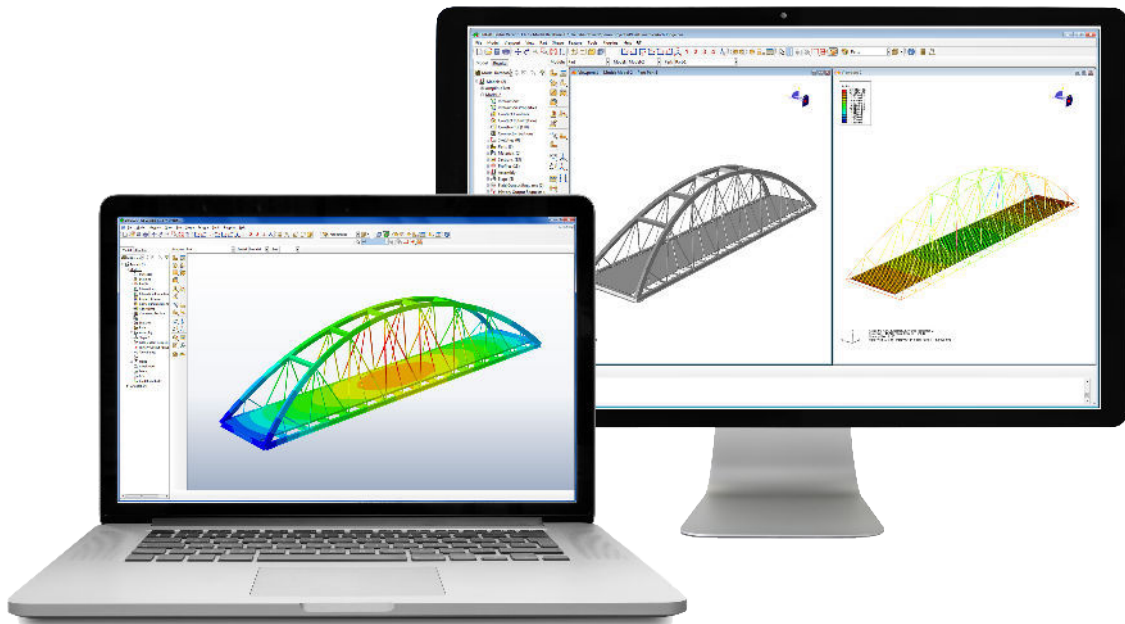




LEADING BRIDGE DESIGN SOFTWARE



BRIGADE is a market-leading software package for structural analysis and design of bridges and civil structures.

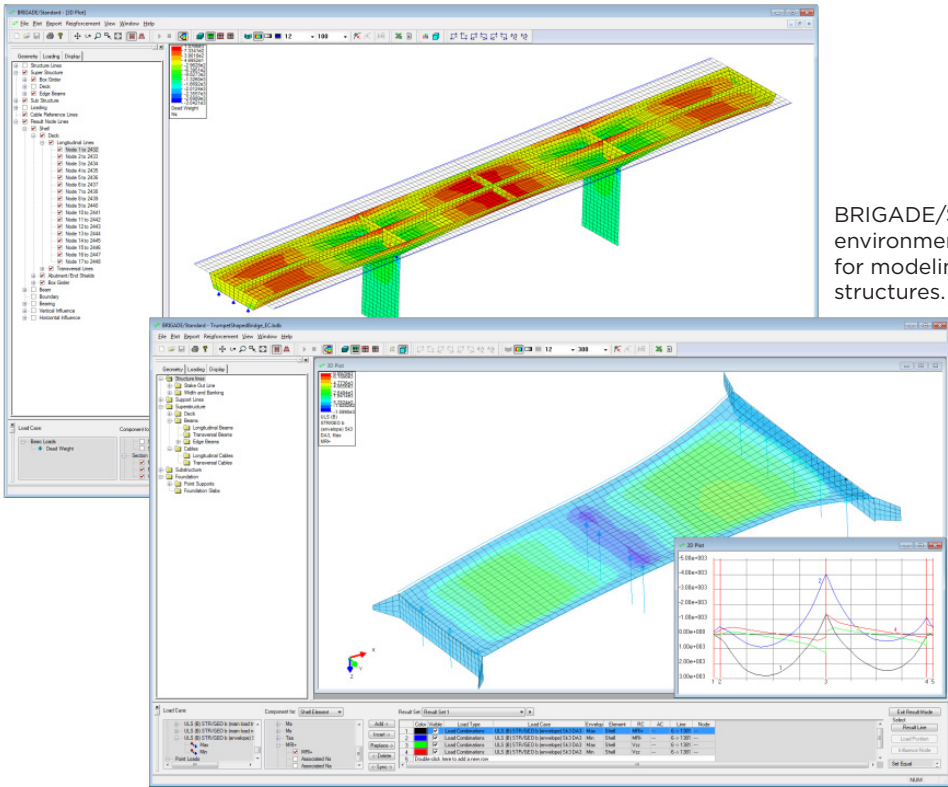
BRIGADE provides a complete range of static and dynamic analysis procedures, moving vehicle loads and non-linear capabilities in a user-friendly environment.

The BRIGADE Software Suite is available in two different versions:

- **BRIGADE/Standard**, a highly efficient modeling tool aimed for common standard bridge structures; and
- **BRIGADE/Plus**, a general modeling tool enabling advanced analysis of all types of bridges and civil structures.

PRODUCT OVERVIEW: BRIGADE/STANDARD

BRIGADE/Standard has a unique user interface specifically designed for 3D modeling and analysis of the most common types of bridge structures. The intuitive interface is easy-to-learn for new users and yet highly productive for experienced users.



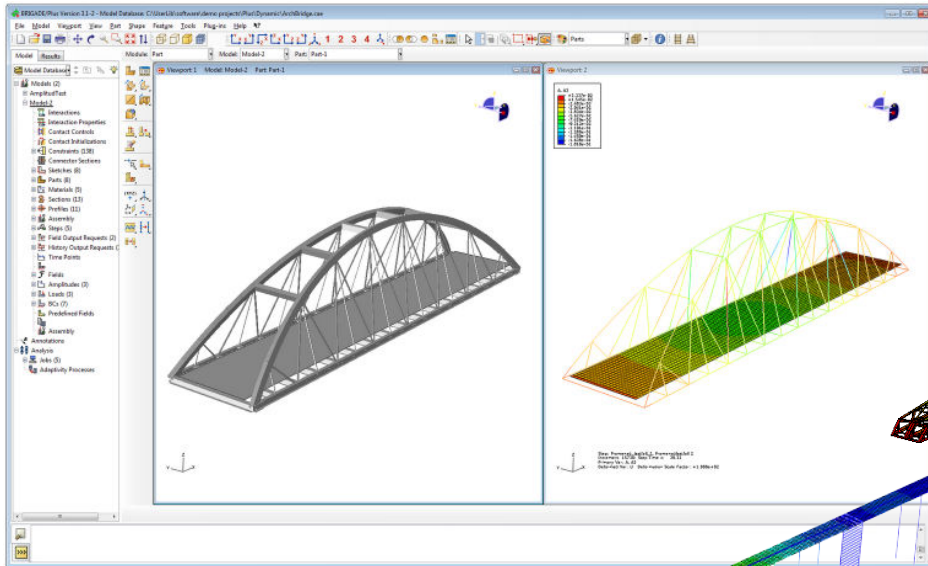
BRIGADE/Standard offers an environment specifically designed for modeling and analysis of bridge structures.

The parametric modeling concept is based on typical bridge components such as stake-out line, support lines, bridge deck, longitudinal and transversal beams, prestressed tendons, supports, foundation etc. In addition, BRIGADE/Standard includes predefined loads, vehicles and load combinations in accordance with a wide range of design codes including the Eurocodes with various National Annexes.

The results are easily visualized in 3D plots and 2D graphs and can be exported to MS Word or MS Excel. Results can automatically be exported to the reinforcement module ConcreteDesigner or to customer's own tools for design of reinforcement.

PRODUCT OVERVIEW: BRIGADE/PLUS

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



BRIGADE/Plus offers an easy-to-use environment for general modeling.

BRIGADE/Plus can be used for the analysis of all kinds of bridge and civil structures.

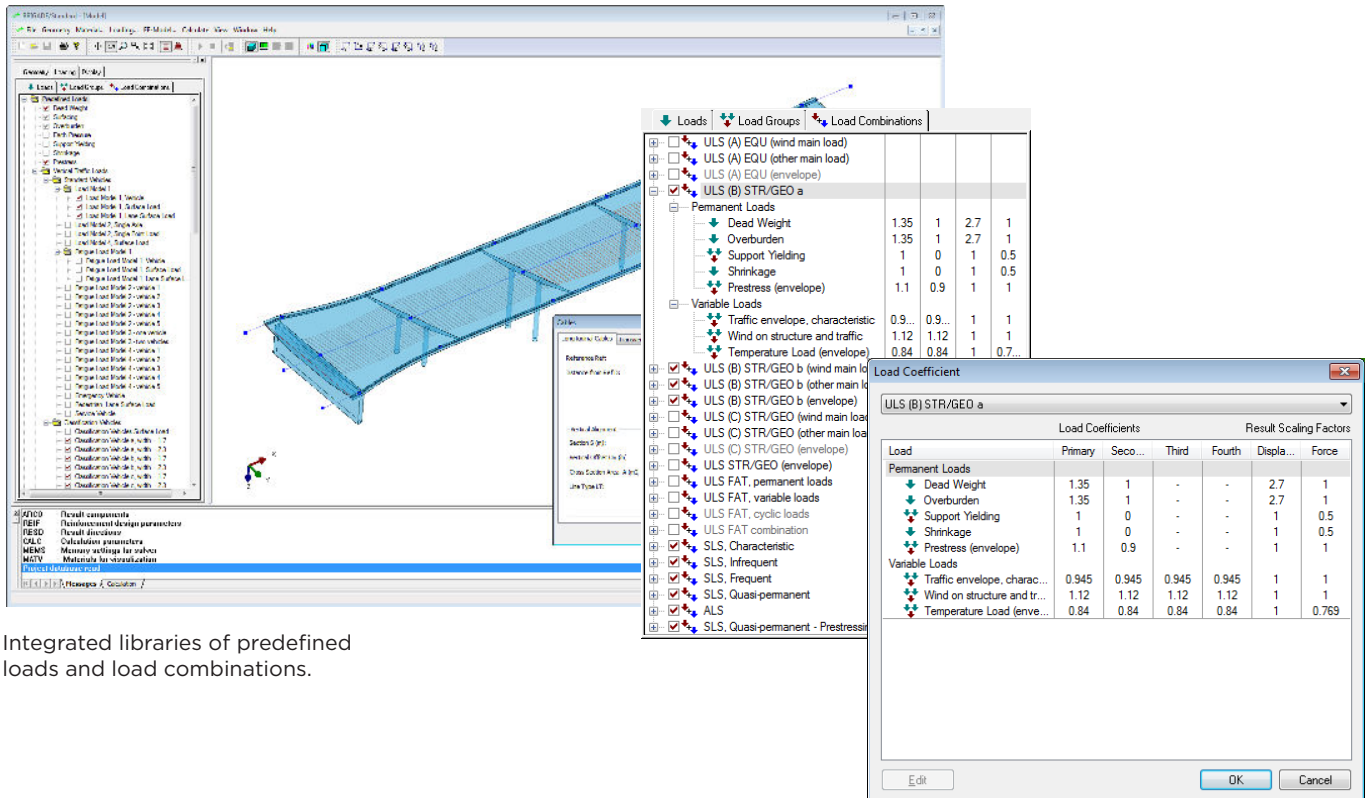
In order to facilitate the modeling, BRIGADE/Plus includes predefined loads, vehicles and load combinations in accordance with a wide range of design codes including the Eurocodes with various National Annexes. BRIGADE/Plus offers a complete range of advanced analysis capabilities such as transient and steady state dynamic analysis, non-linear material models and contact simulations.

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 customer's own tools for design of reinforcement.

MODELING CAPABILITIES

In order to enable time efficient modeling, BRIGADE includes libraries of predefined loads, vehicles and load combinations in accordance with a wide range of design codes including the Eurocodes. The predefined loads include permanent loads such as dead weight, surfacing, earth pressure, support yielding, shrinkage and prestress as well as variable loads such as moving traffic loads, braking forces, centrifugal forces, surcharge, temperature, wind and seismic loads.



The screenshot displays the BRIGADE software interface. On the left, a 3D model of a bridge structure is shown. The main window is divided into several panes: a tree view on the left, a central 3D view, and a right-hand pane with tabs for 'Loads', 'Load Groups', and 'Load Combinations'. The 'Load Combinations' tab is active, showing a list of predefined load combinations with checkboxes and numerical values. A 'Load Coefficient' dialog box is open, displaying a table of load coefficients for various load types under different limit states.

Load	Load Coefficients				Result Scaling Factors	
	Primary	Seco...	Third	Fourth	Displa...	Force
Permanent Loads						
Dead Weight	1.35	1	-	-	2.7	1
Overburden	1.35	1	-	-	2.7	1
Support Yielding	1	0	-	-	1	0.5
Shrinkage	1	0	-	-	1	0.5
Prestress (envelope)	1.1	0.9	-	-	1	1
Variable Loads						
Traffic envelope, charac...	0.945	0.945	0.945	0.945	1	1
Wind on structure and tr...	1.12	1.12	1.12	1.12	1	1
Temperature Load (enve...	0.84	0.84	0.84	0.84	1	0.769

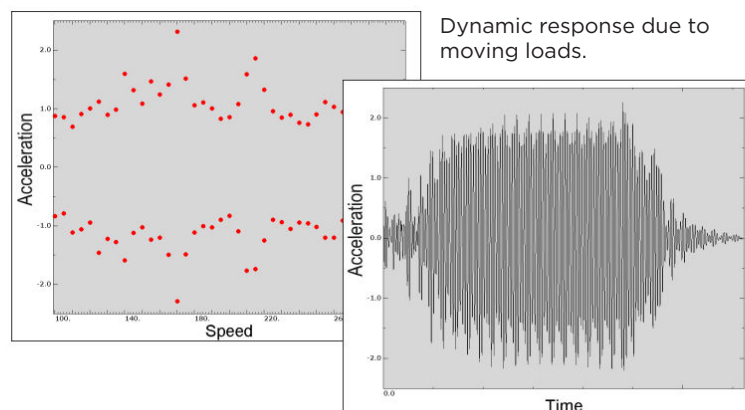
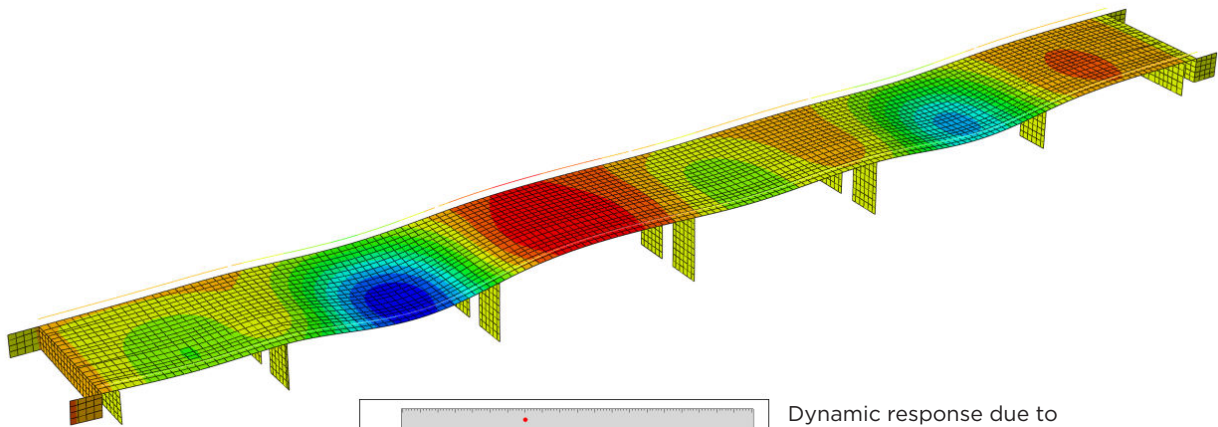
Integrated libraries of predefined loads and load combinations.

BRIGADE allows for analyses of prestressing effects. The alignments of longitudinal and transversal tendons are easily defined. Short-term losses due to friction, wobble and anchorage are calculated automatically. Long-term losses due to shrinkage, creep and relaxation can be defined based on the calculated stresses in the concrete and tendons.

The load combination capability in BRIGADE is specially designed for the needs within bridge engineering. It automatically takes into account whether loads are permanent or variable and if they induce adverse or relieving effects on the structure. Load combinations can be user-defined or imported from an integrated library of predefined load combinations in accordance with various design codes.

MODELING CAPABILITIES

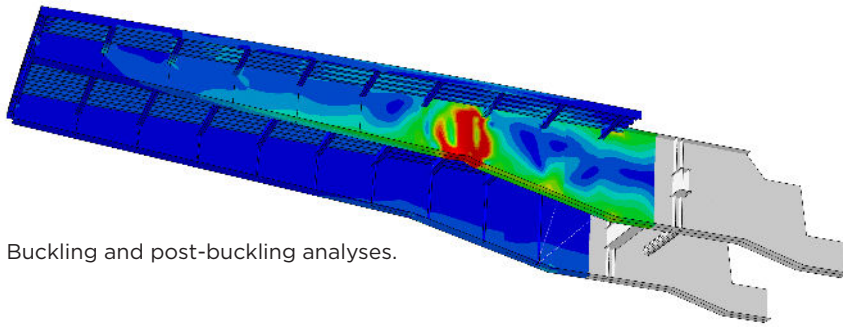
BRIGADE includes a market-leading technique for evaluation of the static response due to moving loads. The technique is based on influence surfaces and mesh-independent traffic lane alignments. Vehicles can consist of axles with fixed or variable internal distances in combination with moving surface loads.



Multiple simultaneous vehicles in different lanes are handled automatically. Vehicles can be created manually or generated from a library of design code specific vehicles e.g. the Eurocodes with various National Annexes.

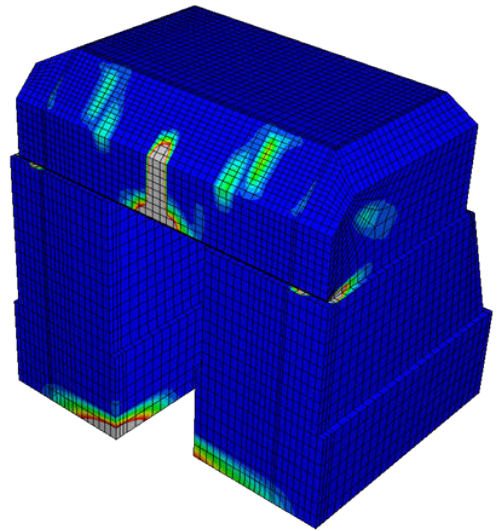
In addition, BRIGADE/Plus offers efficient analysis of the dynamic response due to moving loads. Predefined high-speed trains according to the Eurocodes are provided as well as the possibility to create user-defined vehicles. The vehicles are analyzed for a user-defined set of speeds. Results are automatically enveloped in order to enable efficient evaluation and reporting.

ANALYSIS CAPABILITIES

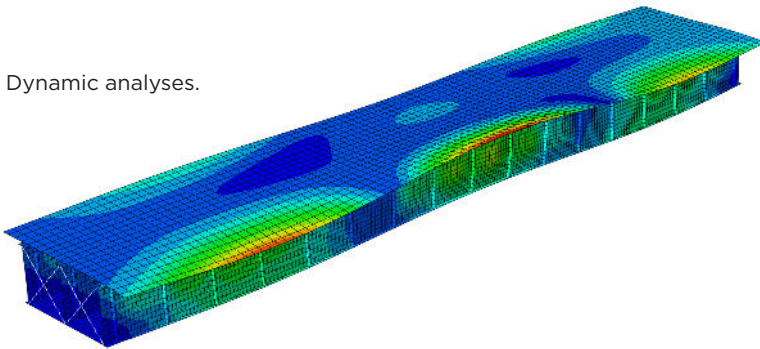


Buckling and post-buckling analyses.

Collapse analysis using non-linear material definition of concrete.



Dynamic analyses.



Analysis Procedures

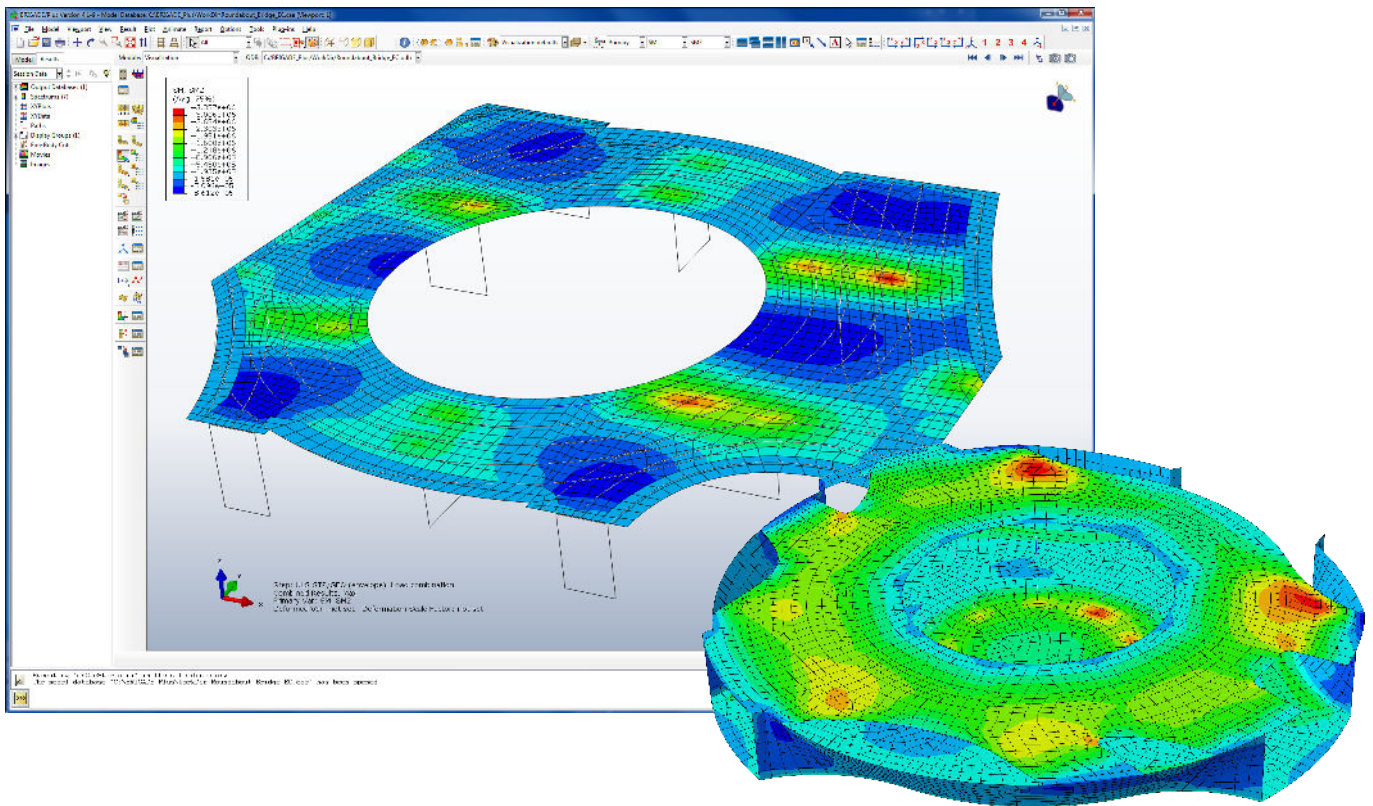
BRIGADE offers a wide range of analysis procedures:

- Linear and nonlinear static response
- Eigenvalue buckling
- Unstable collapse and post buckling
- Natural frequency extraction
- Modal dynamic time history
- Implicit dynamic time history
- Steady-state dynamic response
- Random response
- Time dependent creep and shrinkage analysis
- Segmental construction analysis
- Submodel analysis
- Transient heat transfer analysis
- Steady-state heat transfer analysis
- Sequentially coupled thermal-stress analysis

Special Analysis Techniques

BRIGADE includes several advanced analysis techniques such as the “Free Body Cut” technique that enables an automatic calculation of the resulting beam section forces for user-defined sections in shell and solid models. This technique is available for all types of loads including moving traffic loads.

ANALYSIS CAPABILITIES



Non-linear Capabilities

BRIGADE/Plus offers a wide range of advanced non-linear capabilities including geometrical non-linearity, non-linear material behavior as well as contact interactions. The library of constitutive models includes e.g. concrete, metals, Drucker-Prager and Drucker-Prager/Cap. Material behavior includes temperature and strain rate dependency.

BRIGADE/Plus offers a robust contact capability. Contact can be defined between two deformable bodies or between a deformable body and a rigid surface.

- Element- or node-based contact surfaces
- Hard or softened contact
- Small or finite sliding formulation
- Frictional behavior
- Damping

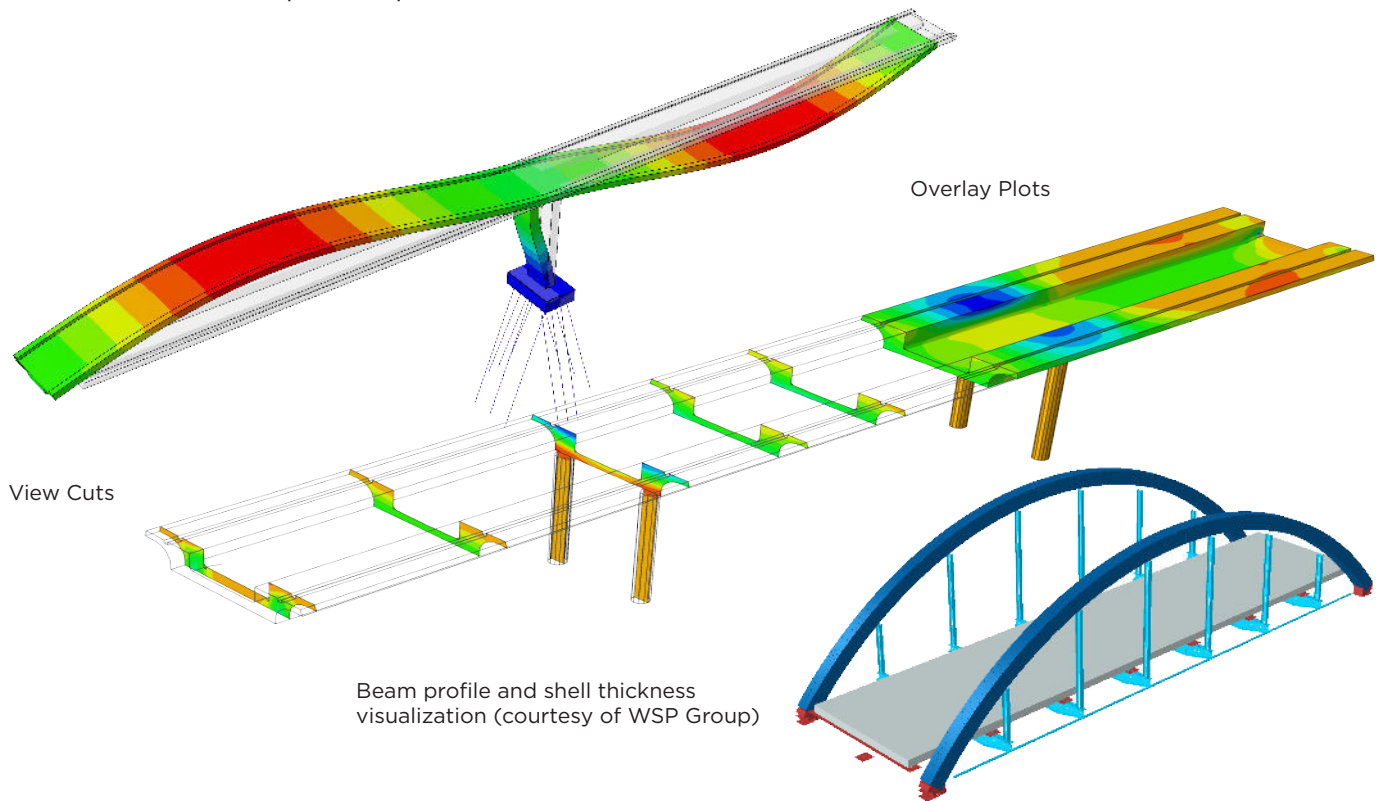
Solver

BRIGADE includes an integrated ABAQUS solver from SIMULIA, the world's leading provider of advanced finite element solvers. This assures:

- Accurate and reliable results
- Robust solution of non-linear cases
- Efficient solution of large models

POST-PROCESSING CAPABILITIES

BRIGADE includes a complete range of post-processing capabilities including a plot control panel where sets of results easily can be created, plotted and reported. Results from the same analysis can be visualized in multiple viewports.



Result plots can be animated and screenshots can be exported to various file formats.

BRIGADE offers a wide range of result plots:

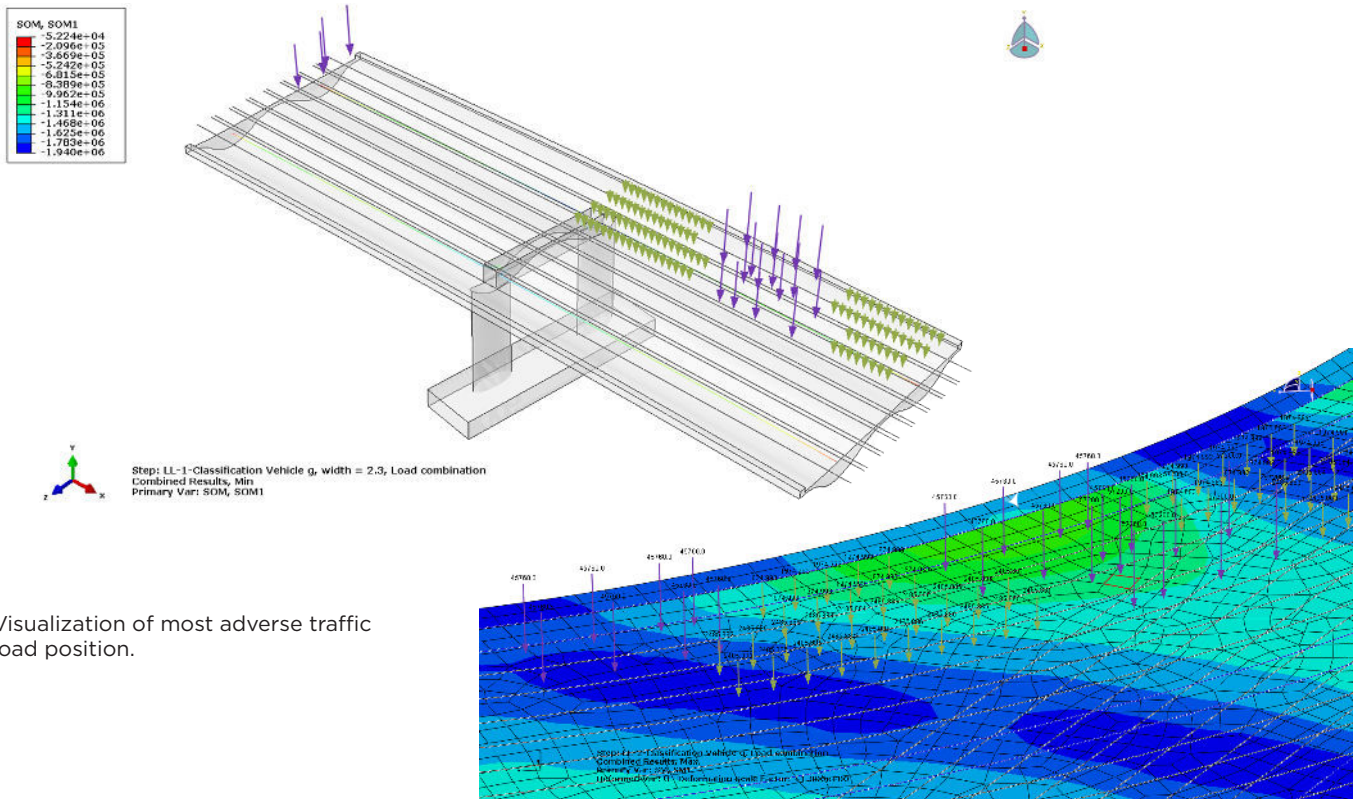
- Contour plots
- Vector plots
- Deformation plots
- Overlay plots
- View cuts
- Iso-surface plots
- XY diagram plots
- Critical moving load position plots

In addition, important model properties can be visualized, such as:

- Beam profile and shell thickness
- Material orientation
- Load position and intensity

POST-PROCESSING CAPABILITIES

BRIGADE offers the possibility to visualize the most critical moving load positions. Choose a point of interest on the structure and a result component and BRIGADE will visualize the moving load position that has been calculated to be the most adverse. This is an easy-to-use feature that facilitates the understanding of the results from the moving load analysis.



Visualization of most adverse traffic load position.

BRIGADE also includes report generators for enabling time efficient creation of input and result reports. The input report includes a complete description of the model geometry, material properties, loading, boundary conditions etc. The result report is based on a userdefined set of results that can contain an arbitrary number of load cases, load combinations, result components etc.

The required reinforcement in Ultimate and Serviceability Limit State can be calculated using the add-on module ConcreteDesigner. The calculations are carried out in accordance with the requirements in the Eurocodes. In Serviceability Limit State the design of reinforcement is based on a crack width limit criteria. Reinforcement in slabs can be orthogonal or non-orthogonal.

FEATURE OVERVIEW
Modeling Concept

	Standard	Plus
Parametric modeling of conventional bridge structures	○	○
General feature based geometry modeling		○
CAD import/export		○
Scripting		○

Element Library

Beam elements	○	○
Truss elements	○	○
Shell elements	○	○
Membrane elements		○
Solid elements		○
Spring elements	○	○
Dashpots		○
Connector elements		○
Rigid elements		○
Mass elements		○

Analysis Procedures

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		○

FEATURE OVERVIEW

Loading

Standard

Plus

Libraries of permanent and variable loads in accordance with various design codes	<input type="checkbox"/>	<input type="checkbox"/>
Fully automatic analysis of static response due to moving loads	<input type="checkbox"/>	<input type="checkbox"/>
Fully automatic analysis of dynamic response due to moving loads	<input type="checkbox"/>	<input type="checkbox"/>
Libraries of predefined vehicles in accordance with various design codes	<input type="checkbox"/>	<input type="checkbox"/>
Pre-stressing using tendons with arbitrary alignment	<input type="checkbox"/>	<input type="checkbox"/>
Calculation of pre-stress losses	<input type="checkbox"/>	<input type="checkbox"/>
Advanced load combination algorithms	<input type="checkbox"/>	<input type="checkbox"/>
Libraries of predefined load combinations in accordance with various design codes	<input type="checkbox"/>	<input type="checkbox"/>

Non-linear Capabilities

Geometric non-linearity (large deflections and rotations)	<input type="checkbox"/>
Material non-linearity (concrete, metals, Drucker-Prager etc)	<input type="checkbox"/>
Contact interaction (hard or softened, damping, friction)	<input type="checkbox"/>

Post-processing

Contour plots	<input type="checkbox"/>	<input type="checkbox"/>
Deformation plots	<input type="checkbox"/>	<input type="checkbox"/>
XY diagram plots	<input type="checkbox"/>	<input type="checkbox"/>
Vector plots	<input type="checkbox"/>	<input type="checkbox"/>
Tick mark plots	<input type="checkbox"/>	<input type="checkbox"/>
Overlay plots	<input type="checkbox"/>	<input type="checkbox"/>
View cuts	<input type="checkbox"/>	<input type="checkbox"/>
Visualization of critical traffic load positions	<input type="checkbox"/>	<input type="checkbox"/>
Beam profile and shell thickness visualization	<input type="checkbox"/>	<input type="checkbox"/>
Tabulated results	<input type="checkbox"/>	<input type="checkbox"/>
Animation of results	<input type="checkbox"/>	<input type="checkbox"/>
Input report generator	<input type="checkbox"/>	<input type="checkbox"/>
Result report generator	<input type="checkbox"/>	<input type="checkbox"/>

SUPPORT & SERVICES

TECHNIA have highly qualified simulation engineers that offer:

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