

# A STUDY ON RECLAIMED ASPHALT PAVEMENT (RAP) MATERIAL USING SUB-GRADE LAYER OF FLEXIBAL PAVEMENT IN VIDISHA CITY

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**ABSTRACT** -Flexible pavement reclaimed bituminous pavement (FPRBP) is describe as removing pavement material containing bitumen and aggregates. These material are generated, when bitumen pavement is reconstruction, resurfacing, obtain access to coursed utilities. All though much of the composed rap is recycled pavement material, a big part of its wasted or down-graded whenever using in land filling, embankment or base layers. In huge amount Reclaimed asphalt pavement is evolved that cannot be used in the same year, so it will be according to the requirement. It has been predicted that as most as approximately 36 million metric tons (39 million tons), or 85 to 87 percent of the excess bitumen concrete immediately generated.

In this thesis we study the effect on soil with different percentage of reclaimed asphalt pavement material and check the CBR value and comparing with a normal soil. After that find the maximum replacement of reclaimed asphalt pavement material at which gives the higher bearing capacity of soil.

For sub-grade, the CBR value is minimum 8% and the thickness of sub-grade should be 150mm. Thickness of the sub-grade is vary according to the bearing capacity of soil in different area and the properties of soil for sub-grade is also changes. CBR is reducing below the applicable value for conventional granular base layer whenever the amount of RAP road exceeding 15 and 20%. CBR test method is used for evaluation of strength of soil in mixing of a reclaimed bitumen pavement (RBP) material in different percentage. After 25% mix of reclaimed asphalt pavement material in soil, the CBR value of a sample is found 10.29%.

Key words: -flexible pavement reclaimed bituminous pavement (FPRBP), CBR value, sub grade layer, sub base layer, reclaimed bitumen pavement (RBP), recycling pavement, land filling, and embankment.

## 1. INTRODUCTION -

Reclaimed bituminous pavement (RBP) is explained because the retired pavement material is said to contain

bitumen and aggregates. This material arising due to the stabilization of bitumen pavement is a reconstruction, resurfacing, and gaining access to a burial utility. Whenever fine rock and screened rock is crushed, the wrap consists of high-quality, well-graded aggregates coated with pavements of bitumen that have long-term US recycled materials. The financial and environmental benefits from the use of wrap materials have been well recognized. While all is too much rake recycling, in a large part, whenever landfills, embankments or base layers are used, it is ruined or down. The bulk of the wrap is manufactured in recycling and use, although it is not always in a year that it is produced. Recycled wrap is routinely used as sometime around returning tails to the pavement structure, usually included in bitumen paving for hot or cold recycling means, this can be added to the base layer or sub-base layer construction at any time is using.

## 1.1 NEEDS OF STUDY -

When the CC road is to be built, the flexible payment is broken due to which a lot of waste comes out. These materials are totally waste, so it can be reused in sub grade layer of road. It will decrease the landfill by using the waste material. By using these waste materials, the cost of construction of road will decease up to 25 to 30% of total construction of road. Before using these materials, the material should be tested in the laboratory and find that it is suitable for construction or not. The water adsorption on these material is to less as compression to the natural aggregate used for construction due to coating of bitumen into the aggregate, which is very helpful in sub grade layer for reducing the capillary action and easing water removal from these layer and prefaced the top layer.

## 1.2 OBJECTIVE:-

- To evaluate the use of Reclaimed asphalt pavement material is sub-grade layer in pavement.

- To enhance the bearing capacity of soil (CBR) to mix with reclaimed asphalt pavement.

**2. EXPERIMENTAL INVESTIGATION**

**2.1 Aggregate Testing**

Aggregate is combination of sand, gravel and crushed stone for bind all the ingredient into a single unit used binding material like Portland cement, lime, asphalt, etc with some percentage of water ( For proper mixing all the ingredient ). Aggregate is used upto 90 to 98% of the total ingredient used in asphalt concrete and upto 65 to 85% of total in ingredient used in Portland cement concrete. Aggregate can be used in base layer and sub-base layer in both type of construction work weather it is flexible or rigid pavement. Aggregate formed by crushing of the rock as per desired shape and size. At the time of crushing may be material are formed many test following are:-

1. Sieve size analysis test
2. Impact test
3. Los Angeles abrasion test
4. Aggregate crushing value test
5. Specific gravity test
6. Water absorption test

**2.2 Soil testing**

Soil testing for any construction depends on the properties of a soil and design of a construction. Some test can be performed on soil for better construction that includes liquid limit, plastic limit, moisture content, specific gravity and particle size distribution. These tests can be performed at site or in laboratory for determine the bearing capacity of soil, California bearing ratio test is conducted & for moisture content, proctor test is conducted. At the time may be material are testing of different test following are:-

1. Sieve size analysis test
2. Liquid limit test
3. Plastic limit test
4. Plastic index test
5. Proctor test
6. Free Swell index test
7. California bearing ratio (CBR) test
8. Specific gravity test

**3. RESULT AND DISCUSSION**

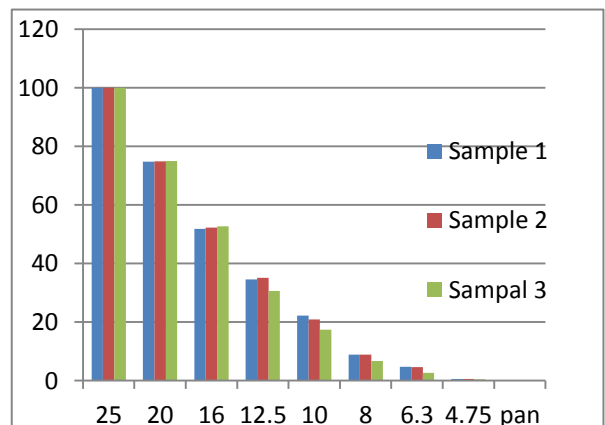
**3.1 Aggregate -**

Aggregate is a construction material which is used obediently. It is made up of different material depending

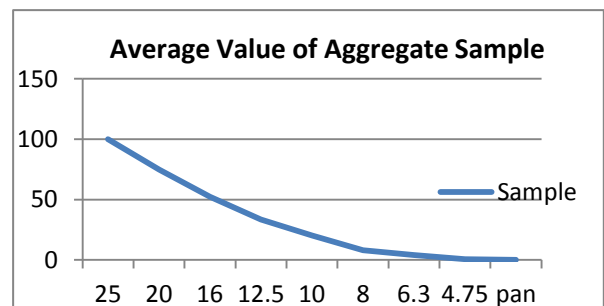
on the parent rock and the Impact value, Abrasion value, Crushing value, Specific gravity is also different for different aggregate. Aggregate will be available in different shape and size like 6mm, 8mm, 10mm, 12.5mm, 16mm and 20mm is used top layer and 25mm to 40mm is used for DLC layer. Sand is used as a filler material in voids of an aggregate. Some important property present in Table.

Table 1 Sieve Analysis Data of 20mm Coarse Aggregate (Sample)

Sieve size (mm)	Cumulative % Wt. Passing			Average
	Sample 1	Sample 2	Sample 3	
25	100.00	100.00	100.00	100.00
20	74.82	74.88	74.94	74.88
16	51.76	52.24	52.74	52.24
12.5	34.53	35.14	30.60	33.42
10	22.18	20.90	17.42	20.16
8	8.88	8.88	6.70	8.15
6.3	4.66	4.64	2.62	3.97
4.75	0.60	0.60	0.40	0.53
pan	0.00	0.00	0.00	0.00



Graph1 Sieve Size Analysis of Aggregate (Sample)



Graph 2 Sieve Size Analysis of Average Value of Aggregate

Since the concrete pavement are subjected to dynamic load due to the vehicular movement, therefore some special properties in aggregate as such impact value, abrasion value & crushing value, in addition to its normal properties, evaluated generally for the common use of aggregate for making concrete, were also determined. The results and permissible limits for are presented in Table.

Table 2 Important Physical Properties of 20mm Aggregate (Sample)

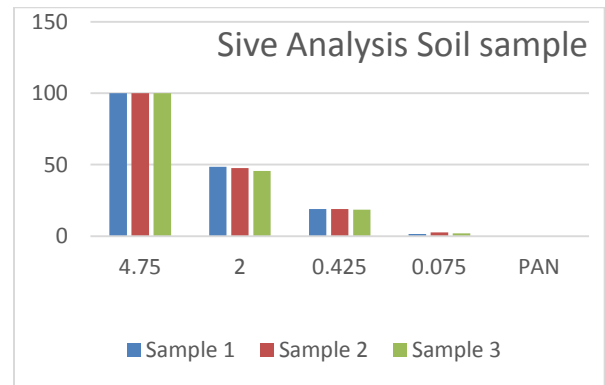
properties	Measured value	Permissible value as per code
Specific Gravity	2.75	2.5 – 2.9
Water absorption (%)	1.54	< 2%
Crushing Value (%)	23.27	30
Impact Value (%)	22.17	30
Abrasion Value (%)	23.23	30

**3.2 Soil: -**

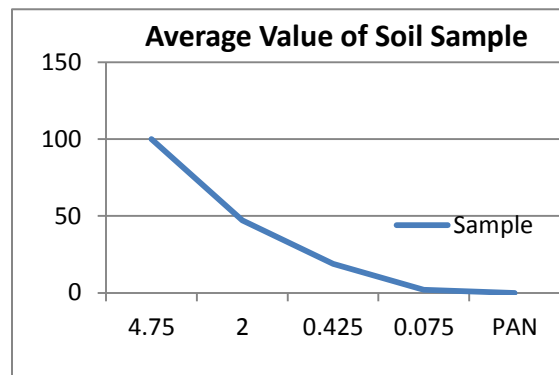
Soil is a mixture of broken rocks and mineral and load of whole structure whether it is road, building or bridge is bear by the soil. So the soil bearing capacity is high to resist the structure for long time. For increasing the bearing capacity of soil, soil stabilization is necessary. Soil stabilization alters the property of soil and in erasing the shear strength of soil & control the swelling shrinkage of a soil. .

Table 3 Sieve Size Analysis of Soil (Samples)

Sieve size (mm)	Cumulative % Wt. Passing			Average
	Sample1	Sample 2	Sample 3	
4.75	100.00	100.00	100.00	100.00
2	48.50	47.50	45.50	47.16
0.425	19.00	19.00	18.50	18.83
0.075	1.50	2.50	2.00	2.0
PAN	0.00	0.00	0.00	00



Graph 3 Sieve Size Analyses of Soil (Samples)



Graph 4 Sieve Size Analyses Average Value of Soil

Table 4 Important Properties of Soil (Sample)

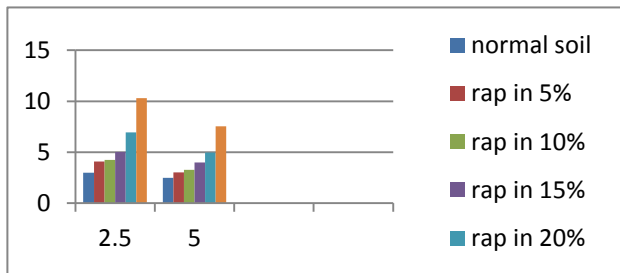
Physical properties	Value (%)
Natural water content	26%
Liquid limit	33.66%
Plastic limit	21.68%
Plasticity index	11.98%
Linear shrinkage	6.71%
Specific gravity	2.66
Free swell index	40%

**3.3 CBR Test of Soil:-**

In this test a soil sample is taken over the vessel & the load is applied over the soil load values & corresponding penetration value is measured for 2.5mm penetration 1370 kg load is applied & for 5.0 penetration 2055 kg load is applied through plunger. California bearing ratio test is performed for sub-grade, sub-base, base course layer material in flexible pavement

Table 5 CBR result in soil and Reclaimed Asphalt Pavement (RAP) Materiel

Penetration	normal soil	RAP material in 5 %	RAP material in 10 %	RAP material in 15 %	RAP material in 20 %	RAP material in 25 %
2.5	3.0	4.08	4.23	5.03	6.93	10.29
5	2.5	3.01	3.26	3.99	4.96	7.54



Graph 5 CBR Result of Soil



Fig 1:- CBR Result of Soil

#### 4. CONCLUSION

It is lowest most layer of the flexible pavement. Sub grade layer manly prepared with yellow color type soil. All the loads coming from the sub grade course, base course & sub-base is transferred through the sub grade. So, the design of flexible pavement in such a way so the load reaches in the sub grade layer is not exceeding the bearing capacity of soil of sub grade layer. The thickness of sub grade is depending on the strength of the soil and it will also affect cost of construction of pavement. The bearing capacity of a soil (CBR value) present in sub-grade is found low as per the requirement. So, we have to increase the bearing capacity of soil by stabilization process. For stabilization of soil, in some percentage reclaimed asphalt

pavement material is replaced with soil. According to IRC code 37:2012, the CBR value of soil in sub-grade is minimum 8% for having traffic of 450 commercial vehicle / day or higher for Expressway, National highway, State highway and district road. The outcome of study 25% of reclaimed asphalt pavement material in place with soil, the CBR value is increase up to 10.29%, which is higher than recommended by IRC 37:2012.

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