Name_____ Period _____ Date _____

Car Crash STEM Sims

Lesson 3: How does crush zone stiffness affect a vehicle's crashworthiness?

Is a stiffer or softer frame better at protecting the occupants during a vehicle crash? That's the question engineers who design the crumple zone of vehicles must answer. Can you determine the crush zone frame stiffness that best protects a vehicle's occupants? Stiffen up your investigative skills and start this simulation.

Doing the Science

1. Start the Car Crash Simulation.
2. Select the red car on the right side of the screen.
3. Select the "Soft" crush zone stiffness.
4. Select the "Short" crush zone length.
5. Select the "Crash Center" button at the bottom of the screen.
6. Select the "40 MPH" speed, and then select the "Crash It" button.
7. Note and record in Table 1 the average acceleration and crash duration for the crash.
8. Select the "Analysis Center" button at the bottom of the screen.
9. Select the "Measure" button. Select the green round target, then select the next green round target to measure the crush zone deformation. Record this information in Table 2.
10. Repeat measuring the intrusion for the other two targets (yellow and red). Record this information in Table 2.
11. Select the "Medical Report" button. Record this information in Table 3.
12. Select the "Design Center" button at the bottom of the screen.
13. Repeat steps 3–12, except choose the "Medium" frame stiffness.
14. Repeat steps 3–11, except choose the "Stiff" frame stiffness.

Table 1. Acceleration and Crash Duration

Crush Zone Stiffness	Average Acceleration (g's)	Crash Duration (seconds)
Soft		
Medium		
Stiff		

Table 2. Crash Zone Intrusion

Crush Zone Stiffness	Frontend Deformation (green target in meters)	Footwell Intrusion (yellow target in meters)	Dashboard Intrusion (red target in meters)
Soft			
Medium			
Stiff			

Table 3. Possible Injuries

Crush Zone Stiffness	Frame Intrusion	Body Acceleration	Overall
Soft			
Medium			
Stiff			

Do You Understand?

1. How did the stiffness of the crush zone affect the average acceleration and crash duration times?

2. How did the stiffness of the crush zone affect the intrusion for various parts of the frame?

3. How did the stiffness of the crush zone affect the injuries experienced by crash occupants?

4. Based on your overall results, which crush zone stiffness tested provided the vehicle's occupants with the greatest protection during a crash? Provide an explanation for this additional safety.