The Comparative Analysis and Examination of Strength Properties using Crushed Glass and Over-Burnt Bricks

TAJMAUL ISLAM BHAT[1], SHIVANI BHARDWAJ[2]

[1,] PG Student, Department of Civil Engineering, Sri Sai College of Engineering and Technology. Badhani Pathankot
[2]assistant Professor, Department of Civil Engineering, Sri Sai College of Engineering and Technology. Badhani Pathankot

---

Abstract – The present work is based on the advancement in construction in Republic of India additionally as different developing countries. Due to the rapid increase in consideration activities has promoted a dramatic increase in the price of conventional construction materials. In this context a study was done in order to find out the appropriateness of the substitute materials, such as over-burnt bricks and crushed glass waste are replaced with coarse-aggregate and fine-aggregate respectively since these materials are effectively accessible at very low cost when compared with other coarse aggregates. Suitable quantities of super-plasticizer materials are added to improve the workability and stability.

Key Words: conventional, over-burnt bricks, crushedglass. coarse aggregate. fine aggregate.

1. INTRODUCTION

CONCRETE: The word concrete denotes to a combination of aggregates, typically sand, and each gravel or crushed stone, seized together by a binder of cementations paste. The paste is normally made up of Portland cement and admixtures. Concrete's flexibility, durability, sustainability, and low-cost have made it the world's most extensively used construction material. It is one of the most essential and valuable materials for structure work. When all the elements (cement, aggregate, water) are mixed in the required proportions, the cement and water start a reaction with each other to fix themselves into a hardened mass. This hardened rock-like mass is identified as concrete. Most concretes used are lime based concretes such as Portland cement concrete or concretes made with other hydraulic cements

CEMENT: Cement is a binder, a substance used for construction that sets, hardens and adheres to other materials, binding them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement is used with fine aggregate to produce mortar for masonry, or with sand and gravel aggregates to produce concrete. Cements used in construction are usually inorganic, often lime or calcium silicate based, and can be characterized as being either hydraulic or non-hydraulic, depending upon the ability of the cement to set in the presence of water (see hydraulic and non-hydraulic lime plaster). Non-hydraulic cement will not set in wet conditions or underwater; rather, it sets as it dries and reacts with carbon dioxide in the air. It is resistant to attack by chemicals after setting.

Hydraulic cements (e.g., Portland cement) set and become adhesive due to a chemical reaction between the dry ingredients and water. The chemical reaction results in mineral hydrates that are not very water-soluble and so are quite durable in water and safe from chemical attack. This allows setting in wet condition or underwater and further protects the hardened material from chemical attack.

COARSE AGGREGATE: Coarse aggregates are particles greater than 4.75mm, but generally range between 9.5mm to 37.5mm in diameter. The code to be referred to understand the specification of the coarse aggregates from natural sources is: IS 383:1970. According to size coarse aggregate is described as graded aggregate of its nominal size i.e. 40 mm, 20 mm, 16 mm and 12.5 mm etc. for example a graded aggregate of nominal size 20 mm means an aggregate most of which passes 20 mm IS sieve. A coarse aggregate which has the sizes of particles mainly belonging to a single sieve size is known as single size aggregate. For example 20 mm single size aggregate mean an aggregate most of which passes 20 mm IS sieve and its major portion is retained on 10 mm IS sieve

FINE AGGREGATE : Fine aggregates generally consist of natural sand or crushed stone with most particles passing through a 9.5mm sieve. Fine aggregates generally consist of natural sand or crushed stone with most particles passing through a 3/8-inch sieve. Fine aggregate is natural sand which has been washed and sieved to remove particles larger than 5 mm. The code to be referred to understand the specification for fine aggregates is: IS 383:1970.According to size the fine aggregate may be described as coarse sand, medium sand and fine sand.IS specifications classify the fine aggregate into four types according to its grading as fine aggregate of grading Zone-1 to grading Zone-4.

1.1 Admixtures

To change the properties of concrete for better results, admixtures are used. These are used externally either before or during mixing of concrete to alter its properties to cater our desired requirements. With the addition of admixtures, enhanced workability and reduced setting time can be achieved even with low water cement ratio. These are basically of two types, first is mineral admixtures (ex.blast-furnace slag, fly ash, rice husk ash, silica fume etc.) And second is chemical admixture (ex. calcium chloride, oxides of lead, zinc phosphate and magnesium salts etc.)

Mineral Admixture: Admixtures like fly ash, blast furnace slag and silicate fumes come in this category. The use of mineral admixture enhances the workability, curtails bleeding, segregation and reduces heat of hydration, improves compressive strength, bond strength, abrasion resistance, dense concrete that results in protection of reinforcement against corrosion.

Chemical Admixture: They are broadly categorised as super plasticizers, accelerators, retarders, water reducers and air entraining admixtures. They are added to concrete immediately before or during mixing in very small amounts. Addition of super plasticizers reduces the requirement of water, accelerators are added to reduce the setting time of concrete, retarders are added to increase the setting time, water reducers are added to attain certain workability at low water cement ratio and air entraining mixtures entrain small bubbles in concrete, which helps in improving workability.

1.2 Over-Burnt Brick

Bricks, produced by burning the moulded soil consist of an adequate percentage of clay. Approximately 13 % of bricks are severely over burnt due to uncontrolled distribution of temperature in the kiln during manufacture. These over burnt bricks have no use in cement concrete preparation and considered as wastage. Moreover it creates problem for the brick manufacturers disposing those wastage. Over burnt brick can be considered as good material suitable for plain concrete work as well as reinforced work where stresses are not very high. Brick aggregates should be saturated with water for 24 hours before use to avoid absorption of the mixing water which is necessary for hydration of cement and for the setting and hardening of the concrete .brick aggregates more fire resistant and sound absorbent than crushed stone aggregate : The over burnt bricks are of an Irregular shape and dark color. These bricks are used as aggregate for concrete in the foundation, floors, roads, etc. because of the fact that the over burnt bricks have compacted structure and hence, they are sometimes found stronger than even first class bricks.

1.3 Crushed glass waste

Glass recycling is the processing of waste glass into usable products. Glass waste should be separated by chemical composition, and then, depending on the end use and local processing capabilities, might also have to be separated into different colors. Many recyclers collect different colors of glass separately since glass retains its color after recycling. The most common types used for consumer containers are colorless glass, green glass, and brown or amber glass. Glass is ideal for recycling since none of the material is degraded by normal use.

In recent years there has been an increasing worldwide demand for the construction of buildings, roads and airfields which has led to a local depletion of aggregates. In some urban areas, the enormous quantities of aggregate that have already been used means that local materials are no longer available and the deficit has to be made up by importing materials from other locations. Most cities have areas of land covered by spoil heaps which are unsightly and prevent large areas of land being used for anything else. If the large amount of waste materials generated were used instead of natural materials in the construction industry there would be three benefits: conserving natural resources, disposing of waste materials (which are often unsightly) and freeing up valuable land for other uses . Glass is a common product that can be found in different forms: bottles, jars, windows and windshields, bulbs, cathode ray tubes, etc. These products have a limited lifetime and must be used in order to avoid environmental problems .This project deals with the recycling of glass bottles, which can usually be reused after being crushed and melted. Civil engineers have been challenged to convert this waste glass, in general, to useful building and construction materials. Utilization of waste glass for construction shall not only solve waste problems, but also provide a new resource for construction purposes.

1.4 Composition of Glass

Glass can be generally divided into two groups: oxide glass and non-oxide glass. The ingredients of oxide glasses include oxides (chemical compounds that include oxygen). Non-oxide glasses are made from compounds that contain no oxides, and which often instead contain sulfides or metals. Oxide glasses are much more widely used commercially. The common types of glass discussed below are all oxide glasses.Soda-lime glass is the kind of glass used for flat glass, most

containers and electric light bulbs, and many other industrial and art objects. More than 90 percent of all glass is soda-lime glass. It has been made of almost the same materials for hundreds of years.

2. PROBLEM IDENTIFICATION

In the recent historical, many surveys have been approved out on the properties of concrete by using both the crushed glass waste as a partial replacement of fine aggregate and OBBA as partial replacement of coarse aggregates individually. Hence the present work is deliberate to study the properties of concrete at the fresh and solid stage comprising both crushed glass waste as a partial replacement of fine aggregate and OBBA as a partial replacement of coarse aggregates composed in different mixtures. An experimental program was planned in which one lean concrete mix which did not include any percentage of crushed glass waste and OBBA and fifteen different mixes with different combinations of crushed glass waste and OBBA were prepared.

3. MATERIALS USED

The materials used are as follows:

OPC CEMENT 43 GRADE: Ordinary Portland cement (OPC 43) of brand Khyber was used in this study. Cement bags were bought from the local dealer. The physical properties of the cement as determined from various tests should conforming to Indian standard IS 1489-1991.

TABLE 1. physical properties of cement

Sr. No.	Properties	Observations
	Bulk density	1450 kg/m^3
1	Specific gravity	3.15
2	Initial setting time	30 min
3	Final setting time	600 min
4	Standard Consistency	5-7%
5	Fineness (90 micron IS Sieve)	5%
6	28-days compressive strength	42.17Mpa

Crushed Glass Waste (CGW):
Glass Waste used in this investigation was taken from dumping site of Glass shop clean located at Anantnag and were crushed in crusher plant finer than 4.75 mm located at Nepora Anantnag. Sieve analysis of Crushed glass waste is performed for particle size distribution

Natural Sand:
Fine aggregate used in this investigation was taken from River Jhelum clean sand passing through 4.75 mm IS sieve. Sieve analysis of fine aggregate is performed for particle size distribution and other physical properties are listed in Table 4.2 and Table 4.4respectively. The total sample taken of Natural fine aggregates (NFA) was 1500 grams.

Jhama brick aggregates:

The Jhama brick aggregates used for making concrete, which is obtained from kiln.. The total sample taken of coarse aggregates was 1200 grams.

WATER:

Water that has comparatively free from harmful ingredients like oils, acidic and basic impurities similarly objectionable organic matter determined to explain quality of cement. In general, water used for concrete intermixture ought to be in and of itself as suited drinking. Water from lakes similarly as streams that contain marine life and free from any industrial

pollution is additionally appropriate. Water impure by waste, industrial wastes and different harmful ingredients ought to be rejected if its use is inevitable; it should be subjected to correct treatment.

4. SUPER-PLASTICIZER

In order to achieve desired slump, high range water reducing admixture of Auramix 400 was used. Auramix 400 complies with IS: 9103-1999(2007). It also complies with ASTM C494 Type G depending on the dosage used.

Auramix 400 is a unique combination of the latest generation superplasticisers, based on a polycarboxylic ether polymer with long lateral chains. This greatly improves cement dispersion. At the start of the mixing process an electrostatic dispersion occurs but the cement particle's capacity to separate and disperse. This mechanism considerably reduces the water demand in flowable concrete. Auramix 400 combines the properties of water reduction and workability retention. It allows the production of high performance concrete and/or concrete with high workability.

1) Dry mix cement, fine and coarse aggregates.

2) Add Auramix 400 in gauging water the normal dosage range is between 0.5 to 3.0 ltrs/100 kg of cementitious material and stir well.

3) Pour water in the dry mix and complete mixing to get a cohesive mix.

4) For better results Restrict water between 20-25 liters per 50kg bag of cement.

5) Mix should be used within 30 minutes.

6) Adjust water depending on floe and cohesively desired.

4.1 Properties of Auramix 400

The properties of Auramix 400 are given in table 2 below:

Table 2: Properties of Auramix 400 Super plasticizer

Properties	Specifications
Appearance	Light yellow coloured liquid
pH	Minimum 6.0
Volumetric mass @ 200^0 C	1.09 kg/litre
Chloride content	Nil to IS:456
Alkali content	Typically less than 1.5 g Na2O equivalent / litre of admixture.
Minimum shelf life	1 years
Temperature	20C to 500 C.

4.2 Advantages of Aura mix 400:

The following are the advantages of the Aura mix 400:

- Improved adhesion to reinforcing and prestressing steel.
- Better resistance to carbonation.
- Lower permeability.
- Better resistance to aggressive atmospheric conditions.

- Reduced shrinkage and creep.
- Increased durability.
- High performance concrete and/or concrete with high workability.

5. CONCLUSION

In this paper I had discussed that Over-burnt block chips and crushed glasss waste have a potential to provide alternative to conventional coarse aggregate and helps in maintaining the environment as well as economical balance. The experimental investigation is to be done on the overbunt bricks and crushed glass. The super plastizers are used to improve the properties.

REFRENCE:

1) Ardalan Baradaran-Nasiri and Mahdi Nematzadeh , "The effect of elevated temperatures on the mechanical properties of concrete with fine recycled refractory brick aggregate and aluminate cement", Construction and Building Materials, Vol. 147, pp 865–87, 2017.

2) Eva Navrátilová and Pavla Rovnaníková, "Pozzolanic properties of brick powders and their effect on the properties of modified lime mortars", Construction and Building Materials ,Vol. 120 ,pp 530–539, 2016.

3) Farid Debieb and Said Kenai,"The use of coarse and fine crushed bricks as aggregate in concrete",Construction and Building Materials, Vol. 22, pp 886–893, 2008.

4) Fatih Bektas, "Alkali reactivity of crushed clay brick aggregate", Construction and Building Materials, Vol. 52, pp 79–85, 2014.

5) M. Adamson, A. Razmjoo and A. Poursaee, "Durability of concrete incorporating crushed brick as coarse aggregate", Construction and Building Materials, Vol. 94, pp 426–432, 2015.

6) B.V. Kavyateja, P. Narasimha Reddy and U.Vamsi Mohan, "Study of strength characteristics of crushed glass used as fine aggregate in concrete", International Journal of Research in Engineering and Technology, Vol. 05 Issue: 02 ,pp 157-160, 2016.

7) Sadoon Abdallah and Mizi Fan, "Characteristics of concrete with waste glass as fine aggregate replacement," International Journal of Engineering and Technical Research (IJETR)", Vol. 2, Issue-6, , pp11-17 2014.