PERFORMANCE OF BITUMEN MIXES USING E-WASTE FOR FLEXIBLE PAVEMENTS

Tawqeer Firdous Ganaie[1], Er. Aman Bathla[2], Er. Awais Nazir Malik[3]

M.tech Scholar in GEC Panipat[1], Assistant Professor in GEC Panipat[2, 3]

Abstract: In India, due to new techniques, the electronic equipments are gathering more attention across the globe, due to modern upgraded version is available in the market and the older becomes scrap. Most of electronic waste materials are recyclable, but some are not recyclable. Higher transportation cost for processing of worthless pieces which may be higher than its scrap value. Electronic waste consists of discarded old computers, televisions, radios, refrigerators etc. In short electronics appliance that has reached its end of life. E-waste may involve significant risk as leaking of materials and unsafe exposure during recycling and disposal operations like landfills and burning. The use of these materials as an alternative to conventional material for the construction industry which may not only helps in decreasing the manufacturing cost of a particular item but also helps in saving the environment from pollution and other harmful effects which causes problems, reduce landfill cost and also helps in saving our natural resources.

Keywords: Marshall Stability Test, Flow value Analysis, Partial Replacement, and Electronic waste.

1.1 INTRODUCTION

Around the world, manageability is the squeezing need of great importance in the development business and towards this end utilization of waste material in street development is in effect progressively urged to diminish ecological effect. In the high way framework, countless materials and innovations have been imagined to decide their reasonableness for the plan, development and support of these asphalts. Plastics and rubbers are one of them. Too thinking about the natural methodology, because of intemperate utilization of polythenes in everyday business, the contamination to the condition is tremendous. The utilization of plastic materials, for example, conveys packs, containers, and so on is always expanding step by step. Since the polythenes are not biodegradable, the need of the present hour is to utilize the waste polythene in a few advantageous purposes.

Deficient consideration over the span of activity of waste organization outlets may achieve the infringement of the statutory requirements of the Waste Management Acts. Other than attracting the probability of legal action, powerlessness to comply with the institution may realize deferments to road headways, achieving unconstrained utilization and may invite close-by dispute and the thought of the media.

These components necessitate that squander organization issues be honestly tended to for the span of the life-cycle of a road adventure. This short guide is proposed to support all social occasions - fashioners, neighborhood authorities, transitory specialists, etc - on how the trial of convincing waste organization could be met in a road building setting. A key inspiration driving this file is to empower all social occasions to fathom

the tangled authentic framework which speaks to the organization of wastes delivered by national road improvement adventures. A second call attention to set out incredible practice standards to ensure that convincing waste organization remains a need all through the arrangement and advancement periods of these endeavors. The reason here is to help the minimization of the natural impacts of boulevards related improvement waste, and what's more the volume of the certified waste being delivered and to empower consistence with the courses of action of the Waste Management Acts. Finally, these guidelines similarly have the objective of offering information to support an incredible talk between road authoritative specialists, relevant statutory bodies and outcasts on how squander should be properly managed in a road building setting. Certain reused material and waste results have extensive notable properties over others and extraordinary advantages would be procured when portrayed appropriately and consolidated with some other development materials.

1.2 E-WASTE

E-waste is a well known, easygoing name for electronic things touching base toward the completion of their "accommodating life". As per the Hazardous Wastes (Management and Handling) Rules, 2003, e-waste can be described as "squander Electrical and Electronic Equipment including all sections, sub-assemblies.

Figure 1.1: E-waste

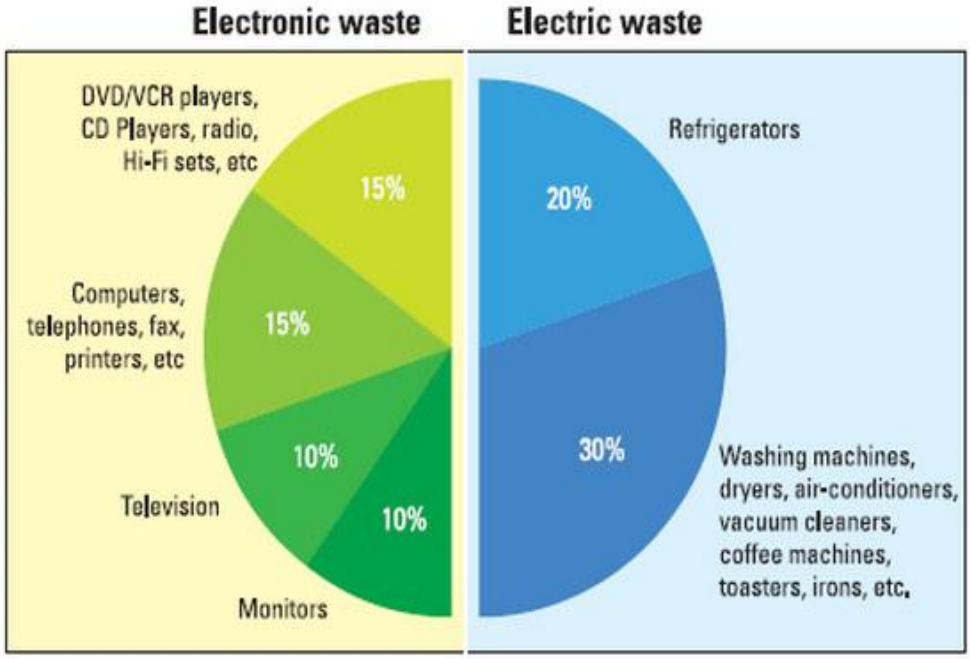

Figure 1.2: Sources of E-waste

1.3 LITERATURE REVIEW ON E-WASTE

AMIT GAWANDE et al contemplated the usage of waste plastic in asphalting of streets. This investigation created strategies to utilize plastic waste for development motivation behind streets and adaptable asphalts have explored. In ordinary street making process bitumen is utilized as cover. Such bitumen can be adjusted with waste plastic pieces and bitumen blend is made, which can be utilized as a top layer of adaptable asphalt. This waste plastic altered bitumen blend show better restricting property, strength, thickness and increasingly impervious to water. This survey expected to locate the powerful approaches to reutilize the hard plastic waste particles as bitumen modifier for adaptable asphalts. The utilization of reused squander plastic in asphalt black-top speaks to a profitable outlet for such materials. The utilization of adjusted bitumen with the expansion of handled waste plastic of around 5-10% by weight of bitumen helps in considerably improving the Marshall steadiness, quality, exhaustion life and other attractive properties of bituminous solid blend, coming about which improves the life span and asphalt execution with negligible sparing in bitumen use. The procedure is condition well disposed. The utilization of waste plastics in the production of streets and covered material additionally help to expend extensive amount of waste plastics. Accordingly, these procedures are socially profoundly pertinent, giving better framework.

Amol S. Parcel audited the potential reuse of plastic waste in street development. An audit of different plastic squanders for use in the development of streets has been examined in this examination. Presently a-days Plastic is wherever in the present way of life. The transfer of plastic squanders is an incredible issue. These are non-biodegradable item because of which these materials present ecological contamination and issues like bosom malignant growth, regenerative issues in people and creatures, genital variations from the norm and even a decrease in human sperm tally and quality. Lately, uses of plastic squanders have been considered in street

development with extraordinary enthusiasm for some creating nations. The utilization of these materials in street making depends on specialized, financial, and environmental criteria. A few million metric tons plastic squanders are created in India consistently. On the off chance that these materials can be appropriately used in expressway street development, the contamination and transfer issues might be mostly decreased. Remembering the requirement for mass utilization of these losses in India, it was thought convenient to test these materials and to create determinations to upgrade the utilization of plastic squanders in street making, in which higher financial returns might be conceivable.

Sangita et al contemplated on the novel way to deal with improve street quality by using plastic waste in street development. The primary focal point of this paper is to audit and examine plastic as bundling material and the plausibility and obstacles of joining postconsumer plastic waste in urban and provincial territories. Officially created innovations on usage of waste plastic for development of streets in four metros (Bangalore, Delhi, Bombay and Calcutta) are the premise of executing these advances in urban and rustic zones. Plastic altered bituminous street surfacing will be first of its sort in Haryana state. Lab test results demonstrate the improvement in building properties like Marshall Stability, held solidness and backhanded elasticity of adjusted bituminous blends when contrasted with unmodified bituminous blends regardless to the three distinct methodologies received as expounded in the on-going content. The discoveries explained in this paper can likewise fill in as the base for the utilization of different squanders from the business in street innovation on which the exploration is now in advancement.

Sundaram and Rojasay considered the Effective mixing strategy for the utilization of plastic waste into bitumen for street laying and Polymer-bitumen blends of various structures were arranged and utilized for doing different tests.

Dr. R.Vasudevan and S. Rajasekaran expressed that the polymer bitumen mix is a superior folio contrasted with plain bitumen. Mix has expanded Softening point and diminished Penetration esteem with a reasonable pliability.

Sabina examined the similar execution of properties of bituminous blends containing plastic/polymer (PP) (8% and 15% by wt of bitumen) with traditional bituminous solid blend (arranged with 60/70 infiltration evaluation bitumen). Improvement in properties like Marshall Stability, held soundness, roundabout elasticity and rutting was seen in Plastic altered bituminous cement blends. The research center examinations directed by CRRI in use of waste plastic sacks in bituminous cement blends have demonstrated that these improve the properties of blend notwithstanding tackling transfer issues. The outcomes showed that there was an improvement in quality properties when contrasted with a regular blend. In this manner, the life of asphalt surfacing utilizing the waste plastic is required to increment considerably in contrast with the utilization of regular bituminous blend.

V.S. Punith some promising outcomes were accounted for in this investigation that there is plausibility to improve the execution of bituminous blends of street asphalts. Squander plastics (polythene convey packs, and so on.) on warming diminish at around 130°C. Thermo gravimetric investigation has appeared there is no gas development in the temperature scope of 130-180°C. Diminished plastics have a coupling property. Consequently, it very well may be utilized as a folio for street development.

Dr. R. Vasudevan states that the polymer bitumen mix is a superior folio contrasted with plain bitumen. Mix has expanded Softening point and diminished Penetration esteem with a reasonable malleability. When it utilized for street development it can withstand higher temperature and burden. The covering of plastics decreases the porosity, ingestion of dampness and improves soundness. The polymer covered total bitumen blend frames better material for adaptable asphalt development as the blend demonstrates higher Marshall Stability esteem and appropriate Marshall Coefficient. Subsequently the utilization of waste plastics for adaptable asphalt is a standout amongst the best techniques for simple transfer of waste plastics. Utilization of plastic sacks in street help from multiple points of view like Easy transfer of waste, better street and counteractive action of contamination, etc.

1.4 PREPARATION OF MARSHALL SAMPLES

Roughly 1200gm of Aggregates mix and the filler are warmed to a temperature of around 170°C-180°C for the readiness of the example. The bitumen is warmed up to streaming condition of around 125°C with the primary preliminary level of bitumen. The warmed totals and the bitumen are mixed in the mixer at a temperature of around 165°C-185°C. The mix is evacuated and set in a pre-warmed form and compacted with the assistance of the rammer weighing 4.5kg with the fall of 45.7cm, giving 50blows on each face of the example at a temperature of around 130°C-150°C. Distinctive grouping of the bitumen and different materials to be utilized are foreordained and the Marshall Test is done on these examples to get advanced estimations of the bitumen and the materials utilized. For SMA Conventional mix to know the ideal folio substance and security, the Marshall Stability test was directed in the research facility. In this investigation, E-waste is added to different level of bitumen i.e 4 %, 5 %, 6 %, 7 % and Marshall Stability test is led by including E-waste at the level of 3%, 6%, 9% and 12 % and Optimum bitumen substance and fiber content are resolved through exploratory examination.

MARSHALL STABILITY TEST

The Marshall Stability and stream test gives the execution expectation measure to the Marshall Mix structure technique. The steadiness part of the test estimates the most extreme burden bolstered by the test example at a stacking rate of 50.8 mm/minute. Burden is connected to the example till disappointment, and the most extreme burden is assigned as soundness. Amid the stacking, a connected dial check estimates the example's plastic stream (distortion) because of the stacking. The stream esteem is recorded in 0.25 mm (0.01 inch) augments in

the meantime when the most extreme burden is recorded. The consequences of the Marshall trial of examples arranged with e-squander as filler for fluctuating bitumen substance have been introduced in tables 4.3.

Table 4.3: Marshall Properties of Specimens with Filler E-waste

E-waste (%)	Bitumen Content (%)	Unit Weight (kg/m^3)	Stability (KN)	Flow Value (mm)	Air Void VA (%)	VMB %
0	4	2.147	16.25	2.65	5.87	59.21
3		2.242	15.24	2.85	5.57	57.85
6		2.641	18.35	3.15	5.21	55.74
9		2.541	17.45	3.25	4.94	49.85
12		2.358	16.45	3.40	4.53	48.24
0	5	2.214	16.80	3.25	4.92	62.47
3		2.358	15.32	3.30	4.87	59.87
6		2.714	19.32	3.40	4.62	57.32
9		2.654	17.74	3.70	4.50	52.96
12		2.451	16.87	3.90	4.27	50.35
0	6	2.512	18.45	4.25	4.32	63.85
3		2.625	18.74	4.50	4.22	61.95
6		2.748	19.87	5.50	4.02	59.96
9		2.715	18.12	7.80	3.97	53.57
12		2.546	17.24	8.54	3.75	54.25
0	7	2.121	17.25	4.87	3.56	69.54
3		2.542	15.95	5.10	3.47	67.24
6		2.421	18.74	5.80	3.25	61.54
9		2.325	16.32	8.20	3.21	57.22
12		2.241	17.01	8.80	3.54	56.28

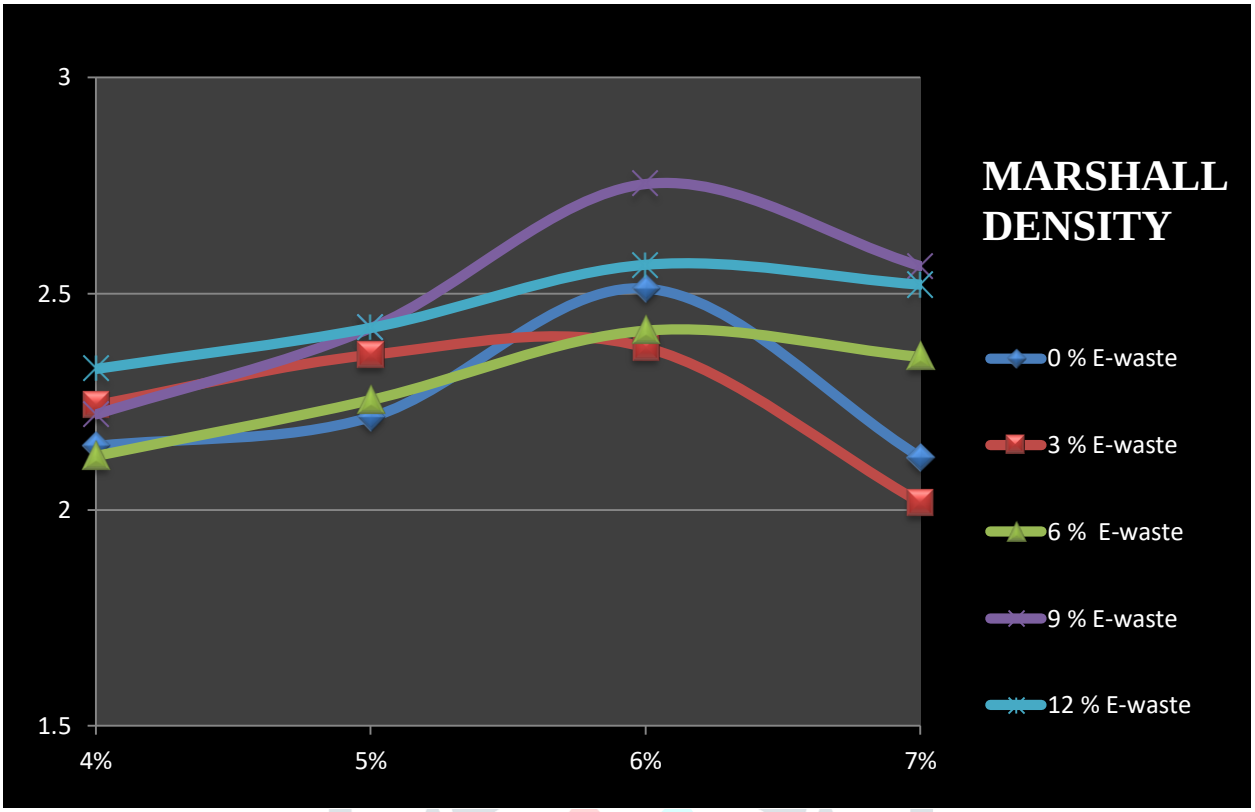

Figure 1.3: Variation of Marshall Density With %age of E-Waste

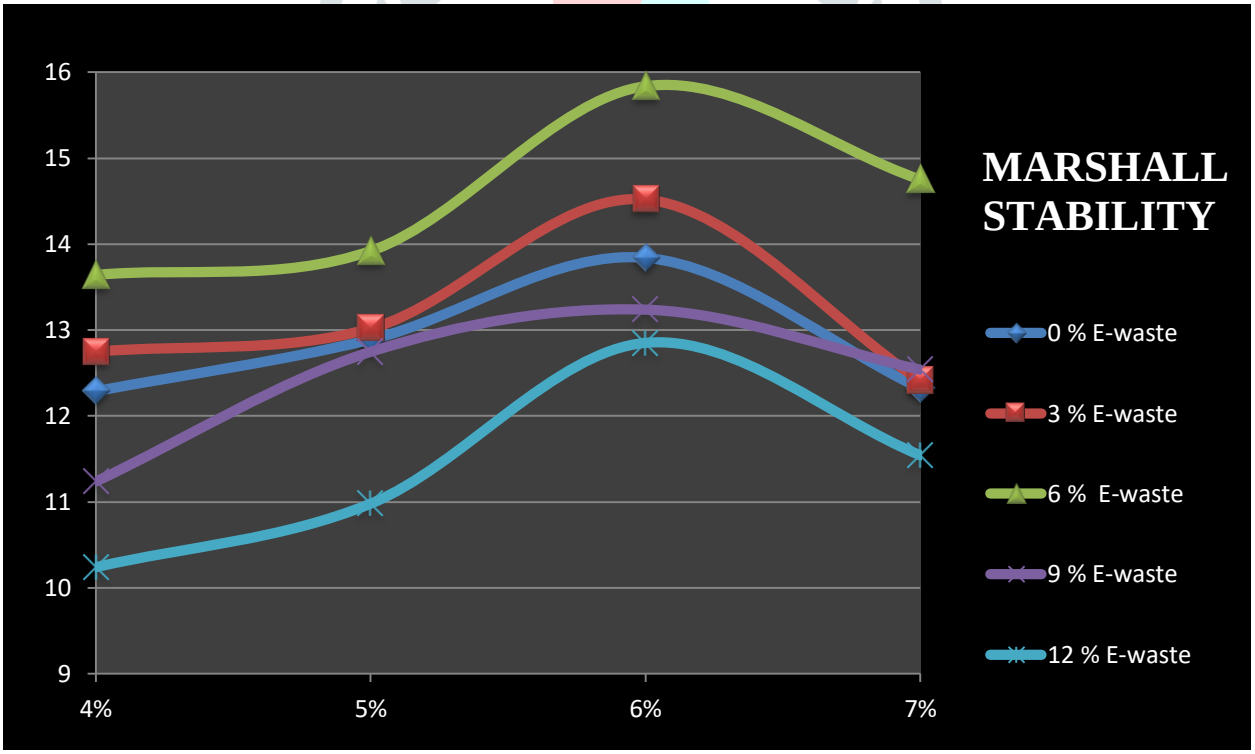

Figure 1.4: Variation of Marshall Stability With %age of E-Waste

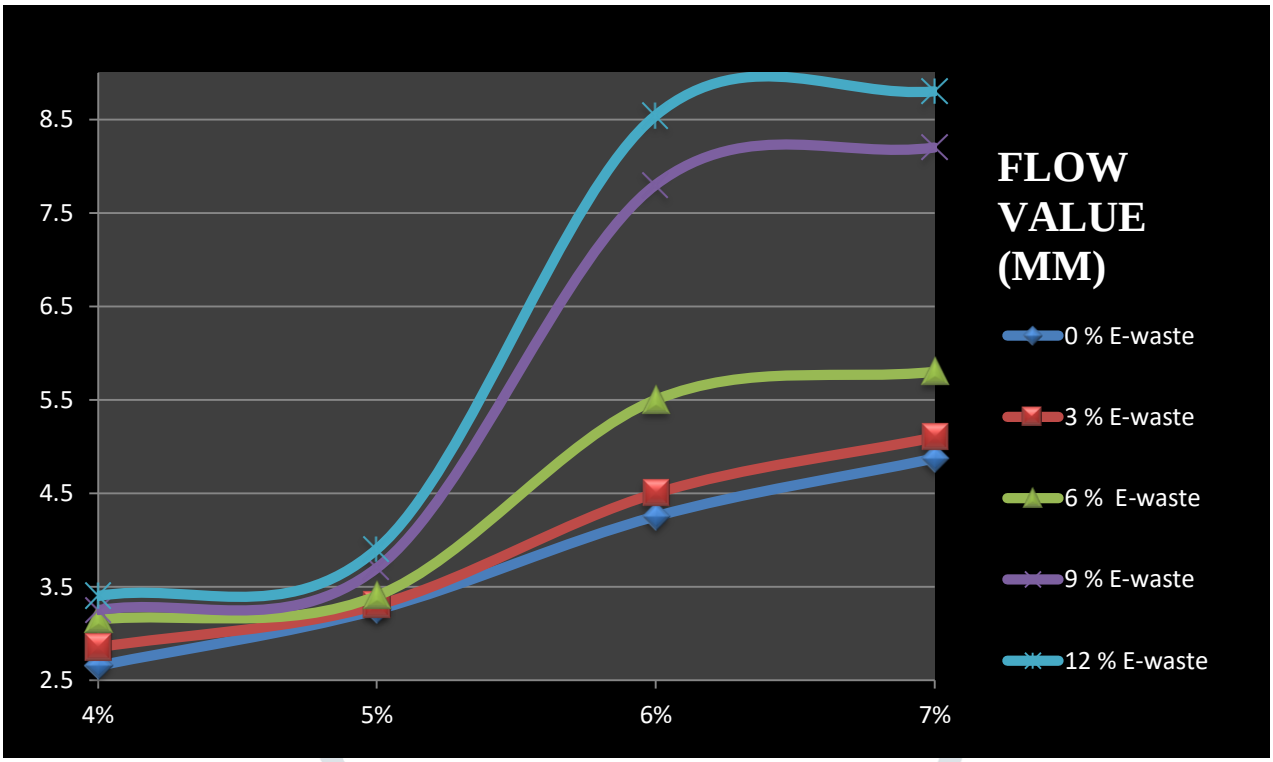

Figure 1.5: Variation of Marshall Flow Value With %age of E-Waste

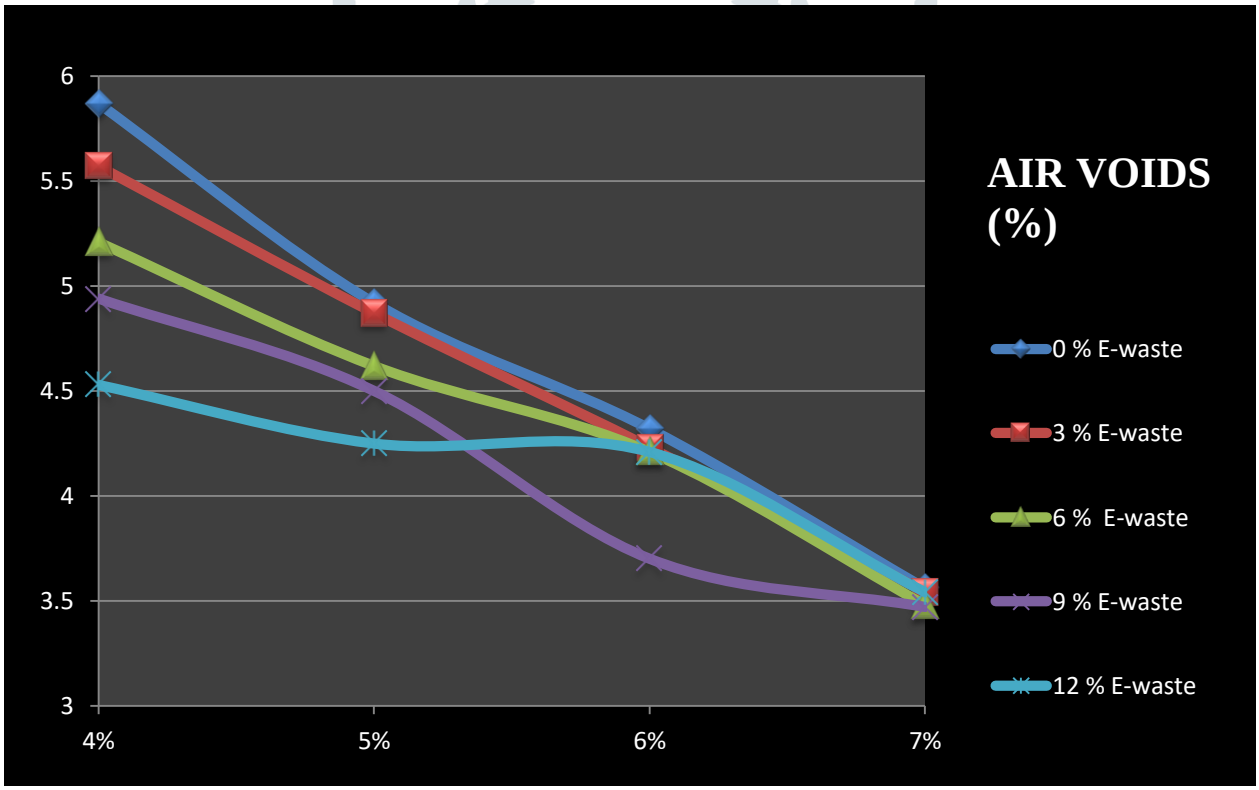

Figure 1.6: Variation of Marshall Air Voids With %age of E-Waste

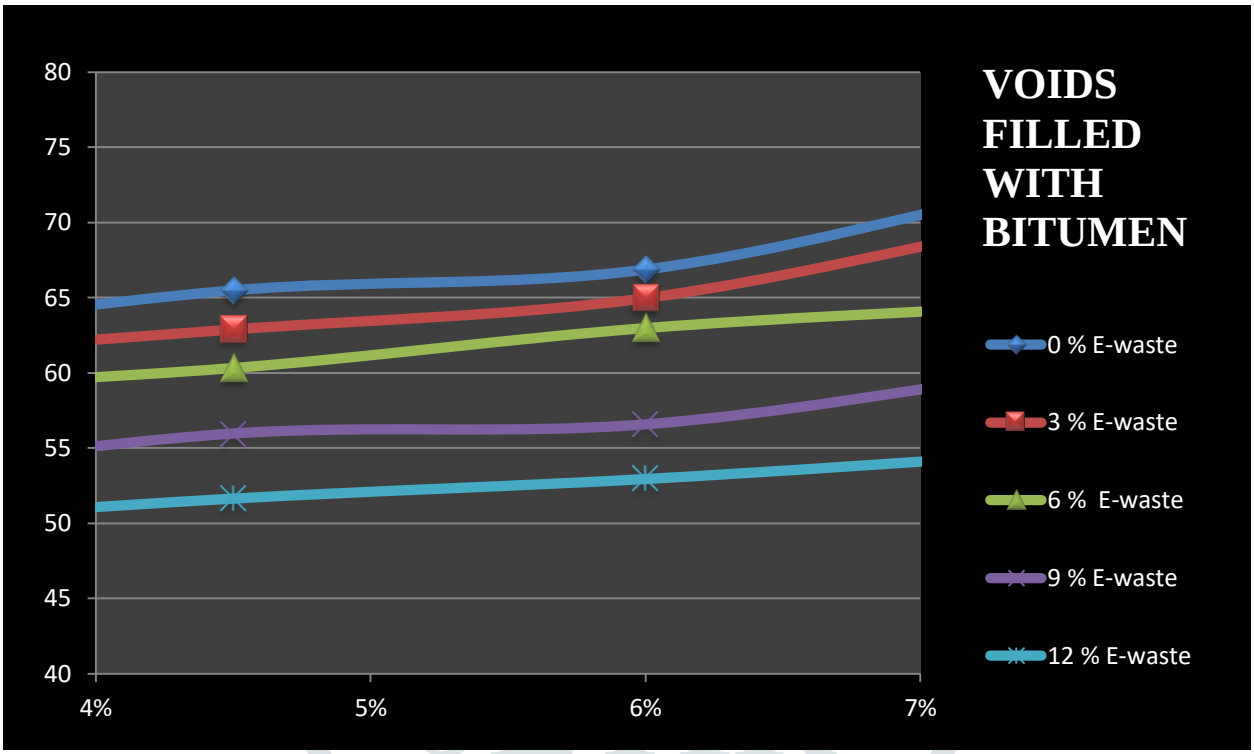

Figure 1.7: Variation of Voids filled with bitumen with %age of E-Waste

CONCLUSION

Following are the various conclusions drawn from this study:

1. The results from the research facility examination demonstrate the reasonableness of electronic waste in street development with significant cost sparing. Along these lines, transfer of unsafe electronic waste in the asphalt can demonstrate to be one of the choices to make the earth greener and asphalts progressively tough
2. Bituminous mixes containing E-waste as filler displayed maximum stability at 6% content of bitumen having an increasing trend up to 6% and then gradually decreasing.
3. The result of present study clearly shows that the stability of BC mixes was improved significantly on addition of electronic-Waste plastic to the mixes.
4. The flow value of mix was increasing with increase in the e-waste plastic content in the mix from 3 to 12 %.
5. The decrement in the Vv values show that the stability of the mixes was improving on addition of e-waste plastic.
6. The optimum content of e-waste plastic to be used is bitumen the ranges of 3 % to 12 %.

REFERENCES

1. S.P.Kale, H.I.Pathan, “Recycling of Demolished Concrete and E-waste”, International Journal of Science and Research (IJSR) ISSN (Online):23197064.

2. Shubham Gupta, Gaurav Modi, Rahul Saini, Vijaya Agarwala "A Review on Various Electronic Waste Recycling Techniques and Hazards due to its Improper Handling". International Refereed Journal of Engineering and Science (IRJES) ISSN (Online) 2319-183X, (Print) 2319-1821 Volume 3, Issue 5(May 2014), PP.05-17.
3. Pravin A. Manatkar, Ganesh P. Deshmukh "Use of Non-Metallic E-Waste as a Coarse Aggregate in a Concrete" IJRET: International Journal of Research in Engineering and Technology, eISSN: 2319-1163 pISSN: 2321-7308.
4. P.K. Roy, Devansh Jain, Vijay Meshram "Use of Electronic Waste as a Partial Replacement of Coarse Aggregate in Concrete" International Journal of Engineering Research-Online Vol.3., Issue.4., 2015 (July-Aug).
5. Atul A. Pasalkar, Yogesh M. Bajaj, Amol A. Wagh, Jitendra D. Dalvi, "Comprehensive Literature Review on use of Waste Tyres Rubber in Flexible Road Pavement", (IJERT): International Journal of Engineering Research & Technology ISSN: 2278-0181, Vol. 4 Issue 02, February-2015
6. Sultana, S. K., Prasad, K.S.B., Utilization of Waste Plastic as a Strength Modifier in Surface Course of Flexible and Rigid Pavements. International Journal of Engineering Research and Applications, 2(4), 2012, pp. 1185-1191.
7. Zoorab S.E, and Suparma L.B, "Laboratory Design and Performance of Improved Bituminous Composites Utilizing Recycled Plastics Packaging waste", Presented at technology Watch and Innovation in the Construction Industry, Palais Descongres, Brussels, Belgium 5-6, April 2000, pp. 203-209.
8. Denning,J.H, and Carswell.j., " Improvements in rolled Asphalt Surfacing by the Addition of organic Polymers ", Department of the Environment Department of Transport. Report LR 989. Transportation Road Research Laboratory (TRRL), Crow throne, 1981.
9. Salter, R.J., and Rafati-Afshar, F., "Effect of Additives on Bituminous Highway Pavement Materials Evaluated by the Indirect Tensile Test", Transportation Research Record 1115, 1987. pp 183-195.
10. Dallas, N. Little : AN Additive of Asphalt Additives to Reduce Permanent Deformation and Cracking in Asphalt Pavements: A brief Synopsis of Ongoing Research", Proceedings of the Association of Asphalt Paving Technologists(AAPT), Vol. 55, 1986, pp 314-320.
11. Walter j. Tappeinier, "Performance and Economical Advantage of Polymer Modified Asphalt", Richard Felisinger, Vienna, Austria 1999.
12. King, G.N., Muncy, H.W., and Prudhome, J.B., " Polymer Modification: Binder's Effect on Mix Properties", Proceedings of the Association of Asphalt Paving Technologists(AAPT), Vol. 55 , 1986 pp 519-540.
13. Sunil Bose, and Jain, P.K," Laboratory Studies on the Use of Organic Polymers in Improvement of Bituminous Road Surfacing", Highway Research Bulletin 38, 1989, New Delhi.

14. Sunil Bose, and Jain, P.K, Sangita, and Arya, I.R., "Characterization of Polymer Modified Asphalt Binders for Roads and Air Field Surfacing, Polymer Modified Asphalt Binders", ASTM: S.T.P:1108, American Society of Testing Materials, Philadelphia, USA, 19923. Pp.331-355.

15. Mahabir Panda and Mayajit Muzumdar, "Development and Evaluation of a Bituminous Paving Binder Containing Reclaimed Polyethylene", Indian Highways, Indian Roads Congress, New Delhi, Vol. 25(5), 1997.

16. IS: 2386 "Methods of Test for Aggregates for Concrete", Bureau of Indian Standards, New Delhi (1963).

17. IS: 1203 (1978), "Methods for Testing Tar and Bituminous Materials: Determination of Penetration", Bureau of Indian Standards, New Delhi.

18. IS: 1205 (1978), "Methods for Testing Tar and Bituminous Materials: Determination of Softening Point", Bureau of Indian Standards, New Delhi.

19. ASTM D 1559 (1989), "Test Method for Resistance of Plastic Flow of Bituminous Mixtures Using Marshall Apparatus".