ISSN (Online) 2456-1290

International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)

Special Issue

INSIGHT'17 - Advanced Transportation Systems And Infrastructure Development in Developing India

Road Accident Prediction Models based on Geopathic Stress

[1]Dr. S. S. Pimplikar, [2]Rohit R. Salgude
[1]Head of the department, [2]Assistant professor
[1] [2]Maharashtra Institute of Technology, Pune, Maharashtra, India
[1]sunil.pimplikar@mitpune.edu.in, [2]rohit.salgude@mitpune.edu.in

Abstract :- **This paper attempts to contribute to the research by suggesting 3 models – one relating the current measured on the geopathic stress zone with the body voltage of the drivers, secondly the average number of accidents with respect to the body voltage and thirdly the average number of accidents with respect to the current on the geopathic zone. In this paper the geopathic stress is one of the cause for road accident has been studied. For this, in all 50 accident spots were selected on the Mumbai-Pune Expressway, the Mumbai-Bangalore highway NH-4, the Pune-Nagar highway and the Mumbai-Pune National highway.**

Keywords: **- Geopathic stress, accident, bio-voltage, current**

I. INTRODUCTION

Importance of geopathic stress in spatial planning is recognized and used by many researchers; Bachler (1970), Bergsmann (1989), Croome (1994), Bird 1997), Christpher and Cantab (1997), Silk and Cown (1999), Agarwal (2004), Assa (2004), Chouhan (2004), Bogus (2010), Tsai (2010), Underwood (2011), Khan (2013).

However, the significance of geopathic stress as a causative factor of road accidents has been studied only by few researchers; Maston (1955), Mazharul (1988), Meliknow (1997), Kharat (2000), Bradna (2002), Read (2006), Pimplikar (2005), Jarad (2013) Sorte (2015).

Furthermore, many mathematical models exist for road accident prediction such as accident prediction models using generalized linear models, negative binomial models, regression model, dynamic analysis model, roller model, predictive model, accident causation model, mixed traffic condition model and Smeed's model.

However, these models are based on the conventional causes of accidents such as heterogeneous traffic flow, negative binomial, mixed traffic flow, number of vehicles passing, length of road, geometric and vehicle factors.

It may be noted here, that there does not exist any quantitative model which enables to predict the road accidents at specified spots, arising due to the existence of geopathic stress.

This paper attempts to contribute to the research by suggesting 3 models – one relating the current measured on the geopathic stress zone with the body voltage of the drivers, secondly the average number of accidents with respect to the body voltage and thirdly the average number of accidents with respect to the current on the geopathic zone.

II. RESEARCH METHODOLOGY

In all 50 accident spots were selected on the Mumbai-Pune Expressway, the Mumbai-Bangalore highway NH-4, the Pune-Nagar highway and the Mumbai-Pune National highway. These spots were so selected that the conventional causes of road accidents as mentioned above did not exist at these locations; yet the number of accidents averagely occurring per year ranged from 6 to 32, as obtained from the traffic authorities.

For detecting and confirming the existence of geopathic stress at these locations, 3 methods were used;

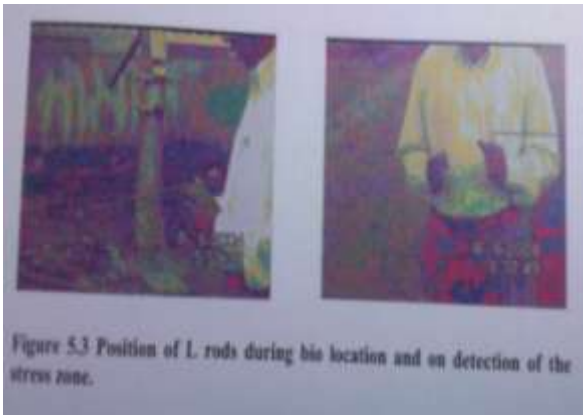
a) Bio-location using 2 copper L rods as transducers
b) Polycontrast Inference Photography (PIP) scans on the roadway
c) Selenium photo-cell using normal bulb source as well as laser beam source. Refer figure 1,2,3 and table no. 1 based on the detection of Current (I).

ISSN (Online) 2456-1290

International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)

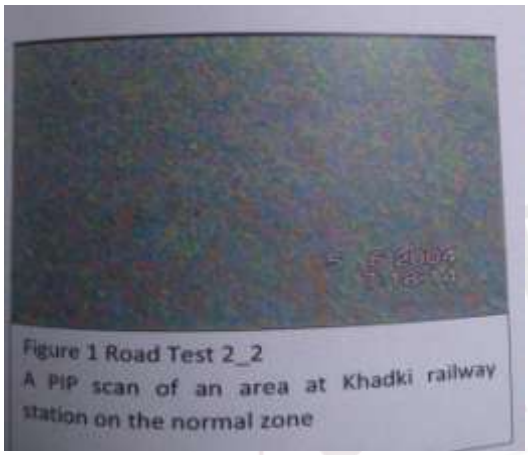
Special Issue

INSIGHT'17 - Advanced Transportation Systems And Infrastructure Development in Developing India



Position of L rods during bio location of the stress zone

Figure No. 1



A PIP scan of an area at Khadki railway station on normal zone

Figure No. 2

A reference reading being set on a non-stress zone

Figure No. 3

Body voltage of the drivers were measured on the Stress Zones using an electro-stress meter, in the following conditions

1. While standing on and off the stress zone
2. While walking from outside the stress zone, into the stress zone and moving out again and
3. While driving on the road at a constant speed of 40 Km/hr.

Refer to figure 4 and table no. 2.

Measurement of body voltage due to geopathic stress

Figure No. 4

Based on the data generated, Karl Pearson's co-relation coefficients were determined, graphs were drawn and the empirical mathematical models were generated.

Results and Discussion:

1) Based on the bio-location experiences, the geopathic stress zones were qualitatively classified as medium, strong and very strong.
2) PIP scans at accidents spots showed combinations of very bright colors as well as dull colours, contrasting red and green colours as against the uniform green colour on a non-accident spot. Also at few spots, magnetic polarity was exhibited in the scan.
3) Current difference values between the stress zones on accident spots and the non-stress zones, using the laser beam source varied from 164 µA to 1000 µA depending upon the level of intensities as mentioned above. It was also observed that the sensitivity of the laser source used was more than 30 times that of the normal bulb source.

ISSN (Online) 2456-1290

International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)

Special Issue

INSIGHT'17 - Advanced Transportation Systems And Infrastructure Development in Developing India

Table No. 1 Electro-stress meter readings at accidents spots

Sr. No.	Name of expressway/Highway	Location of the accident spot or chainage	Reference reading on electro-stress meter on normal zone (mV)	Electro-stress meter reading on stress zone (mV)	Difference (mV)
1	Mumbai-Pune-Banglore (NH-IV)	120 m ahead of spot No 41	5	305	300
2	Mumbai-Pune-Banglore (NH-IV)	On the connecting road between Mumbai-Banglore Highway and JSPM's JSCOE,Hadaspar	7	217	210
3	Mumbai-Pune-Banglore (NH-IV)	On the road entry to JSCOE college, Hadapsar	6	381	375
4	Mumbai-Pune-Banglore (NH-IV)	At well on an internal road, Hadapsar	9.5	360	350.5
5	Mumbai-Pune-Banglore (NH-IV)	At intersection of 2 water veins, on an internal road, Hadapsar	10	405	395
6	Mumbai-Pune-Banglore (NH-IV)	Shirwal	4.5	294.5	290
7	Mumbai-Pune-Banglore (NH-IV)	Shivapur	3	418	415
8	Mumbai-Pune Expressway	50 Km	8	115	107

Table No. 2 Bio Voltmeter readings in mV

Sr. No.	Day	Bio Voltmeter readings in mV at						
		0˚ Non stress zone	30˚ Stress zone	60˚ Stress zone	90˚ Stress zone	120˚ Stress zone	150˚ Stress zone	180˚ Non Stress zone
1	22-06-08	1.2	31	70	65	51	33	1.8
2	23-06-08	0.8	23	50	42	40	19	1.0
3	24-06-08	0.4	72	80	80	62	31	4.5
4	25-06-08	4.5	77	76	72	43	25	1.9
5	26-06-08	6.5	66	76	70	40	28	4.0
6	27-06-08	2.5	45	53	47	42	18	6.0
7	28-06-08	1.5	39	55	50	43	20	2.1
8	29-06-08	1.5	36	53	48	43	25	3.1
9	30-06-08	3.5	40	51	46	41	23	2.3
10	1-07-08	4.5	38	51	48	40	31	4.0
11	2-07-08	2.5	55	72	68	60	28	2.1
12	3-07-08	3.5	78	92	88	82	55	6.1
13	4-07-08	2.5	15	28	26	24	12	3.1
14	5-07-08	4.5	75	88	82	78	35	5.1
15	6-07-08	1.6	15	30	28	24	12	2.1
16	7-07-08	4.5	76	80	72	63	36	1.2
17	8-07-08	4.8	65	92	88	80	41	4.8
18	9-07-08	2.5	46	50	43	38	29	1.5
19	10-07-08	0.5	26	29	25	24	9	1.5
20	11-07-08	0.3	24	27	21	20	6	0.8
21	12-07-08	4.5	61	64	68	63	55	3.5

ISSN (Online) 2456-1290

International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)

Special Issue

INSIGHT'17 - Advanced Transportation Systems And Infrastructure Development in Developing India

Figure No. : 4

4) Body voltage of drivers on non-stress zones varied from 3 mV to 10 mV, whereas those on the stress zone varied from 15 mV to 545 mV, indicating the sudden increase of about 5 times to upto 50 times. This clearly indicates that the normal functioning of the human body is affected on the stress zones. Averagely, the body voltage increase on the stress zone is about 20 times the normal value. Also while entering the stress zone there was an increase of about 16 times, but while coming back from zone, the decrease in the voltage was only about 12 times, indicating that there is retention of electricity within the body.

5) For variation of body voltage during motion, refer to figures (6, 7, 8, 9, 10 the variation clearly indicate that when a number of stress zones are transited sequential the initial body voltage pattern existing on the non-stress zones is not recovered. Also sudden peaks are observed.

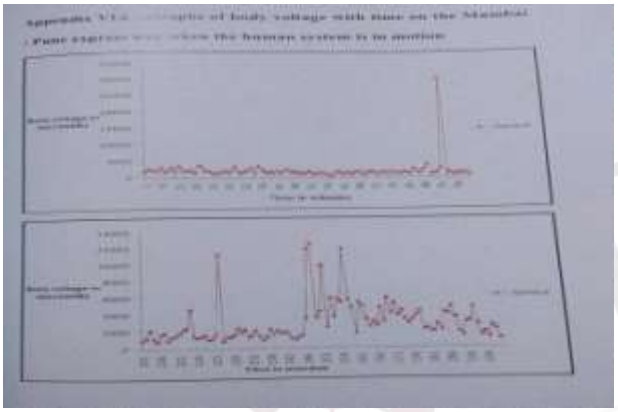


Figure No. 5

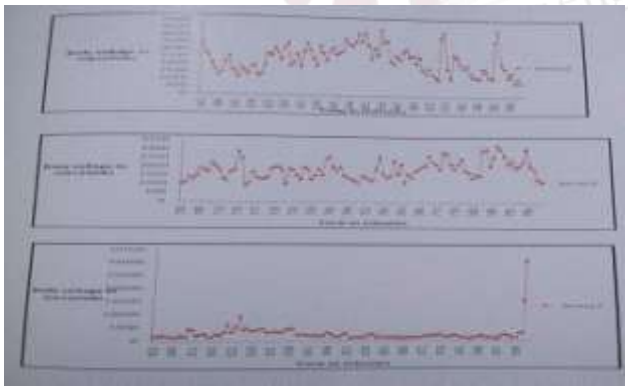


Figure No. : 6

Body voltage in micrometer vs time in minutes

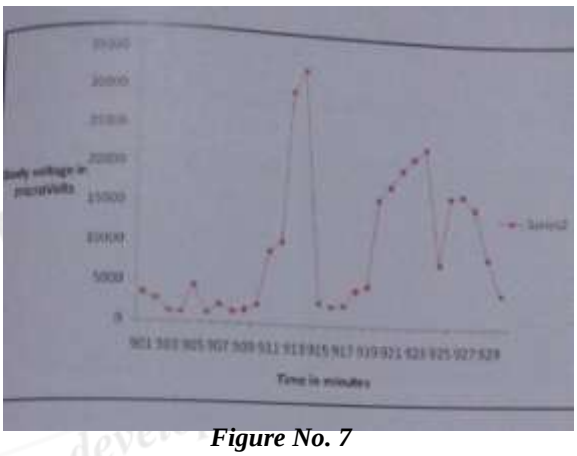


Figure No. 7

Body voltage in micrometer vs time in minutes

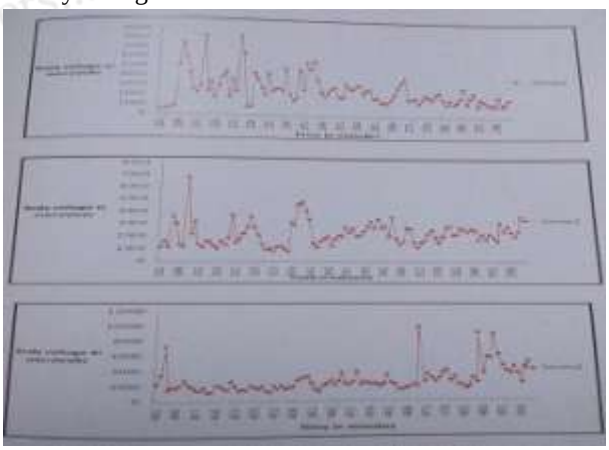


Figure No.: 8

Body voltage in micrometer vs time in minutes

Model Suggested:

1) Relationship between the current (I) measured on the stress zone in micro Amperes and the driver's body voltage (BV) measured in milli Volts is,

ISSN (Online) 2456-1290

International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)

Special Issue

INSIGHT'17 - Advanced Transportation Systems And Infrastructure Development in Developing India

$I = 120 (BV)^{1/3}$ …….Equation 1

Or

$BV = 5.787 \times 10^{-7} I^3$ ……..Equation 2

Knowing the current, based on precise measurement from the stress zone using equation (1), body voltage can be forecast.

2) Linear equations relating the average accidents due to geopathic stress (Ā) with current (I) on stress zone and the driver's body voltage (BV) are:

$\bar{A} = 0.010 (BV) + 13$……Equation 3

$\bar{A} = 0.079 I – 26.22$……..Equation 4

Utility of the Prediction models

In this study, a simple, speedy, precise experimental system has been developed, using the selenium photo-cell and the laser beam source. Using this system, the value of current "I" can be easily measured on the geopathic stress zone. Using equation 2 the body voltage of the driver passing the stress zone can be forecast. If the forecast value is within 0 to 10 milli Volts, there is no chance of an occurrence of an accident.

If the forecast value is in between 10 milli volts to 100 millivolts, there is a lower probability of occurrence of an accident. If the forecast value is between 100 milli volts to 1000 milli volts, based on the value, there exists a very high probability of occurrence of an accident on a geopathic stress zone.

Further, forecast value of the body voltage can be substituted using equation 3, so as to predict the average number of accidents likely to occur per day, at any geopathically stressed location. Equation 4 can also be used to predict the same, based on the value of current I.

A large database can be generated at various geopathically stressed locations along different National Highways and Expressway, using the above equations. This database can be used to classify the accidents spots as black spots or otherwise, based on the value of Ā. This, in turn will enable in the strategic planning of such locations.

For very critical locations, nullification work can be prioritized. The model can further help in predicting the success or failure of the nullification process by re-measuring the reduced or nullified current and repeating the above calculations. Based on this, it is possible to obtain the road user satisfaction, through fulfillment of functional needs, economic needs from the transportation system.

Geopathic Stress as – A Novel Road Design Parameter:

The empirical investigations carried out in this study, have shown that geopathic stress does exist and it affects in a detrimental manner, the human system using the road. Considering the research objectives aforementioned for this study, it is suggested that the geopathic stress should be considered as a design parameter by Indian Road's Congress (IRC) and similar such organizations in various countries**.** As per IRC-37 and IRC-58, the design parameters which presently considered for the flexible and rigid pavements include only the roads, the subgrade characteristics and the temperature variations.

Critical observations of these parameters reveal that they focus mainly on the pavement itself. There is no consideration given to the interaction of the subterranean features like underground water veins, or geological anomalies, with the pavement. Furthermore, the interaction of such features with the road user is also completely ignored, whereas the safety considerations of the road user are basic in nature, for the road accidents. Based on the results obtained in the study, it is therefore argued that geopathic stress should be considered as a road design parameter. This will enable the planners to reduce the pavement deterioration, economize on the road maintenance and most important, reduce the number of road accidents.

REFERENCES

[1] Bobade, Patil, Sorte (2015), "Identification of Accidental Black spots on National Highways and Expressways", International Journal of Research in Advent Technology (E-ISSN:2321-9637) Special Conference, Page No. 82-85.

[2] Bogus, Song, Waggerman, and Lenke (2010), "Rank Correlation Method for Evaluating Manual Pavement Distress Data Variability", Journal of Infrastructure Systems, ASCE, Page No. 66-72.

[3] Chafekar, Jarad, Pimplikar, Kharat, and Sorte (2012), "Effect of Geopathic Stress on Pavement Distresses", IOSR Journal of Mechanical and Civil Engineering ISSN: 2278-1684, Page No. 1-8.

[4] Dharmadhikari N., Kharat A. G., Pimplikar S. S. (2010) "Detection of Geopathic Stresss using Light Inferences Technique", Research Communications – Current Science, Volume 98, No. 5, Page No.695-697.

[5] Dharmadhikari. Meshram, Kulkarni etc., "Use of Dowsing and Geo-Resistivity meter For Detection of Geopathic Stress Zone", International Journal of Modern Engineering Research, Volume 1, Issue 2, Page No. 609-614.

[6] Jamal R. M. Ameen, Jamil A. Naji (2001), "Causal models for road accident fatalities in

Yemen", Accidents analysis and Prevention 33 page no. 547-561.

[7] Kharat, A. G. (2000), "Theoretical and Empirical Investigations on Built Environment", Ph.D. Thesis. Relator: Pune University, India.

[8] Lee, Nam, and Abdel-ATy (2015), "Effects of Pavement Surface Conditions on Traffic Crash Severity", Journal of Transportation Engineering, ISSN 0733-947X/04015020(11), ASCE, Page No. 1-11.

[9] Lee and Halpin (2003), "Predictive Tool for Estimating Accident Risk", Journal of Construction Engineering and Management ASCE, Page No. 431-436.

[10] Pimplikar, Kharat, etc. (2012) "Effect of Geopathic Stress on the performance of roadways", IJECS Volume 4, page no. 125-128.

[11] Pimplikar S. S. (2010), "Empirical and Theoretical Investigations of Accidents on Expressways and National Highways", Ph.D. Thesis. Relator: Pune University, India.

[12] Sorte, Zode, Hire, Kharat (2014), "Geopathic Stress: A Threat to the Built Environment", IJLTEMAS, Volume III, Issue V, ISSN: 2278-2540,Page No. 30-32.

[13] Tsai, Kaul, and Mersereau (2010) "Critical Assessment of Pavement Distress Segmentation Methods, Journal of Transportation Engineering, ASCE, Page No. 11-19

[14] Underwood, Kim, Lay (2011), "Assessment of Use of Automated Distress Survey Methods for Network-Level Pavement Management", Journal of Performance of Constructed Facilities, ASCE, Page No. 250-258.

CODES

[1] IRC 37, 2012, Guidelines for design of flexible pavement.

[2] IRC 58, 2012, Guidelines for design of plain jointed rigid pavement for highways.

WEBSITES

[1] https://data.gov.in/keywords/indian-road-accident-data Accessed on 15/12/2015

[2] http://sites.ndtv.com/roadsafety/important-feature-to-you-in-your-car/ Accessed on 12/01/2016.