Study on Crushed PQC Material use as GSB Layer & Comparison of Recycled GSB vs Normal GSB

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Abstract - **Granular Sub-Base is a segment of pavement construction work were naturally occurring resources are utilised for preparation of GSB layer, principally for the seepage of water and brawniness of pavement (Rigid & Flexible).**

The laboratory Experiments were conducted obeying limits and specifications as per MORTH and the denouements extracted were Crushed PQC (Pavement Quality Concrete) or Recycled GSB can be substituted as Normal GSB Material.

Index Terms - **Granular Sub-base, Recycle GSB, Size Gradation, MDD & OMC, CBR, FDD Etc.**

1.INTRODUCTION

Granular Sub-Base is a segment of pavement construction work were naturally occurring resources are utilised for preparation of GSB layer, principally for the seepage of water and brawniness of pavement (Rigid & Flexible).

Extraction of GSB is generally obtained by blending of granular materials (crushed stones, moorum, natural sand, gravel), obeying the limits and specifications as per MORTH (Ministry of Road and Highway) which consist of size and Gradation of material, water content, strength and brawniness characteristics.

Fulfilling the requirement and locally availability of the material satisfying the necessity is still consider as challenge in the growing demand, as an alternative to GSB material one of the best methods that can be think about is recycling of old PQC (Pavement Quality Concrete) material, which will ultimately cause reduction of material cost, lesser extraction of natural resources, environment friendly and easy local availability of material.

Figure 1 Granular sub-Base Material (GSB)

Figure 2 PQC Material Before crush


Figure 3 PQC Material After Crush

1. Laboratory Experiments on GSB and PQC Crush as Per MORTH (Revision v)

- Sieve Analysis
- Maximum Dry Density & Optimum Moisture Content
- California Bearing Ratio
- Field Dry Density

1.1 *Sieve Analysis*

Sieve Analysis is a procedure followed according to Indian standard code (IS-code) Is: 2386 (part-1)-1963, which specifies certain gradation for analysis of sieving aggregates, in sieve analysis granular Materials of various size distribution are allowed to pass under different size sieves progressively and recording the weight of material retained on the smaller sieve as a part of whole mass.

Experiment was conducted on GSB and Recycled GSB (Crushed PQC materials) according to Gradation V and results were plotted on a chart of the collected material
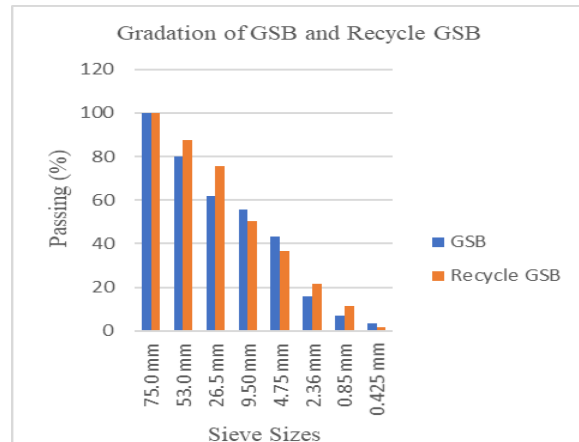
### 1.2 *Maximum Dry Density (MDD) & Optimum Moisture Content (OMC)*

During the construction of pavement sub-base layer Quantity of moisture is maintained which is known as OMC within a required compaction is termed as MDD which is carried-out according to IS 2720 (part 8)-1983, experiment to be followed to obtain MDD & OMC is Modified Proctor Test, in this test we plot a compaction curve between dry density and moisture content from the collected materials

Moisture content

$(OMC) = 100 \times \dfrac{weight\ of\ wet\ sample - weight\ of\ dry\ sanple}{weight\ of\ dry\ sample}$

$MDD = 100 \times \dfrac{wet\ denstity\ of\ material}{100 + moisture\ content}$

| Moisture Content (%)		Dry Density (t/m^3)	
GSB	Recycle	GSB	Recycle
3.4	3.2	2.052	2.055
4.6	4.55	2.072	2.080
5.7	5.8	1.877	1.880
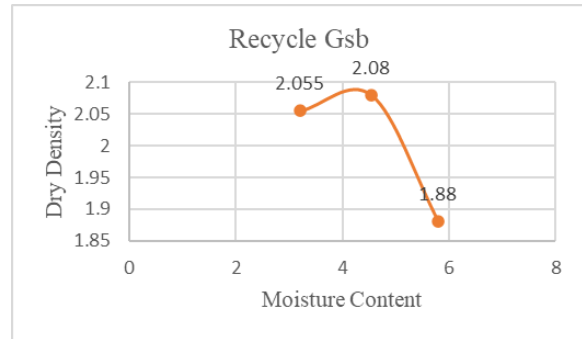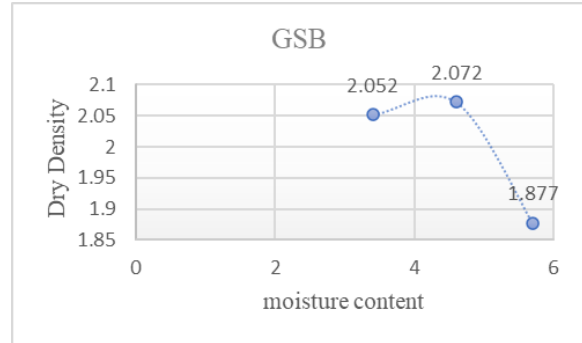
1.3 *California Bearing Ratio (CBR)*

IS code 2720(part 16)-1987 suggest methods of testing of Aggregates: Determination of CBR, CBR is a laboratory experiment in which strength of Pavement layers are determined with the use of empirical curve, that also suggest the thickness of pavement and of its corresponding layers, CBR value is expressed in percentage (%). In this method force is applied per unit area and mass of the aggregate are allowed to penetrate at a speed of 1.25mm/min and penetration is recorded at depth of 2.5mm and 5mm, if force at 5mm is continuously greater than 2.5mm then 5mm penetrated data is been used.

This table gives the standard load used for different penetration for the standard material with a CBR value of 100%.

Penetration of plunger standard load

mm	Kg
2.5	1370
5	2055

Recycle GSB

GSB
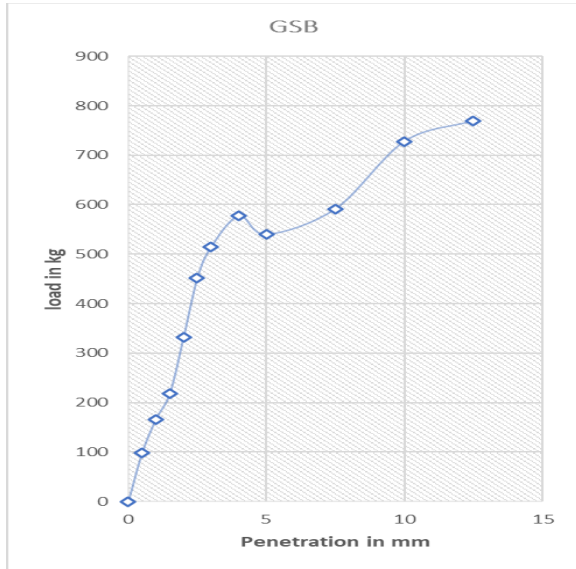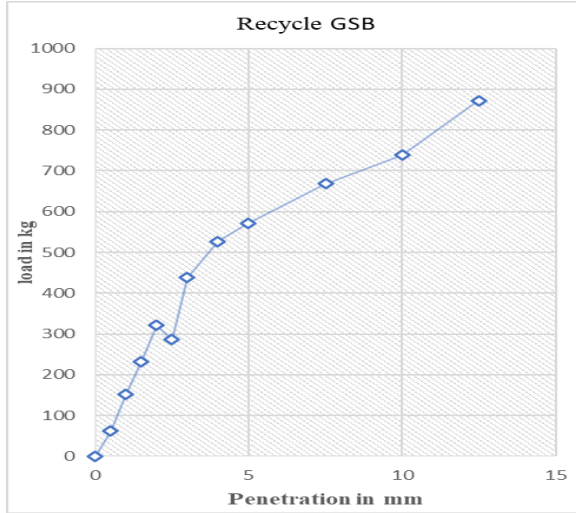
$$CBR = \frac{Corrected\ load}{standard\ load} \times 100$$

1.4 Field Dry Density

Field Dry Density is generally carried out at sight or on field as per IS 2720 (Part -28) to determine whether the specified compaction is achieved or not, usually sand replacement method is used for determining FDD. Obtained Results form the experiment are shown below,

FDD GSB   :   98%

Recycled GSB (PQC crush):   99.15%

2. FINDINGS AND CONCLUSION

- Best findings that were obtained from the experiments were Recycling of the old material.
- Lesser use of Natural Resources which leads in prevention and Extension of natural substance for future studies.
- Crushed PQC material shows the exact Grading of material sizes as of GSB as per IS- 2386.
- From the experiment we obtained Crushed PQC material can be used as an alternative to GSB with similar Dry density and moisture containing properties.
- Obtained CBR value of Crushed PQC material was Greater than 30 which satisfies the strength charactersties to be suitable for GSB layer in Pavement works (Flexible/ Rigid).
- With the help of Sand replacement method, Recycled PQC Crushed material can be compacted to 99.15 % achieving strength and water seepage properties. For Drainage layer in Pavement construction.
- Hence, from all prospective of finding and experiment we have obtained a result that, Recycled Crush PQC material can be used as GSB material. Satisfying MORTH and IRC specifications and Regulations.

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