Use of Quarsite Dolomite Stone in Permeable Asphalt, for Load Test as Research Overview and Application in the Laboratory

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Abstract

This study is to examine the nature of the stress and strain by using permeable asphalt and Quarsite Dolomite Stone with But on Natural Asphal. But on Natural Asphal is a type of modified asphalt is made of75

Index terms— quarsite dolomitestone, cantabro loss, indirect tensile strength, permeability, unconfined compressive strength, multi layer test, everstress. FE.

1 Introduction

he natural rock asphalt is a sedimentary rock containing of high hydrocarbon substances. The natural rock asphalt with deposit of approximately 60,991,554.38 ton (24, ??52, ??33.07 barrel oil equivalent) occurs in the southern area of Buton Island, Indonesia (Asep ??uryana et.all, 2003). Buton natural asphalt (BNA) blend is a type of modification asphalt which is made of 75% petroleum asphalt and 25% rock asphalt extraction. The rapid growth of national economic in recent years resulted in a lot of transportation infrastructure demand. Approximately 600,000 tons of petroleum bitumen must be imported annually to fulfill the maintenances and construction of new road demand. The utilization of Buton Natural Asphal for the road development increases the national asphalt industry growth.

The water ponding on the road surface is caused by the heavy precipitation of high intensity rain fall. The water ponding problem during the rainy condition can be decreased by the employment of the permeable asphalt (porous asphalt) as a surfacing road pavement.

Many islands in Indonesia possess lime stones resources that can be used as coarse aggregate. Quarsite Dolomite stone is a local name of lime stone (quartzite dolomite) that can be found in around of Banggailaut area, Indonesia. In order to produce permeable asphalt, Firdaus et.al (2014) employed Quarsite Dolomite stone and Buton Natural Asphal as coarse aggregate and bituminous material, respectively. The results of porosity test, permeability test, stability test, flow test, indirect tensile test and material loss test (Cantabro test) showed the bonding strength between Buton Natural Asphal and Quarsite Dolomite stones can be established thus can enhanced the resistance of porous asphalt against raveling, rutting and shoving.

The solid that is subjected to the short time load are fundamentally characterized by the parameters of stress-strain curve. The failure of asphalt concrete specimens, the behavior of asphalt concrete under load as degeneration of the material and the limit of elasticity can be described by the stress-strain relationship for asphalt concrete in compression (S. ??tarodusbsky et.all., 1994). The unconfined compressive test combined with the indirect strength test can be used to calculate the cohesion strength and the angle of internal strength of the porous asphalt (Wu Shao Peng.all., 2006).

S. Stardubski et all, the peak strain changes on average from 19 mill strain (0.0019) to 22 (0.0022) or 23 mill strain (0,0023) in the compressive strength of dense asphalt concrete with interval of 1.6 Mpa-5.4 Mpa. As the strength of permeable asphalt increases from 1,2Mpa to 2,1Mpa, the range of its peak strain is average from 0.001 to 0.005, which is similar to the peak strain of dense asphalt concrete. The unconfined compressive test result of porous asphalt containing Quarsite Dolomite stone and Buton Natural Asphal showed that the mixtime with 4% has compressive strength value and void, respectively.

This work is a part of various extensive investigation projects on the development liquid Asbuton as bituminous asphalt binder and the suitability of Quarsite Dolomite stone as coarse aggregate in the permeable asphalt production. This paper reported the test results those are carried out to study the compressive strength and the strength strain curve in compression of the permeable asphalt.

As course agregate on the surface layer Road Pavement.Capasity drain porous Asphalt were connecting correlasion with spacing hight and small porousity in structure Asphalt. Stability and Durability and Hydrolic conductivity its must be hight test than **??**0% (Ruz. et. al, 1990).Asphalt porous is open graded course Aggregate. Porousity asphalt porous (10%-15%) the structure made drain for flow water **??**Nur Ali, et al. 2005).

2 Fig. 1 : Permeable Asphalt Pavement

Aggregate was specimen mineral who was done for mixture road construktion in the asphalt pavement it's mush be 90%-95% for the total weight strukture or 77%-85% for all volume (Alkin,et.

3 Methodology a) Mix Design Permeable Asphalt Pavement Testing

Mix design permeable asphalt pavement the used composition open graded system. Who was Mix Trial Gradation lost of material ¾", 1/2 " be stopped filter ½" and loss of material ½" be stopped filter 3/8" with composition coMparative 50-50 to course aggregate. The used fine aggregate lost filter number 4, and stopped filter number 200 all of 10% for mould capacity. Asphalt Blend Pertamina the use variation standard 3%, 3.5%, 4%, 4.5% and 5%. Briquette make in for ? 10 cm and depth + 6.5cm. For open gradation we use lost aggregate ¾", ½" and lost filter by comparative 50 : 50. Fine aggregate we use filter number 4, finally number 200, we used 10%. Buton Natural Asphal we use all variation asphalt category: 3%, 3.5%, 4%, 4.5% and 5%.

Test Indirect Tensile Strength (ITS) has been controlled by ASTM D6931-07.

4 c) Permeability Test i. Limitation Of Darcy's Law

In a porous media, the hydraulic conductivity K represents the specific discharge per unithydraulic gradient, which means that the coefficient depends on both matrix and fluidproperties **??**Bear, 1972). From a dimensional analysis, the hydraulic conductivity can bederived as (Nutting, 1930):( ) 2 v g k K = Re v d q = b) Multi Layer Test

The roads are very important for land transportation infrastructure especially for distribution of goods and services, and to support the economic growth. The safety, comfortable, robust and economic roads will make people easier in their movement. There are three types of pavement construction known today, such as flexible pavement, rigid pavement, and the combinations that known ascomposite pavement. Permeable asphalt pavement was produced with used Quarsite Dolomite stone as course aggregate. The Quarsite Dolomite stone were broken in the spacing ? 3/8" ½"-¾" with the Buton Natural Asphal penetration 60/70. Briket at the Bitumen be done as the standard variation asphalt 3%, 3,5%, 4%, and 5% for testing Where k is the intrinsic permeability, v the kinematic viscosity and g the gravity acceleration.The intrinsic permeability is only a function of the matrix composing the porous media and its characteristics such as grain size distribution, tortuosity and porosity. For porous media, the Reynolds number (Re) can be defined as **??**Charbeneau, 2000):

By the information the writers have, to determine the loads effect to the pavement construction of multilayer can be simulated using computer software i.e. EverStressFE.A pavement construction is a construction of pavement put over the subgrade to serves the traffic loads.

Based on the bonding materials,pavement construction can be divided to:a. Flexible Pavement, b. Rigid Pavement, c. Composite Pavement. Modulus of elasticity, often called as Young Modulus isa coMparison between stress axial strainin an elastic deformation, so that modulus of elasticity shows the trend to deformed and back to the original form when under loads **??**SNI 2826 **??**SNI -2008)). This shownby equation:E = ? ? (4)

while E = modulus of elasticity, ? = stress and ? = strain Poisson Ratio (?) is the values of coMparison between horizontal strain (lateral strain) and vertical strain (axial strain) caused by loads thatparallel to axisand axial strain (Yoder, E.Y. and M.W Witczak. 1975). This shown by equation:? = ? h ? v**(5)**

While:? = poisson ratio, ? h = lateral strain, ? v = axial strain EverStressFE 1.0 version 1.0 (available for download at www.civil.umaine.edu/EverStressFE 1.0) is a user-friendly three-dimensional (3D) finite-element based software package for the analysis of asphalt pavement systems subjected to various wheel/axle load combinations.EverStressFE 1.0 is useful for both flexible pavement researchers and designers who must perform complex mechanics-based analyses of flexible asphalt pavement systems.Some of the major features of EverStressFE 1.0 are summarized below, Intuitive and user-friendly graphical user interface., Ability to model systems with 1-4 layers.., Modeling of multiple-wheel systems, Batch analysis capabilities. , Visualization of results.

5 Research Methods

Methods that using in the tests are laboratory experimentaland analysis using software EverStressFE 1.0. The steps are : ?

6 Result and Discussion

7 a) Analysis Indirect Tensile Strength

8 d) Analysis Unconfined Compressed Test

There are two configurations of stress strain curve were seen in all mixtures irrespective of the Buton Natural Asphal content. The first configuration shows some porous asphalt specimens have the initial bottom concave part that represents the settling of the specimen, the linear zone, the nonlinear zone of the ascending branch and comprises the peak and stretch immediately adjoining it on other side. This pattern is similar to the pattern of the dense asphalt concrete. The second configuration shows some porous asphalt specimens have the linear zone, the nonlinear zone of the ascending branch and comprises the peak and stretch immediately adjoining it on other side without the initial bottom concave part. This pattern slightly differs to the pattern of the dense asphalt concrete. The nonlinear part of stress strain curve of porous asphalt reflects the degeneration of the latter rather than the flow of very thin bitumen micro layers in it. Micro cracking process [1] [2]

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Figure 1: Fig. 3 :Fig. 2 :

Figure 2:

5634

Figure 3: Fig. 5 : 6 : 3 Fig. 4 :

89 

Figure 4: Fig. 8 : 9 :

10 

Figure 5: Fig. 10 :

16 

Figure 6: Fig. 16 :

Figure 7:

1718192021222324252627283031

Figure 8: Fig . 17 :Fig. 18 : 19 :Fig. 20 :Fig. 21 :Fig. 22 :Fig. 23 :Fig. 24 :Fig. 25 :Fig. 26 : 27 :Fig. 28 :Fig. 30 :Fig. 31 :

[Note: WU Shao Peng, et. all. (2006) employed asphalt butadiene styrene polymer (SBS) modified asphalt with performance grade PG76-22, crushed basalt aggregate and limestone to product porous asphalt. Unconfined T]

Figure 9:

II.

Figure 10:

1

Sampel	Percen tage asphalt quality (%)		Diameter briket mm	High Briket mm	
			D	H	
I			102.3	66.9	
II			102.22	69.3	
III			102	68.5	
IV	3.0		102.4	67.7	
V			102.4	67	125.00
					0.113807734
		Average			0.067384524
I			102.5	67.5	
II			101.8	67.2	
III	3.5 4.0	Average Average	102.4	68.4 68.8 68 69 68.2 68.9 69 67.4 68.4 68.3 6	
IV			102.1		
V I			102 102.8		
II			102.5		
III			102.2		
IV			102 102.3		
V I			102.3		
II			102.4		
III			102.5		
IV	4.5 5.0	Average Average	102.6	67.6 68 61.7 68 65 66.1 68.2	
V I			102.2		
II			102.2		
III			102.5		
IV			102.4		
V			102.4		
			102.2		

Tabel 2 : Recapitulation	R maks Value No. Quality asphalt	Maximum Loading (Kgf)	ITS Value (Mpa)	RMaks
1	3,00	125	0,1140	0,0180
2	3,50	275	0,2483	0,0234
3	4,00	400	0,3574	0,0283

Figure 11: Table 1 :

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Sample	Percen	tage quality asphalt (%) Weight before	test (Gram) M		Weight aftertest (Gram) M		Loss Weight (Gram)		Loss Weight (%) L
I			1081		244		837.00		77.43
II			1083		248		835.00		77.10
III IV V	3.0		1090	1091	281	226	809.00	865.00	74.22 79.29 77.48
			1070		241		829.00		
		Average							77.10
I II III IV	3.5	Average	1085	1089	731	760	354.00	329.00	32.63 30.21 30.16
V I II III	4.0	Av-	1071	1069	748	711	323.00	358.00	33.49 35.20 32.34
IV V I II	4.5	er-	1088	1081	705	913	383.00	168.00	15.54 13.49 14.43
III IV		age	1082	1088	936	931	146.00	157.00	13.09 16.24 14.56
			1086	1090	944	913	162.00	177.00	11.53 12.01 13.44
			1084	1082	959	952	125.00	130.00	11.67
			1086 1088		940 961		146.00 127.00		
V I II		Average	1084	1075	948	956	136.00	119.00	12.55 12.24 11.07
			1084		968		116.00		10.70
III			1090		984		106.00		9.72
IV	5.0		1078		994		84.00		7.79
V			1105		1003		102.00		9.23
		Average							9.70

Figure 12: Table 3 :

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Quality	Asphalt (%)	Weight (Kg)	Height (mm)	Peak Load (KN)	UCS (N/mm 2)	Vertical Strain	Modulus Elasticity	Pois
3	1,69	128,3		15,51825	1,918	0,0130875	146,543	0,09
	1,67	127		15,347	1,897	0,030	63,683	0,30
	1,71	131		15,12397	1,869	0,022	85,395	0,25
3,5	1,715	117		15,22	1,881	0,020	93,452	0,26
	1,73	119		15,516	1,918	0,065	29,357	0,27
	1,73	120		16,118	1,992	0,021	97,013	0,42
4	1,685	121,2		15,7653	1,948	0,021	91,450	0,20
	1,65	120		16,1498	1,996	0,029	67,990	0,38
	1,67	123		16,228	2,006	0,038	53,373	0,49
4,5	1,655	133,5		10,2816	1,271	0,048	26,502	0,38
	1,675	135		9,838	1,216	0,026	46,140	0,37
	1,65	131		10,3113	1,274	0,039	32,710	0,37
5	1,67	114		9,922	1,226	0,038	32,119	0,77
	1,69	117		10,219	1,263	0,033	38,682	0,39
	1,63	113		15,234	1,883	0,018	104,238	0,53
c) Analysis Permeability								

Figure 13: Table 4 :

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Quality Asphalt (%)	Thickness (

Figure 14: Table 5 :

iv. Conclusions

1. Permeable asphalt pavement mixture for Cantabro test we can see that optimum Buton Natural Asphal for the coarse aggregate Quarsite Dolomite stone it was bigger porous when quality asphalt 3%. Loss weight Cantabro 77.10% correlation with quality asphalt 3%, loss weight Cantabro 32,34% correlation with quality asphalt 3.5%, loss weight Cantabro 14,56% correlation with quality asphalt 4%, Loss weight Cantabro 12,24% correlation with quality asphalt 4.5% and loss weight Cantabro 9,70% correlation with quality asphalt 5%.
2. Unconfined Compressive Strength, Modulus elasticity 146.543 and ratio poisson 0.095831 for asphalt 3%, Modulus elasticity 93.452 and ratio poisson 0.268231 for asphalt 3,5%, Modulus elasticity 91.450 and ratio poisson 0.206009 for asphalt 4%, Modulus elasticity 26.502 and Poisson rasio 0.384759 for asphalt 4,5%, and Modulus elasticity 32.119 and Poisson rasio 0.778059 for asphalt 5%.
3.

[Note: Testing Multilayer Soil-Rigid-Asphalt iii. Analysis Multilayer using Software EverStressFE E © 2016 Global Journals Inc. (US) 11. Firdaus Chairuddin, et.al. 2014. Climate Change Implications for Permeable Asphalt Pavement Used Quarsite Dolomite Stone (Quarsite Dolomite) on]

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