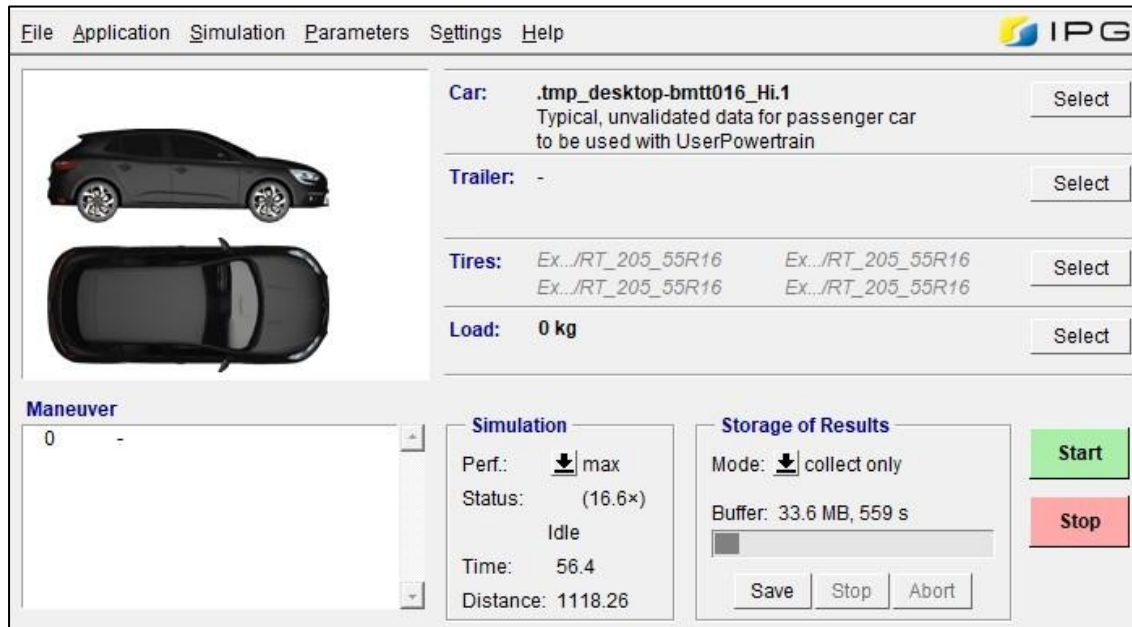


Task 1: To examine how altering the position of a vehicle's centre of gravity impacts its acceleration and braking performance.

Procedure:

- In this study Demo_Renault_Megane vehicle has been used for IPG CraMaker, the vehicle is a front wheel driven with length of 4.359m, all the manoeuvre parameter are set default driver behaviour.



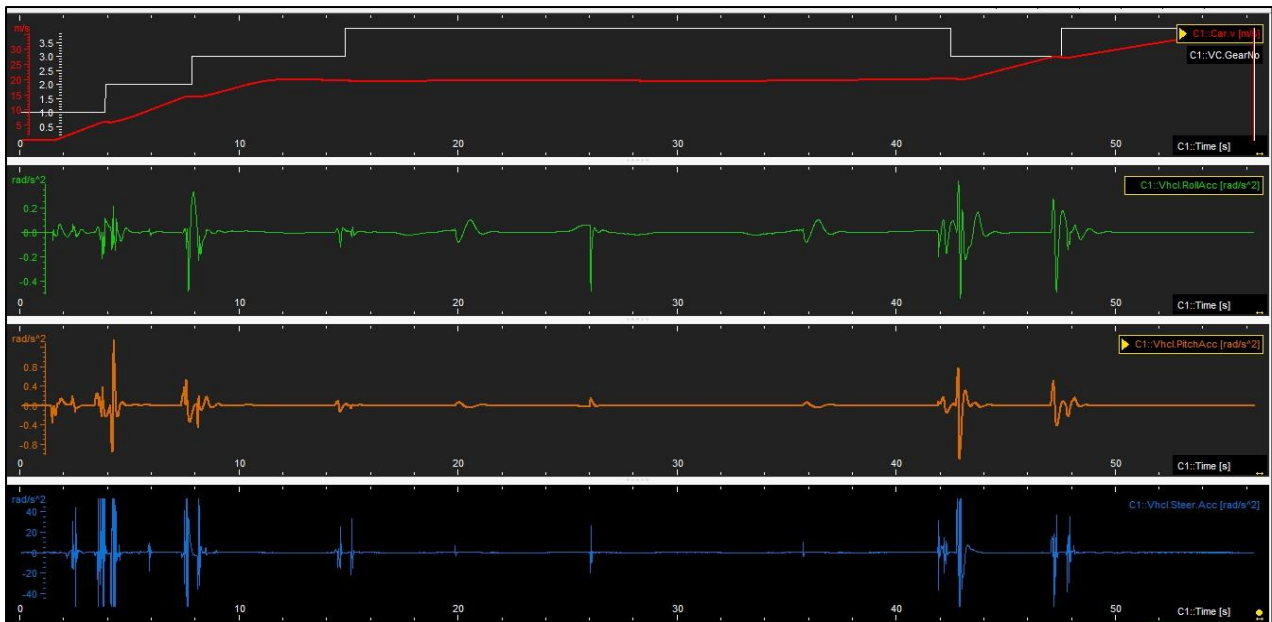
- CG1 Default Parameter:** The CG parameter is set to default values which is 2.399/0.436/0.594 of x/y/z parameter

CM CarMaker - Information to the entire vehicle

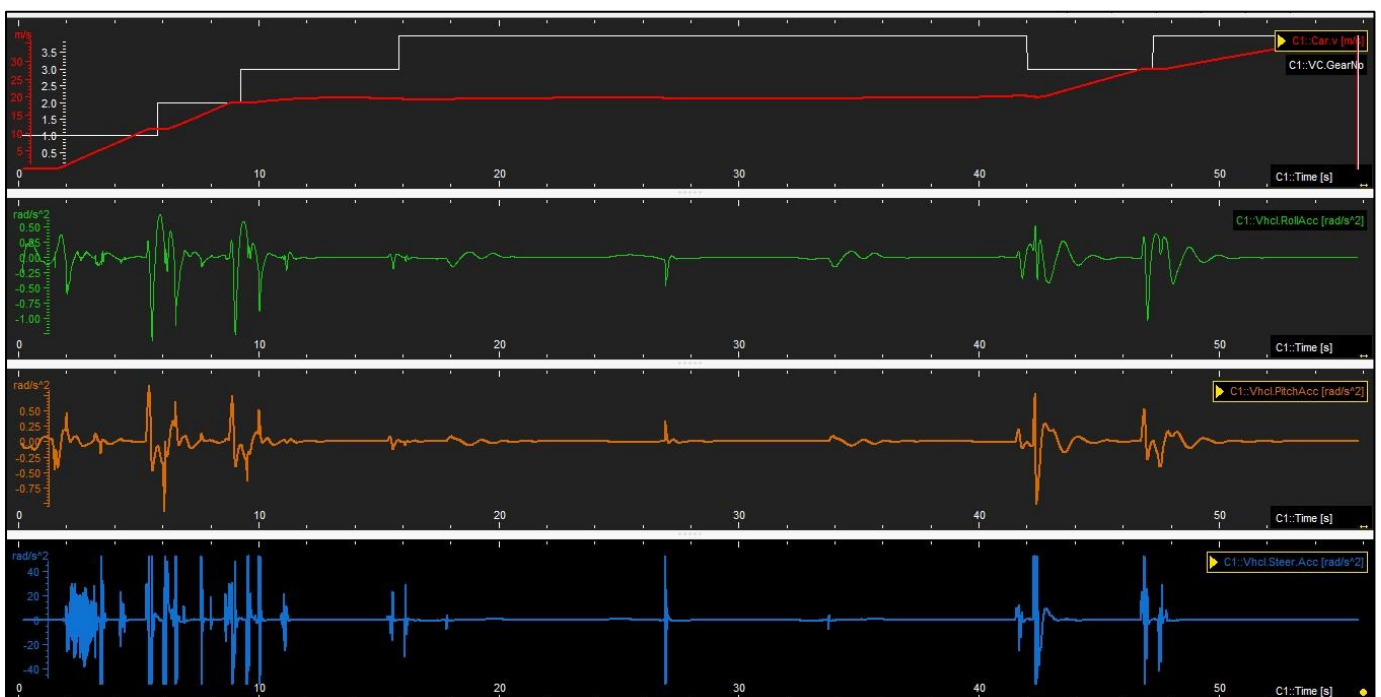
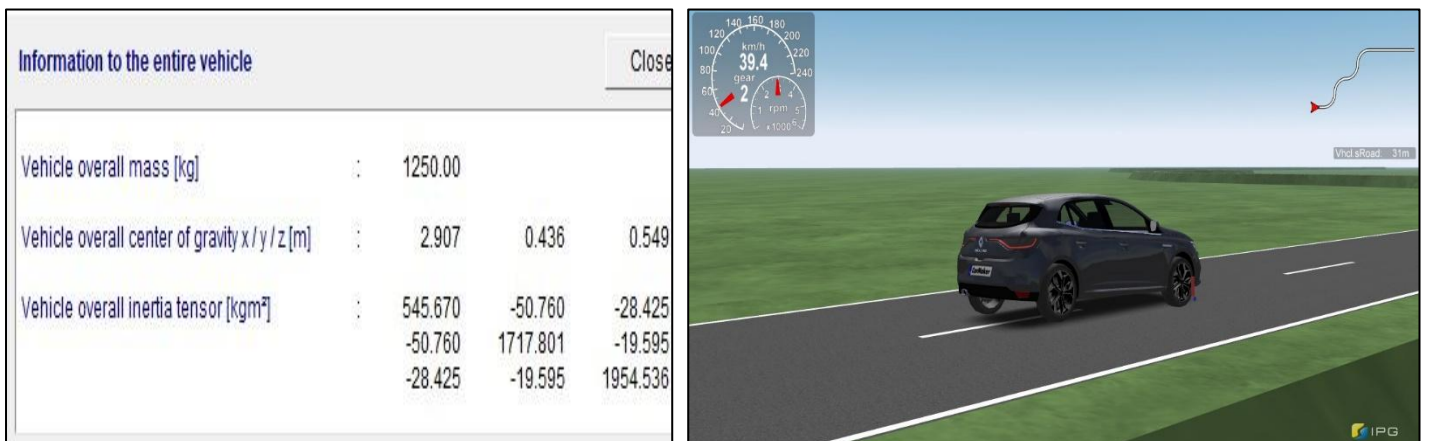
Information to the entire vehicle Close

Vehicle overall mass [kg]	:	1250.00		
Vehicle overall center of gravity x / y / z [m]	:	2.399	0.436	0.549
Vehicle overall inertia tensor [kgm ²]	:	545.670	-9.959	-5.577
		-9.959	1647.003	-19.595
		-5.577	-19.595	1883.738

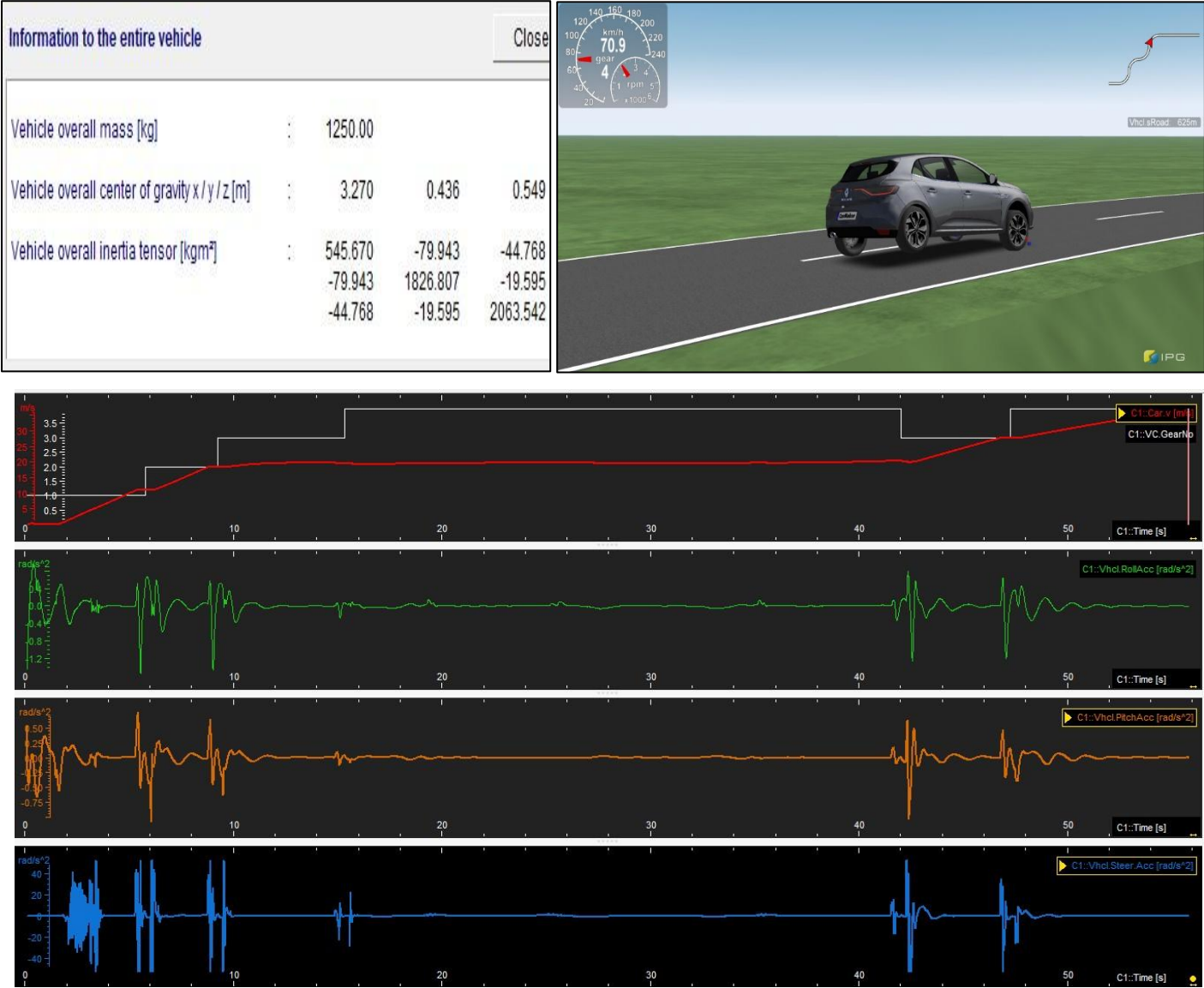




- CG2 Moving Toward Front Side:** The CG parameter is set to values which is 2.907/0.436/0.594 of x/y/z parameter

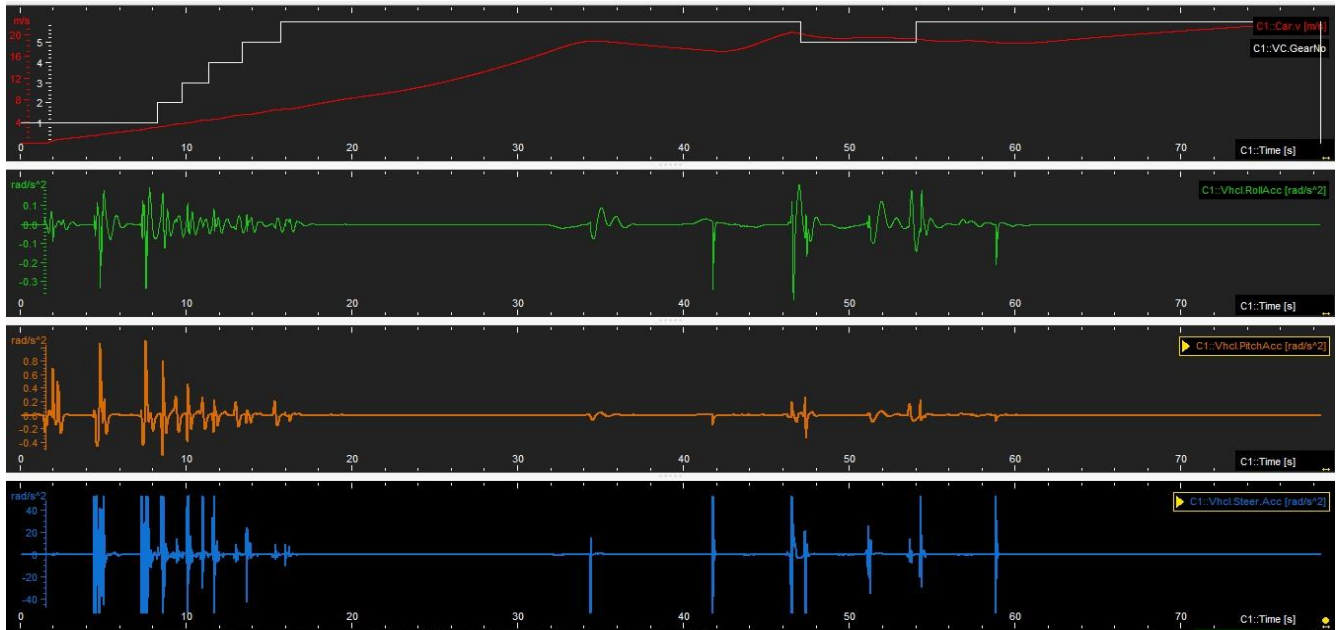


- CG3 Moving Toward Front Side:** The CG parameter is set to values which is 3.270/0.436/0.594 of x/y/z parameter



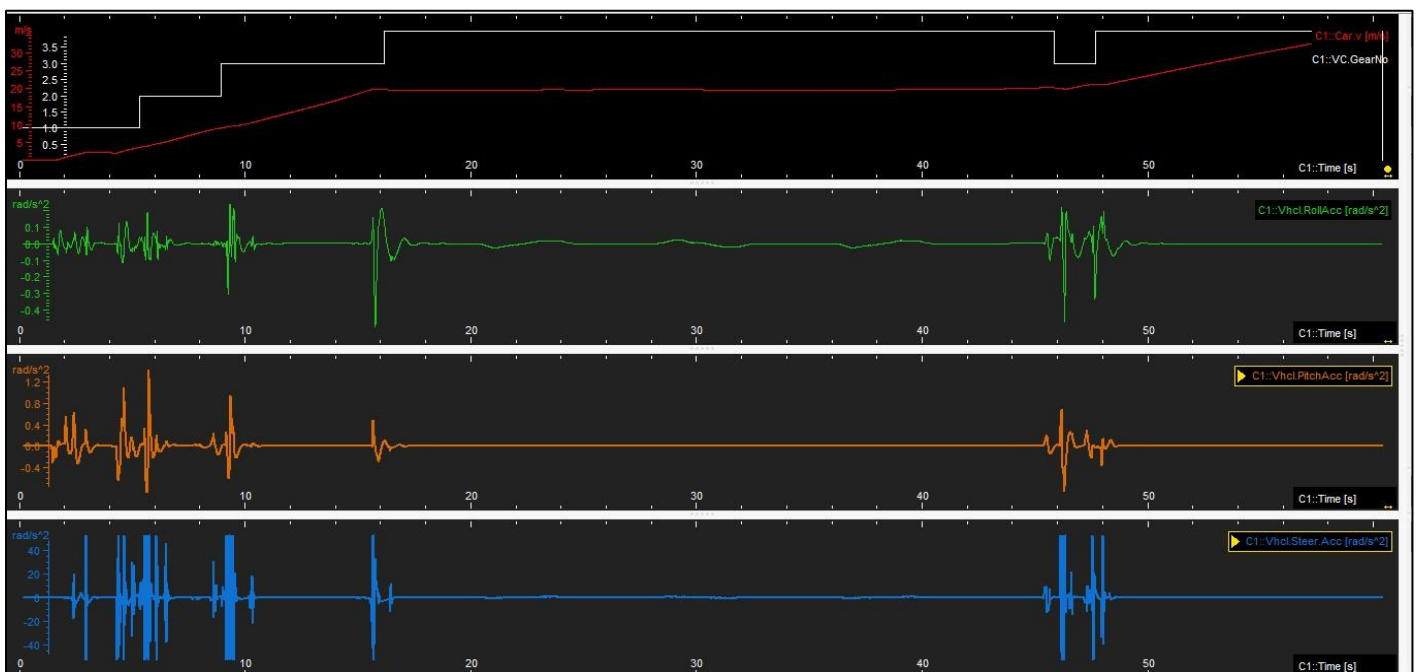
- G4 Moving Toward Rear Side:** The CG parameter is set to values which is 1.687/0.436/0.594 of x/y/z parameter





- G5 Moving Toward Rear Side:** The CG parameter is set to default values which is 2.035/0.436/0.594 of x/y/z parameter

Information to the entire vehicle				Close	
Vehicle overall mass [kg]	:	1250.00			
Vehicle overall center of gravity x / y / z [m]	:	2.035	0.436	0.549	
Vehicle overall inertia tensor [kgm ²]	:	545.670	19.224	10.766	
		19.224	1654.730	-19.595	
		10.766	-19.595	1891.466	



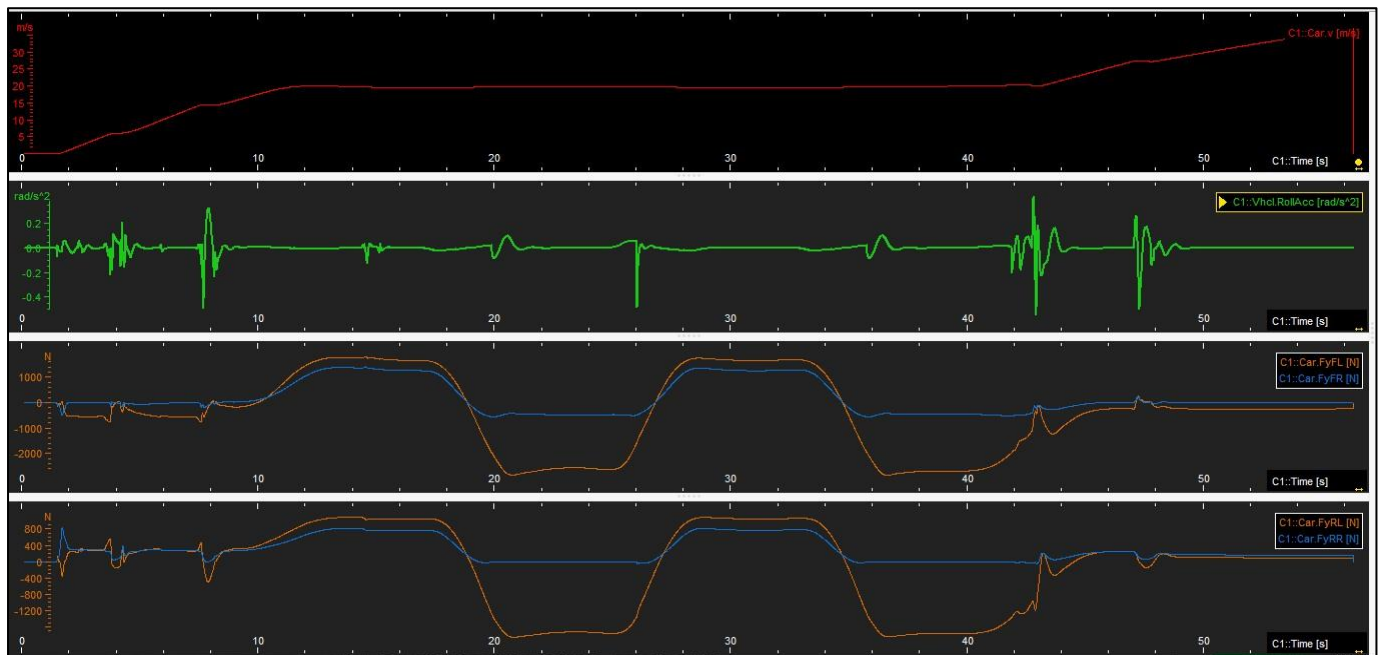
Inferences:

1. When the centre of gravity is shifted ahead of the default position in the car, especially during high-speed acceleration, the vehicle's stability is compromised. This leads to a significant increase in the pitch angle, often exceeding 80 degrees. Consequently, the vehicle risks flipping over from the front side due to the intense speed.
2. Shifting the centre of gravity behind the default position of the car affects its balance during high-speed turns. This alteration results in a sudden change in the car's yaw angle, prompting an unintended manoeuvre that can lead to a lane change without the driver's intention.
3. If the centre of gravity is shifted behind the car's centre, there is a noticeable rise in the vehicle's pitch angle right from the start. Consequently, the simulation process becomes suspended due to this anomalous behaviour.

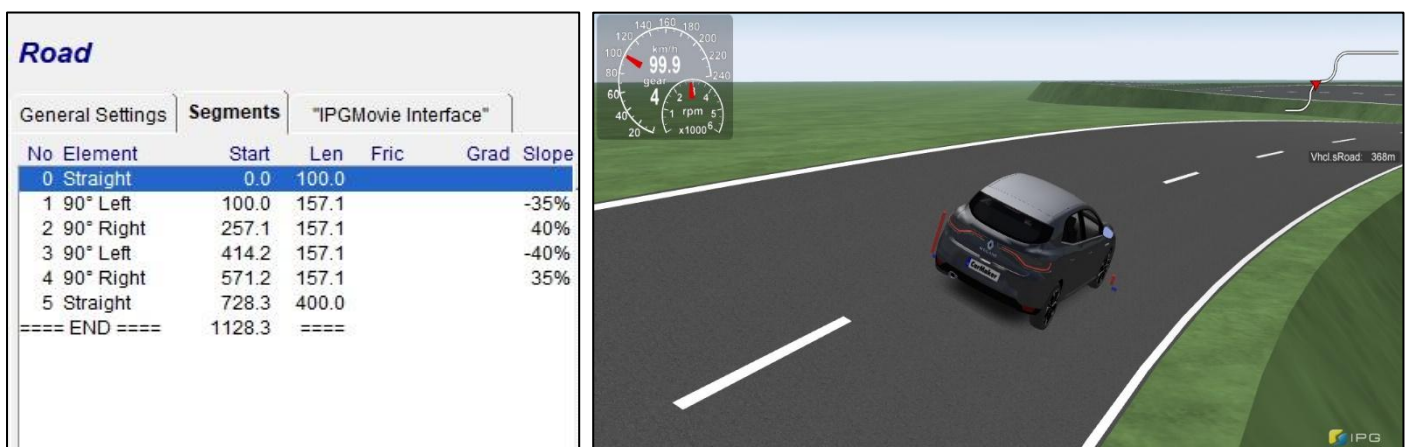
Task 2: To study the impact of banking on lateral forces.

Procedure:

- In this study the Demo_Renault_Megane from IPG CarMaker has been used to study the effect of slope elevation on the lateral dynamic forces of the vehicle
- Without Banking:** The following road parameter has been for the simulating the vehicle, here no slope elevation is given to the road scenario and the lateral force behaviour is measured.



- With Banking:** The following road parameter has been for the simulating the vehicle, here different slope elevation is given to the road scenario and the lateral force behaviour is measured.





Inferences:

- In Case 2, characterized by track banking, positive roll angles indicate that the vehicle leans inward, effectively counterbalancing the outward forces generated during turns.
- In contrast, Case 1 lacks track banking, leading to an absence of roll angles, signifying that the vehicle remains upright and experiences standard forces from the road surface.
- Positive lateral forces observed on both tires in Case 2 signify their active generation of forces to maintain traction and stability on the banked road surface. Conversely, in Case 1, lateral forces fluctuate as tires continuously adjust to maintain equilibrium on the flat road during small steering corrections.
- It serves as a valuable indicator of steering behaviour in both cases, offering insights into how the presence or absence of track banking influences the dynamics of vehicle movement and stability.