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A review Paper on Comparative Study On Basalt Reinforcement with Conventional reinforcement.

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Abstract — *Steel is a very basic and important material used in reinforcement of concrete. But as steel is heavy in weight and also increases self weight of concrete and gets corroded easily. So this is an effort made to replace steel TMT bars with basalt rebars partially or fully. As basalt rebars are 89% lighter than steel and also noncorrosive in nature and posses high tensile strength. The mechanical properties like tensile and elasticity will be tested compared to steel. The physical properties like strength and durability will also be tested compared to steel. The beam and slab will be casted by using basalt rebars and the load carrying capacity will be checked. Further the feasibility of using basalt rebars in reinforced cement concreteshall be concluded.*

Keywords- *Basalt Fiber, High Tensile Strength, Anti-corrosion Bars, Reinforcement, Concrete*

I. INTRODUCTION

Many industries are trying to search better and most economical material to manufacture as a new product which is beneficial to industry and also stand as an advantage in construction works. Nowadays many new composite materials are manufactured in industry on large scale which are used in day to day construction works. The other materials which are used blindly as a conventional material without taking care of its strength, risk of corrosion, sustainability and environment are in need to replace by new material which an industry can manufacture. Basalt fibre is that material which can be manufacture on large scale. Basalt is an extrusive volcanic rock which is formed by the rapid cooling of basaltic lava .They are dark gray in colour. Basalt fibre can be from the molten rock through small nozzles to produce continuous filament. Basalt fibre is available in many different forms such as basalt chopped fibres , basalt rebars, basalt mesh, basalt fibre rovings, etc. Basalt fibre is having high strength, noncorrosive, and also lighter in weight. They do not contain any other additives in its processing period and it also has an advantage of cost which is economical. Basalt fibre are non-toxic in nature, non-combustible and also do not explode when comes directly in contact with fire .When they comes in direct contact with chemicals they will not form a product which is harmful and dangerous to environment.

II. LITERATURE REVIEW

Eigabbas et al (2016) have performed series of experiments in which they have taken total of six concrete beams reinforced with BFRP bars were built and tested up to failure. The test beams measured 200 mm wide, 300 mm high, and 3100 mm long. 10, 12, and 16 mm BFRP bars with sand-coated surfaces over helical wrapping were used. The beam specimens were designed in accordance with Annex S of CSA S806-12 and tested under four-point bending over a clear span of 2700 mm until failure. The beam test results are introduced and discussed in terms of cracking behaviour, deflection, and failure modes.

Eigabbas et al (2015) have investigated the physical, mechanical, and durability characteristics of basalt fibre-reinforced polymer (BFRP) bars. Durability and long-term performance were assessed by conditioning the BFRP bars in an alkaline solution simulating the concrete environment (up to 3000 h at 60 _C) to determine their suitability as internal reinforcement for concrete elements. Thereafter, the properties were assessed and compared with the unconditioned (reference) values. In this study, three types of BFRP bars were investigated. The test results revealed that the BFRP bars had good mechanical behaviour and could be placed in the same category as grade II and grade III GFRP bars (according to tensile modulus of elasticity).

Iyer (2014) has investigated the mechanical properties of smart concrete made of chopped basalt fibre. Two different types of basalt fibres (bundles and filaments) were used. The basalt fibre specimens were cast using basalt fibres of varying length (12 mm, 36 mm, and 50 mm) and varying fibre dosage (4 kg/m3, 8 kg/m3,and 12 kg/m3). The results indicated that the 50 mm basalt bundled fibre at 8 kg/m3 was the optimum fibre length and fibre volume for basalt bundled fibres. It provided the optimum increase in flexural strength, compressive strength, and split tensile strength when compared with plain concrete.

Banibabayat (2011) have performed experiments to determine long term and short term characteristics of Basalt Fiber Reinforced Polymer (BFRP) bars and mechanical properties of BFRP bars such as tensile strength, rupture strain and modulus of elasticity were determined from short-term experimental tests. Also, a set of durability tests were performed to study creep rupture behavior of BFRP bars and to find creep rupture coefficient to be used for creep design based on the concrete design codes. Finally, BFRP bars were used in design of a seawall structure in order to study the feasibility implementation of BFRP reinforced concrete seawall system instead of currently existing steel reinforce concrete seawalls.

Ludovico et al (2010) have investigated about the structural upgrade using basalt fibers for concrete reinforcement. The authors have used basalt fibers bonded with a cement based matrix as a strengthening material for confinement of reinforced concrete members. The effectiveness of the proposed technique was assessed by comparing different confinement schemes on concrete cylinders like uni-axial glass fiber reinforced polymer (FRP) laminates, alkali resistant fiberglass girds bonded with a cement based mortar, bidirectional basalt laminates pre-impregnated with epoxy resin or latex and then bonded with a cement based mortar and a cement based mortar jacket. Finally the authors have concluded that the confinement based on basalt fibers bonded with a cement based mortar could be a promising solution to overcome certain limitations of epoxy based FRP laminates.

Hannibal et al (2009) have reviewed the production methods and review of tests on basalt fibre as a strengthening material for concrete structures. It is concluded that whenever corrosion problems exist such as reinforcing concrete structure located close to the sea such as bridges and houses, basalt fibre composite bars have the potential to replace steel in reinforced concrete. It is concluded that basalt bars are of great interest for the building industry and can be used for example in bridge decks, offshore structure and in element buildings.

Parnas et al (2007) have researched to determine if basalt fibre reinforced polymer composites are feasible, practical, and a beneficial material alternative for transportation applications. No significant differences in stiffness and strength were found between basalt fabric reinforced polymer composites and glass composites reinforced by a fabric of similar weave pattern. Tests were also done with glass-reinforced composites using the same polymer as the basalt specimens to permit direct comparison between the two reinforcing materials. The major focus of this work is the durability of the composite to environmental exposure. The factors considered for environmental exposure were time, temperature, moisture and salinity.

Ramakrishnan et al (1998) have performed experiments to evaluate the performance characteristics of basalt fibre reinforced concrete and basalt bar reinforced concrete. The test program was conducted for fresh and hardened concrete properties. The fresh concrete properties consisted of the following tests: Slump, Vebe slump, Vebe time, concrete temperature, air content and unit weight. The hardened concrete properties determined were compressive strength, static modulus, flexural strength, load-deflection behaviour, comparison of load-deflection curves, ASTM toughness indices, first crack toughness, post crack behaviour, Japanese standard method for toughness indices and equivalent flexural strength. The test results show that the basalt fibre can be easily mixed in the concrete without any balling, bridging or segregation. There was a noticeable increase in the post crack energy absorption capacity and ductility due to the addition of basalt fibres.

III. CONCLUSION

We concluded that basalt fiber has an advantage of high strength, light weight, and also non-corrosive in nature therefore it would be best material used as a reinforcing material in concrete structure; especially marine structures. The strength is extremely good which is approximately three times than that of traditional steel bars. As this material is formed from volcanic eruption it contains good thermal resistance which is an important factor for R.C.C buildings. Basalt is naturally available material so there is no lack of source, which means that it will be economical, than any other material for example: carbon fiber.

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