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Evaluation of Feasibility and Effect of Adding Kota Stone Waste in Bituminous Macadam

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Abstract—*Recent decades were the scene of colossal development in development industry, this has both positive and negative effect on the general public or we can state on condition. This development an action prompts much sort of squanders in our general public. This examination fundamentally focuses on the utilization such modern development squander in the street asphalt development and streamlines their utilization for player substitution of characteristic totals. In the present study, using Kota stone waste aggregate 20%,40%,60%,80%,100% replacement of natural aggregate in bituminous macadam pavement. Marshal steadiness, stream esteem and were controlled by substitution of Kota stone totals and contrast and the normal total security and stream esteem. It is observed that by replacing 20%, 40%, 60%, 80%, and 100% natural aggregates with Kota stone waste there in not remarkable reduction in stability values.*

Keywords*:-Bituminous macadam, Marshal Stability, Flow value, Kota stone waste.*

1. INTRODUCTION

Roads are the economic lifeline for a developing country like India in sustainable development is the key to future thus moving toward it we need technology that make construction of pavements economic as well as which can outdo the conventional one in performance along with minimizing the environment impact.[1] However construction of highway involve a huge amount of natural resource with time as construction of road network is increase, so is the requirement of aggregate to fulfill this demand, mixing of natural aggregate is also increase making the availability of good quality of natural aggregate scares. [3]It's time to find an alternative for these resources. Stone cutting industry is a classic example of unscientific mixing and improve waste disposal regardless of aesthetic senses and proper land use particles. Kota stone industry is also one of them. The large amount of Kota stone waste thrown over waste land in Rajasthan. Every year dumping of the waste has much negative impact on the environment. [4] It leads to land and water pollution. The safe disposal of Kota stone waste is a big problem as it occupies huge space and is an environmental hazard. [5] In present days because of colossal increment in rush hour gridlock stack, adequate great quality is fundamental for various layers of asphalt. Contingent on the nature and method of burdens to be upheld and dispersed, asphalts are delegated adaptable, semi-adaptable and inflexible, however the fundamental regular part of every one of these sorts is bituminous layer. [5] This bituminous layer ought to be proficient to withstand the dynamic wheel heap of vehicles and also it ought to be steady against various climatic, natural and geographical conditions too.

2. MATERIALS REQUIRED

1. Kota stone waste

2. Aggregate

3. Bitumen

1. Kota stone waste: - Kota stone is a fine grained variety of lime stone, quarried at Kota district, Rajasthan. In the Kota stone industry, about 20%-30% waste material generated from the total production. Kota stone wastes are generated as a waste during the process of cutting and polishing of Kota stone. Kota stone waste powder is settled by sedimentation and then dumped away which results in environmental pollution [6].

2._Aggregate: - Aggregate from the major portion of the pavement structure. Different size of aggregate is used for different layer of flexible pavement. It bears stresses occurring on the roads and has to resist wear due to abrasive action of traffic. Aggregates are also used in flexible as well as in rigid pavements. Therefore, the properties of aggregates are of considerable significance to highway. [6]

3. Bitumen: - Bitumen is a dark material that can be found in various structures, for example, shake perspective, characteristic bitumen tar and oil. It makes water evidence layers which ensure the basic asphalt. There are many types of bitumen as VG10, VG20, VG30, VG40 (VG indicates viscosity grade of bitumen).In this research we use VG30 bitumen. [6

3. METHODOLOGY

4. RESULTS AND ANALYSIS

TABLE 1: PROPERTIES OF AGGREGATE

S.No.	Tests	Results	Specified limit
1	Penetration test	68	50-70
2	Ductility test	100	min40
3	Softening point	47	40 to 55
4	Specific gravity	0.99	min0.99

TABLE2 PROPERTIES OF BITUMEN

S.No.	Test performed	100%NA+ 0%KSW	0%NA+100 %KSW	20%NA+ 80%KSW	40%NA+60 %KSW
1	Impact test	21.32	17.53	20.68	19.35
2	Loss angles abrasion test	25.63	23.98	26.13	25.54
3	Flakiness & elongation index	21.83	22.4	22.10	22.25
4	Crushing test	9.77	10.11	11.42	10.92
5	Water absorption	1.25	0.35	1.1	0.95
6	Stripping test	1.2	0.85	1.15	1.00

TABLE 3 PROPERTIES OF BM (II) CONVENTIONAL AGGREGATE)

Marshall Parameters	Natural Aggregate		
Bitumen by weight of mix	3.4	3.5	3.6
Sample Height	62	63	63.5
Stability in kilograms	998	1000	993
Flow	2.25	2.35	2.48
Air Voids (%)	6.5	5.4	5.2
Voids in Mineral Aggregate (%)	14.34	13.81	13.57
Voids filled with Bitumen (%)	54.3	58.3	60.2

TABLE 4 PROPERTIES OF BM (II) (20% KSW AGGREGATE)

Marshall Parameters	20% Replacement		
Bitumen by weight of mix	3.4	3.5	3.6
Sample Height	64	64	64
Stability in Kilograms	975	980	985
Flow	2.4	2.45	2.52
Air Voids (%)	6.8	6.7	6.5
Voids in Mineral Aggregate (%)	14.35	14.37	14.38
Voids filled with Bitumen (%)	52.1	52.4	52.5

TABLE 5 PROPERTIES OF BM (II) (40% KSW AGGREGATE)

Marshall Parameters	40% Replacement		
Bitumen by weight of mix	3.4	3.5	3.6
Sample Height	64	64	64
Stability in Kilograms	983	985	987
Flow	255	2.58	2.63
Air Voids (%)	6.9	6.9	6.9
Voids in Mineral Aggregate (%)	14.34	14.36	14.38
Voids filled with Bitumen (%)	52.1	52.3	52.4

TABLE 6 PROPERTIES OF BM (II) (60% KSW AGGREGATE)

Marshall Parameters	60% Replacement		
Bitumen by weight of mix	3.4	3.5	3.6
Sample Height	64	64	64
Stability in Kilograms	972	978	986
Flow	2.60	2.64	2.62
Air Void (%)	6.8	6.7	6.6
Voids in Mineral Aggregate (%)	14.38	14.40	14.41
Voids filled with Bitumen (%)	52.1	52.3	52.4

TABLE 7 PROPERTIES OF BM (II) (80% KSW AGGREGATE)

MARSHALL PARAMETERS	80% REPLACEMENT		
BITUMEN BY WEIGHT OF MIX	3.4	3.5	3.6
SAMPLE HEIGHT	64	64	64
STABILITY IN KILOGRAMS	975	987	990
FLOW	2.80	2.75	2.65
AIR VOIDS (%)	6.9	6.7	6.4
VOIDS IN MINERAL AGGREGATE (%)	14.38	14.41	14.43
VOIDS FILLED WITH BITUMEN (%)	52.1	52.2	52.3

TABLE 8 PROPERTIES OF BM (II) (100% KSW AGGREGATE)

Marshall Parameters	100% Replacement		
Bitumen by weight of mix	3.4	3.5	3.6
Sample Height	64	64	64
Stability in Kilograms	965	975	985
Flow	2.62	2.65	2.68
Air Voids (%)	6.6	6.4	6.2

Voids in Mineral Aggregate (%)	14.42	14.44	14.45
Voids filled with Bitumen (%)	51.6	51.8	52.2

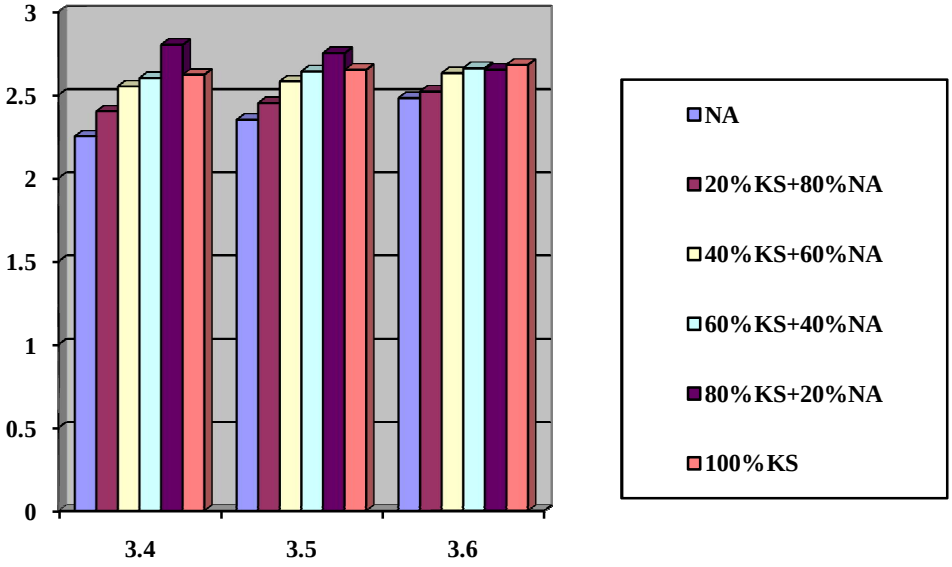

Fig. 2: Flow Value vs. Bitumen Content

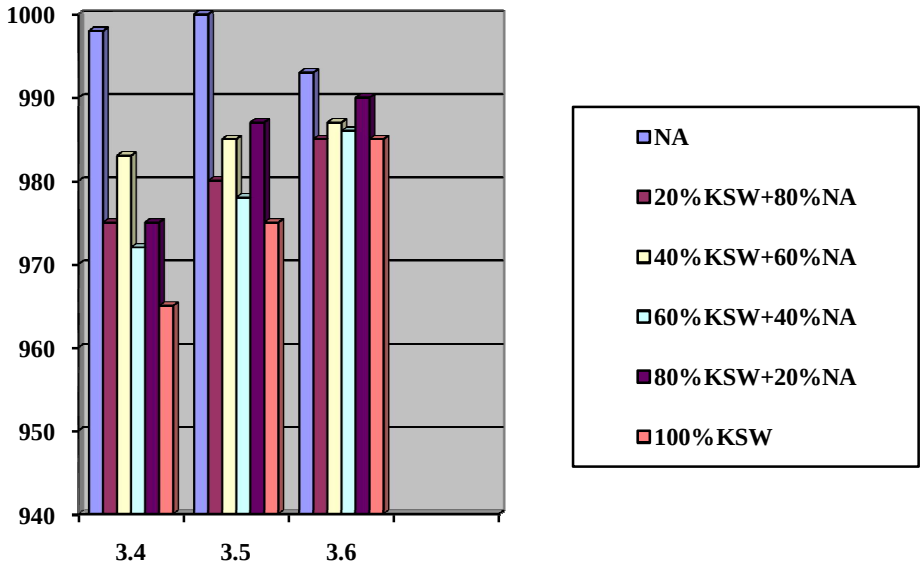

Fig. 3: Stability vs. Bitumen Content

5. CONCLUSION

From the above perception following conclusions consequently:

Kota stone waste utilized as a part of bituminous macadam up as far as possible give impressive estimation of marshal strength and lower marshal stream esteem.

By expanding the estimation of Kota stone waste in substitution of common total reduction in Marshall Value and increment in stream esteem.

Ideal bitumen content changes with the expansion with the Kota stone waste substance.

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