



Empirical Study of Human Body Voltage Behavior in Contact with Conductive Floorings in Residential Buildings

Arjun Vasatkar¹, A. G. Kharat²

¹*Department of Civil Engineering, JSPM's RSCOE Tathawade, India*

²*Professor at Department of Civil Engineering, JSPM's RSCOE Tathawade, India*

Abstract

The floorings used in residential buildings are resistive towards carrying the voltage and due to which the voltage induced in human body does not get discharged by just coming in contact with the flooring. The Present work focuses on using the conductive materials in floorings so that the person coming in contact with it will get benefit of earthing in residential buildings itself instead of going outside for getting in contact with earth. Electronics firms adopt the conductive or static dissipative type of flooring system to reduce impacts of electrostatic charge. Static charge in human body goes on increasing because of electronic gadgets and appliances and even small movement on floor. There are different conductive materials available in market used in various industries which can also be used for residential buildings for benefits.

© 2019 The Authors. Published by IEREK press. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

Keywords

Floorings; Residential Building; Voltage; Human Body

1. Introduction

In houses or residential buildings mostly used floorings consist of insulative properties, as well as these consists electrical gadgets and appliances which increases electrostatic charge however the body voltage reaches more than recommended body voltage. The study shows that human body is an electrostatic generator so it is necessary to discharge the electricity. This charge can be increased even if small movement such as walking on floor or any movement. The proper flooring system can dissipate static energy and contribute to safer environment which is used in ESD safe industries. To remove such static electricity it is required to provide good flooring system so that it can dissipate easily. A conductive floor is the floor having resistance less than 1×10^6 ohms and static dissipative floor is having resistance more than 1×10^6 ohms. A 'grounded' person is said to be connected to earth and receives direct benefit from the free electrons generated directly from earth. It is known that electrical systems of houses or electrical equipment must be grounded to make them function safely and effectively.

2. Literature Review

Justine Mooney (2009) have studied the flooring and footwear system with respect to electrostatic discharge control and concluded that the human body can generate electrostatic charge which needs to discharge the electricity to protect sensitive electronic components. A recent industry study has shown permanent resilient static floor

coverings made from either a rubber composition. These types of resistive floor coverings are the most commonly used for static charge control.

William Beaty (2006) has worked on static electricity in human body and found that Static electricity is not electricity which is stable also It is not a form of energy. For example, the imbalance of voltage can flow along as current, it loses none of its familiar static electrical nature. The entire literature review is suggesting the use of conductive materials in floors for discharging body voltage, but they were not considered the use in residential building for users.

3. Methodology of work

Following factors are considered in methodology of work:-

1. Collection the flooring materials such as tiles, sand.
2. Collection of the conductive materials to be used as a flooring.
3. Analysis of conductivity of flooring materials by means of surface resistivity meter.
4. Determining the static charge built on human body in case of residential building by using body voltage checker.

Various flooring tiles had collected from the nearest construction sites as well as from flooring tiles shops such as Granite, Marble, Ceramic, and Shahabad with their 8-10 samples. The Resistivity test carried on it by means of multi meter. The resistivity test carried over each sample of the flooring tile and results are obtained.

3.1. Antistatic and conductive Tiles

A conductive rubber tile manufacturing company provided various samples of it. Such flooring rubber tiles available in rolled carpet of 2M X 20M in size. 2ft x2ft tiles are also available.

This tile mostly used for operation theaters, server rooms, path labs, I.C.U etc it has all German based certificates. It is required to import from US.

3.2. Feature

- High resistance to corrosion
- Resistance of conductivity
- Good shielding from magnetic frequencies
- Mechanical resistance wear and tear.

Surface Resistance range observed for different materials is given below

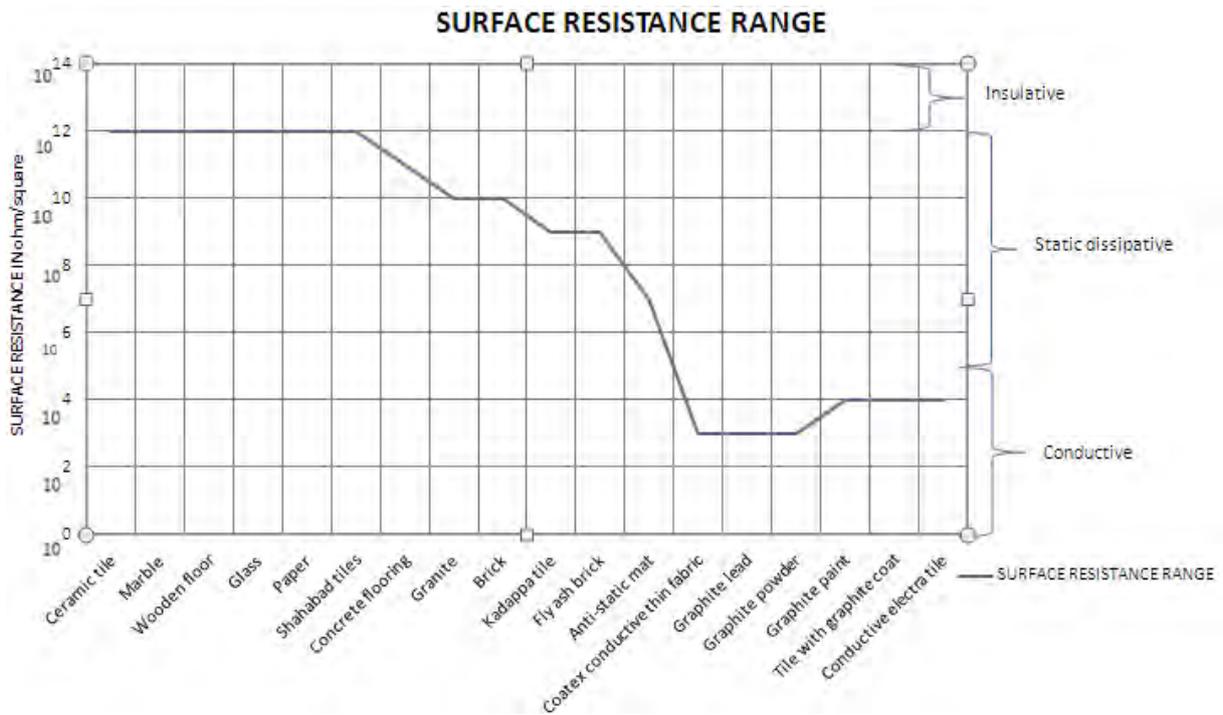


Figure 1. Surface resistance of different materials

4. Case study

Analysis of data at Digital Circuit Private Limited Khalumbre village .

A site visit carried out at D.C.P.L. on 13/05/2017.the following details regarding the topic are obtained

Details -

1. Area of workshop-45ft X 200ft=9000 sq.ft. on Ground floor.
2. Production –Electrical circuits used in television and digital flex used in buses.
3. Type of flooring-Anti-Static mat flooring with Blue color.
4. The Two earthing pits on right side of workshop as a common Earthing points.



Figure 2. Antistatic Mat Provision At D.C.P.L.



Figure 3. Antistatic Mat Provision At D.C.PL with grounding



Figure 4. ESD Footwears used at D.C.PL



Figure 5. ESD Wrist straps used at D.C.PL



Figure 6. An Earthing pit-1



Figure 7. An Earthing pit-2

5. Results and discussion

An experimental setup on the third floor of a five storey building has been done and the testing and experiments were conducted to get the voltage variations data of users, the setup is as shown below.



Figure 8. Final installed conductive tile and antistatic mat flooring

The results obtained from testing the floorings resistivity and person coming in contact has shown some remarkable differences in barefoot and with footwear state of human beings as shown in figures below.

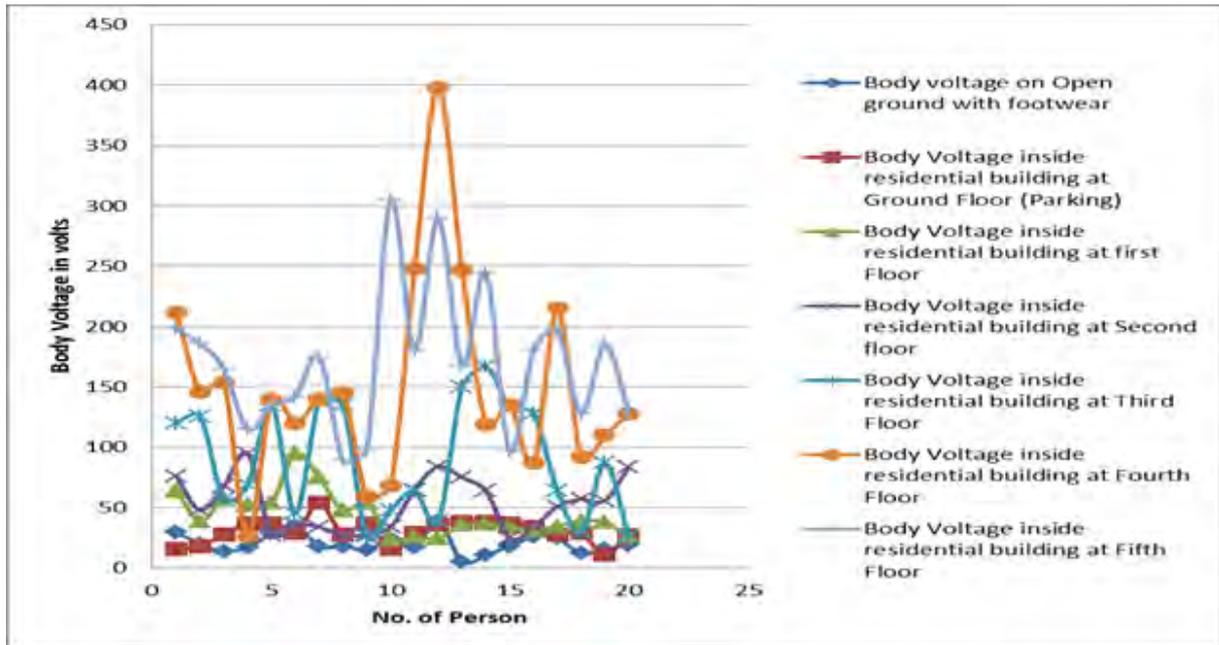


Figure 9. Body voltage (Volts) at different locations with Footwear

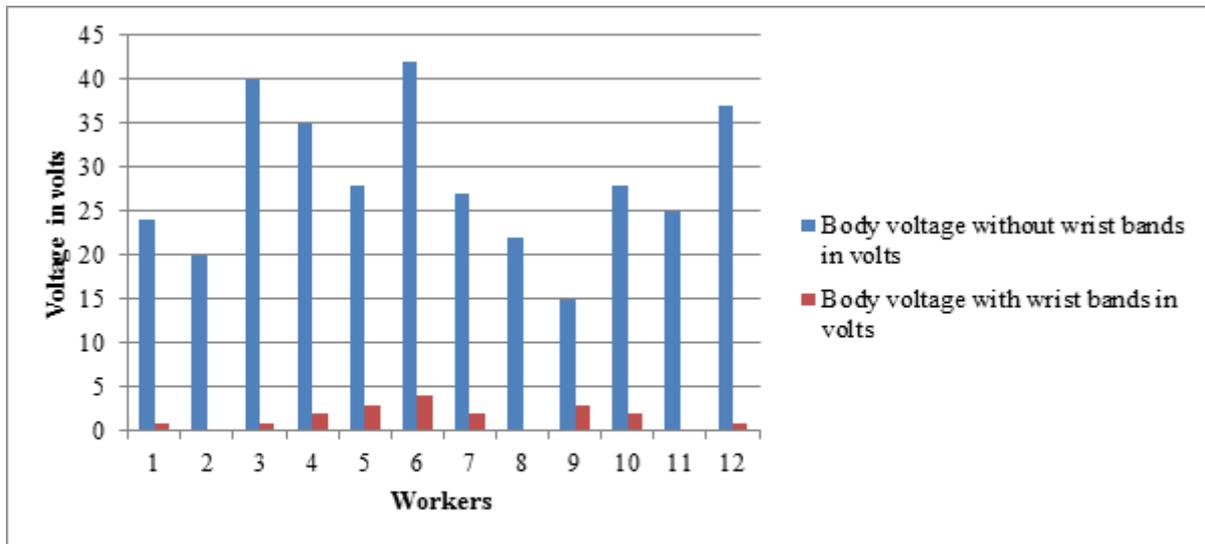


Figure 10. Body Voltage readings of workers at D.C.P.L.

The readings as per above fig clearly suggest that the voltage of human being at different locations changes with respect to person and his current location ground floor to fifth floor. Also the changes in voltage reading can be observed through the physical state of person weather he/she is in rest position or active state, because during active state the voltage is high as compared to rest condition due continuous movement of body. This variation of voltages can be controlled and maintained to desirable level by using the conductive flooring instead of insulative flooring and also being barefoot on natural soil. The changes in reading can be seen in following figure.

It is clear from the above reading that the voltage can be reduced to desirable level being in contact with the conductive media which thereby also imparts connection to ground which is very beneficial for the human beings

in view of health also.

6. Conclusion

The use of conductive materials in flooring in residential buildings are shown the reduction in body voltage and the persons with footwear cannot get the benefit of voltage discharge through his body as the footwear are generally insulative in nature. Also the methods of installing antistatic mats and conductive floors in building has variety of voltage reading when coming in contact with users. The setup has illustrated the energy efficiency as well by reducing the fatigue and work environment to users.

7. References

1. Chevalier, G., Sinatra, S. T., Oschman, J. L., Sokal, K., & Sokal, P. (2012). Earthing: health implications of reconnecting the human body to the earth's surface electrons. *Journal of Environmental and Public Health*.
2. Justine, M., Frank R. (2007). M Electronic Solutions Division. *The Flooring and Footwear System – An Important Part of any Electrostatic Discharge Control Program*,2-6.
3. William, J. B. (1999). *static electricity means High Voltage measuring your body voltage*,01-02.
4. Peter S., Tom M., Polymers, G. (2000). *Static Control Flooring: trends in technology*.
5. Thomas H. B., Francis L. He., Edgar H. M., and Rita C. M. (1960). *Conductive Flooring for Hospital Operating Rooms*, 5-17.