International Journal of Health, Economics, and Social Sciences (IJHESS)
Vol. 7, No. 3, July 2025, pp. 1072~1075
DOI: 10.56338/ijhess.v7i3.8159
Website: https://jurnal.unismuhpalu.ac.id/index.php/IJHESS

Comparison of Mixed Marshall Characteristics Asphalt Concrete AC-BC Post-Immersion Lime Filler in River Water And Seawater

Hasanuddin[1]*, Mohamad Ikbal Z. Abd. Wahid[2], Dewi Ayu Setiawati[3]
[1,2,3]Program Studi Teknik Sipil Fakultas Teknik Universitas Muhammadiyah Palu

Article Info

Article history:

Received 24 May, 2024
Revised 07 Jun, 2024
Accepted 15 Jul, 2025

Keywords:

Immersion Comparison, Marshall Test, lime filler, River Water, Sea Water

ABSTRACT

Indonesia has several roads adjacent to the coast so that if the sea tide rises, the road will be flooded by floodwater. One of them is Palu City which often experiences rob events. To achieve quality road conditions, it is necessary to provide handling technology with economic value, one of the alternatives is to provide fillers that can be used in asphalt concrete mixtures, namely lime. The purpose of the study was to evaluate and compare the characteristics of marshall mixed asphalt concrete AC-BC lime filler post-immersion in river water and seawater. The type of research used is experimental research by making samples or test objects carried out at the Transportation and Highway Laboratory, Faculty of Engineering, Tadulako University. The researcher took samples directly at the research location and used as raw materials for testing and obtained data from the results of the test through the laboratory. The results of the Marshall test of AC-BC asphalt concrete mixture lime filler on 2 types of immersion, The immersion of AC-BC asphalt concrete mixture using river water and seawater showed a decrease in stability value. In immersion in river water, the lowest was 3.94% and the highest stability decrease percentage value was 22.63%. The lowest percentage value of stability decline in immersion in seawater was 3.69% and the highest stability reduction percentage value was 29.23%. Soaking the AC-BC asphalt concrete mixture using river water and seawater showed an increase in flow value. The value of the percentage of increase in flow in immersion in river water was the lowest of 0.07% and the value of the highest percentage of flow increase was 1.30%. The lowest flow increase percentage value in seawater immersion was 0.14% and the highest flow increase percentage value was 1.47%. Then for the soaking of AC-BC asphalt concrete mixture using river water and seawater, it showed a decrease in the Marshall Quotient (MQ) value. The percentage value of MQ reduction in immersion in river water is the lowest of 6.70% and the highest MQ reduction percentage value is 46.05%. The value of the MQ decrease in immersion in seawater was the lowest at 8.37% and the highest MQ reduction percentage value was 52.73%.

Corresponding Author:
Hasanuddin
Program Studi Teknik Sipil Fakultas Teknik Universitas Muhammadiyah Palu
mohamadikbal847@gmail.com

INTRODUCTION

Nowadays, the development of road transportation infrastructure is increasing due to the number of vehicles, both motorcycles and cars, used by the community. Good road conditions have a great effect on the smooth flow of vehicle traffic, so a layer of pavement, road structure and good maintenance are needed so that road conditions remain safe and comfortable for vehicles to cross.

Indonesia has several roads adjacent to the coast so that if the sea tide rises, the road will be flooded

by floodwater. One of them that often experiences rob events is Palu City. Flash flooding is one of the causes of road structure damage that often occurs. Changing weather causes air temperatures to also change, changes in land surface that fall every year can affect sea level so that it results in inundation. Seawater has a fairly high acid content so that it can affect the quality of the road structure.

Road damage can be caused by contour topography and overflow of seawater, river water and the proper malfunction of drainage channels. When asphalt is submerged by water continuously, it can result in cracks that then develop into holes caused by the release of aggregate grains. The overflow of water on the road in the city of Palu causes damage to the road because the durability force on the surface layer experiences a saturation point so that the connection between the mixtures is cracked. When a crack occurs, the load received is not in line with the ability to cause more severe road damage.

To achieve quality road conditions, it is necessary to provide handling technology with economic value, one of the alternatives is to provide fillers that can be used in asphalt concrete mixtures, namely lime. Because besides its relatively cheap price, lime is also a local additive material that is widely found in the middle of the country. The use of limestone natural materials as fillers is one of the efforts to make maximum use of natural potential. So that it will be very beneficial for increasing production in the community, and also useful as an alternative option as input in the field of road engineering, especially planning for construction implementations which have been experiencing difficulties in providing filler fillers in sufficient quantities.

Departing from the above, a study was conducted on the comparison of the characteristics of marshall mixed asphalt concrete AC-BC lime filler after immersion in river water and seawater.

Based on the above background, the researcher tried to research how the influence and comparison of the characteristics of marshall mixed asphalt concrete AC-BC lime filler after immersion in river water and seawater.

METHODS

Types of Research

The type of research used is experimental research by making samples or test objects carried out at the Transportation and Highway Laboratory, Faculty of Engineering, Tadulako University to obtain data. The data obtained is then processed in accordance with the specifications that have been determined by SNI and Bina Marga 2018 revision 2.

Material Collection Locations

The crushed stone material used in this study comes from the location of the stone crusher PT. Ratu Tambang Mandiri Buluri Village, Ulujadi District, Palu City, Central Sulawesi. The location of the collection of crushed stone materials can be seen as shown in Figure 3.1. The asphalt used is Pen 60/70 asphalt obtained from the Transportation and Highway Laboratory, Faculty of Engineering, Tadulako University. The lime used in this study is extinguished lime in the form of Calcium Hydroxide (Ca(OH)2) which is traded by the residents of Tondo East Palu District, Palu City.

Figure 1. Map of Material Collection Locations
Source: Google Earth, 2022

River Water Collection Locations

The river water used for soaking the test object in this study comes from the uwentumbu river located in Kawatuna Village, Mantikulore District, Palu City, Central Sulawesi.

Seawater Extraction Locations Seawater used for immersion

The test specimen in this study came from Talise Village, Mantikulore District, Palu City, Central Sulawesi.

Data Source

Primary Data

The researcher took samples directly at the research site and was used as a raw material for testing and obtained data from the results of the test through the laboratory.

Secondary Data

The researcher used existing asphalt data, namely pre-existing 60/70 penetration asphalt data.

Testing Procedure

This research contains several testing steps to obtain design results that meet the standards or are in accordance with the specifications determined by the Directorate General of Highways 2018 revision 2.

Aggregate Testing
Mixed Planning
Determination of Asphalt Rate
Manufacture of Test Pieces
Pengujian Marshall Test

Table 1. Aggregate Wear Test Results

Berat Benda Uji (Gram)	Berat Tertahan Saringan No.12		Nilai Keausan %		Keausan Rata-rata %
	Sampel 1	Sampel 2	Sampe 11	Sampe 12	
5000	4428.7	4444.3	11.43	11.11	11.27

RESULTS AND DISCUSION

Asphalt Testing

In asphalt testing, several tests were carried out, including, penetration testing,

specific gravity testing, ductality testing, soft spot testing and viscosity testing. Source: Laboratory Test Results, 2022

Table 2. Asphalt Test Results The following is a graph of the percentage pass relationship of coarse aggregate and fine aggregate with sieve size.

No	Jenis Pengujian	Persyaratan		Hasil	Satuan
		Min	Maks		
1	Penetrasi Aspal	60	70	65.33	mm/gr
2	Berat Jenis	1.0	-	1.039	gr/cc
3	Daktalitas	100	-	152	cm
4	Titik Lembek	48	-	49.75	°C
5	Viskositas 135 °C	300	-	587,1	cst

Source: ResulfTesting Laboratory 2022

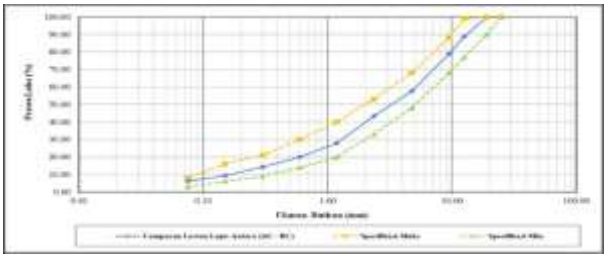

Figure 2 Combined Gradient Graph
Source: Laboratory Test Results, 2022

Figure 2 is a graph of the combined gradation of coarse aggregates and fine aggregates that shows that the gradation values are all included in the upper and lower limits.

Planning Marshall Test Testing

Optimum Asphalt Rate (PKAO)

The Marshall test aims to obtain values from stability, flow, density, VIM, VMA, VFA, and MQ. Marshall. These values are then made in the form of a bar chart to determine the optimum asphalt level (KAO), by creating maximum and minimum values of asphalt levels that meet all marshall parameters. Then the middle value will be taken which is the average of the percentage of asphalt content. It is this value that will be used as the optimal asphalt rate of the mixture. The following is the determination of the optimal asphalt rate (PKAO):

CONCLUSION

After testing, evaluating, and analyzing the results of the Marshall test of asphalt concrete mixture AC-BC lime filler on 2 types of immersion, immersion in river water and immersion in seawater accompanied by variations in immersion duration are as follows:

Soaking AC-BC asphalt concrete mixture using river water and seawater showed a decrease in stability value.

The lowest percentage value of stability reduction in river water was 3.94% and the highest stability decrease percentage value was 22.63%.

The lowest percentage value of stability decline in sea water was 3.69% and the highest stability reduction percentage value was 29.23%.

Soaking the AC-BC asphalt concrete mixture using river water and seawater showed an increase in flow value.

The value of the percentage increase in flow in immersion in river water was the lowest of 0.07% and the highest percentage value of flow increase was 1.30%.

The lowest flow increase percentage value in seawater immersion was 0.14% and the highest flow increase percentage value was 1.47%.

Soaking the AC-BC asphalt concrete mixture using river water and seawater showed a decrease in the Marshall Quotient (MQ) value.

The value of the percentage of MQ decrease in immersion in river water was the lowest of 6.70% and the highest MQ decrease percentage value was 46.05%.

The value of the MQ decrease in immersion in seawater was the lowest at 8.37% and the highest MQ reduction percentage value was 52.73%.

SUGGESTION

Based on the research that has been carried out, the researcher conveyed several suggestions related to this research, including the following:

One of the factors that can damage asphalt is water. The slope of the road surface and drainage must also be considered so that the road pavement can be protected as much as possible from seawater. This is because seawater can damage or weaken pavement structures that are higher than river water.

To be able to further develop this research or conduct additional research for future researchers by selecting or using different materials, immersion duration, different types of asphalt and asphalt penetration.

REFERENCES

Andri, A., Setiawan, A., & Pradani, N. (2012). Influence Use Lime As an Ingredient Fillers (Filler) towards Characteristics of Wear Coated Asphalt Concrete Mixture (AC-WC). Engineering Journal and Transportation Management, 2(2).

Devi, S. M., & Raesandi, W. (2021). Analysis of Asphalt Immersion of AC-WC in Freshwater and Seawater on Marshall Characteristics by Utilizing Local Materials from Paser Regency. Journal Scientific Civil Engineering TRANSUKMA, 3(2), 77- 88.

Director General of Highways, 2018, General Specifications 2018 for Road and Bridge Works, Jakarta: Ministry of Public Works and Public Housing.

Junaidi, F. F. (2014). Analysis of the distribution of the flow speed of the Musi River (Ampera Bridge to Kemaro Island) (Doctoral dissertation, Sriwijaya University).

Mansur, A. Z., & Bakri, M. D. (2016). Mixed Performance Laston (Ac-WC) Result Soaking seawater and fresh water with the addition of Wetfix Be additives. In Proceedings of the Inter-University Transportation Study Forum.

Muaya, G. S., Kaseke, O. H., & Manoppo, M. R. (2015). The Effect of Submerged Asphalt Pavement by Seawater Reviewed on Marshall Characteristics. Journal Static Civil, 3(8).

SNI 06 2489:1991 on Asphalt Mixture Test Method with Marshall Tools.

SNI 1969:2008 concerning Specific Gravity Test Methods and Absorption of Crude Aggregates.

SNI 1970:2008 concerning Specific Gravity Test Methods and Absorption of Fine Aggregates.

SNI 2417:2008 on How to Test Aggregate Wear with Abrasion Machines Los Angeles, Jakarta.

SNI ASTM C136:2012, On Test Methods for Analysis of Fine Aggregate and Coarse Aggregate Sieve (ASTM C 136-06, IDT), Jakarta.

Suhingtyas, N. D. (2017). Analysis of the Impact of Seawater Immersion on Durability and Marshall Characteristics in Asphalt Concrete–Binder Mixture Course (AC-BC) (Doctoral dissertation, University of Muhammadiyah Surakarta).