International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 02 Issue: 02 | May-2015 www.irjet.net p-ISSN: 2395-0072

Suitability of Different Materials Used for Road Marking : A Review

Sheikh Azhar U Rehman[1], A.K Duggal[2]

[1] *ME Scholar, Constructional Technology & Management, NITTTR, Chandigarh, India*
[2] *Assistant Professor, Constructional Technology & Management, NITTTR, Chandigarh, India*

Abstract - *Road surface marking is any kind of device or material that is used on a road surface in order to convey official information. They can also be applied in other facilities used by vehicles to mark parking spaces or designate areas for other uses. Various types of materials such as Traffic paints, Thermoplastics, Preformed tapes, Epoxy, polyster can be used for pavement marking. The aim of this work is to study various types of road markings available and ascertain the extent of usage of each type and to compare the economy vis-à-vis suitability of these materials in terms of service life, skid resistance, day time luminance and night time reflectivity on different types of roads. The roads of Chandigarh region in North India is taken as a test site. It is also necessary to study the performance w.r.t aging for various types of road marking and examine the adequacy of the IRC specifications w.r.t. various road types and recommend/ suggest modifications if any.*

*Key Words: Pavement Marking, Marking materials, Durability, Day time Luminance, Night time reflectivity, Ski*d Resistance.

1. INTRODUCTION

Pavement marking plays an important role in the roadwaus system because they provide information for drivers to follow the road. [1]. Road surface marking is any kind of device or material that is used on a road surface in order to convey official information. Pavement markings provide important information to motorists, especially in a work zone environment where alignments are often changed from what is typical. Several materials can be used for pavement markings. However, the performance and cost for each material may vary greatly depending on a number of factors, such as traffic volume, surface type, and project duration [2]. Road surface markings are used on paved roadways to provide guidance and information to drivers and pedestrians. Uniformity of the markings is an important factor in minimizing confusion and uncertainty about their meaning, and efforts exist to standardize such markings across borders. However, countries and areas categorize and specify road surface markings in different ways.

Road surface markings are mechanical, non-mechanical, or temporary. They can be used to delineate traffic lanes, inform motorists and pedestrians or serve as noise generators when run across a road, or attempt to wake a sleeping driver when installed in the shoulders of a road. Road surface marking can also indicate regulation for parking and stopping.

Traffic marking performance is evaluated by factors such as general daylight appearance, color, film condition, bead retention, and reflectance. There are various types of traffic marking material available in the market till now which are explained under the subheading marking material

1.1 MARKING MATERIAL

Pavements markings are sometimes defined by type. Migletz and Grahm (2002) listed 16 types of marking materials available on the market as of 2002 [3]. Most of the materials used for pavement marking are durable which refers that they stay for more than one year. Water based or solvent based paints are considered as a non durable because they have a life span of less than one year. The most popularly used pavement marking materials were paint, thermoplastics, epoxy and polyurea. Out of these, the popularly used material for pavement marking in north India are Thermoplastic and plastic paints. Now a days one more material is used for pavement marking that is Glow mark water based road marking compound to meet the growing needs of traffic engineering and to provide improved safety measures in modern control system [4].

The performance of these marking materials are measured in terms of its Durability, reteroreflectivity, skid resistance.Durability refers to the amount of material remaining on the pavement surface over time and it affects both the day time and night time appearance of marking. It is measured by carrying out visibility test or abrasion test.Reteroreflectivity can be defined as a portion of incident light from vechile's headlight reflected back towards the eye of driver of the vechile[1]. It is typically measured in units of millicandelas per square meter per lux using reteroreflectometers.

Skid resistance is a force developed when a tire that is preventing from rotating slides along the pavement surface highway research board ,1972. It is an important evaluation parameter as it will lead to higher incidences of skid related accidents.

2. LITERATURE REVIEW

Road marking on the surface of road is very important as it provides guidance to the driver as well as pedestrians. It also conveys the information regarding traffic signals and signs to regulate the traffic, defines parking spaces, delineate the roads etc. And the signs used for road marking are standardized to avoid the confusion.

Different materials are used for marking of different types of road surface. The aim of this work is to find out the compatibility of the different material used for road marking

Different researchers carried out the research regarding the use of different material for marking the different roads. So before starting the actual work, the first step is to study the research papers of the required field that have been performed previous by other researchers, to know the level of advancement. For this work, paper related to different material used for pavement marking is studied.

Praprut Songchitruksa et al [2] developed a systematic approach to provide practitioners with objective guidance for selecting cost effective pavement marking material for work zone that meet specific requirements. Four types of material were considered to carry out these study i.e. thermoplastic, paints, temporary tapes and traffic buttons. Various approaches were considered for combining pavement marking performance and work zone project phase duration data so as to establish recommendations for the best marking material to use for a particular work zone situation. And the Monte Carlo simulation analysis method was adopted as it is the most appropriate and flexible approach to address the problem. It was concluded from the research that on asphalt surfaces, traffic buttons were most effective choice for high traffic volume and long project duration. On the other hand, on concrete surfaces the material used is either paint or buttons. Paint was used for short project duration and for long project duration buttons were used. Temporary paints were also analysed and not recommended for any surface.

Dale M. Mull et al [5] developed a new performance prediction model for paint pavement marking that includes effects of snow removal operations.The data for this was taken from North Carolina. And it was concluded that each snowplow degrades the paint pavement marking which degrades the service life of paint pavement marking. Otherwise when there was no snowfall the paint pavement marking had a service life of more than five years with AADT of 4000 vehicles per day.

Pan Liu et al [6] developed a test procedure that can be used to determine whether a thermoplastic traffic marking is a no track thermoplastic traffic marking and to run field tests to obtain performance data through real applications of industry-proclaimed no track thermoplastic traffic markings.

Sven-Olof Lundkvist et al [7] investigated if results obtained on dry road markings can be used for prediction of the retro reflectivity of wet markings. The results presented in paper indicate the possibility of predicting retro reflectivity and skid resistance of wet road markings from R_L dry and MPD (mean profile depth) values. If a mobile reflecto-meter was supplemented with an equipment for measurement of road marking texture, not only will R_L dry would be known, but also R_L wet and skid resistance, with acceptable reliability. It is important not to generalize the results to other types of road markings than those included in this study. Consequently, the model for retro reflectivity of wet road markings was valid for profiled thermoplastic materials and the two skid resistance models for profiled and flat thermoplastics, respectively, all applied in test field.

Luana Ozelim et al [1] undertook a case study based on the data collected by Alabama to model the retro reflectivity performance of thermoplastic pavement markings. The pavement marking must be replaced when retro reflectivity falls below the acceptable value. Thus the purpose of this research was to find out how the existing model fits the data and to develop a new statistical model that could predict retro reflectivity over time. The initial variable that were considered to model the retro reflectivity were initial retro reflectivity, age, AADT etc. Retro reflectivity data was collected by handheld reflecto meter by some group of people. One retro reflectivity curve was developed for each milepost in accordance with color and type of marking. Retro reflectivity data from 2007–2010 were used to create models of retro reflectivity over time. Since only 4 years of data exist, the created curves had to be extrapolated to reach minimum retro reflectivity values.

William E Sitzabee et al [3] determined the performance characteristics of thermoplastic pavement markings in North Carolina and thus create viable life cycle predicative model for those markings. Also the evaluation for paint pavement material was conducted and model was constructed for the performance of both thermoplastic and paints. The data used for this study were collected by an independent contractor who was originally hired by the NCDOT to measure retro reflectivity for specified North Carolina roads for the purpose of quality assurance for new markings. Since the researchers did not have control over the data collection methodology there were some limitations on the analysis associated with using the existing data. Most of the data set of roads that was available, the roads with thermoplastic pavement marking was selected. And limited data for paint pavement marking roads were analysed. The modelling method used was least square analysis. This study confirmed that both

thermoplastics on asphalt and paint pavement markings could be modelled as linear through 60 months for thermoplastics and through 12 months for paint. From the testing site point of view the following conclusions were made that Paints have a service life slightly greater than 2 years, and both thermoplastic and paint pavement markings were found to have a far greater life expectancy than originally expected.

3. DISCUSSION

From the literature survey carried out it has been found that Effective Pavement marking provides reduction in accident by delineating the roads. It has also been found out that thermoplastics have greater life span than any other material. The total expected cost of selecting particular marking material depends on several factors, such as the actual material service life, construction phase completion, and unit cost of materials.

Some gaps are identified from the literature survey that In has been carried out are that most of studies regarding this have been carried outside India. Therefore application under Indian environmental and traffic conditions need to be verified. Also all these researchers have compared only two materials at time; though there is more variety of materials.
As per codal provisions there is no restriction on thickness i.e. how much thickness should one use on a specific type of road.. Life cycle studies are not done specifically

4. METHODOLOGY

This includes the detailed description of the different road marking material and various tests that are to be carried out on different road marking material on different road to compare the suitability in terms of Skid Resistance, Durability, night time reflectivity and day time luminance. The step by step procedure of work is as follows:

Step 1. It is desired to categorize different types of roads such as Freeway, Highway, Street, Urban roads, Parking Lot areas based on their usage characteristics.

Step 2. Different types of material such as thermoplastic paint, Traffic paint, preformed tapes, Glowmark water based paint will be studied and their suitability of application shall be ascertained

Step 3. Data shall be collected on application details of various materials on various roads. This will include time of application, thickness applied, traffic conditions etc

Step 4. Various Properties will be measured on old applications. Then we will check the suitability and durability of thermoplastic materials that have been already applied on various roads in Chandigarh by carrying out different tests on this material.

Step 5. Now application of alternate material on the road for road marking shall be made to compare the suitability of different material.

Step 6. Then to compare the suitability of different materials by checking their Durability, Skid Resistance, Daytime Luminance and Nighttime reflectivity.

Step 7. Then we compare the different materials of road marking for cost analysis by determining their life span on various roads they are being used.

Skid resistance will be measured by using britsh pendulum tester

Reteroreflectivity will be measured by using reteroreflectometer.

Durability will be measured by carrying out visibility test or abrasion test.

5. CONCLUSIONS

This paper a review of suitability of different materials used for road marking is presented. It is expected that proposed study will help in reducing the cost and increase the life span of road marking material. It will help us to give exact details as on to which type of road which material is suitable It will help us in determining the thickness of marking material that we should be using on different types of roads. It will give us idea about which type of material is most suitable on Indian environmental and traffic conditions.

ACKNOWLEDGEMENT

Sheikh Azhar U Rehman is thankful to Prof A.K Duggal for his valuable guidance and encouragement . Author is also thankful to Mr. Sanjeev for his constant help in carrying out this work.

REFERENCES

[1]. Luana Ozelim and Rod E. Turochy, "Modeling Retro reflectivity Performance of Thermoplastic Pavement Markings in Alabama", Journal of Transportation Engineering, Page140, 2014.

[2]. Praprut Songchitruksa, Gerald L. Ullman, and Adam M. Pike, "Guidance for Cost-Effective Selection of Pavement Marking Materials for Work Zones" Journal Of Infrastructure Systems , Vol 17, Page 55-65, June 2011.

[3]. William E. Sitzabee, Joseph E. Hummer, and William Rasdorf, Pavement Marking Degradation Modelling and Analysis, Journal Of Infrastructure Systems, Vol 15, Page 190-199, September 2009.

[4]. Manual of Jayanti Constructions limited.

[5]. Dale M.Mull, and William E. Sitzabee, "Paint Pavement Marking Performance Prediction Model", Journal of Transportation Engineering, Vol. 138, pp. 618-624, May 2012.

[6]. Pan Liu, Jian John Lu, Qin Wang, and Paul Vinik, "Performance Evaluation of No Track Thermoplastic Traffic Markings", Journal Of Transportation Engineering, Vol 136, pp. 998-1007, November 2010.

[7]. Sven-Olof Lundkvist ,Ulf Isacsson, Prediction Of Road Marking Performance, Journal Of Transportation Engineering,June 2007

BIOGRAPHIES

Sheikh Azhar U Rehman received his B.tech degree from Punjab Technical University in 2012. Currently he is pursuing his M.Tech degree from Punjab University. His area of interest are transportation engineering, public health engineering, structure engineering.

Er. A.K duggal received his B.Tech degree from REC Kurukshetra and M.Tech Degree from University of Roorkee. Currently he is working as a Associate Professor in National Institute of Technical Teacher Training and Research Centre. He has number of papers published in his credits in various National and international journals. His area of interest are civil engineering and highway engineering.

