Feasibility Study to Evaluate Brick Aggregates and Foam Bitumen treated RAP for Pavement Design and Construction of NH-44 in Tripura - A State without Aggregates

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Introduction

- Project for the improvement and widening to two lane with paved shoulder for 73km was awarded to a Contracting firm by NHIDCL.
- Due to paucity of good quality aggregates, it was proposed to use over burnt brick aggregates in cement treated sub-base and use of foam bitumen/bitumen emulsion treated RAP/aggregate as base layer.
- CRRI was appointed by NHIDCL to check the properties of the various materials proposed to be used for mix designs and crust composition etc as per relevant codes and clauses of IRC and MoRTH specifications of Road and Bridge Works
- This presentation confines to the necessary laboratory and field investigations carried out to assess the condition of trial section made of brick aggregates for sub-base layer.

Laboratory Investigations at Site and CRRI

Tests Carried out at Site Laboratory (In presence of CRRI , Authority Engineers and EPC Contractor representative)

- Dry and Wet Aggregate Impact Test
- Gradation of brick aggregates collected at plant
- Gradation of brick, sand and cement mix obtained from plant
- Gradation of mix obtained from the trial section
- Soundness of brick aggregates
- Unconfined Compressive strength of mix of cement treated brick aggregates
- Durability tests at different curing and soaking period

Aggregate Impact Value Test (Wet AIV)

Description	Test Number			
	I	II	III	IV
Wt. of Cylinder (W1)	1355.00	1355.00	1355.00	1355.00
Wt. of Cylinder (W1) + Aggregates (W2)	1594.25	1596.10	1598.25	1592.39
Wt. of Samples (W2 - W1)	239.25	241.10	243.25	237.39
Wt. of Crushed Material passing 2.36 mm sieve (W3)	80.50	84.22	80.46	79.35
$AIV = \frac{100 \times W3}{(W2-W1)}$	33.69	34.93	33.07	33.42
Average AIV (Wet) = 135.06/4 = 33.76 ~ 34% < 40% (Permissible value)				

Test Results of Cement Treated Sub-base Material

Cube No.	Strength (MPa)
1	4.89
2	4.27
3	4.17
Average = 4.45 MPa	

Soundness Test

Soundness tests(Using Na_2SO_4)

- Average loss in weight after 5 cycles = 3%

- Maximum Permissible Limit = 12%

Durability Test on Cement Stabilised Brick Aggregates and Sand Mix

Moist Cured for 14 Days

Sample No.	Size of the Cube (cmxcmxcm)	Density (gm/cc)	Weight of the cube (gms)	Compressive Strength (MPa)
1	15 x 15 x 15	1.96	6615	8.2
2	15 x 15 x 15	1.98	6687	8.9
3	15 x 15 x 15	2.023	6828	9.5
Average				**8.86**

Moist Cured for 7 Days and Immersed in Water for 7 Days

Sample No.	Size of the Cube (cmxcmxcm)	Density (gm/cc)	Weight of the cube (gms)	Compressive Strength (MPa)
1	15 x 15 x 15	1.95	6610	6.95
2	15 x 15 x 15	1.98	6683	7.14
3	15 x 15 x 15	2.021	6820	7.83
Average				**7.30**

% Value= 7.30/8.86= 82.39 %> 80%

General Condition of Cement Treated Sub-base (CTSB)

Mosaic showing homogenous mix of ingredients

Drained Pit of CTSB at Chainage 75+510

Condition of Test Pit showing drainage through CTSB layer.

Field Inspection of Brick Aggregate Plant

Collection of Brick Aggregates and Sand Mixed Samples for Testing

Conclusions and Recommendations:

Based on the field investigations as well as laboratory investigations carried out at site as well as at CRRI laboratory, it was concluded

- The brick aggregates produced at site from Jhama bricks meet the requirements as stipulated in IRC codes and is suitable for use in sub-base layer.
- The composition of brick as proposed i.e., 56.5 %aggregate; 40% sand and 3.5 % cement meets the minimum specified requirements as per IRC;37-2012.
- The condition of the test section of Cement Treated Sub-base (CTSB) laid with above specifications was found to be satisfactory.
- It is therefore recommended the use of brick aggregates with suitable design thickness may be used in the construction of the pavement for the project highway.

Thank you