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AN EXPERIMENTAL STUDY ON E-WASTE IN CONCRETE BY PARTIAL REPLACEMENT OF FINE AGGREGATE A REVIEW

Prof. S. A. Zambre[*1], Yashwant S. Nasre[*2], Vaibhav M. Wandade[*3], Ruchika V. Alone[*4], Sushant A. Mahakalkar[*5], Sonali R. Uike[*6], Pranay A. Jagtap[*7]

[*1]Asst. prof. Department Of Civil Engineering, SSPACE, Wardha, Maharashtra, India.

[*2,3,4,5,6,7]Students, Department Of Civil Engineering, SSPACE, Wardha, Maharashtra, India.

ABSTRACT

Waste from Electric and Electronic Equipment (WEEEs) is currently considered to be one of the fastest growing waste streams in the world, with an evaluated growth rate going from 3% up to 5% per year this rapid growth is due to continuous improvement of technology and introduction of new technologies to the market. India has emerged as 5th highest waste producer in the world. Destroy E-waste is a typical task faced in many regions across the globe. Acids and sludge are obtained from melting computer chips if removal in the ground causes acidification of soil. fulfilment of E-waste is the partial solution to Ecological and Environmental problems. The rapid increase in t constructionactivity in India has -and adverse changes in the environment. This fast development in the infrastructure has led to a shortage of natural sand. This study shows the efforts to use E-plastic, Non-metallic Printed Circuit Board (NMPCB) as a filler material in concrete. In the research, the present practical solution for the disposal of Waste Non-metallic Printed Circuit Board fractions (NMPCB) was caste by weight of the fine aggregate using Ordinary Portland Cement (OPC) for M25 grade of operate concrete having 0.42 water cement ratio. Results showed by comparing with the conventional instance that all the physical tests were conducted on materials. So, by noticing experimental results and environmental monitoring of (NMPCB), the best optimum replacement percentage of (NMPCB) is with a fine aggregate of control concrete. The main aim of this study recommends recycling E-waste as an aggregate in the production of new concrete.

Keywords -:E-waste, Non-metallic printed circuit board, Ordinary Portland Cement, Concrete, Bulk Density, Compressive Strength, Fine aggregate partial replacement.

I. INTRODUCTION

Nowadays, the world faces a real challenge in the disposal of solid waste, particularly, e-waste without including any environmental issues....utilization of crushed e-waste material as conventional concrete and other materials in building construction, helps in reducing the cost of concrete manufacturing. Every year, 20–50 million tons of waste electrical and electronic equipment (WEEE) are produced worldwide. India is ranked 5th in the world among the top e-waste producing countries-USA, China, Japan, and Germany. 70% of E-waste is generated in ten states. Maharashtra ranks first come after by Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh, and Punjab. Among the cities, Mumbai ranks first followed by Delhi, Bangalore, Chennai, and Hyderabad.

1.1 E-waste

Electronic waste or e-waste describes electrical devices. Used electronics that are destined for reuse, resale, salvage, recycling, or destruction are also considered e-waste. E-waste encompasses ever growing range of obsolete electronic devices, such as computers, servers, mainframes, monitors, TVs and display devices, cellular phones, calculators, audio and video devices, printers, scanners, copiers, refrigerators, air conditioners, washing machines, microwave ovens, electronic chips, processors, motherboards, printer circuit boards(PCBs), industrial electronics such as sensors, alarms, etc.

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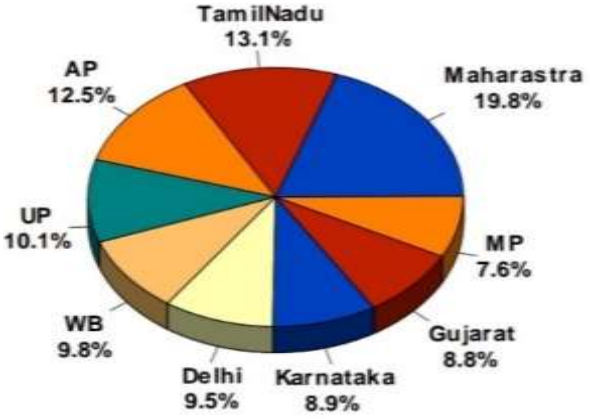

Figure1.1. State wise E-waste Generation in India(Tonnes/year)

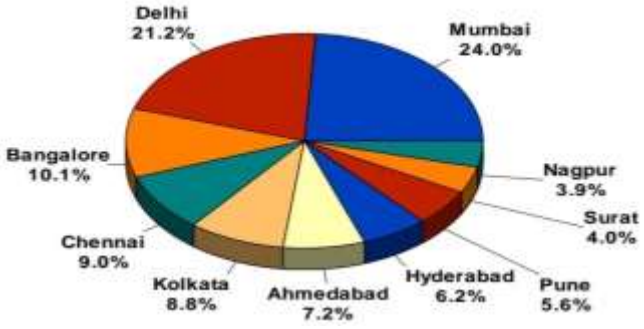

Figure1.2. City wise E-waste Generation in India(Tonnes/year)

1.2 Printed Circuit Board

Printed Circuit Boards (PCBs) are important parts of Electrical and Electronic (EE) equipment and present about 3-6% of the overall amount in it. In general, waste PCBs contain about 30% metals and 70% non-metals. The material present in PCB is classified into three groups 1st one organic, 2nd metals, and last ceramics.

Hazardous compounds such as arsenic, lead, mercury, cadmium, beryllium, and bromine-based retardants. About 30% mass of PCBs includes a wide range of different metals. These hazardous metals are metals with properties that make them likely harmful and toxic to health and the environment. The rest of 70% of printed circuit boards' mass includes Non-Metallic Components plastics, ceramics, glass, fibers, and similar compounds without any significant market value. This can cause pollution and other environmental issues if waste from such equipment is not perfectly managed. This encourages research and innovation in the of Non-Metallic printed circuit boards (NMPCBs) from recycled electronic waste. In addition, it ensures an environmentally-friendly product (Green-Product) and contributes to the economy as modernized construction material. PCBs are crushed, compressed, and trim into fine powder. Therefore, the utilization of NMP in concrete products is an encouraging alternative recycling technique and further development is mandatory.

II. LITERATURE REVIEW

1.1 Title:-An experimental study of e-waste concrete

Author:-K.Alagusankareware, S.Sandip Kumar, K. K. Vignesh, and K.Abdulhameedniyas

Year of publication:-January 2016(Indian Journal of Science and Technology)

This project deals with the experimental analysis of E-waste concrete. Methods/Statistical Analysis: An experimental setup placed the specimens on the loading frame for twopointed loading conditions. Findings: Determined the compressive strength, cube weight comparison, split tensile strength, and flexural strength. Applications: Self-weight of concrete reduces when there is a arise in E-Waste percentage. Hence it can be

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consumed as lightweight concrete. The supply of concrete reduces when E-Waste is used as a replacement material for sand. It is coherent that E-waste can be preferred by u them as constructional material. The compressive strength and split tensile strength of concrete pertaining to E-Waste aggregate are slightly lesser in comparison with the control mix concrete sample.

1.2 Title:-Study of e-waste concrete

Author:-GaonkarRasikashir, Shinde Nimisha, Chandansarang, BhagatDhiraj, PatilVibhor.

Year of publication:-April 2019(International Research Journal of Engineering and Technology (IRJET))

The management and recycling of E plastic waste are rapidly growing as it is a valuable resource of IT industries and it is a very hazardous substance with a low recycling rate. The utilization of e-waste materials is a partial solution to environmental or ecological problems. As the use of E plastic waste will reduce the aggregate cost and provides good strength for the structure and roads. It will reduce the dumping ground and it is energy-saving. The plastic used in this project is e-waste plastic which consists of all plastic materials used to make electronic equipment. This plastic is ground and then used as a filler material in concrete. The plastic which has been fractionally replaced by fine aggregate in the project is Acrylonitrile butadiene styrene (ABS). Four trials were taken in which plastic was added in various proportions and compression strength tests and compared with M20 nominal concrete. The scope of this project is to study the change in the percentage of electronic waste plastic as a filter material on the strength of concrete of certain mixes. The compressive strength of concrete with different percentages of plastic was carried out at the edge of 3 days, 7 days, and 28 days.

1.3 Title :-Experimental Study on Utilization of E -Waste in Cement Concrete

Author:-Sagar R. Raut, Roshani S. Dhapudkar, Monali G. Mandaokar

Year of publication:- 2018(The International Journal of Engineering and Science (IJES)

We cannot imagine civil engineering structures without concrete. Concrete is the backbone of infrastructural development and hence manufactured in large quantities. On the other hand, a large amount of e-waste is generated every year, out of which a very small percentage of e-waste is treated by either recycling it or reusing it. From the study, it is found that only 12.5% of e-waste is recycled. E-waste like non-metal parts in PCBs (printed circuit boards) can be recovered & used as an ingredient in concrete. So, partial replacement of aggregate by e-waste has been temporarily carried out in several parts of the world. With the use of e-waste, we can overcome many environmental problems as it reduces the landfill due to e-waste and reduced the use of natural resources like aggregates. As the use of concrete and the generation of e-waste is increasing rapidly to meet the demand and technological advancement In this paper relative study is produced by replacing the coarse aggregate with e-waste in different percentages and to find the behavior of concrete with these replacements and to find the optimum percentage replacement.

2.1 Future Scope of the Project

- Decreasing the unorganized disposal of E-waste material causing dangerous poisonous substances by utilizing concrete.
- Chancing a volition in construction for the proper conservation of natural summations and reducing the over-operation of Natural summations.
- Purpose of Physical partials and computation of energy parameters of E-Waste NMPCB concrete.
- Estimate the reduction of PCC concrete construction by negotiation of the natural total with E-waste NMPCB material.
- The use of recycled fine aggregates saves natural and jilting spaces and helps to maintain a clean terrain.
- The application of E-waste materials accoutrements is a partial result of environmental issues.
- It is eco-friendly for nature
- It is provident.

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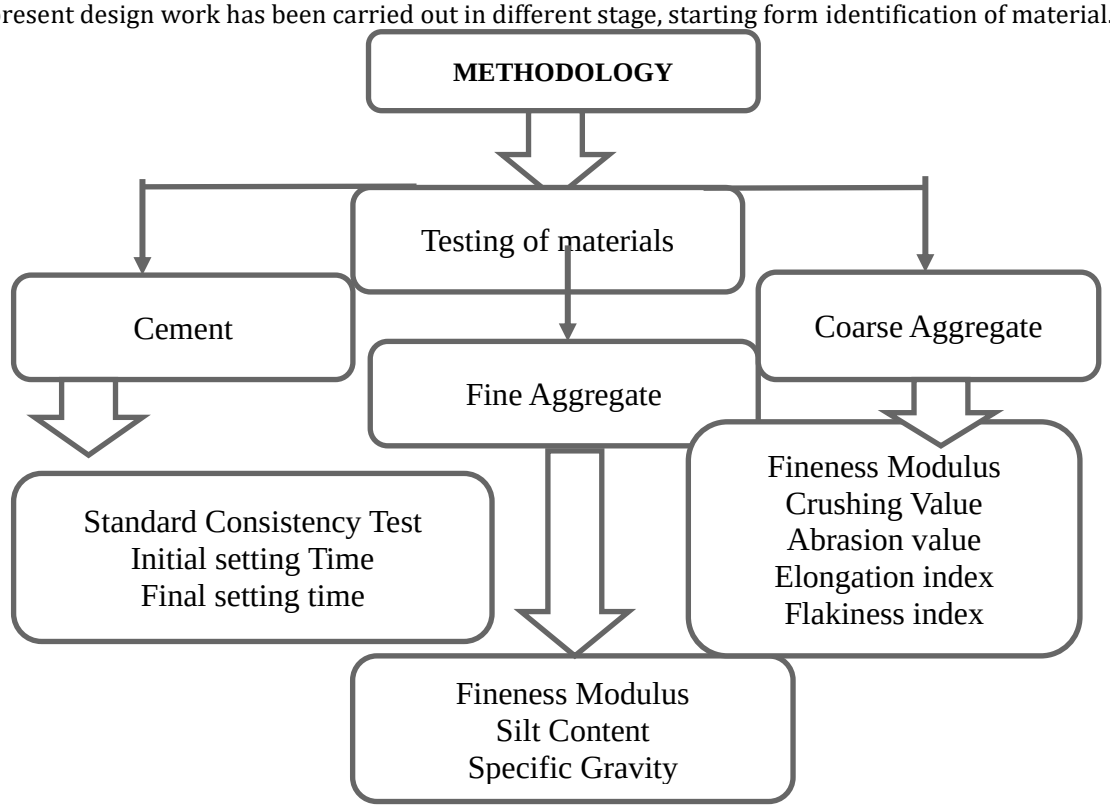
III. METHODOLOGY

3.1 Method

In the present design work has been carried out in different stage, starting form identification of material.



IV. CONCLUSION

1. M25 grade concrete can be adopted of the mix (1:2:3)using Ordinary Portland Cement with a water-cement ratio of 0.42.
2. The different ranges of E-waste NMPCB (10%, 20%, 30%, 40%) are taken whose slump value, Bulk density, and Compressive strength is conducted which is compared with the conventional mix grade of concrete.
3. The Workability of fresh concrete is decreased by the increase inthe substitute percentage of E-waste NMPCB. The decreasein consistency is due to the angularity of E-waste (NMPCB).
4. The Density of the concrete was found to be reduced with the increase in the e-waste quantity. Self-weight ofconcrete reduces when there is a rise in E-waste percentage. Hence it can be consumed as lightweight concrete.
5. The cost of the EC can be reduced and made further economical if proper support and legal amendments are madethrough government organizations to process it on a large scale.
6. Utilization of E-Waste NMPCB in concrete may be efficient given an optimum value of 8.5% in terms of Strengthas a partial replacement of E-WNMPCB using Portland Composite Cement (PCC)shows the economical and bestway of disposing of the e-waste which is now the fastest growing solid waste in the world

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