

Blast Performance Finite Element Analysis Report

20ft Modified Explosion-Proof Cabinet

Report No.: FB-FEA-2025-008

Project: Blast Resistance Verification of 20ft Shelter

Analysis Software: ABAQUS Explicit Dynamics

Date: April 15th, 2026

Status: Official Final Version

1. Executive Summary

This report presents a non-linear explicit dynamic finite element analysis (FEA) for a 20ft modified explosion-proof cabinet. The analysis evaluates structural stress, deformation, and integrity under external blast shock loads (10 PSI and 20 PSI) to verify compliance with international safety standards.

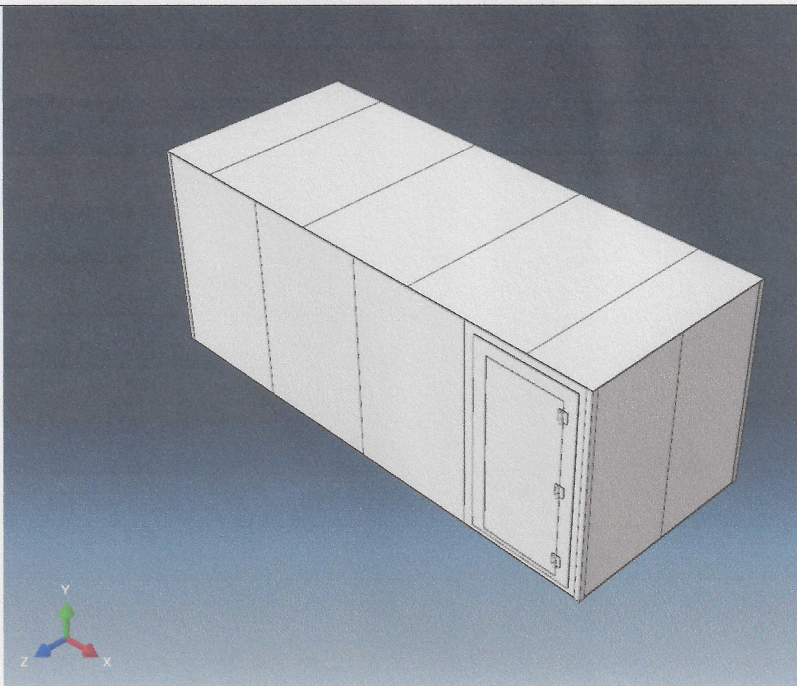
2. Design Code & Reference Standards

- ◆ ASCE: Design of Blast-Resistant Buildings in Petrochemical Facilities

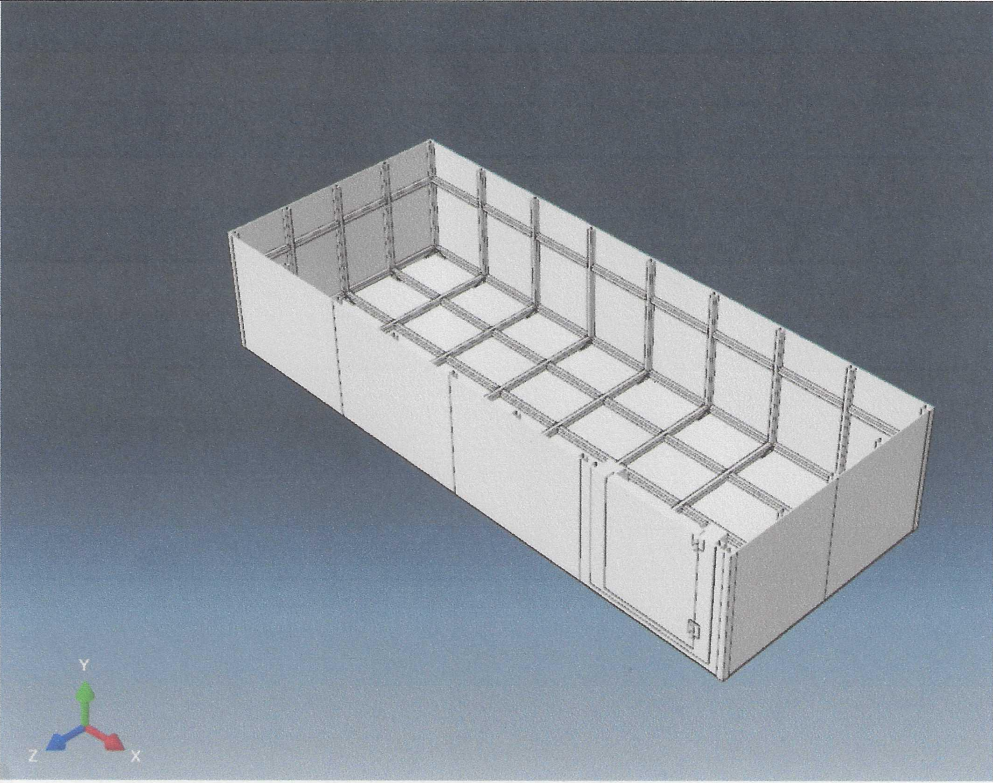
- ◆ API RP 752/753: Management of Hazards Associated with Location of Process Plant Buildings
- ◆ AISC 360: Specification for Structural Steel Buildings
- ◆ ABAQUS: Explicit Dynamics Analysis User Manual

3. Structural Configuration & Materials

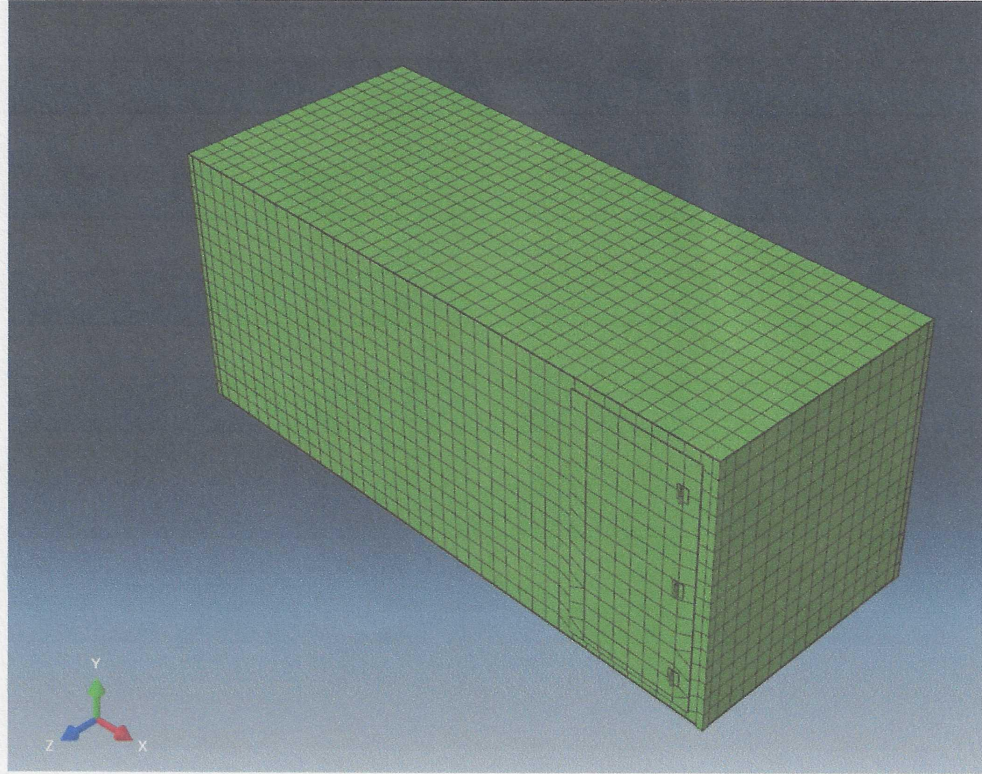
- ◆ Main Shell: 10mm Q345B Manganese Steel Plate
- ◆ Main Frame: 60x60x6mm Square Tube Grid System
- ◆ Reinforcement: 300+ Symmetric 10mm Gusset Plates & Corner Stiffeners
- ◆ Blast Door: Composite structure (10mm Steel + 70mm C30 Concrete + Rebar Grid) with 16x 35mm Solid Locking Bolts



Schematic Diagram Of The Model's Overall Structure 1



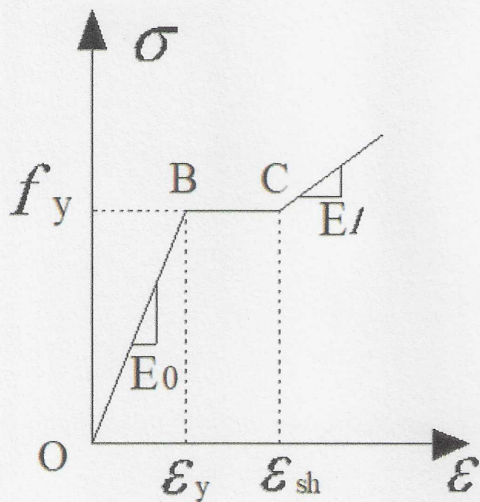
Schematic Diagram Of The Model's Overall Structure 2



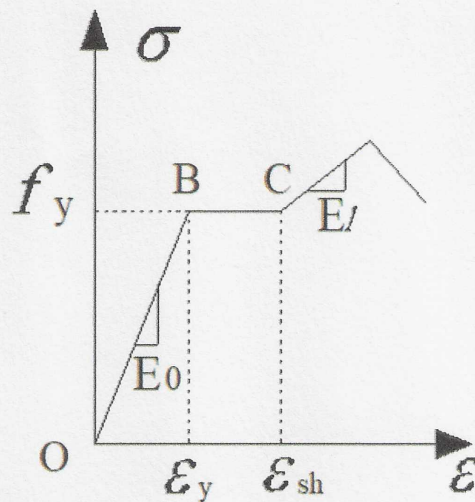
Schematic Diagram Of The Model's Overall Structure 3

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(c) Three-line Model



(d) Four-line Model

Figure: Material Constitutive Model

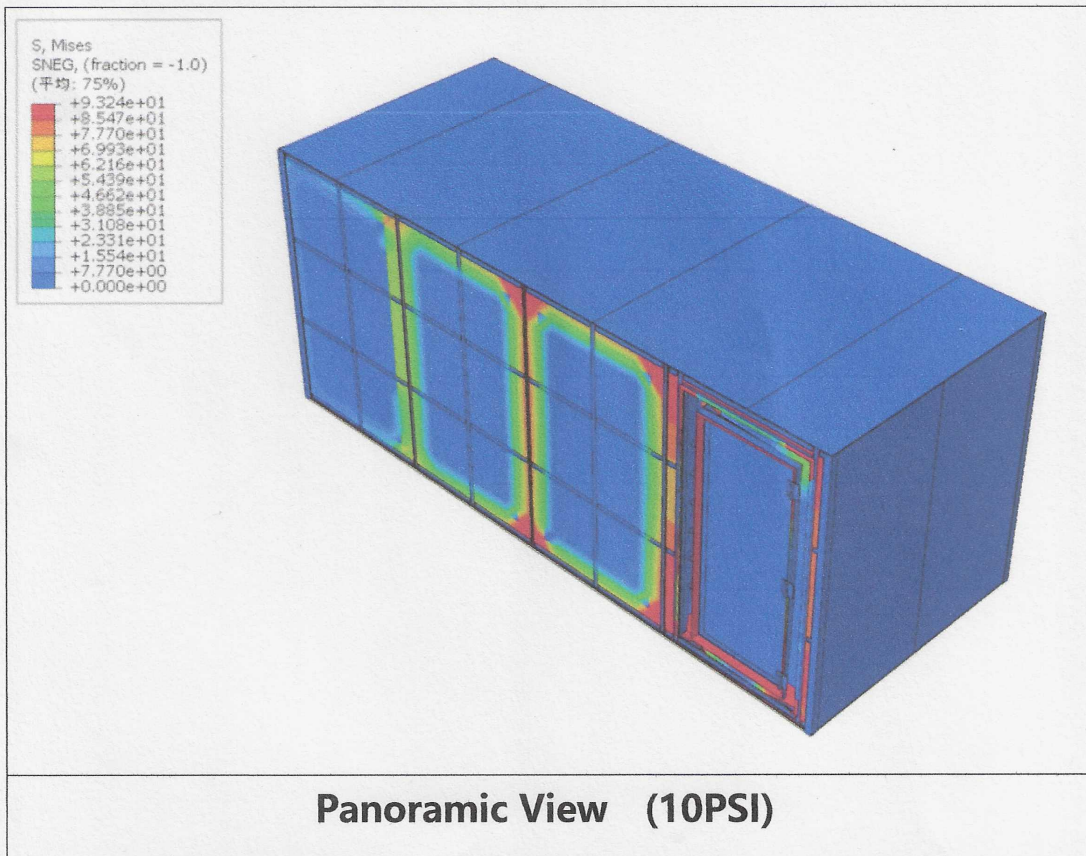
4. Loading Cases & Methodology

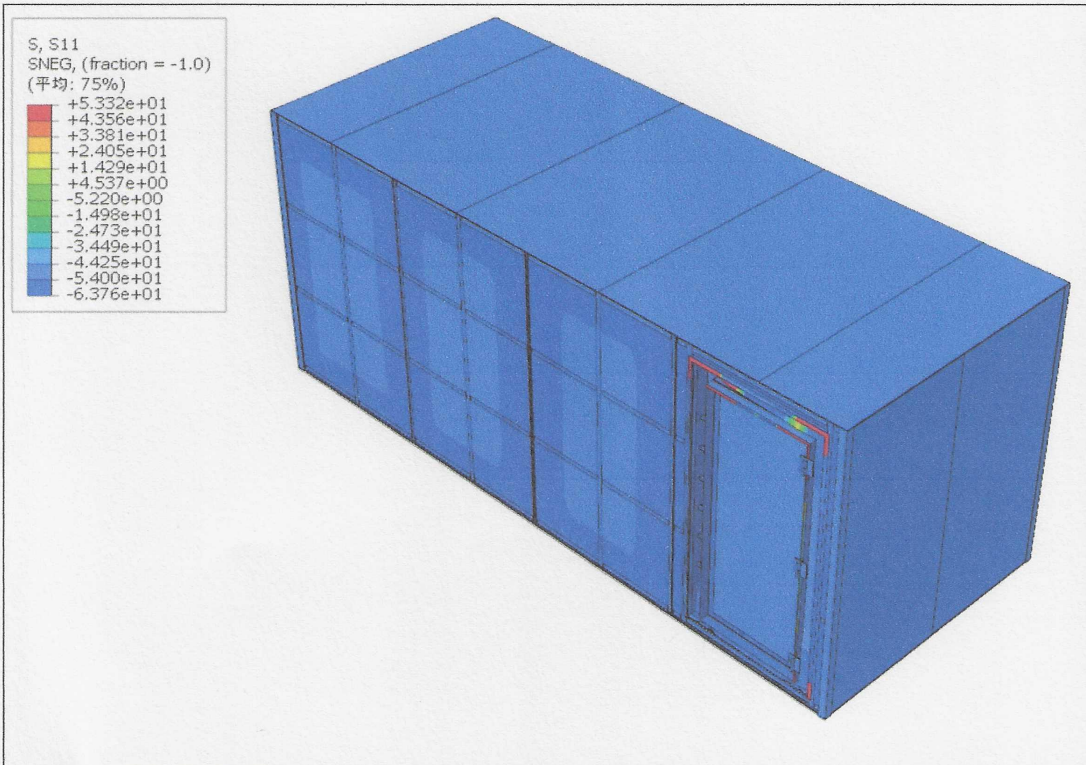
- ◆ Methodology: ABAQUS/Explicit solver using Johnson-Cook (J-C) model for high strain-rate response.
- ◆ Case 1 (Operational): Peak Overpressure 10 PSI (69 kPa), 20ms duration.
- ◆ Case 2 (Survival): Peak Overpressure 20 PSI (138 kPa), 20ms duration.

5. Simulation Results & Safety Evaluation

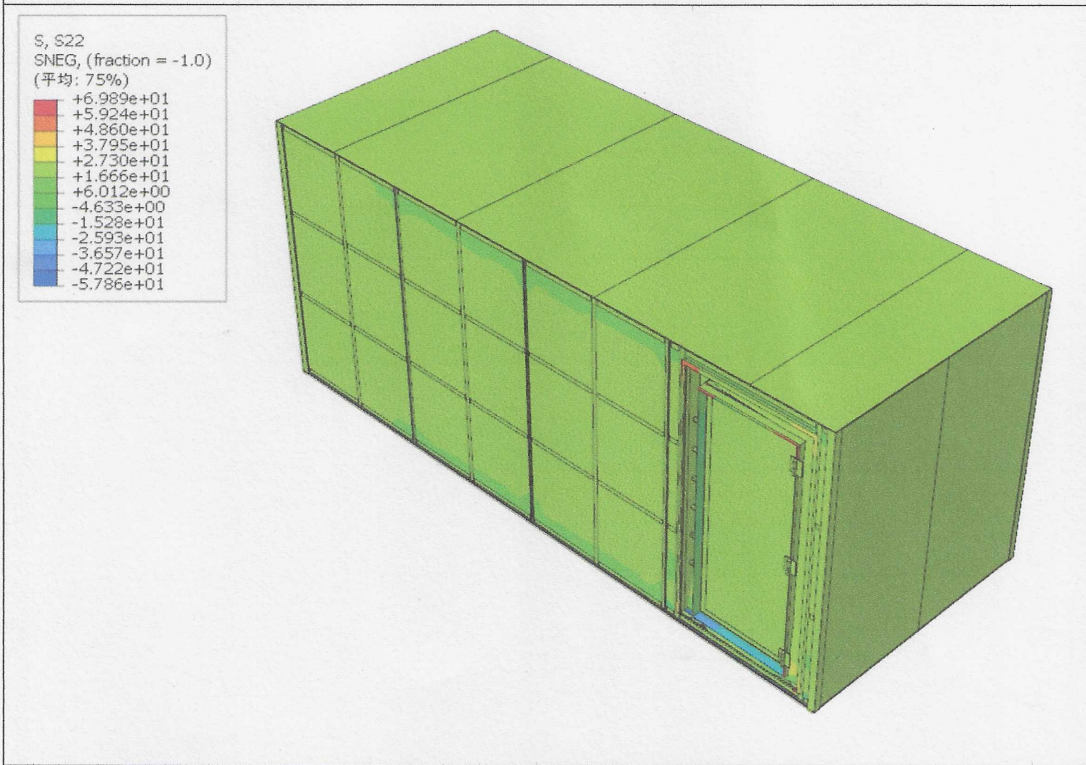
5.1 Case 1: 10 PSI Blast Load

- ◆ Maximum Mises Stress: 93.24 MPa
- ◆ Safety Factor (SF): **SF > 2.0**
- ◆ Assessment: Pass. Structure remains in the Elastic Range. No permanent deformation.





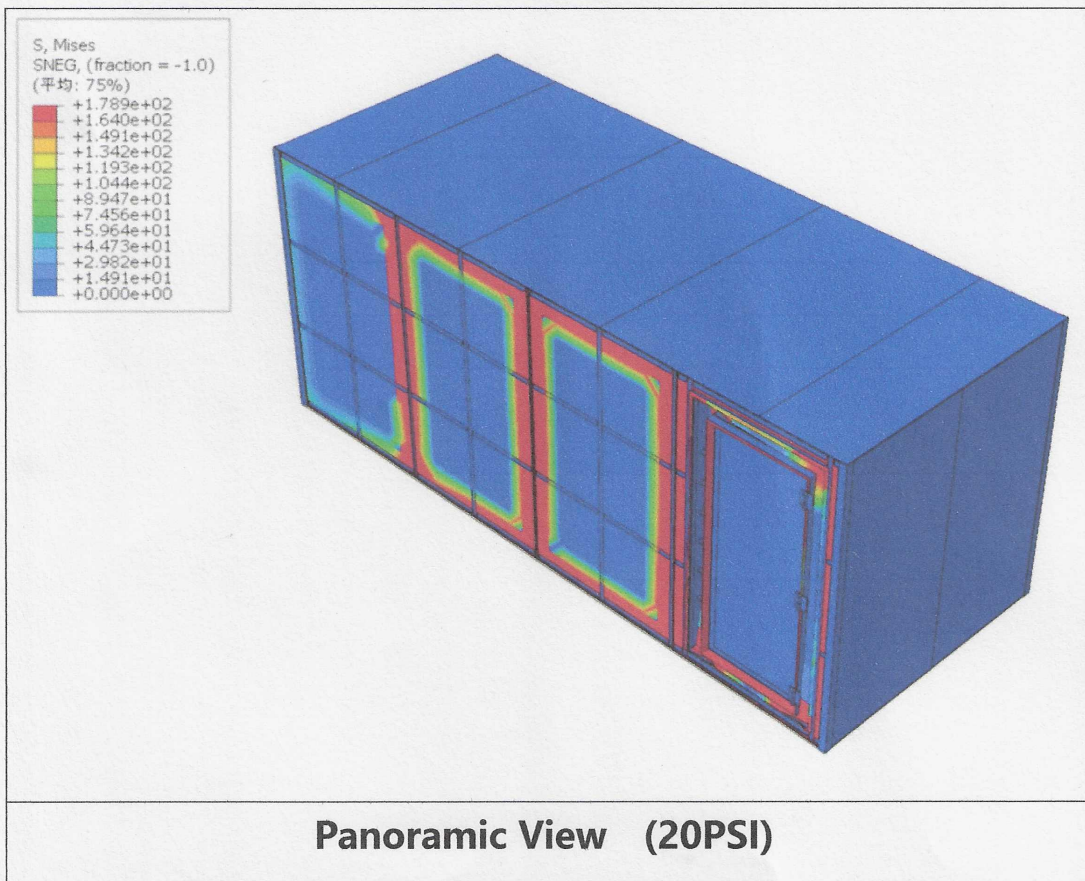
Local Stress Diagram (10PSI)

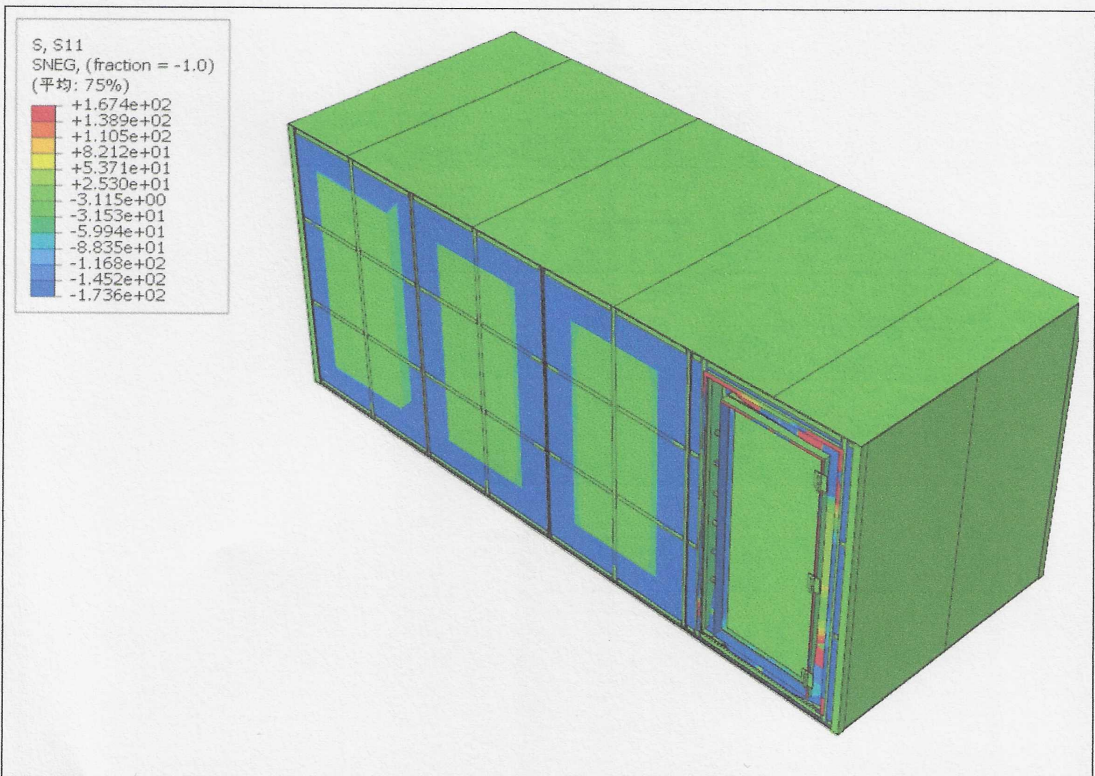


Local Stress Diagram (10PSI)

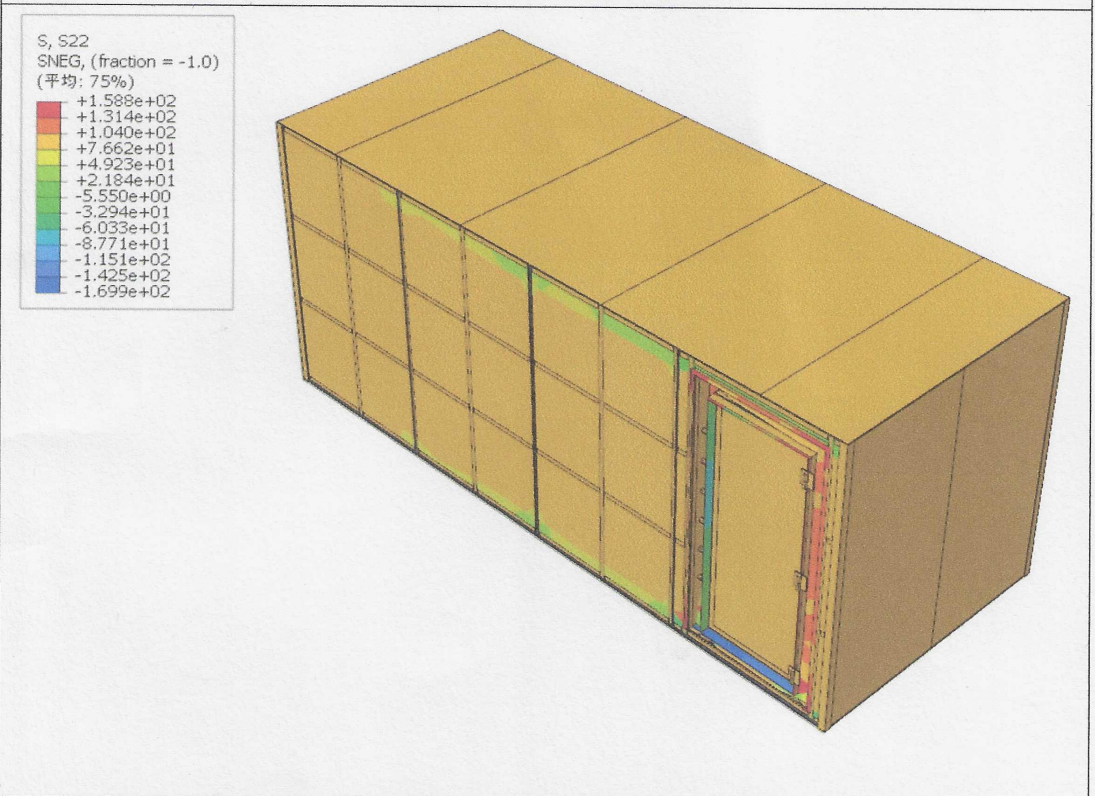
5.2 Case 2: 20 PSI Blast Load

- ◆ Maximum Mises Stress: 178.91 MPa
- ◆ Safety Factor (SF): **SF > 1.3**
- ◆ Assessment: Pass. Meets Life Safety criteria. Primary skeleton and locking system remain fully intact. No breach observed. Despite the extreme impulse, the structure exhibits negligible displacement, ensuring the internal safety zone is perfectly maintained and all egress mechanisms remain fully operational.





Local Stress Diagram (20PSI)



Local Stress Diagram (20PSI)

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6. Conclusion & Verdict

Based on the FEA results, the 20ft cabinet exhibits superior structural resilience. The design is conservative with a high safety margin, meeting the requirements for high-hazard industrial zones (Zone 1 / Zone 2).

Final Verdict: STRUCTURALLY SAFE

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Company Stamp: _____

