2020 Impact Attenuator Data Report

This form must be completed and submitted by **all teams no later than the date specified in the Action Deadlines on Formula Imperial**. The Formula Imperial Technical Committee will review all submissions which deviate from the Formula Hybrid® rules and reply with a decision about the requested deviation. All requests will have a confirmation of receipt sent to the team. Impact Attenuator Data (IAD) and supporting calculations must be submitted electronically in Adobe Acrobat Format (*.pdf). The submissions must be named as follows: schoolname_IAD.pdf using the complete school name. **Submit the IAD report as instructed on the event website.**

*In the event that the Formula Imperial Technical Committee requests additional information or calculations, teams have **one week from the date of the request** to submit the requested information or ask for a deadline extension.

University Name: VELLORE INSTITUTE OF TECHNOLOGY Car Number: H-690
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Faculty Advisor: BASKAR P E-mail Address: pbaskar@vit.ac.in

Material(s) Used	Aluminium Honeycomb	
Description of form/shape	5052 3-3/16”-200mm x 200mm x 100mm	
IA to Anti-Intrusion Plate mounting method	LOCTITE- E-120 HP Hysol Epoxy Adhesive	
Anti-Intrusion Plate to Front Bulkhead mounting method	4x8 mm Grade 8.8 bolts	
Peak deceleration (<= 40 g's)	22.72 g’s.	
Average deceleration (<= 20 g's)	16.18 g’s.	
Vehicle Mass	Amount = 300 kg	ESTIMATED

Confirm that the attenuator contains the minimum volume 200mm wide x 100mm high x 200mm long YES

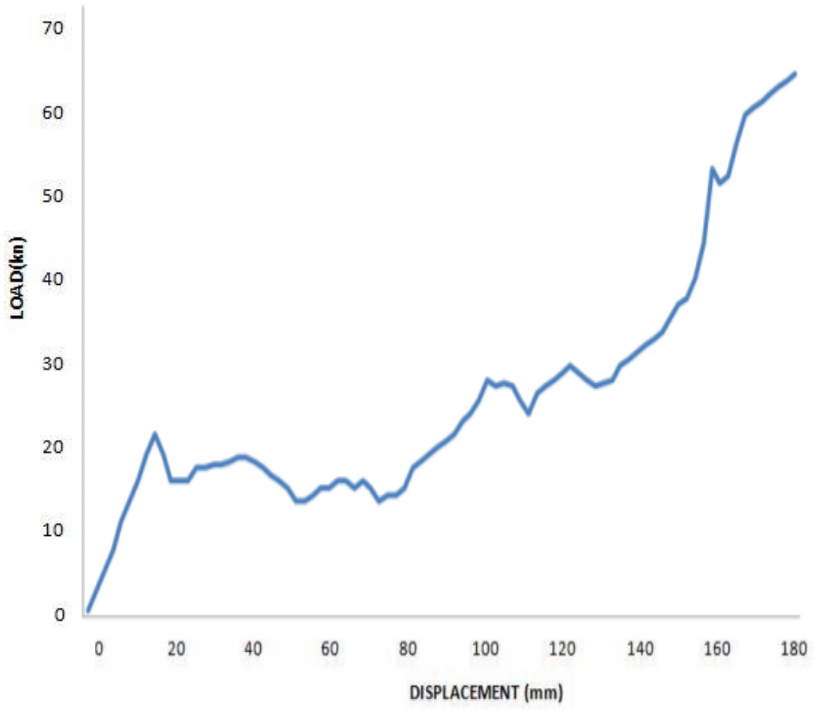

Figure 1: Force-Displacement Curve (dynamic tests must show displacement during collision and after the point v=0)

2020 Impact Attenuator Data Report

TECHNICAL COMMITTEE DECISION/COMMENTS

_____

Approved by_____ Date_____

NOTE: THIS FORM AND THE APPROVED COPY OF THE SUBMISSION MUST BE PRESENTED AT TECHNICAL INSPECTION

University Name: VELLORE INSTITUTE OF TECHNOLOGY Car Number:H-690

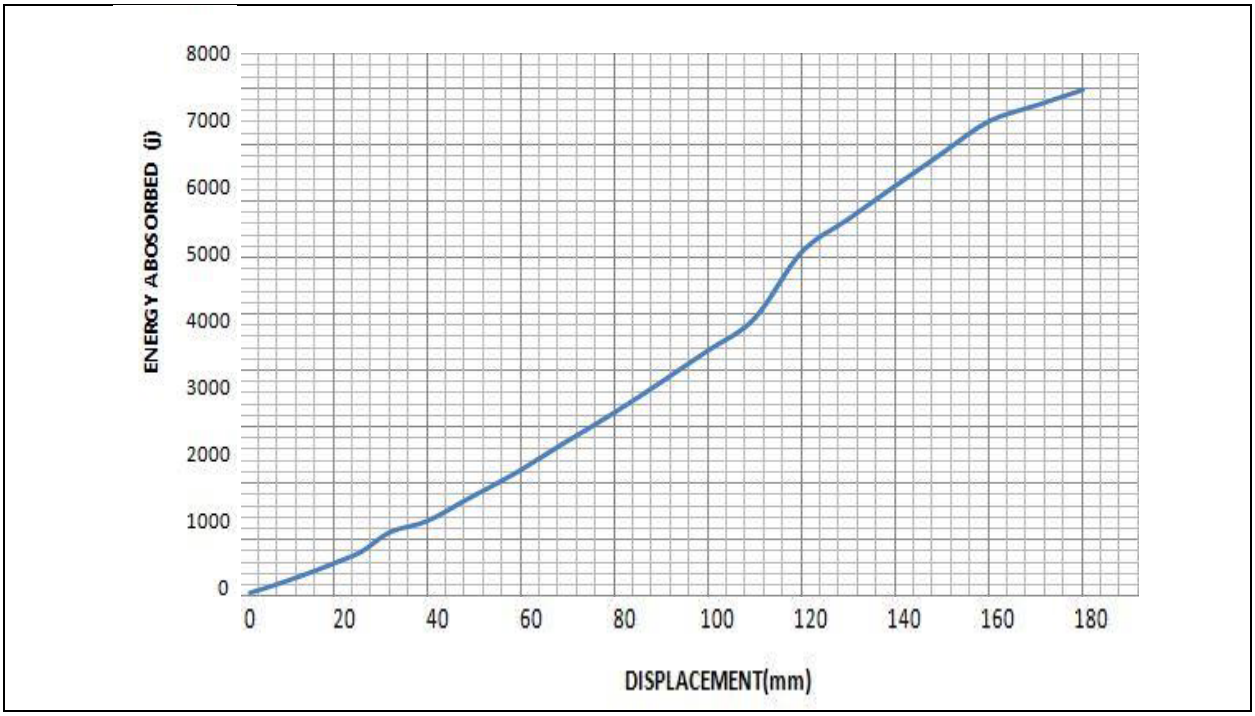

Figure 2: Energy-Displacement Curve (dynamic tests must show displacement during collision and after v=0)

2020 Impact Attenuator Data Report

Figure 3: Attenuator as Constructed

Figure 4: Attenuator after Impact

Energy Absorbed (J):	7350 J	Vehicle includes front wing in front of front bulkhead?	No
IA Max. Crushed Displacement (mm):	180 mm	Wing structure included in test?	No
IA Post Crush Displacement - demonstrating any return (mm):	30 mm	Test Type: (e.g. barrier test, drop test, quasi-static crush)	Quasi static crush testing
Anti-Intrusion Plate Deformation (mm)	14mm	Test Site: (must be from approved test site list on website for dynamic tests)	VELLORE INSTITUTE OF TECHNOLOGY(STRENGTH OF MATERIALS)

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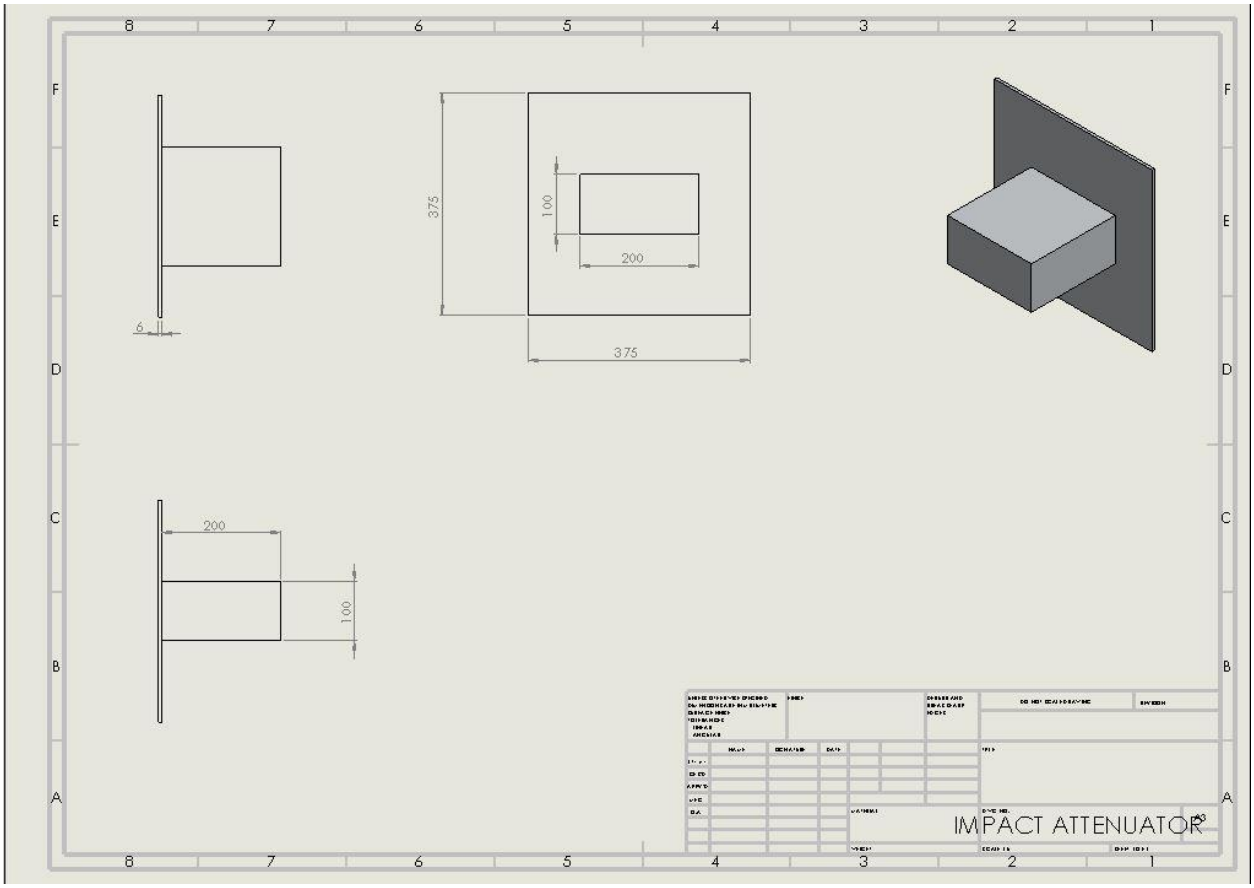
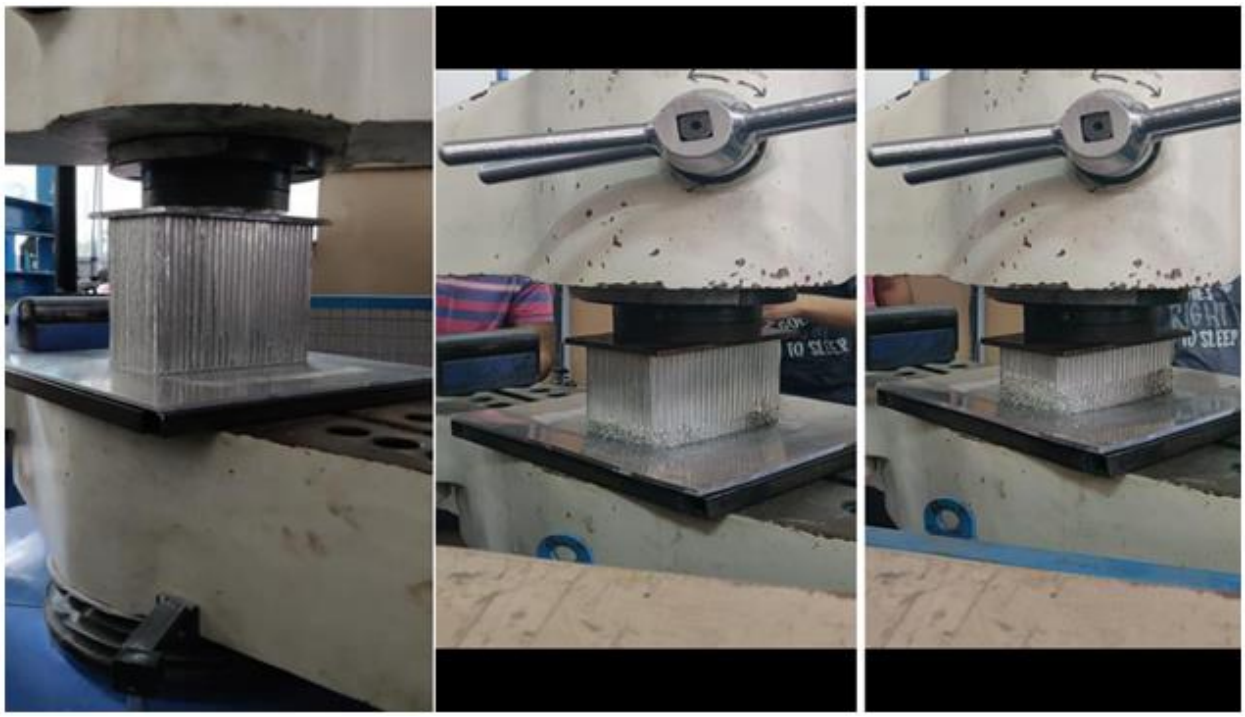


Length (fore/aft direction): 200 mm (>=200mm)
Width (lateral direction): 200 mm (>=200mm)
Height (vertical direction): 100 mm (>=100mm)
Attenuator is at least 200mm wide by 100mm high for at least 200mm: Yes

Additional information below this point and/or on additional sheets



Pictures before, during and after crush test

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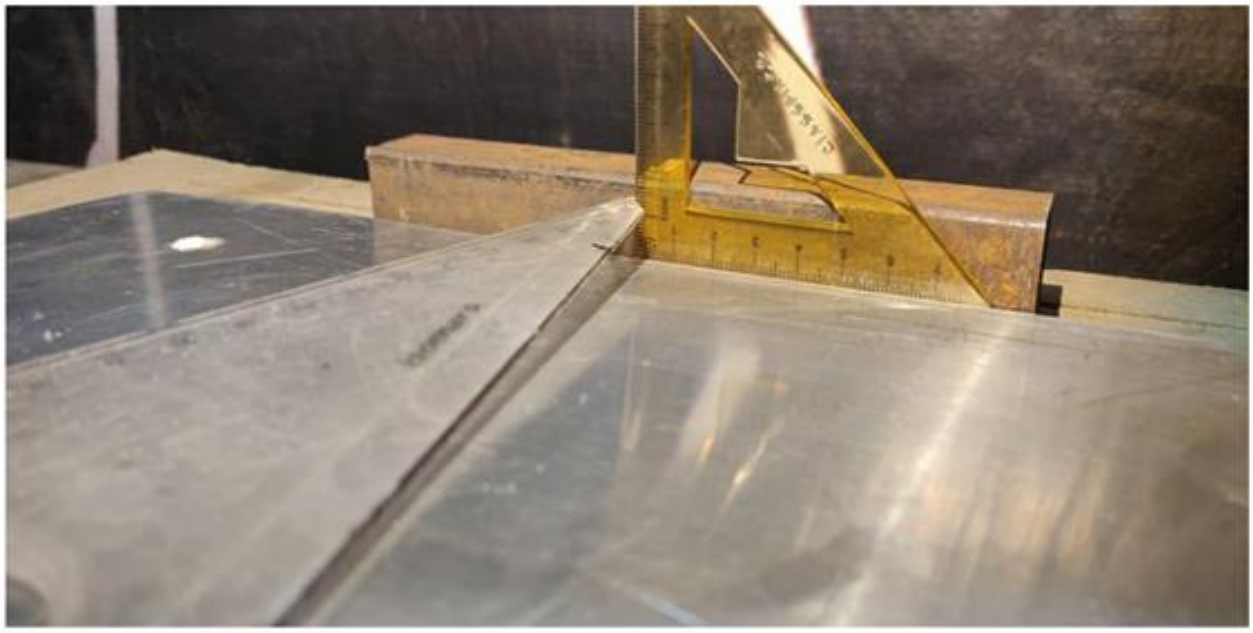

MEASURING THE DEFLECTION IN ANTI ITRUSION PLATE

DESIGN SELECTION:

As per the layout given by our power train department there was a increment in wheel base with respect to our last year's car. The change led to an increase in weight of the chassis. Weight increased due to change in choice of the motor controller this year. The battery pack mounts were redesigned which also increased the weight of the car. We had to take all measures to keep the car as light weight as possible thus aluminum core honeycomb impact attenuator was used. It helps in reducing the weight and also satisfies the criteria of impact attenuator if in case the car goes above 300kgs.

- Calculations Per T3.21.2

  Mass of the car – 300 kg (661.387 lbs)
  As per T3.21.3 vehicle mass is rounded up to 800 lbs (363 kg)
  1. Calculations of total vehicle energy prior to impact.

  Initial Conditions:

$$V\ impact = 7m/s$$
$$V\ Final = 0m/s$$
$$G = 9.8m/s2$$
$$M = 300kg$$
$$Acceleration = 20*G = 196m/s2$$

  Kinetic Energy:

$$Ke = 1/2*M*V\ impact\text{^}2 = 1/2 \text{ x } 300 \text{ x } (7)\text{^}2$$
$$= 7350\ (kg*m2/s2)$$
$$= 7350\ J$$

By Conservation of Energy, Kinetic Energy is equal to potential energy

$$Ke = P\ e$$

2. Calculations of total energy absorbed and how this value was determined.

Total energy absorbed is given by the area under load vs displacement graph **(Figure 2).**

3. Calculations of average and peak acceleration and how these values were determined.

- **Peak Deceleration:**
  Here, Load= load_peak
  load_peak = 66.870 kN
  Load = mass*acceleration
  Acceleration = Load / mass
  = 66.870 (KN) / 300kg
  = 222.9 /9.81
  = 22.72 g's.
- **Average Deceleration:**
  Here, Load= load_average
  load_average = 47.630 KN (calculated)
  Load= mass*acceleration
  Acceleration = Load / mass
  = 47630 (N) / 300 kg
  = 158.76 /9.81
  = 16.18 g's.