

Analysis of Shop Cold Water Stability of Asphalt Concrete Composite

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Abstract—He cold asphalt concrete is laid composite that combines the advantages of rigid cement concrete and asphalt concrete flexible pavement materials and new waterproof materials, and it is also known as semi-rigid concrete or semi-rigid waterproof concrete. Cold paved asphalt concrete composite retains the advantages of rigid and flexible waterproof material waterproof material which abandoned both of their inadequacies, is waterproof material with a wide range of space research and application prospects. This study immersion Marshall test and freeze-thaw split test two test methods for cold-laid asphalt concrete composite conducted a comprehensive analysis of the stability of the water; the highest draw AC1-6 AC-20 immersion Marshall stability and 20.59, respectively, by testing MPa and 19.96 Mpa, freeze-thaw splitting strength to reach the highest ratio of 91% and 93% respectively, the value specification can be met, and through the analysis of the test data to identify the content of the asphalt cement content and cold water laid asphalt compound affect the stability of the peak will occur, so that it can be combined with concrete interfacial adhesion studies to further the comprehensive and accurate assessment of water resistance of the material.

Keywords-cold-laid asphalt concrete composite water resistance strength test.

I. INTRODUCTION

Cold asphalt concrete is laid composite cement, emulsified asphalt binder mainly to gravel as aggregate, within which incorporate small amounts of lime to improve their adhesion by adjusting the mix to increase the density of the material between the various other methods, preparation of cold-laid composite concrete has a certain resistance to penetration ability, known as semi-rigid concrete or semi-rigid waterproof concrete. Cold paved asphalt concrete composite retains the advantages of rigid and flexible waterproof material waterproof material, abandoned the inadequacies of the two, is waterproof material with a wide range of space research and application prospects. We evaluated the ordinary asphalt concrete hot water resistance in two ways: The first way is through the adhesion performance evaluation between binder and aggregate; the second method is to evaluate the concrete the water stability indicators. However, in general, for the first method, the adhesion properties of bitumen with aggregate material belonging to the selection control indicators, and in most cases it can fill requirements. So when determining the type of asphalt and aggregates, the second method of evaluation of concrete indicators of water stability is particularly important.

At present, There are many ways to elevate water stability of asphalt concrete, such as immersion Marshall test, vacuum saturated Marshall test, soaking split test and vacuum saturated split test and freeze-thaw splitting test. But the current "highway asphalt and asphalt testing procedures" (JTJ 05222000) specified test method to evaluate water stability of asphalt concrete is mainly immersion Marshall test and freeze-thaw splitting test. Evaluation of cold mix asphalt paved compound flooding Marshall test conducted by the ordinary method, This study still learn from these two methods to spread the composite asphalt cold water stable analyzed.

II. EXPERIMENTAL STUDIES

A. Immersions Marshall test

Cold paved asphalt concrete composite Marshall Immersion test is in accordance with the "highway asphalt and asphalt test procedures" requirement. Molded specimen of health after 28 days is in accordance with the prescribed regimen, which will be divided into two groups, and then were given safe conduct of the test and stability test after 48h of immersion. The test results are shown in Tab.1, Tab.2.

TABLE.I. AC-16 GRADED CONCRETE IMMERSION MARSHALL TEST

Proportion of emulsified asphalt (%)	Proportion of cement (%)	Porosity (%)	stability (MPa)	Stability in water (MPa)	Stability of residue (%)
7	2	4.4	14.63	13.02	89
	3	4.1	17.50	16.10	92
	4	4.5	21.01	20.59	98
8	2	3.7	12.83	11.17	87
	3	3.4	16.21	14.75	91
	4	3.8	18.81	18.06	96
9	2	3.1	11.45	9.50	83
	3	2.7	14.22	12.51	88
		3.2	17.85	16.42	92

TABLE.II. AC-20 GRADED CONCRETE IMMERSION MARSHALL TEST

Proportion of emulsified asphalt (%)	Proportion of cement (%)	Porosity (%)	stability (MPa)	Stability in water	Stability of residue (%)
	2	4.3	15.86	13.67	86
7	3	4.0	20.15	17.61	89
	4	4.5	21.16	19.96	95
8	2	3.6	15.55	13.46	86
	3	3.2	17.42	15.40	89
	4	3.5	20.83	19.25	94
9	2	2.9	12.91	10.79	84
	3	2.7	18.16	15.86	89
	4	3.1	18.33	16.93	93

Data analysis that is from the test results: First, Tab.1 and 2 can be seen laying composite cold asphalt concrete AC-16 and AC-20 two dense graded at different combinations of emulsified asphalt and cement, the stability of a residual concrete is respectively basically able to reach more than 85 percent, to meet regulatory requirements for value ordinary hot mix asphalt residue stability; secondly, when we fixed emulsified asphalt content, along with the amount of cement from 2% to 4% increased in the cold shop complex residual stability of asphalt concrete also will be increased; when we fixed the same cement content in concrete, with emulsified asphalt content from 7% to 9% increased in cold-laid asphalt concrete composite residual stability consequent change small. These changes are basically the same rules of law and stability of. But this change to the relative relationship between porosity and analysis of the reasons is because with the increasing content of emulsified asphalt, and concrete is porosity smaller; increased emulsified asphalt bitumen content of ingredients makes freedom between aggregate number of factors affecting degree of stability of concrete, 28 days age concrete moisture evaporation has been basically completed. Third, the same as the content of emulsified asphalt and cement graded as cold AC-20 asphalt concrete paving composite flooding residual stability ratio gradation of AC-16 mix flooding large residual stability. Analysis of the main reason is because it is in the same content and emulsified asphalt cement content, with increasing particle size of coarse aggregate, wedging force and friction between aggregate and aggregate of increases, so the rough grading AC-20 mixture of residual stability is better than soaking fine gradation AC-16 mix flooding large residual stability.

B. Thaw splitting test

Cold paved asphalt concrete composite thaw fold test in solid cylindrical specimen molding method which is in accordance with further amendments Marshall compaction test methods using compaction twice. The test temperature

is 25 °C, the loading rate is 50mm / min. The freeze-thaw cycle specific reference "highway asphalt and asphalt test procedures" is in the freeze-thaw splitting test project. Test results are shown in Tab.3 and Tab.4.

TABLE.III. AC-16 GRADED CONCRETE FREEZING AND SPLITTING TEST RESULTS

Emulsified asphalt content (%)	Cement content (%)	Porosity (%)	Before	after	freeze-
			freeze-thaw splitting strength (MPa)	freeze-thaw splitting strength (MPa)	thaw splitting strength ratio (%)
7	2	4.5	0.65	0.56	85
	3	4.2	0.74	0.62	87
	4	4.6	0.77	0.68	91
8	2	3.6	0.65	0.57	85
	3	3.5	0.79	0.71	89
	4	3.9	0.82	0.72	91
9	2	3.2	0.62	0.53	82
	3	2.8	0.74	0.63	85
	4	3.3	0.76	0.66	87

TABLE.IV. AC-18 GRADED CONCRETE FREEZING AND SPLITTING TEST RESULTS

(Emulsified asphalt content %)	cement content (%)	Porosity (%)	Before	after	freeze-
			freeze-thaw splitting strength (MPa)	freeze-thaw splitting strength (MPa)	thaw splitting strength ratio (%)
7	2	4.3	0.56	0.46	83
	3	4.0	0.69	0.59	86
	4	4.5	0.71	0.64	90
8	2	3.6	0.63	0.52	82
	3	3.2	0.73	0.63	87
	4	3.5	0.76	0.70	93
9	2	2.9	0.67	0.55	81
	3	2.7	0.70	0.59	84
	4	3.1	0.73	0.64	88

The results showed that:

First, it can be seen from Tab.3 and 4, AC-16 and AC-20 with two dense freezing cold shop minimum splitting strength of asphalt concrete composite ratio greater than 80%, to meet the "asphalt pavement construction technical specifications "[8] in a conventional hot mix asphalt specification values thaw splitting strength ratio; secondly, when certain content emulsified asphalt concrete, two cold

dense graded asphalt concrete paved splitting complex before and after freezing and thawing strength and freeze-thaw intensity ratio increased with increasing cement content; when certain cement content is in concrete, with two dense than cold-laid composite asphalt splitting strength before and after freezing and thawing, they are emulsified asphalt content with the changes appear a highest peak (see Fig.1, Fig.2); the third, the splitting strength and the low temperature peak value than this situation occurs split Test appear very similar, essentially the same reasons. Finally, under the same emulsified asphalt concrete and cement content, graded as cold AC-20 asphalt concrete paving compound splitting strength grading is significantly less than the melting AC-16 splitting strength of concrete, but the two split strength the gap between the ratio is not obvious.

After an emulsified asphalt content map and splitting strength before thawing relations Fig.2 emulsified asphalt content and freeze-thaw splitting strength of the relationship.

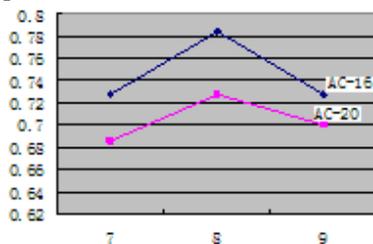


Figure 1. Content of asphalt emulsion and freeze-thaw splitting strength before

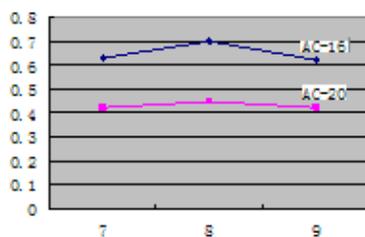


Figure 2. Content of asphalt emulsion and after freeze-thaw splitting strength

III. TEST CONCLUSION ANALYSES

(1) cold-laid asphalt concrete composite cement changes with different content, emulsified asphalt content in different aggregate gradation with AC-16 and AC-20 ratio, the number of dynamic stability and dynamic stability Marshall Variation consistent with the variation of compressive strength. Dynamic stability and dynamic stability number of cold-laid composite Marshall asphalt concrete are far superior to conventional hot mix asphalt concrete and SMA asphalt concrete and concrete composite cold shop also showed a good high temperature rutting resistance. In addition, this study also showed that the cold shop has a good correlation between the dynamic stability of asphalt concrete composite Marshall Stability test and

rutting tests, which can also be used to determine the degree of stability through the use of high temperature stability, is good or bad.

(2) cold-laid asphalt concrete composite cryogenic Split Test failure stress value increases then decreases with emulsified asphalt concrete 7% to 9% of the content and presentation after the first increases and then decreases, and there will be a peak. Cold paved asphalt concrete composite cryogenic fracture strain increases the amount of cement decreases with the increase of emulsified asphalt content increases. Cold paved asphalt concrete composite stiffness modulus variation with emulsified asphalt content and cement content and failure strain is very similar. Therefore, we can not just rely on low failure stress or damage as a standard to determine the strain of cold lay asphalt concrete cracking resistance of composite is good or bad.

Residual stability (3) cold-laid asphalt concrete composite water immersion test increases with increasing cement content, with the increase of the amount of emulsified asphalt decreased. Freeze-thaw splitting strength ratio increases with increasing the amount of cement in concrete, then decreases with the increase in the amount of emulsified asphalt concrete to increase. In short, cold asphalt concrete composite shop has a good water stability, residual stability and dynamic financial splitting strength than fully able to meet the existing asphalt pavement construction specifications for ordinary asphalt concrete demands, and even the water stability over conventional hot mix asphalt concrete.

IV. SUMMARY

In this study, cold-laid asphalt concrete composite flooding residual stability increases with Marshall test concrete cement content increases, along with the amount of emulsified asphalt concrete increases decreased. Thaw splitting strength thaw splitting test is better than with the increase in the amount of cement in concrete increases, then decreases with the increase in the amount of emulsified asphalt concrete to increase. Generally speaking, cold asphalt concrete composite shop has good water stability properties, the residual stability and dynamic financial splitting strength ratio are better able to meet the existing asphalt pavement construction specifications for ordinary asphalt concrete requirements, the water stability is better than ordinary asphalt concrete.

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