Modeling and Simulation of HD 1.3 Thermal Initiation Tests on a Small Reinforced Concrete Storage Structure

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NAVFAC EXWC
CI7 Explosives Effects and Consequences

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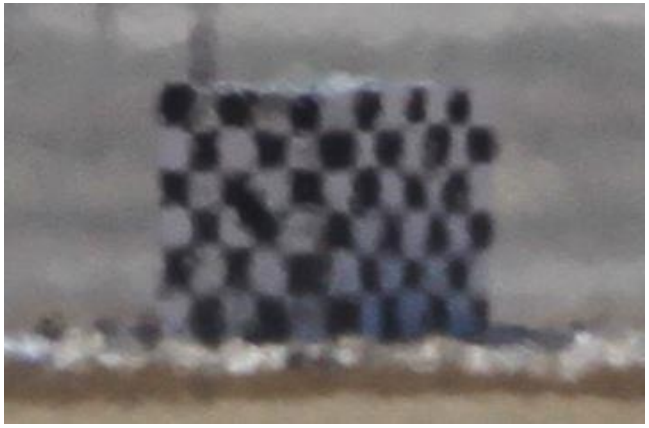
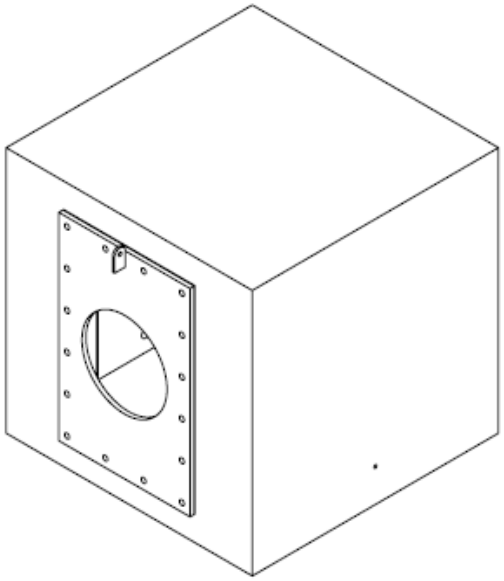
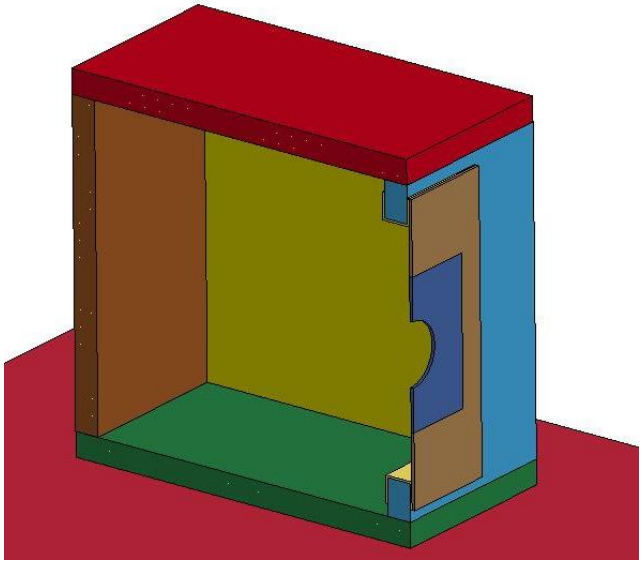
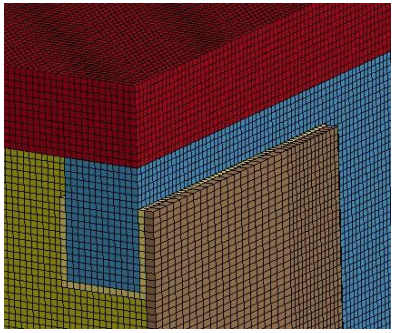
2018 International Explosives Safety Symposium and Exposition
San Diego, California, USA
7-9 August 2018

Kasun Structure (2m x 2m x 2m cube)

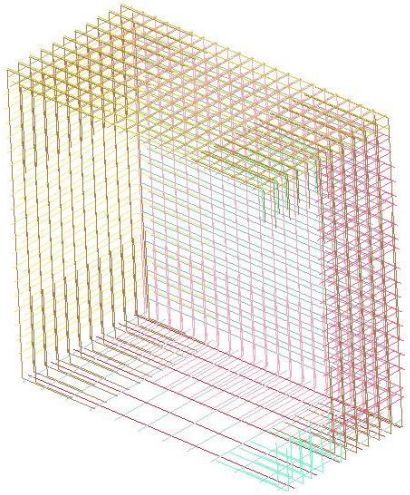




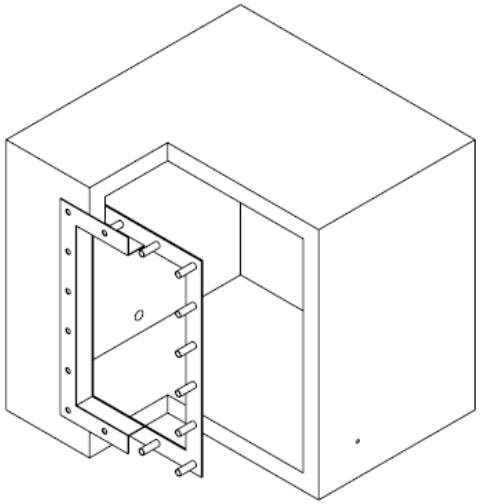


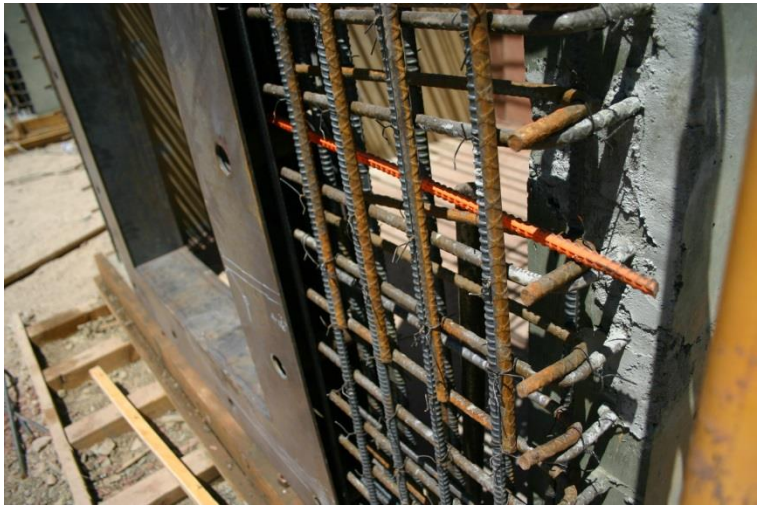


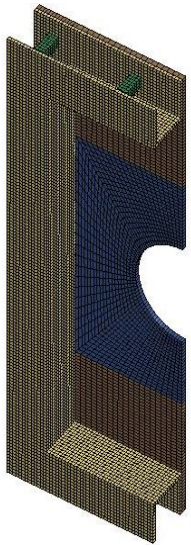
Details of Steel Reinforcement

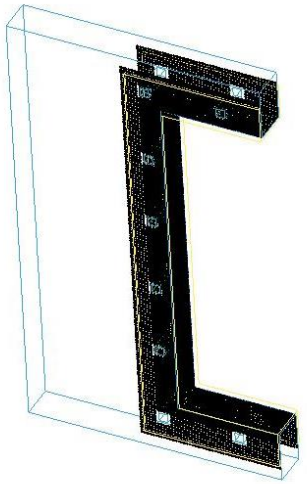


Details of Steel Door

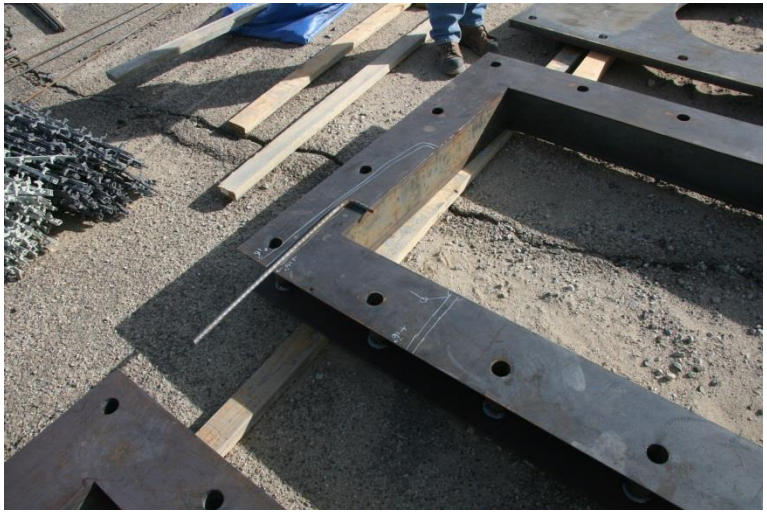


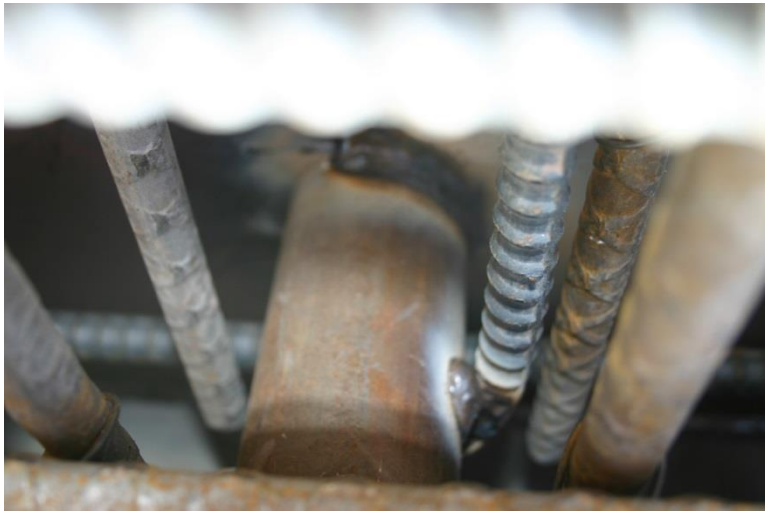


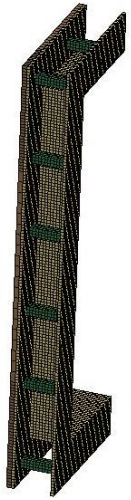




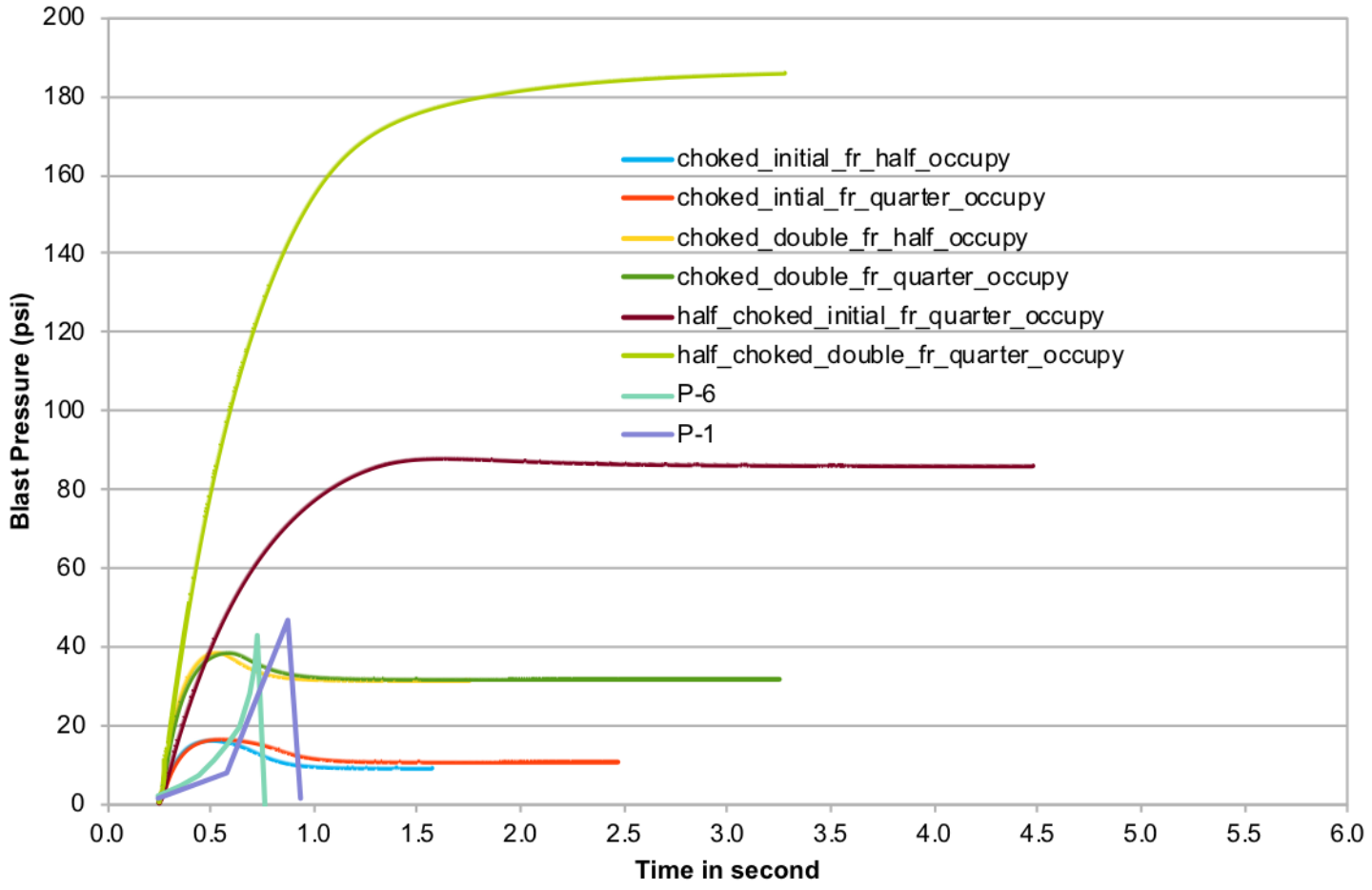
Door Connection



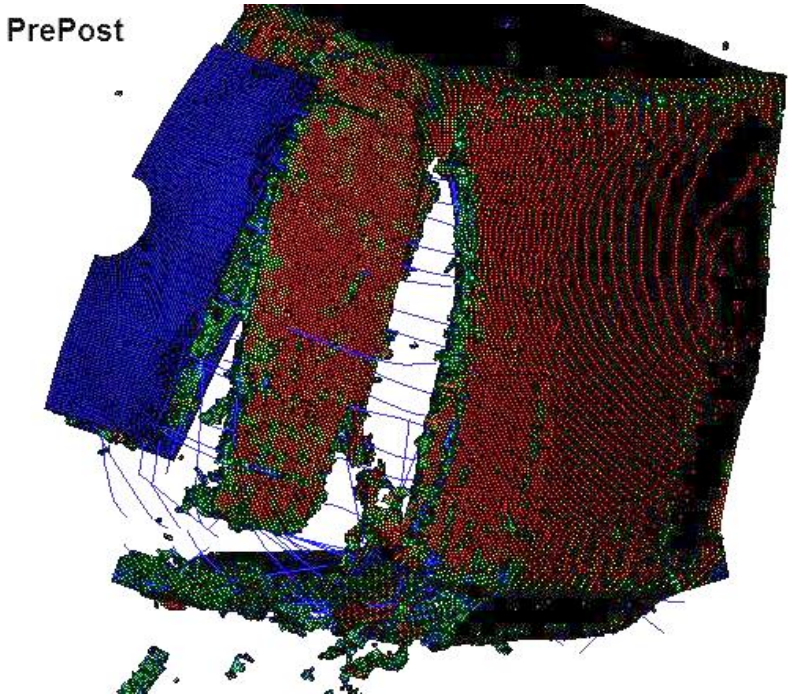




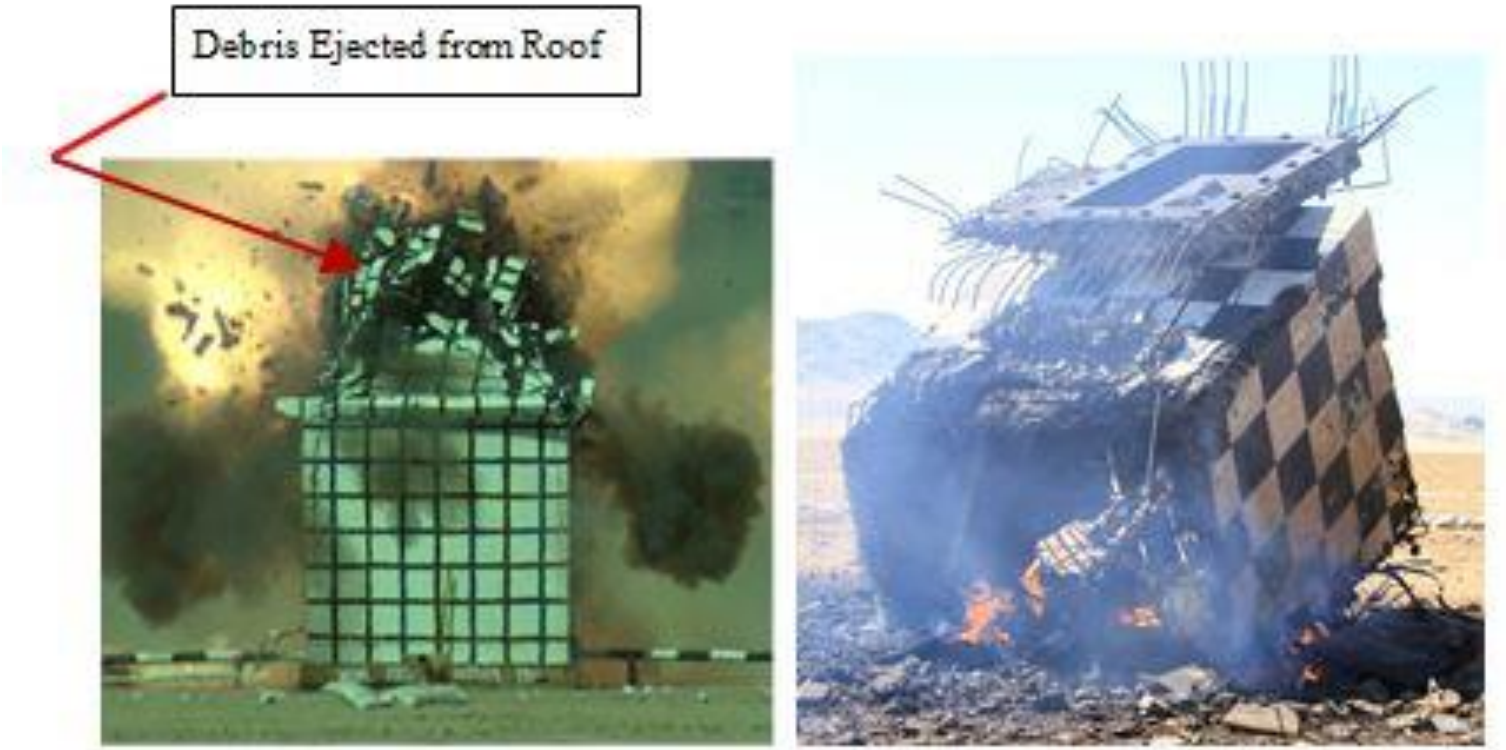
Loading Curves



LS-DYNA Simulations for Test No. 6



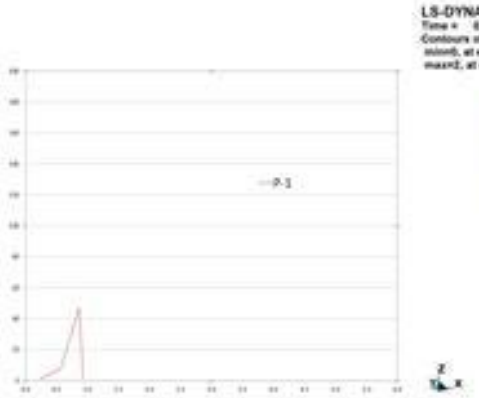
Failure Modes of Tests No. 4 and No. 6



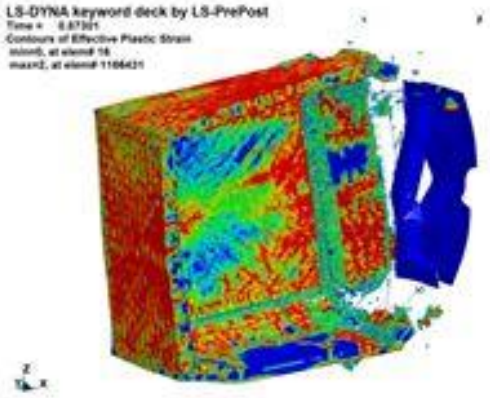
(a) Test 4 (Back View)

(b) Test 6 (Front View)

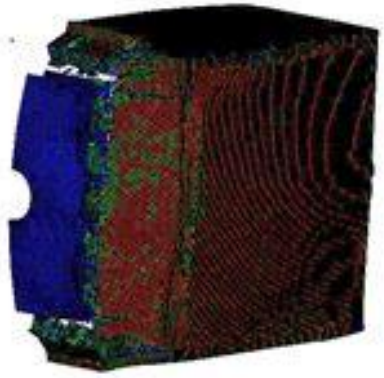
Effects of Door Connection on Failure Modes



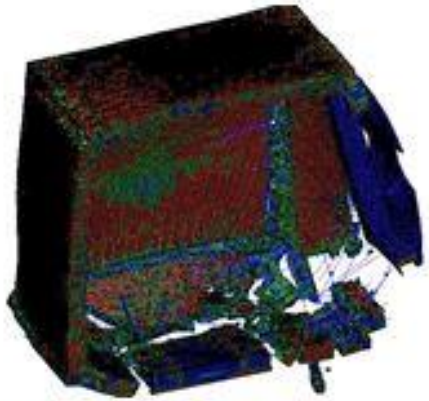
(a) Loading Curve



(b) Not Connected

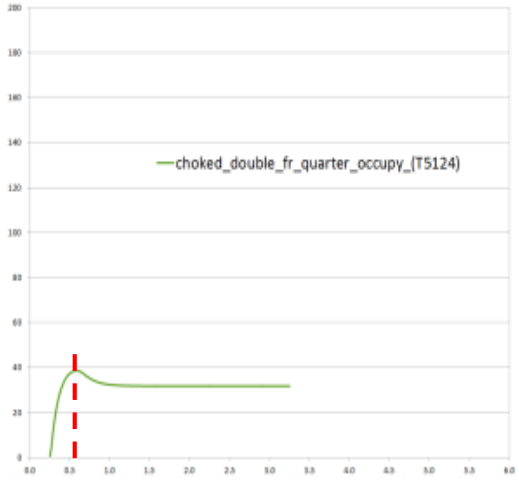


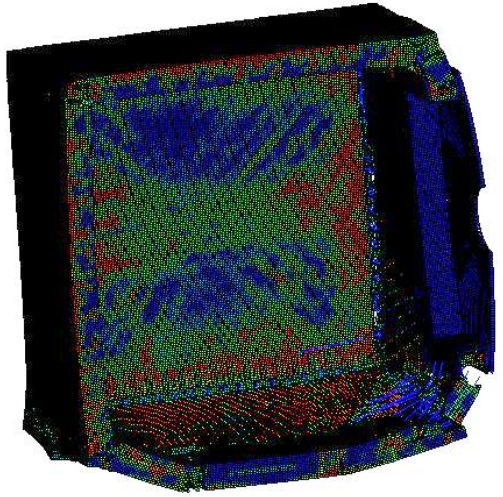
(c) Partially Connected along Side Edges



(d) Fully Connected

T8124 Loading (Chocked, Double Fr)





LS-DYNA keyword deck by LS-PrePost
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Contours of Effective Plastic Strain
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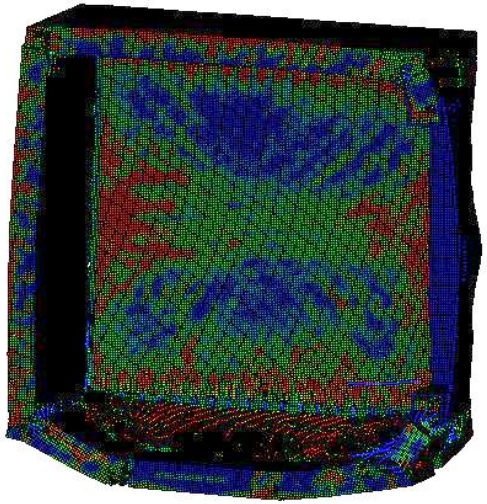
max=1.99995, at elem# 92703



Fringe Levels
2.000e+00
1.800e+00
1.600e+00
1.400e+00
1.200e+00
1.000e+00
8.000e-01
6.000e-01
4.000e-01
2.000e-01
0.000e+00

Z
Y X

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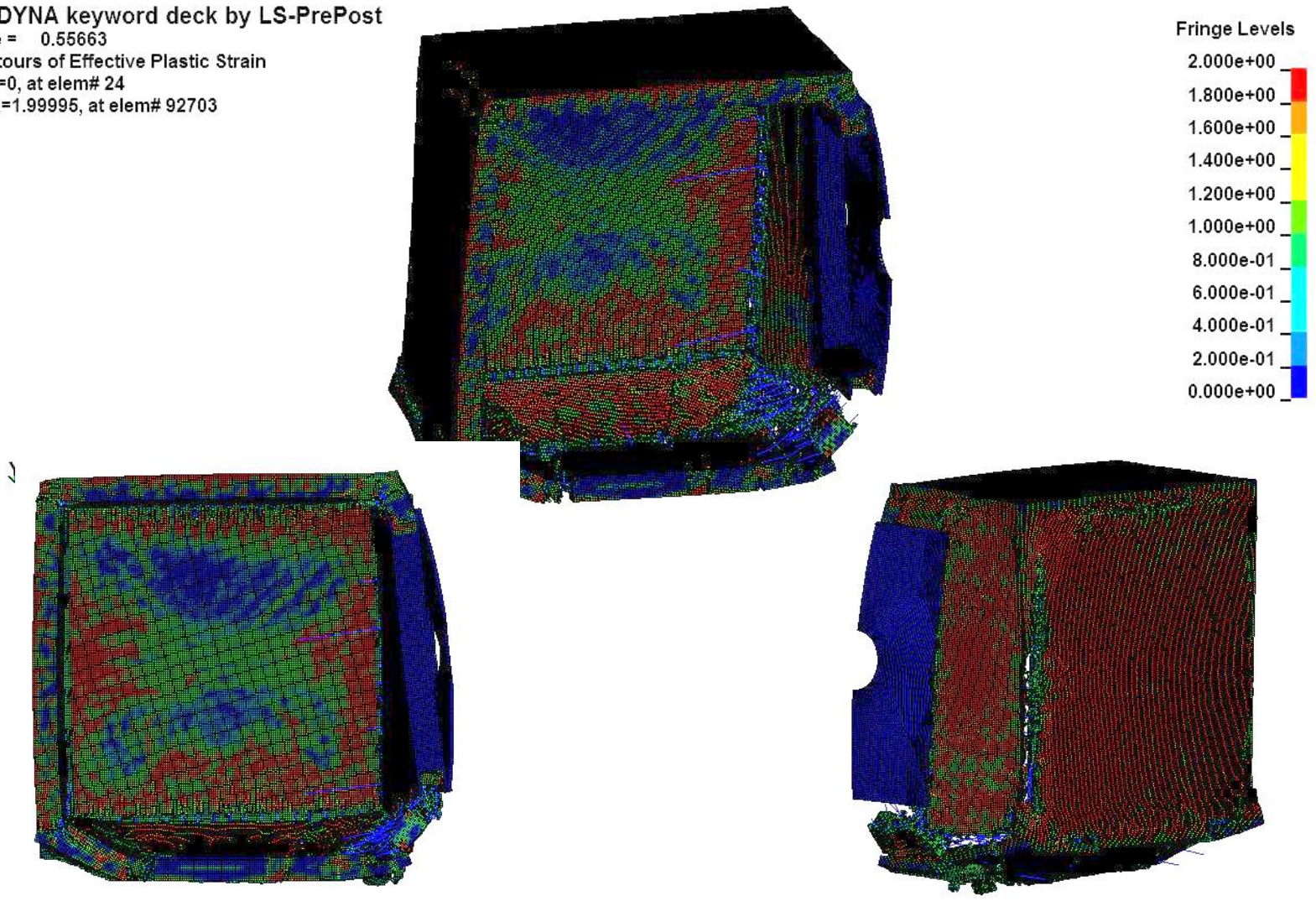

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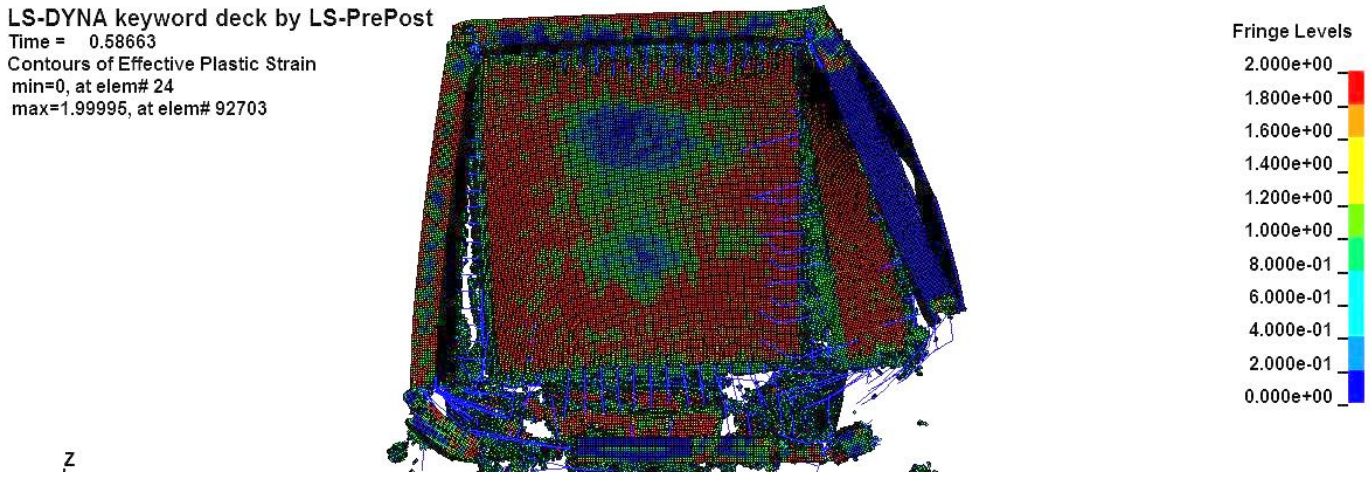

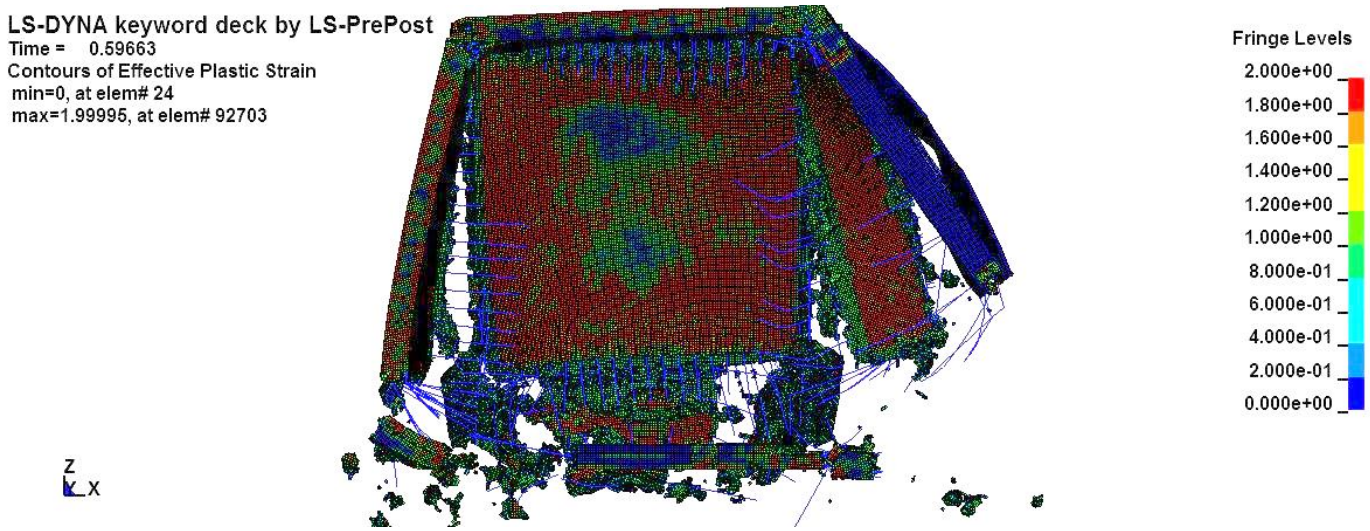

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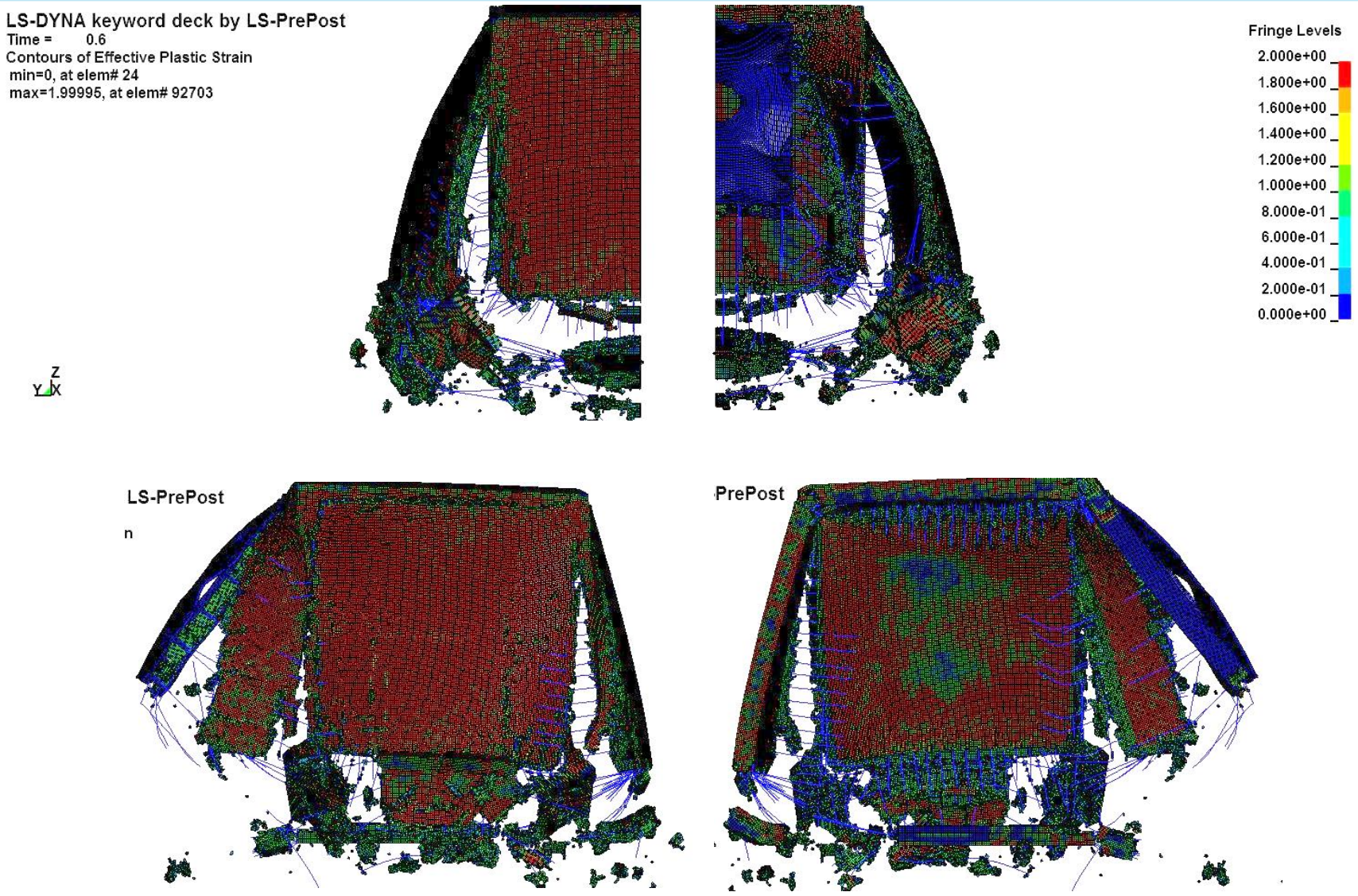
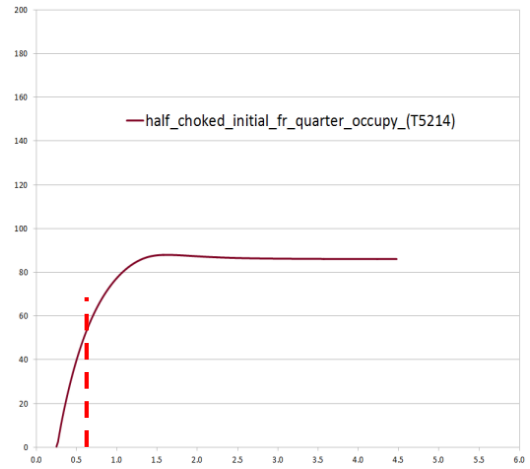
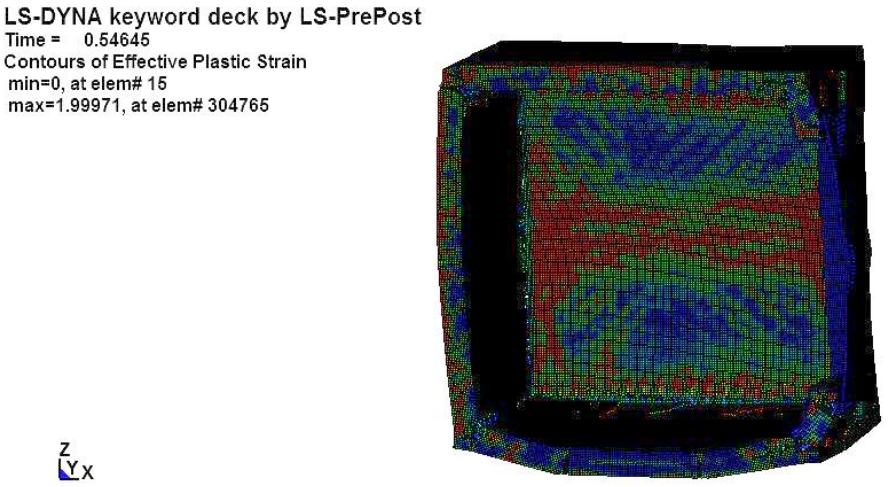
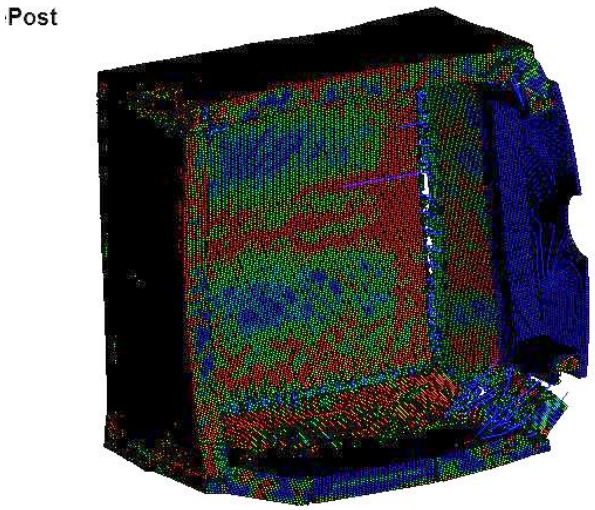
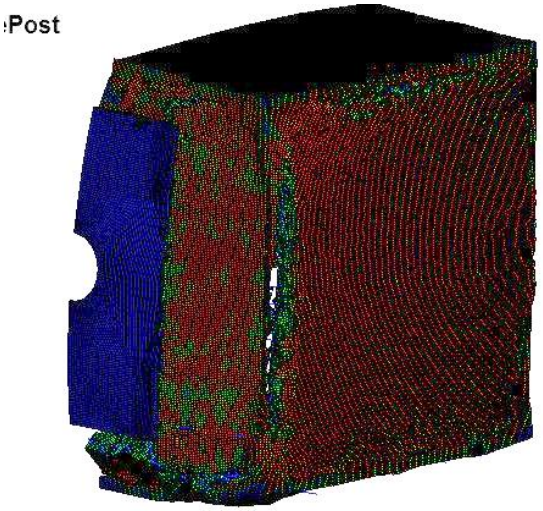


T8214 Loading (Half-Chocked, Initial Fr)









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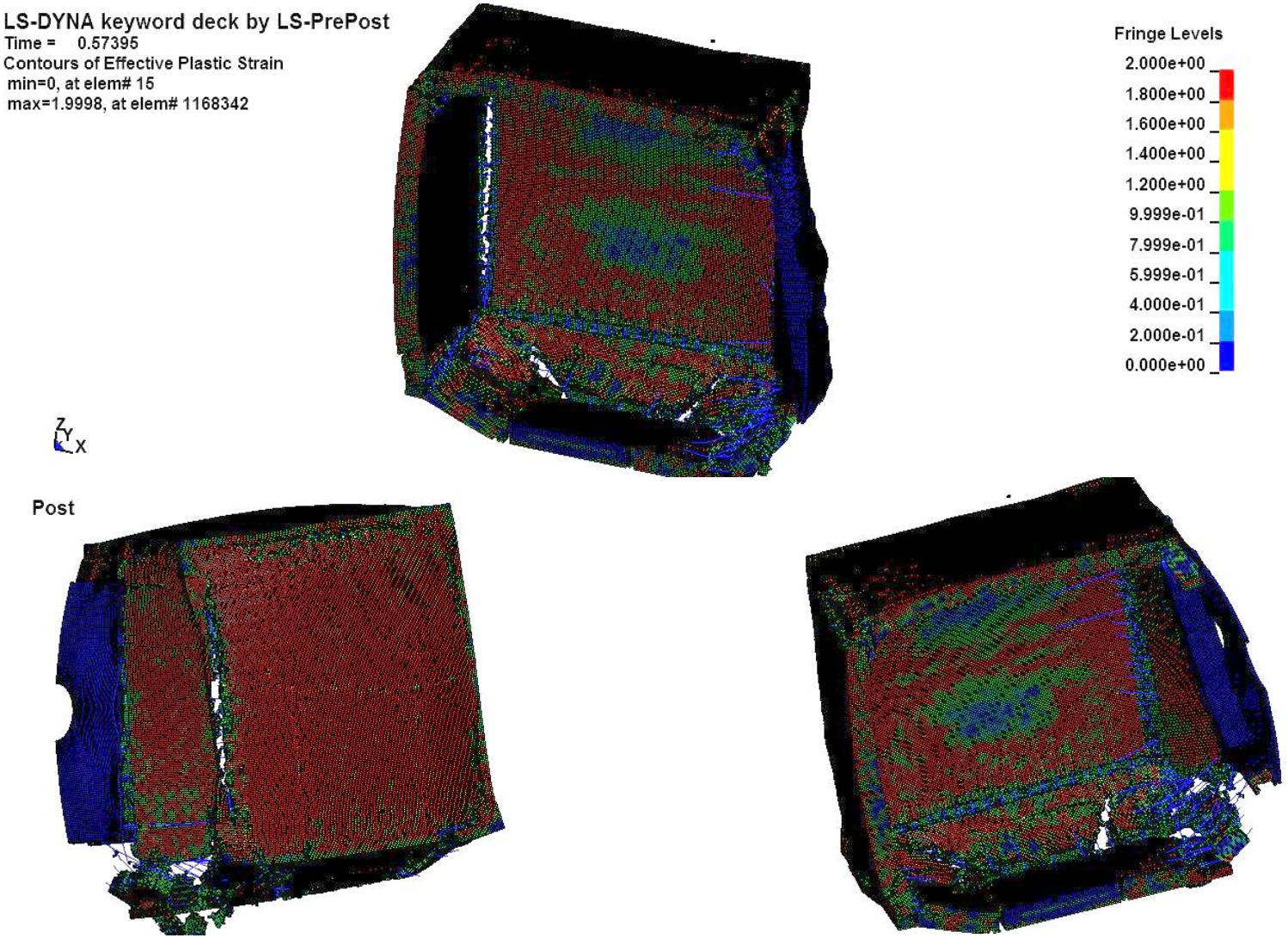

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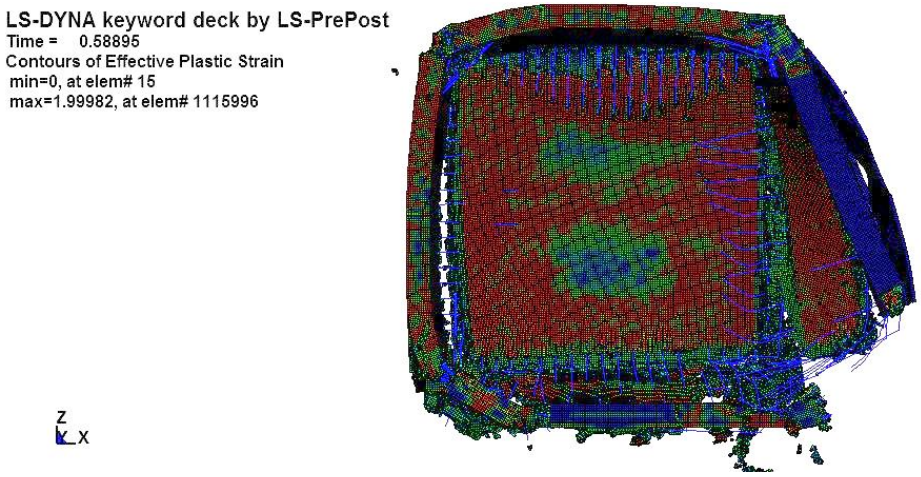

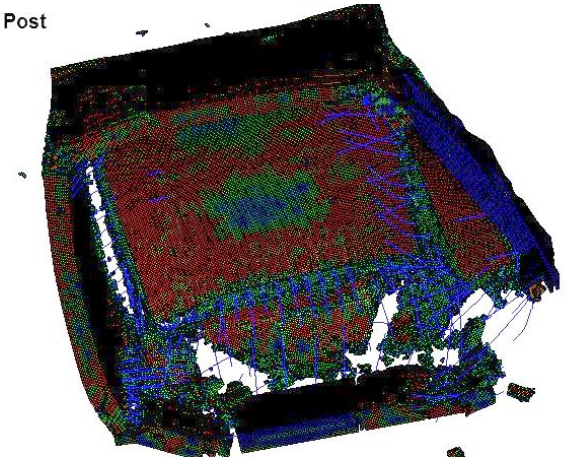

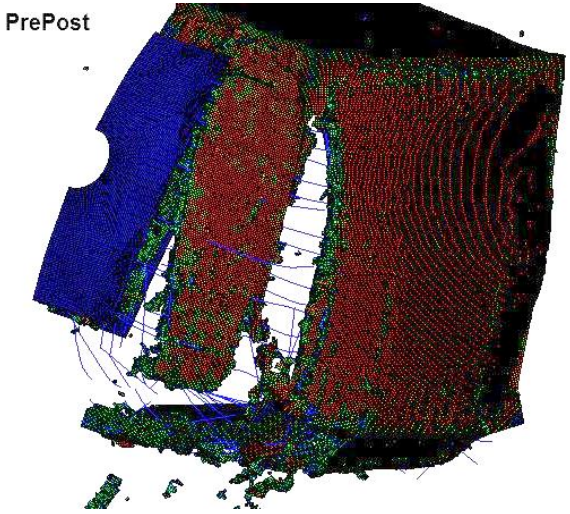

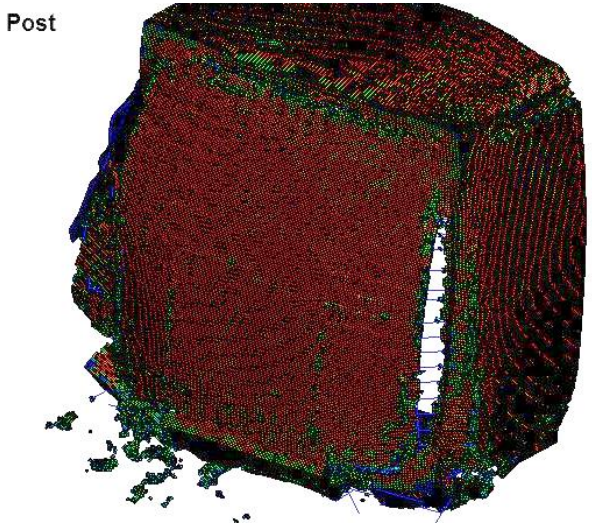

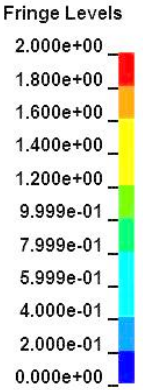

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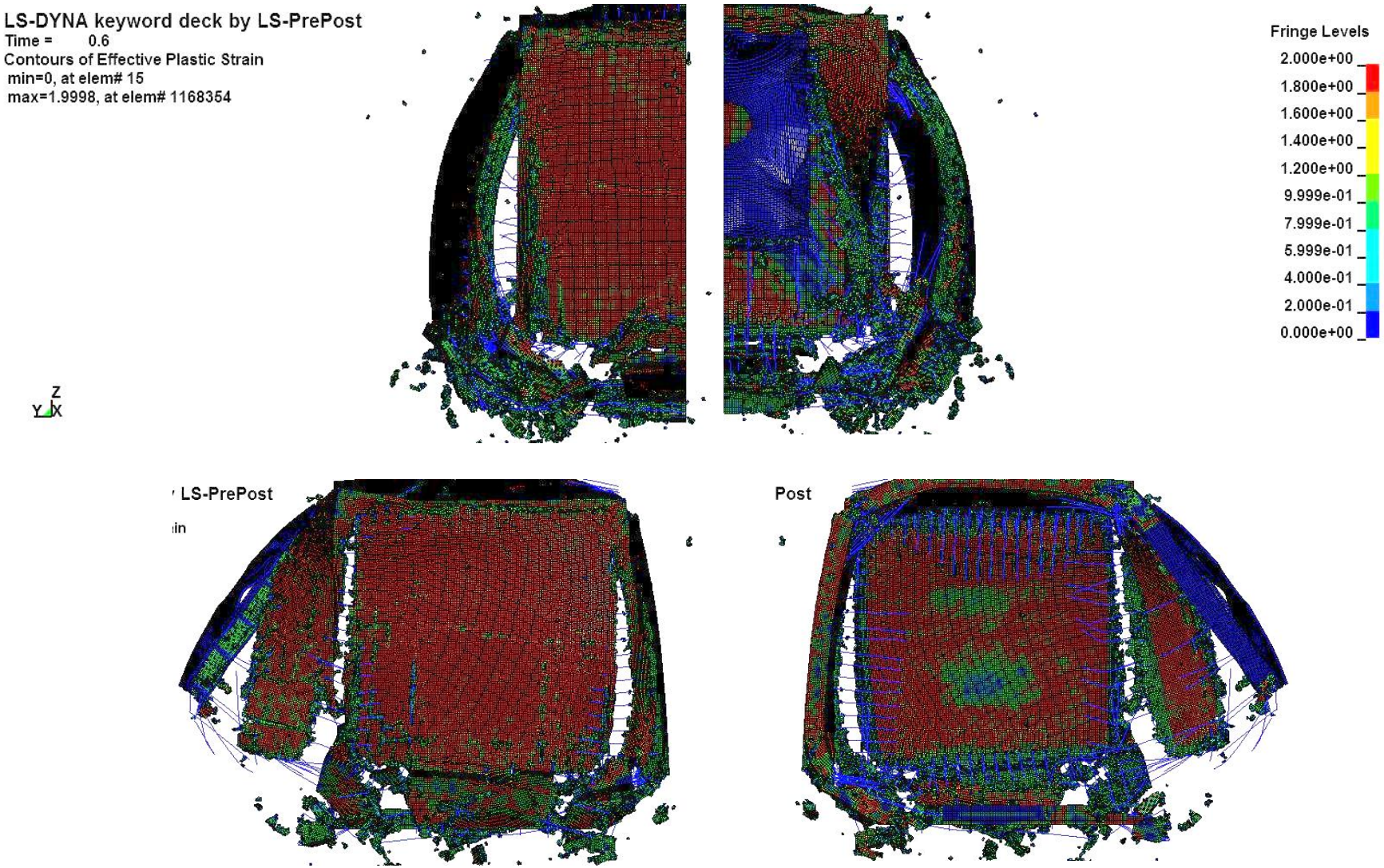

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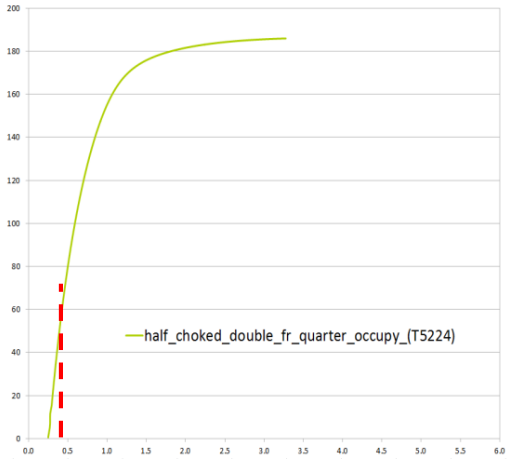

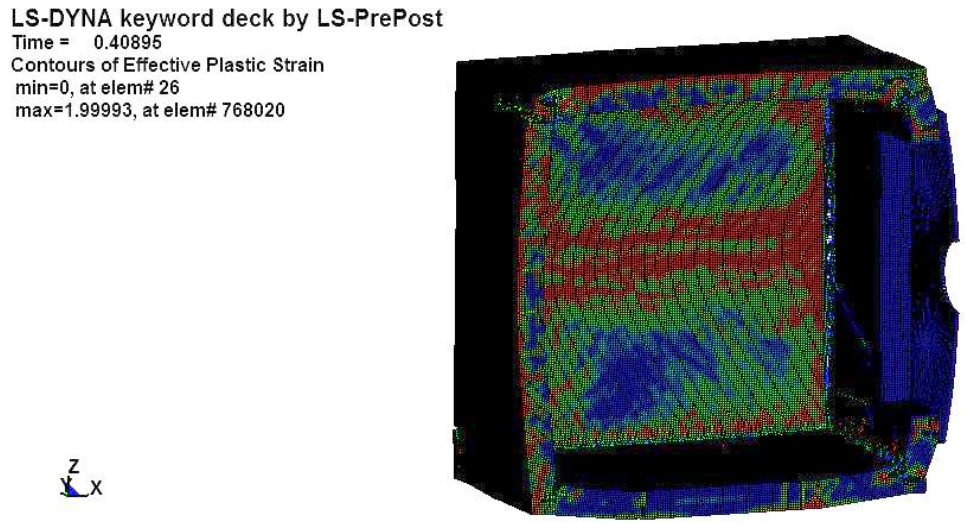

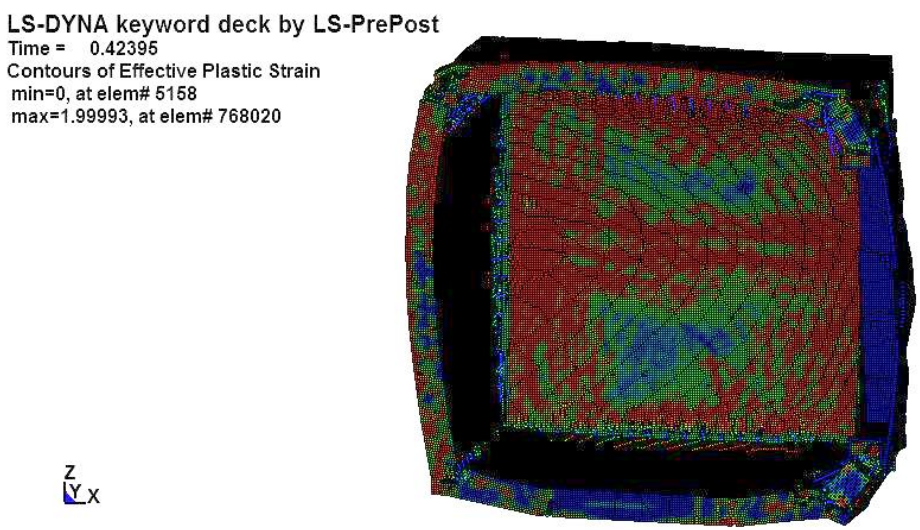

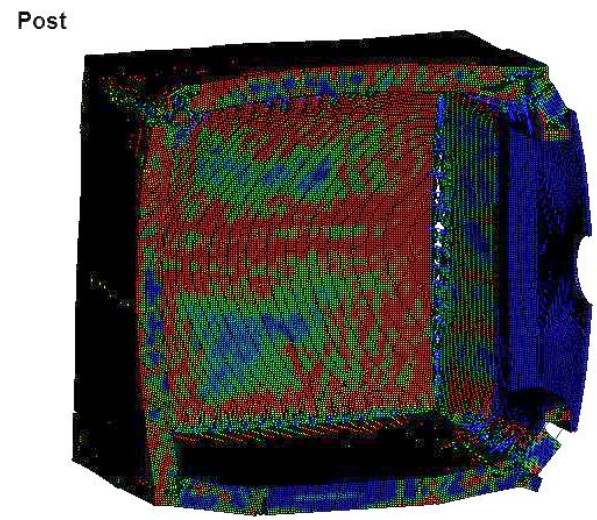

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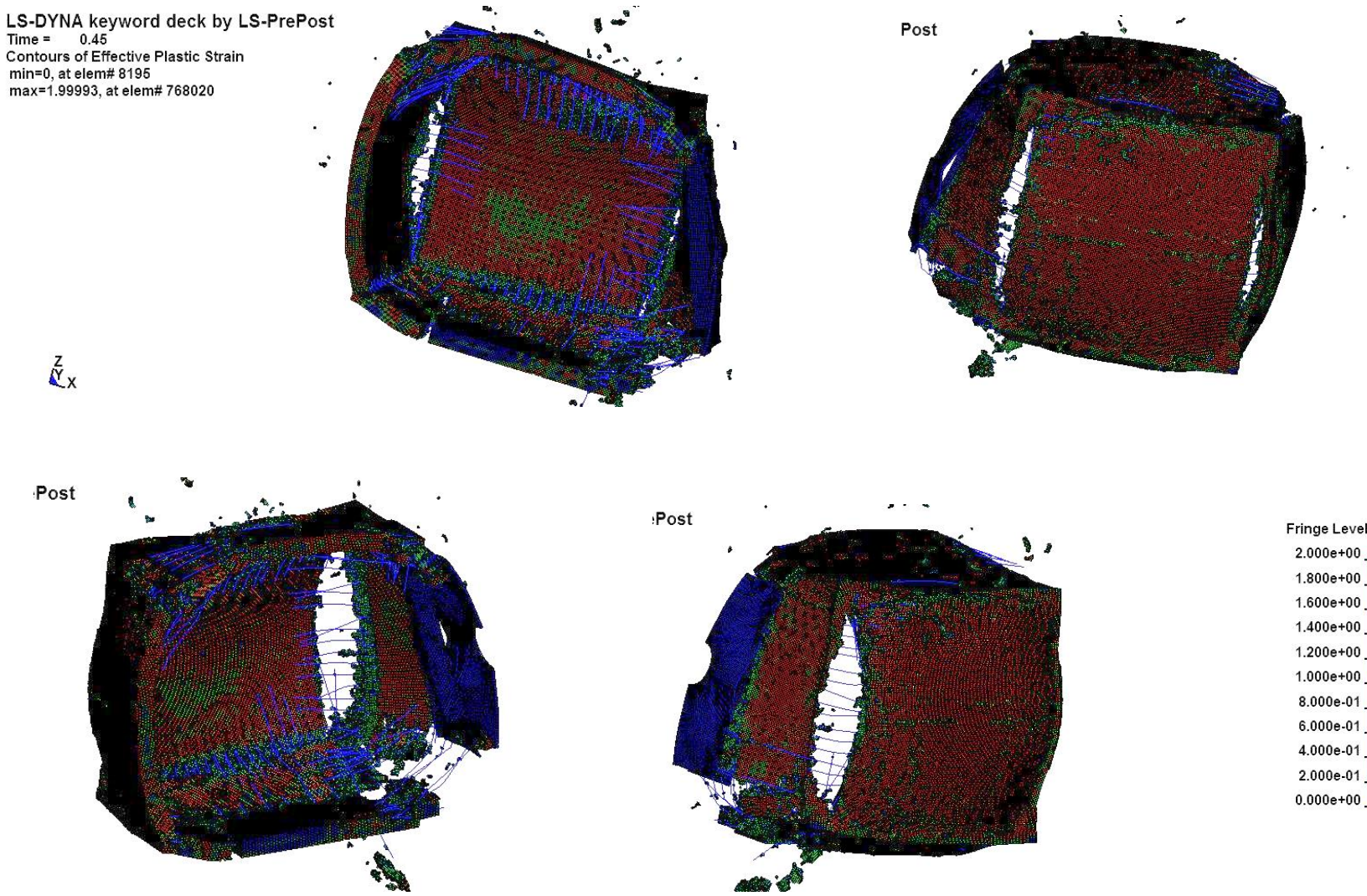
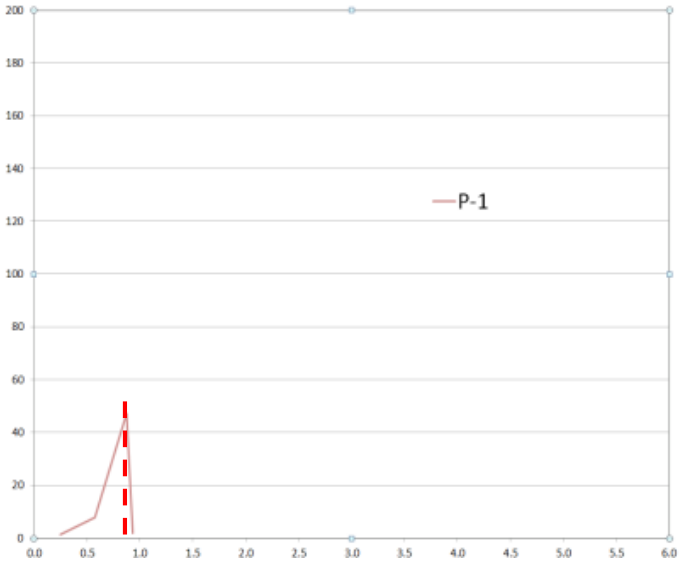
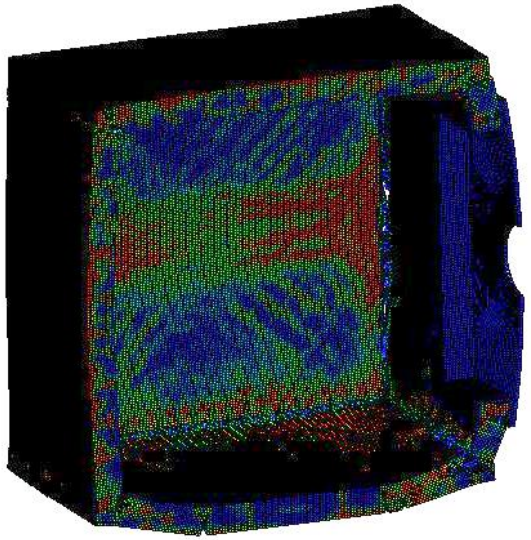
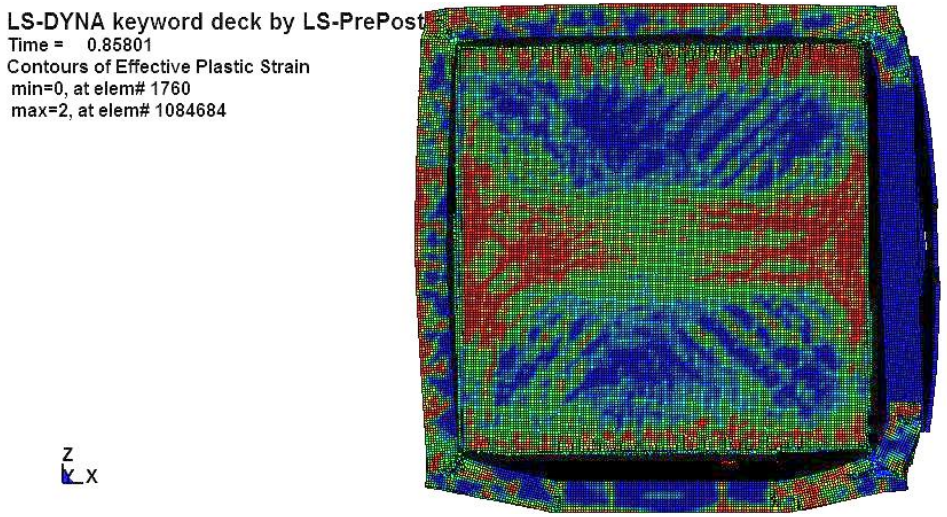


T8P1 Loading







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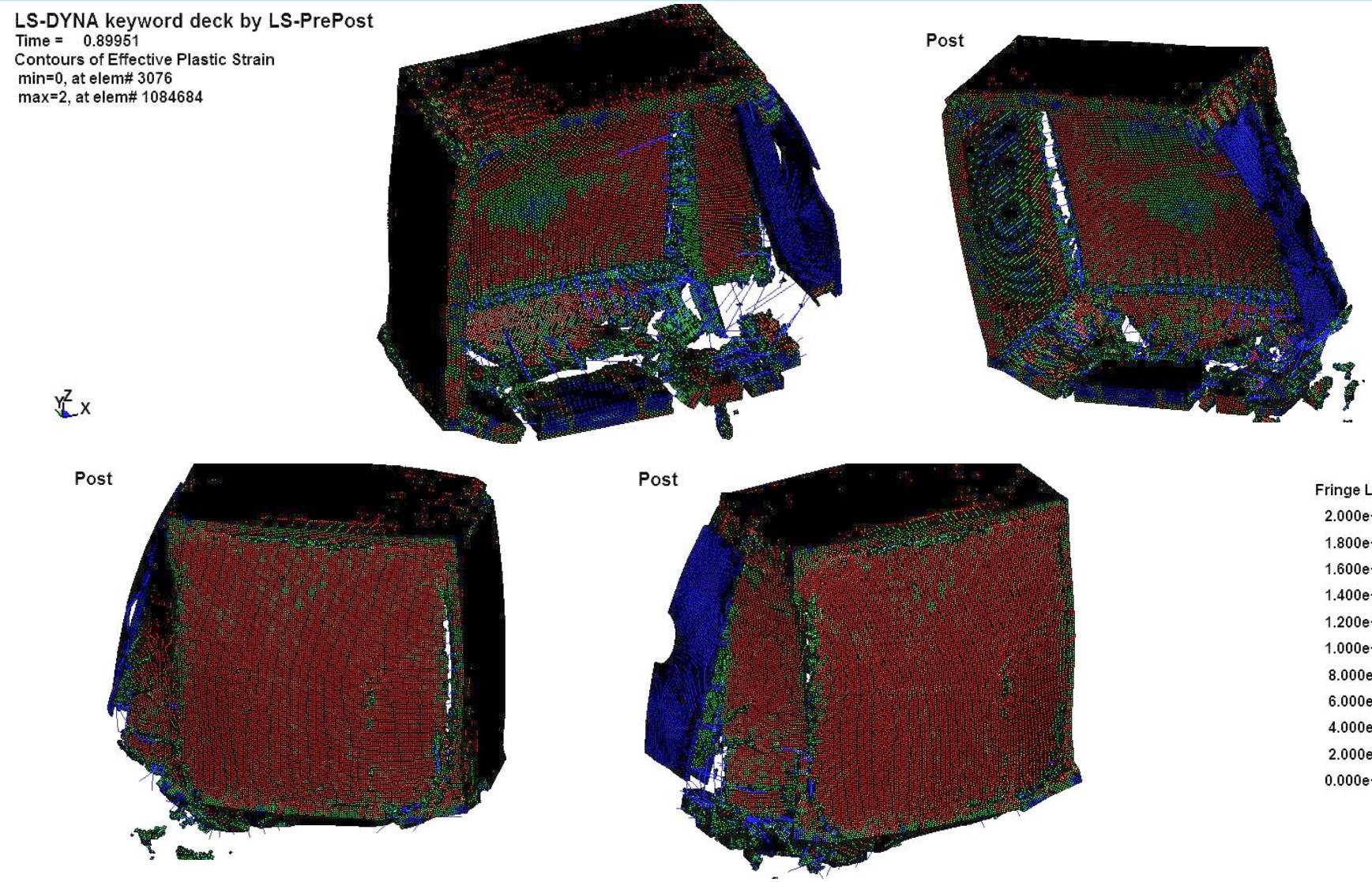

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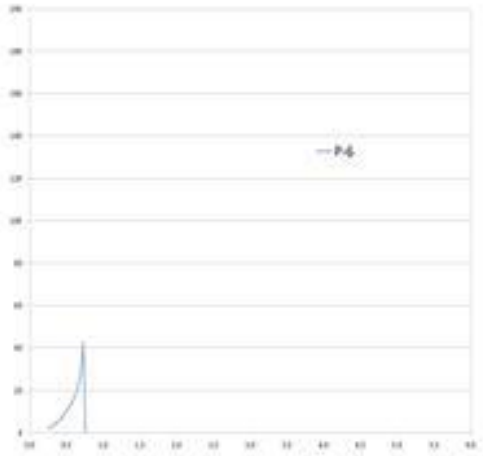
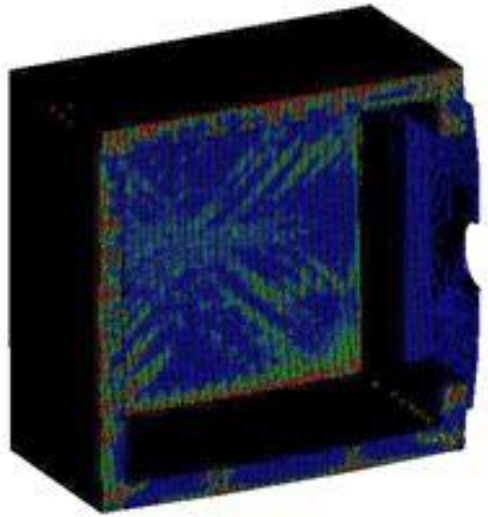


(a) **Loading Curve**

with the peak pressure of 42.7 psi



(b) **Damage Indices Contour**

at 0.90 second

Lessons Learned

1. Modeling the rebar tied to the door and the corner rebar is critical.

2. Modeling the rebar contact each other is very important.

3.

Table 4-1: Break-Up Time and Blast Pressure for Full Connection Models

Loading Curve	Flow Rate	Occupied	Failure Time (second)	Blast Pressure (psi)
Half Choked	double	quarter	0.420	60.0
Half Choked	initial	quarter	0.545	52.4
Choked	double	quarter	0.545	39.5
P1	N/A		0.858	47.0

3. P6 Loading Curve: no break-up (peak pressure 42.7 psi)