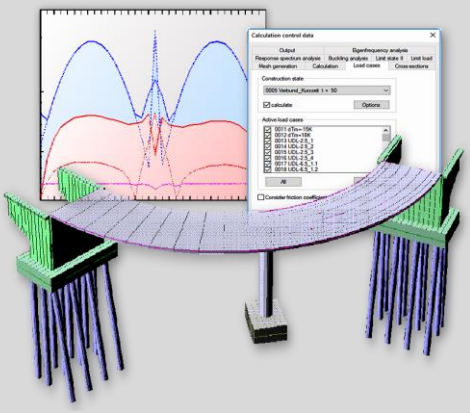
Product Information **Structural engineering**

Product Information PB 390 | 02.2022

PONTI®

High-performance FEM system for building construction and solid bridges
11.10.490 PONTI ® Compact
11.10.491 PONTI ®
11.10.492 PONTI ® EXPERT

FEM system for solid bridges incl. TRIMAS®



- **Efficient design according to DIN technical report, ÖNorm and Eurocode**
- **Fast and safe processing of bridge systems on the basis of axial data**
- **Simple acquisition of the building history of construction stages via subsystem allocations**
- **Simplified usage of templates for cross sections, superstructure systems and tendons**
- **Efficient analysis and design of complex, spatial overall models**

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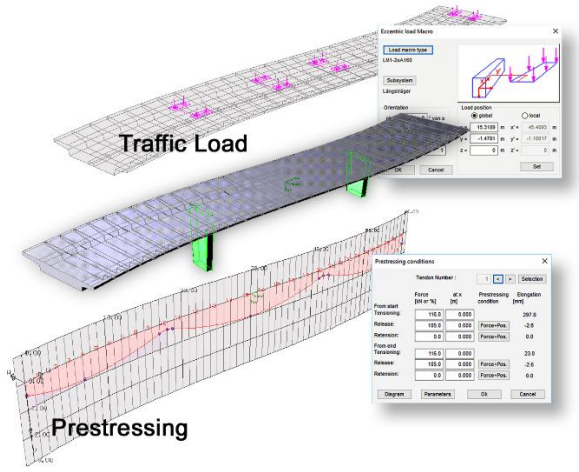
PONTI® EXPERT

Continuous software solutions for solid reinforced concrete bridges in accordance with DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT. The Windows®-oriented working environment supports graphically interactive input, analysis and evaluation for beam, slab, wall and general shell structures. The application contains the following input, calculation and design options:



TRIMAS® fem:

- Usage of templates for user-defined programme configuration
- Filter functions for the specific processing of structure types, e.g. grid, plane frame, plates etc.
- Interfaces for ZEICON®, 3D-DXF, DIAMO as well as different point and axial data formats, e.g. DA040
- Parameterised standard profiles for all applications
- Profile database for standard profiles in steel construction
- Material database for concrete, wood, steel and soil materials that comply with the standards, as well as option to input self-defined material characteristics
- Working environment for 3D constructions with straights, clothoids, circular arcs, polygons and splines
- Processing of the structure geometry in arbitrary construction planes
- Measuring functions, text functions and chain dimensioning
- Names of positions and objects, object descriptions and texts
- Model-oriented mesh generation and beam generation
- Support of a continuous and consistent h- or p-refinement in the FE meshing
- High-quality triangle and rectangle elements for slabs, plates and shells according to the Reissner-Mindlin Theory of realistic structure models (incl. shear deformations)
- Truss elements and beam elements according to the Timoshenko Theory of realistic framework models (incl. shear deformations)
- Modern element library with linear and quadratic element shape functions
- Exact acquisition of bar construction and shell curvature
- Subsystem technique (layer technique) for a clear spatial structure modelling

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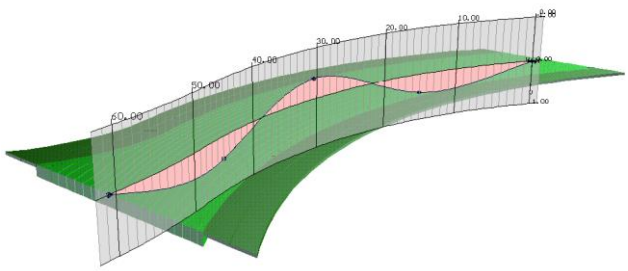
- 3D visualisation with lighting effects
- Acquisition of the orthotropic bearing behaviour of element and ribbed slabs as well as material orthotropy
- Option to process arbitrarily haunched cross-sectional distributions and effective widths of girders
- Definition of haunches in the cases of slabs, plates and shells
- Eccentric connections for bar and plane structures
- Definition of component-independent attribute areas for material, cross section and bedding
- Simple definition of free line joints, edge joints and bar hinges with/without stiffnesses
- Elastic bedding with loss of bedding in the cases of pressure and tension
- Definition of component-independent point, line and area loads with efficient copying and generation functions
- Eccentric beam loads
- Definition of areas of loading for a fast generation of load models
- Free definition of load macros and efficient generation of load arrangements for variable loads



- Efficient result evaluation for deformations, bearing forces, stress resultants, stresses and design results
- Visualisation of the results at line cuts and 3D sections
- Output of component-oriented result diagrams and list outputs
- Visualisation of the results as isolines and isoareas as well as trajectory figures
- Automatic and user-defined load case and Reinforcement steel (As) superposition
- Efficient superposition model for all result quantities with code-related, component and user-defined submittals
- ULS for bending and normal force according to DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT for beams, slabs, plates and shells as well as for downstand and suspender beams
- ULS for shear force according to DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT for beams, slabs and shells as well as for downstand and suspender beams
- ULS for torsion according to DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT for beams as well as for downstand and suspender beams
- ULS for punching (rebars or Shear dowel as HALFEN, DEHA) according to DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT
- SLS for general stress analyses in beams as well as slabs, plates and shells

Processing of bridge cross sections according to the requirements of the DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT:

- Open and closed, polygonal thick-walled cross sections with an arbitrary outline
- Homogeneous bridge cross sections and compound cross sections
- Evaluation of the total cross section values and the effective cross section values
- Result diagrams for geometry with dimensions, chord thicknesses and effective widths, principal axes

Programme component RTconstruction stages for the treatment of advancing and deconstruction stages of general structural and bridge constructions:

- Graphical input of the construction phases via subsystems with the respective administration
- Visualisation of the construction phases in order to control the building history
- Simple allocation of load and building stages via subsystems
- Arbitrary definition of construction stages via alteration of materials, cross sections, bearings etc.
- Modification of hinge or joint properties
- Adding/removing of parts of the structure

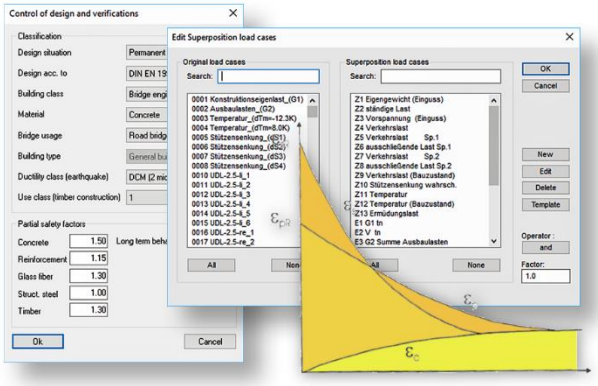
Programme component for framed structures with Windows®-oriented working environment for the geometrically non-linear analysis of structures:

- Consistently linearised element formulation for the acquisition of the geometrically non-linear structural behaviour (theory of 2nd to 3rd order)
- Standardised non-linear formulation in all element types
- Element method for bar elements includes failure of buckling and flexural-torsional buckling
- Element load for bar elements with arbitrary position of load action
- Exact acquisition of the component curvature and the shear ratio in non-linear calculation
- Complete coupling of bending and torsion in the case of bar elements
- Consideration of failure of tension/pressure in the case of truss bars with graphical display of the failed elements

Programme component for general structures with Windows®-oriented working environment and graphically interactive input of internal or external tendons:

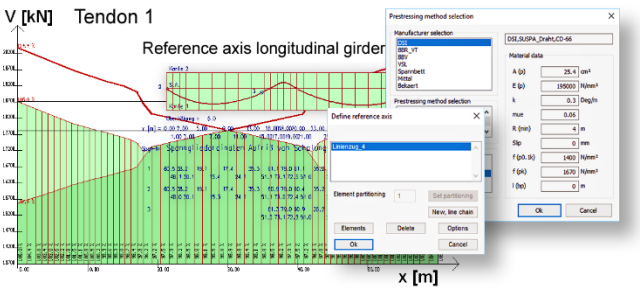
- Graphically interactive input of spatially bent tendons for arbitrary reference axes
- Bonded/unbonded prestress, exclusively or in mixed prestressed construction projects
- Independent processing of tendons in ground plan and vertical section
- Powerful and efficient alteration functions for geometry and tensioning force
- Standard curves for internal and external prestressing
- Processing of placement of tendons in different advancing and retreating stages
- Database for all established prestressing methods
- Presettings of arbitrary anchorage and coupling conditions

- 4 different stress conditions at each end of the tendons; prestressing, abatement, stressing and anchoring with wedgeslip
- Acquisition of prestress force diagrams considering the stress conditions and the friction losses
- Output of change of direction and stress resultants Vo, V´, Vtotal
- Output of the tendon curvatures, lengths and information per tensioning strand
- Output of the stress instructions including extensions and weight of prestressed steel
- Acquisition of a DXF plan for the placement of tendons



The following calculation and design methods are performed in the limit states of bearing capacity and in the limit states of serviceability and durability, according to DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT:

- Prestressing with or without bond or mixed prestressed construction project
- Single-stage or multi-stage prestressing with advancing and retreating construction stages
- Consideration of the production process if produced separately for each construction stage
- Decompression including creep, shrinkage and relaxation
- Limitation of concrete compressive stress
- Limitation of reinforcement steel and prestressed steel tensile stress
- Design decision for the minimum reinforcement in order to avoid wide single cracks
- Design decision for the control of stress in a cracked or uncracked state
- Design decision for completed cracking
- Automatic formation of design forces
- Minimum surface reinforcement



- Analysis of robustness reinforcement
- Analysis of single crack width
- Completed analysis of crack width– simplified and as a direct analysis
- Stress limitation for concrete and reinforcement steel in a cracked state
- Bearing capacity due to biaxial bending and normal force
- Bearing capacity and referring compressive zone conditions
- Bearing capacity as a result of fatigue due to bending by normal force (reinforcement steel, prestressed steel and concrete)
- Analysis and design of coupling joints
- Bearing capacity as a result of shear force and torsion
- Bearing capacity as a result of fatigue due to lateral force and torsion
- Limitation of shear cracking due to principal tensile stresses in the uncracked cross section
- Result diagrams including limit stress lines and optimisation hints for all stress analyses
- Interactive graphical analysis of details for the longitudinal and latitudinal reinforcement
- Result documents in accordance with requirements issue 504
- Document output in RTF format according to user's requirements
- The design in the transverse direction of the bridge deck can be carried out for beam or shell behaviour

With the Programme component for SLS design in structural and bridge engineering for plane structures for general plate and shell structures the entire program system is extended for analysis in limit states of serviceability and fatigue at plane structures according to DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT:

- Graphically interactive input of design parameters for ULS and SLS analyses
- Analysis control with automatic formation of the relevant design forces
- Evaluation of the minimum surface reinforcement
- Evaluation of the robustness reinforcement
- Minimum reinforcement in order to avoid wide individual cracks – individual crack width analysis
- Completed crack width analysis – as simplified and as direct analysis
- Limitation of stress for concrete and reinforcement steel in a cracked state
- Bearing capacity resulting from fatigue due to bending with normal force for concrete and reinforcement steel
- Evaluation of deformations in condition II for plane structures mainly strained due to bending
- Consideration of the concrete age for "early" or "late" forced strain
- Consideration of requirements for waterproof concrete
- Consideration of requirements of the ZTV-ING tunnel construction directive
- Acquisition of the requirements even for thick structural components
- Can be applied in structural and bridge engineering
- Interactive graphical evaluations with overview of ULS and SLS analyses
- Result documents according to requirements issue 504
- Document output in RTF format according to user's requirements

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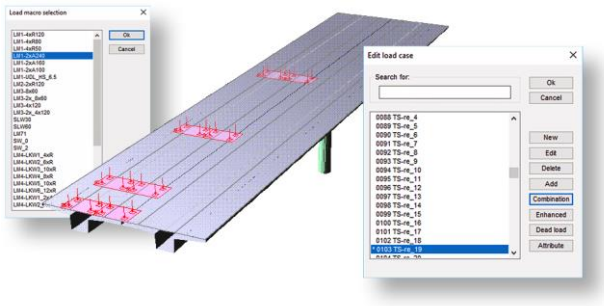
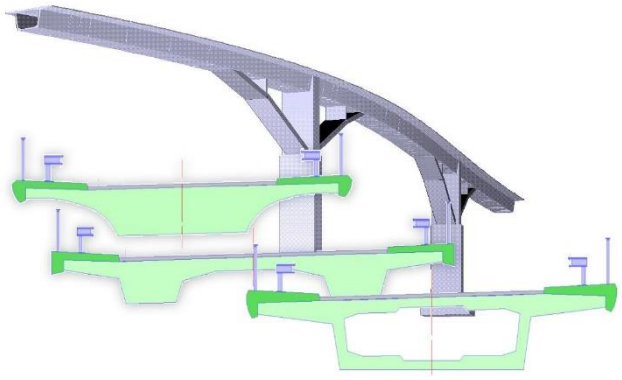
PONTI®

Continuous software solutions for solid reinforced concrete bridges in accordance with DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT. The application supports the following input, calculation and design options for beam constructions:

- Usage of templates for user-defined programme configurations
- Filter function for specific processing of structure types, e.g. grid, flat frame
- Interfaces for ZEICON®, 3D-DXF, DIAMO, as well as different point and axis data formats, e.g. DA040
- Parameterised standard profiles for all applications
- Profile databases for standard profiles in steel construction
- Material database for concrete, wood, steel materials that comply with the standards, as well as input option for self-defined material properties
- Working environment for 3D constructions with straights, clothoids, circular arcs, polygons and splines
- Processing of structure geometry in arbitrary construction planes
- Measuring functions, text functions and chain dimensioning
- Names of positions and objects, object descriptions and texts
- Model-oriented beam generation
- Truss components and beam elements according to Timoshenko's Theory for realistic framework models (incl. shear deformations)
- Modern element library with linear and quadratic element shape functions
- Exact representation of framework curvature
- Subsystem technique (layer technique) for clear spatial structure modelling
- 3D visualisation with the help of lighting effects
- Option to process arbitrarily haunched cross-sectional distributions and effective width of girders
- Eccentric connections
- Simple definition of bar end hinges with/without stiffnesses
- Elastic bedding with loss of bedding due to pressure and tension
- Definition of point and line loads that are independent of structural components and have efficient copying and generation functions
- Arbitrary beam loads
- Eccentric load macros
- Free definition of load macros and efficient generation of load arrangements for variable loads



- Powerful result evaluation for deformations, support forces, stress resultants, tensions and design results
- Output of component-oriented result diagrams and list outputs
- Automatic and user-defined load case and reinforcement steel (As) superposition
- Efficient superposition module for all result parameters with code-related, component and user-defined templates
- ULS (Ultimate Limit State) for bending and normal force according to DIDIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT for beams as well as downstand and suspender beams
- ULS (Ultimate Limit State) for lateral force according to DIDIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT for beams as well as downstand and suspender beams
- ULS (Ultimate Limit State) for torsion according to DDIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT for beams as well as downstand and suspender beams



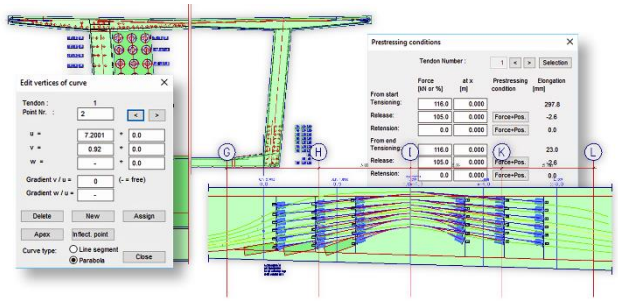
Processing of bridge cross sections according to the requirements of the DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT:

- Open and closed, polygonal thick-walled cross sections with an arbitrary outline
- Homogeneous bridge cross sections and compound cross sections
- Evaluation of the total cross section values and the effective cross section values
- Result diagrams for geometry with dimensions, chord thicknesses and effective widths, principal axes

The following calculation and design methods are performed in the limit states of bearing capacity and in the limit states of serviceability and durability, according to the DIN technical reports, EC and ÖNorm:

- Prestressing with or without bond or mixed prestressed construction project
- Single-stage or multi-stage prestressing with advancing and retreating construction stages
- Consideration of the production process if produced separately for each construction stage
- Decompression including creep, shrinkage and relaxation

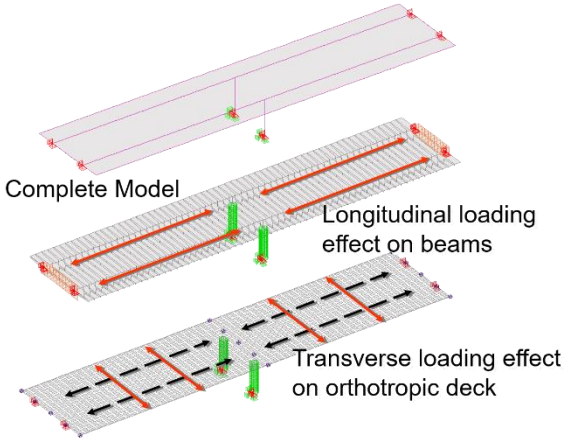
- Limitation of concrete compressive stress
- Limitation of reinforcement steel and prestressed steel tensile stress
- Design decision for the minimum reinforcement in order to avoid wide single cracks
- Design decision for the control of stress in a cracked or uncracked state
- Design decision for completed cracking
- Automatic formation of design forces
- Minimum surface reinforcement
- Analysis of robustness reinforcement
- Analysis of single crack width
- Completed analysis of crack width– simplified and as a direct analysis
- Stress limitation for concrete and reinforcement steel in a cracked state
- Bearing capacity due to biaxial bending and normal force
- Bearing capacity and referring compressive zone conditions
- Bearing capacity as a result of fatigue due to bending by normal force (reinforcement steel, prestressed steel and concrete)
- Analysis and design of coupling joints
- Bearing capacity as a result of shear force and torsion
- Bearing capacity as a result of fatigue due to lateral force and torsion
- Limitation of shear cracking due to principal tensile stresses in the uncracked cross section
- Result diagrams including limit stress lines and optimisation hints for all stress analyses
- Interactive graphical analysis of details for the longitudinal and latitudinal reinforcement
- Result documents in accordance with requirements issue 504
- Document output in RTF format according to user's requirements



PONTI® COMPACT

Continuous software solutions for reinforced concrete bridges in accordance with DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT. The Windows®-oriented working environment supports graphically interactive input, calculation and evaluation for general beam, slab, wall and shell structures. The application contains the following input, calculation and design options for General plane and spatial FEM system including framed structures:

- Usage of templates for user-defined programme configuration
- Filter functions for the specific processing of structure types, e.g. grid, plane frame, plates etc.
- Interfaces for ZEICON®, 3D-DXF, DIAMO as well as different point and axial data formats, e.g. DA040
- Parameterised standard profiles for all applications
- Profile database for standard profiles in steel construction
- Material database for concrete, wood, steel and soil materials that comply with the standards, as well as option to input self-defined material characteristics
- Working environment for 3D constructions with straights, clothoids, circular arcs, polygons and splines
- Processing of the structure geometry in arbitrary construction planes
- Measuring functions, text functions and chain dimensioning
- Names of positions and objects, object descriptions and texts
- Model-oriented mesh generation and beam generation
- Support of a continuous and consistent h- or p-refinement in the FE meshing
- High-quality triangle and rectangle elements for slabs, plates and shells according to the Reissner-Mindlin Theory of realistic structure models (incl. shear deformations)
- Truss elements and beam elements according to the Timoshenko Theory of realistic framework models (incl. shear deformations)
- Modern element library with linear and quadratic element shape functions
- Exact acquisition of bar construction and shell curvature
- Subsystem technique (layer technique) for a clear spatial structure modelling
- 3D visualisation with lighting effects
- Acquisition of the orthotropic bearing behaviour of element and ribbed slabs as well as material orthotropy
- Option to process arbitrarily haunched cross-sectional distributions and effective widths of girders
- Definition of haunches in the cases of slabs, plates and shells
- Eccentric connections for bar and plane structures
- Definition of component-independent attribute areas for material, cross section and bedding
- Simple definition of free line joints, edge joints and bar hinges with/without stiffnesses
- Elastic bedding with loss of bedding in the cases of pressure and tension
- Definition of component-independent point, line and area loads with efficient copying and generation functions
- Eccentric beam loads
- Definition of areas of loading for a fast generation of load models



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- Free definition of load macros and efficient generation of load arrangements for variable loads
- Efficient result evaluation for deformations, bearing forces, stress resultants, stresses and design results
- Visualisation of the results at line cuts and 3D sections
- Output of component-oriented result diagrams and list outputs
- Visualisation of the results as isolines and isoareas as well as trajectory figures
- Automatic and user-defined load case and Reinforcement steel (As) superposition
- Efficient superposition model for all result quantities with code-related, component and user-defined submittals
- ULS for bending and normal force according to DDIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT for beams, slabs, plates and shells as well as for downstand and suspender beams
- ULS for shear force according to DDIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT for beams, slabs and shells as well as for downstand and suspender beams
- ULS for torsion according to 1DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT for beams as well as for downstand and suspender beams
- ULS for punching (rebars or Shear dowel as HALFEN, DEHA) according to DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT
- SLS for general stress analyses in beams as well as slabs, plates and shells

Beyond the previous program options PONTI® COMPACT also includes the program option RTsls-building&bridge for SLS analyses in structural and bridge engineering for plane structures according to DDIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT. The following analyses are available for TRIMAS® and PONTI® for plane structures:

- Graphically interactive input of design parameters for ULS and SLS analyses
- Analysis control with automatic formation of the relevant design forces
- Evaluation of the minimum surface reinforcement
- Evaluation of the robustness reinforcement
- Minimum reinforcement in order to avoid wide individual cracks – individual crack width analysis
- Completed crack width analysis – as simplified and as direct analysis
- Limitation of stress for concrete and reinforcement steel in a cracked state
- Bearing capacity resulting from fatigue due to bending with normal force for concrete and reinforcement steel
- Evaluation of deformations in condition II for plane structures mainly strained due to bending

The option SLS analyses in structural and bridge engineering according to DIN 1045, DIN 1045-1, DIN technical report 102, EC2 and EN 1992 and according to national annexes for DE, UK, CZ/SK, AT enhances the basic system TRIMAS® fem for the processing of serviceability observations. The fully graphically interactive processing enables fast familiarisation and provides the following advantages:

- Simple input of design parameters
- Consideration of the concrete age for “early“ or “late“ forced strain
- Consideration of requirements for waterproof concrete
- Consideration of requirements of the ZTV-ING tunnel construction directive
- Acquisition of the requirements even for thick structural components
- Can be applied in structural and bridge engineering
- Interactive graphical evaluations with overview of LSBC and LSS analyses
- Result documents according to requirements issue 504
- Document output in RTF format according to user’s requirements