

INTISARI

Saluran drainase yang kurang memadai dalam menampung air hujan dapat mengakibatkan banjir di permukaan jalan beraspal sehingga menimbulkan kerusakan, menurunkan tingkat keamanan dan kenyamanan pengguna jalan, serta biaya perbaikan kerusakan relatif sangat besar. Keawetan perkerasan beraspal kondisi terendam air dipengaruhi oleh gradasi agregat. Optimasi ketahanan campuran beraspal berdasarkan jenis gradasi akibat pengaruh air banjir belum dilakukan. Oleh karena itu, tujuan utama penelitian ini menentukan gradasi optimum campuran beton aspal pada kondisi terendam air banjir dan menyelidiki kinerja campuran beraspal berdasarkan kuat tarik, kuat tekan, modulus elastisitas, serta rayapan statis selama rangkaian waktu perendaman dan penuaan.

Lima jenis gradasi agregat, dua jenis aspal, AC 60/70 dan aspal modifikasi elastomer (AME) dipilih sebagai bahan susun campuran beton aspal. Air banjir di karakterisasi berdasarkan pH dan *Total Suspended Solids* (TSS). Kesesuaian air banjir sebagai media perendaman ditentukan berdasarkan pencocokan pH genangan air banjir dan air dari Selokan Mataram, Yogyakarta pada musim hujan. Pengondisian menggunakan rendaman air banjir dan penuaan campuran beraspal. Simulasi rangkaian waktu perendaman selama 0, 1, 2, 4, dan 7 hari, suhu 25 °C, dan simulasi penuaan campuran beraspal *short term oven aging* (STOA) dan *long term oven aging* (LTOA). Pengujian yang digunakan untuk mengukur keawetan campuran beraspal akibat air banjir adalah kuat tarik tidak langsung (*indirect tensile strength*, ITS), kuat tekan bebas (*unconfined compressive strength*, UCS) dan rayapan statis (*static creep*). Pengembangan pengujian UCS, perangkat lunak delta dimensi *software* dan alat pengujian rayapan statis dilakukan untuk menentukan kuat tekan, modulus elastisitas dan parameter rayapan pada kondisi terendam air banjir. Indikator keawetan diukur berdasarkan *equivalent retained strength* (ERS) dan indeks keawetan (*durability index*) pada setiap jenis pengujian. Penentuan gradasi optimum campuran beton aspal berdasarkan pemeringkatan ERS pada setiap pengujian.

Hasil penelitian adalah pengembangan indeks gradasi sebagai ukuran kuantitatif perubahan gradasi agregat mampu menunjukkan pengaruh gradasi pada campuran beton aspal berdasarkan pengujian Marshall, ITS dan UCS. Perancang campuran beraspal dapat menggunakan indeks gradasi sebagai bagian dalam optimasi campuran beraspal. Analisis pengujian ITS campuran beton aspal selama rangkaian waktu perendaman belum mampu mengidentifikasi kelemahan akibat air banjir. Pengembangan pengujian UCS menghasilkan kuat tekan dan modulus elastisitas pada campuran beton aspal selama rangkaian waktu perendaman air banjir. Hasil pengujian UCS menunjukkan pelemahan campuran beton aspal akibat rendaman air banjir. Model hubungan antara indeks keawetan-kuat tarik, indeks keawetan-kuat tekan, indeks keawetan-modulus elastisitas dan indeks gradasi adalah polinomial pangkat dua. Pemahaman model dan hasil pemeringkatan ERS pada pengujian ITS dan UCS menemukan bahwa gradasi optimum campuran beton aspal terhadap pengaruh air banjir terletak pada rentang indeks gradasi (GI) 21,53-27,29%. Berdasarkan pemeringkatan ERS, penggunaan aspal AME memberikan keawetan lebih baik daripada AC 60/70 pada kondisi rendaman air banjir. Hasil pengujian rayapan statis pada campuran beraspal terendam air banjir menunjukkan bahwa perendaman air banjir meningkatkan potensi kerusakan alur dan menurunkan kemampuan pemulihan kekuatan campuran beton aspal.

Kata kunci: air banjir, campuran beton aspal, indeks keawetan, gradasi optimum

ABSTRACT

Inadequate drainage channels capacity during the rainy season can cause flooding on the surface of road pavement which causes damage and decrease the safety, convenience of road users, and the cost of repair the road damage is relatively very high. The durability of flexible pavement due to water immersion is influenced by aggregate gradation. Asphalt mixture optimization of flood water resistance by type of gradation has not been done. Therefore, the main objective of this study was to determine the optimum gradation of asphalt concrete mixture in flood water immersion and investigate the performance of asphalt mixture based on tensile strength, compressive strength, elastic modulus, and static creep during the period of immersion and aging.

Five types of aggregate gradation, two types of asphalt, Asphalt Cement (AC) 60/70 and elastomer modified asphalt (AME) were selected as binder mixture of asphalt concrete. Flood waters are characterized by pH and Total Suspended Solids (TSS). The suitability of the flood water to become the immersion medium is determined based on the pH of flood and Selokan Mataram's water Yogyakarta in the rainy season. Conditioning using flood water immersion and aging of the asphalt mixture. Immersion time series of 0, 1, 2, 4, and 7 days, temperature 25 ° C, and aging simulation of short-term oven aging (STOA) dan long-term oven aging (LTOA). Tests used to measure the durability of asphalt mixtures due to flood water are an indirect tensile strength (ITS), unconfined compressive strength (UCS) and static creep. Development of UCS testing, delta dimensi software and static creep testing tools were performed to determine compressive strength, elastic modulus and creep parameters under flood water immersion. The durability indicator is measured based on equivalent retained strength (ERS) and durability index (DI) on the test. Determination of optimum gradation of asphalt concrete mixture based on ERS rating on each test.

The result of the research is the development of gradation index (GI) as a quantitative measure of aggregate gradation. GI able to show the effect of gradation on asphalt concrete mixture based on Marshall, ITS and UCS test. Accordingly, the designer of asphalt mixtures can use GI as part of the optimization of the asphalt mixture. Analysis of ITS testing of asphalt concrete mixture during the time immersion series has not been able to identify the weakness caused by flood waters consistently. Development of UCS testing yields compressive strength and elastic modulus on asphalt concrete mixtures during a series of flood-immersion periods. UCS test results showed the weakening of asphalt concrete mixture due to flood water immersion. The relationship model of durability index-tensile strength, durability index-compressive strength, durability index-elastic modulus and gradation index are 2nd order polynomial. Understanding model and the result of ERS rating on ITS and UCS test found that optimum gradation of asphalt concrete mixture against flood water influence lies on GI 21.53%-27.29%. Based on the ERS rating, the use of AME asphalt provides better durability than AC 60/70 under flood water conditions. The results of static creep test show that flood water immersion will increase the rutting potential and decrease the recovery capability of asphalt concrete mixtures.

Keywords: flood water, asphalt concrete, durability index, optimum gradation