

STRUCTURAL ANALYSIS

& Design Projects Portfolio

Buildings | Foundations | Slabs | Trusses | Water tanks | Seismic analysis

PREPARED BY

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Structural Modelling, Analysis & Design | ETABS | SAFE

SOFTWARE

ETABS BUILDING STRUCTURES	SAFE SLABS AND FOUNDATIONS
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Projects at a glance

Project	Software	Key parameter
Six-storey RC building	ETABS	6 stories + base; 15 × 15 in columns; ACI 318-19
Response spectrum analysis	ETABS	UBC 97, zone 2, CQC, 5% damping
Elevated circular water tank	ETABS	Cylindrical grid; 21 in columns; 10 in walls
Steel truss, 2D and 3D	ETABS	W8x31 members; pin and roller supports
RC roof slab with design strips	ETABS, SAFE	25 × 25 ft panel; 8 in slab
Raft foundation	SAFE	6 × 6 m; 600 mm; subgrade 20,000 kN/m/m ²
Isolated footing	SAFE	150 kips dead + 80 kips live; 375 mm column
Combined footing	SAFE	6 × 2.5 m; two columns; 4 × 4 mesh

1. Profile & Software Expertise

I am a structural engineer who models, analyses and designs buildings, slabs and foundations in CSI ETABS and CSI SAFE. I work from model initialisation through loading, analysis and code-based design to a verified result that is ready to report.

The eight projects in this portfolio cover the full range of everyday structural work: a multi-storey concrete frame, seismic response spectrum analysis, an elevated water tank, a steel truss, roof slabs and three types of foundation.

Software

Software	Best for	Typical outputs
ETABS	Multi-storey buildings: frames, shear walls, slabs	Forces, drift, story response, frame and slab design
SAFE	Foundations (raft, isolated, combined) and floor slabs	Soil pressure, settlement, reinforcement, deflection

What I deliver

- Structural models built from architectural grids, with correct sections, materials and supports.
- Load definition and combinations according to ACI 318-19, AISC 360-16 and UBC 97.
- Linear static and response spectrum analysis with P-Delta effects where required.
- Concrete frame design, slab design with design strips, and foundation design with soil springs.
- Clear result tables and plots: reactions, drift, shear, moment, soil pressure and settlement.

Codes and standards

Code	Used for
ACI 318-19	Concrete frame, slab and footing design
AISC 360-16	Steel member design and truss checks
UBC 97	Seismic load patterns and response spectrum function

2. Analysis & Design Workflow

Every model in this portfolio follows the same disciplined sequence, so results are repeatable and easy to check.

Typical workflow

1. Model initialisation: units, design codes and section database.
2. Define materials and sections.
3. Draw the structure.
4. Assign supports, diaphragms and loads.
5. Define load combinations.
6. Check the model and run the analysis.
7. Review results: reactions, forces, displacements.
8. Run the design check and detail the members.

Quality checks on every model

- Check Model run with all options selected before analysis, to catch disconnected nodes and undefined geometry.
- Support reactions compared with applied loads to confirm equilibrium.
- Service combinations used for settlement and bearing checks; ultimate combinations for strength design.
- Design check repeated until every member passes, with analysis and design sections verified to match.

Key terms

Term	Meaning
Grid system	Reference lines that define column positions
Story	A single level of the building
Diaphragm	Rigid slab element that distributes lateral forces to vertical elements
P-Delta effect	Secondary moments from axial loads acting through lateral displacement
Subgrade modulus	Soil stiffness used to model foundation settlement and pressure

Project 1: Multi-Storey RC Building (ETABS)

Reinforced concrete frame building | Modelling, analysis and design

7 STORIES INCL. BASE	6 × 4 GRID LINES	ACI 318-19 CONCRETE CODE	ETABS SOFTWARE
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Overview

Six-storey reinforced concrete frame building modelled, analysed and designed in ETABS, with one extra base story for foundation design. The model carries wall, floor and seismic loads, a rigid diaphragm at every story, default code combinations and a full concrete frame design check.

Model data

Stories and heights	6 stories plus base story; 8 ft base height, 10 ft typical height
Grid	6 lines in X and 4 in Y; spacing 15 ft (X) and 10 ft (Y)
Concrete	5,000 psi for beams and columns; 3,000 psi for slabs
Reinforcement	Grade 60 longitudinal bars; Grade 40 ties
Sections	Columns 15 × 15 in; beams 15 × 18 in; slab 8 in
Loads	Self-weight; wall load 0.9375 kips/ft (0.469 on top story); live load 50 psf; seismic EQX and EQY (UBC 97)
Design preferences	ACI 318-19; live load reduction factor 0.5; pattern live load on; utilisation limit 1.0

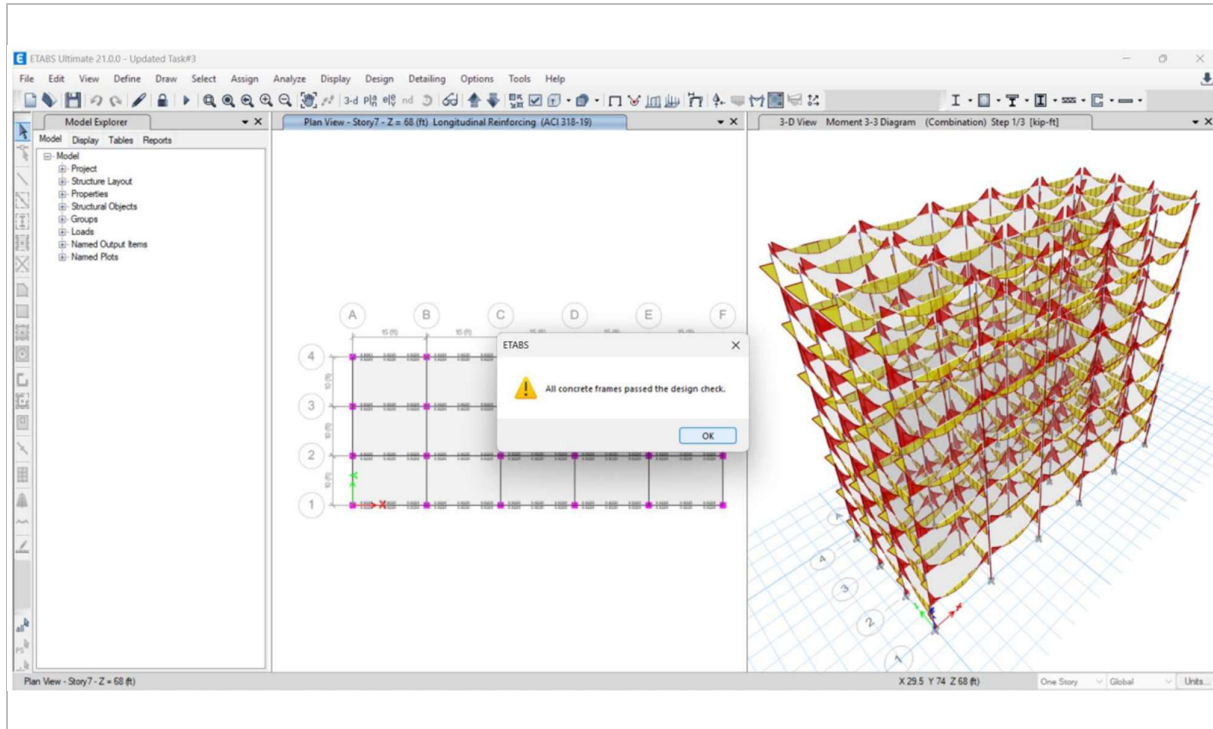
Workflow

1. Initialise the model with US customary units, AISC 360-16 and ACI 318-19; define grid, story data, materials and sections.
2. Draw columns, beams and slabs with the quick-draw tools, then remove the base slabs.
3. Assign a rigid diaphragm to each story (D1 to D7) and fixed supports at the base.
4. Define dead, wall (super dead), live and seismic load patterns; apply wall and floor loads; mesh the floors.
5. Add default design combinations such as 1.2D + 1.6L and 1.2D + 1.0E + 1.0L.
6. Check the model, run the analysis and review axial force, shear and bending moment diagrams.
7. Run the concrete frame design, set the detailing rules and verify that all members pass.

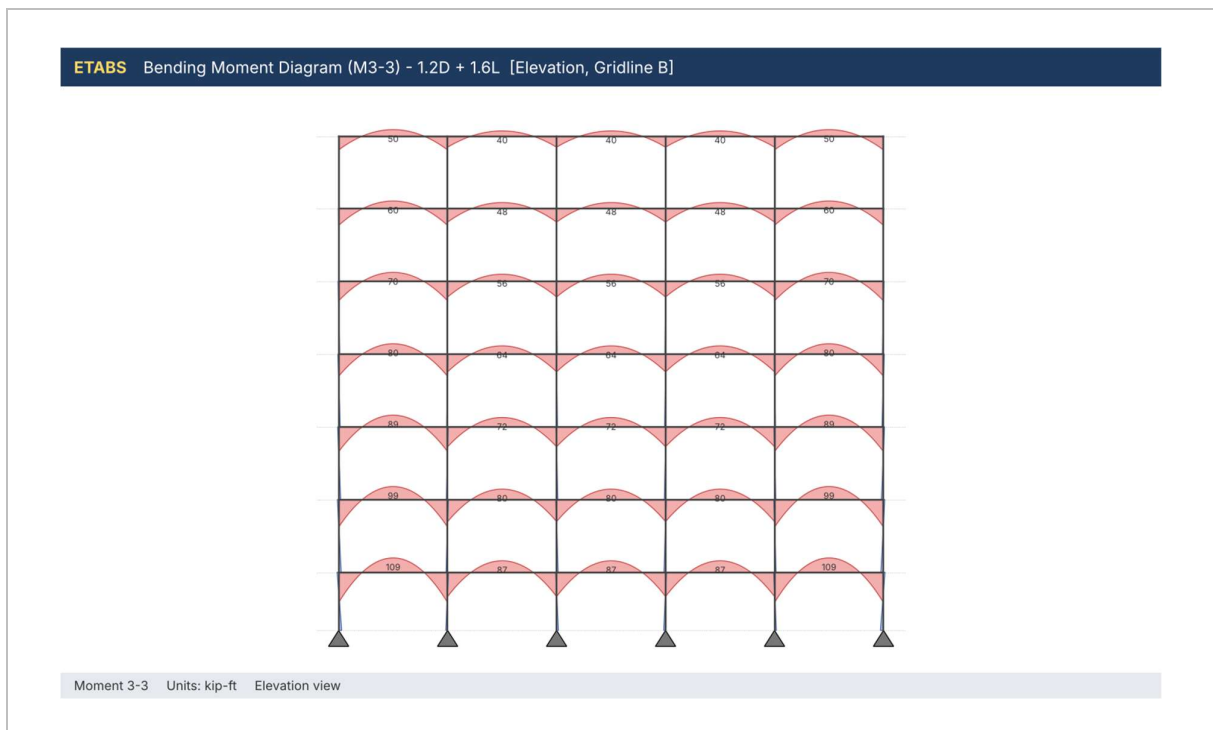
Results reviewed

- Axial, shear and moment diagrams reviewed for each design combination.
- Concrete frame design completed with every member verified as passed.

Final model image



Result image



Project 2: Response Spectrum Seismic Analysis (ETABS)

Seismic analysis | Dynamic response of a multi-storey frame

UBC 97 SEISMIC CODE	Zone 2 SEISMIC ZONE	CQC MODAL COMBINATION	0.05 MODAL DAMPING
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Overview

Dynamic seismic analysis of a multi-storey concrete frame using a code-based response spectrum. The spectrum function and the RS-X and RS-Y load cases are defined in ETABS, and the response is reported through story plots and tables for a professional report.

Model data

Code and zone	UBC 97, seismic zone 2, with soil type and zone coefficients set in the load pattern
Materials	Concrete 4,000 psi for beams and columns, 3,000 psi for slabs; Grade 40 rebar
Supports	Fixed supports at the base level
Load cases	Response spectrum in X (RS-X) and Y (RS-Y); acceleration load with UBC 97 function and scale factor
Modal setup	CQC modal combination; constant modal damping 0.05
Gravity loads	Live load and super dead load applied to all floors

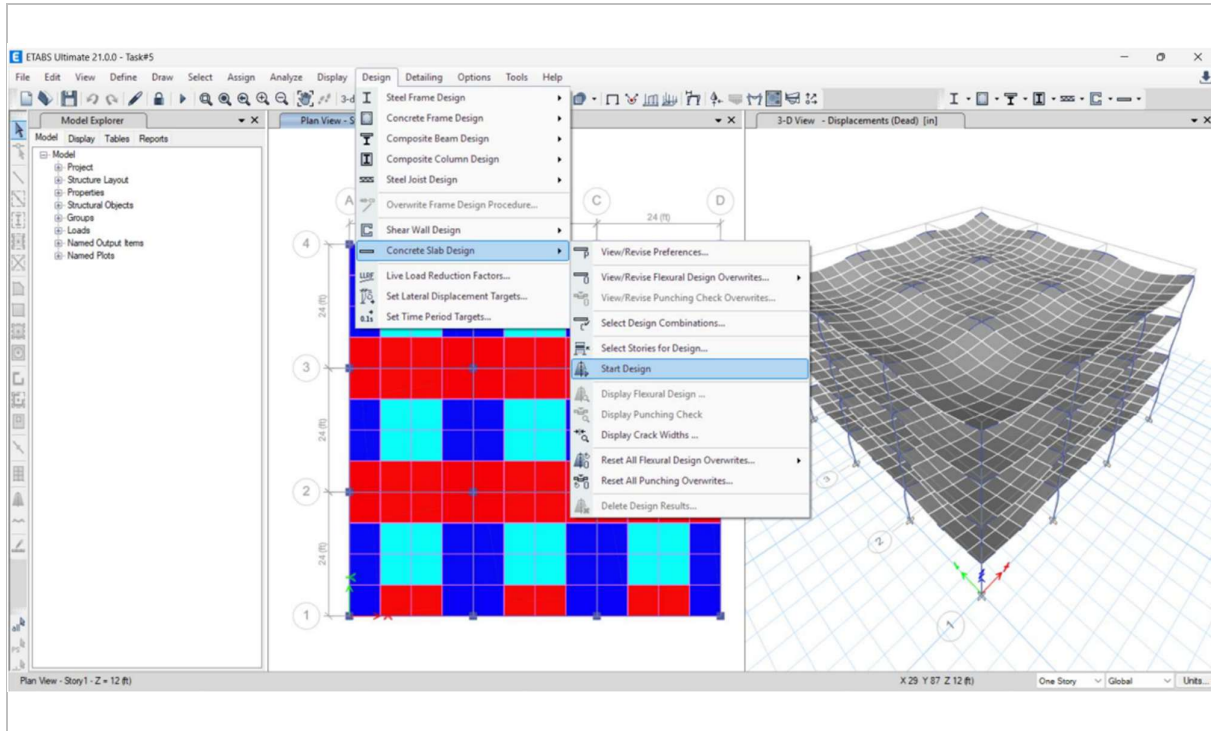
Workflow

1. Initialise the model and define materials, frame sections and slab sections.
2. Draw columns, beams and slabs on all stories and fix the base joints.
3. Define dead, live, super dead and UBC 97 seismic load patterns for X and Y.
4. Create the UBC 97 response spectrum function with zone 2 coefficients.
5. Create RS-X and RS-Y load cases with CQC combination and 0.05 damping.
6. Run the analysis, then review deformations, moment (M33, M22) and shear diagrams.
7. Run the concrete frame design check and revise any overstressed sections.

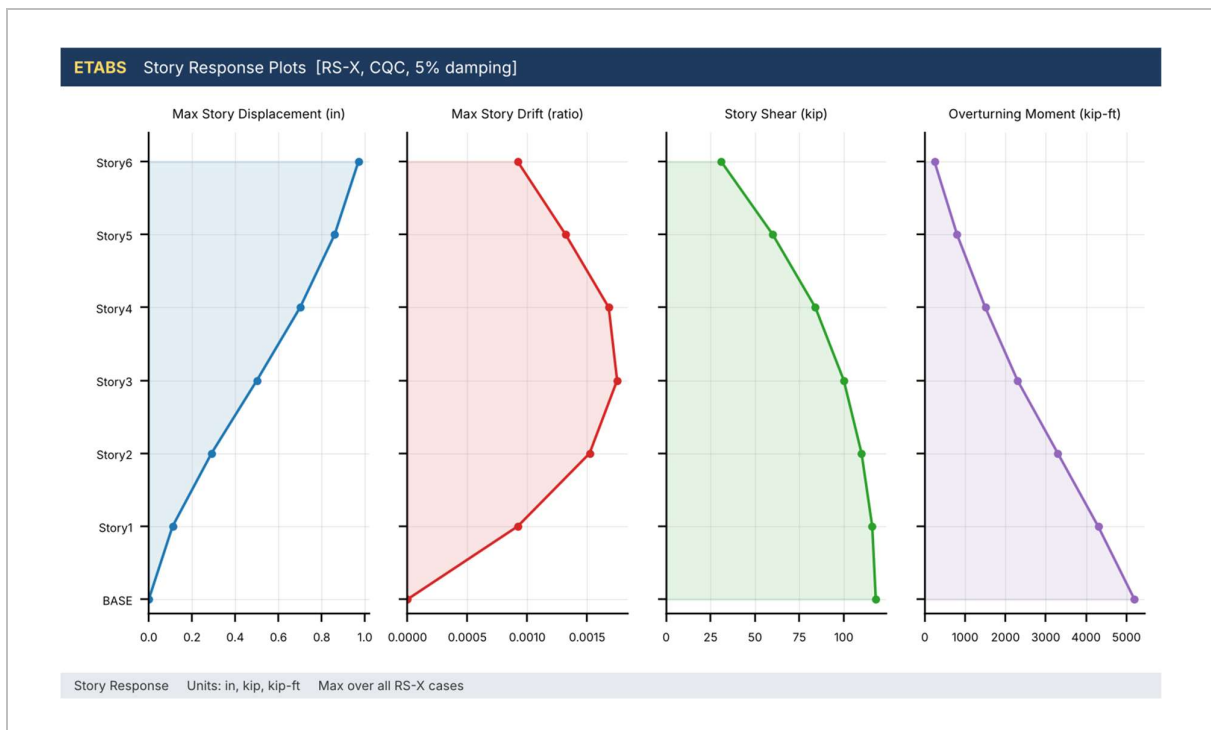
Results reviewed

- Story response plots for maximum displacement, story drift, story shear and overturning moment.
- Tables of joint displacements, joint reactions and design results for reporting.

Final model image



Result image



Project 3: Elevated Circular Water Tank (ETABS)

Overhead water tank | Circular tank with columns and walls

2 STORIES	21 in COLUMN DIAMETER	10 in WALL THICKNESS	5,000 psi CONCRETE
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Overview

Circular elevated water tank modelled on a cylindrical grid in ETABS, using circular columns, a thin-shell slab and shell walls. The model is loaded with wind and floor loads, analysed, and designed with a full set of verification checks.

Model data

Grid	Cylindrical grid system created in Edit Story and Grid System Data
Materials	Concrete 5,000 psi; Grade 60 rebar
Columns	Circular, 21 in diameter, 5,000 psi
Slab and walls	10 in slab (shell thin); 10 in walls, 5,000 psi
Diaphragms	Two diaphragms (D1 and D2), one per story
Loads	Uniform shell load 25 psf on story one; wind as distributed frame loads; default and custom combinations

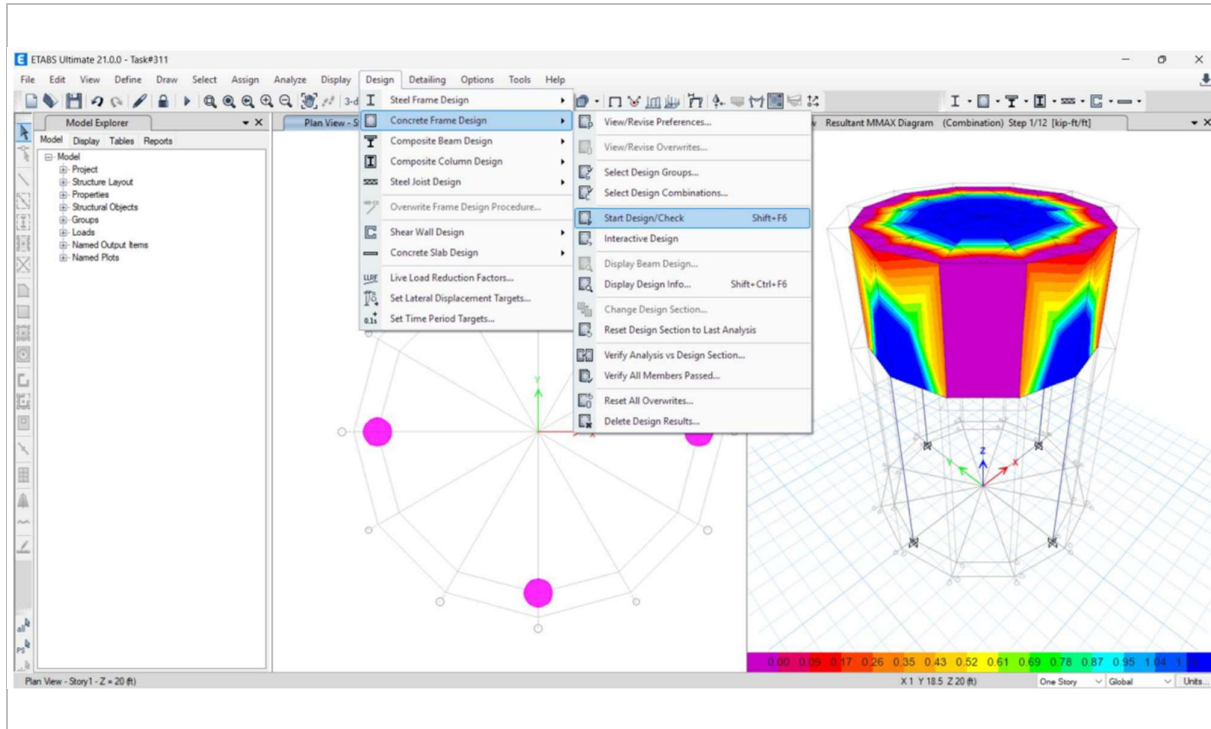
Workflow

1. Initialise the model and create a cylindrical grid system with the required story data.
2. Define materials, circular column, slab and wall sections, and the two diaphragms.
3. Draw the slabs, columns and walls for both stories and apply base restraints.
4. Define load patterns and combinations; assign wind and shell loads and the diaphragms.
5. Check the model and run the analysis (F5), then review deformation and animation.
6. Review support reactions, shear and moment diagrams, and shell stresses.
7. Run concrete frame design, verify analysis against design sections and confirm all members pass.

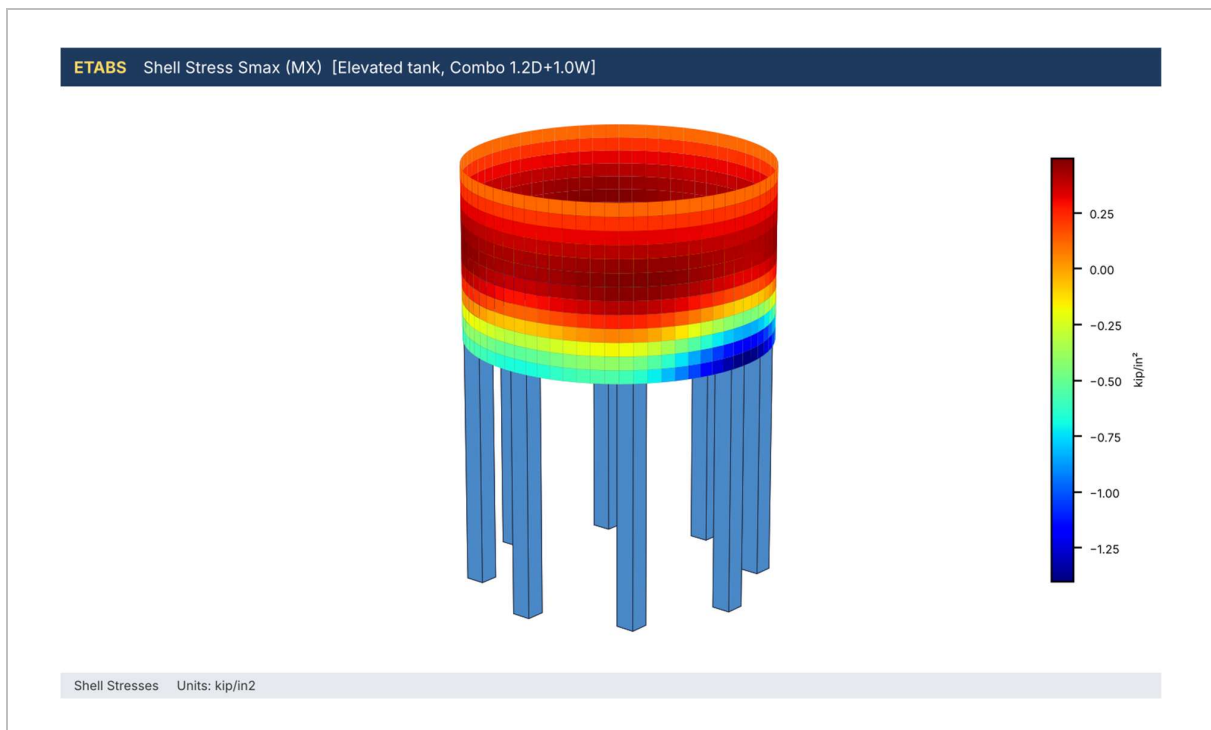
Results reviewed

- Support reactions, frame shear and moment diagrams, and shell stress (MX) reviewed.
- Analysis and design sections verified to match; all members passed the design check.

Final model image



Result image



Project 4: Steel Truss, 2D and 3D (ETABS)

Steel truss | Pin and roller supported truss under point loads

W8x31 STEEL SECTION	5 × 2 GRID LINES	20 ft GRID SPACING	3 kips JOINT LOAD
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Overview

Steel truss modelled and analysed in ETABS to confirm support reactions and to identify tension, compression and zero-force members. Self-weight is switched off so the results reflect only the applied joint loads.

Model data

Units	US customary (kip, ft)
Grid	Grid-only model with 5 lines in X and 2 lines in Y at 20 ft spacing
Member section	Steel W8x31 imported from the section database
Supports	Pinned support at the primary joint; roller at the other
Loads	Concentrated 3 kip loads in the negative Z direction; self-weight multiplier set to 0

Workflow

1. Create the model with grid only and define the steel W8x31 section.
2. Draw the truss members with the beam tool and connect all joints.
3. Assign the pinned and roller supports at the base joints.
4. Create a super dead load pattern with self-weight multiplier 0 and apply the joint forces.
5. Check the model for disconnected nodes, then run the analysis.
6. Review support reactions and the axial force diagram.

Results reviewed

- Support reactions checked for equilibrium at the base.
- Axial forces show tension and compression members and any zero-force members.

Final project image



Project 5: RC Roof Slab with Design Strips (ETABS & SAFE)

Two-way roof slab | Design strips in ETABS and a single panel in SAFE

25 × 25 ft SAFE PANEL	8 in SLAB THICKNESS	3,000 psi CONCRETE	ACI 318-19 DESIGN CODE
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Overview

Roof slab designed two ways. In ETABS, column strips and middle strips are drawn in both layers and designed for reinforcement. In SAFE, a single 25 ft panel is meshed, loaded, designed with strips and checked for serviceability deflection.

Model data

ETABS strips	Column strip width based on half the span (e.g. 72 in); layers A (X) and B (Y); edge strips set to zero width on the outer side
SAFE panel	25 ft × 25 ft single panel, 8 in slab, 3,000 psi concrete, supports at the four corners
SAFE loads	Dead (self-weight 1), super dead 20 psf, live 40 psf
SAFE strips	Column strip 75 in wide, plus middle strips in both directions
Meshing	Fine auto mesh applied to the slab for reliable results

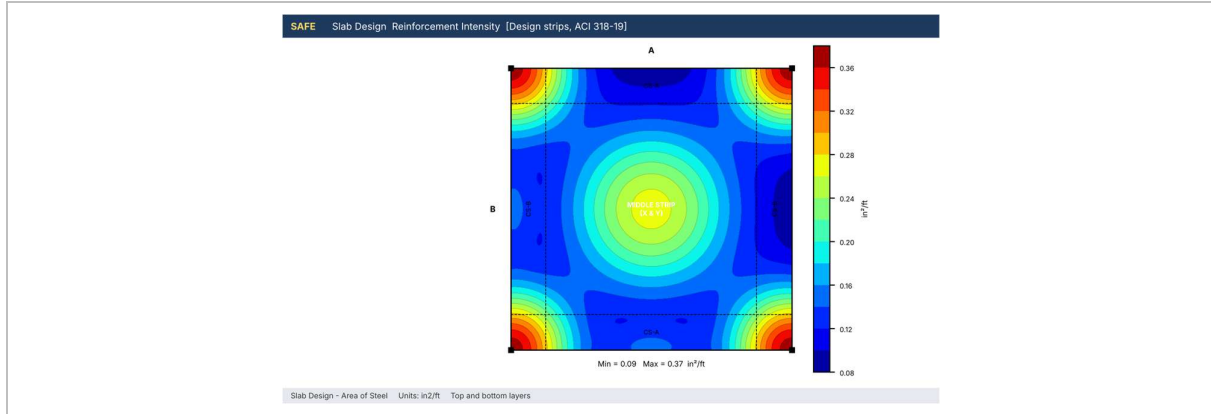
Workflow

1. In ETABS, draw column strips for layers A and B, then draw the middle strips with snap options.
2. Check the model, run the analysis and set the slab design preferences (ACI 318-19).
3. Select design combinations and stories, run slab design and view reinforcement intensity.
4. In SAFE, define the 25 ft grid, the slab section, corner supports and load patterns.
5. Mesh the slab, draw design strips in both directions, check the model and run the analysis.
6. Run slab design, view the area of steel, and review the deformed shape for deflection.

Results reviewed

- Reinforcement intensity and bar areas displayed for the strips.
- Detailing rules adjusted (bar sizes, spacing, hooks) and deflection checked for serviceability.

Final project image



Project 6: Raft Foundation (SAFE)

Mat foundation | Soil pressure and settlement on a flexible subgrade

6 × 6 m RAFT SIZE	600 mm RAFT THICKNESS	20,000 SUBGRADE MODULUS	SAFE SOFTWARE
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Overview

Raft foundation created from the SAFE base mat template and analysed on a subgrade modulus taken from the geotechnical report. Service and ultimate combinations are used to check bearing pressure, settlement and differential settlement.

Model data

Geometry	Length 6 m (X); width 6 m (Y)
Mat thickness	600 mm
Soil	Subgrade modulus 20,000 kN/m ²
Combinations	Default design combinations, including service combinations for settlement and bearing checks
Units	US customary settings with metric template inputs

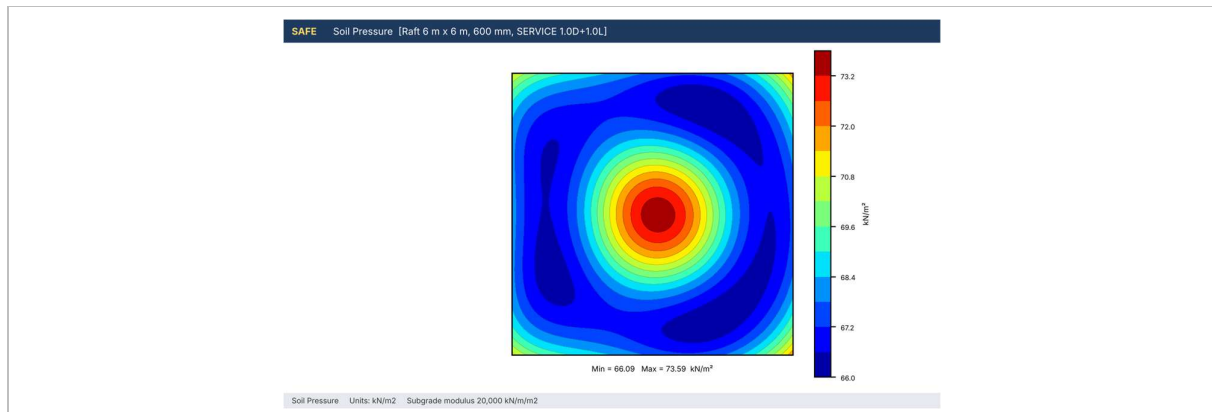
Workflow

1. Start a new model and choose the Base Mat quick template.
2. Enter the footing length, width, mat thickness and subgrade modulus.
3. Add default design combinations and confirm the service combinations.
4. Check the model and run the analysis (F5).
5. Display the soil pressure distribution and the deformed shape.

Results reviewed

- Soil pressure distribution reviewed against bearing capacity.
- Maximum and differential settlement checked.

Final project image



Project 7: Isolated Footing (SAFE)

Spread footing | Single column footing under dead and live load

150 kips DEAD LOAD	80 kips LIVE LOAD	2 ft OVERHANG	ACI 318-19 DESIGN CODE
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Overview

Isolated footing generated from the SAFE single footing template with column reactions from the superstructure. Service and ultimate combinations are used to check bearing pressure and settlement.

Model data

Overhangs	2 ft on all four sides
Column loads	Dead 150 kips; live 80 kips
Column size	375 mm square
Self-weight	Multiplier set to 0 for the dead load pattern (handled by soil springs)
Combinations	Service 1.0 DEAD + 1.0 LIVE for bearing; ultimate 1.2 DEAD + 1.6 LIVE for design

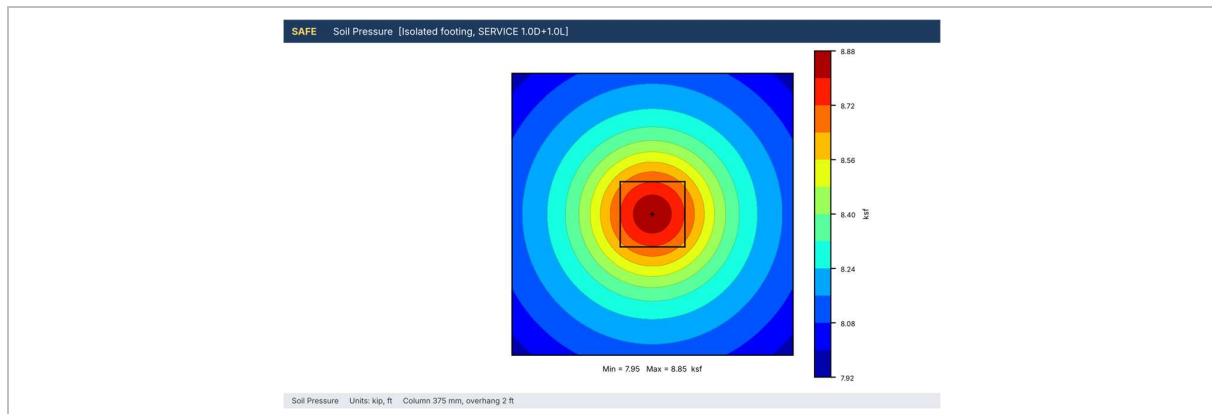
Workflow

1. Start a new model with US customary units and ACI 318-19; choose the Single Footing template.
2. Enter overhangs, dead and live column loads and the column size.
3. Verify the DEAD and LIVE load patterns and the self-weight multiplier.
4. Add default design combinations for ACI 318-19.
5. Check the model, run the analysis and review soil pressure under the service combination.
6. Check settlement against allowable limits.

Results reviewed

- Soil bearing pressure checked under service load.
- Maximum settlement verified within allowable limits.

Final project image



Project 8: Combined Footing (SAFE)

Combined footing | Two columns on one strip footing

6 × 2.5 m FOOTING SIZE	600 mm THICKNESS	4 × 4 MESH	ACI 318-19 DESIGN CODE
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Overview

Combined footing for two columns with different loads, generated from the SAFE combined footing template. The footing is meshed, analysed under service and ultimate combinations, and checked through the soil pressure distribution.

Model data

Geometry	Length 6 m; width 2.5 m; thickness 600 mm
Column 1	Dead 300 kN; live 150 kN
Column 2	Dead 200 kN; live 100 kN
Soil	Subgrade modulus 20,000 kN/m ²
Combinations	Service 1.0D + 1.0L; ultimate 1.2D + 1.6L
Meshing	Auto mesh 4 × 4 on the footing slab

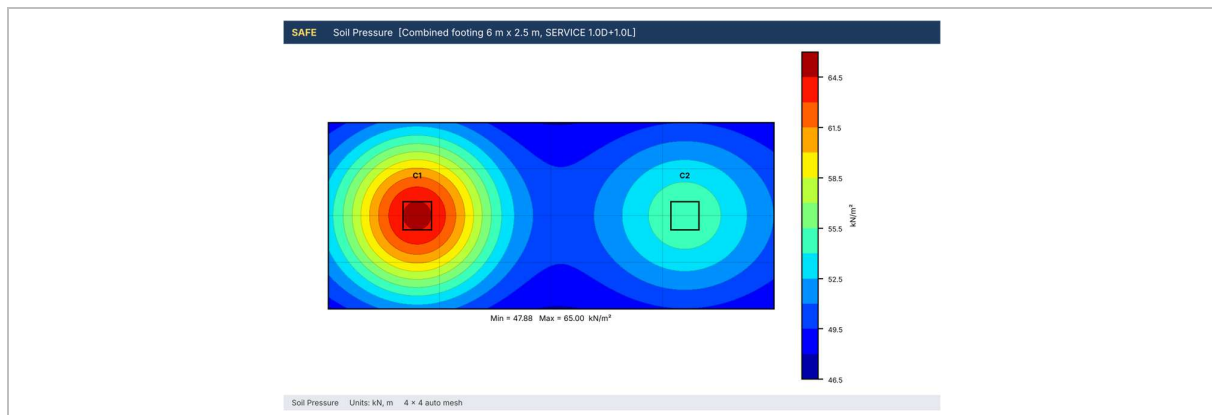
Workflow

1. Start a new model with US customary units and ACI 318-19; choose the Combined Footing template.
2. Enter the geometry, column loads and soil subgrade modulus.
3. Add default design combinations and verify the service and ultimate combinations.
4. Apply a 4 × 4 auto mesh to the footing slab.
5. Check the model, run the analysis (F5) and display the soil pressure distribution.

Results reviewed

- Soil pressure distribution reviewed under the service combination.

Final project image



3. Let's Work Together

I can build and check your structural models, or take a hand-drawn or CAD layout through to analysis and design results in ETABS or SAFE.

How I can help	Typical first step
New building model	Share architectural drawings and loads; I return a model and analysis results
Foundation design	Send column reactions and soil data; I return a SAFE model with pressure and settlement checks
Seismic analysis	Send the building model or drawings; I return response spectrum results and story plots
Model review	Send your ETABS or SAFE file; I return a checked model with findings

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