Release Note

Release Date : Dec. 2024

Product Ver. : CIVIL 2025 (v1.1)

DESIGN OF CIVIL STRUCTURES

Integrated Solution System for Bridge and Civil Engineering

Enhancements

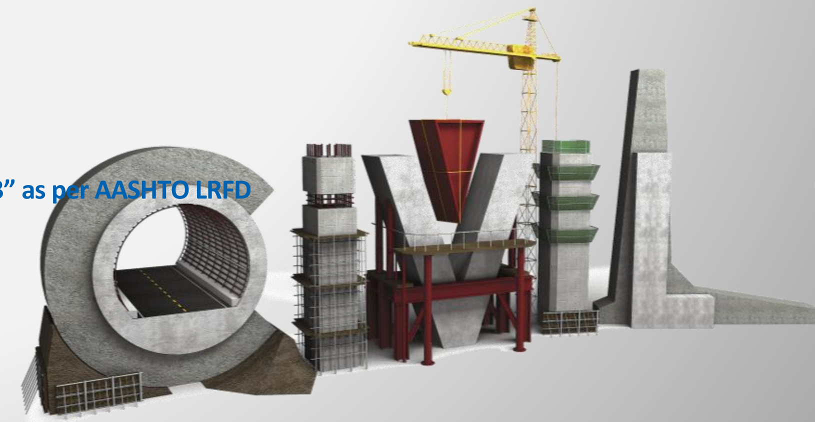
Enhancements in CIVIL 2025 (v1.1)

- Pre & Post processing

1. CQC 3 Directional Combination for Response Spectrum
2. Considering Elastic/General Link Forces in Moving Load Tracer
3. B-double rating vehicle as per AS 5100.7
4. Considering two trucks for substructure members or Elastic/General Link as per AASHTO LRFD Vehicle Loads
5. Moving patch load analysis as per AASHTO LRFD traffic loads
6. IRC Fatigue Vehicle
7. Time Dependent Materials as per SP/M/022 v 3.4, AS5100.5:2017(Amd 2:2024) and AS3600:2018(Amd 2)
8. Addition of Response Spectrum Function as per DPT.1301/1302-61:2018 and Eurocode Malaysia NA
9. Addition of H and Channel shape section database as per EN 10365
10. Addition of new Design Spectrum Database in Artificial Earthquake Data Generator
11. Addition of Element Stiffness Scale Factor

- Design

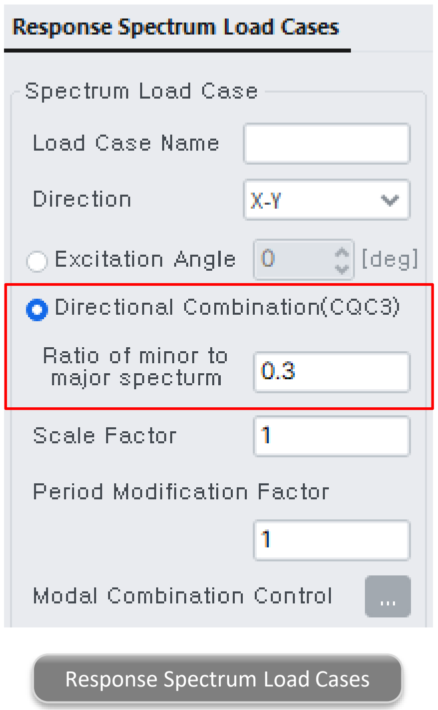
12. RC Design for 1D Beam & Column, Plate Beam & Column as per BS 5400
13. RC & Steel Design as per CSA S6:19
14. Response Modification Factor by members and components as per AASHTO LRFD
15. Addition of an option “Long-term Section Property of Cracked Composite Section: Rebar Area/3” as per AASHTO LRFD



1. CQC 3 Directional Combination for Response Spectrum

- The CQC3 rule has been developed to estimate the peak value of the combined response due to simultaneous application of the principal components of ground motion.
- The user defines the ratio (ɣ) of minor to major spectrum, and the program finds the critical angle and provides the maximum response for each component.

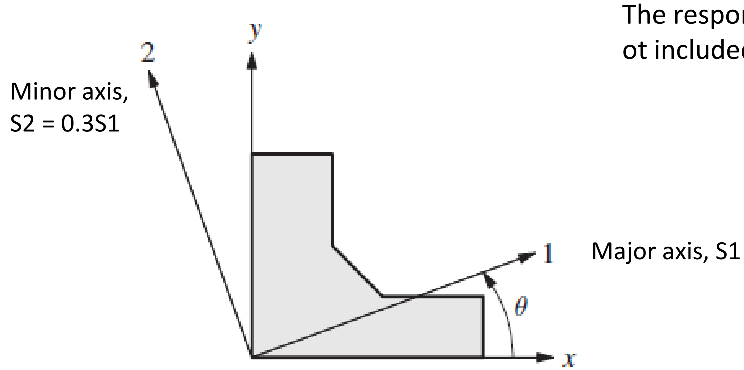
- ***Load > Dynamic Loads > RS Load Cases***



$$\theta_{cr} = \frac{1}{2}\tan^{-1}\left(\frac{2r_{xy}}{r_x^2 - r_y^2}\right)$$

$$r_{cr} \equiv r_{max} \simeq \left[(1+\gamma^2)\left(\frac{r_x^2 + r_y^2}{2}\right) + (1-\gamma^2)\sqrt{\left(\frac{r_x^2 - r_y^2}{2}\right)^2 + r_{xy}^2} + r_z^2\right]^{1/2}$$

The responses due to vertical ground motion, r_z are n ot included in the CQC3 results.

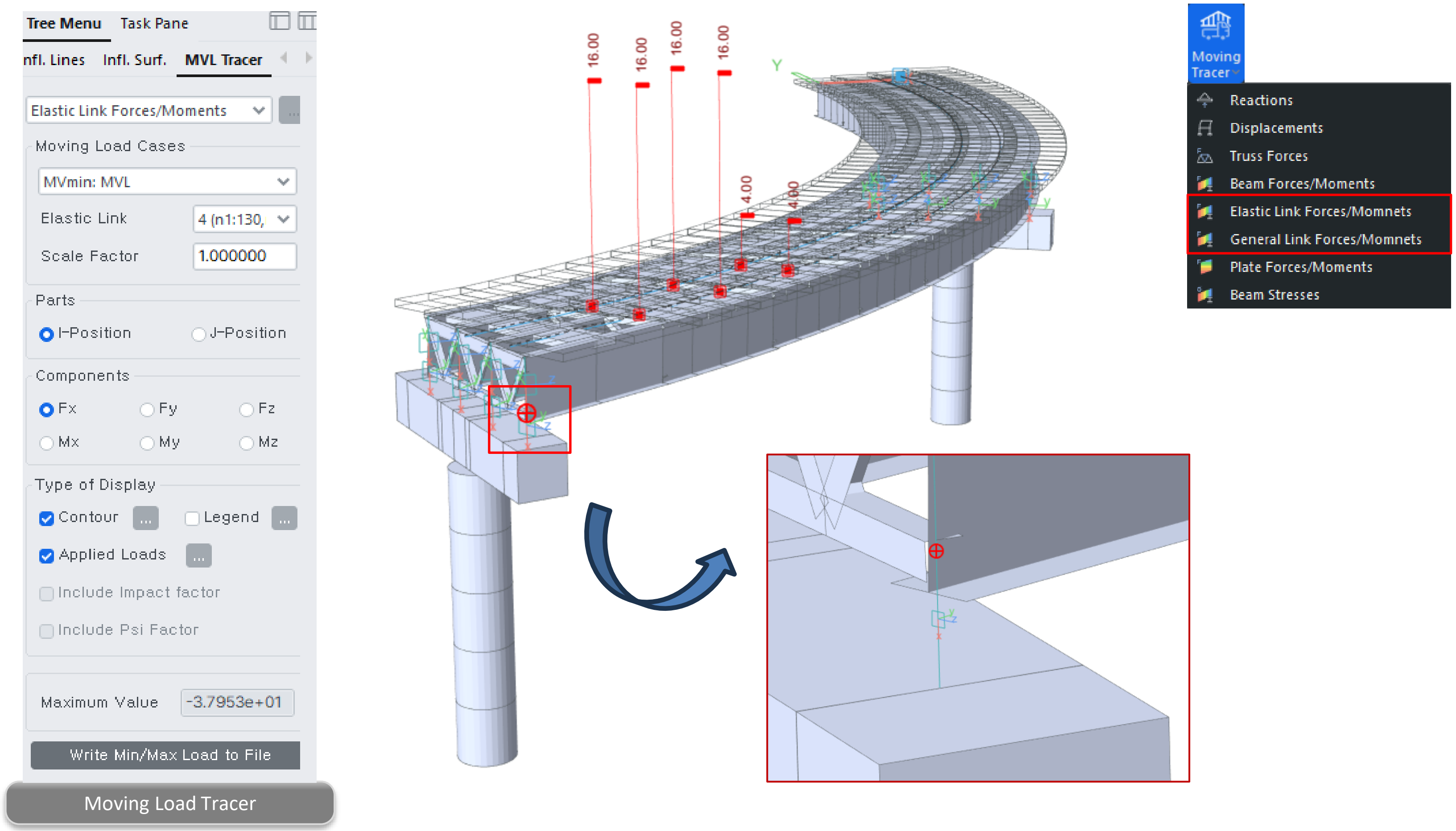


1 and 2: principal axes of ground motion

2. Considering Elastic/General Link Forces in Moving Load Tracer

- Bridge bearings are often simulated with Elastic Links or General Links to represent the stiffness of the bearings.
- Now, Moving Load Tracer supports Elastic Links and General Links to find the critical position of the vehicle loads and to convert it into equivalent static loads.

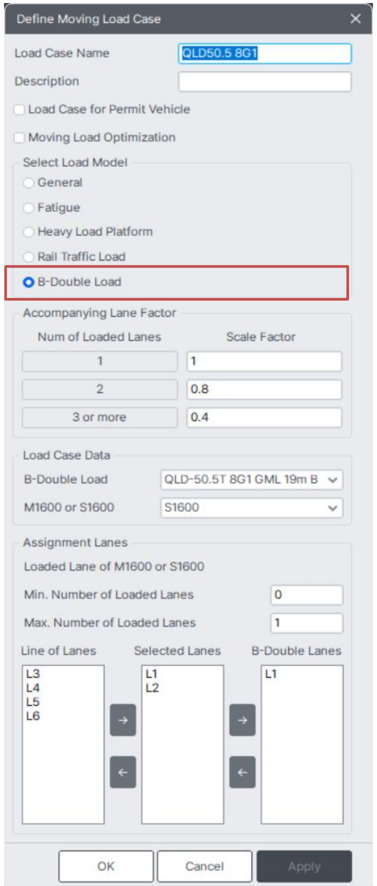
- ***Results > Analysis Result > Moving Tracer > Elastic Link Forces/Moments***
- ***Results > Analysis Result > Moving Tracer > General Link Forces/Moments***



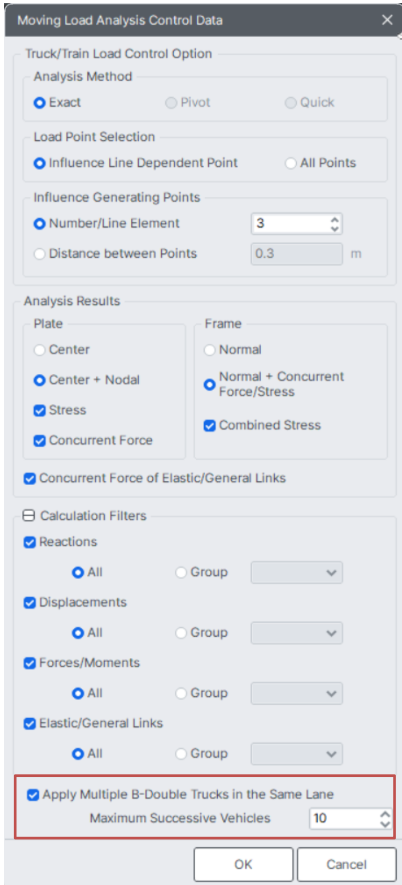
3. B-double rating vehicle as per AS 5100.7

- A B-double is defined in the Heavy Vehicle National Law (HVNL) as a combination consisting of a prime mover towing two semitrailers.
- New B-double assessment vehicle DB for Queensland(QLD) and Victoria(VIC) is now available. More than 2 B-double vehicles can be loaded by checking on the option in Moving Load Analysis control.

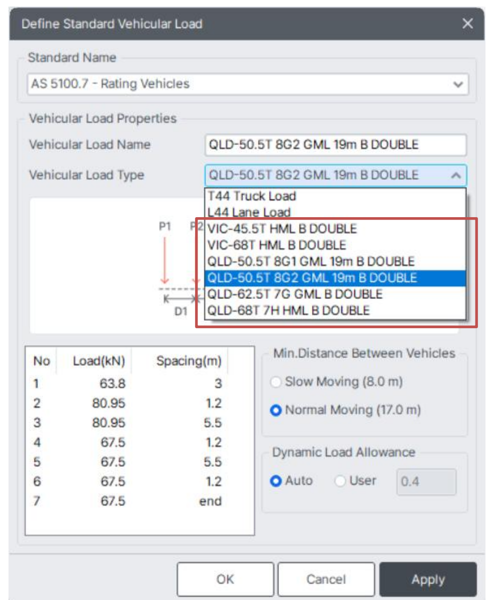
▪ ***Load > Moving Load > Moving Load Code : Australia***



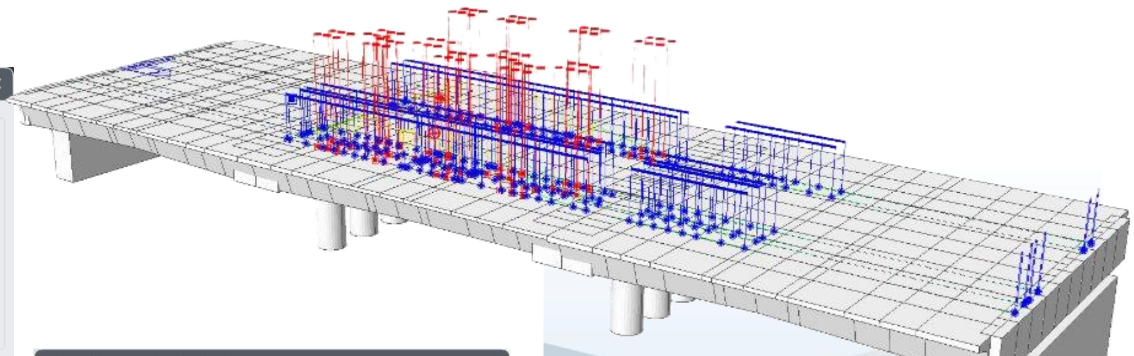
Moving Load Cases

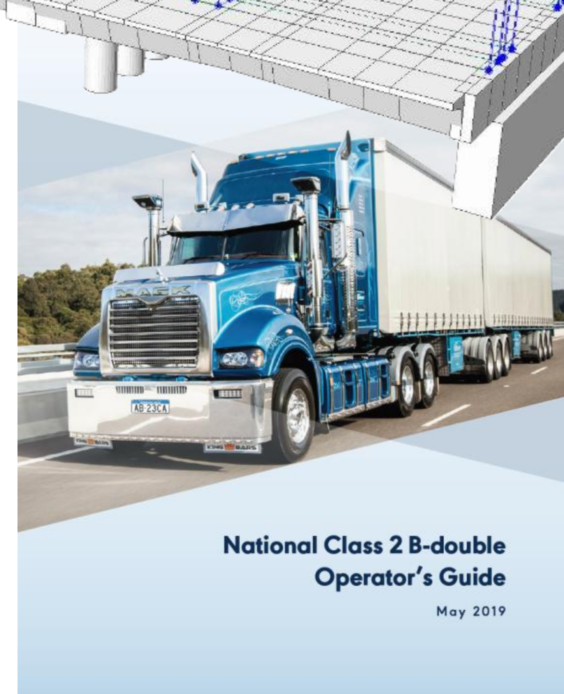


Moving Load Analysis Control



MB-double Vehicles

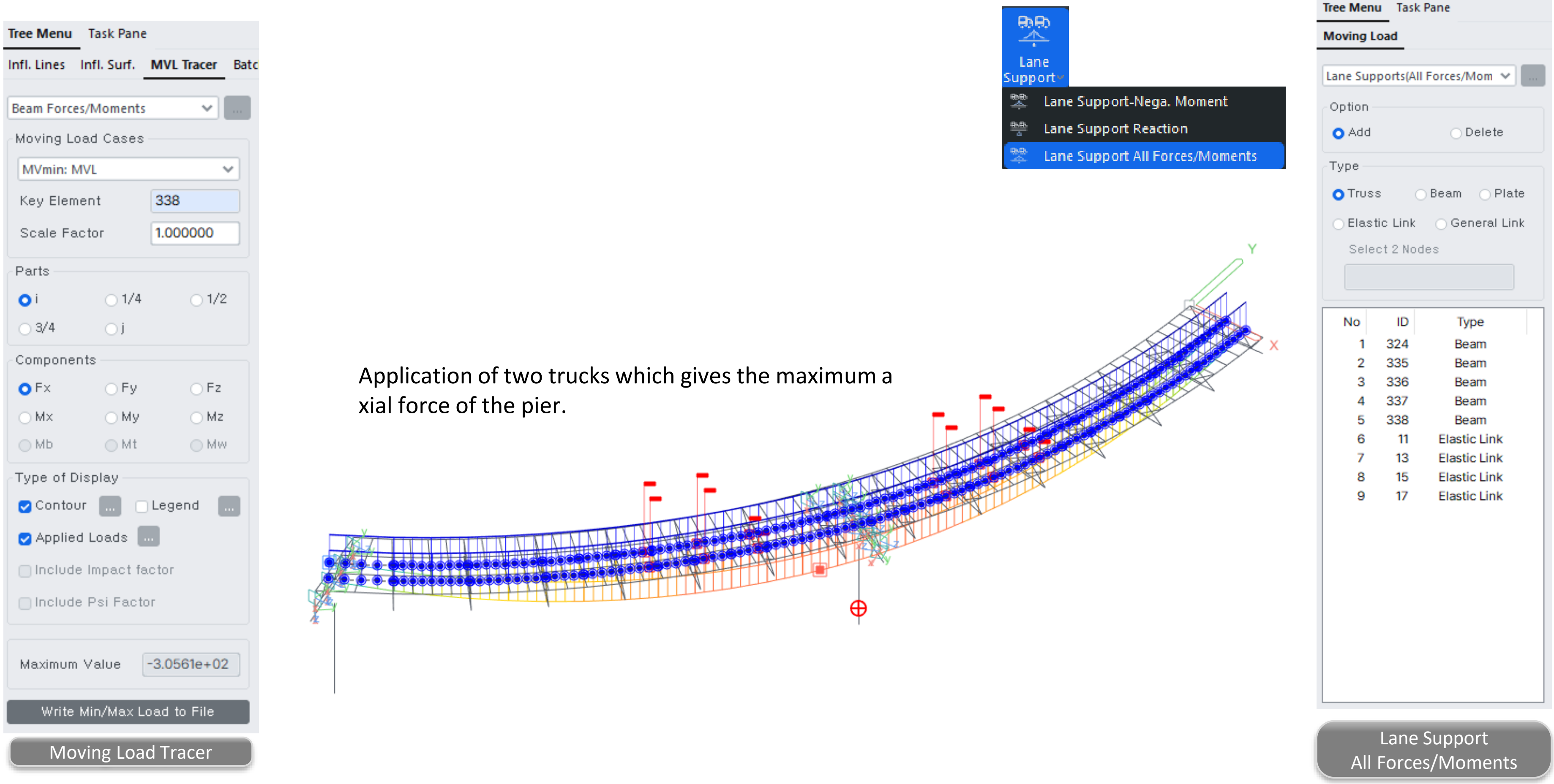




4. Considering two trucks for substructure members or Elastic/General Links as per ASHTO LRFD vehicle loads

- Although AASHTO LRFD says, "For negative moment between points of contraflexure under a uniform load on all spans, 90 percent of the effect of two design trucks combined with 90 percent of the effect of the design lane load, force components other than negative moment need to be determined based on the two-truck rule in some projects.
- Now, it is possible to select elements or links to apply the two-truck rule to obtain maximum results for all force components in moving load analysis.

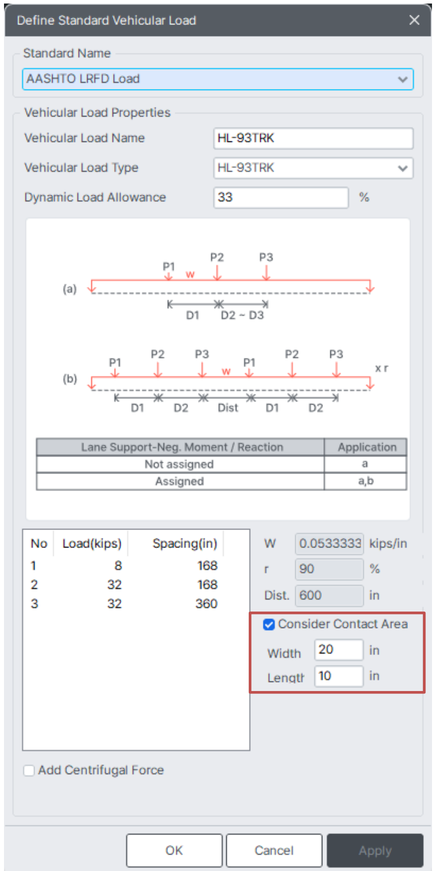
▪ ***Load > Moving Load > Lane Support > Lane Support All Forces/Moments***



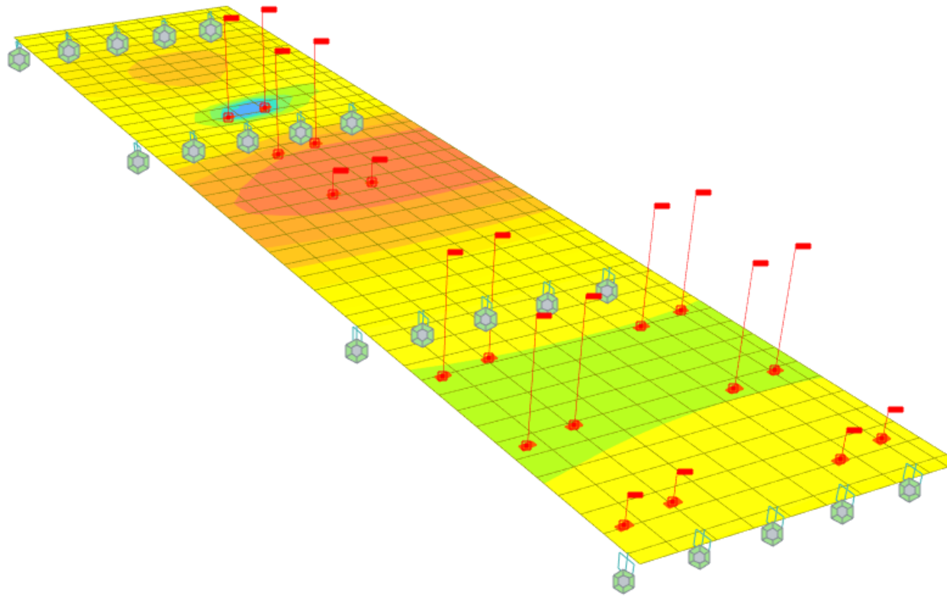
5. Moving patch load analysis as per AASHTO LRFD traffic loads

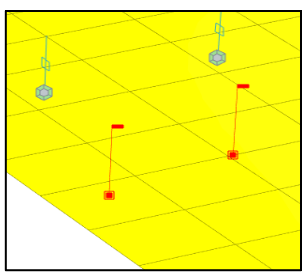
- The tire contact area of a wheel can be applied during moving load analysis. In this version, HL-93TRK, HL-93TDM, and HS20-FTG vehicles of AASHTO LRFD are only supported.
- The design forces of plate elements can be noticeably reduced with the patch/area loads compared to concentrated wheel loads.

▪ ***Load > Moving Load (AASHTO LRFD) > Vehicles***

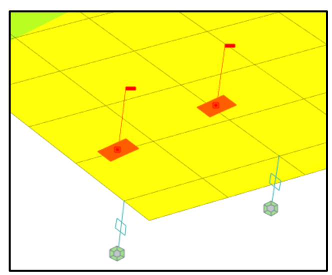


Standard Vehicle

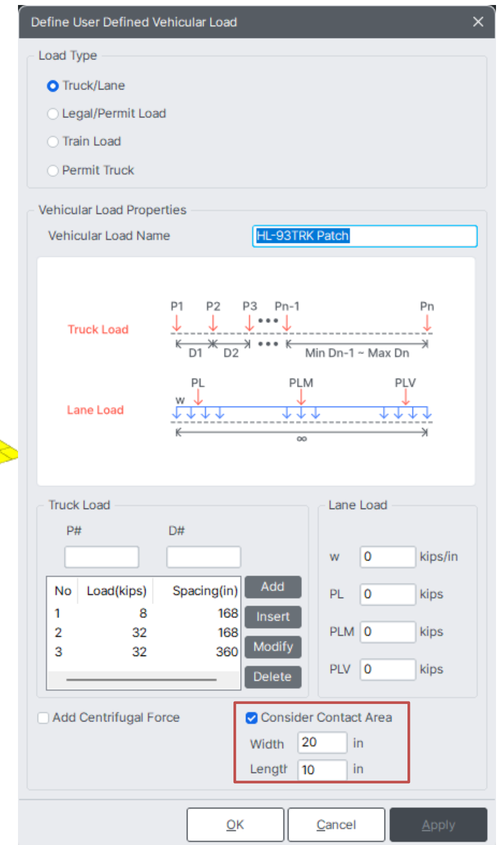




Concentrated wheel loads



Patch/area wheel loads

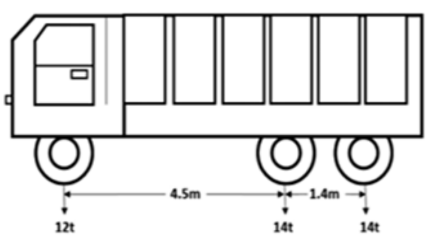
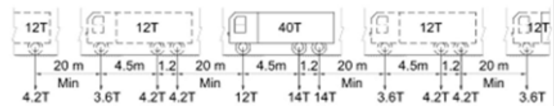
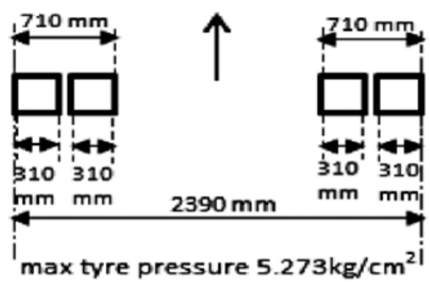


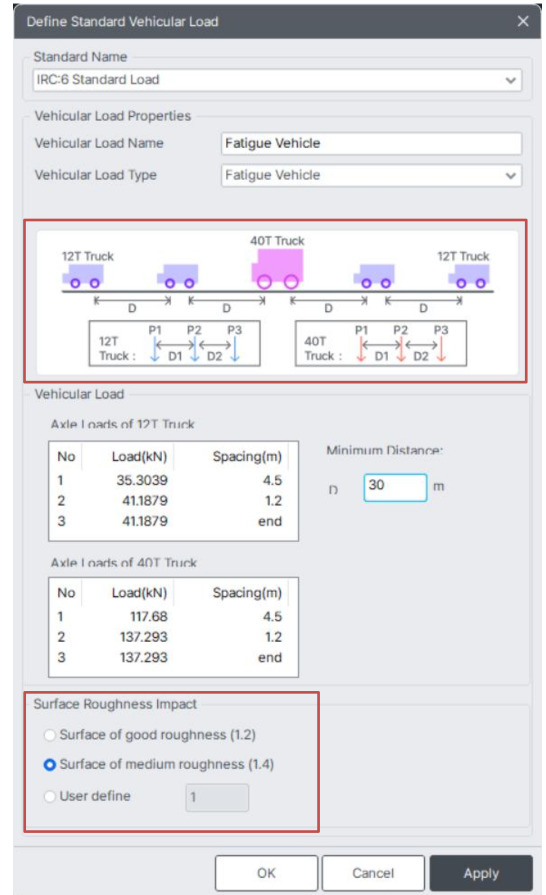
User-Defined Vehicle

6. Fatigue Vehicle to IRC 6 : Standard Load

- Fatigue Vehicle has been added to existing vehicle library of IRC 6 : Standard Load as per latest amendment to IRC : 6 Fatigue Load Clause 204.6.
- For assessment, impact factor has been replaced with surface roughness impact depending upon type of surface.

▪ ***Load > Load Type > Moving Load > Moving Load Code > India***

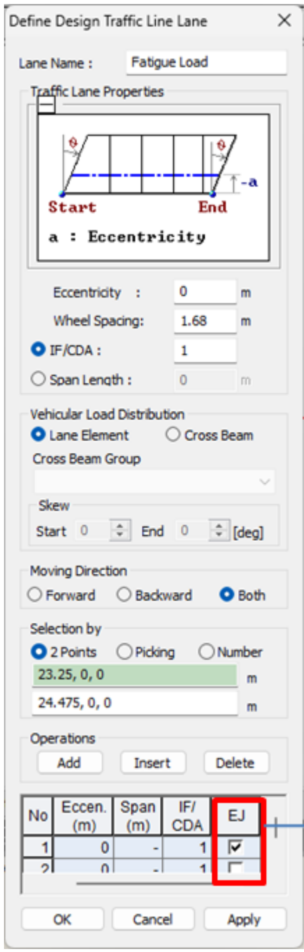
S. No.	Clause No.	AS EXISTS IN THE CODE	PROPOSED NEW CLUASE / MODIFICATION	REMARKS
		longitudinal direction of the bridge, shall be used for fatigue assessment with the fatigue load so positioned as to have worst effect on the detail or element of the bridge under consideration. The minimum clearance between outer edge of the wheel of the fatigue vehicle and roadway face of the kerb shall be 150 mm.  **Fig. 7A: Fatigue Truck**	increased by a dynamic amplification factor, I_{ej} as given below: $I_{ej} = 1.3(1\text{-}x/26) > 1.0$ where x = distance of section/detail from nearest expansion joint.  Fig. 7A : Fatigue Load Train NOTE: 1. Fatigue truck of 40 T must be included in Fatigue Load Train 2. Only such number of additional 12 T trucks shall be included in train as can be accommodated in influence line of detail under consideration  **Fig. 7B: T Arrangement Transverse Wheel Spacing and Tyre** **Fig. 7: Fatigue Load (40T)** The stress range resulting from the single passage of	second/more vehicles in lane included in line with Euro codes.

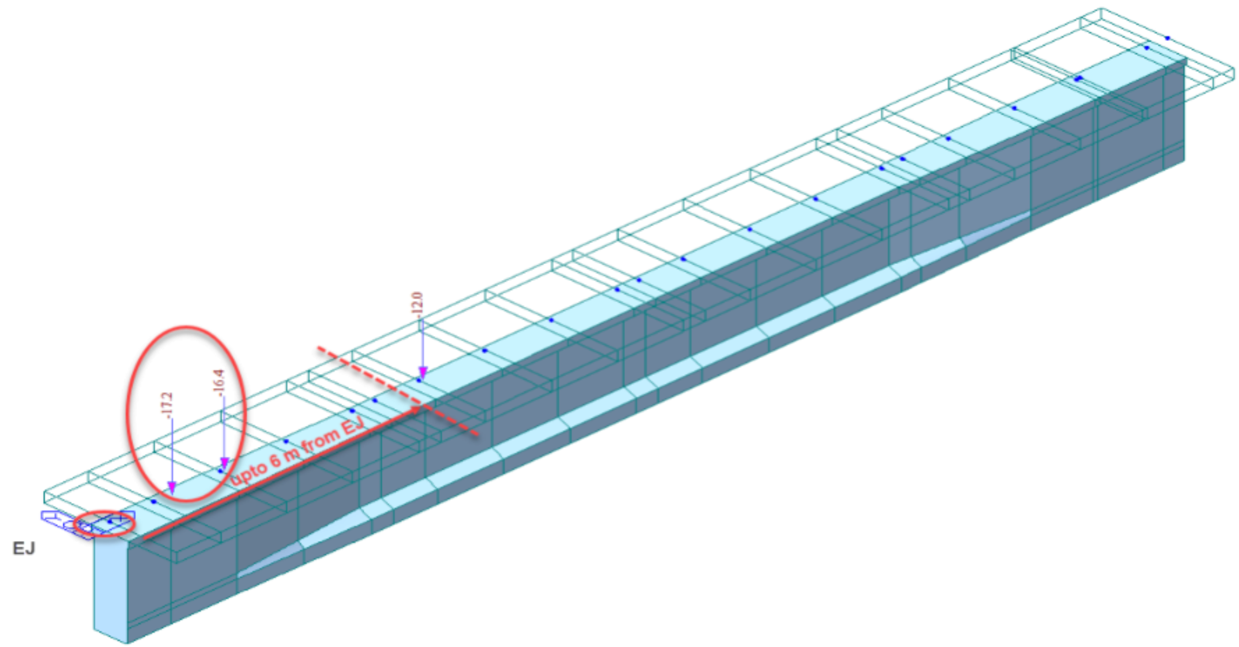


6. Fatigue Vehicle to IRC 6 : Standard Load

- The Traffic Lane Definitions now include an "EJ" checkbox for specifying expansion joint locations.
- For sections/ details within 6.0 m of the expansion joint, the fatigue load arrived as above shall further be increased by a dynamic amplification factor, I_{ej}.

▪ ***Load > Load Type > Moving Load > Moving Load Code > India***





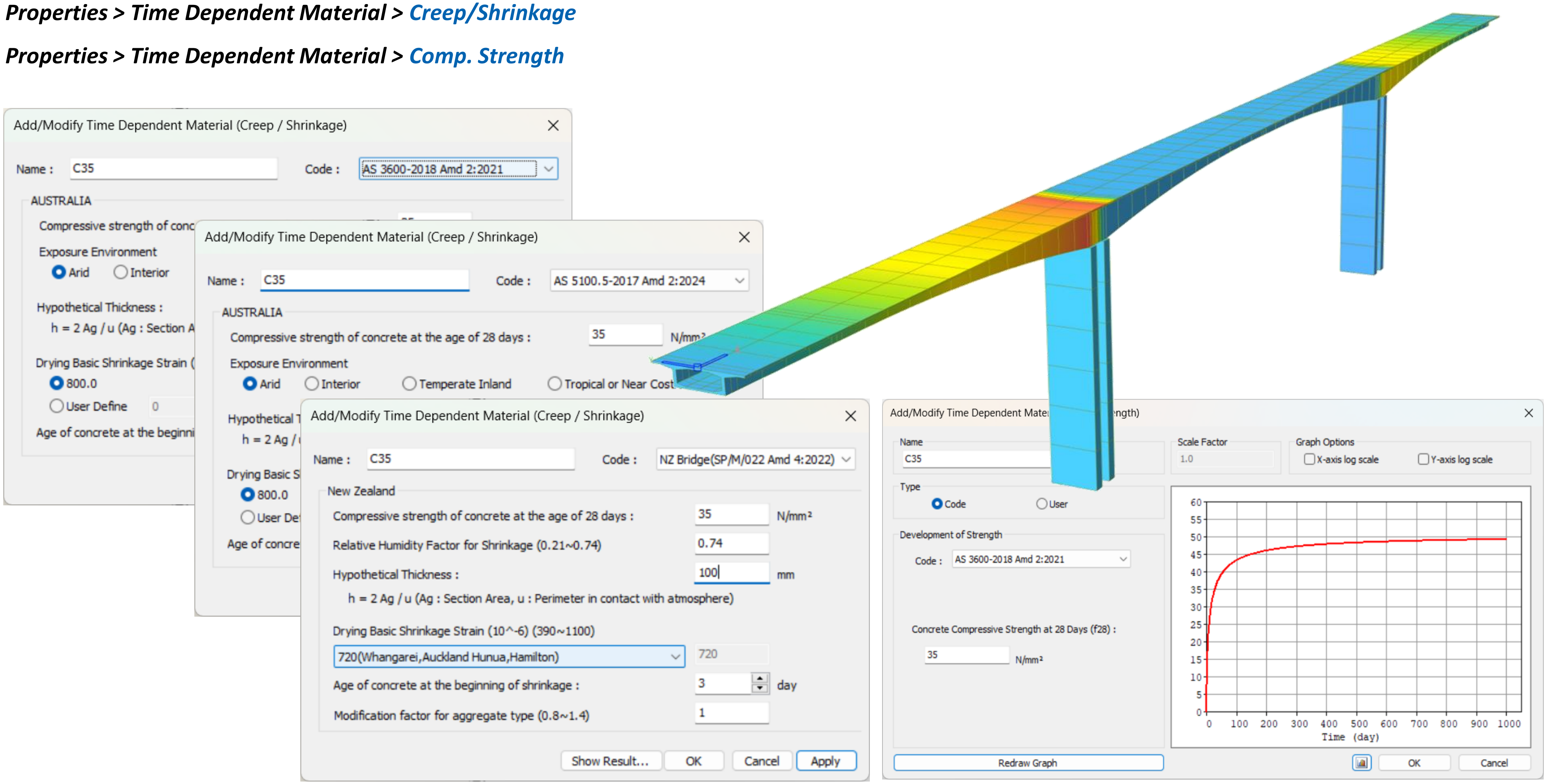
$$I_{ej} = 1.3\left(1-\left(\frac{x}{26}\right)\right) \geq 1$$

x= distance of section/detail from nearest expansion joint

7. Time Dependent Materials as per the latest Australian and New Zealand Standards

- Time Dependent Materials (Creep, Shrinkage and Compressive Strength) as per the following Australian and New Zealand Standards are updated: SP/M/022 v 3.4, AS5100.5:2017(Amd 2:2024) and AS3600:2018(Amd 2).

- ***Properties > Time Dependent Material > Creep/Shrinkage***
- ***Properties > Time Dependent Material > Comp. Strength***



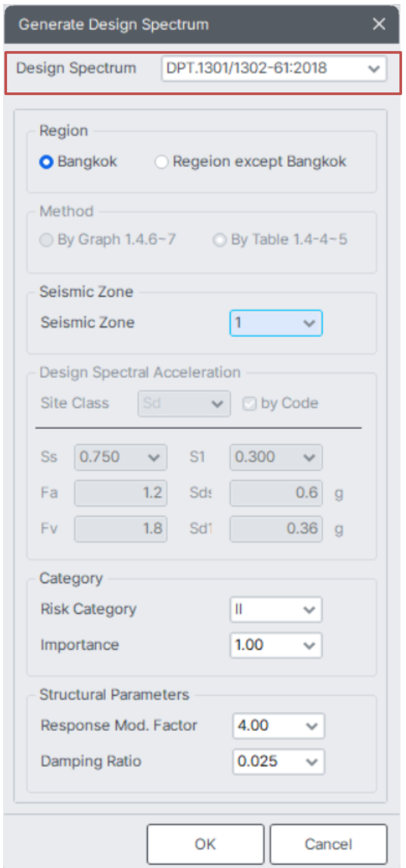
Creep & Shrinkage

Compressive Strength

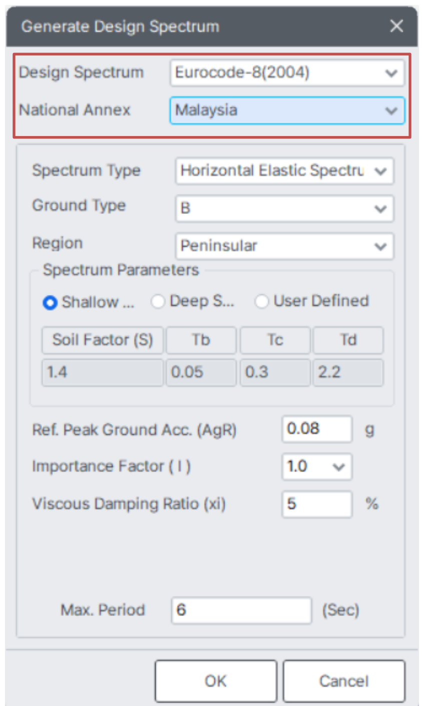
8. Addition of Response Spectrum Function as per DPT.1301/1302-61:2018 and Eurocode Malaysia NA

- Design Spectrums for Thailand specifications(DPT.1301/1302-61:2018) and Eurocode Malaysian National Annex are added.

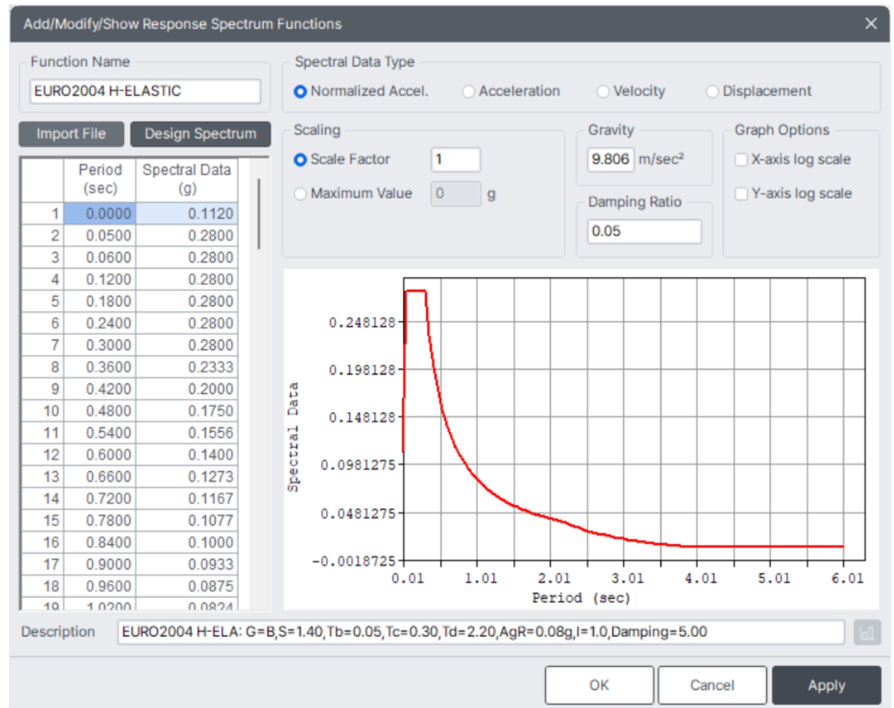
▪ ***Load > Dynamic Loads > RS Functions***



DPT1301/1302-61 Design Spectrum



MY EN 1998 Design Spectrum

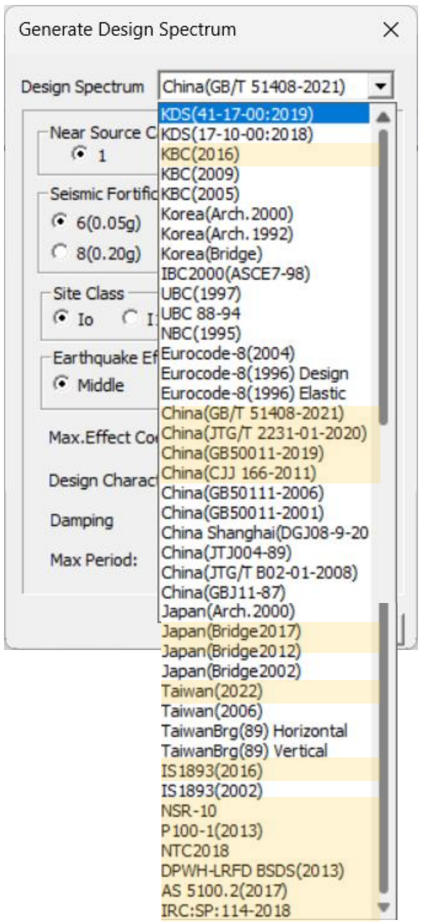


Response Spectrum Function

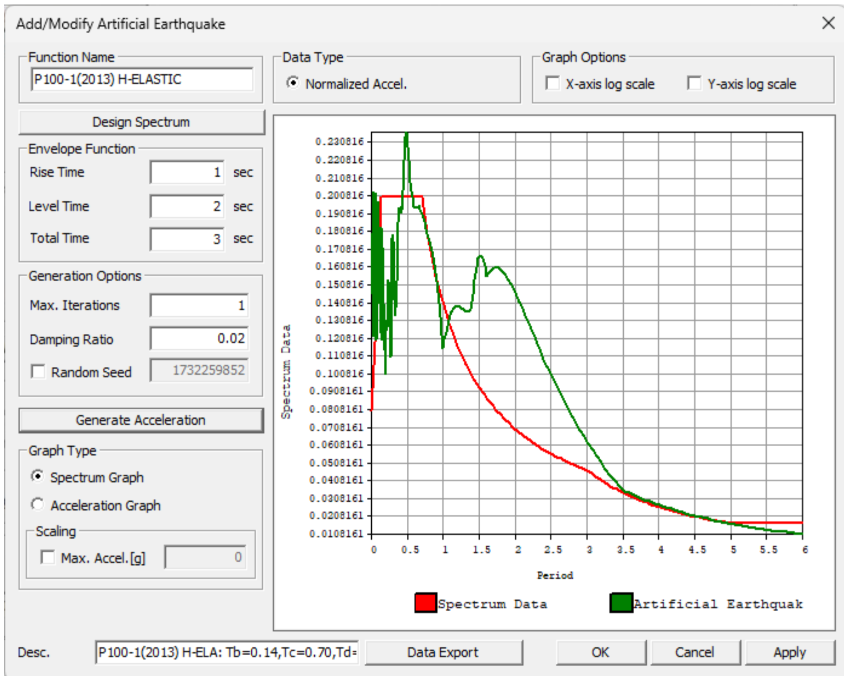
9. Addition of new Design Spectrum Database in Artificial Earthquake Data Generator

- AGS (Artificial Data Generation System for windows) extracts artificial earthquake and design response spectrum using the design spectrum of each standard. Following design spectra are now added: Taiwan (2022), IS1938(2016), NSR-10, P100-1(2013), NTC 2018, DBWH-LRFD BSDS(2013), AS 5100.2(2017), IRC:SP:114-2018, KBC(2016), China (GB/T 51408-2021), China(JTG/T 2231-01-2020), China (GB50011-2019), China (CJJ 166-2011), Japan(Bridge2017), Japan(Bridge 2012)

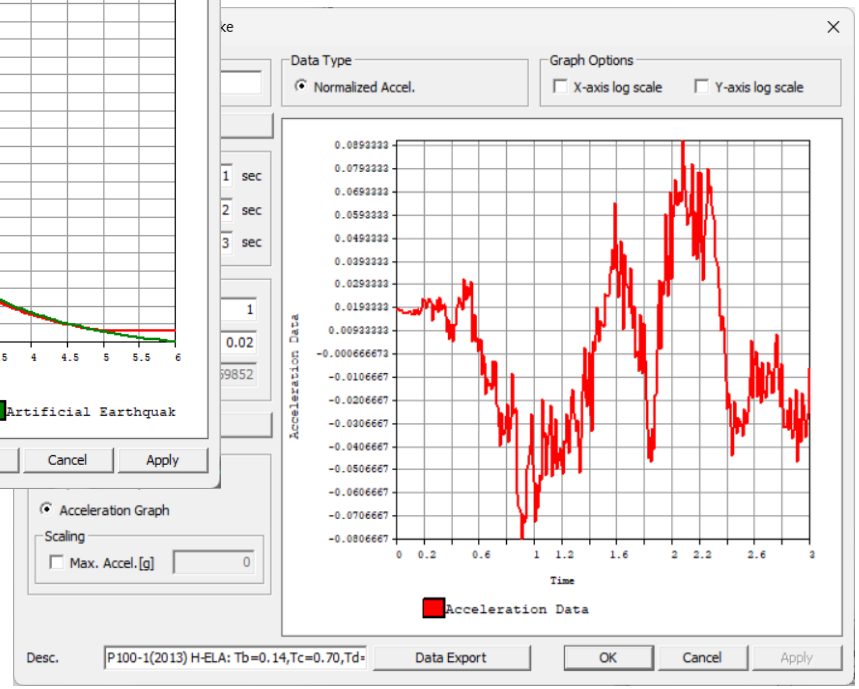
- ***Tools > Data Generator > Artificial Earthquake***



Design Spectrum DB



Artificial Earthquake (RS Spectrum Conversion)

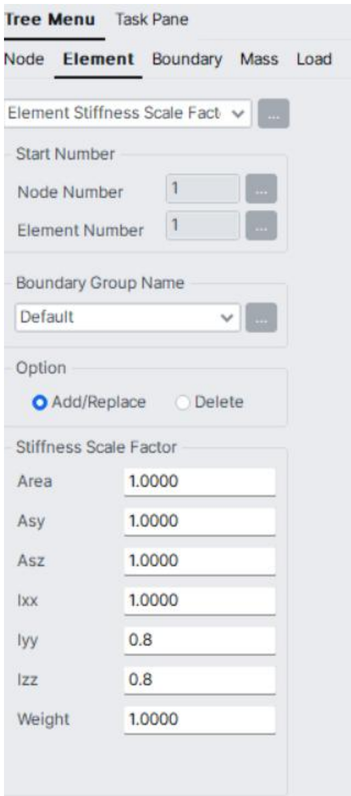


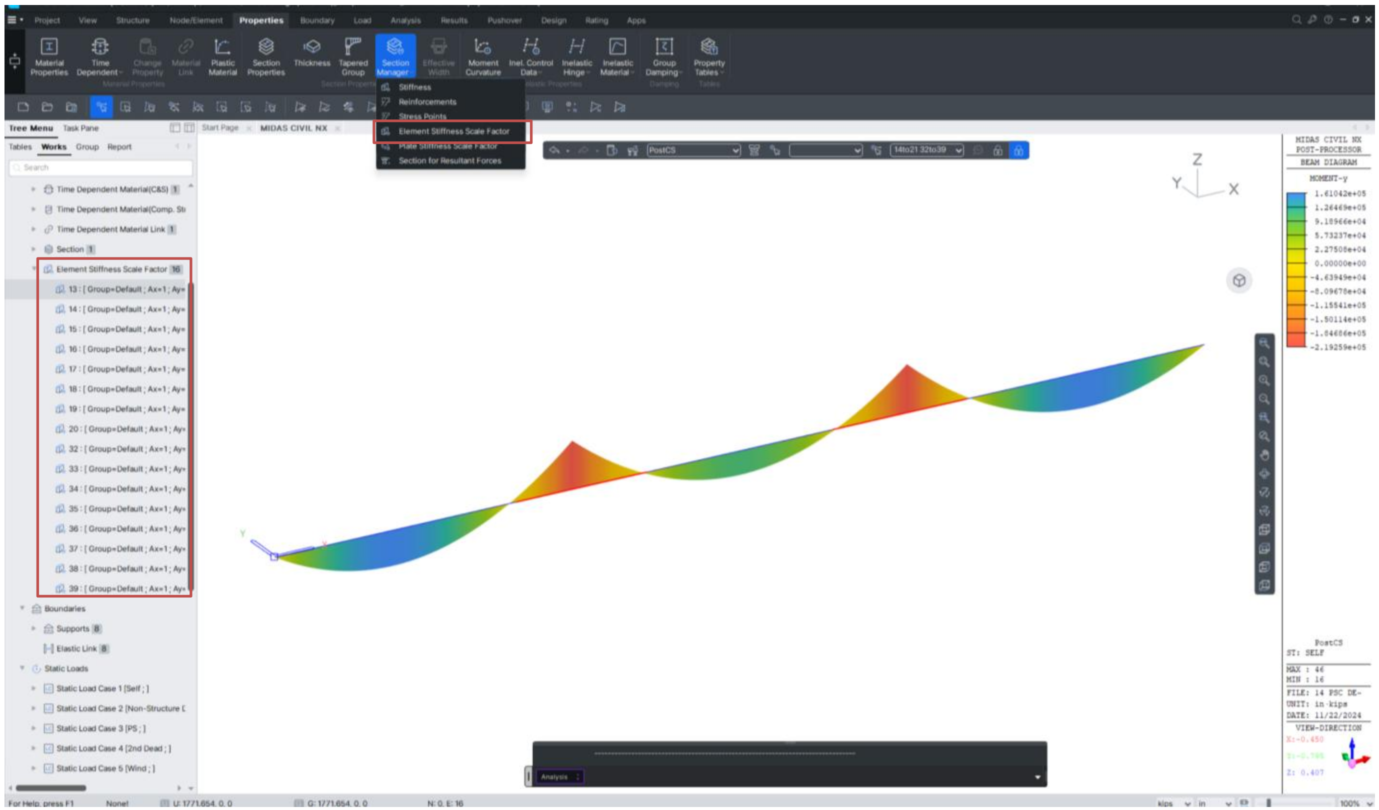
Artificial Earthquake (Time History Acceleration Conversion)

10. Addition of Element Stiffness Scale Factor

- Apply scale factors to the cross-sectional linear elements (Truss, Tension-only, Compression-only, Cable, Gap, Hook & Beam Elements). Specific stiffness may be reduced such as the case where the flexural stiffness of girders in the negative moment region may require reduction to reflect cracked sections of concrete.

- ***Properties > Section Manager > Element Stiffness Scale Factor***



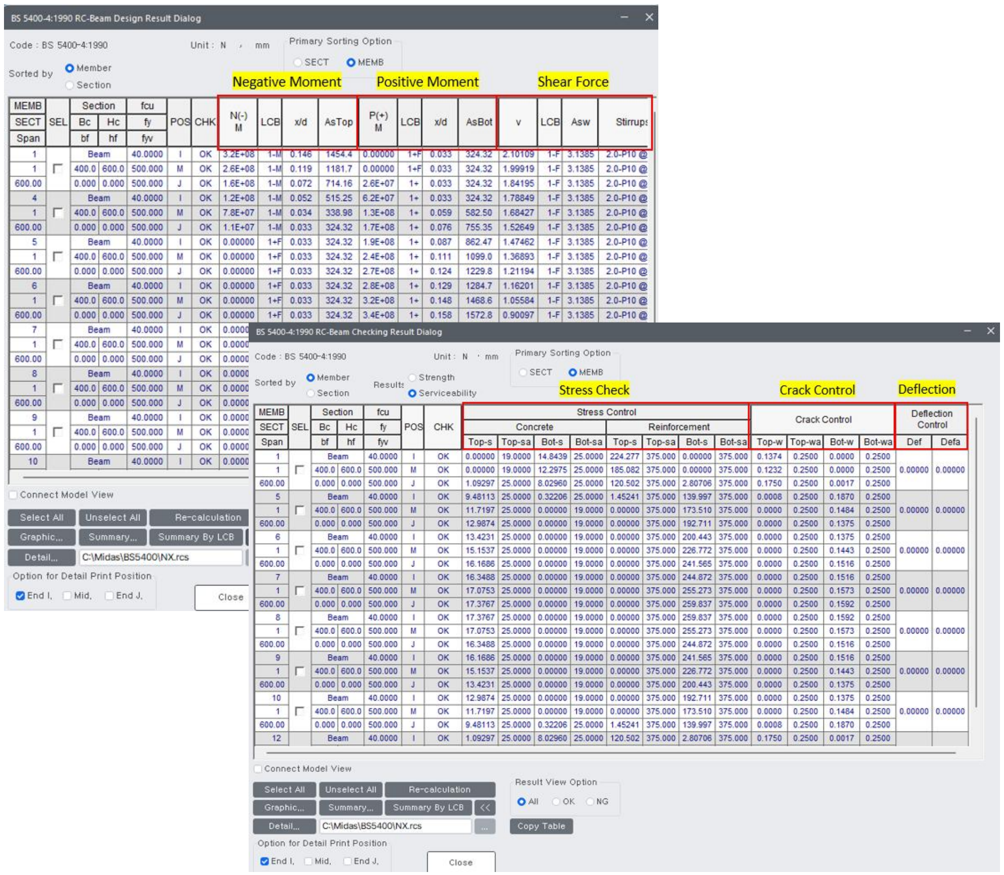


Element Stiffness Scale Factor

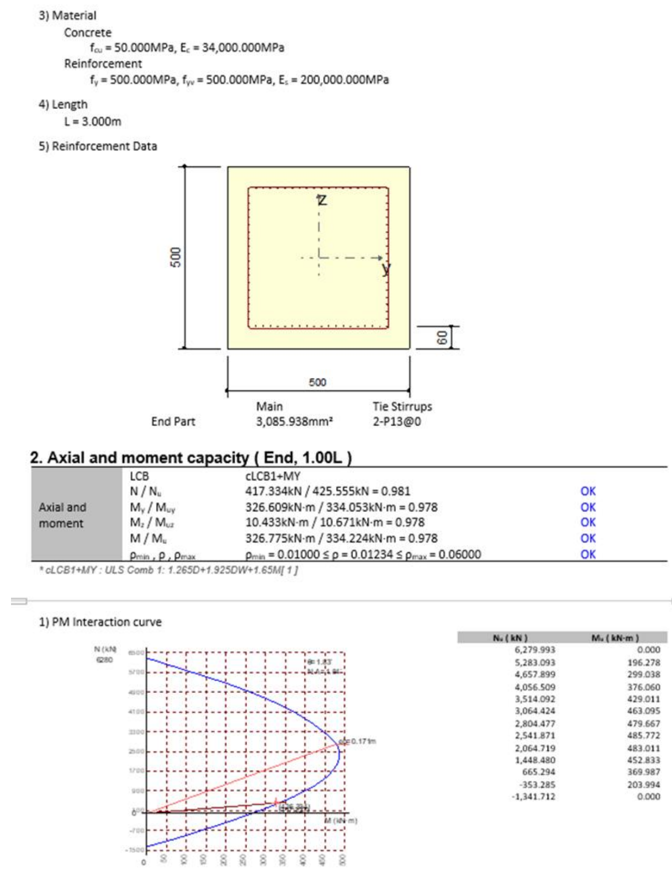
11. RC Design for 1D Beam & Column, Plate Beam & Column as per BS 5400

- Design and checking of RC frame elements to BS 5400 are newly introduced in midas.
- This feature can be applied to piers or RC beams.

▪ ***Design > RC Design > RC Code Design > Beam/Column Design***



Design Result Table

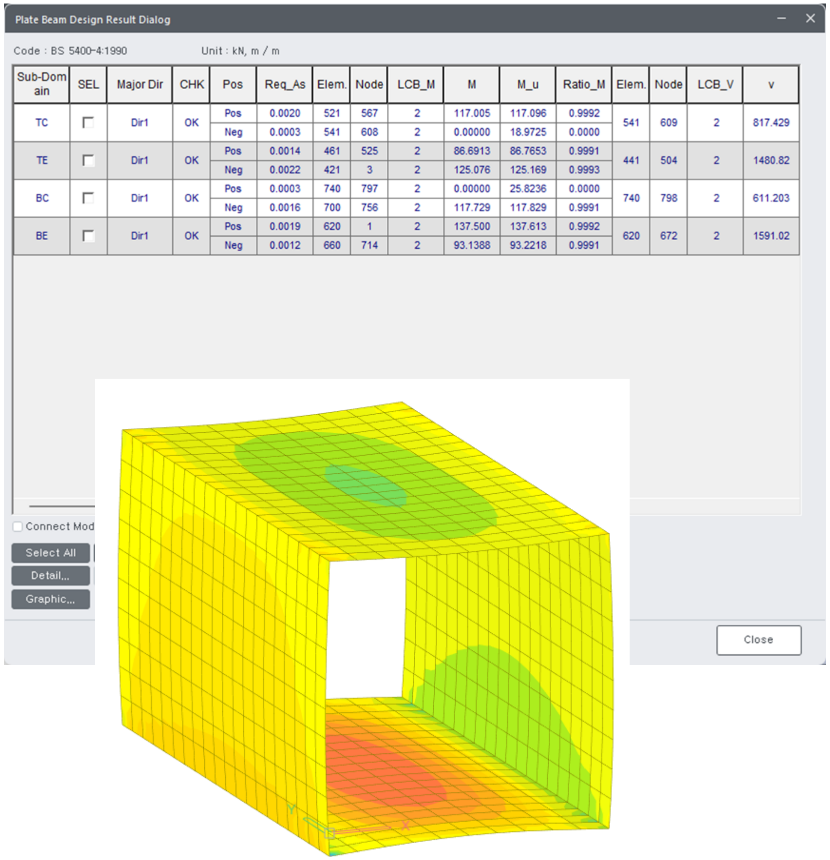


Detailed Calculation Report

12. RC Design for 1D Beam & Column, Plate Beam & Column as per BS 5400

- Design and checking of RC plate elements to BS 5400 are newly introduced in midas.
- This feature can be applied to culvert, pier walls or slabs where the stresses are distributed in one way.

- ***Design > RC Design > RC Code Design > Plate Beam/Column Design***



Sub-Domain	SEL	Major Dir	CHK	Pos	Req_As	Elem.	Node	LCB_M	M	M_u	Ratio_M	Elem.	Node	LCB_V	v
TC	☐	Dir1	OK	Pos	0.0020	521	567	2	117.005	117.096	0.9992	541	609	2	817.429
				Neg	0.0003	541	608	2	0.00000	18.9725	0.0000				
TE	☐	Dir1	OK	Pos	0.0014	461	525	2	86.6913	86.7653	0.9991	441	504	2	1480.82
				Neg	0.0022	421	3	2	125.076	125.169	0.9993				
BC	☐	Dir1	OK	Pos	0.0003	740	797	2	0.00000	25.8236	0.0000	740	798	2	611.203
				Neg	0.0016	700	756	2	117.729	117.829	0.9991				
BE	☐	Dir1	OK	Pos	0.0019	620	1	2	137.500	137.613	0.9992	620	672	2	1591.02
				Neg	0.0012	660	714	2	93.1388	93.2218	0.9991				

Plate Beam/Column Design Result Table

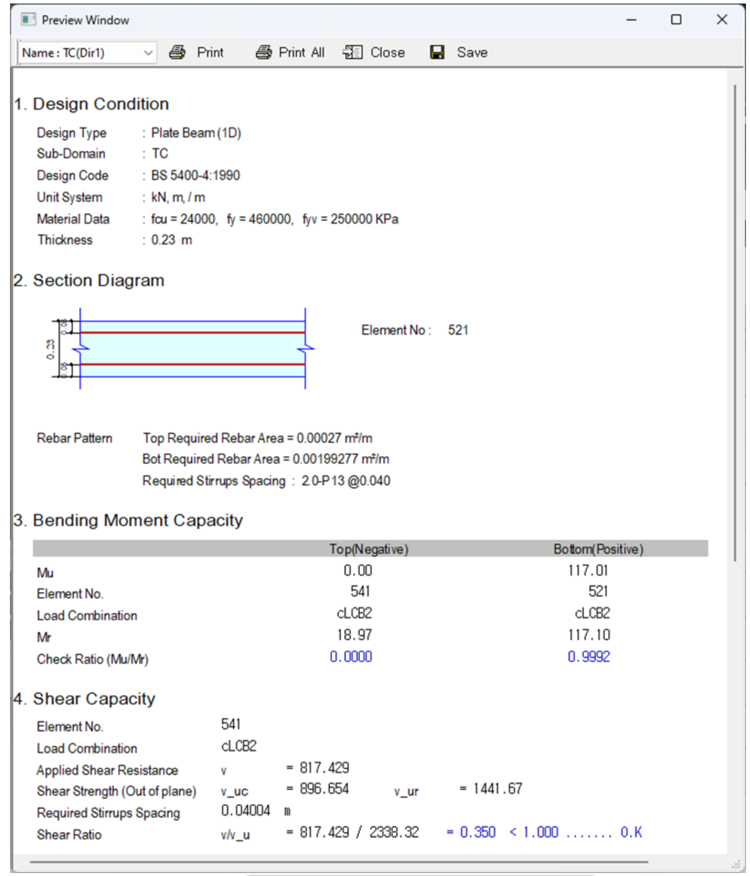
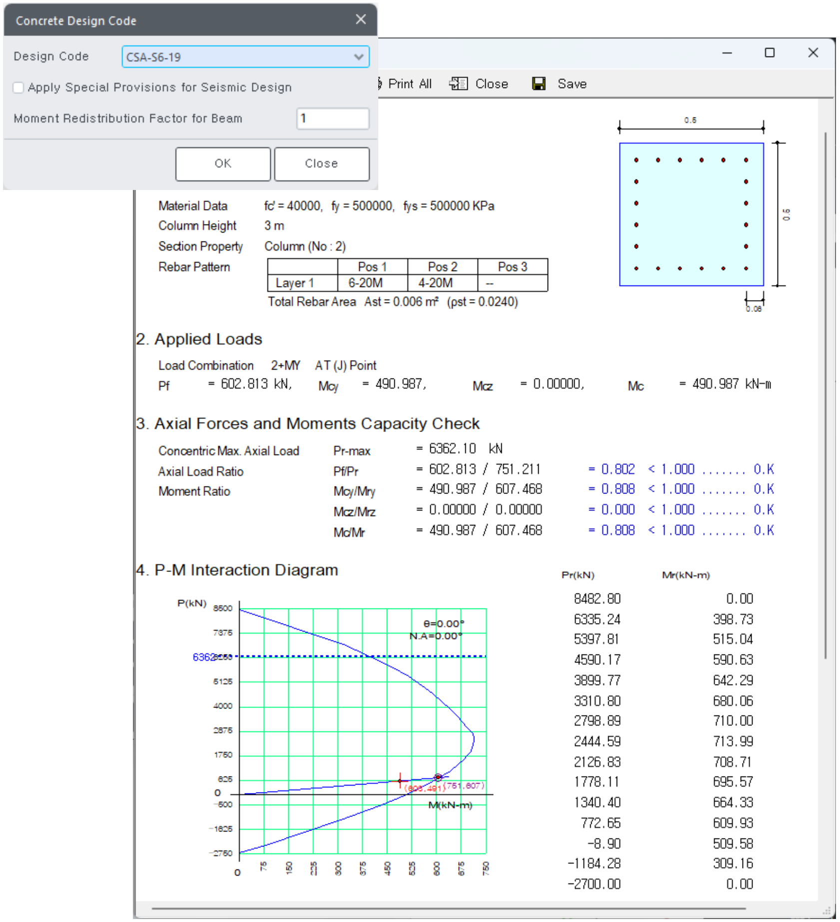


Plate Beam Design Summary

13. RC & Steel Design as per CSA S6:19

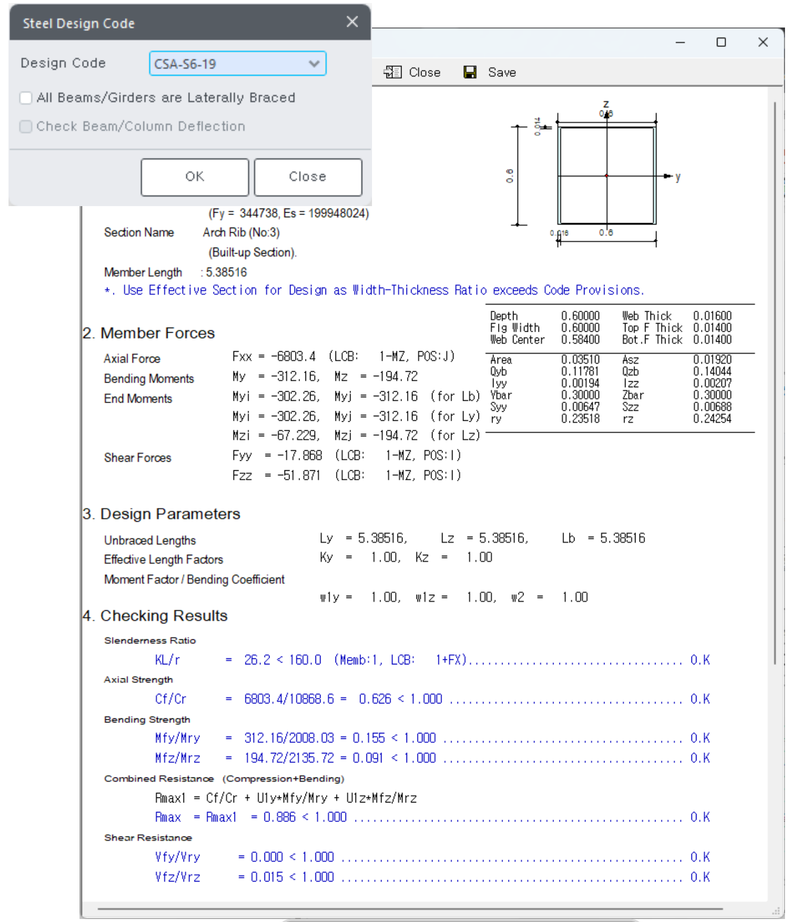
- RC member design and steel member design have been updated as per CSA S6: 19.

▪ ***Design > RC Design > Design Code Option***



RC Design Summary Report

▪ ***Design > Steel Design > Design Code Option***

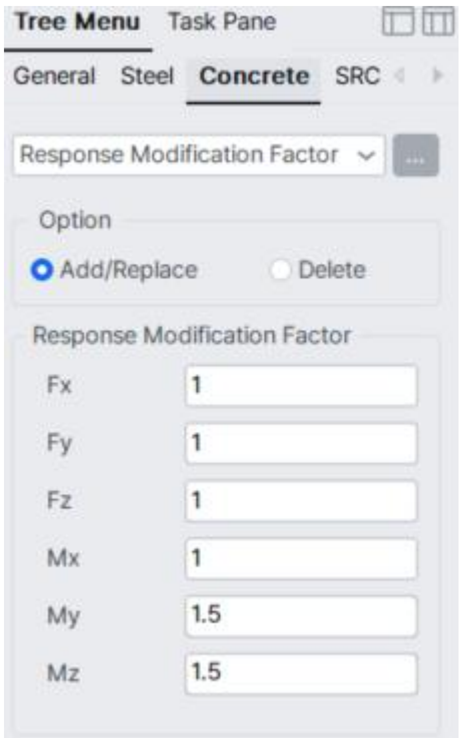


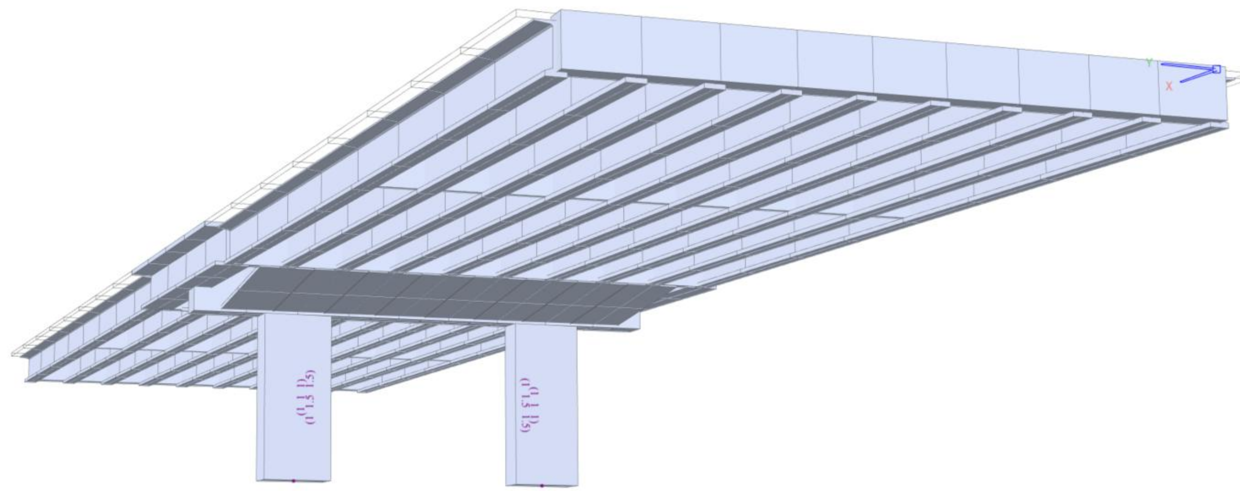
Steel Design Summary Report

14. Response Modification Factor by members and components as per AASHTO LRFD

- Seismic design force effects for substructures shall be determined by dividing the force effects resulting from elastic analysis by the appropriate response modification factor, R.
- In the previous version, only a single response modification factor could be applied. However, the current version allows for the application of response modification factors based on substructure types and load components.
- Applicable Code: AASHTO-LRFD

- ***Design > RC Design > Design Parameters > Response Modification Factor (R)***





Start Page × MIDAS CIVIL NX × **Response Modification Factor (R)** ×

	Elem	R factor for Fx	R factor for Fy	R factor for Fz	R factor for Mx	R factor for My	R factor for Mz
	390	1.00	1.00	1.00	1.00	1.50	1.50
	391	1.00	1.00	1.00	1.00	1.50	1.50
*							

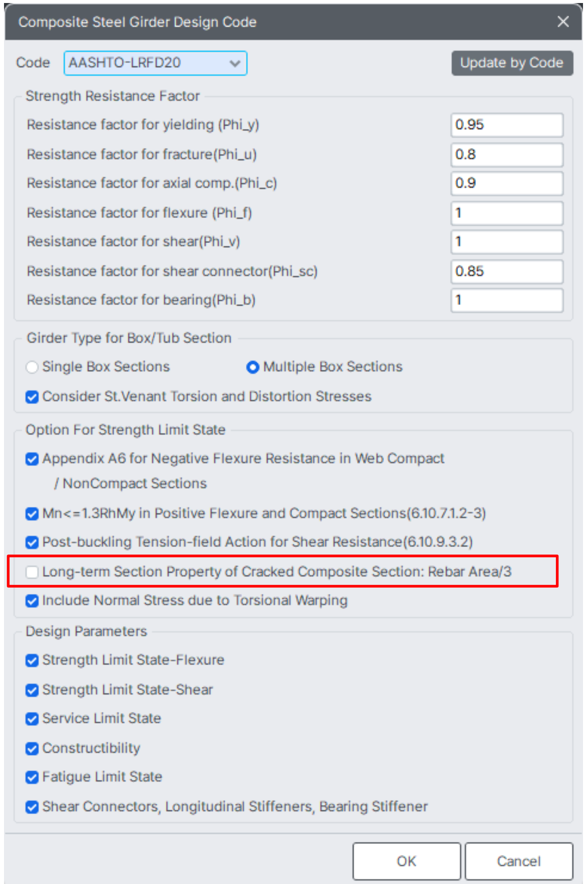
Response Spectrum Modificatio n Factor Dialog

Response Spectrum Modificatio n Factor Table

15. Addition of an option "Long-term Section Property of Cracked Composite Section: Rebar Area/3" as per AASHTO LRFD

- In previous versions, the long-term section properties of the composite girder subjected to negative moment were calculated as "Steel Section + Long. Reinforcement/3".
- Now, an option is added to determine the section properties as "Steel Section + Long. Reinforcement".

▪ ***Design > Composite Design > Design Code Option***



Composite Steel Girder Design Code Option

3) Long-term Composite Section

(Es/Ec = 3n

$A_{(n)}$(mm²)	114055.580	$I_{y(n)}$(mm⁴)	84815877315.974	$I_{z(n)}$(mm⁴)	20571628095.453
$d_{Top(n)}$(mm)	693.811	$d_{Bot(n)}$(mm)	1185.789		
$S_{Top(n)}$(mm³)	122246331.502	$S_{Bot(n)}$(mm³)	71526969.459		
$S_{L(n)}$(mm³)	80990661.793	$S_{R(n)}$(mm³)	80990661.793		
$w_{1(n)}$(mm²)	-10138.241	$w_{2(n)}$(mm²)	10138.290	$I_{w(n)}$ (mn	2.751341E+15
$w_{3(n)}$(mm²)	488492.120	$w_{4(n)}$(mm²)	-488491.491		

4) Short-term Composite Section(Long. Reinforcement)

$A_{(R)}$(mm²)	100601.412	$I_{y(R)}$(mm⁴)	73165083170.475	$I_{z(R)}$(mm⁴)	10775758973.804
$d_{Top(R)}$(mm)	810.378	$d_{Bot(R)}$(mm)	1069.222		
$S_{Top(R)}$(mm³)	90285105.810	$S_{Bot(R)}$(mm³)	68428350.798		
$S_{L(R)}$(mm³)	42424247.928	$S_{R(R)}$(mm³)	42424247.928		
$w_{1(R)}$(mm²)	0.000	$w_{2(R)}$(mm²)	0.000	$I_{w(R)}$ (mn	0.000000E+00
$w_{3(R)}$(mm²)	0.000	$w_{4(R)}$(mm²)	0.000		

5) Long-term Composite Section(Long. Reinforcement)

$A_{(R3)}$(mm²)	100601.412	$I_{y(R3)}$(mm⁴)	73165083170.475	$I_{z(R3)}$(mm⁴)	10775758973.804
$d_{Top(R3)}$(mm)	810.378	$d_{Bot(R3)}$(mm)	1069.222		
$S_{Top(R3)}$(mm³)	90285105.810	$S_{Bot(R3)}$(mm³)	68428350.798		
$S_{L(R3)}$(mm³)	42424247.928	$S_{R(R3)}$(mm³)	42424247.928		
$w_{1(3R)}$(mm²)	-10138.241	$w_{2(3R)}$(mm²)	10138.290	$I_{w(3R)}$ (mn	2.751341E+15
$w_{3(3R)}$(mm²)	488492.120	$w_{4(3R)}$(mm²)	-488491.491		

Design Report