International Journal of Latest Engineering Research and Applications (IJLERA) ISSN: 2455-7137

Volume – 03, Issue – 03, March 2018, PP – 41-43

Utilization of Glass waste in concrete - A review

Suchampa Bagchi,
Assistant Professor, Department of Civil Engineering, Jeppiaar SRR Engineering college

R Rashmi Mano,
Assistant Professor, Department of Civil Engineering, Jeppiaar SRR Engineering college

N Thangam,
Assistant Professor, Department of Civil Engineering, Jeppiaar SRR Engineering college

Abstract: This paper focuses on the effective utilization of glass waste in concrete as a building product. The existing research papers on glass waste is reviewed and shown here. The main objective of this review is to study all the available research papers on glass waste and suggest the various ways by which glass waste can be effectively used in concrete for construction.

Keywords: fibres, glass waste, recycled aggregate

In todays fast growing world, with increase in population, each sector is developing day by day. A lot of construction activities are going on all over the world. A huge amount of materials is manufactured every day. With increase in the number of construction activities simultaneously demolition of building is taking place. A huge amount of waste is generated from various sectors from various industries whose disposal is a major problem in todays world. Therefore, reusing the wastes effectively in various sectors will solve the disposal problem and will minimize the utilization of natural resources. This paper includes a brief literature survey on glass waste.

Literature Survey

Seung-BumParkBong-ChunLee, studied on "**Expansion properties in mortar containing waste glass and fibers**". Waste glass when used in concrete can cause cracking and weakening of concrete due to alkali- aggregate reaction which results in expansion of concrete. Strength properties and alkali silicate reaction expansion was analysed in this study in terms of content of waste glass, glass colour i.e brown and green, steel and polypropylene fibres and its content.

Accelerated ASTM C 1260 test was conducted for waste glass for both green and brown glass to determine pessimum content. Various tests were conducted to determine the expansion of waste glass and its strength in concrete. Results showed that the expansion of green waste glass was less than that of brown glass Further more, when fibers and waste glass were combined, there was an effect on the reduction of expansion and strength loss due to ASR between the alkali in the cement paste and the silica in the waste glass. In particular, adding 1.5 vol.% of steel fiber to concrete containing 20% waste glass reduced the expansion ratio by 40% and increased flexural strength by up to 110%, a vast improvement when compared with using only waste glass (80 °C H_2O curing) by itself

Yue Huang[a] Roger Bird[b] Oliver Heidrich[c] investigated **"Development of a life cycle assessment tool for construction and maintenance of asphalt pavements**".The increasing use of recycled materials in asphalt pavements calls for environmental assessment of such impacts as the energy input and CO_2 footprint. Life cycle assessment (LCA) is being accepted by the road industry for such purpose. It aims to quantify and collate all the environmental impacts from the life time of the product or process. This paper reviews relevant LCA resources worldwide, identifies the knowledge gap for the road industry, and describes the development of an LCA model for pavement construction and maintenance that accommodates recycling and up-to-date research findings. Details are provided of both the methodology and data acquisition. This is followed by a discussion of the challenges of applying LCA to the pavement construction practice, and recommendations for further work. In the case study, the model is applied to an asphalt paving project at London Heathrow Terminal-5 (LHR), in which natural aggregates were replaced with waste glass, incinerator bottom ash (IBA) and recycled asphalt pavements (RAP). Production of hot mix asphalt and bitumen was found to represent the energy intensive processes. This is followed by data analysis and sensitivity check. Further development of the model includes expanding the database to accommodate the recycling and maintenance practice in the UK, and taking into account the effect that roadwork has on traffic emissions. The LCA model can be further tested and calibrated as a decision support tool for sustainable construction in the road industry.

P. Colombo[ab] G. Brusatin[c] E. Bernardo[c] G. Scarinci[c] investigated on "Inertization and reuse of waste materials by vitrification and fabrication of glass-based products**.** Vitrification is widely accepted as the most safe process for treating hazardous wastes and converting them into leach-resistant materials. In this paper a review of the current and emerging waste vitrification technologies is reported. Analysis of different methods of vitrification, according to physical state and composition of the waste, can offer a guideline for process selection. Moreover, the most recent studies on vitrification of various types of industrial and civil wastes and their further transformation in useful marketable products are presented and discussed

Ahmad Shayan Aimin Xu, investigated on "**Value-added utilisation of waste glass in concre**te"A large proportion of the postconsumer glass is recycled into the packaging stream again, and some smaller proportions are used for a variety of purposes, including concrete aggregate. However, a significant proportion, which does not meet the strict criteria for packaging glass, is sent to landfill, taking the space that could be allocated to more urgent uses. Glass is unstable in the alkaline environment of concrete and could cause deleterious alkali-silica reaction (ASR) problems. This property has been used to advantage by grinding it into a fine glass powder (GLP) for incorporation into concrete as a pozzolanic material. In laboratory experiments, it can suppress the alkali reactivity of coarser glass particles as well as that of natural reactive aggregates. It undergoes beneficial pozzolanic reactions in the concrete and could replace up to 30% of cement in some concrete mixes with satisfactory strength development. The drying shrinkage of the concrete containing GLP was acceptable.

Malek Batayneh Iqbal Marie Ibrahim Asi investigated the **"Use of selected waste materials in concrete mixes**", A modern lifestyle, alongside the advancement of technology has led to an increase in the amount and type of waste being generated, leading to a waste disposal crisis. This study tackles the problem of the waste that is generated from construction fields, such as demolished concrete, glass, and plastic. In order to dispose of or at least reduce the accumulation of certain kinds of waste, it has been suggested to reuse some of these waste materials to substitute a percentage of the primary materials used in the ordinary portland cement concrete (OPC).

The waste materials considered to be recycled in this study consist of glass, plastics, and demolished concrete. Such recycling not only helps conserve natural resources, but also helps solve a growing waste disposal crisis. Ground plastics and glass were used to replace up to 20% of fine aggregates in concrete mixes, while crushed concrete was used to replace up to 20% of coarse aggregates. To evaluate these replacements on the properties of the OPC mixes, a number of laboratory tests were carried out. These tests included workability, unit weight, compressive strength, flexural strength, and indirect tensile strength (splitting). The main findings of this investigation revealed that the three types of waste materials could be reused successfully as partial substitutes for sand or coarse aggregates in concrete mixtures

Seung Bum Park Bong Chun Lee Jeong Hwan Kim studied the "**Quantities of waste glass have been on the rise in recent years due to an increase in industrialization and the rapid improvement in the standard of living**". Unfortunately, the majority of waste glass is not being recycled but rather abandoned, and is therefore the cause of certain serious problems such as the waste of natural resources and environmental pollution. For these reasons, this study has been conducted through basic experimental research in order to analyze the possibilities of recycling waste glasses (crushed waste glasses from Korea such as amber, emerald green, flint, and mixed glass) as fine aggregates for concrete. Test results of fresh concrete show that both slump and compacting factors are decreased due to angular grain shape and that air content is increased due to

the involvement of numerous small-sized particles that are found in waste glasses. In addition the compressive, tensile and flexural strengths of concrete have been shown to decrease when the content of waste glass is increased. In conclusion, the results of this study indicate that emerald green waste glass when used below 30% in mixing concrete is practical along with usage of 10% SBR latex. In addition, the content of waste glasses below 30% is practical along with usage of a pertinent admixture that is necessary to obtain workability and air content.

Bashar Taha Ghassan Nounu investigated "**the Properties of concrete contains mixed colour waste recycled glass as sand and cement replacement".** Mixed colour waste recycled glass is waste material that cannot be reused in glass industry. Concrete can be considered as an outlet for the surplus quantities of the mixed colour waste recycled glass. This research work studies the feasibility of recycled glass sand (RGS) and pozzolanic glass powder (PGP) in concrete as sand and cement replacement, respectively. Ground granulated blastfurnace slag (GGBS) and metakaolin (MK) were used in this study to replace

Portland cement and investigate the effect of RGS on the behaviour and properties of concrete contains blend of different cementitious materials. Severe bleeding and segregation were observed when normal sand was replaced by RGS and the plastic properties of the concrete undergo clear changes. However, the presence of the PGP in concrete enhanced the plastic properties of concrete. No significant differences were observed in compressive strength of concrete with the presence of RGS in concrete, while an average reduction of 16% was occurred when 20% of the Portland cement was replaced by PGP.

The effects of utilising waste recycled glass as sand/cement replacement in concrete were further explored by applying different tests such as, tensile splitting strength, flexural strength, static modulus of elasticity and water absorption.

References

[1]. Surya, Kanta Rao, Lakshmy, "Recycled aggregate concrete for Transportation Infrastructure*", 2nd Conference of Transportation Research Group of India (2nd CTRG),* Procedia - Social and Behavioral Sciences 104 (2013) 1158 – 1167 Science Direct.

[2]. Ahmed Shaban Abdel-Hay, "Properties of recycled concrete aggregate underdifferent curing conditions ", *Housing and Building National Research Center HBRC Journal,* HBRC Journal (2017) 13, 271–276.

[3]. Shahid Kabir*, Ammar Al-Shayeb and Imran M. Khan, "Recycled Construction Debris as Concrete Aggregate forSustainable Construction Materials", *International Conference on Sustainable Design, Engineering and Construction,* Procedia Engineering 145 (2016) 1518 – 1525, Science Direct.

[4]. Tomas U. Ganiron Jr, "Recycling Concrete Debris from Construction and Demolition Waste**",** *International Journal of Advanced Science and Technology* Vol.77 (2015), pp.7-24.

[5]. R. B. Sheral, D. Sutar & P. Jagdane, "Utilization of Waste Materials (GGBS+FLY ASH)", *International Journal of Latest Technology in Engineering, Management & Applied Science (IJLTEMAS)* Volume V, Issue VII, July 2016 | ISSN 2278-2540.

[6]. RuoyuJina, Qian Chen, "Investigation of concrete recycling in the U.S. construction industry", *International Conference on Sustainable Design, Engineering and Construction*, Procedia Engineering 118 (2015) 894 – 901, ScienceDirect.

