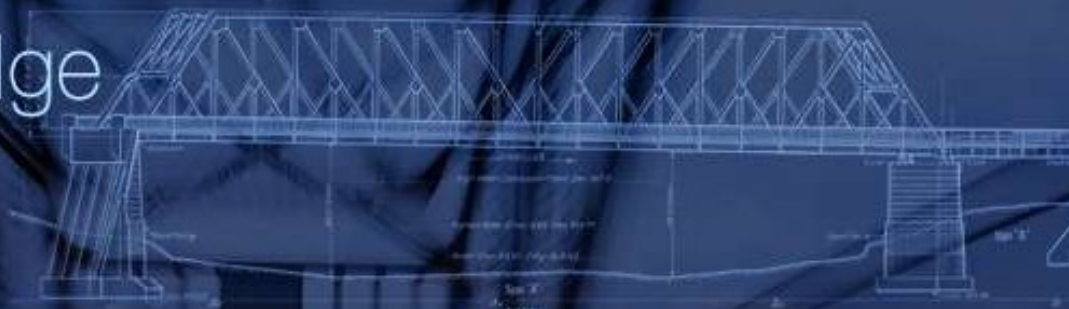
2016 MIDAS Complex Bridge Test Drive Event

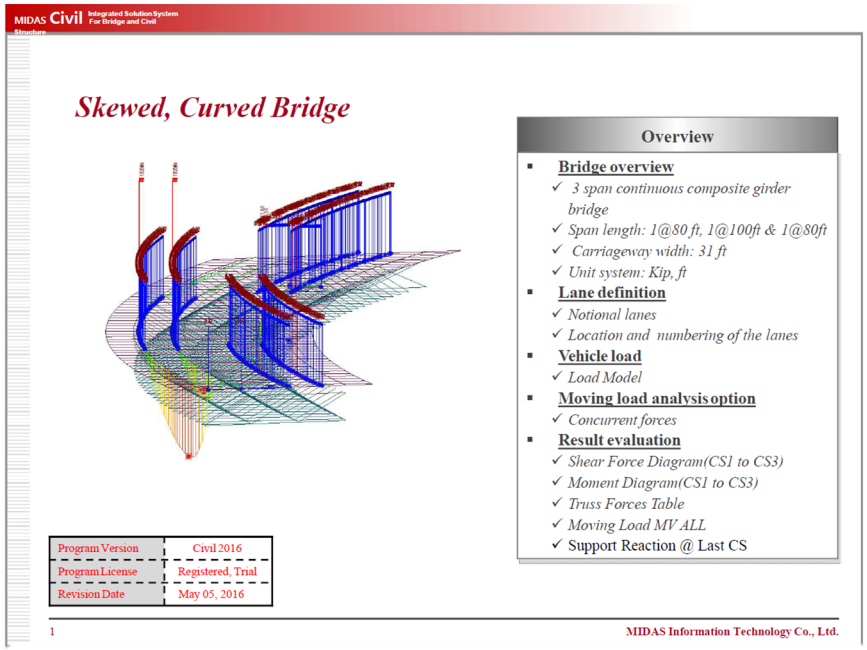


Lucas Park(CAE Consultant)
E mail: Lucaspark@midasit.com

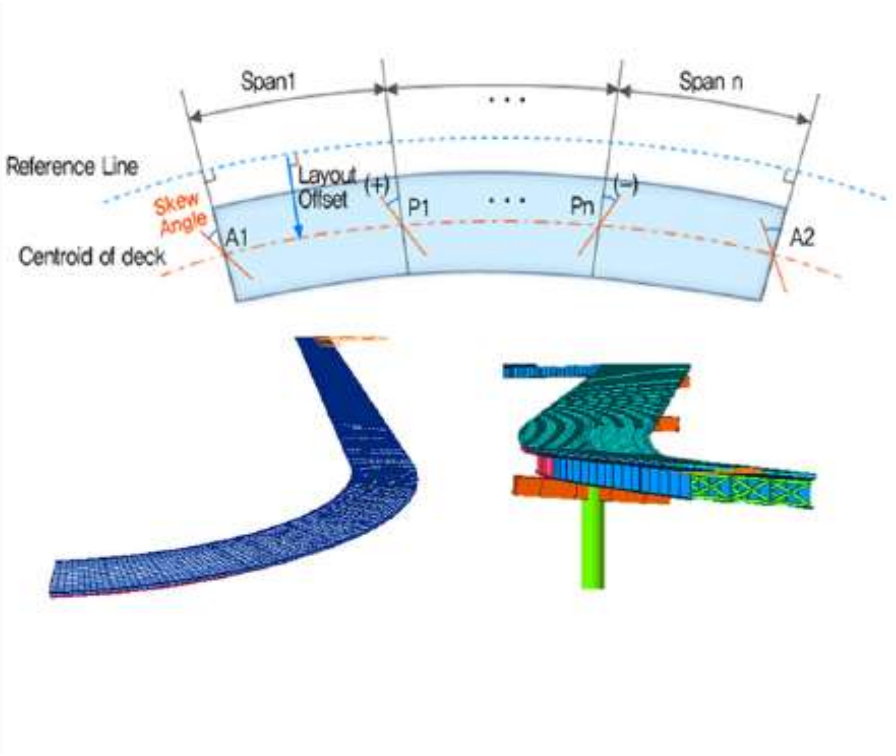
May.09	**Steel Composite Bridge Analysis & Design** - Different Modeling Methods - Modifying a model from Wizard - Analysis / Design
May.11	**Cable Stayed Bridge Analysis** - Modeling through Wizard/Modification - Auto-adjusting Cable Pretension forces - Construction Stages
May.12	**Suspension Bridge Analysis** - Modeling through Wizard/Modification - Auto calculation of tensions in main Cables and Coordinates - Steel column design of irregular sections

Steel Composite Test Drive Event 05/16/2015

- **Tutorial Based Modeling**



- **Multi-Curve Option Explanation**



About MIDAS

Company Size

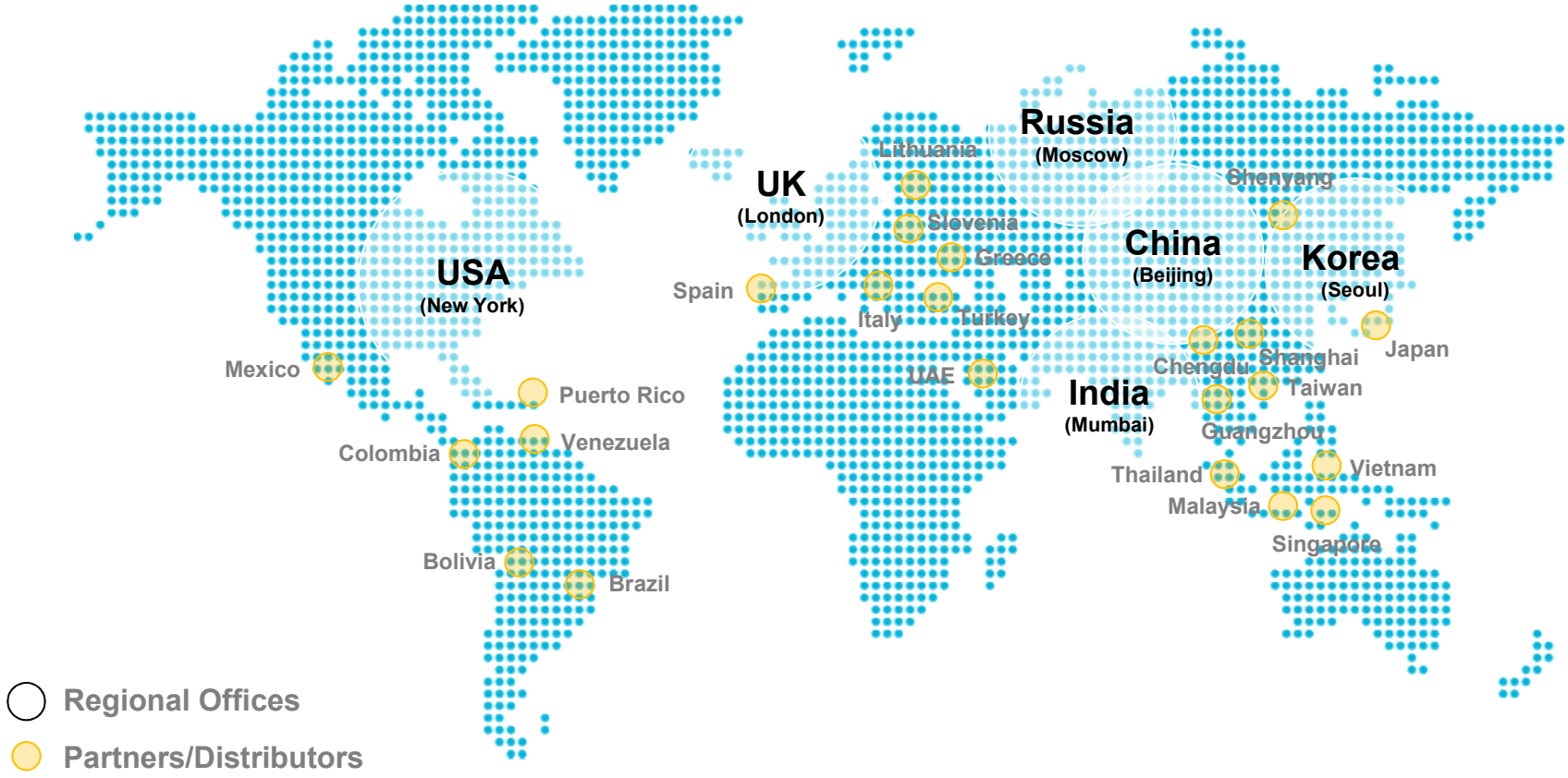
540

Engineers

Established

1989

World wide existence



8
Branch Offices

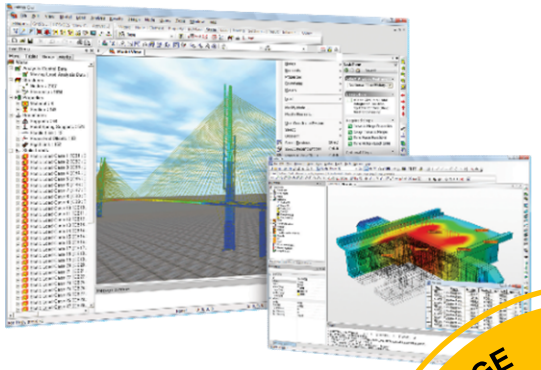
100,000
Number of Licenses

"Biggest CAE Software Developer"in Civil Engineering

Bridge

midas Civil
Integrated Solution System for Bridge and Civil Structures

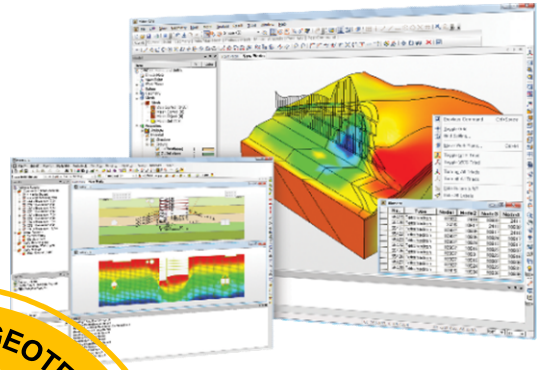
midas FEA
Advanced Nonlinear and Detailed Analysis System

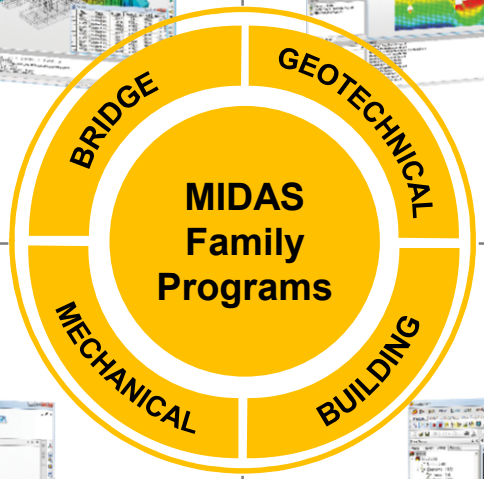


Geotechnical

GTS NX
GeoTechnical analysis System

SoilWorks
Geotechnical Solutions for practical Design

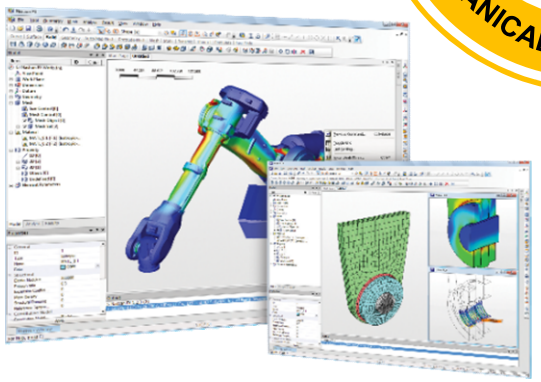




Mechanical

midas NFX
Total Solutions for Mechanical Engineering in structural Mechanics and CFD

midas FX+
General Pre & Post Processor for Finite Element Analysis

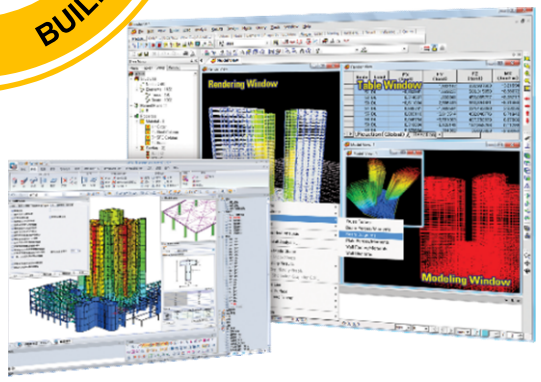


Building

midas Gen
Integrated System for building and General Structures

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

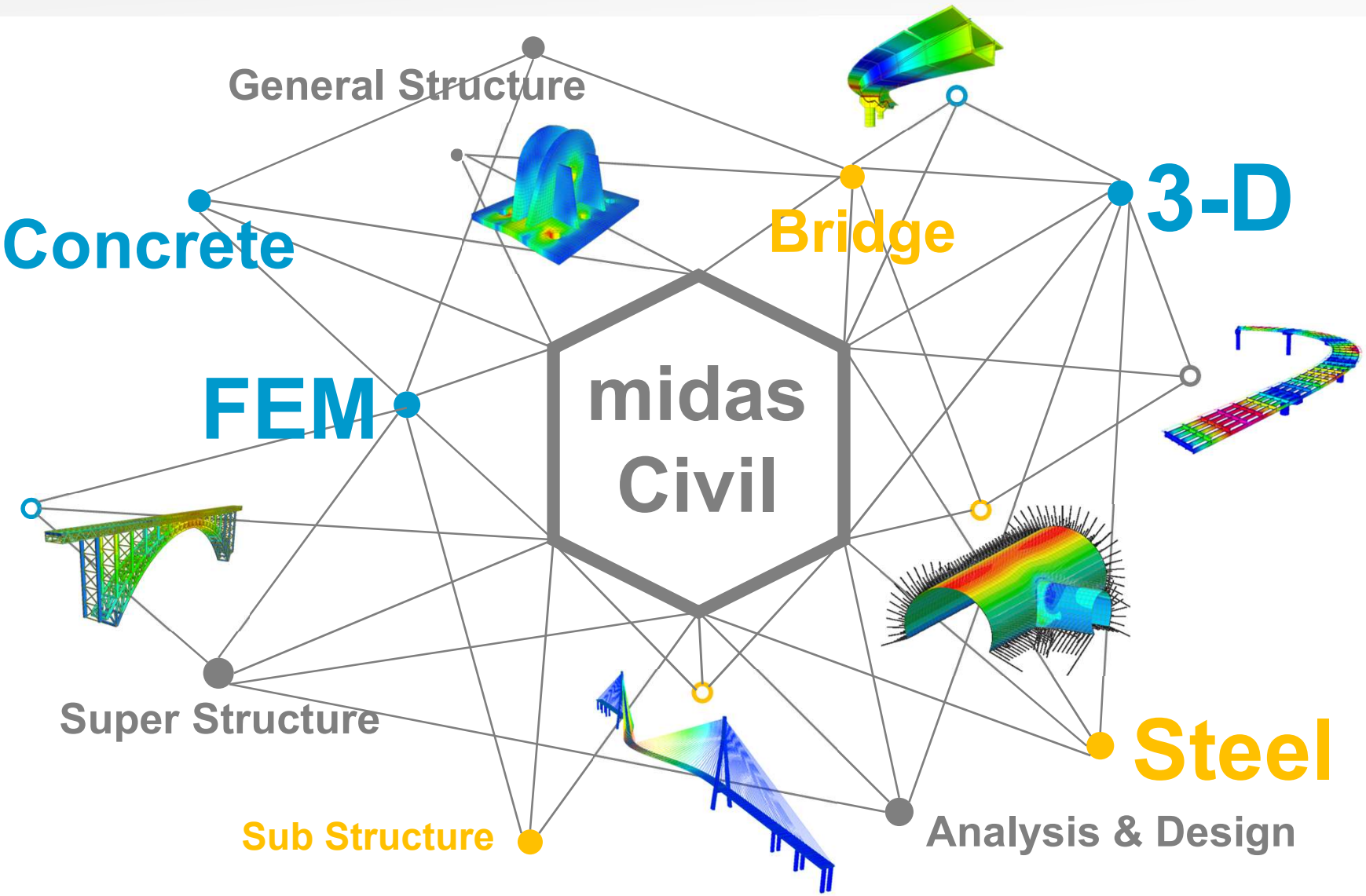
midas Design+
Structural engineer's tools



USERS Across North America (partial list)


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

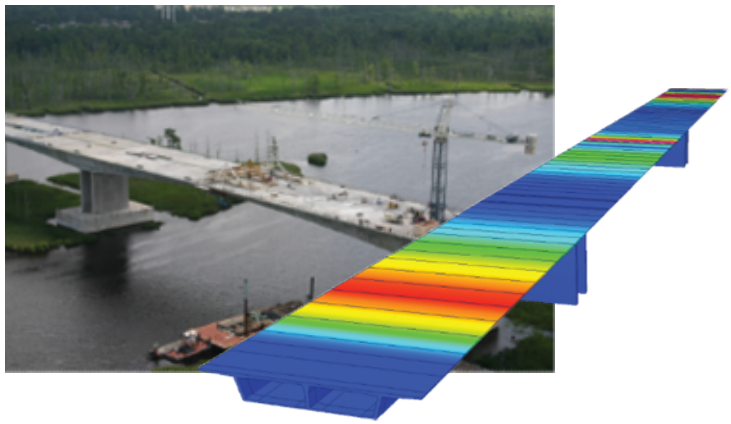

Cable Stayed Bridge


Extra-doesd Bridge

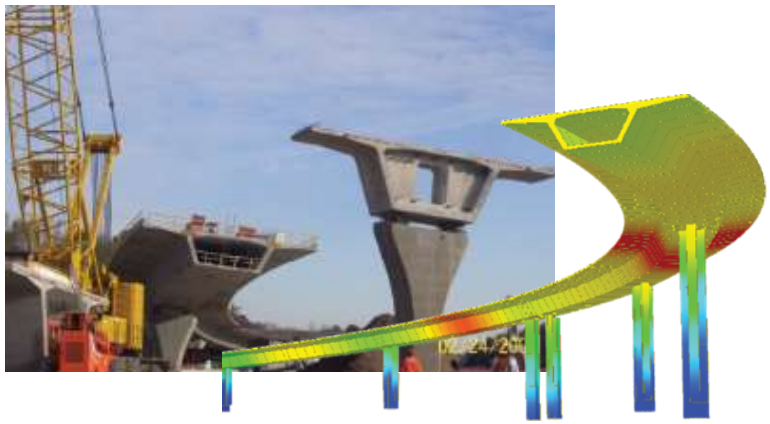

Suspension Bridge

Few project examples - USA

US 17 Wilmington By Pass in USA

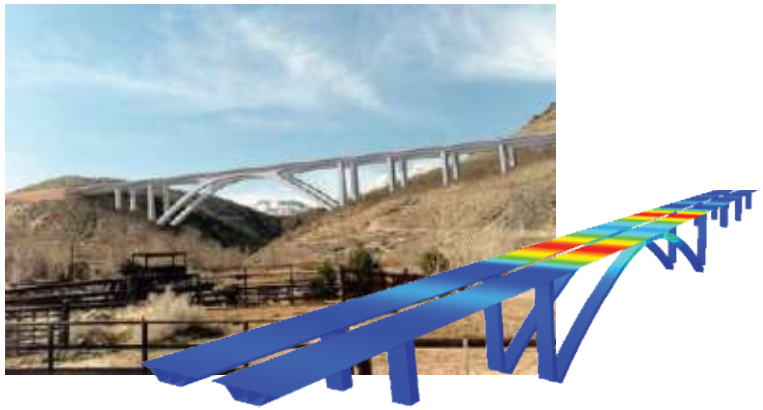


Lee Roy Selmon Flyovers in FL USA



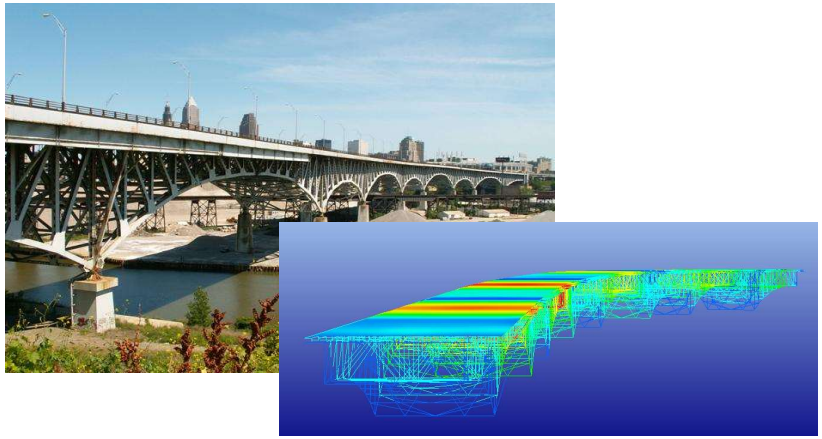
Port Access Bridge, Alaska

Galena Creek bridge in NV USA

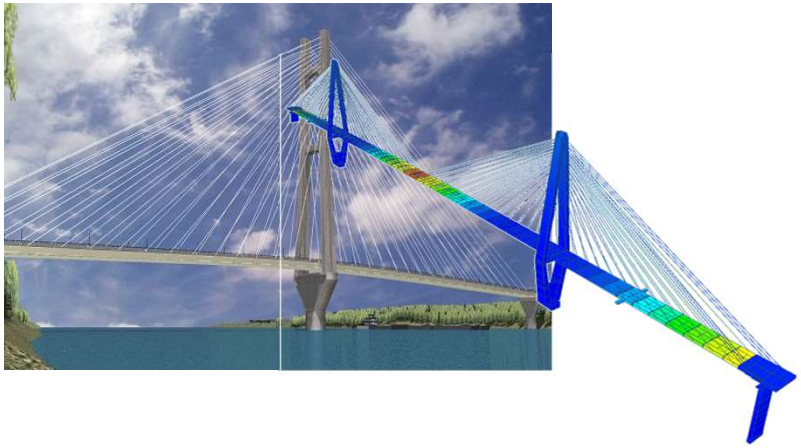


Few project examples - USA

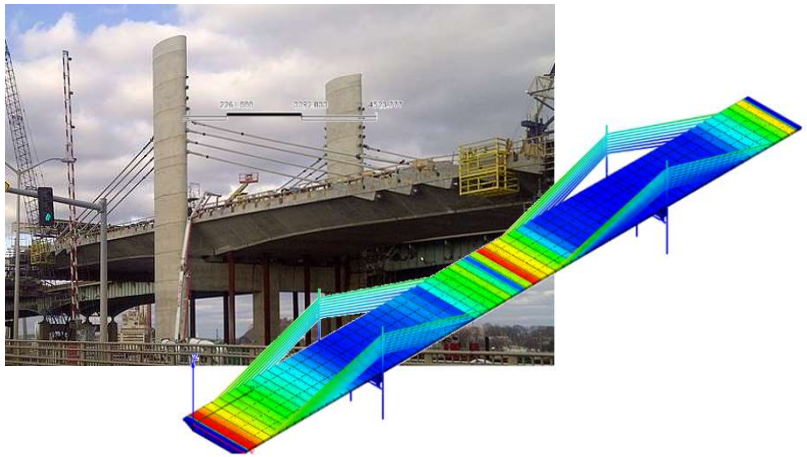
Innerbelt Bridge in Cleveland OH



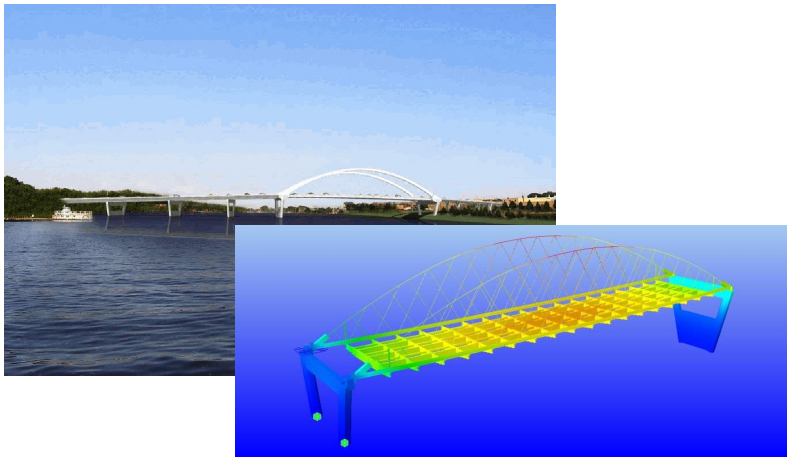
Ironton-Russell Bridge



Pearl Harbor Memorial Bridge



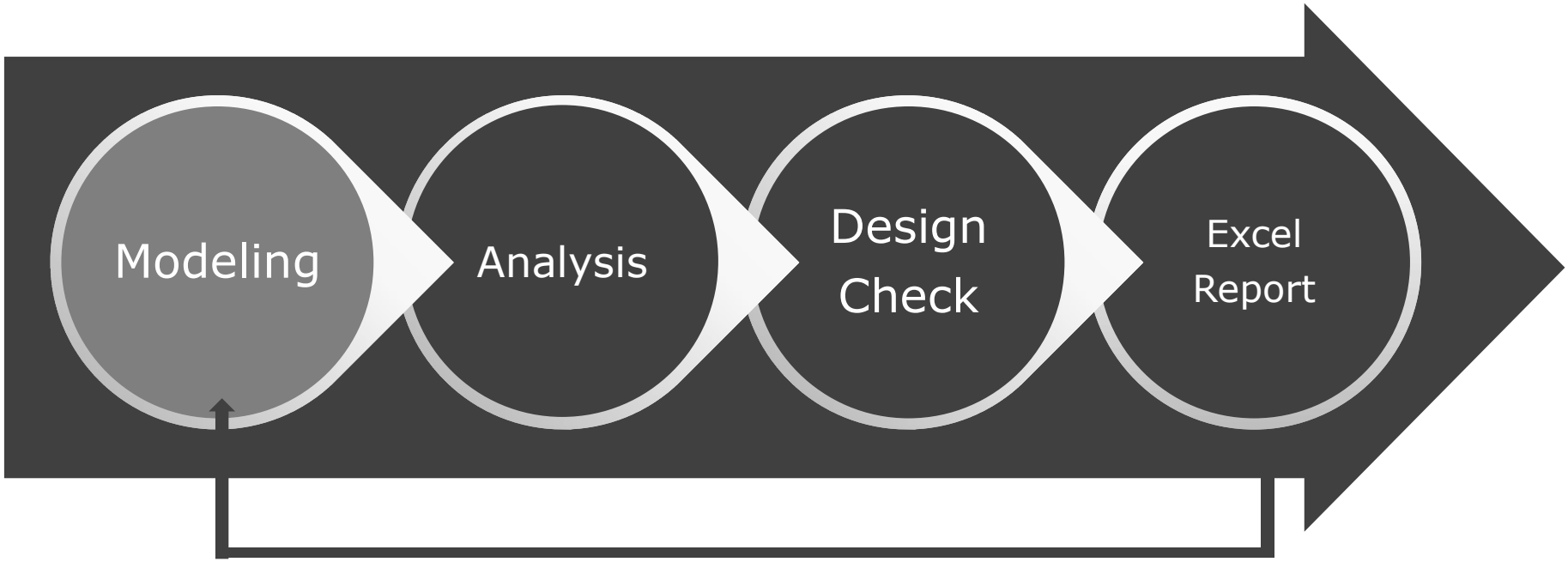
Hastings Bridge



Overview

- Modeling Part
  - Wizard Part
  - Auto CAD
  - Generate different modeling types
- Analysis
  - Review Result Value
    - Moment/Shear/Stress/Deflection/Reaction
- Design Check Parameter
- Excel Report

Demonstration



- Wizard
- Node & Element
- Drawing Program
- Modeling Type
  - Plate Element
  - Frame Element

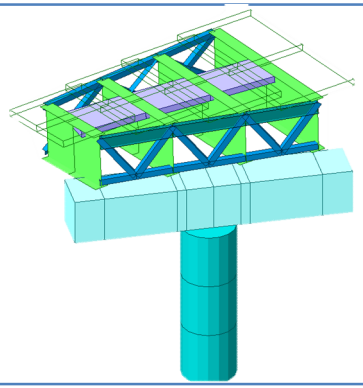
- Static Load Analysis
- Moving Load Analysis

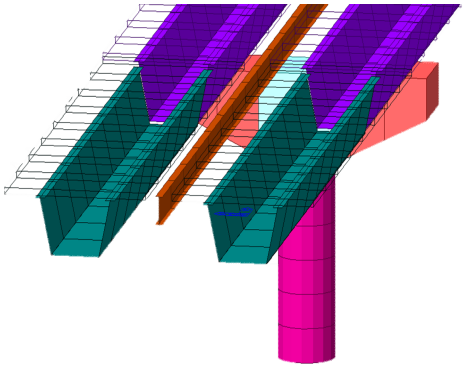
- Flexure Strength
- Shear
- Constructability
- Servicablity

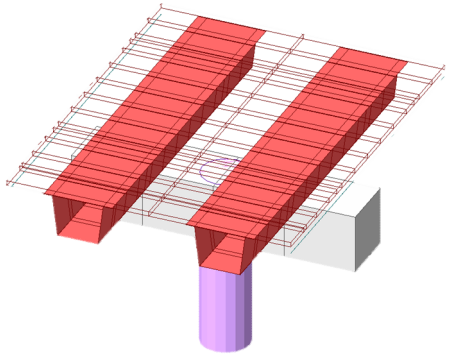
- Auto-Generation

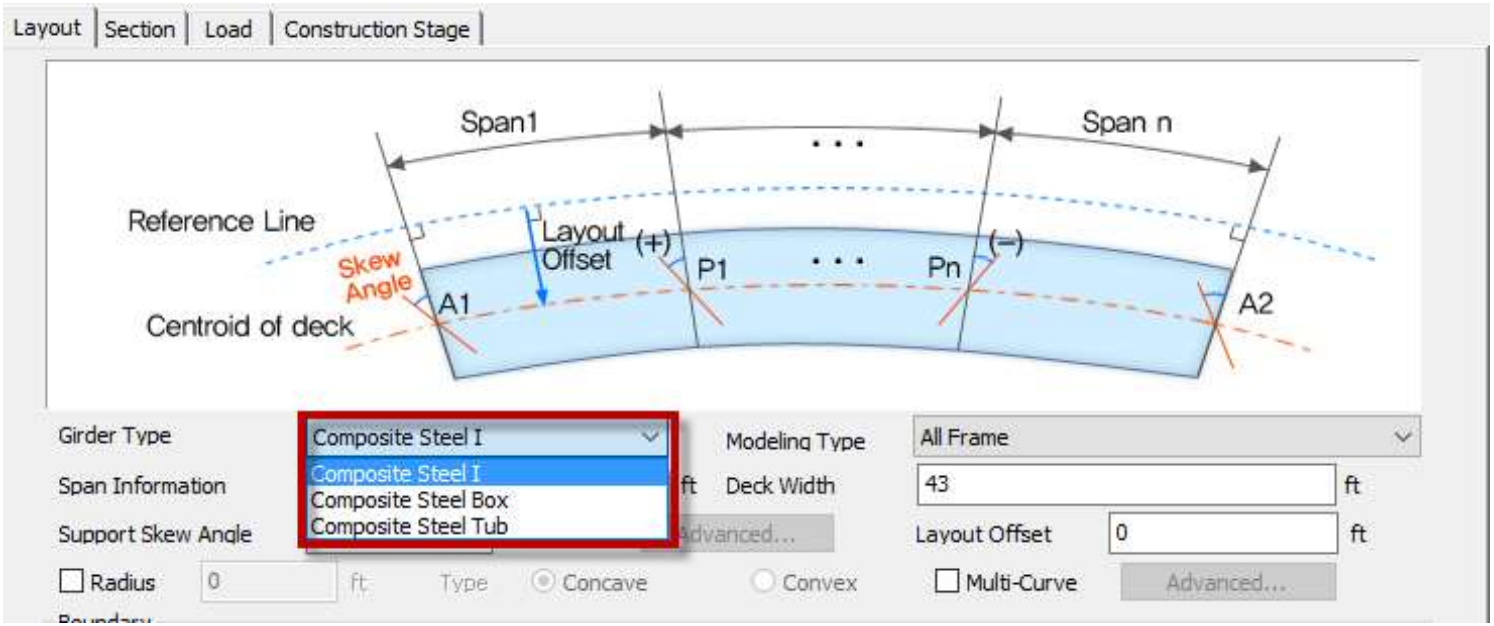
All Types of Steel Girder

Steel-I Girder	Steel-Tub Girder	Steel-Box Girder

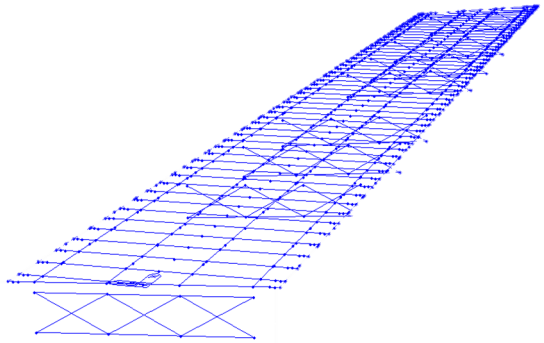
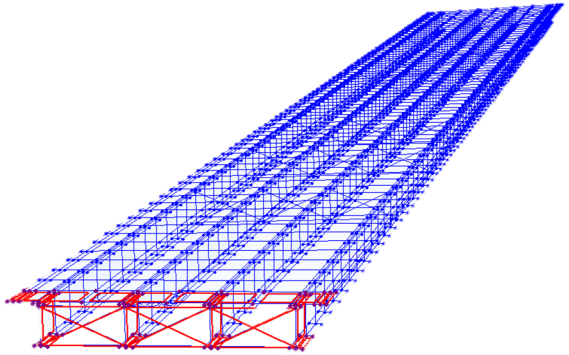
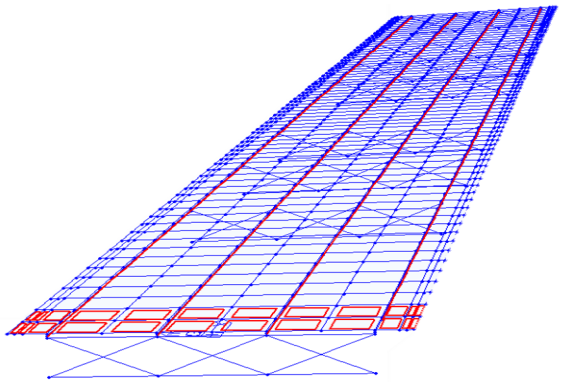


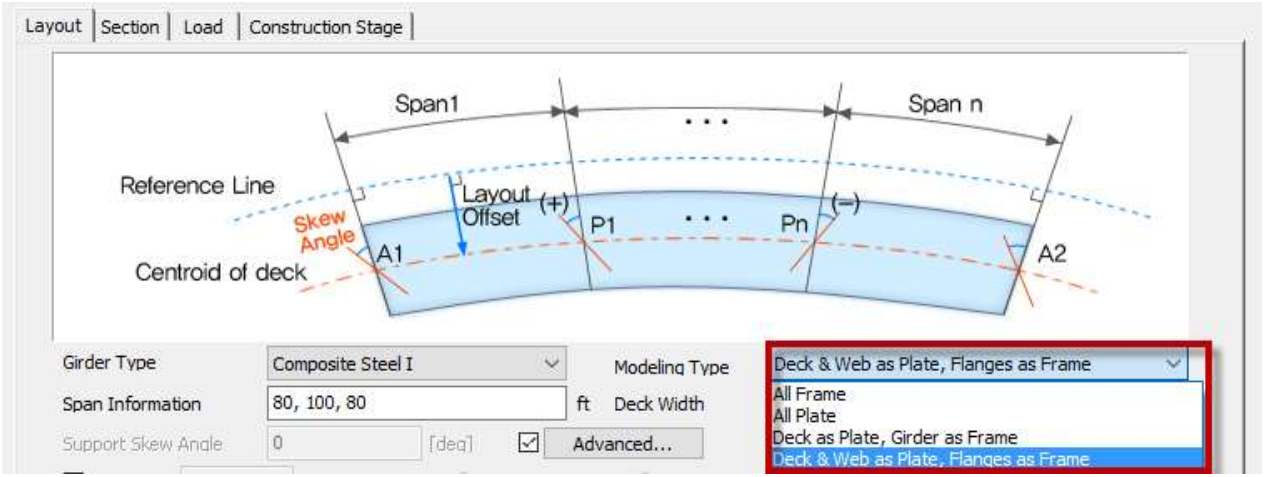




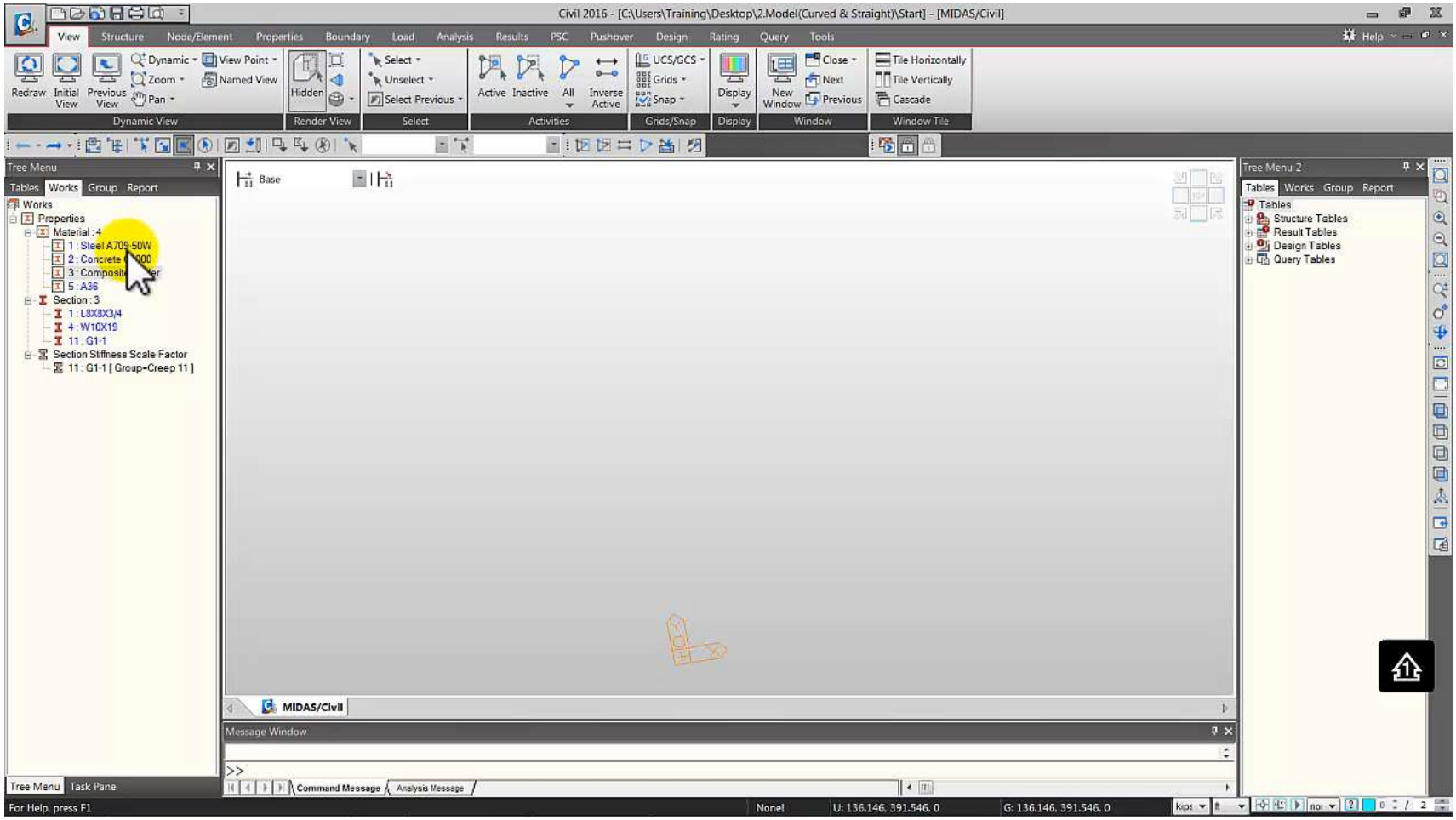


All Modeling Type

All Frame	All Plate	Deck as Plate & Girder as Frame
		

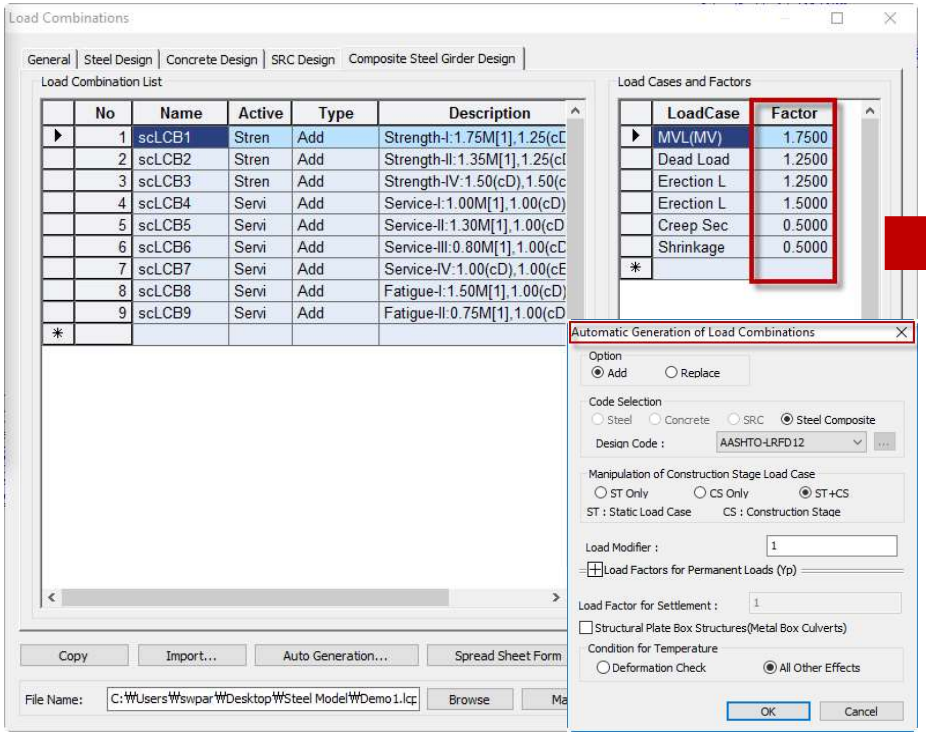


Drawing Program Import/Export

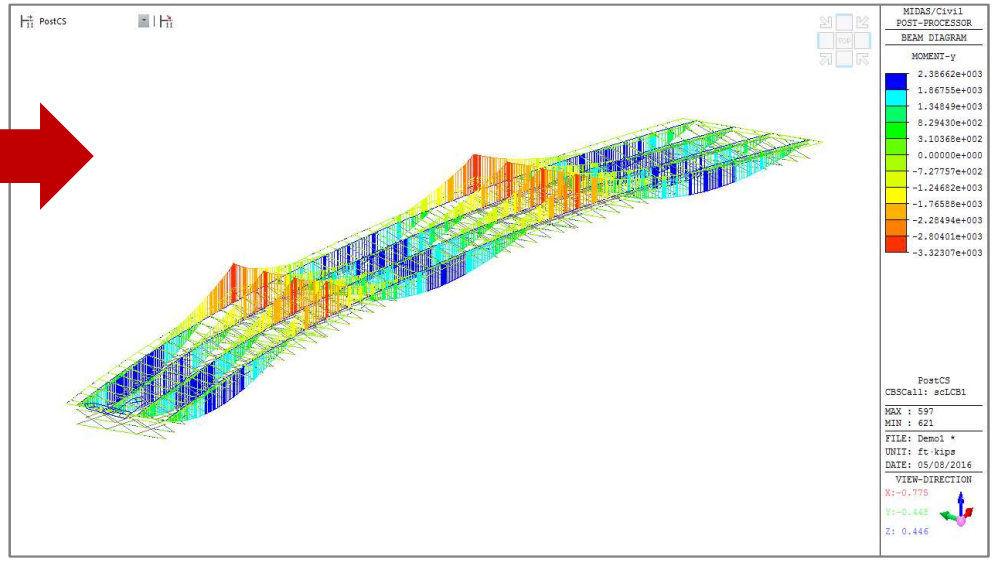


Load Combination(Envelope)

Auto-Generation



Moment/Shear Values(Envelope)

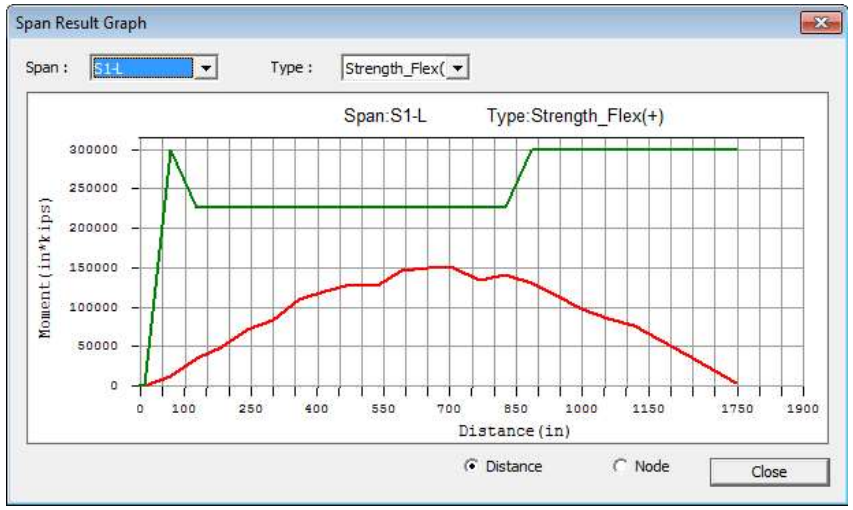


Design Check Output

Table Format

Span	Positive/ Negative	Strength Limit(Flexure)				
		Elem	part	Lcom	Mu/Mr	CHK
S1-L	Pos	107	I[117]	scLCB1	0.66	OK
S1-R	Pos	386	I[296]	scLCB1	0.40	OK
S2-L	Pos	93	I[104]	scLCB1	0.49	OK
S2-R	Pos	32	I[47]	scLCB1	0.34	OK
S3-L	Pos	417	I[327]	scLCB1	0.32	OK
S3-R	Pos	360	J[35]	scLCB1	0.24	OK
S4-L	Pos	404	I[314]	scLCB1	0.15	OK
S4-R	Pos	347	I[257]	scLCB1	0.15	OK

Graph Format



Automatic Excel Report Format

II. Strength Limit State - Flexural Resistance

1. Flexure

■ Positive moment

- Flange Lateral bending Stress (AASHTO LRFD Bridge, 2012, 6.10.1.6)

Because of discretely braced tension fla (for curved bridge)

$$f_l = \frac{M_u}{S_l} = \frac{M_w}{t_{ft}(b_{ft})^2/6} = \frac{545.359}{108.000} = 5.050 \text{ ksi}$$

List of Design Check

Required Design Parameter

- **Check Strength Limit State**
- **Check Service Limit State**
- **Check Fatigue Limit State**
- **Check Constructability**
- **Check Shear Connector**
- **Check Longitudinal Stiffener**

II. Strength Limit State - Flexural Resistance

1. Flexure

■ **Positive moment**

1) Design Forces and Stresses

Loadcombination Name: scLCB1

Loadcombination Type: FX-MAX

Component		M_u (kips-in) Steel (M_{D1})	Long-term (M_{D2})	Short-term	Sum	V_u (kips)	T (kips-in)
Forces	(+)	14920.812	6476.404	21800.744	43197.960	-45.905	433.787

Component		$f_{c,t}$ (ksi) Steel (M_{D1})	Long-term (M_{D2})	Short-term	Sum
Stresses	Top	-5.698	-1.029	-1.384	-8.111
	Bot	5.281	1.960	6.112	13.353

2) Cross-section Proportions

① Web Proportions (AASHTO LRFD Bridge, 2012, 6.10.2.1)

$\frac{D}{t_w} = 138.000 \le 150$ ..... OK

② Flange Proportions (AASHTO LRFD Bridge, 2012, 6.10.2.2)

$\frac{b_f}{2t_w} = 4.500 \le 12$ ..... OK

$b_f = 16.000 \ge D/6 = 11.500$ ..... OK

$t_f = 2.000 \ge 1.1t_w = 0.550$ ..... OK

$I_{yc} = \frac{t_{fc} \cdot b_{fc}^3}{12} = 682.663\ in^4$

$I_{yt} = \frac{t_{ft} \cdot b_{ft}^3}{12} = 972.002\ in^4$

$0.1 \le \frac{I_{yc}}{I_{yt}} = 0.702 \le 10.0$ ..... OK

3) Flexural Strength Limit State in positive flexure

▪ Section Classification (AASHTO LRFD Bridge, 2012, 6.10.6.2)

$\min(F_{yc}, F_{yt}) = 50.000\ ksi \le 70.0\ ksi$ ..... OK

$\frac{D}{t_w} = 138.000 \le 150$ ..... OK

$\frac{2 \cdot D_{cp}}{t_w} = 0.000 \le 3.76\sqrt{\frac{E_s}{F_{yc}}} = 90.553$ ..... OK

in which :

$D_{cp} = 0.000$ in

∴ Compact section.

Lucas Park(CAE Consultant)
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