Structural Calculation Report of Aluminum Frame for Outdoor LCD Digital Signage Display

GuangZhou CNLC Trading Company
Add: Building E Hengbang Science Park N.99 Tianyuan Rd. Yonghe Economic Development Zone, Huangpu District, GZ, China

Chapter 1: Load Calculations

1.1 Wind Load Calculation

Based on GB 50009-2012 Code for Load of Building StructuresLocation:

Location:	city := "Guangzhou City"
Wind Pressure Return Period:	windperiod := "50 Years"
Basic Wind Pressure:	$w_o := 0.5kPa$
Calculation Height of Building:	$z := 2 \cdot m$
Ground Roughness Category:	roughness := "C"
Height Variation Coefficient of Wind Pressure:	$\mu_z = 0.65$
Gust Coefficient:	$\beta_{gz} = 2.052$
Local Shape Coefficient (Calculated Value):	$\mu_{sl} := 1.6$
Standard Value of Wind Load:	$q'_{wk} := \beta_{gz} \cdot \mu_{sl} \cdot \mu_z \cdot w_o = 1.07 \cdot kPa$
Standard Value of Wind Load:	$q_{wk} := (q'_{wk}) = 1.07 \cdot kPa$

1.2 Dead Load Calculation

Average Surface Load of Panel and Comp	$q_{dk} := 0.3kPa$

1.3 Seismic Load Calculation

<Based on GB 50011-2010 Code for Seismic Design of Buildings>

Seismic Intensity (Degree):	seismic_intensity := 7
Basic Seismic Acceleration (g):	acceleration := 0.1·g
Maximum Horizontal Seismic Influence Coefficient:	$\alpha_{max} := 0.08$
Dynamic Amplification Factor:	$\beta_e := 5$
Standard Value of Horizontal Seismic Action:	$q_{ek} := \beta_e \alpha_{max} \cdot q_{dk} = 0.12 \cdot kPa$

1.4 Load Combinations

Load Combination 1 (Strength Verification):	1.3D+1.5W+0.7E
Load Acting Perpendicular to Curtain Wall Surface:	$q_y := 1.5q_{wk} + 0.7q_{ek} = 1.685 \cdot kPa$
Load Acting Parallel to Curtain Wall Surface:	$q_z := 1.3q_{dk} = 0.39 \cdot kPa$
Load Combination 2 (Deflection Verification):	1.0D+1.0W
Load Acting Perpendicular to Curtain Wall Surface:	$q'_y := 1.0q_{wk} = 1.067 \cdot kPa$
Load Acting Parallel to Curtain Wall Surface:	$q'_z := 1.0q_{dk} = 0.3 \cdot kPa$

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Chapter 2: Keel (Frame) Verification

1. Calculation Description

The self-weight of the steel keel is automatically loaded using SAP2000 software.

The structural model is illustrated below:

Keel Designations:

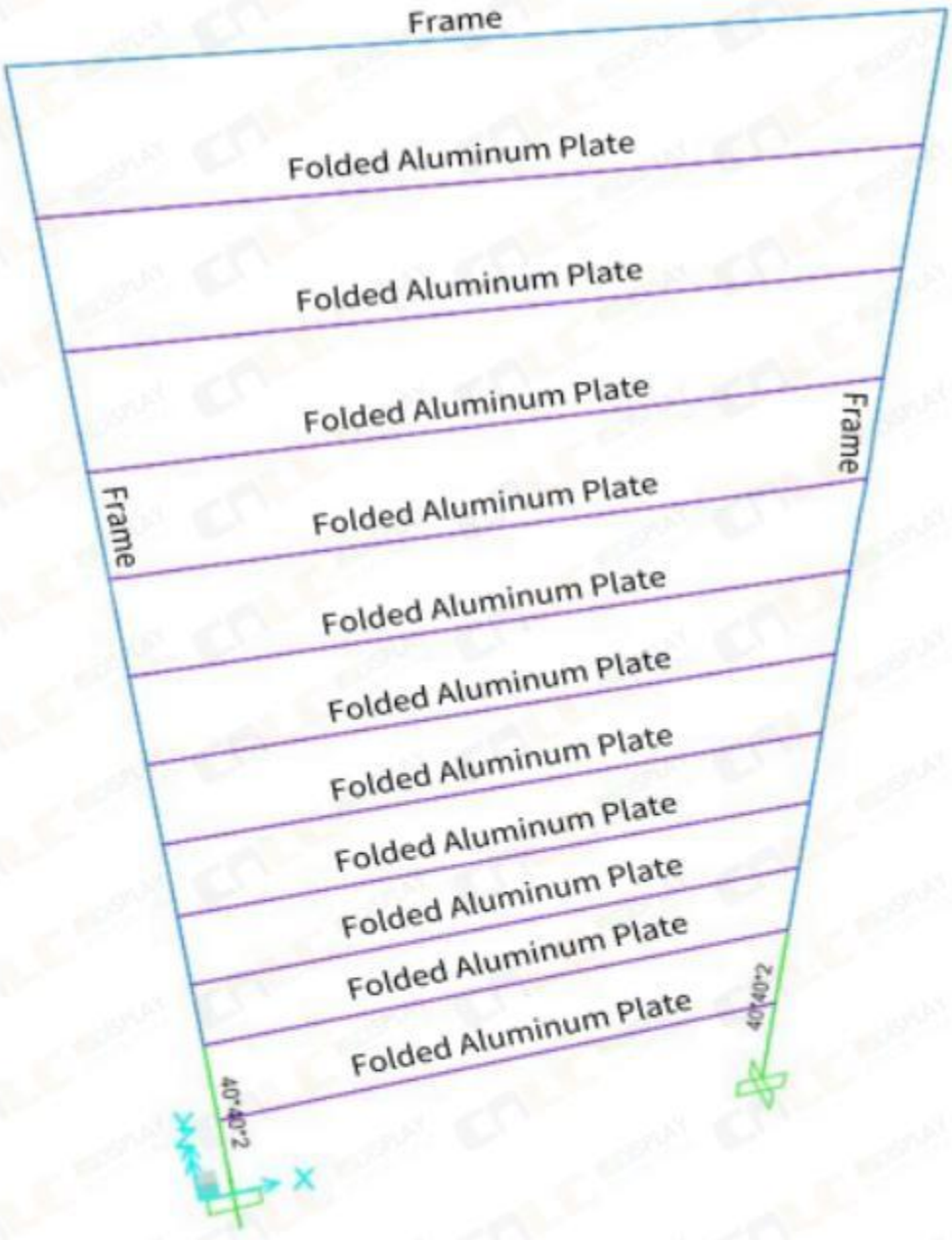
Blue keel sections are custom-shaped aluminum profiles used for framing.

Green keels are 40×40×2 mm square tubes.

Purple keels are cold-formed steel plates.

Material Specifications:

Steel: Q235B Aluminum: 6061-T6



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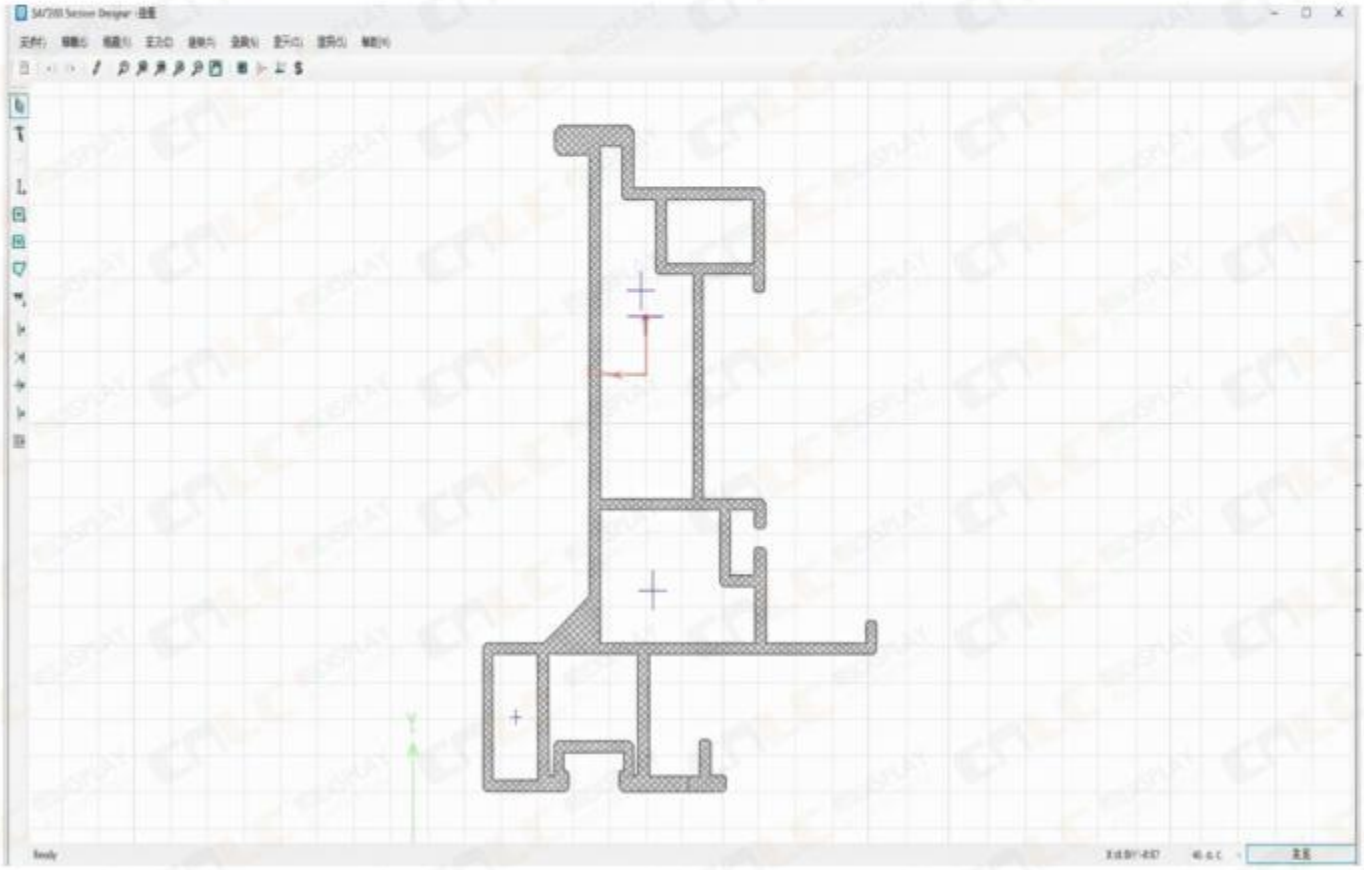

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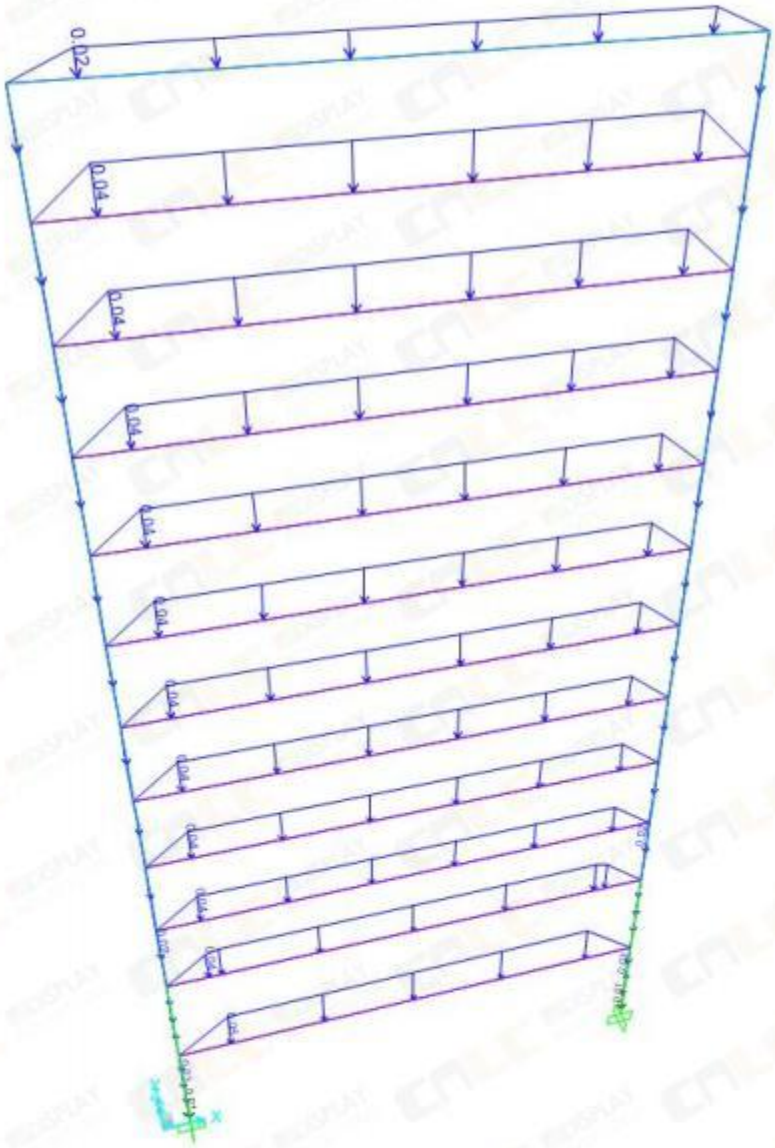
2. Load Definition

Dead Load (D):	Surface load of signage components:q =0.3KPa
Wind Load (W):	Surface load taken as: =1.07kPa
Live Load (L):	Surface load taken as:L=0.5kPa
Seismic Load (EQ):	Designed for Seismic Intensity 7, with a seismic acceleration of 0.10g. The self-weight of the steel tube is automatically applied by the software.

Load Application Model:

Dead Load: (self-weight load applied in model)



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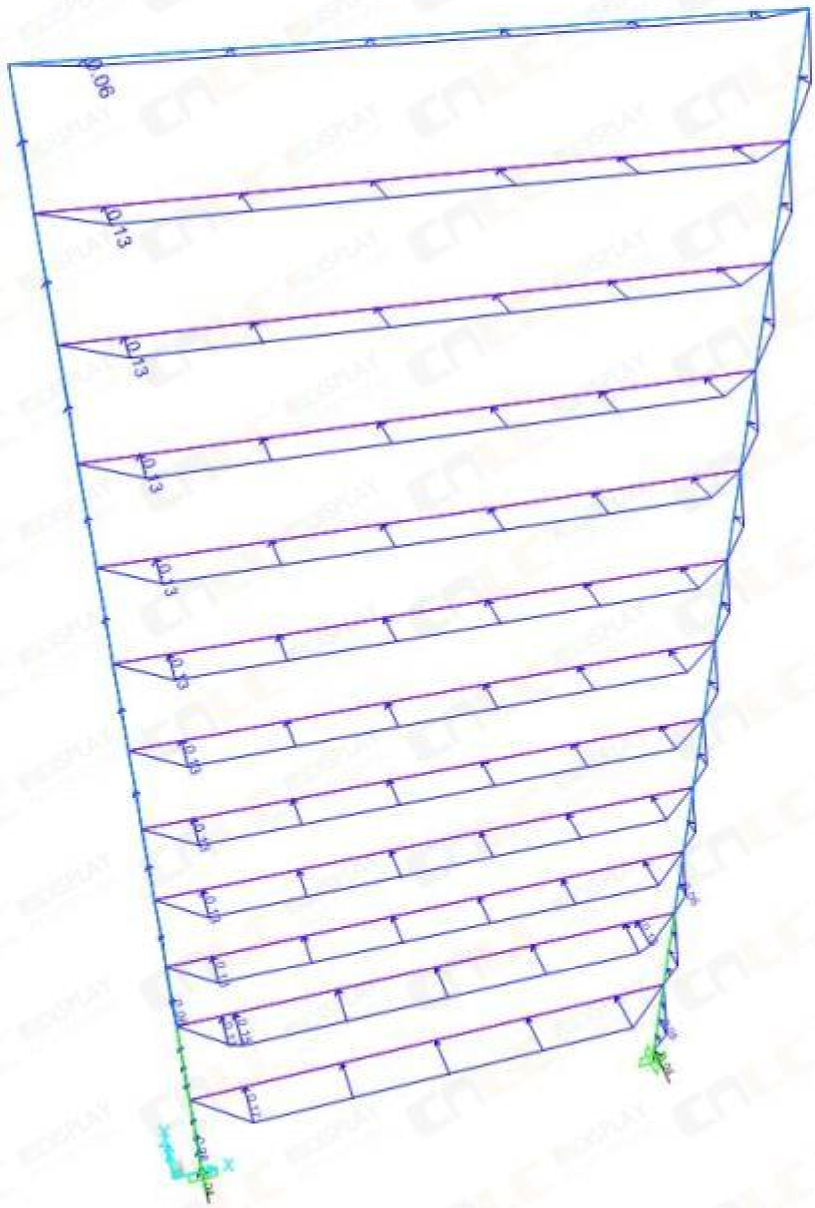
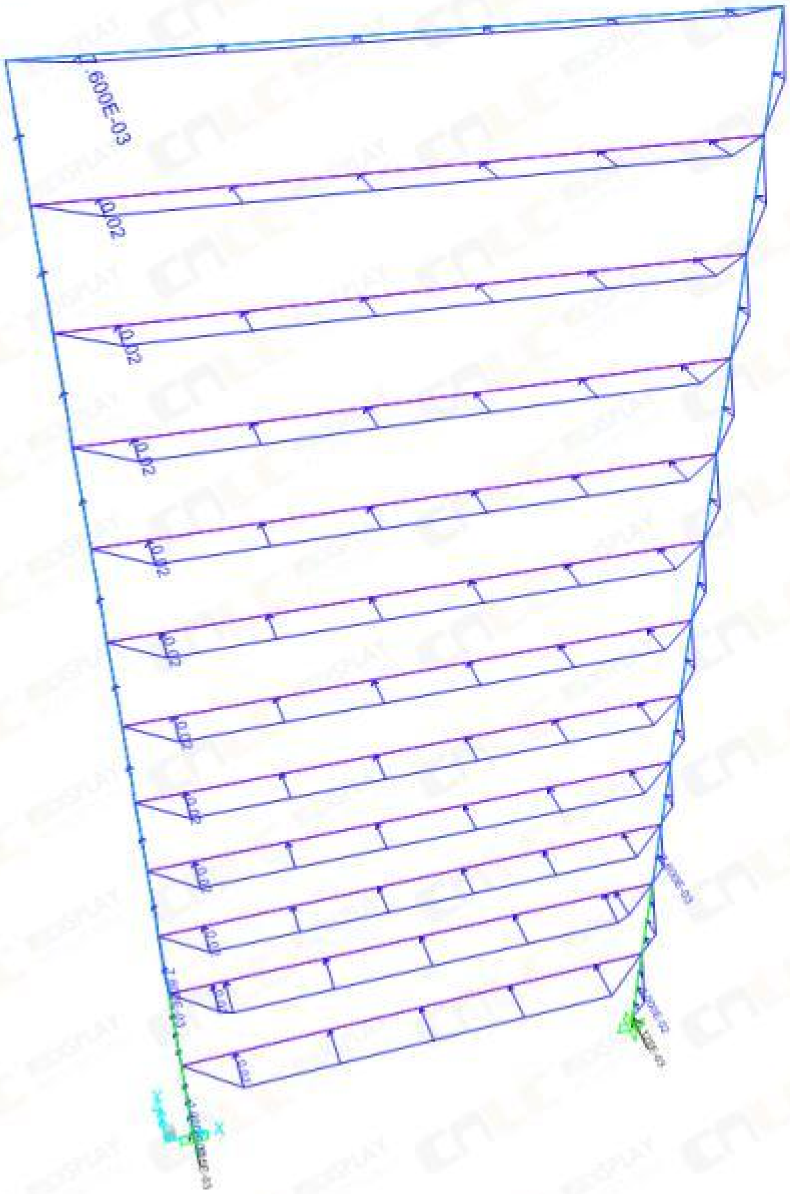
Wind Load





3. Load Combinations

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4. Strength and Deflection Check

Aluminum Frame Verification:

Maximum member stress under strength condition:
77 MPa < 200 MPa (6061-T6) — Strength requirement satisfied.

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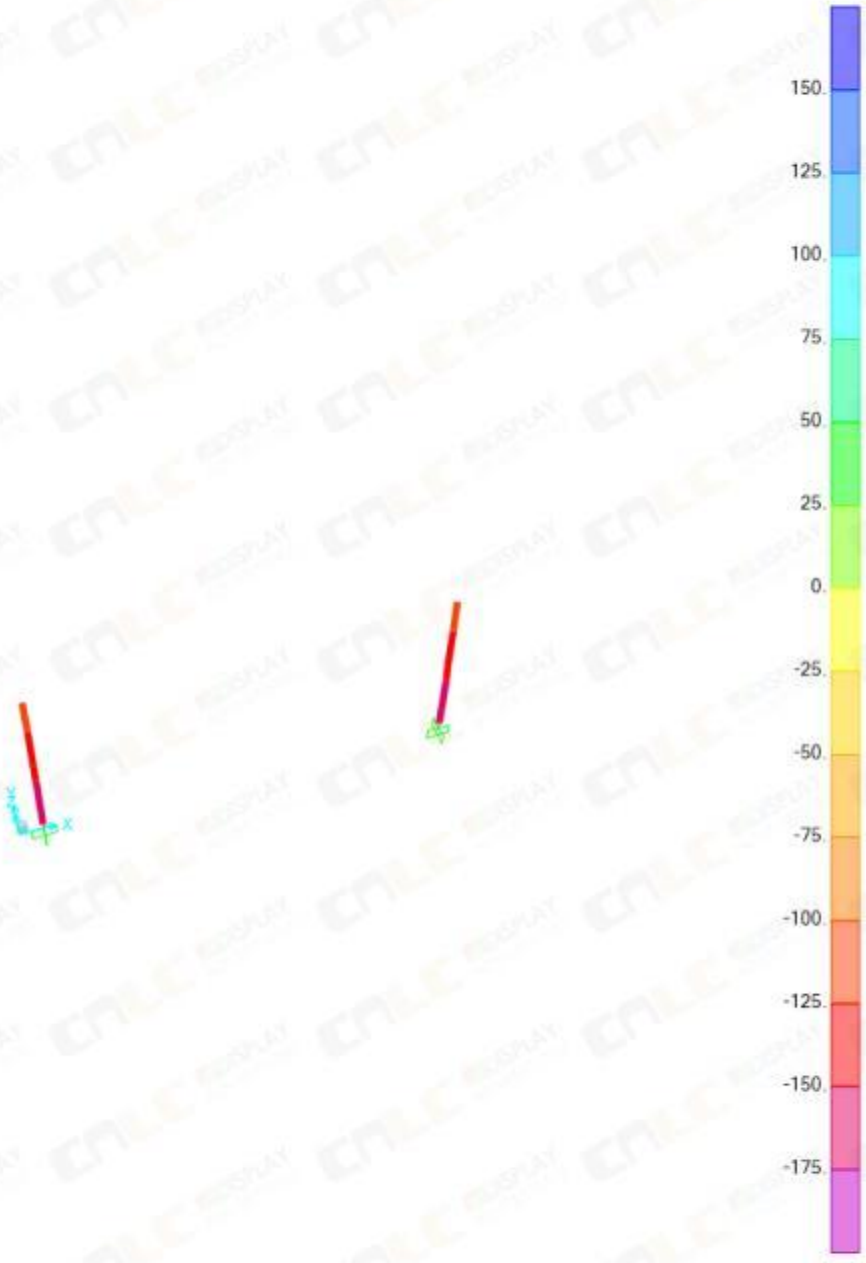
40×40×2 Tube Verification:



Maximum member stress under strength condition:
175 MPa < 215 MPa — Strength requirement satisfied.

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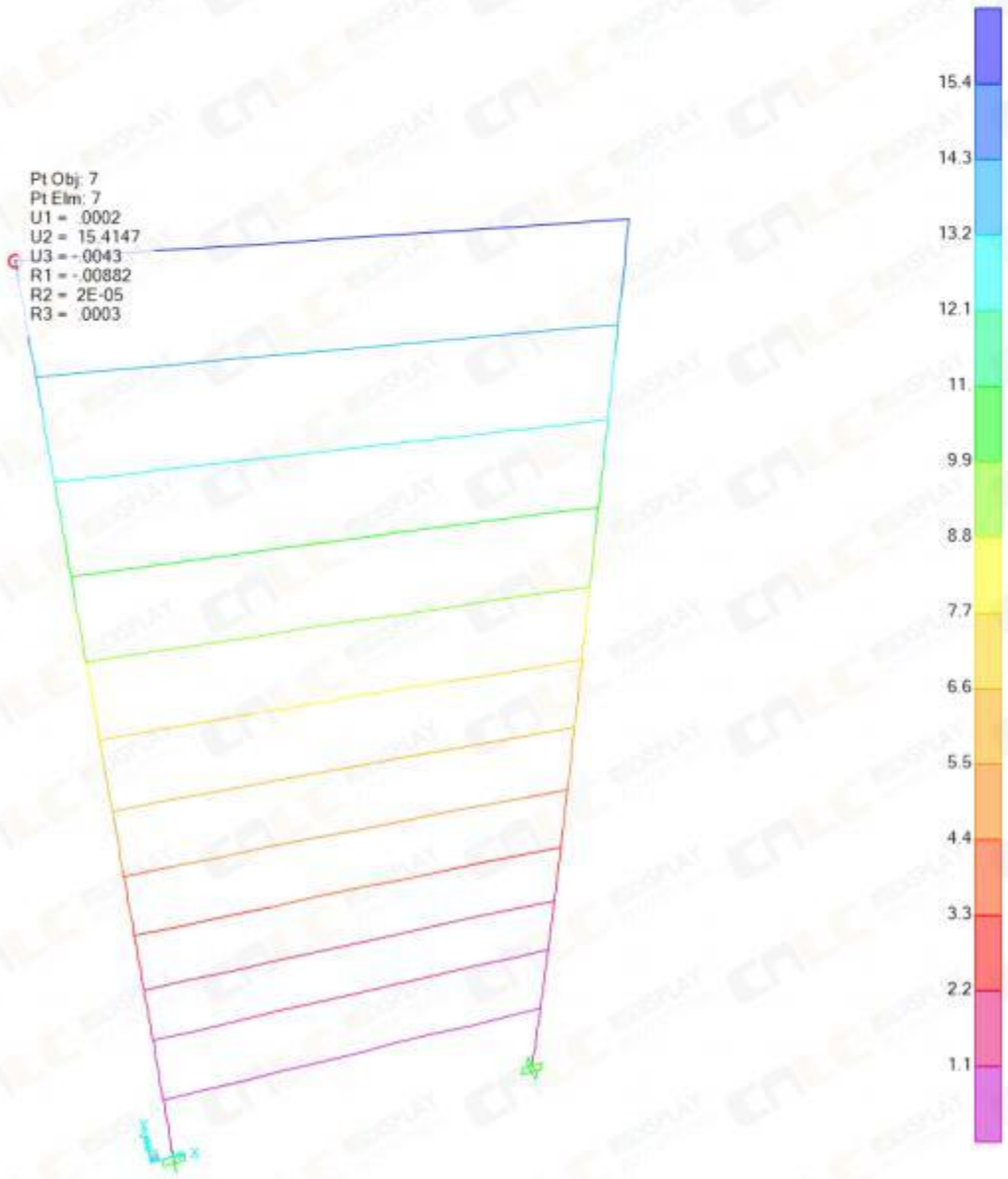

Maximum deflection under deflection condition:
15.4 mm<(2400 / 125) = 19.2 mm — Strength requirement satisfied.

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5. Support Reactions

Conclusion

Based on the above calculations, all signage structure components meet the stress and deflection criteria.The design passes the structural verification.