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Pavement Design with Hot-Mix Reclaimed Asphalt Pavement (RAP) Bituminous Concrete as the Surface Course

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***Abstract*: The scrap pneumas are pneumatics that can no longer be utilized to build them. The destruction or accumulation of discarded pneumatic garbage in landfills has several environmental problems and adverse effects on human health. One of the uses of discarded tires is Bitumen Pavement Amendment. The aim of this study is the examination of the different characteristics of bitumen produced by adding scrap value and checking the working ability of the mixture. Scrap pneumatic materials increase the physical characteristics of bitumen, including penetration and softening point, and a changed binder has a lower penetration and a better softening point in comparison with plain bitumen. The application of scrap The use of scrap tires has been demonstrated to enhance the physical characteristics of bitumen including penetrating points and smoothing, and a changed binder has less penetration and a greater softening point when compared with nice bitumen. Using waste pneumas enhances bitumen's physical characteristics. Hot-mix reclaimed asphalt pavement (RAP) bituminous concrete has a bulk specific gravity (Gsb) 2.604, apparent specific gravity (Gsa) 2.689, and effective specific gravity (Gse) 2.647 The static stability of hot-mix reclaimed asphalt pavement (RAP) bituminous concrete is 92.95%. The physical characteristics of bitumen, such as penetration and softening point, are improved when scrap is used. A modified binder has a lower penetration value than pure bitumen. Drink more softly in a modified binder. It happens in than ordinary bitumen.**

***Keywords*: Scrap tyres, Bitumen, Bitumen pavement amendment.**

1. Introduction

The traditional method of providing bituminous surfacing on flexible pavements as well on the rigid pavement require higher amount of energy for manufacturing of bituminous binder, drying aggregates and subsequently production of bituminous mix at Hot Mix Plant (HMP). For example, approximately 6 litres of fuel is used for drying and heating one ton of aggregates, which would expand to enormously huge quantities considering lakhs of tons of aggregates that are used for road construction every year. The heating of bituminous binder, aggregates and production of huge quantities of HMA releases a significant amount of greenhouse gases and harmful pollutants. The amount of emissions becomes two fold for every 10C increase in mix production temperature, and increasingly, higher temperature is actually being used for the production of HMA with modified binders. Also, there is a problem of the scarcity of aggregates, which forces transportation of materials from long distance. The use of diesel for running trucks leads to emission of pollutants. Therefore, an attempt has to be made to develop and adopt alternative technologies for road construction and maintenance to reduce consumption of fuel and aggregates. Recycling of pavements, particularly HMA recycling is one such technology which may be adopted for Indian conditions (Ministry of Finance, Govt. of India, 2009). Many studies are available on performance evaluation with conventional asphalt mixes (mix without RAP). Therefore there is a necessity for study on mechanistic evaluation of hot recycled mixes with and without utilization of recycling agents. Apart from environment concern, urbanization is growing in the present days, where people are looking for a comfortable life with safe shelter and well-connected roads for transportation. To meet these basic needs people are heavily dependent on the natural resources. This results in depletion of natural resources. Especially in construction industry; water, aggregates and cement are one of the major ingredients. To address the above issue we have to practice industrial ecology, i.e. treat the waste of a particular industry as a raw material for other industry. In case of aggregates, the present study looks at alternative resources which can replace the available natural resources. Most of these alternative resources are recycled aggregates e.g., Recycled Concrete Aggregates (RCA), mining wastes like Iron Ore Tailings and infrastructural wastes such as RAP (Recycled Asphalt Pavements). BCSJ (1978) studied recycle aggregates and concluded that 20% of cement Mortar changed into attached to twenty to 30mm size coarse mixture particles. Hasaba (1981) identified the quantity of mortar adhesion and electricity of original Concrete is proportional low strength concrete contained lesser mortar at the same time as excessive Strength concrete adhered mortar become better. Fergus (1981) look at discovered that loss of weight due to sulfate changed from 0.9 to 2.0% for recycled coarse aggregates. Hansen and narud (1983) studies confirmed that the concrete overwhelmed with the identical Grinding machine energy used, as the size of

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aggregates decreases the mortar Adoration additionally reduces and the water-cement ratio has an impact on the mortar at the Aggregates and also suggested that recycle combination obtained from high power Concrete has better density. Kasai (1985) studied that, the sulfate soundness takes a look at the conduct of recycling Combination concrete and mentioned that the sulfate soundness take a look at is wrong for the Assessment of the durability of recycled aggregates. Bairagi et al. (1990) studied the properties of recycled aggregates obtained by Crushing m15 grade concrete and concluded that there's no a lot of distinction in the Grading curve for both recycles coarse combination and herbal coarse combination. Residences of recycle coarse mixture Recycled coarse mixture concrete includes natural combination adhered with Cement paste residue, or simply cement paste and a few impurities. There may be a consensus That the quantity of cement paste has a huge impact at the first-rate and the Bodily, mechanical, and chemical residences of the aggregates, and has a potential impact on the houses of recycling combination concrete. Bairagi et al. (1993) concluded that absorption for recycling combination was at a Faster charge and 75% of the 1 day's absorption changed into attained in the first 30 minutes of The immersion. Environmental council of concrete agencies (1997) provided requirements for Recycled combination and stated that, if the concrete became long-lasting in its previous lifestyles, Resistance to weathering of a recycled concrete aggregate is acceptable without Sulfate soundness check. Ravindraraja (2000) reported that the water absorption capacity of recycled and Herbal aggregate depends on satisfactory and amount of adhered mortar.

2. Research Methodology

For this experiment, ordinary Portland Cement (OPC) of gradeM30 grade was utilized. It was examined for physical characteristics such as normal consistency, specific gravity, and initial and ultimate weight, time, soundness, fineness, and compressive strength are all set according to IS 456:2000.

1) Aggregates

The sand utilized was clean river sand that complied with IS 383:1970. In accordance with IS 10262: 2004, physical properties such as Fineness Modulus, Specific gravity, Bulking, Bulk density, and so on were studied. Before use, the sand was surface dried.

2) Water

Potable tap water that is free of harmful quantities of oils, acids, and alkalies Sugar, salts, and organic compounds with PH are all available in the lab. The worth of for mixing, the software version 7.01 was utilized, which met the standards of IS: 456 -2000. concrete, as well as curing the sample.

3) Steel fibres

The fiber used in this study was commercially available binding wire from the local market. The wire was discovered to have a diameter of 925mm, and a consistent aspect ratio of 40 was used throughout the project.

For SCC mix design, the ratio used is:

1. 150–210 liters of water
2. 350 – 450 kg cement
3. Powder: 360–650 kg
4. Water-to-powder ratio: 0.28–0.50
5. Aggregate, coarse: 750–1000 kg

Basic tests were performed, including split tension, flexure, compression, and impact. Ending experiments on RCC beams were conducted to investigate flexural behavior. The amount of cement, aggregate, and admixtures was proportioned by weight according to the mix proportions. Water, all measuring equipment was cleaned regularly and serviceable, and its reliability was tested on a regular basis. A pan mixer was used to complete the stirring operation. To achieve a uniform color, the fibers were placed down evenly and dried mixed.

The basic mechanical parameters of the toughened SFRSCC are primarily used to evaluate the performance of the specified SFR-SCC. The tests were conducted on specimens of plain and steel fiber-reinforced concrete with fibre content of 0.5 and 1%, respectively, in line with IS requirements. At the ages of 28, 56, and 90 days, standard cubes of 15cm x 15cm x 15cm, cylinders of 15 cm x 30 cm, and prisms of 10cm x 10cm x 50cm were tested according to relevant IS regulations to determine compressive, split tensile, and flexural strengths. The capacity of a substance to withstand compressive force without failing is known as compressive strength. The cube 60 sample were retrieved from the curing tank and cleaned to eliminate any surface water after the requisite curing period. The specimen cubes were subjected to IS:516-1969 testing.

The compression testing was carried out on a digital type Compression Testing Machine (CTM) with a capacity of 2000kN.

4) Split tensile strength tests on SFR-SCC specimens

Direct tension tests are rarely performed, owing to secondary stresses introduced by specimen holding mechanisms that cannot be ignored. The splitting tension test is the most popular method for determining concrete's tensile strength.

Compression loads are applied to a 150mm diameter by 300mm height cylinder along two diametrically opposed axial lines. Until the specimen fails, the load is delivered continually at a steady pace. The compressive force causes a homogeneous transverse tensile stress along the vertical diameter.

5) Flexural strength

The Modulus of Rupture, or maximum stress at the extreme fibres in bending, is used to describe flexural strength. A microprocessor-based Universal Testing Machine (UTM) with a 1000kN capacity was used to test the specimen. At the bottom of the loading frame are two 400mm apart rollers. Two comparable rollers are attached at the third point of the supporting span, 133 mm apart and centrally with respect to the base rollers, to apply the load.

Impact tests on SFR-SCC specimens have been studied.

Short-duration loads are common in concrete constructions (dynamic).

Contact from missiles and projectiles, wind gusts, earthquakes, and machine vibrations are all sources of such loads. Concrete's impact resistance is inadequate due to its low tensile strength and fracture energy. As a result, substantial research has gone into making concrete that has a 65 percent higher impact resistance than normal concrete. In such situations, FRC has proven to be a promising structural material.

Studies on the durability of SFR-SCC mixtures.

Concrete must be able to survive the deteriorating processes to which it will be subjected. This type of concrete is referred to as "durable concrete."

Furthermore, durable concrete prevents reinforcing steel from corrosion and holds up the environmental and working conditions to which it is subjected for the duration of its life. The premise was that "strong concrete is durable concrete," with the only exceptions being the impacts of alternating freezing and thawing, as well as various chemical attacks. The alkali-silica and alkali-carbonate reactions are two chemical processes that cause degradation.

This sentence relates to Charles McDonald's original wet technology for the production of RTR-MB in the 1960's. The McDonald Mixer is a Bitumen Rubber Mixture produced in a mixing tank with Crumb Rubber and Bitumen. This modified binding tank with augers is then passed to guarantee circulation so that the mixture can react for a reasonable duration (often 45–60 minutes). The reactive binder is then used for mixing.

6) Mc Donald Process

This research was based on a combination of 80/100 grade bitumen, and waste tyre crumb. Characteristics of bitumen and aggregates were in fact examined. Then produce several bitumen and scrap mixes and apply the dry method Then produce several mixes of bitumen and scrap pipe in different proportions and utilise the dry process. The scrap pneumatic weight must be replaced by the weight of the aggregate in the test. The feasibility of several mixtures of bitumen and tyre rubber with different aggregate amounts was examined.

Regular checks are performed onsite on the condition of the resulting concrete mixture and paving surface.

a) Grading of the aggregate
b) Degree of bitumen
c) Aggregate temperature
d) The paver mix temperature is monitored on a regular basis during the mixing and compression.

At least one specimen is collected and examined for each 100 tonnes of a mix that is discharged by the hot mix facility.

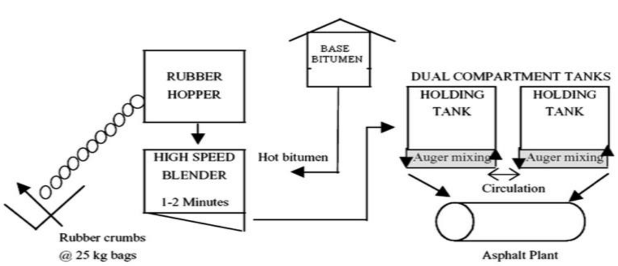

Fig. 1. Schematic diagram of Mc Donald process

Testing Marshal: This test is used to assess the stability of the bituminous mix, i.e. the durability and resistance of cylindrical specimens loaded at a 60-degree Celsius lateral area of the bituminous mix. Here was produced the Dense Bituminous Macadam.

The Marshall Stability Test includes two key aspects for building the mix:

i. density avoidance analysis
ii. stability flow analysis. Analysis

The test is pertinent for designs of bitumen-based heat mix with aggregates of up to 25mm. This technique is used to assess the susceptibility to deformation of cylindrical specimens. The measurement is performed when a bituminous mix is loaded at perimeter at 5 cm per minute. In creating a pavement mix, this test method is used. This shows the real strength and load capacity of road materials in the Marshall Stability test findings.

3. Results and Discussion

Table 1
Mix proportions

Hot bin sieve size		Proportions %	
19 mm- 13 mm		17	16.08
13 mm- 06 mm		23	21.76
6 mm to down		15	42.57
RAP		15	14.19
Bituman (CRMB-60)	Rap 15%= 0.54%	-	-
	Virgin = 4.86%	-	-
	Total	100	100

Table 2
Physical properties of aggregates

S. No.	Test description	Effects obtained	Specification limits as per MORTH
1	Gradations of aggregates	Within the specified	Table 500-17 grading 2
2	Aggregates impact value %	14.83	Max 24%
3	Flakiness and elongation indicate percentages	24.18	Max 30%
4	Cleanliness	2.85	Max 5%

Table 3
Properties of bitumen

S. No.	Test description	Effects obtained	Specification limits as per IRC
1	Penetration 1/10mm	39	Max 50
2	Softening ^{o}c	65.08	Min 60

Table 4
Marshal test at OBC (5.46%)

S. No.	Test Description	Results	As per MORTH
1.	Marshall Density (gm./cc)	2340	-
2	Air Voids (%)	4.22	3.1-5.2
3.	Stability(KG)	14.20	Min^m 901
4.	Voids in mineral Aggregate VMA (%)	71.76	Min^{m}13
	Voids field with bitumen BFB (%)	15.04	66-76
	Flow mm	3.1	2.6-4.1

Marshall test mold casting:

The mould is within the footstool of the Marshall Compaction. The materials are crushed with 50 hammer blows (or as required) and the sample is inverted with the same number of blows and compacted in the opposite face. The mould is reversed after compression. The test values are:

Table 5
RAP reclaimed Asphalt pavement) material binder content

Description	Test 1	Test 2	Test 3	Test 4	Test 5	Average
Rap Material binder content (%)	3.61	3.66	3.81	3.46	3.51	3.61

Table 6
Binder content in mold casting

Description	Test 1	Test 2	Test 3	Test 4	Test 5	Average
Basic dry material (%)	86	4.44	4.57	4.87	5.04	5.24
RAP material	14	0.56	0.53	0.53	0.56	0.56
Total binder content (%) use in design mold casting	100	5.0	5.2	5.4	5.6	5.8

Table 7

Description		Test 1	Test 2	Test 3	Test 4	Test 5
Wt. of Marshall mould (gm)		1200	1200	1200	1200	1200
Wt. of basic dry material gm	1020	974.1	972.06	970.06	967.98	965.94
Wt. of content use of basic dry material gm		45.9	47.94	49.98	52.02	54.06
Wt. of RAP mix gm		180	180	180	180	180
Total wt.		1200	1200	1200	1200	1200

Table 8
Marshall test data

Bulk specific gravity of Aggregate (G_{sb})	: 2.604										P Ring correction factor :2.19				
Effective Specific Gravity of Aggregate (G_{sb})	: 2.647														
% of Bitumen by Wt. of Mix	% of Aggregate=100-a	Wt. in Air	Wt. in Water	S.S.D Weight	Volume f=e-d	Density=c/f (G_{mb})	G_{mm}	V_a=((i-h)/i)*100	V.M.A= 100-((h*b)/G_{sb})	V.F.B= ((k-j)/k)*100	P.R.R	Load	Corr. Factor	Corr. Load	Flow
a	b	d	e	F	g	H	I	j	k	l	m	n	o	*	*
5.00	95.00	1200.5	680.5	1202.0	521.5	2.302	2.457	6.30	16.01	60.65	335	734	1.00	734	3.80
	95.00	1197.5	681.0	1199.0	518.0	2.312	2.457	5.90	15.65	62.29	315	690	1.00	690	4.50
	95.00	1197.5	681.5	1200.0	518.5	2.310	2.457	5.99	15.73	61.91	320	701	1.00	701	4.00
Average						**2.308**	**2.457**	**6.06**	**15.80**	**61.62**		**708**		**708**	**4.10**
5.20	94.80	1198.0	681.0	1200.5	519.5	2.306	2.450	5.86	16.04	63.43	485	1062	1.00	1062	3.90
	94.80	1198.0	682.5	1199.0	516.5	2.319	2.450	5.32	15.55	65.80	500	1095	1.00	1095	4.10
	94.80	1198.5	680.0	1200.0	520.0	2.305	2.450	5.92	16.08	63.21	490	1073	1.00	1073	2.85
Average						**2.310**	**2.450**	**5.70**	**15.89**	**64.15**		**1077**		**1077**	**3.62**

Table 9

Bulk specific gravity of Aggregate (G_{sb})	: 2.604										P Ring correction factor :2.19				
Effective Specific Gravity of Aggregate (G_{sb})	: 2.647														
% of Bitumen by Wt. of Mix	% of Aggregate=100-a	Wt. in Air	Wt. in Water	S.S.D Weight	Volume f=e-d	Density=c/f (G_{mb})	G_{mm}	V_a=((i-h)/i)*100	V.M.A= 100-((h*b)/G_{sb})	V.F.B= ((k-j)/k)*100	P.R.R	Load	Corr. Factor	Corr. Load	Flow
a	b	d	E	F	g	H	I	j	k	l	m	n	o	*	*
5.40	94.60	1200.0	687.5	1201.0	514.0	2.335	2.443	4.43	15.18	70.83	660	1445	1.00	1445	3.10
	94.60	1197.0	685.5	1198.0	513.0	2.333	2.443	4.48	15.22	70.57	650	1424	1.00	1424	2.80
	94.60	1197.0	689.0	1198.0	509.0	2.348	2.443	3.89	14.70	73.54	655	1434	1.00	1434	2.90
Average						**2.339**	**2.443**	**4.26**	**15.03**	**71.65**		**1434**		**1434**	**2.93**
5.60	94.40	1201.0	692.0	1204.5	512.0	2.346	2.436	3.70	14.95	75.26	525	1150	1.00	1150	3.90
	94.40	1200.0	688.5	1204.0	515.5	2.328	2.436	4.43	15.60	71.59	540	1183	1.00	1183	4.20
	94.40	1200.0	690.0	1204.0	514.0	2.335	2.436	4.15	15.35	72.95	535	1172	1.00	1172	3.95
Average						**2.336**	**2.436**	**4.09**	**15.30**	**73.27**		**1168**		**1168**	**4.02**

Table 10

Bulk specific gravity of Aggregate (G_{sb})	: 2.604										P Ring correction factor :2.19				
Effective Specific Gravity of Aggregate (G_{sb})	: 2.647														
% of Bitumen by Wt. of Mix	% of Aggregate=100-a	Wt. in Air	Wt. in Water	S.S.D Weight	Volume f=e-d	Density=c/f (G_{mb})	G_{mm}	V_a=((i-h)/i)*100	V.M.A= 100-((h*b)/G_{sb})	V.F.B= ((k-j)/k)*100	P.R.R	Load	Corr. Factor	Corr. Load	Flow
a	b	d	e	F	g	H	I	J	k	l	m	n	o	*	*
5.80	94.20	1199.0	688.0	1201.5	513.5	2.335	2.429	3.87	15.52	75.08	520	1139	1.00	1139	3.90
	94.20	1201.0	690.5	1204.5	514.0	2.337	2.429	3.80	15.46	75.42	505	1106	1.00	1106	4.30
	94.20	1199.5	686.0	1200.0	514.0	2.334	2.429	3.92	15.57	74.81	510	1117	1.00	1117	4.10
Average						**2.335**	**2.429**	**3.86**	**15.52**	**75.11**		**1121**		**1121**	**4.10**

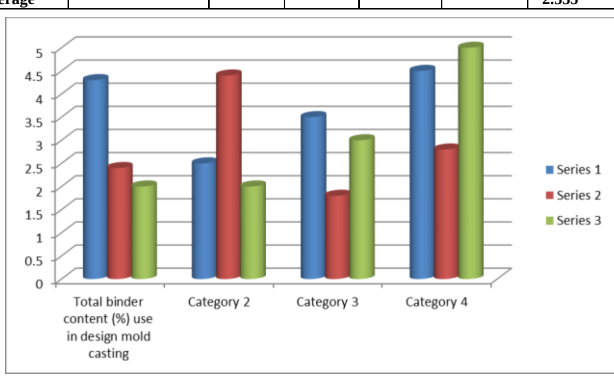

Fig. 2. Binder content in mold casting

Percentage of aggregate =100-Percentage of bitumen by weight of mix (1)

$$VOLUME\ OF\ SSD\ WEIGHT = \frac{weight of\ water}{weight\ of\ air} \quad (2)$$

$$\text{Density} = \frac{\text{weight of water}}{\text{SSD weight}} * \text{volume of GB} \quad (3)$$

$$V_a = \frac{\text{Gmm} - \text{Density}}{\text{Gmm}} * 100 \quad (4)$$

$$\text{VMA} = \frac{Density * \%\ of\ aggregate}{Specific\ Gravity\ of\ Bituman} \quad (5)$$

$$VFB = \frac{V.M.A - V.A}{V.M.A} * 100 \quad (6)$$

Table 11

Aggregate Size	% Blend	Bulk Specific Gravity	Apparent Specific Gravity
19mm to 13mm	17	2.668	2.725
13mm to 6mm	23	2.645	2.744
6mm Down	45	2.555	2.643
RAP	15	2.619	2.709

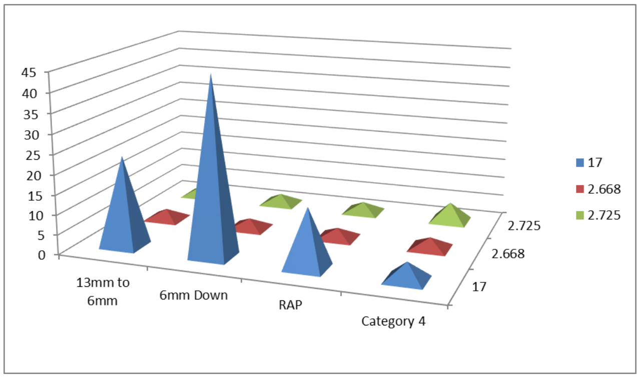

Fig. 3.

Table 12
Maximum theoretical specific gravity (gmm)

Gmm at 5.0% Bitumen Content	2.457
Gmm at 5.20% Bitumen Content	2.450
Gmm at 5.40% Bitumen Content	2.443
Gmm at 5.60% Bitumen Content	2.436
Gmm at 5.80% Bitumen Content	2.429
Gmm at 5.40% at OBC	**2.443**

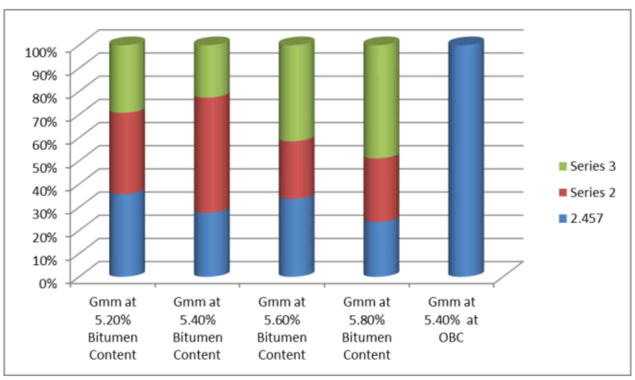

Fig. 4. % Bitumen Content, Specific Gravitie – (Gsb), (Gse), (Gsa)

Table 13
Maximum Therotical Specific Gravity (Gmm

% of Bitumen	Gsb	Gse	Gsa	Gmm
5.00		2.647	2.689	2.457
5.20				2.450
5.40				2.443
5.60	2.604			2.436
5.80				2.429
OBC 5.40				**2.443**

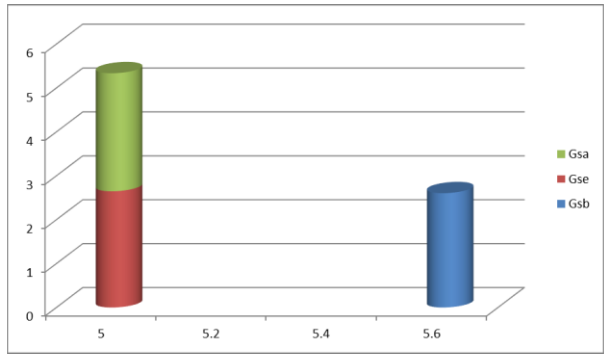

Fig. 5.

Table 14

Item	S-1	S-2	S-3	S-4	S-5	Specification as per MORTH'S
Bitumen	5.0	5.2	5.4	5.6	5.8	Minimum 5.4%
Density	2.308	2.310	2.339	2.336	2.335	
Stability	708	1077	1434	1168	1121	Minimum 1200
Air Voids	6.06	5.70	4.26	4.09	3.86	3-5
VMA	15.80	15.89	15.03	15.30	15.52	Minimum 13
VFB	61.62	64.15	71.65	73.27	75.11	65-75
Flow	4.10	3.62	2.93	4.02	4.10	2.5-4

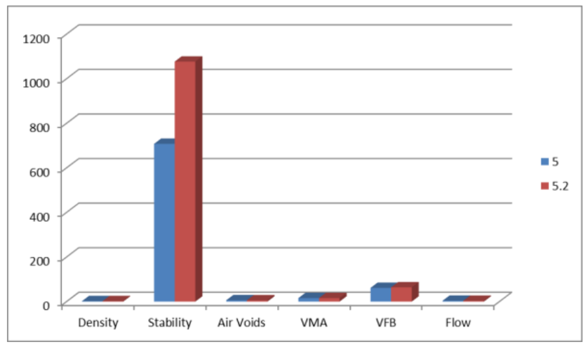

Fig. 6.

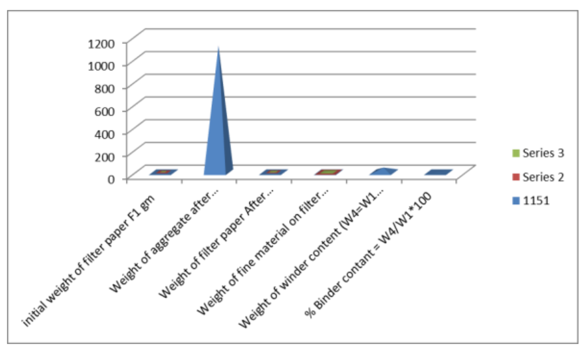

Fig. 7. Bitumen content

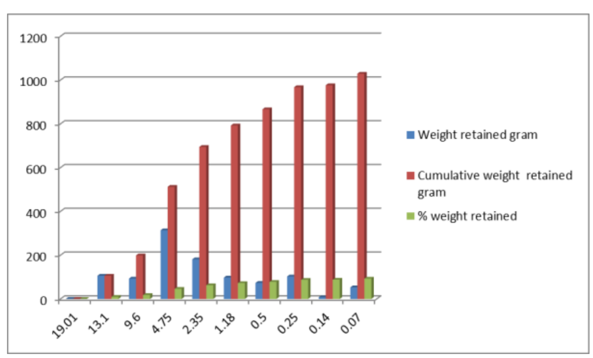

Fig. 8. Grading analysis after extraction

Table 15

Bulk specific gravity of Aggregate (Gsb) : 2.604											P Ring correction factor :2.19				
Effective Specific Gravity of Aggregate (Gsb) : 2.647															
Group – 2 (24 Hours in Water Bath @ 60^0C)															
% of Bitumen by Wt. of Mix	% of Aggregate=100-a	Wt. in Air	Wt. in Water	S.S.D Weight	Volume f=e-d	Density=c/f (G_{mb})	G_{mm}	V_a=((i-h)/i)*100	V.M.A= 100-((h*b)/G_{sb})	V.F.B= ((k-j)/k)*100	P.R.R	Load=m*z	Corr. Factor	Corr. Load=o*n	Flow (mm)
A	b	d	e	f	g	h	I	J	k	l	m	n	o	*	*
5.40	94.60	1197.0	685.5	1198.0	512.5	2.336	2.443	4.39	15.14	71.03	615	1347	1.00	1347	3.30
	94.60	1199.5	689.0	1201.5	512.5	2.340	2.443	4.19	14.96	72.02	600	1314	1.00	1314	3.80
	94.60	1200.0	687.5	1200.5	513.0	2.339	2.443	4.24	15.01	71.75	630	1380	1.00	1380	3.60
Average						**2.338**	**2.443**	**4.27**	**15.04**	**71.60**		**1347**		**1347**	**3.6**
Bulk specific gravity of Aggregate (Gsb) : 2.604											P Ring correction factor :2.19				
Effective Specific Gravity of Aggregate (Gsb) :2.647															
Group – 2 (30 Minutes in Water Bath @ 60^0C)															
% of Bitumwn by Wt. of Mix	% of Aggregate=100-a	Wt. in Air	Wt. in Water	S.S.D Weight	Volume f=e-d	Density=c/f (G_{mb})	G_{mm}	V_a=((i-h)/i)*100	V.M.A= 100-((h*b)/G_{sb})	V.F.B= ((k-j)/k)*100	P.R.R	Load=m*z	Corr. Factor	Corr. Load=o*n	Flow(mm)
A	b	d	e	f	g	h	I	J	k	l	m	n	o	*	*
5.40	94.60	1199.0	686.0	1200.0	514.0	2.333	2.443	4.51	15.25	70.45	665	1456	1.00	1456	3.00
	94.60	1200.0	688.0	1201.5	513.5	2.337	2.443	4.33	15.09	71.29	670	1467	1.00	1467	3.10
	94.60	1198.5	688.5	1199.0	510.5	2.348	2.443	3.89	14.70	73.53	650	1424	1.00	1424	2.90
Average						**2.339**	**2.443**	**4.24**	**15.01**	**71.76**		**1449**		**1449**	**3.0**

Table 17
Grading analysis after extraction

I S Sieve size mm	Weight retained gram	Cumulative weight retained gram	% weight retained	% weight passing	Specification limit
19.01	0	0	0.00	100.00	100
13.10	105.8	105.9	9.54	90.46	90-100
9.60	93.05	199.06	17.97	82.01	70-88
4.75	313.7	512.04	46.25	53.74	53-71
2.35	181.2	694.4	62.55	37.420	42-58
1.18	97.7	792.5	72.38	28.60	34-48
0.500	73.3	866.5	77.99	22.02	26-38
0.250	102.7	967.4	87.25	12.75	18-28
0.140	7.5	976.2	87.94	12.05	12-20
0.070	53.07	1028.8	92.78	7.25	4-10

Average Marshall Stability of Group-1	1449
Average Marshall Stability of Group-2	1347

$$Retained\ Stability = \frac{Average\ Marshall\ Stability\ of\ Group-2}{Average\ Marshall\ Stability\ of\ Group-1} \times 100$$

$$\frac{1347}{1449} \times 100$$

Retained Stability = 92.95%

Table 16

S. no.	Description	Trial no.1
1	Weight of mix, W1	1151
2	initial weight of filter paper F1 gm	4.0
3	Weight of aggregate after extraction W2	1111
4	Weight of filter paper After extraction with fine material F2 gm	4.4
5	Weight of fine material on filter paper (W3=F2-F1) gm	0.6
6	Weight of winder content (W4=W1 (W2+W3)gm	41.6
7	% Binder contant = W4/W1*100	3.7

4. Conclusion

- Hot-mix reclaimed asphalt pavement (RAP) bituminous concrete has bulk specific gravity (Gsb) 2.604, apparent specific gravity (Gsa) 2.689, and effective specific gravity (Gse) 2.647.
- The static stability of hot-mix reclaimed asphalt pavement (RAP) bituminous concrete is 92.95%.
- The physical characteristics of bitumen, such as penetration and softening point, are improved when scrap is used.
- A modified binder has a lower penetration value than pure bitumen.
- Drink more softly in a modified binder. It happening than ordinary bitumen.

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