

Vehicle Impact Analysis

The frame will be constructed from 4130 cold-drawn seamless normalized steel tubing, manufactured in accordance with AMS-T-6736 specifications.

Assumption and Parameters

- Estimated Weight of vehicle: 320kg
- Weight of the driver: 80kg
- Total Estimated Weight = 400kg
- 1G Impact Force = $400\text{kg} \times 10\text{m/s}^2 = 4000\text{N}$
- Yield Strength: 435MPa
- Mesh type: 3D tetrahedral mesh
 - Min Element Size: 0.0002m
 - Average Element size: 0.001m

Per the 2026 Regulations:

For the Occupant Cell Impact Tests, a load of 5G was applied in front, rear and 3 locations at the sides at the bumper height of 100mm, width of 600mm and elevation off the ground of 350 mm.

For the roll cage, the following 5 load cases were applied on a loading patch of 150mm on each front and back hoop:

1. Combined Loading (5g down, 4g backward, 1.5g lateral)
2. Sideways angled loading (5g at 30 degrees downward from horizontal)
3. Sideways angled loading (5g at 60 degrees downward from horizontal)
4. Sideways horizontal loading (5g at the top of the hoop)
5. Rearward horizontal loading (5g at the top of the hoop)

Occupant Cell Impact Tests

Load Case	Max Principal Stress (MPa)	Min Principal Stress (MPa)	Min Factor of Safety	Max Displacement
Front 5G	72.13	-75.52	4.3	1.398
Back 5G	88.82	-55.04	5.1	1.869
Side 5G - Location 1	130.8	-50.32	3.3	0.7382
Side 5G - Location 2	193.2	-64.60	2.2	1.338
Side 5G - Location 3	272.7	-40.21	1.5	1.246

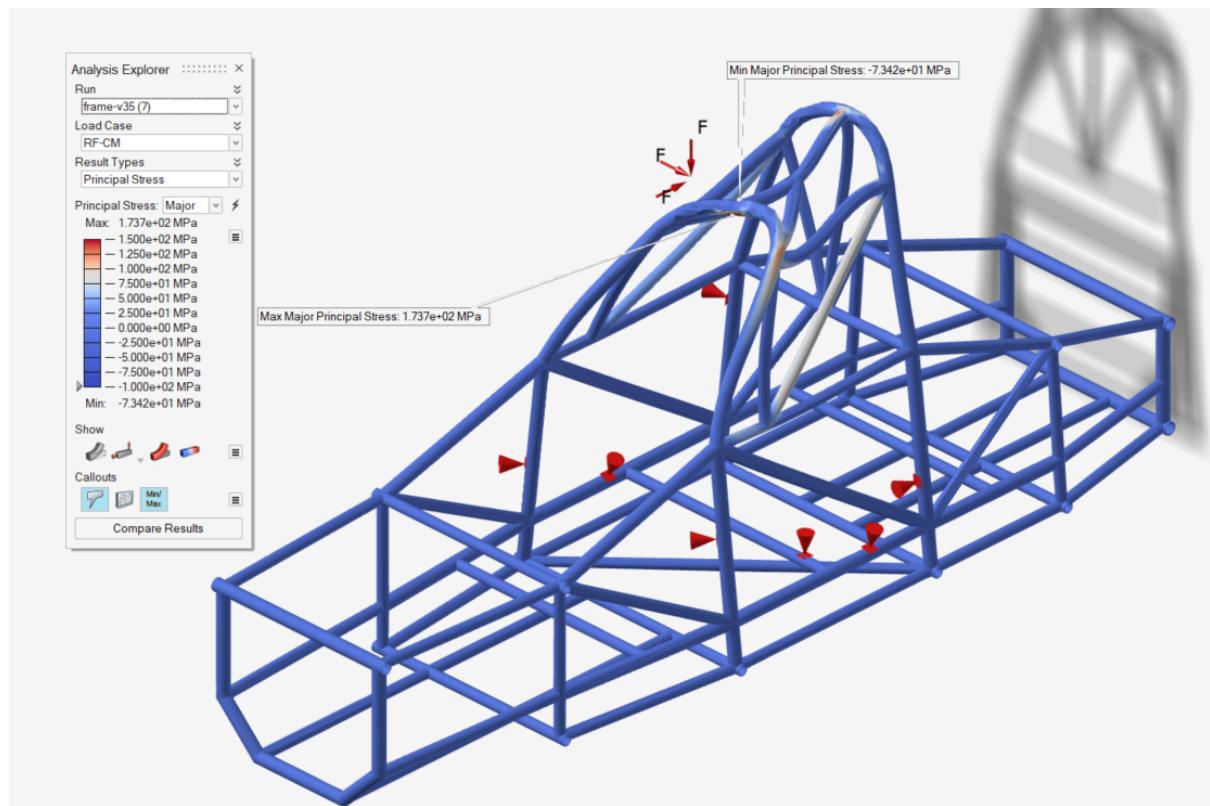
Roll Cage tests

Load Case	Max Principal Stress (MPa)	Min Principal Stress (MPa)	Factor of Safety
Roll-cage - Front combined	173.7	-73.42	1.7
Roll-cage - Front 5g 30 deg	267.9	-119.6	1.2
Roll-cage - Front 5g 60 deg	204.4	-91.44	1.6

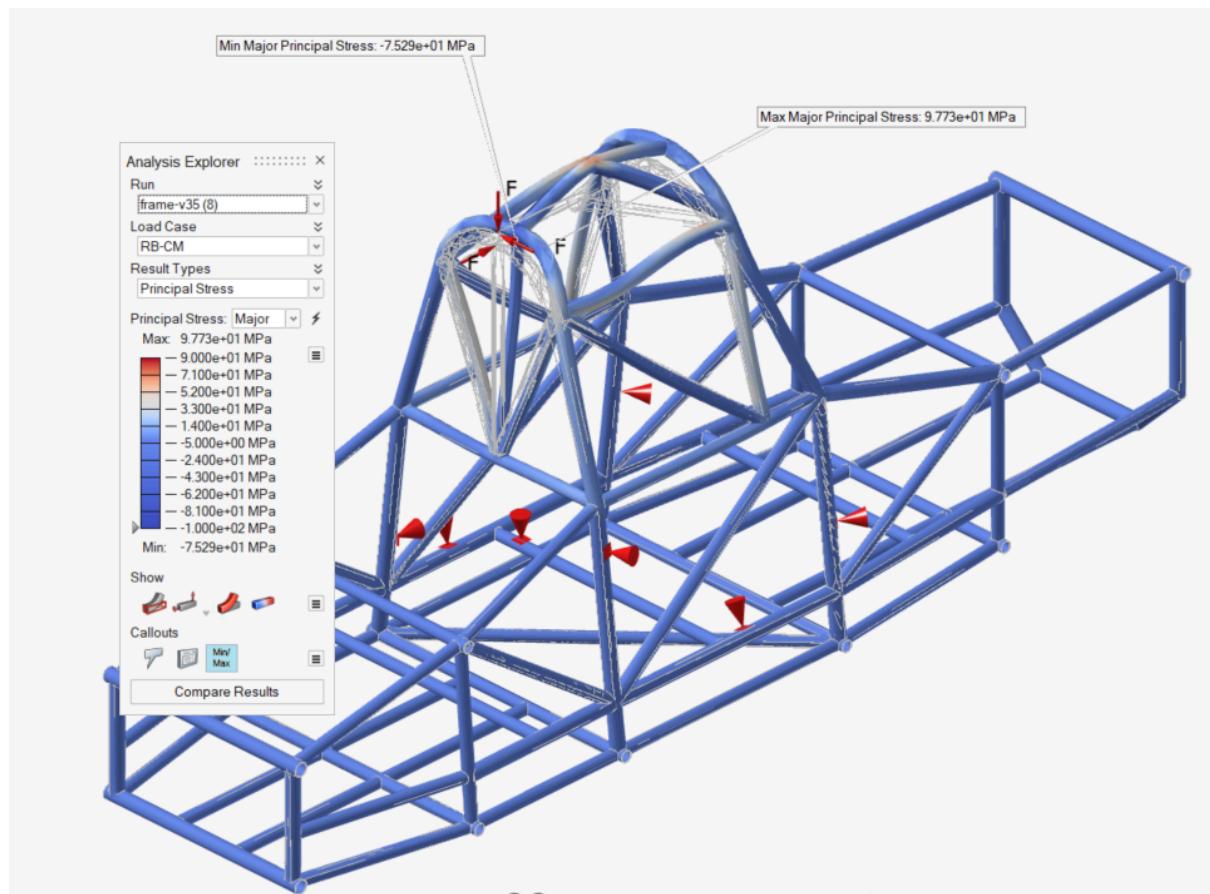
Roll-cage - Front 5g side	389.6	-113.2	1.2
Roll-cage - Front 5g horizontal	115.0	-30.08	3.0
Roll-cage - Back combined	97.73	-75.29	3.1
Roll-cage - Back 5g 30 deg	110.1	-12.01	2.8
Roll-cage - Back 5g 60 deg	66.16	-52.02	3.2
Roll-cage - Back 5g side	161.8	-12.09	2.9
Roll-cage - Back 5g horizontal	137.8	-62.29	2.5

Below are some deformation pictures of various load cases:

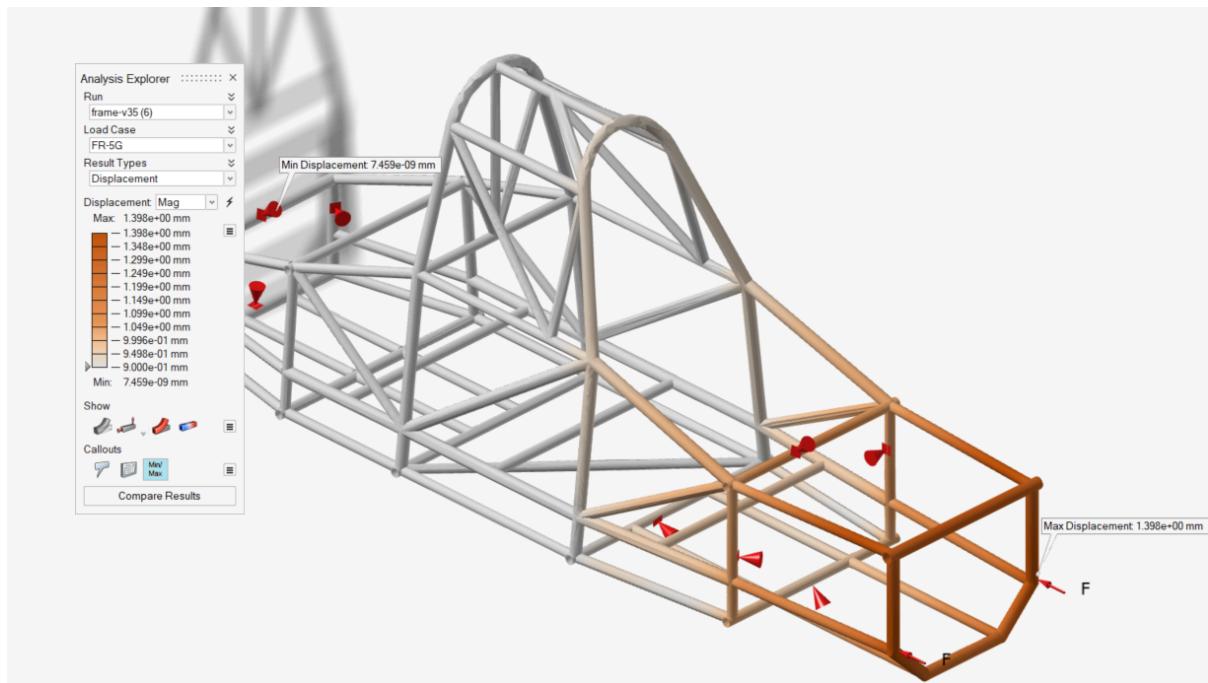
Front Hoop Combined Load Case:



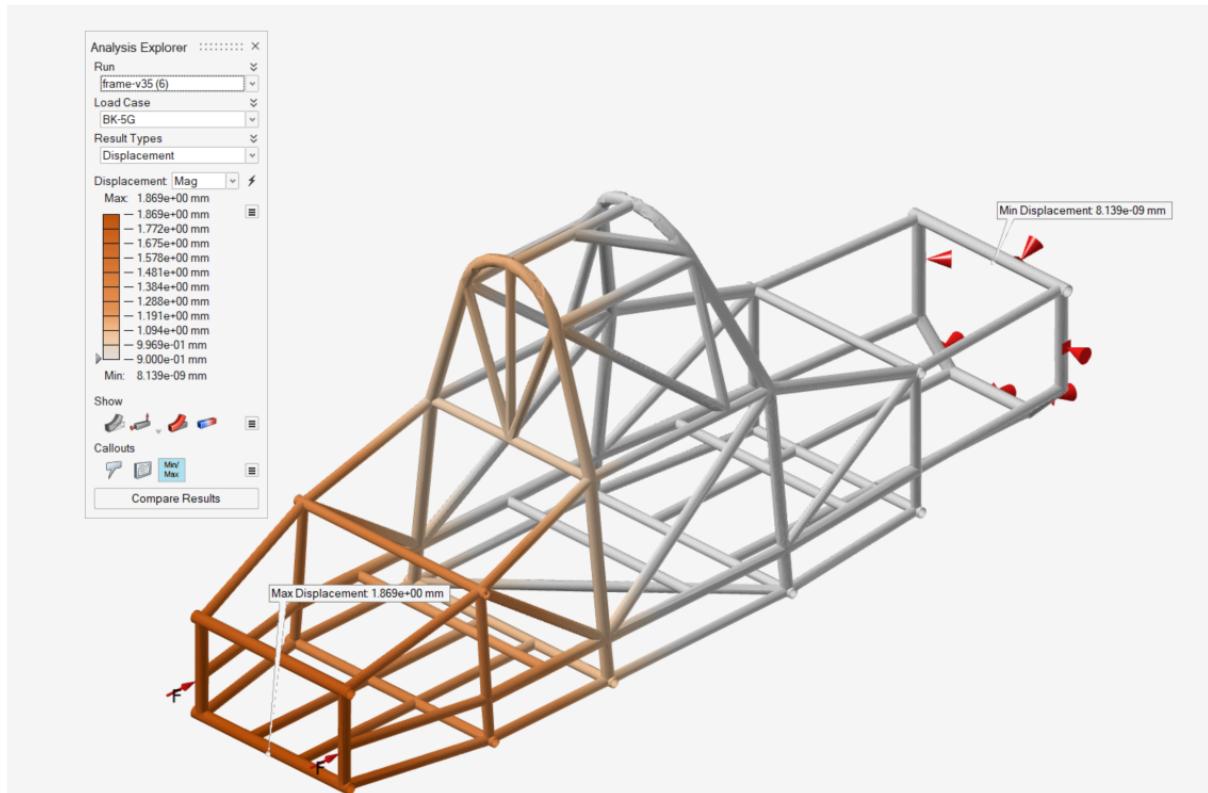
Back hoop Combined Load Case:



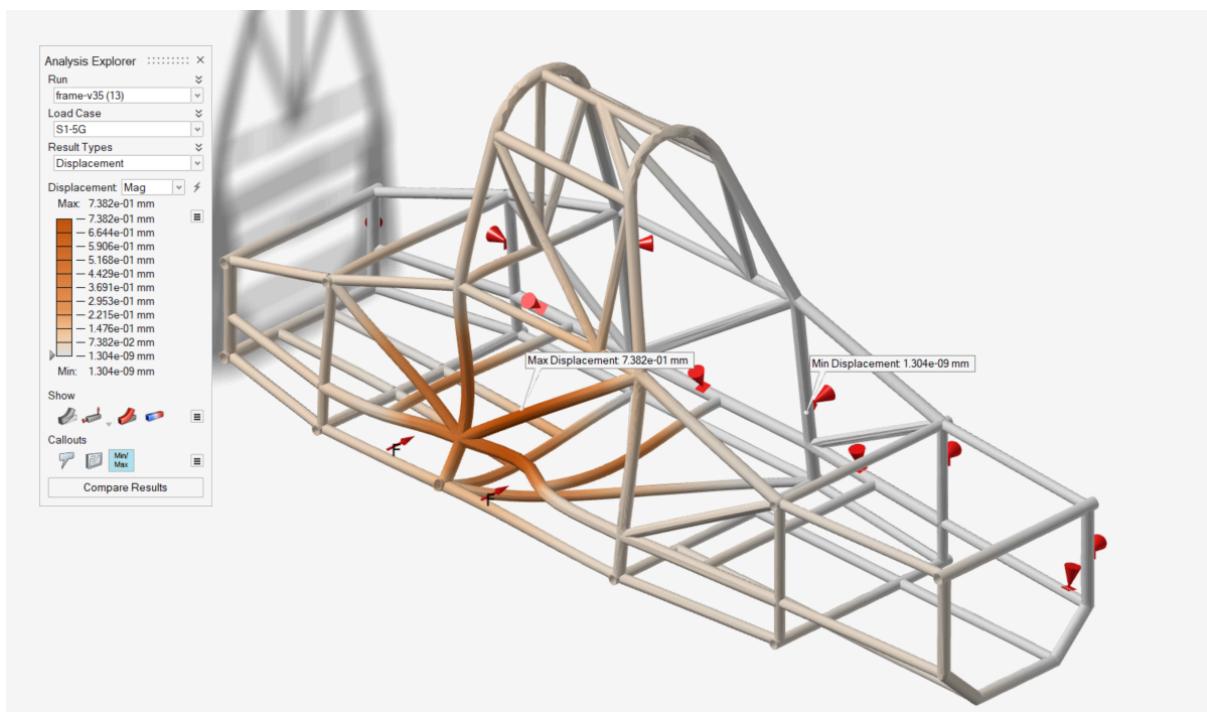
Front 5G Impact:



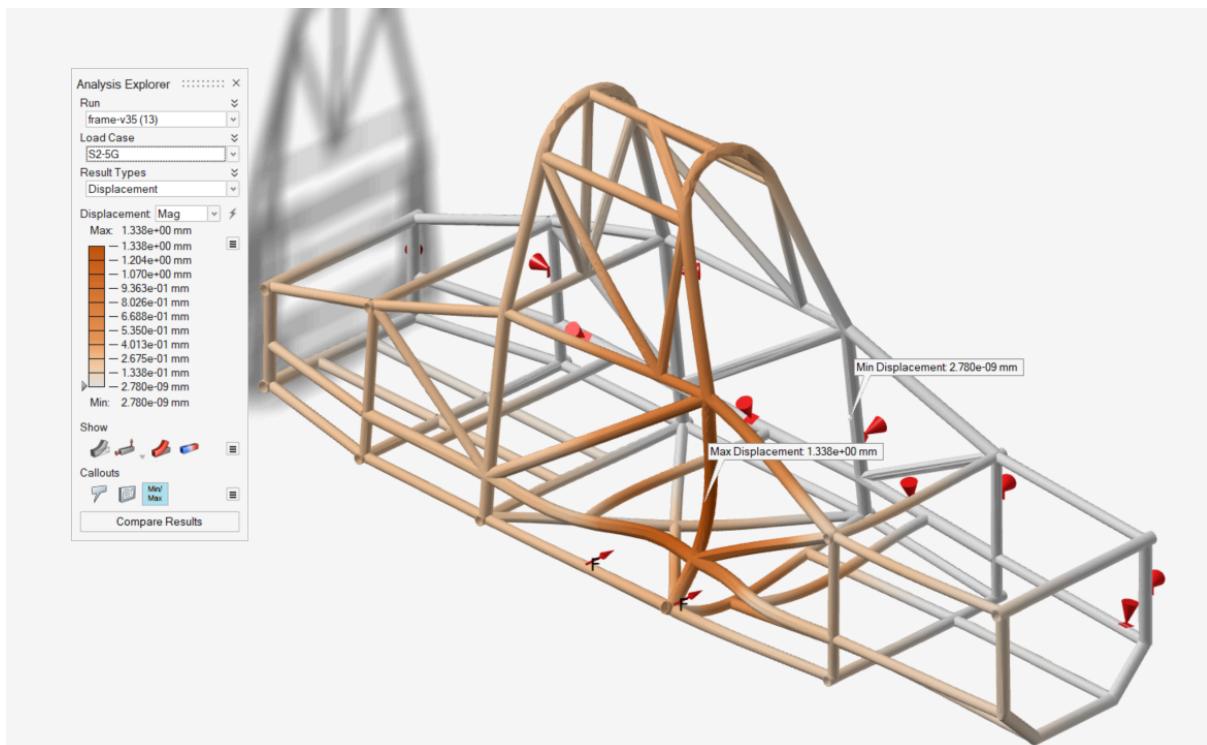
Back 5G Impact:



Side 5G Location 1:



Side 5G Location 2:



Side 5G Location 3:

