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Study of the Modify of Mechanical Behaviour of Concrete

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Abstract: In this study, modification of the mechanical behavior of concrete is studied. Where low concrete resistance can lead to deformation due to changes in mixing ratios and lead to changes in mechanical properties such as stretching, splits, cracks, ratchet, fracture resistance and slip resistance steps. To improve these mechanical properties of concrete and to study its effect on the mechanical properties of hot asphalt mixed, some materials such as flexible scrap and iron filings were added to the mixture with ratio: 5, 10 and 15% of the total weight of aggregate. Also, some results and comparisons between these ratios of addition materials upon the mechanical properties were given.

Key words: Study, modify, mechanical, behavior, concrete

INTRODUCTION

To play down harm to asphalt surfaces and increase its flexible strength, ordinary bitumen needs change with regard to performance-related characteristics such as resistance to changeless distortion (splits) and weakness splits, to improve resistance to changeless distortion, increasingly researchers and asphalt engineers have been setting accentuation on the advancement of adjusted folio blends the utilize of squander vehicle tire in asphalt is one of the steps taken in this course over the past a few decades. In any case, the execution of mixtures altered by crumb elastic and iron filings are impacted by numerous variables. For occurrence, the mixing prepare (wet or dry), binder types, elastic substance and total degrees all play a portion. In expansion, there's lacking data and a need of comprehensive rules for achieving good. Hence, there ought to conduct a think about to evaluate the hot blend asphalt execution after include the crumb elastic and iron filings as a modifier agreeing to Iraq condition. Bitumen added substance can be characterized as a fabric included to the bitumen to progress the properties and execution of bitumen. Yildirim (2007) found that an "ideal additive should be able to decrease the temperature susceptibility, control age hardening and must be compatible with any type of bitumen". Various researchers such as and Airey (2002) were working in this field to advance the foremost suitable added substance that can move forward generally performance of bitumen. Numerous investigations have been carried out utilizing two primary assessment methods, firstly, testing bitumen either with or without added substances, to decide its chemical, rheological, flexible and thermal properties as well as its sensitivity to heat and oxidation (AAPA., 2007). Secondly, testing bituminous blend to decide its stability, water susceptibility, solidness, tensile quality, weakness resistance and creep resistance. An overview in 2002, conducted by division of transportation, USA, found that out of 50 states, forty seven states claimed to utilize altered binders in future. Whereas 35 offices of transport claimed that they would utilize adjusted binders greater amount (Bahia *et al*., 1997). Lenk *et al*. (2004), found that the same phenomenon happened in Austria within the mid-1990 where the utilization of altered bitumen had come to up to 10% of add up to bitumen utilized in street development. An inner report of the asphalt organized recognized 48 types of bitumen modifiers comprising of 13 polymers, 10 hydrocarbons, 6 mineral fillers, 6 antioxidants, 6 anti-stripping added substances, 4 fibers asphalt concrete (binder layer) containing crumb elastic and Iron filings, moreover to evaluate the execution of asphalt concert blend joined crumb elastic and iron filings.

MATERIALS AND METHODS

Research methodology and procedure: Material characterization is the measurement of the response of HMA mixtures to loading under varying temperature and other environmental factors (Airey, 2002; Airey and Rahimzadeh, 2004). The most popular empirical test is Marshall stability test and creep test will evaluate engineering properties and evaluate properties of asphalt pavement. The total number of simples that will used in this study will be (48) simple. The process of this project is shown in the flow chart in Fig. 1-3.

Aggregate: The properties of aggregate like molecule shape, texture and crushed faces and degree, influence the

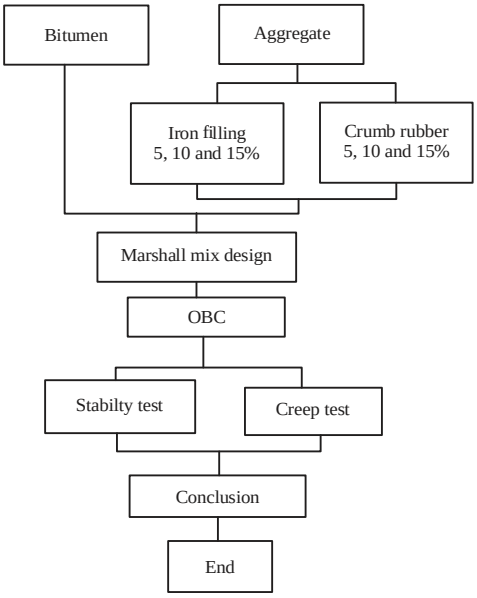

Fig. 1: Flow chart

Fig. 2: Crumb rubber

Fig. 3: Iron filings

Fig. 4: Marshall stability test

properties of HMA (Airey, 2002; Airey and Rahimzadeh, 2004). In this consider, we are going utilize two type of aggregate and we are going evaluate the impact of each type on execution of asphalt.

Bitumen: Bitumen is generally obtained from the distillation of crude petroleum using different refining techniques. At ambient temperature bitumen is a semi-solid material that must be heated in order to mix aggregate. Bitumen is strong and durable with excellent adhesive and water proofing characteristics. The bitumen that we use in this study is 40/50.

Crumb rubber: Crumb rubber that we used in our study is fine crumb rubber with the (5, 10 and 15%) by weight of binder (Almudaiheem and Al-Sugair, 1991).

Iron filings: Exceptionally little pieces of iron that see like a light powder, the Iron filings that we utilized in our consider are (5, 10 and 15%) by weight of aggregate.

Marshall stability test: Marshall stability test was carried out on compacted examples at different bitumen substance agreeing to ASTM (2005). It is a test in which cylindrical compacted specimens, 100 mm diameter and around 63.5 mm tallness were utilized. A water shower was prepared at a temperature of 60°C and all specimens were inundated for 30-40 min within the water. Its machine was washed and set up to being the test. After the specimens had been conditioned, a load was at that point connected to the specimen at a steady rate (50 mm/min) until disappointment, watching the flow and stability whereas loading. When the Marshall stability gauge perusing come to its most extreme and started to drop, the stability value (in kN) was famous as the deformation at the point of failure; Fig. 4 are appeared the Marshall stability test (AASHTO 2007; Airey, 2002).

Dynamic creep test: Creep can be characterized as the slow and dynamic distortion of a fabric under consistent

stress. The creep test was created to appraise the rutting potential of asphalt blends (Airey and Rahimzadeh, 2004). It is carried out either within the inactive or dynamic mode of loading. Each test ordinarily takes 1 or 2 h and gives comes about that represent characterization of the blends in terms of their long-term distortion behavior (Almudaiheem and Al-Sugair, 1991).

RESULTS AND DISCUSSION

Materials preparation: Main materials used for this study were aggregate, asphalt cement and crumb rubber and iron filings. All properties of the materials utilized were measured for advance analysis consideration. A few tests were conducted in order to measure their properties.

Aggregate: Aggregates were sieved and separated to two groups according to the sizes. The total weight of aggregates needed in test is 1200 g. Figure 2 give the form of crumb rubber and Fig. 3 give the type of iron filings which has been used in tests. Figure 4 shows a machine which was used in the testing type Marshall stability test. Table 1 and 2 are shown the result of aggregate gradation sieve analysis and determines two types of gradation aggregate that used for this study. They have been showed small difference in aggregate between type 1 and 2 in gradation.

Bitumen: It was used type 40/50 penetration grade asphalt cement for this study; Table 3 shows the results for bitumen tests.

Marshall sample: The equipment's and procedures for preparing the Marshall sample were outlined by ASTM (2005). Modified samples were prepared using dry process that was recommended by the Arkansas state highway and transportation department with some modifications based on the experience from past researchers (Bahia *et al*., 1997; Billiter *et al*., 1997).

Determination of Optimum Bitumen asphalt Content (OBC): The mean ideal bitumen substance was decided by selecting the bitumen substance at VTM = 4.0% (from the VTM chart) and VFB = 75% (from VFB chart), top of curve taken from the stability chart and peak of curve taken from the bulk specific gravity. Table 4 shows the comes about of OBC for all types of blends.

The results in Table 4 shown that after added 5% from the additives (crumb rubber, iron filings) the OBC had significant effect on optimum bitumen content compared to conventional mix. Also, for 10 and 15%, the optimum bitumen content is increasing. This increasing in the optimum bitumen content due to the bitumen absorption by crumb rubber and iron filings, the stiffness decreased after added the crumb rubber but increased with iron filings due to the elasticity behavior of crumb rubber and iron filings and it can be seen that the effect of crumb rubber and Iron filings on other volumetric properties such VTM, the values slightly increased as the percentages of crumb rubber and iron filings increased also the degree of compaction it affected on the values of VTM and VFB.

Table 1: Aggregate gradation type 1

Sieve size	Passing %	Specification
37.5	100	100-100
25	100	100-100
19	93	100-90
12.5	76	90-70
9.5	70	80-56
4.75	40	65-35
2.36	33	49-23
0.3	10	19-5
0.075	6	9-3

Table 2: Aggregate graduation type 2

Sieve size	Passing %	Specification
37.5	100	100-100
25	100	100-100
19	94	100-90
12.5	71	90-70
9.5	64	80-56
4.75	58	65-35
2.36	45	49-23
0.3	9	19-5
0.075	4	9-3

Table 3: The results of bitumen tests

Bitumen test	Results	Specification
Penetration at 25°C (mm)	44	40-50
Ductility at 25°C (min, cm)	119	>100
Flash point (°C)	283	>232
Solubility (%)	101.5	>99

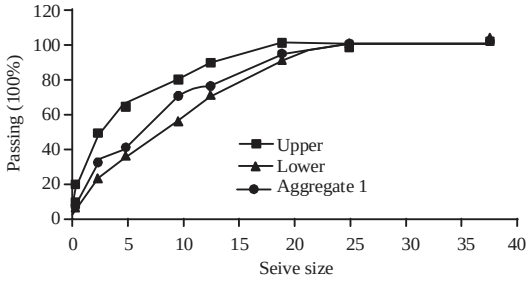

Fig. 5: Result of sieve analysis for aggregate type 1

Materials preparation Marshall stability test: The stability of road pavement is important indicator to improve the resists the deformations that may happen due to traffic load. Table 5 and Fig. 5-11 are shows the result of stability tests for two additives (crumb rubber and iron filings) and the effect of graduation of two different type of aggregate on the stability results.

Table 4: OBC results

		Crumb rubber				Iron filings			
Properties	Specif-ication	0%	5%	10%	15%	0%	5%	10%	15%
OBC	4-6	4.8	5.1	5.3	5.5	5	5.2	5.5	5.7
Density	-	2.5	2.3	2.3	2.1	2.2	2.3	2.4	2.41
Stiffness	>203	500	310	265	190	420	445	460	480
VTM	3-5%	4.6	4.9	5.1	4.9	3.8	4.1	4.4	4.5
VFB	70-80%	70	72	74	77	72	75	78	80

Table 5: Stability test results

Crumb rubber stability (kN)				Iron filings stability (kN)			
0%	5%	10%	15%	0%	5%	10%	15%
10.1	9.7	9.2	8.6	7	7.1	5.7	5

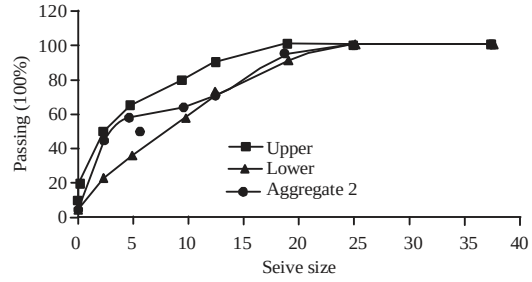

Fig. 6: Result of sieve analysis for aggregate type 2

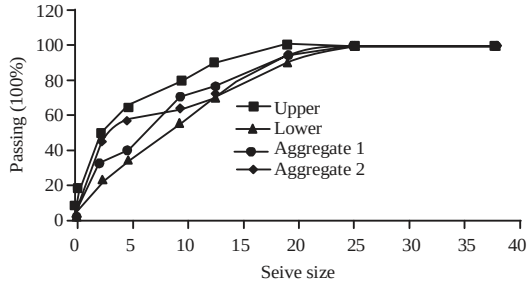

Fig. 7: Result of sieve analysis for two type of aggregate

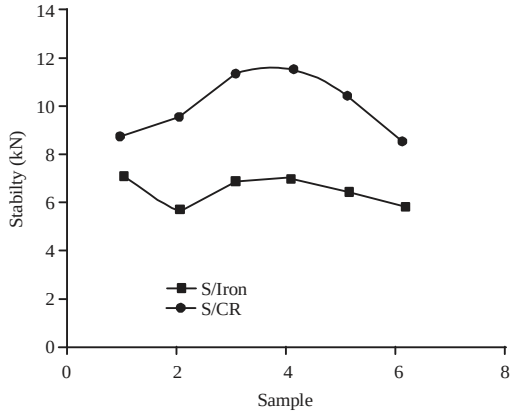

Fig. 8: Stability result

There are two important things that could effect on the stability results aggregate graduation and additives.

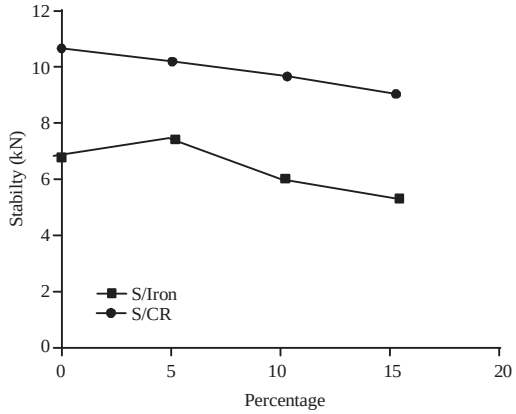

Fig. 9: Stability result

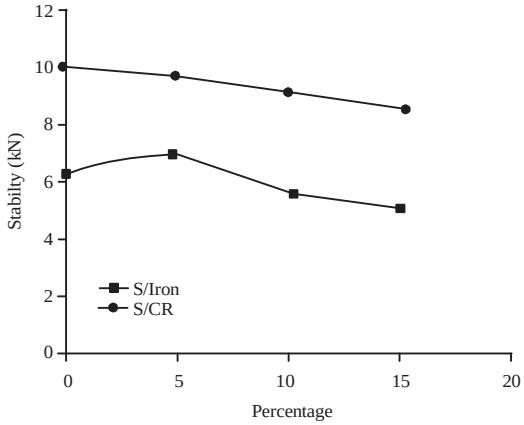

Fig. 10: Stability result

The results show the effect of graduation on the control simple for each type of aggregate. In the first type of aggregate, the stability is 10.1 kN due to the graduation of course aggregate more enough also the OBC is 4.8. In the second type of aggregate the stability 7 kN and the OBC is 5 due the percentage of fine aggregate more than the percentage of course aggregate, after added the crumb rubber the stability decreased from 10.1-9.7 and after add 15% crumb rubber the stability will decreased to 8.6 kN.

Table 6: Creep test results

Crumb rubber flow (mm)				Iron filings flow (mm)			
0%	5%	10%	15%	0%	5%	10%	15%
2.30	2.52	2.81	3.41	2.85	3.20	3.23	2.8

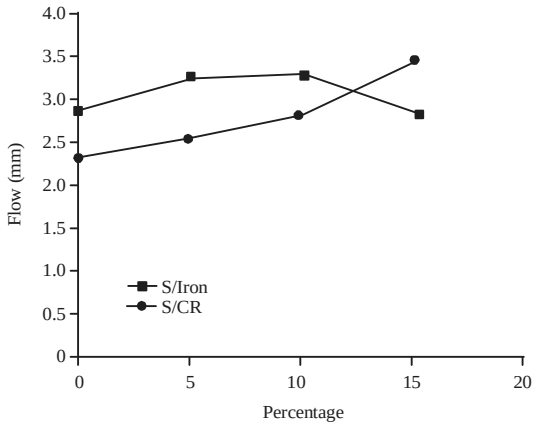

Fig. 11: Flow result

After add the iron filings the stability will increased after add 5% iron filings but when increased the percentage of iron filings the stability will reduce.

Dynamic creep test: The creep test was created to appraise the rutting potential of asphalt blends. The creep test is carried out either within the inactive or dynamic mode of loading. Each test typically takes one or two hour and gives results that represent characterization of the mixes in terms of their long-term deformation behavior Table 6 and Fig. 2-7 shows the result of creep tests for two additives (crumb rubber and iron filings) and the effect of graduation of two different type of aggregate on the results.

According to the specification the flow result most be from 2-4 mm and Table 6 shows that the effect of aggregate graduation and the additives on the results. In control simple there is no big different but after add the crumb rubber and iron filings the flow results changing with crumb rubber the flow results will increasing and the simple will be more plastic and that's leads to rutting and bleeding deformation under traffic load. After added Iron filings the flow value decreasing, specially, after add 15% iron filings which means the air voids will be high and that's will lead to cracking deformation under weather condition.

CONCLUSION

From this study, it can conclude that the performance of asphalt concrete mixes was significantly affected after added crumb rubber and iron filings. The increasing in the percentage of crumb rubber and iron filings will leads to increase the optimum bitumen content and also decreased the stability of the samples and density the main factor that will effect on it after add crumb rubber and iron filings is the degree of compaction and for stiffness it will decreased after added the crumb rubber but increased with iron filings. Also, for the flow it will increased after add crumb rubber but decreased with iron filing. 5% iron filing gave the best result from 10 and 15% for the crumb rubber 15% given the best results from 5 and 10%.

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