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Design and Construction of Perpetual Salvage Asphalt Pavement

[1]Manikanta Vangari

(Assistant professor Department of Civil engineering,

Aurora's Technological and Research Institute, Hyderabad, India)

[2]Gopi Sai Reddy

(UG student,Department of Civil engineering,

Aurora's Technological and Research Institute, Hyderabad, India)

[3] N.Rajesh

(UG Student, Department of Civil Engineering,

Aurora's Technological and Research Institute, Hyderabad, Telangana,India)

[4]D.Devsingh

(UG Student, Department of Civil Engineering,

Aurora's Technological and Research Institute, Hyderabad, Telangana,India)

ABSTRACT

The report provides information about the use of salvage asphalt for perpetual pavement to increase the properties of the asphalt pavement. Salvaging asphalt pavement creates a cycle of reusing materials that optimizes the use of natural resources. Salvaged asphalt pavement (SAP) is a useful alternative to virgin materials because it reduces the need to use virgin aggregate, which is a scarce commodity in some areas. It also reduces the amount of costly new asphalt binder required in the production of asphalt paving mixtures. The use of certain percentage of SAP can improve the performance of pavements constructed using SAP similar to that of pavements constructed from virgin materials with no SAP.

Perpetual pavement is a flexible but strong asphalt pavement that doesn't exhibit structural damage even when very high traffic flows over long periods of time. They're made up of multiple layers of durable asphalt. The bottom layer is designed to be strong but flexible to resist strains that could cause cracks to form from the bottom up. A similar intermediate layer adds additional structural protection, and the final layer, made of rut-resistant hot-mix asphalt (HMA), requires only minimal maintenance.

The significance of this topic is to provide a review of design and construction of perpetual pavement using salvaged asphalt with the addition of polymer

Keywords: Salvage asphalt pavement, perpetual pavement, Marshall mix design.

1. INTRODUCTION

Perpetual salvage asphalt pavement is defined as the pavement which is constructed using the salvaged asphalt in such a way that it serves for a period of more than 50 years with only periodic maintenance. Salvage asphalt is the waste pavement materials containing waste asphalt and aggregates. These materials are generated when asphalt pavements are removed for reconstruction, resurfacing. When properly crushed and screened,

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SAP consists of high-quality, well-graded aggregates coated by asphalt

2. OBJECTIVE

The objective of this project were to study the pavement performances , durability ,maintenance of perpetual pavements when they are constructed with salvage asphalt .To increase the performance characteristics and strength of the pavement the polymer admixture is used along with the salvage asphalt as a binder .The perpetual pavements constructed by using salvaged asphalt and polymer will last for long time when compared to the conventional asphalt pavement which will have tremendous effect on the economy and the resource required for the pavement laying .

Salvage Asphalt Pavement (SAP) is encouraged to be used in the construction of new roadways and pavements. Its use reduces cost and environmental impacts of road construction by reusing existing asphalt pavement. In Minnesota existing asphalt pavement material is often crushed and blended with other aggregates to create aggregate base or shouldering materials or transported to an Asphalt plant, crushed, and incorporated into new asphalt material. Both strategies reduce demand for virgin aggregates. Incorporation into new asphalt material has the additional benefit of reducing demand for asphalt binder material. It is recognized that a greater benefit to the environment and economy can be realized when incorporated into new asphalt material. This document was developed as a reference for local agencies that have minimal knowledge of incorporating SAP material into new asphalt and would like to understand more.

3.SCOPE

Perpetual Salvage asphalt pavements are the flexible pavements designed from bottom to up to resist structural failure, minimizing cracking and rutting with only periodic maintenance of the wearing coarse for a period of more than 50 years using salvaged asphaltic material to increase the pavement performances the polymer admixture is added .The use of polymer make it possible to use the maximum amount of salvaged asphaltic material. Reuse of salvage asphalt will have tremendous effect on the economy of construction.

4. MATERIALS USED

4.1 AGGREGATES

It is a term for the mineral materials, for example, sand, rock and pulverized stone that is utilized with a coupling medium. The properties of the aggregates used are:

SI.NO	TESTS PERFORMED	OUTPUT
1	Aggregate crushing value	26.25%
2	impact value	15.1%
3	Specific gravity	2.6
4	Los Angeles abrasion test	30.1%

4.2 Polyethylene Poly ethylene is used to increase the pavement properties. The addition of suitable percentage of polymer help to achieve higher softening point, keeping the values of ductility at minimum range of specification .by adding polyethylene to the salvage asphalt makes it possible to achieve more strength when compared to the normal asphalt pavement.

4.3 BITUMEN

Bitumen is the material which is used to bind the materials together .in this we use 70/80 grade of bitumen which has more viscosity when compared to the other grades.

SI.no	**tests**	**results**
1	Ductility	80
2	Softening Point	55
3	Penetration	65
4	Flash and fire	241and221

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5 .METHODOLOGY

Marshall Mix Design

MARSHAL STABILITY TEST

Mix design procedure for determining strength and flow vale carried out. Marshal stability measures the most load assist by the bituminous asphalt material at a loading rate will be 50.8 mm per minute, the test ends when it reaches maximum load. Note down the record when loading is decreasing to breakdown stage (given sample). The dial gauge is measures the specimen's flow and strength (in KN) by applying load. The flow value refers the vertical deformation to reached maximum load.

Marshal stability is relative shows deformation, displacement, shear stress and rutting. The stability in asphaltic pavement mainly derived from friction and cohesion. Cohesion is the binding force acts at an internal binder material of sample to engage and frictional resistance of aggregates. Bitumen pavement is subjected maximum traffic loads from all the time (including peaks time), it is necessary to occur the material with a good stability (strength) and flow.

Test Procedure:

Marshall Strength test apparatus is described as following:

i. The specimen together comprises of a cylinder with a base plate, extension collars and 10.16cm diameter & 6.35cm height.

ii. A Specimen extractor is worn in sort to extract the compressed sample from the mould. To transfer the load from conservatory collar to the higher proving ring attachment a suitable bar is used, while extracting the specimen.

iii. A flat circular compaction hammer having tamping face of 4.5kg sliding weight is constructed to provide a free fall from the height of 45 cm. iv. During compaction to hold the MS plate together the mould, compaction pedestal consisting of a 20×20×45 cm and wooden block capped with 30×30×2.5 cm are utilized. In order to hold the compaction mould in place on compaction pedestal, mould holder is provided with a spring tension device which is mainly designed to hold the compaction mould.

v. Breaking head is made up of two segments namely upper and lower cylindrical segments. Breaking head consists of experiment head with and within radius curve of 5 cm. The longer section is settled on a base which consists of two vertical steer rods that facilitate insertion in to the hole of higher segment.

vi. Loading Machine: It is provided with a equipment structure to lift the upward direction. On the higher ending of the apparatus pre-calibrated ring proving 5 tone capacities is fixed. The specimen contained in this test is placed in between the base and the proving ring. A uniform vertical moment of 5cm per minute is produced on the load jack. This machine is capable for its movement reverse and forward moment.

vii. Flow meter is composed of a guide, sieve and gauge. Due to frictional confrontation the activating pin of the gauge moves inside the guide sleeve. Least count of 0.025mm is adequate. At maximum load from initial site at zero loads, the flow value refers to the total vertical upward movement. Flow meter should contain a dial-gauge which measures the total upward vertical moment accurately.

Marshall Mix design is used to find the optimum binder content of the bitumen, Stability, flow value and bulk density for the bitumen content

1. Select the different types of aggregates for grading by using MORTH table.
2. First we need to assemble the mold with a base plate and we need to apply sum lubricate.
3. Before that we need to sieve the aggregate as par the MORTH table.
4. And then we need to take the sample of aggregate as par the MORTH table and heat thesample up to certain temperature by using pan.
5. And add the bitumen content to the sample and mix thoroughly then take it into the moldimmediately.
6. And give 75 blows on the both sides of the sample by using mechanical or manual.
7. Put the sample ideally for 24 hours after that remove the sample from the mold.
8. Take the water bath at 60degrees for the sample after that clean the surface of the sample
9. Then do the marshal stability test and note down the proving ring readings

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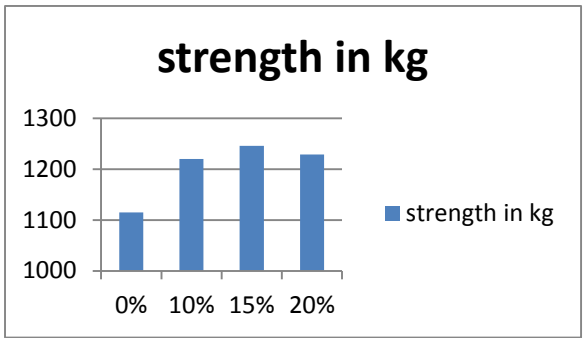
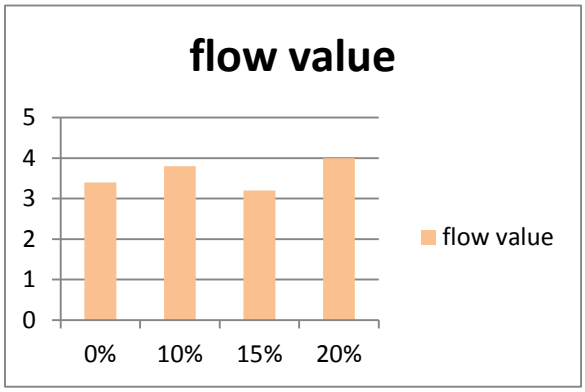
5. RESULTS AND DISCUSSIONS

5.1 Marshal Stability Strength and Flow Value for normal BC

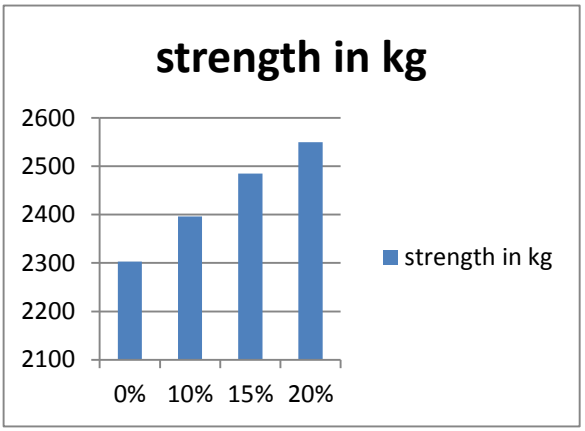


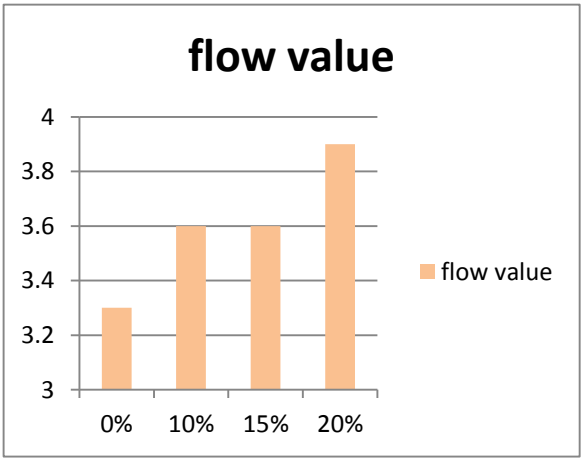


S.NO	% Of FIBERS	STABILITY (KN)	TEST (Kgs)	FL OW
1	0%	231	2266	3.2
2	0%	235	2305	3.5
3	0%	238	2335	3.4
4	10%	245	2403	3.8
5	10%	240	2354	3.4
6	10%	248	2433	3.8
7	15%	257	2521	3.7
8	15%	254	2492	3.8
9	15%	249	2443	3.4
10	20%	258	2531	3.9
11	20%	259	2541	3.8
12	20%	263	2580	4.2

5.2 Marshal Stability Strength and Flow Value for normal DBM

S.NO	% Of FIBERS	STABILITY (KN)	TEST (Kgs)	FLOW
1	0%	110	1079	3.5
2	0%	122	1197	3.6
3	0%	109	1069	3.3
4	10%	124	1216	4
5	10%	128	1256	3.6
6	10%	111	1189	3.8
7	15%	123	1207	3.0
8	15%	133	1305	3.50
9	15%	125	1226	3.30
10	20%	122	1177	3.90
11	20%	130	1275	4.10
12	20%	126	1236	4.00





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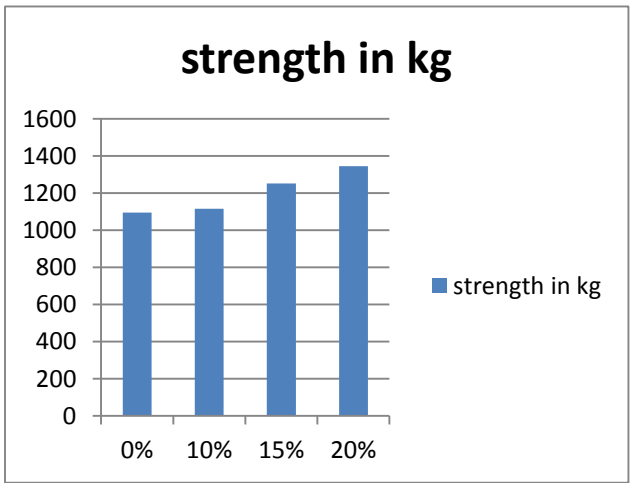
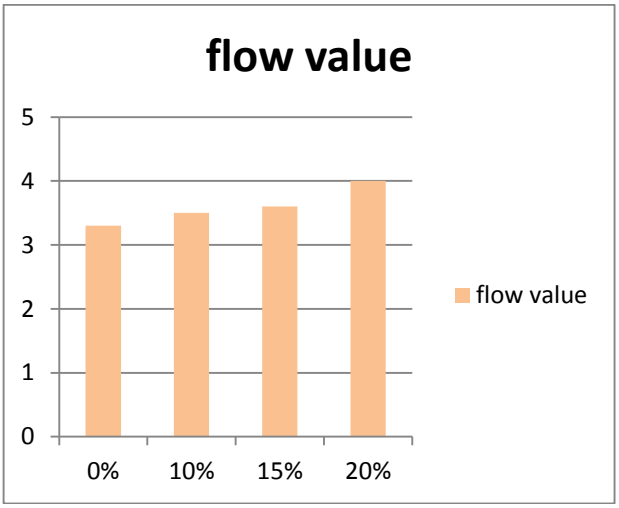
5.3 Marshal Stability Strength and Flow Value for salvaged Aggregate BC

S.NO	% Of FIBERS	STABILITY (KN)	TEST (Kgs)	FLOW
1	0%	112	1099	3.1
2	0%	108	1059	3.4
3	0%	115	1128	3.5
4	10%	110	1079	3.6
5	10%	117	1148	3.7
6	10%	114	1118	3.4
7	15%	124	1216	3.4
8	15%	129	1265	3.9
9	15%	130	1275	3.7
10	20%	137	1344	4.0
11	20%	135	1324	3.9
12	20%	139	1364	4.1





5.4 Marshal Stability Strength and Flow Value for salvaged Aggregate DBM

S.NO	% Of FIBERS	STABILITY (KN)	TEST (Kgs)	FLOW
1	0%	229	2246	3.4
2	0%	234	2296	3.6
3	0%	231	2266	3.7
4	10%	241	2364	3.2
5	10%	235	2305	3.4
6	10%	249	2443	3.5
7	15%	251	2462	3.1
8	15%	255	2502	3.3
9	15%	253	2482	3.6
10	20%	249	2443	3.9
11	20%	257	2521	4.0
12	20%	261	2560	3.8

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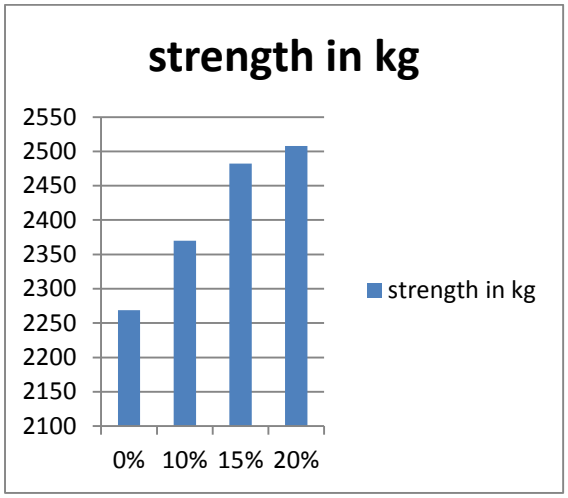

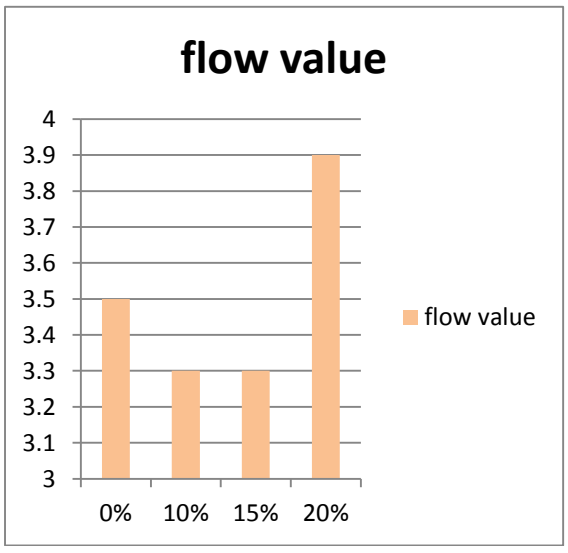

6.CONCLUSION

Using salvage asphalt pavement for road laying makes it economic and at the same time gives more strength when compared to the road with new materials .but use of salvage in high percentages can sometimes alter the properties of the pavement, to counterbalance this additional polymers which enhances the salvage asphalt pavement properties should be added in suitable quantities

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National asphalt pavement association