SCADA Pro® Flat Slab

SCADA Pro Flat Slab module for analysis and design is an advanced finite element solution that can operate independently or fully integrated with SCADA Pro Structural Analysis and Design software.

Key Features:
- **Generates a true 3D model of an entire concrete building** – accurate FRM analysis
- **Supports input and export of various file and model formats** (DWG/DXF, ETABS/SAP2000 model, IFC file)
- **Generates buildings with highly detailed aspects such as elevated floors and foundations**, containing different slab regions, walls, beams, columns, drop panels, and openings.
- **Easy to draw support lines anywhere on slab – even for complex geometries**
- **Automatically accounts for all critical design sections** – different approach between column/mobile strips
- **Graphical display of total bending moment diagram for a slab strip**
- **Performs code check and reports the location and amount of reinforcement needed for concrete design codes** (Eurocode 2 and Saudi Building Code)
- **Calculates and checks punching shear stresses and designs shear stud or stirrup reinforcing**
- **Rebar calculations for any slab – Automatic enveloping and rebar detailing** – providing unlimited capabilities
- **Graphical display of total bending moment diagram for a design strip**
- **Automatically accounts for all critical design sections** – different approach between column/mobile strips
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Special Features of Flat Slab Flexural Analysis and Design:
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Special Features of Punching Shear Design:
- **Automatic computation of all the parameters important for the punching shear checks**: 
  - Type of column (i.e. internal column, side column, corner column or reentrant column)
  - Correct side of the slab concerning longitudinal reinforcement and slab cover (e.g. different choice for a floor slab vs. a foundation slab)
  - An equivalent rectangular shape for columns of arbitrary section shape
- **User freedom to choose different values for all the parameters incorporated in the design – providing unlimited capabilities.**
- **Two types of reinforcement arrangement compatible to the code proposed ones**: (radial arrangement vs. cruciform arrangement)
- **Easy to interpret tabular formats of results – fully compliant to the code regulations.**
- **Graphical visualization of the reinforcement arrangement – can be interpreted both in text files or in 2D- or 3D-view.**

Special Features of Flat Slab Flexural Analysis and Design:
- **Self weight of slabs is automatically calculated and may be optionally excluded in the analysis.**
- **Spatial and scalar conditions are taken into account:**
  - a. Drop panels affect column strip width
  - b. Reinforcement concentration over a column
  - c. Difference in concentration width of side/corner columns to internal columns
  - d. Limitation of upper reinforcement over a slabstrip column – simultaneous increase of span reinforcement
  - e. Strip-width calculation for support lines at the edge of a slab
- **User freedom to choose different values for all the parameters incorporated in the design – providing unlimited capabilities.**
- **Two types of reinforcement arrangement compatible to the code proposed ones**: (radial arrangement vs. cruciform arrangement)
- **Easy to interpret tabular formats of results – fully compliant to the code regulations.**
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ACE OCP

ACE OCP is a module in SCADA Pro, representing an advanced real-world optimum design computing platform for structural systems. It also provides a complete optimization approach in terms of final design stage for real-world civil engineering structures. The main goal for the implementation of ACE OCP module is to help engineers to design safer and economic structures within an affordable and reliable technological framework.

- **ACE OCP is a tool for sizing optimization; search for the optimum size of all cross-sections with respect to the design code provisions.**
- **ACE OCP provides a numerical procedure that can replace the traditional trial-and-error design approach with an automated one.**
- **ACE OCP provides the optimum design with reference to the lower material and construction costs.**
- **ACE OCP provides the optimum design with reference to the lower environmental impact.**
- **Multiple state-of-the-art optimization algorithms are available in this innovative SCADA Pro module all of which have been successfully tested in various challenging civil engineering problems.**

ACE OCP is the only commercially available solution on the global market for value engineering. ACE OCP harmonizes technology to drive efficiency, reduce performance and risk, while preserving safety excellence and lifecycle performance. It takes the power and skill of large consulting enterprises and the knowledge of the world’s top universities and makes it available to every engineer with an intuitive interface that produces superior results. The module’s advanced optimization techniques have been developed by the SCADA Pro R&D team in collaboration with leading European and North American academic institutions in order to reduce construction and/or material costs by at least 10%, consistent with the required performance, reliability, quality and safety. The methodologies integrated into the ACE OCP module have been approved with the publication of the theoretical framework and indeterminate results in the official journal (http://dx.doi.org/10.1111/j.1468-0262.2012.00812.x) of the International Society for Structural and Multidisciplinary Optimization (ISSMO). www.scadapro.com

ACE OCP

- **Solution based on the selection of a powerful algorithm chosen from a list of state of the art numerical optimization algorithms.**
- **Numerous options to define the design bounds of the design variables; either as an input or as an expression.**
- **Practical comparison of initial and optimized designs.**

ACE OCP is an easy to interface engine, makes structural optimization a single-click process.

www.scadapro.com
Saudi Building Code (SBC) is a set of legal, technical and administrative regulations and requirements that specify the minimum standards of buildings' construction in order to ensure public health and safety. The code takes into consideration the cultural and social environment, the climatic and natural conditions, as well as the soil types and materials' properties in the Kingdom.

In SCADA Pro, SBC Parts 301, 303, 304 and 306 have been fully implemented. Specifically:

1. **301 Structural – Loading and Forces**
   - Fully implemented.
   - In SCADA Pro, SBC Parts 301, 303, 304 and 306 have been included. The Seismic Ground motion values (Ground Motion Acceleration, Site coeff.

2. **303 Structural – Soil and Foundations**
   - All the required checks according to the Section 5-4 are performed.
   - The software calculates automatically all the necessary values and carries out all the checks.

3. **304 Structural – Concrete Structures**
   - All the required checks are performed automatically for the following cases:
     - Design of Footings
     - Loads and the appropriate load combinations
     - Vertical irregularities as well.

4. **306 Structural – Steel Structures**
   - All the required checks are performed automatically for the following cases:
     - Flexural and Axial Loads, Magnified Moments for Sway and Non-Sway Frames
     - Flexural-Torsional Buckling check
     - Column and other Compression Members Design and checks
     - Design of members under Shear
     - Design of members under Combined Forces and Torsion
     - Flexural members check
     - Tension Members check
     - Shear and Torsion
     - Design of members under Combined Forces and Torsion
     - Verification of slabs.

5. **Building Information Modeling (BIM) compliance.**
   - Avoids errors and mismatches between architecture design and structural
   - Significant reduction of the modeling time through automation.
   - Using the editors of steel reinforcement in SCADA Pro for detailed modification of
   - Automatic slab recognition, loads definition, design and detailing of reinforcement
   - Design checks that cannot be performed in SAP2000 or ETABS (e.g. Punching

6. **ETABS SCADA Pro**
   - The two-way communication module supports:
     - 1. All types of materials, i.e. reinforced concrete, structural steel, masonry, wood
     - 2. Frame and surface elements
     - 4. Rigid offsets and moment pins
     - 5. Multiple types of frame, frame and shell loads and load patterns (e.g. quake seismic
     - 6. Force and line springs for the simulation of the soil-structure interaction.
     - 7. Analysis results (e.g. Static analysis, Response spectrum analysis) derived from

7. **Report in any regional language (e.g. English, German, Italian, Polish, Turkish)***
   - 1. Automatic slab recognition, loads definition, design and detailing of reinforcement
   - 2. Design of a structure based on multiple design code provisions, e.g. IBC, EC3, EC5, SCI, CIC, SE71, SBC by applying the analysis results derived from SAP2000 and
   - 3. Design checks that cannot be performed in SAP2000 or ETABS (e.g. Punching
   - 4. Take advantage of the advanced analysis types that SAP2000 and ETABS support.
   - 5. Using the editors of steel reinforcement in SCADA Pro for detailed modification of
   - 6. Creating structural drawings and detailing designs, that can be modified, continues
   - 7. Report in any regional language (e.g. English, German, Italian, Polish, Turkish)
SBC in SCADA Pro

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In SCADA Pro, SBC Parts 301, 303, 304 and 306 have been fully implemented. Specifically:

1. 301 Structural – Loading and Forces

   a. Load Requirements
   - SBC provides, the minimum load requirements for the design of buildings and other structures. The loads and the appropriate load combinations are created simultaneously and automatically from the program.

   b. Wind Loads Design
   - Both Methods, Simplified and Analytical, are included. A large set of tools guide the user in selecting correctly the various parameters.

   c. Seismic Design Criteria
   - Four Analyses Procedures (Index Force, Simplified, Static and Dynamic Analysis) are included. The Seismic Ground motion values (Ground Motion Acceleration, Site coefficients etc.) are defined automatically according to the Country Regions. The automatic calculation also applies for the Design Response Spectrum and the structural Plan and Vertical irregularities as well.

2. 303 Structural – Soil and Foundations

   a. Design of Footings
   - All the required checks according to the Section 5.4 are performed.

   b. Contact Pressure over total base area Calculation

3. 304 Structural – Concrete Structures

   a. Design of members under Combined Forces and Torsion
   - Flexural, Torsional Buckling, shear check, design checks of bearing masonry structures, timber connections).

   b. Design of members under Shear
   - Design of members under Combined Forces and Torsion

   c. Complete Library of all the types of steel connections

4. 306 Structural – Steel Structures

   a. Steel and Gross Area Calculation, Effective Area of Tension members
   - Net and Gross Area Calculation. Effective Area of Tension members

   b. Classification of Steel Sections
   - Standard cross-sections, Sections Designer cross-sections, Libraries of standard steel sections.

   c. Tension Members check
   - Rigid offsets and insertion points

   d. Column and other Compression Members Design and checks
   - Design checks that cannot be performed in SAP2000 or ETABS (e.g. Punching shear check, design checks of bearing masonry structures, timber connections).

   e. Flexural-Torsional Buckling check
   - Significant reduction of the modeling time through automation.

   f. Column and other Compression Members Design and checks
   - Automatic slab recognition, loads definition, design and detailing of reinforcement slabs.

   g. Design of members under Shear
   - ETABS SCADA Pro

   h. Design of members under Combined Forces and Torsion
   - Creation of structural drawings and detailing designs, that can be modified, continuity of beams and columns and complete print out results of the project.

   i. Complete Library of all the types of steel connections

2-way communication between SCADA Pro & SAP2000 & ETABS

The two-way communication module supports:

1. Automatic slab recognition, loads definition, design and detailing of reinforcement slabs.
2. Design of a structure based on multiple design code provisions (i.e., EC2, EC3, EC5, SBC) by applying the analysis results derived from SAP2000 and ETABS.
3. Design checks that cannot be performed in SAP2000 or ETABS (e.g. Punching shear check, design checks of bearing masonry structures, timber connections).
4. Multiple types of point, frame and shell loads and load patterns (e.g. quake/seismic load pattern, wind loads, snow loads)
5. Point and line springs for the simulation of the soil-structure interaction.
6. Multiple types of point, frame and shell loads and load patterns (e.g. quake/seismic load pattern, wind loads, snow loads)
7. Rigid offsets and insertion points
8. Design of a structure based on multiple design code provisions (i.e., EC2, EC3, EC5, SBC) by applying the analysis results derived from SAP2000 and ETABS.
9. Significant reduction of the modeling time through automation.
10. Automatic slab recognition, loads definition, design and detailing of reinforcement slabs.

SCADA Pro can be imported in SCADA Pro and the corresponding P-M-V diagrams or the deformed shape to be displayed.

In SCADA Pro there are the following advanced features additional to those in SAP2000 and ETABS:

1. 2-way communication between SCADA Pro & SAP2000 & ETABS
2. Automatic slab recognition, loads definition, design and detailing of reinforcement slabs.
3. Design of a structure based on multiple design code provisions (i.e., EC2, EC3, EC5, SBC) by applying the analysis results derived from SAP2000 and ETABS.
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- Automatically accounts for all critical design sections – different approach between columns/middle strips
- Graphical display of total bending moment diagram for a design strip
- Performs code check and reports the location and amount of reinforcement
- Self-weight of slabs is automatically calculated and may be optionally excluded in the analysis
- Generates a true 3D model of an entire concrete building – accurate FEM analysis
- Two types of reinforcement arrangement compatible to the code proposed ones
- User freedom to choose different values for all the parameters incorporated in the design – providing unlimited capabilities
- Solution based on the selection of a powerful algorithm chosen from a list of state-of-the-art numerical optimization algorithms.
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- Practical comparison of initial and optimized designs.

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