

Suspension System for Semi Low Floor Bus

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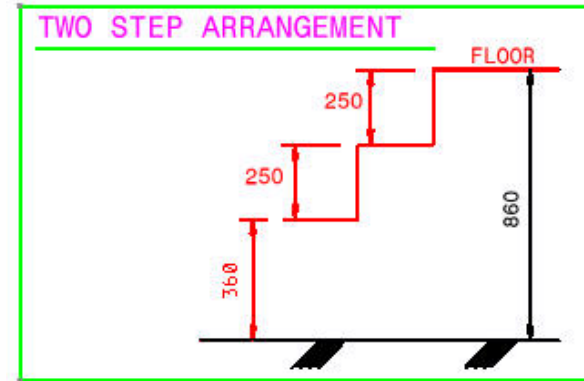


ASHOK LEYLAND

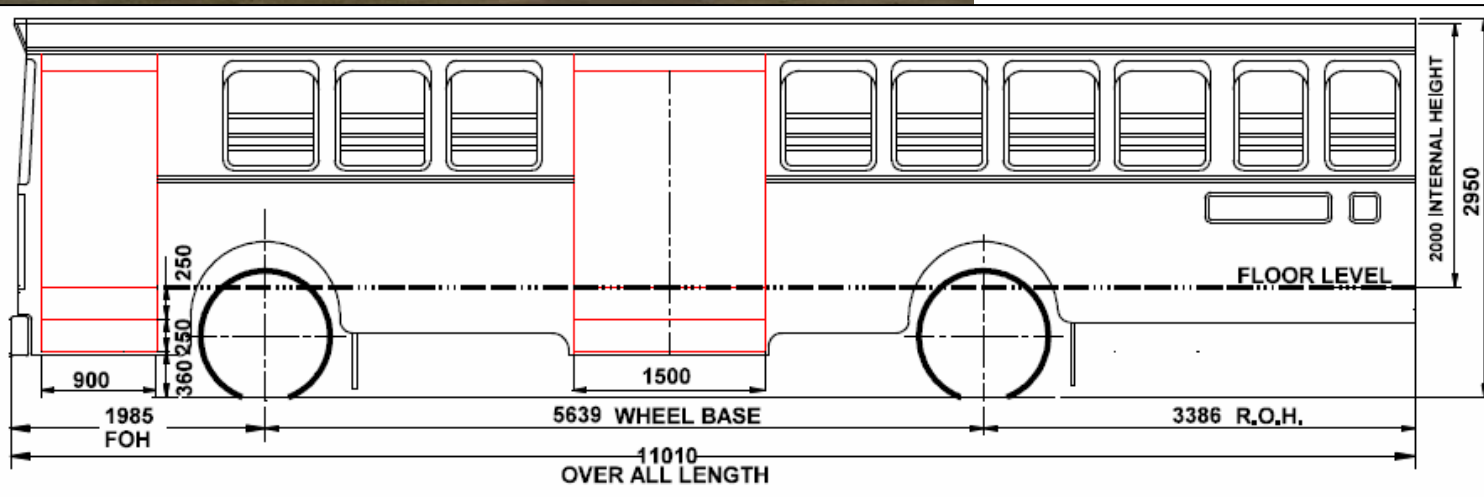
CITY BUS

Semi Low Floor - Entry + Two Steps

Cost effective unique solution pioneered by Ashok Leyland

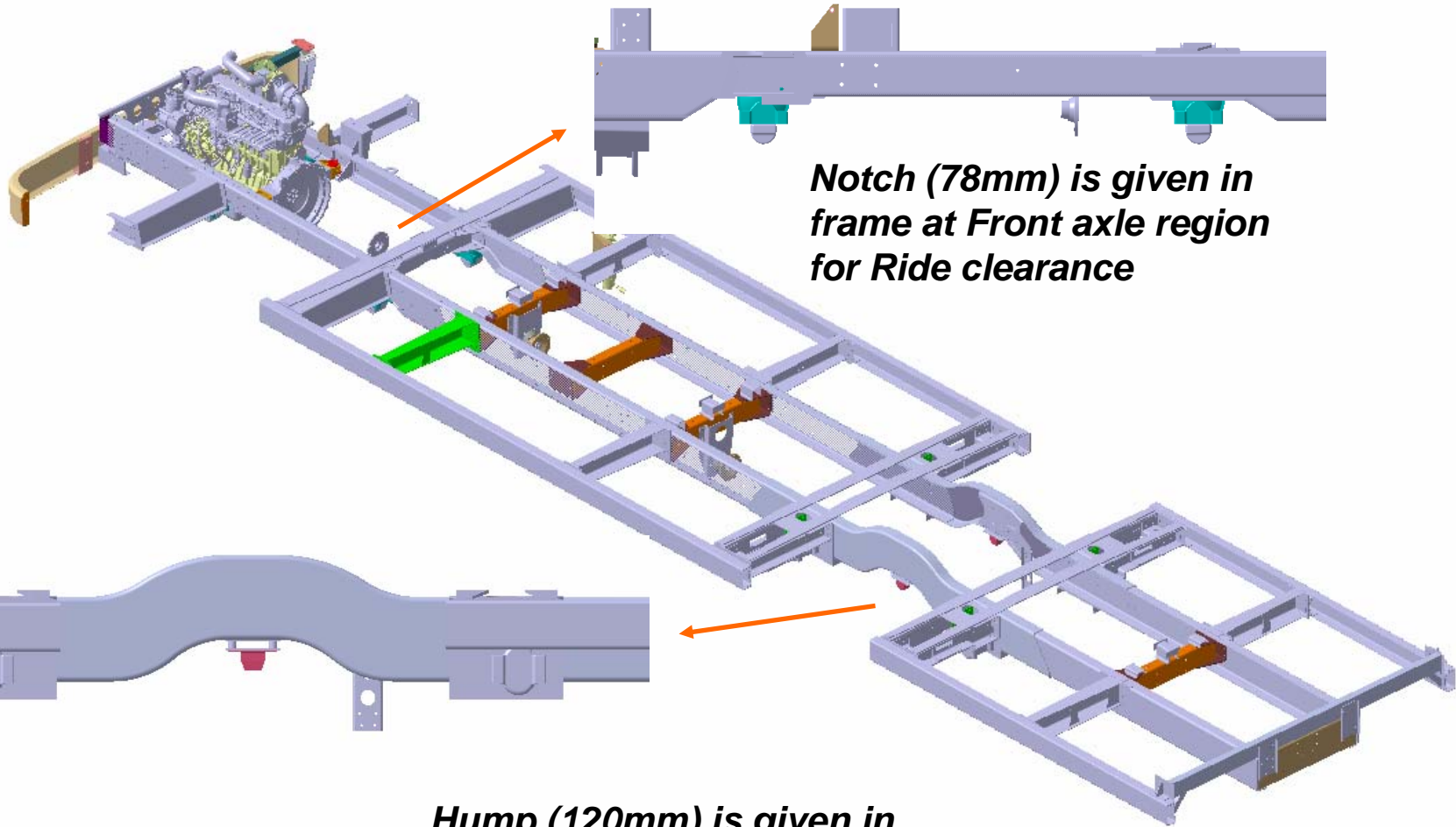


**860mm
Floor
Height**





Frame Assembly



Notch (78mm) is given in frame at Front axle region for Ride clearance

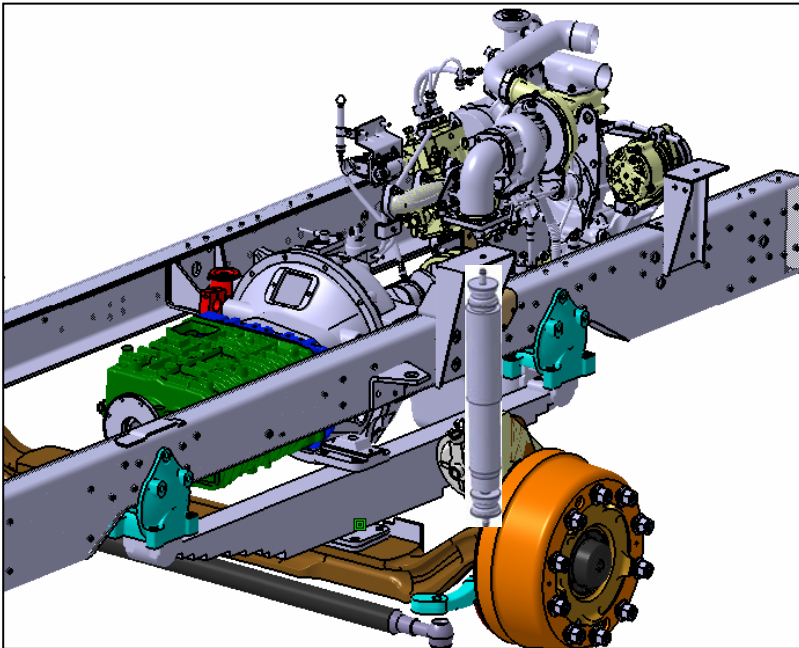
Hump (120mm) is given in frame at Rear axle region for Ride clearance

Front & Rear Suspension

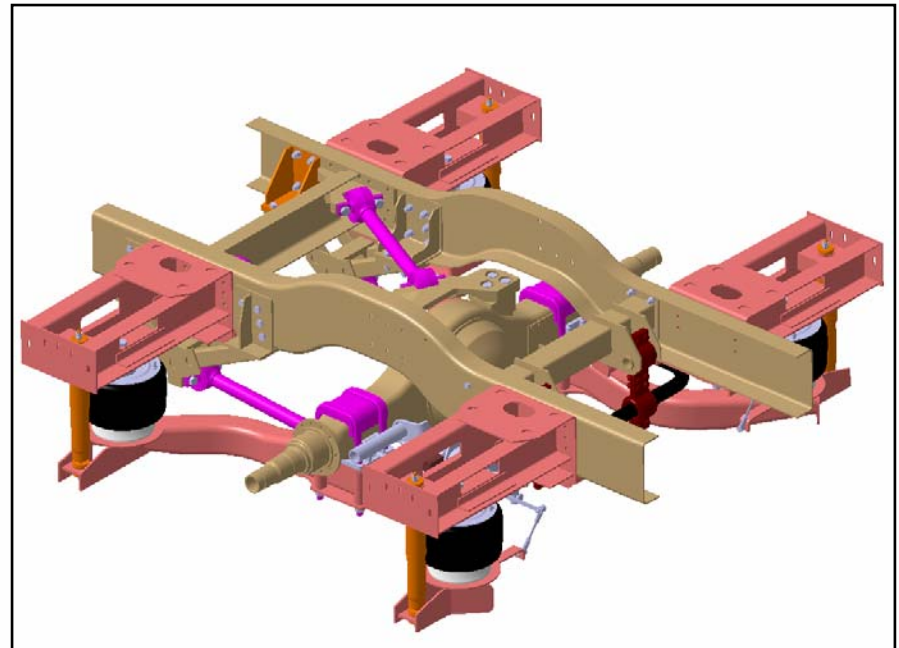
Front - Rubber ended spring suspension

Rear- Air Suspension (Cowhorn type Suspension)

Front Suspension



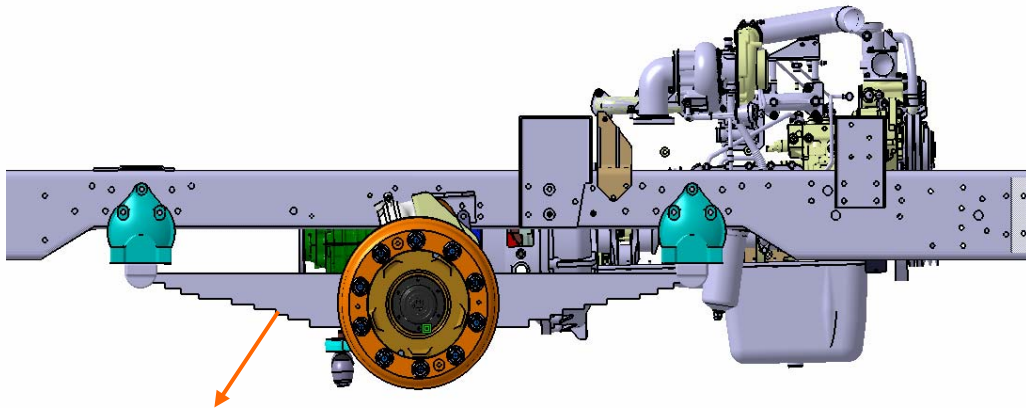
Rear Suspension



Suspension Characteristics

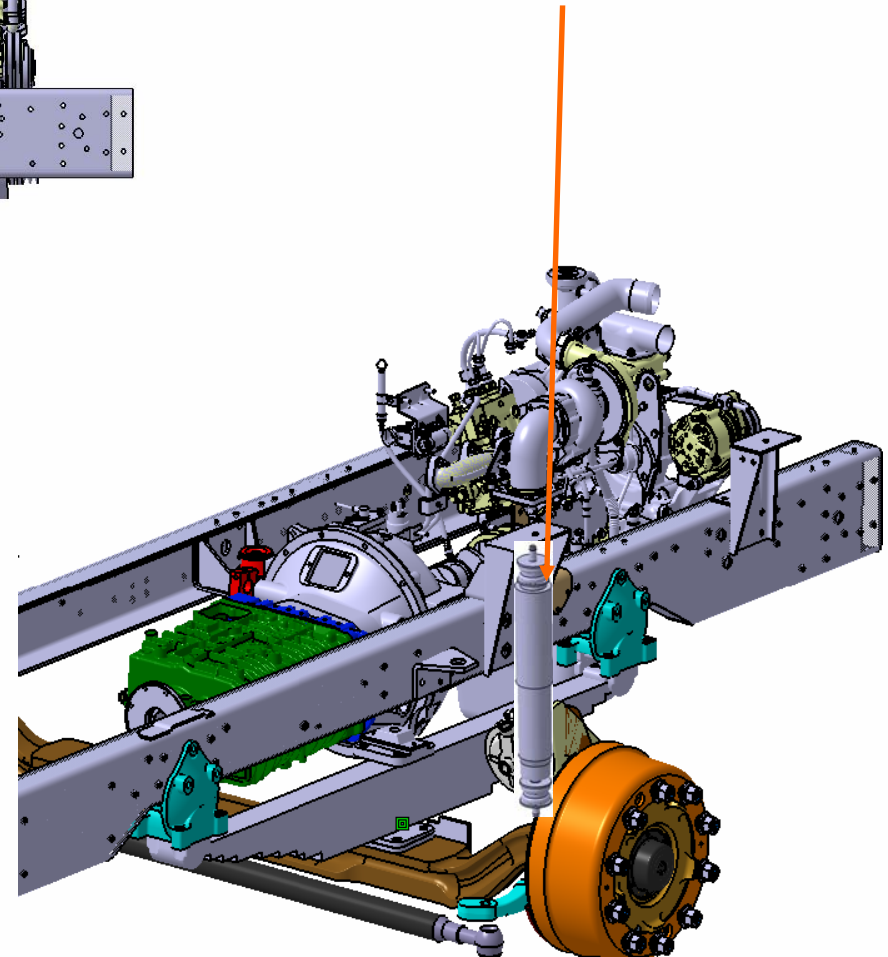
Suspension Characteristics		
Sl.No	Description	
1	FAW-Kg	5460
2	RAW-Kg	10200
3	Front Leaf Spring Stiffness-Kg/mm	34.7
4	Rear Air Spring Stiffness-Kg/mm	15.42
5	Front Suspension Natural Frequency - Hz	1.7
6	Rear Suspension Natural Frequency - Hz	1.3
9	Front Suspension (Leaf Spring) Roll Stiffness-Nm/deg	1960
10	Rear Air spring Roll Stiffness-Nm/deg	7415.6
11	Rear ARB Roll Stiffness-Nm/deg	5554.7
12	Rear Suspension Roll Stiffness-Nm/deg	12970.3

Front Suspension



Shock absorber

Dampens Suspension travel



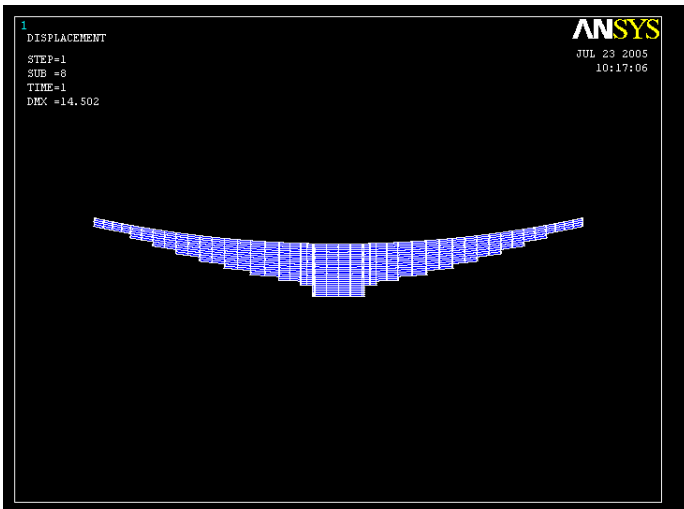
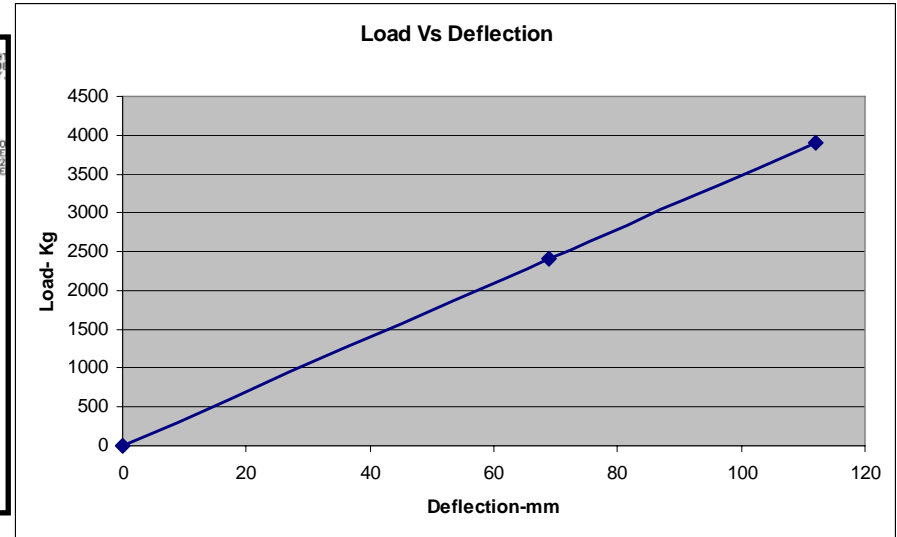
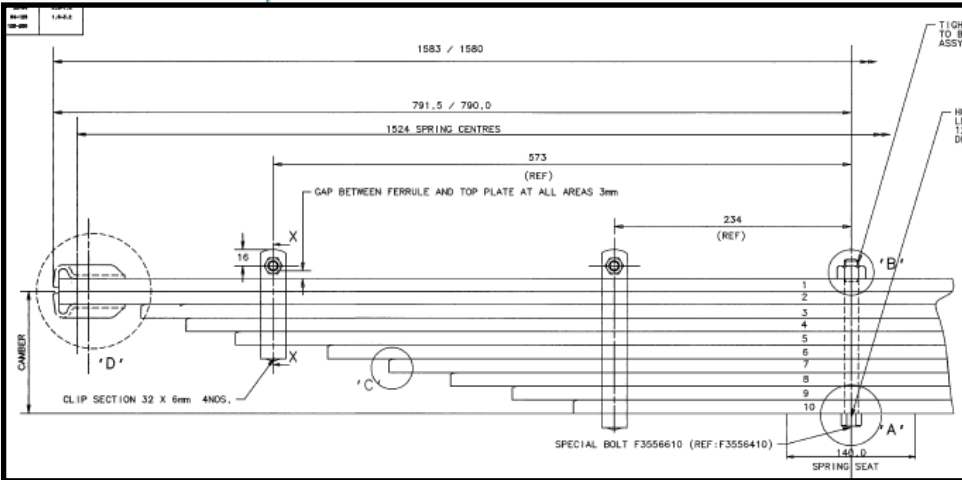
Rubber ended spring

1. Takes Vertical load and offers Stiffness
2. Takes driving, braking and cornering load

Advantages

- Leaf spring ends are connected to Frame brackets through Rubber pads. Rubber pads absorb vibrations.
- Weweller Spring helps the Axle to travel in Straight line path during Suspension travel articulation, which improves tyre life.

Front Spring

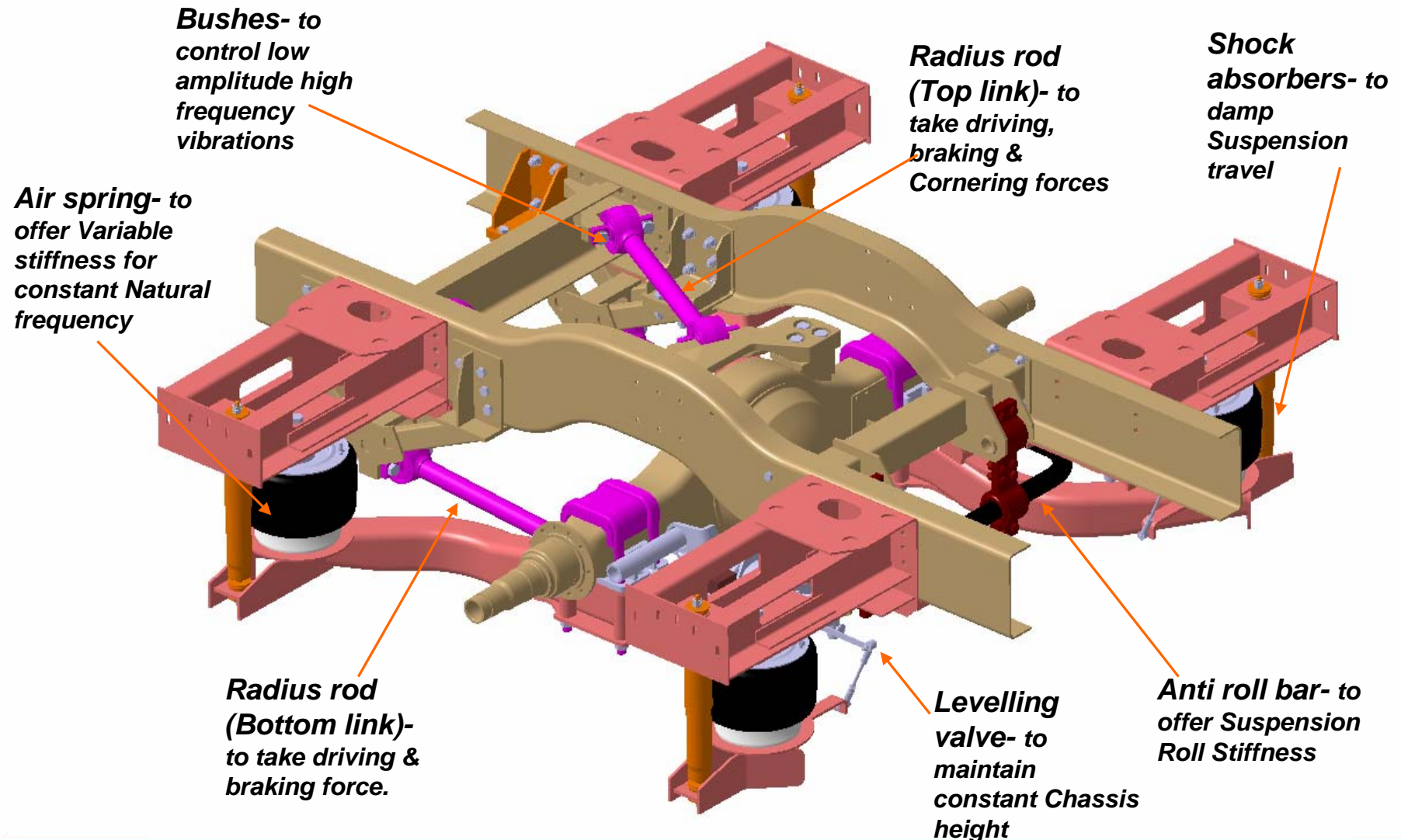


Rated Load- 2400 kg

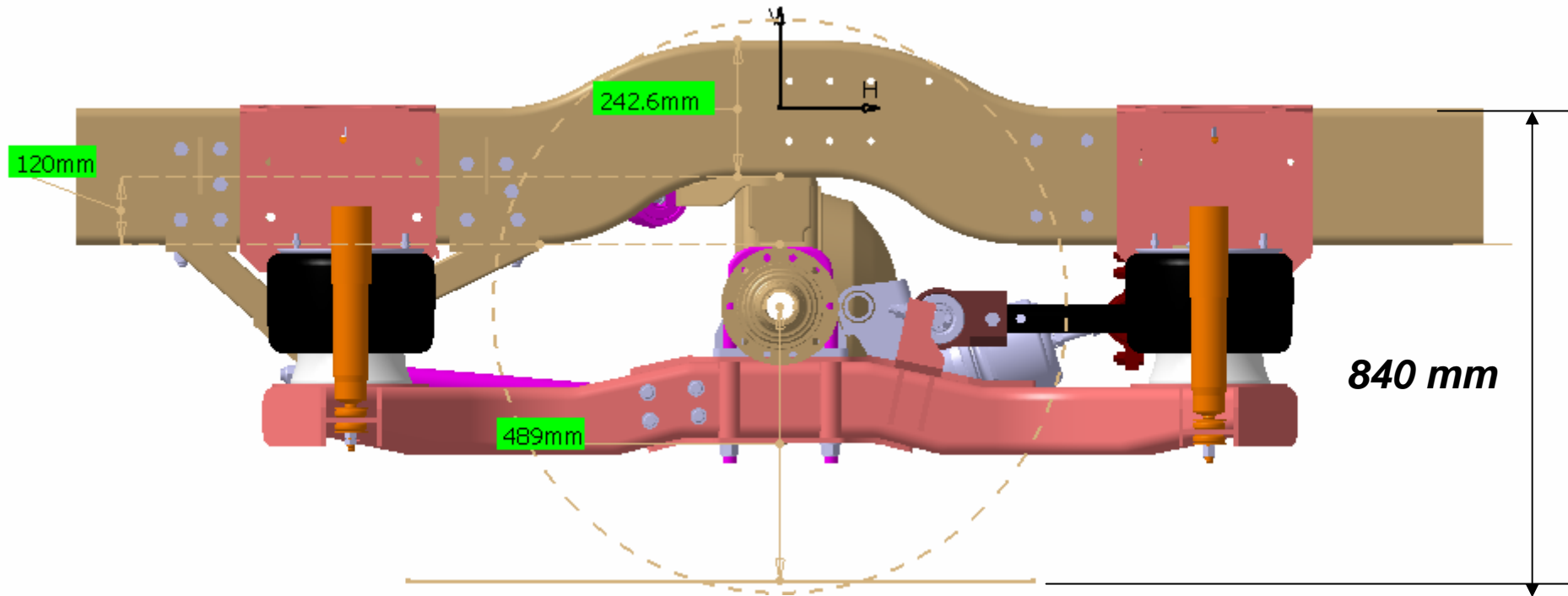
Stiffness- 34.7 Kg/mm

Stress @ Rated load- 50 Kg/mm²

Rear Air suspension



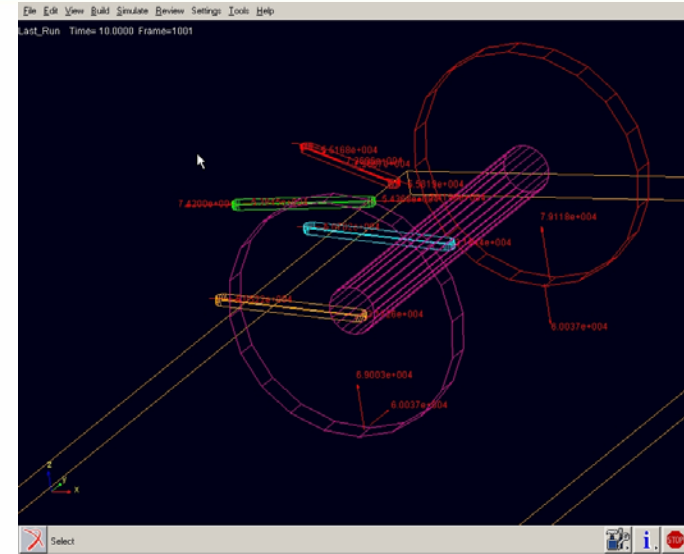
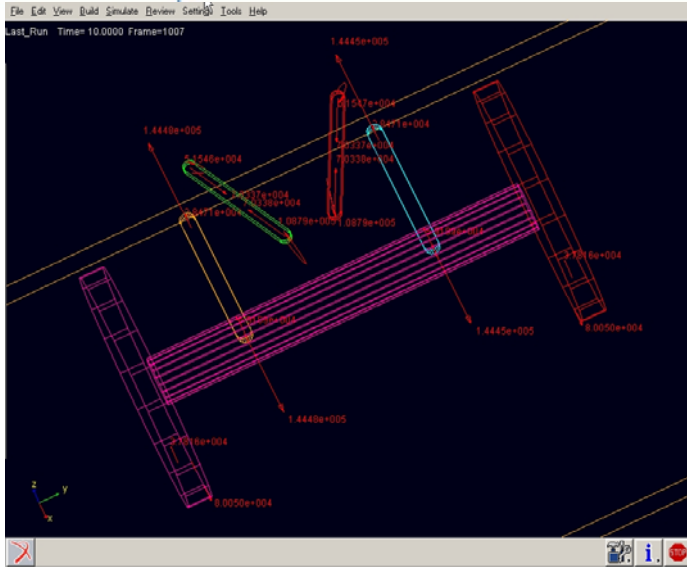
Rear Air suspension



Frame is modified at Rear axle to have Ride clearance. Hump(124mm) is given in Frame.

Vehicle Frame height from Ground- 840 mm

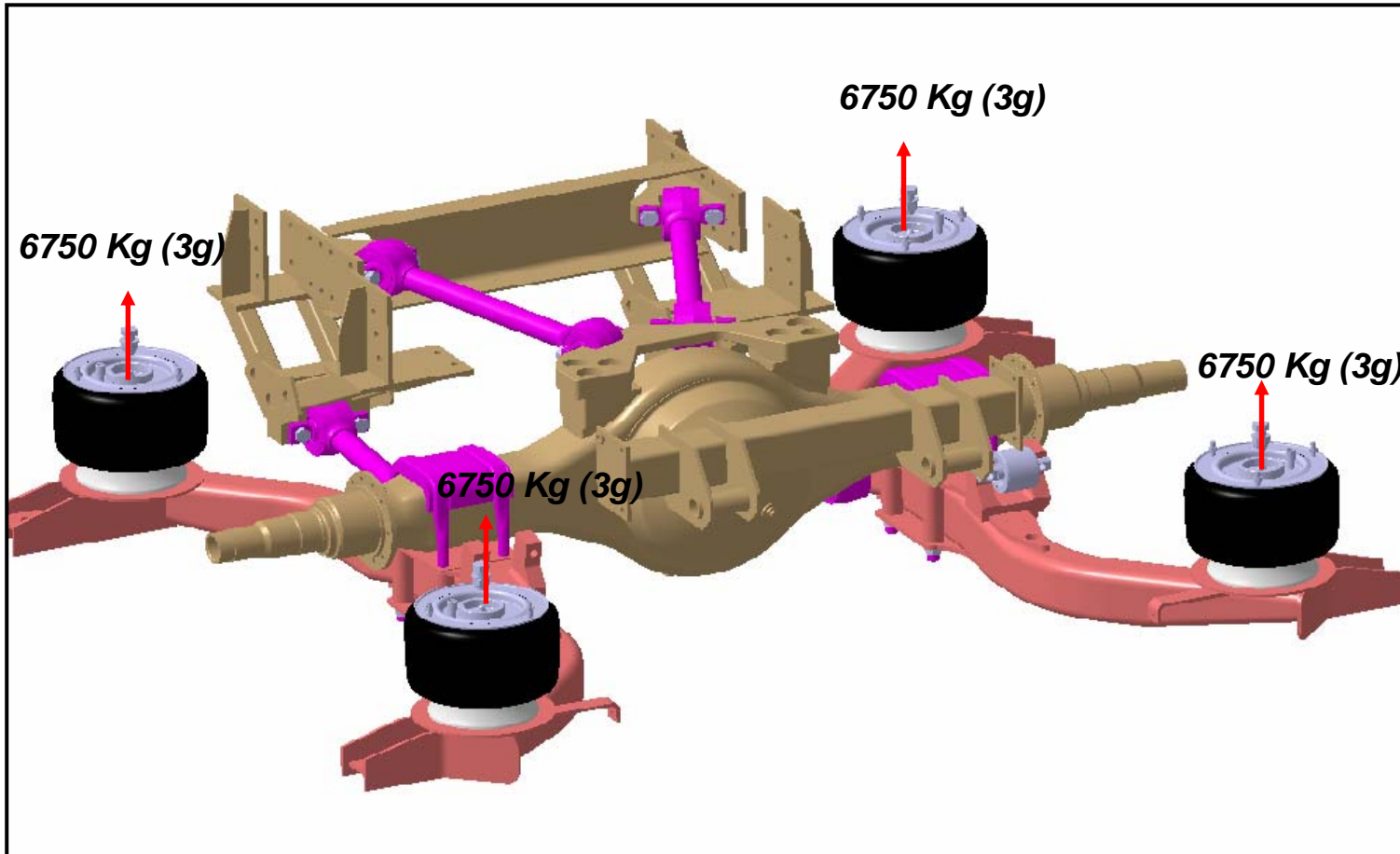
Rear Air suspension – Kinematics Analysis



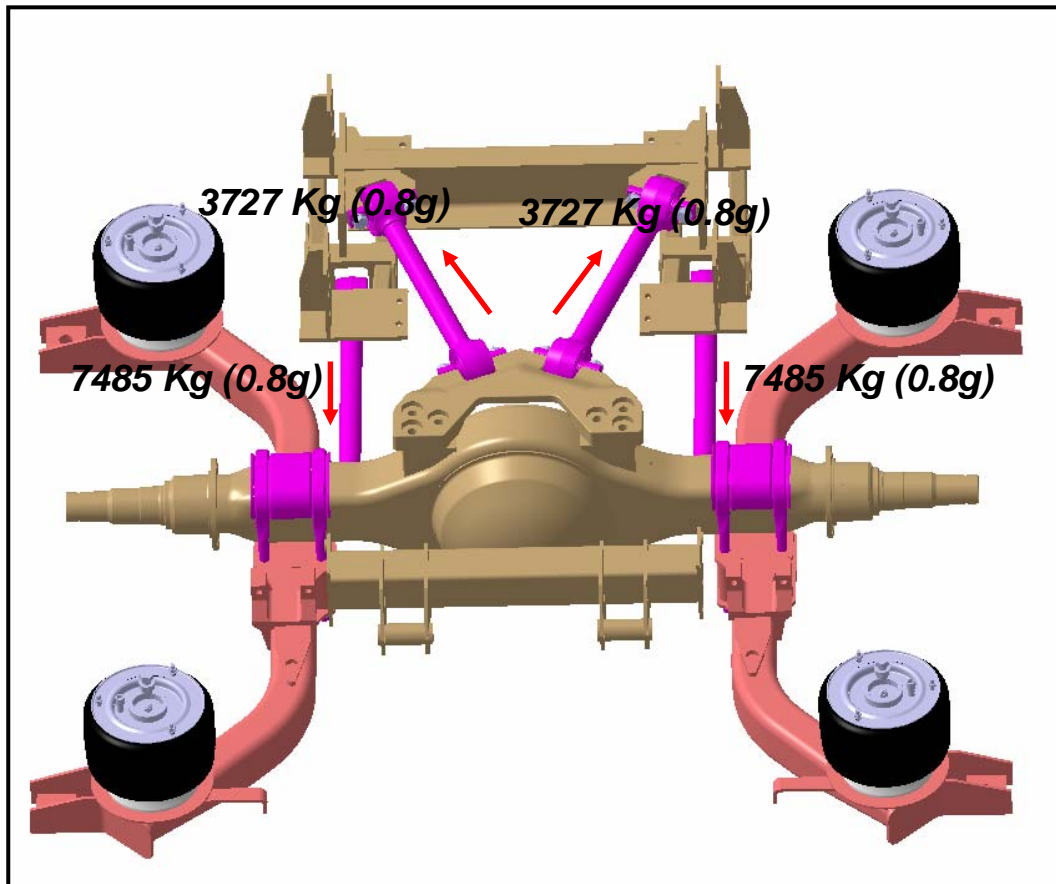
Kinematic analysis is done for the following conditions to arrive forces at Suspension –Frame Reaction points.

- ***Vertical- 3g***
- ***Braking- 0.8g***
- ***Cornering- 0.6g***

Vertical loading

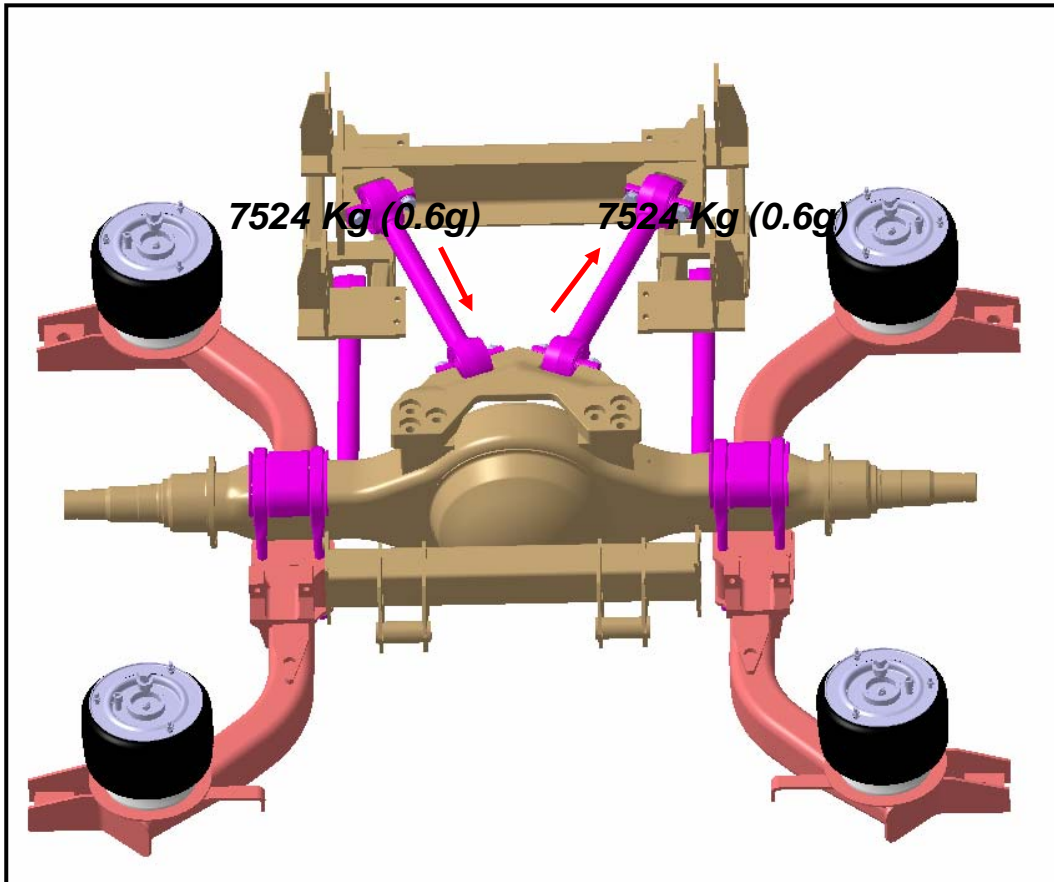


Braking loading



- *Top & bottom link will take Brake force.*
- *Top link will be in compression and bottom link will be in tension during Braking.*

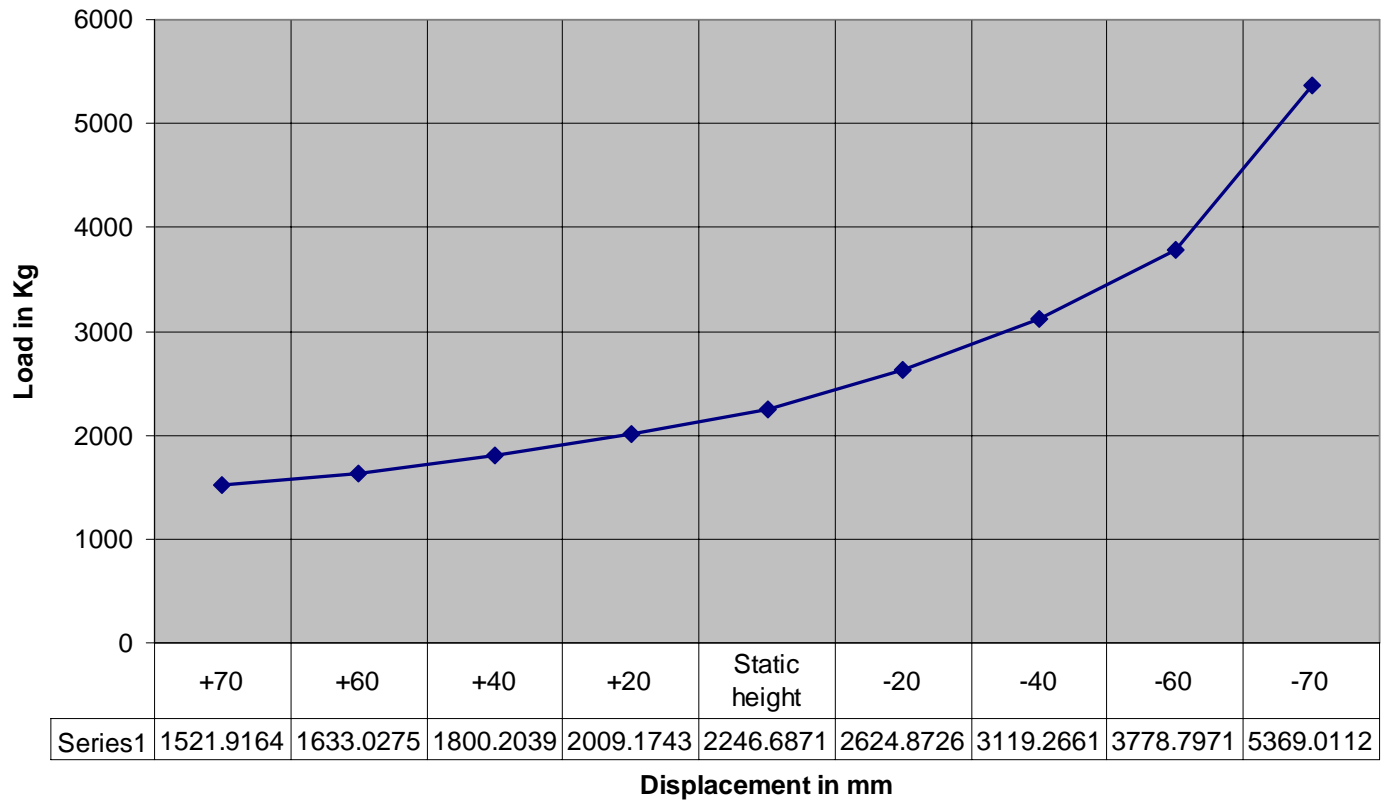
Cornering loading



Cornering load acting on Top links. One link will be Tension and other link will be compression..

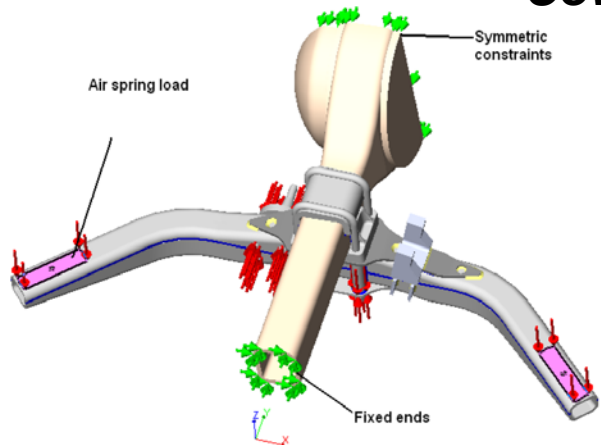
Rear Spring Variable Stiffness graph

Air Spring Data

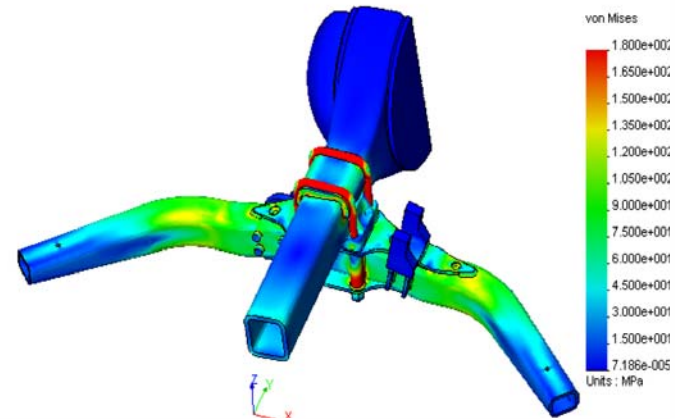


Rear Air suspension Brackets FEA

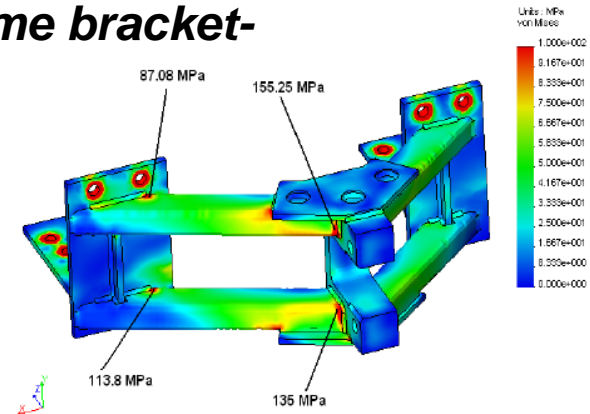
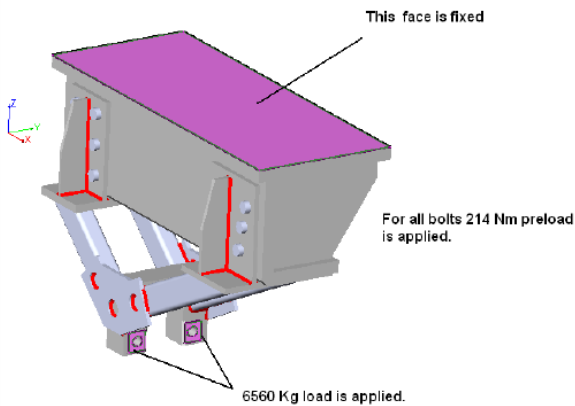
Cowhorn- Stress Analysis



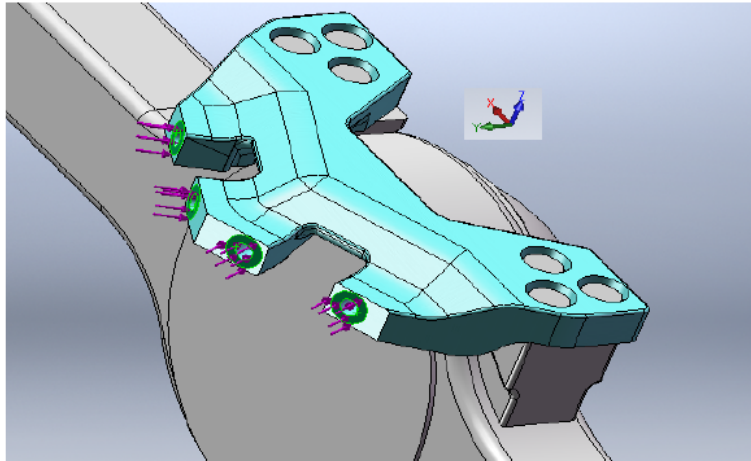
Vonmises stress plot



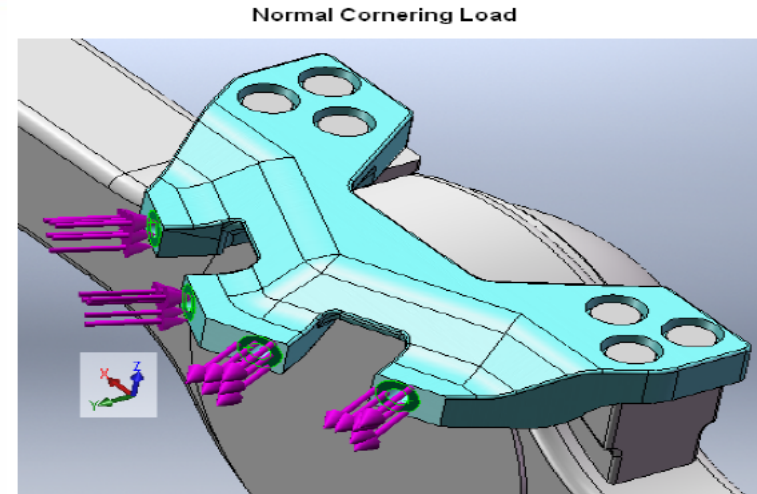
Radius Rod Frame bracket- Stress Analysis



Rear Air suspension – Axle Bracket Analysis

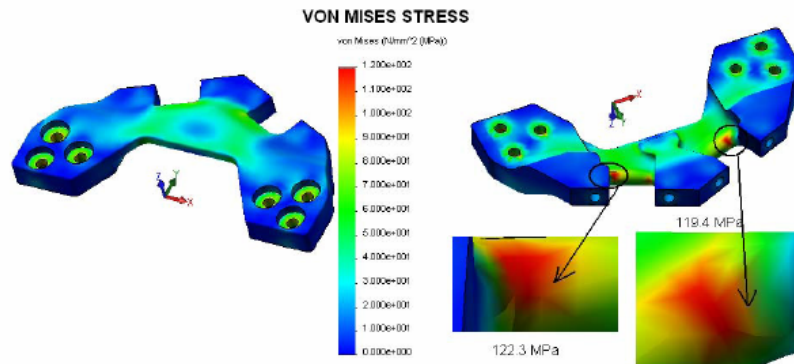


Braking load of 1854 Kgf is applied normally on each of the selected faces



Normal Cornering Load
Cornering load of 4040 Kgf is applied normally on each of the selected faces -
(pulling on one set of faces and braking on other set)

VONMISES STRESS



Rear Air suspension – Rig testing



Air Suspension System Rig testing is done for the following conditions:

- ***Case-1: 0.5g-2g Vertical load for 1 Lac Cycles***
- ***Case-2: 1g Vertical & 0.8g (+/-) Braking for 1 Lac Cycles***
- ***Case-3: 1g Vertical & 0.6g (+/-) Cornering for 1 Lac Cycles***

Rear Air suspension – Rig testing





Summary

- ***Front engine SLF is the Cost effective solution offered by Ahokleylend for City bus application.***
- ***Rubber ended Leaf spring suspension at Front and Air suspension at Rear is new concept driven by Ashokleyland.***

Thank you