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A review on analysis the characteristic behaviour of quarry and furnace waste kerb stone

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ABSTRACT

Quarry Dust and the crushed stone as alternative aggregates for concrete production for low-cost housing since it is clear that the rising cost of concrete materials coupled with environmental degradation has impaired the construction industry. The following tests were carried out to determine the physical properties of these materials; density tests, silt content, water absorption, sieve analysis, specific gravity, flakiness index and aggregate crushing value. The research was conducted by testing concrete cylinder and cubes specimens at ages of 7, 14 and 28 days concrete with concrete mix ratios 1:1.5:3 with a target strength of 25N/mm2 and 1:2:4 with a target strength of 20N/mm2. Samples of concrete specimens were made using varying contents of quarry dust and laterite as fine aggregate. India is a developing contrary due to there is a huge need for infrastructure that is why construction is very important. In the construction the main material his problem we are making Kerb stone using this. This Kerb stone is stronger economical and effective than the clay Kerb stone. This process also helps in converting the industrial waste material into quality building material. **In this study, the fine and coarse aggregates were completely replaced by Quarry & Furnace Waste aggregates in Quarry & Furnace Waste concrete.** ***In the present study, we are making three types of Quarry & Furnace Waste Kerb stones in the different percentage of cement such as 3%, 5% and without cement. And after making these Kerb stones various tests were performed such as compressive strength test, water absorption test, efflorescence, weight test, structural test, and cost analysis and these results were compared with normal Kerb stones results.***

Keywords— *Quarry dust, Kerb stone, Furnance, Concrete*

1. INTRODUCTION

In normal Kerb stone, the weight of Kerb stone is one of the parameters to compare with the weight of Quarry & Furnace Waste Kerb stone. This heavy self-weight makes an uneconomical structural material compared to low self-weight of Quarry & Furnace Waste Kerb stone. In order to produce Kerb stone of desired density to suit the required application, the self-weight of structural and nonstructural members are to be reduced. Hence economy is achieved in the design of supporting structural elements which lead to the development of Kerb stone. Lightweight Kerb stone is defined as a Kerb stone that has been made lighter than the normal Kerb stone by changing the material composition or production method. Lightweight Kerb stone is the Kerb stone made by replacing the usual material with light weight material. Quarry & Furnace Waste Kerb stones are made of Quarry & Furnace Waste, lime, gypsum cement and sand. These can be extensively used in all building constructional activities similar to that of common burnt clay Kerb stones. The Quarry & Furnace Waste Kerb stones are comparatively lighter in weight and stronger than common clay Kerb stones. Since Quarry & Furnace Waste is being accumulated as waste material in large quantity near thermal power plants and creating serious environmental pollution problems,

Fig. 1: Kerb used in side of pathway

Vision has a predominant role in determining these critical factors hence it will be of a large relief to all concerned if Quarry & Furnace Waste from these thermal stations are used on a large scale. The government has formulated policies that for every construction agency within a radius 50 to 100 kilometer from a coal or lignite based thermal plant and engaged in the construction of building to use Quarry & Furnace Waste Kerb stone or similar products as per minimum volume by percentage of the total Kerb stone as prescribed below:

(i) 25% by 31st August 2004
(ii) 50% by 31st August 2005
(iii) 75% by 31st August 2006
(iv) 100% by 31st August 2007

The importance of product is not complete without knowing its economics &various characteristics relating to its quality. It has been acknowledged that marking Kerb stones with the normal material is becoming costlier day by day. This is more predominant for marking normal Kerb stone of higher compressive strengths. It is already known that the normal red Kerb stone is susceptible to efflorescence. Also, in the area of high moistures the weakness of red Kerb stone masonry due to great absorption of water is well known and needs to be improved to prevent and failure of the structure during its lifetime, further these Kerb stones are kiln made the causing Emission of harmful gases.

2. OBJECTIVE AND MOTIVE OF THIS STUDY

The objective is to compare the structural of Quarry & Furnace Waste Kerb stone with normal Kerb stone and to determine the most suitable Kerb stone and cost optimization of Quarry & Furnace Waste Kerb stone.

Quarry and Furnace Waste Kerb stones are eco-friendly as it protects environment though Conservation of top soil and utilization of waste products of coal or lignite based Thermal Power Plants. It is stronger than the normal Kerb stones. It plays a vital role in the abetment of carbon-die-oxide a harmful greenhouse gas mass emission of which is threatening to throw the earth's atmosphere out of balance.

The motive of this thesis is to prepare material used for the low cost of the project without compromising with the durability and compressive strength. Effort has been made by making different proportions of ingredients having composition of Quarry & Furnace Waste, cement, lime, gypsum, and sand this standard size of Kerb stone used in structural work has been adopted low cost Kerb stone will be easy to handle and transport and it will require less labour used for handing during industrial work. That will reduce the cost of construction without compromising the strength of construction. In India around 80 thermal power plants which produce a lot of Quarry & Furnace Waste as a waste material. But in Kerb stones manufacturing any kind of pollution not produced. It is ecofriendly. As the Quarry & Furnace Waste used in the manufacturing of Kerb stones the storage of waste reduces and reduced the soil pollution.

3. STRUCTURAL CAPABILITY

- These Kerb stones provide advantage being available in several loads bearing grades and giving smarts looking Kerb stonework.
- High compressive strength eliminates breakages/wastages during transport and handing.
- Due to its comparable density, do not cause any extra load on structures and suitable for earthquake loads.

Fig. 2: Kerb used in side of road pavement

4. LITERATURE REVIEW

In 1898, Kerb stone made of lime and sand, popularly known as calcium silicate Kerb stones and hardened by high-pressure steam curing, were commonly manufactured first in Germany. This process required finely ground sand. So, it was thought that Quarry & Furnace Waste, which an already if fine size, could replace ground sand totally or partially, thus conserving the cost. Being a pozzolana Quarry & Furnace Waste also reacts with lime at a low temperature resulting in Kerb stone of superior quality and although the Quarry & Furnace Waste Kerb stone masonry has been a subject for past many years, yet not much literature is available on this subject. The Quarry & Furnace Waste Kerb stone have characteristics different from the latter Kerb stones but some of the major problems and constraints in this way of large-scale utilization of these Kerb stones are:

(a) The reluctance of the consumer to accept Quarry & Furnace Waste base product due to lack of knowledge.
(b) Quality variation in the Quarry & Furnace Waste and non available of certified quality of Quarry & Furnace Waste.
(c) The bulk of Quarry & Furnace Waste is available in wet states.

These problems can be removed by educating the people about the benefits of Quarry & Furnace Waste Kerb stone through literature and media can also play a vital role.

5. CHARACTERIZATION OF QUARRY AND FURNACE WASTE

Coal-based thermal power plants from all over the world facing serious problems of handling and disposal of the furnace material produced. The high ash content (30–50%) of the Indian coal makes this problem more complex. At present, about 85 thermal power stations produce nearly 120 million tonnes of furnace material per annum. For safe disposal of the furnace material without affecting the natural environment attempts are being made to utilize the furnace material rather than dumping it to somewhere else. The furnace material is utilized in geotechnical applications such as the construction of embankments, as a sub-base material, as a backfill material, etc. in bulk only. For this, an in-depth study of the physical and chemical properties, and engineering and leaching behavior are required.

5.1 Review of Literature

Although Kerb have been used throughout modern history, and indeed were present in ancient Pompeii their widespread construction and use only began in the 18th century, as a part of the various movements towards city beautification that were attempted in the period.

As can already be derived from history, safety is not the only function of a Kerb. This paragraph lists all functions and discusses to what extent they matter for traffic safety and this research. Only a few (and even less scientific) literature is available on the actual functions of Kerb, therefore multiple sources are used in listing the functions. Based on Wignall, Kendrick & Ancil (1991), Marracon Civil (2016), Victoria Transport Policy Institute (2016) and Thomas (2009), six functions of Kerb are identified: Traffic Safety of Kerbs 19 - Structural: Kerb provide strength to the sides of road pavements and avoid lateral displacement of carriageway due to traffic loads. - Safety: Physically, Kerb serves as a separation between pedestrians and other modes. They also aid car drivers in driving safely and help contain low speeds near the edges of pavements. Visually, Kerb serves as the optical separation between sidewalk and road, guiding different road users by alignment. - Accessibility: Sloped or leveled Kerbs enable driving over pavements to allow cars to park or access their driveway more easily (especially in residential areas). - Drainage: They act as a vertical barrier to guide the surface runoff (water and dirt) collected in road pavements to the gullies. - Environment: Prevent encroachment of vegetation on to the road. - Aesthetic: Embedding the Kerb in the streetscape, and creating an ending" or finish of the road. In finding out to what extent these functions matter, two Dutch Kerb specialists are consulted: Frank Kolderie of Kerb supplying company Struyk Verwvo (Personal communication, May 19, 2016) and Marcel van Hallem, advisor for material(-use) for the municipality of Amsterdam (Personal communication, June 7, 2016). They acknowledge especially the structural, accessibility, and safety functions of a Kerb. The other functions (drainage, environment & aesthetics) are considered debatable. In terms of drainage, gutters are basically a consequence of using Kerb. To guide the runoff water into gullies for different Kerb types, many solutions are forehand. Hence, this function might be neglected. The environmental function might become important when Kerb is applied near large trees, parks or edges near vegetation, but is not considered as the main function. The aesthetic argument might come from urban designers who have a certain demand to incorporate Kerb into the streetscape. It might not have a function from a traffic engineering point of view, but could be of more importance on issues related to the built environment. Since this thesis focuses on the traffic safety of Kerb, only the safety function of Kerbs is discussed. Thus, only the physical and optical safety is taken into account, automatically neglecting all other functions. This does not mean that these other functions are of less importance. Whenever new Kerb is designed, all mentioned functions should be considered.

6. CONCLUSION

On the basis of the experimental work undertaken and discussion presented in the previous chapters the following conclusions are drawn:

1. The compressive strength of Quarry & Furnace Waste Kerb stone with 2% cement is 27% more than that of class I normal Kerb stone but when 3% cement is added in the Quarry & Furnace Waste Kerb stone then compressive strength is 52.04% more than that of normal Kerb stone and also when 5% cement added in Quarry & Furnace Waste Kerb stone then the compressive strength is more than 63.77%.
2. Water absorption of Quarry & Furnace Waste Kerb stone with 2% cement is 21.82% less as compared to that of normal Kerb stones and 34.36% less as compared to normal Kerb stone when 3% cement is added and 47.21% less as compared to normal Kerb stone when 5% cement is added.
3. Quarry & Furnace Waste Kerb stones are eco-friendly as it protects environment though conservation of top soil and utilization of waste products of coal or lignite used in thermal power plants. It is three times stronger than the normal burnt clay Kerb stones. It plays a vital role in the abatement of carbon dioxide a harmful greenhouse gas mass emission of which is threatening to throw the earth's atmosphere out of balance.
4. Being lighter in weight as compared to normal Kerb stones, the dead load on the structure is reduced and hence saving is the overall cost of construction.
5. The cost of materials required for $1m^3$ of Kerb stone using work using normal Kerb stones is considered for comparison of the cost of Kerb stone with Quarry & Furnace Waste Kerb stones as the cost of labour and other miscellaneous expenses are same. The cost of Kerb stones decreases with the use of Quarry & Furnace Waste Kerb stones as the volume of Quarry & Furnace Waste Kerb stones are 2.5% more than that normal Kerb stones.
6. Quarry & Furnace Waste Kerb stone masonry in 1:7 cement mortars can replace normal Kerb stone masonry in1:6 cement mortar and Quarry & Furnace Waste Kerb stone masonry in 1:5 can replace normal Kerb stone masonry in 1:4 cement mortars thereby saving the consumption of cement and Kerb stone.

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