

# Evaluation of Rheological Properties and Performance of Asphalt Binder Modified With Nano Clay

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## Abstract

The rheological behaviour of bitumen is very complex and it can vary from purely viscous to elastic, depending on the loading time and the temperature. Bitumen plays a major role in many aspects of road performance. Various investigations have been carried out related to the modified bitumen, to improve the performance of bituminous mixtures. Most of the Roads have failed due to the rutting and cracking of the bituminous layer, which is mostly due to the poor performance of bituminous binders. So, the modification of the bitumen is a major approach, and modified bitumen has been effectively used in many countries to construct pavements during the last three decades. This research presents a laboratory scale evaluation of the conventional and the fundamental rheological characteristics of modified binders with micro clay and Nano clay contain 2%, 4%, 6% & 8% by its weights.

Engineering fields widely use montmorillonite (MMT) Nano clay for a wide range of applications. In Sri Lanka also, there had been research about the usability and characterization of MMT clay available at Mannar area near the Giant tank. The clay powder prepared from the original samples taken from the above area were added to the original bitumen of 60/70 penetration grade binder to prepare the modified binder.

Modified bitumen samples were prepared at a mixing time of 25 minutes by adding Nano clay mixed at 160<sup>0</sup>C. The properties of the modified binders with Nano clay were evaluated in terms of penetration, softening temperature, ductility and dynamic viscosity tests. Finally each sample of modified bitumen was evaluated for rutting and fatigue resistance for fresh and aged samples with the Dynamic Shear Rheometer (DSR) test.

It was observed by the results obtained from the tests that the softening point and viscosity increased up to 4% clay, penetration and ductility had decreased with the increasing of clay percentage. Rutting resistance had not improved compared to conventional bitumen and it showed that modified bitumen and the original sample showed PG 70 grade with 2%, 4%, 6% and original bitumen sample.

It can be concluded that the montmorillonite clay modification helped to improve some characteristics of the bitumen binders. But at this level they are not at a stage enabling the verification of their application at a large scale.

**Key Words:** Nano clay, Montmorillonite, Viscosity, Penetration, Softening point, Dynamic Shear Rheometer

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