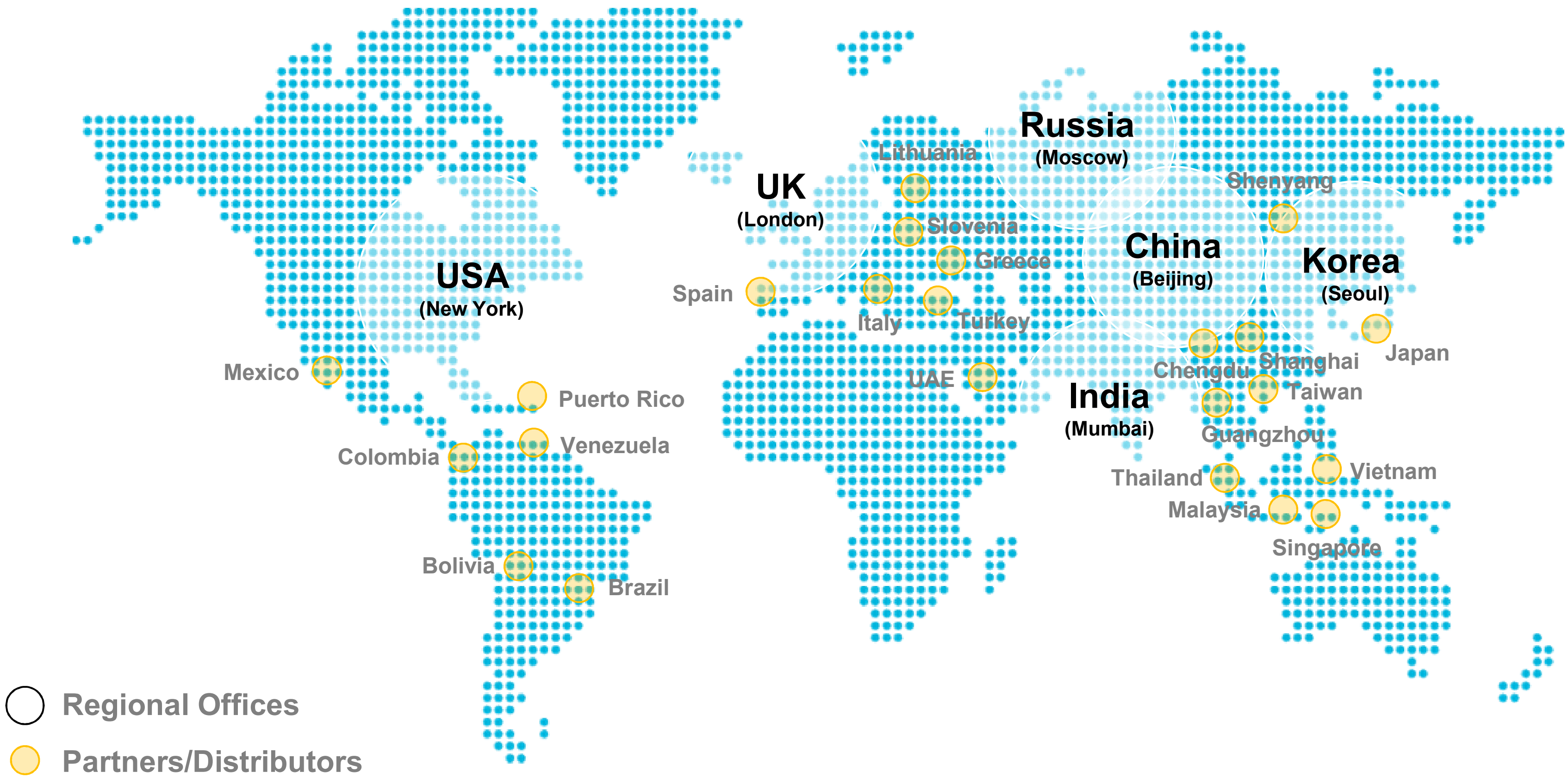
540

Engineers

Established

1989

World wide existence



8
Branch Offices

100,000
Number of Licenses

"Biggest CAE Software Developer"in Civil Engineering

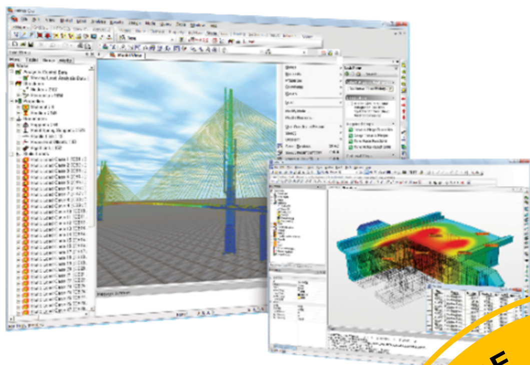
Bridge

midas Civil

Integrated Solution System for Bridge and Civil Structures

midas FEA

Advanced Nonlinear and Detailed Analysis System



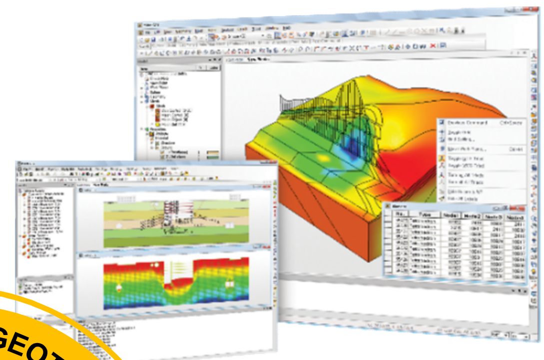
Geotechnical

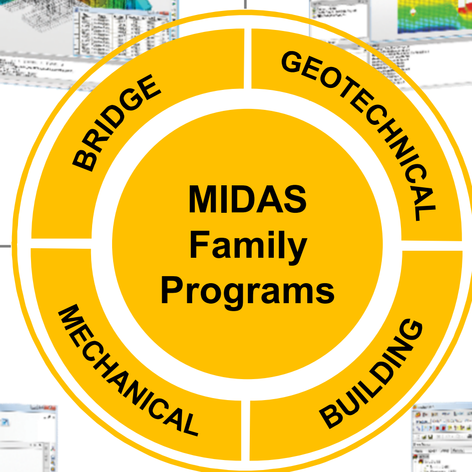
GTS NX

GeoTechnical analysis System

SoilWorks

Geotechnical Solutions for practical Design





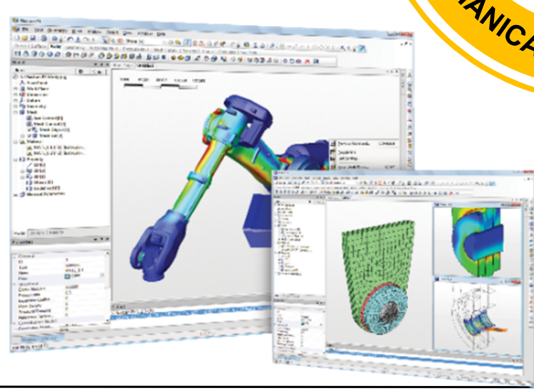
Mechanical

midas NFX

Total Solutions for Mechanical Engineering in structural Mechanics and CFD

midas FX+

General Pre & Post Processor for Finite Element Analysis



Building

midas Gen

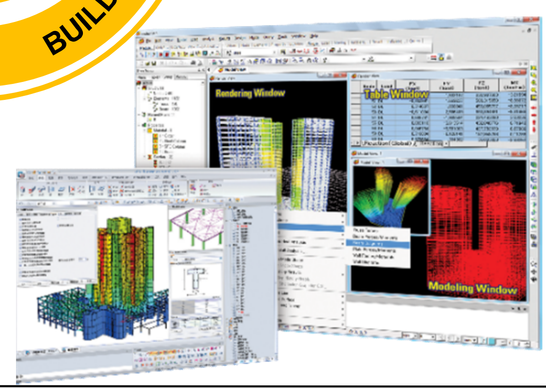
Integrated System for building and General Structures

midas DShop

Auto-Drawing Module and generate Structural drawing and Bill of Materials

midas Design+

Structural engineer's tools



USERS Across North America (partial list)

Oregon Department of Transportation
State of Florida Department of Transportation
Caltrans
VTrans Working to Get You There
British Columbia
Department of Transportation State of Hawaii

Ontario
Yukon
PENNDOT
City of Milwaukee Emerging Business Enterprise
AECOM
NRC·CNRC Canada

ARUP
BURGESS & NIPLE
HANSON
LOCHNER ADVANCE YOUR VISION
WHPacific
SNC·LAVALIN

Delcan
HNTB
McINTOSH PERRY
Associated Engineering
RK&K
Burns & McDonnell SINCE 1898

Mead & Hunt
MMM GROUP
Tutor Perini Corporation
ALLNORTH CONSULTANTS LIMITED
CHA
HDR

GARVER
Klohn Crippen Berger
EAC
TETRA TECH
OBEC CONSULTING ENGINEERS
WILSON & COMPANY ENGINEERS & ARCHITECTS

COEG
Dewberry
URS
CH2MHILL
PARSONS BRINCKERHOFF
Baker

Caltrans

Connecticut Department of Transportation

Florida Department of Transportation

Department of Transportation State of Hawaii

Illinois Department of Transportation

DOTD Louisiana Department of Transportation & Development

MoDOT

Montana MDT Department of Transportation

Department of Transportation The State of New Jersey

Minnesota Department of Transportation

Oregon Department of Transportation

Iowa Department of Transportation

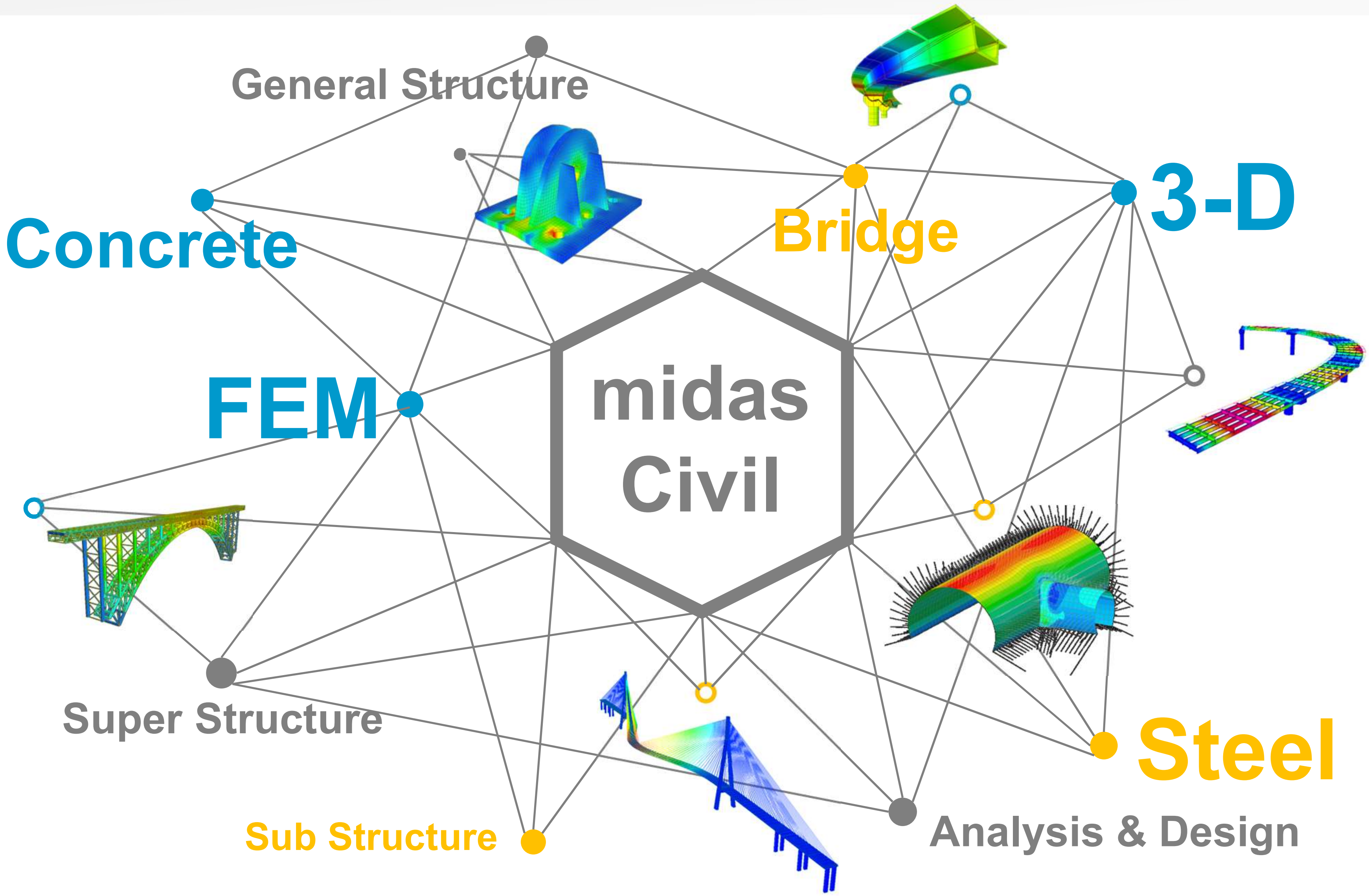
Nevada DOT

State of Ohio Department of Transportation

Oklahoma Department of Transportation

VTrans Working to Get You There Vermont Agency of Transportation

midas Civil Bridge Engineering Software



What kind of bridge type can midas Civil handle?

Conventional Bridge


Culvert


Frame Bridge


Slab Bridge


Precast (Spliced) Girder Bridge


Integral Bridge


Steel Plate (Flare) Girder Bridge


Steel Box Girder Bridge

Staged Segmental Bridge


Balanced Cantilever Method Bridge


Incremental Launching Method Bridge


Movable Scaffolding Method Bridge


Precast Segmental Method Bridge


Fill Staging Method Bridge

Cable-stayed Bridge & Suspension Bridge

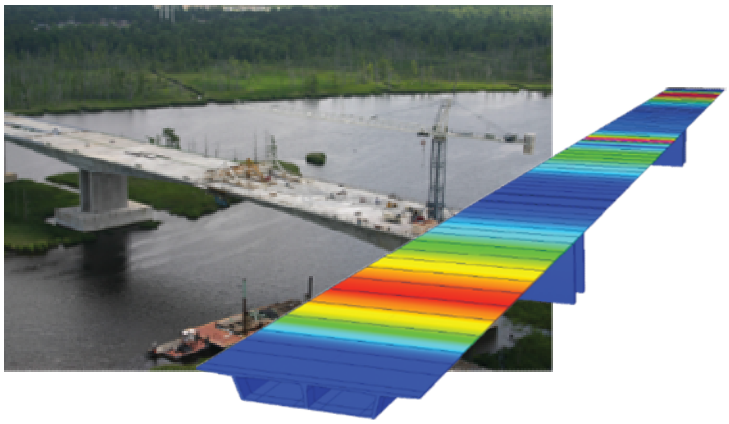

Cable Stayed Bridge


Extra-doesd Bridge

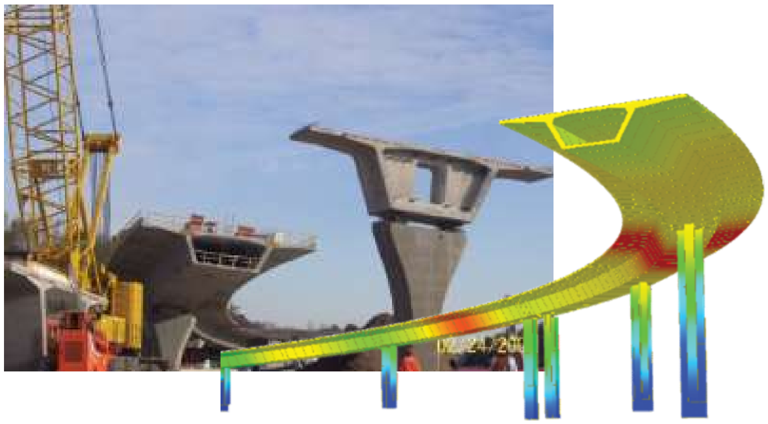

Suspension Bridge

Few project examples - USA

US 17 Wilmington By Pass in USA

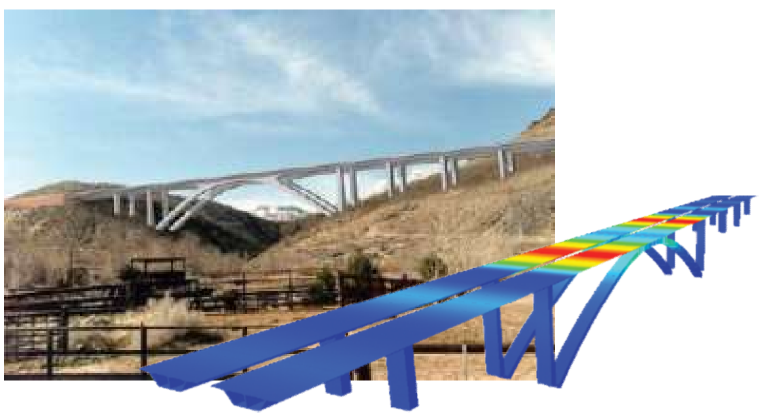


Lee Roy Selmon Flyovers in FL USA



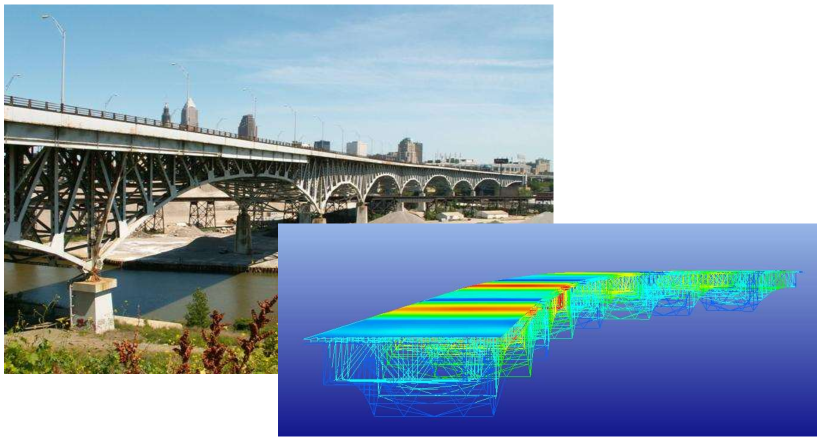
Port Access Bridge, Alaska

Galena Creek bridge in NV USA

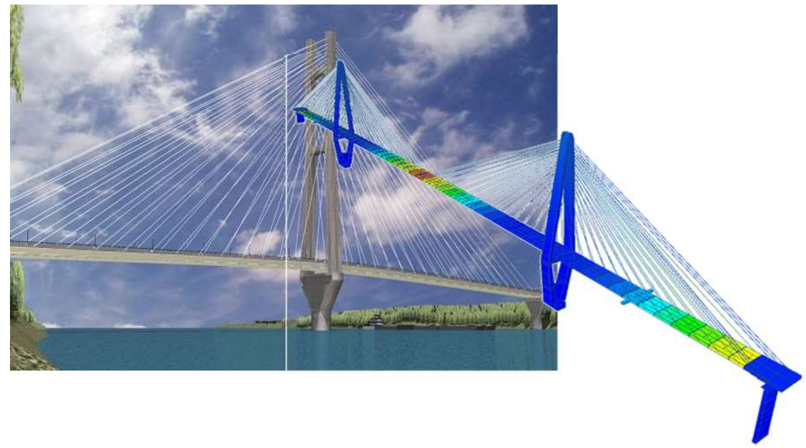


Few project examples - USA

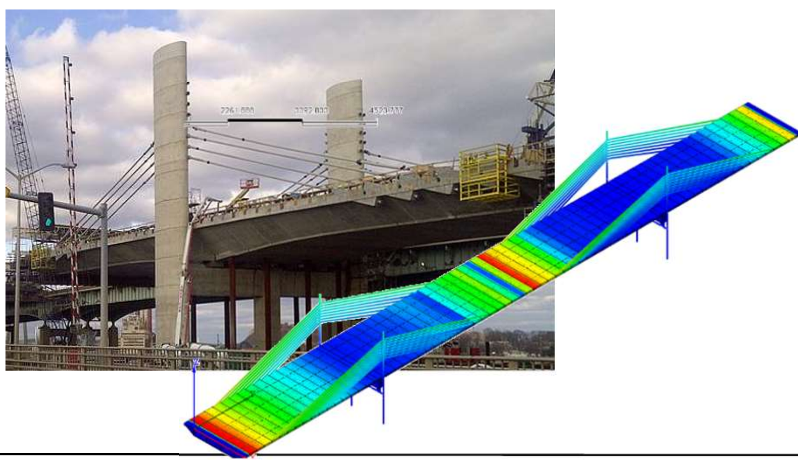
Innerbelt Bridge in Cleveland OH



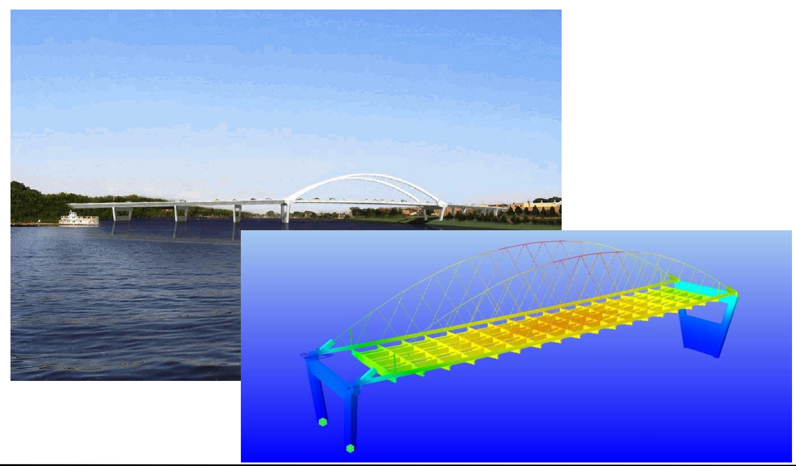
Ironton-Russell Bridge



Pearl Harbor Memorial Bridge



Hastings Bridge



Learning Objectives

- **Why FEA is required for Segmental Bridges?**
- **Typical Modeling issues with Finite Element Modeling**
- **How Midas Civil will help you to set Up the Model**
- **How Midas Civil will help you in Precise Analysis?**

Finite Element Analysis of Segmental Bridges

Why FEA is required for Segmental Bridges?

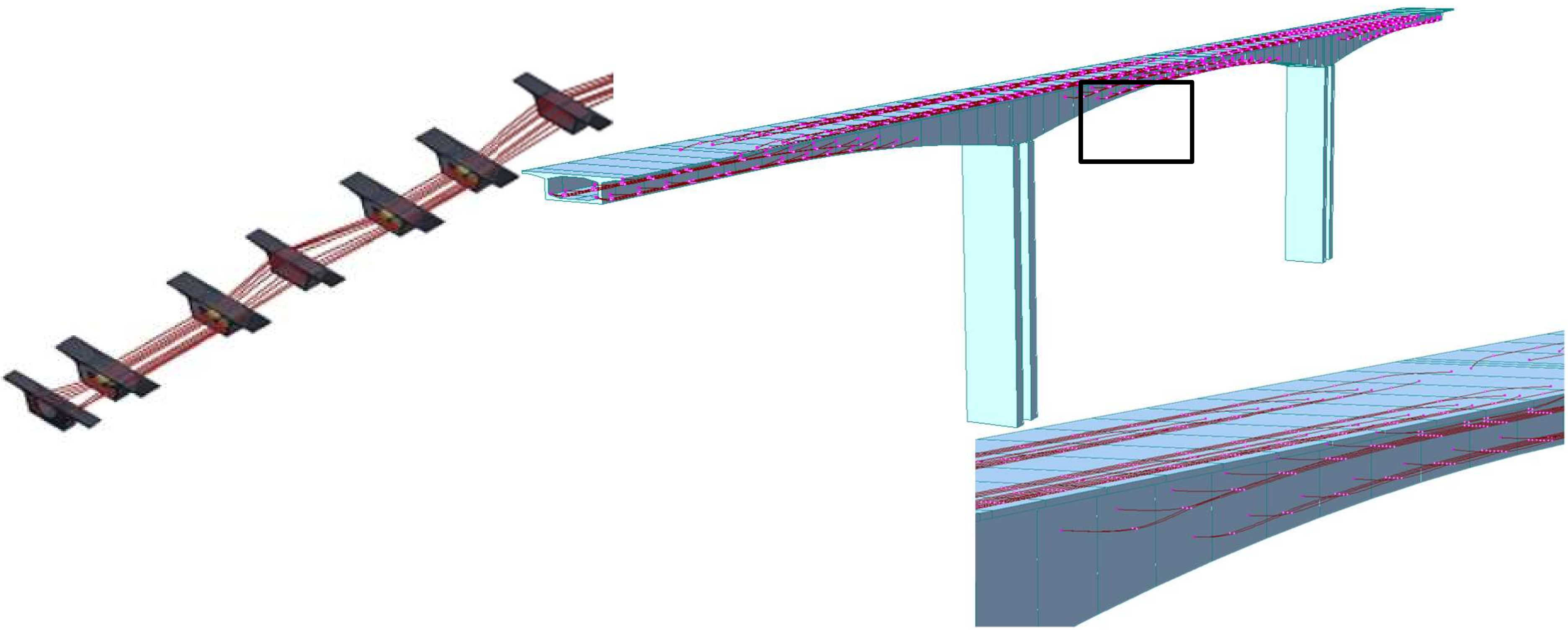
- Segmental Bridges need to be carefully analyzed
- The effect of prestressing needs to be carefully evaluated
- The time dependent material behavior
- The construction loads need to be considered in analysis

Typical Modeling issues with FEM

1. **The depth of the girder changes from the mid span to the mid support, which requires creation of several cross sections along the length of the Girder.**

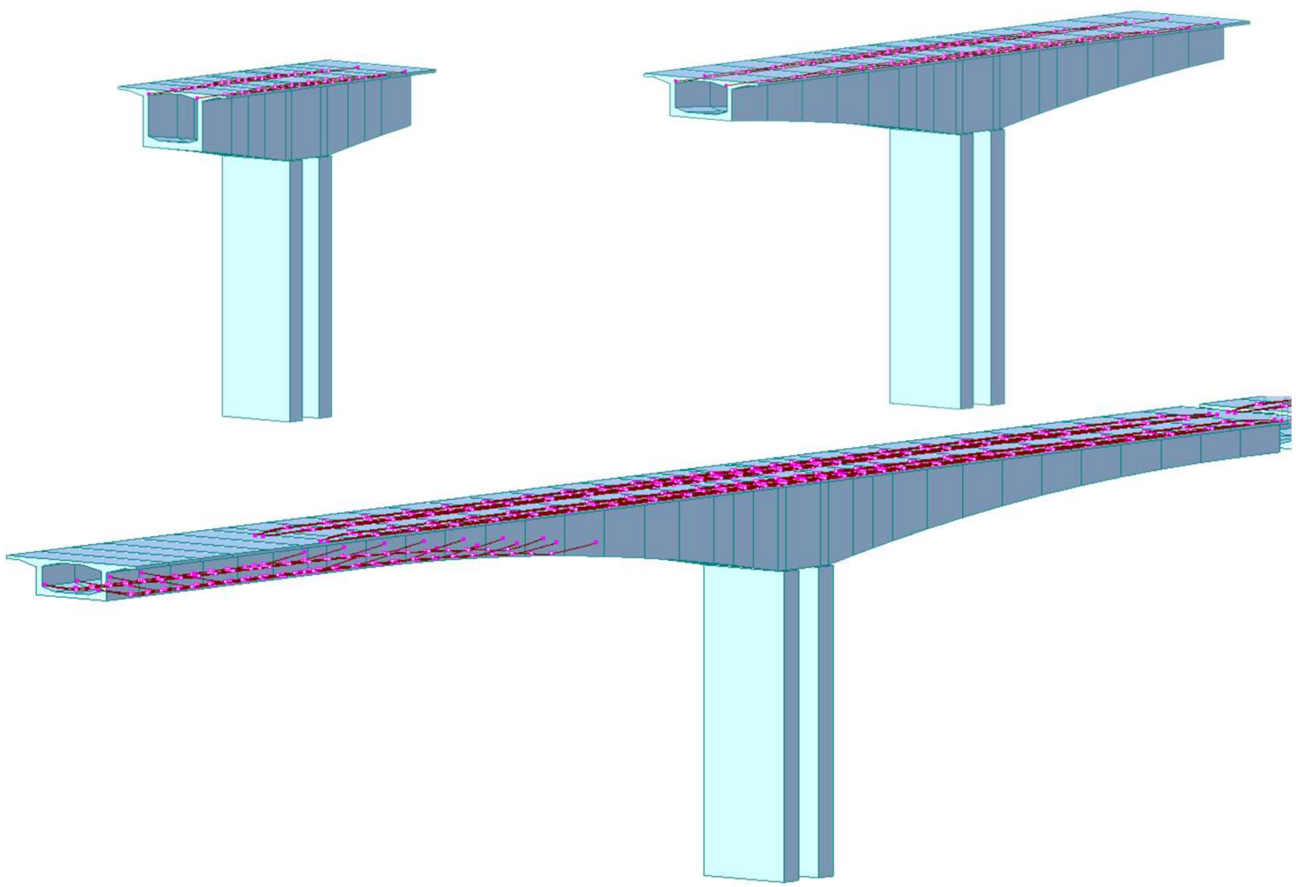
Typical Modeling issues with FEM

2. A large number of Prestressing Tendons need to be modeled.



Typical Modeling issues with FEM

3. Tendons must be defined in individual stages as they appear in the bridge



Typical Modeling issues with FEM

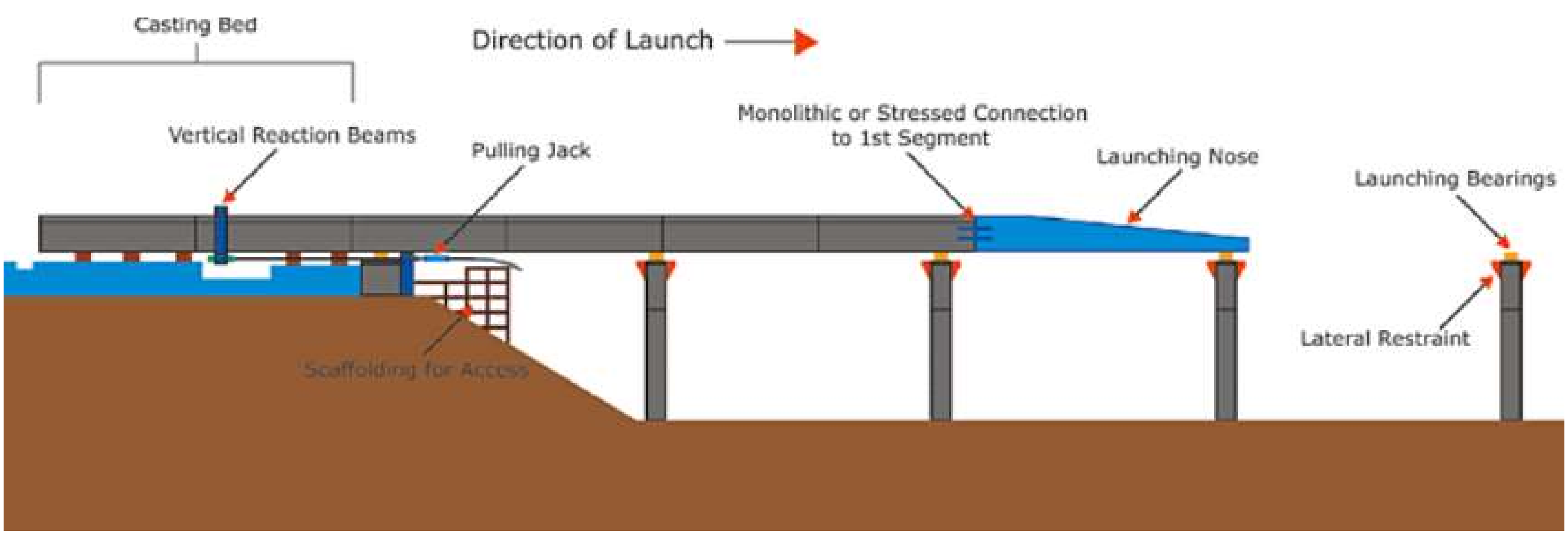
4. Individual Construction Stages must be defined depending on the construction type

Balance Cantilever Bridge

4. Individual Construction Stages must be defined depending on the construction type

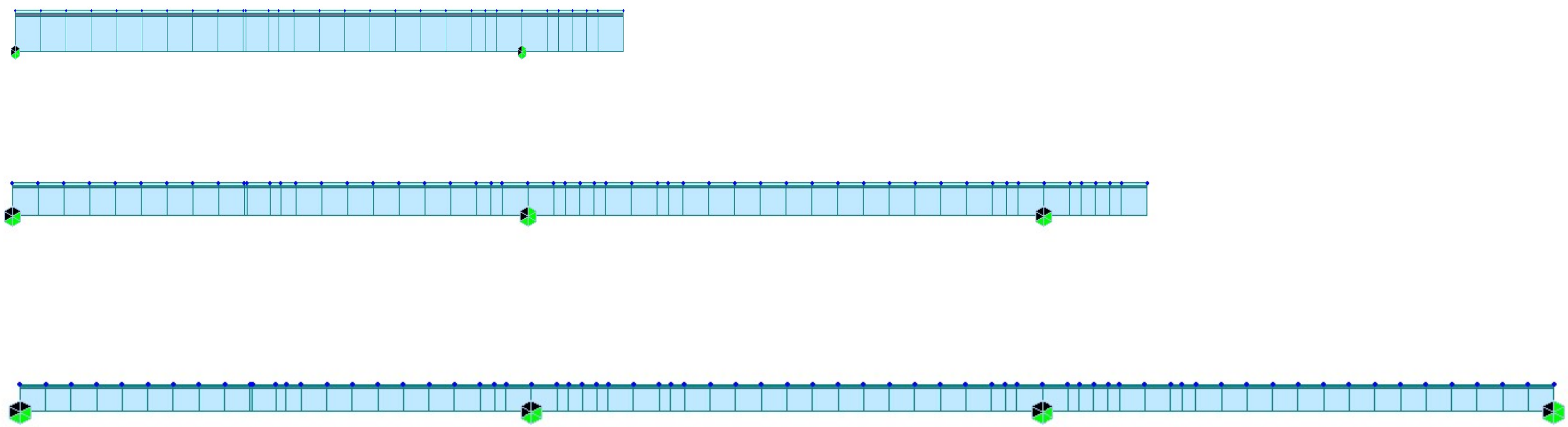
Incremental Launching Method

4. Individual Construction Stages must be defined depending on the construction type



Span by Span Construction

4. Individual Construction Stages must be defined depending on the construction type

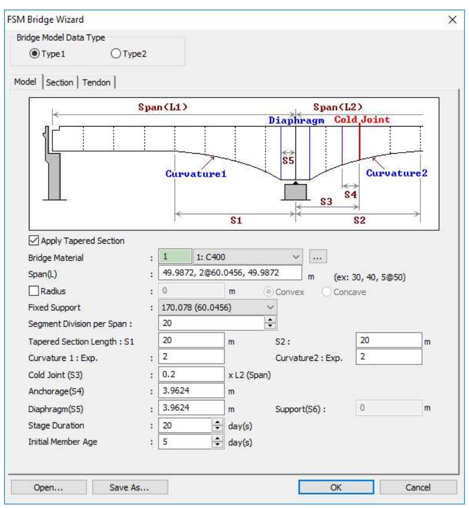


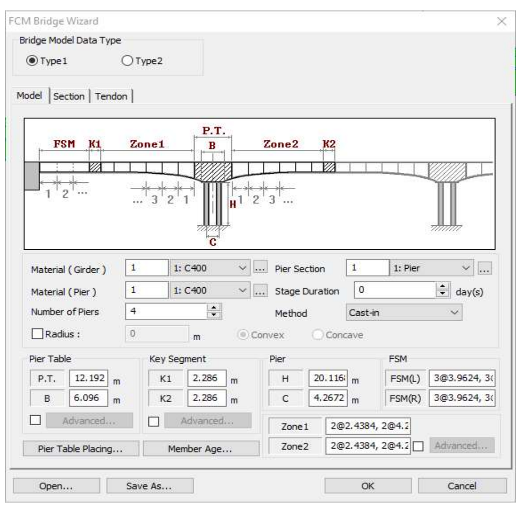
5. Temporary Supports need to be defined in the Construction Stage

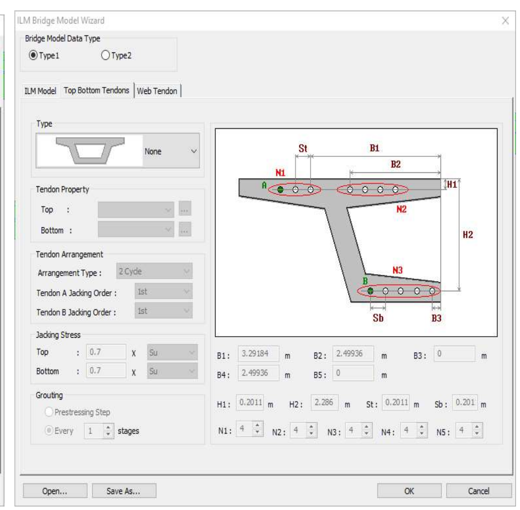
How midas Civil will help you to set up the Model

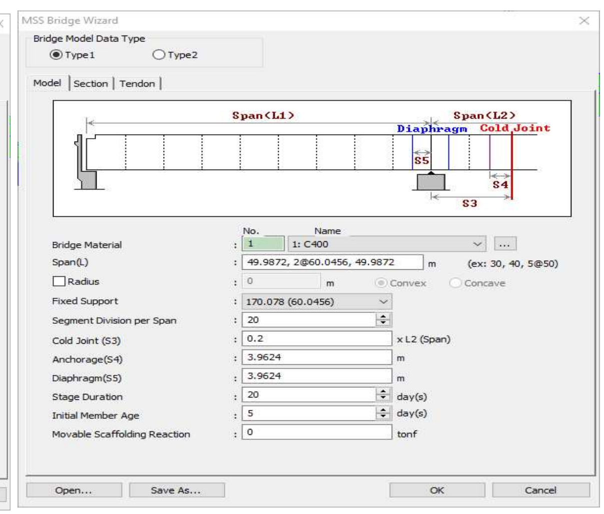
Use Wizard to do the Modeling, Wizard automatically creates:

- **Geometric Model of the bridge**
- **3D Tendons are automatically generated**
- **Construction Stages are automatically generated**
- **Loads in Construction Stages are automatically defined**





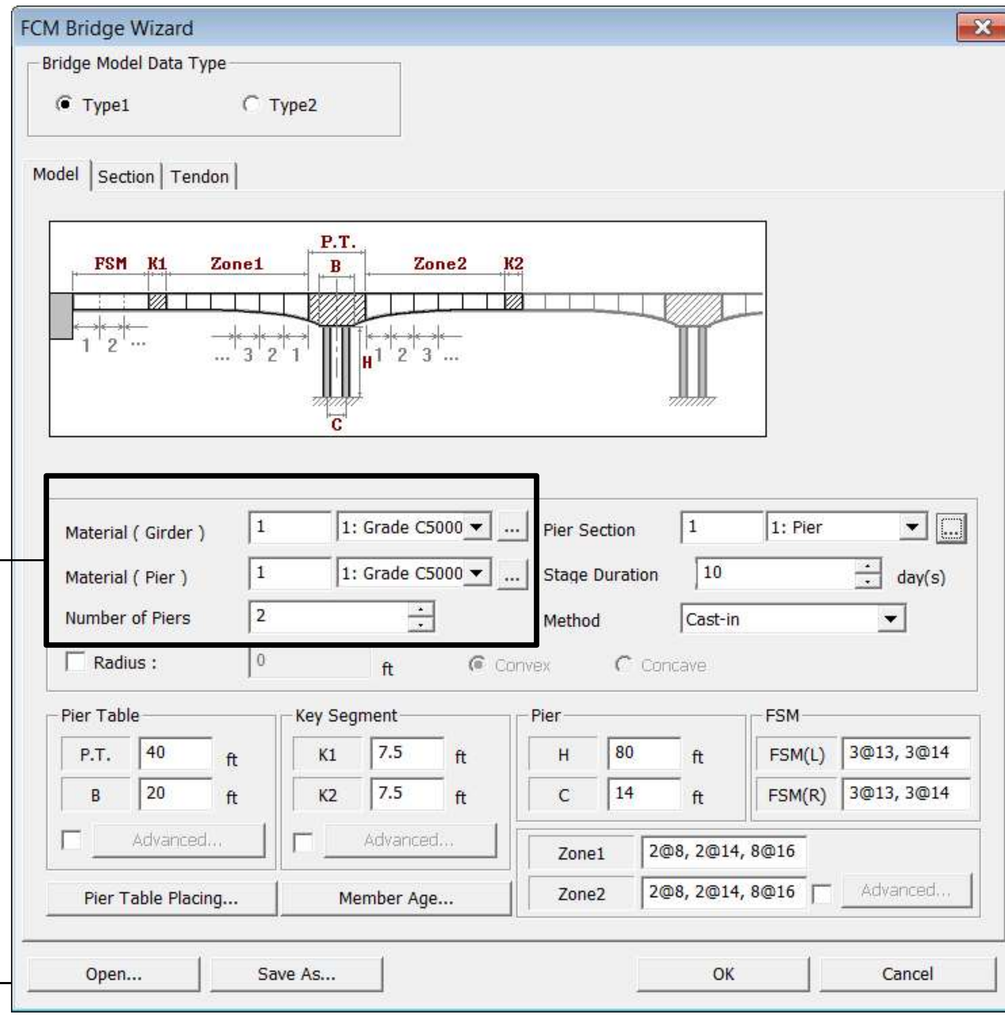




Balanced Canterliver Construction Method

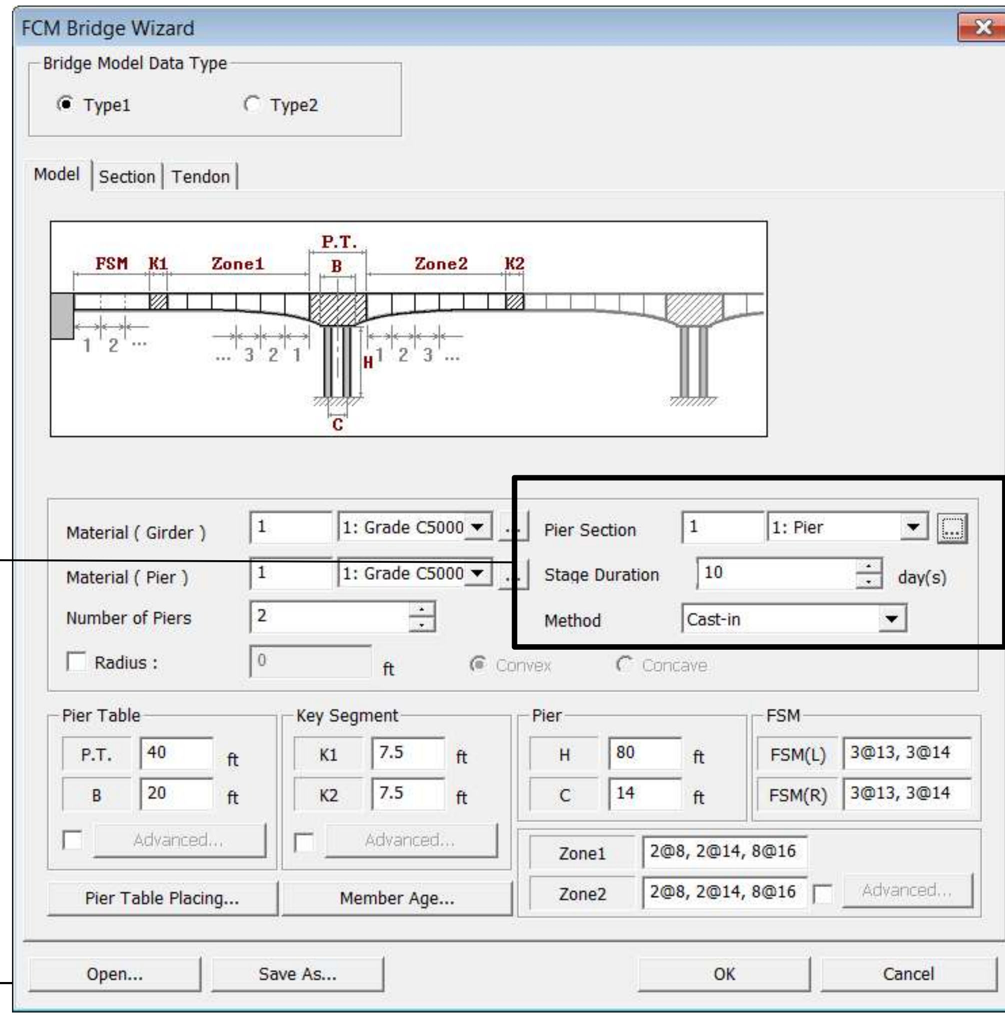
Balanced Cantilever Bridge Wizard:

Define the Material and the number of pier in the bridge



Balanced Canterliver Construction Method

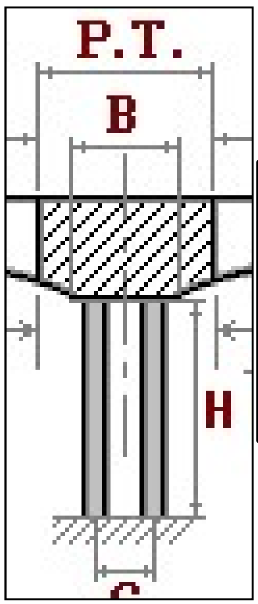
Balanced Cantilever Bridge Wizard:



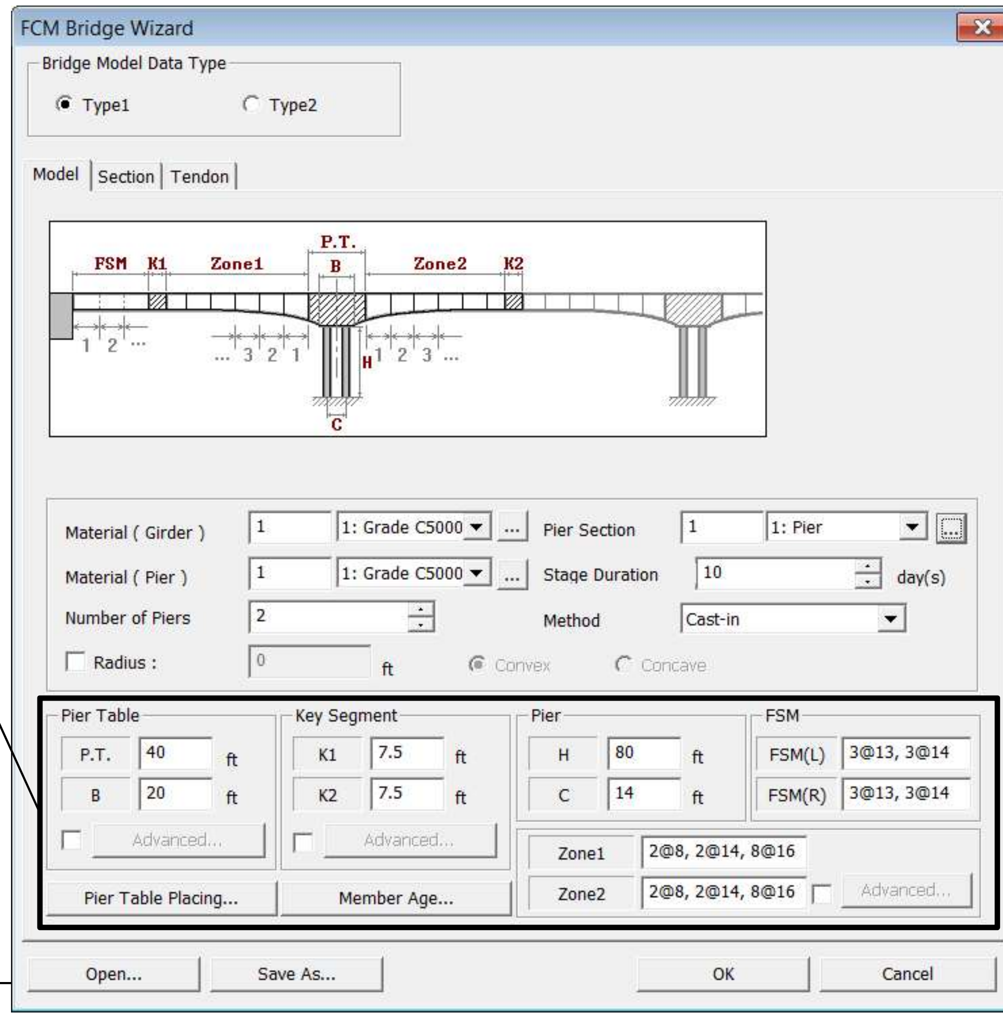
Define the Number of Stages and the method of construction cast in place or Precast

Balanced Canterliver Construction Method

Balanced Cantilever Bridge Wizard:



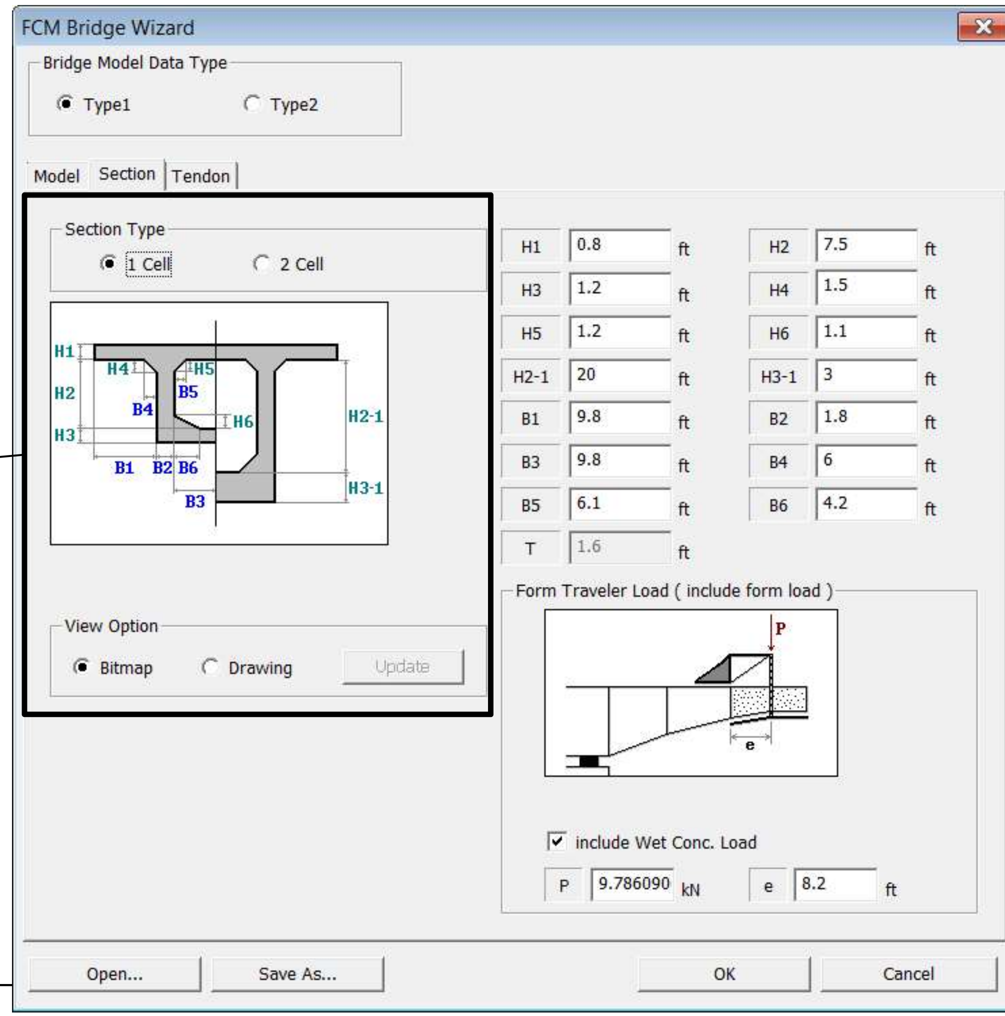
Define number of Zones, Pier Table and Pier Height
Define the connection element.



Balanced Canterliver Construction Method

Balanced Cantilever Bridge Wizard:

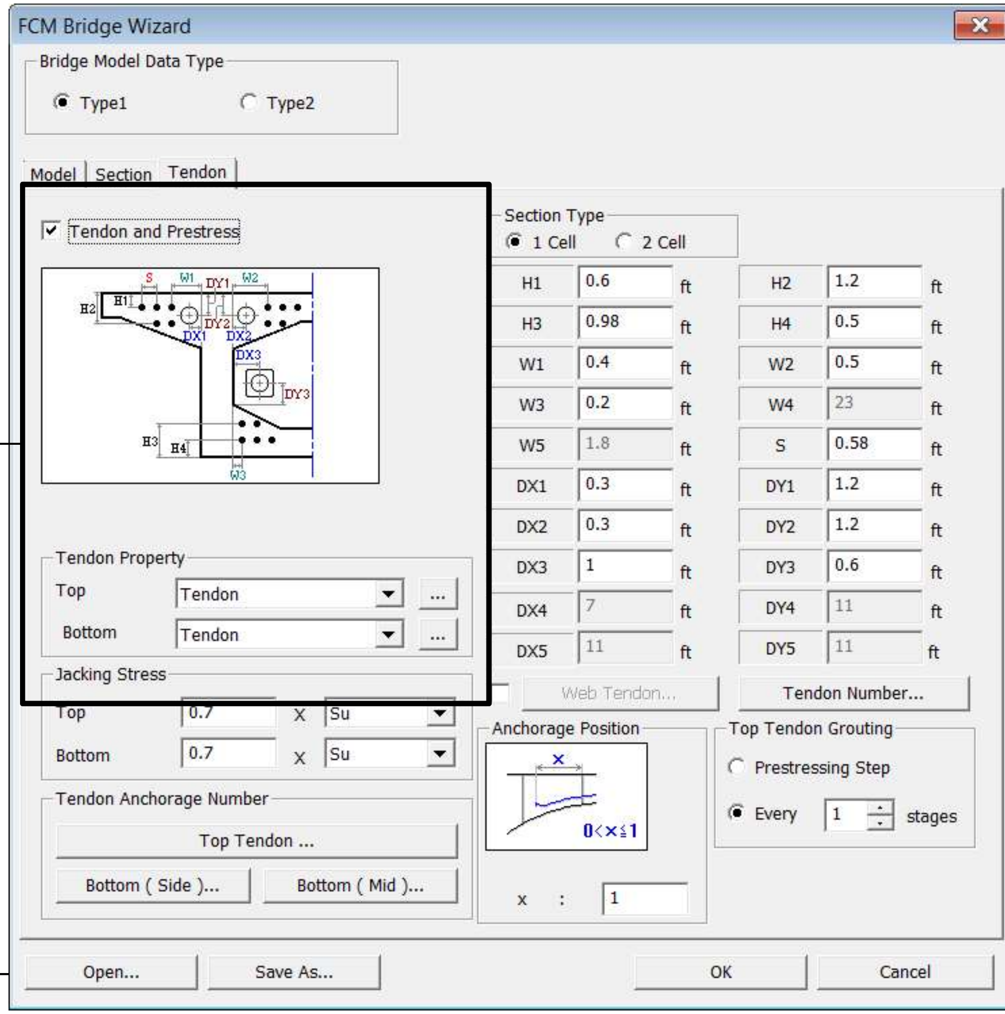
Define the Section at the Mid Support and the Mi d Span



Balanced Canterliver Construction Method

Balanced Cantilever Bridge Wizard:

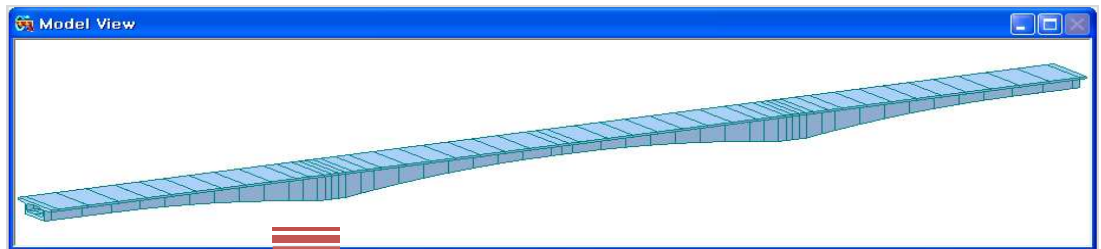
Define the Typical Tendon location

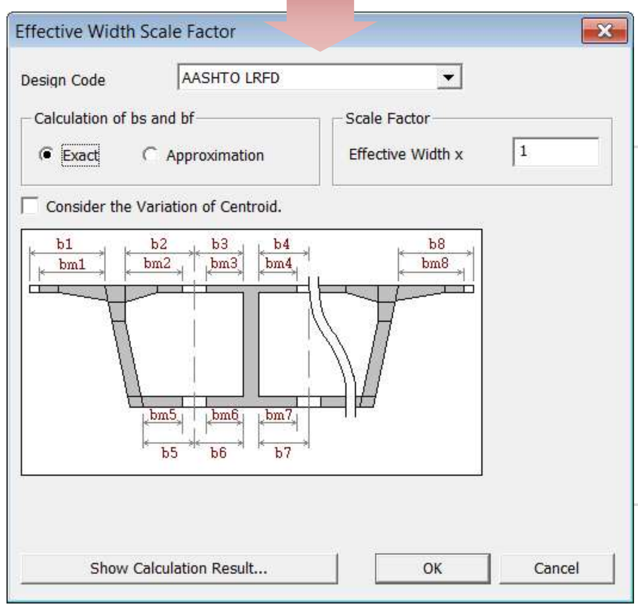


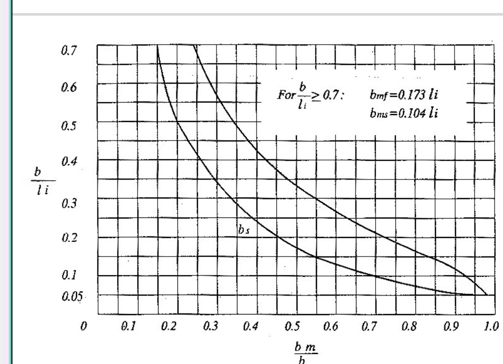
Balanced Canterliver Construction Method

Balanced Cantilever Bridge Wizard:

Auto Calculation of Effective Width Scale Factor







Balanced Canterliver Construction Method

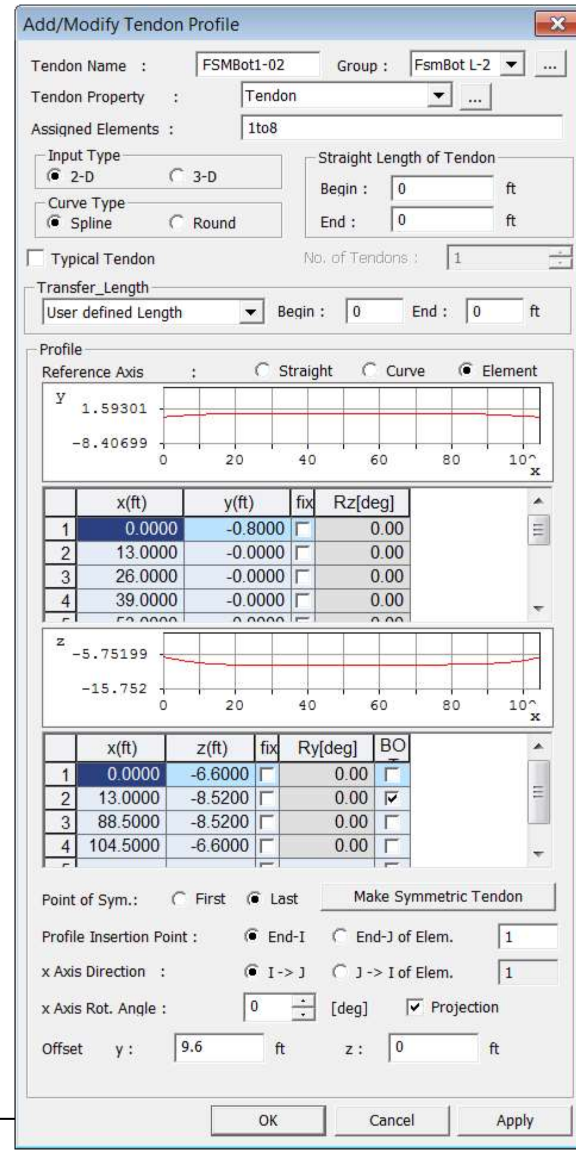
Manual Tendon Definition

> Enter Tendon in 2D or 3D

> Typical tendon : Defines lumped representativ e tendon. Only one tendon profile is defined at t he centroid of the all the tendons. It is multiplied with number of tendons at the time of analysis.

> Reference Axis

Straight: Reference axis is straight
Curved: Circular reference axis can be define d
Element: Element is taken as the reference a xis

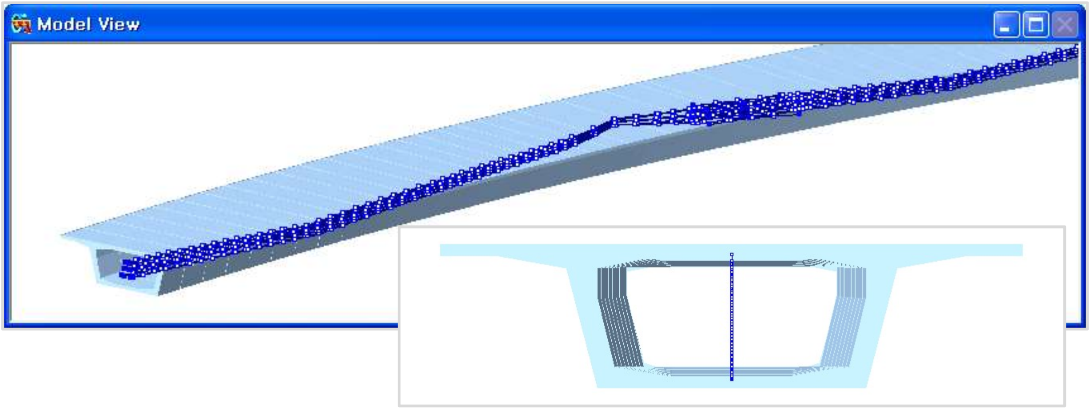


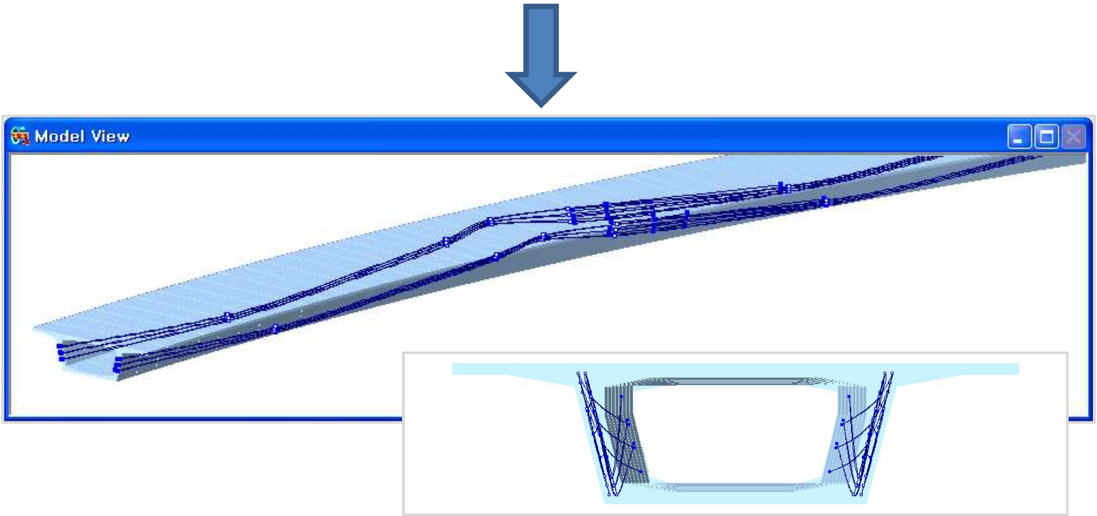
Balanced Canterliver Construction Method

Manual Tendon Definition

X Axis Rot Angle: The tendon placed in the table is rotated about its local x-axis by the specified angle. Useful while placing tendons on inclined w ebs

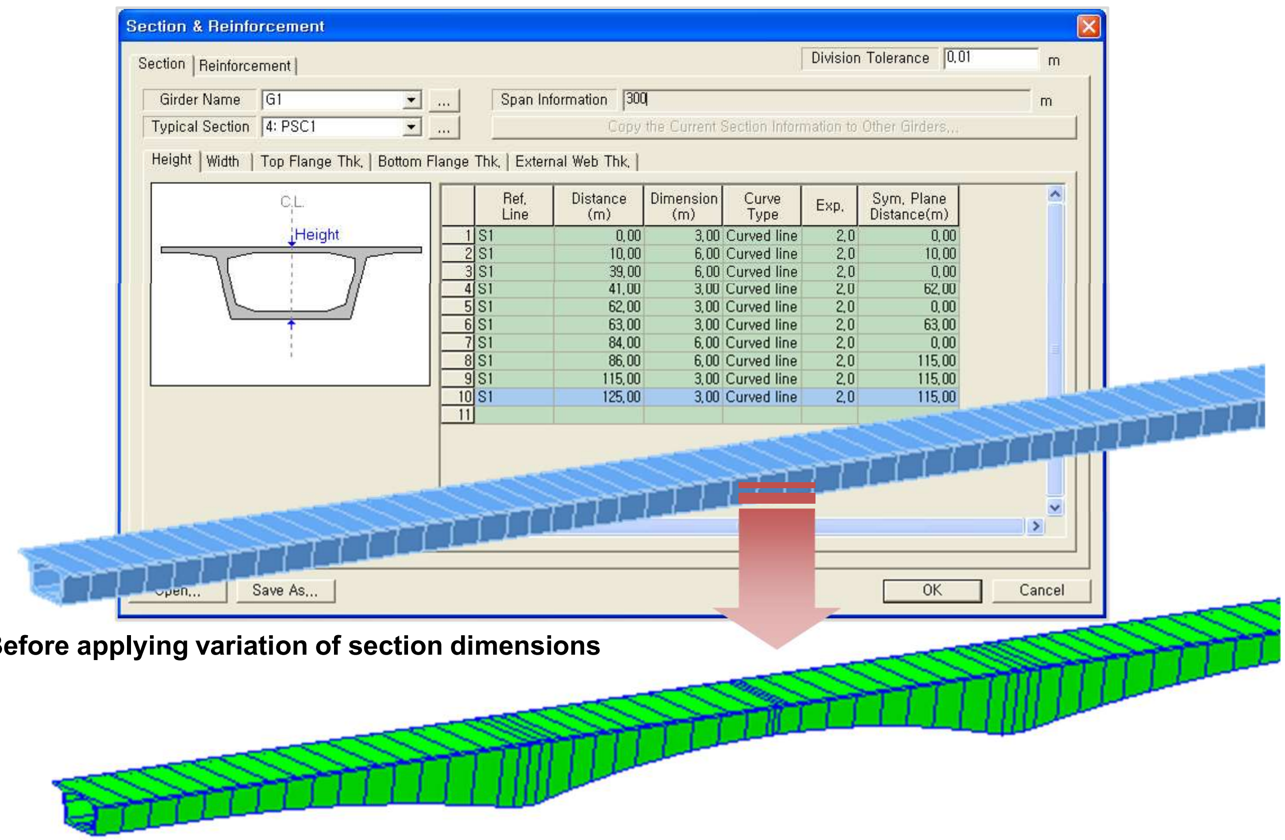
Tendon can be imported from Auto CAD too.





Balanced Canterliver Construction Method

Auto Tapered Generation



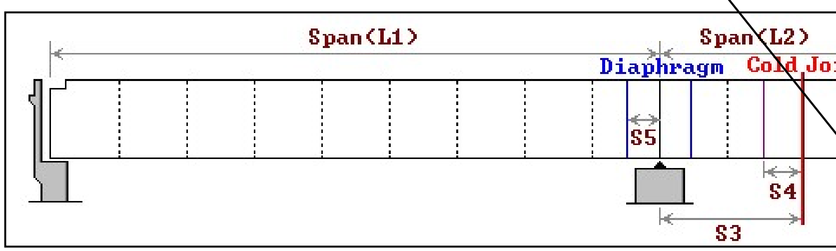
	Ref. Line	Distance (m)	Dimension (m)	Curve Type	Exp.	Sym. Plane Distance(m)
1	S1	0.00	3.00	Curved line	2.0	0.00
2	S1	10.00	6.00	Curved line	2.0	10.00
3	S1	39.00	6.00	Curved line	2.0	0.00
4	S1	41.00	3.00	Curved line	2.0	62.00
5	S1	62.00	3.00	Curved line	2.0	0.00
6	S1	63.00	3.00	Curved line	2.0	63.00
7	S1	84.00	6.00	Curved line	2.0	0.00
8	S1	86.00	6.00	Curved line	2.0	115.00
9	S1	115.00	3.00	Curved line	2.0	115.00
10	S1	125.00	3.00	Curved line	2.0	115.00
11						

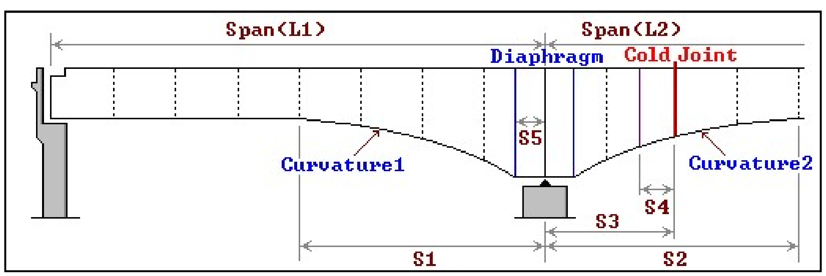
Before applying variation of section dimensions

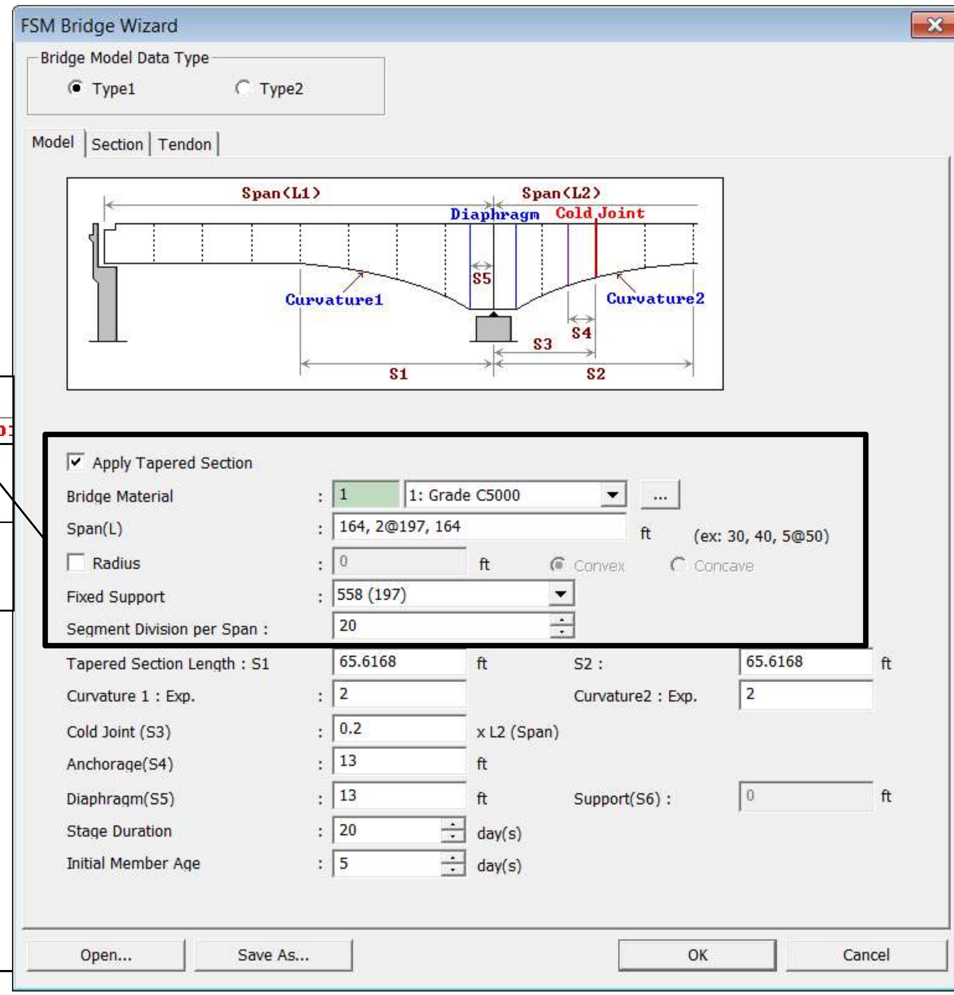
Span by Span Construction Method

Span by Span Construction Method

Define the Type, Span number and the material of the bridge

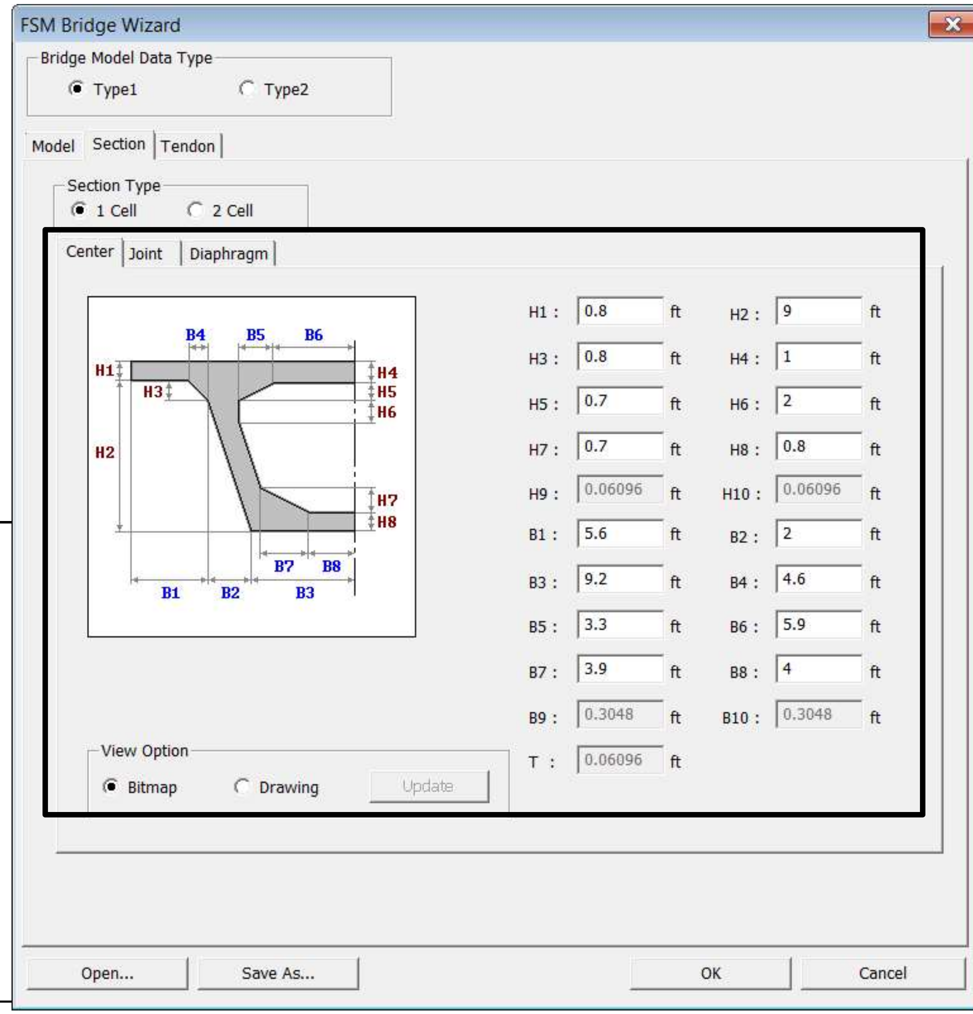






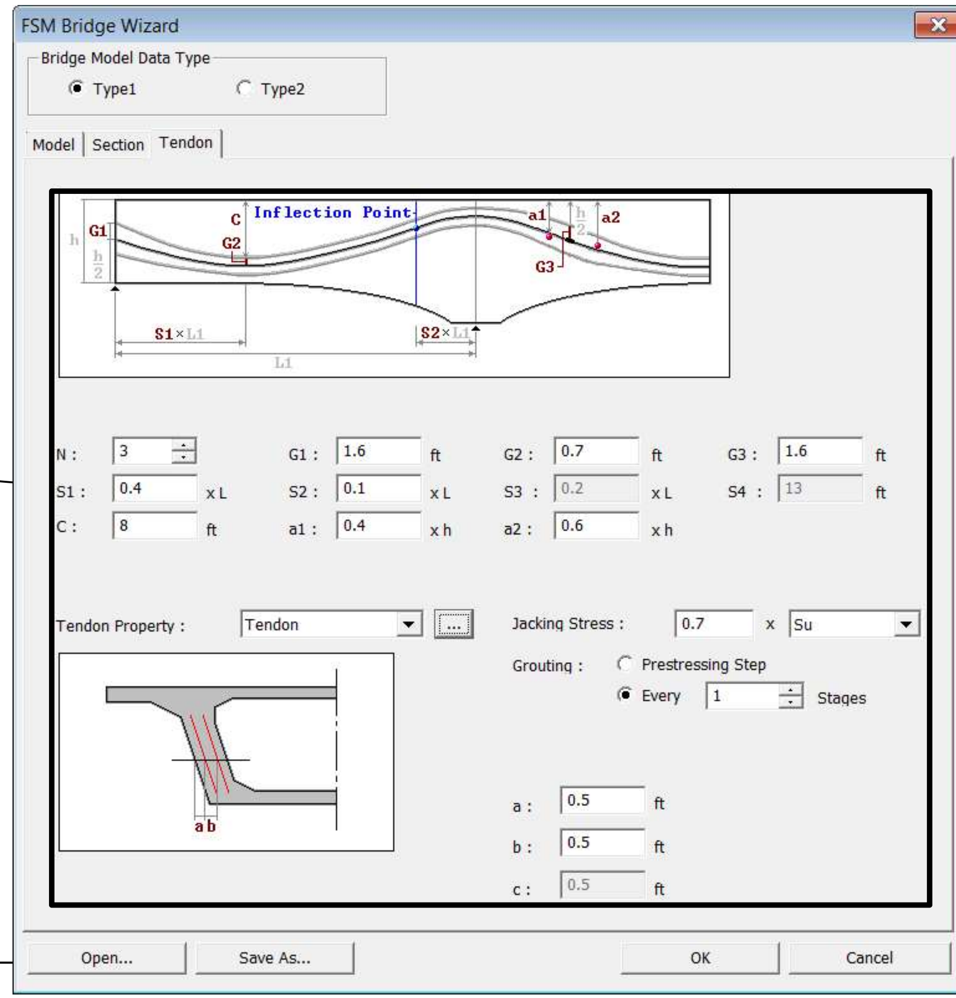
Span by Span Construction Method

Define the cross section at the Centre, Joint and Diaphragm

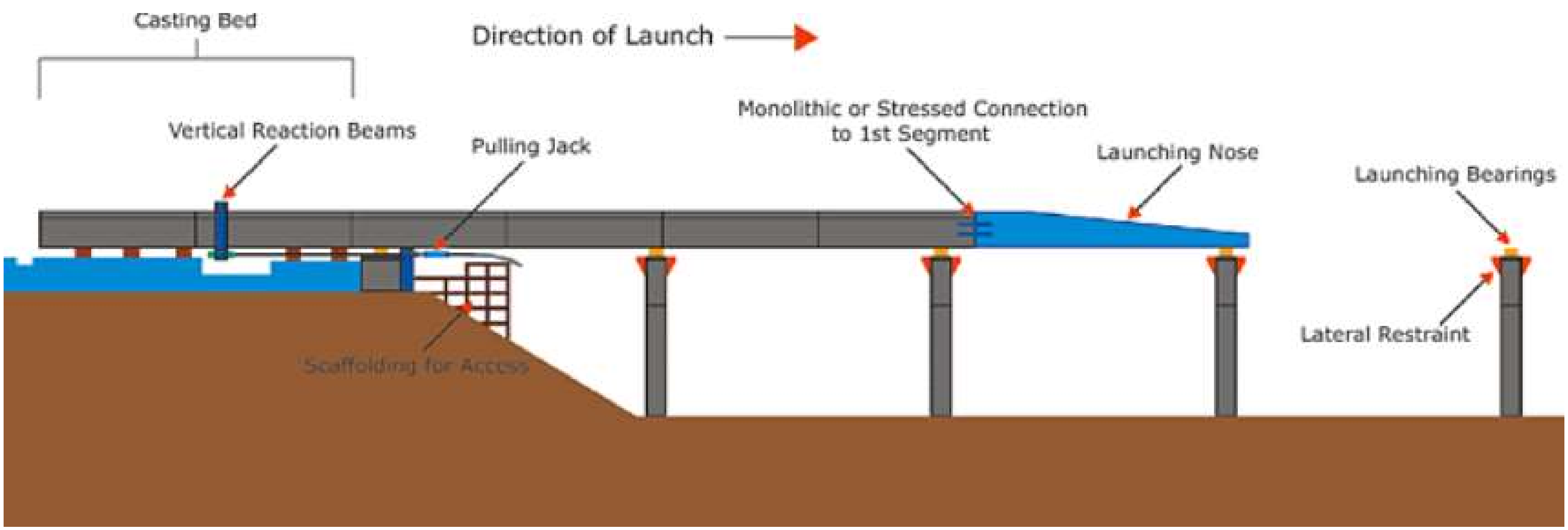


Span by Span Construction Method

Define Typical Tendon Location and Tendon Property

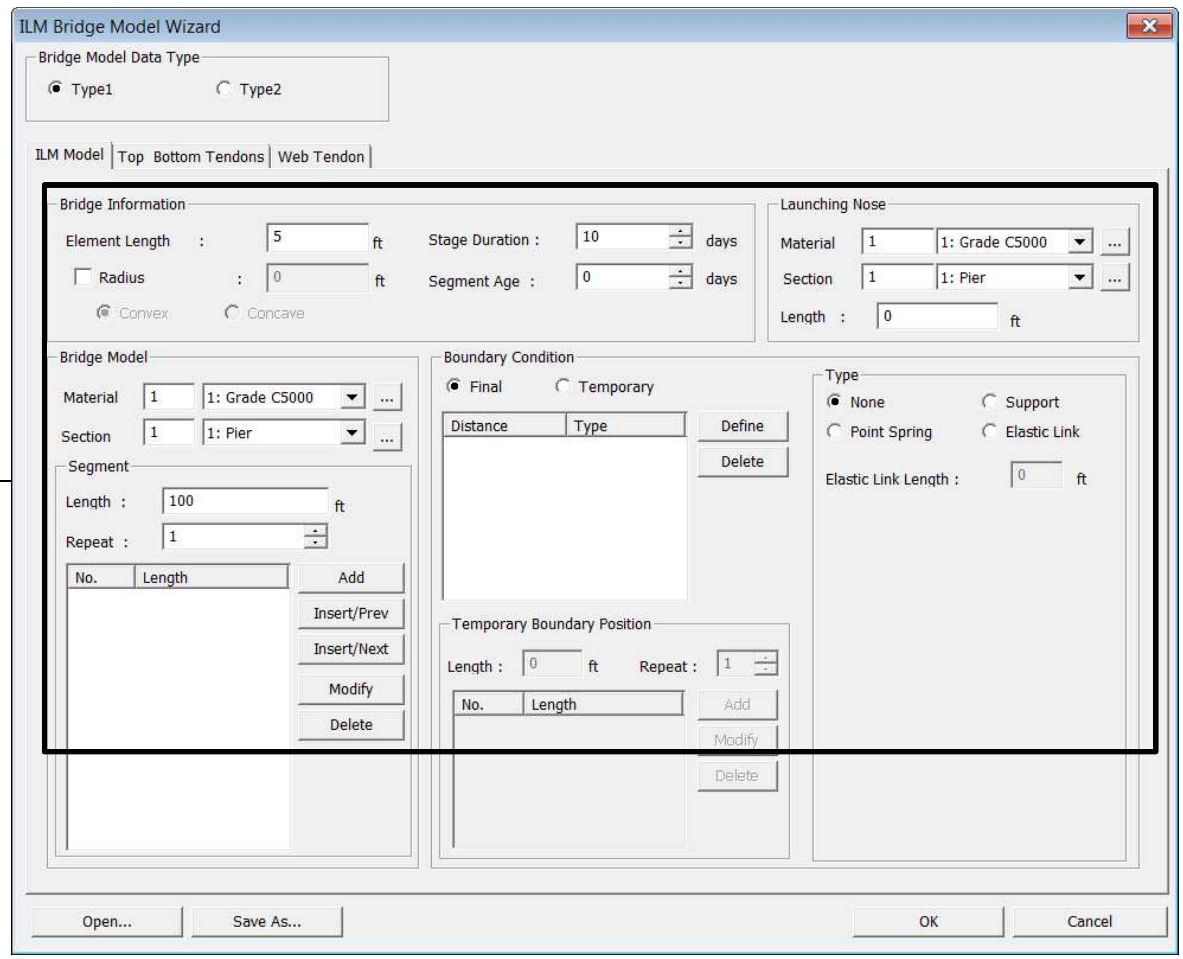


Incremental Launching Method



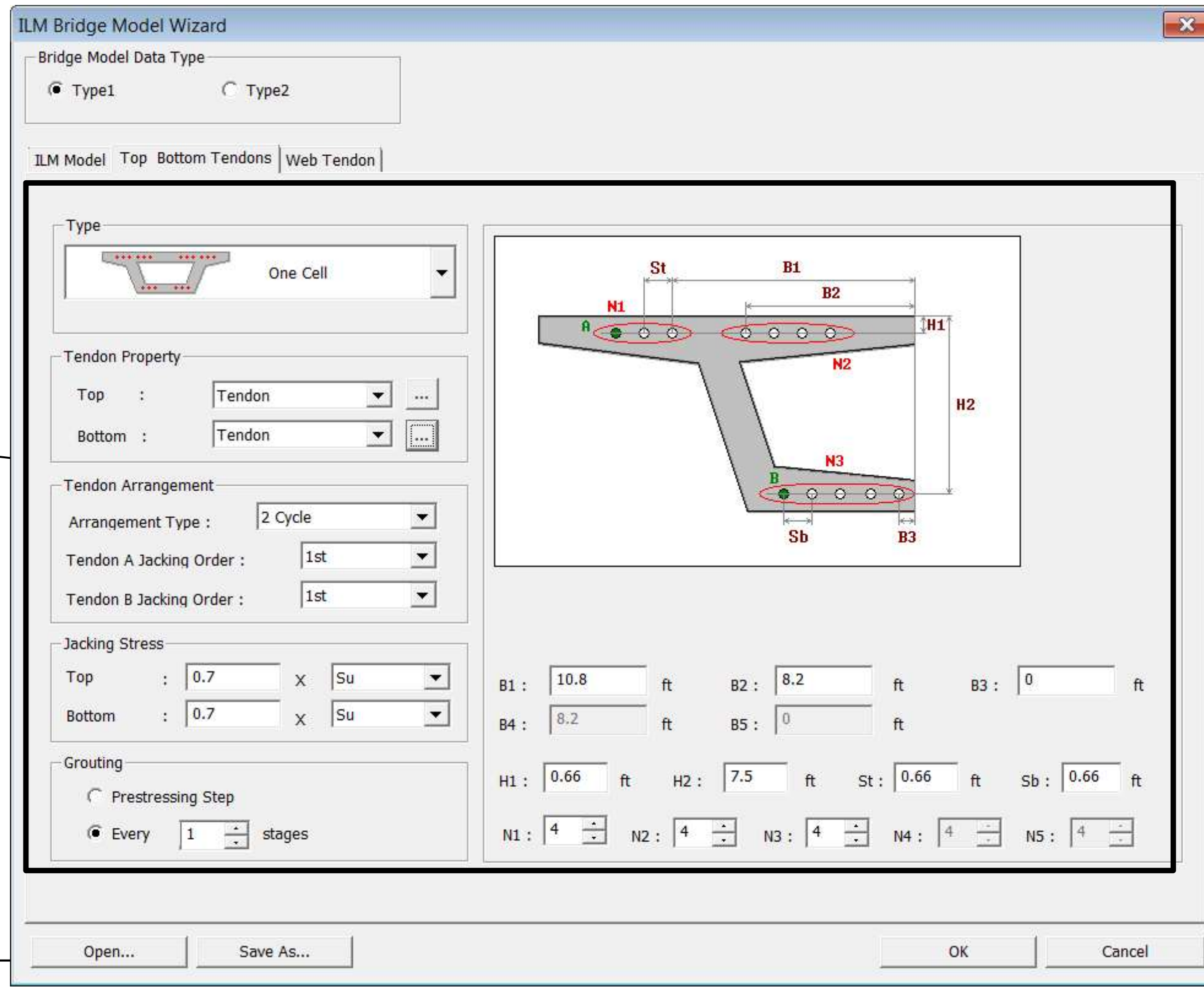
Incremental Launching Method

Define the bridge geometric parameters, material and number of spans



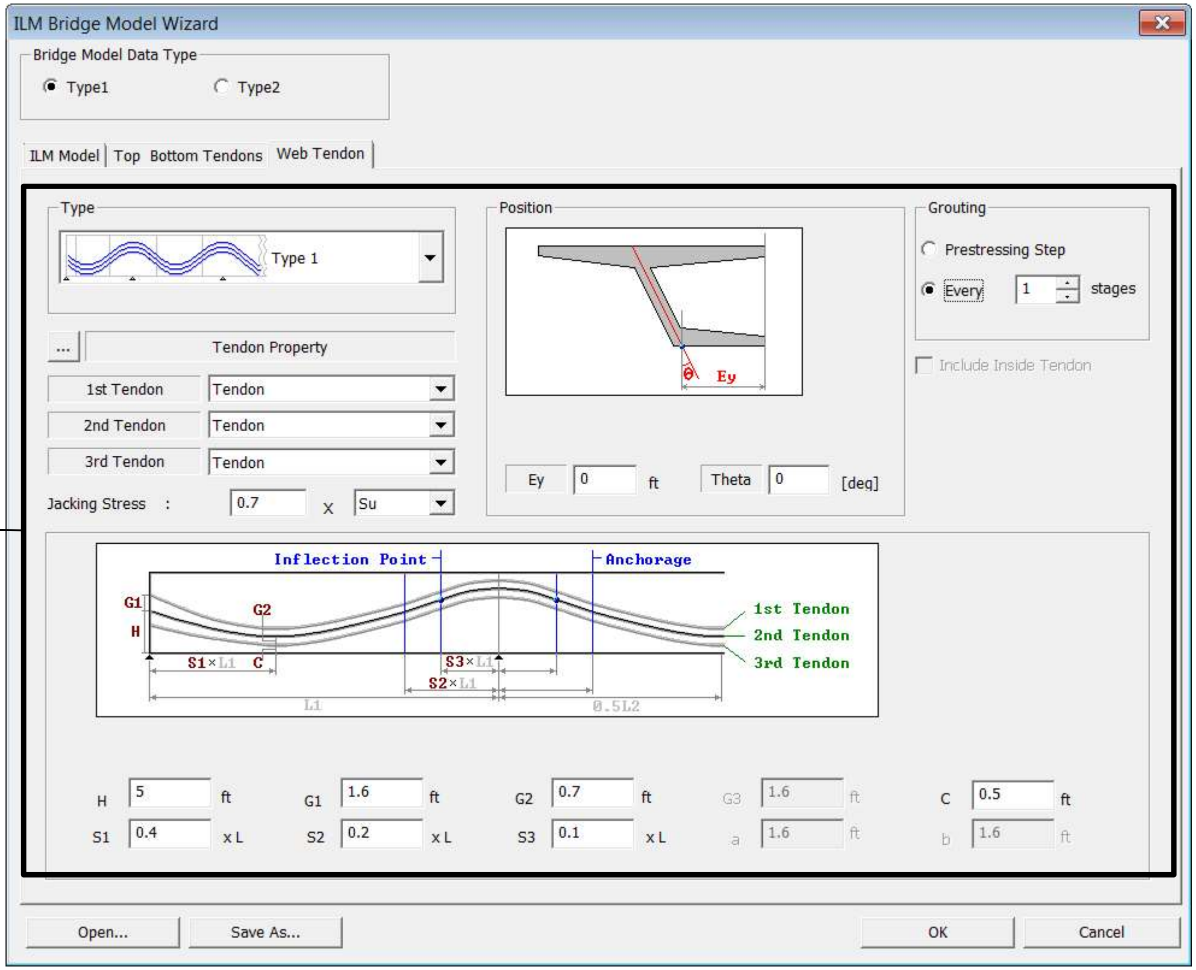
Incremental Launching Method

Define the Location of the bottom tendons



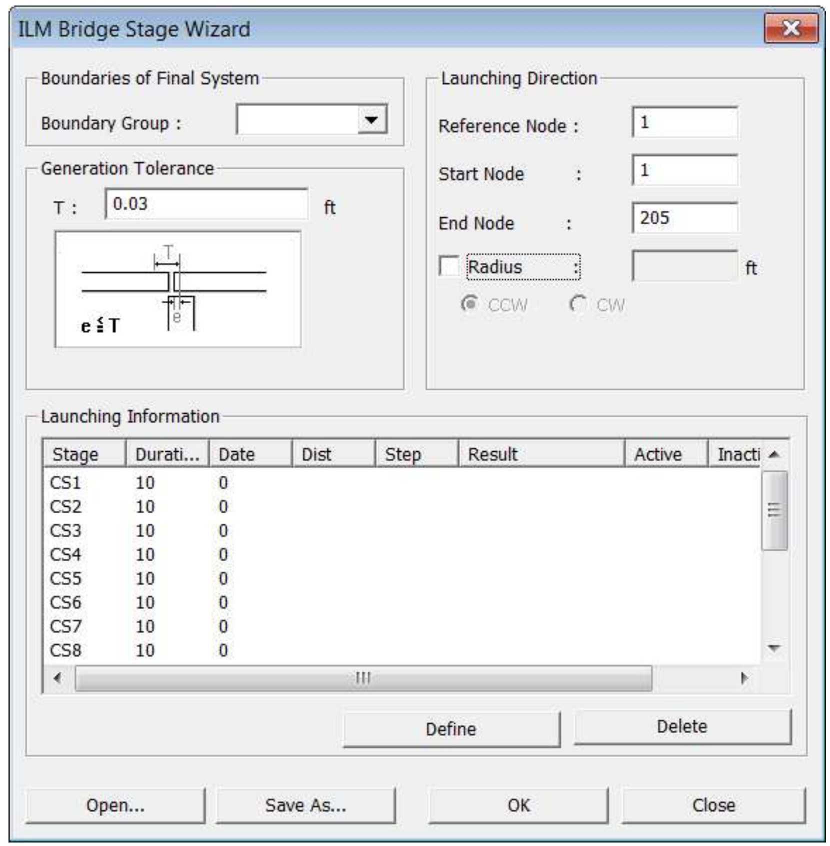
Incremental Launching Method

Define the Web Tendons and the typical locations with number



Incremental Launching Method

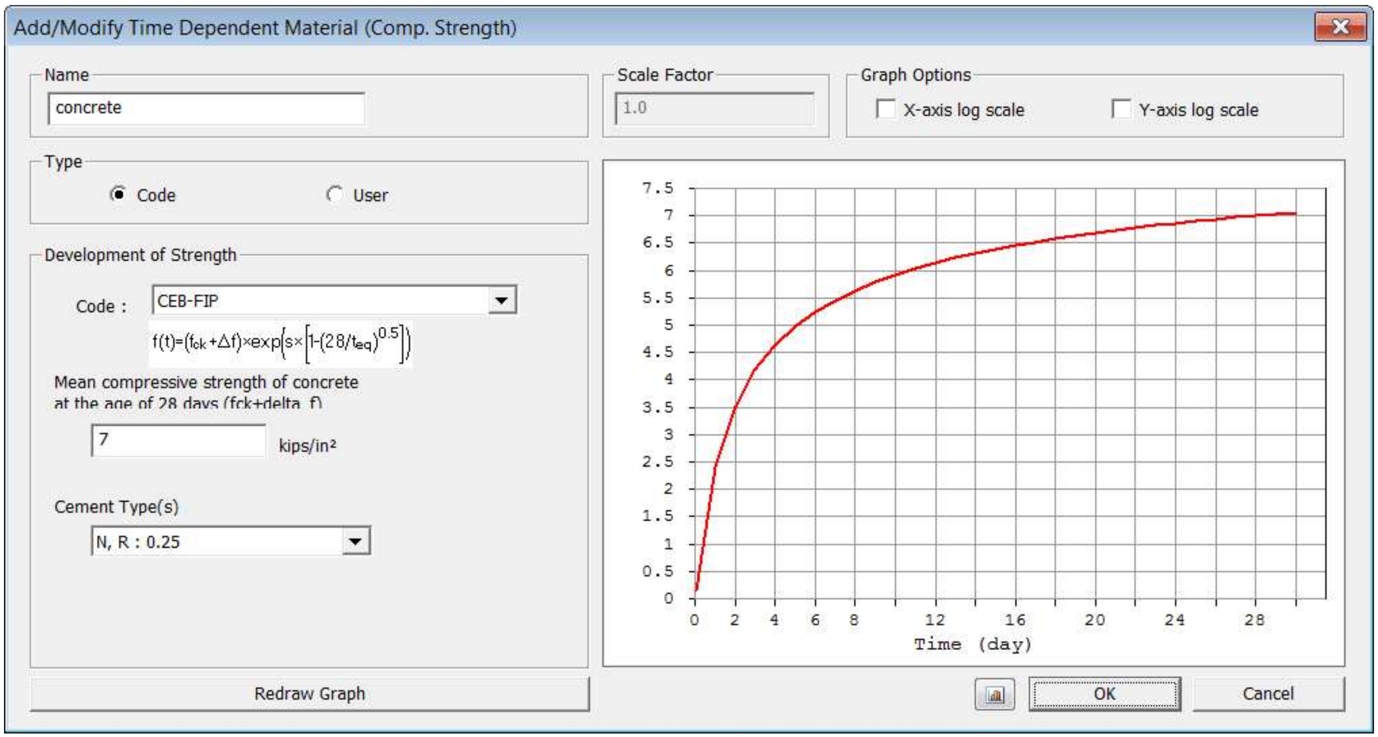
Define the Launching sequence



How Midas Civil will help you in Precise Analysis?

1. Consideration of Time Dependent Material Strength:

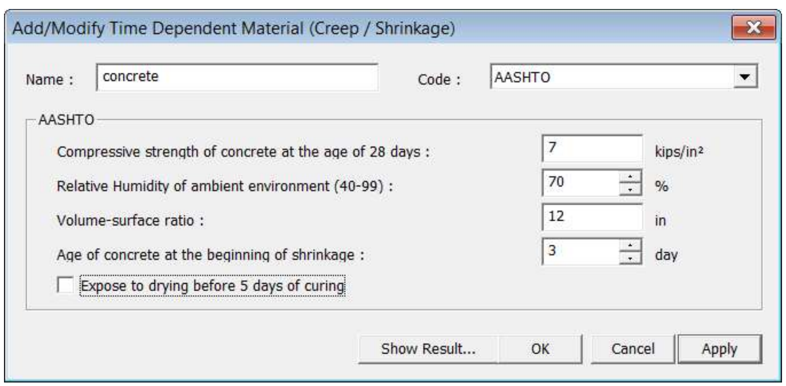
- **Midas Civil can consider the change in modulus of elasticity of the material depending on the Element age**

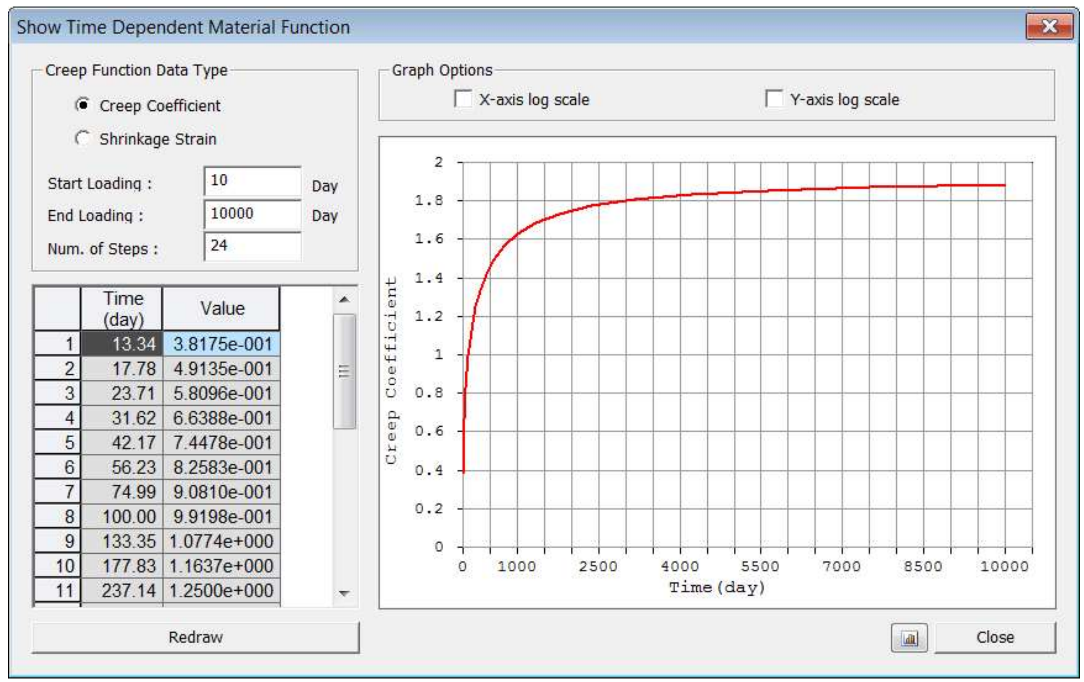


How Midas Civil will help you in Precise Analysis?

2. Consideration of Creep and Shrinkage:

- **Midas Civil can consider the creep and shrinkage of concrete for estimation of deformation And secondary effects.**

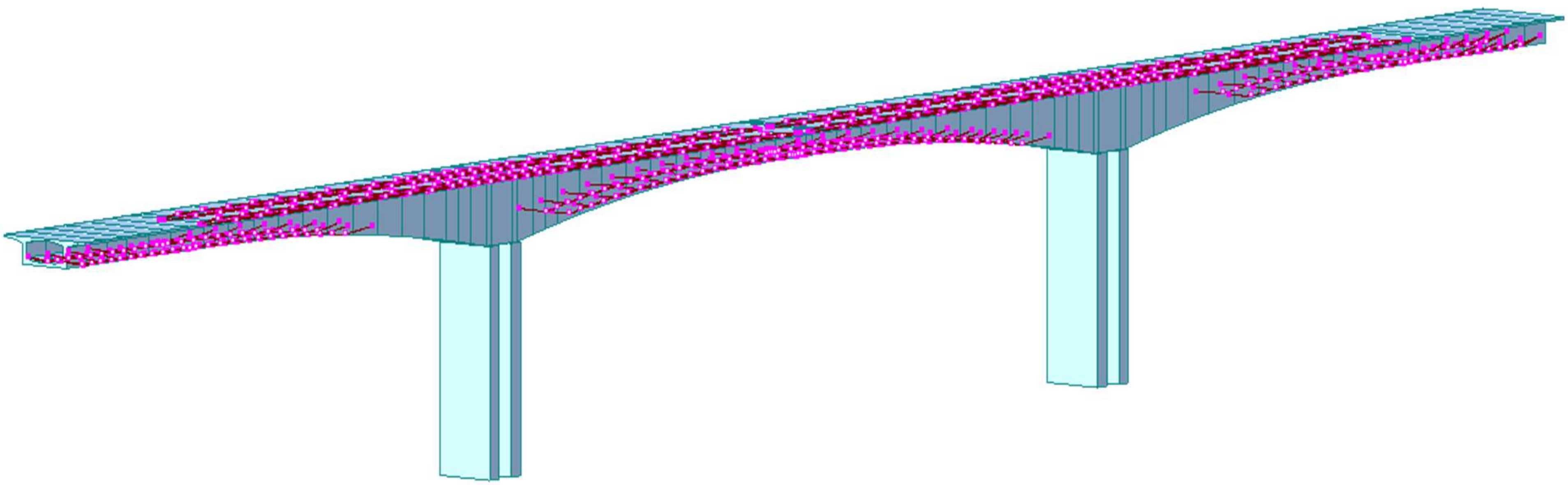




How Midas Civil will help you in Precise Analysis?

3. Consideration of Secondary effects of Prestressing:

- **Midas Civil can consider the secondary effects of prestressing**

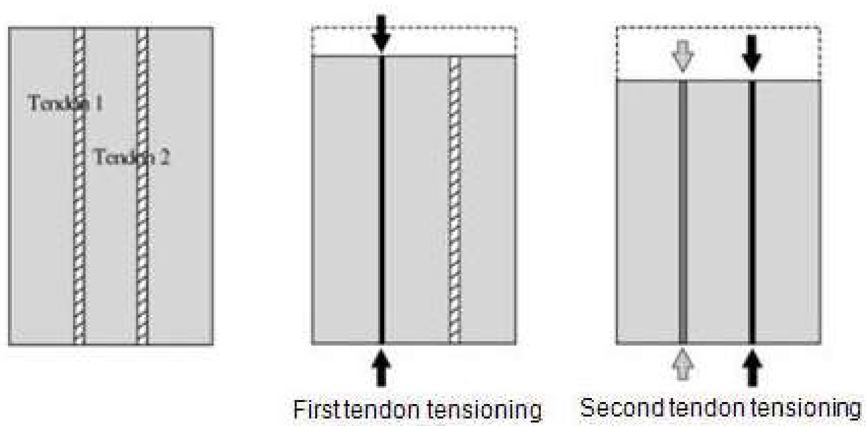


How Midas Civil will help you in Precise Analysis?

4. Staged Post Tensioning

- Midas Civil can be used to define the staged post tensioning on the bridges and a single tendon can be prestressed in several stages depending on the scenario

- Losses can be obtained for the staged post tensioning

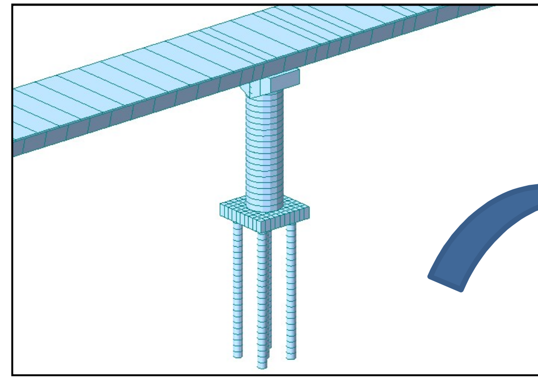


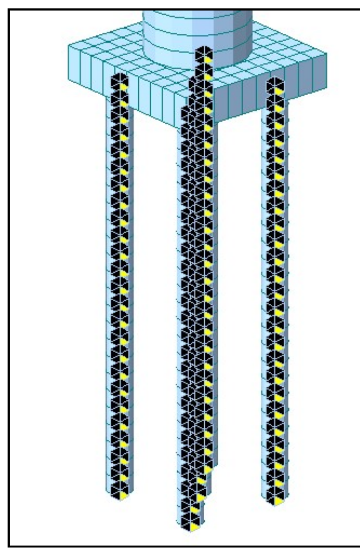
How Midas Civil will help you in Precise Analysis?

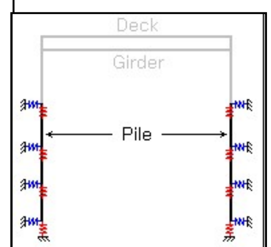
5. Soil Structure Interaction

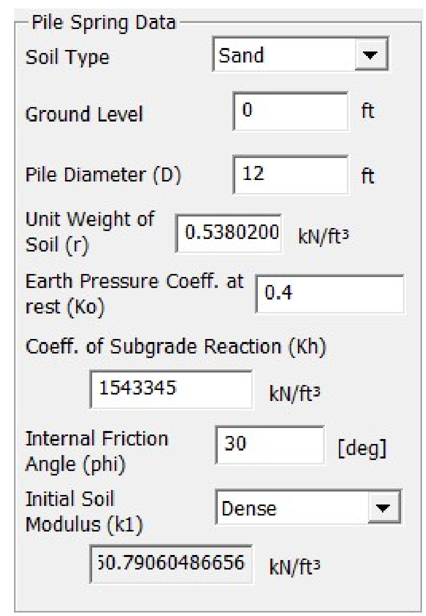
Soil Structure Interaction is Mandatory :

- Static Load Distribution might change
- Settlement effects may be there
- Better visualization of Load Transfer Mechanism
- Forces for Foundation Design



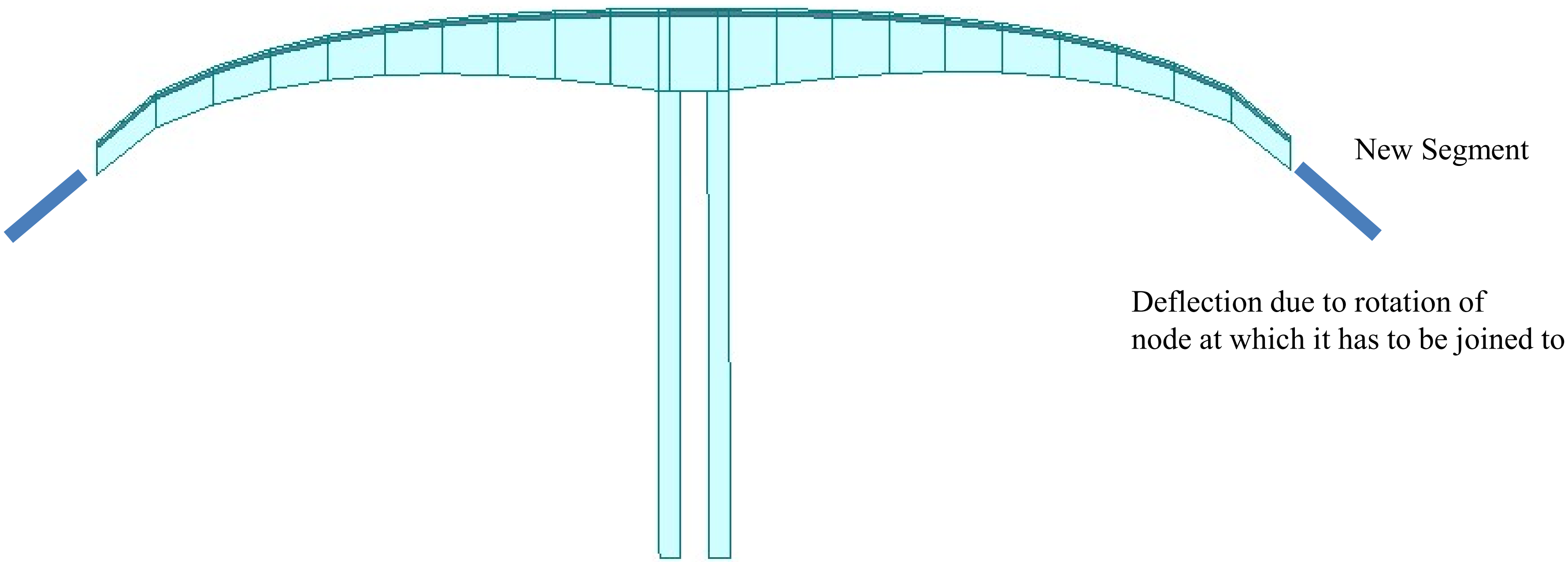






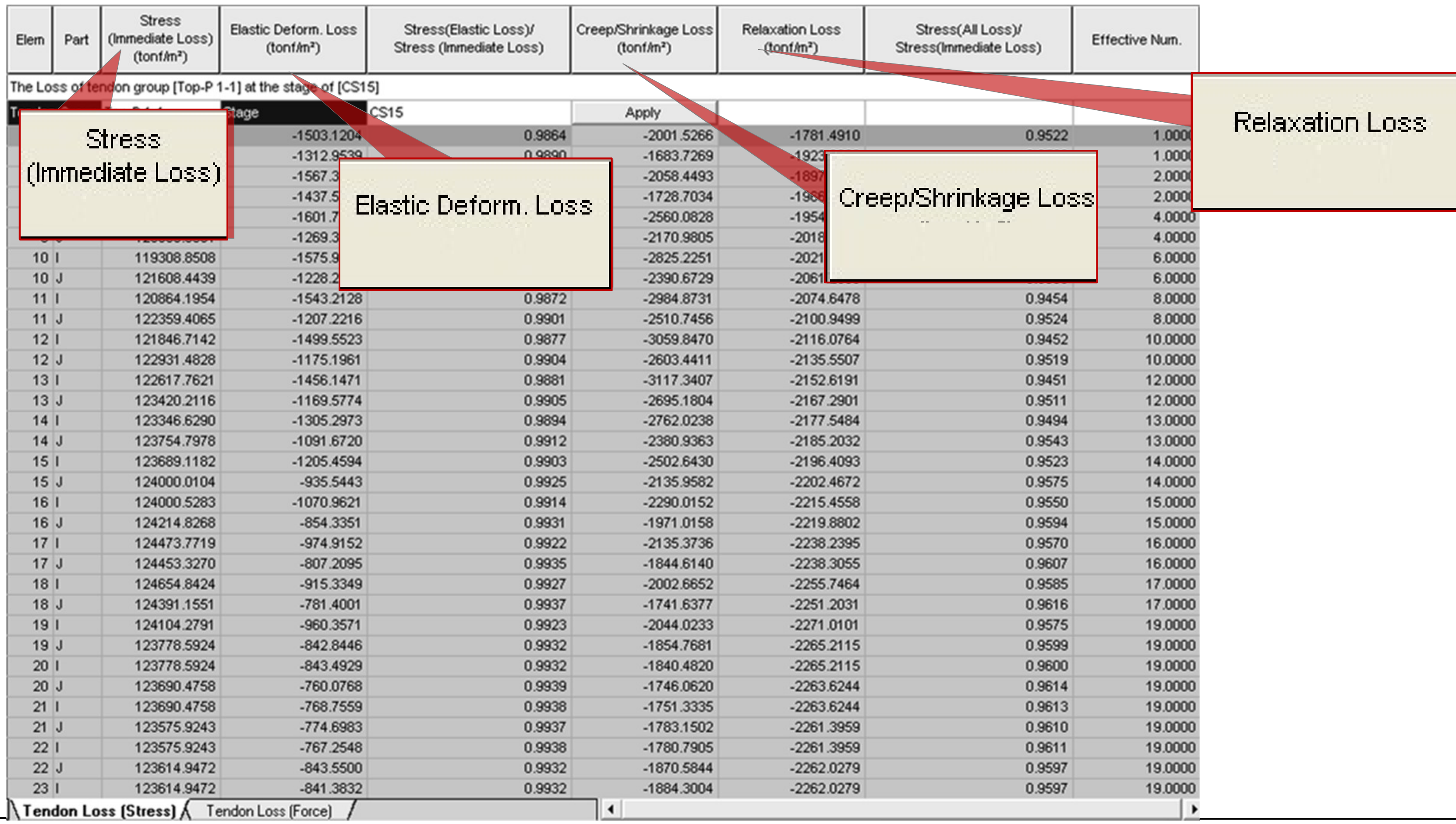
How Midas Civil will help you in Precise Analysis?

6. Initial Tangent Displacement to Erected Structures



How Midas Civil will help you in Precise Analysis?

7. Comprehensive Tendon Loss Table



The Loss of tendon group [Top-P 1-1] at the stage of [CS15]

Elem	Part	Stress (Immediate Loss) (tonf/m²)	Elastic Deform. Loss (tonf/m²)	Stress(Elastic Loss)/ Stress (Immediate Loss)	Creep/Shrinkage Loss (tonf/m²)	Relaxation Loss (tonf/m²)	Stress(All Loss)/ Stress(Immediate Loss)	Effective Num.
[illegible]	[illegible]	[illegible]	-1503.1204	0.9864	-2001.5266	-1781.4910	0.9522	1.000
[illegible]	[illegible]	[illegible]	-1312.9539	0.9890	-1683.7269	-1923	[illegible]	1.000
[illegible]	[illegible]	[illegible]	-1567.3	[illegible]	-2058.4493	-1897	[illegible]	2.000
[illegible]	[illegible]	[illegible]	-1437.5	[illegible]	-1728.7034	-1966	[illegible]	2.000
[illegible]	[illegible]	[illegible]	-1601.7	[illegible]	-2560.0828	-1954	[illegible]	4.0000
[illegible]	[illegible]	[illegible]	-1269.3	[illegible]	-2170.9805	-2018	[illegible]	4.0000
10	I	119308.8508	-1575.9	[illegible]	-2825.2251	-2021	[illegible]	6.0000
10	J	121608.4439	-1228.2	[illegible]	-2390.6729	-2061	[illegible]	6.0000
11	I	120864.1954	-1543.2128	0.9872	-2984.8731	-2074.6478	0.9454	8.0000
11	J	122359.4065	-1207.2216	0.9901	-2510.7456	-2100.9499	0.9524	8.0000
12	I	121846.7142	-1499.5523	0.9877	-3059.8470	-2116.0764	0.9452	10.0000
12	J	122931.4828	-1175.1961	0.9904	-2603.4411	-2135.5507	0.9519	10.0000
13	I	122617.7621	-1456.1471	0.9881	-3117.3407	-2152.6191	0.9451	12.0000
13	J	123420.2116	-1169.5774	0.9905	-2695.1804	-2167.2901	0.9511	12.0000
14	I	123346.6290	-1305.2973	0.9894	-2762.0238	-2177.5484	0.9494	13.0000
14	J	123754.7978	-1091.6720	0.9912	-2380.9363	-2185.2032	0.9543	13.0000
15	I	123689.1182	-1205.4594	0.9903	-2502.6430	-2196.4093	0.9523	14.0000
15	J	124000.0104	-935.5443	0.9925	-2135.9582	-2202.4672	0.9575	14.0000
16	I	124000.5283	-1070.9621	0.9914	-2290.0152	-2215.4558	0.9550	15.0000
16	J	124214.8268	-854.3351	0.9931	-1971.0158	-2219.8802	0.9594	15.0000
17	I	124473.7719	-974.9152	0.9922	-2135.3736	-2238.2395	0.9570	16.0000
17	J	124453.3270	-807.2095	0.9935	-1844.6140	-2238.3055	0.9607	16.0000
18	I	124654.8424	-915.3349	0.9927	-2002.6652	-2255.7464	0.9585	17.0000
18	J	124391.1551	-781.4001	0.9937	-1741.6377	-2251.2031	0.9616	17.0000
19	I	124104.2791	-960.3571	0.9923	-2044.0233	-2271.0101	0.9575	19.0000
19	J	123778.5924	-842.8446	0.9932	-1854.7681	-2265.2115	0.9599	19.0000
20	I	123778.5924	-843.4929	0.9932	-1840.4820	-2265.2115	0.9600	19.0000
20	J	123690.4758	-760.0768	0.9939	-1746.0620	-2263.6244	0.9614	19.0000
21	I	123690.4758	-768.7559	0.9938	-1751.3335	-2263.6244	0.9613	19.0000
21	J	123575.9243	-774.6983	0.9937	-1783.1502	-2261.3959	0.9610	19.0000
22	I	123575.9243	-767.2548	0.9938	-1780.7905	-2261.3959	0.9611	19.0000
22	J	123614.9472	-843.5500	0.9932	-1870.5844	-2262.0279	0.9597	19.0000
23	I	123614.9472	-841.3832	0.9932	-1884.3004	-2262.0279	0.9597	19.0000

2016 MIDAS Complex Bridge Test Drive Event

Thank You

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