

UPDATES WITH CIVIL NX

A 3D architectural rendering of a building structure, possibly a bridge or a large industrial facility, is shown in the background. The structure features a grid of light blue and orange beams, with white rectangular panels forming the walls and floor. The perspective is from an elevated angle, looking down at the structure.

Manoj Kheterpal

Technical/ Business Development Manager
(UK/IE Region)
MIDAS IT UK



CONTENTS

01 Introduction to MIDAS

02 Why Civil NX?

03 Updates with v2.1 and v2.2

04 Updates with Highway and Rail Bridge Assessments

05 Updates with APIs Features

06 Updates with Solver

MIDAS GLOBAL NETWORK

"Through MIDAS, South Korea's design technology is reaching out to the world."

20

Overseas Branches

1000

Employees

110

Countries



MIDAS CHINA



MIDAS JAPAN



MIDAS UK



MIDAS RUSSIA



MIDAS USA



MIDAS INDIA



MIDAS COLOMBIA



MIDAS PHILIPPINES



MIDAS MEXICO



MIDAS POLAND



MIDAS THAILAND



MIDAS AUSTRALIA



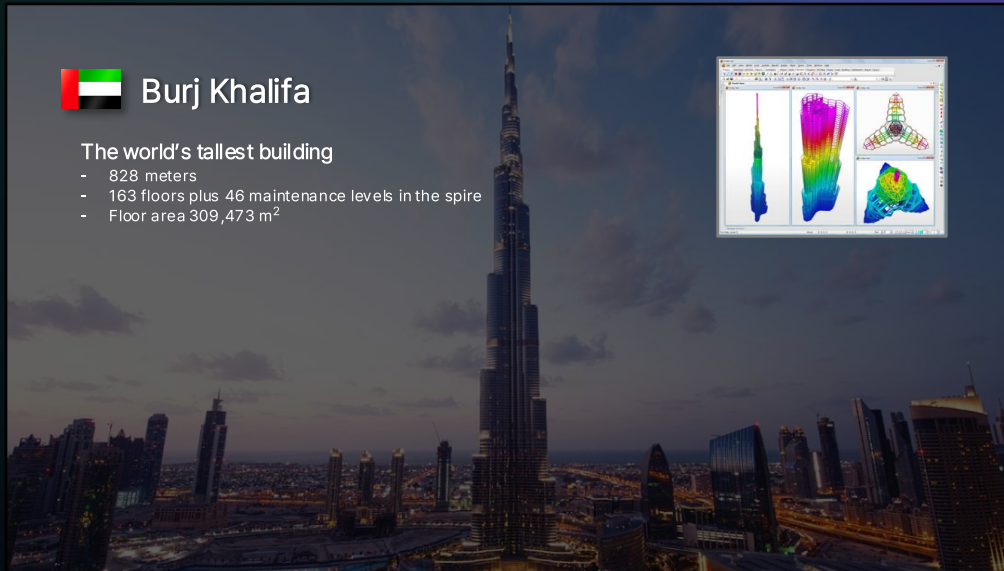
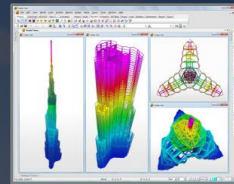
MIDAS MALAYSIA



Burj Khalifa

The world's tallest building

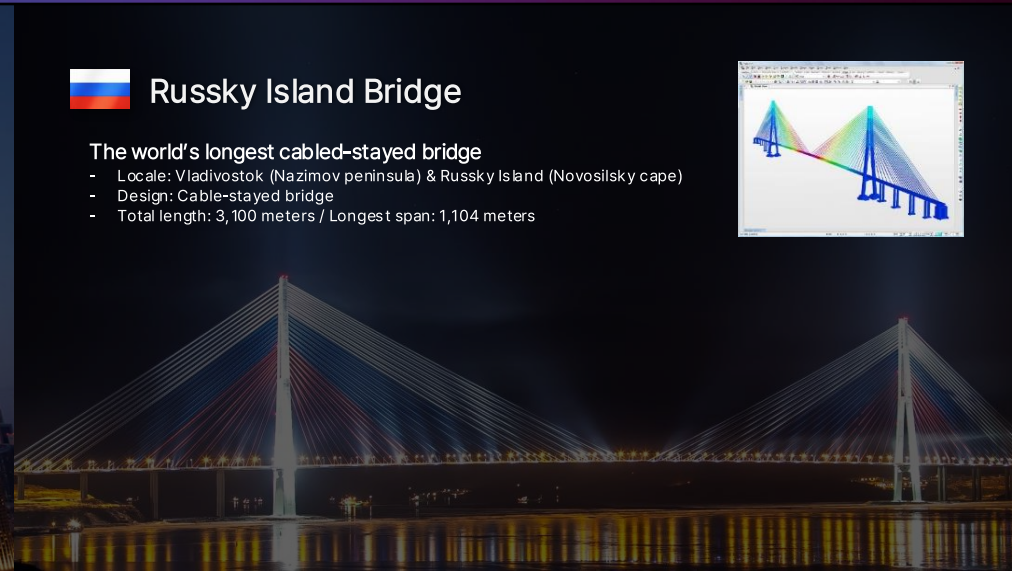
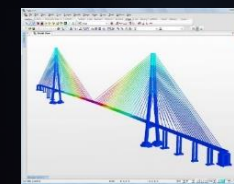
- 828 meters
- 163 floors plus 46 maintenance levels in the spire
- Floor area 309,473 m²



Russky Island Bridge

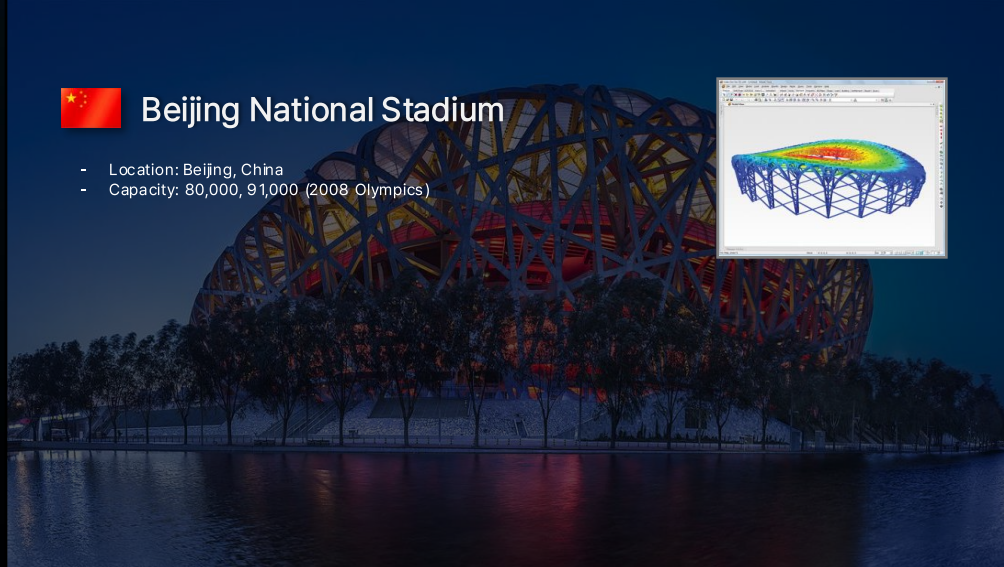
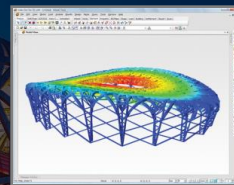
The world's longest cable-stayed bridge

- Locale: Vladivostok (Nazimov peninsula) & Russky Island (Novosilsky cape)
- Design: Cable-stayed bridge
- Total length: 3,100 meters / Longest span: 1,104 meters



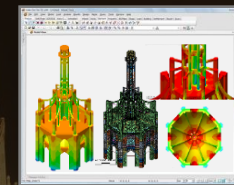
Beijing National Stadium

- Location: Beijing, China
- Capacity: 80,000, 91,000 (2008 Olympics)



Duomo Di Milano

- Location: Milan, Italy
- Capacity: 40,000 width 92 meters

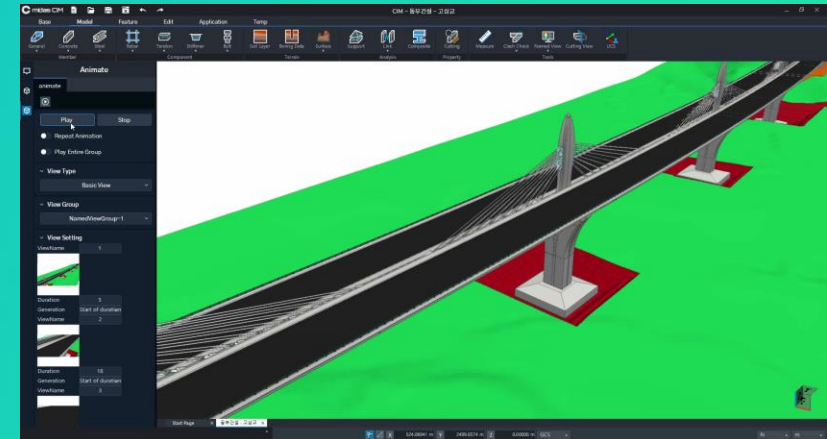
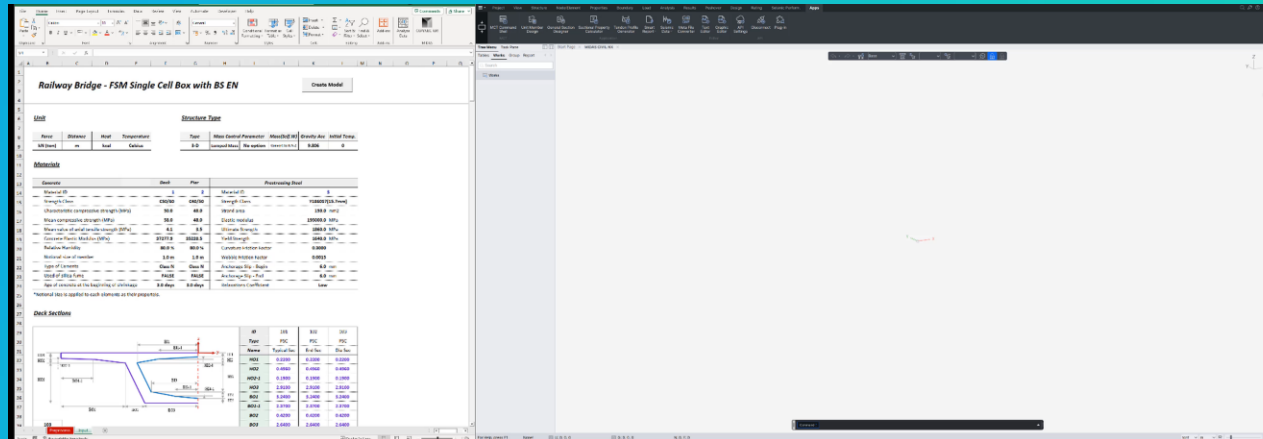


EMPOWERING ENGINEERS ACROSS WORLD

- **Enhancing Skills Through Direct Engagement**
Regular and on-demand visits to provide hands-on product training.
- **Boosting Technical Expertise and Global Competitiveness**
Dedicated to improving the skills and global standing of Southeast Asian engineers.



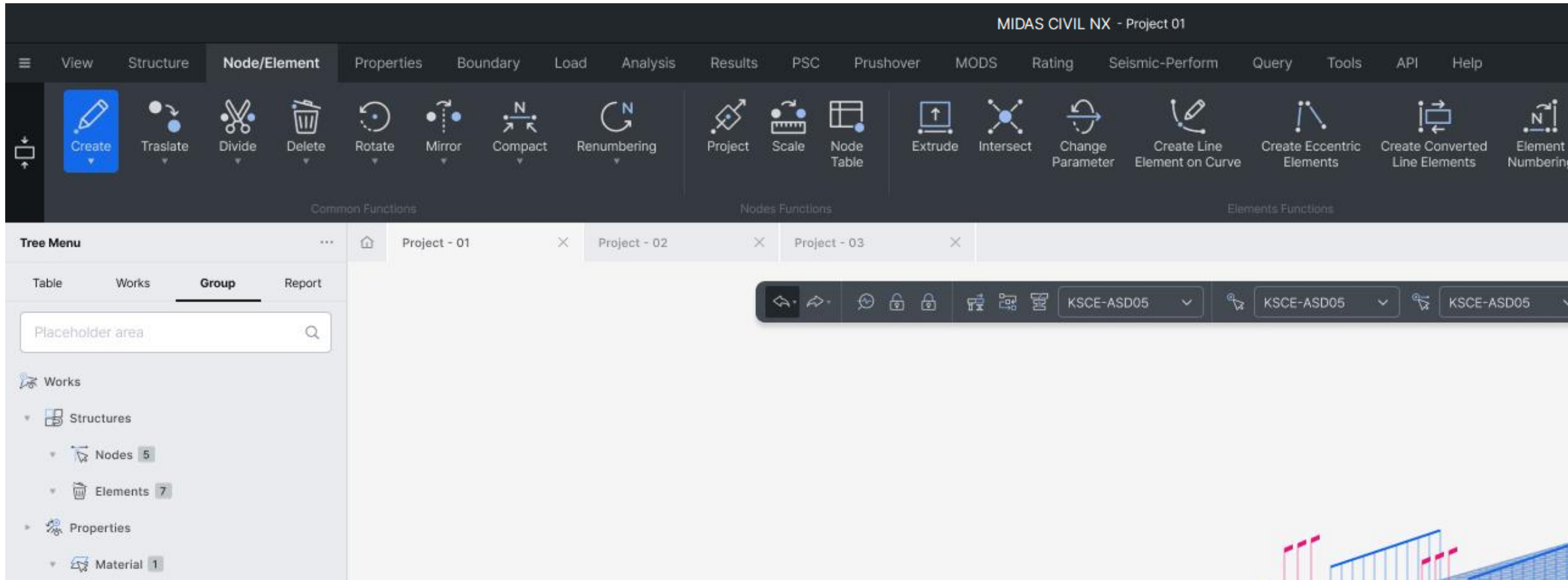
We focus on **PRACTICALITY** for civil engineers

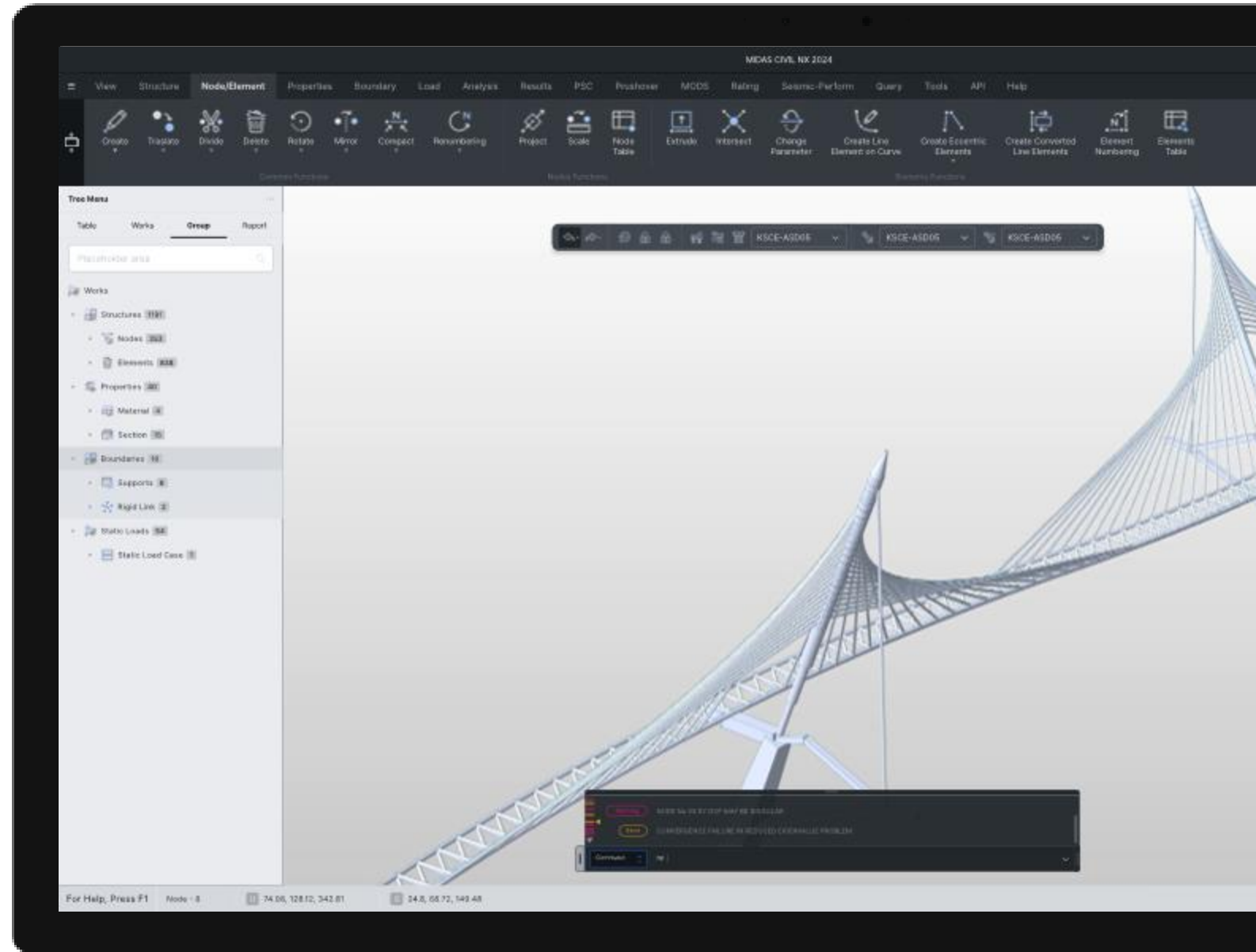


Why MIDAS CIVIL NX?

No more hide-and-seek with the icons.

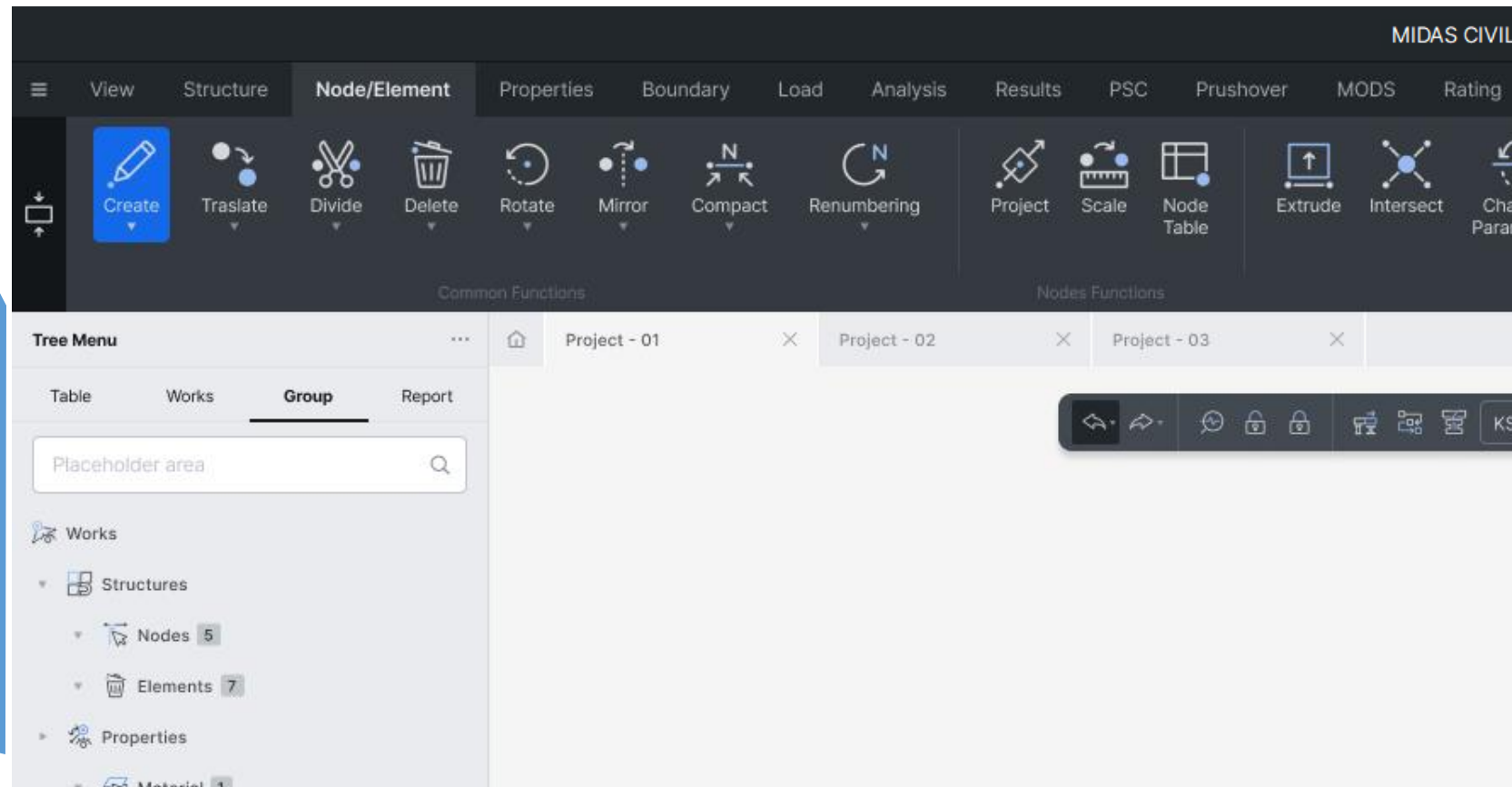
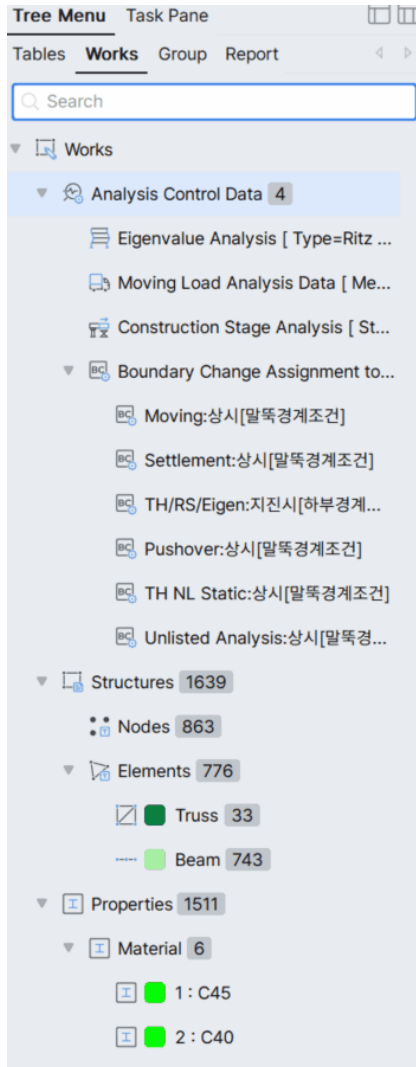
CIVIL NX has updated its design features, introducing a user interface for easier design workflows.
Explore the new changes firsthand.

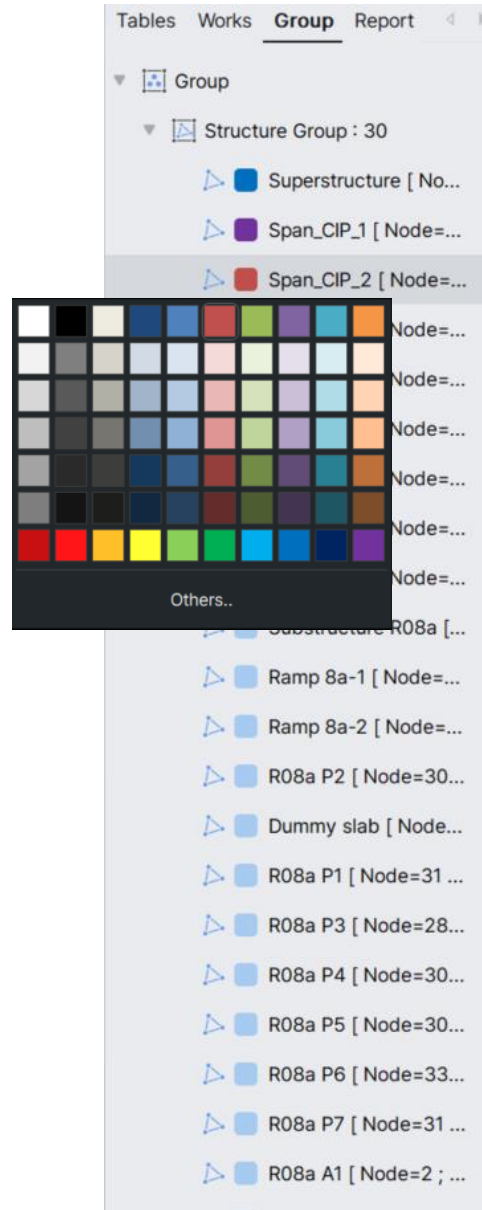
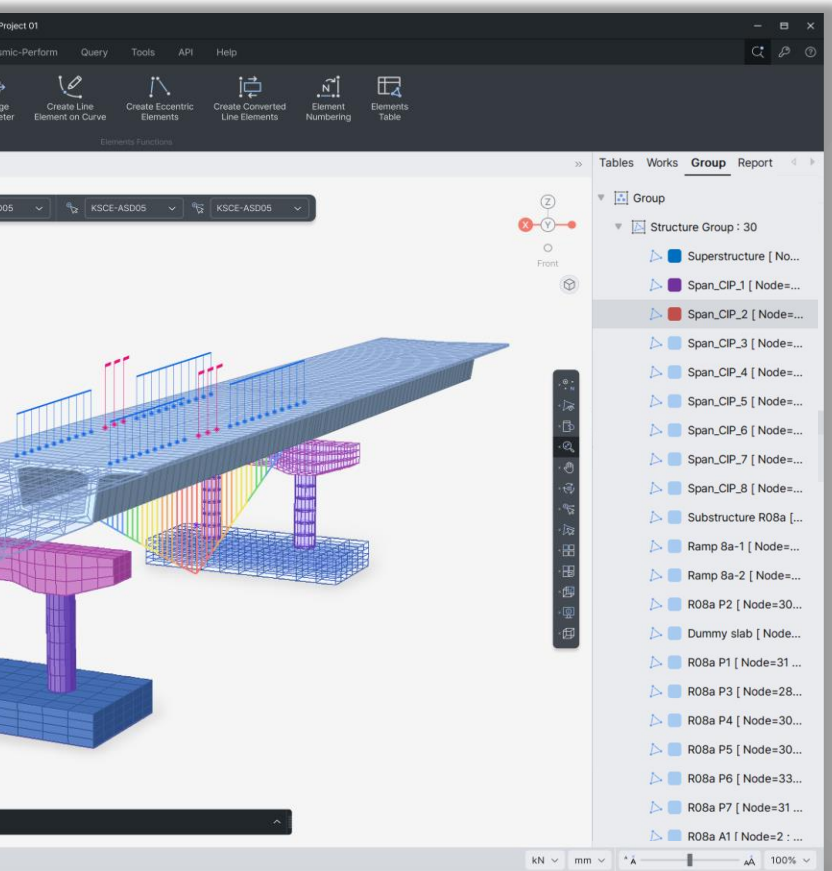




In one quick look.

Tree menu in CIVIL NX allows users to quickly view all the model applications at a glance. Additionally, it features a search function for efficient navigation and review.





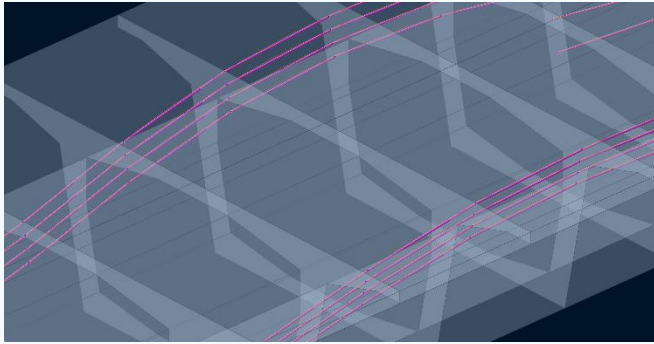
Colors Everywhere

User can assign custom colors to elements and categorize them into groups. Apply colors according to the construction phase or structure type for intuitive visualization.

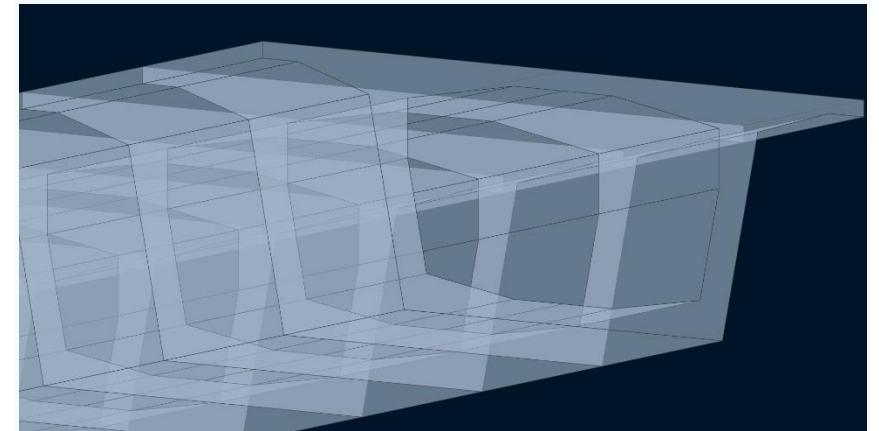
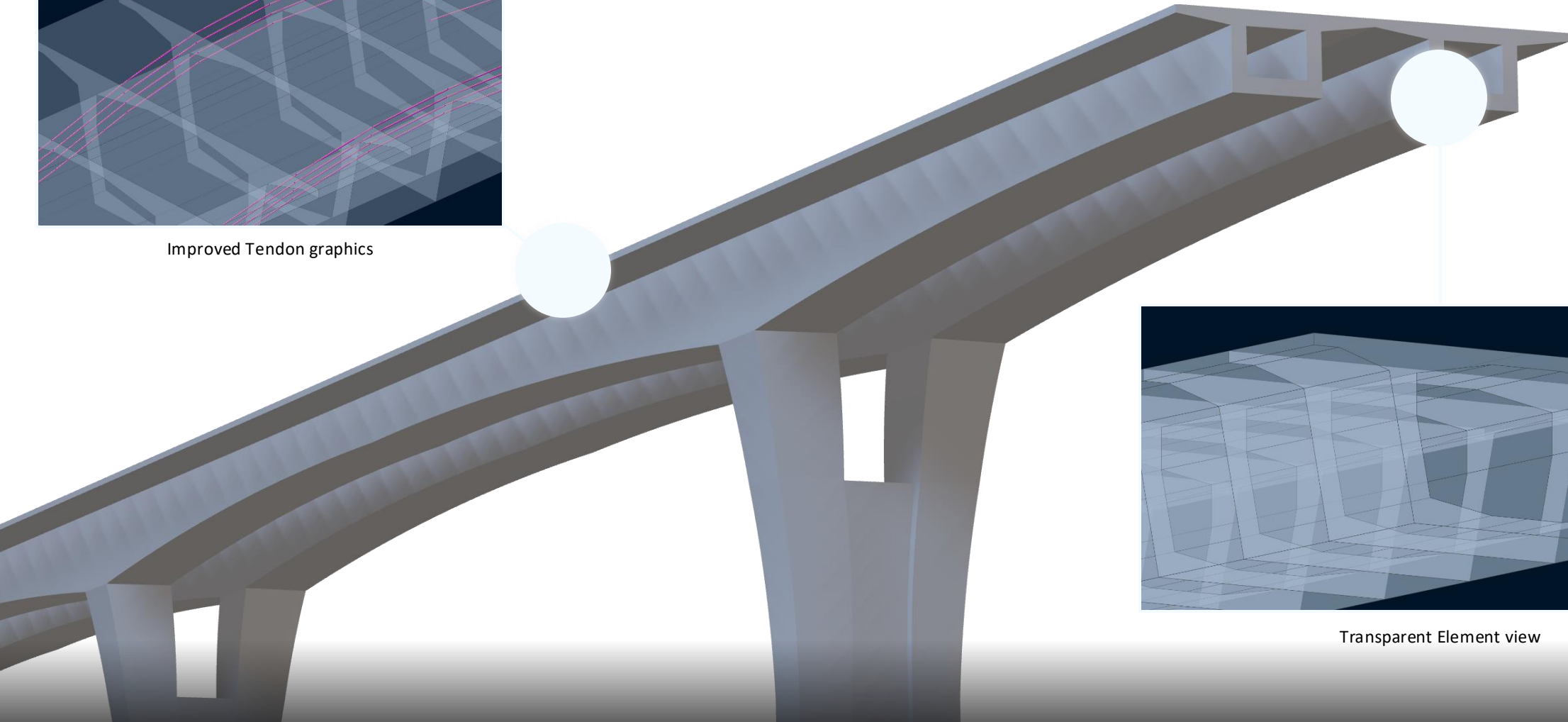
Improved Visibility.

CIVIL NX has significantly improved the visibility of the model.

With transparent elements and high-resolution tendon images, users can accurately visualize the shape of the structure.



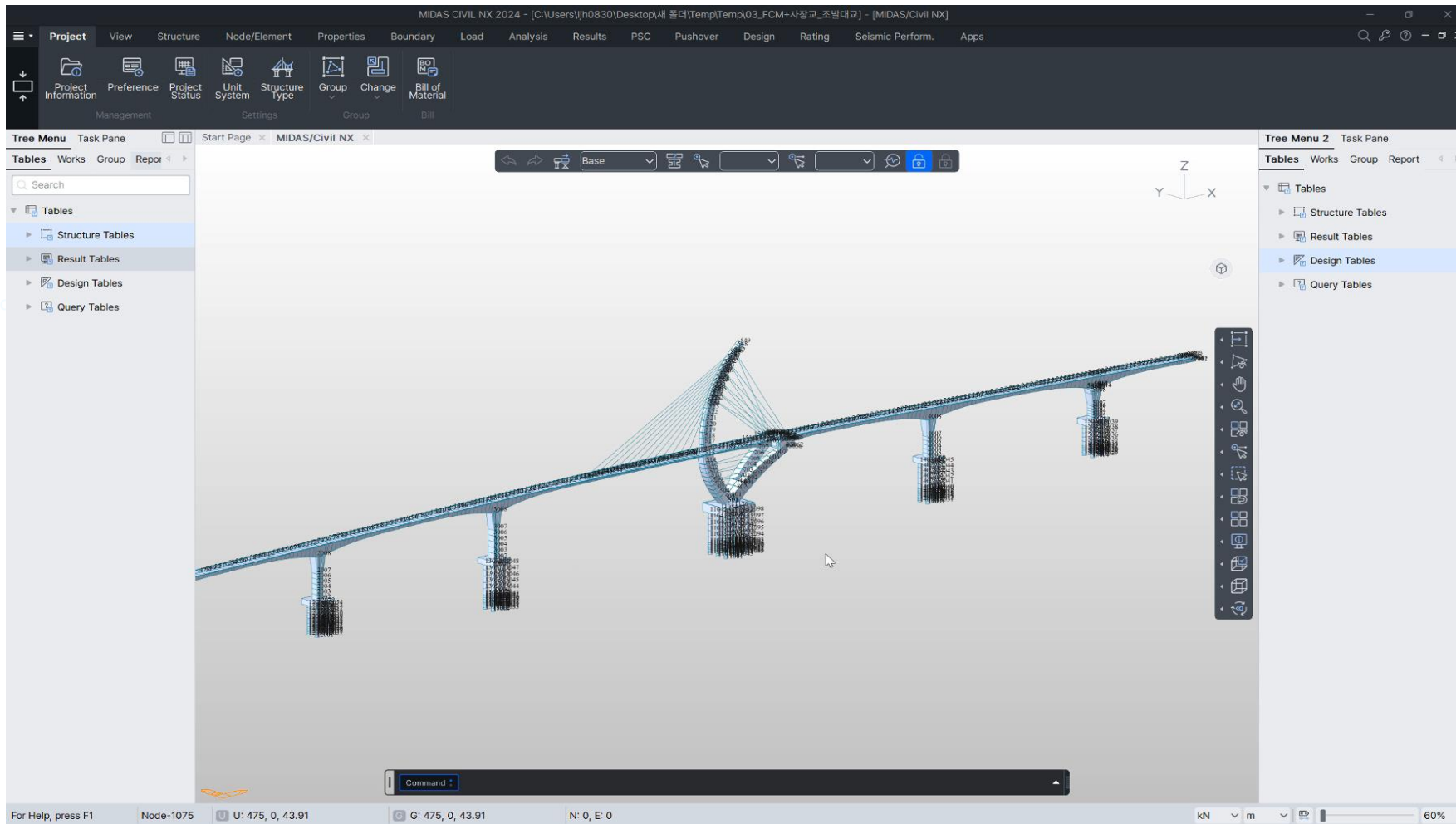
Improved Tendon graphics



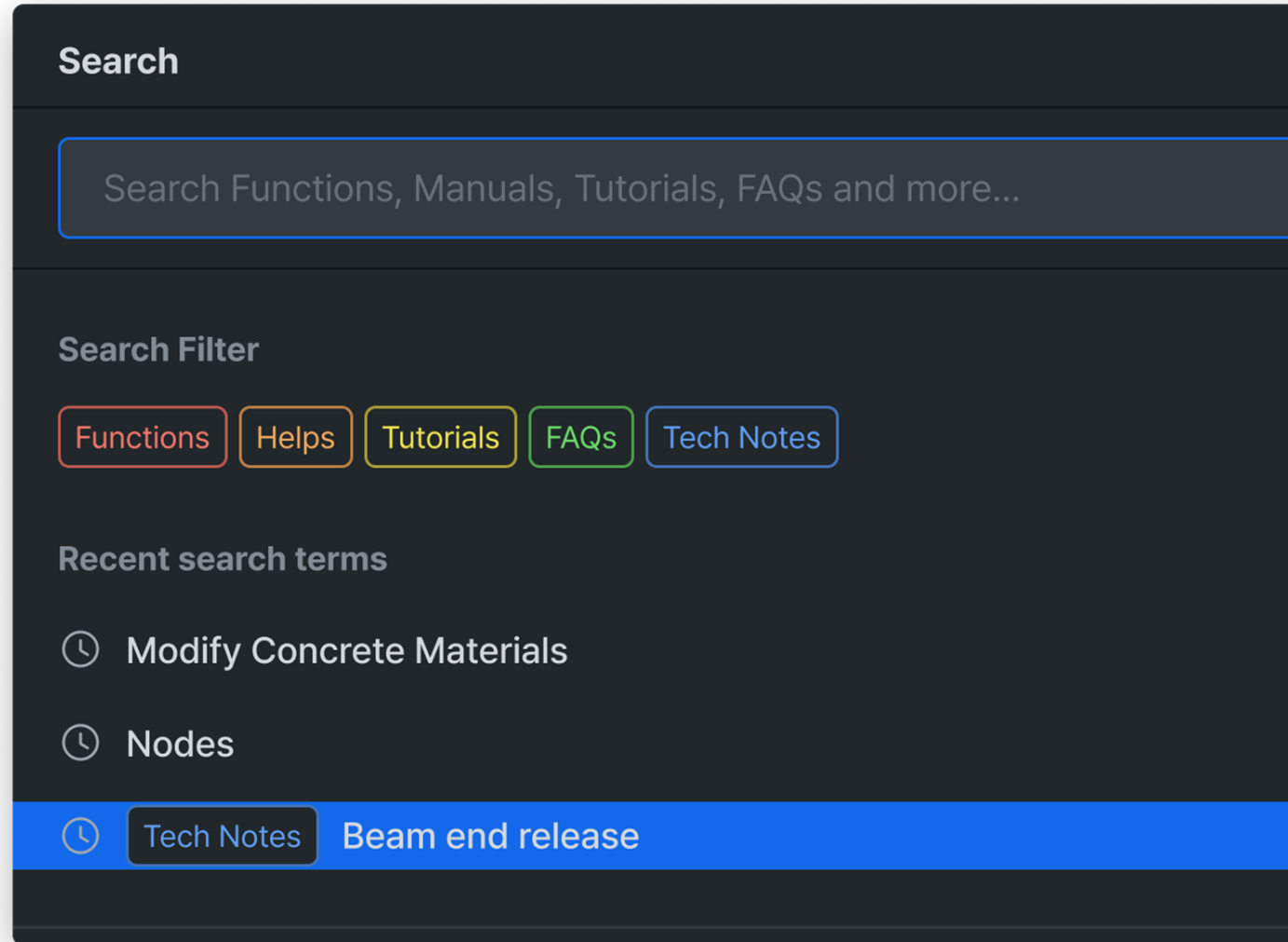
Transparent Element view

Customized User Interface.

Font size customization is now available,
allowing users to adjust text sizes independently of zoom levels during modeling.



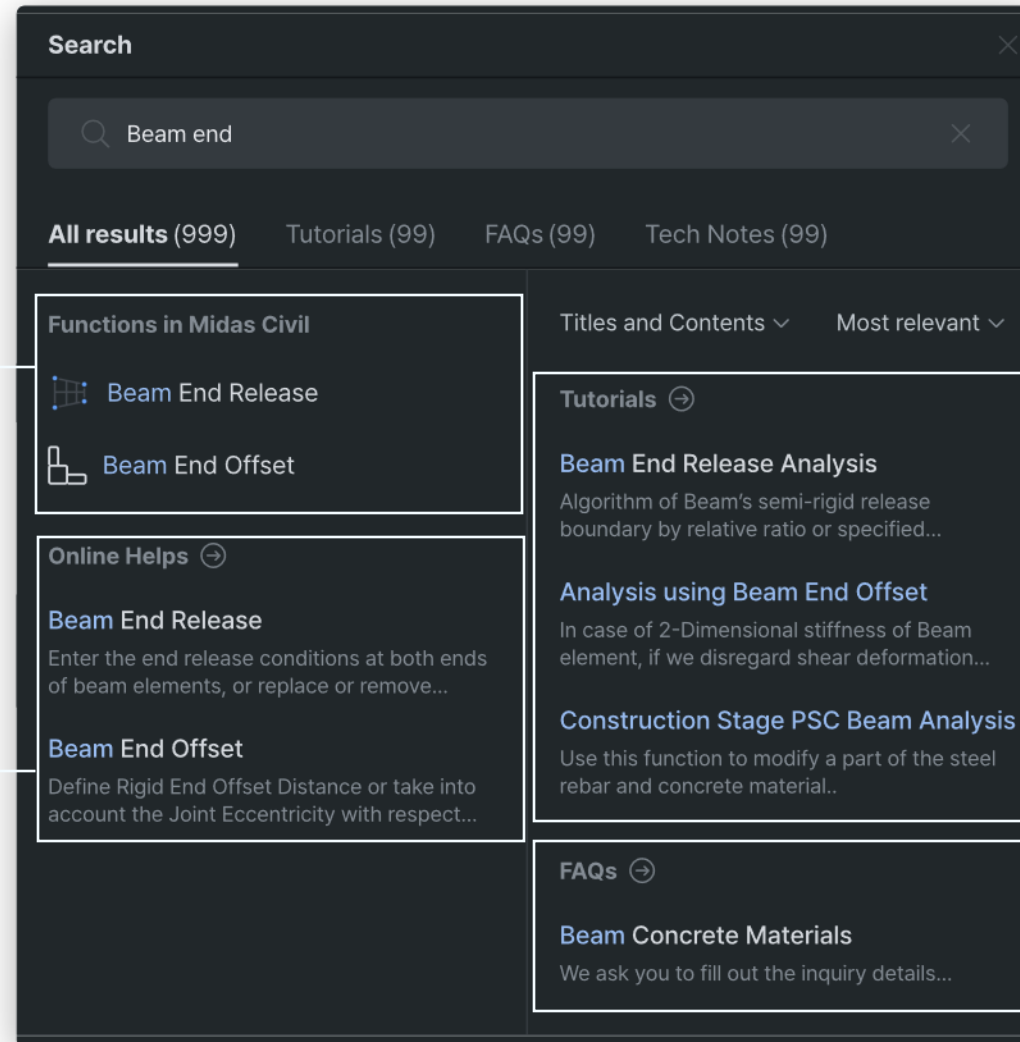
No more Googling:
CIVIL NX brings document
Search in-house



Utilize the search feature in CIVIL NX to quickly and easily obtain the desired information.
From product features to tutorials and technical inquiries, you can find everything you need in one place.

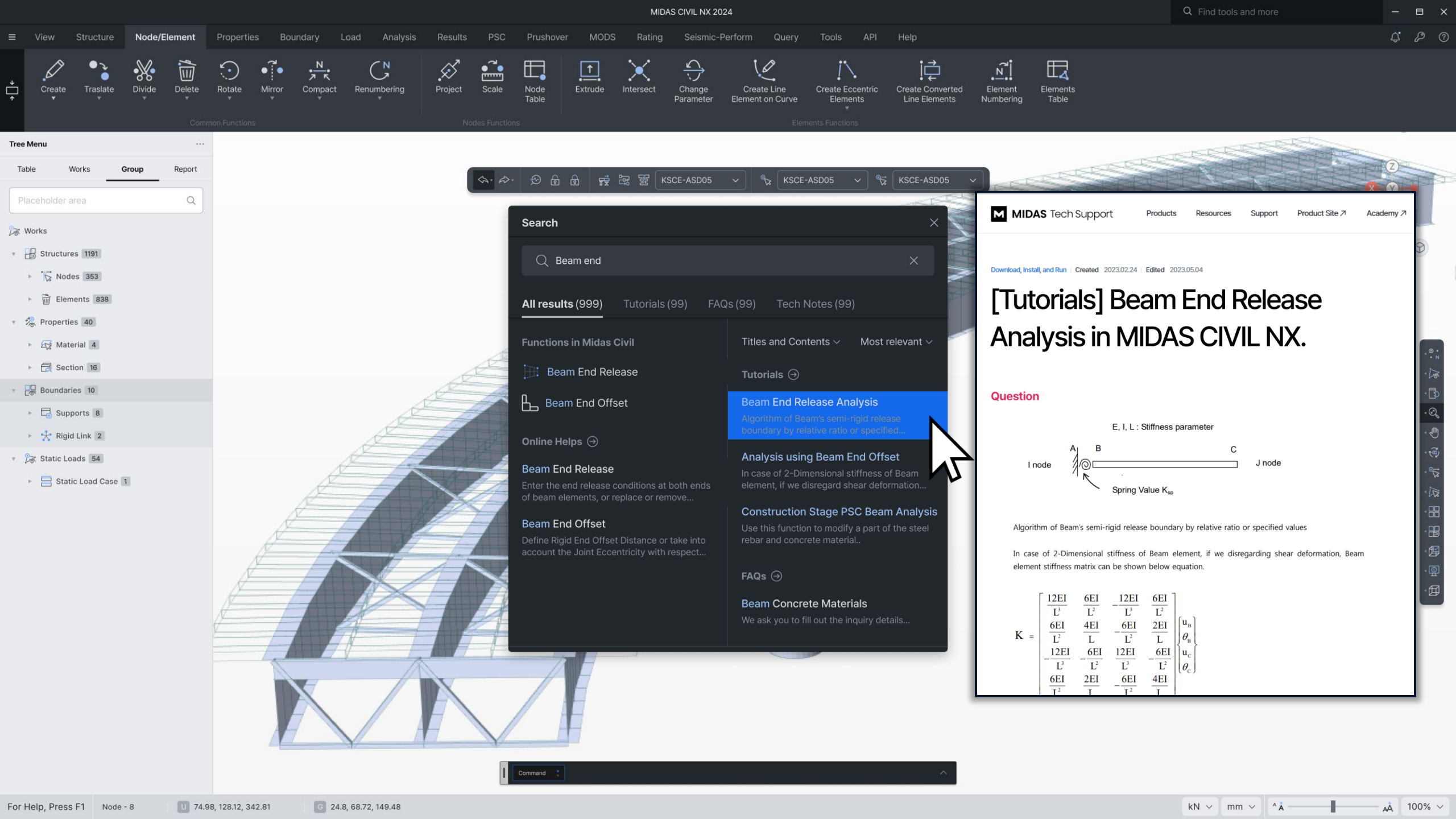
Functions

Helps



Tutorials

FAQs



Search

Beam end

All results (999)

Tutorials (99)

FAQs (99)

Tech Notes (99)

Functions in Midas Civil

Beam End Release

Beam End Offset

Online Helps

Beam End Release

Enter the end release conditions at both ends of beam elements, or replace or remove...

Beam End Offset

Define Rigid End Offset Distance or take into account the Joint Eccentricity with respect...

Titles and Contents

Most relevant

Tutorials

Beam End Release Analysis

Algorithm of Beam's semi-rigid release boundary by relative ratio or specified...

Analysis using Beam End Offset

In case of 2-Dimensional stiffness of Beam element, if we disregard shear deformation...

Construction Stage PSC Beam Analysis

Use this function to modify a part of the steel rebar and concrete material...

FAQs

Beam Concrete Materials

We ask you to fill out the inquiry details...

MIDAS Tech Support

Products

Resources

Support

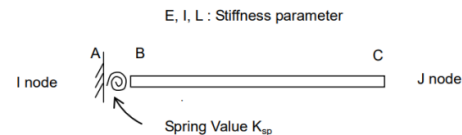
Product Site

Academy

Download, Install, and Run | Created 2023.02.24 | Edited 2023.05.04

[Tutorials] Beam End Release Analysis in MIDAS CIVIL NX.

Question



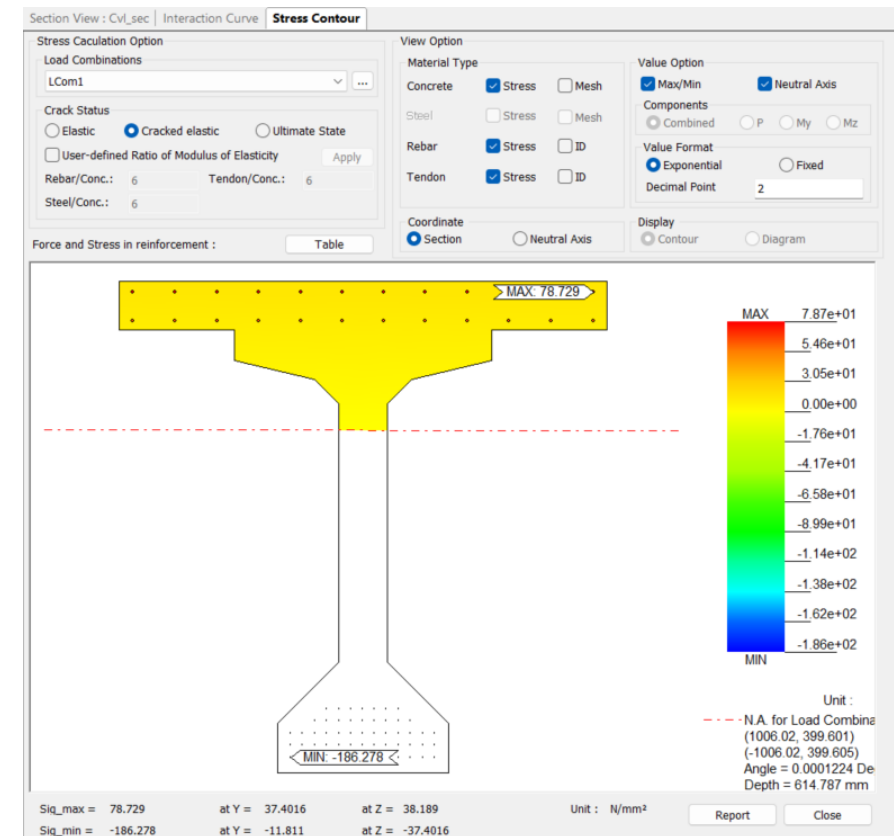
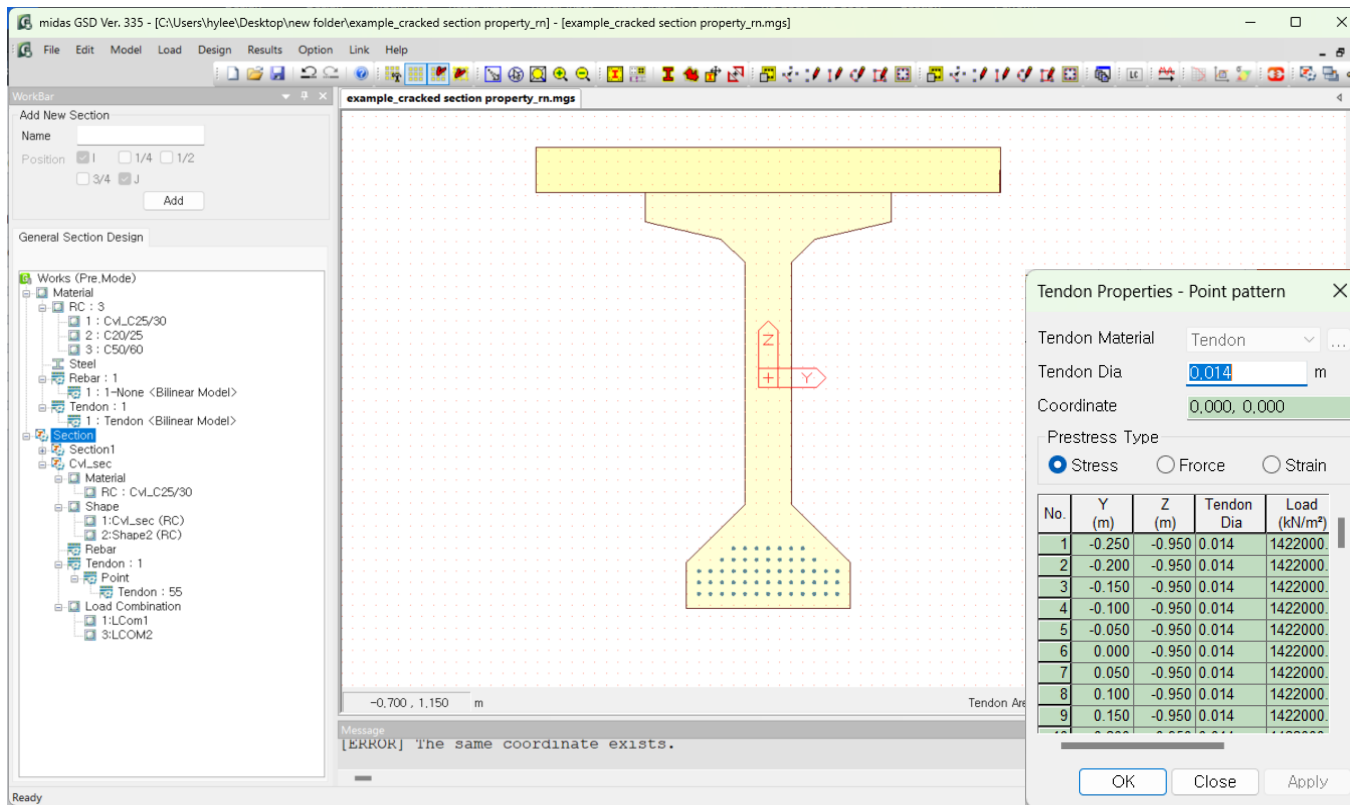
Algorithm of Beam's semi-rigid release boundary by relative ratio or specified values

In case of 2-Dimensional stiffness of Beam element, if we disregarding shear deformation, Beam element stiffness matrix can be shown below equation.

$$K = \begin{bmatrix} \frac{12EI}{L^3} & \frac{6EI}{L^2} & -\frac{12EI}{L^3} & \frac{6EI}{L^2} \\ \frac{6EI}{L^2} & \frac{4EI}{L} & -\frac{6EI}{L^2} & \frac{2EI}{L} \\ \frac{12EI}{L^3} & \frac{6EI}{L^2} & \frac{12EI}{L^3} & -\frac{6EI}{L^2} \\ \frac{6EI}{L^2} & \frac{2EI}{L} & -\frac{6EI}{L^2} & \frac{4EI}{L} \end{bmatrix} \begin{Bmatrix} u_B \\ \theta_B \\ u_C \\ \theta_C \end{Bmatrix}$$

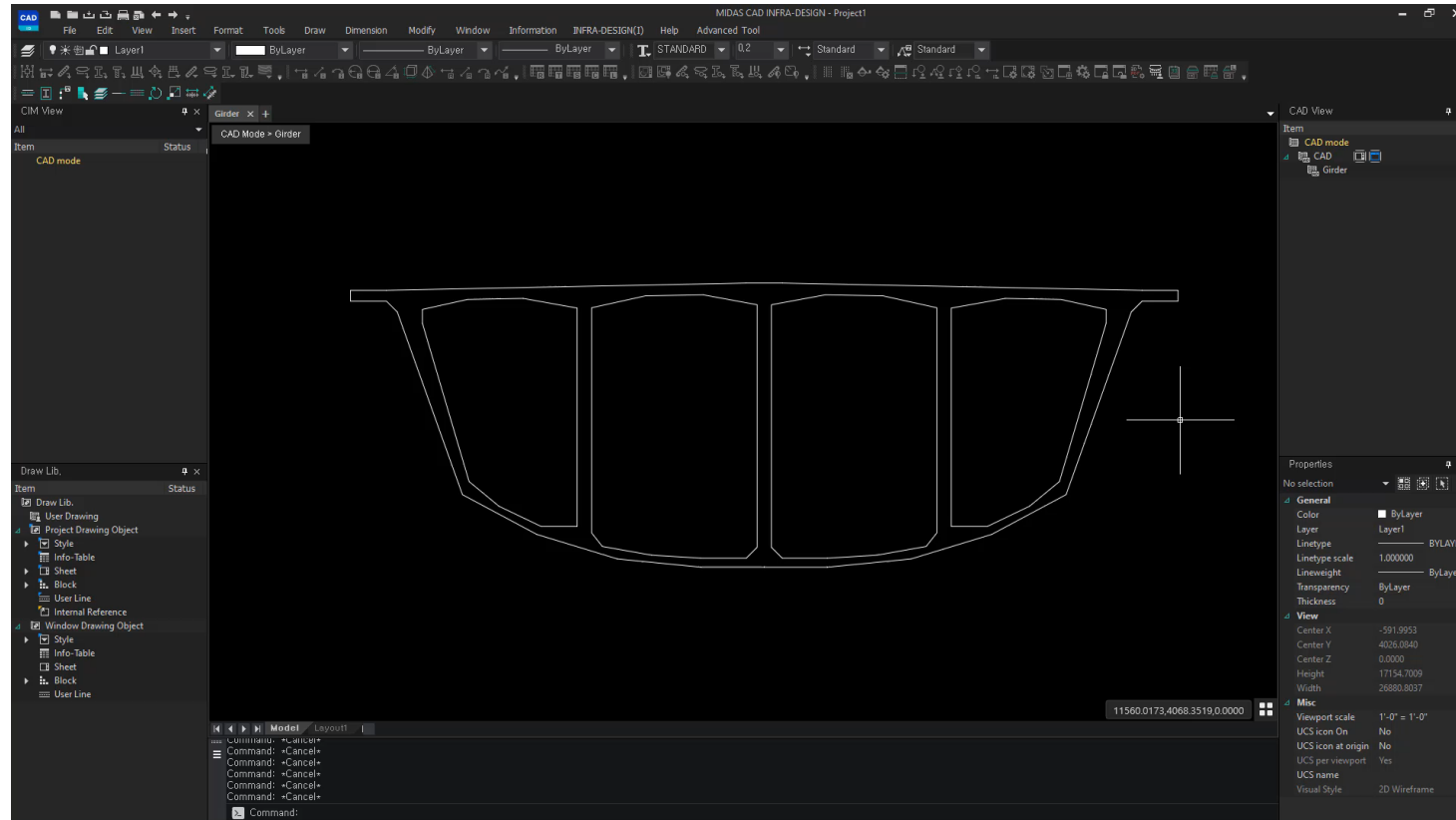
Comprehensive section verification tool

GSD in CIVIL NX now supports prestressed concrete section verification with tendons and multiple material definitions for cross-section. These features provide enhanced flexibility and are exclusive to MIDAS CIVIL NX.



Sectional Property Calculator

Create or modify the cross section from CAD. (Easier than existing SPC function)



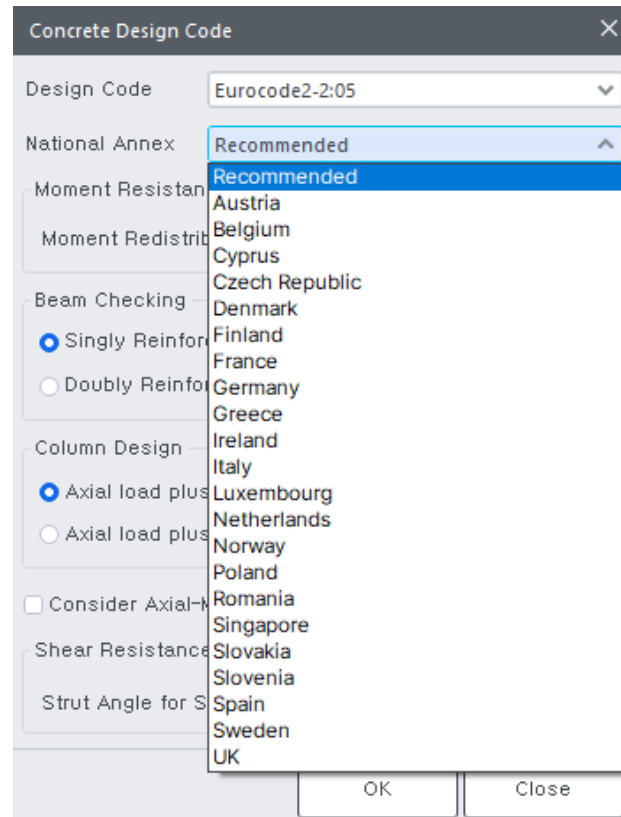
Built-in Civil Design Standard in 120+ Countries incl. Eurocode

Civil NX supports various Design Codes such as Australian code, AASHTO, Eurocode for Reinforced Concrete, Steel, SRC, Composite, PSC, etc.
It can generate design review reports based on the reviewed.

RC Design	Steel Design	SRC Design	Composite Design	Steel Ortho. Design	PSC Design
AASHTO-LRFD17	AASHTO-LRFD17	SSRC79	AS 5100.6:17	SNIP 2.05.03-84*	AS 5100.5:17
AASHTO-LRFD16	AASHTO-LRFD16	AIJ-SRC01	AASHTO-LRFD17	SP 35.13330.2011	AASHTO-LRFD17
AASHTO-LRFD12	AASHTO-LRFD12	JGJ138-01	AASHTO-LRFD16	Steel Rating Design	AASHTO-LRFD16
AASHTO-LRFD07	AASHTO-LRFD02	AIK-SRC2K	AASHTO-LRFD12		AASHTO-LRFD14
AASHTO-LRFD02	AASHTO-ASD96	KSCE-USD96	AASHTO-LRFD07		AASHTO-LRFD12
AASHTO-LFD96	AASHTO-LFD96	TWN-SRC100	CSA-S6-14	AASHTO LRFR19	AASHTO-LRFD07
ACI 318-02	CSA-S6-14	TWN-SRC92	EN 1994-2	AASHTO LRFR11	CSA-S6S1-10
CSA-S6-00	JTJ025-86		IRC:22-2008	CS 454	CSA-S6-14
CSA S6-14	IRC:24-2010		IRC:22-2015	PSC Rating Design	Eurocode2-2:05
Eurocode2-2:05	ACI 318-02		KSCE-LSD15		BS 5400-4:1990
SNIP 2.05.03-84*	TWN-BRG-LSD90		SNIP 2.05.03-84*		SNIP 2.05.03-84*
SP 35.13330.2011	Eurocode2-2:05		SP 35.13330.2011	AASHTO LRFR11	SP 35.13330.2011
SNIP 2.05.03-84*(MKS)	Eurocode3-2:05			AASHTO LRFD05	SNIP 2.05.03-84*(MKS)
SP 35.13330.2011(MKS)	AISC-LRFD 2K			CS 454	SP35.13330.2011(MKS)
JTJ023-85	AISC-LRFD 93				KSCE-USD10
IRC:21-2011	AISC-ASD 89				KSCE-LSD15
IS456:2000	BS 950-90				KDS 24 14 21
IRS	IS:800 - 2007				JTG D62-04
KSCE-USD	IS:800 - 1984				CJJ11-2011
KSCE-LSD	KSCE-ASD				IRC:112-2011
KDS 24 14 21	KSCE-LSD				IRS
KCI-USD12					
TWN-BRG-LSD90					
CJJ11-2011					
CJJ166-2011					

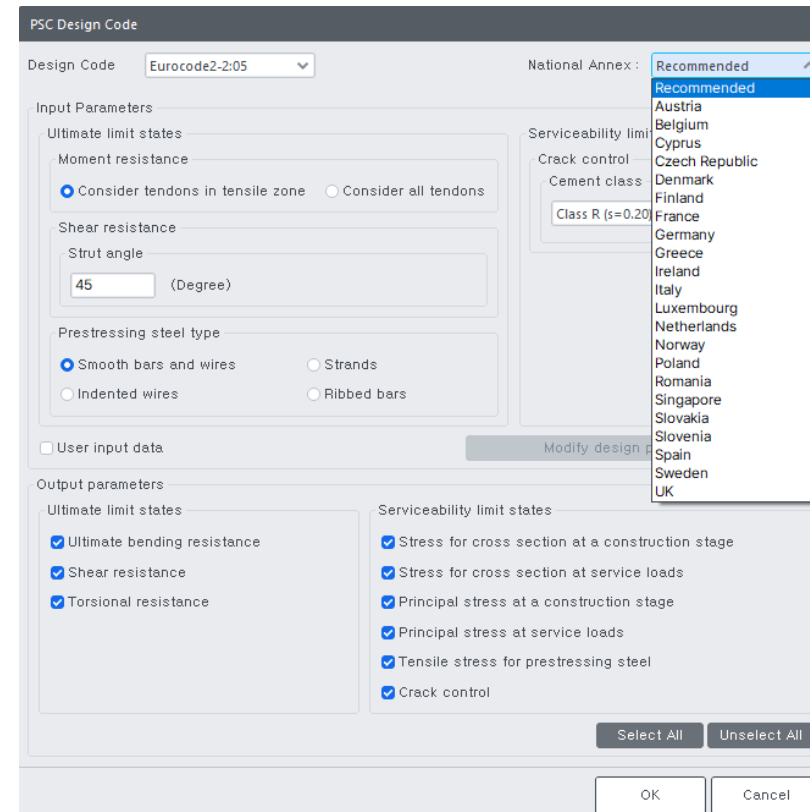
Eurocode 22 National Annexes for RC and PSC Design

This feature is exclusively available in MIDASCIVIL NX.



The 'Concrete Design Code' dialog box is shown. It features a 'Design Code' dropdown set to 'Eurocode2-2:05'. The 'National Annex' dropdown is open, showing a list of countries including Austria, Belgium, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Romania, Singapore, Slovakia, Slovenia, Spain, Sweden, and UK. The 'Recommended' option is selected. The dialog also includes sections for 'Moment Resistance', 'Moment Redistribution', 'Beam Checking' (with 'Singly Reinforced' selected), 'Column Design' (with 'Axial load plus bending moment' selected), and 'Shear Resistance'. 'OK' and 'Close' buttons are at the bottom.

Concrete Design Code



The 'PSC Design Code' dialog box is shown. It features a 'Design Code' dropdown set to 'Eurocode2-2:05'. The 'National Annex' dropdown is open, showing the same list of countries as the Concrete Design Code dialog. The 'Recommended' option is selected. The dialog includes 'Input Parameters' for 'Ultimate limit states' (Moment resistance, Shear resistance, Prestressing steel type) and 'Serviceability limit states' (Crack control, Cement class). It also has 'Output parameters' for 'Ultimate limit states' and 'Serviceability limit states'. 'OK' and 'Cancel' buttons are at the bottom.

PSC Design Code

Updates with v2.1

Enhancements in CIVIL NX 2025 (v2.1)

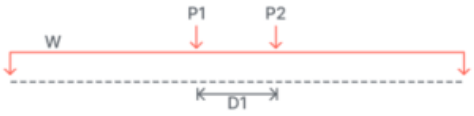
1. Addition of evaluation truck loads for existing bridges in New Zealand(Based on SP/M/022 v3.4)
2. Moving patch load analysis as per Eurocode, BS & NZ traffic loads
3. Addition of special permit trucks for load rating of existing bridges in Western Australia
4. Enhancement of Australian moving load options: Add lateral offset distance option
5. Update PSC section design criteria for Australia to the latest 2024 standard
6. Addition of Material Database for Structural Steel Reinforcement as per NR/GN/CIV/025
7. Addition of Section Properties for U-girder Bridge as per NR/GN/CIV/025
8. Addition of Moving Load for UK Network Rail Bridge Assessment as per NR/GN/CIV/025
9. UK Network Rail Bridge Assessment as per NR/GN/CIV/025
10. Enhancement of Load All Model 1 in the UK rating system to support envelope type loads
11. Addition of cross-section databases for the US and Canada
12. Addition of vehicle database for 46 US states
13. Automated design support for asymmetric (Type 2) composite steel bridges(Eurocode, AASHTO)
14. Add California-specific provisions from AASHTO LRFD
15. RC design support for US railway bridges(Based on AREMA design code)
16. Auto-generate Load combination (RC) as per TMH07 : 1981
17. PSC Design as per TMH07-3 : 1989
18. Significantly Improved Excel Design Report Generation Speed
19. Batch output for tendon loss table by construction stage and tendon group

Moving Patch load – Tyre Contact Area

Define Standard Vehicular Load

Standard Name
Traffic Load

Vehicular Load Properties
Vehicular Load Name
HO (overload) loading (b)
Vehicular Load Type
HO (overload) loading (b)

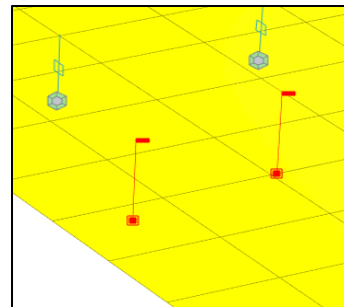


No	Load(kN)	Spacing(m)
1	240	5
2	240	end

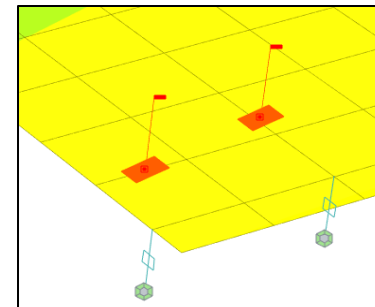
W 10.5 kN/m

☒ Consider Contact Area
Width 0.9 m
Length 0.6 m

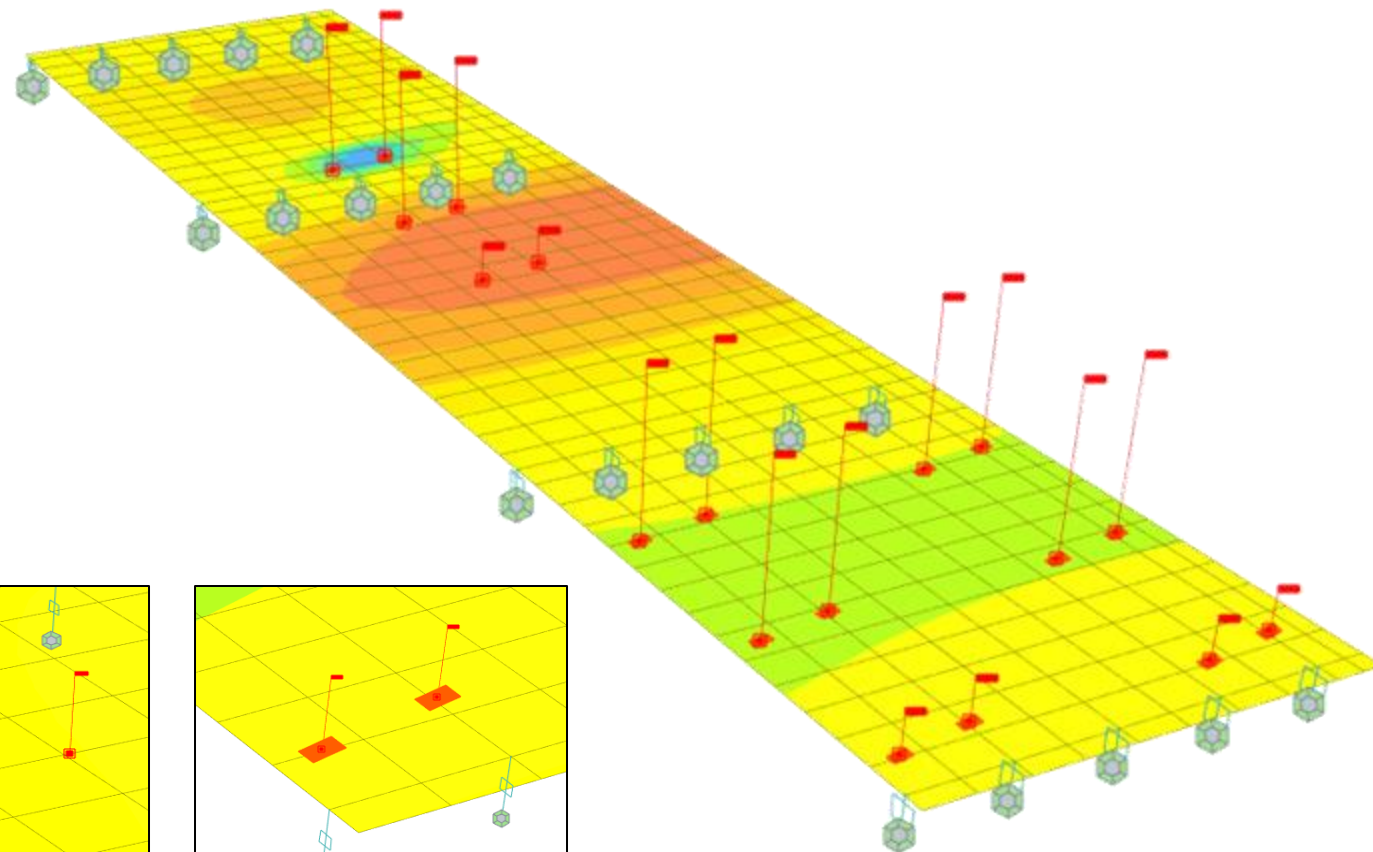
OK Cancel Apply



Concentrated wheel loads



Patch/area wheel loads

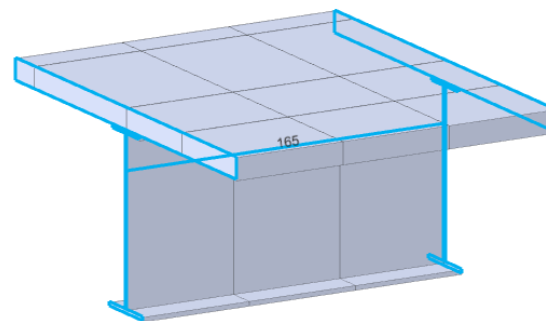
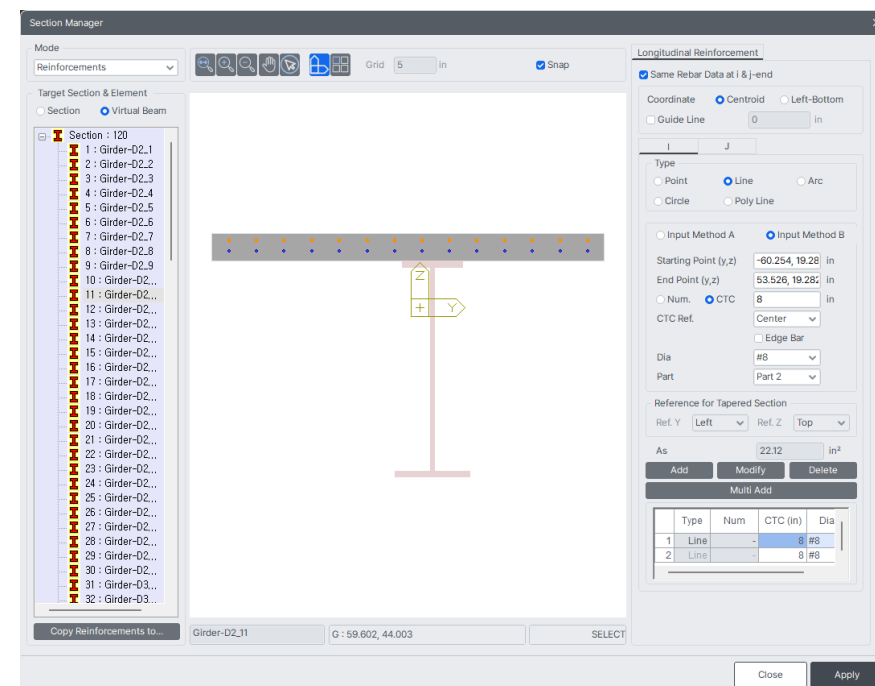
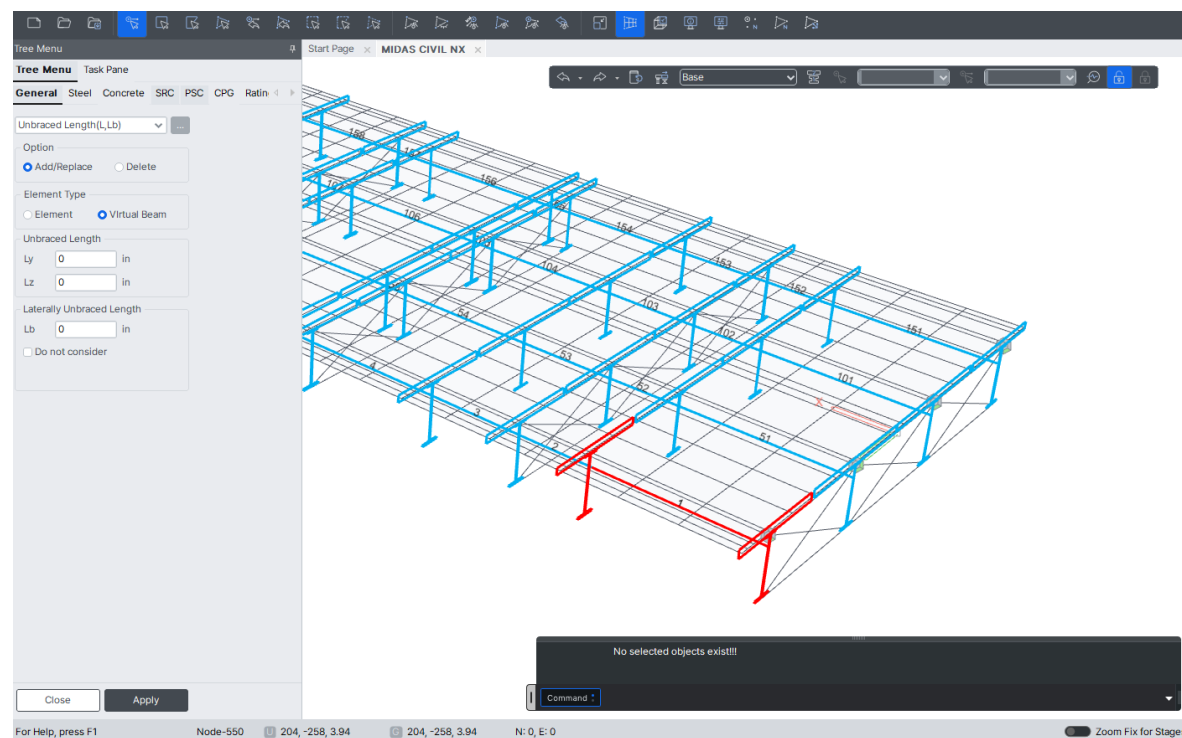


Updates with v2.2

Enhancements in CIVIL NX 2025 (v2.2)

1. Steel-Composite Girder Design & Assessment Enhancements
2. Virtual Beam Display for Plate and Mixed Models
3. Virtual Beam + Span Information: Faster LTB checks on plate or mixed models
4. Virtual Beam Selection & Management
5. Virtual Beam Reinforcement Input
6. Virtual Beam Transverse Stiffener Input
7. Virtual Beam Design & Assessment for Steel-Composite Girders
8. Virtual Section for Design
9. Bearing Stiffener Check (NR/GN/CIV/025) for Steel Railway Bridges
10. Intermediate Stiffener Check (NR/GN/CIV/025) for Steel Railway Bridges
11. Local Coordinate Displacement Output under Moving Load Cases

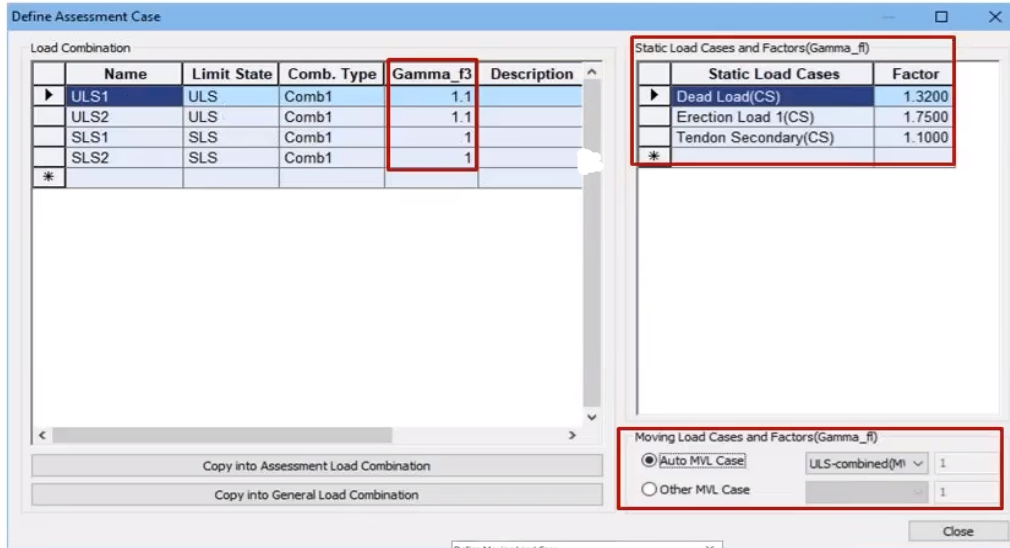
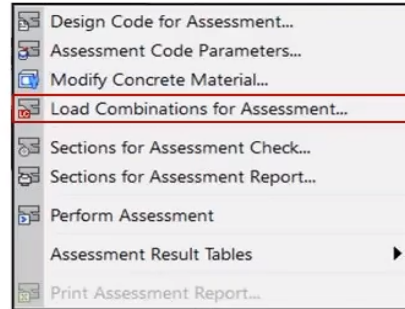
VIRTUAL BEAM DESIGN FEATURES



Highway and Railway Bridge Assessment

Overview

- Revision 0 released in June 2019; Revision 1 released in Mar 2020
- Supersedes BD 21/01, BA 16/97, and BD 37/01
 - Inclusion of wind, thermal and HB load models in new appendices, Previously BD 37
 - Traffic load models for loaded lengths greater than 50m, previously in BD 50
 - Increase in the lane width for ALL Model 1 (based on real vehicles) in single vehicle load case
- CS458 (Special vehicles(STGO,SO)), replaces BD 86/11



Equation 3.7 Assessment action effects

$$S_a^* = \gamma_{f3}(\text{effects of}(Q_a^*))$$

Equation 3.3 Assessment actions

$$Q_a^* = \gamma_{fL} Q_k$$

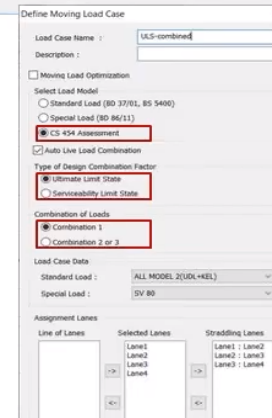
Table A.1 Partial factors for actions

Action	Reference	Limit state	Cast iron structures	Structures excluding cast iron			
				Combination			
				1	2	3	4
Concrete, stone, masonry or timber dead load	Section 5	ULS	1.00	1.15 ⁽¹⁾			
		SLS	-	1.00			
Surfacing superimposed dead load	Section 5	ULS	1.5 ⁽¹⁾	1.75 ⁽¹⁾			
		SLS	-	1.20			
Other superimposed dead loads	Section 5	ULS	1.0	1.20 ⁽¹⁾			
		SLS	-	1.00			
Traffic actions for normal traffic and restricted traffic	Section 5	ULS	1.00	1.50	1.25		
		SLS	-	1.20	1.00		
Abnormal traffic actions (SV, SOV, STGO and SO vehicles)	CS 458 [Ref 7.N]	ULS	1.00	1.10	1.00		
		SLS	-	1.00	1.00		

3.8 The value of γ_{f3} at SLS shall be 1.0.

3.9 The value of γ_{f3} at ULS shall be taken as 1.1, except in the following cases:

- 1) 1.0 for cast iron bridges;
- 2) 1.0 for masonry arches;



Overview

- The Structural Assessment of Underbridges
- June 2006 – Latest Issue
- **RT/CE/C/025**, titled *The Structural Assessment of Underbridges*, and served as a direct predecessor to **NR/GN/CIV/025**.
- Earlier also BD21/01 was also being used for Railway Bridge Assessments
- It bridges the gap between the BD 21 and the more rail-specific needs.

Ref	NR/GN/CIV/025
Issue	3
Date	June 2006

Guidance Note

The Structural Assessment of Underbridges



Assessment Live Load and Level of Assessment

Assessment Objective – To determine load carrying capacity in terms of live load and speed

Rail Traffic Loadings (1.5.3 – NR/GN/CIV/025)

☐ Route Availability

- In terms of BSUs of Type *RAI Loading* at permissible speed
(other speeds if Capacity < RA10)

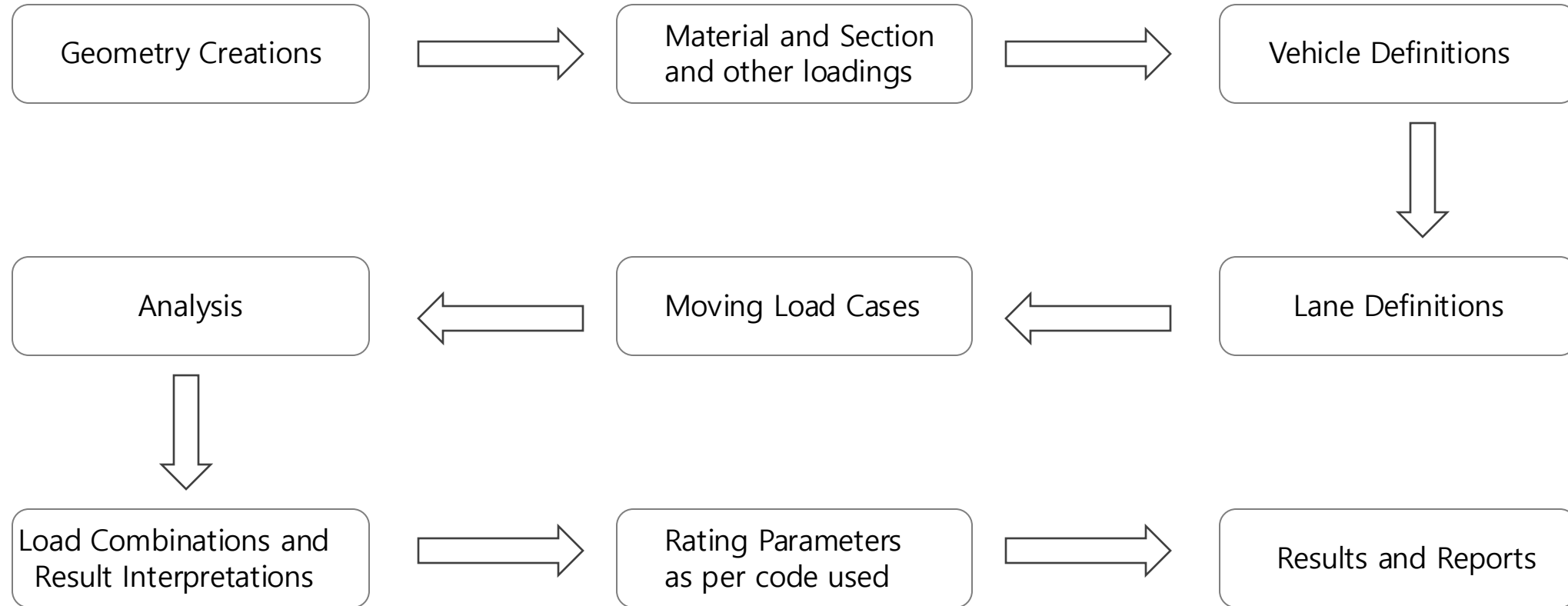
☐ Wagons

- All structures need to be assessed for carrying *D4 Wagons* in accordance with UIC 700-0

Level 1 Simplest level using assumptions known to be conservative and, where appropriate, consideration of loading by real trains.

Level 2 Use of more refined analysis and better structural idealisation. This level may also include use of data on materials strengths based on mill test certificates or recent material tests on another structure of similar form, materials and age.

Level 3 Use of a bridge specific live loading based on a statistical model of the known traffic and/or the use of tests on materials samples or the use of worst credible strengths or the use of load tests.



Material and Section Property

Section Property – I Girders

Section Data

DB/User Steel Girder

Section ID 2 Name CG

Section Type Steel Girder I

☒ Symmetric Section Auto Calculation

Distance from Reference Line

Top 0 m

Bottom 0 m

B1 0.3 H 0.6 m

B2 0.3 t1 0.014 m

B3 0.3 t2 0.014 m

B4 0.3 tw 0.014 m

Stiffener...

Riveted Angle...

Riveted Angle

Defined Angles

Define Angles...

Name Type

a Angle

☒ Symmetric

☒ Angle 1 a

☒ Angle 2 a

☐ Angle 3 a

☐ Angle 4 a

☒ Angle 5 a

☒ Angle 6 a

☐ Angle 7 a

☐ Angle 8 a

☒ Rivet

Component	Angle	Ref.Pos (lateral)	Ref.Pos (vertical)	dR (m)	Diameter (m)
Top Left Flange	Angle 1	Left		0	0
Top Right Flange	Angle 5	Right		0	0
Web	Angle 1		Top	0	0
Web	Angle 2		Top	0	0
Bottom Left Flange	Angle 2	Left		0	0
Bottom Right Flange	Angle 6	Right		0	0

OK Cancel

Section Stiffener

Stiffener

Name a

Type Angle

Properties

H 0.1 m

B 0.1 m

tw 0.016 m

tf 0.016 m

Add Modify Delete

Name Type

a Angle

OK Cancel

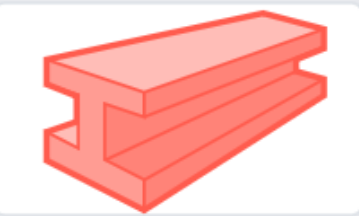
Riveted Angles Definition for I Girders

Control the Rivet Positioning as per different angles

Define different Angle sections

Elasticity Data

Type of Design Steel



Type of Material
☒ Isotropic ☐ Orthotropic

Steel

Modulus of Elasticity 1.9000e+08 kN/m²

Poisson's Ratio 0.3

Thermal Coefficient 1.2000e-05 1/[C]

Weight Density 75.51 kN/m³

☐ Use Mass Density 7.7 kN/m³/g

☐ Concrete

Modulus of Elasticity 0.0000e+00 kN/m²

Poisson's Ratio 0

Thermal Coefficient 0.0000e+00 1/[C]

Weight Density 0 kN/m³

☐ Use Mass Density 0 kN/m³/g

Steel

Standard NR/GN/CIV/025(S)

DB Wrought Iron

Concrete

Standard

Code

DB

Pre1906
BS15:1906
BS15:1948
BS15:1961
BS548:1934
BS968:1941
BS968:1962
BS2762:1956(A)
BS2762:1956(B)
Wrought Iron

Different Steel and Wrought Iron Materials as per old standard codes

Consideration of Live Load for Assessments in Civil NX

RAI Loading

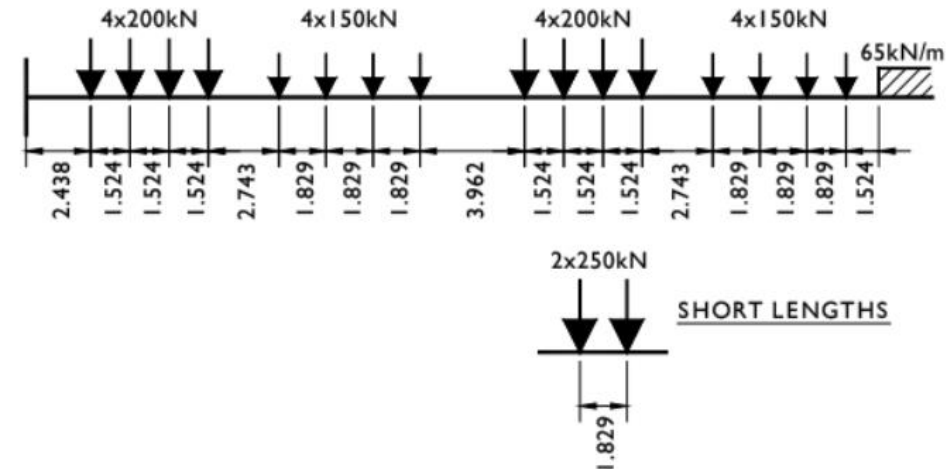
4.3.1.1 Route Availability (RA) Number

The assessment of a Bridge should be determined in terms of its Route Availability (RA) number, that is its safe rail traffic load capacity. Route Availability numbers generally range from the lowest capacity RA0 to the highest at RA15 represented by 25 British Standard Units (BSUs) of Type RAI loading as shown by Table 4.3.

RA NUMBER	RANGE OF UNITS	RANGE OF SINGLE AXLE WEIGHTS
RA0	Up to 10.99 units	Under 13.96 tonnes
RA1	11.00 to 11.99 units	13.97 to 15.23 tonnes
RA2	12.00 to 12.99 units	15.24 to 16.50 tonnes
RA3	13.00 to 13.99 units	16.51 to 17.77 tonnes
RA4	14.00 to 14.99 units	17.78 to 19.04 tonnes
RA5	15.00 to 15.99 units	19.05 to 20.31 tonnes
RA6	16.00 to 16.99 units	20.32 to 21.58 tonnes
RA7	17.00 to 17.99 units	21.59 to 22.85 tonnes
RA8	18.00 to 18.99 units	22.86 to 24.12 tonnes
RA9	19.00 to 19.99 units	24.13 to 25.39 tonnes
RA10	20.00 to 20.99 units	25.40 to 26.66 tonnes
RA11	21.00 to 21.99 units	26.67 to 27.93 tonnes
RA12	22.00 to 22.99 units	27.94 to 29.20 tonnes
RA13	23.00 to 23.99 units	29.21 to 30.47 tonnes
RA14	24.00 to 24.99 units	30.48 to 31.74 tonnes
RA15	25.00 units and over	31.75 tonnes and over

4.3.1.2 RAI Loading

The static loading used to determine the RA number is shown in Figure 4.1 for 20 units of Type RAI loading. The Short Lengths configuration should be used when it produces more onerous effects than the axle and uniformly distributed load model.



Live Load for Railway Assessments

Define Standard Vehicular Load

Standard Name: NR/GN/CIV/025

Vehicular Load Properties

Vehicular Load Name: RA10 Loading

Vehicular Load Type: Type RAI Loading

Sub Type: RA10

RA Loading Type: ☒ Train ☐ Short

RA Loading Type: RA10, RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9, RA10, RA11, RA12, RA13, RA14, RA15

RA Loading

No	P (kN)	D (m)
1	200	1.524
2	200	1.524
3	200	1.524
4	200	2.743
5	150	1.829
6	150	1.829
7	150	1.829
8	150	3.692
9	200	1.524

Short lengths

No	P (kN)	D (m)
1	250	1.829
2	250	end

dW1 = 65 kN/m

dD1 = 1.524 m

dD2 = 100 m

Railway Dynamic Factor: ☐ Static ☒ Dynamic

Assessment Speed: 90 mph

OK Cancel Apply

Can consider both RAI and EUDL for the moving loads

Both Train and Short Length loads can be defined (together or separate)

Assessment Speed for calculation of Dynamic Factor

Sub Type: RA10

RA Loading Type: ☒ Train ☐ Short Length ☐ More Critical

Train

P1 P2 P3 P4 P5 P6 P7 P8 P9 P10 P11 P12 P13 P14 P15 P16

dW1

dD1 dD2

Short Length

P1 P1

dD1

Assessment Load Wagon

4.3.1.4 Assessment Load Wagon

The loading and axle configuration of the Assessment Load Wagon is as shown in Figure 4.2. Dynamic factors should be based on a maximum speed of the lesser of 60 mph or the permissible speed at the site.

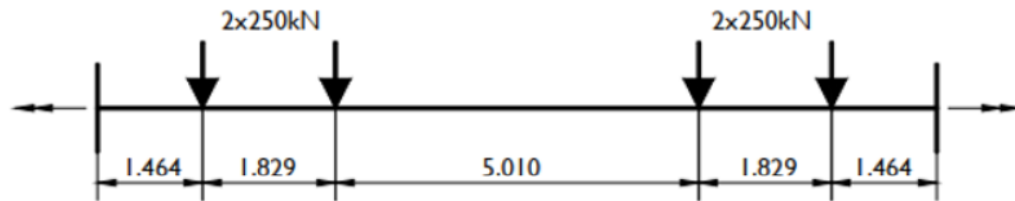


Figure 4.2
Assessment Load Wagon

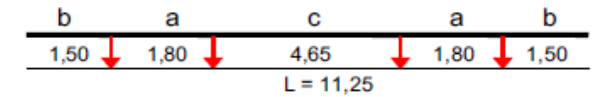
4.3.1.5 Wagon Type D4

The loading and axle configuration of Wagon Type D4 is defined in UIC700-O. Dynamic factors should be based on a maximum speed of the lesser of 60 mph or the permissible speed at the site.

D4

$P = 22,5 \text{ t}$

$p = 8,0 \text{ t/m}$



Live Load for Railway Assessments

Define Standard Vehicular Load

Standard Name
NR/GN/CIV/025

Vehicular Load Properties

Vehicular Load Name
Wagon Type D4

Vehicular Load Type
Wagon

Sub Type
Wagon Type D4

* Wagon

No	P (kN)	D (m)
1	220.65	1.8
2	220.65	4.65
3	220.65	1.8
4	220.65	end

Wagon Type D4 as per UIC-700

Assessment Load Wagon as per CIV/025

Define Standard Vehicular Load

Standard Name
NR/GN/CIV/025

Vehicular Load Properties

Vehicular Load Name
Assessment Load Wagon

Vehicular Load Type
Wagon

Sub Type
Assessment Load Wagon

* Wagon

No	P (kN)	D (m)
1	250	1.829
2	250	5.01
3	250	1.829
4	250	end

Dynamic Effects

4.3.2.2 Dynamic Factor for Longitudinal Members

The dynamic factor $(1 + \varphi)$ appropriate to the train speed should be applied to all members other than transverse floor members (see Clause 4.3.2.4) using the dynamic increment φ which should be taken as in Table 4.5.

	Dynamic Increment φ for Bending	Dynamic Increment φ for Shear
Normal track maintained for Permissible speed ≤ 100 mph	$(\varphi_1 + \varphi_{11})$	$\frac{2}{3} \times \varphi$ for Bending
Track maintained for Permissible speed > 100 mph – 125 mph	$1.3 \left(\varphi_1 + \frac{\varphi_{11}}{2} \right)$ (see note below table)	
Fatigue calculations only	$0.5 \left(\varphi_1 + \frac{\varphi_{11}}{2} \right)$	

4.3.2.4 Dynamic Factor for Transverse Floor Members

The dynamic factor for cross girders and other discrete transverse floor members $(1 + \varphi_T)$ appropriate to the train speed should be applied using the dynamic increment φ_T , which should be taken as in Table 4.7.

	Dynamic increment φ_T for bending	Dynamic increment φ_T for shear
Normal track maintained for permissible speed ≤ 100 mph	0.008v	$\frac{2}{3} \times \varphi_T$ for bending
Track maintained for permissible speed > 100 mph – 125mph	* 1.3 (0.008v)	
Fatigue calculations only.	0.004v	

Dynamic Effects

Railway Dynamic Factor

Select Structure Group

☐ Cross Girder
☐ Main Girder
☐ Railbearer

☒ Auto Input

Bending and Shear

Natural Frequency, no 2 Hz

Span Length, L 25 m

Determinant Length, Lp 23 m

Permissible Speed of Track, v 100 mph

Depth of Ballast, h 0.8 m

Angle of Skew, α 90 deg
(Longitudinal Member: 65 to 90, Transverse Member: 0 to 25)

Effects

Bending and Shear for Beam Element Auto

All Other Effects 0
(e.g.Axial, Torsion, Stress, Displacements, Reactions, etc)

Separate Dynamic Factor as per structure group

☒ User Input

Effects

Bending for Beam Element 0

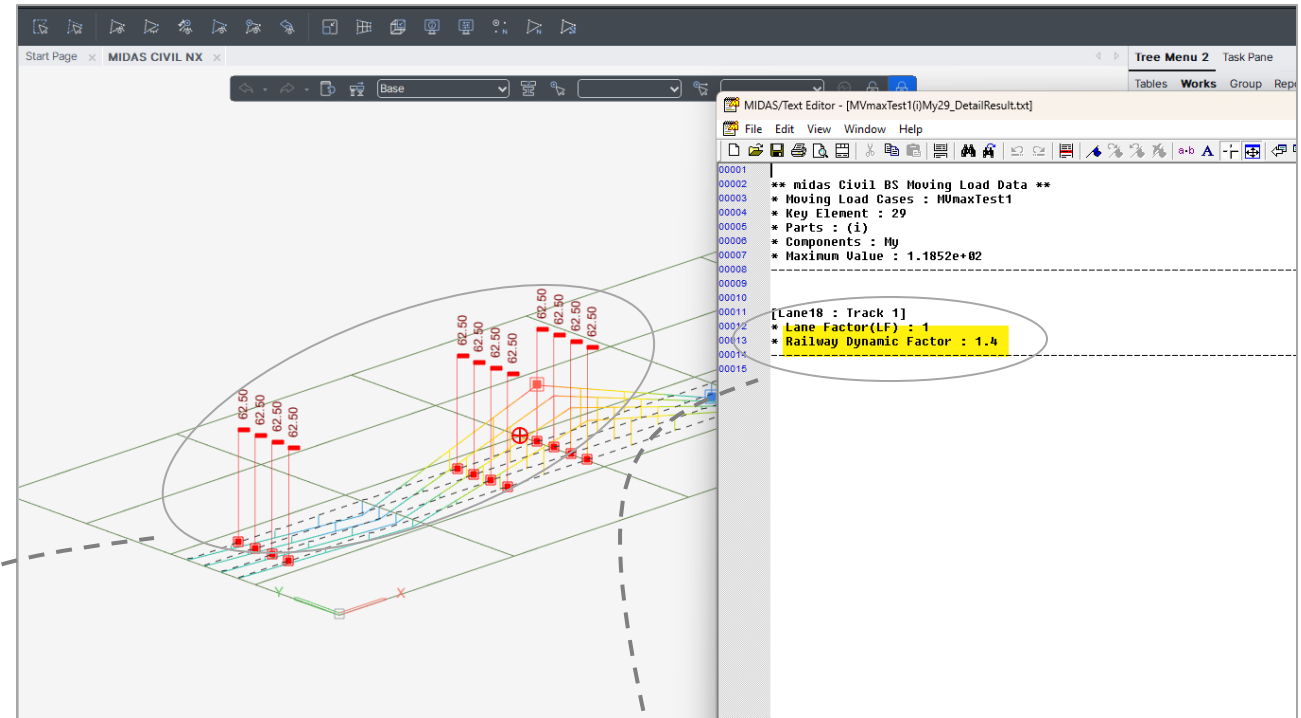
Shear for Beam Element 0

All Other Effects 0
(e.g.Axial, Torsion, Stress, Displacements, Reactions, etc)

Group List	Bending	Shear	Other

Add Modify Delete

Auto/ User Input of Dynamic Factor as per the different members



Lane Definitions and Moving Load Cases

Traffic Line Lanes

Lane Name:

Traffic Lane Properties

Lane Width: m
 Eccentricity: m
 Wheel Spacing: m

☐ Transverse Lane Optimization
 Allowable Width: m

Vehicular Load Distribution

☐ Lane Element ☒ Cross Beam

Cross Beam Group:

Skew:

Start: End: [deg]

Moving Direction

☐ Forward ☐ Backward ☒ Both

Input Lane Factors for more than one lane loadings

Lane Definitions

Distribute Loads Transversally as per Cross Girders

Define Moving Load Case

Load Case Name:

Description:

☐ Moving Load Optimization

Select Load Model

☐ Standard Load (BD 37/01, BS 5400)
☐ Special Load (BD 86/11)
☐ CS 454 Assessment (ALL Model 1, Special Load)
☐ CS 454 Assessment (ALL Model 2, Special Load)
☒ NR GN CIV 025 (Network Rail)

Track Factor

Num of Loaded Track	Scale Factor
1	1
2 or more	1

Sub-Load Cases

Loading Effect:

☒ Combined ☐ Independent

Vehicle	Scale	Lane1	Lane2	Lane3
EUDL L...	1	Track 1		

Sub-Load Case

Load Case Data

Scale Factor:

Number of Loaded Lanes:

Vehicle:

Assign Lanes

List of Lanes:

Create any combination for the loads for the Trains Loads

Assessment Parameters and Reporting

Assessment Load Combinations

Define Assessment Case

Load Combination

	Name	Limit State	Comb. Type	Description
	DL	ULS	Comb1	
*				

Static Load Cases and Factors(Gamma_{fl})

	Static Load Cases	Factor
	DL(ST)	1.0000
*		

Assessment Live Load

☒ Type RAI Loading ☐ Wagon Loading

Moving Load Cases and Factors(Gamma_{fl})

Static Live Load Test 1(MV)

Dynamic Live Load Test 1(MV)

Copy into Assessment Load Combination

Copy into General Load Combination

Close

Create different load combinations as per ULS

Provide load factors quickly according to combinations

Connect already defined Moving Load and provide gamma_{fl} accordingly

Factors for Assessment Checks

Project View Structure Node/Element Prop

Steel Bridge

NR/GN/CIV/025:06

AASHTO-LRFR19

AASHTO-LRFR11

CS454/20

NR/GN/CIV/025:06

Assessment Parameter

Resistance Formula as per

☒ NR/GN/CIV/025

☐ BS5400 Part3

Required Route Availability Number RA1

Condition Factor(Fc) 1

Material Strength used for Assessment

☒ Characteristic Strength

☐ Worst Credible Strength

Effective Length (BS5400 Part3, 9.6.4.1.1.2)

Span Type

☒ Simply Supported Spans

☐ Continuous Beams

k2 1

k3 1

U-frame Spacing 0 m

☒ Apply Equation A4 of NR/GN/CIV/025, 9.6.4.1.1.2A

Select Assessment Code

Control material factors as per manual inputs too

Manual Inputs for k2 and k3

Modify Design Parameters

NR/GN/CIV/025

Update by Code

Partial Safety Factors for Materials (gamma_m)

Characteristic Strength

ULS

Wrought Iron or Steel 1.05

Buckling of Transverse Stiffener 1.2

Yielding of Transverse Stiffener 1.05

Fasteners in Shear

Web/Flange Rivets 1.2

All Other Rivets 1.33

Worst Credible Strength

ULS

Wrought Iron or Steel 1.05

Buckling of Transverse Stiffener 1.2

Yielding of Transverse Stiffener 1.05

Fasteners in Shear

Web/Flange Rivets 1.2

All Other Rivets 1.33

Partial Safety Factors for Loads (gamma_f3)

ULS

1.1

OK Cancel

Parameters for Assessment Checks

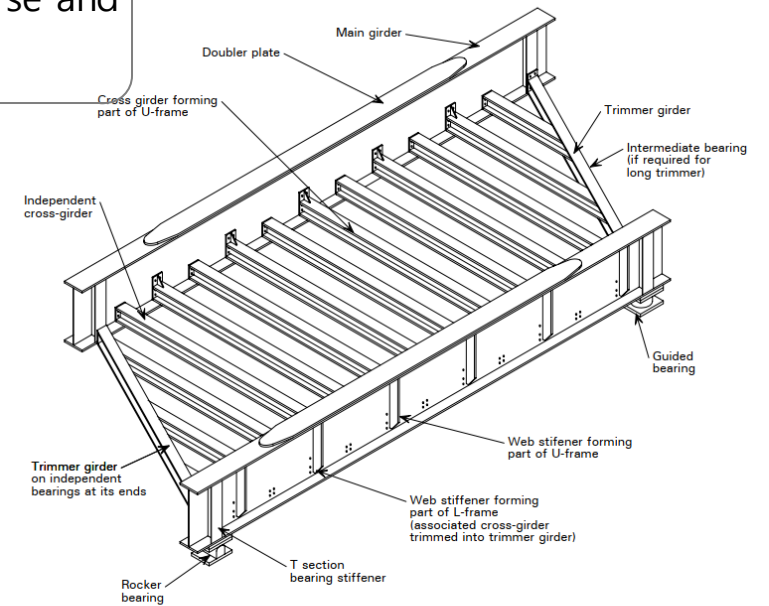
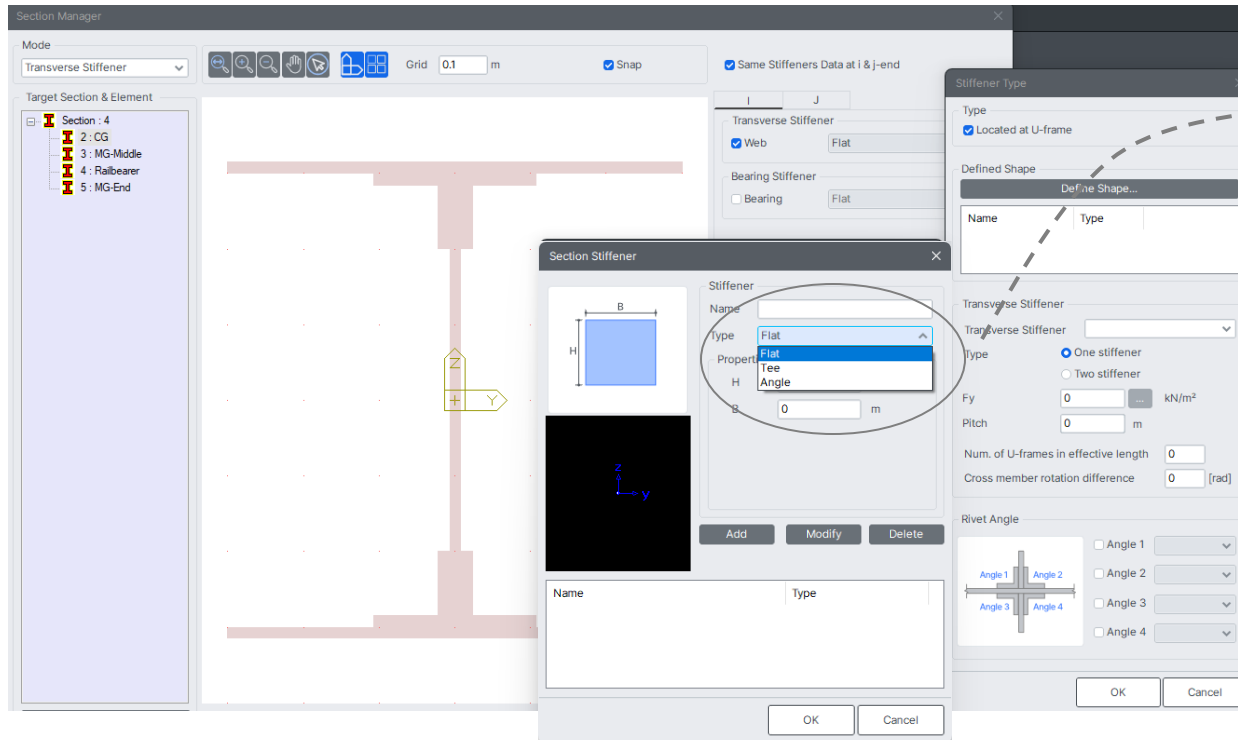
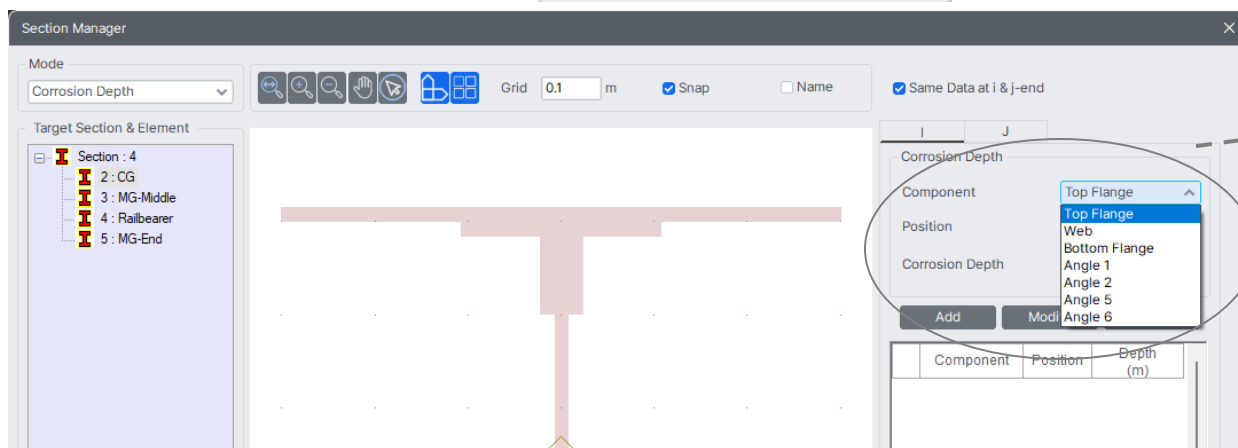


Figure 10.2 Components of half through plate girder bridge (bridge floor not shown)



Parameters for Assessment Checks

C PSC CPG Rating(PSC) **Rating(Steel)**

Effective Length of U-frame

Option
☒ Add/Replace ☐ Delete

Effective Length of U-frame

d1, d2

Cross Member is
☐ connected to the Bottom Flange
☒ User Input

d1 m
 d2 m

u
☒ Outer Beam (u=0.5)
☐ Inner Beam (u=0.33)

Member Assignments

Assign Member Type

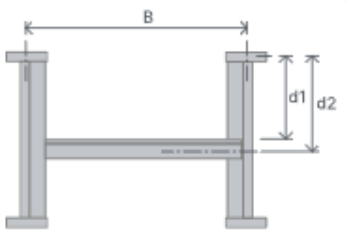
Option
☒ Add/Replace ☐ Delete

Member Type
☒ Main Girder
☐ Cross Girder
☐ Railbearer

U frame action parameters

Flexibility of Joint, f (rad/Nmm)

☒ Type (a) 0.5×10^{-10}
☐ Type (b) 0.2×10^{-10}
☐ Type (c) 0.1×10^{-10}



Rivet Parameters

Fastener-Rivets

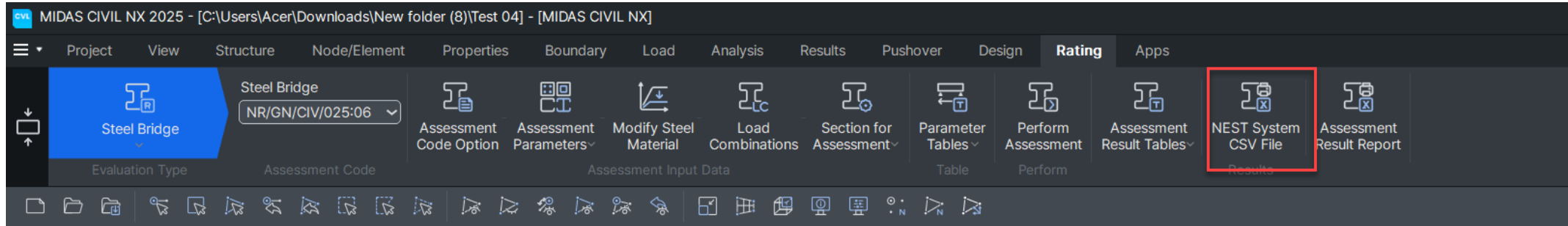
Option
☒ Add/Replace ☐ Delete

☒ Both end parts(i & j) have the same type

I J

Longitudinal Spacing
 m

Ultimate Tensile Strength
 kN/m²



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
		Work Order ID	Asset / Assessment Group	Parent Asset Name	Major Element Name	Major Element Physical ID	Minor Element Name	Minor Element Physical ID	Minor Element Primary Material	Element Section Reference	Element Section Location (m)	Assessed Condition	Structural Action	Description	Engineer's Line Reference Code	Track ID
1																
2	DBP1	00000000	-	-	-	-	Main Girder	1	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
3	DBP1	00000000	-	-	-	-	Main Girder	1	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
4	DBP1	00000000	-	-	-	-	Main Girder	1	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
5	DBP1	00000000	-	-	-	-	Main Girder	2	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
6	DBP1	00000000	-	-	-	-	Main Girder	2	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
7	DBP1	00000000	-	-	-	-	Main Girder	3	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
8	DBP1	00000000	-	-	-	-	Main Girder	3	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
9	DBP1	00000000	-	-	-	-	Main Girder	4	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
10	DBP1	00000000	-	-	-	-	Main Girder	4	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
11	DBP1	00000000	-	-	-	-	Main Girder	5	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
12	DBP1	00000000	-	-	-	-	Main Girder	5	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
13	DBP1	00000000	-	-	-	-	Main Girder	6	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
14	DBP1	00000000	-	-	-	-	Main Girder	6	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
15	DBP1	00000000	-	-	-	-	Main Girder	7	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
16	DBP1	00000000	-	-	-	-	Main Girder	7	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
17	DBP1	00000000	-	-	-	-	Main Girder	8	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
18	DBP1	00000000	-	-	-	-	Main Girder	8	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
19	DBP1	00000000	-	-	-	-	Main Girder	9	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
20	DBP1	00000000	-	-	-	-	Main Girder	9	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
21	DBP1	00000000	-	-	-	-	Main Girder	10	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
22	DBP1	00000000	-	-	-	-	Main Girder	10	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
23	DBP1	00000000	-	-	-	-	Main Girder	10	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
24	DBP1	00000000	-	-	-	-	Main Girder	11	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000
25	DBP1	00000000	-	-	-	-	Main Girder	11	Wrought Iron	-	-	As Built	Bending Moment		DBP1	0000

Future Roadmap

Shell Elements Assessment Results

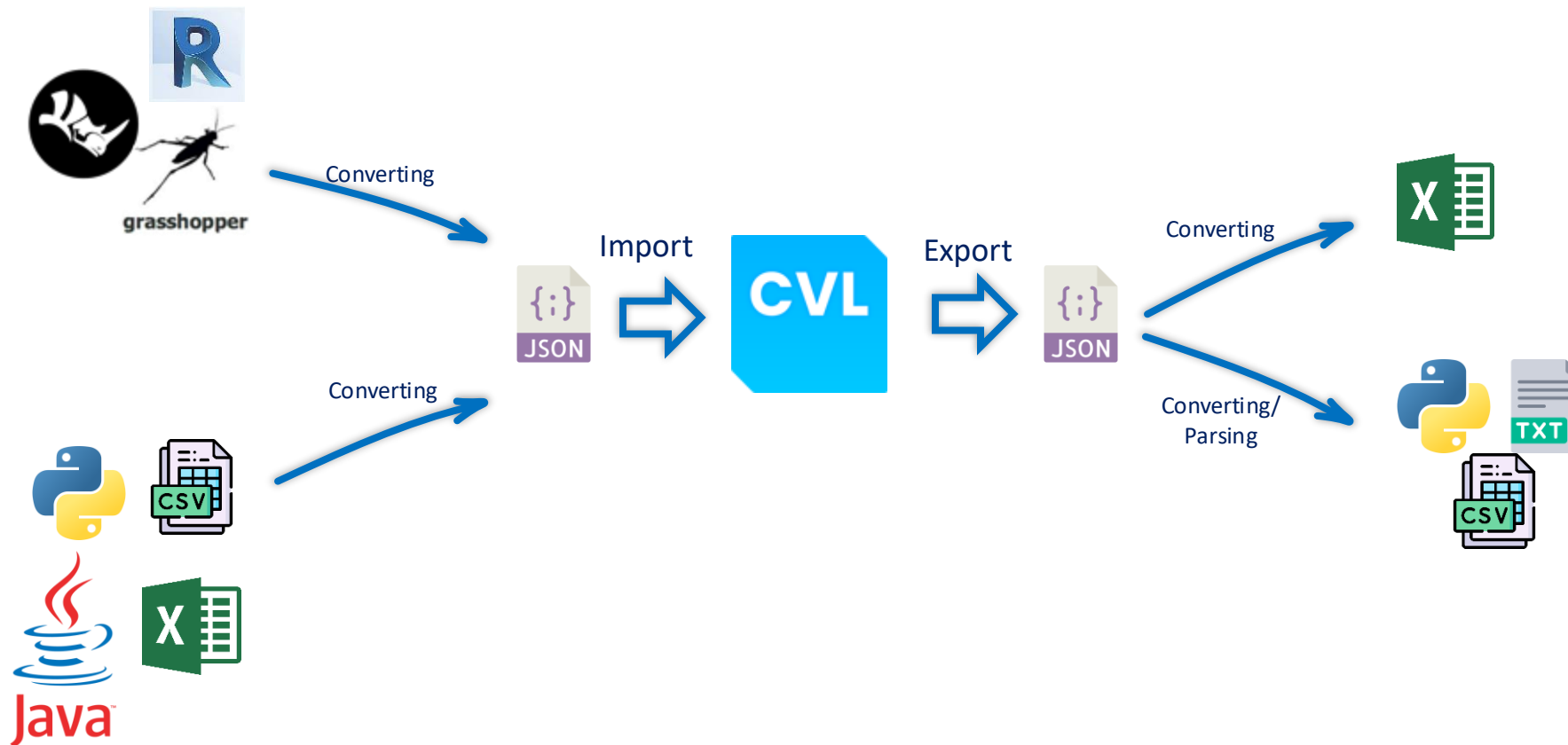
- For Level 2 Assessments, mostly shell elements are used
- Development is underway to extend NR assessment checks to plate elements in addition to beam elements.
- This will allow full finite element-based bridge assessments using regulatory standards.

Improved Corrosion Modeling with Mesh Control

- Investigating a method to model corrosion directly within finite element models by adjusting local mesh geometry.
- This would allow more accurate and flexible representation of corroded regions in steel or composite bridges.

Updates with API

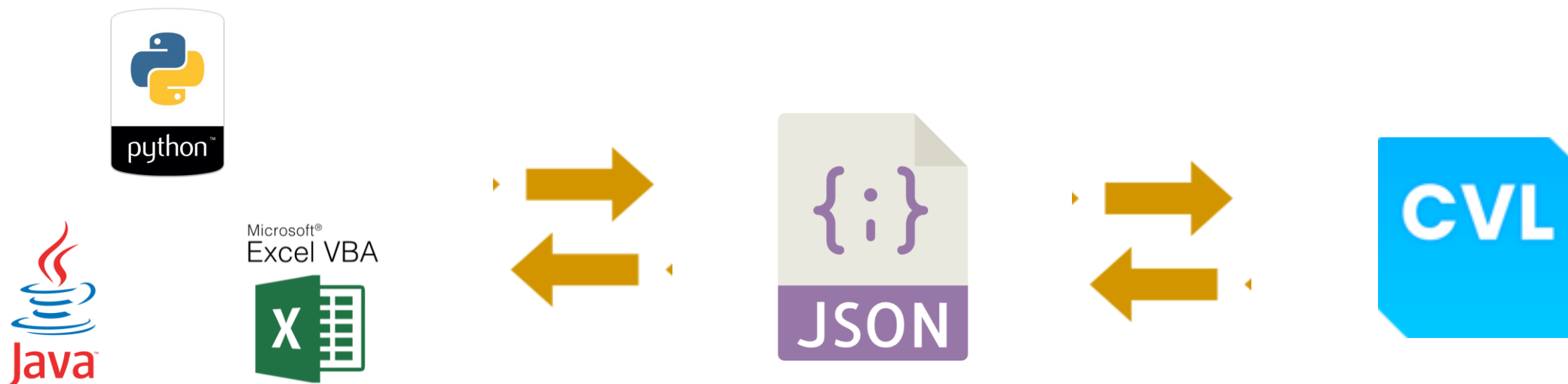
The concept of Data Transferring using API



MIDAS CIVIL NX

Open API Process

Supported by major software packages (Java, Python, C++, C# ...)



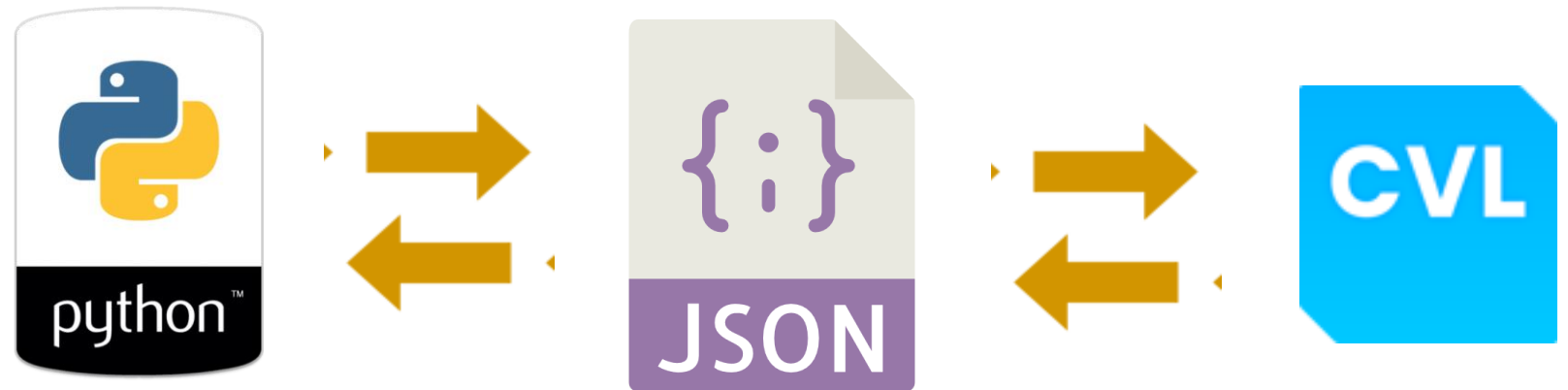
MIDAS CIVIL NX

PYTHON

Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation.

TYPICAL USE CASES :

- Optimisation
- Load automation
- Batch File creation

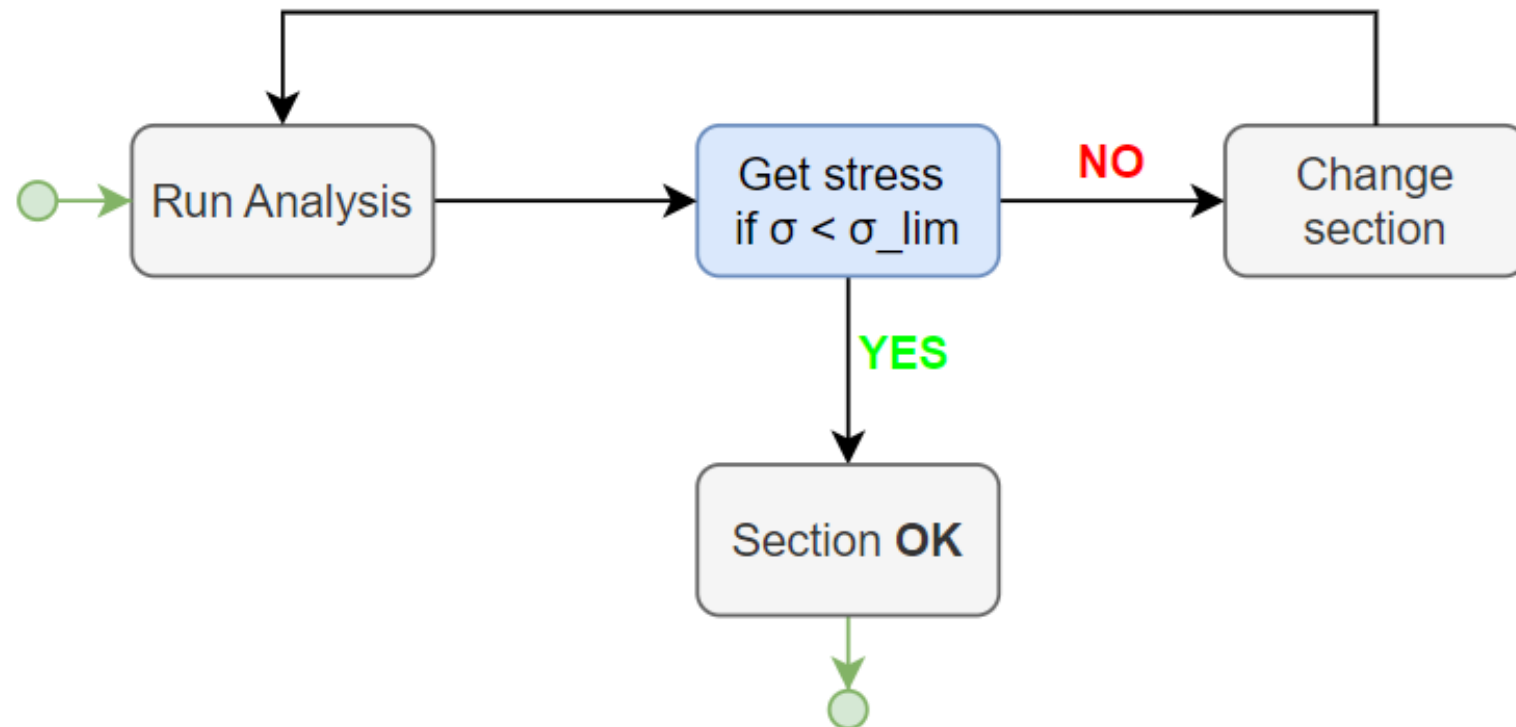


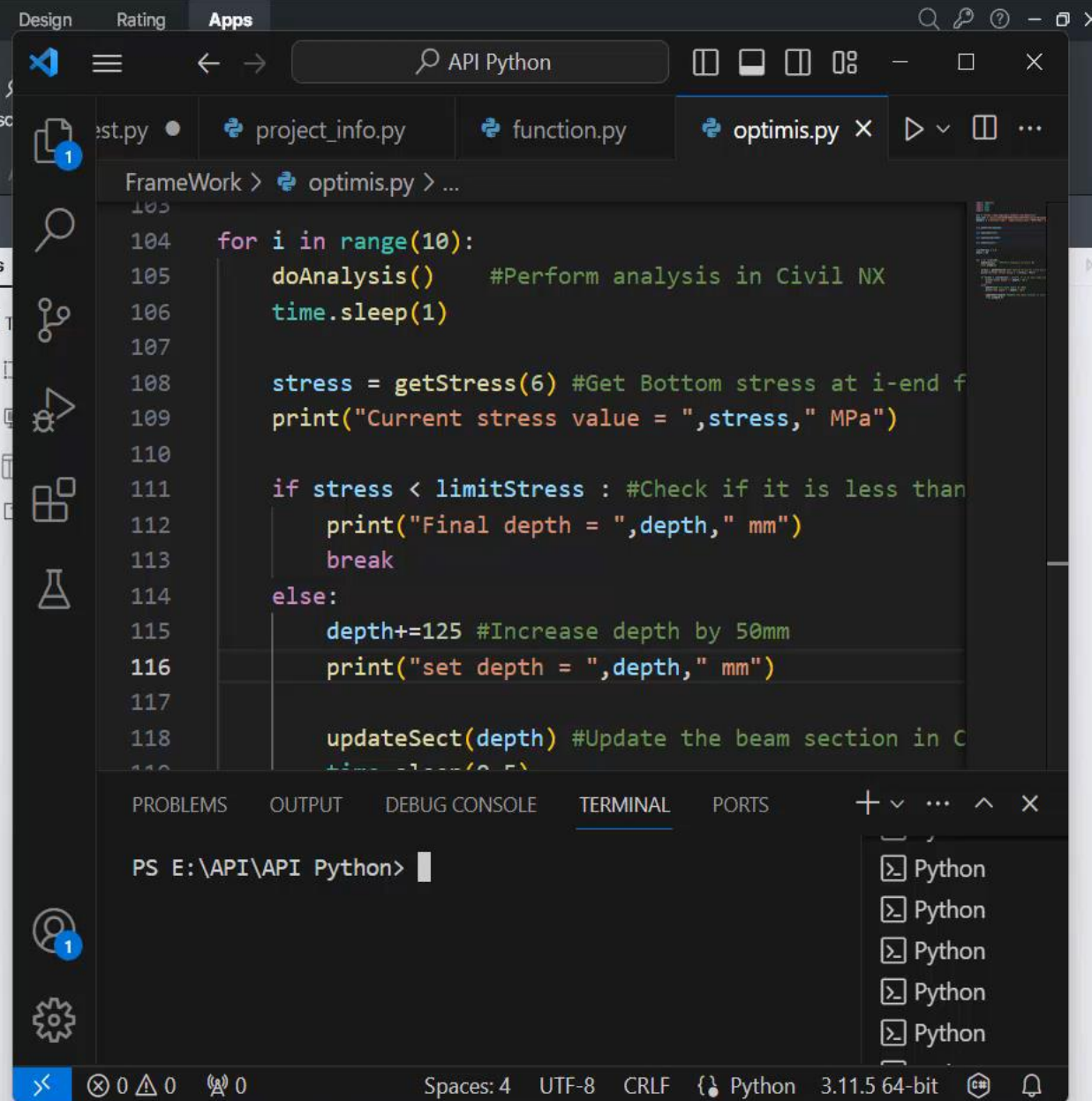
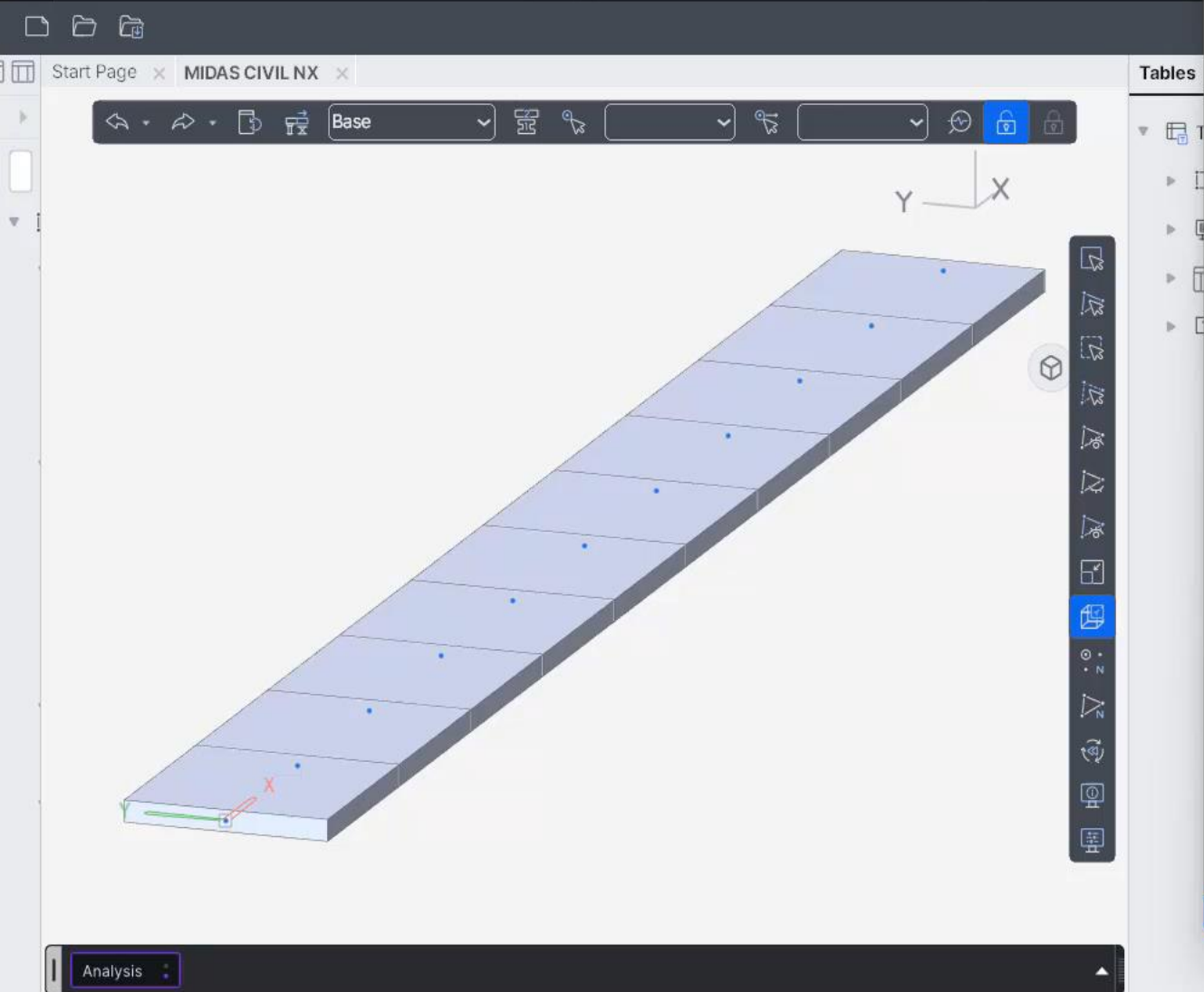
MIDAS CIVIL NX

PYTHON

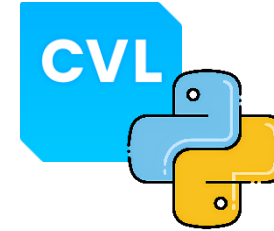
Now you can control MIDAS Softwares using highly accessible programming languages such as Python or Java. Create the commands you need to optimize your design and fine-tune your models and parameters in detail.

Design OPTIMISATION





MIDAS Python Library



```
# Create Material Body
matl_json = {"Assign" : {
    material_ID : {
        "TYPE" : "CONC",
        "NAME" : mat_grade,
        "PARAM" : [
            {
                "P_TYPE":1,
                "STANDARD" : mat_standard,
                "DB" : mat_grade
            }
        ]
    }
}}

# Create Section Body
sect_json = {"Assign" : {
    section_ID : {
        "SECTYPE" : "DBUSER",
        "SECT_NAME" : "Rectangular",
        "SECT_BEFORE" : {
            "USE_SHEAR_DEFORM" : True,
            "SHAPE": "SB",
            "DATATYPE": 2,
            "SECT_I": {
                "vSIZE" : [height, width]
            }
        }
    }
}}
```

Material

Section

```
# Create Material Body
Material.CONC(mat_grade, mat_standard, mat_grade, material_ID)

# Create Section Body
Section.DBUSER("Rectangular", "SB", [height, width])
```

MIDAS Python Library

```
full json.py > ...
147 }
148 load_case_req = MidasAPI("PUT", "/db/Stld", stld_json)
149
150 bodf_json = {"Assign" : {
151     "1" : {
152         "LCNAME" : load_case_name[0],
153         "FV" : [
154             0,
155             0,
156             -1
157         ]
158     }
159 }}
160 sw_req = MidasAPI("PUT", "/db/bodf", bodf_json)
161
162 bmld_json = {"Assign" : {}}
163
164 for i in range(num_divisions):
165     bmld_json["Assign"][start_elem_ID + i] = {
166         "ITEMS" : [
167             {
168                 "ID" : 1,
169                 "LCNAME" : load_case_name[1],
170                 "CMD" : "BEAM",
171                 "TYPE" : "UNILOAD",
172                 "DIRECTION" : "GZ",
173                 "D" : [
174                     0,
175                     1
176                 ],
177                 "P" : [
178                     add_vertical_load,
179                     add_vertical_load
180                 ]
181             }
182         ]
183     }
184 bmld_req = MidasAPI("PUT", "/db/bmld", bmld_json)
```

```
using library.py > ...
1 #Importing the midas-civil package
2 from midas_civil import*
3 MAPI_KEY('eyJ1ciI6InN1bWl0QG1pZGFzaXQuY29tIiwicGciOiJjaXZpbCI6ImN1Ijoib3R3aXF0NHNR')
4
5 #Input data
6 length : float = 10.0
7 height : float = 1.0
8 width : float = 0.8
9 add_vertical_load : float = -30.0
10
11 Model.units(length='M', force='KN')
12
13 Material.CONC("C32", 'AS17(RC)', "C32", 1)
14 Section.DBUSER("Rectangular", "SB", [height, width])
15
16 num_divisions = 20
17 Element.Beam.SE([0,0,0],[length,0,0],num_divisions,1,1)
18
19 Boundary.Support(1,"1111000")
20 Boundary.Support(1 + num_divisions, "0111000")
21
22 Load_Case("USER", "DL", "SIDL")
23 Load.SW("DL", "Z", -1)
24 for i in range(num_divisions):
25     Load.Beam(1 + i, "SIDL", add_vertical_load)
26
27 Model.create()
```

184 lines vs 27 lines

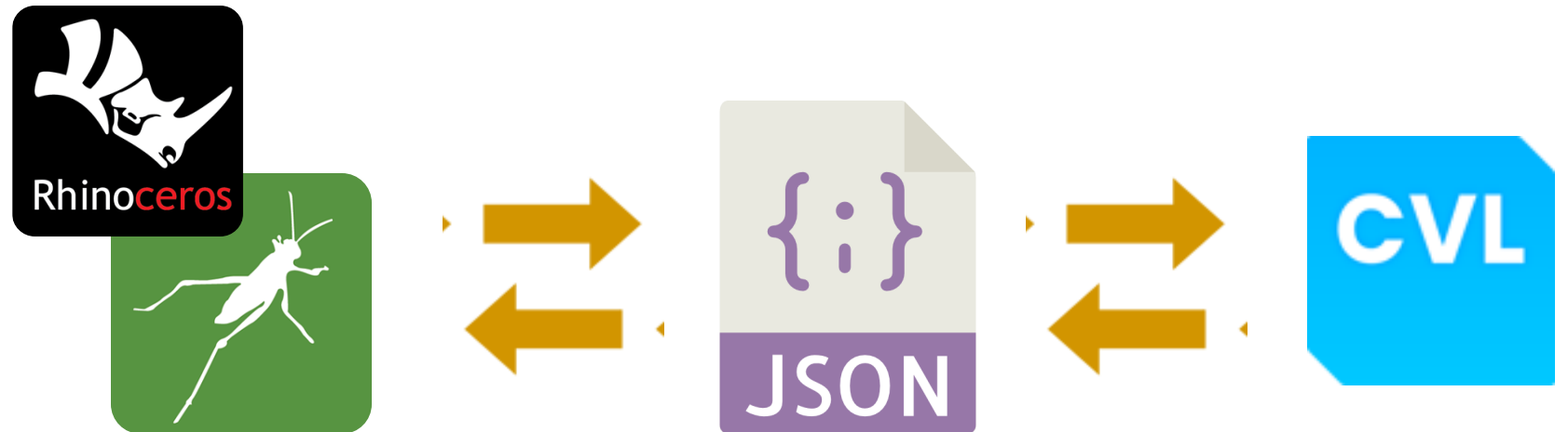
MIDAS CIVIL NX

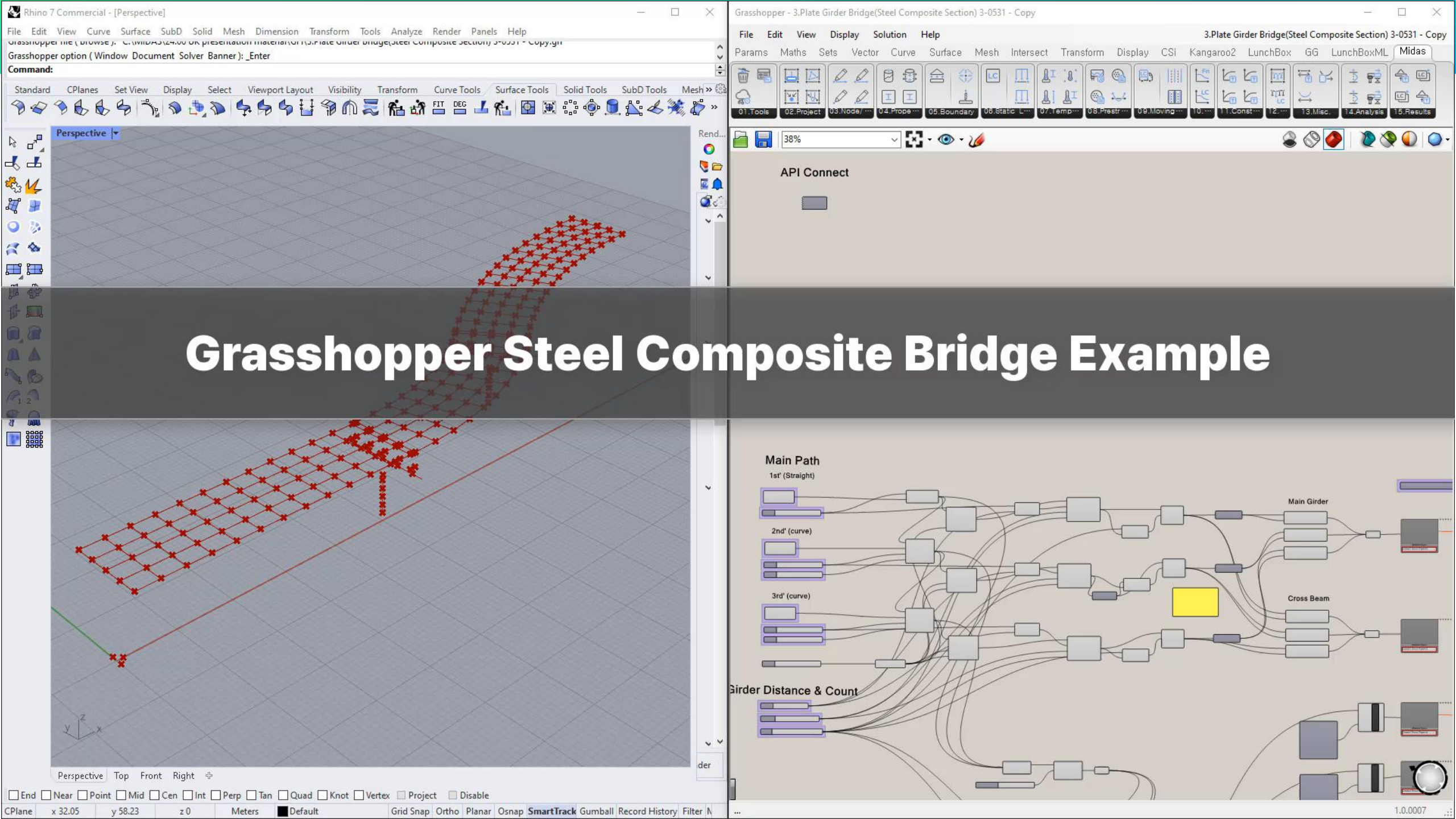
RHINO X GRASSHOPPER

Grasshopper is a visual programming environment tightly integrated with Rhino's 3D modeling tools. Grasshopper requires no knowledge of programming or scripting, but still allows designers to build generative forms.

TYPICAL USE CASES :

- Parametric modelling
- Load automation
- BIM export to REVIT





Grasshopper Steel Composite Bridge Example

MIDAS GH v3.0.0 (update)

System Improvements

New Components

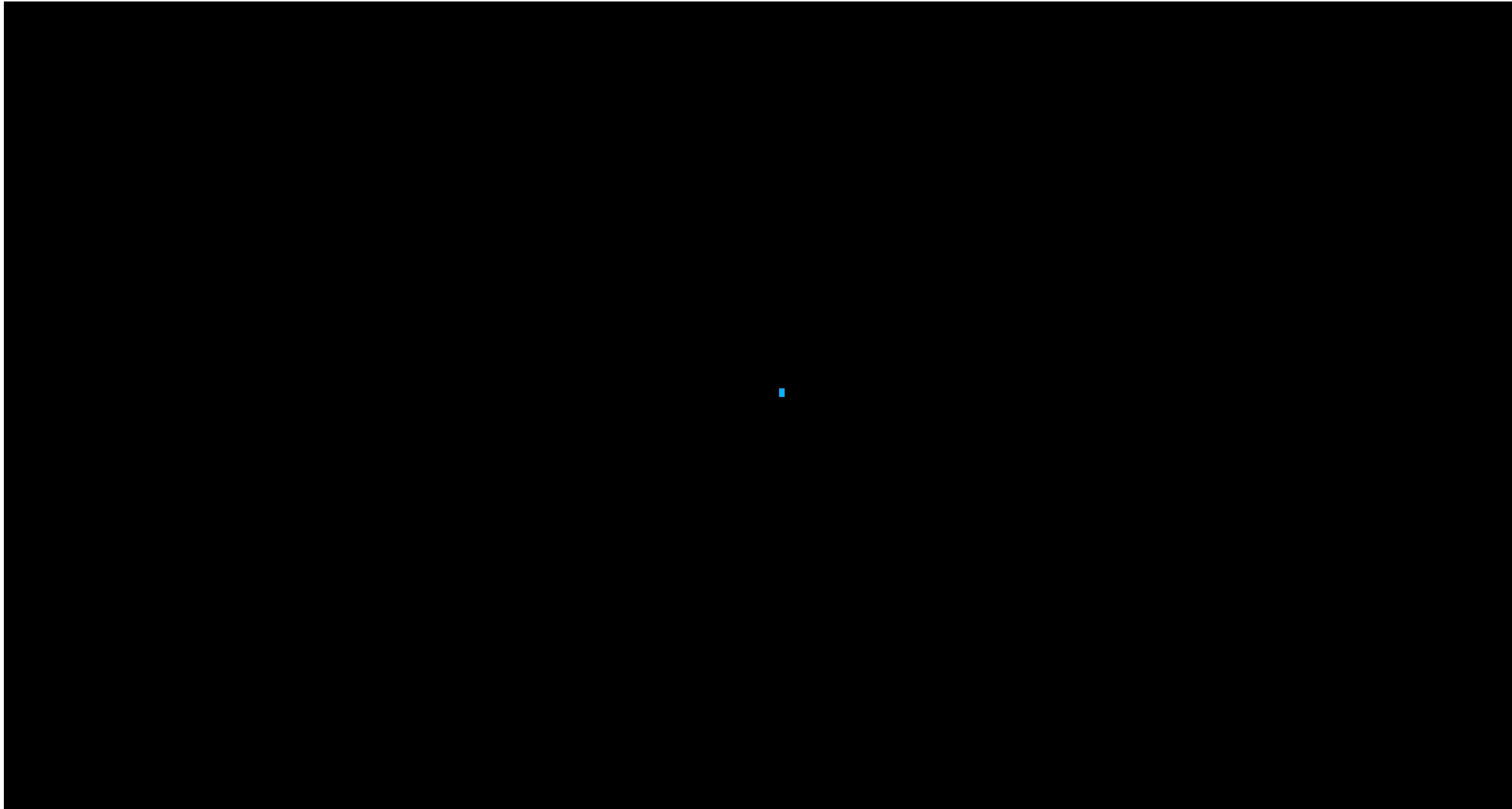
- Import from CIVIL NX
- Draw CIVIL model

Bug Fixes

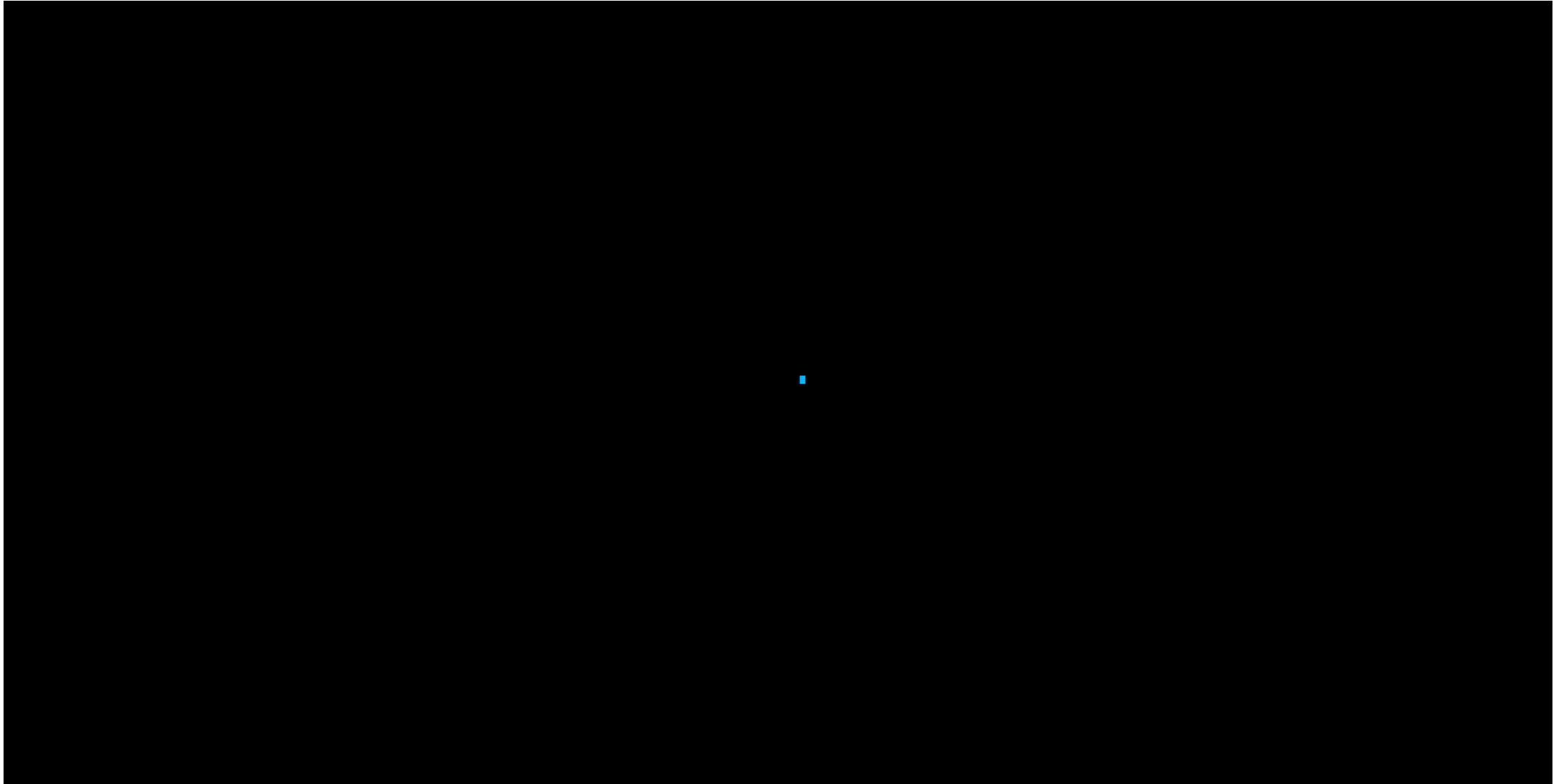
The screenshot shows the MIDAS Support website interface. At the top, there is a navigation bar with the MIDAS logo and links for Products, Resources, Support, MIDAS ↗, and Academy ↗. Below the navigation bar, the breadcrumb trail reads: MIDAS Support > Online Help_GrassHopper API > Introduction. The page title is "[MIDAS GH] 2025. V3.0.0". Below the title, there is a section for "1. Update Item" which is expanded. Under this section, there are three main categories of updates:

- 1) System Improvements
 - System Improvements
 - Improved Data Review
 - Real-time DB Update
 - Enhanced Data Processing Speed
- 2) Expanded Auto/Manual ID Input Support
 - Import Civil NX
 - Draw Civil Model
- 3) Changes to Existing Components
 - Added Button
 - Send Request
 - Delete Component
 - ID Input Field Removed*
 - Define General Spring Type
 - Small Disp. Initial Force Control Data
 - Settlement Group Name
 - Settlement Load Cases

MIDAS GH v3.0.0 (update) – Import CIVIL NX



Sneak Peak – Beam to Plate convertor



Sneak Peak – Drawing Generation

The image displays a workflow for generating drawings using the MIDAS API. On the left, the MIDAS CIVIL NX 2025 interface shows a project titled 'Sample Grillage 1'. The 'Works' tree on the left lists various structural elements: Structures (Nodes: 550, Elements: 820), Properties (Material: 4, Section: 18), Boundaries (Supports: 20), and Static Loads (Static Load Case 1 [Self-Weight], Static Load Case 2 [Wearing Cou], Static Load Case 3 [CB;]). The main workspace shows a 3D model of a skewed deck plan with a grid of nodes and elements. The right side of the image shows a VS Code editor with a Python script named 'Midas.py' that uses the MIDAS API to generate drawings. The script imports libraries like requests, json, pandas, math, ezdxf, and units. It creates a document and a model space, then defines a function 'MidasAPI' that sends a request to the MIDAS Open API to generate a drawing. The terminal at the bottom shows the command 'PS E:\API\Drawing>' being executed.

MIDAS CIVIL NX 2025 - [E:\API\Drawing\Sample Grillage 1] - [MIDAS CIVIL NX]

Project View Structu Node/E Proper Bound Load Analysi Results Pushov Design Rating Apps

MCT Command Shell General Section Designer Sectional Property Calculator Tendon Profile Generator Dynamic Report Seismic Data Meta File Converter Editor API

Tables Works Group Report Start Page x MIDAS CIVIL NX x

Search

Works

- Structures
 - Nodes 550
 - Elements 820
- Properties
 - Material 4
 - Section 18
- Boundaries
 - Supports 20
- Static Loads
 - Static Load Case 1 [Self-Weight ;
 - Static Load Case 2 [Wearing Cou
 - Static Load Case 3 [CB;]
- Construction Stage 1
 - CS [0 day(s)]

Command *

For Help, press F1 Node-244 kN mm 100%

VS Code Explorer

- DRAWING
 - _pycache_
 - Deck_plan.dxf
 - Deck_plan.py
 - Midas.py
 - Sample Grillage 1.mcb
 - Skewed Deck Plan.py
 - SKGLIBDRW.py

Midas.py

```
1
2 import requests
3 import json
4 import pandas as pd
5 import math
6 from Deck_plan import Midas_Span_Data, Girder_offset_b
7 from SKGLIBDRW import Skewed_Deck, cross_section, cros
8 import ezdxf
9 from ezdxf import units
10 import os
11
12 # Create document
13 doc = ezdxf.new("R2010", setup=True)
14 doc.units = units.MM
15 msp = doc.modelspace()
16
17
18
19 Span_data = pd.DataFrame(Midas_Span_Data)
20
21 # Function for MIDAS Open API
22 def MidasAPI(method, command, body=None):
23     base_url = "https://moa-engineers.midasit.com:443/"
24     mapi_key = "eyJ1ciI6InN1bWl0QG1pZGFzaXQuY29tIiwicG
25
26     url = base_url + command
```

Terminal

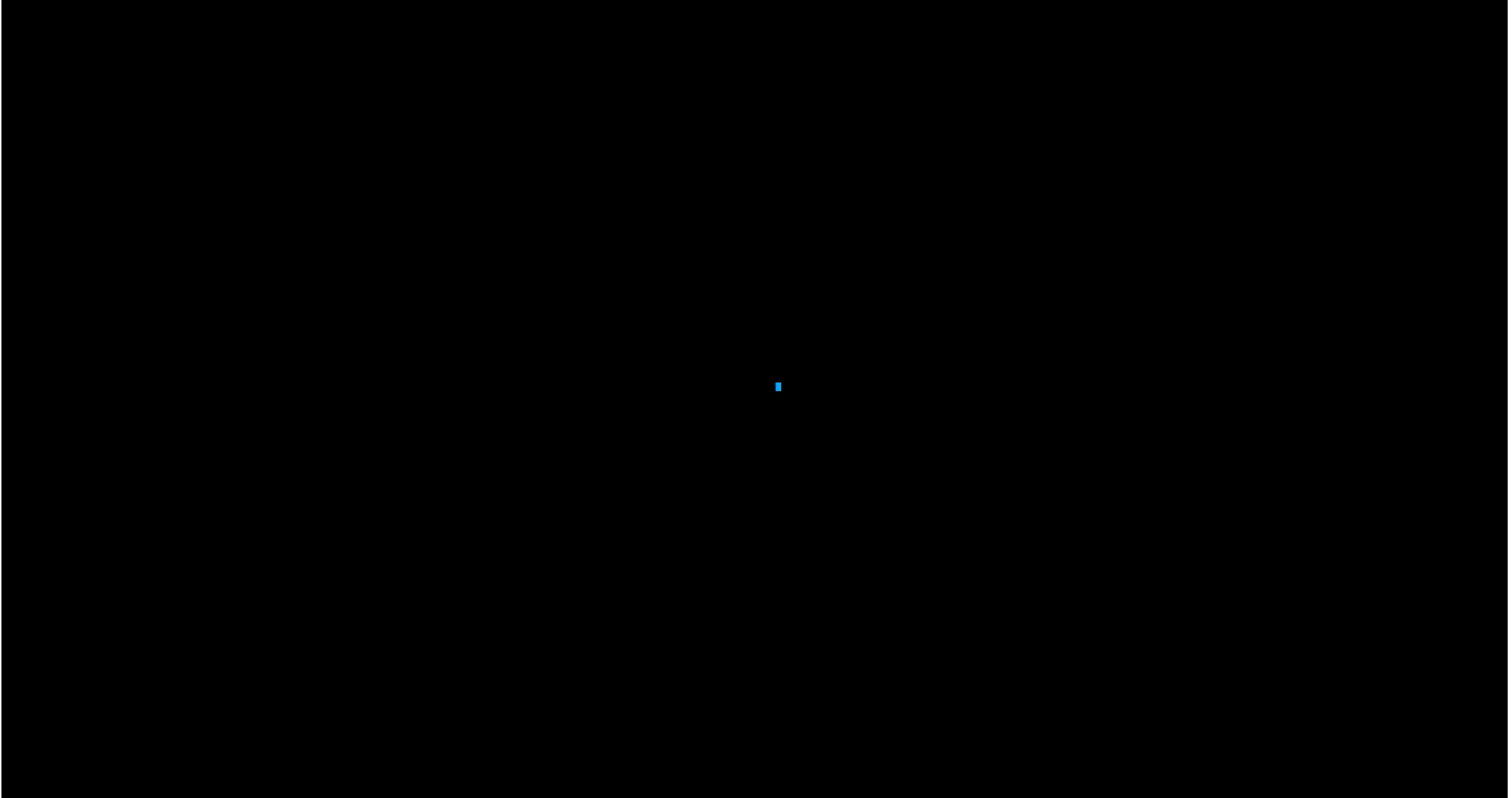
```
PS E:\API\Drawing>
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

powerShell Python

Ln 25, Col 1 Spaces: 4 UTF-8 CRLF Python 3.12.10 64-bit

LLM Integration – future of API !!



Updates with Solver

Structural limitations of the existing solver

FES Solver

- Developed in Fortran (Language developed in the 50's)
- Specialized for numerical computation
- Reliable for small to medium-scale models
- Slower for very large or highly nonlinear models
- Less efficient memory usage
- Limited parallel computing capabilities



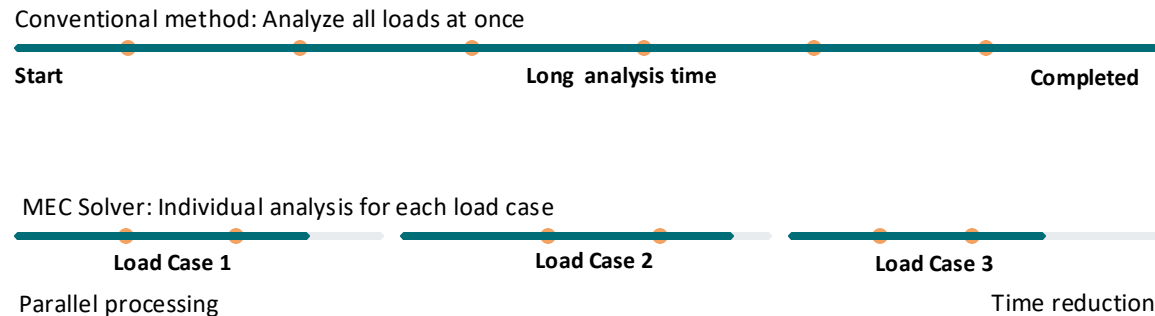
VS

MEC Solver

- Developed in C++ (Language developed in the 80's)
- Enables performance optimization and versatile programming
- Optimized memory management for ultra-large models (millions of DOFs)
- Faster convergence in nonlinear/dynamic/soil-structure analyses
- More scalable for modern infrastructure and bridge projects



Conventional method vs. MEC Solver method



Key Improvements of the MEC Solver



Selective analysis support



Boundary Change Assignment



Improved time-history analysis



Material/Geometric Nonlinear Analysis



Improved analysis speed



Expansion of analysis functions

Selective analysis support – drastically reduced analysis time



Concept of selective analysis



Rapid decision-making



Enables precise review



Reduced analysis time



Increased design efficiency

Perform Analysis

Analysis & Load Cases

Analysis	Analysis & Load Cases	Type	Status
Construction Stage Analysis			
☒	Construction Stage	Construction Stage	Not Run
Static Analysis			
☒	All	Static	Not Run
Moving Load Analysis			
☒	All	Moving	Not Run
Settlement Analysis			
☒	All	Settlement	Not Run

Check All Check None Run Close

Improved Material and Geometric Nonlinear Analysis

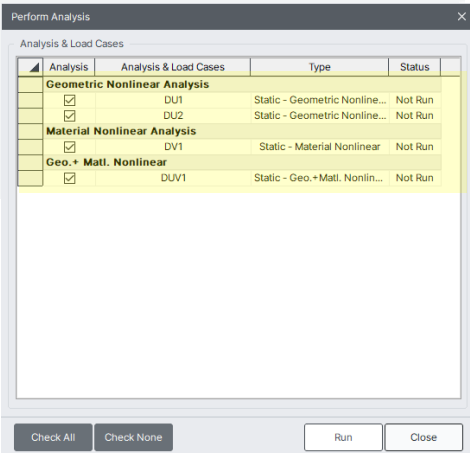


Single-Model Nonlinear Analysis

Conventional method



- ✗ Linear and Nonlinear Models Generated Separately
- ✗ Greater complexity in management
- ✗ Difficulty in maintaining data consistency
- ✗ Inefficient use of computational resources

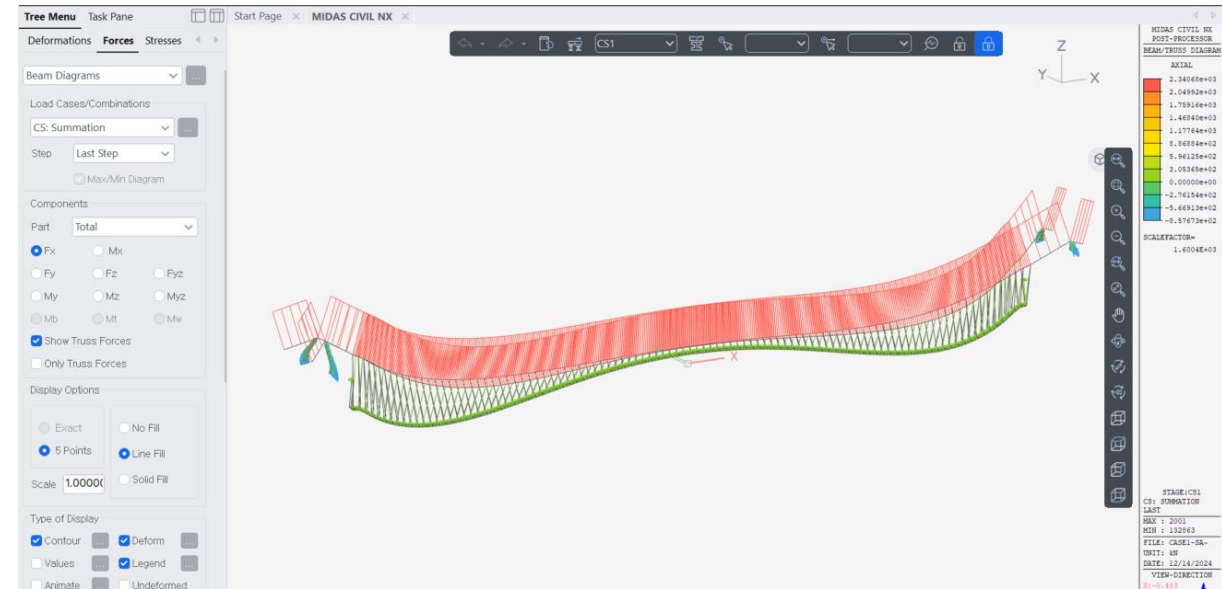


VS

MEC Solver



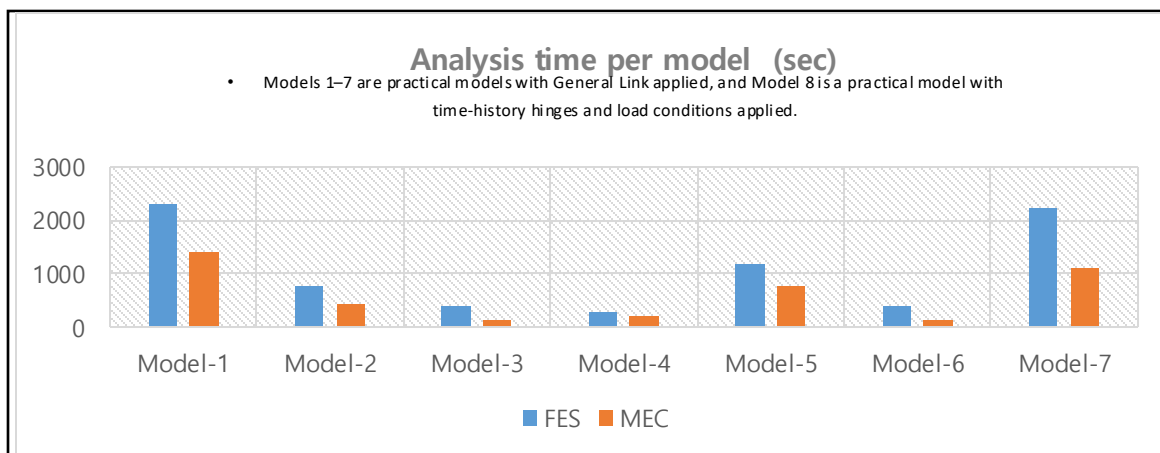
- ✓ Nonlinear analysis loads in a single integrated model
- ✓ Case-specific nonlinear analysis support
- ✓ Accurate nonlinear behavior simulation and analysis
- ✓ Optimal use of resources



Improved analysis speed

Nonlinear analysis time reduced by 1.3 to 6 times

Speed improvement by analysis type



	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6	Model-7	Model-8
Number of nodes	3,500	1,189	2,053	1,069	154	679	263	44,325
Number of elements	2,373	1,840	1,992	1,159	147	554	282	49,965
Number of steps	65,000	27,000	7,500	48,000	300,000	14,000	345,000	4,000
FES [sec]	2306.21	776.17	417.59	285.47	1193.06	404.07	2231.98	18,202
MEC [sec]	1419.98	458.65	151.18	219.42	778.09	136.02	1121.10	3,073
Comparison (FES/MEC)	1.6	1.7	2.8	1.3	1.5	3.0	2.0	5.9

Core Technology



Optimized numerical analysis algorithms



Parallel processing technology

Key Effects



Reduced project duration



More design reviews



Increased precision



Cost reduction

Contact Us

uksupport@midasuser.com

Roy Han
Account/Business Development Manager
(UK/IE)
Midas IT UK
royhan@midasit.com

Manoj Kheterpal
Technical/Business Development Manager
(UK/IE)
Midas IT UK
manoj@midasit.com