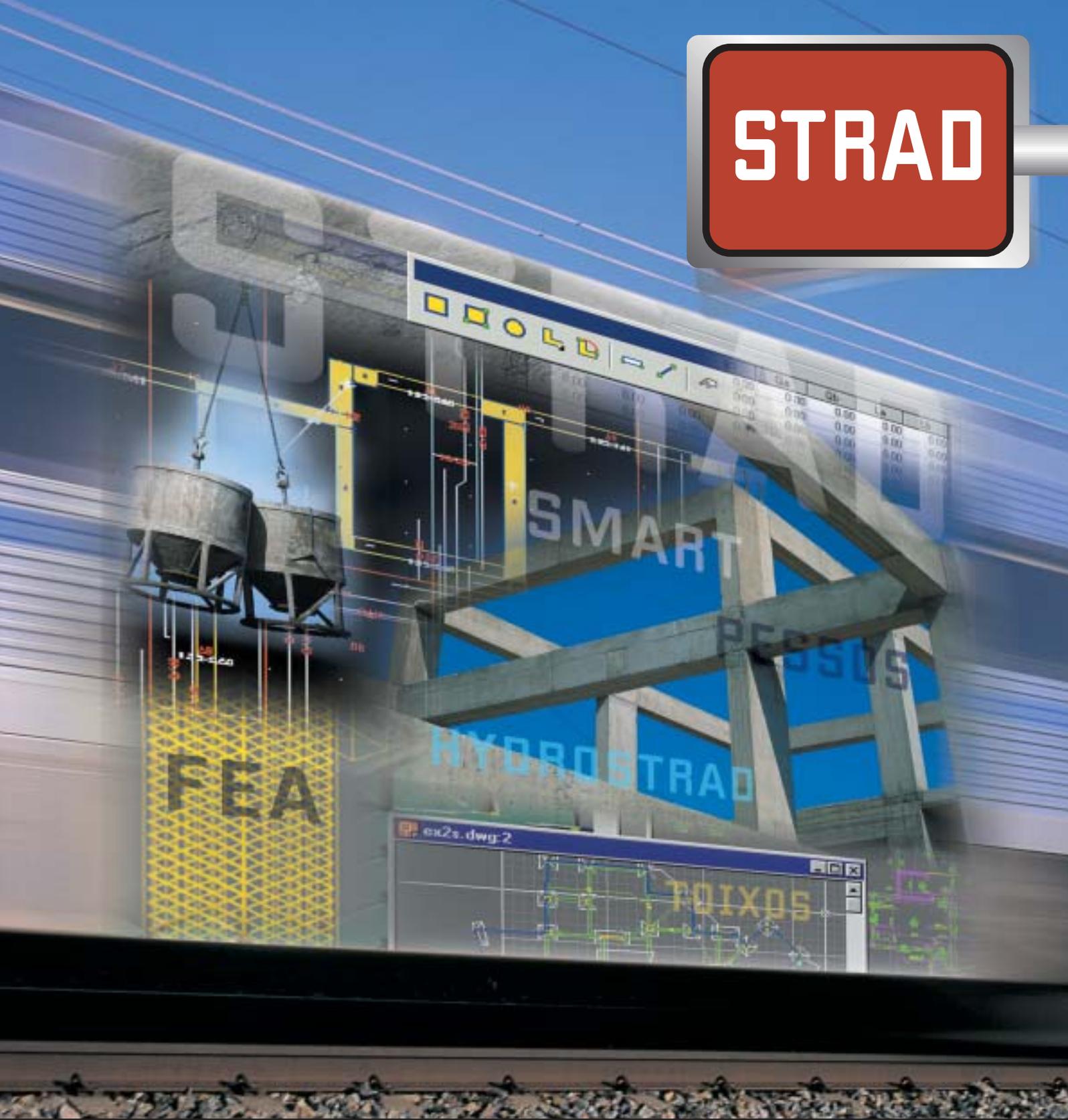# STRAD

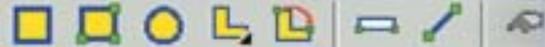**Structural Analysis**

& RC Design Workstation

4M
UK

# Powerful Analysis and Design Tool of 3D Concrete Frames

STRAD is a unique tool for Structural Analysis and Design of 3D Concrete Frames. STRAD has a friendly and autonomous 3D CAD environment, a powerful finite element analysis engine performing both static and modal (eigenvalue) analysis and a reliable design module for concrete members, highly customisable to accept parameters of any seismic code of your choice. STRAD has an advanced interface with the famous GT.STRUDL(*) so as to perform advanced analysis options such as push over, non-linear and transient dynamic analysis.

STRAD combines the scientific completeness, proved by a volume of papers, in European and International sessions, the speed derived from advanced computational and programming techniques, the easy of use with many automations that help to quickly input the design study data and the automatic production of the final drawings and reports. The program is addressed to engineers demanding correct simulations and solutions by providing them with all-powerful tools, as well to those working on usual projects and wishing to quickly and safely reach to the final drawings production.

✔ Multi-parametric to fit your needs

STRAD's philosophy is the free access of the user to the majority of analysis and design parameters. The engineer may follow the auto program flow for simple structures analysis, whilst, for complex ones, may interfere in all stages. The program provides for all required checking and documentation of the solutions. The results (stresses, deflections, reinforcements, moment envelops ea.) are graphically displayed and printed to file or printer for all building elements.
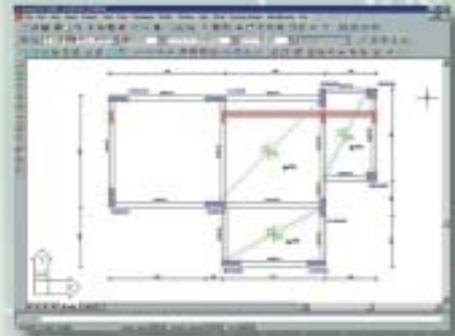
✔ Advanced Finite Element Analysis

The computational core of STRAD expands with the finite element analysis program (FEA), which automatically discriminates the plane parts of the structure into plane finite elements and solves them (perimeter underground walls, building cores, slabs). So, the structural engineer can achieve a high standard solution of complex structures. The finite elements net can be easily modified to describe voids in structure. Also, there is possibility for working together with GT.STRUDL.

✔ Advanced user interface

- Possibility to select the most convenient CAD platform that best serves users' demands. You can use its autonomous cad environment or AutoCAD.
- Importing a finished plan drawing created by any architectural design tool, in the form of *.DWG or *.DXF files, and of course, from the IDEA architectural program of 4M.
- The model processing is executed graphically by using AutoCAD commands, whilst the structure can be represented in 3D with shadows and photo-realism.
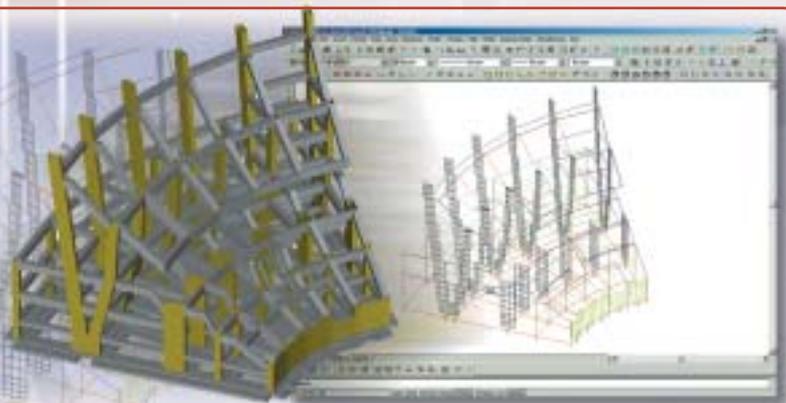
(*) GT.STRUDL is a registered service mark of the Georgia Tech Research Corporation, Atlanta, Georgia, USA

STRAD

Data Input

Working with STRAD you can easily enter any structure in the minimum time.

- Take advantage of any of the AutoCAD's options, such as zoom, snap, move, rotate.
- 3D model representation
- Automatic generation of loads
- Copying entities from level to level
- Changing the properties of multiple entities.
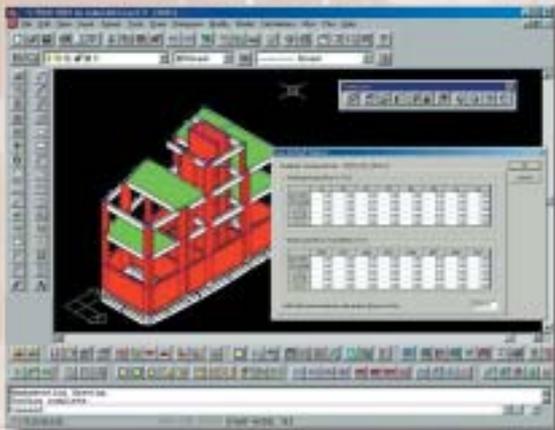
Advanced Modelling

- Unlimited number of nodes and elements
- Inclined beams
- Plates with openings
- Shear walls with openings
- Foundation in different levels
- Space Frames
- Building retrofitting
- Basements
- Stairs
- Rigid offsets
- Suspension columns
- Members with internal releases

Parameters

STRAD can be easily customised to fit your needs. All the parameters for the modelling and r/c design of the structure are given in "Data Files", that can be changed. Parameters that can be defined by the user are:
Loading Combinations, Material Properties, Allowed Stresses, Safety Factors, Bar Diameters, Distances between Bars, Anchorage types, Bar Positions, Bar Lengths.

Static and Dynamic Analysis

- Both static and dynamic analysis are performed using 6 degrees of freedom per node
- Foundation is solved together with the rest of the structure
- There is an option for linking the 3 in-plane degrees of freedom that lie on a slab so as to model the diaphragm

Design

All checks according to Eurocode 2 for:
- Slabs (Bending and shear check for the worst loading combination)
- Beams
- Columns

Advanced Finite Element Analysis (STRAD FEA)

The finite element analysis program (FEA) performs static and dynamic analysis. The results of the program are verified with a number of papers in European and International magazines and conferences. Finite element library includes
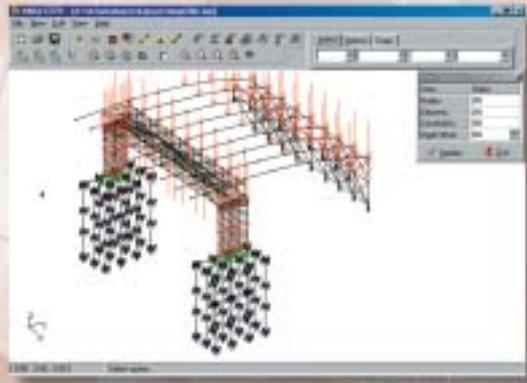
- Linear 2D or 3D beam elements, including internal releases and rigid offsets. Loads include uniform loading in any axes and loads from temperature difference. There also available a beam on elastic foundation
- Plate elements, plain stress and plain strain elements
- Shell elements with 5 or 6 degrees of freedom (including the drilling degree of freedom). They can be on elastic foundation also and loading includes stress from temperature difference
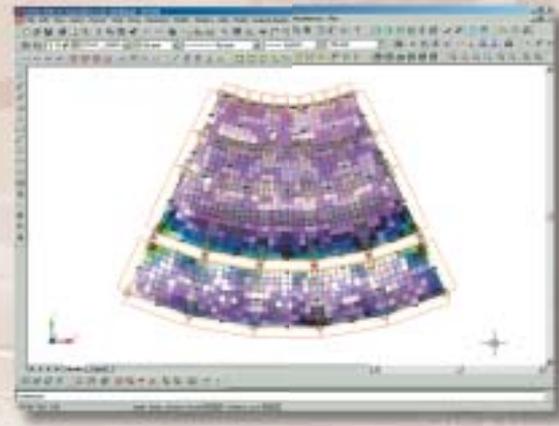
The FEA program works together with STRAD 2003. The finite element model is created automatically by STRAD under the supervision of the user. First the program generates the finite element mesh, by modelling the shear walls and basement walls with shell elements and the rest of beams and columns with beam elements. Loads are generated automatically for all loading cases. Experienced users can modify the model to create openings on slabs or shear walls.

Solving Slabs Using Finite Elements Analysis (PLATE)

PLATE is a module that solves and designs slabs that were described using STRAD. It uses shell finite elements with 6 d.o.f. and some of its features are:

- Up to 10 000 elements and 10 000 nodes (or even more)
- Calculates the worst loading combination for every slab
- Control over the size of the finite element mesh
- Results are compared with the ones given from other methods such as Marcus, Hahn – Czerny.
- Graphic output of stresses and displacements
- Moments are automatically transformed to STRAD to continue with design
- Option to solve founding slabs (slab based on ground)

FUEL