

[ Product Information 2008 ]

| SOFiSTiK  
Finite Element Software

| SOFiCAD  
CAD for Structural Detailing



## Finite Element Software

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## Dialogue creates added value

The SOFiSTiK AG develops high-quality and sustainable software solutions for structural engineering. Hereby we guarantee your competitiveness and success.

The vital basis for a fruitful and lasting relation is the dialogue with our clients – together with you as one team, we would like to master the daily demands of your engineering work.

Even the best software is only profitable for you, if you can start working with it immediately and receive the optimum of quality. Therefore the SOFiSTiK Academy offers more than just training “off the peg”. We will also show you, in addition to any standard analysis, how to realize your individual project and how to maintain constantly perfect time- and cost-control within your project management.

Your benefit working with us:

- Scalable FEA and CAD solutions tailored to your demands
- Exclusive hotline and support for competent and fast problem solving
- Web-access via customer interaction center to the SOFiSTiK information pool
- Internet user forum
- Consulting, project planning and installation of hardware – including networks
- Regular product information through road shows, trade fairs, internet and newsletters
- Yearly user's conference with presentations, case studies and workshops
- And of course – you have one individual contact person

### Our partners

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## Innovation through tradition

Already in 1973 several German civil engineers began to develop a software package, which should be specialized in supporting the design process in civil and structural engineering by the use of “modern” computers. In 1999 a merger between the individual engineering offices and the marketing company formed the corporation SOFiSTiK AG. This was only the beginning of an ongoing success story in high-end civil engineering software. Until today, we have managed to become one of the world’s leading software suppliers in the field of civil engineering.

We are very proud of our international team of structural engineers, computer scientists, experienced technicians and professional draftsmen. We work closely together with computer- and building scientists from academia as well as with other engineers in interdisciplinary development teams.

SOFiSTiK is also an active member of national and international associations and societies of our industry and profession: IABSE, IACM, GACM, NAFEMS, IAI, VBI, DBV, BVBS etc.

The largest amount of our revenue is re-invested into research and development to become your profit in the future and ensure your sustainable productivity using the software.

The cornerstones of our development philosophy:

- Our software is always a step ahead.
- Our software is modular, therefore adapted easily to individual requirements.
- Our products are always targeted at the practical application.
- The products are efficient for the everyday use and specialized high-end engineering challenges.

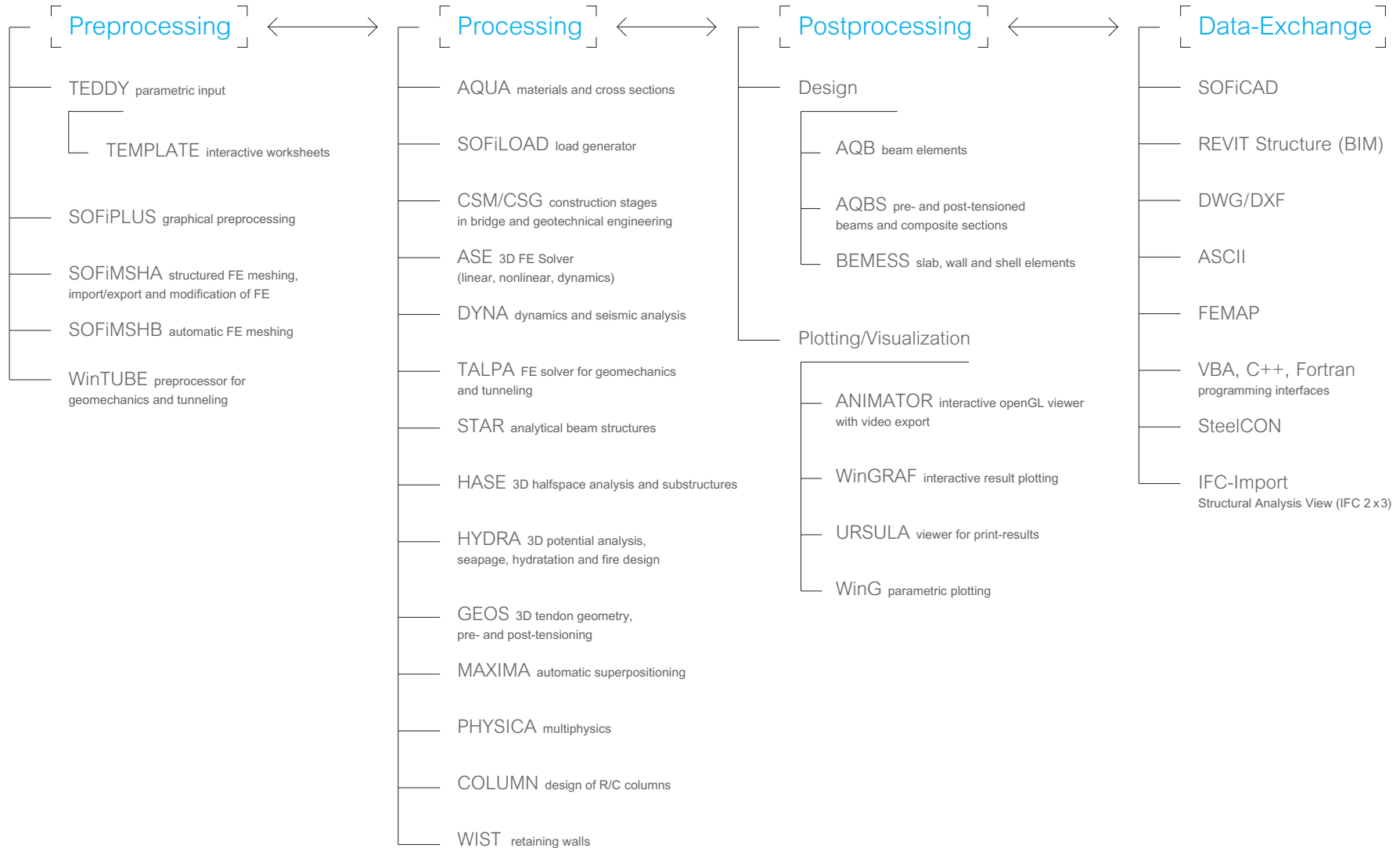
### Certificates

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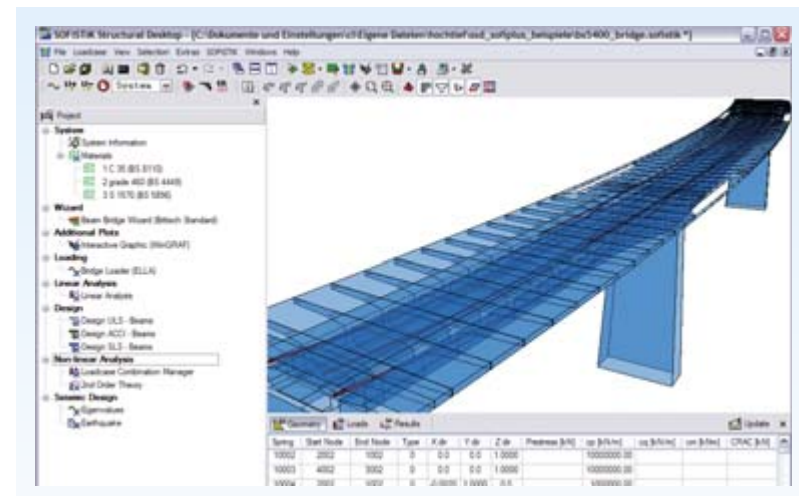
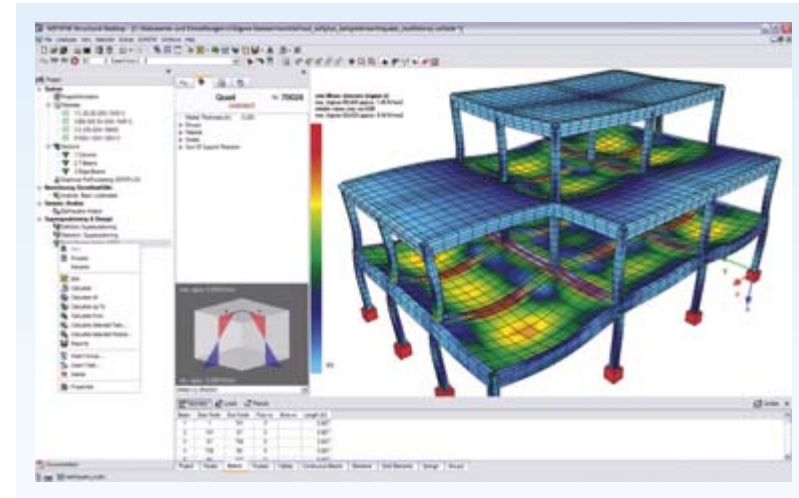
# SOFiSTiK Structural Desktop

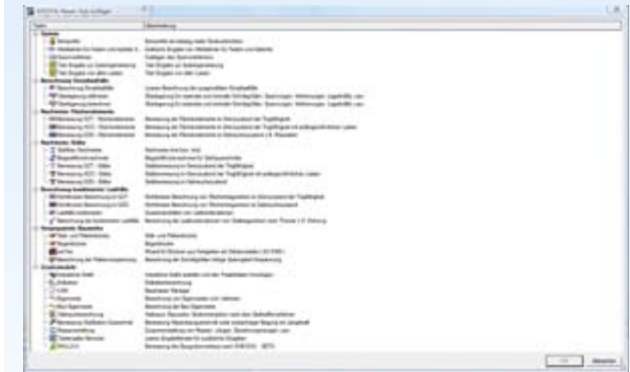
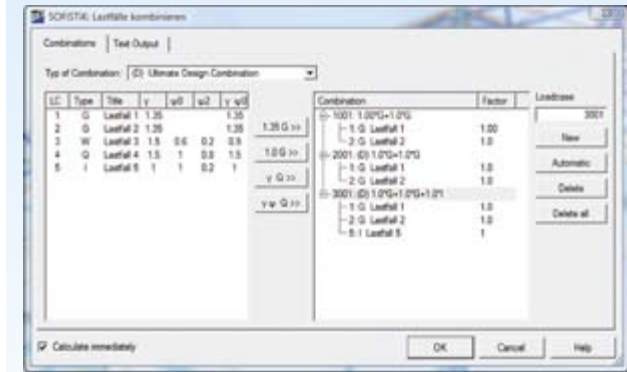
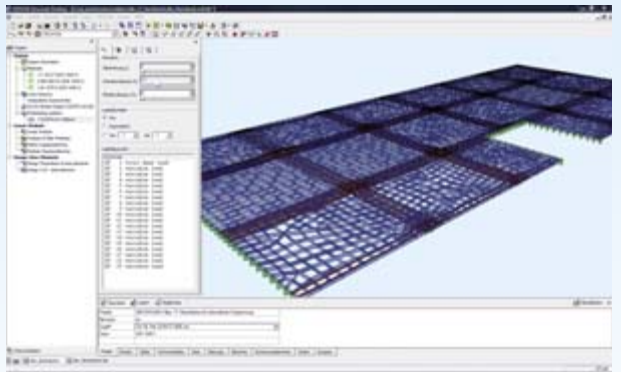
## SOFiSTiK Database/CDB



## SOFiSTiK Structural Desktop-SSD

The SOFiSTiK Structural Desktop (SSD) is SOFiSTiK's modern interactive user interface guiding the user in controlling the various program capabilities. The SSD works in a task-oriented manner by structuring the engineering workflow in tasks that are offered through an extensive Task-Library. This intelligent guidance allows the user to perform everyday and high-end calculations with similar comfort and user friendliness. The SSD allows to combine the flexible parametric CADiNP-Input with interactive modules like the AutoCAD-based SOFiPLUS preprocessor. To avoid any black-box feeling the SSD exports a complete CADiNP ASCII dataset on-demand, enabling the user to take full control of any calculation step and to tweak every program option. Once an engineering workflow has been generated for a specific project the data can be saved as a workflow template to be used as office standard for similar systems and applications. The SOFiSTiK Structural Desktop is included in all SOFiSTiK packages. The availability of the Tasks depends on the individual license situation.





### Task-Library:

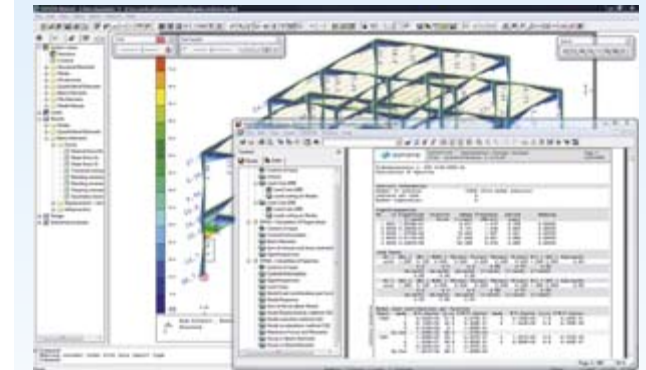
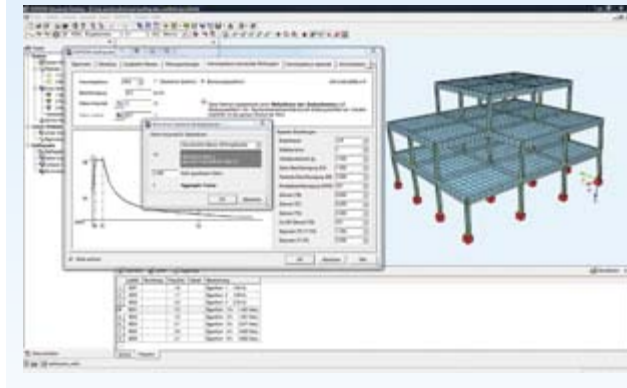
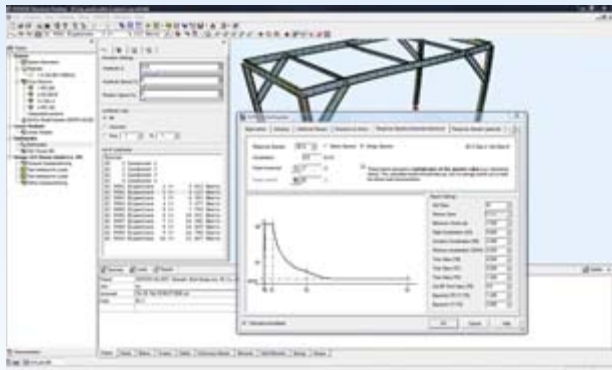
- Library of cross-sections and materials
- Worklaws for springs and implicit beam hinges
- Prestressing systems
- Soil profiles for piles and halfspace
- CAD-based input of cross-sections
- Calculation acc. t. theory of 1st/2nd/3rd order
- Halfspace analysis
- R/C design for beam and shell elements ULS/SLS
- R/C section design (w/o system)
- Steeldesign acc. EC3/DIN 18800 (E-E, E-P)
- Lateral Torsional Buckling
- Eigenvalue analysis
- Buckling analysis
- Loadcombinations

- Material nonlinear analysis for shell elements (Reinforced Concrete, Steel)
- Superpositioning of results
- Summary of masses
- Construction Stage Manager (CSM)
- Excavation pit wall design (WALLS-X)
- Text-Task for including standard CADINP ASCII input
- Revit Structure 2009 Interface

### Wizards:

- Seismic analysis using response spectra
- Post-tensioned beam- and slab bridge including design
- Arch-bridge wizard





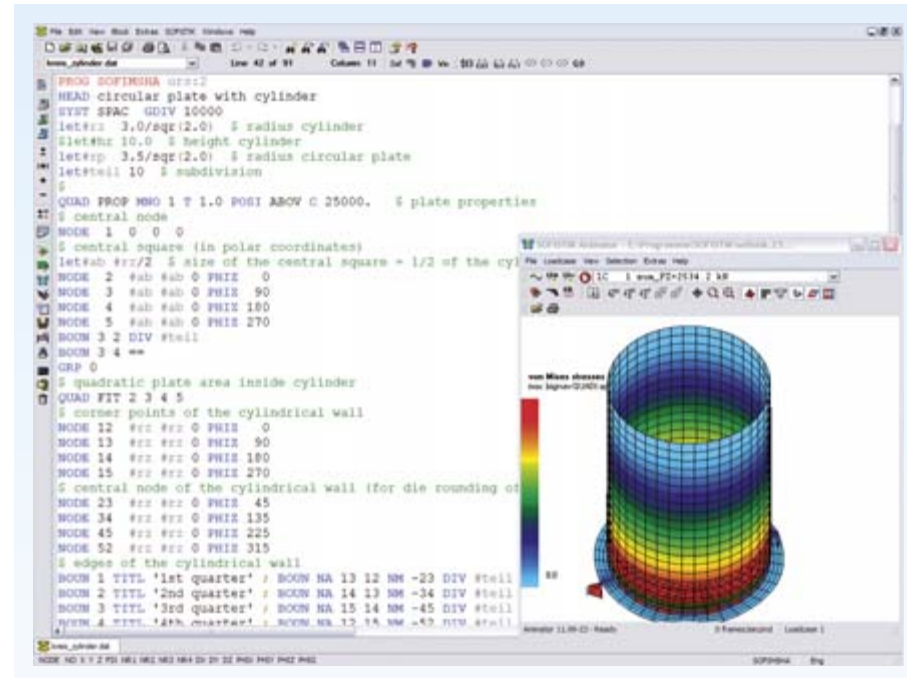
## Earthquake Wizard

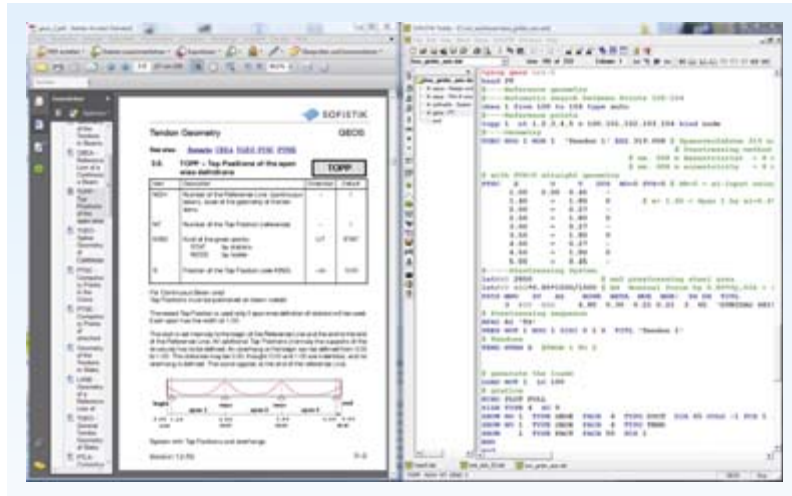
- Seismic analysis using response spectra
- Horizontal and vertical acceleration
- Eigenvalue solvers: simultaneous vector-iteration/ Lanczos/Rayleigh
- Consistent and diagonalized mass matrices
- Library of response spectra e.g. EC8, German DIN 4149, ÖNorm B4015, Swiss SIA 160, US UBC, Indian Standard 1893, Russian SNIP, Chinese GBJ 11.89
- Manual modification of response spectra
- Signed superpositioning of corresponding spectral results
- SRSS,CQC-method and absolute addition

# CADiNP-Parametric Input

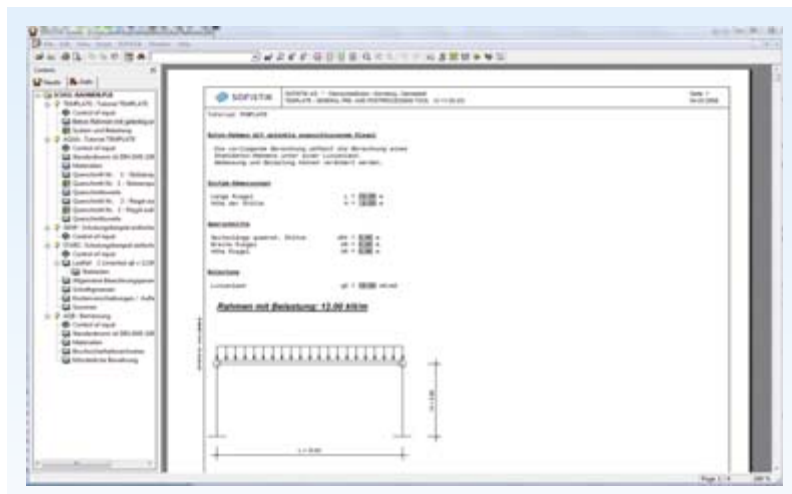
Besides the graphical preprocessing with SOFiPLUS and SSD, SOFiSTiK offers a very powerful text-editor and script language to control the functionality of all modules. Using the SOFiSTiK editor TEDDY allows the engineer to create parametric data-sets for any SOFiSTiK module. The input language CADiNP offers powerful options to generate FE-structures and to control the computation with result output and post-processing.

- Input and control of all SOFiSTiK modules
- Local and global variables and arrays
- Arithmetic operations (LOG, EXP, SIN, COS)
- Loops (LOOP)
- Logical statements (IF, ENDIF, ELSE)
- Direct access to the SOFiSTiK database (@key)
- Simple sketches
- Free comments
- User defined macros
- Line or column-Input
- Archive-Wizard
- Input language German and English
- Powerful search and replace
- Context-sensitive online-manuals (.pdf)
- Interactive worksheets (TEMPLATE)





The major strength of the text-based parametric input is generating regular structures like tanks, frames and pre-cast girders. Data-sets can be used to build up a company database of text-templates being used for standard systems and procedures. SOFiSTiK offers many types of structural systems and tasks as example files that can be modified individually.



# SOFiPLUS - AutoCAD-based Preprocessing

SOFiPLUS is SOFiSTiK's standard pre-processor.

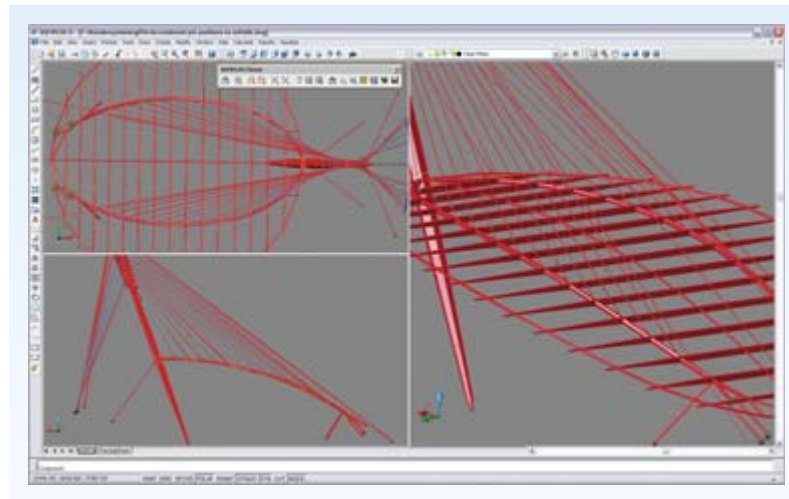
Based on AutoCAD the program takes full advantage of the enhanced AutoCAD modeling-technology enabling the engineer to generate almost any FE-structure – from simple slabs to complicated freeform-surfaces. SOFiPLUS is available as:

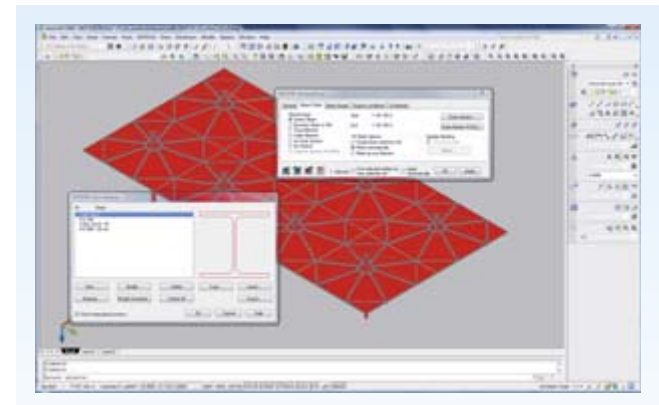
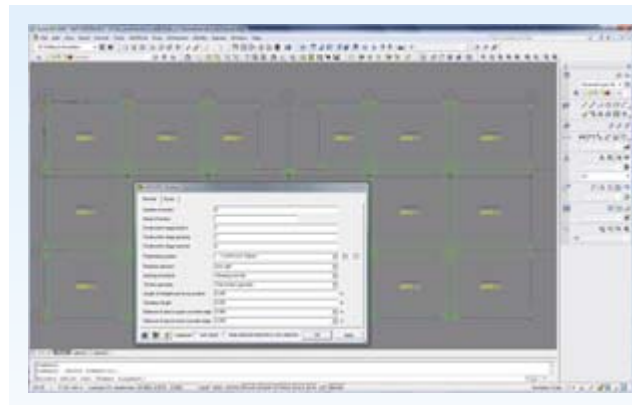
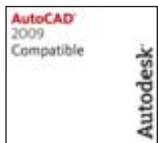
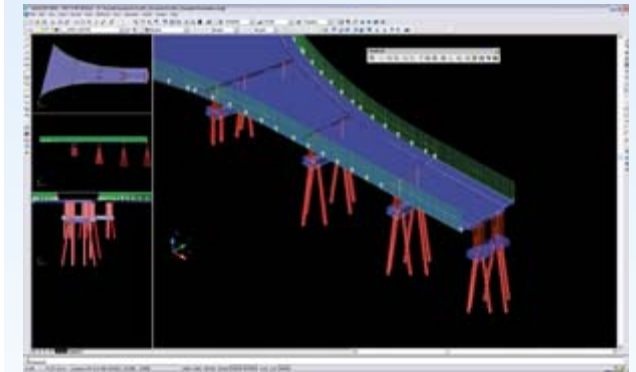
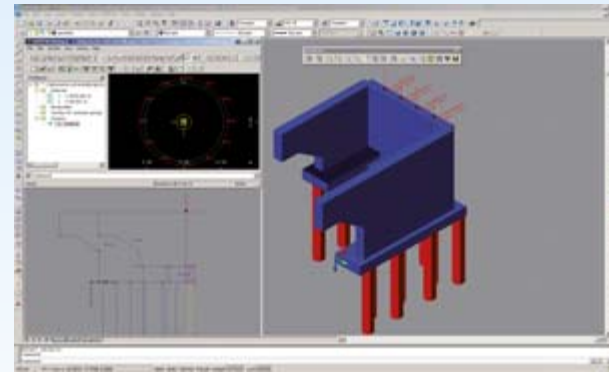
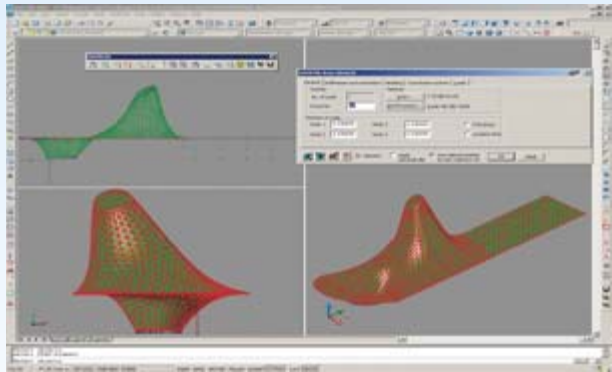
- Add-on to AutoCAD up to 2009
- Stand-alone application SOFiPLUS-X with integrated AutoCAD-Technology

- Automatic distribution of loads along any line, curve or spline
- Free loading, element-loads, volume-loads
- Automatic mesh generator (triangular, quadrilateral elements)
- Graphical tendon input for slabs
- Interactive cross-section generator
- Data-Exchange with Nemetschek (\*.fem)
- DWG/DXF Import/Export

## Features

- Modeling of almost any 3D structure
- 100% AutoCAD compatible
- Use all AutoCAD-commands on SOFiPLUS-elements
- Full integration into the SOFiSTiK Structural Desktop
- Multi Document Environment – keep several projects opened
- Unlimited “undo”-steps
- Import of SOFiSTiK databases
- Full interaction with SOFiSTiK's text-input via TEDDY/CADINP
- Multiple viewports
- Database for materials and cross-sections
- Interactive/automatic superpositioning
- Freeform-Surfaces

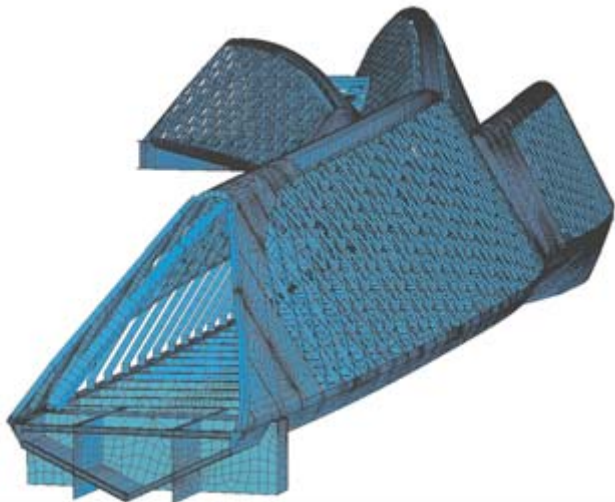




## ASE - 3D FEA

The integrated finite element analysis of 3D structures has become a standard task in structural engineering. SOFiSTiK's flagship ASE provides state-of-the-art FE analysis with high-performance solvers. ASE is the powerful tool to analyze even the most complex and largest structures. ASE systems are entered graphically via SOFiPLUS and the SOFiSTiK Structural Desktop (SSD) as well as with parametric CADINP input.

Depending on the ASE extension linear, nonlinear and time-step analysis of Building-, Steel-, Tunnel-, Bridge- and Membrane-Structures is possible.



### Elements

- 4-noded plate-, disk- and shell-elements with nonconforming shape functions (QUAD)
- Membrane elements
- Volume elements (BRIC)
- Nonlinear contact elements
- Nonlinear bedding elements
- Layered quad-elements for glass and composite material
- Analytical pile elements
- Sophisticated beam elements including haunching, eccentricity and warping torsion
- Cables incl. catenary effects
- Trusses
- Linear and nonlinear springs and dampers
- Implicit beam hinges
- Line/area bedding
- Halfspace
- External stiffness matrices
- Substructures

### ASE Extensions:

ASE Basic:

- Linear analysis
- R/C design of shell elements and standard cross-sections acc. t. DIN, ÖNorm, SIA, EC, BS and other design codes (BEMESS/AQB light)
- Automatic superpositioning (MAXIMA)

ASE 1 (req. ASE Basic)

- Primary loadcases
- Construction stages
- Time dependent effects (Creep, Shrinkage, Relaxation)
- Volume elements
- Eigenvalue analysis
- Enhanced serviceability checks with input of crack width or allowable steel stress

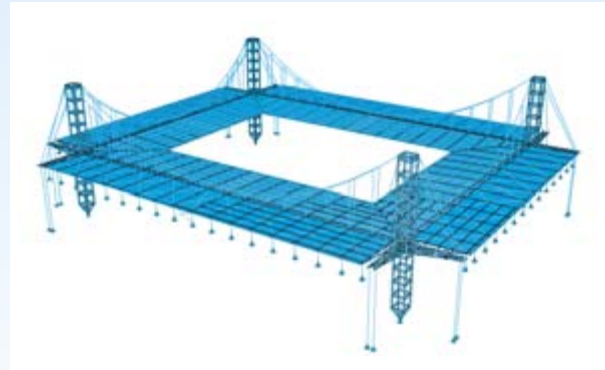
ASE 2 (req. ASE Basic)

- Theory of 2nd order for beam structures
- Nonlinear steel or reinforced concrete beam analysis (req. full AQB license)
- Nonlinear bedding
- Nonlinear spring effects
- Pile elements
- Time-step dynamics



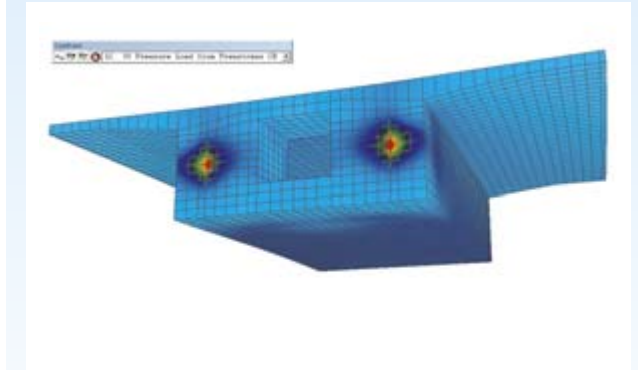
- ASE 3 (req. ASE Basic + ASE 1 + ASE 2)
- Full geometrical nonlinear analysis (Theory 3rd order)
  - Ultimate load iteration
  - Buckling analysis
  - Catenary effects of cables
  - Formfinding

- ASE 4 (req. ASE Basic + ASE 1 + ASE 2)
- Nonlinear material model for steel and reinforced concrete shell elements
  - Various soil models (Drucker-Prager, Mohr-Coulomb, von Mises, etc.)



## Analysis

- Theory 1st/2nd/3rd order
- High performance sparse direct and iterative parallel solver
- Cables with catenary effects
- Nonlinear stress-strain for metallic materials
- Nonlinear stress-strain for reinforced concrete
- User-defined nonlinear stress-strain curves
- General nonlinear material models for volume elements
- Tension stiffening effects
- Elastic and plastic buckling analysis
- Ultimate load iteration
- Time step method



- Torsional warping effects
- Eigenvalues, -frequencies
- Construction stages
- Primary stress and deformation
- Time dependent effects (Creep, Shrinkage, Relaxation)

# STAR - 3D Frame Analysis

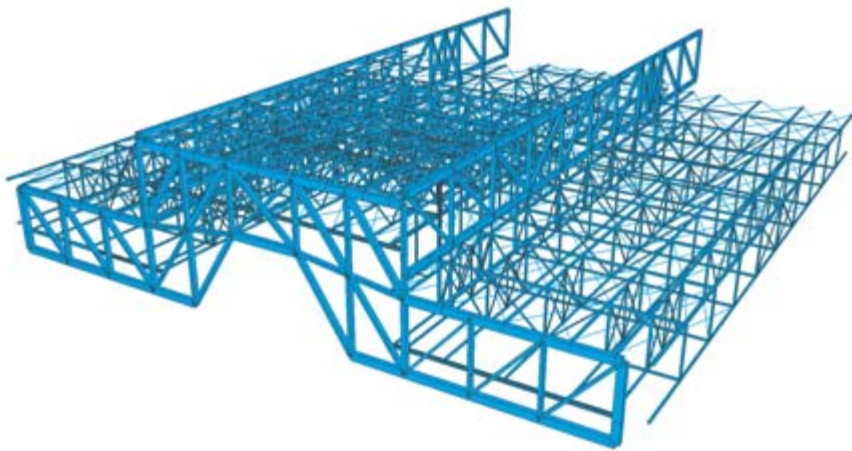
Frame and girder systems are among the most common systems in structural design. The STAR module enables the engineer to solve complex problems associated with these structures. Different module extensions allow that STAR can be used for steel-, concrete-, timber-, composite-, and bridge structures. A robust solver grants a very high convergence rate, even when analyzing large non-linear systems.

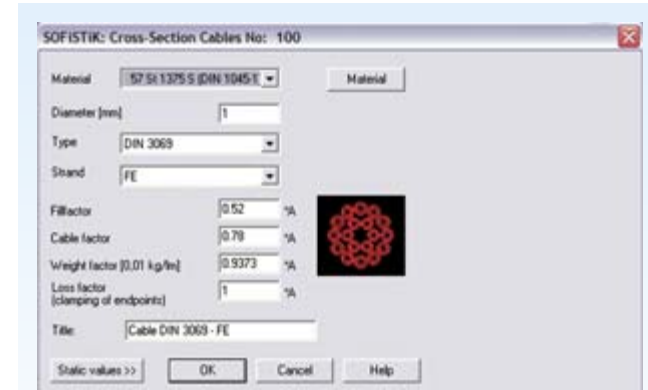
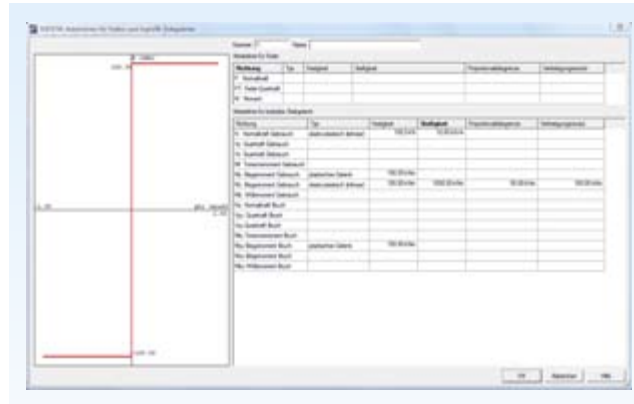
## Materials

- Material data base (DIN, EC, BS, ACI, AASHTO etc.)
- Non-linear material law for concrete and metals
- Interactive input of any stress-strain curves
- Individual modification of material attributes

## Cross sections

- Table with standard rolled steel profiles acc. to DIN, EC, BS etc.
- Standard cross section library
- Cable cross-sections (e.g. DIN 3052, VVS etc.)
- Geometry-free input only via parameters
- Any thick or thin walled polygonal cross sections
- Polygonal cross sections with cut-outs/voids
- Correct shear stress, shear center, torsional moment of inertia
- Composite cross sections
- Comfortable graphical CS-generation and management with WinAQUA
- DXF-Interface
- Interactive input of welds, shear sections, reinforcement, effective widths





## Analysis

- 1st, 2nd and 3rd order theory (e.g. cable systems with large deformations)
- Non-linear material laws for concrete incl. tension stiffening
- Plastification and hinges for steel and other metallic materials with consideration of any of the 6 internal forces
- Pre-deformations, imperfections (global and local)
- Time dependent effects Time dependent effects (Creep, Shrinkage, Relaxation)
- System transfer to ASE and DYNA

- Generating and analyzing influence lines with ELLA/ELSE
- Loads independent of element division via beam groups
- Automatical min/max analysis of internal forces and moments, support reactions, deformations, stresses, bedding forces
- Enveloping curve for extreme values
- Alternative load cases and groups

## Reinforced Concrete Design

- DIN 1045, 1045-1, 4227, ÖNorm B4700, EC2, ACI, SIA, BS, SNIP, etc.

## Steel Design

- DIN 18800, 1052, EC 3/4/5, ÖNorm, SIA, AASHTO, India, China
- W/D-check, fatigue resistance
- Checks E-E, E-P and P-P

## Building Design

For general building design SOFiSTiK offers various attractive FEA-packages based on the SOFiSTiK high-end 3D solver ASE. Any package can be upgraded for special tasks like bridge design, dynamics or tunneling

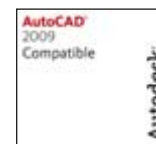
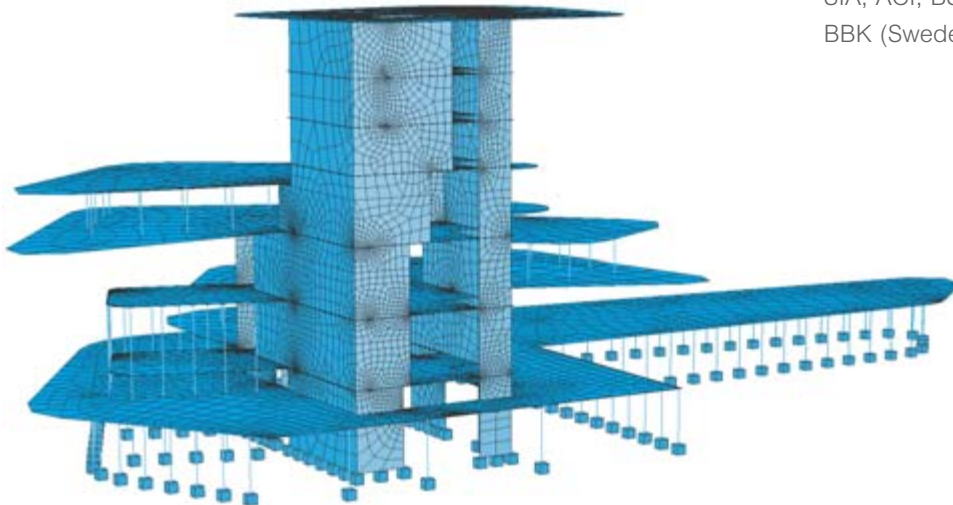
### SlabDesigner PRO

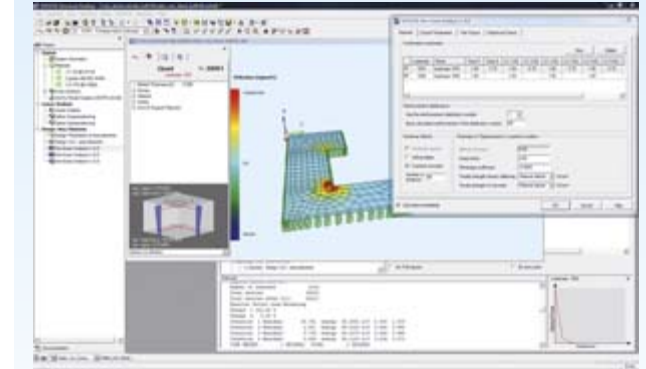
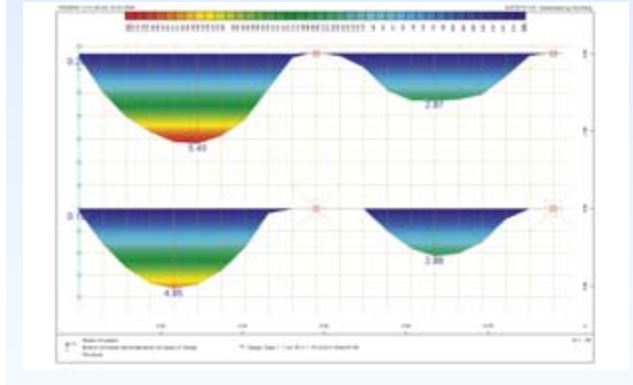
The SlabDesigner PRO is a powerful 2D FEA package handling the analysis of slabs, walls, frames or grillages for a very competitive price. It comes with an AutoCAD-based pre-processor, CAD-based section generator,

automatic superpositioning, interactive result viewers and automatic report generation controlled by the SOFiSTiK Structural Desktop (SSD). For full AutoCAD-technology and compatibility this package can be purchased with the add-on SOFiPLUS or the stand-alone SOFiPLUS-X. SlabDesigner PRO provides many advanced features like nonlinear cracking analysis for slabs and beams (with full AQB license), nonlinear bedding and supports, integrated T-beam design and theory of 2nd order along with many international codes like DIN, EC, ÖNorm, SIA, ACI, BS, AS (Australia), EHE (Spain), BBK (Sweden), SNIP (Russia).

### Basic 3D FEA & Design

Like the SlabDesigner PRO this package is AutoCAD-based and is an economical start into the 3D FE-analysis using SOFiSTiK. The package comes with an interactive pre- and postprocessor and an automatic mesh-generator. The user can perform linear analysis for all 3D structures, from simple slabs to freeform surfaces including R/C-design for slab-, shell- and beam-elements. Implemented codes are identical to the SlabDesigner PRO.





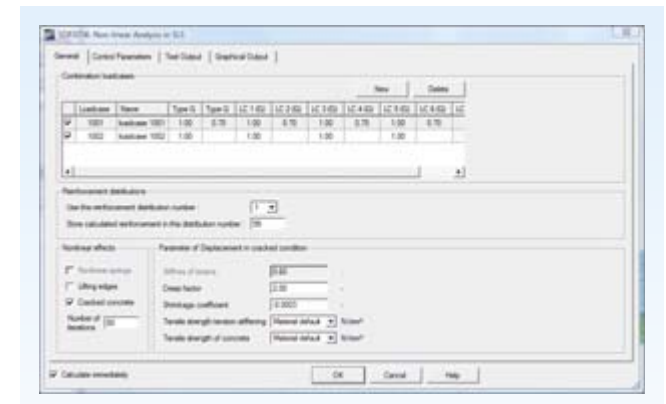
## SOFiSTiK Premium

SOFiSTiK Premium is the ideal package for integrated 3D analysis and design of any complex structural system in building design as well as in bridge and geomechanical engineering. Besides AutoCAD preprocessing and SSD control the package offers analysis acc. t. theory of 2nd order, nonlinear beam elements and bedding, construction stages (CSM), analytical pile elements, lateral torsional buckling (BDK) and interactive integration of slab and shell results to sectional forces (SIR). Design acc. t. DIN 1045-1, EC 2/3, ÖNorm B4700/4300, SIA 262, ACI 318-02, BS 8110/5950, AS 3600 (Australia), EHE (Spain), BBK 04 (Sweden), SNIP (Russia) etc.

## Post-Tensioned Systems

All packages can be enhanced for SOFiPLUS-based graphical definition and analysis of post-tensioned slab and shell systems. The slab tendons can be analyzed including realistic redistribution of forces and restraining effects with construction stages. In the design procedures the additional strain in the prestressing steel can be taken into account for economical design.

Individual offers and further information can be obtained from our sales partner or [info@sofistik.com](mailto:info@sofistik.com)



# Building Design

## COLUMN–Design of R/C Columns, Fire Design acc. t. EN 1992-1-2

COLUMN is a modern graphical tool based on the modules STAR 3 and STUE for column design using the nominal curvature method of German DIN 1045-1 and Austrian ÖNorm B4700. COLUMN also provides nonlinear design procedures including time dependent effects with AQB. Special fire protection checks of German DIN 4102-22 and, with integration of the module HYDRA for temperature distribution calculation, fire design according to DIN EN 1992-1-2 (Eurocode 2) is available

## COLUMN Features

Cross-sections:

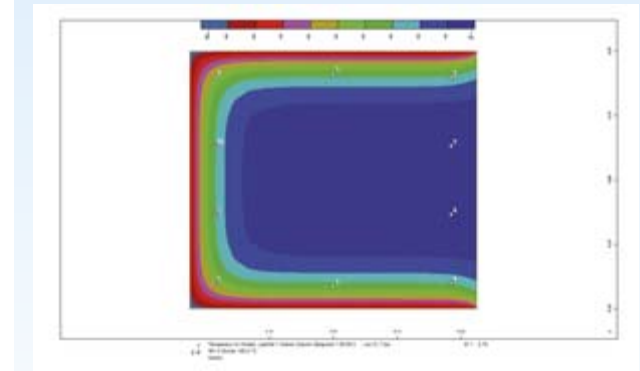
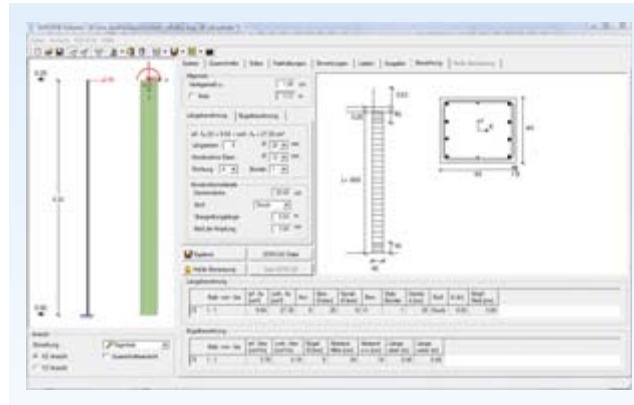
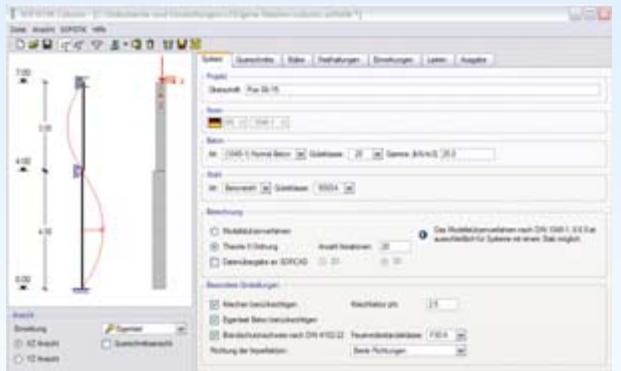
- Rectangular and circular cross-sections (max. 10).
- Changing cross-sections.
- Reinforcement in concentrated and distributed layout.

System:

- Eccentricities for beams can be included.
- Elastic and rigid supports

Loading:

- Point-loads, eccentric point-loads and linear varying line loads.
- Selfweight is considered automatically.
- Automatic determination of column imperfection.
- Time dependent creep effect can be considered.



Calculation:

- Calculation according German DIN 1045-1, ÖNorm B4700 and EC2-2004 UK amendment.
- Design combination including safety factors is generated automatically.
- Design in ULS and for impact.
- Calculation and design for biaxial bending and theory of 2nd order.
- Effective (cracked) stiffness is considered.
- Nominal curvature method as alternative calculation procedure.
- Design for net cross-section.
- Prescribed reinforcement layout.

- Fire protection check acc. table 31 of the German DIN 4102-4.
- Additional checks acc. to the enhanced table 31 (MLTB)
- Design as wall structure.
- Output of support reactions for theory of 2nd order analysis.
- Fire design acc. t. DIN EN 1992-1-2 with integrated temperature analysis (HYDRA), automated modification of cross-sectional parameters and nonlinear design acc. t. German DIN 1045-1.

Results:

- Short printout with graphical plots of important results.
- Protocol of all combination for easy checking.
- Detailed extensive output on-demand.
- Reinforcement layout sketch for easy drafting and documentation.
- Data-exchange of the reinforcement distribution to SOFiCAD Reinforcement.

# Bridge Design

The SOFiSTiK module portfolio is especially powerful and versatile for advanced analysis and design in all fields of bridge engineering. Seamless integration of construction stage analysis, precambering and force optimization for large bridges is available. Analysis with nonlinear effects as well as economical influence line evaluation is possible. From a library of standard load models (roads and railway) to special design and serviceability assessments a large amount of design code information is implemented.

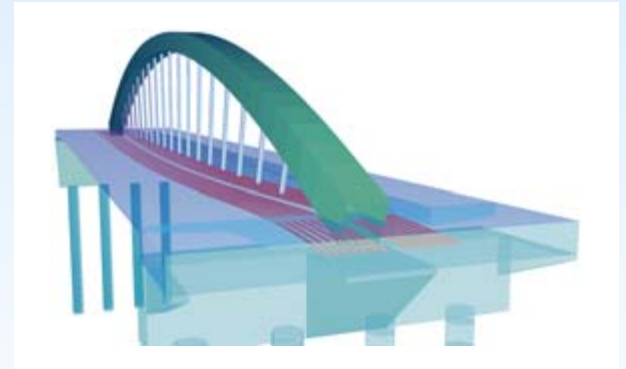
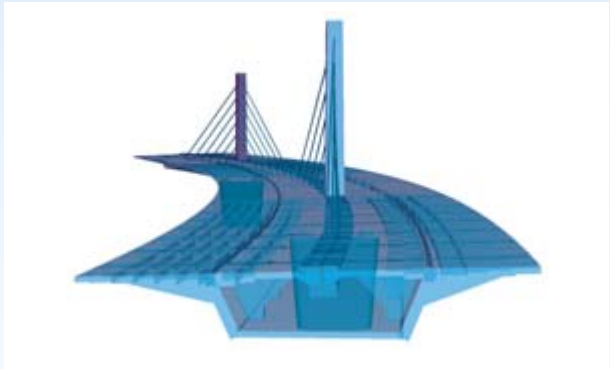
## Pre- / Post-Tensioning

- Cubic 3D spline tendon geometry
- Full 3D geometry definition in plan-, elevation and cross-sectional views
- Jacking and construction sequences
- Prestress for beam and shell structures
- Immediate bond
- Unbonded tendons
- Internal and external tendons
- Library of prestressing systems
- Tendon stress diagram
- Jacking protocol (numerical and graphical)

## Bridge Types / Construction Methods

- Single or multi-web beam systems
- Cable stayed bridges
- Suspension bridges
- Slab/Frame/Integral systems
- Moving and foldable systems
- Hybrid systems (beam and orthotropic shell deck)
- Grillages
- Span-by-span erection with precamber
- Free and balanced cantilever method (FCM/BCM)
- Incremental launching with special contact bearing elements (ILM)
- Extradosed bridges
- Composite systems





## Analysis

- 1st, 2nd, 3rd order theory
- Nonlinear material
- Nonlinear spring and damper elements
- Contact elements for ILM
- Primary states for deformation and stress (“construction memory”)
- Time-step integration
- Influence lines
- Hydratation
- Buckling analysis
- Construction stages
- Dynamic wind analysis
- Earthquake and response spectra analysis
- Eigenvalues
- Moving loads (rolling stock)
- Vehicle-Structure Interaction

## Loads

- Library for traffic loads (road and railway)
- Influence lines and influence surfaces
- Free or element/node related load definition
- Settlement, temperature, wind, collision, support jacking
- Load combinations according to selected standard

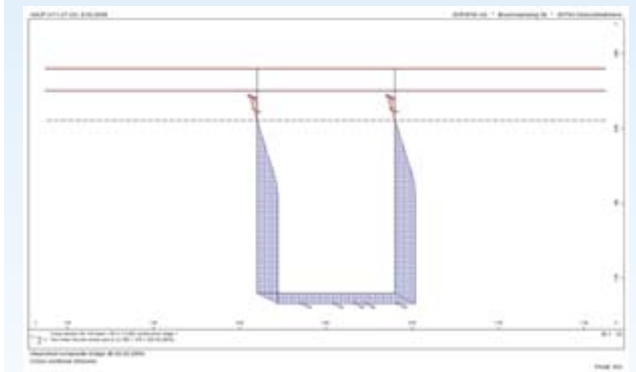
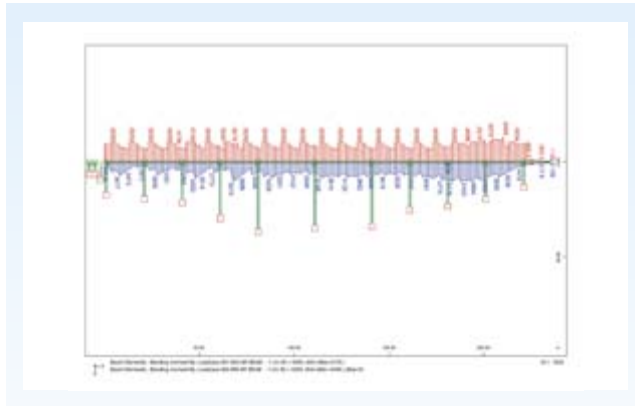
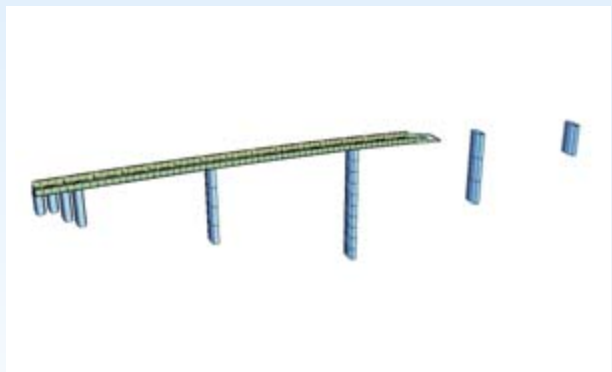
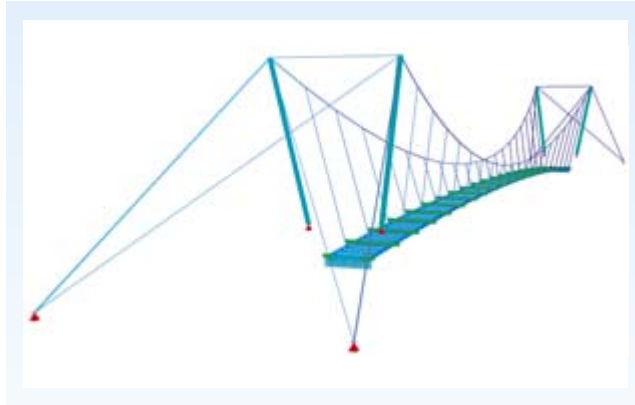
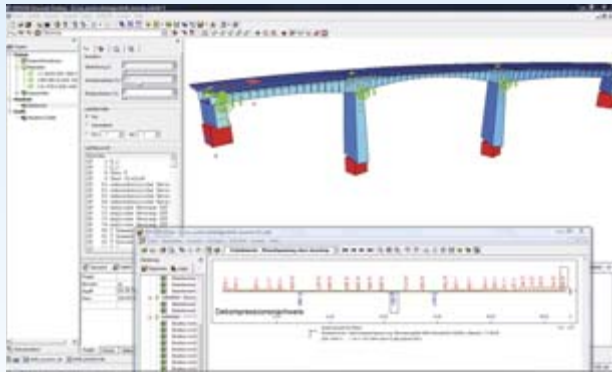
## Cross-sections

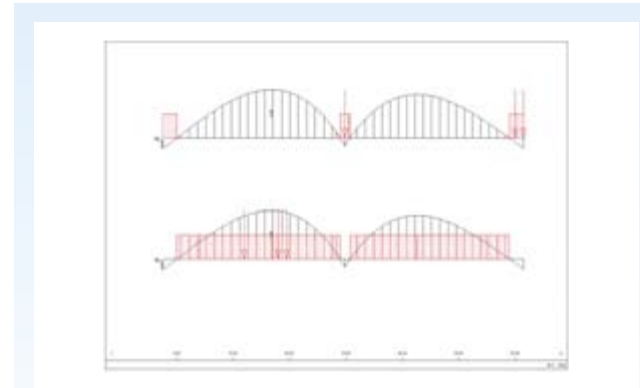
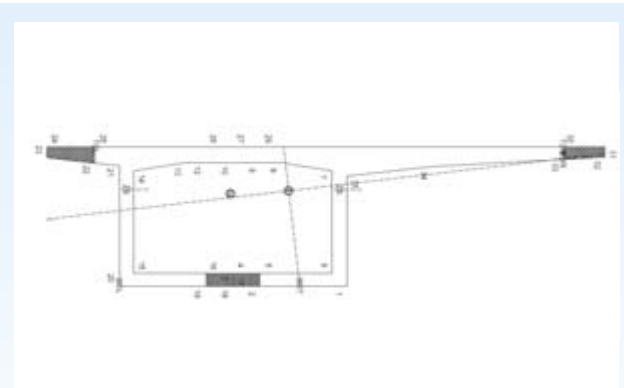
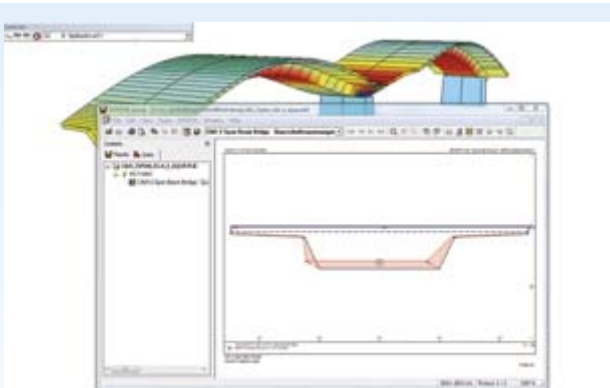
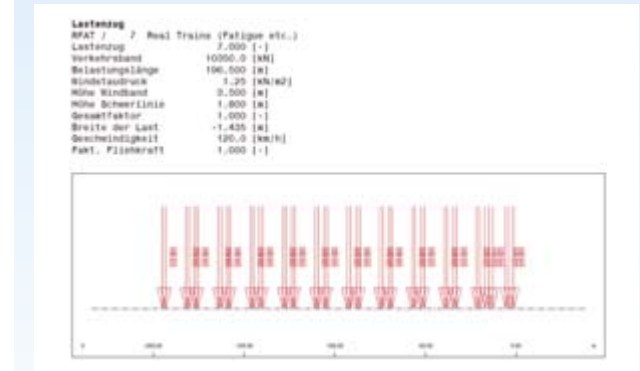
- Open and closed sections
- Thick- and thin-walled
- Effective widths (shear lag)
- Composite cross-sections
- Stress points (automatic and user defined)
- Cross sectional construction stages

## Design Code Checks

- SLS and ULS in general with reinforcement design, stress checks, decompression, crack widths, robustness, fatigue
- DIN-FB 101, 102-104
- Eurocode 2/3/4/9
- ÖNorm B 4750
- SIA
- AASHTO 2002/2004, LRFD
- ACI 318-02
- BS 5400
- AS 5100 (Australia)
- EHE (Spain)
- IRC (India)
- S-BRO 2004 (Sweden)
- NS (Norway)
- SNIP (Russia)
- Hong Kong concrete model

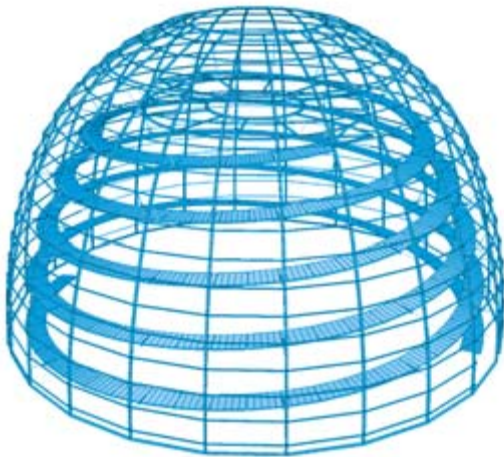
# [ Bridge Design ]





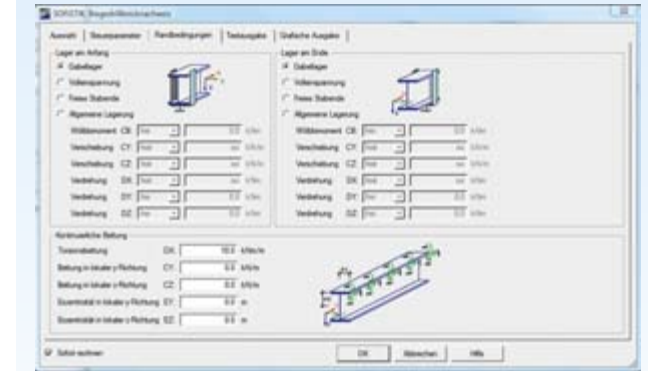
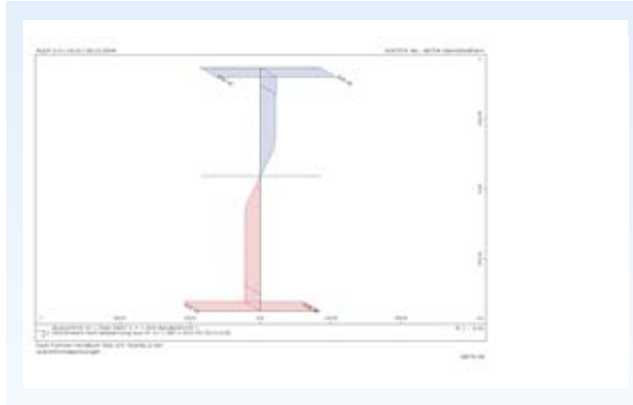
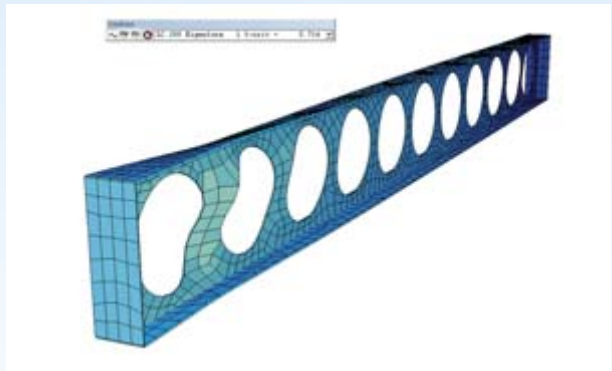
# Steel Design

The SOFiSTiK modules ASE, STAR and DYNA offer powerful tools for analysis and design of complex steel design problems. Besides the possibility to analyze acc. to 3rd order theory the programs offer nonlinear material models for metallic materials. The applied elasto-plastic-zone theory is based on the interaction of all internal forces and moments.



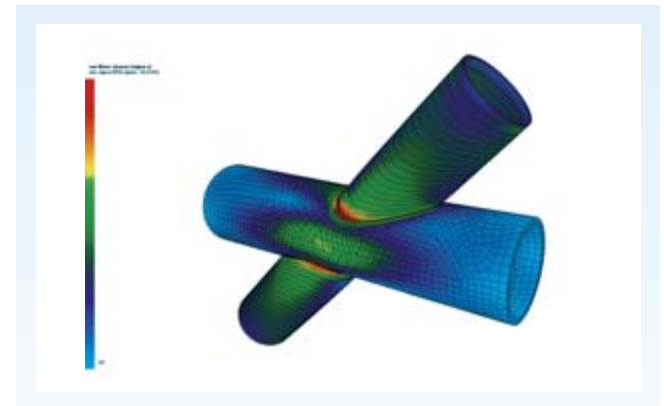
## Features

- 3D-Truss and cable structures, 3D-folded structures
- Volume elements
- 1st, 2nd and 3rd order theory
- Primary load cases for construction stages
- Checks: E-E, E-P, P-P
- Elasto-plastic zones, plastic hinges
- Implicit beam hinges (ASE)
- Profile library
- User-defined sections
- Composite sections
- Elastic and plastic buckling
- Eigenvalues
- Uniform/ lateral torsional buckling
- Profile optimization
- Warping stress
- Buckling of shells and slabs
- User-defined stress-strain for springs and steel-material
- Multi-layered shell element
- Non-linear dynamics
- Non-linear springs
- Interfaces: FEMAP, SteelCON, AutoCAD, SOFiCAD-S, IFC Structural Analysis View
- SteelCON – Connection design



## Design Codes

- DIN 18800
- EC 3/4/9
- ÖNorm B4300
- SIA 263
- BS 5950
- US AISC
- AS 4100
- NS 3472

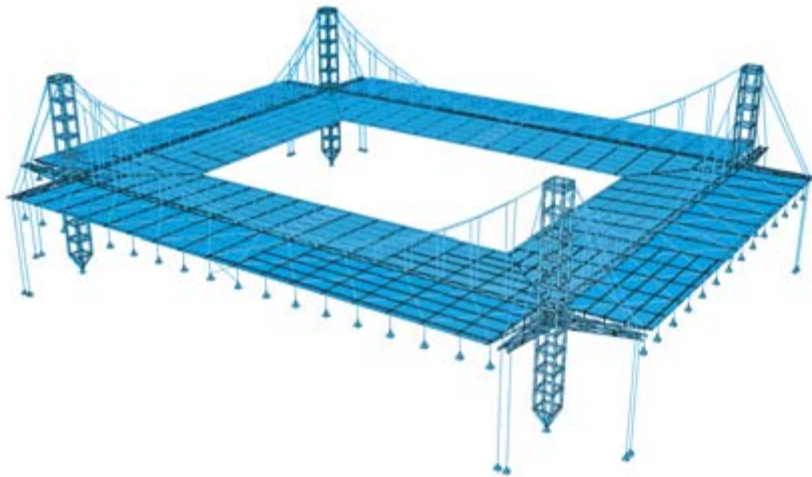


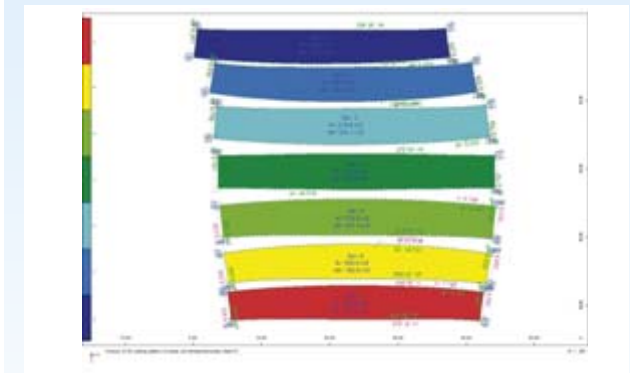
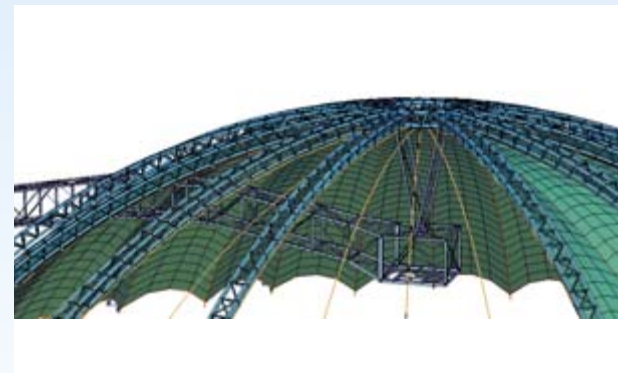
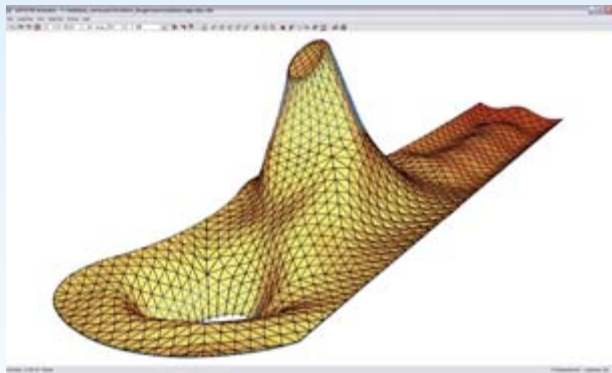
# Lightweight Structures

Characteristic for these types of systems is the relation of low weight to long spans. This is accomplished by avoiding that the loads are converted to bending stresses, instead they should be deducted as tension and compression. The FE-analysis of lightweight and shell structures is among the most difficult tasks – challenging the engineer and the software!

## Features

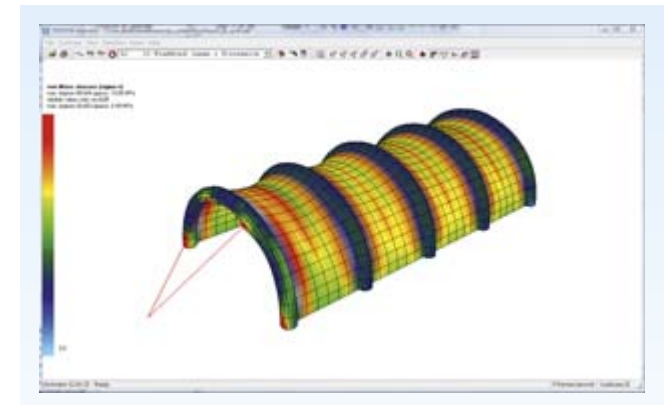
- Analysis of the entire system with the combination of different types of elements such as beams, slabs, walls and shells using different materials like steel, glass, concrete and membranes
- User defined materials
- User defined stress- strain curves for material and spring elements
- Construction stages
- Partial system failure
- Non-linear material behavior for concrete or metallic materials
- 3rd order theory/ full geometric nonlinear analysis
- Ultimate load capacity determination
- Local and global stability analysis (plate buckling, lateral buckling)
- Eigenvalues and eigenmode shapes
- Global and local imperfections based on eigenmode shapes
- Global buckling analysis
- Warping torsion
- Catenary effects
- Post-tensioned shells





## Membrane and Form Finding

- Form finding with the FE method following the membrane theory
- Iterative analysis with interaction between primary and secondary structure
- Orthotropic pre-stress
- Minimum surface (membrane) with isotropic pre-stress
- Form finding with inner pressure (pneumatic structures)
- Cutting patterns with consideration of material compensation
- Consideration of the shear stiffness of the membrane fabric
- Compression failure for the determination of wrinkling effects



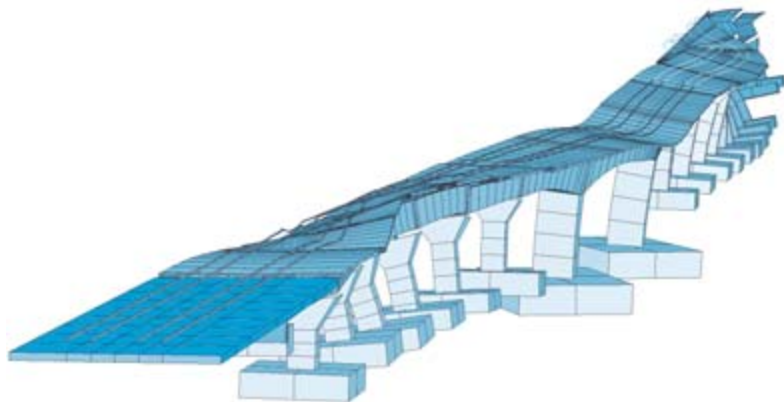
# Dynamic & Seismic Analysis

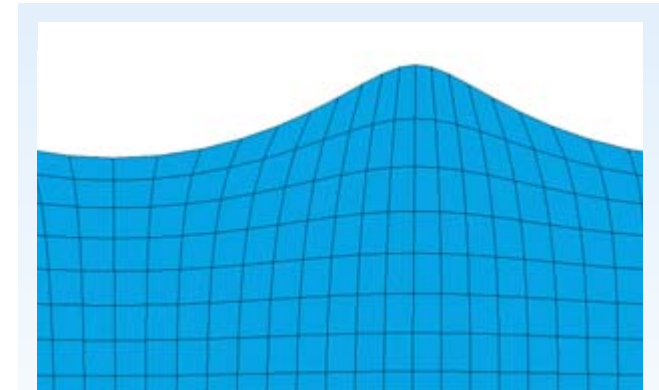
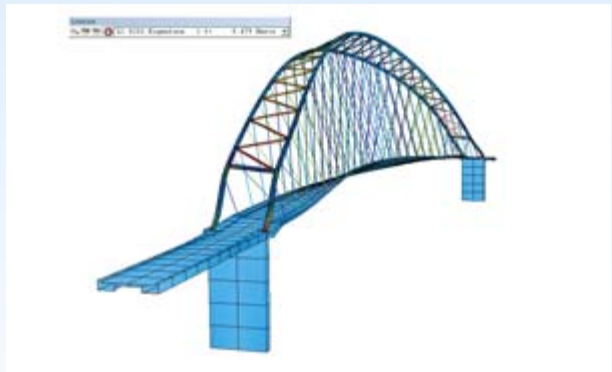
SOFiSTiK offers two programs to solve dynamic problems. DYNA is the dedicated and fast tool for linear dynamic and seismic analysis & design. Depending on the extensions ASE offers dynamic analysis from eigenvalue computation to geometrical and material nonlinear time-step method.

- High performance sparse direct and iterative parallel solver
- Eigenvalue solvers: simultaneous vector-iteration/Lanczos/Rayleigh
- Time Step Method with direct integration of equations of motion
- Integration through superpositioning of the eigenvalues (even for 3D continua)

- Stationary or spectra-induced oscillation
- Consistent or diagonalized mass- and damping-matrices
- Consistent consideration of eccentricities also for mass matrices
- Geometric stiffness and buckling eigenvalues
- Single masses (incl. off-diagonal entries)
- 3D beams incl. uniform and warping torsion
- Truss- and cable elements
- Spring-, boundary- and FLEX elements
- Nonlinear damper elements
- 3D-shell elements
- 3D-continuum elements (only via ASE)

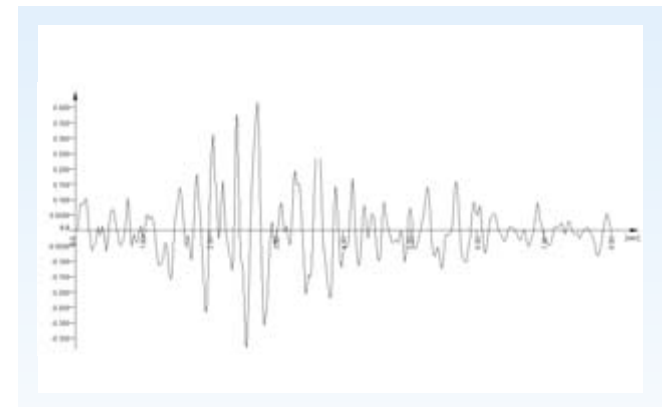
- Library of response spectra e.g. EC8, German DIN 4149, ÖNorm B4015, Swiss SIA 160, US UBC, Indian Standard 1893, Russian SNIP, Chinese GBJ 11.89
- Manual modification of response spectra
- Signed superpositioning of corresponding spectral results
- SRSS, CQC-method and absolute addition
- Stationary response with frequency response (dynamic stiffness)
- Groups with variable damping characteristics (Rayleigh damping)
- Non-linear damping





- Time-History with modal analysis
- Time-History with direct analysis
- Evaluation of maxima and time histories
- Calculation of floor response spectra with DYNR
- Wind-History analysis with (SOFiLOAD-WH)
- Rolling stock with library of train loads (e.g. EC HSLMA)
- Vehicle-structure-interaction (Hughes- $\alpha$ )
- Dynamic contact problems

- Saving of results for movies and ANIMATOR visualization
- Time history analysis with blast loading and multiple arrival times for multiple vibrational sources
- Modal damping for time history and spectra
- Base shear analysis includes direction factors
- Push-over analysis



# Wind

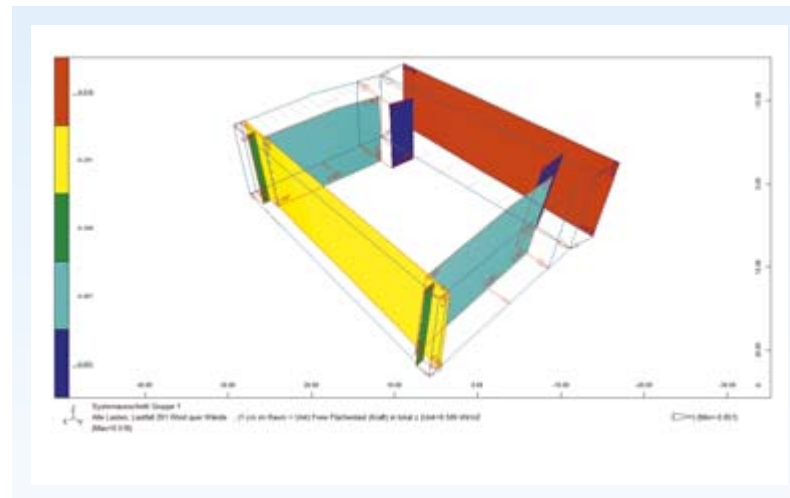
The modules SOFiLOAD-W (Wind) and SOFiLOAD-WH (Wind History) are extending the capabilities of ASE and DYNA for steady state and dynamic wind analysis. Especially the calculation of dynamic wind histories for large bridge aerodynamics is one of the most challenging tasks in high-end engineering and can be performed with SOFiLOAD-WH and DYNA.

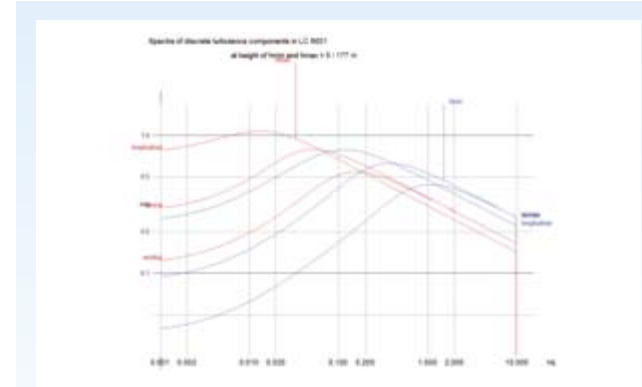
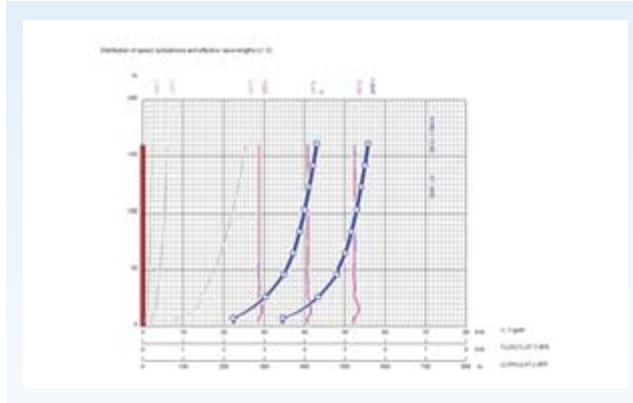
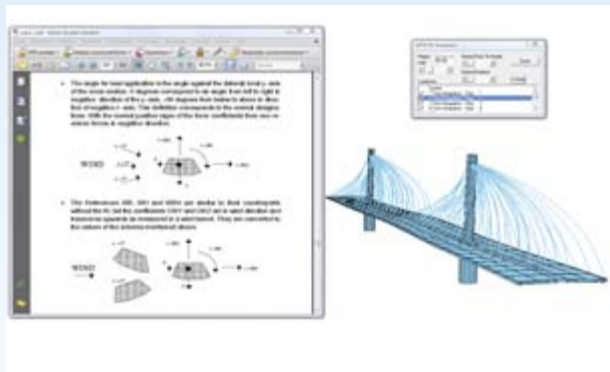
Following complex effects can be considered:

- Wind climate (global wind)
- Topology and roughness of the terrain (local wind)
- Aerodynamics and aeroelasticity with drag coefficients and wind force derivatives
- Structural dynamics (response of the structure)

## Features SOFiLOAD -W

- Static wind loads on area- or beam-elements
- Automatic consideration of the wind pressure values according following codes: DIN 1055-4 (2006), 1056, ENV 1991 2-3 (1995), VGB-BTR (1997/2005) etc. and atmospheric wind
- Easy input and determination of wind profiles considering the surface/terrain properties (e.g. roughness)
- Wind zones with atmospheric wind map





## Features SOFiLOAD -WH

- Generation of dynamic wind histories for time-step calculations
- 10-minute-wind simulations (time constant, but spatial variant basic mean wind)
- Determination of the wind profile, wind speeds and turbulence parameters with input of atmospheric wind speed and terrain class and roughness
- Standard wind profiles
- Wind spectra according to Karmann, Davenport, Harris, EC1, Fichtl/McVehil, Simiu/Scanlan
- Wind-structure interaction in combination with DYNA

# Geomechanics

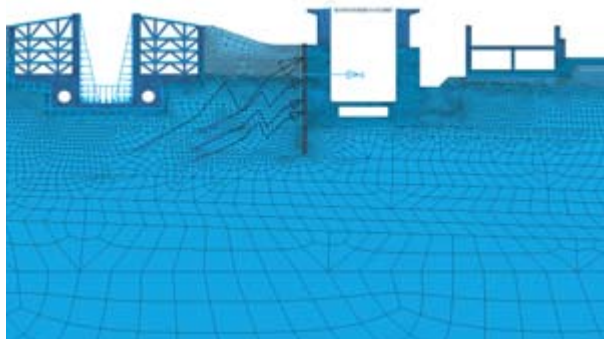
SOFiSTiK offers many dedicated modules for general geotechnics such as soil and foundation engineering tasks:

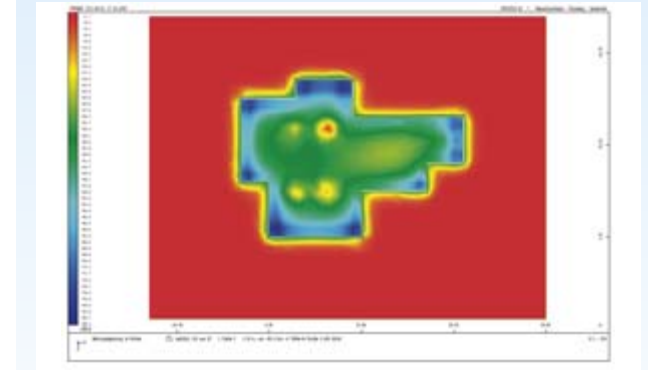
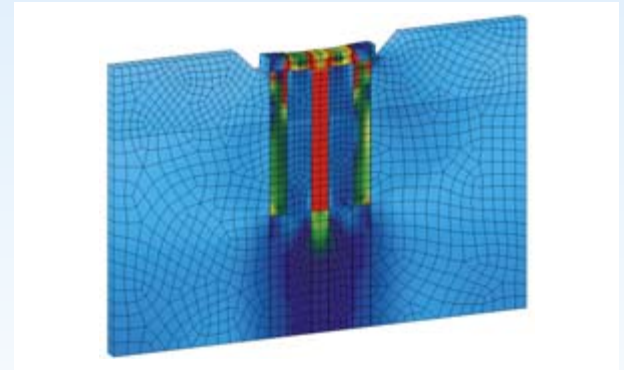
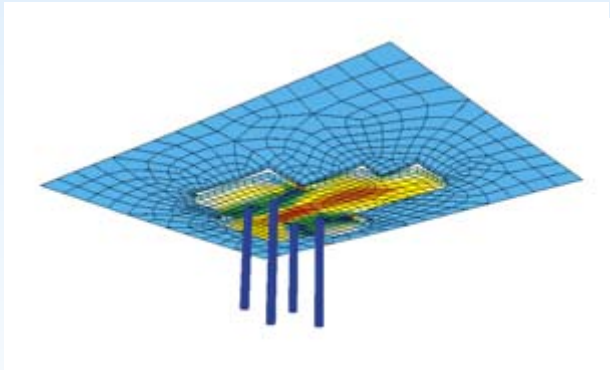
## TALPA

TALPA allows the linear and non-linear plain strain/stress FE-analysis of any plane (2D) structure. The system input can be done using CADINP, SOFiPLUS, SSD or via the FIDES program WallsFEM. TALPA is mostly used to analyse axisymmetric systems (e.g. tanks) or 2D system like excavation pits, tunnels or dams. For the implemented material models please refer to the tunneling pages.

## HASE

The program HASE is used for the analysis of vertical deformations in semi-infinite solids according to the stiffness coefficient method. The settlement of large complex constructions can be analyzed, as well as their influence on neighboring structures. A 2/3D Ground-Soil interaction can be conducted via the combination with the modules SEPP, ASE and STAR. The system input is done via CADINP, SOFiPLUS, SSD or the FIDES input program GroundSlab (WinGEL), which is especially suited for 2D-systems.



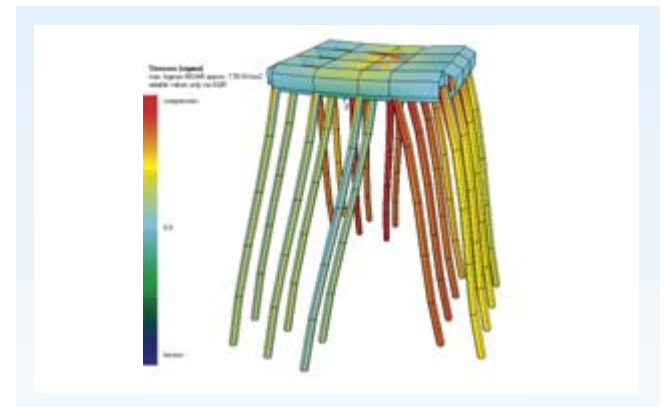


## PFAHL

The program PFAHL is used for the analysis of individual piles and general pile structures. The pile element is an elastically bedded beam, for which a variable bedding profile can be defined in circumferential- and longitudinal direction. The superstructure is defined as a rigid system via coupling or as an elastic system with existing stiffness via beams or finite elements. In addition an analysis according to 2nd order theory is also possible. Therefore the buckling check can be conducted in an easy, concise and graphical way. The input is done using CADINP, SOFiPLUS, SSD or the FIDES program PilePRO, which is especially suited for pile structures.

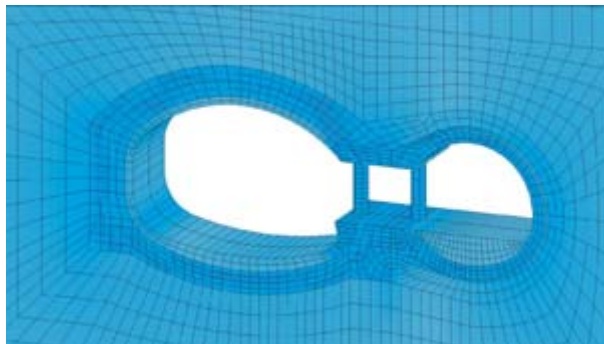
## HYDRA

A large number of physical problems can be described as potential problems and can thus be classified as Laplace's ( $DH=0$ ) or Poisson's ( $DH=q$ ) differential equations. For example heat conduction problems and groundwater flow. HYDRA is specialized on the calculation of these problems, although it can also handle other problems of this type. The system input is mainly done using CADINP and SOFiPLUS. For fire design HYDRA computes the temperature distribution over the cross-section.



# Tunnel Design

SOFiSTiK software is a very powerful and effective FE-package to perform 2/3D FEA based on the solvers TALPA and ASE. In addition to the deformation and stability analysis of tunnel systems, SOFiSTiK offers, as one of the few solutions on the market, extensive design capabilities for various international codes like EC, BRO, BS, SNIP, DIN, etc. Further functionality can be added for seepage analysis using the SOFiSTiK modules HDYRA, seismic and dynamic analysis using DYNA/ASE and CFD analysis using the multiphysics code PHYSICA.



## Application Areas:

### Tunneling

- Cut and cover
- Shotcreting method (New Austrian Tunneling Method – NATM)
- Tunnel boring machines (TBMs)
- Pipe jacking
- Tubbing-lining
- Special structures like tunnel-junctions, branch of emergency exits, portals etc...
- Renovation/extension of existing tunnels

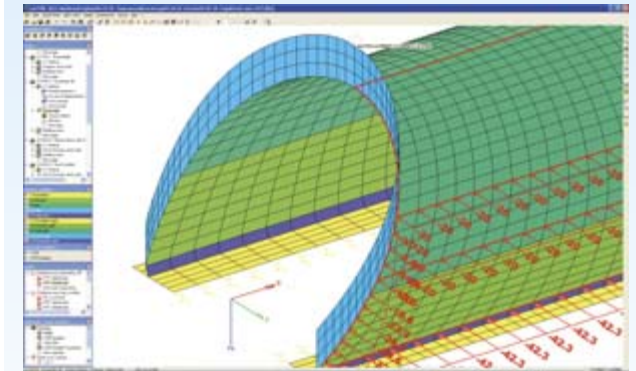
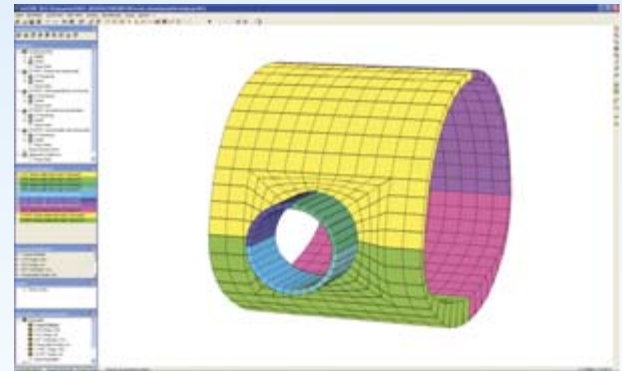
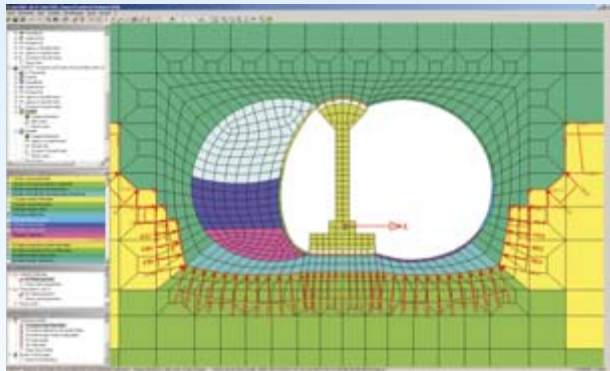
### Geotechnics

- Slope failure
- Dams
- Raft-pile-foundations

### General

- 3D settlement analysis
- General 3D volume systems

The specialized preprocessor WinTUBE, developed by our partner FIDES DV-Partner, can be used as a very powerful tool for the system, mesh and loading generation, as well as for the management of construction stages. WinTUBE is 100% compatible with the ASE and TALPA solvers and will create a SOFiSTiK database, so ANIMATOR, WinGRAF and URSULA can be used for post-processing as usual.



### WinTUBE Features:

- CAD-based functionality
- On/off visibility settings
- User defined views
- Intelligent object selection
- DXF-import
- SOFiSTiK CDB import
- Undo/redo, copy/paste
- Wizards for tunnels, intersections, automatic intersection of structural volumes or surfaces

### SOFiSTiK Material Models

#### Elastoplastic models

- Von Mises, associated
- Drucker-Prager, associated
- Mohr-Coulomb, non-associated
- Gudehus, non-associated
- Lade, non-associated

#### Hypoplastic models

- Acc. v. Wolffersdorff

#### Granular soils (GRAN)

- Hyperbolic consolidation acc. to Kondner (triaxial stress state)
- Stress-related stiffness
- Different stiffness in loading and unloading behavior

- Failure criteria acc. to Mohr-Coulomb
- Dilatancy (non-associated plastic yielding)
- Automatic calibration for volumetric loading (cap model)

#### Swelling soils (SWEL)

- Consideration of the stress dependent swelling strains for the final state

#### Shear fault planes for jointed materials

- Scalar damage model e.g. for tensile failure

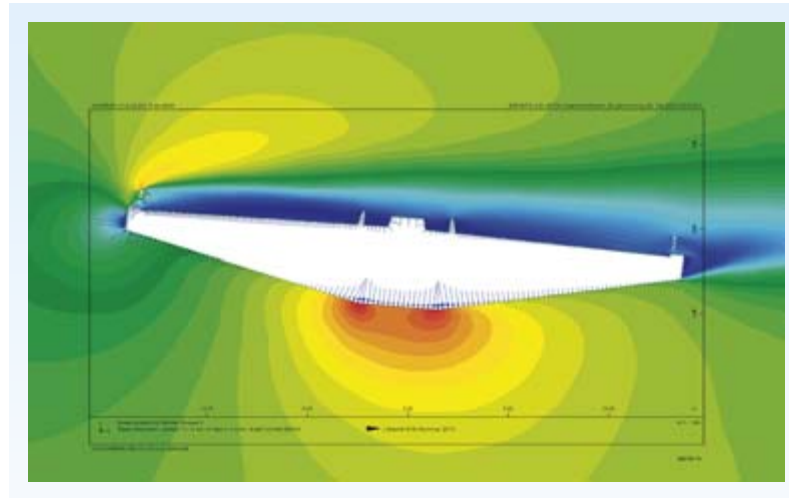
Interface to create user-defined material models

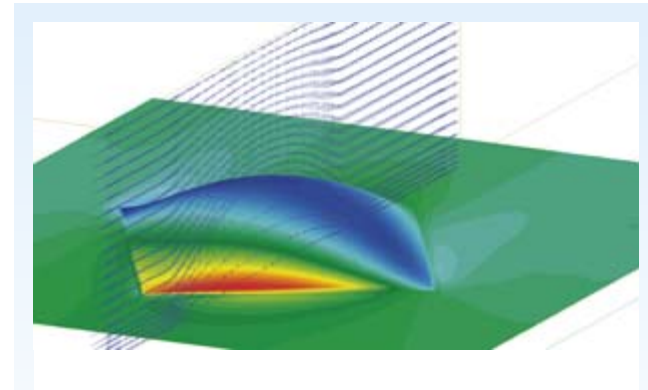
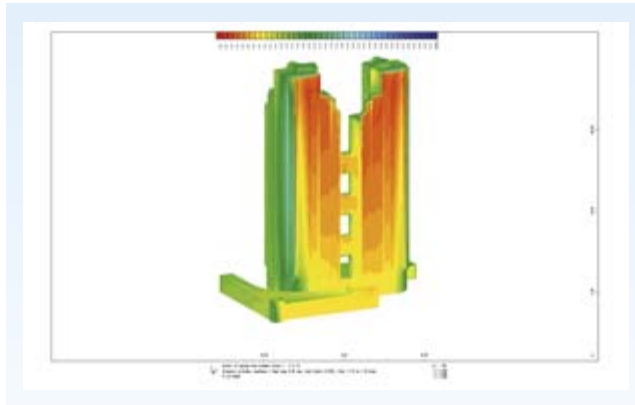
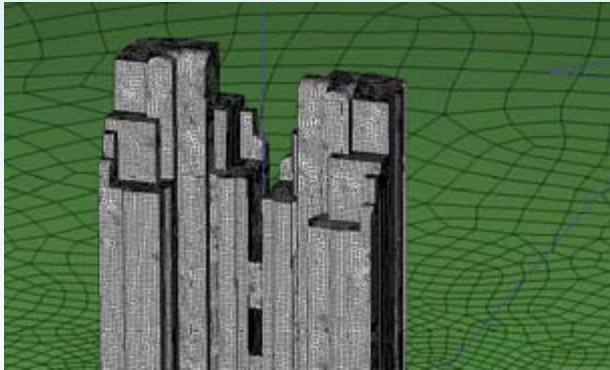
## [ Computational Fluid Dynamics / Multiphysics ]

PHYSICA is a program for the analysis of Multiphysics and Computational Fluid Dynamics (CFD) fully integrated into the SOFiSTiK environment. The program is developed by the team of Prof. Marc Cross from the University of Wales Swansea.

PHYSICA can solve the following tasks:

- Fluid mechanic (Navier-Stokes equations)
- RANS family turbulence models ( $k-\epsilon$ , MMK  $k-\epsilon$ ,  $k-\omega$ )
- Free Surfaces for Fluids
- Heat Conduction and Convection
- Combustion
- Melting and Solidification
- Elasticity and plasticity of solids





PHYSICA is a general unstructured grid 3D Finite Volume solver, hence coupled easily to the FE solvers of SOFiSTiK. The integration into the SOFiSTiK pre- and postprocessing environment is seamless, automatic volume meshing and powerful WinGRAF plotting can be employed. Online manual and help is available for CADINP input with TEDDY. The fluid domain boundary conditions can be applied automatically by the module SOFiLOAD for prescribed

wind parameters like wind speed profile and terrain roughness. Evaluated results of the CFD computation like pressure and wall shear stress can be transferred to loads available for structural analysis.

# Detailing

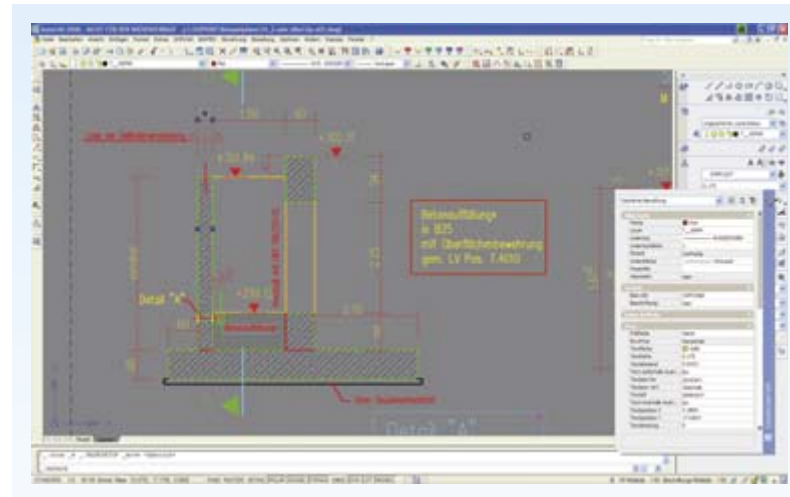
SOFiCAD Structural Detailing is the perfect tool for designer and draftsmen, allowing the fast creation of formwork and shop drawings. Clear and personal catalogues, integrated help functions and a graphical display of tools allow a fast start to work with it. SOFiCAD offers a comfortable support of paperspaces and viewports as well as drawing-oriented construction, associative dimensions and hatches, constructional symbols and automatic labeling of openings, special catalogues for the construction, a flexible catalogue-manager and much more.

## General Features

- Openings with labeling
- Large symbol library
- Support of the AutoCAD tool palettes including catalogue functions
- Tablet menu
- Modifications via property manager
- Selection of objects via quick select
- Creation of palettes based on the catalogues
- Creation of drawings sets based on the SOFiCAD project data base
- Link between title block and project data base

## Staircases

- Flights of stairs with user defined boundary
- Optional compliance of DIN 18064
- Concrete or wooden staircase in catalogues
- Automatic creation of unrolling and section

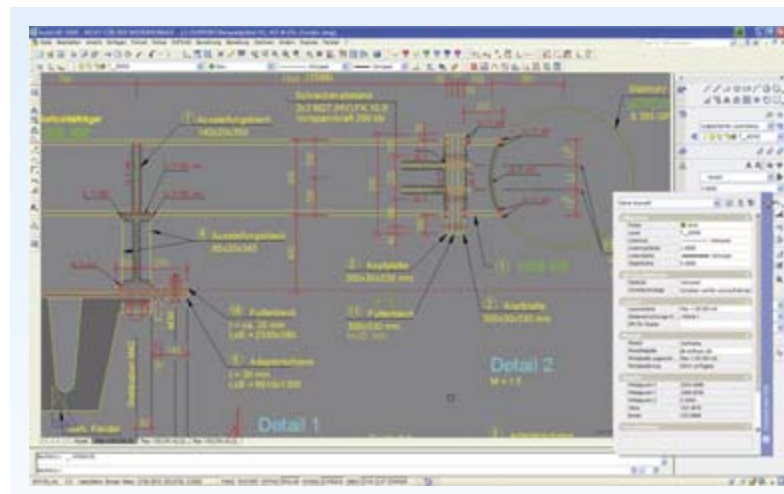
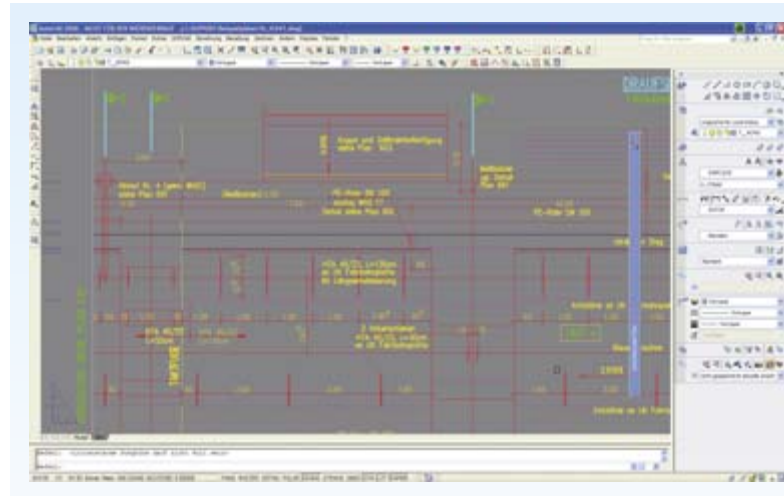
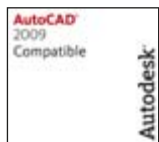


## Dimensioning

- Fully associative dimension
- Quick dimension
- Inclined extension lines
- Associative level marks
- User defined symbols for level marks
- Dimension of inclinations with proportion or percentage

## Miscellaneous

- Minimum turning curve
- Integrated project management
- Wizard for tunnel sections
- Catalogue with soil hatches
- Command to arrange blocks along polylines (e.g. sheet-piles)
- Export of coordinates in a text file
- Support of annotation including an automatic management of scales
- Extensive user settings

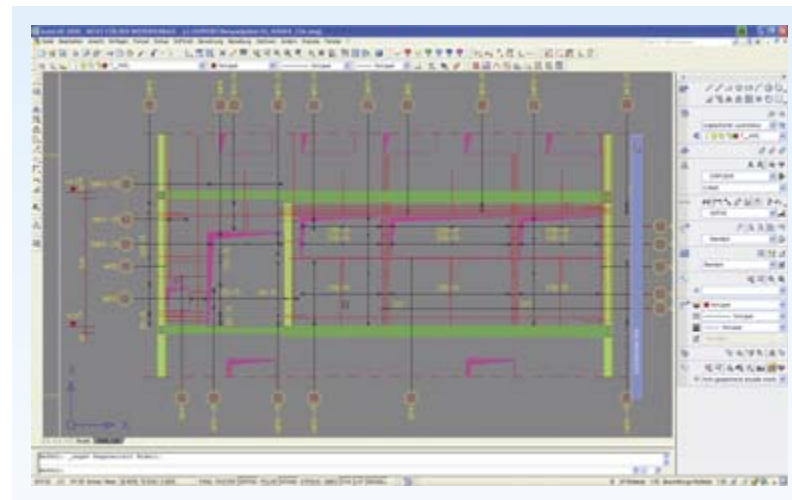
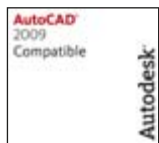


# Reinforcement

SOFiCAD Reinforcement is the modern drawing tool used to generate reinforcement drawings with AutoCAD.

## General

- Seamless integration into AutoCAD
  - Any AutoCAD editing command can be applied to reinforcement objects
  - Context sensitive, intuitive right-click menu
  - Easy modification of arranged reinforcement
  - Working with styles allows to adjust the display in a very flexible way
  - Easy generation of “office standards”
  - Browse command to find bar marks fast and easy
  - Automatic update of quantities.
  - Automatic or manual specification of bar marks
  - Visible multiplier for layings and ranges.
  - Steel list and bending schedules on demand
  - Meshes, rebar diameters and spacers can freely be defined in an external file
- Grid with profiles for rebar and stirrup meshes
  - Import of analysis results from SOFiSTiK and other FEA programs
  - Export of the “real” reinforcement into the SOFiSTiK-database for further calculations

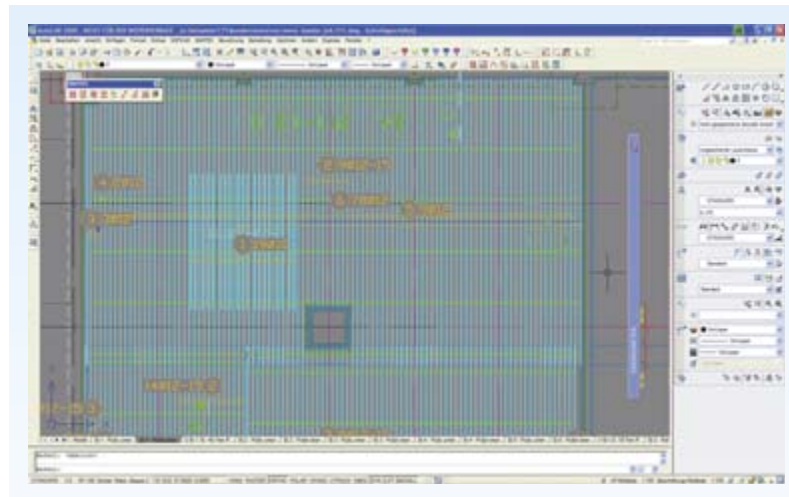
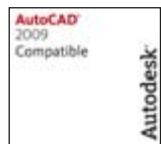




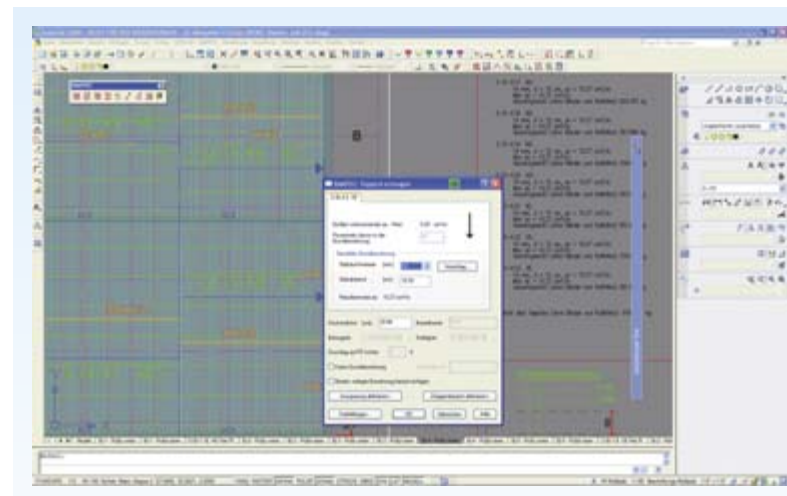
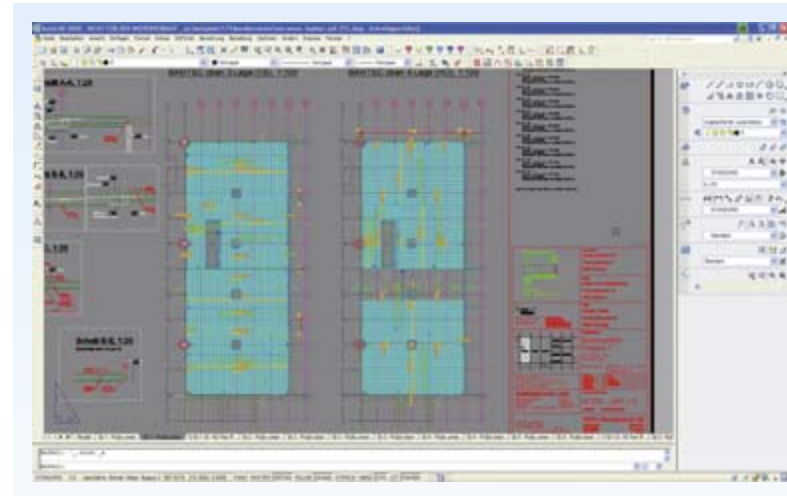
# BAMTEC

BAMTEC uses individual machine-made reinforcement carpets for concrete slabs or foundation rafts instead of conventional reinforcement with meshes or bars. These carpets consist of uniaxial straight rebars welt with transverse strips.

- Create carpets fully automatic including their corresponding rollout, check and production drawings.
- Full support of AutoCAD layouts, viz. one dwg-file includes all of the necessary drawings
- Applicable with or without corresponding FEM-analysis.
- Subsequent splitting of carpets. Rollout regions are only allocated, once reinforcement in the carpet is known
- Easy switching of rolling direction
- Additional reinforcement areas can be defined based on as-values or given diameter and spacing



- Bar diameters and lengths can be modified at any time.  
The included schedule adjusts automatically.
- Carpets can be exploded into rebar ranges (if SOFiCAD-reinforcement is available)
- Easy update of drawings after finishing modifications
- Only one click to generate machine control files in any directory in the network
- Program control via intuitive right-click menu or tool bars
- Subsequent editing of the boundary of single carpets
- Definition of additional areas with easy modifications



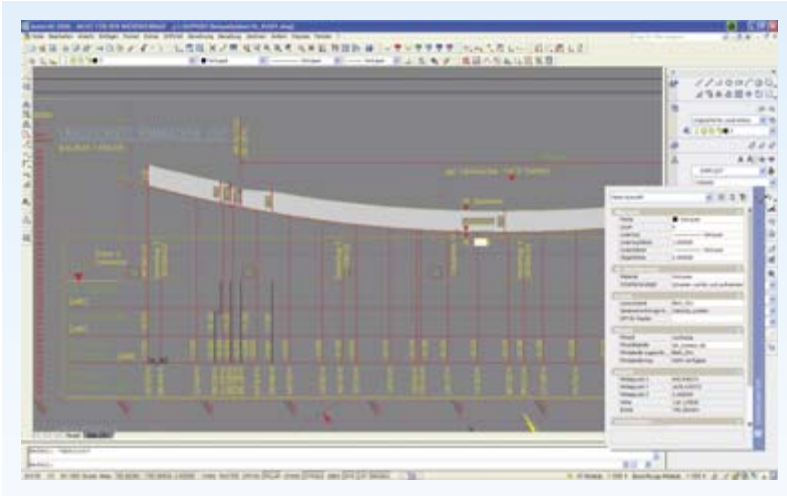
# Alignment

The SOFiCAD-Alignment module allows the planning of highway structures according to road alignments. An arbitrary number of alignments, including their axes, gradients and cross-falls, can be imported or exactly re-drawn. Using the interface for data- or map-types DA001, KA021 and KA040 alignments can be taken as the basis for the further planning process.

## General Features

An axis can be drawn via the parameters (length, radius, A) of its elements (straight line, arc and spiral). The gradient can be generated with a polygon (horizontal line and longitudinal gradient) or by entering the coordinates with station and height. The cross fall can be generated with the station and the longitudinal gradient due to longitudinal gradient changes.

Any SOFiCAD-Alignment element can be ex- or imported via a user-defined format. Alignment points can thus be taken over directly into the plan from the MEM of the tachymeter. The data- or map-types 001, 021 and 040 are recognized; ground points, gradients and axes can thus be imported from any other alignment applications. Slab Height Plan Sections of an axis can be assigned with standard cross-sections. The analysis of such an axis section results in the slab height plan.

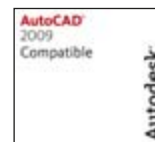


## Export into CDB

Along with an axis the cross section and if applicable the assigned enlargement and haunches can be exported into the CDB. The CDB then serves as basis for the structural analysis in SOFiPLUS.

## Coordinate Systems

An arbitrary number of coordinate systems and their corresponding alignment points can be defined. It is possible to simulate any system, from the local construction site system up to the countries coordinate system. The corresponding alignment points of these systems can also be issued. If the alignment points relate to an axis, then a point-list with height, station and offset of each point can be issued. This point-list will be stored in an ASCII-file and can be inserted into the drawing.



## Steelwork 2D

The steel detailing module SOFiCAD-S is an optimal supplement for engineers to generate overview and shop drawings in steel detailing. SOFiCAD-S allows generating any current steel profile and user defined profiles in section or any oblique view.

Bolts can be drawn in the sectional, the elevated and the plan view. In the normal display, depending on the scale, the bolts will be depicted as a symbol or a cross. The type of display can subsequently be changed. The nominal length will automatically be determined by the entered grip length.

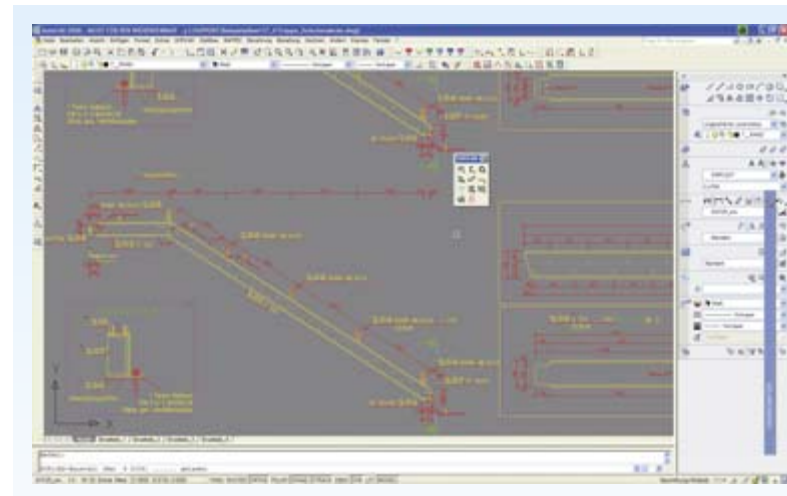
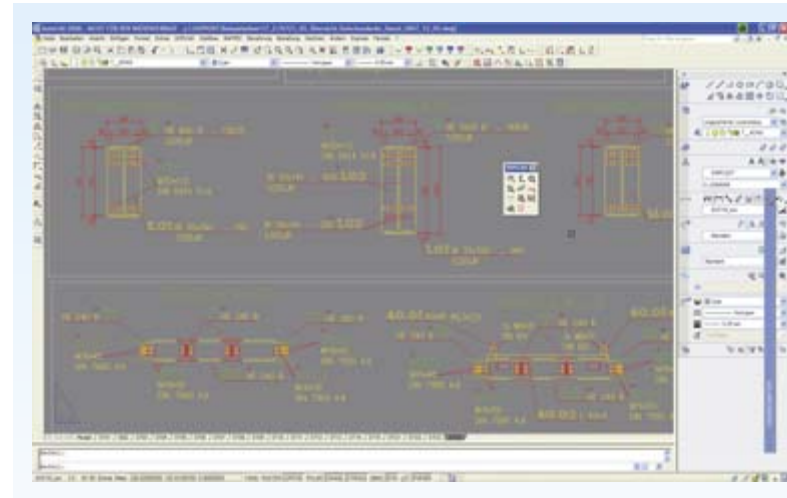
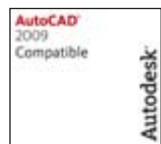
Any drawn element is considered in the schedule. Weights, coating areas and transport weight of the pre-assembled main-positions will automatically be calculated. The positioning can either be done drawing- or project related.

- In case of plan related positioning, the position numbers will be assigned independently of the positions on other drawings of the project.
- In the case of project related positioning, any position number assigned to the project can be accessed. Thus a building part from an other drawing can be inserted into the current drawing, simply by indicating the position number. The building part does therefore not have to be designed again.

With SOFiCAD-S single position numbers can be changed and all the positions of a plan can be re-numbered. If a profile's length is modified using an AutoCAD command, the internal data list and the structural steel labeling block can easily be updated. SOFiCAD-S will substantially facilitate the workload and increase the planning quality for every engineer dealing with steel component design.

## Features

- Drawing- or project related positioning
- SOFiCAD automatically keeps an internal data list with information such as position number, multiplier, type, dimension etc.
- Generating a schedule on demand from the internal data-list, with output of the total weight of any structural steel position, summary of the coating areas as well as the connection devices
- Automatic generation of a project data base
- Through browsing each position can be viewed individually
- User defined profiles according to arbitrary poly-lines, management via catalogues
- Commands to generate plates, flat steel and universal plates in different views, as well as their management in the internal data-list
- Option to configure user-profiles for profile- and material data



## [ Data-Exchange ]

Using the world-standard data format DWG, which is the AutoCAD file format, exchange to other CAD programs is almost unlimited when using SOFiSTiK tools.

### SOFiCAD ObjectEnabler

Should SOFiCAD drawings (DWG) be displayed or plotted correctly on seats without SOFiCAD or programs such as AutoCAD LT, ObjectEnabler are required in most cases. The ObjectEnabler are automatically installed with the normal SOFiCAD-installation. Otherwise special installations are available either on the current SOFiCAD-CD or as download from our website. The SOFiCAD ObjectEnabler are freeware and may be transmitted free of charge and without license-agreement.

### Explodeall

The command "Explodeall" allows disassembling any SOFiCAD object into simple AutoCAD elements. For scale dependent objects such as e.g. reinforcements the dimension of an object in the scale corresponding size will be stored on an scale dependent layer. The command is required if objects should not be transmitted or in case the recipient is unable to read it.

## References

Abbey Pynford, England  
ABES International, Austria  
Adams Kara Taylor, England  
Arup  
Bauunternehmung E. Heitkamp, Germany  
Benaim (China/UK) Ltd.  
BGS Ingenieursozietät, Germany  
Bilfinger Berger AG, Germany  
Boll & Partner, Germany  
BPI-Consult, Germany  
BUNG Ingenieure AG, Germany  
C & E Ingenierie, France  
Centerlöf & Holmberg, Sweden  
Cronauer Beratung Planung, Germany  
Dywidag International, Germany  
Ed. Züblin AG, Germany  
FaberMaunsell, England  
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KBR Australia  
KLING Consult, Germany  
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