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THE EFFECT OF FLOOD CAUSED BY CLIMATE CHANGE TO POROUS ASPHALT PAVEMENT

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ABSTRACT

The test Indirect Tensile Strength for asphalt quality 3%, 4%, 5% are 0.0673, 0.325, 0.2370 subsequently. Cantabro test, loss weight for asphalt quality 3%, 4%, 5% are 77.10, 14.56, 9.70 subsequently. Coefficient vertical test permeability 0.1795 for asphalt 3%, 0.2029 for asphalt 4%, and 0.1596 for asphalt 5%, Unconfined Compressive Strength, Modulus elasticity 146.543 and ratio poisson 0.095831 for asphalt 3%, Modulus elasticity 91.450 and Ratio poisson 0.206009 for asphalt 4%, and, Modulus elasticity 32.119 and radio poisson 0.778059 for asphalt 5%, Scanning Electron Microscope (SEM) Oxygen 58.46%, Silicon 2.60%, Aluminium 2.91%, Sodium 5.75%, Calcium 19.11%, Sulfur 7.83%, Magnesium 3.52%, SiO2 6.73%, Al2O3 6.40%, Na2O 7.45%, CaO 46.25%, SO3 27.05%, MgO 6.12%, The results of EverStressFE analysis for multilayer soil-rigid are vertical deflection 0.5 mm, vertical microstrain (εz) + 0 s/d 200 on deepness 150 mm, and for multilayer soil- rigid-asphalt results vertical deflection (Uz) + 0.64 mm on the surface and + 0.4 mm on the deepness of 50 mm, and vertical microstrain vertical (εz) + -6400 s/d -7200 on the surface, + -4800 s/d -5600 on the deepness of 150 mm. As the result of laboratory test soil-rigid are vertical deflection each point 1.535 mm, 1.535 mm, 4.505 mm, 2.45 mm, 4.19 mm, dan 3.61 mm, and microstrain C1 to C4 0.36, -37.68, 44.44, 43.48, and the results of test Multilayer soil-rigid-asphalt are vertical deflection each point 1.576 mm, 0.075 mm, 3.7 mm, 1.985 mm, 2.48 mm, 0.986 mm, and the value of asphalt course microstrain is 655.

KEYWORDS: Domato stone; Cantabro Loss; Indirect Tensile Strength; Permeabilit y; X- RD and SEM; Unconfined Compressive Strength; Multi Layer.

INTRODUCTION

Utilization of national resources of the region, Buton Island, Southeast Sulawesi is buton. One asbuton processing technology is BNA (Buton Natural Asphalt) Blend between the buton that have been made in the form of liquid and asphalt oil (petroleum asphalt). Use of Stone domato abundant in the coastal areas of Banggai Island Sea Banggai expected to be used as local resources in infrastructure development in the area of remote islands and coast in improving people's lives. Porous asphalt has been used in many countries to use oil as a binder asphalt and has provided a number of advantages in supporting the development of transport networks. This is what motivates research on porous asphalt using domato stone (Quarsite Dolomite) as a coarse aggregate gradation open that qualify as the surface layer.

Porous asphalt is different from the solid asphalt, where porous asphalt shaft consists mostly of coarse aggregate gradation open (open-graded aggregate course) and a small amount of sand and filler. Cavities are formed from a stack frame (skeleton) where coarse aggregates and air void content in the porous asphalt is 10% -25% air voids are concatenated to form subsurface drainage water that can spread rapidly down vertically so that no puddles (Nur. Ali, et al., 2005). This study aimed to design the composition of aggregate and Optimum Blend BNA as water

penetrating the surface layer (permeable asphalt pavement), and analyze the response of porous asphalt layers containing rock Domato and BNA Blend due to the static load test of the structure layer by layer.

MATERIALS AND METHODS

The method used was a laboratory experimental method. The study began with a literature study as a reference implementation of observation and hypothesis formulation. Followed examination material characteristics to be used in order to know the feasibility of such material. This study made some observations on the characteristics of the porous asphalt mix and perform static load testing on composite pavement that has a porous asphalt surface layer. Making the test object there are three different types that will be inserted into the box size 100x100x70 cm 3 as shown in Figure 1

Gambar 1. Model test multilayer

Testing I consists of subgrade size 100x100x40 cm3. Testing II consists of a concrete slab the size of 100x100x15 cm 3 placed on the subgrade 100x100x40 cm3. III testing is testing a multilayer structure composed of ground-porous asphalt concrete-size 100x100x7 cm 3 above the concrete surface size 100x100x15 cm 3 is placed just above the subgrade 100x100x40 cm3.

Data Collection

Examination of the characteristics of the material consists of porous asphalt test the physical properties of the material consists of fine aggregate, stone domato, BNA asphalt and stone domato XRD test. Further examination of the material characteristics of pore asphalt, concrete, and soil. Examination of the characteristics of the pore asphalt binder content of 3%, 3.5%, 4%, 4.5%, 5% ie marshall test, cantabro, permeability and testing Indirect Tensile Strength in Figure 2 and Unconfined Compressive Strength and in Figure 3. Examination of the characteristics of the basic soil compaction test, CBR laboratory and field. While the concrete load test such as compressive strength, flexural strength, split tensile strength, elasticity, and Poisson ratio. Static testing on the test specimen using a hydraulic jack to apply a load on the steel plate as a foothold and use LVDT on the surface to determine the type deflection occurs. Installation of strain gauge on the surface and under the concrete, and asphalt strain gauge planting depth 3.5cm conducted to determine the strain value of the test specimen. Planting soil pressure transducer in the soil at a depth of 20cm to determine the value of the voltage that occurs at the time of loading.

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Gambar 2. UTM Machine untuk pengujian ITS

Gambar 3. UTM Machine untuk pengujian UCS

RESULTS

Test Material

Test results show the physical properties of stone aggregate and sand domato Jeneberang river can be used as a material for making porous asphalt mixture. Chemical properties domato rock consists of lime (CaCO3) at 97% and silica (SiO2) 3:13%. The physical properties of BNA Blend Pertamina in accordance with ISO test method with the results of 54% penetration, penetration after weight loss of 79.29%, flash point 301.5oC, 93.93oC softening point, density 1.04gr / cc, 0:18 weight%, viscosity 1826oC, asphalt ductility 150cm. Test Characteristics Marshall testing process carried out according to the procedure of testing which refers to the SNI 06 - 2489-1991. Test results on asphalt pore marshall known from marshall test results obtained BNA level relationships with VMA, VFB, stability, flow and Marshall Quotient (MQ). Seiiring addition of BNA levels do not affect the permeability, Cantabro test results, weight loss reached 77.10% for the quality of the asphalt 3%, 14.92% for the quality of the asphalt 4% and 9.7% to 5% asphalt quality. Koeficient vertical permeability test 0.18 to 3% asphalt, asphalt 0.20 to 4%, and 0:16 to 5% asphalt, unconfined compressive strength, modulus of elasticity 90.886 and Poisson's ratio of 0.024 to 3% asphalt, 101.950 elasticity modulus and Poisson Ratio 0151 for asphalt 4%, and, modulus of elasticity 29.277 and the Poisson ratio of 0347 to 5% asphalt. Cantabro and porosity values due to the smaller stone structure domato establish order and cavities are interconnected so as to drain the water, and power tie between aggregate and asphalt mixture, the better. Domato rock XRD test data shows the results of testing the chemical properties of rocks that show rock domato domato consists of limestone (CaCO3) at 97% and silica (SiO2) 3:13%. SEM images of asphalt testing briquettes hollow look that up on the thoroughness of 100 lm, the entire surface is covered by asphalt aggregate, as well as predictable or asphalt film thickness covering the aggregate briquettes is approximately 60 to 70 lm. Microstructure and chemical constituents domato stone bond with BNA Blend shown in Figure 4 where the porous asphalt mixture in Table 1 is composed of chemical elements Oxygen (O), calcium (Ca), aluminum (Al), Silicon (Si), magnesium (Mg), Sulfur (S), Sodium (Na), Potassium (K).

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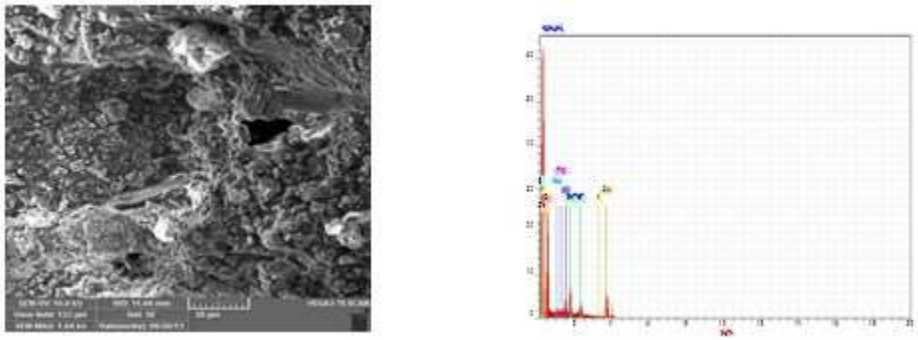
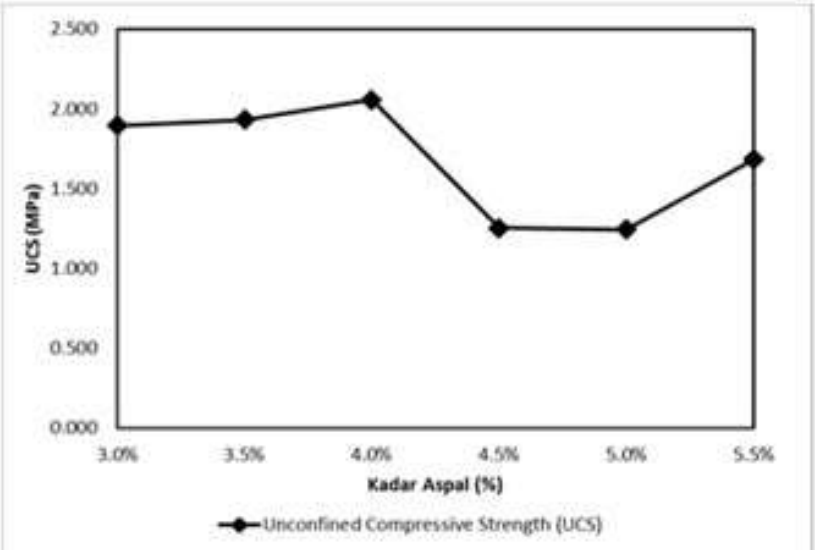


Figure 4. Microstructure and chemical content and BNA domato stone Blend

Table 1. Chemical Ingredients briquettes domato stone asphalt mix and BNA Blend

Element	unn. C [wt.%]	norm. C [wt.%]	Atom. C [at.%]	Compound norm.	Comp. [wt.%]	C Error	(3 Sigma) [wt.%]
Oxygen	41.56	42.98	58.53		0.00		15.03
Silicon	10.48	10.83	8.41	SiO2	23.18		1.46
Aluminium	8.06	8.33	6.73	Al2O3	15.74		1.29
Sodium	7.35	7.60	7.21	Na2O	10.25		1.59
Magnesium	4.74	4.90	4.39	MgO	8.12		0.92
Potassium	1.50	1.55	0.86	K2O	1.86		0.26
Calcium	16.39	16.95	9.21	CaO	23.71		1.58
Sulfur	6.64	6.86	4.66	SO3	17.14		0.84
Total:	96.71	100.00	100.00				

Indirect Tensile Strength test results are at 4% bitumen content of 0.46 MPa, the Unconfined Compressive Strength test the optimum bitumen content of 4% by 2:05 MPa are shown in Figures 5 and 6. The modulus of elasticity of 101,950MPa.



Gambar 5. Hasil uji ITS

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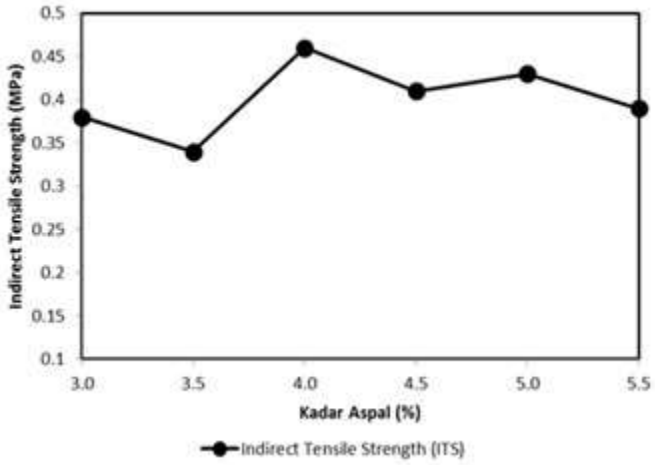

Gambar 6. Hasil uji UCS

Loading test results to determine the strength of concrete obtained concrete quality equivalent K-400 that meets the standards of use as a concrete slab pavement with split tensile strength reaches 4:23 MPa, 5.82 MPa flexural strength and modulus of elasticity 26089.72 MPa. From the results of laboratory CBR CBR unknown field used in this study is the limit of 10.84% - 31.31% Static Test Field CBR test at three points subgrade with 40 cm thick on the box size 100x100 gained an average of 20.76% which is correlated with soil reaction modulus obtained a value of 70 kPa / mm or 0.070 MPa/ mm.Static tests on the subgrade (PI) is known to have the ability to withstand the load 45 482 KN to 0927 MPa surface tension and deflection (decrease) reaches 9.22mm. Vertical depth of 20cm ground voltage due to the load is 0359 MPa. Static test on a concrete slab on top of subgrade (P-II) have the ability to accept a load of up to 142 443 KN to 2903 MPa surface tension and deflection 2.618mm. Vertical depth of 20cm ground voltage due to the load is 0.1909 MPa. Compressive strain in the concrete surface reaches the value of 1.1x10 -4 while tensile strain that occurs under a concrete slab 1.52x10-4 until failure at maximum load. Static test multilayer structure composed of ground-porous asphalt concrete (P-III) has the ability to load up to 221.2 KN with surface tension reached 4,508 and deflection behavior in Figure 7, which is known deflection 1.64mm.

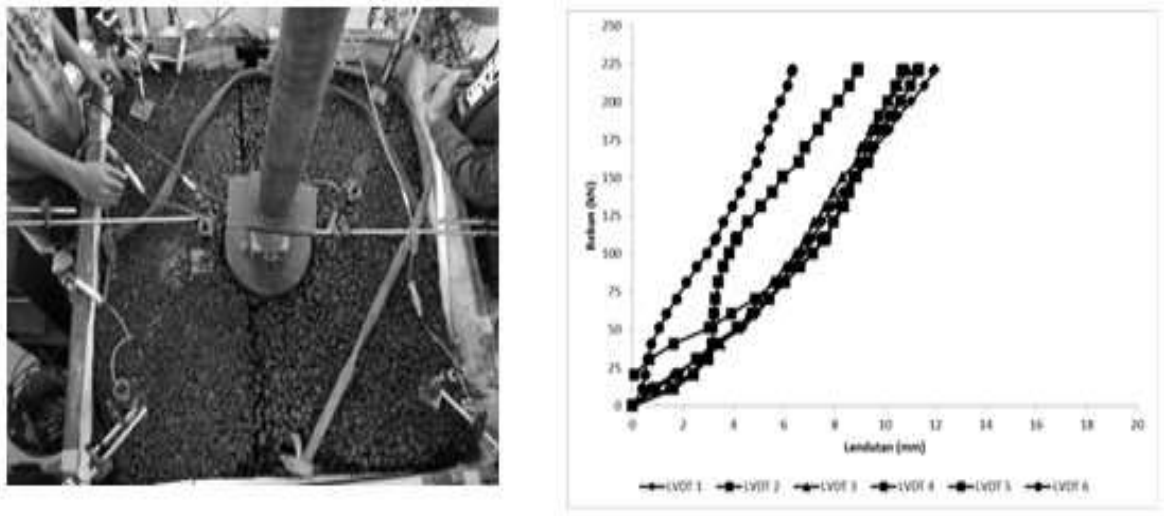

Figure 7. Results of the static test and test behavior due to the imposition of the multilayer soil-concrete- asphalt

Vertical depth of 20cm ground voltage reaches 0156 MPa. Strain at a point on the surface of the concrete strain gauge shows the value press to 1.5x10-4 while behavior under tensile strain plate with 1.3x10-4.

DISCUSSION

The result of rock pore characteristics of asphalt mixture domato and BNA Blend is at 4% bitumen content is best with 1229.27 kg stability, permeability of 0.2 cm / sec, split tensile strength and compressive strength reaches 0.46MPa 2.05MPa than 3% bitumen content 1087.63kg stability, permeability 0.18cm / sec, split tensile strength of 0.38MPa, 1.89MPa compressive strength, and 5% bitumen content 1127.66kg stability, permeability 0:16 cm / sec, split tensile strength of 0.43MPa, 1.24MPa while the compressive strength test results earlier by Nur Ali (2014) with a 4% bitumen content of stability and permeability 0:28 1003.85 kg cm / sec, Natsir (2014) 5.75% bitumen content of stability and permeability 0:28 685.85 kg cm / sec, Wu Shao Peng (2000) asphalt content of 4.5% by 0335 split tensile strength MPa and compressive strength of 3.6MPa, Shiuh Jian Chen (2013) 5% bitumen content permeability 0:23 cm / sec and split tensile strength of 0.52MPa, and MO Hamzah, et al (2013) with 4.1% bitumen content, 4.6%, and 5.2% bertrut-join split tensile strength is 0897, 1006, and 0.98MPa.

CONCLUSIONS AND SUGGESTIONS

From the results of testing the relationship between levels of BNA Blend Pertamina asphalt aggregate can be shown that the bitumen content of experiment 3%, 3.5%, 4%, 4.5% and 5% is seen that the volume of bitumen content of 4% to reach optimum bitumen content . To permeable asphalt pavement size of 1 x 1 meter by using the BNA Blend 4% result that the ability to bear the burden of using stone domato pore asphalt is at 22 tons. Turns Stone domato containing quarsite dolomite comes from a very good beach is used as a material porous asphalt mixture. Expected future porous asphalt testing using domato stones leading to a depth assessment related to the behavior of the model microstructure and chemical properties influence on vehicle load varies.

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