



# ACHIEVING EURO NCAP BEST-IN-CLASS CRASH SAFETY FOR THE NEXT GENERATION OF LIGHTWEIGHT URBAN ELECTRIC VEHICLE (BEHICLE)

**Presented by  
Michelle Tress**



ECTRI – FEHRL – FERSI  
Young Researchers Seminar 2015





# Agenda

**1** BEHICLE Project Background

**2** Paper Objectives

**3** Test Configurations

**4** Results and Discussion

**5** Conclusions



# BEHICLE: BEst in class veHICLE



## BEHICLE Project

### **Aim: Design a safe lightweight electric vehicle**

- Consumer performance and range expectations
- Lightweight
- Crashworthiness performance



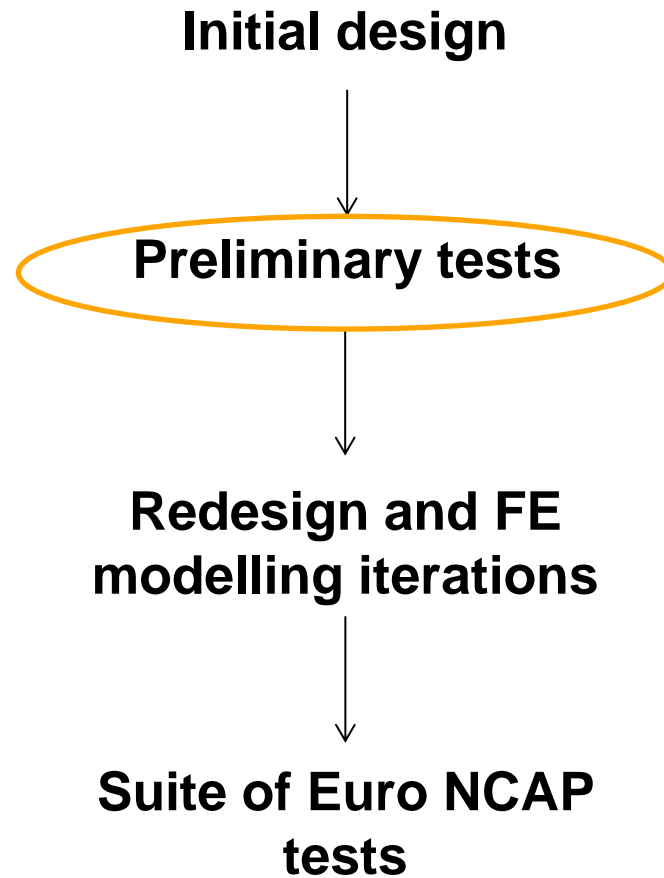


## About the BEHICLE

- One central front seat, two rear passenger seats
- Multi-material chassis
- Battery underneath passenger compartment
- Maximum weight target = 550kg



## Stages of the project





# OBJECTIVES OF THE STUDY

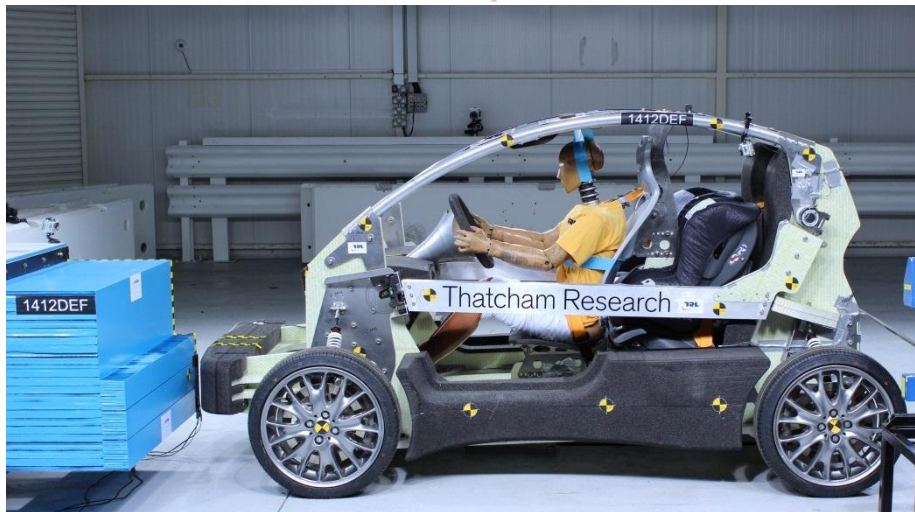
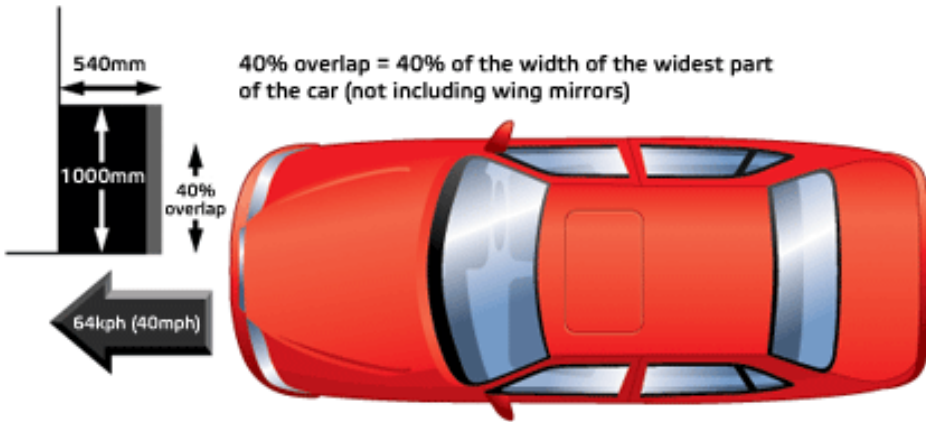


## Objectives

- Assess structural crashworthiness of the rolling chassis
- Carry out preliminary front and side crash tests
- Validate FE model
- Provide design recommendations



## Frontal Impact Test Description

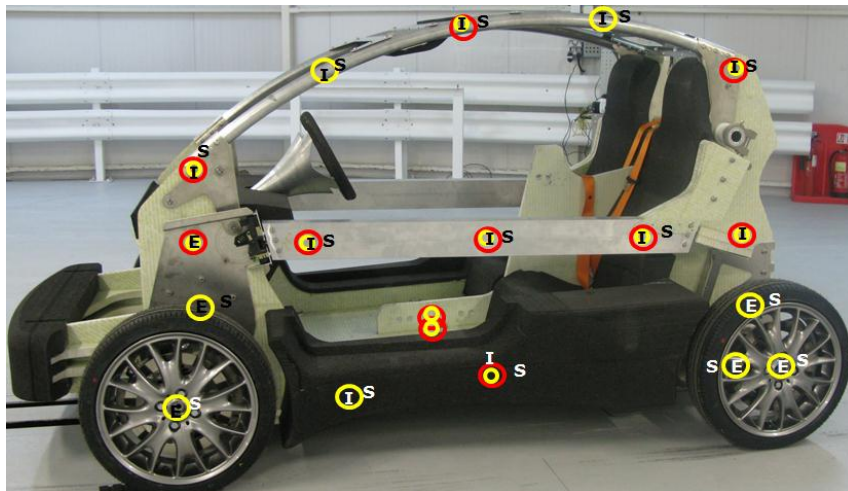
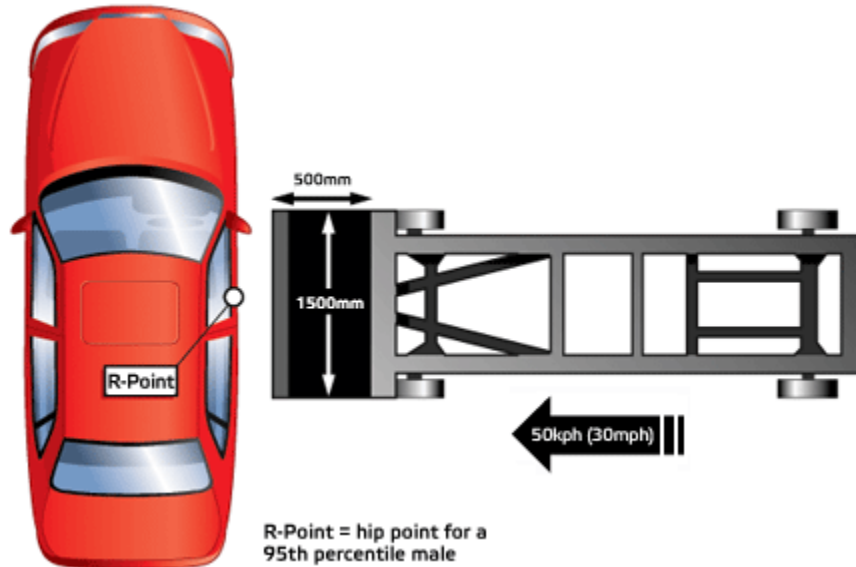


## Test Specification

- Euro NCAP frontal impact test setup
- Vehicle strikes a 40% offset deformable barrier at 64 km/h
- LHS chosen as struck side
- Makeweight dummy and CRS installed
- Simple restraint system



## Side Impact Test Description



## Test Specification

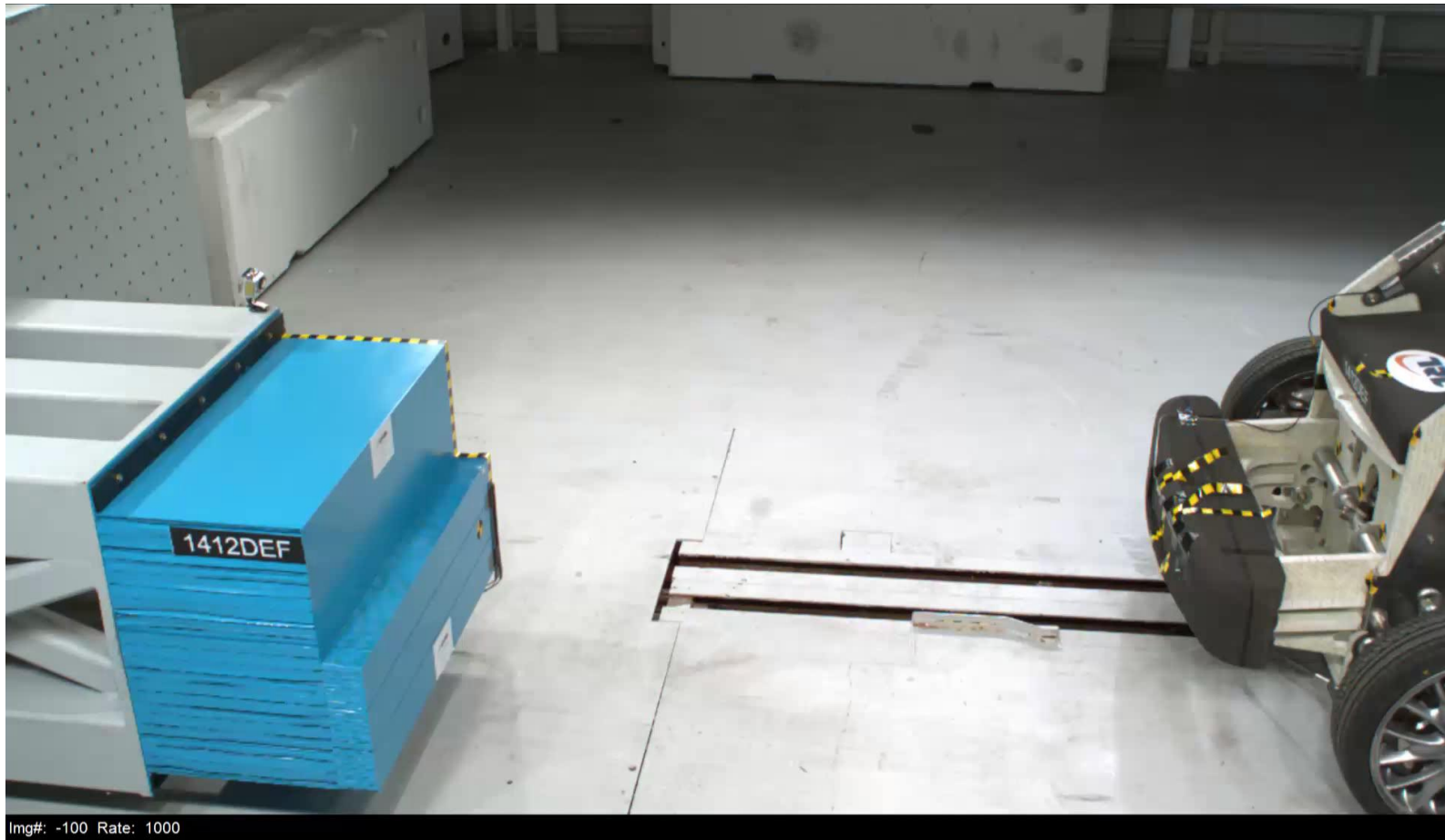
- Euro NCAP side impact test setup
- Left side of vehicle is struck
- 50 km/h moving deformable barrier
- Makeweight dummy and CRS installed
- Simple restraint system



# TEST VIDEOS



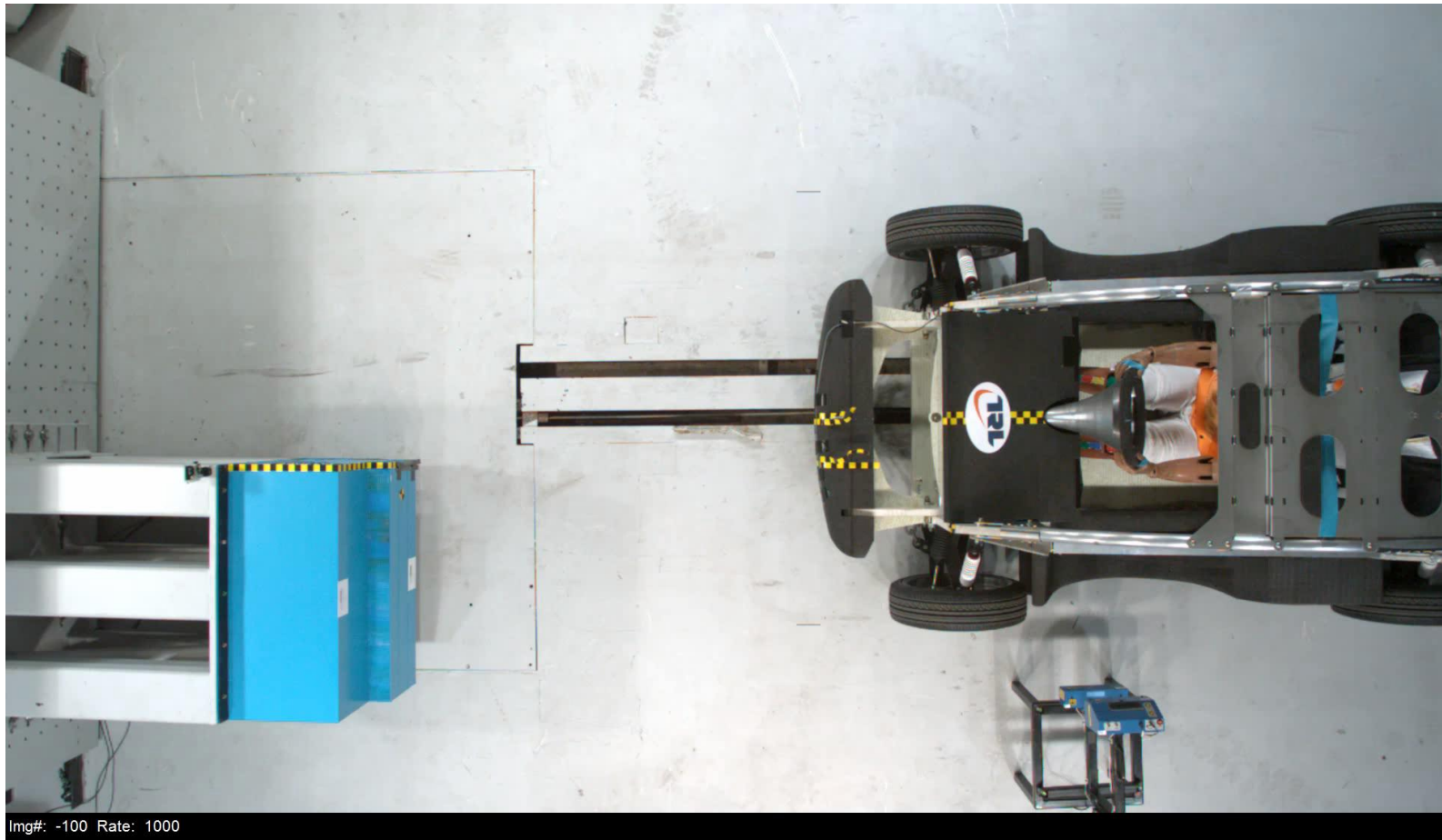
## Frontal Impact High Speed Video (side view)



Img#: -100 Rate: 1000



## Frontal Impact High Speed Video (top view)

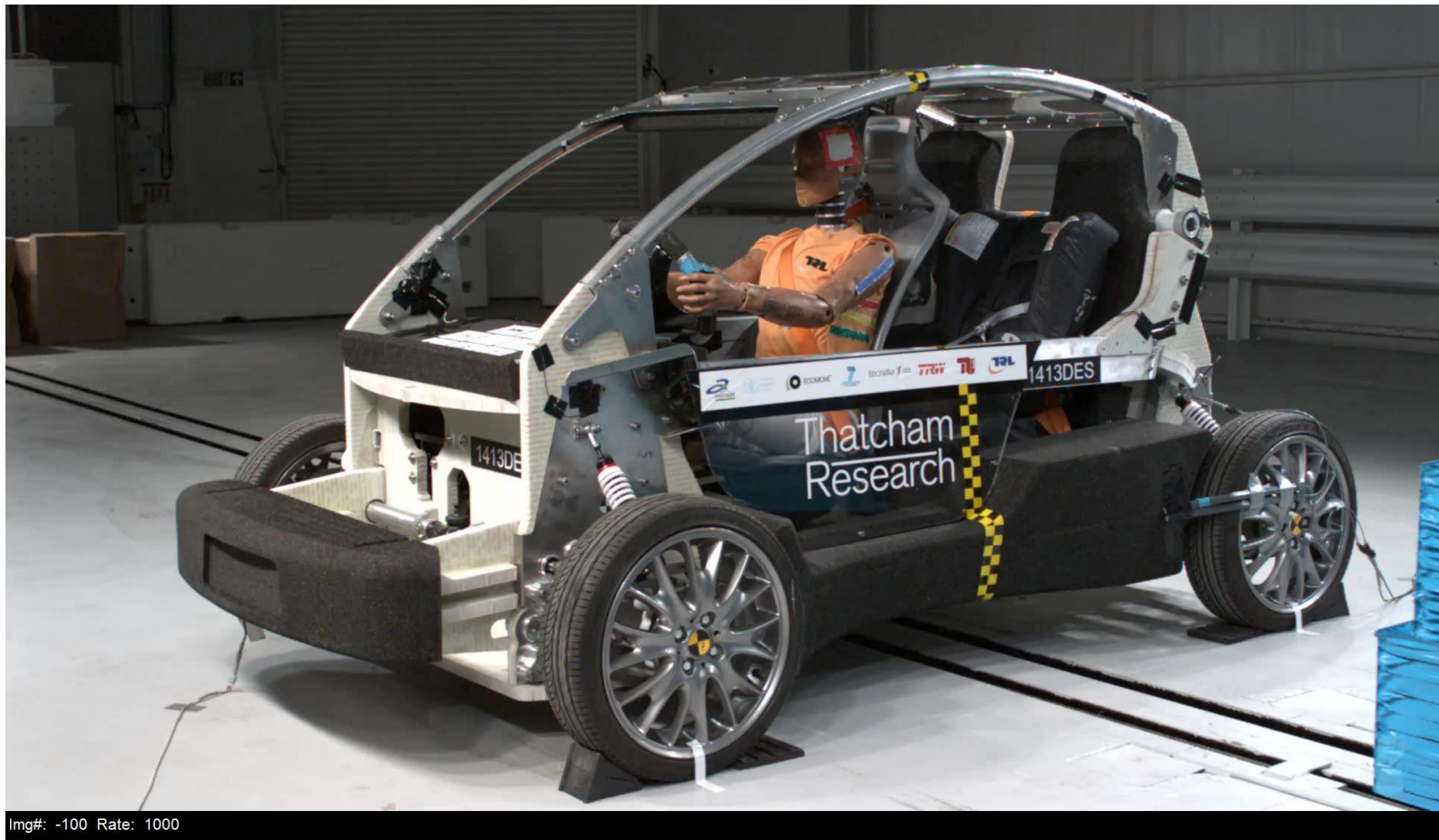


Img#: -100 Rate: 1000





## Side Impact High Speed Video (45 degree view)





## Side Impact High Speed Video (front view)



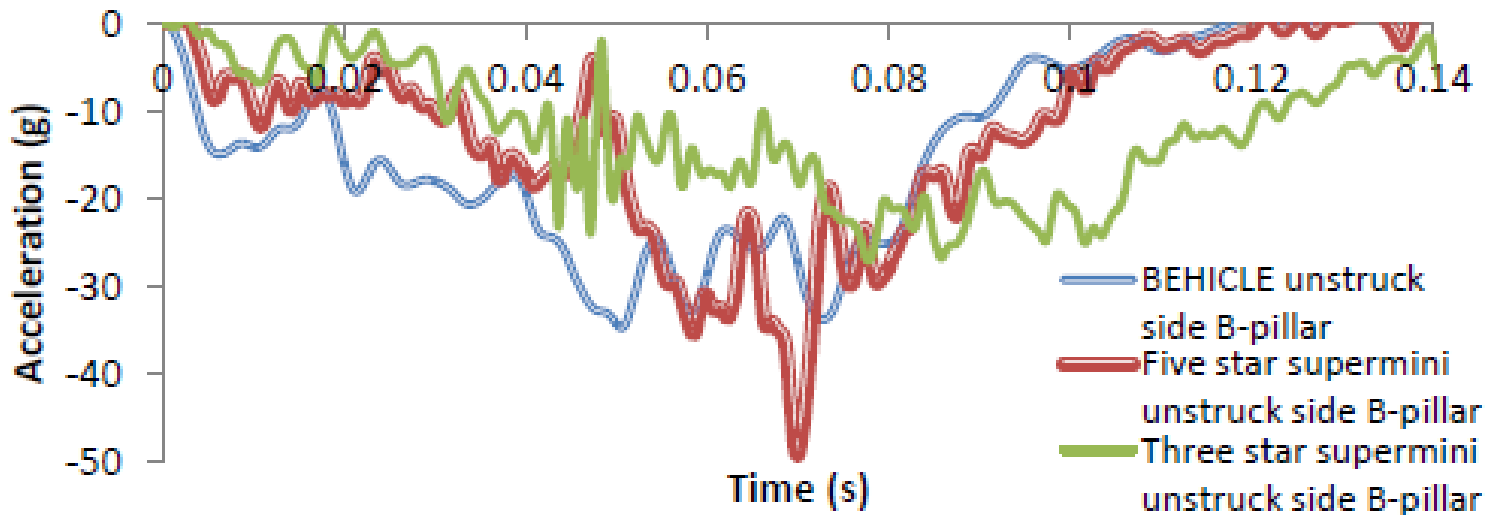
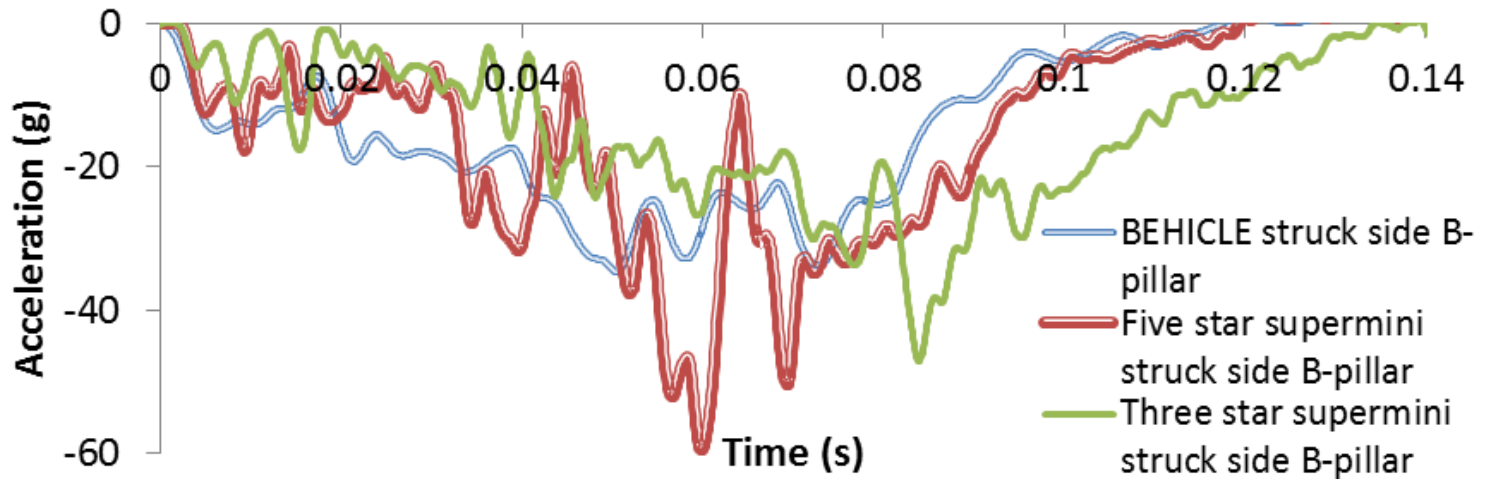


# RESULTS

**FRONTAL IMPACT**  
**SIDE IMPACT**



# Frontal Impact Pulse





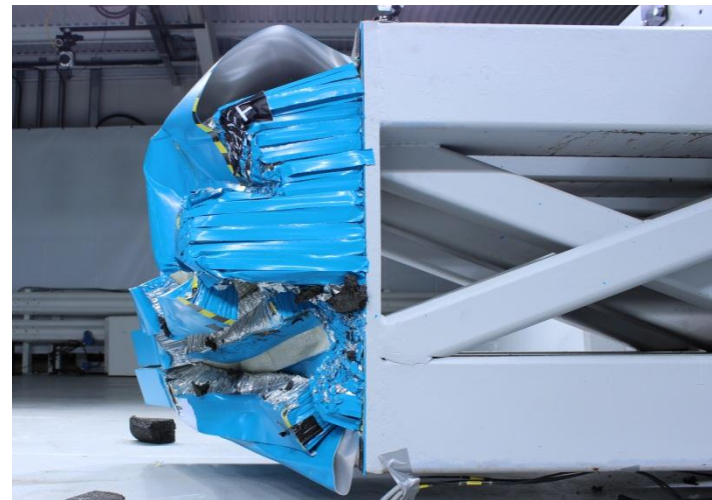
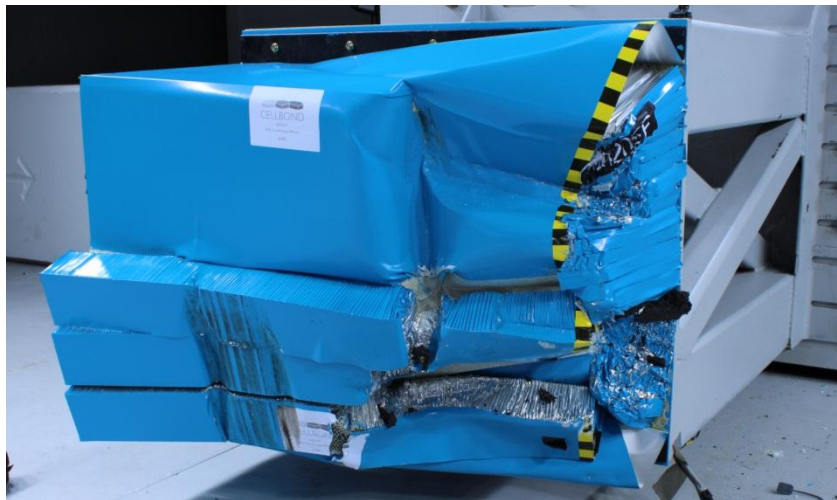
## Test Observations – Front Crash Structure



Z 29.8

### Observations

- Longitudinal structure deformed
- Material has recovered
- Strike caused barrier to bottom out
- Barrier absorbed ~ 31 kJ of 92 kJ crash energy

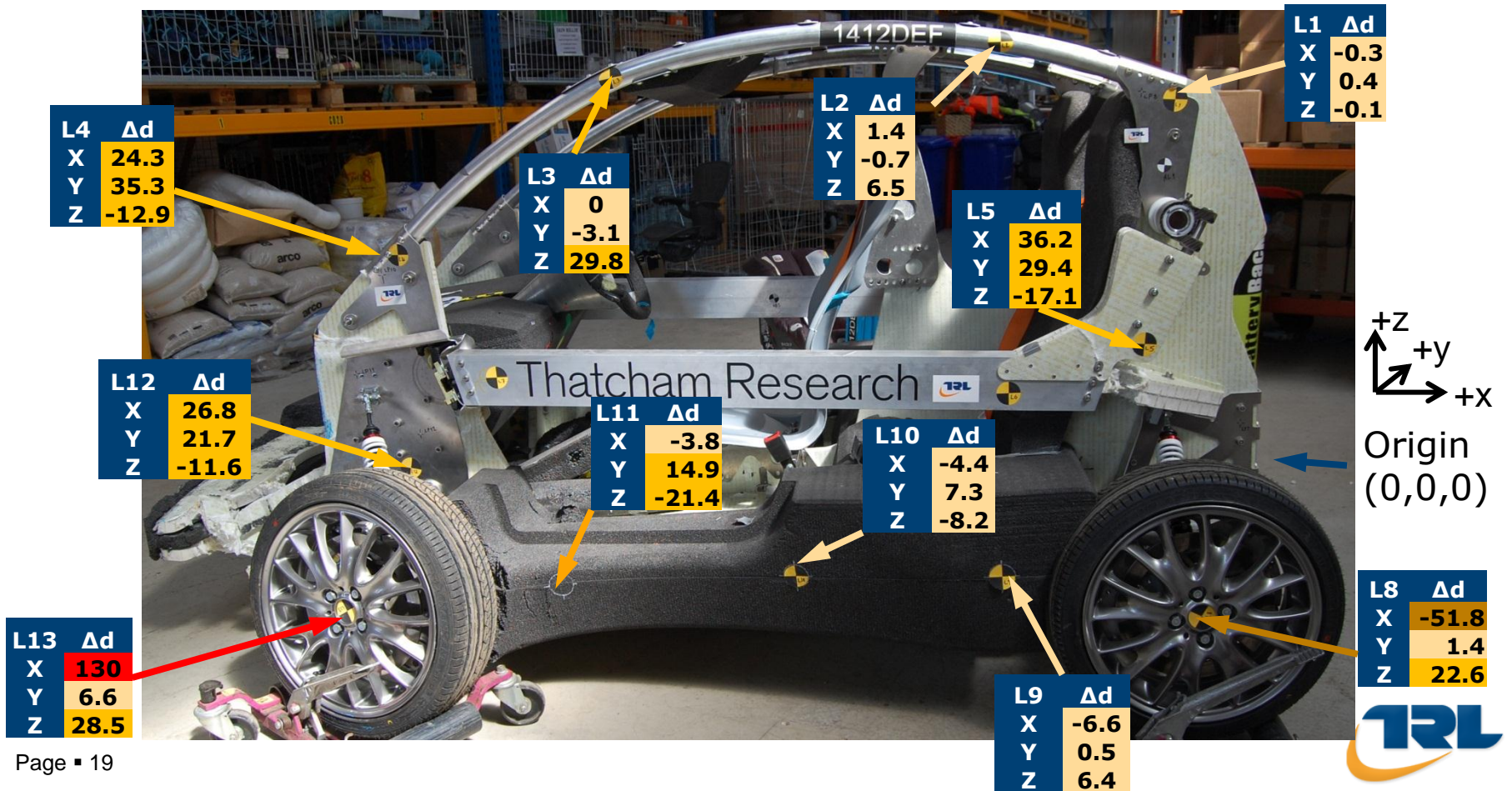




# Frontal impact Compartment Deformation

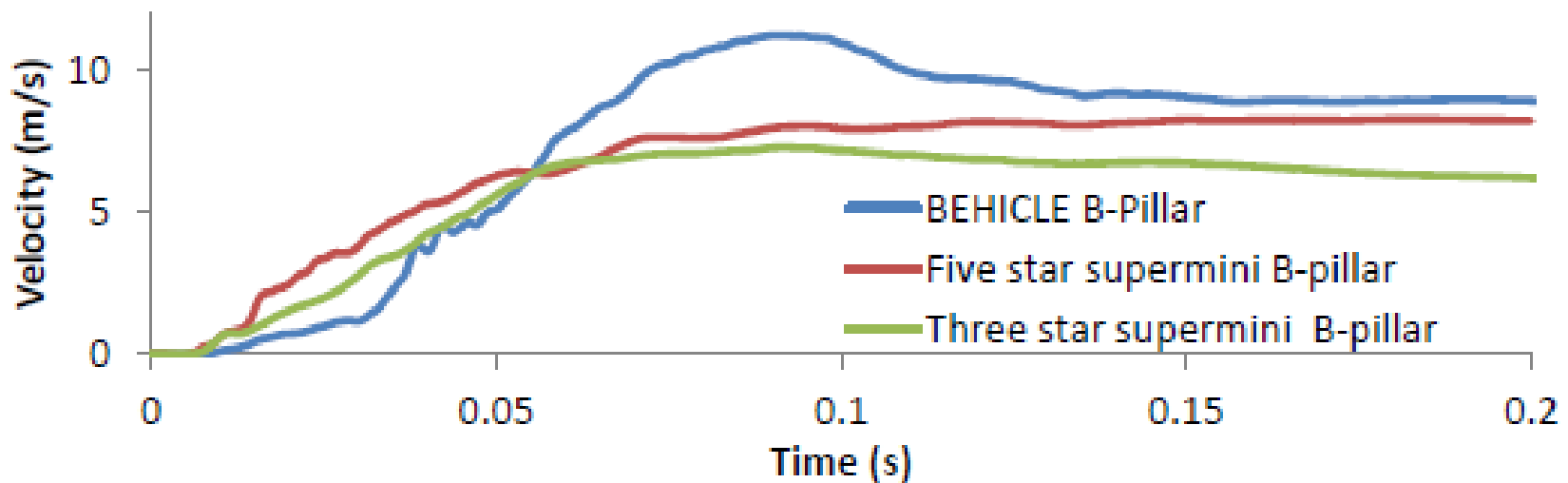
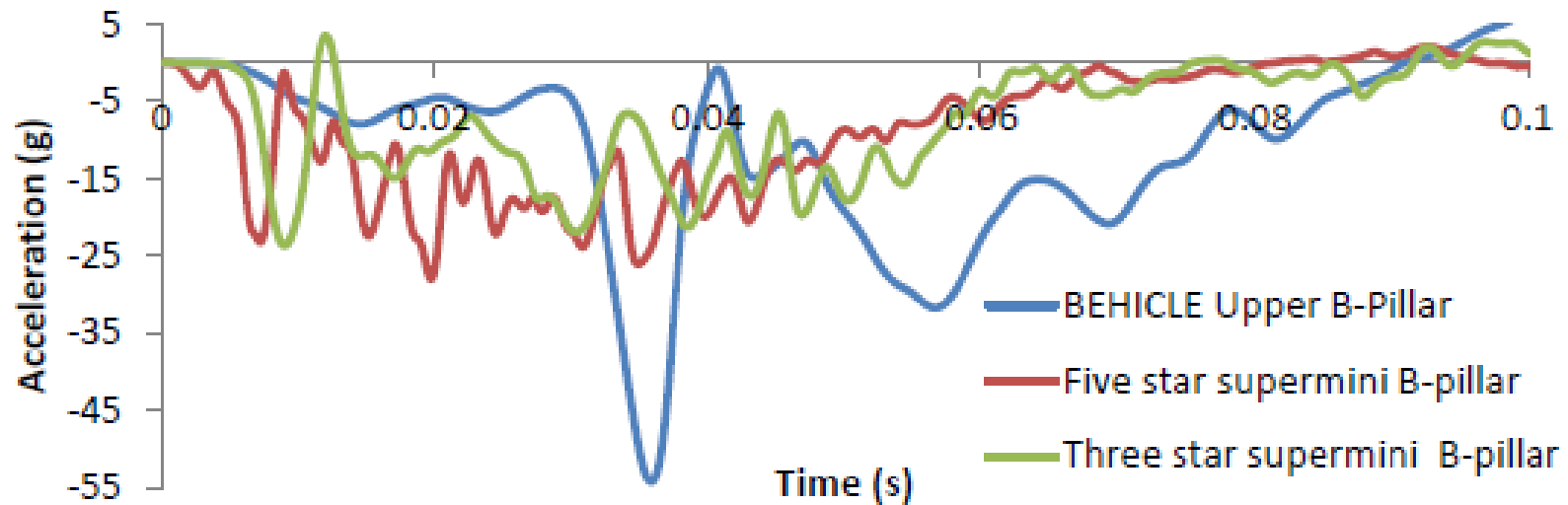
Severity	Low	Medium	High	Very High
Colour				

Note: Deformation measurements are in mm.



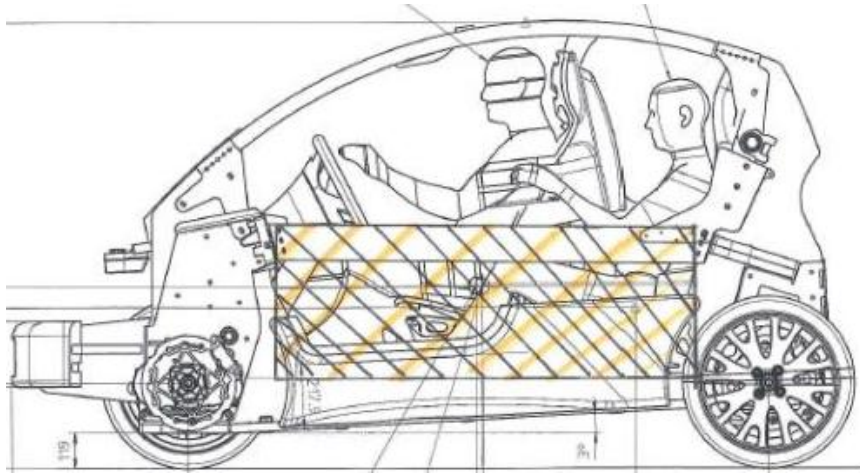


## Side Impact Pulse





## Test observations – side structure



### Observations

- Barrier transferred a lot of energy
- Good sill engagement
- High deformation of centre of door beam
- Large dynamic intrusion around CRS

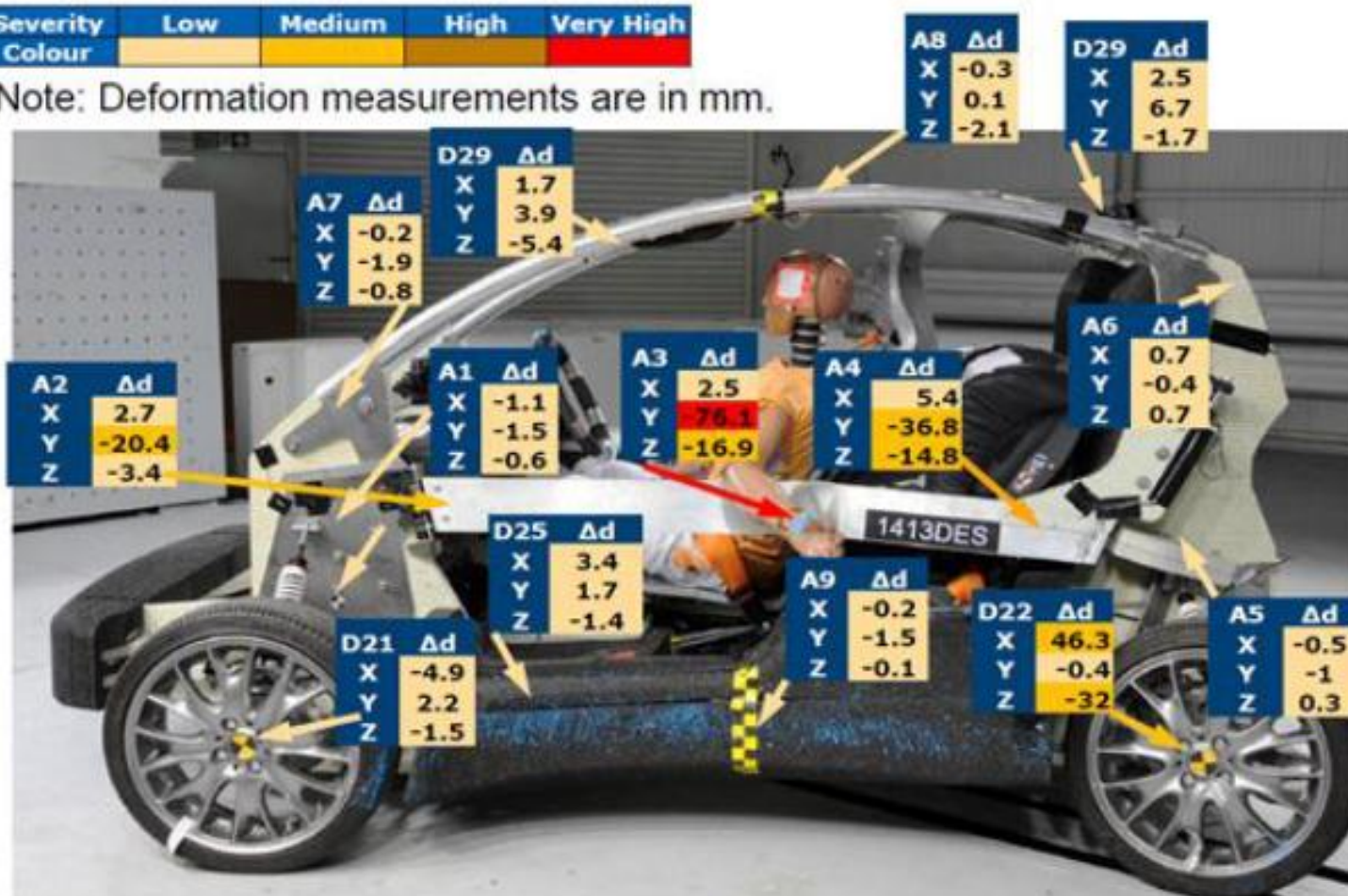




# Side impact compartment deformation

Severity	Low	Medium	High	Very High
Colour	Yellow	Orange	Red	Dark Red

Note: Deformation measurements are in mm.



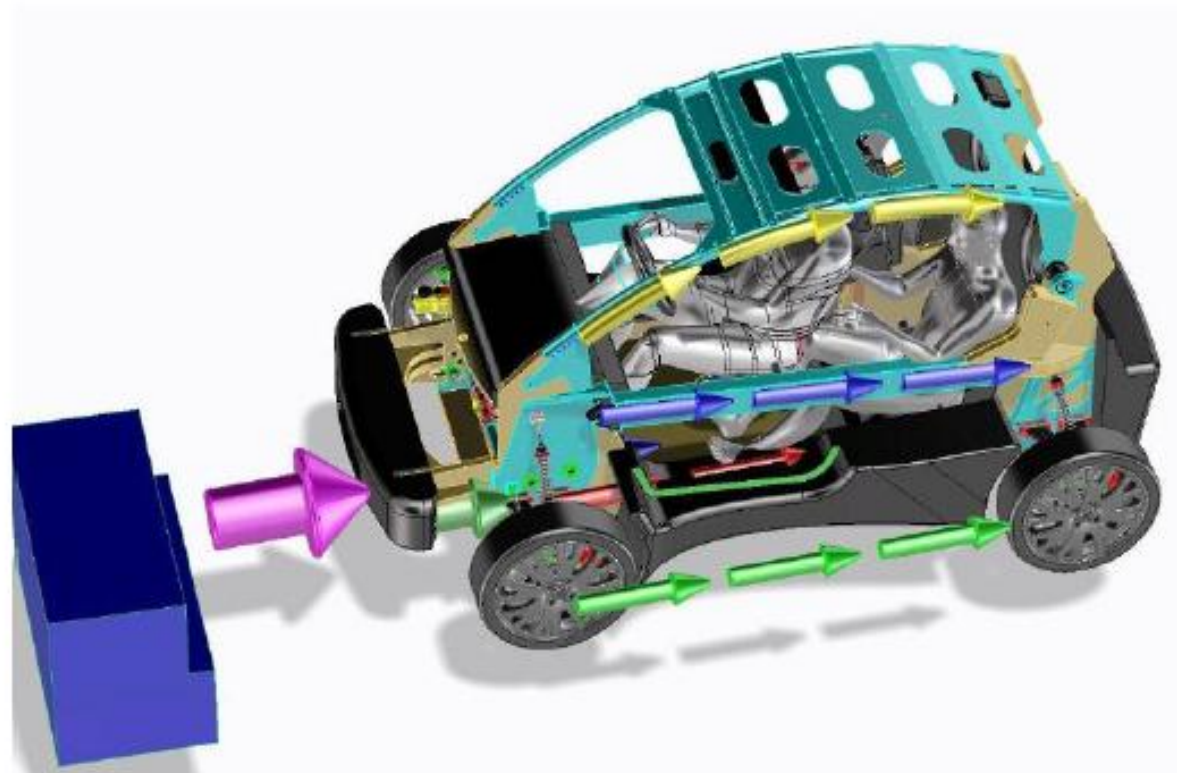


# RECOMMENDATIONS



## Recommendations for frontal impact

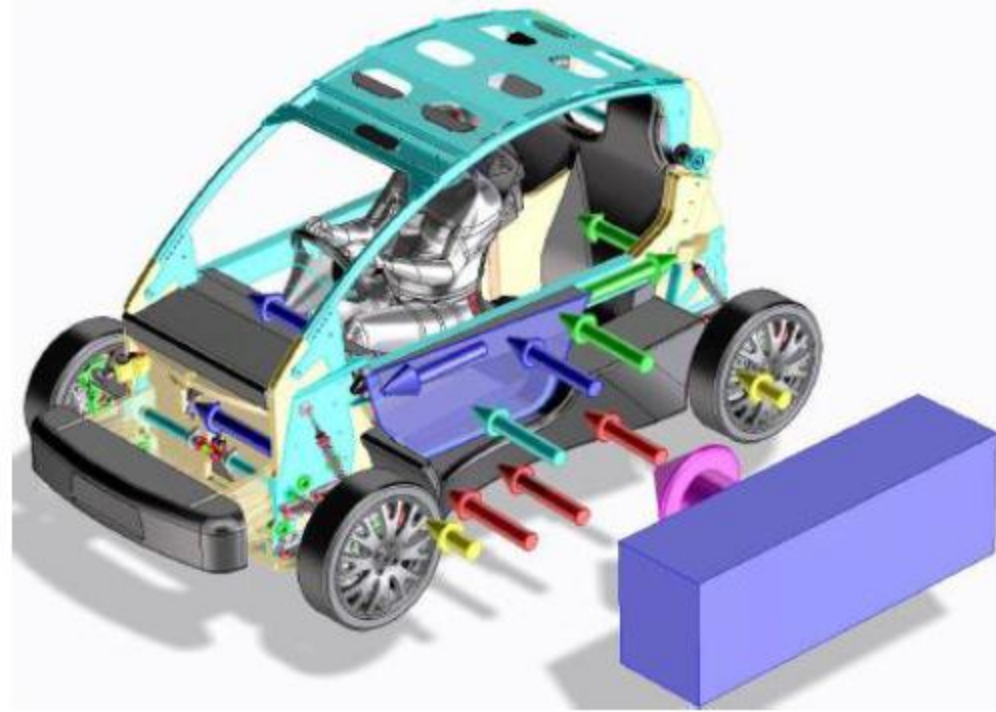
- Implement load paths to reduce compartment deformation
- Decrease stiffness of front crash structure
- Reinforce door latch mechanism





## Recommendations for side impact

- Implement load paths to reduce compartment deformation
- Fit additional energy absorbing structures
- Additional protection for CRS region





**Thank You**

**Do You  
Have Any  
Questions?**