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1.1 Prologue

The World Health Organization (WHO), in its global status report on road safety 2013, observes that road traffic injuries are “the leading cause of death for young people aged 15-29, worldwide, and for that many countries have taken steps to reduce fatalities from road traffic accidents, the total “ remains unacceptably high at 1.24 million per year”. More than 80,000 people are killed on Indian roads every year and almost 1.2 million are injured. India is having road fatality ratio 14 per 10,000 vehicles which is highest in the world. National highways and Expressways are considered as main elements for development of the country. An unfortunate incident that happen unexpectedly and unintentionally resulting in damage or injury is termed as accident. It has been observed that 13 people are dying in road accident per hour all over the world. The Mumbai – Pune expressway (Officially known as Yeshwantrao Chavan Expressway) is India’s first six lane, concrete, high speed, access controlled tolled expressway, which has been designed and constructed as per international standards and it is one of the busiest roads of the country. The expressway handles about 43,000 PCU’s daily and it is designed to handle upto 1,00,000 PCU’s. It spans over a distance of 93 km from Mumbai, the administrative capital of Maharashtra and financial capital of India to Pune, an industrial and educational hub.

Road accidents are a major concern for any country. There are various factors which are responsible for occurrence of road accidents. People lose their valuable life; many get permanent disabilities due to accidents. Hence, it is necessary to study
accidents for saving valuable lives of our country. Analysis of accidental data reveals that loss of control of vehicle is the major cause of accidents among various other parameters. Unlike other Expressways and National Highways, Yeshwantrao Chavan Expressway has witnessed high rate of accidents in recent years.

While designing and planning of Yeshwantrao Chavan Expressway, the vision was to construct accident free expressway. normal cause of accidents were taken into consideration. Still after it was made fully operational from April 2002, observed that large number of accidents are occurring which exhibit serious fatal accidents. Recently according to MSRDC statistics from 15\textsuperscript{th} April 2005 to 30\textsuperscript{th} Nov 2010, total 8225 accidents had occurred on Mumbai- Pune Expressway.

As per the accidental data issued from Maharashtra State Road Development Corporation (MSRDC), high rate of accidents were observed on a particular stretch of 79 KM to 81 KM. When this stretch was inspected, it was observed that it is mostly a straight road. No geometric fault was observed in the location. Finding out the cause of such a high number of accidents is the matter of great concern.

These accidents attracted media attention when two Marathi actors, Anand Abhyankar and Akshay Pendse, met a tragic death near Urse Toll Booth. In a separate study conducted by Pimplikar (2011), he identified many Geopathically stressed locations on the Yeshwantrao Chavan Expressway.

Energies from the earth at certain locations which have an ability to disturb normal functions of human body systems were termed as geopathic stress. When the accidental data and the locations discovered by Pimplikar were correlated, it was inferred that many of these accidents could have occurred because of presence of geopathic stress zones. Moving on the road, if vehicle crosses geopathic stress zone.
it affects driver physically and mentally. It increases his reaction time which may lead delay in applying brakes to the vehicle than what is required and this may cause serious accident. If such accidents are of heavy vehicles like truck, car, jeep etc., it may lead to death of many people and damage of vehicles. Thus, increase in human reaction time might be the cause of such accidents. This study aims at reducing such accidents caused by geopathic stress by attenuating the stress by using NAAVRAJ attenuation system.

1.2 The Setting- Geopathic Stress

In ancient times, people were aware of “Geopathic Stress” associated with specific areas and were very particular in selecting location for civilizations and sites for construction of any structure and dwelling. Geopathic stress is a natural phenomenon which affects certain places and can be detrimental to human health. The most usual cause of geopathic stress is certain mineral concentration or an underground water stream, flowing beneath the structures. Geopathic stress can also arise out of a geological fault line i.e., a deep crack in the bed rock which allows radiations from deep within the earth to come up to the surface. Literature survey reveals that very little research has happened on attenuation of geopathic stress till date. This research aims at attenuation of geopathic stress on Expressways and National Highways for the reduction of accidents.

1.3 Rationale and Significance of the Study

Bird (1994) has tried to hint that, earth radiations from the nadir directions could be associated with road accidents. Meliknow (1997) observed that, a large number of accidents had occurred at the intersection of ground water zones where other technical causes of accidents did not exist. Kharat (2000), through his empirical
investigations at some spots on National Highway, observed that reaction time of
driver changes on Geopathic stress zones, leading to road accidents. Several other
researchers have reported the presence of ground water veins as one of the key factor
for certain types of diseases like cancer, long lasting illness etc. In many cases, the
people living in areas prone with geopathic stress acquire illness which does not cure
despite of good treatment. Also, they wake up feeling tired or feel worse in the
mornings. This is because when people are affected by geopathic stress for longer
periods their body resistance drops to one third of normal during sleep. Pimplikar
(2011) has studied the human body system in motion while travelling at high speeds.
He has developed simple models that are expected to identify the relationship of
subterranean features and the human body system in motion on highways and
expressways. However, studies related to attenuation of geopathic stress on
Expressways and National Highways are very few. This is an endeavor to study the
possible attenuation means and methods in order to save lives of people travelling on
Expressways and National Highways.

1.4 Expressways and National Highways Parameters Related With Accidents

There are various parameters responsible for accidents on expressways and national
highways such as animals on road, attempts of robbery, boulders on road, break
failure, dashed with parked vehicle, driver feeling sleepy, wrong turn, overtaking,
fire in vehicle, driver lost control, people on the road, sudden breaking, tyre burst,
vehicle slipped, mechanical problem of vehicle etc. After analyzing all the
parameters, it is observed that the “driver lost control” is the major cause of
accidents on expressways and national highways. Geopathic stress is one of the
parameters which need to be considered responsible for accidents. So, literature
revealed that change in reaction time of drivers because of geopathic stress is major cause of accidents. Hence this parameter of geopathic stress needs to be consider while planning of Expressways and National Highways.

1.5 Aim and Objectives of the study

The aim of this study is attenuation of the Geopathic stress.

1.5.1 Research objectives

- To investigate characteristic features of Geopathic stress on the part of Yeshwantrao Chavan Expressway (18°44'N, 73°28'E) and National highway 9 i.e Pune- Solapur highway from Patas- Chaufula (20°00'N, 76°00'E).
- To explore the use of metal pining technique for attenuation of Geopathic stress on Yeshwantrao Chavan Expressway and National highway 9 i.e Pune-Solapur highway from Patas to Chaufula.
- To carry out experimental investigation of attenuation of Geopathic stress on the Yeshwantrao Chavan Expressway and National Highway 9 i.e Pune-Solapur highway from Patas to Chaufula to investigate parameters like depth of pining, diameter of pin, zone of influence of pin etc.
- To develop models and sub-models for attenuation of Geopathic stress using the metal pining technique.

1.6 Limitations of the Study

It has been observed from the study that the combined effect of geopathic stress and surges coming from sky are responsible for causing accidents on expressways and national highways. The reductions in accidents on selected spots were observed on expressway after successful implementation of attenuation of geopathic stress.
There are some of the limitations of placing components of NAAVRAJ attenuation system such as AVRAN, RAAV ABSORBERS etc. because of heavy traffic on Yeshwantrao Chavan Expressway. The efforts have been made to attenuate the geopathic stress by putting RAAV absorbers at the shoulder of the cross section of expressway. In many cases the circle of influence so formed by the RAAV absorber cuts the full width of cross section of expressway, in some cases the part of expressway was not fully attenuated. Lightening normally has affinity to geopathic stress zones. A vehicle crossing geopathic stress zone at the time of occurrence of lightening on that zone has major possibility of meeting with an accident. The theoretical aspect has been considered, however due to various limitations an empirical aspect could not be addressed in this study.

1.7 Research Methodology

- Identification of geopathic stress zone using dowsing technique on the expressways and national highways.
- Carrying out theoretical aspect in terms of pining technique of attenuation of Geopathic stress on the expressways and national highways.
- Experimental findings by using metal pining technique for attenuation of Geopathic stress on the expressways and national highways.
- Developing a model for attenuation of geopathic stress at the specified location using pining technique on the expressways and national highways, based on experimental and theoretical findings.
1.8 Organization of the Thesis

1.8.1 Chapter I: Introduction

In this chapter the presence of geopathic stress on Expressways and National Highways which causing accidents has been highlighted.

Geopathic stress is closely associated with presence of ground water veins. Accidents have occurred after the vehicle has crossed over ground water veins \(^{[21]}\). Literature review reveals that there is relationship between subterranean features and human body in system in motion on highways and expressways \(^{[5]}\). The studies related to attenuation of geopathic stress are very few. This is an endeavor to study the possible attenuation means and methods in order to save lives of people by reducing accidents on expressways and national highways.

1.8.2 Chapter II: Review of Geopathic Stress

This chapter incorporates some of the research findings related to geopathic stress. The well-established dowsing technique is explained in detail. NAAV meter an instrument for detection of geopathic stress is discussed \(^{[22]}\). The relationship between geopathic stress and lightening is explained.

The ability of a person to detect certain natural fields is called ‘Dowsing’ \(^{[12]}\). Dowsing is the most common technique used for detection of ground water \(^{[3]}\). There are various instruments which can be used for dowsing such as L-rod, coconut, Y-twig pendulum etc. NAAV meter is an instrument which is devised recently based on light interference. It is an instrument with wooden box enclosed with laser and selenium photocell which gives output in current. It has been observed that on
geopathic stress locations current sharply decreases and then remains constant. This may be due to less photon reaching the detector on geopathic stress zone.

The effect of geopathic stress on human body [23], properties of soil [27] and concrete[33] is also presented in this chapter. There is change in reaction time of drivers when he passes over geopathic stress zone [18]. Index properties of soil changes on geopathic stress zone as compared to normal zone. A concrete road shows deterioration due to presence of geopathic stress zone.

1.8.3 Chapter III: Research Findings of Accidents on Yeshwantrao Chavan Expressway and Pune-Solapur National Highway

This chapter represents the research findings of accidents on Yeshwantrao Chavan Expressway and Pune-Solapur National Highway. According to statistics by MSRDC, from 15th April 2005 to 30th November 2010, 8225 accidents have occurred on Yeshwantrao Chavan Expressway. Relationship between presence of geopathic stress and occurrence of accidents is discussed in this chapter. Reaction time which is the major parameter related to accidents get changed on geopathic stress zones as compared to normal zones. Hence, the relationship between reaction time of drivers with presence of geopathic stress is established. According to PIEV (Perception, Intellection, Emotional, Volition time) theory, the PIEV time should be 0.5 sec for normal healthy drivers whereas for stressed and unhealthy drivers it may increase beyond 0.5 sec. Yeshwantrao Chavan Expressway has speed limit of 80kmph however, most of the drivers travel higher than this limit. A vehicle travelling at a speed of 80 kmph on Expressway covers 22.22 m in one second and if reaction time changes over geopathic stress zone in case of stressed driver, the vehicle will travel more than 22.22 m without any reaction from the driver. It is
shown that, very few attempts have been made in attenuation of geopathic stress. According to various researchers, for around 30% of total accidents the cause of accidents is unknown \cite{26}. So in this chapter how geopathic stress is one of the parameters causing accidents on Mumbai- Pune Expressway and Pune- Solapur National Highway is explained.

1.8.4 Chapter IV: Attenuation of Geopathic Stress

This chapter deals with theoretical investigation of attenuation of geopathic stress. The theoretical aspect of attenuation like change of place to avoid geopathic stress, use of different materials for attenuation of geopathic stress are discussed. The material and method which is best suited for road environment is selected for investigation. In this investigation two methods are conceived one is use of metal rings for attenuation which is based on Lenz’s law in electrical engineering and second is use of metal rods for attenuation.

This chapter incorporates use of metal rods for attenuation of geopathic stress on road environment. The relationship between depth of pining rod, diameter of rod, width of ground water vein and zone of attenuation is established. On the roads it is difficult to incorporate metal rings for attenuation of geopathic stress.

NAAVRAJ attenuation system was invented which consists of various components such as AVARAN, RAAV CONNECTOR and RAAV ABSORBER are discussed in this chapter. Attenuation effect due to lightening on geopathic stress zone by using lightening arrestors is discussed.
1.8.5 Chapter V: Empirical Investigation of Accidents on Yeshwantrao Chavan Expressway and National Highway

This chapter highlights empirical investigation on Yeshwantrao Chavan Expressway and Pune – Solapur National Highway. The detection of geopathic stress was done by using L-rods and intensity was measured with NAAV meter. After detection of geopathic stress, correlation coefficient between numbers of accidents with drop in NAAV reading was established. In addition to this, experimental work related to determination of reaction time measurement device is discussed. With the available data from Maharashtra State Road Development Cooperation Ltd. (MSRDC) the analysis of road accidents on Yeshwantrao Chavan Expressway was done, plan for attenuation was prepared by correlating the accidental data with presence of geopathic stress zones. The attenuation was done by using NAAVRAJ attenuation system is explained in detail in this chapter. Analysis of accidental data after attenuation and before attenuation is carried out. The reduction of accidents due to introduction of new system is discussed along with its limitations.

1.8.6 Chapter VI: Models of Relation between Geopathic Stress, Road Accidents and Human Body

This chapter deals with study of interaction between geopathic stress and human body further interaction between geopathic stress and road accidents. Software is developed in Visual Basics to identify geopathic stress locations. Geopathic Stress and lightening are the new parameters for design of roadways and for attenuation of geopathic stress, the different models can be used depending upon environmental conditions and are explained in this chapter. Using such models and sub- models,
attenuation of geopathic stress can be done for reduction of accidents on Expressways and National Highways to save precious lives of people travelling on it.

1.8.7 Chapter VII: Summary and Conclusions

This chapter highlights the brief summary and conclusions of empirical and theoretical investigations of attenuation of geopathic stress on national highways and expressways.

Characteristic features of Geopathic stress need further investigations as the nature is still a matter of study. Some of the researchers have characterized it as electromagnetic, electrical or with some unknown energy.

One of the research objectives of present thesis was to explore metal pining technique. For attenuation of Geopathic stress, metal pins were used. However, after study it has been observed that only pins are not sufficient. It is necessary to have a conductive material coating in the form of conductive clay in order to protect metal and to increase area of conductance.

After empirical and theoretical investigations, it is observed that there is effect of diameter of pin and depth of pin on sphere of attenuation.

NAAVRAJ attenuation system is developed after study of characteristic features of Geopathic stress zones. Its contribution in attenuation over a period of time is significant. Models based on attenuation of Geopathic stress are developed.

From overall study, conclusions are made such as; NAAV meter can be used to identify and measure intensity of geopathic stress zones. Further NAAVRAJ attenuation system is effective technique for attenuation of geopathic stress. The rate of accidents got reduced in attenuated part of the Expressway which concludes that
the technique can be used for selected roads for investigations and even for all other Expressways and National Highways.