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# A Review: Improvement in Patient Comfortless in Ambulance Traveling

**Vikrant D. Londhe [1], Nitin Sonawane[2], Yash Pawar[3], Anil More[4], Snenal Pawar[5]**

*[1]Asst. Prof. Mechanical Department, S.N.D.C.O.E & R. C, Yeola.*
*[3452]Student B.E. Mechanical Department, S.N.D.C.O.E & R. C, Yeola.*

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**Abstract -** Ambulance transportation is a crucial element of emergency medical services, with the primary goal of quickly transporting patients from accident sites to hospitals. However, the comfort of patients during ambulance transport is often compromised due to the shocks and vibrations transmitted through the uneven road surface. These vibrations can cause additional injuries to the patient and discourage paramedics from providing necessary emergency care.

The aim of this project is to investigate the vibrations experienced by patients during ambulance transport and develop new methodologies to mitigate them. Our research will focus on identifying the factors contributing to patient discomfort during ambulance transport and exploring innovative solutions to address them, including suspension systems, cushioning, shock absorbers, and dampers.

As part of our investigation, we will explore the potential of adding shock absorbers and dampers to the stretcher to reduce the transmission of harmful vibrations to the patient. We will evaluate the effectiveness of these solutions through experimental testing and simulation, and refine the design based on the results.

Our project has the potential to significantly improve the comfort of patients during ambulance transport and enhance the quality of care and patient outcomes. The key words for our research include ambulance transport, patient comfort, vibration mitigation, shock absorbers, and dampers.

By mitigating the harmful effects of vibrations, we aim to contribute to the development of new and innovative ambulance stretcher designs that can provide better comfort and safety for patients during transport.

## 1. INTRODUCTION

### 1.1 Problem Statement

In all vehicles, the shocks and vibrations are partially transmitted to patient. Currently there are no any systems for this purpose the vehicle and remaining is transmitted to the passenger, but the vehicles which are used for general purpose this shocks and vibrations are feasible and the vehicles like ambulance this forms the uncomforted for the patient and also inconvenience for the doctor for pre-treatment.

Ambulance service is to transport the patient from the accident site to the hospital as quickly as possible. It is not an easy procedure to comfortably transport patient in the ambulance.

Since the patient is already injured and it is difficult to treat the patient in the moving ambulance, the role of improving the existing emergency medical services is crucial.

The risks and injuries are generated from potentially dangerous shocks and vibrations transmitted through the ambulance as it transmit over the uneven road surface.

The level of vibrations that a patient experiences during ambulance transport is often too high. The vibration produced in ambulance can lead to a secondary injury to the patient and discourage a parametric from providing emergency care.

Now days it is common procedure to strap the patient to the stretcher and transport in the ambulance. However, it will not effectively reduce the vibrations that are transmitted. The ambulance crew must take measures to reduce the effects of vibration.

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**Following are the problems that are faced by the patient and the doctors in ambulance:-**

1. The shocks and vibrations passed to the patient due to which the patient condition becomes more critical.
2. Inconvenience for the doctor for pre-treatment due to unsteady base.
3. There will be difficult for imparting medical instruments like, Oxygen mask, Saline, Injections etc.

To minimise this, currently there is no any system for this purpose, hence there is a need to improve the comfort level for patient. This we will try to achieve in this project by the use of tuned mass vibration absorber along with shock absorber and bearings.

### 1.2 Objective

1. To study and analyse existing solutions and theoretical papers available.
2. To fabricate vibration isolation bed for ambulance.
3. To build an effective and cost-efficient model that will be a solution to existing current problems.

4. To develop and fabricate vibration isolation bed for ambulance by locally available materials.
5. To conduct the different experiments for analysing the comfortless provided by our solution.
6. To evaluate the performance of vibration isolation bed for ambulance on different road conditions or with various levels of shocks and vibrations.
7. To find a feasible solution for Vibrations induced in ambulances.

### 1.3 Methodology

a) Ideas generation based on the requirements.
b) Do qualitative research to understand the need of such a device in today's patient transport scenario.
c) Analyze existing solutions and theoretical papers available.
d) Study various methods used for vibration control.
e) Experimentally determine the Displacement of vibration, frequency external excitation and a typical ambulance ride, and correlate those vibrational characteristics to human physical impacts on ambulance passengers and EMT crews.
f) Manufacture shock absorber based vibration control system
g) By setting up our system in ambulance will carry out actual readings for various road conditions & then compare the results of both existing system & our system. The broader significance of this study lies in enhancing the patient-centered care associated with ambulance travel by improving patient comfort and safety.

## 2. LITRETURE REVIEW

In the paper titled " Improvement of ride quality for patient lying in ambulance with a new hydro-pneumatic suspension", the authors Bohuan Tan , Yang Wu , Nong Zhang , Bangji Zhang and Yuanchang Chen (2019): This article proposes a pitch–roll-interconnected hydro-pneumatic suspension system which can achieve the resistance control for pitch, roll, and bounce modes of ambulances to improve the stability and attenuate the vibration for the lying patients. The ambulance with pitch–roll-interconnected hydro-pneumatic suspension is characterized by 7 degrees of freedom dynamic model, in which the characteristics of pitch–roll-interconnected hydro-pneumatic suspension are explicitly formulized using hydrodynamic equation derivation. A motion-mode energy spectral density method is proposed to decouple the vibration energy for bounce, pitch, and roll modes in frequency domain. Subsequently, the parameter design approach incorporated with the suspension characteristic equations and motion-mode energy spectral density method is also presented to optimize the lying patient's ride comfort and ambulance is handling stability. The numerical simulation results show that the proposed pitch–roll-interconnected hydro-pneumatic suspension system can simultaneously provide pitch–roll–stiffness and damping without generating additional bounce-stiffness, resulting in superior ride comfort and handling stability compared to the conventional suspension.

In the paper titled " VIBRATION ISOLATION BED-DESIGN AND FABRICATION", the authors Mohammed Jabir, Nimin Joshy , Noel Cheriyan, Siddanth G, Jojo Saju (2019): Designed a new vibration isolation bed stage with scissor shaped structure with spring has been used to ensure ride quality as well as better care for the patient. The X structure with spring is established to control the vibrations caused from the imposed excitation signals when subjected to bump and uneven road conditions. The analysis is done by implementing a gyroscope and an accelerometer with the use of an arduino and MPU-6050 breakout board. Analysis results suggest that the magnitude of the vibrations inside a vehicle can be reduced when the vehicle is moving in different road conditions.

In the paper titled "Innovative Vibration Dampers in Ambulance", the authors Prof. A. K. Lavnis et. al. have experimented with the Vikas Parmar (2019): This paper presents a review of important features and techniques used for reducing vibration in ambulance by the use of mechatronics along with electromagnets and conventional suspension system. When two same poles of different magnets are come together then they are trying to oppose each other, which are called as repulsion and by controlling the rate of repulsion the shocks and vibrations can be minimize.

In the paper titled "Design and Validation of a Mass Tuned Dynamic Vibration Absorber", the authors Vaibhav Ghodge et, al. have experimented with the S. B. Patil (2018): This paper presents the effectiveness of a new cantilever dynamic vibration absorber in reducing the vibrations of a primary system at resonance. The designed absorber is tested for cantilever and simply supported conditions of the beam with motor/rotor assembly to create harmonic excitations. The setup is tested numerically using modal and harmonic response analyses of ANSYS and further validated by building a prototype and conducting experiments using vibration analyzer. The proposed system was found to considerably reduce the vibrations in the primary system when the vibration absorber was tuned to the operating frequency.

Books:

Singiresu S. Rao. Mechanical Vibration. 5th ed. Pearson Prentice Hall. 2010. This book provides the information about the basic principles of vibrations and what are the different types of vibration in automobile also how to eliminate this vibration in automobile.

## 3. CONCLUSIONS

The literature review presents information about the effects of vibrations on the human body. The literature also presents information about the road induced vibrations and the suspension systems used in ambulances. Even though there is research work available, it only gives some input about the issues. Research that is more intensive is needed to truly understand the effects of these vibrations. The research shows that very few solutions are available on the market, which improves the transport conditions of the patients. Most of the products available fit into the ambulance. This causes ergonomic issues in an already cramped ambulance. Most of the other solutions available are research papers or patents. Very few solutions consider adopting a device that would fit into a stretcher. Some solutions suggested using suspensions for the stretchers. Other solutions suggested using Magneto rheological dampers or to use gyroscopic stabilizers. The research shows that even though theoretical solutions are available, there is still a need for a product that compensates the effects of vibrations in real time. Even though achieving the solution can be tricky, research has shown that there is a possibility to make such a product.

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