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DESIGN AND OPTIMIZATION OF IMPACT ATTENUATOR

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Abstract

This document draws on the examination of researchers' work in the area of architecture and impact mitigation analysis to explain the behavior of vehicle impact crushing. The geometric structure and material chosen for the impact attenuator by researchers is first outlined briefly, and the FEA analysis and experimental testing methods are listed below. Test, simulated test, and comparison of the experimental and simulation experiments shall be divided into three groups.

Keywords: *FEA, Lightweight material, Impact Attenuator, Vehicle.*

I. INTRODUCTION

The impact attenuator is a key feature of the vehicle and is the race car's most essential device as it serves as a shield of protection between the driver and the affected area. The impact attenuator is designed for even deformation to withstand the kinetic energy of the vehicle and retains a sufficiently low degree of force. The driver can be injured if the deformation is uneven by G's spikes. The absorptive energy usually happens by substantial longitudinal stress and crumbling. In case of off-center and off-axis impacts, the impact attenuator gives a charge route for cross and vertical loads. The distinctive feature of the impact attenuator is that the energy dissipation rate is concentrated in a small zone and that the system is recognised by a static body movement. Lightweight materials can help to increase the vehicle acceleration and fuel saving efficiency by designing the impact attenuators. Impact attenuators commonly include titanium, waveburn, nomex, carbon fibre, Kevlar or Aluminium foil as they give the driver optimal safety[1].
A wreck, crash, cowboy or cowboy cushion is an impact attenuator that eliminates the damage caused to buildings, cars and drivers by motor vehicle accident. Impact attenuators may often be

designed to remove the car from risk or to remove it from road equipment and staff. Impact attenuators are typically placed around fixed facilities on near highway roads like gore points, accident barrier introduction, and overpass supports. Impact attenuators are designed to withstand kinetic energy. For road building projects, provisional models can be used.
Impact attenuator are designed to consume the kinetical energy of the colliding vehicle to safely stop the vehicle. If a car that hits a solid obstacle on the roadside has no effect attenuator, it may stop abruptly. An internal human will instantly collision with the vehicle's interior and the inner organs of the person will crash with their chest wall, leading to significant inner injury and death. The impact attenuator helps avoid such accidents by efficiently dissipating the kinetic energy of the vehicle[2].
The system used to dissipate kinetic energy will define impact attenuators:

i. Shift momentum. Many models used consecutive lines of barrels or modules loaded with sand or water. Sand or water is moved, reducing the vehicle's impact speed.
ii. Deformation stuff. Many new attenuators use crushable materials (such as several forms of foam) to provide a crumpled region that absorbs energy. Others flatten a railway corrugated steel guard or cut a beam in a steel box.
iii. Rubbish. Any attenuators act by pressing a steel cable or strapping into a tube or angle slot to turn cinematic energy into heat.

On the chassis' bulkhead the impact attenuator is mounted[3]. The design of lightweight materials to reduce the effect can help to increase the acceleration and fuel saving of the car. Impact attenuators commonly include titanium, waveburn, nomex, carbon fibre, kevlar or aluminium foil as they give the driver optimal safety. There are different forms of structure of impact attenuator. Organized tube and plate form, truncated trapezoid shaped and structured sandwich. Motorsports are all about speed, but also at the cost of driver safety. This research concerns the concept, development and test of an impact attenuator on the front of the vehicle. In Formula One there have been some fatal accidents. The FIA group has also laid down certain rules for all driver safety teams. Measures to shield the driver during a rollover, side impact and frontal effect is introduced.

In the course of the period, technical innovations have emerged in the automobile industry. One is the idea of fast cars one of them. The higher the speed of the vehicle, the safer the driver would have. In this case, the student formula is defined as requiring that the impact attenuator is used by each team for the driver's protection. Impact mitigation may be said as artefacts that can tolerate the collision blow to preserve the effect Stable cab. The method of attenuating the effect in addition to the ability to consume electricity, but also as an attenuator for the effects, fast production and easy obtaining of essential material. The shape of a rectangular prism, a steel truncated pyramid, and cubes also alter the effect attenuator. Examples of effect reducing shapes of a labyrinth consuming day and even a basic procedure based on the substance picked by a truncated pyramid.

If you click to spread out the load from the front for the chosen impact attenuator, the form of a truncated pyramid. A truncated pyramid is the shape chosen for the crash scenario. This type is an axial loading goal[4].

II. LITERATURE REVIEW

The impact attenuator is a key feature of the vehicle and is the race car's most essential device as it serves as a shield of protection between the driver and the affected area. The impact attenuator is designed for even deformation to withstand the kinetic energy of the vehicle and retains a sufficiently low degree of force. The driver can be injured if the deformation is uneven by G's spikes[5].

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III. DISCUSSION

Past effect attenuation studies and analyses were carried out on vehicles weighing 2 250 pounds or more (1023 kg). This class is now a large portion of vehicle population due to the recent rise in minicar sales (1800 lb, 818 kg, and range). This raises questions over new car accidents. The small size and weight of minibuses reduces wheel base lengths, track widths and crush space and reduces mass inertia times as against larger vehicles. Variations impact the car's actions in a crash. A series of 20 total crash experiments were performed with a contract entitled 'Experience Attenuators-A Current Engineering Assessment' under the federal highway administration (FHWA), to clarify the actions of mini cars in impact attenuation collisions. The key goals of this project were:

i. To research the complexities of mini and full-size vehicles that are currently in conflict with impact attenuators on our nation's roads.
ii. To detect the problems of inertial effect attenuators associated with frozen sand.
iii. To examine the performance with alternative fill materials and technology of inertial effect attenuators.

IV. CONCLUSION

This thesis has provided a detailed literature analysis of the previous studies on effect reduction in recent years. All the significant contributions have been made and the literature on impact attenuator science available has been illustrated. The conclusion of the latest literature review is: -

i. The analysis explicitly indicates that the impact attenuator limits the car frame damage and protects the driver from damaging himself during the crash. The crush of the impact dimmer can absorb kinetic energy and uniformly transmit low load to the rest.
ii. The analysis reveals that most research focused on architecture focuses on reducing the weight of the effect attenuator. The weight of the impact attenuator has an important impact on the total vehicle weight allocation. In addition, the material selected for impact attenuator should have a high capacity to absorb energy within a deformation acceptance level.
iii. The study of previous studies on comparative analysis of the impact attenuator experimental and simulation test has shown that the impact attenuator is also crushed by the same pattern. Simulation-based analysis is therefore easier and more feasible in science.

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