

MOISTURE SUSCEPTIBILITY OF BITUMINOUS MIXES

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TRC 13 - CET RP5

OBJECTIVES

The objectives of the study are,

- To examine the possibility of making nano-sized lime particles through a commonly available mechanical method known as ball milling process using Los Angeles abrasion machine and planetary ball milling machine
- To study the properties of bitumen modified with different percentages of nano sized lime
- To evaluate anti-stripping properties of compacted and loose HMA mixtures prepared with base and modified bitumen

METHODOLOGY

- It consists of preparation of nano scale lime particles by ball milling process, mixing of lime with bitumen, evaluation of engineering properties of component materials.
- QL was super fine in Los Angeles (LA) abrasion machine to reduce the size of lime particles to the nano scale.
- All the tests on bitumen was done at Cochin Refinery.
- The dosage of quick lime added was limited to 4% because further addition highly increased the viscosity of bitumen and hence uniform blending was difficult to achieve using a mechanical stirrer.

OUTCOME

- The particles obtained were of irregular size and a maximum particle size reduction of 1025 nm was obtained for 2500 levels of rotation
- The dosage of quick lime added was limited to 4 % because further addition highly increased the viscosity of bitumen and hence uniform blending was difficult to achieve using a mechanical stirrer
- A percentage reduction in viscosity ratio of 27%, 49% and 64% were obtained for VG 10 with 1%, 2 % and 4% of lime and 12%, 22% and 33% for VG 30 with 1%, 2% and 4 % of lime
- The reduction in viscosity ratio is significant and more for VG 10
- This shows that powdered quick lime particles reduced the short term ageing effect of the binder
- Thus oxidative age hardening and fatigue cracking can be reduced by the addition of quick lime in bitumen
- The percentage loss of stability of control mix prepared with VG 10 and VG 30 binder was of the order of 20.5 and 18.2 percent
- The stability losses of HMA mixes with the addition of 1%, 2% and 4% of powdered QL in VG 10 and VG 30 binder was obtained as 15.2%, 14.3%, 12.8% and 14.4%, 12.5%, 11.3% respectively. The percentage of stability losses are found to be less than a maximum requirement of 25% as specified in MORTH
- The addition of QL in bitumen increased the Marshall stability of the mix
- TSR of the control mixes prepared with VG 10 and VG 30 binder was obtained as 79% and 78.2% which was less than 81%, a requirement by AASHTO

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OUTCOME (contd..)

- TSR values obtained by adding 1%, 2% and 4% of powdered QL in VG 10 and VG 30 binder was obtained as 92.4%, 88.9%, 87% and 86.1%, 89.2%, 91% respectively which was greater than 84%, a minimum requirement by SCDOT
- A percentage gain in TSR value of 17%, 13%, 10% and 10%, 14%, 16% was obtained with the addition of 1%, 2% and 4% of QL in VG 10 and VG 30 binder respectively
- The percentage of bitumen retained after conducting Texas boiling water test on mixes prepared with VG 10 and VG 30 binder was obtained as 70%, and 65% respectively
- The percentage of bitumen retained was found to be 80%, 85% and 95% for the mixes prepared with modified VG 10 binder having 1%, 2% and 4% of powdered QL
- The percentage of bitumen retained for the mix prepared with modified VG 30 binder having 1%, 2% and 4% of powdered QL was found to be 85%, 90% and 97% respectively

M-TECH PROJECTS (1 No's)

1. "Moisture Susceptibility of HMA Mixtures Modified with Nano Sized Lime", 2014

PUBLICATIONS (1 No's)

1. Maneeta Sukumaran and Priya R, "Effect on Addition of Sub Nano Sized Quick Lime on the Properties of Bitumen", NCTT, 2014.

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