IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

UTILIZATION AND APPLICATION OF FOUNDRY WASTE SAND IN CONSTRUCTION INDUSTRY, A CASE OF KOLHAPUR FOUNDRY

[1]Rewati Sanjay Jadhav, [2]Sandeep G. Dige, [3]Anjali S. Jadhav, [4]Rakhi Begampure

[1]P.G.Student, [2] I/C Principal, [3]Professor, [4] Professor

[1]Architectural construction project management,

[1]S.P.S.M.B.H's College Of Architecture, Kolhapur, India

Abstract:

Sand, water, coal powder, and bentonite clay are the ingredients that make up foundry sand. The main purpose of it is to make metal casting molds. A sizable portion of the combination is almost always made up of sand, either silica or olivine. Casting sand has excellent pozzolanic properties. It is used in the process of sand casting. This review does a thorough task regarding industrial waste materials that can be adequately used in building work as a replacement. This essay examines foundry sand as a type of industrial waste. During the sand rehabilitation procedure, sand from industrial effluents flow completed the machines mostly. Waste foundry sand has been used in experiments. The study concerns the usage of foundry sand, which is mostly utilized in construction and is created from waste sand from foundries combined with other materials and admixtures that improve the result.

Index terms: waste foundry sand, industrial waste, construction.

I. Introduction:

An enterprise called a foundry manufactures metal by melting liquid metal and pouring it into a mold that has already been created to generate a hardened cast. Sand, water, coal powder, and bentonite clay are the ingredients that make up foundry sand. The main purpose of it is to make metal casting molds. A sizable portion of the combination is almost always made up of sand, either silica or olivine. Casting sand has excellent pozzolanic properties. It is used in the process of sand casting. The primary metals cast include ferrous metals like iron and steel, as well as nonferrous metals like aluminum and copper. Fine quality silica sand is a by-product of the use of ferrous and nonferrous metals and is found in foundry sand. The type of casting technique used, and consequently the industrial sector from which it originates, will influence some of the physical characteristics of foundry sand. Sand is a key component in the metal casting process used by metal foundries. Sand is constantly recycled and used again and again in foundries. The quality of the raw sand is typically good. Sand is utilized repeatedly by foundry enterprises, and after several cycles, it is removed and disposed of at neighboring places. Used foundry sand is the name for this leftover foundry sand (USF). The physical-chemical characteristics of foundry sand depend on the type of casting technology used and the type of industry it was created for. The automobile industries are the main producers of foundry sand. (1)

1.1 Types of foundry sand:

Chemically bonded sand: Sand that has been chemically bound has a silica content of 93 to 99% and a chemical binder of 1 to 3%. After carefully mixing the chemicals with the silica sand, a catalyst ignites a procedure that cures and binds the mass of sand. A number of chemical binders are used in the foundry business. The most widely used chemical binders include sodium silicates, farfel alcohol, epoxy resins, and phenolic-urethanes.

Green sand: 85% to 95% of green sand is silica, 0 to 12% of it is clay, 2 to 10% of it contains carbonaceous materials like soft coal, and 25% of it is water. Greensand is the moulding substance that foundries utilise most commonly. A clay covering holds silica sand, a bulk material that can withstand high temperatures, together. The water that is poured makes things more plastic.

Sand cannot "burn on" or fuse to the casting surface due to the inclusion of carbonaceous additives. The green sands also contain trace amounts of Mgo, K2O, and tio2.

1.2 Foundry sand reuse:

Foundry sand will be used as structural fill to support a variety of buildings, equipment, parking lots, and roads. By preventing water from reaching the foundry sand, the use of clay in "embedded" structural fill can lessen the risk of leaching.

a) Flowable fill: Flowable fill is used to backfill holes rather than soil since it self-compacts and mimics liquid. The items have been repositioned and may be re-dug. The standard mixture contains sand, fly ash, Portland cement, and water. It is easy to switch out foundry sand with virgin sand.

b) Concrete and cement: Sand could be a component in concrete and cement. The lot of foundry sands meet the cement's minimum requirement of 80% silica content. It also requires specific minerals, including the iron and aluminium oxides found in foundry sands. Concrete also contains cement and additional sand or gravel, thus foundry sand can be utilised once more.

1.3 Sources of used foundry sand:

UFS can be supplied directly to foundries because it is a uniformly graded material. However, big moulds, metal from the moulding process, and core materials made of partially degraded binder are typically used. Heavy metal ions and phenols are collected by the sand throughout the moulding process, and leachable pollutants from those processes may also be present in UFS. Phenols are produced during the metal bucketing process as a result of the thermal breakdown at high temperatures and the reorganisation of organic binder. The accumulation of toxic metals in ferrous foundry sands created by ferrous foundries is of greater significance.

II. Aim: The use of foundry sand as industrial waste in building components as a partial material.

III. Objectives:

- To find out what other applications it might have.
- To improve foundry sand's strength and utility, a new cleaning and reuse technique must be created.
- To research the cost-effectiveness and application of spent foundry sand for building purposes.

IV. Literature review:

The literature study is done to know the application and utilization of foundry sand, different construction sectors

There are two types of foundry sand. There are two main categories of foundry sand: green sand, commonly referred to as moulding sand, and chemically bonded sand, which uses polymers to bind the sand grains together. Clay is used as the binder component in green sand. 0 to 12 percent clay, 2 to 10 percent carbonaceous additives, such as light coal, and 25 percent water make up the majority of green sand's composition, which is 85 to 95 percent silica. (2)

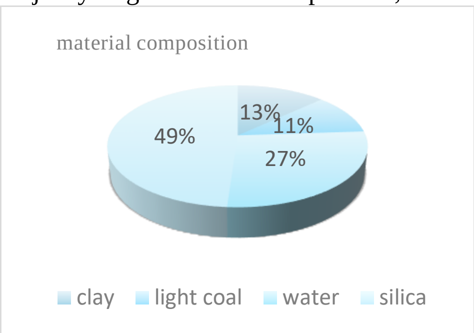


chart 1 material composition

The application of ceramic waste and foundry sand in civil engineering. The factory generated large amounts of waste foundry sand and calcined clay every year. Therefore, landfills may be used to dispose of these wastes. Bricks produced with these wastes can be quite useful in the construction industry. As a result, they might produce concrete that is more sustainable by reducing the usage of non-renewable resources like cement and aggregates. Tackling environmental challenges related to landfill trash while being sustainable at the same time. They learn that foundry sand contains 80–90% silica and 60–70% silica to boost the durability and strength of concrete. (4)

The combination with FWS discovered to have a lower density than the combination without FWS. They evaluated the compressive strength of both the ferrous and non-ferrous FWS. Ferrous FWS, which substitutes for fine aggregate by 20%, superior strength at 28 days compared to non-ferrous FWS. While both the ferrous and non-ferrous FWS produce dense concrete at a 20% addition, the ferrous FWS at 30% produces denser concrete delivers strength that is comparable to that of even concrete. (5)

To ascertain the effects of fly ash and foundry sand on the porosity of flowable slurry mixtures. Two primary sources of ASTM class F fly ash were used to proportion the two different flowable fly ash slurry mixtures in this study, with strengths ranging from 0.34 to 0.69 N/mm2 over a 28-day period. Other combinations substituted clean foundry sands for fly ash in amounts ranging from 30 to 95 percent. The experiments' outcomes showed that either an increase in the water-to-cement ratio or the amount of foundry sand present had an impact on the mixtures' permeability.

The used foundry sand might be converted into flowable fill for geotechnical needs. The WFS samples used in this investigation came from 17 different metal casting companies, each of which used a different casting technique and so exhibited different WFS properties. The physical, geotechnical, and leaching properties of the flowable fill at different water concentrations were examined in the laboratory. The main parameters measured are WFS physical properties, WFS flowable fill geotechnical properties, and the fill's leaching capabilities (heavy metals).

Cost-effectiveness of the materials:

Before being used in construction, sand is frequently cleaned and taken out of the riverbed. In addition, it is possible to locate manufactured sand, also known as M-sand, which is becoming more popular due to government regulations, as well as its fineness and dust-free qualities. Sand aggregate costs between 1600 and 3300 rupees per kilogram. Bricks and blocks are used to construct most walls. Bricks come in a range of shapes, sizes, and strengths depending on the various construction needs.

V. Methodology:

Understanding the chosen research methodologies is important given the purpose of the study. Therefore, all techniques will be finished one by one, and the selection and defection of the points will be discussed in accordance, in order to justify the criterion of research method selection. According to a set of objectives, the case study approach has been chosen for the study. To fulfil these research-related aims. The tentative study was done as part of the research involved parametric analysis of the data that was available.

- Following the analysis of the studies and visits and the creation of tables, charts, and graphs, all data was collected via questionnaires.
- With the help of a questionnaire survey tool, calculations of amounts and percentages were made in order to obtain a general understanding of the needs.
- As the creation of the survey questions was divided into various groups, including managers, workers, and transporters.

VI. Sample design:

Owners/managers, workers, and transporters in the industries make up the study's sample. Taking into account Kolhapur's location in relation to the foundry industry and neighborhood. Owners/managers, laborers, and transporters were chosen from the based sample using a quota convenience sampling technique. The foundry industries, which were classified into major, medium, and small size sectors, decided on a quota. In order to obtain this data, there were visits made to foundry firms and a questionnaire was administered.

VII. Results and analysis:

For the aforementioned study, both primary and secondary data are now being obtained. The knowledge amassed using both primary and secondary sources. A separate review provided to foundry owners served as the primary source. With the aid of case studies and interviews.

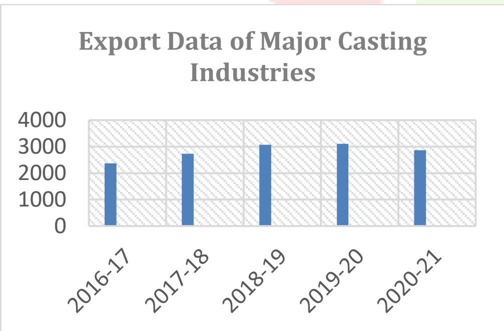
a) Major Foundry Clusters:

For the study, a number of clusters that are each well-known for a certain line of goods were found. Major foundry clusters may be found throughout India in places like Hyderabad, Howrah, Kolkata, Bombay, Gujarat, Dinajpur, Chennai, Kolkata, Indore, Chennai, Ahmedabad, Delhi, Gurgaon, and many others. Punjab, Sholapur, Rajkot, Punjab, Agra, Pune, Kolhapur, and Batal. Every foundry cluster typically concentrates on providing a small number of certain end-use industries. The Kolhapur and Belgaum clusters, for example, are both excellent for making automobiles.

Governmental publications are the secondary information source of information, together with the internet. The Indian foundry industry manufactures metal cast parts for use in power equipment, sanitary systems, electronic wiring, defense (benson, 1998) systems, aerospace systems, pipe work, and earth moving systems, textile structures, cement systems, wind turbine systems, autos, tractors, railroads, pumps, and valves, among other things. An estimated 19 billion USD in annual revenue and 3.1 billion USD in exports are generated by the foundry sector.

About 50,000 people are employed directly and 15,000 indirectly by the foundry sector. It might potentially result in the creation of more jobs during the following ten years. The foundry industry currently uses a lot of labor and directly and economically, many of whom come from both economically and socially underprivileged areas.

Table 1 export of major castings



More than 300 foundry facilities can be located in the nearby Kolhapur and Sangli districts. While foundries are primarily distributed around eight sizable industrial parks in the Kolhapur district, units in Sangli are primarily found in the industrial regions of Palus and Miraj. Grey-iron and SG iron are mostly produced by the cluster. Castings that fall within the ferrous (iron) castings category. According to estimates, the collection of Around 600,000 tonnes are produced annually by foundries in Kolhapur.

Minor Units	(yearly development 1,000 tonnes or less)
Average Units	(yearly development from 1,001 to 10,000 tonnes)
Substantial Units	(yearly development in excess of 10,000 tonnes)

A total of 6682 acres make up the Kolhapur city, of which 50% are categorized as farmland. Housing, industrial, and commercial districts are further separated into the remaining built-up area (28 percent). In KMC, there are roughly 15% of areas with no vegetation, comparing to 6% and 1%, respectively, of areas with vegetation and water bodies. The authorized DPR for the year 2000 shows that residential areas increased by 100% while agricultural and water bodies decreased by 50% in the city, indicating that many agricultural lands have been transferred to non-agricultural plots since 1977. (6)

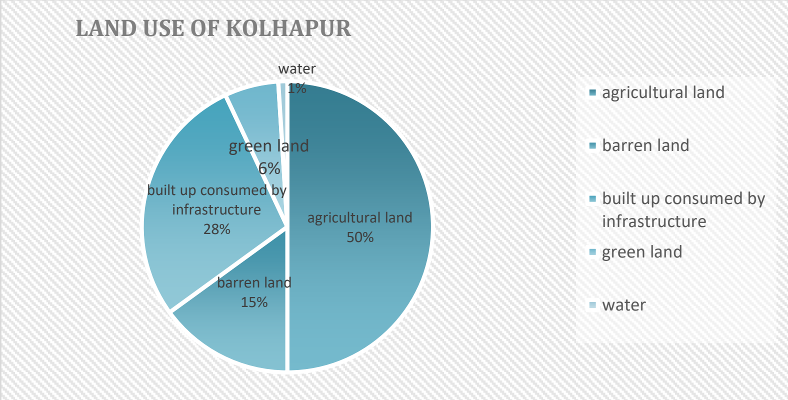


chart 2 land use of Kolhapur

b) Products and production:

According to the studies, there are businesses producing compressors, gas stoves, hammers, needles, and building materials in addition to units producing castings for auto, oil, and engine parts. The data analysis was completed after careful study and using the information gathered during data collecting. The analysis was conducted using case studies and information on foundries from the cluster of foundries in Kolhapur. According to the studies it can be concluded that the total quantity of sand dumped is about 17,300kg approximately. The cost of foundry sand after the reclamation process is about 300-1300rs/ton as compared to the river sand, M-sand is less so it is beneficial to replace foundry sand as a component in construction work. (7)

c) Role in Manufacturing Sector:

Over the next ten years, 100 million new jobs will be created as part of the new manufacturing policy, which aims to increase manufacturing's GDP share from its current 15% to 25%. Metal castings are utilised in the manufacture of all engineering and other sectors, therefore the foundry industry is essential to supporting manufacturing. It is challenging to meet the evaluation goals without continued expansion in the foundry industry.

VIII. Conclusion:

According to the research, this is advantageous in helping to improve the environment as well as the building sector, where it may also help in resource conservation, resource balancing, and resource cost effectiveness.

IX. Recommendations:

Reusing leftover foundry sand will be a significant strategy for achieving sustainability. Making the correct rules, regulations, policies, and implementation for the reuse of sand will have a significant impact on the economy and the environment. Models for reusing waste foundry sand will be a significant step toward achieving sustainability. Making the correct rules, regulations, policies, and implementation for the reuse of sand will have a significant impact on the economy and the environment.

REFERENCES

1. Benson. (1998). *Beneficial reuse of foundry sands in construction of hydraulic barrier layers.*
2. Chevuri. (2015). A study on foundry sand: opportunities for sustainable and economical concrete.
3. Guatavo. (2019). Surface electrical resistivity and compressive strength of concrete with the use of waste foundry sand as aggregate.
4. Jagtap. (2015). A review on utilization of waste foundry sand for producing economical and sustainable concrete.
5. Kaur, r. (2019). Strength properties and microstructural analysis of self-compacting concrete incorporating waste foundry sand.
6. Ma, m. (2014). Mechanical and toxicological evaluation of concrete artifacts containing waste foundry sand.
7. R. (2017). Partial replacement of sand by waste foundry sand.