International Journal of Innovative Research in Computer Science and Technology (IJIRCST)
ISSN (online): 2347-5552, Volume-11, Issue-3, May 2023
https://doi.org/10.55524/ijircst.2023.11.3.14
Article ID IJIRD-1252, Pages 76-79
www.ijircst.org

Analysis of Bituminous Concrete Mixes Using H.D.P.E & Crumb Rubber as Admixtures

Dr. A. Ranganathan[1], M kranthikumar[2], D. Sudheerbabu[3], N. Badulla[4], T. Tejaswini[5], D. Nagarjuna[6], Y.V. Durgaprasad[7]

[1]Professor, Department of Civil Department, PACE Institute of Technology & Sciences, Ongole, Andhra Pradesh, India
[2]AssistantProfessor, Department of Civil Department, PACE Institute of Technology & Sciences, Ongole, Andhra Pradesh, India
[3,4,5,6,7]B. Tech Student, Department of Civil Department, PACE Institute of Technology & Sciences, Ongole, Andhra Pradesh, India

Correspondence should be addressed to M kranthikumar; kranthikumar_m@pace.ac.in

ABSTRACT- Flexible pavements need more attention in selection of Resources and preparation of mixes now a day's temperature is the main criteria which affect the mix quality, strength and durability. Rapid changes in temperature now a day's big problem to face worst situations, Durability point is a big factor which affects the life period of the pavement surface and its components, Nominal mixes which consists of inert material doesn't gives better Durability in severe traffic and climate conditions Today's flexible pavements are Required to perform better as they are facing increased volume of traffic, increased loads and increased variations in daily or seasonal temperature over what has been Challenged in the past. In addition, the performance of bituminous roads is to be identified that they are poor in high drainage situations. Present scenario on using various additives for better drainage is not satisfying the expected results. However, the additive that is to be used for modification of mix or binder should satisfy both the strength, durability requirements as well as economical aspects. Plastics are using extensively in all over world and developing country like India. As these are non-biodegradable there is a major problem posed to the society with regard to the management of these solid wastes. Even, the reclaimed polyethylene originally made of HDPE has been observed to modify bitumen. In the present study, an attempt has been made to use HDPE and CRUMB RUBBER as admixtures in nominal bitumen mix to overcome the problem of resistance to weathering actions and repetitive wheel load

KEYWORDS- High Density Polyethylene, Crumb Rubber.

I. INTRODUCTION

Highway construction now a day's being a tough job for selection of construction resources in industry, resources involves Material, Manpower, Machinery and Time, Finance. Construction agents are highly dedicating their worth in investing about finance and time but they can't involve much better in the better selection of qualitative material and their proportions. they don't have proper knowledge in selection of materials in terms of quality. Though materials were selected now the tough job is to selecting the group of materials.

Construction of a pavement is not a mechanical process that involves a high concentration on protecting various aspects that are required for achieving better output.

The quality of a pavement that was constructed will be measured by its Durability; the word durability says that resistance to wear and tear and also against weathering agencies. So that the quality construction requires high level of durability and resistance to wear and tear, Durability of pavement structure depends upon the material used in the construction and its quality and characteristics. Selection of a good suitable material for construction of pavement based on type of pavement and level of classification of that road.

Figure 1: Aggregate composition for mix design
Materials and properties

II. MODIFIED BITUMEN

Proper additives or blend of additives called as bitumen modifiers may improve properties of Binder and bituminous mixes. Bitumen treated with these modifiers is known as modified bitumen. Polymer modified bitumen (PMB)/crumb rubber modified bitumen (CRMB) should be used only in wearing course depending upon the requirements of extreme climatic variations. The detailed specifications for modified bitumen have been issued by IRC: SP: 53-1999.It must be noted that the

performance of PMB and CRMB is dependent on strict control on temperature during construction. The advantages of using modified bitumen areas follow

- Lower susceptibility to daily and seasonal temperature variations Higher resistance to deformation at high pavement temperature Better age resistance properties
- Resistance to Fatigue & Resistance to Repetitive Loads Admixtures

Bitumen admixtures are mostly chemical in nature which temperature sensitive than bitumen. Bitumen will induce health effects to the workers paving the surface be dissolved in petroleum oils where unlike tar with admixture added bitumen. With this perspective, in this study an attempt is made to utilize waste materials such as High Density Polyethylene (HDPE) and Crumb rubber.

High-density polyethylene (HDPE) or polyethylene high-density (PEHD)is

a polyethylene thermoplastic made from petroleum. It is sometimes called "alkathene" or "polythene" when used for pipes. With a high strength-to-density ratio, HDPE is used in the production of plastic bottles, corrosion-resistant piping, geo membranes, and plastic lumber. HDPE is commonly recycled, and has the number "2" as its resin identification.

Crumb Rubber is a product obtained by crushing of waste tyres those can recycled, that tyres can be make into pieces and then to required size. Basically it is to be used after sieving it through 1.7mm sieve forms of all works.

A. Scope and Objective of Project

- The present study aimed at preparation of Gap–graded mix of bitumen and modified with crumb rubber and to find the variation of conventional properties.
- Study the effect of adding polyethylene on the hot mix asphalt.
- To identify the best mechanism of adding the polyethylene (dry or wet process) to the asphalt mixture to achieve better mixture properties.
- To find out the optimum percentage of HDPE and asphalt to be used in the mix.

Figure 2: H.D.P.E Granules (Blow grade, Re-cycled)

III. TESTS ON AGGREGATE

- Impact test the aggregate available in the Laboratory were used for the study. Some quantity was also collected from a crusher site nearby N.B.K.R.I.S.T. Vidyanagar, Kota Mandal, and S.P.S.R Nellore District. They were sieved according to the irrespective sizes. The tests carried out to determine the properties of aggregate are specific gravity, water absorption, Los Angeles Abrasion test and Impact test accordingtoIS:2386(part iv).

Figure 3: Impact test Apparatus

Observation and calculation for Impact test of normal aggregate

Average Impact value of the given aggregate samples=24.09%

Observation and calculation for Impact test of 6% HDPE coated aggregate

Average Impact value of the given aggregate samples=12.4%

Observation and calculation for Impact test of 8%HDPE coated aggregate

Average Impact value of the given aggregate samples=10.98%

Observation and calculation for Impact test of 10%HDPE coated aggregate

Average Impact value of the given aggregate samples=9.87%

Observations for crushing test of Normal aggregate

Aggregate crushing value =26.29

Observations for crushing test of 6%HDPE coated aggregate

Aggregate crushing value =18.68%

Observations for crushing test of 8%HDPE coated aggregate

Aggregate crushing value =16.48%

Observations for crushing test of 10%HDPE coated aggregate

Aggregate crushing value =14.54%

Observations for abrasion value of Normal aggregate

Abrasion value =30%

Observations for abrasion value of 6%HDPE coated aggregate

Abrasion value =14.2%

Observations for abrasion value of 8%HDPE coated aggregate

Abrasion value =12%

Figure 4: Aggregate after abrasion test

IV. PROPERTIES OF BITUMINOUS MIX

After completion of finding stability and flow values, test a density and voids analysis was made for each series of test specimen

- Bulk specific gravity values corresponding to given bitumen content were determined.
- The unit weight for bitumen content was determined by multiplying the bulk specific gravity Value by1.02gm/cm
- The percentage of air voids was calculated for Vv = (Gt–Gm)/Gm*100

Gm = Bulk Density
Gt= Theoretical specific gravity of mixture
Gt =100/(W1/G1+W2/G2+W3/G3+W4/G4)
Where,
W1 = Percentage by weight of coarse aggregates in total mix
W2 = Percentage by weight of fine aggregates in total mix
W3 = Percentage by weight of filler in total mix
W4 = Percentage by weight of bitumen in total mix
G1 = Apparent specific gravity of coarse aggregate
G2 = Apparent specific gravity of fine aggregate
G3 = Apparent specific gravity of filler
G4=Apparent specific gravity of bitumen

- The percent voids in mineral aggregate(VMA) corresponding to given %of bitumen and various fillers was determined using formula given below

VMA = Vv + Vb

Where
Vv = Volume of air voids
Vb = Volume of bitumen

Gm = (W4/G4)

Gm=Bulk Density

- Percentage of voids filled with bitumen (VFB) VFB =100× (Vb/VMA)

V. GRAPHS FOR TEST RESULTS FOR CONTROL MIX

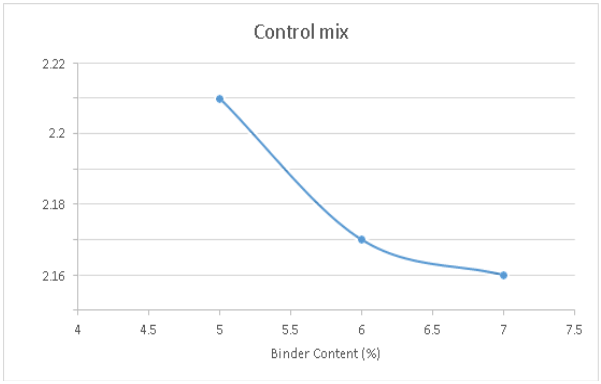

Figure 5: Relation between binder Percentage Vs Bulk Density

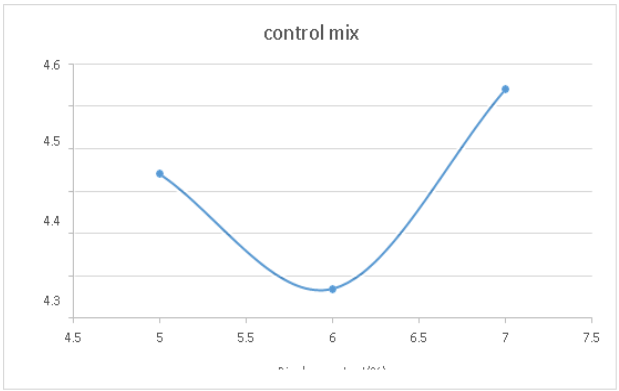

Figure 6: Relation between binder Percentage Vs Air Voids

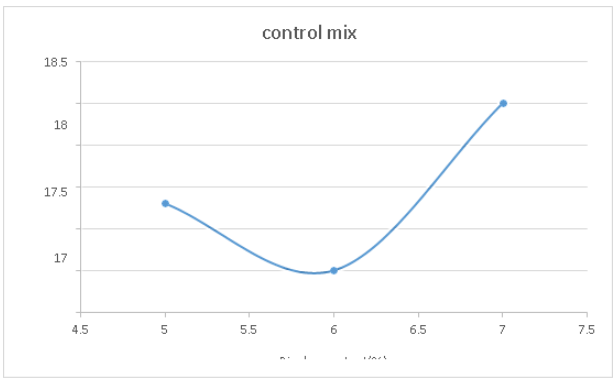

Figure 7: Relation between binder Percentage Vs Flow Value

A. Marshall Stability

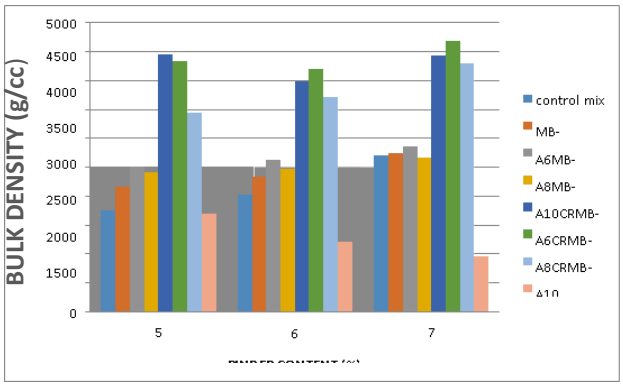

Figure 8: Flow value

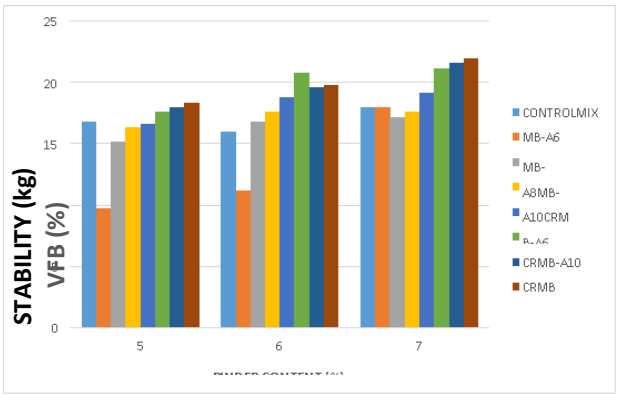

Figure 9: Bulk density (g/cc)

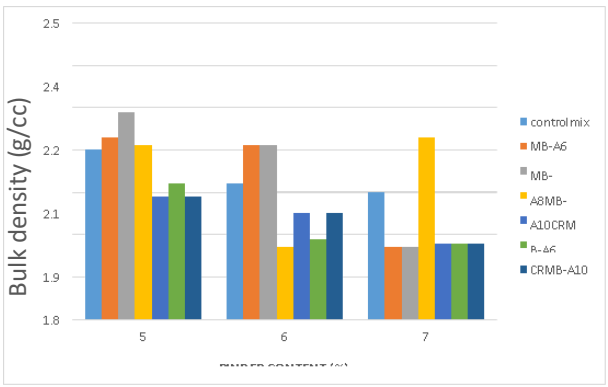

Figure 10: Air voids (%)

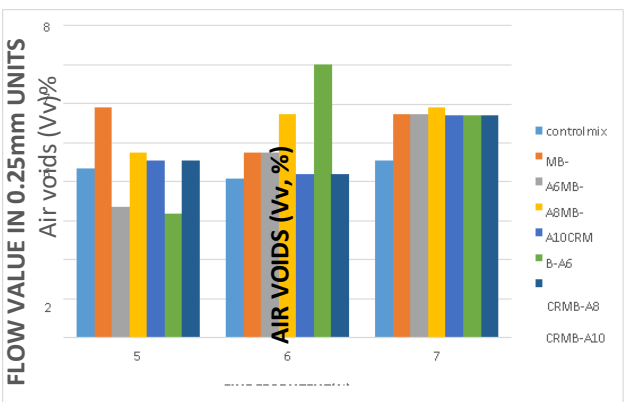

Figure 11: Void filled with bitumen (%)

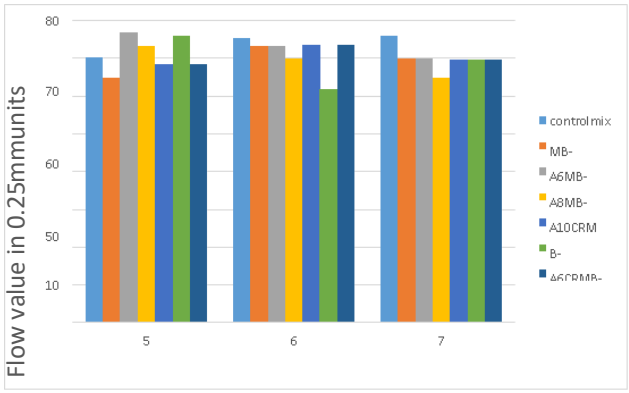

Figure 12: VFB

VI. CONCLUSIONS

- HDPE coating of aggregates increases abrasion, crushing value and impact resistance ofaggregatesthusimprovingstrengthandwearresistanc epropertiesofthetreatedaggregates.
- Modified bitumen with crumb rubber as admixture improves ductility and softening point thus increasing ability of sustaining under high temperatures and plastic deformation.
- Optimum binder content obtained is 7% which is common for both control mix (without admixtures) and modified bituminous mixes (with admixtures).
- Mixture modification using 8% shredded HDPE improves the Marshall Stability of the mixture and thus increasing its rutting resistance and load carrying capability.
- Stability of bituminous mix is increasing on proportional to increasing of HDPE up to10%

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFRENCES

[1] Highway Engineering by S.K. KHANNA & C.E.G. JUSTO.
[2] IRC: 29-1988 Specification for Bituminous mix design for Road Pavement.
[3] Design and construction of Bitumen Pavements by Martin J. ROGERS & Wallace AHUGH.
[4] Effect of Aggregate Gradation Limits of Fatigue Life of Neat &SBS Modified Bituminous Concrete mixes by S. Sawanthi, M.S. Amarnath & Prof A. Veeraragavan.
[5] ASTM D 1559 (1989), "Test Method for Resistance of Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.