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Utilization of Waste Foundry Sand in Concrete– A Review

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Abstract

The paper presents the experimental investigations done using waste or used foundry sand effectively in concrete as a replacement to the natural fine aggregate. Many researchers around the world have tried to find out the best possible ways to incorporate the used foundry sand to the maximum percentage possible which results in minimizing the use of natural aggregates. This paper presents a wide range of research done in utilizing the waste foundry sand along with the fibers and other admixtures used in concrete to get a required strength suitable for various structural and non-structural applications.

Keywords*: - Waste Foundry, sand, Concrete*

INTRODUCTION

The waste or used foundry sand is the result of the by-product from metal casting industries. A huge amount of waste foundry sand is generated from industries every year which will eventually end up in the disposal site harming the environment if not recycled and reused effectively in various fields. Usually the grain size of the used foundry sand around 0.6 to 0.15mm but some percentage of sand is very fine with size as low as 0.075mm. This waste sand can be effectively used in concrete in various percentages along with various mineral and chemical admixtures and by altering the percentage of cement used as it acts as a binder material, to produce a concrete of desired strength making it suitable for many wide range of applications.

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DETAILED LITERATURE REVIEWS

R.N. Kraus et al. (2009) investigated the use of foundry silica-dust in manufacturing economical self-consolidating concrete. Silica-dust was used to replace 10%, 20%, and 30% of fly ash at a 1:2 (fly ash to foundry dust) ratio by mass with using HRWRA (High Range Water Reducing Admixture) and VMA (Viscosity modifying admixture).The extra amount of foundry dust was treated as very fine sand. fly ash with foundry silica-dust is replaced in SCC (Self Consolidating Concrete) at 30% by weight of cement.SCC can spread and fill all corners of the formwork compared to conventional concrete and cost effective. At 30% replacement of fly ash with silica-dust, a large increase in the HRWRA demand for the mixture was observed. Increased amount of foundry silica-dust decreased the VMA demand. Foundry silica dust developed the basis strength at 28 days.

Thiruvenkitam Manoharan et al. (2018) investigated the engineering properties of concrete with partial replacement of used foundry sand by fine aggregate. The percentage replacements were 0, 5, 10, 15, 20 and 25weight percentage respectively. Experimental investigations were carried out to evaluate the mechanical, durability and micro structural properties of M20 concrete at the age of 7, 28 and 91 days and also analyzed the various cracks with using XRD (X-ray Diffraction), EDX (Energy Dispersive X-ray). This investigation was comparative studies on compression strength, flexural strength also durability test on concrete. Durability testing resistance of concrete against abrasion and rapid chloride permeability of the concrete mixture containing UFS up to 20 weight percentage were almost similar to the values of control mix. The findings suggest that UFS can effectively replace river sand. However, it is recommended that the replacement should not exceed 20 weight percentages. Resistance of concrete against abrasion and rapid chloride permeability of the concrete mixture containing UFS up to 20 weight percentage were almost similar to the values of control mix. The findings suggest that UFS can effectively replace river sand. However, it is recommended that the replacement should not exceed 20 weight percentages. The mechanical, durability and micro structural properties test results obtain with 20 weight percentage replacement of UFS were comparatively higher than the other mixes.

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Regina Mambeli Barros (2019) studied the effect of using waste foundry exhaust sand, WFES, as a partial substitute of fine aggregates in conventional concrete, also study physical characters like size classification, specific gravity and density. The fine aggregate was partially replaced with the WFES with six different proportions in conventional concrete, 0%, 10%, 20%, 30%, 40% and 50% by weight, in order to obtain the compressive strength of more than 25 MPa. An experimental investigation on the mechanical properties such as compressive strength, splitting tensile strength, modulus of elasticity, water absorption, with the durability of the concrete. The results indicated an increase in the strength and durability properties. The compressive strength, the splitting tensile strength and modulus of elasticity of hardened concrete did not increase with increase the waste foundry sand above at 50% by fine aggregate.

Paulo Ricardo de Matos (2019) Study about the applications of waste foundry sand in conventional and dry-mix concretes.0, 50 and 100% replacement of natural sand by WFS on concrete. This study evaluated the fresh state properties, volumetric variation, cement hydration and 28-days compressive strength of the mortars. For the dry-mix concrete study, compositions with two densities (2.20 and 2.25 g/cm3), further three cement contents and 0, 50 and 100% WFS in natural sand replacement were produced in the laboratory. For analyzed the compression strength and fresh state properties of concrete in M25. The replacement of natural sand by WFS reduced the flow ability and the compressive strength of the mortar sand the replacement of natural sand by WFS in dry-mix concretes of up to 20 MPa did not significantly affect the compressive strength of the material. The total replacement of natural sand by WFS produced concrete blocks with compressive strengths similar to the reference, within the compressive strength ranges previously established in the laboratory.

V Divya Prasad (2018) studied the effect of concrete containing Waste Foundry Sand, Fly Ash and Polypropylene fibre. Investigation With increment in amounts of modern bi-items, strong waste administration is of uncommon essentialness. Around two million tons of Waste Foundry Sand (WFS) is created yearly in India. Inappropriate removal of waste foundry sand force natural impacts, for example, restraint of soil microbial

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movement and ground water toxication. Utilizing WFS as structure materials can adequately diminish the ecological impacts and removal concerns. Quality prerequisites and cost decrease is accomplished by in part supplanting concrete with fly debris. Polypropylene fiber builds the malleability of the solid. Right now, work conduct of M25 concrete was contemplated by supplanting regular sand with WFS (10%, 20% and 30%) by weight, concrete with fly ash (20%, 25% and 30%) by weight and polypropylene fiber was included (0.5%, 1% and 1.5%) by weight of concrete. The blend extent parameters of the solid were dissected utilizing Taguchi strategy for ideal structure of tests. Concrete blends were structured in L9 symmetrical cluster with three control factors to be specific WFS, fly debris and polypropylene fiber. The blends were tried both in new and solidify state, and the upgraded blend was recognized dependent on the test outcomes utilizing Sign to Noise proportion. Concrete with 25% replacement of cement with Fly ash, 20% replacement of fine aggregate with Waste Foundry Sand and addition of 1% Polypropylene fibres is found to be the optimal mix for maximum compressive strength and split tensile strength.

Ahmad Shayan and Pud Baburamani investigated test methods for sulfate resistance of concrete and mechanism of sulfate attack. Sulfate attack on concrete has been studied worldwide for more than 60 years.

However, the mechanisms of attack are still not entirely understood, and deterioration of concrete from sulfates still occurs. Standard tests have been developed to evaluate the resistance of concretes to sulfate attack. Some national codes and worldwide measures associations have built up particulars for concrete/solid that is in administration in sulfate-forceful situations. Such details may incorporate criteria for various severities of sulfate assault, just as standard test techniques to assess the presentation of cement. It ought to be noticed that standard test techniques change from nation to nation regarding the test conditions and appraisal of different sorts of solid disappointment; many test strategies are as yet being adjusted. Tests are most commonly used for evaluating the resistance of concrete to sulfate attack for specified for freeze—thaw resistance.

Rafat Siddique (2009) studied the effect of used-foundry sand on the mechanical

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properties of concrete. This paper presents the results of an experimental investigation carried out to evaluate the mechanical properties of concrete mixtures in which fine aggregate (regular sand) was partially replaced with used-foundry sand (UFS). Fine aggregate was replaced with three percentages (10%, 20%, and 30%) of UFS by weight. Tests were performed for the properties of fresh concrete. Compressive strength, splitting- tensile strength, flexural strength, and modulus of elasticity were determined at 28, 56, 91, and 365 days. Compressive strength, splitting-tensile strength, flexural strength, and modulus of elasticity of concrete mixtures increased with the increase in foundry sand contents. Compressive strength, splitting-tensile strength, flexural strength, and modulus of elasticity of concrete mixtures increased with age for all the foundry sand contents.

Rafat Siddique et al. (2010) carried out research on Waste foundry sand and its leachate characteristics. The beneficial use of such by-products in construction materials results in reducing the cost of construction materials' ingredients and also helps in reducing disposal problem. The leachate obtained from such materials may contain hazardous compounds, which may possibly effect the environment. So, it is important to know the characteristics of leachate obtained from waste foundry sand. Understanding the leachate characteristics of WFS is essential in its disposal, environmental impact, and potential development for beneficial utilization towards solid waste management. This paper describes the physical, chemical properties of WFS, various leachate test methods, and research published on leachate characteristics of waste foundry sand. From investigation Waste foundry sand is waste material from foundries which exhibits lower unit weight, higher water absorption and higher percentage of void compared to regular sand.

Gurpreet Singh (2012) studied the effect of waste foundry sand (WFS) as partial replacement of sand on the strength, investigated ultrasonic pulse velocity and permeability of concrete. Natural sand was replaced with five percentage (0%, 5%, 10%, 15%, and 20%) of WFS by weight. A total of five concrete mix proportions (M-1, M-2, M-3, M-4 and M-5) with and without WFS were developed. Compression test and splitting tensile strength test were carried out to evaluate the strength properties of concrete at the age of 7, 28 and 91 days. Modulus of

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elasticity and ultrasonic pulse velocity test were conducted at the age of 28 and 91 days. This experimental investigation was performed to evaluate the strength and durability properties of concrete mixtures, in which natural sand was partial replaced with (WFS). In case of durability property, Rapid Chloride Permeability test was performed on all five mix proportion at the age of 28 and 91 days. Partial replacement of sand with WFS (up to 15%) increases the strength properties (compressive strength, splitting tensile strength and modulus of elasticity) of concrete. Maximum increase in compressive strength, splitting tensile strength and modulus of elasticity of concrete was observed with 15% WFS, both at 28 and 91 days. Inclusion of WFS increases the USPV values and decreased the chloride ion penetration in concrete, which indicates that concrete has become denser and impermeable WFS can be suitably used in making structural grade concrete.

Gritsada Sua-iam (2019) conducted experimental study on Workability and compressive strength development of self-consolidating concrete incorporating rice husk ash and foundry sand waste. This study aims to examine the effect of foundry sand waste (FDW) as a fine aggregate replacement (30 and 50%wt) on the properties of self-consolidating concrete (SCC) mixed with untreated rice husk ash (RHA) as a cement replacement (10 and 20%wt) with controlling water-binder materials ratios (w/b) of 0.35 and 0.45. The workability and strength characteristics of SCC are considered. Based on the results of this investigation, the following conclusions Are SCC containing RHA and FDW has higher compressive and splitting tensile strengths than the control SCC. The 10% RHA-SCC with 30%wt FDW achieved the highest strength. It is possible to use RHA and FDW as materials in the production of economically friendly SCC. Not only can the replacement of OPC reduce CO2 emissions by decreasing the OPC but the recycling of fine aggregate as partial replacement in river sand can also develop sustainability of SCC production.

QCL Group of companies has conducted experimental study on the concrete in durability such as sulphate attack and chloride ion penetration test. This paper addresses two aspects of concrete serviceability, which has been the subject of extensive recent discussion and research: sulphate attack and chloride ion penetration. The basic chemistry involved

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in each of these processes is outlined and differentiated and their effects on concrete and reinforcing steel described. The paper reports the recent introduction of performance tests intended to provide a means of assessing the contribution to resistance to these chemical actions of various cementations binder options now available for inclusion in concrete. sulphate attack can be excessive expansion, delamination, cracking chloride ion penetration is more physics in action with ion bonding and reduction, if not elimination, of these ions reaching the reinforcing steel. This investigation Resistance to sulphate attack and chloride ion penetration is two of the latest areas of durability concern to specifies and users of concrete.

Anthony Torres et al. (2017) investigated the effect of foundry waste on the mechanical properties of Portland Cement Concrete. This was done by partially replacing both fine aggregate and coarse aggregate of concrete with lightly processed foundry waste. Both coarse aggregate and fine aggregate were replaced by mass at 10%, 20%, and 30%. The compressive strength, splitting-tensile strength, flexural strength, and modulus of elasticity were measured for all groups at 7, 14, and 28 days. The results indicated that general foundry waste as either coarse, fine, or combined by mass replacement of natural aggregate has no impact on the mechanical performance of PCC up to 30% for individual replacement or 20% combined. This result not only demonstrates a possible avenue to increase the amount of foundry waste recycled annually, but it also reduces the demand for coarse aggregates for PCC. Coarse foundry waste had no impact on mechanical properties up to 30% by mass replacement Combined foundry waste had a negative impact on mechanical properties at 40% and 60% by mass replacement.

O. Yazoghli-Marzouk et al. (2014) has conducted study on recycling foundry sand in road construction–field assessment. This paper presents the chemical analysis of this by-product, the formulation of a sub-grade material and its leaching behavior assessed by experimental site monitoring. The results show that this foundry sand, treated by 5.5% of hydraulic binder, displays acceptable mechanical performances and doesn't show environmental impacts. This investigation demonstrates that this foundry sand can be used in road layers as road materials.

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However, to quantify the assessment of road release to water, flux would give better comprehension of the behavior of this alternative road material. Hence, the changes of the cumulated flux of the elements as a function of time and as ratio of liquid/solid (L/S), during the period of monitoring, are going to be analysed in future work.

Vema Reddy Chevuri et al. (2015) has investigated the experimental work is mainly concern with the study of mechanical properties like compressive strength, split tensile strength and as well as flexural strength of concrete by partial replacement of artificial sand by foundry sand as fine aggregate. In this project the behavior of concrete is assure by partial replacing the natural sand with foundry sand which is a waste product from the machine industries. Compressive test, split tensile test and flexural strength test were carried out to evaluate the strength properties concrete at the age of 7 and 28 days. The studies can be conducted to know the performance under impact and torsion loading. Studies can be conducted by incorporation of plasticizer admixture and accelerators. Durability studies such as resistance to sulphate attack, acid resistance etc., can be carried out on foundry sand concrete.

Smit M. kacha et al. (2014) summarized the conclusions of experiments conducted for the properties of concrete like strength and durability. It was observed the results have shown positive change and improvement in strength and durability properties of the conventional cementations concrete due to the addition or replace of fine sans with used foundry sand in different proportions. Based upon above literature review it could be concluded that all researchers gave their finding with concrete up to 30-40% replacement of fine aggregate with foundry sand in which compressive and tensile strength is increased up to 20% whereas not much change occurs in modulus of elasticity. Also workability is decreases with the increases of foundry sand content because of very fine particles. However all research noted that concrete made with foundry sand can be suitably used in making structural grade concrete. But very few researchers go up to 100% replacement where strength and durability criteria needed to be studied further effectively in future.

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Sowmya M et al. (2015) studied the usage of alternate materials in concrete which includes upcoming changes in concrete technology that paves the way to utilize
Some of the alternative materials that can be utilized as a composition to the ingredients of concrete that can be partially or completely be replaced with one or more materials that can be used other than the traditional concrete as alternate aggregate band changes in strength parameters with different composition mixture of concrete and usage of alternate materials in concrete at present scenario.

Sohail Md et al. (2013) studied the effect of foundry sand as fine aggregate replacement on the compressive strength, split tensile strength and flexural strength having mix proportions of M30 was investigated. The percentages of replacements were 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, & 100% by weight of fine aggregate. Test were performed for compressive strength, split tensile strength, and flexural strength tests for all replacement levels of foundry sand at different curing period. Waste foundry sand can be effectively used as fine aggregate in place of conventional river sand in concrete. Fine aggregate with waste foundry sand showed increase in the compressive strength of plain concrete up to 90% and then there was marginal decrease in strength. At 40%& 50% replacement of Sand with waste foundry sand concrete had gained full strength at the end of 7 days. The maximum compressive strength was achieved with 50% replacement of fine aggregate with foundry sand. Replacement of fine aggregate with waste foundry sand showed increase in the split tensile strength of plain concrete up to 70% and then there was a marginal decrease in the strength. There was increase in flexural strength of concrete up to 50% replacement. Flexural strength of concrete decreased after 50% compared to the plain concrete.

Deepak Chaurasiya et al. (2016) has conducted studies on the fine aggregate replaced by used foundry sand accordingly in the range of 10%, 20% & 30% by weight for M-30 grade concrete. Concrete mixture were produced, tested and compared in terms of workability and strength with the conventional concrete. These tests were carried out to evaluate the Compressive strength for 7, 14 and 28 days. As a result, the compressive increase up to 20% addition of used foundry sand. This research work is anxious with

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experimental investigation on strength of concrete and optimum percentage of the partial replacement by replacing fine aggregate via 10%, 20% and 30% of used foundry sand. Compressive strength of concrete increased with the increase in sand replacement with various replacement levels of foundry sand. However, at each replacement level of fine aggregate with foundry sand, an increase in strength was observed with the increase in age. The compressive strength increased by 2.5% and 3.7%, when compared to ordinary mix without foundry sand at 28 days. Decrease in compressive strength shown when 30% replacement done. Split tensile strength also showed an increase with increase in 10% and 20% replacement levels of foundry sand with fine aggregate but sudden fall in 30% replacement seen. Split tensile Strength also increased with increasing age.

Dushyant R.Bhimani et al (2016) has conducted studies on the information about the opportunities for sustainable and economical concrete. Applications of foundry sand, which is technically, sound, environmentally safe for sustainable development. Use of foundry sand in various engineering application can solve the problem of disposal of foundry sand and other purposes. Foundry sand consists primarily of silica sand, coated with a thin film of burnt carbon, residual and dust. Foundry sand can be used in concrete to improve its strength and other durability factors. Foundry sand can be used as a partial replacement of cement or as a partial replacement of fine aggregates or total replacement of fine aggregate and as supplementary addition to achieve different properties of concrete. Uses of foundry sand in concrete can save the metal industry disposal costs and produce a ‘greener’ concrete for construction. An innovative supplementary construction material is formed through this study.

Dushyant Ramesh bhai Bhimani et al. (2013) studied about the experimental investigation on strength of concrete and optimum percentage of the partial replacement by replacing fine aggregate via 10%, 30% and 50% of used foundry sand. Keeping all these view, the aim of investigation is the behavior of concrete while adding of waste in different proportions of used foundry sand in concrete by using tests like compression strength and water absorption. The water absorption decreased upto 50% replacement of fine aggregates by used foundry sand. Compressive strength

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increase when replacement of used foundry sand percentage increases when compared to traditional concrete. From this study, replacement of fine aggregates with these used foundry sand material provides maximum compressive strength at 50% replacement. Use of foundry sand in concrete can save the ferrous and non-ferrous metal industry disposal, cost and produce a 'greener' concrete for construction. Environmental effects from wastes and disposal problems of waste can be reduced through this research. A better measure by an innovative construction material is formed through this research. The results indicate that the % change in cost reduce up to 3.39 for 50% replacement of used foundry sand.

J. Anto et al. (2019) study about experimental investigation on strength properties of recron fiber with fly ash in concrete. The main objective is to determine the properties of concrete by adding recron fiber and replacing cement by fly ash in certain% and compare with the Conventional Concrete. recron fiber is a discontinuous short fiber that can be used in concrete to control and arrest cracks. The variation of recron fiber by 0%, 0.25%, 0.5%, 0.75%, 1% and fly ash by 25% in concrete was studied. The study includes workability of fresh concrete, compressive strength, splitting tensile strength, flexural strength for hardened concrete. The test was conducted in 7 days and 28 days on the specimen and the result are compared with the conventional concrete. The experimental results shown that Recon Fiber gave maximum strength in 0.75% of Recon Fiber and also Fly ash gave maximum strength in 25% of replacement of cement. Based on the experimental study, the addition of super plasticizer improves the workability of mix and satisfies the characteristics of SCC such as passing ability, filling ability and resistance of segregation.

Attar. M. I et al. (2018) investigated on recycling of waste foundry sand in the manufacture of brick. By recycling of waste foundry sand reduces damping area as well as control the pollution. The success of using foundry sand depends upon economics. The bottom line issues are cost. Availability of the foundry sand and availability of similar natural aggregates in the region. If these issues can be successfully resolved, the competitiveness of using foundry sand will increase foundries and for end users of the sand. This is true of any recycled material. From physical analysis the physical

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properties are somewhat similar to the natural sand & chemical analysis there is no harmful chemical in it which gives no hazardous to use in concrete initially strength increases as the foundry sand replaces sand from 8% to 13% and a drop takes place in same after that as we go on replacing foundry sand by natural sand in more quantity by till 13% to 20% and increase takes place as we go from 20% to 40% replacement and slight decreases occurs at 60% replacement. But even than it gives more split tensile strength than the minimum strength of concrete given by natural sand.

Ganesh Prabhu G et al. (2015) carried out on the reuse of waste FS as an alternative material to natural sand in concrete production, satisfied with relevant international standards. The physical and chemical properties of the FS were addressed. The influence of FS on the behavior of concrete was evaluated through strength and durability properties. The test results revealed that compared to the concrete mixtures with a substitution rate of 30%, the control mixtures hade strength value that was only 6.3% higher, and this enhancement is not particularly high. In a similar manner, the durability properties of the concrete mixtures containing FS up to 30% were relatively close to those of control mixture. From this study, it is suggested that FS with a substitution rate of up to 30% can be effectively used in concrete production without affecting the strength and durability properties of the concrete. The chloride penetration value of the CM was 420 coulombs, whereas the mixture FS 30% achieved the value of 621 coulombs at the age of 180 days, which is much less than the maximum value recommended in ASTM C1202-97. The carbonation coefficient of the concrete mixtures with a substitution rate of up to 30%was never exceeded the value of 6mm/ month 0.5, it can be considered as good concrete. The presence of Sulphur traces in the FS increased the strength of the NaSO4 and MgSO4 solution and enhanced the ettringite formation, causing the deterioration of concrete.

Gireesh Mailar et al. (2017) studied the experimental the experimental program involved casting of six distinct mixes with 0%, 20%, 40%, 60%, 80%& 100% replacement of fine aggregate by discarded foundry sand. Even though the 80% and 100% replacement mixes were found to be less dense than the rest of mix, the blend of 40% replacement acquired desirable

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mechanical and durability properties when compared to that of all other mixes. The optimum replacement level of the discarded foundry sand by mass to the river sand was 40%. The light weight concrete produced by utilizing crushed brick masonry aggregate and discarded foundry sand (40% substitution level) can be employed in all major structural light weight construction aspects and is ideally suited for sloped roof slabs and making architectural or decorative concrete blocks.

Jadha et al. (2017) studied the effect of foundry sand as fine aggregate replacement on the compressive strength, split tensile strength and modulus of elasticity of concrete having mix proportions of M25 grade was investigated. The percentages of replacements were 0, 5, 10, 15, 20, 25, 30, 35, 40, 45 and 50% by weight of fine aggregate. From the study of 28 days compressive strength comparison, it can be seen that compressive strength of concrete with partial replacement of UFS (0% to 30%) has increased up to 30% replacement and after that goes on decreasing as compared to concrete mix with natural sand. The compressive strength of concrete mix with 10%, 30%, 50% foundry sand has increased as compared to concrete mix with artificial sand. The compressive strength of concrete mix with 100% foundry sand has decreased as compared to concrete mix with natural sand.

Jagannathan saravannan et al. (2014) investigated on the used foundry sand has been tried as fine aggregate in place of sand and ceramic waste has been used as partial substitute to conventional coarse aggregate by 15%, 20%, & 30%in concrete making. Cubes, cylinder and prisms were casted and tested for compressive strength, split tensile strength and modulus of rupture after a curing period of 28 days. Compressive strength of concrete increases in 20% replacement of fine aggregate and coarse aggregate with foundry sand ceramic waste was observed. Split tensile strength concrete increases in 20% replacement of fine aggregate and coarse aggregate with foundry sand ceramic waste were observed. Ceramic waste and foundry sand were partially used to replacement of conventional aggregate and the replacement of 15%, & 30% shows decrease in strength parameter and 20% replacement show an increase in strength parameter.

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Preeti Pandeyetai. (2015) investigated the fine aggregate has been replaced by foundry sand accordingly in the range of (10-60% at the interval of 10%). Concrete mixes were cost and tested for workability and compressive strength. It was observed that at 10% replacement of fine aggregate by foundry sand compressive strength was increased. Also up to 20% replacement of fine aggregate by foundry sand strength is comparable to conventional concrete. Workability of concrete made using foundry sand observed to be increased slightly with replacement level. Compressive strength of concrete at 10% replacement level was more than that of conventional concrete. At 20% replacement level compressive strength of concrete was comparable to referral conventional concrete. Optimum replacement level of foundry sand as is 10%.

Pranita Bhandrari et al. (2016) Carried out the experimental investigation was carried out a concrete containing waste foundry sand in the range of 0%, 10%, 30%, 40%, 60%, 80% and 100% weight for M25 grade concrete. The concrete containing foundry sand was tested and compared with conventional concrete in terms of workability, compressive strength and acid attack. Cubes were casted and compressive test was performed on 3rd, 7th and 28th day for mix of 1:1.01:2.5 at w/c of 0.4. Compressive strength decreases on increase in percentage of WFS. In this study, maximum compressive strength is obtained at 10% and 20% replacement of fine aggregate by waste foundry sand. Use of waste foundry sand in concrete reduces the production of waste through metal industries i.e., it's an eco-friendly building material. The problem of disposal and maintenance cost of land filling is reduced.

Muhanmmad Umar Farooq et al. (2014) studied on the use of non- ferrous RFS as a partial replacement of regular sand to produced low cost, environmental friendly concrete. To investigate the effect on fresh and hardened properties of such concrete a detailed experimental study is conducted. The fine aggregate has been replaced as 0%, 10%, 30% & 45% with non- ferrous RFS. Concrete mixtures were prepared, cured, tested and compared with ordinary concrete in terms of compressive strength and workability. The compressive strength was investigated at 7, 14 and 2 days. Test results indicate a drop in workability and increase in the Strength up to 30% replacement. Based on experimental research work regarding the compressive

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strength of non-ferrous RFS concrete. It is observed that compressive strength of concrete increases up to 30% replacement of non-ferrous RFS but optimum value was 10% of non-ferrous concrete. Hence it concludes from the present study that production of good quality concrete non-ferrous RFS can be used.

Krishna B Dave et al. (2017) investigated on effect of waste foundry sand on concrete properties such as compressive strength, split tensile strength, modulus of elasticity is presented. Waste foundry sand can be used as a partial replacement for regular sand in making concrete or concrete products. Strength properties of concrete mixtures increase with increase in foundry sand contents and also with the age. Strength properties results indicate that waste foundry sand could be very conveniently used in making good quality concrete and construction materials.

Koshti R.D et al. (2016) carried out to use maximum foundry sand with retaining the properties of the concrete, and to produce a low cost and eco-friendly concrete. In the present work, experimental investigations were performed to calculate comparative study of properties of fresh concrete using replacement of fine aggregate with foundry sand. Foundry sand is replaced by 10%, 20%, 22%, 24%, 26% 28%, 30%, & 40% by weight of fine aggregate. M20 grade of concrete is designed & test is taken for compressive strength, flexural strength & split tensile strength for 7 & 28 days curing period. Though the results are positive for most of the combinations. According to various reasons the use of river sand is increased which increases the over use of natural sand which leads to ageing of river. As we use the foundry sand in percentage variation up to 40%, which reduces the use of river sand which avoids ageing and proper flow of river, and as foundry sand is a waste product which gives the benefits of using wastage from mechanical industries, and which also reduces the cost of work.

CONCLUSION

From the extensive research done it is concluded that the used foundry sand produced from the metal casting industries can be effectively used in concrete as a partial replacement to the natural fine aggregate. The replacement ratio varied from 5% to 100% i.e. full replacement but it was observed that when the percentage of used foundry sand was more than 30 %, a decrease in the mechanical properties of

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the concrete was observed and hence the use of admixture and fiber was incorporated.

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