STRUCTURAL DESIGN OF REINFORCED AND PRESTRESSED CONCRETE MEMBERS
WHY WE DEVELOP IDEA STATICa

IDEA StatiCa is an engineering software dedicated to structural design and code-check of joints, cross sections, beams and other details in structures. We develop it for structural engineers, fabricators, detailers and all others who perform or use structural analysis. Our development team researches, tests and applies new methods of analyzing behavior of structures. IDEA StatiCa enables engineers to work faster, evaluate requirements of the national code thoroughly and use optimal amount of material. For us, creating software is a way to contribute to making every new construction around the world safer and cheaper.

Creating software for structural engineering is a complex process. The final user (engineer) sees the GUI and the report. But the story of every IDEA StatiCa application starts years before any GUI is available – with research and development which combines physics, mechanics and deep understanding of codes of practice. And IDEA StatiCa cannot do this alone so we cooperate with technical universities, especially with engineering faculties at ETH Zurich, CVUT Prague and VUT Brno.

OUR TEAM

www.idealstatica.com
IDEA StatiCa Concrete & Prestressing

IDEA StatiCa is suitable for an extensive range of applications in three main fields of concrete and prestressed concrete market:

- **Bridges of medium and small spans**
- **Prefabricated concrete structures**
- **Cast-in-place buildings**

Structural analysis and design of concrete and prestressed structures is a challenging task – both because of the natural complexity of the subject and because of the regulation an engineer has to comply with to get the project done. Engineers try to catch up with the complexity and insane size of related documentation. Developing software for structural analysis and design is our way to help engineers work fast, better and comply with this swelling regulation.

Key value of IDEA StatiCa is the design of members, cross-sections and details. As a result of our long-term experience in the area of reinforced and prestressed concrete, IDEA StatiCa provides set of tools that are:

**Easy to use**
- Fast and simple input with help of specialized wizard
- Input data generated automatically
- User templates of reinforcement and tendons
- DXF/TXT import & export
- Beam uncoiling – simplify 3D to 2D
- Vertical and horizontal scaling of slender prestressed beams
- Perfect guide through complex Eurocode requirements

**Comprehensive**
Comprehensive design including references to code provisions, tooltips, and explanations

**Economic**
- Optimum use of all materials in the cross-section
  - concrete in compression diagonal
  - shear reinforcement and longitudinal reinforcement
  - Fast and precise design of the reinforcement for both ULS and SLS conditions
  - The weight of shear and longitudinal reinforcement is optimized
Safe and Comprehensible

Transparent assumptions and white box results allow for minimizing risks of structural defects.

Clear information about beam load, behavior and utilization of particular sections

BIM – Effective Workflow

IDEA StatiCa design modules work as standalone or with results calculated by other FEA programs. IDEA StatiCa BIM reduces the transfer of data to minimum and provides easy import of structural geometry, internal forces of all load cases, combinations and construction stages. Thanks to that engineer can design a simple beam in the same way as for example segments of the bridge constructed by cantilever method.
Bridges

IDEA StatiCa is used by engineers for the design of members, cross-sections, and details of prestressed and reinforced concrete bridges of small and medium spans.

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<th>Bridge piers</th>
<th>Bridges cast-in-place into falsework</th>
<th>Continuous beams with composite slab</th>
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Renovation, repair and strengthening of old structures

Bridge load rating

Easy to use specialized wizard

Reinforcement editor and templates

Comfortable tendon shape design

IDEA StatiCa provides “uncoiling of the beam” and simplifies the definition of tendon geometry from 3D to 2D – the beam appears straight in XY and XZ planes and the input is no longer a challenging task.

The beams are usually very long and shallow and one can hardly differentiate the tendon’s details. That is why we offer the possibility to scale selected element vertically and horizontally. Tendon shape is generated from templates or imported from TXT, DXF. Then it is wound up the beam and the beam is coiled back.
Bridge combinations

The introduction of load groups and the possibility of automatic generation of bridge combinations significantly improve the effectiveness and speed of design process, decrease its laboriousness, and help the designer to cope with complexity of Eurocode.

Construction stages

- Prefabricated beams made subsequently monolithic by cast-in-place concrete
- Time dependent analysis of nonlinear creep, shrinkage and ageing
- Rotation of members with asymmetrical cross-section to its principal axis might be prevented due to e.g. composite slab

Comprehensive and safe design

- Calculation of second order effects
- Stress-strain response of cross-section loaded by any combination of internal forces
- Strength in flexure, shear, torsion
- Interaction of all components of internal forces (N, My, Mz, Vz, T)
- Shear in composite joint
- Fatigue
- Stress limitation
- Crack width
- Decompression condition
- Brittle failure

Bridge Load Rating

Most of unique innovations have been introduced due to the fact that a man is lazy and wants to make his life easier than before. Undoubtedly bridge load rating is laborious hand-iterative process, especially when it comes to reinforced and/or prestressed concrete bridges. The engineer can spend days and weeks trials and errors in the estimation of bridge load-carrying capacity. That is why we granted a wish of bridge engineers to help them with this tedious task...

Repair and strengthening old structures
Effective Workflow

The objective is to enable an effective way of the design of prestressed slabs and grillages in IDEA StatiCa.

**3D FEA software**

Let us assume that bridge slab is modeled by 2D elements in some 3D FEA system. “Integration strips” are defined in order to integrate 1D internal forces. Only moving loads are defined and analyzed in 3D FEA system.

**IDEA StatiCa**

The effects of moving loads are imported into IDEA Prestressing. Load groups for bridges, construction stages are defined and tendons are designed.

All specialized features of IDEA StatiCa are used – detailed and comprehensive sectional design, tendon stress check, export of drawings into DXF, output report and bill of material.

**IDEA StatiCa**

Prestressing losses and load equivalent to the effects of prestressing are calculated. Finite Element Method in combination with TDA analysis is used to obtain internal forces caused by all loads except the effects of moving loads.

**Use your current FEA program and analyze prestressing in IDEA StatiCa at the same time.**

**Tendon drawings and export into CAD programs**

*Calculate yesterday’s estimates*
Prefabricated concrete structures

Prefab industry and their pre-manufacturing processing and design offices can achieve very economic and effective design using IDEA StatiCa for:

- **Precast hollow core slabs with or without topping**
- **Prefabricated girders with various CSS**
- **Columns, details**

### Automatic reinforcement generation in tapered beams

Reinforced, pre-tensioned and post-tensioned beams

### Step-by-step construction

- Floors composed of prefabricated beams made subsequently monolithic by cast-in-place concrete
- Permanent shuttering floor systems

### Economic and comprehensive

Detailed stress-strain response of floor cross-section made of pre-tensioned beam with composite slab
Safe and comprehensible

Equivalent thin-walled section for torsion check

Both nominal curvature and nominal stiffness methods for the calculation of second order effects

Corbel/bracket design using Strut&Tie method

- Rectangular/sloped shape of corbels/brackets aligned symmetrically or to column edges
- Prismatic column or reduced depth of column above the corbel
- Variety of predefined reinforcement templates, automatic/manual position
- Primary reinforcement: plane looped/space looped/framing bars
- Secondary reinforcement: vertical and/or horizontal stirrups
- Strength of struts, ties, nodal zones
- Detailing – vertical and horizontal stirrups, anchorage lengths, mandrel diameters

CAD programs

IDEA StatiCa provides export of all drawings into DXF. This feature can save a lot of engineer's time during manufacturing drawings preparation.
Cast-in-place buildings

Specialized building design offices appreciate IDEA StatiCa in design of shopping malls, residential and industrial buildings especially for:

- **Cast-in-place beams, slabs and columns**
- **Liquid retaining and containment structures**
- **Beams and design strips of post-tensioned slabs**

PT slabs

- **Design strips of 3D model of post-tensioned slab**
- **XY and XZ projections of design strips with post-tensioned tendon**

Safe and comprehensible

- Fast and optimized design of reinforcement is not limited to necessary areas. Number and diameter of reinforcement bars are calculated in real-time when selecting reinforcement template
- Stirrups and bent-up bars
- Calculation of crack width of liquid retaining and containment structures according to EN 1992-3
  - classification of tightness
  - check of depth of compression zone
### 2D and 3D beams

- Structural analysis
- Reinforcement design
- Assessment of sections
- Report
- Construction stages
- Force reduction
- Deflection control
- Bill of material
- Creep and shrinkage of concrete
- Force redistribution
- Long term effects
- Draft of reinforcement drawings

### Seismic design

M-N-rotation diagram can be used for the calculation of properties of plastic hinges e.g. for Pushover Method.

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