# REVIEW OF PENETRATION GRADING SYSTEM AND SUITABILITY OF THE VISCOSITY GRADING SYSTEM FOR ASPHALT BINDERS IN SRI LANKAN HIGHWAYS

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(118019N)



Degree of Master of Science

Department of Civil Engineering

University of Moratuwa

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April 2014

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## Declaration

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out this research for the dissertation under my supervision.

…….. ……...

Signature of the supervisor Date

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# ABSTRACT


## Review of penetration grading system and suitability of the viscosity grading system for asphalt binders in Sri Lankan highways

Road development has become a dominant component in modern Sri Lanka. As a developing nation durability and long term performance of roads are very much important to the country. In Sri Lanka flexible pavements are the frequently used for road construction. In flexible pavement bitumen and aggregate are the main ingredients for surface layer. The quality of bitumen for roads is assessed using penetration grading system which was initiated in early 19$^{th}$ century. The quality of bitumen and the method of grading bitumen in Sri Lanka have made several discussions among the professionals because of the premature failures on some major roads. In this research twenty three bitumen samples were collected from various construction sites and tests were carried out to assess their quality. A sample of test reports issued by the bitumen suppliers were also taken in to consideration. Penetration test, Softening point test and Viscosity test were carried out using the collected samples. Penetration and Softening Point were assessed using the local bitumen specifications and viscosity was assessed based on the requirements of viscosity grading system. The Quality of bitumen was further analysed using the temperature susceptible measures such as Penetration Index, Viscosity Temperature Susceptibility and Pen-Vis Number. Relationship of temperature susceptibility measures were carried out using statistical means. Behaviour of bitumen at operation level was analysed using equi-viscous method of Asphalt Institute MS-2. Indirect methods were used to obtain the stiffness of bitumen and asphalt concrete. Stiffness measures were analysed with climatic considerations and traffic loading. Based on the test results and analysis, modifications for the standard of bitumen selection are recommended. Testing of bitumen properties at construction temperature range is essential. So, addition of kinematic viscosity at 135 C to the current specification in selecting bitumen for road construction in Sri Lanka and the importance of viscosity based grading system in bitumen selection was emphasized in this study.





*Key words*: Bitumen, Penetration, Viscosity, Grading

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| Abbreviation | | Description |
|---|---|---|
| AI | - | Asphalt Institute |
| PI | - | Penetration Index |
| VTS | - | Viscosity Temperature Susceptibility |
| PVN | - | Penetration Viscosity number |
| HMA | - | Hot Mix Asphalt |
| ICTAD | - | Institute of Construction Training And Development |

## LIST OF APPENDICES