

# TECHNIA

PART OF ADDNODE GROUP

## BRIGADE/Plus Datasheet

This document provides an overview of information about the various tools and features available in BRIGADE/Plus.

For more detailed information about the product, please contact one of our experts via the BRIGADE webpage. For troubleshooting, please send in your service request via our TECHNIA Customer Care portal.



## Contents

BRIGADE/Plus Datasheet .....	1
Overview .....	3
Key Features of BRIGADE/Plus .....	4
Easy-to-Use Modeling Environment.....	4
Modeling Concept .....	5
Auto-Meshing.....	6
Complete Set of Analysis Procedures.....	7
Complete Set of Element Library .....	7
Prestressing .....	8
Extended Free-Body Cut .....	9
Staged Construction Analysis .....	10
Buckling.....	11
Load Combination.....	12
Static Response of Moving Loads .....	13
Dynamic Response of Moving Loads .....	14
Result Visualization .....	15
Nonlinear Material Behaviour .....	16
Robust Contact Capabilities .....	17
Reinforcement Design .....	18
Integrated Abaqus Solver Technology .....	19
System requirements .....	20
Hardware .....	20
Software .....	20
Summary .....	20

## Overview

BRIGADE/Plus provides an easy-to-use environment for modelling of all types of bridges and civil structures. The intuitive user-interface integrates modelling, analysis and visualization of results. The parametric, feature-based, concept enables efficient modelling of complex structures.

Our software includes predefined loads, vehicles and load combinations in accordance with a wide range of design codes including the Eurocodes with various National Annexes.

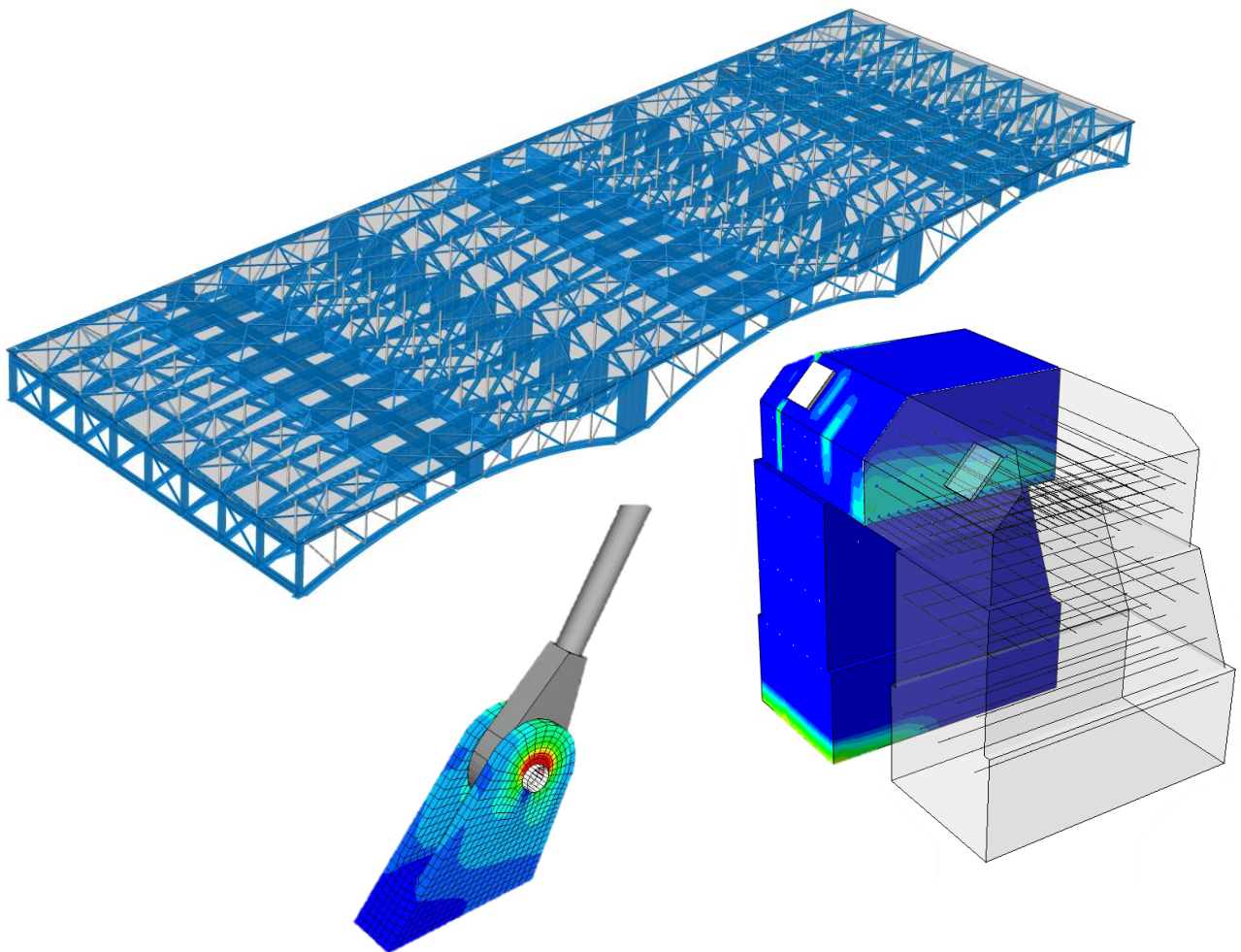
BRIGADE/Plus offers a complete range of advanced capabilities such as transient- and steady state dynamic analysis, non-linear material models and contact interactions. The results are easily visualized in 3D plots and 2D graphs. The integrated report generator can be used for efficient creation of input and result reports. Results can be automatically exported to the reinforcement module ConcreteDesigner or to customers own tool for design of reinforcement.

## Key Features of BRIGADE/Plus

### EASY-TO-USE MODELING ENVIRONMENT

BRIGADE/Plus provides an easy-to-use environment for modelling of any type of bridge and civil structures such as tunnels, dams and towers etc. The GUI is based on the ABAQUS CAE and further tailored to facilitate the design and analysis work for bridge engineers.

The consistent GUI integrates modelling, analysis and visualization of results and is simple to learn for new users, yet highly productive for experienced users.



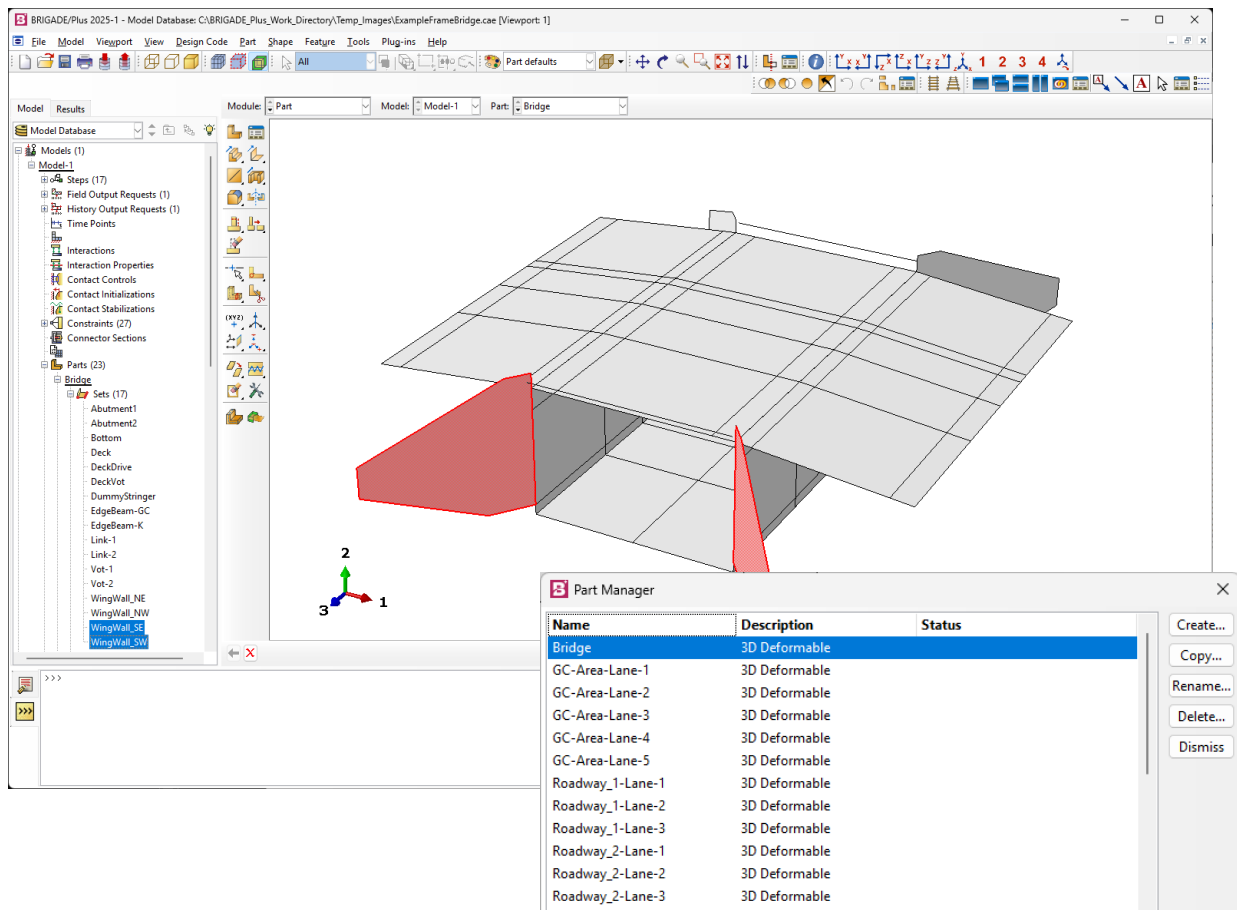
## MODELING CONCEPT

BRIGADE/Plus offers a parametric, feature-based, concept enabling fast and simple modelling of complex geometries.

The user builds the model through high-level features such as beams, slabs, supports and traffic loads that encapsulate both geometry and associated attributes. This feature-based approach aligns closely with engineering thinking, allowing users to define structural components and their behavior in a modular and traceable way.

Model properties – such as materials, cross-sectional data, boundary conditions, and loads – are explicitly named and easily assigned to selected parts of the model. Because each assignment is tied to specific features rather than raw geometry (e.g., surfaces or nodes), it becomes easier to update, reuse, or review the model. This makes the modeling process not only more efficient but also more robust and transparent.

BRIGADE/Plus uses the same feature-based workflow as used in Abaqus/CAE, which emphasizes reusability and clarity. Parametric inputs and associative relationships between features allow engineers to explore design alternatives, manage changes during project iterations, and maintain a high level of model consistency throughout the design lifecycle.



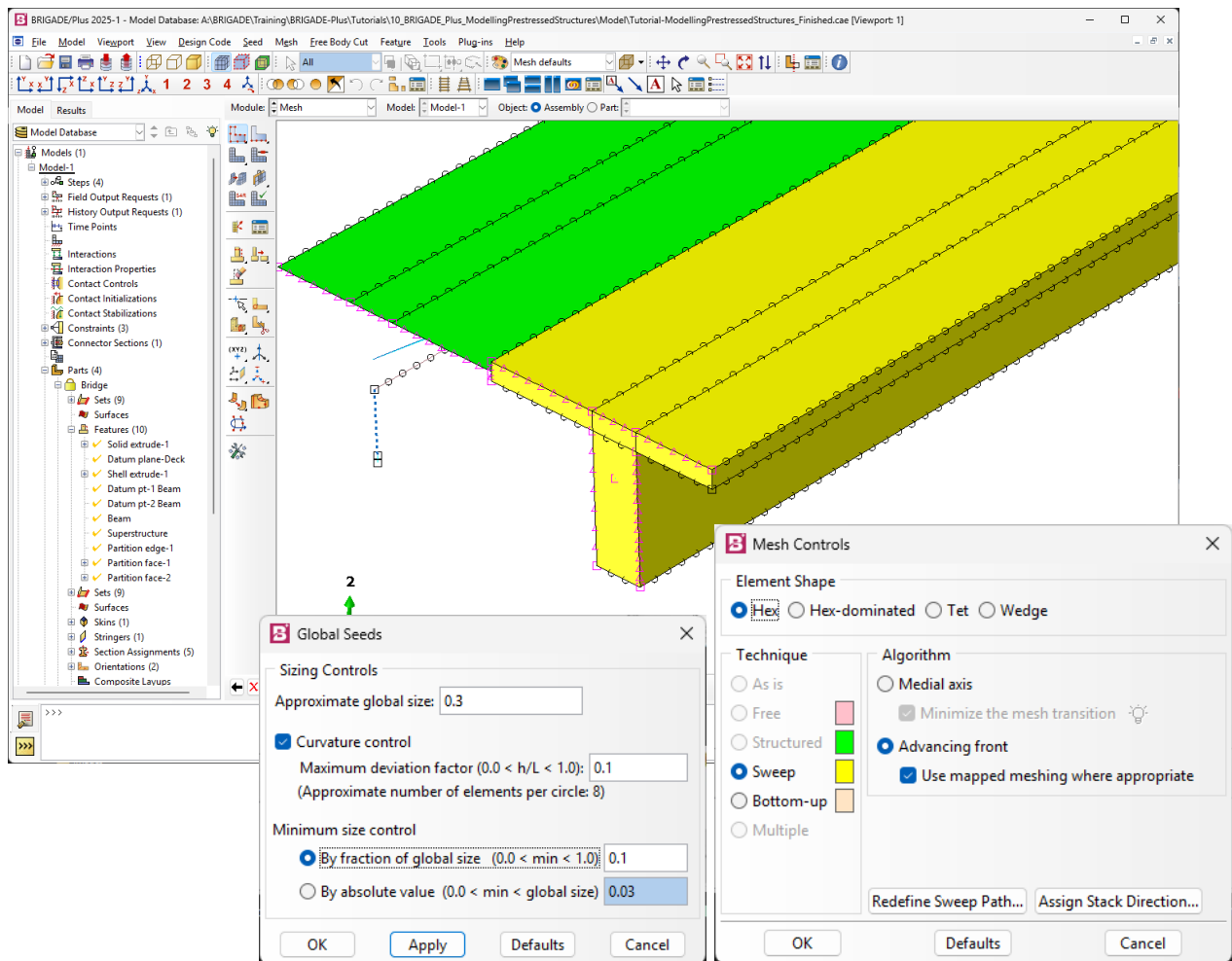
## AUTO-MESHING

BRIGADE/Plus provides robust and flexible meshing capabilities powered by the Abaqus/CAE meshing engine. The model is automatically meshed based on its defined geometry, with support for structural and analytical element types—including 1D beam elements, 2D shell elements, and 3D solid meshes.

The built-in auto-meshing functionality intelligently recognizes topological features such as edges, corners, and surfaces, generating high-quality elements that conform to the model geometry. This enables quick and reliable mesh generation even for complex bridge geometries.

Users retain full control over meshing parameters, including element type, target size, and transition settings. Both structured and unstructured meshing strategies are supported, along with advanced options such as mesh seeding, biasing, and local refinement.

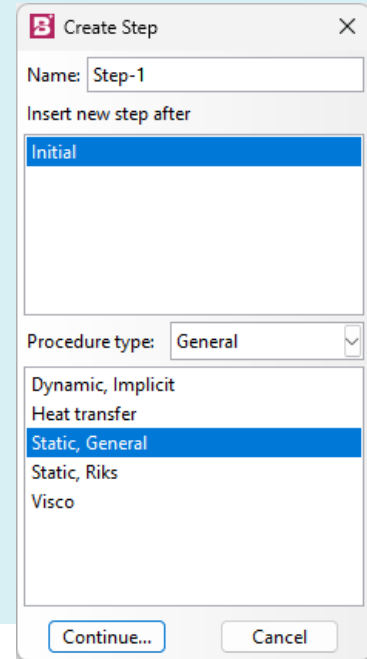
Because the mesh is associatively linked to the model’s geometry and feature-based architecture, it automatically updates in response to any design changes, ensuring that the mesh always reflects the current state of the model. This streamlines the modelling workflow and enhances consistency across design iterations.



## COMPLETE SET OF ANALYSIS PROCEDURES

BRIGADE/Plus is built to handle the full spectrum of structural behaviour encountered in bridge engineering, from early design stages to advanced damage assessments. Using the Abaqus/Standard (implicit) industry-leading solver, the software supports a wide range of predefined analysis procedures that are easy to configure, even for large-scale and complex models.

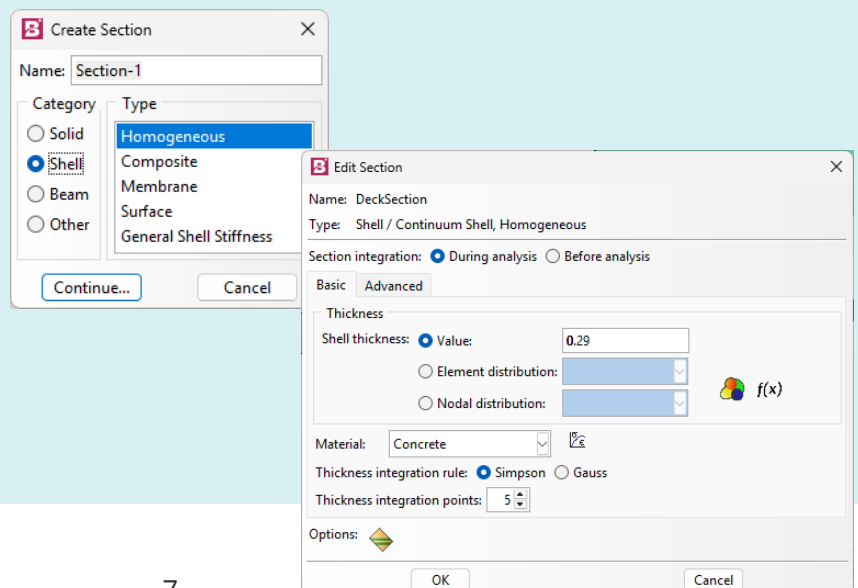
- Static stress/displacement analysis
- Natural frequency analysis
- Modal transient dynamic analysis
- Non-linear transient dynamic analysis
- Steady state dynamic analysis
- Response spectra analysis
- Random response analysis
- Eigenvalue buckling
- Non-linear buckling and post-buckling
- Sub model analysis
- Segmental construction analysis
- Time dependent creep and shrinkage analysis
- Heat transfer analysis (transient & steady-state)
- Sequentially coupled thermal-stress analysis



## COMPLETE SET OF ELEMENT LIBRARY

BRIGADE/Plus includes a comprehensive set of finite element types designed to cover the full spectrum of bridge modeling needs—from global behavior to detailed local response. Whether you're simulating load paths in a steel girder, plate action in a concrete deck, or dynamic damping in expansion joints, the right elements are ready to use.

- Beam element
- Truss element
- Shell element
- Membrane element
- Solid element
- Spring element
- Dashpot
- Connector element
- Rigid element
- Mass element

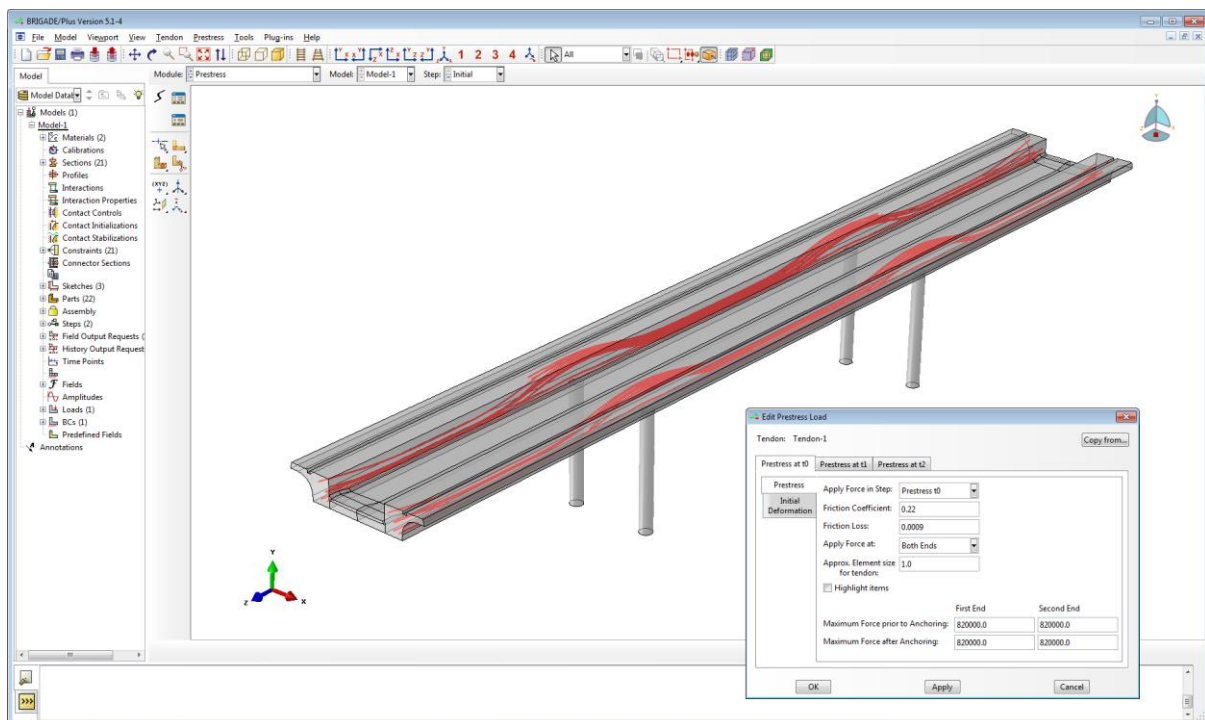


## PRESTRESSING

BRIGADE/Plus offers dedicated functionality for modelling and analysing prestressed structures. Both longitudinal and transverse tendon layouts can be intuitively defined using geometry-based input, enabling accurate representation of tendon profiles within slabs, girders, or box sections.

Short-term prestress losses—including friction, wobble, and anchorage slip—are automatically calculated based on tendon geometry and system parameters. The software also supports multiple prestress stages, allowing engineers to simulate construction sequences and time-dependent behaviour with precision.

This integrated approach streamlines prestressed bridge design by combining geometric flexibility with robust physical modelling, ideal for post-tensioned or pre-tensioned systems.



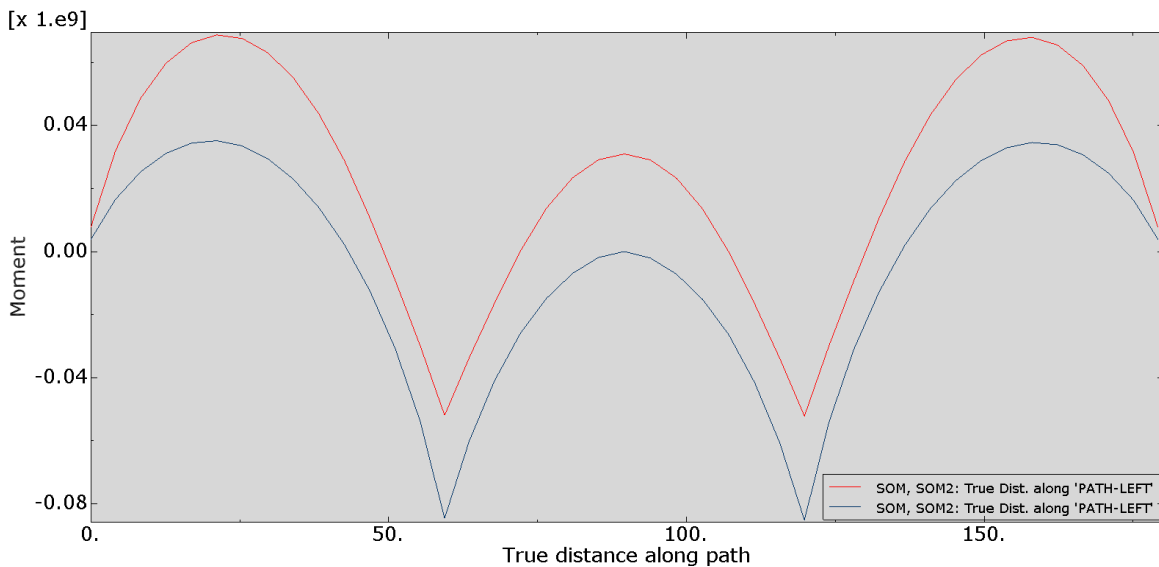
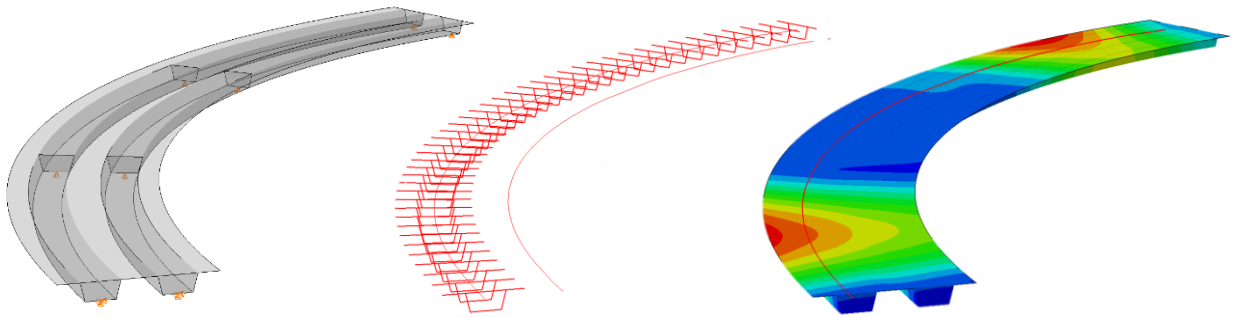
## EXTENDED FREE-BODY CUT

BRIGADE/Plus features the Extended Free Body Cut tool, enabling engineers to extract force and moment resultants across arbitrary cross-sections, regardless of element types (beam, shell or solid elements) or mesh density. This powerful functionality goes beyond traditional element-based outputs by ensuring equilibrium-consistent sectional forces, even in complex geometries or refined local meshes.

The tool is ideal for analysing structures with complex, non-conventional cross-sections. The complex structure can be modelled with for example shell or solid elements to be able to analyse any critical local effects. At the same time the total response for the section can be received. Engineers can pre-define cuts at any angle or location, and immediately obtain bending moments, shear forces, normal forces, and torsion, ready for sectional checks against design codes. The section can be the full section or a sub-set of the full section.

Compared to the Abaqus-based Free Body Cut or View Cut feature – which also exist in BRIGADE/Plus – this BRIGADE-unique feature can also be used for load combinations since the section is defined before the analysis starts.

Here you can read more about the [Extended Free Body Cut](#) functionality.

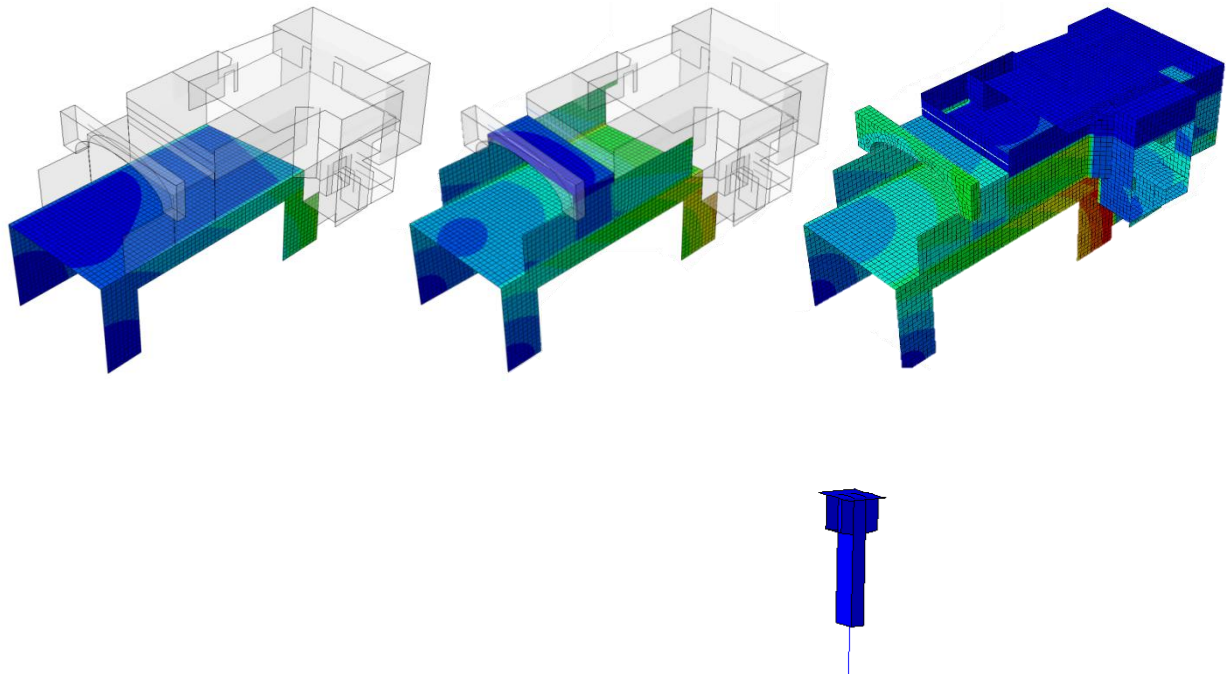


## STAGED CONSTRUCTION ANALYSIS

BRIGADE/Plus enables detailed simulation of segmental or staged construction, a critical aspect of bridge design. Structural components, loads, supports, and boundary conditions can be activated or deactivated step-by-step during the analysis, to reflect the actual construction sequence.

It allows engineers to assess the transient stress states, internal force redistributions, and deformation accumulation that occur as the structure is gradually built. It is especially useful for evaluating cantilever construction, incremental launching and segment-by-segment construction methods, including segmental post-tensioning of cables.

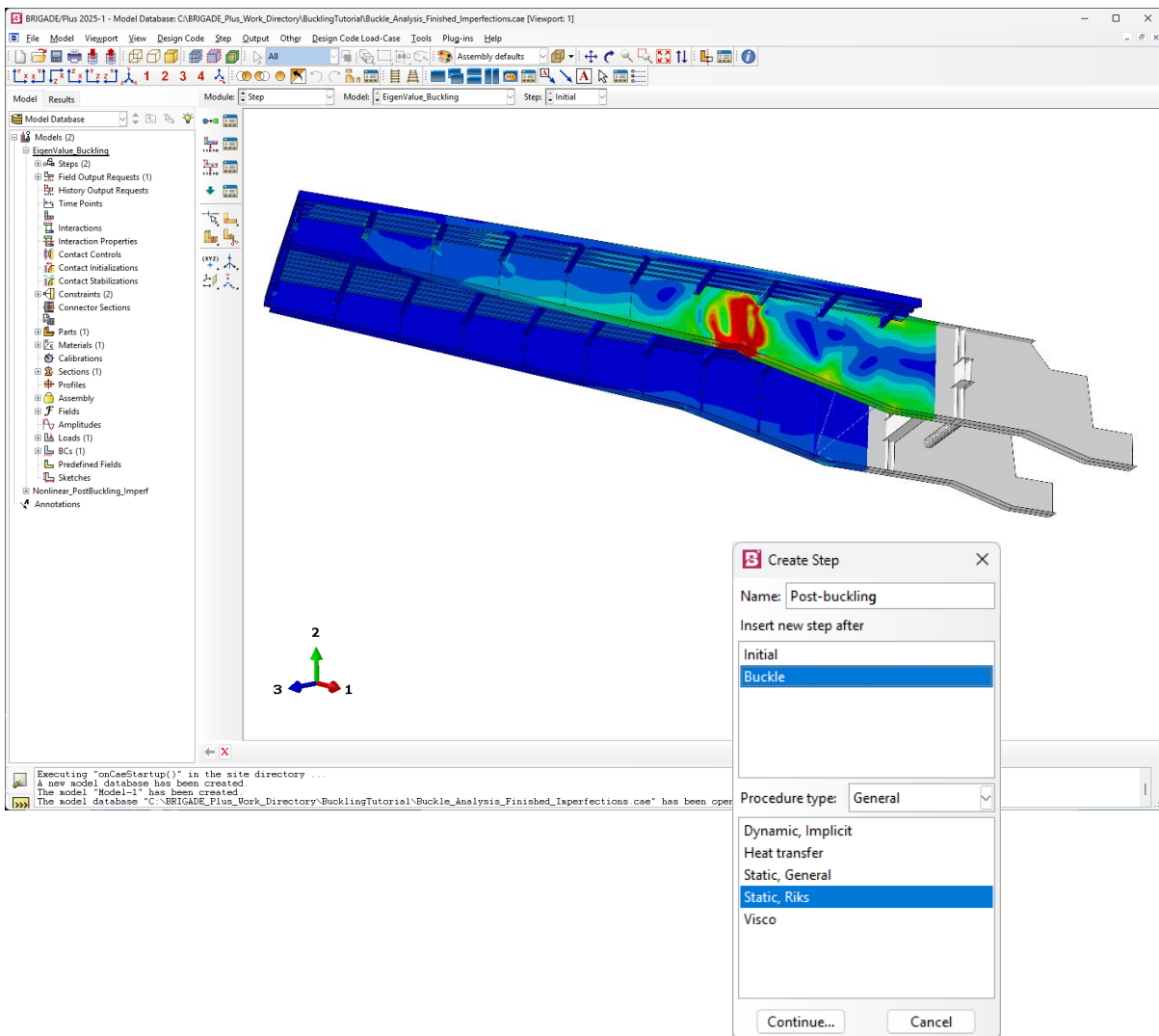
By replicating construction stages within the analysis, BRIGADE/Plus helps engineers ensure safety, serviceability, and performance throughout all phases of the project, not just in the final structure.



## BUCKLING

BRIGADE/Plus supports both eigenvalue buckling and nonlinear post-buckling analyses, including RIKS (arc-length) analysis for tracing unstable equilibrium paths beyond peak loads.

These capabilities are essential for evaluating the stability of slender components—such as girders, pylons, and deck slabs—under compression or asymmetrical loading. Engineers can include geometric and material nonlinearity, imperfections, and staged loading, enabling realistic simulation of buckling and collapse scenarios during both construction and service phases.



## LOAD COMBINATION

BRIGADE/Plus features a powerful and flexible load combination engine, designed specifically for bridge analysis. It automatically accounts for whether individual loads have adverse or beneficial effects, ensuring safe and efficient design envelope generation.

Users can define combinations manually or import/load built-in design code libraries according to for example Eurocode, including national annexes, for both road and railway bridges.

The system supports both ultimate and serviceability limit state combinations, and enables fast iteration over multiple scenarios, critical for assessing governing cases in complex loading situations such as moving traffic, wind, thermal actions, and construction stages.

The screenshot displays three overlapping windows from the BRIGADE/Plus software interface:

- Load Combination Manager:** Shows a list of imported design code load combinations. The table below represents the data visible in this window.
- Load Group Manager:** Shows a list of imported design code load groups. The table below represents the data visible in this window.
- Edit Load-Combination:** Shows the configuration for a specific load combination, including a table of variable loads and their coefficients.

Name	Summation Type	Active
Accidental load combination	User-Defined	<input type="checkbox"/>
SLS, Quasi-permanent	User-Defined	<input checked="" type="checkbox"/>
SLS, characteristic (envelope)	Pick Most Adverse	<input checked="" type="checkbox"/>
SLS, characteristic (main load not traffic)	User-Defined	<input checked="" type="checkbox"/>
SLS, characteristic (main load traffic)	User-Defined	<input checked="" type="checkbox"/>
SLS, frequent (envelope)	Pick Most Adverse	<input checked="" type="checkbox"/>
SLS, frequent (main load not traffic)	User-Defined	<input checked="" type="checkbox"/>
SLS, frequent (main load traffic)	User-Defined	<input checked="" type="checkbox"/>
ULS (A) EQU (envelope) Sk2	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (A) EQU (envelope) Sk3	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (A) EQU (envelope) Sk4	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (A) EQU (main load not traffic)	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (A) EQU (main load traffic)	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (B) STR/GEO a Sk2 D	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (B) STR/GEO a Sk2 D	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (B) STR/GEO a Sk3 D	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (B) STR/GEO a Sk3 D	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (B) STR/GEO a Sk4 D	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (B) STR/GEO a Sk4 D	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (B) STR/GEO b (envelope)	Pick Most Adverse	<input checked="" type="checkbox"/>
ULS (B) STR/GEO b (envelope)	Pick Most Adverse	<input checked="" type="checkbox"/>

Name	Summation Type	Active
Temperature Difference	Pick Most Adverse	<input checked="" type="checkbox"/>
Temperature Load (envelope)	Pick Most Adverse	<input checked="" type="checkbox"/>
Temperature Mean	Pick Most Adverse	<input checked="" type="checkbox"/>
TemperatureGradient + wnTemperatureMean	Conditional	<input checked="" type="checkbox"/>
TemperatureMean + wmTemperatureGradient	Conditional	<input checked="" type="checkbox"/>
Traffic Group 1b, characteristic	Conditional	<input checked="" type="checkbox"/>
Traffic Group 1b, frequent	Conditional	<input checked="" type="checkbox"/>
Traffic Group 2 LM, combination	Conditional	<input checked="" type="checkbox"/>
Traffic Load Model 1	Conditional	<input checked="" type="checkbox"/>
Traffic Load Model 1, TS	Conditional	<input checked="" type="checkbox"/>
Traffic Load Model 1, UDL	Conditional	<input checked="" type="checkbox"/>
Traffic Load Model 2	Pick Most Adverse	<input checked="" type="checkbox"/>

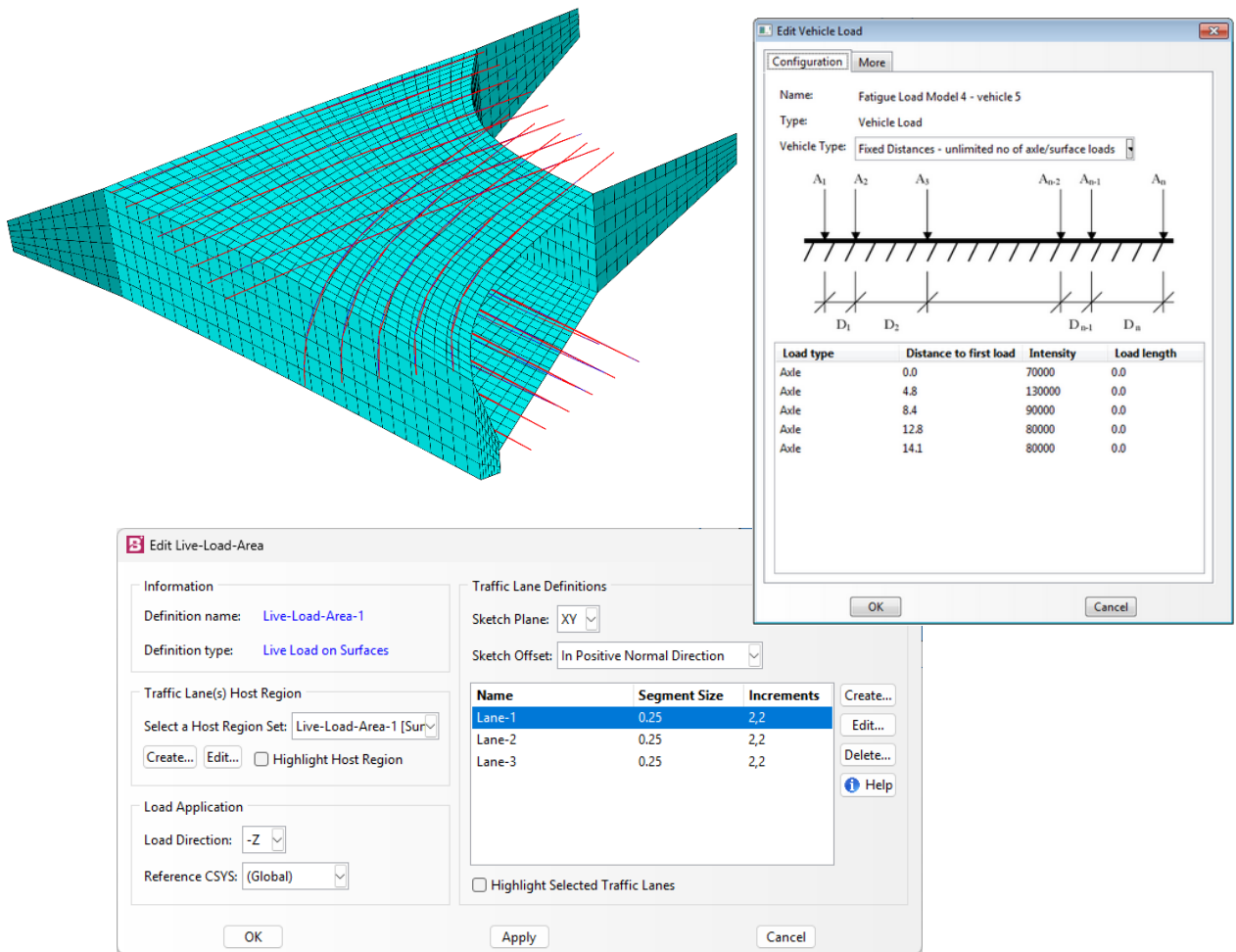
Name	Type	Setting	Load Coefficients				Scale Factors	
			1'st	2'nd	3'rd	4'th	Displ.	Other
Surcharge (envelope)	Load-Group		1.024	1.024	1.024	1.024	1	1
Temperature Load (envelope)	Load-Group		0.82	0.82	0.82	0.82	1	1
Traffic, combination (envelope)	Load-Group		1.365	1.365	1.365	1.365	1	1

## STATIC RESPONSE OF MOVING LOADS

BRIGADE/Plus offers a market-leading solution for static analysis of moving loads, purpose-built for bridge design. By leveraging influence lines and influence surfaces, the software enables fast, mesh-independent evaluation of traffic load effects, automatically identifying the most unfavourable load positions for design verification.

Traffic lanes are defined independently of the mesh. Vehicles can include axle loads with fixed or variable spacing, optionally combined with distributed surface loads. Multiple vehicles in parallel lanes are handled automatically, considering that the vehicle is moving along the bridge, staggering and side-by-side configurations.

Vehicles can be created manually or selected from a library of standardized design models, including Eurocode, AASHTO, British Standards, and Scandinavian bridge codes for both road and rail applications.



## DYNAMIC RESPONSE OF MOVING LOADS

BRIGADE/Plus provides advanced yet efficient tools for analysing the dynamic effects of moving loads, crucial for high-speed railway bridge design. One or multiple travel paths (tracks) can be defined with ease. Vehicles may be user-defined or selected from a library of predefined standard load models, such as HSLM-A according to EUROCODE.

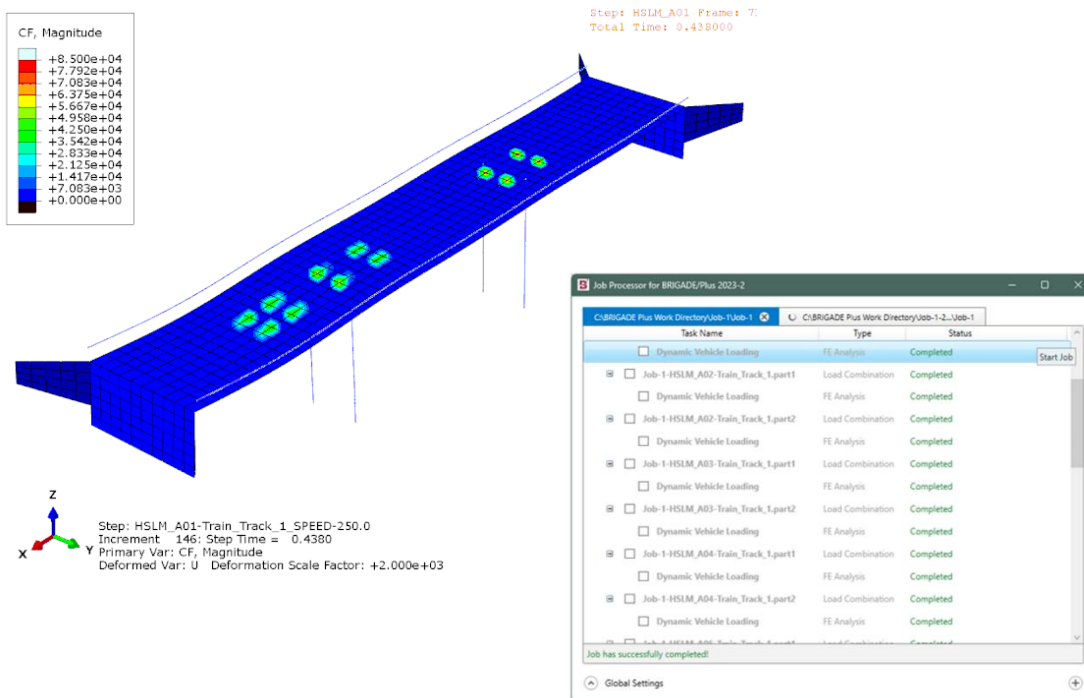
Dynamic simulations are easily performed over a range of user-defined speeds, to identify critical resonant responses. The software automatically generates envelopes of results, such as accelerations, for clear and efficient evaluation.

This functionality enables engineers to assess compliance with serviceability and comfort criteria, and to investigate resonance effects, impact amplification, and frequency-dependent behaviour, all directly within the BRIGADE/Plus environment.

Dynamic load analyses can be computationally demanding, especially for moving vehicles over multiple speeds and load combinations. To address this, BRIGADE/Plus includes the BRIGADE Job Processor, which intelligently manages the execution of multiple analysis tasks in large simulation sets. It automates the sequential and parallel execution of individual simulations and significantly reduces manual workload.

In addition, the FE solver supports parallel computation (if analysis tokens are available), which means that individual analyses run faster.

Here you can read more about [Best Practices for Dynamic Analysis of Bridges](#).



## RESULT VISUALIZATION

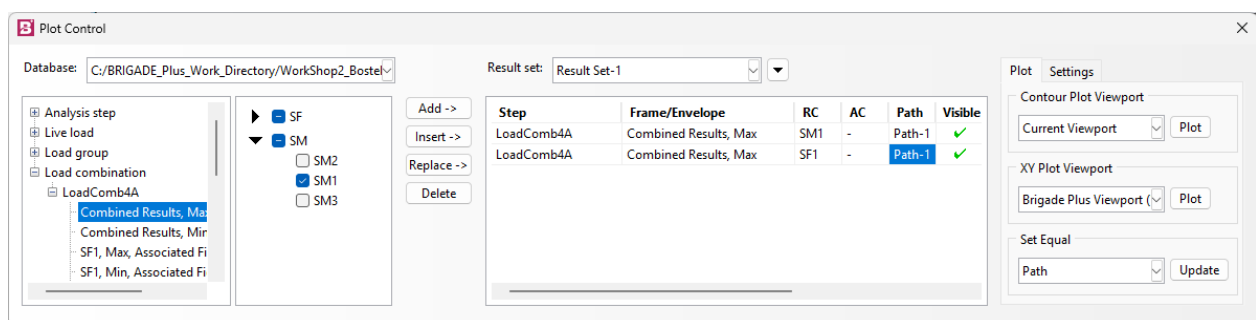
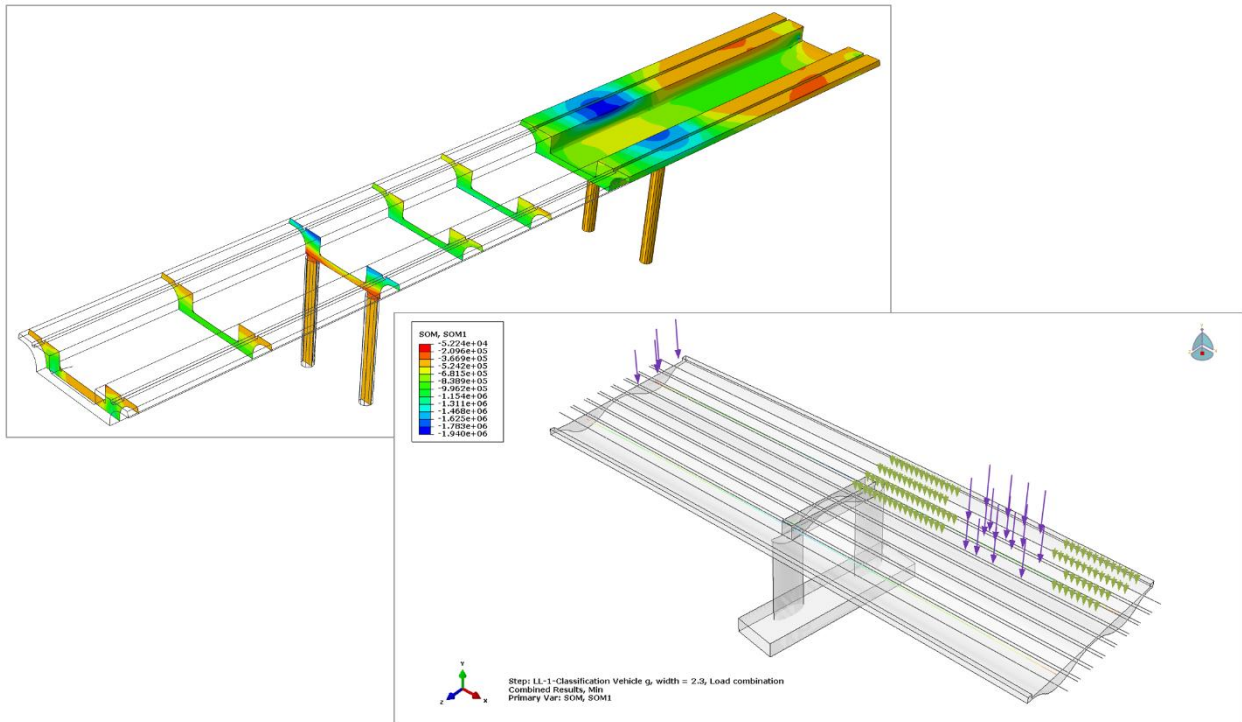
BRIGADE/Plus offers a comprehensive suite of tools for interpreting and visualizing analysis results with clarity and precision, which is crucial for understanding the structural behaviour and verifying design compliance. It includes

- Contour plots
- Diagram plots (2D-plots)
- Vector plots
- Tick-mark plots
- Overlay plots
- Animation of results
- Visualization of most adverse live load positions
- Export to MS Excel

Results such as displacements, stresses, reactions, internal forces, utilization ratios, and mode shapes can be visualized directly on the model using intuitive, colour-contoured plots and vector displays. Engineers can easily switch between different display modes and extract detailed output at points, along lines, or across sections.

Visualization settings and results can be saved to result files or separate files (xml) to be able to continue work after longer periods of time.

The BRIGADE unique Plot Control tool helps the analyst to quickly plot the results in the 3D-view to more comprehensible 2D-plots along a certain path/line to get better understanding of the results.



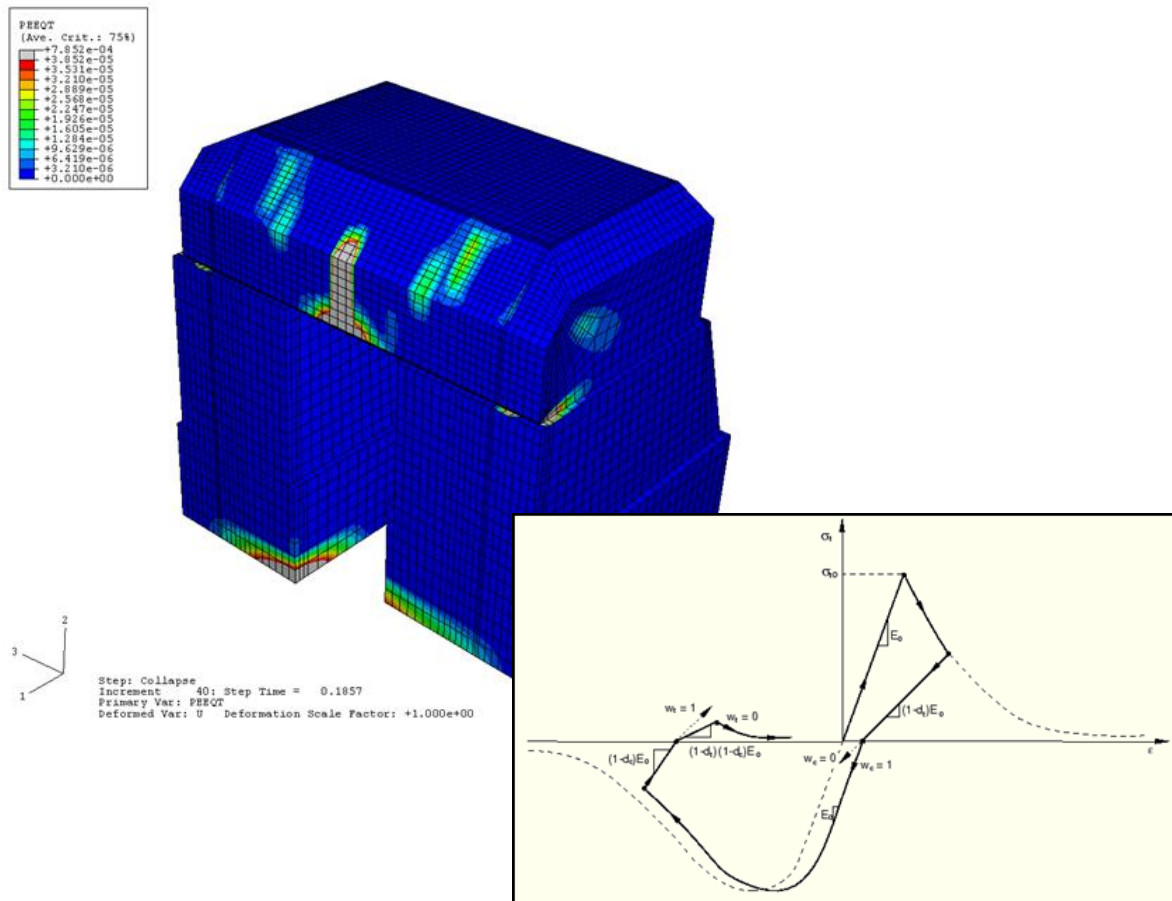
## NONLINEAR MATERIAL BEHAVIOUR

BRIGADE/Plus provides robust support for nonlinear material modelling, essential for capturing structural response under ultimate and accidental load conditions. A comprehensive library of constitutive models is available, including metal plasticity, temperature-dependent materials, and advanced concrete models.

For reinforced concrete structures, the Concrete Damage Plasticity (CDP) model is often used, enabling simulation of cracking, crushing, stiffness degradation, and load redistribution under both monotonic and cyclic loading. This makes it possible to evaluate performance beyond elastic limits, including failure modes and post-peak behaviour.

These capabilities allow engineers to assess structural capacity more accurately, verify ductility and energy dissipation, and ensure compliance with nonlinear design requirements in codes and guidelines.

Here you can read more about how a [viscoelastic concrete material](#) model can be set up to be used when studying long-term behavior of concrete under sustained loads.

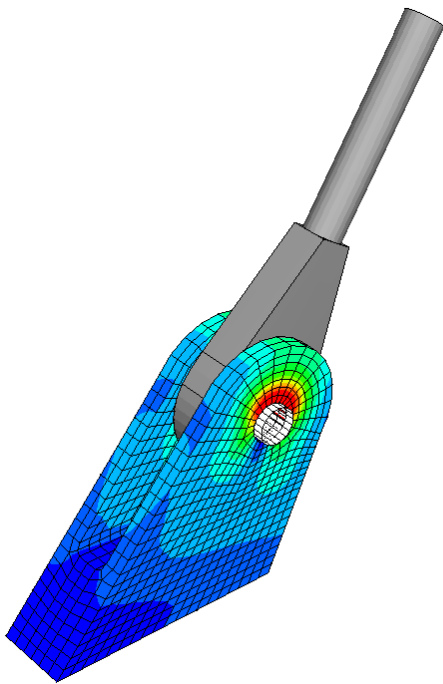


## ROBUST CONTACT CAPABILITIES

BRIGADE/Plus includes robust and highly configurable contact modelling capabilities, powered by the industry-leading contact solver from Abaqus. Contact can be defined between two deformable bodies, or between a deformable body and a rigid surface, covering a wide range of bridge-related scenarios such as bearings, joints, and temporary supports. The following contact types are supported:

- Element- or node-based contact definitions
- Hard or softened contact formulations
- Small or finite sliding
- Frictional behaviour, including static and kinetic friction
- Optional contact damping for dynamic stability

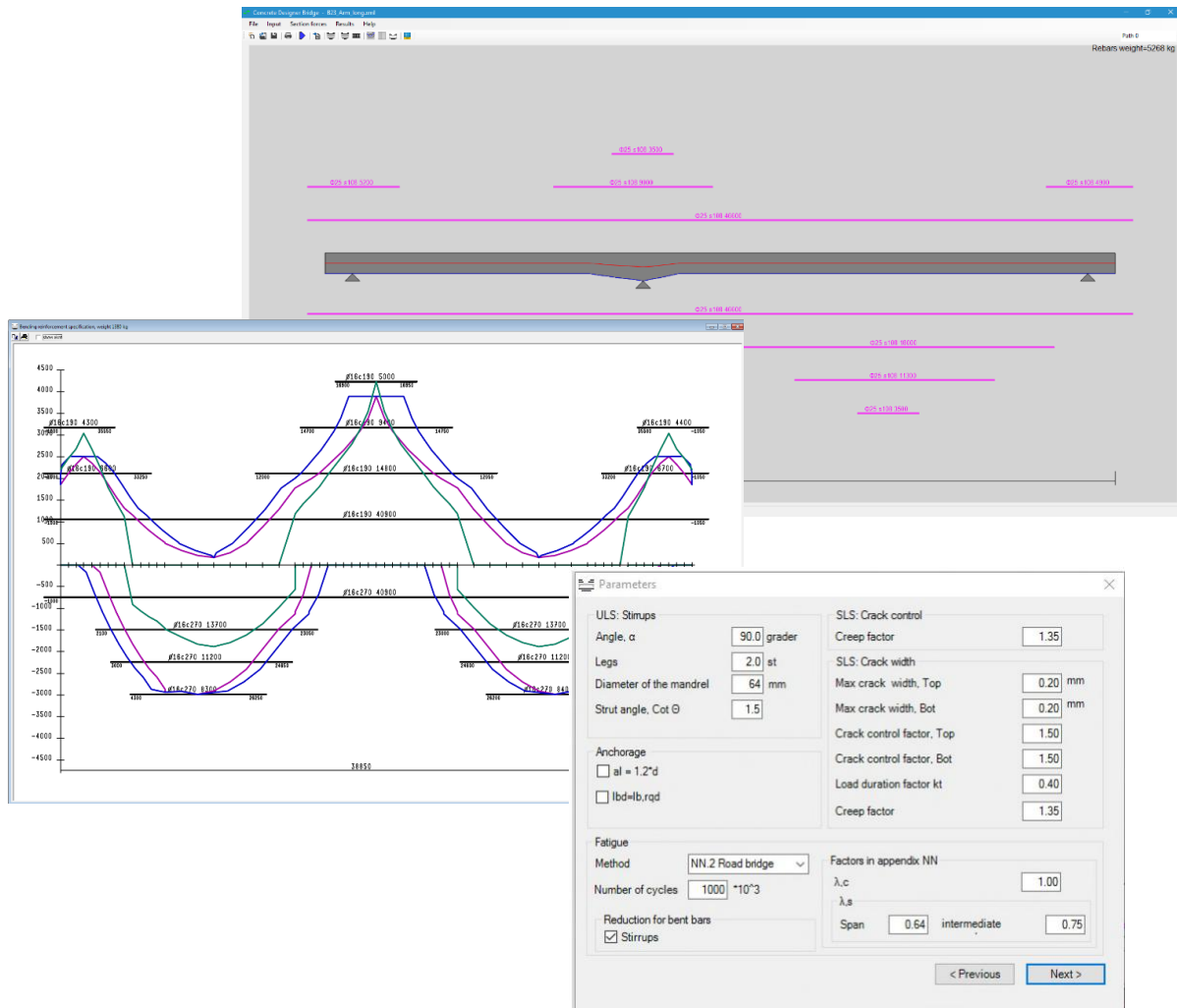
These features allow engineers to accurately capture load transfer, separation, sliding, and frictional effects, ensuring realistic assessment of local behaviour in critical interfaces.



## REINFORCEMENT DESIGN

BRIGADE/Plus calculates the design section forces and moments automatically. The need for reinforcement in accordance with Eurocode can then be easily calculated using these results.

The results can be exported on a format that is specially tailored for the Software ConcreteDesigner, developed by [Eurocode Software \(demo video\)](#)



## INTEGRATED ABAQUS SOLVER TECHNOLOGY

BRIGADE/Plus includes an integrated **ABAQUS** FEA solver from Dassault Systèmes, the leading provider of high-end finite element technology. This ensures not only accurate and efficient analysis, but also long-term continuity.

Since ABAQUS is under active development by a global R&D team, users of BRIGADE benefit from a solver that steadily improves in performance, robustness and numerical capabilities.



# System requirements

BRIGADE/Plus is a powerful tool, yet systems requirements are relatively low.

## HARDWARE

It is possible to set up, analyse and post-process a bridge model in BRIGADE/Plus with a regular laptop. Although there is a 3D-representation of the model in the software, there will never be any heavy load on the graphics card. The analysis always run on one CPU (no parallelization).

The FE-solver is memory intensive. You will benefit most from more RAM and fast storage

## SOFTWARE

BRIGADE/Plus only run on Windows OS. We always recommend using the latest Windows OS although it is likely that it will run on older versions of Windows as well.

## SUMMARY

The following list is a recommendation for computer system requirement. It considers that you probably want to be able to run other applications on your computer at the same time as you work with BRIGADE/Plus.

What	Minimum Requirements	Recommendation
Processor	Dual-core Intel i5 or AMD Ryzen 5	Intel i7 / i9 (12 <sup>th</sup> -14 <sup>th</sup> Gen) or AMD Ryzen 7/9 / Threadripper
Memory (RAM)	8 GB	32 GB DDR4 or DDR5
Storage	50 GB free space	512 GB NVMe SSD
Graphics	Integrated GPU or 1 GB OpenGL-compatible GPU	Dedicated GPU, NVIDIA RTX A2000 or 3060 or graphics card with similar capabilities.
Network	Required for floating license	Required for floating license
Operating System	Windows 10/11 64-bit	Latest Windows OS