KWARA STATE POLYTECHNIC ILORIN, KWARA STATE
DEPARTMENT OF CIVIL ENGINEERING

PROJECT TOPIC

INVESTIGATING THE EFFECT OF ROAD BUMPS ON PASSENGER COMFORT

BY

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PROJECT OUTLINE

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INTRODUCTION

-Road bumps, often implemented as traffic-calming measures, are designed to reduce vehicle speeds in specific areas, such as residential neighborhoods or near schools(Zhang et al. 2020).

While effective at improving safety, road bumps can significantly influence passenger comfort during a vehicle's motion (Zhang et al. 2020).

-Passenger effort encompasses several factors, including muscular strain required to maintain balance, perceived discomfort, and even the psychological response to repeated exposure(Zhang et al. 2020).

These effects depend on various parameters such as the design and height of the bump, vehicle speed, suspension system efficiency, and passenger posture(Zhang et al. 2020).

PROBLEM STATEMENT

Road bumps are widely used as traffic-calming devices to enhance safety by reducing vehicle speeds.

However, their design and implementation often fail to consider the impact on passenger comfort and safety.

Many passengers experience significant physical strain and discomfort when vehicles traverse road bumps, especially at inappropriate speeds or over poorly designed bumps.

1.2 AIM

-Aim of this project is to investigate the effect of bumps on the passenger comfort.

OBJECTIVES

The Objectives of this project is:

1. Determine the Passenger Factors: Seat position, posture, and physical fitness impact how a passenger experiences and responds to these motions.
2. Determine the impact of vertical jolting of passenger inside the vehicle.
3. Characterize the types of existing bumps on the study road.
4. Determine the climbing speed of the vehicle on each bump: Higher speeds result in more pronounced vibrations and jolts, increasing the physical effort passengers need to stabilize themselves.

JUSTIFICATION OF THE STUDY

This is to explore the effect of road bumps for the passengers comfort and finding possible remedies to decrease discomfort receive by both the driver and the passengers in the study area.

SCOPE OF THE STUDY

The scope of the study is to examine the acceleration of vehicles when crossing speed bumps at different speeds and its influence on passengers comfort using metropolitan areas in Ilorin as a case study.

LITERATURE REVIEW

Author(s)	Year	Title	Study Focus	Key Findings
Ochieng, O. & Njoroge, C.	2015	Impact of Road Humps on Vehicular Speed and Passenger Comfort	Investigated speed control effectiveness and discomfort due to humps.	Road humps effectively reduce speed but often cause significant passenger discomfort, especially at higher speeds.
Jazar, R.	2017	Vehicle Dynamics: Theory and Application	Studied vehicle dynamics in relation to road irregularities.	Sudden elevation changes (e.g., bumps) cause vertical acceleration leading to ride discomfort. Suspension design plays a critical role.
Yadav, V. & Tiwari, G.	2018	Evaluation of Road Safety Interventions in Urban India	Evaluated various traffic calming measures including speed bumps.	Speed bumps reduce crash rates but compromise passenger comfort if poorly designed.
Al-Masaeid, H.R.	2019	Speed Control Humps: Do They Really Slow Down Vehicles?	Investigated different designs and their impact on speed and comfort.	Humps with poor geometric design induce excessive vertical acceleration, causing back and neck strain.
Chen, L., et al.	2020	Human Response to Vehicle Ride over Speed Bumps	Focused on the biomechanical response of the human body.	High bump height and poor approach angle result in spinal discomfort and fatigue among frequent passengers.

DATA COLLECTED

This chapter explains the various types of data that was collected and the methodology that was adopted in this study; the data was collected on the following parameter:

S/N	Location	Bumps width (m)	Bumps Length (m)	Bumps Height (m)	Bumps Type	Road Type
1.	kulende estate junction	0.16	7.6	0.17	Asphaltic	Dual Carriage Way
2.	Fct kulende estate junction	0.16	7.6	0.17	Asphaltic	Dual Carriage Way
3.	Nigeria police division	0.35	12.5	0.04	Asphaltic	Dual Carriage Way
4.	National police university	0.35	12.5	0.04	Asphaltic	Dual Carriage Way
5.	Police medical service	0.35	12.7	0.04	Asphaltic	Dual Carriage Way
6.	Adewumi street Beside railway	0.45	6.15	0.12	Concrete	Single lane
7.	Olorunshogo christ apostolic church	0.35	9.4	0.04	Asphaltic	Dual Carriage Way

METHODOLOGY contn

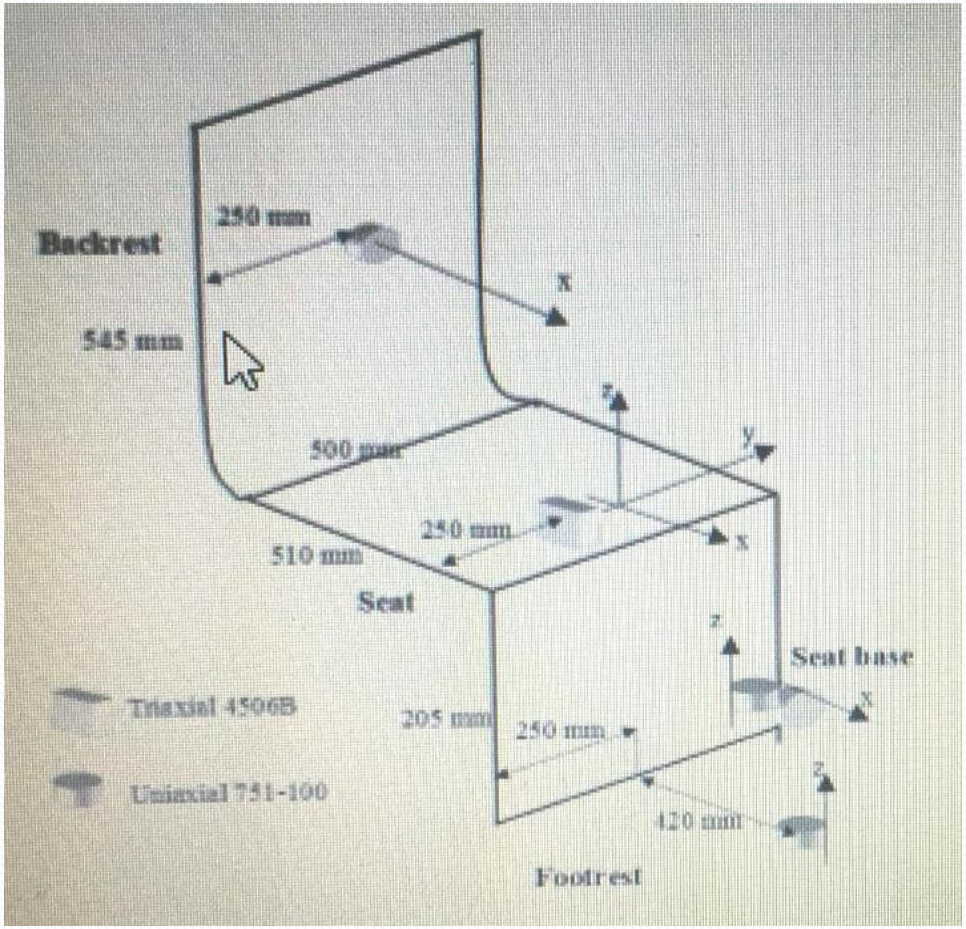
- The method of this study was done to analyze the impact of bumps on the driver and the occupants of the vehicle. The amount of shock, which might harm the health of occupants, depends on the operating speed, speed bumps geoetry, vehicle type, the position of occupants, and evaluation method.

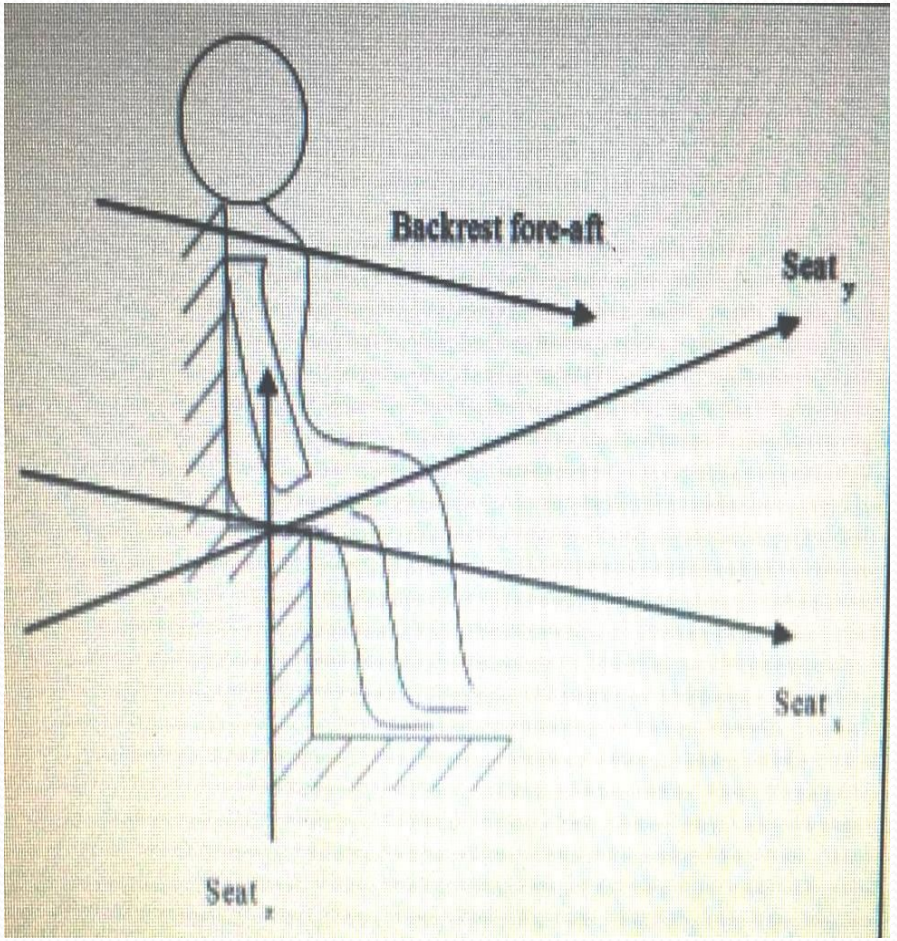
- This experiment was carried out by using a mobile phone. A car phone holder was attached to the windscreen. The experiment procedure as follows:
- Data on the vibrations and the frequencies inside the vehicle was determine using the vibration meter *VibSensor* in a mobile phone when the car was passing through the speed bump at a permissible speed. Vibrations was divided into three orthogonal axes depending on the direction in which it affects the human body: – vertical vibrations – from feet towards the head (in this case X vibration (axis)); – horizontal vibrations – from right to left (in this case Y vibration (axis)); – horizontal vibrations – from the chest to the back (in this case Z vibration (axis)). Two charts will be obtained showing: – acceleration over time, – Power Spectral Density (PSD).

- Using a Digital Spirit Level the approach slope of the speed bump was measured (a Digital Spirit Level measures angles and inclinations). This will show vibration changes with the change in acceleration (in m/s2) over time in X, Y, and Z-axes. The chart will show the time when the vehicle reaches the bump – after the first second.

- Different cars was used carrying passengers sitting in front seat and rear seat across different speed bumps at various speeds.


Oils
Incense
ALADE
ZANGELES
EMPIRE
POS
AVAILABLE


Backrest
250 mm
545 mm
x
z
500 mm
y
250 mm
x
510 mm
Seat
z
Seat base
x
Triaxial 4506B
205 mm
250 mm
Uniaxial 751-100
z
420 mm
Footrest


Backrest fore-aft
Seat y
Seat x
Seat z

Age / Gender	Male	Female
Under 30	7	3
30 – 40	5	2
Over 40	2	1

MODEL	VEHICLE CLASSIFICATIONS
Land Rover	SUV
Toyota Corolla	Compact Car
Toyota RV4	Jeep
Toyota Sienna	Minibus

QUESTIONNARIA

- **How do you feel when your vehicle passes over a road bump?**
- How frequently do you encounter road bumps during your travels?
- Do drivers slow down adequately before passing road bumps?
- Do you think the design or height of road bumps affects comfort?
- In your opinion, are road bumps necessary for road safety?

RESULT AND DISCUSSION

1. Results presented in Table 1 can be compared with the general specification of speed bump design parameters ranging from 300 – 1000mm for length and 50 – 150mm for the height as shown in Fig. 1.
2. It was observed that all the bumps heights are outrageously higher than the specification while the bump lengths are at the maximum limit of the range.
3. Although, length of speed bumps is the most important parameter, bump heights can influence the magnitudes of vertical accelerations and the maximum levels of perceived discomfort.
4. This explains why exposure of human body to vibration can cause discomfort to the motorists.
5. This is an indication that the driver and passengers bodies will be exposed to vibration and tilting as their vehicles wheels pitching and rolling on sharp bumps.

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THANKS FOR LISTENINIG