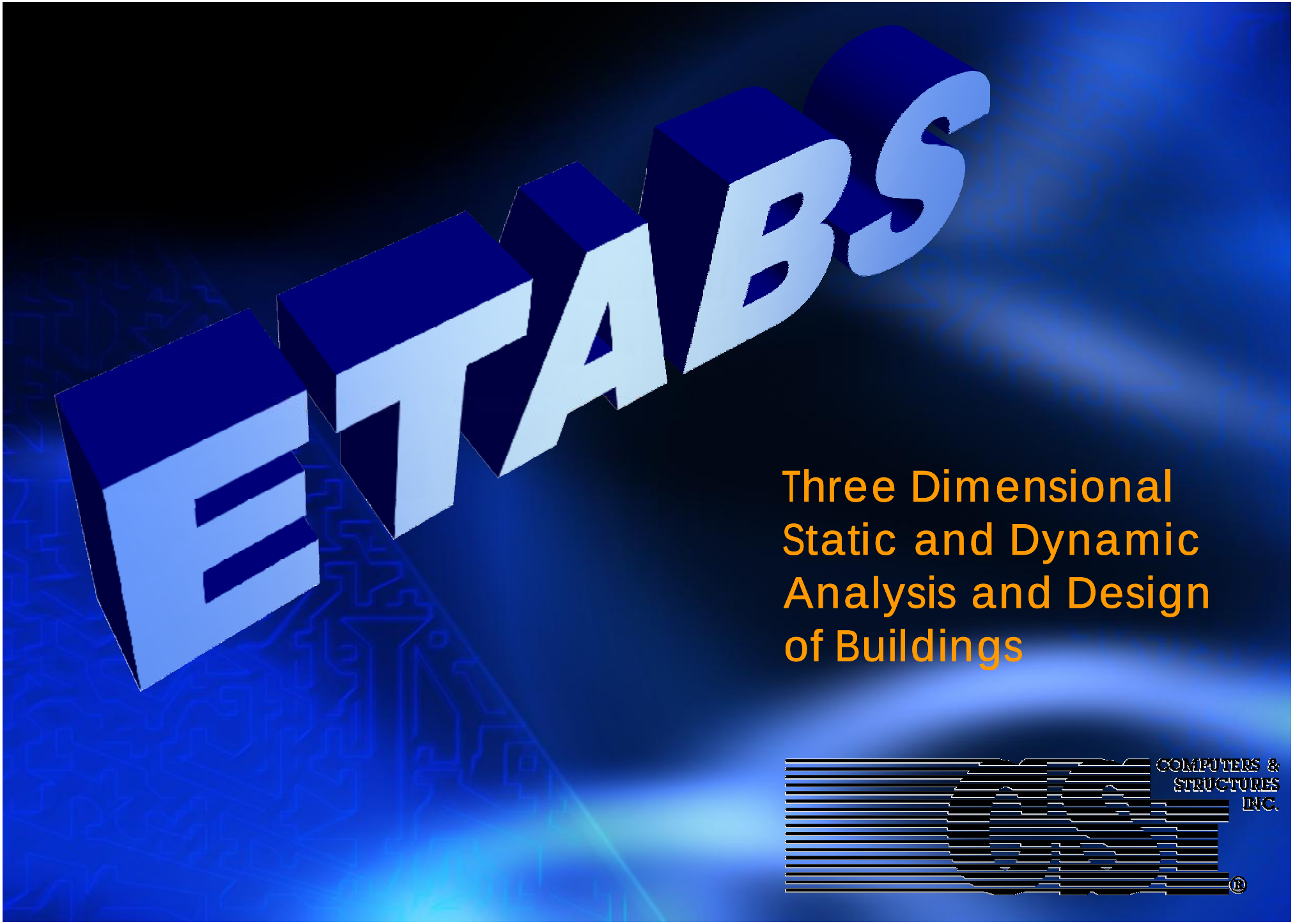
ETABS
Three Dimensional
Static and Dynamic
Analysis and Design
of Buildings
COMPUTERS &
STRUCTURES
INC.

ETABS

The Most Comprehensive Software for the Modeling, Analysis and Design of Buildings

Key Features

Key Features

- **Fully integrated interface within Windows 95/98/NT/2000**
- **Optimized for modeling of multistory buildings**
- **3D perspective, plan, elevation, developed elevation, and custom views**
- **3D model generation using plans and elevations**
- **CAD drawing/editing for fast, intuitive framing layout**

ETABS

Key Features

Key Features

- **Extensive Analysis Capabilities**
  - *Linear Static Analysis*
  - *Linear Dynamic Analysis*
  - *Static and Dynamic P-Delta Analysis*
  - *Static Non-Linear Analysis*
  - *Dynamic Non-Linear Analysis*
  - *Pushover Analysis*
  - *Multiple Response Spectrum Analysis*
  - *Multiple Time History Analysis*
  - *Construction sequence loading analysis*

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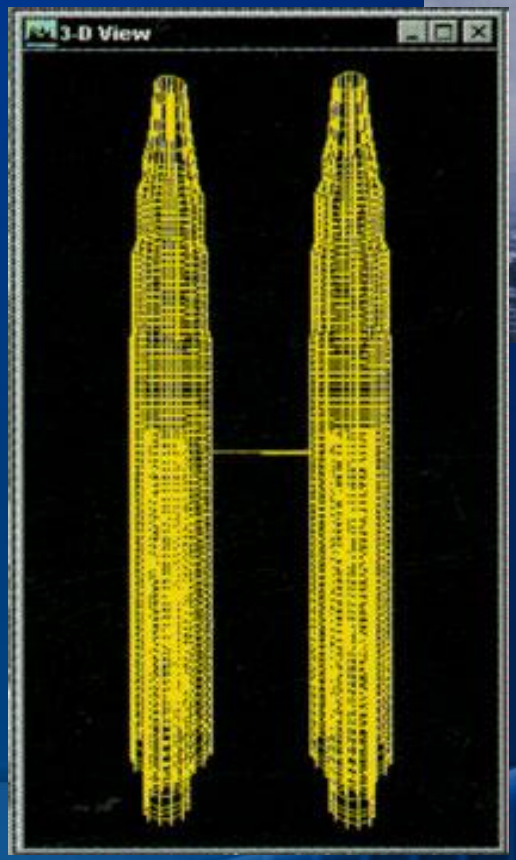
Key Features

Key Features

- **Fast generation of model using the concept of similar stories**
- **Automated templates for typical structures**
- **Easy editing with move, merge, mirror and replicate**



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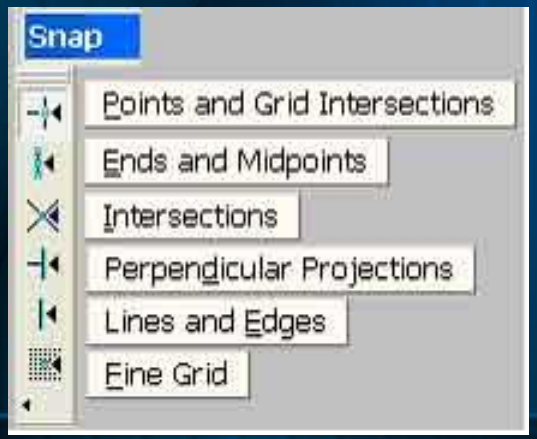
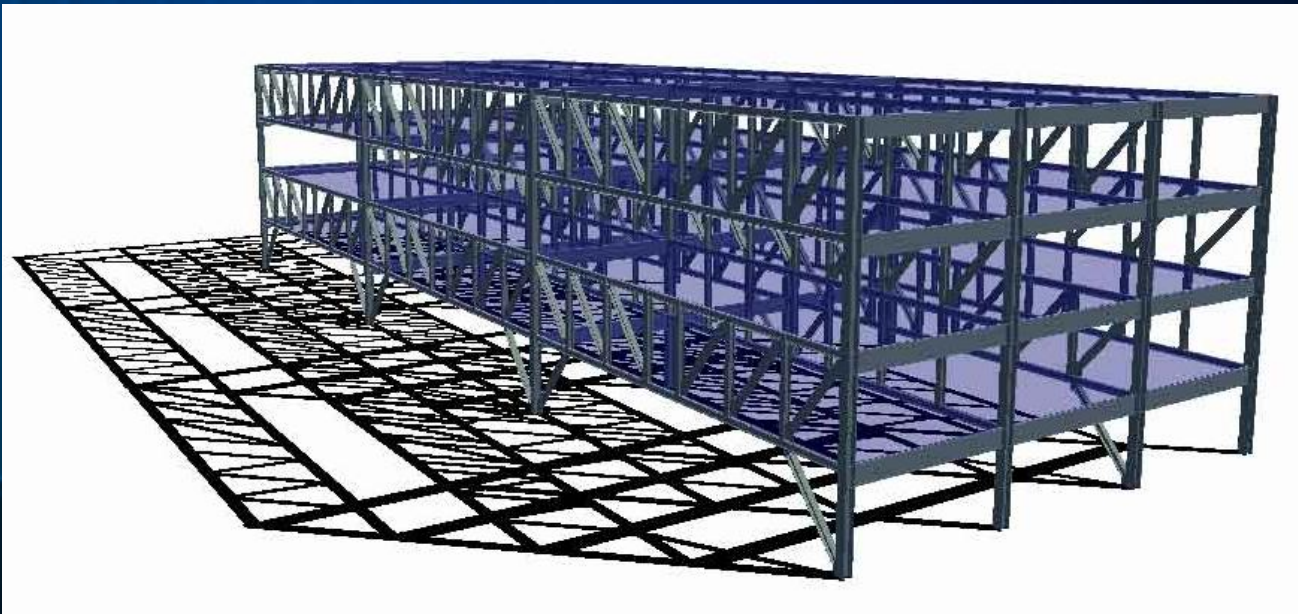
Key Features

Key Features

- **Multiple views in 3D perspective with zooming and snapping**
- **Onscreen assignment of properties, loading and supports**
- **Powerful grouping, selection and Display options**
- **Cut, copy and paste options**





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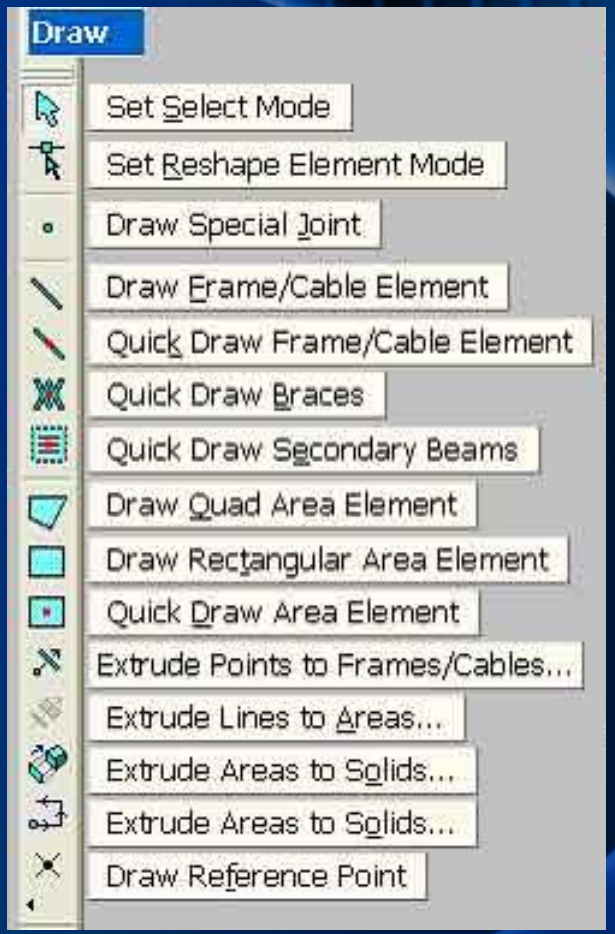
Key Features

Key Features

- Unlimited levels of undo and redo
- Cut/Paste geometry to and from spreadsheets
- Import and export of .DXF file for model geometry
- Detailed context-sensitive online help
- Analysis integrated with post-processing and design



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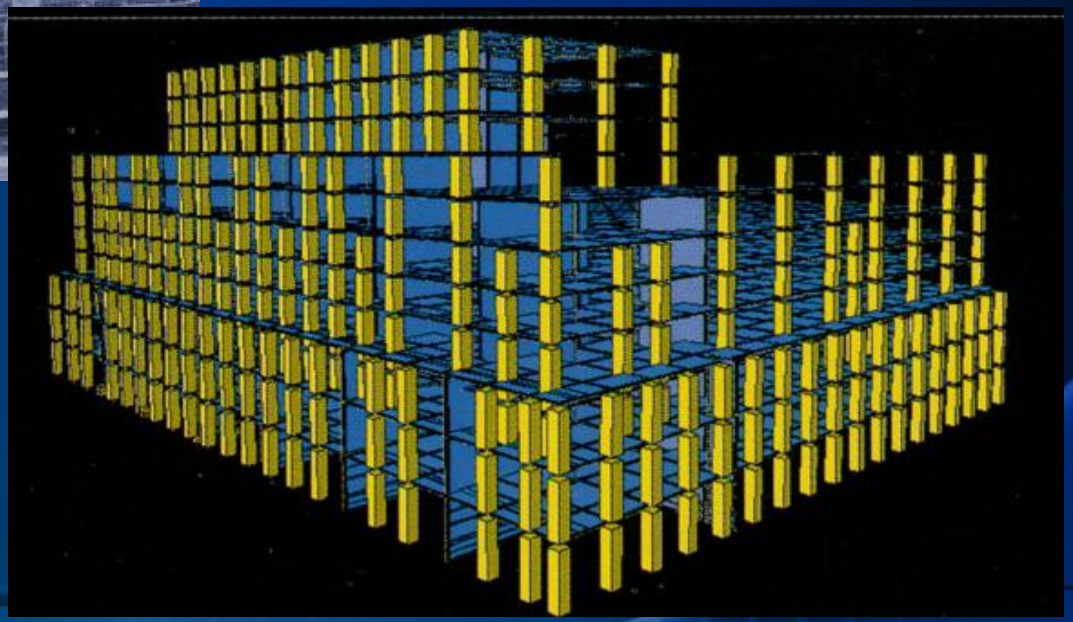
Interactive Model Creation
Fully Graphical Interface

Realistic Modeling

Interactive Modeling



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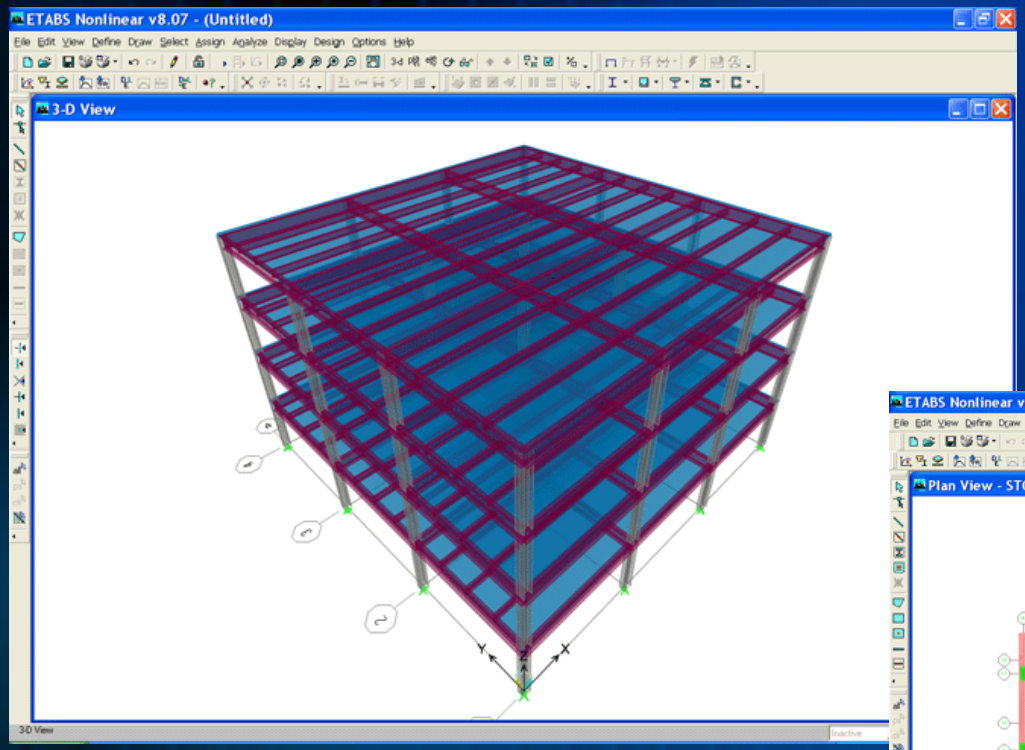
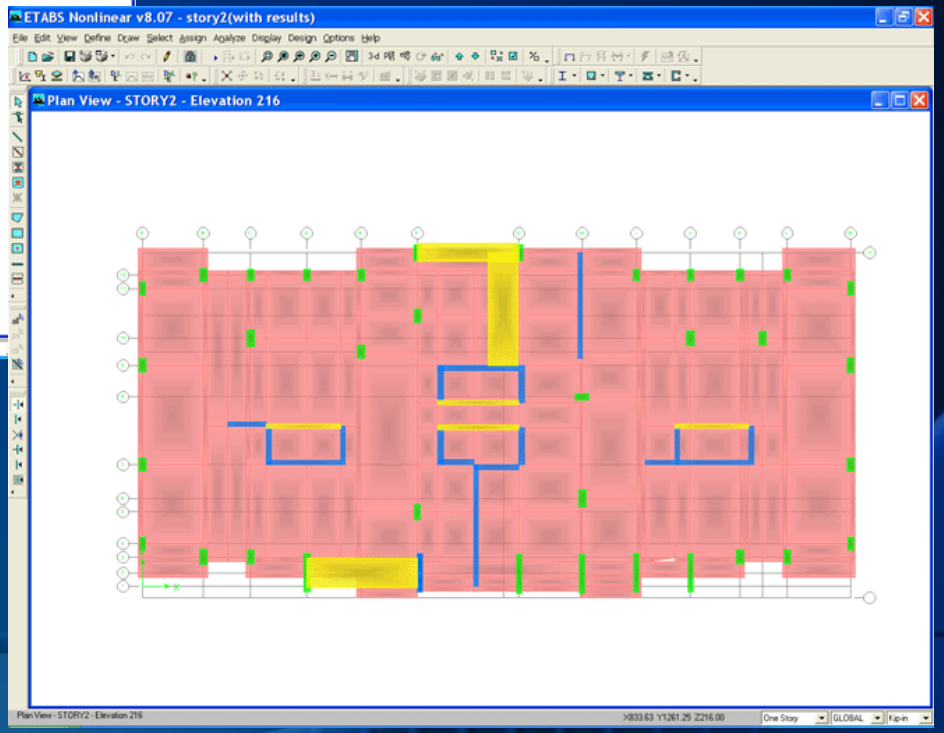
Interactive Modeling

Powerful Viewing Options





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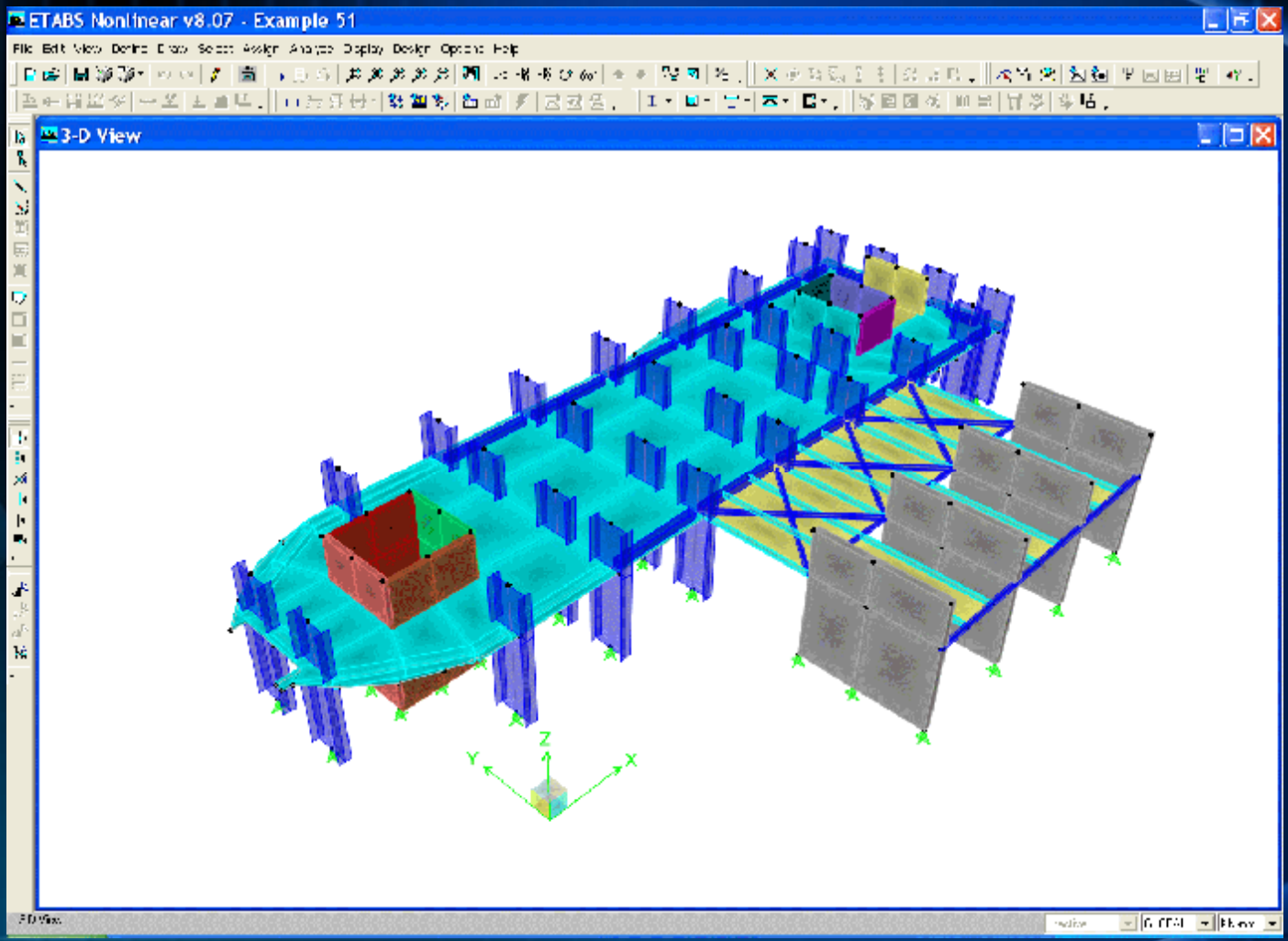
Interactive Modeling

Powerful Viewing Options



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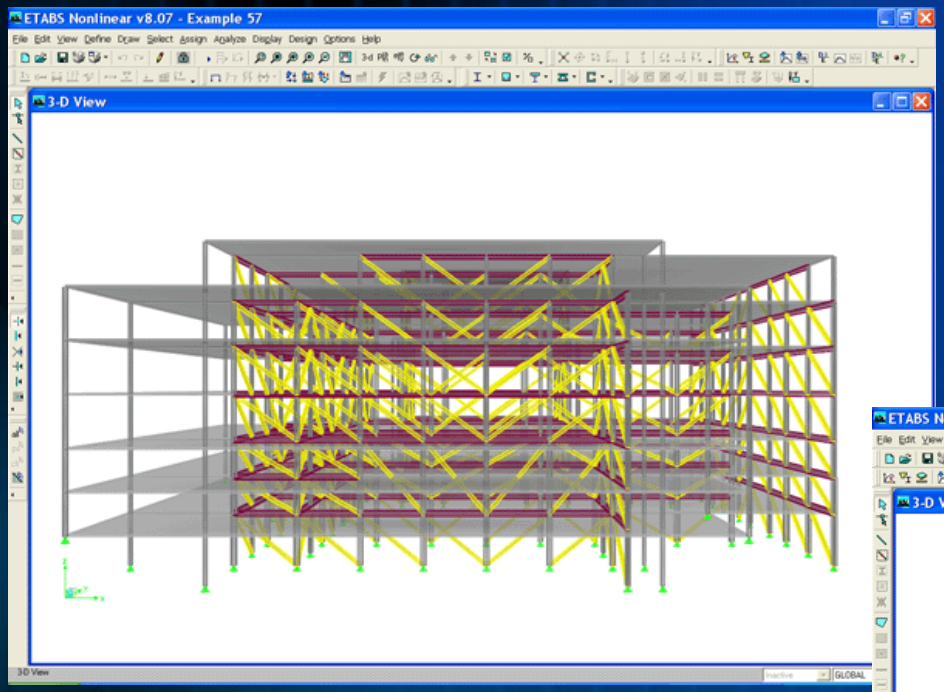
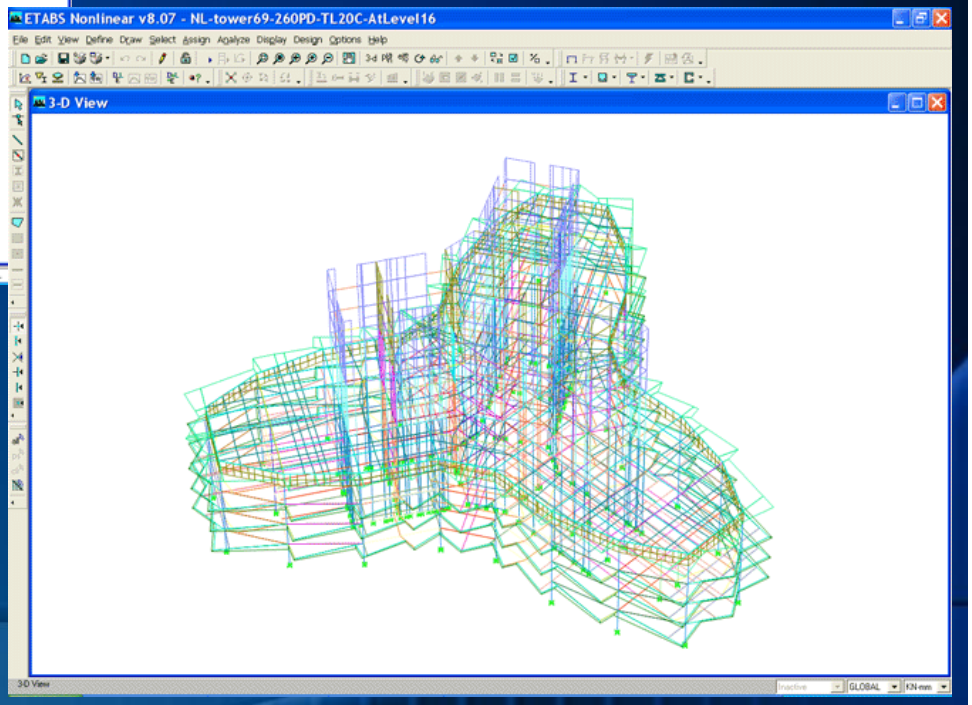
Interactive Modeling

Powerful Viewing Options





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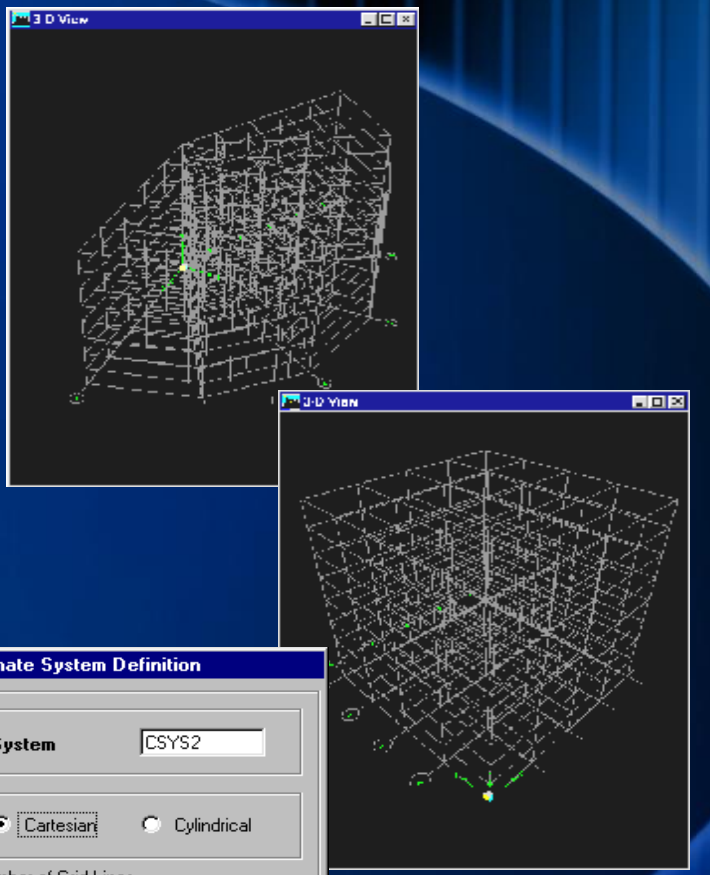
Interactive Modeling

Flexible Grid Systems

- Convenient dividing and meshing of design objects
- Multiple simultaneous rectangular and cylindrical grid systems
- Accurate dimensioning with guidelines and snapping
- Quick-draw options to create objects with one mouse click



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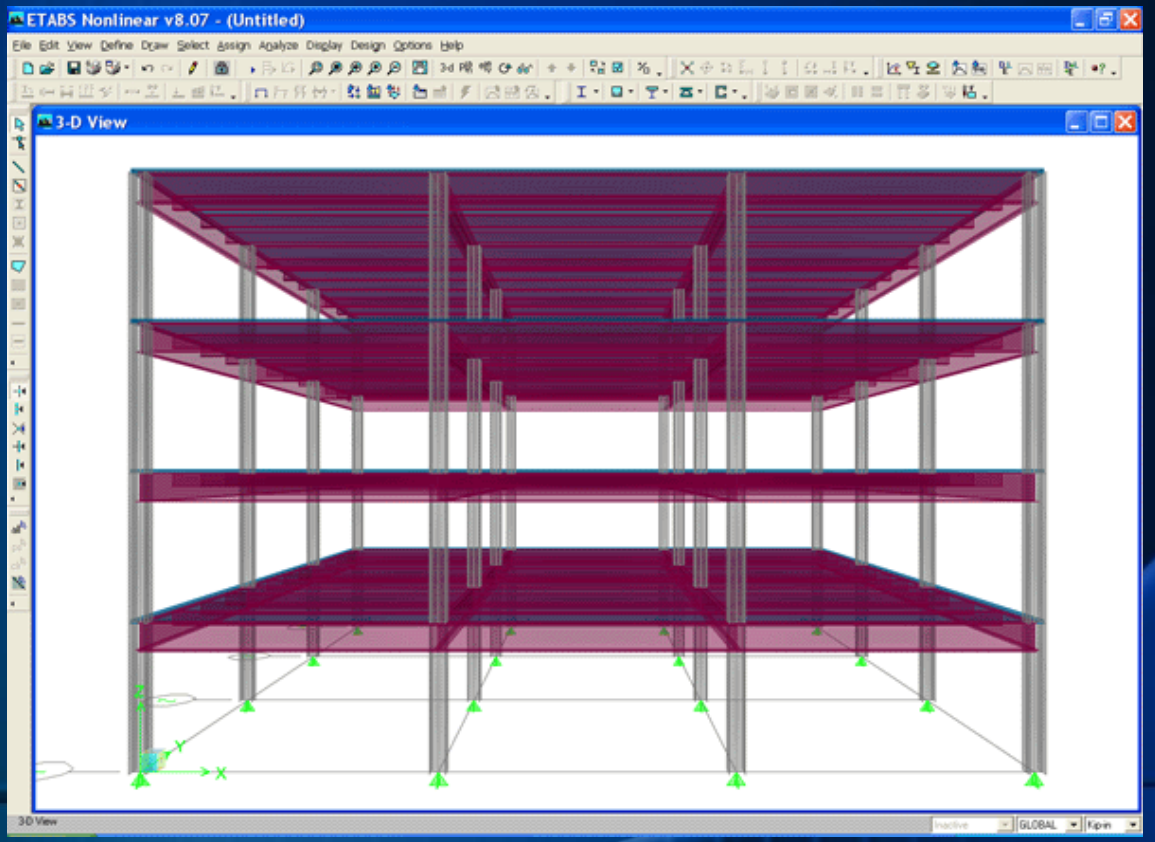
Interactive Modeling

Parametric Templates

- **Automated model generation for typical structures using powerful templates**
  - ***Steel Deck***
  - ***Flat Slab***
  - ***Two-way Slab***
  - ***Waffle Slab***
  - ***Ribbed Slab***



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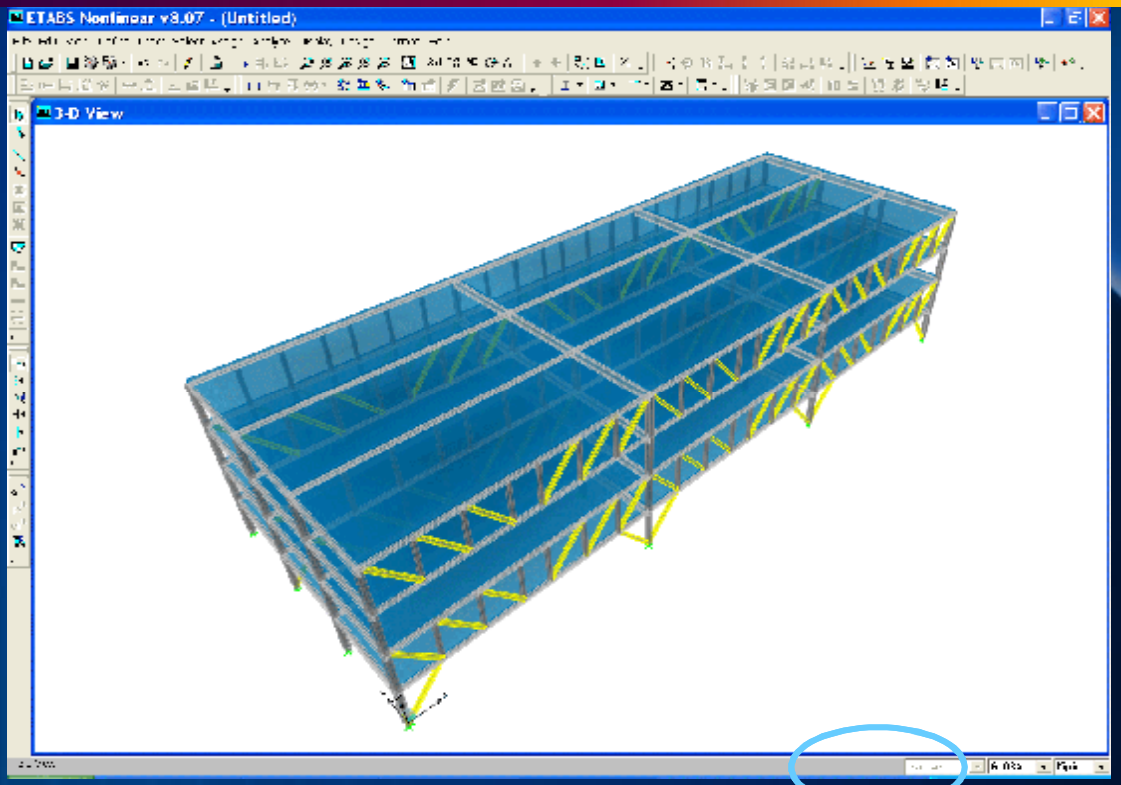
Interactive Modeling

“Similar “ Story Concept

- Time saving Story definitions using the concept of similar Stories
- Common labeling of Objects between similar Stories



Story Data

	Label	Height	Elevation	Similar To
9	STORY8	144.	1152.	NONE
8	STORY7	144.	1008.	STORY8
7	STORY6	144.	864.	STORY8
6	STORY5	144.	720.	STORY8

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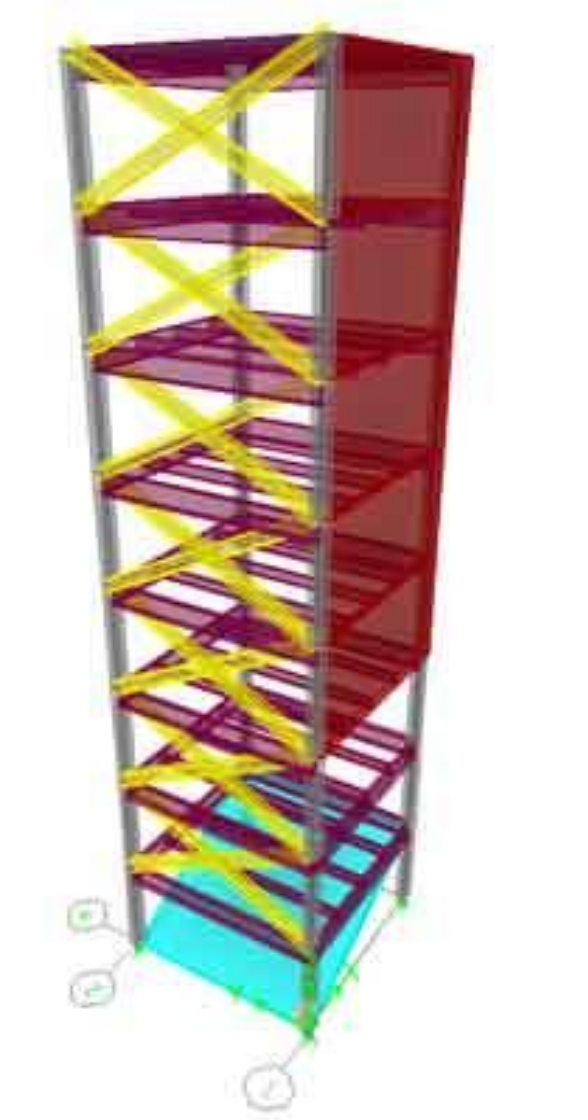
Interactive Modeling

Object Based Modeling

- **Area objects for**
  - ***Walls, Slabs/Decks, Opening, Springs, Mass, Loads***
- **Line objects for**
  - ***Columns, Beams, Braces, Links, Springs, Mass, Loads***
- **Point objects for**
  - ***Supports, Springs, Mass, Loads***



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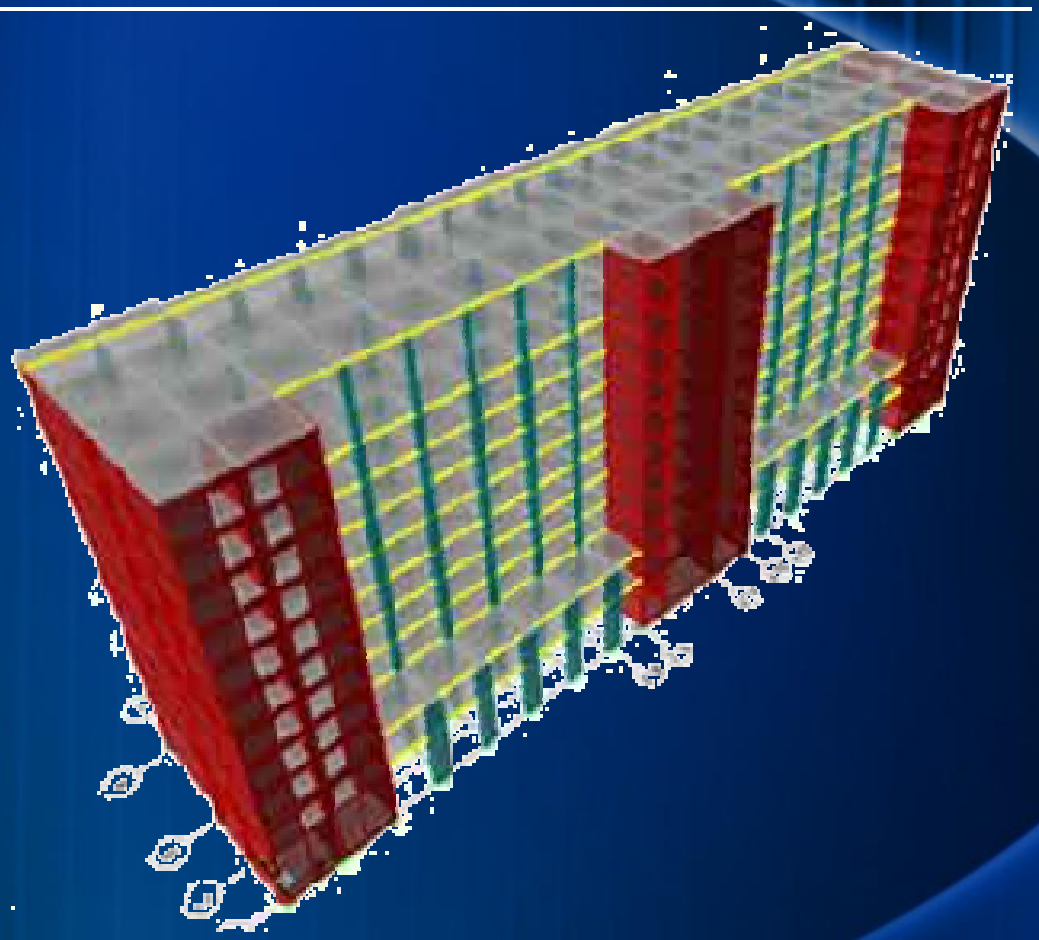
Interactive Modeling

Rigid Diaphragm Concept

- **Define Rigid Diaphragms to effectively model floor slabs and to constrain deformations**



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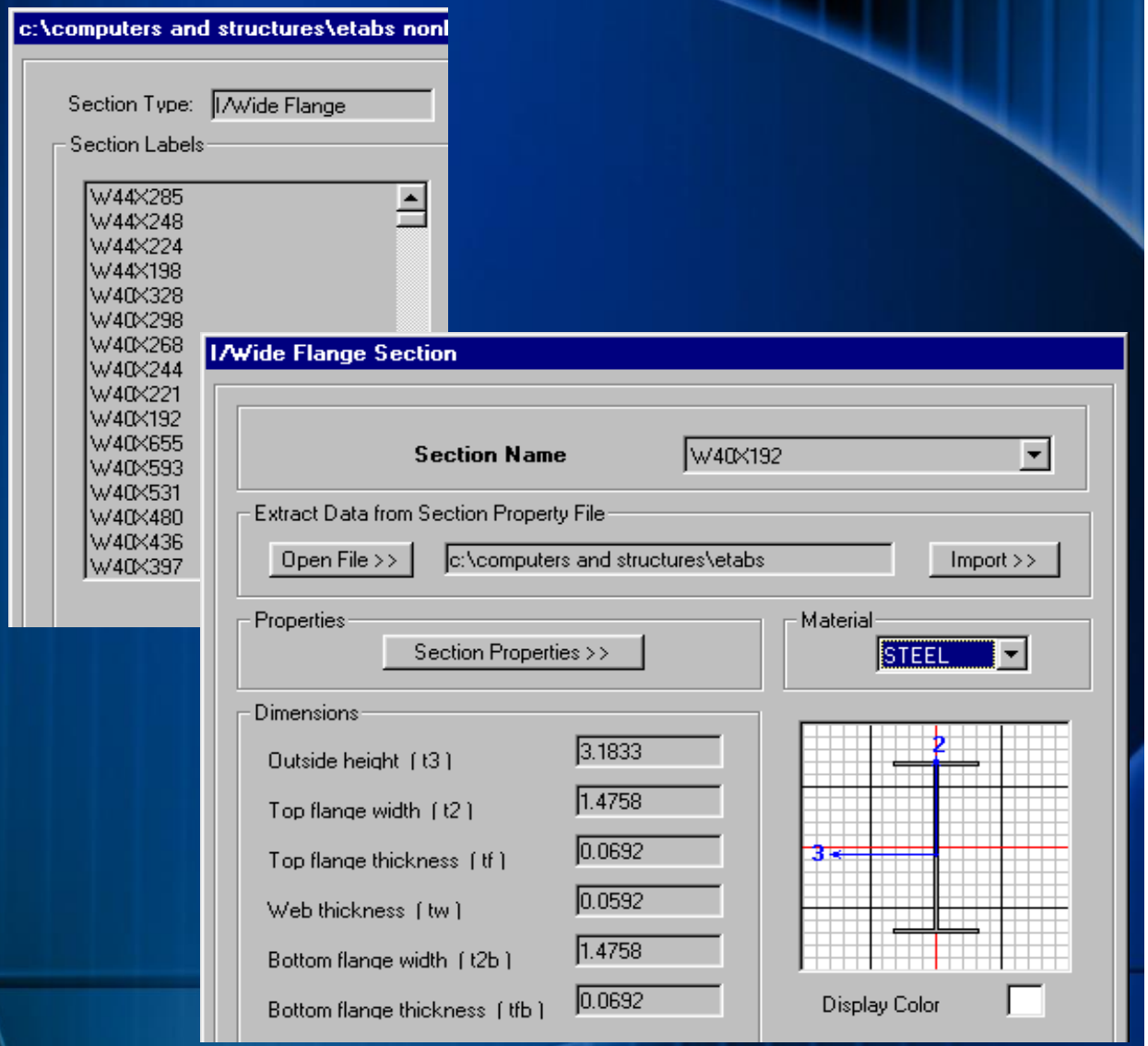
Interactive Modeling

Extensive Section Database

- **Built-in database of steel sections**



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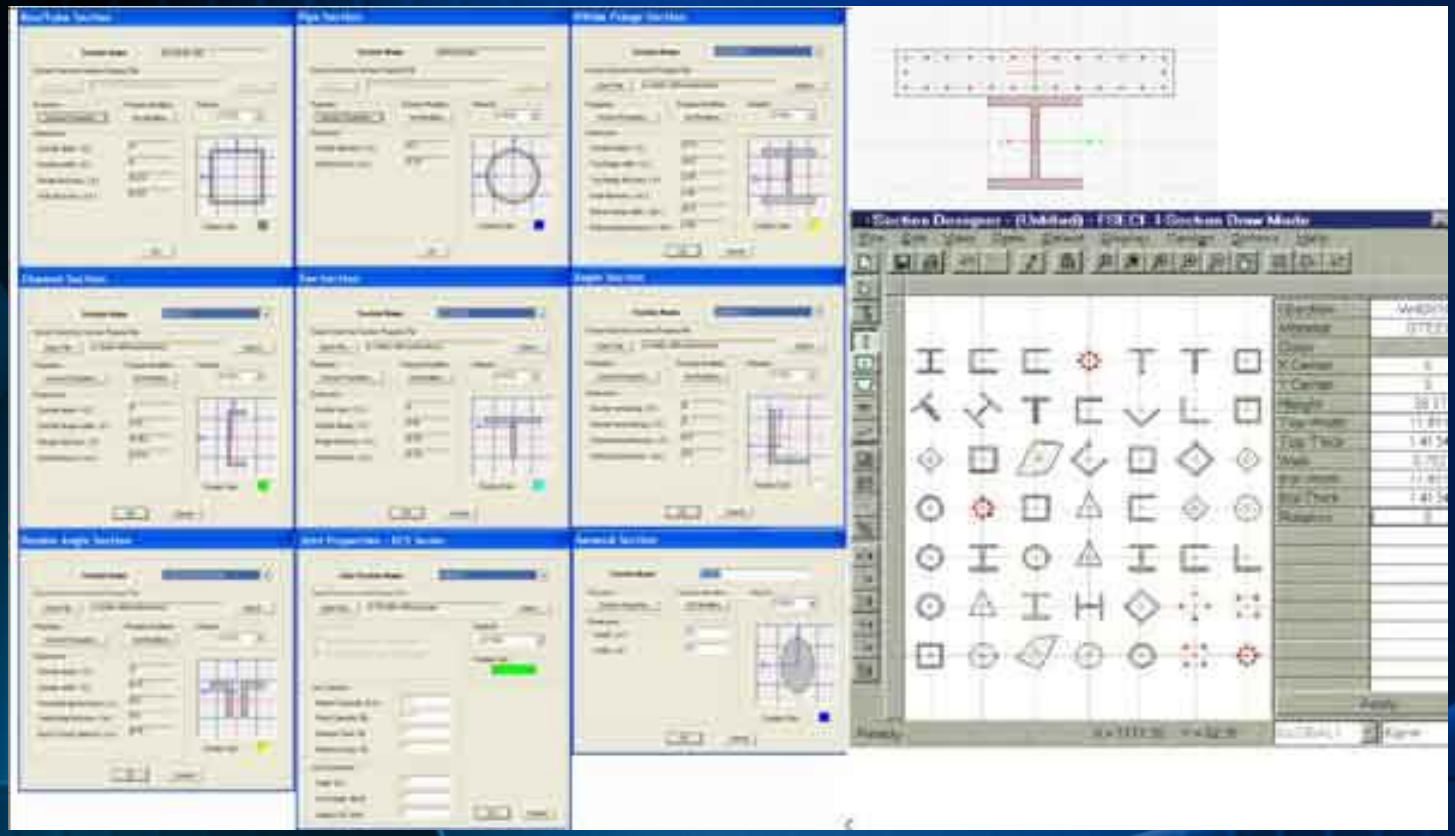
Interactive Modeling

Powerful Section Designer

- **Graphical Section Designer for defining custom sections**



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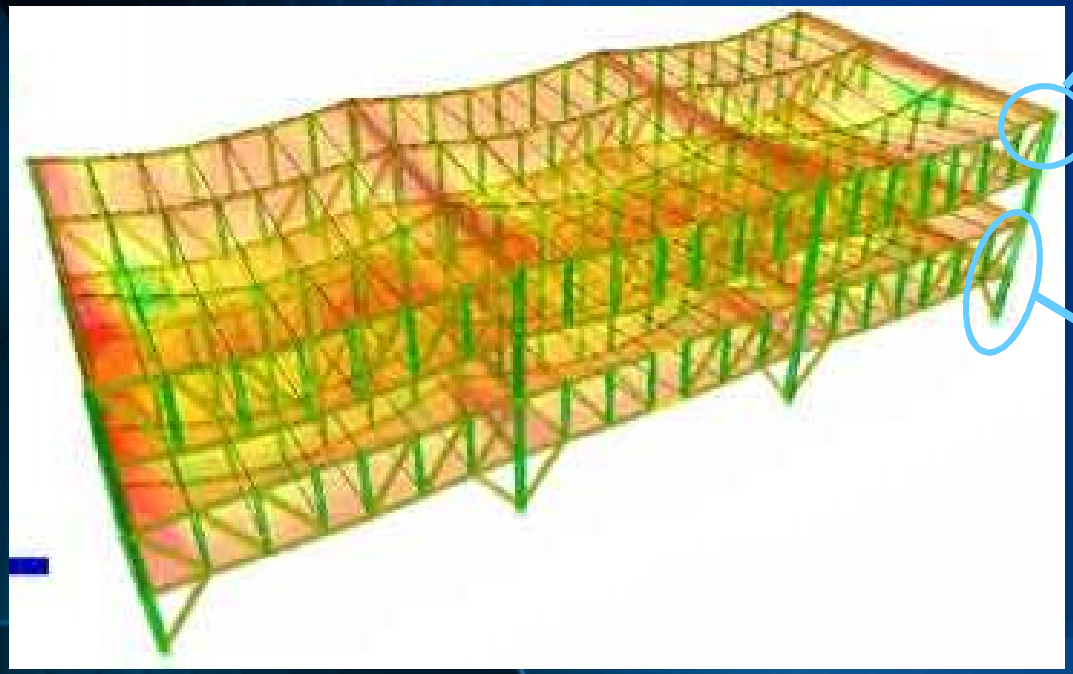
Interactive Modeling

Feedback and Information

- **Right button click for element or design information**
- **Customized display of parameters and attributes**



Point Information

Location | Assignments | Loads

Identification

Label: 19

Story: STORY8

X	816.
Y	-6.
Delta Z	0.
Connectivity	
Area	F18
Area	F19

Line Information

Location | Assignments | Loads

Identification

Label: C4 — Line Type:

Story: STORY8 — Design Procedure:

Section Property	CSEC1
Releases	None
Partial Fixity Springs	None
End Length Offsets	Automatic
End I Length Offset	0.
End J Length Offset	0.
Rigid Zone Factor	0.
Joint Offsets	None
Min. Number Stations	3
Local axis 2 Angle	Default
Property Modifiers	None
Link Properties	None
Nonlinear Hinges	None
Pier	No
Spandrel	No
Line Springs	None
Line Mass	None

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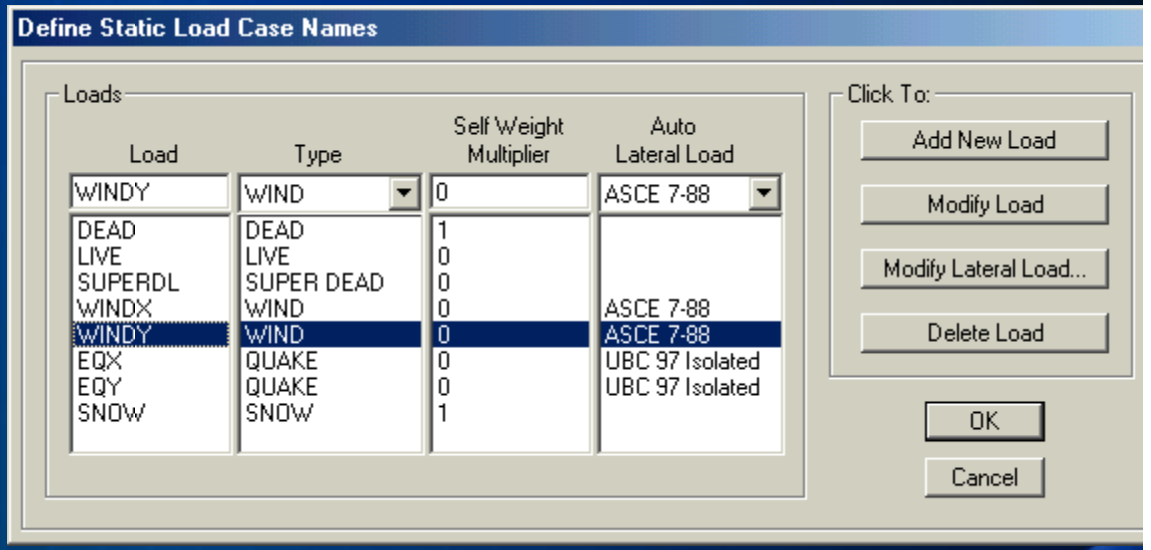
Interactive Modeling

Building Loads

- No limit on number of independent load cases
- Gravity loads specified as point, line or area loads
- Wind and Seismic Load Generator for several codes



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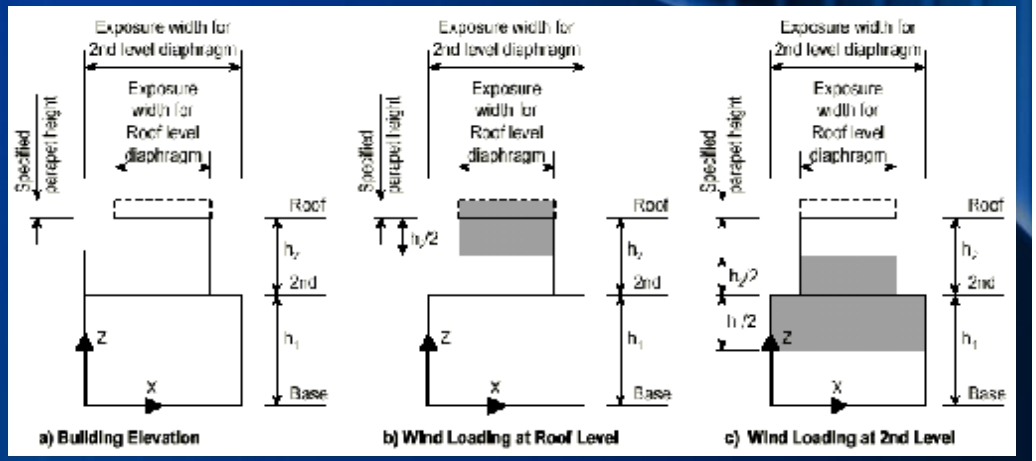
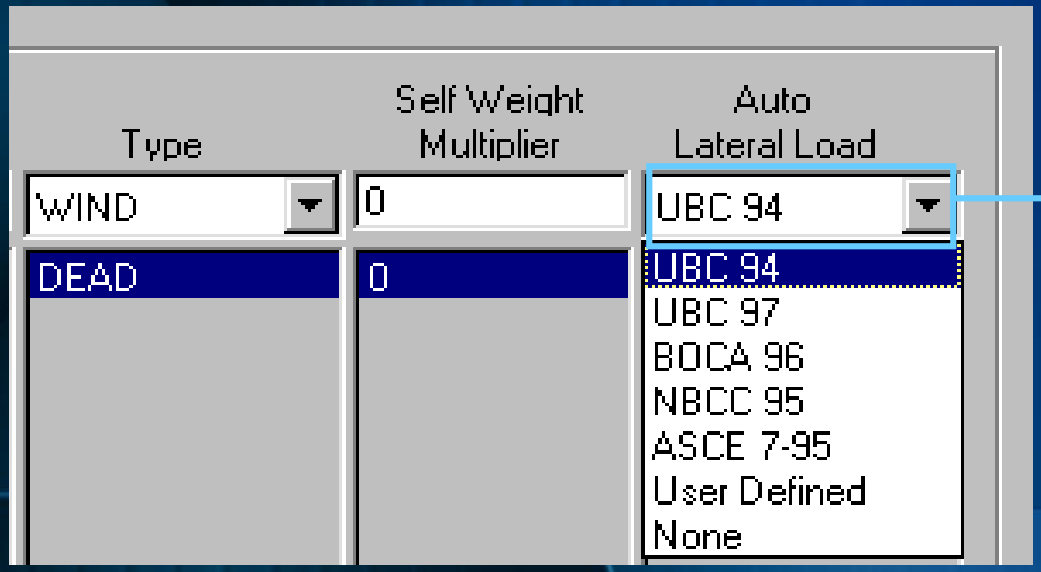
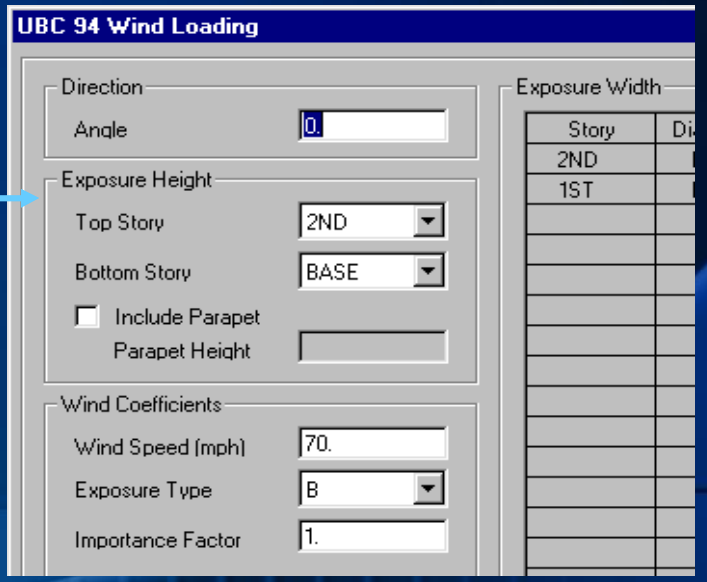
Interactive Modeling

Building Loads

- **Automatic wind load generation**
  - ***UBC, BOCA, ASCE, NBCC***







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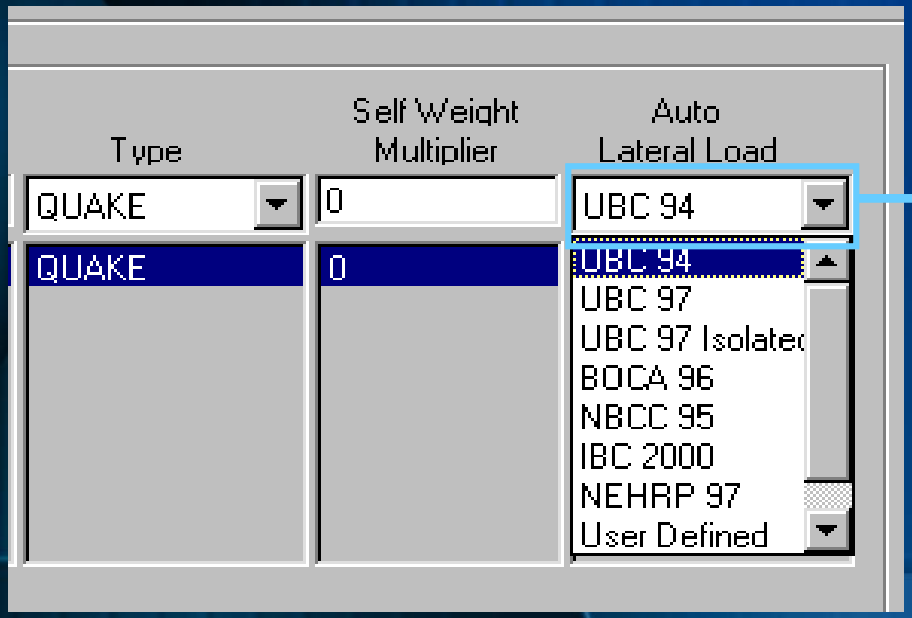
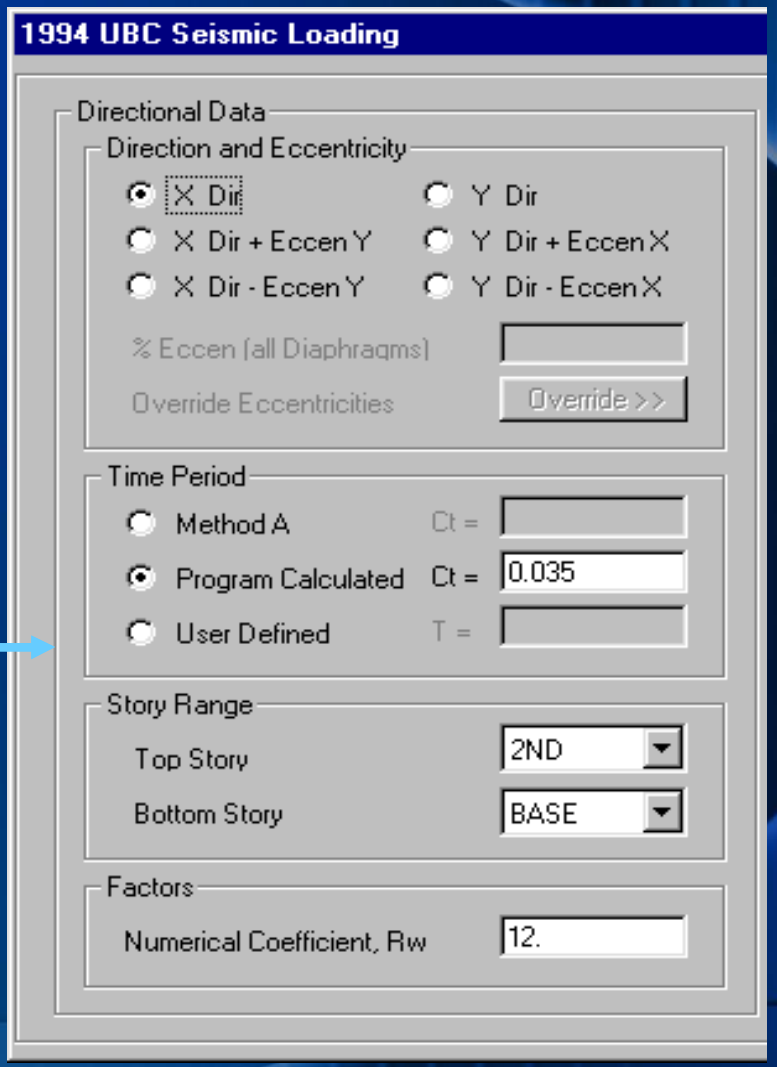
Interactive Modeling

Building Loads

- **Automatic Seismic Load Generation**
  - ***UBC, BOCA, NBCC***





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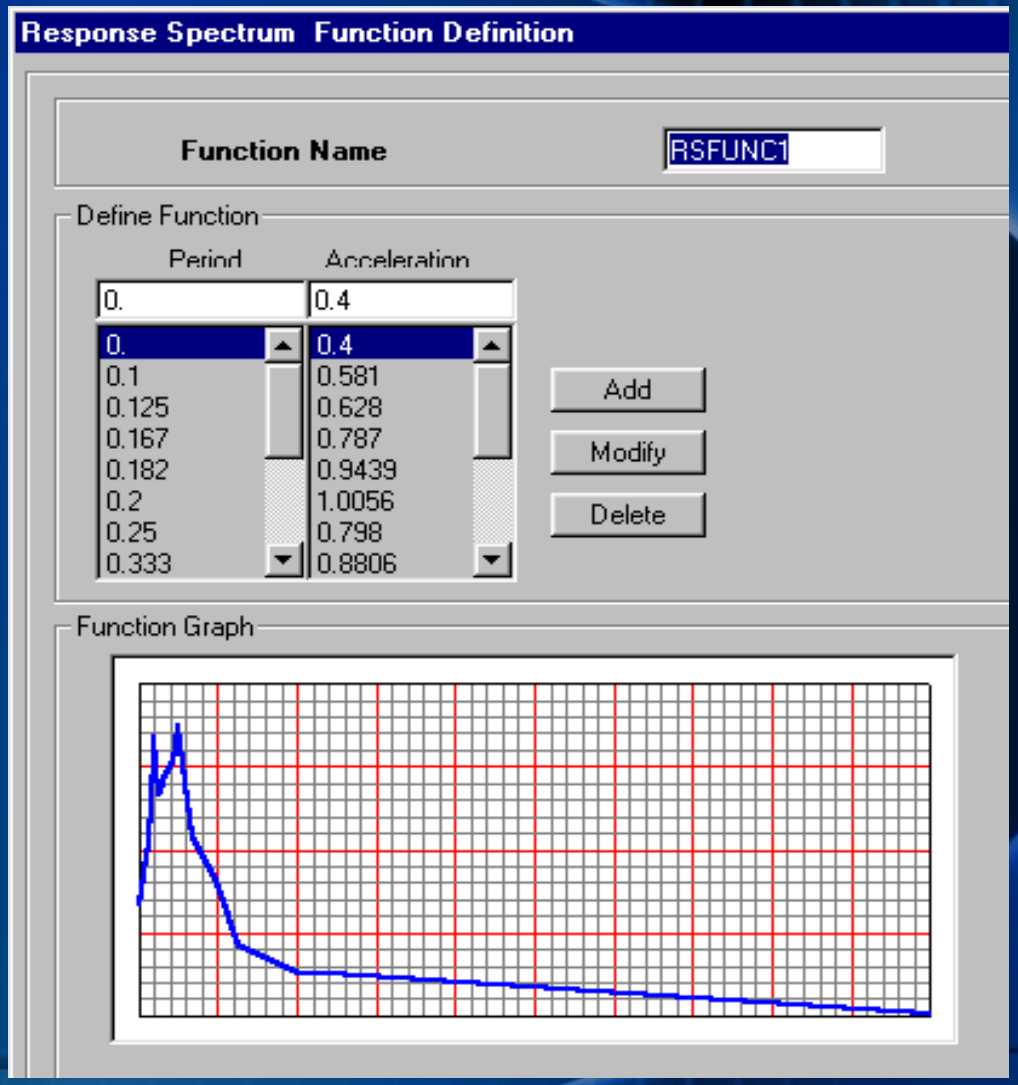
Building Loads

Interactive Modeling

- Built-in response spectrum and time history input
- User-defined response spectrum functions
- User defined time history functions



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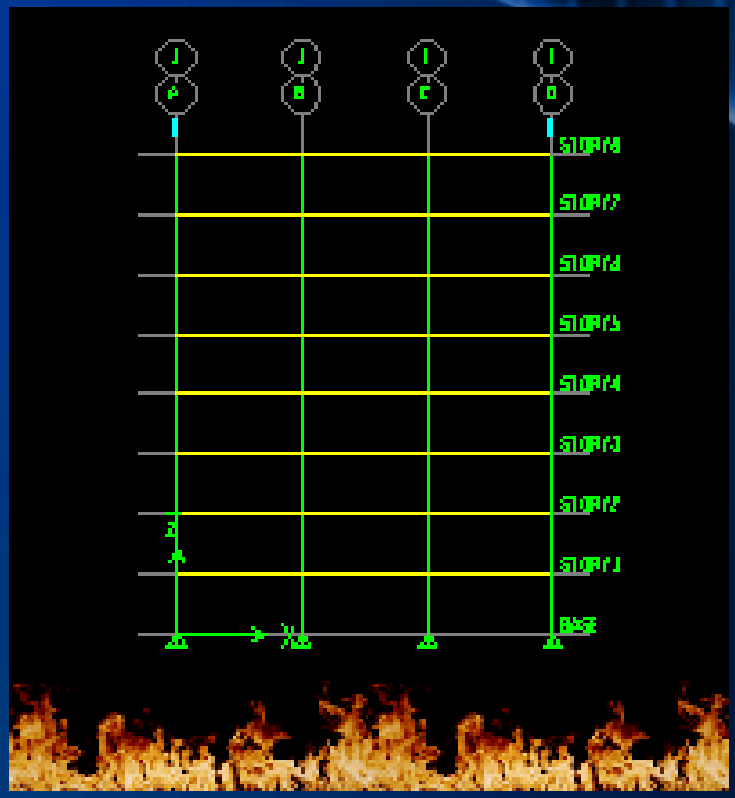
Interactive Modeling

Building Loads

- Temperature and thermal-gradient loads
- Algebraic, absolute, SRSS, and enveloping load combination
- Mass directly specified or calculated from gravity load



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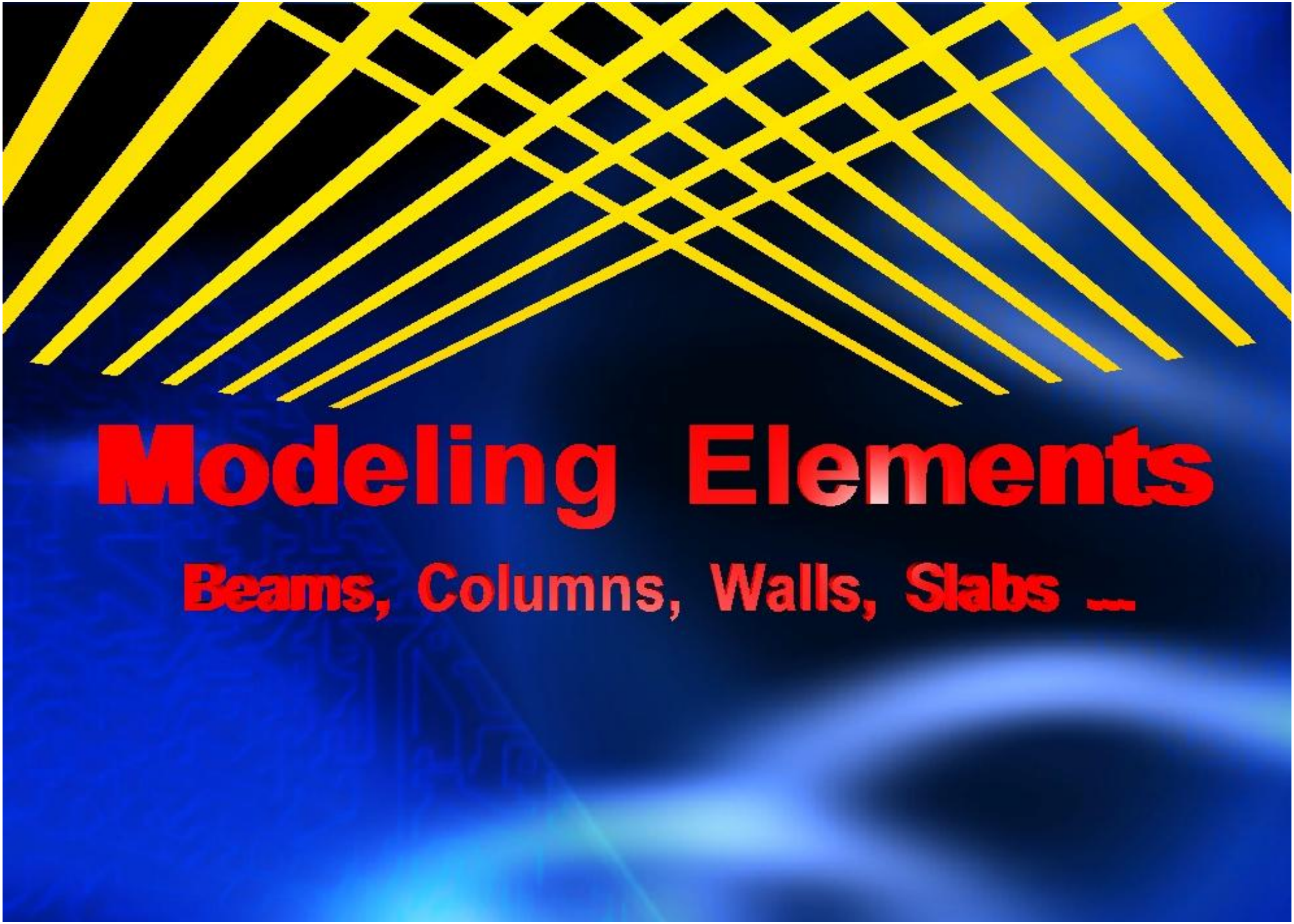
Modeling Elements
Beams, Columns, Walls, Slabs ...

Powerful Object Based Elements

Modeling Elements

- **Area objects**
  - *Walls*
  - *Slabs/Decks*
  - *Opening*
  - *Mass*
  - *Loads*
- **Lines objects**
  - *Columns*
  - *Beams*
  - *Braces*
  - *Links*
  - *Springs*
  - *Mass*
  - *Loads*
  - *Plastic Hinge*
  - *Non-linear Link*
- **Point objects**
  - *Supports*
  - *Springs*
  - *Mass*
  - *Loads*

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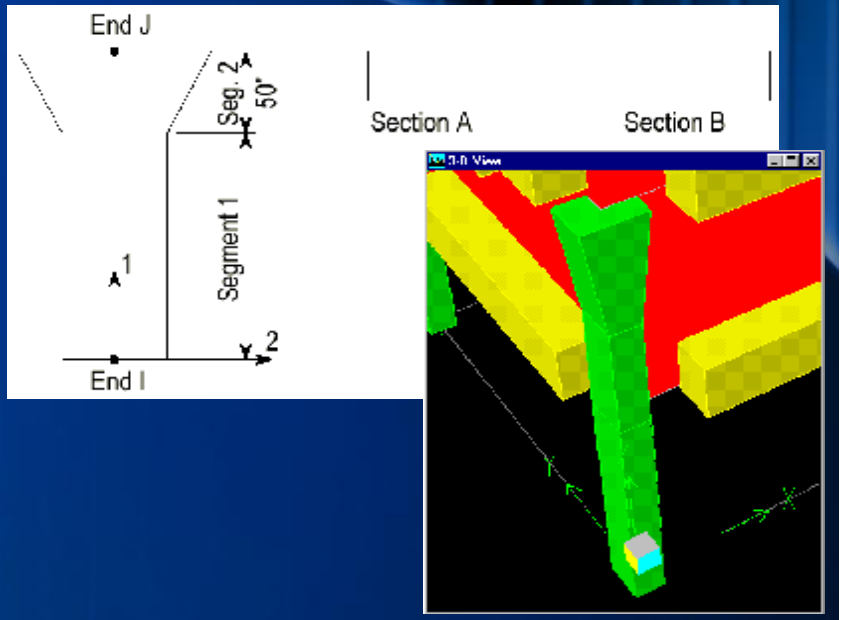
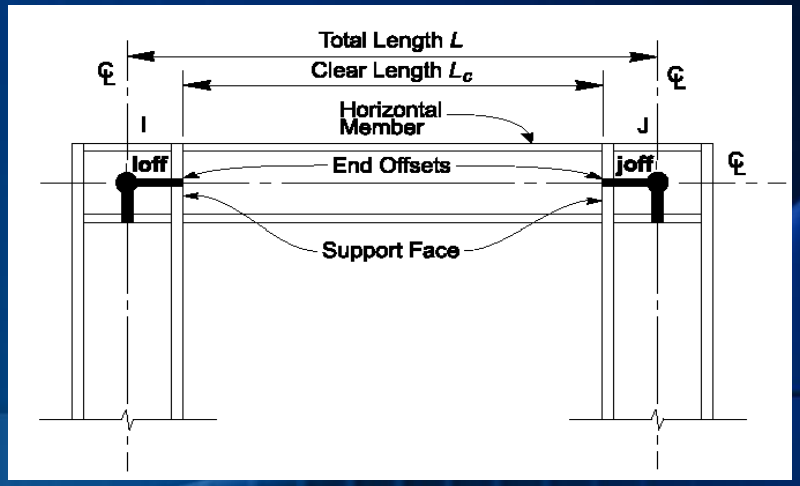
Modeling Elements

Beam, Column and Brace Elements

- 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





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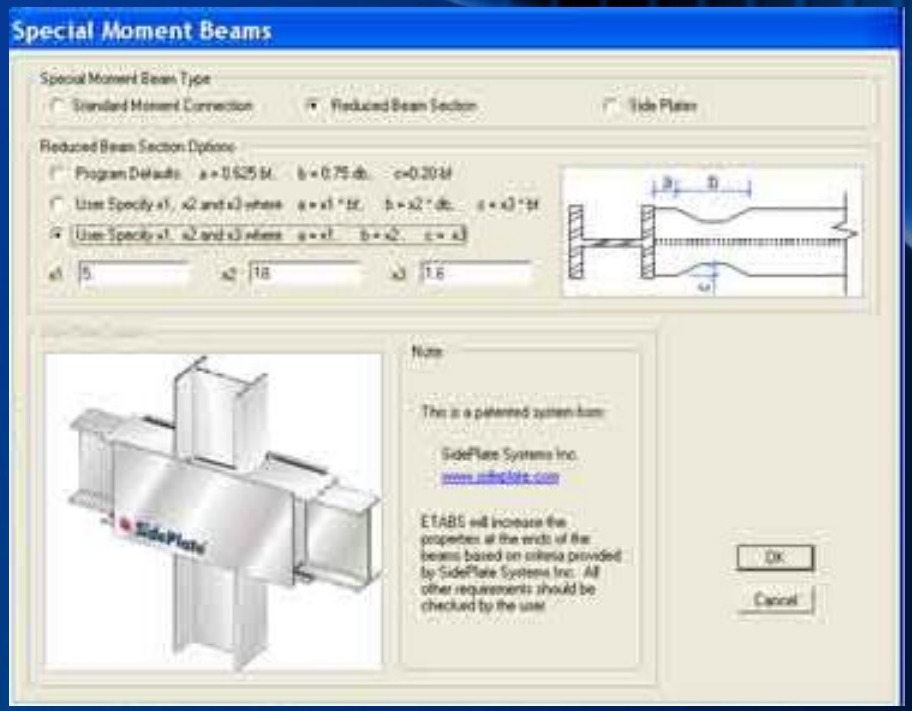
Modeling Elements

Beam, Column and Brace Elements

- **Moment and shear releases and partial-fixity**
- **Point, uniform and trapezoidal loading in any direction**
- **Temperature and thermal-gradient loading**



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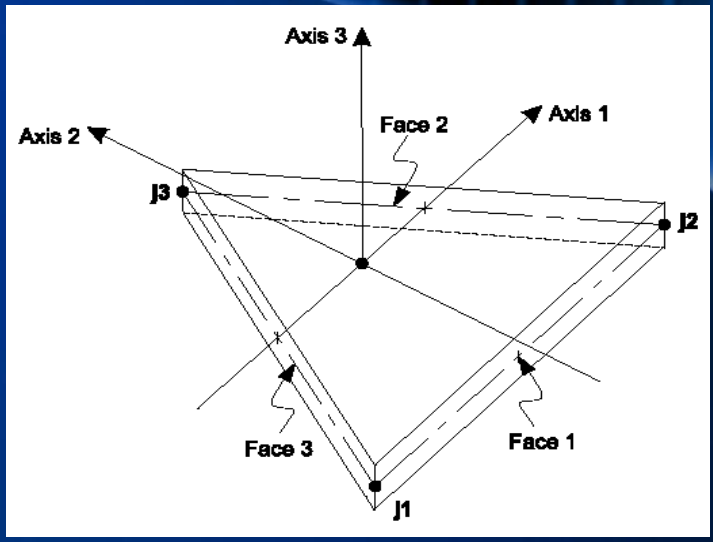
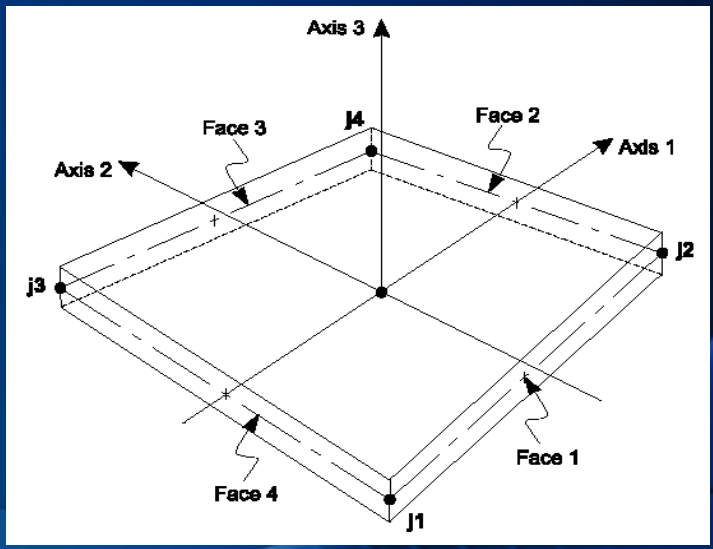
Modeling Elements

Wall, Slab, Deck Elements

- Shell, plate or membrane action
- General quadrilateral or triangular element
- Six degree of freedom per joint
- Uniform load in any direction
- Temperature and thermal-gradient loading





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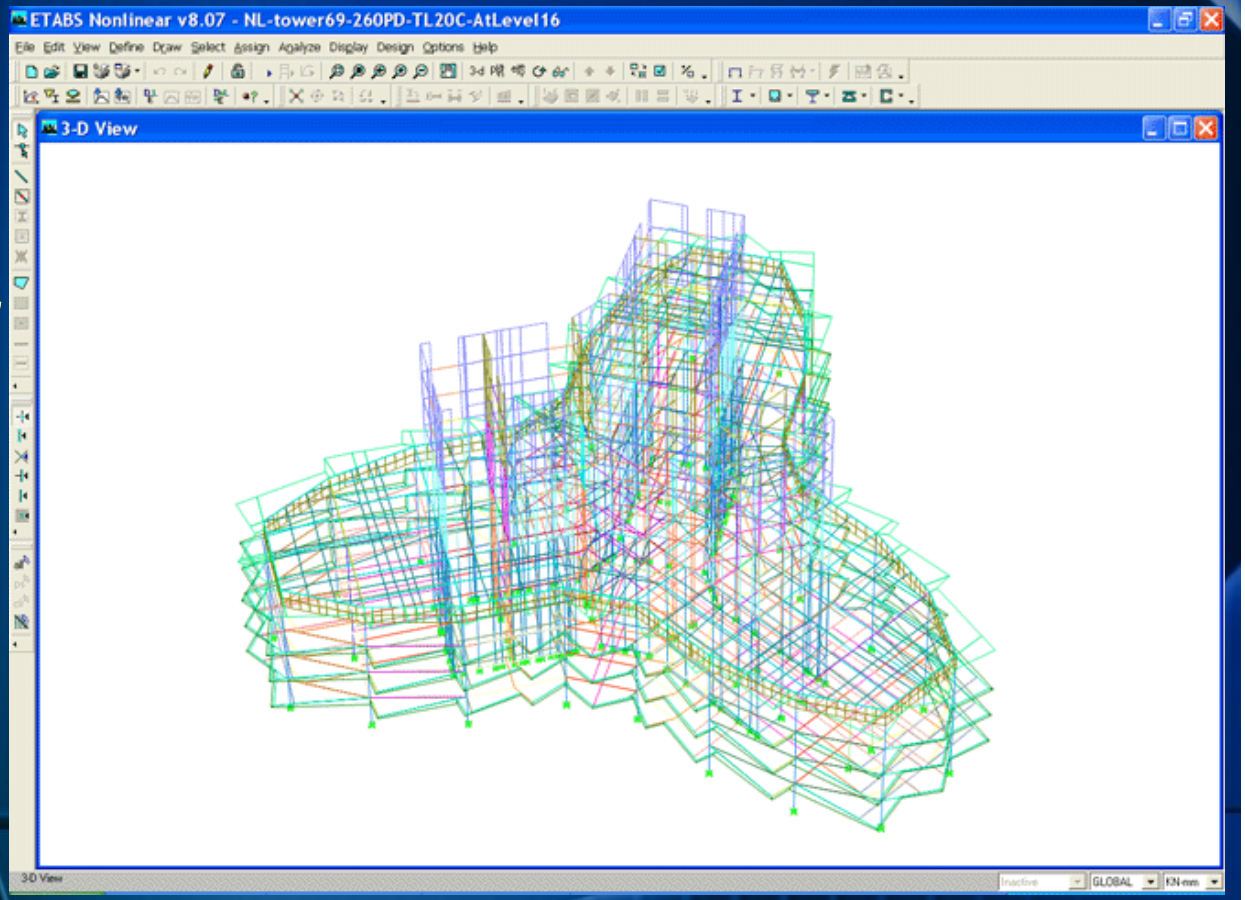
Modeling Elements

Wall, Slab and Deck Elements

- **Use these Elements to Model**
  - *Shear Walls*
  - *Bearing Walls*
  - *Wall Panels*
  - *Concrete Slabs*
  - *Diaphragms*
  - *Metal Decks*



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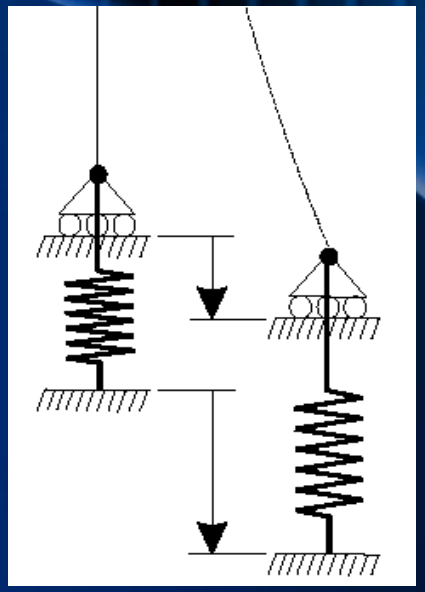
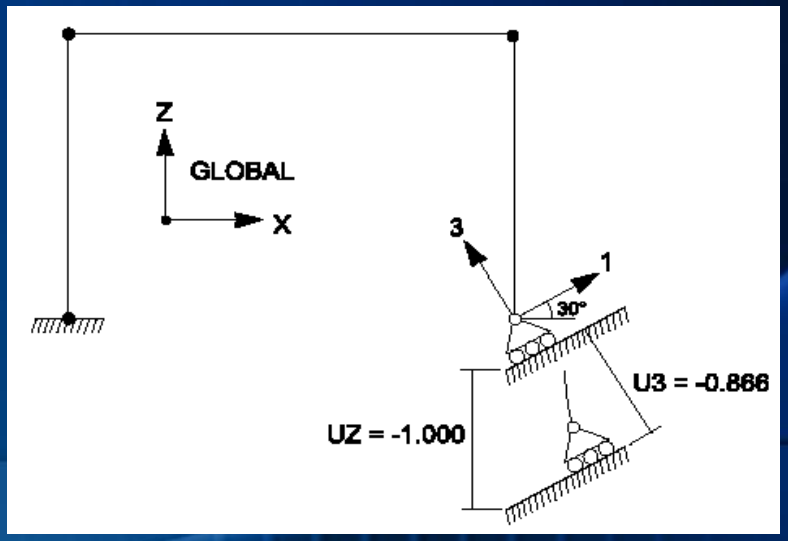
Modeling Elements

Joint Element

- For modeling of Support
- Coupled or uncoupled grounded springs
- Force loads
- Ground-displacement loads
- Inclined Supports





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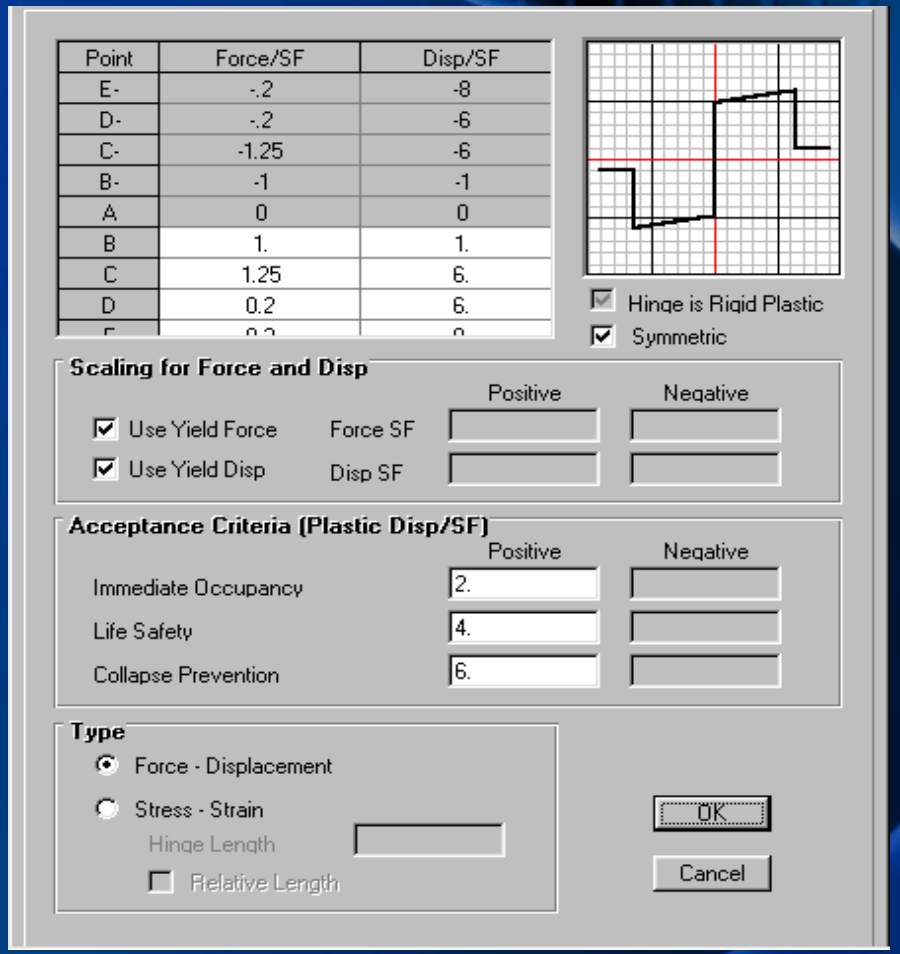
Modeling Elements

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



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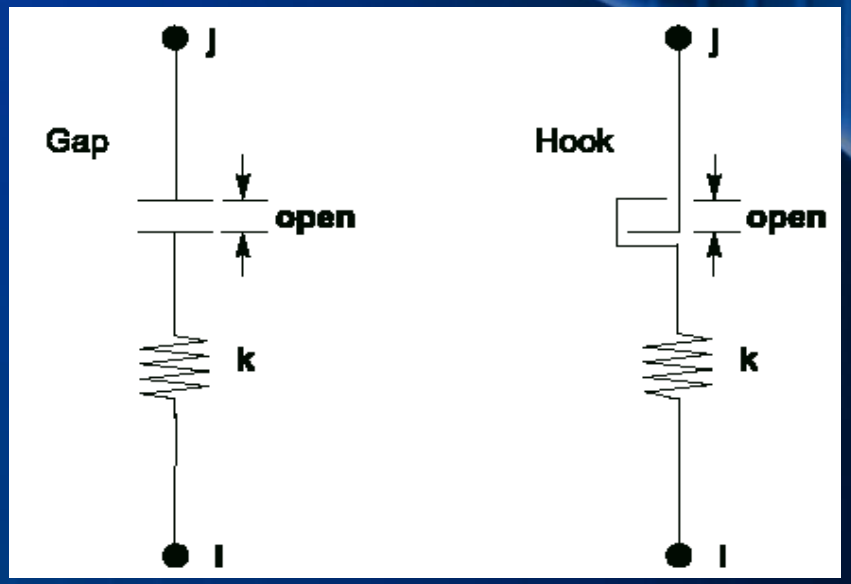
Modeling Elements

Nonlinear Link Elements

- Used with the Dynamic Nonlinear Analysis option
- Used as Link, Spring or as Panel zone
- Viscous damper with nonlinear exponent on velocity term
- Gap (compression only) and Hook (tension only)



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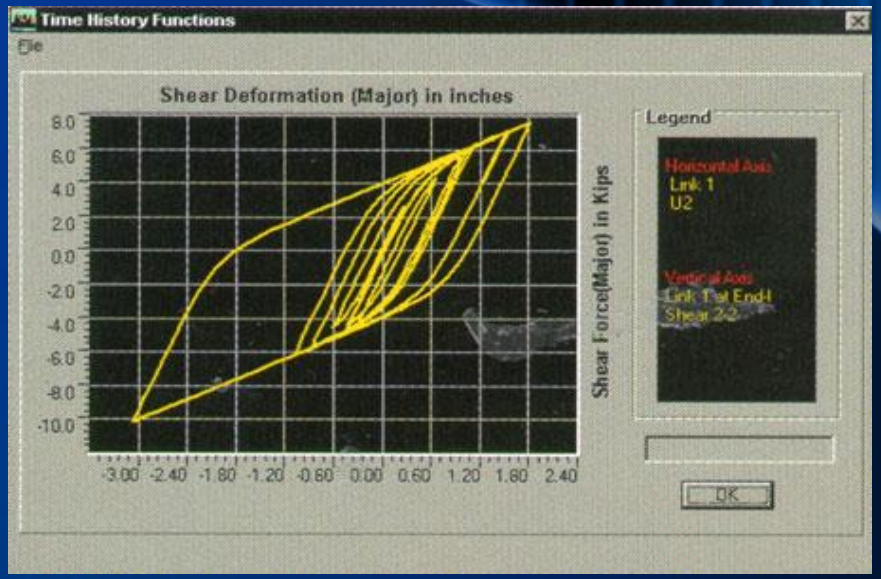
Modeling Elements

Nonlinear Link Elements

- Uniaxial plasticity (all 6 degree 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



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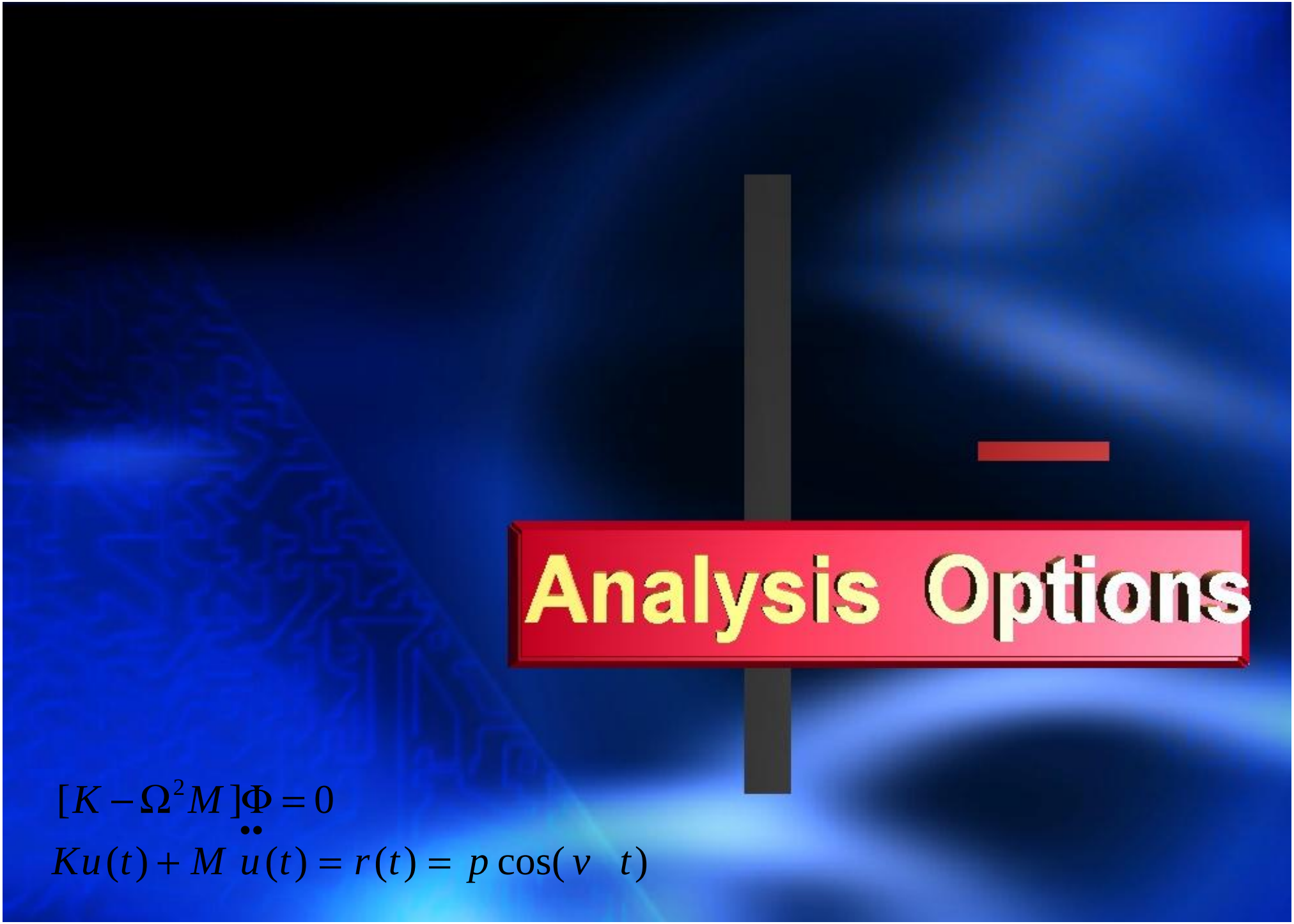
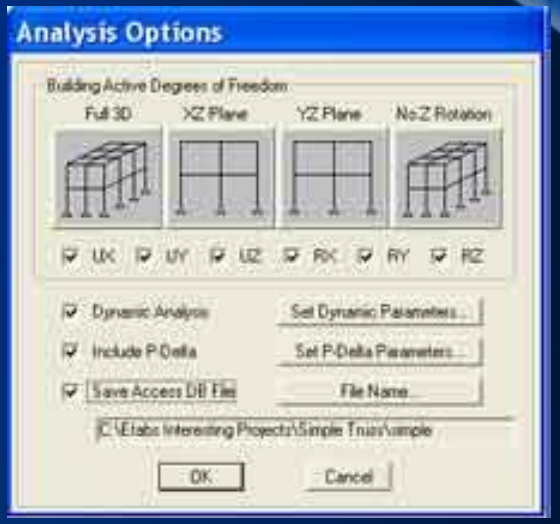

Analysis Options
$[K - \Omega^2 M]\Phi = 0$
$Ku(t) + M\ddot{u}(t) = r(t) = p\cos(v\ t)$

Analysis Options

Main Analysis Options

- Linear Static Analysis
- Linear Dynamic Analysis
- Static and Dynamic P-Delta Analysis
- Static Non-Linear Analysis



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Main Analysis Options

- Dynamic Non-Linear Analysis
- Pushover Analysis
- Multiple Response Spectrum Analysis
- Multiple Time History Analysis
- Construction sequence loading analysis

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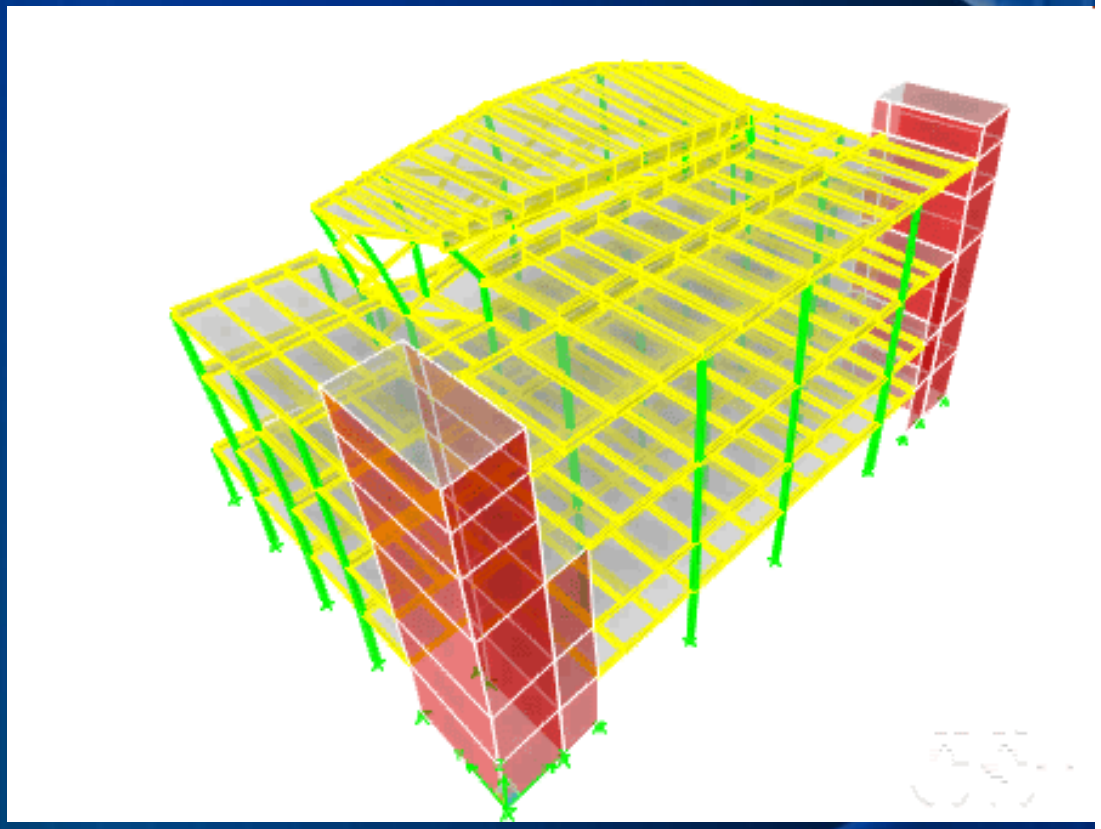
Analysis Options

Special Analysis Options

- **Explicit Panel-zone deformations**
- **Automatic tributary-area calculations for Live-Load reduction factors**
- **Construction sequence loading analysis**
- **Automated center of rigidity calculations**



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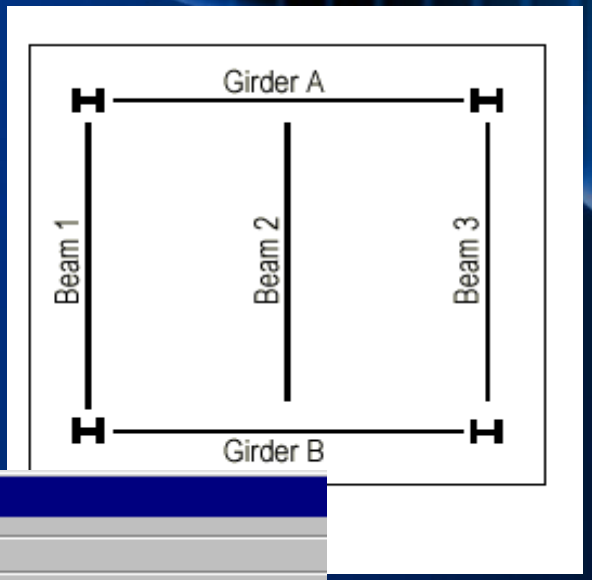
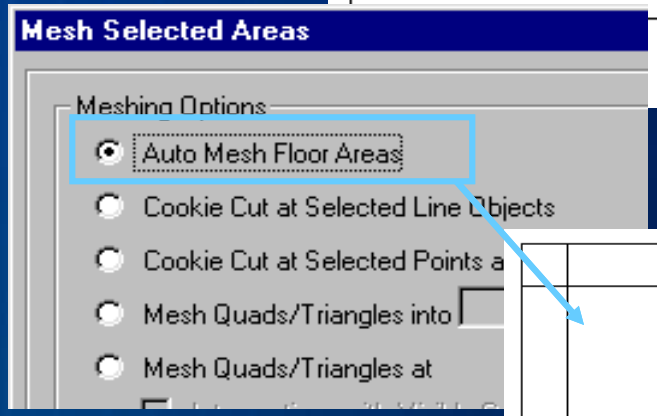
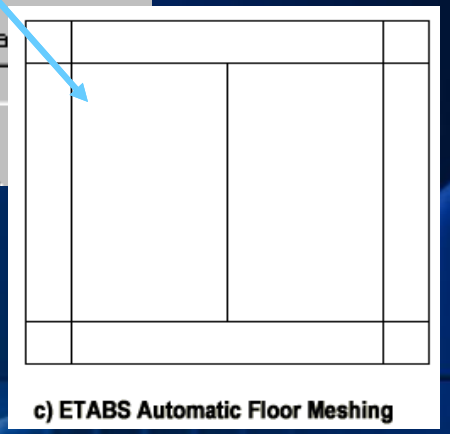
Analysis Options

Special Analysis Options

- Automatic transfer of loads on decks/slabs to beams and walls
- Automatic meshing of frame members into analysis elements
- Automatic meshing of decks/slabs for flexible diaphragm analysis







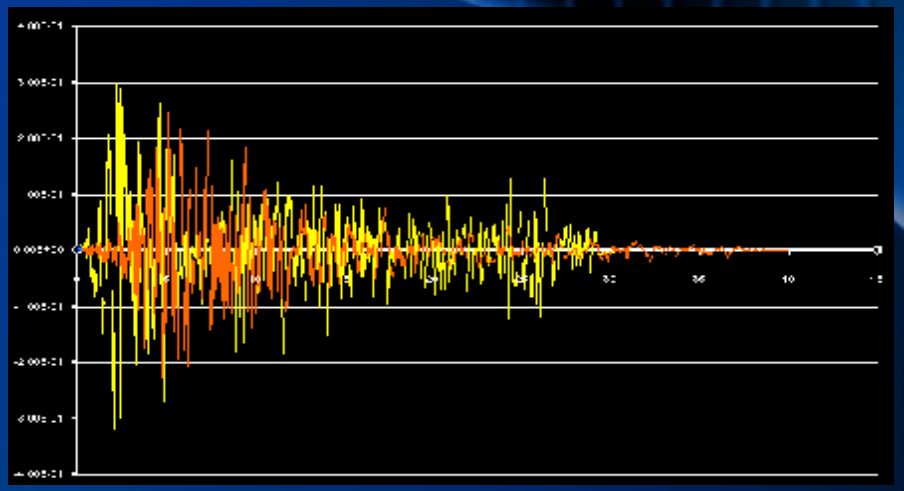
c) ETABS Automatic Floor Meshing

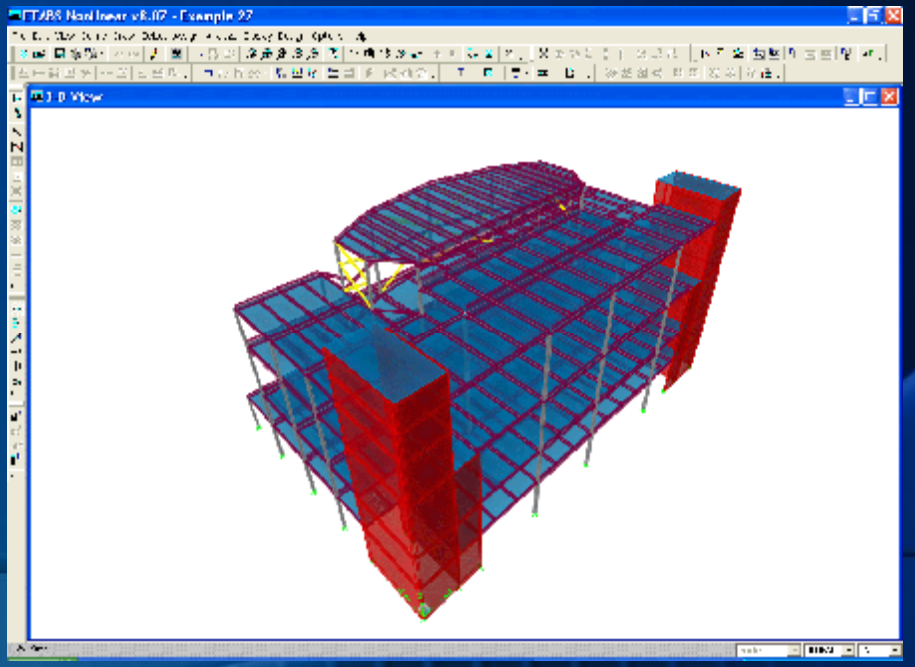
ETABS

Analysis Options

Dynamic Analysis Options

- Static and dynamic response combinations by ABS or SRSS method
- Eigen and load-dependent Ritz vector determination
- Model combination by SRSS, CQC or GMC (Gupta) method
- Combination of three direction by ABS or SRSS method



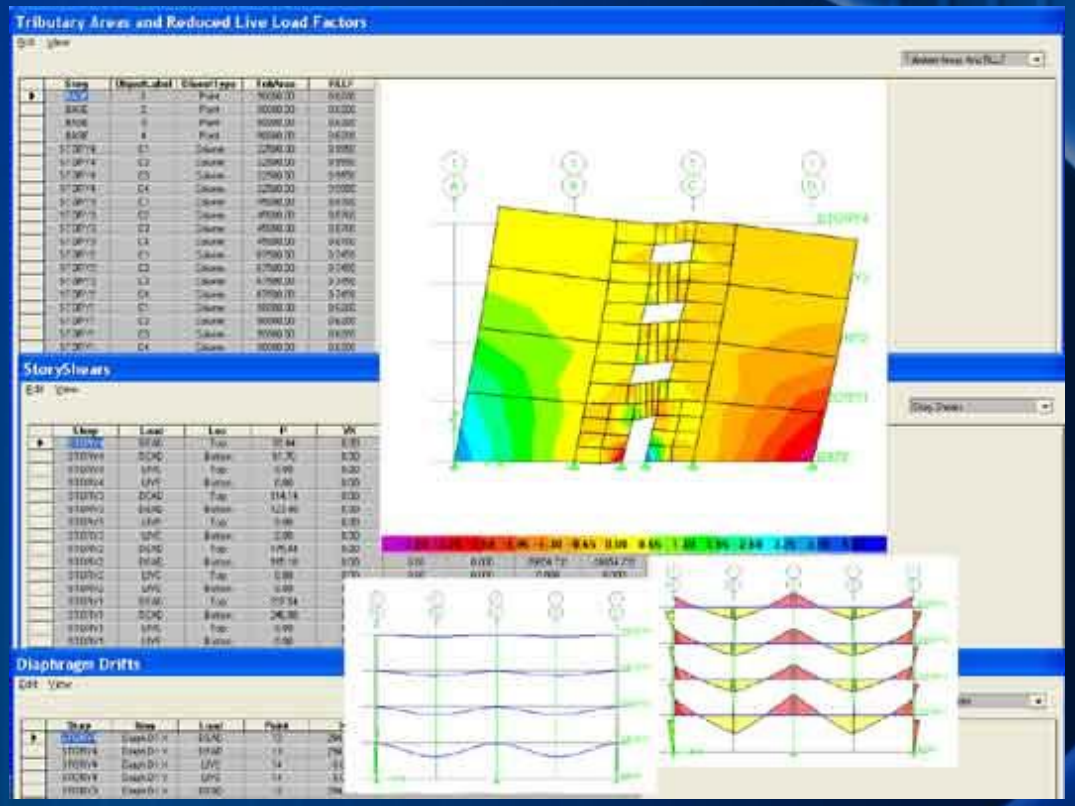


ETABS

Analysis Options

Dynamic Analysis Options

- Multiple Response Spectrum cases
- Multiple Time history cases
- Sequential Time History cases
- Seismic acceleration or displacement excitation
- Wind-load forcing functions
- Transient or steady-state excitation
- Envelope or step-by-step design for Time-History loads



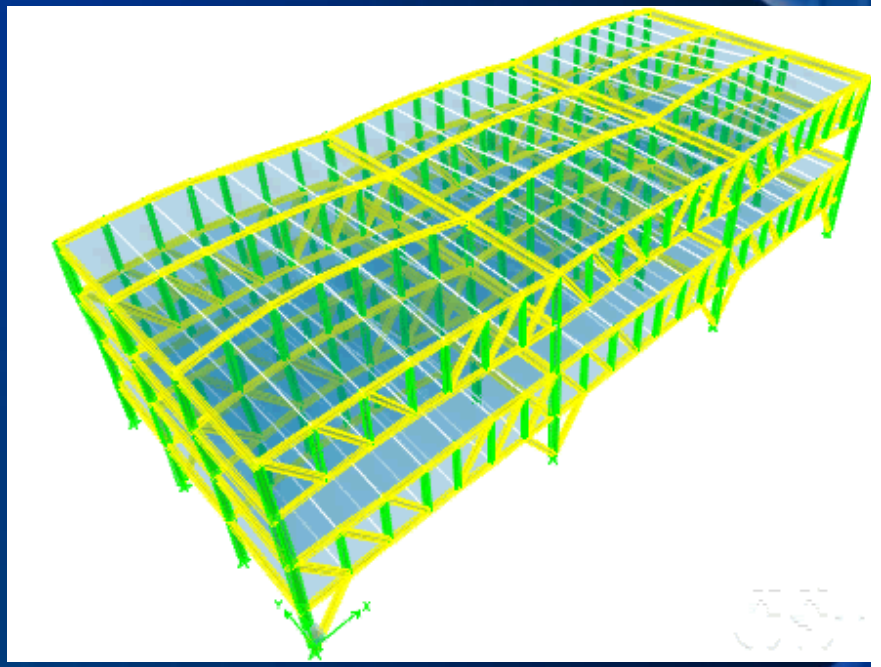
ETABS

Analysis Options

Non-Linear Analysis Options

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

  The nonlinear dynamic analysis option extends the capabilities of the Linear Time History option by allowing for nonlinearity in predefined nonlinear element



ETABS

Analysis Options

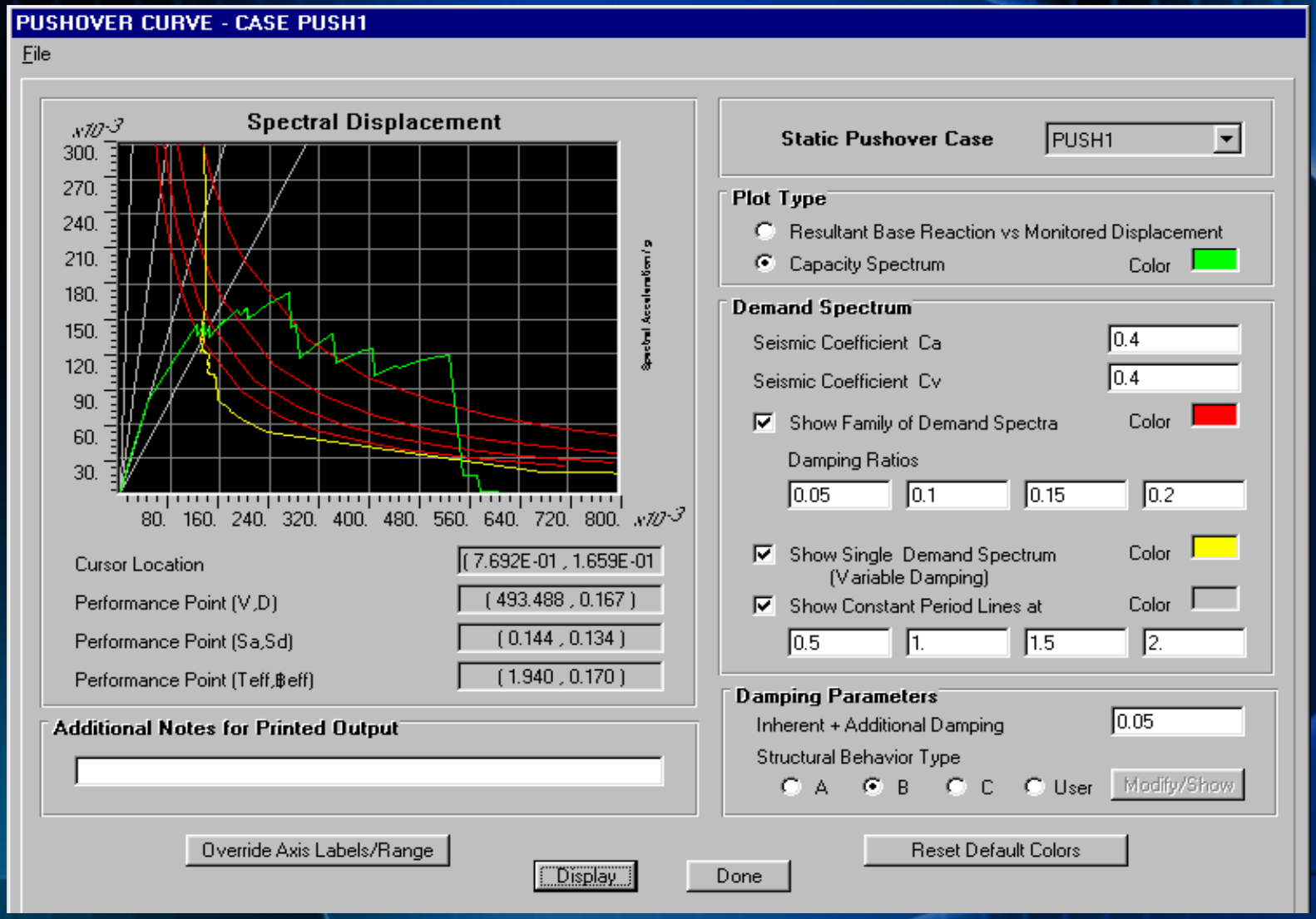
Static Pushover Analysis

- Considers FEMA 273, ATC-40 provisions
- 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

ETABS

Static Pushover Analysis

Analysis Options



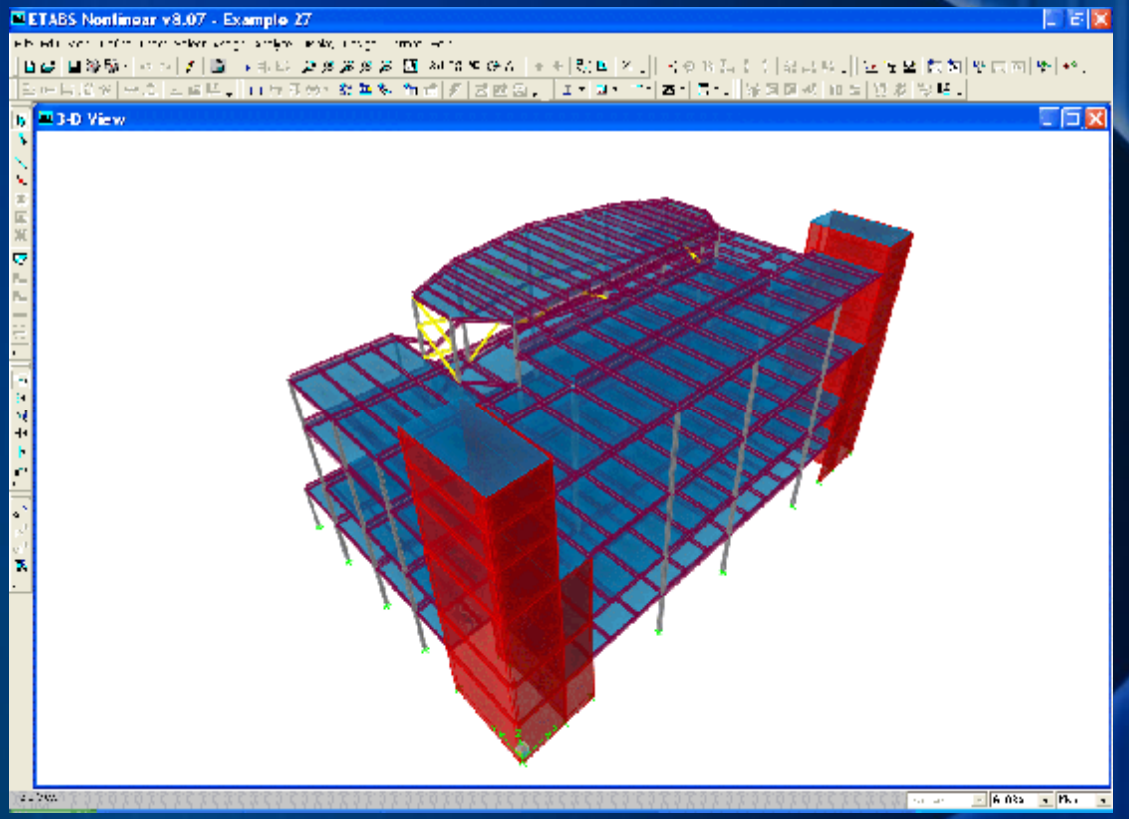
ETABS


Viewing Results

Analysis Results

Analysis Results

- **Deformed and Un-deformed geometry in 3D perspective**
- **Animation of deformed shapes**



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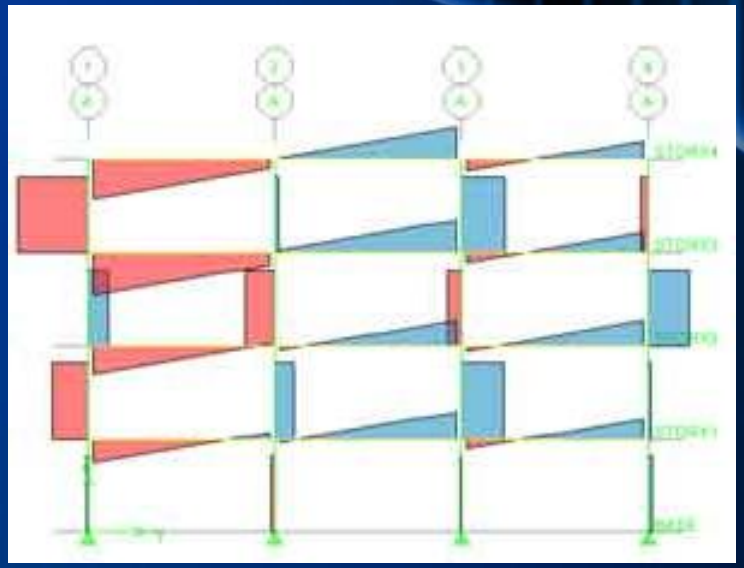
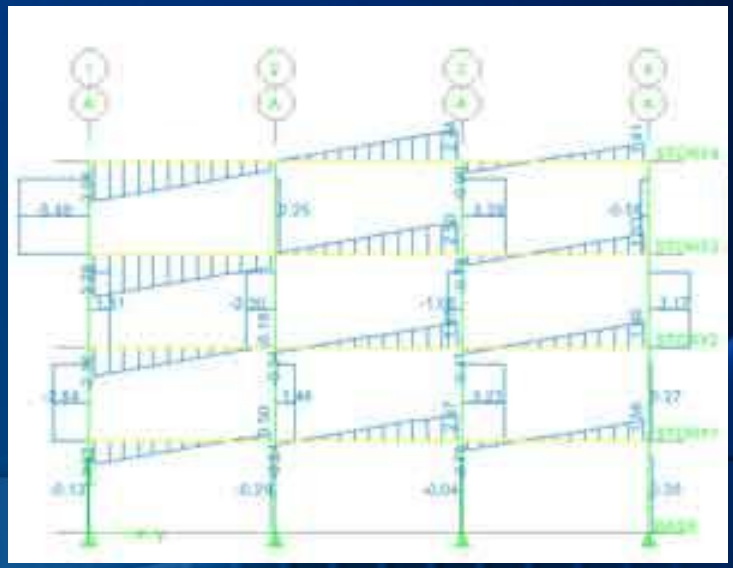
Analysis Results

Analysis Results

- **Bending-Moment and Shear-Force diagrams for Frames**
- **Instantaneous on-screen results output with right-button click on element**
- **Integrated-force diagrams for Wall Piers and Spandrels**



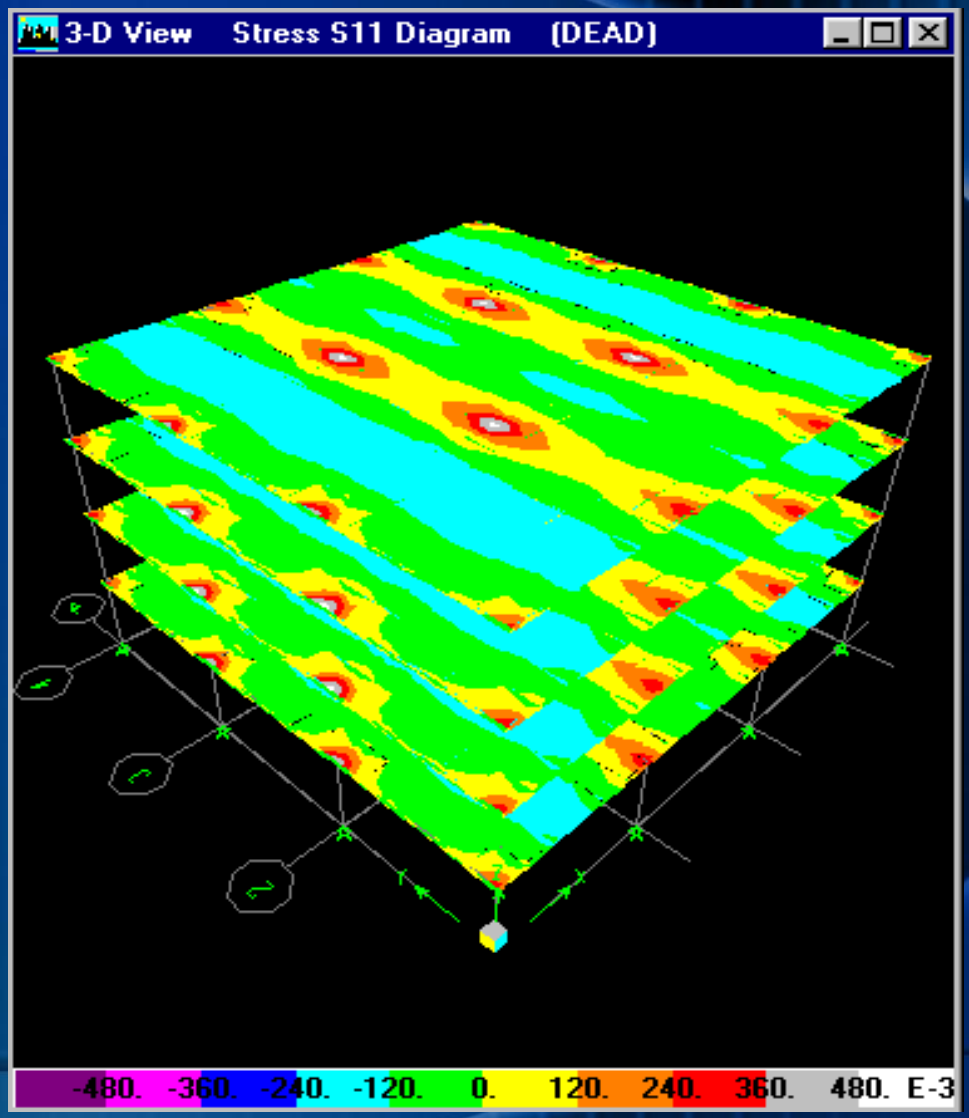


ETABS

Analysis Results

Analysis Results

- Loading diagrams
- Stress contours for shells
- Interactive Section-force results using Groups

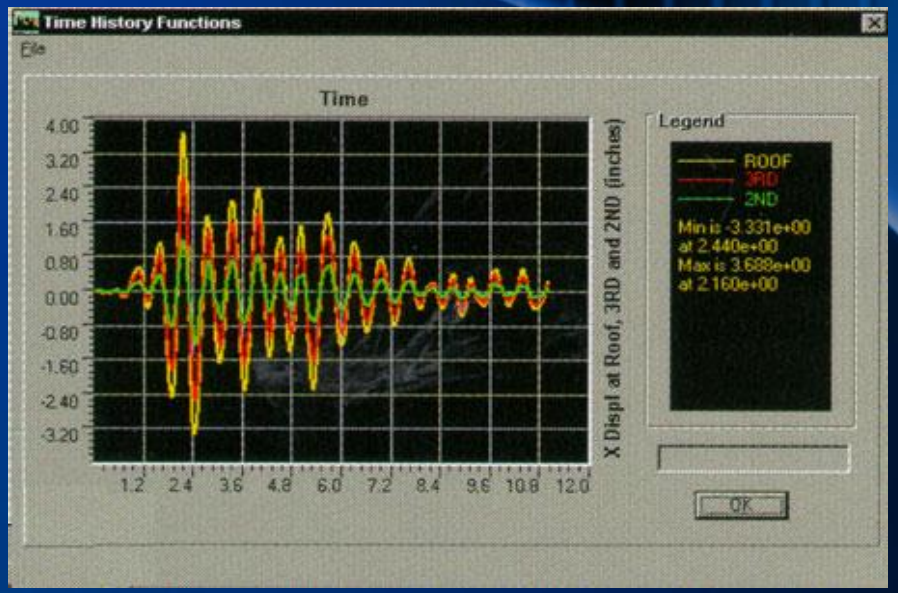


ETABS

Analysis Results

Dynamic Analysis Results

- Time-History deformed shapes as real time AVI file
- Displays of nodal and element time-history records
- Time History displays of function vs. time or function vs. function
- Response spectrum curves for any joint from Time History response



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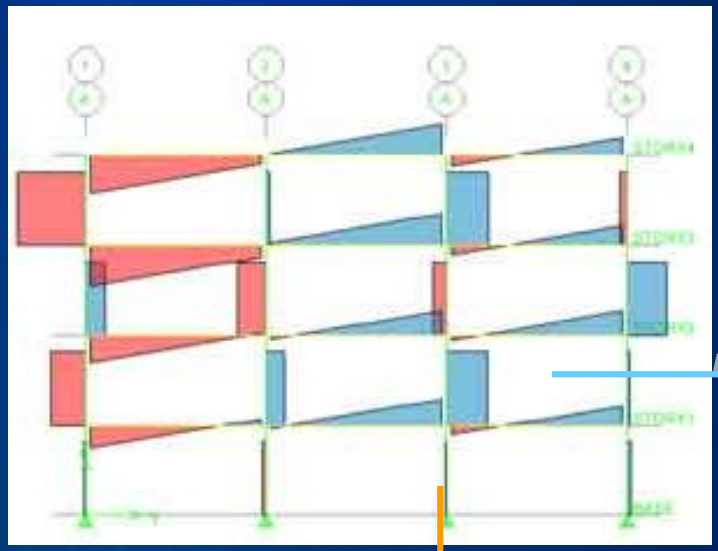
Analysis Results

Analysis Output

- **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**



Beam Forces

Edit View

	Story	Beam	Load	Loc	P	V2
▶	STORY4	B1	DEAD	12	0	-9.919177
	STORY4	B1	DEAD	30	0	-9.469206
	STORY4	B1	DEAD	48	0	-9.019235
	STORY4	B1	DEAD	48	0	-5.107079
	STORY4	B1	DEAD	72	0	-4.507117
	STORY4	B1	DEAD	96	0	-3.907155
	STORY4	B1	DEAD	96	0	-1.694391

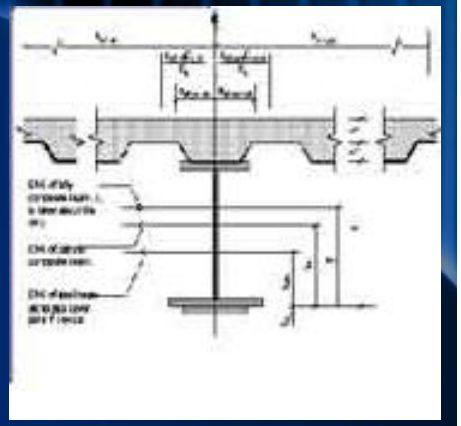
ETABS

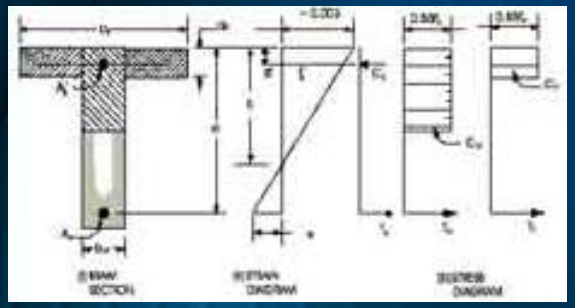

Member Design

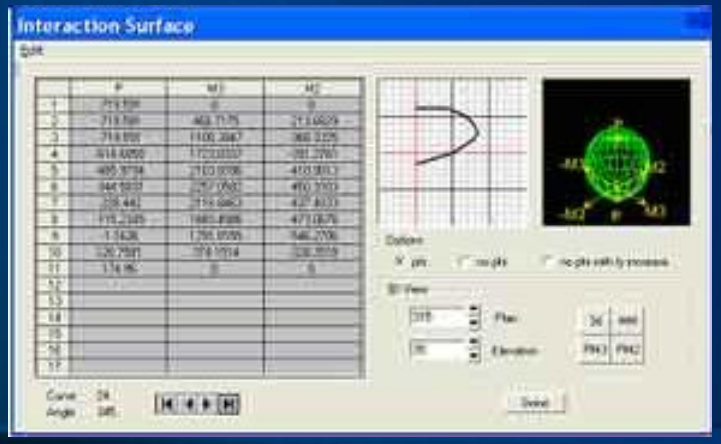
Member Design

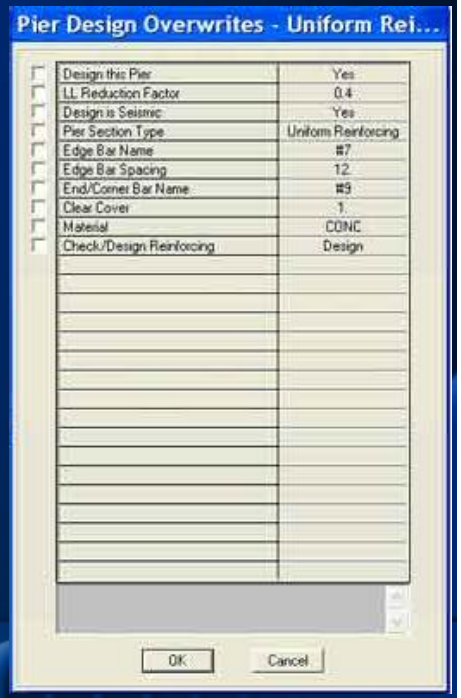
Fully Integrated Element Design

- Design of Steel Beams, and Columns
- Design of Concrete Beams and Columns
- Design of Composite Beams
- Design of Concrete Shear Walls





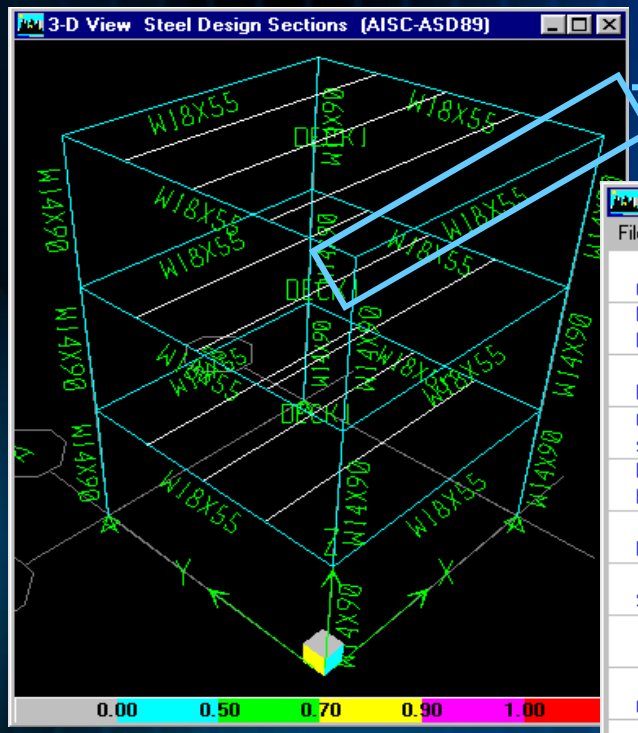




ETABS

Steel Frame Design

Member Design



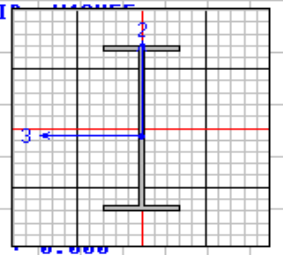
Analysis Model

Design Output

Steel Stress Check Information AISC-ASD89

File

```
AISC-ASD89 STEEL SECTION CHECK     Units: Kip-in
Level: STORY3  Element: B3  Station Loc: 144.000  Section ID: W14X90
Element Type:  Moment Resisting    Classification:  Compact

L=288.000
A=16.200  i22=44.900  i33=890.000
s22=11.926  s33=98.288  r22=1.665  r33=7.412
E=29000.000  fy=36.000
RLLF=0.947  EQF=1.000

P-M33-M22 Demand/Capacity Ratio is   0.302 = 0.000 + 0.302 + 0.000

STRESS CHECK FORCES & MOMENTS
                          P          M33          M22          V2          V3
     Combo    DSTL2      0.000      706.294      0.000       -3.209      0.000

AXIAL FORCE & BIAXIAL MOMENT DESIGN   (BENDING)
                         fa           Fa           Ft
                     Stress    Allowable    Allowable
     Axial            0.000       18.926       21.600

                         fb           Fb           Fe           Cm            K            L
                     Stress    Allowable    Allowable       Factor       Factor       Factor       Fact
     Major Bending    7.186       23.760      110.726       1.000        1.000        0.945        1.0
     Minor Bending    0.000       27.000       79.839       1.000        1.000        0.250

SHEAR DESIGN
                         fv           FV       Stress
```



ETABS

Member Design

Steel Frame Design

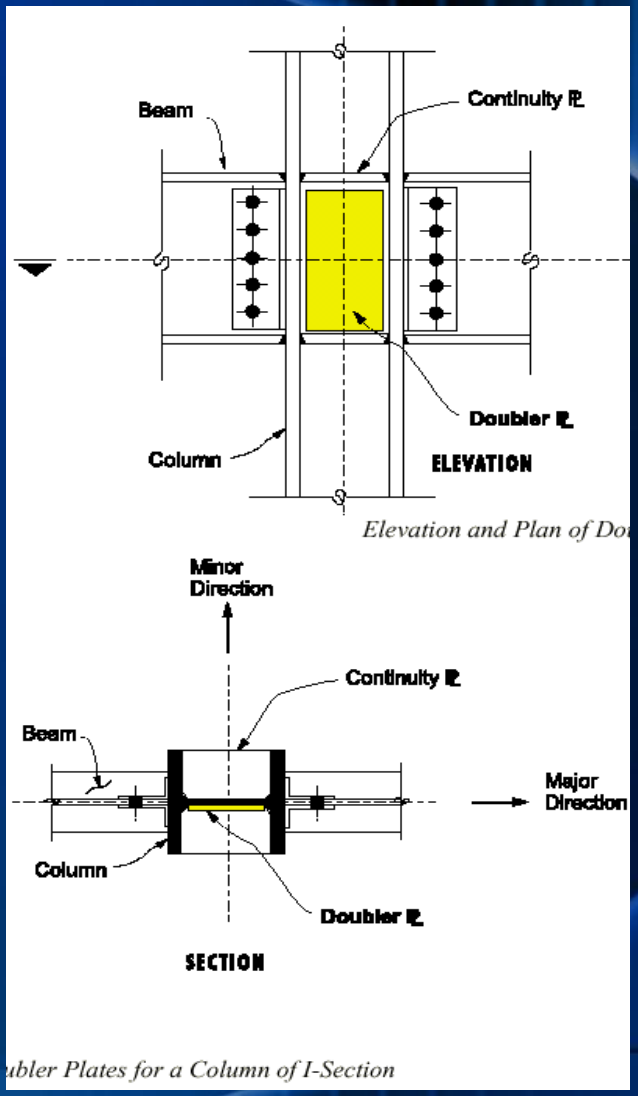
- Fully integrated steel frame design
- AISC-ASD, AISC-LRFD, UBC, Canadian and Euro codes
- Design for static and dynamic loads
- Graphical display of stress ratios
- Interactive design and review
- Summary and detailed reports including database formats

ETABS

Steel Frame Design

Member Design

- Optimizations 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 stiffener and continuity plates



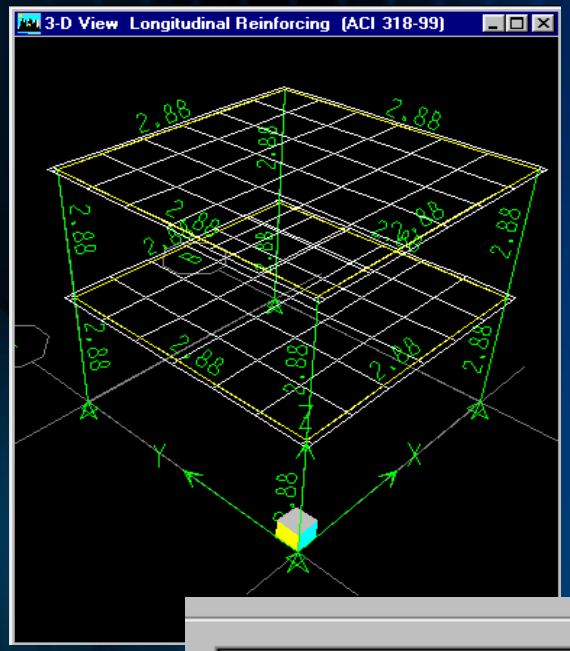
Elevation and Plan of Do

ubler Plates for a Column of I-Section

ETABS

Concrete Frame Design

Member Design



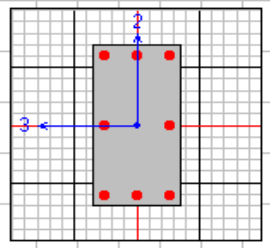
Concrete Design Information ACI 318-99

File

ACI 318-99 COLUMN SECTION DESIGN Type: Sway Special Units: Kip-in

Level: STORY2 Element: C2
Station Loc 120.000
Section ID CSEC1
Combo ID DCON2

L=144.000
B=12.000 D=24.000 dc=1.500
E=3600.000 fy=60.000 fc=4.000 Light Wt. Shr. Fac.=1.000
RLLF=0.995 EQF=1.000



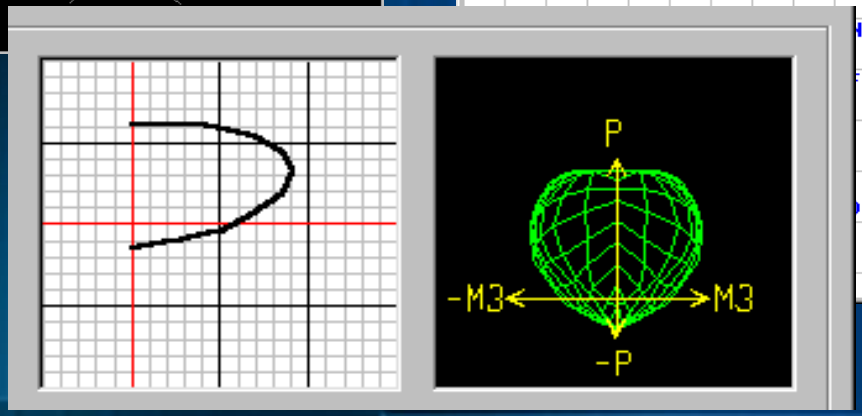
AXIAL FORCE & BIAXIAL MOMENT DESIGN FOR PU, M2, M3

Rebar Area	Design Pu	Design M2	Design M3	Minimum M2	Minimum M3
2.880	43.730	369.087	-667.306	41.981	57.723

NT FACTORS

Cm Factor	Delta_ns Factor	Delta_s Factor	K Factor	L Length
0.400	1.000	1.000	1.000	120.000
0.400	1.000	1.000	1.000	120.000

Design Rebar	Shear Vu	Shear phi*Vc	Shear phi*Vs	Shear Vp
0.032	36.452	0.000	36.452	36.452
0.068	36.445	0.000	36.445	36.445

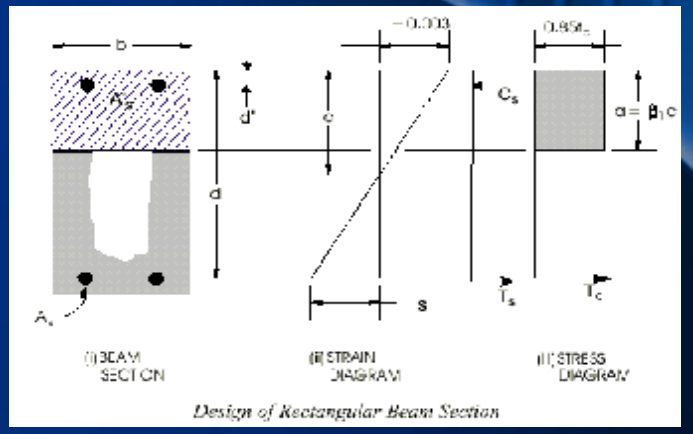


ETABS

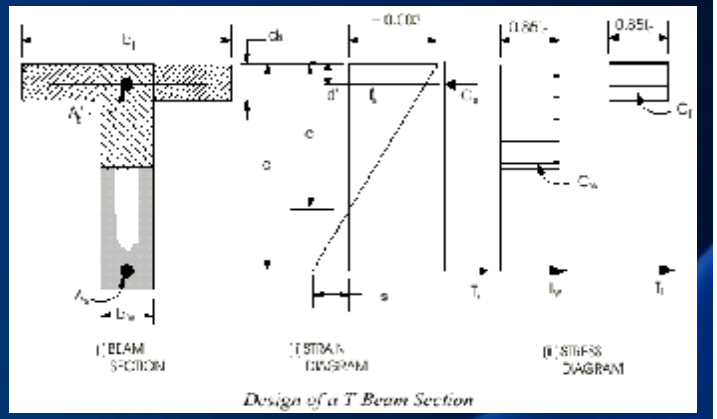
Concrete Frame Design

Member Design

- Fully integrated concrete frame design
- ACI, UBC, Canadian and Euro codes
- 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



Design of Rectangular Beam Section



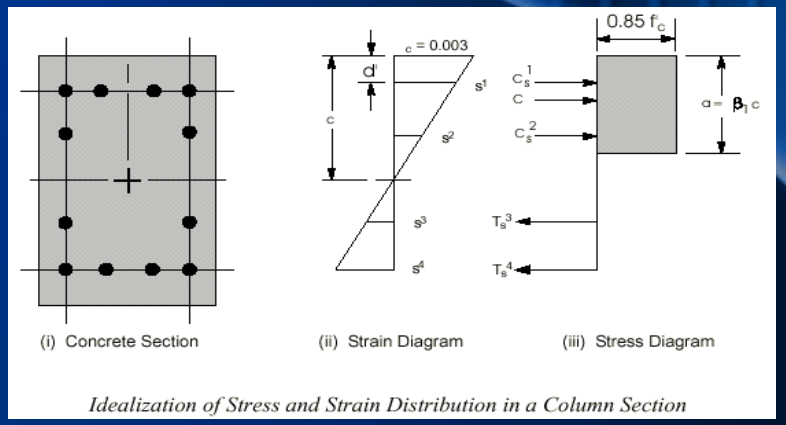
Design of a T Beam Section

ETABS

Member Design

Concrete Frame 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 detail reports including database formats

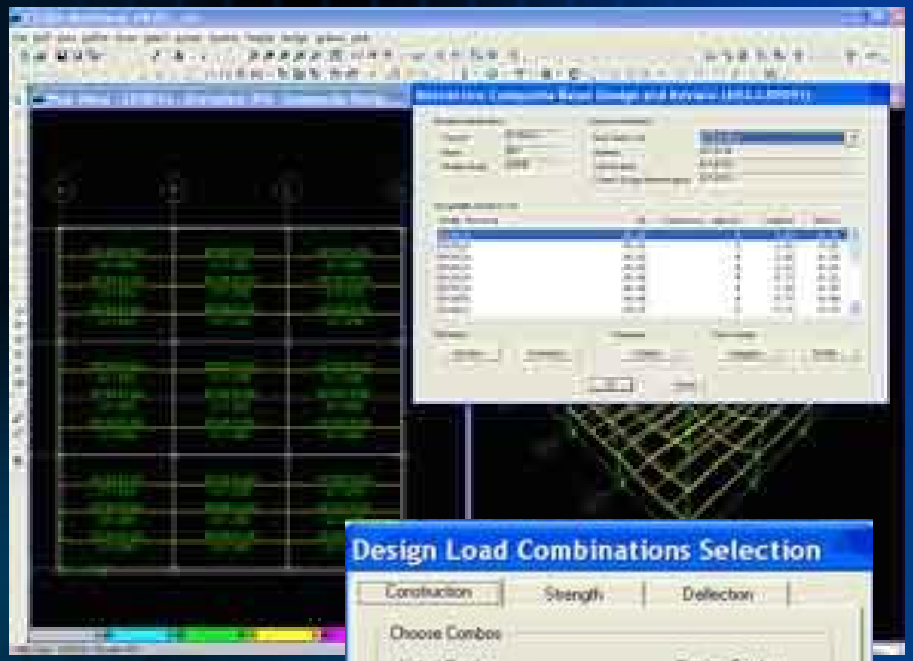


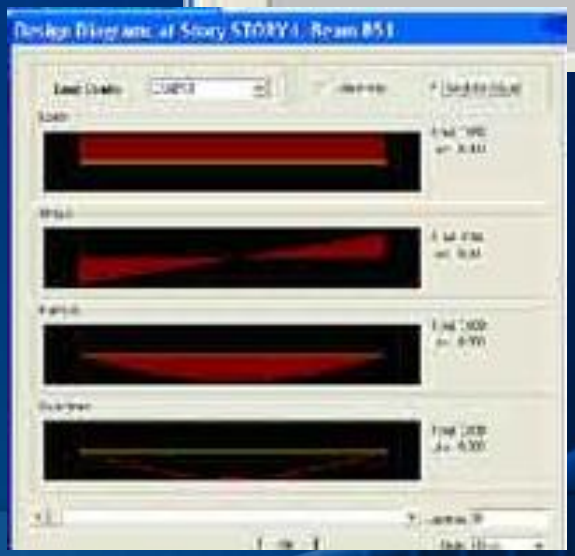
Idealization of Stress and Strain Distribution in a Column Section

ETABS

Member Design

Composite Beam Design



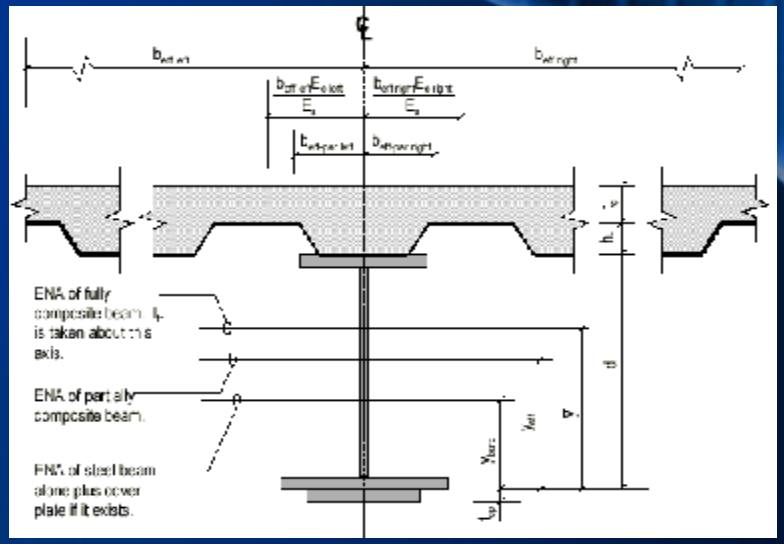


ETABS

Member Design

Composite Beam Design

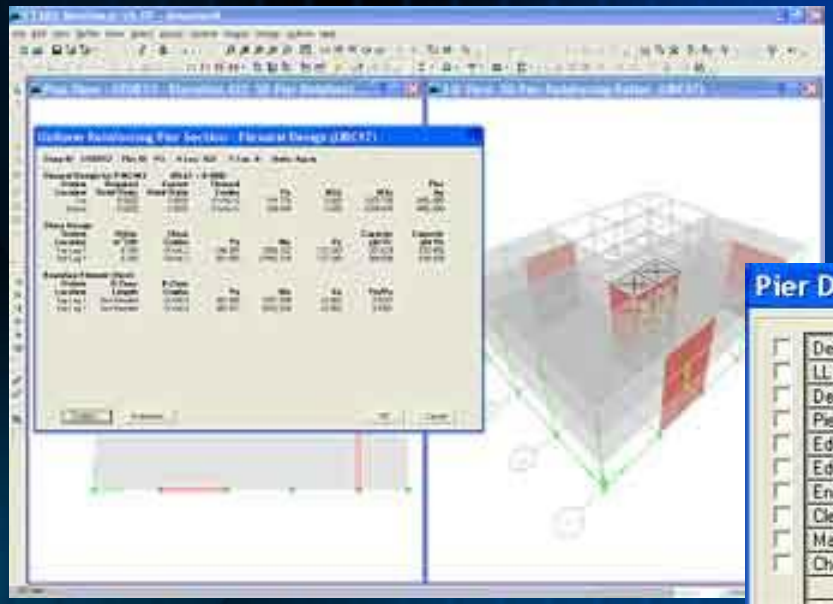
- AISC-ASD and AISC-LRFD Specifications
- Automatic calculation of effective slab widths
- Numerous user-specified constraints
- Shored and un-shored design
- Optimal design for strength and deflections
- Camber calculation
- Floor Vibration analysis

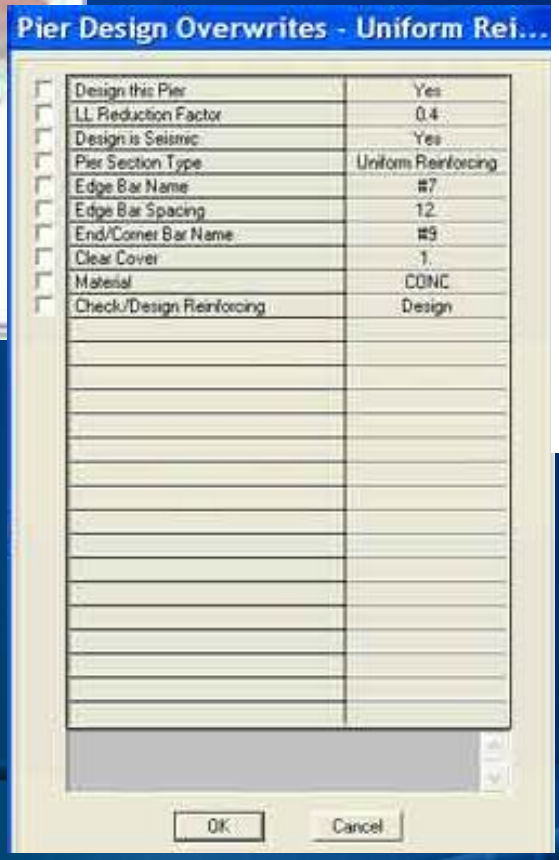


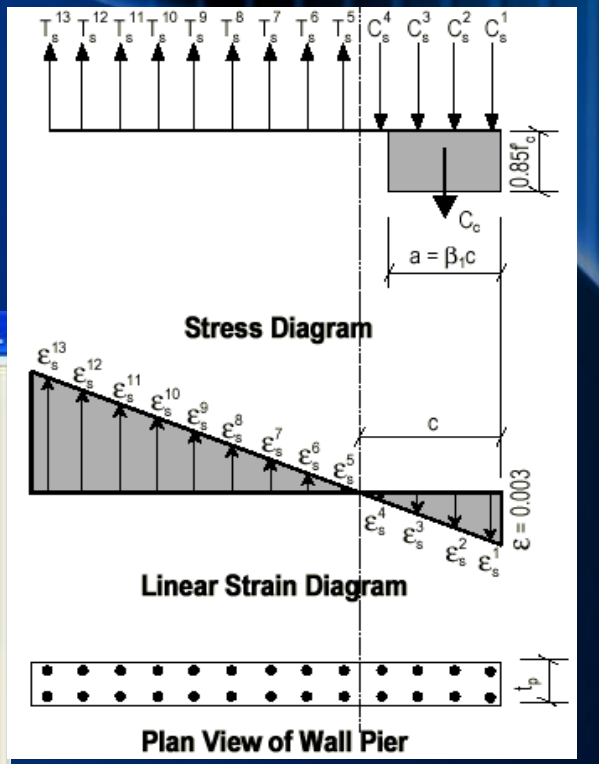
ETABS

Shear Wall Design

Member Design





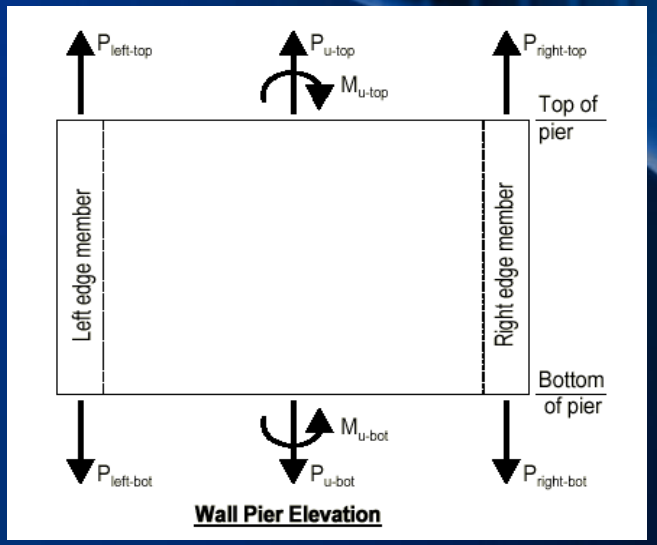


ETABS

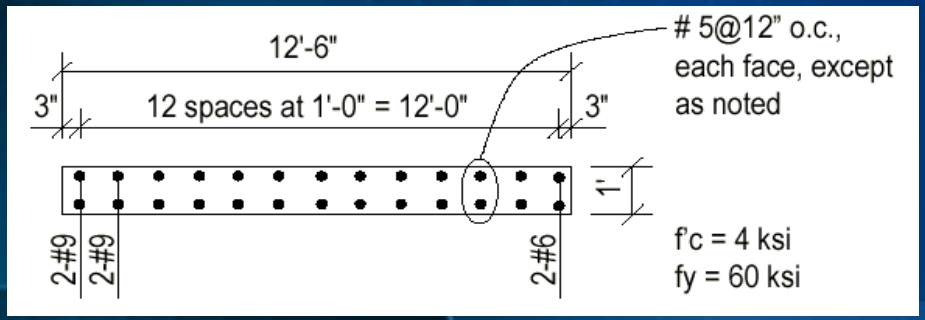
Member Design

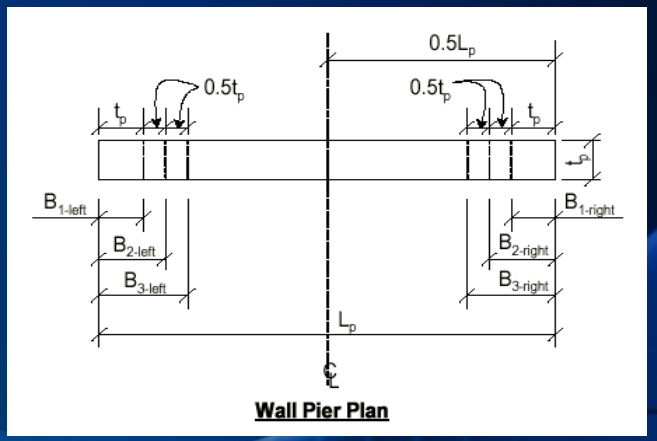
Concrete Shear Wall Design

- Fully integrated wall pier and spandrel design
- ACI, UBC and Canadian Codes
- Design for static and dynamic loads
- Automatic integration of forces for piers and spandrel



Wall Pier Elevation





Wall Pier Plan

ETABS

Member Design

Concrete Shear Wall Design

- 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

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V7 – Non Linear

The Most Comprehensive Software for the Modeling, Analysis and Design of Buildings