Side Impact Car Crash

External Airbag

To Reduce Injury Severity Through B-Pillar Intrusion Reduction

Problem / Question

Car safety has increased in the last few decades. A significant challenge remains - Side and Angle Collisions. Collisions with T-bone car crash, it accounts for 44% of fatalities across 35% of multiple car accidents.

1. What is the best way of reducing fatalities & serious injuries in a T-bone car crash?
2. Can we apply airbag technology progress in creating External Airbag that reduces the risk of fatal & serious injury?
3. Can we prove that viability of external airbags using multiple simulations?

Background Research

- Accident statistics show that T-bone and angle collisions are one of the more dangerous kinds (44% (~60,000)) of all fatalities involving multiple cars across 35% of multiple car accidents.
- Fatality rates are down across factors - vehicle design, population, car population and licensed drivers (Chart 1).
- The external airbag is ineffective across both sedan and SUV at 20 mph and 40 mph. At 60 mph, the external airbag shows effectiveness across all vehicles.
- At 80 mph, the speed at which serious injury and higher is forecasted, there is a large reduction in B-pillar intrusions.
- SUV performance, both with and without external airbags, is better than Sedan performance at secondary collisions.

Engineering Goal

- Design a safety mechanism that can be added to cars to increase the safety of car occupants to society from side collision fatalities is $11.2 billion.
- Surviving the car occupants of rear-seat occupant protection in last twenty years.

Simulation Results

- Materials
  - Software for Simulation: BeamNG V0.27 & Blender
  - In beamNG, a 170 lb king size mattress was used as a stand-in for the external airbag.

Procedure

1. Following scenarios were simulated for 4 speeds: 20 mph, 40 mph, 60 mph and 80 mph.
   a. Standing sedan being hit by pickup truck
   b. Standing sedan being hit by pickup truck
   c. Standing SUV being hit by sedan
   d. Standing SUV being hit by pickup truck
   e. The simulations were run with and without an external airbag.
   f. In beamNG, a 170 lb king size mattress was used as a stand-in for the external airbag.
   g. I was able to measure the B-pillar collapse in all these scenarios, and mapped the outcome.

2. In beamNG, a 170 lb king size mattress was used as a stand-in for the external airbag.

3. In beamNG, a 170 lb king size mattress was used as a stand-in for the external airbag.

Simulation Results

- Chart: B-Pillar Intrusion Measurement

- Target: SUV
  - Moving Car: Sedan - B-Pillar Intrusion (in cm)
    - 20 MPH
    - 40 MPH
    - 60 MPH
    - 80 MPH

- Target: Sedan
  - Moving Car: SUV - B-Pillar Intrusion (in cm)
    - 20 MPH
    - 40 MPH
    - 60 MPH
    - 80 MPH

- Target: SUV
  - Moving Car: Pickup - B-Pillar Intrusion (in cm)
    - 20 MPH
    - 40 MPH
    - 60 MPH
    - 80 MPH

- Simulation Results

- Chart: Hit by Sedan

- Chart: Hit by SUV

- Chart: Hit by Pickup

Conclusion

- Sedan crashes have physics going against them. External Airbags can reduce severity of severe accidents and increase the chances of car occupant's survival.
- Putting the airbag in upper side rail aids develop after market solution for existing cars.
- Project validates safety concept. Future expansion in model development, simulation in LS-DYNA and simulating for simultaneous travelling vehicles.

Works Cited