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The study of the basic mechanical properties of polyvinyl alcohol fiber cement stabilized macadam

Wang Shipeng* Liang Nai Xing

*(School of Traffic and transportation, Chongqing Jiaotong University, Chongqing 400074, China)

ABSTRACT
As a new material in the construction field，polyvinyl alcohol fiber cement stabilized macadam pavement has a very broad application prospects. The study of the basic mechanical properties of polyvinyl alcohol fiber cement stabilized macadam is also a hot spot today. This paper studies the flexural strength of polyvinyl alcohol fiber content is at 0.9Kg / m^3,and the affect between the splitting tensile strength and the polyvinyl alcohol fiber**.**
Keywords **–**polyvinyl alcohol fiber, engineering application ,splitting strength, flexural strength.

I. Introduction

Polyvinyl alcohol is a high strength and high el astic modulus fibers.It has good hydrophilic fiber s urface that can absorb a small amount of free water, and the bond strength with cement matrix is high. Polyvinyl alcohol fiber itself has a higher strength a nd elastic modulus, it not only can effectively inhib it the early cracks of cement stabilized gravel base l ayer, but also can improve the toughness and impac t resistance, while improving primary barrier prope rties and abrasion resistance, thereby improving the durability of the grass-roots and extending the life of the road. In this paper, We use different contents and different lengths of polyvinyl alcohol fiber to s tudy the flexural strength and splitting strength of p olyvinyl alcohol fiber cement stabilized macadam.

Ⅱ. Test generalization

The cement used in this test is 32.5 ordinary por tland cement of Anhui Huaihai United Cement Fact ory;the polyvinyl alcohol fiber is made of Shanghai Kaidu Industrial Development Limited Liability C ompany,its cross-sectional area is 1.52×10^{-4}mm^2, e lastic modulus is 3.5×10^4Mpa and tensile strength i s 1600Mpa.There are five gravel particle size: 1# （19-31.5mm）、2#（9.5-19mm）、3#（4.75-9. 5mm）、4#（2.36-4.75mm）、5#（0-2.36mm）. After testing we identified the target proportion of cement stabilized macadam is 1#：2#：3#：4#：5 #：=12:30:23:6:29,and the dose of cement is 3.2%.

The formula of prism flexural strength is

$$f_{cf}=\frac{F_{\max}l}{bh^2}$$

Explanation: f_{cu} **—**prism flexural strength(Mpa);

$F_{\max}$ **—**maximum load（KN）；

l—seat pitch（mm）；

b—sectional width（mm）；

h—sectional height（mm）.

The formula of splitting tensile strength is

$$f_{st}=\frac{2F_{\max}}{\pi A}=0.637\frac{F_{\max}}{A}$$

Explanation: f_{st} — splitting tensile strength （MPa）；

A—Bearing area（mm^2）;

$F_{\max}$ —maximum load（KN）.

III. Test results and analysis

2.1 The flexural strength of polyvinyl alcohol fiber cement stabilized macadam

The polyvinyl alcohol fiber's cement of cemen t stabilized macadam is 0.9Kg/m^3,and the length of the fiber is 0mm, 12mm, 18mm, 24mm, 30mm. Th e size of the specimen is 100mm×100mm×400mm, and the curing period of the specimen is 7days. We found that when the fiber length is 0mm, the flexur al strength of specimens is 1.54Mpa; when the fiber length is 12mm, the flexural strength of specimens is 1.35Mpa; when the fiber length is 18mm, the fle xural strength of specimens is 1.50Mpa; when the f iber length is 24mm, the flexural strength of specim ens is 1.58Mpa; when the fiber length is 30mm, the flexural strength of specimens is 1.44Mpa. Accord ing to the results, when the fiber length of 24mm, t he flexural strength of specimens is biggest as 1.58 MPa.By contrast the flexural strength of different fi ber length,we find the flexural strength of specimen s show a decreasing trend.

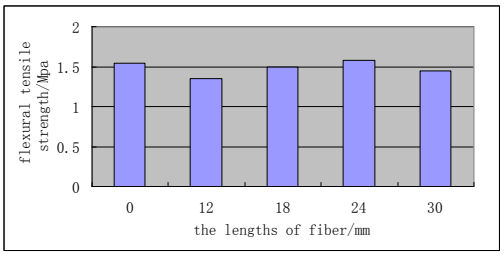

Figure 1:the flexural strength when the cement is 0.9Kg/m^3

2.2 The splitting tensile strength of polyvinyl alcohol fiber cement stabilized macadam

The polyvinyl alcohol fiber's cement of cemen t stabilized macadam is0、0.6 Kg/m^3、0.9 Kg/m ^{3}、1.2 Kg/m^3, each cement of fiber has four kinds l ength:12mm, 18mm, 24mm, 30mm. The specimen size of cylinder is diameter 150mm, height 150mm, and the curing period of the specimen is 7days. We found that the flexural strength of specimens is 1.5 4Mpa when the fiber length is 0mm; when the cem ent of the fiber is 0.6 Kg/m^3 and the length of the fi ber is 12mm、18mm、24mm、30m, the splitting t ensile strength of specimens is 0.206 MPa、0.221 MPa、0.192MPa、0.210MPa; when the cement of the fiber is 0.9Kg/m^3 and the length of the fiber is 12mm、18mm、24mm、30m, the splitting tensile strength of specimens is 0.203MPa、0.229MPa、 0.217MPa、0.222MPa; when the cement of the fib er is 1.2Kg/m^3 and the length of the fiber is 12m m、18mm、24mm、30m, the splitting tensile stre ngth of specimens is 0.181MPa、0.240MPa、0.17 7MPa、0.209MPa. Thus, polyvinyl alcohol fiber c ould improved the splitting strength of cement stabi lized macadam to a certain extent.

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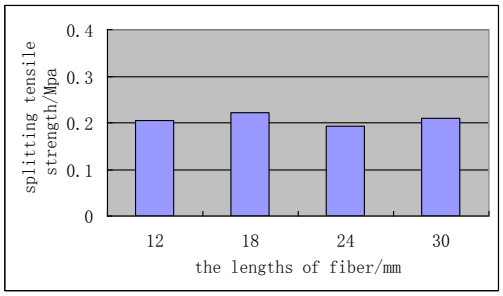

Figure 2: the splitting tensile strength when the fiber volume fraction is 0.6Kg/m^3

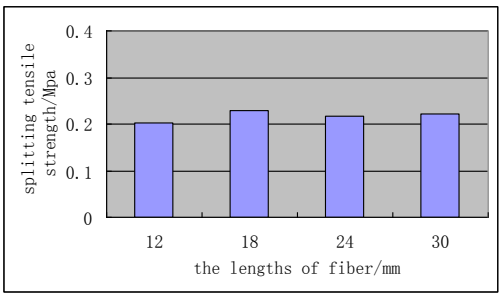

Figure 3: the splitting tensile strength when the fiber volume fraction is 0.9Kg/m^3

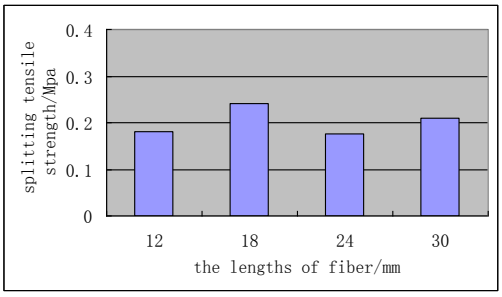

Figure 4: the splitting tensile strength when the fiber volume fraction is 1.2Kg/m^3

IV. Conclusion

(1) When the fiber content is 0.9 Kg / m^3 in polyvin yl alcohol fiber cement stabilized macadam, the fle xural strength of specimens increases first and then tends to be smaller with the bending strength of fib er length increases. The flexural strength of cement stabilized macadam is largest when the length of th e fiber is 24mm.

(2) Polyvinyl alcohol fiber could improved the split ting strength of cement stabilized macadam to a cer tain extent. The splitting tensile strength of cement stabilized macadam is largest when the length of th e fiber is 18mm and the fiber content is 0.9 Kg / m^3.

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