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Non-Newtonian Fluid Speed Bump

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ABSTRACT: The following technical paper relates to the design and construction of a modern Oobleck speed bump based on the principles of non-Newtonian fluid to comfort the vehicles travelling at a speed below the restricted limit and to prove deleterious to over speeding vehicles. The aim of this project is to overcome the pertinent issues posed by the conventional concrete speed breakers, to minimize the damage to the automobiles, thus reducing fatal accidents. The Oobleck mixture is preferred in this project owing to its dilatant shear thickening properties, which makes the mixture stiffer when a vehicle approaches it at a high speed, whereas it exhibits liquid properties when an automobile passes over it below a predetermined speed. The exception case when the emergency vehicles legally approach the modern bump with an exceptional speed is also addressed by installing an emergency vehicle detection system. Thus, we try to construct a sustainable eco-friendly replacement to these concrete speed breakers and try to bridge the challenges as they come our way.

KEYWORDS: Oobleck mixture, Stainless Steel(SS), Rubber, Bond tite, Polyethylene Glycol 400.

I. INTRODUCTION

A Conventional speed breaker usually consists of a concrete or asphalt breaker formed in the road . They are made to be driven over at a pre-set comfortable speed, while causing exceeding discomfort at higher speeds. Driver must slow down when driving over these speed breakers to prevent damage to their vehicle. However, even if travelling at the posted speed limit or below, these conventional speed breaker can take a toll on a vehicles mechanical component, such as the shock absorbers and steering system. This paper relates to a traffic control device sensitive to the speed of a vehicle.

The ideal situation is that if the vehicle travels at a very low speed, the Stiffness of the obstacle reduce to facilitate the vehicles passage without any bounce or jump. However if the vehicle exceeds the advisable minimum speed the obstacle stiffness increases and the vehicle encounters a considerable jump. This speed control device will also allow emergency vehicles to traverse speed breakers without having to reduce their speed which in turn will reduce their response time to emergencies.

II. LITERATURE REVIEW

No.	Paper Title	Author Name	Key Points	Remark
1	High velocity impact on a thin (non-Newtonian) fluid layer	B. Veltkamp, K.P. Velikov, and D. Bonn.	Lubrication theory, viscoelasticity.	It is found that the slipperiness of certain fluids can be explained by their response on high velocity impact.
2	Developing a Prototype of Non-Newtonian Fluid Speed Hump	Shuhairy Norhisham, Nor Najwa Irina Mohd Azlan, Muhammad Fadhlullah Abu Bakar, Dinesh Raja, Nor Hazwani	Speed Hump, Non-Newtonian Fluid, Traffic Problems, Traffic Calming Measures, Vehicle Speed.	Developing a prototype of non-Newtonian fluid speed hump is easy with low installation and maintenance cost compared to the conventional speed

		Nor Khalid		hump.
3	Non-Newtonian fluid breaker	Runal P. Pawar, Shruti Donode, Prafulsingh Chouhan, Satendrakumar Bopche, Pranali Ramteke, Prof. Pooja J. Chavhan.	Non Newtonian Fluid Speed Breaker, Speed Breaker, Non –Newtonian Fluid, Advance speed bump, Liquid Breaker, Traffic calming measures.	It does not damage on a vehicle's mechanical components, such as the shock absorbers and steering system if the vehicle is following the speed limit.
4	The influence of speed bumps heights to the decrease of the vehicle speed – Belgrade experience	Boris Antić, Dalibor Pešić, Milan Vujanić, Krsto Lipovac	Compared to the state before the speed bumps were installed, statistically significant speed reducing was achieved.	Although speed bumps and the other types of the vertical raisings of the road pavement have been implemented in Belgrade and Serbia for more than 20 year.
5	Vibration analysis of automobile tire due to bump impact	Tae Keun Lee, Byoung Sam Kim	Car driving comfort and noise control, reduced tire and wheel vibration energy.	Decreasing of stiffness and hardness in the tread rubber. Increasing of belt width, decreasing of belt angle.

III.METHODOLOGY

- 1) Take stainless steel base plate of size 900×250 mm thick stainless strips of size 800×25 mm and 1.5 mm thick and the ship stainless steel of size 250×25×125 mm height and 1.2 mm thick.
- 2) Then drill the base plate and stainless steel strips of 5 mm diameter.
- 3) Then fix the rubber of 3mm thick on base plate.
- 4) After that fix the rubber, base plate and strips with the help of nut bolt and visor.
- 5) Fill the small gaps with the help of bond tite.
- 6) Then fix the D-shape stainless steel on one side and leave the side open to fill the fluid (oobleck mixture).
- 7) To make the oobleck mixture take required quantity of corn flour, water and polyethylene glycol 400, and mix it thoroughly.
- 8) Fill the oobleck mixture in the speed bump and close the other side tightly with nut bolt.
- 9) And then test by using motorcycle and bicycle.

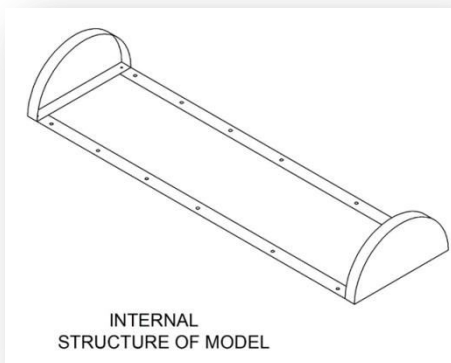


Fig.1. Internal Structure of Model.

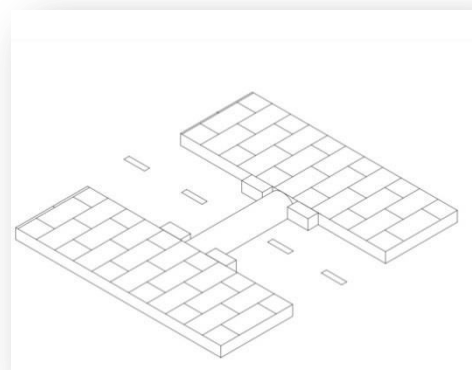


Fig. 2. 3D Overview of Model.

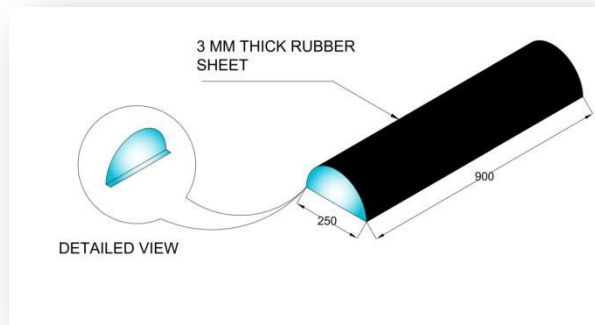


Fig.3. Detailed View



Fig.4. Making Of Speed Bump

IV. EXPERIMENTAL RESULTS

No. of testing	Speed before impact	Speed after impact	Speed before impact	Speed after impact	Speed before impact	Speed after impact
1	30 km/hr.	25 km/hr.	40 km/hr.	32 km/hr.	45 km/hr.	33 km/hr.
2	30 km/hr.	26 km/hr.	40 km/hr.	32 km/hr.	45 km/hr.	32 km/hr.
3	30 km/hr.	27 km/hr.	40 km/hr.	33 km/hr.	45 km/hr.	31 km/hr.
4	30 km/hr.	24 km/hr.	40 km/hr.	30 km/hr.	45 km/hr.	30 km/hr.
5	30 km/hr.	28 km/hr.	40 km/hr.	29 km/hr.	45 km/hr.	29 km/hr.
Total Average speed	30 km/hr.	26 km/hr.	40 km/hr.	31.2 km/hr.	45 km/hr.	31 km/hr.
Percentage of speed reduction	15.38 %		28.20 %		45.16 %	

V. CONCLUSION

As per test conduction we can conclude that it gives safety and comfort to the vehicle as well as to the pedestrian. We also observe that the reduction in speed is variable at different speed of vehicle such as for speed of 45 km/hr. the reduction of speed is much higher than that of the speed 30 km/hr. because of the non-Newtonian fluid which has property opposite to the newtons law of viscosity.



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