

Release Note

Release Date : 2026/01/27

Product ver. : CIVIL NX 2026 (v1.1)

CIVIL NX 2026 v1.1 개정내용

01 콘크리트 극한강도설계법(KDS 14 20 00:2022)

- Beam Design
- Column Design
- Wall Design
- Foundation Design

02 한계상태설계법 차량하중의 접지면 고려 해석

03 MIDAS PRO(기술지원 GPT)

04 Pre-Post Processing

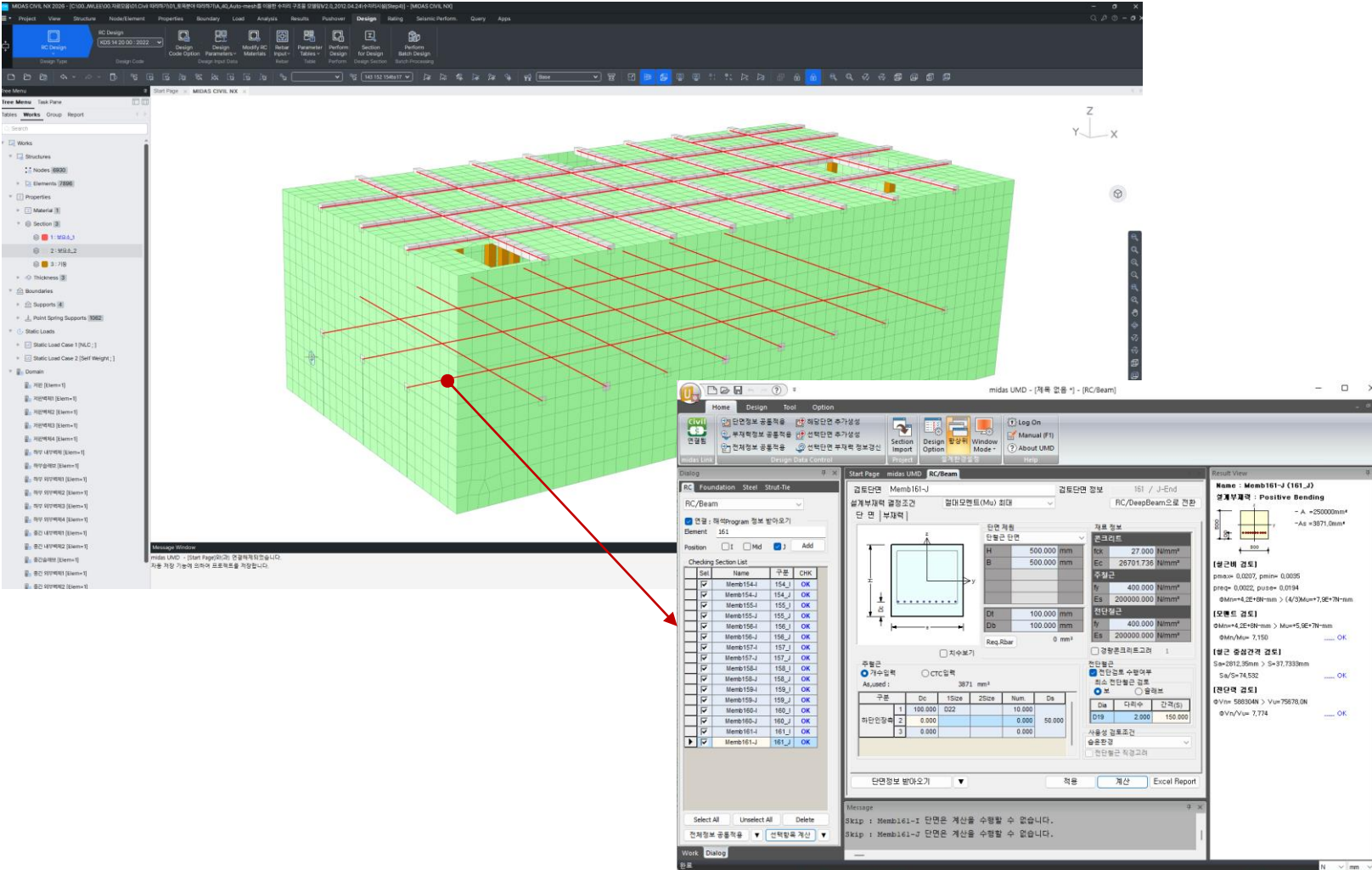
- Local Coordinate Displacement Output under Moving Load Cases
- Batch output for tendon loss table by construction stage and tendon group
- Flexible Dual Tree Menu Layout and External Docking
- Full Customization of Horizontal Toolbar Functions
- Addition of Active Fix and Zoom Fix for Stage to Status Bar

05 해외 출시 기능

- Addition of Material Database for Structural Steel Reinforcement as per NR/GN/CIV/025
- Addition of Section Properties for U-girder Bridge as per NR/GN/CIV/025
- Addition of Moving Load for UK Network Rail Bridge Assessment as per NR/GN/CIV/025
- UK Network Rail Bridge Assessment as per NR/GN/CIV/025
- Automated design support for asymmetric (Type 2) composite steel bridges(Eurocode, AASHTO)
- RC design support for US railway bridges(Based on AREMA design code)
- Update PSC section design criteria for Australia to the latest 2024 standard
- Add California-specific provisions from AASHTO LRFD
- Auto-generate Load combination (RC) as per TMH07 : 1981
- PSC Design as per TMH07-3 : 1989
- Significantly Improved Excel Design Report Generation Speed
- Steel-Composite Girder Design & Assessment Enhancements
- Virtual Beam Display for Plate and Mixed Models
- Virtual Beam + Span Information: Faster LTB checks on plate or mixed models
- Virtual Beam Selection & Management
- Virtual Beam Reinforcement/Transverse Stiffener Input
- Virtual Beam Design & Assessment for Steel-Composite Girders
- Virtual Section for Design
- Bearing Stiffener/ Intermediate Stiffener Check (NR/GN/CIV/025) for Steel Railway Bridges
- Local Coordinate Displacement Output under Moving Load Cases

1. Beam Design(보 / 슬래브 설계)

- 비교량 구조물의 콘크리트 극한강도설계법(KDS 14 20 00:2022)에 대한 보/슬래브 설계가 가능한 Beam Design을 제공
- 콘크리트 설계에 필요한 Member Assignment를 활용한 부재단위 설계 지원
- 콘크리트 강도에 따른 극한 상태의 압축 연단 콘크리트 변형률 반영(공칭 모멘트 산정에 영향)



1. Memb161-J

1) 계산조건

설계기준강도	$f_{ck} = 27.00 \text{ MPa}$	부재폭	$b_w = 500.00 \text{ mm}$
인장철근항복강도	$f_y = 400.00 \text{ MPa}$	부재의 총 높이	$h = 500.00 \text{ mm}$
전단철근항복강도	$f_{yt} = 400.00 \text{ MPa}$	유효높이	$d = 400.00 \text{ mm}$
계수 모멘트	$M_u = 58.93 \text{ kN}\cdot\text{m}$	최외측 인장철근중심에서 인장연단까지의 거리	$d_c = 100.00 \text{ mm}$
계수 전단력	$V_u = 75.68 \text{ kN}$	사용철근량	$A_s = 3871.00 \text{ mm}^2$
활강도 감소계수	$\phi_p = 0.818$	사용전단철근량	$A_v = 573.00 \text{ mm}^2$
전단강도 감소계수	$\phi_s = 0.75$		

2) 철근량 산정

$$\begin{aligned} reqA_s &= 441.60 \text{ mm}^2 \\ reqE_s &= 0.06536 \\ req\phi_f &= 0.85 \\ a_{req} &= 15.38 \text{ mm} \end{aligned}$$

최소허용변형률($\epsilon_{s,allow}$) 검토

$$\epsilon_s = \epsilon_{cu} \cdot (h - d_c) / c = 0.0045 \geq \epsilon_{s,allow} = 0.004 \quad \dots \text{OK}$$

여기서, $\epsilon_s, \epsilon_{cu}$ 는 각각 철근의 변형률과 압축연단에서 콘크리트의 극한 변형률을 나타낸다.

$$\rho_b = \left(\frac{\eta \cdot (0.85 \cdot f_{ck}) \cdot \beta_1}{f_y} \right) \times \left(\frac{\epsilon_{cu}}{\epsilon_{cu} + f_y/E_s} \right) = 0.0286$$

$$\rho_b' = \left(\frac{\eta \cdot (0.85 \cdot f_{ck}) \cdot \beta_1}{f_y} \right) \times \left(\frac{\epsilon_{cu}}{\epsilon_{cu} + \epsilon_{s,allow}} \right) = 0.0207$$

$$\begin{aligned} \eta &= 1 \\ maxA_s &= \rho_b \cdot b_w \cdot d = 4149.86 \text{ mm}^2 \end{aligned}$$

1 페이지

$$H22-10.00EA = 3871.00 \text{ mm}^2$$

설계모멘트 강도

$$\begin{aligned} \phi M_n &= 0.818 \cdot A_s \cdot f_y \cdot (d - a/2) = 421.32 \text{ kN}\cdot\text{m} \geq M_u = 58.93 \text{ kN}\cdot\text{m} \quad \dots \text{OK} \\ a &= 134.96 \text{ mm} \\ \epsilon_s &= 0.00452 \\ f_s &= 400.00 \text{ MPa} \end{aligned}$$

최소철근량 검토

$$\phi M_n = 421.32 \text{ kN}\cdot\text{m} \geq (4/3) M_u = 78.57 \text{ kN}\cdot\text{m}$$

3) 전단철근량 산정

$$\begin{aligned} \lambda &= 1 && \text{경량콘크리트 계수} \\ \phi V_c &= \phi \cdot 1/6 \cdot \lambda \sqrt{f_{ck}} \cdot b_w \cdot d = 129.90 \text{ kN} && \text{콘크리트 공칭전단강도} \end{aligned}$$

구분	ϕV_c	$\phi V_c/2$	V_u
보	129.90 kN	64.95 kN	75.68 kN

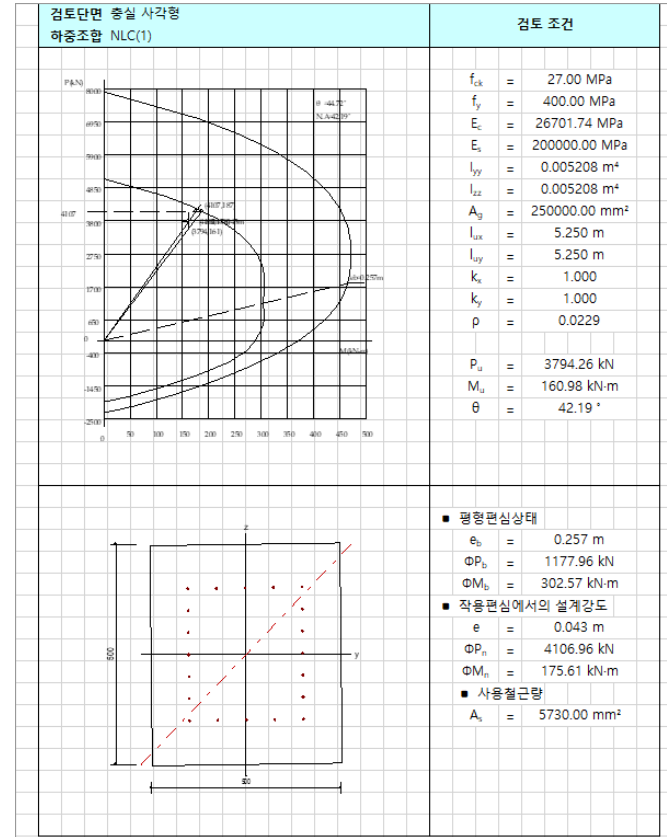
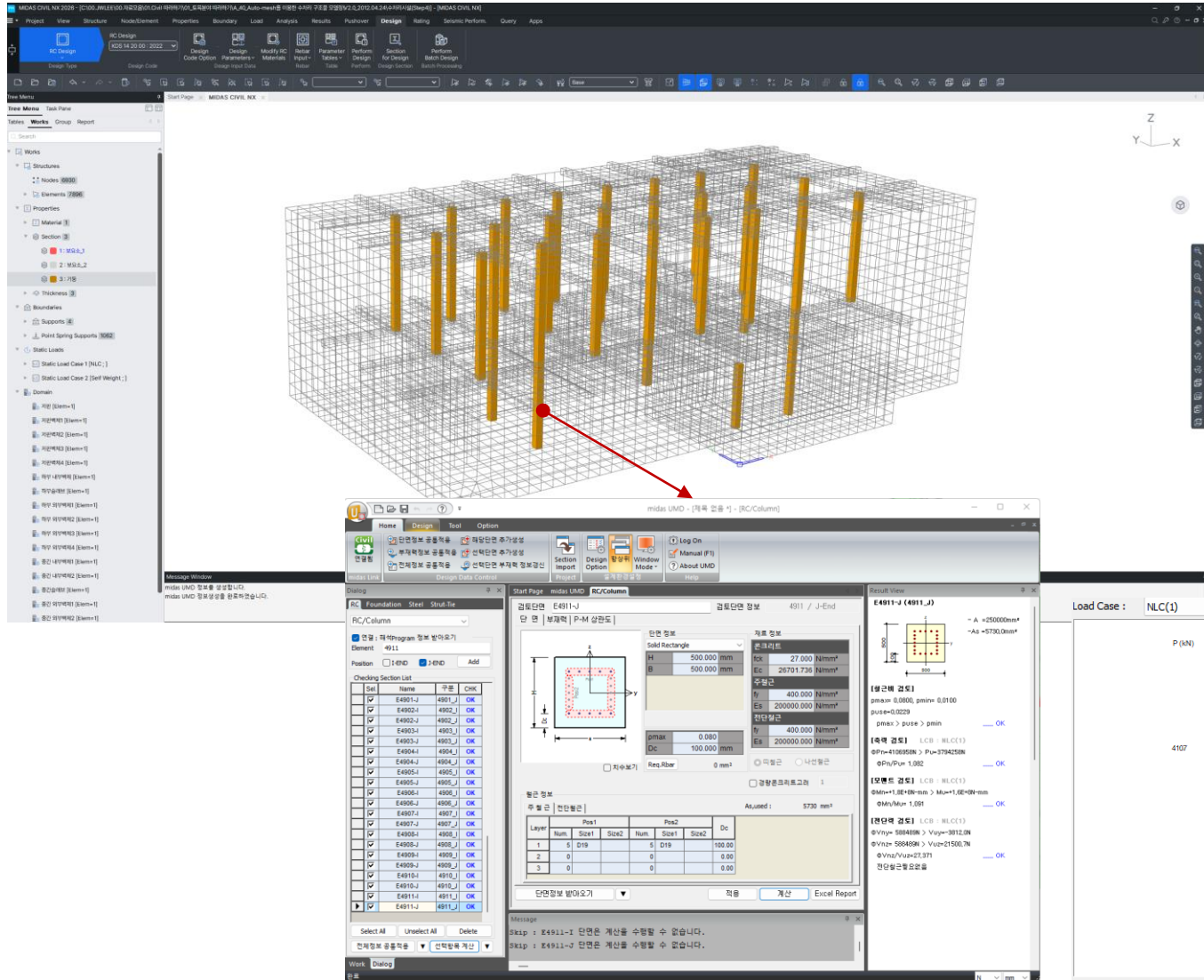
$\therefore \phi V_c/2 < V_u < \phi V_c$ 이므로 최소전단철근 보강

$$\begin{aligned} minA_{v,1} &= 0.35 \cdot b_w \cdot s / f_{yt} = 65.63 \text{ mm}^2 \\ minA_{v,2} &= 0.0625 \sqrt{f_{ck}} \cdot b_w \cdot s / f_{yt} = 60.89 \text{ mm}^2 \\ minA_v &= \max [minA_{v,1}, minA_{v,2}] = 65.63 \text{ mm}^2 \end{aligned}$$

$$\begin{aligned} \text{사용철근량 } A_v &= H19 - 2.00 \text{ Legs} = 573.00 \text{ mm}^2 \geq minA_v \quad \dots \text{OK} \\ \text{수평간격 } s &= 150.00 \text{ mm} \leq \min[0.5d, 600\text{mm}] = 200.00 \text{ mm} \quad \dots \text{OK} \end{aligned}$$

2. Column Design(기둥 설계)

- 비교량 구조물의 콘크리트 극한강도설계법(KDS 14 20 00:2022)에 대한 P-M 상관도를 포함한 Column Design을 제공
- 콘크리트 강도에 따른 극한 상태의 압축 연단 콘크리트 변형을 반영(균형 편심비, 균형 축하중/모멘트 산정)



검토단면 하중조합 NLC(1)	검토 조건
	$f_{ck} = 27.00 \text{ MPa}$ $f_y = 400.00 \text{ MPa}$ $E_c = 26701.74 \text{ MPa}$ $E_s = 200000.00 \text{ MPa}$ $I_{yy} = 0.005208 \text{ m}^4$ $I_{zz} = 0.005208 \text{ m}^4$ $A_g = 250000.00 \text{ mm}^2$ $l_{ux} = 5.250 \text{ m}$ $l_{uy} = 5.250 \text{ m}$ $k_x = 1.000$ $k_y = 1.000$ $\rho = 0.0229$
	$P_u = 3794.26 \text{ kN}$ $M_u = 160.98 \text{ kN-m}$ $\theta = 42.19^\circ$

- 평형편심상태
 - $e_b = 0.257 \text{ m}$
 - $\Phi P_b = 1177.96 \text{ kN}$
 - $\Phi M_b = 302.57 \text{ kN-m}$
- 작용편심에서의 설계강도
 - $e = 0.043 \text{ m}$
 - $\Phi P_n = 4106.96 \text{ kN}$
 - $\Phi M_n = 175.61 \text{ kN-m}$
- 사용철근량
 - $A_s = 5730.00 \text{ mm}^2$

6. 기둥 전단 검토

1) 작용하중

구분	V _{uy}	V _{uz}	합성전단력	N _u
NLC(1)	-3.81 kN	21.50 kN	21.84 kN	3794.26 kN

2) 전단철근량 산정 : V_y
 인장철근들의 도심과 압축연단까지의 거리
 $d = 400.00 \text{ mm}$
 경량콘크리트 계수
 $\lambda = 1$
 콘크리트 공칭전단강도

$$V_c = \frac{1}{6} \left(1 + \frac{N_u}{14A_g} \right) \lambda v (f_{ck}) \cdot b_o \cdot d = 360.97 \text{ kN}$$

ΦV_c	$\Phi V/2$	V _u (V _{max})	비고
270.73 kN	135.37 kN	-3.81 kN	$\lambda V_c/2 \geq V_u$ 이므로, 전단보강 필요없음

3. Wall Design(벽체 Plate 설계)

- 비교량 구조물의 콘크리트 극한강도설계법(KDS 14 20 00:2022)에 대한 Member Assignment(Plate)를 활용한 Wall Design을 제공

The image shows the MIDAS CIVIL NX software interface. The main window displays a 3D model of a wall structure. A red box highlights a specific section of the wall. Below the model, there are two windows:

- RC/Wall (Design):** Shows design parameters for the wall section.

구분	Dc	1Size	2Size	Num
상단	100.000	D19	2.000	10.000
2	0.000		0.000	
3	0.000		0.000	
하단	100.000	D19	2.000	10.000
2	0.000		0.000	
3	0.000		0.000	
- RC/Wall (P-M Interaction):** Shows a P-M interaction diagram for the wall section. The diagram plots axial force (P) in kN on the y-axis (ranging from -2500 to 2750) against bending moment (M) in kN-m on the x-axis (ranging from 0 to 4000). The diagram shows a curved interaction curve with a peak axial force of approximately 2700 kN and a peak bending moment of approximately 3100 kN-m. The diagram also shows the design load path and the resulting internal forces.

4) P-M상관도

검토단면	중실사각형	검토조건
하중조합	NLC(1)	

f_{ck}	= 27.00 MPa
f_y	= 400.00 MPa
E_c	= 26701.74 MPa
E_s	= 200000.00 MPa
l_{uy}	= -
k_y	= -
ρ	= 0.0057
P_u	= 992.52 kN
M_u	= -514.45 kN-m
θ	= 0.00°

평형편심상태

- e_b = 364.73 mm
- ΦP_b = 6644.80 kN
- ΦM_b = 2423.58 kN-m

좌편심에서의 설계강도

- e = 518.33 mm
- ΦP_n = 5064.83 kN
- ΦM_n = 2645.19 kN-m

사용철근량

- A_s = 5730.00 mm²

5) 단면 전단 검토

인장철근들의 도심과 압축연단까지의 거리

$d = 900.00$ mm

경량콘크리트 계수

$\lambda = 1.00$

콘크리트 공칭전단강도

$$V_c = \frac{1}{6} \left(1 + \frac{N_u}{14A_g} \right) \lambda \nu (f_{ck}) \cdot b_w \cdot d = 834.679$$

ΦV_c	$\Phi V_c/2$	V_u (V_{max})	비고
626.01 kN	313.00 kN	489.53 kN	

$\therefore \Phi V_c/2 < V_u < \Phi V_c$ 이므로 최소전단철근 보강

최소철근율

$$\min A_{v1} = 0.35 \cdot \frac{b_w \cdot s}{f_{yt}} = 131.25 \text{ mm}^2$$

$$\min A_{v2} = \frac{0.0625 \cdot \nu (f_{ck}) \cdot b_w \cdot s}{f_{yt}} = 121.78 \text{ mm}^2$$

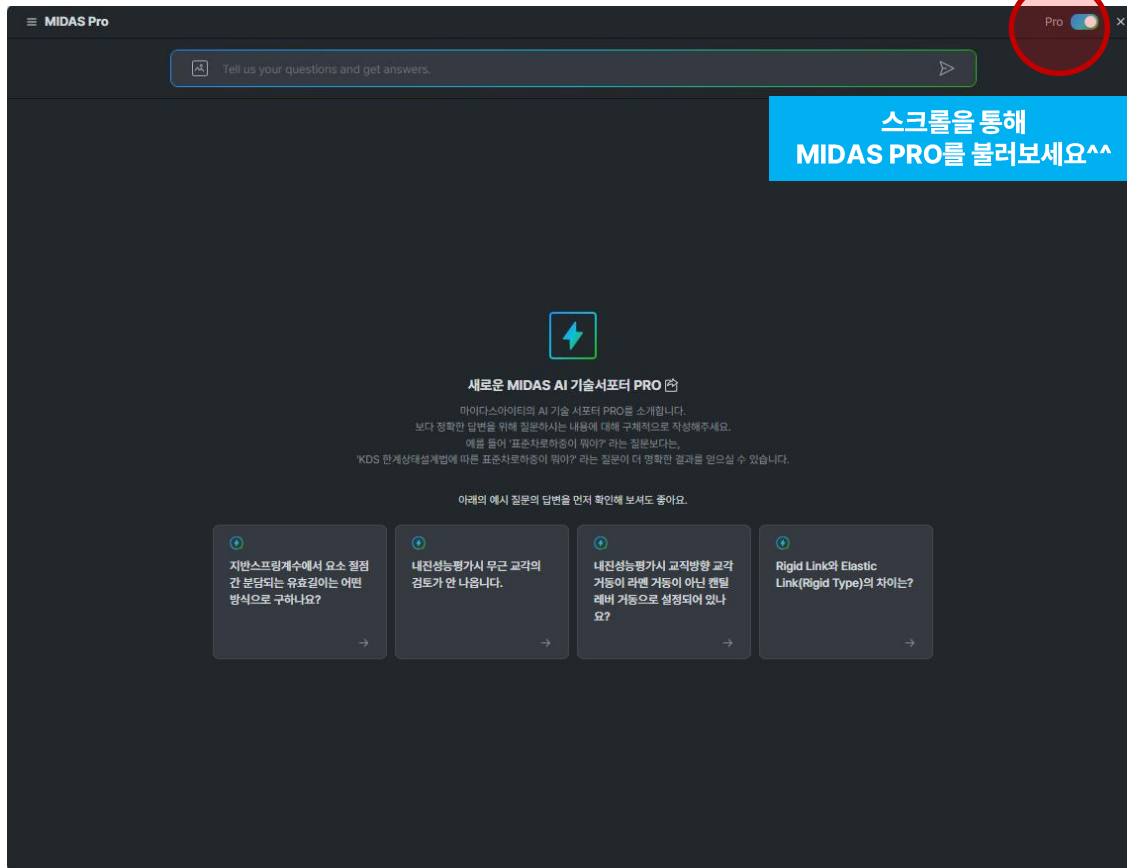
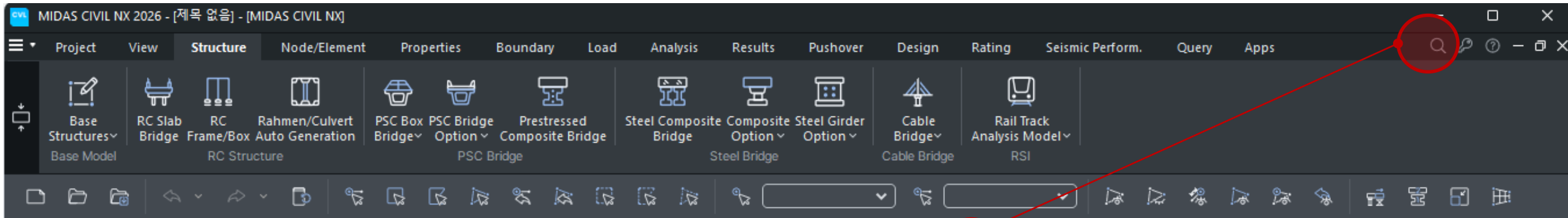
사용철근율

$$\min A_v = \max [\min A_{v1}, \min A_{v2}] = 131.25 \text{ mm}^2$$

수평간격

$$s = 150.00 \text{ mm} \leq \min [0.5d, 600\text{mm}] = 450.00 \text{ mm}$$

..... OK



새로운 AI 기술 서포터인 MIDAS PRO를 소개합니다.

이제, 포럼에 질문하고 기다리실 필요가 없습니다.
바로 내 옆에서 나의 궁금한 부분을
MIDAS PRO가 해결해줄 수 있습니다.

기능 설명과 비교 뿐 아니라
과업 중 해결하고 넘어가고 싶은 질문들...
결과값에 대한 의문점...

이 모든 것에 대한 명확한 가이드를
실시간으로 내 옆에서 함께 합니다.

- 질문 내용을 실시간으로 파악하여 두괄식 형태의 기본 답변 → 기본 원리 → 계산 방법 및 알고리즘 → 기능 활용 소개 → 정리 요약 의 체계적인 순서로 명확한 답변을 제공합니다.

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지반스프링계수에서 요소 절점간 분담되는 유효길이는 어떤 방식으로 구하나요?

안녕하세요, Midas Pro 입니다.

좋은 질문 주셨어요.

지반스프링계수를 적용할 때 말씀하신 ***요소 절점 간 분담되는 유효길이(Tributary length)***는 지반반력계수를 **절점 스프링 강성(kN/m 단위)**으로 변환하기 위해 자동으로 계산되는 값인데요, 그 방식은 모델의 요소 형태(선요소인지, 판-솔리드 요소인지)에 따라 달라집니다.

기분 답변

1. 기본 원리 (공통식)

지반스프링 절점강성은 다음 식으로 계산됩니다.

$$K_{\text{절점}} = k_{\text{지반반력계수}} \times A_{\text{유효면적}}$$

K절점 = k지반반력계수 × A유효면적
여기서

- (k_{지반반력계수}): 입력한 단위면적당 지반반력계수 (kN/m²)
- (A_{유효면적}): 해당 절점이 분담하는 면적 = 분담길이 × 폭(Width)

2. 요소 형식별 유효길이 계산 방식

☉ Plate / Solid 요소 (판요소, 압축요소)

- 프로그램이 각 절점이 주변 요소와 공유하는 면적을 자동 계산합니다.
- 예를 들어 한 절점이 4개의 판요소에 공유되어 있다면, 각 요소의 분담면적의 1/4씩을 자동으로 합산하여 그 절점의 유효면적으로 반영합니다.
- 즉, 사용자가 따로 계산할 필요 없이 CIVIL NX가 절점당 분담면적을 자동 산출합니다.

☉ Frame (선요소, Beam, Truss 등)

- 선요소에는 면이 없으므로, 대신 "폭(Width)" 개념을 사용합니다.
- 입력된 폭(Width) × 절점의 분담길이를 유효면적을 구합니다.
- 절점의 **유효길이(분담길이)**는 아래와 같이 계산됩니다.
 - 선요소가 길이 (L)일 때, 양끝 절점이 공유하므로 각 절점은 (L/2)를 분담
 - 즉, 절점 유효길이 = 요소길이의 절반(양쪽 요소에서 공유 시 합산)

예시)
한 절점이 길이 3m의 보요소 2개에 연결되어 있다면,
유효길이 = 3/2 + 3/2 = 3.0 m
→ (A_{유효면적}) = Width × 3.0

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3. Surface Spring Supports 사용 시 자동계산

Civil NX에서 [Model > Boundaries > Surface Spring Supports] 기능을 사용하면, 위에서 설명드린 절점별 유효면적(또는 유효길이)을 **모델 형상으로부터 자동으로 산출**합니다.

따라서 사용자가 해야 할 일은

- "단위면적당 지반반력계수(kN/m²)" 입력
- (선요소인 경우만) "Width" 입력 뿐입니다.

프로그램이 절점별로 분담된 유효면적을 계산하여, 각 절점 스프링 강성을 아래처럼 자동 변환합니다 📌

$$K_{\text{절점}} = k_n \times A_{\text{유효면적}}$$

K절점 = kn × A유효면적

정리 요약

요소 타입	유효길이 계산 방법	필요 입력
Plate / Solid	절점 주변 분담면적 자동계산	지반반력계수
Frame	요소길이/2 × 2(양쪽 연결 시)	지반반력계수 + Width

이 과정을 통해 Surface Spring Supports는 수많은 절점에 대한 **지반스프링을 자동으로 배분**합니다. 복잡한 면적 산정 없이 지반반력계수만으로 실제 스프링 강성을 반영할 수 있습니다.

진행 중인 모델이 2D 프레임인지, 3D 구조물인지 알려주시면 실제 예시로 유효길이 계산을 단계별로 보여드릴 수도 있습니다. 원하실까요?

Tell us your questions and get answers.
▶

AI 기반 응답은 부정확하거나 일부 왜곡된 사실을 포함할 수 있습니다. 이점 유의하여 활용하시기 바랍니다.

기능 소개

정리 요약

- 아래와 같이 그림을 포함한 실무 적용에 대한 컨설팅과 유사한 질문에 대해서도 그림을 분석하여 다수의 질문에 대한 각 답변과 표를 통한 정리를 통해 가이드를 해드립니다.

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1. 열차하중의 수평 관성력 적용

- 열차하중의 수평 관성력에 고려할 질량을 "열차하중 특성값 x 0.3"로 한다고 하는데, Midas(또는 사용 중인 해석프로그램)의 Loads to Masses 기능에서 scale에 0.3을 반영하여 질량으로 변환하면 되는지?

2. 토압의 적용 방식(상사-지진)

- 모델의 우측에 라면 형식의 높은 벽체가 있어 토압을 무시할 수 없는 상황입니다. 상시토압(정적 토압)은 Loads to Masses로 변환하여 질량/정적하중으로 적용해도 되는지? 아니면 지진 시의 추가 토압(지진토압)은 별도로 계산(예: Monobe-Okabe 등)하여 응답스펙트럼 해석 결과와 조합하여 수등으로 추가해야 하는지?

그림을 포함한 질문

안녕하세요, 고객님의 Midas Pro입니다. 문의 주신 내용은 내진성능평가 시 (1) 열차하중의 관성력 질량환산과 (2) 토압의 내진 반영 방식에 관한 부분입니다. 두 가지 모두 응답스펙트럼 해석 시 매우 중요한 설정입니다. 아래와 같이 정리에 드리겠습니다.

1 열차하중의 수평 관성력 적용

"열차하중의 수평방향 관성력에 고려하는 질량은 열차하중 특성값의 0.3배로 한다." 즉, 전체 열차하중의 30%만 유요질량으로 환산해서 지진 관성력 산정에 반영하는 개념입니다.

✓ 설정 방법 (올바른 방식)

Loads to Masses 창에서 아래와처럼 설정하시면 됩니다.

항목	설정값
Load Case	열차하중 (DL)
Scale Factor	0.3
Mass Direction	X, Y, Z (지진 방향에 따라 선택)

✗ 이렇게 하면, 열차하중의 30%가 질량으로 변환되어 해당 방향 지진하중 시 관성력으로 자동 반영됩니다.
 ✗ Scale = 0.3 은 정확한 적용입니다.

1번 질문에 대한 답변

2 토압의 적용 방식 (상사-지진 구분)

토압(Earth Pressure)은 구조물 자중에서 유발되는 질량하중이 아니므로 단순히 Loads to Masses 기능으로 질량화하는 것은 적절하지 않습니다.

✓ (1) 상시토압 (Static Earth Pressure)

- 상시 상태에서 벽체에 작용하는 정적 토압은 Hydrostatic Pressure Load 또는 Pressure on Element 기능으로 직접 제어합니다.
- 이 하중은 **정적 해석(DC, DW 등)**에 포함시켜야 하며, Loads to Masses로 질량 변환은 불필요(✗)합니다.

✗ 즉, 상시토압은 단순 외력으로 직접 제어합니다.

2번 질문에 대한 답변

✓ (2) 지진시 토압 (Seismic Earth Pressure)

- 지진 시 발생하는 추가 토압은 **자변의 동적 변위 차이에 따른** 부가적으로 구조물 자중에서 계산되는 것이 아니기 때문에, 반드시 별도로 **장력 하중케이스**로 입력해야 합니다.
- 산정 방법은 현장 조건에 따라 다르지만 통상적으로 **Mononobe-Okabe(M-O)** 식이나 **응답변위법(Response Displacement Method)**을 사용하여 수등 계산합니다.
- 계산된 값을 Static Load Case (예: EQ_EarthPressure)로 정의한 다음, 응답스펙트럼 해석 결과(Response Spectrum)와 **하중조합 단계에서 함께** 고려합니다.

2번 질문에 대한 답변

✓ (3) 정리 - 토압 반영 전략

구분	적용 방법	Loads to Masses 변환 여부
상시토압	Pressure(정적 하중으로 직접 제어)	✗
지진토압	M-O식 또는 응답변위법으로 산정 후 별도 하중케이스 입력	✗
지진 응답	Response Spectrum 해석 수행	-
최종 조합	Response Spectrum 결과 + 지진토압(정적)	✓ 조합 필요

2번 질문에 대한 표 구분 정리

◆ 추가 팁: 상사 ↔ 지진 경계조건 차이 처리

CIVIL NX에서는 지진 시 벽체나 받침의 거동을 달리 처리해야 할 때 [Analysis > Analysis Control > Boundary Change Assignment] 기능을 활용하면, 한 모델 안에서 상사-지진시의 경계조건을 손쉽게 구분하여 해석할 수 있습니다.

예)

- "상시 해석": 고정단(Support)
- "지진 해석": 지반스프링(Point Spring)

이 기능을 사용하면 두 조건의 단면력 비교가 매우 효율적으로 가능합니다.

추가 팁 제시

✓ 결론 요약

항목	적용	비고
열차하중(DL) 질량환산	Loads to Masses → Scale = 0.3	✓ 올바른 설정
상시토압	Pressure Load로 직접 제어	Loads to Masses 변환 ✗
지진토압	별도 계산 후 Static Load Case로 추가 입력	응답스펙트럼 결과와 조합
상시/지진 조건 구분	Boundary Change Assignment 기능 활용	하나의 모델에서 조합 가능

결론 요약

- 질문에 대한 답변 내용이 만족하지 않거나 원하는 답변이 아닌 경우에는 아래 헤드셋 아이콘을 통해 기존 포럼으로 연동하여 질문을 진행하실 수 있습니다.

MIDAS Pro

반드시 별도의 정적 하중케이스로 입력해야 합니다.

- 산정 방법은 환경 조건에 따라 다르지만 통상적으로 Mononobe-Okabe(M-O) 식이나 응답변위법(Response Displacement Method) 을 사용하여 수동 계산합니다.
- 계산된 값을 Static Load Case (예: EQ_EarthPressure)로 정의한 다음, 응답스펙트럼 해석 결과(Response Spectrum)와 하중조합 단계에서 함께 고려합니다.

(3) 정리 - 토압 반영 전략

구분	적용 방법	Loads to Masses 변환 여부
상시토압	Pressure(정적 하중으로 직접 재하)	✗
지진토압	M-O식 또는 응답변위법으로 산정 후 별도 하중케이스 입력	✗
지진 용압	Response Spectrum 해석 수행	-
최종 조합	Response Spectrum 결과 + 지진토압(정적)	✓ 조합 필요

추가 팁: 상시 ↔ 지진 경계조건의 차이 처리

CIVIL NX에서는 지진 시 벽체나 받침의 거동을 달리 처리해야 할 때 [Analysis > Analysis Control > Boundary Change Assignment] 기능을 활용하면, 한 모델 안에서 상시-지진시의 경계조건을 손쉽게 구분하여 해석할 수 있습니다.

예)

- *상시 해석*: 고정단(Support)
- *지진 해석*: 지반스프링(Point Spring)

Tell us your questions and get answers.

사기범 응답은 부정확하거나 일부 왜곡된 사실을 포함할 수 있습니다. 이를 위하여 활용하시기 바랍니다.

[선택] 문의를 더 자세하게 작성할게요.

문의 유형*
기술 문의

국가 (선택 사항)
KR

제품 버전 (선택 사항)
CIVIL NX v2.1

회사 (선택 사항)
마이다스아이티

제목*
보도교 구조해석 시 주빔 유효좌굴길이 산정 (재문의)

문의에 대한 상세한 내용을 요청드립니다.*

부재 좌굴 검토 시 유효좌굴길이를 실제 지지 간격인 1.6m로 적용하는 것이 타당인지에 대한 검토 의견을 요청드립니다. UMD 적용에 따른 국부 응력 검토와 부재 좌굴 검토에서 유효좌굴길이 적용 기준에 대한 판단을 부탁드립니다. 감사합니다.

지금까지 대화 내용을 바로 보낼게요.

모델 파일이나 이미지 등 첨부 파일이 있으면 더 정확한 기술 지원이 가능해요. 없다면 첨부하지 않으셔도 괜찮아요.

첨부할 파일을 여기에 끌어다 놓거나 파일 업로드 버튼을 통해 파일을 직접 선택해주세요.

제품에서 파일 가져오기 파일 선택하기

*업로드 가능 파일 형식 : zip, 7z, alz, gif, jpg, jpeg, png, bmp, pdf
*최대 20MB까지 업로드 가능합니다. 용량을 초과한 경우 아래의 각 분야를 클릭하여 메일로 별도 첨부 바랍니다.
[이메일 문의하기](#) <

[선택] 문의를 더 자세하게 작성할게요.

[필수] 개인정보 수집 및 이용 동의 자세히 보기

제출하기

1. 이동하중해석에 대한 Local Axis 기준 변위결과 출력

- 이전 버전까지는 이동하중해석에 대한 변위를 Global Axis 기준으로 확인할 수 있었지만 이번 버전부터는 Local Axis 기준의 변위결과를 추가 제공
- Local Axis에 대한 변위 결과는 모든 이동하중 기준에 대해 지원됨.
- 단, Moving Load Tracer 기능에서는 미 제공됨.
- Local Axis 기준의 변위 결과는 받침의 이동 방향 기준으로 확인할 수 있기 때문에 곡선 교량의 거동을 보다 정확하게 평가할 수 있습니다.
- Local Axis 기준의 변위 결과는 Node Local Axis가 정의된 노드에 대해서 결과가 제공됨.

Results > Result Display > Deformations > Displacement Contour

Components

DX DY DZ

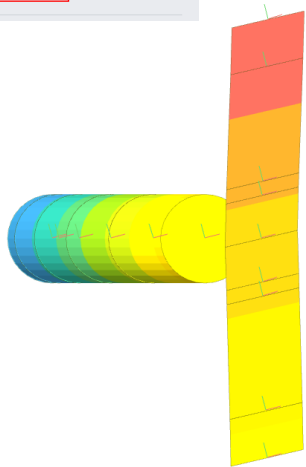
RX RY RZ

RW

DXY DYZ DXZ

DXYZ

Local (if defined)



Global Displacements

Components

DX DY DZ

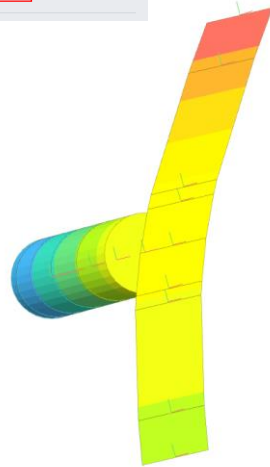
RX RY RZ

RW

DXY DYZ DXZ

DXYZ

Local (if defined)



Local Displacements

Node	Load	Dx (in)	Dy (in)	Dz (in)	Rx (rad)	Ry (rad)	Rz (rad)
130	MVL(max)	0.185	0.045	0.222	0.002	0.000	0.001
131	MVL(max)	0.192	0.023	0.221	0.002	0.000	0.001
132	MVL(max)	0.199	0.025	0.221	0.002	0.000	0.000
133	MVL(max)	0.206	0.108	0.222	0.001	0.000	0.000
234	MVL(max)	0.021	0.120	0.214	0.001	0.000	0.000
235	MVL(max)	0.013	0.034	0.210	0.001	0.000	0.000
237	MVL(max)	0.005	0.012	0.208	0.001	0.000	0.000
238	MVL(max)	0.000	0.036	0.207	0.001	0.000	0.000
130	MVL(min)	-0.270	-0.149	-0.086	-0.001	-0.000	-0.003
131	MVL(min)	-0.261	-0.060	-0.082	-0.000	-0.000	-0.003
132	MVL(min)	-0.246	-0.000	-0.077	-0.000	-0.000	-0.002
133	MVL(min)	-0.229	-0.016	-0.072	-0.000	-0.000	-0.001
234	MVL(min)	-0.076	-0.032	-0.062	-0.000	-0.000	-0.000
235	MVL(min)	-0.071	-0.010	-0.065	-0.000	-0.000	-0.000
237	MVL(min)	-0.072	-0.050	-0.068	-0.000	-0.000	-0.000
238	MVL(min)	-0.075	-0.141	-0.070	-0.000	-0.000	-0.000
130	sLCB1(max)	-0.466	-0.391	0.976	0.013	0.000	-0.014
131	sLCB1(max)	-0.424	-0.153	0.980	0.012	0.001	-0.012
132	sLCB1(max)	-0.368	0.083	0.977	0.010	0.001	-0.009
133	sLCB1(max)	-0.297	0.442	0.984	0.008	0.002	-0.005
234	sLCB1(max)	-0.173	0.505	0.946	0.004	-0.000	0.001
235	sLCB1(max)	-0.199	0.134	0.923	0.004	-0.000	0.001
237	sLCB1(max)	-0.238	-0.142	0.916	0.004	-0.000	0.002
238	sLCB1(max)	-0.272	-0.381	0.906	0.004	-0.000	0.002
130	sLCB1(min)	-1.262	-0.729	0.439	0.008	0.000	-0.021
131	sLCB1(min)	-1.217	-0.297	0.449	0.007	0.000	-0.017
132	sLCB1(min)	-1.148	0.039	0.455	0.006	0.000	-0.013
133	sLCB1(min)	-1.058	0.224	0.470	0.005	0.001	-0.007
234	sLCB1(min)	-0.343	0.238	0.463	0.002	-0.000	0.001

Local Displacement Table

2. 시공단계 및 텐던 그룹별 긴장력 손실 Table 결과 일괄 출력 기능 제공

- 이전 버전에서는 사용자가 한번에 하나의 텐던 그룹과 하나의 시공단계에 대해서만 긴장력 손실 결과를 Table로 확인할 수 있었지만 이번 버전부터는 Table 상에서 다수 텐던 그룹과 시공단계를 동시에 선택할 수 있고 다수의 결과를 한번에 검토가 가능하게 되었습니다.
- 주요 장점
 - 다양한 그룹 및 시공단계 간의 긴장력 손실을 검토하고 비교하는 과정을 간소화시켜줄 수 있습니다.
 - 보고서를 작성하거나 결과를 요약할 때 효율성이 크게 향상되며 개별적으로 데이터를 확인할 필요가 없습니다.
 - 선택된 모든 항목의 결과가 하나의 통합된 테이블 형태로 제공됩니다.

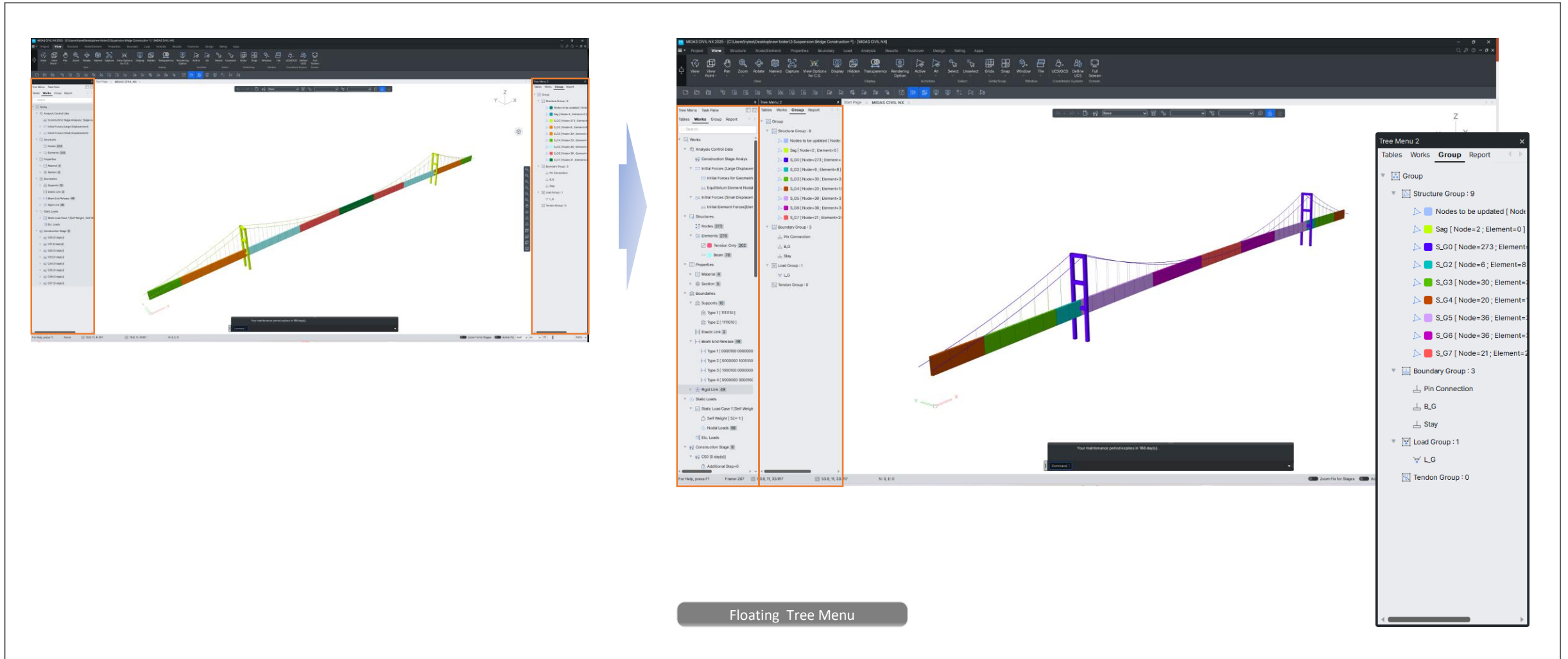
■ Results > Result Tables > Tendon > Tendon Loss

Elem	Part	Stress (A/After Immediate Loss) - A (N/mm ²)	Elastic Deform. Loss B (N/mm ²)	Stress(Elastic Loss)/ Stress(Immediate Loss) (A/B)	Creep/Shrinkage Loss (N/mm ²)	Relaxation Loss (N/mm ²)	Stress(A/After All Loss/ Stress(A/After Immediate Loss))	Effective Num.
The Loss of tendon group (Tendon-Span1) at the stage of [Stage2]								
Tendon Group		Stage	Elem	Part	Apply			
90	J	601261.7614	5814.4553	Stage2		0.0000	1.0058	44.0000
90	J	601261.7614	5870.3434	Stage3-1		0.0000	1.0098	44.0000
91	I	601261.7614	1441.4976	Stage3-2		0.0000	1.0024	44.0000
91	J	601261.7614	13077.0406	Stage5		0.0000	1.0231	44.0000
92	I	601261.7614	13077.0406	Stage5		0.0000	1.0231	44.0000
92	J	601261.7614	27214.1713	1.0453		0.0000	1.0453	44.0000
93	I	601261.7614	27214.1713	1.0453		0.0000	1.0453	44.0000
93	J	601261.7614	29714.8786	1.0494		0.0000	1.0494	44.0000
94	I	601261.7614	29714.8786	1.0494		0.0000	1.0494	44.0000
94	J	601261.7614	39148.4665	1.0651		0.0000	1.0651	44.0000
95	I	601261.7614	39148.4665	1.0651		0.0000	1.0651	44.0000
95	J	601261.7614	49679.9261	1.0826		0.0000	1.0826	44.0000
96	I	601261.7614	49679.9261	1.0826		0.0000	1.0826	44.0000
96	J	601261.7614	53502.1487	1.0890		0.0000	1.0890	44.0000
97	I	601261.7614	53502.1487	1.0890		0.0000	1.0890	44.0000
97	J	601261.7614	58008.5502	1.0978		0.0000	1.0978	44.0000
98	I	601261.7614	58008.5502	1.0978		0.0000	1.0978	44.0000
98	J	601261.7614	68534.3387	1.1107		0.0000	1.1107	44.0000
99	I	601261.7614	68534.3387	1.1107		0.0000	1.1107	44.0000
99	J	601261.7614	70494.8280	1.1172		0.0000	1.1172	44.0000
100	I	601261.7614	70494.8280	1.1172		0.0000	1.1172	44.0000
100	J	601261.7614	72857.2917	1.1212		0.0000	1.1212	44.0000
101	I	601261.7614	72857.2917	1.1212		0.0000	1.1212	44.0000
101	J	601261.7614	77777.4092	1.1294		0.0000	1.1294	44.0000
102	I	601261.7614	77777.4092	1.1294		0.0000	1.1294	44.0000
102	J	601261.7614	80703.0552	1.1342		0.0000	1.1342	44.0000
103	I	601261.7614	80703.0552	1.1342		0.0000	1.1342	44.0000
103	J	601261.7614	81294.6911	1.1352		0.0000	1.1352	44.0000
104	I	601261.7614	81294.6911	1.1352		0.0000	1.1352	44.0000
104	J	601261.7614	83409.1375	1.1387		0.0000	1.1387	44.0000
105	I	601261.7614	83409.1375	1.1387		0.0000	1.1387	44.0000
105	J	601261.7614	84120.0581	1.1399		0.0000	1.1399	44.0000
106	I	601261.7614	86981.0753	1.1447		0.0000	1.1447	44.0000
106	J	601261.7614	86956.4939	1.1446		0.0000	1.1446	44.0000
107	I	601261.7614	86956.4939	1.1446		0.0000	1.1446	44.0000
107	J	601261.7614	85251.8262	1.1418		0.0000	1.1418	44.0000
108	I	601261.7614	85251.8262	1.1418		0.0000	1.1418	44.0000
108	J	601261.7614	82144.3229	1.1366		0.0000	1.1366	44.0000
109	I	601261.7614	82144.3229	1.1366		0.0000	1.1366	44.0000
109	J	601261.7614	81353.9453	1.1353		0.0000	1.1353	44.0000
110	I	601261.7614	81353.9453	1.1353		0.0000	1.1353	44.0000
110	J	601261.7614	77933.9841	1.1291		0.0000	1.1291	44.0000
111	I	601261.7614	77933.9841	1.1291		0.0000	1.1291	44.0000
111	J	601261.7614	71720.8097	1.1193		0.0000	1.1193	44.0000
112	I	601261.7614	71720.8097	1.1193		0.0000	1.1193	44.0000
112	J	601261.7614	68960.8626	1.1147		0.0000	1.1147	44.0000
113	I	601261.7614	68960.8626	1.1147		0.0000	1.1147	44.0000
113	J	601261.7614	64404.7998	1.1071		0.0000	1.1071	44.0000
114	I	601261.7614	64404.7998	1.1071		0.0000	1.1071	44.0000

Tendon Group	Stage	Elem	Part	Stress (A/After Immediate Loss) - A (N/mm ²)	Elastic Deform. Loss B (N/mm ²)	Stress(Elastic Loss)/ Stress(Immediate Loss) (A/B)	Creep/Shrinkage Loss (N/mm ²)	Relaxation Loss (N/mm ²)	Effective Num.
Tendon-Span1	Stage2	601.0000	I	1.0077	-43813.6287	-18682.8073	0.9582	1.0000	1.0000
Tendon-Span1	Stage2	601.0000	J	1.0077	-43323.2191	-18755.9957	0.9595	1.0000	1.0000
Tendon-Span1	Stage2	462.0000	I	1.0049	-44758.0615	-18537.9068	0.9557	1.0000	1.0000
Tendon-Span1	Stage2	462.0000	J	1.0037	-45356.8002	-18461.2163	0.9542	1.0000	1.0000
Tendon-Span1	Stage2	607.0000	I	1.0091	-42569.1826	-18688.2434	0.9615	1.0000	1.0000
Tendon-Span1	Stage2	607.0000	J	1.0087	-42781.8576	-18836.4456	0.9609	1.0000	1.0000
Tendon-Span1	Stage2	137.0000	I	1.0066	-43765.9623	-18676.2654	0.9582	1.0000	1.0000
Tendon-Span1	Stage2	137.0000	J	1.0075	-43304.7568	-18742.2595	0.9593	1.0000	1.0000
Tendon-Span1	Stage2	143.0000	I	1.0082	-42376.3314	-18687.9251	0.9616	1.0000	1.0000
Tendon-Span1	Stage2	143.0000	J	1.0089	-42519.1993	-18647.2048	0.9613	1.0000	1.0000
Tendon-Span1	Stage2	149.0000	I	1.0049	-44607.3267	-18542.9682	0.9559	1.0000	1.0000
Tendon-Span1	Stage2	274.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	274.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	280.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	280.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	286.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	286.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	411.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	411.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	538.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	538.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	417.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	417.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	542.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	542.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	667.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	667.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	673.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	673.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	203.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	203.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	209.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	209.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	215.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	215.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	340.0000	J	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	340.0000	I	1.0037	-45249.5909	-18448.7618	0.9543	1.0000	1.0000
Tendon-Span1	Stage2	346.0000	J	1.0095	-42352.4354	-18889.9819	0.9619	1.0000	1.0000
Tendon-Span1	Stage2	346.0000	I	1.0096	-42270.4995	-18991.5994	0.9621	1.0000	1.0000
Tendon-Span1	Stage2	346.0000	J	1.0072	-43551.0737	-18718.0384	0.9589	1.0000	1.0000
Tendon-Span1	Stage2	471.0000	J	1.0081	-43982.0674	-18786.8666	0.9601	1.0000	1.0000
Tendon-Span1	Stage2	352.0000	J	1.0070	-43619.3025	-18698.5487	0.9588	1.0000	1.0000
Tendon-Span1	Stage2	352.0000	I	1.0069	-44198.5811	-18613.2378	0.9617	1.0000	1.0000
Tendon-Span1	Stage2	477.0000	J	1.0093	-42434.7663	-18679.2253	0.9617	1.0000	1.0000
Tendon-Span1	Stage2	477.0000	I	1.0088	-42690.3720	-18841.5412	0.9611	1.0000	1.0000
Tendon-Span1	Stage2	602.0000	J	1.0077	-43322.7694	-18736.0015	0.9595	1.0000	1.0000
Tendon-Span1	Stage2	602.0000	I	1.0084	-42943.4964	-18813.0884	0.9605	1.0000	1.0000
Tendon-Span1	Stage2	608.0000	J	1.0087	-42781.8576	-18836.4456	0.9609	1.0000	1.0000
Tendon-Span1	Stage2	608.0000	I	1.0081	-43104.4930	-18788.4941	0		

3. 유연한 이중 트리 메뉴 레이아웃 제공

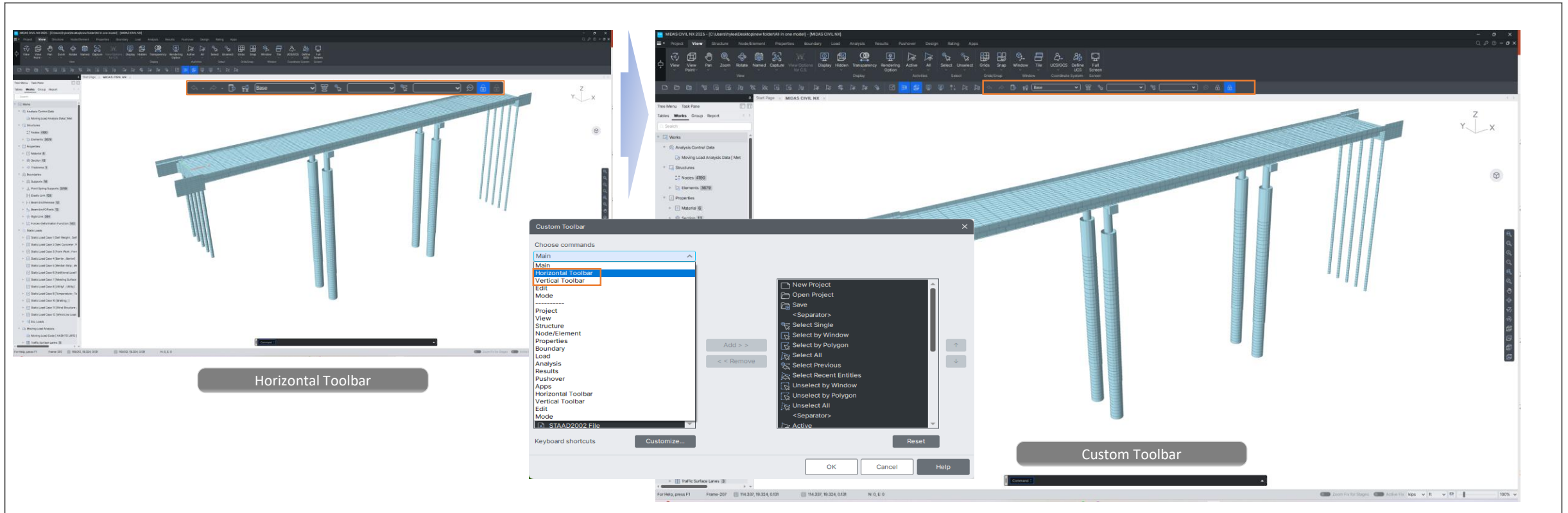
- 이중 트리 메뉴 기능이 대형 및 복잡한 프로젝트에서도 더 나은 사용성이 제공되도록 개선되었습니다.
- 기존에는 좌우로 나뉜 화면에서 각각 하나의 트리만 배치할 수 있었으나 이번 버전부터는 두개의 트리 메뉴를 좌측 또는 우측 한쪽에 모두 배치할 수 있게 되었습니다.
- 또한, 트리 메뉴를 도킹 해제하여 별도의 플로팅 창으로 사용할 수 있어 듀얼 모니터 환경에 적합하게 활용할 수 있습니다.



Floating Tree Menu

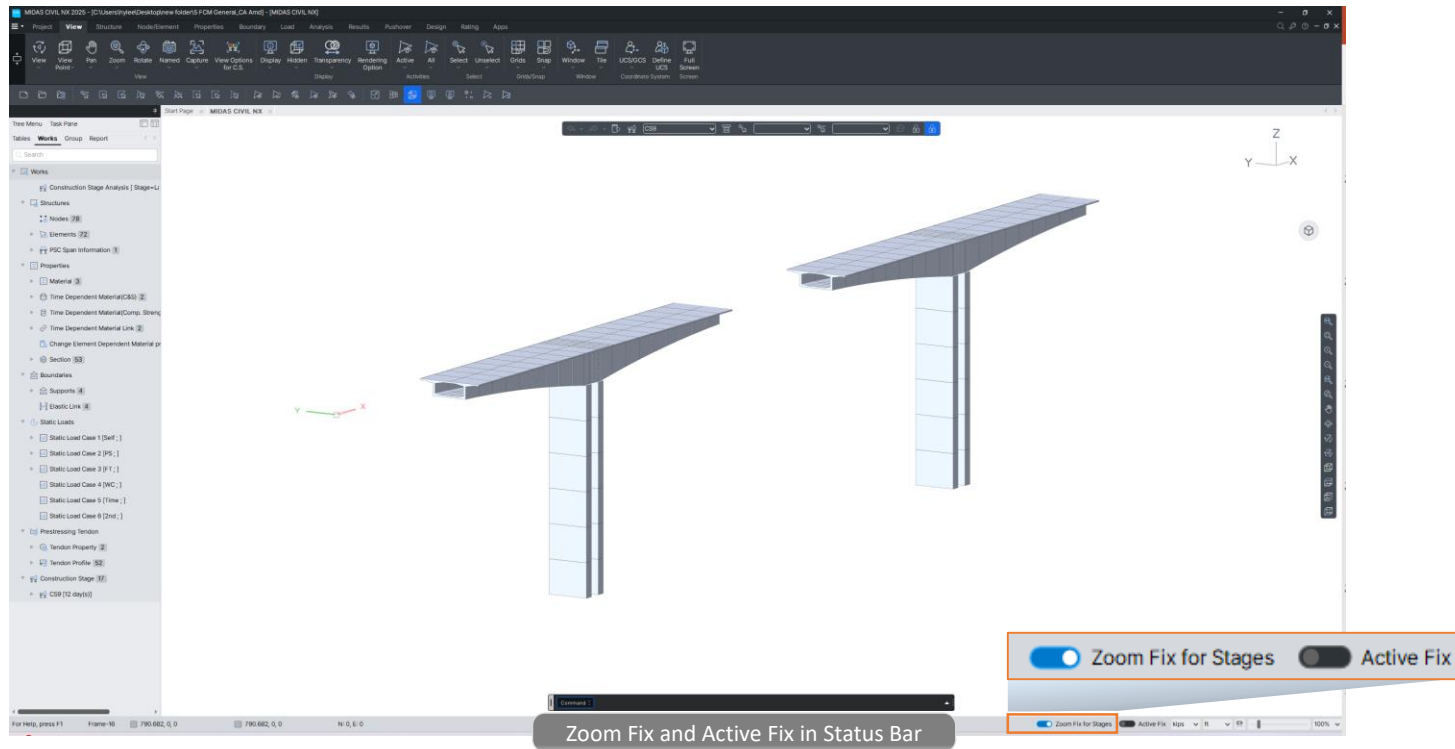
4. Full Customization of Horizontal Toolbar Functions

- 기존에는 모델 보기 상단에 고정되어있던 수평 도구 모음(Horizontal Toolbar)이 이제 완전한 사용자 지정 및 도킹 유연성을 제공합니다.
- 이전 버전에서는 노드/요소 선택 콤보 박스나 시공단계 선택 기능과 같은 주요 도구들을 사용자 정의 도구 모음(Custom Toolbar)에 추가할 수 없었으나 이번 버전부터는 수평 도구 모음에 포함된 모든 기능과 아이콘을 사용자 정의 도구 모음에 직접 추가할 수 있습니다.
- 또한, 수평 도구 모음을 하나의 그룹 항목으로 선택하여 사용자 정의 도구 모음에 통합할 수 있으므로 기능을 하나씩 개별적으로 추가할 필요가 없습니다.
- 모델 뷰의 깔끔한 화면을 선호하는 사용자들을 위해 수평 도구 모음을 완전히 숨기고 필요한 기능만 사용자 정의 도구 모음에 배치하는 것도 가능합니다.
- 주요 장점
 - 도구 모음이 모델 뷰를 가리거나 화면 캡처 시 함께 나타나는 것을 방지할 수 있습니다.
 - 보다 깔끔하고 개인화된 인터페이스 제공으로 모델링 및 리포트 작성 시 사용성과 가시성을 향상시킬 수 있습니다.



5. Active Fix and Zoom Fix for Stage to Status Bar 추가

- 기존에 제공되던 Active Fix 및 Zoom Fix for Stage 기능이 이제 상태 표시줄(Status Bar)에 직접 추가되어 더 빠르고 쉽게 접근할 수 있습니다.
- Zoom Fix for Stage 기능은 시공단계를 전환하더라도 모델 뷰의 확대/축소 비율과 방향을 고정하여 시각적 일관성을 유지할 수 있도록 개선되었습니다.
- Active Fix 기능은 활성화된 요소를 모델 뷰에서 고정하여 뷰를 다시 설정하지 않고도 시공단계해석 결과를 검토할 수 있는 효율성을 제공합니다.
- 주요 장점
 - 현재 뷰를 유지한 상태로 단계별 결과 검토를 간소화시킬 수 있습니다.
 - 핵심 요소에 대한 일관된 시야를 유지하여 단계별 해석 결과 확인을 효율적으로 향상시킬 수 있습니다.



1. Addition of Material Database for Structural Steel Reinforcement as per NR/GN/CIV/025

- To support bridge assessment in accordance with NR/GN/CIV/025, MIDAS Civil now includes a comprehensive set of steel and wrought iron materials used in UK railway structures from the pre-1906 era onward.
- 10 new material types** added to the database, including: Wrought Iron, **BS 2762:1956(A)**, **BS 2762:1956(B)**, **BS968:1962**, **BS968:1941**, **BS548:1934**, **BS15:1961**, **BS15:1948**, **BS15:1906**, **Pre1906**. This includes definition of **Yield strength values** by thickness.
- This addition enables accurate structural assessments for **existing UK railway bridges**, including heritage structures and simplifies compliance with Network Rail's material classification and evaluation requirements.

- **Properties > Material Properties**
- **Rating > Steel Bridge > NR/GN/CIV/025 > Modify Steel Material**

Material Data

General
Material ID: 1 Name: Wrought Iron

Elasticity Data
Type of Design: Steel

Steel
Standard: NR/GN/CIV/025(S)
DB: Wrought Iron

Concrete
Standard: BS15:1906, BS15:1948, BS15:1961, BS548:1934, BS968:1941, BS968:1962, BS2762:1956(A), BS2762:1956(B)
Code: Wrought Iron

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

Plasticity Data

Material Properties

Modify Steel Material

Material List

ID	Name	Es	Fu	Fy1Fy1	Fy2
1	Wrought I...	1.9e+08	285000	190000	190000

Steel Material Selection
Code: NR/GN/CIV/025(S) Grade: BS968:1941

Modulus of Elasticity (Es): 205000000 kN/m²
Poisson's Ratio (Ps): 0.3

Tensile Strength (Fu): 570000 kN/m²
Yield Strength (Fy1): 355000 kN/m²
Yield Strength (Fy2): 325000 kN/m²
Yield Strength (Fy3): 295000 kN/m²
Yield Strength (Fy4): 295000 kN/m²
Yield Strength (Fy5): 295000 kN/m²

Buttons: Close, Modify

Modify Steel Material

2. Addition of Section Properties for U-girder Bridge as per NR/GN/CIV/025

- Riveted steel plate girders can be defined, including detailed configuration of riveted angles. By accounting for rivet holes, the software automatically computes the net stiffness, which is then applied in the assessment for more accurate structural evaluation.

Properties > Section Properties

Section Data

DB/User: Steel Girder

Section ID: 2, Name: CG

Section Type: Steel Girder I

Size: Symmetric Section Auto Calculation

Distance from Reference Line: Top: 0 m, Bottom: 0 m

Dimensions: B1: 0.3, B2: 0.3, B3: 0.3, B4: 0.3, H: 0.6, t1: 0.014, t2: 0.014, tw: 0.014

Buttons: Stiffener..., Riveted Angle...

Options: Consider Shear Deformation, Consider Warping Effect (7th DOF)

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

Riveted Angle

Defined 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

Buttons: OK, Cancel

Riveted Steel Plate Girder

3. Addition of Moving Load for UK Network Rail Bridge Assessment as per NR/GN/CIV/025

- MIDAS Civil now supports Network Rail Standards-based moving load configurations for bridge assessment, in accordance with NR/GN/CIV/025. This enhancement ensures compliance with UK railway bridge evaluation guidelines and expands the platform's global code coverage.

- **Key Features:**

- **Vehicle Types Included:**

- Equivalent Uniformly Distributed Load (EUDL)
 - RAI (RA1 ~ RA15)
 - Load Wagon (Convoy Mode supported)
 - Wagon Type D4 (as per UIC700 standard)

- **Dynamic Factor Configuration:**

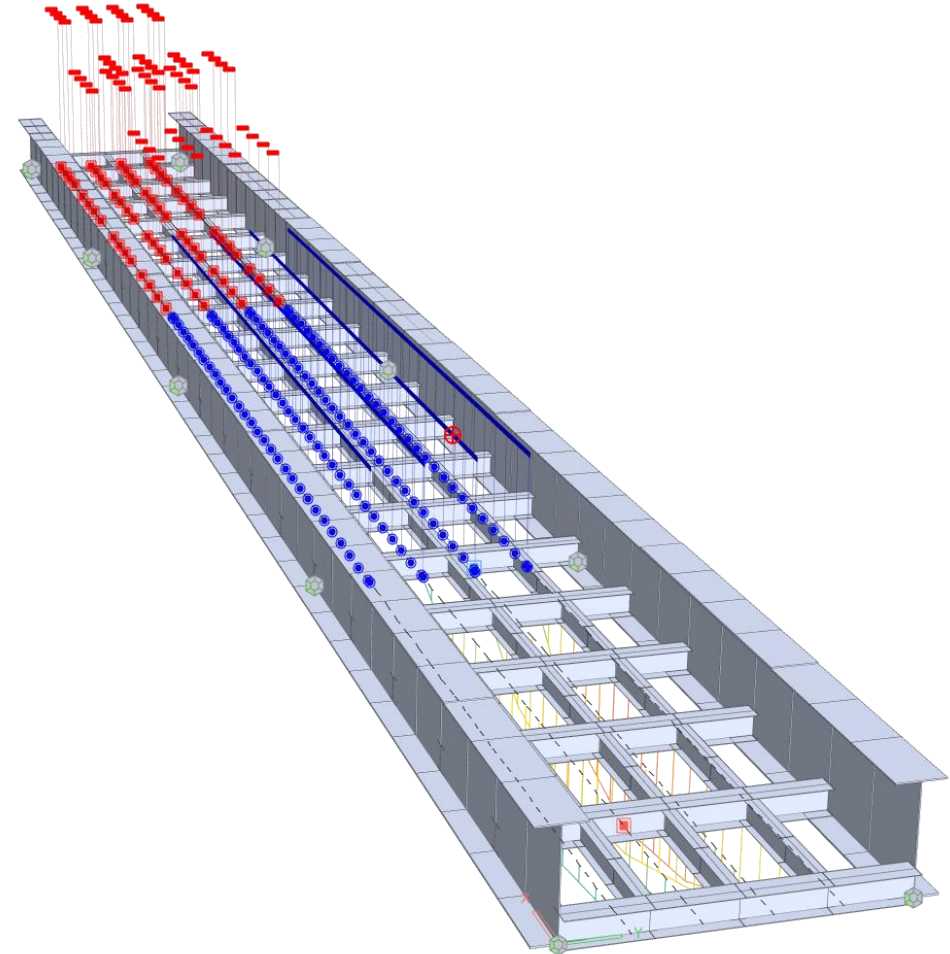
- Dynamic Amplification Factors (DAF) can be automatically calculated by defined *Determinant Length* and *group-based* selection.
 - This enables accurate load effect estimation under various speed rail conditions.

- **Track Factor Input:**

- Track Factor can be defined per lane in the Moving Load Case for consistent multi-track evaluation.

- **Benefits:**

- EUDL (Equivalent Uniformly Distributed Load) automatically provided, enhancing compatibility with simplified evaluation methods.
 - Provides detailed moving load simulation tailored to UK railway infrastructure.
 - Allows for accurate modeling of various speed rail effects through Dynamic Factor options.
 - Enables bridge engineers to perform assessments using familiar UK-specific load definitions and parameters.



3. Addition of Moving Load for UK Network Rail Bridge Assessment as per NR/GN/CIV/025

- A new Railway Lane type has been added to support Network Rail moving load assessments, allowing users to define track-specific configurations aligned with UK railway standards.
- The following vehicle types have been newly added: Equivalent Uniformly Distributed Load (EUDL), RA1–RA15 load types, Load Wagon with Convoy Mode, and Wagon Type D4 in accordance with the UIC700 standard.

- **Load > Moving Loads > BS**
- **Load > Moving Loads > Traffic Line/Surface Lanes**
- **Load > Moving Loads > Vehicles**
- **Load > Moving Loads > Moving Load Cases**

Define Standard Vehicular Load

Standard Name: NR/GN/CIV/025

Vehicular Load Name: EUDL Loading

Vehicular Load Type: Type RAI Loading

Sub Type: EUDL

W = 85 kN/m

Railway Dynamic Factor: Static Dynamic

Assessment Speed: 90 mph

Define Standard Vehicular Load

Standard Name: NR/GN/CIV/025

Vehicular Load Name: RA10 Loading

Vehicular Load Type: Type RAI Loading

Sub Type: RA10

RA Loading Type: Train Short Length More Critical

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

Railway Dynamic Factor: Static Dynamic

Assessment Speed: 90 mph

Define Standard Vehicular Load

Standard Name: NR/GN/CIV/025

Vehicular Load Name: Assessment Load Wagon

Vehicular Load Type: Wagon

Sub Type: Assessment Load Wagon

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

Loading Case: Single Convoy

Railway Dynamic Factor: Static Dynamic

Assessment Speed: 60 mph

Define Moving Load Case

Load Case Name: RA10 S

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	0.75

Sub-Load Cases:

Loading Effect: Combined Independent

Vehicle	Scale	Lane1	Lane2	Lane3
RA10 S	1	Track 2	Track 1	

Traffic Line Lanes

Lane Name: Track 1

Traffic Lane Properties:

a : Eccentricity

Lane Type: Roadway Railway

Lane Width: 3 m

Eccentricity: 0 m

Wheel Spacing: 1.6 m

Allowable Width: 3 m

Vehicular Load Distribution: Lane Element Cross Beam

Cross Beam Group: Cross Girder

Skew: Start 0 End 0 [deg]

Moving Direction: Forward Backward Both

Train Database for UK Network Rail Bridge

Moving Load Cases

Traffic Line Lanes

4. UK Network Rail Bridge Assessment as per NR/GN/CIV/025

- MIDAS Civil now supports a fully automated assessment process for railway bridge structures in accordance with Network Rail standards (NR/GN/CIV/025), including the ability to generate structured Excel reports summarizing all verification results.

- Key Features:**

- Automated Assessment Workflow**

Perform Ultimate Limit State checks (Flexure, Shear, Longitudinal Shear, Intermediate and Bearing Stiffener) on main girders, cross girders, rail bearers, and stiffeners automatically after analysis.

- Code Selection Flexibility**

Assessment can be carried out based on either **NR/GN/CIV/025** or **BS 5400 Part 3**, allowing users to choose the appropriate code depending on project requirements.

- Utilisation Factor Calculation**

Includes auto-calculation of Utilisation Factors based on RA rating criteria, with support for historic steel materials (e.g., Wrought Iron, Early Steel).

- Excel Report Output**

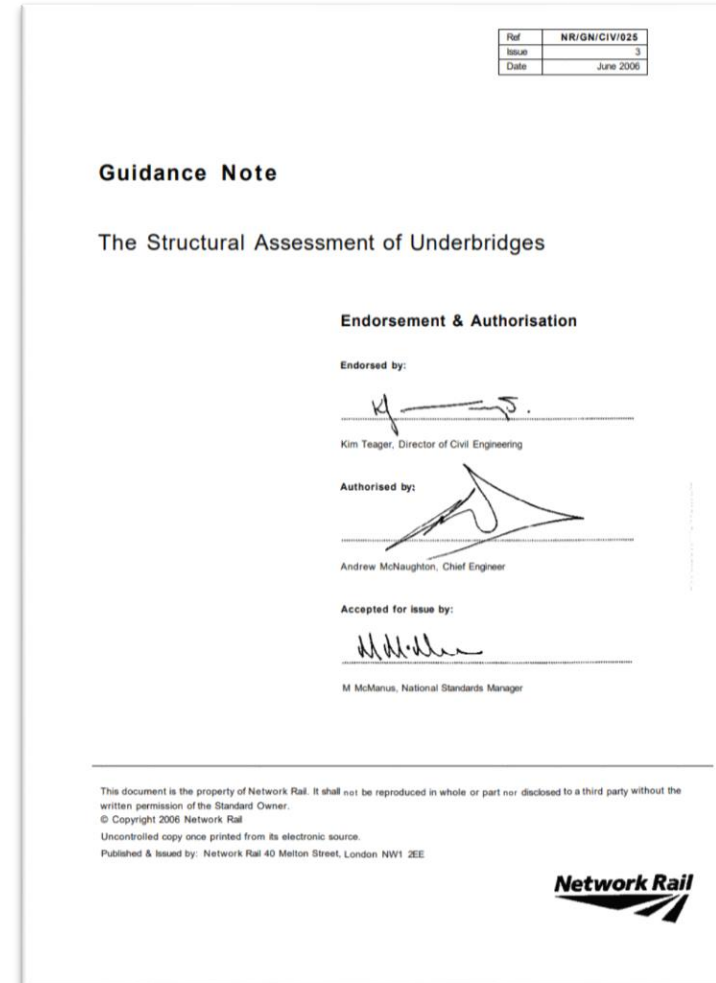
A detailed **Excel-format report** is generated, capturing all input parameters, applied load cases (e.g., RA1-RA15, EUDL), rating factors, section capacities, and final utilisation results.

- Supports Various Design Inputs**

Corrosion depth, riveted angle, effective length, and U-girder specific parameters are fully reflected in both calculation and reporting.

- Benefits:**

- Streamlines compliance with UK Network Rail bridge assessment procedures.
- Minimizes manual input and post-processing by automating the full assessment-to-report pipeline.
- Produces **clear, exportable documentation** for design review, audit, and submission to authorities.



4. UK Network Rail Bridge Assessment as per NR/GN/CIV/025

- When **NR/GN/CIV/025** is selected in the **Steel Bridge Rating** menu, all relevant **input and output menus** specific to the Network Rail assessment criteria are displayed.

Rating > Steel Bridge > NR/GN/CIV/025

The screenshot displays the MIDAS CIVIL NX 2025 software interface. The 'Rating' menu is active, and the 'Steel Bridge' sub-menu is open, showing the 'NR/GN/CIV/025' assessment code. A dropdown menu lists the following assessment parameters:

- Assessment Code Parameters
- Unbraced Length(L,Lb)
- Span Length
- Transverse Stiffener...
- Web Panel Assignment...
- Effective Length of U-frame
- Moment Distribution Factor for Slenderness
- Fastener-Rivets
- Assign Member Type
- Corrosion Depth

The background features a 3D model of a U-girder bridge with a color-coded stress distribution. Several Excel report windows are overlaid, showing detailed assessment results for various parameters such as Section Properties, Material Properties, Partial Safety Factors, and Buckling assessment.

U-girder Bridge Assessment

Excel Report

4. UK Network Rail Bridge Assessment as per NR/GN/CIV/025

- In Assessment Parameter, Users can modify and apply condition factors, material factors, and other parameters as needed to suit specific project conditions.
- In the **assessment case**, when **static live load**, **dynamic live load**, and **dead load** are defined, the software automatically calculates the **utilisation factor** based on these inputs.

Rating > Steel Bridge > NR/GN/CIV/025

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

User Input

Ultimate Limit State
 Flexure
 Shear
 Longitudinal Shear
 Intermediate and Bearing Stiffener

Assessment Parameter

Define Assessment Case

Load Combination				
Name	Limit State	Comb. Type	Description	
▶ EUDL	ULS	Comb1		
RA 10	ULS	Comb1		
* [Empty]				

Static Load Cases and Factors(Gamma_fl)		
Static Load Cases	Factor	
▶ DL(ST)	1.2000	
* [Empty]		

Assessment Live Load
 Type RAI Loading Wagon Loading

Moving Load Cases and Factors(Gamma_fl)
 Static (Dynamic Factor = 1)
 EUDL S(MV) 1

Dynamic (Dynamic Factor= 1 + phi)
 EUDL D(MV) 1

Assessment Case

4. UK Network Rail Bridge Assessment as per NR/GN/CIV/025

- **Transverse and bearing stiffeners** can be defined, along with **riveted angles** used for their reinforcement. These inputs are considered in the automatic calculation of **section properties**, which are then used directly in the assessment process.
- Assessment can be performed using **net section properties** that account for **corrosion depth**, ensuring more accurate evaluation of deteriorated structures.

Rating > Steel Bridge > NR/GN/CIV/025

The screenshot displays the software interface for defining stiffeners and corrosion depth for a steel bridge section. The interface is divided into several panels:

- Stiffener Type:** This panel allows defining the stiffener type and shape. The "Type" is set to "Located at U-frame". Under "Defined Shape", a table lists the components: S (Flat) and A (Angle). The "Transverse Stiffener" section is set to "Two stiffener" with a yield strength F_y of 190000 kN/m² and a pitch of 0.7 m. The "Rivet Angle" section shows four angles, all set to "A".
- Section Manager:** This panel shows the target section and element. The "Corrosion Depth" is set to 0.04 m. The "Component" is set to "Top Flange" and the "Position" is set to "Top". A table below shows the component, position, and depth (m).
- 3D Model:** A 3D perspective view of the steel bridge section, showing the stiffeners and the corrosion depth.

Component	Position	Depth (m)
Top Flange	Top	0.04

Buttons for "OK", "Cancel", "Close", and "Apply" are visible at the bottom of the panels.

Transverse and
Bearing Stiffener

Corrosion Depth

4. UK Network Rail Bridge Assessment as per NR/GN/CIV/025

- After completing the assessment, results can be reviewed through both the **table view** and a generated **Excel report**.

Rating > Steel Bridge > NR/GN/CIV/025

Element	Part	Rating Case	Loading (kN/m)			Capacity (kN/m)	BSU		RA		U for RAB		Assessed Category	
			Dead	Static	Dynamic		Static	Dynamic	Static	Dynamic	Static	Dynamic	Static	Dynamic
1	J (1)	Positive (max)	-16.949	0.558	3.496	-	-	-	-	-	-	-	AT	AT
1	J (3)	Positive (max)	1184.805	1216.417	-	-	-	-	-	-	-	-	AT	AT
2	J (3)	Positive (max)	1184.805	1864.275	647.859	-	-	-	-	-	-	-	AT	AT
2	J (4)	Positive (max)	2177.280	2473.866	-	-	-	-	-	-	-	-	AT	AT
3	J (4)	Positive (max)	2164.762	3732.097	1296.597	-	-	-	-	-	-	-	AT	AT
3	J (5)	Positive (max)	2681.521	2985.194	-	-	-	-	-	-	-	-	AT	AT
4	J (5)	Positive (max)	2654.792	4542.817	1577.475	-	-	-	-	-	-	-	AT	AT
4	J (6)	Positive (max)	2935.749	3514.227	-	-	-	-	-	-	-	-	AT	AT
5	J (6)	Positive (max)	2932.225	6111.904	2848.492	-	-	-	-	-	-	-	AT	AT
5	J (7)	Positive (max)	2704.454	3293.989	-	-	-	-	-	-	-	-	AT	AT
6	J (7)	Positive (max)	2704.454	5812.539	2518.940	-	-	-	-	-	-	-	AT	AT
6	J (8)	Positive (max)	2254.418	3132.588	-	-	-	-	-	-	-	-	AT	AT
6	J (9)	Positive (max)	1207.680	3875.865	1679.516	-	-	-	-	-	-	-	AT	AT
7	J (9)	Negative (max)	1301.396	-31.122	-13.456	-	-	-	-	-	-	-	AT	AT
7	J (9)	Positive (max)	1301.396	2161.713	-	-	-	-	-	-	-	-	AT	AT
8	J (9)	Positive (max)	1307.680	3875.865	1679.516	-	-	-	-	-	-	-	AT	AT
8	J (10)	Positive (max)	132.940	1317.981	-	-	-	-	-	-	-	-	AT	AT
9	J (10)	Positive (max)	140.657	2261.569	960.013	-	-	-	-	-	-	-	AT	AT
9	J (11)	Positive (max)	-1529.661	92.385	-	-	-	-	-	-	-	-	AT	AT
10	J (11)	Positive (max)	-1529.661	163.932	71.037	-	-	-	-	-	-	-	AT	AT
10	J (2)	Positive (max)	-3429.488	-	-	-	-	-	-	-	-	-	AT	AT
11	J (2)	Positive (min)	-	-	-	-	-	-	-	-	-	-	AT	AT
11	J (2)	Positive (min)	-	-	-	-	-	-	-	-	-	-	AT	AT

Element	Part	Component	Rating Case	Loading (kN/m)			Capacity (kN/m)	BSU		RA		U for RAB		Assessed Category			
				Dead	Static	Dynamic		Static	Dynamic	Static	Dynamic	Static	Dynamic	Static	Dynamic		
14	J (15)	Positive (min)	1	J (1)	Bearing Stiffener	max	-	0.070	17.243	-	-	-	-	-	AT	AT	
15	J (16)	Positive (min)	1	J (1)	Intermediate Stiffener	max	-	0.340	-	-	-	-	-	-	AT	AT	
15	J (17)	Positive (min)	1	J (3)	Bearing Stiffener	max	-	0.340	-	-	-	-	-	-	AT	AT	
16	J (17)	Positive (min)	1	J (3)	Intermediate Stiffener	max	-	0.340	-	-	-	-	-	-	AT	AT	
16	J (18)	Positive (min)	2	J (3)	Bearing Stiffener	max	-	0.070	17.243	-	-	-	-	-	AT	AT	
17	J (18)	Positive (min)	2	J (4)	Bearing Stiffener	max	-	0.340	-	-	-	-	-	-	AT	AT	
17	J (19)	Positive (min)	2	J (4)	Intermediate Stiffener	max	-	0.340	-	-	-	-	-	-	AT	AT	
18	J (19)	Positive (min)	3	J (4)	Bearing Stiffener	max	-	2960.577	1587.951	-	-	-	-	-	AT	AT	
18	J (20)	Positive (min)	3	J (4)	Intermediate Stiffener	max	-	14347.900	-	-	-	-	-	-	AT	AT	
19	J (20)	Positive (min)	3	J (4)	Bearing Stiffener	max	-	14347.900	-	-	-	-	-	-	AT	AT	
19	J (21)	Positive (min)	3	J (5)	Intermediate Stiffener	max	-	2960.577	1587.951	-	-	-	-	-	AT	AT	
20	J (21)	Positive (min)	4	J (5)	Bearing Stiffener	max	-	17135.5	3539.35	-87.684	1872787	RA 15	-1.82	-	-	AT	AT
20	J (22)	Positive (min)	4	J (5)	Intermediate Stiffener	max	-	17135.5	3539.35	-87.684	1872787	RA 15	-1.82	-	-	AT	AT
21	J (23)	Positive (min)	4	J (6)	Bearing Stiffener	max	-	-	136604.1	272082	272082	RA 15	RA 15	-	-	AT	AT
21	J (23)	Positive (min)	4	J (6)	Intermediate Stiffener	max	-	-	136604.1	272082	272082	RA 15	RA 15	-	-	AT	AT
22	J (4)	Positive (min)	5	J (6)	Bearing Stiffener	max	-	11485.94	8791.916	-	-	-	-	-	-	AT	AT
22	J (4)	Positive (min)	5	J (6)	Intermediate Stiffener	max	-	11485.94	8791.916	-	-	-	-	-	-	AT	AT
22	J (37)	Positive (min)	5	J (7)	Bearing Stiffener	max	-	-	136604.1	272082	272082	RA 15	RA 15	-	-	AT	AT
23	J (6)	Positive (min)	6	J (7)	Bearing Stiffener	max	-	-	136604.1	272082	272082	RA 15	RA 15	-	-	AT	AT
23	J (6)	Positive (min)	6	J (7)	Intermediate Stiffener	max	-	-	136604.1	272082	272082	RA 15	RA 15	-	-	AT	AT
24	J (8)	Positive (min)	6	J (7)	Bearing Stiffener	max	-	-	136604.1	272082	272082	RA 15	RA 15	-	-	AT	AT
24	J (8)	Positive (min)	6	J (7)	Intermediate Stiffener	max	-	-	136604.1	272082	272082	RA 15	RA 15	-	-	AT	AT
6	J (8)	Positive (min)	6	J (8)	Bearing Stiffener	max	-	2426.91	18865.25	-	-	-	-	-	-	AT	AT
7	J (8)	Positive (min)	6	J (8)	Intermediate Stiffener	max	-	2426.91	18865.25	-	-	-	-	-	-	AT	AT
7	J (8)	Positive (min)	6	J (8)	Bearing Stiffener	max	-	2426.91	18865.25	-	-	-	-	-	-	AT	AT
7	J (8)	Positive (min)	6	J (8)	Intermediate Stiffener	max	-	2426.91	18865.25	-	-	-	-	-	-	AT	AT
8	J (9)	Positive (min)	6	J (9)	Bearing Stiffener	max	-	2426.91	18865.25	-	-	-	-	-	-	AT	AT
8	J (9)	Positive (min)	6	J (9)	Intermediate Stiffener	max	-	2426.91	18865.25	-	-	-	-	-	-	AT	AT
8	J (9)	Positive (min)	6	J (9)	Bearing Stiffener	max	-	2426.91	18865.25	-	-	-	-	-	-	AT	AT
8	J (9)	Positive (min)	6	J (9)	Intermediate Stiffener	max	-	2426.91	18865.25	-	-	-	-	-	-	AT	AT
8	J (10)	Positive (min)	6	J (10)	Bearing Stiffener	max	-	47768.24	31955.71	-	-	-	-	-	-	AT	AT
9	J (11)	Positive (min)	6	J (11)	Bearing Stiffener	max	-	202519.2	-	-	-	-	-	-	-	AT	AT
9	J (11)	Positive (min)	6	J (11)	Intermediate Stiffener	max	-	202519.2	-	-	-	-	-	-	-	AT	AT
10	J (11)	Positive (min)	6	J (11)	Bearing Stiffener	max	-	47768.24	31955.71	-	-	-	-	-	-	AT	AT
10	J (11)	Positive (min)	6	J (11)	Intermediate Stiffener	max	-	47768.24	31955.71	-	-	-	-	-	-	AT	AT
10	J (12)	Positive (min)	6	J (12)	Bearing Stiffener	max	-	322519.2	-	-	-	-	-	-	-	AT	AT
10	J (12)	Positive (min)	6	J (12)	Intermediate Stiffener	max	-	322519.2	-	-	-	-	-	-	-	AT	AT
11	J (12)	Positive (min)	6	J (12)	Bearing Stiffener	max	-	322519.2	-	-	-	-	-	-	-	AT	AT
11	J (12)	Positive (min)	6	J (12)	Intermediate Stiffener	max	-	322519.2	-	-	-	-	-	-	-	AT	AT
12	J (13)	Positive (min)	6	J (13)	Bearing Stiffener	max	-	77.439	-	-	-	-	-	-	-	AT	AT
12	J (13)	Positive (min)	6	J (13)	Intermediate Stiffener	max	-	77.439	-	-	-	-	-	-	-	AT	AT

Table Results

The screenshot shows an Excel report generated from the assessment. It contains several summary tables:

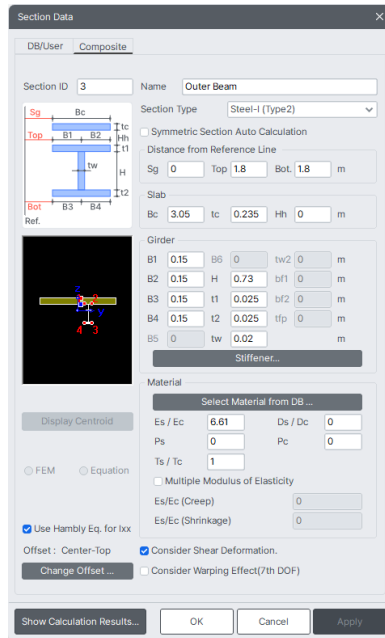
- Design Condition:** Shows design code NR/GN/CIV/025.06 and member type Main Girder.
- Bending Result Summary:** Lists assessment cases (e.g., EUL_D_Fac/Max) with loading, capacity, BSU, RA, and U for RAB values.
- Shear Result Summary:** Lists assessment cases with loading, capacity, BSU, RA, and U for RAB values.
- Bearing Stiffener Result Summary:** Includes sub-sections for Web Yielding, Yielding, and Buckling, each with assessment cases and their respective results.

Excel Report

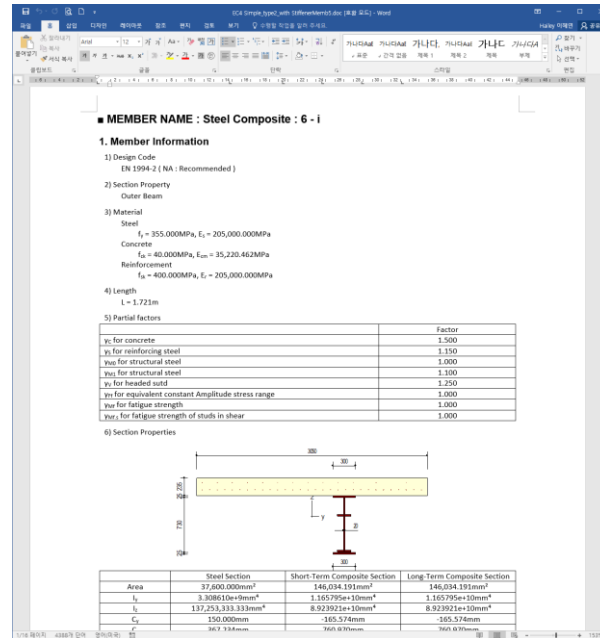
5. Automated design support for asymmetric (Type 2) composite steel bridges as per Eurocode4 & AASHTO LRFD

- In the case of exterior girders in girder bridges, the deck often needs to be modeled asymmetrically. However, previous versions did not support the design of such asymmetric sections in the automatic section design feature.
- Starting from this version, Steel Composite Design now supports asymmetric (Type 2) sections, in addition to the previously supported symmetric sections.
- The supported design codes are Eurocode 4 and AASHTO LRFD, and Type 2 section checks are available for Steel I-girders, Steel Tub girders, and Steel Box girders.

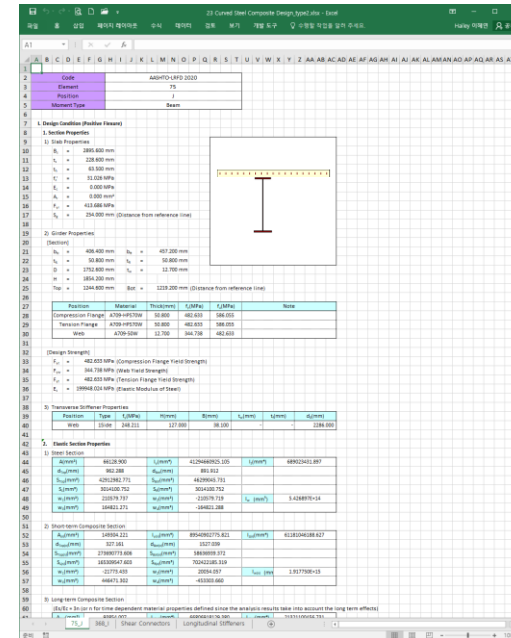
- **Properties > Section Properties**
- **Design > Composite Design > EN 1994-2, AASHTO-LRFD20**



Composite Steel-I (Type2) Section



Steel Composite Design Report as per Eurocode4

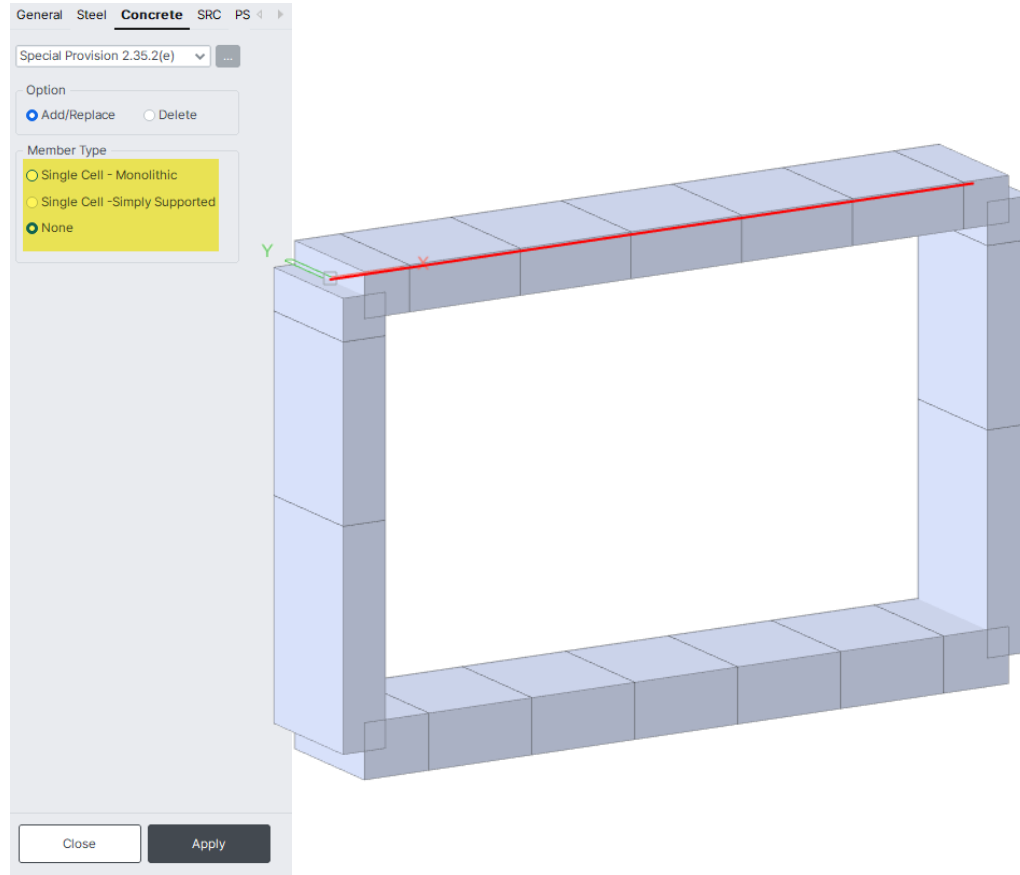


Steel Composite Design Report as per AASHTO LRFD

6. RC Design for 1D Beam & Column as per AREMA 2023

- A new option, "Special Provision 2.35.2(e)" has been added under Design Parameters to specify the type of box culvert.

Design > RC Design > Design Parameters > Special Provision 2.35.2(e)



Special Provision 2.35.2(e)

Concrete Structures and Foundations

$$v_c = 2 \left(1 + 0.0005 \frac{N_u}{A_g} \right) \sqrt{f'_c} \quad \text{EQ 2-47}$$

$$v_c = 0.17 \left(1 + 0.072 \frac{N_u}{A_g} \right) \sqrt{f'_c} \quad \text{EQ 2-47M}$$

The quantity $\frac{N_u}{A_g}$ shall be expressed in psi (MPa).

- d. For members subject to significant axial tension, shear reinforcement shall be designed to carry the total shear, unless a more detailed analysis is made using

$$v_c = 2 \left(1 + 0.002 \frac{N_u}{A_g} \right) \sqrt{f'_c} \quad \text{EQ 2-48}$$

$$v_c = 0.17 \left(1 + 0.29 \frac{N_u}{A_g} \right) \sqrt{f'_c} \quad \text{EQ 2-48M}$$

where:

N_u is negative for tension

the quantity $\frac{N_u}{A_g}$ shall be expressed in psi (MPa).

- e. Special provisions for slabs of box culverts. For slabs of box culverts under rail with 18 inches (450 mm) or more of fill (base of rail to top of culvert), shear stress v_c may be computed by:

$$v_c = 2.14 \sqrt{f'_c} + 4600 \rho \frac{V_u d}{M_u} \quad \text{EQ 2-49}$$

$$v_c = 0.18 \sqrt{f'_c} + 32 \rho \frac{V_u d}{M_u} \quad \text{EQ 2-49M}$$

but v_c shall not exceed $4 \sqrt{f'_c}$ (or $\frac{1}{3} \sqrt{f'_c}$ in metric). For single cell box culverts only, v_c need not be taken

less than $3 \sqrt{f'_c}$ (or $\frac{\sqrt{f'_c}}{4}$ in metric) for slabs monolithic with walls or $2.5 \sqrt{f'_c}$ (or $\frac{5}{24} \sqrt{f'_c}$ in metric)

for slabs simply supported. The quantity $\frac{V_u d}{M_u}$ shall not be taken greater than 1.0, where M_u is factored moment occurring simultaneously with V_u at section considered.

6. RC Design for 1D Beam & Column as per AREMA 2023

- Design and checking of RC frame elements to AREMA 2023 are newly introduced in midas.
- This feature can be applied to RC beam & RC column (T-girder, diaphragm, pier, pier cap & other related substructure components).
- The detailed design report provides calculations in both SI and US units, available in Word format.

Design > RC Design > RC Code Design > Beam/Column Design

AREMA-2023 RC-Beam Design Result Dialog

Code: AREMA-2023 Unit: kN, mm Primary Sorting Option

Sorted by: Member Section

Negative Moment **Positive Moment** **Shear & Torsion**

MEMB	Section	fc	POS	CHK	N(-) Mu	LCB	AsTop	P(+) Mu	LCB	AsBot	vu	LCB	AsV	Tu	LCB	St	Stirrups
7	Pier Cap Mid	0.04826	I	OK	2.0E+07	1+F	29121	0.00000	3	0.0000	0.00572	1+F	17.878	4376.23	2+F	101.83	9.0-#5 @100
8	1500, 2000	0.41369	M	OK	2.6E+07	1+F	37933	0.00000	3	0.0000	0.00573	1+F	17.528	4376.23	2+F	102.69	9.0-#5 @100

AREMA-2023 RC-Beam Checking Result Dialog

Code: AREMA-2023 Unit: kN, mm Primary Sorting Option

Sorted by: Member Section

Stress Check

MEMB	Section	fc	POS	CHK	Stress Control			
SECT	Bc	Hc	fy		Concrete			
Span	bf	hf	fys		Top-s	Top-sa	Bot-s	Bot-sa
7	Pier Cap Mid	0.04826	I	OK	205.00	206.00	0.0000	206.00
8	1500, 2000	0.41369	M	OK	184.00	206.00	0.0000	206.00

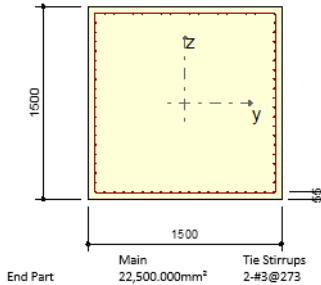
Design Result Table

Detailed Design Report

MEMBER NAME : Pier (Section ID : 9, Element No.1)

1. Member Information

- 1) Design Code
AREMA-2023
- 2) Section Property
Pier (ID : 9)
- 3) Material
Concrete
 $f_c = 48.263\text{MPa}$, $E_c = 0.043w_c^{1.5}f_c^{0.5} = 35,219.834\text{MPa}$
Reinforcement
 $f_y = 413.686\text{MPa}$, $f_{yt} = 413.686\text{MPa}$, $E_s = 199,948.024\text{MPa}$
- 4) Length
 $L = 10.000\text{m}$
- 5) Reinforcement Data



2. Axial and moment capacity (End, 1.00L)

Axial and moment	LCB	Strength Group I-FX	
$P_u / \phi P_n$	30,926.254kN / 60,413.089kN	= 0.512	OK
$M_{uy} / \phi M_{uy}$	7.118kN-m / 17.308kN-m	= 0.411	OK
$M_{ux} / \phi M_{ux}$	97.692kN-m / 237.556kN-m	= 0.411	OK
ρ_{min} / ρ_{max}	97.950kN-m / 238.186kN-m	= 0.411	OK
	ρ_{min} / ρ_{max}	$0.01000 \leq \rho \leq 0.01000 \leq \rho_{max} = 0.08000$	OK

* Strength Group I-FX : (1.400) Dead Load, FX minimum concurrent force

7. Update PSC section design criteria for Australia to the latest 2024 standard

- The PSC Design feature has been updated to support the latest amendment of the Australian bridge design standard: AS 5100.5:2017 Amendment 2024.
- Key Updates** : Support for the 2024 Amendment is now available in the PSC Design Parameters.
 Updated reinforcing steel material properties in accordance with the new amendment.
 All relevant design equations and checks have been revised to comply with the updated provisions.
- This update ensures that engineers can perform PSC design fully aligned with the most current Australian bridge design standards.

Design > PSC Design > AS 5100.5:17 > Amd 2:2024

PSC Design Code

Design Code: AS 5100.5:17 Amendments: Amd 2:2024

Input Parameters

Maximum nominal aggregate size (8.2.4.2): d_g 0.016 m

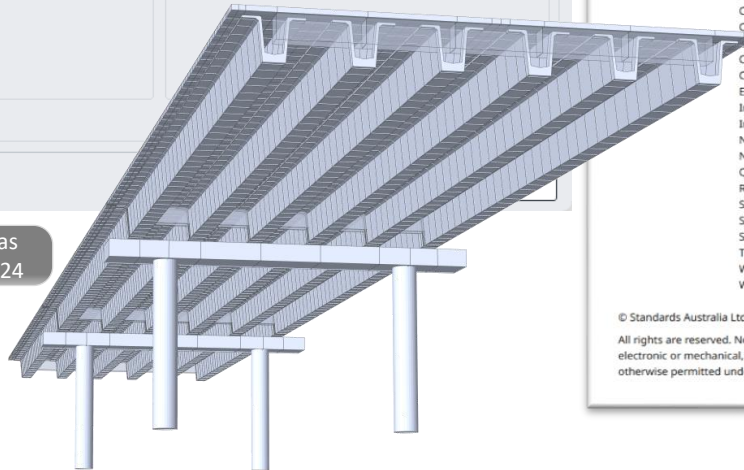
Crack Control: Maximum Increment of Steel Stress: 160000 kN/m²

Output Parameters

Ultimate limit states: Transfer Check Flexural resistance Shear resistance Torsional resistance

Serviceability limit state: Control of Cracking

PSC Design Parameter as per AS5100:5 Amd 2:2024



AS 5100.5:2017 Amd 2:2024

Bridge design, Part 5: Concrete

This Australian Amendment was prepared by BD-090, Bridge Design. It was approved on behalf of Standards Australia's Standards Development and Accreditation Committee on 29 April 2024.

- Published:** 24 May 2024
Draft published as: DR AS 5100.5:2017 Amd 2:2024
Committee: BD-090
Committee members: ARRB (Australian Road Research Board), Australian Industry Group, Australian Steel Institute, Austroads Ltd, Bureau of Steel Manufacturers of Australia Limited, Cement Concrete & Aggregates Australia - Cement Concrete Institute of Australia, Concrete NZ Inc, Concrete Pipe Association of Australasia, Consult Australia, Engineers Australia, Independent Chairperson (Australasia), Institute of Public Works Engineering Australasia, National Precast Concrete Association Australia, New Zealand Heavy Engineering Research Association, Queensland University of Technology, Rail Industry Safety and Standards Board, Standards New Zealand (SNZ), Steel Construction New Zealand, Steel Reinforcement Institute of Australia, The University of Sydney, WSP New Zealand Ltd, Waka Kotahi-NZ Transport Agency

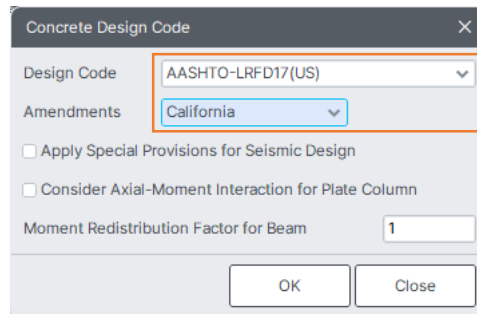
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1. Design Condition		Element	Node(s)				
Design Code		AS5100.5:17 Amd2 24	506				
Section Properties							
Section Type: Composite							
Gross section		Transformed section					
	Before	After	Before				
H (mm)	1500.0	1680.0	H (mm)	1500.0			
B (mm)	2100.0	2860.0	B (mm)	2100.0			
C _{top} (mm)	823.3	389.7	C _{top} (mm)	858.3			
C _{bot} (mm)	576.7	1163.3	C _{bot} (mm)	548.7			
A _g (mm ²)	5.557 E+05	1.058 E+06	A _{tr} (mm ²)	5.855 E+05			
I _g (mm ⁴)	1.588 E+11	3.802 E+11	I _{tr} (mm ⁴)	1.669 E+11			
S _x (mm ³)	1.929 E+08	4.075 E+08	S _x (mm ³)	1.983 E+08			
S _y (mm ³)	2.347 E+08	1.431 E+08	S _y (mm ³)	2.569 E+08			
S _{xx} (mm ⁴)		6.674 E+08	S _{xx} (mm ⁴)	6.382 E+08			
S _{yy} (mm ⁴)		9.756 E+08	S _{yy} (mm ⁴)	9.166 E+08			
Materials							
Concrete							
	f _c (MPa)	E _c (MPa)	f _{ctm} = 0.6f _c (MPa)				
Order	50 000	34800 000	4.243				
Slab	65 000	37400 000	4.837				
* α ₁ = 1.0 - 0.003f _c (within the limits of 0.67 ≤ α ₁ ≤ 0.85)							
* γ = 1.05 - 0.007f _c (within the limits of 0.67 ≤ γ ≤ 0.87)							
Pre-stressing steel information							
No.	Tendon name	Bond type	d _s (mm)	A _{ps} (mm ²)	Strength (MPa)	E _s (MPa)	
					f _{yk}	f _{tk}	
1	S_Span1-175	Bond	1465.0	138.7	1559.1	1863.3	205000.0
2	S_Span1-165	Bond	1465.0	138.7	1559.1	1863.3	205000.0
3	S_Span1-155	Bond	1515.0	138.7	1559.1	1863.3	205000.0
4	S_Span1-145	Bond	1555.0	138.7	1559.1	1863.3	205000.0
5	S_Span1-135	Bond	1615.0	138.7	1559.1	1863.3	205000.0
6	S_Span1-125	Bond	1465.0	138.7	1559.1	1863.3	205000.0
7	S_Span1-115	Bond	1515.0	138.7	1559.1	1863.3	205000.0
8	S_Span1-105	Bond	1555.0	138.7	1559.1	1863.3	205000.0
9	S_Span1-95	Bond	1615.0	138.7	1559.1	1863.3	205000.0
10	S_Span1-85	Bond	1465.0	138.7	1559.1	1863.3	205000.0
11	S_Span1-75	Bond	1515.0	138.7	1559.1	1863.3	205000.0
12	S_Span1-65	Bond	1555.0	138.7	1559.1	1863.3	205000.0
13	S_Span1-55	Bond	1615.0	138.7	1559.1	1863.3	205000.0
14	S_Span1-45	Bond	1465.0	138.7	1559.1	1863.3	205000.0
15	S_Span1-35	Bond	1515.0	138.7	1559.1	1863.3	205000.0
16	S_Span1-25	Bond	1555.0	138.7	1559.1	1863.3	205000.0
17	S_Span1-15	Bond	1615.0	138.7	1559.1	1863.3	205000.0
18	S_Span1-173	Bond	1465.0	138.7	1559.1	1863.3	205000.0
19	S_Span1-163	Bond	1515.0	138.7	1559.1	1863.3	205000.0
20	S_Span1-153	Bond	1515.0	138.7	1559.1	1863.3	205000.0
21	S_Span1-143	Bond	1555.0	138.7	1559.1	1863.3	205000.0
22	S_Span1-133	Bond	1615.0	138.7	1559.1	1863.3	205000.0
23	S_Span1-123	Bond	1465.0	138.7	1559.1	1863.3	205000.0
24	S_Span1-113	Bond	1515.0	138.7	1559.1	1863.3	205000.0
25	S_Span1-103	Bond	1555.0	138.7	1559.1	1863.3	205000.0
26	S_Span1-93	Bond	1615.0	138.7	1559.1	1863.3	205000.0
27	S_Span1-83	Bond	1465.0	138.7	1559.1	1863.3	205000.0
28	S_Span1-73	Bond	1515.0	138.7	1559.1	1863.3	205000.0
29	S_Span1-63	Bond	1555.0	138.7	1559.1	1863.3	205000.0

8. Add California-specific provisions from AASHTO LRFD

- To meet the specific requirements of California bridge projects, MIDAS CIVIL NX now supports the California Amendment to AASHTO LRFD design specifications.
- Applicable Design Modules : Steel Design, RC Design, PSC Design, Steel Composite Design
- Users can now perform code checks and design in full compliance with California Department of Transportation (Caltrans) standards, ensuring regional accuracy and approval readiness.

- **Design > Steel Design > AASHTO-LRFD17 > California Amendments**
- **Design > RC Design > AASHTO-LRFD17 > California Amendments**
- **Design > PSC Design > AASHTO-LRFD17 > California Amendments**
- **Design > Composite Design > AASHTO-LRFD17 > California Amendments**



Concrete Design Code

Design Code: AASHTO-LRFD17(US)

Amendments: California

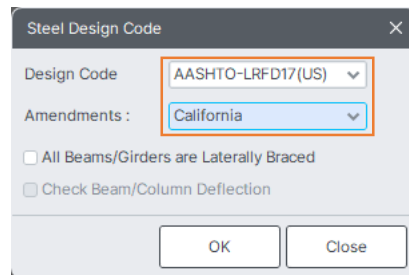
Apply Special Provisions for Seismic Design

Consider Axial-Moment Interaction for Plate Column

Moment Redistribution Factor for Beam: 1

OK Close

RC Design – CA Amendment



Steel Design Code

Design Code: AASHTO-LRFD17(US)

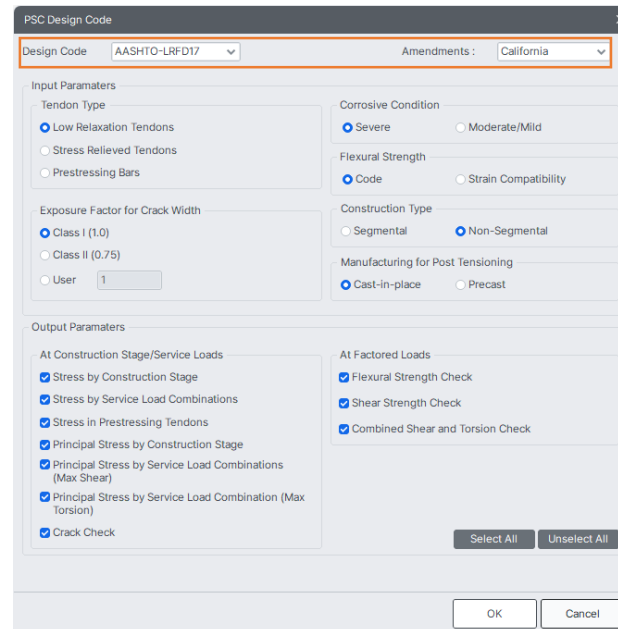
Amendments: California

All Beams/Girders are Laterally Braced

Check Beam/Column Deflection

OK Close

Steel Design – CA Amendment



PSC Design Code

Design Code: AASHTO-LRFD17

Amendments: California

Input Parameters

Tendon Type

Low Relaxation Tendons

Stress Relieved Tendons

Prestressing Bars

Corrosive Condition

Severe Moderate/Mild

Flexural Strength

Code Strain Compatibility

Exposure Factor for Crack Width

Class I (1.0)

Class II (0.75)

User: 1

Construction Type

Segmental Non-Segmental

Manufacturing for Post Tensioning

Cast-in-place Precast

Output Parameters

At Construction Stage/Service Loads

Stress by Construction Stage

Stress by Service Load Combinations

Stress in Prestressing Tendons

Principal Stress by Construction Stage

Principal Stress by Service Load Combinations (Max Shear)

Principal Stress by Service Load Combination (Max Torsion)

Crack Check

At Factored Loads

Flexural Strength Check

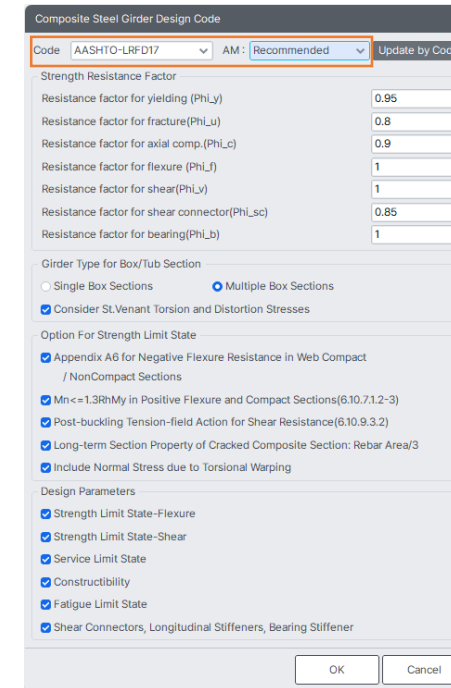
Shear Strength Check

Combined Shear and Torsion Check

Select All Unselect All

OK Cancel

PSC Design – CA Amendment



Composite Steel Girder Design Code

Code: AASHTO-LRFD17

AM: Recommended

Update by Code

Strength Resistance Factor

Resistance factor for yielding (Phi_{Ly}): 0.95

Resistance factor for fracture (Phi_{Lu}): 0.8

Resistance factor for axial comp. (Phi_{Lc}): 0.9

Resistance factor for flexure (Phi_{Lf}): 1

Resistance factor for shear (Phi_{Lv}): 1

Resistance factor for shear connector (Phi_{Lsc}): 0.85

Resistance factor for bearing (Phi_{Lb}): 1

Girder Type for Box/Tub Section

Single Box Sections Multiple Box Sections

Consider St.Venant Torsion and Distortion Stresses

Option For Strength Limit State

Appendix A6 for Negative Flexure Resistance in Web Compact / NonCompact Sections

Mn <= 1.3RhMy in Positive Flexure and Compact Sections (6.10.7.1.2-3)

Post-buckling Tension-field Action for Shear Resistance (6.10.9.3.2)

Long-term Section Property of Cracked Composite Section: Rebar Area/3

Include Normal Stress due to Torsional Warping

Design Parameters

Strength Limit State-Flexure

Strength Limit State-Shear

Service Limit State

Constructibility

Fatigue Limit State

Shear Connectors, Longitudinal Stiffeners, Bearing Stiffener

OK Cancel

Steel Composite Design – CA Amendment

9. Auto-generate Load combination (RC) as per TMH07 : 1981

- Load combination are generated as per Table 17 of TMH07 : 1981
- For automatically generated load combinations, the SLS combinations are classified according to TMH07-1981 for serviceability checks under PSC Design.

Results > Load Combination > Concrete Design > Auto Generation > TMH07: 1981

Type of action	Nominal actions F _k	Notation	Clause number	Limit state	% S ₁ = 7% < S ₂ < 7% to be considered in combination:			ULS = Ultimate Limit State SLS = Serviceability Limit State	
					1	2	3		
PRINCIPAL ACTIONS PERMANENT AND LONG TERM	Dead loads: concrete	G _k	2.2.2	ULS SLS	1.2 1.0	1.05 1.0	1.0 1.0		
	Dead loads: steel	G _k	2.2.2	ULS SLS	1.1 1.0	1.05 1.0	1.1 1.0		
	Superimposed dead loads	Q _k	2.3.2	ULS SLS	1.2 1.0	1.05 1.0	1.2 1.0		
	Reduced load for dead and superimposed dead load where this has a more severe effect	G _k	2.2.2.2 2.3.2.2	ULS SLS	1.0 1.0	1.0 1.0	1.0 1.0		
	Vertical earth loading on curbs	Method (I)	G _k	2.3.3.3	ULS SLS	1.4 1.1	1.2 1.1	1.4 1.1	
		Methods (II) & (III)	G _k	2.3.3.3	ULS SLS	1.4 1.1	1.2 1.1	1.4 1.1	
	Earth pressure due to retained fill	Approximate theory	E _k	2.4.3	ULS SLS	1.5 1.1	1.3 1.1	1.5 1.1	
		More accurate theory	E _k	2.4.3	ULS SLS	1.4 1.0	1.2 1.0	1.4 1.0	
	As above but causing relieving effect	E _k	2.4.3	ULS SLS	1.4 1.0	1.2 1.0	1.4 1.0		
	Water pressure of retained or excluded water	W _k	2.5.2	ULS SLS	1.2 1.0	1.05 1.0	1.2 1.0		
As above but causing relieving effect	W _k	2.5.2	ULS SLS	1.0 1.0	1.0 1.0	1.0 1.0			
PRIMARY LIVE LOADS Vehicle traffic loading and surcharge	NA	Q _k	2.6.3.3	ULS SLS	1.5 1.0	1.3 1.0	—		
	NB	Q _k	2.6.4.3	ULS SLS	1.2 1.0	1.1 1.0	—		
	NC = 1/2 NA on separate carriageways	Q _k	2.6.5.3	ULS SLS	1.2 1.0	1.1 1.0	—		
	Sidewalk and cycle track loading	Q _k	2.7.1.2	ULS SLS	1.5 1.0	1.3 1.0	—		
SHORT TERM Erection loads		Q _k	2.8.2.2	ULS SLS	—	1.50 1.0	—		
	Centrifugal forces	F _k	3.2.4	ULS SLS	—	1.50 1.0	—		
Longitudinal braking and traction forces		NA load	F _k	3.3.6 3.6.4	ULS SLS	—	1.25 1.0	—	
	NB load	F _k	3.3.6 3.6.4	ULS SLS	—	1.1 1.0	—		
Accidental skidding	F _k	3.4.4	ULS SLS	—	1.25 1.0	—			
	Impact due to vehicle collision with bridge balustrades or parapets	F _k	3.5.4	ULS SLS	—	1.25 1.0	—		
TRANSIENT Impact due to vehicle collision with bridge supports	(A)	F _k	3.7.5	ULS SLS	—	1.25 1.0	—		
	(B)	F _k	3.8.7	ULS SLS	—	1.1 1.0	—		
Wind action	(I)	W	3.8.7	ULS SLS	—	1.1 1.0	—		
	(II)	W	3.8.7	ULS SLS	—	1.0 1.0	—		
Flood action	F _k	3.9.8	ULS SLS	—	0.95 1.0	1.3 1.0	—		
	Earthquake action	F _k	3.10.5	ULS SLS	—	1.3 1.0	—		
LONG TERM Creep and shrinkage	F ₁ , F ₂	F ₁ , F ₂	4.2.2	ULS SLS	1.0 1.0	1.0 1.0	1.0 1.0		
	Parastic prestress and prestress	F ₁ , F ₂	4.3.2	ULS SLS	1.0 1.0	1.0 1.0	1.0 1.0		
Differential settlement	F ₁	F ₁	4.4.2	ULS SLS	1.0 1.0	1.0 1.0	1.0 1.0		
	Temperature range	F ₁	4.5.8	ULS SLS	—	0.9 1.0	1.3 1.0		
Temperature gradient	F ₁	F ₁	4.5.8	ULS SLS	—	0.9 1.0	1.3 1.0		
	Frictional bearing restraint	F ₁	4.1-1-P	ULS SLS	—	1.3 1.0	—		

TABLE 17 Combinations of nominal actions F_k and partial action factors γ_k.
Note: The total design action S_{Ed} = γ_k · F_k.
Values for γ_k are given in Part 3.

Auto Load Combination

SLS Load combination Type

10. PSC Design as per TMH07-3 : 1989

- The design of PSC elements as per TMH07-3:1989 has been newly implemented in MIDAS.
- This feature can be applied to all the PSC girder.

Design > PSC Design > TMH07-3 : 1989

PSC Design Code

Design Code: TMH07-3:1989

Input Parameters

User Input Data Modify Design Parameters...

Principal Stress Limitation

Serviceability Limit States		Construction Stage	
Comp.	<input type="text" value="0"/> kN/m ²	Comp.	<input type="text" value="0"/> kN/m ²
Tens.	<input type="text" value="0"/> kN/m ²	Tens.	<input type="text" value="0"/> kN/m ²

Output Parameters

Serviceability Limit States		Ultimate limit states	
<input checked="" type="checkbox"/> Concrete stress limitation under service loads		<input checked="" type="checkbox"/> Bending resistance	
<input checked="" type="checkbox"/> Concrete stress limitation at Construction Stage		<input checked="" type="checkbox"/> Shear resistance	
<input checked="" type="checkbox"/> Principal stress under service loads		<input checked="" type="checkbox"/> Torsional resistance	
<input checked="" type="checkbox"/> Principal stress at Construction Stage			
<input checked="" type="checkbox"/> Tensile stress for prestressing steel			

Select All Unselect All

OK Cancel

PSC Design

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BAC	ADAE	AFAG	AH	
2 Shear Design for a Section																															
- Strength limit load combination :																trial															
- Strength limit load combination type :																-															
- Axial force due to ultimate loads																P = 0.00 (kN)															
- Shear force due to ultimate loads																V = 0.00 (kN)															
- Bending moment due to ultimate loads																M = 36750.01 (kN m)															
1) Crack Check for Flexure																															
- Cracking moment (M _{cr})																(see Clause 4.3.4.3 - TMH7-3 : 1989)															
$M_{cr} = (0.37\sqrt{f_{cu}} + f_{pt}) \times \frac{I}{y} = 11246.70 \text{ (kN-m)}$																															
where,																															
f _{pt} = 0.02 (MPa) : Stress due to prestress only at the tensile fibre																															
I = 9.5410E+12 (mm ⁴) : Second moment of area																															
y = 2001.44 (mm) : Tensile fibre distance																															
Y _{FL} = 1.15																															
Since,																															
M _{cr} ≤ M : Section is cracked in flexure																															
2) Shear resistance of Concrete																															
• Ultimate Shear Resistance of Concrete (V _{cr}).																(Clause 4.3.4.3 (Eq-34) - TMH7-3 : 1989)															
$V_{cr} = 0.037bd\sqrt{f_{cu}} + \frac{M_{cr}}{M} \gamma + 0.5 \cdot V_p \cdot \gamma_{fl} \geq 0.1bd\sqrt{f_{cu}}$																															
= 294.29 ≥ 704.99																∴ V _{cr} = 704.99 (kN)															

Detailed Excel Report

11. Significantly Improved Excel Design Report Generation Speed

- The generation speed of Excel-based design reports has been dramatically improved by adopting the LibXL library. This enhancement reduces the time required to export large and complex design calculation sheets.
- Key Improvements** : Significantly faster export performance for design reports.
Improved stability when generating large files.
- This update enhances user productivity, especially for projects requiring frequent report generation and documentation submission.

■ Design > Steel Design ,RC Design , PSC Design , Composite Design

• Applicable to the following design codes:

PSC/PSC Composite

- AASHTO-LRFD20
- AS 5100.5:17
- BS 5400-4:1990
- CSA-S6-14
- CSA-S6-19
- CSA-S6S1-10
- KSCE-LSD15
- KDS 24 14 21 : 2021
- TMH07
- Eurocode2-2:05
- IRC112, IRS
- BD44/15 for CS455, CS457
- SNiP 2.05.03-84*
- SP 35.13330.2011

Steel Composite

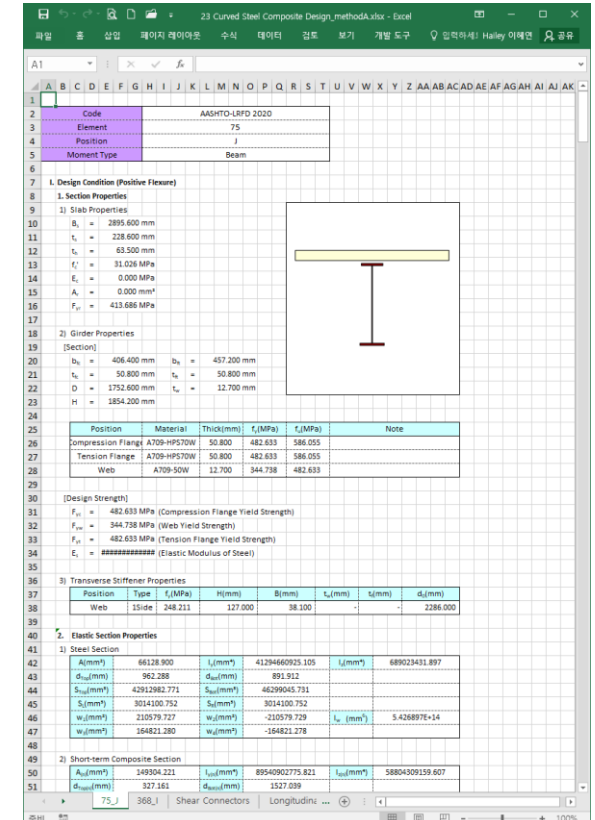
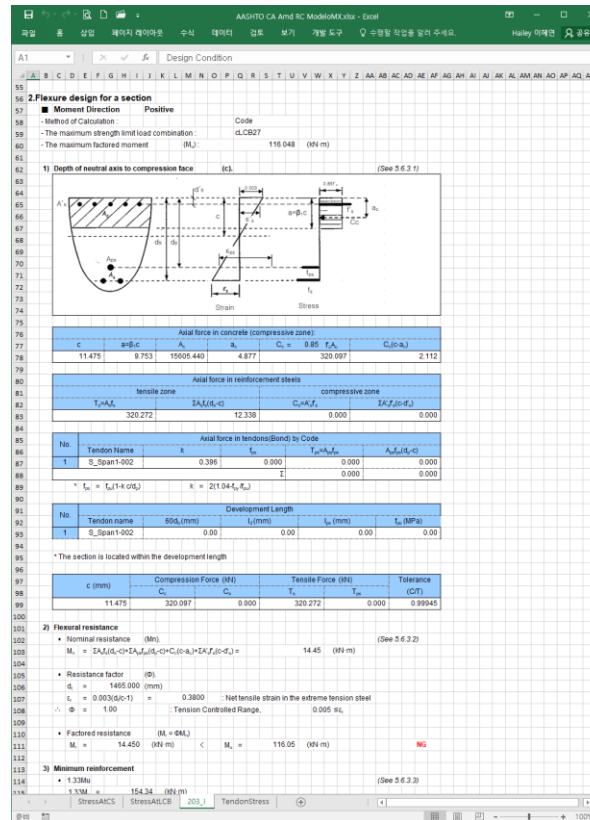
- AASHTO-LRFD20
- CSA-S6-14
- CSA-S6-19
- SNiP 2.05.03-84*
- SP 35.13330.2011
- EN 1994-2
- KSCE-LSD15
- KDS 24 14 31 : 2018
- Steel SOD**
- SNiP 2.05.03-84*
- SP 35.13330.2011

Steel Rating

- AASHTO-LRFR11
- AASHTO-LRFR19
- CS454/20
- NR GN CIV 025

PSC Rating

- AASHTO-LRFR11
- AASHTO-LRFR19
- CS454/20
- KSCE-LSD15



Excel Report

12. Moving patch load analysis as per Eurocode, BS & NZ traffic loads

- The tire contact area of a wheel can now be applied during moving load analysis not only for AASHTO LRFD vehicles (as in previous versions), but also for all road bridge vehicles defined in Eurocode, BS and New Zealand standards.
- By applying patch (area) loads instead of concentrated wheel loads, the resulting design forces on plate elements can be significantly reduced, leading to more realistic and optimized analysis results. This enhancement improves modeling accuracy, especially for deck and slab structures where local stress distribution is critical.

Load > Moving Load (AASHTO LRFD) > Vehicles


Define Standard Vehicular Load

Standard Name: CS 458 (BD96/11) Special Load

Vehicular Load Properties

Vehicular Load Name: SV 80

Vehicular Load Type: SV 80



No	P (kN)	D (m)
1	130	1.2
2	130	1.2
3	130	A
4	130	1.2
5	130	1.2
6	130	end

A is Critical of 1.2m or 5.0m or 9.0m

Dynamic Amplification Factor

Auto User Input

ψ : 1

Overload Factor

Auto User Input

Critical Axle: 1.2

All Other Axles: 1.1

Distance to Front and Rear Vehicles

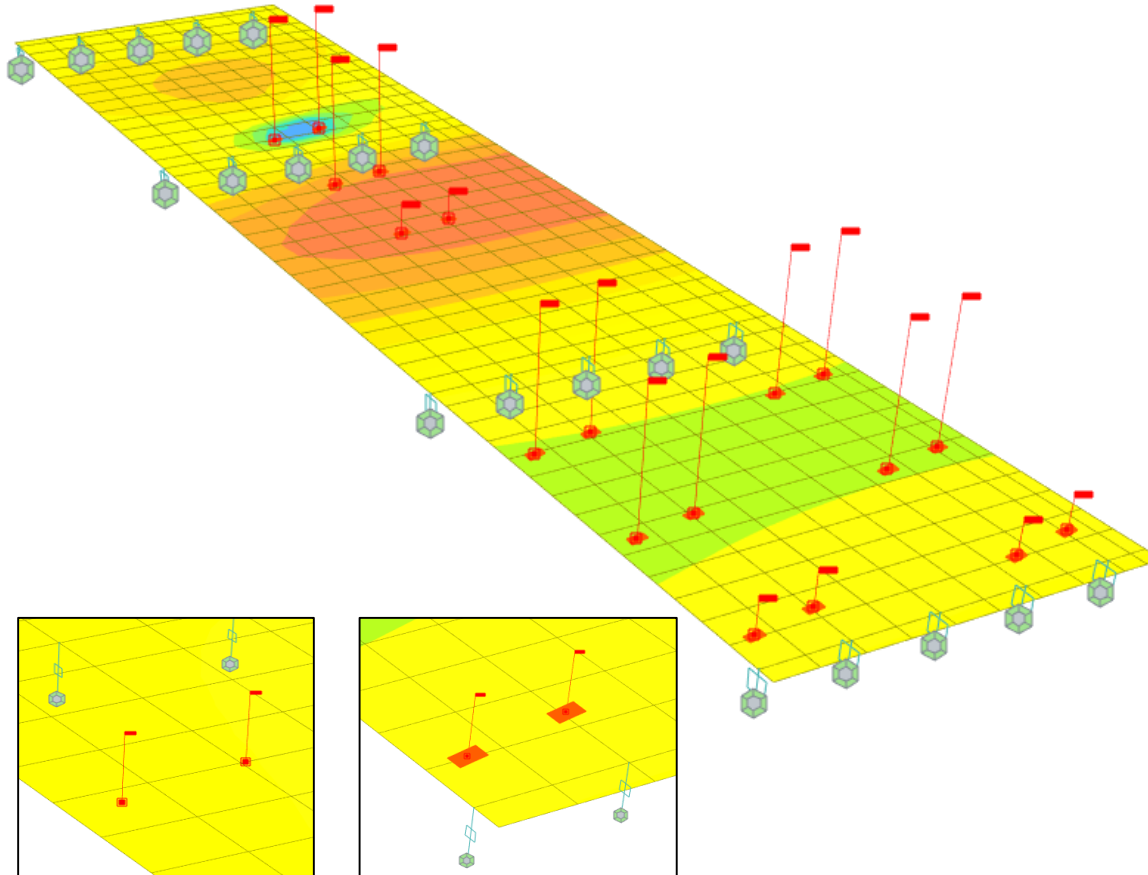
25m 5m

Consider Contact Area

Width: 0.35 m

Length: 0.35 m

OK Cancel Apply



Concentrated wheel loads

Patch/area wheel loads

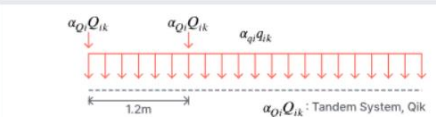
Define Standard Vehicular Load

Standard Name: EN 1991-2:2003 - RoadBridge

Vehicular Load Properties

Vehicular Load Name: Load Model 1

Vehicular Load Type: Load Model 1



$\alpha_{Qi} Q_{ik}$: Tandem System, Q_{ik}

$\alpha_{qj} q_{ik}$: UDL System, q_{ik}

Dynamic amplification factor included

Location	Tandem System		UDL System	
	Adjustment Factor	Axle Loads (kN)	Adjustment Factor	Uniformly Dist. Loads (kN/m ²)
Lane Number1	1	300	1	9
Lane Number2	1	200	1	2.5
Lane Number3	1	100	1	2.5
Other Lanes & Remaining Area	0	0	1	2.5

ψ factor for Tandem System: 0.75

ψ factor for UDL System: 0.4

Consider Contact Area

Width: 0.4 m

Length: 0.4 m

OK Cancel Apply

Eurocode Load Model1 Vehicle

BS Special Vehicle

13. Addition of evaluation truck loads for existing bridges in New Zealand(Based on SP/M/022 v3.4)

- A full set of New Zealand vehicle load models, as specified in SP/M/022 v3.4, has been added, including: HN (normal) loading, HO (overload) loading, TT530 (Fatigue), HPMV evaluation loading, General access and 50MAX reference vehicles
- This enhancement is integrated with the lane optimization feature and the patch load (tire contact area) function for improved load distribution on deck elements.
- Users can define the target element and span length, and the Dynamic Factor is automatically calculated and applied in the analysis, ensuring more accurate simulation of vehicle effects on bridge structures.

Load > Moving Load > New Zealand

Define Standard Vehicular Load

Standard Name: Traffic Load

General Access Vehicle
50MAX Conforming Vehicle
High Productivity Motor Vehicle
Deck Evaluation Vehicle
Fatigue Loading Model

No	Load(kN)	Spacing(m)	W	Unit
1	120	5	10.5	kN/m
2	120	end		

Consider Contact Area
Width: 0.5 m
Length: 0.2 m

OK Cancel Apply

New Zealand Vehicles

Dynamic Load Factor

Select Structure Group

- SG-P2Seg12
- SG-KeySeg1
- SG-KeySeg2
- SG-KeySeg3
- SG-FSM1
- SG-FSM2
- BG-S-Pier
- BG-S-FsmLeft
- BG-S-FsmRight
- BG-EL-Pier
- BG-EL-FsmLeft
- BG-EL-FsmRight

Dynamic Factor Input Type
 Auto Input User Input

Auto Calculation

Span Length: 80 m

Bending and Shear for Beam Element: Auto

Reaction: Auto

All Other Effects: 1

(e.g.Axial, Torsion, Stress, Displacements, etc)

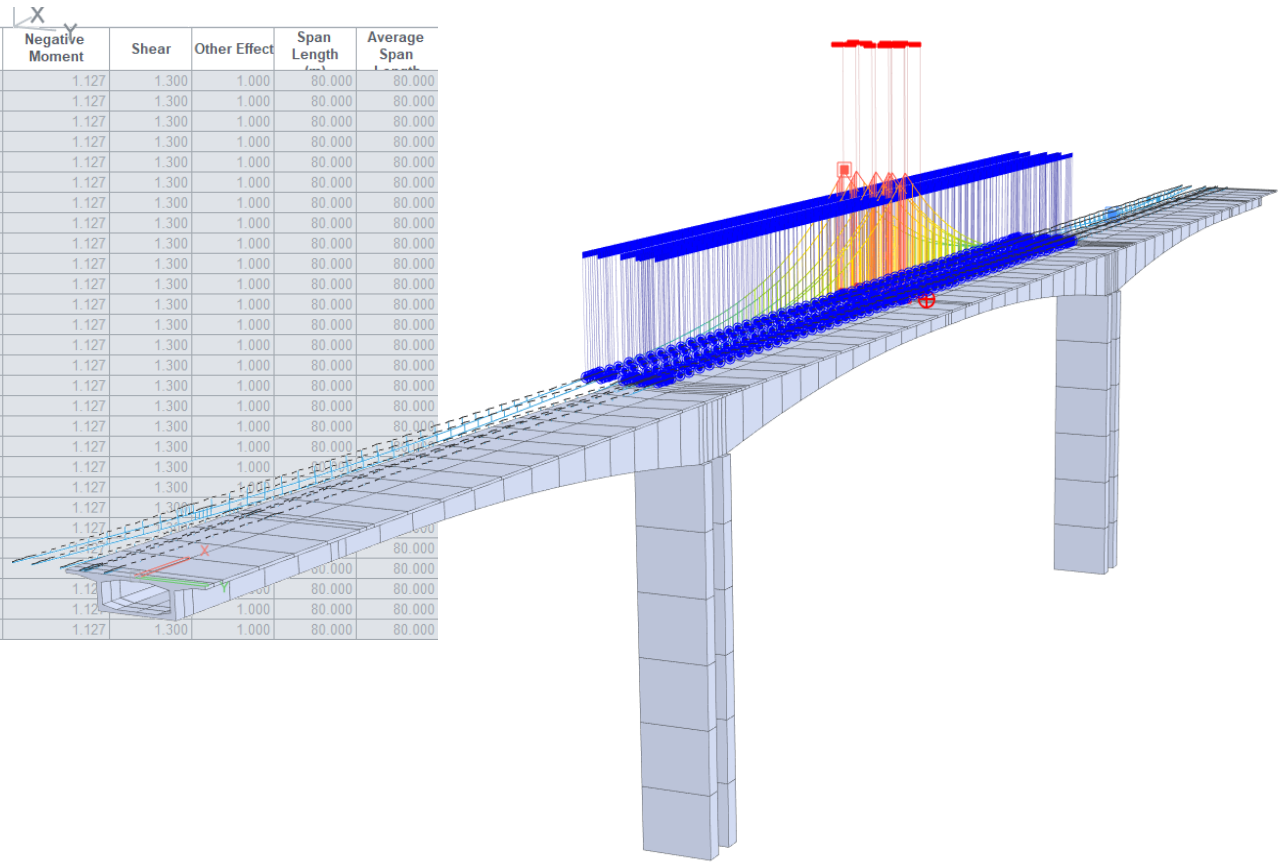
Span ID	Group List	Length	Other
1	SG-P1Seg1, SG-P1S...	80	1

Add Modify Insert Delete

OK Cancel

Dynamic Load Factor

Element	Positive Moment	Negative Moment	Shear	Other Effect	Span Length	Average Span
7	1.127	1.127	1.300	1.000	80.000	80.000
8	1.127	1.127	1.300	1.000	80.000	80.000
9	1.127	1.127	1.300	1.000	80.000	80.000
10	1.127	1.127	1.300	1.000	80.000	80.000
11	1.127	1.127	1.300	1.000	80.000	80.000
12	1.127	1.127	1.300	1.000	80.000	80.000
13	1.127	1.127	1.300	1.000	80.000	80.000
14	1.127	1.127	1.300	1.000	80.000	80.000
15	1.127	1.127	1.300	1.000	80.000	80.000
16	1.127	1.127	1.300	1.000	80.000	80.000
17	1.127	1.127	1.300	1.000	80.000	80.000
18	1.127	1.127	1.300	1.000	80.000	80.000
19	1.127	1.127	1.300	1.000	80.000	80.000
20	1.127	1.127	1.300	1.000	80.000	80.000
29	1.127	1.127	1.300	1.000	80.000	80.000
30	1.127	1.127	1.300	1.000	80.000	80.000
31	1.127	1.127	1.300	1.000	80.000	80.000
32	1.127	1.127	1.300	1.000	80.000	80.000
33	1.127	1.127	1.300	1.000	80.000	80.000
34	1.127	1.127	1.300	1.000	80.000	80.000
35	1.127	1.127	1.300	1.000	80.000	80.000
36	1.127	1.127	1.300	1.000	80.000	80.000
37	1.127	1.127	1.300	1.000	80.000	80.000
38	1.127	1.127	1.300	1.000	80.000	80.000
39	1.127	1.127	1.300	1.000	80.000	80.000
40	1.127	1.127	1.300	1.000	80.000	80.000
41	1.127	1.127	1.300	1.000	80.000	80.000
48	1.127	1.127	1.300	1.000	80.000	80.000



14. Addition of special permit trucks for load rating of existing bridges in Western Australia

- The latest version of MIDAS Civil includes a newly added vehicle database for Western Australia (WA) to support region-specific bridge assessments.
- Group 1 and Group 2 vehicles can be selected while optionally enabling Multiple Lane Factors and Accompanying Lane Factors. Group2 vehicles are fully compatible with SM1600 vehicle configurations.
- This enhancement provides improved flexibility and regulatory compliance for bridge evaluations in Western Australia.

▪ Load > Moving Load > Australia

Define Standard Vehicular Load

Standard Name: AS 5100.7 - Rating Vehicles

Vehicular Load Properties

Vehicular Load Name: WA-Group1-Vehicle1

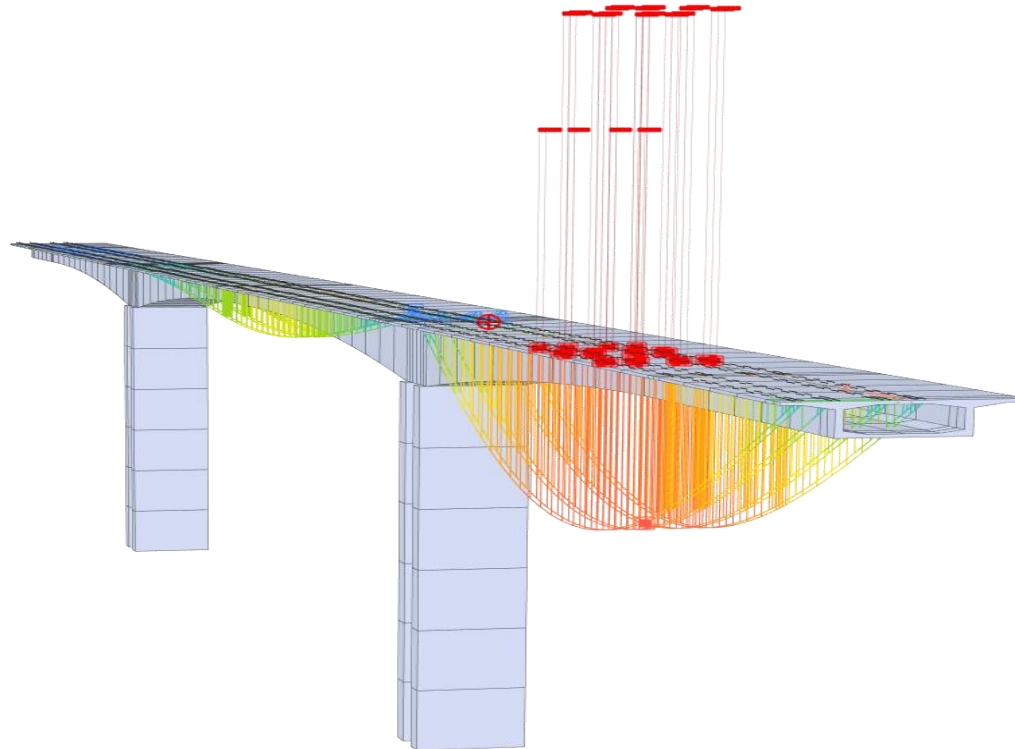
Vehicular Load Type: WA-Group1-Vehicle1

Dynamic Load Allowance: 0.4

No	Load(tonf)	Spacing(m)
1	6	4.9
2	9	1.2
3	9	7.25
4	9	1.2
5	9	end

OK Cancel Apply

- T44 Truck Load
- L44 Lane Load
- VIC-45.5T HML B DOUBLE
- VIC-68T HML B DOUBLE
- QLD-50.5T 8G1 GML 19m B DOUBLE
- QLD-50.5T 8G2 GML 19m B DOUBLE
- QLD-62.5T 7G GML B DOUBLE
- QLD-68T 7H HML B DOUBLE
- WA-Group1-Vehicle1
- WA-Group1-Vehicle2
- WA-Group1-Vehicle3
- WA-Group1-Vehicle4
- WA-Group2-Vehicle1 (3.01m O/A)
- WA-Group2-Vehicle1 (3.70m O/A)
- WA-Group2-Vehicle2 (3.01m O/A)
- WA-Group2-Vehicle2 (3.70m O/A)
- WA-Group2-Vehicle4
- WA-Group2-Vehicle5
- WA-Group2-Vehicle7
- WA-Group2-Vehicle8



Define Moving Load Case

Load Case Name: Lane

Description:

Load Case for Permit Vehicle

Moving Load Optimization

Select Load Model

- General
- Fatigue
- Heavy Load Platform
- Rail Traffic Load
- B-Double Load
- WA Rating Vehicle Group1
- WA Rating Vehicle Group2

Multiple Lane Factor

Accompanying Lane Factor

Num of Loaded Lanes	Scale Factor
1	1
2	0.8
3 or more	0.4

Optimization

Min. Vehicle Distance: 1 m

Load Case Data

Loaded Lane: Lane

Min. Number of Vehicle: 0

Max. Number of Vehicle: 2

Loading Effect

Combined Independent

Assignment Vehicle

Selected Vehicle: VLWA-Group1-Vehic

Scale Factor: 1.0

Vehicle	Scale
VLWA-Group1-Vehicle1	1

Add Modify Delete

OK Cancel Apply

Western Australia Vehicles

Moving Load Cases

15. Enhancement of Australian moving load options: Add lateral offset distance option

- When performing moving load analysis for Heavy Load Platform (HLP) vehicles under AS 5100.2 or WA Group 2 vehicles under AS 5100.7, it is important to evaluate the critical vehicle position considering lateral eccentricity. In previous versions, lateral eccentricity was fixed at 1.0 m during vehicle placement. With this update, users can now manually define lateral eccentricity up to 1.0 m, allowing for more accurate and flexible simulation of critical load positions.
- Benefits :** Improves accuracy in rating calculations by reflecting realistic vehicle positioning.
 Enables detailed control of vehicle eccentricity in accordance with project-specific requirements.
 Enhances compliance with AS 5100.2 and AS 5100.7 practices.
- This feature provides more robust control for heavy vehicle evaluation, especially in rating scenarios involving wide bridges or straddling lanes.

▪ **Load > Moving Load > Australia**

Define Standard Vehicular Load

Standard Name: AS 5100.2 - Heavy Load Platform


Vehicular Load Properties

Vehicular Load Name: HLP320

Vehicular Load Type: HLP320

Dynamic Load Allowance: 0.1

Lateral Eccentricity: 1 m



P = 200 kN
D = 1.8 m
Number of Axles = 16

OK Cancel Apply

Heavy Load Platform

Define Standard Vehicular Load

Standard Name: AS 5100.7 - Rating Vehicles

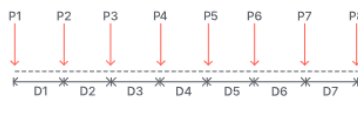
Vehicular Load Properties

Vehicular Load Name: WA-Group2-Vehicle1 (3.01m O/A)

Vehicular Load Type: WA-Group2-Vehicle1 (3.01m O/A)

Dynamic Load Allowance: 0.1

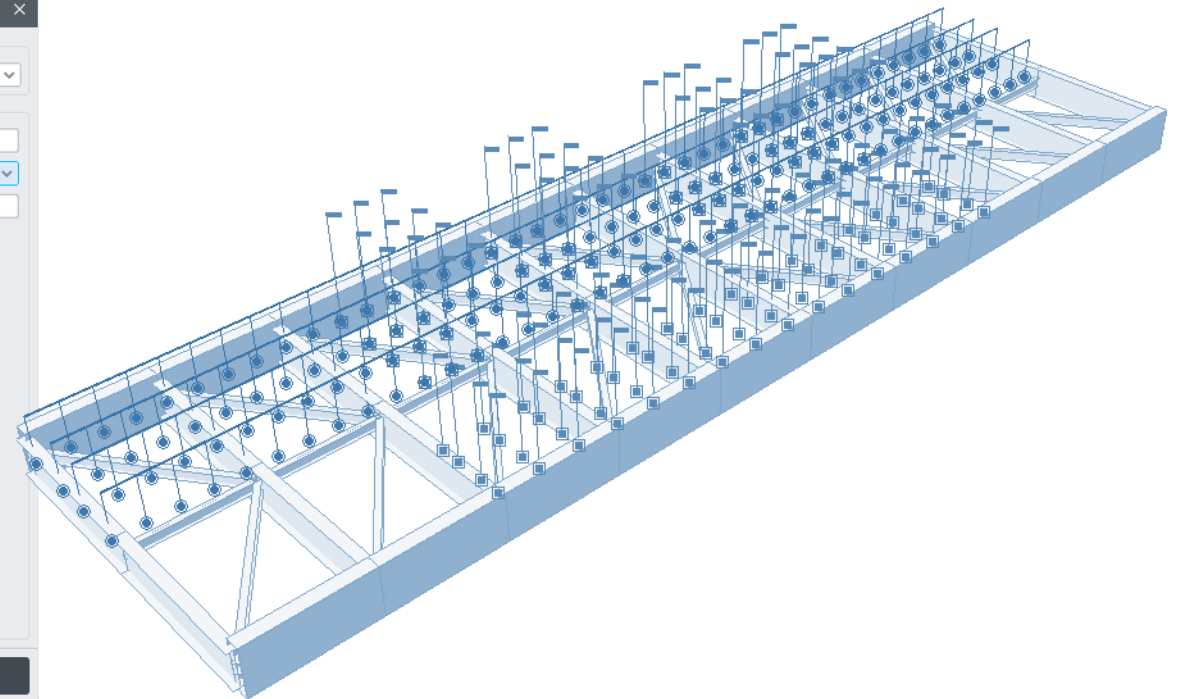
Lateral Eccentricity: 1 m



No	Load(kN)	Spacing(m)
1	58.8399	4.9
2	88.2598	1.2
3	88.2598	3
4	176.52	1.2
5	176.52	6.5
6	176.52	1.8
7	176.52	1.8
8	176.52	end

OK Cancel Apply

WA Rating Vehicles



16. Enhancement of Load All Model 1 in the UK rating system to support envelope type loads

- The UK rating system has been enhanced to support Vehicle Class functionality for BS moving loads, including All Model 1 as per CS454.
- Previously, reviewing All Model 1 required checking results for over 20 different vehicles individually, which was time-consuming. With the new Vehicle Class feature, users can now define a single moving load case that automatically evaluates all vehicles in the class and returns results for the most critical vehicle.
- This significantly improves efficiency by: Reducing setup and post-processing time, Automatically identifying governing cases, Enabling envelope-type load evaluations in a single step. This update streamlines the BS-based assessment process and enhances productivity, especially for complex rating projects.

▪ Load > Moving Load > BS

No	P (kN)	D (m)
1	64	1.2
2	64	3.9
3	113	1.3
4	74	end

All Model1 Vehicles

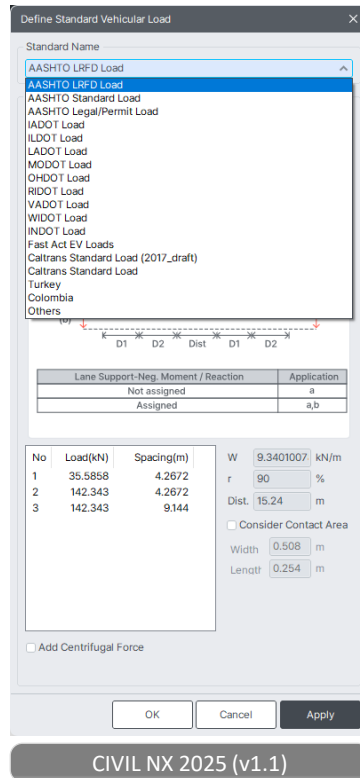
Moving Load Case

Vehicle Class

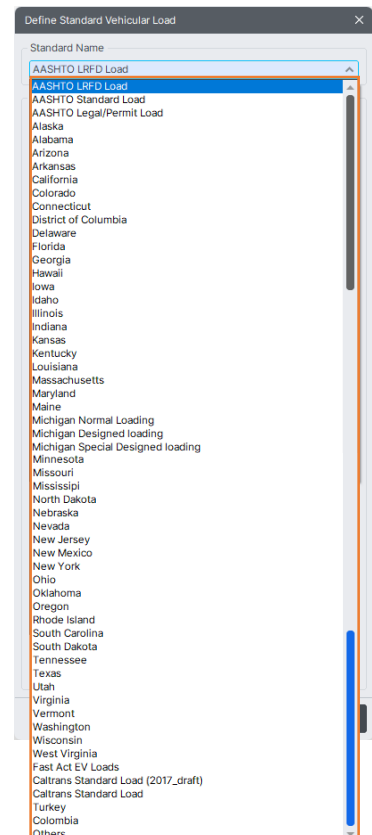
17. Addition of vehicle database for 46 US states

- In previous versions, MIDAS Civil provided AASHTO LRFD vehicle databases for only 10 states, including California. With this update, the database has been expanded to cover all 46 U.S. states that follow the AASHTO LRFD specification.
- Key Additions: State-specific Design Trucks, Legal Trucks, and Permit Trucks are now included for each state.
- This enhancement allows users to perform more accurate and regionally compliant bridge load rating and design across a wide range of jurisdictions in the United States.

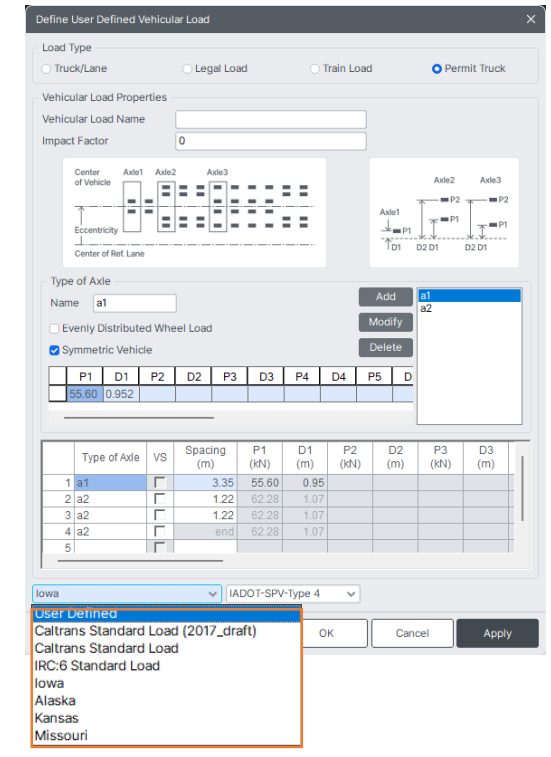
▪ Load > Moving Load > AASHTO LRFD



CIVIL NX 2025 (v1.1)



CIVIL NX 2026 (v1.1)



Moving Load Cases

18. Addition of cross-section databases for the US and Canada

- The section database has been significantly expanded to support regional standards in the U.S. and Canada, enhancing modeling accuracy and design efficiency. These additions provide engineers with ready-to-use section profiles that comply with local specifications, streamlining design workflows for North American bridge projects.
- Canada : Added steel section database according to CISC-ICCA 2022, including : Angle, Channel, I-section, T-section, Box, Pipe, and Double Angle profiles.
Added 12 PSC sections used in Ontario, including : PSC I-girders and PSC Box-girders.
- United States – Florida : Added 41 prestressed concrete (PSC) sections based on Florida Department of Transportation (FDOT) standards, covering : PSC I-Girders, PSC U-Girders, Interior & Exterior Slab Beams, PSC Pile (Square Sections)

■ **Properties > Section Properties**

Canada CISC Steel DB sections

Canada Ontario PSC DB Sections

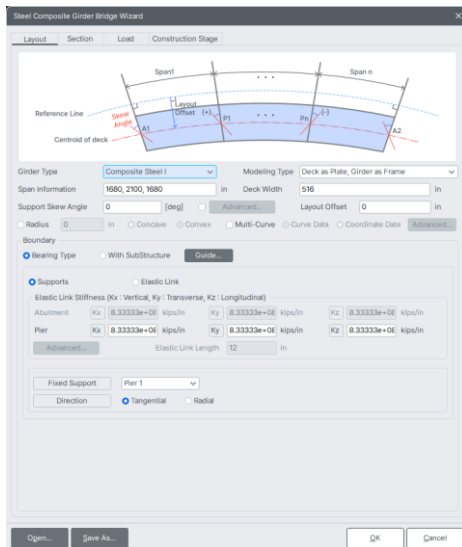
Florida-I 36 Beam - Standard Details
 Florida-I 45 Beam - Standard Details
 Florida-I 54 Beam - Standard Details
 Florida-I 63 Beam - Standard Details
 Florida-I 72 Beam - Standard Details
 Florida-I 78 Beam - Standard Details
 Florida-I 84 Beam - Standard Details
 Florida-I 96 Beam - Standard Details
 AASHTO Type II Beam
 Florida-U 48 Beam - Standard Details
 Florida-U 54 Beam - Standard Details
 Florida-U 63 Beam - Standard Details
 Florida-U 72 Beam - Standard Details
 12" Florida Slab Beam
 15" Florida Slab Beam
 18" Florida Slab Beam

USA Florida PSC DB Sections

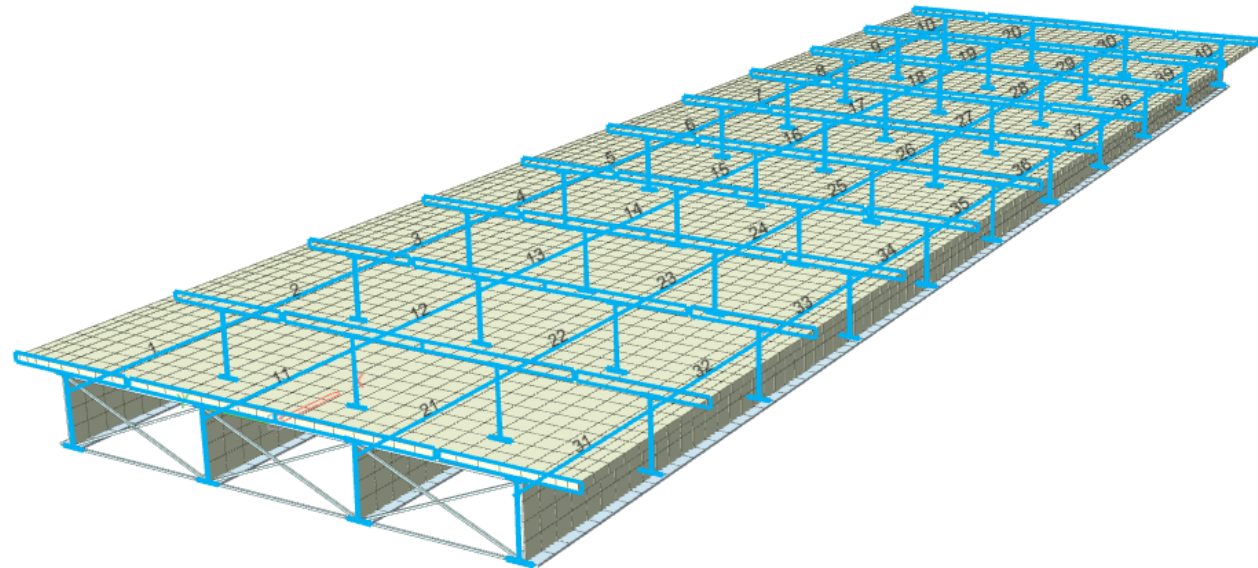
19. Steel-Composite Girder Design & Assessment Enhancements

- Until the previous version, Steel-Composite Girder Design was supported only when the girders were modeled as Beam Elements. With this release, the design workflow has been significantly extended:
 - Full Plate Modeling Support: Entire steel-composite girders modeled with **Plate Elements** can now be directly designed.
 - Mixed Modeling Support: Structures modeled with a combination of **Beam Elements and Plate Elements** are also supported, allowing more flexible modeling strategies.
- Supported Codes
 - **Design:** AASHTO LRFD (Load and Resistance Factor Design), **Assessment:** CS 454 (Assessment of Highway Structures)
- Key Benefits
 - Engineers can now freely choose between beam-only, plate-only, or hybrid modeling approaches depending on project requirements.
 - Plate-element-based modeling better captures local effects and distribution of stresses in steel-composite girders.
- Limitation
 - Design and Assessment are supported only for Virtual Beams generated via the **Steel Composite Bridge Wizard**.

■ Structure > Steel Bridge > Steel Composite Bridge



Steel Composite Bridge Wizard



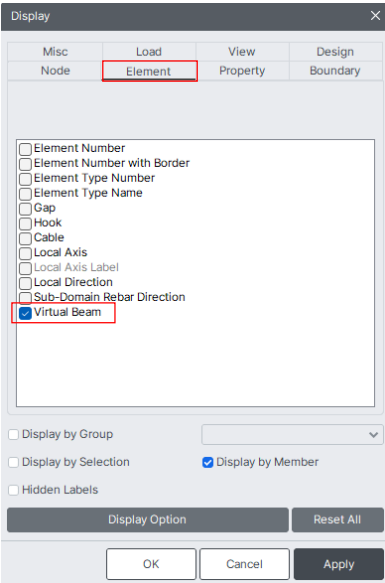
Steel-Composite Girder Bridge — Virtual Beam Display

20. Virtual Beam Display for Plate and Mixed Models

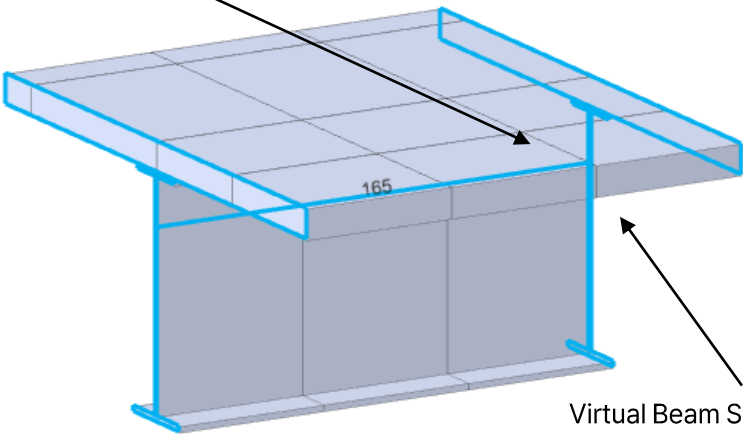
- A new Virtual Beam Display option has been added to support the design of steel-composite girders modeled with Plate Elements or a combination of Plate and Beam Elements.
- Display Settings
 - In the Display > Element tab, users can enable Virtual Beam.
 - In the Display > Property tab, users can enable Virtual Beam Section.
 - Once activated, the model view will display the virtual beam representation.
- What is a Virtual Beam?

A Virtual Beam is not a physically modeled element. Instead, it is a design-oriented beam representation automatically generated from plate elements (or plate + beam elements). This allows users to conduct design checks as if the structure were modeled with traditional beam elements, while still benefiting from the accuracy of plate modeling.
- Benefits for Users
 - Clear Visualization: View beam-like design references even in complex plate or mixed models.
 - Seamless Design Integration: Perform design checks on virtual beams without remeshing or remodelling.
 - Time Savings: Avoid manual re-modeling by directly using virtual beams derived from your analysis model.

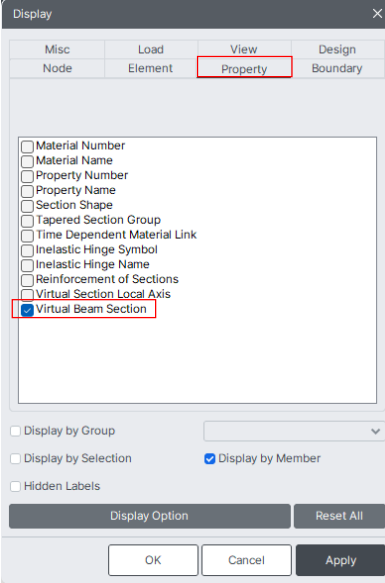
▪ **View > Display**



Virtual Beam



Virtual Beam Section



21. Virtual Beam + Span Information: Faster LTB checks on plate or mixed models

- You can now define Virtual Beams per girder and perform lateral-torsional buckling (LTB) checks even when the steel-composite girder is modeled entirely with plates or with a plate + beam (mixed) model.

How it works

Create Virtual Beams by Girder

Open **Span Information** and set **Element Type** → **Virtual Beam**.

Select the plate/beam elements that belong to each girder to generate its Virtual Beam.

Tell the program where the girder is braced

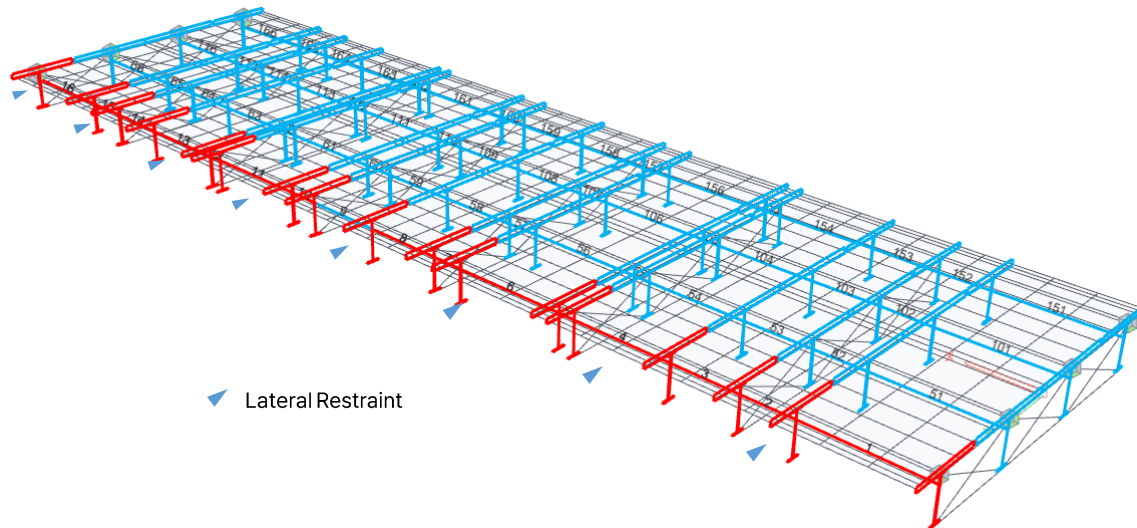
In **Span Information**, set **Support** at each **cross-frame (or diaphragm) location**.

Civil NX then **automatically determines the unbraced length** between supports.

Automatic critical moment search

During the **LTB verification**, the program **searches the maximum bending moment within each unbraced segment** and uses that value for the check—no manual segmenting or re-meshing required.

Structure > Steel Bridge > Composite Option > Span Information



Span Information
✕

Girder Name

Element Type

Element Virtual Beam

Assign Elements

By Selection Number

Add/Replace
Delete All

No.	Virtual Beam	Length (in)	Support
1	1	168	I
2	2	72	None
3	3	96	I
4	4	144	None
5	5	24	I
6	6	168	None
7	7	48	None
8	8	120	I
9	9	120	None
10	10	48	I
11	11	168	None
12	12	24	None
13	13	144	I

Span by Element Length

in

Exact Span

in

(ex : 2, 3@4, 5)

Inner Direction of Multiple Girders

(-)Local-y (+)Local-y

Both None

Girder Information

No.	No.	Name	Element List
1	G1	1, 2, 3, 4,...	

Add
Modify
Delete

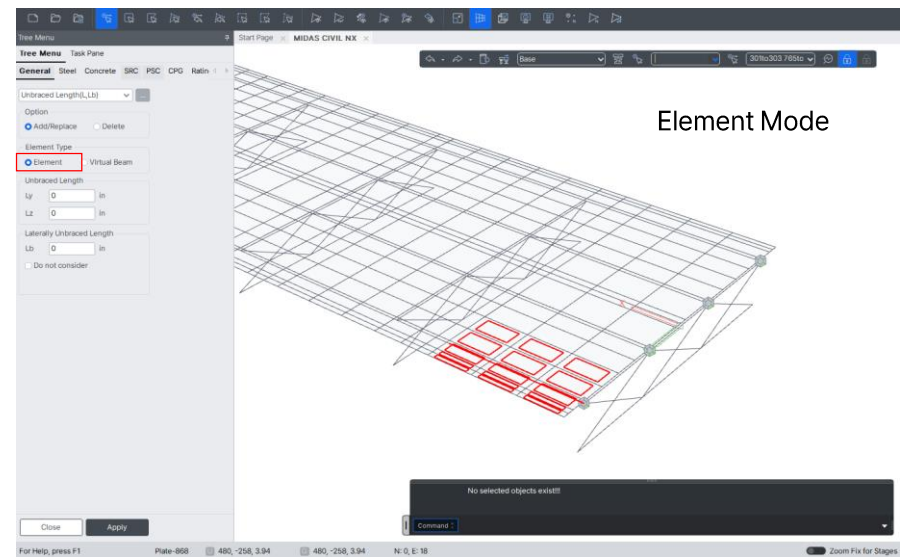
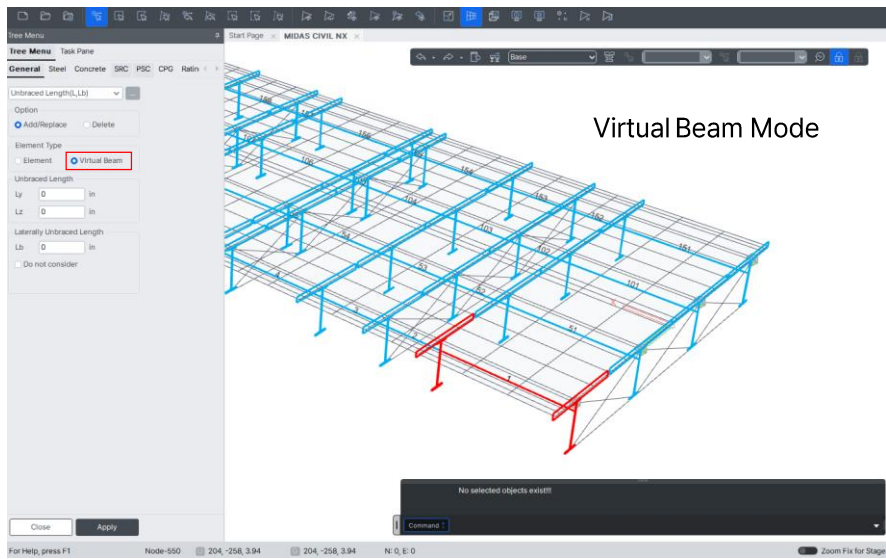
Close

Span Information

22. Virtual Beam Selection & Management

- Selection
 - Supported selection icons: Select Single /Select by Window/Select All/Unselect by Window/Unselect All
 - When Virtual Beams are displayed, only Virtual Beams can be selected. This ensures a clear and convenient workflow, preventing accidental selection of structural elements.
- Activation :
 - Activating or deactivating specific Virtual Beams only is not supported.
 - Virtual Beams are always kept in a fully active state when displayed.
- Deletion of Virtual Beams
 - Virtual Beams can be deleted in two ways:
 1. Properties → Section Properties → Section for Resultant Forces → delete the corresponding Virtual Beam.
 2. If the elements assigned to a Virtual Beam are deleted, the Virtual Beam is automatically removed.
- Zoom Functions
 - When all structural elements are deactivated and only Virtual Beams remain active, **Zoom All** and **Zoom Fit** do not operate.
 - These functions always work relative to **activated elements** only.

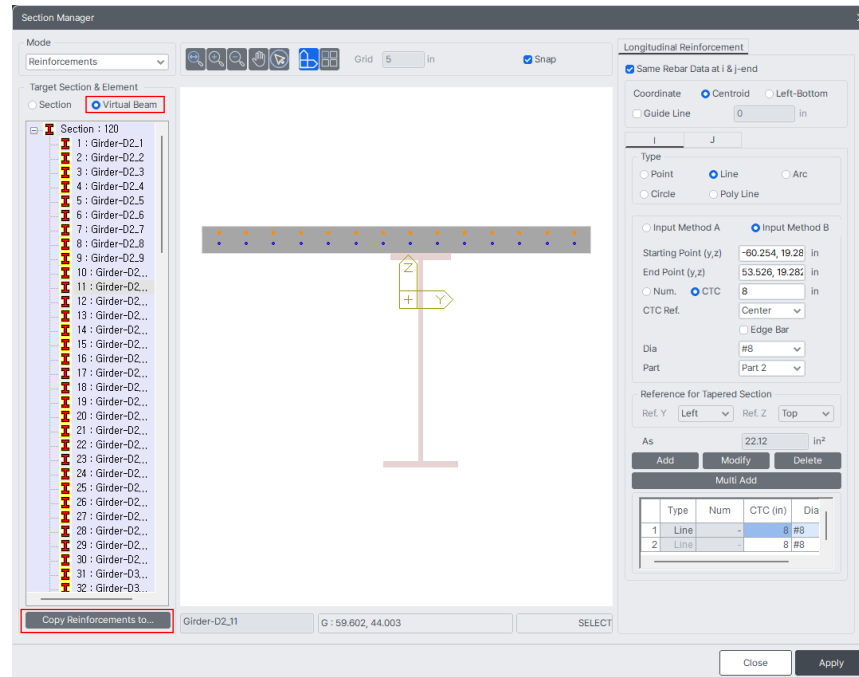
View > Select > Select Single



23. Virtual Beam Reinforcement Input

- You can now directly assign reinforcement to Virtual Beams through the familiar Longitudinal Rebar dialog.
 - In the **Longitudinal Rebar dialog**, select **"Virtual Beam"** mode.
 - Choose the Virtual Beam number from the list (Virtual Beam IDs can be confirmed in **Model View**).
 - Reinforcement is then defined in the **same manner as for standard Beam Elements**, ensuring a consistent workflow.
 - For multiple Virtual Beams with the same reinforcement pattern, the **Copy Reinforcement** function enables quick and easy input.
 - Design-only usage:** Reinforcement assigned to Virtual Beams is used **only for design and assessment** purposes.
 - No impact on analysis:** The reinforcement data is **not reflected in the structural analysis** results.

■ Design > Composite Design > Design Input Data > Longitudinal Rebar

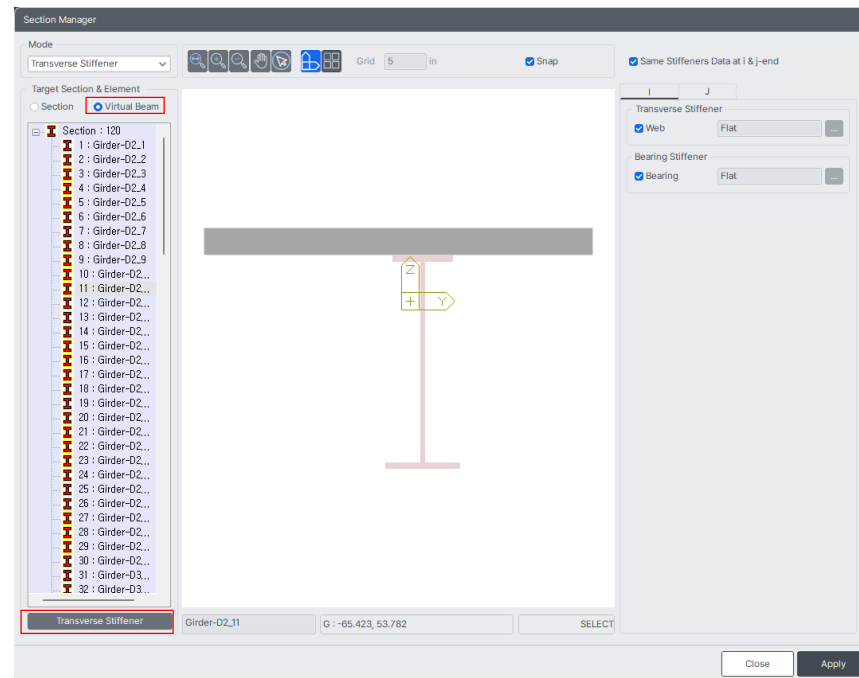


Longitudinal Rebar Dialog

24. Virtual Beam Transverse Stiffener Input

- You can now directly assign transverse stiffener to Virtual Beams through the familiar Transverse Stiffener dialog.
 - In the **Transverse Stiffener dialog**, select **“Virtual Beam” mode**.
 - Choose the Virtual Beam number from the list (Virtual Beam IDs can be confirmed in **Model View**).
 - Transverse stiffener is then defined in the **same manner as for standard Beam Elements**, ensuring a consistent workflow.
 - For multiple Virtual Beams with the same stiffener pattern, the **Copy Transverse Stiffener** function enables quick and easy input.

■ Design > Composite Design > Design Input Data > Design Parameters > Transverse Stiffener



Transverse Stiffener Dialog

25. Virtual Beam Design & Assessment for Steel-Composite Girders

- Civil NX now supports the design and assessment of steel-composite girders modeled as Virtual Beams, extending the workflow beyond conventional beam elements.
 - **Design:** Perform Virtual Beam design according to **AASHTO LRFD**.
 - **Assessment:** Carry out Virtual Beam assessment following **CS 454** provisions.
- Virtual Beam design and assessment follow the **same calculation procedures as existing beam element design**.
- Results are automatically generated in **tabular format** and can be exported as **comprehensive reports**.
- Section properties, material data, and reinforcement/stiffener inputs defined in the Virtual Beam workflow are fully integrated into the design/assessment process.
- Design and Assessment are supported only for Virtual Beams generated via the **Steel Composite Bridge Wizard**.

Design > Composite Design > Perform > Perform Design

Code	AASHTO-LRFD 2020	
Element	165	
Position	I	
Element Type	Virtual Beam	

1. Design Condition (Positive Flexure)

1. Section Properties

1) Slab Properties

$B_s = 144.000$ in
 $t_s = 7.874$ in
 $t_b = 0.000$ in
 $f'_c = 4.000$ ksi
 $E_c = 3986.000$ ksi
 $A_c = 22.120$ in²
 $F_{cr} = 60.000$ ksi
 $S_x = 0.000$ in (Distance from reference line)

2) Girder Properties

[Section]

$b_{fc} = 17.717$ in $b_{tc} = 21.654$ in
 $t_{fc} = 1.181$ in $t_{tc} = 1.575$ in
 $D = 59.055$ in $t_w = 1.181$ in
 $H = 61.811$ in
 $Top = 63.142$ in $Bot = 61.173$ in (Distance from reference line)

Position	Material	Thick(in)	f_y (ksi)	f_u (ksi)	Note
Compression Flange	A53	1.181	35.000	60.000	less than 2 in.
Tension Flange	A53	1.575	35.000	60.000	less than 2 in.
Web	A53	1.181	35.000	60.000	less than 2 in.

[Design Strength]

$F_u = 35.000$ ksi (Compression Flange Yield Strength)

165_I Shear Connectors Longitudinal Stiffeners Bearing Stiffeners

Design Report – AASHTO LRFD

Rating > Steel/Composite Bridge > Perform > Perform Assessment

Design code	Element	Node(I/J)
CS 457 R1	21	I

■ Section Properties

1) Slab Properties

$B_s = 3600.000$
 $t_s = 200.000$
 $t_b = 0.000$
 $f'_c = 30.000$
 $E_c = 24596.000$
 $A_c = 0.000$
 $F_{cr} = 460.000$

2) Girder Properties

[Section]

$b_{fc} = 450.000$ $b_{tc} = 550.000$
 $t_{fc} = 30.000$ $t_{tc} = 40.000$
 $D = 1500.000$ $t_w = 30.000$
 $H = 1570.000$

3) Transverse Stiffener Properties

Position	Type	F_y (MPa)	H (mm)	B (mm)	t_w (mm)	t_f (mm)	d_s (mm)
Web	1Side	275.000	200.000	20.000	-	-	1500.000

■ Elastic Section Properties

1) Steel Section

A (mm ²)	80500.000	I_x (mm ⁴)	2.884E+10	I_y (mm ⁴)	7.858E+08
d_{na} (mm)	862.143	d_{ny} (mm)	707.857		
S_{na} (mm ³)	33454564.347	S_{ny} (mm ³)	40746376.556		
S_x (mm ³)	2857348.485	S_y (mm ³)	2857348.485		
w_x (mm)	-	w_y (mm)	-	i_w (mm)	-
w_y (mm)	-	w_x (mm)	-		

2) Short-term Composite Section

A_{sc} (mm ²)	193080.571	I_{sc} (mm ⁴)	7.267E+10	I_{scy} (mm ⁴)	1.234E+11
P_{sc} (mm)	301.141	d_{sc} (mm)	1268.859		
P_{sc} (mm)	241311989.780	I_{sc} (mm ⁴)	57271045.958		

D6_I D21_I D26_I

Assessment Report – CS 454

26. Virtual Section for Design

- The new **Virtual Section for Design** functionality enables engineers to quickly optimize cross-sectional dimensions during the design process.
 - After completing the design with an **initial section**, if the section fails to meet design requirements, users can:
 - Use **Virtual Section for Design** to **modify flange or web dimensions**.
 - Re-run the **design checks** with the updated dimensions **without re-analysis**.
 - By repeating the design step with revised dimensions, users can rapidly identify a section that satisfies the design criteria.
 - The **same** dialog also allows the user to **add longitudinal stiffeners** into the section.
 - Analysis not updated automatically:**
 - Changes made in Virtual Section for Design are **applied only to the design process**.
 - To update the structural analysis with the final modified dimensions, users must **manually reflect the changes in the analysis model**.
 - Faster optimization:** Quickly iterate on section dimensions without time-consuming re-analysis.

Design > Composite Design > Virtual Section for Design

The image illustrates the workflow for the Virtual Section for Design feature. It consists of three main dialog boxes:

- Sections for Design:** A list of available sections with columns for ID, Name, Type, and Shape. A 'Modify...' button is present for each entry.
- Section Data:** A configuration window for a specific section (Girder-D3_37). It includes fields for Section ID, Name, Section Type (Steel-I (Type2)), and various geometric parameters like Bc, H, B1, B2, B3, B4, t1, t2, tw1, tw2, etc. A 'Stiffener...' button is highlighted with a red box.
- Section Deck & Stiffener:** A window for defining deck and stiffener properties. It includes a 'Define Stiffener...' dialog, a table for 'Defined Stiffeners', and a table for 'Deck Pos.', 'Deck Part', 'Deck Name', and 'Name'.

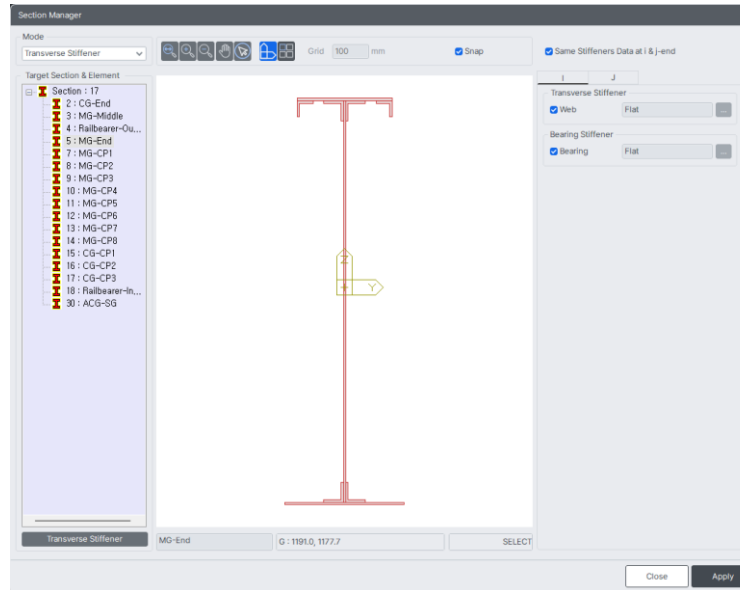
A blue arrow points from the 'Section Data' window to the 'Section Deck & Stiffener' window, indicating the transition between these steps.

Virtual Section for Design

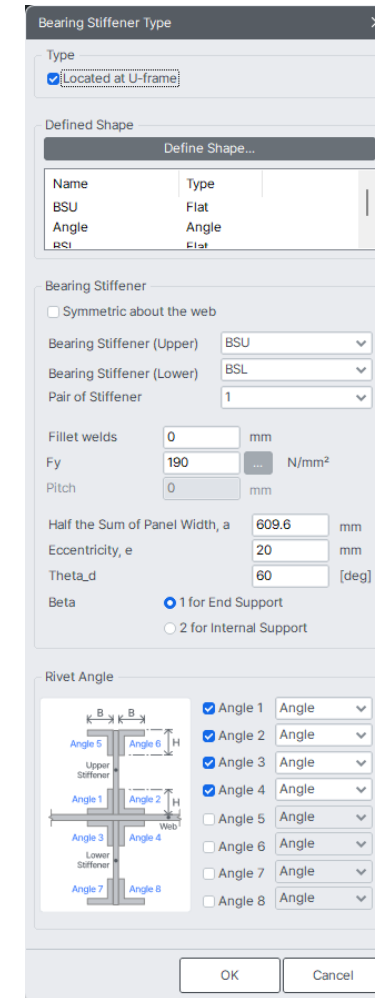
Longitudinal Stiffener

27. Bearing Stiffener Check (NR/GN/CIV/025) for Steel Railway Bridges

- Civil NX now supports Bearing Stiffener assessment in accordance with NR/GN/CIV/025 within the steel railway bridge Assessment workflow.
- You can **define the angle connecting the web and the stiffener**, and **account for corrosion** of both the **stiffener and the angle** in the checks.
- Actions & Load Effects Considered
 - Axial Forces on Bearing Stiffener
 - Reaction from the support bearing
 - Destabilising influence of the web
 - Bending Moment
 - **Tension-field action moment** acting on the bearing stiffener
 - Restraining Forces
 - F_{S1} : Force due to bow of the compression flange
 - F_{S2} : Force due to non-verticality of the web at supports
 - F_L : Additional force due to cross members in U-frames subjected to vertical loading
- Verification Performed
 - Yielding of web plate
 - Yielding of stiffener
 - Buckling of stiffener



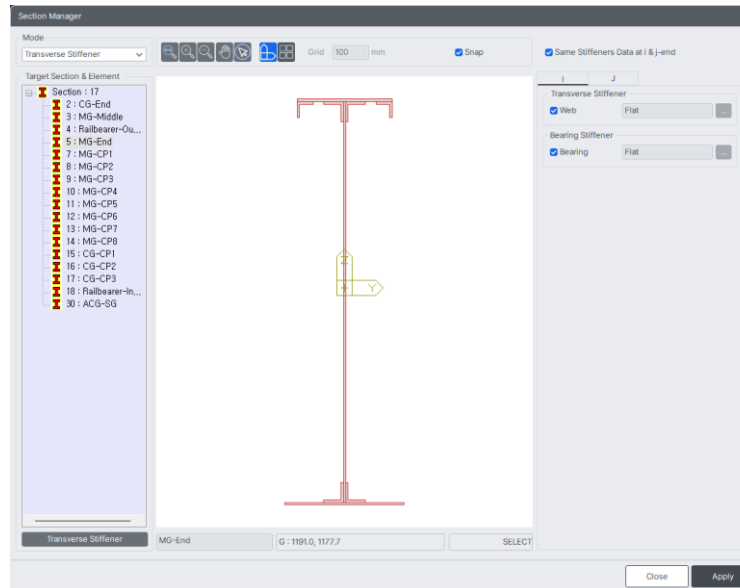
Transverse Stiffener Dialog



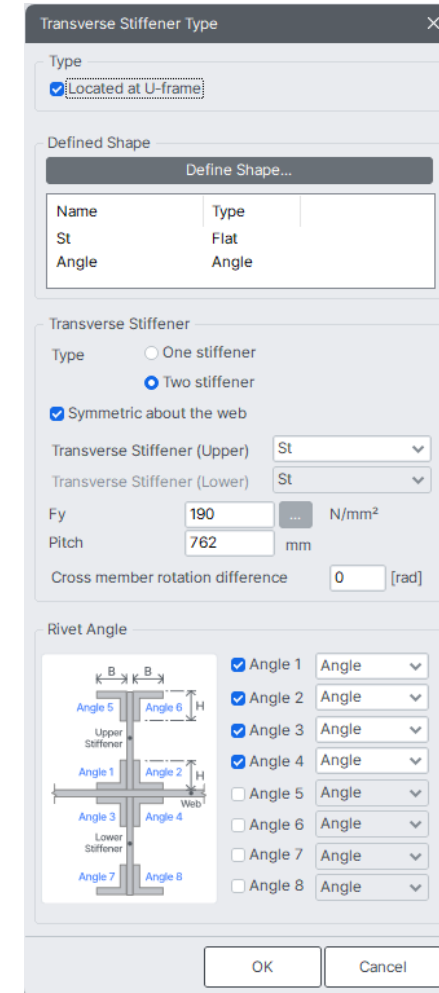
Bearing Stiffener

28. Intermediate Stiffener Check (NR/GN/CIV/025) for Steel Railway Bridges

- Civil NX now supports Intermediate Stiffener assessment in accordance with NR/GN/CIV/025 within the steel railway bridge Assessment workflow.
- You can **define the angle connecting the web and the stiffener**, and **account for corrosion** of both the **stiffener and the angle** in the checks.
- Actions & Load Effects Considered
 - Axial Forces on Bearing Stiffener
 - Tension-field action
 - Destabilising influence of the web
 - Restraining Forces on U-frame stiffeners
 - F_R : Elements providing discrete intermediate restraints
 - F_C : U-frames with cross members subjected to vertical loading
- Verification Performed
 - Yielding of web plate
 - Yielding of stiffener
 - Buckling of stiffener



Transverse Stiffener Dialog



Intermediate Stiffener

Thank You!