

ANALYSIS OF THE USE OF USED TIRE RUBBER WASTE IN ASPHALT MIXTURES (AC-WC) USING THE MARSHALL METHOD

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ABSTRACT

The accumulation of waste tires poses a significant threat of environmental pollution, making their utilization as an asphalt modifier in Asphalt Concrete – Wearing Course (AC-WC) mixtures a viable, sustainable solution. This study aims to analyze the effect of substituting crumb rubber on the volumetric and mechanical characteristics of AC-WC mixtures using the Marshall method in accordance with the Bina Marga General Specifications. Testing commenced with determining the conventional Optimum Asphalt Content (OAC), which was established at 5.25%. Subsequently, Penetration 60/70 asphalt binder was modified via the wet process by incorporating waste tire crumb rubber at variations of 0%, 4%, 6%, 8%, 10%, and 12% by weight of OAC. Laboratory test results indicated that the Optimum Crumb Rubber Content (OCRC) was achieved at 6%. At the 6% OCRC condition, the resulting Marshall parameters yielded a Density of 2.18 g/cm³, Void in Mineral Aggregate (VMA) of 17.16%, Void in Total Mix (VIM) of 4.91%, Void Filled with Asphalt (VFA) of 71.52%, Stability of 840.03 kg, Flow of 3.10 mm, and a Marshall Quotient (MQ) of 275.19 kg/mm. All parameters at 6% OCRC fully complied with 100% of the Bina Marga technical specifications. The addition of crumb rubber proved to enhance the flexibility and elasticity of the mixture, despite a reduction in stability and MQ values compared to neat asphalt. Conversely, substitution levels ranging from 8% to 12% failed to satisfy the specifications due to VIM values exceeding the maximum limit of 5.0% and VFA falling below the minimum limit of 65%.

Keywords: *Flexible Pavement, Crumb Rubber, Marshall Method, Volumetrics, Stability.*