

Liquid Speed Bump

TEAM: 86



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Introduction

Our project is a liquid speed bump that will solve the traffic jam problem. Furthermore, the liquid speed bump will enhance the driving experience in Saudi Arabia by making it smoother and more comfortable.

Problem Statement

Traditional rigid speed bumps are effective at reducing vehicle speeds but often cause significant discomfort to drivers and passengers, increase wear and tear on vehicles, and contribute to noise pollution.

Objective

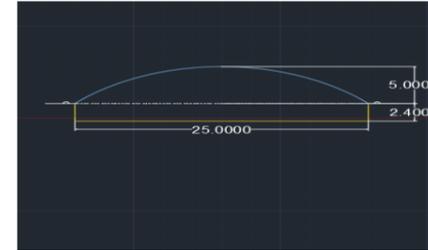
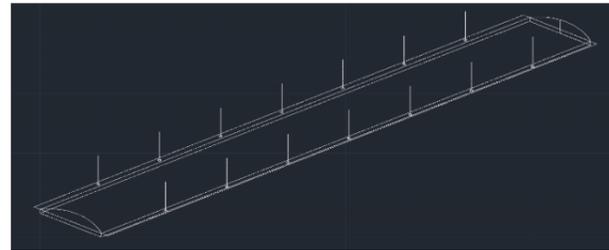
- Innovative Traffic Management: develop a liquid-based speed bump that force vehicle drivers to comply to the street speed.
- Safety Enhancement: Ensure the bump reduces vehicle speeds without causing abrupt impacts or damage to vehicles.

Constraints

- Height < 100 mm.
- Life Span between 5 – 10 Years.
- Weather Condition $\leq 70^{\circ}\text{C}$.
- Load Capacity ≤ 13 tons.

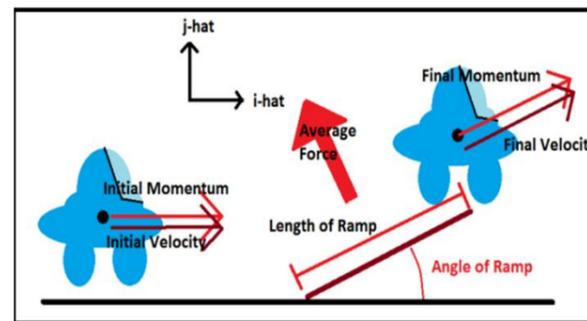
Target Specifications	Results
Height	100 mm
Length	300 mm
Width	2000 mm
Approaching Angle $3^{\circ} - 6^{\circ}$	6°
Life Span 5 – 10 years	2 years
Weather Condition	70°
Load Capacity	13 tons

Prototype Design



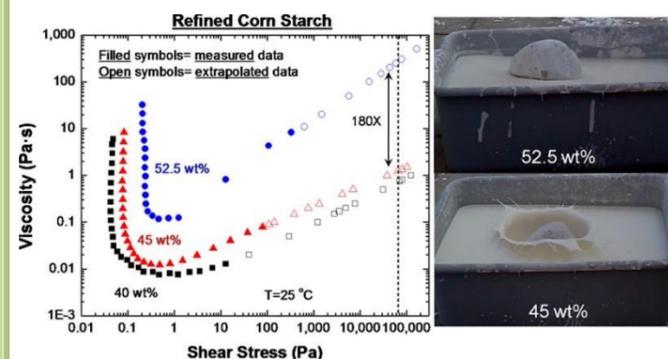
Prototype Design. EPDM rubber will be used for its characteristics in resisting extreme harsh weather conditions. Furthermore, EPDM rubber has high tensile strength which is a crucial factor for handling the high pressure that will be generated by vehicles when they drive on the speed bump. In addition, the flexibility of the rubber will ensure meeting our goal which is providing a comfortable and safe driving experience.

Car Momentum Model



To determine the concentration of the liquid to use. We had to calculate the force of the average car exerting on the bump. we assumed that the bump to act like a ramp when the car exceeds the speed limits. The velocity of the car will be constant before and after the collision. The ramp will change the momentum of the car. Therefore, we were able to calculate the force of the car.

Shear stress and Viscosity Relationship



By fitting the data into a proper equation by using Python code, we relate the mixtures viscosity with the concentration of corn starch in water and the pressure applied to it. Thus, we were able to calculate the concentration of corn starch that satisfy our chosen speed limit.

$$\mu = 2,069,482(\text{wt}\%)^{25.86}(P)^{0.7}$$

Where,

- μ = Viscosity (Pa.s)
- $\text{wt}\%$ = mass concentration of cornstarch (kg corn starch/kg total)
- P = Pressure (Pa)

Tools Used in The Project

- Rubber
- Iron sheet
- Glue
- Screws
- Brush
- Cornstarch

Project Impact

Societal Impact:

- Traffic Control
- Road Safety

Economic impact:

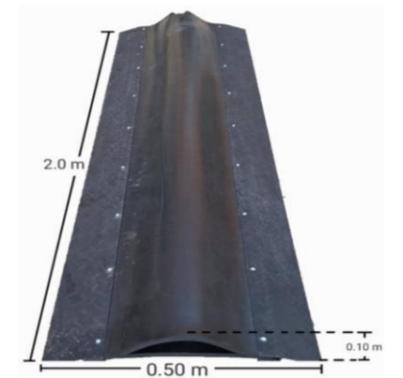
- Cars wear and tear
- Fuel Consumption

Environmental impact:

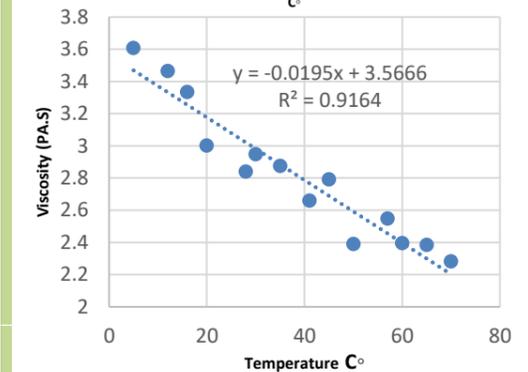
- Harmless to Local Ecosystems
- Reduce Vehicles Emmission

Validation

Prototype Dimensions



Liquid Viscosity (PA.S) Vs Liquid Temperature $^{\circ}\text{C}$



Conclusion

This project can be further enhanced by exploring additional applications of the liquid speed bump technology, such as integrating it with smart traffic management systems or adapting it for specific vehicle types and road conditions. These advancements would create a more versatile and effective solution, contributing to improved road safety and traffic efficiency while fostering a smarter and more sustainable infrastructure.