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Utilization of Pre-Stressed Sleeper Waste as Road Material

Nitish Kumar K[1],
[1]*Department of Civil Engineering, New Horizon College of Engineering*

Abstract: ***After the service life of Pre-stressed concrete sleepers it is discarded as wastes. There is no use of this sleeper further in railway. So the waste generated by sleepers will affect the environment and occupying the valuable land fill. So to overcome from this problem we are collecting the aggregate sleepers waste (ASW) and using it as aggregate in the road construction to preserve the fresh aggregate for next generation. In our project we are collecting the sleeper waste from the Indian railway department. Natural aggregate are not available predominantly in the nature. To overcome this problem we can use sleeper waste as the alternative material for Road and construction work. It will help waste disposal problem and as well as supply the material to construction. In present study we carry out the work on use of sleeper waste as alternative aggregate material in different layers of road. The material is collected in nearby railway station. The crushed sleeper consists of combination of aggregate combined with cement and stirrups. The material is sieved properly and required gradation is selected. The laboratory test like sieve , Aggregate impact value test, Flaky & Elongation test, Impact value test, Los Angeles Abrasion test, Water absorption test are carried out to find the behaviour of crushed aggregate suitability for road material. Also the different percent of material are combined with normal aggregate and testes are carried out to see the behaviour of road material and also getting optimum combination of good aggregate / sleeper waste. The test is carried out for full and partial replacement of aggregate in the percentage of 0,25,50,75 and 100 to natural aggregate. By partial and full replacement of aggregate with sleeper waste the test result obtained shows the initial increment in Aggregate impact value, Los Angeles Abrasion value and Specific gravity value up to 50% replacement of ASW. The shape test value is increasing up to 75%.***

Keywords: ***Aggregate sleepers waste (ASW), Aggregate Impact Test (AIT), Los Angeles Abrasion Test (LAS), Aggregate crushing test (ACT), Shape test, Marshal Stability test.***

I. INTRODUCTION

Naturally available materials becoming less and cost of materials also high. In road construction there is a huge scarcity of aggregate. On the same side the excess amount of solid waste as became the a serious environmental problem in present days there for in order to protect the environment and to save the economy manage of solid waste material through their recycling and reusing has attracted the attention of researchers and engineers. In Indian railway industry there is a large numbers of productions of pre-stressed concrete sleeper to lay the railway.

After life span of sleepers it will be replaced by new sleepers. The old sleepers will be declared as waste and it will be destroyed. So the waste generated by sleepers will affect the environment problem and occupying the valuable land fill. So to overcome from this problem we are collecting the sleepers waste and using it as aggregate in the road construction, so to preserve the fresh aggregate for next generation.

In our project we are collecting the destroyed sleeper from the Indian railway department and conducting the several test by full and partial replacement of aggregate by the percentage of 0,25,50,75,100. The test are carried out for full and partial replacement of aggregate in the percentage of 0,25,50,75 and 100 to natural aggregate.

From the test it was observed that test result satisfy the standard requirement as per MORTH & IS: 73-2013 by partial and full replacement of ASW. By partial and full replacement of aggregate with sleeper waste the test result obtained shows the initial increment in Aggregate impact value, Los Angeles Abrasion value and Specific gravity value up to 50% replacement of ASW. The shape test value is increasing up to 75%.

II. MATERIALS USED

A. An Bitumen (VG – 30)
B. Aggregates
C. Pre-stressed concrete sleeper waste (coarse aggregates) collected from chikkabanavara railway station area.

III. METHODOLOGY AND TEST

We carried out the test on natural aggregate, ASW and aggregate replaced with 0,25,50,75,100% of ASW. Test material are collected and cleaned properly. ASW collected are sieved properly and oven dried are used for test.

Aggregate basic test property determined as follows.

A. Aggregate crushing test
B. Abrasion test
C. Aggregate impact test
D. Shape test
E. Specific Gravity test

IV. RESULT AND DISCUSSION

TABLE I
TEST RESULTS OF AGGREGATE

Property Tested	Test Methods	Results	MORTH Specification
Aggregate Impact Value	IS:2386 (Part-4)	18.68%	24% max
Los Angeles Abrasion Value	IS:2386 (Part4)	23.58%	30% max
Flakiness	IS:2386 (Part1)	18.60%	30% max
Elongation	IS:2386 (Part1)	16.06%	30% max
Specific Gravity	IS:2386(Part3)	2.50%	2.5-3% max
Crushing test	IS:2386 (Part4)	10.40%	45%

From the above table it was observed that the basic property of aggregate used satisfies the MORTH specification.

TABLE IIII
TEST RESULTS OF AGGREGATE REPLACED WITH DIFFERENT PERCENT OF SLEEPER WASTE

TEST ON AGGREGATE	TEST METHOD	0% of ASW	25% of ASW	50% of ASW	75% of ASW	100% of ASW
AGGREGATE IMPACT TEST	IS:2386 (Part-4)	18.68	20	21.9	22.2	25.71
SHAPE TEST FLAKENESS TEST	IS:2386 (Part-1)	18.6	20	21	24	18
ELONGATION TEST	IS:2386 (Part-1)	16.06	16	19	21	24
ABRASION TEST	IS:2386 (Part-4)	20.8	21	22.6	24.1	29.4
SP.GRAVITY TEST	IS:2386 (Part 3)	2.77	2.88	2.92	2.89	2.73
CRUSHING TEST	IS:2386 (Part-4)	20.8	22	33.5	31.2	24.4

A. Figures

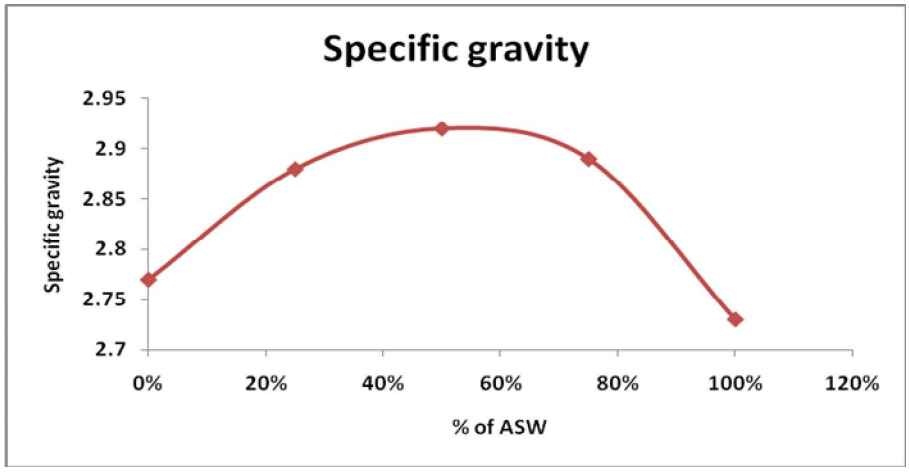

Fig. 1 Specific gravity V/S % of ASW

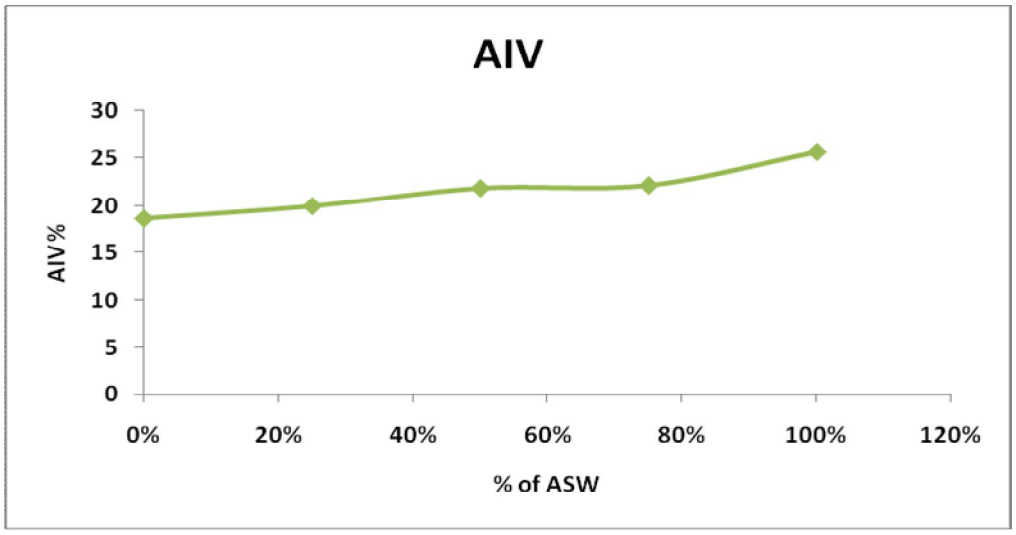

Fig. 2 Aggregate impact value V/S % of ASW

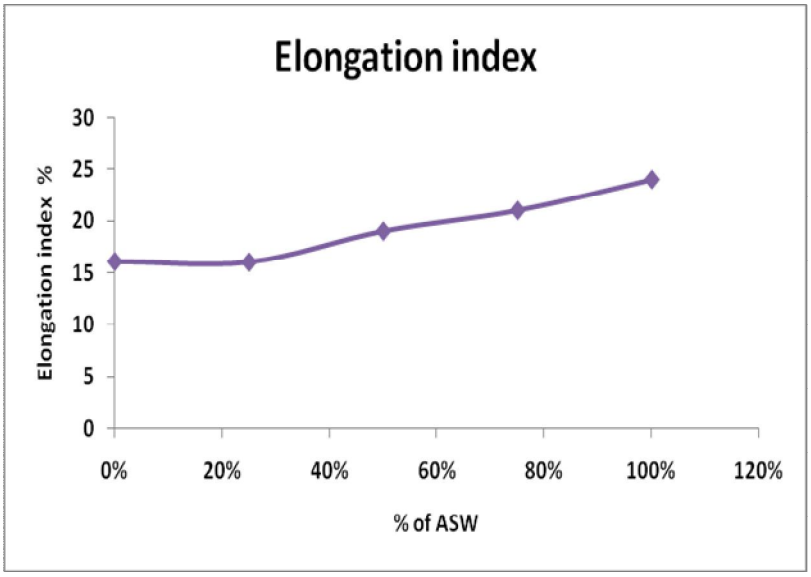

Fig. 3 Aggregate Elongation index value V/S % of ASW

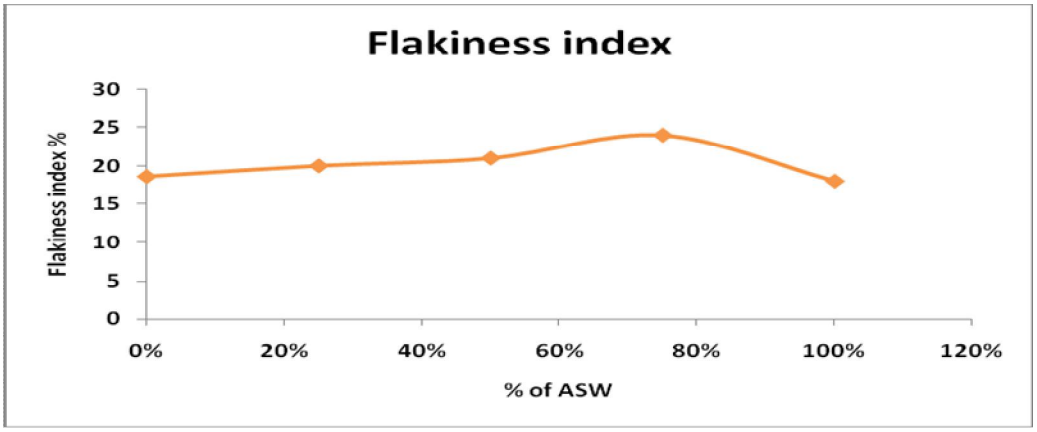

Fig. 4 Aggregate Flakiness index value V/S % of ASW

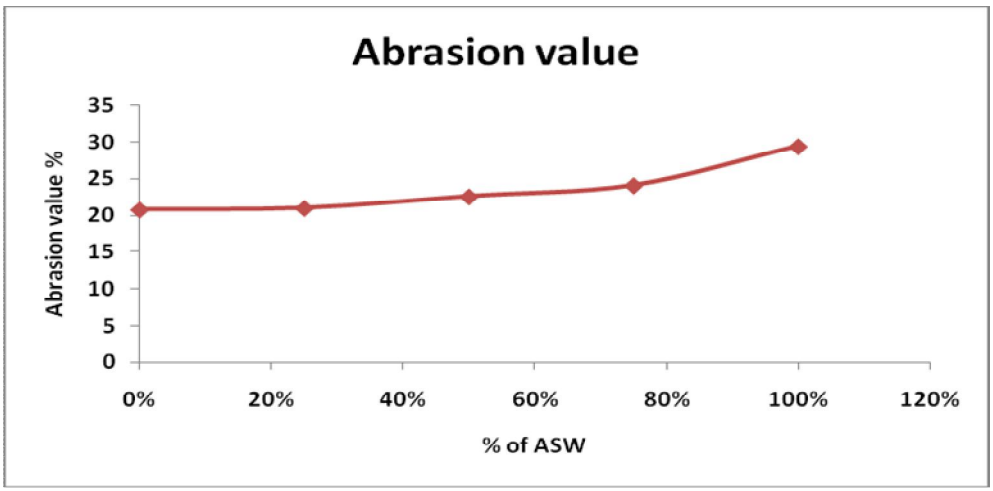

Fig. 5 Aggregate Abrasion value V/S % of ASW

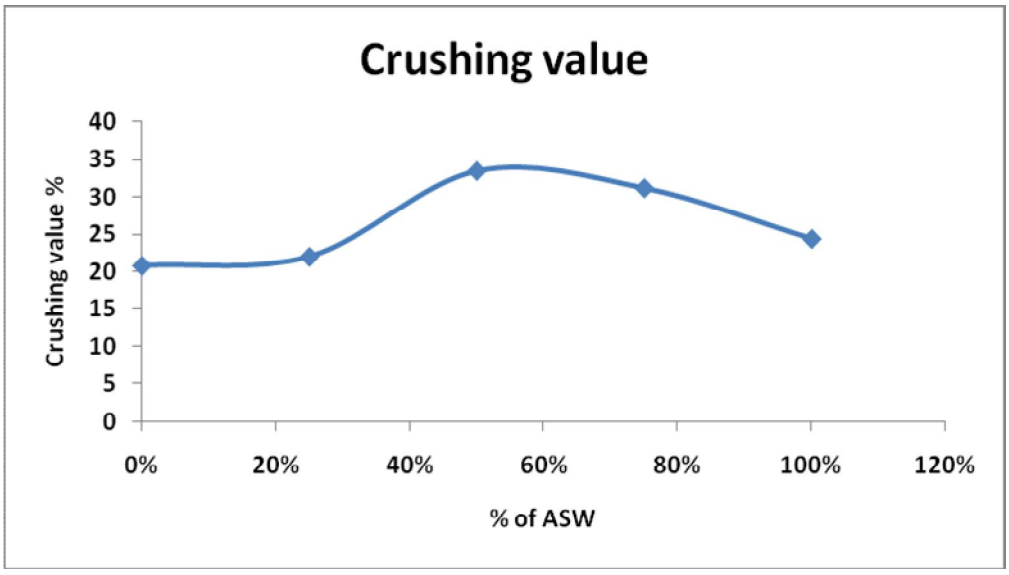

Fig. 6 Aggregate Crushing value V/S % of ASW

From the above figure it was observed that Specific gravity and Crushing value are increasing up to 60% replacement of ASW. Aggregate impact value, Elongation index, flakiness index and Abrasion value are increasing with replacement of ASW.

V. CONCLUSIONS

The use of Aggregate sleeper waste in construction of roads brings out a better reduction of natural aggregate. This not only minimizes the natural material and also reduce waste disposal problem. Hence following conclusion are drawn based on the analysis of the result. Specific gravity and Crushing value are increasing up to 50% replacement of ASW. Aggregate impact value and Abrasion value are increasing with replacement of ASW. The value of shape test are increasing up to 75% replacement of ASW.

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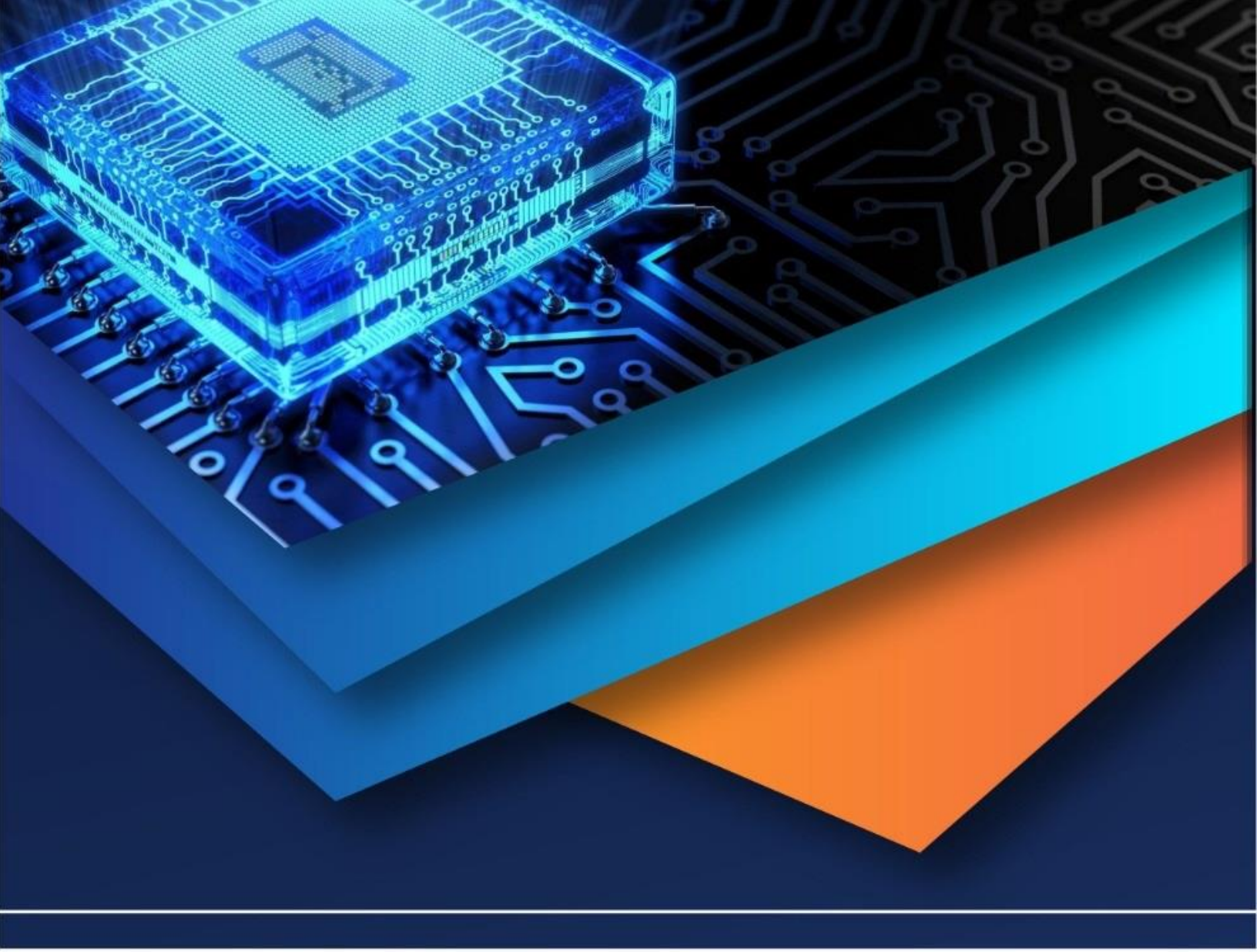

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