

# Effects of Nano-kaolin Clay on the Rutting Resistance of Asphalt Binder

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**Abstract.** Nowadays, nanotechnology has been widely study because it's proven to improve the properties of asphalt. There a lot of nano-materials in industrial area and one of them are Nano clay. Therefore, this study was performed to investigate the rutting resistance of asphalt incorporating Nano-kaolin. The asphalt was evaluated in fresh and aged condition. In this study, asphalt binders with five different percentages of Nano-kaolin (0%, 3%, 5%, 7%, and 9%) contain was prepared. The results indicated that the addition of Nano-kaolin was helpful in enhance the rutting resistance of the binders. In addition, based on the testing results, the ideal asphalt was achieved at 5% of Nano-kaolin content.

5. M.S. Prasad, K.J. Reid, and H.H. Murray, "Kaolin: processing, properties and applications," [Applied Clay Science](#), 6 (2) pp. 87-119 (1991).
6. E.C. Leong, C.C. Lee, and K.S. Low, "An active control system for matric suction measurement," [Soils and Foundation](#), 49 (5) pp. 807-811 (2009).
7. K.A.H. Saeed, K.A. Kassim, N.Z.M. Yunus, H. Nur, "Physico-chemical characterization of lime stabilized tropical kaolin clay," [Jurnal Teknologi](#), 72 (3) pp.83-90. 2014.
8. ASTM-D7175, Standard Test Method for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer, American Society of Testing and Materials, Pennsylvania: West Conshohocken; 2015.
9. C.M. Nurulain, P.J. Ramadhansyah, Y. Haryati, A.H Norhidayah, M.E. Abdullah and M.H. Wan Ibrahim, "Performance of macro clay on the porous asphalt mixture properties," [IOP Conference Series: Materials Science and Engineering](#), 271 (1), pp. 1-5 (2017).
10. BS EN 14770:2012. Bitumen and bituminous binders. Determination of complex shear modulus and phase angle. Dynamic Shear Rheometer (DSR). British Standards Institution, UK.
11. M.D. Nazzal, S. Kaya, T. Gunay and P. Ahmedzade, "Fundamental Characterization of Asphalt Clay Nano-Composites," [Journal of Nanomechanics and Micromechanics](#), 3 (1) pp. 1-8 (2013).
12. M. El-Shafie, I.M. Ibrahim and A.M.M. Abd El Rahman, "The addition effects of macro and nano clay on the performance of asphalt binder," [Egyptian Journal of Petroleum](#), 21 (2), pp. 149-154 (2012).