# FEAKalc3D

## Temperature Load Verification

Comparison with ETABS

9 November 2026 | Comparative verification | Revision 0

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# 1. Summary

The supplied comparisons show strong agreement between ETABS and FEAKalc for the two temperature-load benchmarks. The 2D frame response is an exact match. For the 3D slab model, the shell stress contours and deformed shape are extremely close; some supporting-column results differ locally, while the overall response remains acceptable for this comparison.

The results support FEAKalc's implementation for the two models and load cases shown. The assessment is based on the supplied graphical outputs; numerical tables and the model files were not part of this review. Accordingly, the report records qualitative agreement and does not assign percentage errors or solver tolerances.

| Benchmark | Comparison outcome |
|---|---|
| 2D frame under temperature load | Member axial force, shear, bending moment and deformation plots are almost identical in overall pattern and displayed values. |
| 3D shell slab under temperature load | Shell deformation and shell result contours are extremely close. Local differences occur in columns supporting the slab; the overall response is acceptable. |
| Verification conclusion | Good agreement for the cases examined. Further numeric checks are appropriate if this report is used as a formal acceptance record. |

# 2. Scope and Verification Basis

This report compares FEAKalc with ETABS for two independent temperature-load models: a 2D concrete frame and a 3D shell slab supported by columns. The supplied screenshots document the model setup and program results. The ETABS output is treated as the reference for comparison; this comparison alone does not establish which program is closer to the exact solution.

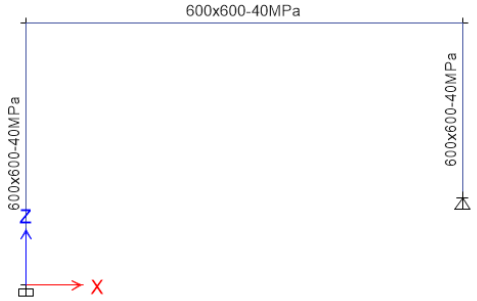
The review considers the visible result patterns, labels and contour distributions. The figures retain each application's original legends and display settings. Where the two programs use different contour ranges, plot scaling or view angles, the visual comparison is interpreted by the overall distribution and shape rather than by matching colours pixel for pixel.

# 3. 2D Frame Temperature Benchmark

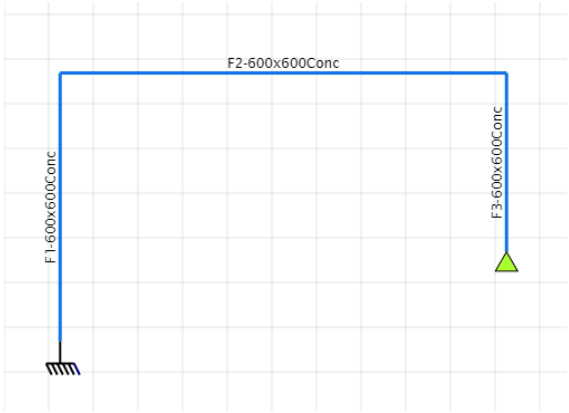
The first benchmark is a planar concrete frame with a beam and two columns. The supplied model images identify 600 mm by 600 mm concrete members and a 40 MPa concrete label. Material screenshots show an elastic modulus of approximately 28 GPa, Poisson ratio 0.20, unit weight 25 kN/m$^3$ and thermal expansion coefficient 10 × 10$^{-6}$/°C. The result views identify a +10°C temperature change. These setup details are transcribed from the supplied screenshots.

The ETABS and FEAKalc diagrams show the same response pattern across the frame. Axial force and shear values appear to match at corresponding member regions. Bending-moment distributions have the same shape and similar values. The deformed shapes are also very close. The supplied comparison is consistent with the reported near-exact agreement for this 2D case.

## 3.1. Frame geometry and section labels



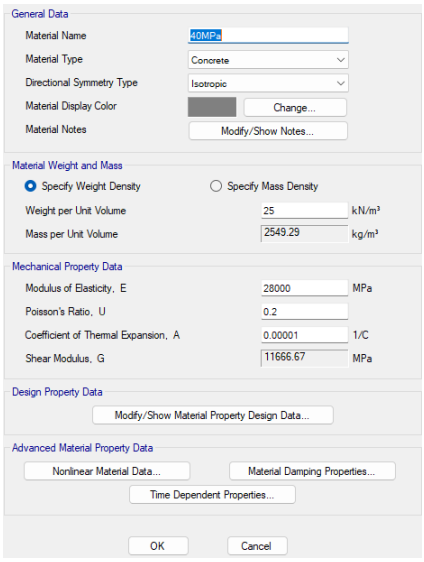

ETABS



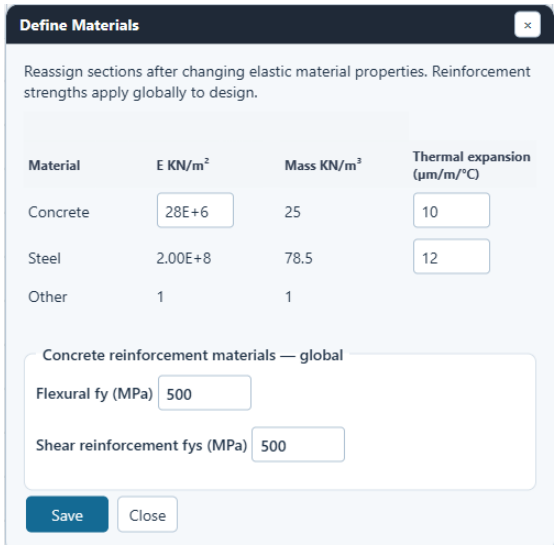

FEAKalc

*Figure 1. The frame layout and member section labels shown in the two applications.*

## 3.2. Material properties




ETABS




FEAKalc

*Figure 2. Concrete material property views. Units and field presentation differ between applications.*

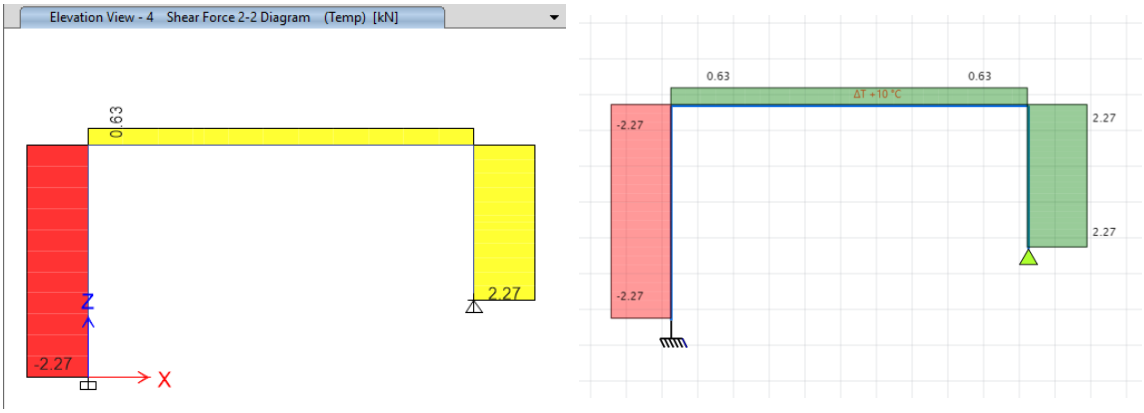
## 3.3. Axial force




*ETABS* *FEAKalc*

*Figure 3. Axial force diagrams for the temperature case. The original labels and units are retained.*

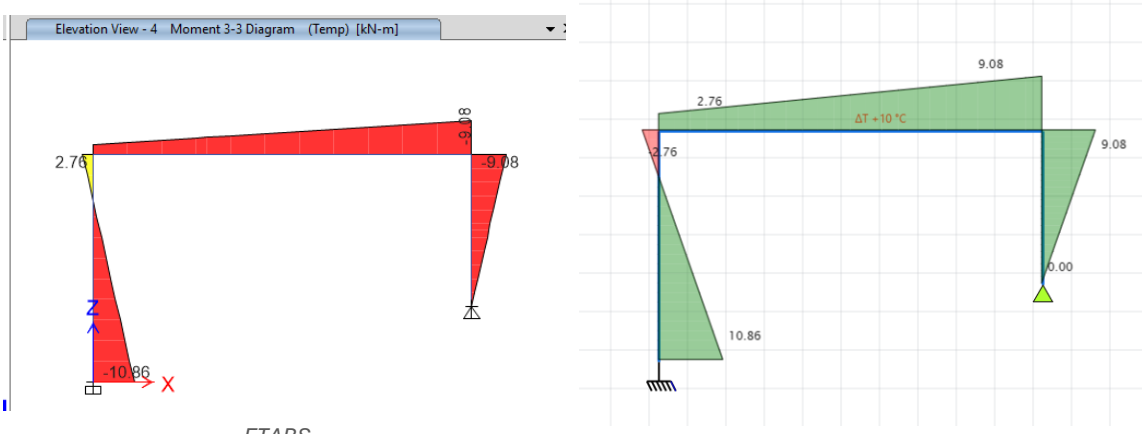
## 3.4. Shear force




*ETABS* *FEAKalc*

*Figure 4. Shear diagrams for the temperature case. Compare corresponding member regions and the displayed values.*

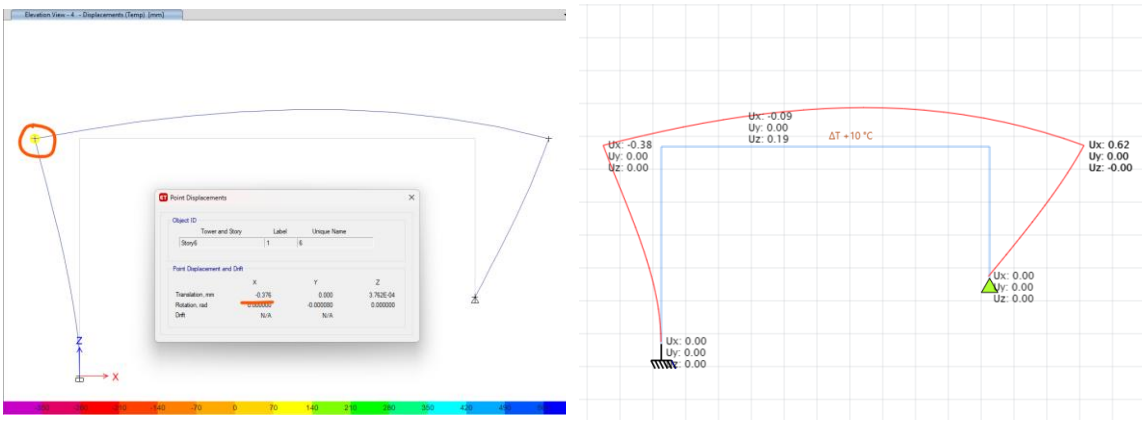
## 3.5. Bending moment




*ETABS* *FEAKalc*

*Figure 5. Bending-moment diagrams for the temperature case. Plot widths and colours are application-specific.*

## 3.6. Deformation




*ETABS* *FEAKalc*

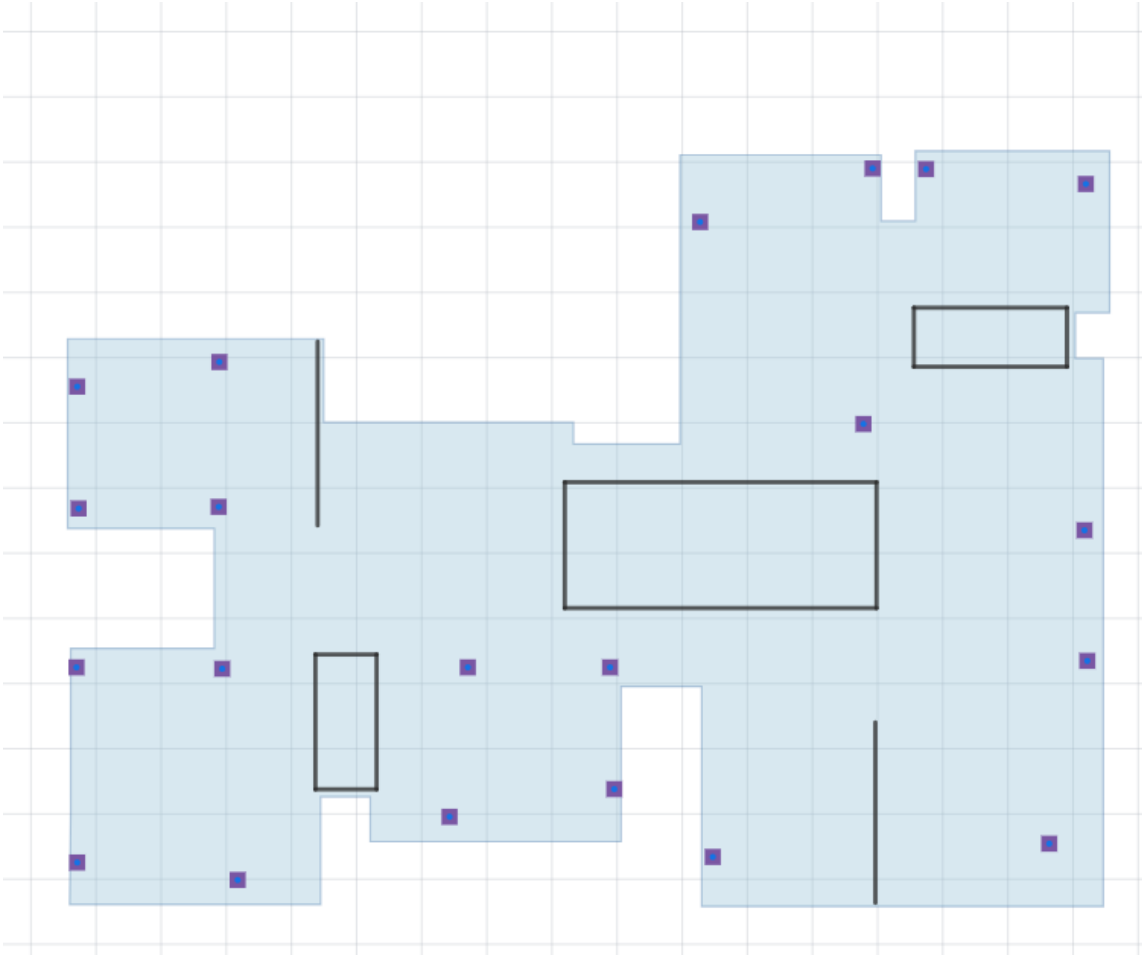
*Figure 6. Deformed-shape views for the temperature case. The graphical magnification and legends differ.*

# 4. 3D Shell Slab Temperature Benchmark

The second benchmark is a three-dimensional shell slab model supported by columns. The floor plan and result screenshots show slab regions, supporting columns and temperature-case responses. The slab response is compared through deformation and shell-result contours. Separate screenshots show axial force, shear and moment results in the supporting frame members.

The shell deformation shapes and stress/result contours are extremely close between ETABS and FEAKalc. The broad spatial patterns agree across the displayed shell components. Some differences are visible in the supporting columns, but they do not materially change the overall structural response shown in the supplied comparison. This is considered acceptable for the stated benchmark, subject to the limitations in this report.

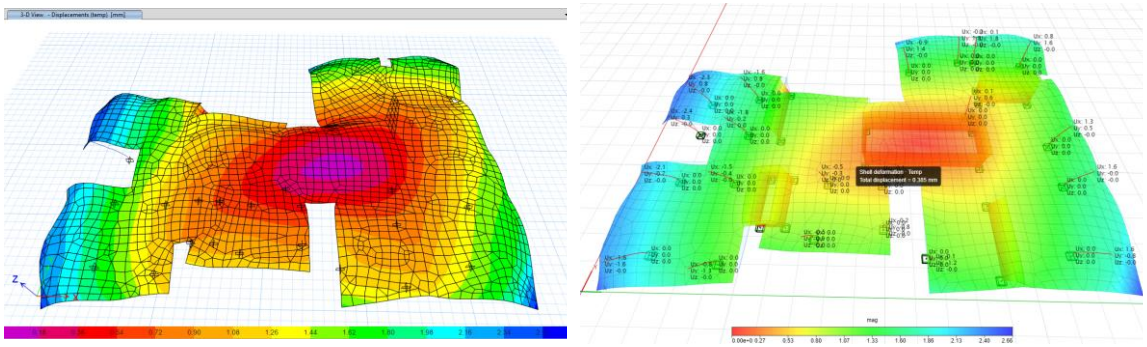
## 4.1. Slab layout



*FEAKalc*

*Figure 7. FEAKalc floor plan supplied with the shell comparison.*

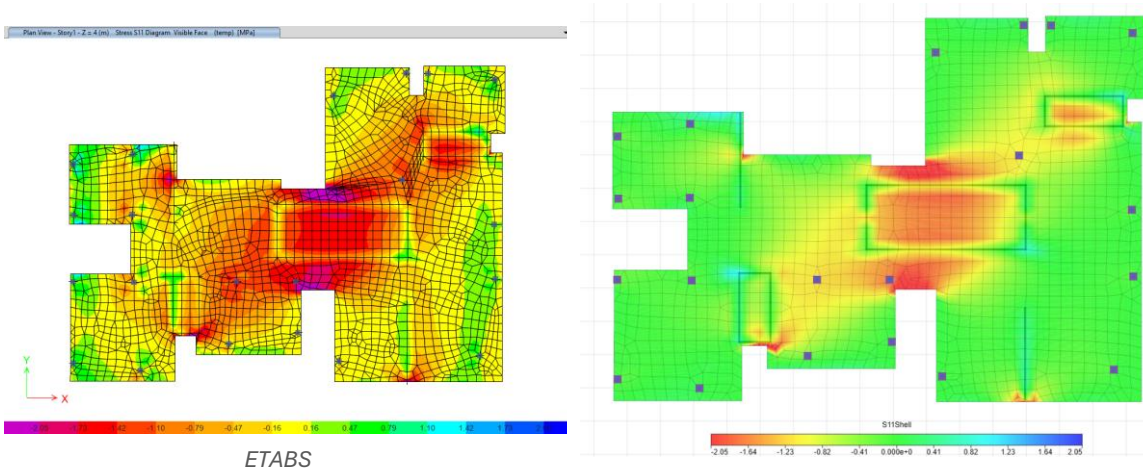
## 4.2. Deformation



ETABS FEAKalc

*Figure 8. Deformed shell shapes for the temperature case. Colour ranges are shown as supplied and should be interpreted with each program's legend.*

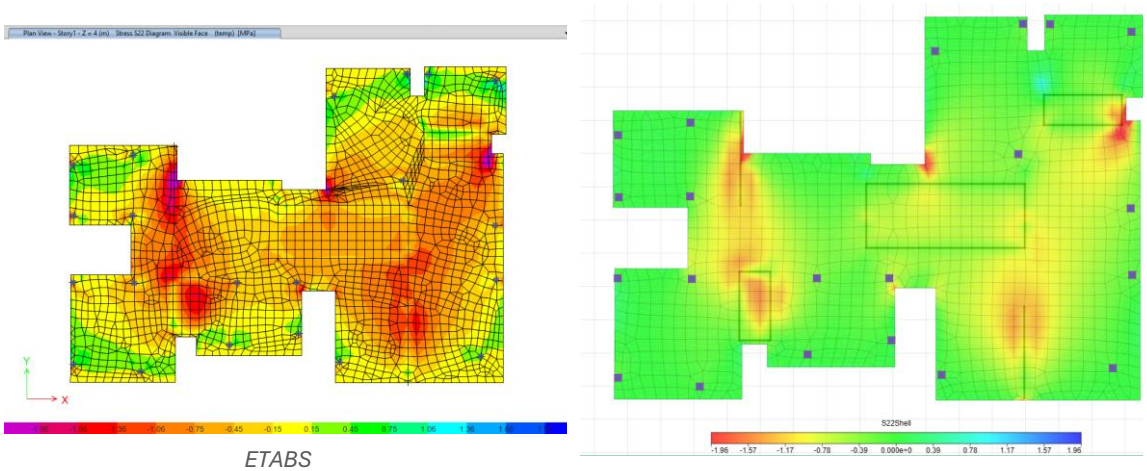
## 4.3. Shell result S11



ETABS FEAKalc

*Figure 9. S11 shell result contours from ETABS and FEAKalc.*

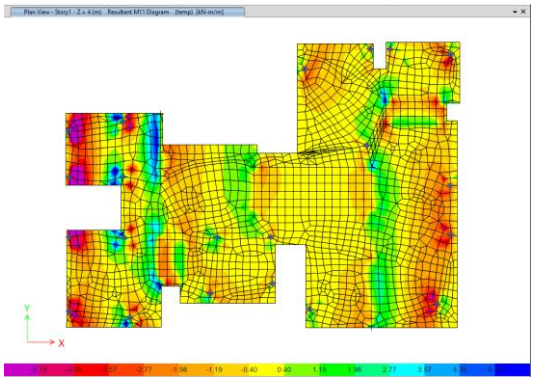
## 4.4. Shell result S22



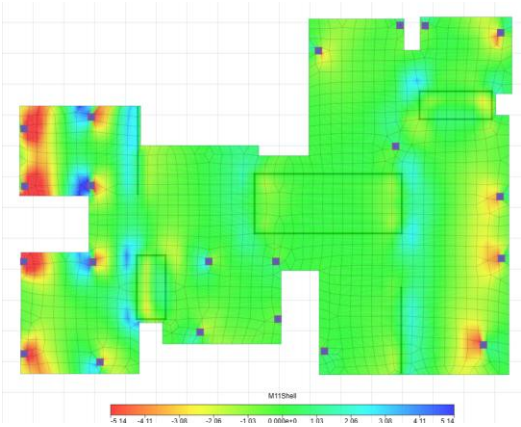
ETABS FEAKalc

*Figure 10. S22 shell result contours from ETABS and FEAKalc.*

## 4.5. Shell result M11



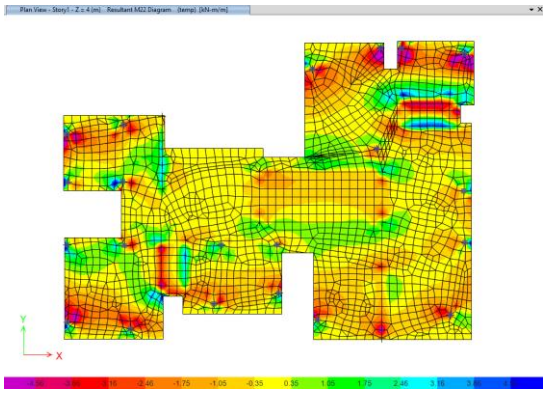
ETABS



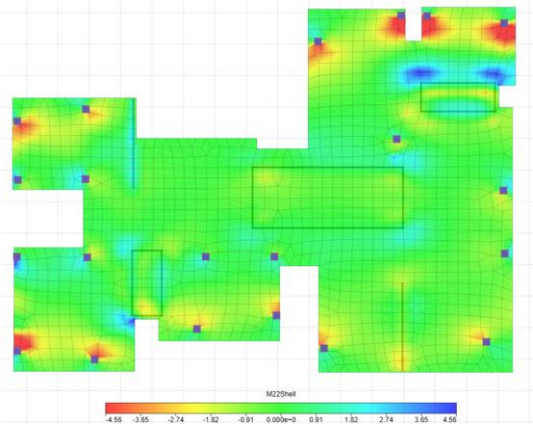
FEAKalc

*Figure 11. M11 shell result contours from ETABS and FEAKalc.*

## 4.6. Shell result M22



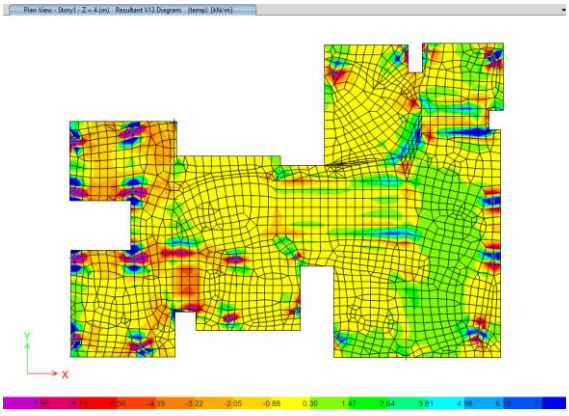
ETABS



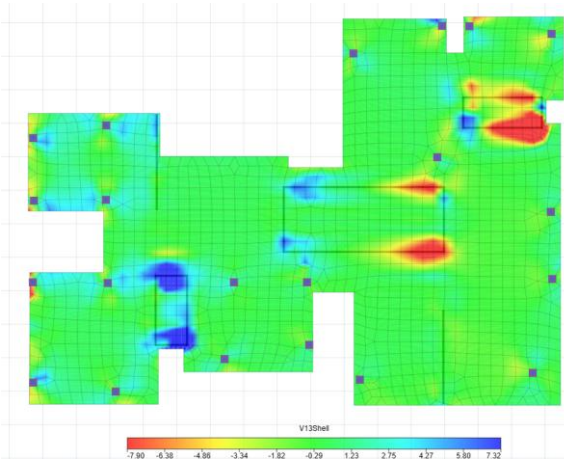
FEAKalc

*Figure 12. M22 shell result contours from ETABS and FEAKalc.*

## 4.7. Shell result V13



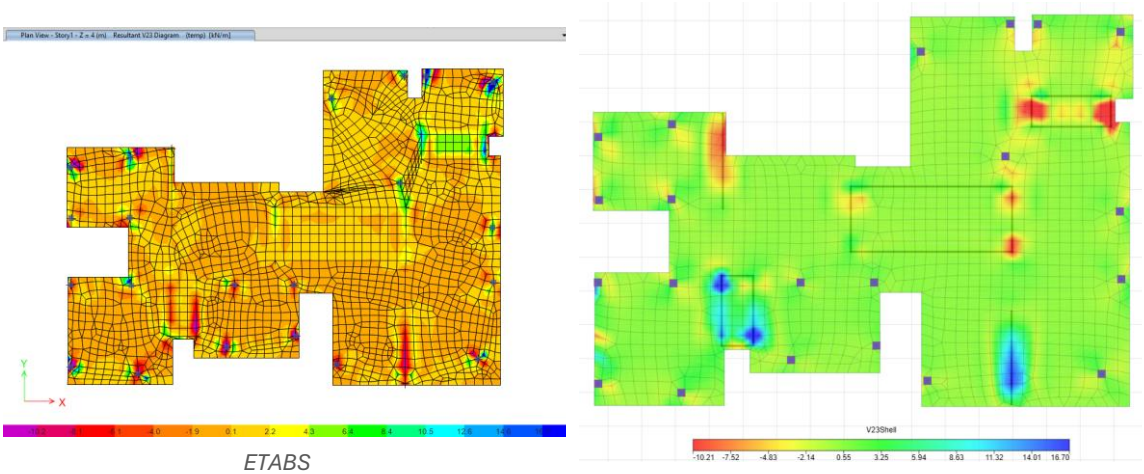
ETABS



FEAKalc

*Figure 13. V13 shell result contours from ETABS and FEAKalc.*

## 4.8. Shell result V23



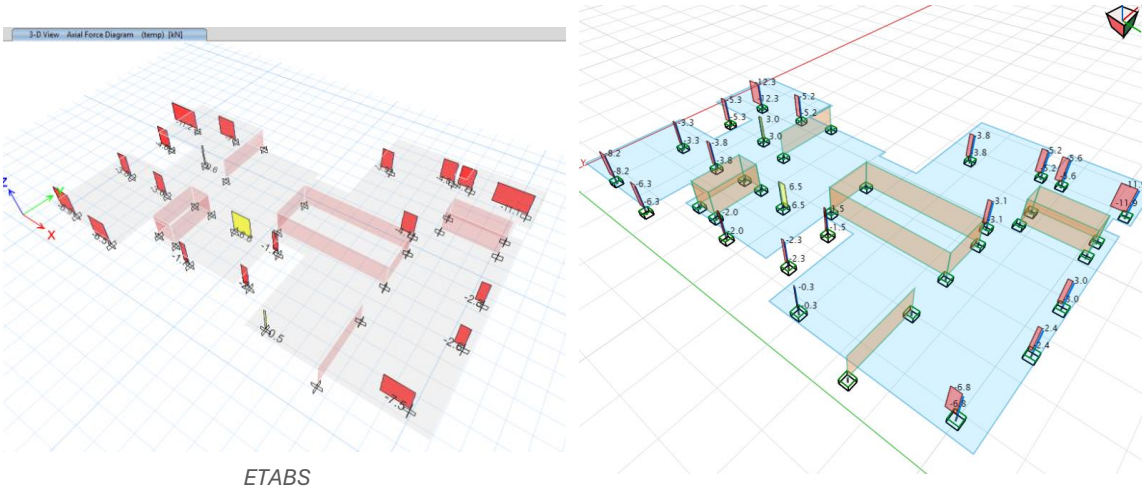
ETABS FEAKalc

*Figure 14. V23 shell result contours from ETABS and FEAKalc.*

## 4.9. Supporting Column Results

The following comparisons show the supporting-member force and moment displays. The column differences are localized in the supplied views; graphical scaling, local-axis conventions and result recovery can affect the appearance of individual diagrams. The screenshots support the qualitative conclusion but are not sufficient to diagnose the source of each local difference.

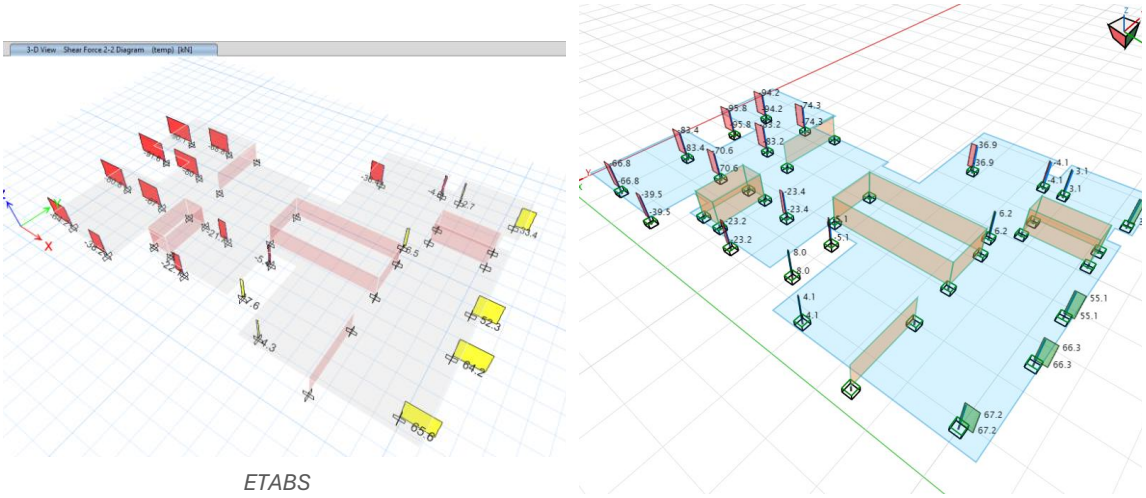
## 4.10. Supporting-member axial force



ETABS FEAKalc

*Figure 15. Axial force display for the supporting members.*

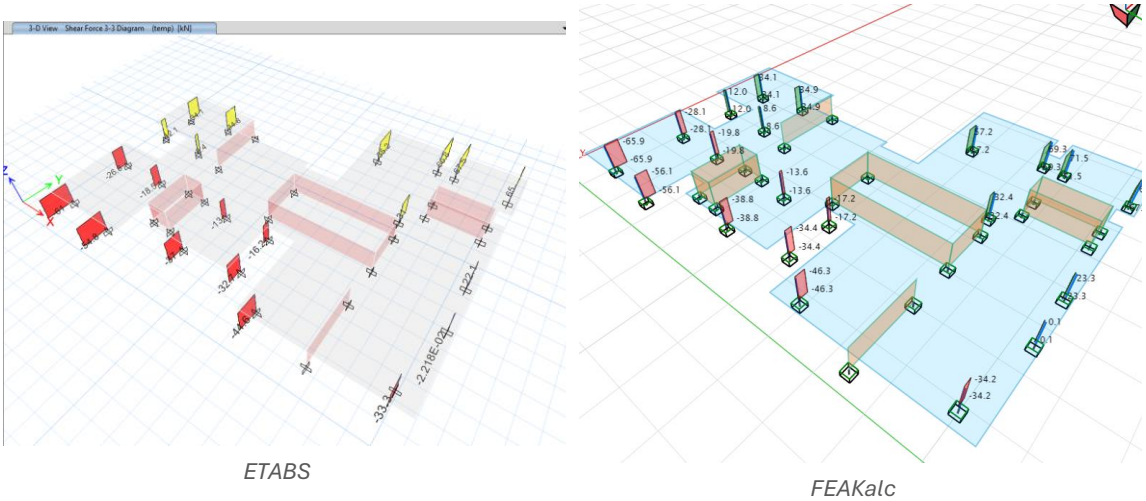
## 4.11. Supporting-member shear V2



*ETABS* *FEAKalc*

*Figure 16. V2 shear display for the supporting members.*

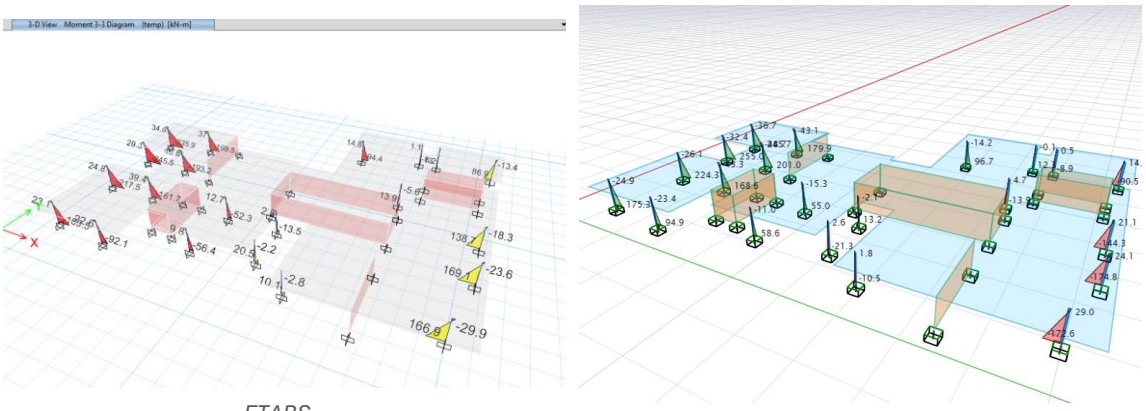
## 4.12. Supporting-member shear V3



*ETABS* *FEAKalc*

*Figure 17. V3 shear display for the supporting members.*

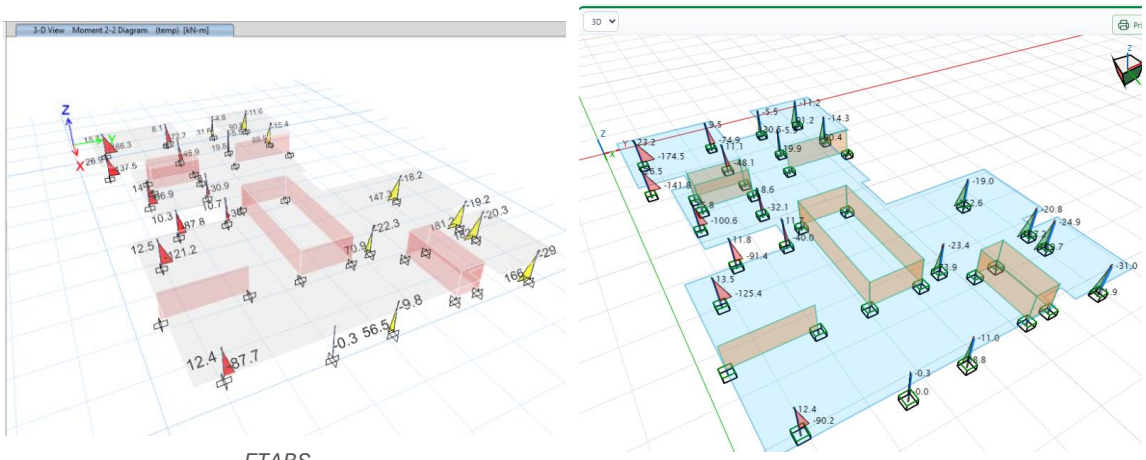
## 4.13. Supporting-member moment M33



*ETABS* *FEAKalc*

*Figure 18. M33 bending-moment display for the supporting members.*

### 4.14. Supporting-member moment M22



*ETABS* *FEAKalc*

*Figure 19. M22 bending-moment display for the supporting members.*

## 5. Conclusion and Use of Results

For the temperature case examined, the 2D frame results from FEAKalc and ETABS are almost identical. For the 3D slab model, shell deformation and shell-result contours are extremely close, with a few localized differences in the supporting columns. The overall comparison is acceptable and supports the use of FEAKalc for these benchmark cases.

This conclusion is limited to the two supplied models and the visible temperature-load results. Before using the report as a quantitative acceptance record, retain matched numerical exports for corresponding nodes and members, confirm units, sign conventions, local axes and contour ranges, and calculate component-by-component differences. Those checks would quantify the small frame differences and the localised column discrepancies.