Formula SAE 2008
Minnesota State University, Mankato
Car #68
Impact Attenuator Data Form

Materials Used: Owens Corning Foamular, 16 ga. Steel backing plate, Ballistics restraint straps.

Distance Forward of Front Bulkhead: 8”

Calculations:

Velocity = 23 ft/s
Acceleration due to gravity = 32.2 ft/s^2

Time to obtain speed of 23 fps $= \frac{V}{A} = \frac{23\ ft/s}{32.2\ ft/s^2} = 0.715$ seconds

Distance required to obtain 23 fps

$= V_0 \cdot T + \frac{1}{2} A \cdot T = (0 \cdot 0.715s) + \left(\frac{1}{2} 32.2\ ft/s^2 \cdot (0.715^2) \right) = 8.23$ feet = 8’4”

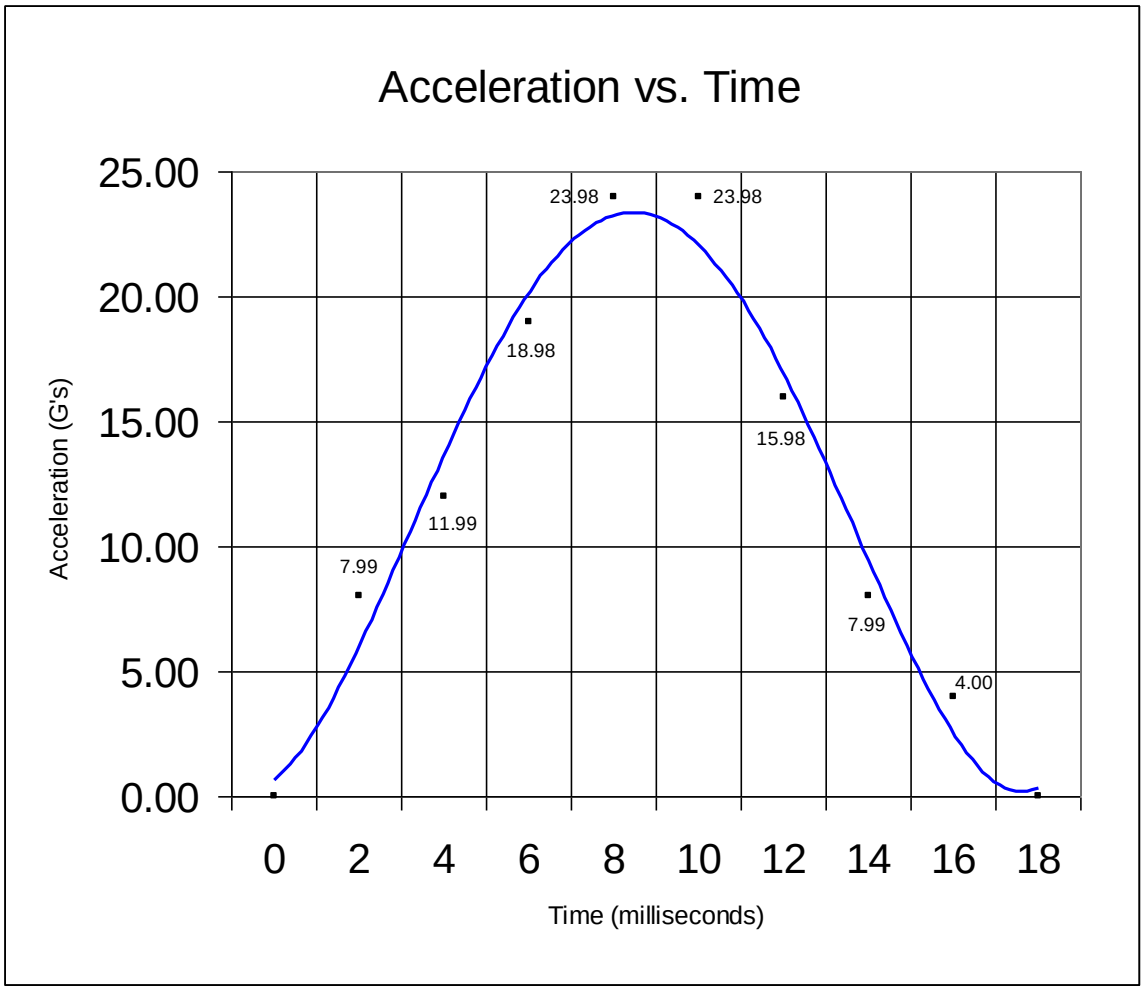
Vehicle momentum $= M \cdot V = 661 lbs \cdot 23\ ft/s = 15203\ lb \cdot ft/s$

Scaled momentum $= 66 lbs \cdot 23\ ft/s = 1518\ lb \cdot ft/s$

Scaled impact attenuator volume = L x W x H =5” x 5” x 2” = 50 in^3

Procedure:

The scaled weight of 66 lbs was dropped from a height of 8 feet 4 inches to obtain the velocity of 23 feet per second onto the scale sized impact attenuator. Using an accelerometer connected to an oscilloscope the deceleration of the weight was recorded. From the wave produced by the scope, a series of data points were generated and inserted in Microsoft Excel. The output voltages were converted into g-forces based on the conversion given by the accelerometer’s manufacturer. The average g-forces were then calculated, and the average deceleration was found to be 463.7 ft/s^2 or 14.4 g’s.



Conclusion:

Increasing the size of the volume of the impacted foam by a factor of 10 will consequently allow it to decelerate an object with a weight of 661 lbs traveling at a speed of 23 fps 5 g's at 14.4 g's, well below the required average of 20g's. The foam portion of the attenuator has a volume of 500 cubic inches and is attached by 2 ballistic mesh straps held onto the front bulkhead by four grade 8 5/16" bolts. The backing plate attached to the front bulkhead is 16 ga. mild steel.

Photographs: