LINEAR AND NONLINEAR STATIC AND DYNAMIC ANALYSIS AND DESIGN OF BUILDING SYSTEMS FOR STEEL, CONCRETE AND MASONRY. STRUCTURAL AND EARTHQUAKE ENGINEERING SOFTWARE Win 2000/NT/XP

HIGHRISE BUILDINGS, MULTIPLE TOWER BUILDINGS, RIGID OR SEMI-RIGID DIAPHRAGMS, RAMPS AND PARKING STRUCTURES, MEZZANINE FLOORS, STEPPED DIAPHRAGM SYSTEMS, LINEAR AND NONLINEAR STATIC AND DYNAMIC ANALYSIS AND DESIGN OF BUILDING SYSTEMS INCLUDING NONSymETRICAL-GENERAL SHAPEd STRUCTURES.

FULL 3D BUILDING MODEL, STEEL AND CONCRETE FRAME DESIGN, CONCRETE SHEAR WALL AND SLAB DESIGN, STAGGERED TRUSS BUILDINGS DESIGN, STEEL JOIST DESIGN. DESIGN OPTIMIZATION, CONSTRUCTION SEQUENCE LOADING.

RESPONSE SPECTRUM ANALYSIS, LINEAR and NONLINEAR TIME HISTORY ANALYSIS, STATIC PUSHOVER ANALYSIS, BASE ISOLATORS, VISCous DAMPERS, STRUCTURAL POUNDING, EARTHQUAKE SIMULATION, STAGED CONSTRUCTION.

ETABS IS THE SOLUTION, WHETHER YOU ARE DESIGNING A SIMPLE 2D FRAME or PERFORMING A DYNAMIC ANALYSIS OF A COMPLEX HIGHRISE THAT UTILIZES NONLINEAR DAMPERS FOR INTERSTORY DRIFT CONTROL OR DESIGNING THE HIGHEST BUILDING OF THE WORLD.
For nearly thirty years, the TABS and ETABS series of computer programs have defined the standard for building analysis and design software, and the tradition continues with this latest release of ETABS. These programs were the first to take into account the unique properties inherent in a mathematical model of a building, allowing a computer representation to be constructed in the same fashion as a real building: floor by floor, story by story. ETABS uses terminology familiar to the building designer such as columns, beams, braces and walls rather than nodes and finite elements.

In any endeavor, a tool tailored to a task is the most efficient. For buildings, ETABS provides the automation and specialized options needed to make the process of model creation, analysis and design fast and convenient. Tools for laying out floor framing, columns, frames and walls, in either concrete or steel, as well as techniques for quickly generating gravity and lateral loads offer many advantages not available from most general purpose finite element programs. Seismic and wind loads are generated automatically according to the requirements of the selected building code. All of these modeling and analysis options are completely integrated with a wide range of steel and concrete design features.

While ETABS is familiar and straightforward to use for the building designer, it also offers many sophisticated analytical and design capabilities not found in other commercial programs. Full dynamic analysis, including nonlinear time-history capabilities for seismic base isolation and viscous dampers, along with static nonlinear pushover features offer state-of-the-art technology to the engineer doing performance design. Powerful features for the selections and optimization of vertical framing members as well as the identification of key elements for lateral drift control provide significant time savings in the design cycle. In addition, because ETABS includes complete and detailed steel and concrete design calculations for beams and columns, braces, walls and slabs, the time typically associated with the transfer of data between analysis and design programs has been eliminated. This design integration, in combination with the fact that ETABS generates CAD output files, means that production drawings can be generated faster and with greater accuracy.

ETABS has long been a favorite for the analysis and design of buildings, and whether the project is a one story shopping center or the tallest building in the world, this latest release offers the comprehensive tools needed to produce timely, efficient and elegant engineering solutions.
Summary:

**ETABS PLUS** is fully integrated with Windows NT/2000/XP and features a powerful graphical interface unmatched in ease of use, sophistication and productivity.

ETABS PLUS includes:
- Full 3D Building Model, Building Terminology, Automated Gravity Load Tracing, Automated Wind Loads, Automated Seismic Loads
- 3D Finite Element Analysis, Frame, Shell, Joint, Link Elements, P-Delta Option, Linear Static Analysis, Modal Analysis, Response Spectrum Analysis, Linear Time History Analysis
- Steel Frame Design, Concrete Frame Design, Composite Beam Design, Concrete Shear Wall Design, Truss and Steel Joist Design

**ETABS NONLINEAR** extends the capabilities of the Plus version to include nonlinear analysis options:

**Static Nonlinear Analysis Options**
- Large Displacement Option, Sequential Loading Option, Plastic Hinge Element, Static Pushover Analysis – FEMA 273 and ATC-40

**Dynamic Nonlinear Analysis Options**
- Gap / Hook Element, Damper Element, Plasticity Element, Base Isolator with Plasticity Behavior, Base Isolator with Friction / Pendulum Behavior, Nonlinear Time History Analysis.

**The Wilson FNA Method**
The ETABS nonlinear time history analysis uses the new numerical Integration technique known as the Wilson FNA (Fast Nonlinear Analysis) Method. The procedure uses an iterative vector superposition algorithm that is extremely efficient for analyzing structures with predefined, localized nonlinearity. The method has demonstrated significant reductions in processing times when compared with other nonlinear analysis methods.

The ETABS Package comes with a comprehensive set of printed and online documentation including: User Manuals, Tutorials, Watch and Learn Videos.
DETAILER
Reinf. Details for ETABS (Soon)
MODELING and USER FRIENDLY GRAPHICAL INTERFACE:

New physical object based modeling environment • Automated templates for typical structures • Easy and Enhanced drawing tools with several new snaps • Optimized for modeling of multistory buildings • Enhanced selection options • Enhanced extrusion routines • Auto line constraints for mismatched shell meshes • Fast generation of straight and circular ramps • Internal meshing properties for floors, ramps and wall panels • Enhanced model building with walls and openings • On screen precise nudging and duplication of beams, columns and walls • On screen creation of beams and columns with parallel offsets • On screen plan editing shear walls • Area-object thickness and joint offset overwrites • Powerful new 2D and 3D model builder • 3D model generation using plans, elevations and developed views • Editing with move, merge, mirror and replicate • Accurate dimensioning with guidelines and snapping

Multiple simultaneous cartesian (rectangular), cylindrical and skewed grid systems • Story definitions using the concept of similar Stories • Building modeled as Area, Line and Point objects • Common labeling of Objects between similar Stories • Area objects for: Walls, Slabs/Decks, Openings, Springs, Mass, Loads • Line objects for: Columns, Beams, Braces, Links, Springs, Mass, Loads • Point objects for: Supports, Springs, Mass, Loads • Rigid Diaphragm definitions • Built-in database of steel sections • Graphical Section Designer for defining custom sections • Option to convert cartesian and cylindrical system to new general system • Option to glue joints to grid lines • Different grid systems possible for each story • Manipulation of grid labelling – Switching order and labelling

Cut, copy and paste options • Unlimited levels of undo and redo • Quick draw options to create elements with one mouse click • Powerful grouping, selection and display options • Onscreen assignment of properties, loading and supports • Multiple views in 3D perspective with zooming and panning • Orthographic and user defined views • Copy/Paste to and from spread sheets and Access Database • Copying and pasting assignment patterns across a series of objects • Multiple rectangular and cylindrical coordinate systems • Detailed context sensitive online help • Analysis integrated with postprocessing and design • Right button click for instantaneous current element or joint information • Fast OpenGL graphics now available for drawing and display windows • Enhanced OpenGL viewer • Enhanced animation capability • Enhanced tabular display options • Graphical section cut definitions for forces and stresses • Analysis case tree display 3D rendering and flythrough views • Interactive spreadsheet input of model geometry, loading and assignments • 3D perspective graphical displays of undeformed and deformed structural geometries • Static deformed shapes and mode shapes • Bending moment and shear force diagrams • Stress contours • Animation of deformed shapes and mode shapes • Animated stress contours • Multiple windows displaying different parameters • Instantaneous graphical and tabulated output details for specific joint or element with right button click • Convenient unit conversion ant time • Extensive customizable tool bar • Drawing and aligning controls for structural geometry • Generation of reference lines and planes for structural geometry • Single click rectangle area creation for drop panels and spread footings • Option to set deck orientation normal to a selected beam • Option to add elevation view at any skewed grid line or beam • Activating nudge, snaps and drawing options in elevation views • Floor area edge selection • Option to split or merge the edge of a floor deck for extra joint or to remove joint • Enhanced auto floor meshing for semi rigid floor diaphragm modelling • Fine grid snaps activated with respect to origin or last mouse down • Reverse fence selection to allow box intersection selection • Floor and wall mesh size defined as object based internal property • Detailed cross referenced online technical notes and documentation.
Building Loads
No limit on number of independent load cases • Gravity loads specified as point, line or area loads • Automatic wind load generation: UBC, BOCA, ASCE, NBCC • Wind loading codes ASCE 7-88, ASCE 7-93 and BS 6399-1995 • Automatic seismic load generation: UBC, BOCA, NBCC • Added IBC 2003 seismic and wind loads • Built-in response spectrum and time history input • Temperature and thermal-gradient loads • Algebraic, absolute, SRSS, and enveloping load combinations • Mass directly specified or calculated from gravity loads • Spread sheet input of lateral loads from wind tunnel tests • Applying wind without rigid diaphragms – Using cladding panels • Static and dynamic load combinations and envelopes • Automated construction sequence loading • Auto transfer of area loads to frames • Open-structure wind loads • Display of automated loads • Enhanced vertical load transfer from floors to girders and walls • Option to display final distribution of loads transferred from floors to beams • General curves for the live load reduction based on DL/LL ratios • Added auto-permutation of Wind directions and eccentricities • Added Open-structure wind loads • Added Story vertical load, shear and overturning plots.

IMPORT – EXPORT OPTIONS:
Import:
Import from AutoCAD: Arbitrary nonrectangular grid systems, Framing plans, 3D Framing models; CIS/2 (.step), FrameWorks Plus (.sfc), Strudl-Staad (.gti, .std), Prosteel (.mdb), IFC-Tekla-Xsteel (.ifc), IGES (.igs), Autodesk Revit Structure (.exr)
Export:
Export to AutoCAD: Floor plans w/ composite design info, User defined framing elevations; ACCESS (.mdb), CIS/2 (.step), FrameWorks Plus (.sfc), Prosteel (.mdb), Steel Detailing Neutral File (SNDF)-Xsteel, CSI DETAILER (.adi), IFC-Tekla-Xsteel (.ifc), IGES (.igs), Autodesk Revit Structure (.exr), Export to safe with Poly areas. Capture graphics of any ETABS Window.

SECTION DESIGNER:
A powerful utility to define frame and wall pier sections for use in analysis and design. It is fully integrated into ETABS. The section can be of any arbitrary shape and they can consist of one or more material properties. Reinforcing bars can be specified for concrete sections. Modification factors for cracked sections. Definition of unsymmetrical concrete section with reinforcing and the development of the associated PMM interaction surface for use in the concrete frame design postprocessor integrated within ETABS. Definition of wall pier geometry and reinforcing and development of the associated PMM interaction surface for use in the shear wall design postprocessor.
ETABS PLUS FEATURES

FULL 3D BUILDING MODEL, LINEAR STATIC AND DYNAMIC ANALYSIS, STEEL AND CONCRETE FRAME DESIGN, COMPOSITE BEAM DESIGN, CONCRETE SHEAR WALL DESIGN, STAGGERED TRUSS AND STEEL JOIST DESIGN

THE ELEMENT LIBRARY
Underlying the ETABS object-based building models is a comprehensive analysis engine comprised of the following element types.

LINE OBJECT:
The 3D Beam / Column / Brace (Frame) Element
- Axial, bending, torsional and shear deformations
- Multiple non-prismatic segments over element length
- Ends offset from reference nodes in any direction
- Automated evaluation of offsets for joint size
- Moment and shear releases and partial-fixity
- Point, uniform and trapezoidal loading in any direction
- Temperature and thermal-gradient loading

AREA OBJECT:
The 3D Wall / Slab / Deck (Shell) Element
- Shell, plate or membrane action
- Thick-shell option
- General quadrilateral or triangular element
- Orthotropic materials
- Six degrees of freedom per joint
- Uniform load in any direction
- Temperature and thermal-gradient loading

POINT OBJECT:
The Joint Element (Spring)
- Support, Coupled or uncoupled grounded springs,
- Force loads, Ground-displacement loads

The Link Element
- Two node linear spring with 6 degrees of freedom
- Can be used to model Panel-zone deformations

ANALYTICAL OPTIONS
- Static and dynamic analysis
- Automatic meshing of frame members into analyses elements
- Automatic transfer of loads on decks / slabs to beams and walls
- Automatic meshing of decks / slabs for flexible diaphragm analysis
- P-delta analysis with either static or dynamic analysis
- Automated center-of-rigidity calculations
- Integrated output forces for walls / slabs / decks for all loads
- Explicit Panel-zone deformations
- Automatic tributary-area calculations for Live-Load reduction factors
- Construction sequence loading analysis
- Eigen and load-dependent Ritz vector determination
- Multiple Response Spectrum cases
- Modal combination by SRSS, CQC or GMC (Gupta) method
- Static and dynamic response combinations and envelopes
- Multiple Time History cases
- Seismic acceleration or displacement excitation
- Wind-load forcing functions
- Transient or steady-state excitation
- Envelope or step-by design for Time-History loads
ANALYSIS OUTPUT OPTIONS

- Deformed and Undeformed geometry in 3D perspective
- Loading diagrams
- Bending-Moment and Shear-Force diagrams for Frames
- Stress contours for Shells
- Intergrated-force diagrams for Wall Piers and Spandrels
- Interactive Section-force results using Groups
- Animation of deformed shapes
- Time-History deformed shapes as real time AVI files
- Displays of nodal and element time-history records
- Time History displays of function vs. Time or function
- Response spectrum curves for any joint from Time History response
- Instantaneous on-screen results output with right-button click on element
- Selective or complete tabulated output for all output quantities
- Graphics output to screen, printer, DXF file, or Windows Metafile
- Tabulated output to screen, printer or Access Database

DESIGN OPTIONS

General:
Steel frame design, reinforced concrete frame design, composite beam design, reinforced concrete shear wall design, steel truss and steel joist design.

Typical master floor in story data for typical floor design efficiency • Splice story and splice height in story data • Composite beam and steel joist design of typical floor without analysis of whole structure • Auto grouping to enforce same size columns between story splice points • Weak beam / strong column design in optimization • Treshold stress ratio for auto steel and concrete design • Auto iteration control for stress optimization • Design template for fast generation of staggered truss buildings • Automated steel joist design • Auto creation of drift targets based upon floor elevations • Frame member size optimization for a target time period • ACI torsion design for beams • Concrete non-prismatic frame section design • Added Design output to Database • Improved plan display of most design quantities.

Complete geometry, loading and analysis interface with SAFE • Spread footing, strip footing and mat foundation design • Elevated flat slab design.

The following design options are fully integrated with analysis in the ETABS graphical user interface.

Steel Frame Design

- Fully intergrated steel frame design
- Design for static and dynamic loads
- Grouping for design envelopes
- Optimization for strength and lateral drift
- Seismic design of special moment-resisting frames
- Seismic design of concentric and eccentric braced frames
- Check of panel zones for doubler and continuity plates
- Graphical display of stress ratios
- Interactive design and review
- Summary and detailed reports including database formats
Concrete Frame Design
- Fully integrated concrete frame design
- Design for static and dynamic loads
- Seismic design of intermediate / special moment-resisting frames
- Seismic design of beam / column joints
- Seismic check for strong-column / weak-beam design
- Graphical Section Designer for concrete rebar location
- Biaxial-moment / axial-load interaction diagrams
- Graphical display of reinforcement and stress ratios
- Interactive design and review
- Summary and detailed reports including database formats

Composite Beam Design
- Fully integrated composite beam design
- AISC-ASD01, AISC ASD89, AISC-LRFD99, AISC-LRFD93, BS5950 90, CISC95, Indian IS 800-1998
- Automatic calculation of effective slab widths
- Numerous user specified constraints
- Shored and unshored design
- Optimal design for strength and deflections
- Camber calculations
- Floor vibration analysis
- Graphical display of all design quantities
- Interactive design and review
- Summary and detailed reports including database formats

Concrete Shear Wall Design
- Fully integrated wall pier and spandrel design
- Design for static for and dynamic loads
- Automatic integration of forces for piers and spandrels
- 2D wall pier design and boundary-member checks
- 2D wall spandrel design
- 3D wall pier check for provided reinforcement
- Graphical Section Designer for concrete rebar location
- Graphical display of reinforcement and stress ratios
- Interactive design and review
- Summary and detailed reports including database formats
- Simplified shear wall design option for uniformly distributed rebar
- Allows powerful design of curved and other 3-D shear walls
- Design of deep spandrels spanning over more than one story
- Auto breakdown of 3D shear wall for torsional effects in shear design
- Assembling wall panels into one 3D section – Eliminating overlaps
- Creating moment curvature from user input stress/strain curves
ETABS NONLINEAR FEATURES

STATIC PUSHOVER ANALYSIS, NONLINEAR TIME HISTORY ANALYSIS, BASE ISOLATORS, VISCOUS DAMPERS, STRUCTURAL POUNDING

ETABS Nonlinear extends the capabilities of the PLUS version to include the following static and dynamic nonlinear analysis options

**Static Nonlinear Analysis Options**
- Large displacement option
- Sequential loading option

**Nonlinear Link Element**
- Used with the Dynamic Nonlinear Analysis option
- Used as Link, Spring or Panel zone
- Viscous damper with nonlinear exponent on velocity term
- Gap (compression only) and Hook (tension only) element
- Uniaxial plasticity (all 6 degrees of freedom)
- Base isolator with biaxial-plasticity behavior
- Base isolator with friction and / or pendulum behavior
- Force or displacement vs. Time plots
- Force vs. Deformation plots

**Plastic Hinge Element**
- Used as Spring, Link, Panel zone or inside Frame Elements
- Axial, flexural, shear and torsional behavior
- Axial-load / biaxial-moment interaction
- Multilinear behavior including softening
- Tabulated and Graphical display of hinge status

**Specialization for Static Pushover Analysis**
- FEMA 273, ATC-40
- Automated force-deformation relations for steel and concrete hinges
- Modal, uniform, or user-defined lateral load patterns
- Start from applied gravity load
- Capacity Spectrum conversions
- Effective damping calculation
- Demand Spectrum comparisons
- Performance point calculation
- Summary reports including plastic-hinge deformations

**Dynamic Nonlinear Analysis Options**
The nonlinear dynamic analysis option extends the capabilities of the Linear Time History option of the ETABS Plus by allowing for nonlinearity in predefined nonlinear elements.

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Techiesoft

P.O. Box 30345, Dubai, U.A.E.
Tel: +971 4 367 2287
Fax: +971 4 359 5978
E-Mail: sales@techiesoft.com

www.techiesoft.com

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Fax: +971 4 359 5978

Abu Dhabi:
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Fax: +971 2 631 1218